

Nuclear Structure and Decay Data for A=149 Isobars*

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Abstract: Experimental nuclear structure and decay data are evaluated for all the 17 known nuclides of mass 149 (Xe, Cs, Ba, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb). Detailed compiled and evaluated spectroscopic information is presented for each reaction and decay dataset, and recommended values are provided for level properties, α , β and γ radiations, and other spectroscopic parameters, based on an evaluation of all the available experimental data for A=149 isobaric nuclides. Although large amounts of nuclear spectroscopic data are available for nuclides of A=149, yet large gaps in knowledge exist, as described below. For the lowest atomic number nuclide ^{149}Xe , only the isotopic identification has been made, with no data for its ground-state half-life. For ^{149}Cs , ^{149}Tm and ^{149}Yb information is available for only the respective ground states. For ^{149}Ba , ^{149}La and ^{149}Er , limited data exist for excited states. Many of the decay schemes of radioactive nuclei of A=149 are considered as incomplete, either due to large energy differences between the highest observed excited states in daughter nuclides and the respective Q-values, or due to the lack of confirmed γ -ray data, as listed below: $^{149}\text{Cs} \rightarrow ^{149}\text{Ba}$, $^{149}\text{Ba} \rightarrow ^{149}\text{La}$, $^{149}\text{La} \rightarrow ^{149}\text{Ce}$, $^{149}\text{Ce} \rightarrow ^{149}\text{Pr}$, $^{149}\text{Pr} \rightarrow ^{149}\text{Nd}$, $^{149}\text{Tb}(4.17 \text{ min}) \rightarrow ^{149}\text{Gd}$, $^{149}\text{Ho}(21.0 \text{ s and } 56 \text{ s}) \rightarrow ^{149}\text{Dy}$, $^{149}\text{Er}(4 \text{ s and } 9.6 \text{ s}) \rightarrow ^{149}\text{Ho}$, and $^{149}\text{Tm} \rightarrow ^{149}\text{Er}$. No data exist for the decay of ^{149}Yb to ^{149}Tm . Data for half-lives of the excited states in this mass chain are generally lacking as given below by the number of excited levels of known half-life / approximate number of known levels in a nuclide: 2/17 for ^{149}Ba , 0/18 for ^{149}La , 3/53 for ^{149}Ce , 3/44 for ^{149}Pr , 17/110 for ^{149}Nd , 9/90 for ^{149}Pm , 10/210 for ^{149}Sm , 2/125 for ^{149}Eu , 6/270 for ^{149}Gd , 5/200 for ^{149}Tb , 3/80 for ^{149}Dy , 3/90 for ^{149}Ho , and 3/14 for ^{149}Er . This work supersedes earlier evaluations of A=149 published by [2004Si16](#), [1994Si18](#), [1985Sz01](#) and [1976Ho17](#).

Cutoff Date: Literature available up to August 16, 2022 has been consulted. Main bibliographic source was the NSR database ([2011Pr03](#)) at Brookhaven laboratory webpage: www.nndc.bnl.gov/nsr/.

General Policies and Organization of Material: See the January issue of the *Nuclear Data Sheets* or <http://www.nndc.bnl.gov/nds/NDSPolicies.pdf>.

General Comments: The statistical analysis of γ -ray data and deduced level schemes is carried out through computer codes available at IAEA-NDS webpage. The direct feedings to excited states in β^- and ε decays have generally been computed from $I(\gamma+\text{ce})$ intensity balances at each level; the associated $\log ft$ values are deduced using the $\log ft$ code. Theoretical total conversion coefficients are calculated using the BrIcc code ([2008Ki07](#)) for frozen-orbit option with an implicit uncertainty of 1.4%, when not stated. Q values and particle separation energies have been adopted from [2021Wa16](#) (AME2020). Static magnetic dipole moments are taken from [2019StZV](#) and [2020StZV](#) evaluations and static electric quadrupole moments from [2021StZZ](#) evaluation, when available in these publications. Nuclear rms charge radii have been adopted from [2013An02](#) evaluation. In cases where weighted averaging procedures have been used, the assigned uncertainty in the result is generally not lower than the lowest uncertainty amongst the data points used in the procedure.

Acknowledgements: Evaluators thank Drs. Rafal Broda and Witold Meczynsk (Institute of Nuclear Physics, Krakow) for sending detailed results of their study of the decay of ^{149}Gd to ^{149}Tb , in response to our query in connection with selected data presented in their conference and lab reports in the early nineties.

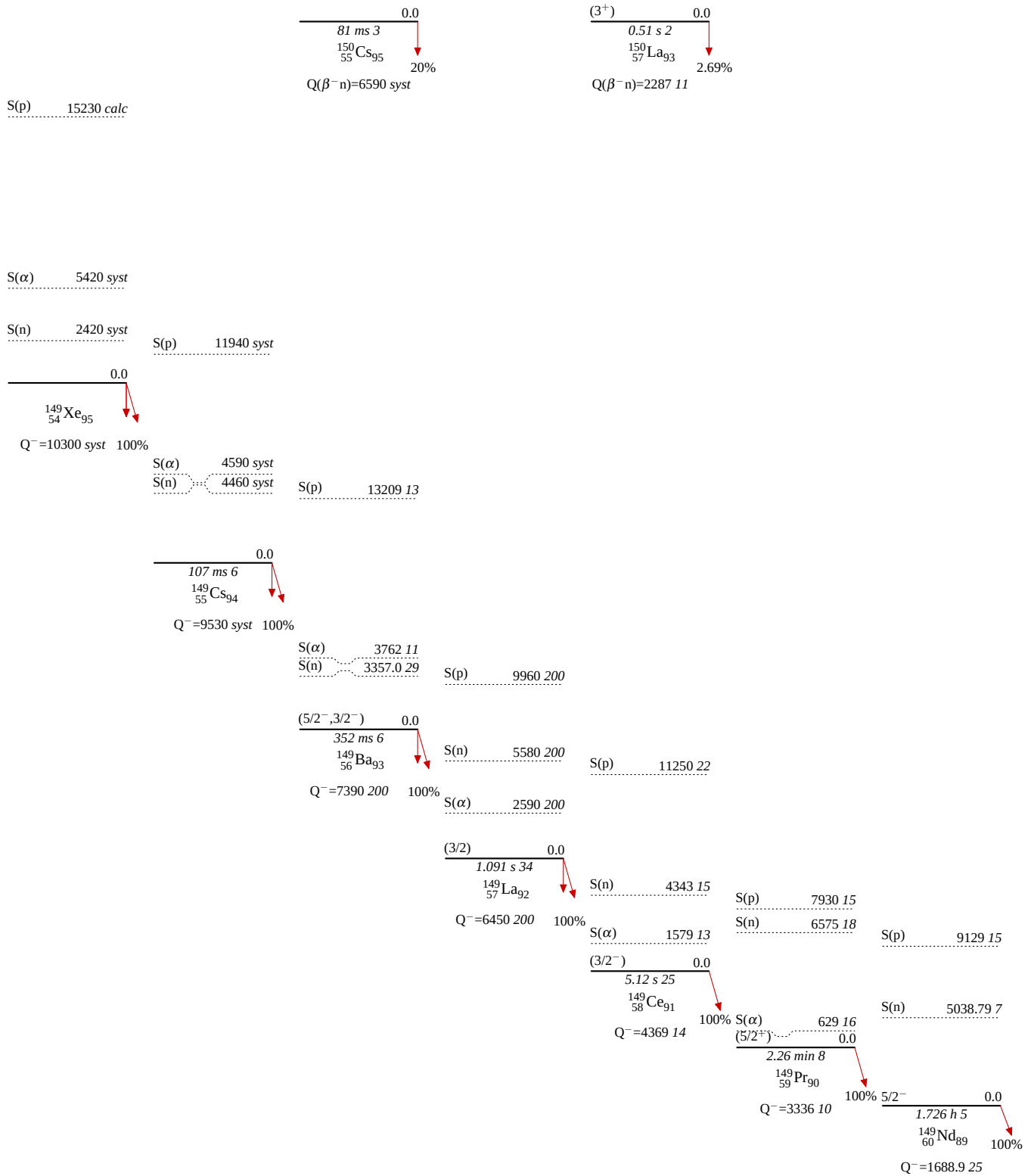
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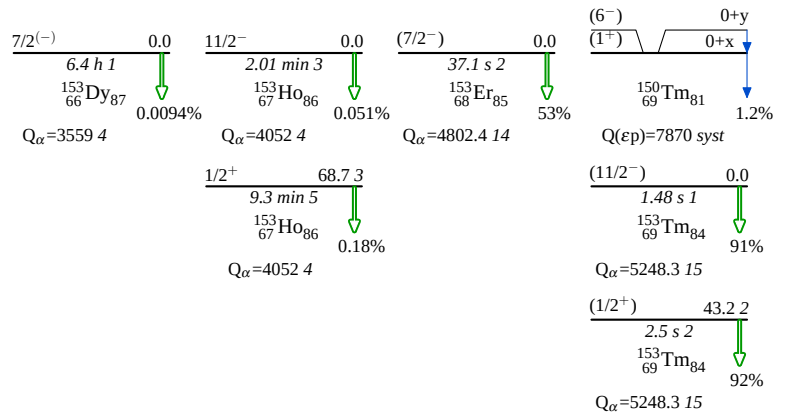
Nuclide	Data Type	Page	Nuclide	Data Type	Page
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$^{149}_{54}\text{Xe}_{95}$	Adopted Levels	8	$^{148}\text{Sm}(\alpha, ^3\text{He})$		281
$^{149}_{55}\text{Cs}_{94}$	Adopted Levels	9	$^{148}\text{Sm}(^{16}\text{O}, ^{15}\text{O}), (^{13}\text{C}, ^{12}\text{C})$		282
$^{149}_{56}\text{Ba}_{93}$	Adopted Levels	9	$^{149}\text{Sm}(\gamma, \gamma): \text{Mossbauer}$		283
	Adopted Levels, Gammas	10	$^{149}\text{Sm}(\text{d}, \text{d}')$		284
	$^{149}\text{Cs} \beta^-$ decay (107 ms)	13	$^{150}\text{Sm}(\text{n}, 2\text{n}\gamma)$		285
	$^{150}\text{Cs} \beta^- \text{n}$ decay (81 ms)	17	$^{150}\text{Sm}(\text{p}, \text{d})$		288
$^{149}_{57}\text{La}_{92}$	Adopted Levels, Gammas	18	$^{150}\text{Sm}(\text{d}, \text{t})$		290
	$^{149}\text{Ba} \beta^-$ decay (352 ms)	22	$^{150}\text{Sm}(^3\text{He}, \alpha)$		293
	^{248}Cm SF decay	25	$^{151}\text{Sm}(\text{p}, \text{t})$		295
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	$^{149}\text{La} \beta^-$ decay (1.091 s)	38	Coulomb excitation		298
	$^{150}\text{La} \beta^- \text{n}$ decay (0.51 s)	45	muonic atom		301
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	^{252}Cf SF decay	52		$^{149}\text{Gd} \varepsilon$ decay (9.28 d)	321
$^{149}_{59}\text{Pr}_{90}$	Adopted Levels, Gammas	56		$^{139}\text{La}(^{13}\text{C}, 3\text{n}\gamma)$	343
	$^{149}\text{Ce} \beta^-$ decay (5.12 s)	63		$^{145}\text{Nd}(^7\text{Li}, 3\text{n}\gamma), ^{146}\text{Nd}(^6\text{Li}, 3\text{n}\gamma)$	354
	$^{248}\text{Cm}, ^{252}\text{Cf}$ SF decay	67		$^{148}\text{Sm}(\text{p}, \text{p}), (\text{p}, \text{p}'), (\text{p}, \text{n})$ IAR	357
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$^{149}_{60}\text{Nd}_{89}$	Adopted Levels, Gammas	76		$^{149}\text{Sm}(\text{d}, 2\text{n}\gamma)$	360
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	^{252}Cf SF decay	103		$^{150}\text{Sm}(\text{p}, 2\text{n}\gamma)$	365
	$^{148}\text{Nd}(\text{n}, \gamma)$ E=th	106		$^{150}\text{Sm}(\text{d}, 3\text{n}\gamma)$	368
	$^{148}\text{Nd}(\text{n}, \gamma), (\text{n}, \text{n}): \text{resonances}$	116		$^{152}\text{Sm}(\text{p}, 4\text{n}\gamma)$	371
	$^{148}\text{Nd}(\text{d}, \text{p})$	119		$^{151}\text{Eu}(\text{p}, \text{t})$	376
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	$^{150}\text{Nd}(\text{p}, \text{d})$	123		$^{149}\text{Tb} \varepsilon$ decay (4.12 h)	427
	$^{150}\text{Nd}(\text{pol d}, \text{t}), (\text{d}, \text{t})$	124		$^{149}\text{Tb} \varepsilon$ decay (4.17 min)	452
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	$^{150}\text{Sm}(\mu^-, \text{p}\gamma)$	133		$^{147}\text{Sm}(\alpha, 2\text{n}\gamma)$	488
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$^{149}_{61}\text{Pm}_{88}$	Adopted Levels, Gammas	137	$^{149}_{65}\text{Tb}_{84}$	Adopted Levels, Gammas	497
	$^{149}\text{Nd} \beta^-$ decay (1.726 h)	159		$^{149}\text{Dy} \varepsilon$ decay (4.2 min)	533
	$^{148}\text{Nd}(^3\text{He}, \text{d})$	189		$^{149}\text{Dy} \varepsilon$ decay (0.490 s)	560
	$^{148}\text{Nd}(\alpha, \text{t})$	191		$^{153}\text{Ho} \alpha$ decay (2.01 min)	562
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	$^{150}\text{Nd}(\text{d}, 3\text{n}\gamma)$	199		$^{122}\text{Sn}(^{31}\text{P}, 4\text{n}\gamma)$	564
	$^{150}\text{Sm}(\mu^-, \text{n}\gamma)$	207		$^{128}\text{Te}(^{27}\text{Al}, 6\text{n}\gamma): \text{SD}$	572
	$^{150}\text{Sm}(\text{d}, ^3\text{He})$	209		$^{142}\text{Nd}(^{10}\text{B}, 3\text{n}\gamma)$	579
	$^{150}\text{Sm}(\text{pol t}, \alpha)$	210		$^{144}\text{Sm}(^7\text{Li}, 2\text{n}\gamma)$	584
	$^{152}\text{Sm}(\text{p}, \alpha)$	211		$^{151}\text{Eu}(\alpha, 6\text{n}\gamma)$	591
$^{149}_{62}\text{Sm}_{87}$	Adopted Levels, Gammas	212		$^{148}\text{Gd}(^3\text{He}, \text{d})$	595
	$^{149}\text{Pm} \beta^-$ decay (53.08 h)	237	$^{149}_{66}\text{Dy}_{83}$	Adopted Levels, Gammas	596
	$^{149}\text{Eu} \varepsilon$ decay (93.1 d)	243		$^{149}\text{Ho} \varepsilon$ decay (21.0 s)	607
	$^{146}\text{Nd}(\alpha, \text{n}\gamma)$	251		$^{149}\text{Ho} \varepsilon$ decay (56 s)	622
	$^{148}\text{Nd}(\alpha, 3\text{n}\gamma), ^{150}\text{Nd}(^3\text{He}, 4\text{n}\gamma)$	257		^{149}Dy IT decay (0.490 s)	625
	$^{148}\text{Sm}(\text{n}, \gamma)$ E=thermal	276		$^{153}\text{Er} \alpha$ decay (37.1 s)	628
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	$^{148}\text{Sm}(\text{d}, \text{p})$	278		$^{122}\text{Sn}(^{32}\text{S}, 5\text{n}\gamma)$	632
				$^{136}\text{Ce}(^{16}\text{O}, 3\text{n}\gamma)$	637
				$^{141}\text{Pr}(^{16}\text{O}, \text{p}7\text{n}\gamma)$	640
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			$^{149}_{67}\text{Ho}_{82}$	Adopted Levels, Gammas	648
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^{149}Er ε decay (4 s)	660	^{149}Er IT decay (9.6 s)	692
^{149}Er ε decay (9.6 s)	662	$^{92}\text{Mo}(^{60}\text{Ni},2\text{pn}\gamma)$	694
^{150}Tm εp decay:mixed	674	$^{149}_{69}\text{Tm}_{80}$	697
^{153}Tm α decay (1.48 s)	677	Adopted Levels	697
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$^{112}\text{Sn}(^{40}\text{Ar},\text{p}2\text{n}\gamma)$	681	Adopted Levels	698
$^{121}\text{Sb}(^{32}\text{S},4\text{n}\gamma),^{106}\text{Pd}(^{50}\text{Ti},\text{p}6\text{n}\gamma)\dots$	685	^{150}Lu p decay (45 ms)	699
$^{149}_{68}\text{Er}_{81}$	687	^{150}Lu p decay (43 μs)	700
Adopted Levels, Gammas	687	$^{149}_{71}\text{Lu}_{78}$	701
^{149}Tm ε decay (0.9 s)	690	Adopted Levels	701
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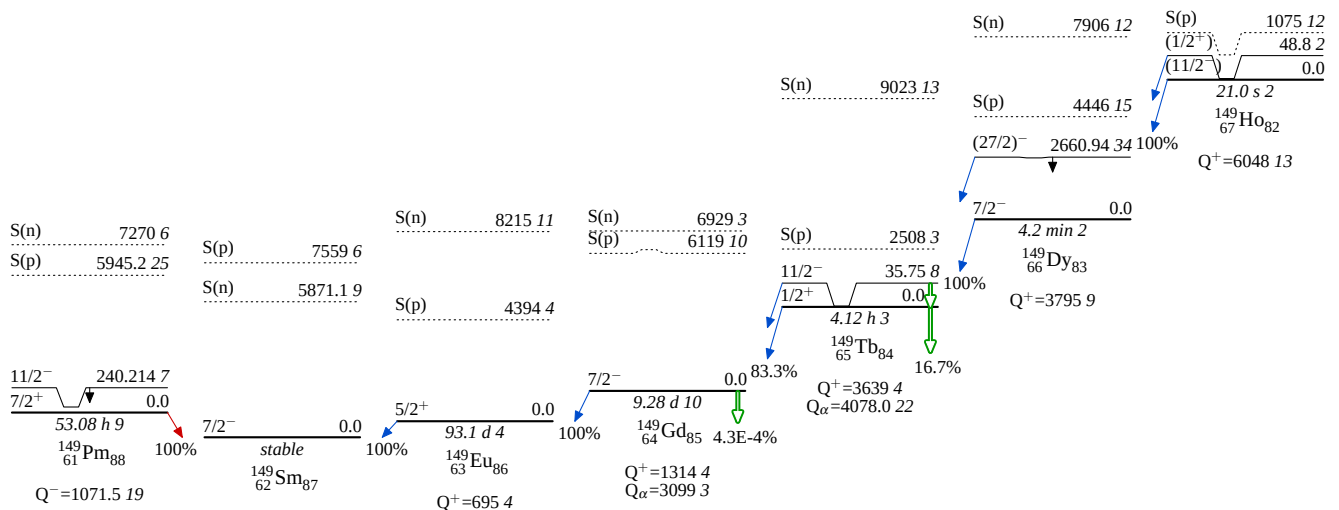
Skeleton Scheme for A=149



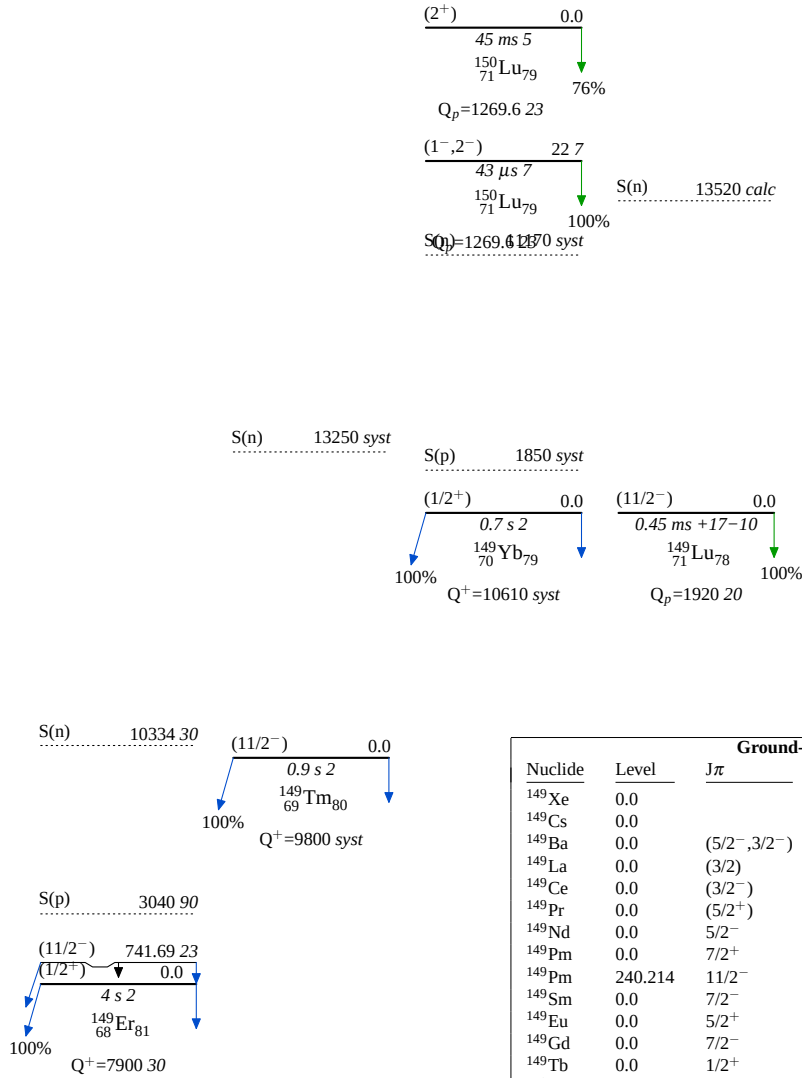
Skeleton Scheme for A=149 (continued)



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Skeleton Scheme for A=149 (continued)



Ground-State and Isomeric-Level Properties				
Nuclide	Level	J π	T _{1/2}	Decay Mode
¹⁴⁹ Xe	0.0			%β ⁻ =100; %β ⁻ n=?; %β ⁻ 2n=?
¹⁴⁹ Cs	0.0		107 ms 6	%β ⁻ =100; %β ⁻ n=25 4
¹⁴⁹ Ba	0.0	(5/2 ⁻ , 3/2 ⁻)	352 ms 6	%β ⁻ =100; %β ⁻ n=2.2 17
¹⁴⁹ La	0.0	(3/2)	1.091 s 34	%β ⁻ =100; %β ⁻ n=1.41 34
¹⁴⁹ Ce	0.0	(3/2 ⁻)	5.12 s 25	%β ⁻ =100
¹⁴⁹ Pr	0.0	(5/2 ⁺)	2.26 min 8	%β ⁻ =100
¹⁴⁹ Nd	0.0	5/2 ⁻	1.726 h 5	%β ⁻ =100
¹⁴⁹ Pm	0.0	7/2 ⁺	53.08 h 9	%β ⁻ =100
¹⁴⁹ Pm	240.214	11/2 ⁻	35 μs 3	%IT=100
¹⁴⁹ Sm	0.0	7/2 ⁻	stable	
¹⁴⁹ Eu	0.0	5/2 ⁺	93.1 d 4	%ε=100
¹⁴⁹ Gd	0.0	7/2 ⁻	9.28 d 10	%ε+%β ⁺ =100; %α=4.3×10 ⁻⁴ 10
¹⁴⁹ Tb	0.0	1/2 ⁺	4.12 h 3	%ε+%β ⁺ =83.3 17; %α=16.7 17
¹⁴⁹ Tb	35.75	11/2 ⁻	4.17 min 5	%ε+%β ⁺ =99.978 4; %α=0.022 4
¹⁴⁹ Dy	0.0	7/2 ⁻	4.2 min 2	%ε+%β ⁺ =100
¹⁴⁹ Dy	2660.94	(27/2) ⁻	0.490 s 15	%IT=99.3 3; %ε+%β ⁺ =0.7 3
¹⁴⁹ Ho	0.0	(11/2 ⁻)	21.0 s 2	%ε+%β ⁺ =100
¹⁴⁹ Ho	48.8	(1/2 ⁺)	56 s 3	%ε+%β ⁺ =100
¹⁴⁹ Er	0.0	(1/2 ⁺)	4 s 2	%ε+%β ⁺ =100; %εp=7 2
¹⁴⁹ Er	741.69	(11/2 ⁻)	9.6 s 6	%ε+%β ⁺ =96.5 7; %IT=3.5 7; %εp=0.18 7
¹⁴⁹ Tm	0.0	(11/2 ⁻)	0.9 s 2	%ε+%β ⁺ =100; %εp=0.2 +2-1
¹⁴⁹ Yb	0.0	(1/2 ⁺)	0.7 s 2	%ε+%β ⁺ =100; %εp>0
¹⁴⁹ Lu	0.0	(11/2 ⁻)	0.45 ms +17-10	%p=100
¹⁵⁰ Cs	0.0		81 ms 3	%β ⁻ n=20 10
¹⁵⁰ La	0.0	(3 ⁺)	0.51 s 2	%β ⁻ n=2.69 34
¹⁵³ Dy	0.0	7/2 ⁽⁻⁾	6.4 h 1	%α=0.0094 14
¹⁵³ Ho	0.0	11/2 ⁻	2.01 min 3	%α=0.051 25
¹⁵³ Ho	68.7	1/2 ⁺	9.3 min 5	%α=0.18 8
¹⁵³ Er	0.0	(7/2 ⁻)	37.1 s 2	%α=53 3
¹⁵⁰ Tm	0+x	(1 ⁺)		%εp=1.2 3
¹⁵³ Tm	0.0	(11/2 ⁻)	1.48 s 1	%α=91 3
¹⁵³ Tm	43.2	(1/2 ⁺)	2.5 s 2	%α=92 3
¹⁵⁰ Lu	0.0	(2 ⁺)	45 ms 5	%p=76 12
¹⁵⁰ Lu	22	(1 ⁻ , 2 ⁻)	43 μs 7	%p=100

Adopted Levels

$Q(\beta^-)=10300$ syst; $S(n)=2420$ syst; $S(p)=15230$ calc; $Q(\alpha)=-5420$ syst [2021Wa16,2019Mo01](#)

Estimated uncertainties ([2021Wa16](#)): $\Delta Q(\beta^-)=500$, $\Delta S(n)=\Delta Q(\alpha)=420$.

All values are from [2021Wa16](#), except $S(p)$, which is from [2019Mo01](#).

$S(2n)=6740$ 360, $Q(\beta^-n)=5840$ 300 (syst, [2021Wa16](#)). $S(2p)=28860$ ([2019Mo01](#),theory). $Q(\beta^-2n)=2780$ 300 (syst) deduced by evaluators from mass excesses in [2021Wa16](#).

[2018Sh11](#): ^{149}Xe nuclide produced and identified at the RIBF-RIKEN facility using the $^9\text{Be}(^{238}\text{U},\text{F})$ reaction with a $^{238}\text{U}^{86+}$ beam of $E=345$ MeV/nucleon produced by the RIBF accelerator complex. Target= ^9Be with a thickness of 2.92 mm. Nuclidic identification (PID) was made by determining the atomic number Z and mass-to-charge (A/Q) ratio of the ions using magnetic rigidity, time-of-flight, and energy loss (tof- $B\rho$ - ΔE method) using the BigRIPS fragment separator. The time-of-flight was measured using thin plastic scintillators placed at foci of the BigRIPS. The $B\rho$ values were deduced from trajectory reconstruction of measured position and angle of fragments at each focus using parallel plate avalanche counters (PPACs). The ΔE values were measured using multisampling ionization chambers (MUSICs). Two HPGe clovers were used for isomer tagging by detecting delayed gamma rays from known μs isomers in fission fragments. The separated ions were then transported to the EURICA setup, where decay measurements were made through the ZeroDegree spectrometer. Comparison of measured cross sections with theoretical calculations using LISE⁺ abrasion-fission (AF) model.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for two references dealing with nuclear structure theory.

 ^{149}Xe Levels

E(level)	Comments
0	$\% \beta^- = 100$; $\% \beta^- n = ?$; $\% \beta^- 2n = ?$ Theoretical $T_{1/2}=46.8$ ms, $\% \beta^- n=13$, $\% \beta^- 2n=0$ (2019Mo01). Theoretical $T_{1/2}=34.9$ ms, $\% \beta^- n=15.3$, 15.2, $\% \beta^- 2n=0.3$, 0.4 for different fission barriers (2021Mi17). E(level): it is assumed that the observed events correspond to ground-state activity. J^π: $\Omega(n)=5/2$ in theoretical calculations of 2019Mo01. $T_{1/2}$: lower limit from time-of-flight of 550 ns given in 2018Fu08. Actual half-life is expected to be much longer as suggested by the theoretical values of 46.8 ms (2019Mo01) and 34.9 ms (2021Mi17). From a general decreasing trend of half-lives with increasing neutron number in neutron-rich nuclei, $T_{1/2}$ for ^{149}Xe is expected to be <150 ms, based on measured half-lives of 188 ms for ^{145}Xe, 146 ms for ^{146}Xe, and 0.10 s for ^{147}Xe, as adopted in the corresponding Adopted Levels in the ENSDF database. Only β^- decay mode is expected, followed by delayed-neutron decay. A total of 15 counts were assigned to ^{149}Xe, for spectrometer setting on Te. Probability of misidentification of this isotope is $<0.01\%$ (2018Sh11). Production $\sigma=2.4$ pb for Te setting, with 30% systematic uncertainty for σ value.

Adopted Levels

$Q(\beta^-)=9530$ syst; $S(n)=4460$ syst; $S(p)=11940$ syst; $Q(\alpha)=-4590$ syst [2021Wa16](#)

Estimated uncertainties ([2021Wa16](#)): $\Delta Q(\beta^-)=400$, $\Delta S(n)=400$, $\Delta S(p)=500$, $\Delta Q(\alpha)=640$.

$S(2n)=7520$ 400, $S(2p)=26680$ 500, $Q(\beta^-n)=6170$ 400 (syst, [2021Wa16](#)).

[1987Ra12](#): Yield of ^{149}Cs is reported as 10^5 atoms/s in U(p,X) E=600 MeV reaction using ISOLDE On-Line Mass Separator.

[2000KoZH](#): ISOLDE On-Line Mass Separator. Measured E_γ , I_γ , E_n , I_n ; deduced $T_{1/2}$, nuclear magnetic moments, β -delayed neutron emission probabilities.

[2017Wu04](#): The ^{149}Cs nuclide was produced at the RIBF-RIKEN facility using the $^9\text{Be}(^{238}\text{U},\text{F})$ reaction at E=345 MeV/nucleon.

Two experiments, optimized for the transmission of ^{158}Nd and ^{170}Dy ions, were carried out with average beam intensities of 7 pA and 12 pA, respectively. The identification of the nuclide of interest was made in the BigRIPS separator by determining the atomic number and the mass-to-charge ratio of the ion using the tof-B ρ - ΔE method. The reaction products were transported through the ZeroDegree Spectrometer and implanted into the beta-counting system WAS3ABi that was surrounded by the EURICA array comprising of 84 HPGe detectors. The typical implantation rate was ≈ 100 ions/s. Measured (implanted ions) β^- , (implanted ions) β^- - γ and (implanted ions) γ correlations. Deduced half-life of the decay of ^{149}Cs g.s.

[2017Li06](#): ^{149}Cs produced at ISOLDE-CERN facility through U(p,X) reaction with E(p)=1.4 GeV beam from the PS-Booster incident on UC_x target. Measured yield, E_γ , I_γ , $\beta\gamma$ -coin, half-life of ground state of ^{149}Cs isotope from γ -decay curves using plastic scintillation detectors for β particles, LaBr₃(Ce) and HPGe clover detectors for γ detection.

[2018Sh11](#): ^{149}Cs produced at the RIBF-RIKEN facility using $^9\text{Be}(^{238}\text{U},\text{F})$ reaction with $^{238}\text{U}^{86+}$ beam of E=345 MeV/nucleon.

Comparison of measured cross sections with theoretical calculations using LISE⁺ abrasion-fission (AF) model.

[2020Wu04](#): ^{149}Cs nuclide produced at the RIBF-RIKEN facility in $^9\text{Be}(^{238}\text{U},\text{F})$ reaction at E=345 MeV/nucleon and an intensity of 5 pA. Identification of fission fragments of interest was made based ON time-of-flight (tof), magnetic rigidity (B ρ), and energy loss (ΔE) using the BigRIPS spectrometer, determining atomic Z and mass-to-charge ratio A/Q, where Q=charge state of the ions. The separated nuclei were implanted at a rate of 100 ions/s in the beta counting system of the Wide range Active Silicon-Strip Stopper Array for Beta and ion detection (WAS3ABi), which included a stack of five Double Sided Silicon Strip Detectors (DSSSDs). The WAS3ABi setup was surrounded by Euroball Riken Cluster Array (EURICA) array of 84 HPGe detectors for γ detection. Half-life of the separated and implanted ions was determined by fitting the time distribution of β (implants)- and/or $\beta\gamma$ (implants)-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β -delayed neutron daughter and grand-daughter nuclei, and a constant background. Comparison of measured half-lives with FRDM+QRPA (2003), FRDM+QRPA (2019), KTUY+GT2, RHB+pn-RQRPA, and DF+CQRPA theoretical calculations.

^{150}Xe isotope has been identified by [2018Sh11](#) at RIKEN, but its decay characteristics through β^- and β^-n , populating ^{150}Cs and ^{149}Cs , respectively are unknown.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for two references dealing with nuclear structure theory.

 ^{149}Cs Levels

E(level)	$T_{1/2}$	Comments
0	107 ms 6	$\% \beta^- = 100$; $\% \beta^-n = 25$ 4 (2017Li06) Theoretical $T_{1/2} = 113$ ms, $\% \beta^-n = 57$ (2019Mo01). Theoretical $T_{1/2} = 73.1$ ms, $\% \beta^-n = 33.7$ and 27.8 for different fission barriers (2021Mi17). E(level): it is assumed that the observed events correspond to the ground-state activity of ^{149}Cs. J^π: $3/2^+$ from systematic trend (2021Ko07). $\Omega(p) = 3/2^+$ (2019Mo01, theory). $T_{1/2}$: unweighted average of 113 MS 6 (2020Wu04, (implanted ions)$\beta\gamma$-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β^-n daughter and grand-daughter nuclei, and a constant background at RIBF-RIKEN); 113 ms 8 (2017Wu04) from (implanted ions)β^--correlated decay curve at RIBF-RIKEN; group and laboratory); 84 ms 2 (2017Li06, γ-decay at ISOLDE-CERN), 112 ms 3 from β^-n decay and 114 ms 16 from $\beta^-n\gamma$ decay (2000KoZH, ISOLDE-CERN). only the β^- decay mode is expected, and has been observed. $\% \beta^-n$ deduced by 2017Li06 from the ratio of number of ^{148}Ba ^{149}Cs nuclei using absolute γ-ray intensities in ^{149}Ba, ^{148}La and ^{148}Cs, the latter two from β^-n decay modes. Production $\sigma = 33.7$ nb for Te setting, with 30% systematic uncertainty (2018Sh11). Measured yield of $^{149}\text{Cs} = 100$ ions/μC (2017Li06).

Adopted Levels, Gammas

$Q(\beta^-)=7.39\times 10^3$ 20; $S(n)=3357.0$ 29; $S(p)=13209$ 13; $Q(\alpha)=-3762$ 11 2021Wa16

$S(2n)=8709$ 20, $S(2p)=25010$ 200 (syst), $Q(\beta^-n)=1807$ 20 (2021Wa16).

Isotopic assignment: 1986ReZU, 1987MaZY, 1993Ru01, 2017Wu04.

2016Kn03: measurement of mass excess of ¹⁴⁹Ba g.s. using FRS-ESR-facility at GSI.

2017Wu04: The ¹⁴⁹Ba nuclide was produced at the RIBF-RIKEN facility using the ⁹Be(²³⁸U,F) reaction at E=345 MeV/nucleon.

Two experiments, optimized for the transmission of ¹⁵⁸Nd and ¹⁷⁰Dy ions, were carried out with average beam intensities of 7 pnA and 12 pnA, respectively. The identification of the nuclide of interest was made in the BigRIPS separator by determining the atomic number and the mass-to-charge ratio of the ion using the tof-Bρ-ΔE method. The reaction products were transported through the ZeroDegree Spectrometer and implanted into the beta-counting system WAS3ABi that was surrounded by the EURICA array comprising of 84 HPGe detectors. The typical implantation rate was 100 ions/s. Measured: implanted ion-β⁻-t, implanted ion-β⁻-γ-t and implanted ions-γ-t correlations. Deduced: T_{1/2}.

2020Wu04: ¹⁴⁹Ba nuclide produced at the RIBF-RIKEN facility in ⁹Be(²³⁸U,F) reaction at E=345 MeV/nucleon and an intensity of 5pnA. Identification of fission fragments of interest was made based on time-of-flight (tof), magnetic rigidity (Bρ), and energy loss (ΔE) using the BigRIPS spectrometer, determining atomic Z and mass-to-charge ratio A/Q, where Q=charge state of the ions. The separated nuclei were implanted at a rate of 100 ions/s in the beta counting system of the Wide range Active Silicon-Strip Stopper Array for Beta and ion detection (WAS3ABi), which included a stack of five Double Sided Silicon Strip Detectors (DSSSDs). The WAS3ABi setup was surrounded by Euroball Riken Cluster Array (EURICA) array of 84 HPGe detectors for γ detection. Half-life of the separated and implanted ions was determined by fitting the time distribution of β(implants)- and/or βγ(implants)-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β-delayed neutron daughter and grand-daughter nuclei, and a constant background. Comparison of measured half-lives with FRDM+QRPA (2003), FRDM+QRPA (2019), KTUY+GT2, RHB+pn-RQRPA, and DF+CQRPA theoretical calculations.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for three references dealing with nuclear structure theory.

¹⁴⁹Ba Levels

Cross Reference (XREF) Flags

- A** ¹⁴⁹Cs β⁻ decay (107 ms)
B ¹⁵⁰Cs β⁻n decay (81 ms)

E(level) [†]	J ^π	T _{1/2} [‡]	XREF	Comments
0.0	(5/2 ⁻ ,3/2 ⁻)	352 ms 6	AB	%β⁻=100; %β⁻n=2.2 17 (1993Ru01,1986ReZU) %β⁻n is unweighted average of 3.9% 12 (1993Ru01) and 0.58 8 (1986ReZU, previous value was 0.43 12 in 1986Wa17). Theoretical T_{1/2}=272 ms, %β⁻n=0 (2019Mo01). Theoretical T_{1/2}=177 ms, %β⁻n=1.26 and 1.38 for different fission barriers (2021Mi17). J^π: 5/2⁻ proposed by 2017Li06, based on comparison with J^π=(5/2⁻) for ¹⁴⁷Ba g.s., but authors mention that 3/2⁻ is also possible, as 2005Sy01 assigned 3/2⁻ for g.s. of ¹⁴⁷Ba Others: 3/2⁻ from systematic trend (2021Ko07), and Ω(n)=3/2⁻ (2019Mo01, theory). T_{1/2}: weighted average of 368 ms 19 (2020Wu04, (implanted ions)β-correlated decay curves to the sum of activities of parent nuclei, daughter nuclei, grand-daughter nuclei, β⁻n daughter and grand-daughter nuclei, and a constant background); 352 ms 6 (2017Wu04, implanted ion-β⁻-t spectrum using the least-squares and maximum-likelihood methods); 324 ms 18 (1993Ru01); and 356 ms 8 (1986ReZU, neutron timing, previous value was 346 ms 6 in 1986Wa17). Other: 0.4 s (γ timing,1987MaZY).
46.87 10	(1/2 to 7/2)[-]	0.6 ns 2	A	J ^π : γ to (5/2 ⁻ ,3/2 ⁻) g.s.
68.19 9	(1/2 to 7/2)[-]	0.6 ns 5	A	J ^π : γ to (5/2 ⁻ ,3/2 ⁻) g.s.
124.93 13			A	
164.79 20	(1/2 to 7/2)(⁺)		A	J ^π : (E1) γ to (5/2 ⁻ ,3/2 ⁻) g.s.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Ba Levels (continued)

<u>E(level)[†]</u>	<u>XREF</u>	<u>E(level)[†]</u>	<u>XREF</u>	<u>E(level)[†]</u>	<u>XREF</u>
236.45 10	A	362.29 23	A	665.33 9	A
279.27 12	A	389.64 13	A	682.56 17	A
282.73 10	AB	481.83 25	A	727.05 16	A
316.56 9	AB	488.05 10	A	911.3 21	A
				917.7 4	A

[†] From a least-squares fit to E_γ values. Uncertainties of 205.9 γ and 487.7 γ were doubled to 0.24 and 0.22 keV, respectively to obtain a better fit for the 488-keV level.

[‡] From $\beta\gamma(t)$ in ^{149}Cs β^- decay (2017Li06), except where noted.

 $\gamma(^{149}\text{Ba})$

<u>$E_i(\text{level})$</u>	<u>J_i^π</u>	<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.</u>	<u>$\alpha^{\#}$</u>	<u>Comments</u>
46.87	(1/2 to 7/2) ^[-]	46.80 18	100	0.0	(5/2 ⁻ , 3/2 ⁻)	[M1] [‡]	8.87 16	B(M1)(W.u.)=0.036 +18-9
68.19	(1/2 to 7/2) ^[-]	68.10 13	100	0.0	(5/2 ⁻ , 3/2 ⁻)	[M1] [‡]	2.98 4	B(M1)(W.u.)=0.029 +34-14
124.93		78.20 13	100 26	46.87	(1/2 to 7/2) ^[-]			
		124.70 23	77 11	0.0	(5/2 ⁻ , 3/2 ⁻)			
164.79	(1/2 to 7/2) ⁽⁺⁾	96.60 18	100	68.19	(1/2 to 7/2) ^[-]	(E1)	0.250 4	Mult.: from lack of observation of Ba X-rays in coincidence with the 68.1 γ .
236.45		168.10 11	100 13	68.19	(1/2 to 7/2) ^[-]			
		189.50 30	41 6	46.87	(1/2 to 7/2) ^[-]			
		236.70 13	24 7	0.0	(5/2 ⁻ , 3/2 ⁻)			
279.27		211.20 11	100 14	68.19	(1/2 to 7/2) ^[-]			
		279.00 17	57 8	0.0	(5/2 ⁻ , 3/2 ⁻)			
282.73		282.90 13	100	0.0	(5/2 ⁻ , 3/2 ⁻)			
316.56		248.20 46	5.3 10	68.19	(1/2 to 7/2) ^[-]			
		316.6 1	100 5	0.0	(5/2 ⁻ , 3/2 ⁻)			
362.29		294.10 21	100	68.19	(1/2 to 7/2) ^[-]			
389.64		342.90 19	100 15	46.87	(1/2 to 7/2) ^[-]			
		389.70 21	41 29	0.0	(5/2 ⁻ , 3/2 ⁻)			
481.83		356.90 21	100	124.93				
488.05		171.60 13	100 6	316.56				
		205.90 12	50 4	282.73				
		363.30 21	26 8	124.93				
		441.00 12	56 5	46.87	(1/2 to 7/2) ^[-]			
		487.70 11	100 7	0.0	(5/2 ⁻ , 3/2 ⁻)			
665.33		275.90 21	21 3	389.64				
		348.60 24	26 4	316.56				
		382.60 11	92 5	282.73				
		665.30 11	100 6	0.0	(5/2 ⁻ , 3/2 ⁻)			
682.56		366.00 14	100	316.56				
727.05		490.60 13	100	236.45				
911.3		594.7 21	100	316.56				
917.7		601.10 32	100	316.56				

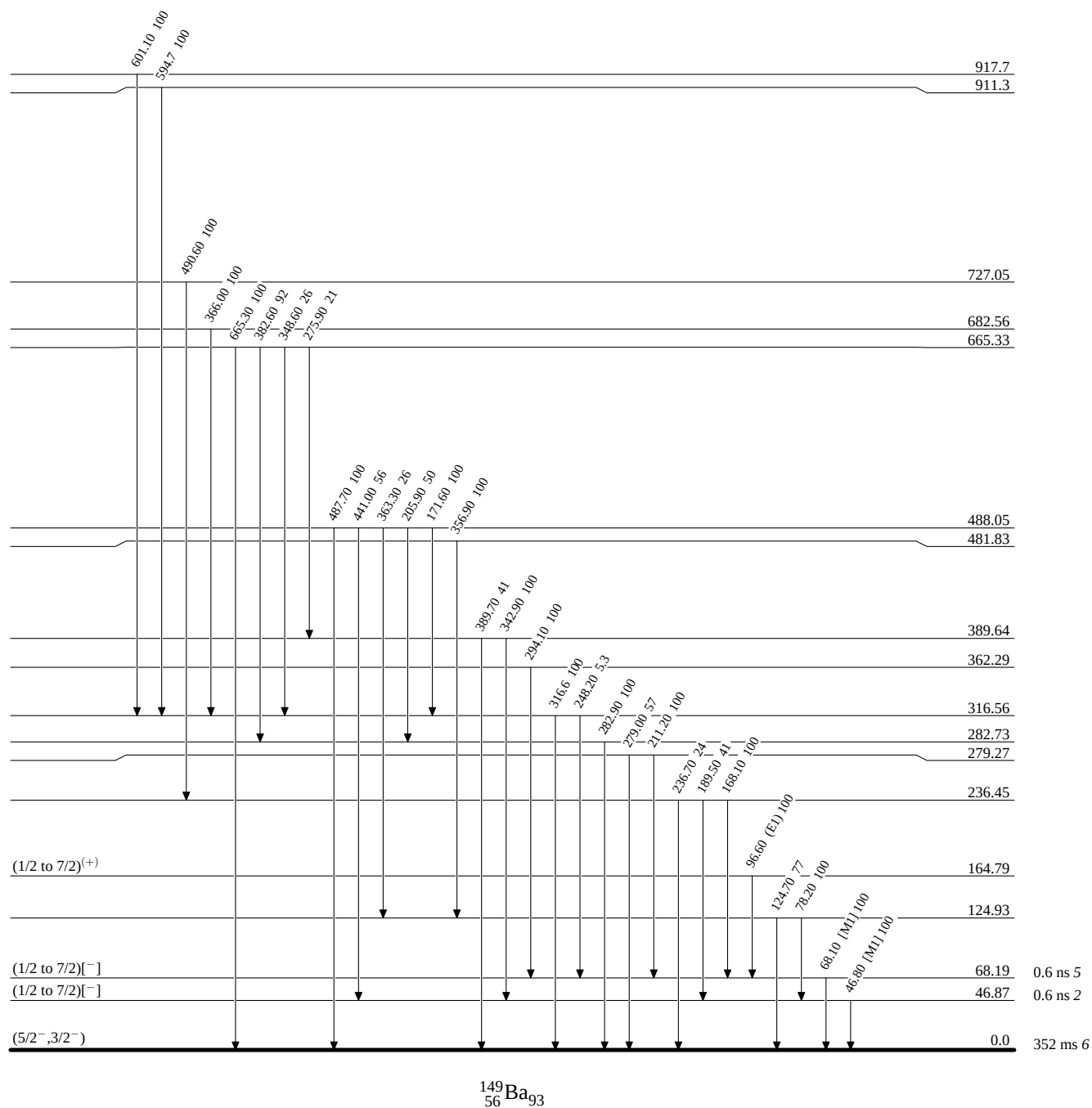
[†] From ^{149}Cs β^- decay (2017Li06).

[‡] From analogy with ^{147}Ba structure. Pure E2 is not allowed by RUL.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

Adopted Levels, GammasLevel Scheme

Intensities: Relative photon branching from each level



^{149}Cs β^- decay (107 ms) 2017Li06

Parent: ^{149}Cs : $E=0$; $T_{1/2}=107$ ms 6; $Q(\beta^-)=953\times 10^1$ syst; $\% \beta^-$ decay=100

^{149}Cs - $T_{1/2}$: From ^{149}Cs Adopted Levels.

^{149}Cs - $Q(\beta^-)$: 9530 400 (syst, 2021Wa16).

^{149}Cs - $\% \beta^-$ decay: $\% \beta^- n=25$ 4 (2017Li06, from the ratio of number of ^{148}Ba and ^{149}Cs nuclei using absolute γ -ray intensities in ^{149}Ba , ^{148}La and ^{148}Cs , the latter two from $\beta^- n$ decay modes).

2017Li06: ^{149}Cs produced at ISOLDE-CERN facility through $\text{U}(p,X)$ reaction with $E(p)=1.4$ GeV beam from the PS-Booster incident on UC_x target. Measured yield, $E\gamma$, $I\gamma$, $\beta\gamma$ -coin, $\gamma\gamma$ -coin, half-life of ground state of ^{149}Cs isotope from γ -decay curves using plastic scintillation detectors for β particles, two $\text{LaBr}_3(\text{Ce})$ and four HPGe clover detectors for γ detection. Deduced levels, β feedings.

Total decay energy deposit of 7.38 MeV 50 calculated by RADLIST code is lower than the systematics value of 9.53 MeV (2021Wa16), which indicates the incompleteness of the decay scheme.

 ^{149}Ba Levels

E(level) [†]	J^π [‡]	$T_{1/2}$ [#]	Comments
0.0	(5/2 ⁻ , 3/2 ⁻)	352 ms 6	J^π : 5/2 ⁻ proposed by 2017Li06 based on comparison with $J^\pi=(5/2^-)$ for ^{147}Ba g.s., but mention that 3/2 ⁻ is also possible, as 2005Sy01 assigned 3/2 ⁻ for g.s. of ^{147}Ba . $T_{1/2}$: from the Adopted Levels.
46.87 10	(1/2 to 7/2)[-]	0.6 ns 2	
68.19 9	(1/2 to 7/2)[-]	0.6 ns 5	
124.93 13			
164.79 20	(1/2 to 7/2)(⁺)		
236.45 10			
279.27 12			
282.73 10			
316.56 9			
362.29 23			
389.64 13			
481.83 25			
488.05 10			
665.33 9			
682.56 17			
727.05 16			
911.3 21			
917.7 4			
3357.0+x			$S(n)(^{149}\text{Ba})=3357.0$ 29 (2021Wa16). $x<[Q(\beta^-)-S(n)]$ i.e. $x<6173$ 300. This represents a range of unobserved levels that subsequently decay to ^{148}Ba via one-neutron emission.

[†] From a least-squares fit to $E\gamma$ values. Uncertainties of 205.9 γ and 487.7 γ were doubled to 0.24 and 0.22 keV, respectively to obtain a better fit for the 488-keV level.

[‡] From the Adopted Levels.

[#] From $\beta\gamma(t)$ (2017Li06) for excited states. Values are adopted in the Adopted Levels.

 β^- radiations

E(decay)	E(level)	$I\beta^-$ ^{†#}	Log $f t$ [‡]	Comments
(3087 ^{&} syst)	3357.0+x	25 4		$I\beta^-$: $\% \beta^- n=25$ 4 (2017Li06, from the ratio of number of ^{148}Ba and ^{149}Cs nuclei using absolute γ -ray intensities in ^{149}Ba , ^{148}La and ^{148}Cs , the latter two from $\beta^- n$ decay modes.
(8612 syst)	917.7	0.58 12	6.7	

Continued on next page (footnotes at end of table)

^{149}Cs β^- decay (107 ms) 2017Li06 (continued) β^- radiations (continued)

E(decay)	E(level)	$I\beta^-$ ^{†#}	Log ft [‡]	E(decay)	E(level)	$I\beta^-$ ^{†#}	Log ft [‡]
(8619 syst)	911.3	0.25 7	7.1	(9247 syst)	282.73	1.6 4	6.4
(8803 syst)	727.05	0.64 12	6.7	(9251 syst)	279.27	0.91 18	6.7
(8847 syst)	682.56	0.32 8	7.0	(9294 syst)	236.45	1.7 4	6.4
(8865 syst)	665.33	3.1 6	6.0	(9365 syst)	164.79	0.31 6	7.2
(9042 syst)	488.05	4.0 7	6.0	(9405 @ syst)	124.93	1.0 8	6.6
(9048 syst)	481.83	0.27 8	7.1	(9462 syst)	68.19	5.3 10	5.9
(9140 syst)	389.64	0.23 13	7.2	(9483 syst)	46.87	5.6 13	5.9
(9168 syst)	362.29	0.61 21	6.8	(9530 syst)	0.0	45 6	5.02 11
(9213 syst)	316.56	3.4 7	6.1				

[†] Deduced by evaluators from intensity balances and adopting $\% \beta^- n = 25.4$. All values, except for the 25% feeding to levels above the neutron-separation energy, should be treated as apparent i.e. as upper limits, since a significant contribution is expected from higher levels populated due to large $Q(\beta)$ values.

[‡] Deduced by evaluators using the log ft code. All values should be treated as lower limits. See comment for $I\beta^-$ feedings.

[#] Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

& Estimated for a range of levels.

 $\gamma(^{149}\text{Ba})$

I_γ normalization: From 2017Li06, based on normalizing total number of decays to the number of daughter nuclei ^{149}La and ^{149}Ce .

E_γ [†]	I_γ ^{†@}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	α ^{&}	Comments
46.80 18	14.0 5	46.87	(1/2 to 7/2) ^[-]	0.0	(5/2 ⁻ , 3/2 ⁻)	[M1] [#]	8.87 16	$\%I_\gamma = 0.84$ 14
68.10 13	35.8 11	68.19	(1/2 to 7/2) ^[-]	0.0	(5/2 ⁻ , 3/2 ⁻)	[M1] [#]	2.98 4	$\%I_\gamma = 2.1$ 4
78.20 13	5.3 14	124.93		46.87	(1/2 to 7/2) ^[-]	[D,E2]	2.6 21	$\%I_\gamma = 0.32$ 10
96.60 18	5.2 5	164.79	(1/2 to 7/2) ⁽⁺⁾	68.19	(1/2 to 7/2) ^[-]	(E1)	0.250 4	$\%I_\gamma = 0.31$ 3
Mult.: from lack of observation of Ba x-rays in coincidence with the 68.1 γ .								
^x 118.00 13	7.9 15							$\%I_\gamma = 0.47$ 12
E γ : its assignment to ^{149}Ba is from similar time behavior as for the other gamma rays, and even though there can be two possible locations (between 165 to 47 level and/or 283 to 165 levels) based on energy matching, the $\gamma\gamma$ -coincidence data do not permit such placement, thus kept as an unplaced γ ray, as per e-mail reply of July 4, 2017 from R. Lica to B. Singh, which mentioned that the coincidence data were reanalyzed for the 118 γ .								
124.70 23	4.1 6	124.93		0.0	(5/2 ⁻ , 3/2 ⁻)	[D,E2]	0.5 4	$\%I_\gamma = 0.25$ 5

Continued on next page (footnotes at end of table)

$^{149}\text{Cs} \beta^-$ decay (107 ms) **2017Li06** (continued) $\gamma(^{149}\text{Ba})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^{\dagger@}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\alpha^\&$	Comments
168.10 11	20.7 26	236.45		68.19	(1/2 to 7/2)[-]	[D,E2]	0.18 13	%I γ =1.24 26
171.60 13	20.8 13	488.05		316.56		[D,E2]	0.17 12	%I γ =1.25 22
189.50 30	8.5 13	236.45		46.87	(1/2 to 7/2)[-]	[D,E2]	0.12 8	%I γ =0.51 12
205.90 12	10.5 9	488.05		282.73				%I γ =0.63 12
211.20 11	9.6 13	279.27		68.19	(1/2 to 7/2)[-]			%I γ =0.58 12
236.70 13	5.0 14	236.45		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =0.30 10
248.20 46	5.3 10	316.56		68.19	(1/2 to 7/2)[-]			%I γ =0.32 8
275.90 21	4.4 6	665.33		389.64				%I γ =0.26 6
279.00 17	5.5 8	279.27		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =0.33 7
282.90 13	57.5 34	282.73		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =3.4 6
294.10 21	10.2 30	362.29		68.19	(1/2 to 7/2)[-]			%I γ =0.61 21
316.6 1	100.0 54	316.56		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =6.0 11
342.90 19	5.9 9	389.64		46.87	(1/2 to 7/2)[-]			%I γ =0.35 8
348.60 24	5.6 8	665.33		316.56				%I γ =0.34 7
356.90 21	4.5 10	481.83		124.93				%I γ =0.27 7
363.30 21	4.5 13	488.05		124.93				%I γ =0.27 9
366.00 14	5.3 10	682.56		316.56				%I γ =0.32 8
382.60 11	19.7 10	665.33		282.73				%I γ =1.18 21
389.70 21	2.4 17	389.64		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =0.14 10
441.00 12	9.8 9	488.05		46.87	(1/2 to 7/2)[-]			%I γ =0.59 11
487.70 11	17.4 12	488.05		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =1.04 19
490.60 13	10.7 9	727.05		236.45				%I γ =0.64 12
594.7 21	4.1 8	911.3		316.56				%I γ =0.25 6
E γ : value of 595.7 in level-scheme Fig. 7 of 2017Li06 seems a misprint, as the level-energy difference suggests. Value listed here is from e-mail reply from the authors.								
601.10 32	9.6 10	917.7		316.56				%I γ =0.58 11
665.30 11	21.4 13	665.33		0.0	(5/2 ⁻ ,3/2 ⁻)			%I γ =1.28 23

[†] From e-mail reply of April 18, 2017 from R. Lica to B. Singh.

[‡] Mult=[D,E2] assumed by evaluators to account for conversion coefficients.

From analogy with ^{147}Ba structure. Pure E2 is not allowed by RUL.

@ For absolute intensity per 100 decays, multiply by 0.06.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^x γ ray not placed in level scheme.

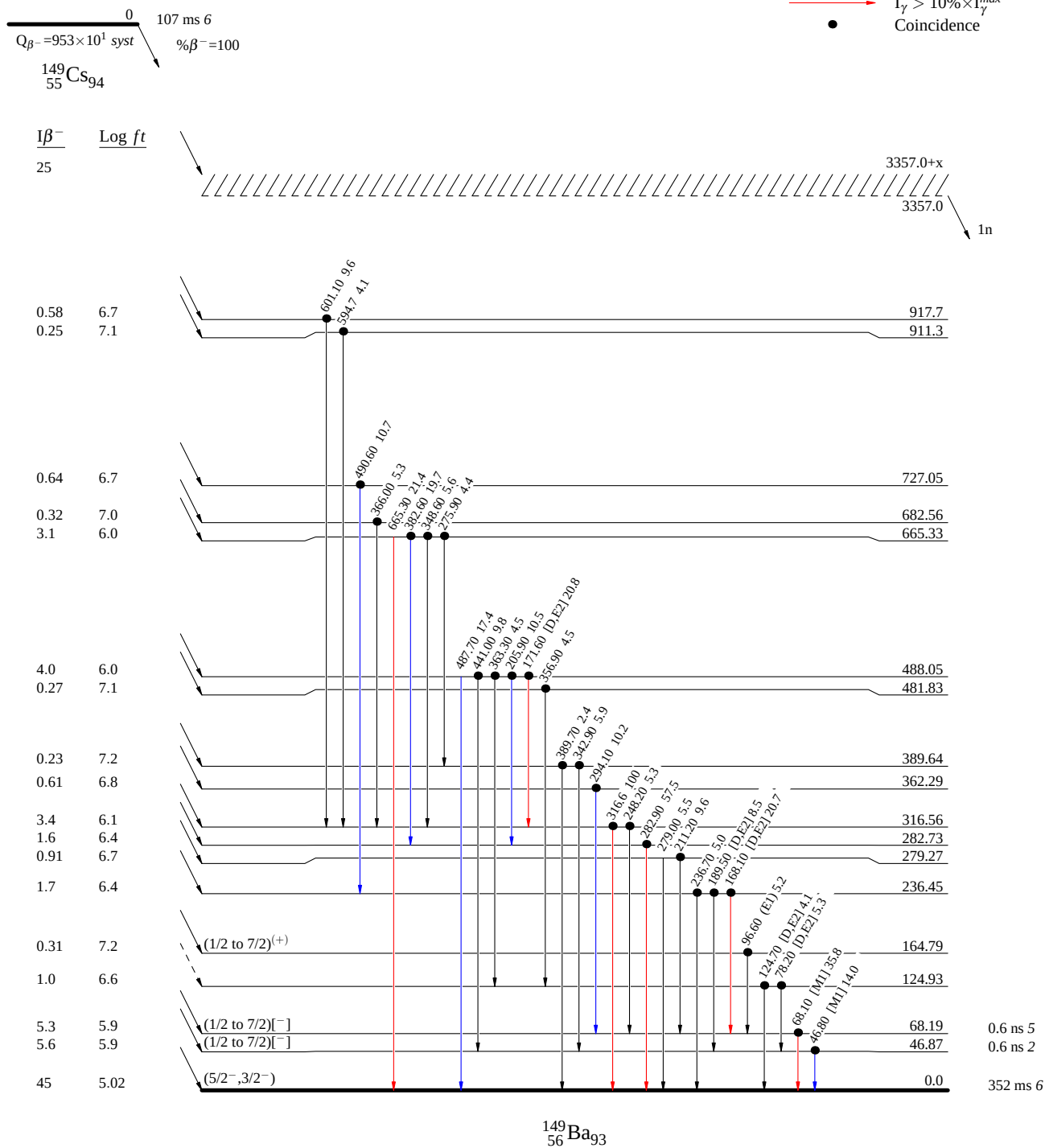
$^{149}\text{Cs} \beta^-$ decay (107 ms) 2017Li06

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\bullet$ Coincidence



$^{150}\text{Cs} \beta^- n$ decay (81 ms) 2018Li06

Parent: ^{150}Cs : $E=0$; $T_{1/2}=81$ ms 3; $Q(\beta^- n)=6590$ syst; $\% \beta^- n$ decay=20 10

$^{150}\text{Cs}-T_{1/2}$: Weighted average of 80 ms 3 (2018Li06, also 80 ms 4 in 2017Li06); 84.4 ms 82 (2017Wu04); 82 ms 7 (2000KoZH).

$^{150}\text{Cs}-Q(\beta^- n)$: 6590 400 (syst, 2021Wa16).

$^{150}\text{Cs}-\% \beta^- n$ decay: $\% \beta^- n=20$ 10 for ^{150}Cs decay (2000KoZH). Other: $\approx 44\%$, estimated by 2018Li06 from γ intensities.

2018Li06: ^{150}Cs produced at ISOLDE-CERN by fission of UC_x induced by the 1.4-GeV proton beam from PS Booster (PSB).

Measured E_γ , I_γ , $\beta\gamma$ and $\gamma\gamma$ -coin, half-lives of decay of ^{150}Cs g.s. The only information available about γ -ray data from $^{150}\text{Cs} \beta^- n$ decay to ^{149}Cs is observation of two γ rays of 282.9 and 316.6 keV displayed in $\beta\gamma$ -coin spectrum Fig. 5a, and brief discussion in text. These two γ rays are most strongly emitted in the decay of ^{149}Ba to ^{149}Cs .

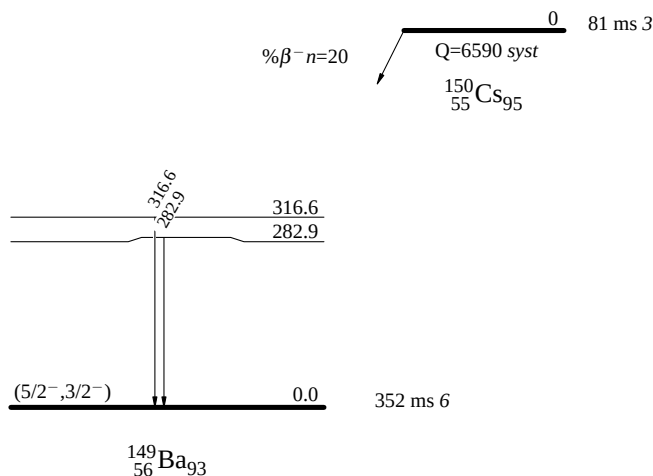
 ^{149}Ba Levels

E(level)	J^π	$T_{1/2}$	Comments
0.0	(5/2 ⁻ , 3/2 ⁻)	352 ms 6	$J^\pi, T_{1/2}$: from the Adopted Levels.
282.9			
316.6			

 $\gamma(^{149}\text{Ba})$

$E_\gamma^\dagger$	$E_i(\text{level})$	E_f	J_f^π	Comments
282.9	282.9	0.0	(5/2 ⁻ , 3/2 ⁻)	E_γ : read by evaluators from spectral Fig. 5a in 2018Li06.
316.6	316.6	0.0	(5/2 ⁻ , 3/2 ⁻)	E_γ : value is mentioned in the text by 2018Li06.

[†] From spectrum Fig. 5a and text in 2018Li06.

 $^{150}\text{Cs} \beta^- n$ decay (81 ms) 2018Li06Decay Scheme

Adopted Levels, Gammas

$Q(\beta^-)=6.45\times 10^3$ 20; $S(n)=5.58\times 10^3$ 20; $S(p)=9.96\times 10^3$ 20; $Q(\alpha)=-2.59\times 10^3$ 20 2021Wa16

$S(2n)=9680$ 200, $S(2p)=22880$ 200, $Q(\beta^-n)=2110$ 200 (2021Wa16).

^{149}La isotope produced through mass separation of fission fragments from $^{235}\text{U}(n,F)$ $E(n)=\text{thermal}$ (1979En02,1986ReZU,2002Sy01,2004Sy01). See also 2017Wu04, with isotope production in $^9\text{Be}(^{238}\text{U},F)$ reaction, followed by half-life measurement of ^{149}La decay.

Mass measurement using Penning-trap method: 2003SaZU.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for two references dealing with nuclear structure theory.

 ^{149}La LevelsCross Reference (XREF) Flags

A ^{149}Ba β^- decay (352 ms)
B ^{248}Cm SF decay

E(level) [†]	J^π [‡]	$T_{1/2}$	XREF	Comments
0.0	(3/2)	1.091 s 34	AB	$\% \beta^- = 100$; $\% \beta^- n = 1.41$ 34 XREF: B(?). J^π : from 2002Sy01, 2004Sy01 and 2007Ur03, based on suggested β feeding to 3/2, 5/2 levels in ^{149}Ce . $T_{1/2}$: weighted average of 1.11 s 4 (2017Wu04, implants- β correlated decay curve); 1.066 s 34 (1993Ru01, neutron decay curve); 1.10 s 3 (1986ReZU, neutron decay curve, earlier value of 1.04 s 4 in 1986Wa17); and 1.2 s 4 (1979En02, β timing). Other: 1.2 s (1987MaZY, γ timing). $\% \beta^- n$: unweighted average of 1.74 13 (1993Ru01) and 1.07 13 (1986ReZU, earlier value was 1.17 12 in 1986Wa17). Other: 1.46 29 (2002Pf04 compilation).
0+x [#]	(7/2 ⁻)		B	E(level): x<35 keV if 3/2 for g.s. and <20 keV if J=5/2 for g.s., estimated by 2007Ur03 from non-observation of a γ ray of this energy or enhanced intensity of x rays. J^π : possible 7/2 member of configuration= $\pi 3/2[402]$. J^π : 46.0 γ M1+E2 to (3/2).
45.97 8	(1/2,3/2,5/2)		A	
81.5+x [#] 3	(11/2 ⁻)		B	
83.00 10			A	
164.50 18			A	
226.03 8			A	
280.8+x [#] 5	(15/2 ⁻)		B	
286.30 17			A	
357.32 15			A	
505.7 3			A	
516.53 22			A	
598.3+x [#] 6	(19/2 ⁻)		B	
843.6 5			A	
893.9 3			A	
1016.5+x [#] 6	(23/2 ⁻)		B	
1510.3+x [#] 7	(27/2 ⁻)		B	
2051.1+x [#] 8	(31/2 ⁻)		B	
2606.7+x [#] 8	(35/2 ⁻)		B	

[†] From a least-squares fit to E_γ values, assuming an uncertainty of 0.3 keV if not available.

Adopted Levels, Gammas (continued) ^{149}La Levels (continued)

$\ddagger$ $\Delta J=2$ high-spin band based on $(7/2^-)$ in ^{248}Cm SF decay, also supported by a cascade of quadrupole transitions (most likely E2) from $\gamma\gamma(\theta)$ data.

$\#$ Band(A): $\pi 3/2[402], \alpha=-1/2$.

$\gamma(^{149}\text{La})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	$\alpha^@$	Comments
45.97	(1/2,3/2,5/2)	46.0 1	100	0.0	(3/2)	M1+E2 ‡	23 13	Mult.: from ce data in ^{248}Cm SF decay.
81.5+x	(11/2 $^-$)	81.5		0+x	(7/2 $^-$)	(E2)	4.15 6	
83.00		83.0 1	100	0.0	(3/2)			
164.50		81.5 2	100	83.00		M1,E2 ‡	3.0 11	
226.03		180.1 1	100 5	45.97	(1/2,3/2,5/2)			
		226.0 1	87 6	0.0	(3/2)			
280.8+x	(15/2 $^-$)	199.3		81.5+x	(11/2 $^-$)	(Q) $^\#$		
286.30		121.8 2	16 4	164.50				
		286.3 2	100 24	0.0	(3/2)			
357.32		131.3 2	27 5	226.03				
		357.3 2	100 16	0.0	(3/2)			
505.7		219.4 2	100	286.30				
516.53		290.5 2	100	226.03				
598.3+x	(19/2 $^-$)	317.5		280.8+x	(15/2 $^-$)	(Q) $^\#$		
843.6		617.6 5	100	226.03				
893.9		607.6 2	100	286.30				
1016.5+x	(23/2 $^-$)	418.2		598.3+x	(19/2 $^-$)	(Q) $^\#$		
1510.3+x	(27/2 $^-$)	493.8		1016.5+x	(23/2 $^-$)	(Q) $^\#$		
2051.1+x	(31/2 $^-$)	540.8		1510.3+x	(27/2 $^-$)	(Q) $^\#$		
2606.7+x	(35/2 $^-$)	555.6		2051.1+x	(31/2 $^-$)			

$\dagger$ From β^- decay or ^{248}Cm SF decay.

$\ddagger$ From conversion coefficients deduced based on $I(\gamma+\text{ce})$ intensity balance in ^{149}Ba β^- decay (2004Sy01).

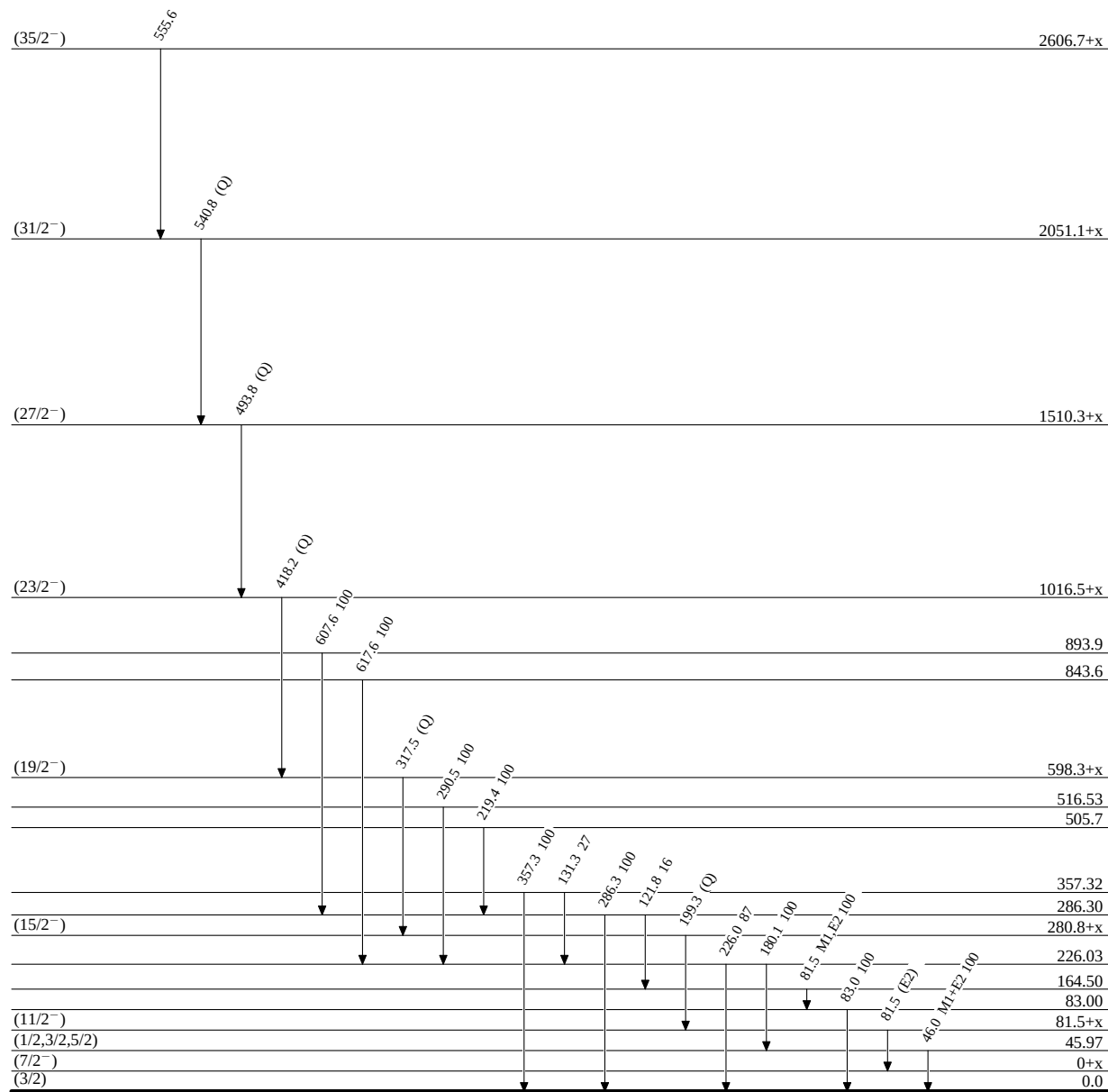
$\#$ From $\gamma\gamma(\theta)$ in ^{248}Cm SF decay. Mult=(Q) corresponds to $\Delta J=2$ transition, most likely E2.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

Adopted Levels, Gammas

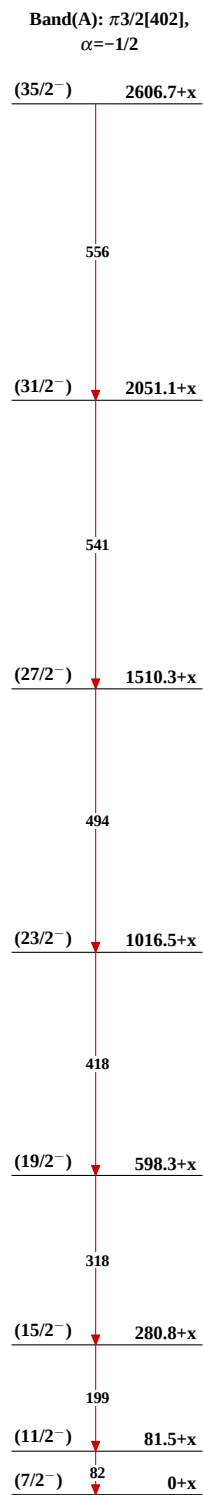
Level Scheme

Intensities: Relative photon branching from each level



1.091 s 34

$^{149}_{57}\text{La}_{92}$

Adopted Levels, Gammas $^{149}_{57}\text{La}_{92}$

$^{149}\text{Ba } \beta^-$ decay (352 ms) 2004Sy01

Parent: ^{149}Ba : $E=0.0$; $J^\pi=(5/2^-, 3/2^-)$; $T_{1/2}=352$ ms 6; $Q(\beta^-)=7.39 \times 10^3$ 20; $\% \beta^-$ decay=100

$^{149}\text{Ba}-J^\pi, T_{1/2}$: From ^{149}Ba Adopted Levels.

$^{149}\text{Ba}-Q(\beta^-)$: From 2021Wa16.

$^{149}\text{Ba}-\% \beta^-$ decay: $\% \beta^- = 100$; $\% \beta^- n = 2.2$ 17.

2004Sy01 (also 2007SyZZ thesis): radioactive beam of mass $A=149$ was produced at the OSIRIS online fission-product mass separator by thermal-neutron induced fission of a ^{235}U target, which consisted of about 1 g of uranium dispersed in graphite, at $T=2300^\circ$. Measured E_γ , I_γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ with two Compton-suppressed NORDBALL Ge spectrometers. Low-energy photons were measured with a high-purity X-ray detector (LEP). The $\gamma\gamma$ coincidence events were performed in a second measurement in which the BGO shields of both Ge detectors had been removed. Transitions belonging to ^{149}Ba decay were identified on the basis of coincidences with the x rays of La and $\gamma\gamma$ coincidences. 1987MaZY was an earlier brief report of production of ^{149}Ba isotope with the observation of γ and x rays, without any details of level population.

2004Sy01 proposed two bands of opposite parities based on $(3/2^-)$ for g.s. and multiplicities of 46.0 and 81.5 transitions, but 2007Ur03 conclude that both $3/2^+$ and $3/2^-$ are possible, which precludes the band assignments.

The decay scheme is incomplete due to a large gap of about 6.5 MeV between Q-value and the highest observed level.

 ^{149}La Levels

Two possible bands of opposite parities are proposed in 2004Sy01: a negative-parity band consisting of 46, 226, 357, 517 and 844 levels; and a positive-parity band consisting of 83, 165, 286, 506 and 894 levels.

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0	(3/2)	1.091 s 34	J^π : (3/2 ⁻) in 2004Sy01.
45.97 8	(1/2, 3/2, 5/2)		J^π : From the Adopted Levels.
83.00 10			$\pi=(-)$ in 2004Sy01.
164.50 18			$\pi=(+)$ in 2004Sy01.
226.03 8			$\pi=(+)$ in 2004Sy01.
286.30 17			$\pi=(-)$ in 2004Sy01.
357.32 15			$\pi=(+)$ in 2004Sy01.
505.7 3			$\pi=(-)$ in 2004Sy01.
516.53 22			$\pi=(+)$ in 2004Sy01.
843.6 5			$\pi=(-)$ in 2004Sy01.
893.9 3			$\pi=(+)$ in 2004Sy01.

[†] From a least-squares fit to E_γ values.

[‡] From the Adopted Levels.

 $\gamma(^{149}\text{La})$

$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\alpha^\#$	Comments
46.0 1	16 2	45.97	(1/2, 3/2, 5/2)	0.0	(3/2)	M1+E2	23 13	$\alpha(\text{exp}) > 3.6$ if $\text{mult}(180.1\gamma)=\text{E1}$; > 4.3 if $\text{mult}(180.1\gamma)=\text{M1}$; > 4.5 if $\text{mult}(180.1\gamma)=\text{E2}$ suggest that $\text{mult}(46.0\gamma)$ not E1.
81.5 2	7 2	164.50		83.00		M1, E2	3.0 11	$\alpha(\text{exp})=1.7$ 5 if $\text{mult}(83.0\gamma)=\text{E1}$; 4.6 15 if $\text{mult}(83.0\gamma)=\text{M1}$.
83.0 1	14 2	83.00		0.0	(3/2)			
121.8 2	16 4	286.30		164.50				
131.3 2	12 2	357.32		226.03				E_γ, I_γ : average value from singles and $\gamma\gamma$ coincidence spectra.
180.1 1	79 4	226.03		45.97	(1/2, 3/2, 5/2)			
219.4 2	25 4	505.7		286.30				

Continued on next page (footnotes at end of table)

^{149}Ba β^- decay (352 ms) [2004Sy01](#) (continued) $\gamma(^{149}\text{La})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
226.0 1	69 5	226.03		0.0	(3/2)	
286.3 2	100 24	286.30		0.0	(3/2)	I_γ : from $\gamma\gamma$ spectra.
290.5 2	12 4	516.53		226.03		
357.3 2	45 7	357.32		0.0	(3/2)	
607.6 2	10 2	893.9		286.30		E_γ, I_γ : from $\gamma\gamma$ coin data.
617.6 5	8 2	843.6		226.03		E_γ, I_γ : from $\gamma\gamma$ coin data.

[†] From γ -ray singles spectra, unless otherwise stated.

[‡] From conversion coefficients, deduced based on $I(\gamma+\text{ce})$ intensity balance by [2004Sy01](#).

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^{149}Ba β^- decay (352 ms) 2004Sy01

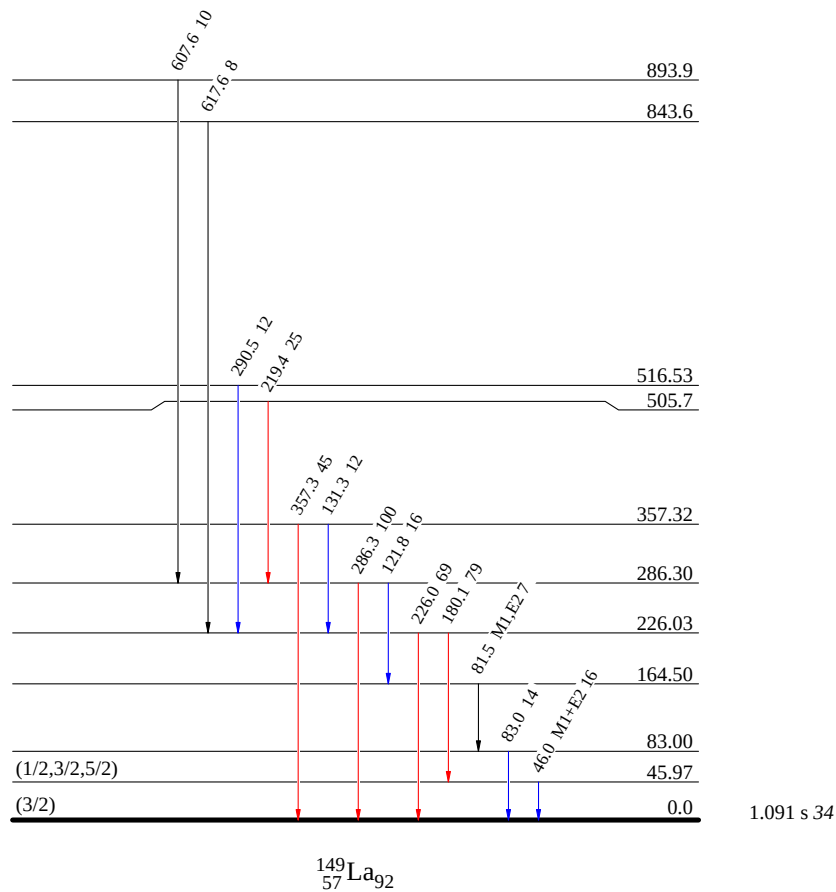
Decay Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$

$(5/2^-, 3/2^-)$ 0.0
 $Q_{\beta^-} = 7.39 \times 10^3$ 20
 $^{149}_{56}\text{Ba}_{93}$
352 ms 6
% $\beta^- = 100$



^{248}Cm SF decay 2007Ur03

Parent: ^{248}Cm : $E=0$; $J^\pi=0^+$; $T_{1/2}=3.48\times 10^5$ y 6; %SF decay=8.39 16

^{248}Cm - $T_{1/2}$: From ^{248}Cm Adopted Levels in the ENSDF database (Sept 2014 update).

^{248}Cm -%SF decay: %SF=8.39 16 for ^{248}Cm decay.

2007Ur03: measured E_γ , $\gamma\gamma$ coin using EUROGAM2 and four low-energy photon detectors. Deduced levels, J , π , band structure.

 ^{149}La Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	Comments
0	(3/2)	J^π : 3/2 is considered as favored by 2007Ur03. Other possible spin of 5/2 is not completely ruled out but less probable.
$0+x^\#$	(7/2 ⁻)	$E(\text{level})$: $x<35$ keV if 3/2 for g.s. and <20 keV if 5/2 for g.s., estimated by 2007Ur03 from non-observation of a γ ray of this energy or enhanced intensity of x rays.
$81.5+x^\#$ 3	(11/2 ⁻)	
$280.8+x^\#$ 5	(15/2 ⁻)	
$598.3+x^\#$ 6	(19/2 ⁻)	
$1016.5+x^\#$ 6	(23/2 ⁻)	
$1510.3+x^\#$ 7	(27/2 ⁻)	
$2051.1+x^\#$ 8	(31/2 ⁻)	
$2606.7+x^\#$ 8	(35/2 ⁻)	

[†] From a least-squares fit to E_γ values, assuming an uncertainty of 0.3 keV for each γ ray.

[‡] As assigned by 2007Ur03, based on band structure and $\gamma\gamma(\theta)$ data.

[#] Band(A): $\pi 3/2[402], \alpha=-1/2$.

 $\gamma(^{149}\text{La})$

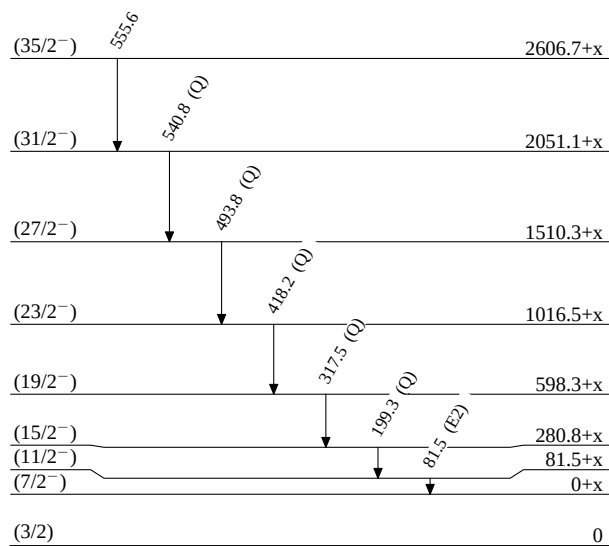
E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	$\alpha^\ddagger$	Comments
81.5	$81.5+x$	(11/2 ⁻)	$0+x$	(7/2 ⁻)	(E2)	4.15 6	$\alpha(\text{exp})=6$ 1; $\alpha(\text{K})\text{exp}=3.5$ 6 Mult.: from $\alpha(\text{exp})$ and $\alpha(\text{K})\text{exp}$.
199.3	$280.8+x$	(15/2 ⁻)	$81.5+x$	(11/2 ⁻)	(Q)		(199.2 γ)(81.5 γ)(θ): $A_2=+0.07$ 1, $A_4=-0.04$ 2.
317.5	$598.3+x$	(19/2 ⁻)	$280.8+x$	(15/2 ⁻)	(Q)		(199.3 γ)(317.5 γ)(θ): $A_2=+0.11$ 2, $A_4=-0.03$ 2.
418.2	$1016.5+x$	(23/2 ⁻)	$598.3+x$	(19/2 ⁻)	(Q)		(317.5 γ)(418.2 γ)(θ): $A_2=+0.09$ 2, $A_4=+0.02$ 3.
493.8	$1510.3+x$	(27/2 ⁻)	$1016.5+x$	(23/2 ⁻)	(Q)		(199.3 γ +317.5 γ)(493.8 γ)(θ): $A_2=+0.07$ 2, $A_4=+0.04$ 5.
540.8	$2051.1+x$	(31/2 ⁻)	$1510.3+x$	(27/2 ⁻)	(Q)		(199.3 γ +317.5 γ +418.3 γ)(540.1 γ)(θ): $A_2=+0.12$ 4, $A_4=+0.01$ 6.
555.6	$2606.7+x$	(35/2 ⁻)	$2051.1+x$	(31/2 ⁻)			

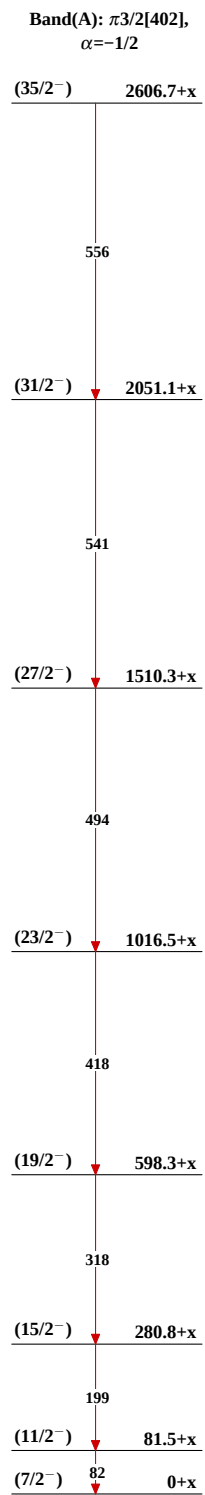
[†] From $\gamma\gamma(\theta)$ data in 2007Ur03. Mult=(Q) is for $\Delta J=2$, quadrupole (most likely E2) transition, unless otherwise stated. 2007Ur03 assigned (E2).

[‡] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

^{248}Cm SF decay 2007Ur03

Level Scheme


 $^{149}_{57}\text{La}_{92}$

^{248}Cm SF decay 2007Ur03

 $^{149}_{57}\text{La}_{92}$

Adopted Levels, Gammas

$Q(\beta^-)=4369$ 14; $S(n)=4343$ 15; $S(p)=11250$ 22; $Q(\alpha)=-1579$ 13 [2021Wa16](#)

$S(2n)=10799$ 13, $S(2p)=20984$ 22 ([2021Wa16](#)).

Mass measurements: [2006Sa56](#), [2004Cl07](#).

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for four references dealing with nuclear structure theoretical calculations.

 ^{149}Ce LevelsCross Reference (XREF) Flags

- A** ^{149}La β^- decay (1.091 s)
B ^{150}La β^-n decay (0.51 s)
C ^{248}Cm SF decay
D ^{252}Cf SF decay

E(level) [†]	J^π [‡]	$T_{1/2}$	XREF	Comments
0.0 ^{&}	(3/2 ⁻) [#]	5.12 s 25	ABCD	$\% \beta^- = 100$ $T_{1/2}$: unweighted average of 4.94 s 3 (58 γ timing, 1996YaZV), 5.4 s 3 (β timing, 1993RuZW); 4.7 s 8 (β timing, 1979En02); 5.7 s 5 (γ timing, 1977ArZS); 5.0 s 5 (γ timing, 1977Pf01); 5.0 s 10 (γ timing, 1973SeYX).
55.08 [@] 6	(5/2 ⁻) [#]		A C	
133.47 ^b 7	(3/2 ⁺)	0.60 ns 10	A C	$T_{1/2}$: from $\beta\gamma\gamma(t)$ in ^{149}La β^- decay (2003Sy01). J^π : 78.4 E1 γ to (5/2 ⁻); 133.5 γ to (3/2 ⁻); band member.
142.61 ^a 7	(5/2 ⁺)		A CD	J^π : 87.5 E1 γ to (5/2 ⁻); 142.6 γ to (3/2 ⁻); band member.
147.73 ^{&} 9	(7/2 ⁻) [#]		A C	
187.29 15	(3/2 ⁻ , 5/2, 7/2 ⁻)		A C	J^π : γ s to (3/2 ⁻) and (5/2 ⁻); 101.5 γ from (7/2 ⁻).
190.88 ^b 9	(7/2 ⁺)		A CD	
206.70 ^a 14	(9/2 ⁺)	3.7 ns 5	CD	$T_{1/2}$: 1974ClZX reported half-lives of 3.5 ns 5 for 135.6 γ and 3.9 ns 5 for 142.2 γ . 2003Sy01 propose that these two half-lives correspond to a common value of 3.7 ns 5, probably for the 206.7 level, since 135.8 γ and 142.6 γ are fed from the 206.7 level by 16.0 γ and 64.2 γ , respectively.
239.51 [@] 10	(9/2 ⁻)		C	J^π : 91.7 γ to (7/2 ⁻); 184.5 γ to (5/2 ⁻); band member.
245.40 ^c 7	(3/2 ⁻)	≤ 0.12 ns	A	J^π : possible bandhead. $T_{1/2}$: from $\beta\gamma\gamma(t)$ in ^{149}La β^- decay (2003Sy01).
288.97 11	(7/2 ⁻)		A C	J^π : 141.3 γ to (7/2 ⁻); 233.9 γ to (5/2 ⁻); yrast pattern of level population.
305.52 ^c 11	(5/2 ⁻)		A	J^π : γ s to (3/2 ⁻), (3/2 ⁺), (7/2 ⁺) and (7/2 ⁻); possible band member.
335.76 ^b 12	(11/2 ⁺)		CD	
347.05 ^a 19	(13/2 ⁺)		CD	
391.22 ^c 17	(7/2 ⁻)		A	J^π : 200.3 γ to (7/2 ⁺); 248.5 γ to (5/2 ⁺); 336.3 γ to (5/2 ⁻); band member.
403.68 ^{&} 15	(11/2 ⁻)		C	
433.25 17			A	
444.10 12			A	
459.76 17			A	
525.69 [@] 14	(13/2 ⁻)		C	
557.39 20			A	
575.2 4			A	
588.00 ^b 15	(15/2 ⁺)		CD	
588.45 ^a 22	(17/2 ⁺)		CD	
605.10 22			A	
615.4 3			A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Ce Levels (continued)

E(level) [†]	J^π [‡]	XREF	Comments
630.6 3		A	
638.9 3		A	
654.8 3		A	
661.7 7		A	
694.6 4		A	
752.18 ^{&} 18	(15/2 ⁻)	C	
760.3 5		A	
826.1 5		A	
896.79 [@] 17	(17/2 ⁻)	C	
931.65 ^a 24	(21/2 ⁺)	CD	
945.20 ^b 18	(19/2 ⁺)	CD	
1163.2 ^{&} 3	(19/2 ⁻)	C	
1329.0 [@] 3	(21/2 ⁻)	C	
1362.7 ^a 3	(25/2 ⁺)	CD	
1395.6 ^b 3	(23/2 ⁺)	CD	
1621.0 ^{&} 4	(23/2 ⁻)	C	
1791.2 5		A	
1803.9 [@] 4	(25/2 ⁻)	C	
1842.1 7		A	
1864.7 ^a 4	(29/2 ⁺)	CD	
1868.9 10		A	
1923.5 ^b 4	(27/2 ⁺)	CD	
2313.4 [@] 10	(29/2 ⁻)	C	
2421.9 ^a 4	(33/2 ⁺)	CD	
2510.5 ^b 5	(31/2 ⁺)	CD	
3018.1 ^a 5	(37/2 ⁺)	CD	
3141.8 ^b 7	(35/2 ⁺)	D	E(level), J^π : this level corresponds to 3087.2, $J^\pi=(33/2^-)$ in ^{252}Cf SF decay dataset.
3635.6 ^a 7	(41/2 ⁺)	D	E(level), J^π : this level corresponds to 3568.9 ξ , $J^\pi=(41/2^+)$ in ^{252}Cf SF decay dataset.

[†] From least-squares fit to E_γ data, assuming $\Delta E_\gamma=0.5$ keV, when not stated.

[‡] From probable band structures for levels of $J^\pi=7/2^+$ and higher, assuming (3/2⁺) and (5/2⁺) for bandheads. Exceptions are noted.

From systematic trends of spacings of band members in N=91 isotones from ^{151}Nd to ^{161}Yb .

@ Band(A): $\nu 3/2[532], \alpha=+1/2$.

& Band(a): $\nu 3/2[532], \alpha=-1/2$.

^a Band(B): $\nu 3/2[651], \alpha=+1/2$. Decoupled $\nu i_{13/2}$ band. Dominant component is proposed as 3/2[651] (2002Sy01), with strong Coriolis mixing with other Nilsson orbitals.

^b Band(b): $\nu 3/2[651], \alpha=-1/2$. Decoupled $\nu i_{13/2}$ band. Dominant component is proposed as 3/2[651] (2002Sy01), with strong Coriolis mixing with other Nilsson orbitals.

^c Band(C): Band based on (3/2⁻). Band suggested by 2002Sy01.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Ce})$										
$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [‡]	δ [‡]	α ^{&}	$I_{(\gamma+ce)}$	Comments
55.08	(5/2 ⁻)	55.1 1	100	0.0	(3/2 ⁻)	M1(+E2)	≤ 0.42	7.5 9		
133.47	(3/2 ⁺)	78.4 1	9.3 14	55.08	(5/2 ⁻)	E1		0.474 7		B(E1)(W.u.)= 6.2×10^{-5} +15-12 I _γ : from β ⁻ decay. Value of 35 11 from ²⁴⁸ Cm SF decay is in poor agreement. Intrinsic dipole moment D ₀ =0.034 7 efm (2003Sy01).
		133.5 1	100 3	0.0	(3/2 ⁻)	[E1]		0.1096 16		B(E1)(W.u.)= 1.35×10^{-4} +27-20 Intrinsic dipole moment D ₀ =0.041 5 efm (2003Sy01).
142.61	(5/2 ⁺)	(9.1) 87.5 1 142.6 1	26 4 100 4	133.47 (3/2 ⁺) 55.08 (5/2 ⁻) 0.0 (3/2 ⁻)		E1		0.351 5	40 6	T _{1/2} =3.9 ns 5 (1974ClZX) for a 142.2γ (see comment for 206.9 level).
147.73	(7/2 ⁻)	92.6 1 147.7 2	100 10 36 5	55.08 (5/2 ⁻) 0.0 (3/2 ⁻)		E2(+M1)		2.1 6		
187.29	(3/2 ⁻ , 5/2, 7/2 ⁻)	132.2 3 187.2 2	43 6 100 6	55.08 (5/2 ⁻) 0.0 (3/2 ⁻)						
190.88	(7/2 ⁺)	48.3 2 57.4 3	10 3 24 6	142.61 (5/2 ⁺) 133.47 (3/2 ⁺)						E _γ : γ from ²⁴⁸ Cm SF, not reported in β ⁻ decay. T _{1/2} =3.5 ns 3 (1974ClZX) for 135.6γ (see comment for 206.7 level).
		135.8 1	100 12	55.08 (5/2 ⁻)						
206.70	(9/2 ⁺)	(15.8@) 64.0@ 2	10 3	190.88 (7/2 ⁺) 142.61 (5/2 ⁺)					100 33	
239.51	(9/2 ⁻)	91.7 2 184.5 1	44 6 100 9	147.73 (7/2 ⁻) 55.08 (5/2 ⁻)						
245.40	(3/2 ⁻)	102.8 1	11 3	142.61 (5/2 ⁺)		[E1]		0.2253 32		B(E1)(W.u.) $\geq 6.6 \times 10^{-5}$ Intrinsic dipole moment D ₀ ≥ 0.045 e fm (2003Sy01).
		112.0 2	36 3	133.47 (3/2 ⁺)		[E1]		0.1779 26		B(E1)(W.u.) $\geq 2.1 \times 10^{-4}$ Intrinsic dipole moment D ₀ ≥ 0.058 e fm (2003Sy01).
		190.3 2	28.8 24	55.08 (5/2 ⁻)		[M1+E2]		0.206 11		B(M1)(W.u.) ≥ 0.0031 if M1, B(E2)(W.u.) ≥ 47 if E2.
		245.4 1	100 19	0.0 (3/2 ⁻)		[M1+E2]		0.0956 29		B(M1)(W.u.) ≥ 0.0053 if M1, B(E2)(W.u.) ≥ 48 if E2.
288.97	(7/2 ⁻)	101.5 3 141.3 3 233.9 1	43 14 100 12 33 5	187.29 (3/2 ⁻ , 5/2, 7/2 ⁻) 147.73 (7/2 ⁻) 55.08 (5/2 ⁻)						E _γ : γ from ²⁴⁸ Cm SF only.
305.52	(5/2 ⁻)	114.6 3 157.8 2	14.3 13 29 5	190.88 (7/2 ⁺) 147.73 (7/2 ⁻)						E _γ : γ from β ⁻ only.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Ce})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$I_{(\gamma+ce)}$	Comments
305.52	(5/2 ⁻)	162.9 3	23 6	142.61	(5/2 ⁺)		
		172.1 3	33 7	133.47	(3/2 ⁺)		
		250.4 8	22 3	55.08	(5/2 ⁻)		
		305.5 2	100 9	0.0	(3/2 ⁻)		
335.76	(11/2 ⁺)	96.3 3	15.0 22	239.51	(9/2 ⁻)		
		129.0 1	78 11	206.70	(9/2 ⁺)		I_γ : 28 in ²⁵² Cf SF is in poor agreement.
		144.9 1	100 11	190.88	(7/2 ⁺)		
347.05	(13/2 ⁺)	(11.3)		335.76	(11/2 ⁺)	13 4	
		140.5 2	100 5	206.70	(9/2 ⁺)		
391.22	(7/2 ⁻)	200.3 2	81 19	190.88	(7/2 ⁺)		
		248.5 4	69 19	142.61	(5/2 ⁺)		
		336.3 3	100 25	55.08	(5/2 ⁻)		
403.68	(11/2 ⁻)	164.2 2	44 6	239.51	(9/2 ⁻)		
		255.8 2	100 11	147.73	(7/2 ⁻)		
433.25		243.0 9	15 4	190.88	(7/2 ⁺)		
		246.1 8	38 19	187.29	(3/2 ⁻ , 5/2, 7/2 ⁻)		
		290.5 3	13 4	142.61	(5/2 ⁺)		
		299.8 2	100 13	133.47	(3/2 ⁺)		
444.10		198.7 1	100 29	245.40	(3/2 ⁻)		
		310.6 7	30 5	133.47	(3/2 ⁺)		
459.76		154.2 2	69 42	305.52	(5/2 ⁻)		
		214.5 5	25 8	245.40	(3/2 ⁻)		
		317.2 3	42 12	142.61	(5/2 ⁺)		
		404.6 5	100 15	55.08	(5/2 ⁻)		
525.69	(13/2 ⁻)	121.9 2	17 4	403.68	(11/2 ⁻)		
		286.2 1	100 8	239.51	(9/2 ⁻)		
557.39		409.7 5	100 18	147.73	(7/2 ⁻)		
		502.3 2	22 7	55.08	(5/2 ⁻)		
575.2		520.1 4	100	55.08	(5/2 ⁻)		
588.00	(15/2 ⁺)	241.1 2	74 11	347.05	(13/2 ⁺)		
		252.2 1	100 11	335.76	(11/2 ⁺)		
588.45	(17/2 ⁺)	241.4 1	100	347.05	(13/2 ⁺)		
605.10		462.5 3	18 5	142.61	(5/2 ⁺)		
		605.1 3	100 36	0.0	(3/2 ⁻)		
615.4		481.9 3	100 17	133.47	(3/2 ⁺)		
		560.3 10	56 17	55.08	(5/2 ⁻)		
630.6		497.1 3	100	133.47	(3/2 ⁺)		
638.9		393.5 3	100	245.40	(3/2 ⁻)		
654.8		409.5 5	46 14	245.40	(3/2 ⁻)		
		507.1 3	100 20	147.73	(7/2 ⁻)		
661.7		519.1 7	100	142.61	(5/2 ⁺)		
694.6		639.5 4	100	55.08	(5/2 ⁻)		
752.18	(15/2 ⁻)	226.3 ^a 4	12 6	525.69	(13/2 ⁻)		

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Ce})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	Comments
752.18	(15/2 ⁻)	348.5 1	100 6	403.68	(11/2 ⁻)		
760.3		626.8 5	100	133.47	(3/2 ⁺)		
826.1		638.4 8	71 36	187.29	(3/2 ⁻ , 5/2, 7/2 ⁻)		
		692.8 6	100 21	133.47	(3/2 ⁺)		
896.79	(17/2 ⁻)	371.1 1	100	525.69	(13/2 ⁻)		
931.65	(21/2 ⁺)	343.2 1	100	588.45	(17/2 ⁺)	Q [#]	
945.20	(19/2 ⁺)	357.2 1	100	588.00	(15/2 ⁺)		
1163.2	(19/2 ⁻)	411.0 2	100	752.18	(15/2 ⁻)		
1329.0	(21/2 ⁻)	432.2 2	100	896.79	(17/2 ⁻)		
1362.7	(25/2 ⁺)	431.0 1	100	931.65	(21/2 ⁺)	Q [#]	
1395.6	(23/2 ⁺)	450.4 2	100	945.20	(19/2 ⁺)		
1621.0	(23/2 ⁻)	457.8 3	100	1163.2	(19/2 ⁻)		
1791.2		1648.5 10	26 11	142.61	(5/2 ⁺)		
		1657.7 5	100 19	133.47	(3/2 ⁺)		
1803.9	(25/2 ⁻)	474.9 2	100	1329.0	(21/2 ⁻)		
1842.1		1700.0 13	57 29	142.61	(5/2 ⁺)		
		1708.5 7	100 29	133.47	(3/2 ⁺)		
1864.7	(29/2 ⁺)	502.0 2	100	1362.7	(25/2 ⁺)		
1868.9		1681.6 9	100	187.29	(3/2 ⁻ , 5/2, 7/2 ⁻)		
1923.5	(27/2 ⁺)	527.9 2	100	1395.6	(23/2 ⁺)		
2313.4	(29/2 ⁻)	509.5 9	100	1803.9	(25/2 ⁻)		
2421.9	(33/2 ⁺)	557.2 2	100	1864.7	(29/2 ⁺)		
2510.5	(31/2 ⁺)	587.0 3	100	1923.5	(27/2 ⁺)		
3018.1	(37/2 ⁺)	596.2 3	100	2421.9	(33/2 ⁺)		
3141.8?	(35/2 ⁺)	631.3 ^a	100	2510.5	(31/2 ⁺)		E _γ : this γ was not seen in ²⁴⁸ Cm SF decay (2012Ur04).
3635.6?	(41/2 ⁺)	617.5 ^a	100	3018.1	(37/2 ⁺)		E _γ : this γ was not seen consistently in γγ-coin data in ²⁴⁸ Cm SF decay (2012Ur04).

[†] Weighted averages taken when a level is populated in ¹⁴⁹La β⁻ and ²⁴⁸Cm SF. Otherwise, values are from either of the two datasets.

[‡] Estimated from I(x ray)/I_γ in ¹⁴⁹La β⁻ decay, unless otherwise stated.

[#] From DCO ratio in ²⁴⁸Cm SF.

@ From ²⁴⁸Cm SF decay, the placement is based on analysis and discussion in 2002Sy01.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

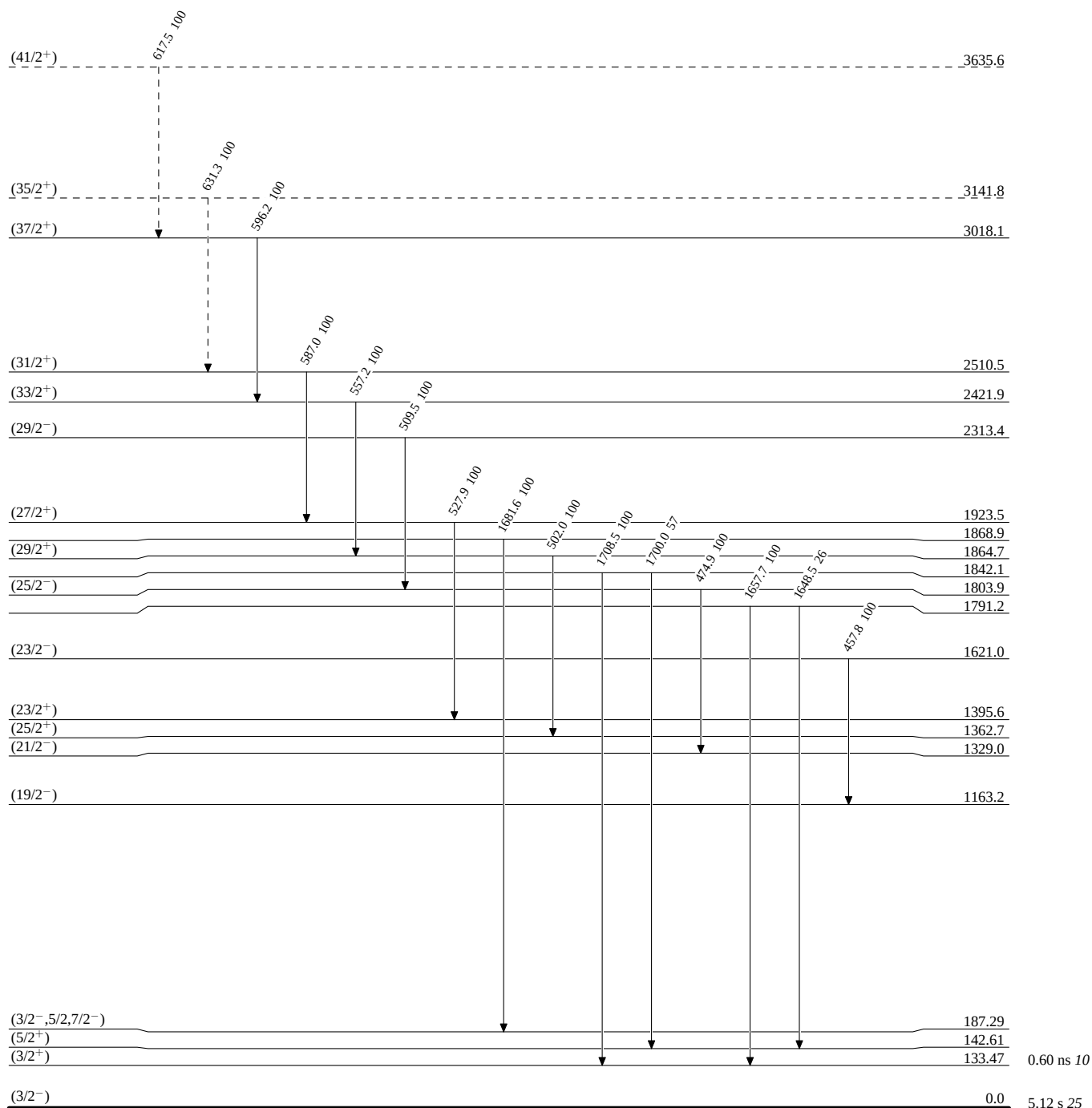
^a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

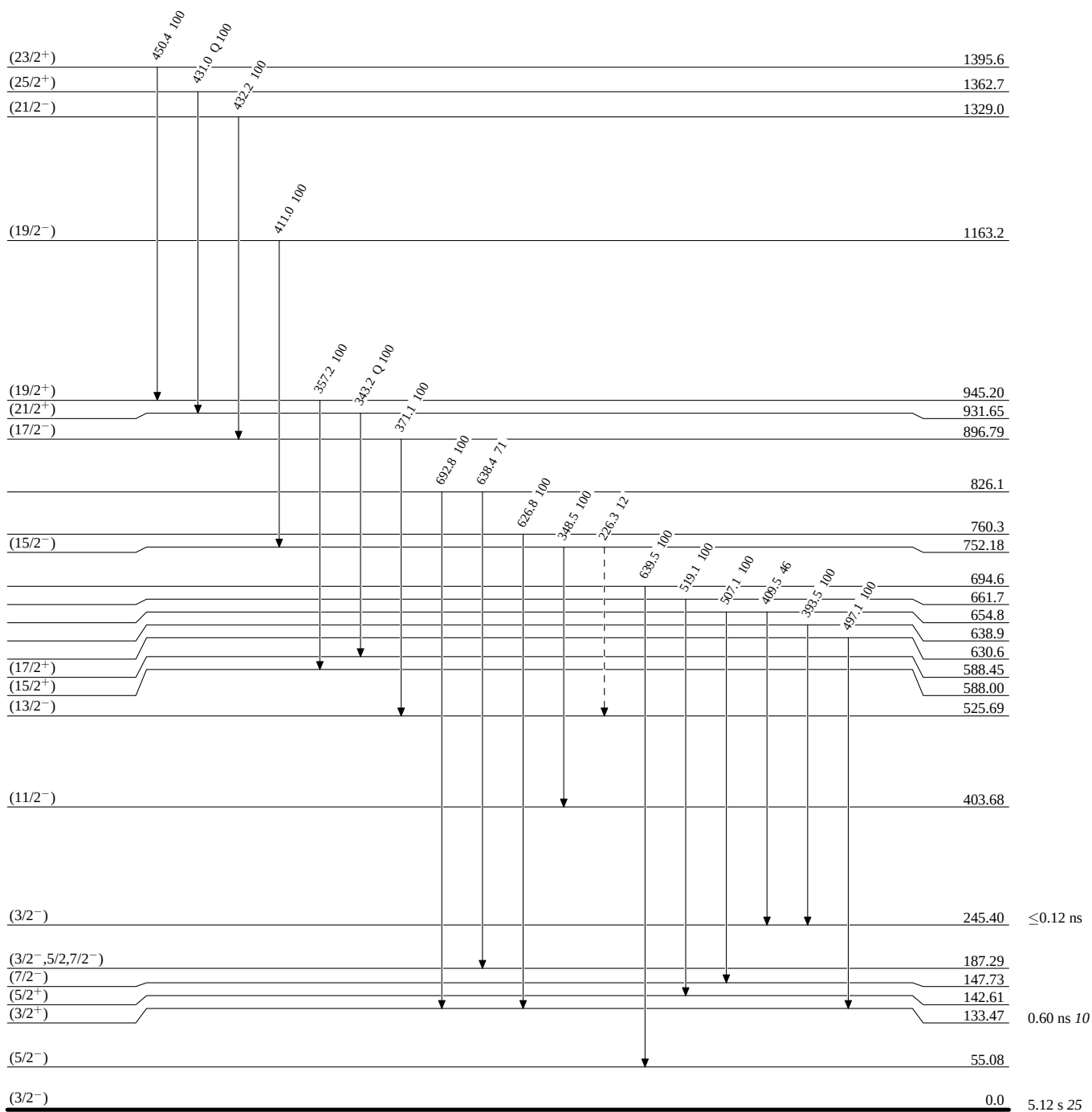
 ----- ► γ Decay (Uncertain)


Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

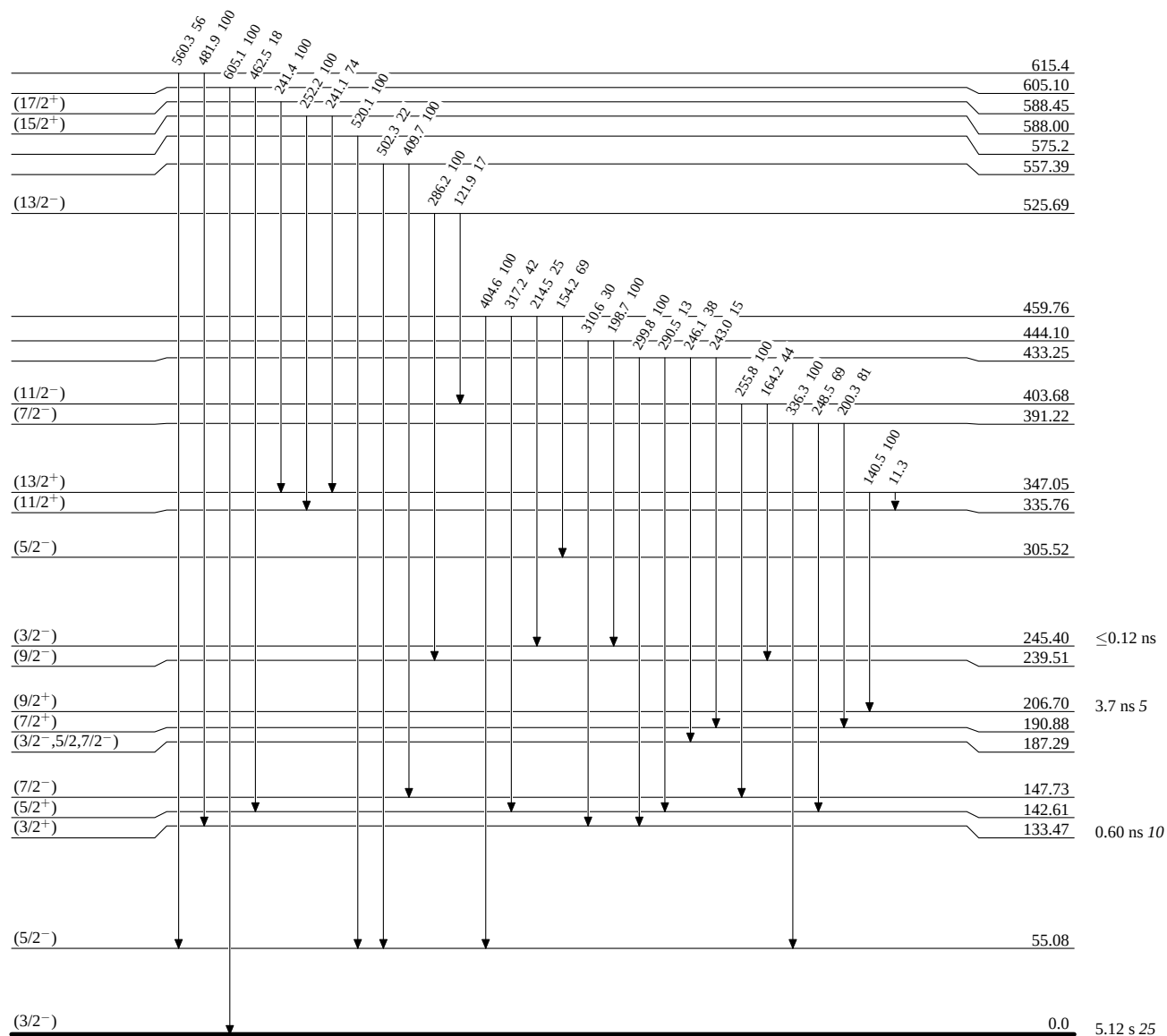
 - - - - - ► γ Decay (Uncertain)


Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

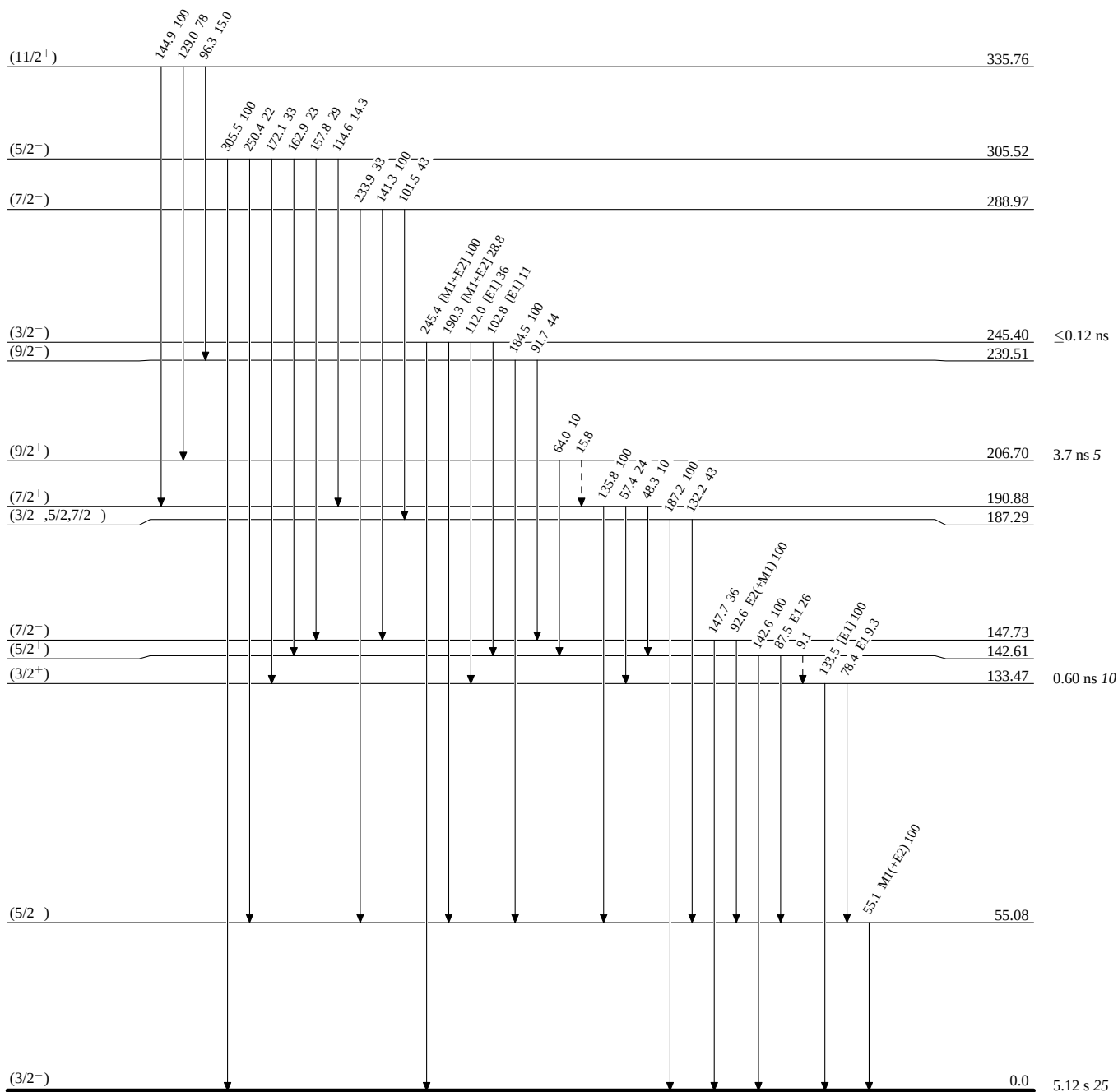
-----► γ Decay (Uncertain) $^{149}_{58}\text{Ce}_{91}$

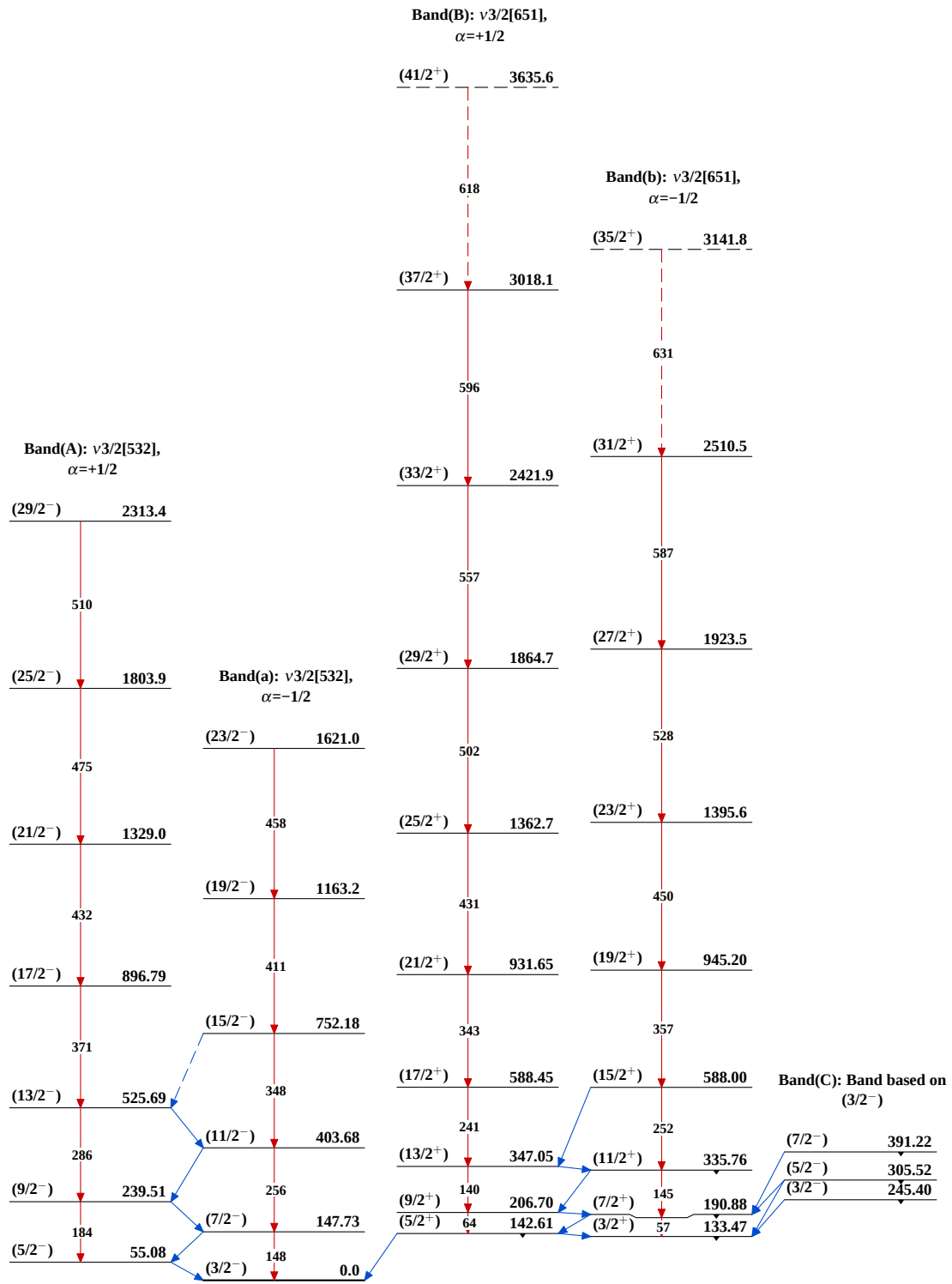
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain) $^{149}_{58}\text{Ce}_{91}$

Adopted Levels, Gammas $^{149}_{58}\text{Ce}_{91}$

$^{149}\text{La} \beta^-$ decay (1.091 s) 2002Sy01

Parent: ^{149}La : $E=0.0$; $J^\pi=(3/2^-)$; $T_{1/2}=1.091$ s 34; $Q(\beta^-)=6.45\times 10^3$ 20; % β^- decay=100

^{149}La - J^π , $T_{1/2}$: From ^{149}La Adopted Levels.

^{149}La - $Q(\beta^-)$: From 2021Wa16.

2002Sy01 (also 2007SyZZ thesis, 2002SyZY): measured E_γ , I_γ , $\gamma\gamma$ -coin using two Compton-suppressed NORDBALL Ge spectrometers, and a high-purity x-ray detector (LEPS) for low-energy photons at Studsvik.

2003Sy01 (same group as 2002Sy01): measured $\beta\gamma\gamma(t)$, half-life of the 133.5 level, and intrinsic electric dipole moments.

Others:

1987MaZY: $T_{1/2}$, eight γ rays reported.

$T_{1/2}$ and production of ^{149}La : 1993Ru01, 1986ReZU (also 1986Wa17), 1979En02.

$Q(\beta^-)$ measurement by TAGS method: 2008HaZO.

All data are from 2002Sy01 unless otherwise stated.

Total decay energy deposit of 6.40 MeV 70 calculated by RADLIST code is in agreement with the expected value of 6.45 MeV 20 (2021Wa16). However the decay scheme is considered as incomplete in view of a large gap of about 4 MeV between $Q(\beta^-)$ value and the highest known populated level at 1868.8 keV.

 ^{149}Ce Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0@	$(3/2^-)$	5.12 s 25	
55.10@ 7	$(5/2^-)$		
133.48& 7	$(3/2^+)$	0.60 ns 10	
142.60& 7	$(5/2^+)$		
147.70@ 10	$(7/2^-)$		
187.24 18	$(3/2^-, 5/2, 7/2^-)$		J^π : 2002Sy01 give $(3/2, 5/2)$.
190.94& 13	$(7/2^+)$		
245.41 ^a 7	$(3/2^-)$	≤ 0.12 ns	
289.00 12	$(7/2^-)$		
305.53 ^a 11	$(5/2^-)$		
391.26 ^a 18	$(7/2^-)$		
433.25 17			
444.10 12			
459.76 17			
557.40 20			
575.2 4			
605.10 22			
615.4 3			
630.6 3			
638.9 3			
654.8 3			
661.7 7			
694.6 4			
760.3 5			
826.1 5			
1791.2 5			
1842.1 7			
1868.8 10			
4343+x			$S(n)(^{149}\text{Ce})=4343$ 15 (2021Wa16). $x < [Q(\beta^-) - S(n)]$ i.e. $x < 2107$ 200. This represents a range of unobserved levels that subsequently decay to ^{148}Ba via one-neutron emission.

[†] From least-squares fit to E_γ data.

[‡] From the Adopted Levels.

^{149}La β^- decay (1.091 s) 2002Sy01 (continued) ^{149}Ce Levels (continued)# From $\beta\gamma\gamma(t)$ (2003Sy01).@ Band(A): $K^\pi=3/2^-$ band.

& Band(B): Decoupled band.

^a Band(C): $K^\pi=3/2^-$ band. β^- radiations

E(decay)	E(level)	$I\beta^-$ ^{†‡}	Log ft [‡]	Comments
(1.1×10^3 & 11)	4343+x	1.41 34		$I\beta^-$: % β^- -n=1.41 34 (from ^{149}La Adopted Levels).
(4.58×10^3 20)	1868.8	0.3	6.8	
(4.61×10^3 20)	1842.1	0.3	6.8	$I\beta^-$: 0.7 (2002Sy01); revised to 0.3 in 2007SyZZ.
(4.66×10^3 20)	1791.2	0.8	6.4	$I\beta^-$: 0.8 (2002Sy01); revised to 0.9 in 2007SyZZ.
(5.62×10^3 20)	826.1	0.3	7.2	$I\beta^-$: 0.7 (2002Sy01); revised to 0.3 in 2007SyZZ.
(5.69×10^3 20)	760.3	0.5	7.0	
(5.76×10^3 20)	694.6	0.2	7.4	
(5.79×10^3 20)	661.7	0.1	7.7	
(5.80×10^3 20)	654.8	1.2	6.7	
(5.81×10^3 20)	638.9	0.4	7.1	
(5.82×10^3 20)	630.6	0.7	6.9	
(5.84×10^3 20)	615.4	0.4	7.1	
(5.85×10^3 20)	605.10	1.2	6.7	$I\beta^-$: 1.0 (2002Sy01); revised to 1.3 in 2007SyZZ.
(5.88×10^3 20)	575.2	0.7	6.9	
(5.89×10^3 20)	557.40	1.1	6.7	$I\beta^-$: 1.2 (2002Sy01).
(5.99×10^3 20)	459.76	1.8	6.5	$I\beta^-$: 2.0 (2002Sy01).
(6.01×10^3 20)	444.10	1.5	6.6	$I\beta^-$: 1.6 (2002Sy01).
(6.02×10^3 20)	433.25	1.1	6.8	$I\beta^-$: 1.2 (2002Sy01).
(6.06×10^3 20)	391.26	0.6	7.0	$I\beta^-$: 0.5 (2002Sy01).
(6.14×10^3 20)	305.53	7.0	6.0	$I\beta^-$: 7.9 (2002Sy01).
(6.16×10^3 20)	289.00	1.7	6.6	$I\beta^-$: 1.9 (2002Sy01).
(6.21×10^3 20)	245.41	9.3	5.9	$I\beta^-$: 11.5 (2002Sy01).
(6.26×10^3 20)	190.94	2.3	6.5	$I\beta^-$: 2.0 (2002Sy01).
(6.26×10^3 20)	187.24	4.2	6.3	$I\beta^-$: 4.5 (2002Sy01); revised to 4.6 in 2007SyZZ.
(6.30×10^3 @ 20)	147.70	<1.8	>6.6	$I\beta^-$: 1.6 (2002Sy01).
(6.31×10^3 20)	142.60	7.5	6.0	$I\beta^-$: 7.9 (2002Sy01).
(6.32×10^3 20)	133.48	7.2	6.0	$I\beta^-$: 5.6 (2002Sy01); but revised to 6.1 in 2007SyZZ.
(6.40×10^3 20)	55.10	16	5.7	$I\beta^-$: ≈ 12 (2002Sy01).
(6.45×10^3 20)	0.0	≈ 30	≈ 5.5	$I\beta^-$: estimated by 2002Sy01 from Alaga rule, assuming spin of 3/2 or 5/2 for the parent level, although as 2002Sy01 mention that this rule is not strictly valid for K-mixed states. For comparison, log $ft=5.7$ for ^{147}La to ^{147}Ce g.s. Other: $I\beta^- < 12$ if first forbidden decay (log $ft > 5.9$), as for ^{141}La decay to ^{141}Ce g.s.

[†] Deduced by the evaluators from intensity balance, using theoretical conversion coefficients for assumed multipolarity assignments. Values given by 2002Sy01 and some of the revised values (2002SyZY) are given under comments, when different. Since there is a gap of about 4 MeV between Q value and the last known populated level at 1868.8, there remains the likelihood of missing transitions and levels above 1868.8. Thus all the $I\beta^-$ values, especially weak feedings (<5% or so), should be treated as upper limits; and associated Log ft values as lower limits.

[‡] Lower limits for listed $I\beta^-$ values.

Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

& Estimated for a range of levels.

¹⁴⁹La β⁻ decay (1.091 s) 2002Sy01 (continued)

γ(¹⁴⁹Ce)

I_γ normalization: Feeding to g.s. assumed as ≈30%; and %β⁻n=1.41 34 from ¹⁴⁹La Adopted Levels. Due to incomplete decay scheme and possible unobserved transitions, this normalization is considered as approximate.

E _γ	I _γ ^a	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.&	δ&	α ^b	I _(γ+ce) ^a	Comments
(9.1)		142.60	(5/2 ⁺)	133.48	(3/2 ⁺)				20.2 34	E _γ : from level-energy difference; transition required from γγ coin data. I _(γ+ce) : from 2002Sy01, deduced from intensity balance of γ-transitions observed in the singles and coincidence spectra.
48.4 2	0.7 2	190.94	(7/2 ⁺)	142.60	(5/2 ⁺)	[M1+E2]		20 11		
55.1 1	27.6 [#] 25	55.10	(5/2 ⁻)	0.0	(3/2 ⁻)	M1(+E2)	≤0.42	7.5 9		α(K)exp=5.3 6
78.4 1	9.3 [@] 14	133.48	(3/2 ⁺)	55.10	(5/2 ⁻)	E1		0.474 7		α(exp)≤1.45 Intrinsic dipole moment D ₀ =0.034 7 e fm (2003Sy01).
87.5 1	11.3 [@] 20	142.60	(5/2 ⁺)	55.10	(5/2 ⁻)	E1		0.351 5		α(exp)≤1.35
92.6 1	10.0 [@] 13	147.70	(7/2 ⁻)	55.10	(5/2 ⁻)	E2(+M1)		2.1 6		α(exp)≥1.71 α: for E2.
102.8 1	4.7 13	245.41	(3/2 ⁻)	142.60	(5/2 ⁺)	[E1]		0.2253 32		Intrinsic dipole moment D ₀ ≥0.045 e fm (2003Sy01).
112.0 2	15.3 [#] 14	245.41	(3/2 ⁻)	133.48	(3/2 ⁺)	[E1]		0.1779 26		Intrinsic dipole moment D ₀ ≥0.058 e fm (2003Sy01).
114.6 3	3.3 [#] 3	305.53	(5/2 ⁻)	190.94	(7/2 ⁺)	[E1]		0.1670 26		
132.2 4	9.0 [#] 13	187.24	(3/2 ⁻ ,5/2,7/2 ⁻)	55.10	(5/2 ⁻)	[D,E2]		0.44 33		
133.5 1	100.0 [#] 34	133.48	(3/2 ⁺)	0.0	(3/2 ⁻)	[E1]		0.1096 16		Intrinsic dipole moment D ₀ =0.041 5 e fm (2003Sy01).
135.8 2	7.5 9	190.94	(7/2 ⁺)	55.10	(5/2 ⁻)	[E1]		0.1046 15		
141.3 6	7.5 [#] 9	289.00	(7/2 ⁻)	147.70	(7/2 ⁻)	[M1+E2]		0.53 8		
142.6 1	50.2 [#] 20	142.60	(5/2 ⁺)	0.0	(3/2 ⁻)	[E1]		0.0914 13		
147.7 2	4.1 [#] 9	147.70	(7/2 ⁻)	0.0	(3/2 ⁻)	[E2]		0.520 8		
154.2 [‡] 2	3.6 22	459.76		305.53	(5/2 ⁻)	[D,E2]		0.26 19		
157.8 2	6.8 11	305.53	(5/2 ⁻)	147.70	(7/2 ⁻)	[M1+E2]		0.37 4		
162.9 3	5.3 [#] 13	305.53	(5/2 ⁻)	142.60	(5/2 ⁺)	[E1]		0.0634 9		
172.1 3	7.6 [@] 17	305.53	(5/2 ⁻)	133.48	(3/2 ⁺)	[E1]		0.0546 8		
187.2 2	20.9 [#] 12	187.24	(3/2 ⁻ ,5/2,7/2 ⁻)	0.0	(3/2 ⁻)	[D,E2]		0.13 9		
190.3 2	12.1 [#] 10	245.41	(3/2 ⁻)	55.10	(5/2 ⁻)	[M1+E2]		0.206 11		
198.7 1	7.7 22	444.10		245.41	(3/2 ⁻)	[D,E2]		0.11 7		

$^{149}\text{La} \beta^-$ decay (1.091 s) 2002Sy01 (continued) $\gamma(^{149}\text{Ce})$ (continued)

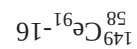
E_γ	$I_\gamma^{\dagger a}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	α^b
200.3 $\frac{+}{-} 2$	1.3 3	391.26	(7/2 ⁻)	190.94	(7/2 ⁺)	[E1]	0.0362 5
214.5 $\frac{+}{-} 5$	1.3 4	459.76		245.41	(3/2 ⁻)	[D,E2]	0.09 6
233.9 1	2.5 4	289.00	(7/2 ⁻)	55.10	(5/2 ⁻)	[M1+E2]	0.1103 21
243.0 $\frac{+}{-} 9$	0.7 2	433.25		190.94	(7/2 ⁺)	[D,E2]	0.06 4
245.4 1	42 8	245.41	(3/2 ⁻)	0.0	(3/2 ⁻)	[M1+E2]	0.0956 29
246.1 $\frac{+}{-} 8$	1.8 9	433.25		187.24	(3/2 ⁻ , 5/2, 7/2 ⁻)	[D,E2]	0.06 4
248.5 4	1.1 3	391.26	(7/2 ⁻)	142.60	(5/2 ⁺)	[E1]	0.02033 30
250.4 8	5.1 8	305.53	(5/2 ⁻)	55.10	(5/2 ⁻)	[M1+E2]	0.090 4
290.5 3	0.6 2	433.25		142.60	(5/2 ⁺)	[D,E2]	0.038 24
299.8 2	4.7 6	433.25		133.48	(3/2 ⁺)	[D,E2]	0.035 23
305.5 2	23.1 [#] 20	305.53	(5/2 ⁻)	0.0	(3/2 ⁻)	[M1+E2]	0.050 5
310.6 $\frac{+}{-} 7$	2.3 4	444.10		133.48	(3/2 ⁺)	[D,E2]	0.032 21
317.2 $\frac{+}{-} 3$	2.2 6	459.76		142.60	(5/2 ⁺)	[D,E2]	0.030 20
336.3 $\frac{+}{-} 3$	1.6 4	391.26	(7/2 ⁻)	55.10	(5/2 ⁻)	[M1+E2]	0.038 4
393.5 3	3.0 [#] 7	638.9		245.41	(3/2 ⁻)		
404.6 $\frac{+}{-} 5$	5.2 8	459.76		55.10	(5/2 ⁻)		
409.5 5	2.7 8	654.8		245.41	(3/2 ⁻)		
409.7 5	6.8 12	557.40		147.70	(7/2 ⁻)		
462.5 $\frac{+}{-} 3$	1.4 4	605.10		142.60	(5/2 ⁺)		
481.9 $\frac{+}{-} 3$	1.8 3	615.4		133.48	(3/2 ⁺)		
497.1 $\frac{+}{-} 3$	5.2 7	630.6		133.48	(3/2 ⁺)		
502.3 $\frac{+}{-} 2$	1.5 5	557.40		55.10	(5/2 ⁻)		
507.1 3	5.9 12	654.8		147.70	(7/2 ⁻)		
519.1 $\frac{+}{-} 7$	0.8 3	661.7		142.60	(5/2 ⁺)		
520.1 4	4.8 9	575.2		55.10	(5/2 ⁻)		
560.3 $\frac{+}{-} 10$	1.0 3	615.4		55.10	(5/2 ⁻)		
605.1 3	7.7 [#] 28	605.10		0.0	(3/2 ⁻)		
626.8 $\frac{+}{-} 5$	3.7 6	760.3		133.48	(3/2 ⁺)		
638.4 $\frac{+}{-} 8$	1.0 5	826.1		187.24	(3/2 ⁻ , 5/2, 7/2 ⁻)		
639.5 $\frac{+}{-} 4$	1.3 4	694.6		55.10	(5/2 ⁻)		
692.8 $\frac{+}{-} 6$	1.4 3	826.1		133.48	(3/2 ⁺)		
1648.5 $\frac{+}{-} 10$	1.2 5	1791.2		142.60	(5/2 ⁺)		
1657.7 $\frac{+}{-} 5$	4.7 9	1791.2		133.48	(3/2 ⁺)		

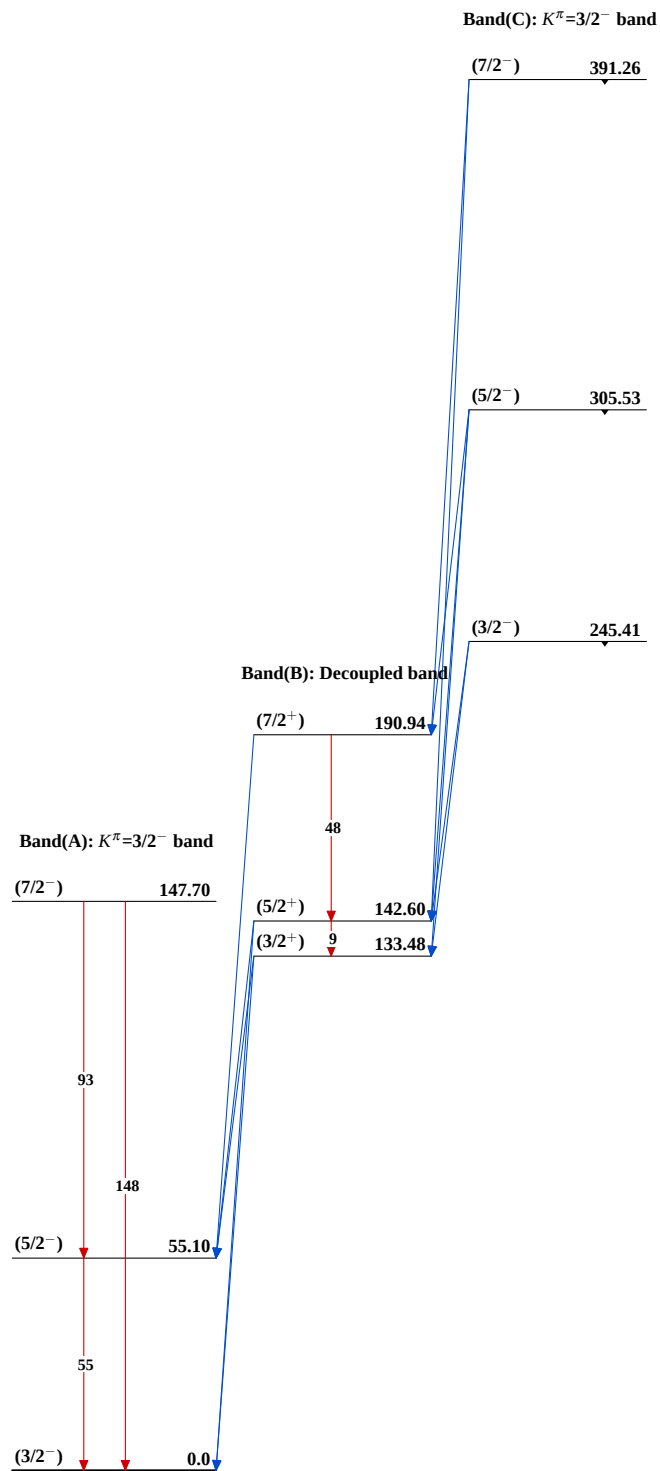
¹⁴⁹La β⁻ decay (1.091 s) [2002Sy01](#) (continued)

γ(¹⁴⁹Ce) (continued)

<u>E_γ</u>	<u>I_γ^{†a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>
1681.6 [‡] 9	2.4 10	1868.8		187.24	(3/2 ⁻ , 5/2, 7/2 ⁻)
1700.0 [‡] 13	0.8 4	1842.1		142.60	(5/2 ⁺)
1708.5 [‡] 7	1.4 4	1842.1		133.48	(3/2 ⁺)

[†] From γγ coin spectra unless otherwise stated.
[‡] From γγ coin.
[#] From singles γ spectra.
[@] From average of singles γ and γγ coin spectra.
[&] Estimated from I(x ray)/Iγ ([2002Sy01](#)). Most assignments are assumed from proposed ΔJ^π; mult=[D,E2] indicates dipole or E2 since no long-lived levels have been reported by [2002Sy01](#).
^a For absolute intensity per 100 decays, multiply by ≈0.135.
^b Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.



$^{149}\text{La} \beta^-$ decay (1.091 s) 2002Sy01

 $^{149}_{58}\text{Ce}_{91}$

¹⁵⁰La β⁻n decay (0.51 s) [1993Ru01](#)

Parent: ¹⁵⁰La: E=0.0; J^π=(3⁺); T_{1/2}=0.51 s 2; Q(β⁻n)=2287 11; %β⁻n decay=2.69 34

¹⁵⁰La-T_{1/2}: Weighted average of 0.519 s +10-22 ([2017Wu04](#)), 0.51 s 3 ([1995Ok02](#)), and 0.4 s 1 ([1991AyZY](#)). Others: 0.86 s 5 ([1993Ru01](#)), 0.7 ([1987MaZY](#)). Value is 0.59 s 11 in ¹⁵⁰La Adopted Levels in the ENSDF database, based on data in [1995Ok02](#), [1993Ru01](#) and [1991AyZY](#).

¹⁵⁰La-Q(β⁻n): From [2021Wa16](#).

¹⁵⁰La-%β⁻n decay: From %β⁻n=2.69 34 ([1993Ru01](#)).

[1993Ru01](#): Measured T_{1/2}(¹⁵⁰La)=0.86 s 5 and %β⁻n=2.69 34, at Studsvik.

¹⁴⁹Ce Levels

<u>E(level)</u>	<u>J^π</u>	<u>T_{1/2}</u>	<u>Comments</u>
0.0	(3/2 ⁻)	5.12 s 25	Assumed that g.s. of ¹⁴⁹ Ce is populated in this decay mode. J ^π , T _{1/2} : from the Adopted Levels.

^{248}Cm SF decay [2012Ur04,1997Ho11](#)

Parent: ^{248}Cm : $E=0.0$; $J^\pi=0^+$; $T_{1/2}=3.48\times 10^5$ y 6; %SF decay=8.39 16

^{248}Cm - $T_{1/2}$: From ^{248}Cm Adopted Levels in the ENSDF database (Sept 2014 update).

^{248}Cm -%SF decay: %SF=8.39 16 for ^{248}Cm decay.

[2012Ur04](#): measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin using EUROGAM2 array of anti-Compton spectrometers and four LEPS. Deduced levels, J, π , bands, and configurations.

[1997Ho11](#): measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma\gamma(\theta)$ (DCO) using EUROGAM II array 52 escape-suppressed Ge detectors, 24 Clovers, and four LEPS at Strasbourg. Some authors are the same on [1997Ho11](#) and [2012Ur04](#).

All data are from [2012Ur04](#), unless otherwise stated.

 ^{149}Ce Levels

Following levels proposed in [1997Ho11](#) are omitted, as not confirmed in [2012Ur04](#): 57.4, 64.2, 119.2 keV.

E(level) [†]	J^π [‡]	Comments
0.0@	3/2 ⁻	
55.0# 1	5/2 ⁻	
133.5 ^a 1	3/2 ⁺	
142.6& 1	5/2 ⁺	
147.7@ 2	7/2 ⁻	
187.3 2	(5/2 ⁻)	
190.8 ^a 2	7/2 ⁺	B(E1)/B(E2)= 8.3×10^{-7} b ⁻¹ 19. Electric dipole moment $D_0=0.020$ efm 3, using $Q_0=4.75$ eb.
206.7& 2	9/2 ⁺	
239.5# 2	9/2 ⁻	
288.9 3	(7/2 ⁻)	
335.7 ^a 2	11/2 ⁺	B(E1)/B(E2)= 6.5×10^{-8} b ⁻¹ 16. Electric dipole moment $D_0=0.023$ efm 4, using $Q_0=4.75$ eb.
347.0& 2	13/2 ⁺	
403.7@ 2	11/2 ⁻	
525.7# 2	13/2 ⁻	
587.9 ^a 2	15/2 ⁺	
588.4& 2	17/2 ⁺	
752.1@ 2	15/2 ⁻	
896.8# 2	17/2 ⁻	
931.6& 3	21/2 ⁺	
945.1 ^a 2	19/2 ⁺	
1163.1@ 3	19/2 ⁻	
1329.0# 3	21/2 ⁻	
1362.6& 3	25/2 ⁺	
1395.5 ^a 3	23/2 ⁺	
1620.9@ 5	(23/2 ⁻)	
1803.9# 4	25/2 ⁻	
1864.6& 4	29/2 ⁺	
1923.4 ^a 4	27/2 ⁺	
2313.4# 10	(29/2 ⁻)	
2421.8& 4	33/2 ⁺	

Continued on next page (footnotes at end of table)

^{248}Cm SF decay [2012Ur04](#), [1997Ho11](#) (continued) ^{149}Ce Levels (continued)

$E(\text{level})^\dagger$	$J^\pi^\ddagger$
2510.4 ^a 5	(31/2 ⁺)
3018.0 ^{&} 5	(37/2 ⁺)

[†] From least-squares fit to E_γ data.[‡] As proposed by [2012Ur04](#) based on band assignments and decay modes.# Band(A): $\nu 3/2[532], \alpha = +1/2$.@ Band(a): $\nu 3/2[532], \alpha = -1/2$.& Band(B): $\nu 3/2[651], \alpha = +1/2$.^a Band(b): $\nu 3/2[651], \alpha = -1/2$. $\gamma(^{149}\text{Ce})$

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	$I_{(\gamma+ce)}$	Comments
(9.1 [†])		142.6	5/2 ⁺	133.5	3/2 ⁺		40 [†] 15	
(11.3 [†])		347.0	13/2 ⁺	335.7	11/2 ⁺		7 [†] 2	
(15.9 [†])		206.7	9/2 ⁺	190.8	7/2 ⁺		60 [†] 20	
48.1 2	8 3	190.8	7/2 ⁺	142.6	5/2 ⁺			
55.1 3	18 3	55.0	5/2 ⁻	0.0	3/2 ⁻			$E_\gamma=54.9$ (1997Ho11).
57.4 3	12 3	190.8	7/2 ⁺	133.5	3/2 ⁺			
64.0 2	6 2	206.7	9/2 ⁺	142.6	5/2 ⁺			$E_\gamma=64.2$ (1997Ho11 , assigned from a 64 level).
78.5 2	7 2	133.5	3/2 ⁺	55.0	5/2 ⁻			
87.5 1	13 2	142.6	5/2 ⁺	55.0	5/2 ⁻			$E_\gamma=87.4$ (1997Ho11 , assigned from 207 level)).
91.7 2	14 2	239.5	9/2 ⁻	147.7	7/2 ⁻			
92.6 2	20 2	147.7	7/2 ⁻	55.0	5/2 ⁻			
96.3 3	2.7 4	335.7	11/2 ⁺	239.5	9/2 ⁻			
101.5 3	3 1	288.9	(7/2 ⁻)	187.3	(5/2 ⁻)			
121.9 2	4 1	525.7	13/2 ⁻	403.7	11/2 ⁻			
129.0 1	14 2	335.7	11/2 ⁺	206.7	9/2 ⁺			$E_\gamma=129.0$, % $I_\gamma=41$ 2 (1997Ho11).
132.2 3	4 2	187.3	(5/2 ⁻)	55.0	5/2 ⁻			
133.5 1	20 2	133.5	3/2 ⁺	0.0	3/2 ⁻			$E_\gamma=133.4$ (1997Ho11 , assigned from 191 level).
135.8 1	49 3	190.8	7/2 ⁺	55.0	5/2 ⁻			$E_\gamma=135.8$ (1997Ho11).
140.5 2	55 3	347.0	13/2 ⁺	206.7	9/2 ⁺			$E_\gamma=140.6$ (1997Ho11).
141.3 3	7 1	288.9	(7/2 ⁻)	147.7	7/2 ⁻			
142.6 2	44 3	142.6	5/2 ⁺	0.0	3/2 ⁻			$E_\gamma=142.5$ (1997Ho11 , assigned from 207 level).
144.9 1	18 2	335.7	11/2 ⁺	190.8	7/2 ⁺			$E_\gamma=144.9$, % $I_\gamma=59$ 2 (1997Ho11).
147.7 3	7 1	147.7	7/2 ⁻	0.0	3/2 ⁻			
164.2 2	8 1	403.7	11/2 ⁻	239.5	9/2 ⁻			
184.5 1	32 3	239.5	9/2 ⁻	55.0	5/2 ⁻			
187.2 3	8 2	187.3	(5/2 ⁻)	0.0	3/2 ⁻			
226.3 [‡] 4	2 1	752.1	15/2 ⁻	525.7	13/2 ⁻			
241.1 2	14 2	587.9	15/2 ⁺	347.0	13/2 ⁺			$E_\gamma=241.2$, % $I_\gamma=41$ 2 (1997Ho11).
241.4 1	100 4	588.4	17/2 ⁺	347.0	13/2 ⁺			$E_\gamma=241.3$ (1997Ho11).
252.2 1	19 2	587.9	15/2 ⁺	335.7	11/2 ⁺			$E_\gamma=252.2$, % $I_\gamma=59$ 2 (1997Ho11).
255.8 2	18 2	403.7	11/2 ⁻	147.7	7/2 ⁻			
286.2 1	24 2	525.7	13/2 ⁻	239.5	9/2 ⁻			
343.2 1	72 4	931.6	21/2 ⁺	588.4	17/2 ⁺	Q		$E_\gamma=342.9$ (1997Ho11). DCO=0.96 6, gated on stretched quadrupole 241.2 γ (1997Ho11).

Continued on next page (footnotes at end of table)

^{248}Cm SF decay [2012Ur04](#), [1997Ho11](#) (continued) $\gamma(^{149}\text{Ce})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.	Comments
348.5 1	17 2	752.1	15/2 ⁻	403.7	11/2 ⁻		DCO=0.96 6, gated on stretched quadrupole 241.2 γ (1997Ho11).
357.2 1	19 2	945.1	19/2 ⁺	587.9	15/2 ⁺		$E_\gamma=357.2$ (1997Ho11).
371.1 1	16 2	896.8	17/2 ⁻	525.7	13/2 ⁻		
411.0 2	6 1	1163.1	19/2 ⁻	752.1	15/2 ⁻		
431.0 1	38 2	1362.6	25/2 ⁺	931.6	21/2 ⁺	Q	$E_\gamma=430.7$ (1997Ho11). DCO=0.90 6, gated on stretched quadrupole 342.9 γ (1997Ho11).
432.2 2	9 2	1329.0	21/2 ⁻	896.8	17/2 ⁻		
450.4 2	11 1	1395.5	23/2 ⁺	945.1	19/2 ⁺		$E_\gamma=450.2$ (1997Ho11).
457.8 3	2 1	1620.9	(23/2 ⁻)	1163.1	19/2 ⁻		
474.9 2	5 1	1803.9	25/2 ⁻	1329.0	21/2 ⁻		
502.0 2	25 2	1864.6	29/2 ⁺	1362.6	25/2 ⁺		$E_\gamma=501.7$ (1997Ho11).
509.5 9	3 1	2313.4	(29/2 ⁻)	1803.9	25/2 ⁻		
527.9 2	7 1	1923.4	27/2 ⁺	1395.5	23/2 ⁺		$E_\gamma=527.9$ (1997Ho11).
557.2 2	9 1	2421.8	33/2 ⁺	1864.6	29/2 ⁺		$E_\gamma=556.9$ (1997Ho11).
587.0 3	4 1	2510.4	(31/2 ⁺)	1923.4	27/2 ⁺		$E_\gamma=586.7$ (1997Ho11).
596.2 3	5 1	3018.0	(37/2 ⁺)	2421.8	33/2 ⁺		

[†] Energy deduced by evaluators from level-energy difference. Transition intensity listed by [2012Ur04](#) is from intensity balance at the relevant level.

[‡] Placement of transition in the level scheme is uncertain.

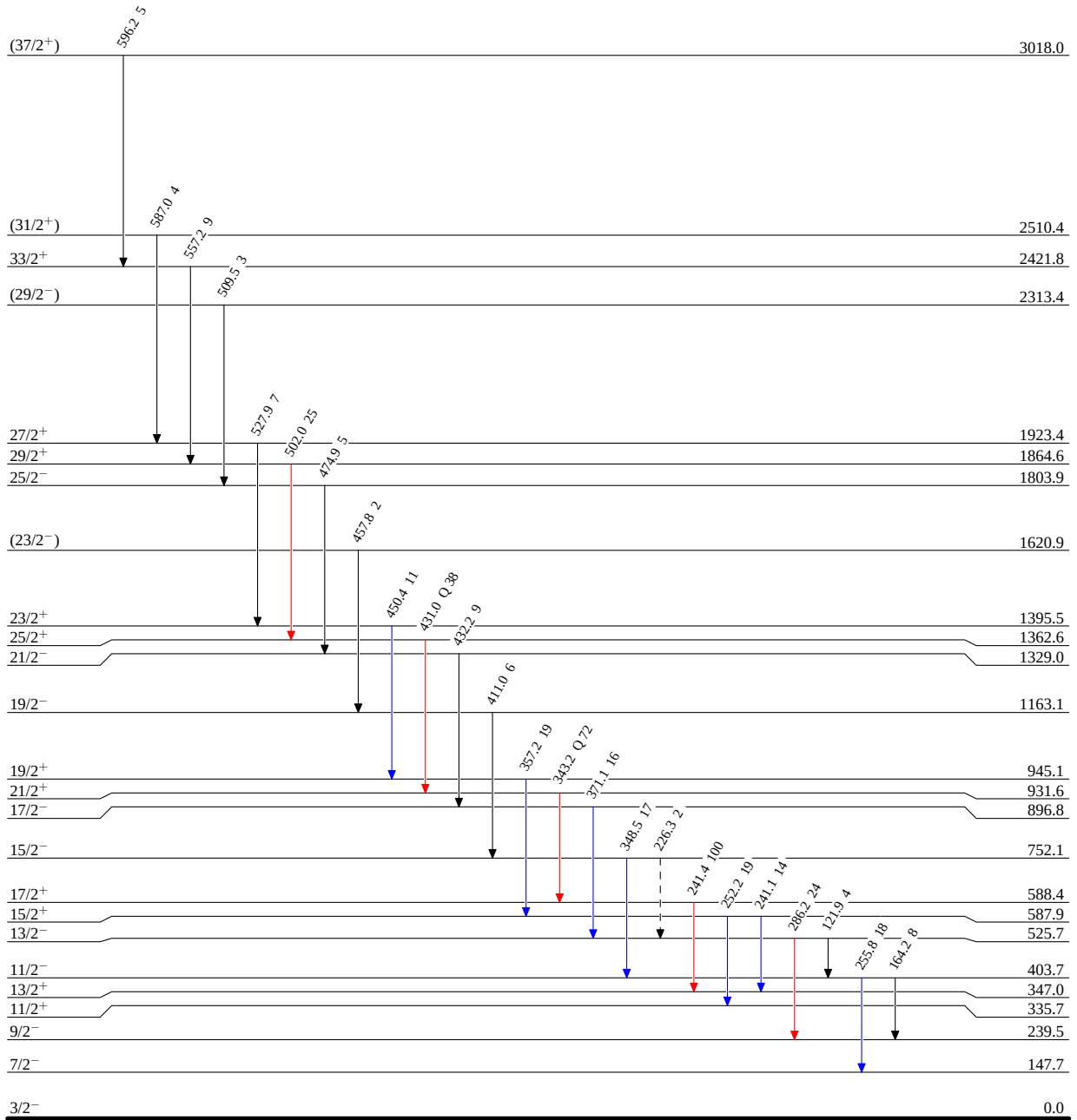
^{248}Cm SF decay 2012Ur04,1997Ho11

Legend

Level Scheme

Intensities: Relative I_γ

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\cdots$ γ Decay (Uncertain)

 $^{149}_{58}\text{Ce}_{91}$

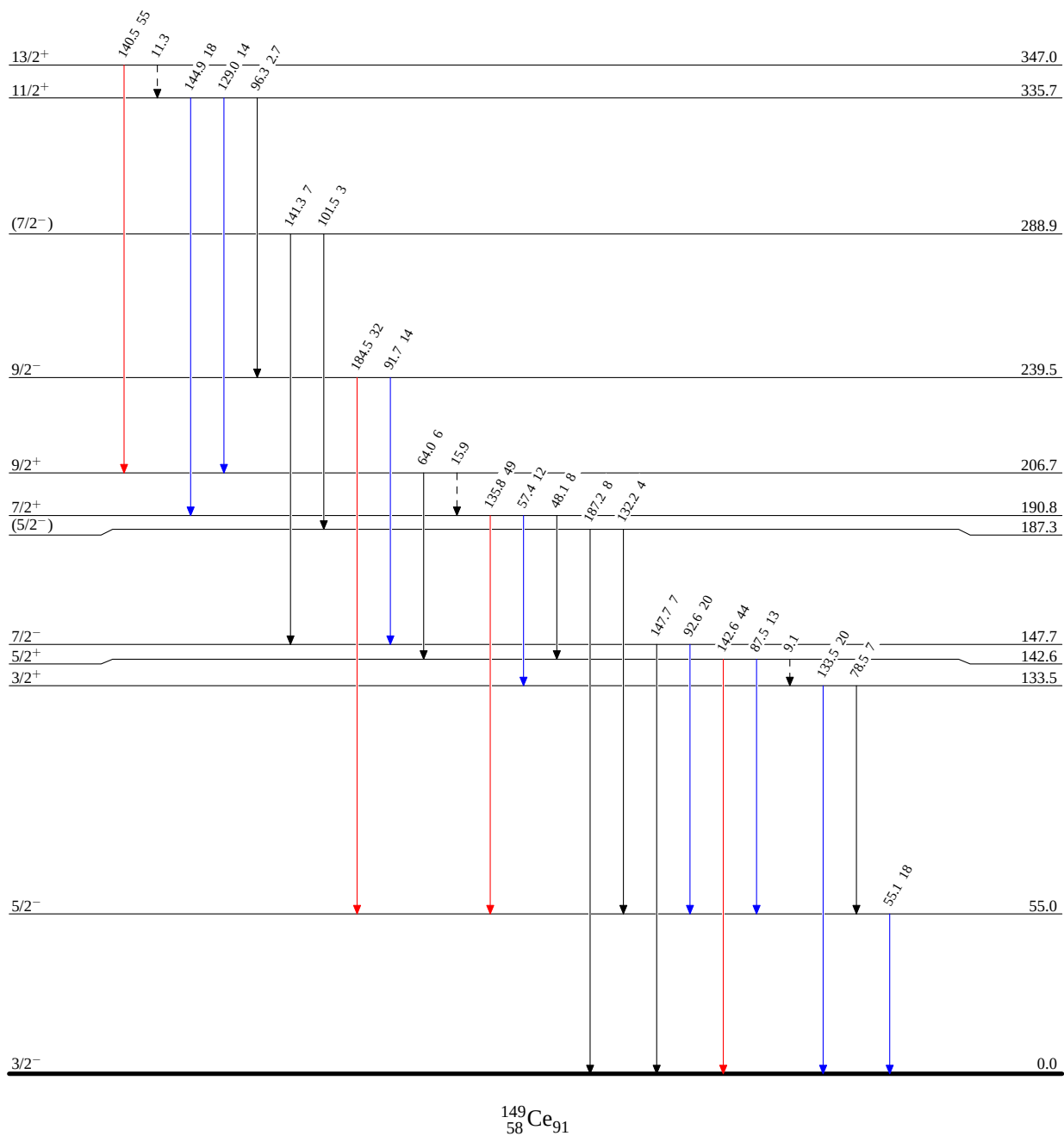
^{248}Cm SF decay 2012Ur04,1997Ho11

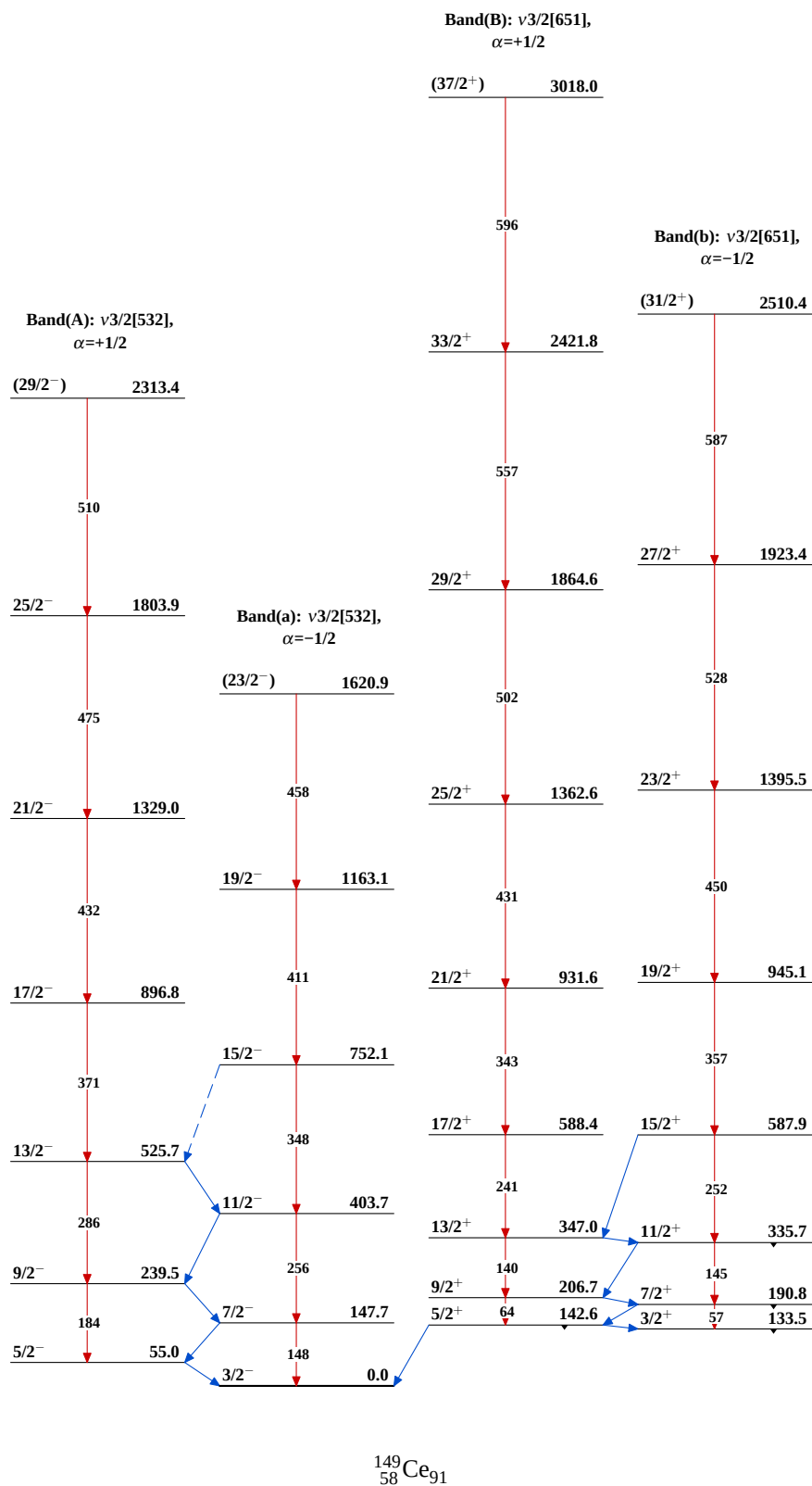
Legend

Level Scheme (continued)

Intensities: Relative I_γ

- ▶ $I_\gamma < 2\% \times I_\gamma^{\max}$
- ▶ $I_\gamma < 10\% \times I_\gamma^{\max}$
- ▶ $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - -▶ γ Decay (Uncertain)

 $^{149}_{58}\text{Ce}_{91}$

^{248}Cm SF decay 2012Ur04,1997Ho11

^{252}Cf SF decay [1996Ba34](#)

Parent: ^{252}Cf : $E=0$; $J^\pi=0^+$; $T_{1/2}=2.647$ y 3; %SF decay=3.102 3

^{252}Cf - $T_{1/2}$: From ^{252}Cf Adopted Levels in the ENSDF database (Jan 2021 update).

^{252}Cf -%SF decay: %SF=3.102 3 for ^{252}Cf decay.

[1996Ba34](#): Measured E_γ , I_γ , $\gamma\gamma$ using Gammasphere array with with 36 Ge detectors at LBNL.

Others: [1974CIZX](#) (also [1973CIZV](#), [1972CIZN](#)): measured γ , $T_{1/2}$ in 6-parameter coin. experiment. Mass assignment of γ rays is within one unit (148-150) ([1974CIZX](#)). Fission fragment isomers populated before β decay in deexcitation of fission fragments observed through (x-ray) γ and $\gamma\gamma$ coincidences. Mass assignments, energies, lifetimes measured in 6-parameter experiment using a Ge(Li) and a Si(Li) detector.

[1971Ho29](#) (also [1969WiZX](#)). Measured γ .

The level scheme and band structures proposed by [1996Ba34](#) are extensively revised by [2002Sy01](#), based on their ^{149}La β^- decay study. These revisions are incorporated in the Adopted Levels, Gammas.

 ^{149}Ce Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	Comments
0	(3/2 ⁻)	J^π : from the Adopted Levels.
0+x	(5/2 ⁺)	E(level): 142.6 in the Adopted Levels.
135.3 3	(5/2 ⁻)	E(level): 135.3 γ placed from 190.9, (9/2 ⁺) level in the Adopted dataset.
142.2+x 3	(9/2 ⁺)	E(level): 142.6 γ placed from 142.6, (5/2 ⁺) level in the Adopted dataset.
151.8 4	(7/2 ⁻)	E(level): 206.7, (9/2 ⁺) in the Adopted Levels.
280.7@ 4	(9/2 ⁻)	E(level): 335.7, (11/2 ⁺) in the Adopted Levels.
282.8+x# 5	(13/2 ⁺)	E(level): 347.0, (13/2 ⁺) in the Adopted Levels.
524.1+x# 6	(17/2 ⁺)	E(level): 588.4, (17/2 ⁺) in the Adopted Levels.
533.2@ 5	(13/2 ⁻)	E(level): 588.0, (15/2 ⁺) in the Adopted Levels.
866.7+x# 6	(21/2 ⁺)	E(level): 931.6, (21/2 ⁺) in the Adopted Levels.
890.4@ 6	(17/2 ⁻)	E(level): 945.2, (19/2 ⁺) in the Adopted Levels.
1297.4+x# 7	(25/2 ⁺)	E(level): 1362.7, (25/2 ⁺) in the Adopted Levels.
1340.8@ 7	(21/2 ⁻)	E(level): 1395.6, (23/2 ⁺) in the Adopted Levels.
1798.9+x# 8	(29/2 ⁺)	E(level): 1864.7, (29/2 ⁺) in the Adopted Levels.
1868.5@ 8	(25/2 ⁻)	E(level): 1923.5, (27/2 ⁺) in the Adopted Levels.
2355.4+x# 8	(33/2 ⁺)	E(level): 2421.9, (33/2 ⁺) in the Adopted Levels.
2455.9@ 8	(29/2 ⁻)	E(level): 2510.5, (31/2 ⁺) in the Adopted Levels.
2951.4+x# 9	(37/2 ⁺)	E(level): 3018.1, (37/2 ⁺) in the Adopted Levels.
3087.2@ 9	(33/2 ⁻)	E(level): 3141.8, (35/2 ⁺) in the Adopted Levels.
3568.9+x# 9	(41/2 ⁺)	E(level): 3635.6, (41/2 ⁺) in the Adopted Levels.

[†] From least-squares fit to E_γ data assuming $\Delta E_\gamma=0.3$ keV. In [2012Ur04](#) and [2002Sy01](#), all the positive-parity states are built on a 142.6 level with $64.0 \rightarrow 142.6$ cascade from a 206.6 level ($x=64.0$ for states above 206.9), and all the excited negative-parity states on a 55.0 level. The low-lying level structure from ^{149}La β^- decay ([2002Sy01](#)) differs substantially from that in [1996Ba34](#).

[‡] As proposed by [1996Ba34](#); based on band assignments.

Band(A): $\nu_{13/2}$. See Adopted Levels for dominant 3/2[651] assignment by [2002Sy01](#).

@ Band(B): $\nu_{h9/2}$. Negative-parity band is suggested in [1996Ba34](#), but positive-parity band in the Adopted Levels from [2012Ur04](#), with $\nu_{3/2}[651]$ configuration.

^{252}Cf SF decay **1996Ba34** (continued) $\gamma(^{149}\text{Ce})$

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
(16.5)		151.8	(7/2 ⁻)	135.3	(5/2 ⁻)	
128.9	5.9	280.7	(9/2 ⁻)	151.8	(7/2 ⁻)	
135.3	81	135.3	(5/2 ⁻)	0	(3/2 ⁻)	Other: $E_\gamma=135.6$ 2, $I_\gamma/100$ fissions=0.293 17 (1974ClZX , 1973ClZV). $T_{1/2}=3.5$ ns 5 (1974ClZX) for 135.3 γ is proposed (2003Sy01) as half-life of 206.6 level.
140.6	145	282.8+x	(13/2 ⁺)	142.2+x	(9/2 ⁺)	
142.2	100	142.2+x	(9/2 ⁺)	0+x	(5/2 ⁺)	Other: $E_\gamma=142.2$ 2, $I_\gamma/100$ fissions=0.303 18(1974ClZX , 1973ClZV). γ also reported by 1971Ho29 . $T_{1/2}=3.9$ ns 5 (1974ClZX) for 142.2 γ is proposed (2003Sy01) as half-life of 206.6 level.
145.4	21	280.7	(9/2 ⁻)	135.3	(5/2 ⁻)	
241.3	80	524.1+x	(17/2 ⁺)	282.8+x	(13/2 ⁺)	
252.5	75	533.2	(13/2 ⁻)	280.7	(9/2 ⁻)	
342.6	56	866.7+x	(21/2 ⁺)	524.1+x	(17/2 ⁺)	
357.2	50	890.4	(17/2 ⁻)	533.2	(13/2 ⁻)	
430.7	32	1297.4+x	(25/2 ⁺)	866.7+x	(21/2 ⁺)	
450.4	31	1340.8	(21/2 ⁻)	890.4	(17/2 ⁻)	
501.5	15	1798.9+x	(29/2 ⁺)	1297.4+x	(25/2 ⁺)	
527.7	14	1868.5	(25/2 ⁻)	1340.8	(21/2 ⁻)	
556.5	4.3	2355.4+x	(33/2 ⁺)	1798.9+x	(29/2 ⁺)	
587.4	3	2455.9	(29/2 ⁻)	1868.5	(25/2 ⁻)	
596.0	2.1	2951.4+x	(37/2 ⁺)	2355.4+x	(33/2 ⁺)	
617.5	1.0	3568.9+x	(41/2 ⁺)	2951.4+x	(37/2 ⁺)	E_γ : this γ was not seen consistently in $\gamma\gamma$ -coin data in ^{248}Cm SF decay (2012Ur04).
631.3	1.1	3087.2	(33/2 ⁻)	2455.9	(29/2 ⁻)	E_γ : this γ was not seen in ^{248}Cm SF decay (2012Ur04).

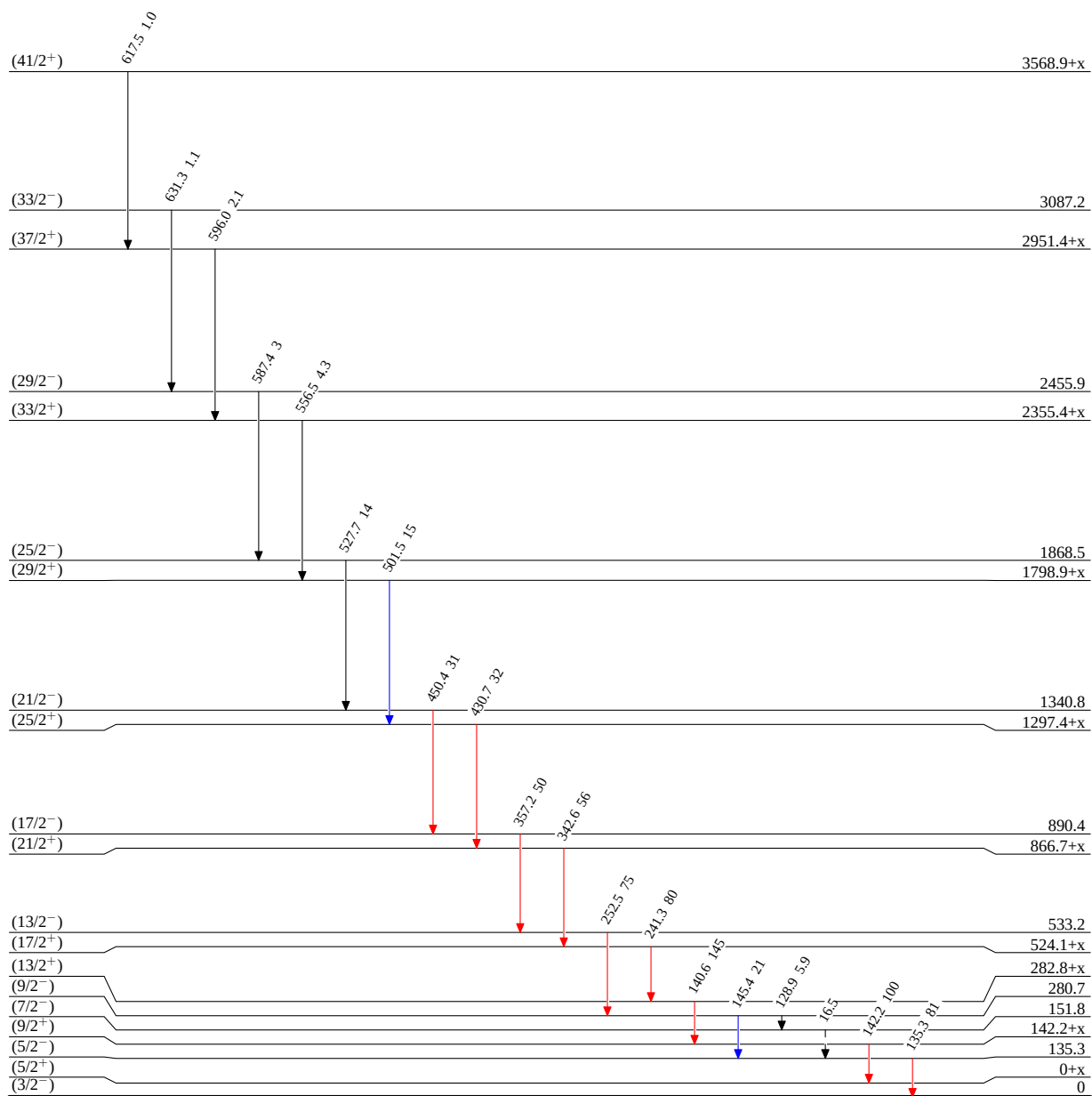
^{252}Cf SF decay $^{1996}\text{Ba}34$

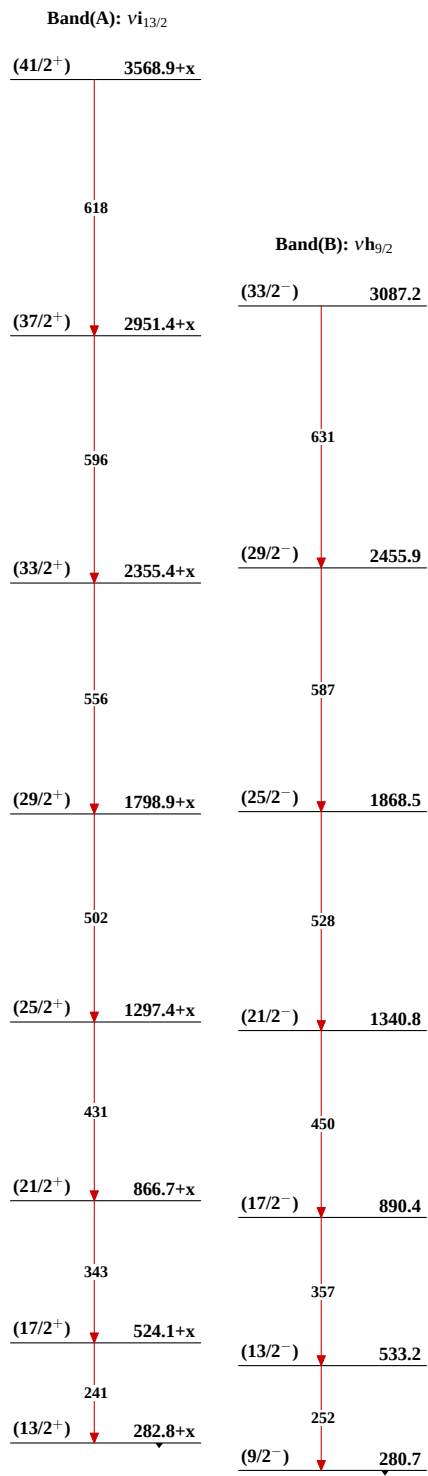
Legend

Level Scheme

 Intensities: Relative I_γ

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - - γ Decay (Uncertain)


 $^{149}_{58}\text{Ce}_{91}$

^{252}Cf SF decay $^{1996}\text{Ba}34$

 $^{149}_{58}\text{Ce}_{91}$

Adopted Levels, Gammas

$Q(\beta^-)=3336$ 10; $S(n)=6575$ 18; $S(p)=7930$ 15; $Q(\alpha)=-629$ 16 2021Wa16

$S(2n)=11738$ 19, $S(2p)=18939$ 15 (2021Wa16).

Mass measurements by Penning-trap method: 2006Sa56, 2004Cl07.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for five references dealing with nuclear structure theoretical calculations.

¹⁴⁹Pr Levels

Cross Reference (XREF) Flags

- A** ¹⁴⁹Ce β^- decay (5.12 s)
- B** ²⁴⁸Cm, ²⁵²Cf SF decay
- C** ²⁵²Cf SF decay
- D** ¹⁵⁰Nd(d, ³He)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
0.0 ^a	(5/2 ⁺)	2.26 min 8	ABCD	% β^- =100 XREF: D(?). J^π : (5/2 ⁺ , 7/2 ⁺) is suggested based on shell-model orbitals d _{5/2} or g _{7/2} consistent with systematics of odd Pr isotopes; 5/2 ⁺ is suggested by particle-triaxial rotor model (PTRM) calculations (1993Ma39) and by dominant (~95%) configuration= $\pi 5/2[413]$ from quasiparticle-rotor model (QPRM) calculations (2010Rz02); observed β^- feedings to 3/2 ⁺ levels in ¹⁴⁹ Nd also support 5/2 ⁺ . However, L(d, ³ He)=4 suggests 7/2 ⁺ , 9/2 ⁺ . T _{1/2} : weighted average of 2.3 min 2 ($\gamma(t)$, 1967Va14), 2.25 min 8 ($\gamma(t)$, 1977Pi06). Others: 2.9 min 1 (1973Oh08), 2.3 min (1964Ho03).
40 [#]			D	J^π : L(d, ³ He)=2 suggests 3/2 ⁺ , 5/2 ⁺ .
58.11 [@] 6	(7/2 ⁻)	23.4 ns 18	ABC	J^π : E1 γ to (5/2 ⁺); possible bandhead. T _{1/2} : from weighted average of 26 ns 4 (2010Rz02, $\gamma\gamma(t)$ in ²⁵² Cf SF) and 22.9 ns 18 (1974ClZX, (fragment-fragment)(x ray) $\gamma(t)$ in ²⁴⁸ Cm, ²⁵² Cf SF). Others: 7.2 ns 6 (2014Ko27, $\gamma\gamma(t)$ in ¹⁴⁹ Ce β^-), 9.7 ns 21 (1996YaZV, $\beta\gamma(t)$ in β^- , two authors are the same as in 2014Ko27); in severe disagreement with the values from SF decays. Reason for the discrepancy is not clear, if it is assumed that the same 58-keV γ ray is involved in the SF decays and in ¹⁴⁹ Ce β^- decay.
80 [#]			D	E(level): this level may correspond to 86.3 level.
86.40 ^a 6	(7/2 ⁺)	4.2 ns 5	A C	J^π : L(d, ³ He)=2 suggests 3/2 ⁺ , 5/2 ⁺ . J^π : M1 γ to (5/2 ⁺); band member. T _{1/2} : from $\gamma\gamma(t)$ in β^- decay (2014Ko27). Other: 4.2 ns 21 ($\beta\gamma$ -coin in β^- , 1996YaZV).
106.86 7			A	
125.55 7		1.0 ns 2	A	T _{1/2} : from $\gamma\gamma(t)$ in β^- decay (2014Ko27).
161.3 [@] 3	(11/2 ⁻)		BC	
162.97 7			A	
174.5 ^{&} 4	(9/2 ⁺)		C	J^π : γ to (7/2 ⁻); band based on this level interpreted as possible octupole band as the transitions (implied as E1) connect this band to band 1.
215.46 8			A	
220 [#]			D	E(level): this level may correspond to 215.6 and/or 230.8 level. J^π : L(d, ³ He)=(2) suggests (3/2 ⁺ , 5/2 ⁺).
230.98 8			A	
260 [#]			D	J^π : L(d, ³ He)=4 suggests 7/2 ⁺ , 9/2 ⁺ .
311.90 12			A	
364.9 ^a 5	(11/2 ⁺)		C	
380.27 7			A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Pr Levels (continued)

E(level) [†]	J^π [‡]	XREF	Comments
381.1 [@] 4	(15/2 ⁻)	BC	
397.70 12		A	
406.9 ^{&} 4	(13/2 ⁺)	C	
440 [#]		D	E(level): this level may correspond to 448.3 level. J^π : L(d, ³ He)=2 suggests 3/2 ⁺ , 5/2 ⁺ .
448.33 7		A	
546.16 13		A	
550 [#]		D	E(level): this level may correspond to 546 level. J^π : L(d, ³ He)=4 suggests 7/2 ⁺ , 9/2 ⁺ .
575.28 13		A	
590 [#]		D	E(level): this level may correspond to 575 level. J^π : L(d, ³ He)=2 suggests 3/2 ⁺ , 5/2 ⁺ .
660 [#]		D	J^π : L(d, ³ He)=(2) suggests (3/2 ⁺ , 5/2 ⁺).
711.4 [@] 5	(19/2 ⁻)	BC	
736.5 ^a 7	(15/2 ⁺)	C	
751.6 ^{&} 5	(17/2 ⁺)	C	
951.11 9		A	
980 [#]		D	J^π : L(d, ³ He)=(0) suggests (1/2 ⁺).
1127.5 [@] 6	(23/2 ⁻)	BC	
1173.9 ^a 9	(19/2 ⁺)	C	
1189.0 ^{&} 6	(21/2 ⁺)	C	
1607.4 [@] 6	(27/2 ⁻)	BC	
1664.6 ^a 10	(23/2 ⁺)	C	
1695.3 ^{&} 6	(25/2 ⁺)	C	
2129.9 [@] 8	(31/2 ⁻)	BC	
2191.9 ^a 12	(27/2 ⁺)	C	
2230.4 ^{&} 7	(29/2 ⁺)	C	
2664.4 [@] 10	(35/2 ⁻)	BC	
2722.1 ^{&} 9	(33/2 ⁺)	C	
3184.7 [@] 11	(39/2 ⁻)	BC	
3723.6 [@] 12	(43/2 ⁻)	C	

[†] From a least-squares fit to E_γ data. There is some evidence of two additional nanosecond isomers, connected with 54.7γ and 143γ, which are not placed in a decay scheme.

[‡] As proposed by 2015Wa28 in ²⁵²Cf SF decay, based on band structures.

Tentative level energy from (d,³He) (1981VaZJ report). It is possible levels are shifted in energy, due to calibration issues, as pointed out in the ¹⁵⁰Nd(d,³He) dataset.

@ Band(A): π1/2[550] band. Dominant configuration=π1/2[550] from QRPM calculations (2010Rz02); the levels of this band can mix with π3/2[541] orbital. 2015Wa28 interpret this band also as a possible octupole band, with bands 1 and 2 in Fig. 14 forming an alternating-parity structure.

& Band(B): Possible octupole band. Based on the presence of E1 transitions from band 2 to band 1, bands 1 and 2 in Fig. 14 of 2015Wa28 possibly form alternating-parity band structure.

^a Band(C): π5/2[413] band. Band assignment proposed by 2015Wa28, based on interpretation of ¹⁴⁹Pr g.s. with dominant configuration=π5/2[413] by 2010Rz02.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pr})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	$\alpha^\#$	Comments
58.11	(7/2 ⁻)	58.2 1	100	0.0	(5/2 ⁺)	E1	1.089 16	B(E1)(W.u.)=2.50×10 ⁻⁵ +21-18 Mult.: from ce data in ^{248}Cm , ^{252}Cf SF (2010Rz02). E_γ : from β^- decay. Other: 58.5 3 in ^{252}Cf SF.
86.40	(7/2 ⁺)	28.4 1 86.5 $\ddagger$ 1	>27 100 $\ddagger$ 5	58.11 (7/2 ⁻) 0.0 (5/2 ⁺)	[E1] M1	1.347 23 1.963 28		1.6×10 ⁻⁴ <B(E1)(W.u.)<0.0012 B(M1)(W.u.)<0.0023 Mult.: from total conversion coefficient in ^{252}Cf SF decay (2015Wa28).
106.86		48.8 1 106.9 1	100 5 7.2 4	58.11 (7/2 ⁻) 0.0 (5/2 ⁺)				
125.55		67.4 1 125.6 1	100 5 0.8 3	58.11 (7/2 ⁻) 0.0 (5/2 ⁺)				
161.3	(11/2 ⁻)	103.2 3	100	58.11 (7/2 ⁻)	(E2)	1.893 33		Mult.: M1,E2 from total conversion coefficient in ^{248}Cm , ^{252}Cf SF (2010Rz02), but (E2) from assigned J^π values.
162.97		56.2 1 76.5 1 104.9 1	27.3 21 100 5 87 4	106.86 86.40 (7/2 ⁺) 58.11 (7/2 ⁻)				
174.5	(9/2 ⁺)	(13.2) 116.4 5		161.3 (11/2 ⁻) 58.11 (7/2 ⁻)				
215.46		52.6 1 128.9 1 157.5 1	12.9 10 100 5 6.2 10	162.97 86.40 (7/2 ⁺) 58.11 (7/2 ⁻)				
230.98		144.9 1 172.6 1	100 4 66 4	86.40 (7/2 ⁺) 58.11 (7/2 ⁻)				
311.90		225.5 1	100	86.40 (7/2 ⁺)				
364.9	(11/2 ⁺)	278.5 5	100	86.40 (7/2 ⁺)				
380.27		294.1 $\ddagger$ 1 322.2 $\ddagger$ 1 380.0 1	21.5 $\ddagger$ 11 17.0 $\ddagger$ 7 100 4	86.40 (7/2 ⁺) 58.11 (7/2 ⁻) 0.0 (5/2 ⁺)				
381.1	(15/2 ⁻)	219.8 3	100	161.3 (11/2 ⁻)				
397.70		311.3 1	100	86.40 (7/2 ⁺)				
406.9	(13/2 ⁺)	(25.8) 232.4 3 245.6 3		381.1 (15/2 ⁻) 174.5 (9/2 ⁺) 161.3 (11/2 ⁻)				
448.33		217.4 1 233.0 1 285.3 1 322.8 1 361.8 1 390.2 1	6.8 6 42.3 23 49.4 26 100 6 45.2 26 61 3	230.98 215.46 162.97 125.55 86.40 (7/2 ⁺) 58.11 (7/2 ⁻)				
546.16		330.7 1	100	215.46				
575.28		344.3 1	100	230.98				
711.4	(19/2 ⁻)	330.3 3	100	381.1 (15/2 ⁻)				
736.5	(15/2 ⁺)	371.6 5	100	364.9 (11/2 ⁺)				
751.6	(17/2 ⁺)	344.7 5 370.5 5	69 5 100 10	406.9 (13/2 ⁺) 381.1 (15/2 ⁻)				
951.11		864.7 1 893.0 1	89 4 100 5	86.40 (7/2 ⁺) 58.11 (7/2 ⁻)				
1127.5	(23/2 ⁻)	416.0 3	100	711.4 (19/2 ⁻)				
1173.9	(19/2 ⁺)	437.4@ 5	100	736.5 (15/2 ⁺)				

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{149}\text{Pr})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π
1189.0	(21/2 ⁺)	437.4@ 5	100 9	751.6 (17/2 ⁺)		2191.9	(27/2 ⁺)	527.3 5	100	1664.6 (23/2 ⁺)	
		477.6 5	30 4	711.4 (19/2 ⁻)		2230.4	(29/2 ⁺)	535.5 5	100 10	1695.3 (25/2 ⁺)	
1607.4	(27/2 ⁻)	479.8 3	100	1127.5 (23/2 ⁻)				622.7 5	<13	1607.4 (27/2 ⁻)	
1664.6	(23/2 ⁺)	490.7 5	100	1173.9 (19/2 ⁺)		2664.4	(35/2 ⁻)	534.5 5	100	2129.9 (31/2 ⁻)	
1695.3	(25/2 ⁺)	506.4 5	100 8	1189.0 (21/2 ⁺)		2722.1	(33/2 ⁺)	491.7 5	100	2230.4 (29/2 ⁺)	
		568.0 5	27 3	1127.5 (23/2 ⁻)		3184.7	(39/2 ⁻)	520.3 5	100	2664.4 (35/2 ⁻)	
2129.9	(31/2 ⁻)	522.5 5	100	1607.4 (27/2 ⁻)		3723.6	(43/2 ⁻)	538.9 5	100	3184.7 (39/2 ⁻)	

[†] From either $^{149}\text{Ce } \beta^-$ or ^{252}Cf SF decay.

[‡] From $^{149}\text{Ce } \beta^-$ decay.

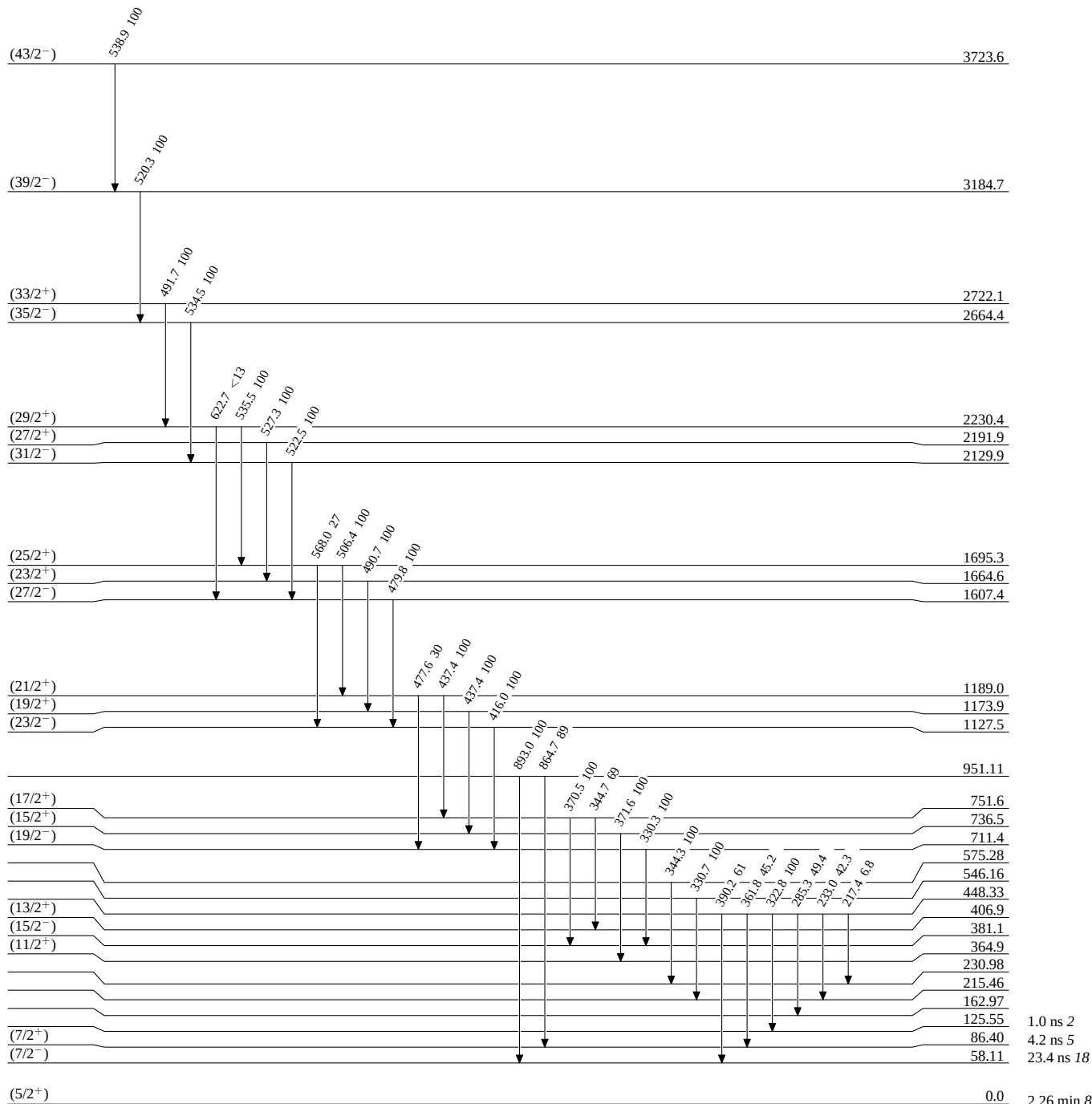
Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

@ Multiply placed.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level


¹⁴⁹Pr₅₉

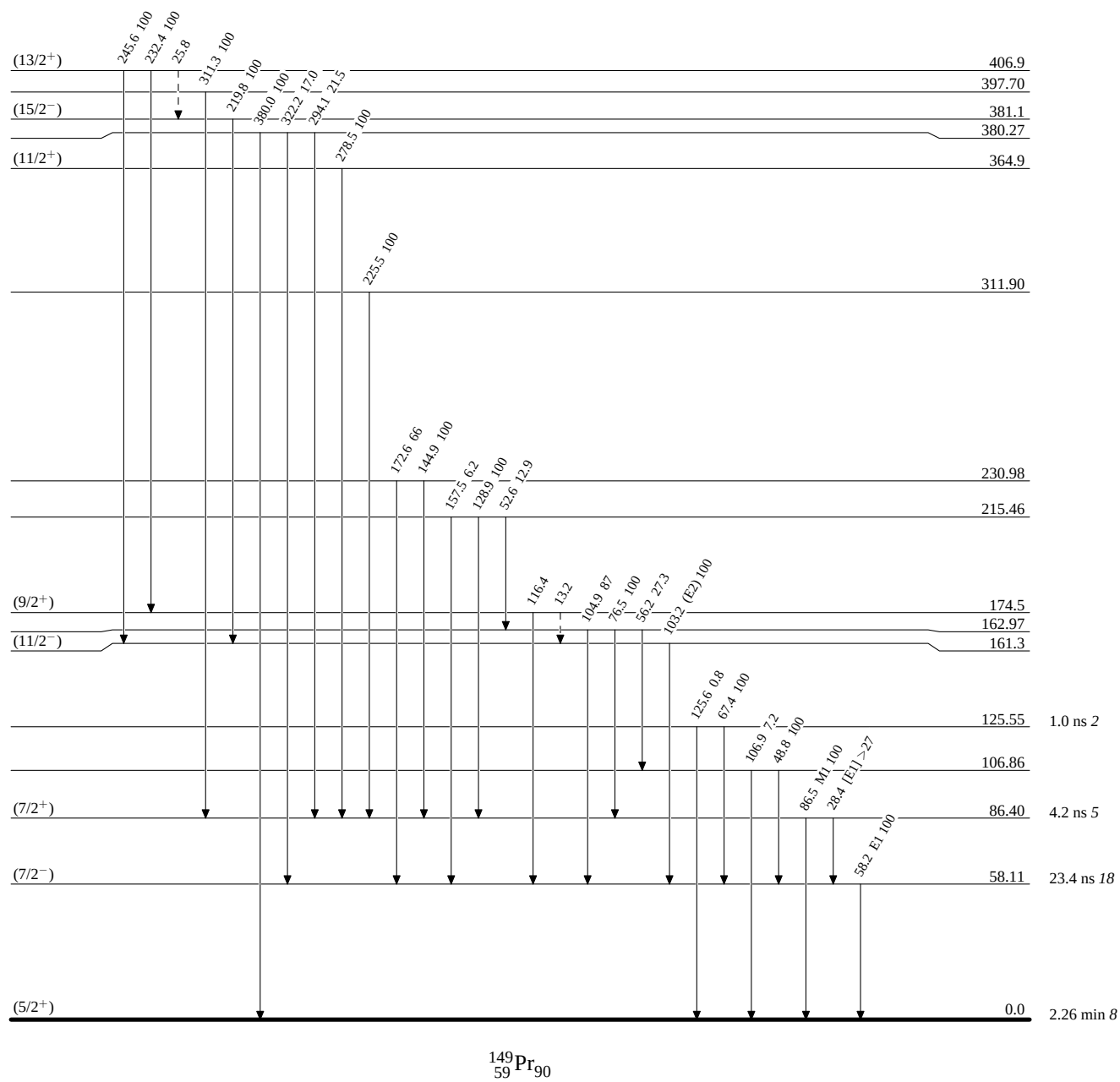
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



Adopted Levels, Gammas**Band(A): $\pi 1/2[550]$ band**

(43/2⁻) 3723.6

539

(39/2⁻) 3184.7

520

(35/2⁻) 2664.4

534

(31/2⁻) 2129.9

522

(27/2⁻) 1607.4

480

(23/2⁻) 1127.5

416

(19/2⁻) 711.4

330

(15/2⁻) 381.1

220

(11/2⁻) 161.3

103

(7/2⁻) 58.11

**Band(B): Possible
octupole band**

(33/2⁺) 2722.1

492

(29/2⁺) 2230.4

536

(25/2⁺) 1695.3

506

(21/2⁺) 1189.0

437

(17/2⁺) 751.6

345

(13/2⁺) 406.9

232

(9/2⁺) 174.5

Band(C): $\pi 5/2[413]$ band

(27/2⁺) 2191.9

527

(23/2⁺) 1664.6

491

(19/2⁺) 1173.9

437

(15/2⁺) 736.5

372

(11/2⁺) 364.9

278

(7/2⁺) 86.40

(5/2⁺) 86 0.0

 $^{149}_{59}\text{Pr}_{90}$

$^{149}\text{Ce} \beta^-$ decay (5.12 s) [1996YaZV](#), [1977Pf01](#), [2014Ko27](#)

Parent: ^{149}Ce : $E=0.0$; $J^\pi=(3/2^-)$; $T_{1/2}=5.12$ s 25; $Q(\beta^-)=4369$ 14; $\% \beta^-$ decay=100

$^{149}\text{Ce}-J^\pi, T_{1/2}$: From ^{149}Ce Adopted Levels.

$^{149}\text{Ce}-Q(\beta^-)$: From [2021Wa16](#).

[1996YaZV](#): ^{149}Ce was produced at KUR-ISOL (Kyoto University Reactor, Isotope Separator On-Line) in the thermal-neutron induced fission of ^{235}U , followed by mass-separation using KUR-ISOL. Measured E_γ , I_γ , $\gamma\gamma$ -coin, half-life of decay of ^{149}Ce by decay curve for 58-keV γ , and level half-lives by $\beta\gamma(t)$. Deduced levels, and decay scheme.

[1977Pf01](#): measured E_γ , I_γ , $T_{1/2}$. ^{149}Ce obtained as recoil fragments from fission and analyzed according to mass and ionic charge at Lohengrin.

The decay scheme is considered incomplete due to a large $Q(\beta^-)$ value of 4369 14 and the highest populated level at 951 keV.

[2014Ko27](#): measured level half-lives by $\gamma\gamma(t)$ using LaBr_3 and HPGe detectors at KUR-ISOL, and decay curves analyzed by slope method.

[1980KeZQ](#) (also [1986Gr11](#)): $\beta\gamma$ -coin and $Q(\beta^-)$ value. $Q(\beta^-)=4190$ 75 ([1986Gr11](#) reanalyzed their earlier ([1980KeZQ](#)) data).

Others:

[1995Ik03](#): measured $Q(\beta^-)$ from $\beta\gamma$.

[1993RuZW](#): $T_{1/2}$.

[1987Ka20](#): yield in $^{235}\text{U}(n,F)$.

[1979En02](#): $T_{1/2}$ and yield in $^{235}\text{U}(n,F)$.

[1977ArZS](#): γ , $T_{1/2}$.

[1974Ar17](#): $T_{1/2}$.

[1973SeYX](#): γ , $T_{1/2}$.

The decay scheme is from [1996YaZV](#). It is considered by the evaluators as incomplete.

 ^{149}Pr Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^{\ddagger\#}$	Comments
0.0	$(5/2^+)$	2.26 min 8	
58.11 6	$(7/2^-)$	7.4 ns 7	$T_{1/2}$: from weighted average of 7.2 ns 6 (2014Ko27 , average of 7.2 ns 8 from $(105\gamma)(58\gamma)(t)$ and 7.2 ns 10 from $(173\gamma)(58\gamma)(t)$; and 9.7 ns 21 (1996YaZV , $\beta\gamma(t)$). Note that the value in the Adopted Levels is 23.4 ns 18 from SF decays (2010Rz02 , 1974ClZX). Reason for the discrepancy is not clear, if the same 58.2-keV transition is involved in SF decays and β^- decay.
86.40 6	$(7/2^+)$	4.2 ns 5	$T_{1/2}$: from 2014Ko27 ; average of 4.0 ns 8 from $(76\gamma)(86\gamma)(t)$ and 4.3 ns 7 from $(129\gamma)(86\gamma)(t)$.
106.86 7			
125.55 7		1.0 ns 2	$T_{1/2}$: from $(323\gamma)(67\gamma)(t)$ (2014Ko27).
162.97 7			
215.46 8			
230.98 8			
311.90 12			
380.27 7			
397.70 12			
448.33 7			
546.16 13			
575.28 13			
951.11 9			

† From a least-squares fit to γ -ray energies.

‡ From the Adopted Levels.

$^\#$ From $\gamma\gamma(t)$ and slope method ([2014Ko27](#)), unless otherwise noted. The same values are recommended in the Adopted Levels.

¹⁴⁹Ce β^- decay (5.12 s) [1996YaZV,1977Pf01,2014Ko27](#) (continued)

β^- radiations

E(decay) [†]	E(level)	Comments
(3418 14)	951.11	E(decay): 3530 250, 3400 180 (1980KeZQ).
(3989 14)	380.27	E(decay): 3770 150 (1980KeZQ), 4040 230 ($\beta\gamma$, 1995Ik03).
(4283 14)	86.40	E(decay): 3990 150 (1980KeZQ), 4210 300 ($\beta\gamma$, 1995Ik03).
(4311 14)	58.11	E(decay): 4120 180 (1980KeZQ), 4370 230 ($\beta\gamma$, 1995Ik03).
(4369 14)	0.0	E(decay): 4330 24 (1995Ik03).

[†] Measured values from $\beta\gamma$ ([1980KeZQ](#)) are given under comments. [1980KeZQ](#) analyzed their $\beta\gamma$ data using level energies from a preliminary report (priv. comm. to [1980KeZQ](#)).

$\gamma(^{149}\text{Pr})$

I γ normalization: The γ -normalization factor (I γ /100 decays of the parent) cannot be determined, since the decay scheme of ¹⁴⁹Pr is considered incomplete, and multipolarities of low-energy transitions are unknown.

E γ [†]	I γ [†]	E _i (level)	J $^\pi_i$	E _f	J $^\pi_f$	Mult. [‡]	$\alpha^@$	Comments
28.4 1	>4.2	86.40	(7/2 ⁺)	58.11	(7/2 ⁻)	[E1]	1.347 23	
48.8 1	7.2 4	106.86		58.11	(7/2 ⁻)			
52.6 1	0.27 2	215.46		162.97				
56.2 1	0.39 3	162.97		106.86				
58.2 1	100 5	58.11	(7/2 ⁻)	0.0	(5/2 ⁺)	E1	1.089 16	E γ =57.7 3, I γ =100 (1977Pf01).
67.4 1	3.7 2	125.55		58.11	(7/2 ⁻)			
^x 72.4 1	0.12 2							
76.5 1	1.43 7	162.97		86.40	(7/2 ⁺)			
86.5 1	15.3 8	86.40	(7/2 ⁺)	0.0	(5/2 ⁺)	M1	1.963 28	E γ =86.4 3, I γ =20.2 (1977Pf01).
104.9 1	1.25 6	162.97		58.11	(7/2 ⁻)			E γ =104.5 3, I γ =2.2 (1977Pf01).
106.9 1	0.52 3	106.86		0.0	(5/2 ⁺)			
125.6 1	0.03 1	125.55		0.0	(5/2 ⁺)			
128.9 1	2.1 1	215.46		86.40	(7/2 ⁺)			E γ =129.2 3, I γ =1.8 (1977Pf01).
144.9 1	2.6 1	230.98		86.40	(7/2 ⁺)			E γ : level-energy difference=144.6. E γ =144.7 3, I γ =2.7 (1977Pf01).
157.5 1	0.13 2	215.46		58.11	(7/2 ⁻)			
172.6 1	1.72 9	230.98		58.11	(7/2 ⁻)			E γ =172.5 3, I γ =2.8 (1977Pf01).
^x 211.4 [#] 3	2.0							
217.4 1	0.21 2	448.33		230.98				
225.5 1	0.43 3	311.90		86.40	(7/2 ⁺)			E γ =225.7 3, I γ =1.3 (1977Pf01).
233.0 1	1.31 7	448.33		215.46				E γ =232.8 3, I γ =1.8 (1977Pf01).
^x 258.5 [#] 3	1.5							
285.3 1	1.53 8	448.33		162.97				E γ =284.9 3, I γ =1.5 (1977Pf01).
294.1 1	5.8 3	380.27		86.40	(7/2 ⁺)			E γ =294.0 3, I γ =6.3 (1977Pf01).
311.3 1	0.89 5	397.70		86.40	(7/2 ⁺)			E γ =311.0 3, I γ =1.3 (1977Pf01).
322.2 1	4.6 2	380.27		58.11	(7/2 ⁻)			E γ =322.4 3, I γ =7.2 (1977Pf01).
322.8 1	3.1 2	448.33		125.55				
330.7 1	0.58 4	546.16		215.46				
344.3 1	0.32 4	575.28		230.98				
361.8 1	1.40 8	448.33		86.40	(7/2 ⁺)			
380.0 1	27 1	380.27		0.0	(5/2 ⁺)			E γ =380.0 3, I γ =33.7 (1977Pf01).
390.2 1	1.9 1	448.33		58.11	(7/2 ⁻)			E γ =390.0 3, I γ =2.3 (1977Pf01).
^x 417.3 [#] 3	1.8							
^x 438.5 1	0.53 4							
^x 460.0 [#] 3	2.0							

Continued on next page (footnotes at end of table)

¹⁴⁹Ce β⁻ decay (5.12 s) [1996YaZV](#), [1977Pf01](#), [2014Ko27](#) (continued)

γ(¹⁴⁹Pr) (continued)

<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
^x 702.5 1	0.55 6				Eγ=702.8 3, Iγ=2.5 (1977Pf01).
^x 831.2 1	0.33 6				
864.7 1	6.5 3	951.11	86.40	(7/2 ⁺)	Eγ=864.5 3, Iγ=7.8 (1977Pf01).
893.0 1	7.3 4	951.11	58.11	(7/2 ⁻)	Eγ=892.7 3, Iγ=8.0 (1977Pf01).

[†] From [1996YaZV](#), unless otherwise stated.

[‡] From the Adopted Gammas.

[#] From [1977Pf01](#). This γ is not reported by [1996YaZV](#). Evaluators consider this γ uncertain, as with the intensity reported by [1977Pf01](#), this γ should have been detected by [1996YaZV](#).

[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^x γ ray not placed in level scheme.

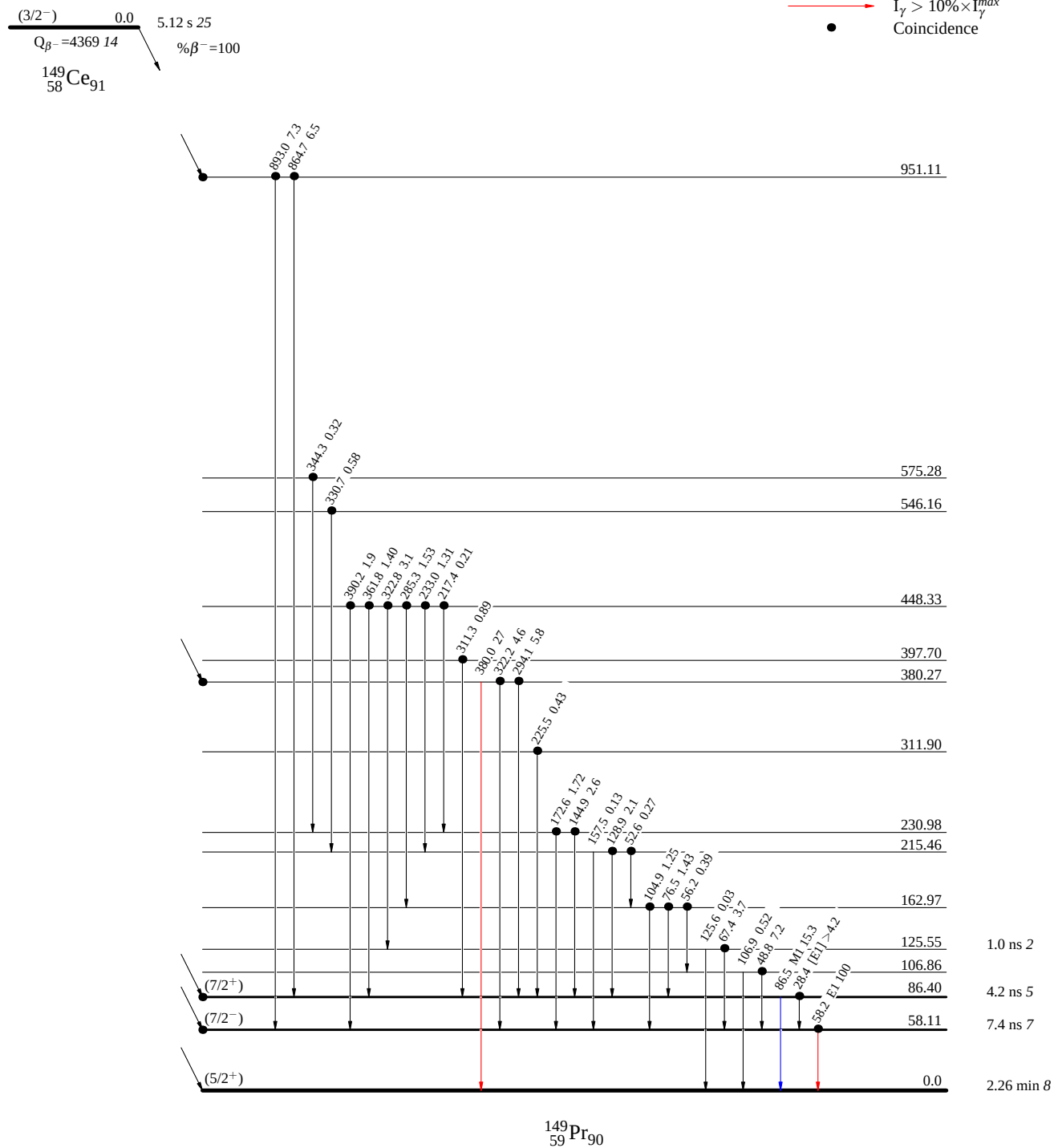
¹⁴⁹Ce β⁻ decay (5.12 s) 1996YaZV,1977Pf01,2014Ko27

Decay Scheme

Intensities: Relative I_γ

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence



²⁴⁸Cm, ²⁵²Cf SF decay **2010Rz02**

Parent: ²⁴⁸Cm: E=0.0; J^π=0⁺; T_{1/2}=3.48×10⁵ y 6; %SF decay=8.39 16

Parent: ²⁵²Cf: E=0.0; J^π=0⁺; T_{1/2}=2.647 y 3; %SF decay=3.102 3

²⁴⁸Cm(0.0)-T_{1/2}: From ²⁴⁸Cm Adopted Levels in the ENSDF database (Sept 2014 update).

²⁴⁸Cm(0.0)-%SF decay: %SF=8.39 16 for ²⁴⁸Cm SF decay.

²⁵²Cf(0.0)-T_{1/2}: From ²⁵²Cf Adopted Levels in the ENSDF database (Jan 2021 update).

²⁵²Cf(0.0)-%SF decay: %SF=3.102 3 for ²⁵²Cf SF decay.

2010Rz02: measured E_γ, I_γ and γγ using EUROAM2 array and four LEPS detectors for ²⁴⁸Cm SF decay in Strasbourg, and GAMMASPHERE array for ²⁵²Cf SF decay at ANL. Also coincidences with γ rays from complementary fission fragments of Rb isotopes for ²⁴⁸Cm experiment and with γ rays from Y isotopes for ²⁵²Cf SF decay. Comparison with quasiparticle-rotor model calculations.

¹⁴⁹Pr Levels

E(level) [†]	J ^π	T _{1/2}	Comments
0.0	(5/2 ⁺)		Dominant configuration=π5/2[413] from QRPM calculations (2010Rz02).
58.1 [‡] 3	(7/2 ⁻)	26 ns 4	T _{1/2} : from γγ(t) (2010Rz02) in ²⁵² Cf SF decay. Other: 22.9 ns 18 from 1974ClZX using (fragment)(fragment)(x-ray)γγ(t) in ²⁴⁸ Cm, SF decay. See also the Adopted Levels, where the T _{1/2} values from ¹⁴⁹ Ce β ⁻ decay, shorter by a factor of ≈3 from those in SF decays are discussed. Dominant configuration=π1/2[550] from QRPM calculations (2010Rz02); the levels of this band mix with π3/2[541] orbital.
160.7 [‡] 4	(11/2 ⁻)		
380.4 [‡] 5	(15/2 ⁻)		
710.7 [‡] 6	(19/2 ⁻)		
1126.7 [‡] 7	(23/2 ⁻)		
1606.3 [‡] 7	(27/2 ⁻)		
2128.6 [‡] 8	(31/2 ⁻)		
2663.4 [‡] 8	(35/2 ⁻)		
3183.7 [‡] 9	(39/2 ⁻)		

[†] From E_γ in **2010Rz02**, assuming Δ(E_γ)=0.3 keV for each γ ray.

[‡] Band(A): Band based on π1/2[550], α=-1/2.

γ(¹⁴⁹Pr)

E _γ	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [†]	α [‡]	Comments
58.1	58.1	(7/2 ⁻)	0.0	(5/2 ⁺)	E1	1.094 15	α(K)exp=0.9 4 (2010Rz02); α(exp)=1.7 6 (2010Rz02) α(K)exp: from intensities of 58γ, 35.9 and 40.7 keV K-x rays of Pr. B(E1)(W.u.)=2.6×10 ⁻⁵ 2 deduced by 2010Rz02 using a T _{1/2} =22.9 ns 18. B(E1) rates and deduced electric dipole moments in neighboring nuclides and from predictions of QRPM calculations are discussed in 2010Rz02 . T _{1/2} in the Adopted Levels is 23.4 ns 18.
102.6	160.7	(11/2 ⁻)	58.1	(7/2 ⁻)	(E2)	1.933 27	α(exp)=2.2 6 (2010Rz02) Mult.: M1,E2 from total conversion coefficient (2010Rz02), but (E2) from assigned J ^π values.
219.7	380.4	(15/2 ⁻)	160.7	(11/2 ⁻)			
330.3	710.7	(19/2 ⁻)	380.4	(15/2 ⁻)			
416.0	1126.7	(23/2 ⁻)	710.7	(19/2 ⁻)			

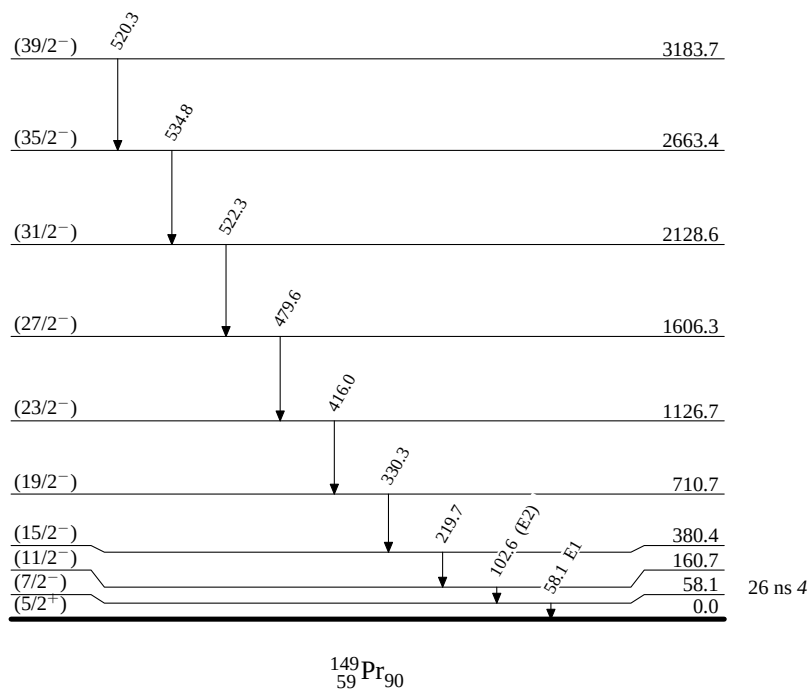
Continued on next page (footnotes at end of table)

$^{248}\text{Cm}, ^{252}\text{Cf}$ SF decay **2010Rz02** (continued) $\gamma(^{149}\text{Pr})$ (continued)

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π
479.6	1606.3	(27/2 ⁻)	1126.7	(23/2 ⁻)
520.3	3183.7	(39/2 ⁻)	2663.4	(35/2 ⁻)
522.3	2128.6	(31/2 ⁻)	1606.3	(27/2 ⁻)
534.8	2663.4	(35/2 ⁻)	2128.6	(31/2 ⁻)

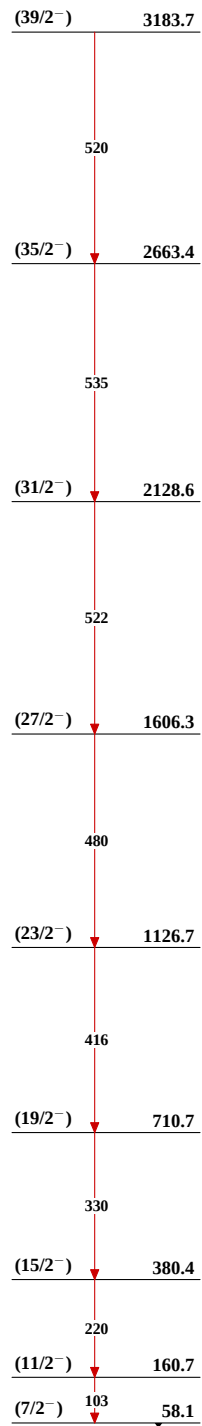
[†] From $\alpha(\text{K})_{\text{exp}}$ and/or $\alpha(\text{exp})$ obtained in **2010Rz02**.

[‡] Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

 $^{248}\text{Cm}, ^{252}\text{Cf}$ SF decay **2010Rz02**Level Scheme

$^{248}\text{Cm}, ^{252}\text{Cf}$ SF decay 2010Rz02

Band(A): Band based on
 $\pi 1/2[550], \alpha = -1/2$



$^{149}_{59}\text{Pr}_{90}$

²⁵²Cf SF decay [2015Wa28](#)

Parent: ²⁵²Cf: E=0; J^π=0⁺; T_{1/2}=2.647 y 3; %SF decay=3.102 3

²⁵²Cf-T_{1/2}: From ²⁵²Cf Adopted Levels in the ENSDF database (Jan 2021 update).

²⁵²Cf-%SF decay: %SF=3.102 3 for ²⁵²Cf SF decay.

Includes prompt γ-ray study from ⁹Be(²³⁸U,Fγ) reaction from [2015Wa28](#).

[2015Wa28](#): data from two experiments have been combined: 1. ²⁵²Cf SF decay: measured Eγ and γγ using GAMMASPHERE array comprised of 101 Compton-suppressed Ge detectors at LBNL facility 2. ⁹Be(²³⁸U,Fγ),E=6.2 MeV/nucleon, measured Eγ, Iγ, Z- and A- gated γγ coincidences with isotopically identified fission fragments using VAMOS++ and EXOGAM array at GANIL facility. Deduced high-spin levels.

Others:

[2000Hw03](#) (also [2001Ha14](#),[1998Hw08](#)): measured Eγ and γγ using GAMMASPHERE array comprised of 72 Compton-suppressed Ge detectors. Band assigned to ¹⁴⁹Pr in [1998Hw08](#) actually belongs to ¹⁵¹Pr.

Others:

[1974ClZX](#) (also [1972ClZN](#)): fission fragment isomers populated before β decay in deexcitation of fission fragments observed through (x-ray)γ and γγ coin. Mass assignments, energies and lifetimes measured in 6-parameter experiment with two fission, one Ge(Li) and one Si(Li) detectors.

[1970Wa05](#) (also [1966WaZX](#) from the same group): ce data.

¹⁴⁹Pr Levels

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
0.0	(5/2 ⁺)		Possible configuration=π5/2[413] from quasiparticle-rotor model calculations (2015Wa28).
58.5 [#] 3	(7/2 ⁻)	22.9 ns 18	T _{1/2} : (fragment)(fragment)(x-ray)γ(t) (1974ClZX). Other: 26 ns 4 from γγ(t) (2010Rz02) in ²⁵² Cf SF decay. See also the Adopted Levels, where the T _{1/2} values from ¹⁴⁹ Ce β ⁻ decay, shorter by a factor of ≈3 from those in SF decays are discussed.
86.5 ^{&} 5	(7/2 ⁺)		
161.7 [#] 4	(11/2 ⁻)		
174.9 [@] 5	(9/2 ⁺)		
365.0 ^{&} 7	(11/2 ⁺)		
381.5 [#] 5	(15/2 ⁻)		
407.3 [@] 5	(13/2 ⁺)		
711.8 [#] 6	(19/2 ⁻)		
736.6 ^{&} 9	(15/2 ⁺)		
752.0 [@] 6	(17/2 ⁺)		
1127.9 [#] 6	(23/2 ⁻)		
1174.0 ^{&} 10	(19/2 ⁺)		
1189.3 [@] 6	(21/2 ⁺)		
1607.8 [#] 7	(27/2 ⁻)		
1664.7 ^{&} 12	(23/2 ⁺)		
1695.6 [@] 7	(25/2 ⁺)		
2130.3 [#] 9	(31/2 ⁻)		
2192.0 ^{&} 13	(27/2 ⁺)		
2230.8 [@] 8	(29/2 ⁺)		
2664.8 [#] 10	(35/2 ⁻)		
2722.5 [@] 9	(33/2 ⁺)		
3185.1 [#] 11	(39/2 ⁻)		
3724.0 [#] 12	(43/2 ⁻)		

Continued on next page (footnotes at end of table)

²⁵²Cf SF decay **2015Wa28** (continued)

¹⁴⁹Pr Levels (continued)

† From least-squares fit to E_γ data.

‡ As proposed by **2015Wa28**. Note that spins were two units higher in their previous work **2000Hw03**, for band based on (7/2⁻).

Band(A): Band based on (7/2⁻). Possible octupole band. Bands 1 and 2 in Figure 14 of **2015Wa28** possibly form alternating-parity bands.

@ Band(B): Band based on (9/2⁺). Possible octupole band. Bands 1 and 2 in Figure 14 of **2015Wa28** possibly form alternating-parity bands.

& Band(C): Band based on (7/2⁺).

$\gamma(^{149}\text{Pr})$								Comments
E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	α [#]	
(13.2)		174.9	(9/2 ⁺)	161.7	(11/2 ⁻)			T _{1/2} =5.8 ns 11 from (fragment)(fragment)(x ray)γ(t) (1974ClZX), γ probably a precursor of the 58.0γ.
(25.8)		407.3	(13/2 ⁺)	381.5	(15/2 ⁻)			
^x 54.7 1								I _γ /100 fissions=0.183 27 (1974ClZX).
58.5 3	<500	58.5	(7/2 ⁻)	0.0	(5/2 ⁺)			E _γ : 58.0 1 (1974ClZX), 58.5 (2000Hw03).
86.5 5		86.5	(7/2 ⁺)	0.0	(5/2 ⁺)	M1	1.96 4	I _γ /100 fissions=0.421 7 (1974ClZX).
103.2 3	<80	161.7	(11/2 ⁻)	58.5	(7/2 ⁻)			α(exp)=1.63 22 (2015Wa28)
116.4 5		174.9	(9/2 ⁺)	58.5	(7/2 ⁻)			E _γ : 103.2 (2000Hw03).
^x 143 1								E _γ : from ce(K)=100 keV (1970Wa05).
								Mult.: consistent with E2 from K/L=3.6 (1970Wa05).
								T _{1/2} =1.8 ns 4 (1970Wa05) from (fragment)(fragment)(x ray)ce(t).
								I(ce)/100 fissions=0.32 (1970Wa05).
219.8 3	100 5	381.5	(15/2 ⁻)	161.7	(11/2 ⁻)			E _γ : 220.3 (2000Hw03).
232.4 3	20 1	407.3	(13/2 ⁺)	174.9	(9/2 ⁺)			
245.6 3	20 1	407.3	(13/2 ⁺)	161.7	(11/2 ⁻)			
278.5 5	15 1	365.0	(11/2 ⁺)	86.5	(7/2 ⁺)			
330.3 3	79 5	711.8	(19/2 ⁻)	381.5	(15/2 ⁻)			E _γ : 330.8 (2000Hw03).
344.7 5	6.9 5	752.0	(17/2 ⁺)	407.3	(13/2 ⁺)			
370.5 5	10 1	752.0	(17/2 ⁺)	381.5	(15/2 ⁻)			
371.6 5	10 1	736.6	(15/2 ⁺)	365.0	(11/2 ⁺)			
416.0 3	41 3	1127.9	(23/2 ⁻)	711.8	(19/2 ⁻)			E _γ : 415.8 (2000Hw03).
437.4 @ 5	4.2 @ 4	1174.0	(19/2 ⁺)	736.6	(15/2 ⁺)			
437.4 @ 5	11 @ 1	1189.3	(21/2 ⁺)	752.0	(17/2 ⁺)			
477.6 5	3.3 4	1189.3	(21/2 ⁺)	711.8	(19/2 ⁻)			
479.8 3	21 1	1607.8	(27/2 ⁻)	1127.9	(23/2 ⁻)			E _γ : 480.0 (2000Hw03).
490.7 5	1.4 2	1664.7	(23/2 ⁺)	1174.0	(19/2 ⁺)			
491.7 5	2.7 3	2722.5	(33/2 ⁺)	2230.8	(29/2 ⁺)			
506.4 5	7.5 6	1695.6	(25/2 ⁺)	1189.3	(21/2 ⁺)			
520.3 5	2.4 5	3185.1	(39/2 ⁻)	2664.8	(35/2 ⁻)			E _γ : 520.3 (2000Hw03).
522.5 5	7.8 5	2130.3	(31/2 ⁻)	1607.8	(27/2 ⁻)			E _γ : 522.5 (2000Hw03).
527.3 5	1.1 1	2192.0	(27/2 ⁺)	1664.7	(23/2 ⁺)			
534.5 5	5.7 11	2664.8	(35/2 ⁻)	2130.3	(31/2 ⁻)			E _γ : 534.5 (2000Hw03).
535.5 5	4.0 4	2230.8	(29/2 ⁺)	1695.6	(25/2 ⁺)			
538.9 5	1.1 2	3724.0	(43/2 ⁻)	3185.1	(39/2 ⁻)			
568.0 5	2.0 2	1695.6	(25/2 ⁺)	1127.9	(23/2 ⁻)			
622.7 5	<0.5	2230.8	(29/2 ⁺)	1607.8	(27/2 ⁻)			

Continued on next page (footnotes at end of table)

^{252}Cf SF decay [2015Wa28](#) (continued)

$\gamma(^{149}\text{Pr})$ (continued)

[†] Uncertainty is stated as 0.5 keV for strong transitions and as much as 1 keV in prompt γ -spectra, whereas from ^{252}Cf SF decay, uncertainty is stated as 0.1 keV for strong γ rays and 0.5 for weaker lines. Evaluators assign 0.3 keV uncertainty for $I_{\gamma} \geq 20$ and 0.5 for $I_{\gamma} < 20$, or when I_{γ} not stated.

[‡] From ^{252}Cf SF decay, according to e-mail reply from the first author (E.H. Wang) of [2015Wa28](#) on Sept 17, 2015.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[@] Multiply placed with intensity suitably divided.

^x γ ray not placed in level scheme.

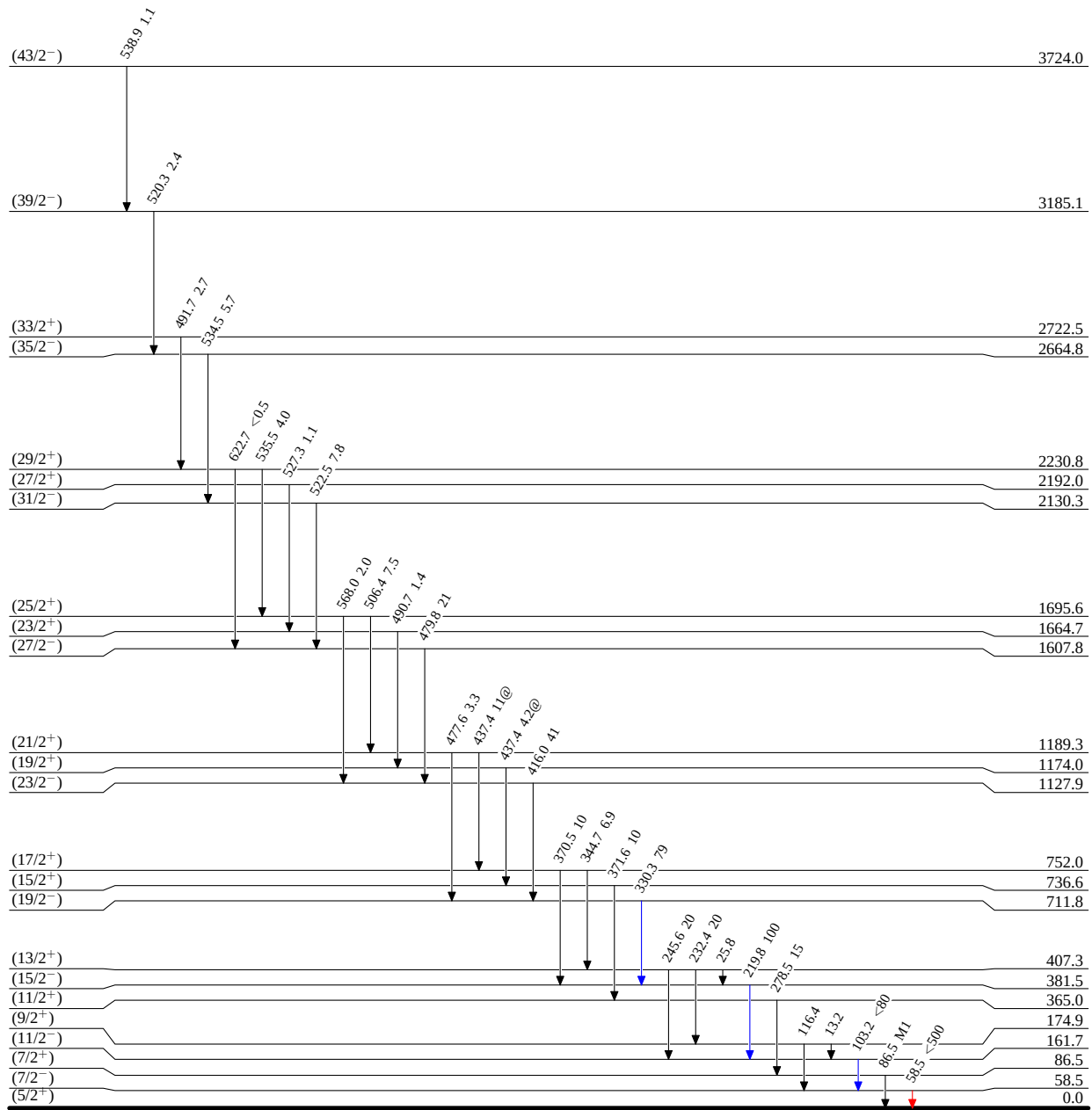
²⁵²Cf SF decay 2015Wa28

Level Scheme

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend

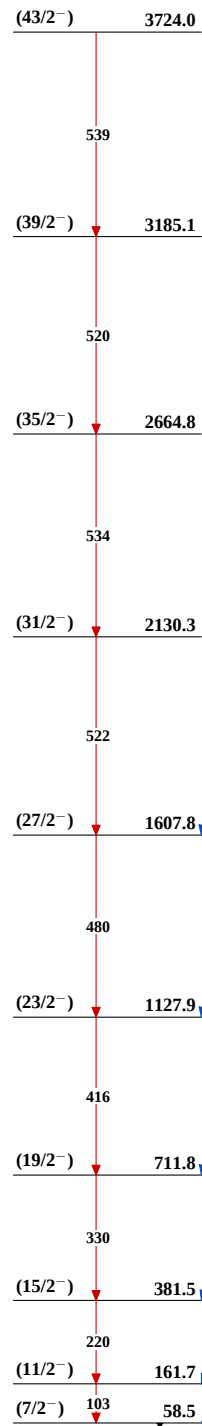
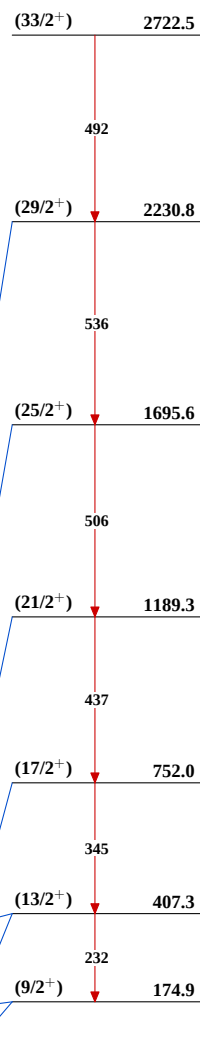
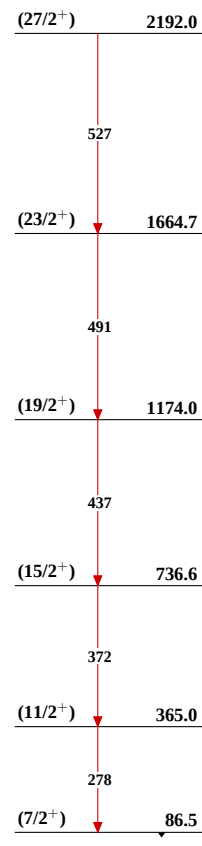
- ▶ I_γ < 2% × I_γ^{max}
- ▶ I_γ < 10% × I_γ^{max}
- ▶ I_γ > 10% × I_γ^{max}
- - - - -▶ γ Decay (Uncertain)



22.9 ns 18

¹⁴⁹Pr₉₀

^{252}Cf SF decay 2015Wa28

 Band(A): Band based on
(7/2⁻)

 Band(B): Band based on
(9/2⁺)

 Band(C): Band based on
(7/2⁺)

 $^{149}_{59}\text{Pr}_{90}$

$^{150}\text{Nd}(\text{d},^3\text{He})$ 1981VaZJ

1981VaZJ (also 1979SaZQ,1978SaZP): E=50 MeV. Self-supporting and enriched targets. Measured ^3He spectra, $\sigma(\theta)$.

FWHM=25-30 keV. All the references are from KVI annual lab reports.

The results of this study are considered tentative (evaluators) for the following reasons:

- a) the $L(^3\text{He},\text{d})=4$ for g.s. implying $J^\pi=7/2^+,9/2^+$ disagrees with $J^\pi=(5/2^+)$ inferred from $\log ft$ values to $1/2$ and $3/2$ states in ^{149}Nd (see β^- feeding and $\log ft$ values to 258,286,365,571 and 881 levels in ^{149}Pr β^- decay).
- b) in the isotone, ^{151}Pm , studied by the $^{152}\text{Sm}(\text{t},\alpha)$ reaction (1972Bu22), $\sigma(5/2^+$ g.s. member of the [413] band) is less than 10% of that for the $7/2^+$ member. Since a similar situation exists for the $^{150}\text{Sm}(\text{d},^3\text{He})$ reaction and the background is larger in the $(\text{d},^3\text{He})$ than the (t,α) reaction, it is possible that the g.s. of ^{149}Pr has been incorrectly identified.

$Q(\text{d},^3\text{He})=-4515$ 10 from 1978SaZP.

Mass excess (^{149}Pr)=-70977 10 from 1979SaZQ, which can be compared with -71039 10 in 2021Wa16; difference of 62 keV.

 ^{149}Pr Levels

E(level) [†]	L	Comments
0 [‡]	4	J^π : L=4 inconsistent with $J^\pi=(5/2^+)$ from $\log ft$ values to $1/2^-$ and $3/2^-$ states in ^{149}Nd (see ^{149}Ce β^- decay).
40 [‡]	2	
80 [‡]	2	
220	(2)	
260	4	
440 [‡]	2	
550	4	
590	2	
660	(2)	
980	(0)	

[†] In view of the above discussion, the g.s. of ^{149}Pr may not have been correctly assigned in this reaction. The absolute energies of other groups will then also be questionable. Uncertainty is not given by 1981VaZJ but estimated (evaluators) to be ≈ 8 keV.

[‡] Strongly populated group.

Adopted Levels, Gammas

$Q(\beta^-)=1688.9$ 25; $S(n)=5038.79$ 7; $S(p)=9129$ 15; $Q(\alpha)=270$ 30 [2021Wa16](#)

$S(2n)=12371.4$ 17, $S(2p)=16940$ 9 ([2021Wa16](#)).

Mass measurement: [1975Ka25](#).

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 12 references dealing with nuclear structure theoretical calculations, and two references dealing with half-lives in radioactive decays.

 ^{149}Nd Levels

There are 123 neutron resonances in the region of 0.094 to 11.92 keV. Consult $^{148}\text{Nd}(n,\gamma),(n,n)$:resonances for energies, J^π , widths and resonance strengths.

Cross Reference (XREF) Flags

A	^{149}Pr β^- decay (2.26 min)	E	$^{148}\text{Nd}(d,p)$	I	$^{150}\text{Nd}(^3\text{He},pt)$
B	^{252}Cf SF decay	F	$^{148}\text{Nd}(d,p\gamma)$	J	$^{150}\text{Nd}(^3\text{He},\alpha)$
C	$^{148}\text{Nd}(n,\gamma)$ E=th	G	$^{150}\text{Nd}(p,d)$	K	$^{150}\text{Sm}(\mu^-,p\gamma)$
D	$^{148}\text{Nd}(n,\gamma),(n,n)$:resonances	H	$^{150}\text{Nd}(pol\ d,t),(d,t)$	L	$^{238}\text{U}(^{12}\text{C},F\gamma)$

$E(\text{level})^\dagger$	J^π	$T_{1/2}$	XREF	Comments
0.0	$5/2^-$	1.726 h 5	ABC EF HIJKL	$\% \beta^- = 100$ $\mu = 0.351$ 10 (1970PiZR,2019StZV) $Q = +1.3$ 3 (1970PiZR,2021StZZ) $T_{1/2}$: unweighted average of 1.728 h 1 (γ counting, 1990Ab02); 1.72 h 1 (integral γ counting, 1966Ri03); 1.73 h 1 (integral γ counting, 1966He04). Others: 1.5 h 3 (γ , 2015Ba10); 1.5 h 2 (1999Po32 , 95% confidence limit, authors give units of days which is probably a misprint); 1.73 h (γ , 1981Di01); 1.8 h, 2.0 h, 2.2 h (γ counting, 1973St22); 1.8 h 1 (1967Me19); 1.77 h (β counting, 1964Ho03); 1.8 h 1 (γ , 1960Wi10); 1.8 h 1 (ce counting, 1952Ru10); 1.7 h (1950Ma05); 2.00 h 5 (β , 1946Bo25); 2.0 h (β , 1938Po05). J^π : from atomic beam (1964Bu09,1962Bu21), L(pol d,t)=3; L-1/2 from $Ay(\theta)$. Configuration= $\nu 5/2[523]$. μ, Q : from atomic beam method (1970PiZR). J^π : L(pol d,t)=3; L+1/2 from $Ay(\theta)$. $T_{1/2}$: from β^- decay. Unweighted average of 0.11 ns 3 (2014Ko27 , $\gamma\gamma(t)$) and 278 ps 27 (2010Ru09 , $\beta\gamma\gamma(t)$). J^π : L(pol d,t)=3; L-1/2 from $Ay(\theta)$. $T_{1/2}$: from β^- . Unweighted average of 0.14 ns 3 (2014Ko27 , $\gamma\gamma(t)$) and 216 ps 14 (2010Ru09 , $\beta\gamma\gamma(t)$). J^π : L(pol d,t)=1; L+1/2 marginally supported by $Ay(\theta)$. $T_{1/2}$: $\beta\gamma\gamma(t)$ (2010Ru09) in β^- . J^π : L(pol d,t)=(5); L+1/2 marginally supported by $Ay(\theta)$. J^π : L(pol d,t)=5; L-1/2 from $Ay(\theta)$. $T_{1/2}$: weighted average of 1.60 ns 4 (2014Ko27 , $\gamma\gamma(t)$); 1.65 ns 19 (2010Ru09 , $\beta\gamma\gamma(t)$) in β^- ; and 2.1 ns 5 from $p\gamma(t)$ in (d,p γ) (1979Ka16,1977HaXX). J^π : L(pol d,t)=1; L+1/2 marginally supported by $Ay(\theta)$. However, $J^\pi=1/2^-$ is excluded by γ to $7/2^-$ which cannot be M3 from RUL. $T_{1/2}$: from β^- . Weighted average of 0.22 ns 3 (2014Ko27 , $\gamma\gamma(t)$) and 202 ps 8 (2010Ru09 , $\beta\gamma\gamma(t)$). J^π : L(pol d,t)=3,4; L+1/2 from $Ay(\theta)$. Comparison of γ -ray transition probabilities in (d,p γ) with those from model-dependent calculations; γ from (11/2 $^-$) and population in
108.5206 10	$7/2^-$	0.19 ns 8	ABC EF H J L	
138.4464 8	$5/2^-$	0.178 ns 38	A C EF H J	
165.0868 8	$1/2^-, 3/2^-$	73 ps 11	A C EF H	
192 2	(11/2 $^-$, 9/2 $^-$)		H	
220.7058 23	$9/2^-$	1.61 ns 4	ABC EF H J	
258.3302 9	$3/2^-$	0.203 ns 8	A C F H	
270.8585 23	(9/2 $^+$)	0.42 ns 3	ABC F H J L	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Nd Levels (continued)

E(level) [†]	J ^π #	T _{1/2}	XREF	Comments
				^{252}Cf SF decay also support 9/2 ⁺ . L($^3\text{He},\alpha$)=(3) is inconsistent with (9/2 ⁺).
				T _{1/2} : from β^- . Weighted average of 0.42 ns 3 (2014Ko27, $\gamma\gamma(t)$) and 424 ps 60 (2010Ru09, $\beta\gamma\gamma(t)$). Other: 5.1 ns 3 from $\gamma\gamma(t)$ and/or $p\gamma(t)$ in (d,p γ) is in severe disagreement with the values from β^- decay.
285.4819 11	1/2 ⁻	126 ps 13	A C EF H	J ^π : L(pol d,t)=1; L-1/2 from Ay(θ).
316.230 3	(5/2 ⁻ , 7/2 ⁻)	56 ps 11	A C eF h J	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- . J ^π : L(pol d,t)=3 for 316+321; L-1/2 from Ay(θ). 1981Ha39 favor J=L-1/2.
321.1429 15	(5/2 ⁻ , 7/2 ⁻)	74 ps 17	A C eF h	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. J ^π : see comment for 316 level.
332.9326 17	5/2 ⁺	14 ps 8	A C F H	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. J ^π : L(pol d,t)=2; L+1/2 marginally supported by Ay(θ). However, 3/2 ⁺ is excluded by γ to 7/2 ⁻ which cannot be M2 from RUL.
340.4@ 10	(13/2 ⁺)		EF H J L	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay.
365.9315 15	3/2 ⁻	<0.5 ns	A C EF H J	J ^π : L($^3\text{He},\alpha$)=6; 13/2 ⁺ is favored from systematics. XREF: J(375). J ^π : L(pol d,t)=1; L+1/2 marginally supported by Ay(θ). However, 1/2 ⁻ is excluded by γ to 7/2 ⁻ which cannot be M3 from RUL.
403.7291 14	1/2 ⁻	23 ps 8	A C E H	T _{1/2} : $p\gamma(t)$ in (d,p γ). J ^π : L(pol d,t)=1; L-1/2 from Ay(θ).
450.04 9	5/2 ⁻	≤10 ps	A H j	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. XREF: H(447). J ^π : L(pol d,t)=3 for a doublet (447+459); L+1/2 is favored by Ay(θ). Also L($^3\text{He},\alpha$)=3 for a 455 group.
459.529 4	(3/2 ⁻ , 5/2 ⁻)	31 ps 14	A C E H j	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. J ^π : γ s to 1/2 ⁻ and 7/2 ⁻ . See also comment for 450 level.
474.59 5	(5/2 ⁺ , 7/2)	≤10 ps	A	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. J ^π : log ft=7.2 from (5/2 ⁺); γ to (9/2 ⁺).
482.6733 14	1/2 ⁺	<0.8 ns	A C EF H	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09) in β^- decay. J ^π : L(d,t)=0.
511 2	11/2 ⁺ , 13/2 ⁺		E H j	T _{1/2} : $p\gamma(t)$ in (d,p γ). XREF: E(521). J ^π : L(d,t)=6.
517.44 4	(3/2, 5/2, 7/2)		A C j	J ^π : log ft=7.2 from (5/2 ⁺).
548.655 4	3/2 ⁻	<0.5 ns	A C EF H J	J ^π : L(pol d,t)=1; L+1/2 marginally supported by Ay(θ). However, 1/2 ⁻ is excluded by γ to 5/2 ⁺ which cannot be M2 from RUL.
571.407 4	3/2 ⁺		A C H	T _{1/2} : $p\gamma(t)$ in (d,p γ). J ^π : L(pol d,t)=2; L-1/2 from Ay(θ).
587.7@ 15	(17/2 ⁺)			
590 10	(9/2 ⁻ , 11/2 ⁻)		J	J ^π : L($^3\text{He},\alpha$)=5.
593.22 4	(5/2 ⁺)		A E H	J ^π : L(pol d,t)=2; L+1/2 from Ay(θ).
603.42 8			A	
612 2	(9/2 ⁻ , 11/2, 13/2 ⁺)		H	J ^π : L(d,t)=5,6 (2008Ja01); (6) (1973Bu02).
646 2	11/2 ⁻ , 9/2 ⁻		H J	J ^π : L($^3\text{He},\alpha$)=5; L(pol d,t)=5,(6); L+1/2 is marginally supported by Ay(θ).
689 2			H	
705.128 25	(3/2, 5/2)		A C e h j	J ^π : L(pol d,t)=L($^3\text{He},\alpha$)=2 gives 3/2 ⁺ , 5/2 ⁺ for 705+709 levels; L-1/2 is preferred from Ay(θ); possible β^- feeding from (5/2 ⁺) parent.
709.045 18	(3/2, 5/2 ⁻)		A C e h j	J ^π : γ s to 1/2 ⁻ , 5/2 ⁻ and 5/2 ⁺ . See also comment for 705 level.

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Adopted Levels, Gammas (continued) ^{149}Nd Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
741.06 8	3/2 ⁺	A C E H J	J ^π : L(pol d,t)=2; L-1/2 from Ay(θ).
796 2	1/2 ⁺	E H	XREF: E(807).
			J ^π : L(pol d,t)=0.
804 2		H	
814.40 3	1/2 ⁺	A C H J	J ^π : L(pol d,t)=0.
836 2	1/2 ⁻ , 3/2 ⁻	E H J	XREF: E(830).
			J ^π : L(d,t)=1.
862.81 7	(7/2) ⁺	A H J	J ^π : L(d,t)=4; γ to 5/2 ⁻ . L($^3\text{He},\alpha$)=2 for 873 10 level seems to agree with J ^π value for 881 level, rather than with that for 862.8 level.
881.36 7	3/2 ⁺	A C E H J	J ^π : L(pol d,t)=2; L-1/2 from Ay(θ). See also comment for 862.8 level.
913.57 8	(1/2,3/2)	C e h	J ^π : primary γ from 1/2 ⁺ capture state; L(d,t)=1 for 913 and/or 920 levels suggests negative for either or both levels;
920.65 7	(3/2,5/2,7/2 ⁻)	A e h J	J ^π : possible β^- feeding from (5/2 ⁺); γ to 3/2 ⁻ . See also comment for 913 level.
956 2	5/2 ⁻ , 7/2 ⁻	E H j	J ^π : L(d,t)=3.
963 4		H j	
976.4@ 18	(21/2 ⁺)	L	
985.15 10	1/2 ⁺	E H J	XREF: E(992).
			J ^π : L(pol d,t)=0.
1012.6? 3		A	
1025 2	3/2 ⁻ , 1/2 ⁻	E H	J ^π : L(pol d,t)=1; L+1/2 marginally supported by Ay(θ).
1045 2	3/2 ⁺ , 5/2 ⁺	H J	XREF: J(1054).
			J ^π : L(pol d,t)=2; L-1/2 marginally supported by Ay(θ).
1067 2		E H	
1082 2		E H	
1129 2	5/2 ⁺ , 3/2 ⁺	H j	XREF: j(1144).
			J ^π : L(pol d,t)=2; L+1/2 marginally supported by Ay(θ).
1149 2	3/2 ⁺ , 5/2 ⁺	H j	XREF: j(1144).
			J ^π : L(pol d,t)=2; L-1/2 marginally supported by Ay(θ). L($^3\text{He},\alpha$)=(5) is inconsistent, but L($^3\text{He},\alpha$)=2 is also possible.
1168 4		H	
1178 2		e H	
1189 4		e H	
1220 2		H	
1232 2		H	
1245 2	1/2 ⁻ , 3/2 ⁻	E H J	XREF: J(1260).
			J ^π : L(d,t)=1.
1283 2	1/2 ⁻	E H	J ^π : L(pol d,t)=1; L-1/2 from Ay(θ).
1305.7& 18	(19/2 ⁻)	L	
1311 4		H	
1358 2	1/2 ⁺	E HI	J ^π : L(pol d,t)=0.
1386 6		E	
1413 6		E H	
1446 6		E	
1465 2		H	
1469.0@ 20	(25/2 ⁺)	L	
1481 2		E H	
1505 2	1/2 ⁻ , 3/2 ⁻	E H	J ^π : L(d,t)=1.
1531 2	1/2 ⁻ , 3/2 ⁻	E H	J ^π : L(d,t)=1.
1553 2	1/2 ⁻ , 3/2 ⁻	E H J	J ^π : L(d,t)=1.
1594 6		E	
1622 2	9/2 ⁻ , 11/2 ⁻	E H J	J ^π : L(d,t)=L($^3\text{He},\alpha$)=5.
1634 6		E	
1682 5		E H	XREF: E(1671).
1683.4& 20	(23/2 ⁻)	L	

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Adopted Levels, Gammas (continued) ^{149}Nd Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
1708 2	9/2 ⁻ , 11/2 ⁻	E H J	J ^π : L(d,t)=L(³ He,α)=5.
1721 5	3/2 ⁺ , 5/2 ⁺	H	J ^π : L(d,t)=2.
1742 [‡] 5	3/2 ⁺ , 5/2 ⁺	E H	J ^π : L(d,t)=2.
1785 [‡] 5	3/2 ⁺ , 5/2 ⁺	E H	J ^π : L(d,t)=2.
1797 2	3/2 ⁺ , 5/2 ⁺	H J	J ^π : L(pol d,t)=2; L-1/2 marginally supported by Ay(θ).
1819 5		E H	
1857 [‡] 5	3/2 ⁺ , 5/2 ⁺	E H j	J ^π : L(d,t)=2.
1868 6		E j	
1884 [‡] 5		E H j	
1913 5		H	
1925 6		E	
1953 [‡] 5	3/2 ⁺ , 5/2 ⁺	E H	XREF: E(1947).
1981 5	3/2 ⁺ , 5/2 ⁺	H J	J ^π : L(d,t)=2.
2031 5	3/2 ⁺ , 5/2 ⁺	H	J ^π : L(d,t)=2.
2040.4 [@] 23	(29/2 ⁺)	L	
2054 5		H	
2065 6		H	
2081.0 ^{&} 23	(27/2 ⁻)	L	
2081 5	3/2 ⁺ , 5/2 ⁺	H	J ^π : L(d,t)=2.
2099 [‡] 5		E H	
2121 5		H	
2147 [‡] 5		E H	
2231 5	3/2 ⁺ , 5/2 ⁺	H	J ^π : L(d,t)=2.
2266 5		H	
2297 5	3/2 ⁺ , 5/2 ⁺	H	J ^π : L(d,t)=2.
2321 10		J	
2595.4 ^{&} 25	(31/2 ⁻)	L	
2650.4 25		L	
2672.2 [@] 25	(33/2 ⁺)	L	
3179 ^{&} 3	(35/2 ⁻)	L	
3345 [@] 3	(37/2 ⁺)	L	
4018 [@] 3	(41/2 ⁺)	L	
4646 [@] 3	(45/2 ⁺)	L	
(5038.82 3)	1/2 ⁺	C	J ^π : s-wave capture in ^{148}Nd (J ^π =0 ⁺). E(level): S(n)=5038.79 7 (2021Wa16).

[†] From a least-squares fit to E_γ data for levels populated in γ-ray studies, assuming 1 keV uncertainty when not stated.

Uncertainties of five E_γ values were doubled to obtain an acceptable reduced $\chi^2=2.1$ in place of original 3.8, as compared to critical $\chi^2=3.8$. For levels populated only in particle-transfer studies, the energies are from (d,t), due to better energy resolution in this reaction. Exceptions are noted. A few levels are populated only in (d,p) and/or (³He,α).

[‡] Weighted average of values from (d,t) and (p,d).

All L-transfers are from 0⁺ targets.

@ Band(A): Band based on $\nu_{13/2}$. Band proposed in $^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ (2006Ve04).

& Band(B): Possible $\nu_{13/2}\otimes 3^-$ octupole band. Band proposed in $^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ (2006Ve04).

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Nd})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.	α^c	Comments
108.5206	7/2 ⁻	108.520 1	100	0.0	5/2 ⁻	[M1] ^b	1.121 16	B(M1)(W.u.)=0.043 +31-13
138.4464	5/2 ⁻	138.447 1	100	0.0	5/2 ⁻	[M1] ^b	0.563 8	B(M1)(W.u.)=0.030 +8-5
165.0868	1/2 ⁻ , 3/2 ⁻	165.087 1	100	0.0	5/2 ⁻	[M1] ^b	0.344 5	B(M1)(W.u.)=0.050 +9-7
220.7058	9/2 ⁻	112.185 2	100 7	108.5206	7/2 ⁻	[M1+E2]	1.24 22	B(M1)(W.u.)=0.00393 16 if M1, B(E2)(W.u.)=146 5 if E2.
		220.78 5	39 6	0.0	5/2 ⁻	[E2]	0.1409 20	B(E2)(W.u.)=2.07 +36-33 I_γ : weighted average of 40 6 in β^- decay and 21 21 (from $I_\gamma < 42$) in (n, γ).
258.3302	3/2 ⁻	93.243 1	7.4 & 14	165.0868	1/2 ⁻ , 3/2 ⁻	[M1] ^b	1.730 24	B(M1)(W.u.)=0.0065 11
		119.885 1	10.5 5	138.4464	5/2 ⁻	[M1+E2]	1.00 15	B(M1)(W.u.)=0.00438 +32-30 if M1, B(E2)(W.u.)=164 11 if E2.
		149.790 8	1.3 2	108.5206	7/2 ⁻	[E2]	0.526 7	B(E2)(W.u.)=6.7 11
		258.327 2	100 4	0.0	5/2 ⁻	[M1+E2]	0.093 9	B(M1)(W.u.)=0.00410 21 if M1, B(E2)(W.u.)=34.1 17 if E2.
270.8585	(9/2 ⁺)	162.338 2	100	108.5206	7/2 ⁻	[E1]	0.0689 10	B(E1)(W.u.)=1.25×10 ⁻⁴ 9
285.4819	1/2 ⁻	120.395 1	100 ^a 11	165.0868	1/2 ⁻ , 3/2 ⁻	[M1] ^b	0.835 12	B(M1)(W.u.)=0.050 +6-5
		147.036 2	4.4 ^a 5	138.4464	5/2 ⁻	[E2]	0.561 8	B(E2)(W.u.)=31 +6-5
		285.511 @ 20	10 1	0.0	5/2 ⁻	[E2]	0.0612 9	B(E2)(W.u.)=2.51 +48-40
316.230	(5/2 ⁻ , 7/2 ⁻)	151.120 20	7.5 8	165.0868	1/2 ⁻ , 3/2 ⁻	[M1,E2]	0.475 35	B(M1)(W.u.)=0.0034 +9-7 if M1, B(E2)(W.u.)=81 +22-16 if E2.
		177.783 10	15.4 & 28	138.4464	5/2 ⁻	[M1+E2]	0.286 7	B(M1)(W.u.)=0.0043 +13-10 if M1, B(E2)(W.u.)=74 +23-17 if E2.
		207.710 3	100 5	108.5206	7/2 ⁻	[M1+E2]	0.178 6	B(M1)(W.u.)=0.0173 +43-29 if M1, B(E2)(W.u.)=2.2×10 ² +6-4 if E2.
		316.236 10	99 4	0.0	5/2 ⁻	[M1+E2]	0.052 8	B(M1)(W.u.)=0.0049 +12-8 if M1, B(E2)(W.u.)=27 +7-5 if E2.
321.1429	(5/2 ⁻ , 7/2 ⁻)	156.061 2	73 & 17	165.0868	1/2 ⁻ , 3/2 ⁻	[M1] ^b	0.403 6	B(M1)(W.u.)=0.017 +6-5
		182.694 2	58 & 18	138.4464	5/2 ⁻	[M1+E2]	0.263 5	B(M1)(W.u.)=0.0086 +35-27 if M1, B(E2)(W.u.)=1.4×10 ² +6-5 if E2.
		212.613 4	41 2	108.5206	7/2 ⁻	[M1+E2]	0.166 7	B(M1)(W.u.)=0.0039 +13-8 if M1, B(E2)(W.u.)=47 +16-10 if E2.
		321.124 8	100 8	0.0	5/2 ⁻	[M1+E2]	0.050 7	B(M1)(W.u.)=0.0027 +9-6 if M1, B(E2)(W.u.)=14.6 +50-30 if E2.
332.9326	5/2 ⁺	194.468 @ 10	1.56 13	138.4464	5/2 ⁻	[E1]	0.0423 6	B(E1)(W.u.)=3.3×10 ⁻⁵ +33-13
		224.437 10	6.3 6	108.5206	7/2 ⁻	[E1]	0.0288 4	B(E1)(W.u.)=9×10 ⁻⁵ +9-3
		332.944 13	100 5	0.0	5/2 ⁻	[E1]	0.01042 15	B(E1)(W.u.)=0.00043 +41-16
340.4	(13/2 ⁺)	69.5	100	270.8585	(9/2 ⁺)			
365.9315	3/2 ⁻	32.999 @ 1	≈19	332.9326	5/2 ⁺	[E1]	0.916 13	B(E1)(W.u.)>4.0×10 ⁻⁴
		80.449 @ 2	16.1 17	285.4819	1/2 ⁻	[M1+E2]	3.7 11	B(M1)(W.u.)>0.004 if M1. B(E2)(W.u.)>306 exceeds RUL=300 if E2.
		200.844 @ 5	9.8 10	165.0868	1/2 ⁻ , 3/2 ⁻	[M1+E2]	0.197 5	B(M1)(W.u.)>1.4×10 ⁻⁴ if M1, B(E2)(W.u.)>1.8 if E2.
		227.481 ^d 6	50 ^d 5	138.4464	5/2 ⁻	[M1+E2]	0.135 8	B(M1)(W.u.)>4.9×10 ⁻⁴ if M1, B(E2)(W.u.)>5.2 if E2.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Nd})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.	α^c	Comments
365.9315	3/2 ⁻	257.442@ 20	5.5 5	108.5206	7/2 ⁻	[E2]	0.0852 12	B(E2)(W.u.)>0.3
		365.953 8	100 10	0.0	5/2 ⁻	[M1+E2]	0.035 6	B(M1)(W.u.)>2.4×10 ⁻⁴ if M1, B(E2)(W.u.)>0.99 if E2.
403.7291	1/2 ⁻	118.244@ 3	5.7 5	285.4819	1/2 ⁻	[M1]	0.879 12	B(M1)(W.u.)=0.014 +8-4
		145.397 2	18.6 ^a 19	258.3302	3/2 ⁻	[M1] ^b	0.491 7	B(M1)(W.u.)=0.025 +13-7
		238.638 3	100 ^a 10	165.0868	1/2 ⁻ ,3/2 ⁻	[M1] ^b	0.1258 18	I _γ : 100 40 in β ⁻ decay is too large. B(M1)(W.u.)=0.031 +15-8
		265.290 8	41 ^a 4	138.4464	5/2 ⁻	[E2]	0.0774 11	238.6γ is an unresolved doublet in β ⁻ decay, perhaps the intensity split is not correct in that dataset.
		403.51 17	33 ^a 5	0.0	5/2 ⁻	[E2]	0.02143 30	B(E2)(W.u.)=72 +37-20 I _γ : 118 15 in β ⁻ decay is too large. B(E2)(W.u.)=7.1 +37-21
450.04	5/2 ⁻	285.8 [#] 1	25 5	165.0868	1/2 ⁻ ,3/2 ⁻	[M1,E2]	0.069 8	I _γ : 95 25 in β ⁻ decay is too large. E _γ : Poor fit. Level-energy difference=284.96. Uncertainty doubled in the fitting procedure.
		341.31 [#] 5	100 9	108.5206	7/2 ⁻	[M1+E2]	0.042 7	B(M1)(W.u.)≥0.014 if M1, B(E2)(W.u.)≥93 if E2. E _γ : level-energy difference=341.52. Uncertainty doubled in the fitting procedure.
459.529	(3/2 ⁻ ,5/2 ⁻)	143.299 2	62 7	316.230	(5/2 ⁻ ,7/2 ⁻)	[M1+E2]	0.56 5	B(M1)(W.u.)≥0.039 if M1, B(E2)(W.u.)≥187 if E2.
		174.031 18	11 ^a 2	285.4819	1/2 ⁻	[M1+E2]	0.306 9	B(M1)(W.u.)=0.043 +32-14 if M1. B(E2)(W.u.)=1.1×10 ³ +8-4 exceeds RUL=300 if E2.
		294.44 4	57 ^a 7	165.0868	1/2 ⁻ ,3/2 ⁻	[M1+E2]	0.064 8	B(M1)(W.u.)=0.0042 +33-15 if M1, B(E2)(W.u.)=8×10 ¹ +6-3 if E2.
		321.28 ^{d#e} 10	<10 ^d	138.4464	5/2 ⁻	[M1+E2]	0.050 7	B(M1)(W.u.)=0.0045 +34-15 if M1, B(E2)(W.u.)=29
		351.001 20	70 11	108.5206	7/2 ⁻	[M1+E2]	0.039 6	+23-10 if E2. B(M1)(W.u.)<0.0013 if M1, B(E2)(W.u.)<6.7 if E2.
		459.52 11	100 10	0.0	5/2 ⁻	[M1+E2]	0.019 4	B(M1)(W.u.)=0.0033 +25-11 if M1, B(E2)(W.u.)=15 +11-5 if E2. B(M1)(W.u.)=0.0021 +16-7 if M1, B(E2)(W.u.)=5.4 +41-18 if E2.
474.59	(5/2 ⁺ ,7/2)	204.15 [#] 10	14.3 14	270.8585	(9/2 ⁺)			E _γ : poor fit. Level-energy difference=203.73. Uncertainty doubled in the fitting procedure.
		366.02 [#] 10	50 5	108.5206	7/2 ⁻			
		474.57 [#] 6	100 6	0.0	5/2 ⁻			
482.6733	1/2 ⁺	78.943@ 1	15 2	403.7291	1/2 ⁻	[E1]	0.494 7	B(E1)(W.u.)>2.5×10 ⁻⁵
		116.742 1	92 ^a 9	365.9315	3/2 ⁻	[E1]	0.1697 24	B(E1)(W.u.)>5.2×10 ⁻⁵
		197.194 2	100 ^a 10	285.4819	1/2 ⁻	[E1]	0.0407 6	B(E1)(W.u.)>1.2×10 ⁻⁵
		224.350@ 10	40 5	258.3302	3/2 ⁻	[E1]	0.0289 4	B(E1)(W.u.)>3.0×10 ⁻⁶
		317.57@ 3	15.8 19	165.0868	1/2 ⁻ ,3/2 ⁻	[E1]	0.01173 16	B(E1)(W.u.)>4.1×10 ⁻⁷
517.44	(3/2,5/2,7/2)	408.92 15	12.8 10	108.5206	7/2 ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Nd})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult.	α^c	Comments
517.44	(3/2,5/2,7/2)	517.44 4	100 4	0.0	5/2 ⁻			
548.655		215.724 4	46 4	332.9326	5/2 ⁺	[E1]	0.0320 4	B(E1)(W.u.)>5.9×10 ⁻⁶
		227.481 ^d 6	100 ^d 10	321.1429	(5/2 ⁻ ,7/2 ⁻)	[M1,E2]	0.135 8	E _γ : poor fit. Level-energy difference=227.512. Uncertainty doubled in the fitting procedure.
		383.566 21	56 ^{&} 17	165.0868	1/2 ⁻ ,3/2 ⁻	[M1+E2]	0.030 6	B(M1)(W.u.)>0.001 if M1, B(E2)(W.u.)>11 if E2.
		410.29 3	73 7	138.4464	5/2 ⁻	[M1+E2]	0.025 5	B(M1)(W.u.)>9.6×10 ⁻⁵ if M1, B(E2)(W.u.)>0.36 if E2.
		548.72 [@] 17	15.7 14	0.0	5/2 ⁻	[M1+E2]	0.0118 27	B(M1)(W.u.)>1.2×10 ⁻⁴ if M1, B(E2)(W.u.)>0.41 if E2.
571.407	3/2 ⁺	88.731 4	2.2 ^a 3	482.6733	1/2 ⁺			B(M1)(W.u.)>1.1×10 ⁻⁵ if M1, B(E2)(W.u.)>0.02 if E2.
		238.453 20	23 ^{&} 10	332.9326	5/2 ⁺			
		313.088 14	27 ^{&} 9	258.3302	3/2 ⁻			
		406.400 12	100 5	165.0868	1/2 ⁻ ,3/2 ⁻			E _γ : poor fit. Level-energy difference=406.319. Uncertainty doubled in the fitting procedure.
		432.95 3	80 20	138.4464	5/2 ⁻			
587.7	(17/2 ⁺)	247.3		340.4	(13/2 ⁺)			
593.22	(5/2 ⁺)	260.10 [#] 9	79 15	332.9326	5/2 ⁺			
		322.40 [#] 4	100 15	270.8585	(9/2 ⁺)			
603.42		494.90 [#] 8	100	108.5206	7/2 ⁻			
705.128	(3/2,5/2)	245.588 25	84 8	459.529	(3/2 ⁻ ,5/2 ⁻)			
		389.00 10	100 11	316.230	(5/2 ⁻ ,7/2 ⁻)			
		540.1 [#] 3	92 15	165.0868	1/2 ⁻ ,3/2 ⁻			γ not reported in (n,γ).
		566.85 16	69 6	138.4464	5/2 ⁻			
709.045	(3/2,5/2 ⁻)	249.51 [@] 5	10.5 12	459.529	(3/2 ⁻ ,5/2 ⁻)			
		305.325 [@] 22	34 4	403.7291	1/2 ⁻			
		375.95 8	27.0 23	332.9326	5/2 ⁺			
		387.93 12	30 5	321.1429	(5/2 ⁻ ,7/2 ⁻)			
		450.72 5	82 10	258.3302	3/2 ⁻			
		545.3 ^e 5	10 4	165.0868	1/2 ⁻ ,3/2 ⁻			γ not reported in (n,γ).
		570.72 10	100 10	138.4464	5/2 ⁻			
741.06	3/2 ⁺	455.55 [@] 20	21.8 23	285.4819	1/2 ⁻			
		576.03 12	100 9	165.0868	1/2 ⁻ ,3/2 ⁻			
814.40	1/2 ⁺	354.89 [@] 4	29 3	459.529	(3/2 ⁻ ,5/2 ⁻)			
		528.91 10	100 9	285.4819	1/2 ⁻			
		649.22 16	17 3	165.0868	1/2 ⁻ ,3/2 ⁻			
		675.90 7	191 15	138.4464	5/2 ⁻	[M2]	0.02460 34	γ from γγ-coin in (n,γ) and ¹⁴⁹ Pr β ⁻ , but placement seems unlikely, since it requires M2 for 675.9γ.
862.81	(7/2) ⁺	592.1 [#] 2	53 13	270.8585	(9/2 ⁺)			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Nd})$ (continued)						
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Comments
862.81	(7/2) ⁺	642.03 [#] 8	100 23	220.7058	9/2 ⁻	
		724.7 [#] 2	63 15	138.4464	5/2 ⁻	
881.36	3/2 ⁺	622.97 [#] 10	100 8	258.3302	3/2 ⁻	
		716.5 [#] 3	19 9	165.0868	1/2 ⁻ , 3/2 ⁻	γ not reported in (n, γ).
		742.94 [#] 10	78 8	138.4464	5/2 ⁻	γ not reported in (n, γ).
913.57	(1/2, 3/2)	430.76 15	100	482.6733	1/2 ⁺	
920.65	(3/2, 5/2, 7/2 ⁻)	604.07 [#] 14	67 3	316.230	(5/2 ⁻ , 7/2 ⁻)	
		662.45 [#] 9	100 7	258.3302	3/2 ⁻	
		755.81 [#] 15	47 7	165.0868	1/2 ⁻ , 3/2 ⁻	
		781.99 [#] 15	72 11	138.4464	5/2 ⁻	
976.4	(21/2 ⁺)	388.7		587.7	(17/2 ⁺)	
985.15	1/2 ⁺	436.5 1		548.655	3/2 ⁻	E_γ : from $\gamma\gamma$ in (d,t γ).
		820 1		165.0868	1/2 ⁻ , 3/2 ⁻	E_γ : from $\gamma\gamma$ in (d,t γ).
1012.6?		874.11 ^e 26	100	138.4464	5/2 ⁻	
1305.7	(19/2 ⁻)	718		587.7	(17/2 ⁺)	
1469.0	(25/2 ⁺)	492.6		976.4	(21/2 ⁺)	
1683.4	(23/2 ⁻)	707		976.4	(21/2 ⁺)	
2040.4	(29/2 ⁺)	571.4		1469.0	(25/2 ⁺)	
2081.0	(27/2 ⁻)	612		1469.0	(25/2 ⁺)	
2595.4	(31/2 ⁻)	555		2040.4	(29/2 ⁺)	
2650.4		610		2040.4	(29/2 ⁺)	
2672.2	(33/2 ⁺)	631.8		2040.4	(29/2 ⁺)	
3179	(35/2 ⁻)	507		2672.2	(33/2 ⁺)	
3345	(37/2 ⁺)	672.9		2672.2	(33/2 ⁺)	
4018	(41/2 ⁺)	673.1		3345	(37/2 ⁺)	
4646	(45/2 ⁺)	627.6		4018	(41/2 ⁺)	
(5038.82)	1/2 ⁺	4125.13 9	4.7 5	913.57	(1/2, 3/2)	
		4224.33 8	5.6 6	814.40	1/2 ⁺	
		4297.73 10	2.12 25	741.06	3/2 ⁺	
		4329.74 7	11.6 11	709.045	(3/2, 5/2 ⁻)	
		4467.28 8	2.99 25	571.407	3/2 ⁺	
		4556.07 9	2.62 25	482.6733	1/2 ⁺	
		4634.98 8	4.0 4	403.7291	1/2 ⁻	
		4672.82 7	100.0 10	365.9315	3/2 ⁻	
		4753.26 7	20.2 20	285.4819	1/2 ⁻	
		4780.43 10	2.00 25	258.3302	3/2 ⁻	
		4873.68 8	6.6 6	165.0868	1/2 ⁻ , 3/2 ⁻	

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Nd})$ (continued)

- [†] From (n, γ) for low-spin ($J \leq 9/2$) levels, unless otherwise stated. For high-spin ($J > 9/2$) levels, values are from $^{238}\text{U}(^{12}\text{C}, \text{F}\gamma)$.
- [‡] From weighted averages of values from (n, γ) and β^- decay, when a level and gamma are seen in both the studies, unless otherwise indicated.
- [#] From $^{149}\text{Pr} \beta^-$.
- [@] γ from (n, γ) only, not reported in β^- decay.
- [&] Unweighted average of values from (n, γ) and β^- decay, when the two values are in poor agreement.
- ^a From (n, γ).
- ^b Dominant M1 expected from RUL=300 for E2 transitions.
- ^c Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
- ^d Multiply placed with intensity suitably divided.
- ^e Placement of transition in the level scheme is uncertain.

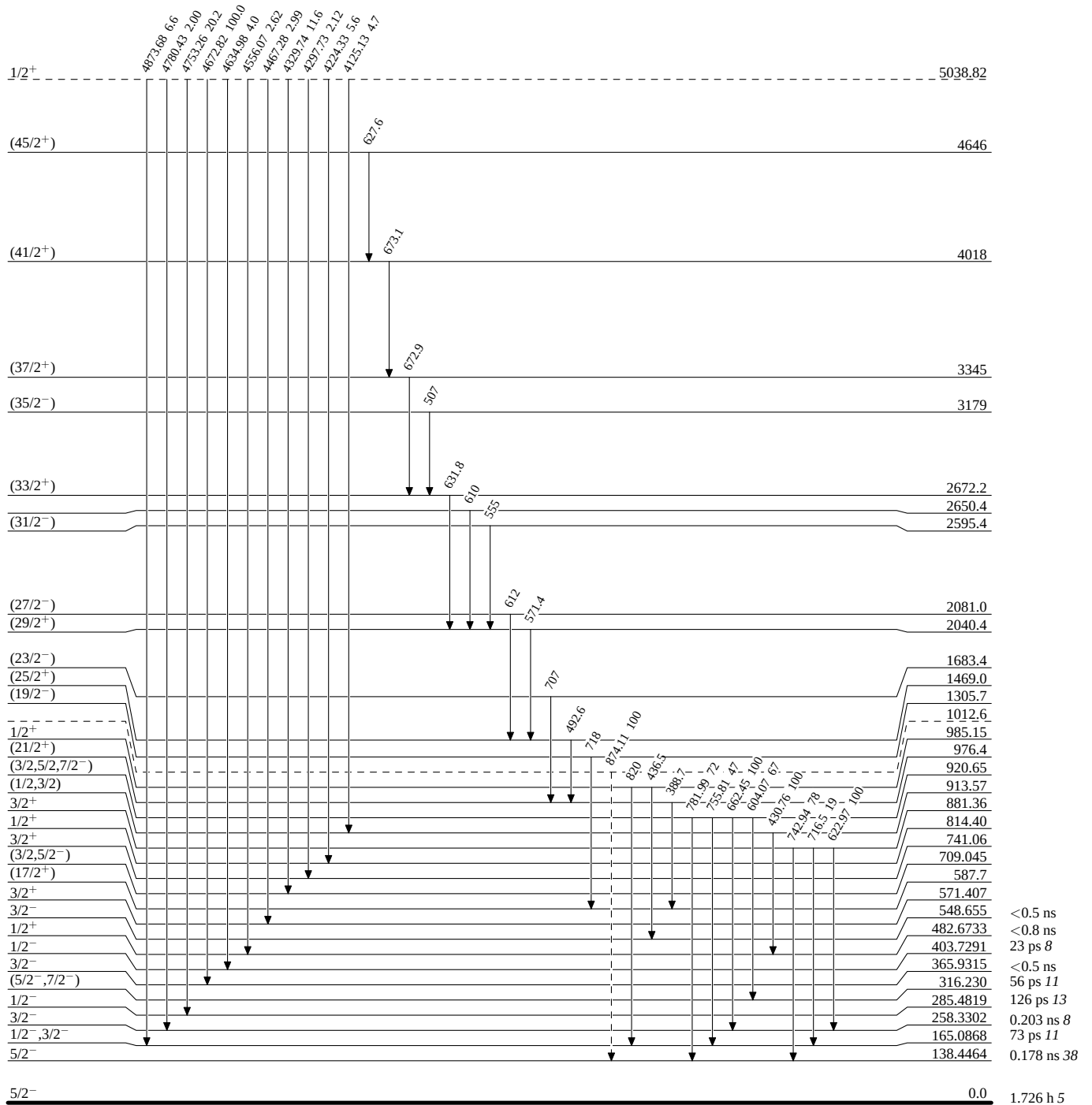
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

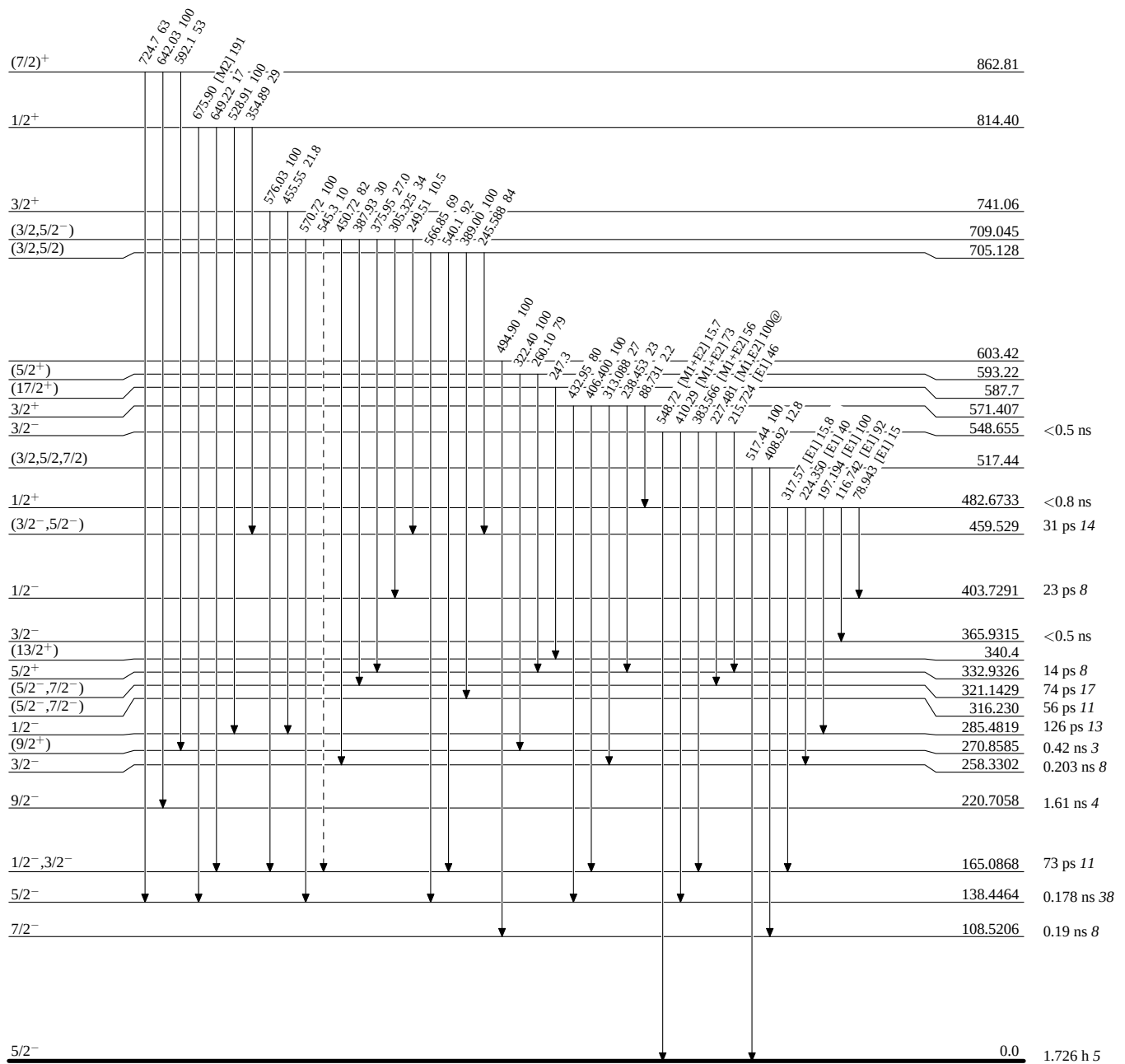


Adopted Levels, Gammas

Legend

Level Scheme (continued)

 Intensities: Relative photon branching from each level
 @ Multiply placed: intensity suitably divided

 -----► γ Decay (Uncertain)

 $^{149}_{60}\text{Nd}_{89}$

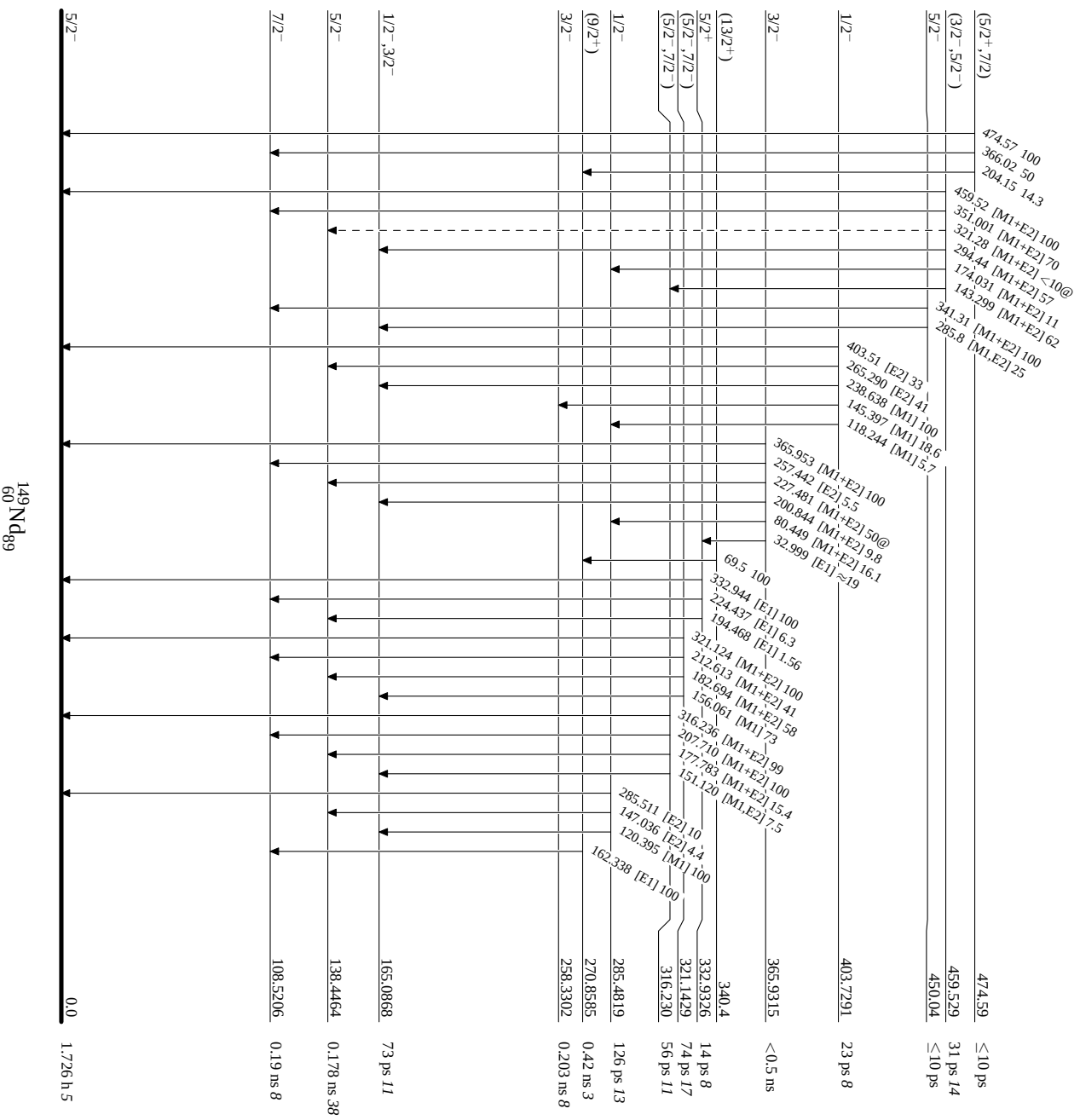
Adopted Levels, Gammas

Level Scheme (continued)

Legend

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

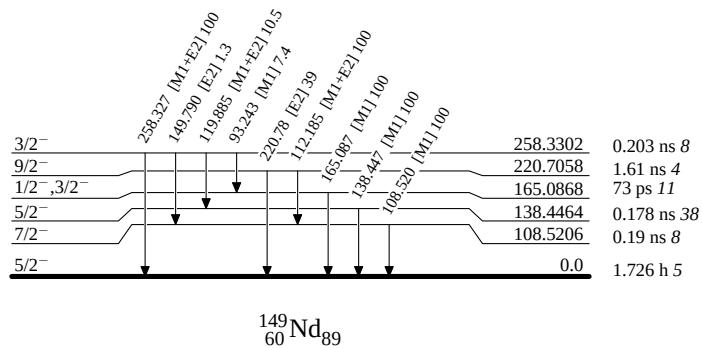
-----▶ γ Decay (Uncertain)



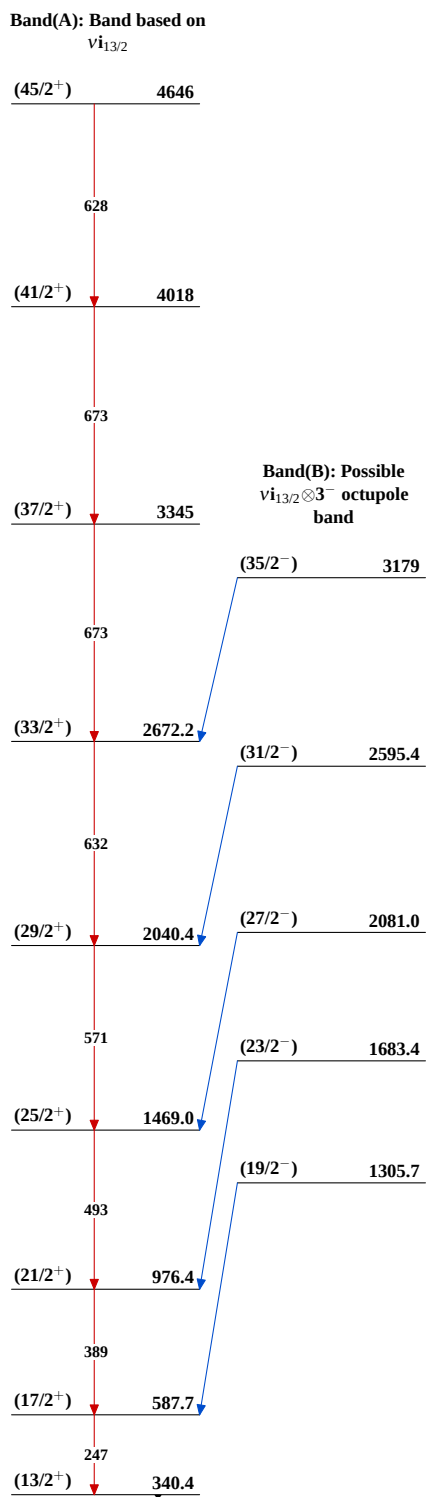
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
 @ Multiply placed: intensity suitably divided



Adopted Levels, Gammas


 $^{149}_{60}\text{Nd}_{89}$

¹⁴⁹Pr β⁻ decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09

Parent: ¹⁴⁹Pr: E=0; J^π=(5/2⁺); T_{1/2}=2.26 min 8; Q(β⁻)=3336 10; %β⁻ decay=100

¹⁴⁹Pr-J^π, T_{1/2}: From ¹⁴⁹Pr Adopted Levels.

¹⁴⁹Pr-Q(β⁻): From 2021Wa16.

1977Pi06 (also 1976RoYT): measured E_γ, I_γ, γγ-coin at Grenoble and at the Kernforschungsanlage Julich.

2010Ru09: main emphasis in this work is the measurement of the half-lives of 14 levels in ¹⁴⁹Nd using advanced fast-timing techniques in βγγ coin studies at Studsvik. Some new γ rays and levels were also reported. The ¹⁴⁹Pr source was obtained from decay chain starting from ¹⁴⁹Cs and ¹⁴⁹Ba (¹⁴⁹Cs → ¹⁴⁹Ba → ¹⁴⁹La → ¹⁴⁹Ce → ¹⁴⁹Pr). The ¹⁴⁹Cs and ¹⁴⁹Ba were produced in ²³⁵U(n,f), E=thermal at OSIRIS on-line fission-product mass separator facility in Studsvik. The A=149 activities were mass separated and deposited on a mylar tape. Measured βγγ using NE111A plastic scintillator, one low-energy x-ray detector and a 50% HPGe detector. Lifetime measurements were made by βγγ(t) using fast timing coincidence between NE111A β detector and BaF₂ γ detector together with coin requirement with a γ ray detected in a Ge detector.

1997Gr09, 1996Gr20: total absorption γ-ray spectra (TAGS) at the Idaho National Engineering Lab, deduced β feedings.

2014Ko27: measured level half-lives by γγ(t).

Others:

1995Ik03: measured Q(β⁻)=3390 70 from βγ-coin.

1977Pf01: E_γ, I_γ, most of the γ rays are the same as in 1977Pi06.

1976Sk04: E_γ, γγ for intense transitions.

1974Bu09: E_γ, T_{1/2} of ¹⁴⁹Pr decay.

1973Oh08: E_γ, T_{1/2} of ¹⁴⁹Pr decay.

1967Va14: β, γ (five intense γ rays reported).

1964Ho03: T_{1/2} of ¹⁴⁹Pr decay.

The level scheme as given here is incomplete as compared with the TAGS data of 1997Gr09 (also 1996Gr20). For example 1997Gr09 obtain 55% β feeding to levels above 920.7. For low-lying excited levels (108.5-403.7), 1997Gr09 obtain total β feeding of 5.5%, whereas the gamma-ray intensity balance in the proposed level scheme gives about 50%.

Total decay energy deposit of 2997 keV 66 calculated by RADLIST code is somewhat lower than the expected value of 3336 keV 10 (2021Wa16), which could indicate the incompleteness of the decay scheme.

¹⁴⁹Nd Levels

E(level) [†]	J ^π [‡]	T _{1/2} [#]	Comments
0.0	5/2 ⁻	1.726 h 5	T _{1/2} : from the Adopted Levels.
108.54 4	7/2 ⁻	0.19 ns 8	T _{1/2} : unweighted average of 0.11 ns 3 (2014Ko27, from average of three values for (162γ)(109γ)(t), (208γ)(109γ)(t), and (224γ)(109γ)(t)) and 278 ps 27 (2010Ru09, βγγ(t)).
138.44 3	5/2 ⁻	0.178 ns 38	T _{1/2} : unweighted average of 0.14 ns 3 (2014Ko27, from average of three values for (120γ)(138γ)(t), (227γ)(138γ)(t), and (433γ)(138γ)(t)) and 216 ps 14 (2010Ru09, βγγ(t)).
165.12 3	1/2 ⁻ , 3/2 ⁻	73 ps 11	T _{1/2} : from βγγ(t) (2010Ru09).
220.73 8	9/2 ⁻	1.61 ns 4	T _{1/2} : from the Adopted Levels. 1.60 ns 4 from weighted average of 1.60 ns 4 (2014Ko27, (112γ+109γ)(t)) and 1.65 ns 19 (2010Ru09, βγγ(t)).
258.33 3	3/2 ⁻	0.203 ns 8	T _{1/2} : weighted average of 0.22 ns 3 (2014Ko27, average of three values for (313γ)(258γ)(t), (623γ)(258γ)(t), and (662γ)(258γ)(t)) and 202 ps 8 (2010Ru09, βγγ(t)).
270.69 6	(9/2 ⁺)	0.42 ns 3	T _{1/2} : weighted average of 0.42 ns 3 (2014Ko27, (162γ+109γ)(t)) and 424 ps 60 (2010Ru09, βγγ(t)).
285.48 3	1/2 ⁻	126 ps 13	T _{1/2} : from βγγ(t) (2010Ru09).
316.25 4	(5/2 ⁻ , 7/2 ⁻)	56 ps 11	T _{1/2} : from βγγ(t) (2010Ru09).
321.17 4	(5/2 ⁻ , 7/2 ⁻)	74 ps 17	T _{1/2} : from βγγ(t) (2010Ru09).
332.99 4	5/2 ⁺	14 ps 8	T _{1/2} : from βγγ(t) (2010Ru09).
365.84 6	3/2 ⁻		
403.76 3	1/2 ⁻	23 ps 8	T _{1/2} : from βγγ(t) (2010Ru09).
449.85 7	5/2 ⁻	≤10 ps	T _{1/2} : βγγ(t) (2010Ru09). Level proposed by 2010Ru09, with the two new γ rays of 285.8 and 341.31 from this level, which do not fit well in the decay scheme within the quoted uncertainties.

Continued on next page (footnotes at end of table)

^{149}Pr β^- decay (2.26 min) [1977Pi06](#),[2010Ru09](#),[1997Gr09](#) (continued) ^{149}Nd Levels (continued)

E(level) [†]	J π [‡]	T _{1/2} [#]	Comments
459.53 4	(3/2 ⁻ , 5/2 ⁻)	31 ps 14	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09).
474.63 5	(5/2 ⁺ , 7/2)	≤10 ps	T _{1/2} : $\beta\gamma\gamma(t)$ (2010Ru09).
482.71 4	1/2 ⁺		
517.43 6	(3/2, 5/2, 7/2)		
548.70 4	3/2 ⁻		
571.44 4	3/2 ⁺		
593.09 7	(5/2 ⁺)		E(level): level proposed by 2010Ru09 .
603.44 9			E(level): level proposed by 2010Ru09 .
705.01 11	(3/2, 5/2)		
709.45 9	(3/2, 5/2 ⁻)		
741.51 16	3/2 ⁺		
814.35 9	1/2 ⁺		
862.81 10	(7/2) ⁺		E(level): level proposed by 2010Ru09 .
881.36 8	3/2 ⁺		
920.66 7	(3/2, 5/2, 7/2 ⁻)		
1000@ 50			
1012.6? 3			E(level): level proposed by 2010Ru09 , considered as uncertain by the evaluators, as it is not supported by $\gamma\gamma$ -coin data.
1100@ 50			
1200@ 50			
1300@ 50			
1400@ 50			
1500@ 50			
1600@ 50			
1700@ 50			
1800@ 50			
1900@ 50			
2000@ 50			
2100@ 50			
2200@ 50			
2300@ 50			
2400@ 50			
2500@ 50			
2600@ 50			
2700@ 50			
2800@ 50			
2900@ 50			
3000@ 50			
3100@ 50			

[†] From least-squares fit to E γ data. As indicated by comments, 285 γ from 450 level was not used in the least-squares fit procedure, due to its very poor fit, the deviation being ≈ 1 keV. Uncertainties of three γ rays from the 709 level were doubled in the fitting procedure to obtain an acceptable reduced χ^2 fit, consistent with critical reduced χ^2 of 1.5. Without the above adjustments, reduced χ^2 is 4.3.

^{149}Pr β^- decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09 (continued) ^{149}Nd Levels (continued)

‡ From the Adopted Levels.

From this dataset, unless otherwise noted. Quoted values are the same in the Adopted Levels.

@ Pseudolevel from β feeding deduced from TAGS (total absorption γ ray spectra) data (1997Gr09). Uncertainty of 50 keV assigned by the evaluators based on choice of 100 keV bins for the TAGS spectrum of 1997Gr09. β^- radiations

E(decay)	E(level)	$I\beta^-$ ‡	Log ft †	Comments
(2.4×10^2 5)	3100	0.034	5.1	
(3.4×10^2 5)	3000	0.085	5.2	
(4.4×10^2 5)	2900	0.18	5.3	
(5.4×10^2 5)	2800	0.57	5.1	
(6.4×10^2 5)	2700	1.0	5.1	
(7.4×10^2 5)	2600	1.6	5.1	
(8.4×10^2 5)	2500	3.2	5.0	
(9.4×10^2 5)	2400	4.1	5.1	
(1.04×10^3 5)	2300	3.6	5.3	
(1.14×10^3 5)	2200	3.4	5.4	
(1.24×10^3 5)	2100	12.7	5.0	
(1.34×10^3 5)	2000	11.8	5.2	
(1.44×10^3 5)	1900	0.87	6.4	
(1.54×10^3 5)	1800	1.6	6.3	
(1.64×10^3 5)	1700	1.3	6.5	
(1.74×10^3 5)	1600	1.0	6.7	
(1.84×10^3 5)	1500	1.4	6.6	
(1.94×10^3 5)	1400	1.8	6.6	
(2.04×10^3 5)	1300	1.3	6.8	
(2.14×10^3 5)	1200	1.1	7.0	
(2.24×10^3 5)	1100	1.1	7.1	
(2323# 10)	1012.6?	0.80 15	7.3	$I\beta^-$: from intensity balance; value not available from TAGS data.
(2.34×10^3 5)	1000	0.87	7.3	
(2415 10)	920.66	6.6	6.4	$I\beta^-$: intensity balance gives 5.2 9. E(decay): 2430 160 ($\beta\gamma$, 1995Ik03).
(2455 10)	881.36	4.5	6.6	$I\beta^-$: intensity balance gives 3.6 6. E(decay): 2490 160 ($\beta\gamma$, 1995Ik03).
(2473 10)	862.81	0.65 14	7.5	$I\beta^-$: from intensity balance; value not available from TAGS data.
(2522# 10)	814.35	3.2	6.8	$I\beta^-$: intensity balance gives 1.13 24, including contributions identified in (n, γ) by 1976Pi04; expected to be negligible due to $\Delta J=2$ and $\Delta\pi=\text{no}$ for the β transition.
(2595 10)	741.51	0.39	7.8	$I\beta^-$: intensity balance gives 0.45 12, including contributions identified in (n, γ) by 1976Pi04.
(2627 10)	709.45	1.0	7.4	$I\beta^-$: intensity balance gives 1.9 4, including contributions identified in (n, γ) by 1976Pi04.
(2631 10)	705.01	1.1	7.4	$I\beta^-$: intensity balance gives 2.3 5.
(2733 10)	603.44	0.89 21	7.5	$I\beta^-$: from intensity balance; value not available from TAGS data.
(2743 10)	593.09	1.5 3	7.3	$I\beta^-$: from intensity balance; value not available from TAGS data.
(2765 10)	571.44	5.5	6.8	E(decay): 2820 190 ($\beta\gamma$, 1995Ik03). $I\beta^-$: intensity balance gives 6.8 11, including contributions identified in (n, γ) by 1976Pi04.
(2787 10)	548.70	0.78	7.6	$I\beta^-$: intensity balance gives 2.0 4, including contributions identified in (n, γ) by 1976Pi04.
(2819 10)	517.43	2.1	7.2	E(decay): 2970 220 ($\beta\gamma$, 1995Ik03). $I\beta^-$: intensity balance gives 5.5 9.
(2853# 10)	482.71	0.36	8.0	$I\beta^-$: intensity balance gives 0.55 16, including contributions identified in (n, γ) by 1976Pi04. $\Delta J=2$ $\Delta\pi=+$ requires negligible β feeding.

Continued on next page (footnotes at end of table)

^{149}Pr β^- decay (2.26 min) [1977Pi06](#), [2010Ru09](#), [1997Gr09](#) (continued) β^- radiations (continued)

E(decay)	E(level)	$I\beta^-$ ^{†‡}	Log ft [†]	Comments
(2861 10)	474.63	2.1	7.2	$I\beta^-$: intensity balance gives 4.7 8.
(2877 10)	459.53	0.97	7.6	$I\beta^-$: intensity balance gives 2.9 7, including contributions identified in (n, γ) by 1976Pi04 .
(2886 10)	449.85	1.4 3	7.4	$I\beta^-$: from intensity balance; value from TAGS data not available.
(2932 [#] 10)	403.76	0.0		$I\beta^-$: intensity balance gives 1.9 4, including contributions identified in (n, γ) by 1976Pi04 .
(2970 [#] 10)	365.84	0.0		$I\beta^-$: intensity balance gives 2.3 5, including contributions identified in (n, γ) by 1976Pi04 .
(3003 10)	332.99	1.4	7.5	$I\beta^-$: intensity balance gives 4.4 8, including contributions identified in (n, γ) by 1976Pi04 .
(3015 10)	321.17	1.6	7.4	$I\beta^-$: intensity balance gives 6.0 10.
(3020 10)	316.25	1.1	7.6	$I\beta^-$: intensity balance gives 4.2 8, including contributions identified in (n, γ) by 1976Pi04 .
(3051 [#] 10)	285.48	0.0		$I\beta^-$: intensity balance gives 1.9 4, including contributions identified in (n, γ) by 1976Pi04 .
(3065 [#] 10)	270.69	0.0		$I\beta^-$: intensity balance gives 1.9 4, expected to be negligible, based on $\Delta J=2$, $\Delta\pi=\text{no}$, involved in β transition.
(3078 [#] 10)	258.33	0.0		$I\beta^-$: intensity balance gives 3.6 8.
(3115 [#] 10)	220.73	0.0		$I\beta^-$: intensity balance gives 2.4 8.
(3171 [#] 10)	165.12	0.0		$I\beta^-$: intensity balance gives <1.3.
(3198 10)	138.44	0.56	8.0	$I\beta^-$: intensity balance gives 4.0 9.
(3228 10)	108.54	0.87	7.8	$I\beta^-$: intensity balance gives 4.5 14.
(3336 10)	0.0	11.4 14	6.77 6	E(decay): 3000 200 from 1967Va14 . $I\beta^-$: from TAGS data of 1996Gr20 .

[†] β feedings are from TAGS data in [1997Gr09](#), unless otherwise noted. The β feedings deduced from γ -ray intensity balances are given under comments which differ significantly from those deduced from TAGS data of [1997Gr09](#). Since there are 29 unplaced γ rays with a total intensity of 15%, and multipolarities of several γ rays are unknown, the present decay scheme is likely to be incomplete, thus the $I\beta$ values listed in comments can only be considered as upper limits.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

γ(¹⁴⁹Nd)

I_γ normalization: 1977Pi06 provide in Table 1 intensities per 100 decays with statistical uncertainties, with a statement that 15% uncertainty from arising from calibration procedure is not included. Summed I(γ+ce)(to g.s.)=88.6 14, obtained from 100-(measured Iβ=11.4 14 to g.s.) gives γ-normalization factor of 1.109 26, which agrees with 1.00 15 within the uncertainties, however, note that the uncertainty in normalization factor of 1.109 26 is based on γ-ray intensities with statistical uncertainties only.

E _γ [†]	I _γ ^{†ch}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	α ⁱ	Comments
88.731 ^e 4	0.053 8	571.44	3/2 ⁺	482.71	1/2 ⁺	[M1+E2]	2.7 7	%I _γ =0.053 11
93.11 8	0.50 5	258.33	3/2 ⁻	165.12	1/2 ⁻ , 3/2 ⁻	[M1] ^g	1.737 25	%I _γ =0.50 9
^x 103.99 [#] 16	0.70 21							%I _γ =0.70 23
108.51 6	9.5 4	108.54	7/2 ⁻	0.0	5/2 ⁻	[M1] ^g	1.122 16	%I _γ =9.5 15
112.12 [#] 9	1.0 3	220.73	9/2 ⁻	108.54	7/2 ⁻	[M1+E2]	1.24 22	%I _γ =1.00 34
117.19 [#] 17	0.40 8	482.71	1/2 ⁺	365.84	3/2 ⁻	[E1]	0.1679 24	%I _γ =0.40 10
119.885 ^b 1	0.61 ^b 3	258.33	3/2 ⁻	138.44	5/2 ⁻	[M1+E2]	1.00 15	%I _γ =0.61 10
								E _γ : poor fit, level-energy difference=119.836.
120.30 6	1.40 8	285.48	1/2 ⁻	165.12	1/2 ⁻ , 3/2 ⁻	[M1] ^g	0.837 12	%I _γ =1.40 22
^x 129.3 [#] 4	0.26 16							%I _γ =0.26 16
^x 134.07 [#] 25	0.36 14							%I _γ =0.36 15
138.46 5	11.02 33	138.44	5/2 ⁻	0.0	5/2 ⁻	[M1] ^g	0.563 8	%I _γ =11.0 17
								Measured I _γ /100 decays=11.0 17 (1977Pi06 give 15% uncertainty for absolute intensities). Other: I _γ (138.46γ)/100 decays=13 5 (1967Va14).
143.31 [#] 20	0.60 25	459.53	(3/2 ⁻ , 5/2 ⁻)	316.25	(5/2 ⁻ , 7/2 ⁻)	[M1+E2]	0.56 5	%I _γ =0.60 27
145.92 20	0.40 16	403.76	1/2 ⁻	258.33	3/2 ⁻	[M1] ^g	0.486 7	%I _γ =0.40 17
								Placement proposed by 2010Ru09 based on possible γγ-coin evidence. The γ was unplaced in 1977Pi06.
147.036 ^e 2	0.062 ^e 7	285.48	1/2 ⁻	138.44	5/2 ⁻	[E2]	0.561 8	%I _γ =0.062 12
149.8 [#] 3	0.26 16	258.33	3/2 ⁻	108.54	7/2 ⁻	[E2]	0.526 8	%I _γ =0.26 16
151.120 ^e 20	0.19 ^e 3	316.25	(5/2 ⁻ , 7/2 ⁻)	165.12	1/2 ⁻ , 3/2 ⁻	[M1,E2]	0.475 35	%I _γ =0.19 4
156.04 5	1.40 ^{&} 14	321.17	(5/2 ⁻ , 7/2 ⁻)	165.12	1/2 ⁻ , 3/2 ⁻	[M1] ^g	0.403 6	%I _γ =1.40 25
162.30 8	3.1 2	270.69	(9/2 ⁺)	108.54	7/2 ⁻	[E1]	0.0690 10	%I _γ =3.1 5
165.08 6	9.9 4	165.12	1/2 ⁻ , 3/2 ⁻	0.0	5/2 ⁻	[M1] ^g	0.345 5	%I _γ =9.9 15
^x 172.92 [#] 6	0.60 7							%I _γ =0.60 11
174.031 ^e 18	0.10 ^e 3	459.53	(3/2 ⁻ , 5/2 ⁻)	285.48	1/2 ⁻	[M1,E2]	0.306 9	%I _γ =0.100 34
^x 175.70 [#] 14	0.25 5							%I _γ =0.25 6
177.73 7	0.50 [@] 5	316.25	(5/2 ⁻ , 7/2 ⁻)	138.44	5/2 ⁻	[M1+E2]	0.286 7	%I _γ =0.50 9
182.55 7	1.00 5	321.17	(5/2 ⁻ , 7/2 ⁻)	138.44	5/2 ⁻	[M1+E2]	0.264 5	%I _γ =1.00 16
197.13 [#] 17	0.27 7	482.71	1/2 ⁺	285.48	1/2 ⁻	[E1]	0.0408 6	%I _γ =0.27 8
204.15 ^d 10	0.40 ^d 4	474.63	(5/2 ⁺ , 7/2)	270.69	(9/2 ⁺)	[D,E2]	0.11 7	%I _γ =0.40 7

¹⁴⁹Pr β⁻ decay (2.26 min) [1977Pi06,2010Ru09,1997Gr09](#) (continued)

γ(¹⁴⁹Nd) (continued)

E _γ [†]	I _γ ^{†ch}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	α ⁱ	Comments
207.67 ²⁰	2.75 ¹⁴	316.25	(5/2 ⁻ ,7/2 ⁻)	108.54	7/2 ⁻	[M1+E2]	0.178 6	%I _γ =2.8 4
212.65 ¹⁰	1.00 5	321.17	(5/2 ⁻ ,7/2 ⁻)	108.54	7/2 ⁻	[M1+E2]	0.166 7	%I _γ =1.00 16
215.67 [#] ¹⁵	0.40 8	548.70	3/2 ⁻	332.99	5/2 ⁺	[E1]	0.0321 5	%I _γ =0.40 10
220.76 [#] ¹⁶	0.40 6	220.73	9/2 ⁻	0.0	5/2 ⁻	[E2]	0.1409 ²⁰	%I _γ =0.40 8
224.25 ¹¹	0.40 5	332.99	5/2 ⁺	108.54	7/2 ⁻	[E1]	0.0289 4	%I _γ =0.40 8
227.36 ^{ja} 7	0.85 ^j 9	365.84	3/2 ⁻	138.44	5/2 ⁻	[M1+E2]	0.136 8	%I _γ =0.85 16
								I _γ : combined intensity of the doublet=1.55 11.
227.36 ^{ja} 7	0.70 ^j 7	548.70	3/2 ⁻	321.17	(5/2 ⁻ ,7/2 ⁻)	[M1+E2]	0.136 8	%I _γ =0.70 13
								E _γ : poor fit, level-energy difference=227.59.
238.453 ^b ²⁰	0.80 ^b 8	571.44	3/2 ⁺	332.99	5/2 ⁺	[M1+E2]	0.118 9	%I _γ =0.80 14
								E _γ : other: 238.68 10 for the unresolved doublet in β ⁻ decay
								(1977Pi06).
								I _γ : combined intensity of the doublet=1.00 7 in β ⁻ decay.
238.638 ^b 3	0.40 ^b 4	403.76	1/2 ⁻	165.12	1/2 ⁻ ,3/2 ⁻	[M1] ^g	0.1258 18	%I _γ =0.40 7
								E _γ : other: 238.68 10 for the unresolved doublet in β ⁻ decay
								(1977Pi06).
								I _γ : combined intensity of the doublet=1.00 7 in β ⁻ decay.
								E _γ : poor fit, level-energy difference=238.623.
245.4 [#] 3	0.60 18	705.01	(3/2,5/2)	459.53	(3/2 ⁻ ,5/2 ⁻)	[D,E2]	0.07 5	%I _γ =0.60 20
258.27 ¹⁰	5.7 2	258.33	3/2 ⁻	0.0	5/2 ⁻	[M1+E2]	0.093 9	%I _γ =5.7 9
260.10 ^d 9	0.64 ^d 12	593.09	(5/2 ⁺)	332.99	5/2 ⁺	[M1+E2]	0.091 9	%I _γ =0.64 15
265.48 [‡] 19	0.47 6	403.76	1/2 ⁻	138.44	5/2 ⁻	[E2]	0.0772 11	%I _γ =0.47 9
^x 277.17 [#] 13	0.30 6							%I _γ =0.30 7
^x 282.83 [#] 20	0.36 4							%I _γ =0.36 7
285.8 ^d 1	0.27 ^d 5	449.85	5/2 ⁻	165.12	1/2 ⁻ ,3/2 ⁻	[M1,E2]	0.069 8	%I _γ =0.27 6
								E _γ : Poor fit. Level-energy difference=284.7. This γ was not
								used in the used in the least-squares fitting procedure.
^x 288.38 [#] 11	0.30 6							%I _γ =0.30 7
^x 293.18 [#] 20	0.50 12							%I _γ =0.50 14
294.44 ^e 4	0.54 ^e 14	459.53	(3/2 ⁻ ,5/2 ⁻)	165.12	1/2 ⁻ ,3/2 ⁻	[M1,E2]	0.064 8	%I _γ =0.54 16
^x 295.14 [#] 20	0.50 12							%I _γ =0.50 14
^x 301.42 [#] 10	0.50 7							%I _γ =0.50 10
^x 303.61 [#] 15	0.20 6							%I _γ =0.20 7
312.91 ¹⁵	0.85 ¹⁰	571.44	3/2 ⁺	258.33	3/2 ⁻	[E1]	0.01218 17	%I _γ =0.85 16
316.35 ¹⁰	2.70 ¹⁰	316.25	(5/2 ⁻ ,7/2 ⁻)	0.0	5/2 ⁻	[M1+E2]	0.052 8	%I _γ =2.7 4
321.28 ^{jb} 10	2.50 ^{jb} 20	321.17	(5/2 ⁻ ,7/2 ⁻)	0.0	5/2 ⁻	[M1+E2]	0.050 7	%I _γ =2.5 4
321.28 ^{jbk} 10	<0.10 ^{jb}	459.53	(3/2 ⁻ ,5/2 ⁻)	138.44	5/2 ⁻	[M1+E2]	0.050 7	%I _γ <0.10
								Placement proposed by 2010Ru09 based on possible
								γγ-coin evidence, considered as uncertain by the
								evaluators.

¹⁴⁹Pr β⁻ decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09 (continued)γ(¹⁴⁹Nd) (continued)

E _γ [†]	I _γ ^{†ch}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.	α ⁱ	Comments
322.40 ^d 4	0.81 ^d 12	593.09	(5/2 ⁺)	270.69	(9/2 ⁺)	[E2]	0.0419 6	%I _γ =0.81 17
332.97 6	6.15 30	332.99	5/2 ⁺	0.0	5/2 ⁻	[E1]	0.01042 15	%I _γ =6.2 10
^x 336.45 [#] 24	0.60 6							%I _γ =0.60 11
341.31 5	1.1 1	449.85	5/2 ⁻	108.54	7/2 ⁻	[M1+E2]	0.042 7	%I _γ =1.10 19
								E _γ , I _γ : from 2010Ru09. This γ was reported in 1977Pi06 with E _γ =341.26 13, I _γ =0.90 8 (1977Pi06), but was unplaced.
^x 345.87 [#] 40	0.30 15							%I _γ =0.30 16
351.2 [#] 13	0.80 12	459.53	(3/2 ⁻ , 5/2 ⁻)	108.54	7/2 ⁻	[M1,E2]	0.039 6	%I _γ =0.80 17
^x 355.67 [#] 15	0.60 12							%I _γ =0.60 15
366.02 ^{ja} 10	1.7 ^j 2	365.84	3/2 ⁻	0.0	5/2 ⁻	[M1+E2]	0.035 6	%I _γ =1.70 32
								I _γ : total intensity of the doublet=3.1 3.
366.02 ^{ja} 10	1.4 ^j 2	474.63	(5/2 ⁺ , 7/2)	108.54	7/2 ⁻	[D,E2]	0.024 16	%I _γ =1.40 29
375.95 ^{ef} 8	0.22 3	709.45	(3/2, 5/2 ⁻)	332.99	5/2 ⁺	[D,E2]	0.023 15	%I _γ =0.22 4
383.61 18	0.27 4	548.70	3/2 ⁻	165.12	1/2 ⁻ , 3/2 ⁻	[M1+E2]	0.030 6	%I _γ =0.27 6
388.70 ^{ja} 12	0.60 ^j 9	705.01	(3/2, 5/2)	316.25	(5/2 ⁻ , 7/2 ⁻)	[D,E2]	0.021 14	%I _γ =0.60 13
								I _γ : combined intensity of the doublet=0.80 10.
388.70 ^{jaf} 12	0.20 ^j 3	709.45	(3/2, 5/2 ⁻)	321.17	(5/2 ⁻ , 7/2 ⁻)	[D,E2]	0.021 14	%I _γ =0.20 4
^x 390.59 [#] 16	0.70 11							%I _γ =0.70 15
^x 393.32 [#] 10	0.70 18							%I _γ =0.70 21
403.50 [‡] 22	0.38 10	403.76	1/2 ⁻	0.0	5/2 ⁻	[E2]	0.02143 30	%I _γ =0.38 12
406.34 6	2.40 12	571.44	3/2 ⁺	165.12	1/2 ⁻ , 3/2 ⁻	[E1]	0.00640 9	%I _γ =2.4 4
408.92 ^b 15	0.60 ^b 9	517.43	(3/2, 5/2, 7/2)	108.54	7/2 ⁻	[D,E2]	0.019 11	%I _γ =0.60 13
								E _γ : other: 409.70 9 for the unresolved doublet in β ⁻ decay (1977Pi06).
								I _γ : combined intensity of the doublet=1.1 1 in β ⁻ decay.
410.29 ^b 3	0.50 ^b 7	548.70	3/2 ⁻	138.44	5/2 ⁻	[M1+E2]	0.025 5	%I _γ =0.50 10
								E _γ : other: 409.70 9 for the unresolved doublet in β ⁻ decay (1977Pi06).
								I _γ : combined intensity of the doublet=1.1 1 in β ⁻ decay.
^x 413.56 [#] 37	0.18 9							%I _γ =0.18 9
432.96 7	2.40 12	571.44	3/2 ⁺	138.44	5/2 ⁻	[E1]	0.00550 8	%I _γ =2.4 4
450.40 ^{#f} 20	0.56 9	709.45	(3/2, 5/2 ⁻)	258.33	3/2 ⁻	[D,E2]	0.014 10	%I _γ =0.56 12
								E _γ : poor fit, level-energy difference=451.24.
459.9 [#] 3	0.95 20	459.53	(3/2 ⁻ , 5/2 ⁻)	0.0	5/2 ⁻	[M1+E2]	0.019 4	%I _γ =0.95 25
^x 465.65 [#] 25	0.36 13							%I _γ =0.36 14
474.57 [#] 6	2.80 17	474.63	(5/2 ⁺ , 7/2)	0.0	5/2 ⁻	[D,E2]	0.013 8	%I _γ =2.8 5
494.90 8	0.88 13	603.44		108.54	7/2 ⁻	[D,E2]	0.011 7	%I _γ =0.88 19

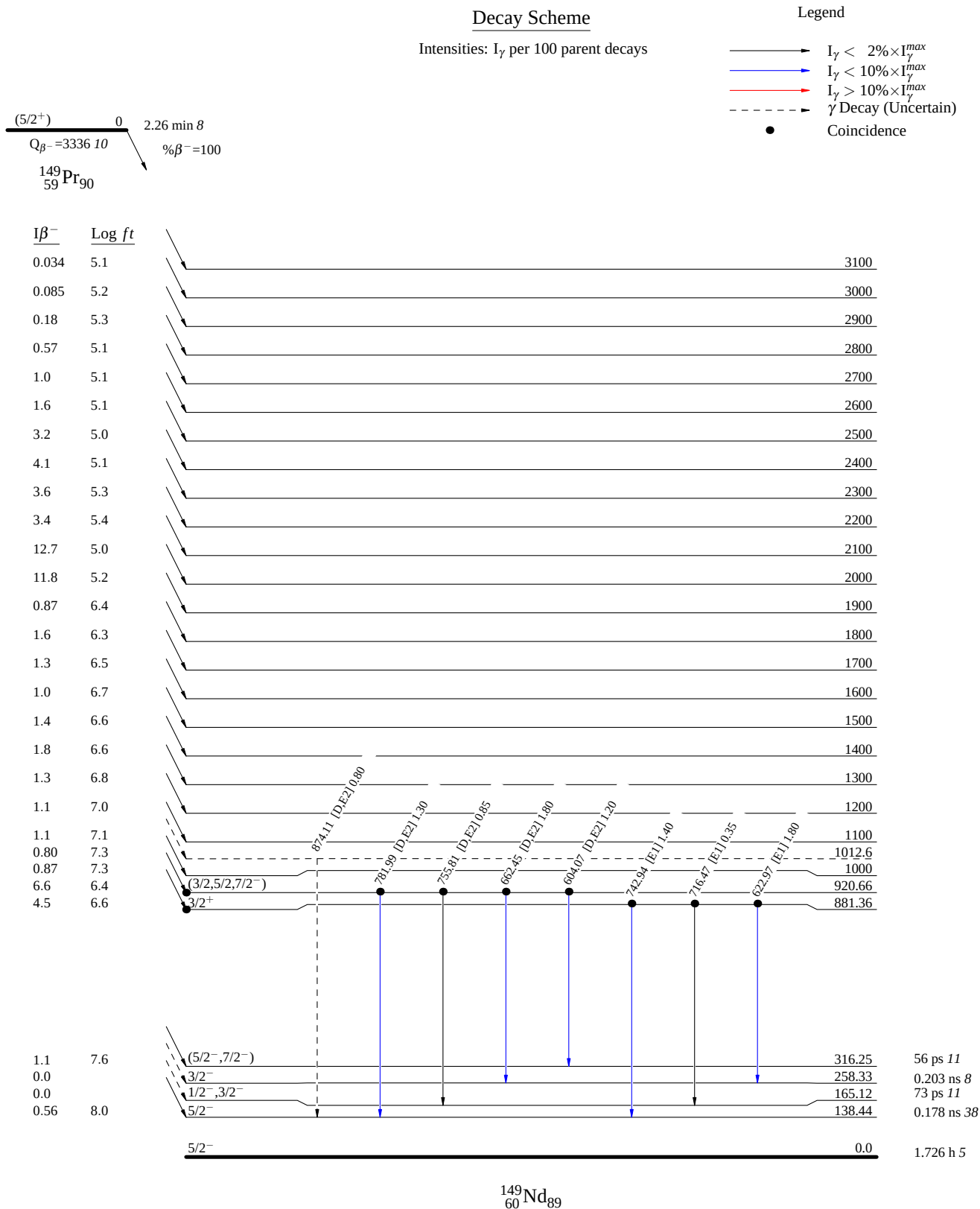
¹⁴⁹Pr β⁻ decay (2.26 min) [1977Pi06,2010Ru09,1997Gr09](#) (continued)γ(¹⁴⁹Nd) (continued)

<u>E_γ[†]</u>	<u>I_γ^{†ch}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.</u>	<u>αⁱ</u>	<u>Comments</u>
								E _γ , I _γ : from 2010Ru09 . This γ was reported in 1977Pi06 with E _γ =494.62 12, I _γ =0.74 5 (1977Pi06), but was unplaced.
517.43 [#] 6	4.80 20	517.43	(3/2,5/2,7/2)	0.0	5/2 ⁻	[D,E2]	0.010 6	%I _γ =4.8 7
528.91 ^e 10	0.31 7	814.35	1/2 ⁺	285.48	1/2 ⁻	[E1]	0.00347 5	%I _γ =0.31 8
^x 530.59 [#] 25	0.85 17							%I _γ =0.85 21
540.1 ^d 3	0.55 ^d 9	705.01	(3/2,5/2)	165.12	1/2 ⁻ , 3/2 ⁻	[D,E2]		%I _γ =0.55 12
								E _γ : uncertainty assigned by the evaluators.
545.3 ^{dk} 5	0.08 ^d 3	709.45	(3/2,5/2 ⁻)	165.12	1/2 ⁻ , 3/2 ⁻	[D,E2]	0.009 6	%I _γ =0.08 3
566.8 [#] 3	0.47 8	705.01	(3/2,5/2)	138.44	5/2 ⁻	[D,E2]		%I _γ =0.47 11
571.13 [#] 10	0.80 9	709.45	(3/2,5/2 ⁻)	138.44	5/2 ⁻	[D,E2]	0.008 5	%I _γ =0.80 15
576.39 [#] 15	0.45 10	741.51	3/2 ⁺	165.12	1/2 ⁻ , 3/2 ⁻	[E1]	0.00287 4	%I _γ =0.45 12
592.1 ^d 2	0.16 ^d 4	862.81	(7/2) ⁺	270.69	(9/2 ⁺)	[M1+E2]	0.0098 22	%I _γ =0.16 5
604.07 [#] 14	1.20 6	920.66	(3/2,5/2,7/2 ⁻)	316.25	(5/2 ⁻ , 7/2 ⁻)	[D,E2]	0.007 4	%I _γ =1.20 19
622.97 [#] 10	1.80 14	881.36	3/2 ⁺	258.33	3/2 ⁻	[E1]	2.42×10 ⁻³ 3	%I _γ =1.80 30
^x 632.11 [#] 31	0.30 9							%I _γ =0.30 10
642.03 ^d 8	0.30 ^d 7	862.81	(7/2) ⁺	220.73	9/2 ⁻	[E1]	2.27×10 ⁻³ 3	%I _γ =0.30 8
649.22 [#] 20	0.20 10	814.35	1/2 ⁺	165.12	1/2 ⁻ , 3/2 ⁻	[E1]	2.22×10 ⁻³ 3	%I _γ =0.20 10
662.45 [#] 9	1.80 13	920.66	(3/2,5/2,7/2 ⁻)	258.33	3/2 ⁻	[D,E2]	0.0056 35	%I _γ =1.80 30
675.6 [#] 3	0.60 10	814.35	1/2 ⁺	138.44	5/2 ⁻	[M2]	0.02463 35	%I _γ =0.60 13
								Mult.: M2 required from ΔJ ^π . Placement is unlikely.
716.47 [#] 27	0.35 17	881.36	3/2 ⁺	165.12	1/2 ⁻ , 3/2 ⁻	[E1]	1.80×10 ⁻³ 3	%I _γ =0.35 18
^x 721.63 [#] 31	0.53 13							%I _γ =0.53 15
724.7 2	0.19 5	862.81	(7/2) ⁺	138.44	5/2 ⁻	[E1]	1.76×10 ⁻³ 3	%I _γ =0.19 6
								E _γ , I _γ : from 2010Ru09 . This γ was reported in 1977Pi06 with E _γ =724.30 30, I _γ =0.80 11 (1977Pi06), but was unplaced.
742.94 [#] 10	1.40 14	881.36	3/2 ⁺	138.44	5/2 ⁻	[E1]	1.67×10 ⁻³ 2	%I _γ =1.40 25
755.81 [#] 15	0.85 12	920.66	(3/2,5/2,7/2 ⁻)	165.12	1/2 ⁻ , 3/2 ⁻	[D,E2]	0.0041 25	%I _γ =0.85 18
^x 766.86 [#] 28	0.40 20							%I _γ =0.40 21
781.99 [#] 15	1.3 2	920.66	(3/2,5/2,7/2 ⁻)	138.44	5/2 ⁻	[D,E2]	0.0038 23	%I _γ =1.30 28
^x 797.35 [#] 30	0.88 15							%I _γ =0.88 20
874.11 ^k 26	0.80 8	1012.6?		138.44	5/2 ⁻	[D,E2]	0.003 2	%I _γ =0.80 14
								Placement proposed by 2010Ru09 . E _γ =874.8 in 2010Ru09 . Placement considered uncertain by the evaluators.

γ(¹⁴⁹Nd) (continued)

- † From [1977Pi06](#), unless otherwise stated. According to [1977Pi06](#), uncertainties quoted for the intensities in their Table 1 do not take into account 15% uncertainty resulting from the absolute intensity calibration procedure.
- ‡ Placed by evaluators.
- # From [1977Pi06](#) only.
- @ Corrected for weak contribution from ¹⁴²Ba β⁻.
- & Corrected for weak contribution from ¹⁴⁹Nd β⁻.
- ^a γγ data indicate an unresolved doublet. Intensity is split between two locations. Uncertainty of 10-15% is assigned by the evaluators based on the uncertainty for the combined intensity of the unresolved doublet in β⁻ decay.
- ^b γγ-coin data indicate a doublet ([1977Pi06](#)). Energy is from curved crystal data in (n,γ) ([1976Pi04](#)). Split intensity is taken from [1977Pi06](#), probably from their γγ-coin data.
- ^c [1977Pi06](#) establish the absolute intensity of 138.46γ as 11.0 17 per 100 disintegrations, in agreement with 13 5 from [1967Va14](#).
- ^d γ from [2010Ru09](#), energy and intensity data obtained through an e-mail reply of June 8, 2010 from the authors.
- ^e γ taken by [2010Ru09](#) from the Adopted Gammas from the 2004 version of the A=149 ENSDF database; γγ-coin evidence is from [2010Ru09](#). Intensity is based on branching ratios in the Adopted Gammas.
- ^f Uncertainty doubled in the least-squares fit procedure, due to its poor fit in the level scheme.
- ^g Dominant M1 expected from RUL=300 for E2.
- ^h For absolute intensity per 100 decays, multiply by 1.00 15.
- ⁱ Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
- ^j Multiply placed with intensity suitably divided.
- ^k Placement of transition in the level scheme is uncertain.
- ^x γ ray not placed in level scheme.

¹⁴⁹Pr β⁻ decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09



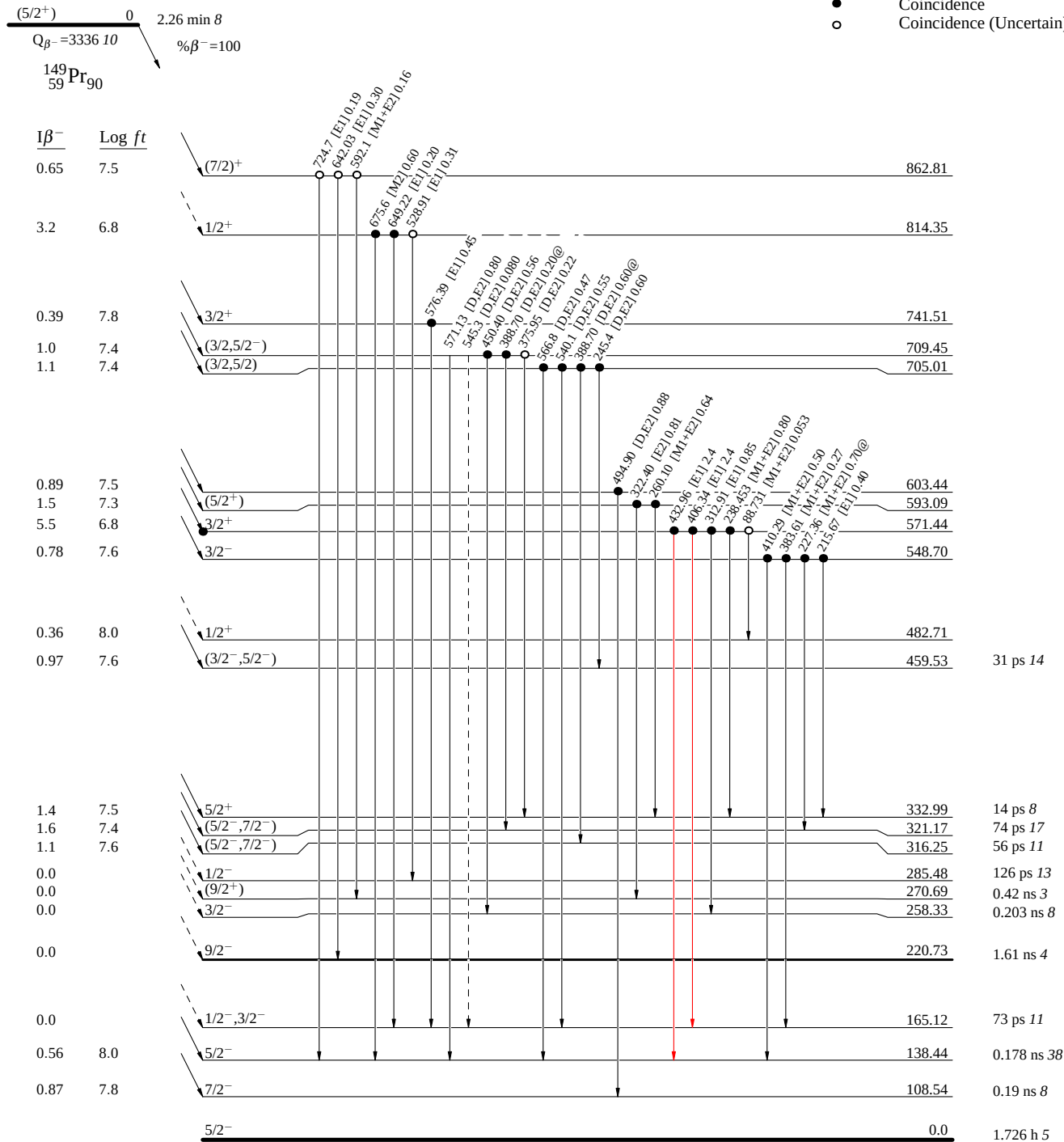
^{149}Pr β^- decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09

Decay Scheme (continued)

Legend

Intensities: I_γ per 100 parent decays
@ Multiply placed: intensity suitably divided

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence
- Coincidence (Uncertain)



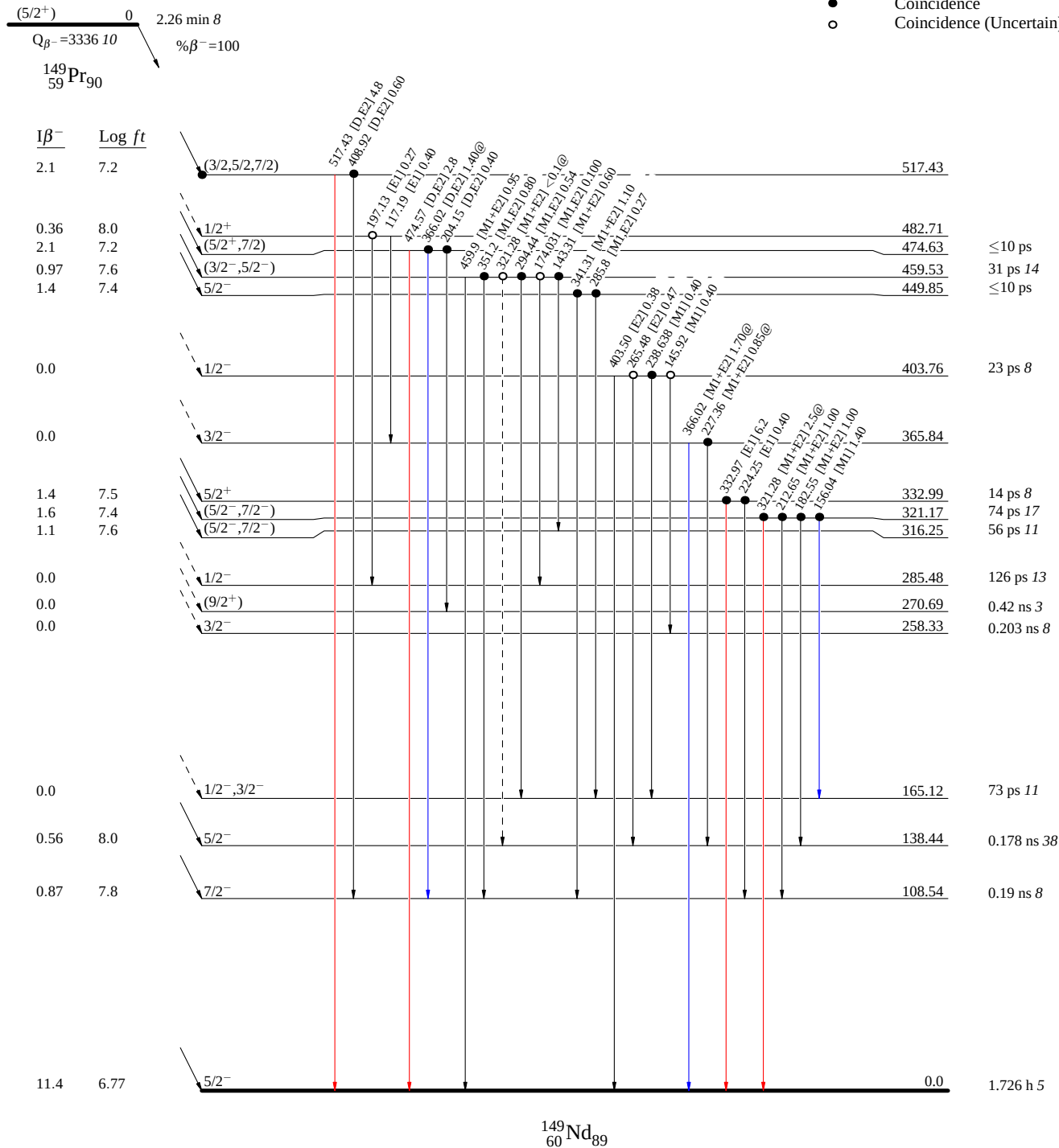
¹⁴⁹Pr β⁻ decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09

Decay Scheme (continued)

Legend

Intensities: I_γ per 100 parent decays
@ Multiply placed: intensity suitably divided

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)
- Coincidence
- Coincidence (Uncertain)



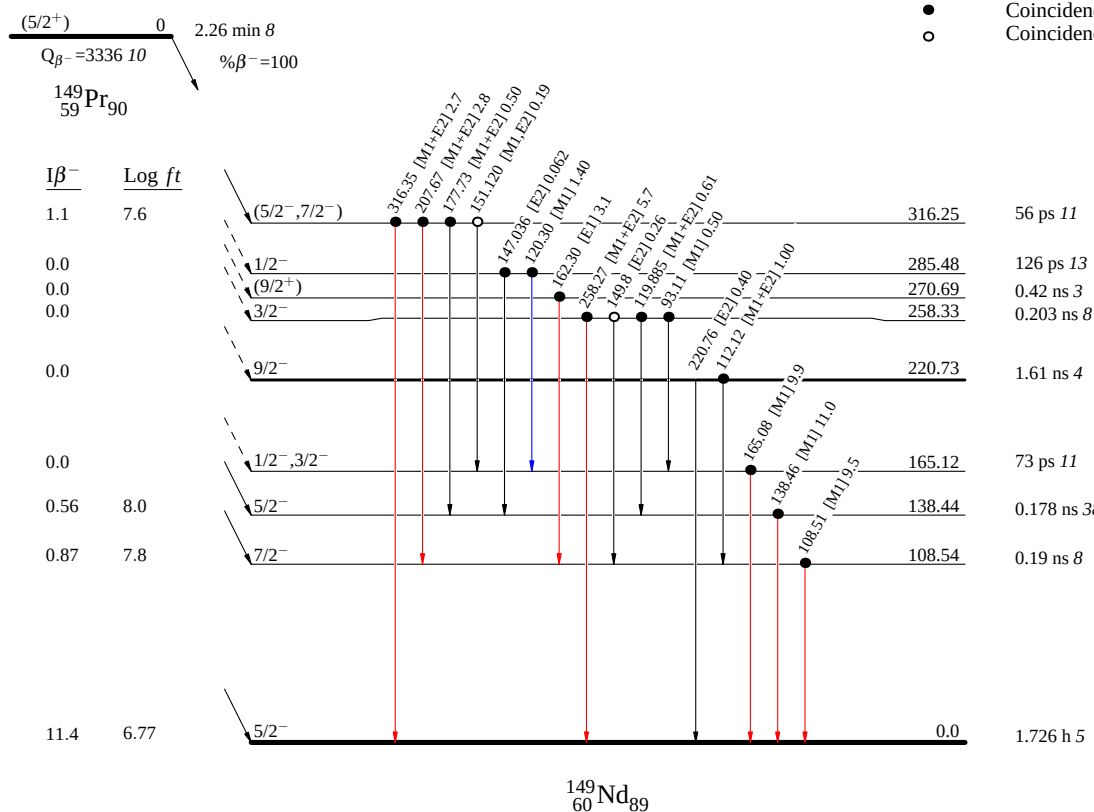
^{149}Pr β^- decay (2.26 min) 1977Pi06,2010Ru09,1997Gr09

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays
 @ Multiply placed: intensity suitably divided

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\bullet$ Coincidence
 $\circ$ Coincidence (Uncertain)



^{252}Cf SF decay [1997Hw02](#)

Parent: ^{252}Cf : $E=0.0$; $J^\pi=0^+$; $T_{1/2}=2.647$ y 3; %SF decay=3.102 3

$^{252}\text{Cf}-T_{1/2}$: From ^{252}Cf Adopted Levels in the ENSDF database (Jan 2021 update).

^{252}Cf -%SF decay: %SF=3.102 3 for ^{252}Cf decay.

[1997Hw02](#): measured E_γ , I_γ , $\gamma\gamma$ using an array of 72 Compton-suppressed Ge detectors.

 ^{149}Nd Levels

$E(\text{level})^\dagger$	$J^\pi^\#$
0.0	$5/2^-$
108.3 3	$7/2^-$
220.9 3	$9/2^-$
270.6 4	$(9/2^+)$
352.0 ‡ 5	$(13/2^+)$
493.3 ‡ @ 5	$(11/2^-)$
699.6 ‡ @ 6	$(13/2^-)$
918.3 ‡ @ 6	$(15/2^-)$
1166.6 ‡ @ 6	$(17/2^-)$

† From E_γ data, assuming $\Delta(E_\gamma)=0.3$ keV for each γ ray.

‡ Level not included in the Adopted dataset, as it has not been confirmed by [2006Ve04](#) in their study of high-spin levels using $^{238}\text{U}(^{12}\text{C},F\gamma)$ reaction.

$^\#$ From the Adopted Levels.

@ Band(A): $\nu 11/2[505]$ band. Assignment from systematics of $N=89$ isotones. But the existence of this band is not confirmed by [2006Ve04](#) in their study of high-spin levels using $^{238}\text{U}(^{12}\text{C},F\gamma)$ reaction, and $\gamma\gamma$ -coin with transitions from complementary fission fragments. This band is not included in the Adopted dataset due to its uncertain existence.

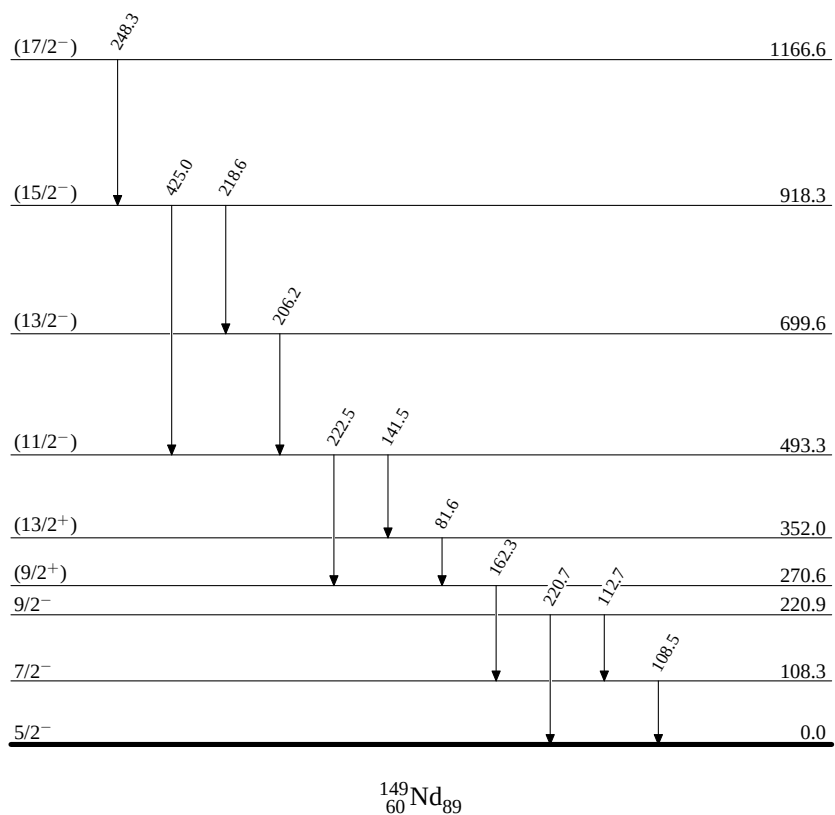
 $\gamma(^{149}\text{Nd})$

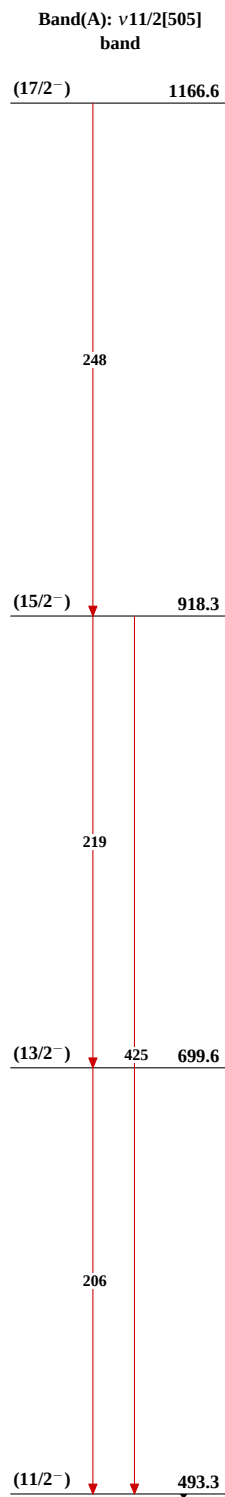
E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π
81.6 ‡	352.0	$(13/2^+)$	270.6	$(9/2^+)$	218.6 ‡	918.3	$(15/2^-)$	699.6	$(13/2^-)$
108.5	108.3	$7/2^-$	0.0	$5/2^-$	220.7	220.9	$9/2^-$	0.0	$5/2^-$
112.7	220.9	$9/2^-$	108.3	$7/2^-$	222.5 ‡	493.3	$(11/2^-)$	270.6	$(9/2^+)$
141.5 ‡	493.3	$(11/2^-)$	352.0	$(13/2^+)$	248.3 ‡	1166.6	$(17/2^-)$	918.3	$(15/2^-)$
162.3	270.6	$(9/2^+)$	108.3	$7/2^-$	425.0 ‡	918.3	$(15/2^-)$	493.3	$(11/2^-)$
206.2 ‡	699.6	$(13/2^-)$	493.3	$(11/2^-)$					

‡ Gamma not included in the Adopted dataset, as it has not been confirmed by [2006Ve04](#) in their study of high-spin levels using $^{238}\text{U}(^{12}\text{C},F\gamma)$ reaction, and $\gamma\gamma$ -coin with transitions from complementary fission fragments. [2006Ve04](#) mention that the γ ray was seen weakly in a spectrum in coincidence with the 108 γ and 162 γ , but disappeared when a double gate was placed on gamma transitions in complementary Sr fission nuclides.

^{252}Cf SF decay 1997Hw02

Level Scheme



^{252}Cf SF decay 1997Hw02

 $^{149}_{60}\text{Nd}_{89}$

$^{148}\text{Nd}(n,\gamma) \text{E=th}$ **1976Pi04**

1976Pi04: target material neodymium oxide powder enriched in ^{148}Nd to 95% to yield a capture contribution of 57%. The remaining contribution is from ^{142}Nd (3.9%), ^{143}Nd (33.4%), ^{144}Nd (0.8%), ^{145}Nd (4.3%), ^{146}Nd (0.4%), ^{150}Nd (0.28%). γ rays were measured with curved-crystal spectrometer, and Ge(Li) detectors at Grenoble. See also thesis by **1976RoYT** from the same group.

Others (cross section data):

1999An02: $\text{E}(n)=0.46\text{-}3.44$ MeV.

1997Wi13: $\text{E}(n)=10, 30$ keV.

1995To01: $\text{E}(n)=25, 30$ keV.

1978Ko04: $\text{E}(n)=5\text{-}350$ keV.

1974Si11 (also **1973Si45**): $\text{E}(n)=18\text{-}28$ keV.

1973Ri08: deduced resonance integrals.

1972Th03: $\text{E}(n)=25$ keV.

1972Ki24: E=th .

1967Al12: E=th and res.

1979NaZZ, **1973LaYG**, **1973HaYX**: cross section data.

 ^{149}Nd Levels

$\text{E}(\text{level})^{\dagger}$	$J^{\pi\ddagger}$	Comments
0.0	$5/2^{-}$	
108.5206 10	$7/2^{-}$	
138.4465 8	$5/2^{-}$	
165.0867 8	$3/2^{-}, 1/2^{-}$	
220.7057 23	$9/2^{-}$	
258.3303 9	$3/2^{-}$	
270.8587 23	$(9/2^{+})$	
285.4818 11	$1/2^{-}$	
316.230 3	$(5/2^{-}, 7/2^{-})$	
321.1435 15	$(5/2^{-}, 7/2^{-})$	
332.928 5	$5/2^{+}$	
365.9311 15	$3/2^{-}$	
403.7289 14	$1/2^{-}$	
459.529 4	$(3/2^{-}, 5/2^{-})$	
482.6729 14	$1/2^{+}$	
517.44 4	$(3/2, 5/2, 7/2)$	
548.645 5	$3/2^{-}$	
571.442 8	$3/2^{+}$	
705.128 25	$(3/2, 5/2)$	
709.045 18	$(3/2, 5/2^{-})$	
741.06 8	$3/2^{+}$	
814.40 3	$1/2^{+}$	
881.17 16	$3/2^{+}$	
913.58 8	$(1/2, 3/2)$	
(5038.82 3)	$1/2^{+}$	J^{π} : s-wave capture in ^{148}Nd ($J^{\pi}=0^{+}$). $\text{E}(\text{level})$: $\text{S}(n)=5038.79$ 7 (2021Wa16).

† From least-squares fit to $\text{E}\gamma$ data. Reduced $\chi^2=2.2$ is somewhat larger than critical χ^2 of 1.5, with four γ rays fitting poorly, two each from 548 and 571 levels.

‡ From the Adopted Levels. The primary transitions in (n,γ) populate mainly $1/2$ and $3/2$ states since $J^{\pi}(\text{capture state})=1/2^{+}$.

$^{148}\text{Nd}(\text{n},\gamma)\text{E}=\text{th}$ **1976Pi04 (continued)** $\gamma(^{149}\text{Nd})$

I γ normalization: absolute γ yields (per 100 neutrons) deduced from the absolute intensity (photons per 100 decays) of the 114.3 γ =19.2 15 in the decay of ^{149}Nd to ^{149}Pm .

E_γ	I_γ ^{$\dagger$} _{g}	$E_i(\text{level})$	J_i^π	E_f	J_f^π
$^{x}26.8528^{\dagger} 4$					
$^{x}32.999^{\dagger i} 1$	≈ 1.0	365.9311	$3/2^-$	332.928	$5/2^+$
$^{x}35.4085^{\dagger} 22$					
$^{x}56.731^{\dagger} 1$	1.17				
$^{x}67.234^{\dagger} 4$	0.13				
$^{x}72.516^{\dagger} 2$	0.11				
$^{x}75.084^{\dagger} 3$	0.28				
$^{x}78.943^{\dagger} 1$	0.24 2	482.6729	$1/2^+$	403.7289	$1/2^-$
$^{x}80.449^{\dagger} 2$	0.87 9	365.9311	$3/2^-$	285.4818	$1/2^-$
$^{x}88.731^{\dagger ei} 4$	0.05	571.442	$3/2^+$	482.6729	$1/2^+$
$^{x}93.243^{\dagger} 1$	0.37 4	258.3303	$3/2^-$	165.0867	$3/2^-, 1/2^-$
$^{x}96.588^{\dagger} 4$	0.07				
$^{x}97.533^{\dagger} 4$	0.04				
$^{x}100.031^{\dagger} 4$	0.05				
$^{x}100.947^{\dagger} 5$	0.07				
$^{x}101.781^{\dagger} 5$	0.06				
$^{x}102.328^{\dagger} 4$	0.07				
$^{x}103.194^{\dagger} 4$	0.05				
$^{x}104.858^{\dagger} 4$	0.07				
$^{x}106.873^{\dagger} 5$	0.06				
$^{x}108.520^{\dagger} 1$	3.2 3	108.5206	$7/2^-$	0.0	$5/2^-$
$^{x}111.067^{\dagger} 3$	0.11				
$^{x}111.337^{\dagger} 5$	0.15				
$^{x}112.185^{\dagger} 2$	0.14 1	220.7057	$9/2^-$	108.5206	$7/2^-$
$^{x}112.598^{\dagger} 4$	0.08				
$^{x}115.513^{\dagger} 4$	0.09				
$^{x}116.742^{\dagger} 1$	1.45 2	482.6729	$1/2^+$	365.9311	$3/2^-$
$^{x}117.371^{\dagger} 6$	0.09				
$^{x}118.244^{\dagger} 3$	0.12 1	403.7289	$1/2^-$	285.4818	$1/2^-$
$^{x}119.885^{\dagger} 1$	0.61 6	258.3303	$3/2^-$	138.4465	$5/2^-$
$^{x}120.395^{\dagger} 1$	5.7 6	285.4818	$1/2^-$	165.0867	$3/2^-, 1/2^-$
$^{x}124.975^{\dagger} 4$	0.06				
$^{x}127.865^{\dagger} 25$	0.07 [#]				
$^{x}128.585^{\dagger} 10$	0.04				
$^{x}129.726^{\dagger} 13$	0.06				
$^{x}132.490^{\dagger} 7$	0.09				
$^{x}133.804^{\dagger} 6$	0.12				
$^{x}135.166^{\dagger} 13$	0.09				
$^{x}135.460^{\dagger} 10$	0.07				
$^{x}137.040^{\dagger} 8$	0.07				
$^{x}138.447^{\dagger} 1$	8.7 9	138.4465	$5/2^-$	0.0	$5/2^-$
$^{x}143.299^{\dagger} 2$	0.38 4	459.529	$(3/2^-, 5/2^-)$	316.230	$(5/2^-, 7/2^-)$
$^{x}143.638^{\dagger} 9$	0.04				
$^{x}145.397^{\dagger c} 2$	0.39 4	403.7289	$1/2^-$	258.3303	$3/2^-$
$^{x}146.656^{\dagger} 8$	0.07				
$^{x}147.036^{\dagger} 2$	0.25 3	285.4818	$1/2^-$	138.4465	$5/2^-$
$^{x}147.566^{\dagger} 4$	0.08				
$^{x}149.790^{\dagger} 8$	0.08 1	258.3303	$3/2^-$	108.5206	$7/2^-$

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(n,\gamma) E=\text{th}$ **1976Pi04 (continued)** $\gamma(^{149}\text{Nd})$ (continued)

E_γ	I_γ ^g	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
^x 150.57 4	0.08					
^x 150.992 5	0.08					
^x 151.01 5	0.13					
151.120 20	0.060 6	316.230	(5/2 ⁻ , 7/2 ⁻)	165.0867	3/2 ⁻ , 1/2 ⁻	
^x 151.468 4	0.13					
^x 152.666 10	0.06					
^x 155.433 12	0.06					
156.061 2	1.15 11	321.1435	(5/2 ⁻ , 7/2 ⁻)	165.0867	3/2 ⁻ , 1/2 ⁻	
^x 158.018 5	0.12					
^x 158.78 3	0.03					
^x 159.843 24	0.04					
^x 160.684 14	0.06					
162.338 2	0.47 5	270.8587	(9/2 ⁺)	108.5206	7/2 ⁻	
^x 163.645 5	0.09					
^x 164.882 20	0.20					
165.087 1	20.1 20	165.0867	3/2 ⁻ , 1/2 ⁻	0.0	5/2 ⁻	
^x 167.789 2	0.24					
^x 168.578 8	0.10					
^x 172.278 7	0.16					
^x 172.942 20	0.06					
174.031 18	0.07 1	459.529	(3/2 ⁻ , 5/2 ⁻)	285.4818	1/2 ⁻	
177.783 10	0.10 1	316.230	(5/2 ⁻ , 7/2 ⁻)	138.4465	5/2 ⁻	
182.694 2	0.98 10	321.1435	(5/2 ⁻ , 7/2 ⁻)	138.4465	5/2 ⁻	
^x 191.451 8	0.10					
^x 192.76 4	0.05					
194.468 10	0.12 1	332.928	5/2 ⁺	138.4465	5/2 ⁻	
^x 196.144 12	0.14					
197.194 2	1.58 16	482.6729	1/2 ⁺	285.4818	1/2 ⁻	
^x 197.610 9	0.14					
200.844 5	0.53 5	365.9311	3/2 ⁻	165.0867	3/2 ⁻ , 1/2 ⁻	
^x 201.916 4	0.35					
^x 206.002 15	0.10					
207.710 3	0.80 8	316.230	(5/2 ⁻ , 7/2 ⁻)	108.5206	7/2 ⁻	
212.613 4	0.57 6	321.1435	(5/2 ⁻ , 7/2 ⁻)	108.5206	7/2 ⁻	
215.724 4	0.61 6	548.645	3/2 ⁻	332.928	5/2 ⁺	
220.78 5	<0.06	220.7057	9/2 ⁻	0.0	5/2 ⁻	
^x 222.689 24	0.12					
224.350 10	0.63 6	482.6729	1/2 ⁺	258.3303	3/2 ⁻	
224.437 10	0.48 5	332.928	5/2 ⁺	108.5206	7/2 ⁻	
^x 224.92 4	0.09					
227.481 ^h 6	2.7 ^h 3	365.9311	3/2 ⁻	138.4465	5/2 ⁻	
227.481 ^{hd} 6	1.4 ^h 2	548.645	3/2 ⁻	321.1435	(5/2 ⁻ , 7/2 ⁻)	Level-energy difference=227.501.
238.453 20	0.30 3	571.442	3/2 ⁺	332.928	5/2 ⁺	Level-energy difference=238.514.
238.638 3	2.1 2	403.7289	1/2 ⁻	165.0867	3/2 ⁻ , 1/2 ⁻	
^x 244.744 6	<0.04					
245.588 25	0.30 3	705.128	(3/2, 5/2)	459.529	(3/2 ⁻ , 5/2 ⁻)	
249.51 5	0.09 1	709.045	(3/2, 5/2 ⁻)	459.529	(3/2 ⁻ , 5/2 ⁻)	
^x 255.59 7	0.07					
257.442 20	0.30 3	365.9311	3/2 ⁻	108.5206	7/2 ⁻	
258.327 2	6.2 6	258.3303	3/2 ⁻	0.0	5/2 ⁻	
^x 260.22 9	0.14					
265.290 8	0.87 9	403.7289	1/2 ⁻	138.4465	5/2 ⁻	
^x 266.10 3	0.16					
^x 272.26 10	<0.04					
^x 284.95 4	0.22 [@]					

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(n,\gamma)E=\text{th}$ **1976Pi04 (continued)** $\gamma(^{149}\text{Nd})$ (continued)

E_γ	$I_\gamma^{\pm g}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
285.511 20	0.58 6	285.4818	$1/2^-$	0.0	$5/2^-$	
$\times$ 290.56 3	0.30					
294.44 4	0.35 4	459.529	$(3/2^-, 5/2^-)$	165.0867	$3/2^-, 1/2^-$	
$\times$ 301.823 23	0.23					
305.325 22	0.29@ 3	709.045	$(3/2, 5/2^-)$	403.7289	$1/2^-$	
$\times$ 309.3 3	0.27					
$\times$ 310.45 3	0.30					
313.088 14	0.41 4	571.442	$3/2^+$	258.3303	$3/2^-$	
$\times$ 314.89 8	0.16#					
316.236 10	0.83 8	316.230	$(5/2^-, 7/2^-)$	0.0	$5/2^-$	
317.57 3	0.25 3	482.6729	$1/2^+$	165.0867	$3/2^-, 1/2^-$	
321.12 ^h	<0.06 ^h	459.529	$(3/2^-, 5/2^-)$	138.4465	$5/2^-$	
321.124 ^h 8	1.29 ^h 13	321.1435	$(5/2^-, 7/2^-)$	0.0	$5/2^-$	
$\times$ 322.32 4	0.23					
332.944 13	7.7 8	332.928	$5/2^+$	0.0	$5/2^-$	
$\times$ 337.57 5	0.20					
$\times$ 341.46 13	0.35					
$\times$ 347.96 4	0.32					
351.001 20	0.37 4	459.529	$(3/2^-, 5/2^-)$	108.5206	$7/2^-$	
354.89 4	0.32 3	814.40	$1/2^+$	459.529	$(3/2^-, 5/2^-)$	
$\times$ 356.67 5	0.23					
$\times$ 359.92 8	0.20					
365.953 8	5.4 5	365.9311	$3/2^-$	0.0	$5/2^-$	
$\times$ 370.74& 17	0.1					
375.95 8	0.23 2	709.045	$(3/2, 5/2^-)$	332.928	$5/2^+$	
383.566 21	1.01 10	548.645	$3/2^-$	165.0867	$3/2^-, 1/2^-$	
387.93 12	0.29 3	709.045	$(3/2, 5/2^-)$	321.1435	$(5/2^-, 7/2^-)$	
$\times$ 388.83 10	0.33					
389.00 10	0.36 4	705.128	$(3/2, 5/2)$	316.230	$(5/2^-, 7/2^-)$	
403.51 17	0.7@ 1	403.7289	$1/2^-$	0.0	$5/2^-$	
406.400 12	2.3 2	571.442	$3/2^+$	165.0867	$3/2^-, 1/2^-$	Level-energy difference=406.355.
408.92 15	0.25 2	517.44	$(3/2, 5/2, 7/2)$	108.5206	$7/2^-$	
410.29 3	1.04 10	548.645	$3/2^-$	138.4465	$5/2^-$	Level-energy difference=410.20.
$\times$ 412.04 23	0.20					
$\times$ 414.20 11	0.28					
$\times$ 422.05& 15	0.4					
430.76 15	0.60 6	913.58	$(1/2, 3/2)$	482.6729	$1/2^+$	
432.95 3	1.38 14	571.442	$3/2^+$	138.4465	$5/2^-$	
$\times$ 436.14& 16	0.4					
$\times$ 446.60& 20	0.015					
450.72 5	0.77 8	709.045	$(3/2, 5/2^-)$	258.3303	$3/2^-$	
455.55& 20	0.19 2	741.06	$3/2^+$	285.4818	$1/2^-$	
459.52& 11	0.61 6	459.529	$(3/2^-, 5/2^-)$	0.0	$5/2^-$	
$\times$ 464.45 10	0.9					
$\times$ 468.42& 18	0.25					
$\times$ 493.14& 14	0.25					
$\times$ 495.49 9	0.66					
517.44 4	1.95 20	517.44	$(3/2, 5/2, 7/2)$	0.0	$5/2^-$	
528.91 ^a 10	1.1 1	814.40	$1/2^+$	285.4818	$1/2^-$	
$\times$ 530.48 11	0.94					
$\times$ 531.98 21	0.17					

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$^{148}\text{Nd}(\text{n},\gamma)\text{E=th}$ **1976Pi04 (continued)** $\gamma(^{149}\text{Nd})$ (continued)

E_γ	I_γ ^g	$E_i(\text{level})$	J_i^π	E_f	J_f^π
$^{*539.24}_{12}$	0.63				
$^{*543.39}_{12}$	0.48				
$^{548.72}_{17}$	0.22 2	548.645	$3/2^-$	0.0	$5/2^-$
$^{*553.58}_{17}$	0.19				
$^{566.85}_{16}$	0.24 2	705.128	$(3/2, 5/2)$	138.4465	$5/2^-$
$^{570.72}_{10}$	0.86 9	709.045	$(3/2, 5/2^-)$	138.4465	$5/2^-$
$^{576.03}_{12}$	0.87 8	741.06	$3/2^+$	165.0867	$3/2^-, 1/2^-$
$^{*581.65}_{16}$	0.50				
$^{*606.70}_{13}$	0.53				
$^{*608.09}_{13}$	0.61				
$^{*613.01}_{21}$	0.14				
$^{622.84}_{16}$	0.33 3	881.17	$3/2^+$	258.3303	$3/2^-$
$^{*624.30}_{23}$	0.18				
$^{*628.13}_{13}$	0.30				
$^{*632.8}_{3}$	0.10				
$^{*637.41}_{19}$	0.17				
$^{*642.21}_{16}$	0.23				
$^{649.22}_{16}$	0.19 2	814.40	$1/2^+$	165.0867	$3/2^-, 1/2^-$
$^{*657.80}_{10}$	0.92				
$^{*674.22}_{14}$	0.33				
$^{675.90}_{7f}$	2.10 16	814.40	$1/2^+$	138.4465	$5/2^-$
$^{*680.83}_{17}$	0.17				
$^{*688.80}_{20}$	0.19				
$^{*706.30}_{16}$	0.27				
$^{*727.29}_{15}$	0.31				
$^{*748.02}_{12}$	0.90				
$^{*750.94}_{14}$	0.62				
$^{*762.0}_{3}$	0.17				
$^{*763.82}_{17}$	0.31				
$^{*780.18}_{11}$	1.40				
$^{*782.15}_{18}$	0.24				
$^{*788.80}_{25}$	0.13				
$^{*793.45}_{22}$	0.17				
$^{*811.80}_{17}$	0.27				
$^{*816.48}_{15}$	0.38				
$^{*819.89}_{16}$	0.30				
$^{*824.62}_{20}$	0.26				
$^{*829.04}_{14}$	0.49				
$^{*839.81}_{21}$	0.28				
$^{*841.1}_{3}$	0.21				
$^{*846.76}_{12}$	0.86				
$^{*870.58}_{17}$	0.69				
$^{*875.37}_{20}$	0.29				
$^{*879.5}_{3}$	0.20				
$^{*884.81}_{11}$	0.96				
$^{*891.7}_{4}$	0.14				
$^{*897.65}_{10}$	3.56				
$^{*902.56}_{19}$	0.27				
$^{*907.29}_{20}$	0.26				
$^{*915.22}_{14}$	0.60				
$^{*917.22}_{25}$	0.45				
$^{*918.69}_{13}$	1.02				
$^{*929.73}_{24}$	0.20				
$^{*944.30}_{10}$	4.89				
$^{*960.13}_{16}$	0.47				
$^{*962.17}_{10}$	3.15				

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$^{148}\text{Nd}(n,\gamma) E=\text{th}$ **1976Pi04** (continued) $\gamma(^{149}\text{Nd})$ (continued)

E_γ	I_γ	$E_i(\text{level})$
$^x977.17\ 10$	2.14	
$^x985.49\ 24$	0.34	
$^x998.40\ 12$	0.87	
$^x1004.02\ 14$	0.61	
$^x1010.2\ 3$	0.21	
$^x1035.8\ 3$	0.20	
$^x1046.14\ 12$	0.71	
$^x1051.1\ 3$	0.19	
$^x1061.5\ 3$	0.17	
$^x1065.66\ 13$	0.71	
$^x1070.24\ 22$	0.24	
$^x1080.50\ 19$	0.34	
$^x1091.47\ 24$	0.20	
$^x1099.59\ 24$	0.33	
$^x1105.7\ 3$	0.24	
$^x1107.64\ 10$	2.98	
$^x1119.24\ 10$	1.87	
$^x1129.5\ 3$	0.34	
$^x1131.1\ 3$	0.30	
$^x1137.04\ 12$	0.82	
$^x1141.34\ 12$	0.83	
$^x1153.82\ 12$	0.85	
$^x1159.02\ 12$	0.89	
$^x1183.81\ 16$	1.14	
$^x1185.67\ 22$	1.81	
$^x1186.97\ 12$	3.37	
$^x1204.59\ 21$	0.53	
$^x1219.60\ 13$	0.79	
$^x1222.4\ 3$	0.28	
$^x1230.54\ 13$	0.74	
$^x1242.9\ 3$	0.22	
$^x1259.62\ 18$	0.64	
$^x1261.67\ 20$	0.94	
$^x1278.47\ 15$	0.53	
$^x1297.62\ 24$	0.31	
$^x1343.7\ 3$	0.22	
$^x1364.15\ 23$	0.34	
$^x1372.78\ 21$	0.39	
$^x1378.82\ 17$	0.60	
$^x1384.45\ 13$	0.61	
$^x1388.0\ 3$	0.38	
$^x1449.8\ 3$	0.33	
$^x1463.3\ 3$	0.33	
$^x1505.1\ 4$	0.24	
$^x1552.50\ 14$	0.96	
$^x1568.2\ 3$	0.28	
$^x1587.3\ 3$	0.29	
$^x1590.2\ 3$	0.37	
$^x1596.25\ 16$	0.70	
$^x1636.3\ 3$	0.31	
$^x1664.4\ 4$	0.24	
$^x1678.52\ 16$	0.73	
$^x1726.9\ 3$	0.27	
$^x1791.5\ 3$	0.34	
$^x1799.12\ 24$	0.46	
$^x1811.1\ 3$	0.39	
$^x1813.5\ 4$	0.31	

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(\text{n},\gamma) \text{E=th}$ **1976Pi04 (continued)** $\gamma(^{149}\text{Nd})$ (continued)

E_γ	I_γ ^{†g}	$E_i(\text{level})$	J_i^π	E_f	J_f^π
$^{*1819.8\ 3}$	0.32				
$^{*1827.3\ 4}$	0.22				
$^{*1840.0\ 3}$	0.36				
$^{*1857.1\ 4}$	0.25				
$^{*1863.9\ 4}$	0.28				
$^{*1884.77\ 16}$	0.98				
$^{*1938.31\ 25}$	0.56				
$^{*1951.49\ 24}$	0.60				
$^{*1958.1\ 3}$	0.42				
$^{*2011.4\ 3}$	0.30				
$^{*2134.0\ 4}$	0.27				
$^{*2149.5\ 4}$	0.29				
$^{*2196.4\ 4}$	0.31				
$^{*2294.79^b\ 10}$	0.68				
$^{*2359.69\ 13}$	0.46				
$^{*2532.30\ 9}$	0.58				
$^{*2644.65\ 12}$	0.56				
$^{*2797.75\ 9}$	0.51				
$^{*2835.25\ 9}$	0.69				
$^{*2893.77\ 9}$	0.49				
$^{*2924.87\ 9}$	0.37				
$^{*2947.17\ 9}$	0.65				
$^{*2971.69\ 10}$	0.28				
$^{*3053.98\ 9}$	0.46				
$^{*3165.43\ 8}$	0.53				
$^{*3210.92\ 8}$	0.48				
$^{*3260.97\ 9}$	0.76				
$^{*3359.19\ 8}$	0.41				
$^{*3416.28\ 7}$	1.43				
$^{*3448.02\ 9}$	0.58				
$^{*3485.67\ 7}$	2.03				
$^{*3504.06\ 9}$	0.30				
$^{*3526.59\ 15}$	0.21				
$^{*3533.12\ 11}$	0.22				
$^{*3617.86\ 8}$	0.59				
$^{*3789.19\ 7}$	1.00				
$^{*3850.24\ 11}$	0.17				
$^{*3859.54\ 7}$	1.01				
$^{*3888.35\ 9}$	0.44				
$^{*3954.77\ 7}$	2.25				
4125.13 9	0.38 4	(5038.82)	1/2 ⁺	913.58	(1/2,3/2)
$^{*4199.49\ 7}$	0.81				
4224.33 8	0.45 5	(5038.82)	1/2 ⁺	814.40	1/2 ⁺
4297.73 10	0.17 2	(5038.82)	1/2 ⁺	741.06	3/2 ⁺
4329.74 7	0.93 9	(5038.82)	1/2 ⁺	709.045	(3/2,5/2 ⁻)
4467.28 8	0.24 2	(5038.82)	1/2 ⁺	571.442	3/2 ⁺
4556.07 9	0.21 2	(5038.82)	1/2 ⁺	482.6729	1/2 ⁺
4634.98 8	0.32 3	(5038.82)	1/2 ⁺	403.7289	1/2 ⁻
4672.82 7	8.02 8	(5038.82)	1/2 ⁺	365.9311	3/2 ⁻
4753.26 7	1.62 16	(5038.82)	1/2 ⁺	285.4818	1/2 ⁻
4780.43 10	0.16 2	(5038.82)	1/2 ⁺	258.3303	3/2 ⁻
4873.68 8	0.53 5	(5038.82)	1/2 ⁺	165.0867	3/2 ⁻ , 1/2 ⁻

[†] γ assigned tentatively to Nd(n, γ).

Continued on next page (footnotes at end of table)

 $^{148}\text{Nd}(\text{n},\gamma) \text{E=th}$ **1976Pi04 (continued)**

 $\gamma(^{149}\text{Nd})$ (continued)

[‡] Uncertainties are 10% for curved-crystal and 5% to 8% for Ge(Li) measurements.

[#] Part of intensity belongs to the neighboring Nd isotopes.

[@] Part of intensity attributed to ^{150}Sm .

[&] Observed only with the Ge(Li) detector.

^a Data from the anti-Compton spectrometer.

^b Data from the pair spectrometer.

^c **1976Pi04** quote 145.370 in table and 145.397 in level scheme. The latter value is chosen due to its good fit.

^d Uncertainty increased from 2 eV to 6 eV (evaluators).

^e Fitted value deviates by 0.037 keV.

^f Placement from 814 level probably incorrect since it requires 675 γ to be M2.

^g For intensity per 100 neutron captures, multiply by 1.0.

^h Multiply placed with intensity suitably divided.

ⁱ Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

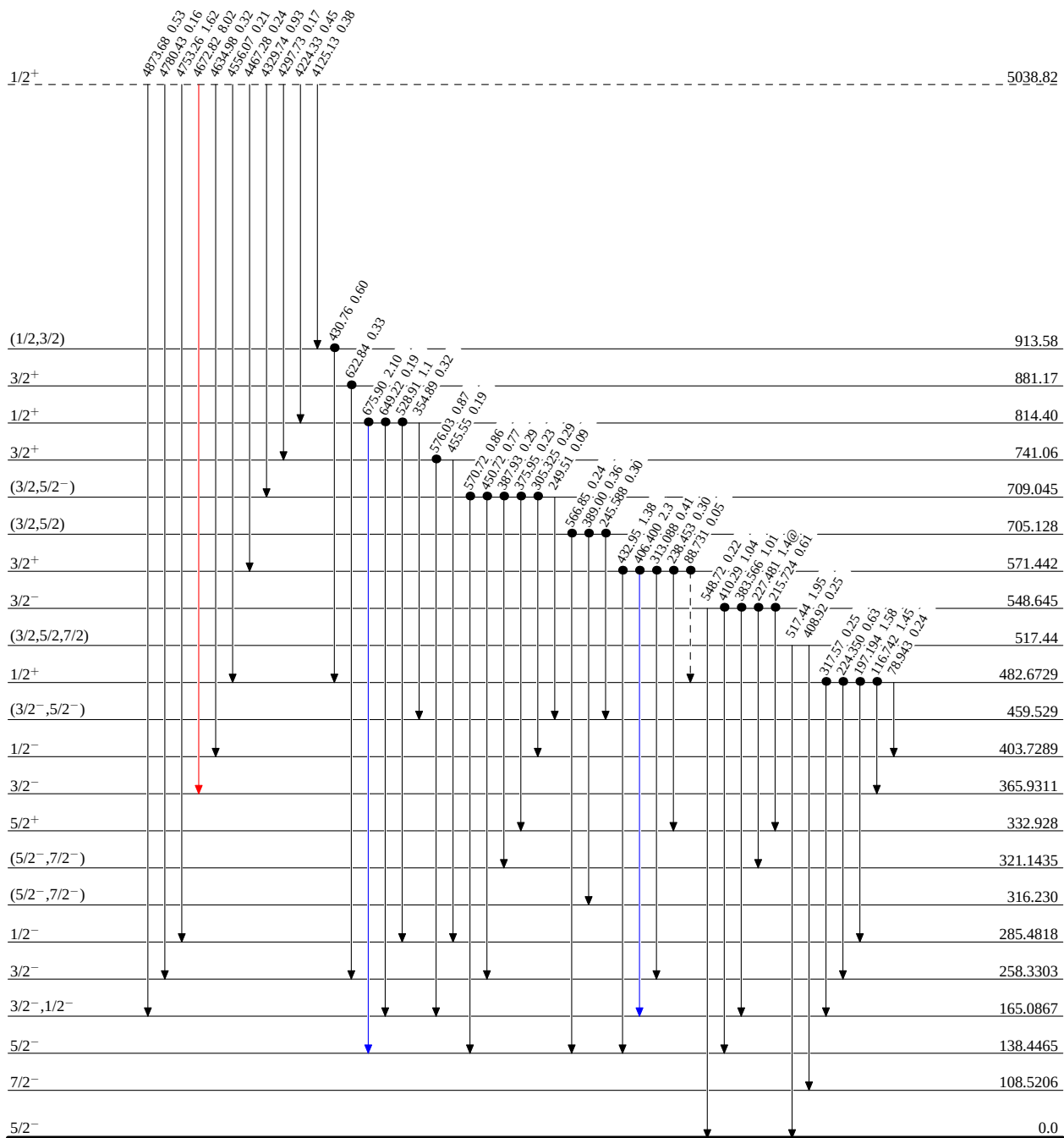
$^{148}\text{Nd}(n,\gamma) \text{E=th}$ 1976Pi04

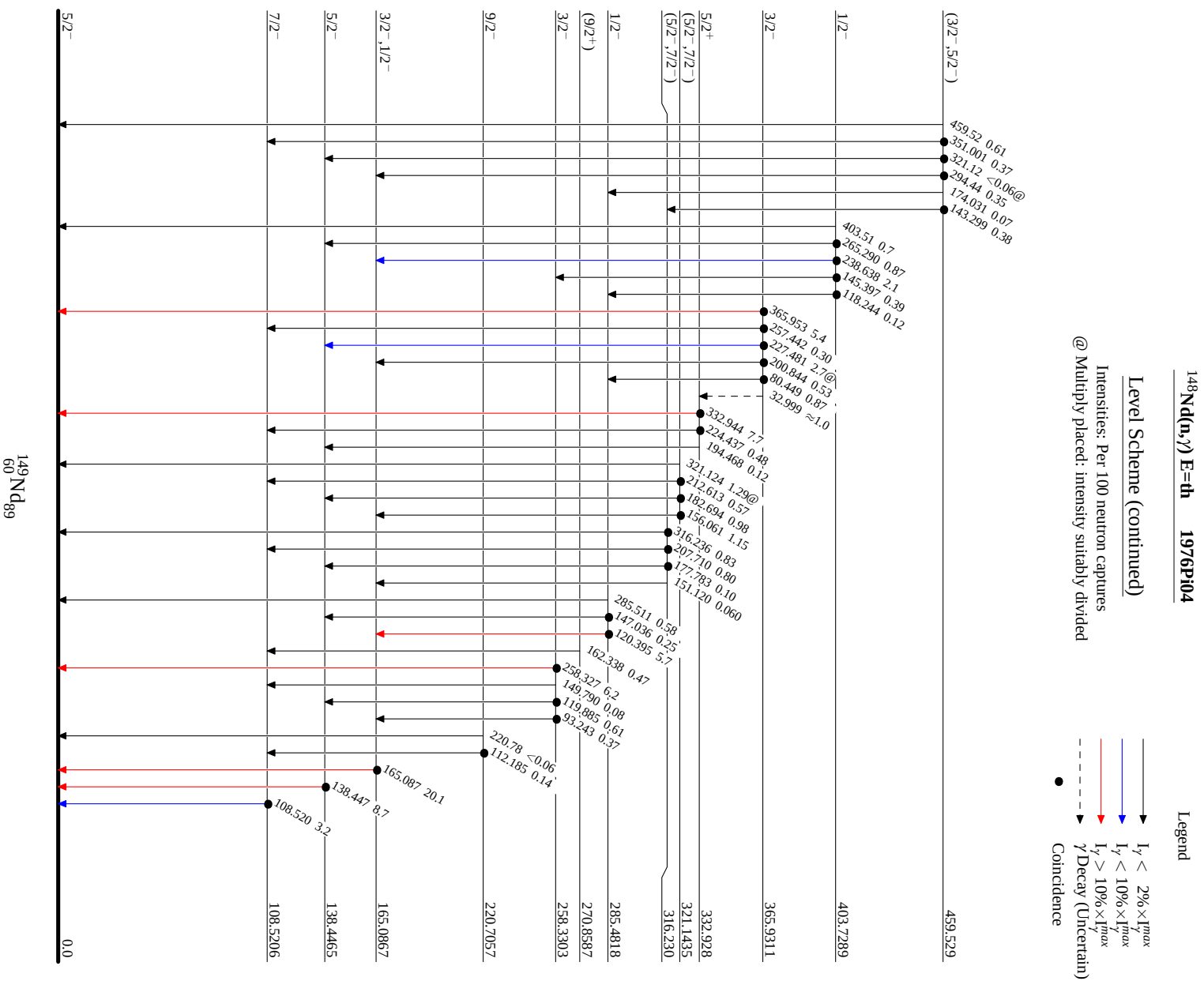
Legend

Level Scheme

Intensities: Per 100 neutron captures
@ Multiply placed: intensity suitably divided

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\dashrightarrow$ γ Decay (Uncertain)
 $\bullet$ Coincidence

 $^{149}_{60}\text{Nd}_{89}$



¹⁴⁸Nd(n,γ),(n,n):resonances 2018MuZY

2018MuZY: evaluation of neutron resonances.

1977MuZC: energies and parameters measured for 80 resonances in the range of E(n)=2710 eV to 7978 eV.

1969Al09: data for three resonances at 155.1, 286.2 and 714.9 eV.

1968Ka28: energies and widths of 29 resonances measured in the range of E(n)=0.155 to 8.78 keV.

Resonance energies, resonance strengths, widths (Γ , Γ_n and Γ_γ), and L-values are from 2018MuZY. Spins of 1/2 are from L=0 (s-wave resonances) in 2018MuZY. $J^\pi=1/2^-, 3/2^-$, and in some cases (1/2⁺) are assigned by evaluators from L=1 (p-wave resonances) and L=(0) in 2018MuZY.

¹⁴⁹Nd Levels

S(n)(¹⁴⁹Nd)=5038.79 7 (2021Wa16).

E(level) [‡]	J ^π	Γ	L	gΓ _n Γ _γ /Γ (meV) [‡]	Comments
S(n)-0.434?	1/2 ⁺		0		E(level): fictitious resonance to fit the low-energy section of the time-of-flight spectrum.
S(n)+0.0949 1	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =0.55 meV 4, Γ _γ =46 meV 5.
S(n)+0.1557 1	1/2 ⁺	1.93 eV 10	0		gΓ _n =1.85 eV 10, Γ _γ =43.4 meV 16.
S(n)+0.1724 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =0.44 meV 3, Γ _γ =45 meV 5.
S(n)+0.1844 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =0.07 meV 5, Γ _γ =45 meV 5.
S(n)+0.2529 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =0.39 meV 10, Γ _γ =45 meV 5.
S(n)+0.2876 3	1/2 ⁺	3.09 eV 10	0		gΓ _n =3.04 eV 10, Γ _γ =53 meV 6.
S(n)+0.3983 4	(1/2 ⁺)		(0)		gΓ _n =350 meV 20, Γ _γ =59 meV 3.
S(n)+0.5140 5	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =1.9 meV 3.
S(n)+0.6285 6	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =0.85 meV 25.
S(n)+0.7149 8	1/2 ⁺	2.42 eV 60	0		gΓ _n =2.35 eV 5.
S(n)+0.7793 8	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =7.5 meV 15.
S(n)+0.8719 9	(1/2 ⁺)	0.345 eV 30	(0)		gΓ _n =315 meV 10.
S(n)+0.9050 9	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =6.9 meV 5.
S(n)+1.0541 10	1/2 ⁺		0		gΓ _n =2.53 eV 15.
S(n)+1.1762 12	1/2 ⁺		0		gΓ _n =2.65 eV 15.
S(n)+1.2088 20	(1/2 ⁺)		(0)		gΓ _n =36.4 meV 25.
S(n)+1.244 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =8.0 meV 5.
S(n)+1.299 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =3.3 meV 10.
S(n)+1.3443 15	1/2 ⁺		0		gΓ _n =1.82 eV 11.
S(n)+1.388 2	(1/2 ⁻ , 3/2 ⁻)		(1)		gΓ _n =8.9 meV 15.
S(n)+1.5335 15	1/2 ⁺		0		gΓ _n =3.69 eV 15.
S(n)+1.7937 20	(1/2 ⁺)		(0)		gΓ _n =112.5 meV 75.
S(n)+2.0283 20	(1/2 ⁺)		(0)		gΓ _n =505 meV 25.
S(n)+2.1777 20	1/2 ⁺		0		gΓ _n =5.88 eV 25.
S(n)+2.3769 20	1/2 ⁺		0		gΓ _n =3.40 eV 15.
S(n)+2.4295 20	1/2 ⁺		0		gΓ _n =2.05 eV 15.
S(n)+2.5623 20	1/2 ⁺		0		gΓ _n =9.0 eV 10.
S(n)+2.710 3	1/2 ⁻ , 3/2 ⁻		1 14 2		gΓ _n =22 meV 8.
S(n)+2.772 3	1/2 ⁻ , 3/2 ⁻		1 11 2		gΓ _n =12 meV 3.
S(n)+2.784 3	1/2 ⁺		0 36 4		gΓ _n =1.21 eV 5, Γ _γ =37 meV 4.
S(n)+2.989 3	1/2 ⁺		0 36 4		gΓ _n =2.17 eV 10, Γ _γ =36 meV 4.
S(n)+3.045 3	1/2 ⁻ , 3/2 ⁻		1 2 1		gΓ _n =2 meV 1.
S(n)+3.065 3	1/2 ⁻ , 3/2 ⁻		1 6 1		gΓ _n =7 meV 2.
S(n)+3.121 3	(1/2 ⁻ , 3/2 ⁻)		(1) 24 3		gΓ _n =60 meV.
S(n)+3.170 3	(1/2 ⁻ , 3/2 ⁻)		(1) 20 2		gΓ _n =40 meV.
S(n)+3.355 3	1/2 ⁻ , 3/2 ⁻		1 12 2		gΓ _n =17 meV 5.
S(n)+3.442 3	1/2 ⁻ , 3/2 ⁻		1 7 1		gΓ _n =8 meV 1.
S(n)+3.484 3	1/2 ⁺		0 30 3		gΓ _n =665 meV 30, Γ _γ =31 meV 5.
S(n)+3.612 3	1/2 ⁻ , 3/2 ⁻		1 6 1		gΓ _n =7 meV 1.
S(n)+3.645 3	(1/2 ⁺)		(0) 28 3		gΓ _n =93 meV.

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(\text{n},\gamma),(\text{n},\text{n}):$ resonances **2018MuZY (continued)** ^{149}Nd Levels (continued)

E(level) [‡]	J ^π	L	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV) [†]	Comments
S(n)+3.769 3	1/2 ⁻ ,3/2 ⁻	1	4 1	$g\Gamma_n=5$ meV 1.
S(n)+3.812 3	1/2 ⁺	0	29 3	$g\Gamma_n=430$ meV 30.
S(n)+3.837 3	1/2 ⁻ ,3/2 ⁻	1	9 1	$g\Gamma_n=12$ meV 3.
S(n)+3.891 3	1/2 ⁺	0	34 4	$g\Gamma_n=19.15$ eV 75, $\Gamma_\gamma=35$ meV 5.
S(n)+3.948 3	1/2 ⁻ ,3/2 ⁻	1	4 1	$g\Gamma_n=4$ meV 1.
S(n)+3.972 3	1/2 ⁻ ,3/2 ⁻	1	3 1	$g\Gamma_n=4$ meV 1.
S(n)+4.027 3	1/2 ⁻ ,3/2 ⁻	1	9 1	$g\Gamma_n=12$ meV 1.
S(n)+4.073 4	1/2 ⁺	0	86 7	$g\Gamma_n=17.55$ eV 40, $\Gamma_\gamma=67$ meV 7.
S(n)+4.145 4	1/2 ⁻ ,3/2 ⁻	1	11 1	$g\Gamma_n=15$ meV 5.
S(n)+4.267 5	1/2 ⁺	0	46 5	$g\Gamma_n=7.20$ eV 40, $\Gamma_\gamma=46$ meV 5.
S(n)+4.307 5	1/2 ⁻ ,3/2 ⁻	1	11 2	$g\Gamma_n=16$ meV 5.
S(n)+4.403 5	1/2 ⁻ ,3/2 ⁻	1	7 1	$g\Gamma_n=8$ meV 1.
S(n)+4.420 5	1/2 ⁺	0	47 6	$g\Gamma_n=1.490$ eV 75, $\Gamma_\gamma=47$ meV 5.
S(n)+4.442 5	1/2 ⁻ ,3/2 ⁻	1	7 1	$g\Gamma_n=8$ meV 1.
S(n)+4.522 5	1/2 ⁻ ,3/2 ⁻	1	3 1	$g\Gamma_n=4$ meV 1.
S(n)+4.565 5	1/2 ⁻ ,3/2 ⁻	1	2 1	$g\Gamma_n=2$ meV 1.
S(n)+4.619 5	1/2 ⁻ ,3/2 ⁻	1	11 2	$g\Gamma_n=15$ meV 1.
S(n)+4.653 6	1/2 ⁺	0	38 4	$g\Gamma_n=4.87$ eV 25, $\Gamma_\gamma=38$ meV 4.
S(n)+4.691 6	1/2 ⁺	0	35 4	$g\Gamma_n=900$ meV 50, $\Gamma_\gamma=37$ meV 5.
S(n)+4.807 6	1/2 ⁻ ,3/2 ⁻	1	3 1	$g\Gamma_n=3$ meV 1.
S(n)+4.838 6	(3/2 ⁻)	(1)	23 2	$g\Gamma_n=45.0$ meV 75, $\Gamma_\gamma=23.5$ meV 70.
S(n)+5.041 6			19 2	$g\Gamma_n=36$ meV.
S(n)+5.068 6			22 2	$g\Gamma_n=49$ meV.
S(n)+5.222 6	1/2 ⁻ ,3/2 ⁻	1	12 2	$g\Gamma_n=18$ meV 7.
S(n)+5.292 6	1/2 ⁺	0	41 4	$g\Gamma_n=3.78$ eV 15, $\Gamma_\gamma=41$ meV 4.
S(n)+5.302 6			16 2	$g\Gamma_n=27$ meV.
S(n)+5.401 6			23 3	$g\Gamma_n=54$ meV.
S(n)+5.460 6	1/2 ⁺	0	32 4	$g\Gamma_n=1.59$ eV 15, $\Gamma_\gamma=32$ meV 4.
S(n)+5.632 6	1/2 ⁻ ,3/2 ⁻	1	5 1	$g\Gamma_n=6$ meV 1.
S(n)+5.669 6	1/2 ⁺	0	81 8	$g\Gamma_n=4.0$ eV 10, $\Gamma_\gamma=83$ meV 8.
S(n)+5.788 6	1/2 ⁺	0	30 4	$g\Gamma_n=255$ meV 90, $\Gamma_\gamma=34$ meV 6.
S(n)+5.933 6			23 3	$g\Gamma_n=54$ meV.
S(n)+5.964 6			15 2	$g\Gamma_n=24$ meV.
S(n)+6.068 6	1/2 ⁻ ,3/2 ⁻	1	6 2	$g\Gamma_n=7$ meV 2.
S(n)+6.093 6	1/2 ⁺	0	45 5	$g\Gamma_n=5.36$ eV 25, $\Gamma_\gamma=46$ meV 6.
S(n)+6.133 6	1/2 ⁻ ,3/2 ⁻	1	5 2	$g\Gamma_n=6$ meV 2.
S(n)+6.165 6	1/2 ⁻ ,3/2 ⁻	1	4 2	$g\Gamma_n=4$ meV 2.
S(n)+6.213 6	1/2 ⁻ ,3/2 ⁻	1	3 1	$g\Gamma_n=4$ meV 2.
S(n)+6.313 6	1/2 ⁻ ,3/2 ⁻	1	10 2	$g\Gamma_n=14$ meV 4.
S(n)+6.343 6	(1/2 ⁻ ,3/2 ⁻)	(1)	23 3	$g\Gamma_n=54$ meV.
S(n)+6.415 6	1/2 ⁻ ,3/2 ⁻	1	9 2	$g\Gamma_n=12$ meV 3.
S(n)+6.460 6	1/2 ⁻ ,3/2 ⁻	1	5 2	$g\Gamma_n=6$ meV 2.
S(n)+6.490 6	1/2 ⁺	0	37 4	$g\Gamma_n=0.50$ eV 10, $\Gamma_\gamma=40$ meV 5.
S(n)+6.545 6	1/2 ⁻ ,3/2 ⁻	1	2 2	$g\Gamma_n=2$ meV 2.
S(n)+6.620 6	1/2 ⁻ ,3/2 ⁻	1	12 2	$g\Gamma_n=18$ meV 5.
S(n)+6.640 6	1/2 ⁺	0	39 5	$g\Gamma_n=3.67$ eV 15, $\Gamma_\gamma=39$ meV 5.
S(n)+6.763 6			24 3	$g\Gamma_n=60$ meV.
S(n)+6.783 6			19 3	$g\Gamma_n=36$ meV.
S(n)+6.860 6	1/2 ⁻ ,3/2 ⁻	1	12 2	$g\Gamma_n=17$ meV 4.
S(n)+6.925 6	1/2 ⁻ ,3/2 ⁻	1	3 2	$g\Gamma_n=3$ meV 2.
S(n)+6.968 6	1/2 ⁻ ,3/2 ⁻	1	6 2	$g\Gamma_n=8$ meV 3.
S(n)+7.058 7	1/2 ⁺	0	50 7	$g\Gamma_n=14.09$ eV 50, $\Gamma_\gamma=50$ meV 7.
S(n)+7.100 7			21 3	$g\Gamma_n=44$ meV.
S(n)+7.133 7	1/2 ⁻ ,3/2 ⁻	1	13 2	$g\Gamma_n=20$ meV 6.
S(n)+7.195 7			26 3	$g\Gamma_n=74$ meV.
S(n)+7.240 7	1/2 ⁻ ,3/2 ⁻	1	11 3	$g\Gamma_n=18$ meV 5.

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(\text{n},\gamma),(\text{n},\text{n}):$ resonances **2018MuZY (continued)** ^{149}Nd Levels (continued)

E(level) [‡]	J ^π	L	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV) [†]	Comments
S(n)+7.303 8	1/2 ⁺	0	80 9	$g\Gamma_n=6.0$ eV 10, $\Gamma_\gamma=82$ meV 9.
S(n)+7.370 8	1/2 ⁺	0	47 5	$g\Gamma_n=2.81$ eV 20, $\Gamma_\gamma=48$ meV 5.
S(n)+7.505 8			22 3	$g\Gamma_n=49$ meV.
S(n)+7.545 8			22 4	$g\Gamma_n=49$ meV.
S(n)+7.586 8			32 4	$g\Gamma_n=160$ meV.
S(n)+7.668 8	1/2 ⁺	0	67 8	$g\Gamma_n=14.00$ eV 50, $\Gamma_\gamma=67$ meV 8.
S(n)+7.710 8	1/2 ⁻ ,3/2 ⁻	1	8 2	$g\Gamma_n=11$ meV 4.
S(n)+7.798 8			18 3	$g\Gamma_n=3.3$ eV.
S(n)+7.893 8	1/2 ⁻ ,3/2 ⁻	1	6 2	$g\Gamma_n=8$ meV 3.
S(n)+7.950 8			26 4	$g\Gamma_n=74$ meV.
S(n)+7.978 8			28 4	$g\Gamma_n=93$ meV.
S(n)+8.646 9	1/2 ⁺	0		$g\Gamma_n=24.3$ eV 10.
S(n)+8.774 9	(1/2 ⁺)	(0)		$g\Gamma_n=7.00$ eV 35.
S(n)+9.049 9	(1/2 ⁺)	(0)		$g\Gamma_n=8.30$ eV 40.
S(n)+9.390 9	(1/2 ⁺)	(0)		$g\Gamma_n=4.76$ eV 35.
S(n)+9.600 10	(1/2 ⁺)	(0)		$g\Gamma_n=1.71$ eV 25.
S(n)+9.676 10	(1/2 ⁺)	(0)		$g\Gamma_n=3.21$ eV 30.
S(n)+9.973 10	(1/2 ⁺)	(0)		$g\Gamma_n=3.70$ eV 30.
S(n)+10.081 10	(1/2 ⁺)	(0)		$g\Gamma_n=2.25$ eV 25.
S(n)+10.279 10	(1/2 ⁺)	(0)		$g\Gamma_n=2.01$ eV 25.
S(n)+10.409 11	(1/2 ⁺)	(0)		$g\Gamma_n=3.44$ eV 30.
S(n)+10.852 10	(1/2 ⁺)	(0)		$g\Gamma_n=9.28$ eV 50.
S(n)+10.905 12	(1/2 ⁺)	(0)		$g\Gamma_n=4.78$ eV 50.
S(n)+11.125 12	(1/2 ⁺)	(0)		$g\Gamma_n=1.55$ eV 30.
S(n)+11.347 12	(1/2 ⁺)	(0)		$g\Gamma_n=2.60$ eV 30.
S(n)+11.462 12	(1/2 ⁺)	(0)		$g\Gamma_n=5.35$ eV 50.
S(n)+11.924 12	(1/2 ⁺)	(0)		$g\Gamma_n=3.13$ eV 30.

[†] Resonance strength.[‡] Resonance energies are in the lab system.

$^{148}\text{Nd}(\text{d,p})$ 2008Ja01

2008Ja01: E=12.1 MeV beam provided by tandem accelerator at Niels Bohr Institute. Enriched target. Detected charged particles using magnetic spectrograph. Recorded proton spectra at 60, 90 and 125°. Resolution (FWHM)=9-13 keV.

 ^{149}Nd Levels

All cross sections listed below are in $\mu\text{b/sr}$. The relative uncertainties are 10%, while absolute uncertainties are 20%.

E(level) [†]	L [‡]	(2J+1)S	Comments
0	[3]	0.05	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=26 (60°), 9 (90°), 7 (125°).
108 3	[3]	2.09	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=1115 (60°), 461 (90°), 202 (125°).
138 3	[3]	0.37	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=159 (60°), 91 (90°), 44 (125°).
166 3	[1]	0.05	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=78 (60°), 34 (90°), 12 (125°).
221 3	[5]	2.35	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=155 (60°), 85 (90°), 65 (125°).
282 3	[1]	0.37	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=550 (60°), 235 (90°), 101 (125°).
318 3	[3]	0.42	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=176 (60°), 114 (90°), 57 (125°).
341 3	[6]	3.11	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=98 (60°), 70 (90°), 56 (125°).
366 3	[1]	0.67	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=1153 (60°), 382 (90°), 177 (125°).
407 3	[1]	0.06	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=75 (60°), 34 (90°), 18 (125°).
459 3	[3]	0.09	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=39 (60°), 22 (90°), 15 (125°).
483 3	[0]	0.01	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=7 (60°), 10 (90°).
521 3	[6]	0.65	E(level): 2008Ja01 associate this level with 510 3 in (d,t) for which L=6 was deduced. $\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=14 (60°), 22 (90°), 11 (125°).
551 3	[1]	0.01	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=6 (90°).
594 3	[2]	0.03	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=27 (60°), 32 (90°), 13 (125°).
709 3	[2]	0.02	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=18 (60°), 17 (90°), 7 (125°).
745 3	[2]	0.02	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=49 (60°), 7 (90°).
807 3	[0]	0.15	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=240 (60°), 125 (90°), 82 (125°).
830 3	[1]	0.25	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=394 (60°), 199 (90°), 91 (125°).
887 3	[2]	0.17	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=200 (60°), 142 (90°), 66 (125°).
916 3	[1]	0.16	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=303 (60°), 122 (90°), 50 (125°).
957 3	[3]	0.29	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=156 (60°), 89 (90°), 47 (125°).
992 3	[0]	0.02	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=33 (60°), 18 (90°), 10 (125°).
1029 6	[1]	0.13	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=172 (60°), 106 (90°), 58 (125°).
1064 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=72 (60°), 69 (90°), 28 (125°).
1086 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=226 (60°), 91 (90°), 44 (125°).
1181 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=507 (60°), 219 (90°), 99 (125°).
1248 6	[1]	0.14	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=227 (60°), 139 (90°), 56 (125°).
1283 6	[1]	0.07	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=75 (60°), 76 (90°), 32 (125°).
1360 6	[0]	0.28	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=717 (60°), 337 (90°), 157 (125°).
1386 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=33 (90°), 16 (125°).
1415 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=16 (90°), 6 (125°).
1446 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=31 (90°), 17 (125°).
1479 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=75 (90°), 47 (125°).
1509 6	[1]	0.03	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=21 (90°), 15 (125°).
1533 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=43 (90°), 25 (125°).
1558 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=146 (90°), 78 (125°).
1594 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=325 (60°), 101 (90°), 55 (125°).
1621 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=20 (90°), 13 (125°).
1634 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=185 (60°), 34 (90°), 13 (125°).
1671 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=124 (60°), 71 (90°), 16 (125°).
1709 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=146 (60°), 71 (90°), 34 (125°).
1747 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=51 (60°), 31 (90°), 10 (125°).
1783 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=77 (60°), 31 (90°), 23 (125°).
1818 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=61 (60°), 29 (90°), 25 (125°).
1852 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=178 (60°), 83 (90°), 48 (125°).
1868 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=55 (90°), 17 (125°).
1885 6			$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b/sr}$)=13 (90°), 15 (125°).

Continued on next page (footnotes at end of table)

 $^{148}\text{Nd}(\text{d,p})$ [2008Ja01](#) (continued)

 ^{149}Nd Levels (continued)

<u>E(level)[†]</u>	<u>Comments</u>
1925 6	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b}/\text{sr}$)=141 (90°), 60 (125°).
1947 6	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b}/\text{sr}$)=49 (90°), 25 (125°).
2094 6	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b}/\text{sr}$)=43 (90°), 23 (125°).
2140 6	$\text{d}\sigma/\text{d}\Omega$ ($\mu\text{b}/\text{sr}$)=157 (90°), 75 (125°).

[†] Uncertainties assigned by evaluators as 3 keV for levels below 1 keV and 6 keV above 1 MeV, based on a statement by [2008Ja01](#) that these are less than 3 keV for levels below 1 MeV and 4-6 keV for levels above this energy.

[‡] Assignments are taken by [2008Ja01](#) from their $^{150}\text{Nd}(\text{d,t})$ data.

$^{148}\text{Nd}(\text{d,p}\gamma)$ 1977HaXX,1979Ka16

1979Ka16, 1977HaXX: E=10 MeV at Jyvaskyla. Measured $E\gamma$, $\gamma\gamma$, $\gamma\gamma(\text{t})$, $\text{p}\gamma(\text{t})$. The authors also report ($^3\text{He,xn}\gamma$) E=27 MeV experiments, but no details are available.

 ^{149}Nd Levels

$E(\text{level})^\dagger$	J^π	$T_{1/2}^\ddagger$	Comments
0.0			
108.5		≤ 0.7 ns	
138.4		< 0.6 ns	
165.1		< 0.5 ns	
220.7		2.1 ns 5	
258.3		< 0.7 ns	
270.9	(9/2 ⁺)	5.1 ns 3	J^π : 1979Ka16 use particle-rotor model with a nonspherical Woods-Saxon potential to predict the 9/2 ⁺ to 7/2 ⁻ transition probability for seven N=89, 91 and 93 nuclei. The qualitative agreement between these and the measured probabilities is used as an argument for the 9/2 ⁺ assignment. $T_{1/2}$: from 1979Ka16. Note that this value is in severe disagreement with 0.42 ns 3 in the Adopted Levels, where the value is from $\gamma\gamma(\text{t})$ and $\beta\gamma(\text{t})$ in β^- decay of ^{149}Pr .
285.5		< 0.6 ns	
316.2		< 0.8 ns	
321.1		< 0.9 ns	
332.9		< 0.4 ns	
340.4			
365.9		< 0.5 ns	
482.7		< 0.8 ns	
548.7		< 0.5 ns	

[†] Rounded values from the Adopted Levels.

[‡] From $\text{p}\gamma(\text{t})$.

 $\gamma(^{149}\text{Nd})$

$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
69.7 [‡]	340.4		270.9	(9/2 ⁺)	Shown as tentative transition to 270.9 level.
108.5	108.5		0.0		
162.3	270.9	(9/2 ⁺)	108.5		

[†] From level diagram in 1979Ka16. No uncertainties were given.

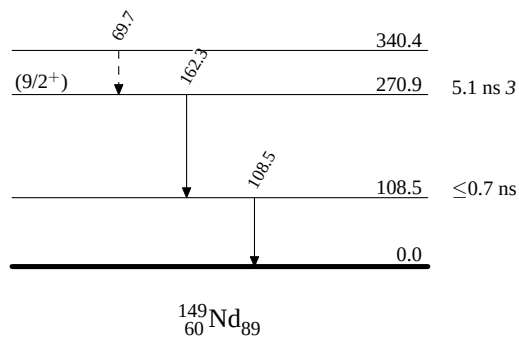
[‡] Placement of transition in the level scheme is uncertain.

$^{148}\text{Nd}(\text{d,p}\gamma)$ 1977HaXX,1979Ka16

Legend

Level Scheme

-----► γ Decay (Uncertain)



 $^{150}\text{Nd}(\text{p},\text{d})$ [1971Ya11](#)

[1971Ya11](#): $E(\text{p})=52$ MeV. Measured σ . [1971Ya11](#) show a deuteron spectrum in a figure. This seems to contain several states in ^{149}Nd up to 4 MeV. No explicit energy values, however, are available.

Other: [1971BaZA](#). Measured $\sigma(\theta)$. About 34 states seem to be present in the spectrum shown by [1971BaZA](#).

$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ [1981Ha39,2008Ja01,1980Lo06](#)

[1981Ha39](#): (pol d,t), E=16 MeV, beam polarization=0.75 from the McMaster University FN tandem Van de Graaff accelerator.

$\sigma(\theta)$ and vector analyzing power measured at 11 angles. Uncertainties in relative and absolute σ values were 10% and 20%, respectively. Overall FWHM=10 keV. Authors state that uncertainty in level energy is 2 keV. Levels are reported to an excitation energy of 1797 keV.

[2008Ja01](#): (d,t), E=12.1 MeV beam provided by tandem accelerator at Niels Bohr Institute. Enriched target. Detected charged particles using magnetic spectrograph. Recorded triton spectra at 60, 90 and 125°, and every 5° from 5° to 50°. DWBA analysis of angular distributions. Resolution (FWHM)=12-15 keV. Absolute cross sections are accurate to 20%, and relative cross sections to $\approx$ 10%.

[1980Lo06](#): (d,t), E=17 MeV from the Niels Bohr Institute Tandem Van de Graaff. Measured $\sigma(\theta)$. FWHM $\approx$ 12 keV. Uncertainty in absolute σ about 15%.

[1980Ka24](#): (d,ty), E=10 MeV. Measured E_γ , $\gamma\gamma$ -coin.

[1973Bu02](#): (d,t), E=12 MeV, measured $\sigma(\theta)$ at 15 angles. Levels reported up to 1311 keV. FWHM=8 keV. DWBA analysis.

Uncertainties in cross sections are 10% for relative and 20% for absolute. Comparison with results from [1965Ne12](#).

[1965Ne12](#): (d,t): thesis, Florida State University.

 ^{149}Nd Levels

Differential cross sections are listed under comments from [2008Ja01](#), [1981Ha39](#), [1980Lo06](#) and [1973Bu02](#). Values from [1981Ha39](#) and [1980Lo06](#) correspond to an angle where cross section is maximum, whereas those from [1973Bu02](#) are at 60°.

In (d,ty) ([1980Ka24](#)), the $\gamma\gamma$ data reveal 120.3 γ , 165.1 γ in coin with 529 γ and 383.6 γ , 436.5 γ in coin with 165.1 γ . These γ rays connect 165, 286, 548, 813 and 985 levels. Full details of this work are not available in the paper.

E(level) [†]	J ^π @	L [#]	S [‡]	Comments
0	5/2 ⁻	3	0.06	L: 3 (1980Lo06,1981Ha39,2008Ja01). S: 0.02 (2008Ja01), 0.08 (1980Lo06). d σ /d Ω (mb/sr)=73 (1981Ha39), 131 (1980Lo06), 27 (1973Bu02). d σ /d Ω (mb/sr)=23 (60°), 8 (90°), 22 (125°) (2008Ja01).
108 2	7/2 ⁻	3	0.36	E(level): 108 3 (2008Ja01), 109 2 (1981Ha39), 108 5 (1980Lo06), 108 2 (1973Bu02). L: 3 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.40 (2008Ja01), 0.48 (1980Lo06). d σ /d Ω (mb/sr)=676 (1981Ha39), 985 (1980Lo06), 292 (1973Bu02). d σ /d Ω (mb/sr)=275 (60°), 141 (90°), 60 (125°) (2008Ja01).
138 2	5/2 ⁻	3	0.22	E(level): 138 3 (2008Ja01), 139 2 (1981Ha39), 138 5 (1980Lo06), 138 2 (1973Bu02). L: 3 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.12 (2008Ja01), 0.20 (1980Lo06). d σ /d Ω (mb/sr)=265 (1981Ha39), 342 (1980Lo06), 81 (1973Bu02). d σ /d Ω (mb/sr)=77 (60°), 35 (90°), 20 (125°) (2008Ja01).
165 2	&	1	0.12	E(level): 165 3 (2008Ja01), 165 2 (1981Ha39), 162 5 (1980Lo06), 165 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.10 (2008Ja01), 0.16 (1980Lo06). d σ /d Ω (mb/sr)=768 (1981Ha39), 817 (1980Lo06), 234 (1973Bu02). d σ /d Ω (mb/sr)=225 (60°), 98 (90°), 36 (125°) (2008Ja01). A 165.1 γ shown in (d,ty) (1980Ka24) in coin with a 120.3 γ .
192 2	&	(5)	0.10	E(level): 192 2 (1981Ha39), 193 2 (1973Bu02). L: (5) (1981Ha39). d σ /d Ω (mb/sr)=20 (1981Ha39), 17 (1973Bu02).
220 2	9/2 ⁻	5	1.08	E(level): 220 3 (2008Ja01), 221 2 (1981Ha39), 217 5 (1980Lo06), 220 2 (1973Bu02). L: 5 (1980Lo06,1981Ha39,2008Ja01). S: 0.49 (2008Ja01), 1.5 (1980Lo06). d σ /d Ω (mb/sr)=90 (1981Ha39), 186 (1980Lo06), 39 (1973Bu02). d σ /d Ω (mb/sr)=27 (60°), 35 (90°), 19 (125°) (2008Ja01).
257 2	3/2 ⁻ &	1	0.04	E(level): 256 3 (2008Ja01), 257 2 (1981Ha39), 258 2 (1973Bu02). L: 1 (1973Bu02,1981Ha39,2008Ja01).

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$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ **1981Ha39,2008Ja01,1980Lo06 (continued)** ^{149}Nd Levels (continued)

E(level) [†]	J ^π @	L [#]	S [‡]	Comments
270 2	(7/2 ⁻ ,9/2 ⁺)	3,4	0.26	S: 0.01 (2008Ja01). dσ/dΩ(mb/sr)=216 (1981Ha39), 54 (1973Bu02). dσ/dΩ (mb/sr)=26 (60°), 10 (90°), 6 (125°) (2008Ja01). E(level): 268 3 (2008Ja01), 270 2 (1981Ha39), 273 5 (1980Lo06), 271 2 (1973Bu02). L: 3 (1980Lo06), 3,4 (1981Ha39), 4 (2008Ja01). S: 0.22 (2008Ja01). J ^π : (9/2 ⁺) (1973Bu02). dσ/dΩ(mb/sr)=267 (1981Ha39), 417 (1980Lo06), 103 (1973Bu02). dσ/dΩ (mb/sr)=81 (60°), 55 (90°), 20 (125°) (2008Ja01). J ^π : 7/2 ⁻ is favored over 9/2 ⁺ by (pol d,t) data. 1973Bu02 and 1981Ha39 suggest that the behavior of these weakly populated states is being distorted by multistep processes not considered in the theoretical calculations. (9/2 ⁺) in Adopted Levels.
285 2	1/2 ⁻	1	0.06	E(level): 285 3 (2008Ja01), 286 2 (1981Ha39), 283 5 (1980Lo06), 285 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.05 (2008Ja01), 0.07 (1980Lo06). dσ/dΩ(mb/sr)=340 (1981Ha39), 397 (1980Lo06), 98 (1973Bu02). dσ/dΩ (mb/sr)=95 (60°), 46 (90°), 20 (125°) (2008Ja01). A 120.3γ shown in (d,tγ) (1980Ka24) in coin with a 165.1γ.
318 2		3	0.66	E(level): 320 3 (2008Ja01), 318 2 (1981Ha39), 319 5 (1980Lo06), 318 2 (1973Bu02). L: 3 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.48 (2008Ja01), 0.79 (1980Lo06). dσ/dΩ(mb/sr)=717 (1981Ha39), 1179 (1980Lo06), 286 (1973Bu02). dσ/dΩ (mb/sr)=302 (60°), 181 (90°), 56 (125°) (2008Ja01). The 316 and 321 levels observed in β ⁻ and (n,γ) are unresolved in this work. See the Adopted Levels for discussion.
333 2	&	2	0.10	E(level): 333 2 (1981Ha39), 332 2 (1973Bu02). L: 2 (1973Bu02,1981Ha39). dσ/dΩ(mb/sr)=192 (1981Ha39), 29 (1973Bu02).
340 2		6	1.14	E(level): 339 3 (2008Ja01), 340 2 (1973Bu02). L: 6 (1973Bu02,2008Ja01). S: from 2008Ja01. dσ/dΩ(mb/sr)=42 (1973Bu02). dσ/dΩ (mb/sr)=10 (60°), 43 (90°), 36 (125°) (2008Ja01).
366 2	&	1	0.16	E(level): 366 3 (2008Ja01), 366 2 (1981Ha39), 365 5 (1980Lo06), 366 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.15 (2008Ja01), 0.19 (1980Lo06). dσ/dΩ(mb/sr)=992 (1981Ha39), 806 (1980Lo06), 296 (1973Bu02). dσ/dΩ (mb/sr)=316 (60°), 137 (90°), 53 (125°) (2008Ja01).
403 2	1/2 ⁻	1	0.04	E(level): 403 3 (2008Ja01), 403 2 (1981Ha39), 402 5 (1980Lo06), 402 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.03 (2008Ja01), 0.06(1980Lo06). dσ/dΩ(mb/sr)=257 (1981Ha39), 268 (1980Lo06), 73 (1973Bu02). dσ/dΩ (mb/sr)=61 (60°), 20 (90°), 11 (125°) (2008Ja01).
447 2		3	0.14	E(level): from 1973Bu02 where it seems resolved from 457 peak. Values are: 447 3 (2008Ja01), 451 2 (1981Ha39, unresolved), 450 5 (1980Lo06), 447 2 (1973Bu02, 447 and 457 resolved). L: 3 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.16 (2008Ja01), 0.22 (1980Lo06). dσ/dΩ(mb/sr)=242 (1981Ha39), 339 (1980Lo06), 82 (1973Bu02). dσ/dΩ (mb/sr)=86 (60°), 57 (90°), 19 (125°) (2008Ja01). E(level): from 1973Bu02 who report partially resolved levels at 447 and 457 with 82% of the cross section associated with the 447 level. They assign L=3 to the composite peak.
457 ^b 2				dσ/dΩ(mb/sr)=15 (1973Bu02). E(level): see also comment for 447 level.
482 2		0	0.04	E(level): 482 3 (2008Ja01), 482 2 (1981Ha39), 483 5 (1980Lo06), 481 2 (1973Bu02). L: 0 (1973Bu02,1980Lo06,1981Ha39,2008Ja01).

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$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ 1981Ha39,2008Ja01,1980Lo06 (continued) ^{149}Nd Levels (continued)

$E(\text{level})^{\dagger}$	$J^{\pi @}$	$L^{\#}$	$S^{\ddagger}$	Comments
511 2		6	0.63	S: 0.02 (2008Ja01), 0.08 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=600$ (1981Ha39), 370 (1980Lo06), 72 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=67$ (60°), 27 (90°), 12 (125°) (2008Ja01). E(level): 510 3 (2008Ja01), 525 2 (1981Ha39, 529 labeled in their spectral Fig. 1), 510 5 (1980Lo06), 512 2 (1973Bu02). Value of 525 2 in 1981Ha39 seems discrepant, not used in averaging. This level is probably same as the 517.44 observed in β^- decay and in (n, γ), and 510 5 in (d,t) and 516 10 in ($^3\text{He},\alpha$) reported by 1980Lo06. L,S: from 2008Ja01 for 510 group. $d\sigma/d\Omega(\text{mb/sr})=117$ (1981Ha39), 44 (1980Lo06), 11 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=9$ (60°), 20 (90°), 16 (125°) (2008Ja01) for a level at 510 keV 3.
547 2	&	1	0.16	E(level): 548 3 (2008Ja01), 548 2 (1981Ha39), 544 5 (1980Lo06), 547 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.13 (2008Ja01), 0.17 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=881$ (1981Ha39), 709 (1980Lo06), 266 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=237$ (60°), 114 (90°), 44 (125°) (2008Ja01). A 383.6 γ shown in (d,t γ) (1980Ka24) in coin with a 165.1 γ .
570 2	3/2 ⁺	2	0.03	E(level): 571 3 (2008Ja01), 570 2 (1981Ha39), 569 2 (1973Bu02). L: 2 (1973Bu02,1981Ha39,2008Ja01). S: from 2008Ja01. $d\sigma/d\Omega(\text{mb/sr})=106$ (1981Ha39), 43 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=43$ (60°), 30 (90°), 9 (125°) (2008Ja01).
590 2		2	0.08	E(level): 589 3 (2008Ja01), 591 2 (1981Ha39), 588 5 (1980Lo06), 590 2 (1973Bu02). L: 5 (1980Lo06), 2 (1981Ha39,2008Ja01). S: 0.03 (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=64$ (1981Ha39), 108 (1980Lo06), 24 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=26$ (60°), 16 (90°), 20 (125°) (2008Ja01). J^{π} : proposed as a doublet by 1981Ha39 to reconcile their 5/2 ⁺ assignment in (pol d,t) with the L($^3\text{He},\alpha$)=5 (1980Lo06) giving 9/2 ⁻ , 11/2 ⁻ for the second component.
612 2		5,6	0.32	E(level): 611 3 (2008Ja01), 613 2 (1973Bu02). L,S: from 2008Ja01. Other: L=(6) (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=4$ (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=7$ (125°) (2008Ja01).
646 2	&	5	1.20	E(level): 645 3 (2008Ja01), 647 2 (1981Ha39), 648 5 (1980Lo06), 646 2 (1973Bu02). L: 5 (1980Lo06), 5,(6) (1981Ha39), 5 (2008Ja01). S: 1.77 (2008Ja01), 1.7 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=222$ (1981Ha39), 389 (1980Lo06), 77 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=65$ (60°), 113 (90°), 71 (125°) (2008Ja01).
689 2				E(level): level from 1981Ha39 only. $d\sigma/d\Omega(\text{mb/sr})=132$ (1981Ha39).
708 2		2	0.90	E(level): 706 3 (2008Ja01), 709 2 (1981Ha39), 708 5 (1980Lo06), 707 2 (1973Bu02). L: 2 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.49 (2008Ja01), 0.70 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=1526$ (1981Ha39), 1359 (1980Lo06), 575 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=561$ (60°), 406 (90°), 185 (125°) (2008Ja01). J^{π} : 3/2 ⁺ from (pol d,t). However, the data may be distorted by an unknown contribution from the 705 state excited in ^{149}Pr β^- decay. See Adopted Levels.
739 2	3/2 ⁺	2	0.44	E(level): 738 3 (2008Ja01), 740 2 (1981Ha39), 742 5 (1980Lo06), 739 2 (1973Bu02). L: 2 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.25 (2008Ja01), 0.44 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=618$ (1981Ha39), 682 (1980Lo06), 264 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=267$ (60°), 193 (90°), 103 (125°) (2008Ja01).
796 2		0	0.06	E(level): 796 2 (1981Ha39), 796 2 (1973Bu02). L: 0 (1981Ha39). $d\sigma/d\Omega(\text{mb/sr})=198$ (1981Ha39), 32 (1973Bu02).
804 ^b 2				$d\sigma/d\Omega(\text{mb/sr})=43$ (1973Bu02).
813 2		0	0.30	E(level): 812 3 (2008Ja01), 813 2 (1981Ha39), 815 5 (1980Lo06), 813 2 (1973Bu02).

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$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ **1981Ha39,2008Ja01,1980Lo06 (continued)** ^{149}Nd Levels (continued)

$E(\text{level})^\dagger$	$J^\pi@$	$L^\#$	$S^\ddagger$	Comments
836 2		1	0.02	L: 0 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.23 (2008Ja01), 0.37 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=1586$ (1981Ha39), 1731 (1980Lo06), 358 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=401$ (60°), 258 (90°), 132 (125°) (2008Ja01). A 529 γ shown in coin with 120.3 γ and 165.1 γ in (d,t γ) (1980Ka24). E(level): 831 3 (2008Ja01), 836 2 (1981Ha39), 837 2 (1973Bu02). L,S: from 2008Ja01.
861 2		4	0.25	$d\sigma/d\Omega(\text{mb/sr})=152$ (1981Ha39), 34 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=10$ (60°), 10 (90°), 14 (125°) (2008Ja01). E(level): 860 3 (2008Ja01), 861 2 (1981Ha39), 862 2 (1973Bu02). L,S: from 2008Ja01.
880 2	3/2 ⁺	2	0.28	$d\sigma/d\Omega(\text{mb/sr})=80$ (1981Ha39), 23 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=16$ (60°), 21 (90°), 13 (125°) (2008Ja01). E(level): 880 3 (2008Ja01), 880 2 (1981Ha39), 881 5 (1980Lo06), 881 2 (1973Bu02). L: 2 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.15 (2008Ja01), 0.28 (1980Lo06).
917 2		1	0.03	$d\sigma/d\Omega(\text{mb/sr})=360$ (1981Ha39), 470 (1980Lo06), 149 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=159$ (60°), 102 (90°), 57 (125°) (2008Ja01). E(level): 918 3 (2008Ja01), 915 2 (1981Ha39), 915 5 (1980Lo06), 918 2 (1973Bu02). L,S: from 2008Ja01.
956 2		3	0.11	$d\sigma/d\Omega(\text{mb/sr})=55$ (1981Ha39), 91 (1980Lo06), 18 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=5$ (60°), 27 (90°), 13 (125°) (2008Ja01). E(level): 959 3 (2008Ja01), 956 2 (1981Ha39), 954 2 (1973Bu02). L,S: from 2008Ja01.
963 ^b 4 985 2		0	0.76	$d\sigma/d\Omega(\text{mb/sr})=435$ (1981Ha39), 16 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=34$ (60°), 33 (90°), 18 (125°) (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=35$ (1973Bu02). E(level): 984 3 (2008Ja01), 985 2 (1981Ha39), 984 5 (1980Lo06), 986 2 (1973Bu02). L: 0 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.53 (2008Ja01), 0.96 (1980Lo06).
1026 2	&	1	0.04	$d\sigma/d\Omega(\text{mb/sr})=3249$ (1981Ha39), 4595 (1980Lo06), 950 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=977$ (60°), 580 (90°), 200 (125°) (2008Ja01). A 436.5 γ shown in coin with a 165.1 γ in (d,t γ) (1980Ka24). E(level): 1025 6 (2008Ja01), 1025 2 (1981Ha39), 1026 5 (1980Lo06), 1027 2 (1973Bu02). L: 1 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.04 (2008Ja01), 0.05 (1980Lo06).
1045 2	^a	2	0.16	$d\sigma/d\Omega(\text{mb/sr})=195$ (1981Ha39), 265 (1980Lo06), 50 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=44$ (60°), 28 (90°), 16 (125°) (2008Ja01). E(level): 1044 6 (2008Ja01), 1045 2 (1981Ha39), 1039 5 (1980Lo06), 1046 2 (1973Bu02). L: 2 (1973Bu02,1980Lo06,1981Ha39,2008Ja01). S: 0.08 (2008Ja01), 0.23 (1980Lo06).
1067 2				$d\sigma/d\Omega(\text{mb/sr})=230$ (1981Ha39), 401 (1980Lo06), 66 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=66$ (60°), 55 (90°), 28 (125°) (2008Ja01). E(level): 1060 6 (2008Ja01), 1067 2 (1981Ha39), 1067 2 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=35$ (1981Ha39), 5 (1973Bu02).
1082 2				$d\sigma/d\Omega(\text{mb/sr})=13$ (90°), 10 (125°) (2008Ja01). E(level): incompletely resolved from 1045. E(level): 1086 6 (2008Ja01), 1081 2 (1981Ha39), 1083 2 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=55$ (1981Ha39), 19 (1973Bu02).
1129 2	&	2	0.18	$d\sigma/d\Omega(\text{mb/sr})=8$ (60°) (2008Ja01). E(level): 1128 6 (2008Ja01), 1129 2 (1981Ha39), 1130 2 (1973Bu02). L: 2 (1973Bu02,1981Ha39,2008Ja01). S: 0.12 (2008Ja01).
1149 2	^a	2	0.08	$d\sigma/d\Omega(\text{mb/sr})=342$ (1981Ha39), 101 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=83$ (60°), 85 (90°), 44 (125°) (2008Ja01). E(level): 1147 6 (2008Ja01), 1149 2 (1981Ha39), 1150 2 (1973Bu02).

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ **1981Ha39,2008Ja01,1980Lo06 (continued)** ^{149}Nd Levels (continued)

$E(\text{level})^\dagger$	$J^\pi@$	$L^\#$	$S^\ddagger$	Comments
				L: 2 (1981Ha39,2008Ja01). S: 0.04 (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=84$ (1981Ha39), 25 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=33$ (60°), 17 (90°), 13 (125°) (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=7$ (1973Bu02). E(level): 1181 6 (2008Ja01), 1178 2 (1981Ha39), 1178 2 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=53$ (1981Ha39), 9 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=14$ (60°) (2008Ja01) for 1181 6 level.
1168 ^b 4				$d\sigma/d\Omega(\text{mb/sr})=12$ (1973Bu02). E(level): 1220 2 (1981Ha39), 1220 2 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=20$ (1981Ha39), 7 (1973Bu02). 1220 2
1178 2				E(level): 1230 2 (1981Ha39), 1233 2 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=134$ (1981Ha39), 13 (1973Bu02). 1232 2
1189 ^b 4				E(level): 1240 6 (2008Ja01), 1244 2 (1981Ha39), 1246 2 (1973Bu02). L,S: from 2008Ja01 . $d\sigma/d\Omega(\text{mb/sr})=85$ (1981Ha39), 24 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=23$ (60°), 29 (90°), 12 (125°) (2008Ja01) for 1240 6 level.
1220 2				E(level): 1287 6 (2008Ja01), 1282 2 (1981Ha39), 1283 2 (1973Bu02). L: 1 (1981Ha39,2008Ja01). S: 0.02 (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=85$ (1981Ha39), 22 (1973Bu02). $d\sigma/d\Omega(\text{mb/sr})=13$ (60°), 12 (90°), 7 (125°) (2008Ja01). J^π : L(d,t)=0 to a 1273 group (1980Lo06) has been ignored in subsequent work (1981Ha39) by same authors, suggesting that they believe there is only one level there with L=1.
1232 2				$d\sigma/d\Omega(\text{mb/sr})=5$ (1973Bu02). E(level): 1353 6 (2008Ja01), 1359 2 (1981Ha39). L: 0 (1981Ha39,2008Ja01). S: 0.01 (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=122$ (1981Ha39). $d\sigma/d\Omega(\text{mb/sr})=17$ (60°), 10 (90°), 5 (125°) (2008Ja01). 1245 2
1245 2	1	0.03		E(level): level from 2008Ja01 only. $d\sigma/d\Omega(\text{mb/sr})=5$ (60°), 2 (90°), 2 (125°) (2008Ja01). E(level): level from 1981Ha39 only. $d\sigma/d\Omega(\text{mb/sr})=40$ (1981Ha39). E(level): 1479 6 (2008Ja01), 1481 2 (1981Ha39). $d\sigma/d\Omega(\text{mb/sr})=170$ (1981Ha39). $d\sigma/d\Omega(\text{mb/sr})=13$ (60°) (2008Ja01). 1283 2
1283 2	$1/2^-$	1	0.06	E(level): 1503 6 (2008Ja01), 1505 2 (1981Ha39). L: 1 (1981Ha39,2008Ja01). S: 0.04 (2008Ja01). $d\sigma/d\Omega(\text{mb/sr})=244$ (1981Ha39). $d\sigma/d\Omega(\text{mb/sr})=36$ (60°), 10 (125°) (2008Ja01). E(level): 1531 2 (1981Ha39), 1531 5 (1980Lo06). L: (0) (1980Lo06), 1 (1981Ha39). S: 0.04 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=116$ (1981Ha39), 176 (1980Lo06). E(level): 1547 6 (2008Ja01), 1553 2 (1981Ha39), 1555 5 (1980Lo06). L: (0) (1980Lo06), 1 (1981Ha39). S: 0.04 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=110$ (1981Ha39), 163 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=18$ (60°) (2008Ja01). 1311 ^b 4
1311 ^b 4				E(level): 1616 6 (2008Ja01), 1622 2 (1981Ha39), 1622 5 (1980Lo06). L,S: from 1980Lo06 . $d\sigma/d\Omega(\text{mb/sr})=40$ (1981Ha39), 100 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=9$ (60°), 22 (90°), 11 (125°) (2008Ja01). 1358 2
1358 2	0	0.02		$d\sigma/d\Omega(\text{mb/sr})=75$ (1980Lo06). 1413 6
1413 6				
1465 2				
1481 2				
1505 2	1	0.08		
1531 2	1	0.04		
1553 2	1	0.04		
1622 2	5	0.72		
1682 ^c 5				

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ **1981Ha39,2008Ja01,1980Lo06 (continued)** ^{149}Nd Levels (continued)

E(level) [†]	L [#]	S [‡]	Comments
1708 2	5	1.1	E(level): 1702 6 (2008Ja01), 1709 2 (1981Ha39), 1706 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=86$ (1981Ha39), 148 (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=34 (90°), 26 (125°) (2008Ja01).
1721 5	2	0.09	E(level): 1724 6 (2008Ja01), 1718 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=103$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=12 (90°), 11 (125°) (2008Ja01).
1738 5	2	0.10	E(level): 1741 6 (2008Ja01), 1736 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=107$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=13 (60°), 15 (90°), 5 (125°) (2008Ja01).
1787 5	2	0.32	E(level): 1789 6 (2008Ja01), 1785 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=340$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=67 (60°), 57 (90°), 44 (125°) (2008Ja01).
1797 2	2	0.24	E(level): level from 1981Ha39 only. L: 2 (1981Ha39).
1819 5			E(level): 1821 6 (2008Ja01), 1817 5 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=198$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=3 (60°), 8 (90°), 8 (125°) (2008Ja01).
1861 5	2	0.31	E(level): 1864 6 (2008Ja01), 1858 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=326$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=53 (60°), 52 (90°), 24 (125°) (2008Ja01).
1883 5			E(level): 1884 6 (2008Ja01), 1882 5 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=103$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=1 (60°), 12 (90°), 8 (125°) (2008Ja01).
1913 5			E(level): 1918 6 (2008Ja01), 1909 5 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=76$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=5 (60°), 4 (90°), 6 (125°) (2008Ja01).
1957 ^C 5	2	0.08	L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=75$ (1980Lo06).
1981 5	2	0.16	E(level): 1983 6 (2008Ja01), 1980 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=179$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=19 (60°), 10 (90°), 11 (125°) (2008Ja01).
2031 5	2	0.26	E(level): 2033 6 (2008Ja01), 2029 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=305$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=24 (60°), 26 (90°), 20 (125°) (2008Ja01).
2054 5			E(level): 2052 6 (2008Ja01), 2055 5 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=135$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=8 (90°), 6 (125°) (2008Ja01).
2065 6			E(level): level from 2008Ja01 only. $d\sigma/d\Omega$ (mb/sr)=16 (90°), 7 (125°) (2008Ja01).
2081 5	2	0.34	E(level): 2086 6 (2008Ja01), 2078 5 (1980Lo06). L,S: from 1980Lo06. $d\sigma/d\Omega(\text{mb/sr})=333$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=54 (60°), 54 (90°), 32 (125°) (2008Ja01).
2102 5			E(level): 2103 6 (2008Ja01), 2102 5 (1980Lo06). $d\sigma/d\Omega(\text{mb/sr})=162$ (1980Lo06). $d\sigma/d\Omega$ (mb/sr)=8 (90°), 5 (125°) (2008Ja01).
2121 ^C 5			$d\sigma/d\Omega(\text{mb/sr})=79$ (1980Lo06).
2151 ^C 5			$d\sigma/d\Omega(\text{mb/sr})=78$ (1980Lo06).
2231 5	2	0.19	E(level): 2237 6 (2008Ja01), 2227 5 (1980Lo06).

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{pol d,t}),(\text{d,t})$ 1981Ha39,2008Ja01,1980Lo06 (continued) ^{149}Nd Levels (continued)

<u>E(level)[†]</u>	<u>L[#]</u>	<u>S[‡]</u>	<u>Comments</u>
2266 ^c 5			L,S: from 1980Lo06. dσ/dΩ(mb/sr)=174 (1980Lo06). dσ/dΩ (mb/sr)=11 (60°), 17 (90°) (2008Ja01) for 2237 6 level. dσ/dΩ(mb/sr)=113 (1980Lo06).
2297 5	2	0.54	E(level): 2303 6 (2008Ja01), 2293 5 (1980Lo06). L,S: from 1980Lo06. dσ/dΩ(mb/sr)=569 (1980Lo06). dσ/dΩ (mb/sr)=47 (60°), 48 (90°) (2008Ja01) for 2303 6 level.

[†] From weighted averages of the energy values available from 2008Ja01, 1981Ha39, 1980Lo06 and 1973Bu02, as listed under comments.

[‡] $\sigma(\text{exp})/(\text{N} \times \sigma(\text{theory}))$. The S values are from 1981Ha39, and have been doubled to fit this definition. $\sigma(\text{theory})$ is derived from a DWBA calculation using the optical model parameters discussed by the authors. N was taken to be 3.33.

[#] From comparison of $\sigma(\theta)$ distributions with DWBA calculations.

@ From $A_y(\theta)$ in (pol d,t).

& The authors assign spin of L+1/2. In the opinion of the evaluators, the analyzing power data do not exclude L-1/2.

^a The authors assign spin of L-1/2. In the opinion of the evaluators, the analyzing power data do not exclude L+1/2.

^b Level from 1973Bu02 only.

^c Level from 1980Lo06 only.

$^{150}\text{Nd}(^3\text{He},\alpha)$ **1980Lo06,1973Bu02**

1980Lo06: E=24 MeV from the Niels Bohr Institute Tandem Van de Graaff. Measured $\sigma(\theta)$, FWHM $\approx$ 30 keV, uncertainty in absolute σ =15%. Experimental $\sigma(\theta)$ were compared with DWBA calculations.

1973Bu02: E=24 MeV from the McMaster University FN tandem Van de Graaff accelerator. Measured $\sigma(\theta)$ at four angles, FWHM=25 keV.

 ^{149}Nd Levels

Cross section data, listed in comments, are for 45° in **1973Bu02**, and for an angle where it is maximum in **1980Lo06**.

E(level) [†]	L [‡]	S [†]	Comments
0	3	0.04	$d\sigma/d\Omega \approx 1 \mu\text{b/sr}$ (1980Lo06), $\approx 0.5 \mu\text{b/sr}$ (1973Bu02).
109 10	3	0.40	$d\sigma/d\Omega = 10 \mu\text{b/sr}$ (1980Lo06), $8.8 \mu\text{b/sr}$ (1973Bu02).
$\approx 148^\#$	(3) [@]		$d\sigma/d\Omega \approx 1 \mu\text{b/sr}$ (1973Bu02).
225 10	5	1.6	$d\sigma/d\Omega = 27 \mu\text{b/sr}$ (1980Lo06), $18.7 \mu\text{b/sr}$ (1973Bu02).
271 [#]	(3) [@]		$d\sigma/d\Omega = 5.1 \mu\text{b/sr}$ (1973Bu02).
$\approx 317^\#$			$d\sigma/d\Omega \approx 6 \mu\text{b/sr}$ (1973Bu02).
341 10	6	1.5	$d\sigma/d\Omega = 98 \mu\text{b/sr}$ (1980Lo06), $56 \mu\text{b/sr}$ (1973Bu02).
$\approx 375^\#$	(1) [@]		$d\sigma/d\Omega \approx 0.9 \mu\text{b/sr}$ (1973Bu02).
455 10	3	0.24	$d\sigma/d\Omega = 6 \mu\text{b/sr}$ (1980Lo06), $4.6 \mu\text{b/sr}$ (1973Bu02).
516 10			$d\sigma/d\Omega = 6 \mu\text{b/sr}$ (1980Lo06), $4.6 \mu\text{b/sr}$ (1973Bu02).
550 [#] 10	(1) [@]		$d\sigma/d\Omega \approx 0.4 \mu\text{b/sr}$ (1973Bu02).
590 10	5	0.33	$d\sigma/d\Omega = 14 \mu\text{b/sr}$ (1980Lo06), $8.1 \mu\text{b/sr}$ (1973Bu02).
650 10	5	2.0	$d\sigma/d\Omega = 92 \mu\text{b/sr}$ (1980Lo06), $43 \mu\text{b/sr}$ (1973Bu02).
713 10	2	1.4	$d\sigma/d\Omega = 18 \mu\text{b/sr}$ (1980Lo06), $7.7 \mu\text{b/sr}$ (1973Bu02).
743 10	2	0.88	$d\sigma/d\Omega = 12 \mu\text{b/sr}$ (1980Lo06), $5.1 \mu\text{b/sr}$ (1973Bu02).
819 10			$d\sigma/d\Omega = 20 \mu\text{b/sr}$ (1980Lo06), $9.4 \mu\text{b/sr}$ (1973Bu02).
842 [#]			
873 10	2	0.81	$d\sigma/d\Omega = 7 \mu\text{b/sr}$ (1980Lo06), $3.0 \mu\text{b/sr}$ (1973Bu02).
881 10			$d\sigma/d\Omega = 4 \mu\text{b/sr}$ (1980Lo06).
923 [#]			$d\sigma/d\Omega = 1.7 \mu\text{b/sr}$ (1973Bu02).
957 [#]			$d\sigma/d\Omega = 1.7 \mu\text{b/sr}$ (1973Bu02).
984 10	(0) [@]		$d\sigma/d\Omega = 10 \mu\text{b/sr}$ (1980Lo06), $3.8 \mu\text{b/sr}$ (1973Bu02).
1054 ^{&} 10			$d\sigma/d\Omega = 3.8 \mu\text{b/sr}$ (1973Bu02).
1144 ^{&} 10	(5) ^a		$d\sigma/d\Omega = 4.0 \mu\text{b/sr}$ (1973Bu02).
1260? ^{&} 10			
1542 10			$d\sigma/d\Omega = 13 \mu\text{b/sr}$ (1980Lo06).
1625 10	5	0.57	$d\sigma/d\Omega = 34 \mu\text{b/sr}$ (1980Lo06).
1708 10	5	0.77	$d\sigma/d\Omega = 44 \mu\text{b/sr}$ (1980Lo06).
1802 10			$d\sigma/d\Omega = 9 \mu\text{b/sr}$ (1980Lo06).
1872 10			$d\sigma/d\Omega = 8 \mu\text{b/sr}$ (1980Lo06).
1979 10			$d\sigma/d\Omega = 10 \mu\text{b/sr}$ (1980Lo06).
2321 10			$d\sigma/d\Omega = 16 \mu\text{b/sr}$ (1980Lo06).

[†] From **1980Lo06** unless otherwise stated.

[‡] From $\sigma(\theta)$ and DWBA calculations (**1980Lo06**) unless otherwise stated.

[#] Reported by **1973Bu02** only.

[@] From $\sigma(^3\text{He},\alpha)/\sigma(d,t)$ (**1973Bu02**).

[&] Energy read from α spectrum given by **1980Lo06**.

^a **1973Bu02** give L=2 for a group at 1134.

 $^{150}\text{Nd}(^3\text{He},\text{pt})$ **1985Ho01**

1985Ho01: $E(^3\text{He})=75$ MeV. Measured (p)(t) coin spectra. IAS in ^{150}Pm were deduced from these data. Proton escape probabilities for final states in ^{149}Nd were deduced. The final states quoted are g.s., ≈ 1350 and >1350 .

 ^{149}Nd Levels

 $E(\text{level})$

0

 ≈ 1350

¹⁵⁰Sm(μ^- ,p γ) [2019Zi01](#)

[2019Zi01](#): Negative muon beams were produced from the μ E4 and μ E1 lines of the Paul Scherrer Institute (Ψ) in Switzerland. Target was 320 mg/cm² Sm₂O₃ powder (92.6% enriched in ¹⁵⁰Sm). μ -x rays and γ rays were detected with HPGe detectors. Measured E γ , I γ , E(μ x-ray), I(μ x-ray), γ (t). Deduced muon lifetime, partial capture rates to excited states.

¹⁴⁹Nd Levels

Muon disappearance lifetime=82.3 ns 5 (capture+decay), from which the total muon capture rate is deduced as $\lambda_{cap}=11.75 \times 10^6 \text{ s}^{-1}$ 7 ([2019Zi01](#)).

<u>E(level)</u>	<u>Jπ</u>	<u>Comments</u>
0	5/2 ⁻	J π : from the Adopted Levels. Capture rate to excited states (directly feeding g.s.)= $0.78 \times 10^6 \text{ s}^{-1}$ 35, corresponding to a percentage of 6.6% 29 per muon capture (2019Zi01).

$^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ 2006Ve04

2006Ve04: E=90 MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ using Euroball III array containing 15 clusters Ge detectors, 26 clovers Ge detectors, and 30 tapered single crystal Ge detectors.

 ^{149}Nd Levels

<u>E(level)[†]</u>	<u>J^π</u>	<u>E(level)[†]</u>	<u>J^π</u>	<u>E(level)[†]</u>	<u>J^π</u>	<u>E(level)[†]</u>	<u>J^π</u>
0	5/2 ⁻	976.0 [‡] 23	(21/2 ⁺)	2081 [#] 3	(27/2 ⁻)	3345 [‡] 3	(37/2 ⁺)
108.4 10	7/2 ⁻	1305.3 [#] 23	(19/2 ⁻)	2595 [#] 3	(31/2 ⁻)	4018 [‡] 4	(41/2 ⁺)
270.5 15	(9/2 ⁺)	1468.6 [‡] 25	(25/2 ⁺)	2650 3		4645 [‡] 4	(45/2 ⁺)
340.0 [‡] 18	(13/2 ⁺)	1683.0 [#] 25	(23/2 ⁻)	2672 [‡] 3	(33/2 ⁺)		
587.3 [‡] 20	(17/2 ⁺)	2040 [‡] 3	(29/2 ⁺)	3179 [#] 3	(35/2 ⁻)		

[†] From $E\gamma$ data, assuming $\Delta(E\gamma)=1$ keV for each γ ray.

[‡] Band(A): Band based on $\nu_{13/2}$.

[#] Band(B): Possible $\nu_{13/2}\otimes 3^-$ octupole band.

 $\gamma(^{149}\text{Nd})$

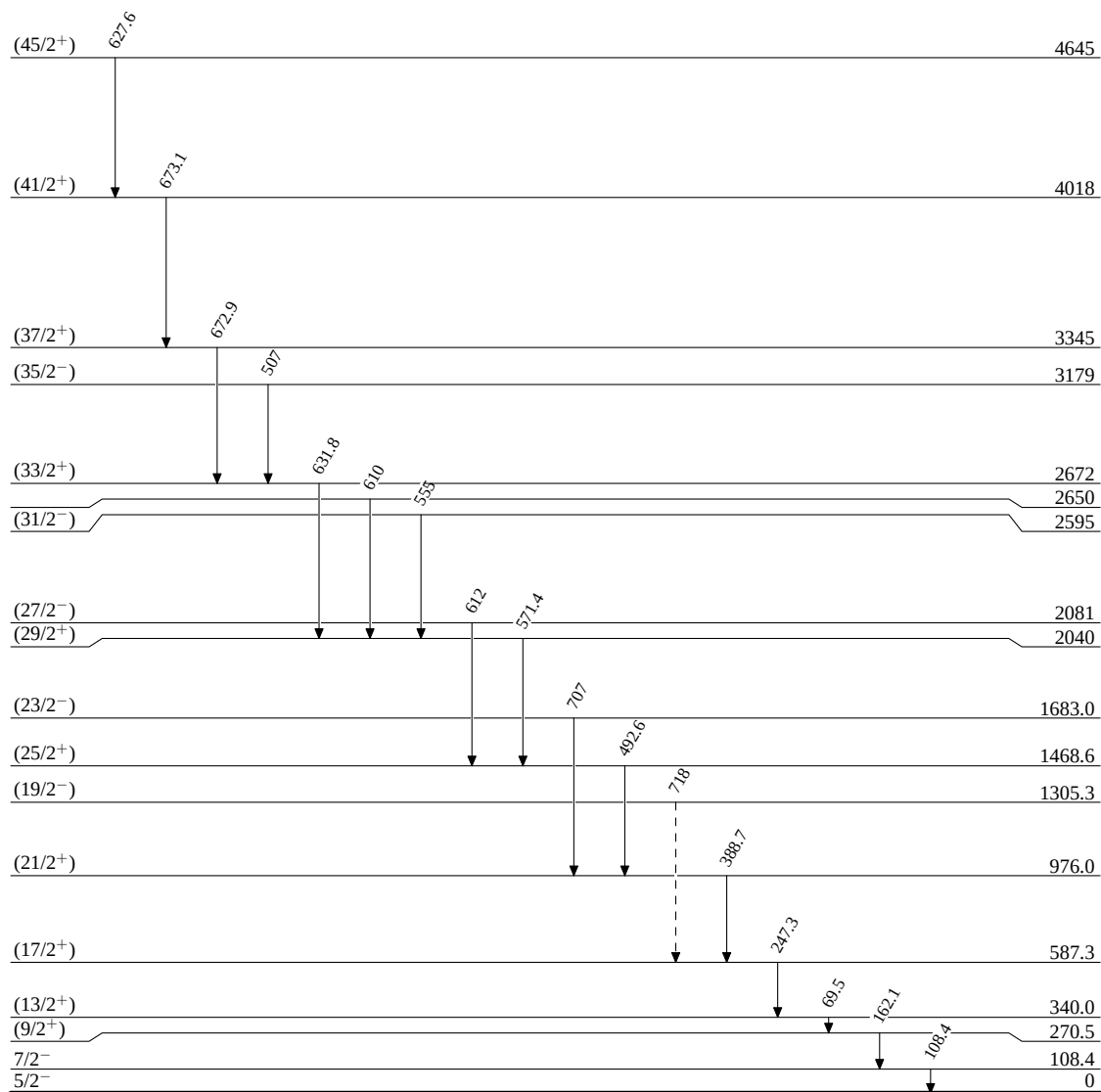
<u>E_γ</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>E_γ</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>
69.5	340.0	(13/2 ⁺)	270.5	(9/2 ⁺)	610	2650		2040	(29/2 ⁺)
108.4	108.4	7/2 ⁻	0	5/2 ⁻	612	2081	(27/2 ⁻)	1468.6	(25/2 ⁺)
162.1	270.5	(9/2 ⁺)	108.4	7/2 ⁻	627.6	4645	(45/2 ⁺)	4018	(41/2 ⁺)
247.3	587.3	(17/2 ⁺)	340.0	(13/2 ⁺)	631.8	2672	(33/2 ⁺)	2040	(29/2 ⁺)
388.7	976.0	(21/2 ⁺)	587.3	(17/2 ⁺)	672.9	3345	(37/2 ⁺)	2672	(33/2 ⁺)
492.6	1468.6	(25/2 ⁺)	976.0	(21/2 ⁺)	673.1	4018	(41/2 ⁺)	3345	(37/2 ⁺)
507	3179	(35/2 ⁻)	2672	(33/2 ⁺)	707	1683.0	(23/2 ⁻)	976.0	(21/2 ⁺)
555	2595	(31/2 ⁻)	2040	(29/2 ⁺)	718 [†]	1305.3	(19/2 ⁻)	587.3	(17/2 ⁺)
571.4	2040	(29/2 ⁺)	1468.6	(25/2 ⁺)					

[†] Placement of transition in the level scheme is uncertain.

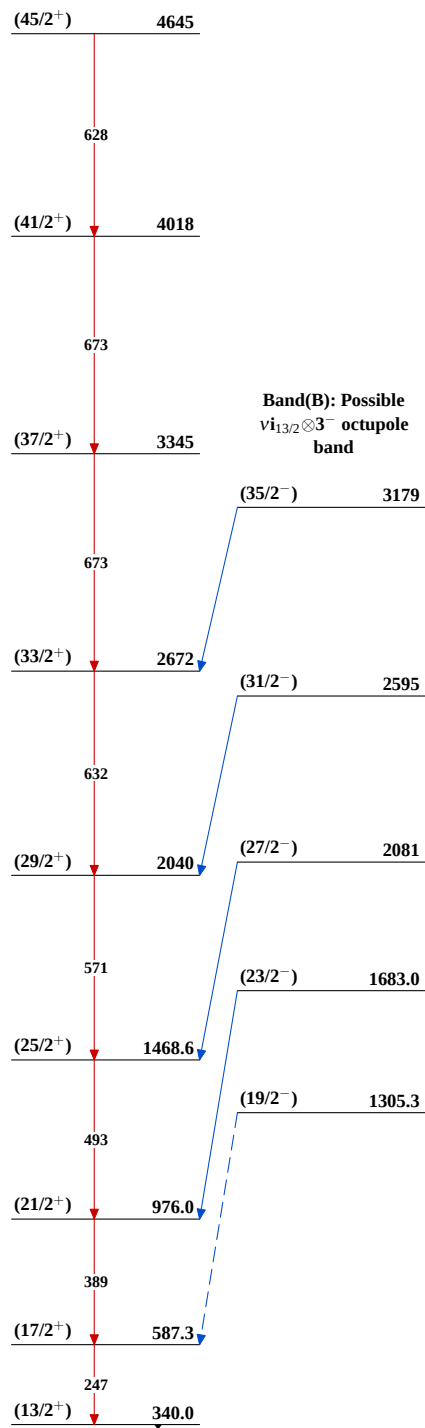
$^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ 2006Ve04

Legend

Level Scheme

 -----► γ Decay (Uncertain)

 $^{149}_{60}\text{Nd}_{89}$

$^{238}\text{U}(^{12}\text{C},\text{F}\gamma)$ 2006Ve04

 Band(A): Band based on
 $\nu_{i13/2}$

 $^{149}_{60}\text{Nd}_{89}$

Adopted Levels, Gammas

Q(β^-)=1071.5 19; S(n)=7270 6; S(p)=5945.2 25; Q(α)=1137 7 2021Wa16

S(2n)=13165.1 21, S(2p)=15198 16 (2021Wa16).

2012Da16 investigated possible α decay of ¹⁵³Eu to the ground state in ¹⁴⁹Pm at the HADES underground laboratory. A lower limit of T_{1/2} of 5.5×10¹⁷ y was established for this decay mode, essentially, with no observation of a signal for α decay of ¹⁵³Eu.

Mass measurement: 1975Ka25.

Other reactions:

¹⁴⁸Pm(n, γ): 1967Fe07, 1995To01.

¹⁴⁸Pm(n,X): E=0.007-317 eV (1973Ki13).

²³²Th(p,F): E=8-22 MeV (1982Ku07).

²³⁸U(n,F): E=8.3 MeV (1985Li23).

²⁵²Cf SF decay: 1972Ho08.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 11 references dealing with nuclear structure theoretical calculations.

¹⁴⁹Pm Levels

Cross Reference (XREF) Flags

A	¹⁴⁹ Nd β^- decay (1.726 h)	F	¹⁵⁰ Sm(μ^- , γ)
B	¹⁴⁸ Nd(³ He,d)	G	¹⁵⁰ Sm(d, ³ He)
C	¹⁴⁸ Nd(α ,t)	H	¹⁵⁰ Sm(pol t, α)
D	¹⁵⁰ Nd(p,2n γ)	I	¹⁵² Sm(p, α)
E	¹⁵⁰ Nd(d,3n γ)		

E(level) [‡]	J π [#]	T _{1/2} [†]	XREF	Comments
0.0@	7/2 ⁺	53.08 h 9	ABCDEFGHI	$\% \beta^- = 100$ $\mu = 3.3$ 5 (1963Gr10,2019StZV) J π : atomic beam (1961Ca07), L(pol t, α)=4; Ay(θ) gives L-1/2. T _{1/2} : weighted average of 53.08 h 11 (1971Ba28), 53.08 h 10 (1966Mc11), 53.07 h 10 (1963Ho15,1964Ho03), 53.09 h 9 (1960Bu06). Others: 53.3 h 7 (2015Ba10), 2.13 d 9 (1999Po32, 95% confidence limit); 48 h 3 (1960Ch15), 50.0 h 15 (1952Ru10), 47 h (1950Ma05). μ : static nuclear orientation (1963Gr10). Other: 1960Ch15. ¹⁵⁰ Sm(t, α) yields spectroscopic strength of 3.2 for ground state. The remaining strength of 0.83 is distributed among the 360, 462 and 475 levels.
114.313 ^d 5	5/2 ⁺	2.53 ns 3	ABCDEFGHI	$\mu = +2.0$ 2 (1970Se11,2020StZV) J π : L(pol t, α)=2; M1+E2 γ to 7/2 ⁺ . T _{1/2} : other: 2.7 ns 2 (γ (t) in (p,2n γ),1979Ko35). μ : from TDPAC (1970Se11). Others: +2.13 15 (IPAC,1970Be67), 2.5 3 (1969Ta08), 2.3 3 (1966Sv01). Strength of d _{5/2} shell in (t, α) is mainly associated with this level. Remaining strength found in 211, 871, 959 levels.
188.631 6	3/2 ⁺	3.27 ns 5	ABCDEF HI	$\mu = +1.09$ 15 (1970Be67,2014StZZ) J π : L(pol t, α)=2; L-1/2 from Ay(θ). T _{1/2} : other: 3.1 ns 2 (γ (t) in (p,2n γ),1979Ko35). μ : from IPAC (1970Be67). Other: 2.25 60 (1970Se11,TDPAC). Value is not listed in 2020StZV.
211.308 5	5/2 ⁺	80 ps 15	ABCDEFgHI	$\mu = +2.20$ 35 (1970Be67,2014StZZ) J π : L(pol t, α)=2; M1+E2 γ to 7/2 ⁺ . μ : from IPAC (1970Be67). Value is not listed in 2020StZV.
240.214 ^a 7	11/2 ⁻	35 μ s 3	ABCDEFgHI	$\%IT = 100$ J π : L(pol t, α)=5; L+1/2 from Ay(θ); M2 γ to 7/2 ⁺ . T _{1/2} : from (ce) γ (t) in β^- (1967Ba27). Other: 41 μ s 10 from $\beta\gamma$ (t) (1966He04).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

¹⁴⁹Pm Levels (continued)

E(level) [‡]	J ^π #	T _{1/2} [†]	XREF	Comments
270.170 5	7/2 ⁻	2.59 ns 2	ABCDE GHI	μ=+3.6 2 (1970Be67,2020StZV) J ^π : L(pol t,α)=3; L+1/2 from Ay(θ). T _{1/2} : other: 2.8 ns 2 (γ(t) in (p,2nγ),1979Ko35). μ: from TDPAC (1970Se11). Other: +2.19 11 IPAC (1970Be67).
288.208@ 8	9/2 ⁺	0.6 ns 1	A DEF	J ^π : M1+E2 γ to 7/2 ⁺ ; γγ(θ) in ¹⁴⁹ Nd β ⁻ decay.
360.046 ^d 9	7/2 ⁺		A DE GHI	J ^π : L(pol t,α)=4; M1+E2 γ to 5/2 ⁺ .
387.559 10	1/2 ⁺		ABCDEFgHI	J ^π : L(pol t,α)=L(³ He,d)=0.
396.774 7	5/2 ⁺		A DEFg	J ^π : E1 γ to 7/2 ⁻ ; M1+E2 γ to 3/2 ⁺ .
415.450 9	3/2 ⁺		ABCD GHI	J ^π : L(pol t,α)=2; L-1/2 from Ay(θ).
425.276 7	7/2 ⁺		A D g	J ^π : M1+E2 γ to 5/2 ⁺ , γ to 9/2 ⁺ . γγ(θ) in ¹⁴⁹ Nd β ⁻ excludes 5/2.
462.191 10	3/2 ⁻		AB D H	J ^π : E1 γ to 1/2 ⁺ ; E2 γ to 7/2 ⁻ .
497.56@ 11	(11/2) ⁺	<3 ns	DE	J ^π : ΔJ=(2), E2 γ to 7/2 ⁺ ; γ to 9/2 ⁺ .
510.17 ^a 17	(15/2) ⁻		bcDE hi	J ^π : ΔJ=2, E2 γ to 11/2 ⁻ ; excitation function. T _{1/2} : γ(t) in (p,2nγ) (1979Ko35).
515.645 ^b 9	(9/2) ⁻	≤50 ps	AbcDE hi	J ^π : M1 γ to 11/2 ⁻ and γs to 7/2 ⁺ and 7/2 ⁻ .
537.863 6	5/2 ⁻		A D g	J ^π : E1 γs to 3/2 ⁺ and 7/2 ⁺ .
547.124 13	(5/2,7/2 ⁺)		A D g	J ^π : γs to 3/2 ⁺ , 7/2 ⁺ and 7/2 ⁻ .
552 3	(11/2) ⁻		BC GHI	J ^π : L(pol t,α)=(5); L+1/2 from Ay(θ). E(level): this state appears to be different from 547 and 558 levels excited in β ⁻ or (p,2nγ).
558.17 ^d 6	(9/2) ⁺	≤0.18 ns	A DE g	J ^π : E2 γ to 5/2 ⁺ ; M1+E2 γ to 7/2 ⁺ ; γ to 7/2 ⁻ and from (11/2 ⁺); probable band member.
636.5 28	1/2 ⁺		BC H	XREF: H(646). J ^π : L(³ He,d)=0.
651.014 18	(5/2 ⁺)		A DE	J ^π : γs to 3/2 ⁺ , 7/2 ⁺ and 7/2 ⁻ . Possible γs to 1/2 ⁺ and 3/2 ⁻ forbid 7/2. 7/2 ⁺ proposed in (d,3nγ).
654.843 5	7/2 ⁻		A D i	J ^π : E1 γs to 5/2 ⁺ and 9/2 ⁺ .
666.55 12	(7/2 ⁻ ,9/2 ⁺)		D i	J ^π : γs to 5/2 ⁺ and 11/2 ⁻ .
716.72 17	(3/2 ⁻)		D	J ^π : ΔJ=2, Q γ to 7/2 ⁻ ; γ to 3/2 ⁺ .
721.23 11	7/2 ⁺		ABCD GHI	J ^π : L(pol t,α)=4; L-1/2 from Ay(θ).
744.579 13	(3/2,5/2 ⁺)		A g	J ^π : γs to 1/2 ⁺ and 5/2 ⁺ ; log f ^{lu} t=7.8 from 5/2 ⁻ .
750.47 3	(7/2 ⁻ ,9/2 ⁺)		A D g	J ^π : γs to 5/2 ⁺ and 11/2 ⁻ .
751.5 19	3/2 ⁺		BC GHI	J ^π : L(pol t,α)=2; L-1/2 from Ay(θ).
758.67 7	(5/2 ⁺ ,7/2,9/2 ⁺)	≤0.18 ns	A	J ^π : γs to 5/2 ⁺ and 9/2 ⁺ .
768.188 17	(5/2,7/2 ⁺)		A D	J ^π : γs to 3/2 ⁺ , 7/2 ⁺ and 7/2 ⁻ .
771.47 ^b 15	(13/2 ⁻)		DE	J ^π : ≥11/2 from excitation function. γ to 11/2 ⁻ .
778.90@ 12	(13/2) ⁺		DE	J ^π : ΔJ=(2), E2 γ to 9/2 ⁺ ; M1+E2 γ to 11/2 ⁺ .
786.72 3	(3/2 ⁺ ,5/2 ⁺)		A g	J ^π : γs to 1/2 ⁺ and 7/2 ⁺ .
791.05& 14	11/2 ⁻		BCDE GHI	J ^π : L(pol t,α)=5; L+1/2 from Ay(θ).
808.66 ^d 15	(11/2) ⁺		DE	J ^π : ΔJ=2, E2 γ to 7/2 ⁺ ; M1+E2 γ to (9/2) ⁺ .
872.94? 8			Abc	XREF: b(871)c(871). J ^π : 3/2 ⁺ ,5/2,7/2,9/2 ⁺ from γs to 5/2 ⁺ and 7/2 ⁺ . L(³ He,d)=2 suggests 3/2 ⁺ , 5/2 ⁺ ; however, 871 group in (³ He,d) may correspond to 885, (5/2 ⁺) level.
884.89 7	(5/2 ⁺)		Abc GHI	XREF: b(871)c(871). J ^π : L(pol t,α)=(2); L+1/2 from Ay(θ).
885.8 5	(11/2,13/2 ⁺)		D	J ^π : ≥11/2 from excitation function; γ to 9/2 ⁺ .
907.1 25	1/2 ⁺	≤0.18 ns	BC HI	J ^π : L(pol t,α)=0 from 0 ⁺ .
923.886 18	(5/2 ⁺ ,7/2)		A g	J ^π : γs to 5/2 ⁺ and 9/2 ⁺ ; log f ^{lu} t=7.9 from 5/2 ⁻ .
942.927 22	(3/2 ⁺ ,5/2,7/2 ⁺)		A g	J ^π : γs to 3/2 ⁺ and 7/2 ⁺ .
955 5	(5/2 ⁺)		C GHI	J ^π : L(pol t,α)=(2); L+1/2 from Ay(θ).
956.92 ^a 22	(19/2 ⁻)		E	J ^π : (E2) γ to (15/2) ⁻ .

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Pm Levels (continued)

E(level) [‡]	J ^π #	XREF	Comments
1006.26 ^{&} 18	(13/2) ⁻	E	J ^π : E1 γ to (11/2) ⁺ ; M1+E2 γ to 11/2 ⁻ .
1008 4	1/2 ⁺	B	J ^π : L(³ He,d)=0.
1008.11 [@] 16	(15/2) ⁺	E	J ^π : E2 γ to (11/2) ⁺ ; M1+E2 γ to (13/2) ⁺ .
1031.68 3	(7/2 ⁺)	ABC	J ^π : γs to 5/2 ⁻ and 9/2 ⁺ and log f ^{lu} _t =8.0 from 5/2 ⁻ restrict J ^π to (5/2 ⁺ , 7/2). L(³ He,d)=5 is inconsistent with this but data would marginally fit L=4 also to allow 7/2 ⁺ .
1043.39 5	(3/2 ⁺ , 5/2, 7/2)	A	J ^π : γs to 5/2 ⁺ and 7/2 ⁺ ; log f ^{lu} _t =8.3 from 5/2 ⁻ .
1050.18 3		A	J ^π : 1/2 ⁺ , 3/2, 5/2, 7/2 ⁺ from γs to 3/2 ⁺ and 5/2 ⁺ .
1141.537 18	5/2 ⁺	ABC	J ^π : L(³ He,d)=2; γ to 7/2 ⁻ .
1145.30 ^{&} 17	(15/2) ⁻	E	J ^π : E1 γ to (13/2) ⁺ ; E2 γ to 11/2 ⁻ .
1156.038 24	(3/2 ⁺ , 5/2, 7/2 ⁺)	A	J ^π : γs to 3/2 ⁺ and 7/2 ⁺ .
1162.90 ^c 24	(15/2 ⁺)	E	J ^π : γs to (15/2) ⁻ and (13/2 ⁻).
1181 3	3/2 ⁺ , 5/2 ⁺	BC	J ^π : L(³ He,d)=2.
1190.274 17	(5/2)	ABC	J ^π : γs to 3/2 ⁺ , 3/2 ⁻ , 7/2 ⁺ and 7/2 ⁻ .
1211.07 ^b 21	(17/2 ⁻)	E	J ^π : (M1+E2) γ to (19/2 ⁻); γs to (15/2) ⁻ and (13/2 ⁻).
1213 4		BC	
1229.13 [@] 19	(17/2) ⁺	E	J ^π : E2 γ to (13/2) ⁺ ; γ to (15/2) ⁺ .
1234.098 9	(7/2)	A	J ^π : γs to 5/2 ⁺ , 5/2 ⁻ , 9/2 ⁺ and (9/2) ⁻ .
1239.622 22	(5/2 ⁺ , 7/2)	A	J ^π : γs to 5/2 ⁺ and 9/2 ⁺ ; log f ^{lu} _t =7.2 from 5/2 ⁻ .
1264.01 6	(5/2, 7/2)	ABC	J ^π : γs to 5/2 ⁺ , 7/2 ⁺ and 7/2 ⁻ ; log f ^{lu} _t =7.5 from 5/2 ⁻ . L(³ He,d)=2,3 from 0 ⁺ would support 5/2 ⁺ or 7/2 ⁻ .
1290.079 25	(3/2 ⁺ , 5/2, 7/2)	A	J ^π : γs to 5/2 ⁺ and 7/2 ⁺ ; log f ^{lu} _t =7.0 from 5/2 ⁻ .
1312.106 15	(5/2)	AB	J ^π : γs to 3/2 ⁺ , 3/2 ⁻ , 7/2 ⁺ and 7/2 ⁻ .
1329 4	3/2 ⁺	C gH	XREF: g(1350). J ^π : L(pol t, α)=2; L-1/2 from Ay(θ). L(d, ³ He)=1 is inconsistent with 3/2 ⁺ . But the level in (d, ³ He) may be 1329 and/or 1367.
1367 4		B g	XREF: g(1350).
1394.25 20	3/2 ⁺	A H	J ^π : L(pol t, α)=2; L-1/2 from Ay(θ).
1405 3	9/2 ⁻ , 11/2 ⁻	BC	J ^π : L(³ He,d)=5.
1406.60 ^{&} 20	(17/2) ⁻	E	J ^π : E1 γ to (15/2) ⁺ ; γ to (15/2 ⁻).
1412.10 4	(5/2, 7/2)	A	J ^π : γs to 7/2 ⁺ and 7/2 ⁻ ; log f ^{lu} _t =6.8 from 5/2 ⁻ .
1448.24 7	(3/2 ⁺ , 5/2, 7/2 ⁺)	A	J ^π : γs to 3/2 ⁺ and 7/2 ⁺ .
1462 3	(7/2 ⁺ , 9/2, 11/2 ⁻)	BC	J ^π : L(³ He,d)=4,5.
1476.97 ^c 25	(19/2 ⁺)	E	J ^π : γs to (19/2 ⁻), (17/2 ⁻) and (15/2) ⁺ .
1495.86 5	(5/2, 7/2 ⁺)	A	J ^π : γs to 3/2 ⁺ , 7/2 ⁺ and 7/2 ⁻ .
1504.7 ^a 3	(23/2 ⁻)	E	J ^π : (E2) γ to (19/2) ⁻ .
1531 3	5/2 ⁻ , 7/2 ⁻	BC	J ^π : L(³ He,d)=3.
1549.19 [@] 21	(19/2) ⁺	E	J ^π : E2 γ to (15/2) ⁺ ; γ to (17/2) ⁺ .
1568.60 5	(5/2 ⁺ , 7/2)	AB	J ^π : γs to 5/2 ⁺ , 9/2 ⁺ ; log ft=6.2 from 5/2 ⁻ .
1589 3	7/2 ⁺ , 9/2 ⁺	BC	J ^π : L(³ He,d)=4.
1590.6 ^{&} 4	(19/2 ⁻)	E	J ^π : γ to (15/2) ⁻ .
1612.7 ^b 3	(21/2 ⁻)	E	J ^π : γ to (19/2) ⁻ .
1642.3 25	(3/2) ⁺	BC H	J ^π : L(³ He,d)=2; L(pol t, α)=(2); L-1/2 from Ay(θ).
1696 3	3/2 ⁺ , 5/2 ⁺	BC	J ^π : L(³ He,d)=2.
1738.6 [@] 4	(21/2) ⁺	E	J ^π : E2 γ to (17/2) ⁺ .
1765 3	1/2 ⁺	BC	J ^π : L(³ He,d)=0.
1782? 4		BC	
1834? 4		B	
1884.9 ^{&} 3	(21/2 ⁻)	E	J ^π : γs to (17/2) ⁻ and (19/2) ⁺ .
1923.6 ^c 3	(23/2 ⁺)	E	J ^π : γs to (19/2) ⁺ , (21/2 ⁻) and (23/2 ⁻).

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Adopted Levels, Gammas (continued) ^{149}Pm Levels (continued)

<u>E(level)[‡]</u>	<u>J^π[#]</u>	<u>XREF</u>	<u>Comments</u>
2112.3 ^a 4	(27/2 ⁻)	E	J ^π : γ to (23/2 ⁻).
2122.0 [@] 3	(23/2 ⁺)	E	J ^π : E2 γ to (19/2 ⁺); γ to (21/2 ⁻).

[†] Unless otherwise stated, values are from $\gamma\gamma(t)$ and/or $\beta\gamma(t)$ in ^{149}Nd β^- .

[‡] From least-squares fit to $E\gamma$ data when a level is populated in γ -ray studies. Uncertainty of 0.2 keV is assumed when not stated. When a level is populated only in particle-transfer reactions, weighted average is taken of values available from ($^3\text{He},d$), (α,t), ($d,^3\text{He}$) and (pol t, α).

[#] For high-spin ($J > 11/2$) states populated in ($d,3n\gamma$), the assignments are based on multipolarities from ce data for selected transitions, probable band assignments, and the assumption of population of ascending order of spins in such reactions. In particle-transfer reactions, when L-transfer arguments are used, all the targets have $J^\pi=0^+$ for the ground states.

[@] Band(A): Band based on 7/2⁺ ground state. Possibly based on $\pi 7/2[404]$ (1996Jo19), although Nilsson- model assignment is not quite valid here for N=88 nuclide. See also comment for band based on 11/2⁻.

[&] Band(B): Band based on 11/2⁻. In comparison with a similar structure of opposite parity bands (probably reflection-asymmetric) in ^{147}Pm , this band may form a parity doublet with the band based on 7/2⁺ g.s. (1996Jo19), the difference in energies of levels of similar spins (but of opposite parity) ranges from about 300 keV at J=11/2 to about 50 keV at J=19/2.

^a Band(C): $\pi h_{11/2}$ band based on 35- μs isomer.

^b Band(D): Band based on (9/2⁻).

^c Band(E): Band based on (15/2⁺). Possible configuration= $\pi h_{11/2} \otimes (3^-)$. Only the 15/2⁺, 19/2⁺, 23/2⁺ members observed.

^d Band(F): Band based on (5/2⁺). Possibly based on $\pi 5/2[402]$ (1996Jo19), although Nilsson model assignment is not quite valid for N=88 nuclide.

Adopted Levels, Gammas (continued)

E _i (level)	J ^π _i	$\gamma(^{149}\text{Pm})$							Comments
		E _γ [†]	I _γ [†]	E _f	J ^π _f	Mult.#	δ [#]	α [@]	
114.313	5/2 ⁺	114.314 11	100	0.0	7/2 ⁺	M1+E2	+0.16 2	1.065 15	B(M1)(W.u.)=2.751×10 ⁻³ +41-43; B(E2)(W.u.)=3.0 +8-7
188.631	3/2 ⁺	74.32 3	62 13	114.313	5/2 ⁺	M1+E2	+0.71 6	4.68 14	B(M1)(W.u.)=0.00142 +11-13; B(E2)(W.u.)=71 +8-10
		188.640 8	100 4	0.0	7/2 ⁺	E2		0.2462 34	B(E2)(W.u.)=3.2 +6-5
211.308	5/2 ⁺	22.7	0.021 6	188.631	3/2 ⁺	[M1]		18.20 25	B(M1)(W.u.)=0.0037 +14-12
									22.7-keV transition cannot be pure E2 or have large E2 admixture, as deduced B(E2)(W.u.) of 3230 100 is much larger than RUL=300.
		97.001 12	5.6 4	114.313	5/2 ⁺	M1(+E2)	+0.09 9	1.696 31	B(M1)(W.u.)=0.0125 +47-33; B(E2)(W.u.)<31
		211.309 7	100 4	0.0	7/2 ⁺	M1+E2	-0.41 3	0.1874 27	B(M1)(W.u.)=0.0186 +41-30; B(E2)(W.u.)=38 +10-8
240.214	11/2 ⁻	240.220 7	100	0.0	7/2 ⁺	M2		0.664 9	B(M2)(W.u.)=0.0237 +22-19
270.170	7/2 ⁻	30.00 3	0.16 4	240.214	11/2 ⁻	(E2)		341	B(E2)(W.u.)=127 +24-26
		58.883 20	12 2	211.308	5/2 ⁺	[E1]		1.110 16	B(E1)(W.u.)=2.26×10 ⁻⁵ 36
		155.873 9	55 2	114.313	5/2 ⁺	E1		0.0798 11	B(E1)(W.u.)=5.59×10 ⁻⁶ +39-35
									δ(M2/E1)<0.012 from ce data gives B(M2)(W.u.)<0.15.
		270.166 7	100 3	0.0	7/2 ⁺	E1(+M2)	-0.07 5	0.021 4	B(E1)(W.u.)=1.94×10 ⁻⁶ 12; B(M2)(W.u.)=0.6 +12-5
									B(M2)(W.u.)=0.6 +12-5 upper bound exceeds RUL=1.
									Note that RUL=1 for B(M2)(W.u.), implying δ(M2/E1)<0.06.
288.208	9/2 ⁺	288.194 10	100	0.0	7/2 ⁺	M1+E2	+0.78 7	0.0747 14	
360.046	7/2 ⁺	245.72 5	100 8	114.313	5/2 ⁺	M1+E2	+0.23 2	0.1255 18	I _γ : from (p,2nγ).
		360.052 18	19.0 6	0.0	7/2 ⁺				
387.559	1/2 ⁺	176.27	3.5 7	211.308	5/2 ⁺	[E2]		0.310 4	B(E2)(W.u.)=2.9 +9-7
		198.928 8	100 3	188.631	3/2 ⁺	M1(+E2)	+0.2 3	0.224 4	B(M1)(W.u.)=0.0032 +9-10; B(E2)(W.u.)<11
		273.24 4	13 3	114.313	5/2 ⁺	E2		0.0728 10	B(E2)(W.u.)=1.22 +36-30
									I _γ : other: 40 9 in (d,3nγ) is discrepant.
396.774	5/2 ⁺	36.7	0.7 3	360.046	7/2 ⁺	[M1]		4.38 6	δ(E2/M1)<0.56 required from γ intensity balance in β ⁻ decay.
		126.630 18	4.4 3	270.170	7/2 ⁻	E1		0.1404 20	
		185.489 25	4.1 2	211.308	5/2 ⁺	[M1,E2]		0.267 7	
		208.147 9	100.0 4	188.631	3/2 ⁺	M1+E2	+0.17 3	0.1980 28	
		282.456 10	24.2 6	114.313	5/2 ⁺	M1+E2	+0.65 20	0.0808 30	I _γ : other: 36 7 in (d,3nγ).
		396.76 4	2.8 1	0.0	7/2 ⁺				
415.450	3/2 ⁺	226.847 19	43 2	188.631	3/2 ⁺	[M1,E2]		0.145 12	
		301.128 14	100 3	114.313	5/2 ⁺	M1,E2		0.064 10	
425.276	7/2 ⁺	65.23	3 1	360.046	7/2 ⁺	[M1,E2]		8.2 29	
		137.05 3	12 1	288.208	9/2 ⁺	[M1,E2]		0.69 5	
		155.1	7 3	270.170	7/2 ⁻	[E1]		0.0808 11	
		213.947 16	78 5	211.308	5/2 ⁺	M1,E2		0.173 12	
		310.979 13	100 3	114.313	5/2 ⁺	M1+E2	+0.23 12	0.0667 15	
		425.22 3	53 2	0.0	7/2 ⁺				
462.191	3/2 ⁻	65.4	3.1 10	396.774	5/2 ⁺	[E1]		0.841 12	
		74.66 10	100 16	387.559	1/2 ⁺	E1		0.590 9	
		192.026 9	58 2	270.170	7/2 ⁻	E2		0.2318 32	
		250.826 31	3.4 3	211.308	5/2 ⁺				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.#	$\delta^\#$	$\alpha^@$	Comments
462.191	3/2 ⁻	273.5	8 4	188.631	3/2 ⁺				
497.56	(11/2) ⁺	209.3 2	18 1	288.208	9/2 ⁺	M1+E2		0.185 11	
		497.8 2	100	0.0	7/2 ⁺	E2		0.01244 17	
510.17	(15/2) ⁻	269.9 3	100	240.214	11/2 ⁻	E2		0.0757 11	B(E2)(W.u.)>2.6
515.645	(9/2) ⁻	245.5 3	34 9	270.170	7/2 ⁻	[M1,E2]		0.115 12	E_γ, I_γ : from (p,2n γ). Same energy is given in (d,n γ). Intensity is not known well in β^- and (d,3n γ). Mult.: ce data in ¹⁴⁹ Nd β^- give M1,E2 but negative A_2 for 275 $\gamma(\theta)$ in (p,2n γ) supports M1 or M1+E2 with small δ .
		275.437 11	100 3	240.214	11/2 ⁻	M1(+E2)		0.082 11	
		515.75 9	5.6 8	0.0	7/2 ⁺				
537.863	5/2 ⁻	75.69 6	3.0 3	462.191	3/2 ⁻	M1(+E2)	<0.8	4.0 6	B(M1)(W.u.) $\geq$ 0.0055
		112.52 4	1.6 2	425.276	7/2 ⁺	[E1]		0.1939 27	B(E1)(W.u.) $\geq$ 1.5 $\times$ 10 ⁻⁵
		122.415 13	3.4 2	415.450	3/2 ⁺	E1		0.1540 22	B(E1)(W.u.) $\geq$ 2.7 $\times$ 10 ⁻⁵
		141.06 7	0.52 3	396.774	5/2 ⁺	[E1]		0.1046 15	B(E1)(W.u.) $\geq$ 2.7 $\times$ 10 ⁻⁶
		177.818 18	2.1 2	360.046	7/2 ⁺	E1		0.0558 8	B(E1)(W.u.) $\geq$ 5.3 $\times$ 10 ⁻⁶
		267.693 8	81 2	270.170	7/2 ⁻	M1+E2	+0.24 7	0.0994 16	B(M1)(W.u.) $\geq$ 0.0055; B(E2)(W.u.) $\geq$ 1.3
		326.554 10	61.3 14	211.308	5/2 ⁺	E1(+M2)	-0.07 6	0.0125 27	B(E1)(W.u.) $\geq$ 2.7 $\times$ 10 ⁻⁵ ; B(M2)(W.u.) $\geq$ 0.12
		349.231 9	18.5 5	188.631	3/2 ⁺	E1		0.00966 14	B(E1)(W.u.) $\geq$ 6.6 $\times$ 10 ⁻⁶
		423.553 10	100 5	114.313	5/2 ⁺	E1		0.00606 8	B(E1)(W.u.) $\geq$ 2.0 $\times$ 10 ⁻⁵
547.124	(5/2,7/2 ⁺)	131.7	1.3	415.450	3/2 ⁺				
		276.960 17	100 3	270.170	7/2 ⁻	D			
		358.49 10	3.0 15	188.631	3/2 ⁺				
		432.8 2	5.9 22	114.313	5/2 ⁺				E_γ : from (p,2n γ). I_γ : unweighted average of 3.8 15 (β^-) and 8.1 27 (p,2n γ).
558.17	(9/2) ⁺	547.1	4.5 22	0.0	7/2 ⁺				
		198.18 16	100 9	360.046	7/2 ⁺	M1+E2		0.218 10	E_γ : weighted average of 198.1 1 (p,2n γ) and 198.5 2 (d,3n γ). I_γ : from (d,3n γ). γ not reported in (p,2n γ) and (d,3n γ).
		287.7	26 10	270.170	7/2 ⁻				
		444.7 [‡] 2	64 5	114.313	5/2 ⁺	E2		0.01693 24	E_γ : level-energy difference=443.9. E_γ, I_γ : from (d,3n γ); in (p,2n γ) value of 200 seems to be in error, perhaps, due to incorrect split of intensity in two locations (558 and 655 levels). γ not reported in (p,2n γ) and (d,3n γ).
651.014	(5/2 ⁺)	558.0	21	0.0	7/2 ⁺				
		188.8	12	462.191	3/2 ⁻				
		254.228 22	100 3	396.774	5/2 ⁺	M1+E2		0.104 12	Mult.: from (d,3n γ), where this is the only γ reported from 651 level. E_γ : γ not in (p,2n γ). E_γ : level-energy difference=380.84. E_γ : from (p,2n γ). E_γ =439.6 in β^- . I_γ : from (p,2n γ). I_γ =48 24 in β^- . E_γ : γ not in (p,2n γ). E_γ : γ not in (p,2n γ).
		263.4	27	387.559	1/2 ⁺				
		380.66 [‡] 5	61 3	270.170	7/2 ⁻				
		439.4 2	42 18	211.308	5/2 ⁺				
		462.34 10	38 8	188.631	3/2 ⁺				
		536.6	55 24	114.313	5/2 ⁺				
		651.0	73 30	0.0	7/2 ⁺				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.#	$\delta^\#$	$\alpha^@$	Comments
654.843	7/2 ⁻	96.9	0.42 15	558.17	(9/2) ⁺	[E1]		0.291 4	B(E1)(W.u.) $\geq 1.5 \times 10^{-6}$
		107.79 3	1.1 2	547.124	(5/2,7/2 ⁺)	[D,E2]		1.0 8	If E1, B(E1)(W.u.) $\geq 4.7 \times 10^{-6}$. B(E2)(W.u.) ≥ 16 if E2.
		116.930 24	1.4 4	537.863	5/2 ⁻	M1+E2	0.5 +11-3	1.05 16	B(M1)(W.u.) $\geq 8.4 \times 10^{-5}$; B(E2)(W.u.) ≥ 0.46
		139.210 12	6.4 3	515.645	(9/2) ⁻	(M1+E2)	+3 3	0.69 9	B(M1)(W.u.) $\geq 2.9 \times 10^{-5}$
		229.566 9	6.06 16	425.276	7/2 ⁺	E1		0.0282 4	B(E1)(W.u.) $\geq 2.6 \times 10^{-6}$
		258.067 13	4.72 13	396.774	5/2 ⁺	E1		0.02079 29	B(E1)(W.u.) $\geq 1.4 \times 10^{-6}$
		294.802 10	7.16 19	360.046	7/2 ⁺	E1		0.01477 21	B(E1)(W.u.) $\geq 1.4 \times 10^{-6}$
		366.634 14	6.80 19	288.208	9/2 ⁺	E1		0.00857 12	B(E1)(W.u.) $\geq 7.0 \times 10^{-7}$
		384.687 16	3.35 9	270.170	7/2 ⁻	[M1,E2]		0.032 7	I_γ : 33 16 in (p,2n γ) is discrepant. If M1, B(M1)(W.u.) $\geq 2.9 \times 10^{-5}$. If E2, B(E2)(W.u.) ≥ 0.11 . B(M1)(W.u.) $\geq 2.7 \times 10^{-5}$ if M1, B(E2)(W.u.) ≥ 0.1 if E2.
		443.551 11	14.4 6	211.308	5/2 ⁺	E1		0.00543 8	B(E1)(W.u.) $\geq 8.3 \times 10^{-7}$
		540.509 10	83 3	114.313	5/2 ⁺	E1		0.00346 5	B(E1)(W.u.) $\geq 2.7 \times 10^{-6}$
		654.831 13	100 5	0.0	7/2 ⁺	E1		2.28 $\times 10^{-3}$ 3	B(E1)(W.u.) $\geq 1.8 \times 10^{-6}$
666.55	(7/2 ⁻ ,9/2 ⁺)	241.2 3	50 19	425.276	7/2 ⁺				
		396.4 3	72 3	270.170	7/2 ⁻				
		426.3 2	100 19	240.214	11/2 ⁻				
		455.3 2	56 10	211.308	5/2 ⁺				
716.72	(3/2 ⁻)	301.2 2	56 16	415.450	3/2 ⁺				
721.23	7/2 ⁺	446.7 3	100 19	270.170	7/2 ⁻	Q			
		361.4 2	49 11	360.046	7/2 ⁺				E_γ, I_γ : from (p,2n γ). Same energy in β^- , but with no uncertainty; $I_\gamma=62$ 25 in β^- , as the 721 level is weakly populated in decay.
744.579	(3/2,5/2 ⁺)	606.67 16	100 22	114.313	5/2 ⁺				I_γ : from (p,2n γ).
		197.4	2.2	547.124	(5/2,7/2 ⁺)				
		282.4	2.9 11	462.191	3/2 ⁻				
		329.18	3.5 17	415.450	3/2 ⁺				
		347.843 18	27.4 9	396.774	5/2 ⁺				
		357.03 4	8.0 4	387.559	1/2 ⁺				
		533.20 4	15.5 9	211.308	5/2 ⁺				
		555.88 9	100 5	188.631	3/2 ⁺				
		630.237 19	32.3 4	114.313	5/2 ⁺				
		480.32 5	67 4	270.170	7/2 ⁻	D(+Q)			
750.47	(7/2 ⁻ ,9/2 ⁺)	510.30 5	100 25	240.214	11/2 ⁻				
		636.2	83 17	114.313	5/2 ⁺				
		749.63 5	22 3	0.0	7/2 ⁺				E_γ : poor fit. Level-energy difference=750.47. Uncertainty increased to 0.20 keV in the fitting procedure.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	$\alpha^@$	Comments
758.67	(5/2 ⁺ , 7/2, 9/2 ⁺)	470.5	67 33	288.208	9/2 ⁺			
		547.4	67 33	211.308	5/2 ⁺			
		758.65 & 8	100 & 10	0.0	7/2 ⁺			
768.188	(5/2, 7/2 ⁺)	342.81 10	19 4	425.276	7/2 ⁺			
		352.78 3	12.5 6	415.450	3/2 ⁺			
		498.06	2.4 6	270.170	7/2 ⁻			
		556.83 9	100 12	211.308	5/2 ⁺			
		653.9	4.2	114.313	5/2 ⁺			
		768.172 21	13.7 12	0.0	7/2 ⁺			
771.47	(13/2 ⁻)	256.0 3	20 10	515.645	(9/2) ⁻			γ from (d,3n γ), not reported in (p,2n γ).
		261.29 12	100 15	510.17	(15/2) ⁻	(M1+E2)	0.096 12	E_γ : weighted average of 261.25 12 (p,2n γ) and 261.4 2 (d,3n γ).
		531.2 2	111 41	240.214	11/2 ⁻			I_γ : unweighted average of 152 22 (p,2n γ) and 70 20 (d,3n γ).
778.90	(13/2) ⁺	281.34 10	18.3 16	497.56	(11/2) ⁺	M1+E2	0.077 11	E_γ : weighted average of 281.3 1 (p,2n γ) and 281.5 2 (d,3n γ).
								I_γ : weighted average of 16.1 29 (p,2n γ) and 19.0 16 (d,3n γ).
		490.75 20	100 9	288.208	9/2 ⁺	E2	0.01292 18	E_γ : average of 490.7 2 (p,2n γ) and 490.8 2 (d,3n γ).
		538.5 3	20 7	240.214	11/2 ⁻			γ from (p,2n γ), not reported in (d,3n γ).
786.72	(3/2 ⁺ , 5/2 ⁺)	239.6	45	547.124	(5/2, 7/2 ⁺)			
		399.1	51 20	387.559	1/2 ⁺			
		575.4 3	27 9	211.308	5/2 ⁺			
		598.06 5	100 9	188.631	3/2 ⁺			
		786.73 4	35 5	0.0	7/2 ⁺			
791.05	11/2 ⁻	232.6 3		558.17	(9/2) ⁺	E1	0.0273 4	γ from (d,3n γ), not reported in (p,2n γ).
		293.6 3	50 15	497.56	(11/2) ⁺			γ from (d,3n γ), not reported in (p,2n γ).
		502.8 2	100 18	288.208	9/2 ⁺	E1	0.00407 6	E_γ : weighted average of 502.8 2 (p,2n γ) and 502.9 3 (d,3n γ).
808.66	(11/2) ⁺	250.4 2	55 15	558.17	(9/2) ⁺	M1+E2	0.108 12	E_γ : weighted average of 250.3 2 (p,2n γ) and 250.7 3 (d,3n γ).
								I_γ : unweighted average of 40 8 (p,2n γ) and 70 10 (d,3n γ).
		448.7 2	100 10	360.046	7/2 ⁺	E2	0.01652 23	
872.94?		512.7 &	&	360.046	7/2 ⁺			
		758.65 & 8	&	114.313	5/2 ⁺			
884.89	(5/2 ⁺)	673.58 7	100	211.308	5/2 ⁺			
885.8	(11/2, 13/2 ⁺)	597.6 5	100	288.208	9/2 ⁺			
923.886	(5/2 ⁺ , 7/2)	498.62	36 3	425.276	7/2 ⁺			
		563.8	9 4	360.046	7/2 ⁺			
		635.7	67 13	288.208	9/2 ⁺			
		712.59 3	69 5	211.308	5/2 ⁺			
		809.6	15	114.313	5/2 ⁺			
		923.874 23	100 8	0.0	7/2 ⁺			
942.927	(3/2 ⁺ , 5/2, 7/2 ⁺)	527.6	30 8	415.450	3/2 ⁺			
		582.9	47 20	360.046	7/2 ⁺			
		754.291 21	100 7	188.631	3/2 ⁺			
		828.6	22 5	114.313	5/2 ⁺			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	$\alpha^@$	Comments
942.927	(3/2 ⁺ , 5/2, 7/2 ⁺)	942.97 17	8 3	0.0	7/2 ⁺			
956.92	(19/2 ⁻)	446.8 2	100	510.17	(15/2) ⁻	(E2)	0.01671 23	
1006.26	(13/2) ⁻	215.0 3	12 3	791.05	11/2 ⁻	M1+E2	0.170 12	
		508.9 2	100 20	497.56	(11/2) ⁺	E1	0.00396 6	
1008.11	(15/2) ⁺	229.2 2	10.9 4	778.90	(13/2) ⁺	M1+E2	0.141 12	
		510.5 2	100 4	497.56	(11/2) ⁺	E2	0.01163 16	
1031.68	(7/2 ⁺)	376.9	13 6	654.843	7/2 ⁻			
		493.85 5	100 9	537.863	5/2 ⁻			
		671.56 10	17 6	360.046	7/2 ⁺			
		743.5 4	4.3 17	288.208	9/2 ⁺			
		761.46 5	48 4	270.170	7/2 ⁻			
		1031.77 8	7.4 21	0.0	7/2 ⁺			
1043.39	(3/2 ⁺ , 5/2, 7/2)	617.9	32 11	425.276	7/2 ⁺			
		832.09 5	100 11	211.308	5/2 ⁺			
		929.2	<45	114.313	5/2 ⁺			
1050.18		861.54 3	100 10	188.631	3/2 ⁺			
		935.90 6	26 4	114.313	5/2 ⁺			
1141.537	5/2 ⁺	390.9	23 8	750.47	(7/2 ⁻ , 9/2 ⁺)			
		594.40 5	85 8	547.124	(5/2, 7/2 ⁺)			
		781.40 6	12 3	360.046	7/2 ⁺			
		871.375 23	100 8	270.170	7/2 ⁻			
		1027.18 4	26 5	114.313	5/2 ⁺			
		1141.77& 8	<8&	0.0	7/2 ⁺			
1145.30	(15/2) ⁻	139.3 3	7.4 10	1006.26	(13/2) ⁻			
		354.2 3	16.8 21	791.05	11/2 ⁻	E2	0.0327 5	
		366.4 2	100 11	778.90	(13/2) ⁺	E1	0.00858 12	
1156.038	(3/2 ⁺ , 5/2, 7/2 ⁺)	740.57 3	100 2	415.450	3/2 ⁺			
		795.93 9	49 7	360.046	7/2 ⁺			
		967.44 4	58 7	188.631	3/2 ⁺			
		1156.3 4	7 4	0.0	7/2 ⁺			
1162.90	(15/2 ⁺)	391.4 3	67 17	771.47	(13/2) ⁻			
		652.9 3	100 33	510.17	(15/2) ⁻			
1190.274	(5/2)	727.88‡ 5	21 2	462.191	3/2 ⁻			E_γ : level-energy difference=728.08.
		765.1	9.7 23	425.276	7/2 ⁺			
		774.6	4.0 17	415.450	3/2 ⁺			
		793.43 3	29 23	396.774	5/2 ⁺			
		920.3 2	5 2	270.170	7/2 ⁻			
		979.013 23	100 13	211.308	5/2 ⁺			
		1075.95 4	27 3	114.313	5/2 ⁺			
		1190.28 7	3.0 7	0.0	7/2 ⁺			
1211.07	(17/2 ⁻)	254.3 3	38 15	956.92	(19/2) ⁻	(M1+E2)	0.104 12	
		439.6 3	46 15	771.47	(13/2) ⁻			
		700.8 2	100 23	510.17	(15/2) ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. #	$\alpha^@$	Comments
1229.13	(17/2) ⁺	221.0 3	5.9 9	1008.11	(15/2) ⁺			
		450.2 2	100 5	778.90	(13/2) ⁺	E2	0.01636 23	
1234.098	(7/2)	483.59 5	36 1	750.47	(7/2 ⁻ , 9/2 ⁺)			
		512.7& 3	7& 3	721.23	7/2 ⁺			
		579.28 3	40 3	654.843	7/2 ⁻			
		583.03 3	26 7	651.014	(5/2 ⁺)			
		675.79‡ 4	13 1	558.17	(9/2) ⁺			E _γ : level-energy difference=675.92.
		686.943 21	46 3	547.124	(5/2, 7/2 ⁺)			
		696.264 21	90 6	537.863	5/2 ⁻			
		718.43 4	26 3	515.645	(9/2) ⁻			
		808.843 20	100 7	425.276	7/2 ⁺			
		837.40 3	16 1	396.774	5/2 ⁺			
		874.00 8	2.5 5	360.046	7/2 ⁺			
		945.80 3	11 1	288.208	9/2 ⁺			
		963.95 3	13 1	270.170	7/2 ⁻			
		1022.78 3	55 4	211.308	5/2 ⁺			
		1234.12 4	14 2	0.0	7/2 ⁺			
1239.622	(5/2 ⁺ , 7/2)	588.5 3	11 4	651.014	(5/2 ⁺)			
		681.34 15	15 3	558.17	(9/2) ⁺			
		842.847 23	100 10	396.774	5/2 ⁺			
		951.3	5 2	288.208	9/2 ⁺			
		1125.32 5	57 7	114.313	5/2 ⁺			
		1239.5 3	3.5 10	0.0	7/2 ⁺			
1264.01	(5/2, 7/2)	993.05	17 8	270.170	7/2 ⁻			E _γ : level-energy difference=993.84.
		1150.08‡ 8	100 10	114.313	5/2 ⁺			E _γ : level-energy difference=1149.70.
		1264.02 6	33 6	0.0	7/2 ⁺			
1290.079	(3/2 ⁺ , 5/2, 7/2)	864.9	5.3 20	425.276	7/2 ⁺			
		893.3	7.0 17	396.774	5/2 ⁺			
		929.8 4	17 2	360.046	7/2 ⁺			
		1078.76 3	100 11	211.308	5/2 ⁺			
		1175.75 6	5.3 12	114.313	5/2 ⁺			
		1290.11 6	6.5 12	0.0	7/2 ⁺			
1312.106	(5/2)	567.56	34 7	744.579	(3/2, 5/2 ⁺)			
		657.2	37 16	654.843	7/2 ⁻			
		849.926 25	44 4	462.191	3/2 ⁻			
		886.59 8	11 2	425.276	7/2 ⁺			
		896.65 14	8 3	415.450	3/2 ⁺			
		915.35 9	4.2 21	396.774	5/2 ⁺			
		952.0	15 6	360.046	7/2 ⁺			
		1041.95 3	58 6	270.170	7/2 ⁻			
		1100.77 3	100 10	211.308	5/2 ⁺			
		1123.47 8	30 5	188.631	3/2 ⁺			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)

E _i (level)	J _i ^π	E _γ [†]	I _γ [†]	E _f	J _f ^π	Mult. #	α [@]	Comments
1312.106	(5/2)	1197.84 6	14 2	114.313	5/2 ⁺			
		1312.13 6	15 2	0.0	7/2 ⁺			
1394.25	3/2 ⁺	978.8	100	415.450	3/2 ⁺			
1406.60	(17/2) ⁻	261.5 3	4.0 13	1145.30	(15/2) ⁻			
		398.4 2	100.0 13	1008.11	(15/2) ⁺	E1	0.00701 10	
1412.10	(5/2,7/2)	661.90 11	39 16	750.47	(7/2 ⁻ ,9/2 ⁺)			E _γ : level-energy difference=853.93.
		854.74	33 8	558.17	(9/2) ⁺			
		865.00 5	100 49	547.124	(5/2,7/2 ⁺)			
		986.68 10	18 4	425.276	7/2 ⁺			
		1051.90 11	33 10	360.046	7/2 ⁺			
		1141.77 & 8	<20 &	270.170	7/2 ⁻			
1448.24	(3/2 ⁺ ,5/2,7/2 ⁺)	1259.62 7	100 19	188.631	3/2 ⁺			
		1448.07 19	12 6	0.0	7/2 ⁺			
1476.97	(19/2 ⁺)	265.8 3	63 13	1211.07	(17/2) ⁻			
		314.2 3	38 13	1162.90	(15/2) ⁺			
		520.0 3	100 25	956.92	(19/2) ⁻			
1495.86	(5/2,7/2 ⁺)	1135.94 9	100 38	360.046	7/2 ⁺			
		1225.67 11	75 25	270.170	7/2 ⁻			
		1284.49 13	75 25	211.308	5/2 ⁺			E _γ : level-energy difference=1307.2.
		1307.6	50 25	188.631	3/2 ⁺			
		1381.42 8	100 25	114.313	5/2 ⁺			
		1495.80 14	75 25	0.0	7/2 ⁺			
1504.7	(23/2) ⁻	547.8 2	100	956.92	(19/2) ⁻	(E2)	0.00966 14	
1549.19	(19/2) ⁺	142.7 3	9 7	1406.60	(17/2) ⁻			
		320.0 3	17.6 17	1229.13	(17/2) ⁺			
		541.1 2	100 7	1008.11	(15/2) ⁺	E2	0.00997 14	
1568.60	(5/2 ⁺ ,7/2)	818.18	100 27	750.47	(7/2 ⁻ ,9/2 ⁺)			
		1021.8	45 18	547.124	(5/2,7/2 ⁺)			
		1171.97 10	68 14	396.774	5/2 ⁺			
		1280.28 12	18 9	288.208	9/2 ⁺			
		1298.32 10	14 9	270.170	7/2 ⁻			
		1357.26 11	36 9	211.308	5/2 ⁺			
		1454.29 12	23 9	114.313	5/2 ⁺			
		1568.43 18	9 5	0.0	7/2 ⁺			
1590.6	(19/2) ⁻	445.3 3	100	1145.30	(15/2) ⁻			
1612.7	(21/2) ⁻	401.6 3	9 6	1211.07	(17/2) ⁻			
		655.7 2	100 18	956.92	(19/2) ⁻			
1738.6	(21/2) ⁺	509.5 3	100	1229.13	(17/2) ⁺	E2	0.01169 16	
1884.9	(21/2) ⁻	335.8 3	100 17	1549.19	(19/2) ⁺			
		478.2 3	75 17	1406.60	(17/2) ⁻			
1923.6	(23/2 ⁺)	310.8 3	68 14	1612.7	(21/2) ⁻			
		419.0 3	91 46	1504.7	(23/2) ⁻			
		446.6 3	100 23	1476.97	(19/2) ⁺			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Pm})$ (continued)

<u>E_i(level)</u>	<u>J^{π}_i</u>	<u>E_{γ}[†]</u>	<u>I_{γ}[†]</u>	<u>E_f</u>	<u>J^{π}_f</u>	<u>Mult.[#]</u>	<u>α[@]</u>
2112.3	(27/2 ⁻)	607.6 2	100	1504.7	(23/2 ⁻)		
2122.0	(23/2) ⁺	237.0 3	47 13	1884.9	(21/2 ⁻)		
		572.8 3	100 25	1549.19	(19/2) ⁺	E2	0.00861 12

[†] Primarily from ¹⁴⁹Nd β^- decay, when a level is populated in this decay, as the energy and intensity data are more precise and complete than in (p,2n γ) and (d,3n γ). Exceptions are noted. Above 900 keV excitation, no levels are reported in (p,2n γ), and levels are separately populated in β^- decay and (d,3n γ).

[‡] Uncertainty doubled in the fitting procedure.

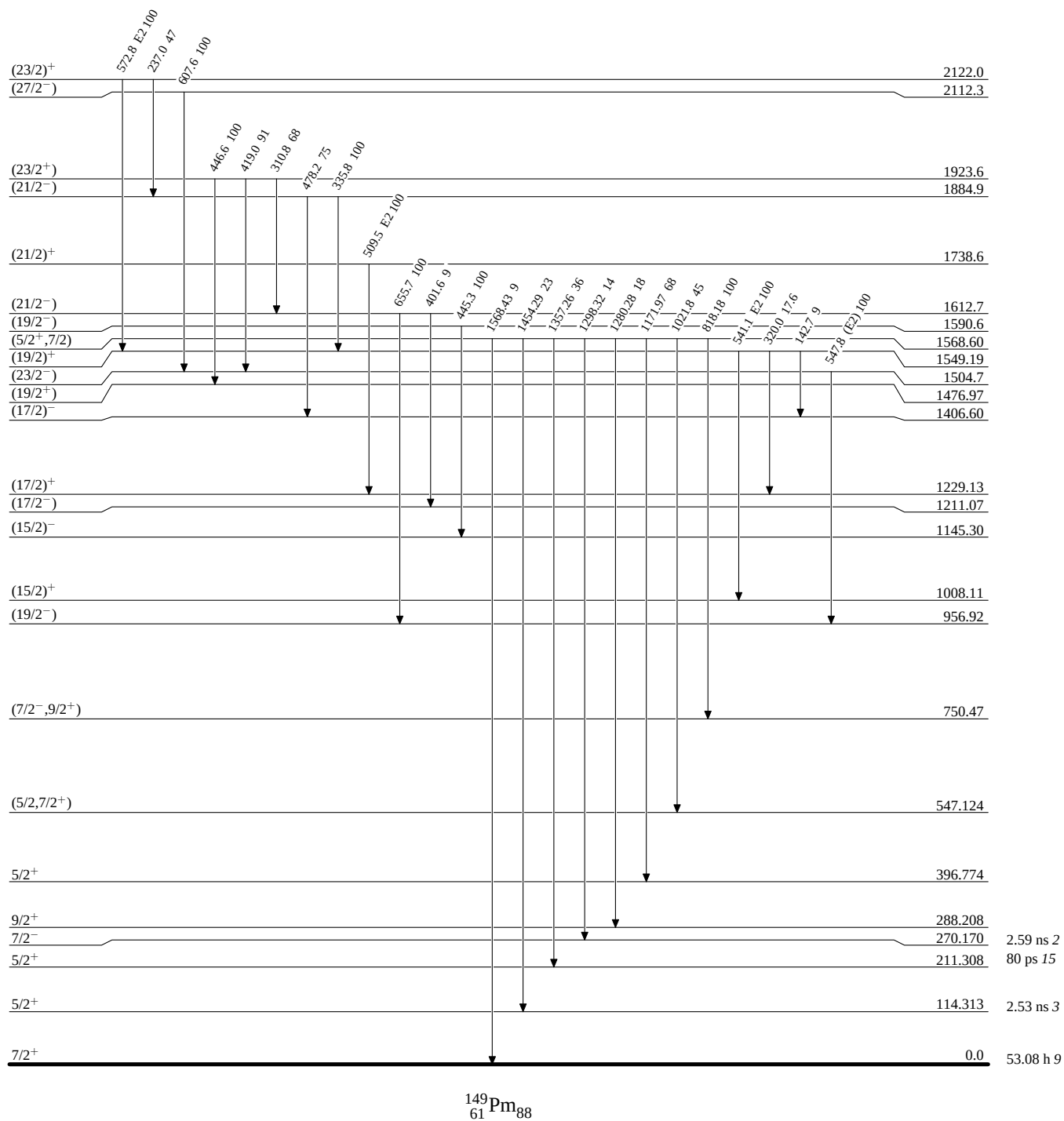
[#] From ce data in ¹⁴⁹Nd β^- decay, and in (d,3n γ). For levels populated in (p,2n γ) only, multipolarity assignment is from $\gamma(\theta)$ data.

[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[&] Multiply placed with undivided intensity.

Adopted Levels, Gammas**Level Scheme**

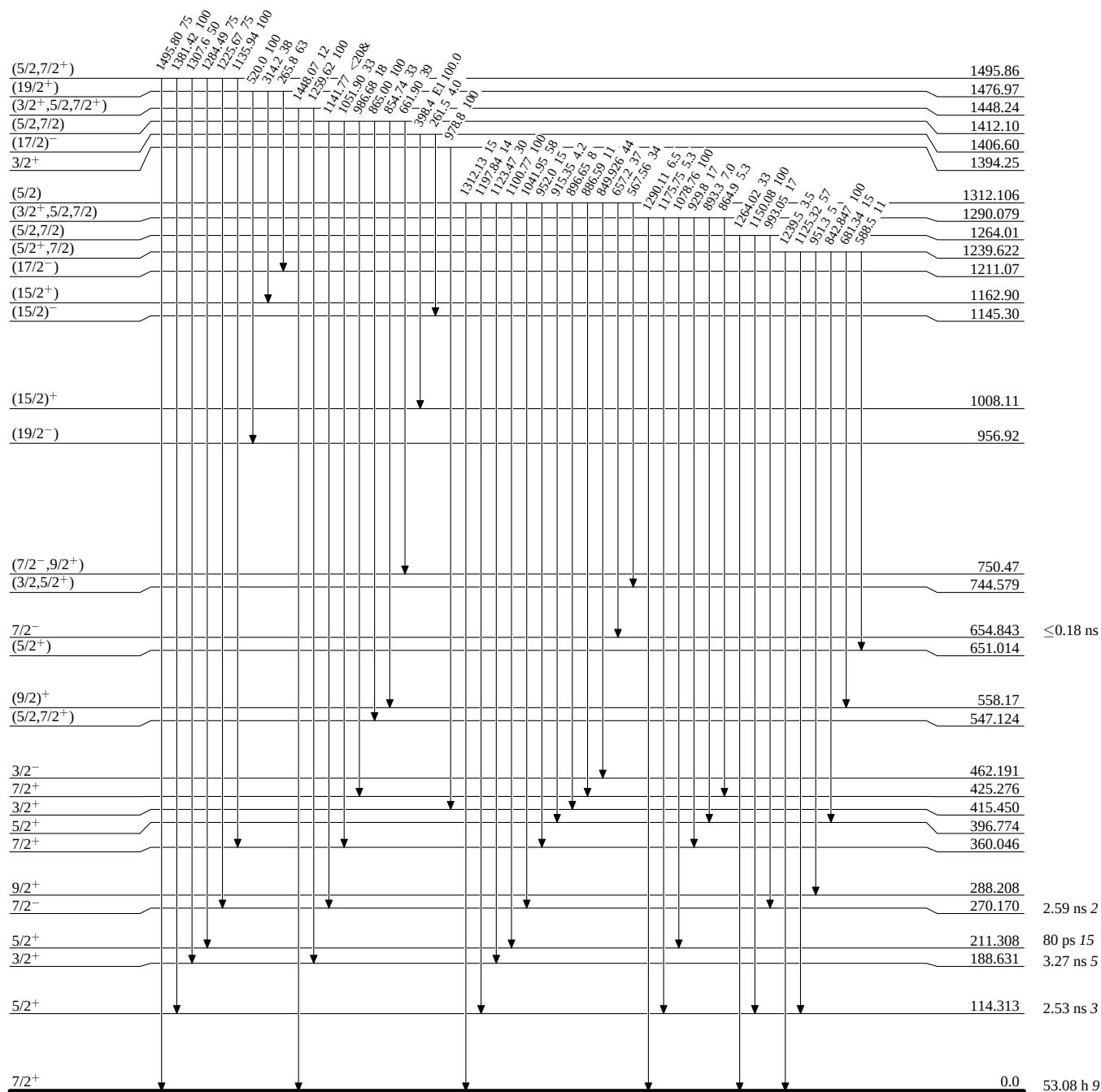
Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Level Scheme (continued)

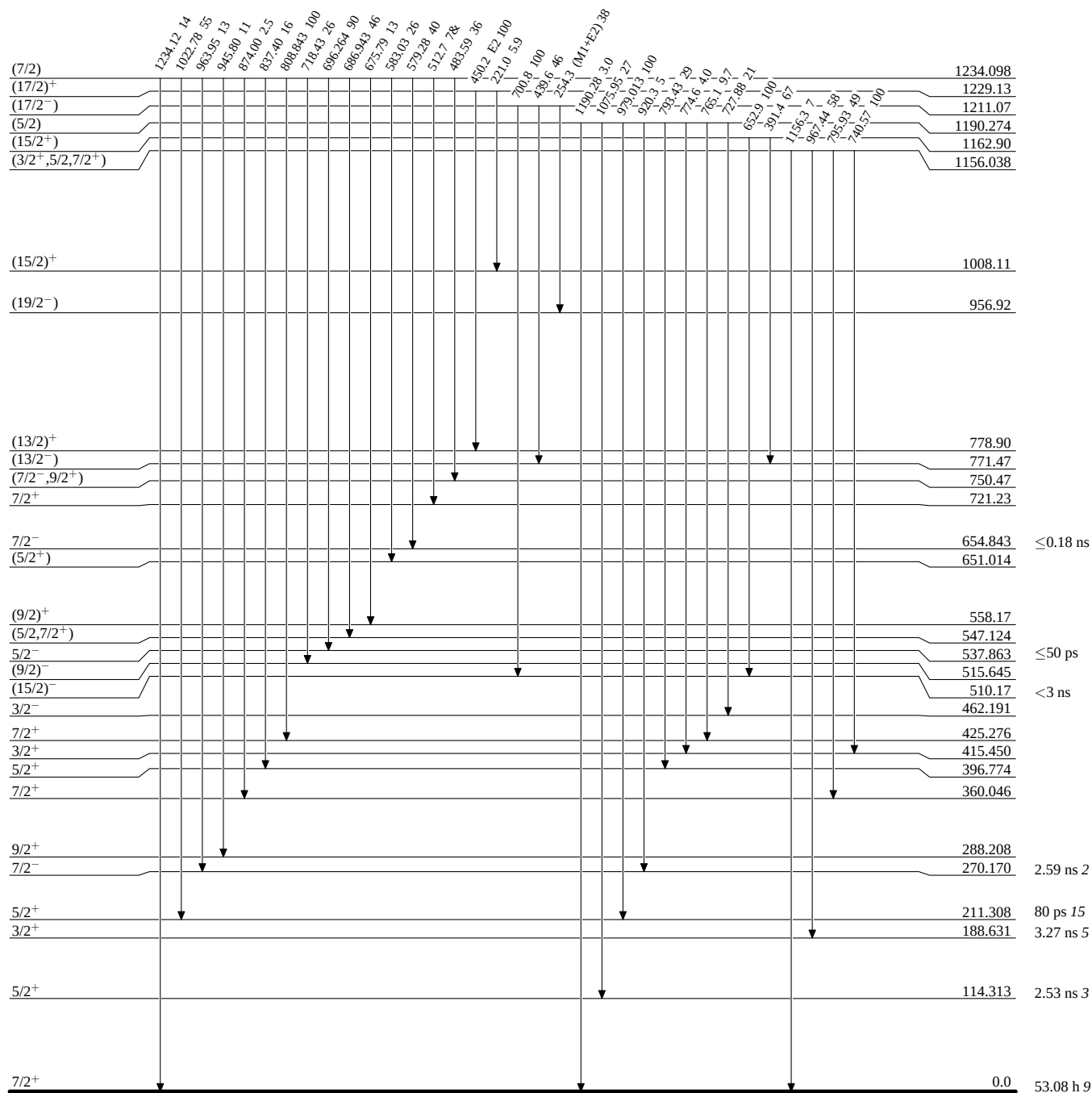
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



Adopted Levels, Gammas

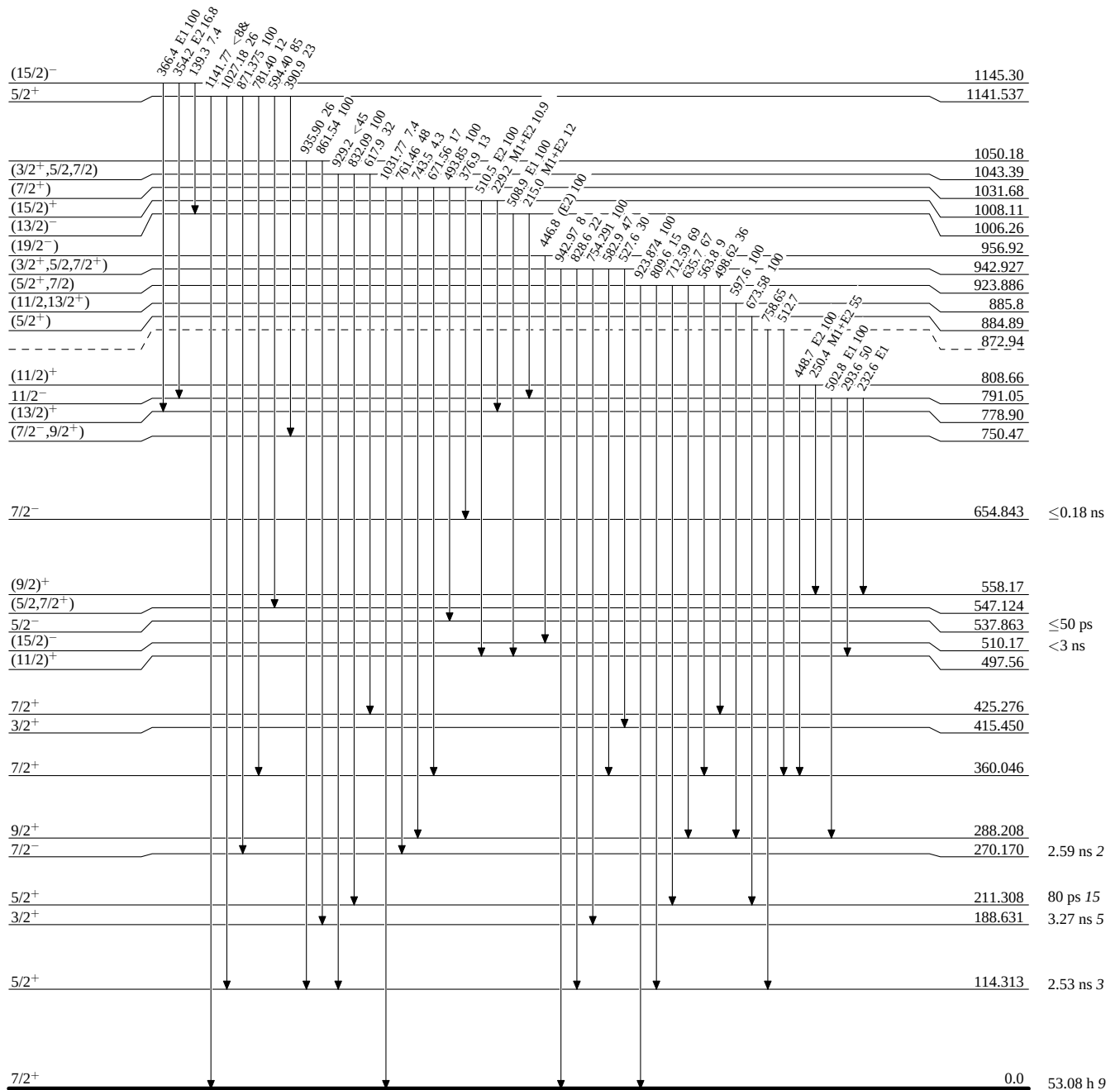
Level Scheme (continued)

Intensities: Relative photon branching from each level
 & Multiply placed: undivided intensity given



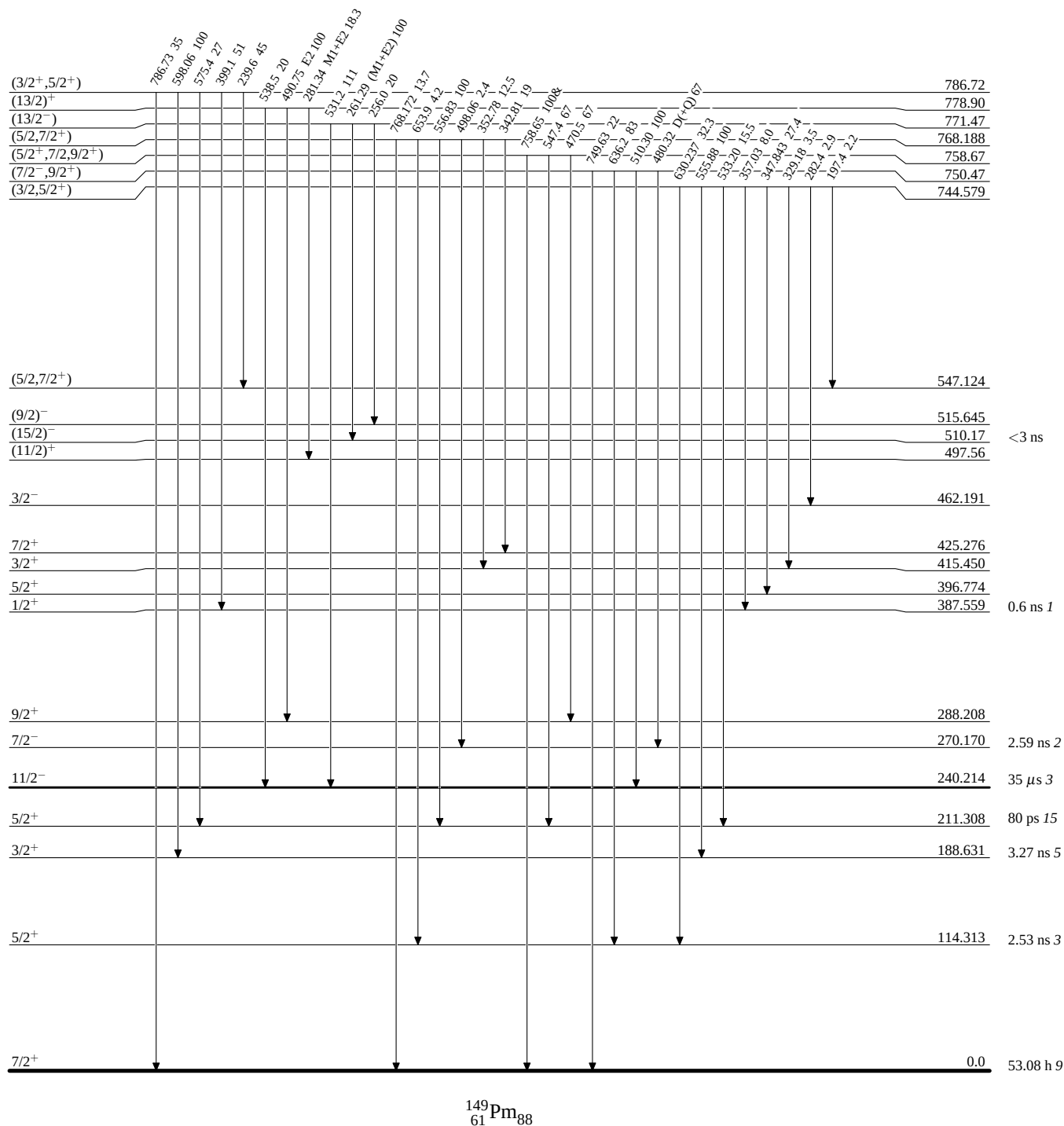
Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

 $^{149}_{61}\text{Pm}_{88}$

Adopted Levels, Gammas

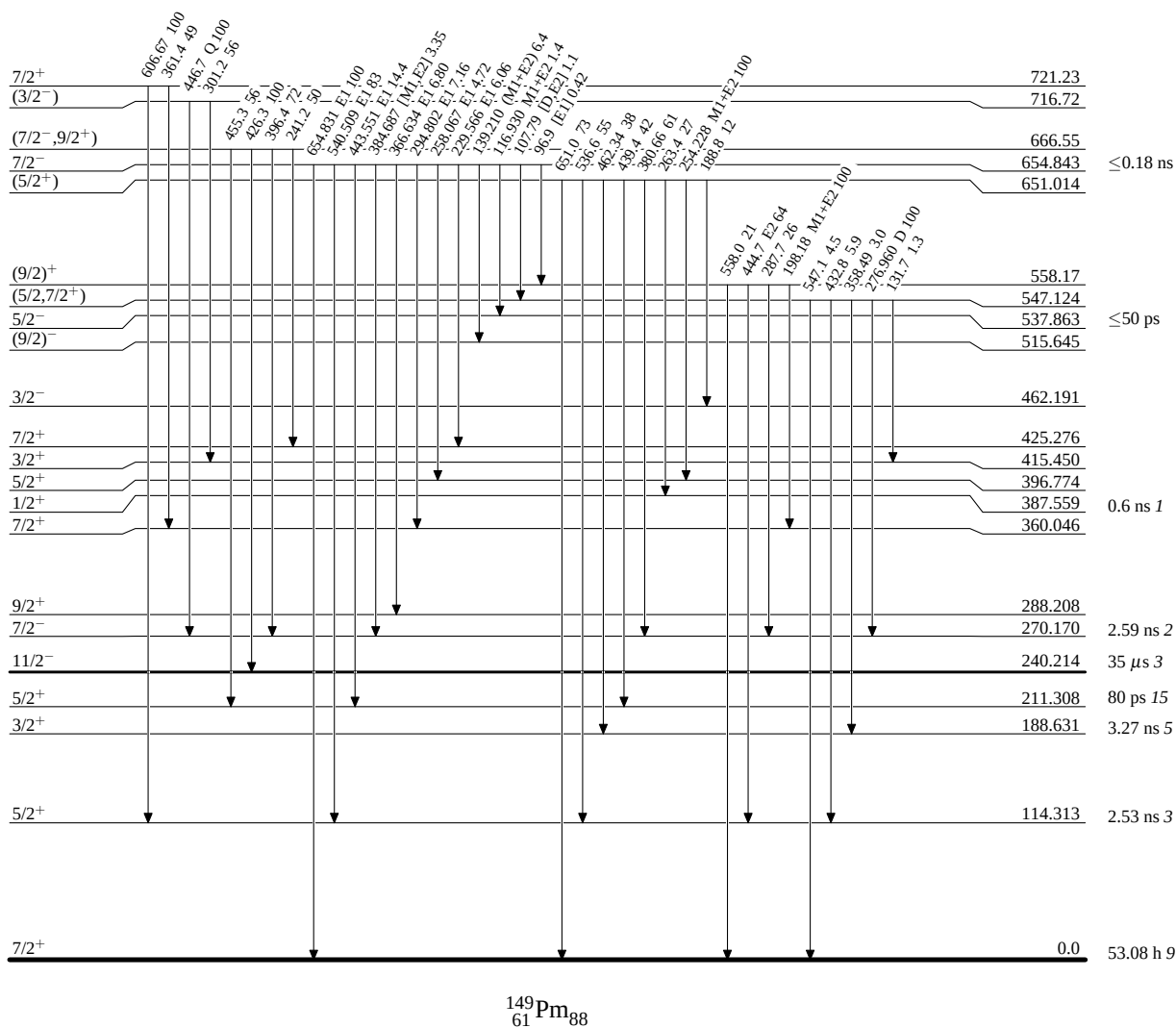
Level Scheme (continued)

 Intensities: Relative photon branching from each level
 & Multiply placed: undivided intensity given


Adopted Levels, Gammas

Level Scheme (continued)

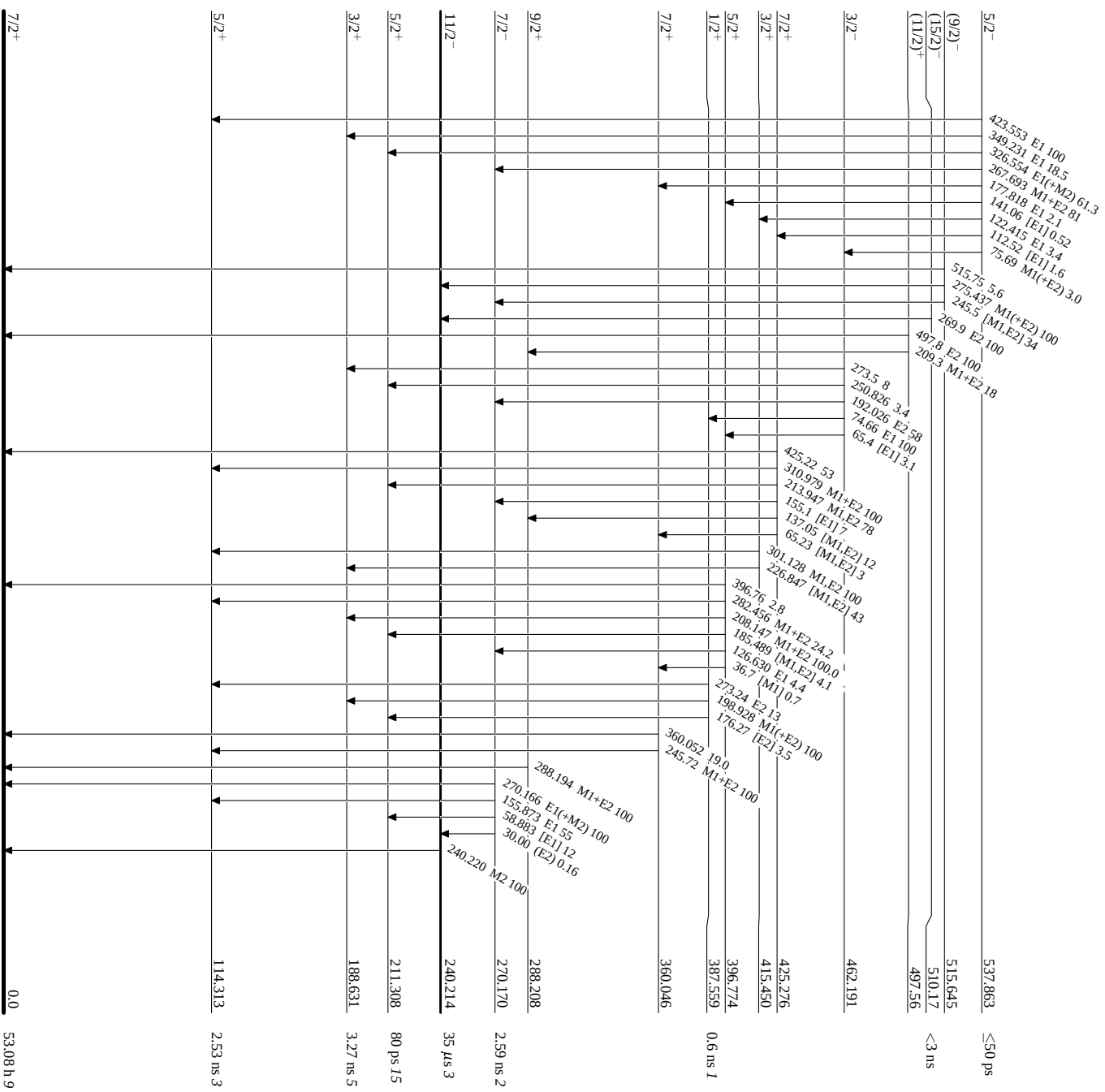
Intensities: Relative photon branching from each level
 & Multiply placed: undivided intensity given


 $^{149}_{61}\text{Pm}_{88}$

Adopted Levels, Gammas

Level Scheme (continued)

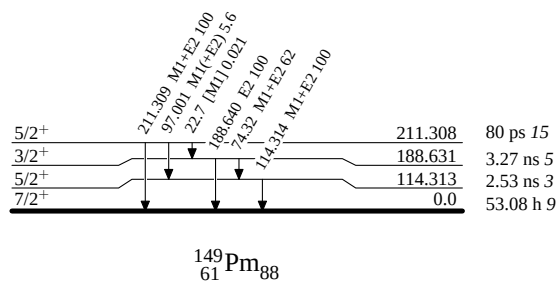
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



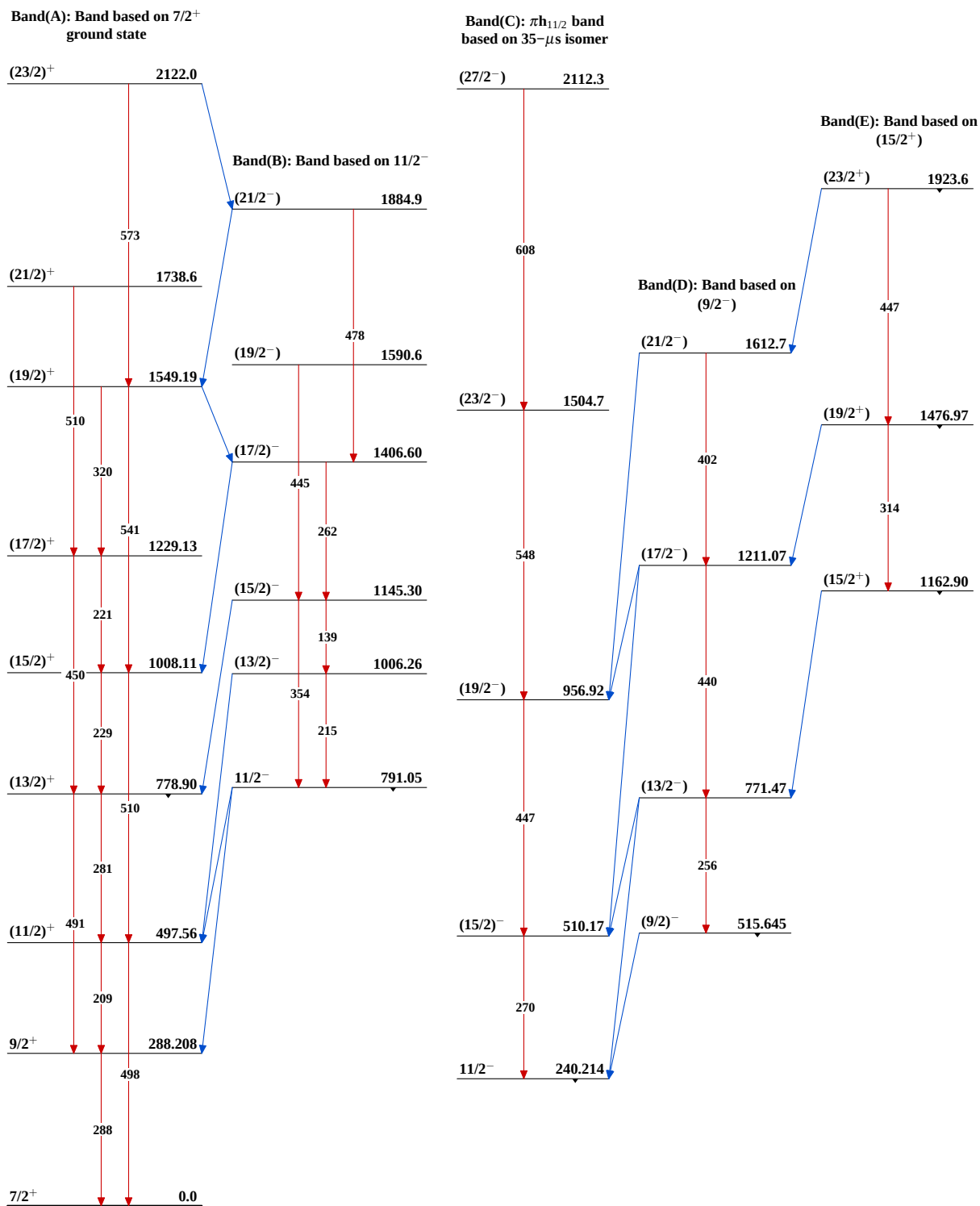
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
 & Multiply placed: undivided intensity given

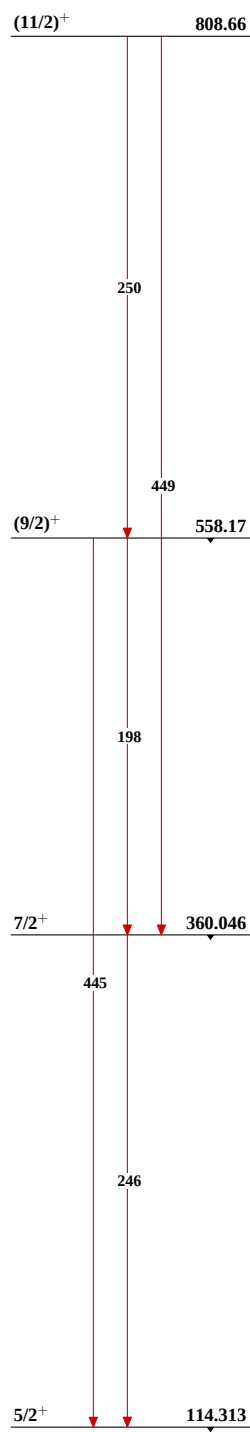


Adopted Levels, Gammas



Adopted Levels, Gammas (continued)

Band(F): Band based on $(5/2^+)$



$^{149}_{61}\text{Pm}_{88}$

¹⁴⁹Nd β^- decay (1.726 h) [1979Sc12](#),[1986Ii01](#),[2003Me01](#)

Parent: ¹⁴⁹Nd: E=0.0; J ^{π} =5/2⁻; T_{1/2}=1.726 h 5; Q(β^-)=1688.9 25; % β^- decay=100

¹⁴⁹Nd-J ^{π} , T_{1/2}: From ¹⁴⁹Nd Adopted Levels.

¹⁴⁹Nd-Q(β^-): From [2021Wa16](#).

[1979Sc12](#) (also [1979ScZL](#) thesis): measured E γ , I γ , $\gamma\gamma$ at Lawrence Livermore National Laboratory (LLNL).

[1986Ii01](#): measured γ , $\gamma\gamma$, $\gamma\gamma(\theta)$ at Kyoto University. γ -ray energies and intensities generally agree with those in [1979Sc12](#) and [1968He19](#). Authors report 199 γ rays, but energy and intensity uncertainties were not given.

[2003Me01](#): measured E γ , I γ , $\gamma\gamma$ at Instituto De Pesquisas Energeticas e Nucleares, Sao Paulo (IPEN).

[1966He04](#), [1968He19](#): measured E γ , I γ , $\gamma\gamma$ -coin, β^- , level half-life by $\beta\gamma(t)$, half-life of ¹⁴⁹Nd decay.

Other main references:

[1997Gr09](#), [1996Gr20](#): total absorption γ ray spectra (TAGS); deduced direct β^- feedings.

[1987Si13](#) (also [1989SiZQ](#)): γ , $\gamma(\theta, H, \text{temp})$ on oriented nuclei. Orientation was done at <16° mK in gadolinium host nuclei. The 654 γ was used for normalization for determination of the orientation parameter B₂. The A₄ terms were all zero within the statistical uncertainties. The A₂ values are given under comments.

[1970Se11](#): $\gamma\gamma(\theta)$, $\gamma\text{ce}(t)$, $\gamma\gamma(\theta, H, t)$ (magnetic moments by DPAC method).

[1970Be67](#): $\gamma\gamma(\theta, H, t)$ (magnetic moments by IPAC method).

Others:

γ : [1976CoZJ](#), [1973St22](#), [1972De67](#), [1972BaZU](#), [1970SeZY](#), [1969Gr32](#), [1967He20](#), [1966He04](#), [1966Go17](#), [1966Go05](#), [1965Ni03](#), [1965Cu01](#), [1965Ch09](#).

ce: [1972BaZU](#).

β^- , $\beta\gamma$: [1964Go08](#), [1952Ru10](#).

$\gamma\gamma$: [1965Cu01](#), [1965Ch09](#).

$\gamma\gamma(t)$: [1970Se11](#), [1969Ta08](#), [1968Az04](#), [1966Go05](#).

$\beta\gamma(t)$: [1965Fo08](#), [1968Az04](#).

β ce(t): [1967Ba27](#).

γ ce(t): [1967Ba27](#), [1970Se11](#).

$\gamma\gamma(\theta)$: [1969Be25](#), [1966Go05](#), [1966Sv01](#), [1965Ch09](#).

$\gamma\gamma(\theta, H, t)$: [1969Ta08](#), [1966Sv01](#), [1965Bo16](#).

T_{1/2} and production of ¹⁴⁹Nd: [1990Ab02](#), [1981Di01](#), [1980GuZN](#), [1973St22](#), [1967Me19](#), [1966Ri03](#), [1966He04](#), [1965Fo08](#),

[1964Go08](#), [1964Ho03](#), [1960Wi10](#), [1952Ru10](#), [1950Ma05](#), [1946Bo25](#), [1938Po05](#).

The level scheme is basically that of [1979Sc12](#) with some modifications as suggested by [1986Ii01](#) and [2003Me01](#).

Total decay energy deposit of 1736 keV 56 calculated by RADLIST code is in general agreement with expected value of 1688.9 keV 25 ([2021Wa16](#)), indicating the completeness of the decay scheme.

¹⁴⁹Pm Levels

E(level) [†]	J ^{π} [‡]	T _{1/2} [‡]	Comments
0.0	7/2 ⁺	53.08 h 9	
114.313 5	5/2 ⁺	2.53 ns 3	E(level): 114.3534 15 (2003Me01). T _{1/2} : weighted average of 2.54 ns 7 ($\gamma\gamma(t)$, 1970Se11); 2.42 ns 9 ($\gamma\gamma(t)$, 1969Ta08); 2.55 ns 5 ($\gamma\gamma(t)$, $\beta\gamma(t)$, 1968Az04); 2.58 ns 7 ($\gamma\text{ce}(t)$, 1967Ba27); 2.4 ns 2 ($\gamma\gamma(t)$, 1966Go05); 2.52 ns 4 ($\gamma\gamma(t)$, 1965Cu01); 2.62 ns 10 ($\beta\gamma(t)$, 1965Fo08). Other: 3.2 ns 1 ($\beta\text{ce}(t)$, 1967Ba27) is not included in the average. g factor=0.83 6 (1970Be67). Others: 0.81 3, 0.77 7 (1970Se11), 1.01 12 (1969Ta08), 0.91 10 (1966Sv01).
188.631 6	3/2 ⁺	3.27 ns 5	E(level): 188.6796 17 (2003Me01). T _{1/2} : weighted average of 3.24 ns 7 ($\gamma\text{ce}(t)$, 1970Se11); 3.24 ns 10 ($\beta\text{ce}(t)$, 1967Ba27); 3.46 ns 14 ($\gamma\gamma(t)$, 1965Cu01). g factor=0.72 10 (1970Be67), 1.5 4 (1970Se11).
211.308 5	5/2 ⁺	80 ps 15	E(level): 211.3624 15 (2003Me01). T _{1/2} : $\beta\text{ce}(t)$ (1967Ba27). Others: ≤ 0.8 ns ($\gamma\gamma(t)$, 1965Cu01); ≤ 0.3 ns ($\beta\gamma(t)$, 1965Fo08). g factor=0.87 14 (1970Be67).
240.215 7	11/2 ⁻	35 μ s 3	E(level): 240.3946 19 (2003Me01). T _{1/2} : cey(t) (1967Ba27). Other: 41 μ s 10 ($\beta\gamma(t)$, 1966He04).
270.170 5	7/2 ⁻	2.59 ns 2	E(level): 270.2069 15 (2003Me01).

Continued on next page (footnotes at end of table)

$^{149}\text{Nd} \beta^-$ decay (1.726 h) [1979Sc12](#), [1986Ii01](#), [2003Me01](#) (continued) ^{149}Pm Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2} [‡]	Comments
			T _{1/2} : weighted average of 2.55 ns 7 ($\gamma\gamma$ (t), 1970Se11); 2.64 ns 7 (βce (t), 1967Ba27); 2.6 ns 2 ($\gamma\gamma$ (t), 1966Go05); 2.58 ns 4 ($\gamma\gamma$ (t), 1965Cu01), 2.7 ns 2 ($\beta\gamma$ (t), 1965Fo08).
288.208 8	9/2 ⁺		g factor=0.62 3 (1970Be67); 0.98 14, 1.07 7 (1970Se11). E(level): 288.2274 21 (2003Me01). J ^π : M1+E2 γ to 7/2 ⁺ gives 5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺ but 5/2 ⁺ , 7/2 ⁺ are excluded by (366 γ)(288 γ)(θ) (1986Ii01).
360.046 9	7/2 ⁺		E(level): 360.139 5 (2003Me01).
387.559 10	1/2 ⁺	0.6 ns 1	E(level): 387.609 4 (2003Me01). T _{1/2} : βce (t) (1967Ba27).
396.774 7	5/2 ⁺		E(level): 396.8556 23 (2003Me01).
415.449 9	3/2 ⁺		E(level): 415.559 5 (2003Me01).
425.276 7	7/2 ⁺		E(level): 425.2798 22 (2003Me01). J ^π : M1+E2 γ to 5/2 ⁺ and γ to 9/2 ⁺ give 5/2 ⁺ , 7/2 ⁺ but (229 γ)(214 γ)(θ) excludes 5/2 ⁺ (1986Ii01).
462.191 10	3/2 ⁻		E(level): 462.349 3 (2003Me01).
515.645 9	(9/2) ⁻		E(level): 515.796 4 (2003Me01).
537.863 6	5/2 ⁻	≤50 ps	E(level): 537.9789 20 (2003Me01). T _{1/2} : βce (t) (1967Ba27). Other: ≤0.5 ns ($\beta\gamma$ (t), 1965Cu01).
547.126 13	(5/2, 7/2 ⁺)		E(level): 547.076 6 (2003Me01).
558.15 5	(9/2) ⁺		E(level): 556.233 4; 9/2 ⁺ (2003Me01).
637.43?# 20			E(level): 635.983 25; (3/2 ⁺ , 5/2 ⁺) (2003Me01). E(level): 635.97 γ proposed from this level by 2003Me01 is a very poor fit. See comment for 635.7 γ from 923.9 level.
651.021 18	(5/2 ⁺)		E(level): 651.132 6 (2003Me01).
654.843 5	7/2 ⁻	≤0.18 ns	E(level): 654.9478 23 (2003Me01). T _{1/2} : $\beta\gamma$ (t) (1965Cu01 , 1966He04).
721.23? 11	7/2 ⁺		E(level): 721.93 3 (2003Me01). E(level): from 1979ScZL , not given in 1979Sc12 and 1986Ii01 .
744.579 13	(3/2, 5/2 ⁺)		E(level): 744.575 6 (2003Me01).
750.41 5	(7/2 ⁻ , 9/2 ⁺)		E(level): 750.491 15; 7/2 ⁻ (2003Me01).
758.67@ 7	(5/2 ⁺ , 7/2, 9/2 ⁺)		E(level): 758.075 19 (2003Me01).
768.188 17	(5/2, 7/2 ⁺)		E(level): 767.482 12; (5/2, 7/2 ⁺) (2003Me01).
786.72 3	(3/2 ⁺ , 5/2 ⁺)		E(level): 785.86 3 (2003Me01).
872.94?& 8			
884.89@ 7	(5/2 ⁺)		E(level): 885.82 14 (2003Me01).
923.886 18	(5/2 ⁺ , 7/2)		E(level): 924.05 21 (2003Me01).
942.926 22	(3/2 ⁺ , 5/2, 7/2 ⁺)		E(level): 942.505 20 (2003Me01).
956.87?# 7			E(level): 956.83 7; 7/2 ⁺ (2003Me01).
1031.68 3	(7/2 ⁺)		E(level): 1031.75 4 (2003Me01).
1043.39 5	(3/2 ⁺ , 5/2, 7/2)		E(level): 1043.69 20 (2003Me01).
1050.18 3			E(level): 1049.655 24; (1/2 ⁺ , 3/2, 5/2 ⁺) (2003Me01).
1141.528 18	5/2 ⁺		E(level): 1141.67 4 (2003Me01).
1156.034 24	(3/2 ⁺ , 5/2, 7/2 ⁺)		E(level): 1156.971 8 (2003Me01).
1181.30?# 7			J ^π : (3/2 ⁺ , 5/2 ⁺) (2003Me01).
1190.274 17	(5/2)		E(level): 1190.728 7 (2003Me01).
1234.099 9	(7/2)		E(level): 1234.242 6 (2003Me01).
1239.616 21	(5/2 ⁺ , 7/2)		E(level): 1239.75 3 (2003Me01).
1264.01 6	(5/2, 7/2)		E(level): 1264.28 5 (2003Me01).
1290.078 25	(3/2 ⁺ , 5/2, 7/2)		E(level): 1290.85 22 (2003Me01).
1293.4?# 4			J ^π : (3/2 ⁺ , 5/2, 7/2).
1312.106 15	(5/2)		E(level): 1312.506 20 (2003Me01).
1328.81?# 7			J ^π : 3/2 ⁺ (2003Me01).
1363.85?# 4			J ^π : 5/2 ⁺ (2003Me01).

Continued on next page (footnotes at end of table)

^{149}Nd β^- decay (1.726 h) [1979Sc12](#),[1986Ii01](#),[2003Me01](#) (continued) ^{149}Pm Levels (continued)

E(level) [†]	J^π [‡]	Comments
1367.97?# 13		J^π : (5/2 ⁺ , 7/2, 9/2).
1394.25@ 20	3/2 ⁺	E(level): 1391.691 6; (5/2 ⁺ , 7/2 ⁺) (2003Me01).
1406.84?# 8		J^π : 9/2 ⁻ (2003Me01).
1412.10 4	(5/2, 7/2)	E(level): 1411.89 3; 7/2 ⁻ (2003Me01).
1448.24 7	(3/2 ⁺ , 5/2, 7/2 ⁺)	E(level): 1449.250 23 (2003Me01).
1495.86 5	(5/2, 7/2 ⁺)	E(level): 1495.19 11 (2003Me01).
1568.60 5	(5/2 ⁺ , 7/2)	E(level): 1568.63 6 (2003Me01).

[†] From least-squares fit to E_γ data, assuming $\Delta E_\gamma = 0.2$ keV, when not stated. With the quoted uncertainties, 13 γ rays from levels above 745 keV fitted poorly, with a resultant reduced $\chi^2 = 4.5$ as compared to critical χ^2 of 1.3. Uncertainties for such γ rays were doubled (generally from 0.05 keV to 0.10 keV) in the least-squares fitting procedure. Exception was 750.63 γ from 750-keV level, where uncertainty was increased to 0.2 keV from the quoted 0.05 keV. With the adjustment of uncertainties, reduced χ^2 is 1.6, and only three γ rays out of a total of 227 γ rays fit somewhat poorly.

[‡] From the Adopted Levels.

Level proposed by [2003Me01](#) only is treated as uncertain by the evaluators, and is not included in the Adopted Levels.

@ Level not reported by [1986Ii01](#).

& Level from [1986Ii01](#) only.

 β^- radiations

E(decay)	E(level)	$I\beta^-$ ^{†‡}	Log f_t	Comments
(120.3 25)	1568.60	0.018 3	6.2 1	$I\beta^-$: 0.045 (TAGS, 1997Gr09), 0.063 (2003Me01).
(193.0 25)	1495.86	0.010 2	7.1 1	$I\beta^-$: 0.059 (TAGS, 1997Gr09), 0.014 (2003Me01).
(240.7 25)	1448.24	0.0047 9	7.7 1	$I\beta^-$: 0.020 (TAGS, 1997Gr09), 0.067 (2003Me01).
(276.8 25)	1412.10	0.032 8	7.1 1	$I\beta^-$: 0.046 (TAGS, 1997Gr09), 0.110 (2003Me01).
(282.1# 25)	1406.84?	0.035 3	7.04 4	$I\beta^-$: 0.049 (2003Me01).
(294.7 25)	1394.25	0.016 6	7.4 2	$I\beta^-$: 0.023 (TAGS, 1997Gr09), 0.101 (2003Me01).
(320.9# 25)	1367.97?	0.016 13	7.6 4	$I\beta^-$: 0.022 (2003Me01).
(325.1# 25)	1363.85?	0.024 3	7.40 6	$I\beta^-$: 0.068 (2003Me01).
(360.1# 25)	1328.81?	0.034 4	7.40 6	$I\beta^-$: 0.039 (2003Me01).
(376.8 25)	1312.106	0.183 13	6.73 4	$I\beta^-$: 0.17 (TAGS, 1997Gr09), 0.273 (2003Me01).
(395.5# 25)	1293.4?	0.018 8	7.8 2	$I\beta^-$: 0.0025 (2003Me01).
(398.8 25)	1290.078	0.090 8	7.12 4	$I\beta^-$: 0.083 (TAGS, 1997Gr09), 0.107 (2003Me01).
(424.9 25)	1264.01	0.035 4	7.62 5	$I\beta^-$: 0.032 (TAGS, 1997Gr09), 0.058 (2003Me01).
(449.3 25)	1239.616	0.10 1	7.25 5	$I\beta^-$: 0.092 (TAGS, 1997Gr09), 0.16 (2003Me01).
(454.8 25)	1234.099	0.94 4	6.29 2	$I\beta^-$: 0.87 (TAGS, 1997Gr09), 1.58 (2003Me01).
(498.6 25)	1190.274	0.16 1	7.19 3	$I\beta^-$: 0.14 (TAGS, 1997Gr09), 1.06 (2003Me01).
(507.6# 25)	1181.30?	0.094 5	7.45 3	$I\beta^-$: 0.11 (2003Me01).
(532.9 25)	1156.034	0.031 2	8.00 3	$I\beta^-$: 0.055 (TAGS, 1997Gr09), 0.44 (2003Me01).
(547.4 25)	1141.528	0.086 6	7.60 4	$I\beta^-$: 0.15 (TAGS, 1997Gr09), 0.052 (2003Me01).
(638.7 25)	1050.18	0.022 2	8.42 4	$I\beta^-$: 0.036 (TAGS, 1997Gr09), 0.16 (2003Me01).
(645.5 25)	1043.39	0.036 5	8.22 6	$I\beta^-$: 0.068 (TAGS, 1997Gr09), 0.019 (2003Me01).
(657.2 25)	1031.68	0.10 1	7.81 5	$I\beta^-$: 0.19 (TAGS, 1997Gr09), 0.090 (2003Me01).
(732.0# 25)	956.87?	<0.01	>9.0	
(746.0 25)	942.926	0.081 10	8.09 6	$I\beta^-$: 0.088 (TAGS, 1997Gr09), 0.57 (2003Me01).
(765.0 25)	923.886	0.30 2	7.56 3	$I\beta^-$: 0.33 (TAGS, 1997Gr09), 0.24 (2003Me01).
(804.0 25)	884.89	0.011 3	9.1 1	$I\beta^-$: 0.012 (TAGS, 1997Gr09).
(816.0 25)	872.94?	0.028 6	8.7 1	$I\beta^-$: 0.031 (TAGS, 1997Gr09).

Continued on next page (footnotes at end of table)

^{149}Nd β^- decay (1.726 h) [1979Sc12](#), [1986Ii01](#), [2003Me01](#) (continued) β^- radiations (continued)

E(decay)	E(level)	$I\beta^{-\dagger\dagger}$	Log ft	Comments
(902.2 25)	786.72	0.074 8	8.42 5	$I\beta^-$: 0.077 (TAGS, 1997Gr09), 0.049 (2003Me01).
(920.7 25)	768.188	0.66 6	7.51 4	$I\beta^-$: 0.69 (TAGS, 1997Gr09), 1.08 (2003Me01).
(930.2 25)	758.67	0.036 8	8.8 1	$I\beta^-$: 0.038 (TAGS, 1997Gr09), 0.24 (2003Me01).
(938.5 25)	750.41	0.08 2	8.5 1	$I\beta^-$: 0.074 (TAGS, 1997Gr09), 0.34 (2003Me01).
(944.3 25)	744.579	1.11 5	7.32 2	E(decay): 920 ($\beta\gamma$, 1966He04), 950 (1952Ru10). $I\beta^-$: 1.16 (TAGS, 1997Gr09), 1.98 (2003Me01).
(967.7 [#] 25)	721.23?	<0.01	>9.4	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.167 (2003Me01).
(1034.1 25)	654.843	19.3 8	6.22 2	E(decay): 1025 20 (1964Go08); 1000, 1020 ($\beta\gamma$, 1966He04). $I\beta^-$: 17.2 (TAGS, 1997Gr09), 30 (1964Go08), 23.9 (2003Me01).
(1037.9 25)	651.021	0.30 5	8.0 1	$I\beta^-$: 0.27 (TAGS, 1997Gr09), 0.12 (2003Me01).
(1051.5 [#] 25)	637.43?	<0.01	>9.5	
(1130.8 [#] 25)	558.15	<0.02	>9.3	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.70 (2003Me01).
(1141.8 [#] 25)	547.126	<0.14	>8.5	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.25 (2003Me01).
(1151.0 25)	537.863	21.5 9	6.35 2	E(decay): 1130 20 (1964Go08); 1100, 1120, 1130 ($\beta\gamma$, 1966He04), 1100 (1952Ru10). $I\beta^-$: 20.6 (TAGS, 1997Gr09), 26 (1964Go08), 23.8 (2003Me01).
(1173.3 [#] 25)	515.645	<0.15	>8.5	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.45 (2003Me01).
(1226.7 25)	462.191	1.2 3	7.7 1	$I\beta^-$: 1.6 (TAGS, 1997Gr09), 1.13 (2003Me01).
(1263.6 25)	425.276	0.61 9	8.1 1	$I\beta^-$: 0.78 (TAGS, 1997Gr09), 1.20 (2003Me01).
(1273.5 25)	415.449	0.16 3	8.6 1	$I\beta^-$: 0.21 (TAGS, 1997Gr09); 0.26 (2003Me01).
(1292.1 25)	396.774	3.31 12	7.34 2	E(decay): 1300 ($\beta(185\gamma)$, 1966He04). $I\beta^-$: 4.3 (TAGS, 1997Gr09), 2.19 (2003Me01).
(1301.3 [#] 25)	387.559	<0.6	>8.8 ^{1u}	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.037 (2003Me01).
(1328.9 [#] 25)	360.046	<0.2	>8.6	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.63 (2003Me01).
(1400.7 [#] 25)	288.208	<0.02	>10.5 ^{1u}	$I\beta^-$: 0 (TAGS, 1997Gr09), 0.025 (2003Me01).
(1418.7 25)	270.170	17.5 18	6.78 5	E(decay): 1425 20 (1964Go08); 1360, 1400 from $\beta\gamma$ (1966He04). $I\beta^-$: 16.7 (TAGS, 1997Gr09), 38 (1964Go08), 12.2 (2003Me01).
(1477.6 25)	211.308	24.7 16	6.70 3	E(decay): 1450 20 ($\beta\gamma$, 1964Go08), 1470 ($\beta\gamma$, 1966He04). $I\beta^-$: 23.5 (TAGS, 1997Gr09), 20.4 (2003Me01).
(1500.3 [#] 25)	188.631	<2.7	>7.7	$I\beta^-$: 0 (TAGS, 1997Gr09).
(1574.6 25)	114.313	6 3	7.4 2	E(decay): 1555 10 (1964Go08), 1560 (1966He04), 1500 (1952Ru10 , 1950Ma05), 1600 (1946Bo25). $I\beta^-$: 7.6 (TAGS, 1997Gr09), 6 (1964Go08), 2.71 (2003Me01).
(1688.9 [#] 25)	0.0	<5	>7.6	$I\beta^-$: 2.8 44 (tags data, 1997Gr09 , 1996Gr20).

[†] From γ -ray intensity balance. The values agree well with those from TAGS data of [1997Gr09](#). [2003Me01](#) quote following β^- feedings for some of the levels where no feedings are found from γ -ray intensity balance based on level scheme and $I\gamma$ data adopted here: 0.52 for 240 level; 0.031 for 636 level; 0.014 for 957 level.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

γ(¹⁴⁹Pm)

I_γ normalization: from Σ(I(γ+ce) of γ rays to g.s.)=100, with no β⁻ feeding to the g.s., consistent with results of TAGS data (1997Gr09,1996Gr20) giving I_β(to g.s.)=2.8 44. If all the unplaced γ intensities were assumed to feed the g.s., I_γ normalization would only be reduced by 0.12%. 1966He04 report I_γ(654γ)=8.4% 5 from 4πβγ which leads to Σ(I(γ+ce) to g.s.)=106% 8 consistent with assumption of I_β(g.s.)=0. This value of I_γ normalization gives absolute intensities which are in good agreement with those given by 1969Gr32 for selected γ rays.

The E_γ and I_γ data from 2003Me01 are not used in averaging E_γ and I_γ values, since the spectra presented in this paper seem to contain large contributions either from background peaks or from other contaminants. Several strong γ rays reported in this paper are not seen in earlier papers (1979Sc12,1986Ii01,1968He19). Moreover, within the quoted uncertainties for E_γ values, many γ-ray energies do not agree well with level-energy differences; deviations being many times the quoted uncertainties. Thus there is a problem of internal consistency of level scheme in this paper. Only some of the weak transitions from 2003Me01 are tentatively incorporated in the level scheme given here. E_γ and I_γ data from 2003Me01 are listed in comments.

E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [†]	δ [‡]	α ^l	Comments
22.7 ^h	0.021 ^{& 6}	211.308	5/2 ⁺	188.631	3/2 ⁺	[M1]		18.20 25	%I _γ =0.0055 16 I _γ : 0.06 (1986Ii01). δ: <1.0 for a non-negative β feed to 188 level.
^x 26.394 ^{j 22} 30.00 ^{@h 3}	0.067 17	270.170	7/2 ⁻	240.215	11/2 ⁻	(E2)		341	%I _γ =0.017 4 E _γ =30.077 26 (2003Me01). δ(E2/M1)>0.7 from L1/L3<0.076 and L2/L3=0.8 +3-2, but E2 required from level scheme.
^x 33.964 ^{j 16} 36.7 ^{he}	0.07 ^{& 3}	396.774	5/2 ⁺	360.046	7/2 ⁺	[M1]		4.38 6	%I _γ =0.018 8 δ: <0.56 for a non-negative β feed to the 360 level.
^x 39.065 ^{j 9} ^x 44.341 ^{j 14} ^x 58.526 ^{j 11} 58.883 20	5.47 9 5.0 8	270.170	7/2 ⁻	211.308	5/2 ⁺	[E1]		1.110 16	%I _γ =1.42 5 %I _γ =1.30 21 E _γ : from 1968He19. E _γ =59.652 8, I _γ =7.66 13 (2003Me01). (59γ)(211γ)(θ): A ₂ =-0.02 3, A ₄ =-0.01 4 (1986Ii01).
65.23 ^f	0.06 ^{a 2}	425.276	7/2 ⁺	360.046	7/2 ⁺	[M1,E2]		8.2 29	%I _γ =0.016 5 E _γ =65.792 8, I _γ =0.34 4 (2003Me01).
65.42 ^{hf}	0.12 ^{a 4}	462.191	3/2 ⁻	396.774	5/2 ⁺	[E1]		0.840 12	%I _γ =0.031 10 E _γ : other: 65.356 24 (1968He19) for doublet.
^x 67.20 ^{j 19} ^x 69.510 ^{j 21} ^x 72.753 ^{j 12} 74.32 ^{@ 3}	0.17 4 0.25 3 2.30 5 4.3 9	188.631	3/2 ⁺	114.313	5/2 ⁺	M1+E2	+0.71 6	4.68 14	%I _γ =0.044 10 %I _γ =0.065 8 %I _γ =0.597 22 %I _γ =1.12 24

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

<u>γ(¹⁴⁹Pm) (continued)</u>									
<u>E_γ[‡]</u>	<u>I_γ^{#k}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[†]</u>	<u>δ[‡]</u>	<u>α^l</u>	<u>Comments</u>
74.66 [@] 10	3.8 6	462.191	3/2 ⁻	387.559	1/2 ⁺	E1		0.590 9	Eγ=74.932 4, Iγ=12.45 10 (2003Me01). δ: from L2/L1=1.6 3 and L3/L1=1.5 2. Other: >+0.1 (γγ(θ), 1986Ii01).
75.69 ^h 6	0.88 8	537.863	5/2 ⁻	462.191	3/2 ⁻	M1(+E2)	<0.8	4.0 6	%Iγ=0.99 16 Eγ=74.932 4, Iγ=12.45 10 (2003Me01). δ(M2/E1)<0.09 from α(K)exp=0.5 3.
^x 77.097 ^j 10	2.35 5								%Iγ=0.229 22 δ: from α(K)exp=4.0 12.
^x 80.305 ^j 10	1.74 3								%Iγ=0.610 23
^x 90.12 ^j 5	0.199 11								%Iγ=0.452 16
^x 91.125 ^d 22									%Iγ=0.0517 33 Proposed placement (2003Me01): 515.8 – 425.3. Poor fit (evaluators).
^x 92.89 ^j 3	0.216 13								%Iγ=0.056 4
^x 94.88 ^e 10	0.16 5								%Iγ=0.042 13
96.9	0.13 ^a 5	654.843	7/2 ⁻	558.15	(9/2) ⁺	[E1]		0.291 4	%Iγ=0.034 13 Eγ=96.3 3, Iγ=0.18 11 (2003Me01).
97.001 12	5.6 ^a 4	211.308	5/2 ⁺	114.313	5/2 ⁺	M1(+E2)	+0.09 9	1.696 31	%Iγ=1.45 11 Eγ=97.354 17, Iγ=4.414 4 (2003Me01). δ: from γγ(θ) (1986Ii01). γγ(θ) also gives -1.3 3 but is inconsistent with <0.14 from α(K)exp=1.8 4 and K/L=8.8 22.
107.79 3	0.33 6	654.843	7/2 ⁻	547.126	(5/2,7/2 ⁺)	[D,E2]		1.0 8	%Iγ=0.086 16 Eγ=108.189 14, Iγ=0.54 4 (2003Me01).
112.52 ^h 4	0.46 6	537.863	5/2 ⁻	425.276	7/2 ⁺	[E1]		0.1939 27	%Iγ=0.119 16
114.314 11	74 5	114.313	5/2 ⁺	0.0	7/2 ⁺	M1+E2	+0.16 2	1.065 15	%Iγ=19.2 8 Eγ=114.066 11, Iγ=65.13 7 (2003Me01). δ: average of 0.180 24 from L1/L2=8.5 20 and L1/L3=14.5 30 and +0.14 5 from A ₂ =0.30 4 in γγ(θ) (1987Si13).
116.930 24	0.42 12	654.843	7/2 ⁻	537.863	5/2 ⁻	M1+E2	0.5 +11-3	1.05 16	%Iγ=0.109 31 Eγ=117.088 8, Iγ=0.809 7 (2003Me01). δ: from K/L=4.5 2 and α(K)exp=0.8 3.
122.415 13	0.99 6	537.863	5/2 ⁻	415.449	3/2 ⁺	E1		0.1540 22	%Iγ=0.257 17 Eγ=122.689 8, Iγ=0.826 4 (2003Me01). δ(M2/E1)<0.1 from α(K)exp=0.15 4.
126.630 18	0.43 3	396.774	5/2 ⁺	270.170	7/2 ⁻	E1		0.1404 20	%Iγ=0.112 8 Eγ=126.513 17, Iγ=0.303 23 (2003Me01). δ(M2/E1)<0.095 from α(K)exp=0.10 7.
131.7 ^{gh}	0.017 ^g	547.126	(5/2,7/2 ⁺)	415.449	3/2 ⁺				%Iγ=0.00441 13

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

$\gamma(^{149}\text{Pm})$ (continued)									Comments
E_γ [‡]	I_γ ^{#k}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α ^l	
137.05 3	0.24 2	425.276	7/2 ⁺	288.208	9/2 ⁺	[M1,E2]		0.69 5	%I γ =0.062 6 E γ =137.288 20, I γ =0.514 4 (2003Me01).
139.210 12	1.96 9	654.843	7/2 ⁻	515.645	(9/2) ⁻	(M1+E2)	+3 3	0.69 9	%I γ =0.509 28 E γ =139.357 7, I γ =2.33 8 (2003Me01). ce(K) not reported by 1967Ba27 although peak should have been prominent in the electron spectrum. K conversion line reported by 1966He04 but no intensity given. δ : from A ₂ =0.34 6, A ₄ =-0.03 11 for (139 γ)(245 γ)(θ) and A ₂ =0.21 2, A ₄ =-0.03 3 for (139 γ)(275 γ)(θ) (1986Ii01).
141.06 7	0.15 1	537.863	5/2 ⁻	396.774	5/2 ⁺	[E1]		0.1046 15	%I γ =0.0390 29 E γ =140.93 5, I γ =0.50 3 (2003Me01).
155.1 ^e	0.13 ^a 6	425.276	7/2 ⁺	270.170	7/2 ⁻	[E1]		0.0808 11	%I γ =0.034 16 E γ =154.74 6, I γ =0.45 3 (2003Me01).
155.873 9	22.9 ^a 8	270.170	7/2 ⁻	114.313	5/2 ⁺	E1		0.0798 11	%I γ =5.95 27 E γ =156.048 3, I γ =2.307 5 (2003Me01). δ (M2/E1)=+0.03 3 from A ₂ =0.26 3 in γ (θ) (1987Si13). α (K)exp=0.059 9 gives <0.012. (156 γ)(114 γ)(θ): A ₂ =0.04 2, A ₄ =0.01 1 (1986Ii01). Others: 1970Se11 , 1966Go05 .
^x 171.17 ^j 10	0.124 22	387.559	1/2 ⁺	211.308	5/2 ⁺	[E2]		0.310 4	%I γ =0.032 6
176.27 ^f	0.19 ^a 4								%I γ =0.049 10 E γ =175.53 8, I γ =0.144 4 (2003Me01). I γ : 0.05 (1986Ii01).
177.818 18	0.60 ^a 6	537.863	5/2 ⁻	360.046	7/2 ⁺	E1		0.0558 8	%I γ =0.156 16 E γ =177.905 13, I γ =0.59 5 (2003Me01). Mult.: α (K)exp<0.07.
185.489 25	0.40 2	396.774	5/2 ⁺	211.308	5/2 ⁺	[M1,E2]		0.267 7	%I γ =0.104 6 E γ =185.617 9, I γ =0.579 12 (2003Me01).
188.640 8	6.9 3	188.631	3/2 ⁺	0.0	7/2 ⁺	E2		0.2462 34	%I γ =1.79 9 E γ =188.7832 23, I γ =6.99 3 (2003Me01). δ (M3/E2)<1 from α (K)exp=0.22 2, but A ₂ =-0.19 8 in γ (θ) (1987Si13) is consistent with E2.
188.8 ^{gh}	0.04 ^g	651.021	(5/2 ⁺)	462.191	3/2 ⁻	E2		0.2318 32	%I γ =0.010
192.026 9	2.20 7	462.191	3/2 ⁻	270.170	7/2 ⁻				%I γ =0.571 25 E γ =192.171 3, I γ =2.207 15 (2003Me01). Mult.: from α (K)exp=0.14 2 and A ₂ =-0.42 17 in γ (θ) (1987Si13). (192 γ)(270 γ)(θ): A ₂ G ₂ =0.145 30, A ₄ G ₄ =-0.01 6 (1986Ii01). Assuming A ₂ =0.204, A ₄ =0.0 for 3/2-(E2)7/2-(E1)7/2 ⁺ cascade, G ₂ =0.71 15.
197.4 ^{gh}	0.05 ^g	744.579	(3/2,5/2 ⁺)	547.126	(5/2,7/2 ⁺)				%I γ =0.0130 4

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

<u>γ(¹⁴⁹Pm) (continued)</u>									Comments
E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [†]	δ [‡]	α ^l	
198.00 ^f	0.19 ^a 2	558.15	(9/2) ⁺	360.046	7/2 ⁺				%I _γ =0.049 5 E _γ =197.75 8, I _γ =0.31 3 (2003Me01).
198.928 8	5.37 ^a 16	387.559	1/2 ⁺	188.631	3/2 ⁺	M1(+E2)	+0.2 3	0.224 4	%I _γ =1.39 6 E _γ =199.066 5, I _γ =5.58 5 (2003Me01). δ: from δ=-0.1 to +2.3 (γγ(θ), 1986Ii01) and <0.5 from α(K)exp=0.20 3 and K/L=8 2. γ(θ): A ₂ U ₂ B ₂ =0.00 3 (1989SiZQ). (199γ)(74γ)(θ): A ₂ G ₂ =0.31 6, A ₄ G ₄ =-0.10 15 (1986Ii01). Data are corrected by 1986Ii01 for unresolved components 74.6γ, 75.7γ. (199γ)(189γ)(θ): A ₂ G ₂ =-0.03 2, A ₄ G ₄ =-0.01 3 (1986Ii01). (199γ)(74γ)(θ): A ₂ =0.095 22, A ₄ =0.0 (1970Se11).
208.147 9	9.83 4	396.774	5/2 ⁺	188.631	3/2 ⁺	M1+E2	+0.17 3	0.1980 28	%I _γ =2.55 8 E _γ =208.3210 21, I _γ =10.526 9 (2003Me01). δ: from A ₂ =0.047 31 in γ(θ) (1987Si13). γγ(θ) (1986Ii01) gives +0.04 4 or -3.9 7 and α(K)exp=0.18 3 gives <0.9. (208γ)(74γ)(θ): A ₂ G ₂ =0.00 3, A ₄ G ₄ =-0.02 7 (1986Ii01). Data are corrected by 1986Ii01 for unresolved components 74.6γ and 75.7γ. (208γ)(189γ)(θ): A ₂ G ₂ =0.00 1, A ₄ G ₄ =0.02 2 (1986Ii01).
211.309 7	100 4	211.308	5/2 ⁺	0.0	7/2 ⁺	M1+E2	-0.41 3	0.1874 27	%I _γ =26.0 10 E _γ =211.4403 20, I _γ =100.0 18 (2003Me01). δ: from γγ(θ) (1986Ii01). Others: -0.44 10 from A ₂ =-0.35 3 in γ(θ) (1987Si13); 0.39 15 from K/L=6.5 8, α(K)exp=0.146 15 and (L1+L2)/L3=15 +15-5.
213.947 16	1.54 10	425.276	7/2 ⁺	211.308	5/2 ⁺	M1,E2		0.173 12	%I _γ =0.400 29 E _γ =213.9414 20, I _γ =1.159 7 (2003Me01). δ: +0.34 5 or +8 +4-2 from (230γ)(214γ)(θ) (1986Ii01). α(K)exp=0.15 5 is consistent with all δ.
224.49 ⁱⁿ 6	0.092 9	1181.30?		956.87?					%I _γ =0.0239 24
226.847 19	0.63 2	415.449	3/2 ⁺	188.631	3/2 ⁺	[M1,E2]		0.145 12	%I _γ =0.164 7 E _γ =227.072 9, I _γ =0.544 6 (2003Me01).
229.566 9	1.86 5	654.843	7/2 ⁻	425.276	7/2 ⁺	E1		0.0282 4	%I _γ =0.483 20 E _γ =229.630 3, I _γ =1.771 9 (2003Me01). δ(M2/E1)=+0.06 to +1.1 from A ₂ =-0.74 15 in γ(θ) (1987Si13); <0.14 from α(K)exp=0.024 14. (230γ)(214γ)(θ): A ₂ =0.13 3, A ₄ =0.00 5 (1986Ii01).
^x 238.611 ^j 3	3.432 11								%I _γ =0.891 27 E _γ : probably from background.

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

$\gamma(^{149}\text{Pm})$ (continued)									
E_γ [†]	I_γ ^{#k}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α ^l	Comments
239.6 ^{gh}	0.05 ^g	786.72	(3/2 ⁺ , 5/2 ⁺)	547.126	(5/2, 7/2 ⁺)				%I _γ =0.0130 4
240.220 7	15.2 6	240.215	11/2 ⁻	0.0	7/2 ⁺	M2		0.664 9	%I _γ =3.95 19 E _γ =240.4660 18, I _γ =12.289 22 (2003Me01). γ(θ): A ₂ U ₂ B ₂ =-0.11 2 (1989SiZQ). Mult.: from α(K)exp=0.47 4 and K/L=5.2 9.
245.5	0.8 ^a 4	515.645	(9/2) ⁻	270.170	7/2 ⁻	[M1,E2]		0.115 12	%I _γ =0.21 10 E _γ =244.89 15, I _γ =0.36 12 (2003Me01). δ: -0.16 24 or -5 2 from γγ(θ) (1986Ii01). (245γ)(270γ)(θ): A ₂ =-0.17 15, A ₄ =0.02 21 (1986Ii01).
245.72 5	3.1 8	360.046	7/2 ⁺	114.313	5/2 ⁺	M1+E2	+0.23 2	0.1255 18	%I _γ =0.81 21 E _γ =245.847 21, I _γ =3.618 15 (2003Me01). (246γ)(114γ)(θ): A ₂ =-0.02 4, A ₄ =-0.01 5 (1986Ii01). E _γ : deduced from 245.699 8 for doublet (1968He19) and I _γ (1979Sc12). δ: from γγ(θ) (1986Ii01). γγ(θ) also gives δ>+30 but is inconsistent with δ<1.1 from α(K)exp=0.13 4.
250.826 31	0.13 1	462.191	3/2 ⁻	211.308	5/2 ⁺	[E1]		0.02239 31	%I _γ =0.0338 28 E _γ =250.82 3, I _γ =0.106 27 (2003Me01).
254.228 22	0.33 1	651.021	(5/2 ⁺)	396.774	5/2 ⁺	[M1+E2]		0.104 12	%I _γ =0.086 4 E _γ =254.783 15, I _γ =0.369 12 (2003Me01).
258.067 13	1.45 4	654.843	7/2 ⁻	396.774	5/2 ⁺	E1		0.02079 29	%I _γ =0.377 15 E _γ =258.144 3, I _γ =1.573 20 (2003Me01). δ(M2/E1)<0.26 from α(K)exp<0.046. (258γ)(208γ)(θ): A ₂ =0.04 1, A ₄ =-0.01 2 (1986Ii01).
263.4 ^{gh}	0.09 ^g	651.021	(5/2 ⁺)	387.559	1/2 ⁺	[E2]		0.0819 11	%I _γ =0.023
267.693 8	23.3 6	537.863	5/2 ⁻	270.170	7/2 ⁻	M1+E2	+0.24 7	0.0994 16	%I _γ =6.05 24 E _γ =267.7873 16, I _γ =21.811 8 (2003Me01). δ: average of δ=+0.20 8 (γγ(θ), 1986Ii01) and +0.28 7 (γ(θ,H,t), 1987Si13). α(K)exp=0.076 8 and K/L=7.5 12 give 0.5 3. γ(θ): A ₂ =0.50 7 (1987Si13,1989SiZQ). (268γ)(156γ)(θ): A ₂ =0.25 6, A ₄ =-0.02 2 (1986Ii01). Others: A ₂ =0.173 12, A ₄ =0.00 (1970Se11); A ₂ =-0.142 9, A ₄ =0.020 11 (1970Be67). (268γ)(270γ)(θ): A ₂ =-0.28 6, A ₄ =-0.01 1 (1986Ii01). Others: 1970Se11 , 1970Be67 , 1966Sv01 , 1966Go05 , 1965Ch09 .
270.166 7	41.4 11	270.170	7/2 ⁻	0.0	7/2 ⁺	E1(+M2)	-0.07 5	0.021 4	%I _γ =10.8 4 E _γ =270.2449 16, I _γ =38.513 11 (2003Me01). δ: from A ₂ =-0.34 3 in γ(θ) (1987Si13). Other: <0.05 from α(K)exp=0.014 2.
273.24 ^h 4	0.7 ^a 3	387.559	1/2 ⁺	114.313	5/2 ⁺	[E2]		0.0728 10	%I _γ =0.18 8 α(K)exp=0.10 5

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

$\gamma(^{149}\text{Pm})$ (continued)									
E_γ [†]	I_γ ^{#k}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α ^l	Comments
273.5 ^h	0.32 ^a 15	462.191	3/2 ⁻	188.631	3/2 ⁺	[E1]		0.01789 25	%I γ =0.08 4
275.437 11	2.51 6	515.645	(9/2) ⁻	240.215	11/2 ⁻	M1(+E2)		0.082 11	%I γ =0.652 25 E γ =275.469 5, I γ =1.529 8 (2003Me01). $\gamma(\theta)$: A ₂ =0.7 3 (1989SiZQ), probably includes 277.0 γ also. δ : +0.23 23, >+2.4 or <-15 from $\gamma\gamma(\theta)$ (1986Ii01). $\alpha(\text{K})\text{exp}$ =0.071 21 is consistent with all δ . $\gamma(\theta)$ in (p,2n γ) forbids pure E2.
276.960 17	1.32 4	547.126	(5/2,7/2 ⁺)	270.170	7/2 ⁻	[D,E2]		0.055 38	%I γ =0.343 15 E γ =276.89 8, I γ =1.009 8 (2003Me01). %I γ =0.017 7
282.4 ^e	0.065 ^a 25	744.579	(3/2,5/2 ⁺)	462.191	3/2 ⁻				E γ =281.958 14, I γ =0.688 21 (2003Me01). %I γ =0.618 24 E γ =282.5292 25, I γ =2.071 12 (2003Me01). δ : from $\gamma\gamma(\theta)$ (1986Ii01). $\gamma\gamma(\theta)$ also allows >+5 or <-11 but is inconsistent with +0.8 7 from A ₂ =-0.70 11 in $\gamma(\theta)$ (1987Si13) and <3.5 from $\alpha(\text{K})\text{exp}$ =0.071 18. (282 γ)(114 γ)(θ): A ₂ =0.08 4, A ₄ =-0.02 5 (1986Ii01). %I γ =0.013 5 E γ =286.034, I γ =1.531 13 (2003Me01); probably an impurity line (evaluators). %I γ =0.693 28 E γ =288.2516 25, I γ =2.331 14 (2003Me01). Mult.: from ce data and $\gamma(\theta)$ in ¹⁵⁰ Nd(p,2n γ). δ : from $\gamma\gamma(\theta)$ (1986Ii01). δ =+1.9 2 is also possible from $\gamma\gamma(\theta)$. Others: δ =+0.74 17 or +2.0 6 from A ₂ =-0.71 9 in $\gamma(\theta)$ (1989SiZQ); $\alpha(\text{K})\text{exp}$ =0.062 16 is consistent with all δ . %I γ =0.0631 25 Proposed placement (2003Me01): 651.1-360.1. Poor fit (evaluators). %I γ =0.571 23 E γ =294.969 7, I γ =3.33 7 (2003Me01). $\delta(\text{M2/E1})$ =-0.11 22 from A ₂ =-0.34 9 in $\gamma(\theta)$ (1987Si13), <0.26 from $\alpha(\text{K})\text{exp}$ <0.03. (295 γ)(245 γ)(θ): A ₂ =0.05 1, A ₄ =0.00 2 (1986Ii01). %I γ =0.377 15 E γ =301.097 9, I γ =1.24 4 (2003Me01). $\gamma(\theta)$: A ₂ =-0.1 3 (1989SiZQ). δ : +0.02 11 or +3.1 +16-9 from A ₂ =0.15 6, A ₄ =-0.01 8 (1986Ii01) for (301 γ)(114 γ)(θ). $\alpha(\text{K})\text{exp}$ =0.040 25 is consistent with all δ .
282.456 10	2.38 ^a 6	396.774	5/2 ⁺	114.313	5/2 ⁺	M1+E2	+0.65 20	0.0808 30	
287.7	0.05 ^a 2	558.15	(9/2) ⁺	270.170	7/2 ⁻	[E1]		0.01572 22	
288.194 10	2.67 ^a 7	288.208	9/2 ⁺	0.0	7/2 ⁺	M1+E2	+0.78 7	0.0747 14	
^x 290.374 ^j 20	0.243 6								
294.802 10	2.20 6	654.843	7/2 ⁻	360.046	7/2 ⁺	E1		0.01477 21	
301.128 14	1.45 4	415.449	3/2 ⁺	114.313	5/2 ⁺	M1,E2		0.064 10	

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

$\gamma(^{149}\text{Pm})$ (continued)									
E_γ [†]	I_γ ^{#k}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	δ [†]	α ^l	Comments
310.979 13	1.97 5	425.276	7/2 ⁺	114.313	5/2 ⁺	M1+E2	+0.23 12	0.0667 15	%I γ =0.512 20 E γ =311.059 3, I γ =1.76 3 (2003Me01). δ : from $\gamma\gamma(\theta)$ (1986Ii01). $\gamma\gamma(\theta)$ also allows +2.6 9 but is inconsistent with δ =+0.22 13 or >8 from A ₂ =-0.08 11 in $\gamma(\theta)$ (1987Si13). $\alpha(\text{K})\text{exp}$ =0.047 11 is consistent with all δ . (311 γ)(114 γ)(θ): A ₂ =-0.06 4, A ₄ =-0.01 6 (1986Ii01). %I γ =0.009 4 E γ =318.02 12, I γ =0.615 18 (2003Me01). Proposed placement (2003Me01): 556.2 – 240.4. Very poor fit (evaluators).
^x 318.2 ^e 3	0.033 17								%I γ =4.57 17 E γ =326.6331 17, I γ =16.589 16 (2003Me01). δ : from A ₂ =-0.36 6 in $\gamma(\theta)$ (1987Si13). $\alpha(\text{K})\text{exp}$ =0.011 3 gives <0.14. (327 γ)(97 γ)(θ): A ₂ =0.22 3, A ₄ =-0.01 6 (1986Ii01). (326 γ)(211 γ)(θ): A ₂ =0.14 1, A ₄ =0.00 1 (1986Ii01). Others: A ₂ =0.109 6, A ₄ =-0.020 10 (1966Go05); A ₂ =-0.230 12, A ₄ =-0.007 9 (1970Be67).
326.554 10	17.6 4	537.863	5/2 ⁻	211.308	5/2 ⁺	E1(+M2)	-0.07 6	0.0125 27	%I γ =0.021 10 I γ : 0.007 (1986Ii01). %I γ =0.0177 12 %I γ =0.083 18 E γ =343.12 5, I γ =0.14 4 (2003Me01). I γ : 0.14 (1986Ii01). %I γ =0.161 7 E γ =347.654 19, I γ =2.38 3 (2003Me01). %I γ =1.38 6 E γ =349.365 4, I γ =8.540 10 (2003Me01). $\delta(\text{M2/E1})$ =+0.04 4 from A ₂ =0.29 4 in $\gamma(\theta)$ (1987Si13). $\alpha(\text{K})\text{exp}$ =0.017 5 gives <0.3. (349 γ)(189 γ)(θ): A ₂ =0.032 7, A ₄ =0.007 15 (1970Be67).
329.18 ^{hbf}	0.08 4	744.579	(3/2,5/2 ⁺)	415.449	3/2 ⁺				%I γ =1.17 4 E γ : probably from background. %I γ =0.0545 31 %I γ =0.0467 30 E γ =357.111 22, I γ =0.282 14 (2003Me01). %I γ =0.010 5 %I γ =0.153 7
332.167 ^{jn} 18	0.068 4	1363.85?		1031.68	(7/2 ⁺)				
342.81 10	0.32 7	768.188	(5/2,7/2 ⁺)	425.276	7/2 ⁺				
347.843 18	0.62 2	744.579	(3/2,5/2 ⁺)	396.774	5/2 ⁺				
349.231 9	5.31 14	537.863	5/2 ⁻	188.631	3/2 ⁺	E1		0.00966 14	
^x 351.632 ^j 3	4.51 6								
352.78 ^h 3	0.21 1	768.188	(5/2,7/2 ⁺)	415.449	3/2 ⁺				
357.03 4	0.18 1	744.579	(3/2,5/2 ⁺)	387.559	1/2 ⁺				
358.49 ^{eh} 10	0.04 2	547.126	(5/2,7/2 ⁺)	188.631	3/2 ⁺				
360.052 18	0.59 2	360.046	7/2 ⁺	0.0	7/2 ⁺	[M1,E2]		0.039 7	

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

$\gamma(^{149}\text{Pm})$ (continued)								
$E_\gamma^{\ddagger}$	$I_\gamma^{\#k}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	α^l	Comments
								$E_\gamma=359.889\ 20$, $I_\gamma=0.593\ 15$ (2003Me01). $\gamma(\theta)$: $A_2=0.7\ 5$ (1989SiZQ). % $I_\gamma=0.0065\ 26$ $E_\gamma=361.76\ 3$, $I_\gamma=0.514\ 13$ (2003Me01). % $I_\gamma=0.543\ 23$ $E_\gamma=366.682\ 3$, $I_\gamma=1.858\ 17$ (2003Me01). $\delta(\text{M2/E1})=-0.04\ 11$ from $A_2=0.09\ 8$ in $\gamma(\theta)$ (1987Si13); <0.31 from $\alpha(\text{K})\text{exp}<0.021$. $\alpha(\text{K})\text{exp}$ also gives E2 but inconsistent with $\gamma(\theta)$ data. (367 γ)(288 γ)(θ): $A_2=-0.22\ 1$, $A_4=0.00\ 2$ (1986Ii01). % $I_\gamma=0.0223\ 27$
361.4 ^{be}	0.025 10	721.23?	7/2 ⁺	360.046	7/2 ⁺			
366.634 14	2.09 6	654.843	7/2 ⁻	288.208	9/2 ⁺	E1	0.00857 12	
371.92 ^{jn} 6	0.086 10	1328.81?		956.87?				
376.9 ^{be}	0.030 15	1031.68	(7/2 ⁺)	654.843	7/2 ⁻	[E1]	0.00801 11	% $I_\gamma=0.008\ 4$ $E_\gamma=376.69\ 10$, $I_\gamma=0.043\ 11$ (2003Me01). % $I_\gamma=0.0519\ 30$ $E_\gamma=380.962\ 22$, $I_\gamma=0.163\ 4$ (2003Me01). E_γ : others: 380.79 (1986Ii01), 380.93 7 (1968He19). % $I_\gamma=0.267\ 11$ $E_\gamma=384.703\ 4$, $I_\gamma=0.937\ 5$ (2003Me01). $\gamma(\theta)$: $A_2=-0.24\ 18$ (1989SiZQ). % $I_\gamma=0.0078\ 26$ $E_\gamma=390.65\ 16$, $I_\gamma=0.021\ 3$ (2003Me01). E_γ : level-energy difference=391.1. % $I_\gamma=0.0727\ 34$ $E_\gamma=396.878\ 12$, $I_\gamma=0.298\ 4$ (2003Me01). % $I_\gamma=0.015\ 6$ % $I_\gamma=0.0174\ 14$ E_γ : uncertainty of 0.015 increased to 0.03 (evaluators). % $I_\gamma=7.5\ 4$ $E_\gamma=423.5600\ 20$, $I_\gamma=25.25\ 4$ (2003Me01). $\delta(\text{M2/E1})=-0.03\ 9$ from $A_2=-0.40\ 5$ in $\gamma(\theta)$ (1987Si13). $\alpha(\text{K})\text{exp}=0.0065\ 16$ gives <0.17 . (423 γ)(114 γ)(θ): $A_2G_2=-0.103\ 10$, $A_4G_4=-0.02\ 2$ (1986Ii01). $G_2=0.76\ 8$ (1986Ii01) was obtained assuming $A_2=-0.135\ 7$ (average A_2 from 1970Se11,1970Be67,1966Sv01 and 1966Go05). % $I_\gamma=0.273\ 13$ $E_\gamma=425.86\ 11$, $I_\gamma=2.55\ 3$ (2003Me01). I_γ : 0.68 (1986Ii01). % $I_\gamma=0.013\ 5$ $E_\gamma=432.76\ 7$, $I_\gamma=0.014\ 4$ (2003Me01). % $I_\gamma=0.0036\ 10$ % $I_\gamma=0.036\ 16$ $E_\gamma=439.11\ 7$, $I_\gamma=0.145\ 14$ (2003Me01).
380.66 5	0.20 1	651.021	(5/2 ⁺)	270.170	7/2 ⁻	[E1]	0.00782 11	
384.687 16	1.03 3	654.843	7/2 ⁻	270.170	7/2 ⁻	[M1,E2]	0.032 7	
390.9 ^{be}	0.03 1	1141.528	5/2 ⁺	750.41	(7/2 ⁻ ,9/2 ⁺)			
396.76 4	0.28 1	396.774	5/2 ⁺	0.0	7/2 ⁺	[M1,E2]	0.030 6	
399.1 ^{bh}	0.056 22	786.72	(3/2 ⁺ ,5/2 ⁺)	387.559	1/2 ⁺			
413.69 ^{jn} 3	0.067 5	1050.18		637.43?				
423.553 10	28.7 15	537.863	5/2 ⁻	114.313	5/2 ⁺	E1	0.00606 8	
425.22 3	1.05 4	425.276	7/2 ⁺	0.0	7/2 ⁺	[M1,E2]	0.025 5	
432.66 ^{bf}	0.05 2	547.126	(5/2,7/2 ⁺)	114.313	5/2 ⁺			
434.90 ^{jn} 7	0.014 4	1156.034	(3/2 ⁺ ,5/2,7/2 ⁺)	721.23?	7/2 ⁺			
439.6	0.14 ^{&} 6	651.021	(5/2 ⁺)	211.308	5/2 ⁺			

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

<u>γ(¹⁴⁹Pm) (continued)</u>								
E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [†]	α ^l	Comments
441.47 ^{jn} 13	0.122 10	956.87?		515.645	(9/2) ⁻			%I _γ =0.0317 28
443.551 11	4.44 ^a 20	654.843	7/2 ⁻	211.308	5/2 ⁺	E1	0.00543 8	%I _γ =1.15 6 E _γ =443.550 3, I _γ =4.221 25 (2003Me01). δ(M2/E1)<0.17 from α(K)exp<0.007. γ(θ): A ₂ =0.35 6 (1989SiZQ). (444γ)(211γ)(θ): A ₂ =0.083 25, A ₄ =0.11 20 (1970Be67). %I _γ =0.01039 31 I _γ : from 1986Ii01 . %I _γ =0.008 4 Placement from 2003Me01 . Poor fit. Level-energy difference=447.88. E _γ =448.82 9, I _γ =0.038 15 (2003Me01). %I _γ =0.042 21 E _γ =462.354 9, I _γ =0.81 3 (2003Me01). %I _γ =0.010 5 E _γ =469.706 20, I _γ =0.049 3 (2003Me01). %I _γ =0.0416 29 E _γ : level-energy difference=480.24. E _γ =480.48 3, I _γ =0.129 15 (2003Me01). %I _γ =0.0675 33 E _γ =483.713 18, I _γ =0.219 18 (2003Me01). E _γ : level-energy difference=483.69. %I _γ =0.060 5 E _γ =493.87 15, I _γ =0.18 6 (2003Me01). I _γ : 0.11 (1986Ii01). %I _γ =0.0104 26 E _γ =498.06 7, I _γ =0.119 25 (2003Me01). E _γ : other: 498.03 8 (1968He19) for a doublet. I _γ : from γγ (1979Sc12). %I _γ =0.0364 28 E _γ =499.44 13, I _γ =0.079 12 (2003Me01). I _γ : from γγ (1979Sc12). %I _γ =0.062 16 E _γ : level-energy difference=510.19. %I _γ =0.013 5 Placement from 1986Ii01 only. %I _γ =0.013 5 %I _γ =0.036 5 E _γ =515.26 19, I _γ =0.511 14 (2003Me01). %I _γ =0.0117 31 E _γ =527.2 3, I _γ =0.168 11 (2003Me01). %I _γ =0.091 6 E _γ =533.130 17, I _γ =0.267 4 (2003Me01).
443.7 ^h	0.04	558.15	(9/2) ⁺	114.313	5/2 ⁺			
448.80 ^{en} 20	0.031 15	637.43?		188.631	3/2 ⁺			
462.34 ^e 10	0.16 8	651.021	(5/2 ⁺)	188.631	3/2 ⁺			
470.5 ^{be}	0.04 2	758.67	(5/2 ⁺ , 7/2, 9/2 ⁺)	288.208	9/2 ⁺			
480.32 ⁱ 5	0.16 1	750.41	(7/2 ⁻ , 9/2 ⁺)	270.170	7/2 ⁻			
483.59 ⁱ 5	0.26 1	1234.099	(7/2)	750.41	(7/2 ⁻ , 9/2 ⁺)			
493.85 5	0.23 2	1031.68	(7/2 ⁺)	537.863	5/2 ⁻			
498.06 ^f	0.04 1	768.188	(5/2, 7/2 ⁺)	270.170	7/2 ⁻			
498.62 ^f	0.14 1	923.886	(5/2 ⁺ , 7/2)	425.276	7/2 ⁺			
510.30 ^{hi} 5	0.24 6	750.41	(7/2 ⁻ , 9/2 ⁺)	240.215	11/2 ⁻			
512.7 ^m	0.05 ^m 2	872.94?		360.046	7/2 ⁺			
512.7 ^{mbh}	0.05 ^m 2	1234.099	(7/2)	721.23?	7/2 ⁺			
515.75 9	0.14 2	515.645	(9/2) ⁻	0.0	7/2 ⁺			
527.6 ^{be}	0.045 12	942.926	(3/2 ⁺ , 5/2, 7/2 ⁺)	415.449	3/2 ⁺			
533.20 4	0.35 2	744.579	(3/2, 5/2 ⁺)	211.308	5/2 ⁺			

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

<u>E_γ[‡]</u>	<u>I_γ^{#k}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[†]</u>	<u>α^l</u>	<u>Comments</u>
536.6 ^h	0.18 ^{&8}	651.021	(5/2 ⁺)	114.313	5/2 ⁺			%I _γ =0.047 21
^x 538.15 ^{d6}								
540.509 10	25.4 9	654.843	7/2 ⁻	114.313	5/2 ⁺	E1	0.00346 5	%I _γ =6.60 31 E _γ =540.513 26, I _γ =23.911 16 (2003Me01). δ(M2/E1)=-0.23 28 from A ₂ =0.370 25 in γ(θ) (1987Si13); <0.24 from α(K)exp=0.0038 16. (540γ)(114γ)(θ): A ₂ =0.05 1, A ₄ =0.00 1 (1986Ii01). Others: 1970Se11 , 1970Be67 , 1966Sv01 , 1966Go05 .
^x 545.5 ^g	0.035 ^g							%I _γ =0.0091
^x 546.5 ^g	0.034 ^g							%I _γ =0.0088
547.1 ^c	0.06 3	547.126	(5/2,7/2 ⁺)	0.0	7/2 ⁺			%I _γ =0.016 8 E _γ =546.22 24, I _γ =0.385 13 (2003Me01). %I _γ =0.010 5 E _γ =548.7 4, I _γ =0.34 8 (2003Me01). E _γ : probably same as 548.3 in 1986Ii01 . %I _γ =0.59 4 E _γ =555.77 3, I _γ =1.77 13 (2003Me01). Mult.: 1967Ba27 give α(K)exp<0.026 for the 555.88+556.83 doublet which allows E1, E2 or M1 for either or both transitions. E _γ : 1968He19 give 556.43 5 as average energy for this doublet. γ(θ) for doublet: A ₂ U ₂ B ₂ =-0.13 2 (1989SiZQ). (556γ)(211γ)(θ): A ₂ =0.13 2, A ₄ =0.02 4 (1986Ii01). %I _γ =0.44 5 E _γ =556.71 4, I _γ =2.39 9 (2003Me01). See comment for 555.88γ.
547.4 ^c	0.04 2	758.67	(5/2 ⁺ ,7/2,9/2 ⁺)	211.308	5/2 ⁺			
555.88 9	2.26 12	744.579	(3/2,5/2 ⁺)	188.631	3/2 ⁺			
556.83 9	1.68 20	768.188	(5/2,7/2 ⁺)	211.308	5/2 ⁺			
558.0 ^h	0.04	558.15	(9/2) ⁺	0.0	7/2 ⁺			%I _γ =0.01039 31 I _γ : from 1986Ii01 . I _γ =0.29 10 (1979Sc12). %I _γ =0.009 4 %I _γ =0.0166 34 E _γ =567.32 14, I _γ =0.06 3 (2003Me01). %I _γ =0.0078 26 %I _γ =0.075 6 E _γ =579.17 5, I _γ =0.12 4 (2003Me01). %I _γ =0.018 8 E _γ =582.144 21, I _γ =0.626 19 (2003Me01). %I _γ =0.049 13 E _γ =583.055 13, I _γ =1.33 4 (2003Me01). %I _γ =0.0057 21 %I _γ =0.0042 10
563.8 ^h	0.036 16	923.886	(5/2 ⁺ ,7/2)	360.046	7/2 ⁺			
567.56 ^f	0.064 13	1312.106	(5/2)	744.579	(3/2,5/2 ⁺)			
575.4 ^{h3}	0.03 1	786.72	(3/2 ⁺ ,5/2 ⁺)	211.308	5/2 ⁺			
579.28 3	0.29 2	1234.099	(7/2)	654.843	7/2 ⁻			
582.9	0.07 ^{a3}	942.926	(3/2 ⁺ ,5/2,7/2 ⁺)	360.046	7/2 ⁺			
583.03 3	0.19 ^{a5}	1234.099	(7/2)	651.021	(5/2 ⁺)			
588.5 ^{h3}	0.022 8	1239.616	(5/2 ⁺ ,7/2)	651.021	(5/2 ⁺)			
590.74 ⁱⁿ¹⁷	0.016 4	1312.106	(5/2)	721.23?	7/2 ⁺			

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

E_γ [†]	I_γ ^{#k}	E_i (level)	J_i^π	E_f	J_f^π	Mult. [†]	α^I	Comments
594.40 5	0.11 1	1141.528	5/2 ⁺	547.126	(5/2,7/2 ⁺)			%I _γ =0.0286 27 E _γ =594.54 5, I _γ =0.047 7 (2003Me01).
598.06 5	0.11 1	786.72	(3/2 ⁺ ,5/2 ⁺)	188.631	3/2 ⁺			%I _γ =0.0286 27 E _γ =598.01 4, I _γ =0.065 7 (2003Me01).
606.67 ^{eh} 16	0.04 2	721.23?	7/2 ⁺	114.313	5/2 ⁺			%I _γ =0.010 5
617.9 ^{hbe}	0.029 10	1043.39	(3/2 ⁺ ,5/2,7/2)	425.276	7/2 ⁺			%I _γ =0.0075 26
630.237 19	0.73 1	744.579	(3/2,5/2 ⁺)	114.313	5/2 ⁺			%I _γ =0.190 6 E _γ =630.225 9, I _γ =0.601 12 (2003Me01).
635.7	0.26 ^a 5	923.886	(5/2 ⁺ ,7/2)	288.208	9/2 ⁺			%I _γ =0.068 13 E _γ =635.97 4, I _γ =0.129 12 (2003Me01) placed from a 635.98 level. See comment for 636.2γ.
636.2 ^f	0.20 ^a 4	750.41	(7/2 ⁻ ,9/2 ⁺)	114.313	5/2 ⁺			%I _γ =0.052 11 E _γ =634.87 5, I _γ =1.065 10 (2003Me01).
651.0 ^h	0.24 ^{&} 10	651.021	(5/2 ⁺)	0.0	7/2 ⁺			E _γ : other: 635.482 25 (1968He19) for doublet. %I _γ =0.062 26 I _γ : 0.051 (1986Ii01).
652.74 ^{jin}		1190.274	(5/2)	537.863	5/2 ⁻			E _γ , I _γ : 2003Me01 quote E _γ =652.744 7, I _γ =2.646 15. There is no evidence of such a strong line in the spectra of 1979ScZL and 1968He19 . This line is probably mainly from background or impurity. There is some γγ coin evidence of this line in table 2 of 2003Me01 .
653.9 ^{gh}	0.07 ^g	768.188	(5/2,7/2 ⁺)	114.313	5/2 ⁺			%I _γ =0.0182 5
654.831 13	30.7 15	654.843	7/2 ⁻	0.0	7/2 ⁺	E1	2.28×10 ⁻³ 3	%I _γ =8.0 4 E _γ =654.838 3, I _γ =27.608 22 (2003Me01). δ(M2/E1)<0.2 from α(K) _{exp} =0.0022 6. γ(θ): A ₂ =-0.436 used to determine orientation parameter β ₂ .
657.2 ^{hbe}	0.07 3	1312.106	(5/2)	654.843	7/2 ⁻			%I _γ =0.018 8
661.90 ^e 11	0.020 ^{&} 8	1412.10	(5/2,7/2)	750.41	(7/2 ⁻ ,9/2 ⁺)			%I _γ =0.0052 21 E _γ =660.97 3, I _γ =0.122 5 (2003Me01).
665.22 ^{jin} 7	0.059 4	1181.30?		515.645	(9/2) ⁻			%I _γ =0.0153 11 E _γ : level-energy difference=665.65.
671.56 ^h 10	0.040 ^{&} 15	1031.68	(7/2 ⁺)	360.046	7/2 ⁺			%I _γ =0.010 4
673.58 ^e 7	0.042 10	884.89	(5/2 ⁺)	211.308	5/2 ⁺			%I _γ =0.0109 26 E _γ =674.38 14, I _γ =0.040 5 (2003Me01).
675.79 ⁱ 4	0.098 7	1234.099	(7/2)	558.15	(9/2) ⁺			%I _γ =0.0255 20 E _γ : level-energy difference=675.94. E _γ =676.17 9, I _γ =0.060 7 (2003Me01).
^x 678.1 ^g	0.02 ^g							%I _γ =0.0052
681.34 8	0.031 6	1239.616	(5/2 ⁺ ,7/2)	558.15	(9/2) ⁺			%I _γ =0.0081 16

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12,1986Ii01,2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

<u>E_γ[†]</u>	<u>I_γ^{#k}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
						E _γ =681.47 15, I _γ =0.023 4 (2003Me01). E _γ : from 1979Sc12 . Others: 681.92 9 (1968He19), 681.47 (1986Ii01). %I _γ =0.088 6
686.943 21	0.34 2	1234.099	(7/2)	547.126	(5/2,7/2 ⁺)	E _γ =686.905 16, I _γ =0.340 21 (2003Me01). %I _γ =0.171 12
696.264 21	0.66 4	1234.099	(7/2)	537.863	5/2 ⁻	E _γ =696.191 9, I _γ =0.560 11 (2003Me01). %I _γ =0.0034 16
^x 704.07 ^e 10	0.013 6					%I _γ =0.070 6
712.59 3	0.27 2	923.886	(5/2 ⁺ ,7/2)	211.308	5/2 ⁺	E _γ =712.542 19, I _γ =0.243 8 (2003Me01). %I _γ =0.049 5
718.43 4	0.19 2	1234.099	(7/2)	515.645	(9/2) ⁻	E _γ =718.44 4, I _γ =0.120 6 (2003Me01). I _γ : 0.11 (1986Ii01). %I _γ =0.0400 29
^x 726.822 ^j 12	0.154 10					Proposed placement (2003Me01): 1264.3 – 537.98. Poor fit (evaluators). Also no such line seen in 1979ScZL and 1968He19 . %I _γ =0.0164 19
727.88 ⁱ 5	0.063 7	1190.274	(5/2)	462.191	3/2 ⁻	E _γ =727.23 3, I _γ =0.255 24 (2003Me01). E _γ : level-energy difference=728.08. %I _γ =0.018 4
^x 736.18 ^j 11	0.071 16					Proposed placement (2003Me01): 924.1 – 188.7. Poor fit (evaluators). %I _γ =0.0143 5
740.57 3	0.055 1	1156.034	(3/2 ⁺ ,5/2,7/2 ⁺)	415.449	3/2 ⁺	E _γ =740.66 7, I _γ =0.083 16 (2003Me01). %I _γ =0.0026 10
743.5 ^{eh} 4	0.010 4	1031.68	(7/2 ⁺)	288.208	9/2 ⁺	%I _γ =0.0135 16
749.63 5	0.052 6	750.41	(7/2 ⁻ ,9/2 ⁺)	0.0	7/2 ⁺	E _γ =750.15 14, I _γ =0.12 9 (2003Me01). E _γ : poor fit; level-energy difference=750.41; γγ from 2003Me01 . Uncertainty was increased to 0.2 keV in the least-squares fitting procedure. %I _γ =0.0390 29
754.291 21	0.15 1	942.926	(3/2 ⁺ ,5/2,7/2 ⁺)	188.631	3/2 ⁺	E _γ =754.43 5, I _γ =0.36 18 (2003Me01). %I _γ =0.0156 16
758.65 ^{mh} 8	0.060 ^m 6	758.67	(5/2 ⁺ ,7/2,9/2 ⁺)	0.0	7/2 ⁺	E _γ =759.13 8, I _γ =0.30 16 (2003Me01). Placed from 872 level by 1986Ii01 . %I _γ =0.0156 16
758.65 ^m 8	0.060 ^m 6	872.94?		114.313	5/2 ⁺	%I _γ =0.0286 27
761.46 5	0.11 1	1031.68	(7/2 ⁺)	270.170	7/2 ⁻	E _γ =762.27 6, I _γ =0.070 5 (2003Me01). %I _γ =0.0075 18
765.1 ^{bh}	0.029 7	1190.274	(5/2)	425.276	7/2 ⁺	%I _γ =0.060 5
768.172 21	0.23 2	768.188	(5/2,7/2 ⁺)	0.0	7/2 ⁺	E _γ =767.793 13, I _γ =0.338 8 (2003Me01). %I _γ =0.049 5
771.91 ^{jn}		1234.099	(7/2)	462.191	3/2 ⁻	E _γ =771.91 4, I _γ =0.10 5 (2003Me01), but no evidence of such a line in 1979ScZL and 1968He19 . Intensity must be much weaker than 0.10 if this line is from ¹⁴⁹ Nd decay.
774.6 ^{bh}	0.012 5	1190.274	(5/2)	415.449	3/2 ⁺	%I _γ =0.0031 13 E _γ =775.97 15, I _γ =0.013 3 (2003Me01) placed from 1412 level.

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12](#), [1986Ii01](#), [2003Me01](#) (continued)γ(¹⁴⁹Pm) (continued)

<u>E_γ[†]</u>	<u>I_γ^{#k}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
775.97 ^{<i>jn</i>} 15	0.013 3	1412.10	(5/2,7/2)	637.43?		%I _γ =0.0034 8 E _γ : 774.6γ placed from 1190 level in 1979Sc12 and 1986Ii01 .
781.40 6	0.015 4	1141.528	5/2 ⁺	360.046	7/2 ⁺	%I _γ =0.0039 10 E _γ =781.32 10, I _γ =0.020 3 (2003Me01).
786.73 4	0.039 5	786.72	(3/2 ⁺ ,5/2 ⁺)	0.0	7/2 ⁺	%I _γ =0.0101 13 E _γ =785.20 3, I _γ =0.070 4 (2003Me01).
793.43 3	0.087 7	1190.274	(5/2)	396.774	5/2 ⁺	%I _γ =0.0226 19 E _γ =793.19 3, I _γ =0.163 7 (2003Me01).
795.93 9	0.027 4	1156.034	(3/2 ⁺ ,5/2,7/2 ⁺)	360.046	7/2 ⁺	%I _γ =0.0070 11 E _γ =794.58 3, I _γ =0.328 18 (2003Me01).
^x 806.10 ^{<i>j</i>} 8	0.097 9					E _γ : 796.64 (1986Ii01). %I _γ =0.0252 25 Proposed placement (2003Me01): 1363.9 – 556.2. Poor fit (evaluators).
808.843 20	0.73 5	1234.099	(7/2)	425.276	7/2 ⁺	%I _γ =0.190 14 E _γ =808.892 12, I _γ =0.545 20 (2003Me01).
809.6 ^{<i>fh</i>}	0.06	923.886	(5/2 ⁺ ,7/2)	114.313	5/2 ⁺	%I _γ =0.0156 5 I _γ : from 1986Ii01 .
813.19 ^{<i>n</i>} 8	0.044 7	1328.81?		515.645	(9/2) ⁻	E _γ : other: 810.54 20 (1968He19) fits poorly. %I _γ =0.0114 19 Placement from 2003Me01 . E _γ =813.09 23, I _γ =0.028 9 (2003Me01).
818.18 ^{<i>hb f</i>}	0.022 6	1568.60	(5/2 ⁺ ,7/2)	750.41	(7/2 ⁻ ,9/2 ⁺)	%I _γ =0.0057 16
828.6 ^{<i>b</i>}	0.033 8	942.926	(3/2 ⁺ ,5/2,7/2 ⁺)	114.313	5/2 ⁺	%I _γ =0.0086 21 E _γ =829.81 14, I _γ =0.071 7 (2003Me01).
^x 829.35 ^{<i>d</i>} 18						
832.09 5	0.09 1	1043.39	(3/2 ⁺ ,5/2,7/2)	211.308	5/2 ⁺	%I _γ =0.0234 27 E _γ =832.25 20, I _γ =0.051 8 (2003Me01).
837.40 3	0.12 1	1234.099	(7/2)	396.774	5/2 ⁺	%I _γ =0.0312 28 E _γ =835.18 6, I _γ =0.124 8 in 2003Me01 is probably the same γ, although 2003Me01 place it from 1391 level.
^x 839.24 ^{<i>j</i>} 5	0.106 8					%I _γ =0.0275 22 Proposed placement (2003Me01): 1049.6 – 211.4. Poor fit (evaluators).
842.847 23	0.20 2	1239.616	(5/2 ⁺ ,7/2)	396.774	5/2 ⁺	%I _γ =0.052 5 E _γ =842.97 4, I _γ =0.143 6 (2003Me01).
849.926 ^{<i>h</i>} 25	0.084 7	1312.106	(5/2)	462.191	3/2 ⁻	%I _γ =0.0218 19
854.74 ^{<i>hb f</i>}	0.017 4	1412.10	(5/2,7/2)	558.15	(9/2) ⁺	%I _γ =0.0044 10 E _γ : poor fit; level-energy difference=854.06.
859.42 ^{<i>din</i>} 5	0.076 7	1406.84?		547.126	(5/2,7/2 ⁺)	%I _γ =0.0197 19 I _γ and placement from 2003Me01 . E _γ : level-energy difference=859.72. E _γ =858.74 11 (2003Me01).

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12](#),[1986Ii01](#),[2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
861.54 3	0.068 7	1050.18		188.631	3/2 ⁺	%I _γ =0.0177 19 E _γ =860.21 3, I _γ =0.264 19 (2003Me01).
864.9	0.013 ^a 5	1290.078	(3/2 ⁺ ,5/2,7/2)	425.276	7/2 ⁺	%I _γ =0.0034 13 E _γ =864.85 11, I _γ =0.068 26 (2003Me01).
865.00 ^h 5	0.051 ^a 25	1412.10	(5/2,7/2)	547.126	(5/2,7/2 ⁺)	%I _γ =0.013 7
871.375 23	0.13 1	1141.528	5/2 ⁺	270.170	7/2 ⁻	%I _γ =0.0338 28 E _γ =871.45 6, I _γ =0.043 9 (2003Me01).
874.00 8	0.018 4	1234.099	(7/2)	360.046	7/2 ⁺	%I _γ =0.0047 10 E _γ =875.46 14, I _γ =0.025 9 (2003Me01).
^x 877.9 ^e 3	0.008 6					%I _γ =0.0021 16
886.59 8	0.021 4	1312.106	(5/2)	425.276	7/2 ⁺	%I _γ =0.0055 11 E _γ =886.54 16, I _γ =0.021 9 (2003Me01).
893.3 ^b	0.017 4	1290.078	(3/2 ⁺ ,5/2,7/2)	396.774	5/2 ⁺	%I _γ =0.0044 10 E _γ =892.94 9, I _γ =0.028 4 (2003Me01).
896.65 14	0.015 5	1312.106	(5/2)	415.449	3/2 ⁺	%I _γ =0.0039 13 E _γ =897.09 22, I _γ =0.011 3 (2003Me01).
^x 907.69 7	0.017 3					%I _γ =0.0044 8
^x 911.3 ^g	0.06 ^g					%I _γ =0.016
915.35 ^h 9	0.008 4	1312.106	(5/2)	396.774	5/2 ⁺	%I _γ =0.0021 10
920.3 ^h 2	0.015 6	1190.274	(5/2)	270.170	7/2 ⁻	%I _γ =0.0039 16
923.874 23	0.39 3	923.886	(5/2 ⁺ ,7/2)	0.0	7/2 ⁺	%I _γ =0.101 8 E _γ =924.21 10, I _γ =0.254 16 (2003Me01).
929.2 ^{gh}	<0.04 ^g	1043.39	(3/2 ⁺ ,5/2,7/2)	114.313	5/2 ⁺	%I _γ <0.010
929.8 ^h 3	0.042 5	1290.078	(3/2 ⁺ ,5/2,7/2)	360.046	7/2 ⁺	%I _γ =0.0109 13 E _γ : from 1979Sc12 . Others: 929.43 5 (1968He19), 929.9 (1986Ii01).
^x 933.24 ^j 4	0.225 20					%I _γ =0.058 5
935.90 ^h 6	0.018 3	1050.18		114.313	5/2 ⁺	%I _γ =0.0047 8 E _γ : 936.67 (1986Ii01).
^x 938.79 ^e 5	0.023 3					%I _γ =0.0060 8
942.97 ^e 17	0.012 4	942.926	(3/2 ⁺ ,5/2,7/2 ⁺)	0.0	7/2 ⁺	%I _γ =0.0031 10 E _γ =943.18 21, I _γ =0.030 13 (2003Me01).
945.80 3	0.083 7	1234.099	(7/2)	288.208	9/2 ⁺	%I _γ =0.0216 19 E _γ =945.83 14, I _γ =0.038 15 (2003Me01).
951.3	0.010 ^a 4	1239.616	(5/2 ⁺ ,7/2)	288.208	9/2 ⁺	%I _γ =0.0026 10 E _γ : see comment on 952.1γ.
952.0 ^f	0.029 ^a 10	1312.106	(5/2)	360.046	7/2 ⁺	E _γ =951.06 18, I _γ =0.013 7 (2003Me01).
						%I _γ =0.0075 26 E _γ : other: 951.95 5 for doublet (1968He19).
963.95 3	0.097 10	1234.099	(7/2)	270.170	7/2 ⁻	E _γ =952.61 4, I _γ =0.039 9 (2003Me01).
						%I _γ =0.0252 27 E _γ =964.048 19, I _γ =0.232 8 (2003Me01).

$\gamma(^{149}\text{Pm})$ (continued)

E_γ [‡]	I_γ ^{#k}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
967.43 4	0.032 4	1156.034	(3/2 ⁺ , 5/2, 7/2 ⁺)	188.631	3/2 ⁺	%I γ =0.0083 11 E γ =968.372 8, I γ =0.799 12 (2003Me01). E γ : 968.28 (1986Ii01). %I γ =0.0029 8
^x 971.77 ^e 9	0.011 3					%I γ =0.0065 26
976.2 ^{jn} 3	0.025 10	1363.85?		387.559	1/2 ⁺	%I γ =0.016 5
978.8 ^e	0.06 ^a 2	1394.25	3/2 ⁺	415.449	3/2 ⁺	E γ =978.43 21, I γ =0.15 4 (2003Me01). %I γ =0.078 11
979.013 23	0.30 ^a 4	1190.274	(5/2)	211.308	5/2 ⁺	E γ =979.52 22, I γ =0.12 3 (2003Me01). %I γ =0.0023 5
986.68 ^h 10	0.009 2	1412.10	(5/2, 7/2)	425.276	7/2 ⁺	%I γ =0.0148 16
992.83 ^{ein} 6	0.057 6	1181.30?		188.631	3/2 ⁺	Placement from 2003Me01 . E γ : level-energy difference=992.66. E γ =992.08 27, I γ =0.013 8 (2003Me01). %I γ =0.0039 18
993.05 ^{bf}	0.015 7	1264.01	(5/2, 7/2)	270.170	7/2 ⁻	E γ : level-energy difference=993.84. E γ =993.56 21, I γ =0.015 9 (2003Me01). I γ : 0.05 (1986Ii01). %I γ =0.0036 13
1016.1 ^{jn} 3	0.014 5	1412.10	(5/2, 7/2)	396.774	5/2 ⁺	%I γ =0.0026 10
1021.8 ^e	0.010 ^a 4	1568.60	(5/2 ⁺ , 7/2)	547.126	(5/2, 7/2 ⁺)	E γ : level-energy difference=1021.5. E γ =1020.99 20, I γ =0.063 8 (2003Me01). %I γ =0.104 8
1022.78 3	0.40 ^a 3	1234.099	(7/2)	211.308	5/2 ⁺	E γ =1022.93 4, I γ =0.266 18 (2003Me01). %I γ =0.0088 16
1027.18 4	0.034 6	1141.528	5/2 ⁺	114.313	5/2 ⁺	E γ =1027.6 3, I γ =0.012 5 (2003Me01). %I γ =0.0044 13
1031.77 8	0.017 ^{&} 5	1031.68	(7/2 ⁺)	0.0	7/2 ⁺	E γ =1031.40 21, I γ =0.028 7 (2003Me01). %I γ =0.0055 18
^x 1040.7 ^j 4	0.021 7					Proposed placement (2003Me01): 1156.97 – 114.35. Very poor fit (evaluators). %I γ =0.0286 27
1041.95 3	0.11 1	1312.106	(5/2)	270.170	7/2 ⁻	E γ =1042.36 17, I γ =0.043 15 (2003Me01). %I γ =0.0044 13
1051.90 11	0.017 ^{&} 5	1412.10	(5/2, 7/2)	360.046	7/2 ⁺	E γ =1051.34 20, I γ =0.015 9 (2003Me01). %I γ =0.0208 27
1075.95 4	0.08 1	1190.274	(5/2)	114.313	5/2 ⁺	E γ =1076.03 5, I γ =0.091 3 (2003Me01). %I γ =0.063 7
1078.76 3	0.244 27	1290.078	(3/2 ⁺ , 5/2, 7/2)	211.308	5/2 ⁺	E γ =1078.68 23, I γ =0.199 3 (2003Me01). %I γ =0.049 5
1100.77 3	0.19 2	1312.106	(5/2)	211.308	5/2 ⁺	E γ =1100.68 3, I γ =0.126 26 (2003Me01). I γ : 0.31 18 (2003Me01), but no evidence of such a line in 1979ScZL and
1119.79 ^{jn}		1234.099	(7/2)	114.313	5/2 ⁺	

¹⁴⁹Nd β⁻ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01 (continued)

γ(¹⁴⁹Pm) (continued)

E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
						1968He19. Intensity must be much weaker than 0.31 if this line is from ¹⁴⁹ Nd decay.
1123.47 8	0.058 9	1312.106	(5/2)	188.631	3/2 ⁺	%I _γ =0.0151 24
1125.32 5	0.114 14	1239.616	(5/2 ⁺ ,7/2)	114.313	5/2 ⁺	E _γ =1124.62 4, I _γ =0.42 6 (2003Me01). %I _γ =0.030 4
x1128.56 ^e 11	0.012 3					E _γ =1125.40 4, I _γ =0.26 3 (2003Me01). %I _γ =0.0031 8
1135.94 ^h 9	0.008 ^{&} 3	1495.86	(5/2,7/2 ⁺)	360.046	7/2 ⁺	%I _γ =0.0021 8
1141.77 ^{mhi} 16	0.010 ^m 4	1141.528	5/2 ⁺	0.0	7/2 ⁺	%I _γ =0.0026 10 E _γ : level-energy difference=1141.53. Placement from 1986Ii01.
1141.77 ^{mh} 8	0.010 ^{m&} 4	1412.10	(5/2,7/2)	270.170	7/2 ⁻	%I _γ =0.0026 10
1150.08 ^{hi} 8	0.089 9	1264.01	(5/2,7/2)	114.313	5/2 ⁺	%I _γ =0.0231 24 I _γ : 0.01 (1986Ii01). E _γ : level-energy difference=1149.70.
1156.3 ^h 4	0.004 2	1156.034	(3/2 ⁺ ,5/2,7/2 ⁺)	0.0	7/2 ⁺	%I _γ =0.0010 5
1171.97 10	0.015 3	1568.60	(5/2 ⁺ ,7/2)	396.774	5/2 ⁺	%I _γ =0.0039 8 E _γ =1170.88 19, I _γ =0.068 9 (2003Me01). %I _γ =0.037 5
x1172.76 ^j 19	0.141 17					Proposed placement (2003Me01): 1411.9 – 240.4. Very poor fit (evaluators); and γ with this large intensity not reported in other studies.
1175.75 ^h 6	0.013 3	1290.078	(3/2 ⁺ ,5/2,7/2)	114.313	5/2 ⁺	%I _γ =0.0034 8
1180.5 ^{jn} 3	0.153 11	1181.30?		0.0	7/2 ⁺	%I _γ =0.0397 31
1190.28 ^h 7	0.009 2	1190.274	(5/2)	0.0	7/2 ⁺	%I _γ =0.0023 5
1197.84 6	0.026 4	1312.106	(5/2)	114.313	5/2 ⁺	%I _γ =0.0068 11 E _γ =1197.47 19, I _γ =0.021 4 (2003Me01). %I _γ =0.0016 5
x1202.29 10	0.006 2					E _γ =1202.1 5, I _γ =0.008 4 (2003Me01). %I _γ =0.0039 16
1206.7 ^{jn} 3	0.015 6	1495.86	(5/2,7/2 ⁺)	288.208	9/2 ⁺	%I _γ =0.0016 5
1225.67 ^h 11	0.006 2	1495.86	(5/2,7/2 ⁺)	270.170	7/2 ⁻	%I _γ =0.0260 35
1234.12 4	0.100 13	1234.099	(7/2)	0.0	7/2 ⁺	E _γ =1234.31 5, I _γ =0.083 8 (2003Me01). I _γ : 0.149 9 (2003Me01), but no evidence of such a line in 1979ScZL and 1968He19.
1237.61 ^{jn}		1448.24	(3/2 ⁺ ,5/2,7/2 ⁺)	211.308	5/2 ⁺	Intensity must be much weaker than 0.149 if this line is from ¹⁴⁹ Nd decay.
1239.5 ^h 3	0.007 2	1239.616	(5/2 ⁺ ,7/2)	0.0	7/2 ⁺	%I _γ =0.0018 5 E _γ : 1238.56 (1986Ii01). %I _γ =0.0042 8
1259.62 7	0.016 3	1448.24	(3/2 ⁺ ,5/2,7/2 ⁺)	188.631	3/2 ⁺	E _γ =1259.22 5, I _γ =0.0048 22 (2003Me01). %I _γ =0.0075 13
1264.02 6	0.029 5	1264.01	(5/2,7/2)	0.0	7/2 ⁺	E _γ =1263.8 5, I _γ =0.0102 23 (2003Me01). %I _γ =0.0010 5
1280.28 12	0.004 2	1568.60	(5/2 ⁺ ,7/2)	288.208	9/2 ⁺	E _γ =1280.57 6, I _γ =0.043 3 (2003Me01).

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12](#),[1986Ii01](#),[2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

E _γ [‡]	I _γ ^{#k}	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
1284.49 ^h 13	0.006 2	1495.86	(5/2, 7/2 ⁺)	211.308	5/2 ⁺	%I _γ =0.0016 5
1290.11 ^h 6	0.016 3	1290.078	(3/2 ⁺ , 5/2, 7/2)	0.0	7/2 ⁺	%I _γ =0.0042 8
1293.4 ^{jin} 4	0.07 3	1293.4?		0.0	7/2 ⁺	%I _γ =0.018 8
1298.32 ^h 10	0.003 2	1568.60	(5/2 ⁺ , 7/2)	270.170	7/2 ⁻	%I _γ =0.0008 5
1307.6 ^{bh}	0.004 2	1495.86	(5/2, 7/2 ⁺)	188.631	3/2 ⁺	%I _γ =0.0010 5 E _γ : level-energy difference=1307.2.
1312.13 ^h 6	0.028 4	1312.106	(5/2)	0.0	7/2 ⁺	%I _γ =0.0073 11
1357.26 ^h 11	0.008 2	1568.60	(5/2 ⁺ , 7/2)	211.308	5/2 ⁺	%I _γ =0.0021 5
1367.96 ^{jin} 13	0.06 5	1367.97?		0.0	7/2 ⁺	%I _γ =0.016 13
1381.42 ^h 8	0.008 2	1495.86	(5/2, 7/2 ⁺)	114.313	5/2 ⁺	%I _γ =0.0021 5
^x 1400.95 ^j 9	0.038 4					%I _γ =0.0099 11
1407.26 ^{jin} 6	0.058 5	1406.84?		0.0	7/2 ⁺	%I _γ =0.0151 14 E _γ : level-energy difference=1406.84.
1448.07 19	0.002 1	1448.24	(3/2 ⁺ , 5/2, 7/2 ⁺)	0.0	7/2 ⁺	%I _γ =0.00052 26 E _γ =1449.56 3, I _γ =0.032 6 (2003Me01).
1454.29 ^h 12	0.005 2	1568.60	(5/2 ⁺ , 7/2)	114.313	5/2 ⁺	%I _γ =0.0013 5
^x 1473.8 ^d 3						
1495.80 14	0.006 2	1495.86	(5/2, 7/2 ⁺)	0.0	7/2 ⁺	%I _γ =0.0016 5 E _γ =1495.36 11, I _γ =0.027 3 (2003Me01).
1568.43 18	0.002 1	1568.60	(5/2 ⁺ , 7/2)	0.0	7/2 ⁺	%I _γ =0.00052 26

[†] From ce data. The α(exp) values are derived by the evaluators from Ice values of [1967Ba27](#) and I_γ data of [1979ScZL](#) assuming 114γ as standard with α(K)=0.9086 8 deduced from L1/L2 and L1/L3 ratios. Sign of δ is from γ(θ) ([1987Si13](#)) and/or γγ(θ) ([1986Ii01](#)).

[‡] Weighted average of [1979Sc12](#) and [1968He19](#). In cases where [1979Sc12](#) have deduced E_γ from level scheme only, the value is given to 0.1 keV without uncertainty. Values from [1986Ii01](#) generally agree with those from [1979Sc12](#) and [1968He19](#). No uncertainties are quoted by [1986Ii01](#). Values from [2003Me01](#) are not used in averaging for reasons quoted above.

[#] From [1979Sc12](#) or [1979ScZL](#). For absolute intensities of prominent γ rays (from fission produced source) see [1969Gr32](#). Values given by [1969Gr32](#) agree well with those deduced from the normalization factor given here. Values from [2003Me01](#) are not used in averaging for reasons quoted above.

@ From ce date of [1967Ba27](#).

& From γγ.

^a Doublet, measured energy associated with stronger component and I_γ of both from γγ.

^b Observed only in γγ.

^c Doublet, seen only in γγ.

^d Reported only by [1968He19](#).

^e Not reported by [1986Ii01](#).

¹⁴⁹Nd β⁻ decay (1.726 h) [1979Sc12](#),[1986Ii01](#),[2003Me01](#) (continued)

γ(¹⁴⁹Pm) (continued)

- ^f From [1986Ii01](#).
^g γ reported by [1986Ii01](#) only.
^h γ not reported by [2003Me01](#).
ⁱ Uncertainty was doubled in the least-squares fitting procedure.
^j γ from [2003Me01](#) only; treated as uncertain by the evaluators, since with the intensity quoted by [2003Me01](#), this line should have been seen by [1979Sc12](#) and [1986Ii01](#). This γ is not included in the Adopted Gammas.
^k For absolute intensity per 100 decays, multiply by 0.260 8.
^l Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
^m Multiply placed with undivided intensity.
ⁿ Placement of transition in the level scheme is uncertain.
^x γ ray not placed in level scheme.

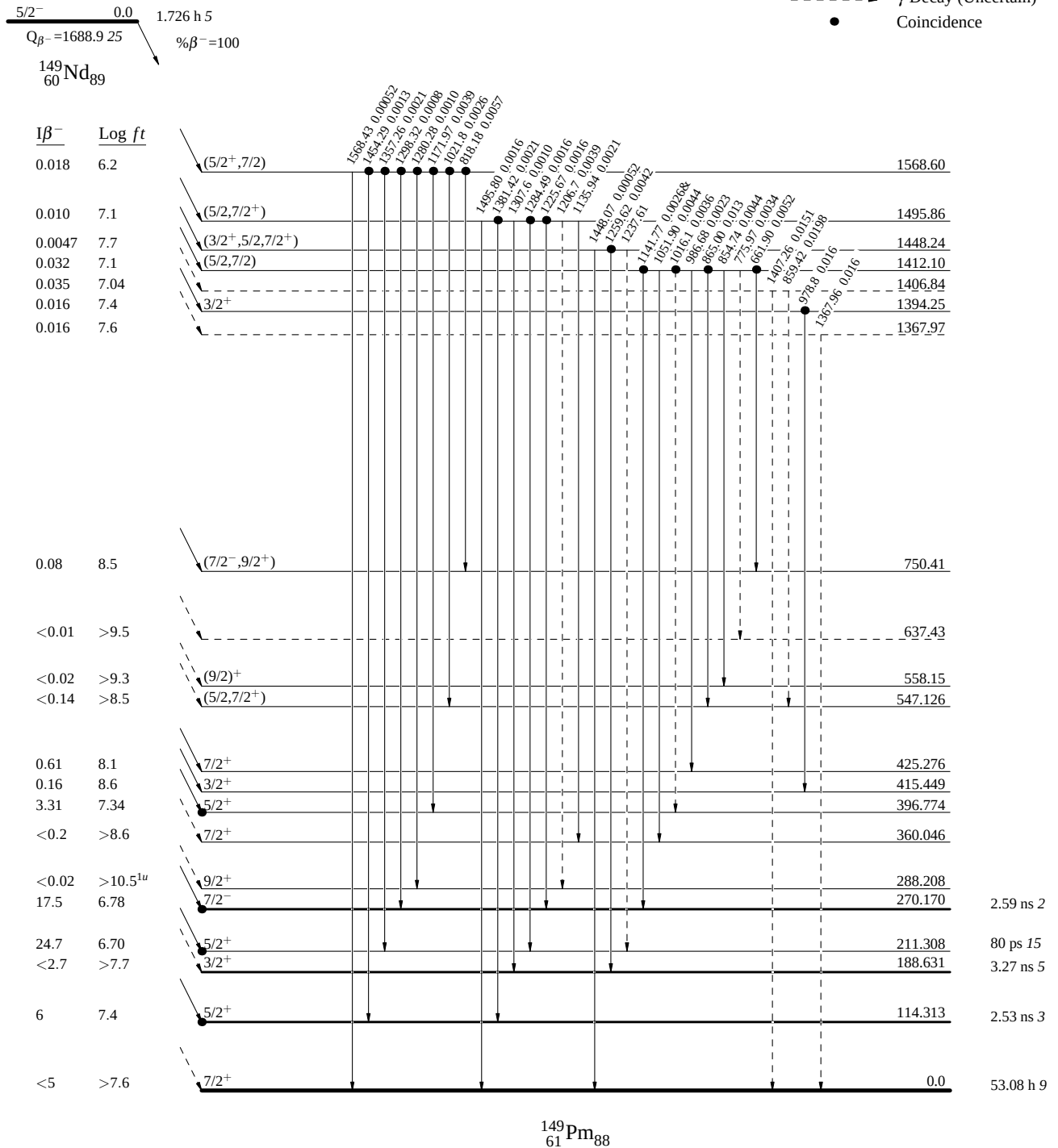
^{149}Nd β^- decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence



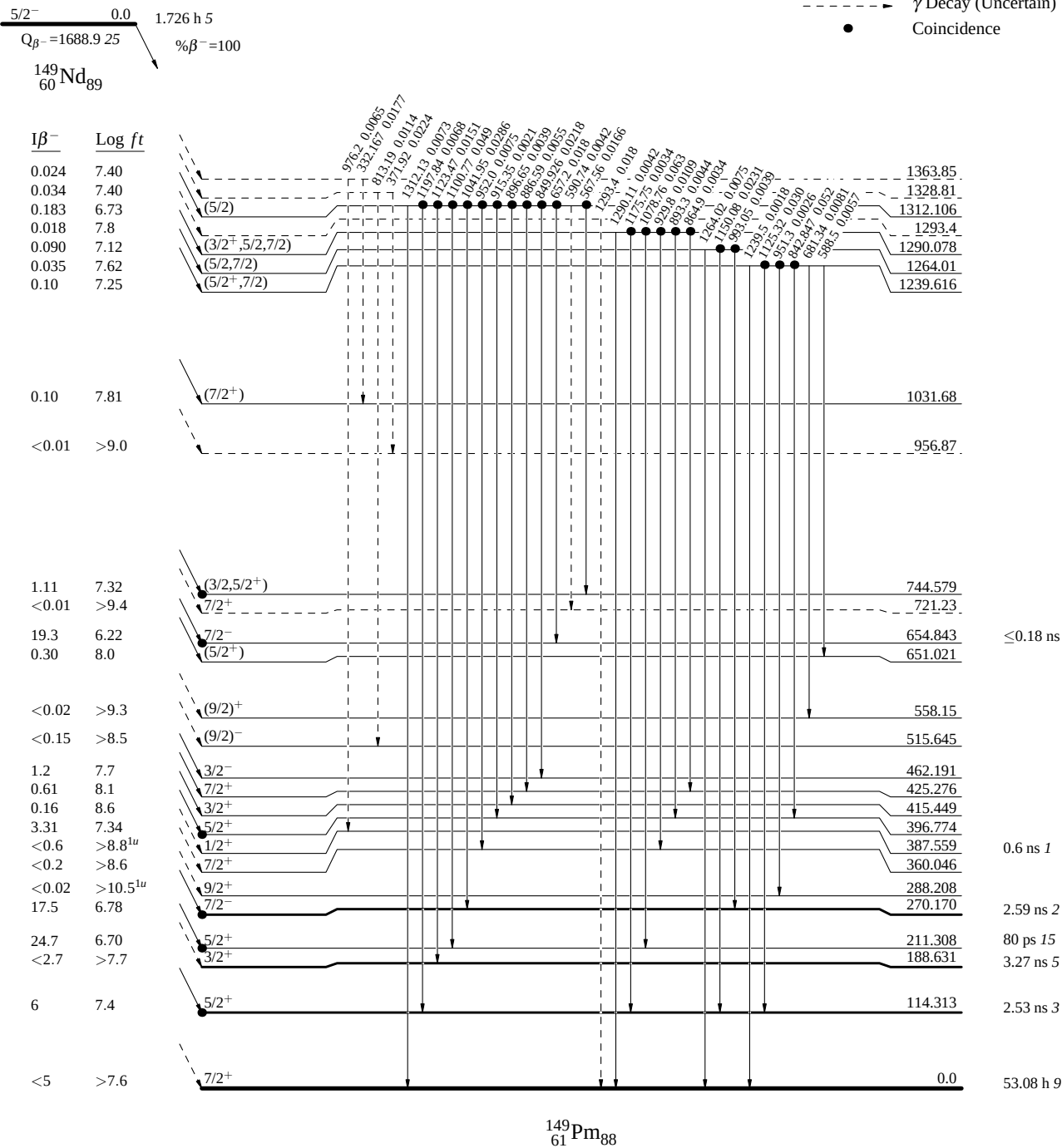
¹⁴⁹Nd β⁻ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - γ Decay (Uncertain)
- Coincidence



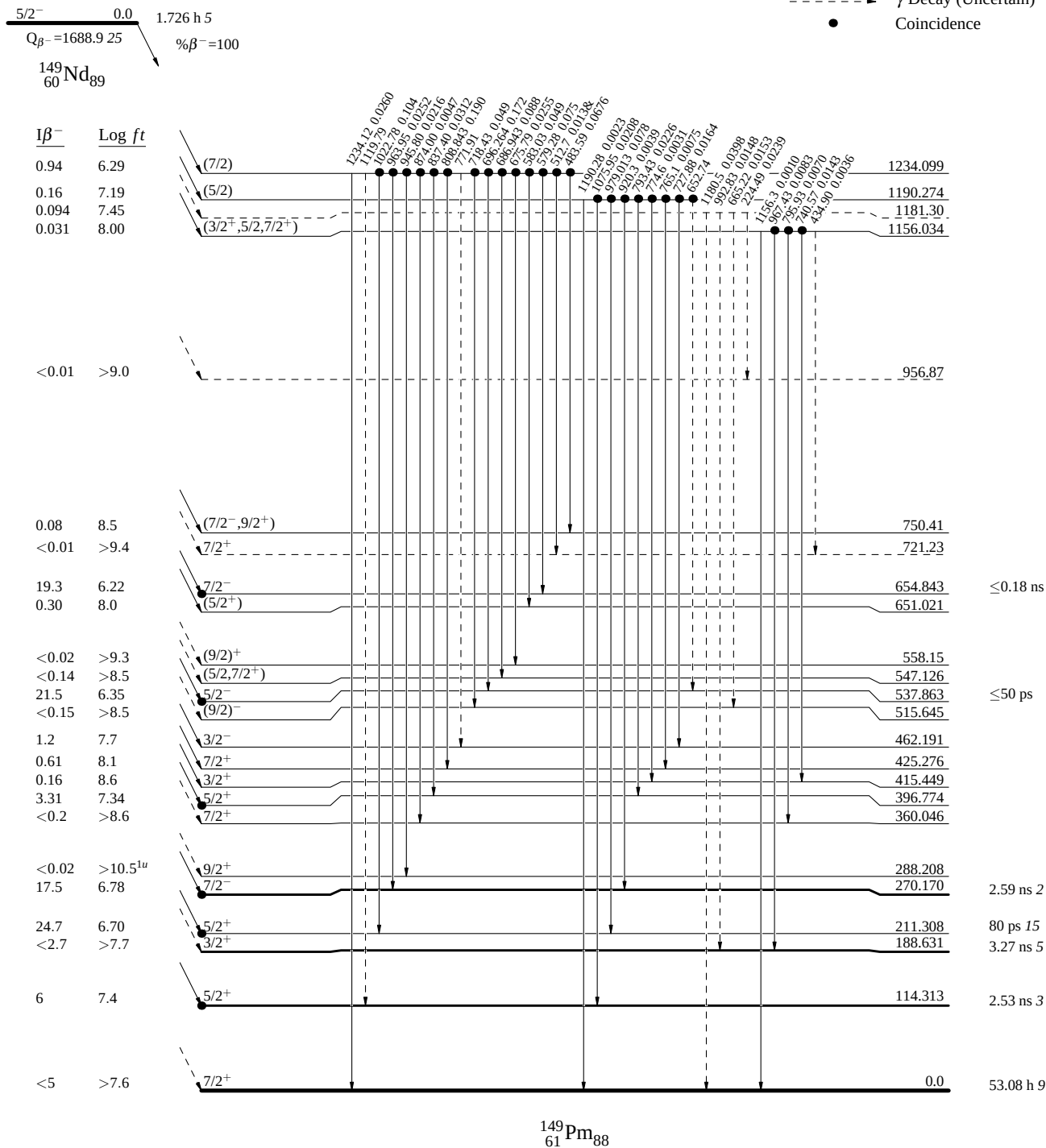
¹⁴⁹Nd β⁻ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - γ Decay (Uncertain)
- Coincidence



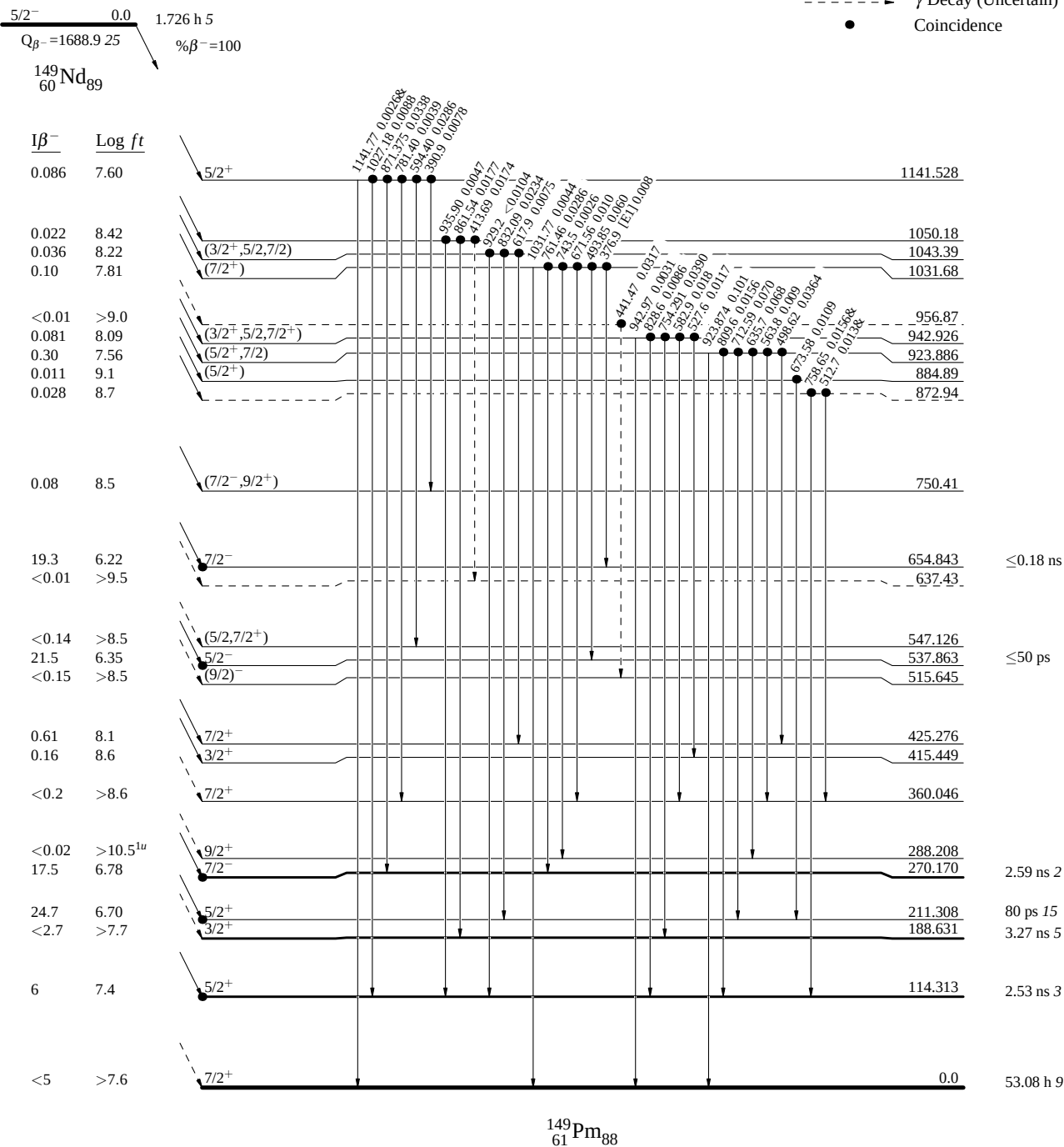
¹⁴⁹Nd β⁻ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)
- Coincidence



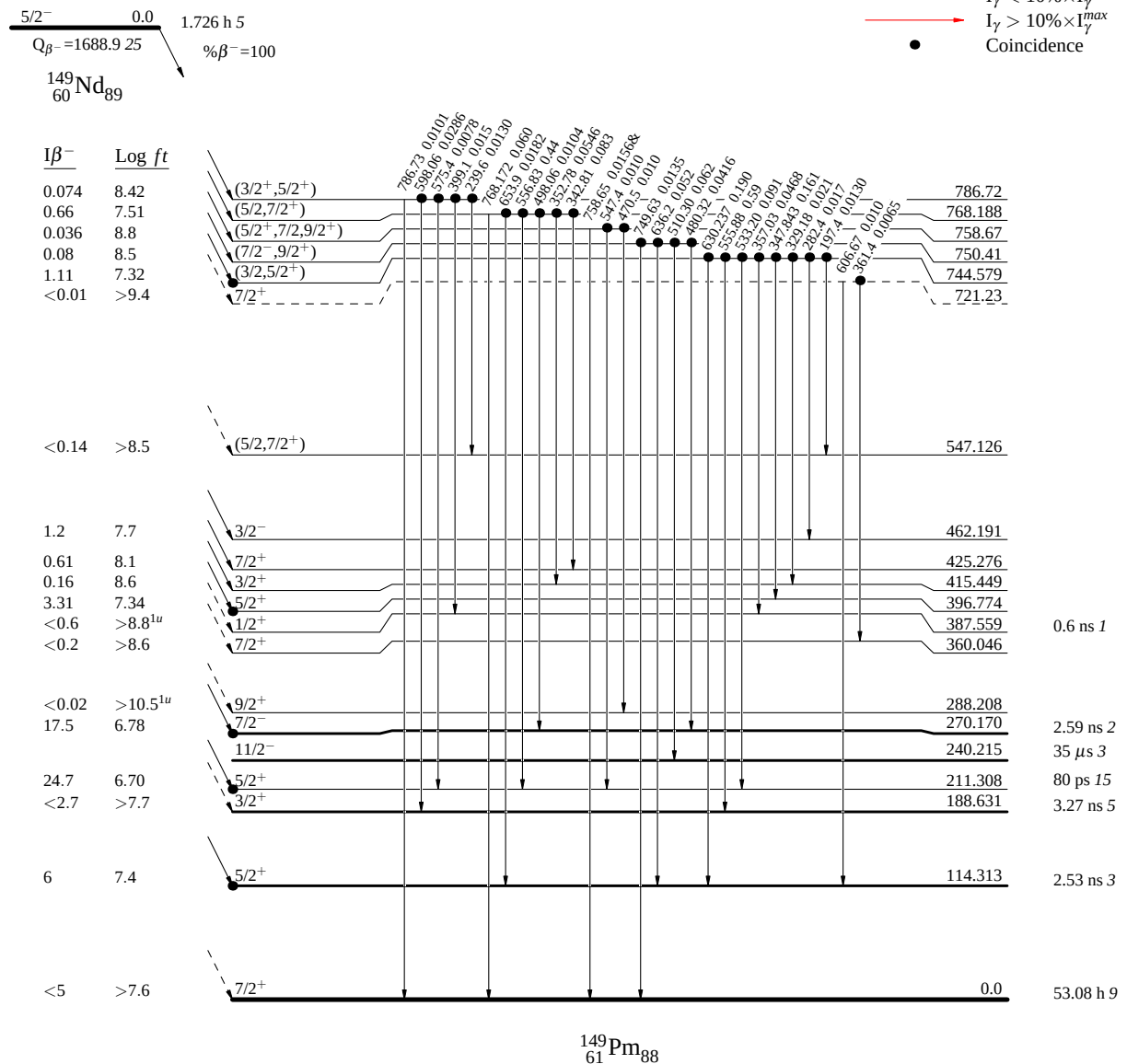
$^{149}\text{Nd} \beta^-$ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiplied by: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- Coincidence



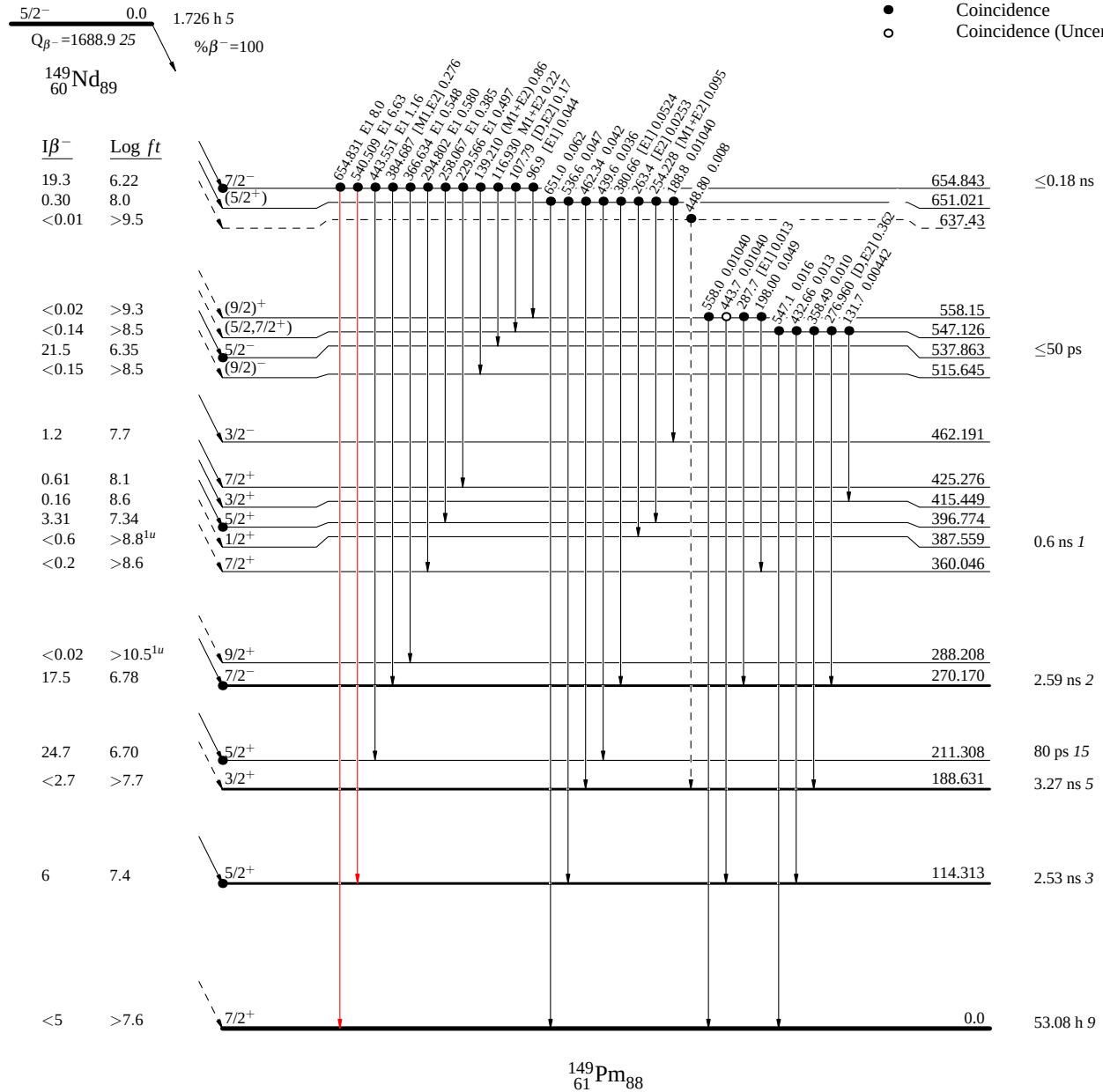
^{149}Nd β^- decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
- $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
- $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
- $\longrightarrow$ γ Decay (Uncertain)
- $\bullet$ Coincidence
- $\circ$ Coincidence (Uncertain)



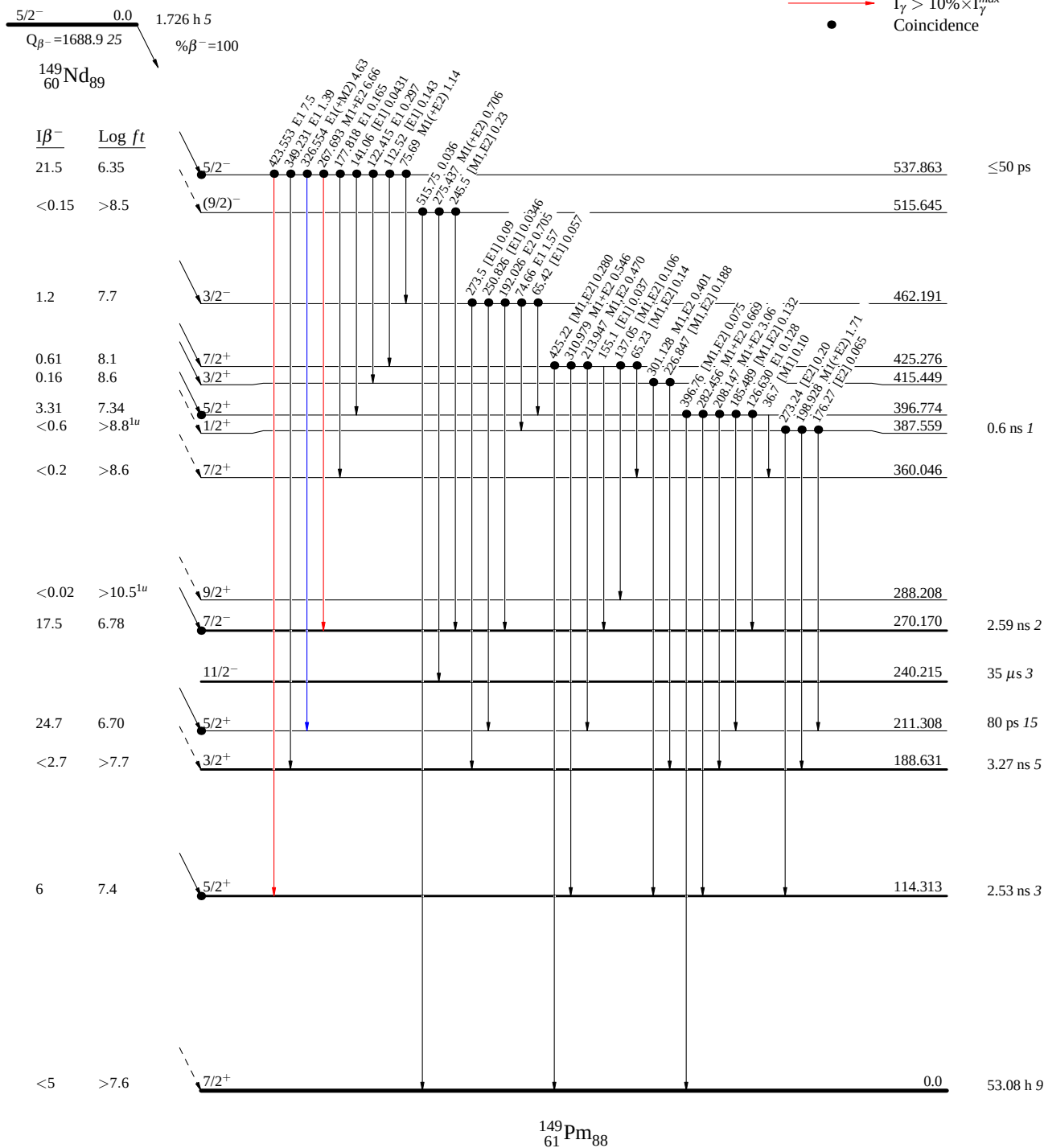
¹⁴⁹Nd β⁻ decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence



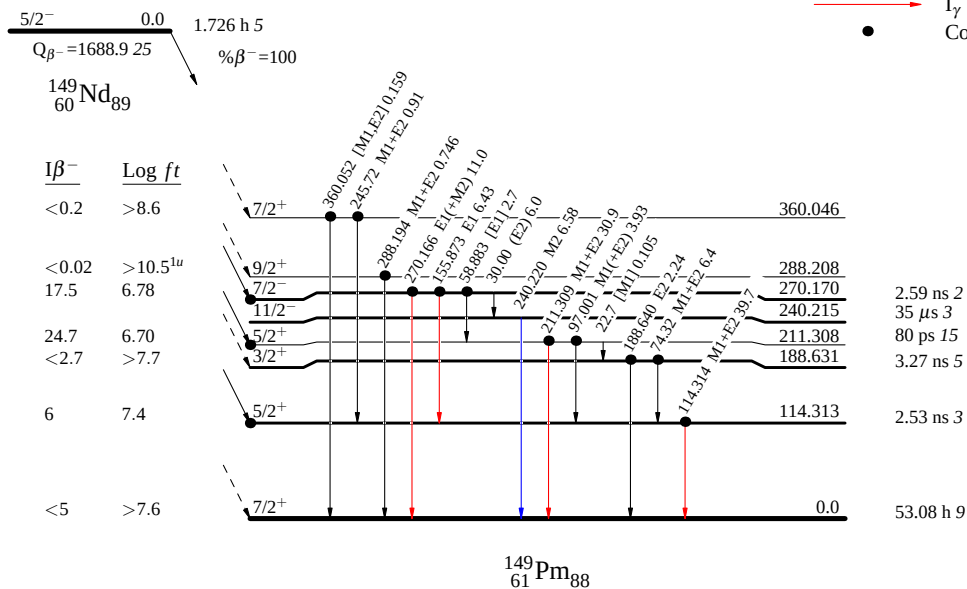
^{149}Nd β^- decay (1.726 h) 1979Sc12,1986Ii01,2003Me01

Decay Scheme (continued)

 Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
 & Multiply placed: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- Coincidence



$^{148}\text{Nd}(^3\text{He},\text{d})$ **1976St10**

1976St10: $E(^3\text{He})=24$ MeV from the McMaster University Tandem. Enriched 95.40% ^{148}Nd deposited on $30\text{ }\mu\text{g}/\text{cm}^2$ carbon foils.

Deuterons analyzed with a magnetic spectrograph. $\sigma(\theta)$ were measured at eight angles. $d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) values at 45° and 60° are listed by **1976St10**. These values are given under comments.

 ^{149}Pm Levels

E(level)	$L^\dagger$	$S^\ddagger$	Comments
0 4	4	1.8	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=35 at 60° , 40 at 45° . L: $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$ gives $L=5$.
114 4	2	2.2	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=146 at 60° , 236 at 45° .
190 4	2,3,4 [#]	0.043	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=3 at 60° , ≈ 2 at 45° . L: $L=3,4$ are not consistent with adopted $J^\pi=3/2^+$. S: for $L=2$.
214 4		0.084	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=6 at 60° , 6 at 45° .
240 4	5	4.8	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=62 at 60° , 74 at 45° .
270 4	3	0.34	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=19 at 60° , 33 at 45° . L: $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$ gives $L=2$, inconsistent with (pol t, α).
387 4	0	0.32	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=38 at 60° , 61 at 45° .
414 4	2	0.71	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=50 at 60° , 91 at 45° .
461 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=3 at 60° , 5 at 45° .
514 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=4 at 60° . E(level): probably a combination of the 510.0 and 515.6 levels.
552 4	(5) [#]	0.39	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=5 at 60° , 5 at 45° .
636 4	0	0.090	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=14 at 60° , 23 at 45° .
721 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=5 at 60° .
749 4	2	0.49	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=42 at 60° , 63 at 45° .
787 4	(5) [#]	0.60	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=17 at 60° , 14 at 45° . L: $\sigma(\theta)$ gives $L=4$ which is not consistent with (pol t, α).
871 4	2	0.39	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=34 at 60° , 49 at 45° . E(level): this may be the $5/2^+$ state at 884.88.
906 4	0	0.28	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=43 at 60° , 58 at 45° .
1008 4	0	0.033	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 5 at 60° , 5 at 45° .
1033 4	(5)	0.65	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=6 at 60° , 11 at 45° . L=(5) is inconsistent with $J^\pi=(7/2^+)$ in the Adopted Levels, while a fit with $L=(4)$ is marginally acceptable, consistent with $J^\pi=(7/2^+)$.
1138 4	2	0.14	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=8 at 60° , 14 at 45° .
1181 4	(2) [#]	0.11	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=4 at 60° , 13 at 45° .
1192? 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 3 at 60° . E(level): from (α,t). Weakly populated in ($^3\text{He},\text{d}$) with $\sigma(60^\circ)\approx 3$.
1211 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 4 at 60° , 8 at 45° .
1259 4	(2,3) [#]		$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=9 at 60° , 15 at 45° .
1319 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=4 at 45° .
1367 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 5 at 60° , 11 at 45° .
1405 4	5	0.67	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=8 at 60° , 12 at 45° .
1464 4	(4,5) [#]		$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 7 at 60° , 14 at 45° .
1531 4	3	0.12	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=6 at 60° , 12 at 45° .
1568 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 3 at 60° , 6 at 45° .
1589 4	(4)	0.32	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=9 at 60° , 9 at 45° . L: $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$ favors $L=5$.
1641 4	2	0.38	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=37 at 60° , 63 at 45° .
1696 4	2	0.15	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=14 at 60° , 21 at 45° . L: $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$ favors $L=3$.
1766 4	0	0.12	$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=19 at 60° , 33 at 45° .
1782? 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$) ≈ 4 at 60° . E(level): from (α,t). Weakly populated in ($^3\text{He},\text{d}$) with $\sigma(60^\circ)\approx 4$.
1834 4			$d\sigma/d\Omega$ ($\mu\text{b}/\text{sr}$)=5 at 60° , 5 at 45° .

Continued on next page (footnotes at end of table)

 $^{148}\text{Nd}({}^3\text{He,d})$ [1976St10](#) (continued)

 ^{149}Pm Levels (continued)

[†] From comparison of $\sigma(\theta)$ with DWBA calculations. For most cases values deduced from $\sigma(\alpha,t)/\sigma({}^3\text{He,d})$ ratios are also given by [1976St10](#) and are consistent with those from $\sigma(\theta)$. The active orbitals are $s_{1/2}$ for $L=0$, $d_{3/2}$ and $d_{5/2}$ for $L=2$, $g_{7/2}$ for $L=4$ and $h_{11/2}$ for $L=5$. For $L=2$, $d_{5/2}$ orbit is more likely at low energies and $d_{3/2}$ at higher energies.

[‡] $\sigma(\text{exp})/(N \times \sigma(\text{theory}))$. $\sigma(\text{theory})$ is derived from a DWBA calculation using the computer code DWUCK, and optical model parameters and normalization factors given by the authors. Relative and absolute σ values are uncertain to 15% and 30%, respectively. The authors also give adopted values deduced from $({}^3\text{He,d})$ and (α,t) .

[#] From $\sigma(\alpha,t)/\sigma({}^3\text{He,d})$ only.

$^{148}\text{Nd}(\alpha, t)$ **1976St10**

1976St10: $E(\alpha)=27$ MeV from the McMaster University Tandem. Enriched 95.4% ^{148}Nd target on carbon foils. The tritons were analyzed with magnetic spectrograph. $\sigma(\theta)$ data at two angles were measured.

 ^{149}Pm Levels

Cross sections listed under comments are from **1976St10**.

E(level)	L [†]	S [‡]	Comments
0	(4,5)	2.6	S: for L=4. $d\sigma/d\Omega$ ($\mu\text{b/sr}$)=108 at 60° , 146 at 40° .
114 4	2	2.5	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=171 at 60° , 209 at 40° .
187 4	2,3,4	0.033	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=2 at 60° , ≈ 3 at 40° . L: adopted $J^\pi=3/2^+$ consistent with L=2 only. S: for L=2.
211 4	(0)	0.033	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=2 at 60° , ≈ 3 at 40° . L: adopted $J^\pi=5/2^+$ requires L=2. S: for L=2.
240 4	5	3.9	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=147 at 60° , 281 at 40° .
271 4	(2)	0.18	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=20 at 60° , 20 at 40° . L: adopted $J^\pi=7/2^-$ requires L=3. S: for L=3.
387 4	0	0.23	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=19 at 60° , 12 at 40° .
414 4	2	0.85	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=56 at 60° , 62 at 40° .
515 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=6 at 60° , 7 at 40° .
550 4	4,5	0.21	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=12 at 60° , 7 at 40° . L: adopted $J^\pi=(11/2^-)$ favors L=5. S: for L=5.
637 4	0,2	0.11	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=8 at 60° , ≈ 4 at 40° . L: adopted $J^\pi=1/2^+$ consistent with L=0. S: for L=0.
722 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=6 at 60° , ≈ 4 at 40° .
751 4	2	0.55	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=33 at 60° , 33 at 40° .
791 4	4,5	0.89	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=29 at 60° , 46 at 40° . L: adopted $J^\pi=11/2^-$ consistent with L=5. S: for L=4.
871 4	2,3	0.48	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=27 at 60° , 26 at 40° . L: 3 is inconsistent with $\sigma(\theta)$ in ($^3\text{He}, d$). S: for L=2.
907 4	0	0.15	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=12 at 60° , ≈ 4 at 40° .
959 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=6 at 60° , ≈ 3 at 40° .
1034 4	(5)	0.73	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=22 at 60° , 38 at 40° . L: adopted $J^\pi=(7/2^+)$ requires L=4.
1139 4	2	0.12	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=4 at 60° , 5 at 40° .
1181 4	2	0.14	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=4 at 60° , 6 at 40° .
1192 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=7 at 60° , 6 at 40° .
1215 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)= ≈ 4 at 60° .
1258 4	2,3		$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=6 at 60° , 8 at 40° .
1327 4			$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=3 at 60° , 4 at 40° .
1405 4	5	0.51	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=14 at 60° , 23 at 40° .
1461 4	4,5		$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=12 at 60° , 19 at 40° .
1531 4	3	0.11	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=4 at 60° , 7 at 40° .
1589 4	4,5	0.50	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=12 at 60° , ≈ 13 at 40° . L: 5 is inconsistent with $\sigma(\theta)$ in ($^3\text{He}, d$). S: for L=4.
1640 4	2	0.33	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=11 at 60° .
1697 4	2,3	0.20	$d\sigma/d\Omega$ ($\mu\text{b/sr}$)=6 at 60° .

Continued on next page (footnotes at end of table)

¹⁴⁸Nd(α ,t) [1976St10](#) (continued)

¹⁴⁹Pm Levels (continued)

<u>E(level)</u>	<u>L</u> [†]	Comments
		L: 3 is inconsistent with $\sigma(\theta)$ in (³ He,d). S: for L=2.
1764 4	0	$d\sigma/d\Omega$ (μ b/sr)<2 at 60°.
1782 4		$d\sigma/d\Omega$ (μ b/sr)=4 at 60°.

[†] As indicated by $\sigma(\alpha,t)/\sigma(^3\text{He},d)$ ratios given in figure 7 by [1976St10](#). The actual L-values assigned by [1976St10](#) differ in some cases since $\sigma(\theta)$ results in (³He,d) are also used.

[‡] $\sigma(\text{exp})/(N \times \sigma(\text{theory}))$. $\sigma(\text{theory})$ is derived from DWBA calculation with N=111. Relative and absolute cross sections are accurate to 15% and 30%, respectively. [1976St10](#) also give adopted values derived from (α ,t) and (³He,d) reactions.

$^{150}\text{Nd}(\text{p}, 2\text{n}\gamma)$ **1979Ko35**

1979Ko35: E(p)=12.1-15.8 MeV from the cyclotron of the University of Jyvaskyla. Enriched target (96%) was used for self supporting targets 0.8-2.0 mg/cm² thickness or mylar backed neodymium oxide targets 10 mg/cm² thick. Measured excitation functions, $\gamma(\theta)$ at 6 angles for E(p)=15.8 MeV, $\gamma\gamma$, $\gamma(t)$.

Level scheme is based on energy fit and $\gamma\gamma$ -coin.

 ^{149}Pm Levels

E(level) [†]	J ^π #	T _{1/2} [‡]	Comments
0.0	7/2 ⁺		
114.32 4	5/2 ⁺	2.7 ns 2	
188.61 6	3/2 ⁺	3.1 ns 2	
211.34 5	5/2 ⁺		
240.23 10	11/2 ⁻	35 μ s 3	T _{1/2} : from the Adopted Levels.
270.15 5	7/2 ⁻	2.8 ns 2	
288.28 7	(7/2,9/2) ⁺		J ^π : 9/2 ⁺ in the Adopted Levels.
360.10 15	7/2 ⁺		
387.51 8	1/2 ⁺		
396.74 6	5/2 ⁺		
415.45 11	3/2 ⁺		
425.30 5	(5/2,7/2) ⁺		J ^π : 7/2 ⁺ in the Adopted Levels.
462.12 10	3/2 ⁻		
497.63 12	(11/2) ⁺		
510.10 25	(13/2,15/2 ⁻)	<3 ns	J ^π : (15/2) ⁻ in the Adopted Levels. 15/2 favored also by excitation function of 269 γ . J ^π : excitation function of 275 γ strongly favors J<11/2.
515.71 16	(9/2) ⁻		
537.83 8	5/2 ⁻		
547.11 13	(5/2,7/2)		J ^π : (5/2,7/2 ⁺) in the Adopted Levels.
558.22 18	(7/2,9/2)		J ^π : (9/2) ⁺ in the Adopted Levels.
650.89 10	(5/2,7/2)		J ^π : (5/2 ⁺) in the Adopted Levels.
655.35 15	7/2 ⁻		
666.57 13	(7/2 ⁻ ,9/2 ⁺)		
716.71 19	(3/2 ⁻)		
721.35 23	7/2 ⁺		
750.75 21	(7/2 ⁻ ,9/2 ⁺)		
767.8 5	(5/2,7/2 ⁺)		
771.36 25	(13/2 ⁻)@		
778.92 13	(13/2) ⁺ @		
791.08 21	11/2 ⁻ @		
808.61 24	(11/2) ⁺ @		
885.9 5	(11/2,13/2 ⁺)@		

[†] From least-squares fit to E γ data.

[‡] From $\gamma(t)$ (**1979Ko35**).

As given in **1979Ko35** up to 655 level, based on $\gamma(\theta)$ data and decay pattern. Above this energy the assignments are from the Adopted Levels as none are given in **1979Ko35**. Up to 655 level, when J^π assignments differ in the Adopted Levels, the latter are given in comments.

@ Excitation function suggests J $\geq$ 11/2 (**1979Ko35**).

$^{150}\text{Nd}(\text{p}, 2\text{n}\gamma)$ **1979Ko35** (continued)

$\gamma(^{149}\text{Pm})$							Comments
E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	
58.81 5	4.5 5	270.15	7/2 ⁻	211.34	5/2 ⁺		E1 in 1979Ko35 .
74.3 1	15 3	188.61	3/2 ⁺	114.32	5/2 ⁺		
97.04 5	2.5 5	211.34	5/2 ⁺	114.32	5/2 ⁺	D+Q	$A_2=+0.05$ 3; $A_4=-0.02$ 4 M1+E2 in 1979Ko35 .
114.35 5	100	114.32	5/2 ⁺	0.0	7/2 ⁺	D+Q	$A_2=-0.04$ 1; $A_4\approx 0$ M1+E2 in 1979Ko35 .
126.59 6	0.9 2	396.74	5/2 ⁺	270.15	7/2 ⁻	D	$A_2=-0.12$ 8; $A_4\approx 0$ E1 in 1979Ko35 .
137.01 6	1.5 3	425.30	(5/2,7/2) ⁺	288.28	(7/2,9/2) ⁺		
155.85 6	21.0 20	270.15	7/2 ⁻	114.32	5/2 ⁺	D	$A_2=-0.06$ 1; $A_4=-0.02$ 1 E1 in 1979Ko35 .
185.42 8	1.0 2	396.74	5/2 ⁺	211.34	5/2 ⁺		
188.58 8	20.5 20	188.61	3/2 ⁺	0.0	7/2 ⁺		E2 in 1979Ko35 .
191.97 8	3.6 6	462.12	3/2 ⁻	270.15	7/2 ⁻		E2 in 1979Ko35 .
198.1 [‡] 1	4.5 [‡] 8	558.22	(7/2,9/2)	360.10	7/2 ⁺		
198.9 1	20 4	387.51	1/2 ⁺	188.61	3/2 ⁺		M1 in 1979Ko35 .
208.15 9	26 3	396.74	5/2 ⁺	188.61	3/2 ⁺	D	$A_2=-0.03$ 2; $A_4\approx 0$ M1 in 1979Ko35 .
209.2 2	5.0 10	497.63	(11/2) ⁺	288.28	(7/2,9/2) ⁺		
211.27 10	61 5	211.34	5/2 ⁺	0.0	7/2 ⁺	D+Q	$A_2=+0.03$ 1; $A_4\approx 0$ M1+E2 in 1979Ko35 .
213.96 10	9.8 10	425.30	(5/2,7/2) ⁺	211.34	5/2 ⁺	D+Q	$A_2=+0.13$ 2; $A_4=+0.03$ 3 M1+E2 in 1979Ko35 .
226.80 12	5.6 6	415.45	3/2 ⁺	188.61	3/2 ⁺		
240.19 12	105 5	240.23	11/2 ⁻	0.0	7/2 ⁺	M2	Mult.: from the Adopted Gammas.
241.2 [‡] 3	4.0 [‡] 15	666.57	(7/2 ⁻ ,9/2 ⁺)	425.30	(5/2,7/2) ⁺		
245.5 [‡] 3	8.0 [‡] 20	515.71	(9/2) ⁻	270.15	7/2 ⁻		
245.7 3	37 3	360.10	7/2 ⁺	114.32	5/2 ⁺	(D+Q)	$A_2=-0.01$ 1; $A_4=+0.01$ 2 (M1+E2) in 1979Ko35 .
250.3 2	4.2 8	808.61	(11/2) ⁺	558.22	(7/2,9/2)		
254.17 12	6.5 8	650.89	(5/2,7/2)	396.74	5/2 ⁺		
261.25 12	5.4 8	771.36	(13/2 ⁻)	510.10	(13/2,15/2 ⁻)		
267.68 15	7.8 7	537.83	5/2 ⁻	270.15	7/2 ⁻	D	$A_2=-0.13$ 3; $A_4\approx 0$ M1 in 1979Ko35 .
269.8 3	43 5	510.10	(13/2,15/2 ⁻)	240.23	11/2 ⁻	(D+Q)	$A_2=+0.17$ 2; $A_4=+0.02$ 2 Mult.: (D+Q) from $\gamma(\theta)$ data deduced from $A_2=+0.13$ 1, $A_4=+0.01$ 1 for 269.8 γ +270.1 γ , using theoretical $\gamma(\theta)$ for 270.1 γ (E1 with $\Delta J=0$) and attenuation factor (for A_2)= $+0.17$ derived from 155 $\gamma(\theta)$. (M1+E2) in 1979Ko35 .
270.1 3	38 5	270.15	7/2 ⁻	0.0	7/2 ⁺	D	$A_2=+0.08$ 1; $A_4\approx 0$ $\gamma(\theta)$ data for 270 doublet. See comment on 269.8 γ . E1 in 1979Ko35 .
*272.0 1	4.4 8						
273.2 1	2.4 5	387.51	1/2 ⁺	114.32	5/2 ⁺		M1,E2 in 1979Ko35 .
275.50 15	23.5 20	515.71	(9/2) ⁻	240.23	11/2 ⁻	D(+Q)	$A_2=-0.19$ 1; $A_4\approx 0$ M1+E2 in 1979Ko35 .
276.95 15	18.5 15	547.11	(5/2,7/2)	270.15	7/2 ⁻	D	$A_2=-0.04$ 2; $A_4=-0.02$ 2
281.3 1	2.2 4	778.92	(13/2) ⁺	497.63	(11/2) ⁺		
282.4 1	6.1 5	396.74	5/2 ⁺	114.32	5/2 ⁺	D+Q	$A_2=+0.08$ 2; $A_4\approx 0$ M1+E2 in 1979Ko35 .
288.22 15	65 5	288.28	(7/2,9/2) ⁺	0.0	7/2 ⁺	D+Q	$A_2=+0.32$ 1; $A_4=-0.02$ 1 M1+E2 in 1979Ko35 .

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{p}, 2\text{n}\gamma)$ **1979Ko35** (continued) $\gamma(^{149}\text{Pm})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	Comments
301.2 2	13 3	415.45	3/2 ⁺	114.32	5/2 ⁺		
301.2 [‡] 2	3.5 [‡] 10	716.71	(3/2 ⁻)	415.45	3/2 ⁺		
311.05 15	14.5 15	425.30	(5/2, 7/2) ⁺	114.32	5/2 ⁺	D+Q	$A_2=+0.10$ 1; $A_4=+0.02$ 1 M1+E2 in 1979Ko35 .
326.5 1	5.6 8	537.83	5/2 ⁻	211.34	5/2 ⁺		E1 in 1979Ko35 .
349.2 1	2.0 5	537.83	5/2 ⁻	188.61	3/2 ⁺		E1 in 1979Ko35 .
360.1 2	7.0 12	360.10	7/2 ⁺	0.0	7/2 ⁺		
361.4 [‡] 2	2.7 [‡] 6	721.35	7/2 ⁺	360.10	7/2 ⁺		
367.2 2	2.5 12	655.35	7/2 ⁻	288.28	(7/2, 9/2) ⁺		
380.8 2	5.0 8	650.89	(5/2, 7/2)	270.15	7/2 ⁻		
396.4 3	0.7 3	396.74	5/2 ⁺	0.0	7/2 ⁺		
396.4 [‡] 3	5.8 [‡] 2	666.57	(7/2 ⁻ , 9/2 ⁺)	270.15	7/2 ⁻		
423.6 2	9.0 10	537.83	5/2 ⁻	114.32	5/2 ⁺		E1 in 1979Ko35 .
425.4 2	8.0 15	425.30	(5/2, 7/2) ⁺	0.0	7/2 ⁺		
426.3 2	8.0 15	666.57	(7/2 ⁻ , 9/2 ⁺)	240.23	11/2 ⁻		
432.8 2	1.5 5	547.11	(5/2, 7/2)	114.32	5/2 ⁺		
439.4 2	3.0 7	650.89	(5/2, 7/2)	211.34	5/2 ⁺		
444.1@ 5	9.0@ 20	558.22	(7/2, 9/2)	114.32	5/2 ⁺	(Q)	$A_2=+0.13$ 3; $A_4=-0.03$ 4
444.1@ [‡] 5	1.0@ [‡] 3	655.35	7/2 ⁻	211.34	5/2 ⁺		E1 in 1979Ko35 .
446.7 3	6.3 12	716.71	(3/2 ⁻)	270.15	7/2 ⁻	Q	$A_2=+0.18$ 4; $A_4=-0.13$ 6
448.7 3	10.5 15	808.61	(11/2) ⁺	360.10	7/2 ⁺	(Q)	$A_2=+0.25$ 5; $A_4=+0.07$ 7
^x 450.1 3	3.0 6						
455.3 2	4.5 8	666.57	(7/2 ⁻ , 9/2 ⁺)	211.34	5/2 ⁺		
462.3 2	2.5 5	650.89	(5/2, 7/2)	188.61	3/2 ⁺		
480.6 2	8.2 10	750.75	(7/2 ⁻ , 9/2 ⁺)	270.15	7/2 ⁻	D(+Q)	$A_2=-0.13$ 4; $A_4=+0.05$ 6
490.7 2	13.7 12	778.92	(13/2) ⁺	288.28	(7/2, 9/2) ⁺	(Q)	$A_2=+0.26$ 3; $A_4=+0.07$ 4
497.8 2	33.0 20	497.63	(11/2) ⁺	0.0	7/2 ⁺	(Q)	$A_2=+0.24$ 2; $A_4\approx 0$ (E2) in 1979Ko35 .
502.8 2	9.0 12	791.08	11/2 ⁻	288.28	(7/2, 9/2) ⁺	D	$A_2=-0.08$ 7; $A_4\approx 0$
531.2 3	8.2 12	771.36	(13/2 ⁻)	240.23	11/2 ⁻		
538.5 3	2.8 10	778.92	(13/2) ⁺	240.23	11/2 ⁻		
540.8 3	5.0 12	655.35	7/2 ⁻	114.32	5/2 ⁺		E1 in 1979Ko35 .
^x 547.8 3	3.2 7						
556.5 5	5.0 15	767.8	(5/2, 7/2 ⁺)	211.34	5/2 ⁺		
597.6 5	13.0 20	885.9	(11/2, 13/2 ⁺)	288.28	(7/2, 9/2) ⁺		
606.5& 4	5.5 12	721.35	7/2 ⁺	114.32	5/2 ⁺		Placement suggested by evaluators.
^x 635.0 5	5.0 10						
^x 651.4 5	7.2 15						
654.9 5	7.5 15	655.35	7/2 ⁻	0.0	7/2 ⁺		E1 in 1979Ko35 .
^x 787.1 5	6.3 12						
^x 790.1 5	4.5 9						
^x 799.7 5	8.5 10						
^x 812.8 5	3.5 7						

[†] At 125° and $E(\text{p})=14.3$ MeV.[‡] From $\gamma\gamma$ -coin data.[#] From $\gamma(\theta)$ in [1979Ko35](#). The evaluators assign D for $\Delta J=1$, dipole (M1 or E1) and Q for $\Delta J=2$, quadrupole (likely E2) due to lack of experimental evidence in this work for magnetic or electric nature of transitions. Assignments in Table 1 of [1979Ko35](#) are listed in comments, some of which are apparently from ΔJ^π .

@ Multiply placed with intensity suitably divided.

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{p}, 2\text{n}\gamma)$ **1979Ko35 (continued)**

$\gamma(^{149}\text{Pm})$ (continued)

& Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

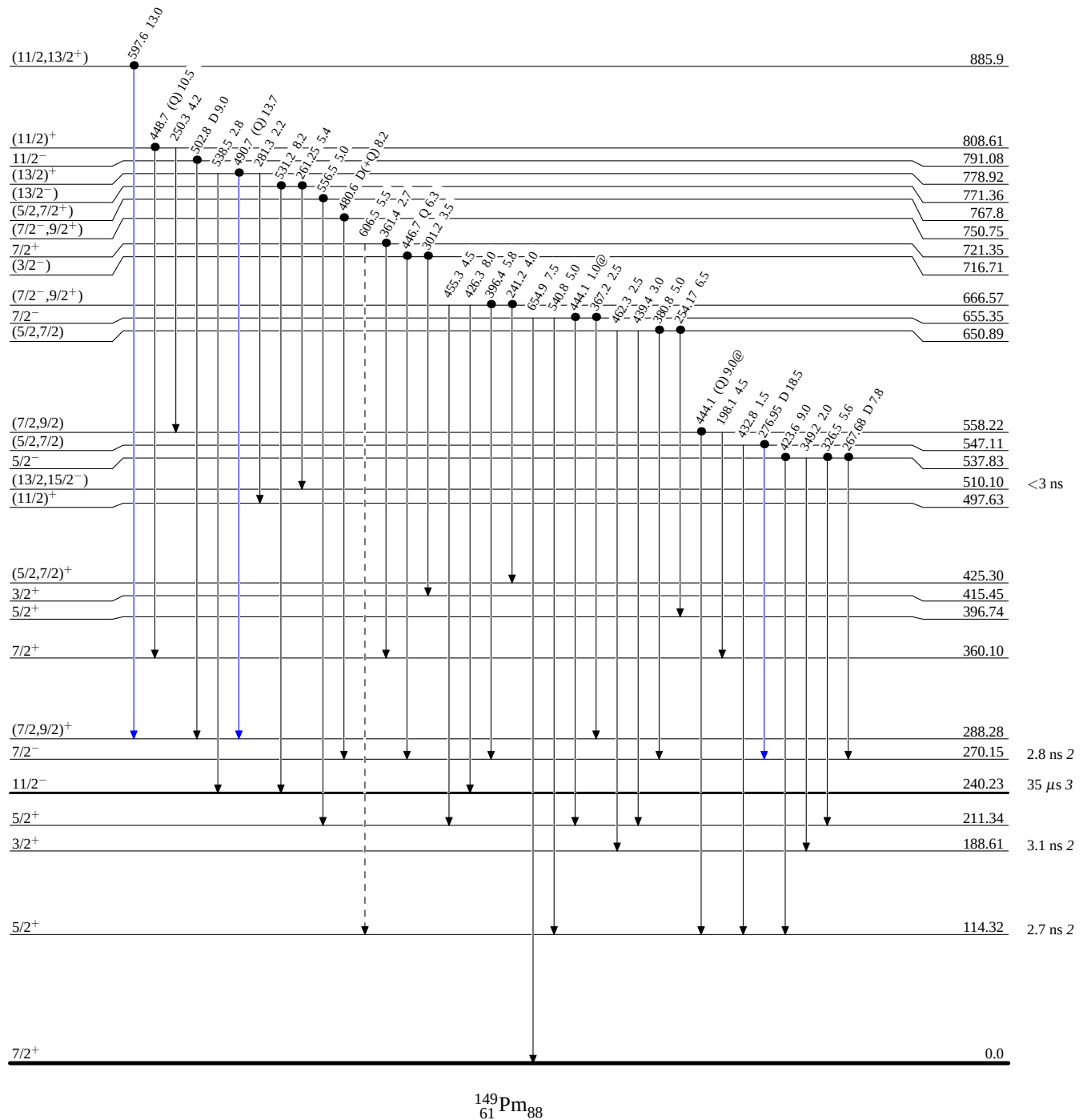
$^{150}\text{Nd}(p,2n\gamma)$ 1979Ko35

Level Scheme

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence



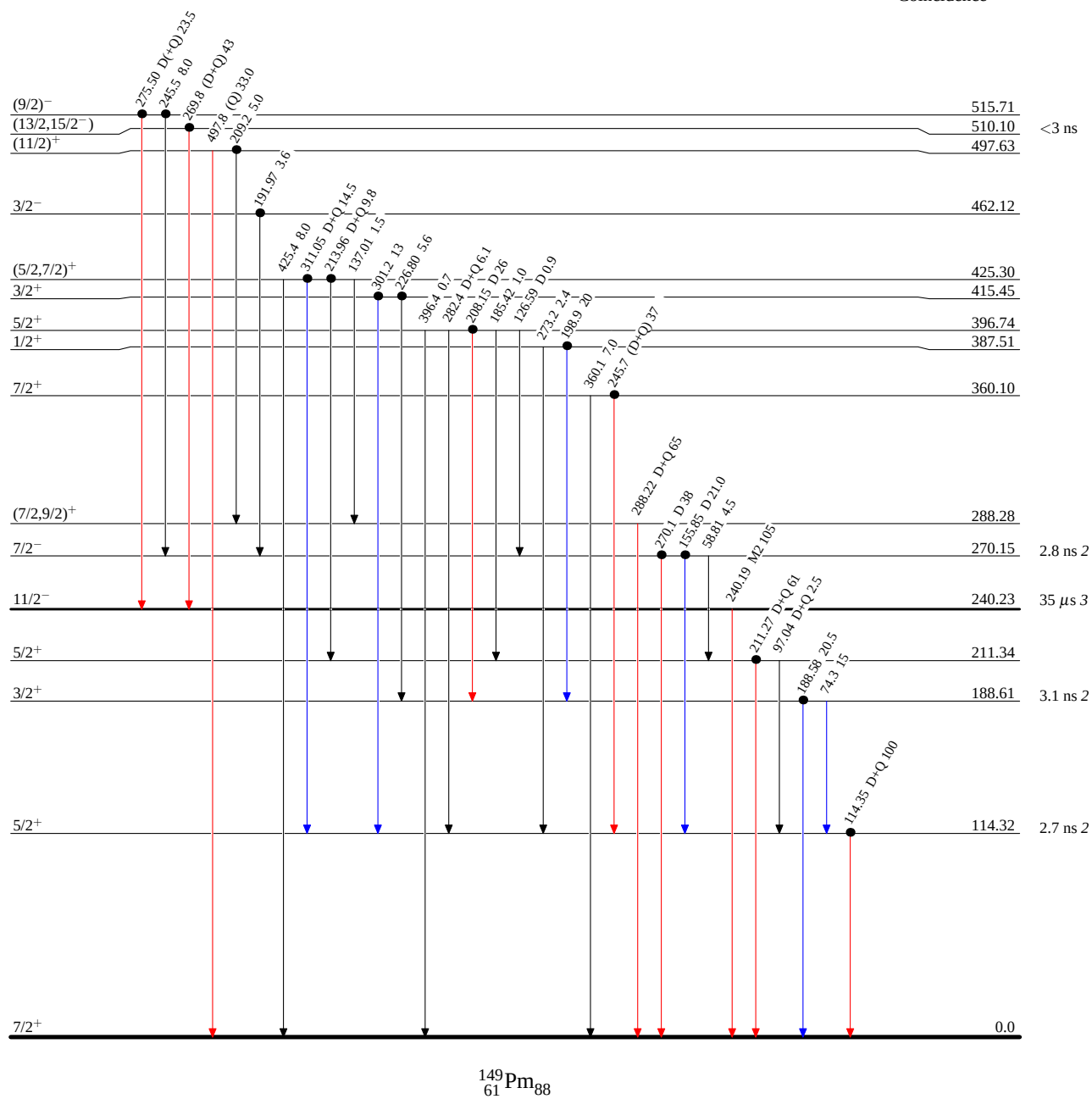
$^{150}\text{Nd}(p,2n\gamma)$ 1979Ko35

Level Scheme (continued)

Intensities: Relative I_γ
 @ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- Coincidence


 $^{149}_{61}\text{Pm}_{88}$

$^{150}\text{Nd}(\text{d},3\text{n}\gamma)$ 1996Jo19

1996Jo19: E=18 MeV from the MP tandem at Orsay. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, ce. Deduced multi-particle configurations and octupole deformation.

 ^{149}Pm Levels

E(level) [†]	$J\pi^{\ddagger}$	$T_{1/2}$	Comments
0.0 [#]	7/2 ⁺		
114.28 ^c 15	5/2 ⁺		
188.55 18	3/2 ⁺		
211.57 23	5/2 ⁺		
240.28 ^{&} 25	11/2 ⁻	35 μs 3	$T_{1/2}$: from the Adopted Levels.
270.23 17	7/2 ⁻		
288.48 [#] 18	9/2 ⁺		
360.34 ^c 18	7/2 ⁺		
387.57 21	1/2 ⁺		
396.79 23	5/2 ⁺		
497.89 [#] 16	11/2 ⁺		
510.2 ^{&} 3	15/2 ⁻		
515.7 ^a 3	(9/2 ⁻)		
558.84 ^c 19	9/2 ⁺		
651.3 4	(5/2 ⁺)		J^{π} : from the Adopted Levels. 7/2 ⁺ proposed by 1996Jo19.
771.5 ^a 3	(13/2 ⁻)		
779.32 [#] 19	13/2 ⁺		
791.49 [@] 20	11/2 ⁻		
809.19 ^c 24	11/2 ⁺		
956.9 ^{&} 4	(19/2 ⁻)		
1006.63 [@] 22	13/2 ⁻		
1008.50 [#] 21	15/2 ⁺		
1145.71 [@] 22	15/2 ⁻		
1162.9 ^b 4	(15/2 ⁺)		
1211.1 ^a 4	(17/2 ⁻)		
1229.53 [#] 24	17/2 ⁺		
1406.99 [@] 25	17/2 ⁻		
1477.0 ^b 4	(19/2 ⁺)		
1504.7 ^{&} 4	(23/2 ⁻)		
1549.58 [#] 25	19/2 ⁺		
1591.0 [@] 4	(19/2 ⁻)		
1612.7 ^a 4	(21/2 ⁻)		
1739.0 [#] 4	21/2 ⁺		
1885.3 [@] 3	(21/2 ⁻)		
1923.6 ^b 4	(23/2 ⁺)		
2112.3 ^{&} 5	(27/2 ⁻)		
2122.3 [#] 4	23/2 ⁺		

[†] From least-squares fit to $E\gamma$ data.

[‡] As proposed by 1996Jo19 based on multipolarity assignments from ce data and band structures, unless otherwise noted. The

Continued on next page (footnotes at end of table)

$^{150}\text{Nd}(\text{d},3\text{n}\gamma)$ **1996Jo19** (continued) ^{149}Pm Levels (continued)

assignments in the Adopted Levels are generally the same, except that some of these are placed in parentheses when strong arguments are lacking.

Band(A): Band based on $7/2^+$ ground state. Possibly based on $\pi 7/2[404]$ (**1996Jo19**), although Nilsson-model assignment is not quite valid here. See also comment for band based on $11/2^-$.

@ Band(B): Band based on $11/2^-$. In comparison with a similar structure of opposite parity bands (probably reflection-asymmetric) in ^{147}Pm , this band may form a parity doublet with the band based on $7/2^+$ g.s. (**1996Jo19**), the difference in energies of levels of similar spins (but of opposite parity) ranges from about 300 keV at $J=11/2$ to about 50 keV at $J=19/2$.

& Band(C): $\pi h_{11/2}$ isomer band.

^a Band(D): $(9/2^-)$ band.

^b Band(E): Band based on $(15/2^+)$. Possibly $\pi h_{11/2} \otimes (3^-)$. Only the $15/2^+$, $19/2^+$, $23/2^+$ members reported.

^c Band(F): Band based on $5/2^+$.

$\gamma(^{149}\text{Pm})$								
E_γ [†]	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	α ^a	Comments
58.6 3	4@ 1	270.23	$7/2^-$	211.57	$5/2^+$			E1 in 1996Jo19 . I_γ : 1996Jo19 give relative to 446.8 γ ; but from their Fig. 2, it should be relative to 246.9 γ .
74.3 2	40@ 3	188.55	$3/2^+$	114.28	$5/2^+$	M1+E2	5.2 16	$\alpha(\text{K})_{\text{exp}}=2.4$ 8
114.3 3		114.28	$5/2^+$	0.0	$7/2^+$	M1+E2	1.23 17	$\alpha(\text{K})_{\text{exp}}=0.8$ 2; $\alpha(\text{L})_{\text{exp}}=0.11$ 2
139.3 3	1.4# 2	1145.71	$15/2^-$	1006.63	$13/2^-$			M1+E2 in 1996Jo19 .
142.7 3	1.1# 8	1549.58	$19/2^+$	1406.99	$17/2^-$			E1 in 1996Jo19 .
155.9 2	54@ 4	270.23	$7/2^-$	114.28	$5/2^+$	E1	0.0797 12	$\alpha(\text{K})_{\text{exp}}=0.05$ 2
188.6 3		188.55	$3/2^+$	0.0	$7/2^+$	(E2)	0.246 4	$\alpha(\text{K})_{\text{exp}}=0.15$ 7 Mult.: $\alpha(\text{K})_{\text{exp}}$ overlaps $\alpha(\text{K})_{\text{theory}}$ for E2 and M1, ΔJ^π suggests E2. 1996Jo19 assign E2.
198.5 2	44@ 4	558.84	$9/2^+$	360.34	$7/2^+$	M1+E2	0.217 10	$\alpha(\text{K})_{\text{exp}}=0.17$ 4
199.1 2	45@ 4	387.57	$1/2^+$	188.55	$3/2^+$	M1+E2	0.215 10	$\alpha(\text{K})_{\text{exp}}=0.16$ 6
208.2 2	33@ 3	396.79	$5/2^+$	188.55	$3/2^+$	M1+E2	0.188 11	$\alpha(\text{K})_{\text{exp}}=0.15$ 5
209.5 2	18# 1	497.89	$11/2^+$	288.48	$9/2^+$	M1+E2	0.184 11	$\alpha(\text{K})_{\text{exp}}=0.15$ 5
211.5 3		211.57	$5/2^+$	0.0	$7/2^+$			M1+E2 in 1996Jo19 .
215.0 3	1.2# 3	1006.63	$13/2^-$	791.49	$11/2^-$	M1+E2	0.170 12	$\alpha(\text{K})_{\text{exp}}=0.13$ 7
221.0 3	1.3# 2	1229.53	$17/2^+$	1008.50	$15/2^+$			M1+E2 in 1996Jo19 .
229.2 2	7.3# 3	1008.50	$15/2^+$	779.32	$13/2^+$	M1+E2	0.141 12	$\alpha(\text{K})_{\text{exp}}=0.14$ 6
232.6 3		791.49	$11/2^-$	558.84	$9/2^+$	E1	0.0273 4	$\alpha(\text{K})_{\text{exp}}=0.02$ 1 I_γ : 6 1, relative to 100 for 246.0 γ from 360.3, $7/2^+$ level.
237.0 3	1.5# 4	2122.3	$23/2^+$	1885.3	$(21/2^-)$			(E1) in 1996Jo19 .
240.2 3		240.28	$11/2^-$	0.0	$7/2^+$	M2	0.664 10	Mult.: from the Adopted Gammas.
245.5 3	1.0& 7	515.7	$(9/2^-)$	270.23	$7/2^-$			(M1+E2) in 1996Jo19 .
246.0 2	100	360.34	$7/2^+$	114.28	$5/2^+$	M1+E2	0.114 12	$\alpha(\text{K})_{\text{exp}}=0.09$ 2
250.7 3	14@ 2	809.19	$11/2^+$	558.84	$9/2^+$	M1+E2	0.108 12	$\alpha(\text{K})_{\text{exp}}=0.07$ 3
254.3 3	5& 2	1211.1	$(17/2^-)$	956.9	$(19/2^-)$	(M1+E2)	0.104 12	$\alpha(\text{K})_{\text{exp}}=0.12$ 5
254.5 3	5@ 1	651.3	$(5/2^+)$	396.79	$5/2^+$	M1+E2	0.103 12	$\alpha(\text{K})_{\text{exp}}=0.06$ 3
256.0 3	4& 2	771.5	$(13/2^-)$	515.7	$(9/2^-)$			
261.4 2	20& 3	771.5	$(13/2^-)$	510.2	$15/2^-$	(M1+E2)	0.096 12	$\alpha(\text{K})_{\text{exp}}=0.11$ 4

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$^{150}\text{Nd}(\text{d}, 3\text{n}\gamma)$ **1996Jo19** (continued) $\gamma(^{149}\text{Pm})$ (continued)

E_γ †	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	α^a	Comments
261.5 3	0.6 [#] 2	1406.99	17/2 ⁻	1145.71	15/2 ⁻			M1+E2 in 1996Jo19 .
265.8 3	5 ^{&} 1	1477.0	(19/2 ⁺)	1211.1	(17/2 ⁻)			(E1) in 1996Jo19 .
269.9 3		510.2	15/2 ⁻	240.28	11/2 ⁻	E2	0.0757 11	$\alpha(\text{K})_{\text{exp}}=0.06$ 1
270.5 3		270.23	7/2 ⁻	0.0	7/2 ⁺			E1 in 1996Jo19 .
273.2 2	18 [@] 4	387.57	1/2 ⁺	114.28	5/2 ⁺	(E2)	0.0729 10	$\alpha(\text{K})_{\text{exp}}=0.06$ 4 Mult.: $\alpha(\text{K})_{\text{exp}}$ gives M1 or E2, but ΔJ^π consistent with E2.
275.4 3	10 ^{&} 3	515.7	(9/2 ⁻)	240.28	11/2 ⁻			(M1+E2) in 1996Jo19 .
281.5 2	12 [#] 1	779.32	13/2 ⁺	497.89	11/2 ⁺	M1+E2	0.077 11	$\alpha(\text{K})_{\text{exp}}=0.06$ 3
282.6 3	12 [@] 2	396.79	5/2 ⁺	114.28	5/2 ⁺	M1+E2	0.076 11	$\alpha(\text{K})_{\text{exp}}=0.08$ 3
288.5 3		288.48	9/2 ⁺	0.0	7/2 ⁺	M1+E2	0.072 11	$\alpha(\text{K})_{\text{exp}}=0.06$ 1
293.6 3	1.7 [#] 5	791.49	11/2 ⁻	497.89	11/2 ⁺			E1 in 1996Jo19 .
310.8 3	1.5 [#] 3	1923.6	(23/2 ⁺)	1612.7	(21/2 ⁻)			(E1) in 1996Jo19 .
314.2 3	3 ^{&} 1	1477.0	(19/2 ⁺)	1162.9	(15/2 ⁺)			(E2) in 1996Jo19 .
320.0 3	2.1 [#] 2	1549.58	19/2 ⁺	1229.53	17/2 ⁺			M1+E2 in 1996Jo19 .
335.8 3	1.2 [#] 2	1885.3	(21/2 ⁻)	1549.58	19/2 ⁺			(E1) in 1996Jo19 . $E_\gamma=355.8$ in Table 1 and Fig. 1 of 1996Jo19 seem a misprint.
354.2 3	3.2 [#] 4	1145.71	15/2 ⁻	791.49	11/2 ⁻	E2	0.0327 5	$\alpha(\text{K})_{\text{exp}}=0.03$ 1
360.1 3		360.34	7/2 ⁺	0.0	7/2 ⁺			
366.4 2	19 [#] 2	1145.71	15/2 ⁻	779.32	13/2 ⁺	E1	0.00858 12	$\alpha(\text{K})_{\text{exp}}=0.012$ 5
391.4 3	4 ^{&} 1	1162.9	(15/2 ⁺)	771.5	(13/2 ⁻)			(E1) in 1996Jo19 .
398.4 2	15.1 [#] 2	1406.99	17/2 ⁻	1008.50	15/2 ⁺	E1	0.00701 10	$\alpha(\text{K})_{\text{exp}}=0.008$ 5
401.6 3	1.0 ^{&} 7	1612.7	(21/2 ⁻)	1211.1	(17/2 ⁻)			(E2) in 1996Jo19 .
419.0 3	2 [#] 1	1923.6	(23/2 ⁺)	1504.7	(23/2 ⁻)			(E1) in 1996Jo19 .
439.6 3	6 ^{&} 2	1211.1	(17/2 ⁻)	771.5	(13/2 ⁻)			(E2) in 1996Jo19 .
444.7 2	28 [@] 2	558.84	9/2 ⁺	114.28	5/2 ⁺	E2	0.01693 24	$\alpha(\text{K})_{\text{exp}}=0.016$ 8
445.3 3	4.4 [#] 6	1591.0	(19/2 ⁻)	1145.71	15/2 ⁻			(E2) in 1996Jo19 .
446.6 3	2.2 [#] 5	1923.6	(23/2 ⁺)	1477.0	(19/2 ⁺)			(E2) in 1996Jo19 .
446.8 2	100	956.9	(19/2 ⁻)	510.2	15/2 ⁻	(E2)	0.01671 23	$\alpha(\text{K})_{\text{exp}}=0.011$ 4
448.7 2	20 [@] 2	809.19	11/2 ⁺	360.34	7/2 ⁺	E2	0.01652 23	$\alpha(\text{K})_{\text{exp}}=0.013$ 4
450.2 2	22 [#] 1	1229.53	17/2 ⁺	779.32	13/2 ⁺	E2	0.01636 23	$\alpha(\text{K})_{\text{exp}}=0.015$ 7
478.2 3	0.9 [#] 2	1885.3	(21/2 ⁻)	1406.99	17/2 ⁻			(E2) in 1996Jo19 .
490.8 2	63 [#] 6	779.32	13/2 ⁺	288.48	9/2 ⁺	E2	0.01292 18	$\alpha(\text{K})_{\text{exp}}=0.009$ 3
497.9 2	100	497.89	11/2 ⁺	0.0	7/2 ⁺	E2	0.01243 17	$\alpha(\text{K})_{\text{exp}}=0.012$ 3
502.9 3	3.4 [#] 6	791.49	11/2 ⁻	288.48	9/2 ⁺	E1	0.00407 6	$\alpha(\text{K})_{\text{exp}}=0.004$ 2
508.9 2	10 [#] 2	1006.63	13/2 ⁻	497.89	11/2 ⁺	E1	0.00396 6	$\alpha(\text{K})_{\text{exp}}=0.003$ 2
509.5 3	3.0 [#] 9	1739.0	21/2 ⁺	1229.53	17/2 ⁺	E2	0.01169 16	$\alpha(\text{K})_{\text{exp}}=0.014$ 5
510.5 2	67 [#] 3	1008.50	15/2 ⁺	497.89	11/2 ⁺	E2	0.01163 16	$\alpha(\text{K})_{\text{exp}}=0.009$ 3
520.0 3	8 ^{&} 2	1477.0	(19/2 ⁺)	956.9	(19/2 ⁻)			(E1) in 1996Jo19 .
531.2 2	14 ^{&} 4	771.5	(13/2 ⁻)	240.28	11/2 ⁻			(M1+E2) in 1996Jo19 .
541.1 2	11.9 [#] 8	1549.58	19/2 ⁺	1008.50	15/2 ⁺	E2	0.00997 14	$\alpha(\text{K})_{\text{exp}}=0.009$ 3
547.8 2	37 ^{&} 5	1504.7	(23/2 ⁻)	956.9	(19/2 ⁻)	(E2)	0.00966 14	$\alpha(\text{K})_{\text{exp}}=0.007$ 2
572.8 3	3.2 [#] 8	2122.3	23/2 ⁺	1549.58	19/2 ⁺	E2	0.00861 12	$\alpha(\text{K})_{\text{exp}}=0.011$ 5
607.6 2	11 ^{&} 3	2112.3	(27/2 ⁻)	1504.7	(23/2 ⁻)			(E2) in 1996Jo19 .
652.9 3	6 ^{&} 2	1162.9	(15/2 ⁺)	510.2	15/2 ⁻			(E1) in 1996Jo19 .

Continued on next page (footnotes at end of table)

¹⁵⁰Nd(d,3nγ) **1996Jo19** (continued)

γ(¹⁴⁹Pm) (continued)

<u>E_γ</u> [†]	<u>I_γ</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
655.7 2	11 ^{&} 2	1612.7	(21/2 ⁻)	956.9	(19/2 ⁻)	(M1+E2) in 1996Jo19 .
700.8 2	13 ^{&} 3	1211.1	(17/2 ⁻)	510.2	15/2 ⁻	(M1+E2) in 1996Jo19 .

[†] Uncertainties are 0.2 keV for I_γ>5 (relative to 100 for 497.9γ); I_γ>10 (relative to 100 for 446.8γ); I_γ>15 (relative to 100 for 246.0γ); and 0.3 keV otherwise.

[‡] From [1996Jo19](#) based on measured ce data. Other assignments, apparently from ΔJ^π, listed in authors' Table 1 are given in comments.

[#] Normalized to 100 for 497.9γ from 497.9, 11/2⁺ level.

[@] Normalized to 100 for 246.0γ from 360.3, 7/2⁺ level.

[&] Normalized to 100 for 446.8γ from 957.0, (19/2⁻) level.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

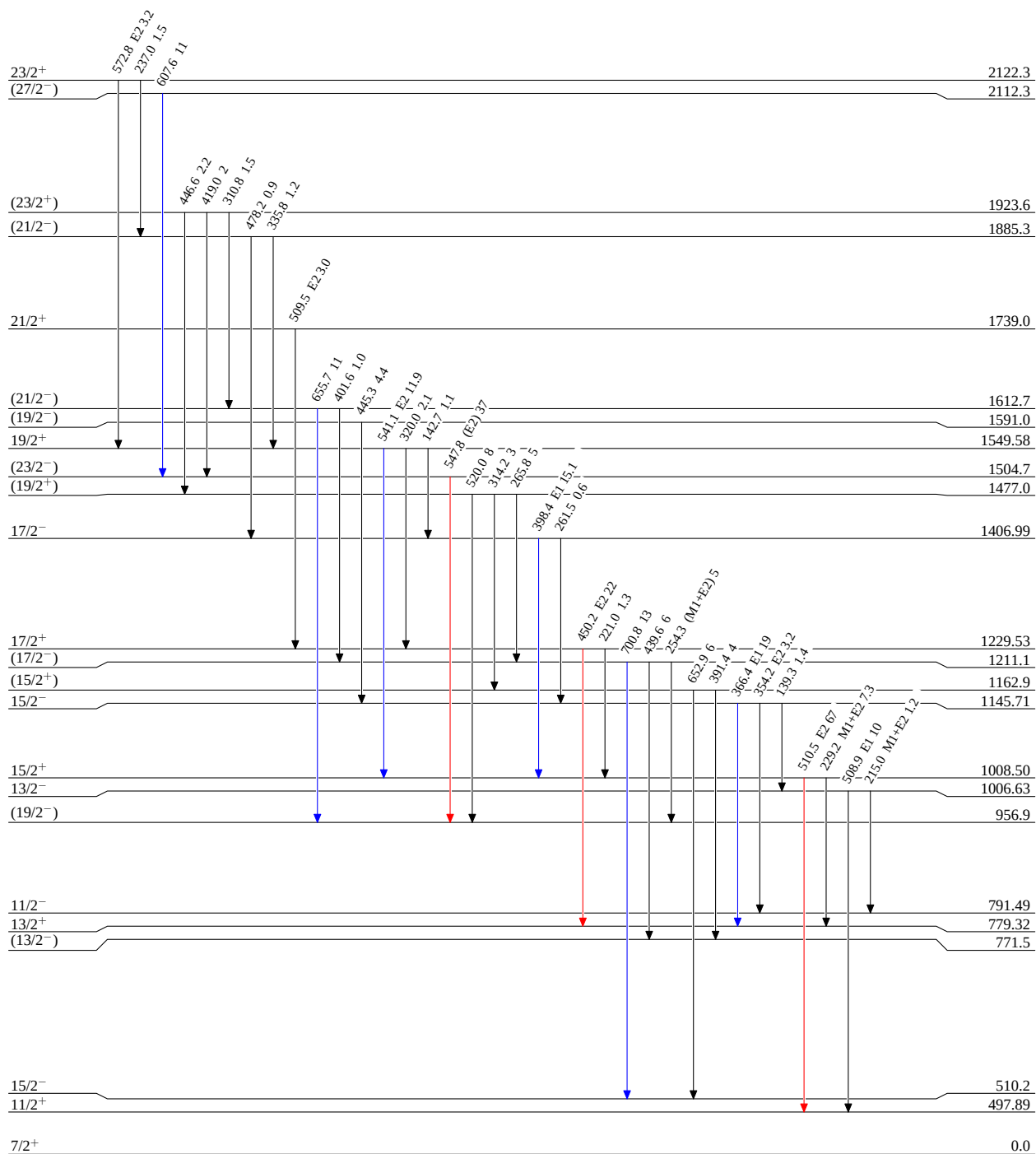
$^{150}\text{Nd}(d,3n\gamma)$ 1996Jo19

Level Scheme

Intensities: Relative intensities within different band structures

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
—→ $I_\gamma < 10\% \times I_\gamma^{\max}$
—→ $I_\gamma > 10\% \times I_\gamma^{\max}$



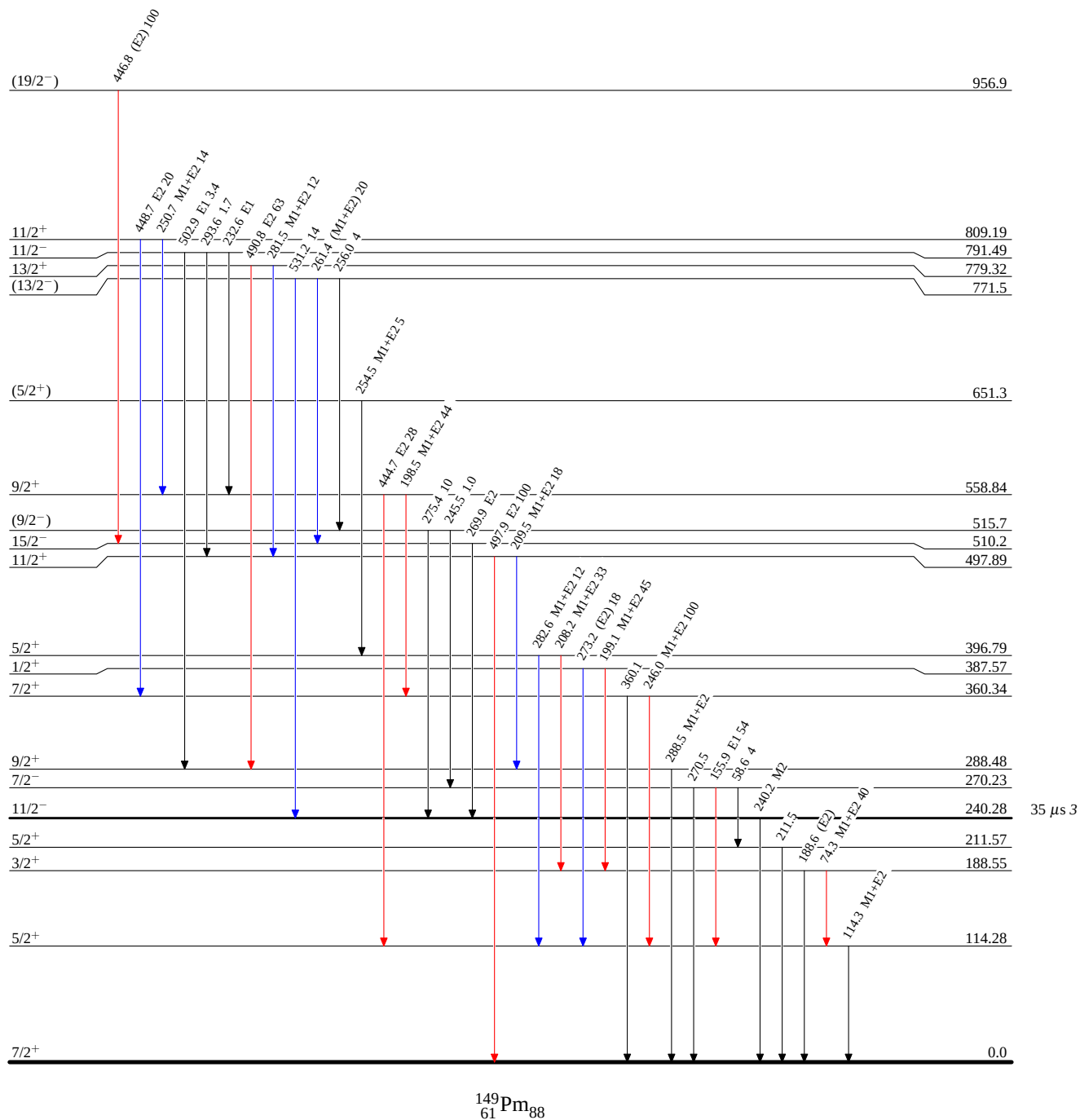
$^{150}\text{Nd}(\text{d},3\text{n}\gamma)$ 1996Jo19

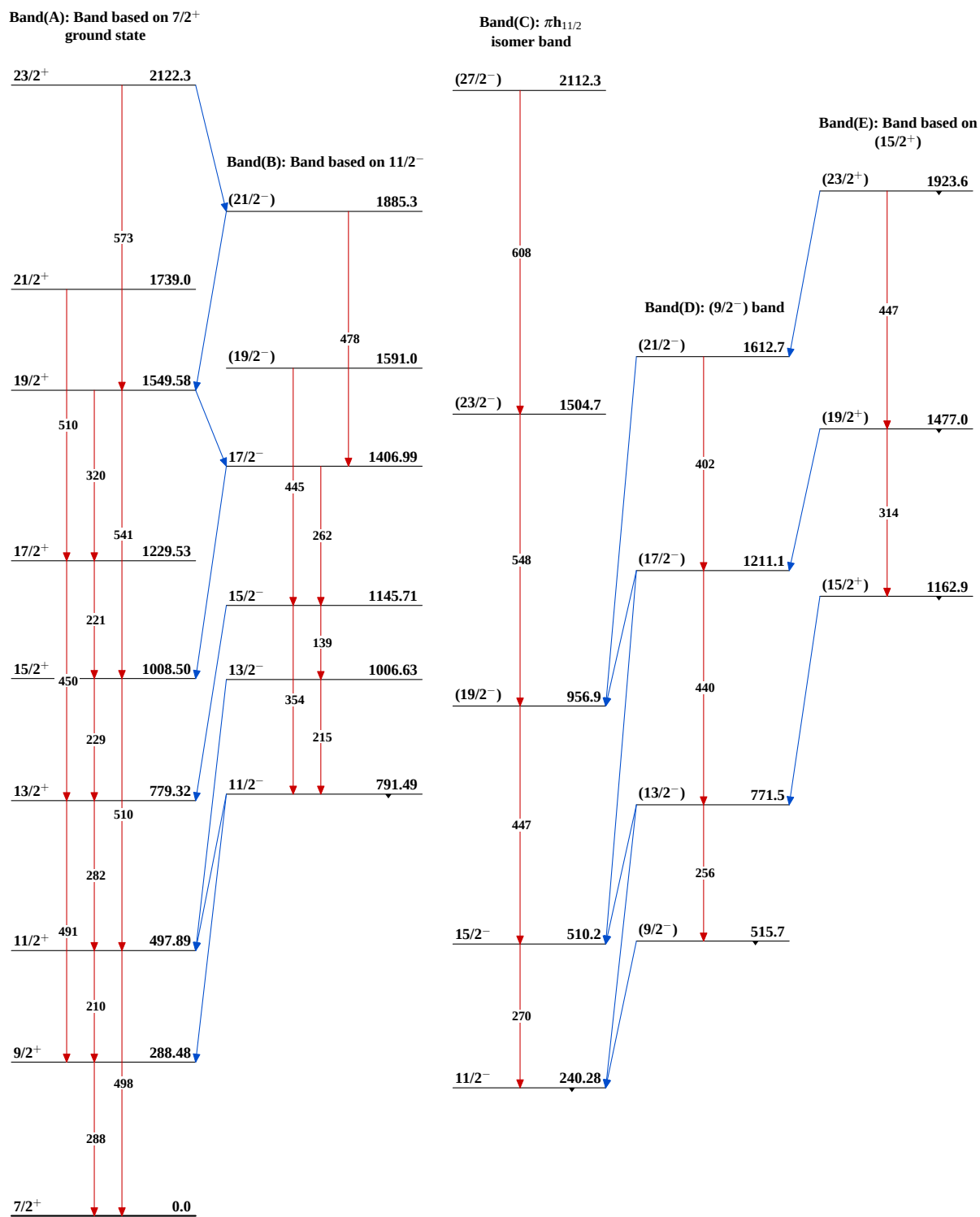
Level Scheme (continued)

Intensities: Relative intensities within different band structures

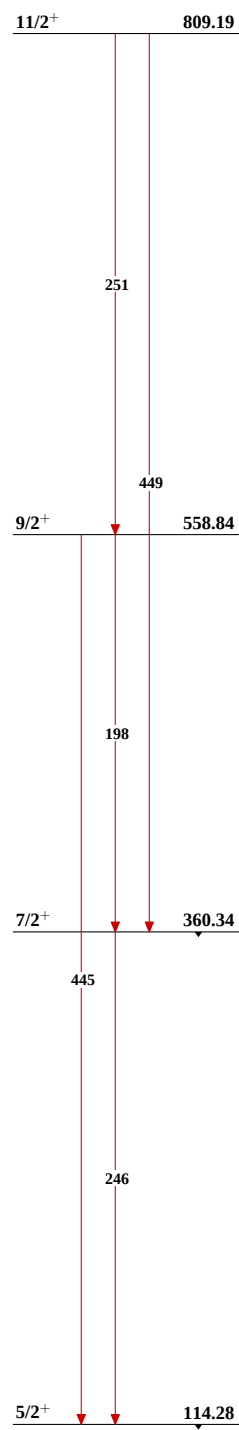
Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{149}_{61}\text{Pm}_{88}$

$^{150}\text{Nd}(\text{d},3\text{n}\gamma)$ 1996Jo19

$^{150}\text{Nd}(\text{d},3\text{n}\gamma)$ 1996Jo19 (continued)

 Band(F): Band based on $5/2^+$

 $^{149}_{61}\text{Pm}_{88}$

$^{150}\text{Sm}(\mu^-, n\gamma)$ 2019Zi01

2019Zi01 (also 2010Zi01): negative muon beams were produced from the μE4 and μE1 lines of the Paul Scherrer Institute (Ψ) in Switzerland. Target was 320 mg/cm² Sm₂O₃ powder (92.6% enriched in ^{150}Sm). μ x-rays and γ rays were detected with HPGe detectors. Measured $E\gamma$, $I\gamma$, $E(\mu \text{ x-ray})$, $I(\mu \text{ x-ray})$, $\gamma(t)$. Deduced muon lifetime, and partial capture rates to excited states.

 ^{149}Pm Levels

Muon disappearance lifetime=82.3 ns 5 (capture+decay), from which the total muon capture rate is deduced as $\lambda_{cap}=11.75\times 10^6 \text{ s}^{-1}$ 7 (2019Zi01).

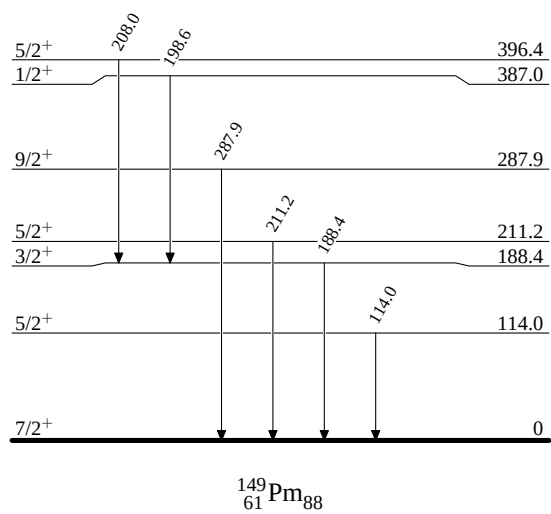
$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0	7/2 ⁺		Capture rate to excited states (directly feeding g.s.)= $2.93\times 10^6 \text{ s}^{-1}$ 60, corresponding to a percentage of 24.9% 51 per muon capture (2019Zi01).
114.0	5/2 ⁺		
188.4	3/2 ⁺		
211.2	5/2 ⁺		
240.2	11/2 ⁻	35 μs 3	Capture rate to this isomer= $1.80\times 10^6 \text{ s}^{-1}$ 31, corresponding to a percentage of 15.3% 26 per muon capture (2019Zi01).
287.9	9/2 ⁺		
387.0	1/2 ⁺		
396.4	5/2 ⁺		

[†] From $E\gamma$ data of 2019Zi01.

[‡] From the Adopted Levels.

 $\gamma(^{149}\text{Pm})$

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π
114.0	114.0	5/2 ⁺	0	7/2 ⁺
188.4	188.4	3/2 ⁺	0	7/2 ⁺
198.6	387.0	1/2 ⁺	188.4	3/2 ⁺
208.0	396.4	5/2 ⁺	188.4	3/2 ⁺
211.2	211.2	5/2 ⁺	0	7/2 ⁺
287.9	287.9	9/2 ⁺	0	7/2 ⁺

$^{150}\text{Sm}(\mu^-, n\gamma)$ 2019Zi01Level Scheme

$^{150}\text{Sm}(\text{d}, ^3\text{He})$ **1981Le21**

1981Le21: E(d)=50 MeV from the KVI AVF cyclotron. Targets of 89% ^{150}Sm in Sm_2O_3 , $650 \mu\text{g}/\text{cm}^2$. $\sigma(\theta)$ measured at 10 angles with uncertainty of 10% and used to deduce L values. FWHM=45 keV. Unresolved multiplets analyzed with a peak fitting program to give level energies to within 10 keV.

 ^{149}Pm Levels

E(level) [†]	L	S [‡]	Comments
0	4	4.0	
110 10	2	1.2	
230 [#] 10	5+(1) [#]	2.0,0.21	E(level),L: part of an unresolved triplet including the 211, 240, and 270 states. S: for L=1 component, value is for $2p_{1/2}$ factor; 0.09 if $3p_{1/2}$ form factor is used.
270 [#] 10	[#]		E(level): see comment for 230 level.
380 10	4+2	2.3,0.42	E(level),L: part of an unresolved triplet of energies 360, 387, and 415 with L=4,0,2, respectively, as seen in $^{150}\text{Sm}(\text{pol } t, \alpha)$ reaction. The L=0 component is not found in the analysis of the compound peak in the $^{150}\text{Sm}(\text{d}, ^3\text{He})$ reaction.
420 10			E(level): see comment for 380 state.
560 [#] 20	4+(1) [#]	0.29,0.05	E(level),L: L=4 inconsistent with 552 L=5 level from (pol t, α). S: for L=1 component, value is for $2p_{1/2}$ factor; 0.02 if $3p_{1/2}$ form factor is used.
730 10	2+4	0.15,0.94	E(level): corresponds to the 721(L=4) and 751(L=2) states in (pol t, α).
790 10	2+4	0.08,0.67	E(level): possibly corresponds to 786.72 ($3/2^+, 5/2^+$) state seen in β^- decay and the 791 (L=5) state in (t, α) and other reactions.
880 10	2+4	0.16,0.79	E(level): there are probably several states contributing to this peak.
940 [#] 10	2+(1) [#]	0.13,0.09	E(level),L: in addition to the L=2 state which may be the 955($5/2^+$) level there appears to be an L=1 component. S: for L=1 component, value is for $2p_{1/2}$ factor; 0.04 if $3p_{1/2}$ form factor is used.
1350 10	1	0.2	E(level): probably corresponds to 1329 and/or 1367 in Adopted Levels. S: for L=1 component, value is for $2p_{1/2}$ factor; 0.09 if $3p_{1/2}$ form factor is used.

[†] Most levels reported here are unresolved multiplets.

[‡] $\sigma(\text{exp})/(\text{N} \times \sigma(\text{theory}))$. $\sigma(\text{theory})$ obtained from a DWBA calculation using computer code DWUCK, and optical model and normalization factors given by authors. Despite slight differences in nomenclature, the S values derived from the ($^3\text{He}, \text{d}$), (α, t), (t, α) and ($\text{d}, ^3\text{He}$) reactions are comparable.

[#] The authors fit unresolved multiplets with incoherent combinations of DWBA distributions using L values from earlier work for the strong components and allowing the program to seek other L values. Strong L=1 state is thus identified. Whether this is a real state or a creation of the analysis remains unclear. This state is not included in the Adopted Levels.

$^{150}\text{Sm}(\text{pol } t, \alpha)$ **1979St18**

1979St18: E(t)=17 MeV, beam polarization=80% from the FN tandem Van de Graaff at the Los Alamos Scientific Laboratory.

Targets of 99.9% ^{150}Sm 100 $\mu\text{g}/\text{cm}^2$ on carbon backing. $\sigma(\theta)$ measured at 7 angles, for both spin up and spin down tritons.

FWHM $\approx$ 25 keV. Q3D spectrometer calibrated using $^{152}\text{Sm}(t, \alpha)$ reaction (**1972Bu22**). Uncertainties in absolute and relative σ values are about 20% and 5%, respectively.

Other: **1978Sh17**. $^{150}\text{Sm}(t, \alpha)$, E=17 MeV. Spectrum shown up to 2 MeV.

 ^{149}Pm Levels

Cross sections listed under comments are at 25° with respect to the beam direction.

E(level)	J^π [‡]	L [#]	S [†]	Comments
0 5	7/2 ⁺	4	3.2	$d\sigma/d\Omega=325 \mu\text{b}/\text{sr}$.
114 5	5/2 ⁺	2	2.1	$d\sigma/d\Omega=483 \mu\text{b}/\text{sr}$.
188 5	3/2 ⁺	2	0.07	$d\sigma/d\Omega=16 \mu\text{b}/\text{sr}$.
210 5	5/2 ⁺	2	0.05	$d\sigma/d\Omega=9 \mu\text{b}/\text{sr}$.
240 5	11/2 ⁻	5	2.8	$d\sigma/d\Omega=268 \mu\text{b}/\text{sr}$.
272 5	7/2 ⁻	3	0.16	$d\sigma/d\Omega=44 \mu\text{b}/\text{sr}$.
360 5	7/2 ⁺	4	0.35	$d\sigma/d\Omega=32 \mu\text{b}/\text{sr}$.
390 5	1/2 ⁺	0	0.27	$d\sigma/d\Omega=66 \mu\text{b}/\text{sr}$.
420 5	3/2 ⁺	2	0.55	$d\sigma/d\Omega=119 \mu\text{b}/\text{sr}$.
≈ 462		(1,4)	0.05	$d\sigma/d\Omega=5 \mu\text{b}/\text{sr}$.
				L, J ^π : 1979St18 give L=4 and J=L-1/2 which is inconsistent with 3/2 ⁻ from Adopted Levels.
				After discussion with one of the authors of 1979St18 , in 1985 evaluation of A=149, it was agreed that the data are not inconsistent with L=1, J=L+1/2.
513 5				$d\sigma/d\Omega=32 \mu\text{b}/\text{sr}$.
556 5	(11/2 ⁻)	(5)	0.40	$d\sigma/d\Omega=37 \mu\text{b}/\text{sr}$.
≈ 646	(1/2 ⁺)	(0)	0.02	$d\sigma/d\Omega=8 \mu\text{b}/\text{sr}$.
725 5	7/2 ⁺	4	0.43	$d\sigma/d\Omega=43 \mu\text{b}/\text{sr}$.
756 5	3/2 ⁺	2	0.43	$d\sigma/d\Omega=103 \mu\text{b}/\text{sr}$.
795 5	11/2 ⁻	5	0.53	$d\sigma/d\Omega=48 \mu\text{b}/\text{sr}$.
881 5	(5/2 ⁺)	(2)	0.19	$d\sigma/d\Omega=54 \mu\text{b}/\text{sr}$.
909 5	1/2 ⁺	0	0.18	$d\sigma/d\Omega=36 \mu\text{b}/\text{sr}$.
950 5	(5/2 ⁺)	(2)	0.27	$d\sigma/d\Omega=68 \mu\text{b}/\text{sr}$.
1331 5	3/2 ⁺	2	0.15	$d\sigma/d\Omega=35 \mu\text{b}/\text{sr}$.
1392 5	3/2 ⁺	2	0.13	$d\sigma/d\Omega=33 \mu\text{b}/\text{sr}$.
1648 5	(3/2 ⁺)	2	0.14	$d\sigma/d\Omega=33 \mu\text{b}/\text{sr}$.

[†] $\sigma(\text{exp})/(\text{N} \times \sigma(\text{theory}))$. $\sigma(\text{theory})$ derived from a DWBA calculation using the same optical model parameters and normalization factor as in $^{152}\text{Sm}(t, \alpha)$ (**1972Bu22**). Absolute and relative values have uncertainties of 30% to 50% and 10%, respectively.

[‡] From $A_y(\theta)$ in this reaction. The assignments are the same in Adopted Levels.

[#] From comparison of $\sigma(\theta)$ with DWBA calculations.

¹⁵²Sm(p,α) **1978Sh17**

1978Sh17: E(p)=17 MeV from the McMaster University FN Tandem. Measured $\sigma(\theta)$ at three angles. FWHM=16 keV. Reaction mechanism discussed.

Others (dealing with reaction mechanism):

1985Bo52 (E=18 MeV), **1976SnZZ** (E=17 MeV), **1974Mi04** (E=18 MeV), **1977Ba79** (theory).

¹⁴⁹Pm Levels

E(level) [†]	J ^π	$\sigma(\text{exp})/\sigma(\text{theory})$	Comments
0	7/2 ⁺ [‡]	0.29	d $\sigma/d\Omega(45^\circ)$ =3.1 $\mu\text{b/sr}$.
115	5/2 ⁺ [‡]	1.69	d $\sigma/d\Omega(45^\circ)$ =4.1 $\mu\text{b/sr}$.
188			
210			
241	11/2 ⁻ [‡]	5.21	d $\sigma/d\Omega(45^\circ)$ =8.2 $\mu\text{b/sr}$.
272			
360			
390			
420			
513			
556			
660			
725			
756			
795			
881			
909			
950			

[†] Values given here are from (t,α) and correspond to common peaks seen in (p,α) and (t,α) work as shown in figure 2 by **1978Sh17**. The (p,α) spectrum contains many peaks above 1 MeV but it is difficult to compare these with levels known from (t,α) work. The uncertainty is probably 8 keV.

[‡] Single proton hole state. The g.s. is from g_{7/2}, 114 from d_{5/2} and 240 from h_{11/2} shells. The assignments are the same in the Adopted Levels.

Adopted Levels, Gammas

$Q(\beta^-) = -695.4$; $S(n) = 5871.1$; $S(p) = 7559.6$; $Q(\alpha) = 1871.3$ 10 2021Wa16

$S(2n) = 14012.5$ 9, $S(2p) = 13567.0$ 10 (2021Wa16).

Mass measurements: 1975Ka25, 1972Ba08, 1970Ma05, 1968De17, 1966Ma05.

Hyperfine structure studies of the ground state: 2003Pa30, 1999Ku26, 1997Ko33, 1994Ji08, 1990Wa25, 1990En01 (also 1984Ea02), 1987Yo05, 1985Al06 (also 1984Al35, 1986Al33) (laser spectroscopy), 1975St15 (NMR technique), 1972Ch55, 1972Ch27, 1968Ro16.

Isotope shifts: 1990Wa25, 1990En01, 1987Bo58, 1985Al06, 1980Br15, 1976ClZY, 1973Le16, 1971Le12.

Isomer shifts: 1976Co14, 1972Ei05, 1983St17 (compilation).

2017Wi01: measured isotopic abundances of natural Sm samples using inductively coupled plasma mass spectrometry (ICP-MS) technique.

Other reactions:

2015Ba20: ²⁰⁸Pb(¹³⁶Xe, X γ), E=85 MeV; measured E γ , I γ , $\gamma\gamma$ -coin using Gammasphere at ATLAS-ANL facility. Levels and γ rays in ¹⁴⁹Sm populated; deduced cross section.

1993Ge07: measured energies and widths of 22 neutron resonances from 94.9-2955 eV. See ¹⁴⁸Sm(n, γ), (n,n):Resonances dataset for details.

2014Fi17: ¹⁵⁰Sm(γ , n), E=6-17 MeV; measured E(n), I(n), monochromatic and nonmonochromatic $\sigma(E)$.

2003Ka23: analyzed neutron resonances.

¹⁴⁸Sm(n, γ): 1982Ba15, 1986Wi02.

¹⁴⁸Sm(n,n): 1990Ly01 (E=0.01-0.5 eV), 1971KaZS (E<0.5 keV).

¹⁴⁹Sm(⁵⁸Ni, ⁵⁸Ni), E=245 MeV: 1987Va22, measured $\sigma(\theta)$.

2017No07: theory: calculated single-particle energies, occupation probabilities of the single-particle orbitals, levels, J^π , B(E2), B(M1), electric quadrupole and magnetic dipole moments using Interacting boson fermion model (IBFM).

Theoretical calculations: consult NSR database at www.nndc.bnl.gov/nsr/ for 27 references dealing with nuclear structure and seven for radioactivity related calculations.

The statement "in-beam γ -ray" includes the datasets: (α , n γ); and (α , 3n γ), (³He, 4n γ).

¹⁴⁹Sm Levels

The band assignments are from 1977KI04, 1979Ha19, 1990UrZR and 1994Ba01 in ¹⁴⁸Nd(α , 3n γ), ¹⁵⁰Nd(³He, 4n γ) dataset. It should, however, be noted that Nilsson-model assignments proposed by 1994Ba01 may not be valid for N=87 nuclide, and the levels are expected to be strongly (Coriolis) mixed.

Cross Reference (XREF) Flags

A	¹⁴⁹ Pm β^- decay (53.08 h)	H	¹⁴⁸ Sm(d,p)	O	¹⁵⁰ Sm(p,d)
B	¹⁴⁹ Eu ε decay (93.1 d)	I	¹⁴⁸ Sm(α , ³ He)	P	¹⁵⁰ Sm(d,t)
C	Muonic atom	J	¹⁴⁸ Sm(¹⁶ O, ¹⁵ O), (¹³ C, ¹² C)	Q	¹⁵⁰ Sm(³ He, α)
D	¹⁴⁶ Nd(α , n γ)	K	¹⁴⁹ Sm(γ , γ): Mossbauer	R	¹⁵¹ Sm(p,t)
E	¹⁴⁸ Nd(α , 3n γ), ¹⁵⁰ Nd(³ He, 4n γ)	L	¹⁴⁹ Sm(d, d')	S	¹⁵¹ Eu(μ^- , 2n γ)
F	¹⁴⁸ Sm(n, γ) E=thermal	M	Coulomb excitation		
G	¹⁴⁸ Sm(n, γ), (n,n):resonances	N	¹⁵⁰ Sm(n, 2n γ)		

E(level) [†]	J π [#]	T _{1/2} [‡]	XREF	Comments
0.0 ^b	7/2 ⁻	stable	ABCDE HIJKLMNOPS	$\mu = -0.6677$ 11 (1990En01, 2019StZV) $Q = +0.075$ 8 (1972Ch55, 1992Le09, 2021StZZ) Evaluated rms charge radius = 5.0134 fm 35 (2013An02). Evaluated difference in charge radius: $\delta \langle r^2 \rangle (^{144}\text{Sm}, ^{149}\text{Sm}) = +0.6125$ fm ² 4 (2013An02). J^π : atomic-beam method; EPR, optical spectroscopy (1962Sp03). Others: 1958Hu17, 1954Mu15, 1952Bo21. Parity from L(p,d)=L(³ He, α)=L(α , ³ He)=3.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J ^π #	T _{1/2} [‡]	XREF	Comments
				T_{1/2}: >2×10¹⁵ y from limit on detection of a possible α peak near 2 MeV (1970Gu14). Others: 1968Ko06, 1961Ma05, 1960Ka23. μ: laser resonance fluorescence spectroscopy (1990En01). Others: −0.6717 7 (atomic beam, 1966Wo05); −0.6692 11 (electron-nuclear double resonance technique (ENDOR), 1972Ch27); −0.6708 10 (collinear fast-beam laser spectroscopy, 1985Al06). Q: from atomic beam (1972Ch55), and +0.075 2 (1992Le09, collinear fast-beam laser spectroscopy, +0.075 25 in 1985Al06). Others: +0.078 8 (1990En01, laser resonance fluorescence spectroscopy); +0.075 8 (atomic beam, 1966Wo05), 0.060 15 (Mössbauer spectroscopy, 1970EiZY), 0.094 24 from muonic atom (1981Ba28). Configuration=νf_{7/2}. δ<r²>(148Sm, 149Sm)=0.080 fm² 8 (1971Le12, 1973Le16), 0.084 fm² 28 (1979Po04), 0.092 fm² 5 (1980Br15), 0.092 fm² (1985Al06), 0.080 fm² 8 (1986Al33), 0.093 fm² 5 (1987Bo58), 0.092 fm² 4 (1990Wa25), 0.089 fm² (1990En01).
22.5002 ^f 8	5/2 [−]	7.33 ns 9	ABCDE H K MN PQRS	μ=−0.6200 11 (1970EiZY, 2020StZV) Q=+1.01 9 (1981Ba28, 2021StZZ) J^π: L(p,t)=0 from 5/2[−]. T_{1/2}: from ¹⁴⁹Eu ε decay. Others: 7.4 ns 12 (2000Ki15), 6.9 ns 5 (1966Be39), 7.6 ns 5 (1963Ki15), 1962Jh04, 1962Al13. From B(E2)=0.229 17 and δ (22.5γ)=0.0715 11, T_{1/2}(22.51 level)=5.9 ns 10. B(E2)=0.229 17 from muonic atom (1981Ba28). μ: from Mössbauer effect (1970EiZY). Sign from 1967Of01. Q: from muonic atom (1981Ba28). Other: +0.50 1 from Mössbauer (1970EiZY, 1967Of01).
277.071 7	5/2 [−]	≤0.2 ns	AB DE H MNOP RS	J^π: M1+E2 γ to 7/2[−]; M1+E2 γ from 3/2[−]. T_{1/2}: (x ray)γ(t) in ¹⁴⁹Eu ε (1970Ko30). T_{1/2}<1.3 ns from B(E2) in Coul. ex.
285.946 ^c 10	9/2 [−]	0.22 ns 4	AB DE HIJ MNOPQ S	J^π: L(³He,α)=L(α,³He)=5; M1 γ to 7/2[−]. T_{1/2}: average of 0.182 ns 7 γγ(t) (1965Cu01) and 0.253 ns 27 βγ(t) (1968Ak02) in ¹⁴⁹Pm β[−]. Others: 1960Ma27, 1960Ch15.
350.035 6	3/2 [−]	9.5 ps 3	AB DE H LMNOPQRS	Configuration=νh _{9/2} .
399.08 7	(1/2 [−] , 3/2 [−])		B D H OPQ	J ^π : L(p,d)=L(d,t)=1; M1+E2 γ to 5/2 [−] .
528.593 7	3/2 [−]	24 ps 3	AB DE H J LM oPQR	XREF: Q(422).
558.373 7	5/2 [−]	24 ps 8	AB DE H MN PQR	J ^π : L(p,d)=(1).
590.883 ^f 10	9/2 [−]	3.0 ps 7	AB DE H LMNOPQR	XREF: H(535).
636.459 18	7/2 [−]	<1.5 ps	AB DE H LMNOPQR	J ^π : L(d,t)=1; E2 γ to 7/2 [−] .
658.66 4	(≤7/2)		B o	XREF: H(566).
				J ^π : L(p,t)=0 from 5/2 [−] .
				XREF: O(583)R(606).
				J ^π : ΔJ=2 E2 γ to 5/2 [−] from 568γ(θ,pol) in in-beam γ-ray.
				L(p,d)=(1) is inconsistent with 9/2 [−] . Either the level in (p,d) is different from 591 or the L-value is suspect.
				Dominant configuration=νh _{9/2} .
				J ^π : L(p,d)=L(³ He,α)=L(d,t)=3; ΔJ=0, M1+E2 γ to 7/2 [−] from 636γ(θ); ce data in in-beam γ-ray.
				XREF: o(665).

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Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J^π	$T_{1/2}$ [‡]	XREF				Comments
664.09 ^b 6	11/2 ⁻	2.7 ps 3	A	DE	H	LMNoPQR	J^π : γ to 5/2 ⁻ ; possible γ to 3/2 ⁻ . L(p,d)=(2) suggests 3/2 ⁺ , 5/2 ⁺ . XREF: H(675)o(665). J^π : L($^3\text{He},\alpha$)=5; $\Delta J=2$, E2 γ to 7/2 ⁻ . Configuration= $\nu h_{11/2}$.
697.2 5	(3/2) ⁻				H	L OP	J^π : L(p,d)=1; possible contribution from $\nu p_{3/2}$.
709.85 7	(3/2,5/2 ⁺)			D	H	LM PQ	XREF: M(?). J^π : L(d,t)=1,2. $\gamma(\theta)$ of γ to 3/2 ⁻ suggests 3/2 or 5/2.
747.39 ^c 7	13/2 ⁻			DE		MN	J^π : $\Delta J=2$, E2 γ to 9/2 ⁻ from $\gamma(\theta, \text{pol})$ in in-beam γ -ray.
785.23 12	5/2 ⁻		A			l o R	J^π : L(p,t)=0 from 5/2 ⁻ . L(p,d)=(0) is inconsistent with $J^\pi=5/2^-$ for 785 and $J^\pi=11/2^+$ for 789 level. Either the level in (p,d) is different or the L transfer is suspect.
789.51 ^{&} 6	11/2 ⁺			DE		lMNo	J^π : $\Delta J=1$, E1 γ to 9/2 ⁻ ; $\Delta J=0$, dipole γ to 11/2 ⁻ from $\gamma(\theta)$; ce in in-beam γ -ray.
830.46 5	(5/2 ⁻ , 7/2, 9/2 ⁻)		A			l r	J^π : γ s to 5/2 ⁻ and 9/2 ⁻ .
833.23 5	(5/2 ⁻ to 11/2 ⁻)		A		h	lM r	J^π : γ s to 7/2 ⁻ and 9/2 ⁻ .
835.59 7	(5/2 ⁻ , 7/2, 9/2 ⁻)		A		h	l r	J^π : γ s to 5/2 ⁻ and 9/2 ⁻ .
878.80 ^a 8	13/2 ⁺			DE	HIJ	LMNoPQ	XREF: I(910). E(level): L(α , ^3He)=6+5 suggests a doublet with $J^\pi=11/2^+, 13/2^+$ for one and 9/2 ⁻ , 11/2 ⁻ for the other. The latter level is not listed here.
881.97 4	(5/2, 7/2 ⁻)		A			o	J^π : L($^3\text{He},\alpha$)=6; $\Delta J=1$, E1 γ to 11/2 ⁻ from $\gamma(\theta)$. L(p,d)=6(+1) is consistent with 13/2 ⁺ for one component. The other component may correspond to 881.9 level, but L=1 is inconsistent.
925.47 10	(3/2 ⁺ , 5/2 ⁺)			D	H	L OPQ	J^π : γ s to 3/2 ⁻ and 7/2 ⁻ ; $\log f^{lu}t=6.9$ from 7/2 ⁺ . L(p,d)=(1) is inconsistent with the J^π assignment.
952.78 9	(5/2, 7/2, 9/2 ⁻)		A		H	L	XREF: L(914)P(922). J^π : L(p,d)=L(d,t)=(2).
967.2	(1/2 ⁺)					OP	J^π : γ to 5/2 ⁻ ; $\log f^{lu}t=8.0$ from 7/2 ⁺ .
994.65 10	(9/2, 11/2, 13/2 ⁻)			DE		L PQR	J^π : L(p,d)=(0). XREF: P(988).
1012.3	(1/2 ⁻ , 3/2 ⁻)				H	OP	J^π : γ to 9/2 ⁻ . J^π : L(p,d)=(1).
1038.97 10	(5/2 ⁻)			D		L	J^π : $\Delta J=0$ γ to 5/2 ⁻ with dominant quadrupole (E2) component.
1048.2	(3/2) ⁺					L OPQ	J^π : L(p,d)=L($^3\text{He},\alpha$)=L(d,t)=2; probable contribution from $\nu d_{3/2}$.
1083.2	($\leq 7/2$)				H	L P	XREF: L(1072). J^π : L ≤ 3 (L from $\sigma(^3\text{He},\alpha)/\sigma(d,t)$).
1113.5						L PQ	
1123.2	($\leq 7/2$)				H	L P R	J^π : L ≤ 3 (L from $\sigma(^3\text{He},\alpha)/\sigma(d,t)$).
1132.37 8	(9/2 ⁻ , 11/2, 13/2 ⁻)			DE			J^π : γ s to 9/2 ⁻ and 13/2 ⁻ .
1154.2	(3/2 ⁺ , 5/2, 7/2 ⁻)				H	PQ	J^π : L=2,3 (L from $\sigma(^3\text{He},\alpha)/\sigma(d,t)$).
1173.21 12	(7/2 ⁺ , 9/2, 11/2)			D			J^π : γ to 11/2 ⁺ ; J $\leq 11/2$ from excitation function.
1181.10	(3/2, 5/2) ⁺					o	J^π : L(p,d)=0+2. L=0 component corresponds to 1195 level in (d,t), whereas L=2 most probably corresponds to 1181 level.
1187.3	5/2 ⁻				h	L R	J^π : L(p,t)=0 from 5/2 ⁻ .
1192.80 ^e 8	13/2 ⁺			DE			J^π : $\Delta J=0$, dominant M1 to 13/2 ⁺ ; $\Delta J=1$, M1+E2 γ to 11/2 ⁺ .
1195.2	1/2 ⁺					L oPQ	XREF: o(1181). J^π : L(d,t)=0.
1207?	(5/2 ⁻)					R	J^π : L(p,t)=(0) from 5/2 ⁻ .

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Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J ^π #	XREF			Comments
1226 10				O	
1237.95 10	(9/2 ⁻ , 11/2 ⁻)	D	L	PQ	J ^π : L(³ He, α)=(5).
1240.13 ^{&} 11	(15/2) ⁺	DE		N	J ^π : ΔJ=1, E1 γ to 13/2 ⁻ .
1282 10		H	L		
1304 10				P	
1308.47 ^d 9	11/2 ⁻	DE	H	L OPQ	XREF: O(1285)P(1311). J ^π : L(p,d)=L(³ He, α)=5; ΔJ=1, M1+E2 γ to 9/2 ⁻ . XREF: H(1316). J ^π : L(p,t)=0 from 5/2 ⁻ .
1325 3		H	L	R	
1339 3	5/2 ⁻		L	R	J ^π : L(p,t)=0 from 5/2 ⁻ .
1343.33 ^f 7	(13/2 ⁻)	DE			J ^π : γs to 9/2 ⁻ and 13/2 ⁻ ; possible band assignment (1990UrZR).
1353 2	(5/2 ⁻ , 7/2 ⁻)	H		OP R	J ^π : L(p,d)=(3).
1360.96 ^c 11	17/2 ⁻	DE			J ^π : ΔJ=2, E2 γ to 13/2 ⁻ ; γ to (15/2) ⁺ .
1362.60 ^a 13	17/2 ⁺	DE		N	J ^π : ΔJ=2, E2 γ to 13/2 ⁺ .
1378 2	(5/2 ⁻ , 7/2 ⁻ , 9/2 ⁺)	H	L	OPQ	J ^π : L=(3,4) (L from σ(³ He, α)/σ(d,t)). L(p,d)=(0) is inconsistent.
1393 2	(5/2) ⁻		L	OP	XREF: O(1408). J ^π : L(p,d)=3; probable contribution from νf _{5/2} orbital.
1398.70 ^b 9	15/2 ⁻	DE			J ^π : ΔJ=2, E2 γ to 11/2 ⁻ ; ΔJ=1 γs to 13/2 ⁻ and 13/2 ⁺ .
1413.28 11	(13/2 ⁺ , 15/2 ⁺)	DE			J ^π : γs to 11/2 ⁺ and 13/2 ⁻ ; γ from (17/2 ⁺); excitation function of 624γ suggests 11/2, 13/2, 15/2.
1428 4	-	i		PQ	XREF: i(1410). E(level), J ^π : L(α, ³ He)=1+5 suggests a doublet with J ^π =1/2 ⁻ , 3/2 ⁻ for one and 9/2 ⁻ , 11/2 ⁻ for the other. L=1,2 from σ(³ He, α)/σ(d,t) is consistent with 1/2 ⁻ , 3/2 ⁻ for one component in (α, ³ He).
1442 2	(≤5/2)	i		PQ	XREF: i(1410). J ^π : L≤2 (L from σ(³ He, α)/σ(d,t)).
1470 2	(3/2, 5/2) ⁺	H	L	OPQR	XREF: O(1456)Q(1474). J ^π : L(p,d)=2. L(³ He, α)=(5) from σ(θ) data is inconsistent with the assigned J ^π . There could be two separate levels near this energy.
1483 2	(≤5/2)	H	L	OPQR	XREF: O(1480)Q(1474). J ^π : L≤2 (L from σ(³ He, α)/σ(d,t)). L(p,d)=(1) supports 1/2 ⁻ , 3/2 ⁻ .
1505 10			L		
1535 10	(1/2 ⁺)		L	O	J ^π : L(p,d)=(0).
1549 2	5/2 ⁻		L	P R	J ^π : L(p,t)=0 from 5/2 ⁻ .
1558 3		H		R	
1571 2	(7/2 ⁺ , 9/2, 11/2 ⁻)	H	L	PQ	J ^π : L=(4,5) (L from σ(³ He, α)/σ(d,t)).
1574.57 ^d 14	(13/2) ⁻	DE			J ^π : ΔJ=1, M1+E2 γ to 11/2 ⁻ .
1584 2	(3/2, 5/2) ⁺			OP R	J ^π : L(p,d)=2.
1617 2	(5/2) ⁻	H	L	OP	J ^π : L(p,d)=3; probable contribution from νf _{5/2} orbital.
1641 2			L	P	
1656 2		h	L	P	XREF: h(1662).
1670.25 ^{&} 12	(19/2) ⁺	DE			J ^π : ΔJ=2, E2 γ to (15/2) ⁺ ; ΔJ=1, E1 γ to 17/2 ⁻ .
1672 3	5/2 ⁻	h	L	OP R	XREF: h(1662). J ^π : L(p,t)=0 from 5/2 ⁻ .
1684.60 13	(15/2, 17/2, 19/2 ⁻)	D			J ^π : γ to 15/2 ⁻ .
1685 10		H	l	Q	XREF: H(1678)l(1690).
1695.7 ^e 3	(17/2 ⁺)	E			J ^π : ΔJ=2 (E2) γ to 13/2 ⁺ ; γ to 15/2 ⁻ .
1699 3	5/2 ⁻	H	l	PQR	XREF: H(1705)l(1690). J ^π : L(p,t)=0 from 5/2 ⁻ .
1731 10			L		
1757 3	5/2 ⁻	H	L	P R	J ^π : L(p,t)=0 from 5/2 ⁻ .
1776 10	(7/2 ⁺)&(5/2 ⁺)	H		oPQ	XREF: H(1782).
1782 3	5/2 ⁻			R	J ^π : L(p,d)=4+2 for a doublet. J ^π : L(p,t)=0 from 5/2 ⁻ .

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Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J ^π #	XREF			Comments
1817 3	5/2 ⁻	H	L	R	J ^π : L(p,t)=0 from 5/2 ⁻ .
1837 10			L		
1846.87 ^d 17	(15/2) ⁻	DE			J ^π : ΔJ=(1), M1+E2 γ to (13/2) ⁻ ; probable band assignment.
1851.2 6	(17/2 ⁺)@	E			
1857 10			L		
1880 10	(7/2) ⁺	H		O	J ^π : L(p,d)=4.
1891 3	5/2 ⁻	i	l	R	XREF: i(1890)l(1903). E(level): L(α, ³ He)=3+6 suggests a doublet with J ^π =5/2 ⁻ , 7/2 ⁻ for one and 11/2 ⁺ , 13/2 ⁺ for the other. The latter level is not listed here, separately.
1917 4	5/2 ⁻	Hi	l	R	J ^π : L(p,t)=0 from 5/2 ⁻ . XREF: i(1890)l(1903).
1924 10	(7/2 ⁺)&(5/2 ⁺)		L	o	J ^π : L(p,t)=0 from 5/2 ⁻ . XREF: o(1946).
1925.99 ^a 16	(21/2) ⁺	DE			J ^π : L(p,d)=4+2 for a doublet.
1950 10	(7/2 ⁺)&(5/2 ⁺)	H	L	o	J ^π : ΔJ=2, E2 γ to 17/2 ⁺ .
1979 10		H	L	P	J ^π : L(p,d)=4+2 for a doublet.
1993 3		H		R	
2005 3				R	
2026 10	(5/2 ⁺)&(11/2 ⁻)	H		oPQ	XREF: Q(2043). J ^π : L(p,d)=2+5.
2041.0 ^b 3	(19/2 ⁻)	E			J ^π : γs to 15/2 ⁻ , 17/2 ⁻ and 17/2 ⁺ ; band assignment.
2059 4	5/2 ⁻	H	L	P R	J ^π : L(p,t)=0 from 5/2 ⁻ .
2098 3	5/2 ⁻	H	L	R	J ^π : L(p,t)=0 from 5/2 ⁻ .
2117 4	5/2 ⁻	H	L	R	XREF: H(2137). J ^π : L(p,t)=0 from 5/2 ⁻ .
2130.6 ^d 3	(17/2) ⁻	E			J ^π : M1 γ to (15/2) ⁻ ; band assignment.
2139 10	(5/2 ⁺)&(11/2 ⁻)	H	L	o	XREF: o(2174). E(level): from (d,d').
2142.30 ^c 24	(21/2 ⁻)	E			J ^π : L(p,d)=2+5 for a doublet.
2145.5? 4	(15/2, 17/2, 19/2 ⁻)	E			J ^π : ΔJ=(2), (E2) γ to 17/2 ⁻ ; γ to 19/2 ⁺ .
2159 15		H			J ^π : γ to 15/2 ⁻ .
2183 10	(5/2 ⁺)&(11/2 ⁻)	H	L	o Q	J ^π : L(³ He,α)=(5) for 2187 10 level favors (11/2 ⁻) which implies (5/2 ⁺) for 2139 level.
2192.2 ^{&} 3	(23/2) ⁺	E			J ^π : ΔJ=2, E2 γ to 19/2 ⁺ ; band assignment.
2210 10	(5/2 ⁺)&(11/2 ⁻)	H		o	J ^π : L(p,d)=2+5 for a doublet.
2242 10	(5/2 ⁺)&(11/2 ⁻)	H		o	J ^π : see 2210 level.
2272 10	(5/2 ⁺)&(7/2 ⁺)	H	L	o	J ^π : L(p,d)=2+4.
2280 15	(5/2 ⁺)&(7/2 ⁺)	H		o	J ^π : see 2272 level.
2299 10		H	L	Q	
2332 15		H			
2344.5 ^e 4	(21/2 ⁺)	E			J ^π : possible band member.
2358 13		H			
2377 15		H			
2387 10		H			
2404.4 7	(21/2 ⁺)@	E			
2415 10	(5/2 ⁺)&(11/2 ⁻)	H		O Q	J ^π : L(p,d)=2+5 for the doublet. Also L(³ He,α)=(2) for a 2412 10 level.
2427.1 ^d 3	(19/2 ⁻)	E			J ^π : ΔJ=0,1 γ to (17/2 ⁻); γ to (15/2) ⁻ ; band assignment.
2442 10	(5/2 ⁺) & (11/2 ⁻)	H		O Q	XREF: O(2459). J ^π : L(p,d)=2+5 for a doublet; L(³ He,α)=(5).

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Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J ^π #	T _{1/2} [‡]	XREF		Comments
2487 10	(11/2 ⁻)		H	Q	J ^π : L(³ He,α)=(5) from 0 ⁺ .
2508 11			H		
2534 11			H		
2537.2 ^a 3	(25/2) ⁺		E		J ^π : ΔJ=2, E2 γ to (21/2) ⁺ ; band assignment.
2568 11			H		
2590 10	(5/2) ⁺		H	O Q	J ^π : L(p,d)=L(³ He,α)=2.
2622 11			H		
2640 11			H		
2671 11			H		
2701.7 ^b 5	(23/2 ⁻) [@]		E		
2711 11	(5/2 ⁺)&(11/2 ⁻)		H	o	J ^π : L(p,d)=2+5 for a doublet.
2723 15	(5/2 ⁺)&(11/2 ⁻)		H	o	J ^π : see 2711 level.
2734.9 ^d 4	(21/2 ⁻)		E		J ^π : γ to (19/2 ⁻); band assignment.
2737 12			H		
2762 12			H		
2797 12			H		
2828.2 9	(25/2 ⁻) [@]		E		
2830 12			H		
2834.3 ^{&} 4	(27/2) ⁺		E		J ^π : ΔJ=2, E2 γ to (23/2) ⁺ .
2842.2 ^c 5	(25/2 ⁻) [@]		E		
2858 12			H		
2875.5 ^e 4	(25/2 ⁺) [@]		E		
2891 12			H		
2923 12			H		
2932.9 4	(21/2,23/2,25/2 ⁻)		E		J ^π : γ to (21/2 ⁻).
2949 12			H		
2968 12			H		
2987.2 9	(25/2) [@]		E		
2995 12			H		
3008.4 12	(25/2 ⁺) [@]		E		
3015 12			H		
3055.1 ^d 5	(23/2 ⁻)		E		J ^π : γs to (19/2 ⁻) and (21/2 ⁻); band assignment.
3072 12			H		
3094 12			H		
3159.3 7	(25/2) [@]		E		
3160 12			H		
3181.3 ^a 4	(29/2 ⁺)		E		J ^π : ΔJ=2, (E2) γ to (25/2) ⁺ ; band assignment.
3181.0+x	(25/2 to 33/2)	4 ns 1	E		J ^π : possible decay to (29/2 ⁺) level. T _{1/2} : from γ(t) of γs from 3181 level and levels below 3181. E(level): x ≤200, since no delayed γs observed above 200 keV.
3194 12			H		
3218 12			H		
3220.3 9	(25/2) [@]		E		
3257 12			H		
3303 13			H		
3324 13			H		
3328.0 ^b 8	(27/2 ⁻) [@]		E		
3360				O	E(level): centroid of a bump between 2800 and 4000 in (p,d). A similar wide structure observed in (³ He,α) at about 3600. J ^π : L(p,d)=5+2 of the bump from 0 ⁺ shows contributions

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Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

E(level) [†]	J ^π #	XREF	Comments
			from h _{11/2} and d _{5/2} . Tail of this bump (4000-7200 range) agrees with L=4 or L=4+2 indicating contribution from g _{7/2} orbit.
3361.2 ^c 4	(29/2 ⁻)@	E	
3364.8 ^e 5	(29/2 ⁺)@	E	
3377 13		H	
3384.0 ^d 9	(25/2 ⁻)@	E	
3393 14		H	
3419 14		H	
3436 14		H	
3461 14		H	
3478 14		H	
3533 14		H	
3545 15		H	
3564.1 5	(29/2 ⁻)@	E	
3575 15		H	
3595 15		H	
3623 15		H	
3636 15		H	
3651.8 ^{&} 5	(31/2 ⁺)	E	J ^π : ΔJ=2, E2 γ to (27/2 ⁺).
3661 15		H	
3687 15		H	
3700 15		H	
3734 15		H	
3765 15		H	
3777.3 8	(29/2)@	E	
3806 15		H	
3859.6 ^a 5	(33/2 ⁺)	E	J ^π : (E2) γ to (29/2 ⁺); band assignment.
3880.3 11	(31/2 ⁻)@	E	
3953.3 ^b 11	(31/2 ⁻)@	E	
3968.4 ^c 6	(33/2 ⁻)@	E	
4005.9 5	(33/2 ⁻)@	E	
4054.7 ^e 6	(33/2 ⁺)@	E	
4486.8 12	(33/2)@	E	
4543.8 ^b 6	(35/2 ⁻)@	E	
4575.1 ^{&} 9	(35/2 ⁺)@	E	
4597.3 ^a 6	(37/2 ⁺)@	E	
4606.6 10	(37/2 ⁻)@	E	
4686.4 ^c 7	(37/2 ⁻)@	E	
4799.0 ^e 10	(37/2 ⁺)@	E	
5140.6 ^b 9	(39/2 ⁻)@	E	
5173.4 11	(39/2 ⁺)@	E	
5325.4 12	(39/2)@	E	
5361.3 ^a 12	(41/2 ⁺)@	E	
5372.5 12	(41/2 ⁻)@	E	
5477.4 ^c 12	(41/2 ⁻)@	E	
5600		0	E(level): centroid of a wide structure between 4000 and 7200.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Sm Levels (continued)

<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>
5791.5 16	(43/2) [@]	E
5801.6 ^b 14	(43/2 ⁻) [@]	E
6189.5 19	(45/2) [@]	E

[†] From least-squares fit to $E\gamma$ data for levels populated in γ -ray studies. In cases, where $\Delta E\gamma$ is not stated, 0.3 keV is assumed when $E\gamma$ is stated to nearest tenth of a keV, and 1 keV when $E\gamma$ is stated to nearest keV. Energy uncertainties of 11 γ rays were doubled to obtain an acceptable reduced $\chi^2=1.9$ as compared to critical $\chi^2=1.4$. Without this adjustment reduced χ^2 was 3.7. For levels populated in particle transfer reactions only, weighted averages have been taken of all the available values. In case of unresolved doublets in particle transfer reactions, quoted energy value not included in obtaining average level energy.

[‡] Unless stated otherwise, values are derived from B(E2) values in Coul. ex., adopted branchings and mixing ratios.

[#] When assigned from L(p,d), the following shell-model orbitals are assumed (by 1983Ga07) for the transferred nucleon: $p_{3/2}$ for L(n)=1; $d_{3/2}$ (below ≈ 1.5 MeV excitation) and $d_{5/2}$ (above ≈ 1.5 MeV excitation) for L(n)=2; $f_{5/2}$ for L(n)=3; $g_{7/2}$ for L(n)=4; $h_{11/2}$ for L(n)=5. In in-beam γ -ray study when no $\gamma(\theta)$ and/or ce data are available, it is assumed that in such reactions, levels of ascending J^π are populated with increasing excitation energy. Absence of transitions to levels of low J^π values also supports such a conclusion. Unless otherwise stated, L transfers are from 0^+ targets.

[@] Assignments taken from 1990UrZR and 1990UrZX which are probably based on authors' $\gamma(\theta)$, $\gamma(\text{lin pol})$ data. But no details of these data are available. Assignment is considered tentative by evaluators.

[&] Band(A): $\nu 7/2[633]$ band. Based on $i_{13/2}$ neutron orbital. From observation of interconnecting E1 transitions, 1994Ba01 suggest octupole deformation and propose that this band and the band with configuration $h_{9/2} 9/2[505]$ form an alternating parity band with simplex quantum number $s=-i$.

^a Band(B): $\nu 9/2[624]$ band. Based on $i_{13/2}$ neutron orbital. From observation of interconnecting E1 transitions, 1994Ba01 suggest octupole deformation and propose that this band and the band with configuration $f_{7/2} 7/2[514]$ form an alternating parity band with simplex quantum number $s=+i$.

^b Band(C): $\nu 7/2[514]$ band. Based on $f_{7/2}$ neutron orbital.

^c Band(D): $\nu 9/2[505]$ band. Based on $h_{9/2}$ neutron orbital.

^d Band(E): $\nu 11/2[505]$ band. Based on $h_{11/2}$ neutron orbital.

^e Band(F): Band based on $13/2^+$.

^f Band(G): Band based on $5/2^-$.

Adopted Levels, Gammas (continued)

E _i (level)	J ^π _i	γ(¹⁴⁹ Sm)							Comments
		E _γ [†]	I _γ [‡]	E _f	J ^π _f	Mult. ^b	δ ^c	α ^g	
22.5002	5/2 ⁻	22.5002 8	100	0.0	7/2 ⁻	M1+E2	0.0784 9	30.0 5	B(M1)(W.u.)=0.00846 17; B(E2)(W.u.)=56.2 17 E _γ : from ¹⁴⁹ Eu ε decay, value is from 2011In01. Others: 22.519 8 (1982Me10) and 22.494 11 (1970An17). δ: from subshell ratios in ¹⁴⁹ Eu ε decay (2011In01).
277.071	5/2 ⁻	254.566 [#] 23	17.82 25	22.5002	5/2 ⁻	M1+E2	+0.20 ^f +8-6	0.1242 20	B(M1)(W.u.)≥8.3×10 ⁻⁴ ; B(E2)(W.u.)≥0.15 I _γ : weighted average of 18.3 11 from ¹⁴⁹ Pm β ⁻ decay, 17.93 23 from ¹⁴⁹ Eu ε decay, and 16.9 6 from (α,nγ). Others: 97 5 from (α,3nγ) and 46 12 from (μ ⁻ ,2nγ) are discrepant. δ: +0.6 4 from γ(θ,T) in ¹⁴⁹ Eu ε decay.
		277.089 [#] 10	100.0 5	0.0	7/2 ⁻	M1+E2	-0.08 ^f +1-2	0.0997 14	B(M1)(W.u.)≥0.0039; B(E2)(W.u.)≥0.14 δ: +0.036 18 from γ(θ,T) in ¹⁴⁹ Eu ε decay.
285.946	9/2 ⁻	263.23 ^{a@} 4	0.31 1	22.5002	5/2 ⁻	[E2]		0.0849 12	B(E2)(W.u.)=0.123 +27-19 Poor energy fit, deviates by 0.21 keV.
		285.95 [@] 1	100	0.0	7/2 ⁻	M1(+E2)	+0.06 6	0.0917 13	B(M1)(W.u.)=0.0039 +9-6; B(E2)(W.u.)<0.46 δ: from γ(θ,T) in ¹⁴⁹ Pm β ⁻ decay. Others: <0.1 from γ(θ) in in-beam γ-ray; <0.8 from ce data in ¹⁴⁹ Pm β ⁻ decay.
350.035	3/2 ⁻	72.983 [#] 10	0.347 17	277.071	5/2 ⁻	M1+E2	0.23 ^d 4	4.36 9	B(M1)(W.u.)=0.0167 10; B(E2)(W.u.)=91 +32-28 I _γ : other: 26 8 from (α,3nγ) is discrepant.
		327.526 [#] 10	100.0 5	22.5002	5/2 ⁻	M1+E2	+0.14 3	0.0637 9	B(M1)(W.u.)=0.0551 18; B(E2)(W.u.)=5.5 +26-21 δ: γ(θ,T) data in ¹⁴⁹ Eu decay. Others: -0.03 4 from γ(θ) in in-beam γ ray, +0.27 +30-45 from γ(θ) in Coul. ex.
		350.016 [#] 10	8.95 14	0.0	7/2 ⁻	E2		0.0352 5	B(E2)(W.u.)=18.4 7 I _γ : others: 9.6 17 from Coulomb excitation; 16.5 23 from (α,nγ) and 19 8 from (α,3nγ) are discrepant.
399.08	(1/2 ⁻ ,3/2 ⁻)	122.0 [#] 2	100 72	277.071	5/2 ⁻	[M1,E2]		1.05 10	
		376.5 ^{#h} 2	10 7	22.5002	5/2 ⁻				
528.593	3/2 ⁻	129.50 [#] 7	0.07 4	399.08	(1/2 ⁻ ,3/2 ⁻)	[M1,E2]		0.87 6	B(M1)(W.u.)=1.5×10 ⁻⁴ +9-7 if M1, B(E2)(W.u.)=4.7 +30-23 if E2.
		178.580 [#] 16	4.0 2	350.035	3/2 ⁻	M1+E2	+0.5 2	0.325 6	B(M1)(W.u.)=0.0025 5; B(E2)(W.u.)=11 7 Mult.,δ: ce and γγ(θ) data in ¹⁴⁹ Eu decay.
		251.510 [#] 37	2.0 2	277.071	5/2 ⁻	[M1,E2]		0.114 16	B(M1)(W.u.)=5.7×10 ⁻⁴ +10-9 if M1,

$B(E2)(\text{w.u.})=4.9+9-7$ if E2.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. ^b	δ^c	α^g	Comments
528.593	3/2 ⁻	506.093 [#] 10 528.587 [#] 10	100.0 8 93.7 13	22.5002 0.0	5/2 ⁻ 7/2 ⁻	E2+M1 E2	+4.9 ^e +31-15	0.0128 4 0.01108 16	B(M1)(W.u.)=0.00014 +15-8; B(E2)(W.u.)=7.1 +10-9 B(E2)(W.u.)=5.6 +8-6 I _γ : from ¹⁴⁹ Eu ε decay. Others: 100 25 from ¹⁴⁹ Pm β ⁻ decay.
558.373	5/2 ⁻	208.283 [#] 21	9.6 6	350.035	3/2 ⁻	M1+E2	-0.45 ^f 15	0.210 4	B(M1)(W.u.)=0.0033 +16-9; B(E2)(W.u.)=8 +7-4 I _γ : weighted average of 9.6 6 from ¹⁴⁹ Pm β ⁻ decay, 23.1 19 from ¹⁴⁹ Eu ε decay, 8.3 17 from (α,nγ), and 8.1 17 from (α,3nγ). I _γ : weighted average of 9.6 6 from ¹⁴⁹ Pm β ⁻ decay, 8.3 17 from (α,nγ), and 8.1 17 from (α,3nγ). Other: 23 2 from ¹⁴⁹ Eu ε decay seems discrepant.
		272.21 ^{#h} 14 281.295 [#] 16	0.24 17 46 4	285.946 277.071	9/2 ⁻ 5/2 ⁻	[E2] M1+E2		0.0763 11 0.0954 16	B(E2)(W.u.)=0.32 +33-18 B(M1)(W.u.)=0.0075 +36-20; B(E2)(W.u.)=1.0 +20-9 δ: γγ(θ) data in ¹⁴⁹ Eu decay. Other: -0.07 +22-17 from γ(θ) in in-beam γ-ray.
		535.897 [#] 12	84 3	22.5002	5/2 ⁻	M1+E2	-0.65 ^e +23-43	0.0159 18	B(M1)(W.u.)=0.0014 +7-6; B(E2)(W.u.)=1.1 +12-6 I _γ : weighted average of 76 4 from ¹⁴⁹ Pm β ⁻ decay, 85.5 27 from ¹⁴⁹ Eu ε decay, 88 4 from (α,nγ), and 96 27 from Coulomb excitation. Other: 13.9 17 from (α,3nγ) is discrepant.
		558.372 [#] 10	100 6	0.0	7/2 ⁻	M1+E2	+1.2 ^d +7-4	0.0124 13	B(M1)(W.u.)=0.0009 +6-4; B(E2)(W.u.)=2.2 +13-9 δ: sign from δ=+1.6 11 from γ(θ) in in-beam γ-ray.
590.883	9/2 ⁻	305.22 ^{a@} 8	3.72 23	285.946	9/2 ⁻	M1(+E2)	+0.15 15	0.0767 18	B(M1)(W.u.)=0.0072 +33-22; B(E2)(W.u.)<5.1 Poor fit, deviates by 0.28 keV. I _γ : from ¹⁴⁹ Pm β ⁻ decay. Others: 3.5 8 from Coulomb excitation and 4.5 18 from (α,3nγ); 2.27 22 from (α,nγ) is discrepant. Mult.: ce data in in-beam γ-ray. δ: γγ(θ) in ¹⁴⁹ Pm β ⁻ .
		568.36 [@] 7	25.9 17	22.5002	5/2 ⁻	E2		0.00919 13	B(E2)(W.u.)=13.4 +41-26 I _γ : weighted average of 26.9 18 from ¹⁴⁹ Pm β ⁻ decay, 25 9 from ¹⁴⁹ Eu ε decay, 24.0 22 from (α,nγ), 31.3 18 from (α,3nγ), and 22.7 14 from Coulomb excitation. Mult.: γ(θ,pol) in in-beam γ-ray.
		590.88 [@] 1	100.0 22	0.0	7/2 ⁻	E2+M1	-1.5 +9-4	0.0101 25	B(M1)(W.u.)=0.008 +9-3; B(E2)(W.u.)=30 +9-13 I _γ : from (α,3nγ). Others: 100 4 from ¹⁴⁹ Pm β ⁻ decay, 100 9 from ¹⁴⁹ Eu ε decay, 100 5 from (α,nγ), 100.0

E _i (level)	J _i ^π	E _γ [†]	I _γ [‡]	E _f	J _f ^π	Mult. ^b	δ ^c	α ^g	Comments
636.459	7/2 ⁻	287 ^h 1		350.035	3/2 ⁻				26 from Coulomb excitation. Mult.: ce data in in-beam γ-ray. δ: γ(θ) in Coulomb excitation. Seen in Coul. ex. only.
		350.71 [@] 7	10.0 6	285.946	9/2 ⁻	M1+E2	-0.30 10	0.0521 13	B(M1)(W.u.)>0.015; B(E2)(W.u.)>2.9 δ: γγ(θ) data in ¹⁴⁹ Pm β ⁻ . Mult.: from RUL; E1+M2 not allowed.
		359.57 [@] 7	10.0 8	277.071	5/2 ⁻	M1+E2	+0.9 5	0.042 6	B(M1)(W.u.)>0.0052; B(E2)(W.u.)>9.0 δ: γγ(θ) data in ¹⁴⁹ Pm β ⁻ . Mult.: from RUL; E1+M2 not allowed.
		613.92 [@] 2	100 4	22.5002	5/2 ⁻				
		636.50 [@] 5	60 4	0.0	7/2 ⁻	M1+E2	-0.30 +16-18	0.0114 5	B(M1)(W.u.)>0.014; B(E2)(W.u.)>0.45 Mult.,δ: from ce and γ(θ) in in-beam γ-ray.
658.66	(≤7/2)	130.10 ^{#h} 4	90 23	528.593	3/2 ⁻				
		308.0 ^{a#h} 1	3 3	350.035	3/2 ⁻				Poor energy fit, deviates by 0.6 keV.
		381.7 [#] 2	100 23	277.071	5/2 ⁻				
664.09	11/2 ⁻	636.05 ^{#h} 10	9	22.5002	5/2 ⁻				
		73.3	5.3 7	590.883	9/2 ⁻	[M1]		4.13 6	B(M1)(W.u.)=0.83 +14-12 γ from (α,3nγ), (³ He,4nγ) only. δ(E2/M1)<0.025 from RUL(E2)=300.
		378.3 ^{&} 1	4.74 ^{&} 30	285.946	9/2 ⁻	M1(+E2)	0.00 3	0.0440 6	B(M1)(W.u.)=0.0054 +8-7; B(E2)(W.u.)=0.000 +37-0 I _γ : weighted average of 4.92 25 from (α,nγ), 4.6 7 from (α,3nγ), and 3.5 7 from Coulomb excitation. Mult.,δ: γ(θ,pol) in in-beam γ-ray.
		664.1 ^{&} 1	100.0 ^{&} 17	0.0	7/2 ⁻	E2		0.00625 9	B(E2)(W.u.)=26.1 +34-27 Mult.: ce and γ(θ,pol) in in-beam γ-ray.
		709.85	(3/2,5/2 ⁺)	359.8 ^{&} 1	34 ^{&} 2	350.035	3/2 ⁻		
747.39	13/2 ⁻	432.8 ^{&} 1	100 ^{&} 5	277.071	5/2 ⁻				
		84 ^h 1		664.09	11/2 ⁻				γ from (α,3nγ),(³ He,4nγ) (1994Ba01) only; treated here as tentative.
785.23	5/2 ⁻	461.9 ^{a&} 1	100 ^{&}	285.946	9/2 ⁻	E2		0.01589 22	Poor fit, deviates by 0.4 keV.
785.23 [@] 12		785.23 [@] 12	100	0.0	7/2 ⁻				
789.51	11/2 ⁺	125.4 ^{&} 1	14.9 ^{&} 6	664.09	11/2 ⁻	(E1)		0.1490 21	Mult.: γ(θ) data consistent with ΔJ=0, dipole; ΔJ ^π requires E1.
		198.6 ^{&} 1	100.0 ^{&} 34	590.883	9/2 ⁻	E1		0.0431 6	δ(M2/E1)=0.09 +10-15 from ce data, and -0.02

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. ^b	δ^c	α^g	Comments
									10 from $\gamma(\theta)$ data (1979Ha19) in ¹⁴⁸ Nd($\alpha,3n\gamma$), ¹⁵⁰ Nd(³ He,4n γ). E $_\gamma$: γ from (n,2n) only.
789.51	11/2 ⁺	504		285.946	9/2 ⁻				Poor fit, deviates by 0.24 keV.
830.46	(5/2 ⁻ , 7/2, 9/2 ⁻)	544.27 ^{a@} 6	7.6 4	285.946	9/2 ⁻				Poor energy fit, deviates by 0.47 keV.
		552.92 ^{a@} 9	1.8 1	277.071	5/2 ⁻				
		808.11 ^{a@}	51 4	22.5002	5/2 ⁻				
		830.53 [@] 7	100 8	0.0	7/2 ⁻				
833.23	(5/2 ⁻ to 11/2 ⁻)	242.10 [@] 14	0.6 1	590.883	9/2 ⁻				
		547.17 [@] 7	4.9 4	285.946	9/2 ⁻				
		833.40 [@] 7	100 8	0.0	7/2 ⁻				
835.59	(5/2 ⁻ , 7/2, 9/2 ⁻)	550.01 [@] 15	17 3	285.946	9/2 ⁻				
		812.92 [@]	29 3	22.5002	5/2 ⁻				
		835.55 [@] 11	100 9	0.0	7/2 ⁻				
878.80	13/2 ⁺	89.3 ^{&} 1	8.5 ^{&} 4	789.51	11/2 ⁺				$\delta(Q/D) = -0.12$ 11 or $-3.6 + 27 - 10$ from $\gamma(\theta)$ in in-beam γ -ray. γ from ($\alpha,3n\gamma$), (³ He,4n γ).
		131		747.39	13/2 ⁻				
		214.8 ^{&} 1	100 ^{&} 3	664.09	11/2 ⁻	E1		0.0350 5	
881.97	(5/2, 7/2 ⁻)	323.95 ^{a@} 9	1.40 14	558.373	5/2 ⁻				Poor energy fit, deviates by 0.35 keV.
		353.46 [@] 11	0.29 3	528.593	3/2 ⁻				
		531.61 ^{a@} 6	1.37 12	350.035	3/2 ⁻				Poor fit, deviates by 0.33 keV.
		859.46 [@] 6	100 3	22.5002	5/2 ⁻				
		881.98 [@] 5	22 1	0.0	7/2 ⁻				
925.47	(3/2 ⁺ , 5/2 ⁺)	648.4 ^{&} 1	100 ^{&}	277.071	5/2 ⁻				
952.78	(5/2, 7/2, 9/2 ⁻)	930.2 [@] 2	68 11	22.5002	5/2 ⁻				
		952.8 [@] 1	100 11	0.0	7/2 ⁻				
994.65	(9/2, 11/2, 13/2 ⁻)	708.7 ^{&} 1	100 ^{&}	285.946	9/2 ⁻				
1038.97	(5/2 ⁻)	761.9 ^{&} 1	100 ^{&}	277.071	5/2 ⁻	D+Q			
1132.37	(9/2 ⁻ , 11/2, 13/2 ⁻)	385.2 ^{&} 1	10.8 ^{&} 25	747.39	13/2 ⁻				
		846.2 ^{&} 1	100 ^{&} 5	285.946	9/2 ⁻				
1173.21	(7/2 ⁺ , 9/2, 11/2)	383.7 ^{&} 1	100 ^{&}	789.51	11/2 ⁺				
1192.80	13/2 ⁺	314.0 ^{&} 1	100 ^{&} 5	878.80	13/2 ⁺	M1(+E2)	+0.4 5	0.069 7	Mult.: from $\gamma(\theta)$ and pol data in ($\alpha,3n\gamma$), (³ He,4n γ).
		403.4 ^{&} 1	75 ^{&} 6	789.51	11/2 ⁺	M1+E2	-1.1 8	0.030 7	

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)										
$E_i(\text{level})$	J_i^π	E_γ [†]	I_γ [‡]	E_f	J_f^π	Mult. ^b	δ^c	α^g	Comments	
1192.80	13/2 ⁺	528.6 ^{& 1}	<248 ^{&}	664.09	11/2 ⁻				I_γ : doublet with undivided intensity, where part of its intensity is from 528.6 level.	
1237.95	(9/2 ⁻ , 11/2 ⁻)	952.0 ^{& 1}	100 ^{&}	285.946	9/2 ⁻				Complex peak.	
1240.13	(15/2 ⁺)	450.8	17 ³	789.51	11/2 ⁺					
1308.47	11/2 ⁻	492.6 ^{& 1}	100 ^{& 3}	747.39	13/2 ⁻	E1		0.00446 ⁶	Poor fit, deviates by 0.5 keV.	
		561.0		747.39	13/2 ⁻					
		644.9 ^{a& 1}	33 ^{& 5}	664.09	11/2 ⁻	M1+E2	-2.8 ⁴	0.00253 ⁶		
		1022.4 ^{& 1}	100 ^{& 8}	285.946	9/2 ⁻					
1343.33	(13/2 ⁻)	1309		0.0	7/2 ⁻					
		553.6 ^{& 1}	75 ^{& 13}	789.51	11/2 ⁺					
		596.1 ^{& 1}	100 ^{& 3}	747.39	13/2 ⁻					
		752.5 ^{& 1}	73 ^{& 10}	590.883	9/2 ⁻					
1360.96	17/2 ⁻	121.0 ⁸	11.4 ³	1240.13	(15/2 ⁺)				E_γ, I_γ : γ from ($\alpha, 3n\gamma$), ($^3\text{He}, 4n\gamma$) with $I(121\gamma)/I(614\gamma)=0.114$ ³ .	
1362.60	17/2 ⁺	613.7 ^{& 1}	100 ^{&}	747.39	13/2 ⁻	E2		0.00758 ¹¹		
		483.8 ^{& 1}	100 ^{&}	878.80	13/2 ⁺	E2		0.01401 ²⁰		
1398.70	15/2 ⁻	520.7 ^{& 1}	21.4 ^{& 14}	878.80	13/2 ⁺	D			Poor energy fit, deviates by 0.8 keV. Uncertainty of 0.3 keV assumed for fitting purpose.	
1413.28	(13/2 ⁺ , 15/2 ⁺)	651.1 ^{& 1}	11 ^{& 2}	747.39	13/2 ⁻	E2		0.00492 ⁷	$\delta(E2/M1)>2$.	
		734.7 ^{& 1}	100 ^{& 5}	664.09	11/2 ⁻					
		623.8 ^{& 1}	13 ^{& 3}	789.51	11/2 ⁺					
		665.7	100	747.39	13/2 ⁻					
1574.57	(13/2 ⁻)	266.1 ^{& 1}	100 ^{&}	1308.47	11/2 ⁻	M1+E2	-0.50 ⁵	0.1054 ¹⁸	E_γ : other: 664.1 ¹ from ($\alpha, n\gamma$) is for a doublet.	
1670.25	(19/2 ⁺)	309.4 ^{& 1}	100 ^{& 3}	1360.96	17/2 ⁻	E1		0.01361 ¹⁹		
1684.60 1695.7	(15/2, 17/2, 19/2 ⁻) (17/2 ⁺)	430.0 ^{& 1}	51 ^{& 3}	1240.13	(15/2 ⁺)	E2		0.01937 ²⁷		
		285.9 ^{& 1}	100 ^{&}	1398.70	15/2 ⁻					
		283		1413.28	(13/2 ⁺ , 15/2 ⁺)					
		296		1398.70	15/2 ⁻					
		333	<52	1362.60	17/2 ⁺					
		455		1240.13	(15/2 ⁺)					
		503.0	100.0 ²³	1192.80	13/2 ⁺	(E2)		0.01262 ¹⁸		
		272.3 ^{& 1}	100 ^{&}	1574.57	(13/2 ⁻)	M1+E2	-0.7 ²	0.095 ⁴		
1846.87	(15/2 ⁻)	538		1308.47	11/2 ⁻					
		452		1398.70	15/2 ⁻					
1851.2	(17/2 ⁺)	452		1398.70	15/2 ⁻					

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_f	J_f^π	Mult. ^b	α^g
1851.2	(17/2 ⁺)	611		1240.13	(15/2 ⁺)		
1925.99	(21/2 ⁺)	563.4 ^{&} 1	100 ^{&}	1362.60	17/2 ⁺	E2	0.00939 13
2041.0	(19/2 ⁻)	641		1398.70	15/2 ⁻		
		678		1362.60	17/2 ⁺		
		680.2		1360.96	17/2 ⁻		
2130.6	(17/2 ⁻)	283.8	100 43	1846.87	(15/2 ⁻)	M1	0.0937 13
		555.9 ^h		1574.57	(13/2 ⁻)		
2142.30	(21/2 ⁻)	472.0	≈14	1670.25	(19/2 ⁺)		
		781.4	100 27	1360.96	17/2 ⁻	(E2)	0.00427 6
2145.5?	(15/2,17/2,19/2 ⁻)	746.8 ^h	100	1398.70	15/2 ⁻		
2192.2	(23/2 ⁺)	521.9	100	1670.25	(19/2 ⁺)	E2	0.01145 16
2344.5	(21/2 ⁺)	304		2041.0	(19/2 ⁻)		
		419		1925.99	(21/2 ⁺)		
		493		1851.2	(17/2 ⁺)		
		649		1695.7	(17/2 ⁺)		
		674 1		1670.25	(19/2 ⁺)		
2404.4	(21/2 ⁺)	553		1851.2	(17/2 ⁺)		
		709		1695.7	(17/2 ⁺)		
		734		1670.25	(19/2 ⁺)		
2427.1	(19/2 ⁻)	296.4	100 10	2130.6	(17/2 ⁻)	D	
		580.2	≈16	1846.87	(15/2 ⁻)		
2537.2	(25/2 ⁺)	611.2	100	1925.99	(21/2 ⁺)	E2	0.00765 11
2701.7	(23/2 ⁻)	661		2041.0	(19/2 ⁻)		
		776		1925.99	(21/2 ⁺)		
2734.9	(21/2 ⁻)	307.5	100	2427.1	(19/2 ⁻)		
		606		2130.6	(17/2 ⁻)		
2828.2	(25/2 ⁻)	636		2192.2	(23/2 ⁺)		
2834.3	(27/2 ⁺)	642.0	100	2192.2	(23/2 ⁺)	E2	0.00678 9
2842.2	(25/2 ⁻)	141		2701.7	(23/2 ⁻)		
		650		2192.2	(23/2 ⁺)		
		700		2142.30	(21/2 ⁻)		
2875.5	(25/2 ⁺)	174		2701.7	(23/2 ⁻)		
		339		2537.2	(25/2 ⁺)		
		531.0		2344.5	(21/2 ⁺)		
		683		2192.2	(23/2 ⁺)		
2932.9	(21/2,23/2,25/2 ⁻)	790.6	100	2142.30	(21/2 ⁻)		
2987.2	(25/2)	159		2828.2	(25/2 ⁻)		
		795		2192.2	(23/2 ⁺)		
3008.4	(25/2 ⁺)	604		2404.4	(21/2 ⁺)		
3055.1	(23/2 ⁻)	320.1		2734.9	(21/2 ⁻)		
		629		2427.1	(19/2 ⁻)		
3159.3	(25/2)	325		2834.3	(27/2 ⁺)		

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)

<u>E_i(level)</u>	<u>J_i^{π}</u>	<u>E_{γ}^{$\dagger$}</u>	<u>I_{γ}^{$\ddagger$}</u>	<u>E_f</u>	<u>J_f^{π}</u>	<u>Mult.^{<i>b</i>}</u>	<u>α^g</u>
3159.3	(25/2)	967		2192.2	(23/2) ⁺		
3181.3	(29/2 ⁺)	644.0	100	2537.2	(25/2) ⁺	(E2)	0.00673 9
3220.3	(25/2)	1028		2192.2	(23/2) ⁺		
3328.0	(27/2 ⁻)	626		2701.7	(23/2 ⁻)		
		791		2537.2	(25/2) ⁺		
3361.2	(29/2 ⁻)	519.0		2842.2	(25/2 ⁻)		
		526.9		2834.3	(27/2) ⁺	E1	0.00383 5
3364.8	(29/2 ⁺)	489.4		2875.5	(25/2 ⁺)		
		530		2834.3	(27/2) ⁺		
		828		2537.2	(25/2) ⁺		
3384.0	(25/2 ⁻)	329		3055.1	(23/2 ⁻)		
		649		2734.9	(21/2 ⁻)		
3564.1	(29/2 ⁻)	203.1		3361.2	(29/2 ⁻)		
		730		2834.3	(27/2) ⁺		
3651.8	(31/2 ⁺)	291	<29	3361.2	(29/2 ⁻)		
		817.0 7	100 8	2834.3	(27/2) ⁺	E2	0.00386 5
3777.3	(29/2)	557		3220.3	(25/2)		
		618		3159.3	(25/2)		
		943		2834.3	(27/2) ⁺		
3859.6	(33/2 ⁺)	678.0	100	3181.3	(29/2 ⁺)	(E2)	0.00594 8
3880.3	(31/2 ⁻)	699		3181.3	(29/2 ⁺)		
3953.3	(31/2 ⁻)	772		3181.3	(29/2 ⁺)		
3968.4	(33/2 ⁻)	316.6		3651.8	(31/2 ⁺)		
		607		3361.2	(29/2 ⁻)		
4005.9	(33/2 ⁻)	354.0		3651.8	(31/2 ⁺)		
		442.0		3564.1	(29/2 ⁻)		
		644		3361.2	(29/2 ⁻)		
4054.7	(33/2 ⁺)	691		3364.8	(29/2 ⁺)		
		875		3181.3	(29/2 ⁺)		
4486.8	(33/2)	835		3651.8	(31/2 ⁺)		
4543.8	(35/2 ⁻)	489.4		4054.7	(33/2 ⁺)		
		684.0		3859.6	(33/2 ⁺)		
4575.1	(35/2 ⁺)	607		3968.4	(33/2 ⁻)		
		923		3651.8	(31/2 ⁺)		
4597.3	(37/2 ⁺)	737.7	100	3859.6	(33/2 ⁺)		
4606.6	(37/2 ⁻)	601		4005.9	(33/2 ⁻)		
4686.4	(37/2 ⁻)	718.0		3968.4	(33/2 ⁻)	(E2)	0.00519 7
4799.0	(37/2 ⁺)	744		4054.7	(33/2 ⁺)		
5140.6	(39/2 ⁻)	543		4597.3	(37/2 ⁺)		
		597		4543.8	(35/2 ⁻)		
5173.4	(39/2 ⁺)	374		4799.0	(37/2 ⁺)		
		567		4606.6	(37/2 ⁻)		
5325.4	(39/2)	639		4686.4	(37/2 ⁻)		

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Sm})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π
5361.3	(41/2 ⁺)	764	4597.3	(37/2 ⁺)	5477.4	(41/2 ⁻)	791	4686.4	(37/2 ⁻)
5372.5	(41/2 ⁻)	199	5173.4	(39/2 ⁺)	5791.5	(43/2)	419	5372.5	(41/2 ⁻)
		766	4606.6	(37/2 ⁻)	5801.6	(43/2 ⁻)	661	5140.6	(39/2 ⁻)
					6189.5	(45/2)	398	5791.5	(43/2)

[†] As indicated, values for γ rays from low-spin ($J \leq 9/2$) are from ¹⁴⁹Eu and ¹⁴⁹Pm decay data, and for higher-spins, values are from ($\alpha, n\gamma$) when given with uncertainties, and from ¹⁴⁸Nd($\alpha, 3n\gamma$), ¹⁵⁰Nd(³He, $4n\gamma$), when given without uncertainties, unless otherwise noted.

[‡] Below 953 excitation energy, I_γ data are mainly from ¹⁴⁹Pm β^- decay or ¹⁴⁹Eu ε decay or weighted average when values from these two datasets have comparable uncertainties; above this energy, values available from ($\alpha, n\gamma$) and ¹⁴⁸Nd($\alpha, 3n\gamma$), ¹⁵⁰Nd(³He, $4n\gamma$) are considered, unless otherwise noted.

From ¹⁴⁹Eu ε decay. Available value from ¹⁴⁹Pm β^- decay is nearly the same but slightly less precise in most cases.

@ From ¹⁴⁹Pm β^- decay.

& From ($\alpha, n\gamma$) or ($\alpha, 3n\gamma$), (³He, $4n\gamma$).

^a Uncertainty doubled for fitting purpose, as the E_γ value fits poorly.

^b From ce studies in ¹⁴⁹Pm β^- , ¹⁴⁹Eu ε and in-beam γ -ray. Above 636 keV level, the assignment is from ce and/or $\gamma(\theta)$ and $\gamma(\text{lin pol})$ data in in-beam γ -ray studies.

^c Deduced from ce data in ¹⁴⁹Eu decay, $\gamma\gamma(\theta)$ in ¹⁴⁹Pm β^- , and ce and $\gamma(\theta)$ data in in-beam γ -ray work. Above 636 level, value is from ce and/or $\gamma(\theta)$ data in in-beam γ -ray studies.

^d From ce data in ¹⁴⁹Eu ε decay.

^e $\gamma(\theta, T)$ data in ¹⁴⁹Eu decay.

^f From $\gamma(\theta)$ in ($\alpha, n\gamma$).

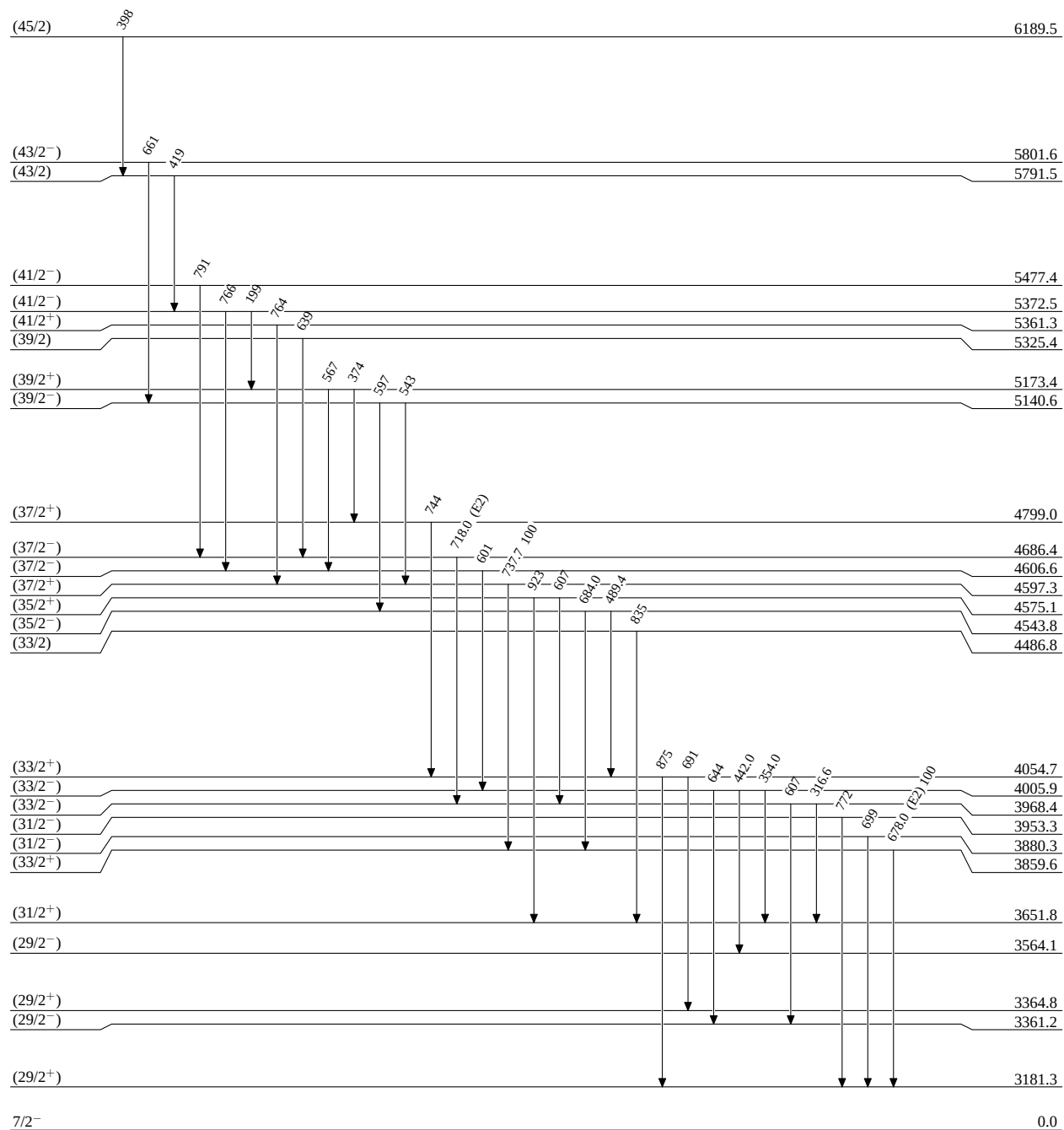
^g Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^h Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

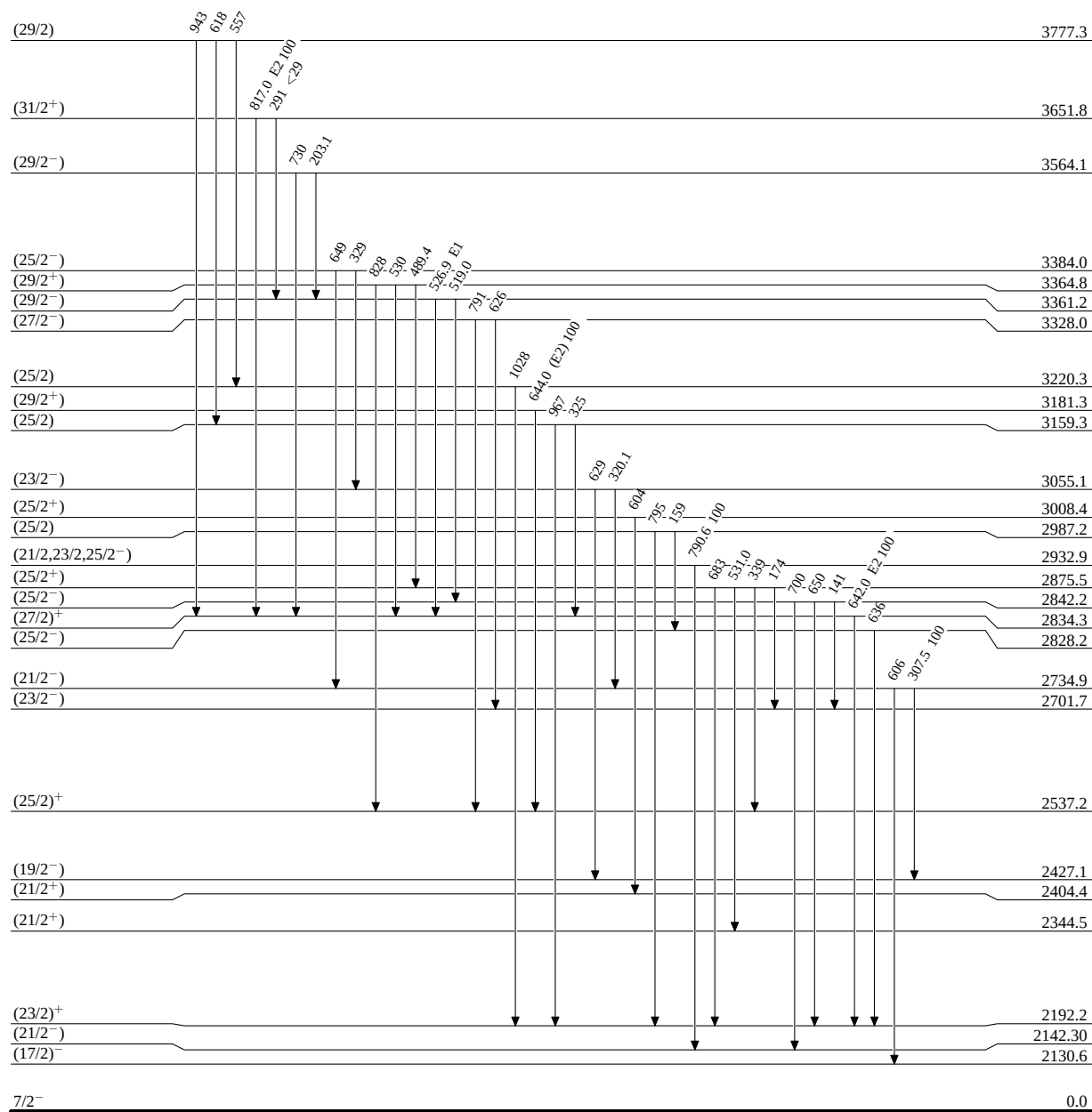


stable

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



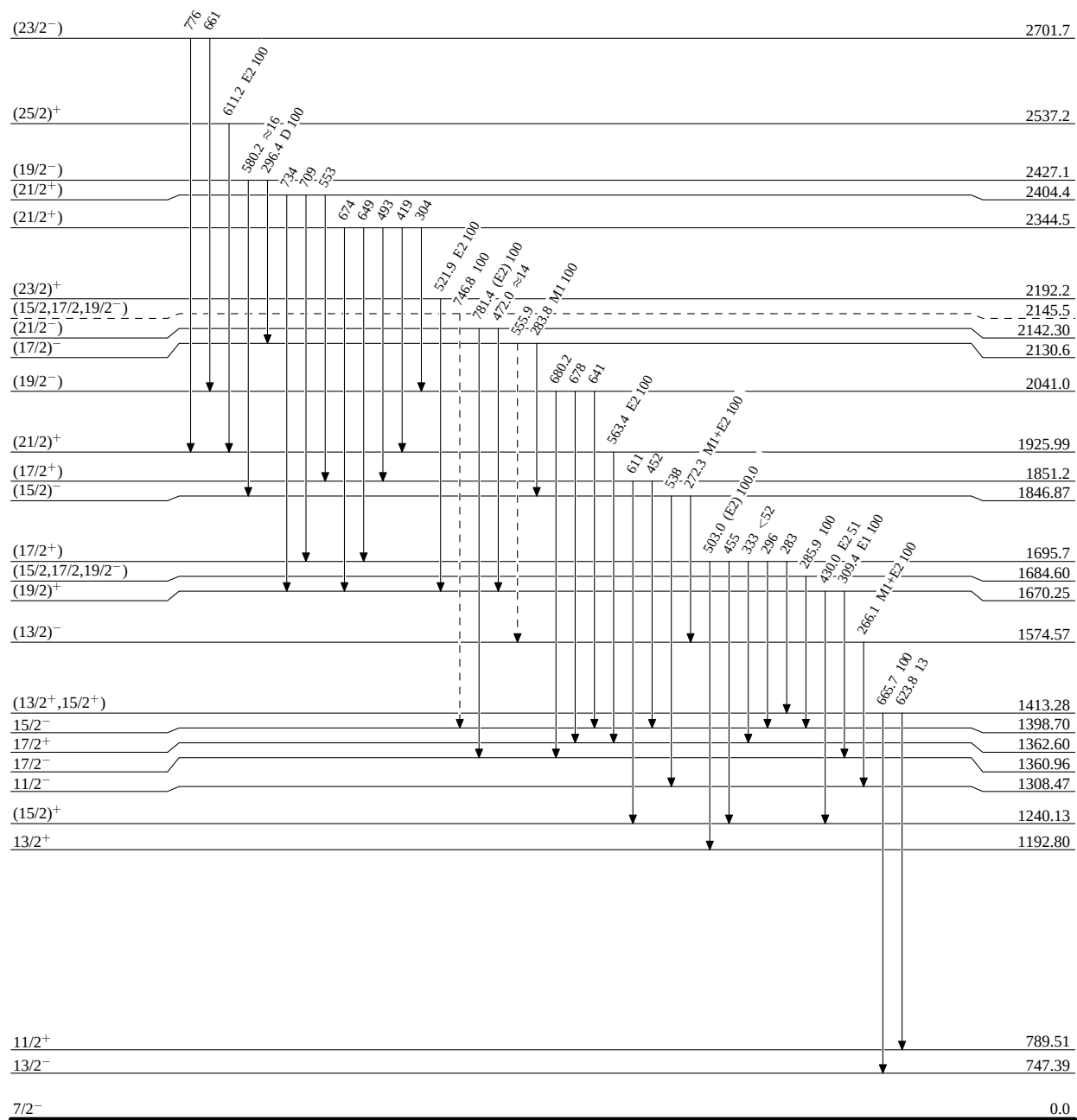
stable

Adopted Levels, Gammas

Legend

Level Scheme (continued)

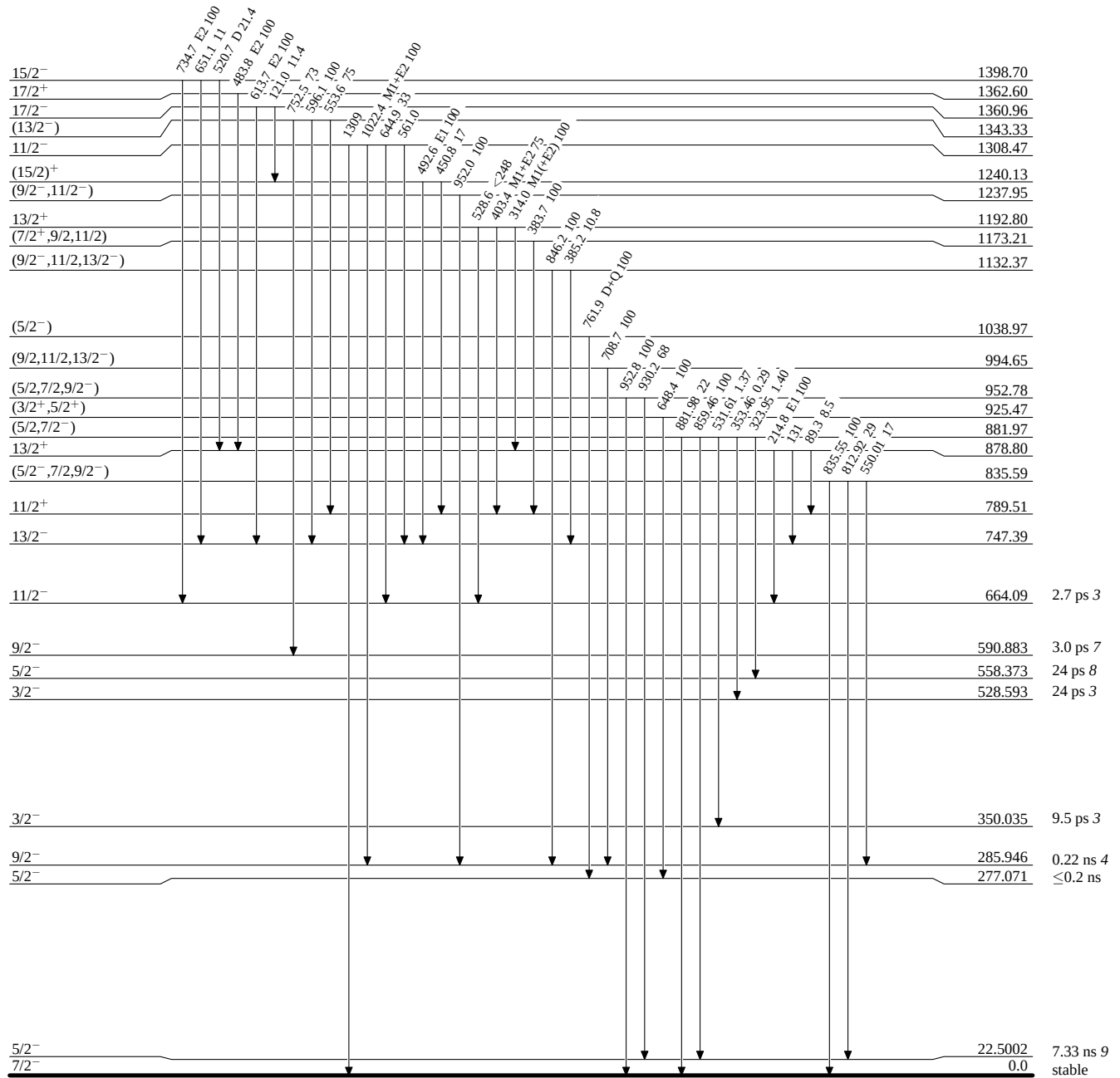
Intensities: Relative photon branching from each level

 ----- ► γ Decay (Uncertain)


Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



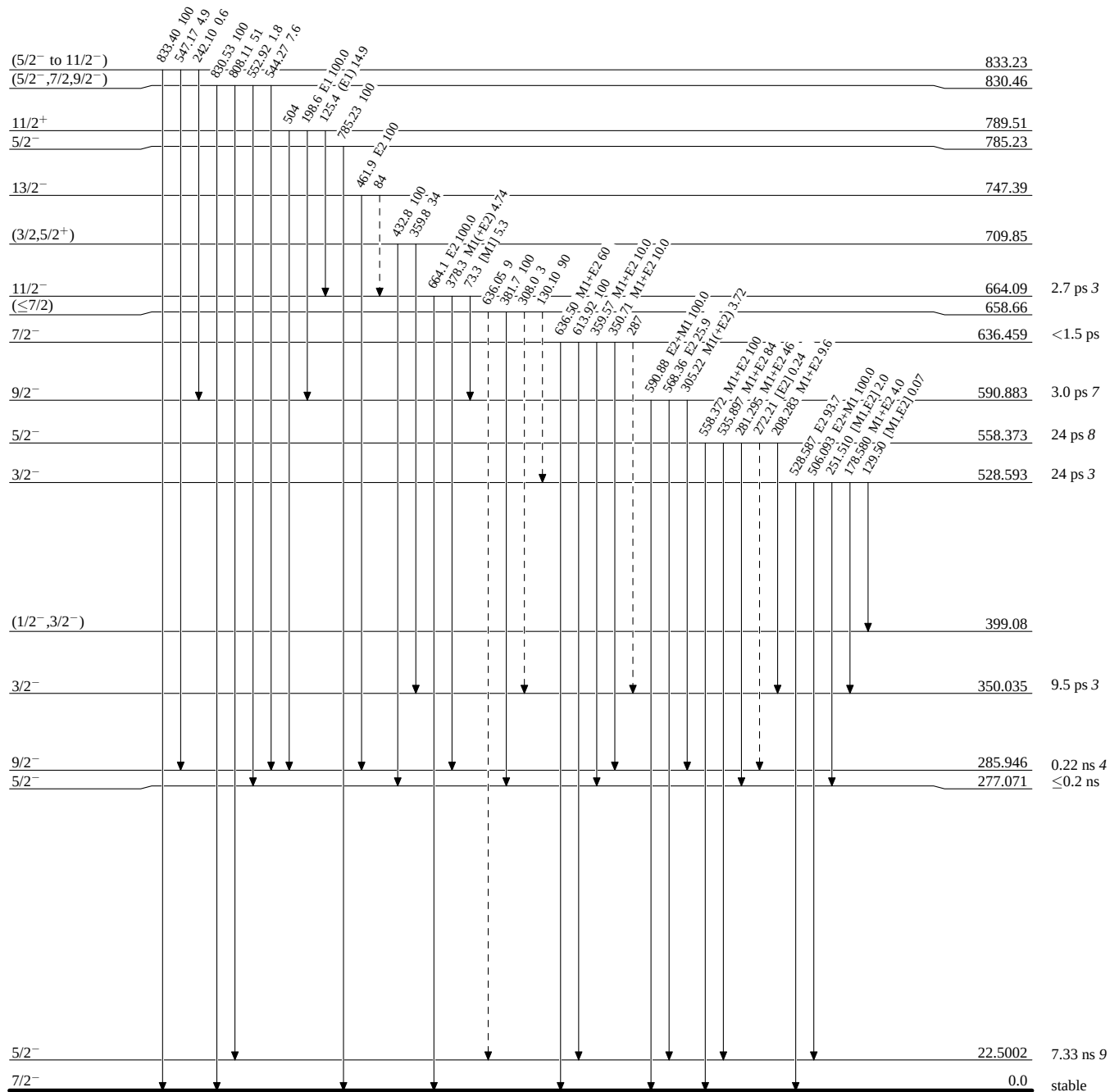
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

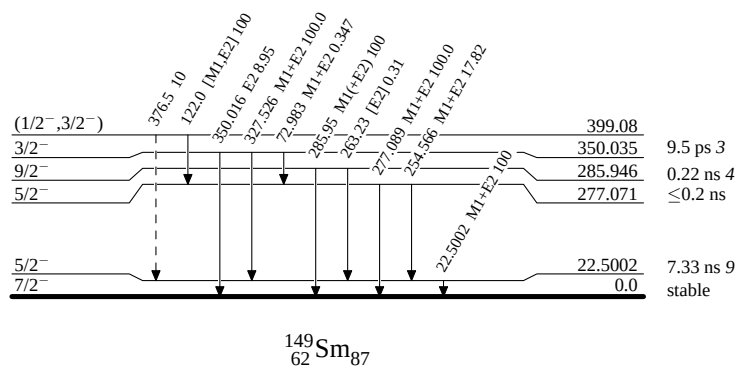


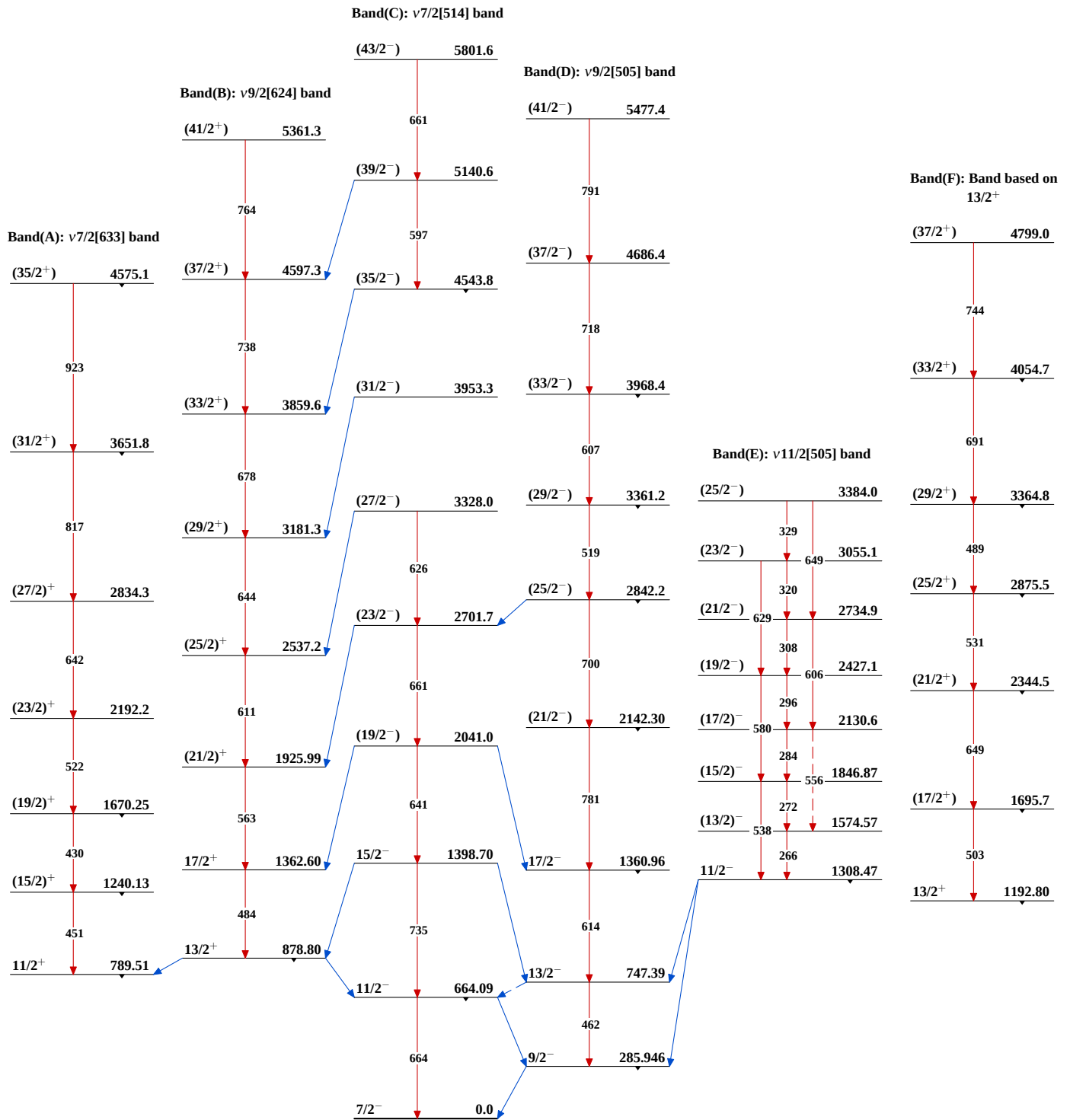
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

 - - - - - $\rightarrow$ γ Decay (Uncertain)


Adopted Levels, Gammas $^{149}_{62}\text{Sm}_{87}$

Adopted Levels, Gammas (continued)

Band(G): Band based on
5/2⁻

(13/2⁻) 1343.33

↓

752

9/2⁻ 590.883

↓

568

5/2⁻ 22.5002

↓

¹⁴⁹Sm₆₂

$^{149}\text{Pm} \beta^-$ decay (53.08 h) [1982Me10](#)

Parent: ^{149}Pm : $E=0.0$; $J^\pi=7/2^+$; $T_{1/2}=53.08$ h 9; $Q(\beta^-)=1071.5$ 19; $\% \beta^-$ decay=100

$^{149}\text{Pm}-J^\pi, T_{1/2}$: From ^{149}Pm Adopted Levels.

$^{149}\text{Pm}-Q(\beta^-)$: From [2021Wa16](#).

[1982Me10](#): measured γ , $\gamma\gamma$ at LLNL. Mass separated source and Compton suppression spectrometer used for this study.

Others: [1976MiZJ](#), [1972Ho08](#), [1972De67](#), [1971Ba28](#), [1970Ch09](#), [1969Gr32](#), [1966Mc11](#), [1963Ho15](#), [1960Ch15](#), [1960Ar05](#), [1960Bu06](#), [1960Sc08](#).

$\gamma\gamma$ -coin: [1976MiZJ](#), [1966Mc11](#), [1960Ar05](#), [1960Sc08](#).

$\gamma\gamma(\theta)$: [1976MiZJ](#) (semi-scin system). Reanalysis by [1980Mi07](#).

$\gamma(\theta, t)$: [1984Pr04](#), [1960Ch15](#).

$\gamma\gamma(t)$: [1965Cu01](#), [1960Ma27](#).

ce: [1960Ar05](#), [1960Sc08](#), [1952Ru10](#).

References prior to 1960 dealing mainly with production and identification of ^{149}Pm : [1954Fi29](#), [1952Ki25](#), [1952Ru10](#), [1951Ko01](#), [1949Ma02](#), [1947Ma28](#), [1947In06](#), [1946Bo25](#), [1941La01](#).

Following γ rays [$E\gamma(I\gamma)$] seen by [1976MiZJ](#) have been omitted by (evaluators) for lack of confirmation: 64.1(0.0033);

239.5(0.19); 278.6(0.0066); 487.0(0.33); 553.4(0.0165); 556.2(0.0033); 605.0(0.01); 920.0; 925.6. A level proposed at 836.8 from 278.6 γ and 487.0 γ has also been omitted. It may be pointed out that the source material used by [1976MiZJ](#) contained several impurities.

β^- and $\gamma\beta^-$: [1978Re01](#), [1960Sc08](#), [1960Ar05](#), [1960Ch15](#).

$\beta\gamma(\theta)$: [1980Mi07](#), [1979Ra11](#), [1977Mi17](#).

β^- shape: [1978Re01](#).

$\beta\gamma(t)$: [1968Ak02](#), [1960Ch15](#).

The statement “in-beam γ -ray” includes ($\alpha, n\gamma$); and ($\alpha, 3n\gamma$), ($^3\text{He}, 4n\gamma$) reactions.

Total decay energy deposit of 1065 keV 4 calculated by RADLIST code is in agreement with expected value of 1071.5 keV 19, indicating the completeness of the decay scheme.

 ^{149}Sm Levels

E(level) [‡]	J^π [†]	$T_{1/2}$	Comments
0.0	7/2 ⁻	stable	
22.5002 8	5/2 ⁻		
277.093 17	5/2 ⁻		
285.948 10	9/2 ⁻	0.22 ns 4	$T_{1/2}$: unweighted average of 0.182 ns 7 ($\gamma\gamma(t)$, 1965Cu01), 0.253 ns 27 ($\beta\gamma(t)$, 1968Ak02). Other: 1960Ma27 .
350.08 4	3/2 ⁻		
528.54 9	3/2 ⁻		
558.352 23	5/2 ⁻		
590.883 10	9/2 ⁻	3.0 ps 7	
636.54 3	7/2 ⁻	<1.5 ps	
664.40 10	11/2 ⁻		
785.23 12	5/2 ⁻		
830.38 4	(5/2 ⁻ , 7/2, 9/2 ⁻)		
833.23 5			
835.59 7	(5/2 ⁻ , 7/2, 9/2 ⁻)		
881.97 4	(5/2, 7/2 ⁻)		
952.78 9	(5/2, 7/2, 9/2 ⁻)		

[†] From the Adopted Levels.

[‡] From least-squares fit to $E\gamma$ values. Energy uncertainties of six γ rays were doubled to obtain a fairly acceptable reduced $\chi^2=2.9$ as compared to critical $\chi^2=1.8$. Without this adjustment reduced χ^2 was 5.9.

^{149}Pm β^- decay (53.08 h) **1982Me10** (continued) β^- radiations

E(decay)	E(level)	$I\beta^-$ [†] #	Log ft	Comments
(118.7 19)	952.78	0.0015 2	8.7 1	Measured $E\beta=190$ 40, $I\beta=0.6$ (1960Sc08), $E\beta=210$ (1978Re01).
(189.5 19)	881.97	0.136 10	7.41 4	
(235.9 19)	835.59	0.0016 2	9.6 1	
(238.3 19)	833.23	0.035 4	8.31 5	
(241.1 19)	830.38	0.052 5	8.16 5	
(286.3 19)	785.23	0.00037 7	10.5 1	Measured $E\beta=470$ 40 and $I\beta=0.3$ (1960Sc08); $E\beta=470$ (1978Re01).
(407.1 19)	664.40	0.00077 11	10.7 ^{1u} 1	
(435.0 19)	636.54	0.027 2	9.28 4	
(480.6 19)	590.883	0.090 7	8.90 4	
(513.2 19)	558.352	0.035 3	9.40 4	
(721.4 19)	350.08	0.0013 3	11.6 ^{1u} 1	E(decay): measured $E\beta=786$ 7 from weighted average of 788 9 (1960Ar05), 784 10 (1960Sc08), 770 50 (1960Ch15). Other: 776 (1978Re01). $I\beta^-$: from absolute intensity measurement of 286 γ (1982Me10,1970Ch09,1966Mc11). Measured $I\beta$: 2.9 4 (1960Ar05), 10 3 (1960Sc08), 11 (1978Re01).
(785.6 19)	285.948	3.4 2	8.06 3	
(794.4 19)	277.093	0.027 2	10.17 4	$I\beta^-$: total β^- feeding to g.s. and 22 level is 95.6% 5. From the measured endpoint energy it is estimated that feeding to g.s. is >50%, implying <46% β feeding for 22.5-keV level. See also comment with 1071.5 β .
(1049.0 19)	22.5002	[‡]		
(1071.5 19)	0.0	95.6 [‡] 5	7.092 4	E(decay): measured $E\beta=1067$ 5 from weighted average of 1062 2 (1978Re01), 1072 2 (1960Ar05), 1064 8 (1960Sc08), 1050 50 (1960Ch15). $I\beta^-$: total β^- feeding to g.s. and 22.5 level. Measured $I\beta$ corresponding to endpoint energy of 1072: 97.1 4 (1960Ar05), 89 3 (1960Sc08), 88 (1978Re01), which indicates that a large fraction (probably>50%) of β^- feeding proceeds to the g.s. The shape of 1067 β is neither statistical nor characteristic of a unique transition. Log ft: combined value for β feedings to 0 and 22 levels.

[†] From intensity balance at each level.[‡] Total β feeding is 95.6 5 for 0+22.5 levels. Feeding for the g.s. is estimated as >50% implying <46% for 22.5 level.

Absolute intensity per 100 decays.

¹⁴⁹Pm β⁻ decay (53.08 h) ^{1982Me10} (continued)γ(¹⁴⁹Sm)I_γ normalization: From absolute intensity (in 4πβγ measurement) %I_γ(286γ)=3.1 2 (^{1966Mc11}).

E _γ	I _γ ^{†@}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [‡]	δ [‡]	α ^{&}	Comments
22.5002 8	<54	22.5002	5/2 ⁻	0.0	7/2 ⁻	M1+E2	0.0784 9	30.0 5	%I _γ ≤0.0496 E _γ : from ¹⁴⁹ Eu ε decay (^{2011In01}), γ not observed in ¹⁴⁹ Pm β ⁻ . I _γ : from Iβ(22.5 level)<46% (see comment for Iβ to 22.5 level). For Iβ(22 level)=0%, I _γ (22γ)≈0.2. Mult.,δ: from ¹⁴⁹ Eu ε decay; δ(E2/M1) from ce measurements by ^{2011In01} .
72.98 7	0.0010 8	350.08	3/2 ⁻	277.093	5/2 ⁻	M1+E2	0.27 6	4.42 12	%I _γ =3.1×10 ⁻⁵ 25
208.28 11	0.047 3	558.352	5/2 ⁻	350.08	3/2 ⁻	M1+E2	-0.45 15	0.210 4	%I _γ =0.00146 13 δ: from γ(θ) in in-beam γ-ray.
^x 238.38 12	0.007 1								%I _γ =0.000217 34
242.10 14	0.006 1	833.23		590.883	9/2 ⁻				%I _γ =0.000186 33
254.57 8	0.17 1	277.093	5/2 ⁻	22.5002	5/2 ⁻	M1+E2	+0.20 +8-6	0.1242 20	%I _γ =0.0053 5 δ: from γ(θ) in in-beam γ-ray.
^x 257.77 11	0.011 1								%I _γ =0.00034 4
263.23 [#] 4	0.31 1	285.948	9/2 ⁻	22.5002	5/2 ⁻	[E2]		0.0849	%I _γ =0.0096 7
277.09 2	0.93 4	277.093	5/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.08 +1-2	0.0997 14	%I _γ =0.0288 22 δ: from γ(θ) in in-beam γ-ray.
281.24 3	0.24 1	558.352	5/2 ⁻	277.093	5/2 ⁻	M1+E2	+0.14 9	0.0955 16	%I _γ =0.0074 6 Mult.,δ: from ¹⁴⁹ Eu ε decay.
									(281γ)(277γ)(θ): A ₂ =-0.08 5 (^{1976MiZJ}). Consistent with δ=0.14 from ¹⁴⁹ Eu ε decay.
285.95 1	100	285.948	9/2 ⁻	0.0	7/2 ⁻	M1(+E2)	+0.06 6	0.0917 13	%I _γ =3.10 20 I _γ : I _γ /100 decays=3.1 2 (^{1966Mc11}). Others: ^{1970Ch09} , ^{1960Bu06} . δ: from γ(θ,t) (^{1984Pr04}). α(K)exp=0.075 8, K/L=6.5 7, L/M=4 1 (^{1960Ar05}). Others: α(K)exp=0.16 5, K/L=9.0 15 (^{1960Sc08}), K/L=8.0 25 (^{1952Ru10}). A ₂ =+0.097 to +0.30 in γ(θ,t) (^{1984Pr04}).
305.22 [#] 8	0.083 5	590.883	9/2 ⁻	285.948	9/2 ⁻	M1(+E2)	+0.15 15	0.0767 18	%I _γ =0.00257 23 δ: from (305γ)(286γ)(θ): A ₂ =-0.104 12, A ₄ =-0.004 15 (^{1976MiZJ} , ^{1980Mi07}).
^x 314.85 15	0.009 1								%I _γ =0.00028 4
323.95 [#] 9	0.049 5	881.97	(5/2,7/2 ⁻)	558.352	5/2 ⁻				%I _γ =0.00152 18
327.53 7	0.120 6	350.08	3/2 ⁻	22.5002	5/2 ⁻	M1+E2	+0.14 3	0.0637 9	%I _γ =0.00372 30 δ: from γ(θ,t) in ¹⁴⁹ Eu decay (^{1981KrZS}).
350.0 1	0.0111	350.08	3/2 ⁻	0.0	7/2 ⁻	E2		0.0352 5	%I _γ =0.000344 γ not resolved from 350.71γ.

¹⁴⁹Pm β⁻ decay (53.08 h) **1982Me10** (continued)

$\gamma(^{149}\text{Sm})$ (continued)									
E_γ	$I_\gamma^{\dagger@}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\delta^\ddagger$	$\alpha^\&$	Comments
350.71 7	0.048 3	636.54	7/2 ⁻	285.948	9/2 ⁻	M1+E2	-0.30 10	0.0521 13	%I _γ =0.00149 13 δ: from (351γ)(286γ)(θ): A ₂ =-0.074 14, A ₄ =-0.023 19 (1976MiZJ , 1980Mi07).
353.46 11	0.010 1	881.97	(5/2,7/2 ⁻)	528.54	3/2 ⁻				%I _γ =0.00031 4
359.57 7	0.048 4	636.54	7/2 ⁻	277.093	5/2 ⁻	M1+E2	+0.9 5	0.042 6	%I _γ =0.00149 16 δ: from (360γ)(277γ)(θ): A ₂ =-0.08 2 (1976MiZJ).
506.1 2	0.004 1	528.54	3/2 ⁻	22.5002	5/2 ⁻	E2+M1	+4.9 +31-15	0.0128 4	%I _γ =0.000124 32 Mult.,δ: from γ(θ,t) in ¹⁴⁹ Eu decay (1981KrZS).
528.6 2	0.004 1	528.54	3/2 ⁻	0.0	7/2 ⁻	E2		0.01108 16	%I _γ =0.000124 32
531.61 [#] 6	0.048 4	881.97	(5/2,7/2 ⁻)	350.08	3/2 ⁻				%I _γ =0.00149 16
535.90 5	0.37 2	558.352	5/2 ⁻	22.5002	5/2 ⁻	E2+M1	-0.65 +23-43	0.0159 18	%I _γ =0.0115 10 Mult.,δ: from γ(θ,t) in ¹⁴⁹ Eu decay (1981KrZS).
544.27 6	0.080 4	830.38	(5/2 ⁻ ,7/2,9/2 ⁻)	285.948	9/2 ⁻				%I _γ =0.00248 20
547.17 7	0.052 4	833.23		285.948	9/2 ⁻				%I _γ =0.00161 16
550.01 15	0.006 1	835.59	(5/2 ⁻ ,7/2,9/2 ⁻)	285.948	9/2 ⁻				%I _γ =0.000186 33
552.92 [#] 9	0.019 1	830.38	(5/2 ⁻ ,7/2,9/2 ⁻)	277.093	5/2 ⁻				%I _γ =0.00059 5
558.37 4	0.49 3	558.352	5/2 ⁻	0.0	7/2 ⁻	M1+E2	+1.5 5	0.0117 13	%I _γ =0.0152 14
568.36 7	0.60 4	590.883	9/2 ⁻	22.5002	5/2 ⁻	E2		0.00919 13	%I _γ =0.0186 17
^x 571.08 9	0.078 7								%I _γ =0.00242 27
590.88 1	2.23 9	590.883	9/2 ⁻	0.0	7/2 ⁻	E2+M1	-1.5 +9-4	0.0101 25	%I _γ =0.069 5
^x 598.42 15	0.007 1								%I _γ =0.000217 34
613.92 6	0.48 3	636.54	7/2 ⁻	22.5002	5/2 ⁻				%I _γ =0.0149 13
636.50 5	0.30 2	636.54	7/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.30 +16-18	0.0114 5	%I _γ =0.0093 9
664.4 1	0.025 3	664.40	11/2 ⁻	0.0	7/2 ⁻	E2		0.00624 9	%I _γ =0.00078 11
785.23 12	0.012 2	785.23	5/2 ⁻	0.0	7/2 ⁻				%I _γ =0.00037 7
808.11 [#]	0.53 4	830.38	(5/2 ⁻ ,7/2,9/2 ⁻)	22.5002	5/2 ⁻				%I _γ =0.0164 16
812.92	0.010 1	835.59	(5/2 ⁻ ,7/2,9/2 ⁻)	22.5002	5/2 ⁻				%I _γ =0.00031 4
^x 824.3 2	0.004 1								%I _γ =0.000124 32
830.53 7	1.05 8	830.38	(5/2 ⁻ ,7/2,9/2 ⁻)	0.0	7/2 ⁻				%I _γ =0.0325 32
833.40 7	1.07 8	833.23		0.0	7/2 ⁻				%I _γ =0.0332 33
835.55 11	0.035 3	835.59	(5/2 ⁻ ,7/2,9/2 ⁻)	0.0	7/2 ⁻				%I _γ =0.00108 12
859.46 6	3.5 1	881.97	(5/2,7/2 ⁻)	22.5002	5/2 ⁻				%I _γ =0.108 8
881.98 5	0.77 3	881.97	(5/2,7/2 ⁻)	0.0	7/2 ⁻				%I _γ =0.0239 18
^x 915.5 3	0.0003 1								%I _γ =9.3×10 ⁻⁶ 32
930.2 2	0.019 3	952.78	(5/2,7/2,9/2 ⁻)	22.5002	5/2 ⁻				%I _γ =0.00059 10
^x 950.6 2	0.007 2								%I _γ =0.00022 6
952.8 1	0.028 3	952.78	(5/2,7/2,9/2 ⁻)	0.0	7/2 ⁻				%I _γ =0.00087 11
^x 964.4 5	0.00010 3								%I _γ =3.1×10 ⁻⁶ 10
^x 969.6 5	0.00010 3								%I _γ =3.1×10 ⁻⁶ 10

¹⁴⁹Pm β⁻ decay (53.08 h) [1982Me10](#) (continued)

γ(¹⁴⁹Sm) (continued)

- † 3% uncertainty added (evaluators) in quadrature to uncertainties given by [1982Me10](#).
- ‡ From the Adopted Gammas, where the assignments are from ce data in ¹⁴⁹Eu decay and γ(θ), γ(lin pol) data in in-beam γ-ray.
- # Uncertainty doubled for fitting purpose, as the Eγ fits poorly.
- @ For absolute intensity per 100 decays, multiply by 0.031 2.
- & Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
- ^x γ ray not placed in level scheme.

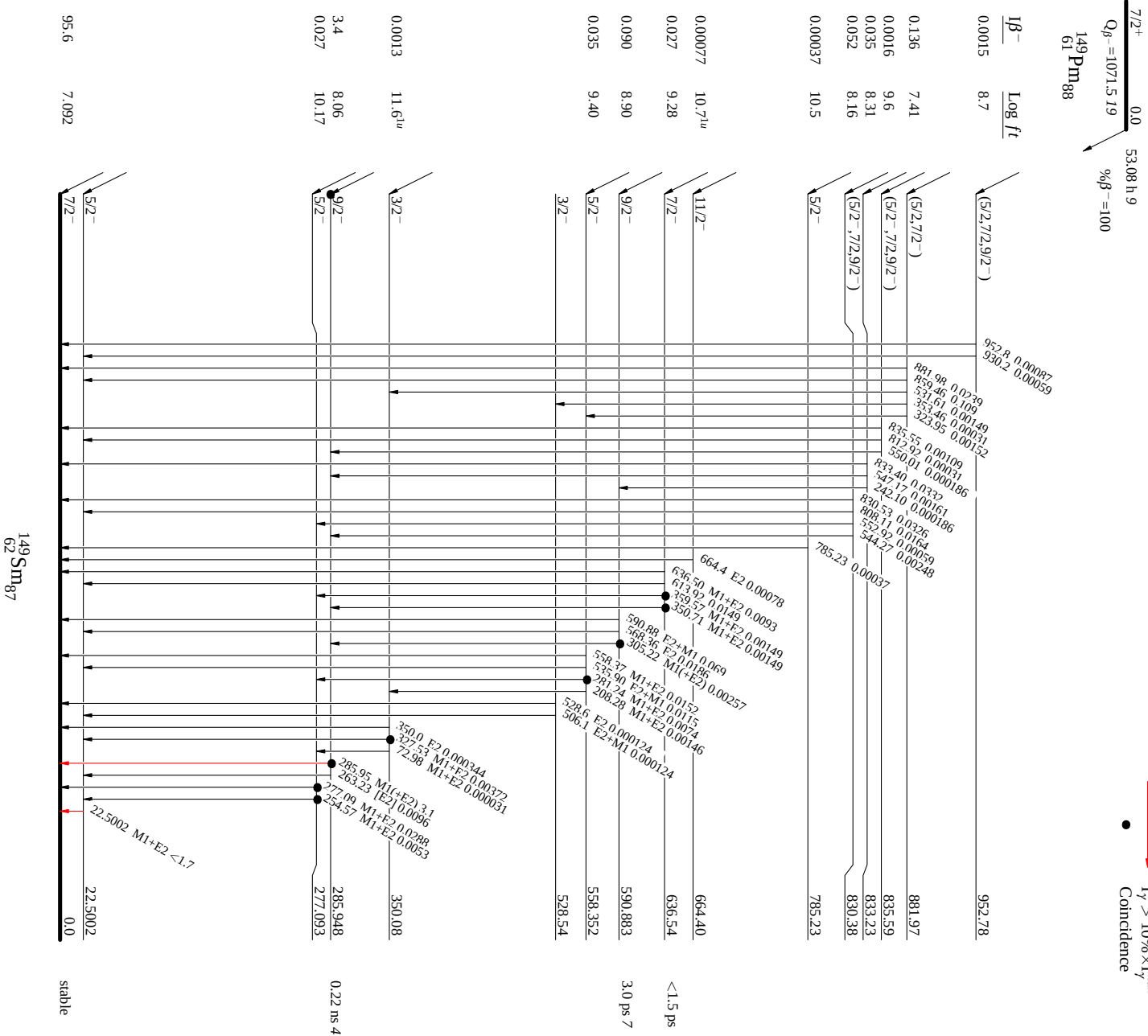
¹⁴⁹Pm β⁻ decay (53.08 h) ¹⁹⁸²Me10

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

-  I_γ < 2% × I_γ^{max}
-  I_γ < 10% × I_γ^{max}
-  I_γ > 10% × I_γ^{max}
-  Coincidence



^{149}Eu ε decay (93.1 d) [1982Me10,1992Ca11](#)

Parent: ^{149}Eu : $E=0.0$; $J^\pi=5/2^+$; $T_{1/2}=93.1$ d 4; $Q(\varepsilon)=695$ 4; % ε decay=100

^{149}Eu - J^π , $T_{1/2}$: From ^{149}Eu Adopted Levels.

^{149}Eu - $Q(\varepsilon)$: From [2021Wa16](#).

[1982Me10](#): measured γ , $\gamma\gamma$, ce using a mass-separated source and a Compton suppression spectrometer at LLNL.

[1992Ca11](#): measured $E\gamma$, ce using a mass-separated source and a double focusing magnetic spectrometer at CERN.

[2004Mi43](#): measured emission probabilities of 277.1 γ and 327.5 γ as 4.13 3 and 4.75 3, respectively using a 4π $\beta\gamma$ coin apparatus at JAERI.

[2011In01](#), [2011In04](#): measurement of high-resolution ce data for 22.5-keV transition using a combined electrostatic electron spectrometer consisting of a retarding sphere followed by a double-pass cylindrical mirror energy analyzer. The electron spectra were recorded by sweeping the retarding voltage while the analyzer voltage was kept constant. FWHM=7 eV. Sources of ^{149}Eu were prepared from bombardment of natural Er by 500-MeV protons from JINR accelerator followed by chemical separation of Eu fraction as Eu_2O_3 and EuF_3 compounds. Conversion lines of 22.5-keV transition recorded were: L1, L2, L3, M1, M2, M3, M4+M5, N1, N2, N3, O1, O2+O3. Natural widths of Sm atomic levels were deduced from the conversion electron lines of 22.5-keV transition as follows: 3.9 eV 1 for L1 shell, 3.6 eV 1 for L2 shell, 3.3 eV 1 for L3 shell, 13.4 eV 3 for M1 shell, 5.9 eV 3 for M2 shell, 7.3 eV 4 for M3 shell, 5.6 eV 4 for N1 shell, 2.3 eV 8 for N3 shell. Values are averages from Eu_2O_3 and EuF_3 sources ([2011In04](#)).

[1996Vy01](#) (also [1979VyZV](#)): analysis of ^{149}Eu ε decay data from authors' earlier (1978-1980) studies reported in secondary publications; five excited states reported at 22.5, 277.1, 350.0, 528.5 and 558.4 with $\varepsilon+\beta^+$ feedings for g.s. and the five excited states.

Others: [1976Ga10](#), [1970Ch09](#), [1968Wi21](#), [1968Ad01](#), [1966Wi12](#), [1966Mc11](#), [1966Av05](#), [1963Ha43](#), [1962Wa32](#), [1962Dz02](#), [1961Ha40](#), [1961Ha23](#), [1959An36](#), [1953Ma17](#), [1951Ho30](#).

$\gamma\gamma$ -coin: [1976Ga10](#), [1966Mc11](#), [1966Av05](#), [1962Wa32](#).

ce: [1981Ar17](#), [1970An17](#). Others: [1966Mc11](#), [1966Av05](#), [1966Wi12](#), [1962Wa32](#), [1962Dz02](#), [1961Ha23](#), [1959An36](#).

$\gamma\gamma(\theta)$: [1980Kr15](#) (semi-semi and semi-scint systems), [1963Ha43](#).

$\gamma\gamma(\theta, H, T)$: [1981KrZS](#), [1983Kr19](#).

$\gamma\gamma(t)$ and $\text{ce}\gamma(t)$: [1970Ko30](#), [1966Be39](#), [1963Ki15](#).

Total decay energy deposit of 682 keV 39 calculated by RADLIST code is in agreement with expected value of 695 keV 4, indicating the completeness of the decay scheme.

 ^{149}Sm Levels

E(level) [‡]	J^π [†]	$T_{1/2}$ [†]	Comments
0.0	$7/2^-$	stable	
22.5002 8	$5/2^-$	7.33 ns 9	E(level): 22.499 7 (1996Vy01). $T_{1/2}$: adopted value is weighted average of 7.12 ns 11 (cex(t), 1970Ko30) and 7.37 ns 5 ($\gamma\gamma(t)$, 1996Vy01). Others: 6.9 ns 5 (1966Be39), 7.6 ns 5 (1963Ki15).
277.072 7	$5/2^-$	≤ 0.2 ns	E(level): 277.083 4 (1996Vy01). $T_{1/2}$: adopted value from $\gamma(x\text{-ray})(t)$ (1970Ko30).
285.951 10	$9/2^-$	0.22 ns 4	
350.036 6	$3/2^-$	9.5 ps 3	E(level): 350.00 5 (1996Vy01). $T_{1/2}$: value from this dataset: ≤ 0.2 ns from (x-ray) $\gamma(t)$ (1970Ko30).
399.08 7	$(1/2^-, 3/2^-)$		
528.592 7	$3/2^-$	24 ps 3	E(level): 528.484 7 (1996Vy01).
558.374 7	$5/2^-$	24 ps 8	E(level): 558.409 16 (1996Vy01).
590.880 10	$9/2^-$		
636.421 17	$7/2^-$		
658.62 4	$(\leq 7/2)$		

[†] From the Adopted Levels. Comments are given for the source of the Adopted values.

[‡] From least squares fit to $E\gamma$ data.

^{149}Eu ε decay (93.1 d) [1982Me10](#),[1992Ca11](#) (continued) ε radiations

E(decay)	E(level)	$I\varepsilon^\dagger$	Log ft	Comments
(36 4)	658.62	0.0082 15	8.0 2	
(59 4)	636.421	4.85×10^{-4} 17	9.8 1	
(104 4)	590.880	1.43×10^{-4} 14	9.9^{1u} 1	
(137 4)	558.374	0.164 5	8.55 4	$I\varepsilon$: other: 0.13 1 (1996Vy01).
(166 4)	528.592	1.310 15	7.88 3	$I\varepsilon$: other: 1.05 5 (1996Vy01).
(296 ‡ 4)	399.08	<0.0005	$>11.3^{1u}$	
(345 4)	350.036	5.53 5	8.01 1	$I\varepsilon$: other: 4.65 18 (1996Vy01).
(409 4)	285.951	0.00072 28	11.8^{1u} 2	
(418 4)	277.072	5.30 5	8.22 1	$I\varepsilon$: other: 4.29 14 (1996Vy01).
(673 4)	22.5002	77.5 33	7.50 2	$I\varepsilon$: see comment for $I\varepsilon$ to g.s. Values of 25 (1982Me10) and 5 (1978LeZA , 1976Ho17) are incorrect. Other: 60 8 (1996Vy01).
(695 4)	0.0	10.2 33	8.4 2	$I\varepsilon$: from $I(\gamma+ce)$ imbalance. Note that 1982Me10 and earlier compilations (1978LeZA , 1976Ho17) give $I\varepsilon=65$ and 85, respectively. The discrepancy is most probably due to incorrect value of $\alpha(22\gamma)$ used by 1982Me10 and 1978LeZA . Other: 31 9 (1996Vy01).

 † Absolute intensity per 100 decays. ‡ Existence of this branch is questionable.

¹⁴⁹Eu ε decay (93.1 d) [1982Me10](#),[1992Ca11](#) (continued) $\gamma(^{149}\text{Sm})$

I_γ normalization: From $I_\gamma/100$ decays=4.75 4 for 327.5 γ by $4\pi\beta\gamma$ coin method ([2004Mi43](#)). Other: 0.0403 4 ([1982Me10](#), from $I(K \times \text{ray})/I_\gamma(327.5\gamma)$ and decay scheme.

Measured x-ray intensities per 100 decays ([1982Me10](#)): 22.6 8 for $K\alpha_2$, 41.0 8 for $K\alpha_1$, 12.3 2 for $K\beta_1$, 3.18 7 for $K\beta_2$, and 79.1 14 for all the x-rays.

Experimental values of $\alpha(K)\text{exp}$, $\alpha(L)\text{exp}$, $\alpha(M)\text{exp}$ given under comments have been deduced from present I_γ data and $\text{Ice}(K)$, $\text{Ice}(L)$, and $\text{Ice}(M)$ from [1982Me10](#). For 254 γ , 277 γ , 281 γ and 327 γ , weighted average of electron intensities available from [1992Ca11](#) and [1982Me10](#) are taken. The data have been normalized to the 350 γ treated as pure E2. On the basis of $\approx 3\%$ uncertainty on I_γ data and 5% on Ice data an uncertainty of $\approx 7\%$ is assigned to $\alpha(\text{exp})$ values. It may be noted that in some cases the $\alpha(\text{exp})$ data given by [1982Me10](#) cannot be reproduced from their intensities. In these cases it appears that the electron intensities are in error.

E_γ [†]	I_γ ^{‡a}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
22.5002 8	57.1 @ 20	22.5002	5/2 ⁻	0.0	7/2 ⁻	M1+E2	0.0784 9	30.0 5	$\%I_\gamma=2.71$ 10 E_γ: weighted average of 22.4999 9 deduced from an average of nine conversion electron lines and 22.5012 17 from gamma-ray spectroscopy, both measured by 2011In01. Others: 22.519 8 (1982Me10) and 22.494 11 (1970An17). Relative $I_\gamma=55.5$ 20 (1992Ca11), 59.6 25 (1982Me10), 56.8 40 (1976Ga10). $\%I(\gamma+\text{ce})=84$ 4 from I_γ and α. From $\text{Ice}(22\gamma)/\text{Ice}(277K)=185$ 8 (1970An17), $\%I(\gamma+\text{ce})=56$ 3. The ce data of 1966Av05 give $\%I(\gamma+\text{ce})(22\gamma)=82$. Discrepancy is probably due to problems in finding relative ce intensities. Mult., δ: from 2011In01 for penetration parameter $\Lambda=-2$ 10 (2011In01). $\delta=0.0742$ 18 for $\Lambda=2.9$ 12 and 0.0722 20 for $\Lambda=1.5$ 15 Other: 0.0715 11 (1981Ar17, 1970An17). Subshell ratios from ce data: L2/L1=0.30 2, 0.30 2; L3/L1=0.30 2, 0.29 2; M2/M1=0.29 2, 0.29 2; M3/M1=0.32 2, 0.31 2; N3/N1=0.25 6, 0.26 5; P1/N1=0.013 2, 0.014 3; (O2+O3)/O1=0.59 7, 0.64 8. First value for Eu_2O_3, second for EuF_3 (2011In04). Measured electron intensities (2011In01): L1:L2:L3:M1:M2:M3:N1:N3:P1:O1:O2+O3::(49.1 3):(14.5 2):(14.7 2): (10.9 1):(3.1 1):(3.5 1):(2.4 2):(0.6 2):(0.03 1):(0.32 3):(0.21 2). L- and M- subshell ratios. Weighted average of values deduced from 1981Ar17 and 1970An17. 1981Ar17 give following Ice values relative to $\text{ce}(K)=100$ for 277γ. $\text{ce}(L1)=10640$, $\text{ce}(L2)=2756$ 85, $\text{ce}(L3)=2809$ 85, $\text{ce}(M1)=2490$ 150, $\text{ce}(M2)=585$ 64, $\text{ce}(M3)=585$ 64, $\text{ce}(N)=745$ 110, $\text{ce}(O)+\text{ce}(P)=160$ 53. Values from 1970An17 are: $\text{ce}(L1)=9100$ 700, $\text{ce}(L2)=2590$ 180, $\text{ce}(L3)=2560$ 170, $\text{ce}(M1)=2050$ 50, $\text{ce}(M2)=590$ 80, $\text{ce}(M3)=570$ 120, $\text{ce}(N)=800$ 100, $\text{ce}(O)+\text{ce}(P)=200$ 50. Others: 1966Av05, 1962Wa32, 1961Ha23.

¹⁴⁹Eu ε decay (93.1 d) 1982Me10,1992Ca11 (continued) $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ ^{‡a}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
72.983 10	0.347@ 17	350.036	3/2 ⁻	277.072	5/2 ⁻	M1+E2	0.23 4	4.36 9	%I γ =0.0165 8 $\alpha(\text{L})\text{exp}=0.72$ 7; $\alpha(\text{M})\text{exp}=0.13$ 2 Relative I γ =0.38 4 (1992Ca11), 0.342 17 (1982Me10), 0.33 11 (1976Ga10). δ : from ce data.
122.0 2	0.007# 5	399.08	(1/2 ⁻ ,3/2 ⁻)	277.072	5/2 ⁻	[M1,E2]		1.05 10	%I γ =0.00033 24
129.50 7	0.010# 5	528.592	3/2 ⁻	399.08	(1/2 ⁻ ,3/2 ⁻)	[M1,E2]		0.87 6	%I γ =0.00047 24
130.098 ^c 35	0.077# 20	658.62	($\leq 7/2$)	528.592	3/2 ⁻				%I γ =0.0037 10
178.580 16	0.54@ 3	528.592	3/2 ⁻	350.036	3/2 ⁻	M1+E2	+0.5 2	0.325 6	%I γ =0.0257 14 $\alpha(\text{K})\text{exp}=0.27$ 3; $\alpha(\text{L})\text{exp}=0.019$ 2; $\alpha(\text{M})\text{exp}=0.009$ 1 1982Me10 deduce $\alpha(\text{L})\text{exp}=0.05$, incorrectly. Relative I γ =0.52 5 (1992Ca11), 0.571 25 (1982Me10), 0.45 1 (1976Ga10); NRM weighted average. δ : from ce data and $\gamma\gamma(\theta)$ assuming $\delta(328\gamma)=+0.27$ 40 (1980Kr15). (179 γ)(328 γ)(θ): $A_2=+0.114$ 36, $A_4=+0.03$ 4 (1980Kr15).
208.283 21	0.305@ 25	558.374	5/2 ⁻	350.036	3/2 ⁻	M1+E2	-0.45 15	0.210 4	%I γ =0.0145 12 $\alpha(\text{K})\text{exp}=0.056$ 6; $\alpha(\text{L})\text{exp}=0.016$ 2 1982Me10 give $\alpha(\text{K})\text{exp}=0.13$, $\alpha(\text{L})\text{exp}=0.04$, which cannot be reproduced from their intensity data. Relative I γ =0.28 3 (1992Ca11), 0.323 25 (1982Me10). δ : from $\gamma(\theta)$ in in-beam γ -ray.
251.510 37	0.273@ 25	528.592	3/2 ⁻	277.072	5/2 ⁻	[M1,E2]		0.114 16	%I γ =0.0130 12 Relative I γ =0.26 5 (1992Ca11), 0.273 25 (1982Me10), 0.34 11 (1976Ga10).
254.566 23	15.78@ 20	277.072	5/2 ⁻	22.5002	5/2 ⁻	M1+E2	+0.20 +8-6	0.1242 20	%I γ =0.750 11 $\alpha(\text{K})\text{exp}=0.097$ 8; $\alpha(\text{L})\text{exp}=0.0147$ 12; $\alpha(\text{M})\text{exp}=0.0034$ 4 Relative I γ =15.8 2 (1992Ca11), 15.73 20 (1982Me10), 15.8 2 (1976Ga10). δ : from $\gamma(\theta)$ in in-beam γ -ray. $\gamma(\theta, \text{T})$ in ¹⁴⁹ Eu ε decay gives +0.6 4 (1981KrZS); $\delta(\text{E2/M1})<0.9$ from ce data.
272.21 ^c 14	0.0032# 22	558.374	5/2 ⁻	285.951	9/2 ⁻	[E2]		0.0763 11	%I γ =0.00015 10
277.089 10	88.0@ 4	277.072	5/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.08 +1-2	0.0997 14	%I γ =4.18 4 $\alpha(\text{K})\text{exp}=0.085$ 8; $\alpha(\text{L})\text{exp}=0.0123$ 12;

¹⁴⁹Eu ε decay (93.1 d) 1982Me10,1992Ca11 (continued)

$\gamma(^{149}\text{Sm})$ (continued)									
E_γ [†]	I_γ ^{‡a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
281.295 16	0.554 [@] 25	558.374	5/2 ⁻	277.072	5/2 ⁻	M1+E2	+0.14 9	0.0954 16	$\alpha(\text{M})_{\text{exp}}=0.0029$ 3 Relative $I_\gamma=86.9$ 5 (2004Mi43), 88.4 4 (1992Ca11), 88.1 10 (1982Me10), 88.2 3 (1976Ga10). Measured $I_\gamma/100$ decays=4.13 3 (2004Mi43), 3.55 4 (1982Me10). δ : from $\gamma(\theta)$ in in-beam γ -ray. Others: $\gamma(\theta, \text{T})$ in ¹⁴⁹ Eu ε decay gives +0.036 18 (1981KrZS); $\delta(\text{E2/M1}) < 1.0$ from ce data. $\%I_\gamma=0.0263$ 12 $\alpha(\text{K})_{\text{exp}}=0.092$ 10 Relative $I_\gamma=0.53$ 3 (1992Ca11), 0.571 25 (1982Me10). δ : from $\gamma\gamma(\theta)$ (1980Kr15). (281 γ)(277 γ)(θ): $A_2=-0.043$ 35, $A_4=-0.032$ 40 (1980Kr15).
285.95 1	0.017 [#] 5	285.951	9/2 ⁻	0.0	7/2 ⁻	M1(+E2)	+0.06 6	0.0917 13	$\%I_\gamma=0.00081$ 24 δ : from $\gamma(\theta, \text{T})$ in ¹⁴⁹ Pm β^- decay.
308.0 ^c 1	0.0025 [#] 25	658.62	($\leq 7/2$)	350.036	3/2 ⁻				$\%I_\gamma=0.00012$ 12 E_γ : fitted energy deviates by 0.5 keV.
327.526 10	100.0 [#] 5	350.036	3/2 ⁻	22.5002	5/2 ⁻	M1+E2	+0.14 3	0.0637 9	$\%I_\gamma=4.75$ 5 $\alpha(\text{K})_{\text{exp}}=0.056$ 5; $\alpha(\text{L})_{\text{exp}}=0.0083$ 8; $\alpha(\text{M})_{\text{exp}}=0.0019$ 2 Relative $I_\gamma=100.0$ 6 (2004Mi43), 100 (1992Ca11), 100.0 10 (1982Me10), 100.0 4 (1976Ga10). Measured $I_\gamma/100$ decays=4.75 4 (2004Mi43), 4.03 4 (1982Me10). δ : from $\gamma(\theta, \text{T})$ (1981KrZS). Other: < 0.6 from ce data.
350.016 10	8.95 [@] 14	350.036	3/2 ⁻	0.0	7/2 ⁻	E2		0.0352 5	$\%I_\gamma=0.425$ 8 $\alpha(\text{L})_{\text{exp}}=0.0048$ 5; $\alpha(\text{M})_{\text{exp}}=0.0012$ 1 $\alpha(\text{K})(\text{theory})=0.028$ is used for normalization of ce data for other transitions. Relative $I_\gamma=8.7$ 3 (1992Ca11), 8.91 10 (1982Me10), 9.6 2 (1976Ga10); NRM weighted average taken.
376.5 ^c 2	0.0007 [#] 5	399.08	(1/2 ⁻ , 3/2 ⁻)	22.5002	5/2 ⁻				$\%I_\gamma=3.3 \times 10^{-5}$ 24
381.7 2	0.086 [@] 20	658.62	($\leq 7/2$)	277.072	5/2 ⁻				$\%I_\gamma=0.0041$ 10 Relative $I_\gamma=0.094$ 20 (1992Ca11), 0.074 25 (1982Me10).
506.093 10	13.58 [@] 11	528.592	3/2 ⁻	22.5002	5/2 ⁻	E2+M1	+4.9 +31-15	0.0128 4	$\%I_\gamma=0.645$ 8 $\alpha(\text{K})_{\text{exp}}=0.0115$ 11; $\alpha(\text{L})_{\text{exp}}=0.00157$ 16;

¹⁴⁹Eu ε decay (93.1 d) [1982Me10,1992Ca11](#) (continued)

$\gamma(^{149}\text{Sm})$ (continued)									
E_γ [†]	I_γ ^{‡a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
									$\alpha(M)\text{exp}=0.00039$ 4 Relative $I_\gamma=13.60$ 8 (1992Ca11), 13.45 13 (1982Me10), 14.5 2 (1976Ga10); NRM weighted average. δ : from $\gamma(\theta,T)$ (1981KrZS). Other: >1.8 from ce data.
528.587 10	12.73 [@] 18	528.592	3/2 ⁻	0.0	7/2 ⁻	E2		0.01108 16	% $I_\gamma=0.605$ 10 $\alpha(K)\text{exp}=0.0090$ 9; $\alpha(L)\text{exp}=0.0013$ 2; $\alpha(M)\text{exp}=0.00035$ 4 Relative $I_\gamma=12.10$ 4 (1992Ca11), 12.73 13 (1982Me10), 13.0 2 (1976Ga10); NRM weighted average.
535.897 12	1.128 [@] 36	558.374	5/2 ⁻	22.5002	5/2 ⁻	M1+E2	-0.65 +23-43	0.0159 18	% $I_\gamma=0.0536$ 18 $\alpha(K)\text{exp}=0.0082$ 8; $\alpha(L)\text{exp}=0.0014$ 3 Relative $I_\gamma=1.35$ 4 (1992Ca11), 1.117 25 (1982Me10), 1.1 1 (1976Ga10); NRM weighted average.
558.372 10	1.32 [@] 8	558.374	5/2 ⁻	0.0	7/2 ⁻	M1+E2	1.2 +7-4	0.0124 13	Mult.: from $\alpha(K)\text{exp}$ (1982Me10). δ : from $\gamma(\theta,T)$ (1981KrZS). Other: >3 from ce data. % $I_\gamma=0.063$ 4 $\alpha(K)\text{exp}=0.0097$ 10; $\alpha(L)\text{exp}=0.0016$ 2; $\alpha(M)\text{exp}=0.00041$ 5 Relative $I_\gamma=1.20$ 3 (1992Ca11), 1.464 35 (1982Me10), 1.3 1 (1976Ga10).
568.27 10	0.00060 [#] 20	590.880	9/2 ⁻	22.5002	5/2 ⁻	E2		0.00919 13	δ : from $\alpha(K)\text{exp}$. % $I_\gamma=2.9 \times 10^{-5}$ 10
590.88 1	0.00238 [#] 20	590.880	9/2 ⁻	0.0	7/2 ⁻	E2+M1	-1.5 +9-4	0.0101 25	% $I_\gamma=0.000113$ 10 1982Me10 give $\alpha(K)\text{exp}=0.0086$ and assign M1+E2. But from authors' intensities evaluators deduce $\alpha(K)\text{exp}=0.28$ which is too high for an M1+E2 assignment. Evaluators suggests that $I_{ce}(K)=0.96$ 8 (1982Me10) is in error.
613.915 17	0.00645 [#] 25	636.421	7/2 ⁻	22.5002	5/2 ⁻				% $I_\gamma=0.000306$ 12 From authors' intensities, evaluators deduce $\alpha(K)\text{exp}=0.10$ 1. Evaluators suspect that $I_{ce}(K)=0.96$ 8 (1982Me10) is in error.
636.05 ^C 10	0.0074 [#]	658.62	($\leq 7/2$)	22.5002	5/2 ⁻				% $I_\gamma=3.5 \times 10^{-4}$
636.50 7	0.00372 [#] 25	636.421	7/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.30 +16-18	0.0114 5	% $I_\gamma=0.000177$ 12 $\alpha(K)\text{exp}=0.058$ 12 for doublet. Evaluators suggest that $I_{ce}(K)=0.95$ 8 (1982Me10) is in error.

¹⁴⁹Eu ε decay (93.1 d) **1982Me10,1992Ca11 (continued)**

$\gamma(^{149}\text{Sm})$ (continued)

- [†] From [1982Me10](#). In several cases [1982Me10](#) give uncertainties of less than 10 eV. The evaluators have adopted a lowest uncertainty of 10 eV based on least squares fit to E_γ values in the level scheme.
- [‡] Relative intensities with respect to 100.0 for 327.5 γ . Values in [1982Me10](#) were given as intensities per 1000 decays. These have been converted to relative values with respect to $I_\gamma(327.5\gamma)=100$ ($I_\gamma/1000=40.3$ 4 in [1982Me10](#)) using a multiplicative factor of 2.4814.
- [#] From [1982Me10](#), converted to relative intensity.
- [@] Weighted average of [1992Ca11](#), [1982Me10](#) and [1976Ga10](#).
- [&] From the Adopted Gammas. Adopted values are based on ce data ([1982Me10](#)), unless otherwise noted. For 22.5 γ the data are from [2011In01](#) and [2011In04](#). Others: [1981Ar17](#) and [1970An17](#). For normalization, mult(350 γ) was used as pure E2 ([1982Me10](#)).
- ^a For absolute intensity per 100 decays, multiply by 0.0475 4.
- ^b Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
- ^c Placement of transition in the level scheme is uncertain.

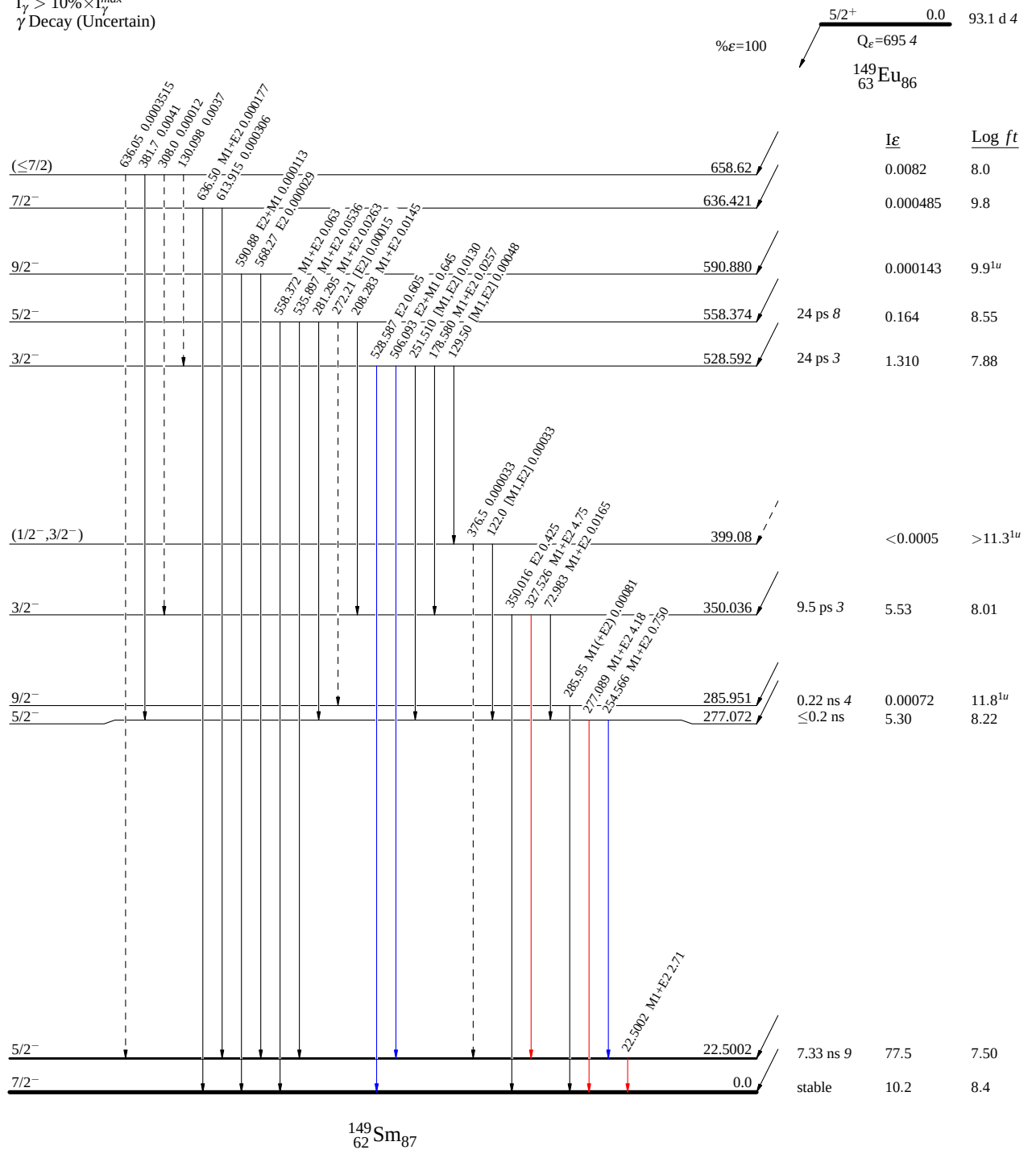
^{149}Eu ε decay (93.1 d) 1982Me10,1992Ca11

Decay Scheme

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - γ Decay (Uncertain)

Intensities: I_γ per 100 parent decays



$^{146}\text{Nd}(\alpha, n\gamma)$ 1989Si11

1989Si11: $^{146}\text{Nd}(\alpha, n\gamma)$, $E=16\text{--}20.4$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(\theta)$, ce, and excitation functions at the University of Jyväskylä cyclotron facility using a Compton-suppressed HPGe detector and other HPGe detectors for γ -ray studies, and a swept-current magnetic-lens with a Si(Li) detector for conversion electrons.

Other:

1976SiZW: $^{146}\text{Nd}(\alpha, n\gamma)$, $E=15\text{--}22$ MeV and $^{148}\text{Nd}(\alpha, 3n\gamma)$, $E=20\text{--}35$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, excitation functions, $\gamma(\theta)$ from 0° to 90° in steps of 15° and ce using Ge detectors for γ -rays and a 7-gap orange magnetic spectrometer at McMaster for conversion electrons. The $(\alpha, n\gamma)$ studies were carried out at McMaster tandem accelerator, while $(\alpha, 3n\gamma)$ work was done at the Chalk River tandem accelerator lab. Main data reported at 18 MeV for $(\alpha, n\gamma)$, and at 33 MeV for $(\alpha, 3n\gamma)$.

 ^{149}Sm Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$E(\text{level})^\dagger$	$J^\pi^\ddagger$
0.0	$7/2^-$	747.80 10	$13/2^-$	1343.54 11	$(9/2^-, 11/2)$
22.50	$5/2^-$	789.54 8	$11/2^+$	1361.38 13	$17/2^-$
277.16 6	$5/2^-$	878.86 9	$13/2^+$	1362.66 14	$17/2^+$
285.90 7	$9/2^-$	925.56 12		1398.92 10	$15/2^-$
350.24 6	$3/2^-$	994.60 12		1412.63 23	$(11/2, 13/2, 15/2)$
398.86 12	$(1/2 \text{ to } 7/2)$	1039.06 12	$(3/2^-, 5/2^-, 7/2^-)$	1574.78 25	$13/2^-$
528.60 10	$3/2^-$	1132.55 23	$(9/2^-, 11/2)$	1670.66 14	$19/2^+$
558.53 6	$5/2^-$	1173.24 13	$(\leq 11/2)$	1684.82 14	
591.04 6	$9/2^-$	1192.85 9	$(13/2^+)$	1847.1 3	$15/2^-$
636.25 7	$7/2^-$	1237.91 12		1926.06 17	$21/2^-$
664.16 7	$11/2^-$	1240.53 13	$15/2^+$		
710.00 9	$(3/2, 5/2^+)$	1308.68 22	$11/2^-$		

[†] From least-squares fit to $E\gamma$ data. Uncertainties of ten γ rays were increased from 0.1 to 0.3 keV for acceptable reduced $\chi^2=2.2$ as compared to critical $\chi^2=1.8$. Without this adjustment, reduced $\chi^2=11$.

[‡] As given in level-scheme Fig. 3 of 1989Si11.

¹⁴⁶Nd(α ,n γ) **1989Si11** (continued)

$\gamma(^{149}\text{Sm})$

A 296.1 γ with I γ =1.7 2 seen only in singles, with no evidence in $\gamma\gamma$ -coin data.
All data are from **1989Si11** unless otherwise stated.

E γ	I γ	E i (level)	J $^{\pi}_i$	E f	J $^{\pi}_f$	Mult. [‡]	$\delta^{\ddagger}$	$\alpha^{\#}$	Comments
22.50		22.50	5/2 ⁻	0.0	7/2 ⁻				E γ : rounded value from the Adopted Gammas.
89.3 1	4.9 2	878.86	13/2 ⁺	789.54	11/2 ⁺	D			A ₂ =-0.39 14; A ₄ =-0.20 29 $\delta(Q/D)$ =-0.12 11 or -3.6 +27-10 from $\gamma(\theta)$.
121.7 1	4.7 2	398.86	(1/2 to 7/2)	277.16	5/2 ⁻				A ₂ =+0.19 8; A ₄ =+0.20 13
125.4 1	8.0 3	789.54	11/2 ⁺	664.16	11/2 ⁻				A ₂ =+0.40 38; A ₄ =+0.01 5 A ₂ =+0.38 7; A ₄ =+0.13 7 (1976SiZW)
^x 168.5 1	2.7 2								
^x 170.7 1	1.4 2								
198.6 1	53.6 18	789.54	11/2 ⁺	591.04	9/2 ⁻	E1		0.0431 6	$\alpha(K)\text{exp}$ =0.044 7 (1976SiZW) Mult.: from $\alpha(K)\text{exp}$ (1976SiZW). A ₂ =-0.29 17; A ₄ =-0.22 13
208.4 1	1.0 2	558.53	5/2 ⁻	350.24	3/2 ⁻	M1+E2	-0.45 15	0.210 4	$\alpha(K)\text{exp}$ =0.14 3 (1976SiZW) Mult.: from $\alpha(K)\text{exp}$ (1976SiZW). A ₂ =-0.20 3; A ₄ =-0.01 4; $\alpha(K)\text{exp}$ =0.023 3
214.8 1	57.4 20	878.86	13/2 ⁺	664.16	11/2 ⁻	E1		0.0350 5	$\delta(M2/E1)$ =+0.02 2 from $\gamma(\theta)$. A ₂ =+0.25 5; A ₄ =+0.03 8
^x 238.3 1	9.9 4								A ₂ =+0.29 2; A ₄ =-0.04 3; $\alpha(K)\text{exp}$ =0.067 12
254.6 1	6.2 2	277.16	5/2 ⁻	22.50	5/2 ⁻	M1+E2	+0.20 +8-6	0.1241 20	A ₂ =-0.79 3; A ₄ =+0.04 4; $\alpha(K)\text{exp}$ =0.071 7
266.1 1	10.1 4	1574.78	13/2 ⁻	1308.68	11/2 ⁻	M1+E2	-0.50 5	0.1054 18	$\alpha(K)\text{exp}$ =0.098 12 (1976SiZW) A ₂ =-0.30 11; A ₄ =-0.70 20
272.3 1	4.2 6	1847.1	15/2 ⁻	1574.78	13/2 ⁻	(M1+E2)	-0.7 2	0.095 4	A ₂ =-0.29 4; A ₄ =-0.04 5 (1976SiZW) Complex peak.
^x 275.6 1	5.2 7					D+Q			A ₂ =-0.63 12; A ₄ =-0.34 23
277.2 1	36.8 16	277.16	5/2 ⁻	0.0	7/2 ⁻	D+Q	-0.08 +1-2		A ₂ =-0.01 1; A ₄ =0.00 2 A ₂ =-0.060 13; A ₄ =-0.016 17 (1976SiZW)
281.4 1	3.8 4	558.53	5/2 ⁻	277.16	5/2 ⁻	D(+Q)	-0.07 +22-17		A ₂ =+0.17 17; A ₄ =+0.04 15
285.9 & 1	191 &	285.90	9/2 ⁻	0.0	7/2 ⁻	M1(+E2)	<0.11	0.0917 13	A ₂ =-0.11 2; A ₄ =-0.02 4; $\alpha(K)\text{exp}$ =0.067 4 1989Si11 suggest a weak component of 285.9 γ from a 1684 level.
285.9 & 1	32 &	1684.82		1398.92	15/2 ⁻				
^x 301.9 1	1.4 2								A ₂ =+0.43 9; A ₄ =+0.68 14
305.1 1	2.1 2	591.04	9/2 ⁻	285.90	9/2 ⁻	M1(+E2)	+0.15 15	0.0768 18	A ₂ =+0.60 3; A ₄ =+0.15 5; $\alpha(K)\text{exp}$ =0.079 15 δ : other: <0.6 from $\alpha(K)\text{exp}$.
309.4 1	6.1 3	1670.66	19/2 ⁺	1361.38	17/2 ⁻	D(+Q)	+0.07 +5-6	0.014	A ₂ =-0.14 11; A ₄ =+0.09 19
314.0 1	6.5 3	1192.85	(13/2 ⁺)	878.86	13/2 ⁺	D(+Q)	+0.4 5		A ₂ =+0.40 8; A ₄ =-0.04 12
327.7 1	30.4 11	350.24	3/2 ⁻	22.50	5/2 ⁻	M1(+E2)	-0.03 4	0.0640 9	A ₂ =-0.02 1; A ₄ =-0.03 2; $\alpha(K)\text{exp}$ =0.0404 35 δ : other: 1.5 5 from $\alpha(K)\text{exp}$.
^x 339.5 1	12.0 5								

¹⁴⁶Nd($\alpha, n\gamma$) **1989Si11** (continued) $\gamma(^{149}\text{Sm})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\delta^{‡}$	$\alpha^\#$	Comments
350.4 1	5.0 7	350.24	3/2 ⁻	0.0	7/2 ⁻				A ₂ =-0.12 6; A ₄ =-0.01 8 (1976SiZW) Mult.: $\Delta J=1$, D from $\gamma(\theta)$ data inconsistent with expected $\Delta J=2$, E2.
351.1 [†] 1	3.7 7	636.25	7/2 ⁻	285.90	9/2 ⁻				Poor fit. Level-energy difference=350.4.
359.8 1	3.0 2	710.00	(3/2,5/2 ⁺)	350.24	3/2 ⁻				A ₂ =+0.18 10; A ₄ =+0.17 16 $\delta(Q/D)=+0.14 +38-28$ or $+2.5 +38-14$ from $\gamma(\theta)$. A ₂ =-0.22 3; A ₄ =+0.01 5
378.3 1	5.9 3	664.16	11/2 ⁻	285.90	9/2 ⁻	D(+Q)	0.00 +2-3		
383.7 1	4.1 4	1173.24	($\leq 11/2$)	789.54	11/2 ⁺				
385.2 [†] 1	2.2 5	1132.55	(9/2 ⁻ , 11/2)	747.80	13/2 ⁻				
403.4 1	4.9 4	1192.85	(13/2 ⁺)	789.54	11/2 ⁺	M1+E2	-1.1 8	0.030 7	A ₂ =-0.78 8; A ₄ =-0.21 15 A ₂ =-0.68 7; A ₄ =+0.20 8; $\alpha(K)\text{exp}=0.016$ 3 (1976SiZW) Mult.: from $\alpha(K)\text{exp}$ (1976SiZW).
430.0 1	5.6 4	1670.66	19/2 ⁺	1240.53	15/2 ⁺	E2		0.01937 27	A ₂ =+0.24 6; A ₄ =-0.09 10 $\alpha(K)\text{exp}=0.021$ 3 (1976SiZW) Mult.: from $\alpha(K)\text{exp}$ (1976SiZW) and $\gamma(\theta)$ in 1989Si11. Complex peak due to a line from ¹⁴⁸ Sm.
432.8 1	8.9 4	710.00	(3/2,5/2 ⁺)	277.16	5/2 ⁻				
^x 435.5 1	4.2 3								
461.9 1	100.0	747.80	13/2 ⁻	285.90	9/2 ⁻	E2		0.01589 22	A ₂ =+0.355 10; A ₄ =-0.112 17; $\alpha(K)\text{exp}=0.0132$ 9 $\alpha(K)\text{exp}=0.014$ 3 (1976SiZW)
483.8 1	20.1 8	1362.66	17/2 ⁺	878.86	13/2 ⁺	E2		0.01401 20	A ₂ =+0.36 16; A ₄ =-0.09 3; $\alpha(K)\text{exp}=0.012$ 2 $\alpha(K)\text{exp}=0.015$ 3 (1976SiZW)
492.6 1	24.6 10	1240.53	15/2 ⁺	747.80	13/2 ⁻	E1		0.00446 6	A ₂ =-0.23 14; A ₄ =+0.01 2; $\alpha(K)\text{exp}=0.0073$ 9 $\delta(M2/E1)=0.00$ 9 from $\gamma(\theta)$.
520.7 [†] 1	4.6 3	1398.92	15/2 ⁻	878.86	13/2 ⁺	D			A ₂ =-0.54 30; A ₄ =+0.3 4 (1976SiZW) E _{γ} : level-energy difference=520.1. Mult.: from $\gamma(\theta)$ (1976SiZW).
528.6 [@] 1	15.5 [@] 6	528.60	3/2 ⁻	0.0	7/2 ⁻				
528.6 [@] 1	15.5 [@] 6	1192.85	(13/2 ⁺)	664.16	11/2 ⁻				
536.1 1	10.6 5	558.53	5/2 ⁻	22.50	5/2 ⁻	D			A ₂ =-0.09 4; A ₄ =+0.003 4 (1976SiZW) Mult.: from $\gamma(\theta)$ (1976SiZW).
538		1847.1	15/2 ⁻	1308.68	11/2 ⁻				
^x 539.9 1	6.0 4								
553.6 [†] 1	9.0 15	1343.54	(9/2 ⁻ , 11/2)	789.54	11/2 ⁺				Complex line.
558.3 1	12.1 15	558.53	5/2 ⁻	0.0	7/2 ⁻	(M1+E2)	+1.6 11	0.0115 35	A ₂ =-0.43 8; A ₄ =-0.07 13
563.4 1	4.5 14	1926.06	21/2 ⁻	1362.66	17/2 ⁺				
568.6 1	22.2 20	591.04	9/2 ⁻	22.50	5/2 ⁻	(Q)			A ₂ =+0.24 2; A ₄ =+0.04 4
^x 577.4 1	1.2 4								
^x 582.9 1	3.9 6								
591.1 1	92.6 41	591.04	9/2 ⁻	0.0	7/2 ⁻	E2+M1		0.0112 29	$\alpha(K)\text{exp}=0.0060$ 9 (1989Si11); $\alpha(K)\text{exp}=0.0082$ 15 (1976SiZW)
596.1 [†] 1	12.0 4	1343.54	(9/2 ⁻ , 11/2)	747.80	13/2 ⁻				

¹⁴⁶Nd($\alpha, n\gamma$) **1989Si11** (continued)

$\gamma(^{149}\text{Sm})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\delta^{\ddagger}$	$\alpha^\#$	Comments
613.7@ 1	37.2@ 15	636.25	7/2 ⁻	22.50	5/2 ⁻				
613.7@ 1	37.2@ 15	1361.38	17/2 ⁻	747.80	13/2 ⁻				
623.8† 1	2.0 5	1412.63	(11/2,13/2,15/2)	789.54	11/2 ⁺				A ₂ =+0.21 33; A ₄ =+0.31 54
636.2 1	16.3 13	636.25	7/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.30 +16-18	0.0114 5	A ₂ =+0.14 4; A ₄ =-0.19 7 $\alpha(\text{K})_{\text{exp}}=0.0095$ 15 (1976SiZW) Mult.: from $\alpha(\text{K})_{\text{exp}}$ (1976SiZW).
644.9† 1	2.6 4	1308.68	11/2 ⁻	664.16	11/2 ⁻				
648.4 1	3.9 5	925.56		277.16	5/2 ⁻				
651.1 1	2.3 4	1398.92	15/2 ⁻	747.80	13/2 ⁻				
^x 656.0 1	2.2 7								
664.1& 1	120&	664.16	11/2 ⁻	0.0	7/2 ⁻	E2		0.00625 9	$\alpha(\text{K})_{\text{exp}}=0.0044$ 9
664.1&† 1	15&	1412.63	(11/2,13/2,15/2)	747.80	13/2 ⁻				
^x 668.5 1	4.5 7								
^x 673.4 1	3.1 7								
708.7 1	35.4 19	994.60		285.90	9/2 ⁻				A ₂ =+0.13 2; A ₄ =+0.25 3
734.7 1	21.5 10	1398.92	15/2 ⁻	664.16	11/2 ⁻				
752.5 1	8.8 12	1343.54	(9/2 ⁻ , 11/2)	591.04	9/2 ⁻				A ₂ =+0.01 6; A ₄ =+0.06 9
761.9 1	5.0 4	1039.06	(3/2 ⁻ , 5/2 ⁻ , 7/2 ⁻)	277.16	5/2 ⁻	D+Q			A ₂ =-0.17 7; A ₄ =-0.26 12
846.2† 1	20.4 9	1132.55	(9/2 ⁻ , 11/2)	285.90	9/2 ⁻				Complex γ , contaminated by a line in ⁵⁶ Fe.
952.0 1	8.4 4	1237.91		285.90	9/2 ⁻				A ₂ =+0.05 6; A ₄ =-0.01 10
^x 955.4 1	4.5 3								
1022.4† 1	7.9 6	1308.68	11/2 ⁻	285.90	9/2 ⁻	(M1+E2)	-2.8 +3-4	0.00253 5	A ₂ =-0.47 4; A ₄ =+0.15 7

† Poor fit in the level scheme. Uncertainty increased to 0.3 keV for fitting purpose.

‡ From **1989Si11** based on their $\gamma(\theta)$ and ce data, unless otherwise stated. For large $\delta(\text{Q/D})$ values, (M1+E2) is assigned when ce data are not available, based on no evidence of levels of long half-lives which could decay by transitions of mult=E1+M2.

Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Multiply placed with undivided intensity.

& Multiply placed with intensity suitably divided.

^x γ ray not placed in level scheme.

$^{146}\text{Nd}(\alpha, n\gamma)$ 1989Si11

Level Scheme

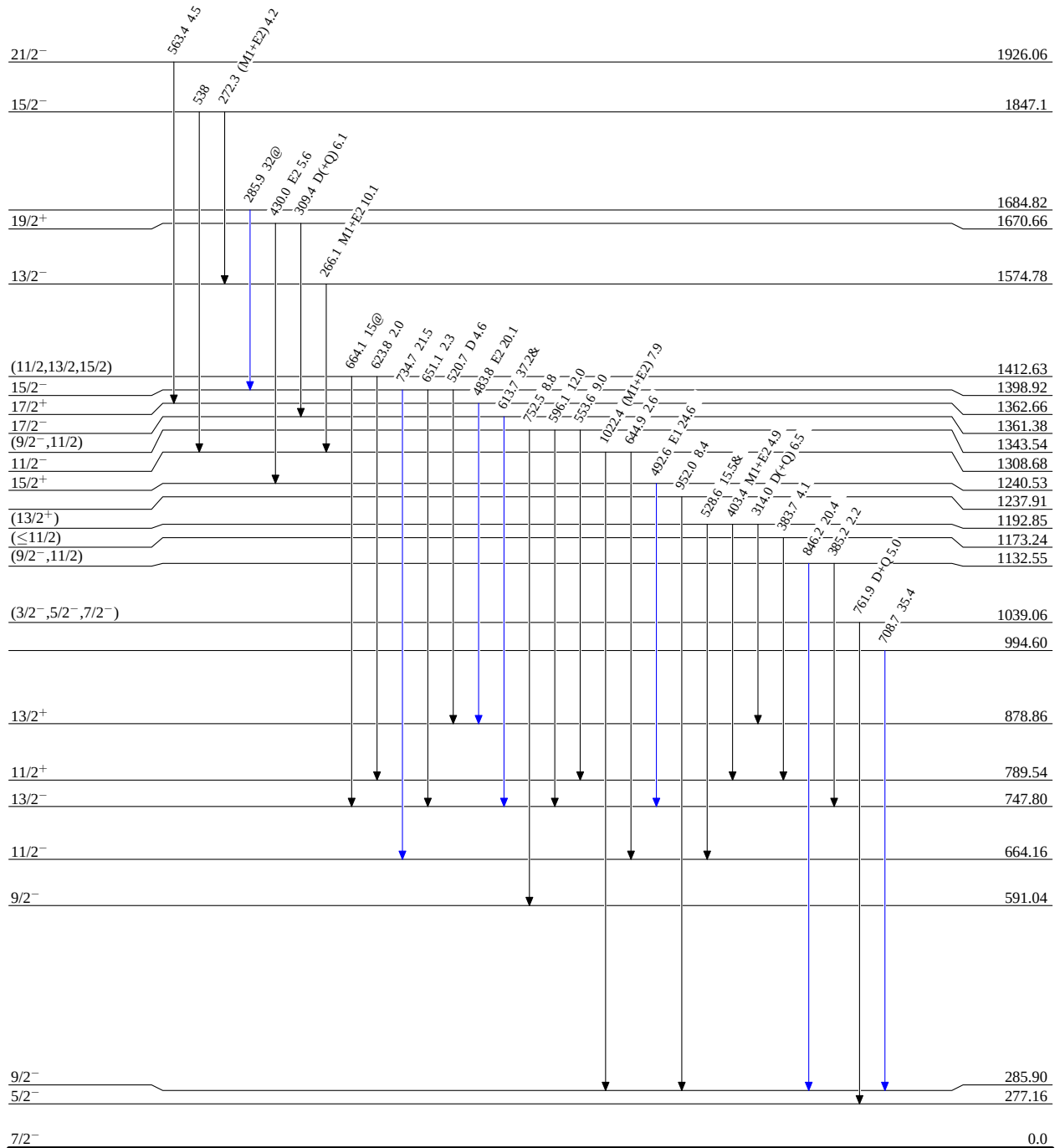
Intensities: Relative I_γ

& Multiply placed: undivided intensity given

@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
→ $I_\gamma < 10\% \times I_\gamma^{\max}$
→ $I_\gamma > 10\% \times I_\gamma^{\max}$



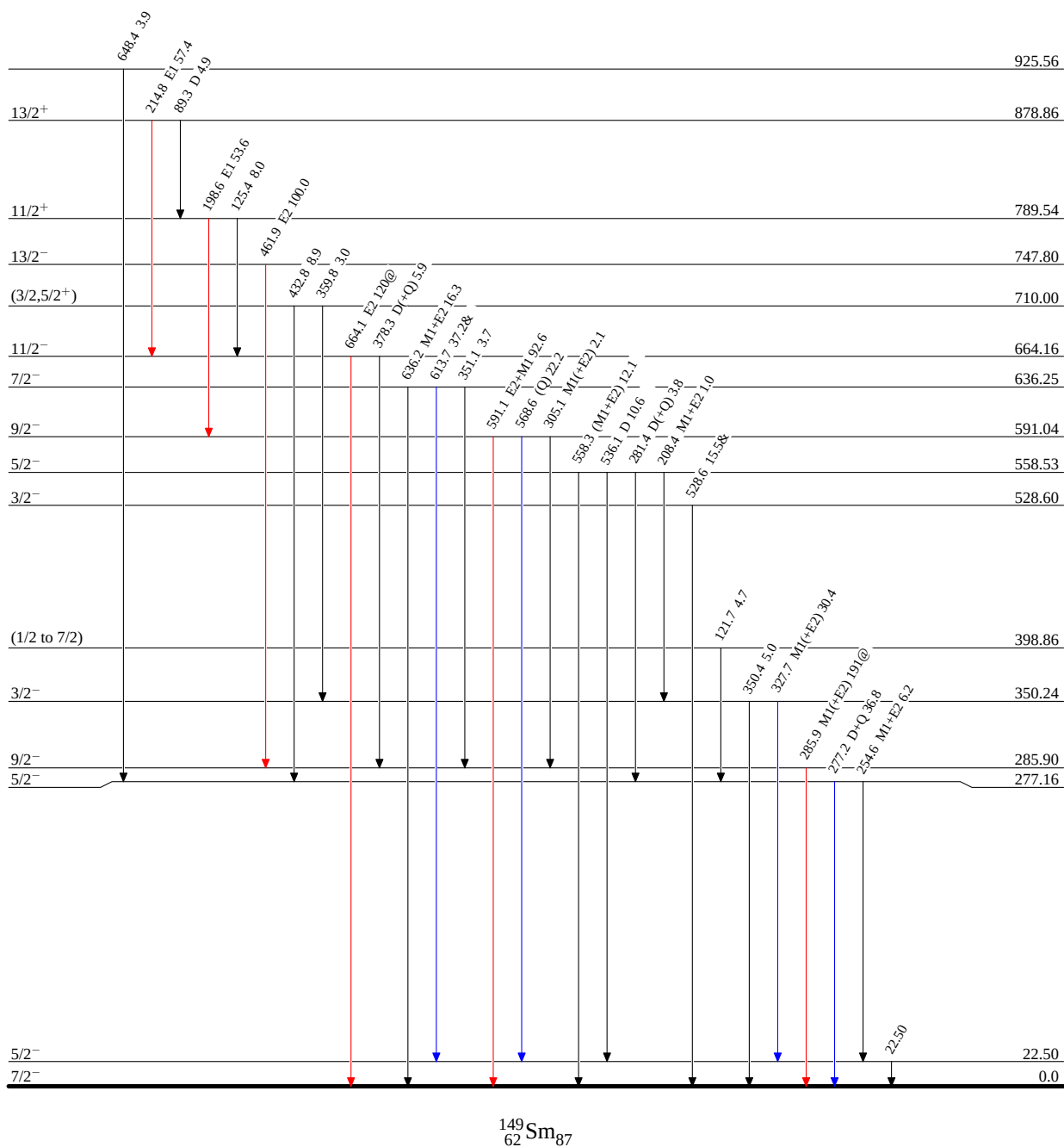
$^{146}\text{Nd}(\alpha, n\gamma)$ 1989Si11

Level Scheme (continued)

Intensities: Relative I_γ
 & Multiply placed: undivided intensity given
 @ Multiply placed: intensity suitably divided

Legend

— $I_\gamma < 2\% \times I_\gamma^{\max}$
 — $I_\gamma < 10\% \times I_\gamma^{\max}$
 — $I_\gamma > 10\% \times I_\gamma^{\max}$

 $^{149}_{62}\text{Sm}_{87}$

¹⁴⁸Nd($\alpha,3n\gamma$),¹⁵⁰Nd(³He,4n γ) 1979Ha19,1990UrZR,1994Ba01

1979Ha19 (also **1978HaYV** thesis): ¹⁴⁸Nd($\alpha,3n\gamma$),E=20-37 MeV and ¹⁵⁰Nd(³He,4n γ),E=19-27 MeV from the Stockholm 225-cm cyclotron. Measured E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, $\gamma(t)$, ce, ce(t) and excitation functions; $\gamma(\theta)$ data in both reactions from 90° to 165° in steps of 15°. Internal conversion data were obtained using ³He beam. Main data at E(³He)=27 MeV and E α =33 MeV.

1990UrZR (also **1990UrZW,1990UrZX,1986UrZZ**): ¹⁴⁸Nd($\alpha,3n\gamma$) at KVI. $\gamma(\text{lin pol})$ reported and level scheme extended to high-spin states, but details of this work are not available.

1994Ba01: ¹⁴⁸Nd($\alpha,3n\gamma$),E=37 MeV from the variable-energy cyclotron at VECC, Calcutta. Measured E γ , I γ , $\gamma\gamma$. The γ -ray energy precision (typical $\Delta E=1.5$ keV) in this study is less than in **1979Ha19** and **1977Kl04**. Also, there are disagreements in γ -branching ratios as compared to those in other studies.

1977Kl04: ¹⁴⁸Nd($\alpha,3n\gamma$),E=35-45 MeV from the 88-inch cyclotron at LBNL. Measured E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, $\gamma(\theta,\text{lin pol})$ and excitation functions; $\gamma(\theta)$ data from 90° to 165° in steps of 15°. This work deals mainly with high-J states. Main data recorded at 38 MeV.

Others:

1976SiZW: ¹⁴⁶Nd($\alpha,n\gamma$),E=15-22 MeV and ¹⁴⁸Nd($\alpha,3n\gamma$),E=20-35 MeV; measured E γ , I γ , $\gamma\gamma$, $\gamma(\theta)$, ce, and excitation functions; $\gamma(\theta)$ from 0° to 90° in steps of 15°. The γ , ce and $\gamma(\theta)$ data reported at 18 MeV for ($\alpha,n\gamma$) and at 33 MeV for ($\alpha,3n\gamma$). The ($\alpha,n\gamma$) studies were carried out at McMaster tandem accelerator, and ($\alpha,3n\gamma$) at the Chalk River tandem accelerator.

1976Ga10 (also **1976Le15**): ¹⁴⁸Nd($\alpha,3n\gamma$),E=34 MeV. $\gamma(\theta)$ for selected levels. Only the 591 and 664 levels studied.

1976KiZM: Nd($\alpha,xn\gamma$) and Te(²²Ne,xn γ). Measured γ , $\gamma\gamma(t)$. Details of this work are not available.

¹⁴⁹Sm Levels

The band assignments are from **1977Kl04**, **1979Ha19**, **1990UrZR** and **1994Ba01**.

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0 ^a	7/2 ⁻		
22.50 ^e 5	5/2 ⁻		
277.40 ¹⁴	5/2 ⁻		
286.01 ^b 19	9/2 ⁻		
350.02 ¹⁶	3/2 ⁻		
528.57 ¹⁸	3/2 ⁻		
558.38 ¹⁶	(5/2 ⁻)		
591.09 ^e 17	9/2 ⁻	≤0.5 ns	T _{1/2} : from $\gamma(t)$ (1979Ha19).
636.13 ¹⁸	7/2 ⁻		
664.32 ^a 18	11/2 ⁻		
747.89 ^b 22	13/2 ⁻		
789.67 [@] 22	11/2 ⁺		
879.06 ^{&} 24	13/2 ⁺		
994.5 ⁴			
1132.6 ⁴	(11/2 ⁻)		
1192.88 ^d 26	(13/2 ⁺)		J π : from 1990UrZR . Other: (9/2 ⁺ ,13/2 ⁺) in 1979Ha19 .
1240.50 [@] 27	15/2 ⁺		
1308.85 ^c 24	11/2 ⁻		
1344.36 ^e 24	(13/2 ⁻ ,11/2 ⁻)		
1361.23 ^b 30	17/2 ⁻		
1362.88 ^{&} 34	17/2 ⁺		
1398.45 ^a 25	15/2 ⁻		
1413.5 ⁴	15/2 ⁽⁺⁾		J π : from 1990UrZR . Other: (11/2 ⁻ ,15/2 ⁻) in 1979Ha19 . J π =13/2 ⁺ ,15/2 ⁺ in the Adopted Levels.
1574.8 ^c 4	13/2 ⁻		
1670.65 [@] 31	19/2 ⁺		

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)** ^{149}Sm Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
1695.80 ^d 33	(17/2 ⁺)		J ^π : band member.
1847.0 ^c 4	15/2 ⁻		
1851.3 [#] 6	(17/2 ⁺) [#]		
1926.2 ^{&} 4	21/2 ⁺		
2041.2 ^{#a} 4	(19/2 ⁻) [#]		
2130.7 ^c 4	17/2 ⁻		
2142.6 ^b 4	21/2 ⁻		
2145.3? 4			
2192.6 [@] 4	23/2 ⁺		
2262.0? 8			Level proposed by 1994Ba01 , based on placements of 336 and 566 transitions. The level is considered uncertain (evaluators) since both these γ rays reported by 1994Ba01 are likely to be complex, as suggested by other studies. This level is not included in the Adopted dataset.
2344.8 ^{#d} 5	(21/2 ⁺) [#]		
2404.6 [#] 7	(21/2 ⁺) [#]		
2427.2 ^c 5	19/2 ⁻		
2537.4 ^{&} 5	25/2 ⁺		
2702.0 ^{#a} 6	(23/2 ⁻) [#]		
2735.0 ^c 5	(21/2 ⁻)		
2828.6 [#] 9	(25/2 ⁻) [#]		
2834.7 [@] 5	27/2 ⁺		
2842.6 ^{#b} 5	(25/2 ⁻) [#]		
2875.8 ^{#d} 5	(25/2 ⁺) [#]		
2933.2? 5			
2987.6 [#] 9	(25/2) [#]		
3008.6 [#] 12	(25/2 ⁺) [#]		
3051.6? 11			Level from 1976SiZW only. This level is not included in the Adopted dataset.
3055.3 ^c 7	(23/2 ⁻)		
3159.7 [#] 8	(25/2) [#]		
3181.4 ^{&} 5	29/2 ⁺		
3180.9+x		4 ns 1	E(level): $x \leq 200$ (1979Ha19). T _{1/2} : from $\gamma(t)$ (1979Ha19).
3220.7 [#] 9	(25/2) [#]		
3328.2 ^{#a} 8	(27/2 ⁻) [#]		
3361.6 ^{#b} 5	(29/2 ⁻) [#]		
3365.1 ^{#d} 5	(29/2 ⁺) [#]		
3384.1 ^{#c} 9	(25/2 ⁻) [#]		
3564.5 [#] 5	(29/2 ⁻) [#]		
3652.2 [@] 6	31/2 ⁺		
3777.7 [#] 8	(29/2) [#]		
3859.6 ^{&} 6	33/2 ⁺		
3880.4 [#] 11	(31/2 ⁻) [#]		The 31/2 ⁻ member of f _{7/2} band is at 3880 or 3953.
3919.2? 13			Level proposed by 1994Ba01 as the 31/2 ⁻ member of f _{7/2} band. It is considered uncertain (evaluators) since main 591 γ deexcites a 591 level and firm evidence for placement from a 3919 level is not given by 1994Ba01 . This level is not included in the Adopted dataset.

Continued on next page (footnotes at end of table)

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)** ^{149}Sm Levels (continued)

E(level) [†]	J π [‡]	Comments
3953.4 ^{#a} 11	(31/2 ⁻) [#]	The 31/2 ⁻ member of f _{7/2} band is at 3880 or 3953.
3968.8 ^{#b} 6	(33/2 ⁻) [#]	
4006.3 [#] 6	(33/2 ⁻) [#]	
4055.7 ^{#d} 7	(33/2 ⁺) [#]	
4487.2 [#] 12	(33/2) [#]	
4543.7 ^{#a} 7	(35/2 ⁻) [#]	
4575.5 ^{#@} 9	(35/2 ⁺) [#]	
4597.3 ^{#&} 7	(37/2 ⁺) [#]	
4607.1 [#] 10	(37/2 ⁻) [#]	
4686.8 ^{#b} 7	(37/2 ⁻) [#]	1994Ba01 propose that 37/2 ⁻ member of this band is at 4605 deexciting through a 637 γ to 33/2 ⁻ level at 3968 level.
4799.9 ^{#d} 10	(37/2 ⁺) [#]	
5140.5 ^{#a} 10	(39/2 ⁻) [#]	
5174.0 [#] 11	(39/2 ⁺) [#]	
5325.8 [#] 12	(39/2) [#]	
5361.3 ^{#&} 12	(41/2 ⁺) [#]	
5373.1 [#] 12	(41/2 ⁻) [#]	
5477.8 ^{#b} 12	(41/2 ⁻) [#]	
5792.1 [#] 16	(43/2) [#]	
5801.5 ^{#a} 14	(43/2 ⁻) [#]	
6190.1 [#] 19	(45/2) [#]	

[†] From least-squares fit to E γ data, assuming 0.3 keV uncertainty when E γ stated to nearest tenth of a keV, and 1 keV when stated to nearest keV.

[‡] As given by **1979Ha19** and **1977Kl04**, unless otherwise stated.

[#] From **1990UrZR** and **1990UrZX**.

@ Band(A): $\nu_{13/2, 7/2}[633]$ band. From observation of interconnecting E1 transitions, **1994Ba01** suggest octupole deformation and propose that this band and the band with configuration h_{9/2, 9/2}[505] form an alternating parity band with simplex quantum number s=-i.

& Band(B): $\nu_{13/2, 9/2}[624]$ band. From observation of interconnecting E1 transitions, **1994Ba01** suggest octupole deformation and propose that this band and the band with configuration f_{7/2, 7/2}[514] form an alternating parity band with simplex quantum number s=+i.

^a Band(C): $\nu_{f_{7/2}, 7/2}[514]$ band.

^b Band(D): $\nu_{h_{9/2}, 9/2}[505]$ band.

^c Band(E): $\nu_{h_{11/2}, 11/2}[505]$ band.

^d Band(F): Band based on (13/2⁺).

^e Band(G): Band based on 5/2⁻.

$\gamma(^{149}\text{Sm})$

A_2 , A_4 and $\alpha(K)\text{exp}$ values are from [1979Ha19](#), unless otherwise indicated, two sets of values correspond to data from $(^3\text{He}, 4n\gamma)$ and $(\alpha, 3n\gamma)$. Values available from [1977Kl04](#) are also listed.

E_γ [†]	I_γ [#]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^a	α^c	Comments
22.50		22.50	5/2 ⁻	0.0	7/2 ⁻			E_γ : rounded value from the Adopted Gammas.
72.5	1.4 4	350.02	3/2 ⁻	277.40	5/2 ⁻			I_γ : value given by 1979Ha19 is too high; probably contributed largely by a contaminant. $I_\gamma=2.4$ (1977Kl04).
73.3	3.1 4	664.32	11/2 ⁻	591.09	9/2 ⁻			$I_\gamma=8.0$ in $(\alpha, 3n\gamma)$ for a complex peak (1979Ha19).
84 1		747.89	13/2 ⁻	664.32	11/2 ⁻			γ from 1994Ba01 only, observed in different gated spectra, no I_γ available.
89.5	2.7 4	879.06	13/2 ⁺	789.67	11/2 ⁺	D		$A_2=-0.32$ 7; $A_4=-0.04$ 9 (1977Kl04)
								$I_\gamma=3.3$ in $(\alpha, 3n\gamma)$ (1979Ha19).
121.0 8		1361.23	17/2 ⁻	1240.50	15/2 ⁺			E_γ : from 1994Ba01 , $I_\gamma=4.55$ 12 (1994Ba01). Placement is shown in 1990UrZR and 1994Ba01 .
								$I_\gamma(121\gamma)/I_\gamma(614\gamma)=0.114$ 3 (1994Ba01).
125.4	3.8 3	789.67	11/2 ⁺	664.32	11/2 ⁻	D		$A_2=+0.30$ 22; $A_4=+0.21$ 36
								$A_2=+0.41$ 10; $A_4=0.00$ 13 (1977Kl04)
								$I_\gamma=4.6$ in $(\alpha, 3n\gamma)$ (1979Ha19), 3.01 11 (1994Ba01).
								Mult.: $\gamma(\theta)$ data consistent with $\Delta J=0$, dipole.
131@		879.06	13/2 ⁺	747.89	13/2 ⁻			
141@		2842.6	(25/2 ⁻)	2702.0	(23/2 ⁻)			
159@		2987.6	(25/2)	2828.6	(25/2 ⁻)			
174@		2875.8	(25/2 ⁺)	2702.0	(23/2 ⁻)			
198.6	21 1	789.67	11/2 ⁺	591.09	9/2 ⁻	E1	0.0431 6	$A_2=-0.26$ 16; $A_4=-0.13$ 20; $\alpha(K)\text{exp}=0.0473$ 15
								$A_2=-0.16$ 7; $A_4=-0.08$ 6; $\text{pol}=+0.41$ 6 (1990UrZW)
								$\delta(M2/E1)=0.09$ +10-15 from $\alpha(K)\text{exp}$, -0.02 10 from $\gamma(\theta)$ (1979Ha19).
								$I_\gamma=23.0$ in $(\alpha, 3n\gamma)$ for a complex peak (1979Ha19), 39.5 3 (1994Ba01).
								$I_\gamma(198\gamma)/I_\gamma(125\gamma)=13.2$ (1994Ba01) is high by a factor of ≈ 2 , as compared to results from many other studies. It is likely that $I_\gamma(198\gamma)$ as reported by 1994Ba01 contains contribution from an impurity.
199@		5373.1	(41/2 ⁻)	5174.0	(39/2 ⁺)			
203.1@		3564.5	(29/2 ⁻)	3361.6	(29/2 ⁻)			$\text{pol}=-0.06$ 18 (1990UrZW)
208.4	1.4 3	558.38	(5/2 ⁻)	350.02	3/2 ⁻			
214.7	38 1	879.06	13/2 ⁺	664.32	11/2 ⁻	E1	0.0350 5	$A_2=-0.26$ 2; $A_4=+0.06$ 4; $\alpha(K)\text{exp}=0.0311$ 20
								$A_2=-0.12$ 4; $A_4=-0.06$ 3
								$A_2=-0.19$ 1; $A_4=-0.06$ 1; $\text{pol}=+0.35$ 15 (1977Kl04); $\text{pol}=+0.39$ 5 (1990UrZW)
								$\delta(M2/E1)=0.00$ 8 from $\alpha(K)\text{exp}$, -0.06 3 from $\gamma(\theta)$ (1979Ha19).
								$I_\gamma=60.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 48.6 3 (1994Ba01).
								$A_2=+0.05$ 5; $A_4=+0.03$ 8; $\alpha(K)\text{exp}=0.172$ 40
								I_γ : $I_\gamma=4.6$ in $(\alpha, 3n\gamma)$ (1979Ha19).
251.3	4.6 3	528.57	3/2 ⁻	277.40	5/2 ⁻			All data for a complex peak, mixed with a line from ^{150}Nd .

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)**

$\gamma(^{149}\text{Sm})$ (continued)									
E_γ [†]	I_γ [#]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^a	δ ^b	α ^c	Comments
255.7	7.5 4	277.40	5/2 ⁻	22.50	5/2 ⁻	M1+E2		0.108 15	$A_2=0.00$ 3; $A_4=+0.15$ 6; $\alpha(\text{K})\text{exp}=0.074$ 20 δ : -0.4 or $\approx +6$ from $\gamma(\theta)$ (1979Ha19); >0.8 from $\alpha(\text{K})\text{exp}$ in 1979Ha19. I_γ : mostly contributed by an impurity. From the Adopted Gammas, I_γ should be ≈ 1.4 . $I_\gamma=1.3$ in $(\alpha, 3n\gamma)$ (1979Ha19).
266.0	4.0 3	1574.8	13/2 ⁻	1308.85	11/2 ⁻	M1+E2	-0.60 30	0.104 6	$A_2=-0.69$ 4; $A_4=-0.09$ 7; $\alpha(\text{K})\text{exp}=0.090$ 10 $A_2=-0.80$ 2; $A_4=-0.04$ 3 $A_2=-0.64$ 8; $A_4=-0.05$ 10 (1977Kl04); $\text{pol}=0.00$ 14 (1990UrZW) δ : -0.60 30 from $\gamma(\theta)$, 0.42 15 from $\alpha(\text{K})\text{exp}$ (1979Ha19). $I_\gamma=2.5$ in $(\alpha, 3n\gamma)$ (1979Ha19), 2.03 11 (1994Ba01, γ unplaced). $\text{pol}=+0.08$ 12 (1990UrZW)
272.1	3.5 3	1847.0	15/2 ⁻	1574.8	13/2 ⁻	M1+E2	-0.25 20	0.1032 34	$A_2=-0.51$ 5; $A_4=-0.15$ 9; $\alpha(\text{K})\text{exp}=0.165$ 30 (1979Ha19) $A_2=-0.64$ 12; $A_4=-0.02$ 16 (1977Kl04) δ : -0.25 20 from $\gamma(\theta)$, 0.85 40 from $\alpha(\text{K})\text{exp}$ (1979Ha19). $I_\gamma=3.3$ in $(\alpha, 3n\gamma)$ (1979Ha19), 3.02 17 (1994Ba01, γ unplaced).
277.2	7.7 & 3	277.40	5/2 ⁻	0.0	7/2 ⁻	M1+E2	+0.20 10	0.0987 18	$A_2=-0.13$ 3; $A_4=+0.06$ 6; $\alpha(\text{K})\text{exp}=0.0875$ 50 $\delta(\text{E2/M1})=0.01$ 8 from $\alpha(\text{K})\text{exp}$, +0.20 10 from $\gamma(\theta)$ (1979Ha19). I_γ : complex peak in $(^3\text{He}, 4n\gamma)$. $I_\gamma=2.4$ in $(\alpha, 3n\gamma)$ (1979Ha19). $\gamma(\theta)$ and $\alpha(\text{K})\text{exp}$ for complex peak.
281.5 283 @ 283.8	≤ 1 0.7 3	558.38 1695.80 2130.7	(5/2 ⁻) (17/2 ⁺) 17/2 ⁻	277.40 1413.5 1847.0	5/2 ⁻ 15/2 ⁽⁺⁾ 15/2 ⁻	M1		0.0937 13	$\alpha(\text{K})\text{exp}=0.150$ 50 (1979Ha19) $I_\gamma=3.0$ in $(\alpha, 3n\gamma)$ (1979Ha19). $\alpha(\text{K})\text{exp}$ overlaps $\alpha(\text{K})\text{theory}$ for M1 within 1.4σ .
286.0	100	286.01	9/2 ⁻	0.0	7/2 ⁻	M1(+E2)	+0.02	0.0918 13	$A_2=-0.14$ 3; $A_4=+0.06$ 4 $A_2=-0.12$ 3; $A_4=+0.01$ 3 $A_2=-0.10$ 1; $A_4=-0.05$ 1; $\text{pol}=-0.22$ 6 (1977Kl04); $\text{pol}=-0.39$ 4 (1990UrZW) $\delta(\text{E2/M1})=+0.02$ (or $<+6.5$) from $\gamma(\theta)$ (1979Ha19). $I_\gamma=100$ in $(\alpha, 3n\gamma)$ (1979Ha19), 100 (1994Ba01).
291 @ 296 @ 296.4	2.0 2	3652.2 1695.80 2427.2	31/2 ⁺ (17/2 ⁺) 19/2 ⁻	3361.6 1398.45 2130.7	(29/2 ⁻) 15/2 ⁻ 17/2 ⁻	D			$E_\gamma=292$, $I_\gamma<0.21$ (1994Ba01). $A_2=-0.22$ 5; $A_4=+0.03$ 5 $A_2=-0.34$ 3; $A_4=+0.03$ 5 $A_2=-0.67$ 18; $A_4=+0.11$ 5 (1977Kl04) $I_\gamma=7.6$ in $(\alpha, 3n\gamma)$ (1979Ha19).
304 @ 305.1	1.0 4	2344.8 591.09	(21/2 ⁺) 9/2 ⁻	2041.2 286.01	(19/2 ⁻) 9/2 ⁻	D			$A_2=-0.16$ 6; $A_4=+0.13$ 10 $I_\gamma=0.8$ in $(\alpha, 3n\gamma)$ (1979Ha19).
307.5 ‡		2735.0	(21/2 ⁻)	2427.2	19/2 ⁻				

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)**
 $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^a	α^c	Comments
309.4	14.0 4	1670.65	19/2 ⁺	1361.23	17/2 ⁻	E1	0.01361 19	$A_2 = -0.27$ 4; $A_4 = +0.07$ 7; $\alpha(\text{K})_{\text{exp}} = 0.0161$ 30 $A_2 = -0.04$ 2; $A_4 = -0.04$ 2 $A_2 = -0.22$ 1; $A_4 = -0.04$ 2; $\text{pol} = +0.31$ 16 (1977Kl04); $\text{pol} = +0.43$ 5 (1990UrZW) δ : -0.06 7 from $\gamma(\theta)$, 0.13 9 from $\alpha(\text{K})_{\text{exp}}$ (1979Ha19). $I_\gamma = 31.3$ in $(\alpha, 3n\gamma)$ (1979Ha19), 37.3 4 (1994Ba01). $A_2 = +0.24$ 8; $A_4 = -0.03$ 13; $\text{pol} = +0.72$ 31 (1990UrZW) $I_\gamma = 1.29$ 11 for 314.2+316.7 (1994Ba01). Mult.: $\gamma(\theta)$ data in 1979Ha19 and pol value in 1990UrZW consistent with $\Delta J = 0$, M1 transition (evaluators).
313.9	3.3 3	1192.88	(13/2 ⁺)	879.06	13/2 ⁺	(M1)	0.0717 10	$\text{pol} = +0.47$ 19 (1990UrZW) $E_\gamma = 316.7$, $I_\gamma = 1.29$ 11 for 314.2+316.7 (1994Ba01). E_γ : from 1977Kl04.
316.6 @		3968.8	(33/2 ⁻)	3652.2	31/2 ⁺			
320.1 5		3055.3	(23/2 ⁻)	2735.0	(21/2 ⁻)			
325 @		3159.7	(25/2)	2834.7	27/2 ⁺			
327.7	5.3 & 5	350.02	3/2 ⁻	22.50	5/2 ⁻	M1(+E2)	0.053 11	$A_2 = -0.08$ 8; $A_4 = +0.02$ 10; $\alpha(\text{K})_{\text{exp}} = 0.0487$ 40 $I_\gamma = 0.9$ in $(\alpha, 3n\gamma)$ (1979Ha19).
329 @		3384.1	(25/2 ⁻)	3055.3	(23/2 ⁻)			
333 @		1695.80	(17/2 ⁺)	1362.88	17/2 ⁺			E_γ : γ in 1990UrZR and 1994Ba01. $E_\gamma = 333.5$, $I_\gamma < 7.3$ for 333.5+336 γ from (1994Ba01). γ from 1994Ba01 only, $E_\gamma = 336$, $I_\gamma < 7.3$ for 333.5 γ +336 γ .
336 f		2262.0?		1926.2	21/2 ⁺			
339 @		2875.8	(25/2 ⁺)	2537.4	25/2 ⁺			
350.0	1.0 4	350.02	3/2 ⁻	0.0	7/2 ⁻			
354.0 @		4006.3	(33/2 ⁻)	3652.2	31/2 ⁺			$\text{pol} = +0.6$ 4 (1990UrZW)
358.8	1.0 3	636.13	7/2 ⁻	277.40	5/2 ⁻			
374 @		5174.0	(39/2 ⁺)	4799.9	(37/2 ⁺)			
378.3	2.7 4	664.32	11/2 ⁻	286.01	9/2 ⁻			$\text{pol} = -0.06$ 22 (1990UrZW) $I_\gamma = 2.8$ in $(\alpha, 3n\gamma)$ (1979Ha19).
398		6190.1	(45/2)	5792.1	(43/2)			
402.8 5		1192.88	(13/2 ⁺)	789.67	11/2 ⁺	D+Q		$A_2 = -0.6$ 2; $A_4 = 0.0$ 3 (1977Kl04); $\text{pol} = +0.09$ 38 (1990UrZW) E_γ : from 1977Kl04. This γ is not reported by 1979Ha19. Mult.: assigned by evaluators from $\gamma(\theta)$ data in 1977Kl04. $I_\gamma = 1.8$ (1977Kl04), 1.69 12 (1994Ba01). γ from 1977Kl04, 1976SiZW and 1994Ba01. This γ was unplaced in 1977Kl04.
419 @		2344.8	(21/2 ⁺)	1926.2	21/2 ⁺			
419 @		5792.1	(43/2)	5373.1	(41/2 ⁻)			
430.1	7.1 4	1670.65	19/2 ⁺	1240.50	15/2 ⁺	E2	0.01936 27	$A_2 = +0.24$ 4; $A_4 = -0.06$ 7; $\alpha(\text{K})_{\text{exp}} = 0.0164$ 24 $A_2 = +0.23$ 9; $A_4 = -0.10$ 4 $A_2 = +0.36$ 2; $A_4 = -0.12$ 3; $\text{pol} = +0.3$ 5 (1977Kl04); $\text{pol} = +0.54$ 9 (1990UrZW) $I_\gamma = 21.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 13.3 4 (1994Ba01).

¹⁴⁸Nd(α ,3n γ), ¹⁵⁰Nd(³He,4n γ) **1979Ha19,1990UrZR,1994Ba01 (continued)** $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^a	α ^c	Comments
442.0 @		4006.3	(33/2 ⁻)	3564.5	(29/2 ⁻)			pol=+1.0 4 (1990UrZW)
450.8	3.1 & 5	1240.50	15/2 ⁺	789.67	11/2 ⁺			$I_\gamma=4.5$ in (α ,3n γ) (1979Ha19), 7.6 3 (1994Ba01).
452 @		1851.3	(17/2 ⁺)	1398.45	15/2 ⁻			
455 @		1695.80	(17/2 ⁺)	1240.50	15/2 ⁺			
461.9	68.2	747.89	13/2 ⁻	286.01	9/2 ⁻	E2	0.01589 22	$A_2=+0.24$ 1; $A_4=-0.24$ 1; $\alpha(K)\text{exp}=0.0125$ 15 $A_2=+0.25$ 7; $A_4=-0.19$ 5 $A_2=+0.36$ 1; $A_4=-0.12$ 1; pol=+0.51 13 (1977Kl04); pol=+0.60 7 (1990UrZW) $I_\gamma=92.0$ in (α ,3n γ) (1979Ha19), 65.3 6 (1994Ba01). Positive sign of A_4 in 1979Ha19 in (³ He,4n γ) seems a misprint. $I_\gamma=1.0$ in (α ,3n γ) (1979Ha19), 12.3 3 (1994Ba01). $A_2=+0.25$ 2; $A_4=-0.02$ 3; $\alpha(K)\text{exp}=0.0128$ 20 $A_2=+0.28$ 3; $A_4=-0.10$ 6 $A_2=+0.37$ 1; $A_4=-0.12$ 1; pol=+0.73 22 (1977Kl04); pol=+0.56 7 (1990UrZW) $I_\gamma=55.0$ in (α ,3n γ) (1979Ha19). E_γ and I_γ not listed by 1994Ba01, although, transition is shown in the decay scheme.
472.0		2142.6	21/2 ⁻	1670.65	19/2 ⁺			
483.9	25.4 6	1362.88	17/2 ⁺	879.06	13/2 ⁺	E2	0.01400 20	pol=+0.4 3 (1990UrZW)
489.4 ^d @		3365.1	(29/2 ⁺)	2875.8	(25/2 ⁺)			
489.4 ^d @ 10		4543.7	(35/2 ⁻)	4055.7	(33/2 ⁺)			
492.6	18.0 5	1240.50	15/2 ⁺	747.89	13/2 ⁻	E1	0.00446 6	$A_2=-0.23$ 3; $A_4=+0.05$ 5; $\alpha(K)\text{exp}=0.0039$ 10 $A_2=-0.23$ 5; $A_4=-0.06$ 5 $A_2=-0.14$ 2; $A_4=-0.08$ 3; pol=+0.7 3 (1977Kl04); pol=+0.39 8 (1990UrZW) $\delta(M2/E1)=0.00$ +7-6 from $\alpha(K)\text{exp}$, -0.02 5 from $\gamma(\theta)$ (1979Ha19). $I_\gamma=22.0$ in (α ,3n γ) (1979Ha19), 25.2 4 (1994Ba01). $I_\gamma(493\gamma)/I_\gamma(451\gamma)=3.3$ (1994Ba01) is low by a factor of ≈ 2 . $\delta(M2/E1)=0.00$ 9 from $\gamma(\theta)$.
493 @		2344.8	(21/2 ⁺)	1851.3	(17/2 ⁺)			
503.0	2.3 4	1695.80	(17/2 ⁺)	1192.88	(13/2 ⁺)	(E2)	0.01262 18	pol=+0.34 21 (1990UrZW) $I_\gamma=5.1$ in (α ,3n γ) (1979Ha19), 14.0 3 (1994Ba01). Mult.: assigned by evaluators from pol value in 1990UrZW. $I_\gamma=25.0$ in (α ,3n γ), for a complex peak in both reactions (1979Ha19). pol=+0.8 6 (1990UrZW) $E_\gamma=519$, $I_\gamma<1.4$ (1994Ba01). E_γ : level-energy difference=520.3.
505.8	23.4 & 12	528.57	3/2 ⁻	22.50	5/2 ⁻			
519.0 @		3361.6	(29/2 ⁻)	2842.6	(25/2 ⁻)			
519.3		1398.45	15/2 ⁻	879.06	13/2 ⁺			
521.9	9.2 4	2192.6	23/2 ⁺	1670.65	19/2 ⁺	E2	0.01145 16	$A_2=+0.24$ 3; $A_4=-0.07$ 5; $\alpha(K)\text{exp}=0.0084$ 15 $A_2=+0.26$ 8; $A_4=-0.10$ 3 $A_2=+0.36$ 1; $A_4=-0.14$ 2; pol=+0.7 3 (1977Kl04); pol=+0.55 8 (1990UrZW) $I_\gamma=37.0$ in (α ,3n γ) (1979Ha19), 23.6 4 (1994Ba01). $A_2=-0.40$ 10; $A_4=+0.05$ 12 (1977Kl04); pol=+0.26 13 (1990UrZW)
526.9 @		3361.6	(29/2 ⁻)	2834.7	27/2 ⁺			

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)**
 $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^a	δ ^b	α ^c	Comments
528.7 ^e	3.9 ^{e&} 4	528.57	3/2 ⁻	0.0	7/2 ⁻				$A_2=-0.27$ 7; $A_4=-0.01$ 10 $I_\gamma=4.5$ in $(\alpha, 3n\gamma)$ (1979Ha19), >5.4 (1994Ba01, γ unplaced). $\gamma(\theta)$ for doublet. $I_\gamma=4.5$ in $(\alpha, 3n\gamma)$ (1979Ha19).
528.7 ^e	3.9 ^e 4	1192.88	(13/2 ⁺)	664.32	11/2 ⁻				
530 [@]		3365.1	(29/2 ⁺)	2834.7	27/2 ⁺				
531.0 [@]		2875.8	(25/2 ⁺)	2344.8	(21/2 ⁺)				pol=+0.46 28 (1990UrZW) $E_\gamma=532.0$ 16, $I_\gamma=5.4$ 3 (1994Ba01), unplaced.
535.4	2.4 ^{&} 3	558.38	(5/2 ⁻)	22.50	5/2 ⁻	D+Q			$A_2=-0.22$ 4; $A_4=-0.17$ 6 $I_\gamma=6.5$ in $(\alpha, 3n\gamma)$ (1979Ha19).
538 [@]		1847.0	15/2 ⁻	1308.85	11/2 ⁻				
543 [@]		5140.5	(39/2 ⁻)	4597.3	(37/2 ⁺)				
553 [@]		2404.6	(21/2 ⁺)	1851.3	(17/2 ⁺)				
554.8 [‡]		1344.36	(13/2 ⁻ , 11/2 ⁻)	789.67	11/2 ⁺				
555.9 [‡]		2130.7	17/2 ⁻	1574.8	13/2 ⁻				
557 [@]		3777.7	(29/2)	3220.7	(25/2)				
558.3	17.3 ^{&} 6	558.38	(5/2 ⁻)	0.0	7/2 ⁻	M1+E2		0.0130 34	$A_2=+0.19$ 5; $A_4=+0.02$ 9; $\alpha(K)\text{exp}=0.0071$ 15 I_γ : for a complex peak. $I_\gamma=21.5$ in $(\alpha, 3n\gamma)$ (1979Ha19). $\delta(E2/M1)>3$ from $\alpha(K)\text{exp}$.
561.0 [‡]		1308.85	11/2 ⁻	747.89	13/2 ⁻				
563.4	12.7 5	1926.2	21/2 ⁺	1362.88	17/2 ⁺	E2		0.00939 13	$A_2=+0.19$ 4; $A_4=+0.06$ 6; $\alpha(K)\text{exp}=0.0074$ 10 (1979Ha19) $A_2=+0.25$ 4; $A_4=-0.10$ 4 $A_2=+0.35$ 2; $A_4=-0.13$ 2; pol=+0.5 3 (1977Kl04); pol=+0.54 8 (1990UrZW) $I_\gamma=35.1$ in $(\alpha, 3n\gamma)$ (1979Ha19), 24.5 4 (1994Ba01). γ from 1994Ba01 only, $E_\gamma=566$, $I_\gamma=1.36$ 31.
566 ^f		2262.0?		1695.80	(17/2 ⁺)				
567 [@]		5174.0	(39/2 ⁺)	4607.1	(37/2 ⁻)				
568.6	7.0 4	591.09	9/2 ⁻	22.50	5/2 ⁻	E2		0.00918 13	$A_2=+0.24$ 3; $A_4=-0.12$ 6; $\alpha(K)\text{exp}=0.0060$ 15 $A_2=+0.10$ 8 $A_2=+0.36$ 9; $A_4=-0.10$ 13 (1977Kl04); pol=+0.22 19 (1990UrZW) $I_\gamma=4.0$ in $(\alpha, 3n\gamma)$ (1979Ha19). pol=+0.8 7 (1990UrZW) $I_\gamma=1.2$ in $(\alpha, 3n\gamma)$ (1979Ha19).
580.2 [‡]		2427.2	19/2 ⁻	1847.0	15/2 ⁻				
591 ^f 1		3919.2?		3328.2	(27/2 ⁻)				
591.1	22.4 5	591.09	9/2 ⁻	0.0	7/2 ⁻	E2+M1	-1.0 4	0.0112 14	$A_2=-0.50$ 2; $A_4=+0.07$ 4; $\alpha(K)\text{exp}=0.0081$ 10 $A_2=-0.80$ 10; $A_4=+0.10$ 10 $A_2=-0.60$ 3; $A_4=+0.04$ 4; pol=+0.3 4 (1977Kl04); pol=+0.23

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(\alpha, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)**
 $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^a	α^C	Comments
								9 (1990UrZW) δ : other: 1.8 +25-6 from $\alpha(\text{K})\text{exp}$ in 1979Ha19. $I_\gamma=15.4$ in $(\alpha, 3n\gamma)$ (1979Ha19), 20.5 4 (1994Ba01). $A_2=+0.06$ 2; $A_4=+0.08$ 3 $I_\gamma=7.0$ in $(\alpha, 3n\gamma)$ (1979Ha19).
596.4	9.1 & 6	1344.36	(13/2 ⁻ , 11/2 ⁻)	747.89	13/2 ⁻			
597@		5140.5	(39/2 ⁻)	4543.7	(35/2 ⁻)			
601@		4607.1	(37/2 ⁻)	4006.3	(33/2 ⁻)			
604@		3008.6	(25/2 ⁺)	2404.6	(21/2 ⁺)			
606@		2735.0	(21/2 ⁻)	2130.7	17/2 ⁻			
607@		3968.8	(33/2 ⁻)	3361.6	(29/2 ⁻)			
607@f		4575.5	(35/2 ⁺)	3968.8	(33/2 ⁻)			
611@		1851.3	(17/2 ⁺)	1240.50	15/2 ⁺			
611.2	7.0 & 7	2537.4	25/2 ⁺	1926.2	21/2 ⁺	E2	0.00765 11	$A_2=+0.22$ 6; $A_4=-0.15$ 5; $\alpha(\text{K})\text{exp}=0.0090$ 20 $A_2=+0.20$ 2; $A_4=-0.13$ 3 (1977Kl04); $\text{pol}=+0.48$ 9 (1990UrZW) $I_\gamma=28.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 19.0 9 (1994Ba01).
613.5 ^e	30.0 ^e 8	636.13	7/2 ⁻	22.50	5/2 ⁻			
613.5 ^e	30.0 ^e 8	1361.23	17/2 ⁻	747.89	13/2 ⁻	E2	0.00758 11	$A_2=+0.24$ 4; $A_4=-0.13$ 4; $\alpha(\text{K})\text{exp}=0.0073$ 10 $A_2=+0.35$ 1; $A_4=-0.13$ 2 (1977Kl04); $\text{pol}=+0.61$ 9 (1990UrZW) $I_\gamma=55.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 39.8 5 (1994Ba01).
618@		3777.7	(29/2)	3159.7	(25/2)			
626@		3328.2	(27/2 ⁻)	2702.0	(23/2 ⁻)			$E_\gamma=626.0$ 17, $I_\gamma=2.04$ 20 (1994Ba01). $I_\gamma(626\gamma)/I_\gamma(791\gamma)=2.1$ (1994Ba01). But 626 γ is likely a complex γ ray.
629@		3055.3	(23/2 ⁻)	2427.2	19/2 ⁻			
636		2828.6	(25/2 ⁻)	2192.6	23/2 ⁺			
636.2	3.0 4	636.13	7/2 ⁻	0.0	7/2 ⁻	M1(+E2)	0.0094 24	γ observed in 1990UrZR and 1994Ba01. I_γ not available. $\alpha(\text{K})\text{exp}=0.0102$ 10 (1979Ha19) $I_\gamma=2.57$ 18 (1994Ba01, γ unplaced).
639@		5325.8	(39/2)	4686.8	(37/2 ⁻)			
641@		2041.2	(19/2 ⁻)	1398.45	15/2 ⁻			
642.0	2.2 4	2834.7	27/2 ⁺	2192.6	23/2 ⁺	E2	0.00678 9	$E_\gamma=642.0$ 17, $I_\gamma=9.7$ 3 (1994Ba01). $A_2=+0.28$ 4; $A_4=-0.18$ 10 $A_2=+0.38$ 3; $A_4=-0.13$ 4 (1977Kl04); $\text{pol}=+0.61$ 12 (1990UrZW) $I_\gamma=17.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 9.7 3 (1994Ba01).
644.0	1.1 5	3181.4	29/2 ⁺	2537.4	25/2 ⁺	(E2)	0.00673 9	$A_2=+0.40$ 10; $A_4=-0.15$ 8 $A_2=+0.29$ 4; $A_4=-0.09$ 5 (1977Kl04); $\text{pol}=+0.21$ 10 (1990UrZW) $I_\gamma=7.2$ in $(\alpha, 3n\gamma)$ (1979Ha19), 7.1 3 (1994Ba01). POL for a complex peak.
644@f		4006.3	(33/2 ⁻)	3361.6	(29/2 ⁻)			
644.5 [‡]		1308.85	11/2 ⁻	664.32	11/2 ⁻			

$^{148}\text{Nd}(\alpha, 3n\gamma), ^{150}\text{Nd}(^3\text{He}, 4n\gamma)$ **1979Ha19, 1990UrZR, 1994Ba01 (continued)**

$\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^a	α^c	Comments
649@		2344.8	(21/2 ⁺)	1695.80	(17/2 ⁺)			
649@		3384.1	(25/2 ⁻)	2735.0	(21/2 ⁻)			
650@		2842.6	(25/2 ⁻)	2192.6	23/2 ⁺			
650.4		1398.45	15/2 ⁻	747.89	13/2 ⁻			$A_2 = -0.30$ 5; $A_4 = +0.06$ 2 $A_2 = -0.34$ 14; $A_4 = +0.1$ 2 (1977Kl04) $I_\gamma = 2.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 4.93 23 (1994Ba01).
661@		2702.0	(23/2 ⁻)	2041.2	(19/2 ⁻)			
661@		5801.5	(43/2 ⁻)	5140.5	(39/2 ⁻)			
664.3	58.7 10	664.32	11/2 ⁻	0.0	7/2 ⁻	E2	0.00624 9	$A_2 = +0.20$ 2; $A_4 = +0.02$ 3; $\alpha(K)\text{exp} = 0.0051$ 6 $A_2 = +0.22$ 6; $A_4 = -0.08$ 3 $A_2 = +0.34$ 1; $A_4 = -0.12$ 1; $\text{pol} = +0.55$ 18 (1977Kl04); $\text{pol} = +0.42$ 8 (1990UrZW) $I_\gamma = 77.0$ in $(\alpha, 3n\gamma)$ (1979Ha19), 51.7 6 (1994Ba01). $I_\gamma = 5.0$ in $(\alpha, 3n\gamma)$ (1979Ha19).
665.7	9.1 6	1413.5	15/2 ⁽⁺⁾	747.89	13/2 ⁻			
674@		2344.8	(21/2 ⁺)	1670.65	19/2 ⁺			
678@		2041.2	(19/2 ⁻)	1362.88	17/2 ⁺			
678.0 [‡]		3859.6	33/2 ⁺	3181.4	29/2 ⁺	(E2)	0.00594 8	$A_2 = +0.11$ 10; $A_4 = -0.24$ 14 (1977Kl04); $\text{pol} = +0.6$ 4 (1990UrZW) Complex peak in 1979Ha19. $I_\gamma = 2.5$ 3 (1994Ba01). $\text{pol} = +0.62$ 19 (1990UrZW)
680.2@		2041.2	(19/2 ⁻)	1361.23	17/2 ⁻			
683@		2875.8	(25/2 ⁺)	2192.6	23/2 ⁺			
684.0@		4543.7	(35/2 ⁻)	3859.6	33/2 ⁺			$\text{pol} = +1.5$ 6 (1990UrZW)
691@		4055.7	(33/2 ⁺)	3365.1	(29/2 ⁺)			
699@		3880.4	(31/2 ⁻)	3181.4	29/2 ⁺			
700@		2842.6	(25/2 ⁻)	2142.6	21/2 ⁻			
708.5	3.0 3	994.5		286.01	9/2 ⁻			$I_\gamma = 1.0$ in $(\alpha, 3n\gamma)$ (1979Ha19).
709@		2404.6	(21/2 ⁺)	1695.80	(17/2 ⁺)			
718.0@		4686.8	(37/2 ⁻)	3968.8	(33/2 ⁻)			$\text{pol} = +0.47$ 13 (1990UrZW)
730@		3564.5	(29/2 ⁻)	2834.7	27/2 ⁺			
734.0	4.7 7	1398.45	15/2 ⁻	664.32	11/2 ⁻	E2	0.00493 7	$A_2 = +0.47$ 24; $A_4 = +0.25$ 30; $\alpha(K)\text{exp} = 0.0037$ 10 $A_2 = +0.30$ 6; $A_4 = -0.12$ 8 $A_2 = +0.35$ 16; $A_4 = 0.0$ 2 (1977Kl04) $I_\gamma = 10.4$ in $(\alpha, 3n\gamma)$ (1979Ha19), 3.01 24 (1994Ba01). $I_\gamma(735\gamma)/I_\gamma(651\gamma) = 0.61$ (1994Ba01) is low by a factor of ≈ 16 . Mult.: $\alpha(K)\text{exp}$ in 1979Ha19 gives $\delta(E2/M1) > 2$.
734@		2404.6	(21/2 ⁺)	1670.65	19/2 ⁺			
737.7@		4597.3	(37/2 ⁺)	3859.6	33/2 ⁺			$\text{pol} = +0.4$ 3 (1990UrZW) $E_\gamma = 736.0$ 18, $I_\gamma = 3.01$ 24 (1994Ba01).

¹⁴⁸Nd($\alpha,3n\gamma$), ¹⁵⁰Nd($^3\text{He},4n\gamma$) 1979Ha19,1990UrZR,1994Ba01 (continued) $\gamma(^{149}\text{Sm})$ (continued)

E_γ [†]	I_γ [#]	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^a	δ ^b	α ^c	Comments
744@		4799.9	(37/2 ⁺)	4055.7	(33/2 ⁺)				
746.8 ^f	1.2 5	2145.3?		1398.45	15/2 ⁻				$I_\gamma=9.0$ in ($\alpha,3n\gamma$) (1979Ha19).
753.2	3.0 5	1344.36	(13/2 ⁻ ,11/2 ⁻)	591.09	9/2 ⁻				E_γ : from level-scheme Fig. 11 in 1979Ha19; $E_\gamma=735.2$ in authors' Table 3 is a misprint.
									$I_\gamma=2.9$ in ($\alpha,3n\gamma$) (1979Ha19).
764@		5361.3	(41/2 ⁺)	4597.3	(37/2 ⁺)				
766@		5373.1	(41/2 ⁻)	4607.1	(37/2 ⁻)				
772@		3953.4	(31/2 ⁻)	3181.4	29/2 ⁺				
776		2702.0	(23/2 ⁻)	1926.2	21/2 ⁺				γ observed in 1990UrZR and 1994Ba01. I_γ not available.
781.4	2.6 7	2142.6	21/2 ⁻	1361.23	17/2 ⁻	(E2)		0.00427 6	$A_2=+0.36$ 10; $A_4=-0.1$ 2 (1977Kl04); $\text{pol}=+0.28$ 19 (1990UrZW)
									$I_\gamma=7.0$ in ($\alpha,3n\gamma$) (1979Ha19), 2.95 24 (1994Ba01).
									$I_\gamma(781\gamma)/I_\gamma(472\gamma)=0.24$ (1994Ba01) is low by a factor of ≈ 30 .
790.6 ^f	1.1 3	2933.2?		2142.6	21/2 ⁻				$I_\gamma=6.0$ in ($\alpha,3n\gamma$) (1979Ha19).
791@		3328.2	(27/2 ⁻)	2537.4	25/2 ⁺				$E_\gamma=791.8$ 18, $I_\gamma=0.95$ 13 (1994Ba01).
791@		5477.8	(41/2 ⁻)	4686.8	(37/2 ⁻)				
795@		2987.6	(25/2)	2192.6	23/2 ⁺				
817.0 7		3652.2	31/2 ⁺	2834.7	27/2 ⁺	E2		0.00386 5	$A_2=+0.24$ 11; $A_4=-0.3$ 2 (1977Kl04); $\text{pol}=+0.60$ 31 (1990UrZW)
									E_γ : from ($\alpha,3n\gamma$), $I_\gamma=3.5$ 4 (1976SiZW), 0.72 6 (1994Ba01).
828@		3365.1	(29/2 ⁺)	2537.4	25/2 ⁺				
835@		4487.2	(33/2)	3652.2	31/2 ⁺				
846.6	15.9& 4	1132.6	(11/2 ⁻)	286.01	9/2 ⁻				$A_2=-0.17$ 7; $A_4=+0.18$ 11
									$\delta(Q/D)=-6.5$ 25 from $\gamma(\theta)$ for a complex line (1979Ha19).
									Complex γ , contaminated by a line in ⁵⁶ Fe.
									$I_\gamma=2.0$ in ($\alpha,3n\gamma$) (1979Ha19).
875@		4055.7	(33/2 ⁺)	3181.4	29/2 ⁺				
909 ^f 1		3051.6?		2142.6	21/2 ⁻				γ from 1976SiZW only.
923@		4575.5	(35/2 ⁺)	3652.2	31/2 ⁺				
943@		3777.7	(29/2)	2834.7	27/2 ⁺				
967@		3159.7	(25/2)	2192.6	23/2 ⁺				
1022.8	3.0 4	1308.85	11/2 ⁻	286.01	9/2 ⁻	M1+E2	+2.5 10	0.00256 23	$A_2=-0.44$ 12; $A_4=+0.18$ 21; $\alpha(K)\text{exp}=0.0022$ 10
									$A_2=-0.35$ 15 (1979Ha19)
									$A_2=-0.46$ 20; $A_4=+0.1$ 3 (1977Kl04)

¹⁴⁸Nd(α ,3n γ), ¹⁵⁰Nd(³He,4n γ) [1979Ha19](#), [1990UrZR](#), [1994Ba01](#) (continued) $\gamma(^{149}\text{Sm})$ (continued)

<u>Eγ</u> [†]	<u>E_i(level)</u>	<u>Jπ_i</u>	<u>E_f</u>	<u>Jπ_f</u>	<u>Comments</u>
					$\delta(E2/M1)=3.5$ 15 from $\alpha(K)\text{exp}$, +2.5 10 from $\gamma(\theta)$ (1979Ha19). I γ =4.0 in (α ,3n γ) (1979Ha19), 3.7 4 (1994Ba01 , γ not placed). Evaluators assume that A ₄ listed in Table 3 of 1979Ha19 from (α ,3n γ) refers to A ₂ , instead.
1028@	3220.7	(25/2)	2192.6	23/2 ⁺	
1309@	1308.85	11/2 ⁻	0.0	7/2 ⁻	

[†] From [1979Ha19](#) unless otherwise stated. Uncertainties not given by the authors. Evaluators assume 0.3 keV for fitting purpose.

[‡] From $\gamma\gamma$ -coin only ([1979Ha19](#)). I γ is not available.

[#] From (³He,4n γ) at E=27 MeV ([1979Ha19](#)). Relative intensities from (α ,3n γ) at E=33 MeV ([1979Ha19](#)), and from (α ,3n γ) at 37 MeV ([1994Ba01](#)) are given in comments.

@ From level energy differences in the scheme shown by [1990UrZR](#). For γ rays of measured linear polarization, values are from [1990UrZW](#). Uncertainty of 0.3 keV in E γ is assumed for fitting purpose when E γ stated to nearest tenth of a keV, and 1 keV when stated to nearest keV.

& Complex peak in (³He,4n γ) ([1979Ha19](#)).

^a From $\gamma(\theta)$ and ce data ([1979Ha19](#)). The $\gamma(\theta)$ data from [1977Kl04](#), as well as polarization data from [1977Kl04](#) and [1990UrZW](#) are also used in the assignments.

^b From $\gamma(\theta)$ in [1979Ha19](#), unless otherwise noted.

^c Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^d Multiply placed.

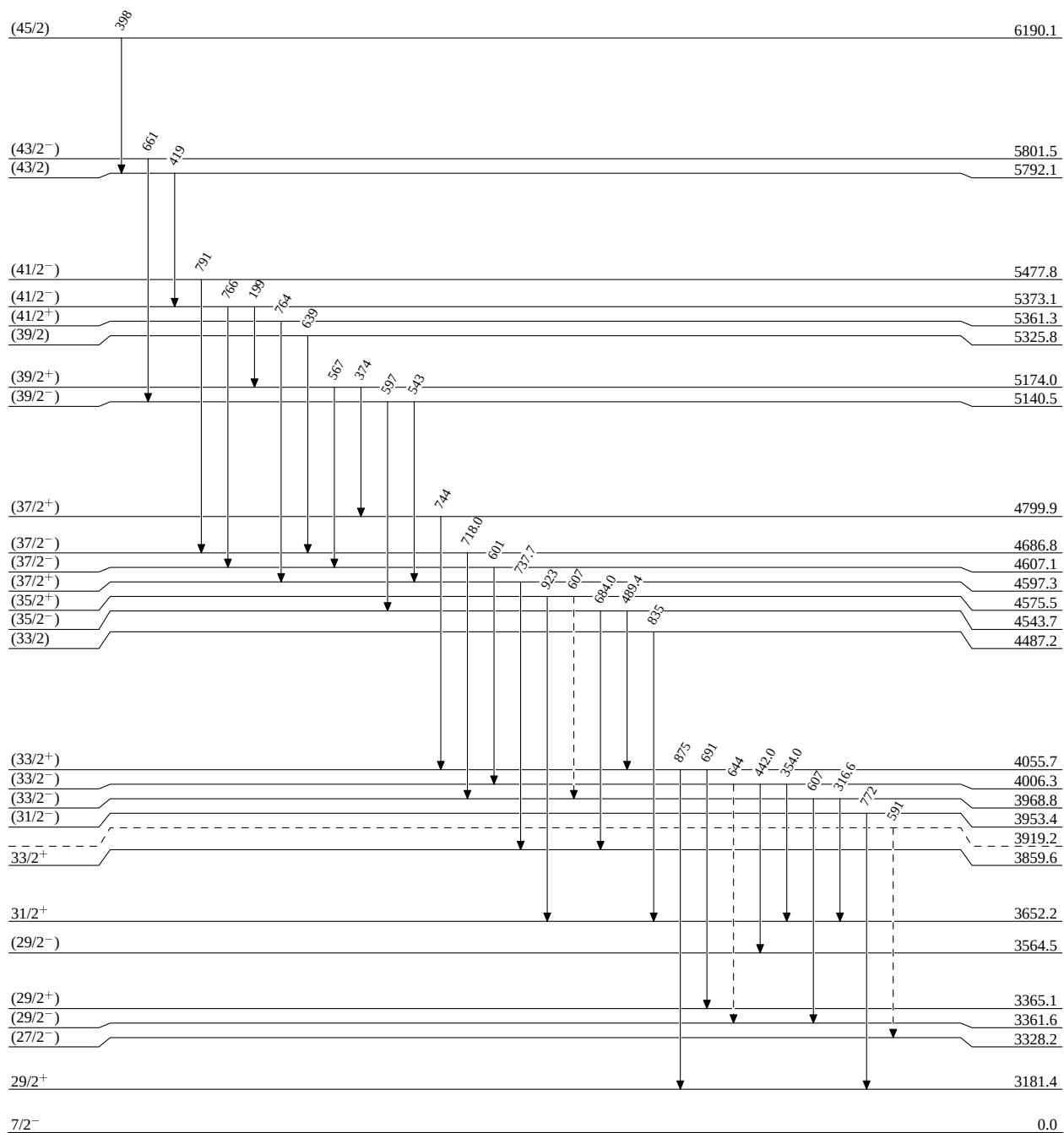
^e Multiply placed with undivided intensity.

^f Placement of transition in the level scheme is uncertain.

Legend

Intensities: Relative I_γ

-----► γ Decay (Uncertain)

 $^{149}_{62}\text{Sm}_{87}$

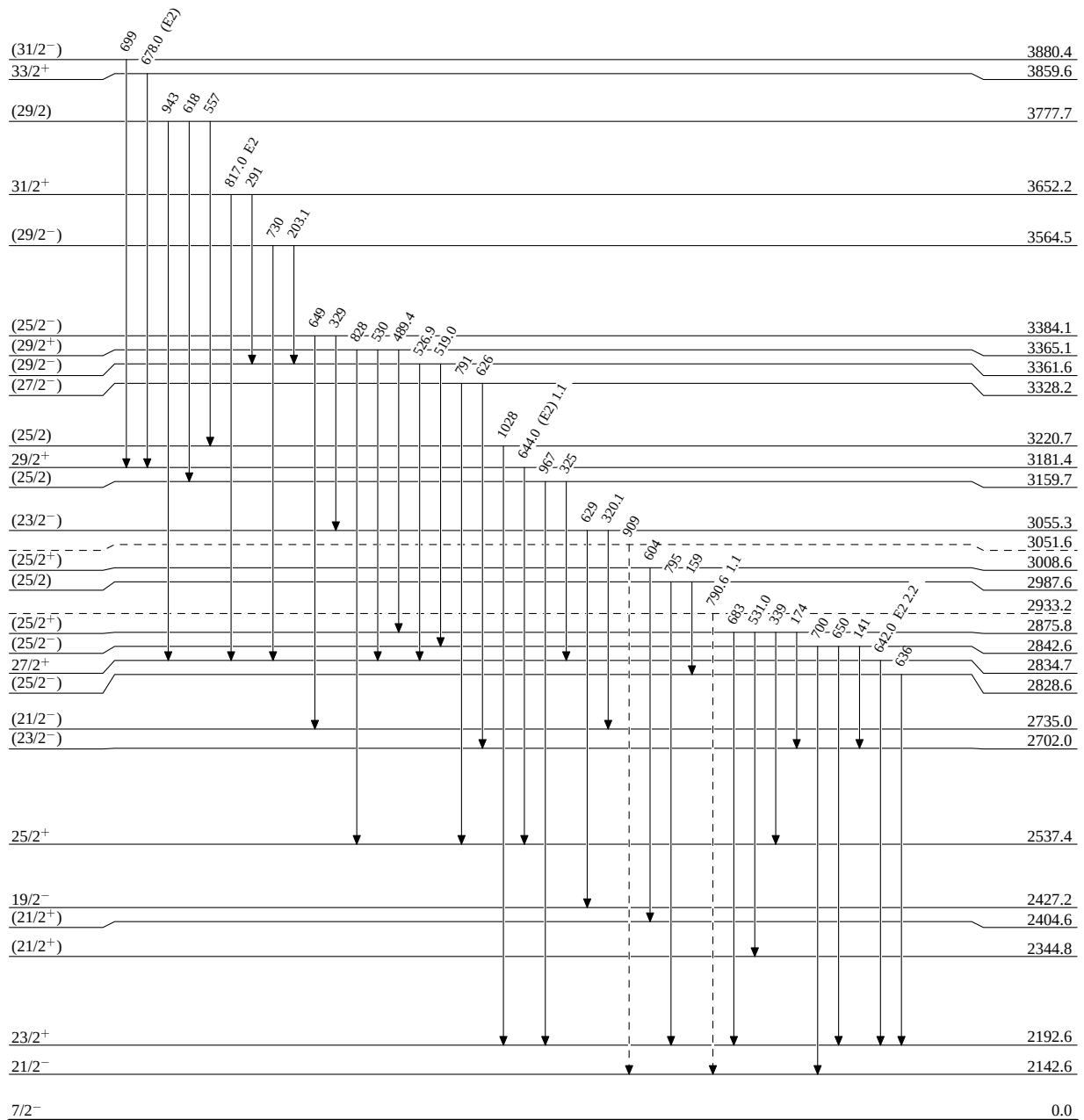
$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01

Legend

Level Scheme (continued)

Intensities: Relative I_γ

- $I_\gamma < 2\% \times I_\gamma^{\max}$
—→ $I_\gamma < 10\% \times I_\gamma^{\max}$
—→ $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - -→ γ Decay (Uncertain)



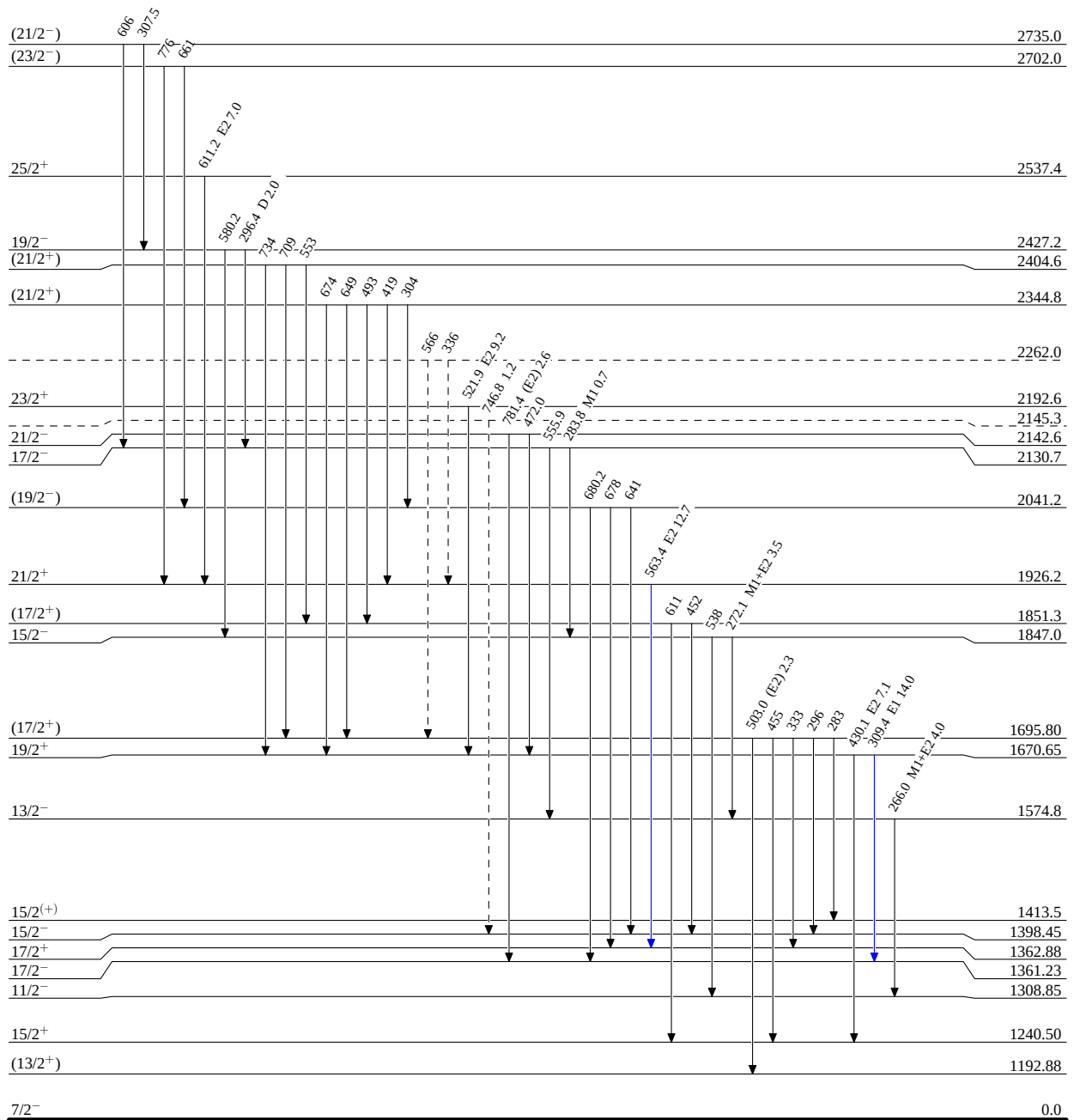
$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01

Legend

Level Scheme (continued)

Intensities: Relative I_γ

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\cdots \longrightarrow$ γ Decay (Uncertain)

 $^{149}_{62}\text{Sm}_{87}$

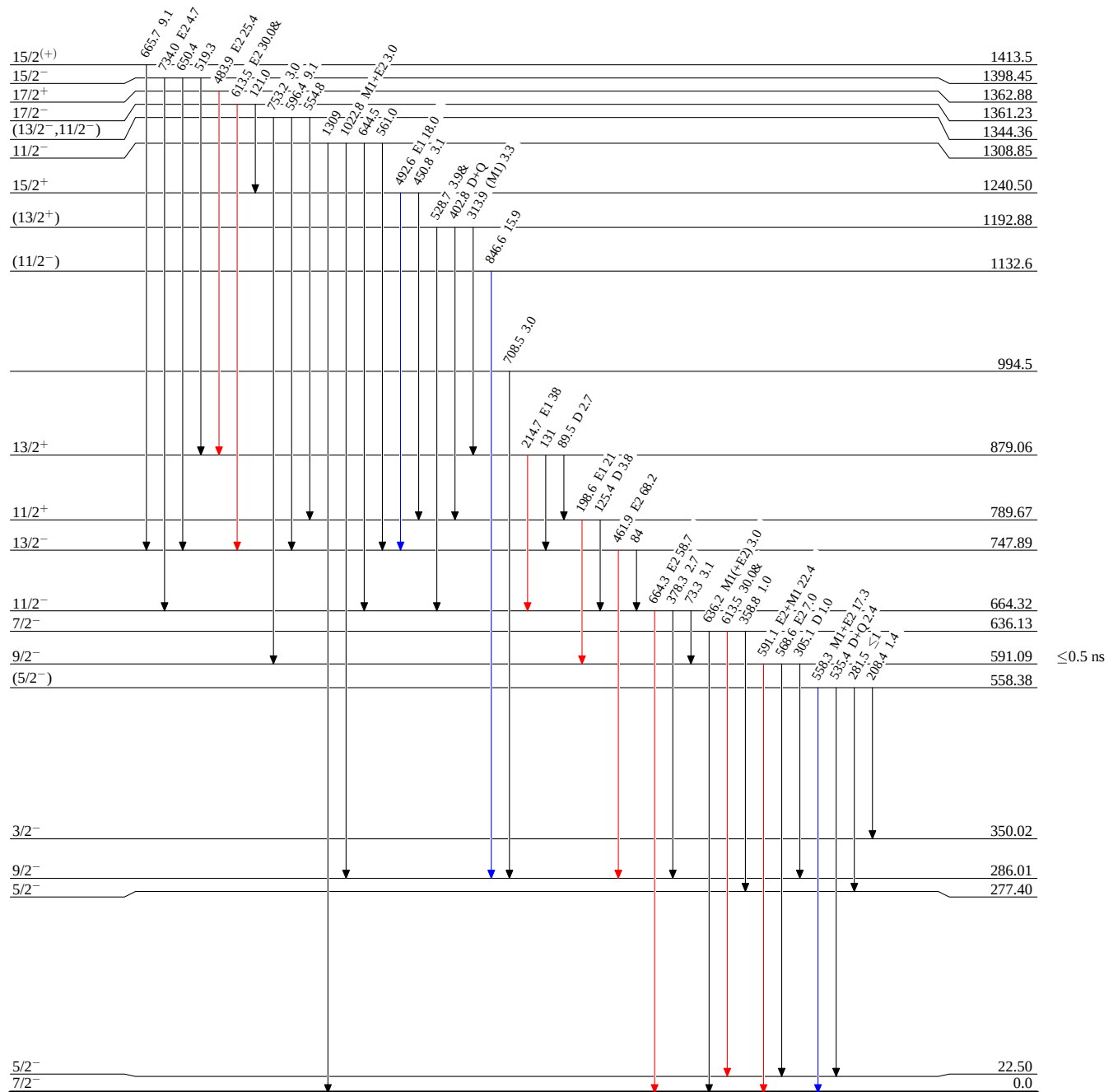
$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01

Level Scheme (continued)

Legend

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

$\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$

 $^{149}_{62}\text{Sm}_{87}$

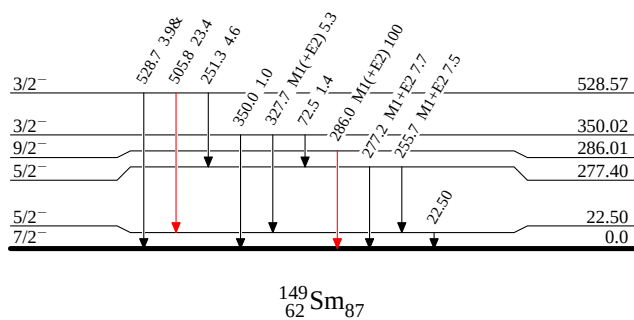
$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01

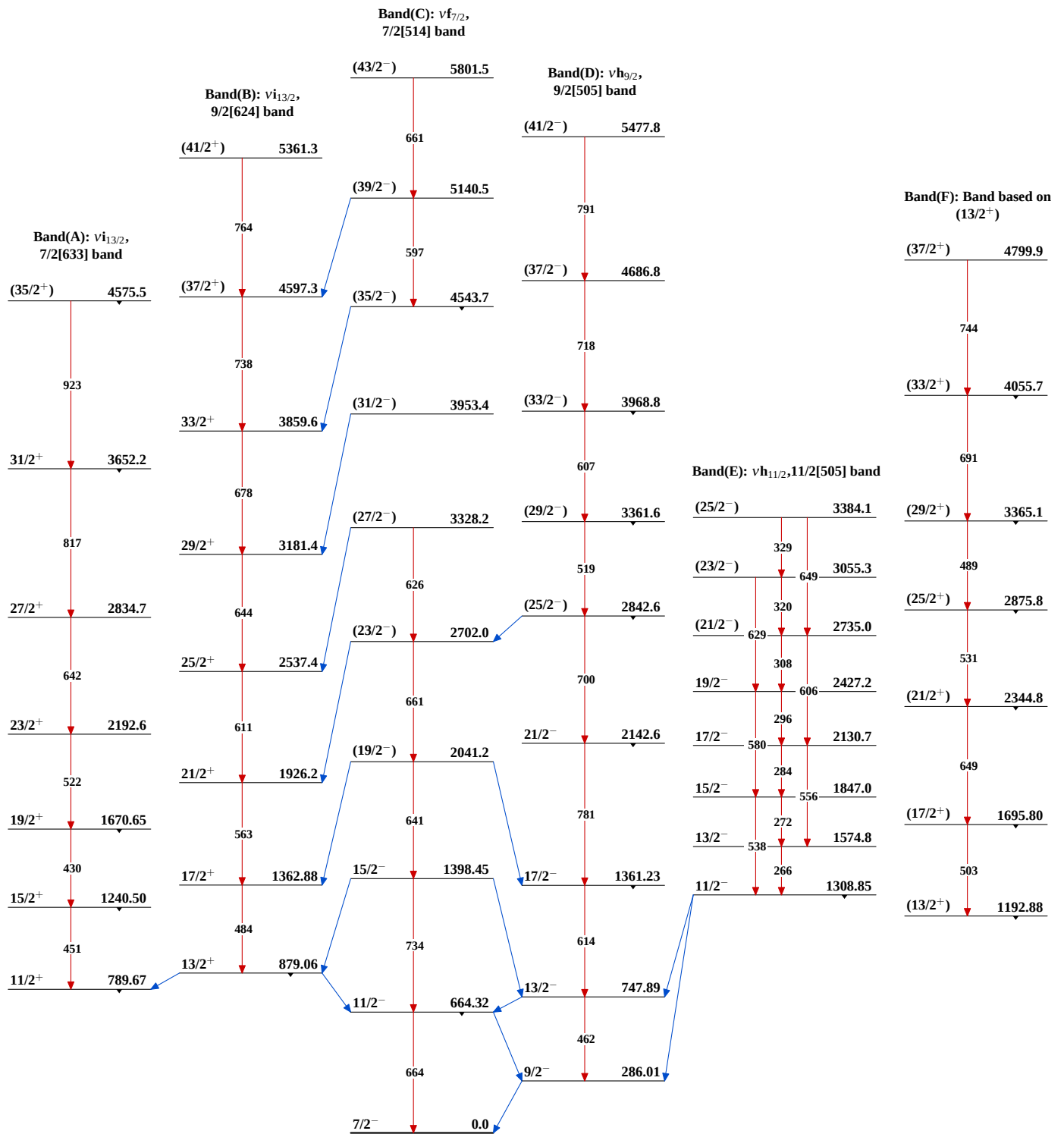
Level Scheme (continued)

Legend

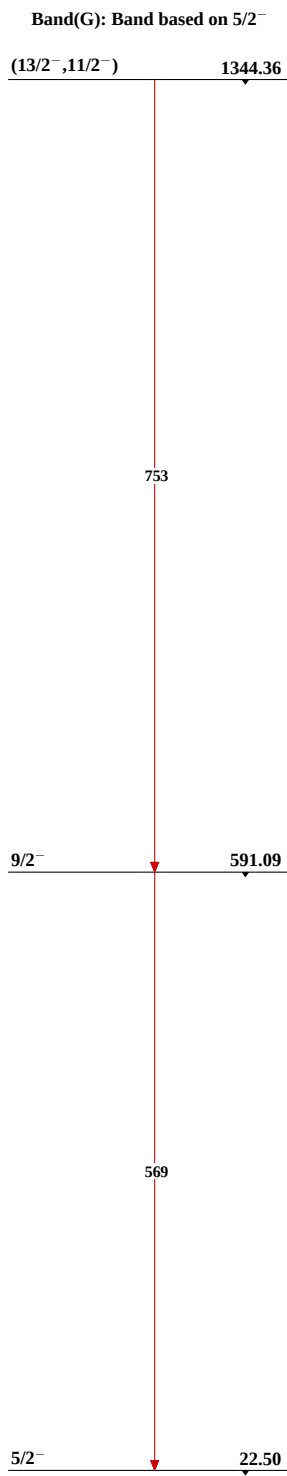
 Intensities: Relative I_γ
 & Multiply placed: undivided intensity given

$\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$



$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01

$^{148}\text{Nd}(\alpha,3n\gamma), ^{150}\text{Nd}(^3\text{He},4n\gamma)$ 1979Ha19,1990UrZR,1994Ba01 (continued)



$^{149}_{62}\text{Sm}_{87}$

 $^{148}\text{Sm}(\text{n},\gamma) \text{E=thermal}$ **1982Ba15**

1982Ba15: E=thermal. Measured E_γ , I_γ .

1976SmZP, **1970SmZZ**: no details are available.

S(n)=5871.1 9 (**2021Wa16**). Other: 5850.8 6 (**1982Ba15**).

$\gamma(^{149}\text{Sm})$

None of the reported γ rays in **1982Ba15** could be assigned in a level scheme.

<u>E_γ</u>	<u>I_γ</u>
^x 4870.1 12	45 2
^x 4914.2 21	56 20
^x 4968.9 12	33 7
^x 5281.7 8	25 2
^x 5412.3 7	33 2
^x 5491.5 5	20 2
^x 5532.7 4	100 2
^x 5617.1 7	20 2
^x 5725.5 6	14 2

^x γ ray not placed in level scheme.

$^{148}\text{Sm}(\text{n},\gamma),(\text{n},\text{n}):$ resonances [1993Ge07,2018MuZZ](#)

[2018MuZZ](#): compilation and evaluation of neutron resonances.

[1993Ge07](#): measured neutron resonances, Γ_n , Γ_γ using multisectional scintillation detector, and IBR-30 pulse booster at neutron physics laboratory of JINR, Dubna.

Others:

[1999Du16](#): $E(\text{n})=10\text{-}90$, 550 keV. Measured cross sections.

[2002Le26](#): $E(\text{n})\approx 0\text{-}30$ eV; resonance parameters.

[1993Wi12](#): $E(\text{n})=3\text{-}225$ keV: measured s.

[1976SmZP](#), [1970SmZZ](#): no details are available.

All data are from [2018MuZZ](#).

 ^{149}Sm Levels

$S(\text{n})(^{149}\text{Sm})=5871.1$ keV 9 ([2021Wa16](#)).

E(level)	$J^\pi^\dagger$	L	Comments
$S(\text{n})-0.0110?$ 1	$1/2^+$	0	Fictitious resonance.
$S(\text{n})+0.0949$ 1	$1/2^+$	0	$\Gamma_n=385$ meV 35.
$S(\text{n})+0.1402$ 6	$1/2^+$	0	$\Gamma_n=34$ meV 4, $\Gamma_\gamma=43$ meV 9.
$S(\text{n})+0.1844$ 1	$1/2^+$	0	$\Gamma_n=780$ meV 70.
$S(\text{n})+0.2882$ 1	$1/2^+$	0	$\Gamma_n=410$ meV 40, $\Gamma_\gamma=51$ meV 10.
$S(\text{n})+0.4220$ 2	$1/2^+$	0	$\Gamma_n=208$ meV 20, $\Gamma_\gamma=43$ meV 7.
$S(\text{n})+0.5135$ 2	$1/2^+$	0	$\Gamma_n=735$ meV 70, $\Gamma_\gamma=41$ meV 10.
$S(\text{n})+0.5574$ 3	$1/2^+$	0	$\Gamma_n=92$ meV 15, $\Gamma_\gamma=42$ meV 10.
$S(\text{n})+0.6229$ 3	$1/2^+$	0	$\Gamma_n=580$ meV 50, $\Gamma_\gamma=40$ meV 10.
$S(\text{n})+0.8831$ 4	$1/2^+$	0	$\Gamma_n=1.05$ eV 15, $\Gamma_\gamma=53$ meV 20.
$S(\text{n})+0.9096$ 5	$1/2^+$	0	$\Gamma_n=2.40$ eV 30.
$S(\text{n})+1.010$ 1			
$S(\text{n})+1.157$ 1			
$S(\text{n})+1.180$ 1			
$S(\text{n})+1.385$ 2			
$S(\text{n})+1.478$ 2			
$S(\text{n})+1.699$ 2			
$S(\text{n})+1.960$ 2			
$S(\text{n})+2.053$ 2			
$S(\text{n})+2.415$ 4			
$S(\text{n})+2.955$ 6			

† Parity from $L=0$ (s-wave) resonance.

$^{148}\text{Sm}(\text{d},\text{p})$ 1965Ke09

1965Ke09: E(d)=12 MeV from the Florida State University tandem. Measured proton spectra with a resolution of 0.1%. L-transfers based on cross section measurements at three angles.

Others:

1967Ve04: E(d)=12 MeV from the Niels Bohr Institute tandem. Measured proton spectra with FWHM=15 keV. Level reported up to 1940 keV, and σ data measured at two angles.

1967Jo04: E(d)=9.6 MeV from the Florida State University tandem. Authors refer to their unpublished work, and list seven levels: 0 with L=3, 380 with L=(1+3), 530 with L=1, 710 with L=1, 1030 with L=(1), 1170 with L=3 and 1490 with L=(1).

All data are from 1965Ke09, unless otherwise stated.

 ^{149}Sm Levels

Cross section data from 1967Ve04 under comments are measured at 60°.

E(level)	L [‡]	Relative intensity at 65°	Comments
0	(3,4)	1.00	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=1000$ (1967Ve04) for 0+20.
20 8		0.01	E(level): 20 (1967Ve04).
280 2		0.38 ^{&}	E(level): 275 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=300$ (1967Ve04) for 275+288.
285 2	(≥ 3) [#]		E(level): 285 (1967Ve04).
350 2	(≤ 2)	0.23	E(level): 343 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=230$ (1967Ve04).
398 3	(≤ 2)	0.19	E(level): 393 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=170$ (1967Ve04).
535 3	(≤ 2)	1.31	E(level): 525 (1967Ve04).
566 3		0.04	E(level): 555 (1967Ve04).
588 [†] 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=13$ (1967Ve04).
640 3	(3,4)	0.03	E(level): 631 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=31$ (1967Ve04).
675 3	(≥ 3)	0.03	E(level): 660 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=13$ (1967Ve04).
700 4		0.52 ^a	E(level): 693 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=470$ (1967Ve04) for 693+710.
712 6			E(level): 710 (1967Ve04).
842 6	(≥ 3)	0.01	E(level): 882 (1967Ve04).
881 5	(≥ 3)	0.16	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=110$ (1967Ve04).
928 7		0.05	E(level): 924 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=49$ (1967Ve04).
956 5	(3,4)	0.09	E(level): 953 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=70$ (1967Ve04).
1013 6	(≤ 2)	0.31	E(level): 1010 (1967Ve04).
1084 8		0.07	E(level): 1080 (1967Ve04).
1125 8		0.15	E(level): 1124 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=120$ (1967Ve04).
1158 6		0.34	E(level): 1152 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=310$ (1967Ve04).
1190 8	(3,4)	0.12	E(level): 1184 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=83$ (1967Ve04).
1280 10	(3,4)	0.01	E(level): 1270 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=8$ (1967Ve04).
1316 7	(3,4)	0.16	E(level): 1305 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=150$ (1967Ve04).
1351 [†] 10			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=19$ (1967Ve04).
1385 10	(3,4)	0.07	E(level): 1365 (1967Ve04).
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=31$ (1967Ve04).

Continued on next page (footnotes at end of table)

$^{148}\text{Sm}(\text{d},\text{p})$ **1965Ke09 (continued)** ^{149}Sm Levels (continued)

E(level)	L^{π}	Relative intensity at 65°	Comments
1465 6		0.39	E(level): 1450 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=370$ (1967Ve04) for 1450+1470.
1484 9	(3,4)		E(level): 1470 (1967Ve04).
1556 6	(≥ 3)	0.10	E(level): 1549 (1967Ve04).
1579 8	(3,4)	0.08	E(level): 1569 (1967Ve04).
1621 9		0.03	
1662 9		0.24	E(level): 1657 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=150$ (1967Ve04) for 1657+1670.
1678 15			E(level): 1670 (1967Ve04).
1705 13		0.03	E(level): 1706 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})\approx 15$ (1967Ve04).
1752 10		0.36	E(level): 1748 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=250$ (1967Ve04).
1782 10		0.17	E(level): 1782 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=120$ (1967Ve04).
1816 10		0.28	E(level): 1816 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=190$ (1967Ve04).
1881 13	(≤ 2)	0.09	E(level): 1885 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})\approx 50$ (1967Ve04).
1910 15		0.02	
1943 10		0.27	E(level): 1940 (1967Ve04). $d\sigma/d\Omega(\mu\text{b}/\text{sr})=200$ (1967Ve04).
1975 12		0.10	
1999 12	(≥ 3)	0.10	
2024 12		0.09	
2059 10		0.24	
2101 10		0.23	
2137 12		0.10	
2159 15		0.04	
2191 15		0.06	
2210 10		0.14	
2242 10		0.19	
2264 15		0.09	
2280 15		0.07	
2295 15		0.07	
2332 15		0.06	
2358 13		0.11	
2377 15		0.05	
2387 10		0.19	
2418 11		0.10	
2443 11		0.15	
2494 11			
2508 11			
2534 11		0.17	
2568 11		0.16	
2590 11		0.26	
2622 11		0.12	
2640 11		0.18	
2671 11		0.14	
2711 11		0.12	
2723 15		0.09	
2737 12		0.14	
2762 12		0.24	
2797 12		0.19	
2830 12		0.13	
2858 12			
2891 12			

Continued on next page (footnotes at end of table)

$^{148}\text{Sm}(\text{d,p})$ **1965Ke09 (continued)** ^{149}Sm Levels (continued)

E(level)	Relative intensity at 65°	E(level)	Relative intensity at 65°	E(level)	Relative intensity at 65°
2923 12	0.13	3303 13	0.42	3595 15	0.12
2949 12	0.22	3324 13	0.18	3623 15	
2968 12	0.18	3377 13	0.17	3636@ 15	
2995 12	0.18	3393 14	0.17	3661 15	
3015 12	0.24	3419 14	0.10	3687 15	
3072 12	0.13	3436 14	0.20	3700 15	
3094 12	0.19	3461 14	0.15	3734 15	
3160 12	0.10	3478 14	0.13	3765 15	
3194 12	0.13	3533 14	0.21	3806 15	
3218 12	0.16	3545 15	0.20		
3257 13	2.71	3575 15	0.22		

† From **1967Ve04** only.

‡ Tentative values based on three-angle data only. These L-values were not used for J^π assignments in the Adopted Levels.

For 280, 285 levels.

@ Authors give 3336. From authors' listed Q values, one gets 3636. Based on authors' spectrum, the latter value is correct.

& For 280+285.

^a For 700+712.

 $^{148}\text{Sm}(\alpha, ^3\text{He})$ [1987DuZX](#)

[1987DuZX](#): $E(\alpha)=100$ MeV from the K500 cyclotron at NSCL. Measured $\sigma(\theta)$, DWBA calculations. $\text{FWHM}\approx 200$ keV. The $\sigma(\theta)$ data measured for each of the 250 keV bins in the range 2 MeV to 14 MeV excitation energy and DWBA fits made to these data using $L=1, 3, 4, 6$ and 7 .

 ^{149}Sm Levels

$E(\text{level})^\dagger$	$L^\#$	$C^2S^\ddagger$
0	3	0.25
290	5	0.38
910	5+6	0.46,0.13
1410	1+5	0.76,0.38
1890	3+6	0.24,0.11

[†] The excitation energy range between 2 and 14 MeV contains many unresolved states of $L=1,3,4,6,7$ as shown by $\sigma(\theta)$ data in this region.

[‡] Cross sections are also listed by [1987DuZX](#).

[#] From comparison of $\sigma(\theta)$ data with DWBA calculations. Active neutron orbitals are $2f_{7/2}$ and $2f_{5/2}$ for $L=3$; $1h_{9/2}$ for $L=5$; $1i_{13/2}$ for $L=6$; and $3p_{3/2}$ and $3p_{1/2}$ for $L=1$.

 $^{148}\text{Sm}(^{16}\text{O}, ^{15}\text{O}), (^{13}\text{C}, ^{12}\text{C})$ **1984BoZZ**

Includes ($^{12}\text{C}, ^{11}\text{C}$).

1984BoZZ: $E(^{16}\text{O})=120$ MeV, $E(^{13}\text{C})=90$ MeV, $E(^{12}\text{C})=90$ MeV at KVI.

^{149}Sm Levels

<u>$E(\text{level})^\dagger$</u>	<u>$J^\pi^\dagger$</u>	<u>Comments</u>
0	$7/2^-$	
286	$9/2^-$	E(level): seen in ($^{16}\text{O}, ^{15}\text{O}$) and ($^{12}\text{C}, ^{11}\text{C}$) reactions.
529	$3/2^-$	E(level): seen in ($^{13}\text{C}, ^{12}\text{C}$) reaction only.
879	$13/2^+$	E(level): seen in ($^{16}\text{O}, ^{15}\text{O}$) and ($^{12}\text{C}, ^{11}\text{C}$) reactions.

† From the Adopted Levels.

$^{149}\text{Sm}(\gamma,\gamma)$:Mossbauer 2000Ki15,2001Ro39,1972Ei05

[2001Ro39](#): coherent Nuclear resonance scattering of synchrotron radiation. Application of ‘nuclear lighthouse effect (NLE)’ which provides a direct mapping of the nuclear response time to an angular scale via resonant scattering from rotating samples. Sample of $^{149}\text{Sm}_2\text{O}_3$ rotating at 15 kHz. Measured time spectrum of the delayed radiation scattered from the Sm sample. Deduced energy of the transition.

[2000Ki15](#): nuclear resonance scattering of synchrotron radiation.

[1972Ei05](#), [1964Al19](#), [1962Jh04](#): measured Mossbauer spectrum.

[2012Ts01](#): measured nuclear resonant inelastic spectra. Deduced a dip structure, and phonon excitations in ^{149}Sm .

[2006Ts03](#): measured Mossbauer spectra in several compounds of ^{149}Sm .

Others: [1976Co14](#) (isomer shifts), [1962Al13](#).

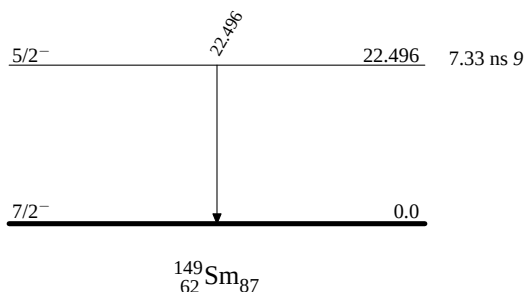
 ^{149}Sm Levels

<u>E(level)</u>	<u>J^π[†]</u>	<u>$T_{1/2}$[†]</u>
0.0	$7/2^-$	
22.496 4	$5/2^-$	7.33 ns 9

[†] From the Adopted Levels.

 $\gamma(^{149}\text{Sm})$

<u>E_γ</u>	<u>$E_i(\text{level})$</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
22.496 4	22.496	$5/2^-$	0.0	$7/2^-$	E_γ : from 2001Ro39 . Other: 22.496 22 (2000Ki15).

 $^{149}\text{Sm}(\gamma,\gamma)$:Mossbauer 2000Ki15,2001Ro39,1972Ei05Level Scheme

$^{149}\text{Sm}(\text{d},\text{d}')$ [1967Ve04](#)

$J^\pi(^{149}\text{Sm g.s.})=7/2^-$.

[1967Ve04](#): E(d)=12 MeV from the Niels Bohr Institute tandem. Measured deuteron spectra at three angles. FWHM=10 keV.

Excitation multiplicities deduced from three-angle data. Authors assign parities to levels based on this information. Evaluators have not used these assignments in the Adopted Levels because of discrepancy in L-values for some of the levels such as 696, 785 and 1046 (see the Adopted Levels).

 ^{149}Sm Levels

<u>E(level)[†]</u>	<u>E(level)[†]</u>	<u>E(level)[†]</u>	<u>E(level)[†]</u>
0	1035 ¹⁰	1461 [#] ¹⁰	1837 ¹⁰
350 [‡] ⁴	1046 [‡] ¹⁰	1482 [#] ¹⁰	1857 ¹⁰
526 [‡] ⁴	1072 [‡] ¹⁰	1505 [#] ¹⁰	1903 ¹⁰
590 [‡] ⁴	1112 [‡] ¹⁰	1533 ¹⁰	1924 ¹⁰
633 [‡] ⁴	1121 [#] ¹⁰	1543 ¹⁰	1956 ¹⁰
665 [‡] ⁴	1182 [#] ¹⁰	1573 [#] ¹⁰	1982 ¹⁰
696 [#] ⁴	1195 [#] ¹⁰	1609 ¹⁰	2056 ¹⁰
709 [#] ⁴	1235 [‡] ¹⁰	1632 [‡] ¹⁰	2083 ¹⁰
785 [#] ⁴	1279 [‡] ¹⁰	1654 ¹⁰	2115 ¹⁰
828 [#] ⁴	1300 [‡] ¹⁰	1667 ¹⁰	2139 ¹⁰
876 [#] ⁴	1330 [#] ¹⁰	1690 ¹⁰	2176 ¹⁰
914 ⁴	1338 [#] ¹⁰	1731 ¹⁰	2275 ¹⁰
948 [‡] ⁴	1370 [#] ¹⁰	1749 ¹⁰	2301 ¹⁰
988 [#] ⁴	1394 [#] ¹⁰	1818 ¹⁰	

[†] Uncertainties assigned based on a general statement by [1967Ve04](#), that these are 4 keV near the ground state and up to 10 keV at the highest energies.

[‡] Negative parity deduced from excitation multiplicity of 2.

[#] Positive parity deduced from excitation multiplicity of 3.

$^{150}\text{Sm}(n,2n\gamma)$ 2010Da13

2010Da13: Target: 1550 mg/cm² of Sm₂O₃ in the form of disks, enriched to 95.6% in ^{150}Sm . E(n)=1-35 MeV (LANSCE facility). The energetic neutrons were produced by bombarding a natural W target with an 800-MeV pulsed proton beam from the LANSCE Linac. The prompt γ -rays were detected using the Compton suppressed GEANIE array consisting of 11 planar Ge detectors and fifteen 25% coaxial HPGe detectors. Incident neutron energies were determined by the time-of-flight technique. Measured E γ , excitation functions and γ -ray yields; deduced partial γ -ray cross sections as a function of neutron energy, and total cross sections for E(n)=8.66-33.11 MeV. Comparisons of measured cross sections with Hauser-Feshbach type calculations (GNASH-FKK reaction model code), ENDF/B-VII evaluations, and earlier measurements.

Partial γ -ray cross section as function of neutron energy for 550.3 γ , in ^{148}Sm , and total cross section in $^{150}\text{Sm}(n,3n)$ reaction were also measured in this work.

The level scheme in figure 1 of **2010Da13** is consistent with that in the Adopted dataset, except for the placement of a 504 transition from 790 level, which is newly assigned in **2010Da13**.

 ^{149}Sm Levels

E(level) [†]	J ^π [‡]	Comments
0	7/2 ⁻	
22.9 8	5/2 ⁻	
277.1 5	5/2 ⁻	
285.8 5	9/2 ⁻	
350.0	3/2 ⁻	E(level): level from the Adopted Levels.
558.4 7	5/2 ⁻	
590.7 7	9/2 ⁻	
636.4 5	7/2 ⁻	
664.0 5	11/2 ⁻	
747.7 7	13/2 ⁻	
789.4 8	11/2 ⁺	
878.8 7	13/2 ⁺	
1239.4 13	(15/2) ⁺	
1362.8 13	17/2 ⁺	

[†] From least-squares fit to E γ data, $\Delta E\gamma=0.5$ keV assumed when E γ stated to tenth of a keV, 1 keV otherwise.

[‡] From the Adopted Levels.

 $\gamma(^{149}\text{Sm})$

E γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Partial γ -ray σ (mb) [@]
198.6	789.4	11/2 ⁺	590.7	9/2 ⁻	95 10
214.8	878.8	13/2 ⁺	664.0	11/2 ⁻	90 10
254 [#]	277.1	5/2 ⁻	22.9	5/2 ⁻	
277.1	277.1	5/2 ⁻	0	7/2 ⁻	85 10
281.3	558.4	5/2 ⁻	277.1	5/2 ⁻	10 2
285.9	285.8	9/2 ⁻	0	7/2 ⁻	400 40
327 [#]	350.0	3/2 ⁻	22.9	5/2 ⁻	
350 [#]	350.0	3/2 ⁻	0	7/2 ⁻	
450 [‡]	1239.4	(15/2) ⁺	789.4	11/2 ⁺	
461.9	747.7	13/2 ⁻	285.8	9/2 ⁻	195 20
484 [‡]	1362.8	17/2 ⁺	878.8	13/2 ⁺	
504 [‡]	789.4	11/2 ⁺	285.8	9/2 ⁻	
568 [‡]	590.7	9/2 ⁻	22.9	5/2 ⁻	
590 [#]	590.7	9/2 ⁻	0	7/2 ⁻	

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¹⁵⁰Sm(n,2nγ) **2010Da13 (continued)**
γ(¹⁴⁹Sm) (continued)

<u>E_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Partial γ-ray σ (mb)[@]</u>	<u>Comments</u>
636.4	636.4	7/2 ⁻	0	7/2 ⁻	25 3	E _γ : γ from Fig. 3 and text in 2010Da13 , not shown in level-scheme Fig. 1 of 2010Da13 .
664.0	664.0	11/2 ⁻	0	7/2 ⁻	245 25	

[†] From excitation functions figures 2 and 3 and text in [2010Da13](#), unless otherwise stated. These are consistent within 0.1 keV to those in adopted gamma rays.

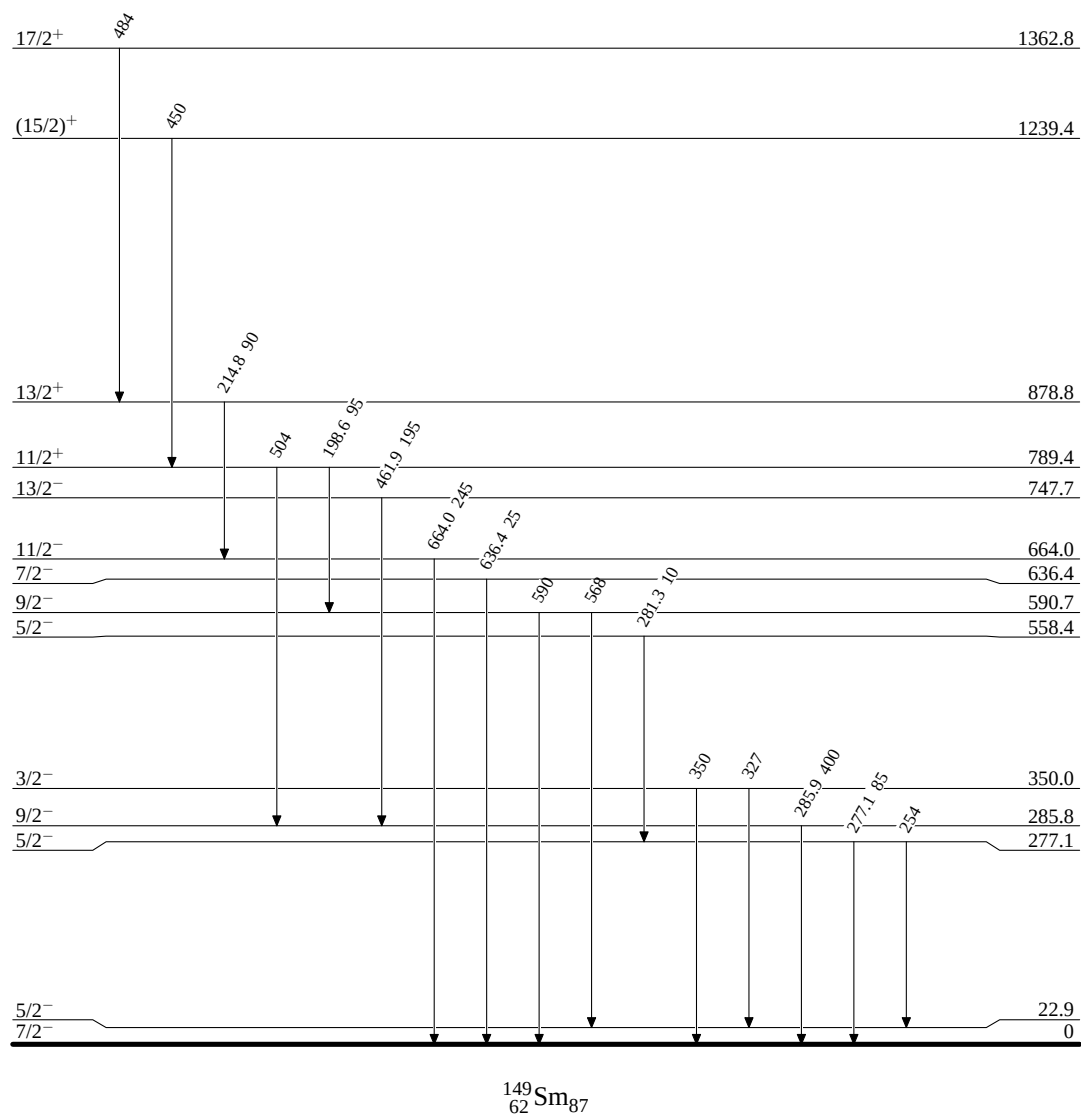
[‡] From level-scheme Fig. 1 in [2010Da13](#).

From text in section 4.2 of [2010Da13](#), for which cross section has been measured. This γ ray is not shown in level-scheme figure 1 of [2010Da13](#).

@ Partial γ-ray cross section at E(n)=15.04 MeV read by the compilers from excitation function figures 2 and 3 of [2010Da13](#). Correction for internal conversion is included by [2010Da13](#). Consult authors' Figs. 2 and 3 for cross section data at 16 other neutron energies from ≈8.5 MeV to 35 MeV.

$^{150}\text{Sm}(n,2n\gamma)$ 2010Da13

Level Scheme



$^{150}\text{Sm}(\text{p,d})$ **1983Ga07**

Includes $^{150}\text{Sm}(\text{p,d}\gamma)$ from **2019Na10**.

1983Ga07: E=42 MeV from the K50 Michigan State University cyclotron. Measured $\sigma(\theta)$ from 7° to 55° (lab system) in steps of 5° . FWHM=25-35 keV. Uncertainty in absolute σ is 10%. DWBA analysis. L-transfers and nuclear structure factors deduced.

1969Ya08: E=55 MeV from the INS Tokyo synchrocyclotron. FWHM $\approx$ 80 keV. $\sigma(\theta)$ from 5° to 50° (lab) in steps of 5° .

Uncertainty in absolute σ is 15%.

1974GrYX (thesis): E=20 MeV. $\sigma(\theta)$ data from 5° to 170° . FWHM $\approx$ 35 keV. DWBA analysis. L-transfers deduced.

2019Na10: $^{150}\text{Sm}(\text{p,d}\gamma)$, E=28 MeV; measured deuteron spectra, $E\gamma$, $I\gamma$, and $\text{d}\gamma$ -coin using the Hyperion array with ΔE -E telescope and HPGe clover detector array at the Cyclotron Institute of Texas A&M University. Deduced nuclear level densities (NLDs) and γ -strength function (γSF) using the Oslo method, total B(M1) strength, parameters for giant resonances.

All data are from **1983Ga07** unless otherwise stated.

 ^{149}Sm Levels

E(level) [†]	J^π &	L [#]	C ² S@	Comments
0	$7/2^-$	3	1.3	L=3, S=3.5 (1969Ya08).
281 [‡] 5	$9/2^-$ & $5/2^-$	5+3	0.43,0.25	L: 50%(L=5)+50%(L=3). E(level): corresponds to 277 and 286 levels. E=280 20, L=3, S=1.4 (1969Ya08).
348 5	$3/2^-$	1	0.20	
392 ^a 10		(1)		
531 [‡] 5	$3/2^-$ & $5/2^-$	1+3	0.09,0.13	L: 50%(L=1)+50%(L=3). E(level): corresponds to 528 and 558 levels. 1974GrYX give energy=560 and L=(3). E=540 20, L=3, S=1.1 (1969Ya08).
583 ^a 10		(1)		L: inconsistent with $J^\pi=9/2^-$ for 591 level in the Adopted Levels.
636 5	$7/2^-$	3	0.35	E=640 20, L=3, S=0.48 (1969Ya08).
665 ^a 10		(2)		E(level),L: not clear whether this level corresponds to a tentative 659 level or the 664, $11/2^-$ level. L=2 is, however, inconsistent with the latter assignment.
694 5	$(3/2)^-$	1	0.13	
777 ^a 10		(0)		E(level),L: from other studies, known levels are 785, $5/2^-$ and 790, $11/2^+$. L=0 is not consistent with either of these.
874 [‡] 5	$13/2^+$ & $(1/2^-)$	6+(1)	0.72,0.07	L: 60%(L=6)+40%(L=1). L=(5) from 1969Ya08 for an 890 20 level is inconsistent with $J^\pi=13/2^+$. C ² S: for $J^\pi=13/2^+$ and $1/2^-$. E(level): 1969Ya08 give 890 20 with L=5, and S=4.1, whereas 1983Ga07 give 847 5 with L=6(+1). Energy quoted by 1983Ga07 seems erroneous. From spectrum in 1983Ga07 , evaluators estimate the peak at 874 and not at 847. The two components with L=6 and L=(1) most likely correspond to 878.6 and 881.9 levels (see Adopted Levels). The L=5 assignment by 1969Ya08 is inconsistent with L=6 from (d,t) and multipolarity assignment from ce data in in-beam γ -ray study.
926 ^a 10		(2)		
968 ^a 10		(0)		
1009 ^a 10		(1)		
1038 10	$(3/2)^+$	2	0.87	E=1040 20, L=2, S=2.3 (1969Ya08).
1181 [‡] 10	$1/2^+$ & $(3/2^+)$	0+2	0.85,0.74	E=1190 20, L=0+2, S=2.1, 1.1 (1969Ya08).
1226 ^a 10				
1285 10	$(11/2)^-$	5	1.60	E(level),L: identified with $\nu h_{11/2}$ level at 1308.8 from in-beam γ -ray. 1969Ya08 give E(level)=1310 and L=5, S=6.5, which agrees with $11/2^-$ assignment. L=0 assignment for a level at 1311 (1974GrYX) seems incorrect.
1352 10	$5/2^-$	(3)	0.07	L: 1974GrYX give L=0 for a level at 1344.
1376 ^a 10		(0)		
1408 10	$(5/2)^-$	3	0.12	
1456 10	$(3/2,5/2)^+$	2	0.12	L: 1974GrYX give L=0 for a level at 1439. E=1480 20, L=2, S=0.70 (1969Ya08).

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$^{150}\text{Sm}(\text{p,d})$ **1983Ga07 (continued)** ^{149}Sm Levels (continued)

E(level) [†]	J ^π &	L [#]	C ² S [@]	Comments
1480 ^a ₁₀		(1)		
1538 ^a ₁₀		(0)		
1579 ₁₀	(3/2,5/2) ⁺	2	0.05	
1616 ₁₀	(5/2) ⁻	3	0.07	E=1640 20, L=(2), S=0.35 (1969Ya08).
1673 ₁₀				
1767 [‡] ₁₀	(7/2 ⁺)&(5/2 ⁺)	4+2	0.09,0.04	L: 40%(L=4)+60%(L=2). E=1780 20, L=2, S=0.33 (1969Ya08).
1880 ₁₀	(7/2) ⁺	4	0.11	
1946 [‡] ₁₀	(7/2 ⁺)&(5/2 ⁺)	4+2	0.09,0.04	L: 80%(L=4)+20%(L=2).
2021 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.16,0.14	L: 70%(L=2)+30%(L=5). L=0 for a 2047 level (1974GrYX) seems suspect. E=2040 20, L=2, S=0.79 (1969Ya08).
2174 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.13,0.25	L: 70%(L=2)+30%(L=5).
2211 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.16,0.31	L: 70%(L=2)+30%(L=5). E=2200 20, L=(2), S=1.1 (1969Ya08).
2283 [‡] ₁₅	(5/2 ⁺)&(7/2 ⁺)	2+4	0.11,0.22	L: 60%(L=2)+40%(L=4).
2422 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.10,0.21	L: 50%(L=2)+50%(L=5).
2459 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.17,0.34	L: 50%(L=2)+50%(L=5). E=2480 20, L=2, S=1.2 (1969Ya08).
2580 ₁₅	(5/2) ⁺	2	0.26	E=2590 20, L=2, S=1.1 (1969Ya08).
2701 [‡] ₁₅	(5/2 ⁺)&(11/2 ⁻)	2+5	0.08,0.07	
3360 ^b				E(level): centroid of a wide bump between 2800 and 4000. $\sigma(\theta)$ shows L=2+5. C ² S=1.6. A similar structure observed at 3600 in (³ He, α).
5600 ^b				E(level): centroid of a bump between 4000 and 7200. $\sigma(\theta)$ shows L=2+4. C ² S=0.9.

[†] From 1983Ga07, unless otherwise stated.[‡] Unresolved doublet inferred from mixed L-transfers (1983Ga07).[#] From 1983Ga07, unless otherwise stated. In several cases $\sigma(\theta)$ data (1983Ga07) were fitted with mixed L-transfers, whereas 1969Ya08 and 1974GrYX generally fitted to a single L-transfer. For mixed L-transfers, contribution from each L-value used in fitting $\sigma(\theta)$ data is given under comments.[@] C²S values defined as $\sigma(\text{exp})/(N \times \sigma(\text{DWUCK})/(2J+1))$, where N=23 (1983Ga07). 1974GrYX do not give S-factors. 1969Ya08 give S-factors but the definition of S in their work is unclear.[&] As proposed by 1983Ga07 with the assumption of the following shell-model orbitals for the transferred nucleon: p_{3/2} for L(n)=1; d_{3/2} (below ≈1.5 MeV excitation) and d_{5/2} (above ≈1.5 MeV excitation) for L(n)=2; f_{5/2} for L(n)=3; g_{7/2} for L(n)=4; h_{11/2} for L(n)=5. These assignments are consistent with those in Adopted Levels.^a Level from 1974GrYX only. Estimated uncertainty=10 keV. L(p,d) assignments treated questionable.^b Wide bumps in continuum region above 2800.

$^{150}\text{Sm}(\text{d,t})$ 1975Lo04,1967Ve04

1975Lo04: E(d)=12 MeV from the McMaster University tandem accelerator. Measured $\sigma(\theta)$ data from 6° to 90° at 13 angles.

Absolute σ accurate to 25%. DWBA analysis.

1967Ve04: E(d)=12 MeV from the Niels Bohr Institute tandem. Measured triton spectra and cross sections at 60° and 90° .

FWHM=10 keV. Energy uncertainty is stated as 4 keV near the ground state to 10 keV at the highest energies.

All data are from 1975Lo04 unless otherwise stated.

 ^{149}Sm Levels

Cross section data from 1975Lo04 are at 90° , and those from 1967Ve04 are at 60° .

E(level)	J^π	$L@$	$S^\#$	Comments
0	$7/2^-$	3	1.41	L: for unresolved doublet at 0 and 22. $d\sigma/d\Omega(\mu\text{b/sr})=343$ (1975Lo04), 650 (1967Ve04).
22 2	$5/2^-$		≈ 0.04	E(level): 20 (1967Ve04). L: see comment for g.s.
277 2	$5/2^-$	(3)		$d\sigma/d\Omega(\mu\text{b/sr})\approx 9$ (1975Lo04), ≈ 20 (1967Ve04). E(level): 275 (1967Ve04). S: 0.19 for $J^\pi=7/2^-$. $d\sigma/d\Omega(\mu\text{b/sr})\approx 42$ (1975Lo04), ≈ 60 (1967Ve04). E(level): 277 and 285 form an unresolved doublet. L: data consistent with L=3 for 277 level and L=5 for 285 level.
285 2	$9/2^-$	(5) [†]	0.67	E(level): 288 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})\approx 24$ (1975Lo04), ≈ 25 (1967Ve04). See comments for 277 level.
350 2	$3/2^-$	1	0.23	E(level): 351 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=144$ (1975Lo04), 280 (1967Ve04).
399 2		≤ 3		E(level): 396 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=13$ (1975Lo04), 27 (1967Ve04).
529 2	$3/2^-$	1	0.18	E(level): 529 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=99$ (1975Lo04), 180 (1967Ve04).
559 2	$5/2^-$	3	0.14	E(level): 559 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=25$ (1975Lo04), 35 (1967Ve04).
592 2				$d\sigma/d\Omega(\mu\text{b/sr})\approx 2$ (1975Lo04).
636 2	$7/2^-$	3	0.45	E(level): 637 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=83$ (1975Lo04), 108 (1967Ve04).
665 2	$11/2^-$	5,4	0.40	E(level): 661 (1967Ve04). S: for L=5. L=4 choice not consistent with adopted J^π . $d\sigma/d\Omega(\mu\text{b/sr})=15$ (1975Lo04), 9 (1967Ve04).
697 2	$(3/2)^-$	1,2	0.07	E(level): 697 (1967Ve04). S: for L=1. L=2 choice not consistent with adopted J^π . $d\sigma/d\Omega(\mu\text{b/sr})=35$ (1975Lo04), 53 (1967Ve04).
710 2		2,1	0.07	E(level): 709 (1967Ve04). S: for L=1, $J^\pi=3/2^-$. $d\sigma/d\Omega(\mu\text{b/sr})=35$ (1975Lo04), 59 (1967Ve04).
878 2	$13/2^+$	6 [†]	0.95	E(level): 877 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=10$ (1975Lo04), 7 (1967Ve04).
922 2		(2) [†]	0.18	E(level): 921 (1967Ve04). S: for $J^\pi=3/2^+$. $d\sigma/d\Omega(\mu\text{b/sr})=39$ (1975Lo04), 53 (1967Ve04).
967 2		$\leq 3^\dagger$		E(level): 965 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})\approx 8$ (1975Lo04), 11 (1967Ve04).
988 [‡] 10				E(level): 988 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=2$ (1967Ve04).
1011 2		$\leq 2^\dagger$		E(level): 1008 (1967Ve04). $d\sigma/d\Omega(\mu\text{b/sr})=20$ (1975Lo04), 46 (1967Ve04).

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$^{150}\text{Sm}(\text{d,t})$ **1975Lo04,1967Ve04 (continued)** ^{149}Sm Levels (continued)

E(level)	J^π &	L@	S#	Comments
1049 2	(3/2) ⁺	2	0.84	E(level): 1048 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=172$ (1975Lo04), 210 (1967Ve04).
1083 2		$\leq 3^\dagger$		E(level): 1080 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=6$ (1975Lo04), 8 (1967Ve04).
1117 $\ddagger$ 10				
1123 2		$\leq 3^\dagger$		E(level): 1122 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=5$ (1975Lo04), 6 for 1117+1122 (1967Ve04).
1154 2		3,2 †		E(level): 1151 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=12$ (1975Lo04), 16 (1967Ve04).
1195 2	1/2 ⁺	0	1.48	E(level): 1191 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=390$ (1975Lo04), 500 (1967Ve04).
1236 2				E(level): 1232 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=5$ (1975Lo04), 5 (1967Ve04).
1304 $\ddagger$ 10				$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=12$ (1967Ve04).
1311 2	11/2 ⁻	(5) †	1.89	E(level): 1309 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=42$ (1975Lo04), 12 (1967Ve04).
1353 2				E(level): 1347 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})\approx 2$ (1975Lo04), 3 (1967Ve04).
1379 2		(4,3) †		E(level): 1371 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=5$ (1975Lo04), 3 (1967Ve04).
1392 2				E(level): 1382 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=3$ (1975Lo04), 5 (1967Ve04).
1430 2		(2,1) †		E(level): 1422 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=15$ (1975Lo04), ≈ 11 (1967Ve04).
1442 2		$\leq 2^\dagger$		E(level): 1431 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=17$ (1975Lo04), ≈ 16 (1967Ve04).
1470 2				E(level): 1460 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=6$ (1975Lo04).
1483 2		(≤ 2) †		E(level): 1474 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=54$ (1975Lo04), 75 (1967Ve04).
1549 2				E(level): 1539 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=3$ (1975Lo04), ≈ 3 (1967Ve04).
1570 2		(5,4) †		$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=2$ (1975Lo04).
1586 2				$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=2$ (1975Lo04).
1617 2				E(level): 1606 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=8$ (1975Lo04), 7 (1967Ve04).
1641 2				E(level): 1630 (1967Ve04). $\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=7$ (1975Lo04), 7 (1967Ve04).
1656 2				$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=2$ (1975Lo04).
1671 2				$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=3$ (1975Lo04).
1698 $\ddagger$ 10				$\text{d}\sigma/\text{d}\Omega(\mu\text{b/sr})=2$ (1967Ve04).
1751 $\ddagger$ 10				
1771 $\ddagger$ 10				
1978 $\ddagger$ 10				
2029 $\ddagger$ 10				
2039 $\ddagger$ 10				

 † From $\sigma(\text{d,t})/\sigma(^3\text{He},\alpha)$. $\ddagger$ From 1967Ve04.

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$^{150}\text{Sm}(\text{d,t})$ [1975Lo04,1967Ve04](#) (continued)

^{149}Sm Levels (continued)

$\sigma(\text{exp})/(\text{N}\times\sigma(\text{DWBA}))$, where $\text{N}=3.0$.

@ From $\sigma(\theta)$, unless otherwise stated.

& From Adopted Levels.

¹⁵⁰Sm(³He,α) **1980Re05,1975Lo04**

1980Re05: E(³He)=24 MeV from the Niels Bohr Institute tandem. Measured $\sigma(\theta)$ at 12 angles from 7.5° to 77.5° (c.m. system). FWHM≈30 keV. Absolute cross sections accurate to 15%. DWBA analysis of $\sigma(\theta)$ data.

1975Lo04: E(³He)=24 MeV from the McMaster University tandem. Measured $\sigma(\theta)$ data at 2 angles. Absolute σ accurate to 25%. Ratios $\sigma(d,t)/\sigma(^3\text{He},\alpha)$ used to assign L-transfers.

Others: **1977Se04.** E=82 MeV. FWHM≈60-120 keV. Measurement of $\sigma(\theta)$ for a wide bump with centroid at 3.6 MeV. Authors deduce $h_{11/2}$ hole strength from the study of the continuum above 2 MeV.

2002Si09 (also **2001Si13**): E=45 MeV. Measured level density and strength functions in (³He,³He') and (³He,α) reactions.

¹⁴⁹Sm Levels

Cross sections from **1980Re05** are for an angle where the value is maximum, whereas those from **1975Lo04** are at 40°. Following levels from (d,t) are listed with $d\sigma/d\Omega < 1 \mu\text{b/sr}$ in (³He,α) by **1975Lo04**: 399, 697, 967, 1011, 1083 and 1123. These are not included in this dataset.

E(level) [†]	J ^π ^b	L [#]	S [@]	Comments
0 [‡]	7/2 ⁻	3	1.07	L,S: most likely for 0+22 levels. Other L=3, S=1.94 for 0+22 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=60$ (1980Re05), 46 (40°) (1975Lo04).
22 [‡]	5/2 ⁻			
282 5	9/2 ⁻	5	0.60	E(level): 280 10 (1980Re05), 282 5 (1975Lo04). L=5, S=1.02 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=45$ (1980Re05), 38 (40°) (1975Lo04).
351? ^{&} 5	3/2 ⁻	1,0	0.23	L: 1,0 from cross section ratio, but (d,t) gives L=1 (1975Lo04). S: for L=1, $J^\pi=3/2^-$ (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr}) < 1$ (40°) (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=9$ (1980Re05).
422 ^a 10				
530? ^{&} 5	3/2 ⁻	(1)	0.12	L=0 suggested from cross section ratio in Fig. 5 of 1975Lo04 , but L=1 in (d,t). S: for L=1, $J^\pi=3/2^-$ (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr}) < 1$ (40°) (1975Lo04).
556 5	5/2 ⁻	3	0.15	E(level): 546 10 (1980Re05), 558 5 (1975Lo04). L=2,3 from cross section ratio, but L=3 from (d,t); S=0.11 for L=3 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=7$ (1980Re05), ≈3 (40°) (1975Lo04).
589 5				E(level): 585 10 (1980Re05), 590 5 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=5$ (1980Re05).
636 5	7/2 ⁻	3	0.31	E(level): 635 10 (1980Re05), 636 5 (1975Lo04). L=2 suggested from cross section ratio, but L=3 in (d,t); S=0.33 for L=3(1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=21$ (1980Re05), 19 (40°) (1975Lo04).
664 5	11/2 ⁻	5	0.16	E(level): 663 10 (1980Re05), 664 5 (1975Lo04). L=4,5 from cross section ratio, but L=5 from (d,t); S=0.38 for L=5(1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=13$ (1980Re05), ≈6 (40°) (1975Lo04).
711? ^{&} 5		(1,2)		L: from cross section ratio (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr}) < 1$ (40°) (1975Lo04).
878 5	13/2 ⁺	6	0.77	E(level): 876 10 (1980Re05), 879 5 (1975Lo04). L=6 from cross section ratio, S=1.66 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=94$ (1980Re05), 94 (40°) (1975Lo04).
925 5		(2)	0.31	E(level): 925 10 (1980Re05), 925 5 (1975Lo04). L=2 from cross section ratio (1975Lo04). S: from 1975Lo04 for L=2. $d\sigma/d\Omega(\mu\text{b/sr})=9$ (1980Re05), 4 (40°) (1975Lo04).
993 5				E(level): 991 10 (1980Re05), 994 5 (1975Lo04). $d\sigma/d\Omega(\mu\text{b/sr})=5$ (1980Re05), 3 (40°) (1975Lo04).
1049 5	(3/2) ⁺	2	0.89	E(level): 1047 10 (1980Re05), 1050 5 (1975Lo04). L=2,1 from cross section ratio, but (d,t) gives L=2 (1975Lo04). S: 1.20 (1975Lo04) for L=2. $d\sigma/d\Omega(\mu\text{b/sr})=22$ (1980Re05), 24 (40°) (1975Lo04).

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$^{150}\text{Sm}(^3\text{He},\alpha)$ **1980Re05,1975Lo04 (continued)** ^{149}Sm Levels (continued)

E(level) [†]	J ^π ^b	L [#]	S [@]	Comments
1112 ^{&} 5				$d\sigma/d\Omega(\mu\text{b/sr})=2$ (40°) (1975Lo04).
1152 5		(2,3)		E(level): 1147 10 (1980Re05), 1153 5 (1975Lo04). L: from cross section ratio (1975Lo04).
				$d\sigma/d\Omega(\mu\text{b/sr})=6$ (1980Re05), 7 (40°) (1975Lo04).
1196 5	1/2 ⁺	(0)	2.10	E(level): 1186 10 (1980Re05), 1199 5 (1975Lo04). L: 1980Re05 state that $\sigma(\theta)$ distribution has poor match with L=0 DWBA distribution. Other: L=1,2 from cross section ratio in 1975Lo04, but L=0 from (d,t). S: 4.9 (1975Lo04) for L=0.
				$d\sigma/d\Omega(\mu\text{b/sr})=25$ (1980Re05), 22 (40°) (1975Lo04).
1242 5		(5)	0.15	E(level): 1236 10 (1980Re05), 1244 5 (1975Lo04).
				$d\sigma/d\Omega(\mu\text{b/sr})=19$ (1980Re05), 14 (40°) (1975Lo04).
1310 5	11/2 ⁻	5	1.2	E(level): 1307 10 (1980Re05), 1311 5 (1975Lo04). J ^π : cross section ratio suggests high-spin level (1975Lo04). S: 2.2 (1975Lo04) for L=5.
				$d\sigma/d\Omega(\mu\text{b/sr})=106$ (1980Re05), 81 (40°) (1975Lo04).
1375 ^{&} 5		(3,4)		L: from cross section ratio (1975Lo04).
				$d\sigma/d\Omega(\mu\text{b/sr})\leq 5$ (40°) (1975Lo04).
1419 ^{&} 5		(1,2)		L: from cross section ratio (1975Lo04).
				$d\sigma/d\Omega(\mu\text{b/sr})\approx 2$ (40°) (1975Lo04).
1442 ^{&} 5				L=1 from cross section ratio (1975Lo04).
1474 5		(5)		E(level): 1464 10 (1980Re05), 1477 5 (1975Lo04). L: from $\sigma(\theta)$ in Fig. 5 of 1980Re05. Other: 0,1,2 (1975Lo04) from cross section ratio.
				$d\sigma/d\Omega(\mu\text{b/sr})=10$ (1980Re05), ≈ 6 (40°) (1975Lo04).
1572 5		(4,5)		E(level): 1575 10 (1980Re05), 1571 5 (1975Lo04). L: from cross section ratio (1975Lo04).
				$d\sigma/d\Omega(\mu\text{b/sr})=9$ (1980Re05), 8 (40°) (1975Lo04).
1683 10				$d\sigma/d\Omega(\mu\text{b/sr})=9$ (1980Re05).
1782 10				$d\sigma/d\Omega(\mu\text{b/sr})=7$ (1980Re05).
2043 10				$d\sigma/d\Omega(\mu\text{b/sr})=12$ (1980Re05).
2187 10		(5)		$d\sigma/d\Omega(\mu\text{b/sr})=30$ (1980Re05).
2298 10				$d\sigma/d\Omega(\mu\text{b/sr})=14$ (1980Re05).
2412 10		(2)		$d\sigma/d\Omega(\mu\text{b/sr})=30$ (1980Re05).
2442 10		(5)		$d\sigma/d\Omega(\mu\text{b/sr})=45$ (1980Re05).
2481 10		(5)		$d\sigma/d\Omega(\mu\text{b/sr})=31$ (1980Re05).
2594 10		2		$d\sigma/d\Omega(\mu\text{b/sr})=23$ (1980Re05).
3600				E(level): from 1977Se04. Centroid of a wide structure. L: $\sigma(\theta)$ data for this bump corresponds to high L-value (1977Se04). A large part of the cross section is due to $h_{11/2}$ single-particle strength.

[†] Weighted averages taken when a level is reported in 1980Re05 and 1975Lo04. Above 1580, levels are reported by 1980Re05 only.

[‡] 0+22 form a composite structure, as stated by 1975Lo04. 1980Re05 do not mention contribution from the 22-keV level, but it must be present as L=3 for both the g.s. and the 22 level.

[#] From comparison of $\sigma(\theta)$ data with DWBA calculations in 1980Re05, unless otherwise stated.

[@] Nuclear structure factors defined as $\sigma(\text{exp})/(2N\times\sigma(\text{DWBA}))$, where $N=12.9$. Values are from 1980Re05 unless otherwise stated. In 1975Lo04, S-factors are $\sigma(\text{exp})/(N\times\sigma(\text{DWBA}))$, where $N=22.6$.

[&] Level from 1975Lo04 only; L-transfer from $[d\sigma/d\Omega(^3\text{He},\alpha)(60^\circ)]/[d\sigma/d\Omega(\text{d,t})(90^\circ)]$ ratios.

^a Level from 1980Re05 only.

^b From the Adopted Levels.

$^{151}\text{Sm}(\text{p},\text{t})$ 1973Ga04

E=18 MeV.

1973Ga04: E(p)=18 MeV from the McMaster University FN tandem. Target enrichment=88.9%. FWHM=10 keV. Measured $\sigma(\theta)$ at 16 angles from 6° to 80° . Absolute cross sections accurate to 20%. DWBA analysis of $\sigma(\theta)$ data.

Other: 1978MuZZ, E=34.7 MeV. Target enrichment=99%. Data from 10° to 55° (lab system). No details are available.

$J^\pi(^{151}\text{Sm g.s.})=5/2^-$.

 ^{149}Sm Levels

Cross sections are from 1973Ga04.

E(level)	L [†]	Comments
0	(2)	$d\sigma/d\Omega(\mu\text{b/sr})=41$ (15°), 17 (25°).
22.5 30	0	$d\sigma/d\Omega(\mu\text{b/sr})=45$ (15°), 262 (25°).
≈ 286	(0)	$d\sigma/d\Omega(\mu\text{b/sr})<5$ (15°), <25 (25°).
352 3		$d\sigma/d\Omega(\mu\text{b/sr})=6$ (15°), 3 (25°).
528 [‡]		
560 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=18$ (15°), 68 (25°).
606 3		$d\sigma/d\Omega(\mu\text{b/sr})=9$ (15°), 4 (25°).
638 3		$d\sigma/d\Omega(\mu\text{b/sr})=16$ (15°), 8 (25°).
664 [‡]		
785 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=19$ (15°), 75 (25°).
833 [‡]		
997 3		$d\sigma/d\Omega(\mu\text{b/sr})=4$ (15°), 4 (25°).
1124 3		$d\sigma/d\Omega(\mu\text{b/sr})=4$ (15°), 2 (25°).
1187 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=2$ (15°), 8 (25°).
1207	(0)	E(level): unresolved from a peak contributed by an impurity. $d\sigma/d\Omega(\mu\text{b/sr})<4$ (15°), <18 (25°).
1325 3		$d\sigma/d\Omega(\mu\text{b/sr})=7$ (15°), 8 (25°).
1339 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=11$ (15°), 26 (25°).
1472 3		$d\sigma/d\Omega(\mu\text{b/sr})=9$ (15°), 5 (25°).
1487 3		$d\sigma/d\Omega(\mu\text{b/sr})=4$ (15°), 8 (25°).
1548 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=8$ (15°), 10 (25°).
1558 3		$d\sigma/d\Omega(\mu\text{b/sr})=2$ (15°), 4 (25°).
1581 3		$d\sigma/d\Omega(\mu\text{b/sr})=3$ (15°), 5 (25°).
1674 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=8$ (15°), 20 (25°).
1699 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=4$ (15°), 5 (25°).
1759 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=4$ (15°), 7 (25°).
1782 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=5$ (15°), 13 (25°).
1817 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=7$ (15°), 35 (25°).
1891 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=2$ (15°), 6 (25°).
1919 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=11$ (15°), 35 (25°).
1993 3		$d\sigma/d\Omega(\mu\text{b/sr})=2$ (15°), 4 (25°).
2005 3		$d\sigma/d\Omega(\mu\text{b/sr})=5$ (15°), 4 (25°).
2061 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=2$ (15°), 7 (25°).
2099 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=5$ (15°), 10 (25°).
2116 3	0	$d\sigma/d\Omega(\mu\text{b/sr})=3$ (15°), 5 (25°).

[†] From comparison of measured $\sigma(\theta)$ data with DWBA calculations.

[‡] Level from 1978MuZZ.

$^{151}\text{Eu}(\mu^-, 2n\gamma)$ **1971Pe14**

Also $^{153}\text{Eu}(\mu^-, 4n\gamma)$.

1971Pe14: measured E_γ , I_γ with a Ge(Li) detector at CERN.

^{149}Sm Levels

<u>E(level)</u>	<u>J^π[†]</u>
0.0	$7/2^-$
22.5	$5/2^-$
277.2 1	$5/2^-$
285.7 1	$9/2^-$
350.2 2	$3/2^-$

[†] From the Adopted Levels.

$\gamma(^{149}\text{Sm})$

<u>E_γ</u>	<u>I_γ[†]</u>	<u>$E_i(\text{level})$</u>	<u>J^π_i</u>	<u>E_f</u>	<u>J^π_f</u>	<u>Comments</u>
22.5		22.5	$5/2^-$	0.0	$7/2^-$	E_γ : rounded value from the Adopted Gammas.
254.27 25	0.60 15	277.2	$5/2^-$	22.5	$5/2^-$	
277.0 1	1.3 3	277.2	$5/2^-$	0.0	$7/2^-$	
285.99 5	1.8 3	285.7	$9/2^-$	0.0	$7/2^-$	
327.50 15	1.7 3	350.2	$3/2^-$	22.5	$5/2^-$	

[†] Yield per 100 μ^- captures.

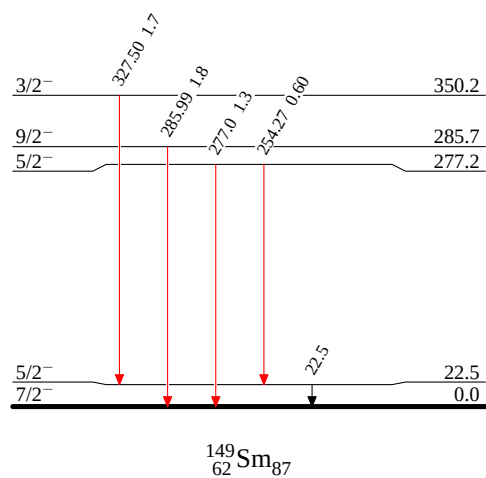
$^{151}\text{Eu}(\mu^-, 2n\gamma)$ 1971Pe14

Level Scheme

 Intensities: Per 100 μ -captures

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$



Coulomb excitation 1976Ga10

1976Ga10: ($^{16}\text{O}, ^{16}\text{O}'$) $E=38\text{--}48$ MeV at ANU. (α, α') $E=6\text{--}11$ MeV. $\gamma, \gamma\gamma, ^{16}\text{O}-\gamma(\theta)$ measurements. Subsequent analysis given by **1976Le15**.

Others:

1976SiZW: ($^{35}\text{Cl}, ^{35}\text{Cl}'$) $E=145$ MeV; measured $E\gamma, I\gamma, \gamma(\theta)$, (^{35}Cl) γ -coin at the Chalk River tandem accelerator facility.

1970Ga20: ($^{14}\text{C}, ^{14}\text{C}'$), $E=46.1$ MeV; measured $E\gamma, I\gamma$.

1967Bo42: ($^{12}\text{C}, ^{12}\text{C}'$), $E=41.6$ MeV; measured $E\gamma, I\gamma$.

1963Al30: ($^{14}\text{N}, ^{14}\text{N}'$), $E=52$ MeV; measured $E\gamma, I\gamma, ^{14}\text{N}-\gamma$ coin.

1960Na13: (α, α') $E=14\text{--}20$ MeV.

 ^{149}Sm Levels

850 level reported by **1967Bo42** and **1963Al30** has been omitted for lack of confirmation by **1976Ga10**.

$B(E2)(\uparrow)$ values are relative to $B(E2)(\uparrow)$ for 664 level.

$E(\text{level})^\dagger$	$J^\pi@$	$T_{1/2}^\ddagger$	Comments
0.0	$7/2^-$		
22.5	$5/2^-$		
277.4 2	$5/2^-$	<1.3 ns	$B(E2)=0.0006$ 6. Other: 0.0047 (1967Bo42). Level probably populated indirectly. $T_{1/2}$: ≤ 0.2 ns from the Adopted Levels.
286.0 2	$9/2^-$	<0.7 ns	$B(E2)=0.0010$ 10. Other: 0.0099 (1967Bo42). Level probably populated indirectly. $T_{1/2}$: 0.22 ns 4 from the Adopted Levels.
350.0 2	$3/2^-$	9.5 ps 3	$B(E2)=0.043$ 1. Other: 0.029 (1967Bo42).
528.3 2	$3/2^-$	24 ps 3	$B(E2)=0.013$ 1. Other: 0.02 (1967Bo42).
558.2 2	$5/2^-$	24 ps 8	$B(E2)=0.009$ 1. Others: 0.020 8 (1970Ga20), <0.02 (1967Bo42).
590.8 2	$9/2^-$	3.0 ps 7	$B(E2)=0.174$ 2. Others: 0.11 (1967Bo42), 0.12 (1963Al30).
636.7 2	$7/2^-$	<1.5 ps	$B(E2)=0.022$ 2. Others: 0.010 4 (1970Ga20), 0.11 (1963Al30). $T_{1/2}$: from $B(E2)=0.022$, adopted branching ratio and δ for 637 γ .
664.0 2	$11/2^-$	2.7 ps 3	$B(E2)=0.223$ 19 (absolute measurement). Others: 0.19 (1967Bo42), 0.21 (1963Al30), 0.21 (1960Na13).
713?			
747 [#] 1	$13/2^-$		
789 [#] 1	$11/2^+$		
834 [#] 1			
878 [#] 1	$13/2^+$		

[†] From least-squares fit to $E\gamma$ data, assuming 0.2 keV uncertainty for $E\gamma$ value, when not stated.

[‡] From $B(E2)$ values, adopted branching ratios and δ .

[#] From **1976SiZW** only. Probably excited through E3 or multiple excitation.

@ From the Adopted Levels.

 $\gamma(^{149}\text{Sm})$

E_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
22.5	22.5	$5/2^-$	0.0	$7/2^-$	E_γ : rounded value from the Adopted dataset.
73.0@	350.0	$3/2^-$	277.4	$5/2^-$	
89 [#] 1	878	$13/2^+$	789	$11/2^+$	
125 [#] 1	789	$11/2^+$	664.0	$11/2^-$	

Continued on next page (footnotes at end of table)

Coulomb excitation 1976Ga10 (continued) $\gamma(^{149}\text{Sm})$ (continued)

E_γ	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	$\delta^\dagger$	Comments
178.6@		528.3	3/2 ⁻	350.0	3/2 ⁻			
198# 1		789	11/2 ⁺	590.8	9/2 ⁻			
208.2& 2		558.2	5/2 ⁻	350.0	3/2 ⁻			
214# 1		878	13/2 ⁺	664.0	11/2 ⁻			
251.5@		528.3	3/2 ⁻	277.4	5/2 ⁻			
254.6@		277.4	5/2 ⁻	22.5	5/2 ⁻			
277.4	2.7 5	277.4	5/2 ⁻	0.0	7/2 ⁻			
281.1	1.1 5	558.2	5/2 ⁻	277.4	5/2 ⁻			
286.0	9.0 6	286.0	9/2 ⁻	0.0	7/2 ⁻			
287& 1		636.7	7/2 ⁻	350.0	3/2 ⁻			
304.9	2.8 6	590.8	9/2 ⁻	286.0	9/2 ⁻			
327.6	36.6 12	350.0	3/2 ⁻	22.5	5/2 ⁻	M1+E2	+0.27 +30-45	$A_2=-0.114$ 44; $A_4=-0.004$ 48
350.0	3.5 6	350.0	3/2 ⁻	0.0	7/2 ⁻			
350& 1	0.4 3	636.7	7/2 ⁻	286.0	9/2 ⁻			
359.4	1.3 3	636.7	7/2 ⁻	277.4	5/2 ⁻			
378.2	3.5 7	664.0	11/2 ⁻	286.0	9/2 ⁻			
436 ^a		713?		277.4	5/2 ⁻			
461# 1		747	13/2 ⁻	286.0	9/2 ⁻			
506.1@		528.3	3/2 ⁻	22.5	5/2 ⁻			
528.3	4.2 7	528.3	3/2 ⁻	0.0	7/2 ⁻			
535.9	2.1 6	558.2	5/2 ⁻	22.5	5/2 ⁻			
558.2	2.2 7	558.2	5/2 ⁻	0.0	7/2 ⁻	E2+M1	1.2 +7-4	Mult., δ : from the Adopted Gammas. $A_2=-0.04$ 8; $A_4=+0.29$ 10
568.3	18.3 11	590.8	9/2 ⁻	22.5	5/2 ⁻			
590.8	80.8 21	590.8	9/2 ⁻	0.0	7/2 ⁻	E2+M1	-1.5 +9-4	$A_2=-0.069$ 37; $A_4=-0.32$ 5
614.0	5.0 7	636.7	7/2 ⁻	22.5	5/2 ⁻			
636.7	1.9 6	636.7	7/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.30 +16-18	Mult., δ : from the Adopted Gammas. $A_2=+0.33$ 4; $A_4=-0.060$ 43
664.0	100.0 23	664.0	11/2 ⁻	0.0	7/2 ⁻	E2		
834# 1		834		0.0	7/2 ⁻			

[†] From $\gamma(\theta)$ data in 1976Ga10 and RUL, unless otherwise noted.[‡] Relative to 100 for 664 γ at $E(^{16}\text{O})=44$ MeV.

From 1976SiZW only.

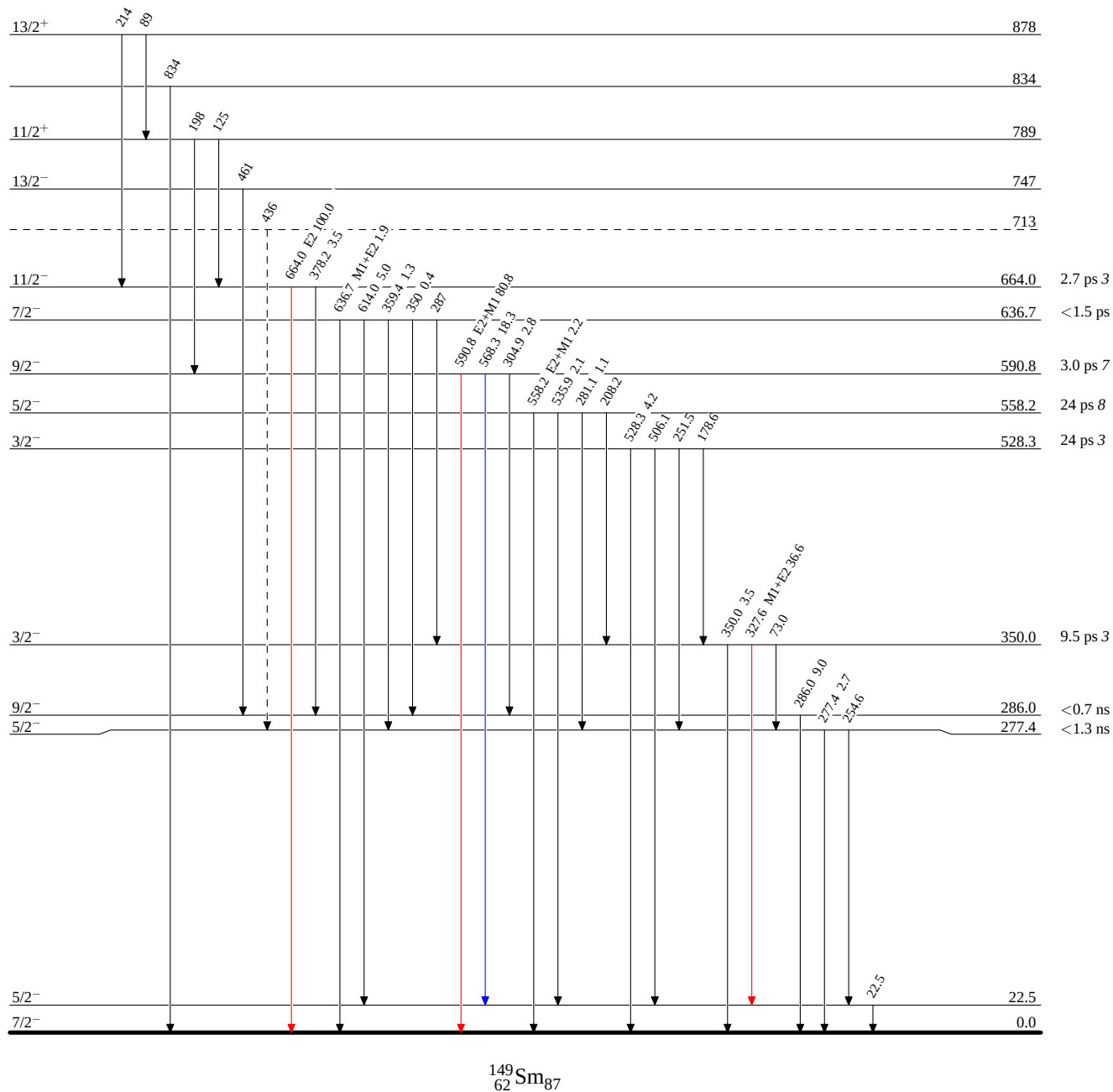
@ Rounded values from the Adopted Gammas.

& From $\gamma\gamma$ only.^a Placement of transition in the level scheme is uncertain.

Coulomb excitation 1976Ga10
Level Scheme

 Intensities: Relative I_γ
Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - -→ γ Decay (Uncertain)



muonic atom **1981Ba28**

1981Ba28: muonic atomic transitions measured at Saclay. Data interpreted in terms of deformed Fermi distribution for the nuclear charge density. Analysis of isotope shifts and comparison with x-ray and optical isotope shifts. Quadrupole moments for g.s. and 22.5 level determined from 2p hyperfine structure. The g.s., 22.5, and 350 levels included in the analysis.

Following muonic transitions reported:

$2p_{3/2}-2p_{1/2}$: 89.47 14.

$4f_{7/2}-3d_{5/2}$: 532.84 12.

$3d_{5/2}-2p_{3/2}$: 1492.69 42.

$2p_{3/2}-1s_{1/2}$: 4491.63 60.

$3d_{5/2}-1s_{1/2}$: 5985.8 16.

 ^{149}Sm Levels

<u>E(level)</u>	<u>J^π[†]</u>	<u>Comments</u>
0.0	$7/2^-$	Q=0.094 24
22.5	$5/2^-$	Q=1.014 93; B(E2) [†] =0.229 17

[†] From the Adopted Levels.

Adopted Levels, Gammas

$Q(\beta^-) = -1314$ 4; $S(n) = 8215$ 11; $S(p) = 4394$ 4; $Q(\alpha) = 2401$ 5 [2021Wa16](#)

$Q(\varepsilon) = 695$ 4, $S(2n) = 15039$ 4, $S(2p) = 11977$ 4 ([2021Wa16](#)).

Mass measurements (Penning-trap method): [2001Bo59](#), [2000Be42](#), [1997Be63](#).

Hyperfine structure and isotope shift measurements: [2000Tr07](#), [1997En08](#).

[2018Qu01](#): theory: calculated low-energy levels, J^π , $S(2n)$, $B(E2)$, spectroscopic quadrupole moments, dominant configurations.

Microscopic core-quasiparticle coupling (CQC), and five-dimensional collective (5DCH) Hamiltonians, based on PC-PK1 energy density functional.

[2017No07](#): theory: calculated single-particle energies, occupation probabilities of the single-particle orbitals, levels, J^π , $B(E2)$,

$B(M1)$, electric quadrupole and magnetic dipole moments. Interacting boson fermion model (IBFM).

Theoretical calculations: consult NSR database at www.nndc.bnl.gov/nsr/ for 20 references dealing with nuclear structure calculations.

¹⁴⁹Eu Levels

The high-spin sequences are discussed by [1994Ur01](#) in ¹³⁹La(¹³C,3n γ) in terms of multi-particle states coupled to even-even core and to octupole-phonon vibrations. The octupole correlations for some of the bands are suggested by presence of interband E1 and E3 transitions.

Cross Reference (XREF) Flags

A	¹⁴⁹ Gd ε decay (9.28 d)	E	¹⁴⁸ Sm(³ He,d)	I	¹⁵⁰ Sm(p,2n γ)
B	¹³⁹ La(¹³ C,3n γ)	F	¹⁴⁸ Sm(α ,t)	J	¹⁵⁰ Sm(d,3n γ)
C	¹⁴⁵ Nd(⁷ Li,3n γ), ¹⁴⁶ Nd(⁶ Li,3n γ)	G	¹⁴⁹ Sm(d,2n γ)	K	¹⁵¹ Eu(p,t)
D	¹⁴⁸ Sm(p,p),(p,p'),(p,n) IAR	H	¹⁴⁹ Sm(³ He,t) IAS	L	¹⁵² Sm(p,4n γ)

E(level) [†]	J^π [‡]	T _{1/2}	XREF	Comments
0.0@	5/2 ⁺	93.1 d 4	ABC EFG IJKL	% ε =100 $\mu = +3.565$ 6 (1985Ah02 , 2019StZV) $Q = +0.75$ 2 (1985Ah02 , 2021StZZ) Evaluated rms charge radius=5.020 fm 10 (2013An02). Evaluated difference in charge radius: $\delta\langle r^2 \rangle(^{145}\text{Eu}, ^{149}\text{Eu}) = +0.5338$ fm ² 1 (2013An02). J^π : spin from atomic beam (1972Ek05); parity from L(p,t)=0 from 5/2 ⁺ . T _{1/2} : from γ and x-ray decay curve (1970Ch09). Others: 93.1 d (1969Gu15); 93 d (D. Barr, Los Alamos Scientific Lab, priv. comm. to 1970Ch09); 90 d 20 (1962Dz02), 106 d 2 (1961Ha40), $\approx$ 120 d (1959An36), $\approx$ 120 d (1953Ma17). μ, Q : from collinear fast-beam laser spectroscopy (1985Ah02). Others: $\mu = +3.576$ 10 (collinear fast-beam laser spectroscopy, 1985Al06 , 1986Al33); 2.5 5 (nuclear orientation, 1983Kr19). $Q = +0.716$ 17 (hyperfine structure, 1997En08); +0.70 8 (collinear fast-beam laser spectroscopy, 1985Al06 , 1986Al33). $\delta\langle r^2 \rangle(^{151}\text{Eu}, ^{149}\text{Eu}) = -0.302$ fm ² 21 (1985Al06 , also 1983Al14 , 1984Al35 and 1986Al33). See 1992He21 for systematics of root-mean square charge radii. Configuration= $\pi d_{5/2}$.
149.732& 5	7/2 ⁺	0.32 ns 2	ABC EFG IJKL	J^π : M1+E2 γ to 5/2 ⁺ ; L(p,t)=4 from 5/2 ⁺ . T _{1/2} : γ ce(t) (1962Be20).
458 4	1/2 ⁺		Ef	J^π : L(³ He,d)=0; $\pi s_{1/2}$ state.
459.826 8	(3/2,5/2) ⁺		A fg I L	J^π : M1(+E2) γ to 5/2 ⁺ ; L(α ,t)=(2).
496.389# 6	11/2 ⁻	2.45 μ s 5	ABC EFG IJ L	$\mu = +7.0$ 3 (1980KI07 , 2020StZV) μ : differential PAD method (1980KI07 , 1979KI02). Other: +6.11 17 (1970KI07). 1980KI07 (also 1979KI02) used their experimentally

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Eu Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
			determined paramagnetic correction, while 1970K107 used theoretical value from 1964GuZZ.
			J ^π : M2+E3 γ to 7/2 ⁺ , E3 γ to 5/2 ⁺ ; L(³ He,d)=5.
			Configuration= $\pi h_{11/2}$.
			T _{1/2} : γγ(t) in ¹⁴⁹ Gd ε (1970K107,1969Iv02,1962Pr06,1961Be08,1961So04).
534.296@ 5	7/2 ⁺	AB G IJKL	J ^π : M1(+E2) γ to 5/2 ⁺ ; E1 γ from 9/2 ⁻ .
666.291& 6	9/2 ⁺	ABC G IJKL	J ^π : M1 γ to 7/2 ⁺ , E1+M2 γ from 9/2 ⁻ ; ΔJ=2, E2 γ to 5/2 ⁺ .
691.8? 3	(3/2,5/2,7/2)	I	J ^π : ΔJ=0,1 γ to (3/2,5/2) ⁺ . J=1/2 not allowed by observed anisotropy.
748.602 6	7/2 ⁻	A E G IJ L	J ^π : E1+M2 γ to 5/2 ⁺ ; E2 γ to 11/2 ⁻ .
754 3	5/2 ⁺	K	J ^π : L(p,t)=0 from 5/2 ⁺ .
767 4	1/2 ⁺	EF	J ^π : L(³ He,d)=0.
776.69 10	(3/2 to 9/2)	A K	J ^π : γ to 5/2 ⁺ ; weak ε feeding (log ft=10.1) from 7/2 ⁻ .
795.030 ^a 7	9/2 ⁻	ABC G IJ L	J ^π : E1 γ to 7/2 ⁺ (149.7 level); M1+E2 γ to 11/2 ⁻ .
798.934@ 15	(9/2 ⁺)	AB G IJKL	J ^π : ΔJ=1, (M1) γ to 7/2 ⁺ ; possible band member; (M2) assignment proposed by 1996Vy02 for 798.9γ is inconsistent.
812.631 7	5/2 ⁺	A EFG I KL	J ^π : M1(+E2) γ to 7/2 ⁺ ; L(³ He,d)=2.
875.939 10	5/2 ⁺	A EFG KL	J ^π : L(p,t)=0 from 5/2 ⁺ .
910.88& 3	11/2 ⁺	ABC G IJ L	J ^π : ΔJ=2, E2 γ to 7/2 ⁺ ; dipole γ to 9/2 ⁺ .
913 3	3/2 ⁺ ,5/2 ⁺	E K	J ^π : L(³ He,d)=2.
933.120 8	(9/2) ⁺	A G I kL	J ^π : E2 γ to 5/2 ⁺ ; (M1,E2) γ to 9/2 ⁺ ; (E1+M2) γ to 9/2 ⁻ ; γ to 11/2 ⁻ .
935 3	(1/2 ⁺)	EF k	XREF: F(929).
			J ^π : L(³ He,d)=0.
938.609 6	7/2 ⁺	A G I kL	J ^π : M1+E2 γ to 5/2 ⁺ ; M1+E2 γ to 9/2 ⁺ .
952.667 18	(3/2 ⁺ to 9/2 ⁺)	A	J ^π : γs to 5/2 ⁺ and 7/2 ⁺ .
955 3	5/2 ⁺	K	J ^π : L(p,t)=0 from 5/2 ⁺ .
992.203 10	(3/2 ⁺ to 9/2 ⁺)	A	J ^π : γ to 5/2 ⁺ ; weak ε feeding (log ft=9.2) from 7/2 ⁻ .
994.79# 6	(15/2) ⁻	BC G IJ L	J ^π : ΔJ=2, E2 γ 11/2 ⁻ .
1012.594 10	(5/2,7/2,9/2)	A G	J ^π : γs to 5/2 ⁺ and 7/2 ⁺ ; log ft=8.4 from 7/2 ⁻ . Negative parity is suggested by (M2) γ to 7/2 ⁺ , but multipolarity of this γ is considered suspect.
1059.68 22	(9/2 ⁻ ,11/2,13/2 ⁻)	BC L	J ^π : γ to 9/2 ⁻ ; γ from (13/2 ⁻).
1064 3	(5/2 ⁺)	K	J ^π : L(p,t)=(0) from 5/2 ⁺ .
1097.590 10	(9/2) ⁻	A G I	J ^π : E1 γs to 7/2 ⁺ and 9/2 ⁺ ; γ to 11/2 ⁺ .
1135 4		EF	J ^π : L(³ He,d)=4,(5) suggest a doublet with J ^π =7/2 ⁺ ,9/2 ⁺ and J ^π =9/2 ⁻ , 11/2 ⁻ .
1150 3	5/2 ⁺	K	J ^π : L=(p,t)=0 from 5/2 ⁺ .
1165.04 3	(5/2,7/2,9/2)	A	J ^π : weak ε feeding (log ft=8.8, log f ^{lu} t<8.5) from 7/2 ⁻ .
1177.32 ^a 6	(13/2 ⁻)	B G I L	J ^π : ΔJ=1 γ to 11/2 ⁻ ; γ to 9/2 ⁻ ; dipole γ to (15/2) ⁻ .
1184.53@ 7	(11/2 ⁺)	B G KL	XREF: K(1190).
			J ^π : γs to 7/2 ⁺ and 9/2 ⁺ ; probable band member.
1207.72 3	(5/2,7/2,9/2)	A K	XREF: K(1212).
			J ^π : γs to 5/2 ⁺ and 7/2 ⁺ ; weak ε feeding (log ft=8.9, log f ^{lu} t<8.5) from 7/2 ⁻ .
1220.56 10	5/2 ⁺	A EF K	XREF: K(1226).
			J ^π : L(p,t)=0 from 5/2 ⁺ . Also L=2 from (³ He,d)/(α,t) ratio.
1231.253 9	9/2 ⁻	A	J ^π : M1(+E2) γs to 11/2 ⁻ and 7/2 ⁻ .
1246.41 5	(5/2,7/2,9/2)	A	J ^π : γs to 5/2 ⁺ and 7/2 ⁺ ; weak ε feeding (log ft=8.4) from 7/2 ⁻ .
1294 3		K	
1312 4	5/2 ⁺	EF K	J ^π : L(p,t)=0 from 5/2 ⁺ .
1333.57& 7	(13/2 ⁺)	B G I L	J ^π : dipole γ to 11/2 ⁺ .
1356 3		K	
1398 4	1/2 ⁺	EF	J ^π : L(³ He,d)=0.
1440 4	1/2 ⁺	EF K	J ^π : L(³ He,d)=0.
1471.75@ 20	(13/2 ⁺)	B G	J ^π : ΔJ=2, (E2) γ to (9/2 ⁺).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Eu Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
1495 4	3/2 ⁺ , 5/2 ⁺	Ef	J ^π : L(³ He,d)=2.
1503.5 3	(11/2 ⁻)	fg K	J ^π : L(α,t)=(5), possibly h _{11/2} orbital.
1529.05 ^b 8	(15/2) ⁺	BC G L	J ^π : ΔJ=0, E1 γ to (15/2) ⁻ ; ΔJ=1 γ to (13/2 ⁻).
1538 4	1/2 ⁺	EF	J ^π : L(³ He,d)=0.
1550 3		K	
1595 4		E	
1610.13 [#] 11	(19/2) ⁻	BC G IJ L	J ^π : ΔJ=2, E2 γ to (15/2) ⁻ .
1625 4		E	
1655 4		E	
1659.47 ^{&} 8	(15/2) ⁺	BC G L	J ^π : ΔJ=2 γ to 11/2 ⁺ .
1680 4		E	
1718? 4	(7/2 ⁺ , 9/2 ⁺)	F	J ^π : L(α,t)=(4).
1743.8 ^{&} 6	(15/2) ⁺	B	J ^π : γ to 11/2 ⁺ .
1752 4		E	
1764.62 ^a 13	(17/2) ⁻	B G L	J ^π : ΔJ=1, (M1+E2) γ to (15/2) ⁻ .
1819 4		EF	
1833.9 [@] 3	(15/2) ⁺	B	J ^π : γs to (11/2 ⁺) and (13/2 ⁺).
1857 4		E	
1890 4		EF	
1898.97? ^c 24	(17/2) ⁺	B	J ^π : γ to (15/2) ⁻ .
1945 4		E	
1998.48 ^{&} 21	(17/2) ⁺	B	J ^π : ΔJ=(2) γ to (13/2 ⁺); γ to (15/2 ⁺).
1999.40 ^b 16	(19/2) ⁺	BC G L	J ^π : ΔJ=2, E2 γ to (15/2) ⁺ ; E1 γ to (19/2) ⁻ .
2029 4		E	
2060 4		E	
2062.60 ^{&} 24	(17/2) ⁺	B	J ^π : γs to (13/2 ⁺) and (15/2 ⁺).
2092 4		E	
2118 4		E	
2144 4		E	
2168 4		E	
2180.84 20	(19/2) ⁻	B	J ^π : ΔJ=(2) γ to (15/2) ⁻ ; (M1) γ to (19/2) ⁻ .
2199 4		E	
2247.0 ^{&} 6	(19/2) ⁺	B	19/2 ⁺ band member is 2247 or 2396 level. J ^π : γs to (15/2 ⁺) and (17/2 ⁺).
2335.78 [#] 18	(23/2) ⁻	BC G L	J ^π : ΔJ=2, E2 γ to 1610, (19/2) ⁻ .
2342.75 ^c 20	(21/2) ⁺	BC L	J ^π : ΔJ=1, M1+E2 γ to 1999.3, (19/2) ⁺ ; dipole γ to 1610, (19/2) ⁻ .
2396.27 ^{&} 25	(19/2) ⁺	B	J ^π : ΔJ=(2) γ to 1659, (15/2 ⁺); γ to 1998.9, (17/2) ⁺ .
2453.40 ^a 22	(21/2) ⁻	B	J ^π : γs to (17/2 ⁻) and (19/2) ⁺ .
2497.10 20	(23/2) ⁻	BC L	J ^π : ΔJ=2, E2 γ from 2752, (27/2) ⁻ ; γ to (23/2) ⁻ .
2562.16 ^b 20	(23/2) ⁺	BC L	J ^π : ΔJ=2, E2 γ to (19/2) ⁺ ; E1 γ to (23/2) ⁻ .
2576.84 19	(25/2) ⁻	BC G J L	J ^π : ΔJ=1, dipole γ to (23/2) ⁻ ; M1 γ from 2752, (27/2) ⁻ .
2609.1 ^{&} 3	(21/2) ⁺	B	J ^π : ΔJ=1, D+Q γ to (19/2 ⁺); γ to (17/2 ⁺).
2752.10 ^d 22	(27/2) ⁻	BC J L	J ^π : ΔJ=2, E2 γ from 3428, (31/2) ⁻ ; γ to (25/2) ⁻ .
2828.16 ^c 21	(25/2) ⁺	B	J ^π : ΔJ=1, E1 γ to (23/2) ⁻ ; ΔJ=(2) γ to (21/2) ⁺ .
3144.02 [#] 24	(27/2) ⁻	B	J ^π : ΔJ=2, E2 γ to (23/2) ⁻ ; γ to (25/2 ⁺).
3218.90 ^b 25	(27/2) ⁺	B	J ^π : ΔJ=2, E2 γ to (23/2) ⁺ ; γ to (25/2 ⁺).
3249.16 ^c 24	(29/2) ⁺	B	J ^π : ΔJ=2, E2 γ to (25/2) ⁺ ; γ to (27/2 ⁻).
3427.8 ^d 3	(31/2) ⁻	B	J ^π : ΔJ=1, E1 γ from (33/2) ⁺ ; ΔJ=2, E2 γ to (27/2) ⁻ .
3442.6 3	(29/2) ⁻	B	J ^π : ΔJ=2, E2 γ to (25/2) ⁻ .
3542.6 ^e 3	(31/2) ⁺	B	J ^π : ΔJ=(2), (E2) γ to (27/2) ⁺ ; ΔJ=1, M1 γ to (29/2) ⁺ .
3616.3 ^e 3	(33/2) ⁺	B	J ^π : ΔJ=2, E2 γ to (29/2) ⁺ ; γ to (31/2) ⁻ .

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Adopted Levels, Gammas (continued) ^{149}Eu Levels (continued)

E(level) [†]	$J^{\pi\ddagger}$	$T_{1/2}$	XREF	Comments
3950.6 [#] 3	(31/2 ⁻)		B	J^{π} : $\Delta J=(2)$ γ to (27/2) ⁻ .
3991.6 ^b 4	(31/2 ⁺)		B	J^{π} : $\Delta J=(2)$ γ to (27/2) ⁺ .
4099.9 ^c 4	(33/2 ⁺)		B	J^{π} : $\Delta J=2$, (E2) γ to (29/2) ⁺ .
4188.5 ^d 4	(35/2) ⁻		B	J^{π} : $\Delta J=2$, E2 γ to 3428, (31/2) ⁻ .
4222.5 ^e 4	(35/2) ⁺		B	J^{π} : $\Delta J=2$, E2 γ to (31/2) ⁺ .
4271.6 5	(33/2) ⁻		B	J^{π} : $\Delta J=(2)$ γ to (29/2) ⁻ .
4359.8 ^e 4	(37/2) ⁺		B	J^{π} : $\Delta J=2$, E2 γ to (33/2) ⁺ ; γ to (35/2) ⁻ .
4404.3 4	(33/2) ⁻		B	J^{π} : $\Delta J=(2)$ γ to (29/2) ⁻ .
4422.4 4	(33/2) ⁻		B	J^{π} : $\Delta J=(2)$ γ to (29/2) ⁻ .
4684.6 [#] 3	(35/2) ⁻		B	E(level): the 35/2 band member is 4685 or 4705 level. J^{π} : $\Delta J=(2)$ γ to (31/2) ⁻ ; γ to (35/2) ⁻ .
4705.3 4	(35/2)		B	J^{π} : γ s to (31/2) ⁻ and (31/2) ⁻ .
4970.0 ^e 5	(39/2) ⁺		B	J^{π} : $\Delta J=2$, E2 γ to (35/2) ⁺ .
4995.3 ^c 5	(37/2 ⁺)		B	J^{π} : $\Delta J=(2)$ γ to (33/2 ⁺).
5049.8 ^e 5	(41/2) ⁺		B	J^{π} : $\Delta J=2$, E2 γ to (37/2) ⁺ .
5070.2 5	(35/2,37/2,39/2 ⁻)		B	J^{π} : γ to (35/2) ⁻ .
5168.0 5	(37/2)		B	J^{π} : $\Delta J=1$ γ to (35/2) ⁻ .
5338.2 5	(39/2)		B	J^{π} : $\Delta J=(2)$ γ to (35/2) ⁻ .
5373.9 [#] 5	(39/2) ⁻		B	J^{π} : γ to (35/2) ⁻ ; probable band member.
5538.6 ^e 6	(45/2) ⁺		B	J^{π} : $\Delta J=2$, E2 γ to (41/2) ⁺ .
5607.8 5	(39/2)		B	J^{π} : $\Delta J=(2)$ γ to (35/2) ⁻ .
5963.4 6	(41/2)		B	J^{π} : $\Delta J=(2)$ γ to (37/2); γ to (39/2).
6030.2? 11	(43/2)		B	J^{π} : γ to (39/2).
6289.1 ^e 6	(47/2)		B	J^{π} : $\Delta J=1$ γ to (45/2) ⁺ .
6809.4 ^e 6	(49/2)		B	J^{π} : γ to (45/2) ⁺ ; possible band member.
6996.8 ^e 7	(51/2)		B	J^{π} : $\Delta J=2$, (E2) γ to (47/2).
7027.6 7	(45/2,47/2,49/2 ⁺)		B	J^{π} : γ to (45/2) ⁺ .
7684.1 ^e 7	(55/2)		B	J^{π} : $\Delta J=(2)$ γ to (51/2).
14287	(7/2) ⁻	102 keV	D	J^{π} : analog of 7/2 ⁻ , g.s. in ^{149}Sm and L=3. Γ : from 1967Jo04.
14635	(3/2) ⁻		D	J^{π} : analog of 3/2 ⁻ , 350 in ^{149}Sm .
14804	(3/2) ⁻	≈ 50 keV	D	J^{π} : analog of 3/2 ⁻ , 528 in ^{149}Sm and L=1. Γ : from 1967Jo04.
15002	(1/2 ⁻ ,3/2 ⁻)		D	J^{π} : analog of (3/2) ⁻ , 696 or (3/2 ⁻ ,5/2 ⁺), 710 in ^{149}Sm . Also L=(1).
15310	(1/2 ⁻ ,3/2 ⁻)		D	J^{π} : L=(1).
15449	(5/2) ⁻		D	J^{π} : analog of 5/2 ⁻ , 1187 in ^{149}Sm and L=(3).
15787			D	

[†] From a least-squares fit to $E\gamma$ data for levels populated in γ -studies, assuming $\Delta E\gamma=0.3$ keV for $E\gamma$ values quoted to tenth of a keV and 1 keV otherwise, where not available. For levels known only from particle transfer reactions, weighted averages have been taken where more than one value is available.

[‡] Above 1250, for levels populated in in-beam γ -ray studies (generally $J>11/2$), together with supporting $\gamma(\theta)$, $\gamma\gamma(\theta)$ (DCO ratios) and $\gamma(\text{lin pol})$ data, ascending spins are assumed as the excitation energy increases (which is consistent with the decay pattern of the levels). Also, probable band assignments are used in several cases where angular data do not give unique values.

[#] Band(A): $\pi h_{11/2} \otimes (^{148}\text{Sm core})$. Octupole correlations are indicated by E3 transitions to $\pi d_{5/2}$ and $\pi g_{7/2}$ states from the 11/2⁻ bandhead.

@ Band(B): $\pi d_{5/2} \otimes (^{150}\text{Gd core})$.

& Seq.(H): Sequence based on 149.7, 7/2⁺ level. The 149.7, 7/2⁺ level is interpreted by 1994Ur01 with configuration of

Adopted Levels, Gammas (continued)

 ^{149}Eu Levels (continued)

- $\pi g_{7/2} \otimes (^{150}\text{Gd} \text{ core})$.
- ^a Band(C): Decoupled $\pi h_{11/2}$ band.
- ^b Band(D): $\pi h_{11/2} \otimes (3^-)$ octupole band #1.
- ^c Band(E): $\pi h_{11/2} \otimes (3^-)$ octupole band #2.
- ^d Band(F): $\pi h_{11/2} \otimes \nu(h_{9/2} f_{7/2})_{8+}$. The $35/2^-$ member may be maximum aligned state.
- ^e Band(G): Multi-particle band based on $31/2^+$.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$									
E _i (level)	J ^{π} _i	E _{γ} [†]	I _{γ} [†]	E _f	J ^{π} _f	Mult. [‡]	δ [‡]	α [#]	Comments
149.732	7/2 ⁺	149.730 10	100	0.0	5/2 ⁺	M1+E2	0.14 3	0.587 8	B(M1)(W.u.)=0.0127 8; B(E2)(W.u.)=6.1 +29-24 δ : from L-subshell ratios in ¹⁴⁹ Gd ε .
459.826	(3/2,5/2) ⁺	459.819 10	100	0.0	5/2 ⁺	M1(+E2)	<0.4	0.0281 9	
496.389	11/2 ⁻	346.650 10	100.0 6	149.732	7/2 ⁺	M2+E3	-0.075 25	0.2326 33	B(M2)(W.u.)=0.0686 14; B(E3)(W.u.)=2.7 +21-15 δ : from L-subshell ratios in ¹⁴⁹ Gd ε . B(E3)(W.u.)=2.71 6 I _{γ} : others: 27 7 in (¹³ C,3n γ) and 9 1 (p,2n γ) seems discrepant.
534.296	7/2 ⁺	496.385 10 384.539 10	6.988 35 2.44 6	0.0 149.732	5/2 ⁺ 7/2 ⁺	E3 D		0.0392 5	
666.291	9/2 ⁺	534.294 10 132.004 10	100.0 8 3.35 18	0.0 534.296	5/2 ⁺ 7/2 ⁺	M1(+E2) M1	<0.4	0.0192 6 0.837 12	I _{γ} : others: 25 12 in (¹³ C,3n γ) and 6.3 16 in (d,2n γ).
		516.550 10 666.289 10	100.0 14 32.46 23	149.732 0.0	7/2 ⁺ 5/2 ⁺	M1+E2 E2	0.75 +27-24	0.0182 14 0.00649 9	Mult., δ : from ce data in ¹⁴⁹ Gd ε , δ (E2/M1)>1.3. From $\gamma(\theta)$ in (p,4n γ) mult=Q. I _{γ} : others: 45 1 in (d,2n γ), 87 25 in (¹³ C,3n γ).
691.8?	(3/2,5/2,7/2)	232.0	100	459.826	(3/2,5/2) ⁺	D			
748.602	7/2 ⁻	82.33 8 214.275 13 252.210 10 598.89 5	0.064 12 2.36 5 3.28 7 0.243 17	666.291 534.296 496.389 149.732	9/2 ⁺ 7/2 ⁺ 11/2 ⁻ 7/2 ⁺	[E1] (E1) E2		0.479 7 0.0365 5 0.1006 14	δ (E2/M1)>1.7.
776.69	(3/2 to 9/2)	748.604 10 776.69 10	100.0 12 100	0.0 0.0	5/2 ⁺ 5/2 ⁺	E1+M2	+0.041 13	0.00194 4	δ : from $\gamma(\theta,T)$ in ¹⁴⁹ Gd ε .
795.030	9/2 ⁻	128.74 2 260.736 10 298.633 10 645.315 10	0.133 9 4.66 5 100.0 5 5.27 3	666.291 534.296 496.389 149.732	9/2 ⁺ 7/2 ⁺ 11/2 ⁻ 7/2 ⁺	E1+M2 E1 M1+E2 E1	0.18 6 +0.15 2	0.36 16 0.02189 31 0.0884 13 0.00259 4	δ : from $\gamma(\theta,T)$ in ¹⁴⁹ Gd ε .
798.934	(9/2 ⁺)	794.7@ 264.66 4 302.58@ 3 649.11 7 798.91 2	<0.0035 77 9 25 4 27 5 100 4	0.0 534.296 496.389 149.732 0.0	5/2 ⁺ 7/2 ⁺ 11/2 ⁻ 7/2 ⁺ 5/2 ⁺	(M1)		0.1229 17	
812.631	5/2 ⁺	278.31 3 352.80 2 662.902 10 812.630 10	28 4 14.5 10 100.0 17 52.5 9	534.296 459.826 149.732 0.0	7/2 ⁺ (3/2,5/2) ⁺ 7/2 ⁺ 5/2 ⁺	[M1,E2] [M1,E2] M1(+E2) M1,E2	<0.85	0.090 17 0.046 11 0.0105 10 0.0055 14	Mult.: (M2) proposed by 1996Vy02 in ¹⁴⁹ Gd ε decay. I _{γ} : from ¹⁴⁹ Gd ε . Value of 16 4 in (d,2n γ) is too low.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\ddagger$	$\alpha^\#$	Comments
875.939	5/2 ⁺	127.1@	<0.95	748.602	7/2 ⁻	[E1]		0.1483 21	
		341.65 5	50.2 35	534.296	7/2 ⁺	[M1,E2]		0.051 12	
		416.08 3	15.4 5	459.826	(3/2,5/2) ⁺	[M1,E2]		0.030 8	
		726.21 1	52.4 16	149.732	7/2 ⁺	M1(+E2)	<0.65	0.0086 6	
		875.91 4	100.0 16	0.0	5/2 ⁺	M1(+E2)	<0.3	0.00573 13	
910.88	11/2 ⁺	244.55 6	20.5 8	666.291	9/2 ⁺	D			I_γ : from (d,2n γ) and (d,3n γ). $I_\gamma=77$ 18 in (^{13}C ,3n γ); 59 5 (p,2n γ) seem too high. This γ is not reported in ε decay, probably because it is too weak to be detected.
933.120	(9/2) ⁺	761.12 5	100 3	149.732	7/2 ⁺	E2		0.00476 7	I_γ : from (d,2n γ).
		138.10 1	12.7 9	795.030	9/2 ⁻	(E1+M2)	0.18 4	0.29 8	
		184.51 1	7.8 3	748.602	7/2 ⁻	(E1+M2)	0.25 5	0.17 4	
		266.91 7	3.9 11	666.291	9/2 ⁺	(M1,E2)		0.102 18	
		398.82 1	7.18 18	534.296	7/2 ⁺	[M1,E2]		0.033 8	
		436.62 17	3.3 5	496.389	11/2 ⁻				
		783.45@ 10	1.24 16	149.732	7/2 ⁺				
938.609	7/2 ⁺	933.06 7	100.0 8	0.0	5/2 ⁺	E2		0.00303 4	$\delta(\text{E2/M1})>1.4$.
		125.98 1	2.00 4	812.631	5/2 ⁺	M1,E2		1.01 5	
		139.74 8	0.19 2	798.934	(9/2 ⁺)				
		189.7@	<0.03	748.602	7/2 ⁻	[E1]		0.0504 7	
		272.320 10	44.0 7	666.291	9/2 ⁺	M1+E2	0.33 +12-8	0.1104 29	
		404.299 10	2.69 3	534.296	7/2 ⁺	M1,E2		0.032 8	
		478.78 2	2.80 4	459.826	(3/2,5/2) ⁺	E2(+M1)	>4	0.0153 4	
		788.875 10	100.0 10	149.732	7/2 ⁺	M1+E2	-5 2	0.00451 20	δ : from $\gamma(\theta,T)$ in ^{149}Gd ε .
952.667	(3/2 ⁺ to 9/2 ⁺)	938.616 10	33.1 3	0.0	5/2 ⁺	M1+E2	1.0 +10-5	0.0040 6	
		418.56 21	11.5 14	534.296	7/2 ⁺				
		492.88 6	39.7 27	459.826	(3/2,5/2) ⁺				
		802.93 2	100 4	149.732	7/2 ⁺				
		952.65 4	26.3 25	0.0	5/2 ⁺				
992.203	(3/2 ⁺ to 9/2 ⁺)	842.29@ 10	16.5 15	149.732	7/2 ⁺				
		992.201 10	100.0 27	0.0	5/2 ⁺				
994.79	(15/2) ⁻	498.45 6	100	496.389	11/2 ⁻	E2		0.01349 19	
1012.594	(5/2,7/2,9/2)	213.39@ 8	5.1 11	798.934	(9/2 ⁺)				E_γ : poor fit.
		478.27 10	27 5	534.296	7/2 ⁺				
		552.761 16	100.0 28	459.826	(3/2,5/2) ⁺	(E2(+M1))	>0.4	0.0137 34	
		862.862 12	76.8 11	149.732	7/2 ⁺				Mult.: (M2) assignment is suspect since it is inconsistent with $\Delta J=0,1$ which would favor E1 over M2.
1059.68	(9/2 ⁻ ,11/2,13/2 ⁻)	1012.61 2	26.0 8	0.0	5/2 ⁺				E_γ : from (p,4n γ).
		264.6 3	100	795.030	9/2 ⁻				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$	Comments
1097.590	(9/2) ⁻	186.67 4	1.02 8	910.88	11/2 ⁺	[E1]		0.0526 7	
		349.04 10	6.9 7	748.602	7/2 ⁻	[M1,E2]		0.048 12	
		431.297 12	7.37 15	666.291	9/2 ⁺	E1		0.00633 9	
		563.49 10	1.11 11	534.296	7/2 ⁺				
		601.201 15	6.17 13	496.389	11/2 ⁻	(M1)		0.01468 21	
		947.858 19	100.0 15	149.732	7/2 ⁺	E1		1.20×10 ⁻³ 2	
		1097.54@	<0.2	0.0	5/2 ⁺				
1165.04	(5/2,7/2,9/2)	1015.30 3	100	149.732	7/2 ⁺				
1177.32	(13/2 ⁻)	117.6	9 3	1059.68	(9/2 ⁻ ,11/2,13/2 ⁻)				
		182.7 1	28 3	994.79	(15/2) ⁻	D			E_γ : from (d,2n γ). I_γ : weighted average of 25.0 94 from (¹³ C,3n γ), 28.9 11 from (d,2n γ), 17.6 44 from (p,2n γ), and 22.4 78 from (p,4n γ).
		382.5 3	22 6	795.030	9/2 ⁻				
		680.88 6	100 4	496.389	11/2 ⁻	D+Q			E_γ, I_γ : from (d,2n γ). Others: I_γ =100 13 in (¹³ C,3n γ), 100 7 in (p,2n γ), 100 10 in (p,4n γ).
1184.53	(11/2 ⁺)	385.7 1	76 4	798.934	(9/2 ⁺)	D			E_γ, I_γ : from (d,2n γ). Other: I_γ =58 25 in (¹³ C,3n γ).
		518.5	50 17	666.291	9/2 ⁺				
		650.1 1	100 4	534.296	7/2 ⁺				
1207.72	(5/2,7/2,9/2)	673.43 3	100 13	534.296	7/2 ⁺				E_γ, I_γ : from (d,2n γ).
		1207.70 7	34 3	0.0	5/2 ⁺				
1220.56	5/2 ⁺	421.59 18	100 15	798.934	(9/2 ⁺)				
		1220.57 12	22.2 14	0.0	5/2 ⁺				
1231.253	9/2 ⁻	436.24 3	34.5 15	795.030	9/2 ⁻	(M1)		0.0331 5	
		482.640 12	58.7 11	748.602	7/2 ⁻	M1(+E2)	<2	0.021 4	
		734.86 1	100.0 23	496.389	11/2 ⁻	M1(+E2)	<2	0.0074 15	
		1081.58 3	14.1 5	149.732	7/2 ⁺				
		1231.2 2	0.27 8	0.0	5/2 ⁺				
1246.41	(5/2,7/2,9/2)	1096.68 5	79 7	149.732	7/2 ⁺				
		1246.38 8	100 5	0.0	5/2 ⁺	[M2]		0.00617 9	
1333.57	(13/2 ⁺)	149.2	33 8	1184.53	(11/2 ⁺)				
		422.67 7	75 25	910.88	11/2 ⁺	D			E_γ : from (d,2n γ). E_γ : from (p,4n γ).
		667.1 5	100 25	666.291	9/2 ⁺				
1471.75	(13/2 ⁺)	287.2	57 29	1184.53	(11/2 ⁺)				
		672.9	100 29	798.934	(9/2 ⁺)	Q			
1503.5	(11/2 ⁻)	708.5 3	100	795.030	9/2 ⁻				E_γ : from (d,2n γ).
1529.05	(15/2) ⁺	351.7 2	48 6	1177.32	(13/2 ⁻)	D			E_γ : from (d,2n γ).
		534.27 6	100 7	994.79	(15/2) ⁻	E1		0.00389 5	E_γ : from (d,2n γ).
1610.13	(19/2) ⁻	615.15 12	100	994.79	(15/2) ⁻	E2		0.00788 11	E_γ : weighted average of 614.9 2 from

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\alpha^\#$	Comments
								(⁶ Li,3n γ), 615.05 8 from (d,2n γ), 615.50 15 from (d,3n γ), and 615.4 2 from (p,4n γ). E γ : from (d,2n γ). E γ : from (d,2n γ).
1659.47	(15/2 ⁺)	325.6 5	27 13	1333.57	(13/2 ⁺)	Q		
		748.60 7	100 27	910.88	11/2 ⁺			
1743.8	(15/2 ⁺)	410	100 25	1333.57	(13/2 ⁺)			
		833	50 13	910.88	11/2 ⁺			
1764.62	(17/2 ⁻)	154.2 2	45 17	1610.13	(19/2 ⁻)			E γ : from (d,2n γ). I γ : weighted average of 33 17 from (¹³ C,3n γ) and 59 19 from (p,4n γ).
		235.8	25 8	1529.05	(15/2 ⁺)			
		587.7	50 17	1177.32	(13/2 ⁻)			
1833.9	(15/2 ⁺)	769.9 2	100 25	994.79	(15/2 ⁻)	(M1+E2)	0.0063 17	E γ : from (d,2n γ).
		362.2	80 40	1471.75	(13/2 ⁺)			
		500	60 20	1333.57	(13/2 ⁺)			
		649	100 40	1184.53	(11/2 ⁺)			
1898.97?	(17/2 ⁺)	371@	60 20	1529.05	(15/2 ⁺)			
		904.3	100 20	994.79	(15/2 ⁻)			
1998.48	(17/2 ⁺)	339.2	40 20	1659.47	(15/2 ⁺)			
		664.8	100 40	1333.57	(13/2 ⁺)	(Q)		
1999.40	(19/2 ⁺)	234.7	20 2	1764.62	(17/2 ⁻)	D		
		389.3 2	55 4	1610.13	(19/2 ⁻)	E1	0.00807 11	E γ : from (d,2n γ).
		470.4 5	100 7	1529.05	(15/2 ⁺)	E2	0.01576 23	E γ : from (p,4n γ).
2062.60	(17/2 ⁺)	228.7	100 40	1833.9	(15/2 ⁺)			
		319	100 40	1743.8	(15/2 ⁺)			
		729.0	100 40	1333.57	(13/2 ⁺)			
2180.84	(19/2 ⁻)	570.8	78 33	1610.13	(19/2 ⁻)	(M1)	0.01672 23	
		1186.2	100 22	994.79	(15/2 ⁻)	(Q)		
2247.0	(19/2 ⁺)	184	100 40	2062.60	(17/2 ⁺)			
		503	80 40	1743.8	(15/2 ⁺)			
		588	80 40	1659.47	(15/2 ⁺)			
2335.78	(23/2 ⁻)	725.6 2	100	1610.13	(19/2 ⁻)	E2	0.00531 7	E γ : weighted average of 725.1 3 from (⁶ Li,3n γ), 725.9 2 from (d,2n γ), and 725.6 3 from (p,4n γ).
2342.75	(21/2 ⁺)	343.5	21 5	1999.40	(19/2 ⁺)	M1+E2	0.050 11	
		444.0	8 3	1898.97?	(17/2 ⁺)			
		732.2 3	100 11	1610.13	(19/2 ⁻)	D		E γ : from (⁶ Li,3n γ).
2396.27	(19/2 ⁺)	334	43 14	2062.60	(17/2 ⁺)			
		398	57 14	1998.48	(17/2 ⁺)			
		736.7	100 29	1659.47	(15/2 ⁺)	(Q)		
2453.40	(21/2 ⁻)	454.0	80 40	1999.40	(19/2 ⁺)			
		689.0	100 40	1764.62	(17/2 ⁻)			
2497.10	(23/2 ⁻)	161.5	4.4 9	2335.78	(23/2 ⁻)	D+Q		
		316.5	3.5 9	2180.84	(19/2 ⁻)			
		886.8 3	100 4	1610.13	(19/2 ⁻)	(E2)	0.00338 5	E γ : from (⁶ Li,3n γ).

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\alpha^{\#}$	Comments
2562.16	(23/2) ⁺	109.0	3.1 15	2453.40	(21/2) ⁻			
		219	2.3 8	2342.75	(21/2) ⁺			
		226.3	4.6 15	2335.78	(23/2) ⁻	E1	0.0316 4	
		562.6 3	100 6	1999.40	(19/2) ⁺	E2	0.00985 14	E_γ : from (⁶ Li,3n γ).
2576.84	(25/2) ⁻	79.9	0.74 25	2497.10	(23/2) ⁻			
		241.0 1	100 3	2335.78	(23/2) ⁻	D		E_γ : from (d,2n γ).
2609.1	(21/2) ⁺	212.8	100 33	2396.27	(19/2) ⁺	D+Q		
		362	50 17	2247.0	(19/2) ⁺			
		610.7	83 50	1998.48	(17/2) ⁺			
2752.10	(27/2) ⁻	174.9 3	100 3	2576.84	(25/2) ⁻	M1(+E2)	0.360 22	E_γ : from (⁶ Li,3n γ).
		255.1	9.2 14	2497.10	(23/2) ⁻	E2	0.0970 14	
		416.5	0.8 3	2335.78	(23/2) ⁻			
2828.16	(25/2) ⁺	266.0	39 7	2562.16	(23/2) ⁺	M1+E2	0.103 18	
		485.4	23 4	2342.75	(21/2) ⁺	(Q)		
		492.4	100 3	2335.78	(23/2) ⁻	E1	0.00467 7	
3144.02	(27/2) ⁻	316.0	8.1 16	2828.16	(25/2) ⁺			
		808.3	100 10	2335.78	(23/2) ⁻	E2	0.00415 6	
3218.90	(27/2) ⁺	390.6	4.8 16	2828.16	(25/2) ⁺			
		656.7	100 10	2562.16	(23/2) ⁺	E2	0.00672 9	
3249.16	(29/2) ⁺	30.3		3218.90	(27/2) ⁺			
		105.1	3.2 8	3144.02	(27/2) ⁻	D		
		421.0	65 3	2828.16	(25/2) ⁺	E2	0.02139 30	
		497.0	100 9	2752.10	(27/2) ⁻	(E1)	0.00457 6	
3427.8	(31/2) ⁻	675.7	100	2752.10	(27/2) ⁻	E2	0.00628 9	
3442.6	(29/2) ⁻	865.8	100	2576.84	(25/2) ⁻	E2	0.00357 5	
3542.6	(31/2) ⁺	293.3	100 4	3249.16	(29/2) ⁺	M1	0.0934 13	
		323.5	4.7 14	3218.90	(27/2) ⁺	(Q)		
3616.3	(33/2) ⁺	73.2		3542.6	(31/2) ⁺			
		188.7	100 8	3427.8	(31/2) ⁻	E1	0.0511 7	
		367.3	55 6	3249.16	(29/2) ⁺	E2	0.0316 4	
3950.6	(31/2) ⁻	806.8	100	3144.02	(27/2) ⁻	(Q)		
3991.6	(31/2) ⁺	772.7	100	3218.90	(27/2) ⁺	(Q)		
4099.9	(33/2) ⁺	850.7	100	3249.16	(29/2) ⁺	(E2)	0.00371 5	
4188.5	(35/2) ⁻	760.7	100	3427.8	(31/2) ⁻	E2	0.00476 7	
4222.5	(35/2) ⁺	680.0	100	3542.6	(31/2) ⁺	E2	0.00619 9	
4271.6	(33/2) ⁻	829.0	100	3442.6	(29/2) ⁻	(Q)		
4359.8	(37/2) ⁺	137.4	3.0 12	4222.5	(35/2) ⁺			
		171.4	3.5 12	4188.5	(35/2) ⁻			
		743.3	100 6	3616.3	(33/2) ⁺	E2	0.00502 7	
4404.3	(33/2) ⁻	961.8	100	3442.6	(29/2) ⁻	(Q)		
4422.4	(33/2) ⁻	979.8	100	3442.6	(29/2) ⁻	(Q)		
4684.6	(35/2) ⁻	262.2	50 17	4422.4	(33/2) ⁻			
		280.3	33 8	4404.3	(33/2) ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Eu})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\alpha^\#$
4684.6	(35/2 ⁻)	496	42 17	4188.5	(35/2 ⁻)		
		733.8	100 25	3950.6	(31/2 ⁻)		
		1256.9	58 25	3427.8	(31/2 ⁻)	(Q)	
4705.3	(35/2)	755.1	100 40	3950.6	(31/2 ⁻)		
		1277.0	100 40	3427.8	(31/2 ⁻)		
4970.0	(39/2) ⁺	747.5	100	4222.5	(35/2) ⁺	E2	0.00496 7
4995.3	(37/2) ⁺	895.4	100	4099.9	(33/2) ⁺	(Q)	
5049.8	(41/2) ⁺	690.0	100	4359.8	(37/2) ⁺	E2	0.00598 8
5070.2	(35/2,37/2,39/2 ⁻)	385.6	100	4684.6	(35/2 ⁻)		
5168.0	(37/2)	979.5	100	4188.5	(35/2 ⁻)	D+Q	
5338.2	(39/2)	1149.7	100	4188.5	(35/2 ⁻)	(Q)	
5373.9?	(39/2 ⁻)	689.3	100	4684.6	(35/2 ⁻)		
5538.6	(45/2) ⁺	488.8	100	5049.8	(41/2) ⁺	E2	0.01421 20
5607.8	(39/2)	1419.3	100	4188.5	(35/2 ⁻)	(Q)	
5963.4	(41/2)	356	9 3	5607.8	(39/2)		
		795.4	100 13	5168.0	(37/2)	(Q)	
6030.2?	(43/2)	692	100	5338.2	(39/2)		
6289.1	(47/2)	750.4	100	5538.6	(45/2) ⁺	D+Q	
6809.4	(49/2)	1270.8	100	5538.6	(45/2) ⁺		
6996.8	(51/2)	187.5	24 8	6809.4	(49/2)		
		707.7	100 24	6289.1	(47/2)	(E2)	0.00563 8
7027.6	(45/2,47/2,49/2 ⁺)	1489.0	100	5538.6	(45/2) ⁺		
7684.1	(55/2)	687.3	100	6996.8	(51/2)	(Q)	

[†] From ¹⁴⁹Gd ε decay, where available, since the E_γ values in this study are known more precisely than in any other γ -ray dataset. For levels populated in in-beam γ -ray studies, values are generally from ¹³⁹La(¹³C,3n γ) (1994Ur01), since this dataset provides most detailed measurements.

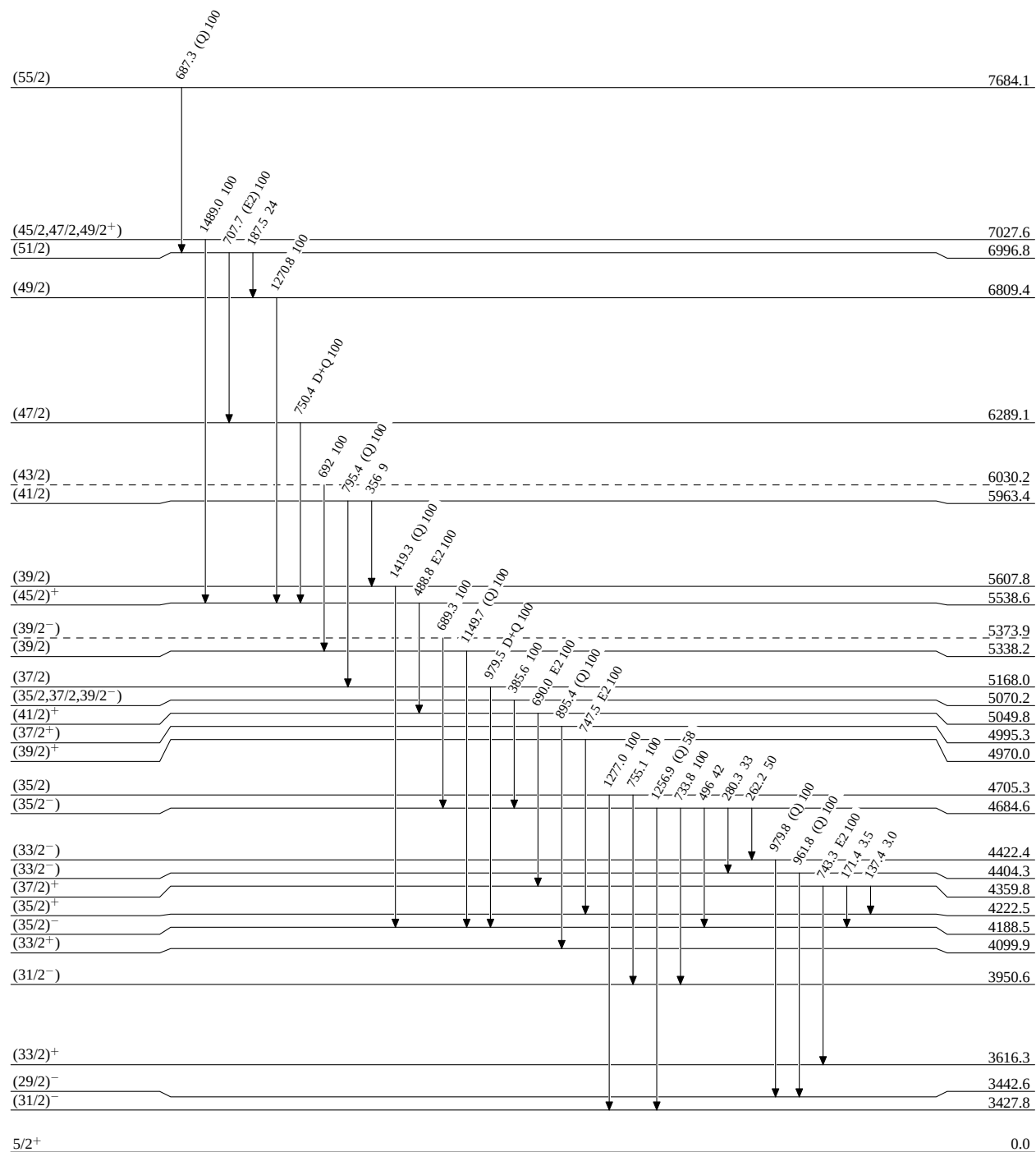
[‡] From ce data in ¹⁴⁹Gd ε decay, $\gamma(\theta)$ in (p,2n γ) and (p,4n γ), $\gamma(\text{lin pol})$ and $\gamma\gamma(\text{DCO})$ in (¹³C,3n γ). For $\gamma(\theta)$ in datasets of high-spin levels, $\Delta J=2$ transitions are given as Q, but from systematics and absence of isomers, mult=E2 is more likely than M2 for all such transitions.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas**Level Scheme**

Intensities: Relative photon branching from each level

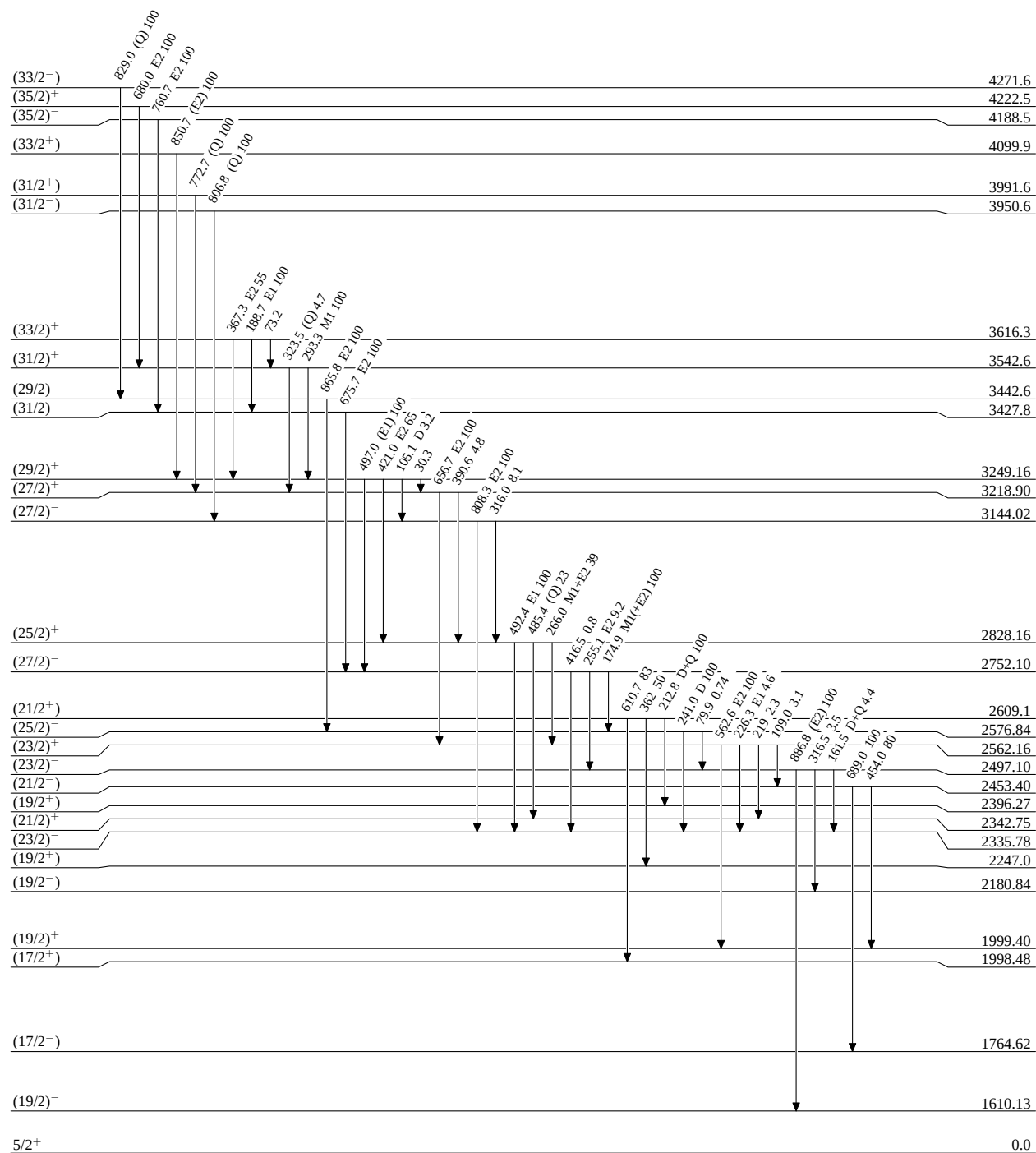


93.1 d 4

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



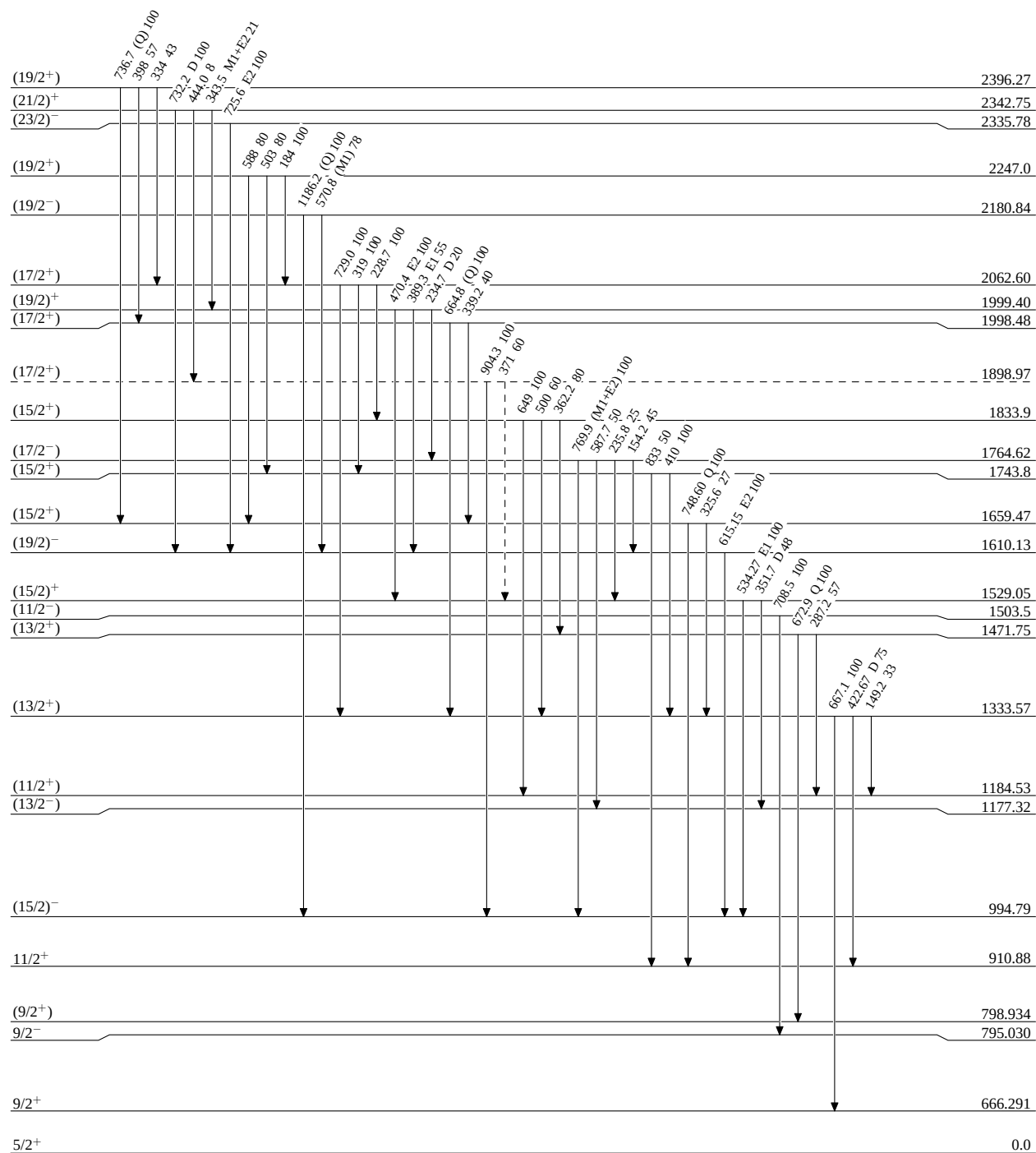
Adopted Levels, Gammas

Legend

Level Scheme (continued)

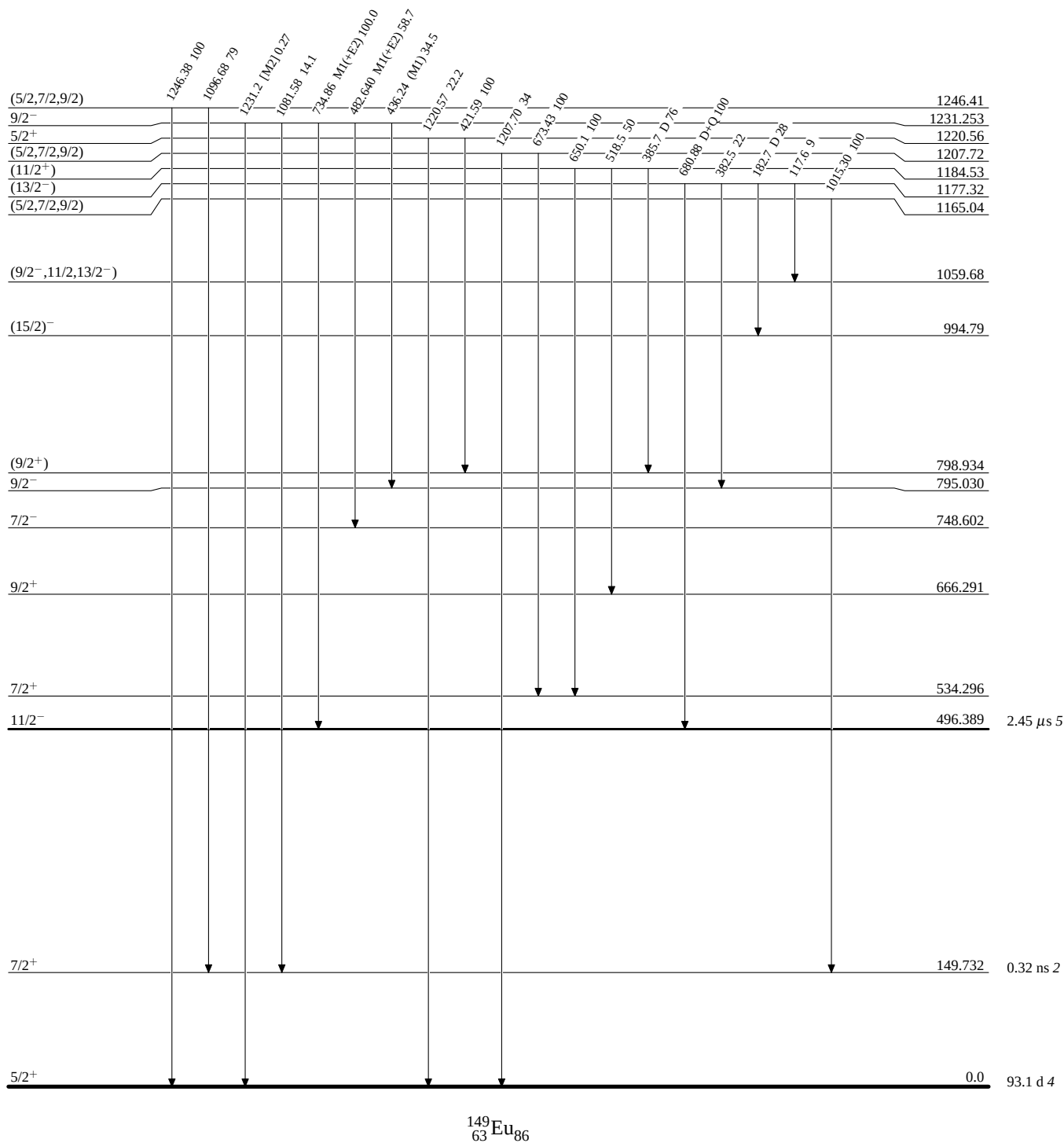
Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Relative photon branching from each level



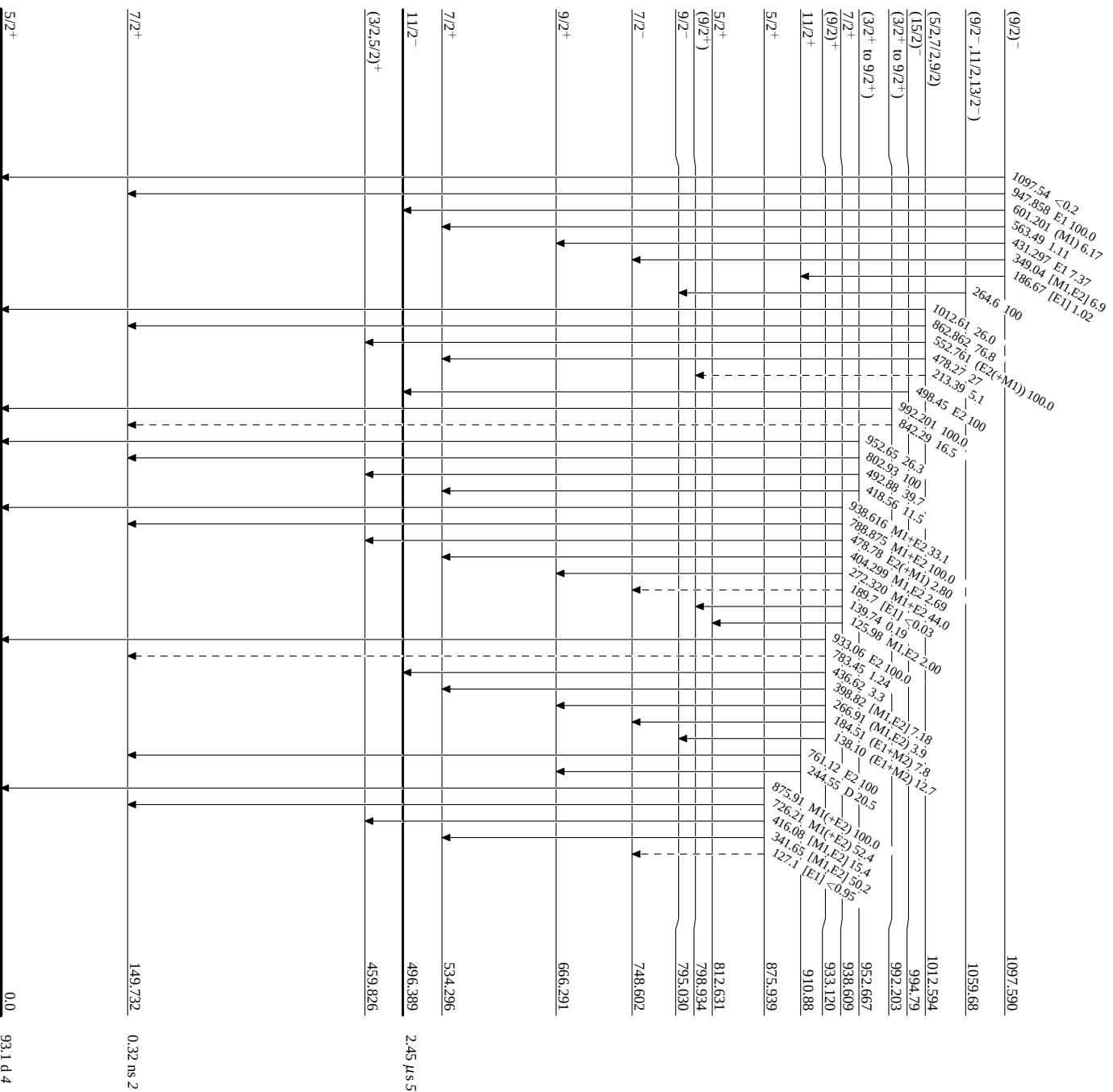
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----▶ γ Decay (Uncertain)



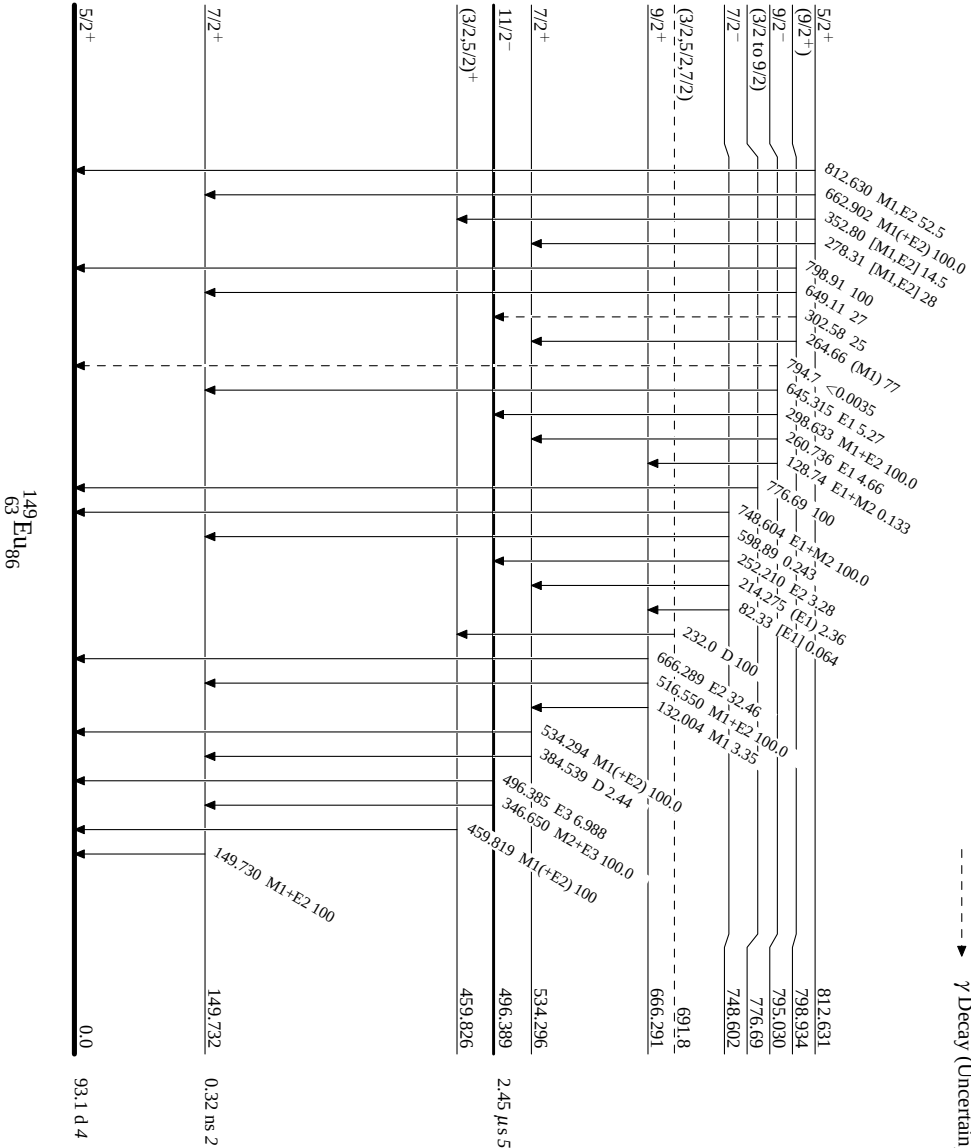
Adopted Levels, Gammas

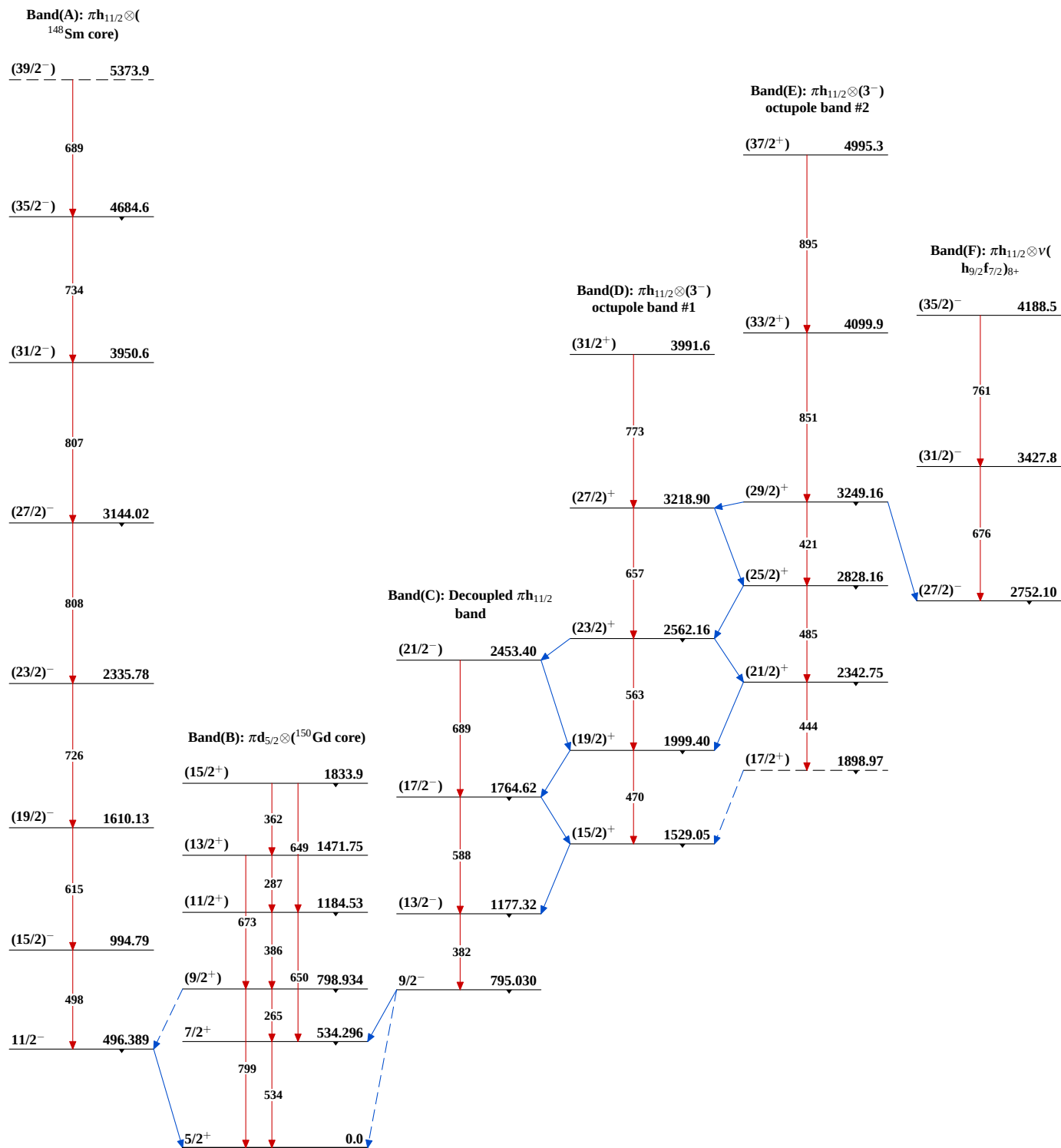
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

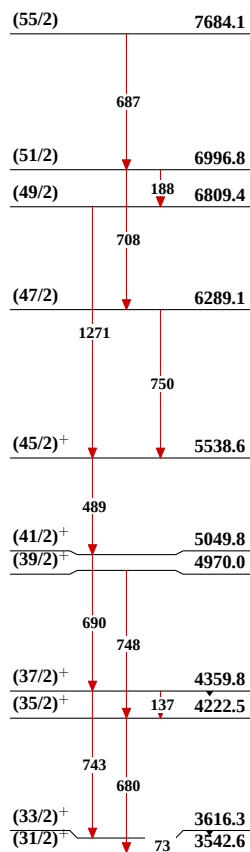
-----▶ γ Decay (Uncertain)



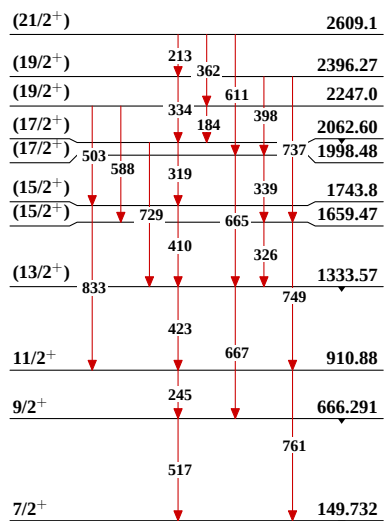
Adopted Levels, Gammas

Adopted Levels, Gammas (continued)

Band(G): Multi-particle band based
on $31/2^+$



Seq.(H): Sequence based on $149.7, 7/2^+$
level



¹⁴⁹Gd ϵ decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#)

Parent: ¹⁴⁹Gd: E=0; J ^{π} =7/2⁻; T_{1/2}=9.28 d 10; Q(ϵ)=1314 4; % ϵ +% β^+ decay=99.9995 1

¹⁴⁹Gd-J ^{π} , T_{1/2}: From ¹⁴⁹Gd Adopted Levels.

¹⁴⁹Gd-Q(ϵ): From [2021Wa16](#).

¹⁴⁹Gd-% ϵ +% β^+ decay: % α =0.00050 12 from weighted average of % α =0.00063 12 ([1996Vy02](#)) (from I α (3019 α in ¹⁴⁹Gd α decay)/I γ (149.8)=0.0000118 23), 0.00046 15 ([1965Si06](#)) (from I α /I(ϵ K)=4.61 $\times 10^{-6}$), and 0.00040 12 ([1966Wi12](#)) (from I α /I(ϵ K)=4.01 $\times 10^{-6}$). Others: I α /I(ϵ K)=3 $\times 10^{-6}$ ([1967Go32](#)), 0.0007% ([1953Ra02](#)).

[2006Ri11](#): ¹⁴⁹Gd obtained from neutron irradiation of ¹⁴⁸Gd using Triga reactor. Measured E γ , I γ , neutron capture σ using a high-efficiency Ge detector.

[1987Ad02](#): measured E γ , I γ , integral $\gamma\gamma$.

[1990Me15](#): measured E γ , I γ , K x ray.

[1992Ca11](#): measured E γ , I γ , ce. E γ values are given without uncertainties.

Other main references for E γ , I γ , ce, $\gamma\gamma$ -coin, (ce) γ -coin and ce data:

[1996Vy02](#): Measured E γ , I γ , $\gamma\gamma$, ce. (ce) γ coin, I(x rays), α decay. Analysis of data reported earlier (1978-1980) in secondary references. Several new γ rays are listed in this paper; energies and ϵ feedings for 16 excited states are also listed. Full details of this work are not available.

[1975Al14](#): measured E γ , I γ , $\gamma\gamma$, ce, (ce) γ coin, I(x rays).

[1975Se18](#): measured E γ , I γ , $\gamma\gamma$, $\gamma\gamma(\theta)$.

[1974Ga13](#): measured ce and E γ .

[1970Ep01](#) (also [1970EpZZ](#)): measured E γ , I γ , $\gamma\gamma$, I(x rays), $\gamma\gamma(t)$.

[1966Ha23](#): measured ce data.

[1966Av05](#): measured ce data.

Other measurements:

No β^+ radiation reported by [1953Ra02](#), and I(β^+)/ ϵ_K <0.001 ([1970Ep01](#)).

E γ , I γ data using Ge(Li) detectors: [1973Ag08](#), [1969Gr32](#), [1968Wi21](#), [1968Ad01](#), [1967Cl05](#), [1966Wi12](#), [1966Ja11](#). Others using NaI(Tl) detectors: [1962Pr06](#), [1961So04](#), [1957Sh46](#).

ce: [1974Ga13](#), [1968Wi21](#), [1958An35](#), [1958Ad38](#).

$\gamma\gamma$ -, γ (ce)-, (ce)(ce)-coin: [1968Wi21](#), [1966Ja11](#), [1962Pr06](#), [1961So04](#), [1961Be36](#), [1961Be33](#), [1959Dz05](#), [1956St23](#).

K x-ray intensity: [1975Al14](#), [1970Ep01](#), [1968Ad01](#), [1962Pr06](#).

$\gamma\gamma(t)$: [1970KI07](#), [1969Iv02](#), [1962Pr06](#), [1962Be25](#), [1962Be20](#), [1961Be08](#), [1961So04](#), [1956St23](#).

$\gamma\gamma(\theta)$: [1985Be64](#), [1962Pr06](#).

$\gamma\gamma(\theta, H, t)$: [1970KI07](#) (also [1969KI12](#)).

$\gamma(\theta, T)$: [1987Kr11](#) (also [1985Fi06](#)), [1987Be33](#), [1986Va16](#) (also [1985Va08](#)). $\mu(^{149}\text{Gd g.s.})$ determined from these data together with δ for some of the transitions in ¹⁴⁹Eu.

T_{1/2}(¹⁴⁹Gd g.s.): [1970Ep01](#), [1962Pr06](#), [1958Pa16](#), [1958An35](#), [1957Sh46](#), [1951Ho30](#).

Assignment for ¹⁴⁹Gd isotope: [1966Mc11](#), [1958Ad38](#), [1958Go72](#), [1957Sh46](#), [1957Go40](#), [1958Go72](#), [1953Ra02](#), [1951Ho30](#).

¹⁴⁹Gd α decay: [1967Go32](#), [1966Wi12](#), [1965Si06](#), [1965Ma48](#), [1953Ra02](#), [1951Ho30](#).

Total decay energy deposit of 1294 keV 71 calculated by RADLIST code is in agreement with expected value of 1314 keV 4, indicating the completeness of the decay scheme.

¹⁴⁹Eu Levels

A tentative 956-keV level proposed by [1975Se18](#); and 869- and 1051-keV levels proposed by [1996Vy02](#) are not confirmed by [2006Ri11](#).

E(level) [‡]	J ^{π} [†]	T _{1/2} [†]	Comments
0.0	5/2 ⁺	93.1 d 4	
149.732 5	7/2 ⁺	0.32 ns 2	T _{1/2} : $\gamma\gamma(t)$ (1962Be25). Others: 1962Pr06 , 1956St23 .
459.826 8	(3/2, 5/2) ⁺		E(level): 459.853 23 (J ^{π} =5/2 ⁺ , 7/2 ⁺) (1996Vy02).
496.389 6	11/2 ⁻	2.45 μ s 5	g=+1.103 (1970KI07) E(level): 496.398 12 (1996Vy02).

Continued on next page (footnotes at end of table)

^{149}Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued) ^{149}Eu Levels (continued)

E(level) [‡]	J ^π [†]	Comments
		T _{1/2} : $\gamma\gamma(t)$. Weighted average of 2.48 μs 5 (1961Be08), 2.43 μs 3 (1970Kl07), 2.42 μs 21 (1962Pr06). Others: 2.6 μs (1969Iv02), 3.3 μs 4 (1961So04).
534.295 5	7/2 ⁺	g factor from (299 γ)(347 γ)(θ ,H,t) (1970Kl07).
666.291 6	9/2 ⁺	E(level): 534.296 22 (1996Vy02).
748.601 6	7/2 ⁻	E(level): 666.290 24 ($J^\pi=7/2^+, 9/2^+$) (1996Vy02).
776.69 10	(3/2 to 9/2)	E(level): 748.610 25 (1996Vy02).
795.030 7	9/2 ⁻	E(level): 794.98 6 (1996Vy02).
798.937 15	(9/2 ⁺)	
812.631 7	5/2 ⁺	E(level): 812.63 5 ($J^\pi=5/2^+, 7/2^+$) (1996Vy02).
875.939 10	5/2 ⁺	E(level): 875.01 5 ($J^\pi=5/2^+, 7/2^+$) (1996Vy02).
910.89 4	11/2 ⁺	
933.119 8	(9/2 ⁺)	E(level): 933.13 3 ($J^\pi=7/2^+$) (1996Vy02).
938.609 6	7/2 ⁺	E(level): 938.61 4 (1996Vy02).
		J^π : 7/2 ⁺ consistent with $\delta(789\gamma)$ from ce and $\gamma(\theta,T)$.
952.667 18	(3/2 ⁺ to 9/2 ⁺)	
992.203 10	(3/2 ⁺ to 9/2 ⁺)	
1012.594 10	(5/2,7/2,9/2)	E(level): 1012.67 7 (1996Vy02).
1097.591 10	(9/2 ⁻)	E(level): 1097.59 4 ($J^\pi=7/2^-, 9/2^-$) (1996Vy02).
1165.04 3	(5/2,7/2,9/2)	
1207.72 3	(5/2,7/2,9/2)	
1220.56 10	5/2 ⁺	
1231.253 9	9/2 ⁻	E(level): 1231.27 4 (1996Vy02).
1246.41 5	(5/2,7/2,9/2)	

[†] From the Adopted Levels.[‡] From least-squares fit to E_γ data. ε, β^+ radiations

E(decay)	E(level)	I ε [†]	Log ft	Comments
(68 4)	1246.41	0.0037 3	8.2 1	
(83 4)	1231.253	0.268 15	6.7 1	I($\varepsilon + \beta^+$): other: 0.20 2 (1996Vy02).
(93 4)	1220.56	0.0043 6	8.7 1	
(106 4)	1207.72	0.0045 5	8.8 1	
(149 4)	1165.04	0.0122 8	8.80 5	
(216 4)	1097.591	1.18 7	7.24 4	I($\varepsilon + \beta^+$): other: 1.04 6 (1996Vy02).
(301 4)	1012.594	0.202 12	8.35 3	I($\varepsilon + \beta^+$): other: 0.24 4 (1996Vy02).
(322 4)	992.203	0.0374 22	9.14 3	
(361 4)	952.667	0.079 5	8.93 3	
(375 4)	938.609	14.0 8	6.72 3	I($\varepsilon + \beta^+$): other: 14.3 6 (1996Vy02).
(381 4)	933.119	0.88 5	7.94 3	I($\varepsilon + \beta^+$): other: 0.83 6 (1996Vy02).
(438 4)	875.939	0.337 19	8.49 3	I($\varepsilon + \beta^+$): other: 0.58 12 (1996Vy02).
(501 4)	812.631	0.264 22	8.72 4	I($\varepsilon + \beta^+$): other: 0.75 6 (1996Vy02).
(515 4)	798.937	0.098 9	9.18 4	
(519 4)	795.030	33.0 18	6.66 3	I($\varepsilon + \beta^+$): other: 36.4 15 (1996Vy02).
(537 4)	776.69	0.0147 11	10.04 4	
(565 4)	748.601	8.6 5	7.32 3	I($\varepsilon + \beta^+$): other: 8.5 4 (1996Vy02).
(648 [‡] 4)	666.291	<0.1	>9.4	I($\varepsilon + \beta^+$): other: 0.17 (1996Vy02).
(780 4)	534.295	1.05 7	8.54 3	I($\varepsilon + \beta^+$): other: 0.75 24 (1996Vy02).
(818 [‡] 4)	496.389	<0.3	>9.1	I($\varepsilon + \beta^+$): other: 1.7 (1996Vy02).

Continued on next page (footnotes at end of table)

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

ε, β^+ radiations (continued)

<u>E(decay)</u>	<u>E(level)</u>	<u>$I\beta^+$ [†]</u>	<u>$I\varepsilon$ [†]</u>	<u>Log <i>ft</i></u>	<u>$I(\varepsilon + \beta^+)$ [†]</u>	<u>Comments</u>
(854 4)	459.826		0.220 14	9.30 3		$I(\varepsilon + \beta^+)$: other: 0.24 5 (1996Vy02).
(1164 4)	149.732		34.2 19	7.39 3	34.2 19	$I(\varepsilon + \beta^+)$: other: 36 6 (1996Vy02).
(1314 4)	0.0	<0.0033	<10.0	>8.0	<10	$I\varepsilon$: limit for g.s. feeding was obtained from γ -ray intensity balance and K x ray intensity ($I\gamma(K \text{ x ray})=211\pm16$, relative to $I\gamma(149.9)=100$, weighted average of 1975Al14 , 1970Ep01 , 1968Ad01 , 1962Pr06), with $\omega(K)=0.932$ (1979Kr13) and $\varepsilon K/(\varepsilon + \beta^+)=0.82$. $I(\beta^+)/I(\varepsilon K)<0.001$ (1970Ep01). Other: 4 (1996Vy02).

[†] For absolute intensity per 100 decays, multiply by 0.999995 1.

[‡] Existence of this branch is questionable.

γ(¹⁴⁹Eu)

I_γ normalization: Σ(I(γ+ce) to g.s.)=95.5, assuming I_ε(g.s.)=5.5. See also comment on g.s. feeding.

Conversion coefficients under comments are deduced by evaluators from I_γ and I(ce) values as given under comments, with the latter being the weighted average of values from [1966Av05](#), [1966Ha23](#), [1974Ga13](#), [1975Al14](#), [1992Ca11](#), unless otherwise noted. The I_γ and I_{ce}(K) values were normalized together to give α(K)_{exp}=0.503 for the 149.7-keV transition, which is the theoretical value for an M1+E2 (δ=0.14.3) transition.

Following weak lines reported by different authors have been omitted for lack of confirmation in more recent work:

[1966Av05](#) (from ce data): 58.68, 64.25, 72.9, 80.2, 86.9, 97.66, 102.6, 106.3, 112.8, 119.5, 119.8, 130.8, 143.0, 178.5, 296.6.

[1966Ha23](#) (from ce data): 76.0, 76.6, 230.4, 235.1, 268.6, 316.9, 325.6, 401.8, 593.5, 613.8, 718.2, 1029.3.

[1968Ad01](#) (from γ-ray data): 230.4, 235.1.

[1975Se18](#) (from γ-ray data): 229.0, 238.5, 610.0.

K-x ray energies (intensities) (relative to I_γ=100 for 149.7γ) ([1990Me15](#)) are: 40.877 (60.1), 41.529 (107.2), 47.027 (34.2), 48.241 (9.2.14). Other measurements: [1996Vy02](#), [1975Al14](#), [1970Ep01](#), [1968Ad01](#), [1962Pr06](#).

<u>E_γ[†]</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.^{&}</u>	<u>δ^{&}</u>	<u>α^b</u>	<u>Comments</u>
^x 37.80 15									E _γ : the details of the observation of this transition in ce data (1975Al14 and 1966Ha23) are not available. Suggested placement (534 (J ^π =7/2 ⁺) to 496 (J ^π =11/2 ⁻)) seems suspect since with the required mult=M2, the deduced T _{1/2} (534 level)>1.7 μs (assuming RUL(M2)<1) is inconsistent with observed γγ coin involving 534γ where the resolving time may be typically 50 ns.
82.33 8	0.011 2	748.601	7/2 ⁻	666.291	9/2 ⁺	[E1]		0.479 7	I(γ+ce)=0.24 4 (1975Al14). %I _γ =0.0053 10 E _γ , I _γ : from 2006Ri11 . E _γ : others: 82.50 15 (1975Al14), 83.01 (1996Vy02). I _γ : others: 0.065 15 (1975Al14), 0.06 2 (1992Ca11), 0.11 1 (1996Vy02). %I _γ =0.147 8 α(K) _{exp} =0.46 8; α(K) _{exp} =0.97 6; α(L1) _{exp} =0.14 4 E _γ =125.99 2 (2006Ri11), 125.98 1 (1990Me15), 125.98 2 (1987Ad02). I _γ =0.300 6 (2006Ri11), 0.313 10 (1990Me15), 0.250 7 (1987Ad02). Value from 1987Ad02 not used in averaging. α(K) _{exp} =0.46 8 (ce(K) from 1975Al14 , 1966Av05), 0.97 6 (ce(K) from 1992Ca11 , 1966Ha23). Mult=E2 from former and M1 from latter. Ice(K)=0.21 4 (1966Av05), 0.26 6 (1975Al14), 0.59 9 (1966Ha23), 0.48 2 (1992Ca11), Ice(L1)=0.07 (1966Ha23).
125.98 1	0.303 6	938.609	7/2 ⁺	812.631	5/2 ⁺	E2, M1		1.01 5	%I _γ =0.00145 E _γ =127.1 3, I _γ =0.02 1, γ reported by 1975Al14 only. 2006Ri11 set an upper limit of 0.003.
127.1 ^c	<0.003	875.939	5/2 ⁺	748.601	7/2 ⁻	[E1]		0.1483 21	%I _γ =0.0373 31
128.74 2	0.077 5	795.030	9/2 ⁻	666.291	9/2 ⁺	E1+M2	0.18 6	0.36 16	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#), [1987Ad02](#), [1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)									Comments
E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	
132.004 10	0.187 10	666.291	9/2 ⁺	534.295	7/2 ⁺	M1		0.837 12	$\alpha(\text{K})_{\text{exp}}=0.26$ 11 $E_\gamma=128.74$ 2 (2006Ri11), 128.75 3 (1990Me15), 128.77 11 (1987Ad02). $I_\gamma=0.081$ 7 (2006Ri11), 0.078 5 (1990Me15), 0.069 7 (1987Ad02). $\text{Ice}(\text{K})=0.039$ 15. $\%I_\gamma=0.091$ 7 $\alpha(\text{K})_{\text{exp}}=0.88$ 8; $\alpha(\text{L}1)_{\text{exp}}=0.16$ 7; $\alpha(\text{L})_{\text{exp}}=0.36$ 12 $E_\gamma=132.00$ 1 (2006Ri11), 132.001 9 (1990Me15), 132.06 3 (1987Ad02). $I_\gamma=0.187$ 11 (2006Ri11), 0.186 10 (1990Me15), 0.147 8 (1987Ad02 , seems discrepant, not used in averaging). $\text{Ice}(\text{K})=0.27$ 2, $\text{Ice}(\text{L}1)=0.05$ 2, $\text{Ice}(\text{L})=0.11$ 3. $(132\gamma)(534\gamma)(\theta)$: $A_2=+0.10$ 6, $A_4=+0.15$ 12 (1975Se18). $\%I_\gamma=0.079$ 7 $\alpha(\text{K})_{\text{exp}}=0.24$ 6 (1975Al14); $\alpha(\text{K})_{\text{exp}}=0.42$ 6; $\alpha(\text{L}1)_{\text{exp}}=0.11$ 5 $E_\gamma=138.10$ 1 (2006Ri11), 138.09 2 (1990Me15), 138.28 4 (1987Ad02). Value from 1987Ad02 not used in averaging. $I_\gamma=0.141$ 8 (2006Ri11), 0.171 15 (1990Me15), 0.181 7 (1987Ad02); unweighted average. $\alpha(\text{K})_{\text{exp}}=0.42$ 6 (using weighted average of $\text{Ice}(\text{K})$ values). $\alpha(\text{K})_{\text{exp}}=0.24$ 6 gives E1+M2 while 0.42 6 is consistent with E2. $\alpha(\text{L}1)_{\text{exp}}$ gives E2 or E1+M2. $\text{Ice}(\text{K})=0.086$ 27 (1975Al14), 0.17 2 (1992Ca11), 0.20 3 (1966Ha23) 0.15 4 (1966Av05), $\text{Ice}(\text{L}1)=0.04$ 2 (1966Ha23). $\%I_\gamma=0.0140$ 16 $\%I_\gamma=48.4$ 26 $\alpha(\text{K})_{\text{exp}}=0.48$ 2 (1975Al14); $\alpha(\text{L}1)_{\text{exp}}=0.062$ 3; $\alpha(\text{L}2)_{\text{exp}}=0.0062$ 7; $\alpha(\text{L}3)_{\text{exp}}=0.0016$ 6 $\alpha(\text{M})_{\text{exp}}=0.023$ 5; $\alpha(\text{M}1)_{\text{exp}}=0.017$ 3; $\alpha(\text{N})_{\text{exp}}=0.0046$ 15; $\alpha(\text{K})_{\text{exp}}=0.459$ 15 (1996Vy02) $E_\gamma=149.72$ 1 (2006Ri11), 149.736 3 (1990Me15), 149.740 14 (1987Ad02). $I_\gamma=100.0$ 6 (2006Ri11), 100.0 7 (1990Me15), 100.0 19 (1987Ad02). $\text{Ice}(\text{K})=100$ 3, $\text{Ice}(\text{L}1)=12.3$ 6, $\text{Ice}(\text{L}2)=1.24$ 13, $\text{Ice}(\text{L}3)=0.32$ 13, $\text{Ice}(\text{M}1)=3.5$ 5, $\text{Ice}(\text{M})=4.7$ 10, $\text{Ice}(\text{N})=0.91$ 30. δ : from L1:L2:L3=12.2 6:1.24 13:0.32 12 (1966Av05 , 1966Ha23). $\%I_\gamma=0.0484$ 32 $\alpha(\text{K})_{\text{exp}}=0.14$ 4; $\alpha(\text{K})_{\text{exp}}=0.046$ 5 $E_\gamma=184.50$ 2 (2006Ri11), 184.51 1 (1990Me15), 184.52 2 (1987Ad02).
139.74 ^{#c} 8 149.730 10	0.029 [#] 3 100.0 6	938.609 149.732	7/2 ⁺ 7/2 ⁺	798.937 0.0	(9/2 ⁺) 5/2 ⁺	M1+E2		0.587 8	
184.51 1	0.100 4	933.119	(9/2) ⁺	748.601	7/2 ⁻	(E1+M2)	0.25 5	0.17 4	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)								Comments
E_γ †	I_γ @a	E_i (level)	J_i^π	E_f	J_f^π	Mult.&	α^b	
								I γ =0.108 3 (2006Ri11), 0.0930 34 (1990Me15), 0.099 3 (1987Ad02): unweighted average. α (K)exp=0.14 4 from ce(K) in 1975Al14 , 0.46 5 (from weighted averaged ce(K)). The former value gives E2 or E1+M2, while the latter (>than that for M1) is inconsistent with either mult. Ice(K)=0.027 8 (1975Al14), 0.092 9 (1992Ca11), 0.08 2 (1966Ha23). %I γ =0.0097 9 E γ =186.63 3 (2006Ri11), 186.729 53 (1990Me15), 186.75 7 (1987Ad02). I γ =0.024 4 (2006Ri11), 0.0206 25 (1990Me15), 0.0192 16 (1987Ad02). %I γ <0.00242 E γ =189.70 20, I γ =0.02 1, γ reported by 1975Al14 only; not confirmed by 2006Ri11 .
186.67 4	0.0201 16	1097.591	(9/2) ⁻	910.89	11/2 ⁺	[E1]	0.0526 7	
189.7 ^c	<0.005	938.609	7/2 ⁺	748.601	7/2 ⁻	[E1]	0.0504 7	
^x 196.93 [‡]	<0.01							%I γ =0.0044 10 E γ : poor fit in the level scheme, fitted value is 213.66 2. %I γ =0.195 11 α (K)exp=0.09 4 E γ =214.28 2 (2006Ri11), 214.28 (1990Me15), 214.268 13 (1987Ad02). Uncertainty of 0.015 keV assumed in 1990Me15 . I γ =0.409 11 (2006Ri11), 0.387 10 (1990Me15), 0.409 8 (1987Ad02). E1 or E2 from α (K)exp. Ice(K)=0.074 38. (214 γ)(534 γ)(θ): A ₂ =+0.11 4, A ₄ =+0.07 10 (1975Se18). Earlier placement from a 1050.8 level not supported by 2006Ri11 .
^x 203.14 [‡]	<0.003							
213.39 ^{#c} 8	0.009 [#] 2	1012.594	(5/2,7/2,9/2)	798.937	(9/2 ⁺)			
214.275 13	0.403 8	748.601	7/2 ⁻	534.295	7/2 ⁺	(E1)	0.0365 5	
^x 238.25 [‡]	<0.003							
^x 239.87 [‡]	<0.003							
^x 248.64 [‡]	<0.01							
252.210 10	0.560 12	748.601	7/2 ⁻	496.389	11/2 ⁻	E2	0.1006 14	%I γ =0.271 16 α (K)exp=0.085 5 E γ =252.19 2 (2006Ri11), 252.222 4 (1990Me15), 252.203 8 (1987Ad02). I γ =0.563 11 (2006Ri11), 0.538 10 (1990Me15), 0.580 11 (1987Ad02): unweighted average. Mult.: δ (E2/M1)=2.5 +33-8 from α (K)exp, but ΔJ^π requires E2. Ice(K)=0.095 5. %I γ =1.30 7 α (K)exp=0.0182 14 E γ =260.73 3 (2006Ri11), 260.737 6 (1990Me15), 260.735 6
260.736 10	2.688 29	795.030	9/2 ⁻	534.295	7/2 ⁺	E1	0.02189 31	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

γ(¹⁴⁹Eu) (continued)

<u>E_γ[†]</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.&</u>	<u>δ&</u>	<u>α^b</u>	<u>Comments</u>
									(1987Ad02).
									I _γ =2.69 5 (2006Ri11), 2.687 29 (1990Me15), 2.69 5 (1987Ad02).
									α(K)exp gives δ(M2/E1)<0.05.
									Ice(K)=0.099 6.
									(261γ)(534γ)(θ): A ₂ =-0.110 25, A ₄ =+0.07 5 (1975Se18).
									γ(θ,T): 1987Kr11 .
264.66 4	0.080 9	798.937	(9/2 ⁺)	534.295	7/2 ⁺	(M1)		0.1229 17	%I _γ =0.039 5
									α(K)exp=0.20 5
									E _γ =264.60 4 (2006Ri11), 264.63 3 (1990Me15), 264.72 3 (1987Ad02).
									I _γ =0.081 4 (2006Ri11), 0.064 5 (1990Me15), 0.095 3 (1987Ad02): unweighted average.
									α(K)exp marginally agrees with M1.
									Ice(K)=0.035 10.
									Placement from 1013 level in 1975Al14 is not supported by 1987Ad02 and 2006Ri11 , and from level energy difference.
266.91 7	0.050 14	933.119	(9/2 ⁺)	666.291	9/2 ⁺	(M1,E2)		0.102 18	%I _γ =0.024 7
									α(K)exp≈0.16
									E _γ =266.82 6 (2006Ri11), 266.97 5 (1987Ad02).
									I _γ =0.036 3 (2006Ri11), 0.063 3 (1987Ad02): unweighted average.
									Ice(K)≈0.02.
^x 270.79 [‡]	<0.01								%I _γ =3.22 18
272.320 10	6.66 10	938.609	7/2 ⁺	666.291	9/2 ⁺	M1+E2	0.33 +12-8	0.1104 29	α(K)exp=0.098 8; α(L1)exp=0.0135 14; α(L2)exp=0.0012 3; α(L3)exp≤0.00055
									α(M1)exp=0.0030 15
									E _γ =272.32 3 (2006Ri11), 272.317 5 (1990Me15), 272.322 6 (1987Ad02).
									I _γ =6.61 13 (2006Ri11), 6.66 10 (1990Me15), 6.69 13 (1987Ad02).
									δ: from experimental α values above, and L1:L2:L3=0.18 2:0.016 4:0.0073 (1966Av05), using the BrIccMixing program.
									Ice(K)=1.30 4, Ice(L1)=0.18 2, Ice(L2)=0.016 4, Ice(L3)≤0.0073, Ice(M1)=0.04 2.
									(272γ)(666γ)(θ): A ₂ =+0.143 24, A ₄ =+0.013 20 (1985Be64).
278.31 3	0.164 21	812.631	5/2 ⁺	534.295	7/2 ⁺	[M1,E2]		0.090 17	%I _γ =0.079 11
									E _γ =278.34 2 (2006Ri11), 278.28 2 (1990Me15).
									I _γ =0.185 6 (2006Ri11), 0.143 3 (1990Me15): unweighted average.
									(278γ)(534γ)(θ): A ₂ =-0.160 20, A ₄ =-0.035 30 (1975Se18).

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)

E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
^x 292.86 [‡] 298.633 10	<0.01 57.72 29	795.030	9/2 ⁻	496.389	11/2 ⁻	M1+E2	+0.15 2	0.0884 13	%I γ =27.9 15 α (K)exp=0.073 4; α (L1)exp=0.0095 12; α (L2)exp=0.00061 16; α (L3)exp≤0.00013 α (K)exp=0.0723 20 (1996Vy02) E γ =298.63 1 (2006Ri11), 298.634 5 (1990Me15), 298.634 10 (1987Ad02). I γ =57.9 6 (2006Ri11), 57.66 24 (1990Me15), 57.9 10 (1987Ad02). Ice(K)=8.6 3, Ice(L1)=1.13 11, Ice(L2)=0.073 18, Ice(L3)≤0.015. δ : from $\gamma(\theta,T)$ (1987Be33). Others: +0.15 3 (1986Va16), +0.11 3 (quoted by 1986Va16 from another work). Combining experimental α values above and L1:L2:L3=1.13 11:0.073 18:0.015 gives δ <0.35.
302.58 ^{#c} 3 341.65 5	0.026 [#] 4 0.158 11	798.937 875.939	(9/2 ⁺) 5/2 ⁺	496.389 534.295	11/2 ⁻ 7/2 ⁺	[M1,E2]		0.051 12	%I γ =0.0126 20 %I γ =0.076 7 E γ =341.66 5 (2006Ri11), 341.65 6 (1990Me15), 341.65 5 (1987Ad02). I γ =0.136 17 (2006Ri11), 0.157 15 (1990Me15), 0.167 11 (1987Ad02). %I γ =0.073 25 γ from 1990Me15 only. Note that this γ is just to left of the third most intense 346.65-keV γ in this decay. No such γ is confirmed by 2006Ri11 .
^x 346.30	0.15 5								%I γ =23.7 13 α (K)exp=0.202 8; α (L1)exp=0.031 3; α (L2)exp=0.0022 4; α (L3)exp=0.00016 7 α (M1)exp=0.007 2; α (K)exp=0.187 6 (1996Vy02) E γ =346.66 3 (2006Ri11), 346.651 3 (1990Me15), 346.648 5 (1987Ad02). I γ =49.8 5 (2006Ri11), 48.80 15 (1990Me15), 49.1 8 (1987Ad02). Mult.: from L1:L2:L3=3.2 3:0.21 4:0.016 7 (1966Av05). Ice(K)=19.9 6, Ice(L1)=3.0 3, Ice(L2)=0.21 4, Ice(L3)=0.016 7, Ice(M1)=0.7 2. δ : from $\gamma(\theta,T)$ (1987Be33). Other: -0.08 +11-5 (1986Va16). ce data consistent with pure M2. (347 γ)(150 γ)(θ): A ₂ =-0.009 19, A ₄ =-0.011 23 (1962Pr06). %I γ =0.066 7 E γ =349.12 10 (2006Ri11), 348.96 10 (1990Me15). I γ =0.133 10 (2006Ri11), 0.20 5 (1990Me15). Ice(K)=0.012 4.
346.650 10	49.0 3	496.389	11/2 ⁻	149.732	7/2 ⁺	M2+E3	-0.075 25	0.2326 33	
349.04 10	0.136 13	1097.591	(9/2 ⁻)	748.601	7/2 ⁻	[M1,E2]		0.048 12	

¹⁴⁹Gd ε decay (9.28 d) 2006Ri11,1987Ad02,1990Me15 (continued)

γ(¹⁴⁹Eu) (continued)

<u>E_γ[†]</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.&</u>	<u>α^b</u>	<u>Comments</u>
352.80 2	0.084 6	812.631	5/2 ⁺	459.826	(3/2,5/2) ⁺	[M1,E2]	0.046 11	%I _γ =0.041 4 E _γ =352.79 5 (2006Ri11), 352.81 2 (1990Me15), 352.72 9 (1987Ad02). I _γ =0.074 9 (2006Ri11), 0.088 15 (1990Me15), 0.088 6 (1987Ad02). Earlier placement from a 869 level not supported by 2006Ri11.
^x 372.62 [‡]	<0.003							
384.539 10	0.157 4	534.295	7/2 ⁺	149.732	7/2 ⁺	[M1,E2]	0.037 9	%I _γ =0.076 4 E _γ =384.54 2 (2006Ri11), 384.52 2 (1990Me15), 384.545 12 (1987Ad02). I _γ =0.154 4 (2006Ri11), 0.157 5 (1990Me15), 0.160 4 (1987Ad02).
^x 394.59 [‡]	<0.002							
398.82 1	0.0925 23	933.119	(9/2) ⁺	534.295	7/2 ⁺	[M1,E2]	0.033 8	%I _γ =0.0448 26 E _γ =398.82 3 (2006Ri11), 398.77 3 (1990Me15), 398.82 1 (1987Ad02). I _γ =0.092 3 (2006Ri11), 0.088 5 (1990Me15), 0.0937 23 (1987Ad02).
^x 400.20 [‡]	<0.002							
404.299 10	0.408 5	938.609	7/2 ⁺	534.295	7/2 ⁺	M1,E2	0.032 8	%I _γ =0.198 11 E _γ =404.32 3 (2006Ri11), 404.294 5 (1990Me15), 404.302 9 (1987Ad02). I _γ =0.402 5 (2006Ri11), 0.416 10 (1990Me15), 0.413 6 (1987Ad02). α(K)exp=0.011 4 (ce(K) from 1975Al14), 0.032 12 (ce(K) from 1966Ha23). Ice(K)=0.0086 26 (1975Al14), 0.026 10 (1966Ha23). (404γ)(534γ)(θ): A ₂ =+0.11 7, A ₄ =+0.11 10 (1975Se18). (404γ)(534γ)(θ): A ₂ =-0.11 5, A ₄ =+0.025 18 (1985Be64).
416.08 3	0.0486 15	875.939	5/2 ⁺	459.826	(3/2,5/2) ⁺	[M1,E2]	0.030 8	%I _γ =0.0235 14 E _γ =416.09 4 (2006Ri11), 416.04 3 (1990Me15), 416.11 3 (1987Ad02). I _γ =0.048 3 (2006Ri11), 0.045 4 (1990Me15), 0.0493 15 (1987Ad02).
418.56 21	0.0106 13	952.667	(3/2 ⁺ to 9/2 ⁺)	534.295	7/2 ⁺			%I _γ =0.0051 7 E _γ =418.35 4 (2006Ri11), 418.77 13 (1987Ad02): unweighted average. I _γ =0.010 2 (2006Ri11), 0.0108 13 (1987Ad02). %I _γ =0.0029 10
^x 419.47 15	0.006 2							E _γ ,I _γ : from 2006Ri11 only, possible assignment to the decay of ¹⁴⁹ Gd.
421.59 18	0.0072 11	1220.56	5/2 ⁺	798.937	(9/2 ⁺)	[E2]	0.02131 30	%I _γ =0.0035 6

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#), [1987Ad02](#), [1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)									
$E_\gamma^{\dagger}$	$I_\gamma^{@a}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. $\&$	$\delta\&$	α^b	Comments
									$E_\gamma=421.55\ 20$ (2006Ri11), $421.63\ 18$ (1987Ad02). $I_\gamma=0.010\ 5$ (2006Ri11), $0.0071\ 11$ (1987Ad02).
^x 429.73 [‡] 431.297 12	<0.002 0.146 3	1097.591	(9/2) ⁻	666.291	9/2 ⁺	E1		0.00633 9	% $I_\gamma=0.071\ 4$ $\alpha(K)_{\text{exp}}=0.010\ 5$ $E_\gamma=431.30\ 2$ (2006Ri11), $431.294\ 12$ (1990Me15), $431.298\ 12$ (1987Ad02). $I_\gamma=0.145\ 4$ (2006Ri11), $0.142\ 10$ (1990Me15), $0.147\ 3$ (1987Ad02). $\alpha(K)_{\text{exp}}$ gives $\delta(M2/E1)<0.3$. $\text{Ice}(K)=0.0031\ 16$. % $I_\gamma=0.0441\ 30$
436.24 3	0.091 4	1231.253	9/2 ⁻	795.030	9/2 ⁻	(M1)		0.0331 5	E_γ, I_γ : from 2006Ri11 , as individual values for the doublet at this energy are given. In other references, values are for an unresolved doublet. $E_\gamma=436.24\ 3$ (2006Ri11). Others: $436.36\ 2$ (1990Me15), $436.37\ 1$ (1987Ad02) for unresolved doublet. $I_\gamma=0.091\ 4$ (2006Ri11). Others: $0.132\ 5$ (1990Me15), $0.132\ 3$ (1987Ad02) for unresolved doublet. Mult.: $\alpha(K)_{\text{exp}}=0.046\ 16$ for the doublet is consistent with M1 for the main placement with 1231 level. $\text{Ice}(K)=0.012\ 4$. % $I_\gamma=0.0208\ 31$
436.62 17	0.043 6	933.119	(9/2) ⁺	496.389	11/2 ⁻				E_γ, I_γ : from 2006Ri11 , as individual values for the doublet at this energy are given. In other references, values are for an unresolved doublet. $E_\gamma=436.62\ 17$ (2006Ri11). Others: $436.36\ 2$ (1990Me15), $436.37\ 1$ (1987Ad02) for unresolved doublet. $I_\gamma=0.043\ 6$ (2006Ri11). Others: $0.132\ 5$ (1990Me15), $0.132\ 3$ (1987Ad02) for unresolved doublet.
^x 447.42 [‡] ^x 456.77 3	<0.01 0.0495 21								% $I_\gamma=0.0240\ 16$ $E_\gamma=456.74\ 4$ (2006Ri11), $456.75\ 4$ (1990Me15), $456.80\ 3$ (1987Ad02). $I_\gamma=0.048\ 6$ (2006Ri11), $0.044\ 5$ (1990Me15), $0.0506\ 21$ (1987Ad02). % $I_\gamma=0.585\ 31$ $\alpha(K)_{\text{exp}}=0.025\ 2$ $E_\gamma=459.84\ 2$ (2006Ri11), $459.812\ 4$ (1990Me15), $459.821\ 8$ (1987Ad02). $I_\gamma=1.224\ 22$ (2006Ri11), $1.199\ 10$ (1990Me15), $1.222\ 17$ (1987Ad02). $\text{Ice}(K)=0.060\ 4$.
459.819 10	1.208 10	459.826	(3/2,5/2) ⁺	0.0	5/2 ⁺	M1(+E2)	<0.4	0.0281 9	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)									
E_γ [†]	I_γ ^{@a}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	δ &	α^b	Comments
478.27 10	0.047 8	1012.594	(5/2,7/2,9/2)	534.295	7/2 ⁺				%I _γ =0.023 4 E _γ ,I _γ : from 2006Ri11 , as individual values for the doublet at this energy are given. In other references, values are for an unresolved doublet. See comments for 478.78γ for data from 1990Me15 and 1987Ad02 . E _γ =478.29 6 in ce spectrum (1975Al14), but it is not clear how the authors resolved the two components of a doublet at this energy.
478.78 2	0.424 6	938.609	7/2 ⁺	459.826	(3/2,5/2) ⁺	E2(+M1)	>4	0.0153 4	Ice(K)=0.0047 25. %I _γ =0.205 11 α(K)exp=0.011 2 E _γ ,I _γ : from 2006Ri11 , as individual values for the doublet at this energy are given. In other references, values are for an unresolved doublet. E _γ =478.78 2 (2006Ri11), 478.71 1 (1990Me15), 478.710 8 (1987Ad02). I _γ =0.424 6 (2006Ri11), 0.475 10 (1990Me15), 0.473 8 (1987Ad02). Ice(K)=0.010 2. %I _γ =0.075 4 α(K)exp=0.021 7 E _γ =482.66 2 (2006Ri11), 482.63 2 (1990Me15), 482.636 12 (1987Ad02). I _γ =0.155 3 (2006Ri11), 0.157 10 (1990Me15), 0.155 4 (1987Ad02). Ice(K)=0.0066 20. %I _γ =0.0178 15 E _γ =492.93 6 (2006Ri11), 492.81 7 (1987Ad02). I _γ =0.034 3 (2006Ri11), 0.0385 25 (1987Ad02). %I _γ =1.66 9 α(K)exp=0.0274 18; α(L1)exp=0.0035 6; α(L2)exp=0.0035 6; α(L3)exp=0.00075 37 α(M1)exp=0.0018 6 E _γ =496.41 2 (2006Ri11), 496.383 2 (1990Me15), 496.380 7 (1987Ad02). I _γ =3.35 6 (2006Ri11), 3.431 15 (1990Me15), 3.41 5 (1987Ad02). Mult.: from L1:L2:L3=0.024 4:0.024 6:0.0051 25 (1966Av05). Ice(K)=0.188 10, Ice(L1)=0.024 4, Ice(L2)=0.024 6, Ice(L3)=0.0051 25, Ice(M1)=0.012 4.
482.640 12	0.155 3	1231.253	9/2 ⁻	748.601	7/2 ⁻	M1(+E2)	<2	0.021 4	
492.88 6	0.0367 25	952.667	(3/2 ⁺ to 9/2 ⁺)	459.826	(3/2,5/2) ⁺				
496.385 10	3.424 17	496.389	11/2 ⁻	0.0	5/2 ⁺	E3		0.0392 5	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

<u>γ(¹⁴⁹Eu) (continued)</u>									
<u>E_γ[†]</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.^{&}</u>	<u>δ^{&}</u>	<u>α^b</u>	<u>Comments</u>
^x 502.12 [‡] 516.550 10	<0.002 5.58 8	666.291	9/2 ⁺	149.732	7/2 ⁺	M1+E2	0.75 +27-24	0.0182 14	%I _γ =2.70 15 α(K)exp=0.0153 7; α(L1)exp=0.0025 7; α(M1)exp=0.0006 2; α(L)exp=0.0018 4 E _γ =516.57 2 (2006Ri11), 516.545 2 (1990Me15), 516.549 7 (1987Ad02). I _γ =5.58 10 (2006Ri11), 5.53 10 (1990Me15), 5.60 8 (1987Ad02). I _γ : 6.28 6 (1975Al14) is not used in averaging. Ice(K)=0.170 5, Ice(L1)=0.028 7, Ice(M1)=0.007 2, Ice(L)=0.020 4. (516γ)(150γ)(θ): A ₂ =-0.120 20, A ₄ =+0.024 25 (1975Se18).
^x 522.12 [‡] ^x 527.92 [‡] 534.294 10	<0.002 <0.003 6.44 5	534.295	7/2 ⁺	0.0	5/2 ⁺	M1(+E2)	<0.4	0.0192 6	%I _γ =3.12 17 α(K)exp=0.0176 12; α(L1)exp=0.0021 6; α(M1)exp=0.00047 15 E _γ =534.31 2 (2006Ri11), 534.296 4 (1990Me15), 534.288 8 (1987Ad02). I _γ =6.49 12 (2006Ri11), 6.41 5 (1990Me15), 6.5 1 (1987Ad02). Ice(K)=0.224 12, Ice(L1)=0.027 7, Ice(M1)=0.006 2, Ice(L)=0.020 4.
552.761 16	0.177 5	1012.594	(5/2,7/2,9/2)	459.826	(3/2,5/2) ⁺	(E2(+M1))	>0.4	0.0137 34	%I _γ =0.086 5 α(K)exp=0.011 4 E _γ =552.76 2 (2006Ri11), 552.75 2 (1990Me15), 552.768 16 (1987Ad02). I _γ =0.156 5 (2006Ri11), 0.171 10 (1990Me15), 0.181 5 (1987Ad02). α(K)exp gives E2(+M1) with δ>0.4 or E1+M2 with δ=0.47 15; the latter value seems less probable due to significant M2 mixture. Ice(K)=0.0039 16.
563.49 10	0.0219 22	1097.591	(9/2) ⁻	534.295	7/2 ⁺	[E1]		0.00346 5	%I _γ =0.0106 12 E _γ =563.58 25 (2006Ri11), 563.48 10 (1987Ad02). I _γ =0.024 4 (2006Ri11), 0.0212 22 (1987Ad02).
^x 574.88 [‡]	<0.002								

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

γ(¹⁴⁹Eu) (continued)

<u>E_γ[†]</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.&</u>	<u>δ&</u>	<u>α^b</u>	<u>Comments</u>
^x 577.96 [‡]	<0.002								
^x 581.79 [‡]	<0.002								
^x 590.96 [‡]	<0.002								Earlier placement from a 1050.8 level not supported by 2006Ri11 .
^x 593.16 [‡]	<0.002								
598.89 5	0.0415 29	748.601	7/2 ⁻	149.732	7/2 ⁺				%I _γ =0.0201 18 E _γ =598.84 4 (2006Ri11), 598.94 4 (1987Ad02). I _γ =0.047 7 (2006Ri11), 0.0400 21 (1987Ad02). %I _γ =0.0591 34 α(K) _{exp} =0.016 3 E _γ =601.21 3 (2006Ri11), 601.206 (1990Me15), 601.196 15 (1987Ad02). Uncertainty of 0.020 keV assumed in 1990Me15 . I _γ =0.126 7 (2006Ri11), 0.122 5 (1990Me15), 0.1216 26 (1987Ad02). α(K) _{exp} : ce(K) may be composite of 599γ and 601γ. Ice(K)=0.0039 8 (probably for both 599γ and 601γ).
601.201 15	0.1221 26	1097.591	(9/2) ⁻	496.389	11/2 ⁻	(M1)		0.01468 21	
^x 629.01 [‡]	<0.001								
645.315 10	3.043 19	795.030	9/2 ⁻	149.732	7/2 ⁺	E1		0.00259 4	%I _γ =1.47 8 α(K) _{exp} =0.0023 3 E _γ =645.31 1 (2006Ri11), 645.315 2 (1990Me15), 645.309 7 (1987Ad02). I _γ =3.12 4 (2006Ri11), 3.035 15 (1990Me15), 3.02 4 (1987Ad02). α(K) _{exp} gives δ(M2/E1)<0.12. Ice(K)=0.014 2. (645γ)(150γ)(θ): A ₂ =+0.13 3, A ₄ =-0.08 6 (1975Se18). γ(θ,T) data: 1987Kr11 . %I _γ =0.0136 25 E _γ =649.15 7 (2006Ri11), 649.06 8 (1987Ad02). I _γ =0.033 4 (2006Ri11), 0.0223 16 (1987Ad02); unweighted average.
649.11 7	0.028 5	798.937	(9/2 ⁺)	149.732	7/2 ⁺	[M1,E2]		0.0095 26	%I _γ =0.280 16 α(K) _{exp} =0.011 3 E _γ =662.91 1 (2006Ri11), 662.89 1 (1990Me15), 662.905 10 (1987Ad02). I _γ =0.568 10 (2006Ri11), 0.578 10 (1990Me15), 0.594 11 (1987Ad02). Ice(K)=0.013 3.
662.902 10	0.579 10	812.631	5/2 ⁺	149.732	7/2 ⁺	M1(+E2)	<0.85	0.0105 10	%I _γ =0.88 5 α(K) _{exp} =0.0062 9; α(L1) _{exp} =0.0084 28 E _γ =666.29 1 (2006Ri11), 666.290 4 (1990Me15), 666.286 6
666.289 10	1.811 13	666.291	9/2 ⁺	0.0	5/2 ⁺	E2		0.00649 9	

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)

E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
									(1987Ad02).
									$I_\gamma=1.853\ 22$ (2006Ri11), $1.801\ 10$ (1990Me15), $1.822\ 28$ (1987Ad02).
									Mult., δ : from ce data $\delta(E2/M1)>1.3$; from $\gamma(\theta)$ in (p,4n γ) mult=Q.
									Ice(K)=0.022 3, Ice(L1)=0.003 1.
^x 672.37 [‡]	<0.001								
673.43 3	0.0070 9	1207.72	(5/2,7/2,9/2)	534.295	7/2 ⁺				% $I_\gamma=0.0034\ 5$
									$E_\gamma=673.43\ 2$ (2006Ri11), $673.65\ 15$ (1987Ad02).
									$I_\gamma=0.0076\ 12$ (2006Ri11), $0.0067\ 9$ (1987Ad02).
^x 688.27 [‡]	<0.003								
^x 711.72 [‡]	<0.001								
^x 715.21 [‡]	<0.001								
^x 719.19 [‡]	<0.002								
									Earlier placement from a 869 level not supported by 2006Ri11 .
726.21 1	0.165 5	875.939	5/2 ⁺	149.732	7/2 ⁺	M1(+E2)	<0.65	0.0086 6	% $I_\gamma=0.080\ 5$
									$\alpha(K)\text{exp}=0.010\ 3$
									$E_\gamma=726.23\ 2$ (2006Ri11), $726.16\ 4$ (1990Me15), $726.21\ 1$ (1987Ad02).
									$I_\gamma=0.168\ 6$ (2006Ri11), $0.166\ 10$ (1990Me15), $0.162\ 5$ (1987Ad02).
									Ice(K)=0.0033 8.
734.86 1	0.264 6	1231.253	9/2 ⁻	496.389	11/2 ⁻	M1(+E2)	<2	0.0074 15	% $I_\gamma=0.128\ 7$
									$\alpha(K)\text{exp}=0.0071\ 22$
									$E_\gamma=734.85\ 3$ (2006Ri11), $734.84\ 2$ (1990Me15), $734.87\ 1$ (1987Ad02).
									$I_\gamma=0.262\ 8$ (2006Ri11), $0.274\ 10$ (1990Me15), $0.261\ 6$ (1987Ad02).
									Ice(K)=0.0037 11.
^x 738.66 [‡]	<0.002								
748.604 10	17.09 20	748.601	7/2 ⁻	0.0	5/2 ⁺	E1+M2	+0.041 13	0.00194 4	% $I_\gamma=8.3\ 4$
									$\alpha(K)\text{exp}=0.0015\ 2$
									$E_\gamma=748.62\ 2$ (2006Ri11), $748.601\ 2$ (1990Me15), $748.603\ 8$ (1987Ad02).
									$I_\gamma=17.19\ 20$ (2006Ri11), $16.94\ 26$ (1990Me15), $17.08\ 27$ (1987Ad02).
									$\alpha(K)\text{exp}$ gives $\delta(M2/E1)<0.1$.
									Ice(K)=0.051 7.
									δ : from $\gamma(\theta,T)$ (1986Va16). Others: +0.034 21 (quoted by 1986Va16 from another work), 1987Kr11 .
^x 756.42 [‡]	<0.003								

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)

E_γ [†]	I_γ ^{@a}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
761.12 5	0.0167 10	910.89	11/2 ⁺	149.732	7/2 ⁺				%I γ =0.0081 6 E γ =761.10 3 (2006Ri11), 761.22 6 (1987Ad02). I γ =0.017 1 (2006Ri11), 0.0156 19 (1987Ad02). %I γ =0.0147 10 E γ =776.59 5 (2006Ri11), 776.78 4 (1987Ad02): unweighted average. I γ =0.033 3 (2006Ri11), 0.0298 14 (1987Ad02). Other: 0.035 7 (1996Vy02).
776.69 10	0.0304 14	776.69	(3/2 to 9/2)	0.0	5/2 ⁺				%I γ =0.0077 11 %I γ =7.3 4 $\alpha(\text{K})\text{exp}=0.0035$ 3; $\alpha(\text{L1})\text{exp}=0.0006$ 2; $\alpha(\text{L})\text{exp}=0.0012$ 6; $\alpha(\text{M1})\text{exp}=0.00015$ 5 E γ =788.87 2 (2006Ri11), 788.878 (1990Me15), 788.873 8 (1987Ad02). Uncertainty assumed as 0.010 keV in 1990Me15 . I γ =15.11 22 (2006Ri11), 15.12 15 (1990Me15), 15.32 26 (1987Ad02). δ : from $\gamma(\theta, \text{T})$ (1987Be33). Others: +0.43 6 (1987Be33 for 5/2 to 7/2 transition), >5 (from ce data). δ from $\gamma\gamma(\theta)$ data is not deduced due to large discrepancy in A_2 values from 1985Be64 and 1975Se18 . Ice(K)=0.106 7, Ice(L1)=0.018 6, Ice(L)=0.035 16, Ice(M1)=0.0045 15. (789 γ)(150 γ)(θ): $A_2=+0.100$ 15, $A_4=-0.05$ 3 (1975Se18). (789 γ)(150 γ)(θ): $A_2=-0.233$ 21, $A_4=-0.023$ 30 (1985Be64). %I γ <0.000968 γ reported only by 1975Al14 and 1996Vy02 . Interpreted by 2006Ri11 as a sum line, an upper limit set. I γ =0.028 12 (1996Vy02), 0.056 19 (1975Al14). E γ : 794.7 3 in 1975Al14 . %I γ =0.0503 33 E γ =798.90 2 (2006Ri11), 798.94 2 (1990Me15), 798.90 2 (1987Ad02). I γ =0.108 3 (2006Ri11), 0.093 5 (1990Me15), 0.104 3 (1987Ad02). Other: 0.090 5 (1996Vy02). Mult.: (M2) from 1996Vy02 proposed by 1996Vy02 for 798.9 γ is inconsistent with positive parity for the 798 level. %I γ =0.0447 29 E γ =802.91 2 (2006Ri11), 802.93 2 (1990Me15), 802.95 2 (1987Ad02).
783.45 ^{#c} 10 788.875 10	0.016 [#] 2 15.15 15	933.119 938.609	(9/2) ⁺ 7/2 ⁺	149.732 149.732	7/2 ⁺ 7/2 ⁺	E2+M1	-5 2	0.00451 20	
794.7 ^c	<0.002	795.030	9/2 ⁻	0.0	5/2 ⁺				
798.91 2	0.104 4	798.937	(9/2 ⁺)	0.0	5/2 ⁺				
802.93 2	0.0924 34	952.667	(3/2 ⁺ to 9/2 ⁺)	149.732	7/2 ⁺				

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11,1987Ad02,1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)									
E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
812.630 10	0.304 5	812.631	5/2 ⁺	0.0	5/2 ⁺	M1,E2		0.0055 14	$I_\gamma=0.098$ 3 (2006Ri11), 0.088 5 (1990Me15), 0.0891 27 (1987Ad02). $\%I_\gamma=0.147$ 8 $\alpha(K)_{\text{exp}}=0.0064$ 22 $E_\gamma=812.62$ 2 (2006Ri11), 812.64 3 (1990Me15), 812.632 10 (1987Ad02). $I_\gamma=0.305$ 7 (2006Ri11), 0.303 5 (1990Me15), 0.305 5 (1987Ad02). $I_{\text{ce}}(K)=0.0039$ 13. $\%I_\gamma=0.0053$ 6 $\%I_\gamma=0.066$ 4 $\alpha(K)_{\text{exp}}=0.018$ 5 $E_\gamma=862.87$ 3 (2006Ri11), 862.86 3 (1990Me15), 862.861 12 (1987Ad02). $I_\gamma=0.135$ 2 (2006Ri11), 0.140 4 (1990Me15), 0.1360 28 (1987Ad02). Mult.: $\alpha(K)_{\text{exp}}$ gives M2. But it is inconsistent with $\Delta J=0,1$ which would favor E1 component over M2. $I_{\text{ce}}(K)=0.0051$ 13.
842.29 ^{#c} 10	0.011 [#] 1	992.203	(3/2 ⁺ to 9/2 ⁺)	149.732	7/2 ⁺				$\%I_\gamma=0.0053$ 6 $\%I_\gamma=0.066$ 4 $\alpha(K)_{\text{exp}}=0.018$ 5 $E_\gamma=862.87$ 3 (2006Ri11), 862.86 3 (1990Me15), 862.861 12 (1987Ad02). $I_\gamma=0.135$ 2 (2006Ri11), 0.140 4 (1990Me15), 0.1360 28 (1987Ad02). Mult.: $\alpha(K)_{\text{exp}}$ gives M2. But it is inconsistent with $\Delta J=0,1$ which would favor E1 component over M2. $I_{\text{ce}}(K)=0.0051$ 13.
862.862 12	0.136 2	1012.594	(5/2,7/2,9/2)	149.732	7/2 ⁺				
^x 872.62 [‡]	<0.005								$\%I_\gamma=0.152$ 8 $\alpha(K)_{\text{exp}}=0.0058$ 9 $E_\gamma=875.95$ 2 (2006Ri11), 875.83 1 (1990Me15), 875.943 10 (1987Ad02): unweighted average. $I_\gamma=0.320$ 5 (2006Ri11), 0.313 5 (1990Me15), 0.312 6 (1987Ad02). $I_{\text{ce}}(K)=0.0036$ 8.
875.91 4	0.315 5	875.939	5/2 ⁺	0.0	5/2 ⁺	M1(+E2)	<0.3	0.00573 13	
^x 880.04 [‡]	<0.002								$\%I_\gamma=0.624$ 33 $\alpha(K)_{\text{exp}}=0.0024$ 8 $E_\gamma=933.13$ 2 (2006Ri11), 932.925 6 (1990Me15), 933.134 14 (1987Ad02): unweighted average. $I_\gamma=1.288$ 12 (2006Ri11), 1.287 10 (1990Me15), 1.31 4 (1987Ad02). $\delta(E2/M1)>1.4$ from $\alpha(K)_{\text{exp}}$, but ΔJ^π requires E2. $I_{\text{ce}}(K)=0.0062$ 20. $\%I_\gamma=2.43$ 13 $\alpha(K)_{\text{exp}}=0.0034$ 5; $\alpha(L1)_{\text{exp}}=0.0005$ 2;
^x 898.99 [‡]	<0.001								
933.06 7	1.288 10	933.119	(9/2) ⁺	0.0	5/2 ⁺	E2		0.00303 4	
938.616 10	5.01 4	938.609	7/2 ⁺	0.0	5/2 ⁺	M1+E2	1.0 +10 ⁻⁵	0.0040 6	$I_{\text{ce}}(K)=0.0062$ 20. $\%I_\gamma=2.43$ 13 $\alpha(K)_{\text{exp}}=0.0034$ 5; $\alpha(L1)_{\text{exp}}=0.0005$ 2;

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#), [1987Ad02](#), [1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)								
E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	α ^b	Comments
								$\alpha(\text{L})_{\text{exp}}=0.00046\ 6$; $\alpha(\text{M1})_{\text{exp}}=0.00016\ 3$ $\alpha(\text{M})_{\text{exp}}=0.00018\ 9$ $E_\gamma=938.63\ 3$ (2006Ri11), $938.605\ 5$ (1990Me15), $938.626\ 11$ (1987Ad02). $I_\gamma=5.03\ 4$ (2006Ri11), $4.97\ 6$ (1990Me15), $4.95\ 10$ (1987Ad02). $\text{Ice}(\text{K})=0.034\ 4$, $\text{Ice}(\text{L1})=0.005\ 2$, $\text{Ice}(\text{L})=0.0046\ 6$, $\text{Ice}(\text{M1})=0.0016\ 3$, $\text{Ice}(\text{M})=0.0018\ 9$.
947.858 19	1.98 3	1097.591	(9/2) ⁻	149.732	7/2 ⁺	E1	$1.20 \times 10^{-3}\ 2$	$\%I_\gamma=0.96\ 5$ $\alpha(\text{K})_{\text{exp}}=0.00099\ 20$ $E_\gamma=947.88\ 3$ (2006Ri11), $947.820\ 6$ (1990Me15), $947.873\ 10$ (1987Ad02): unweighted average. $I_\gamma=1.99\ 3$ (2006Ri11), $1.973\ 34$ (1990Me15), $1.99\ 4$ (1987Ad02). $\alpha(\text{K})_{\text{exp}}$ gives $\delta(\text{M2/E1}) < 0.15$. $(948\gamma)(150\gamma)(\theta)$: $A_2=-0.01\ 4$, $A_4=+0.03\ 7$ (1975Se18). $(948\gamma)(150\gamma)(\theta)$: $A_2=+0.063\ 19$, $A_4=+0.005\ 9$ (1985Be64). $\%I_\gamma=0.0118\ 13$ $E_\gamma=952.61\ 3$ (2006Ri11), $952.68\ 3$ (1987Ad02). $I_\gamma=0.0266\ 15$ (2006Ri11), $0.0220\ 9$ (1987Ad02): unweighted average.
^x 956.4 [‡]	<0.001							Presence of this γ ray in 1992Ca11 ($I_\gamma=0.03\ 3$ and 1975Se18 ($E_\gamma=956.4\ 5$, $I_\gamma=0.55\ 30$, and tentative placement from a 956.4 level by 1975Se18 are not supported by 1996Vy02 and 2006Ri11 . $\%I_\gamma=0.0322\ 19$ $E_\gamma=992.21\ 4$ (2006Ri11), $992.205\ 4$ (1990Me15), $992.192\ 15$ (1987Ad02). $I_\gamma=0.066\ 2$ (2006Ri11), $0.0661\ 20$ (1990Me15), $0.0675\ 18$ (1987Ad02). Other: $0.064\ 4$ (1996Vy02). $\%I_\gamma=0.0233\ 15$ $E_\gamma=1012.61\ 4$ (2006Ri11), $1012.59\ 5$ (1990Me15), $1012.61\ 2$ (1987Ad02). $I_\gamma=0.0514\ 11$ (2006Ri11), $0.0465\ 15$ (1990Me15), $0.0466\ 14$ (1987Ad02): unweighted average. $\%I_\gamma=0.0122\ 8$ $E_\gamma=1015.25\ 9$ (2006Ri11), $1015.31\ 3$ (1987Ad02). $I_\gamma=0.0260\ 24$ (2006Ri11), $0.0252\ 10$ (1987Ad02). Other: $0.027\ 2$ (1996Vy02). $\%I_\gamma=0.0180\ 12$ $\alpha(\text{K})_{\text{exp}}=0.021\ 14$ $E_\gamma=1081.57\ 3$ (2006Ri11), $1081.58\ 6$ (1990Me15), $1081.58\ 3$ (1987Ad02). $I_\gamma=0.0356\ 27$ (2006Ri11), $0.0362\ 15$ (1990Me15), $0.0382\ 14$ (1987Ad02).
992.201 10	0.0666 18	992.203	(3/2 ⁺ to 9/2 ⁺)	0.0	5/2 ⁺			
1012.61 2	0.0482 16	1012.594	(5/2,7/2,9/2)	0.0	5/2 ⁺			
1015.30 3	0.0253 10	1165.04	(5/2,7/2,9/2)	149.732	7/2 ⁺			
1081.58 3	0.0371 14	1231.253	9/2 ⁻	149.732	7/2 ⁺			

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

$\gamma(^{149}\text{Eu})$ (continued)

E_γ [†]	I_γ ^{@a}	E_i (level)	J_i^π	E_f	J_f^π	Mult. ^{&}	α ^b	Comments
								$I_\gamma=0.0356$ 27 (2006Ri11), 0.0362 15 (1990Me15), 0.0382 14 (1987Ad02).
								$\alpha(K)$ exp marginally agrees with M2.
								Ice(K)=0.0016 11.
1096.68 5	0.0034 3	1246.41	(5/2,7/2,9/2)	149.732	7/2 ⁺			% $I_\gamma=0.00165$ 17
								$E_\gamma=1096.79$ 12 (2006Ri11), 1096.70 5 (1990Me15), 1096.59 8 (1987Ad02).
1097.54 ^c	<0.004	1097.591	(9/2) ⁻	0.0	5/2 ⁺			$I_\gamma=0.005$ 3 (2006Ri11), 0.0029 5 (1990Me15), 0.0035 3 (1987Ad02).
								% $I_\gamma<0.00194$
								$E_\gamma=1097.54$, $I_\gamma=0.018$ 7 in 1996Vy02 . 2006Ri11 interpreted this γ ray as a sum line, and set an upper limit of 0.004.
1207.70 7	0.0024 2	1207.72	(5/2,7/2,9/2)	0.0	5/2 ⁺			% $I_\gamma=0.00116$ 11
								$E_\gamma=1207.58$ 12 (2006Ri11), 1207.71 7 (1990Me15), 1207.81 12 (1987Ad02).
								$I_\gamma=0.0030$ 3 (2006Ri11), 0.00220 20 (1990Me15), 0.0024 2 (1987Ad02).
1220.57 12	0.0016 1	1220.56	5/2 ⁺	0.0	5/2 ⁺			% $I_\gamma=0.00077$ 6
								$E_\gamma=1220.49$ 12 (2006Ri11), 1220.64 12 (1987Ad02).
1231.2 2	0.00070 20	1231.253	9/2 ⁻	0.0	5/2 ⁺	[M2]	0.00617 9	$I_\gamma=0.0020$ 3 (2006Ri11), 0.0016 1 (1987Ad02).
								% $I_\gamma=0.00034$ 10
								$E_\gamma=1231.4$ 2 (2006Ri11), 1231.02 (1990Me15).
								$I_\gamma=0.0005$ 5 (2006Ri11), 0.00073 20 (1990Me15).
1246.38 8	0.0043 2	1246.41	(5/2,7/2,9/2)	0.0	5/2 ⁺			% $I_\gamma=0.00208$ 15
								$E_\gamma=1246.27$ 12 (2006Ri11), 1246.4 1 (1990Me15), 1246.41 8 (1987Ad02).
								$I_\gamma=0.0046$ 4 (2006Ri11), 0.00445 34 (1990Me15), 0.0041 2 (1987Ad02).

[†] Weighted average of values from the most precise and consistent data from [2006Ri11](#), [1990Me15](#) and [1987Ad02](#), with uncertainty increased to 0.010 keV, when a lower uncertainty is reported in [1990Me15](#) and/or [1987Ad02](#). As indicated, unweighted averages are taken in a few cases where there is lack of consistent data. Exceptions are noted. Other (less precise) measurements using Ge(Li) detector: [1975Se18](#), [1975Al14](#).

[‡] Transition reported by [1996Vy02](#) not confirmed by [2006Ri11](#), upper limit of intensity is given.

[#] Reported only by [2006Ri11](#). Authors suggest a tentative placement as no $\gamma\gamma$ -coin evidence is available yet for this γ ray.

[@] Weighted average of values from the most precise and consistent data from [2006Ri11](#), [1990Me15](#) and [1987Ad02](#), with uncertainty increased to 0.5%, when a lower uncertainty is reported in [1990Me15](#) and/or [1987Ad02](#). As indicated, unweighted averages are taken in a few cases where there is lack of consistent data. Exceptions are noted. Other (less precise) measurements using Ge(Li) detector: [1992Ca11](#), [1975Se18](#), [1975Al14](#), [1970Ep01](#).

[&] From ce data given under comments, unless otherwise noted. In cases where ce data give M1+E2 or E1+M2 with a significant admixture, the former assignment is preferred, as there is no evidence of long half-lives, as would be expected when there is substantial M2 admixture. Where only ce data are available, the quoted mixing ratio is deduced from those data by the evaluators using the BrIccMixing program.

¹⁴⁹Gd ε decay (9.28 d) [2006Ri11](#),[1987Ad02](#),[1990Me15](#) (continued)

γ(¹⁴⁹Eu) (continued)

^a For absolute intensity per 100 decays, multiply by 0.484 26.
^b Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
^c Placement of transition in the level scheme is uncertain.
^x γ ray not placed in level scheme.

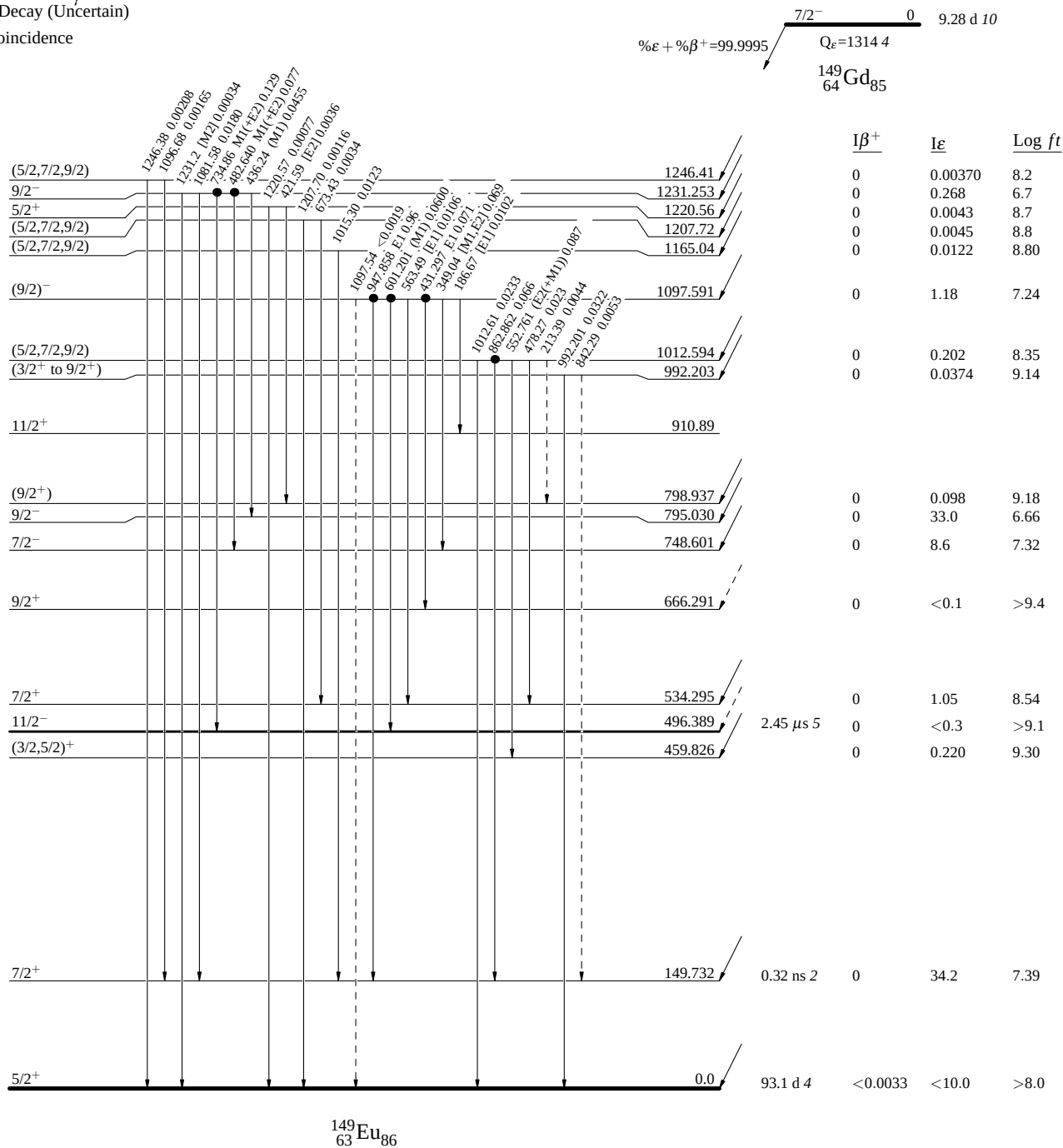
¹⁴⁹Gd ε decay (9.28 d) 2006Ri11,1987Ad02,1990Me15

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)
- Coincidence

Decay Scheme

Intensities: I_(γ+ce) per 100 parent decays



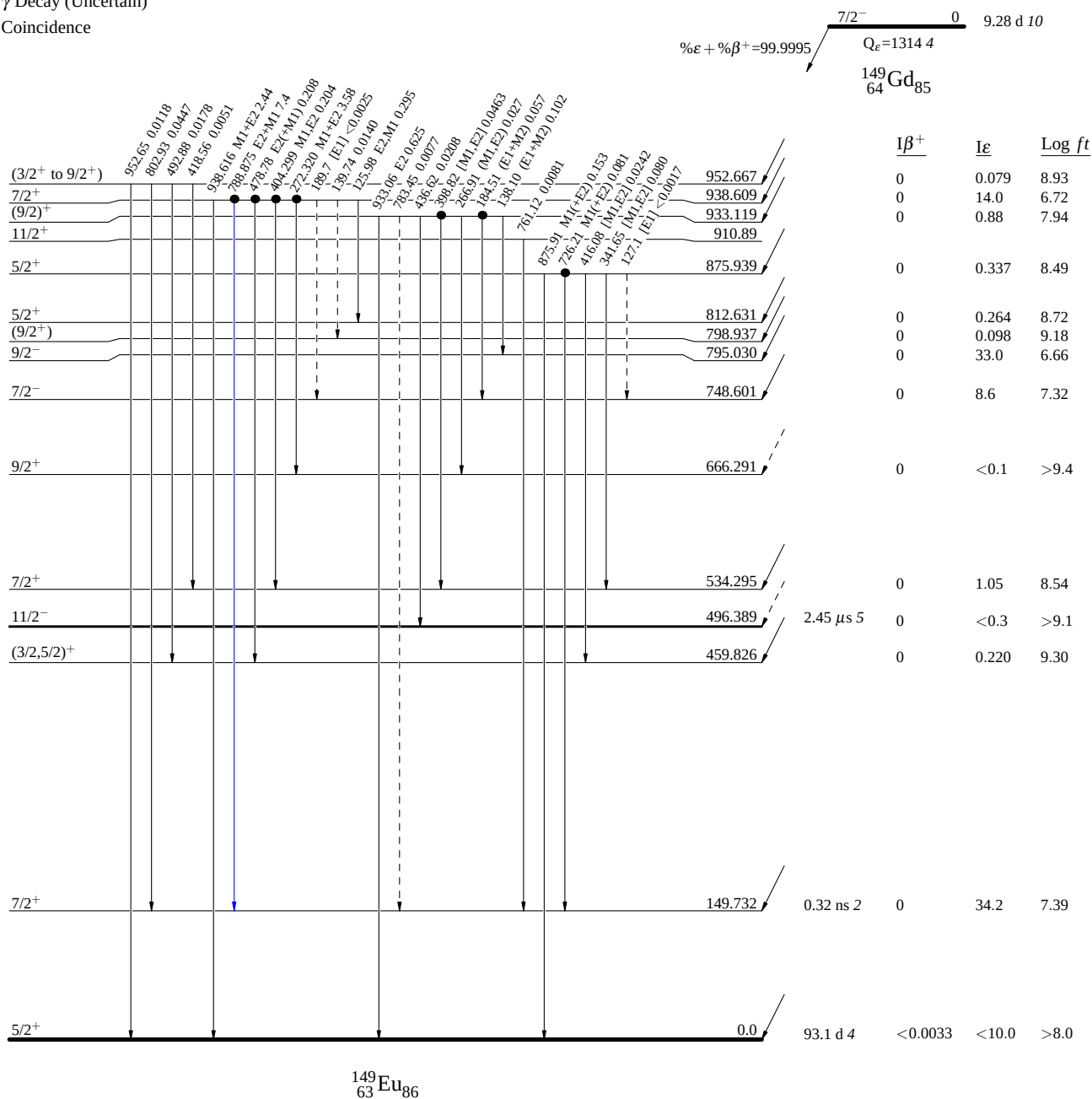
¹⁴⁹Gd ε decay (9.28 d) 2006Ri11,1987Ad02,1990Me15

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays



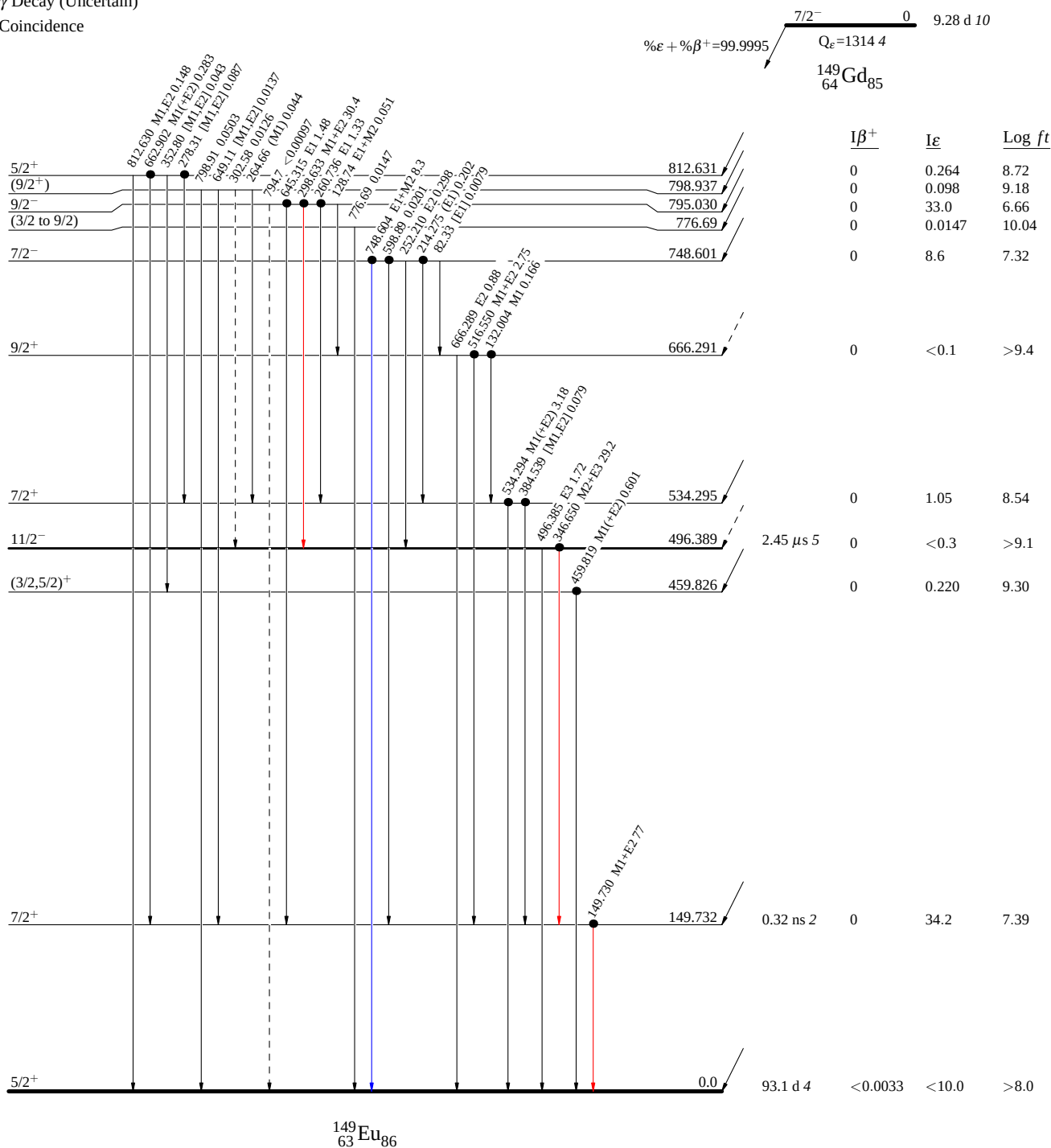
¹⁴⁹Gd ε decay (9.28 d) 2006Ri11,1987Ad02,1990Me15

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



$^{139}\text{La}(^{13}\text{C},3n\gamma)$ [1994Ur01](#)

[1994Ur01](#) (also thesis by [1992JoZM](#)): $E(^{13}\text{C})=58$ MeV from Niels Bohr Institute accelerator for $\gamma\gamma$ -coin measurement and from the KVI AVF cyclotron for $\gamma(\text{lin pol})$ measurements. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(\theta)(\text{DCO})$, $\gamma\gamma(\text{lin pol})$, excitation functions. Deduced levels, J^π , γ -ray multipolarities. $^{136}\text{Xe}(^{19}\text{F},6n\gamma), E=94$ MeV also used to obtain $\gamma\gamma$ -coin data.

Theoretical analysis of octupole correlations: [1994Jo09](#).

 ^{149}Eu Levels

E(level) [†]	J^π [#]	Comments
0.0	5/2 ⁺	
149.8 2	7/2 ⁺	This level interpreted by 1994Ur01 as $\pi g_{7/2} \otimes (^{150}\text{Gd core})$.
496.6 ^a 4	11/2 ⁻	
534.4 2	7/2 ⁺	
666.5 2	9/2 ⁺	
795.3 ^d 5	9/2 ⁻	
799.2 2	9/2 ⁺	
911.3 3	11/2 ⁺	
995.2 ^a 5	15/2 ⁻	
1060.2 5	11/2 ⁻	J^π : (9/2 ⁻ , 11/2, 13/2 ⁻) in the Adopted Levels.
1177.7 ^d 4	13/2 ⁽⁻⁾	
1185.0 2	11/2 ⁺	
1334.1 3	13/2 ⁺	
1472.2 3	13/2 ⁺	
1529.4 ^c 5	15/2 ⁺	
1610.8 ^a 5	19/2 ⁻	
1659.9 3	15/2 ⁺	
1744.2 6	15/2 ⁺	
1765.3 ^d 5	17/2 ⁻	
1834.4 4	15/2 ⁺	
1899.6 ^b 5	17/2 ⁺	
1999.0 4	17/2 ⁺	
2000.0 ^c 5	19/2 ⁺	
2063.1 4	17/2 ⁺	
2181.5 5	19/2 ⁻	
2247.4 6	19/2 ⁺	
2336.5 ^a 5	23/2 ⁻	
2343.5 ^b 5	21/2 ⁺	
2396.7 4	19/2 ⁺	
2454.1 ^d 5	21/2 ⁻	
2497.9 5	23/2 ⁻	
2562.9 ^c 5	23/2 ⁺	
2577.7 5	25/2 ⁻	
2609.6 4	21/2 ⁺	
2753.0 5	27/2 ⁻	
2828.9 ^b 5	25/2 ⁺	
3144.8 ^a 5	27/2 ⁻	
3219.7 ^c 5	27/2 ⁺	
3250.0 ^b 5	29/2 ⁺	
3428.7 5	31/2 ⁻	
3443.4 3	29/2 ⁻	
3543.4 6	31/2 ⁺	
3617.2 5	33/2 ⁺	
3951.4 ^a 6	(31/2 ⁻)	Parity from the Adopted Levels.

Continued on next page (footnotes at end of table)

$^{139}\text{La}(^{13}\text{C},3n\gamma)$ **1994Ur01 (continued)** ^{149}Eu Levels (continued)

E(level) [†]	J ^π [#]	Comments
3992.4 ^c 6	(31/2 ⁺)	
4100.7 ^b 6	(33/2 ⁺)	J ^π : from the Adopted Levels. 1994Ur01 assign (33/2).
4189.3 6	35/2 ⁻	
4223.3 6	35/2 ⁺	
4272.4 6	(33/2 ⁻)	
4360.6 6	37/2 ⁺	
4405.2 6		
4423.2 6		
4685.4 ^{‡a} 6	(35/2 ⁻)	
4706.1 6		
4970.8 7	39/2 ⁺	
4996.1 ^b 7	(37/2 ⁺)	Parity from the Adopted Levels.
5050.6 7	41/2 ⁺	
5071.0 6	(37/2) [@]	
5168.8 7	(37/2)	
5339.0 7	(39/2)	
5374.7? ^a 6		
5539.4 7	45/2 ⁺	
5608.6 7	(39/2)	
5964.3 7	(41/2)	
6031? 1		
6289.9 8	(47/2 ⁺)	
6810.2 8	(49/2)	
6997.6 8	(51/2 ⁺)	
7028.4 8	^{&}	
7684.9 8	(55/2 ⁺)	

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E\gamma=0.3$ keV for $E\gamma$ values quoted to tenth of a keV and 1 keV otherwise.

[‡] The 35/2⁻ band member is the 4685 or 4706 level.

[#] As given by [1994Ur01](#), based on $\gamma\gamma(\theta)(\text{DCO})$ and $\gamma\gamma(\text{lin pol})$ data, and association with band structures. The J^π assignments for high-spin levels in the Adopted Levels are mostly from this work, except that many are placed in parentheses there when strong arguments seem lacking. Exceptions are noted.

[@] [1994Ur01](#) suggest 37/2.

[&] [1994Ur01](#) suggest 49/2.

^a Band(A): $\pi h_{11/2} \otimes (^{148}\text{Sm} \text{ core})$.

^b Band(B): $\pi h_{11/2} \otimes (3^-)$ octupole band #1.

^c Band(C): $\pi h_{11/2} \otimes (3^-)$ octupole band #2.

^d Band(D): Decoupled $\pi h_{11/2}$ band.

 $\gamma(^{149}\text{Eu})$

$R(\text{DCO})=I\gamma(A)/I\gamma(B)$, where $I\gamma(A)$ is from coin between a (known) stretched E2 γ ray measured at 37° and the unknown γ ray at 90° and $I\gamma(B)$ is from coin between a (known) stretched E2 γ ray measured at 90° and the unknown γ ray at 37°. The angles are with respect to the beam axis. Expected $R(\text{DCO})$ values are ≈ 1.7 and ≈ 1.0 for stretched dipole and quadrupole transitions, respectively.

Continued on next page (footnotes at end of table)

$^{139}\text{La}(^{13}\text{C},3n\gamma)$ **1994Ur01 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
30.3		3250.0	29/2 ⁺	3219.7	27/2 ⁺		M1+E2 in 1994Ur01 .
73.2		3617.2	33/2 ⁺	3543.4	31/2 ⁺		M1+E2 in 1994Ur01 .
79.9	0.3 1	2577.7	25/2 ⁻	2497.9	23/2 ⁻		M1+E2 in 1994Ur01 .
105.1	0.8 2	3250.0	29/2 ⁺	3144.8	27/2 ⁻	D	DCO=1.8 4 E1 in 1994Ur01 .
109.0	0.4 2	2562.9	23/2 ⁺	2454.1	21/2 ⁻		(E1) in 1994Ur01 .
117.6	0.3 1	1177.7	13/2 ⁽⁻⁾	1060.2	11/2 ⁻		(M1+E2) in 1994Ur01 .
131.9	0.4 [‡] 2	666.5	9/2 ⁺	534.4	7/2 ⁺		M1+E2 in 1994Ur01 .
137.4	0.5 2	4360.6	37/2 ⁺	4223.3	35/2 ⁺		M1+E2 in 1994Ur01 .
149.2	0.4 1	1334.1	13/2 ⁺	1185.0	11/2 ⁺		M1+E2 in 1994Ur01 .
149.8	4.8 6	149.8	7/2 ⁺	0.0	5/2 ⁺		pol=-0.01 16 M1+E2 in 1994Ur01 .
154.6	0.4 2	1765.3	17/2 ⁻	1610.8	19/2 ⁻		M1+E2 in 1994Ur01 .
161.5	0.5 1	2497.9	23/2 ⁻	2336.5	23/2 ⁻	D+Q	DCO=1.0 4 M1+E2 in 1994Ur01 .
171.4	0.6 2	4360.6	37/2 ⁺	4189.3	35/2 ⁻		E1 in 1994Ur01 .
175.3	35.8 11	2753.0	27/2 ⁻	2577.7	25/2 ⁻	M1(+E2)	DCO=2.21 5; pol=-0.16 6 M1+E2 in 1994Ur01 .
182.4	0.8 3	1177.7	13/2 ⁽⁻⁾	995.2	15/2 ⁻	D	DCO=2.1 5 M1+E2 in 1994Ur01 .
184	0.5 2	2247.4	19/2 ⁺	2063.1	17/2 ⁺		M1+E2 in 1994Ur01 .
187.5	0.6 2	6997.6	(51/2 ⁺)	6810.2	(49/2)		
188.7	6.4 5	3617.2	33/2 ⁺	3428.7	31/2 ⁻	E1	DCO=2.24 11; pol=+0.21 9
212.8	0.6 2	2609.6	21/2 ⁺	2396.7	19/2 ⁺	D+Q	DCO=1.6 2 M1+E2 in 1994Ur01 .
219	0.3 1	2562.9	23/2 ⁺	2343.5	21/2 ⁺		(M1+E2) in 1994Ur01 .
226.3	0.6 2	2562.9	23/2 ⁺	2336.5	23/2 ⁻	E1	DCO=0.8 3; pol=-0.37 25
228.7	0.5 2	2063.1	17/2 ⁺	1834.4	15/2 ⁺		M1+E2 in 1994Ur01 .
234.7	1.8 2	2000.0	19/2 ⁺	1765.3	17/2 ⁻	D	DCO=1.9 2 E1 in 1994Ur01 .
235.8	0.3 1	1765.3	17/2 ⁻	1529.4	15/2 ⁺		E1 in 1994Ur01 .
241.1	40.5 12	2577.7	25/2 ⁻	2336.5	23/2 ⁻	M1+E2	DCO=1.92 3; pol=-0.32 5
244.8	1.7 [‡] 4	911.3	11/2 ⁺	666.5	9/2 ⁺	D	DCO=1.7 3 M1+E2 in 1994Ur01 .
255.1	3.3 5	2753.0	27/2 ⁻	2497.9	23/2 ⁻	E2	DCO=1.2 1; pol=+0.63 21
262.2	0.6 2	4685.4	(35/2 ⁻)	4423.2			
264.8	1.0 3	799.2	9/2 ⁺	534.4	7/2 ⁺		M1+E2 in 1994Ur01 .
265.0	0.5 2	1060.2	11/2 ⁻	795.3	9/2 ⁻		M1+E2 in 1994Ur01 .
266.0	4.9 9	2828.9	25/2 ⁺	2562.9	23/2 ⁺	M1+E2	DCO=1.65 9; pol=-0.19 13
280.3	0.4 1	4685.4	(35/2 ⁻)	4405.2			
287.2	0.4 2	1472.2	13/2 ⁺	1185.0	11/2 ⁺		M1+E2 in 1994Ur01 .
293.3	21.2 9	3543.4	31/2 ⁺	3250.0	29/2 ⁺	M1(+E2)	DCO=2.19 3; pol=-0.23 5 M1+E2 in 1994Ur01 .
298.8	1.5 3	795.3	9/2 ⁻	496.6	11/2 ⁻		M1+E2 in 1994Ur01 .
316.0	0.5 1	3144.8	27/2 ⁻	2828.9	25/2 ⁺		E1 in 1994Ur01 .
316.5	0.4 1	2497.9	23/2 ⁻	2181.5	19/2 ⁻		E2 in 1994Ur01 .
319	0.5 2	2063.1	17/2 ⁺	1744.2	15/2 ⁺		M1+E2 in 1994Ur01 .
323.5	1.0 3	3543.4	31/2 ⁺	3219.7	27/2 ⁺	(Q)	DCO=1.2 2 E2 in 1994Ur01 .
325.7	0.4 2	1659.9	15/2 ⁺	1334.1	13/2 ⁺		M1+E2 in 1994Ur01 .
334	0.3 1	2396.7	19/2 ⁺	2063.1	17/2 ⁺		M1+E2 in 1994Ur01 .
339.2	0.4 2	1999.0	17/2 ⁺	1659.9	15/2 ⁺		M1+E2 in 1994Ur01 .
343.5	0.8 2	2343.5	21/2 ⁺	2000.0	19/2 ⁺	M1+E2	DCO=0.9 3; pol=-0.42 26
346.8		496.6	11/2 ⁻	149.8	7/2 ⁺		pol=-0.06 9 M2 in 1994Ur01 .

Continued on next page (footnotes at end of table)

$^{139}\text{La}(^{13}\text{C},3n\gamma)$ **1994Ur01 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
351.5	4.2 5	1529.4	15/2 ⁺	1177.7	13/2 ⁽⁻⁾		E1 in 1994Ur01.
356@	0.3 1	5964.3	(41/2)	5608.6	(39/2)		
362	0.3 1	2609.6	21/2 ⁺	2247.4	19/2 ⁺		(M1+E2) in 1994Ur01.
362.2	0.4 2	1834.4	15/2 ⁺	1472.2	13/2 ⁺		M1+E2 in 1994Ur01.
367.3	3.5 4	3617.2	33/2 ⁺	3250.0	29/2 ⁺	E2	DCO=0.8 1; pol=+0.18 15
371@	0.3 1	1899.6?	17/2 ⁺	1529.4	15/2 ⁺		(M1+E2) in 1994Ur01.
382.5	0.7 2	1177.7	13/2 ⁽⁻⁾	795.3	9/2 ⁻		E2 in 1994Ur01.
384.5	0.4 ‡ 1	534.4	7/2 ⁺	149.8	7/2 ⁺		M1+E2 in 1994Ur01.
385.6	0.5 2	5071.0	(37/2)	4685.4	(35/2 ⁻)		
385.9	0.7 3	1185.0	11/2 ⁺	799.2	9/2 ⁺	D	DCO=2.2 5
							M1+E2 in 1994Ur01.
389.1	5.0 4	2000.0	19/2 ⁺	1610.8	19/2 ⁻	E1	DCO=1.03 8; pol=-0.72 14
							Mult.: DCO and pol values are consistent with $\Delta J=0$, E1 transition.
390.6	0.3 1	3219.7	27/2 ⁺	2828.9	25/2 ⁺		M1+E2 in 1994Ur01.
398	0.4 1	2396.7	19/2 ⁺	1999.0	17/2 ⁺		M1+E2 in 1994Ur01.
410	0.8 2	1744.2	15/2 ⁺	1334.1	13/2 ⁺		M1+E2 in 1994Ur01.
416.5	0.3 1	2753.0	27/2 ⁻	2336.5	23/2 ⁻		E2 in 1994Ur01.
421.0	16.0 8	3250.0	29/2 ⁺	2828.9	25/2 ⁺	E2	DCO=1.06 5; pol=+0.41 10
422.9	0.9 3	1334.1	13/2 ⁺	911.3	11/2 ⁺	D	DCO=2.1 4
							M1+E2 in 1994Ur01.
444.0	0.3 1	2343.5	21/2 ⁺	1899.6?	17/2 ⁺		(E2) in 1994Ur01.
454.0	0.4 2	2454.1	21/2 ⁻	2000.0	19/2 ⁺		E1 in 1994Ur01.
470.5	9.1 6	2000.0	19/2 ⁺	1529.4	15/2 ⁺	E2	DCO=0.98 7; pol=+0.67 12
485.4	2.9 5	2828.9	25/2 ⁺	2343.5	21/2 ⁺	(Q)	DCO=1.3 2
							E2 in 1994Ur01.
488.8	7.8 6	5539.4	45/2 ⁺	5050.6	41/2 ⁺	E2	DCO=0.93 9; pol=+0.90 24
492.4	12.4 4	2828.9	25/2 ⁺	2336.5	23/2 ⁻	E1	DCO=1.90 4; pol=+0.28 8
496	0.5 2	4685.4	(35/2 ⁻)	4189.3	35/2 ⁻		(M1+E2) in 1994Ur01.
497.0	24.6 21	3250.0	29/2 ⁺	2753.0	27/2 ⁻	(E1)	DCO=0.93 8; pol=+0.31 13
							DCO is inconsistent with $\Delta J=1$, dipole, while it is typical value $\Delta J=2$, quadrupole or $\Delta J=0$, dipole.
498.6	100.0 22	995.2	15/2 ⁻	496.6	11/2 ⁻	(E2)	E1 in 1994Ur01.
							pol=+0.42 7
							E2 in 1994Ur01.
500	0.3 1	1834.4	15/2 ⁺	1334.1	13/2 ⁺		M1+E2 in 1994Ur01.
503	0.4 2	2247.4	19/2 ⁺	1744.2	15/2 ⁺		(E2) in 1994Ur01.
516.8	1.6 ‡ 3	666.5	9/2 ⁺	149.8	7/2 ⁺		M1+E2 in 1994Ur01.
518.5	0.6 2	1185.0	11/2 ⁺	666.5	9/2 ⁺		M1+E2 in 1994Ur01.
534.2	8.8 6	1529.4	15/2 ⁺	995.2	15/2 ⁻	E1	DCO=1.01 7; pol=-0.45 12
							Mult.: for $\Delta J=0$ transition, DCO value and pol are consistent with mult=E1.
534.5	1.5 ‡ 5	534.4	7/2 ⁺	0.0	5/2 ⁺		E1 in 1994Ur01.
563.0	13.0 8	2562.9	23/2 ⁺	2000.0	19/2 ⁺	E2	DCO=1.06 5; pol=+0.29 9
570.8	0.7 3	2181.5	19/2 ⁻	1610.8	19/2 ⁻	(M1)	pol=-0.48 33
							M1+E2 in 1994Ur01.
587.7	0.6 2	1765.3	17/2 ⁻	1177.7	13/2 ⁽⁻⁾		E2 in 1994Ur01.
588	0.4 2	2247.4	19/2 ⁺	1659.9	15/2 ⁺		(E2) in 1994Ur01.
610.7	0.5 3	2609.6	21/2 ⁺	1999.0	17/2 ⁺		(E2) in 1994Ur01.
615.6	89.5 23	1610.8	19/2 ⁻	995.2	15/2 ⁻	E2	DCO=1.01 1; pol=+0.50 7
649	0.5 2	1834.4	15/2 ⁺	1185.0	11/2 ⁺		E2 in 1994Ur01.
650.8	1.2 4	1185.0	11/2 ⁺	534.4	7/2 ⁺		E2 in 1994Ur01.
656.7	6.3 6	3219.7	27/2 ⁺	2562.9	23/2 ⁺	E2	DCO=1.2 1; pol=+0.42 22
664.8	1.0 4	1999.0	17/2 ⁺	1334.1	13/2 ⁺	(Q)	DCO=1.1 3
							E2 in 1994Ur01.

Continued on next page (footnotes at end of table)

$^{139}\text{La}(^{13}\text{C},3n\gamma)$ **1994Ur01 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
666.5	1.4 $\frac{3}{2}^+$ 4	666.5	9/2 ⁺	0.0	5/2 ⁺		E2 in 1994Ur01.
667.5	1.2 3	1334.1	13/2 ⁺	666.5	9/2 ⁺		E2 in 1994Ur01.
672.9	0.7 2	1472.2	13/2 ⁺	799.2	9/2 ⁺	Q	DCO=0.7 3 E2 in 1994Ur01.
675.7	22.7 11	3428.7	31/2 ⁻	2753.0	27/2 ⁻	E2	DCO=1.02 3; pol=+0.52 10
680.0	9.0 8	4223.3	35/2 ⁺	3543.4	31/2 ⁺	E2	DCO=1.05 6; pol=+0.32 7
681.0	3.2 4	1177.7	13/2 ⁽⁻⁾	496.6	11/2 ⁻		M1+E2 in 1994Ur01.
687.3	1.2 4	7684.9	(55/2 ⁺)	6997.6	(51/2 ⁺)	(Q)	DCO=0.7 4 (E2) in 1994Ur01.
689.0	0.5 2	2454.1	21/2 ⁻	1765.3	17/2 ⁻		E2 in 1994Ur01.
689.3	0.6 3	5374.7?		4685.4	(35/2 ⁻)		
690.0	13.1 7	5050.6	41/2 ⁺	4360.6	37/2 ⁺	E2	DCO=1.02 4; pol=+0.57 14
692	0.6 3	6031?		5339.0	(39/2)		
707.7	2.5 6	6997.6	(51/2 ⁺)	6289.9	(47/2 ⁺)	(E2)	DCO=0.9 2; pol=+0.31 30
725.7	79.0 21	2336.5	23/2 ⁻	1610.8	19/2 ⁻	E2	DCO=0.99 1 pol=+0.36 10
729.0	0.5 2	2063.1	17/2 ⁺	1334.1	13/2 ⁺		M1+E2 in 1994Ur01, but from their ΔJ^π , mult should be E2.
732.7	3.8 4	2343.5	21/2 ⁺	1610.8	19/2 ⁻	D	DCO=1.2 1 E1 in 1994Ur01.
733.8	1.2 3	4685.4	(35/2 ⁻)	3951.4	(31/2 ⁻)		(E2) in 1994Ur01.
736.7	0.7 2	2396.7	19/2 ⁺	1659.9	15/2 ⁺	(Q)	DCO=1.0 4 E2 in 1994Ur01.
743.3	16.9 10	4360.6	37/2 ⁺	3617.2	33/2 ⁺	E2	DCO=1.00 3; pol=+0.57 15
747.5	4.9 7	4970.8	39/2 ⁺	4223.3	35/2 ⁺	E2	DCO=1.0 1; pol=+0.39 18
748.6	1.5 4	1659.9	15/2 ⁺	911.3	11/2 ⁺	Q	DCO=1.12 8 E2 in 1994Ur01.
750.4	1.8 3	6289.9	(47/2 ⁺)	5539.4	45/2 ⁺	D(+Q)	DCO=2.1 3; pol=-0.01 14 (M1+E2) in 1994Ur01.
755.1	0.5 2	4706.1		3951.4	(31/2 ⁻)		
760.7	6.6 7	4189.3	35/2 ⁻	3428.7	31/2 ⁻	E2	DCO=1.06 6; pol=+0.25 18
761.5	2.2 $\frac{3}{2}^+$ 4	911.3	11/2 ⁺	149.8	7/2 ⁺		Mult.: 1994Ur01 use this transition as a reference E2 transition.
770.1	1.2 3	1765.3	17/2 ⁻	995.2	15/2 ⁻	(M1)	pol=-0.5 4 M1+E2 in 1994Ur01.
772.7	0.9 3	3992.4	(31/2 ⁺)	3219.7	27/2 ⁺	(Q)	DCO=1.2 3 (E2) in 1994Ur01.
795.4	3.2 4	5964.3	(41/2)	5168.8	(37/2)	(Q)	DCO=1.3 1 (E2) in 1994Ur01.
799.1	1.3 3	799.2	9/2 ⁺	0.0	5/2 ⁺		E2 in 1994Ur01.
806.8	3.3 6	3951.4	(31/2 ⁻)	3144.8	27/2 ⁻	(Q)	DCO=1.2 1 E2 in 1994Ur01.
808.3	6.2 6	3144.8	27/2 ⁻	2336.5	23/2 ⁻	E2	DCO=1.02 8; pol=+0.59 26
829.0	2.2 4	4272.4	(33/2 ⁻)	3443.4	29/2 ⁻	(Q)	DCO=0.9 1 (E2) in 1994Ur01.
833	0.4 1	1744.2	15/2 ⁺	911.3	11/2 ⁺		(E2) in 1994Ur01.
850.7	2.1 3	4100.7	(33/2 ⁺)	3250.0	29/2 ⁺	(E2)	DCO=1.2 1; pol=+0.67 32
865.8	4.9 9	3443.4	29/2 ⁻	2577.7	25/2 ⁻	E2	DCO=0.91 6; pol=+0.31 20
887.1	11.4 4	2497.9	23/2 ⁻	1610.8	19/2 ⁻	(E2)	DCO=1.2 1; pol=+0.1 4 E2 in 1994Ur01.
895.4	1.5 3	4996.1	(37/2 ⁺)	4100.7	(33/2 ⁺)	(Q)	DCO=0.9 2 (E2) in 1994Ur01.
904.3	0.5 1	1899.6?	17/2 ⁺	995.2	15/2 ⁻		(E1) in 1994Ur01.
961.8	1.1 3	4405.2		3443.4	29/2 ⁻	(Q)	DCO=1.1 2
979.5	1.4 3	5168.8	(37/2)	4189.3	35/2 ⁻	D+Q	DCO=1.5 3 (M1+E2) in 1994Ur01.

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$^{139}\text{La}(^{13}\text{C},3n\gamma)$ **1994Ur01 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	Comments
979.8	1.6 4	4423.2		3443.4	29/2 ⁻	(Q)	DCO=1.2 2
1149.7	0.7 2	5339.0	(39/2)	4189.3	35/2 ⁻	(Q)	DCO=0.8 3 (E2) in 1994Ur01 .
1186.2	0.9 2	2181.5	19/2 ⁻	995.2	15/2 ⁻	(Q)	DCO=0.9 2 E2 in 1994Ur01 .
1256.9	0.7 3	4685.4	(35/2 ⁻)	3428.7	31/2 ⁻	(Q)	DCO=0.9 4 (E2) in 1994Ur01 .
1270.8	0.5 2	6810.2	(49/2)	5539.4	45/2 ⁺		(E2) in 1994Ur01 .
1277.0	0.5 2	4706.1		3428.7	31/2 ⁻		
1419.3	0.6 2	5608.6	(39/2)	4189.3	35/2 ⁻	(Q)	DCO=1.1 3 (E2) in 1994Ur01 .
1489.0	0.7 2	7028.4		5539.4	45/2 ⁺		

[†] From [1994Ur01](#).[‡] Branching ratio disagrees with that in the Adopted Gammas.[#] From $\gamma\gamma(\theta)(\text{DCO})$ and $\gamma\gamma(\text{linear polarization})$ in [1994Ur01](#). The assignments given here are not necessarily those given by [1994Ur01](#), but from a reassessment (by the evaluators) of the correlation and polarization coefficients given by [1994Ur01](#). For Mult=Q, E2 is more likely than M2 from systematics and from no evidence of long-lived states, but the present data cannot give a unique assignment. Assignments in Table 1 of [1994Ur01](#), many of which are simply from ΔJ^π , are listed in comments.[@] Placement of transition in the level scheme is uncertain.

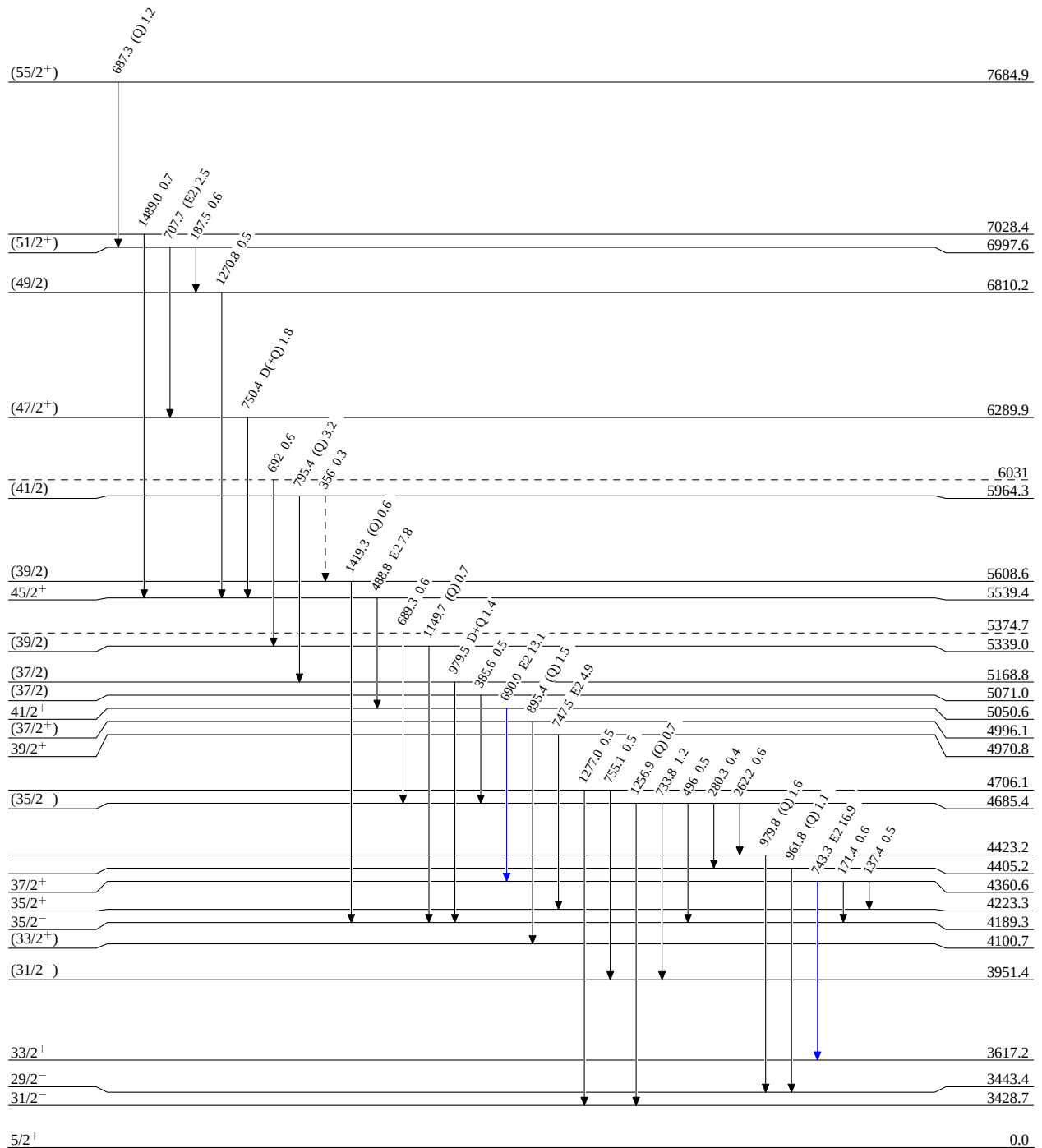
$^{139}\text{La}(^{13}\text{C}, 3n\gamma)$ 1994Ur01

Legend

Level Scheme

Intensities: Relative I_γ

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\cdots\cdots\cdots\longrightarrow$ γ Decay (Uncertain)



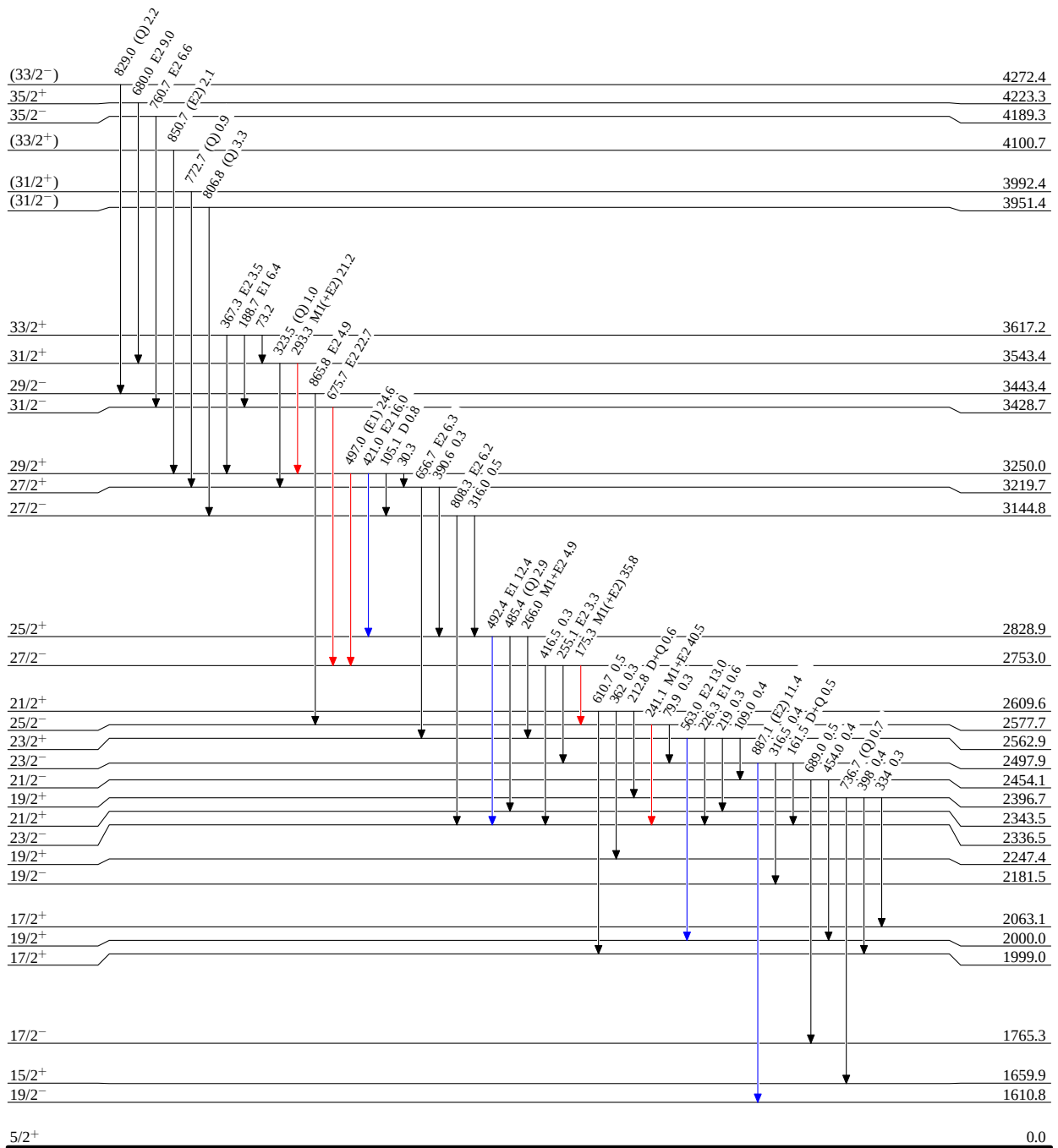
$^{139}\text{La}(^{13}\text{C},3\text{n}\gamma)$ 1994Ur01

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



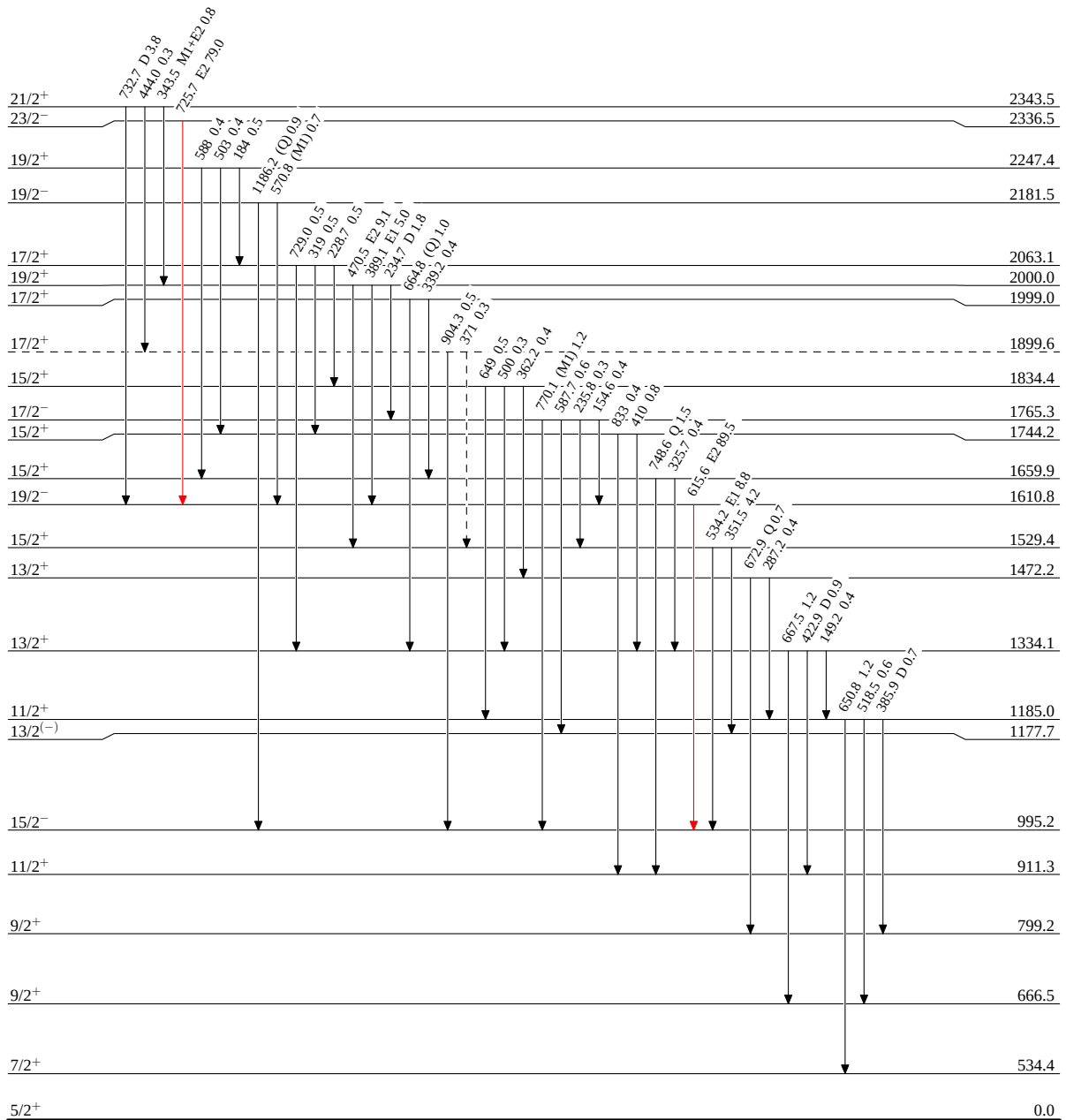
$^{139}\text{La}(^{13}\text{C}, 3n\gamma)$ 1994Ur01

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\cdots\cdots\cdots\longrightarrow$ γ Decay (Uncertain)



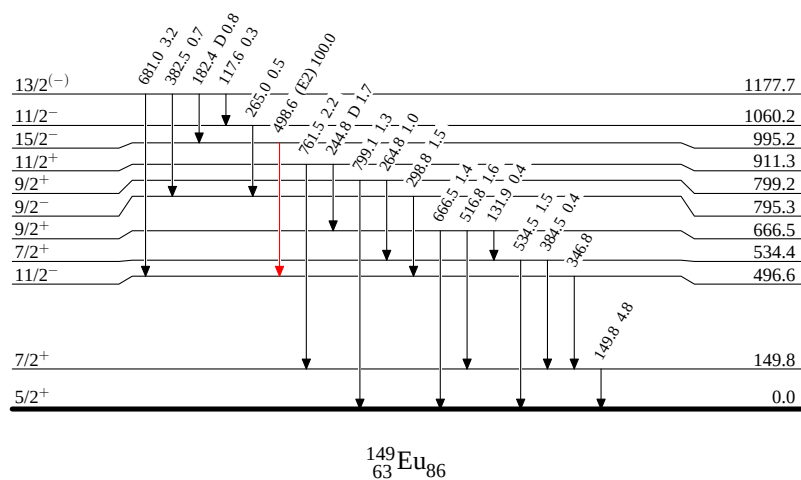
$^{139}\text{La}(^{13}\text{C},3n\gamma)$ 1994Ur01

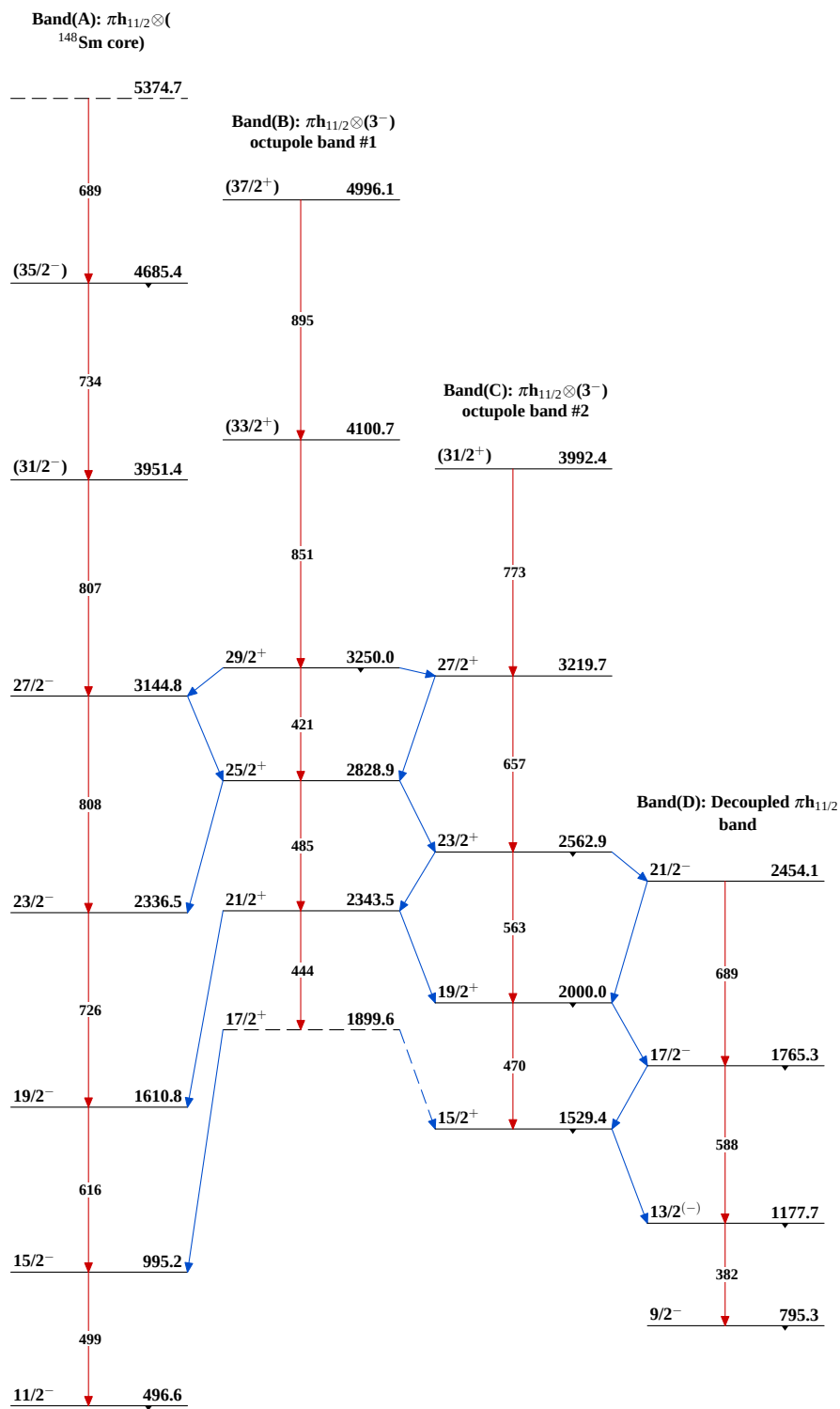
Level Scheme (continued)

 Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$


 $^{149}_{63}\text{Eu}_{86}$

$^{139}\text{La}(^{13}\text{C},3n\gamma)$ 1994Ur01

$^{145}\text{Nd}(^7\text{Li},3n\gamma), ^{146}\text{Nd}(^6\text{Li},3n\gamma)$ **1977FI09**

1977FI09 (also thesis by **1977FI2P**): E=26.0-34.0 MeV beams from the Notre Dame FN tandem. Measured E_γ , I_γ , $\gamma\gamma$, $\gamma(\theta)$, excitation functions.

Level scheme is from **1977FI09**, which is the same as in the Adopted Levels, mostly taken from **1994Ur01** in $^{139}\text{La}(^{13}\text{C},3n\gamma)$ for high-spin section, except for placements of some transitions as noted under comments.

 ^{149}Eu Levels

E(level) [†]	J^π [‡]	Comments
0.0	5/2 ⁺	
149.3 3	7/2 ⁺	
495.6 5	11/2 ⁻	
665.5 5	9/2 ⁺	
793.8 6	9/2 ⁻	
909.8 5	7/2 ⁺	J^π : 11/2 ⁺ in the Adopted Levels.
993.7 6	15/2 ⁻	
1059		J^π : (9/2 ⁻ , 11/2, 13/2 ⁻) in the Adopted Levels.
1527.4 6	(13/2, 17/2) ⁻	J^π : (15/2) ⁺ in the Adopted Levels.
1608.6 6	19/2 ⁻	
1657.6 6	9/2 ⁺	J^π : (15/2 ⁺) in the Adopted Levels.
1997.3 6	(17/2, 21/2) ⁻	J^π : (19/2) ⁺ in the Adopted Levels.
2333.7 7	23/2 ⁻	
2340.8 7	(17/2 ⁺ , 21/2 ⁺)	J^π : (21/2) ⁺ in the Adopted Levels.
2495.4 7	(23/2 ⁻)	J^π : from Fig. 6 in 1977FI09 . However, 15/2 ⁻ and 19/2 ⁻ possibilities are also listed in authors' Table II. J^π =(23/2 ⁻) in the Adopted Levels.
2559.9 7	(21/2, 25/2) ⁻	J^π : (23/2) ⁺ in the Adopted Levels.
2574.4 7	(25/2 ⁺)	J^π : (25/2) ⁻ in the Adopted Levels.
2749.3 8	(27/2 ⁻)	
2982.1? 8		E(level): corresponds to 1744, (15/2) ⁺ level in the Adopted Levels.
3042.0? 9	(29/2 ⁺)	E(level): corresponds to 3543, (31/2) ⁺ level in the Adopted Levels.

[†] From a least-squares fit to γ -ray energies.

[‡] From **1977FI09**, based on measured $\gamma(\theta)$ and known assignments of low-lying levels. Assignments from the Adopted Levels are given under comments, if different.

 $\gamma(^{149}\text{Eu})$

All data are from **1977FI09**, unless otherwise stated.

E_γ	I_γ	$E_i(\text{level})$	J^π_i	E_f	J^π_f	Mult. [‡]	δ [‡]	Comments
149.3 [†] 3		149.3	7/2 ⁺	0.0	5/2 ⁺			
174.9 3	11.4 2	2749.3	(27/2 ⁻)	2574.4	(25/2 ⁺)	D(+Q)	-0.03 4	$A_2=-0.310$ 29; $A_4=+0.014$ 31 E1 in 1977FI09 .
240.7 3	23.3 2	2574.4	(25/2 ⁺)	2333.7	23/2 ⁻	D+Q	-0.05 3	$A_2=-0.185$ 22; $A_4=+0.014$ 24 E1 in 1977FI09 .
265		1059		793.8	9/2 ⁻			E_γ : from Fig. 6 in 1977FI09 , γ not listed in authors' Table II.
292.7 [#] 3	5.3 1	3042.0?	(29/2 ⁺)	2749.3	(27/2 ⁻)	D+Q	-0.09 7	$A_2=-0.351$ 26; $A_4=-0.01$ 6 E1 in 1977FI09 . E_γ : placed from the 3543 level in the Adopted Levels.
298.2 3	<1	793.8	9/2 ⁻	495.6	11/2 ⁻			
346.3 [†] 3		495.6	11/2 ⁻	149.3	7/2 ⁺			

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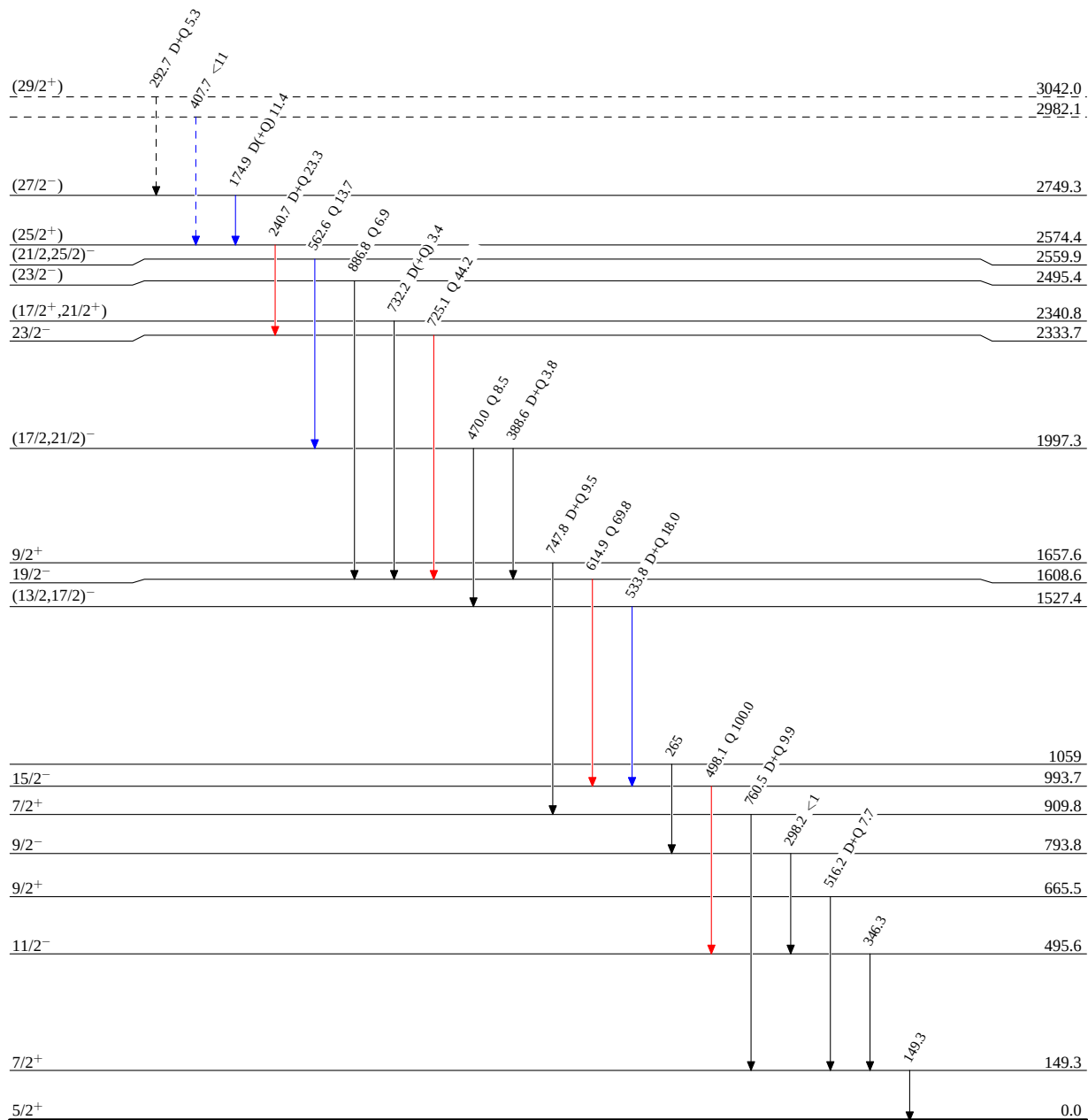
$^{145}\text{Nd}(^7\text{Li},3\text{n}\gamma), ^{146}\text{Nd}(^6\text{Li},3\text{n}\gamma)$ **1977F109 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	$\delta^\ddagger$	Comments
388.6 3	3.8 1	1997.3	(17/2,21/2) ⁻	1608.6	19/2 ⁻	D+Q	-0.7 +3-27	$A_2=+0.42$ 9; $A_4=-0.08$ 9 M1+E2 in 1977F109 .
407.7 [#] 3	<11	2982.1?		2574.4	(25/2 ⁺)			E_γ, I_γ : composite line; placed from the 1744 level in the Adopted Levels.
470.0 3	8.5 2	1997.3	(17/2,21/2) ⁻	1527.4	(13/2,17/2) ⁻	Q		$A_2=+0.21$ 6; $A_4=-0.02$ 6 $\delta(\text{O/Q})=+0.02$ +21-18. E2 in 1977F109 .
498.1 3	100.0 15	993.7	15/2 ⁻	495.6	11/2 ⁻	Q		$A_2=+0.321$ 32; $A_4=-0.09$ 4 $\delta(\text{O/Q})=-0.009$ 11. E2 in 1977F109 .
516.2 3	7.7 3	665.5	9/2 ⁺	149.3	7/2 ⁺	D+Q	+3.1 +25-13	$A_2=+0.412$ 39; $A_4=+0.19$ 10 M1+E2 in 1977F109 .
533.8 3	18.0 2	1527.4	(13/2,17/2) ⁻	993.7	15/2 ⁻	D+Q	0.4 3	$A_2=+0.196$ 31; $A_4=+0.009$ 33 M1+E2 in 1977F109 .
562.6 3	13.7 2	2559.9	(21/2,25/2) ⁻	1997.3	(17/2,21/2) ⁻	Q		$A_2=+0.391$ 37; $A_4=-0.054$ 40 $\delta(\text{O/Q})=+0.044$ 53. E2 in 1977F109 .
614.9 2	69.8 6	1608.6	19/2 ⁻	993.7	15/2 ⁻	Q		$A_2=+0.360$ 21; $A_4=-0.065$ 22 E2 in 1977F109 .
725.1 3	44.2 5	2333.7	23/2 ⁻	1608.6	19/2 ⁻	Q		$\delta(\text{O/Q})=-0.026$ 35. $A_2=+0.306$ 23; $A_4=-0.023$ 26 $\delta(\text{O/Q})=-0.052$ +53-43. E2 in 1977F109 .
732.2 3	3.4 2	2340.8	(17/2 ⁺ ,21/2 ⁺)	1608.6	19/2 ⁻	D(+Q)	-0.02 10	$A_2=-0.24$ 12; $A_4=-0.10$ 11 E1 in 1977F109 .
747.8 3	9.5 3	1657.6	9/2 ⁺	909.8	7/2 ⁺	D+Q	>6	$A_2=+0.08$ 6; $A_4=+0.13$ 6 M1+E2 in 1977F109 .
760.5 3	9.9 2	909.8	7/2 ⁺	149.3	7/2 ⁺	D+Q	+1.35 20	$A_2=+0.318$ 24; $A_4=-0.16$ 6 M1+E2 in 1977F109 .
886.8 3	6.9 2	2495.4	(23/2 ⁻)	1608.6	19/2 ⁻	Q		Mult., δ : 1977F109 propose this as a 7/2 ⁺ to 7/2 ⁺ transition. But 1994Ur01 use this as a reference E2 transition. Note that A_2 and A_4 in 1977F109 are consistent with a stretched quadruple transition ($\Delta J=2$), with $\Delta J=0$ also possible but less common. $A_2=+0.19$ 7; $A_4=-0.6$ 8 E2 with $\delta(\text{O/Q})=-0.07$ 15 for $J(2495)=23/2^-$ or $15/2^-$; M1+E2 with $\delta(\text{E2/M1})=-0.84$ 51 for $J(2495)=19/2^-$ (1977F109).

[†] From γ spectra in Fig. 2 and level scheme Fig. 6 in [1977F109](#), not listed in authors' Table II.[‡] From $\gamma(\theta)$ in [1977F109](#). The assignments given here are not necessarily those given by [1977F109](#) but from a reassessment (by the evaluators) of the angular distribution in [1977F109](#). For Mult=Q, E2 is more likely than M2 from systematics and from no evidence of long-lived states, but the present data cannot give a unique assignment.[#] Placement of transition in the level scheme is uncertain.

Legend

Intensities: Relative I_γ

 $^{149}_{63}\text{Eu}_{86}$

$^{148}\text{Sm}(\text{p,p}),(\text{p,p}'),(\text{p,n})$ IAR [1967Jo04](#),[1966Ba12](#)

[1967Jo04](#): E(p)=9.5-12.0 MeV beams from the Florida State University tandem Van de Graaff. Measured (p,p) excitation functions at $\theta=90^\circ, 125^\circ$ and 165° , (p,n) excitation function at $\theta=90^\circ$. In (p,n) only the 9.9 6-MeV resonance was observed.

[1966Ba12](#): E(p)=9.5-11.0 MeV beams from the Saclay tandem. Measured (p,p) excitation function at $\theta=124^\circ$ and 164° , (p,p') excitation function at $\theta=164^\circ$. In (p,p') only the 10.48 MeV resonance was observed.

 ^{149}Eu Levels

E(level) [†]	J^π	$T_{1/2}$ [#]	L [‡]	Comments
14287 [@]	(7/2 ⁻)	102 keV	3	$\Gamma(\text{p}) \approx 10$ keV. E(p)=9.96 MeV. J^π : L=3; IAR of 7/2 ⁻ , g.s. in ^{149}Sm .
14635	(3/2 ⁻)			E(p)=10.31 MeV. J^π : IAR of 3/2 ⁻ , 350 in ^{149}Sm .
14804 [@]	(3/2 ⁻)	≈ 50 keV	1	$\Gamma(\text{p}) \approx 7$ keV. E(p)=10.48 keV. J^π : L=1; IAR of 3/2 ⁻ , 528 in ^{149}Sm .
15002	(1/2 ⁻ , 3/2 ⁻)		(1)	E(p)=10.68 MeV. J^π : L=(1); IAR of (3/2 ⁻), 697 in ^{149}Sm . This state could also be the IAR of (3/2 ⁺ , 5/2 ⁺), 710 in ^{149}Sm , although, parity is inconsistent with L-transfer.
15310	(1/2 ⁻ , 3/2 ⁻)		(1)	E(p)=10.99 MeV. J^π : L=(1); IAR of (<5/2), 1012 in ^{149}Sm .
15449	(5/2 ⁻)		(3)	E(p)=11.13 MeV. J^π : L=(3); IAR of 5/2 ⁻ , 1187 in ^{149}Sm . All other levels near this energy in ^{149}Sm are of positive parity.
15787				Parent: there are 3-5 levels in this energy range. But definite identification is not possible on the basis of the present data. E(p)=11.47 MeV.

[†] From [1967Jo04](#) with S(p)=4394 4 keV ([2021Wa16](#)).

[‡] From [1967Jo04](#).

[#] From [1967Jo04](#). [1966Ba12](#) report higher values: $\Gamma \approx 100$ keV and $\Gamma(\text{p}) \approx 30$ keV for both resonances.

[@] Reported by [1967Jo04](#) and [1966Ba12](#).

$^{148}\text{Sm}(^3\text{He},\text{d})$ **1979St01**

1979St01: $E(^3\text{He})=24$ MeV beam from McMaster University tandem accelerator. Measured $\sigma(\theta)$, $\theta(\text{c.m.})=10^\circ$ to 70° . FWHM=14 keV. DWBA analysis. Uncertainty for cross sections is 10% (relative), and 25% (absolute).

 ^{149}Eu Levels

$E(\text{level})^\dagger$	L	$(2J+1)S^\ddagger$	Comments
0	2	1.31	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=210$ (25°), 217 (50°).
150 4	4	0.94	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=25$ (25°), 33 (50°).
458 4	0	1.01	L: $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$ ratio is higher than expected for L=0, which may indicate an unresolved doublet near this energy.
			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=420$ (25°), 394 (50°).
496 4	5	7.60	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=100$ (25°), 157 (50°).
745 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=17$ (25°), 19 (50°).
767 4	0	0.23	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=97$ (25°), 95 (50°).
811 4	2	0.19	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=37$ (25°), 44 (50°).
876 4	2	0.25	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=51$ (25°), 60 (50°).
913 4	2	0.13	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=26$ (25°), 23 (50°).
936 4	(0)	0.06	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=26$ (25°), 25 (50°).
1135 4	4,(5)	(0.17)	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=8$ (50°).
1221 4	(2) [#]	0.21	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=35$ (25°), 44 (50°).
1310 4	(2) [#]	0.07	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=19$ (25°), 17 (50°).
1399 4	0	0.16	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=82$ (25°), 81 (50°).
1440 4	0	0.14	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=70$ (25°), 70 (50°).
1495 4	2	(0.25)	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=86$ (25°), 107 (50°).
1537 4	0	0.16	$d\sigma/d\Omega(\mu\text{b}/\text{sr})=100$ (25°), 85 (50°).
1595 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=21$ (25°), 14 (50°).
1625 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=15$ (25°), 8 (50°).
1655 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=46$ (25°), 33 (50°).
1680 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=42$ (25°), 22 (50°).
1752 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=42$ (25°), 22 (50°).
1819 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=48$ (25°), 38 (50°).
1857 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=25$ (25°), 19 (50°).
1890 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=40$ (25°), 22 (50°).
1945 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=38$ (25°), 52 (50°).
2029 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=42$ (25°), 30 (50°).
2060 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=48$ (25°), 15 (50°).
2092 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=28$ (25°), 25 (50°).
2118 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=17$ (25°), 19 (50°).
2144 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=15$ (25°).
2168 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=21$ (25°).
2199 4			$d\sigma/d\Omega(\mu\text{b}/\text{sr})=22$ (25°).

[†] Uncertainty of 4 keV is assigned from a general statement by authors that it is <4 keV.

[‡] The following orbitals are assumed: for L=2, $d_{5/2}$ (all states except 913 and 1495 where both $d_{3/2}$ and $d_{5/2}$ are taken); for L=4, $g_{7/2}$ and for L=5, $h_{11/2}$.

[#] From $\sigma(\alpha,t)/\sigma(^3\text{He},\text{d})$.

$^{148}\text{Sm}(\alpha, t)$ 1979St01, 1987DuZX

1979St01: $E(\alpha)=27$ MeV beam from McMaster University tandem accelerator. Measured $\sigma(\theta)$, $\theta=50^\circ$ and 60° . FWHM ≈ 14 keV. DWBA calculations.

1987DuZX: $E(\alpha)=100$ MeV. Measured $\sigma(\theta)$. FWHM ≈ 300 keV. DWBA calculations. Groups are reported at 110, 496, 1070, 1470 and 1740 keV. C^2S values are given for $L=2, 4$ and 5 for each of these groups. $\sigma(\theta)$ data for high-lying states in the 2-15 MeV range analyzed by slicing the region in 520-keV bins.

 ^{149}Eu Levels

$E(\text{level})^\dagger$	$L^\ddagger$	$d\sigma/d\Omega$ ($\mu\text{b/sr}$) [#]	Comments
0	(2)	51, 61	
150 4	(4,5)	26, 34	E(level): 1987DuZX report a group at 110 (probably g.s.+150) with $L=2+4$ and $C^2S=0.25$ ($L=2$), 0.24 ($L=4$).
460 4	(0,2)	38, 50	E(level): most likely a doublet. $L(^3\text{He}, d)=0$ suggests $1/2^+$ for one and ^{149}Gd ε decay suggests $3/2^+$ to $7/2^+$ for the other. But $L=(2)$ would allow $3/2^+$ or $5/2^+$.
496 4	(5)	167, 165	E(level): 1987DuZX report a group at 496 (probably 460+496) with $L=2+5$ and $C^2S=0.82$ ($L=2$), 0.42 ($L=5$). $L=2$ may correspond to 460, and $L=5$ to 496 (see also the Adopted Levels).
767 4	(0)	3, 3	
809 4	(2)	3, 5	
875 4	(2)	4, 5	
929?		2	$d\sigma/d\Omega$ at 60° .
1130 4	(4,5)	3, 3	E(level): 1987DuZX report a 1070 group (probably 1130+1219) with $L=2+5$ and $C^2S=0.08$ ($L=2$ and 5).
1219 4	(2)	3, 3	
1305 4	(2)		
1396 4	(0)	1, 2	
1440 4	(0,2)	3, 2	E(level): 1987DuZX report a 1470 group (probably 1440+1503) with $L=2+5$.
1503 4	(5)	15, 16	L: from 1987DuZX for a 1470 group with $L=2+5$ and $C^2S=0.33$ ($L=2$), 0.14 ($L=5$).
1539?	(0)	1 LT	$d\sigma/d\Omega$ at 60° .
1718?	(4)	1	L: from 1987DuZX for a group at 1740 with $C^2S=0.42$.
1816?		1	
1888?		1	

[†] From 1979St01. Uncertainty=4 keV, from authors' general statement that it is ≤ 4 keV.

[‡] From $\sigma(\alpha, t)/\sigma(^3\text{He}, d)$ (1979St01).

[#] From 1979St01 at 50° and 60° . First value for 50° , second for 60° , when two values are listed. For high-lying states in the 2-15 MeV range, $\Sigma(C^2S)=3.8$ 8 ($L=3$), 1.14 10 ($L=5$), 0.70 1 ($L=6$).

$^{149}\text{Sm}(\text{d},2\text{n}\gamma)$ 1986Bo131986Bo13: E=13.5 MeV. Measured E_γ , I_γ , $\gamma\gamma$. ^{149}Eu Levels

E(level) [†]	J^π [‡]	Comments
0.0	5/2 ⁺	
149.60 6	7/2 ⁺	
460.3 1	3/2 ⁺	J^π : (3/2,5/2) ⁺ in the Adopted Levels.
496.22 8	11/2 ⁻	
534.28 6	7/2 ⁺	
666.14 8	9/2 ⁺	
748.60 7	7/2 ⁻	
794.80 9	9/2 ⁻	
798.93 6	9/2 ⁺	
812.3 3	5/2 ⁺	
876.0 2	5/2 ⁺	
910.73 8	11/2 ⁺	
933.0 1	7/2 ⁺	J^π : (9/2) ⁺ in the Adopted Levels.
938.7 1	7/2 ⁺	
994.7 1	15/2 ⁻	
1013.3 2	5/2 ⁻	J^π : (5/2,7/2,9/2) in the Adopted Levels.
1097.3 1	7/2 ⁻ , 9/2 ⁻	
1177.1 1	13/2 ⁻	J^π : (9/2) ⁻ in the Adopted Levels.
1184.4 1	(11/2 ⁺)	
1333.4 1	13/2 ⁺	
1473.4? 10	(13/2 ⁺)	
1503.3 4	(11/2 ⁻)	
1528.9 1	15/2 ⁺	
1609.8 1	19/2 ⁻	
1659.3 1	15/2 ⁺	
1764.3 2	17/2 ⁻	
1999.1 3	19/2 ⁺	
2335.7 6	23/2 ⁻	
2576.7 6	25/2 ⁻	

[†] From least-squares fit to E_γ data. Uncertainty on $E_\gamma=0.5$ (assumed) for multiplets.[‡] As given by 1986Bo13, based on $\gamma(\theta)$ data and decay patterns. Assignments from the Adopted Levels are given under comments, if different. $\gamma(^{149}\text{Eu})$

E_γ	I_γ	$E_i(\text{level})$	J^π_i	E_f	J^π_f	Comments
132.2 3	1.2 [†] 3	666.14	9/2 ⁺	534.28	7/2 ⁺	
149.70 6	100	149.60	7/2 ⁺	0.0	5/2 ⁺	
154.2 2	1.6 [†] 3	1764.3	17/2 ⁻	1609.8	19/2 ⁻	
182.7 1	2.6 1	1177.1	13/2 ⁻	994.7	15/2 ⁻	Complex line.
241.0 1	0.8 1	2576.7	25/2 ⁻	2335.7	23/2 ⁻	
244.55 6	2.5 1	910.73	11/2 ⁺	666.14	9/2 ⁺	
264.65 5	6.0 2	798.93	9/2 ⁺	534.28	7/2 ⁺	
272.8 1	1.1 1	938.7	7/2 ⁺	666.14	9/2 ⁺	
278	[‡]	812.3	5/2 ⁺	534.28	7/2 ⁺	From $\gamma\gamma$.
289&		1473.4?	(13/2 ⁺)	1184.4	(11/2 ⁺)	
298.58 5	12.2 2	794.80	9/2 ⁻	496.22	11/2 ⁻	

Continued on next page (footnotes at end of table)

$^{149}\text{Sm}(\text{d}, 2\text{n}\gamma)$ **1986Bo13 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
325.6 5	0.9 [†] 3	1659.3	15/2 ⁺	1333.4	13/2 ⁺	
346.62 5	67.8 10	496.22	11/2 ⁻	149.60	7/2 ⁺	
351.7 2	2.2 3	1528.9	15/2 ⁺	1177.1	13/2 ⁻	
385.7 [@] 1	3.8 [@] 2	534.28	7/2 ⁺	149.60	7/2 ⁺	
385.7 [@] 1	3.8 [@] 2	1184.4	(11/2 ⁺)	798.93	9/2 ⁺	
389.3 2	1.1 1	1999.1	19/2 ⁺	1609.8	19/2 ⁻	
422.67 7	3.0 1	1333.4	13/2 ⁺	910.73	11/2 ⁺	
460.3 1	10 [‡]	460.3	3/2 ⁺	0.0	5/2 ⁺	I_γ : complex line.
495.3		496.22	11/2 ⁻	0.0	5/2 ⁺	Unresolved from a strong line in ^{17}F . Mult=E3 in Adopted Gammas.
498.45 6	34.4 7	994.7	15/2 ⁻	496.22	11/2 ⁻	
516.57 7	18.9 [†] 5	666.14	9/2 ⁺	149.60	7/2 ⁺	
534.27 [@] 6	24.3 [@] 4	534.28	7/2 ⁺	0.0	5/2 ⁺	
534.27 [@] 6	24.3 [@] 4	1528.9	15/2 ⁺	994.7	15/2 ⁻	
553.0 2	1.3 2	1013.3	5/2 ⁻	460.3	3/2 ⁺	
615.05 8	11.4 4	1609.8	19/2 ⁻	994.7	15/2 ⁻	
650.1 [@] 1	5.0 [@] 2	798.93	9/2 ⁺	149.60	7/2 ⁺	Complex line.
650.1 [@] 1	5.0 [@] 2	1184.4	(11/2 ⁺)	534.28	7/2 ⁺	
663.9 1	11.4 [‡] 3	812.3	5/2 ⁺	149.60	7/2 ⁺	
666.7 1	8.6 [†] 2	666.14	9/2 ⁺	0.0	5/2 ⁺	
680.88 6	9.0 3	1177.1	13/2 ⁻	496.22	11/2 ⁻	
708.5 3	1.7 2	1503.3	(11/2 ⁻)	794.80	9/2 ⁻	
725.9 [@] 2	2.1 [@] 2	876.0	5/2 ⁺	149.60	7/2 ⁺	
725.9 [@] 2	2.1 ^{@#} 2	2335.7	23/2 ⁻	1609.8	19/2 ⁻	
748.60 [@] 7	12.8 [@] 3	748.60	7/2 ⁻	0.0	5/2 ⁺	
748.60 [@] 7	12.8 ^{@†} 3	1659.3	15/2 ⁺	910.73	11/2 ⁺	
761.16 6	12.2 3	910.73	11/2 ⁺	149.60	7/2 ⁺	
769.9 2	1.4 [†] 3	1764.3	17/2 ⁻	994.7	15/2 ⁻	
789.1 1	2.2 2	938.7	7/2 ⁺	149.60	7/2 ⁺	
798.9 1	6.9 2	798.93	9/2 ⁺	0.0	5/2 ⁺	
811.9 3	1.8 [†] 5	812.3	5/2 ⁺	0.0	5/2 ⁺	
876.1 2	2.1 2	876.0	5/2 ⁺	0.0	5/2 ⁺	
933.0 1	4.6 2	933.0	7/2 ⁺	0.0	5/2 ⁺	
937.8 2	1.3 2	938.7	7/2 ⁺	0.0	5/2 ⁺	
947.7 1	3.7 2	1097.3	7/2 ⁻ , 9/2 ⁻	149.60	7/2 ⁺	

[†] Branching ratio disagrees with that in the Adopted Gammas.[‡] Also contributed by a competing reaction $^{149}\text{Sm}(\text{d}, \text{d}'\gamma)$.[#] Also contributed by a competing reaction $^{149}\text{Sm}(\text{d}, \text{t}\gamma)^{148}\text{Sm}$.[@] Multiply placed with undivided intensity.[&] Placement of transition in the level scheme is uncertain.

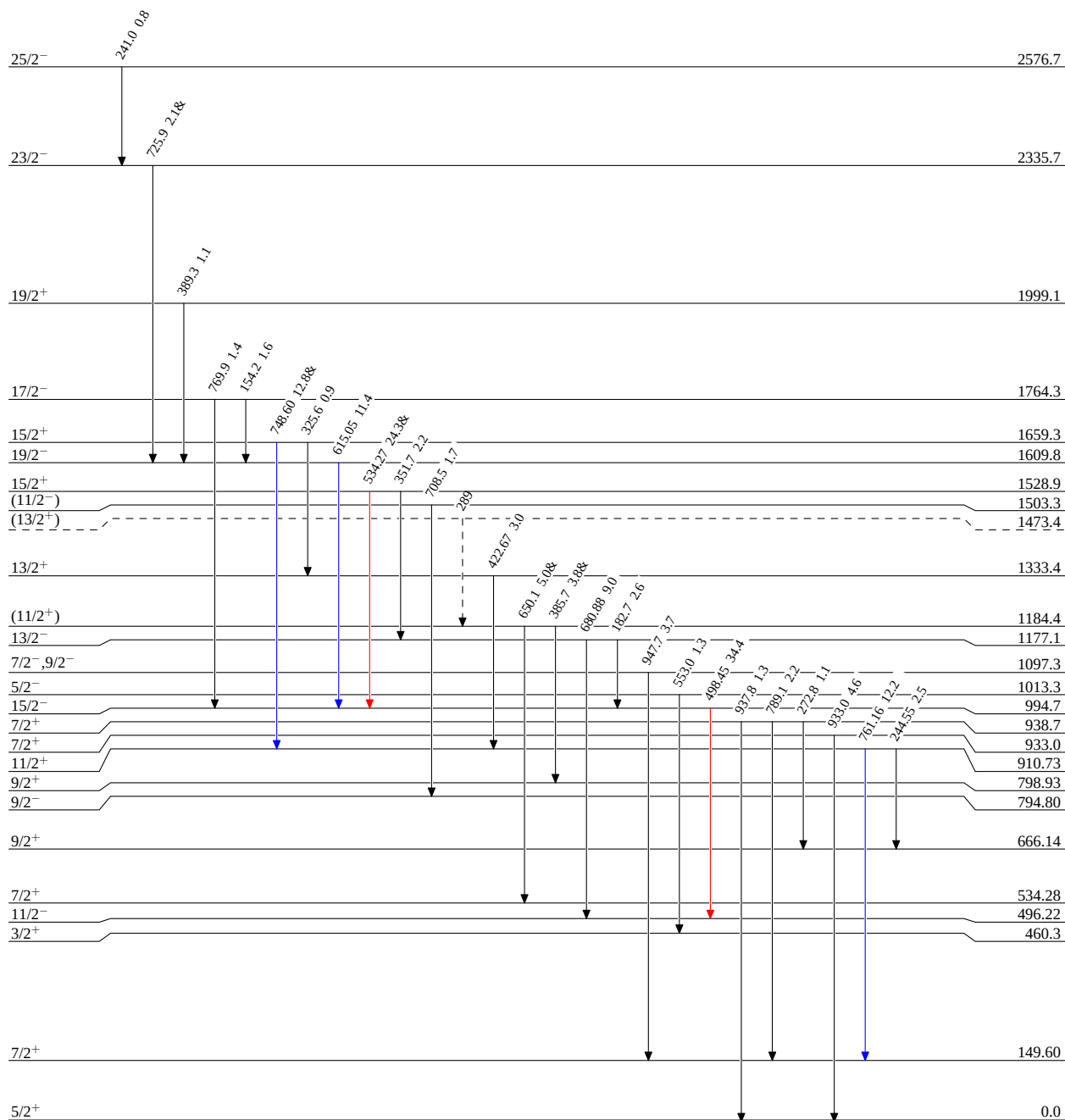
$^{149}\text{Sm}(d,2n\gamma)$ 1986Bo13

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)

 $^{149}_{63}\text{Eu}_{86}$

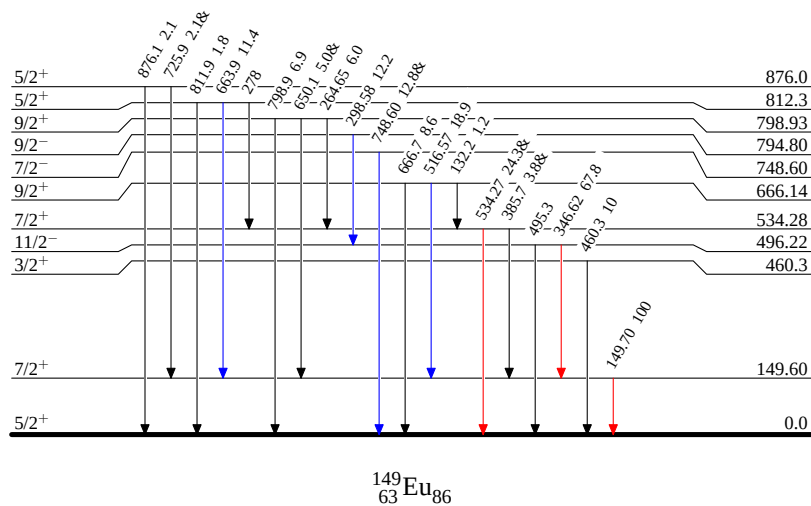
$^{149}\text{Sm}(d,2n\gamma)$ 1986Bo13

Level Scheme (continued)

Intensities: Relative I_γ
 & Multiply placed: undivided intensity given

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$


 $^{149}_{63}\text{Eu}_{86}$

 $^{149}\text{Sm}(^3\text{He},\text{t})\text{IAS}$ [1983Ja07](#)

[1983Ja07](#): $E(^3\text{He})=45.9$ MeV beam from the University of Michigan 83-inch cyclotron. Deduced g.s. isobaric analog state.

Measured reaction cross section at 0° . FWHM=40 keV.

$Q(^3\text{He},\text{t})=-15105$ 15, Coulomb displacement energy=15779 15.

$d\sigma/d\Omega=0.96$ mb/sr 12 (at 0°).

$^{150}\text{Sm}(\text{p},2\text{n}\gamma)$ 1977Na27

1977Na27: E(p)=18-26 MeV beams from the IMS and the INS SF cyclotrons of the University of Tokyo. Measured E_γ , I_γ , prompt and delayed $\gamma\gamma$, $\gamma(\theta)$, excitation functions. Authors assign multipolarities on the basis of the measured angular distributions; however, they do not quote A_4 values because of the large uncertainties. Therefore, evaluators have treated these assignments as well as the spin assignments as tentative.

1977Na27 suggest that the 994.3-keV $(15/2)^-$ and 1609.3-keV $(19/2)^-$ states are members of a decoupled band based on the 496.3-keV $11/2^-$ state (see also (HI,xny) data set).

 ^{149}Eu Levels

E(level) [†]	J^π [‡]	Comments
0.0	$5/2^+$	
149.7 3	$7/2^+$	
459.5 5	$3/2^+, 5/2^+, 7/2^+$	J^π : $(3/2, 5/2)^+$ in the Adopted Levels.
496.2 4	$11/2^-$	
534.4 4	$7/2^+$	
666.2 4	$(7/2^+), 9/2^+$	J^π : from Fig. 9 in 1977Na27 ; $5/2^+, 7/2^+, 9/2^+$ in authors' Table 1. $J^\pi=9/2^+$ in the Adopted Levels.
691.5 7	$5/2^+, 7/2^+$	J^π : $(3/2, 5/2, 7/2)$ in the Adopted Levels.
748.3 5	$7/2^-$	
794.6 7	$9/2^-$	
798.7 4	$(9/2^+)$	
812.7 6	$5/2^+, 7/2^+, 9/2^+$	J^π : $5/2^+$ in the Adopted Levels.
910.4 5	$(9/2^+), 11/2^+$	J^π : $11/2^+$ in the Adopted Levels.
933.1 5	$5/2^+, 7/2^+, 9/2^+$	J^π : $(9/2)^+$ in the Adopted Levels.
938.5 4	$7/2^+, 9/2^+$	J^π : from Fig. 9 in 1977Na27 ; $5/2^+, 7/2^+$ in authors' Table 1. $J^\pi=7/2^+$ in the Adopted Levels.
994.6 6	$15/2^-$	
1096.9 6	$(7/2^-, 9/2^-), 5/2^-$	J^π : $(9/2)^-$ in the Adopted Levels.
1176.5 6	$13/2^-$	
1333.1 5	$(11/2^+), 13/2^+$	J^π : $(13/2^+)$ in the Adopted Levels.
1609.6 8	$19/2^-$	

[†] From least-squares fit to E_γ data, assuming $\Delta E_\gamma=0.5$ keV.

[‡] As given by **1977Na27**, based on $\gamma(\theta)$ data and decay pattern. Exceptions are noted.

 $\gamma(^{149}\text{Eu})$

E_γ	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
149.8	100	149.7	$7/2^+$	0.0	$5/2^+$		$A_2=-0.08$ 2 M1 in 1977Na27 .
181.5	1.6 4	1176.5	$13/2^-$	994.6	$15/2^-$		
232.0	14.9 6	691.5	$5/2^+, 7/2^+$	459.5	$3/2^+, 5/2^+, 7/2^+$	D	$A_2=-0.21$ 5 M1+E2 in 1977Na27 .
244.6	6.6 [#] 5	910.4	$(9/2^+), 11/2^+$	666.2	$(7/2^+), 9/2^+$		$A_2=+0.06$ 13 M1+E2 in 1977Na27 .
264.5	9.3 6	798.7	$(9/2^+)$	534.4	$7/2^+$	D	$A_2=-0.09$ 12 M1+E2 in 1977Na27 .
298.4	15.5 8	794.6	$9/2^-$	496.2	$11/2^-$		$A_2=-0.35$ 4 M1+E2 in 1977Na27 .
346.5	76.9 25	496.2	$11/2^-$	149.7	$7/2^+$		$A_2=-0.03$ 2 M2 in 1977Na27 .
385.2	2.8 [#] 4	534.4	$7/2^+$	149.7	$7/2^+$	D	$A_2=-0.25$ 19 M1+E2 in 1977Na27 .
423.0	3.1 4	1333.1	$(11/2^+), 13/2^+$	910.4	$(9/2^+), 11/2^+$	D	$A_2=-0.18$ 26 M1+E2 in 1977Na27 .
459.5	13.2 6	459.5	$3/2^+, 5/2^+, 7/2^+$	0.0	$5/2^+$		$A_2=+0.01$ 12

Continued on next page (footnotes at end of table)

$^{150}\text{Sm}(p,2n\gamma)$ **1977Na27 (continued)** $\gamma(^{149}\text{Eu})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	Comments
							E_γ : from Fig. 9 in 1977Na27 ; 495.5 in authors' Table 1 is a misprint.
496.3	6.5 <i>10</i>	496.2	11/2 ⁻	0.0	5/2 ⁺	E3	M1(+E2) in 1977Na27 .
498.0	24.0 <i>35</i>	994.6	15/2 ⁻	496.2	11/2 ⁻	(Q)	Mult.: from the Adopted Gammas.
							$A_2=+0.25$ 4
516.0	32.5 <i>50</i>	666.2	(7/2 ⁺),9/2 ⁺	149.7	7/2 ⁺		E2 in 1977Na27 .
534.0	32.1 [#] <i>12</i>	534.4	7/2 ⁺	0.0	5/2 ⁺		$A_2=+0.05$ 3
							M1+E2 in 1977Na27 .
615.0	5.7 <i>6</i>	1609.6	19/2 ⁻	994.6	15/2 ⁻	(Q)	$A_2=+0.33$ <i>14</i>
							E2 in 1977Na27 .
663.0	5.1 <i>8</i>	812.7	5/2 ⁺ ,7/2 ⁺ ,9/2 ⁺	149.7	7/2 ⁺		
666.5 [@]	9.0 [@] <i>13</i>	666.2	(7/2 ⁺),9/2 ⁺	0.0	5/2 ⁺		$A_2=+0.22$ <i>15</i>
							I_γ : from the Adopted Gammas, most of the intensity must belong with 666 level.
							However, the authors attribute this γ to 1334 level only. But from the Adopted Gammas,
							$I_\gamma \approx 3$ with 1334 level.
							E2 in 1977Na27 .
666.5 [@]	≈ 3 [@]	1333.1	(11/2 ⁺),13/2 ⁺	666.2	(7/2 ⁺),9/2 ⁺	D+Q	I_γ : from the Adopted Gammas.
680.7	9.1 <i>6</i>	1176.5	13/2 ⁻	496.2	11/2 ⁻		$A_2=-0.57$ <i>11</i>
							M1+E2 in 1977Na27 .
748.3	12.8 <i>7</i>	748.3	7/2 ⁻	0.0	5/2 ⁺		$A_2=+0.01$ <i>6</i>
							E1(+M2) in 1977Na27 .
760.8	11.2 [#] <i>6</i>	910.4	(9/2 ⁺),11/2 ⁺	149.7	7/2 ⁺		$A_2=+0.20$ <i>7</i>
							E2(+M1) in 1977Na27 .
788.8	2.7 [#] <i>5</i>	938.5	7/2 ⁺ ,9/2 ⁺	149.7	7/2 ⁺		$A_2=-0.19$ <i>28</i>
							M1(+E2) in 1977Na27 .
798.6	11.3 <i>14</i>	798.7	(9/2 ⁺)	0.0	5/2 ⁺		$A_2=+0.06$ <i>14</i>
933.1	16.5 <i>9</i>	933.1	5/2 ⁺ ,7/2 ⁺ ,9/2 ⁺	0.0	5/2 ⁺		
938.5	5.4 [#] <i>6</i>	938.5	7/2 ⁺ ,9/2 ⁺	0.0	5/2 ⁺		I_γ : $I_\gamma(938\gamma)/I_\gamma(789\gamma)=2$ disagrees with 0.33 from ^{149}Gd ε decay. From the published γ -ray singles spectrum it seems that the $I_\gamma(789\gamma)=2.7$ may be a misprint.
947.2	4.9 <i>6</i>	1096.9	(7/2 ⁻ ,9/2 ⁻),5/2 ⁻	149.7	7/2 ⁺		

[†] At 22 MeV.[‡] From $\gamma(\theta)$, unless otherwise stated. Assignments in Table 1 of [1977Na27](#) are given in comments.[#] Branching ratio disagrees with that from the Adopted Gammas.[@] Multiply placed with intensity suitably divided.

$^{150}\text{Sm}(p,2n\gamma)$ 1977Na27

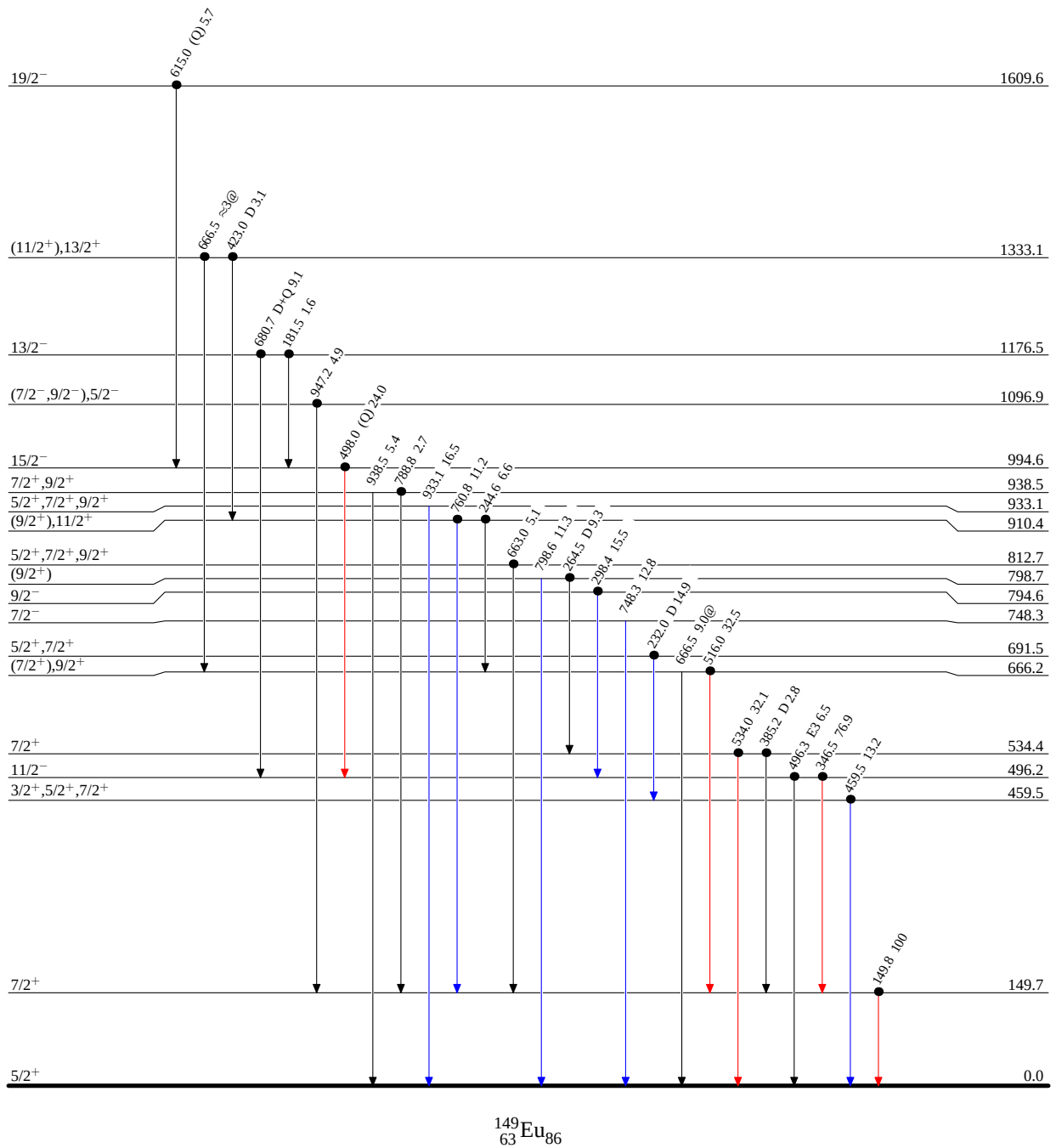
Level Scheme

Intensities: Relative I_γ

@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- Coincidence

 $^{149}_{63}\text{Eu}_{86}$

$^{150}\text{Sm}(\text{d},3\text{n}\gamma)$ 1977Le07

1977Le07: E(d)=18-25 MeV beams from the ANU Cyclo-Graaff. Main data at 23 MeV. Measured E_γ , I_γ , $\gamma\gamma$, $\gamma(\theta)$.

 ^{149}Eu Levels

E(level) [†]	J^π [‡]	Comments
0.0	5/2 ⁺	
149.71 15	7/2 ⁺	
496.41 18	11/2 ⁻	
534.60 15	7/2 ⁺	
665.9 4	(9/2) ⁺	J^π : from the Adopted Levels. $J^\pi=(5/2), 7/2^+$ in 1977Le07.
749.0 3	(7/2) ⁻	
794.9 3	9/2 ⁻	
799.8 3	9/2 ⁺	
910.8 3	(11/2) ⁺	
994.6 3	15/2 ⁻	
1610.1 4	19/2 ⁻	
2328.7? 4	23/2 ⁻	This level (proposed $J^\pi=23/2^-$ by 1977Le07) is considered suspect (evaluators) since no such level is seen in recent (HI,xn γ)
2570.1 6		E(level): 2576.84 in the Adopted Levels.
2745? 1		E(level): 2752.10 in the Adopted Levels.

[†] From least squares fit to E_γ data.

[‡] As given in 1977Le07, based on literature assignments up to 11/2⁺, and from the present work for the three high-spin negative-parity states. Exceptions are noted.

 $\gamma(^{149}\text{Eu})$

E_γ	I_γ	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	Comments
149.70 15	100	149.71	7/2 ⁺	0.0	5/2 ⁺	D	$A_2=-0.032$ 12; $A_4=-0.007$ 16
175 [‡]		2745?		2570.1			Obscured by a line from ^{153}Eu .
^x 182.7	3.2 4						
241.4 4	1.3 3	2570.1		2328.7?	23/2 ⁻		
245.3 4	3.7 12	910.8	(11/2) ⁺	665.9	(9/2) ⁺		
265.2 2	4.9 5	799.8	9/2 ⁺	534.60	7/2 ⁺	D	$A_2=-0.35$ 16
298.50 15	11.3 7	794.9	9/2 ⁻	496.41	11/2 ⁻	D	$A_2=-0.27$ 9
346.70 15	79.2 8	496.41	11/2 ⁻	149.71	7/2 ⁺		
^x 422.7 4							
496.4 3	5.8 10	496.41	11/2 ⁻	0.0	5/2 ⁺	E3	Mult.: from the Adopted Gammas.
498.20 25	63.5 25	994.6	15/2 ⁻	496.41	11/2 ⁻	(Q)	$A_2=+0.21$ 4
516.6 4	20 3	665.9	(9/2) ⁺	149.71	7/2 ⁺		
534.60 15	29.5 16	534.60	7/2 ⁺	0.0	5/2 ⁺		
^x 558.0 4	3.2 10						
^x 563.8 3	8.8 13						
^x 585.2 4	6.6 15						
615.50 15	23.4 16	1610.1	19/2 ⁻	994.6	15/2 ⁻	(Q)	$A_2=+0.35$ 4
666.4	10.6 18	665.9	(9/2) ⁺	0.0	5/2 ⁺		Unresolved doublet.
^x 680.7 3	9.5 18						
718.6 [‡] 2	15.7 23	2328.7?	23/2 ⁻	1610.1	19/2 ⁻	(Q)	$A_2=+0.28$ 6
^x 726.2 4	8.5 26						
^x 737.5 4	5.4 14						
749.00 25	11.0 16	749.0	(7/2) ⁻	0.0	5/2 ⁺	D	A_2 is negative.
760.90 25	15.9 16	910.8	(11/2) ⁺	149.71	7/2 ⁺	(Q)	$A_2=+0.27$ 9

[†] From $\gamma(\theta)$, unless otherwise stated.

Continued on next page (footnotes at end of table)

$^{150}\text{Sm}(\text{d},3\text{n}\gamma)$ **1977Le07 (continued)**

$\gamma(^{149}\text{Eu})$ (continued)

‡ Placement of transition in the level scheme is uncertain.

^{x} γ ray not placed in level scheme.

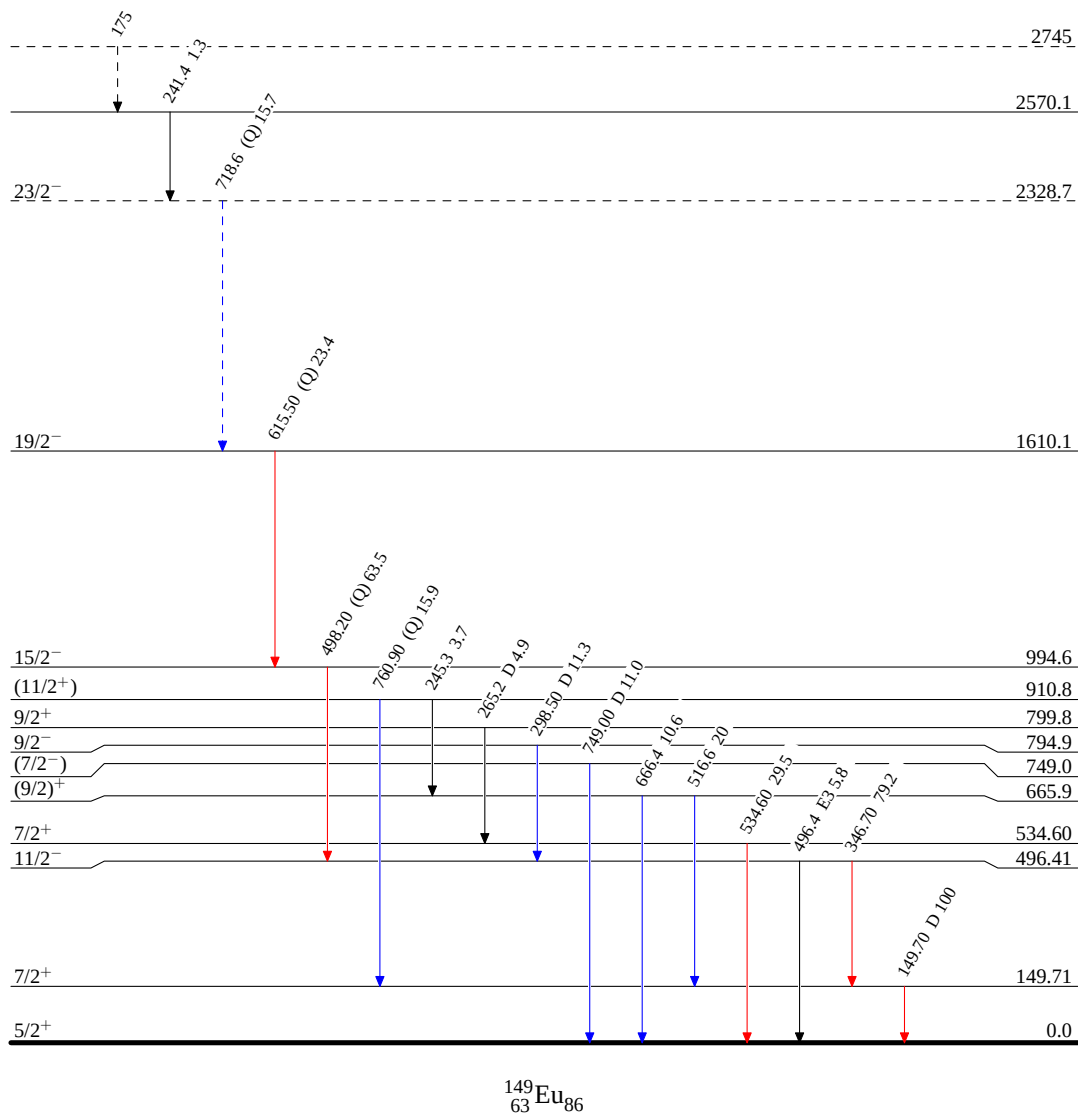
$^{150}\text{Sm}(\text{d},3\text{n}\gamma)$ 1977Le07

Legend

Level Scheme

 Intensities: Relative I_γ

- ▶ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- ▶ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - - -▶ γ Decay (Uncertain)



$^{152}\text{Sm}(\text{p},4\text{n}\gamma)$ **1984Lo17,1986Bo13**

1984Lo17: E=30-42 MeV beam from the University of Milan Cyclotron. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, $\gamma(\theta)$, ce, $\gamma\gamma(t)$, excitation functions.

1986Bo13: E=26-39 MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$, excitation functions.

 ^{149}Eu Levels

E(level) [†]	$J^{\pi\ddagger}$	Comments
0.0	$5/2^+$	
149.6 2	$7/2^+\#$	J^{π} : $7/2^-$ in 1984Lo17 .
459.9 3	$3/2^+\#$	J^{π} : $(3/2,5/2)^+$ in the Adopted Levels.
496.3 2	$11/2^-$	
534.5 2	$7/2^+\#$	
666.2 2	$(9/2^+)$	
748.8 2	$7/2^-\#$	
794.8 3	$9/2^-$	
799.0 3	$9/2^+\#$	
813.4 6	$5/2^+\#$	
875.1? 4	$5/2^+\#$	
910.8 3	$11/2^+\#$	J^{π} : $7/2^+, 9/2^+$ in 1984Lo17 .
933.0 5	$7/2^+\#$	J^{π} : $(9/2)^+$ in the Adopted Levels.
938.4 6	$7/2^+\#$	
994.8 3	$15/2^-$	
1059.4 5		J^{π} : $(9/2^-, 11/2, 13/2)$ in the Adopted Levels.
1177.2 3	$13/2^-$	
1185.0 4	$(11/2^+)\#$	
1333.5 4	$13/2^+\#$	J^{π} : $(9/2, 11/2)^+$ in 1984Lo17 .
1529.0 4	$15/2^+\#$	J^{π} : $11/2^-, 15/2^-$ in 1984Lo17 .
1610.2 4	$19/2^-$	
1658 1	$15/2^+\#$	
1764.5 5	$17/2^-$	
1999.3 5	$19/2^+\#$	J^{π} : $15/2^-, 17/2^-, 19/2^-$ in 1984Lo17 .
2335.8 5	$23/2^-$	
2342? 1		J^{π} : $(21/2)^+$ in the Adopted Levels.
2497? 1	$(21/2^-)\#$	J^{π} : $(23/2)^-$ in the Adopted Levels.
2562? 1	$23/2^+\#$	
2576.9 7	$25/2^-\#$	J^{π} : $21/2, 25/2$ in 1984Lo17 .
2752 1	$(27/2^-)\#$	

[†] From least-squares fit to $E\gamma$ data.

[‡] As given by **1984Lo17** and/or **1986Bo13**, based on their $\gamma(\theta)$ data and decay patterns. Exceptions are noted. Values from the Adopted Levels are given in comments, when these are quite different from those in **1984Lo17** and/or **1986Bo13**.

[#] From **1986Bo13**. Assignment is either not given in **1984Lo17** or it is different from that in **1986Bo13** and in the Adopted Levels.

$^{152}\text{Sm}(\text{p},4\text{n}\gamma)$ **1984Lo17,1986Bo13 (continued)** $\gamma(^{149}\text{Eu})$ A_2 and A_4 values are from **1984Lo17**.

$E_\gamma^\dagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	Comments
149.7 2	119 12	149.6	7/2 ⁺	0.0	5/2 ⁺	D	$A_2=-0.05$ 1; $A_4=-0.004$ 10
154.2 5	2.2& 7	1764.5	17/2 ⁻	1610.2	19/2 ⁻		
161@ ^c 1	0.4@ 2	2497?	(21/2 ⁻)	2335.8	23/2 ⁻		
175 1	5.2 10	2752	(27/2 ⁻)	2576.9	25/2 ⁻		$A_2=0.00$ 6; $A_4=0.00$ 8 I_γ : 1.4 (1986Bo13).
182.4 5	2.6 9	1177.2	13/2 ⁻	994.8	15/2 ⁻		$A_2=+0.05$ 6; $A_4=-0.13$ 9
241.1 5	2.8 9	2576.9	25/2 ⁻	2335.8	23/2 ⁻	D	$A_2=-0.28$ 9; $A_4=+0.01$ 13
244.6 ^a 5		910.8	11/2 ⁺	666.2	(9/2 ⁺)		
264.6 ^b 3	7.5 ^b 15	799.0	9/2 ⁺	534.5	7/2 ⁺	D	$A_2=-0.02$ 2; $A_4=+0.01$ 3 $\gamma(\theta)$ for composite line.
264.6 ^b 3	7.5 ^b 15	1059.4		794.8	9/2 ⁻		
298.5 2	12.3 12	794.8	9/2 ⁻	496.3	11/2 ⁻	D	$A_2=-0.20$ 2; $A_4=-0.008$ 20
346.7 2	100 10	496.3	11/2 ⁻	149.6	7/2 ⁺		$A_2=-0.02$ 1; $A_4=+0.001$ 10
351.6 5	2.6 9	1529.0	15/2 ⁺	1177.2	13/2 ⁻	D	$A_2=-0.31$ 6; $A_4=+0.14$ 9
386.0 ^b 5	4.2 ^b 14	534.5	7/2 ⁺	149.6	7/2 ⁺		
386.0 ^b 3	4.2 ^b 14	1185.0	(11/2 ⁺)	799.0	9/2 ⁺		$A_2=+0.01$ 4; $A_4=0.00$ 6
388.9 ^a 5	2.2 7	1999.3	19/2 ⁺	1610.2	19/2 ⁻		$A_2=+0.36$ 6; $A_4=-0.16$ 8 $\gamma(\theta)$ for composite line.
422.9 5	4.5 15	1333.5	13/2 ⁺	910.8	11/2 ⁺		$A_2=+0.07$ 4; $A_4=+0.06$ 6
459.9@ 3	6.0@ 12	459.9	3/2 ⁺	0.0	5/2 ⁺		
470.4 5	3.8 13	1999.3	19/2 ⁺	1529.0	15/2 ⁺	(Q)	$A_2=+0.25$ 6; $A_4=-0.06$ 8
496.4 3	6.5& 16	496.3	11/2 ⁻	0.0	5/2 ⁺	E3	Mult.: from the Adopted Gammas.
498.5 2	66 6	994.8	15/2 ⁻	496.3	11/2 ⁻	Q	$A_2=+0.23$ 1; $A_4=-0.029$ 10
516.6 2	19 2	666.2	(9/2 ⁺)	149.6	7/2 ⁺		$A_2=+0.24$ 14; $A_4=+0.021$ 20
534.3 ^b 2	23.7 ^b 24	534.5	7/2 ⁺	0.0	5/2 ⁺		$A_2=+0.10$ 2; $A_4=+0.03$ 2 $\gamma(\theta)$ for composite line.
534.3 ^b 2	23.7 ^b 24	1529.0	15/2 ⁺	994.8	15/2 ⁻		
563@ ^c 1	3@ 1	2562?	23/2 ⁺	1999.3	19/2 ⁺		
615.4 2	23.3 24	1610.2	19/2 ⁻	994.8	15/2 ⁻	(Q)	$A_2=+0.26$ 1; $A_4=+0.02$ 2
663.9@ 5	3.9@ 13	813.4	5/2 ⁺	149.6	7/2 ⁺		
666.1 3	6 1	666.2	(9/2 ⁺)	0.0	5/2 ⁺	Q	$A_2=+0.18$ 3; $A_4=-0.07$ 4
667.1 5	3.9 13	1333.5	13/2 ⁺	666.2	(9/2 ⁺)		$A_2=+0.13$ 4; $A_4=+0.20$ 6
680.9 2	11.6 12	1177.2	13/2 ⁻	496.3	11/2 ⁻	D	$A_2=-0.54$ 2; $A_4=+0.11$ 3
725.6 ^b 3	6.3 ^b 13	875.1?	5/2 ⁺	149.6	7/2 ⁺		Placement from 1986Bo13 only.
725.6 ^b 3	6.3 ^b 12	2335.8	23/2 ⁻	1610.2	19/2 ⁻	(Q)	$A_2=+0.29$ 5; $A_4=+0.05$ 6
732@ ^c 1	2@ 1	2342?		1610.2	19/2 ⁻		
747 ^a 1		1658	15/2 ⁺	910.8	11/2 ⁺		
748.8 2	12.5& 12	748.8	7/2 ⁻	0.0	5/2 ⁺		
761.3 2	16.3 16	910.8	11/2 ⁺	149.6	7/2 ⁺		$A_2=+0.15$ 2; $A_4=-0.002$ 22
769.8 5	3.7 12	1764.5	17/2 ⁻	994.8	15/2 ⁻	D+Q	$A_2=-0.62$ 6; $A_4=+0.05$ 8
788.9 5		938.4	7/2 ⁺	149.6	7/2 ⁺		
799.0 3	7.4& 15	799.0	9/2 ⁺	0.0	5/2 ⁺		
933.0 5	2.9& 10	933.0	7/2 ⁺	0.0	5/2 ⁺		

[†] From **1984Lo17**, unless otherwise stated. Uncertainty=0.2-0.5 keV. The evaluators assign uncertainty of 0.2 (for $I_\gamma > 10$), 0.3 (for

 $^{152}\text{Sm}(\text{p},4\text{n}\gamma)$ [1984Lo17](#), [1986Bo13](#) (continued)

 $\gamma(^{149}\text{Eu})$ (continued)

$I_\gamma=5-10$) and 0.5 or 1 (for $I_\gamma<5$).

[‡] From [1984Lo17](#) at $E=37$ MeV unless otherwise stated. Uncertainty=10-30%. I_γ values at 35 and 39 MeV are also available from [1986Bo13](#). The evaluators assign $\Delta I_\gamma=10\%$ (for $I_\gamma>10$), 20% (for $I_\gamma=5-10$) and 30% for $I_\gamma<5$.

[#] From $\gamma(\theta)$. Mult=Q; E2 is more likely than M2 from systematics and from no evidence of long-lived states.

[@] Reported by [1986Bo13](#) only.

[&] From [1986Bo13](#) at 35 MeV.

^a Weak component of a multiplet.

^b Multiply placed with undivided intensity.

^c Placement of transition in the level scheme is uncertain.

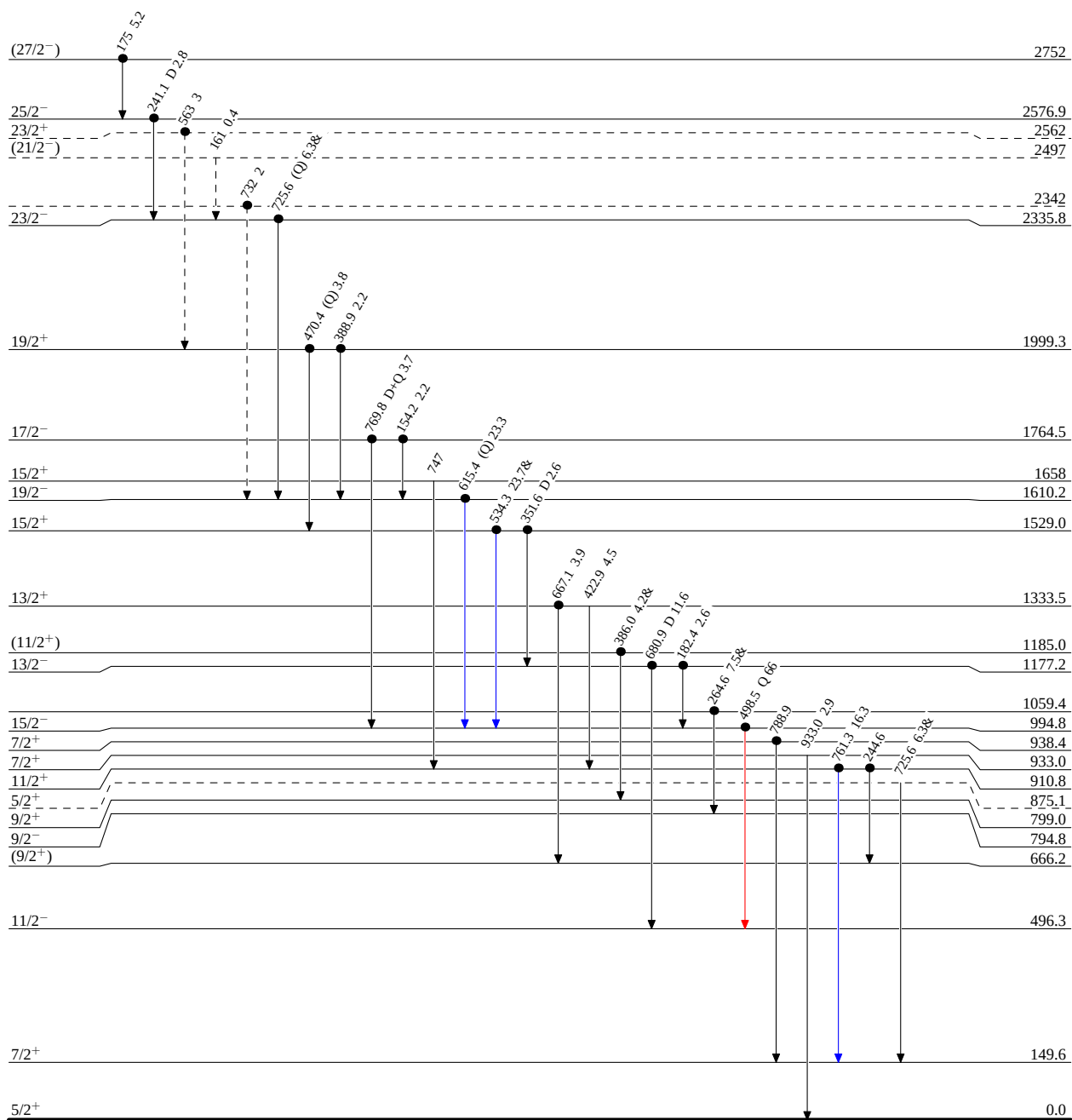
$^{152}\text{Sm}(p,4n\gamma)$ 1984Lo17,1986Bo13

Level Scheme

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - -→ γ Decay (Uncertain)
- Coincidence

 $^{149}_{63}\text{Eu}_{86}$

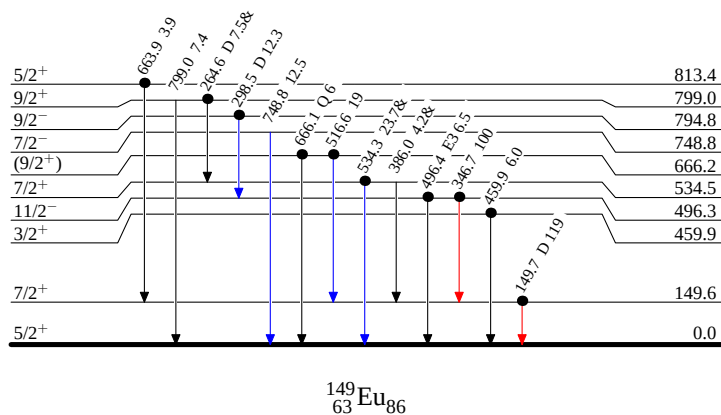
$^{152}\text{Sm}(p,4n\gamma)$ 1984Lo17,1986Bo13

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- Coincidence



¹⁵¹Eu(p,t) 1975Ta12

$J^\pi(^{151}\text{Eu})=5/2^+$.

1975Ta12: E(p)=18.5 and 19.0 MeV beams from the J.H. Williams Laboratory MP tandem. Measured $\sigma(\theta)$, $\theta=10^\circ-70^\circ$.

FWHM=10 keV. DWBA analysis.

¹⁴⁹Eu Levels

E(level) [†]	L	dσ/dΩ (μb/sr) [‡]	E(level) [†]	L	dσ/dΩ (μb/sr) [‡]	E(level) [†]	L	dσ/dΩ (μb/sr) [‡]
0	0	958	879 3	0	2.9	1226 3	0	84
150 3		6.6	911 3		5.5	1294 3		2.4
535 3		17.2	935 3		5.5	1319 3	0	57
666 3		6.1	955 3	0	4.1	1356 3		9.4
754 3	0	27.5	1064 3	(0)	3.3	1439 3		10.1
778 3		8.3	1150 3	0	11.0	1508 3		8.0
801 3		13.5	1190 3		3.2	1550 3		9.0
816 3		11.4	1212 3		3.7			

[†] Assigned uncertainty=3 keV, based on FWHM=10 keV.

[‡] At an angle where the value is maximum.

Adopted Levels, Gammas

$Q(\beta^-) = -3639$ 4; $S(n) = 6929$ 3; $S(p) = 6119$ 10; $Q(\alpha) = 3099$ 3 [2021Wa16](#)

$Q(\varepsilon) = 1314$ 4, $S(2n) = 15913$ 3, $S(2p) = 10439$ 3 ([2021Wa16](#)).

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 34 references dealing with nuclear structure theory, and five for half-lives in radioactive decays.

 ^{149}Gd Levels

Band assignments are from ($^{30}\text{Si}, 5n\gamma$). See [1993FI03](#) in that dataset for 5 additional SD bands.

[1993FI03](#) assign eight SD bands to ^{149}Gd , but more recent results ([1995DeZZ](#)) assign the last two SD bands (labeled g and h by [1993FI03](#)) to ^{148}Gd , instead. Additional bands are from [1998By02](#).

Cross Reference (XREF) Flags

A	^{149}Tb ε decay (4.12 h)	D	$^{124}\text{Sn} (^{30}\text{Si}, 5n\gamma)$
B	^{149}Tb ε decay (4.17 min)	E	$^{147}\text{Sm} (\alpha, 2n\gamma)$
C	^{153}Dy α decay (6.4 h)	F	$^{150}\text{Sm} (\alpha, 5n\gamma)$

E(level) [†]	J^π [‡]	$T_{1/2}$	XREF	Comments
0.0 ^a	7/2 ⁻	9.28 d 10	ABCDEF	$\% \varepsilon + \% \beta^+ = 100$; $\% \alpha = 4.3 \times 10^{-4}$ 10 $\mu = 0.88$ 4 (1987Kr11, 2019StZV) J^π : spin from atomic beam (1972Ek05); parity from shell model configuration = $\nu f_{7/2}^3$ and systematics of neighboring odd-A isotones. $T_{1/2}$: weighted average of 9.25 d 10 (1968Ch30), 9.5 d 3 (1962Pr06), 9.3 d 3 (1957Sh46). Others: 9.0 d 10 (1960To10), 10.3 h (1958Pa16), 10 h 1 (1958An35), 9 h 1 (1951Ho30). μ : from $\gamma(\theta, H, t)$ (1987Kr11 , also 1992KrZO). Others: 0.97 6 (1987Be33), 1.06 16 (1986Va16). $\% \alpha$: weighted average of 4.0×10^{-4} 12 (1966Wi12) and 4.6×10^{-4} 15 (1965Si06). α -decay energy = 3018 5 (1967Go32), 3000 150 (1960To10). $\mu = -0.9$ 2 (1977VaZJ, 2020StZV) J^π : M1+E2 164.98 γ to 7/2 ⁻ ; 652.12 γ M1+E2 from 3/2 ⁻ . $T_{1/2}$: from $\text{cey}(t)$ in ^{149}Tb ε (4.12 h) (1971VaZV). Other: 1.35 ns 30 (1969Ba64). μ : from IPAC and differential PAC (1977VaZJ, 1977GrZF); there are some discrepancies concerning the hyperfine fields used.
164.986 15	5/2 ⁻	1.7 ns 1	ABC EF	J^π : E2 352.24 γ to 7/2 ⁻ , M1+E2 187.22 γ to 5/2 ⁻ ; log $ft = 8.0$ from 1/2 ⁺ . $J = 5/2$ is not allowed by $\gamma\gamma(\theta)$ and ce data in ^{149}Tb ε (4.12 h). $T_{1/2}$: from $\text{cey}(t)$ in ^{149}Tb ε (4.12 h) (1971VaZV).
352.234 15	3/2 ⁻	0.43 ns 5	A E	J^π : $\Delta J = 2$, E2 775.3 γ to 7/2 ⁻ ; member of a sequence. $T_{1/2}$: from $\text{cey}(t)$ in ^{149}Tb ε (4.12 h) (1971VaZV).
775.32 ^a 9	11/2 ⁻		DEF	J^π : $\Delta J = 2$, E2 775.3 γ to 7/2 ⁻ ; member of a sequence.
795.94 ^b 8	9/2 ⁻		AB DEF	J^π : allowed ε feeding from 11/2 ⁻ in ^{149}Tb ε (4.17 min); $\Delta J = 1$, M1+E2 795.9 γ to 7/2 ⁻ .
817.099 18	3/2 ⁻		A E	J^π : E2 817.1 γ to 7/2 ⁻ ; M1(+E2) 464.85 γ to 3/2 ⁻ . $J = 5/2$ is not allowed by $\gamma\gamma(\theta)$ and ce in ^{149}Tb ε .
873.51 ^c 10	11/2 ⁺	1.6 ns 6	DEF	J^π : $\Delta J = 1$, E1 77.6 γ to 9/2 ⁻ , E1 98.2 γ to 11/2 ⁻ ; member of a sequence. $T_{1/2}$: from centroid shift method in ($\alpha, 5n\gamma$) (1981Pi09).
955.98 ^c 10	(13/2 ⁺)		DEF	J^π : (M1) 82.5 γ to 11/2 ⁺ ; $\Delta J = 1$, (E1) 180.6 γ to 11/2 ⁻ ; no γ to 7/2 ⁻ ; member of a sequence.
1026.836 22	3/2 ⁺		A E	XREF: E(?). J^π : 674.61 γ E1 to 3/2 ⁻ , 861.86 γ E1(+M2) to 5/2 ⁻ ; ε feeding from 1/2 ⁺ parent rules out 5/2 ⁺ .
1085.43 14	(5/2 ⁻ , 7/2, 9/2 ⁻)		A E	J^π : 920.5 γ to 5/2 ⁻ ; 289.4 γ to 9/2 ⁻ . Very weak possible ε feeding (log $ft = 9.0$) from 1/2 ⁺ parent favors 5/2 ⁻ ; but dipole γ to 9/2 ⁻ favors 7/2, 9/2 ⁻ .

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J^π [‡]	XREF	Comments
1124.90 3	$1/2^+, 3/2^+, 5/2^+$	A	J^π : E1 772.65 γ to $3/2^-$, M1 98.1 γ to $3/2^+$.
1144.08 5	$(5/2)^+$	A	J^π : E1 979.09 γ to $5/2^-$, 791.8 γ to $3/2^-$, 117.2 γ to $3/2^+$; 1144.09 γ D or E2 to $7/2^-$. But log $f_t=8.5$ from $1/2^+$ parent favors $3/2^+$ over $5/2^+$.
1167.12 5	$(3/2^-)$	A	J^π : (M2) 1167.10 γ to $7/2^-$, 1002.1 γ to $5/2^-$. But note that mult(1167 γ)=(M2) would become unlikely if this level has a $T_{1/2}<0.32$ ns which would only allow mult=D or E2 for this transition based on RUL and the branching, limiting J^π (1167) most likely to be $(3/2^-, 5/2)$.
1205.666 17	$(1/2)^-$	A	J^π : M1+E2 388.57 γ and 853.43 to $3/2^-$; $\gamma\gamma(\theta)$ and ce data support $1/2$, but $J=3/2$ is not completely ruled out.
1348.72 9	$(1/2^-, 3/2, 5/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 1183.7 γ to $5/2^-$.
1402.90 6	$(5/2^-)$	A	J^π : 1402.91 γ to $7/2^-$, 606.7 γ to $9/2^-$; 252.3 γ from $(3/2)^+$ and 1422.1 γ from $(1/2, 3/2)^-$ level.
1484.01 ^a 11	$15/2^-$	DEF	J^π : $\Delta J=2$, E2 708.7 γ to $11/2^-$; $\Delta J=1$, E1 528.0 γ to $(13/2)^+$.
1487.59 6	$(1/2, 3/2)^-$	A	J^π : ε feeding from $1/2^+$ parent; M1(+E2) 1135.3 γ to $3/2^-$.
1544.13 5	$(3/2^-, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 1191.89 γ to $3/2^-$, 1544.1 γ to $7/2^-$.
1557.38 6	$(1/2^-, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 1392.3 γ to $5/2^-$.
1597.30 9	$(1/2, 3/2, 5/2^-)$	A	J^π : ε feeding (log $f_t=8.3$) from $1/2^+$ parent.
1609.16 ^b 14	$13/2^{(-)}$	DEF	J^π : $\Delta J=2$ 813.2 γ to $9/2^-$; $\Delta J=1$ 833.9 γ to $11/2^-$.
1614.04 5	$3/2^+$	A	J^π : E1 1449.10 γ to $5/2^-$; ε feeding from $1/2^+$ parent.
1655.19 6	$(3/2)^+$	A	J^π : E1 1302.92 γ to $3/2^-$, 1490.3 γ to $5/2^-$; ε feeding from $1/2^+$ parent.
1739.97 ^c 17	$(17/2)^+$	DEF	J^π : $\Delta J=2$, E2 784.0 γ to $(13/2)^+$; member of a sequence.
1750.59 9	$(3/2^-, 5/2^-)$	A	J^π : ε feeding (log $f_t=8.0$) from $1/2^+$ parent; 723.8 γ to $3/2^+$, 1398.3 γ to $3/2^-$, probable 1751.0 γ to $7/2^-$;
1751.1? 2	$(15/2^+)$	E	J^π : $\Delta J=2$ 877.8 γ to $11/2^+$.
1772.83 4	$(3/2^+, 1/2^+)$	A	J^π : (E1) 955.71 γ to $3/2^-$; ε feeding from $1/2^+$ parent. Possible 1772.8 γ to $7/2^-$ disfavors $1/2^+$.
1844.31 7	$(1/2^-, 3/2, 5/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 1679.3 γ to $5/2^-$.
1992.49 4	$3/2^-$	A	J^π : 1175.4 γ M1 to $3/2^-$, 1827.5 γ M1(+E2) to $5/2^-$; strong ε feeding from $1/2^+$ parent.
1999.66? 24	$(15/2^+)$	E	J^π : $\Delta J=1$, E1 390.5 γ to $(13/2^-)$.
2058.19 13	$(17/2)^-$	DEF	J^π : $\Delta J=1$, M1 574.2 γ to $(15/2)^-$; $\Delta J=(2)$ 449.0 γ to $(13/2^-)$.
2088.47 8	$(1/2^-, 3/2, 5/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 1923.4 γ to $5/2^-$.
2126.62 22	$(1/2^-, 3/2, 5/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 723.7 γ to $(5/2^-)$.
2158.35 4	$(3/2)^+$	A	J^π : ε feeding from $1/2^+$ parent; E1 1341.19 γ to $3/2^-$, 1993.3 γ to $5/2^-$.
2199.90 8	$(1/2^-, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 2034.8 γ to $5/2^-$, 994.3 γ to $(1/2)^-$.
2231.79 ^b 16	$(17/2^-)$	DEF	J^π : $\Delta J=(2)$ 622.7 γ to $(13/2^-)$; 747.8 γ , $\Delta J=1$ to $(15/2)^-$.
2261.53 8	$(3/2, 1/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 2096.5 γ to $5/2^-$. Possible 2261.5 γ to $7/2^-$ disfavors $1/2^-$.
2300.72 6	$(1/2^-, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 2135.7 γ to $5/2^-$.
2314.10 22	$(1/2^-, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 2149.1 γ to $5/2^-$.
2383.66 16	$(19/2)^-$	DEF	J^π : $\Delta J=1$, E1 643.7 γ to $(17/2)^+$; $\Delta J=(2)$ 899.5 γ to $(15/2)^-$.
2401.37 ^c 18	$(21/2)^+$	DEF	J^π : $\Delta J=2$, E2 661.4 γ to $(17/2)^+$.
2482.72 14	$(1/2^+, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$; 1277.0 γ to $(1/2)^-$, 1338.6 γ to $(5/2)^+$.
2503.72 17	$(1/2^-, 3/2, 5/2^-)$	A	J^π : ε feeding from $1/2^+$ parent; 2338.7 γ to $5/2^-$.
2514.6? 3	$(19/2^+)$	E	J^π : $\Delta J=(2)$ 763 γ to $(15/2^+)$.
2524.09 ^b 18	$(21/2)^-$	DEF	J^π : $\Delta J=2$, E2 466.0 γ to $(17/2)^-$.
2569.75 18	$(1/2, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 1363.8 γ to $(1/2)^-$.
2590.05 8	$(1/2^-, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 1187.1 γ to $(5/2^-)$.
2599.29 8	$(1/2^-, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 2434.5 γ to $5/2^-$.
2613.22 14	$(1/2^-, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 2448.2 γ to $5/2^-$.
2683.46 8	$(1/2^+, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent; 1539.6 γ to $(5/2)^+$.
2703.30 19	$(1/2^-, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 2538.3 γ to $5/2^-$, 1497.6 γ to $(1/2)^-$.
2757.21 9	$(1/2, 3/2)$	A	J^π : ε feeding from $1/2^+$ parent.
2767.95 25	$(1/2^+, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent; 1623.8 γ to $(5/2)^+$.
2808.57 16	$(1/2, 3/2, 5/2^-)$	A	J^π : weak ε feeding from $1/2^+$ parent.
2824.98 7	$(1/2, 3/2)^-$	A	J^π : ε feeding from $1/2^+$ parent; E2(+M1) 2007.9 γ to $3/2^-$.

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
2830.6 3	(1/2,3/2,5/2 ⁻)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2338.7γ to 5/2 ⁻ .
2856.7 5	(21/2,23/2,25/2 ⁺)		EF	J ^π : 455.3γ to (21/2) ⁺ suggests 21/2, 23/2, 25/2 ⁺ . γ(θ) in (α,2nγ) and (α,5nγ) suggest (23/2 ⁺) or (21/2).
2861.84 14	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2696.8γ to 5/2 ⁻ .
2913.07 9	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent.
2918.21 22	(1/2 ⁻ ,3/2,5/2 ⁻)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2753.2γ to 5/2 ⁻ .
2922.73 18	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent.
2961.50 22	(5/2 ⁻ ,3/2,1/2 ⁻)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2796.5γ to 5/2 ⁻ , 1755.8γ to (1/2) ⁻ . Possible 2961.4γ to 7/2 ⁻ disfavors 1/2 and 3/2 ⁺ .
2977.72 12	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2812.7γ to 5/2 ⁻ .
2999.66 6	(3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2834.7γ to 5/2 ⁻ , 1794.1γ to (5/2) ⁺ .
3003.43 14	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2838.4γ to 5/2 ⁻ .
3021.18 11	(3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2856.0γ to 5/2 ⁻ , 1877.1γ to (5/2) ⁺ .
3057.0 4	(1/2 ⁻ ,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2892.0γ to 5/2 ⁻ .
3070.82 22	(1/2 ⁻ ,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2905.8γ to 5/2 ⁻ .
3079.8 3	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent.
3084.7 3	(23/2 ⁺)		F	J ^π : ΔJ=1 683.3γ to (21/2) ⁺ could be M1+E2.
3099.77 10	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 2935.1γ to 5/2 ⁻ .
3124.05 10	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent. Probable 2959.0γ to 5/2 ⁻ disfavors 1/2 ⁺ .
3134.55 22	(23/2 ⁻)		DEF	J ^π : ΔJ=2 750.7γ to (19/2) ⁻ , 733.1γ D to (21/2) ⁺ .
3149.35 18	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 1943.7γ to (1/2) ⁻ .
3175.62 10	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3010.6γ to 5/2 ⁻ .
3201.41 12	(3/2,1/2 ⁻)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 3036.4γ to 5/2 ⁻ . Possible 3201.2γ to 7/2 ⁻ disfavors 1/2 and 3/2 ⁺ .
3206.44 10	(3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3041.4γ to 5/2 ⁻ , 2062.3γ to (5/2) ⁺ .
3227.74 21	(23/2 ⁺)		DEF	J ^π : ΔJ=1, E1 703.6γ to (21/2) ⁻ . Configuration=νh _{9/2} ⊗(7 ⁻ in ^{148}Gd) (1981Pi09).
3231.13 18	(1/2 ⁻ ,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 3066.1γ to 5/2 ⁻ .
3258.38 18	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent.
3272.95 18	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent.
3294.56 20	(25/2 ⁺)		DEF	J ^π : ΔJ=2 893.2γ to (21/2) ⁺ .
3294.9 3	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent.
3313.58 10	(3/2 ⁻)		A	J ^π : possible allowed ε feeding from 1/2 ⁺ parent favors positive parity, but 2961.3γ (M1,E2) to 3/2 ⁻ favors negative parity; 3148.5γ to 5/2 ⁻ disfavors 1/2 ⁺ .
3319.04 20	(1/2 ⁻ ,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 3154.0γ to 5/2 ⁻ .
3340.63 18	(1/2 ⁺ ,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent; 2196.5γ to (5/2) ⁺ , 2135.0γ to (1/2) ⁻ .
3365.23 14	(3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3200.2γ to 5/2 ⁻ , 2221.1γ to (5/2) ⁺ .
3384.7 3	(1/2,3/2)		A	J ^π : weak ε feeding from 1/2 ⁺ parent.
3387.32 21	(27/2 ⁺)	6.0 ns 5	DEF	J ^π : ΔJ=2, E2 159.6γ to (23/2 ⁺). T _{1/2} : from γγ(t) and γ(t) in (α,5nγ) (1981Pi09). Configuration=νh _{9/2} ⊗(9 ⁻ in ^{148}Gd) (1981Pi09). Search for α decay (Eα=6-16 MeV) proved negative (1980Vr01).
3403.43 14	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3238.4γ to 5/2 ⁻ .
3418.82 16	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3254.5γ to 5/2 ⁻ .
3431.26 24	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3266.4γ to 5/2 ⁻ .
3442.84 18	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent.
3466.84 18	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3301.8γ to 5/2 ⁻ .
3473.24 18	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3308.2γ to 5/2 ⁻ .
3486.1 3	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent.
3499.65 22	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3335.0γ to 5/2 ⁻ .
3516.2 4	(1/2,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent.
3535.13 16	(3/2 ⁺)		A	J ^π : probable allowed ε feeding from 1/2 ⁺ parent; 3370.1γ to 5/2 ⁻ .
3543.9 4	(1/2 ⁻ ,3/2)		A	J ^π : ε feeding from 1/2 ⁺ parent; 3378.9γ to 5/2 ⁻ .

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Adopted Levels, Gammas (continued)

¹⁴⁹Gd Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
3611.73 19	(25/2) ⁻	0.7 ns	D F	J ^π : ΔJ=2, E2 1087.7γ to (21/2) ⁻ ; 383.7γ D to (23/2 ⁺).
3632.35 21	(27/2) ⁻		D F	J ^π : ΔJ=(2) 497.3γ to (23/2 ⁻); 337.8γ D to (25/2 ⁺). Other: 27/2 ⁺ in (α,5nγ) (1981Pi09).
				T _{1/2} : quoted by 1991Fl02 from 1983BaZZ in (³⁰ Si,5nγ).
3765.5 4	(29/2)		F	J ^π : ΔJ=1 378γ to (27/2 ⁺).
4054.7 ^d 3	(29/2) ⁻		D	J ^π : ΔJ=1 422.5γ to (27/2 ⁻).
4324.0? 3	(29/2) ⁻		F	J ^π : ΔJ=2, 712.3γ to (25/2) ⁻ .
4340.4 3	(31/2) ⁻		D	J ^π : ΔJ=(2), 708.0γ to (27/2 ⁻); ΔJ=1 285.6γ to (29/2 ⁻).
4343.0 4	(29/2 ⁺)		D	J ^π : ΔJ=1 955.6γ (27/2 ⁺); Member of a possible positive parity sequence.
4571.8? 5	(31/2)		F	J ^π : ΔJ=(1) γ to (29/2 ⁻).
4719.7 ^e 4	(33/2 ⁺)		D	J ^π : ΔJ=(2), 376.6γ to (29/2 ⁺); 379.4γ D to (31/2 ⁻).
4801.8 ^d 4	(33/2) ⁻		D	J ^π : ΔJ=(2), 747.4γ to (29/2 ⁻); ΔJ=1, 461.0γ to (31/2 ⁻).
5052.6 4	(35/2) ⁻		D	J ^π : ΔJ=(2), 712.3γ to (31/2 ⁻); ΔJ=1, 250.8γ to (33/2 ⁻).
5300.8 ^d 4	(37/2) ⁻		D	J ^π : ΔJ=(2), 498.8γ to (33/2 ⁻); ΔJ=1 248.0γ to (35/2 ⁻).
5462.9 ^e 4	(37/2 ⁺)		D	J ^π : ΔJ=(2), 743.2γ to (33/2 ⁺); ΔJ=1 410.5γ to (35/2 ⁻).
5634.2 ^d 4	(41/2) ⁻		D	J ^π : ΔJ=(2), 333.2γ to (37/2 ⁻).
5739.4 4	(39/2) ⁻		D	J ^π : ΔJ=1, D+Q 438.4γ to (37/2 ⁻).
6099.3 ^e 4	(41/2 ⁺)		D	J ^π : ΔJ=(2), 636.6γ to (37/2 ⁺).
6265.4 5	(45/2) ⁻		D	J ^π : 631.3γ to (41/2 ⁻); J ^π =45/2 ⁻ in 1995Fl01 and 1999Fi12.
6299.8? 10	(43/2) ⁻		D	J ^π : 667γ to (41/2 ⁻); J ^π =43/2 ⁻ in 1995Fl01.
6470.7 ^e 5	(45/2 ⁺)		D	J ^π : ΔJ=(2), γ to (41/2 ⁺); γ to (45/2 ⁻).
6504? 1	(47/2) ⁻		D	J ^π : 240γ to (45/2 ⁻); J ^π =47/2 ⁻ in 1995Fl01.
6656.9 ^f 6	(49/2 ⁺)	3.3 ns 4	D	J ^π : ΔJ=(2), (E2) γ to (45/2 ⁺).
				T _{1/2} : from recoil-shadow anisotropy method (2001Gu31) in (³⁰ Si,5nγ).
6786.5? 10	(47/2 ⁺)		D	J ^π : 317γ to (45/2 ⁺); J ^π =47/2 ⁺ in 1995Fl01.
7071.7? 10	(51/2 ⁺)		D	J ^π : 416γ to (49/2 ⁺); J ^π =51/2 ⁺ in 1995Fl01.
7742.0 12	(51/2)		D	J ^π : 1085γ to (49/2 ⁺); J=51/2 in 1999Fi12.
7822.0 ^f 6	(53/2 ⁺)		D	J ^π : ΔJ=(2) γ to (49/2 ⁺).
7824.9 6	(51/2) ⁻		D	J ^π : ΔJ=1 γ to (49/2 ⁺); possible member of a negative parity sequence with configuration= ν2f _{7/2} ⊗νi _{13/2} ² ⊗πd _{5/2} ⁻² ⊗πh _{11/2} ² (1991Fl02).
7997.1 7	(53/2) ⁻		D	J ^π : ΔJ=1, (M1(+E2)) γ to (51/2 ⁻).
				Configuration= νh _{9/2} ⊗νi _{13/2} ² ⊗πd _{5/2} ⁻² ⊗πh _{11/2} ² (1991Fl02).
8218.1 6	(53/2 ⁺)		D	J ^π : ΔJ=(2) γ to (49/2 ⁺).
8433.8 6	(55/2 ⁺)		D	J ^π : ΔJ=1, 215.4γ to (53/2 ⁺); ΔJ=(1), (D+Q) γ to (53/2 ⁺).
8459.0 12	(51/2) ⁻		D	J ^π : 1802γ to (49/2 ⁺); J ^π =51/2 ⁻ in 1999Fi12.
8465.8 11	(47/2) ⁻		D	J ^π : 1995γ to (45/2 ⁺); J ^π =47/2 ⁻ in 1999Fi12.
8557.5 ^f 6	(57/2 ⁺)		D	J ^π : ΔJ=(2), 735.8γ to (53/2 ⁺); ΔJ=1, 123.3γ to (55/2 ⁺).
8658.0 12	(51/2) ⁻		D	J ^π : 2001γ to (49/2 ⁺); J ^π =51/2 ⁻ in 1999Fi12.
8940.9 ^g 7	(57/2) ⁻		D	J ^π : ΔJ=(2) γ to (53/2 ⁻); ΔJ=1, dipole γ to (55/2 ⁺).
9055.8 11	(49/2 ⁺)		D	J ^π : 2585γ to (45/2 ⁺); J ^π =49/2 ⁺ in 1999Fi12.
9273.6 7	(57/2) ⁻		D	J ^π : ΔJ=(2) γ to (53/2 ⁻).
9326.4 7	(59/2 ⁺)		D	J ^π : ΔJ=1 γ to (57/2 ⁺).
9438.5 ^h 7	(59/2 ⁺)		D	J ^π : ΔJ=1 γs to (57/2 ⁺) and (57/2 ⁻).
9502.2 ^g 7	(61/2) ⁻		D	J ^π : ΔJ=(2) γ to (57/2 ⁻); ΔJ=1, dipole γ to (59/2 ⁺).
10362.4 ^h 7	(63/2 ⁺)		D	J ^π : ΔJ=(2) γ to (59/2 ⁺); γ to (61/2 ⁻).
10510.5 7	(63/2 ⁺)		D	J ^π : γ to (61/2); J ^π =63/2 ⁺ in 1995Fl01.
10602.4 ^g 7	(65/2) ⁻		D	J ^π : ΔJ=(2) γ to (61/2 ⁻).
10626.0 ⁱ 15	(47/2) ⁻		D	J ^π : from 1990Ha31, 1995Fl01 and 1999Fi12 and 1995Fl01, based on assigned configurations and decay to normal-deformed levels. 1993Ra07 suggest 47/2, 51/2 based on theoretical analysis.
10851.1 7	(63/2) ⁻		D	J ^π : ΔJ=1, dipole γ to (61/2 ⁻).
10930.9 ^g 7	(65/2) ⁻		D	J ^π : ΔJ=(2) γ to (61/2 ⁻); γ to (63/2 ⁺).

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
11012.0 7	(65/2 ⁻)	D	J ^π : ΔJ=1 γs to (63/2 ⁺) and (63/2 ⁻).
11200.3 ^h 7	(67/2 ⁺)	D	J ^π : ΔJ=(2) γ to (63/2 ⁺); ΔJ=1 γs to (65/2 ⁻).
11243.8 ⁱ 15	(51/2 ⁻)	D	
11712.2 7	(67/2 ⁻)	D	J ^π : ΔJ=1, dipole γ to (65/2 ⁻).
11908.0 ⁱ 15	(55/2 ⁻)	D	
12268.8 7	(69/2 ⁺)	D	J ^π : ΔJ=(1) γ to (67/2 ⁺). Other: (67/2) in 1991FI02.
12384.3 7	(69/2 ⁻)	D	J ^π : ΔJ=(2) γ to (65/2 ⁻); ΔJ=1, dipole γs to (67/2 ⁺) and (67/2 ⁻).
12469.5 8	(69/2 ⁻)	D	J ^π : ΔJ=(2) γ to (65/2 ⁻).
12581.1 8	(71/2 ⁻)	D	J ^π : ΔJ=(2) γ to (67/2 ⁻).
12619.8 ⁱ 15	(59/2 ⁻)	D	
12752.5 7	(71/2 ⁺)	D	J ^π : ΔJ=(2) γ to (67/2 ⁺).
12967.7 7	(71/2 ⁺)	D	J ^π : ΔJ=(2) γ to (67/2 ⁺); ΔJ=1, 583.1γ to (69/2 ⁻).
13189.7 8	(75/2 ⁻)	D	J ^π : ΔJ=(2), (E2) γ to (71/2 ⁻).
13279.1 8	(73/2 ⁻)	D	J ^π : ΔJ=1, dipole γ to (71/2 ⁺).
13379.5 ⁱ 15	(63/2 ⁻)	D	
13567.7 8	(75/2 ⁻)	D	J ^π : ΔJ=1, dipole γ to (73/2 ⁻). Configuration= νd _{3/2} ⁻³ ⊗νf _{7/2} ² ⊗νh _{9/2} ⊗νi _{13/2} ² ⊗πd _{5/2} ⁻³ ⊗πh _{11/2} ³ (1991FI02).
14109.2 8	(77/2 ⁻)	D	J ^π : ΔJ=1 γs to (75/2 ⁻).
14187.6 ⁱ 15	(67/2 ⁻)	D	
15044.7 ⁱ 15	(71/2 ⁻)	D	
15163.9 9	(81/2 ⁻)	D	J ^π : ΔJ=(2) γ to (77/2 ⁻).
15951.4 ⁱ 15	(75/2 ⁻)	D	
15997.4 9	(85/2 ⁻)	D	J ^π : γ to (81/2 ⁻); J ^π =85/2 ⁻ in 1995FI01.
16908.5 ⁱ 15	(79/2 ⁻)	D	
17917.2 ⁱ 16	(83/2 ⁻)	D	
18977.9 ⁱ 16	(87/2 ⁻)	D	
20091.7 ⁱ 16	(91/2 ⁻)	D	
21258.9 ⁱ 16	(95/2 ⁻)	D	
22480.7 ⁱ 16	(99/2 ⁻)	D	
23757.2 ⁱ 16	(103/2 ⁻)	D	
25089.2 ⁱ 16	(107/2 ⁻)	D	
26476.8 ⁱ 16	(111/2 ⁻)	D	
27921.1 ⁱ 16	(115/2 ⁻)	D	
29421.6 ⁱ 16	(119/2 ⁻)	D	
30979.4 ⁱ 16	(123/2 ⁻)	D	
32595.1 ⁱ 16	(127/2 ⁻)	D	
34267.2 ⁱ 17	(131/2 ⁻)	D	
35997.1 ⁱ 19	(135/2 ⁻)	D	
x ^{#j}	(63/2 ⁺)	D	J ^π : from 1993Cu06 and 1995FI01 based on assigned configurations.
858.5+x ^j 3	(67/2 ⁺)	D	
1746.7+x ^j 4	(71/2 ⁺) ^{&}	D	
2624.8+x ^j 5	(75/2 ⁺)	D	
3525.8+x ^j 5	(79/2 ⁺)	D	
4468.1+x ^j 5	(83/2 ⁺)	D	
5455.0+x ^j 5	(87/2 ⁺)	D	
6488.0+x ^j 5	(91/2 ⁺)	D	
7569.3+x ^j 5	(95/2 ⁺)	D	
8699.7+x ^j 5	(99/2 ⁺)	D	
9880.6+x ^j 5	(103/2 ⁺)	D	
11113.1+x ^j 5	(107/2 ⁺)	D	
12398.9+x ^j 5	(111/2 ⁺)	D	

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
13738.6+x ^j 6	(115/2 ⁺)	D	
15133.4+x ^j 6	(119/2 ⁺)	D	
16584.0+x ^j 6	(123/2 ⁺)	D	
18090.7+x ^j 7	(127/2 ⁺)	D	
19654.7+x ^j 8	(131/2 ⁺)	D	
21275.0+x ^j 10	(135/2 ⁺)	D	
y ^k	J1≈(57/2 ⁺)	D	J ^π : from 1995F101 based on assigned configuration.
649.8+y ^k 4	J1+2	D	
1349.6+y ^k 5	J1+4	D	
2098.2+y ^k 5	J1+6	D	
2897.4+y ^k 6	J1+8	D	
3751.5+y ^k 6	J1+10@	D	
4647.5+y ^k 6	J1+12	D	
5600.8+y ^k 7	J1+14	D	
6605.7+y ^k 7	J1+16	D	
7662.4+y ^k 7	J1+18	D	
8772.5+y ^k 8	J1+20	D	
9935.7+y ^k 8	J1+22	D	
11151.2+y ^k 8	J1+24	D	
12420.0+y ^k 8	J1+26	D	
13742.9+y ^k 9	J1+28	D	
15119.7+y ^k 9	J1+30	D	
16550.6+y ^k 9	J1+32	D	
18036.2+y ^k 10	J1+34	D	
19576.4+y ^k 11	J1+36	D	
21170.8+y ^k 13	J1+38	D	
22818.2+y ^k 16	J1+40	D	
z ^l	J2≈(63/2 ⁺)	D	J ^π : from 1995F101 based on assigned configuration.
725.6+z ^l 4	J2+2	D	
1497.5+z ^l 5	J2+4	D	
2315.1+z ^l 5	J2+6	D	
3180.0+z ^l 6	J2+8	D	
4092.1+z ^l 6	J2+10	D	
5052.8+z ^l 6	J2+12	D	
6058.3+z ^l 7	J2+14	D	
7114.5+z ^l 7	J2+16	D	
8218.2+z ^l 7	J2+18	D	
9369.7+z ^l 8	J2+20	D	
10568.7+z ^l 8	J2+22	D	
11815.7+z ^l 8	J2+24	D	
13110.0+z ^l 8	J2+26	D	

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
14451.6+z ^{<i>l</i>} 9	J2+28	D	
15839.7+z ^{<i>l</i>} 9	J2+30	D	
17274.6+z ^{<i>l</i>} 10	J2+32	D	
18757.1+z ^{<i>l</i>} 11	J2+34	D	
20285.7+z ^{<i>l</i>} 13	J2+36	D	
21860.7+z ^{<i>l</i>} 17	J2+38	D	
u ^{<i>m</i>}	J3≈(63/2 ⁻)	D	J ^π : from 1995FI01 based on assigned configuration.
755.7+u ^{<i>m</i>} 4	J3+2	D	
1560.6+u ^{<i>m</i>} 5	J3+4	D	
2415.6+u ^{<i>m</i>} 6	J3+6	D	
3323.6+u ^{<i>m</i>} 7	J3+8	D	
4283.9+u ^{<i>m</i>} 7	J3+10	D	
5299.5+u ^{<i>m</i>} 8	J3+12	D	
6369.4+u ^{<i>m</i>} 8	J3+14	D	
7495.5+u ^{<i>m</i>} 9	J3+16	D	
8678.9+u ^{<i>m</i>} 9	J3+18	D	
9919.8+u ^{<i>m</i>} 10	J3+20	D	
11219.1+u ^{<i>m</i>} 10	J3+22	D	
12576.8+u ^{<i>m</i>} 11	J3+24	D	
13993.9+u ^{<i>m</i>} 11	J3+26	D	
15469.7+u ^{<i>m</i>} 12	J3+28	D	
17004.3+u ^{<i>m</i>} 13	J3+30	D	
18599.3+u ^{<i>m</i>} 17	J3+32	D	
v ^{<i>n</i>}	J4≈(57/2 ⁻)	D	J ^π : from 1995FI01 based on assigned configuration.
688.1+v ^{<i>n</i>} 5	J4+2	D	
1420.7+v ^{<i>n</i>} 6	J4+4	D	
2200.9+v ^{<i>n</i>} 6	J4+6	D	
3030.7+v ^{<i>n</i>} 6	J4+8	D	
3911.7+v ^{<i>n</i>} 7	J4+10	D	
4845.2+v ^{<i>n</i>} 7	J4+12	D	
5832.3+v ^{<i>n</i>} 7	J4+14	D	
6874.3+v ^{<i>n</i>} 8	J4+16	D	
7971.8+v ^{<i>n</i>} 8	J4+18	D	
9126.1+v ^{<i>n</i>} 8	J4+20	D	
10338.1+v ^{<i>n</i>} 9	J4+22	D	
11608.6+v ^{<i>n</i>} 9	J4+24	D	
12937.5+v ^{<i>n</i>} 11	J4+26	D	
14325.9+v ^{<i>n</i>} 12	J4+28	D	
15772.5+v ^{<i>n</i>} 12	J4+30	D	
17278.5+v ^{<i>n</i>} 14	J4+32	D	
18843.7+v ^{<i>n</i>} 15	J4+34	D	
20469.7+v ^{<i>n</i>} 18	J4+36	D	
22155.7+v ^{<i>n</i>} 21	J4+38	D	
w ^{<i>o</i>}	J5	D	
802.9+w ^{<i>o</i>} 3	J5+2	D	
1655.1+w ^{<i>o</i>} 5	J5+4	D	
2557.1+w ^{<i>o</i>} 6	J5+6	D	
3509.2+w ^{<i>o</i>} 7	J5+8	D	
4513.0+w ^{<i>o</i>} 8	J5+10	D	

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

E(level) [†]	J^π [‡]	XREF	E(level) [†]	J^π [‡]	XREF	E(level) [†]	J^π [‡]	XREF
5562.7+w ^o 9	J5+12	D	8087.0+t ^q 10	J7+16	D	10673.9+b ^s 12	J9+20	D
6667.9+w ^o 10	J5+14	D	9289.4+t ^q 10	J7+18	D	12064.0+b ^s 13	J9+22	D
7825.1+w ^o 10	J5+16	D	10549.4+t ^q 11	J7+20	D	13513.0+b ^s 13	J9+24	D
9034.4+w ^o 11	J5+18	D	11867.8+t ^q 11	J7+22	D	15020.6+b ^s 14	J9+26	D
10296.7+w ^o 11	J5+20	D	13243.4+t ^q 12	J7+24	D	16586.6+b ^s 18	J9+28	D
11612.4+w ^o 11	J5+22	D	14683.7+t ^q 12	J7+26	D	c ^t	J10	D
12982.0+w ^o 12	J5+24	D	16178.3+t ^q 13	J7+28	D	855.1+c ^t 10	J10+2	D
14404.8+w ^o 13	J5+26	D	17732.2+t ^q 14	J7+30	D	1757.5+c ^t 12	J10+4	D
15882.3+w ^o 14	J5+28	D	19346.7+t ^q 15	J7+32	D	2713.6+c ^t 14	J10+6	D
17415.0+w ^o 14	J5+30	D	a ^r	J8	D	3726.2+c ^t 14	J10+8	D
19000.8+w ^o 16	J5+32	D	747.6+a ^r 6	J8+2	D	4795.8+c ^t 15	J10+10	D
20642.0+w ^o 19	J5+34	D	1544.3+a ^r 8	J8+4	D	5921.9+c ^t 16	J10+12	D
s ^p	J6	D	2391.6+a ^r 9	J8+6	D	7103.5+c ^t 17	J10+14	D
877.8+s ^p 4	J6+2	D	3290.1+a ^r 10	J8+8	D	8337.5+c ^t 18	J10+16	D
1809.8+s ^p 5	J6+4	D	4240.3+a ^r 11	J8+10	D	9620.0+c ^t 19	J10+18	D
2795.3+s ^p 6	J6+6	D	5242.8+a ^r 12	J8+12	D	10947.1+c ^t 20	J10+20	D
3833.6+s ^p 7	J6+8	D	6305.6+a ^r 12	J8+14	D	12321.0+c ^t 22	J10+22	D
4924.6+s ^p 7	J6+10	D	7422.7+a ^r 13	J8+16	D	13741.3+c ^t 24	J10+24	D
6067.1+s ^p 8	J6+12	D	8595.5+a ^r 14	J8+18	D	15213.0+c ^t 25	J10+26	D
7260.4+s ^p 8	J6+14	D	9826.8+a ^r 14	J8+20	D	16739+c ^t 3	J10+28	D
8503.3+s ^p 9	J6+16	D	11115.2+a ^r 15	J8+22	D	18322+c ^t 3	J10+30	D
9795.2+s ^p 9	J6+18	D	12462.0+a ^r 16	J8+24	D	19961+c ^t 4	J10+32	D
11133.3+s ^p 10	J6+20	D	13869.3+a ^r 16	J8+26	D	d ^u	J11	D
12519.5+s ^p 10	J6+22	D	15332.6+a ^r 17	J8+28	D	850.3+d ^u 10	J11+2	D
13949.5+s ^p 11	J6+24	D	16864.4+a ^r 20	J8+30	D	1741.5+d ^u 15	J11+4	D
15421.8+s ^p 12	J6+26	D	18452.6+a ^r 24	J8+32	D	2677.2+d ^u 17	J11+6	D
16934.9+s ^p 14	J6+28	D	b ^s	J9	D	3663.7+d ^u 19	J11+8	D
18484.3+s ^p 16	J6+30	D	827.6+b ^s 5	J9+2	D	4701.7+d ^u 21	J11+10	D
t ^q	J7	D	1697.3+b ^s 7	J9+4	D	5792.5+d ^u 23	J11+12	D
874.1+t ^q 3	J7+2	D	2621.5+b ^s 7	J9+6	D	6935.4+d ^u 24	J11+14	D
1798.7+t ^q 4	J7+4	D	3596.9+b ^s 8	J9+8	D	8131+d ^u 3	J11+16	D
2771.3+t ^q 6	J7+6	D	4627.3+b ^s 9	J9+10	D	9382+d ^u 3	J11+18	D
3797.2+t ^q 8	J7+8	D	5715.8+b ^s 9	J9+12	D	10688+d ^u 3	J11+20	D
4813.6+t ^q 8	J7+10	D	6864.0+b ^s 10	J9+14	D	12049+d ^u 4	J11+22	D
5851.5+t ^q 9	J7+12	D	8073.3+b ^s 11	J9+16	D	13467+d ^u 4	J11+24	D
6941.4+t ^q 9	J7+14	D	9343.3+b ^s 12	J9+18	D	14941+d ^u 4	J11+26	D

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_\gamma=0.3$ keV, when not given.

[‡] For levels populated in $^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ and $(\alpha,xn\gamma)$ reactions, J^π values have been deduced primarily from $\gamma(\theta)$ data in 1991FI02. In a few cases ce data and $\gamma(\text{lin pol})$ data give strong arguments for J^π values. Following assumptions have been made in such assignments: ascending spins are assumed as the excitation energy increases which is generally supported by deexcitation pattern of levels. $\Delta J=2$, quadrupole transitions are assumed as E2 and $\Delta J=1$ transitions with Q/D admixture are assumed as M1+E2 from RUL for E2 and M2, when no long lifetime for levels is indicated from $\gamma\gamma$ -coin data. Above 5 MeV excitation, only one J value is given but $\gamma(\theta)$ data used to assign these J^π values do not seem to give unique results. Arguments based on sequence assignments, model calculations, etc., seem to have been used by 1991FI02 and 1995FI01 in $(^{30}\text{Si},5n\gamma)$.

The energies of the first four transitions show a backbend in this band. This has been ascribed to the alignment of a neutron pair (1995FI01).

@ $J\approx(77/2)$ from 1993Ra07. $J=73/2$ is also suggested by 1993Ra07.

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Adopted Levels, Gammas (continued) ^{149}Gd Levels (continued)

& [1993Ra07](#) suggest 67/2, 71/2 based on theoretical analysis.

^a Band(A): Band built on $\nu 2f_{7/2}^3$. Assignment from [1981Pi09](#).

^b Band(B): Band built on $\nu h_{9/2} \otimes \nu 2f_{7/2}^2$. Assignment from [1981Pi09](#).

^c Seq.(U): Sequence built on $\nu f_{7/2}^3 \otimes (3^- \text{ in } ^{148}\text{Gd})$. Assignment from [1981Pi09](#). This structure is probably mixed with $\nu i_{13/2}$. [1979RaZZ](#) assign this as a structure based only on the $i_{13/2}$ neutron state.

^d Band(C): Multi-quasiparticle structure #1. Configuration= $\nu 2f_{7/2}^2 \otimes \nu h_{9/2} \otimes \pi d_{5/2}^{-2} \otimes \pi h_{11/2}^2$ ([1991FI02](#)).

^e Band(D): Multi-quasiparticle structure #2. Configuration= $\nu 2f_{7/2}^2 \otimes \nu i_{13/2} \otimes \pi d_{5/2}^{-2} \otimes \pi h_{11/2}^2$ ([1991FI02](#)).

^f Band(E): Multi-quasiparticle structure #3. Configuration= $\nu 2f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2} \otimes \pi d_{5/2}^{-2} \otimes \pi h_{11/2}^2$ ([1991FI02](#)).

^g Band(F): Multi-quasiparticle structure #4. Configuration= $\nu 2f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2} \otimes \pi d_{5/2}^{-3} \otimes \pi h_{11/2}^3$ ([1991FI02](#)).

^h Band(G): Multi-quasiparticle structure #5. Configuration= $\nu 2f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2} \otimes \pi d_{5/2}^{-2} \otimes \pi g_{7/2}^{-1} \otimes \pi h_{11/2}^3$ ([1991FI02](#)).

ⁱ Band(H): SD-1 band; $(\pi, \alpha) = (-, -1/2)$. Q(intrinsic)=14.9 +4-3 ([1998Kh09](#)), 15.0 2 ([1996Sa15](#)), 17 2 ([1988Ha02](#)) (from DSAM). Band assignment from [1999Fi12](#), [1995FI01](#), [1993FI03](#), [1990Ha31](#) and [1988Ha02](#). Percent population=2.5 ([1990Ha31](#)), 1.8 ([1995FI01](#)). See also [1992Vi03](#), [1990Ha25](#), [1989Ta12](#), [1988Ta20](#), [1988Ha02](#). Configuration= $\pi 6^2 \otimes \nu 7^1$ ([1993Cu06](#)). Evidence for a $\Delta J=4$ rotational sequence, associated with an invariance under 90° rotation ([1993FI07](#)). Weak linking transitions have been reported by [1999Fi12](#). Percentage intensities ([1999Fi12](#)) leaking the SD-1 band are: 19% 1 from the (47/2) member, 69% 2 from the (49/2) member and 12% 2 from the (51/2) member of this band. This leaking intensity feeds the following weakly-deformed states in the first potential well: 23% 5 to 5633 level, 9% 3 to 6098 level, 12% 5 to 6470 level, 8% 2 to 6504 level, 23% 5 to 6656 level, 9% 2 to 6787 level, 6% 2 to 7072 level, 5% 1 to 7741 level, 3% 1 to 8458 level and 0.5% 3 to 8657 level ([1999Fi12](#)).

^j Band(I): SD-2 band; $(\pi, \alpha) = (+, -1/2)$. Band assignment from [1995FI01](#), [1993FI03](#), [1990Ha31](#) and [1988Ha02](#). Percent population=1.0 ([1990Ha31](#)), 0.45 ([1995FI01](#)). Q(intrinsic)=15.6 3 ([1996Sa15](#)) (DSAM). Configuration= $\pi 6^2 \otimes \nu 7^2 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1}$ ([1995FI01](#), [1993Cu06](#)). Energies of first four γ rays show a backbend in this SD band.

^k Band(J): SD-3 band; $(\pi, \alpha) = (+, +1/2)$. Band assignment from [1995FI01](#), [1993FI03](#), [1990Ha31](#) and [1988Ha02](#). Percent population=0.3 ([1990Ha31](#)), 0.22 ([1995FI01](#)). Q(intrinsic)=15.2 5 ([1996Sa15](#)) (DSAM). Configuration= $\pi 6^3 \otimes (\pi 1/2[301], \alpha = -1/2)^{-1} \otimes \nu 7^1$ ([1995FI01](#), [1993Cu06](#)).

^l Band(K): SD-4 band; $(\pi, \alpha) = (+, -1/2)$. Percent population=0.25 ([1995FI01](#)). Q(intrinsic)=17.5 6 ([1996Sa15](#)) (DSAM). Configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-2} \otimes \nu 7^2 \otimes (\nu 1/2[411], \alpha = +1/2)^{-1}$ ([1995FI01](#)).

^m Band(L): SD-5 band; $(\pi, \alpha) = (-, -1/2)$. Band assignment from [1995FI01](#), [1994De33](#) and [1993FI03](#). Percent population=0.14 ([1995FI01](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1} \otimes (\nu 5/2[402], \alpha = +1/2)$ ([1995FI01](#)). SD-5 and SD-6 are signature partners.

ⁿ Band(M): SD-6 band; $(\pi, \alpha) = (-, +1/2)$. Band assignment from [1995FI01](#), [1994De33](#) and [1993FI03](#). Percent population=0.14 ([1995FI01](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1} \otimes (\nu 5/2[402], \alpha = -1/2)$ ([1995FI01](#)).

^o Band(N): SD-7 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^3 \otimes (\pi 1/2[301], \alpha = +1/2)^{-1} \otimes \nu 7^1$ ([1998By02](#)).

^p Band(O): SD-8 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-2} \otimes \nu 7^1$ ([1998By02](#)).

^q Band(P): SD-9 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1} \otimes (\nu 9/2[514], \alpha = +1/2)$ ([1998By02](#)).

^r Band(Q): SD-10 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1} \otimes (\nu 9/2[514], \alpha = -1/2)$ ([1998By02](#)).

^s Band(R): SD-11 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha = +1/2)^{-1} \otimes (\nu 3/2[521], \alpha = -1/2)$ ([1998By02](#)).

^t Band(S): SD-12 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes \nu 1/2[651]^{-2} \otimes (\nu 9/2[514]^2 \text{ or } \nu 5/2[402]^2)$ ([1998By02](#)).

^u Band(T): SD-13 band. Percent population is between 5 and 10% of SD-1 band ([1998By02](#)). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 5/2[642], \alpha = +1/2)^{-1} \otimes (\nu 9/2[514] \text{ or } \nu 5/2[402])$ ([1998By02](#)).

Adopted Levels, Gammas (continued)

E _i (level)	J ^π _i	γ(¹⁴⁹ Gd)							Comments
		E _γ [†]	I _γ [†]	E _f	J ^π _f	Mult. [‡]	δ&	α ^a	
164.986	5/2 ⁻	164.98 2	100	0.0	7/2 ⁻	M1+E2@	-0.93 2	0.459 6	B(M1)(W.u.)=1.06×10 ⁻³ 7; B(E2)(W.u.)=18.5 12 E _γ : others: 165.0 1 from ¹⁴⁹ Tb ε decay (4.17 min), 164.9 2 from (α,2nγ), and 165.1 3 from (α,5nγ). δ: value from L-subshell ratios and sign from γγ(θ) in ¹⁴⁹ Tb ε decay (4.12 h). Other: -0.12 7 from γ(θ) in (α,2nγ).
352.234	3/2 ⁻	187.22 2	14.6 2	164.986	5/2 ⁻	M1+E2@	+0.85 +19-16	0.316 8	B(M1)(W.u.)=0.00054 +12-11; B(E2)(W.u.)=6.1 +18-15 E _γ : other: 187.6 2 from (α,2nγ). δ: other: -1.5 +15-28 from γ(θ) in (α,2nγ).
775.32	11/2 ⁻	352.24 2 775.3 1	100 3 100	0.0 0.0	7/2 ⁻ 7/2 ⁻	E2@ E2		0.0371 5 0.00478 7	B(E2)(W.u.)=4.2 +6-5 E _γ : weighted average of 775.1 2 from (α,2nγ) and 775.3 1 from (α,5nγ).
795.94	9/2 ⁻	630.8 2	≈15	164.986	5/2 ⁻	(Q)			E _γ : weighted average of 630.7 3 from ¹⁴⁹ Tb ε decay (4.17 min), 630.9 2 from (α,2nγ), and 630.4 5 from (α,5nγ). I _γ : from (α,5nγ). I _γ ≈3 or <20 in ¹⁴⁹ Tb ε (4.17 min). This γ is contributed by impurities in both cases. γ not reported in ¹⁴⁹ Tb ε (4.12 h) and ¹²⁴ Sn(³⁰ Si,5nγ). Mult.: from γ(θ) for a mixed line in (α,5nγ).
		795.9 1	100 6	0.0	7/2 ⁻	M1+E2	+0.18 2	0.00783 11	E _γ : weighted average of 796.0 1 from ¹⁴⁹ Tb ε decay (4.17 min), 795.7 2 from (α,2nγ), and 795.9 1 from (α,5nγ). Mult.: M1+E2 from γ(θ) and pol in (α,5nγ); ΔJ=1, D+Q γ(θ) in (³⁰ Si,5nγ) and (α,2nγ). δ: from γ(θ) in ¹²⁴ Sn(³⁰ Si,5nγ) (1991Fl02). Other: +0.19 1 from γ(θ) in (α,2nγ) (1979RaZZ).
817.099	3/2 ⁻	464.85 2 652.12 2	34.8 5 100 1	352.234 164.986	3/2 ⁻ 5/2 ⁻	M1(+E2)@ M1+E2@	-0.10 14 -0.57 5	0.0303 7 0.01154 25	
		817.1 2	71.4 11	0.0	7/2 ⁻	E2@		0.00425 6	δ(E2/M1)>4 from ce data in ¹⁴⁹ Tb ε decay (4.12 h).
873.51	11/2 ⁺	77.6 1	100.0 8	795.94	9/2 ⁻	E1#		0.576 8	B(E1)(W.u.)=1.4×10 ⁻⁴ +9-4 I _γ : from (³⁰ Si,5nγ). Other: 100 6 from (α,5nγ). Mult.: γ(θ) from (α,5nγ) gives ΔJ=1.
		98.2 1	44.8 4	775.32	11/2 ⁻	E1#		0.307 4	B(E1)(W.u.)=3.2×10 ⁻⁵ +19-9 E _γ : weighted average of 98.0 2 from (α,2nγ) and 98.2 1 from (α,5nγ). I _γ : from (³⁰ Si,5nγ). Others: 100 3 from (α,2nγ) and 100 6 from (α,5nγ) are in disagreement.
		873.1 ^c 2	9.3 4	0.0	7/2 ⁻	(M2)		0.01645 23	B(M2)(W.u.)=0.056 +34-16 E _γ , I _γ : from (α,2nγ) only.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\&$	α^a	Comments
955.98	(13/2 ⁺)	82.5 1	43.4 5	873.51	11/2 ⁺	(M1) [#]		3.50 5	E_γ : from ($\alpha,5n\gamma$). I_γ : from $^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$. Other: 79 4 in ($\alpha,5n\gamma$) is discrepant.
		180.6 1	100.0 6	775.32	11/2 ⁻	(E1) [#]		0.0595 8	E_γ : weighted average of 180.5 2 from ($\alpha,2n\gamma$) and 180.6 1 from ($\alpha,5n\gamma$). I_γ : from ($^{30}\text{Si},5n\gamma$). Other: 100 5 from ($\alpha,5n\gamma$). Mult.: $\gamma(\theta)$ from ($\alpha,5n\gamma$) and ($\alpha,2n\gamma$) gives $\Delta J=1$.
1026.836	3/2 ⁺	674.61 6	9.1 3	352.234	3/2 ⁻	E1 [@]		2.47×10^{-3} 4	
		861.86 2	100.0 14	164.986	5/2 ⁻	E1(+M2) [@]	-0.05 6	0.00155 15	
1085.43	(5/2 ⁻ , 7/2, 9/2 ⁻)	289.4 2	100 25	795.94	9/2 ⁻	D			E_γ : weighted average of 289.3 3 from ^{149}Tb ε decay (4.12 h) and 289.4 2 from ($\alpha,2n\gamma$). Mult.: from $\gamma(\theta)$ in ($\alpha,2n\gamma$).
1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	920.5	38 13	164.986	5/2 ⁻				
		1085.5	75 38	0.0	7/2 ⁻				
		98.1 2	9.3 11	1026.836	3/2 ⁺	M1 [@]		2.127 32	
		307.79 7	16.5 11	817.099	3/2 ⁻				
1144.08	(5/2) ⁺	772.65 3	100 2	352.234	3/2 ⁻	E1 [@]		1.87×10^{-3} 3	
		117.2	3.6 18	1026.836	3/2 ⁺				
		791.8	13 6	352.234	3/2 ⁻				
		979.09 6	100 6	164.986	5/2 ⁻	E1 [@]		1.18×10^{-3} 2	
		1144.09 9	59 6	0.0	7/2 ⁻	D, E2 [@]			
1167.12	(3/2 ⁺)	1002.1	58 4	164.986	5/2 ⁻				
		1167.10 7	100 6	0.0	7/2 ⁻	(M2) [@]		0.00762 11	Mult.: from ce data in ^{149}Tb ε decay, however, this mult would become unlikely if the 1167 level has a $T_{1/2} < 0.32$ ns, which would only allow mult=D or E2 for this transition based on RUL and the branching ratios.
1205.666	(1/2) ⁻	388.57 2	100.0 7	817.099	3/2 ⁻	M1+E2 [@]	-0.21 9	0.0475 11	
		853.43 1	84.1 12	352.234	3/2 ⁻	E2+M1 [@]	-8 +6-23	0.0039 5	
		1040.65 4	7.9 3	164.986	5/2 ⁻	(E2) [@]		2.53×10^{-3} 4	δ : $\alpha(\text{K})_{\text{exp}}$ gives $\delta(\text{E2/M1})=1.5 +14-5$ but ΔJ^π requires E2.
1348.72	(1/2 ⁻ , 3/2, 5/2 ⁻)	1205.6 ^c	≤ 0.1	0.0	7/2 ⁻	[M3]		0.01350 19	
		321.9	14 7	1026.836	3/2 ⁺				
		996.5 1	100 7	352.234	3/2 ⁻				
		1183.7 2	57 14	164.986	5/2 ⁻				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\&$	α^a	Comments
1402.90	(5/2 ⁻)	317.4	14 4	1085.43	(5/2 ⁻ , 7/2, 9/2 ⁻)				
		606.7	4 2	795.94	9/2 ⁻				
1484.01	15/2 ⁻	1402.91 9	100 6	0.0	7/2 ⁻				
		528.0 1	44 2	955.98	(13/2 ⁺)	E1		0.00417 6	E_γ : weighted average of 527.9 2 from ($\alpha, 2n\gamma$) and 528.0 1 from ($\alpha, 5n\gamma$). Mult.: from ce and $\gamma(\theta)$ in ($\alpha, 2n\gamma$) and $\gamma(\theta)$ in ($\alpha, 5n\gamma$), $\Delta J=1$.
		708.7 1	100 1	775.32	11/2 ⁻	E2		0.00588 8	E_γ : weighted average of 708.5 2 from ($\alpha, 2n\gamma$) and 708.8 1 from ($\alpha, 5n\gamma$). Mult.: from $\gamma(\theta, \text{pol})$ in ($\alpha, 5n\gamma$), $\Delta J=2$.
1487.59	(1/2, 3/2) ⁻	670.4	5.2 15	817.099	3/2 ⁻				
		1135.3 1	100 3	352.234	3/2 ⁻	M1(+E2) [@]	<0.7	0.00317 21	
		1322.7 1	7.5 7	164.986	5/2 ⁻				
1544.13	(3/2 ⁻ , 5/2 ⁻)	1191.89 8	100 7	352.234	3/2 ⁻				
		1379.1 1	100 5	164.986	5/2 ⁻				
		1544.1 2	21 5	0.0	7/2 ⁻				
1557.38	(1/2 ⁻ , 3/2)	390.3	29 7	1167.12	(3/2 ⁺)				
		413.3 1	31 2	1144.08	(5/2) ⁺				
		432.5 2	18 5	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺				
		740.2 1	100 5	817.099	3/2 ⁻				
		1205.20 8	96 9	352.234	3/2 ⁻				
		1392.3 3	13 5	164.986	5/2 ⁻				
1597.30	(1/2, 3/2, 5/2 ⁻)	472.4 1	100 15	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺				
		780.2	9 2	817.099	3/2 ⁻				
		1245.1	12 4	352.234	3/2 ⁻				
1609.16	13/2 ⁽⁻⁾	813.2 2	100.0 12	795.94	9/2 ⁻	Q			E_γ : weighted average of 813.0 2 from ($\alpha, 2n\gamma$) and 813.3 2 from ($\alpha, 5n\gamma$). I_γ : from ($\alpha, 2n\gamma$). Others: 100.0 13 from ($^{30}\text{Si}, 5n\gamma$) and 100 11 from ($\alpha, 5n\gamma$).
		833.9 2	41.7 12	775.32	11/2 ⁻	D+Q	-2.1 21		E_γ : weighted average of 833.7 2 from ($\alpha, 2n\gamma$) and 834.2 3 from ($\alpha, 5n\gamma$). I_γ : from ($\alpha, 2n\gamma$). Others: 99 3 from ($^{30}\text{Si}, 5n\gamma$) and 77 8 from ($\alpha, 5n\gamma$) in disagreement. δ : from $\gamma(\theta)$ in ($\alpha, 2n\gamma$), with $\Delta J=1$.
1614.04	3/2 ⁺	446.7 6	2.8 19	1167.12	(3/2 ⁺)				
		469.9	0.9 6	1144.08	(5/2) ⁺				
		587.2	5.7 19	1026.836	3/2 ⁺				
		796.9	1.9 10	817.099	3/2 ⁻				
		1261.7 2	12.3 19	352.234	3/2 ⁻				
		1449.10 8	100 4	164.986	5/2 ⁻	E1 [@]		0.000753 11	
1655.19	(3/2) ⁺	252.3 1	11.0 22	1402.90	(5/2 ⁻)				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\&$	α^a	Comments
1655.19	(3/2) ⁺	449.6	7.7 22	1205.666	(1/2) ⁻				
		488.1 2	11.0 22	1167.12	(3/2) ⁺				
		628.4 2	9.9 22	1026.836	3/2 ⁺				
		838.1 2	8.8 11	817.099	3/2 ⁻				
		1302.92 8	100 3	352.234	3/2 ⁻	E1@		0.000777 11	
1739.97	(17/2) ⁺	1490.3 2	22 3	164.986	5/2 ⁻				
		784.0 2	100	955.98	(13/2 ⁺)	E2		0.00467 7	E _γ : weighted average of 783.8 2 from (α,2nγ) and 784.3 3 from (α,5nγ).
1750.59	(3/2 ⁻ ,5/2 ⁻)	347.7	79 11	1402.90	(5/2 ⁻)				
		625.7 ^C 3	11 11	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		723.8	63 11	1026.836	3/2 ⁺				
		1398.3 3	32 10	352.234	3/2 ⁻				
		1585.6 1	100 5	164.986	5/2 ⁻				
		1751.0 ^C 4	21 11	0.0	7/2 ⁻				
1751.1?	(15/2 ⁺)	877.8 ^C 2	100	873.51	11/2 ⁺	Q			
1772.83	(3/2 ⁺ ,1/2 ⁺)	648.0 1	100 9	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		746.0 1	49 3	1026.836	3/2 ⁺				
		955.71 5	77 5	817.099	3/2 ⁻	(E1)@		1.24×10 ⁻³ 2	
		1420.6 1	15 2	352.234	3/2 ⁻				
		1772.8 ^C	3 3	0.0	7/2 ⁻				
1844.31	(1/2 ⁻ ,3/2,5/2 ⁻)	677.2 1	100 10	1167.12	(3/2 ⁺)				
		817.5	35 10	1026.836	3/2 ⁺				
		1027.2 2	10 5	817.099	3/2 ⁻				
		1492.2 3	60 10	352.234	3/2 ⁻				
		1679.3 1	90 10	164.986	5/2 ⁻				
1992.49	3/2 ⁻	219.7	0.32 16	1772.83	(3/2 ⁺ ,1/2 ⁺)				
		378.5 1	3.8 6	1614.04	3/2 ⁺				
		448.5	1.4 3	1544.13	(3/2 ⁻ ,5/2 ⁻)				
		786.8 1	4.1 3	1205.666	(1/2) ⁻				
		825.4	1.9 6	1167.12	(3/2 ⁺)				
		867.6	1.2 3	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		965.63 5	16.2 8	1026.836	3/2 ⁺				
		1175.4	100 4	817.099	3/2 ⁻	M1@		0.00312 4	
		1640.26 6	97.3 3	352.234	3/2 ⁻	E2(+M1)@	>1	0.00127 11	
		1827.5	33.5 16	164.986	5/2 ⁻	M1(+E2)@	<1	0.00128 8	
		1992.5 ^C	0.5 5	0.0	7/2 ⁻				
1999.66?	(15/2 ⁺)	390.5 2	100	1609.16	13/2 ⁽⁻⁾	E1		0.00835 12	Mult.: from ce and γ(θ) in (α,2nγ), with ΔJ=1.
2058.19	(17/2) ⁻	449.0 2	18 2	1609.16	13/2 ⁽⁻⁾	(Q)		0.019	I _γ : unweighted average of 20.6 6 from (³⁰ Si,5nγ), 16.1 4 from (α,2nγ), and 18.3 18 from (α,5nγ).

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	α^a	Comments
2058.19	(17/2) ⁻	574.2 1	100 1	1484.01	15/2 ⁻	M1	0.01783 25	Mult.: from ce and $\gamma(\theta)$ in ($\alpha, 2n\gamma$) and $\gamma(\theta, \text{pol})$ in ($\alpha, 5n\gamma$), with $\Delta J=1$.
2088.47	(1/2 ⁻ , 3/2, 5/2 ⁻)	685.6	31 12	1402.90	(5/2 ⁻)			
		944.4 2	71 29	1144.08	(5/2) ⁺			
		963.6	57 29	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		1061.6 1	100 14	1026.836	3/2 ⁺			
2126.62	(1/2 ⁻ , 3/2, 5/2 ⁻)	1736.3 2	93 13	352.234	3/2 ⁻			
		1923.4	16 9	164.986	5/2 ⁻			
		723.7	100 25	1402.90	(5/2 ⁻)			
		1001.7 ^c	≤38	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		1774.4	75 25	352.234	3/2 ⁻			
2158.35	(3/2) ⁺	544.3	1.2 4	1614.04	3/2 ⁺			
		614.2 1	7.3 8	1544.13	(3/2 ⁻ , 5/2 ⁻)			
		670.8	3.5 8	1487.59	(1/2, 3/2) ⁻			
		952.7 1	6.9 8	1205.666	(1/2) ⁻			
		1033.4	10.8 19	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	(M1) [@]	0.00423 6	
		1131.65 7	34.2 12	1026.836	3/2 ⁺	(M1) [@]	0.00341 5	
		1341.19 6	100 4	817.099	3/2 ⁻	E1 [@]	0.000765 11	
		1806.0 1	19.2 12	352.234	3/2 ⁻			
		1993.3	2.3 8	164.986	5/2 ⁻			
		2199.90	(1/2 ⁻ , 3/2, 5/2 ⁻)	797.0	11 5	1402.90	(5/2 ⁻)	
994.3	21 5			1205.666	(1/2) ⁻			
1032.8	53 16			1167.12	(3/2 ⁺)			
1055.8	74 21			1144.08	(5/2) ⁺			
1075.0 1	42 5			1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
1847.7	47 5			352.234	3/2 ⁻			
2034.8	100 16			164.986	5/2 ⁻			
2231.79	(17/2 ⁻)	622.7 2	71 2	1609.16	13/2 ⁽⁻⁾	(Q)		E _γ : weighted average of 622.7 2 from ($\alpha, 2n\gamma$) and 622.6 3 from ($\alpha, 5n\gamma$).
		747.8 2	100 2	1484.01	15/2 ⁻	D		I _γ : from ($\alpha, 2n\gamma$). Other: 93 4 for a mixed line. E _γ : weighted average of 747.9 2 from ($\alpha, 2n\gamma$) and 747.5 5 from ($\alpha, 5n\gamma$). I _γ : from ($\alpha, 2n\gamma$). Other: 100 4 in ($^{30}\text{Si}, 5n\gamma$).
2261.53	(3/2, 1/2 ⁻)	774.0	7 4	1487.59	(1/2, 3/2) ⁻			
		858.6	32 8	1402.90	(5/2 ⁻)			
		1094.3 3	12 4	1167.12	(3/2 ⁺)			
		1117.5	48 8	1144.08	(5/2) ⁺			
		1136.6	12 8	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		1234.7 2	30 5	1026.836	3/2 ⁺			
		1444.4	36 8	817.099	3/2 ⁻			
		1909.3 1	100 8	352.234	3/2 ⁻			
		2096.5	16 4	164.986	5/2 ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\&$	α^a	Comments
2261.53	(3/2,1/2 ⁻)	2261.5 ^C	12 12	0.0	7/2 ⁻				
2300.72	(1/2 ⁻ ,3/2)	686.66 8	48 5	1614.04	3/2 ⁺				
		1175.8	46 7	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		1273.9	3.5 17	1026.836	3/2 ⁺				
		1483.6 1	59 7	817.099	3/2 ⁻				
		1948.5 1	100 5	352.234	3/2 ⁻				
		2135.7 2	26 5	164.986	5/2 ⁻				
2314.10	(1/2 ⁻ ,3/2,5/2 ⁻)	1497.0	100 25	817.099	3/2 ⁻				
		2149.1	75 25	164.986	5/2 ⁻				
2383.66	(19/2) ⁻	325.4 2	67 1	2058.19	(17/2) ⁻	D+Q	-0.09 5		E_γ : weighted average of 325.3 2 from (α ,2n γ) and 325.5 3 from (α ,5n γ). I_γ : from (^{30}Si ,5n γ). Others: 56 6 in (α ,5n γ); 33 1 in (α ,2n γ) seems discrepant. Mult., δ : from D+Q from $\gamma(\theta)$ in (^{30}Si ,5n γ). Other: $\delta=-1.9$ +6-9 from $\gamma(\theta)$ in (α ,2n γ). E_γ : weighted average of 643.6 2 from (α ,2n γ) and 643.7 2 from (α ,5n γ). I_γ : from (^{30}Si ,5n γ). Others: 100 10 in (α ,5n γ), 100 2 in (α ,2n γ). Mult.: from ce and $\gamma(\theta)$ in (α ,2n γ) with $\Delta J=1$. E_γ : weighted average of 899.4 2 from (α ,2n γ) and 899.6 2 from (α ,5n γ). I_γ : from (^{30}Si ,5n γ). Others: 99 10 in (α ,5n γ); 54 3 in (α ,2n γ) seems discrepant. Mult.: (Q) from $\gamma(\theta)$ in (α ,5n γ). E_γ : weighted average of 661.3 2 from (α ,2n γ) and 661.4 1 from (α ,5n γ). Mult.: from $\gamma(\theta,\text{pol})$ in (α ,5n γ).
		643.7 2	100 2	1739.97	(17/2) ⁺	E1		0.00272 4	
		899.5 2	77 2	1484.01	15/2 ⁻	(Q)			
2401.37	(21/2) ⁺	661.4 1	100	1739.97	(17/2) ⁺	E2		0.00692 10	
2482.72	(1/2 ⁺ ,3/2,5/2 ⁻)	1277.0	29 14	1205.666	(1/2) ⁻				
		1338.6	36 14	1144.08	(5/2) ⁺				
		1357.8	9 6	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		2130.5 2	100 14	352.234	3/2 ⁻				
2503.72	(1/2 ⁻ ,3/2,5/2 ⁻)	2151.5	22 11	352.234	3/2 ⁻				
		2338.7 2	100 22	164.986	5/2 ⁻				
2514.6?	(19/2 ⁺)	763.4 ^C 2	100	1751.1?	(15/2 ⁺)	(Q)			
2524.09	(21/2) ⁻	292.4 2	20 2	2231.79	(17/2) ⁻	Q			E_γ : weighted average of 292.3 2 from (α ,2n γ) and 292.5 3 from (α ,5n γ). I_γ : unweighted average of 21.3 4 from (^{30}Si ,5n γ), 16.1 4 from (α ,2n γ), and 22.1 24 from (α ,5n γ).
		466.0 2	100 1	2058.19	(17/2) ⁻	E2		0.01683 24	
2569.75	(1/2,3/2,5/2 ⁻)	1363.8	35 9	1205.666	(1/2) ⁻				
		1402.4	13 6	1167.12	(3/2 ⁺)				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

<u>E_i(level)</u>	<u>J_i^{π}</u>	<u>E_{γ}^{$\dagger$}</u>	<u>I_{γ}^{$\dagger$}</u>	<u>E_f</u>	<u>J_f^{π}</u>
2569.75	(1/2,3/2,5/2 ⁻)	1543.4	3	1026.836	3/2 ⁺
2590.05	(1/2 ⁻ ,3/2)	1045.9	24	1544.13	(3/2 ⁻ ,5/2 ⁻)
		1102.5	18	1487.59	(1/2,3/2) ⁻
		1187.1	29	1402.90	(5/2 ⁻)
		1384.4	12	1205.666	(1/2) ⁻
		1465.1	7	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1563.2	8	1026.836	3/2 ⁺
		1772.9	35	817.099	3/2 ⁻
		2237.8	1	352.234	3/2 ⁻
2599.29	(1/2 ⁻ ,3/2)	1055.1	12	1544.13	(3/2 ⁻ ,5/2 ⁻)
		1111.7	6	1487.59	(1/2,3/2) ⁻
		1474.3	8	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1572.4	6	1026.836	3/2 ⁺
		1782.2	1	817.099	3/2 ⁻
		2247.0	2	352.234	3/2 ⁻
		2434.5	4	164.986	5/2 ⁻
2613.22	(1/2 ⁻ ,3/2)	620.7	50	1992.49	3/2 ⁻
		1488.3	44	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1586.4	25	1026.836	3/2 ⁺
		2261.0	100	352.234	3/2 ⁻
		2448.2	81	164.986	5/2 ⁻
2683.46	(1/2 ⁺ ,3/2)	1069.6	14	1614.04	3/2 ⁺
		1139.5	19	1544.13	(3/2 ⁻ ,5/2 ⁻)
		1477.7	2	1205.666	(1/2) ⁻
		1539.6	4	1144.08	(5/2) ⁺
		1558.5	1	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1656.8	100	1026.836	3/2 ⁺
2703.30	(1/2 ⁻ ,3/2,5/2 ⁻)	1497.6	36	1205.666	(1/2) ⁻
		1536.2	60	1167.12	(3/2 ⁺)
		2538.3	4	164.986	5/2 ⁻
2757.21	(1/2,3/2)	1269.7	5	1487.59	(1/2,3/2) ⁻
		1632.3	9	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺
		1730.4	7	1026.836	3/2 ⁺
		1940.1	1	817.099	3/2 ⁻
		2404.9	2	352.234	3/2 ⁻
2767.95	(1/2 ⁺ ,3/2,5/2 ⁻)	1623.8	67	1144.08	(5/2) ⁺
		2415.8	4	352.234	3/2 ⁻
2808.57	(1/2,3/2,5/2 ⁻)	1320.9	26	1487.59	(1/2,3/2) ⁻
		1641.3	32	1167.12	(3/2 ⁺)
		1991.8	80	817.099	3/2 ⁻
		2456.2	100	352.234	3/2 ⁻
2824.98	(1/2,3/2) ⁻	1280.8	1	1544.13	(3/2 ⁻ ,5/2 ⁻)
		1337.5	3	1487.59	(1/2,3/2) ⁻

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	δ &	α^a	Comments
2824.98	(1/2,3/2) ⁻	1422.1	6 2	1402.90	(5/2 ⁻)				
		1798.2	18 2	1026.836	3/2 ⁺				
		2007.9 1	100 3	817.099	3/2 ⁻	E2(+M1)@	>2	1.03×10 ⁻³ 3	
		2472.7 2	13 2	352.234	3/2 ⁻				
2830.6	(1/2,3/2,5/2 ⁻)	2478.3	100	352.234	3/2 ⁻				
2856.7	(21/2,23/2,25/2 ⁺)	455.3 4	100	2401.37	(21/2) ⁺				
									E_γ : unweighted average of 455.7 2 from (α ,2n γ) and 454.9 2 from (α ,5n γ). Mult.: $\delta(Q/D)=-1.3+10-13$ for $\Delta J=1$ in (α ,2n γ), but (Q), $\Delta J=2$ from (α ,5n γ). However, A ₂ and A ₄ in (α ,2n γ) and (α ,5n γ) are similar and consistent, also with $\Delta J=2$ or 0.
2861.84	(1/2 ⁻ ,3/2)	1656.2	40 20	1205.666	(1/2) ⁻				
		1694.7	60 40	1167.12	(3/2 ⁺)				
		1835.0	50 16	1026.836	3/2 ⁺				
		2044.7	34 16	817.099	3/2 ⁻				
		2696.8	100 40	164.986	5/2 ⁻				
2913.07	(1/2,3/2)	1368.9	15 3	1544.13	(3/2 ⁻ ,5/2 ⁻)				
		1425.6 3	21 6	1487.59	(1/2,3/2) ⁻				
		1707.5 3	9 3	1205.666	(1/2) ⁻				
		1788.1	9 3	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		2560.8 1	100 6	352.234	3/2 ⁻				
2918.21	(1/2 ⁻ ,3/2,5/2 ⁻)	1515.3	100 50	1402.90	(5/2 ⁻)				
		2753.2	60 20	164.986	5/2 ⁻				
2922.73	(1/2,3/2)	1755.6	23 20	1167.12	(3/2 ⁺)				
		1895.9	7 4	1026.836	3/2 ⁺				
		2105.6 3	100 20	817.099	3/2 ⁻				
2961.50	(5/2 ⁻ ,3/2,1/2 ⁻)	1755.8	77 30	1205.666	(1/2) ⁻				
		2796.5	100 33	164.986	5/2 ⁻				
		2961.4 ^c	<100	0.0	7/2 ⁻				
2977.72	(1/2 ⁻ ,3/2)	1574.8	86 28	1402.90	(5/2 ⁻)				
		1810.6 2	100 14	1167.12	(3/2 ⁺)				
		1852.8	28 14	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				
		1950.9	23 11	1026.836	3/2 ⁺				
		2160.6	33 13	817.099	3/2 ⁻				
		2812.7	57 14	164.986	5/2 ⁻				
2999.66	(3/2)	1344.5	4.2 21	1655.19	(3/2) ⁺				
		1402.4	1.9 11	1597.30	(1/2,3/2,5/2 ⁻)				
		1512.1 2	19 4	1487.59	(1/2,3/2) ⁻				
		1651.0	1.7 11	1348.72	(1/2 ⁻ ,3/2,5/2 ⁻)				
		1794.1	3.5 17	1205.666	(1/2) ⁻				
		1855.6	6 4	1144.08	(5/2) ⁺				
		1874.6 1	63 4	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	Comments
2999.66	(3/2)	1972.9 2	38 4	1026.836	3/2 ⁺		
		2182.6 1	100 6	817.099	3/2 ⁻		
		2647.6	48 2	352.234	3/2 ⁻		
		2834.7	6 2	164.986	5/2 ⁻		
3003.43	(1/2 ⁻ ,3/2)	1797.8	25 13	1205.666	(1/2) ⁻		
		1878.5	100 25	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺		
		1976.6	38 25	1026.836	3/2 ⁺		
		2186.3	38 25	817.099	3/2 ⁻		
		2838.4	38 25	164.986	5/2 ⁻		
3021.18	(3/2)	1366.0	13 7	1655.19	(3/2) ⁺		
		1877.1	20 13	1144.08	(5/2) ⁺		
		1896.3	17 6	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺		
		1994.4	20 7	1026.836	3/2 ⁺		
		2204.1	20 7	817.099	3/2 ⁻		
		2669.1	100 13	352.234	3/2 ⁻		
		2856.0 2	60 13	164.986	5/2 ⁻		
3057.0	(1/2 ⁻ ,3/2)	2892.0 4	100	164.986	5/2 ⁻		
3070.82	(1/2 ⁻ ,3/2)	2253.7	100 27	817.099	3/2 ⁻		
		2905.8	66 24	164.986	5/2 ⁻		
3079.8	(1/2,3/2)	1912.7 3	100	1167.12	(3/2 ⁺)		
3084.7	(23/2 ⁺)	683.3 2	100	2401.37	(21/2) ⁺	D+Q	Mult.: $\gamma(\theta)$ in ($\alpha,5n\gamma$) suggests $\Delta J=1$ transition with large δ value which would indicate mult=M1+E2.
3099.77	(1/2 ⁻ ,3/2)	2073.0	7 2	1026.836	3/2 ⁺		
		2282.6 1	100 7	817.099	3/2 ⁻		
		2935.1 3	26 5	164.986	5/2 ⁻		
3124.05	(1/2,3/2)	1918.4	8 4	1205.666	(1/2) ⁻		
		2097.1	27 7	1026.836	3/2 ⁺		
		2771.8 1	100 13	352.234	3/2 ⁻		
		2959.0 ^C	≤20	164.986	5/2 ⁻		
3134.55	(23/2 ⁻)	733.1 4	51 1	2401.37	(21/2) ⁺	D	E_γ : from ($\alpha,5n\gamma$). I_γ : from ($^{30}\text{Si},5n\gamma$). Other: 61 7 from ($\alpha,5n\gamma$).
		750.7 2	100 1	2383.66	(19/2) ⁻	Q	E_γ : weighted average of 750.7 2 from ($\alpha,2n\gamma$) and 750.8 5 from ($\alpha,5n\gamma$). I_γ : from ($^{30}\text{Si},5n\gamma$). Other: 100 10 from ($\alpha,5n\gamma$).
3149.35	(1/2,3/2)	1943.7	12 8	1205.666	(1/2) ⁻		
		2024.4	32 18	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺		
		2797.1	100 20	352.234	3/2 ⁻		
3175.62	(1/2 ⁻ ,3/2)	1772.7	20 10	1402.90	(5/2 ⁻)		
		1826.9	10 4	1348.72	(1/2 ⁻ ,3/2,5/2 ⁻)		
		1970.0	40 10	1205.666	(1/2) ⁻		
		2008.5	30 20	1167.12	(3/2 ⁺)		
		2050.7 4	50 20	1124.90	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺		
		2148.8	40 10	1026.836	3/2 ⁺		
		2358.5	8 5	817.099	3/2 ⁻		

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ [†]	I_γ [†]	E_f	J_f^π	Mult. [‡]	α^a	Comments
3175.62	(1/2 ⁻ , 3/2)	2823.3 2	90 20	352.234	3/2 ⁻			
		3010.6 3	100 20	164.986	5/2 ⁻			
3201.41	(3/2, 1/2 ⁻)	1657.3	48 18	1544.13	(3/2 ⁻ , 5/2 ⁻)			
		1798.5	60 40	1402.90	(5/2 ⁻)			
		2034.3	100 60	1167.12	(3/2 ⁺)			
		2076.4	80 20	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		2384.3	32 12	817.099	3/2 ⁻			
		2849.2	36 14	352.234	3/2 ⁻			
		3036.4 5	60 20	164.986	5/2 ⁻			
		3201.2 ^c	<40	0.0	7/2 ⁻			
3206.44	(3/2)	1592.4	100 40	1614.04	3/2 ⁺			
		1662.3	40 20	1544.13	(3/2 ⁻ , 5/2 ⁻)			
		1718.9	20 12	1487.59	(1/2, 3/2) ⁻			
		1803.5	34 18	1402.90	(5/2 ⁻)			
		2000.8	40 20	1205.666	(1/2) ⁻			
		2062.3	22 14	1144.08	(5/2) ⁺			
		2179.6	100 20	1026.836	3/2 ⁺			
		2389.3 3	100 20	817.099	3/2 ⁻			
		2854.2	60 20	352.234	3/2 ⁻			
		3041.4	40 20	164.986	5/2 ⁻			
3227.74	(23/2 ⁺)	703.6 2	100 2	2524.09	(21/2) ⁻	E1	2.26×10 ⁻³ 3	E_γ : weighted average of 703.5 2 from (α , 2n γ) and 703.6 2 from (α , 5n γ). I_γ : from (³⁰ Si, 5n γ). Other: 100 10 in (α , 5n γ). Mult.: from ce and $\gamma(\theta)$ in (α , 2n γ) and $\gamma(\theta, \text{pol})$ in (α , 5n γ) with $\Delta J=1$. E_γ : from (α , 5n γ). I_γ : weighted average of 13.9 17 from (³⁰ Si, 5n γ) and 15.8 19 from (α , 5n γ).
		826.4 4	15 2	2401.37	(21/2) ⁺	(D+Q)		
3231.13	(1/2 ⁻ , 3/2)	2414.0	11 7	817.099	3/2 ⁻			
		2878.9 3	100 28	352.234	3/2 ⁻			
		3066.1	13 7	164.986	5/2 ⁻			
3258.38	(1/2, 3/2)	2231.5	100 25	1026.836	3/2 ⁺			
		2441.3	63 29	817.099	3/2 ⁻			
		2906.1	58 29	352.234	3/2 ⁻			
3272.95	(1/2, 3/2)	2246.1	47 23	1026.836	3/2 ⁺			
		2455.8	100 33	817.099	3/2 ⁻			
		2920.7	33 20	352.234	3/2 ⁻			
3294.56	(25/2 ⁺)	893.2 1	100	2401.37	(21/2) ⁺	Q		E_γ : weighted average of 893.0 2 from (α , 2n γ) and 893.2 1 from (α , 5n γ).
3294.9	(1/2, 3/2)	2942.6	100	352.234	3/2 ⁻			
3313.58	(3/2 ⁻)	1699.5	3 1	1614.04	3/2 ⁺			
		1769.4	2 1	1544.13	(3/2 ⁻ , 5/2 ⁻)			
		1826.0	10 2	1487.59	(1/2, 3/2) ⁻			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	α^a	Comments
3313.58	(3/2 ⁻)	2108.2	3	1205.666	(1/2) ⁻			
		2188.6	3	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		2496.4	2	817.099	3/2 ⁻			
		2961.3	100	352.234	3/2 ⁻	(M1,E2) [@]	0.00116	7
3319.04	(1/2 ⁻ , 3/2)	3148.5	1.7	164.986	5/2 ⁻			
		1916.1	100	1402.90	(5/2 ⁻)			
		2966.8	55	352.234	3/2 ⁻			
3340.63	(1/2 ⁺ , 3/2)	3154.0	5	164.986	5/2 ⁻			
		2135.0	67	1205.666	(1/2) ⁻			
		2196.5	100	1144.08	(5/2) ⁺			
3365.23	(3/2)	2523.5	90	817.099	3/2 ⁻			
		1877.7	8	1487.59	(1/2, 3/2) ⁻			
		2221.1	4.0	1144.08	(5/2) ⁺			
		2548.1	12	817.099	3/2 ⁻			
3384.7	(1/2, 3/2)	3032.4	100	352.234	3/2 ⁻			
3387.32	(27/2 ⁺)	159.6	1	3227.74	(23/2 ⁺)	E2	0.478	7
								B(E2)(W.u.)=11.8 +11-9 E _γ : weighted average of 159.4 2 from (α,2n _γ) and 159.6 1 from (α,5n _γ). Mult.: Q, ΔJ=2 from γ(θ) in (α,2n _γ) and (α,5n _γ). B(E3)(W.u.)=42.0 +50-42 E _γ : reported in (α,5n _γ) only.
		863.0	4	2524.09	(21/2) ⁻	(E3)	0.00851	12
3403.43	(1/2 ⁻ , 3/2)	1859.3	100	1544.13	(3/2 ⁻ , 5/2 ⁻)			
		1915.8	100	1487.59	(1/2, 3/2) ⁻			
		2586.3	100	817.099	3/2 ⁻			
		3051.2	60	352.234	3/2 ⁻			
3418.82	(1/2 ⁻ , 3/2)	3238.4	50	164.986	5/2 ⁻			
		1931.0	55	1487.59	(1/2, 3/2) ⁻			
		2212.9	100	1205.666	(1/2) ⁻			
		3066.3	73	352.234	3/2 ⁻			
3431.26	(1/2 ⁻ , 3/2)	3254.5	68	164.986	5/2 ⁻			
		3078.9	100	352.234	3/2 ⁻			
		3266.4	4	164.986	5/2 ⁻			
3442.84	(1/2, 3/2)	2317.9	100	1124.90	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			
		2625.7	53	817.099	3/2 ⁻			
		3090.6	42	352.234	3/2 ⁻			
3466.84	(1/2 ⁻ , 3/2)	2440.0	58	1026.836	3/2 ⁺			
		2649.7	83	817.099	3/2 ⁻			
		3301.8	100	164.986	5/2 ⁻			
3473.24	(1/2 ⁻ , 3/2)	2446.4	14	1026.836	3/2 ⁺			
		2656.1	20	817.099	3/2 ⁻			
		3308.2	3	164.986	5/2 ⁻			
3486.1	(1/2, 3/2)	2319.0	59	1167.12	(3/2 ⁺)			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\delta^\&$	α^a	Comments
3486.1	(1/2,3/2)	3133.9 5	100 1	352.234	3/2 ⁻				
3499.65	(1/2 ⁻ ,3/2)	3147.0	90 40	352.234	3/2 ⁻				
		3335.0	100 30	164.986	5/2 ⁻				
3516.2	(1/2,3/2)	3163.9 4	100	352.234	3/2 ⁻				
3535.13	(3/2 ⁺)	2508.3	18 10	1026.836	3/2 ⁺				
		2718.0	18 10	817.099	3/2 ⁻				
		3182.8 4	100 25	352.234	3/2 ⁻				
		3370.1	20 10	164.986	5/2 ⁻				
3543.9	(1/2 ⁻ ,3/2)	3378.9 4	100	164.986	5/2 ⁻				
3611.73	(25/2) ⁻	383.7	12.3 4	3227.74	(23/2 ⁺)	D			
		1087.7 1	100.0 11	2524.09	(21/2) ⁻	E2		2.31×10 ⁻³ 3	
3632.35	(27/2 ⁻)	(21)		3611.73	(25/2) ⁻				
		245.1 2	41.9 3	3387.32	(27/2 ⁺)	(E1)		0.0267 4	B(E1)(W.u.)=4.88×10 ⁻⁶ Mult.: D from $\gamma(\theta)$ in (α ,5n γ) and (³⁰ Si,5n γ).
		337.8 2	55.4 12	3294.56	(25/2 ⁺)	(E1)		0.01186 17	B(E1)(W.u.)=2.47×10 ⁻⁶ Mult.: D from $\gamma(\theta)$ in (α ,5n γ) and (³⁰ Si,5n γ).
		497.3	100.0 21	3134.55	(23/2 ⁻)	(E2)		0.01415 20	B(E2)(W.u.)=0.283 E γ : reported in (³⁰ Si,5n γ) only.
3765.5	(29/2)	378.2 3	100	3387.32	(27/2 ⁺)	D			
4054.7	(29/2 ⁻)	422.5	100	3632.35	(27/2 ⁻)	D			
4324.0?	(29/2 ⁻)	712.3 ^C 2	100	3611.73	(25/2) ⁻	Q			
4340.4	(31/2 ⁻)	285.6	22 1	4054.7	(29/2 ⁻)	D			
		708.0	100 3	3632.35	(27/2 ⁻)	(Q)			
4343.0	(29/2 ⁺)	955.6	100	3387.32	(27/2 ⁺)	D+Q			
4571.8?	(31/2)	248.1 ^C 3	100	4324.0?	(29/2 ⁻)	(D)			
4719.7	(33/2 ⁺)	376.6	5.7 4	4343.0	(29/2 ⁺)	(Q)			
		379.4	100 1	4340.4	(31/2 ⁻)	D			
4801.8	(33/2 ⁻)	461.0	10.6 4	4340.4	(31/2 ⁻)	D+Q			
		747.4	100 4	4054.7	(29/2 ⁻)	(Q)			
5052.6	(35/2 ⁻)	250.8	18.2 11	4801.8	(33/2 ⁻)	D+Q			
		712.3	100.0 5	4340.4	(31/2 ⁻)	(Q)			
5300.8	(37/2 ⁻)	248.0	69.3 3	5052.6	(35/2 ⁻)	D			
		498.8	100 5	4801.8	(33/2 ⁻)	(Q)			
5462.9	(37/2 ⁺)	410.5	22.2 4	5052.6	(35/2 ⁻)	D			
		743.2	100.0 8	4719.7	(33/2 ⁺)	(Q)			
5634.2	(41/2 ⁻)	333.2	100	5300.8	(37/2 ⁻)	(Q)			
5739.4	(39/2 ⁻)	105	10	5634.2	(41/2 ⁻)				
		438.4	100	5300.8	(37/2 ⁻)	D+Q	+0.16 2		
		687	52	5052.6	(35/2 ⁻)				
6099.3	(41/2 ⁺)	359.6	28.9 2	5739.4	(39/2 ⁻)	D			
		636.6	100 2	5462.9	(37/2 ⁺)	(Q)			
6265.4	(45/2 ⁻)	631.3	100	5634.2	(41/2 ⁻)				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ [†]	I_γ [†]	E_f	J_f^π	Mult. [‡]	δ ^{&}	α ^a	Comments
6299.8?	(43/2 ⁻)	667 ^c	100	5634.2	(41/2 ⁻)				
6470.7	(45/2 ⁺)	205.4	4.9 5	6265.4	(45/2 ⁻)				
		371.4	100 1	6099.3	(41/2 ⁺)	(Q)			
6504?	(47/2 ⁻)	240 ^c	100	6265.4	(45/2 ⁻)				
6656.9	(49/2 ⁺)	186.2	100	6470.7	(45/2 ⁺)	(E2)		0.282 4	B(E2)(W.u.)=12.7 +18-14
6786.5?	(47/2 ⁺)	317 ^c	100	6470.7	(45/2 ⁺)				
7071.7?	(51/2 ⁺)	416 ^c	100	6656.9	(49/2 ⁺)				
7742.0	(51/2)	1085 1		6656.9	(49/2 ⁺)				
7822.0	(53/2 ⁺)	1165.3	100	6656.9	(49/2 ⁺)	(Q)			
7824.9	(51/2 ⁻)	1168.0	100	6656.9	(49/2 ⁺)	D			
7997.1	(53/2 ⁻)	172.2	100	7824.9	(51/2 ⁻)	(M1(+E2)) [#]	-0.02 2	0.433 6	
8218.1	(53/2 ⁺)	1560.9	100	6656.9	(49/2 ⁺)	(Q)			
8433.8	(55/2 ⁺)	215.4 ^b	13 ^b 1	8218.1	(53/2 ⁺)	D			
		611.8	100 1	7822.0	(53/2 ⁺)	(D+Q)			
8459.0	(51/2 ⁻)	1802 1		6656.9	(49/2 ⁺)				I_γ : 0.005 2 relative to $I_\gamma(857)=1.0$ in SD-1 band.
8465.8	(47/2 ⁻)	1995 1		6470.7	(45/2 ⁺)				I_γ : 0.006 3 relative to $I_\gamma(857)=1.0$ in SD-1 band.
8557.5	(57/2 ⁺)	123.3	31 1	8433.8	(55/2 ⁺)	D			
		735.8	100 1	7822.0	(53/2 ⁺)	(Q)			
8658.0	(51/2 ⁻)	2001 1		6656.9	(49/2 ⁺)				I_γ : 0.005 3 relative to $I_\gamma(857)=1.0$ in SD-1 band.
8940.9	(57/2 ⁻)	507.1	8.2 2	8433.8	(55/2 ⁺)	D			
		943.8	100 1	7997.1	(53/2 ⁻)	(Q)			
9055.8	(49/2 ⁺)	2585 1		6470.7	(45/2 ⁺)				I_γ : 0.005 2 relative to $I_\gamma(857)=1.0$ in SD-1 band.
9273.6	(57/2 ⁻)	1276.4	100	7997.1	(53/2 ⁻)	(Q)			
9326.4	(59/2 ⁺)	768.7	100	8557.5	(57/2 ⁺)	D+Q			
9438.5	(59/2 ⁺)	164.9	25 1	9273.6	(57/2 ⁻)	D+Q			
		881.1	100 2	8557.5	(57/2 ⁺)	D+Q			
9502.2	(61/2 ⁻)	175.6	12.5 2	9326.4	(59/2 ⁺)	D			
		561.4	100 1	8940.9	(57/2 ⁻)	(Q)			
10362.4	(63/2 ⁺)	860.1	45 1	9502.2	(61/2 ⁻)				
		924.0	100 4	9438.5	(59/2 ⁺)	(Q)			
10510.5	(63/2 ⁺)	1008.3	100	9502.2	(61/2 ⁻)				
10602.4	(65/2 ⁻)	1100.5	100	9502.2	(61/2 ⁻)	(Q)			
10851.1	(63/2 ⁻)	1348.7	100	9502.2	(61/2 ⁻)	D			
10930.9	(65/2 ⁻)	568.3	100 4	10362.4	(63/2 ⁺)				
		1428.7	81 4	9502.2	(61/2 ⁻)	(Q)			
11012.0	(65/2 ⁻)	160.7	48 2	10851.1	(63/2 ⁻)	D			
		501.4	100 4	10510.5	(63/2 ⁺)	D			
11200.3	(67/2 ⁺)	269.3	18 1	10930.9	(65/2 ⁻)	D			
		598.1	100 1	10602.4	(65/2 ⁻)	D			
		838.0	50 2	10362.4	(63/2 ⁺)	(Q)			
11243.8	(51/2 ⁻)	617.8 1	0.16 3	10626.0	(47/2 ⁻)				
		2188 1	0.024 6	9055.8	(49/2 ⁺)				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

<u>E_i(level)</u>	<u>J_i^{π}</u>	<u>E_{γ}^{$\dagger$}</u>	<u>I_{γ}^{$\dagger$}</u>	<u>E_f</u>	<u>J_f^{π}</u>	<u>Mult.^{$\ddagger$}</u>
11243.8	(51/2 ⁻)	2778 ^c 2	<0.005	8465.8	(47/2 ⁻)	
		2785 ^c 2	<0.005	8459.0	(51/2 ⁻)	
11712.2	(67/2 ⁻)	1109.9	100	10602.4	(65/2 ⁻)	D
11908.0	(55/2 ⁻)	664.2 1	0.68 7	11243.8	(51/2 ⁻)	
12268.8	(69/2 ⁺)	1068.6	100	11200.3	(67/2 ⁺)	(D+Q)
12384.3	(69/2 ⁻)	672.1	100 5	11712.2	(67/2 ⁻)	D
		1183.9	78 8	11200.3	(67/2 ⁺)	D
		1372.0	55 8	11012.0	(65/2 ⁻)	(Q)
12469.5	(69/2 ⁻)	1867.1	100	10602.4	(65/2 ⁻)	(Q)
12581.1	(71/2 ⁻)	868.9	100	11712.2	(67/2 ⁻)	(Q)
12619.8	(59/2 ⁻)	711.8 1		11908.0	(55/2 ⁻)	
12752.5	(71/2 ⁺)	1552.4	100	11200.3	(67/2 ⁺)	(Q)
12967.7	(71/2 ⁺)	215.4 ^b	39 ^b 7	12752.5	(71/2 ⁺)	
		583.1	100 6	12384.3	(69/2 ⁻)	D
		698.9	90 4	12268.8	(69/2 ⁺)	(D+Q)
		1767.4	59 4	11200.3	(67/2 ⁺)	(Q)
13189.7	(75/2 ⁻)	608.6	100	12581.1	(71/2 ⁻)	(Q)
13279.1	(73/2 ⁻)	311.4	100	12967.7	(71/2 ⁺)	D
13379.5	(63/2 ⁻)	759.7 1	0.88 9	12619.8	(59/2 ⁻)	
13567.7	(75/2 ⁻)	288.6	100	13279.1	(73/2 ⁻)	D
14109.2	(77/2 ⁻)	541.4	100 4	13567.7	(75/2 ⁻)	D
		919.5	74 4	13189.7	(75/2 ⁻)	D
14187.6	(67/2 ⁻)	808.1 1	0.96 10	13379.5	(63/2 ⁻)	
15044.7	(71/2 ⁻)	857.1 1	1.00	14187.6	(67/2 ⁻)	
15163.9	(81/2 ⁻)	1054.7	100	14109.2	(77/2 ⁻)	(Q)
15951.4	(75/2 ⁻)	906.7 1	1.05 10	15044.7	(71/2 ⁻)	
15997.4	(85/2 ⁻)	834.1 ^c	100	15163.9	(81/2 ⁻)	
16908.5	(79/2 ⁻)	957.1 1	0.98 10	15951.4	(75/2 ⁻)	
17917.2	(83/2 ⁻)	1008.7 1	0.95 10	16908.5	(79/2 ⁻)	
18977.9	(87/2 ⁻)	1060.7 1	0.90 9	17917.2	(83/2 ⁻)	
20091.7	(91/2 ⁻)	1113.8 1	0.83 8	18977.9	(87/2 ⁻)	
21258.9	(95/2 ⁻)	1167.2 2		20091.7	(91/2 ⁻)	
22480.7	(99/2 ⁻)	1221.8 1	0.80 8	21258.9	(95/2 ⁻)	
23757.2	(103/2 ⁻)	1276.5 1	0.72 7	22480.7	(99/2 ⁻)	
25089.2	(107/2 ⁻)	1332.0 1	0.60 6	23757.2	(103/2 ⁻)	
26476.8	(111/2 ⁻)	1387.6 1	0.51 5	25089.2	(107/2 ⁻)	
27921.1	(115/2 ⁻)	1444.2 1	0.38 5	26476.8	(111/2 ⁻)	
29421.6	(119/2 ⁻)	1500.5 2	0.28 4	27921.1	(115/2 ⁻)	
30979.4	(123/2 ⁻)	1557.8 2	0.19 3	29421.6	(119/2 ⁻)	
32595.1	(127/2 ⁻)	1615.7 3	0.10 2	30979.4	(123/2 ⁻)	
34267.2	(131/2 ⁻)	1672.1 4	0.06 2	32595.1	(127/2 ⁻)	
35997.1	(135/2 ⁻)	1729.9 8	0.03 1	34267.2	(131/2 ⁻)	
858.5+x	(67/2 ⁺)	858.5 3		x	(63/2 ⁺)	

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ [†]	I_γ [†]	E_f	J_f^π	$E_i(\text{level})$	J_i^π	E_γ [†]	I_γ [†]	E_f	J_f^π
1746.7+x	(71/2 ⁺)	888.2 2		858.5+x	(67/2 ⁺)	7114.5+z	J2+16	1056.2 2		6058.3+z	J2+14
2624.8+x	(75/2 ⁺)	878.1 2	0.40 6	1746.7+x	(71/2 ⁺)	8218.2+z	J2+18	1103.7 2		7114.5+z	J2+16
3525.8+x	(79/2 ⁺)	901.0 1	0.44 6	2624.8+x	(75/2 ⁺)	9369.7+z	J2+20	1151.5 2		8218.2+z	J2+18
4468.1+x	(83/2 ⁺)	942.3 1		3525.8+x	(79/2 ⁺)	10568.7+z	J2+22	1199.0 2		9369.7+z	J2+20
5455.0+x	(87/2 ⁺)	986.9 1		4468.1+x	(83/2 ⁺)	11815.7+z	J2+24	1247.0 2	1.00 5	10568.7+z	J2+22
6488.0+x	(91/2 ⁺)	1033.0 1	0.86 12	5455.0+x	(87/2 ⁺)	13110.0+z	J2+26	1294.3 2	0.87 5	11815.7+z	J2+24
7569.3+x	(95/2 ⁺)	1081.3 1		6488.0+x	(91/2 ⁺)	14451.6+z	J2+28	1341.5 3	0.72 5	13110.0+z	J2+26
8699.7+x	(99/2 ⁺)	1130.4 1	1.00 14	7569.3+x	(95/2 ⁺)	15839.7+z	J2+30	1388.1 3	0.62 5	14451.6+z	J2+28
9880.6+x	(103/2 ⁺)	1180.9 1	1.02 14	8699.7+x	(99/2 ⁺)	17274.6+z	J2+32	1434.9 3	0.42 5	15839.7+z	J2+30
11113.1+x	(107/2 ⁺)	1232.5 1	0.58 10	9880.6+x	(103/2 ⁺)	18757.1+z	J2+34	1482.5 4	0.22 5	17274.6+z	J2+32
12398.9+x	(111/2 ⁺)	1285.8 1	0.66 10	11113.1+x	(107/2 ⁺)	20285.7+z	J2+36	1528.6 8	0.12 5	18757.1+z	J2+34
13738.6+x	(115/2 ⁺)	1339.6 1	0.56 10	12398.9+x	(111/2 ⁺)	21860.7+z	J2+38	1575.0 10		20285.7+z	J2+36
15133.4+x	(119/2 ⁺)	1394.8 2	0.52 10	13738.6+x	(115/2 ⁺)	755.7+u	J3+2	755.7 4		u	J3≈(63/2 ⁻)
16584.0+x	(123/2 ⁺)	1450.6 2	0.42 8	15133.4+x	(119/2 ⁺)	1560.6+u	J3+4	804.9 3		755.7+u	J3+2
18090.7+x	(127/2 ⁺)	1506.7 3	0.26 6	16584.0+x	(123/2 ⁺)	2415.6+u	J3+6	855.0 3		1560.6+u	J3+4
19654.7+x	(131/2 ⁺)	1564.0 3		18090.7+x	(127/2 ⁺)	3323.6+u	J3+8	908.0 2		2415.6+u	J3+6
21275.0+x	(135/2 ⁺)	1620.3 7		19654.7+x	(131/2 ⁺)	4283.9+u	J3+10	960.3 2		3323.6+u	J3+8
649.8+y	J1+2	649.8 4		y	J1≈(57/2 ⁺)	5299.5+u	J3+12	1015.6 3		4283.9+u	J3+10
1349.6+y	J1+4	699.8 2		649.8+y	J1+2	6369.4+u	J3+14	1069.9 3		5299.5+u	J3+12
2098.2+y	J1+6	748.6 2		1349.6+y	J1+4	7495.5+u	J3+16	1126.1 3		6369.4+u	J3+14
2897.4+y	J1+8	799.2 2		2098.2+y	J1+6	8678.9+u	J3+18	1183.4 3		7495.5+u	J3+16
3751.5+y	J1+10	854.1 2		2897.4+y	J1+8	9919.8+u	J3+20	1240.9 3		8678.9+u	J3+18
4647.5+y	J1+12	896.0 2	0.64 16	3751.5+y	J1+10	11219.1+u	J3+22	1299.3 3		9919.8+u	J3+20
5600.8+y	J1+14	953.3 2		4647.5+y	J1+12	12576.8+u	J3+24	1357.7 3		11219.1+u	J3+22
6605.7+y	J1+16	1004.9 2	0.64 16	5600.8+y	J1+14	13993.9+u	J3+26	1417.0 4		12576.8+u	J3+24
7662.4+y	J1+18	1056.7 2	0.64 16	6605.7+y	J1+16	15469.7+u	J3+28	1475.8 4		13993.9+u	J3+26
8772.5+y	J1+20	1110.1 2	0.80 16	7662.4+y	J1+18	17004.3+u	J3+30	1534.6 5		15469.7+u	J3+28
9935.7+y	J1+22	1163.2 2	0.96 16	8772.5+y	J1+20	18599.3+u	J3+32	1595.0 10		17004.3+u	J3+30
11151.2+y	J1+24	1215.5 2	0.96 16	9935.7+y	J1+22	688.1+v	J4+2	688.1 5		v	J4≈(57/2 ⁻)
12420.0+y	J1+26	1268.8 2	0.96 16	11151.2+y	J1+24	1420.7+v	J4+4	732.6 2		688.1+v	J4+2
13742.9+y	J1+28	1322.8 2	1.20 24	12420.0+y	J1+26	2200.9+v	J4+6	780.2 2		1420.7+v	J4+4
15119.7+y	J1+30	1376.8 2	1.12 24	13742.9+y	J1+28	3030.7+v	J4+8	829.8 2		2200.9+v	J4+6
16550.6+y	J1+32	1430.9 3	0.56 16	15119.7+y	J1+30	3911.7+v	J4+10	881.0 2		3030.7+v	J4+8
18036.2+y	J1+34	1485.6 4	0.56 16	16550.6+y	J1+32	4845.2+v	J4+12	933.5 2		3911.7+v	J4+10
19576.4+y	J1+36	1540.2 5		18036.2+y	J1+34	5832.3+v	J4+14	987.1 2		4845.2+v	J4+12
21170.8+y	J1+38	1594.4 7		19576.4+y	J1+36	6874.3+v	J4+16	1042.0 2		5832.3+v	J4+14
22818.2+y	J1+40	1647.4 9		21170.8+y	J1+38	7971.8+v	J4+18	1097.5 2		6874.3+v	J4+16
725.6+z	J2+2	725.6 4		z	J2≈(63/2 ⁺)	9126.1+v	J4+20	1154.3 2		7971.8+v	J4+18
1497.5+z	J2+4	771.9 2		725.6+z	J2+2	10338.1+v	J4+22	1212.0 3		9126.1+v	J4+20
2315.1+z	J2+6	817.6 2		1497.5+z	J2+4	11608.6+v	J4+24	1270.5 3		10338.1+v	J4+22
3180.0+z	J2+8	864.9 2		2315.1+z	J2+6	12937.5+v	J4+26	1328.9 5		11608.6+v	J4+24
4092.1+z	J2+10	912.1 2		3180.0+z	J2+8	14325.9+v	J4+28	1388.3 5		12937.5+v	J4+26
5052.8+z	J2+12	960.7 2		4092.1+z	J2+10	15772.5+v	J4+30	1446.6 4		14325.9+v	J4+28
6058.3+z	J2+14	1005.5 2		5052.8+z	J2+12	17278.5+v	J4+32	1506.0 6		15772.5+v	J4+30

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π
18843.7+v	J4+34	1565.2 6	17278.5+v	J4+32	10549.4+t	J7+20	1260.0 3	9289.4+t	J7+18
20469.7+v	J4+36	1626.0 10	18843.7+v	J4+34	11867.8+t	J7+22	1318.4 3	10549.4+t	J7+20
22155.7+v	J4+38	1686.0 10	20469.7+v	J4+36	13243.4+t	J7+24	1375.5 3	11867.8+t	J7+22
802.9+w	J5+2	802.9 3	w	J5	14683.7+t	J7+26	1440.3 4	13243.4+t	J7+24
1655.1+w	J5+4	852.2 4	802.9+w	J5+2	16178.3+t	J7+28	1494.6 4	14683.7+t	J7+26
2557.1+w	J5+6	902.0 3	1655.1+w	J5+4	17732.2+t	J7+30	1553.9 4	16178.3+t	J7+28
3509.2+w	J5+8	952.1 2	2557.1+w	J5+6	19346.7+t	J7+32	1614.5 7	17732.2+t	J7+30
4513.0+w	J5+10	1003.8 4	3509.2+w	J5+8	747.6+a	J8+2	747.6 6	a	J8
5562.7+w	J5+12	1049.7 4	4513.0+w	J5+10	1544.3+a	J8+4	796.7 5	747.6+a	J8+2
6667.9+w	J5+14	1105.2 4	5562.7+w	J5+12	2391.6+a	J8+6	847.3 4	1544.3+a	J8+4
7825.1+w	J5+16	1157.2 3	6667.9+w	J5+14	3290.1+a	J8+8	898.5 4	2391.6+a	J8+6
9034.4+w	J5+18	1209.3 3	7825.1+w	J5+16	4240.3+a	J8+10	950.2 4	3290.1+a	J8+8
10296.7+w	J5+20	1262.3 3	9034.4+w	J5+18	5242.8+a	J8+12	1002.5 4	4240.3+a	J8+10
11612.4+w	J5+22	1315.7 3	10296.7+w	J5+20	6305.6+a	J8+14	1062.8 4	5242.8+a	J8+12
12982.0+w	J5+24	1369.5 3	11612.4+w	J5+22	7422.7+a	J8+16	1117.1 4	6305.6+a	J8+14
14404.8+w	J5+26	1422.8 4	12982.0+w	J5+24	8595.5+a	J8+18	1172.8 4	7422.7+a	J8+16
15882.3+w	J5+28	1477.5 5	14404.8+w	J5+26	9826.8+a	J8+20	1231.3 5	8595.5+a	J8+18
17415.0+w	J5+30	1532.7 5	15882.3+w	J5+28	11115.2+a	J8+22	1288.4 4	9826.8+a	J8+20
19000.8+w	J5+32	1585.8 6	17415.0+w	J5+30	12462.0+a	J8+24	1346.8 4	11115.2+a	J8+22
20642.0+w	J5+34	1641.2 11	19000.8+w	J5+32	13869.3+a	J8+26	1407.2 5	12462.0+a	J8+24
877.8+s	J6+2	877.8 4	s	J6	15332.6+a	J8+28	1463.3 6	13869.3+a	J8+26
1809.8+s	J6+4	932.0 3	877.8+s	J6+2	16864.4+a	J8+30	1531.8 10	15332.6+a	J8+28
2795.3+s	J6+6	985.5 3	1809.8+s	J6+4	18452.6+a	J8+32	1588.2 13	16864.4+a	J8+30
3833.6+s	J6+8	1038.3 3	2795.3+s	J6+6	827.6+b	J9+2	827.6 5	b	J9
4924.6+s	J6+10	1091.0 2	3833.6+s	J6+8	1697.3+b	J9+4	869.7 4	827.6+b	J9+2
6067.1+s	J6+12	1142.5 2	4924.6+s	J6+10	2621.5+b	J9+6	924.2 3	1697.3+b	J9+4
7260.4+s	J6+14	1193.3 3	6067.1+s	J6+12	3596.9+b	J9+8	975.4 3	2621.5+b	J9+6
8503.3+s	J6+16	1242.9 3	7260.4+s	J6+14	4627.3+b	J9+10	1030.4 3	3596.9+b	J9+8
9795.2+s	J6+18	1291.9 3	8503.3+s	J6+16	5715.8+b	J9+12	1088.5 3	4627.3+b	J9+10
11133.3+s	J6+20	1338.1 3	9795.2+s	J6+18	6864.0+b	J9+14	1148.2 4	5715.8+b	J9+12
12519.5+s	J6+22	1386.1 3	11133.3+s	J6+20	8073.3+b	J9+16	1209.3 4	6864.0+b	J9+14
13949.5+s	J6+24	1430.0 4	12519.5+s	J6+22	9343.3+b	J9+18	1270.0 4	8073.3+b	J9+16
15421.8+s	J6+26	1472.3 5	13949.5+s	J6+24	10673.9+b	J9+20	1330.6 4	9343.3+b	J9+18
16934.9+s	J6+28	1513.1 6	15421.8+s	J6+26	12064.0+b	J9+22	1390.1 3	10673.9+b	J9+20
18484.3+s	J6+30	1549.4 8	16934.9+s	J6+28	13513.0+b	J9+24	1448.9 4	12064.0+b	J9+22
874.1+t	J7+2	874.1 3	t	J7	15020.6+b	J9+26	1507.6 5	13513.0+b	J9+24
1798.7+t	J7+4	924.6 2	874.1+t	J7+2	16586.6+b	J9+28	1566.0 11	15020.6+b	J9+26
2771.3+t	J7+6	972.6 4	1798.7+t	J7+4	855.1+c	J10+2	855.1 10	c	J10
3797.2+t	J7+8	1025.9 5	2771.3+t	J7+6	1757.5+c	J10+4	902.4 6	855.1+c	J10+2
4813.6+t	J7+10	1016.4 3	3797.2+t	J7+8	2713.6+c	J10+6	956.1 6	1757.5+c	J10+4
5851.5+t	J7+12	1037.9 3	4813.6+t	J7+10	3726.2+c	J10+8	1012.6 5	2713.6+c	J10+6
6941.4+t	J7+14	1089.9 3	5851.5+t	J7+12	4795.8+c	J10+10	1069.6 5	3726.2+c	J10+8
8087.0+t	J7+16	1145.6 3	6941.4+t	J7+14	5921.9+c	J10+12	1126.1 5	4795.8+c	J10+10
9289.4+t	J7+18	1202.4 3	8087.0+t	J7+16	7103.5+c	J10+14	1181.6 5	5921.9+c	J10+12

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	E_f	J_f^π
8337.5+c	J10+16	1234.0 6	7103.5+c	J10+14	2677.2+d	J11+6	935.7 9	1741.5+d	J11+4
9620.0+c	J10+18	1282.5 6	8337.5+c	J10+16	3663.7+d	J11+8	986.5 9	2677.2+d	J11+6
10947.1+c	J10+20	1327.1 7	9620.0+c	J10+18	4701.7+d	J11+10	1038.0 8	3663.7+d	J11+8
12321.0+c	J10+22	1373.8 8	10947.1+c	J10+20	5792.5+d	J11+12	1090.8 8	4701.7+d	J11+10
13741.3+c	J10+24	1420.3 10	12321.0+c	J10+22	6935.4+d	J11+14	1142.9 8	5792.5+d	J11+12
15213.0+c	J10+26	1471.7 8	13741.3+c	J10+24	8131+d	J11+16	1195.2 9	6935.4+d	J11+14
16739+c	J10+28	1525.6 8	15213.0+c	J10+26	9382+d	J11+18	1251.1 10	8131+d	J11+16
18322+c	J10+30	1583.1 12	16739+c	J10+28	10688+d	J11+20	1306.7 7	9382+d	J11+18
19961+c	J10+32	1639.2 13	18322+c	J10+30	12049+d	J11+22	1360.6 15	10688+d	J11+20
850.3+d	J11+2	850.3 10	d	J11	13467+d	J11+24	1418.0 13	12049+d	J11+22
1741.5+d	J11+4	891.2 10	850.3+d	J11+2	14941+d	J11+26	1474.0 15	13467+d	J11+24

[†] From ¹⁴⁹Tb ε decay (4.12 h) for low spin levels ($J \leq 9/2$) and from ¹²⁴Sn(³⁰Si,5n γ), (α ,5n γ) or (α ,2n γ) for high-spin levels with weighted averages taken where multiple values of similar precisions are available. All γ rays from levels above 5000 and for SD-band levels are from ¹²⁴Sn(³⁰Si,5n γ). Quoted values of intensities are photon branching ratios. For SD bands populated in (³⁰Si,5n γ), values are relative γ -ray intensities within each band, normalized to ≈ 1 for one of the most intense γ rays in that band.

[‡] Unless otherwise stated, assignments are from $\gamma(\theta, \text{pol})$ in (α ,5n γ), $\gamma(\theta)$ and ce in (α ,2n γ), and $\gamma(\theta)$ in (³⁰Si,5n γ). From RUL for E2 and M2, mult=Q is most likely E2. In many cases 1991FI02 in (³⁰Si,5n γ) give unique multipolarity assignments, but their $\gamma(\theta)$ which give only A_2 values cannot distinguish between different possible assignments.

From intensity balance in (³⁰Si,5n γ).

@ From ce and/or $\gamma\gamma(\theta)$ data in ¹⁴⁹Tb ε (4.12 h).

& From ce and/or $\gamma\gamma(\theta)$ data in ¹⁴⁹Tb ε (4.12 h), unless otherwise stated.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

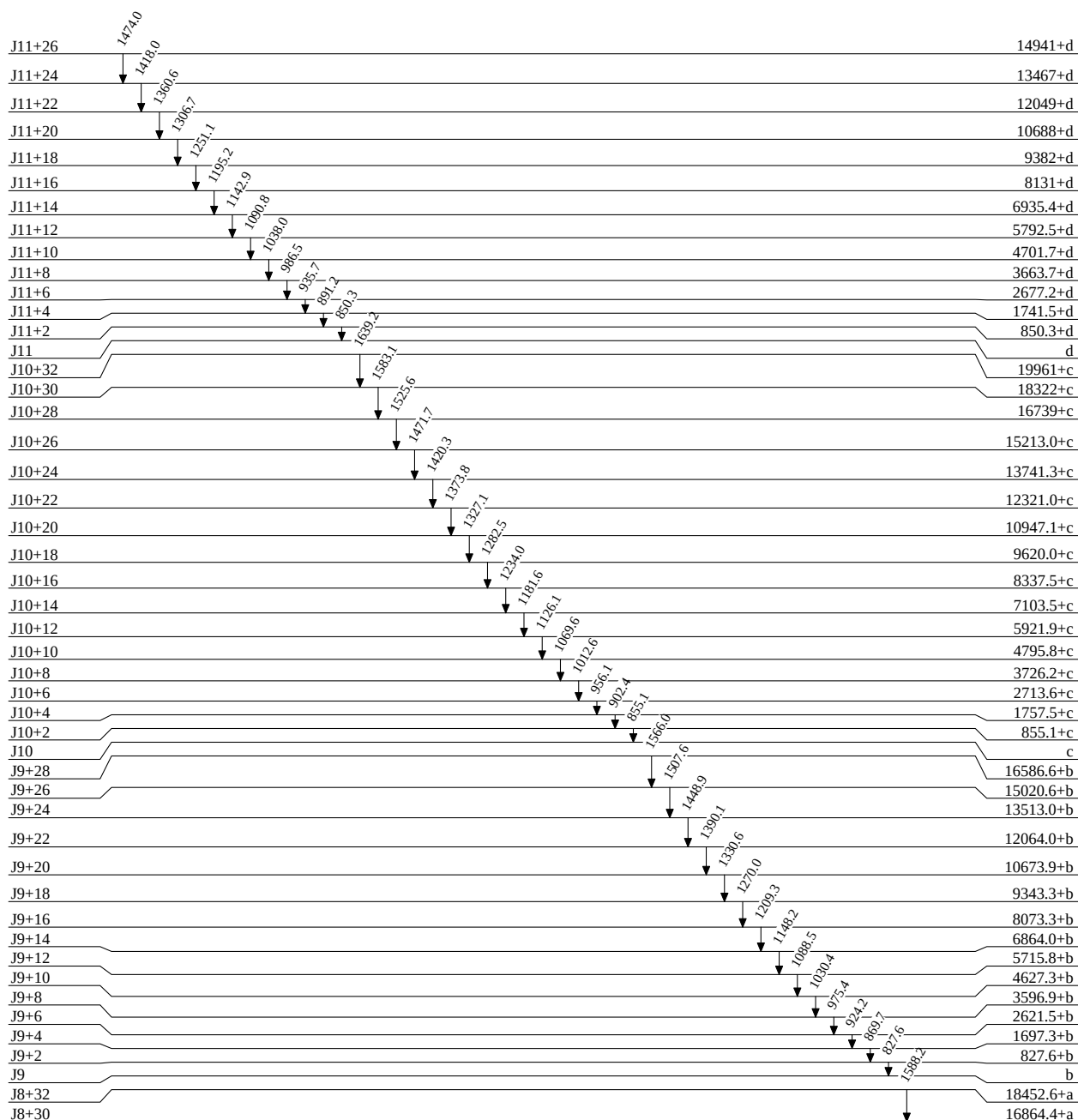
^b Multiply placed with intensity suitably divided.

^c Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level


 $7/2^-$

0.0

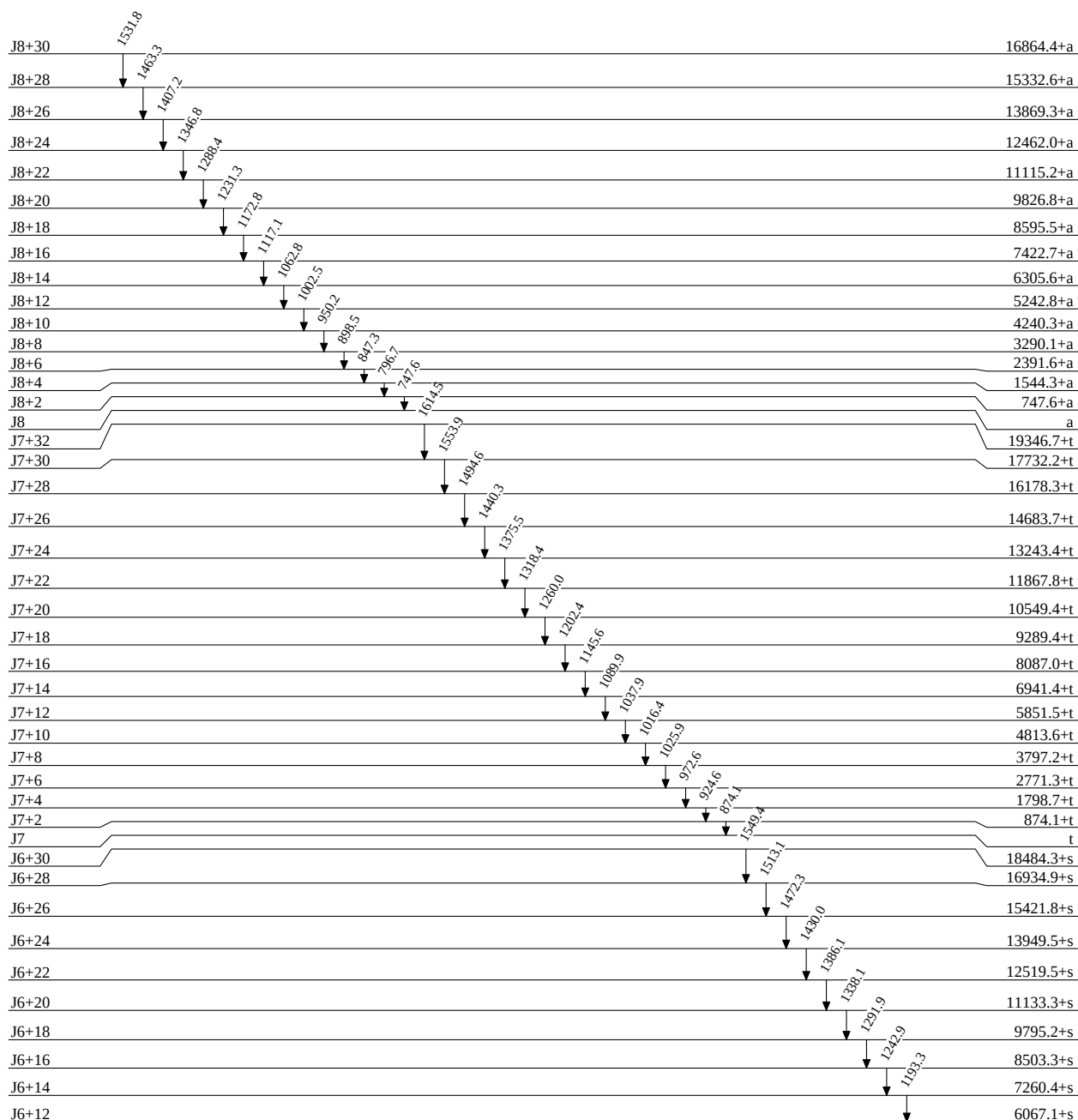
9.28 d 10

 $^{149}_{64}\text{Gd}_{85}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level


 $7/2^-$

0.0

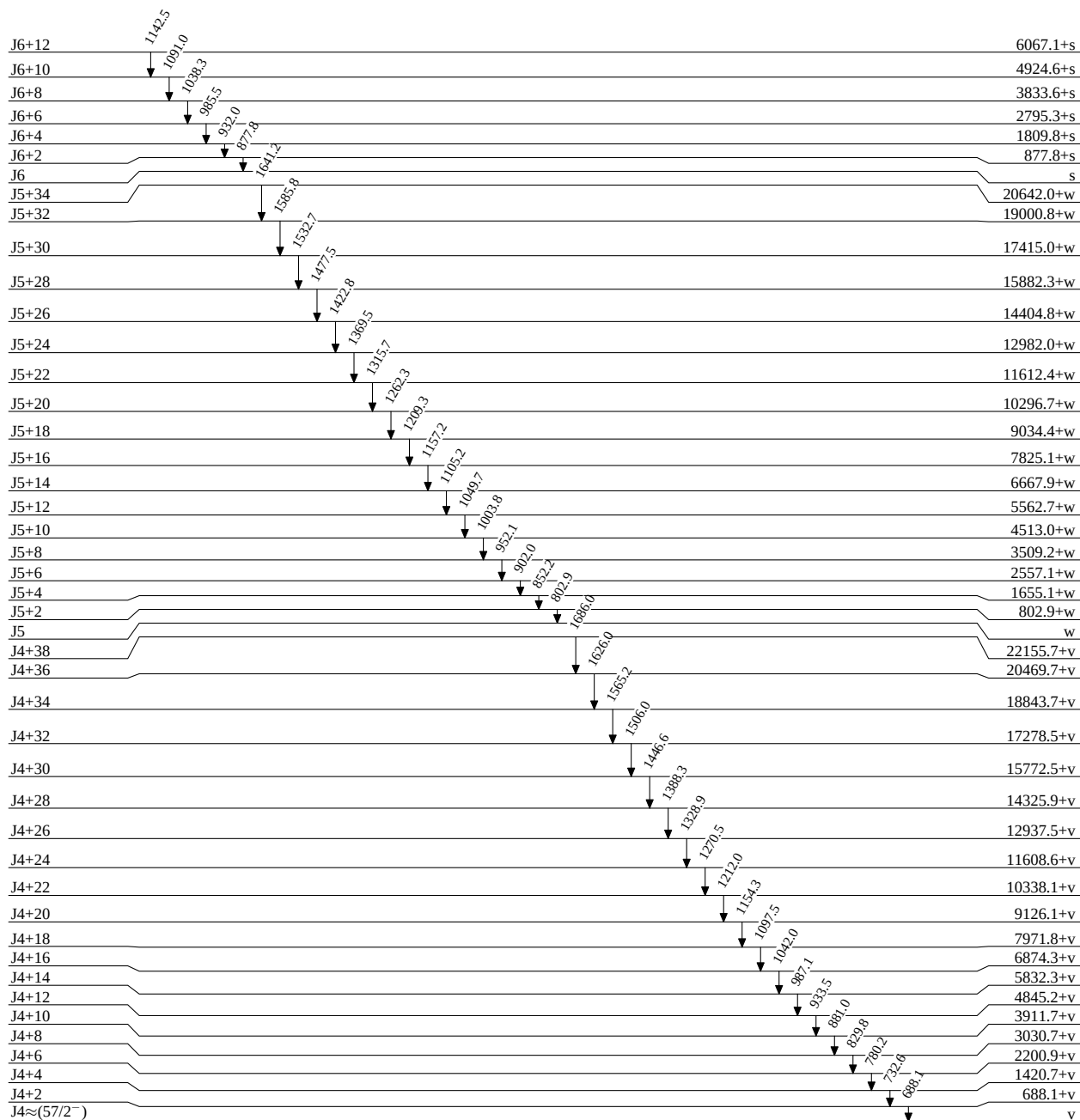
9.28 d 10

 $^{149}_{64}\text{Gd}_{85}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level


7/2⁻

0.0

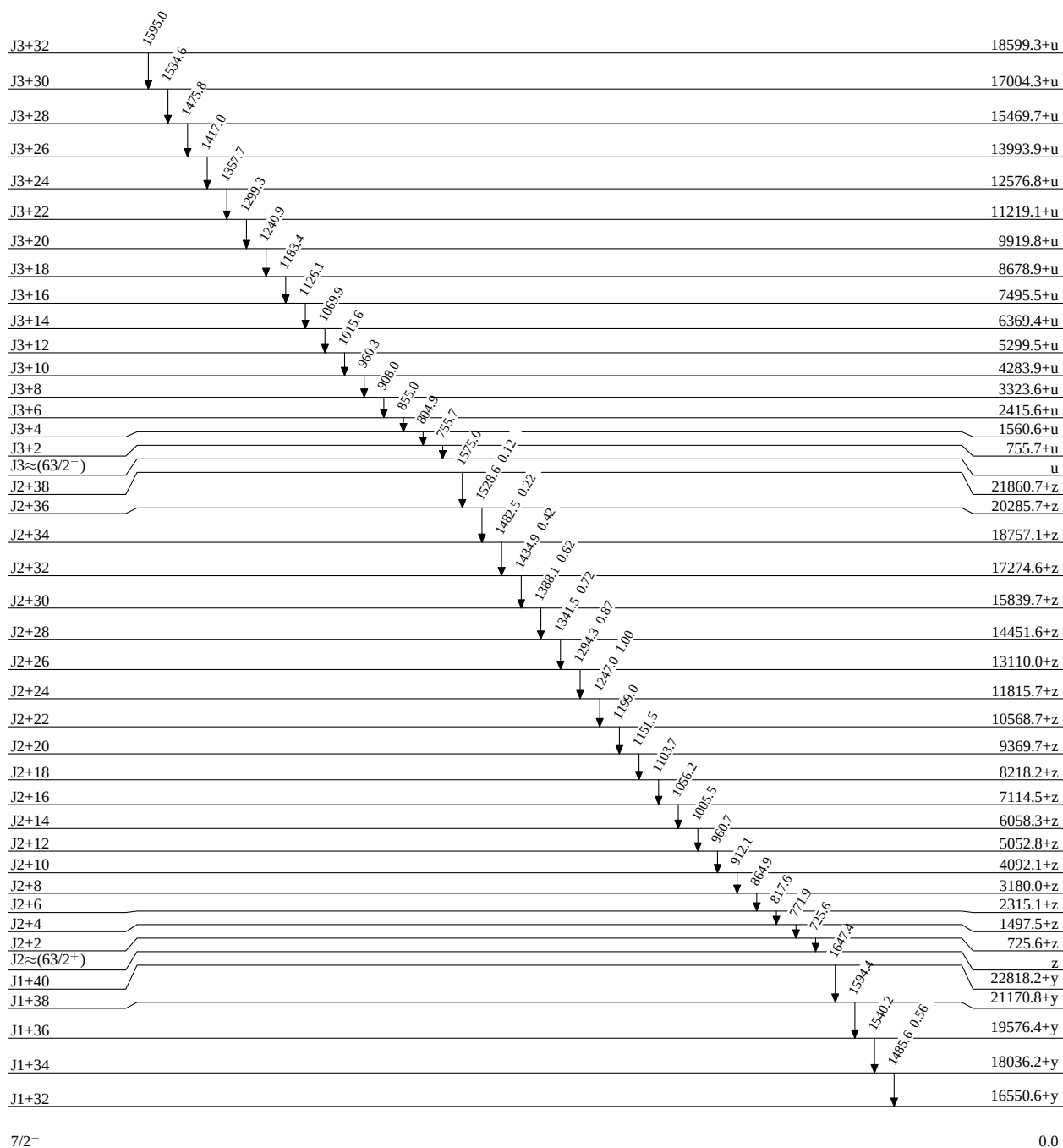
9.28 d 10

¹⁴⁹Gd₈₅

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level


7/2⁻

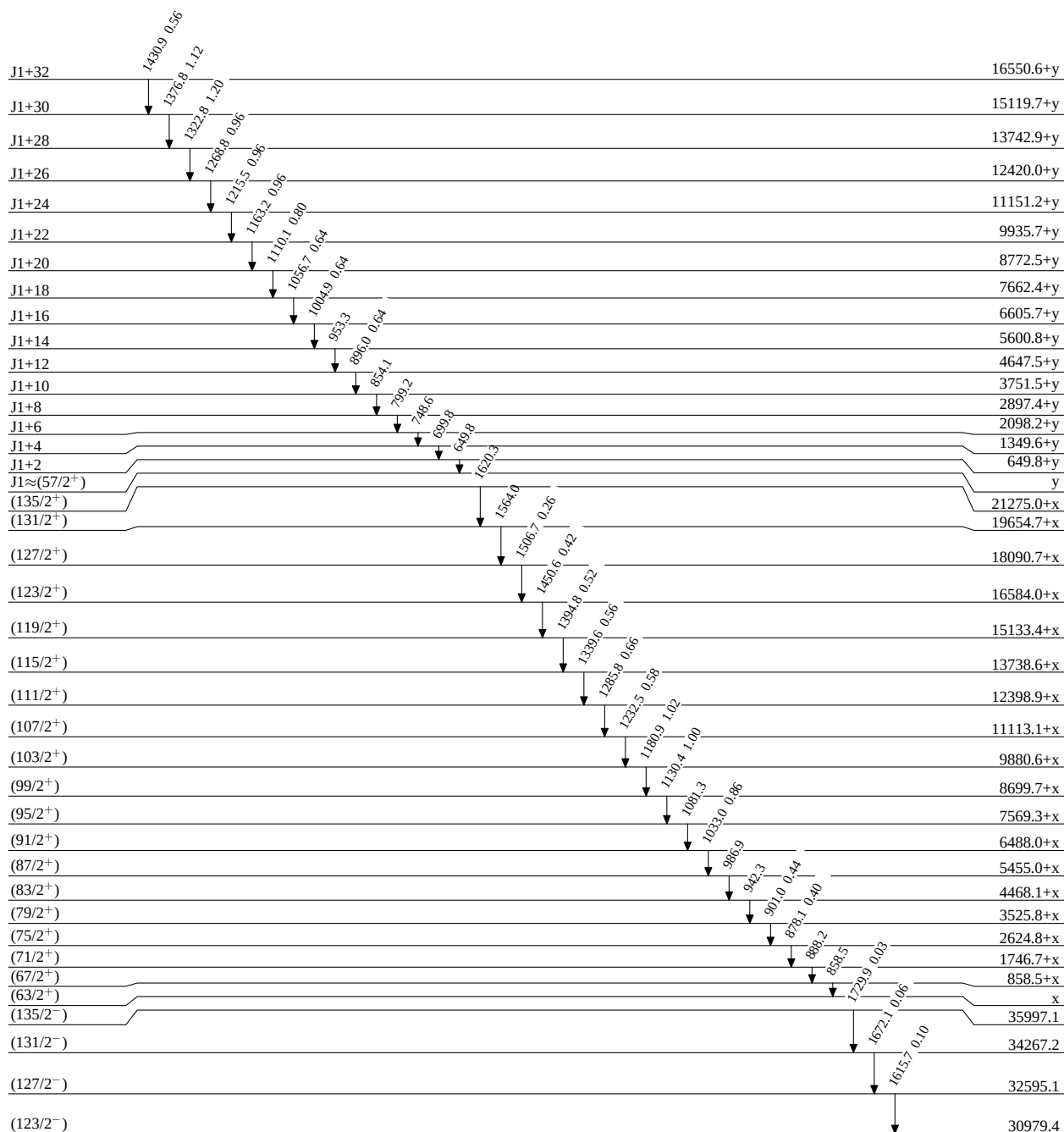
0.0

9.28 d 10

¹⁴⁹Gd₈₅

Adopted Levels, Gammas
Level Scheme (continued)

Intensities: Relative photon branching from each level


 7/2⁻

0.0

9.28 d 10

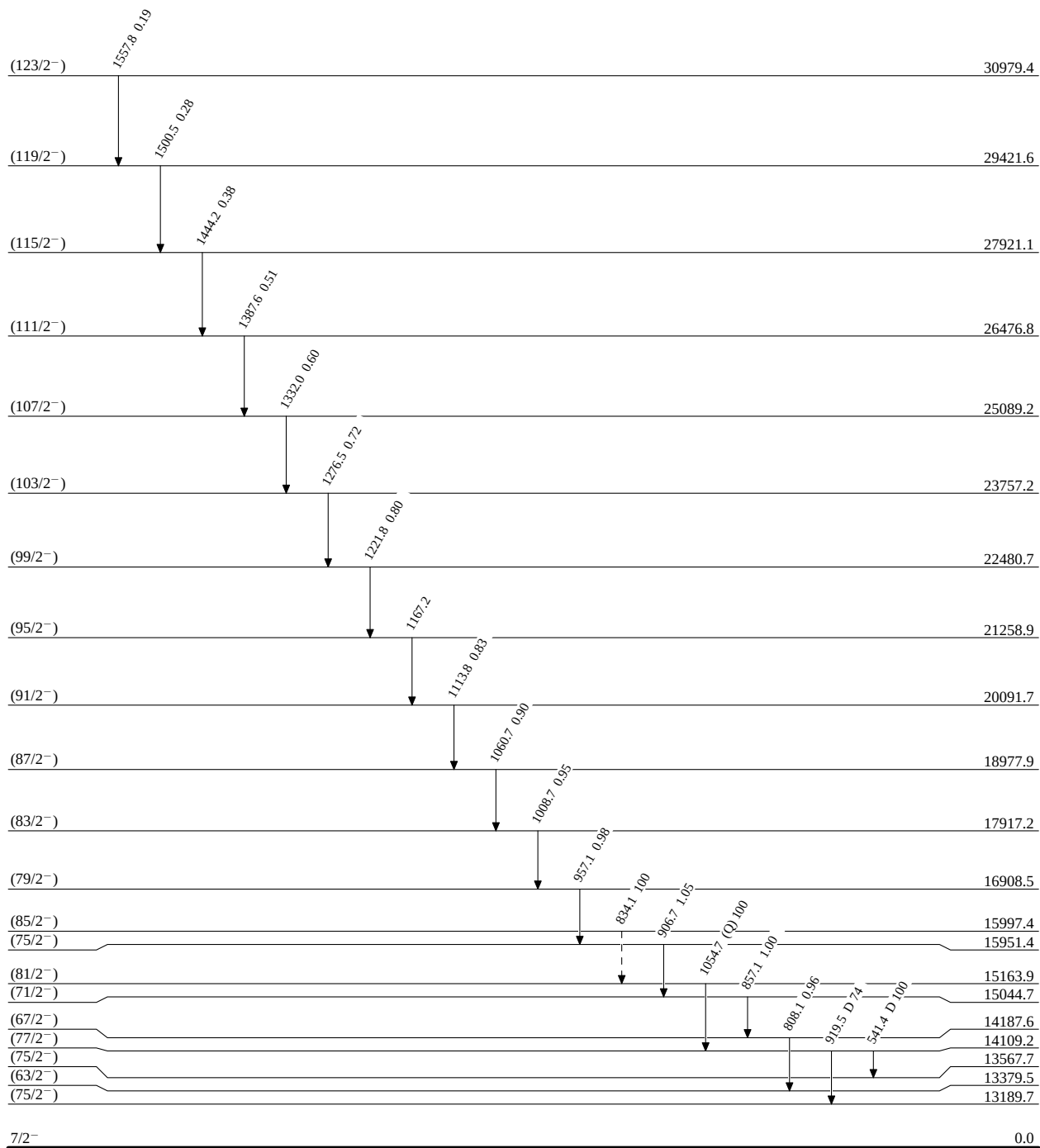
 $^{149}_{64}\text{Gd}_{85}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

 - - - - - $\rightarrow$ γ Decay (Uncertain)

 $^{149}_{64}\text{Gd}_{85}$

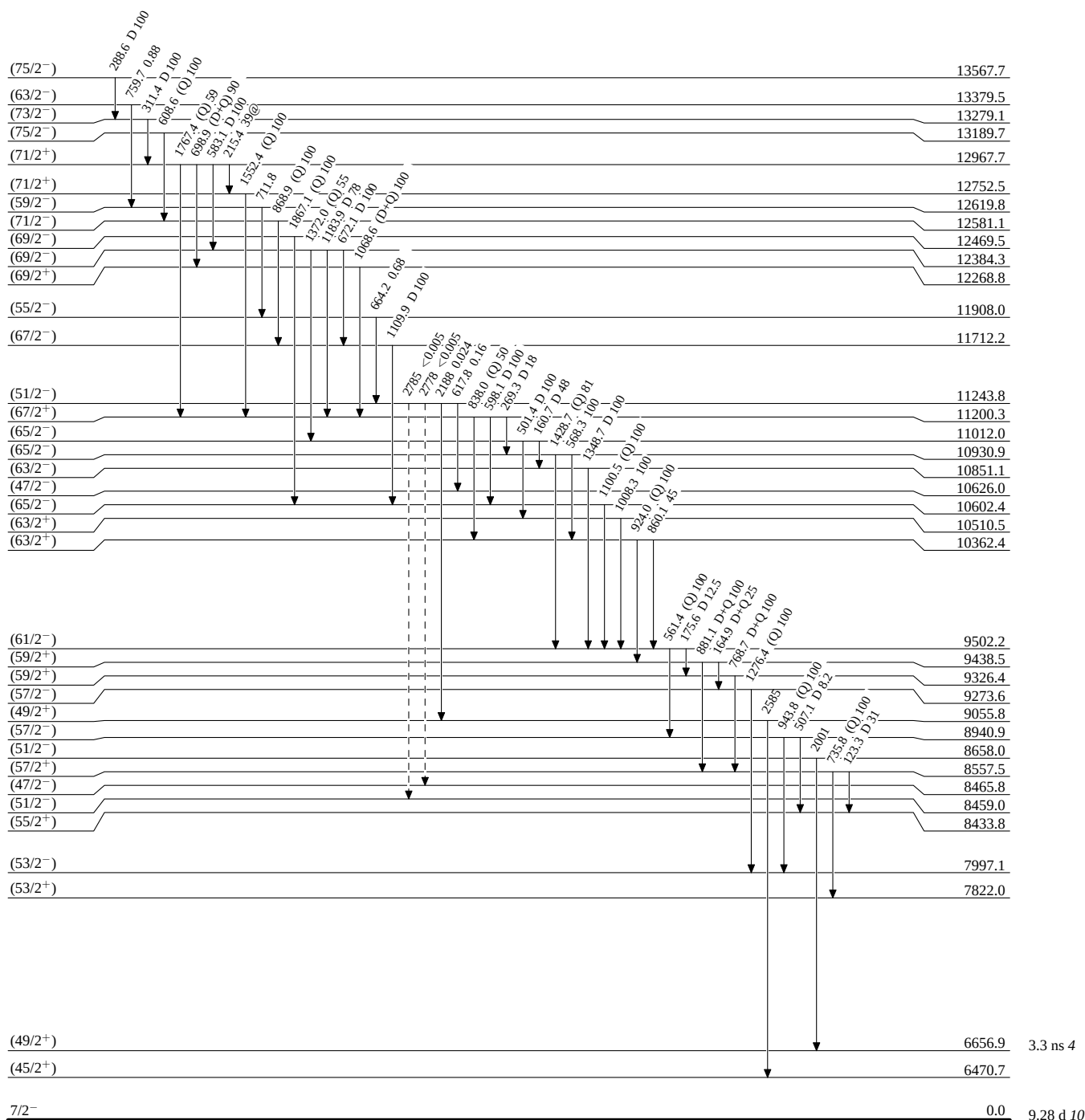
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



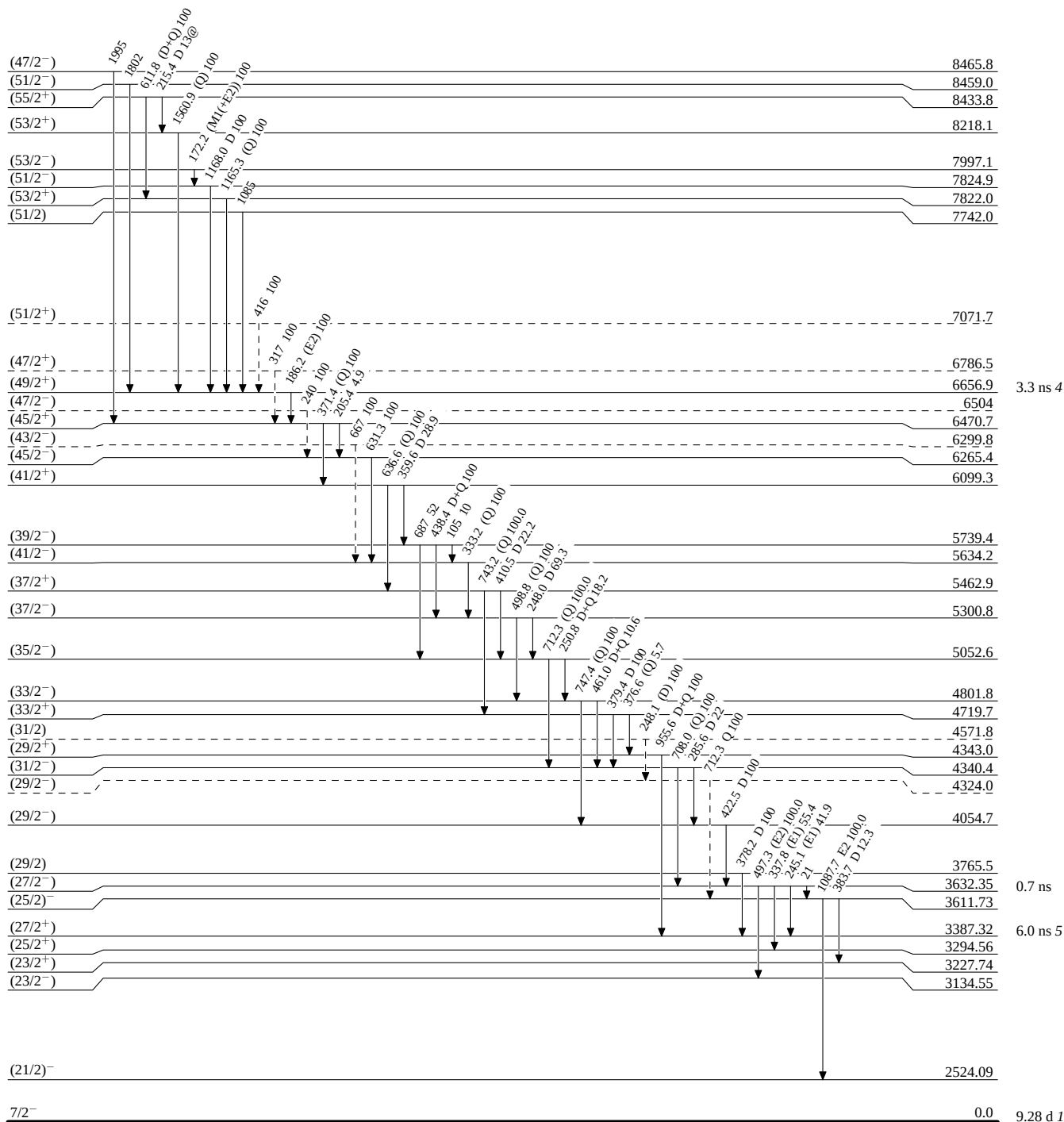
Adopted Levels, Gammas

Level Scheme (continued)

Legend

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)

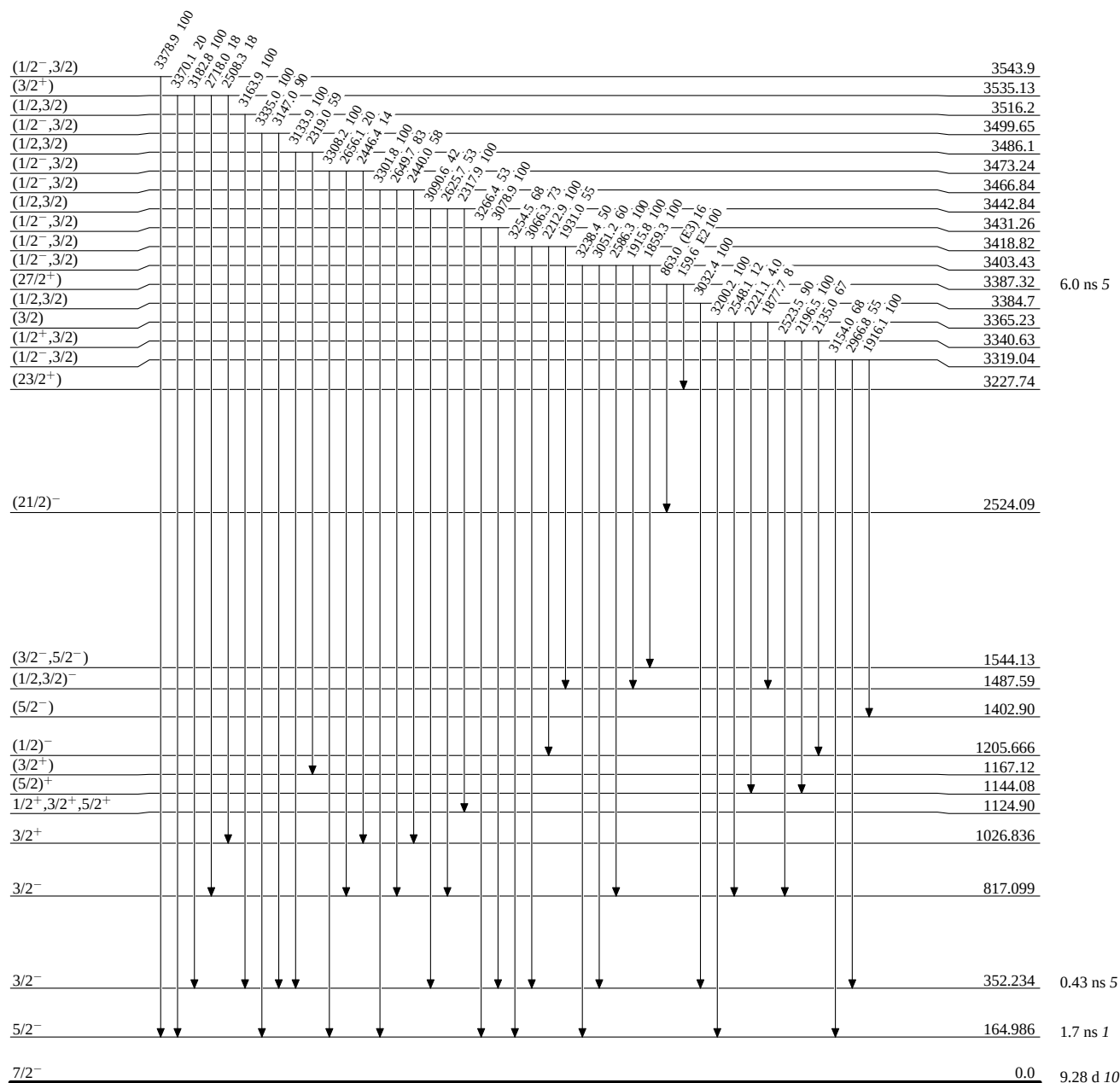


Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

@ Multiply placed: intensity suitably divided



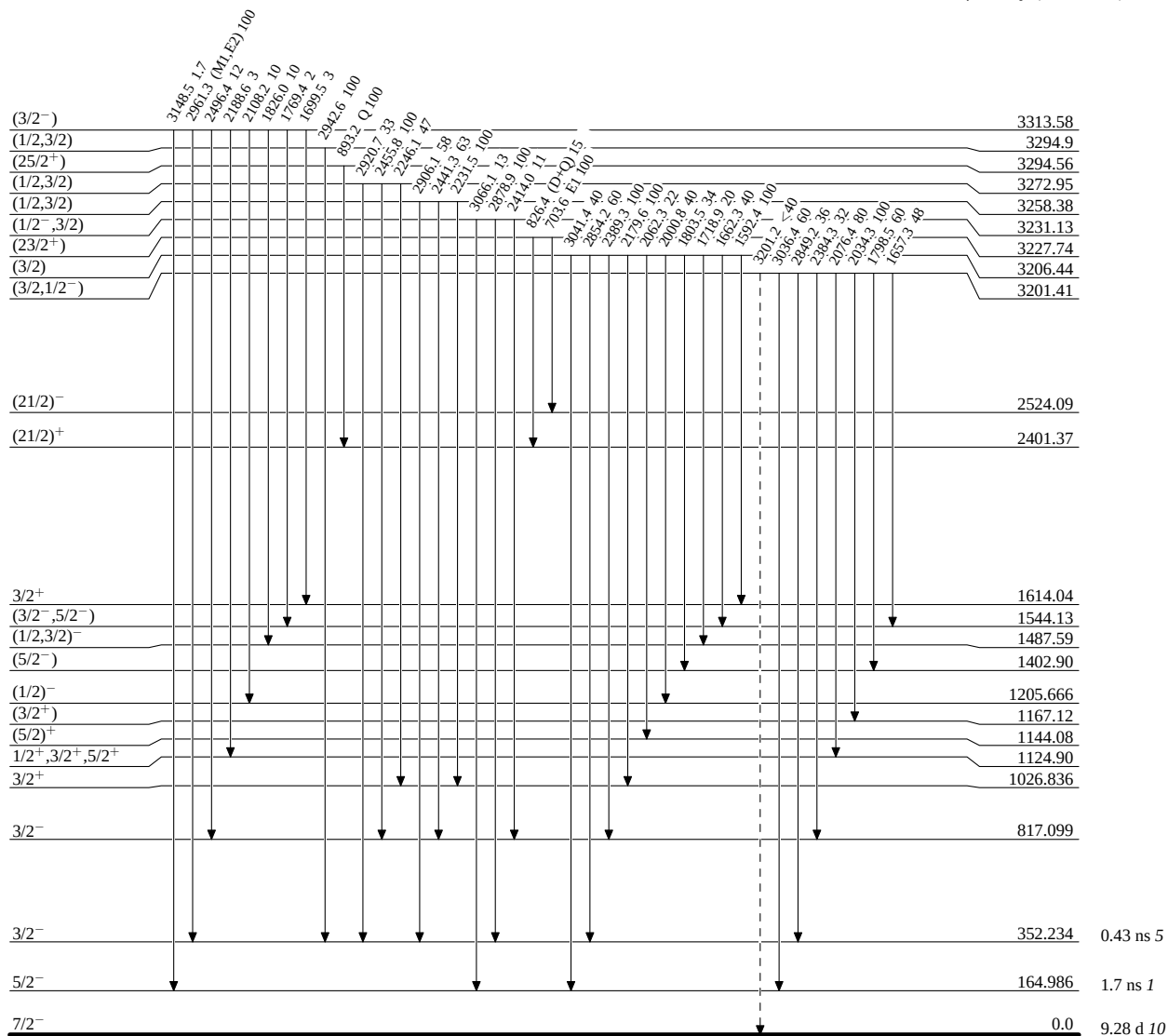
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



$^{149}_{64}\text{Gd}_{85}$

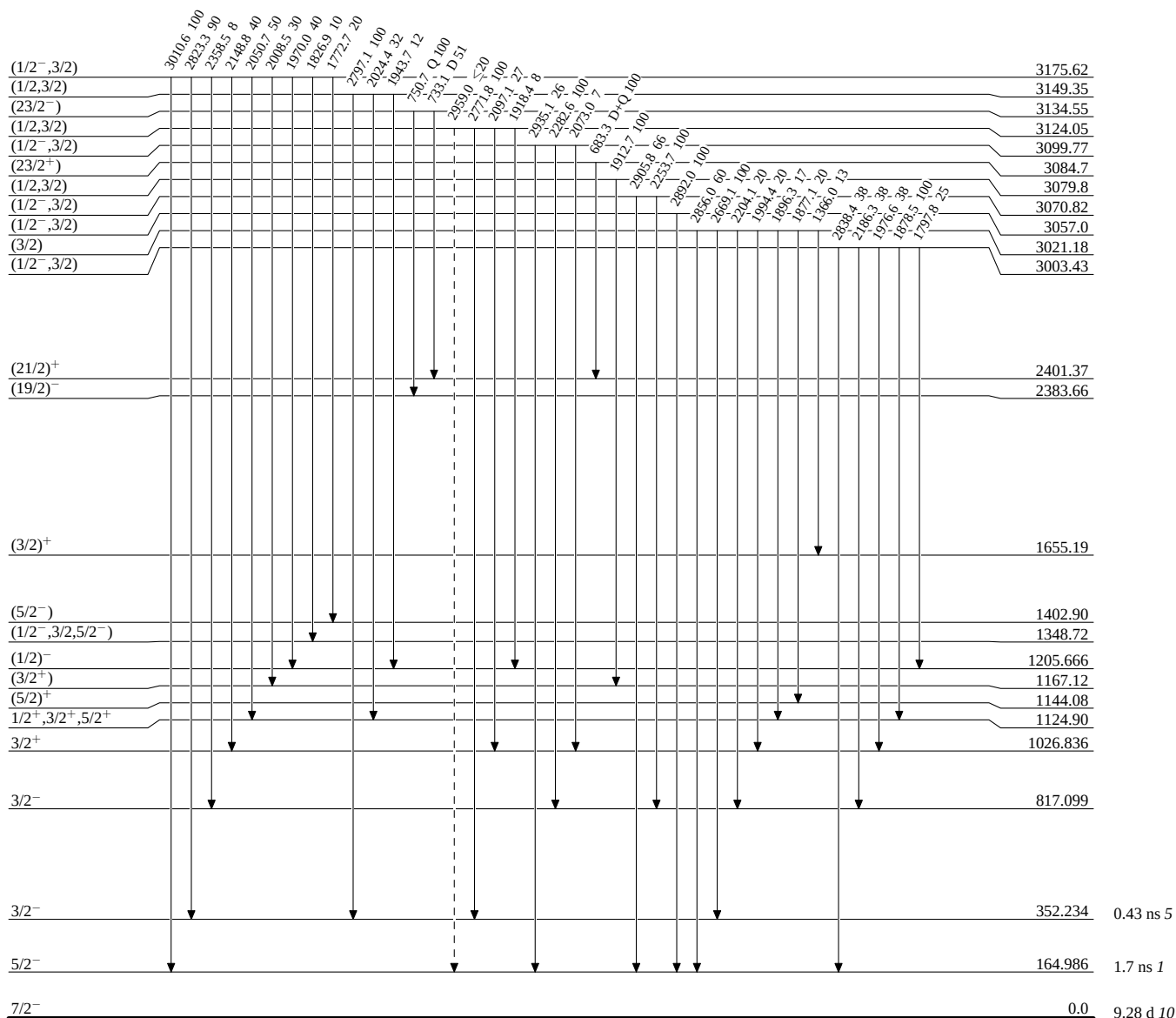
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----▶ γ Decay (Uncertain)



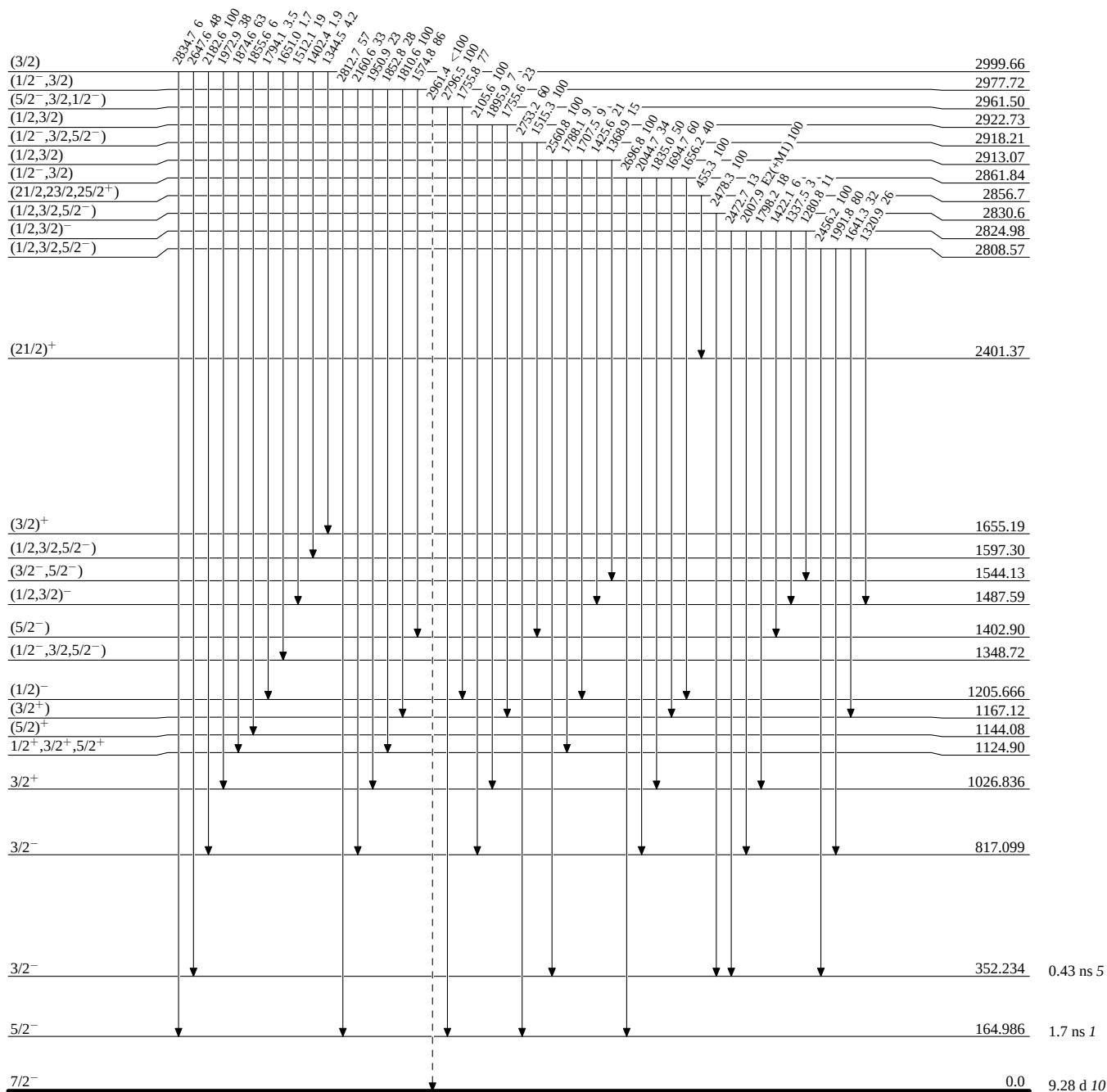
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiplied: intensity suitably divided

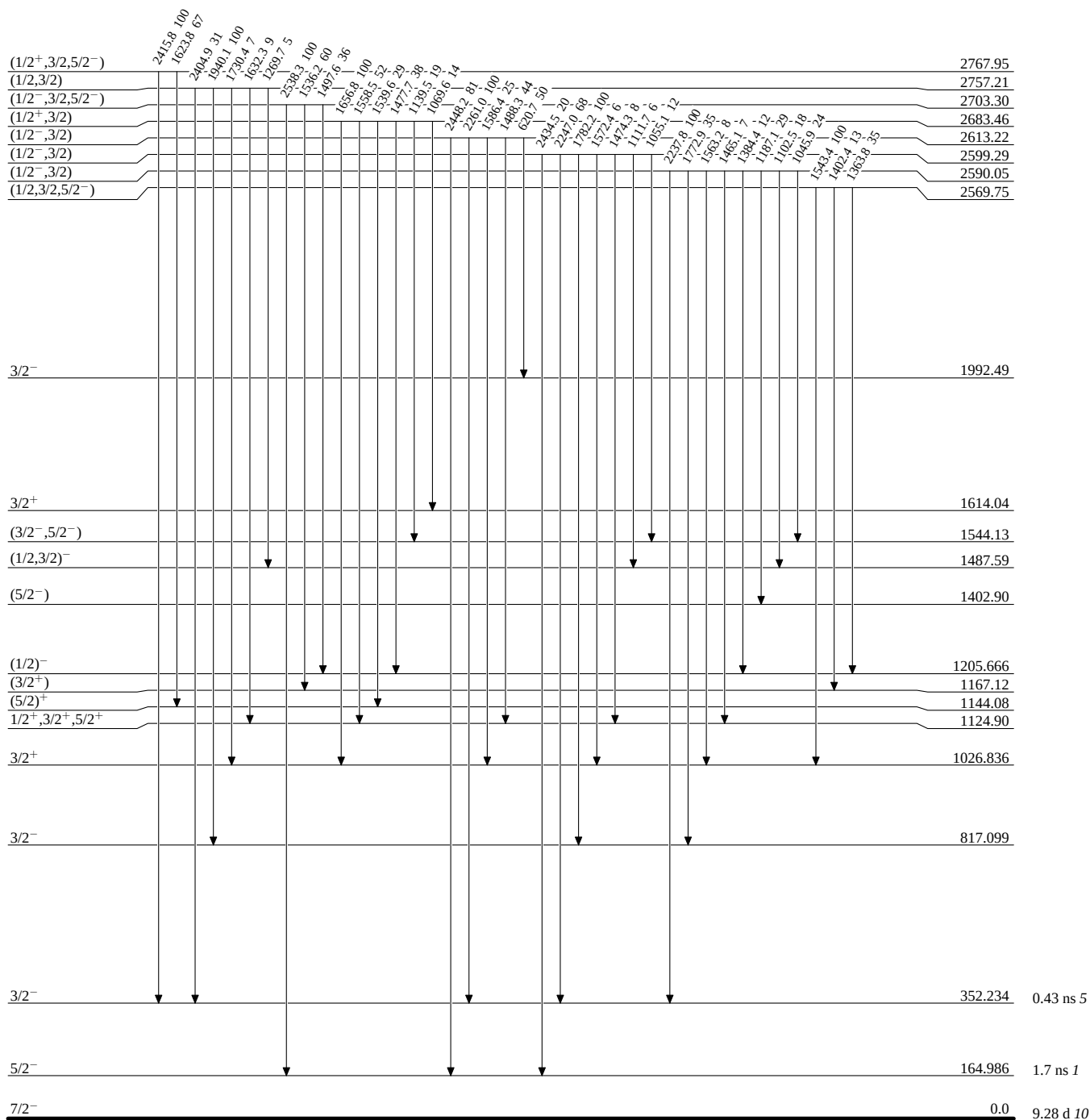
-----► γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiplied: intensity suitably divided



¹⁴⁹Gd₈₅

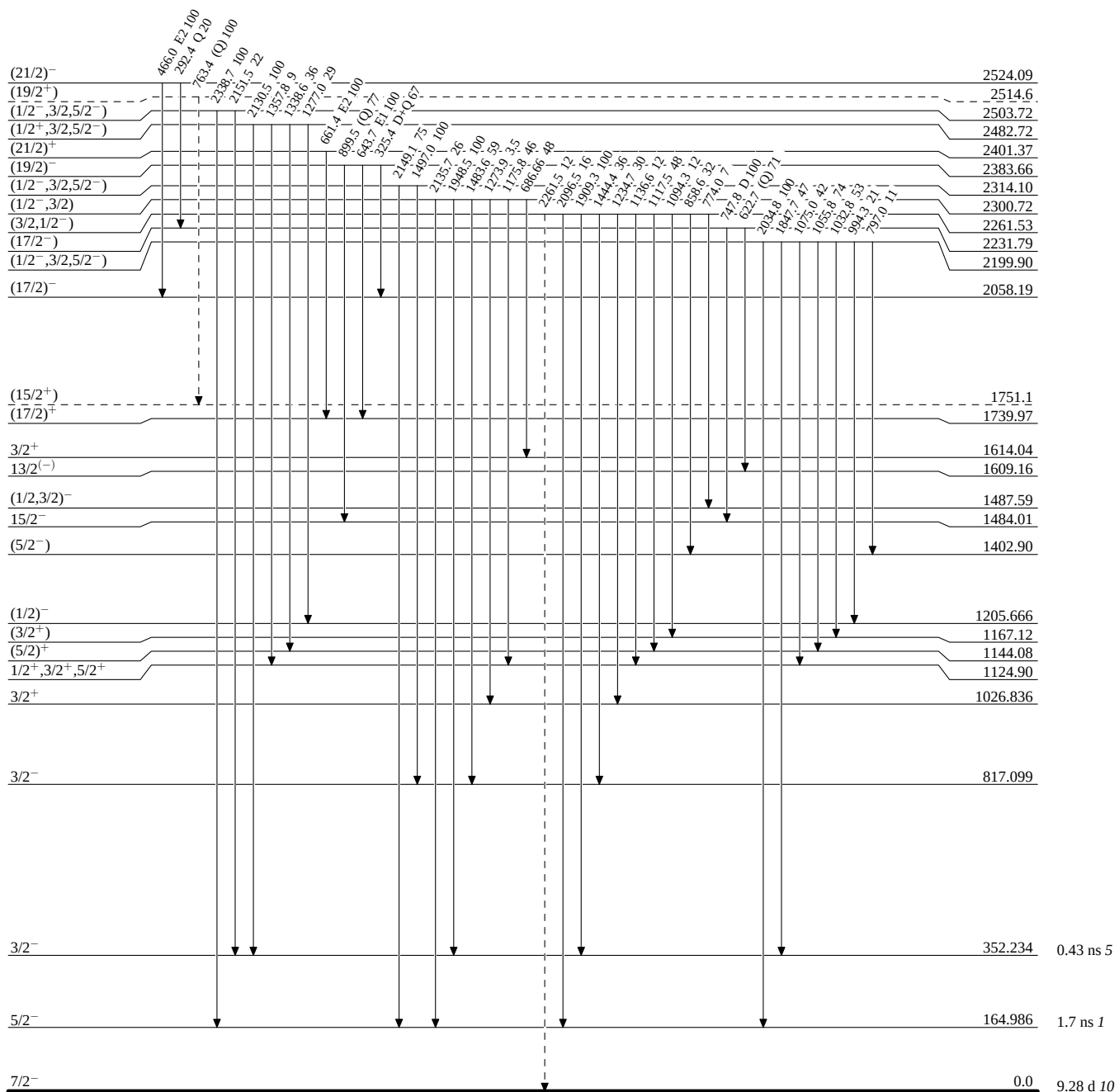
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



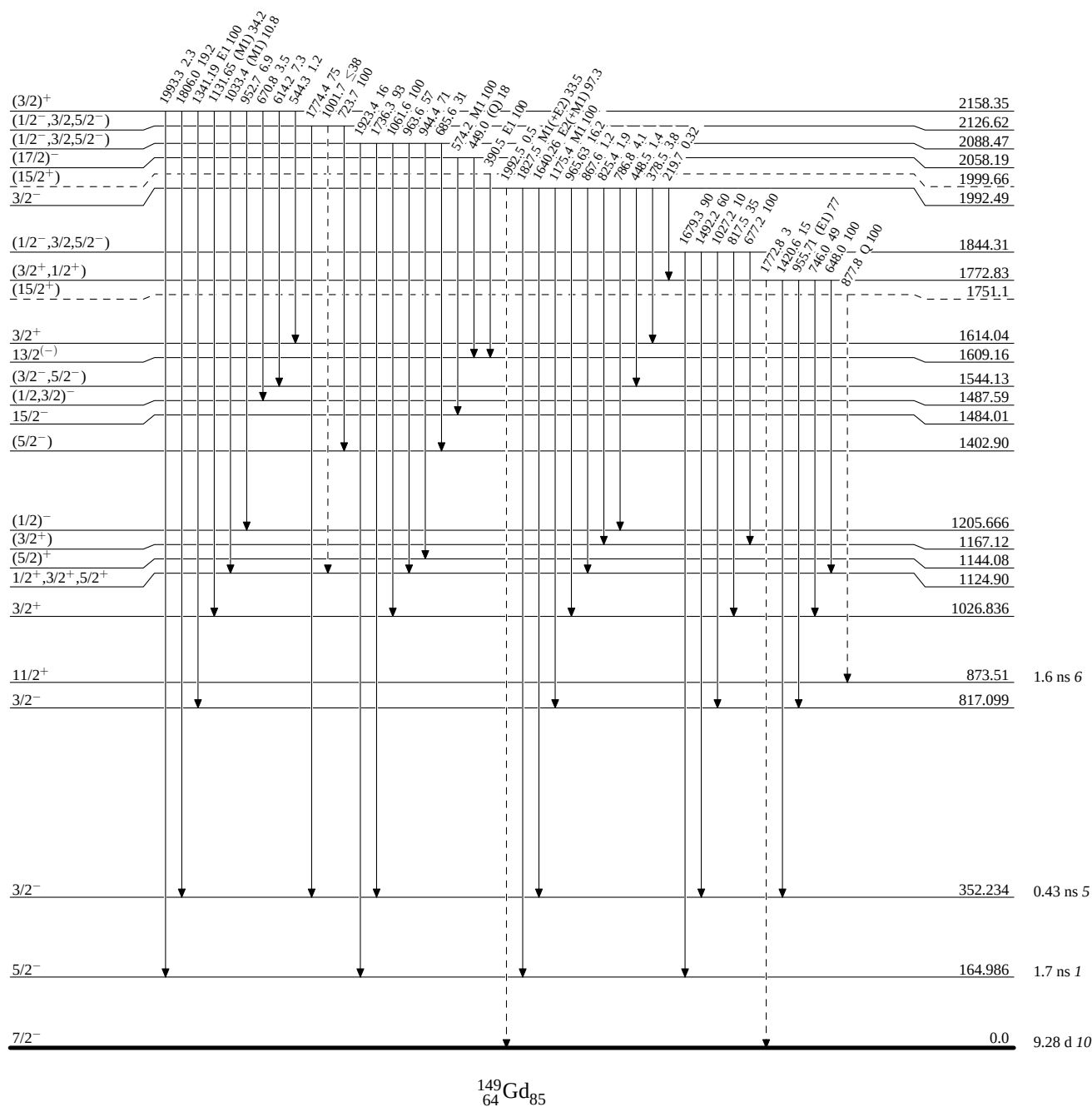
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



Adopted Levels, Gammas

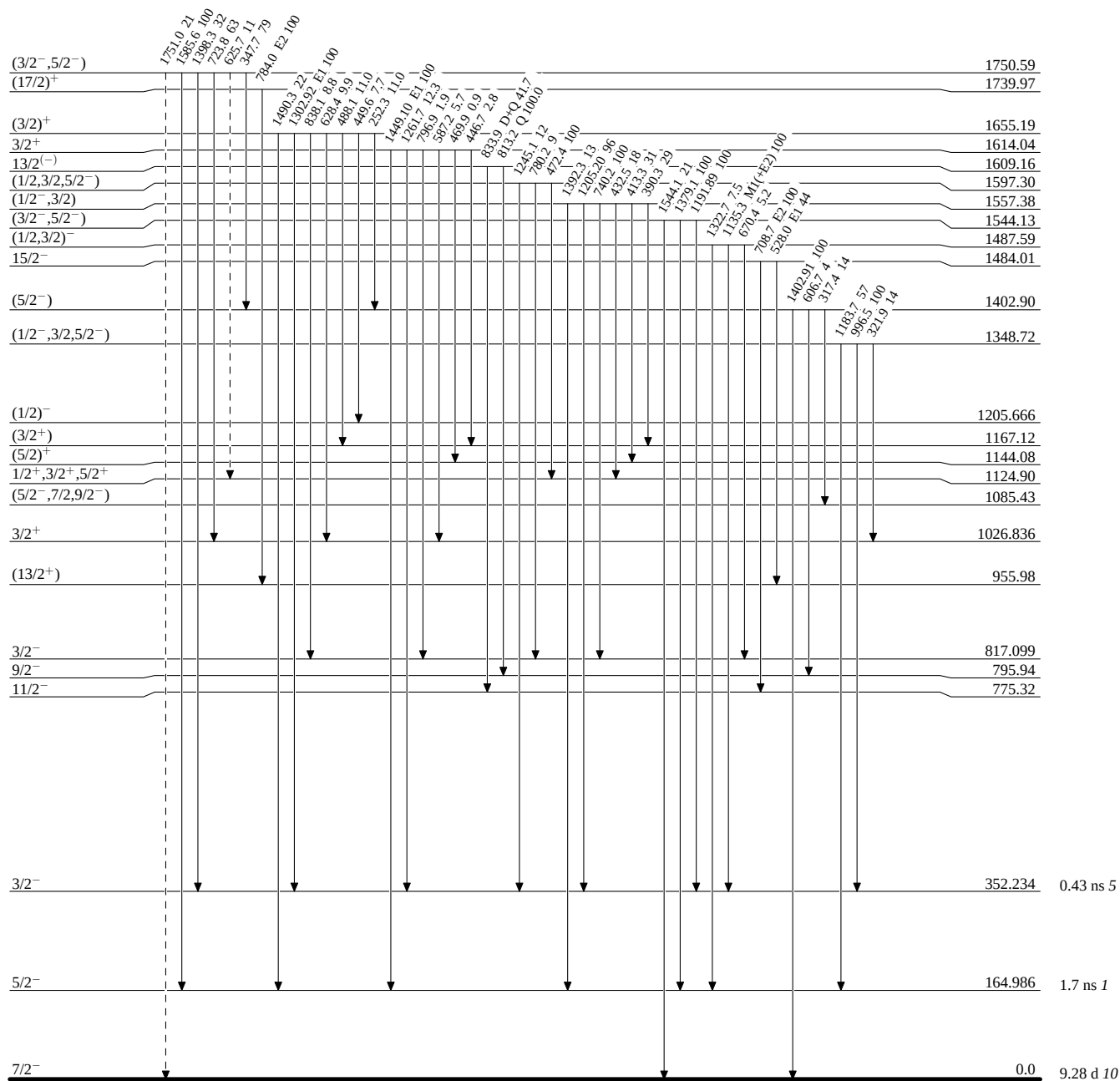
Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



¹⁴⁹Gd₈₅

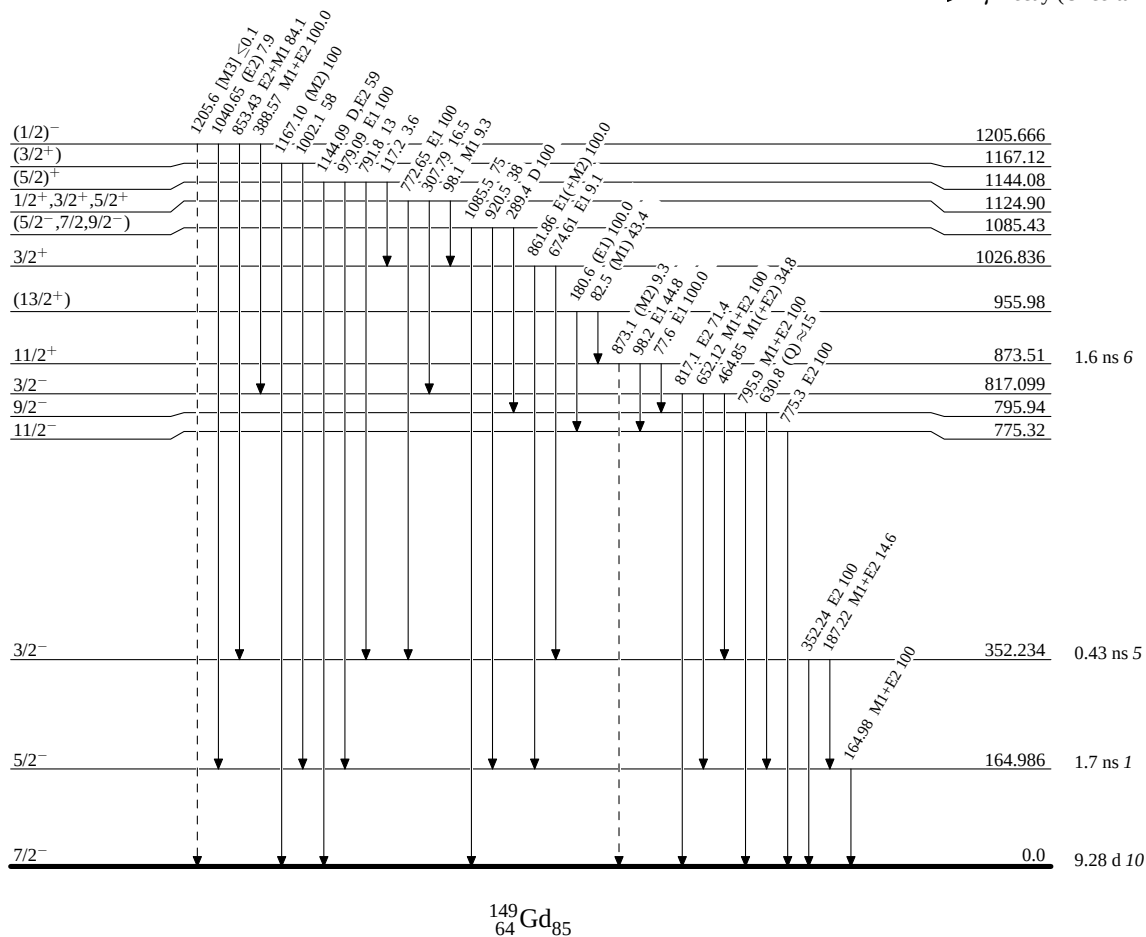
Adopted Levels, Gammas

Legend

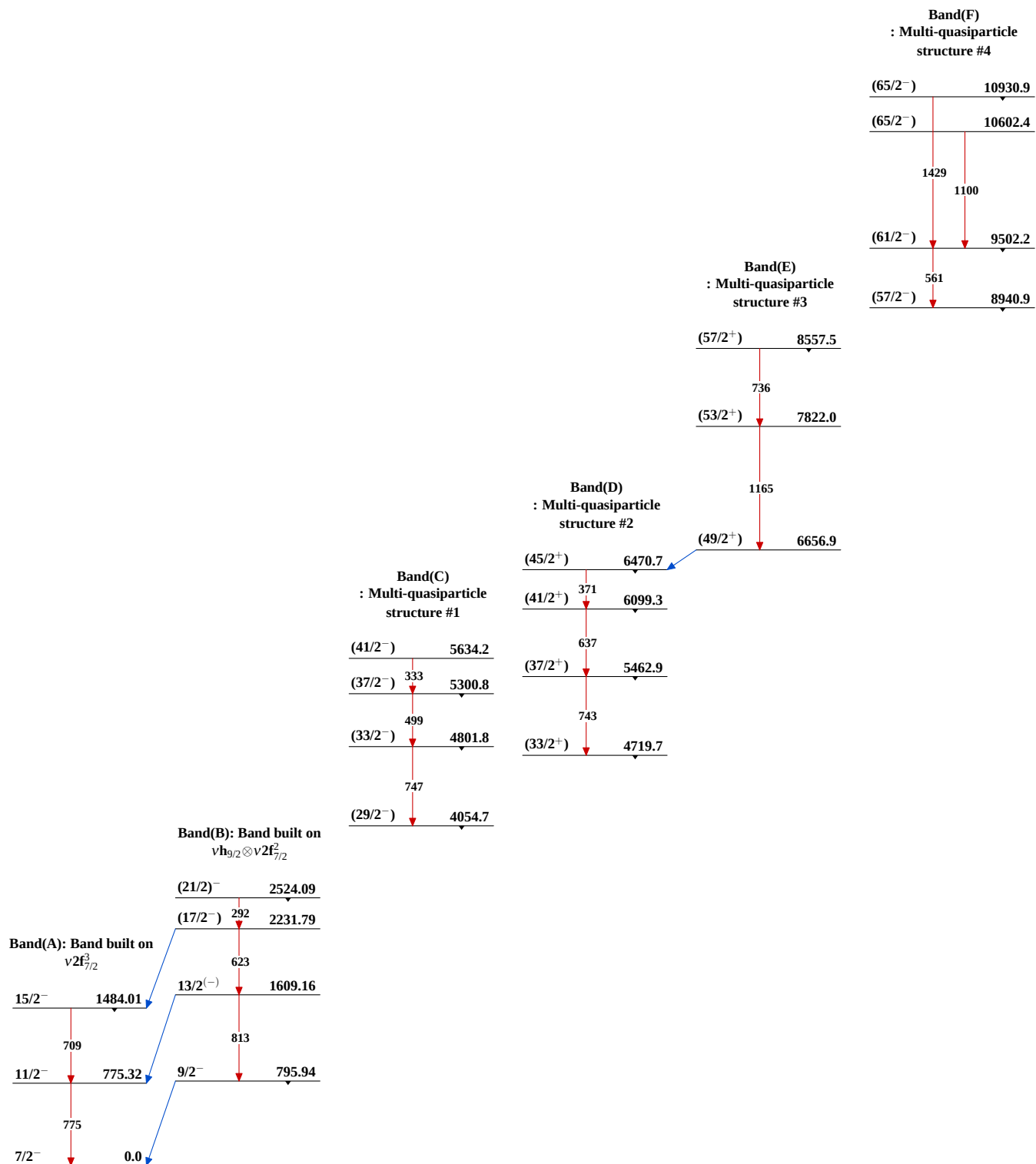
Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

-----► γ Decay (Uncertain)



Adopted Levels, Gammas



Adopted Levels, Gammas (continued)

		Band(I): SD-2 band; (π , α)=(+,-1/2)	
	(135/2 ⁺)	21275.0+x	
	(131/2 ⁺)	19654.7+x	1620
	(127/2 ⁺)	18090.7+x	1564
	(123/2 ⁺)	16584.0+x	1507
	(119/2 ⁺)	15133.4+x	1451
	(115/2 ⁺)	13738.6+x	1395
	(111/2 ⁺)	12398.9+x	1340
	(107/2 ⁺)	11113.1+x	1286
	(103/2 ⁺)	9880.6+x	1232
	(99/2 ⁺)	8699.7+x	1181
	(95/2 ⁺)	7569.3+x	1130
	(91/2 ⁺)	6488.0+x	1081
	(87/2 ⁺)	5455.0+x	1033
	(83/2 ⁺)	4468.1+x	987
	(79/2 ⁺)	3525.8+x	942
	(75/2 ⁺)	2624.8+x	901
	(71/2 ⁺)	1746.7+x	878
	(67/2 ⁺)	858.5+x	888
	(63/2 ⁺)	x	858
		Band(H): SD-1 band; (π , α)=(-,-1/2)	
	(135/2 ⁻)	35997.1	
	(131/2 ⁻)	34267.2	1730
	(127/2 ⁻)	32595.1	1672
	(123/2 ⁻)	30979.4	1616
	(119/2 ⁻)	29421.6	1558
	(115/2 ⁻)	27921.1	1500
	(111/2 ⁻)	26476.8	1444
	(107/2 ⁻)	25089.2	1388
	(103/2 ⁻)	23757.2	1332
	(99/2 ⁻)	22480.7	1276
	(95/2 ⁻)	21258.9	1222
	(91/2 ⁻)	20091.7	1167
	(87/2 ⁻)	18977.9	1114
	(83/2 ⁻)	17917.2	1061
	(79/2 ⁻)	16908.5	1009
	(75/2 ⁻)	15951.4	957
	(71/2 ⁻)	15044.7	907
	(67/2 ⁻)	14187.6	857
	(63/2 ⁻)	13379.5	808
	(59/2 ⁻)	12619.8	760
	(55/2 ⁻)	11908.0	712
	(51/2 ⁻)	11243.8	664
	(47/2 ⁻)	10626.0	618
		Band(G) : Multi-quasiparticle structure #5	
	(67/2 ⁺)	11200.3	
	(63/2 ⁺)	10362.4	838
	(59/2 ⁺)	9438.5	924

Adopted Levels, Gammas (continued)

			Band(K): SD-4 band; (π, α)=(+, -1/2)		
	J2+38			21860.7+z	
		1575			
	J2+36			20285.7+z	
		1529			
	J2+34			18757.1+z	
		1482			
	J2+32			17274.6+z	
		1435			
	J2+30			15839.7+z	
		1388			
	J2+28			14451.6+z	
		1342			
	J2+26			13110.0+z	
		1294			
	J2+24			11815.7+z	
		1247			
	J2+22			10568.7+z	
		1199			
	J2+20			9369.7+z	
		1152			
	J2+18			8218.2+z	
		1104			
	J2+16			7114.5+z	
		1056			
	J2+14			6058.3+z	
		1006			
	J2+12			5052.8+z	
		961			
	J2+10			4092.1+z	
		912			
	J2+8			3180.0+z	
		865			
	J2+6			2315.1+z	
		818			
	J2+4			1497.5+z	
		772			
	J2+2			725.6+z	
	J2≈(63/2 ⁺)	726			z
			Band(J): SD-3 band; (π, α)=(+, +1/2)		
J1+40				22818.2+y	
	1647				
J1+38				21170.8+y	
	1594				
J1+36				19576.4+y	
	1540				
J1+34				18036.2+y	
	1486				
J1+32				16550.6+y	
	1431				
J1+30				15119.7+y	
	1377				
J1+28				13742.9+y	
	1323				
J1+26				12420.0+y	
	1269				
J1+24				11151.2+y	
	1216				
J1+22				9935.7+y	
	1163				
J1+20				8772.5+y	
	1110				
J1+18				7662.4+y	
	1057				
J1+16				6605.7+y	
	1005				
J1+14				5600.8+y	
	953				
J1+12				4647.5+y	
	896				
J1+10				3751.5+y	
	854				
J1+8				2897.4+y	
	799				
J1+6				2098.2+y	
	749				
J1+4				1349.6+y	
	700				
J1+2				649.8+y	
J1≈(37/2 ⁺)	650				y

Adopted Levels, Gammas (continued)

Band(N): SD-7 band		
J5+34	20642.0+w	
J5+32	164119000.8+w	
J5+30	158617415.0+w	
J5+28	153315882.3+w	
J5+26	147814404.8+w	
J5+24	142312982.0+w	
J5+22	137011612.4+w	
J5+20	131610296.7+w	
J5+18	12629034.4+w	
J5+16	12097825.1+w	
J5+14	11576667.9+w	
J5+12	11055562.7+w	
J5+10	10504513.0+w	
J5+8	10043509.2+w	
J5+6	9522557.1+w	
J5+4	9021655.1+w	
J5+2	852802.9+w	
J5	803	w
Band(M): SD-6 band; (π, α)=(-, +1/2)		
J4+38	22155.7+v	
J4+36	168620469.7+v	
J4+34	162618843.7+v	
J4+32	156517278.5+v	
J4+30	150615772.5+v	
J4+28	144714325.9+v	
J4+26	138812937.5+v	
J4+24	132911608.6+v	
J4+22	127010338.1+v	
J4+20	12129126.1+v	
J4+18	11547971.8+v	
J4+16	10986874.3+v	
J4+14	10425832.3+v	
J4+12	9874845.2+v	
J4+10	9343911.7+v	
J4+8	8813030.7+v	
J4+6	8302200.9+v	
J4+4	7801420.7+v	
J4+2	728688.1+v	
J4≈(57/2 ⁻)	688	v
Band(L): SD-5 band; (π, α)=(-, -1/2)		
J3+32	18599.3+u	
J3+30	159517004.3+u	
J3+28	153515469.7+u	
J3+26	147613993.9+u	
J3+24	141712576.8+u	
J3+22	135811219.1+u	
J3+20	12999919.8+u	
J3+18	12418678.9+u	
J3+16	11837495.5+u	
J3+14	11266369.4+u	
J3+12	10705299.5+u	
J3+10	10164283.9+u	
J3+8	9603323.6+u	
J3+6	9082415.6+u	
J3+4	8551560.6+u	
J3+2	805755.7+u	
J3≈(63/2 ⁻)	756	u

Adopted Levels, Gammas (continued)

		Band(Q): SD-10 band	
	J8+32	18452.6+a	
	J8+30	1588 16864.4+a	
	J8+28	1532 15332.6+a	
	J8+26	1463 13869.3+a	
	J8+24	1407 12462.0+a	
	J8+22	1347 11115.2+a	
	J8+20	1288 9826.8+a	
	J8+18	1231 8595.5+a	
	J8+16	1173 7422.7+a	
	J8+14	1117 6305.6+a	
	J8+12	1063 5242.8+a	
	J8+10	1002 4240.3+a	
	J8+8	950 3290.1+a	
	J8+6	898 2391.6+a	
	J8+4	847 1544.3+a	
	J8+2	797 747.6+a	
	J8	748 a	
		Band(P): SD-9 band	
	J7+32	19346.7+t	
	J7+30	1614 17732.2+t	
	J7+28	1554 16178.3+t	
	J7+26	1495 14683.7+t	
	J7+24	1440 13243.4+t	
	J7+22	1376 11867.8+t	
	J7+20	1318 10549.4+t	
	J7+18	1260 9289.4+t	
	J7+16	1202 8087.0+t	
	J7+14	1146 6941.4+t	
	J7+12	1090 5851.5+t	
	J7+10	1038 4813.6+t	
	J7+8	1016 3797.2+t	
	J7+6	1026 2771.3+t	
	J7+4	973 1798.7+t	
	J7+2	925 874.1+t	
	J7	874 t	
		Band(O): SD-8 band	
	J6+30	18484.3+s	
	J6+28	1549 16934.9+s	
	J6+26	1513 15421.8+s	
	J6+24	1472 13949.5+s	
	J6+22	1430 12519.5+s	
	J6+20	1386 11133.3+s	
	J6+18	1338 9795.2+s	
	J6+16	1292 8503.3+s	
	J6+14	1243 7260.4+s	
	J6+12	1193 6067.1+s	
	J6+10	1142 4924.6+s	
	J6+8	1091 3833.6+s	
	J6+6	1038 2795.3+s	
	J6+4	986 1809.8+s	
	J6+2	932 877.8+s	
	J6	878 s	

Adopted Levels, Gammas (continued)

			Band(T): SD-13 band		
			J11+26	14941+d	
			J11+24	$^{1474}_{\downarrow}$	13467+d
			J11+22	$^{1418}_{\downarrow}$	12049+d
			J11+20	$^{1361}_{\downarrow}$	10688+d
			J11+18	$^{1307}_{\downarrow}$	9382+d
			J11+16	$^{1251}_{\downarrow}$	8131+d
			J11+14	$^{1195}_{\downarrow}$	6935.4+d
			J11+12	$^{1143}_{\downarrow}$	5792.5+d
			J11+10	$^{1091}_{\downarrow}$	4701.7+d
			J11+8	$^{1038}_{\downarrow}$	3663.7+d
			J11+6	$^{986}_{\downarrow}$	2677.2+d
			J11+4	$^{936}_{\downarrow}$	1741.5+d
			J11+2	$^{891}_{\downarrow}$	850.3+d
			J11	$^{850}_{\downarrow}$	d
			Band(S): SD-12 band		
			J10+32	19961+c	
			J10+30	$^{1639}_{\downarrow}$	18322+c
			J10+28	$^{1583}_{\downarrow}$	16739+c
			J10+26	$^{1526}_{\downarrow}$	15213.0+c
			J10+24	$^{1472}_{\downarrow}$	13741.3+c
			J10+22	$^{1420}_{\downarrow}$	12321.0+c
			J10+20	$^{1374}_{\downarrow}$	10947.1+c
			J10+18	$^{1327}_{\downarrow}$	9620.0+c
			J10+16	$^{1282}_{\downarrow}$	8337.5+c
			J10+14	$^{1234}_{\downarrow}$	7103.5+c
			J10+12	$^{1182}_{\downarrow}$	5921.9+c
			J10+10	$^{1126}_{\downarrow}$	4795.8+c
			J10+8	$^{1070}_{\downarrow}$	3726.2+c
			J10+6	$^{1013}_{\downarrow}$	2713.6+c
			J10+4	$^{956}_{\downarrow}$	1757.5+c
			J10+2	$^{902}_{\downarrow}$	855.1+c
			J10	$^{855}_{\downarrow}$	c
			Band(R): SD-11 band		
			J9+28	16586.6+b	
			J9+26	$^{1566}_{\downarrow}$	15020.6+b
			J9+24	$^{1508}_{\downarrow}$	13513.0+b
			J9+22	$^{1449}_{\downarrow}$	12064.0+b
			J9+20	$^{1390}_{\downarrow}$	10673.9+b
			J9+18	$^{1331}_{\downarrow}$	9343.3+b
			J9+16	$^{1270}_{\downarrow}$	8073.3+b
			J9+14	$^{1209}_{\downarrow}$	6864.0+b
			J9+12	$^{1148}_{\downarrow}$	5715.8+b
			J9+10	$^{1088}_{\downarrow}$	4627.3+b
			J9+8	$^{1030}_{\downarrow}$	3596.9+b
			J9+6	$^{975}_{\downarrow}$	2621.5+b
			J9+4	$^{924}_{\downarrow}$	1697.3+b
			J9+2	$^{870}_{\downarrow}$	827.6+b
			J9	$^{828}_{\downarrow}$	b

Adopted Levels, Gammas (continued)

Seq.(U): Sequence built
on $\nu f_{7/2}^3 \otimes (3^-$ in
 ^{148}Gd)

(21/2)⁺ 2401.37

661

(17/2)⁺ 1739.97

784

(13/2⁺) 955.98

82

11/2⁺ 873.51

$^{149}_{64}\text{Gd}_{85}$

^{149}Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Parent: ^{149}Tb : $E=0.0$; $J^\pi=1/2^+$; $T_{1/2}=4.12$ h 3; $Q(\varepsilon)=3639$ 4; $\%\varepsilon+\%\beta^+$ decay=83.3 17

^{149}Tb - J^π , $T_{1/2}$: From ^{149}Tb Adopted Levels.

^{149}Tb - $Q(\varepsilon)$: From 2021Wa16.

1978Ja14: ^{149}Tb sources were produced via $^{141}\text{Pr}(^{12}\text{C},4n)$ with 78 MeV ^{12}C beam from the LBNL 80-inch cyclotron for singles measurements and via spallation of tantalum with 800 MeV proton from the Clinton P. Anderson Meson Physics Facility (LAMPF) for more detailed singles and coincidence measurements. Measured E_γ , I_γ , $\gamma\gamma$ -coin with Ge(Li) detectors. Deduced levels, J , π , $\log ft$, conversion coefficients, γ -ray multipolarities. Systematics of neighboring isotones.

1972Vy08 (also 1972Vy09): measured γ , ce. 1972Vy09 report $\gamma\gamma$ data.

1992Tl02: $\gamma\gamma(\theta)$ (7 Ge(Li) detector system).

Others:

$\gamma\gamma(\theta)$: 1974Bu26 (Ge(Li)-NaI system).

$\gamma\gamma(\theta, H)$: 1977VaZJ, 1977GrZF.

$\gamma(\theta, t)$: 1985Fi06 (for 352 γ).

$\beta^+\gamma$ coin: 1968Wi21.

$\gamma(\theta, t)$: 1983Pr04.

ce data: 1987BaZB (also 1987BaYQ), 1968Wi21, 1967Ko09, 1964Da20.

γ data: 1975SpZU, 1973St22, 1968Wi21, 1964Da20 (also 1962St20, 1961St15), 1961Bo19, 1960St33, 1960Ab08, 1960To10, 1959To27.

$\gamma\gamma$: 1975SpZU, 1968Wi21.

$\gamma\gamma(t)$: 1969Ba64.

γ ce(t): 1971VaZV.

ce ce(t): 1969Ba64.

Q value measurement: 2001IzZY.

$T_{1/2}(^{149}\text{Tb})$: 1975SpZU, 1973St22, 1968St09, 1967Go32 (also 1967Ch28, 1965Gr28), 1965Br10, 1960To10, 1957Su23, 1953Ra02.

Production of ^{149}Tb : 1992Ca11, 1968St09, 1950Ra56.

Total decay energy deposit of 3026 keV 28 calculated by RADLIST code is in agreement with expected value of 3030 keV 62, indicating the completeness of the decay scheme.

 ^{149}Gd Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0	$7/2^-$	9.28 d 10	
164.987 15	$5/2^-$	1.7 [#] ns 1	$T_{1/2}$: other: 1.35 ns 30 (1969Ba64).
352.234 25	$3/2^-$	0.43 [#] ns 5	J^π : 5/2 ruled out from combined results of $\gamma\gamma(\theta)$ and ce data.
796.2 5	$9/2^-$		
817.100 18	$3/2^-$		J^π : 5/2 ruled out by combining results from $\gamma\gamma(\theta)$ and ce data.
1026.840 23	$3/2^+$		J^π : from consistency of results from $\gamma\gamma(\theta)$ and ce data.
1085.5 5	$(5/2^-, 7/2, 9/2^-)$		
1124.89 3	$1/2^+, 3/2^+, 5/2^+$		
1144.08 5	$(5/2)^+$		
1167.11 6	$(3/2^+)$		
1205.66 17	$(1/2)^-$		J^π : consistency of $\gamma\gamma(\theta)$ and ce data favors 1/2, but 3/2 is not completely ruled out.
1348.73 9	$(1/2^-, 3/2, 5/2^-)$		
1402.91 7	$(5/2^-)$		
1487.60 7	$(1/2, 3/2)^-$		
1544.13 5	$(3/2^-, 5/2^-)$		
1557.38 6	$(1/2^-, 3/2)$		
1597.29 11	$(1/2, 3/2, 5/2^-)$		
1614.05 6	$3/2^+$		
1655.19 6	$(3/2)^+$		
1750.59 9	$(3/2^-, 5/2^-)$		
1772.83 5	$(3/2^+, 1/2^+)$		
1844.31 7	$(1/2^-, 3/2, 5/2^-)$		

Continued on next page (footnotes at end of table)

¹⁴⁹Tb ε decay (4.12 h) **1978Ja14,1972Vy08,1992Tl02 (continued)**

¹⁴⁹Gd Levels (continued)

E(level) [†]	J ^{π‡}	E(level) [†]	J ^{π‡}	E(level) [†]	J ^{π‡}
1992.49 4	3/2 ⁻	2830.6 10	(1/2,3/2,5/2 ⁻)	3258.4 6	(1/2,3/2)
2088.47 9	(1/2 ⁻ ,3/2,5/2 ⁻)	2861.8 5	(1/2 ⁻ ,3/2)	3272.9 6	(1/2,3/2)
2126.6 7	(1/2 ⁻ ,3/2,5/2 ⁻)	2913.08 10	(1/2,3/2)	3294.9 10	(1/2,3/2)
2158.36 4	(3/2) ⁺	2918.2 7	(1/2 ⁻ ,3/2,5/2 ⁻)	3313.62 16	(3/2 ⁻)
2199.90 9	(1/2 ⁻ ,3/2,5/2 ⁻)	2922.7 3	(1/2,3/2)	3319.0 4	(1/2 ⁻ ,3/2)
2261.54 9	(3/2,1/2 ⁻)	2961.5 7	(1/2 ⁻ ,3/2,5/2 ⁻)	3340.6 6	(1/2 ⁺ ,3/2)
2300.72 6	(1/2 ⁻ ,3/2)	2977.72 19	(1/2 ⁻ ,3/2)	3365.23 19	(3/2)
2314.1 7	(1/2 ⁻ ,3/2,5/2 ⁻)	2999.64 7	(3/2)	3384.7 10	(1/2,3/2)
2482.74 19	(1/2 ⁺ ,3/2,5/2 ⁻)	3003.4 5	(1/2 ⁻ ,3/2)	3403.4 5	(1/2 ⁻ ,3/2)
2503.71 20	(1/2 ⁻ ,3/2,5/2 ⁻)	3021.06 18	(3/2)	3418.8 5	(1/2 ⁻ ,3/2)
2570.1 3	(1/2,3/2,5/2 ⁻)	3057.0 4	(1/2 ⁻ ,3/2)	3431.4 4	(1/2 ⁻ ,3/2)
2590.05 10	(1/2 ⁻ ,3/2)	3070.8 7	(1/2 ⁻ ,3/2)	3442.8 6	(1/2,3/2)
2599.31 9	(1/2 ⁻ ,3/2)	3079.8 3	(1/2,3/2)	3466.8 6	(1/2 ⁻ ,3/2)
2613.2 5	(1/2 ⁻ ,3/2)	3099.76 10	(1/2 ⁻ ,3/2)	3473.2 3	(1/2 ⁻ ,3/2)
2683.42 9	(1/2 ⁺ ,3/2)	3124.06 10	(1/2,3/2)	3486.2 5	(1/2,3/2)
2703.3 4	(1/2 ⁻ ,3/2,5/2 ⁻)	3149.4 6	(1/2,3/2)	3500.0 7	(1/2 ⁻ ,3/2)
2757.20 9	(1/2,3/2)	3175.59 15	(1/2 ⁻ ,3/2)	3516.2 4	(1/2,3/2)
2768.0 4	(1/2 ⁺ ,3/2,5/2 ⁻)	3201.4 4	(3/2,1/2 ⁻)	3535.1 4	(3/2 ⁺)
2808.6 5	(1/2,3/2,5/2 ⁻)	3206.43 23	(3/2)	3543.9 4	(1/2 ⁻ ,3/2)
2824.98 8	(1/2,3/2) ⁻	3231.2 3	(1/2 ⁻ ,3/2)		

[†] From a least-squares fit to γ-ray energies.

[‡] From the Adopted Levels.

From cey(t) (1971VaZV).

ε,β⁺ radiations

E(decay)	E(level)	Iε [‡]	Log ft	E(decay)	E(level)	Iε [‡]	Log ft	I(ε+β ⁺) ^{†‡}
(95 4)	3543.9	0.015 6	6.4 2	(515 4)	3124.06	0.181 21	7.21 6	
(104 4)	3535.1	0.055 11	6.0 1	(539 4)	3099.76	0.51 4	6.81 4	
(123 4)	3516.2	0.0224 5	6.59 5	(559 4)	3079.8	0.063 18	7.8 1	
(139 4)	3500.0	0.017 5	6.9 2	(568 4)	3070.8	0.043 10	7.9 1	
(153 4)	3486.2	0.027 7	6.8 1	(582 4)	3057.0	0.031 10	8.1 2	
(166 4)	3473.2	0.097 20	6.3 1	(618 4)	3021.06	0.34 4	7.11 6	
(172 4)	3466.8	0.026 8	6.9 2	(636 4)	3003.4	0.17 4	7.4 1	
(196 4)	3442.8	0.033 9	7.0 1	(639 4)	2999.64	1.25 6	6.58 3	
(208 4)	3431.4	0.041 10	6.9 1	(661 4)	2977.72	0.20 3	7.40 7	
(220 4)	3418.8	0.058 13	6.9 1	(678 4)	2961.5	0.047 12	8.1 1	
(236 4)	3403.4	0.110 18	6.7 1	(716 4)	2922.7	0.116 19	7.7 1	
(254 4)	3384.7	0.033 8	7.3 1	(721 4)	2918.2	0.057 20	8.0 2	
(274 4)	3365.23	0.277 24	6.41 5	(726 4)	2913.08	0.46 4	7.13 4	
(298 4)	3340.6	0.048 11	7.3 1	(777 4)	2861.8	0.13 3	7.7 1	
(320 4)	3319.0	0.080 20	7.1 1	(808 4)	2830.6	0.024 8	8.5 2	
(325 4)	3313.62	1.18 6	5.95 3	(814 4)	2824.98	1.18 5	6.83 2	
(344 4)	3294.9	0.028 8	7.6 1	(830 4)	2808.6	0.106 22	7.9 1	
(366 4)	3272.9	0.048 13	7.5 1	(871 4)	2768.0	0.045 12	8.3 1	
(381 4)	3258.4	0.047 11	7.5 1	(882 4)	2757.20	0.48 4	7.29 4	
(408 4)	3231.2	0.078 19	7.4 1	(936 4)	2703.3	0.088 21	8.1 1	
(433 4)	3206.43	0.25 4	6.91 7	(956 4)	2683.42	0.47 4	7.37 4	
(438 4)	3201.4	0.19 4	7.0 1	(1026 4)	2613.2	0.43 4	7.47 5	
(463 4)	3175.59	0.35 4	6.83 6	(1040 4)	2599.31	0.49 4	7.43 4	0.49 4
(490 4)	3149.4	0.064 13	7.6 1	(1049 4)	2590.05	0.35 5	7.58 7	0.35 5

Continued on next page (footnotes at end of table)

^{149}Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02 (continued) ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+ \ddagger$	$I\varepsilon \ddagger$	Log ft	$I(\varepsilon + \beta^+) \ddagger \ddagger$	Comments
(1069 4)	2570.1		0.106 20	8.1 1	0.106 20	
(1135 4)	2503.71		0.098 21	8.2 1	0.098 21	
(1156 4)	2482.74		0.22 4	7.9 1	0.22 4	
(1325 4)	2314.1		0.063 13	8.5 1	0.063 13	
(1338 4)	2300.72		1.16 6	7.28 3	1.16 6	
(1378 4)	2261.54		0.66 5	7.55 4	0.66 5	
(1439 4)	2199.90	0.00082 9	0.59 6	7.64 5	0.59 6	
(1481 4)	2158.36	0.0089 5	4.31 15	6.80 2	4.32 15	
(1512 4)	2126.6	0.00035 8	0.13 3	8.3 1	0.13 3	
(1551 4)	2088.47	0.00083 11	0.23 3	8.12 6	0.23 3	
(1647 4)	1992.49	0.059 3	8.4 3	6.61 2	8.5 3	
(1795 4)	1844.31	0.0080 6	0.52 4	7.89 4	0.53 4	
(1866 4)	1772.83	0.0305 16	1.44 7	7.49 3	1.47 7	
(1888 4)	1750.59	0.011 1	0.47 4	7.98 4	0.48 4	
(1984 4)	1655.19	0.0440 24	1.31 7	7.58 3	1.35 7	
(2025 4)	1614.05	0.027 3	0.69 7	7.88 5	0.72 7	
(2042 4)	1597.29	0.011 2	0.26 4	8.31 7	0.27 4	
(2082 4)	1557.38	0.052 3	1.10 7	7.70 3	1.15 7	
(2095 4)	1544.13	0.014 3	0.29 6	8.3 1	0.30 6	
(2151 4)	1487.60	0.049 4	0.83 7	7.85 4	0.88 7	
(2236 [#] 4)	1402.91					$I(\varepsilon + \beta^+) = -0.17$ 8 from γ -intensity balance is non-physical.
(2290 4)	1348.73	0.0159 19	0.183 21	8.56 6	0.199 23	
(2433 4)	1205.66	3.95 11	31.9 8	6.38 2	35.8 9	
(2472 [#] 4)	1167.11					$I(\varepsilon + \beta^+) = -0.12$ 8 from γ -intensity balance is non-physical.
(2495 [#] 4)	1144.08	0.032 10	0.23 7	8.5 2	0.26 8	$I(\varepsilon + \beta^+)$: almost no $\varepsilon + \beta^+$ feeding is expected from $1/2^+$ parent to $(5/2)^+$; apparent feeding of 0.26% 8 is probably due to missing γ transitions feeding this level.
(2514 [#] 4)	1124.89	<0.021	<0.14	>8.8	<0.16	
(2554 [#] 4)	1085.5	0.01 1	0.08 3	9.0 2	0.09 4	
(2612 4)	1026.840	0.74 3	4.02 15	7.34 2	4.76 18	
(2822 4)	817.100	1.0 1	3.8 3	7.43 4	4.8 4	
(3287 4)	352.234	0.68 11	1.22 20	8.1 1	1.90 31	
(3474 4)	164.987	0.35 12	1.4 5	9.7 ^{1u} 2	1.8 6	

[†] From γ +ce intensity balance at each level.[‡] Absolute intensity per 100 decays.[#] Existence of this branch is questionable.

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14](#),[1972Vy08](#),[1992Tl02](#) (continued) $\gamma(^{149}\text{Gd})$

I γ normalization: from $\Sigma I(\gamma+\text{ce})(\text{g.s.})=100$, assuming no g.s. feeding, as expected from 1/2⁺ parent to 7/2⁻ g.s.

E_γ ^{†}	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ^a	α^c	Comments
98.1 2	17 2	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	1026.840	3/2 ⁺	M1		2.127 32	%I γ =0.152 18 $\alpha(\text{K})_{\text{exp}}$ =3.3 17
117.2	2 1	1144.08	(5/2) ⁺	1026.840	3/2 ⁺	[M1+E2]		1.35 7	%I γ =0.018 9
164.98 2	2985 35	164.987	5/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.93 2	0.459 6	%I γ =26.7 6 $\alpha(\text{K})_{\text{exp}}$ =0.36 2; K/L=3.9 2; K/M=11.1 5; L/M=2.7 1 (1972Vy08) K/L=4.43 (1968Wi21); L1/L2=1.77 4; L1/L3=2.11 6 (1987BaZB) L1:L2:L3=135 15:70 10:54 7 (1972Vy08 , 1971GoZS) δ : from precise L-subshell ratios measured by 1987BaZB . Other: 0.93 4 using all the ce data, except seemingly discrepant K/M and L/M ratios from 1972Vy08 . Sign is from $\gamma\gamma(\theta)$ (1992Tl02 , 1974Bu26). Other: 0.82 2 (1972Vy08) from their measured K/L ratio.
187.22 2	487 6	352.234	3/2 ⁻	164.987	5/2 ⁻	M1+E2	+0.85 +19-16	0.316 8	%I γ =4.36 11 $\alpha(\text{K})_{\text{exp}}$ =0.27 1; K/L=5.4 3; L/M=3.1 4 (1972Vy08) K/L=3.1 4 (1968Wi21); K/L1=9.6 (1971GoZS); K/L=2.9 (1971GoZS) δ : from ce and $\gamma\gamma(\theta)$ data, with the sign from $\gamma\gamma(\theta)$ in 1992Tl02 . (187 γ)(165 γ)(θ): A_2 =-0.485 22, A_4 =+0.06 5 (1992Tl02). (187 γ)(165 γ)(θ): A_2 =-0.22 3, A_4 =-0.05 6 (1974Bu26). (187 γ)(165 γ)(θ): A_2 =-0.396 16, A_4 =0.00 4 (quoted by 1992Tl02 from a Ph.D. thesis by I. Kholbaev from JINR, Dubna (1977)).
219.7	1.2 6	1992.49	3/2 ⁻	1772.83	(3/2 ⁺ , 1/2 ⁺)	[E1]		0.0355 5	%I γ =0.011 6
252.3 1	10 2	1655.19	(3/2) ⁺	1402.91	(5/2 ⁻)	[E1]		0.02475 35	%I γ =0.089 18
289.3 3	8 2	1085.5	(5/2 ⁻ , 7/2, 9/2 ⁻)	796.2	9/2 ⁻	D		0.061 44	%I γ =0.072 18
307.79 7	30 2	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	817.100	3/2 ⁻	[E1]		0.01494 21	%I γ =0.268 19
317.4	7 2	1402.91	(5/2 ⁻)	1085.5	(5/2 ⁻ , 7/2, 9/2 ⁻)				%I γ =0.063 18
321.9	2 1	1348.73	(1/2 ⁻ , 3/2, 5/2 ⁻)	1026.840	3/2 ⁺	[D,E2]		0.046 33	%I γ =0.018 9
347.7	15 ^{‡} 2	1750.59	(3/2 ⁻ , 5/2 ⁻)	1402.91	(5/2 ⁻)	[D,E2]		0.038 27	%I γ =0.134 18

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ^a	α^c	Comments
352.24 2	3333 10	352.234	3/2 ⁻	0.0	7/2 ⁻	E2		0.0371 5	%I γ =29.8 7 $\alpha(\text{K})_{\text{exp}}$ =0.0292; K/L=4.3 2; L/M=3.4 5 (1972Vy08)
378.5 1	14 2	1992.49	3/2 ⁻	1614.05	3/2 ⁺	[E1]		0.00900 13	%I γ =0.125 18
388.57 2	2080 15	1205.66	(1/2) ⁻	817.100	3/2 ⁻	M1+E2	-0.21 9	0.0475 11	%I γ =18.6 5 $\alpha(\text{K})_{\text{exp}}$ =0.044 4; K/L=6.8 4; L/M=3.2 8 (1972Vy08) δ : average of δ =-0.31 9 from (389 γ)(817 γ)(θ) and -0.12 4 for (389 γ)(652 γ)(θ) (1992Tl02). For J=3/2, δ =+0.21 11 and +0.49 8 (1992Tl02). Other: $\delta(\text{E2/M1})$ <0.6 from ce data. (389 γ)(165 γ)(θ): A ₂ =-0.026 25, A ₄ =+0.04 5 (1992Tl02). (389 γ)(165 γ)(θ): A ₂ =-0.12 3, A ₄ =-0.09 7 (1974Bu26). (389 γ)(352 γ)(θ): A ₂ =+0.01 3, A ₄ =+0.03 6 (1992Tl02). (389 γ)(465 γ)(θ): A ₂ =-0.09 4, A ₄ =-0.03 7 (1992Tl02). (389 γ)(652 γ)(θ): A ₂ =-0.10 3, A ₄ =+0.00 4 (1992Tl02). (389 γ)(652 γ)(θ): A ₂ =-0.19 3, A ₄ =-0.04 7 (1974Bu26). (389 γ)(817 γ)(θ): A ₂ =+0.010 23, A ₄ =-0.01 5 (1992Tl02). (389 γ)(817 γ)(θ): A ₂ =-0.10 5, A ₄ =+0.05 9 (1974Bu26).
390.3	13 3	1557.38	(1/2 ⁻ ,3/2)	1167.11	(3/2 ⁺)	[D,E2]		0.028 20	%I γ =0.12 3
413.3 1	14 1	1557.38	(1/2 ⁻ ,3/2)	1144.08	(5/2) ⁺	[D,E2]		0.024 17	%I γ =0.125 10
432.5 2	8 2	1557.38	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺	[D,E2]		0.022 15	%I γ =0.072 18
446.7 6	3 2	1614.05	3/2 ⁺	1167.11	(3/2 ⁺)				%I γ =0.027 18
448.5	5 [#] 1	1992.49	3/2 ⁻	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I γ =0.045 9
449.6	7 [#] 2	1655.19	(3/2) ⁺	1205.66	(1/2) ⁻				%I γ =0.063 18
464.85 2	640 9	817.100	3/2 ⁻	352.234	3/2 ⁻	M1(+E2)	-0.10 14	0.0303 7	%I γ =5.73 15 $\alpha(\text{K})_{\text{exp}}$ =0.026 2; K/L=7.0 4; L/M=3.9 15 (1972Vy08) δ : from (465 γ)(352 γ)(θ) (1992Tl02). Others: (465 γ)(187 γ)(θ) (1992Tl02) gives δ =+0.03 13; ce data give $\delta(\text{E2/M1})$ <0.5. (465 γ)(165 γ)(θ): A ₂ =+0.14 12, A ₄ =-0.08 21 (1992Tl02). (465 γ)(187 γ)(θ): A ₂ =-0.22 10, A ₄ =+0.00 18

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)

γ(¹⁴⁹Gd) (continued)

<u>E_γ[†]</u>	<u>I_γ^{†b}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.&</u>	<u>δ^a</u>	<u>α^c</u>	<u>Comments</u>
									(1992Tl02).
									(465γ)(352γ)(θ): A ₂ =+0.08 3, A ₄ =+0.05 5 (1992Tl02).
469.9	1.0 6	1614.05	3/2 ⁺	1144.08	(5/2) ⁺				%Iγ=0.009 6
472.4 1	26 4	1597.29	(1/2,3/2,5/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺	[D,E2]		0.017 12	%Iγ=0.23 4
488.1 2	10 2	1655.19	(3/2) ⁺	1167.11	(3/2 ⁺)				%Iγ=0.089 18
544.3	3 1	2158.36	(3/2) ⁺	1614.05	3/2 ⁺				%Iγ=0.027 9
^x 570.5	1.8								%Iγ=0.0161 4
									E _γ : this γ ray was attributed to the decay of a 1557.4 level (1978Ja14); however, there is no level reported near 986.9 implied by this placement.
587.2	6 2	1614.05	3/2 ⁺	1026.840	3/2 ⁺				%Iγ=0.054 18
606.7	2 1	1402.91	(5/2 ⁻)	796.2	9/2 ⁻				%Iγ=0.018 9
614.2 1	19 2	2158.36	(3/2) ⁺	1544.13	(3/2 ⁻ ,5/2 ⁻)				%Iγ=0.170 19
620.7	8 2	2613.2	(1/2 ⁻ ,3/2)	1992.49	3/2 ⁻				%Iγ=0.072 18
625.7 3	2 2	1750.59	(3/2 ⁻ ,5/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%Iγ=0.018 18
628.4 2	9 2	1655.19	(3/2) ⁺	1026.840	3/2 ⁺				%Iγ=0.081 18
648.0 1	69 6	1772.83	(3/2 ⁺ ,1/2 ⁺)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%Iγ=0.62 6
652.12 2	1840 25	817.100	3/2 ⁻	164.987	5/2 ⁻	M1+E2	-0.57 5	0.01154 25	%Iγ=16.5 4
									α(K)exp=0.0085 10; K/L=7.8 11; L/M=2.9 11 (1972Vy08)
									δ: from (652γ)(165γ)(θ): A ₂ =+0.27 3, A ₄ =+0.01 5 (1992Tl02). Other: δ(E2/M1)=0.9 +7-4 from ce data.
									(652γ)(165γ)(θ): A ₂ =+0.20 2, A ₄ =-0.02 4 (1974Bu26).
670.4	7 [#] 2	1487.60	(1/2,3/2) ⁻	817.100	3/2 ⁻				%Iγ=0.063 18
670.8	9 [#] 2	2158.36	(3/2) ⁺	1487.60	(1/2,3/2) ⁻				%Iγ=0.081 18
674.61 6	77 2	1026.840	3/2 ⁺	352.234	3/2 ⁻	E1		2.47×10 ⁻³ 4	%Iγ=0.689 23
									α(K)exp<0.0038
									Mult.: α(K)exp gives δ(M2/E1)<0.25.
677.2 1	20 2	1844.31	(1/2 ⁻ ,3/2,5/2 ⁻)	1167.11	(3/2 ⁺)				%Iγ=0.179 19
685.6	2.2 8	2088.47	(1/2 ⁻ ,3/2,5/2 ⁻)	1402.91	(5/2 ⁻)				%Iγ=0.020 8
686.66 8	22 2	2300.72	(1/2 ⁻ ,3/2)	1614.05	3/2 ⁺				%Iγ=0.197 19
723.7	8 [#] 2	2126.6	(1/2 ⁻ ,3/2,5/2 ⁻)	1402.91	(5/2 ⁻)				%Iγ=0.072 18
723.8	12 [#] 2	1750.59	(3/2 ⁻ ,5/2 ⁻)	1026.840	3/2 ⁺				%Iγ=0.107 18

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)

γ(¹⁴⁹Gd) (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.&	δ^a	α^c	Comments
740.2 1	45 2	1557.38	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%Iγ=0.403 20
746.0 1	34 2	1772.83	(3/2 ⁺ ,1/2 ⁺)	1026.840	3/2 ⁺				%Iγ=0.304 19
772.65 3	182 4	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺	352.234	3/2 ⁻	E1		1.87×10 ⁻³ 3	%Iγ=1.63 5 α(K)exp<0.0016
774.0	1.8 9	2261.54	(3/2,1/2 ⁻)	1487.60	(1/2,3/2) ⁻				%Iγ=0.016 8
780.2	2.4 6	1597.29	(1/2,3/2,5/2 ⁻)	817.100	3/2 ⁻				%Iγ=0.021 6
786.8 1	15 1	1992.49	3/2 ⁻	1205.66	(1/2) ⁻				%Iγ=0.134 10
791.8	7 3	1144.08	(5/2) ⁺	352.234	3/2 ⁻				%Iγ=0.06 3
796.2	11 3	796.2	9/2 ⁻	0.0	7/2 ⁻	(M1+E2)	+0.18 2	0.00783 11	%Iγ=0.10 3 Mult.,δ: from the Adopted Gammas.
796.9	2 [#] 1	1614.05	3/2 ⁺	817.100	3/2 ⁻				%Iγ=0.018 9
797.0	2 [#] 1	2199.90	(1/2 ⁻ ,3/2,5/2 ⁻)	1402.91	(5/2 ⁻)				%Iγ=0.018 9
817.1 2	1313@ 20	817.100	3/2 ⁻	0.0	7/2 ⁻	E2		0.00425 6	%Iγ=11.8 3 α(K)exp=0.0035 5 Mult.: α(K)exp gives δ(E2/M1)>4.
817.5	7 [#] 2	1844.31	(1/2 ⁻ ,3/2,5/2 ⁻)	1026.840	3/2 ⁺				%Iγ=0.063 18
825.4	7 2	1992.49	3/2 ⁻	1167.11	(3/2 ⁺)				%Iγ=0.063 18
838.1 2	8 1	1655.19	(3/2) ⁺	817.100	3/2 ⁻				%Iγ=0.072 9
853.43 1	1750 25	1205.66	(1/2) ⁻	352.234	3/2 ⁻	E2+M1	-8 +6-23	0.0039 5	%Iγ=15.7 4 α(K)exp=0.0031 2 δ: for J=1/2, from (853γ)(187γ)(θ) (1992Tl02). J=3/2 gives δ=-2.0 8. Small values of δ given by γγ(θ) are ruled out by α(K)exp value, as α(K)exp gives E2. (853γ)(165γ)(θ): A ₂ =+0.31 8, A ₄ =+0.34 16 (1992Tl02). (853γ)(187γ)(θ): A ₂ =-0.43 5, A ₄ =+0.00 10 (1992Tl02). (853γ)(352γ)(θ): A ₂ =+0.101 21, A ₄ =-0.02 4 (1992Tl02). (853γ)(352γ)(θ): A ₂ =+0.07 3, A ₄ =-0.05 6 (1974Bu26). %Iγ=0.072 18
858.6	8 2	2261.54	(3/2,1/2 ⁻)	1402.91	(5/2 ⁻)				%Iγ=7.60 19
861.86 2	849 12	1026.840	3/2 ⁺	164.987	5/2 ⁻	E1(+M2)	-0.05 6	0.00155 15	α(K)exp=0.0009 2 δ: from (862γ)(165γ)(θ): A ₂ =-0.13 4, A ₄ =+0.18 11 (1992Tl02). (862γ)(165γ)(θ): A ₂ =-0.11 3, A ₄ =-0.03 7 (1974Bu26). %Iγ=0.040 8
867.6	4.5 9	1992.49	3/2 ⁻	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%Iγ=0.027 9
920.5	3 1	1085.5	(5/2 ⁻ ,7/2,9/2 ⁻)	164.987	5/2 ⁻				%Iγ=0.045 18
944.4 2	5 2	2088.47	(1/2 ⁻ ,3/2,5/2 ⁻)	1144.08	(5/2) ⁺				

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)γ(¹⁴⁹Gd) (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	α^c	Comments
952.7 1	18 2	2158.36	(3/2) ⁺	1205.66	(1/2) ⁻			%I _γ =0.161 19
955.71 5	53 3	1772.83	(3/2 ⁺ , 1/2 ⁺)	817.100	3/2 ⁻	(E1)	1.24×10 ⁻³ 2	%I _γ =0.47 3 α(K)exp=0.0018 7 Mult.: α(K)exp favors E1 over E2.
963.6	4 2	2088.47	(1/2 ⁻ , 3/2, 5/2 ⁻)	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			%I _γ =0.036 18
965.63 5	60 3	1992.49	3/2 ⁻	1026.840	3/2 ⁺			%I _γ =0.54 3 α(K)exp=0.0024 8 Mult.: α(K)exp gives E2(+M1), δ<1.5 but ΔJ ^π requires E1.
979.09 6	56 3	1144.08	(5/2) ⁺	164.987	5/2 ⁻	E1	1.18×10 ⁻³ 2	%I _γ =0.50 3 α(K)exp<0.0017
994.3	4 1	2199.90	(1/2 ⁻ , 3/2, 5/2 ⁻)	1205.66	(1/2) ⁻			%I _γ =0.036 9
996.5 1	14 1	1348.73	(1/2 ⁻ , 3/2, 5/2 ⁻)	352.234	3/2 ⁻			%I _γ =0.125 10
1001.7 ^d	≤3 [#]	2126.6	(1/2 ⁻ , 3/2, 5/2 ⁻)	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			%I _γ ≤0.027
1002.1	32 [#] 2	1167.11	(3/2 ⁺)	164.987	5/2 ⁻			%I _γ =0.286 19
1027.2 2	2 1	1844.31	(1/2 ⁻ , 3/2, 5/2 ⁻)	817.100	3/2 ⁻			%I _γ =0.018 9
1032.8	10 [#] 3	2199.90	(1/2 ⁻ , 3/2, 5/2 ⁻)	1167.11	(3/2 ⁺)			%I _γ =0.09 3
1033.4	28 [#] 5	2158.36	(3/2) ⁺	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺	(M1)	0.00423 6	%I _γ =0.25 5 α(K)exp=0.0058 12 Mult.: α(K)exp gives M1 or M2+E3. The conversion electron line is unresolved from that of another γ, but probably dominated by this transition.
1040.65 4	165 5	1205.66	(1/2) ⁻	164.987	5/2 ⁻	(E2)	2.53×10 ⁻³ 4	%I _γ =1.48 6 α(K)exp=0.0026 3 Mult.: α(K)exp gives E2+M1 with δ(E2/M1)=1.5 +14-5, but ΔJ ^π requires E2.
1045.9	4 2	2590.05	(1/2 ⁻ , 3/2)	1544.13	(3/2 ⁻ , 5/2 ⁻)			%I _γ =0.036 18
1055.1	3 [#] 1	2599.31	(1/2 ⁻ , 3/2)	1544.13	(3/2 ⁻ , 5/2 ⁻)			%I _γ =0.027 9
1055.8	14 [#] 4	2199.90	(1/2 ⁻ , 3/2, 5/2 ⁻)	1144.08	(5/2) ⁺			%I _γ =0.13 4
1061.6 1	7 1	2088.47	(1/2 ⁻ , 3/2, 5/2 ⁻)	1026.840	3/2 ⁺			%I _γ =0.063 9
1069.6	3 1	2683.42	(1/2 ⁺ , 3/2)	1614.05	3/2 ⁺			%I _γ =0.027 9
1075.0 1	8 1	2199.90	(1/2 ⁻ , 3/2, 5/2 ⁻)	1124.89	1/2 ⁺ , 3/2 ⁺ , 5/2 ⁺			%I _γ =0.072 9
1085.5	6 3	1085.5	(5/2 ⁻ , 7/2, 9/2 ⁻)	0.0	7/2 ⁻			%I _γ =0.05 3
1094.3 3	3 1	2261.54	(3/2, 1/2 ⁻)	1167.11	(3/2 ⁺)			%I _γ =0.027 9
1102.5	3 1	2590.05	(1/2 ⁻ , 3/2)	1487.60	(1/2, 3/2) ⁻			%I _γ =0.027 9
1111.7	1.6 8	2599.31	(1/2 ⁻ , 3/2)	1487.60	(1/2, 3/2) ⁻			%I _γ =0.014 8
1117.5	12 2	2261.54	(3/2, 1/2 ⁻)	1144.08	(5/2) ⁺			%I _γ =0.107 18
1131.65 7	89 3	2158.36	(3/2) ⁺	1026.840	3/2 ⁺	(M1)	0.00341 5	%I _γ =0.80 4 α(K)exp=0.0049 Mult.: α(K)exp gives M1 or M2+E3.

¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02 (continued)γ(¹⁴⁹Gd) (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	δ^a	α^c	Comments
1135.3 1	134 4	1487.60	(1/2,3/2) ⁻	352.234	3/2 ⁻	M1(+E2)	<0.7	0.00317 21	%I _γ =1.20 5 α(K)exp=0.0039 13
1136.6	3 2	2261.54	(3/2,1/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.027 18
1139.5	4 1	2683.42	(1/2 ⁺ ,3/2)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I _γ =0.036 9
1144.09 9	33 3	1144.08	(5/2) ⁺	0.0	7/2 ⁻	D,E2		0.0021 12	%I _γ =0.30 3 α(K)exp<0.0029
									Mult.: α(K)exp gives M1,E2 or E1.
1167.10 7	55 3	1167.11	(3/2 ⁺)	0.0	7/2 ⁻	(M2)		0.00762 11	%I _γ =0.49 3 α(K)exp=0.0069 23
									Mult.: α(K)exp gives δ(E3/M2)<0.7.
1175.4	370 [#] 15	1992.49	3/2 ⁻	817.100	3/2 ⁻	M1		0.00312 4	%I _γ =3.31 15 α(K)exp=0.0030 3
									Mult.: from α(K)exp; ce(K) contains some contribution from another transition (2300 level to 1124 level).
1175.8	21 [#] 4	2300.72	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.19 4
1183.7 2	8 2	1348.73	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻				%I _γ =0.072 18
1187.1	5 3	2590.05	(1/2 ⁻ ,3/2)	1402.91	(5/2 ⁻)				%I _γ =0.04 3
1191.89 8	42 3	1544.13	(3/2 ⁻ ,5/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.38 3
1205.20 8	43 4	1557.38	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻				%I _γ =0.38 4
1205.6 ^d	≤2	1205.66	(1/2) ⁻	0.0	7/2 ⁻				%I _γ ≤0.018
1234.7 2	7.5 13	2261.54	(3/2,1/2 ⁻)	1026.840	3/2 ⁺				%I _γ =0.067 12
1245.1	3 1	1597.29	(1/2,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.027 9
1261.7 2	13 2	1614.05	3/2 ⁺	352.234	3/2 ⁻				%I _γ =0.116 18
1269.7	1.6 9	2757.20	(1/2,3/2)	1487.60	(1/2,3/2) ⁻				%I _γ =0.014 8
1273.9	1.6 8	2300.72	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I _γ =0.014 8
1277.0	4 2	2482.74	(1/2 ⁺ ,3/2,5/2 ⁻)	1205.66	(1/2) ⁻				%I _γ =0.036 18
1280.8 1	10 1	2824.98	(1/2,3/2) ⁻	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I _γ =0.089 10
1302.92 8	91 3	1655.19	(3/2) ⁺	352.234	3/2 ⁻	E1		0.000777 11	%I _γ =0.81 4 α(K)exp<0.00107
1320.9	1.3 6	2808.6	(1/2,3/2,5/2 ⁻)	1487.60	(1/2,3/2) ⁻				%I _γ =0.012 6
1322.7 1	10 1	1487.60	(1/2,3/2) ⁻	164.987	5/2 ⁻				%I _γ =0.089 10
1337.5	2.2 8	2824.98	(1/2,3/2) ⁻	1487.60	(1/2,3/2) ⁻				%I _γ =0.020 8
1338.6	5 2	2482.74	(1/2 ⁺ ,3/2,5/2 ⁻)	1144.08	(5/2) ⁺				%I _γ =0.045 18
1341.19 6	260 10	2158.36	(3/2) ⁺	817.100	3/2 ⁻	E1		0.000765 11	%I _γ =2.33 10 α(K)exp=0.00074 30
1344.5	2 1	2999.64	(3/2)	1655.19	(3/2) ⁺				%I _γ =0.018 9
1357.8	1.3 8	2482.74	(1/2 ⁺ ,3/2,5/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.012 8
1363.8	2.8 7	2570.1	(1/2,3/2,5/2 ⁻)	1205.66	(1/2) ⁻				%I _γ =0.025 7
1366.0	2 1	3021.06	(3/2)	1655.19	(3/2) ⁺				%I _γ =0.018 9
1368.9	5 1	2913.08	(1/2,3/2)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I _γ =0.045 9
1379.1 1	42 2	1544.13	(3/2 ⁻ ,5/2 ⁻)	164.987	5/2 ⁻				%I _γ =0.376 20
1384.4	2 1	2590.05	(1/2 ⁻ ,3/2)	1205.66	(1/2) ⁻				%I _γ =0.018 9

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)γ(¹⁴⁹Gd) (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ^a	α^c	Comments
1392.3 3	6 2	1557.38	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻				%I γ =0.054 18
1398.3 3	6 2	1750.59	(3/2 ⁻ ,5/2 ⁻)	352.234	3/2 ⁻				%I γ =0.054 18
1402.4	1.0 5	2570.1	(1/2,3/2,5/2 ⁻)	1167.11	(3/2 ⁺)				%I γ =0.009 5
1402.4	0.9 5	2999.64	(3/2)	1597.29	(1/2,3/2,5/2 ⁻)				%I γ =0.008 5
1402.91 9	49 3	1402.91	(5/2 ⁻)	0.0	7/2 ⁻				%I γ =0.44 3
1420.6 1	10 1	1772.83	(3/2 ⁺ ,1/2 ⁺)	352.234	3/2 ⁻				%I γ =0.089 10
1422.1	5 2	2824.98	(1/2,3/2) ⁻	1402.91	(5/2 ⁻)				%I γ =0.045 18
1425.6 3	7 2	2913.08	(1/2,3/2)	1487.60	(1/2,3/2) ⁻				%I γ =0.063 18
1444.4	9 2	2261.54	(3/2,1/2 ⁻)	817.100	3/2 ⁻				%I γ =0.081 18
1449.10 8	106 4	1614.05	3/2 ⁺	164.987	5/2 ⁻	E1		0.000753 11	%I γ =0.95 4 $\alpha(K)\text{exp}<0.0009$
1465.1	1.2 7	2590.05	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.011 7
1474.3	2 1	2599.31	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.018 9
1477.7 2	8 2	2683.42	(1/2 ⁺ ,3/2)	1205.66	(1/2) ⁻				%I γ =0.072 18
1483.6 1	27 3	2300.72	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%I γ =0.24 3
1488.3	7 2	2613.2	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.063 18
1490.3 2	20 3	1655.19	(3/2) ⁺	164.987	5/2 ⁻				%I γ =0.18 3
1492.2 3	12 2	1844.31	(1/2 ⁻ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I γ =0.107 18
1497.0	4 1	2314.1	(1/2 ⁻ ,3/2,5/2 ⁻)	817.100	3/2 ⁻				%I γ =0.036 9
1497.6	1.8 7	2703.3	(1/2 ⁻ ,3/2,5/2 ⁻)	1205.66	(1/2) ⁻				%I γ =0.016 7
1512.1 2	9 2	2999.64	(3/2)	1487.60	(1/2,3/2) ⁻				%I γ =0.081 18
1515.3	4 2	2918.2	(1/2 ⁻ ,3/2,5/2 ⁻)	1402.91	(5/2 ⁻)				%I γ =0.036 18
1536.2	3 1	2703.3	(1/2 ⁻ ,3/2,5/2 ⁻)	1167.11	(3/2 ⁺)				%I γ =0.027 9
1539.6 4	6 2	2683.42	(1/2 ⁺ ,3/2)	1144.08	(5/2) ⁺				%I γ =0.054 18
1543.4 3	8 2	2570.1	(1/2,3/2,5/2 ⁻)	1026.840	3/2 ⁺				%I γ =0.072 18
1544.1 2	9 2	1544.13	(3/2 ⁻ ,5/2 ⁻)	0.0	7/2 ⁻				%I γ =0.081 18
1558.5 1	11 2	2683.42	(1/2 ⁺ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.098 18
1563.2	1.4 8	2590.05	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.013 8
1572.4	1.5 8	2599.31	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.013 8
1574.8	6 2	2977.72	(1/2 ⁻ ,3/2)	1402.91	(5/2 ⁻)				%I γ =0.054 18
1585.6 1	19 1	1750.59	(3/2 ⁻ ,5/2 ⁻)	164.987	5/2 ⁻				%I γ =0.170 10
1586.4	4 1	2613.2	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.036 9
1592.4	5 2	3206.43	(3/2)	1614.05	3/2 ⁺				%I γ =0.045 18
1623.8	2.0 9	2768.0	(1/2 ⁺ ,3/2,5/2 ⁻)	1144.08	(5/2) ⁺				%I γ =0.018 8
1632.3	3 1	2757.20	(1/2,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.027 9
1640.26 6	360 10	1992.49	3/2 ⁻	352.234	3/2 ⁻	E2(+M1)	>1	0.00127 11	%I γ =3.22 11 $\alpha(K)\text{exp}=0.00095 10$
1641.3	1.6 8	2808.6	(1/2,3/2,5/2 ⁻)	1167.11	(3/2 ⁺)				%I γ =0.014 8
1651.0	0.8 5	2999.64	(3/2)	1348.73	(1/2 ⁻ ,3/2,5/2 ⁻)				%I γ =0.007 5
1656.2	2 [#] 1	2861.8	(1/2 ⁻ ,3/2)	1205.66	(1/2) ⁻				%I γ =0.018 9
1656.8	21 [#] 2	2683.42	(1/2 ⁺ ,3/2)	1026.840	3/2 ⁺				%I γ =0.188 19
1657.3	2.4 [#] 9	3201.4	(3/2,1/2 ⁻)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I γ =0.021 8
1662.3	2 1	3206.43	(3/2)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I γ =0.018 9

γ(¹⁴⁹Gd) (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^{&}	δ^a	α^c	Comments
1679.3 1	18 2	1844.31	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻				%I _γ =0.161 19
1694.7	3 2	2861.8	(1/2 ⁻ ,3/2)	1167.11	(3/2 ⁺)				%I _γ =0.027 18
1699.5	3 1	3313.62	(3/2 ⁻)	1614.05	3/2 ⁺				%I _γ =0.027 9
1707.5 3	3 1	2913.08	(1/2,3/2)	1205.66	(1/2) ⁻				%I _γ =0.027 9
1718.9	1.0 6	3206.43	(3/2)	1487.60	(1/2,3/2) ⁻				%I _γ =0.009 6
1730.4	2.5	2757.20	(1/2,3/2)	1026.840	3/2 ⁺				%I _γ =0.0224 5
1736.3 2	6.5 9	2088.47	(1/2 ⁻ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.058 9
1751.0 ^d 4	4 2	1750.59	(3/2 ⁻ ,5/2 ⁻)	0.0	7/2 ⁻				%I _γ =0.036 18
1755.6	2.3 2	2922.7	(1/2,3/2)	1167.11	(3/2 ⁺)				%I _γ =0.0206 19
1755.8	2.3 9	2961.5	(1/2 ⁻ ,3/2,5/2 ⁻)	1205.66	(1/2) ⁻				%I _γ =0.021 8
1769.4	2 1	3313.62	(3/2 ⁻)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I _γ =0.018 9
1772.7	2 [#] 1	3175.59	(1/2 ⁻ ,3/2)	1402.91	(5/2 ⁻)				%I _γ =0.018 9
1772.8 ^d	2 [@] 2	1772.83	(3/2 ⁺ ,1/2 ⁺)	0.0	7/2 ⁻				%I _γ =0.018 18
1772.9	6 [#] 2	2590.05	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%I _γ =0.054 18
1774.4	6 2	2126.6	(1/2 ⁻ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.054 18
1782.2 1	25 2	2599.31	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%I _γ =0.224 19
1788.1	3 1	2913.08	(1/2,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.027 9
1794.1	1.7 8	2999.64	(3/2)	1205.66	(1/2) ⁻				%I _γ =0.015 8
1797.8	2 1	3003.4	(1/2 ⁻ ,3/2)	1205.66	(1/2) ⁻				%I _γ =0.018 9
1798.2	16 [#] 2	2824.98	(1/2,3/2) ⁻	1026.840	3/2 ⁺				%I _γ =0.143 19
1798.5	3 [#] 2	3201.4	(3/2,1/2 ⁻)	1402.91	(5/2 ⁻)				%I _γ =0.027 18
1803.5	1.7 9	3206.43	(3/2)	1402.91	(5/2 ⁻)				%I _γ =0.015 8
1806.0 1	50 3	2158.36	(3/2) ⁺	352.234	3/2 ⁻				%I _γ =0.45 3
1810.6 2	7 1	2977.72	(1/2 ⁻ ,3/2)	1167.11	(3/2 ⁺)				%I _γ =0.063 9
1826.0	9 [#] 2	3313.62	(3/2 ⁻)	1487.60	(1/2,3/2) ⁻				%I _γ =0.081 18
1826.9	1.0 [#] 4	3175.59	(1/2 ⁻ ,3/2)	1348.73	(1/2 ⁻ ,3/2,5/2 ⁻)				%I _γ =0.009 4
1827.5	124 [@] 6	1992.49	3/2 ⁻	164.987	5/2 ⁻	M1(+E2)	<1	0.00128 8	%I _γ =1.11 6 α(K) _{exp} =0.0012 3 Mult.,δ: α(K) _{exp} agrees with mult=E3 also.
1835.0	2.5 8	2861.8	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I _γ =0.022 8
1847.7	9 1	2199.90	(1/2 ⁻ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.081 10
1852.8	2 1	2977.72	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.018 9
1855.6	3 2	2999.64	(3/2)	1144.08	(5/2) ⁺				%I _γ =0.027 18
1859.3	3 1	3403.4	(1/2 ⁻ ,3/2)	1544.13	(3/2 ⁻ ,5/2 ⁻)				%I _γ =0.027 9
1874.6 1	30 2	2999.64	(3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.268 19
1877.1	3 2	3021.06	(3/2)	1144.08	(5/2) ⁺				%I _γ =0.027 18
1877.7	2 1	3365.23	(3/2)	1487.60	(1/2,3/2) ⁻				%I _γ =0.018 9
1878.5	8 2	3003.4	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.072 18
1895.9	0.7 4	2922.7	(1/2,3/2)	1026.840	3/2 ⁺				%I _γ =0.006 4
1896.3	2.6 9	3021.06	(3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I _γ =0.023 8
1909.3 1	25 2	2261.54	(3/2,1/2 ⁻)	352.234	3/2 ⁻				%I _γ =0.224 19

¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02 (continued)

$\gamma(^{149}\text{Gd})$ (continued)									
E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. &	δ^a	α^c	Comments
1912.7 3	7 2	3079.8	(1/2,3/2)	1167.11	(3/2 ⁺)				%I γ =0.063 18
1915.8	3 1	3403.4	(1/2 ⁻ ,3/2)	1487.60	(1/2,3/2) ⁻				%I γ =0.027 9
1916.1	4 2	3319.0	(1/2 ⁻ ,3/2)	1402.91	(5/2 ⁻)				%I γ =0.036 18
1918.4	1.2 6	3124.06	(1/2,3/2)	1205.66	(1/2) ⁻				%I γ =0.011 6
1923.4	1.1 6	2088.47	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻				%I γ =0.010 6
1931.0	1.2 6	3418.8	(1/2 ⁻ ,3/2)	1487.60	(1/2,3/2) ⁻				%I γ =0.011 6
1940.1 1	35 3	2757.20	(1/2,3/2)	817.100	3/2 ⁻				%I γ =0.31 3
1943.7	0.6 4	3149.4	(1/2,3/2)	1205.66	(1/2) ⁻				%I γ =0.005 4
1948.5 1	46 2	2300.72	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻				%I γ =0.412 20
1950.9	1.6 8	2977.72	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.014 8
1970.0	4 1	3175.59	(1/2 ⁻ ,3/2)	1205.66	(1/2) ⁻				%I γ =0.036 9
1972.9 2	18 2	2999.64	(3/2)	1026.840	3/2 ⁺				%I γ =0.161 19
1976.6	3 2	3003.4	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.027 18
1991.8	4 [#] 2	2808.6	(1/2,3/2,5/2 ⁻)	817.100	3/2 ⁻				%I γ =0.036 18
1992.5 ^d	2 [@] 2	1992.49	3/2 ⁻	0.0	7/2 ⁻				%I γ =0.018 18
1993.3	6 [#] 2	2158.36	(3/2) ⁺	164.987	5/2 ⁻				%I γ =0.054 18
1994.4	3 1	3021.06	(3/2)	1026.840	3/2 ⁺				%I γ =0.027 9
2000.8	2 1	3206.43	(3/2)	1205.66	(1/2) ⁻				%I γ =0.018 9
2007.9 1	88 3	2824.98	(1/2,3/2) ⁻	817.100	3/2 ⁻	E2(+M1)	>2	1.03×10 ⁻³ 3	%I γ =0.79 4 $\alpha(\text{K})_{\text{exp}}=0.00055$ 10
2008.5	3 2	3175.59	(1/2 ⁻ ,3/2)	1167.11	(3/2 ⁺)				%I γ =0.027 18
2024.4	1.6 9	3149.4	(1/2,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.014 8
2034.3	5 [#] 3	3201.4	(3/2,1/2 ⁻)	1167.11	(3/2 ⁺)				%I γ =0.04 3
2034.8	19 [#] 3	2199.90	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻				%I γ =0.17 3
2044.7	1.7 8	2861.8	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%I γ =0.015 8
2050.7 4	5 2	3175.59	(1/2 ⁻ ,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.045 18
2062.3	1.1 7	3206.43	(3/2)	1144.08	(5/2) ⁺				%I γ =0.010 7
2073.0	3 1	3099.76	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.027 9
2076.4	4 1	3201.4	(3/2,1/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺				%I γ =0.036 9
2096.5	4 [#] 1	2261.54	(3/2,1/2 ⁻)	164.987	5/2 ⁻				%I γ =0.036 9
2097.1	4 [#] 1	3124.06	(1/2,3/2)	1026.840	3/2 ⁺				%I γ =0.036 9
2105.6 3	10 2	2922.7	(1/2,3/2)	817.100	3/2 ⁻				%I γ =0.089 18
2108.2 3	9 2	3313.62	(3/2 ⁻)	1205.66	(1/2) ⁻				%I γ =0.081 18
2130.5 2	14 2	2482.74	(1/2 ⁺ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I γ =0.125 18
2135.0	1.4 7	3340.6	(1/2 ⁺ ,3/2)	1205.66	(1/2) ⁻				%I γ =0.013 7
2135.7 2	12 2	2300.72	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻				%I γ =0.107 18
2148.8	4 1	3175.59	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺				%I γ =0.036 9
2149.1	3 1	2314.1	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻				%I γ =0.027 9
2151.5	2 1	2503.71	(1/2 ⁻ ,3/2,5/2 ⁻)	352.234	3/2 ⁻				%I γ =0.018 9
2160.6	2.3 9	2977.72	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻				%I γ =0.021 8
2179.6	5 1	3206.43	(3/2)	1026.840	3/2 ⁺				%I γ =0.045 9

γ(¹⁴⁹Gd) (continued)

E_γ †	I_γ † ^b	E_i (level)	J_i^π	E_f	J_f^π	Comments
2182.6 1	48 3	2999.64	(3/2)	817.100	3/2 ⁻	%Iγ=0.43 3
2186.3	3 2	3003.4	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.027 18
2188.6	3 1	3313.62	(3/2 ⁻)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺	%Iγ=0.027 9
2196.5	2.1 7	3340.6	(1/2 ⁺ ,3/2)	1144.08	(5/2) ⁺	%Iγ=0.019 7
2204.1	3 1	3021.06	(3/2)	817.100	3/2 ⁻	%Iγ=0.027 9
2212.9	2.2 7	3418.8	(1/2 ⁻ ,3/2)	1205.66	(1/2) ⁻	%Iγ=0.020 7
2221.1	1.0 6	3365.23	(3/2)	1144.08	(5/2) ⁺	%Iγ=0.009 6
2231.5	2.4 6	3258.4	(1/2,3/2)	1026.840	3/2 ⁺	%Iγ=0.021 6
2237.8 1	17 2	2590.05	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻	%Iγ=0.152 19
2246.1	1.4 7	3272.9	(1/2,3/2)	1026.840	3/2 ⁺	%Iγ=0.013 7
2247.0 2	17 2	2599.31	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻	%Iγ=0.152 19
2253.7	2.9 8	3070.8	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.026 8
2261.0	16 [#] 2	2613.2	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻	%Iγ=0.143 19
2261.5 ^d	3 [@] 3	2261.54	(3/2,1/2 ⁻)	0.0	7/2 ⁻	%Iγ=0.03 3
2282.6 1	43 3	3099.76	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.38 3
2317.9	1.9 7	3442.8	(1/2,3/2)	1124.89	1/2 ⁺ ,3/2 ⁺ ,5/2 ⁺	%Iγ=0.017 7
2319.0	1.1 5	3486.2	(1/2,3/2)	1167.11	(3/2 ⁺)	%Iγ=0.010 5
2338.7 2	9 2	2503.71	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻	%Iγ=0.081 18
2358.5	0.8 5	3175.59	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.007 5
2384.3	1.6 6	3201.4	(3/2,1/2 ⁻)	817.100	3/2 ⁻	%Iγ=0.014 6
2389.3 3	5 1	3206.43	(3/2)	817.100	3/2 ⁻	%Iγ=0.045 9
2404.9 2	11 2	2757.20	(1/2,3/2)	352.234	3/2 ⁻	%Iγ=0.098 18
2414.0	0.8 5	3231.2	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.007 5
2415.8 4	3 1	2768.0	(1/2 ⁺ ,3/2,5/2 ⁻)	352.234	3/2 ⁻	%Iγ=0.027 9
2434.5 4	5 1	2599.31	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%Iγ=0.045 9
2440.0	0.7 4	3466.8	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺	%Iγ=0.006 4
2441.3	1.5 7	3258.4	(1/2,3/2)	817.100	3/2 ⁻	%Iγ=0.013 7
2446.4	0.7 4	3473.2	(1/2 ⁻ ,3/2)	1026.840	3/2 ⁺	%Iγ=0.006 4
2448.2	13 [#] 2	2613.2	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%Iγ=0.116 18
2455.8	3 [#] 1	3272.9	(1/2,3/2)	817.100	3/2 ⁻	%Iγ=0.027 9
2456.2	5 [#] 1	2808.6	(1/2,3/2,5/2 ⁻)	352.234	3/2 ⁻	%Iγ=0.045 9
2472.7 2	11 2	2824.98	(1/2,3/2) ⁻	352.234	3/2 ⁻	%Iγ=0.098 18
2478.3	2.7 8	2830.6	(1/2,3/2,5/2 ⁻)	352.234	3/2 ⁻	%Iγ=0.024 8
2496.4 2	11 2	3313.62	(3/2 ⁻)	817.100	3/2 ⁻	%Iγ=0.098 18
2508.3	0.7 4	3535.1	(3/2 ⁺)	1026.840	3/2 ⁺	%Iγ=0.006 4
2523.5	1.9 7	3340.6	(1/2 ⁺ ,3/2)	817.100	3/2 ⁻	%Iγ=0.017 7
2538.3 4	5 2	2703.3	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻	%Iγ=0.045 18
2548.1	3 1	3365.23	(3/2)	817.100	3/2 ⁻	%Iγ=0.027 9
2560.8 1	33 2	2913.08	(1/2,3/2)	352.234	3/2 ⁻	%Iγ=0.295 19
2586.3	3 1	3403.4	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻	%Iγ=0.027 9
2625.7	1.0 5	3442.8	(1/2,3/2)	817.100	3/2 ⁻	%Iγ=0.009 5
2647.6	23 1	2999.64	(3/2)	352.234	3/2 ⁻	%Iγ=0.206 10

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14,1972Vy08,1992Tl02](#) (continued)

γ(¹⁴⁹Gd) (continued)

E _γ [†]	I _γ ^{†b}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. ^{&}	α ^c	Comments
2649.7	1.0 5	3466.8	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻			%I _γ =0.009 5
2656.1	1.1 6	3473.2	(1/2 ⁻ ,3/2)	817.100	3/2 ⁻			%I _γ =0.010 6
2669.1	15 2	3021.06	(3/2)	352.234	3/2 ⁻			%I _γ =0.134 18
2696.8	5 2	2861.8	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.045 18
2718.0	0.7 4	3535.1	(3/2 ⁺)	817.100	3/2 ⁻			%I _γ =0.006 4
2753.2	2.4 8	2918.2	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻			%I _γ =0.021 8
2771.8 1	15 2	3124.06	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.134 18
2796.5	3 [#] 1	2961.5	(1/2 ⁻ ,3/2,5/2 ⁻)	164.987	5/2 ⁻			%I _γ =0.027 9
2797.1	5 [#] 1	3149.4	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.045 9
2812.7	4 1	2977.72	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.036 9
2823.3 2	9 2	3175.59	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.081 18
2834.7	3 1	2999.64	(3/2)	164.987	5/2 ⁻			%I _γ =0.027 9
2838.4	3 2	3003.4	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.027 18
2849.2	1.8 7	3201.4	(3/2,1/2 ⁻)	352.234	3/2 ⁻			%I _γ =0.016 7
2854.2	3 1	3206.43	(3/2)	352.234	3/2 ⁻			%I _γ =0.027 9
2856.0 2	9 2	3021.06	(3/2)	164.987	5/2 ⁻			%I _γ =0.081 18
2878.9 3	7 2	3231.2	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.063 18
2892.0 4	3.5 11	3057.0	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.031 10
2905.8	1.9 7	3070.8	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.017 7
2906.1	1.4 7	3258.4	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.013 7
2920.7	1.0 6	3272.9	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.009 6
2935.1 3	11 2	3099.76	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.098 18
2942.6	3.1 8	3294.9	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.028 8
2959.0 ^d	≤3 [@]	3124.06	(1/2,3/2)	164.987	5/2 ⁻			%I _γ =0.013 14
2961.3	93 4	3313.62	(3/2 ⁻)	352.234	3/2 ⁻	(M1,E2)	0.00116 7	%I _γ =0.83 4 α(K)exp=0.00042 10 Mult.: α(K)exp gives M1, E2 or E3.
2961.4 ^d	<3 [@]	2961.5	(1/2 ⁻ ,3/2,5/2 ⁻)	0.0	7/2 ⁻			%I _γ <0.027
2966.8	2.2 7	3319.0	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.020 7
3010.6 3	10 2	3175.59	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.089 18
3032.4	3.7 8	3384.7	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.033 8
3036.4 5	3 1	3201.4	(3/2,1/2 ⁻)	164.987	5/2 ⁻			%I _γ =0.027 9
3041.4	2 1	3206.43	(3/2)	164.987	5/2 ⁻			%I _γ =0.018 9
3051.2	1.8 7	3403.4	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.016 7
3066.1	0.9 5	3231.2	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.008 5
3066.3	1.6 7	3418.8	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.014 7
3078.9	3 1	3431.4	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.027 9
3090.6	0.8 4	3442.8	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.007 4
3133.9 5	1.9 5	3486.2	(1/2,3/2)	352.234	3/2 ⁻			%I _γ =0.017 5
3147.8	0.9 4	3500.0	(1/2 ⁻ ,3/2)	352.234	3/2 ⁻			%I _γ =0.008 4
3148.5	1.6 6	3313.62	(3/2 ⁻)	164.987	5/2 ⁻			%I _γ =0.014 6
3154.0 5	2.7 7	3319.0	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻			%I _γ =0.024 7

¹⁴⁹Tb ε decay (4.12 h) [1978Ja14](#),[1972Vy08](#),[1992Tl02](#) (continued)

$\gamma(^{149}\text{Gd})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^{\ddagger b}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
3163.9 4	2.5	3516.2	(1/2,3/2)	352.234	3/2 ⁻	%I γ =0.0224 5
3182.8 4	4 1	3535.1	(3/2 ⁺)	352.234	3/2 ⁻	%I γ =0.036 9
3200.2 2	25 2	3365.23	(3/2)	164.987	5/2 ⁻	%I γ =0.224 19
3201.2 ^d	<2 @	3201.4	(3/2,1/2 ⁻)	0.0	7/2 ⁻	%I γ <0.018
3238.4	1.5 5	3403.4	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.013 5
3254.5	1.5 7	3418.8	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.013 7
3266.4 4	1.6 4	3431.4	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.014 4
3301.8	1.2 6	3466.8	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.011 6
3308.2 3	9 2	3473.2	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.081 18
3335.0	1.0 3	3500.0	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.009 3
3370.1	0.8 4	3535.1	(3/2 ⁺)	164.987	5/2 ⁻	%I γ =0.007 4
3378.9 4	1.7 6	3543.9	(1/2 ⁻ ,3/2)	164.987	5/2 ⁻	%I γ =0.015 6

[†] From [1978Ja14](#). When no energy uncertainty is given, γ rays were seen only in the $\gamma\gamma$ coin. The energies given in these cases are the level differences rounded to the nearest 0.1 keV. Their intensities are deduced from $\gamma\gamma$ -coin.

[‡] The intensity has been obtained after correcting for the decay of the ¹⁴⁹Gd daughter.

[#] γ ray is member of a multiplet. Intensity was obtained from coincidence data.

@ The intensity was obtained by subtracting all other components from the total multiplet intensity.

& From $\alpha(K)\text{exp}$ data, deduced by [1978Ja14](#) using $I(\text{ce}(K))$ values from [1972Vy08](#) and I_γ values from [1978Ja14](#), normalized to $\alpha(K)=0.0292$ for 352 γ taken as E2, unless otherwise noted. Assignments in the Adopted Gammas are the same.

^a From $\gamma\gamma(\theta)$ data ([1992Tl02](#),[1974Bu26](#)) with data reanalyzed by the evaluators, unless otherwise noted. The values are the same in the Adopted Levels, Gammas dataset.

^b For absolute intensity per 100 decays, multiply by 0.00895 19.

^c Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

^d Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

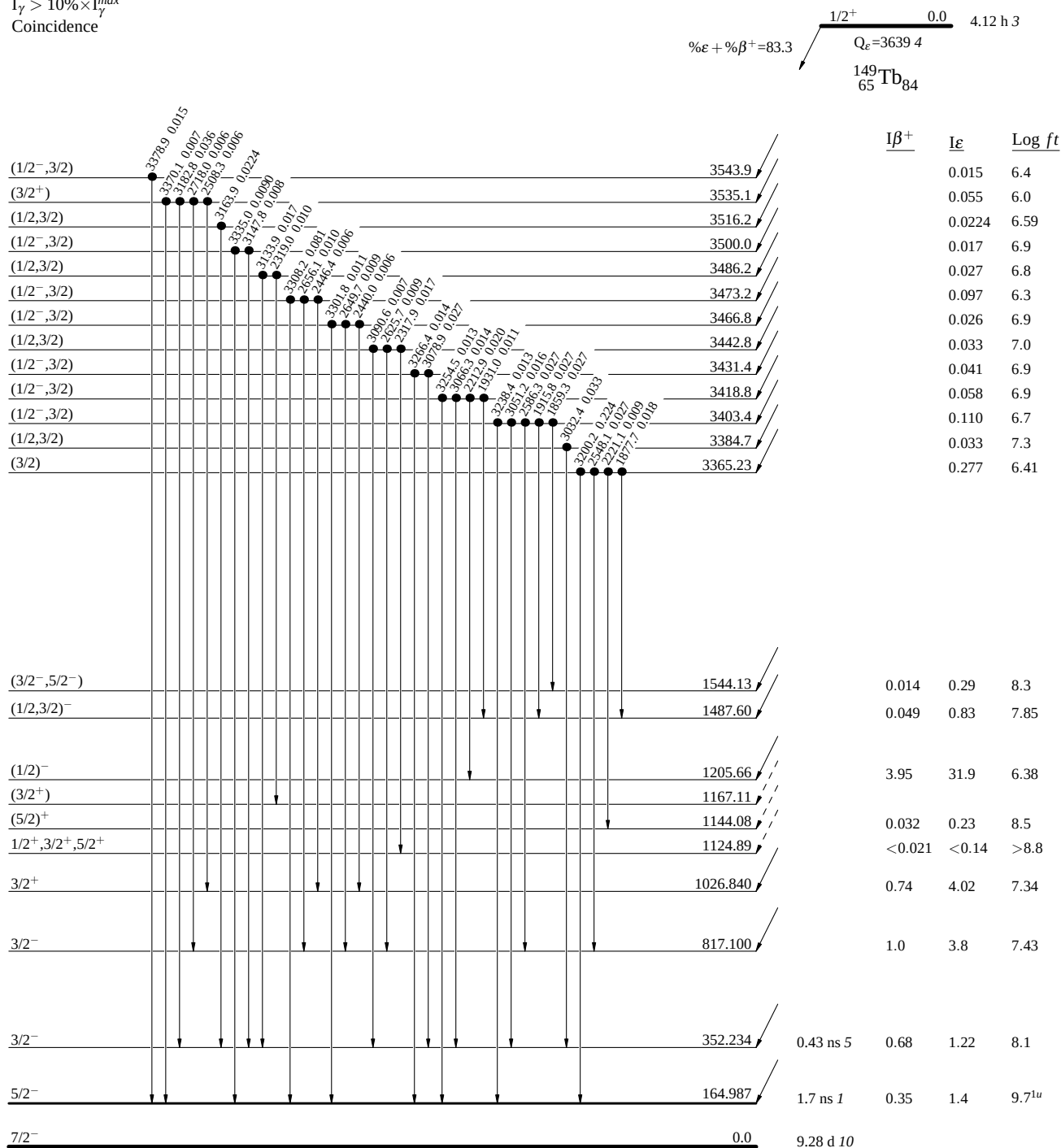
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

Decay Scheme

Intensities: I_(γ+ce) per 100 parent decays



¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

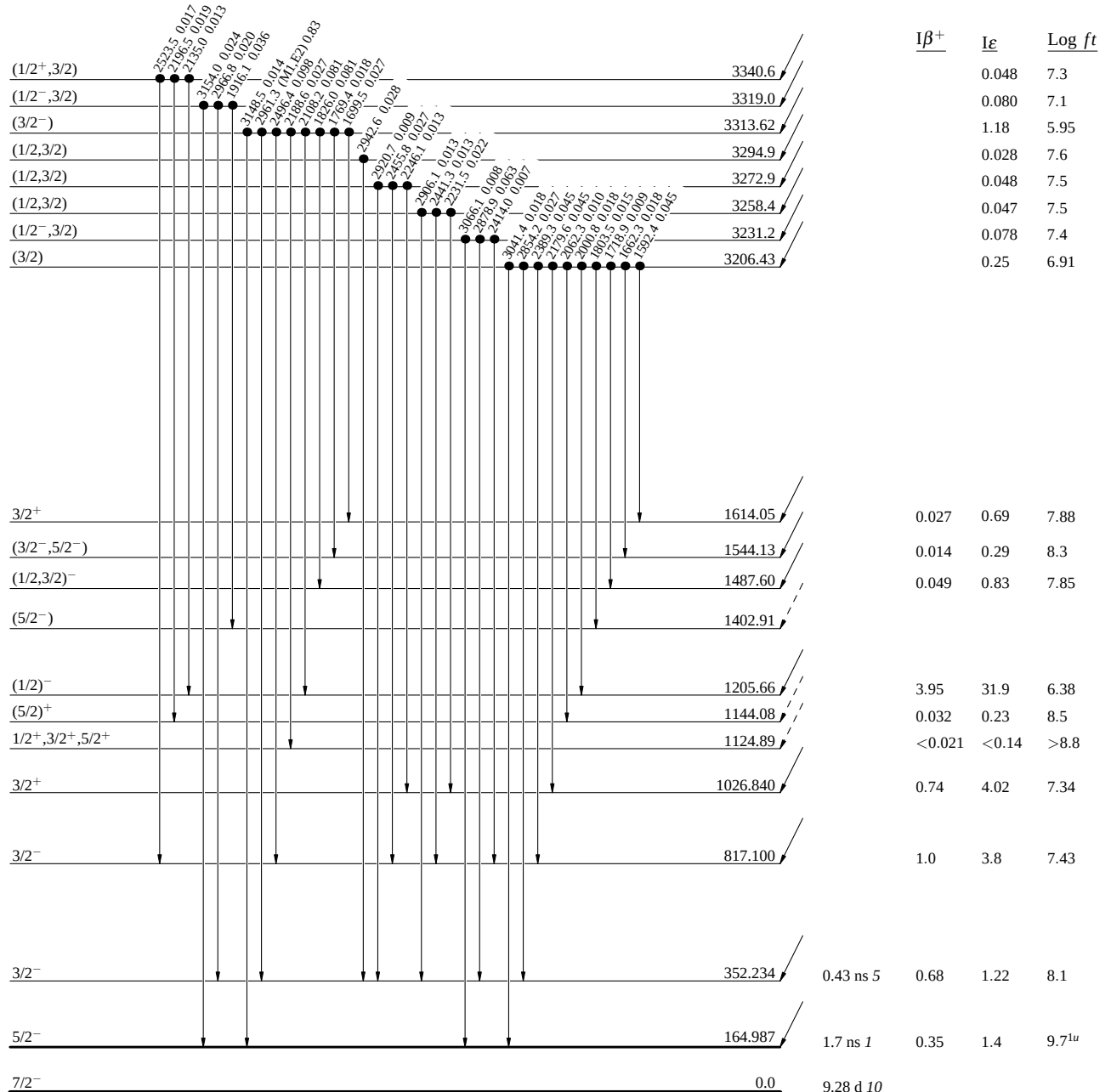
Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

1/2⁺ 0.0 4.12 h 3
Q_ε=3639 4
¹⁴⁹Tb₈₄



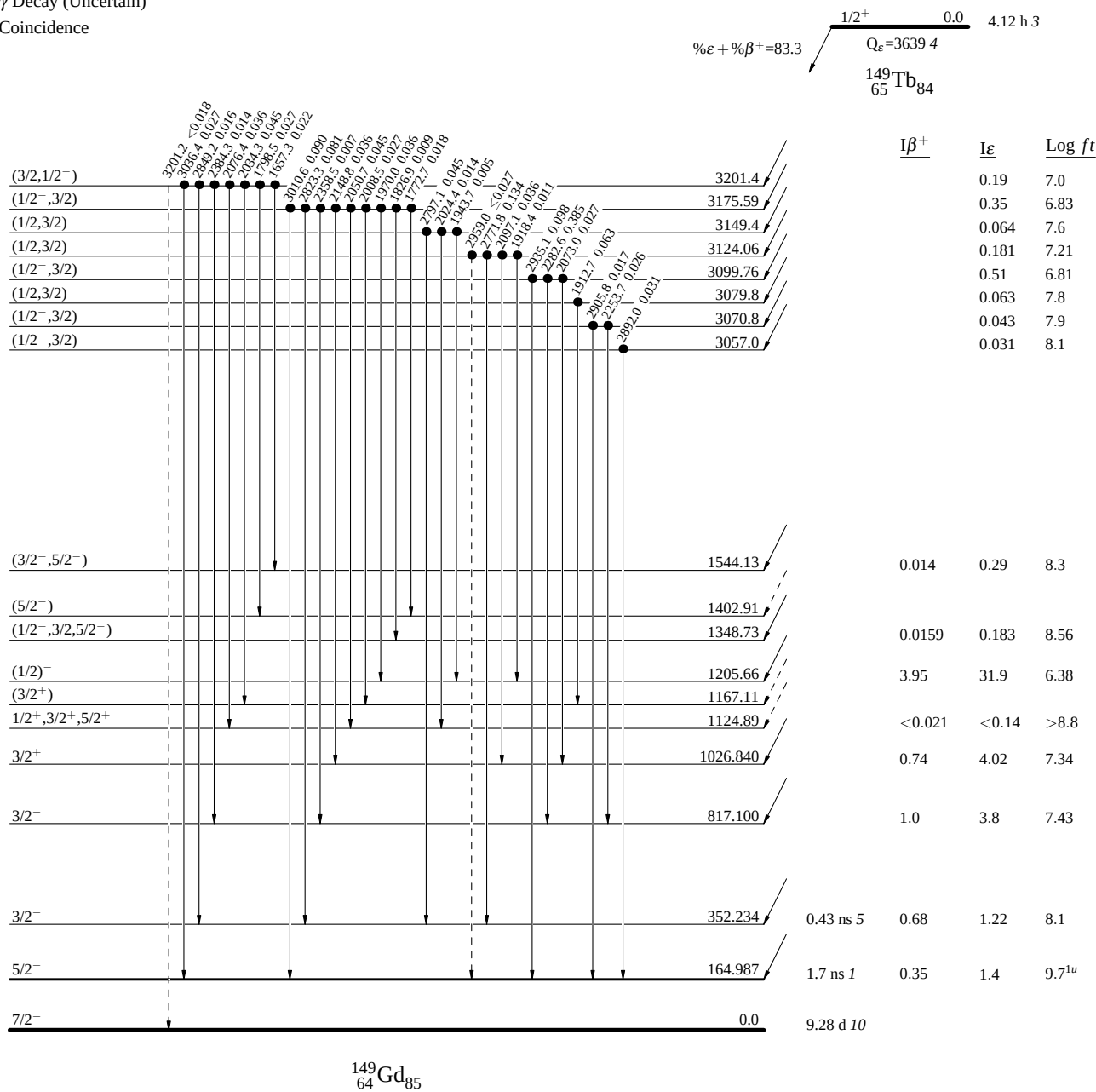
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - -→ γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays



¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

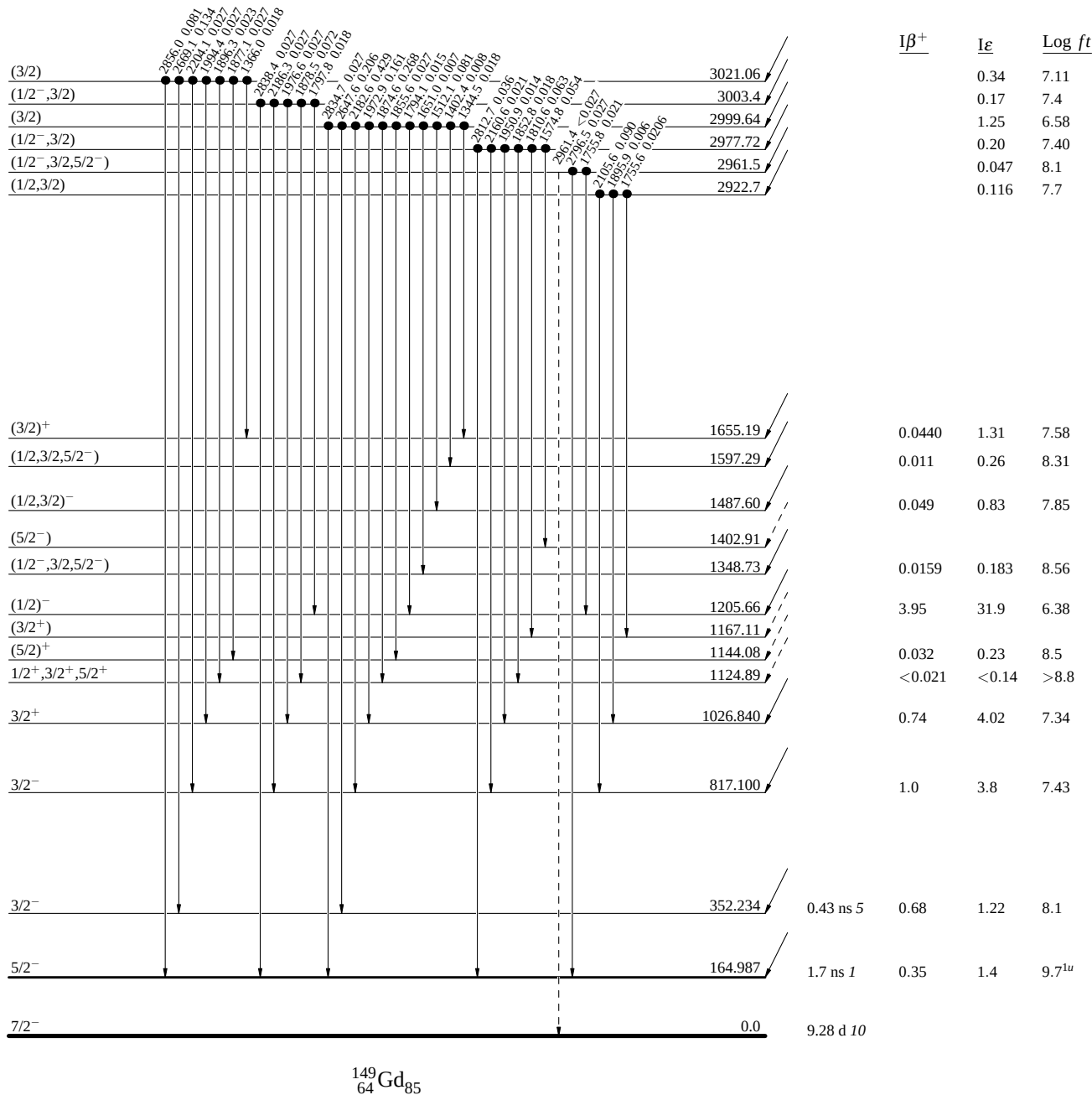
Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays

1/2⁺ 0.0 4.12 h 3
Q_ε=3639.4
¹⁴⁹Tb₆₅₈₄
%ε + %β⁺=83.3



¹⁴⁹Gd₆₄₈₅

¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

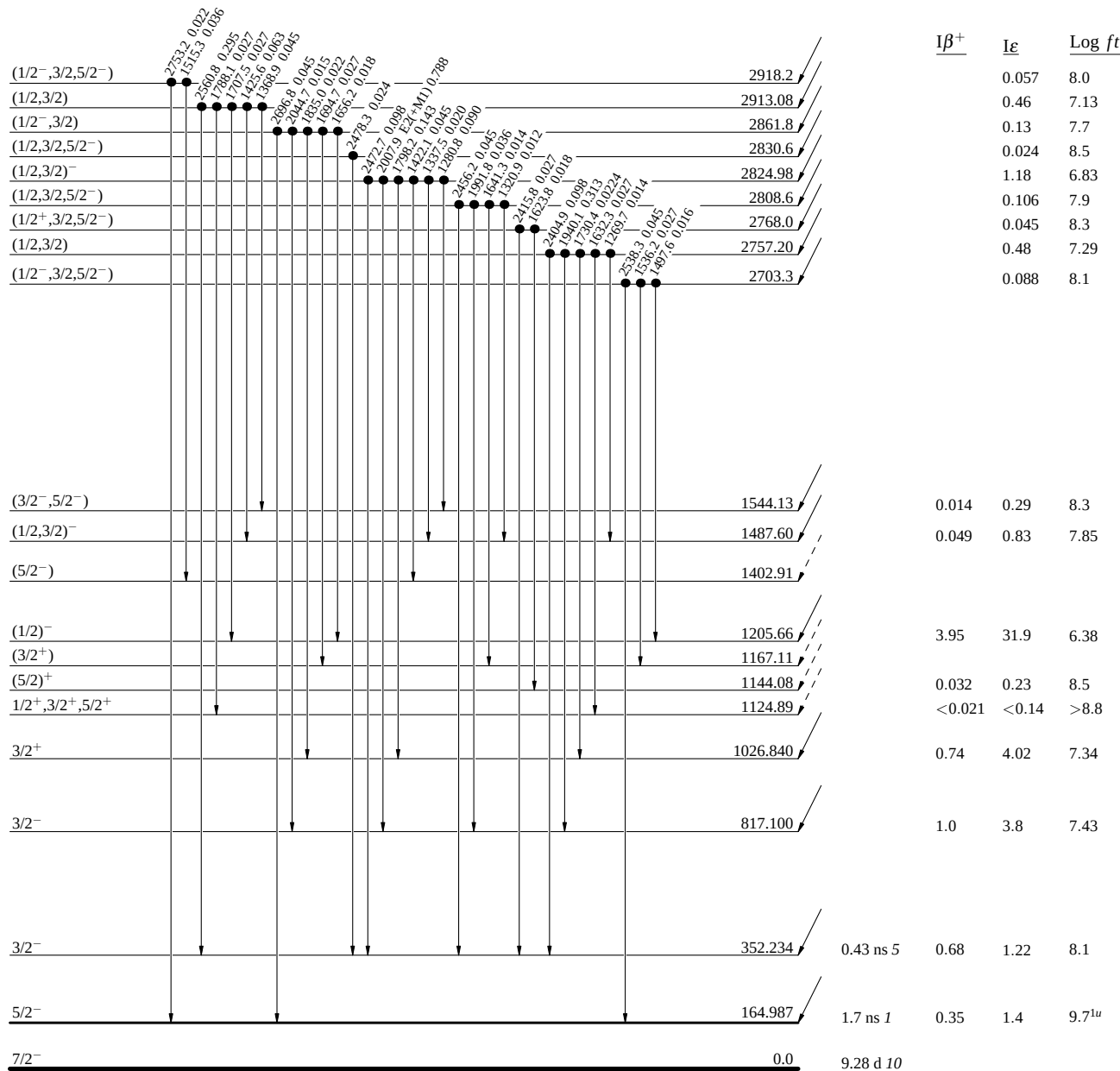
Decay Scheme (continued)

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

Intensities: I_(γ+ce) per 100 parent decays

1/2⁺ 0.0 4.12 h 3
Q_ε=3639.4
¹⁴⁹Tb₈₄



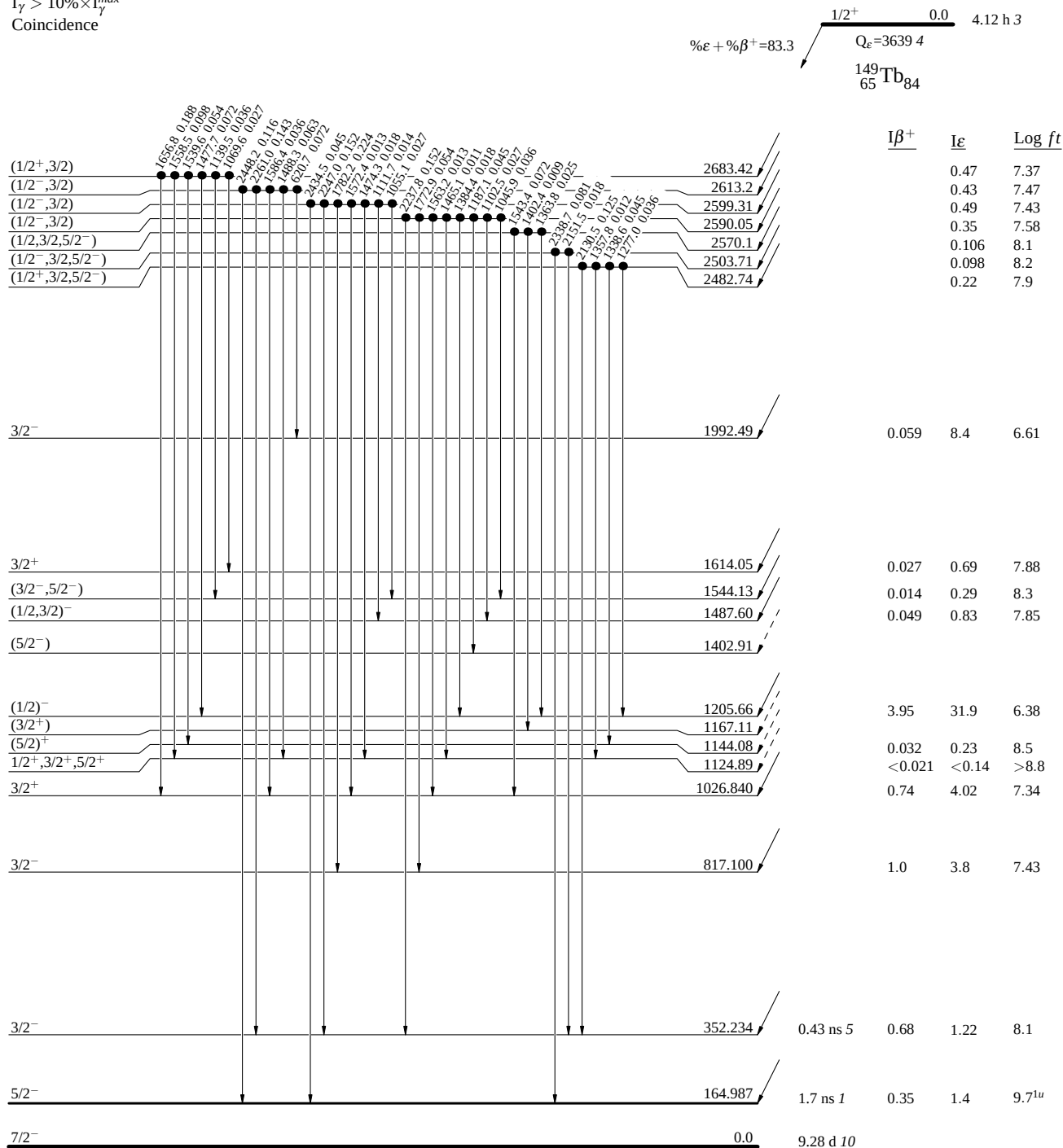
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Decay Scheme (continued)

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

Intensities: I_(γ+ce) per 100 parent decays



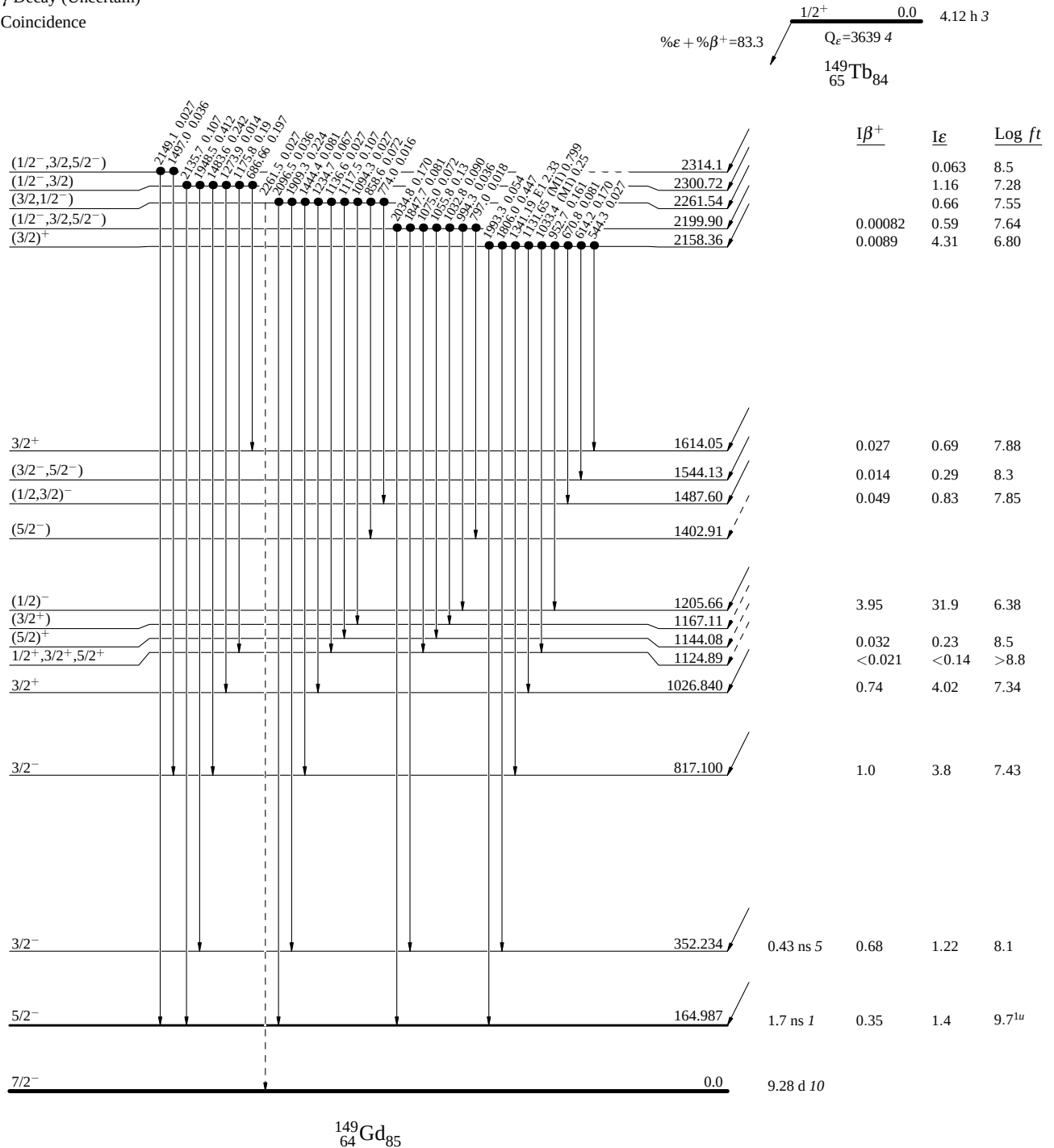
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays



¹⁴⁹Gd₈₅

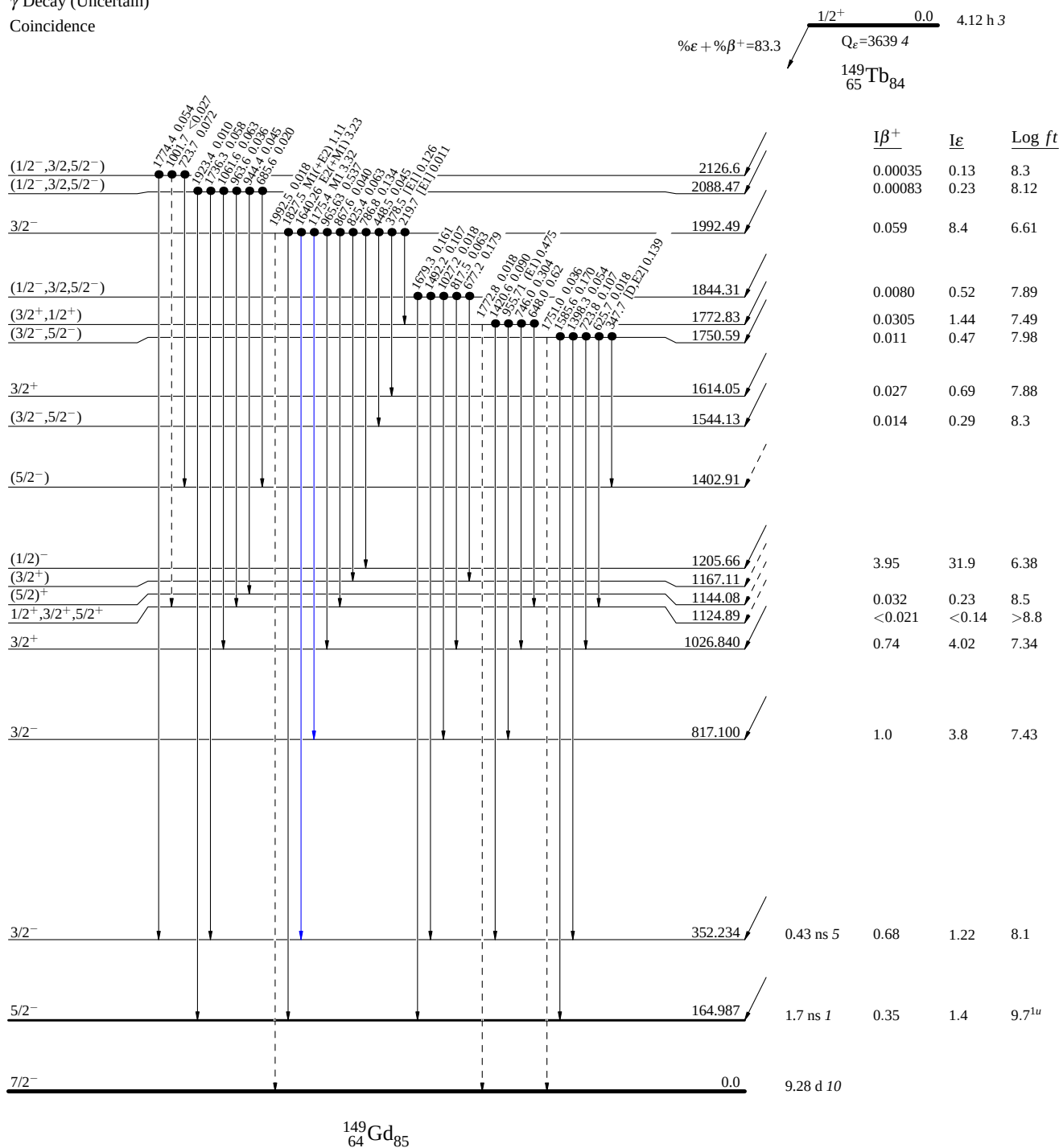
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays



¹⁴⁹Gd₈₅

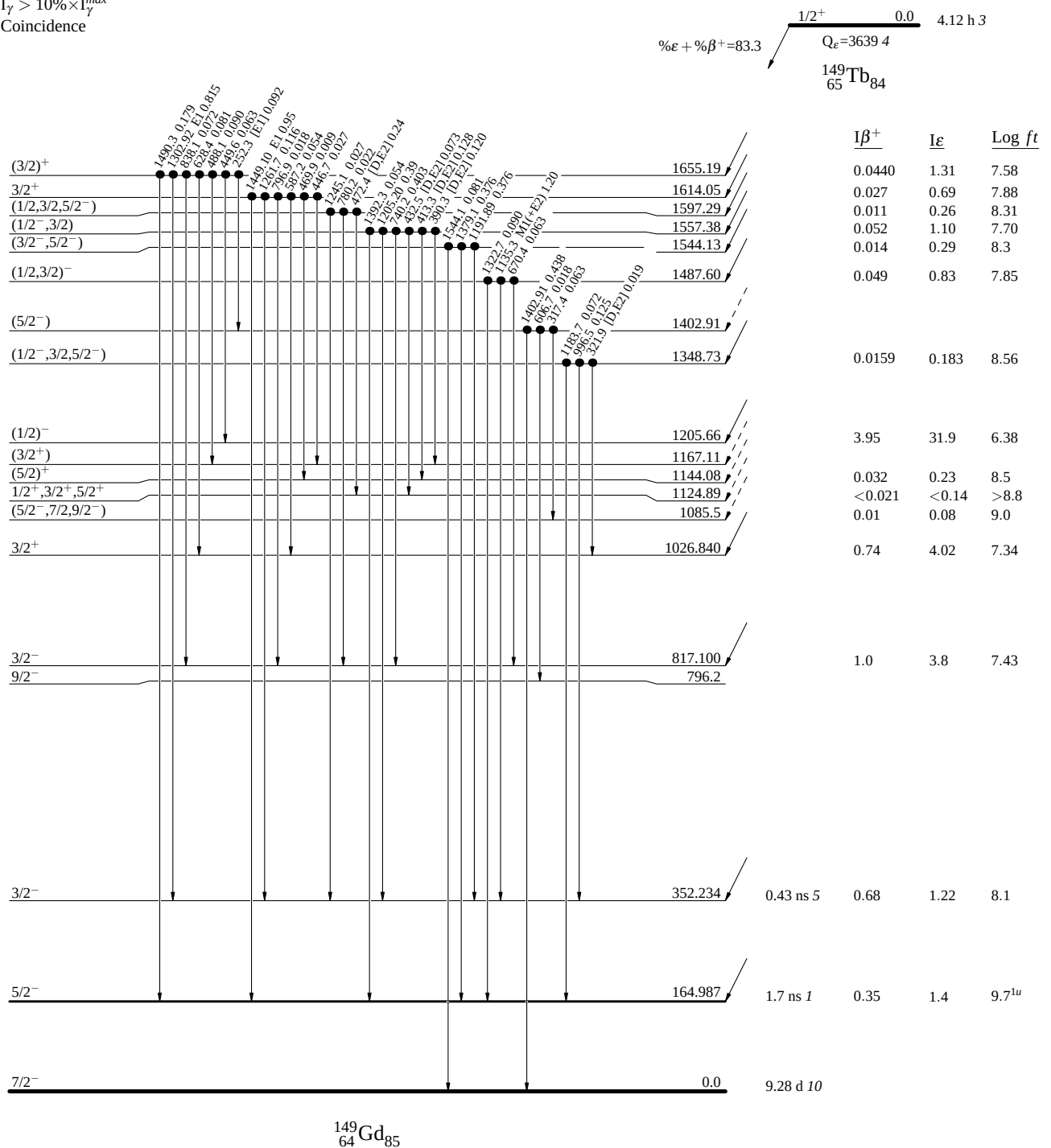
¹⁴⁹Tb ε decay (4.12 h) 1978Ja14,1972Vy08,1992Tl02

Decay Scheme (continued)

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

Intensities: I_(γ+ce) per 100 parent decays



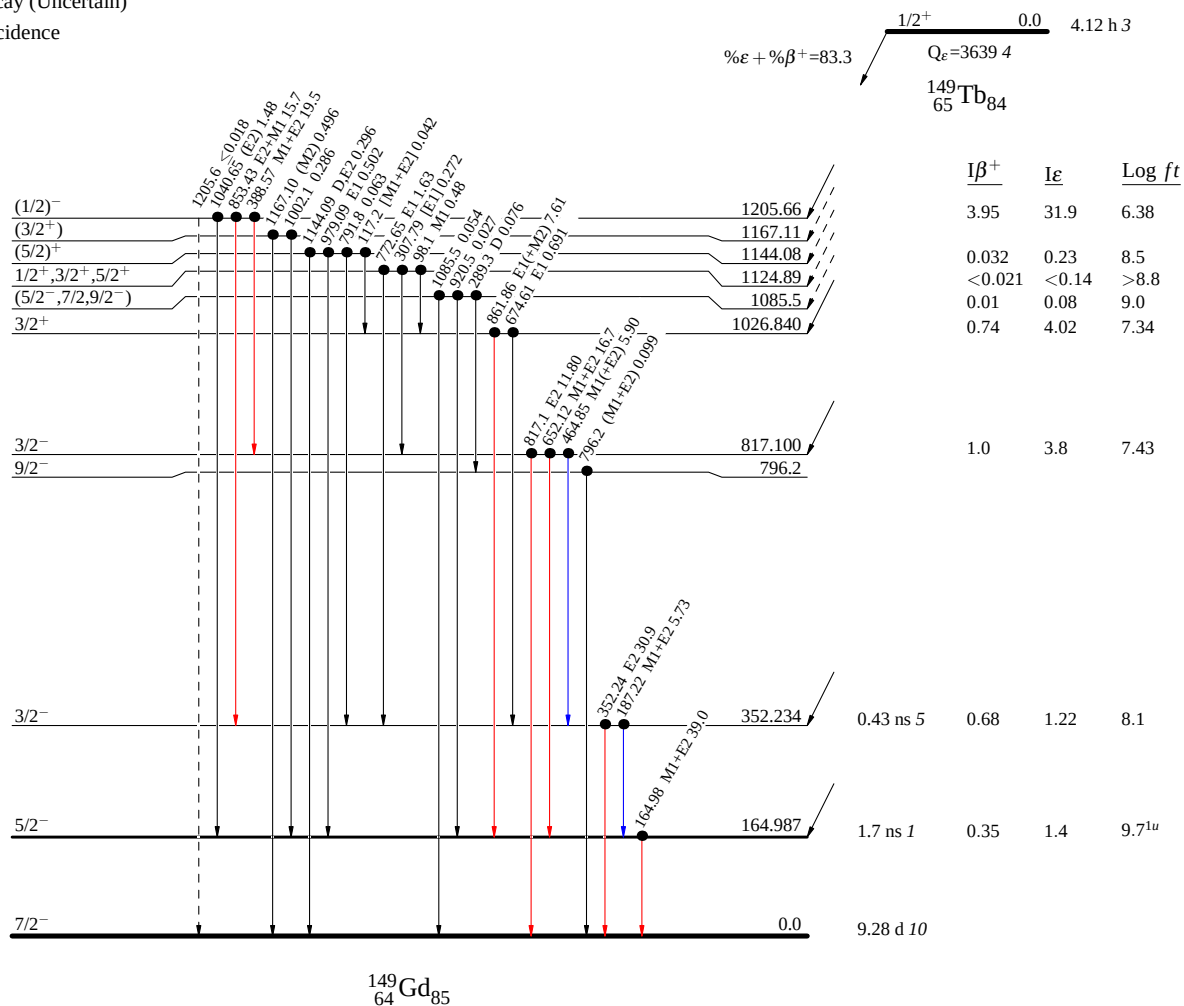
^{149}Tb ϵ decay (4.12 h) 1978Ja14,1972Vy08,1992T102

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



¹⁴⁹Tb ε decay (4.17 min) [1971HaWX](#),[1971Ar31](#),[1975To03](#)

Parent: ¹⁴⁹Tb: E=35.75 8; J^π=11/2⁻; T_{1/2}=4.17 min 5; Q(ε)=3639 4; %ε+%β⁺ decay=99.978 3

¹⁴⁹Tb-E, J^π, T_{1/2}: From the Adopted Levels of ¹⁴⁹Tb.

¹⁴⁹Tb-Q(ε): From [2021Wa16](#).

¹⁴⁹Tb-%ε+%β⁺ decay: From %α=0.022 3 in the Adopted Levels.

Others: [1969Ch32](#), [1975SpZU](#), [1974La28](#).

T_{1/2}(¹⁴⁹Tb isomer): [1973Bi06](#), [1973Bo13](#), [1971Ar31](#), [1969Ch32](#), [1964Ma19](#), [1962Ma14](#).

Q value measurements: [1991Ke06](#) and [1985Sc09](#). From β⁺γ coin, E(β⁺)=1853 10 ([1991Ke06](#)) which gives Q=3671 10. [1985Sc09](#) estimate Q value from I(β⁺)/I(εK(exp)) and I(β⁺)/I(ε+β⁺) ratios deduced from γ[±]/I(x ray) and γ[±]/Iγ(cascades). From I(β⁺)/I(εK(exp))=0.31 3, [1985Sc09](#) deduce Eβ⁺=1790 50 which gives Q=3610 50.

Total decay energy deposit of 3986.6 keV 34 calculated by RADLIST code is higher than the expected value of 3673 keV 4, with a difference=314 keV.

¹⁴⁹Gd Levels

E(level)	J ^π [†]	T _{1/2} [†]	Comments
0.0	7/2 ⁻	9.28 d 10	
165.1 1	5/2 ⁻		Note that there is a significant γ+ce intensity imbalance at 165 level with much less γ feedings to this level than emitted from this level, which could be due to missing transitions feeding this level.
796.0 1	9/2 ⁻		

[†] From the Adopted Levels.

ε,β⁺ radiations

E(decay)	E(level)	Iβ ⁺ [†]	Iε [†]	Log ft	I(ε+β ⁺) [†]	Comments
(2879 4)	796.0	≈21	≈79	≈4.3	≈100	Log ft: assuming 100% ε decay to this level. There are other transitions which are unassigned. But 1975To03 estimate that none of these transitions is intense enough to change log ft value to this level. The allowed β transition is interpreted to proceed between πh _{11/2} and νh _{9/2} states.

[†] Absolute intensity per 100 decays.

γ(¹⁴⁹Gd)

Iγ normalization: From I(630.7γ+796.0γ)≈100 based on the assumption of approximately 100% decay to 796 level since other unassigned transitions are not intense enough to change the feeding to this level ([1975To03](#)).

E _γ	I _γ ^{@a}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. ^{&}	δ ^{&}	α ^b	Comments
^x 75 [†]	1.3								
165.0 [#] 1	7.5 [#] 5	165.1	5/2 ⁻	0.0	7/2 ⁻	M1+E2	-0.93 2	0.459 7	I(γ+ce) of 165.0γ is much higher than the intensity of the 630.7γ feeding this level. As the decay scheme is incomplete, this difference is most likely due to missing feeding transitions to the 165 level.
630.7 [#] 3	≈2.9 [#]	796.0	9/2 ⁻	165.1	5/2 ⁻	[E2]		0.00776 11	I _γ : 1971Ar31 give I _γ <20. 1975SpZU assign this γ ray to ¹⁴⁸ Tb.
^x 651 [‡]	33.6								

Continued on next page (footnotes at end of table)

¹⁴⁹Tb ε decay (4.17 min) [1971HaWX](#),[1971Ar31](#),[1975To03](#) (continued)

γ(¹⁴⁹Gd) (continued)

<u>E_γ</u>	<u>I_γ^{@a}</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.^{&}</u>	<u>δ^{&}</u>	<u>α^b</u>
^x 773 [†]	3.5							
796.0 [#] 1	100 [#]	796.0	9/2 ⁻	0.0	7/2 ⁻	(M1+E2)	+0.18 2	0.00783 11
^x 853 [†]	1.2							
^x 988 [†]	2.0							
^x 1681.4 [‡]	2.5							

[†] Reported only by [1971HaWX](#).

[‡] Reported only by [1975SpZU](#).

[#] From [1975To03](#).

[@] From [1971HaWX](#) unless otherwise stated.

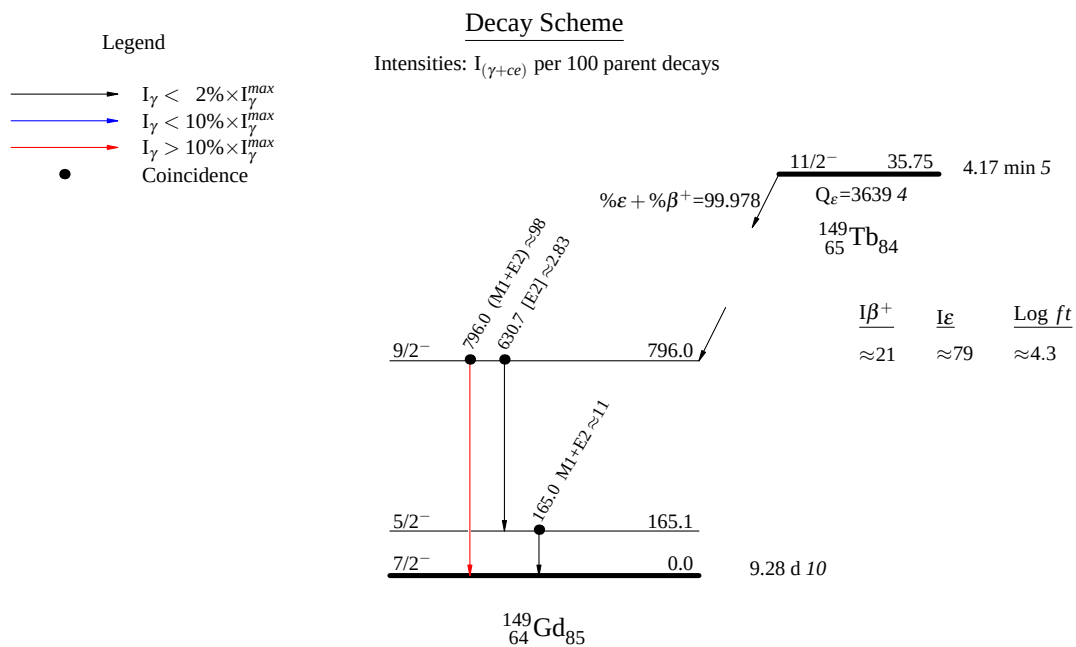
[&] From the Adopted Gammas.

^a For absolute intensity per 100 decays, multiply by ≈0.97.

^b Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^x γ ray not placed in level scheme.

^{149}Tb ϵ decay (4.17 min) 1971HaWX,1971Ar31,1975To03



^{153}Dy α decay (6.4 h) [1974To07](#)

Parent: ^{153}Dy : $E=0.0$; $J^\pi=7/2^{-}$; $T_{1/2}=6.4$ h 1; $Q(\alpha)=3559$ 4; $\% \alpha$ decay=0.0094 14

^{153}Dy - J^π , $T_{1/2}$: From ^{153}Dy Adopted Levels in the ENSDF database (August 2020 update).

^{153}Dy - $Q(\alpha)$: From [2021Wa16](#).

^{153}Dy - $\% \alpha$ decay: [1974To07](#) deduced branching= 1.13×10^{-4} 17 from absolute intensities of 80.75-, 99.65- and 274.7-keV gamma rays measured by [1970Ch09](#), and 0.83×10^{-4} 13 from their observed $K\alpha$ x-ray intensity. The listed value is the weighted average of these results. Both results are in disagreement with the value, Branching= $3.0 \times 10^{-3}\%$ 3, reported by [1964Ma19](#). Compilation of [1991Ry01](#) gives $\% \alpha=0.009$ 4.

[1974To07](#): ^{153}Dy source was produced in $^{142}\text{Nd}(^{12}\text{C},n)$ with 118 MeV ^{12}C beam from the Oak Ridge isochronous cyclotron.

Measured $I\alpha$, $K\alpha$ x-ray, $I\gamma$, $E\gamma$, α -decay branching ratio.

Other measurements: [1978AfZZ](#), [1967Go32](#), [1965Ma51](#), [1964Ma19](#), [1962Ry03](#), [1960To05](#), [1958To27](#).

Theoretical calculations: [1985Ch32](#).

 ^{149}Gd Levels

<u>E(level)</u>	<u>J^π[†]</u>	<u>$T_{1/2}$[†]</u>
0.0	$7/2^{-}$	9.28 d 10
164.5	$5/2^{-}$	

[†] From the Adopted Levels.

 α radiations

<u>$E\alpha$</u>	<u>E(level)</u>	<u>$I\alpha$[‡]</u>	<u>HF[†]</u>	<u>Comments</u>
3305 5	164.5	0.02 1	2.7×10^2 15	$E\alpha, I\alpha$: from 1967Go32 . $I\alpha(3305\alpha)/I\alpha(3464\alpha)=(2.3 \times 10^{-8}$ 12)/(1.13×10^{-4} 17) in 1974To07 .
3464 5	0.0	99.98 1	1.2 2	$E\alpha$: from 1967Go32 and 1978AfZZ . Others: 3480 20 (1964Ma19), 3480 50 (1960To05), 3464 8 (1965Ma51). $I\alpha$: 1967Go32 also report that $I\alpha/I\alpha(3464\alpha)<2 \times 10^{-5}$ for any alpha in the energy range 3000 to 3300 keV.

[†] The nuclear radius parameter $r_0(^{149}\text{Gd})=1.560$ 21 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in [2020Si16](#).

[‡] For absolute intensity per 100 decays, multiply by 9.4×10^{-5} 14.

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991FI02,1995FI01,1998By02

- 1991FI02: $E(^{30}\text{Si})=150$ MeV from the MP Tandem at the TASCC facility in Chalk River. Measured γ , $\gamma\gamma$, $\gamma(\theta)$ with the 8π spectrometer. Deduced levels, J^π , γ -ray multipolarities, mixing ratios. Data for weakly-deformed states in the first potential well.
- 1995FI01 (also 1994De33,1994De24,1993FI03,1990Ha31): $E(^{30}\text{Si})=158$ MeV beam from the tandem accelerator at Daresbury Nuclear Structure Facility. Measured $E\gamma$, $\gamma\gamma$ (multifold) with the Eurogam array. Deduced levels, J^π , band structures. Data for superdeformed states.
- 1996Sa15: $E(^{30}\text{Si})=158$ MeV. Measured lifetimes by DSAM; deduced Q (intrinsic).
- 1998By02: $E(^{30}\text{Si})=158$ MeV beam from the Vivitron accelerator of the Institut de Recherches Subatomiques of Strasbourg. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin with at least eight detectors firing in Eurogam II spectrometer of 54 HPGe detectors. Deduced levels, J^π , band structures. Seven additional SD bands deduced from these data.
- 1999Fi12: $E(^{30}\text{Si})=158$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin using Eurogam II array with 30 large volume Ge detectors and 24 Clover type composite Ge detectors. Weak linking transitions from SD-1 band to normal level structures were reported by 1999Fi12, determining the energy of the lowest member of SD-1 band at 10625 and $J^\pi=(47/2^-)$.
- 1988Ha02: lifetime measurements by DSAM.
- 1998Kh09: $^{128}\text{Te}(^{27}\text{Al},p5n\gamma), E(^{27}\text{Al})=150$ MeV. Measured quadrupole moment for SD-1 band by Doppler-shift attenuation method.
- 1997St17: population mechanism of yrast SD bands studied through two different reactions: $^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ and $^{124}\text{Sn}(^{34}\text{S},\alpha5n\gamma)$.
- Other references for SD bands, dealing with different aspects of population of these bands: 2002By01, 1995Pa02, 1993FI07, 1993Ha19, 1992Vi03, 1992FI03, 1991FI03, 1991FI02, 1990Wa24, 1990Ha25, 1989Ta12, 1988Ta20. 2002By01 used $^{124}\text{Sn}(^{31}\text{P},p5n\gamma)$ reaction at $E=167$ MeV and measured enhanced population with $\sigma(\text{SD})/\sigma(\text{ND})=6.5$ 15; SD=superdeformed, ND=Normal (weakly)-deformed in the first potential well.
- See 1995Xu01, 1995Tw01, 1995Pa02 (for C_4 symmetry), 1994Tw01, 1993Pi13, 1993Sh18, 1993Ra07, 1993Hu06, 1993Lu08 for theoretical studies and systematics of SD structures.
- Others:
- 1983BaZZ: $E(^{30}\text{Si})=135$ MeV. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin; deduced level lifetimes, yrast sequence, J^π , configurations, and shape.
- 1980Vr01: $^{142}\text{Nd}(^{16}\text{O},n2\alpha)$ $E=126$ -146 MeV; $^{139}\text{La}(^{16}\text{O},p5n)$ $E=146$ MeV; $^{141}\text{Pr}(^{16}\text{O},3n\alpha)$. Search for α decay from the 6-ns isomer at 3386.8.

 ^{149}Gd Levels

1993FI03 assigned eight SD bands to ^{149}Gd but more recent results (1995DeZZ) assigned the last two SD bands (labeled g and h by 1993FI03) to ^{148}Gd , instead. Additional bands are from 1998By02. See the Adopted Levels for possible assignment of multi-particle structures to some of the levels below 12 MeV.

<u>E(level)[†]</u>	<u>J^π[‡]</u>
0.0 ^g	7/2 ⁻
775.1 ^g 2	11/2 ⁻
795.8 ⁱ 2	9/2 ⁻
873.0 ^h 3	11/2 ⁺
955.2 ^h 3	13/2 ⁺
1483.4 ^g 3	15/2 ⁻
1609.0 ⁱ 3	13/2 ⁻
1739.1 ^h 4	17/2 ⁺
2057.8 4	17/2 ⁻
2231.3 ⁱ 4	17/2 ⁻
2382.8 4	19/2 ⁻
2400.4 ^h 4	21/2 ⁺
2523.2 ⁱ 4	21/2 ⁻
3133.9 4	23/2 ⁻
3226.8 4	23/2 ⁺

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$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ [1991FI02,1995FI01,1998By02](#) (continued) ^{149}Gd Levels (continued)

E(level) [†]	J π [‡]	T _{1/2} [#]	Comments
3293.7 5	25/2 ⁺		
3386.4 5	27/2 ⁺	6.0 ns 5	T _{1/2} : from the Adopted Levels.
3610.4 4	25/2 ⁻		
3631.2 4	27/2 ⁻	0.7 ns	
4053.6 5	29/2 ⁻		
4339.4 5	31/2 ⁻		
4342.1 5	29/2 ⁺		
4718.7 5	33/2 ⁺		
4800.8 5	33/2 ⁻		
5051.5 5	35/2 ⁻		
5299.7 5	37/2 ⁻		
5461.9 5	37/2 ⁺		
5633.1 6	41/2 ⁻		
5738.5 6	39/2 ^{-d}		
6098.1 6	41/2 ⁺		
6264.4 6	45/2 ^{-d}		
6300.0? 10	43/2 ^{-d}		
6469.7 6	45/2 ⁺		
6504? 1	47/2 ^{-d}		
6655.9 7	49/2 ⁺	3.3 ^{&} ns 4	
6786.6? 10	47/2 ^{++d}		
7071.9? 10	51/2 ^{++d}		
7740.9@ 12	51/2 [@]		
7820.9 7	53/2 ⁺		
7823.9 7	51/2 ⁻		
7996.0 8	53/2 ⁻		
8217.1 7	53/2 ⁺		
8432.7 7	55/2 ^{++e}		
8457.8@ 11	51/2 ^{-@}		
8464.7@ 11	47/2 ^{-@}		
8556.4 7	57/2 ⁺		
8656.9@ 12	51/2 ^{-@}		
8939.8 7	57/2 ⁻		
9054.7@ 11	49/2 ^{++@}		
9272.5 8	57/2 ^{-d}		
9325.3 8	59/2 ^{++e}		
9437.4 8	59/2 ^{++e}		
9501.1 8	61/2 ⁻		
10361.3 8	63/2 ^{++e}		
10509.4 8	63/2 ^{++e}		
10601.3 8	65/2 ⁻		
10624.9j 12	47/2 ^{-b}		
10850.0 8	63/2 ^{-e}		
10929.8 8	65/2 ⁻		
11010.9 8	65/2 ^{-e}		
11199.2 8	67/2 ^{++e}		
11242.7j 12	51/2 ⁻		
11711.1 8	67/2 ^{-e}		
11907.0j 12	55/2 ⁻		

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$^{124}\text{Sn}(^{30}\text{Si},5\text{n}\gamma)$ **1991FI02,1995FI01,1998By02 (continued)** ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	Comments
12267.7 8	69/2 ⁺ ^d	J ^π : (67/2) in 1991FI02.
12383.2 8	69/2 ⁻ ^e	
12468.4 8	69/2 ⁻	
12580.0 8	71/2 ⁻ ^e	
12618.8 ^j 12	59/2 ⁻	
12751.4 8	71/2 ⁺ ^e	
12966.6 8	71/2 ⁺ ^e	
13188.6 9	75/2 ⁻ ^e	
13278.0 9	73/2 ⁻ ^e	
13378.4 ^j 12	63/2 ⁻	
13566.6 9	75/2 ⁻ ^e	
14108.0 9	77/2 ⁻ ^e	
14186.5 ^j 13	67/2 ⁻	
15043.7 ^j 13	71/2 ⁻	
15162.8 9	81/2 ⁻ ^e	
15950.4 ^j 13	75/2 ⁻	
15996.9 10	85/2 ⁻ ^e	
16907.5 ^j 13	79/2 ⁻	
17916.2 ^j 13	83/2 ⁻	
18976.9 ^j 13	87/2 ⁻	
20090.6 ^j 13	91/2 ⁻	
21257.9 ^j 13	95/2 ⁻	
22479.7 ^j 13	99/2 ⁻	
23756.2 ^j 13	103/2 ⁻	
25088.2 ^j 13	107/2 ⁻	
26475.8 ^j 13	111/2 ⁻	
27920.0 ^j 13	115/2 ⁻	
29420.5 ^j 13	119/2 ⁻	
30978.3 ^j 13	123/2 ⁻	
32594.0 ^j 14	127/2 ⁻	
34266.1 ^j 14	131/2 ⁻	
35996.0 ^j 16	135/2 ⁻	
_x ^f ^k	63/2 ⁺	
858.5+x ^k 3	67/2 ⁺	
1746.7+x ^k 4	71/2 ⁺ ^c	
2624.8+x ^k 5	75/2 ⁺	
3525.8+x ^k 5	79/2 ⁺	
4468.1+x ^k 5	83/2 ⁺	
5455.0+x ^k 5	87/2 ⁺	
6488.0+x ^k 5	91/2 ⁺	
7569.3+x ^k 5	95/2 ⁺	
8699.7+x ^k 5	99/2 ⁺	
9880.6+x ^k 5	103/2 ⁺	
11113.1+x ^k 5	107/2 ⁺	
12399.0+x ^k 5	111/2 ⁺	
13738.6+x ^k 6	115/2 ⁺	

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$^{124}\text{Sn}(^{30}\text{Si}, 5n\gamma)$ **1991F102, 1995F101, 1998By02 (continued)** ^{149}Gd Levels (continued)

E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]
15133.4+x ^k 6	119/2 ⁺	18757.1+z ^m 11	J2+34	2556.9+w ^p 6	J5+6
16584.0+x ^k 6	123/2 ⁺	20285.7+z ^m 13	J2+36	3509.0+w ^p 7	J5+8
18090.7+x ^k 7	127/2 ⁺	21860.7+z ^m 17	J2+38	4512.8+w ^p 8	J5+10
19654.7+x ^k 8	131/2 ⁺	u ⁿ	J3≈(63/2 ⁻)	5562.5+w ^p 9	J5+12
21275.0+x ^k 10	135/2 ⁺	755.6+u ⁿ 4	J3+2	6667.6+w ^p 10	J5+14
y ^l	J1≈(57/2 ⁺)	1560.5+u ⁿ 5	J3+4	7824.8+w ^p 10	J5+16
649.8+y ^l 4	J1+2	2415.5+u ⁿ 6	J3+6	9034.1+w ^p 11	J5+18
1349.6+y ^l 5	J1+4	3323.5+u ⁿ 7	J3+8	10296.4+w ^p 11	J5+20
2098.2+y ^l 5	J1+6	4283.8+u ⁿ 7	J3+10	11612.1+w ^p 11	J5+22
2897.4+y ^l 6	J1+8	5299.4+u ⁿ 8	J3+12	12981.6+w ^p 12	J5+24
3751.5+y ^l 6	J1+10 ^a	6369.3+u ⁿ 8	J3+14	14404.4+w ^p 13	J5+26
4647.5+y ^l 6	J1+12	7495.4+u ⁿ 9	J3+16	15881.9+w ^p 14	J5+28
5600.8+y ^l 7	J1+14	8678.7+u ⁿ 9	J3+18	17414.6+w ^p 14	J5+30
6605.7+y ^l 7	J1+16	9919.6+u ⁿ 10	J3+20	19000.4+w ^p 16	J5+32
7662.4+y ^l 7	J1+18	11218.9+u ⁿ 10	J3+22	20641.6+w ^p 19	J5+34
8772.5+y ^l 8	J1+20	12576.6+u ⁿ 11	J3+24	s ^q	J6
9935.7+y ^l 8	J1+22	13993.6+u ⁿ 11	J3+26	877.5+s ^q 4	J6+2
11151.2+y ^l 8	J1+24	15469.4+u ⁿ 12	J3+28	1809.5+s ^q 5	J6+4
12420.0+y ^l 8	J1+26	17004.0+u ⁿ 13	J3+30	2794.9+s ^q 6	J6+6
13742.8+y ^l 9	J1+28	18599.0+u ⁿ 17	J3+32	3833.0+s ^q 7	J6+8
15119.6+y ^l 9	J1+30	v ^o	J4≈(57/2 ⁻)	4924.0+s ^q 7	J6+10
16550.5+y ^l 9	J1+32	688.0+v ^o 5	J4+2	6066.5+s ^q 8	J6+12
18036.1+y ^l 10	J1+34	1420.6+v ^o 6	J4+4	7259.7+s ^q 8	J6+14
19576.3+y ^l 11	J1+36	2200.8+v ^o 6	J4+6	8502.6+s ^q 9	J6+16
21170.7+y ^l 13	J1+38	3030.5+v ^o 6	J4+8	9794.5+s ^q 9	J6+18
22818.1+y ^l 16	J1+40	3911.5+v ^o 7	J4+10	11132.5+s ^q 10	J6+20
z ^m	J2≈(63/2 ⁺)	4845.0+v ^o 7	J4+12	12518.6+s ^q 10	J6+22
725.6+z ^m 4	J2+2	5832.1+v ^o 7	J4+14	13948.6+s ^q 11	J6+24
1497.5+z ^m 5	J2+4	6874.1+v ^o 8	J4+16	15420.9+s ^q 12	J6+26
2315.1+z ^m 5	J2+6	7971.6+v ^o 8	J4+18	16934.0+s ^q 14	J6+28
3180.0+z ^m 6	J2+8	9125.8+v ^o 8	J4+20	18483.4+s ^q 16	J6+30
4092.1+z ^m 6	J2+10	10337.8+v ^o 9	J4+22	t ^r	J7
5052.8+z ^m 6	J2+12	11608.3+v ^o 9	J4+24	874.0+t ^r 3	J7+2
6058.3+z ^m 7	J2+14	12937.2+v ^o 11	J4+26	1798.6+t ^r 4	J7+4
7114.6+z ^m 7	J2+16	14325.5+v ^o 12	J4+28	2771.2+t ^r 6	J7+6
8218.3+z ^m 7	J2+18	15772.1+v ^o 12	J4+30	3797.0+t ^r 8	J7+8
9369.8+z ^m 8	J2+20	17278.1+v ^o 14	J4+32	4813.4+t ^r 8	J7+10
10568.8+z ^m 8	J2+22	18843.3+v ^o 15	J4+34	5851.3+t ^r 9	J7+12
11815.8+z ^m 8	J2+24	20469.3+v ^o 18	J4+36	6941.2+t ^r 9	J7+14
13110.1+z ^m 8	J2+26	22155.3+v ^o 21	J4+38	8086.9+t ^r 10	J7+16
14451.6+z ^m 9	J2+28	w ^p	J5	9289.2+t ^r 10	J7+18
15839.7+z ^m 9	J2+30	802.9+w ^p 3	J5+2	10549.2+t ^r 11	J7+20
17274.6+z ^m 10	J2+32	1655.0+w ^p 5	J5+4	11867.6+t ^r 11	J7+22

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¹²⁴Sn(³⁰Si,5nγ) **1991FI02,1995FI01,1998By02 (continued)**
¹⁴⁹Gd Levels (continued)

E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]
13243.1+t ^r 12	J7+24	827.5+b ^t 5	J9+2	9619.4+c ^u 19	J10+18
14683.4+t ^r 12	J7+26	1697.0+b ^t 7	J9+4	10946.4+c ^u 20	J10+20
16178.0+t ^r 13	J7+28	2621.2+b ^t 7	J9+6	12320.2+c ^u 22	J10+22
17731.9+t ^r 14	J7+30	3596.6+b ^t 8	J9+8	13740.5+c ^u 24	J10+24
19346.4+t ^r 15	J7+32	4627.0+b ^t 9	J9+10	15212.1+c ^u 25	J10+26
a ^s	J8	5715.5+b ^t 9	J9+12	16738+c ^u 3	J10+28
747.4+a ^s 6	J8+2	6863.6+b ^t 10	J9+14	18321+c ^u 3	J10+30
1543.9+a ^s 8	J8+4	8072.9+b ^t 11	J9+16	19960+c ^u 4	J10+32
2391.2+a ^s 9	J8+6	9342.9+b ^t 12	J9+18	d ^v	J11
3289.6+a ^s 10	J8+8	10673.5+b ^t 12	J9+20	850.2+d ^v 10	J11+2
4239.7+a ^s 11	J8+10	12063.6+b ^t 13	J9+22	1741.3+d ^v 15	J11+4
5242.2+a ^s 12	J8+12	13512.5+b ^t 13	J9+24	2677.0+d ^v 17	J11+6
6304.9+a ^s 12	J8+14	15020.1+b ^t 14	J9+26	3663.4+d ^v 19	J11+8
7422.0+a ^s 13	J8+16	16586.1+b ^t 18	J9+28	4701.4+d ^v 21	J11+10
8594.8+a ^s 14	J8+18	c ^u	J10	5792.2+d ^v 23	J11+12
9826.0+a ^s 14	J8+20	854.9+c ^u 10	J10+2	6935.1+d ^v 24	J11+14
11114.4+a ^s 15	J8+22	1757.2+c ^u 12	J10+4	8130+d ^v 3	J11+16
12461.2+a ^s 16	J8+24	2713.2+c ^u 14	J10+6	9381+d ^v 3	J11+18
13868.4+a ^s 16	J8+26	3725.8+c ^u 14	J10+8	10688+d ^v 3	J11+20
15331.7+a ^s 17	J8+28	4795.4+c ^u 15	J10+10	12049+d ^v 4	J11+22
16863.5+a ^s 20	J8+30	5921.4+c ^u 16	J10+12	13467+d ^v 4	J11+24
18451.7+a ^s 24	J8+32	7103.0+c ^u 17	J10+14	14941+d ^v 4	J11+26
b ^t	J9	8337.0+c ^u 18	J10+16		

[†] From least-squares fit to γ-ray energies, assuming ΔEγ=0.3 keV, when not stated. See the Adopted Levels for sequence assignments from [1981Pi09](#) and [1991FI02](#), based on f_{7/2}, h_{9/2}, i_{13/2} neutron orbitals and d_{5/2}, h_{11/2}, g_{7/2} proton orbitals.

[‡] As given in [1991FI02](#) and [1995FI01](#) for normal-deformed level structures, based on γ(θ) and γ-cascades. J^π assignments in the Adopted Levels are the same, except that many are placed in parentheses as, in the opinion of evaluators, strong arguments seem lacking. For SD bands, assignments are implied from [1995FI01](#), based on configuration assignments and also from decay to normal-deformed levels for SD-1 band.

Quoted by [1991FI02](#) from [1983BaZZ](#), although, in the abstract ([1983BaZZ](#)), explicit values are not given. For 49/2⁺ level, value is from [2001Gu31](#).

@ From [1999Fi12](#).

& From recoil-shadow anisotropy method ([2001Gu31](#)). Other: 2.8 ns (quoted by [1991FI02](#) from [1983BaZZ](#)).

^a J≈(77/2) from [1993Ra07](#). J=73/2 is also suggested by [1993Ra07](#).

^b From [1999Fi12](#). [1993Ra07](#) suggest 47/2, 51/2 based on theoretical analysis.

^c [1993Ra07](#) suggest 67/2, 71/2 based on theoretical analysis.

^d From [1995FI01](#).

^e Parity from [1995FI01](#). No parity was given by [1991FI02](#), where most of the data for weakly-deformed states was reported. In the absence of any additional supporting data, it appears that the quoted parity is assumed for analysis of spectral data.

^f The energies of the first four transitions show a backbend in this band. This has been ascribed to the alignment of a neutron pair ([1995FI01](#)).

^g Band(A): ν2f_{7/2}³.

^h Band(B): νf_{7/2}³ ⊗ (3⁻ in ¹⁴⁸Gd).

ⁱ Band(C): νh_{9/2}ν2f_{7/2}².

^j Band(D): SD-1 band; (π,α)=(-,-1/2). Q(intrinsic)=14.9 +4-3 ([1998Kh09](#)), 15.0 2 ([1996Sa15](#)), 17 2 ([1988Ha02](#)) (from DSAM).

Continued on next page (footnotes at end of table)

$^{124}\text{Sn}(^{30}\text{Si}, 5n\gamma)$ **1991FI02, 1995FI01, 1998By02 (continued)** ^{149}Gd Levels (continued)

Band assignment from 1999Fi12, 1995FI01, 1993FI03, 1990Ha31 and 1988Ha02. Percent population=2.5 (1990Ha31), 1.8 (1995FI01). See also 1992Vi03, 1990Ha25, 1989Ta12, 1988Ta20, 1988Ha02. Configuration= $\pi 6^2 \otimes \nu 7^1$ (1993Cu06). Evidence for a $\Delta J=4$ rotational sequence, associated with an invariance under 90° rotation (1993FI07). Weak linking transitions have been reported by 1999Fi12. Percentage intensities (1999Fi12) leaking the SD-1 band are: 19% 1 from the (47/2) member, 69% 2 from the (49/2) member and 12% 2 from the (51/2) member of this band. This leaking intensity feeds the following weakly-deformed states in the first potential well: 23% 5 to 5633 level, 9% 3 to 6098 level, 12% 5 to 6470 level, 8% 2 to 6504 level, 23% 5 to 6656 level, 9% 2 to 6787 level, 6% 2 to 7072 level, 5% 1 to 7741 level, 3% 1 to 8458 level and 0.5% 3 to 8657 level (1999Fi12).

^k Band(E): SD-2 band; $(\pi, \alpha)=(+, -1/2)$. Band assignment from 1995FI01, 1993FI03, 1990Ha31 and 1988Ha02. Percent population=1.0 (1990Ha31), 0.45 (1995FI01). $Q(\text{intrinsic})=15.6$ 3 (1996Sa15) (DSAM). Configuration= $\pi 6^2 \otimes \nu 7^2 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1}$ (1995FI01, 1993Cu06). Energies of first four γ rays show a backbend in this SD band.

^l Band(F): SD-3 band; $(\pi, \alpha)=(+, +1/2)$. Band assignment from 1995FI01, 1993FI03, 1990Ha31 and 1988Ha02. Percent population=0.3 (1990Ha31), 0.22 (1995FI01). $Q(\text{intrinsic})=15.2$ 5 (1996Sa15) (DSAM). Configuration= $\pi 6^3 \otimes (\pi 1/2[301], \alpha=-1/2)^{-1} \otimes \nu 7^1$ (1995FI01, 1993Cu06).

^m Band(G): SD-4 band; $(\pi, \alpha)=(+, -1/2)$. Percent population=0.25 (1995FI01). $Q(\text{intrinsic})=17.5$ 6 (1996Sa15) (DSAM). Configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-2} \otimes \nu 7^2 \otimes (\nu 1/2[411], \alpha=+1/2)^{-1}$ (1995FI01).

ⁿ Band(H): SD-5 band; $(\pi, \alpha)=(-, -1/2)$. Band assignment from 1995FI01, 1994De33 and 1993FI03. Percent population=0.14 (1995FI01). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1} \otimes (\nu 5/2[402], \alpha=+1/2)$ (1995FI01). SD-5 and SD-6 are signature partners.

^o Band(I): SD-6 band; $(\pi, \alpha)=(-, +1/2)$. Band assignment from 1995FI01, 1994De33 and 1993FI03. Percent population=0.14 (1995FI01). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1} \otimes (\nu 5/2[402], \alpha=-1/2)$ (1995FI01).

^p Band(J): SD-7 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^3 \otimes (\pi 1/2[301], \alpha=+1/2)^{-1} \otimes \nu 7^1$ (1998By02).

^q Band(K): SD-8 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-2} \otimes \nu 7^1$ (1998By02).

^r Band(L): SD-9 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1} \otimes (\nu 9/2[514], \alpha=+1/2)$ (1998By02).

^s Band(M): SD-10 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1} \otimes (\nu 9/2[514], \alpha=-1/2)$ (1998By02).

^t Band(N): SD-11 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1} \otimes (\nu 3/2[521], \alpha=-1/2)$ (1998By02).

^u Band(O): SD-12 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes \nu 1/2[651]^{-2} \otimes (\nu 9/2[514])^2$ or $\nu 5/2[402]^2$ (1998By02).

^v Band(P): SD-13 band. Percent population is between 5% and 10% of SD-1 band (1998By02). Configuration= $\pi 6^2 \otimes \nu 7^1 \otimes (\nu 5/2[642], \alpha=+1/2)^{-1} \otimes (\nu 9/2[514]$ or $\nu 5/2[402])$ (1998By02).

¹²⁴Sn(³⁰Si,5n γ) **1991FI02,1995FI01,1998BY02 (continued)** $\gamma(^{149}\text{Gd})$

A₂ values are from **1991FI02**. These are from angular distributions at ten angles from 11° to 90° with respect to the nuclear spin axis determined from the hit pattern of several (minimum 10) E2 transitions in a cascade. The sign of A₂ in this experimental arrangement is opposite to that in $\gamma(\theta)$ experiments where angle is with reference to beam direction.

E _{γ} [†]	I _{γ} [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	$\delta^{\#}$	α^g	Comments
(21)		3631.2	27/2 ⁻	3610.4	25/2 ⁻				
77.0	27.0 2	873.0	11/2 ⁺	795.8	9/2 ⁻	(E1) ^{@a}		0.588 8	A ₂ =+0.06 2 E1 in 1991FI02 .
81.8	8.2 1	955.2	13/2 ⁺	873.0	11/2 ⁺	(M1) [@]		3.59 5	A ₂ =+0.21 2 $\delta(Q/D)=-0.04$ 4. M1 in 1991FI02 .
97.7	12.1 1	873.0	11/2 ⁺	775.1	11/2 ⁻	(E1) [@]		0.311 4	A ₂ =-0.27 1 E1 in 1991FI02 .
105 ^c	1.6 ^c	5738.5	39/2 ⁻	5633.1	41/2 ⁻				
123.3	8.3 1	8556.4	57/2 ⁺	8432.7	55/2 ⁺	D			A ₂ =+0.06 1
159.6	17.2 2	3386.4	27/2 ⁺	3226.8	23/2 ⁺	(E2) ^{&a}		0.478 7	A ₂ =-0.12 2 E2 in 1991FI02 .
160.7	3.5 1	11010.9	65/2 ⁻	10850.0	63/2 ⁻	D			A ₂ =+0.12 2
164.9	4.1 2	9437.4	59/2 ⁺	9272.5	57/2 ⁻	D+Q			A ₂ =+0.06 3
172.2	57.9 7	7996.0	53/2 ⁻	7823.9	51/2 ⁻	(M1(+E2)) [@]	-0.02 2	0.433 6	A ₂ =+0.19 1
175.6	7.3 1	9501.1	61/2 ⁻	9325.3	59/2 ⁺	D			A ₂ =+0.14 2
180.0	18.9 1	955.2	13/2 ⁺	775.1	11/2 ⁻	(E1) [@]		0.0600 8	A ₂ =+0.18 1 E1 in 1991FI02 .
186.2	111.0 5	6655.9	49/2 ⁺	6469.7	45/2 ⁺	(E2)		0.282 4	A ₂ =-0.27 1 E2 in 1991FI02 .
205.4 ⁱ	7.0 5	6469.7	45/2 ⁺	6264.4	45/2 ⁻				
215.4 ^h	3.5 ^h 1	8432.7	55/2 ⁺	8217.1	53/2 ⁺	D			A ₂ =+0.12 3
215.4 ^h	2.3 ^h 4	12966.6	71/2 ⁺	12751.4	71/2 ⁺				
240 ^{ci}	3.1 ^c	6504?	47/2 ⁻	6264.4	45/2 ⁻				
244.9	14.0 1	3631.2	27/2 ⁻	3386.4	27/2 ⁺	D			A ₂ =-0.22 2 E1 in 1991FI02 . $\Delta J=0$ transition.
248.0	21.7 1	5299.7	37/2 ⁻	5051.5	35/2 ⁻	D			A ₂ =+0.17 1 M1(+E2), $\delta(Q/D)=0.00$ 2 in 1991FI02 .
250.8	7.0 4	5051.5	35/2 ⁻	4800.8	33/2 ⁻	D+Q			A ₂ =+0.12 2 M1+E2 in 1991FI02 .
269.3	4.5 3	11199.2	67/2 ⁺	10929.8	65/2 ⁻	D			A ₂ =+0.09 1
285.6	18.8 1	4339.4	31/2 ⁻	4053.6	29/2 ⁻	D			A ₂ =+0.21 1 M1(+E2), $\delta(Q/D)=-0.04$ 3 in 191FI02 .
288.6	9.0 3	13566.6	75/2 ⁻	13278.0	73/2 ⁻	D			A ₂ =+0.14 1
291.8	11.6 2	2523.2	21/2 ⁻	2231.3	17/2 ⁻	(Q) ^{&a}			A ₂ =-0.17 3 E2 in 1991FI02 .

¹²⁴Sn(³⁰Si,5nγ) [1991FI02](#),[1995FI01](#),[1998By02](#) (continued)

γ(¹⁴⁹Gd) (continued)

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	δ [#]	α ^g	Comments
311.4	11.4 3	13278.0	73/2 ⁻	12966.6	71/2 ⁺	D			A ₂ =+0.21 2
317 ^{ci}	8.0 ^c	6786.6?	47/2 ⁺	6469.7	45/2 ⁺				
324.5	8.8 1	2382.8	19/2 ⁻	2057.8	17/2 ⁻	D+Q	-0.09 5		A ₂ =+0.27 2 M1+E2 in 1991FI02 .
333.2	18.0 10	5633.1	41/2 ⁻	5299.7	37/2 ⁻	(Q) ^{&a}			A ₂ =-0.16 2 E2 in 1991FI02 .
337.5	18.5 4	3631.2	27/2 ⁻	3293.7	25/2 ⁺	D			A ₂ =+0.18 1 E1 in 1991FI02 .
359.6	29.9 2	6098.1	41/2 ⁺	5738.5	39/2 ⁻	D			A ₂ =+0.15 1 E1 in 1991FI02 .
371.4	141.7 7	6469.7	45/2 ⁺	6098.1	41/2 ⁺	(Q)			A ₂ =-0.20 1 E2 in 1991FI02 .
376.6	4.5 3	4718.7	33/2 ⁺	4342.1	29/2 ⁺	(Q) ^{&a}			A ₂ =-0.15 1 E2 in 1991FI02 .
379.4	79.5 6	4718.7	33/2 ⁺	4339.4	31/2 ⁻	D			A ₂ =+0.17 1 E1 in 1991FI02 .
383.7	5.7 2	3610.4	25/2 ⁻	3226.8	23/2 ⁺	D ^{&a}			A ₂ =+0.02 2 E1 in 1991FI02 .
410.5	19.5 3	5461.9	37/2 ⁺	5051.5	35/2 ⁻	D			A ₂ =+0.16 1 E1 in 1991FI02 .
416 ^{ci}	1.4 ^c	7071.9?	51/2 ⁺	6655.9	49/2 ⁺				
422.5	18.2 1	4053.6	29/2 ⁻	3631.2	27/2 ⁻	D			A ₂ =+0.18 1 M1(+E2), δ(E2/M1)=-0.01 4 in 1991FI02 .
438.4 ^c	15.4 ^c	5738.5	39/2 ⁻	5299.7	37/2 ⁻	D+Q	+0.16 2		A ₂ =-0.03 1 M1+E2 in 1991FI02 . Other I _γ : 29 (1991FI02). The ordering of 359.6-438.4 cascade is from 1995FI01 . It was reversed in their earlier paper (1991FI02).
448.6	10.5 3	2057.8	17/2 ⁻	1609.0	13/2 ⁻	(Q)			A ₂ =-0.27 3 E2 in 1991FI02 .
461.0	2.5 1	4800.8	33/2 ⁻	4339.4	31/2 ⁻	D+Q			A ₂ =+0.30 5 M1+E2 in 1991FI02 .
465.7	54.5 1	2523.2	21/2 ⁻	2057.8	17/2 ⁻	(Q)			A ₂ =-0.20 1 E2 in 1991FI02 .
497.3	33.4 7	3631.2	27/2 ⁻	3133.9	23/2 ⁻	(E2) ^{&a}		0.01415 20	A ₂ =-0.11 1 E2 in 1991FI02 .
498.8	31.3 14	5299.7	37/2 ⁻	4800.8	33/2 ⁻	(Q) ^{&}			A ₂ =-0.29 2 E2 in 1991FI02 .
501.4	7.3 3	11010.9	65/2 ⁻	10509.4	63/2 ⁺	D			A ₂ =+0.30 4
507.1	6.3 1	8939.8	57/2 ⁻	8432.7	55/2 ⁺	D			A ₂ =+0.28 3
527.6	24.1 2	1483.4	15/2 ⁻	955.2	13/2 ⁺	D			A ₂ =+0.16 1 E1 in 1991FI02 .
541.4	7.7 3	14108.0	77/2 ⁻	13566.6	75/2 ⁻	D			A ₂ =+0.16 2

¹²⁴Sn(³⁰Si,5nγ) **1991FI02,1995FI01,1998By02** (continued)

γ(¹⁴⁹Gd) (continued)

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	Comments
561.4	58.5 3	9501.1	61/2 ⁻	8939.8	57/2 ⁻	(Q)	A ₂ =-0.26 1 E2 in 1991FI02 .
568.3	4.8 2	10929.8	65/2 ⁻	10361.3	63/2 ⁺		
574.2	51.0 5	2057.8	17/2 ⁻	1483.4	15/2 ⁻	D	A ₂ =+0.15 2 M1(+E2) in 1991FI02 . δ(Q/D)=+0.04 5.
583.1	5.9 3	12966.6	71/2 ⁺	12383.2	69/2 ⁻	D	A ₂ =+0.07 4
598.1	25.3 2	11199.2	67/2 ⁺	10601.3	65/2 ⁻	D	A ₂ =+0.09 2
608.6	6.3 3	13188.6	75/2 ⁻	12580.0	71/2 ⁻	(Q) ^{&a}	A ₂ =-0.05 3 E2 in 1991FI02 .
611.8	26.2 3	8432.7	55/2 ⁺	7820.9	53/2 ⁺	(D+Q)	A ₂ =+0.02 2
617.8 1	0.16 3	11242.7	51/2 ⁻	10624.9	47/2 ⁻		
622.7	5.3 2	2231.3	17/2 ⁻	1609.0	13/2 ⁻	(Q) ^{&a}	A ₂ =-0.14 3 E2 in 1991FI02 .
631.3 ^c	14.2 ^c	6264.4	45/2 ⁻	5633.1	41/2 ⁻		Other I _γ : 7.0 (1991FI02).
636.6	103.5 20	6098.1	41/2 ⁺	5461.9	37/2 ⁺	(Q)	A ₂ =-0.24 1 E2 in 1991FI02 .
643.8	13.2 2	2382.8	19/2 ⁻	1739.1	17/2 ⁺	D	A ₂ =+0.12 4 E1 in 1991FI02 .
649.8 4		649.8+y	J1+2	y	J1≈(57/2 ⁺)		
661.3	50.3 3	2400.4	21/2 ⁺	1739.1	17/2 ⁺	(Q)	A ₂ =-0.29 1 E2 in 1991FI02 .
664.2 1	0.68 7	11907.0	55/2 ⁻	11242.7	51/2 ⁻		
667 ^{ci}	1.0 ^c	6300.0?	43/2 ⁻	5633.1	41/2 ⁻		
672.1	4.0 2	12383.2	69/2 ⁻	11711.1	67/2 ⁻	D	A ₂ =+0.17 5
687 ^c	8.0 ^c	5738.5	39/2 ⁻	5051.5	35/2 ⁻		
688.1 5		688.0+v	J4+2	v	J4≈(57/2 ⁻)		
698.9	5.3 2	12966.6	71/2 ⁺	12267.7	69/2 ⁺	(D+Q) ^{&a}	A ₂ =-0.22 1 A ₂ consistent with ΔJ=2, Q; ΔJ=0, dipole; or ΔJ=1, D+Q. Revised J ^π assignment for 12267 level in 1991FI02 suggests ΔJ=1, D+Q for the 698.9γ, not E2 as given in 1991FI02 .
699.8 2		1349.6+y	J1+4	649.8+y	J1+2		
703.7	23.8 5	3226.8	23/2 ⁺	2523.2	21/2 ⁻	D	A ₂ =+0.13 3 Mult.: E1 (1991FI02). E1 in 1991FI02 .
708.0	86.9 25	4339.4	31/2 ⁻	3631.2	27/2 ⁻	(Q)	A ₂ =-0.25 1 E2 in 1991FI02 .
708.7	52.0 15	1483.4	15/2 ⁻	775.1	11/2 ⁻	(Q)	A ₂ =-0.25 1 E2 in 1991FI02 .
711.8 1		12618.8	59/2 ⁻	11907.0	55/2 ⁻		
712.3	38.4 2	5051.5	35/2 ⁻	4339.4	31/2 ⁻	(Q)	A ₂ =-0.23 1 E2 in 1991FI02 .
725.6 4		725.6+z	J2+2	z	J2≈(63/2 ⁺)		

$\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	$\delta^\#$	Comments
732.6 2		1420.6+v	J4+4	688.0+v	J4+2			
733.7	13.8 2	3133.9	23/2 ⁻	2400.4	21/2 ⁺	D&a		A ₂ =+0.01 2 E1 in 1991FI02.
735.8	26.8 3	8556.4	57/2 ⁺	7820.9	53/2 ⁺	(Q)		A ₂ =-0.30 1 E2 in 1991FI02.
743.2	88.0 7	5461.9	37/2 ⁺	4718.7	33/2 ⁺	(Q)		A ₂ =-0.25 1 E2 in 1991FI02.
747.4 ^h	5.7 ^h 2	2231.3	17/2 ⁻	1483.4	15/2 ⁻			
747.4 ^h	23.6 ^h 8	4800.8	33/2 ⁻	4053.6	29/2 ⁻	(Q) ^a		A ₂ =-0.17 1 E2 in 1991FI02.
747.6 6		747.4+a	J8+2	a	J8			
748.6 2		2098.2+y	J1+6	1349.6+y	J1+4			
750.9	27.2 2	3133.9	23/2 ⁻	2382.8	19/2 ⁻	(Q)&		A ₂ =-0.18 1 E2 in 1991FI02.
755.7 4		755.6+u	J3+2	u	J3≈(63/2 ⁻)			
759.7 1	0.88 9	13378.4	63/2 ⁻	12618.8	59/2 ⁻			
768.7	14.0 2	9325.3	59/2 ⁺	8556.4	57/2 ⁺	D+Q		A ₂ =+0.03 2
771.9 2		1497.5+z	J2+4	725.6+z	J2+2			
775.2	100.0 5	775.1	11/2 ⁻	0.0	7/2 ⁻	(Q)		A ₂ =-0.21 1 E2 in 1991FI02.
780.2 2		2200.8+v	J4+6	1420.6+v	J4+4			
784.1	59.0 3	1739.1	17/2 ⁺	955.2	13/2 ⁺	(Q)		A ₂ =-0.23 1 E2 in 1991FI02.
795.7	47.3 3	795.8	9/2 ⁻	0.0	7/2 ⁻	D+Q	+0.18 2	A ₂ =-0.02 1 M1+E2 in 1991FI02.
796.7 5		1543.9+a	J8+4	747.4+a	J8+2			
799.2 2		2897.4+y	J1+8	2098.2+y	J1+6			
802.9 3		802.9+w	J5+2	w	J5			
804.9 3		1560.5+u	J3+4	755.6+u	J3+2			
808.1 1	0.96 10	14186.5	67/2 ⁻	13378.4	63/2 ⁻			
813.2	7.8 1	1609.0	13/2 ⁻	795.8	9/2 ⁻	(Q)&		A ₂ =-0.11 4 E2 in 1991FI02.
817.6 2		2315.1+z	J2+6	1497.5+z	J2+4			
826.4	3.3 4	3226.8	23/2 ⁺	2400.4	21/2 ⁺	(D+Q)		A ₂ =-0.16 2 M1+E2 in 1991FI02.
827.6 5		827.5+b	J9+2	b	J9			
829.8 2		3030.5+v	J4+8	2200.8+v	J4+6			
834.1	7.7 2	1609.0	13/2 ⁻	775.1	11/2 ⁻	D+Q		A ₂ =0.00 2 M1+E2 in 1991FI02. (E2) in 1991FI02.
834.1	1.9 3	15996.9	85/2 ⁻	15162.8	81/2 ⁻			
838.0	12.7 4	11199.2	67/2 ⁺	10361.3	63/2 ⁺	(Q)&		A ₂ =-0.17 2 E2 in 1991FI02.

$\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
847.3 4		2391.2+a	J8+6	1543.9+a	J8+4		
850.3 10		850.2+d	J11+2	d	J11		
852.2 4		1655.0+w	J5+4	802.9+w	J5+2		
854.1 2		3751.5+y	J1+10	2897.4+y	J1+8		
855.0 3		2415.5+u	J3+6	1560.5+u	J3+4		
855.1 10		854.9+c	J10+2	c	J10		
857.1 1	1.00	15043.7	71/2 ⁻	14186.5	67/2 ⁻		
858.5 3		858.5+x	67/2 ⁺	x	63/2 ⁺		
860.1	8.5 2	10361.3	63/2 ⁺	9501.1	61/2 ⁻		
864.9 2		3180.0+z	J2+8	2315.1+z	J2+6		
868.9	7.4 3	12580.0	71/2 ⁻	11711.1	67/2 ⁻	(Q)	$A_2 = -0.24$ 5 E2 in 1991FI02 .
869.7 4		1697.0+b	J9+4	827.5+b	J9+2		
874.1 3		874.0+t	J7+2	t	J7		
877.8 4		877.5+s	J6+2	s	J6		
878.1 2	0.40 6	2624.8+x	75/2 ⁺	1746.7+x	71/2 ⁺		
881.0 2		3911.5+v	J4+10	3030.5+v	J4+8		
881.1	16.2 3	9437.4	59/2 ⁺	8556.4	57/2 ⁺	D+Q	$A_2 = 0.00$ 2
888.2 2		1746.7+x	71/2 ⁺	858.5+x	67/2 ⁺		
891.2 10		1741.3+d	J11+4	850.2+d	J11+2		
893.3	33.1 2	3293.7	25/2 ⁺	2400.4	21/2 ⁺	(Q)	$A_2 = -0.28$ 1 E2 in 1991FI02 .
896.0 2	0.64 16	4647.5+y	J1+12	3751.5+y	J1+10		
898.5 4		3289.6+a	J8+8	2391.2+a	J8+6		
899.6	10.1 2	2382.8	19/2 ⁻	1483.4	15/2 ⁻	(Q)	$A_2 = -0.26$ 3 E2 in 1991FI02 .
901.0 1	0.44 6	3525.8+x	79/2 ⁺	2624.8+x	75/2 ⁺		
902.0 3		2556.9+w	J5+6	1655.0+w	J5+4		
902.4 6		1757.2+c	J10+4	854.9+c	J10+2		
906.7 1	1.05 10	15950.4	75/2 ⁻	15043.7	71/2 ⁻		
908.0 2		3323.5+u	J3+8	2415.5+u	J3+6		
912.1 2		4092.1+z	J2+10	3180.0+z	J2+8		
919.5	5.7 3	14108.0	77/2 ⁻	13188.6	75/2 ⁻	D	$A_2 = +0.07$ 4
924.0	18.7 9	10361.3	63/2 ⁺	9437.4	59/2 ⁺	(Q)&	$A_2 = -0.08$ 3 E2 in 1991FI02 .
924.2 3		2621.2+b	J9+6	1697.0+b	J9+4		
924.6 2		1798.6+t	J7+4	874.0+t	J7+2		
932.0 3		1809.5+s	J6+4	877.5+s	J6+2		
933.5 2		4845.0+v	J4+12	3911.5+v	J4+10		
935.7 9		2677.0+d	J11+6	1741.3+d	J11+4		
942.3 1		4468.1+x	83/2 ⁺	3525.8+x	79/2 ⁺		
943.8	76.3 4	8939.8	57/2 ⁻	7996.0	53/2 ⁻	(Q)	$A_2 = -0.24$ 1 E2 in 1991FI02 .
950.2 4		4239.7+a	J8+10	3289.6+a	J8+8		

¹²⁴Sn(³⁰Si,5nγ) [1991FI02,1995FI01,1998By02](#) (continued)

γ(¹⁴⁹Gd) (continued)

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	Comments
952.1 2		3509.0+w	J5+8	2556.9+w	J5+6		
953.3 2		5600.8+y	J1+14	4647.5+y	J1+12		
955.6	8.2 3	4342.1	29/2 ⁺	3386.4	27/2 ⁺	D+Q	A ₂ =+0.03 2 M1+E2 in 1991FI02 .
956.1 6		2713.2+c	J10+6	1757.2+c	J10+4		
957.1 1	0.98 10	16907.5	79/2 ⁻	15950.4	75/2 ⁻		
960.3 2		4283.8+u	J3+10	3323.5+u	J3+8		
960.7 2		5052.8+z	J2+12	4092.1+z	J2+10		
972.6 4		2771.2+t	J7+6	1798.6+t	J7+4		
975.4 3		3596.6+b	J9+8	2621.2+b	J9+6		
985.5 3		2794.9+s	J6+6	1809.5+s	J6+4		
986.5 9		3663.4+d	J11+8	2677.0+d	J11+6		
986.9 1		5455.0+x	87/2 ⁺	4468.1+x	83/2 ⁺		
987.1 2		5832.1+v	J4+14	4845.0+v	J4+12		
1002.5 4		5242.2+a	J8+12	4239.7+a	J8+10		
1003.8 4		4512.8+w	J5+10	3509.0+w	J5+8		
1004.9 2	0.64 16	6605.7+y	J1+16	5600.8+y	J1+14		
1005.5 2		6058.3+z	J2+14	5052.8+z	J2+12		
1008.3	10.9 4	10509.4	63/2 ⁺	9501.1	61/2 ⁻		
1008.7 1	0.95 10	17916.2	83/2 ⁻	16907.5	79/2 ⁻		
1012.6 5		3725.8+c	J10+8	2713.2+c	J10+6		
1015.6 3		5299.4+u	J3+12	4283.8+u	J3+10		
1016.4 3		4813.4+t	J7+10	3797.0+t	J7+8		
1025.9 5		3797.0+t	J7+8	2771.2+t	J7+6		
1030.4 3		4627.0+b	J9+10	3596.6+b	J9+8		
1033.0 1	0.86 12	6488.0+x	91/2 ⁺	5455.0+x	87/2 ⁺		
1037.9 3		5851.3+t	J7+12	4813.4+t	J7+10		
1038.0 8		4701.4+d	J11+10	3663.4+d	J11+8		
1038.3 3		3833.0+s	J6+8	2794.9+s	J6+6		
1042.0 2		6874.1+v	J4+16	5832.1+v	J4+14		
1049.7 4		5562.5+w	J5+12	4512.8+w	J5+10		
1054.7	5.8 3	15162.8	81/2 ⁻	14108.0	77/2 ⁻	(Q)&	A ₂ =-0.17 3 E2 in 1991FI02 .
1056.2 2		7114.6+z	J2+16	6058.3+z	J2+14		
1056.7 2	0.64 16	7662.4+y	J1+18	6605.7+y	J1+16		
1060.7 1	0.90 9	18976.9	87/2 ⁻	17916.2	83/2 ⁻		
1062.8 4		6304.9+a	J8+14	5242.2+a	J8+12		
1068.6	3.4 2	12267.7	69/2 ⁺	11199.2	67/2 ⁺	(D+Q)	A ₂ =-0.15 6 A ₂ consistent with ΔJ=2, Q; ΔJ=0, dipole; or ΔJ=1, D+Q. Revised J ^π assignment in 1991FI02 suggests ΔJ=1, D+Q.
1069.6 5		4795.4+c	J10+10	3725.8+c	J10+8		
1069.9 3		6369.3+u	J3+14	5299.4+u	J3+12		
1081.3 1		7569.3+x	95/2 ⁺	6488.0+x	91/2 ⁺		

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ **1991FI02,1995FI01,1998By02 (continued)**
 $\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
1085 <i>f</i> 1		7740.9	51/2	6655.9	49/2 ⁺		
1087.3	46.5 5	3610.4	25/2 ⁻	2523.2	21/2 ⁻	(Q)	$A_2 = -0.27$ 1 E2 in 1991FI02 .
1088.5 3		5715.5+b	J9+12	4627.0+b	J9+10		
1089.9 3		6941.2+t	J7+14	5851.3+t	J7+12		
1090.8 8		5792.2+d	J11+12	4701.4+d	J11+10		
1091.0 2		4924.0+s	J6+10	3833.0+s	J6+8		
1097.5 2		7971.6+v	J4+18	6874.1+v	J4+16		
1100.5	47.2 3	10601.3	65/2 ⁻	9501.1	61/2 ⁻	(Q)	$A_2 = -0.26$ 1 E2 in 1991FI02 .
1103.7 2		8218.3+z	J2+18	7114.6+z	J2+16		
1105.2 4		6667.6+w	J5+14	5562.5+w	J5+12		
1109.9	19.2 3	11711.1	67/2 ⁻	10601.3	65/2 ⁻	D	$A_2 = +0.15$ 4
1110.1 2	0.80 16	8772.5+y	J1+20	7662.4+y	J1+18		
1113.8 1	0.83 8	20090.6	91/2 ⁻	18976.9	87/2 ⁻		
1117.1 4		7422.0+a	J8+16	6304.9+a	J8+14		
1126.1 3		7495.4+u	J3+16	6369.3+u	J3+14		
1126.1 5		5921.4+c	J10+12	4795.4+c	J10+10		
1130.4 1	1.00 14	8699.7+x	99/2 ⁺	7569.3+x	95/2 ⁺		
1142.5 2		6066.5+s	J6+12	4924.0+s	J6+10		
1142.9 8		6935.1+d	J11+14	5792.2+d	J11+12		
1145.6 3		8086.9+t	J7+16	6941.2+t	J7+14		
1148.2 4		6863.6+b	J9+14	5715.5+b	J9+12		
1151.5 2		9369.8+z	J2+20	8218.3+z	J2+18		
1154.3 2		9125.8+v	J4+20	7971.6+v	J4+18		
1157.2 3		7824.8+w	J5+16	6667.6+w	J5+14		
1163.2 2	0.96 16	9935.7+y	J1+22	8772.5+y	J1+20		
1165.3	62.0 5	7820.9	53/2 ⁺	6655.9	49/2 ⁺	(Q)	$A_2 = -0.29$ 1 E2 in 1991FI02 .
1167.2 2		21257.9	95/2 ⁻	20090.6	91/2 ⁻		
1168.0	83.5 5	7823.9	51/2 ⁻	6655.9	49/2 ⁺	D	$A_2 = +0.19$ 1 E1 in 1991FI02 .
1172.8 4		8594.8+a	J8+18	7422.0+a	J8+16		
1180.9 1	1.02 14	9880.6+x	103/2 ⁺	8699.7+x	99/2 ⁺		
1181.6 5		7103.0+c	J10+14	5921.4+c	J10+12		
1183.4 3		8678.7+u	J3+18	7495.4+u	J3+16		
1183.9	3.1 3	12383.2	69/2 ⁻	11199.2	67/2 ⁺	D	$A_2 = +0.13$ 8
1193.3 3		7259.7+s	J6+14	6066.5+s	J6+12		
1195.2 9		8130+d	J11+16	6935.1+d	J11+14		
1199.0 2		10568.8+z	J2+22	9369.8+z	J2+20		
1202.4 3		9289.2+t	J7+18	8086.9+t	J7+16		
1209.3 3		9034.1+w	J5+18	7824.8+w	J5+16		
1209.3 4		8072.9+b	J9+16	6863.6+b	J9+14		
1212.0 3		10337.8+v	J4+22	9125.8+v	J4+20		

$^{124}\text{Sn}(^{30}\text{Si}, 5n\gamma)$ [1991FI02, 1995FI01, 1998By02](#) (continued)

 $\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
1215.5 2	0.96 16	11151.2+y	J1+24	9935.7+y	J1+22		
1221.8 1	0.80 8	22479.7	99/2 ⁻	21257.9	95/2 ⁻		
1231.3 5		9826.0+a	J8+20	8594.8+a	J8+18		
1232.5 1	0.58 10	11113.1+x	107/2 ⁺	9880.6+x	103/2 ⁺		
1234.0 6		8337.0+c	J10+16	7103.0+c	J10+14		
1240.9 3		9919.6+u	J3+20	8678.7+u	J3+18		
1242.9 3		8502.6+s	J6+16	7259.7+s	J6+14		
1247.0 2	1.00 ^b 5	11815.8+z	J2+24	10568.8+z	J2+22		
1251.1 10		9381+d	J11+18	8130+d	J11+16		
1260.0 3		10549.2+t	J7+20	9289.2+t	J7+18		
1262.3 3		10296.4+w	J5+20	9034.1+w	J5+18		
1268.8 2	0.96 16	12420.0+y	J1+26	11151.2+y	J1+24		
1270.0 4		9342.9+b	J9+18	8072.9+b	J9+16		
1270.5 3		11608.3+v	J4+24	10337.8+v	J4+22		
1276.4	5.4 3	9272.5	57/2 ⁻	7996.0	53/2 ⁻	(Q)	$A_2 = -0.24$ 5 E2 in 1991FI02 .
1276.5 1	0.72 7	23756.2	103/2 ⁻	22479.7	99/2 ⁻		
1282.5 6		9619.4+c	J10+18	8337.0+c	J10+16		
1285.8 1	0.66 10	12399.0+x	111/2 ⁺	11113.1+x	107/2 ⁺		
1288.4 4		11114.4+a	J8+22	9826.0+a	J8+20		
1291.9 3		9794.5+s	J6+18	8502.6+s	J6+16		
1294.3 2	0.87 ^b 5	13110.1+z	J2+26	11815.8+z	J2+24		
1299.3 3		11218.9+u	J3+22	9919.6+u	J3+20		
1306.7 7		10688+d	J11+20	9381+d	J11+18		
1315.7 3		11612.1+w	J5+22	10296.4+w	J5+20		
1318.4 3		11867.6+t	J7+22	10549.2+t	J7+20		
1322.8 2	1.20 24	13742.8+y	J1+28	12420.0+y	J1+26		
1327.1 7		10946.4+c	J10+20	9619.4+c	J10+18		
1328.9 5		12937.2+v	J4+26	11608.3+v	J4+24		
1330.6 4		10673.5+b	J9+20	9342.9+b	J9+18		
1332.0 1	0.60 6	25088.2	107/2 ⁻	23756.2	103/2 ⁻		
1338.1 3		11132.5+s	J6+20	9794.5+s	J6+18		
1339.6 1	0.56 10	13738.6+x	115/2 ⁺	12399.0+x	111/2 ⁺		
1341.5 3	0.72 ^b 5	14451.6+z	J2+28	13110.1+z	J2+26		
1346.8 4		12461.2+a	J8+24	11114.4+a	J8+22		
1348.7	7.5 2	10850.0	63/2 ⁻	9501.1	61/2 ⁻	D	$A_2 = +0.18$ 3
1357.7 3		12576.6+u	J3+24	11218.9+u	J3+22		
1360.6 15		12049+d	J11+22	10688+d	J11+20		
1369.5 3		12981.6+w	J5+24	11612.1+w	J5+22		
1372.0	2.2 3	12383.2	69/2 ⁻	11010.9	65/2 ⁻	(Q)	$A_2 = -0.30$ 8 E2 in 1991FI02 .
1373.8 8		12320.2+c	J10+22	10946.4+c	J10+20		
1375.5 3		13243.1+t	J7+24	11867.6+t	J7+22		

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ [1991FI02,1995FI01,1998By02](#) (continued)

 $\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	Comments
1376.8 2	1.12 24	15119.6+y	J1+30	13742.8+y	J1+28		
1386.1 3		12518.6+s	J6+22	11132.5+s	J6+20		
1387.6 1	0.51 5	26475.8	111/2 ⁻	25088.2	107/2 ⁻		
1388.1 3	0.62 ^b 5	15839.7+z	J2+30	14451.6+z	J2+28		
1388.3 5		14325.5+v	J4+28	12937.2+v	J4+26		
1390.1 3		12063.6+b	J9+22	10673.5+b	J9+20		
1394.8 2	0.52 10	15133.4+x	119/2 ⁺	13738.6+x	115/2 ⁺		
1407.2 5		13868.4+a	J8+26	12461.2+a	J8+24		
1417.0 4		13993.6+u	J3+26	12576.6+u	J3+24		
1418.0 13		13467+d	J11+24	12049+d	J11+22		
1420.3 10		13740.5+c	J10+24	12320.2+c	J10+22		
1422.8 4		14404.4+w	J5+26	12981.6+w	J5+24		
1428.7	3.9 2	10929.8	65/2 ⁻	9501.1	61/2 ⁻	(Q)	$A_2 = -0.21$ 6 E2 in 1991FI02 .
1430.0 4		13948.6+s	J6+24	12518.6+s	J6+22		
1430.9 3	0.56 16	16550.5+y	J1+32	15119.6+y	J1+30		
1434.9 3	0.42 ^b 5	17274.6+z	J2+32	15839.7+z	J2+30		
1440.3 4		14683.4+t	J7+26	13243.1+t	J7+24		
1444.2 1	0.38 5	27920.0	115/2 ⁻	26475.8	111/2 ⁻		
1446.6 4		15772.1+v	J4+30	14325.5+v	J4+28		
1448.9 4		13512.5+b	J9+24	12063.6+b	J9+22		
1450.6 2	0.42 8	16584.0+x	123/2 ⁺	15133.4+x	119/2 ⁺		
1463.3 6		15331.7+a	J8+28	13868.4+a	J8+26		
1471.7 8		15212.1+c	J10+26	13740.5+c	J10+24		
1472.3 5		15420.9+s	J6+26	13948.6+s	J6+24		
1474.0 15		14941+d	J11+26	13467+d	J11+24		
1475.8 4		15469.4+u	J3+28	13993.6+u	J3+26		
1477.5 5		15881.9+w	J5+28	14404.4+w	J5+26		
1482.5 4	0.22 ^b 5	18757.1+z	J2+34	17274.6+z	J2+32		
1485.6 4	0.56 16	18036.1+y	J1+34	16550.5+y	J1+32		
1494.6 4		16178.0+t	J7+28	14683.4+t	J7+26		
1500.5 2	0.28 4	29420.5	119/2 ⁻	27920.0	115/2 ⁻		
1506.0 6		17278.1+v	J4+32	15772.1+v	J4+30		
1506.7 3	0.26 6	18090.7+x	127/2 ⁺	16584.0+x	123/2 ⁺		
1507.6 5		15020.1+b	J9+26	13512.5+b	J9+24		
1513.1 6		16934.0+s	J6+28	15420.9+s	J6+26		
1525.6 8		16738+c	J10+28	15212.1+c	J10+26		
1528.6 8	0.12 ^b 5	20285.7+z	J2+36	18757.1+z	J2+34		
1531.8 10		16863.5+a	J8+30	15331.7+a	J8+28		
1532.7 5		17414.6+w	J5+30	15881.9+w	J5+28		
1534.6 5		17004.0+u	J3+30	15469.4+u	J3+28		
1540.2 5		19576.3+y	J1+36	18036.1+y	J1+34		

¹²⁴Sn(³⁰Si,5nγ) **1991FI02,1995FI01,1998By02 (continued)**

γ(¹⁴⁹Gd) (continued)

E _γ [†]	I _γ [‡]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	Comments
1549.4 8		18483.4+s	J6+30	16934.0+s	J6+28		
1552.4	3.2 5	12751.4	71/2 ⁺	11199.2	67/2 ⁺	(Q)	A ₂ =-0.22 5 E2 in 1991FI02 .
1553.9 4		17731.9+t	J7+30	16178.0+t	J7+28		
1557.8 2	0.19 3	30978.3	123/2 ⁻	29420.5	119/2 ⁻		
1560.9	5.0 1	8217.1	53/2 ⁺	6655.9	49/2 ⁺	(Q)	A ₂ =-0.28 5 E2 in 1991FI02 .
1564.0 3		19654.7+x	131/2 ⁺	18090.7+x	127/2 ⁺		
1565.2 6		18843.3+v	J4+34	17278.1+v	J4+32		
1566.0 11		16586.1+b	J9+28	15020.1+b	J9+26		
1575.0 10		21860.7+z	J2+38	20285.7+z	J2+36		
1583.1 12		18321+c	J10+30	16738+c	J10+28		
1585.8 6		19000.4+w	J5+32	17414.6+w	J5+30		
1588.2 13		18451.7+a	J8+32	16863.5+a	J8+30		
1594.4 7		21170.7+y	J1+38	19576.3+y	J1+36		
1595.0 10		18599.0+u	J3+32	17004.0+u	J3+30		
1614.5 7		19346.4+t	J7+32	17731.9+t	J7+30		
1615.7 3	0.10 2	32594.0	127/2 ⁻	30978.3	123/2 ⁻		
1620.3 7		21275.0+x	135/2 ⁺	19654.7+x	131/2 ⁺		
1626.0 10		20469.3+v	J4+36	18843.3+v	J4+34		
1639.2 13		19960+c	J10+32	18321+c	J10+30		
1641.2 11		20641.6+w	J5+34	19000.4+w	J5+32		
1647.4 9		22818.1+y	J1+40	21170.7+y	J1+38		
1672.1 4	0.06 2	34266.1	131/2 ⁻	32594.0	127/2 ⁻		
1686.0 10		22155.3+v	J4+38	20469.3+v	J4+36		
1729.9 8	0.03 ^d 1	35996.0	135/2 ⁻	34266.1	131/2 ⁻		
1767.4	3.5 2	12966.6	71/2 ⁺	11199.2	67/2 ⁺	(Q)	A ₂ =-0.31 5 E2 in 1991FI02 .
1802 ^f 1		8457.8	51/2 ⁻	6655.9	49/2 ⁺		I _γ : 0.005 2 relative to I _γ (857)=1.0 in SD-1 band.
1867.1	2.4 4	12468.4	69/2 ⁻	10601.3	65/2 ⁻	(Q)	A ₂ =-0.15 8 E2 in 1991FI02 .
1995 ^f 1		8464.7	47/2 ⁻	6469.7	45/2 ⁺		I _γ : 0.006 3 relative to I _γ (857)=1.0 in SD-1 band.
2001 ^f 1		8656.9	51/2 ⁻	6655.9	49/2 ⁺		I _γ : 0.005 3 relative to I _γ (857)=1.0 in SD-1 band.
2188 ^e 1	0.024 ^e 6	11242.7	51/2 ⁻	9054.7	49/2 ⁺		
2585 ^f 1		9054.7	49/2 ⁺	6469.7	45/2 ⁺		I _γ : 0.005 2 relative to I _γ (857)=1.0 in SD-1 band.
2778 ^{ei} 2	<0.005 ^e	11242.7	51/2 ⁻	8464.7	47/2 ⁻		
2785 ^{ei} 2	<0.005 ^e	11242.7	51/2 ⁻	8457.8	51/2 ⁻		I _γ : I _γ (2778+2785)=0.005 3.

[†] From [1991FI02](#). For SD bands, values are from [1995FI01](#) for bands SD-1 to SD-6 and from [1998By02](#) for SD-7 to SD-13. Exceptions are noted.

[‡] From [1991FI02](#). For SD bands, values are from [1990Ha31](#) (see also [1995FI01](#)) and are relative intensities (normalized to ≈1 for one of the most intense

$\gamma(^{149}\text{Gd})$ (continued)

transitions in the band) within each band. For these bands, intensity relative to the 775 γ in the normal band can be obtained by multiplying by the percent population values given under comments with the first level in each band. Exceptions are noted.

[1991FI02](#) assign multipolarities to a large number of transitions based on A_2 values from their $\gamma(\theta)$ data (relative to nuclear spin axis). [1991FI02](#) have assigned E2 to transitions with negative A_2 and E1 or M1 to transitions with positive A_2 . Since $\gamma(\theta)$ data are insensitive to parity, the assignments given here are mult=Q for negative A_2 and mult=dipole for positive A_2 . But using RUL for E2 and M2 and assuming $T_{1/2}(\text{level}) < 5$ ns, mult=Q is restricted to E2 for $E\gamma < 850$.

From systematics of population of levels in (HI, xn γ) experiments, mult=Q most likely corresponds to E2 in all cases.

@ Deduced from intensity balance ([1991FI02](#)).

& From $\gamma(\theta)$ ([1991FI02](#)) for a mixed line.

^a A_2 value from $\gamma(\theta)$ is for a mixed line.

^b From [1995FI01](#).

^c γ from [1995FI01](#). Intensity obtained by evaluators as priv. comm. from authors of [1995FI01](#).

^d Estimated (by evaluators) from spectrum shown by [1995FI01](#).

^e From [1999Fi12](#).

^f From [1999Fi12](#).

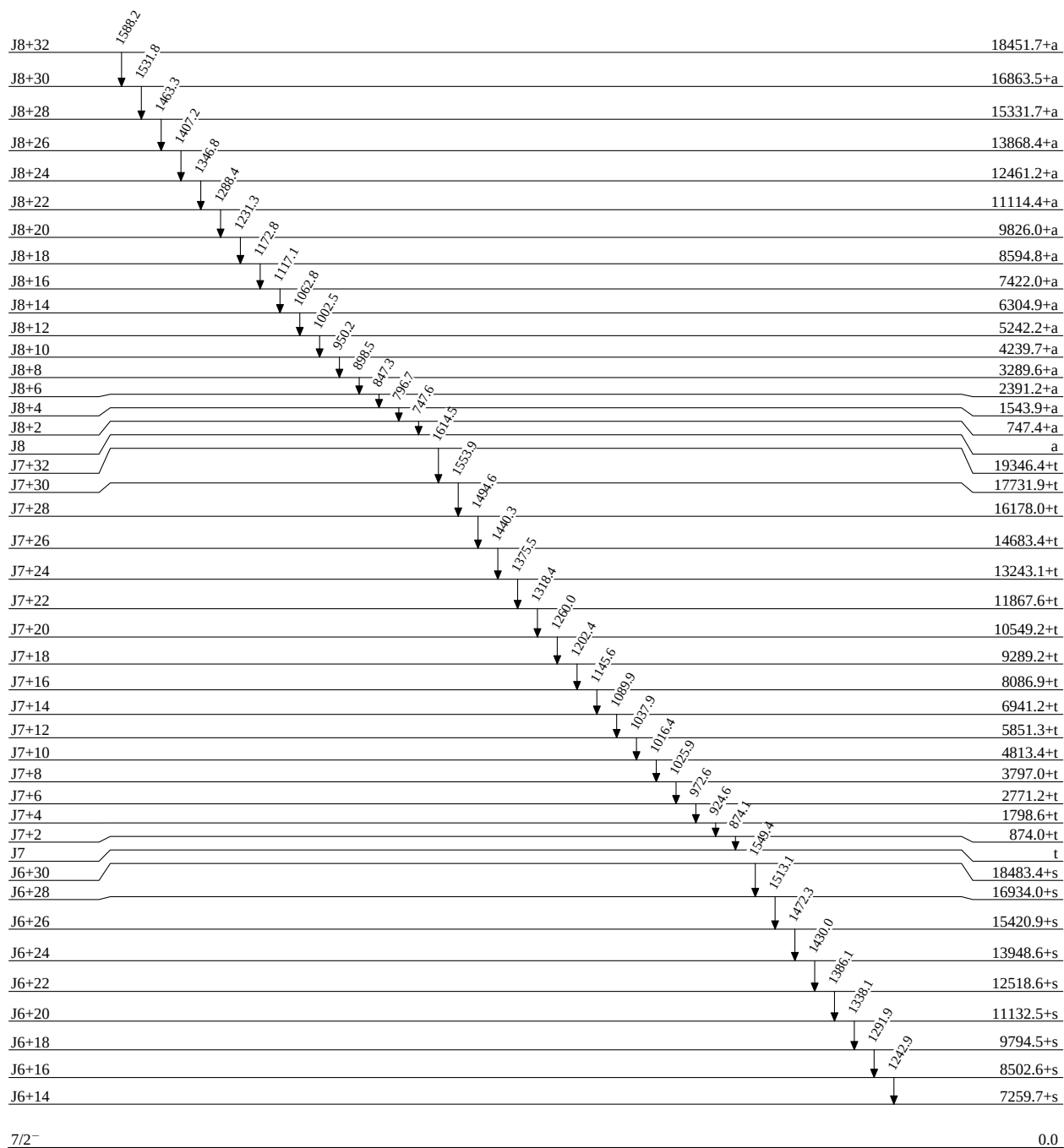
^g Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^h Multiply placed with intensity suitably divided.

ⁱ Placement of transition in the level scheme is uncertain.

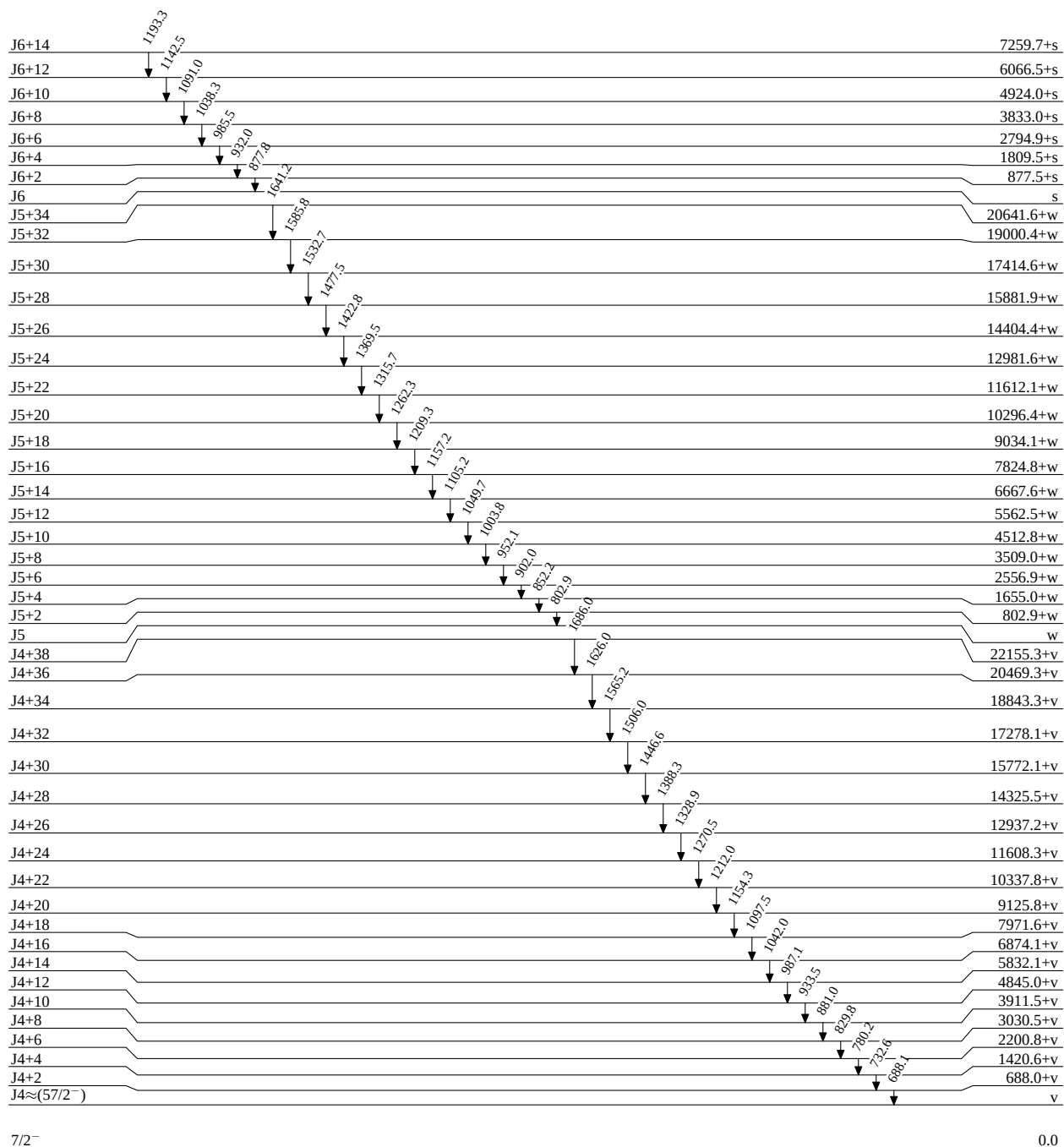
$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991FI02,1995FI01,1998BY02

Level Scheme (continued)

 Intensities: Relative I_γ


$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991FI02,1995FI01,1998By02

Level Scheme (continued)

 Intensities: Relative I_γ


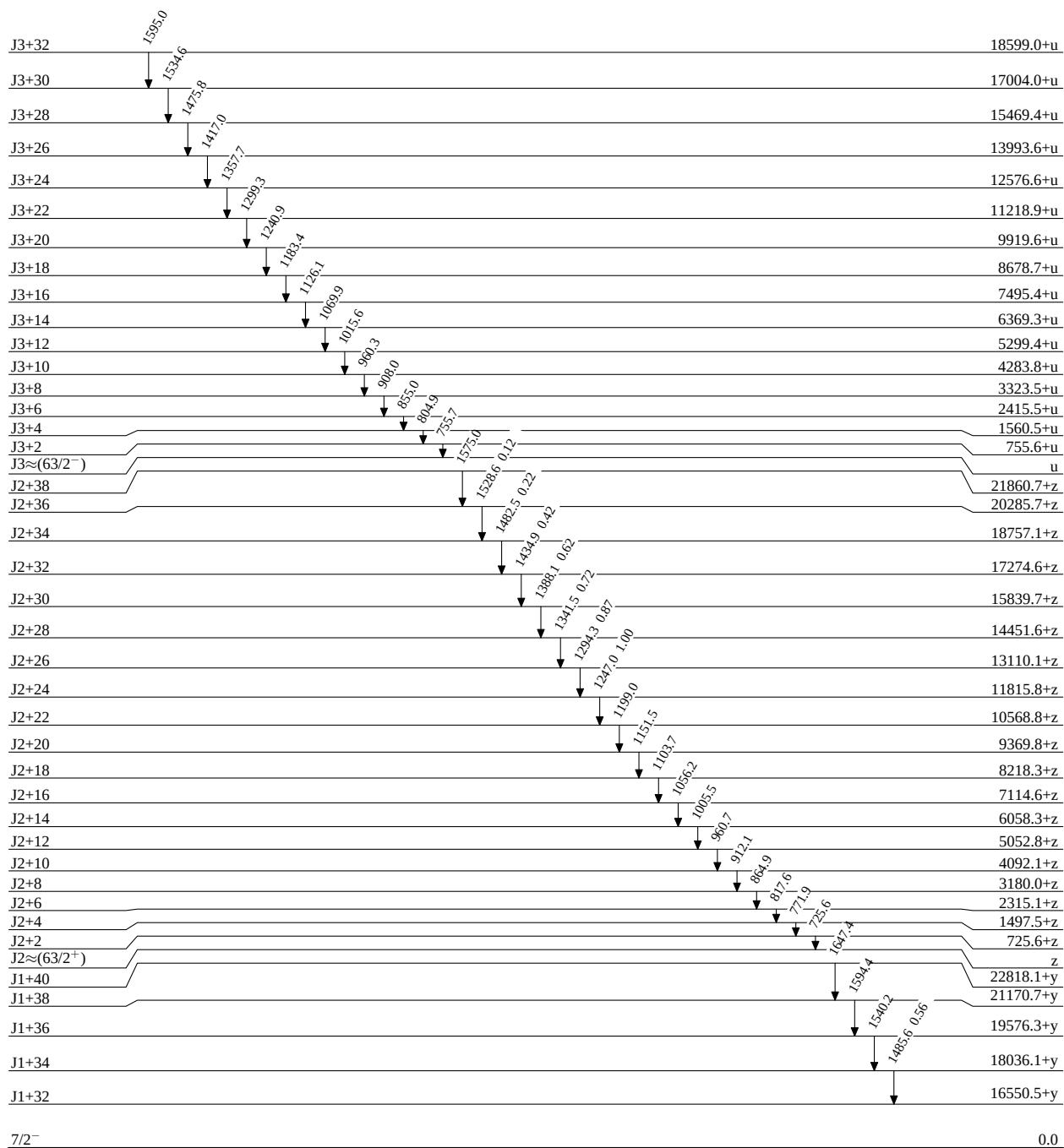
$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991FI02,1995FI01,1998BY02

Level Scheme (continued)

 Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$



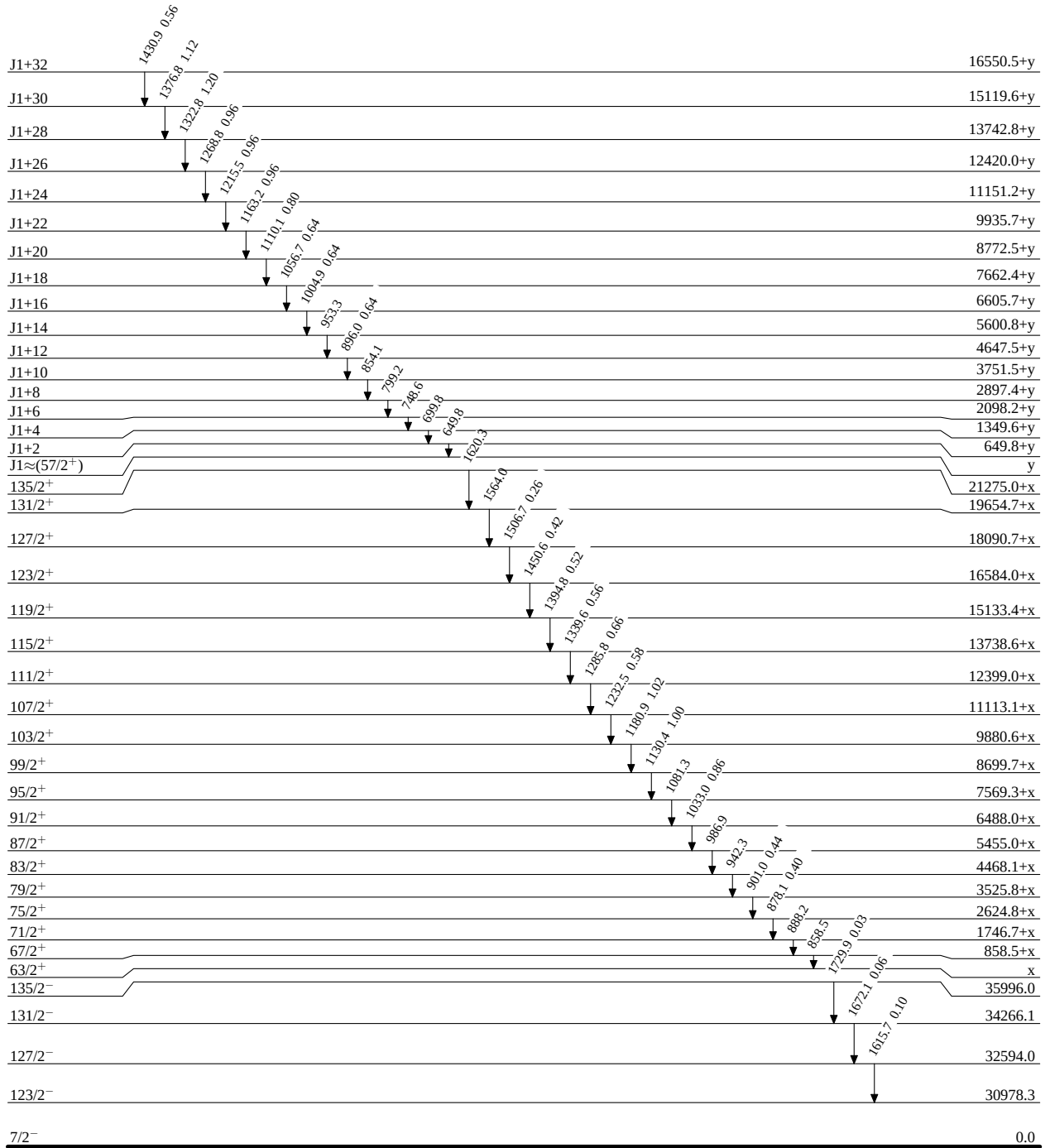
$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991FI02,1995FI01,1998By02

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$



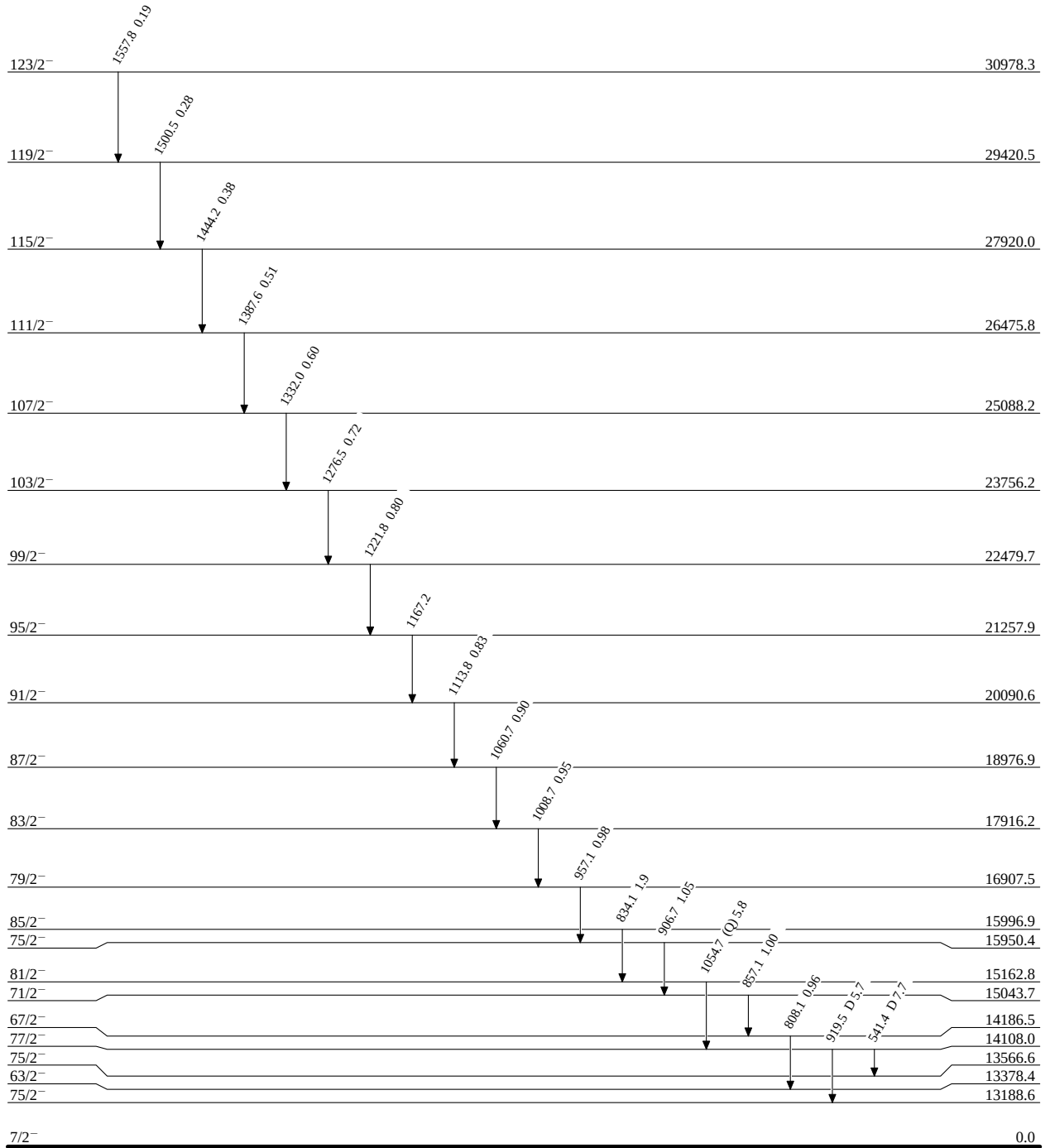
$^{124}\text{Sn}(^{30}\text{Si},5\text{n}\gamma)$ 1991FI02,1995FI01,1998By02

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
→ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
→ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{149}_{64}\text{Gd}_{85}$

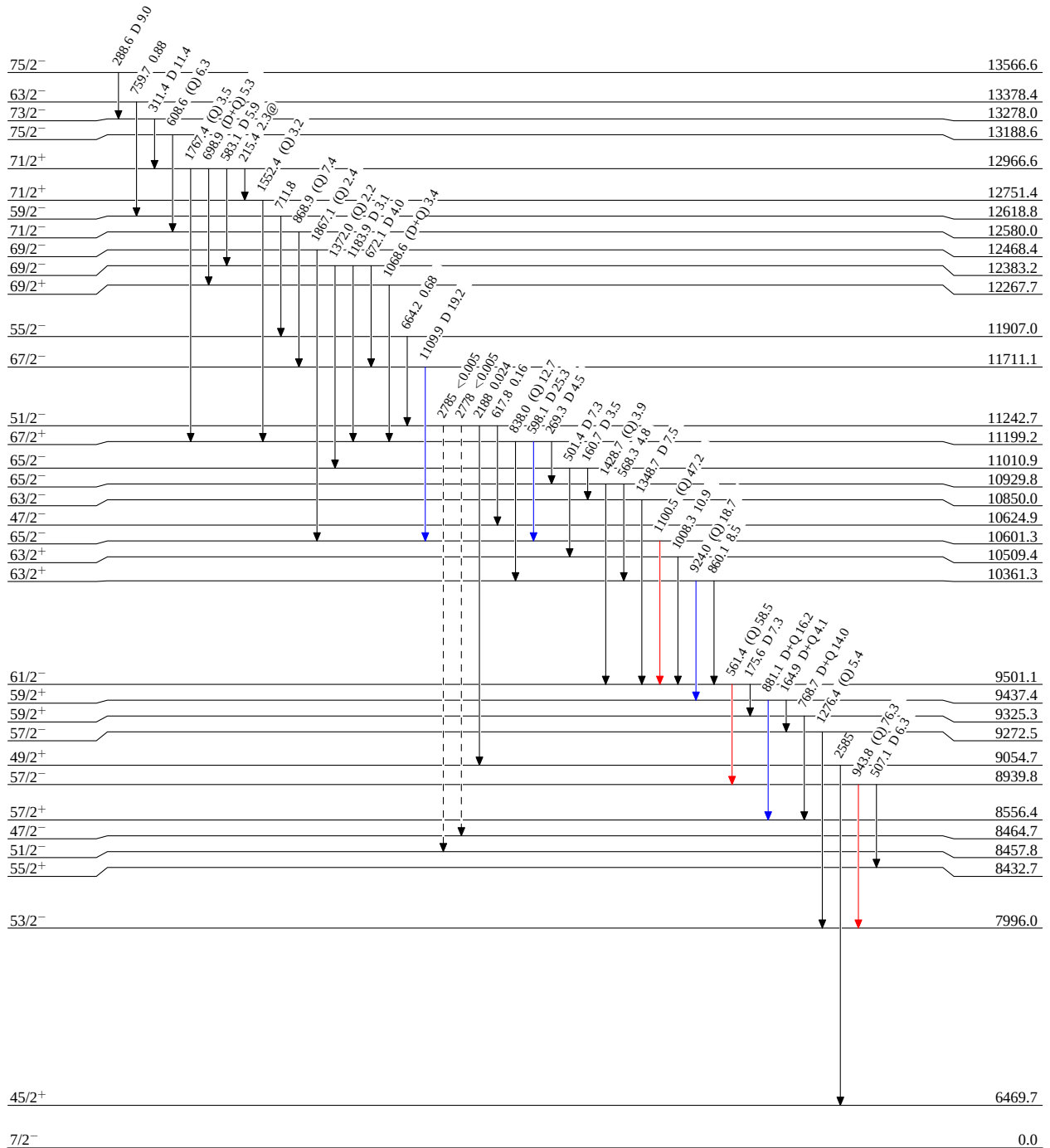
$^{124}\text{Sn}(^{30}\text{Si},5\text{n}\gamma)$ 1991FI02,1995FI01,1998By02

Level Scheme (continued)

Intensities: Relative I_γ
@ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - - -→ γ Decay (Uncertain)

 $^{149}_{64}\text{Gd}_{85}$

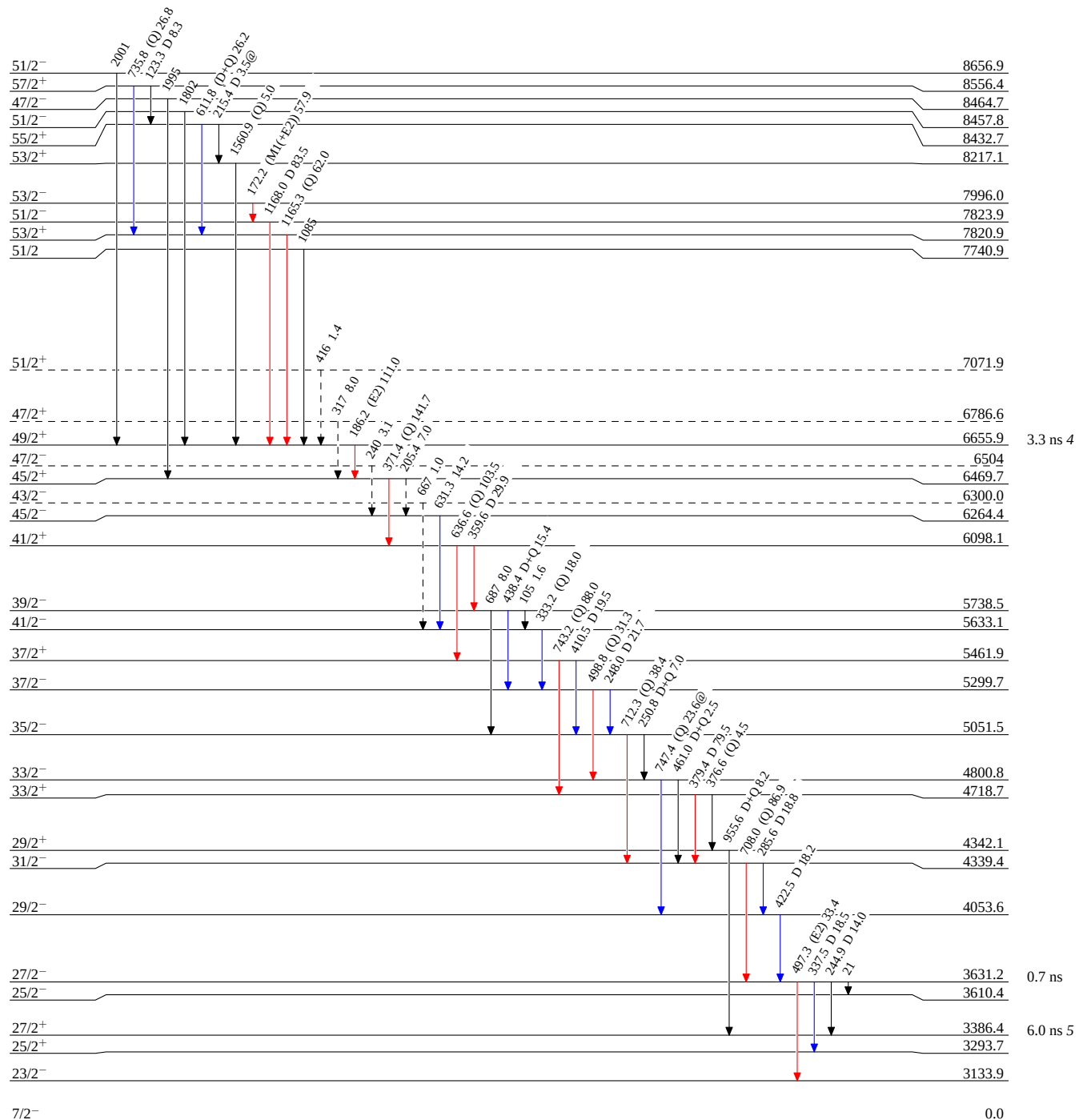
$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991Fl02,1995Fl01,1998By02

Level Scheme (continued)

 Intensities: Relative I_γ
 @ Multiply placed: intensity suitably divided

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)


 $^{149}_{64}\text{Gd}_{85}$

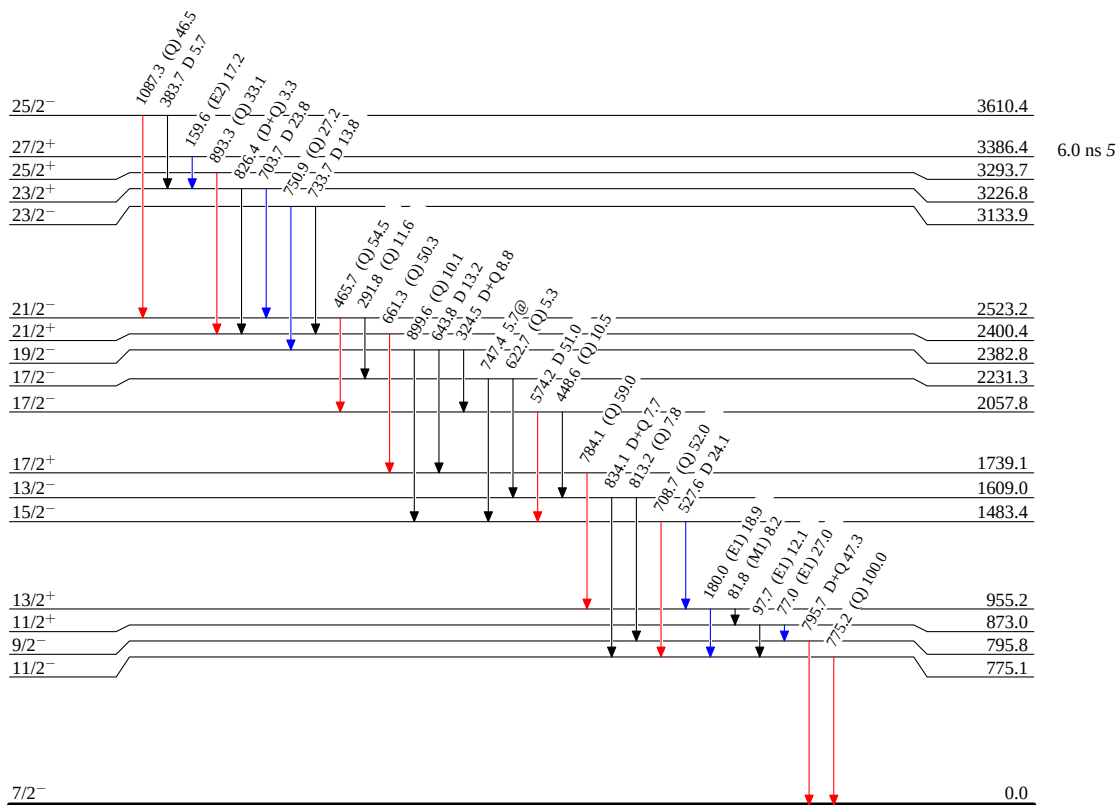
$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991Fl02,1995Fl01,1998By02

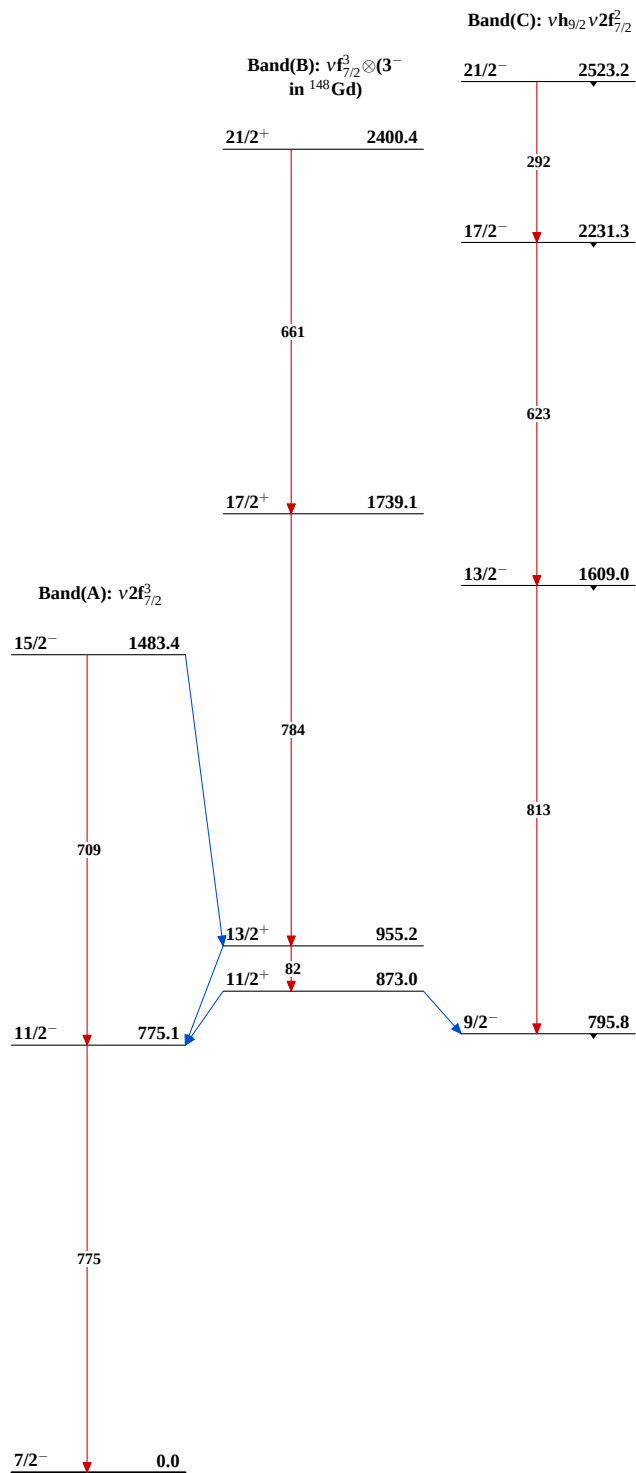
Level Scheme (continued)

Legend

Intensities: Relative I_γ
@ Multiplied: intensity suitably divided

$\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$


 $^{149}_{64}\text{Gd}_{85}$

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991Fl02,1995Fl01,1998By02

 $^{149}_{64}\text{Gd}_{85}$

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991F102,1995F101,1998By02 (continued)

		Band(E): SD-2 band; (π , α)=(+,-1/2)	
		135/2 ⁺	21275.0+x
		131/2 ⁺	1620 19654.7+x
		127/2 ⁺	1564 18090.7+x
		123/2 ⁺	1507 16584.0+x
		119/2 ⁺	1451 15133.4+x
		115/2 ⁺	1395 13738.6+x
		111/2 ⁺	1340 12399.0+x
		107/2 ⁺	1286 11113.1+x
		103/2 ⁺	1232 9880.6+x
		99/2 ⁺	1181 8699.7+x
		95/2 ⁺	1130 7569.3+x
		91/2 ⁺	1081 6488.0+x
		87/2 ⁺	1033 5455.0+x
		83/2 ⁺	987 4468.1+x
		79/2 ⁺	942 3525.8+x
		75/2 ⁺	901 2624.8+x
		71/2 ⁺	878 1746.7+x
		67/2 ⁺	888 858.5+x
		63/2 ⁺	858 x
		Band(D): SD-1 band; (π , α)=(-,-1/2)	
		135/2 ⁻	35996.0
		131/2 ⁻	1730 34266.1
		127/2 ⁻	1672 32594.0
		123/2 ⁻	1616 30978.3
		119/2 ⁻	1558 29420.5
		115/2 ⁻	1500 27920.0
		111/2 ⁻	1444 26475.8
		107/2 ⁻	1388 25088.2
		103/2 ⁻	1332 23756.2
		99/2 ⁻	1276 22479.7
		95/2 ⁻	1222 21257.9
		91/2 ⁻	1167 20090.6
		87/2 ⁻	1114 18976.9
		83/2 ⁻	1061 17916.2
		79/2 ⁻	1009 16907.5
		75/2 ⁻	957 15950.4
		71/2 ⁻	907 15043.7
		67/2 ⁻	857 14186.5
		63/2 ⁻	808 13378.4
		59/2 ⁻	760 12618.8
		55/2 ⁻	712 11907.0
		51/2 ⁻	664 11242.7
		47/2 ⁻	618 10624.9

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991F102,1995F101,1998By02 (continued)

			Band(G): SD-4 band; $(\pi,\alpha)=(+,-1/2)$		
	J2+38			21860.7+z	
		1575			
	J2+36			20285.7+z	
		1529			
	J2+34			18757.1+z	
		1482			
	J2+32			17274.6+z	
		1435			
	J2+30			15839.7+z	
		1388			
	J2+28			14451.6+z	
		1342			
	J2+26			13110.1+z	
		1294			
	J2+24			11815.8+z	
		1247			
	J2+22			10568.8+z	
		1199			
	J2+20			9369.8+z	
		1152			
	J2+18			8218.3+z	
		1104			
	J2+16			7114.6+z	
		1056			
	J2+14			6058.3+z	
		1006			
	J2+12			5052.8+z	
		961			
	J2+10			4092.1+z	
		912			
	J2+8			3180.0+z	
		865			
	J2+6			2315.1+z	
		818			
	J2+4			1497.5+z	
		772			
	J2+2			725.6+z	
	J2 $\approx(63/2^+)$	726			z
			Band(F): SD-3 band; $(\pi,\alpha)=(+,+1/2)$		
J1+40				22818.1+y	
	1647				
J1+38				21170.7+y	
	1594				
J1+36				19576.3+y	
	1540				
J1+34				18036.1+y	
	1486				
J1+32				16550.5+y	
	1431				
J1+30				15119.6+y	
	1377				
J1+28				13742.8+y	
	1323				
J1+26				12420.0+y	
	1269				
J1+24				11151.2+y	
	1216				
J1+22				9935.7+y	
	1163				
J1+20				8772.5+y	
	1110				
J1+18				7662.4+y	
	1057				
J1+16				6605.7+y	
	1005				
J1+14				5600.8+y	
	953				
J1+12				4647.5+y	
	896				
J1+10				3751.5+y	
	854				
J1+8				2897.4+y	
	799				
J1+6				2098.2+y	
	749				
J1+4				1349.6+y	
	700				
J1+2				649.8+y	
J1 $\approx(57/2^+)$	650				y

$^{124}\text{Sn}(^{30}\text{Si},5\text{n}\gamma)$ 1991Fl02,1995Fl01,1998By02 (continued)

Band(J): SD-7 band		
J5+34	20641.6+w	
J5+32	164119000.4+w	
J5+30	158617414.6+w	
J5+28	153315881.9+w	
J5+26	147814404.4+w	
J5+24	142312981.6+w	
J5+22	137011612.1+w	
J5+20	131610296.4+w	
J5+18	12629034.1+w	
J5+16	12097824.8+w	
J5+14	11575562.5+w	
J5+12	11054512.8+w	
J5+10	10503509.0+w	
J5+8	10042556.9+w	
J5+6	9521655.0+w	
J5+4	902802.9+w	
J5+2	852	
J5	803	w
Band(I): SD-6 band; $(\pi,\alpha)=(-, +1/2)$		
J4+38	22155.3+v	
J4+36	168620469.3+v	
J4+34	162618843.3+v	
J4+32	156517278.1+v	
J4+30	150615772.1+v	
J4+28	144714325.5+v	
J4+26	138812937.2+v	
J4+24	132911608.3+v	
J4+22	12709125.8+v	
J4+20	12127971.6+v	
J4+18	11546874.1+v	
J4+16	10985832.1+v	
J4+14	10424845.0+v	
J4+12	9873911.5+v	
J4+10	9343030.5+v	
J4+8	8812200.8+v	
J4+6	8301420.6+v	
J4+4	780688.0+v	
J4+2	688	v
Band(H): SD-5 band; $(\pi,\alpha)=(-, -1/2)$		
J3+32	18599.0+u	
J3+30	159517004.0+u	
J3+28	153515469.4+u	
J3+26	147613993.6+u	
J3+24	141712576.6+u	
J3+22	135811218.9+u	
J3+20	12999919.6+u	
J3+18	12418678.7+u	
J3+16	11837495.4+u	
J3+14	11266369.3+u	
J3+12	10705299.4+u	
J3+10	10164283.8+u	
J3+8	9603323.5+u	
J3+6	9082415.5+u	
J3+4	8551560.5+u	
J3+2	805755.6+u	
J3+0	756	u

$^{124}\text{Sn}(^{30}\text{Si},5n\gamma)$ 1991Fl02,1995Fl01,1998By02 (continued)

		Band(M): SD-10 band	
		J8+32	18451.7+a
		J8+30	1588 16863.5+a
		J8+28	1532 15331.7+a
		J8+26	1463 13868.4+a
		J8+24	1407 12461.2+a
		J8+22	1347 11114.4+a
		J8+20	1288 9826.0+a
		J8+18	1231 8594.8+a
		J8+16	1173 7422.0+a
		J8+14	1117 6304.9+a
		J8+12	1063 5242.2+a
		J8+10	1002 4239.7+a
		J8+8	950 3289.6+a
		J8+6	898 2391.2+a
		J8+4	847 1543.9+a
		J8+2	797 747.4+a
		J8	748 a
		Band(L): SD-9 band	
		J7+32	19346.4+t
		J7+30	1614 17731.9+t
		J7+28	1554 16178.0+t
		J7+26	1495 14683.4+t
		J7+24	1440 13243.1+t
		J7+22	1376 11867.6+t
		J7+20	1318 10549.2+t
		J7+18	1260 9289.2+t
		J7+16	1202 8086.9+t
		J7+14	1146 6941.2+t
		J7+12	1090 5851.3+t
		J7+10	1038 4813.4+t
		J7+8	1016 3797.0+t
		J7+6	1026 2771.2+t
		J7+4	973 1798.6+t
		J7+2	925 874.0+t
		J7	874 t
		Band(K): SD-8 band	
		J6+30	18483.4+s
		J6+28	1549 16934.0+s
		J6+26	1513 15420.9+s
		J6+24	1472 13948.6+s
		J6+22	1430 12518.6+s
		J6+20	1386 11132.5+s
		J6+18	1338 9794.5+s
		J6+16	1292 8502.6+s
		J6+14	1243 7259.7+s
		J6+12	1193 6066.5+s
		J6+10	1142 4924.0+s
		J6+8	1091 3833.0+s
		J6+6	1038 2794.9+s
		J6+4	986 1809.5+s
		J6+2	932 877.5+s
		J6	878 s

$^{124}\text{Sn}(^{30}\text{Si}, 5n\gamma)$ 1991Fl02, 1995Fl01, 1998By02 (continued)

		Band(P): SD-13 band	
		J11+26	14941+d
		J11+24	$^{1474}_{\downarrow}$ 13467+d
		J11+22	$^{1418}_{\downarrow}$ 12049+d
		J11+20	$^{1361}_{\downarrow}$ 10688+d
		J11+18	$^{1307}_{\downarrow}$ 9381+d
		J11+16	$^{1251}_{\downarrow}$ 8130+d
		J11+14	$^{1195}_{\downarrow}$ 6935.1+d
		J11+12	$^{1143}_{\downarrow}$ 5792.2+d
		J11+10	$^{1091}_{\downarrow}$ 4701.4+d
		J11+8	$^{1038}_{\downarrow}$ 3663.4+d
		J11+6	$^{986}_{\downarrow}$ 2677.0+d
		J11+4	$^{936}_{\downarrow}$ 1741.3+d
		J11+2	$^{891}_{\downarrow}$ 850.2+d
		J11	$^{850}_{\downarrow}$ d
		Band(O): SD-12 band	
	J10+32		19960+c
	J10+30	$^{1639}_{\downarrow}$	18321+c
	J10+28	$^{1583}_{\downarrow}$	16738+c
	J10+26	$^{1526}_{\downarrow}$	15212.1+c
	J10+24	$^{1472}_{\downarrow}$	13740.5+c
	J10+22	$^{1420}_{\downarrow}$	12320.2+c
	J10+20	$^{1374}_{\downarrow}$	10946.4+c
	J10+18	$^{1327}_{\downarrow}$	9619.4+c
	J10+16	$^{1282}_{\downarrow}$	8337.0+c
	J10+14	$^{1234}_{\downarrow}$	7103.0+c
	J10+12	$^{1182}_{\downarrow}$	5921.4+c
	J10+10	$^{1126}_{\downarrow}$	4795.4+c
	J10+8	$^{1070}_{\downarrow}$	3725.8+c
	J10+6	$^{1013}_{\downarrow}$	2713.2+c
	J10+4	$^{956}_{\downarrow}$	1757.2+c
	J10+2	$^{902}_{\downarrow}$	854.9+c
	J10	$^{855}_{\downarrow}$	c
		Band(N): SD-11 band	
	J9+28		16586.1+b
	J9+26	$^{1566}_{\downarrow}$	15020.1+b
	J9+24	$^{1508}_{\downarrow}$	13512.5+b
	J9+22	$^{1449}_{\downarrow}$	12063.6+b
	J9+20	$^{1390}_{\downarrow}$	10673.5+b
	J9+18	$^{1331}_{\downarrow}$	9342.9+b
	J9+16	$^{1270}_{\downarrow}$	8072.9+b
	J9+14	$^{1209}_{\downarrow}$	6863.6+b
	J9+12	$^{1148}_{\downarrow}$	5715.5+b
	J9+10	$^{1088}_{\downarrow}$	4627.0+b
	J9+8	$^{1030}_{\downarrow}$	3596.6+b
	J9+6	$^{975}_{\downarrow}$	2621.2+b
	J9+4	$^{924}_{\downarrow}$	1697.0+b
	J9+2	$^{870}_{\downarrow}$	827.5+b
	J9	$^{828}_{\downarrow}$	b

$^{147}\text{Sm}(\alpha, 2n\gamma)$ 1979RaZZ

1979RaZZ: E=25.5 MeV alpha beam from Notre Dame FN-tandem. Measured E_γ , I_γ , $\gamma\gamma$ -coin, excitation functions, $\gamma(\theta)$, $E(\text{ce})$, $I(\text{ce})$. Deduced levels, J , π , conversion coefficients, γ -ray multiplicities, and mixing ratios. ^{149}Gd also studied using $^{141}\text{Pr}(^{11}\text{B}, 3n\gamma)$.

 ^{149}Gd Levels

E(level) [†]	J^π [‡]	Comments
0.0	$7/2^-$	
164.87 16	$5/2^-$	
352.5 3	$3/2^-$	
775.10 15	$11/2^-$	
795.74 15	$9/2^-$	
816.9 11	$3/2^-$	
873.10 16	$11/2^-$	J^π : $11/2^+$ in the Adopted Levels.
955.64 20	$13/2^+$	
1026.4? 3	$3/2^-$	J^π : $3/2^+$ in the Adopted Levels.
1085.14 25	$(5/2^-, 7/2^-)$	J^π : $(5/2^-, 7/2^-)$ in the Adopted Levels.
1483.58 19	$15/2^-$	
1608.77 17	$13/2^-$	
1735.1?		Uncertain level not included in the Adopted Levels.
1739.43 24	$17/2^+$	
1750.9 3	$15/2^-$	J^π : $(15/2^+)$ in the Adopted Levels, however, the level is considered uncertain by evaluators as not confirmed in other studies.
1999.3 3	$15/2^+$	
2057.76 20	$17/2^-$	
2231.47 21	$17/2^-$	
2383.03 22	$19/2^-$	
2400.7 3	$21/2^+$	
2514.3 4	$19/2^-$	J^π : $(19/2^+)$ in the Adopted Levels, however, the level is considered uncertain by evaluators as not confirmed in other studies.
2523.77 24	$21/2^-$	
2856.4 4	$23/2^+$	J^π : $(21/2, 23/2, 25/2^+)$ in the Adopted Levels.
3133.7 3	$23/2^-$	
3227.3 3	$23/2^+$	
3293.7 4	$25/2^+$	
3386.7 4	$27/2^+$	

[†] From a least-squares fit to γ -ray energies.

[‡] As given in 1979RaZZ, based on $\gamma(\theta)$ data and decay pattern. Many assignments are the same as in the Adopted Levels, except that these are placed in parentheses there as strong arguments seem lacking. When different, the assignments from the Adopted Levels are listed in comments.

 $\gamma(^{149}\text{Gd})$

A_2 , A_4 and $\alpha(K)\text{exp}$ values are from 1979RaZZ.

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J^π_i	E_f	J^π_f	Comments
78		873.10	$11/2^-$	795.74	$9/2^-$	
83		955.64	$13/2^+$	873.10	$11/2^-$	
98.0 2	25.8 8	873.10	$11/2^-$	775.10	$11/2^-$	$A_2=+0.131$ 17; $A_4=-0.253$ 21 M1+E2 in 1979RaZZ; E1 in the Adopted Levels, Gammas dataset. $\delta(Q/D)=+1.1$ 2 from $\gamma(\theta)$, in disagreement with adopted mult=E1.

Continued on next page (footnotes at end of table)

$^{147}\text{Sm}(\alpha, 2n\gamma)$ **1979RaZZ (continued)** $\gamma(^{149}\text{Gd})$ (continued)

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	δ ‡	Comments
159.4 2	1.48 4	3386.7	27/2 ⁺	3227.3	23/2 ⁺	Q		$A_2=+0.20$ 5; $A_4=-0.14$ 6 E2 in 1979RaZZ .
164.9 2	13.4 3	164.87	5/2 ⁻	0.0	7/2 ⁻	D+Q	-0.12 7	$A_2=+0.019$ 7; $A_4=-0.019$ 9 M1+E2 in 1979RaZZ ; $\delta(Q/D)$ is in disagreement with 0.93 2 from the value in the Adopted Gammas taken from L-subshell ratios in ^{149}Tb ε decay.
180.5 2	13.5 3	955.64	13/2 ⁺	775.10	11/2 ⁻	D(+Q)	+0.01 2	$A_2=-0.240$ 16; $A_4=-0.010$ 17 E1 in 1979RaZZ .
187.6 2	0.72 4	352.5	3/2 ⁻	164.87	5/2 ⁻	D+Q	-1.5 +15-28	$A_2=+0.23$ 11; $A_4=+0.06$ 12 δ : this value disagrees with adopted $\delta=+0.5$ +2-1 from ^{149}Tb ε .
289.4 2	2.13 4	1085.14	(5/2,7/2,9/2) ⁻	795.74	9/2 ⁻	D		M1+E2 in 1979RaZZ .
292.3 2	1.27 3	2523.77	21/2 ⁻	2231.47	17/2 ⁻	Q		$A_2=-0.07$ 4; $A_4=+0.03$ 4 $A_2=+0.43$ 5; $A_4=-0.09$ 6 E2 in 1979RaZZ .
325.3 2	1.42 5	2383.03	19/2 ⁻	2057.76	17/2 ⁻	D+Q	-1.9 +6-9	$A_2=-0.57$ 8; $A_4=+0.09$ 9
390.5 2	1.59 6	1999.3	15/2 ⁺	1608.77	13/2 ⁻	E1		$A_2=-0.13$ 8; $A_4=-0.10$ 10; $\alpha(K)\text{exp}=0.0061$ 35 Mult.: from $\alpha(K)\text{exp}=0.0061$ 35.
449.0 2	2.46 6	2057.76	17/2 ⁻	1608.77	13/2 ⁻			$\delta(Q/D)=-0.02$ 21 for $\Delta J=1$. $A_2=+0.06$ 4; $A_4=+0.05$ 5 E2 in 1979RaZZ .
455.7 2	3.10 7	2856.4	23/2 ⁺	2400.7	21/2 ⁺	D+Q	-1.3 +10-13	$A_2=+0.32$ 5; $A_4=-0.02$ 5 M1+E2 in 1979RaZZ .
466.0 2	7.9 1	2523.77	21/2 ⁻	2057.76	17/2 ⁻	Q		$A_2=+0.30$ 2; $A_4=-0.08$ 2 E2 in 1979RaZZ .
527.9 2	10.6 2	1483.58	15/2 ⁻	955.64	13/2 ⁺	E1		$A_2=-0.234$ 21; $A_4=-0.003$ 21; $\alpha(K)\text{exp}=0.0035$ 5
574.2 2	15.3 2	2057.76	17/2 ⁻	1483.58	15/2 ⁻	M1		$A_2=-0.171$ 11; $A_4=-0.004$ 13; $\alpha(K)\text{exp}=0.0177$ 5
622.7# 2	3.5 1	2231.47	17/2 ⁻	1608.77	13/2 ⁻	D		$A_2=-0.061$ 54; $A_4=-0.02$ 6 E2 in 1979RaZZ , but $\gamma(\theta)$ data inconsistent with $\Delta J=2$, Q.
630.9# 2		795.74	9/2 ⁻	164.87	5/2 ⁻			E2 in 1979RaZZ .
643.6 2	4.27 9	2383.03	19/2 ⁻	1739.43	17/2 ⁺	E1		$A_2=-0.19$ 4; $A_4=-0.01$ 5; $\alpha(K)\text{exp}=0.0026$ 7
652#		816.9	3/2 ⁻	164.87	5/2 ⁻			M1+E2 in 1979RaZZ .
661.3 2	20.3 2	2400.7	21/2 ⁺	1739.43	17/2 ⁺	Q		$A_2=+0.32$ 10; $A_4=-0.064$ 11 E2 in 1979RaZZ .
703.5 2	2.94 7	3227.3	23/2 ⁺	2523.77	21/2 ⁻	E1		$A_2=-0.34$ 5; $A_4=-0.03$ 5; $\alpha(K)\text{exp}=0.0014$ 5
708.5 2	25.5 3	1483.58	15/2 ⁻	775.10	11/2 ⁻	Q		$A_2=+0.301$ 9; $A_4=-0.063$ 10 E2 in 1979RaZZ .
747.9 2	4.9 1	2231.47	17/2 ⁻	1483.58	15/2 ⁻	D		$A_2=-0.25$ 4; $A_4=+0.06$ 5 $\delta(Q/D)=-4.0$ +9-23.
750.7 2	1.85 6	3133.7	23/2 ⁻	2383.03	19/2 ⁻	Q		M1+E2 in 1979RaZZ .
763.4 2	3.08 12	2514.3	19/2 ⁻	1750.9	15/2 ⁻	(Q)		$A_2=+0.37$ 6; $A_4=-0.10$ 7 E2 in 1979RaZZ .
775.1 2	100 1	775.10	11/2 ⁻	0.0	7/2 ⁻	Q		$A_2=+0.39$ 8; $A_4=-0.07$ 9 E2 in 1979RaZZ .
								$A_2=+0.253$ 6; $A_4=-0.046$ 7 E2 in 1979RaZZ .

Continued on next page (footnotes at end of table)

$^{147}\text{Sm}(\alpha, 2n\gamma)$ **1979RaZZ (continued)** $\gamma(^{149}\text{Gd})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	δ [‡]	Comments
783.8 2	38.9 4	1739.43	17/2 ⁺	955.64	13/2 ⁺	Q		$A_2=+0.308$ 6; $A_4=-0.063$ 7
795.7 2	66.2 7	795.74	9/2 ⁻	0.0	7/2 ⁻	D+Q	+0.19 1	$A_2=+0.060$ 5; $A_4=+0.020$ 6 M1+E2 in 1979RaZZ .
813.0 2	8.4 1	1608.77	13/2 ⁻	795.74	9/2 ⁻	Q		$A_2=+0.28$ 3; $A_4=-0.07$ 4 E2 in 1979RaZZ .
833.7 2	3.5 1	1608.77	13/2 ⁻	775.10	11/2 ⁻	D(+Q)	-2.1 21	$A_2=-0.24$ 6; $A_4=+0.055$ 18 M1+E2 in 1979RaZZ .
861.5@ 2	4.8 1	1026.4?	3/2 ⁻	164.87	5/2 ⁻	D		$A_2=-0.18$ 4; $A_4=-0.02$ 5 E1 in 1979RaZZ .
862@		1735.1?		873.10	11/2 ⁻			
873.1 2	2.4 1	873.10	11/2 ⁻	0.0	7/2 ⁻	Q		$A_2=+0.12$ 6; $A_4=-0.14$ 7 E2 in 1979RaZZ ; (M2) in the Adopted dataset.
877.8 2	7.8 1	1750.9	15/2 ⁻	873.10	11/2 ⁻	Q		$A_2=+0.202$ 17; $A_4=-0.041$ 20 E2 in 1979RaZZ .
893.0 2	3.2 1	3293.7	25/2 ⁺	2400.7	21/2 ⁺	Q		$A_2=+0.40$ 5; $A_4=-0.15$ 6 E2 in 1979RaZZ .
899.4 2	2.3 1	2383.03	19/2 ⁻	1483.58	15/2 ⁻			$A_2=-0.39$ 6; $A_4=+0.12$ 7 DJ=2, E2 in 1979RaZZ , but $\gamma(\theta)$ inconsistent with this assignment.

[†] From [1979RaZZ](#).[‡] From $\gamma(\theta)$ in [1979RaZZ](#), unless otherwise noted. Mult=Q is most likely E2. For those with mult=(Q) from $\gamma(\theta)$, $\Delta J=0$ cannot be ruled out completely.# Composite unresolved transition ([1979RaZZ](#)).

@ Placement of transition in the level scheme is uncertain.

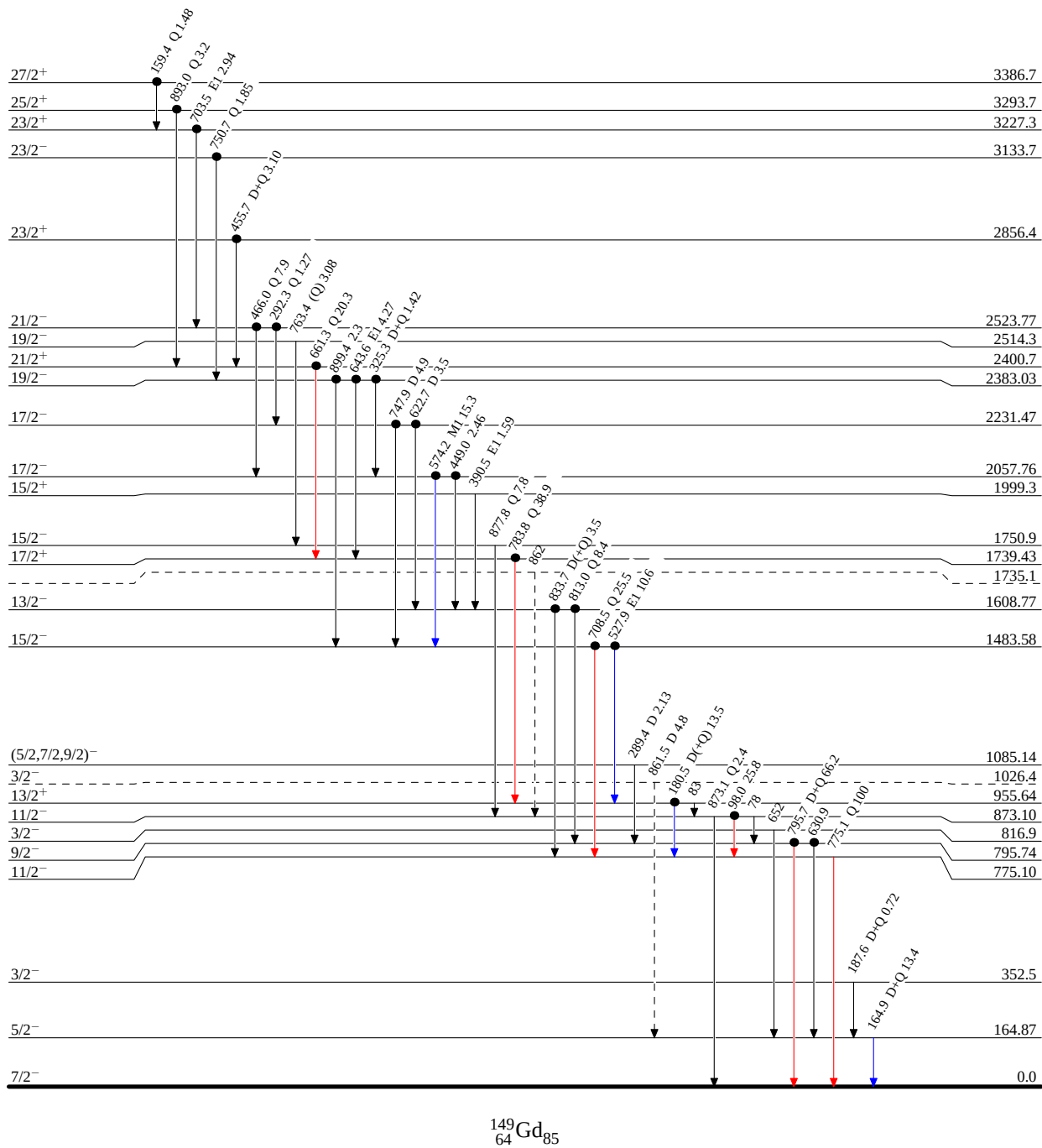
$^{147}\text{Sm}(\alpha, 2n\gamma)$ 1979RaZZ

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - -→ γ Decay (Uncertain)
- Coincidence

 $^{149}_{64}\text{Gd}_{85}$

$^{150}\text{Sm}(\alpha, 5n\gamma)$ 1981Pi09

Also includes $^{148}\text{Sm}(\alpha, 3n\gamma)$ and $^{149}\text{Sm}(\alpha, 4n\gamma)$ from 1981Pi09 which only gives detailed results from $^{150}\text{Sm}(\alpha, 5n\gamma)$.

1981Pi09: ($\alpha, 5n\gamma$) E=67 MeV and ($\alpha, 3n\gamma$) E=44 MeV from the cyclotron at Julich; ($\alpha, 4n\gamma$) E=42-53 MeV from the Stockholm cyclotron. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(t)$, $\gamma(\theta)$, $\gamma(\text{lin pol})$ with two Ge(Li) detectors and a NaI(Tl) scintillator; measured conversion electrons with an orange spectrometer. Deduced levels, J, π , $T_{1/2}$, conversion coefficient, γ -ray multipolarity, transition strength. Comparisons with shell-model calculations. Results from ($\alpha, 4n\gamma$) are not given in details but are mentioned by the authors to be in excellent agreement with those from ($\alpha, 5n\gamma$). Measurement of ($\alpha, 3n\gamma$) was only used for $\gamma\gamma$ -list mode coincidence because of the cleanest selection of the ^{149}Gd exit channel.

All data are from ($\alpha, 5n\gamma$) in 1981Pi09, unless otherwise noted.

Other:

1989Ar10: $\text{Sm}(\alpha, xn)$ E=threshold to 87 MeV; measured cross sections.

 ^{149}Gd Levels

E(level) [†]	$J^{\pi\ddagger}$	$T_{1/2}^{\#}$	Comments
0.0@	7/2 ⁻		
165.2 3	5/2 ⁻		
775.30@ 9	11/2 ⁻		
795.90& 9	9/2 ⁻		
873.49 ^a 10	11/2 ⁺	1.6 ns 6	
955.97 ^a 11	13/2 ⁺		
1484.05@ 11	15/2 ⁻		
1609.26& 15	13/2 ⁻		
1740.10 ^a 20	17/2 ⁺		
2058.25 14	17/2 ⁻		
2231.77& 24	17/2 ⁻		
2383.73 18	19/2 ⁻		
2401.50 ^a 21	21/2 ⁺		
2524.26& 20	21/2 ⁻		
2856.4 3			J^{π} : (21/2, 23/2, 25/2 ⁺) in the Adopted Levels.
3084.8 3	23/2 ⁺		
3134.6 4	23/2 ⁻		
3227.83 23	23/2 ⁺		
3294.70 23	25/2 ⁺		
3387.42 24	27/2 ⁺	6.0 ns 5	$T_{1/2}$: 1979HjZZ report 6.2 ns for a 3382 level. Search for α decay (E α =6-16 MeV) proved negative (1980Vr01).
3611.97 23	25/2 ⁻		
3632.51 25	27/2 ⁺		J^{π} : (27/2 ⁻) in the Adopted Levels.
3765.6 4	29/2		
4324.3? 3	(29/2 ⁻)		
4572.4 5	(31/2)		

[†] From a least-squares fit to γ -ray energies.

[‡] As given in 1981Pi09, based on their $\gamma(\theta)$ data and polarization data for selected transitions. The assignments in the Adopted Levels are almost the same as in 1981Pi09, with the exception that many of the assignments in the Adopted Levels are placed in parentheses as strong arguments seem lacking. Other exception is J^{π} of 3632 level, 27/2⁺ assigned by 1981Pi09, but (27/2⁻) in the Adopted Levels.

[#] From $\gamma\gamma(t)$ of ($\alpha, 4n\gamma$) in 1981Pi09.

@ Band(A): $\nu 2f_{7/2}^3$. Sequence from 1981Pi09.

& Band(B): $\nu h_{9/2} \otimes \nu 2f_{7/2}^2$. Sequence from 1981Pi09.

^a Band(C): $\nu f_{7/2}^3 \otimes (3^-$ in ^{148}Gd). Sequence from 1981Pi09.

$^{150}\text{Sm}(\alpha, 5n\gamma)$ **1981Pi09 (continued)** $\gamma(^{149}\text{Gd})$

A_2 , A_4 and pol values are from **1981Pi09**, with positive pol indicating magnetic nature and negative pol for electric nature. Note that $\text{Pol}=[N(\text{parallel})-N(\text{perpendicular})]/[N(\text{parallel})+N(\text{perpendicular})]$, in **1981Pi09**, where N =number of counts. The numerator in this definition is opposite to the commonly used expression for Pol as $[N(\text{perpendicular})-N(\text{parallel})]/[N(\text{perpendicular})+N(\text{parallel})]$.

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	$\alpha^\#$	Comments
77.6 1	27.7 15	873.49	11/2 ⁺	795.90	9/2 ⁻	E1	0.576	$A_2=-0.20$ 2; $A_4=-0.04$ 3 Mult.: from intensity balance (1981Pi09).
82.5 1	15.8 8	955.97	13/2 ⁺	873.49	11/2 ⁺	D		$A_2=-0.28$ 3; $A_4=-0.05$ 4
98.2 1	27.6 15	873.49	11/2 ⁺	775.30	11/2 ⁻	E1	0.307	$A_2=+0.31$ 1; $A_4=-0.001$ 1 Mult.: from intensity balance (1981Pi09).
159.6 1	14.0 7	3387.42	27/2 ⁺	3227.83	23/2 ⁺	E2	0.478	$A_2=+0.28$ 1; $A_4=-0.06$ 2
165.1 3	3.9 4	165.2	5/2 ⁻	0.0	7/2 ⁻	D+Q		$A_2=+0.10$ 3; $A_4=+0.01$ 4
180.6 1	20.1 10	955.97	13/2 ⁺	775.30	11/2 ⁻	D		$A_2=-0.23$ 1; $A_4=-0.01$ 1
245.1 2	4.3 4	3632.51	27/2 ⁺	3387.42	27/2 ⁺			$A_2=+0.33$ 4; $A_4=+0.03$ 6
248.1@ 3	16.7 17	4572.4	(31/2)	4324.3?	(29/2 ⁻)	(D)		$A_2=-0.15$ 1; $A_4=0.00$ 2 E_γ, I_γ : unresolved from a background line.
292.5 3	7.5 8	2524.26	21/2 ⁻	2231.77	17/2 ⁻	Q		$A_2=+0.32$ 2; $A_4=-0.09$ 3
325.5 3	3.9 4	2383.73	19/2 ⁻	2058.25	17/2 ⁻	D+Q		$A_2=-0.38$ 4; $A_4=-0.01$ 6
337.8 2	5.8 6	3632.51	27/2 ⁺	3294.70	25/2 ⁺	D		$A_2=-0.38$ 3; $A_4=-0.04$ 5
378.2 3	6.9 7	3765.6	29/2	3387.42	27/2 ⁺	D		$A_2=-0.14$ 3; $A_4=-0.01$ 4
449.0 2	6.1 6	2058.25	17/2 ⁻	1609.26	13/2 ⁻	(Q)		$A_2=+0.37$ 3; $A_4=-0.05$ 5
454.9 2	11.7 6	2856.4		2401.50	21/2 ⁺	(Q)		$A_2=+0.26$ 2; $A_4=-0.01$ 3
466.0 2	33.9 17	2524.26	21/2 ⁻	2058.25	17/2 ⁻	E2	0.017	$A_2=+0.31$ 2; $A_4=-0.03$ 3; pol=-0.08 4 $\gamma(\theta)$ data corrected for a 6% contribution from the 465.6 M1 transition in ^{148}Gd .
^x 499.5 3	12.2 6					(Q)		$A_2=+0.33$ 2; $A_4=0.00$ 3
528.0 1	16.4 9	1484.05	15/2 ⁻	955.97	13/2 ⁺	D		$A_2=-0.23$ 2; $A_4=-0.03$ 2
574.2 1	33.4 16	2058.25	17/2 ⁻	1484.05	15/2 ⁻	M1	0.018	$A_2=-0.21$ 1; $A_4=+0.01$ 1; pol=+0.12 3
622.6 3	4.7 5	2231.77	17/2 ⁻	1609.26	13/2 ⁻			$A_2=+0.01$ 6; $A_4=-0.02$ 8
630.4 5	7.6 8	795.90	9/2 ⁻	165.2	5/2 ⁻	(Q)		$A_2=+0.23$ 3; $A_4=-0.07$ 4 E_γ, I_γ : obscured by a strong transition in ^{148}Gd .
643.7 2	7.0 7	2383.73	19/2 ⁻	1740.10	17/2 ⁺	D		$A_2=-0.19$ 4; $A_4=-0.05$ 5
661.4 1	56 3	2401.50	21/2 ⁺	1740.10	17/2 ⁺	E2		$A_2=+0.30$ 1; $A_4=-0.08$ 1; pol=-0.06 3
683.3 2	5.6 6	3084.8	23/2 ⁺	2401.50	21/2 ⁺	D+Q		$A_2=-0.95$ 4; $A_4=-0.02$ 6
703.6 2	15.8 16	3227.83	23/2 ⁺	2524.26	21/2 ⁻	E1		$A_2=-0.21$ 3; $A_4=+0.00$ 3; pol=-0.08 9; $\alpha(K)\text{exp}<0.0065$ (1981Pi09) $\gamma(\theta)$ data corrected for a 28% contribution from 704.0 E2 transition in ^{150}Gd .
708.8 1	54 5	1484.05	15/2 ⁻	775.30	11/2 ⁻	E2		$A_2=+0.34$ 1; $A_4=-0.06$ 1; pol=-0.09 3 E_γ : doublet. The weak component also belongs to ^{149}Gd , but it is not placed (1981Pi09).
712.3@ 2	12.3 6	4324.3?	(29/2 ⁻)	3611.97	25/2 ⁻	Q		$A_2=+0.39$ 2; $A_4=-0.10$ 3
733.1 4	5.5 6	3134.6	23/2 ⁻	2401.50	21/2 ⁺	D		$A_2=-0.16$ 4; $A_4=-0.07$ 6
747.5 5	≈6	2231.77	17/2 ⁻	1484.05	15/2 ⁻			$A_2=+0.18$ 1; $A_4=-0.02$ 2 I_γ : from $\gamma\gamma$. Obscured by a strong 742.2 line in ^{146}Sm .
750.8 5	9.0 9	3134.6	23/2 ⁻	2383.73	19/2 ⁻	Q		$A_2=+0.29$ 2; $A_4=-0.08$ 3
775.3 1	100 5	775.30	11/2 ⁻	0.0	7/2 ⁻	E2		$A_2=+0.26$ 1; $A_4=-0.05$ 1; pol=-0.09 2
784.3 3	67 3	1740.10	17/2 ⁺	955.97	13/2 ⁺	E2		$A_2=+0.27$ 1; $A_4=-0.06$ 1; pol=-0.10 2
795.9 1	52 3	795.90	9/2 ⁻	0.0	7/2 ⁻	M1+E2		$A_2=+0.07$ 1; $A_4=+0.03$ 1; pol=+0.16 5
813.3 2	7.5 8	1609.26	13/2 ⁻	795.90	9/2 ⁻	Q		$A_2=+0.22$ 4; $A_4=-0.08$ 5
826.4 4	2.5 3	3227.83	23/2 ⁺	2401.50	21/2 ⁺			
834.2 3	5.8 6	1609.26	13/2 ⁻	775.30	11/2 ⁻	D(+Q)		$A_2=-0.16$ 3; $A_4=-0.02$ 4

Continued on next page (footnotes at end of table)

$^{150}\text{Sm}(\alpha,5n\gamma)$ **1981Pi09** (continued) $\gamma(^{149}\text{Gd})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
863.0 4	2.3 2	3387.42	27/2 ⁺	2524.26	21/2 ⁻	(E3)	$A_2=+0.54$ 8; $A_4=+0.14$ 12
893.2 1	23.0 12	3294.70	25/2 ⁺	2401.50	21/2 ⁺	Q	$A_2=+0.32$ 1; $A_4=-0.08$ 2
899.6 2	6.9 7	2383.73	19/2 ⁻	1484.05	15/2 ⁻	(Q)	$A_2=+0.28$ 3; $A_4=+0.01$ 5
1087.7 1	19.3 10	3611.97	25/2 ⁻	2524.26	21/2 ⁻	E2	$A_2=+0.34$ 2; $A_4=-0.09$ 3; $\text{pol}=-0.12$ 6

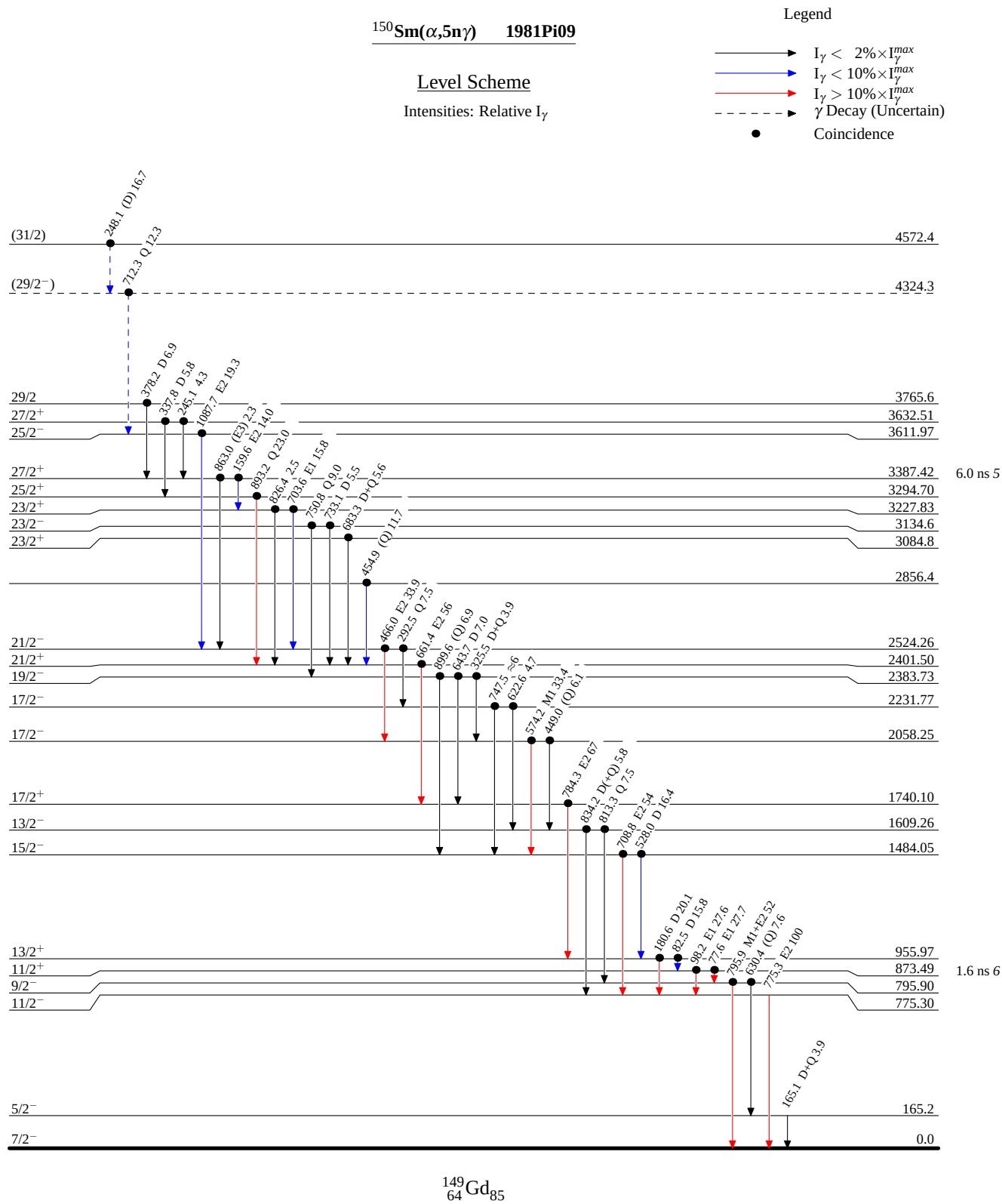
[†] Intensities are from $(\alpha,5n\gamma)$ $E=67$ MeV, $\theta=125^\circ$. Note that the original values have been re-normalized by the evaluators to $I_\gamma(775.3\gamma)=100$ (from original 641). Based on a general statement in **1981Pi09** that the intensity uncertainty is $\approx 5\%$ and larger for weak or unresolved lines, the evaluators have assigned 5% for $I_\gamma > 10$ and 10% for unresolved γ rays and $I_\gamma < 10$.

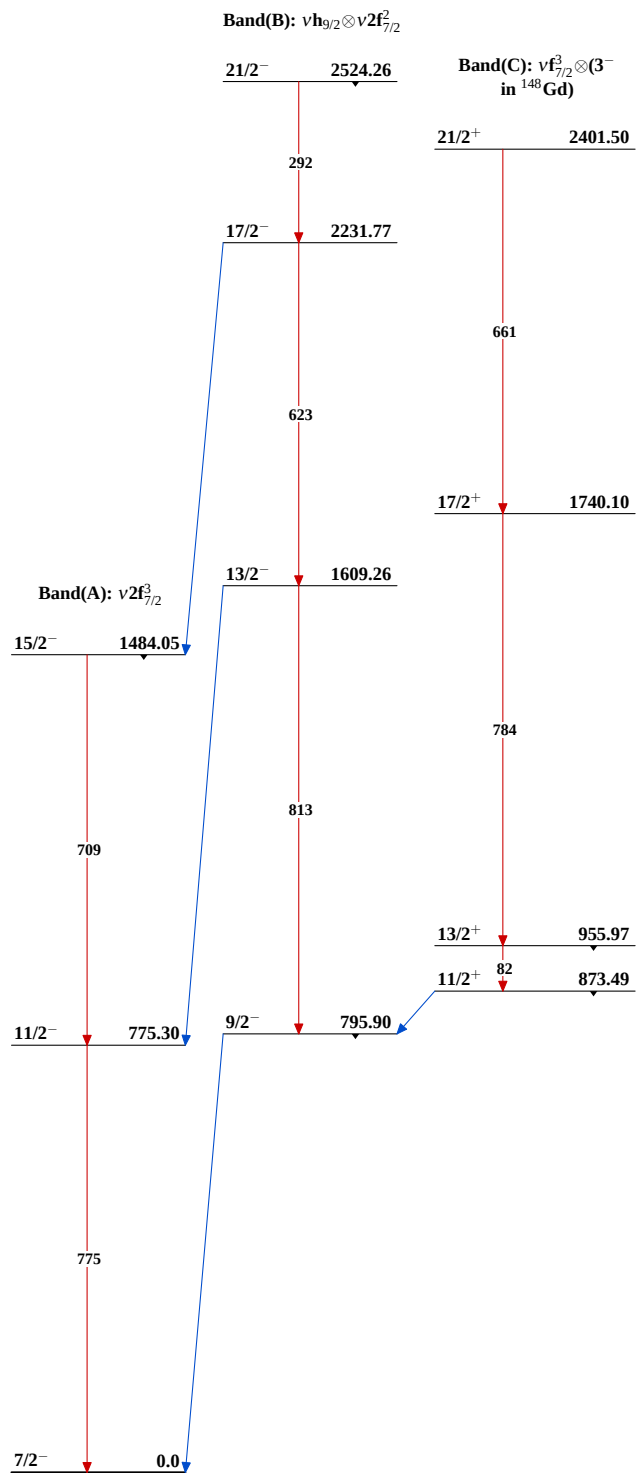
[‡] From $\gamma(\theta)$ of $(\alpha,5n\gamma)$ and $\gamma(\text{lin pol})$ of $(\alpha,4n\gamma)$ (at 51 MeV) in **1981Pi09**, unless otherwise noted. RUL for E2 and M2 is used when deduced from $\gamma(\theta)$ only. Mult=Q is most likely E2.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.



$^{150}\text{Sm}(\alpha, 5n\gamma)$ 1981Pi09

 $^{149}_{64}\text{Gd}_{85}$

Adopted Levels, Gammas

$Q(\beta^-) = -3795$ 9; $S(n) = 9023$ 13; $S(p) = 2508$ 3; $Q(\alpha) = 4078.0$ 22 [2021Wa16](#)

$Q(\varepsilon) = 3639$ 4, $S(2n) = 16889$ 9, $S(2p) = 8522$ 4 ([2021Wa16](#)).

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 16 references dealing with nuclear structure theory, and 11 for half-lives and α widths in radioactive decays.

 ^{149}Tb Levels

Configurations are from [1991La17](#) in ($^7\text{Li}, 2n\gamma$) and ($\alpha, 6n\gamma$), [1994Me12](#) in ($^{31}\text{P}, 4n\gamma$) and [1998Kh09](#) in ($^{27}\text{Al}, 6n\gamma$).

Cross Reference (XREF) Flags

A	^{149}Dy ε decay (4.2 min)	E	$^{122}\text{Sn}(^{31}\text{P}, 4n\gamma)$	I	$^{148}\text{Gd}(^3\text{He}, d)$
B	^{149}Dy ε decay (0.490 s)	F	$^{128}\text{Te}(^{27}\text{Al}, 6n\gamma): \text{SD}$	J	$^{151}\text{Eu}(\alpha, 6n\gamma)$
C	^{153}Ho α decay (2.01 min)	G	$^{142}\text{Nd}(^{10}\text{B}, 3n\gamma)$		
D	^{153}Ho α decay (9.3 min)	H	$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$		

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
0.0	1/2 ⁺	4.12 h 3	A D I	$\% \varepsilon + \% \beta^+ = 83.3$ 17; $\% \alpha = 16.7$ 17 $\mu = +1.36$ 2 (1990Al36 , 2019StZV) Evaluated rms charge radius = 4.94 fm 15 (2013An02). Evaluated difference in charge radius: $\delta \langle r^2 \rangle (^{159}\text{Tb}, ^{149}\text{Tb}) = -1.175$ fm ² 9 (2013An02). J^π : $L(^3\text{He}, d) = 0$ from 0 ⁺ ; s _{1/2} proton state. $T_{1/2}$: weighted average of 4.15 h 5 (1968St09), 4.10 h 5 (1967Go32 , 1967Ch28), 4.17 h 7 (1965Br10), 4.06 h 8 (1965Gr28), 4.10 h 5 (1960To10), and 4.1 h 2 (1953Ra02). Others: 4.1 h (1978AfZZ), 4.3 h 2 (1957Su23). μ : from laser-resonance ionization spectroscopy (1990Al36). Other: <0.9 from nuclear orientation (1983Pr04). $\% \alpha$: from 1978Ja14 . Others: 16 4 (1960To10), 20 6 (1967Ko09), 13 4 (1968Wi21), 22.6 23 (1968Ch30), 20 2 (1972Vy08), 1967Go32 , 1965Gr28 , 1958Wi43 . $\Delta \langle r^2 \rangle (^{149}\text{Tb} - ^{159}\text{Tb}) = 1.116$ fm ² 9 (1990Al36). α -decay energy = 3973 4 (1996Pa01), 3972 5 (1982Bo04), 3963 10 (1981HoZM , 1979Ho10), 3965 10 (1978AfZZ), 3967 3 (1968Go13 , 1967Go32), 3950 20 (1960To10).
35.75 [#] 8	11/2 ⁻	4.17 min 5	ABC E GHI J	$\% \varepsilon + \% \beta^+ = 99.978$ 4; $\% \alpha = 0.022$ 4 J^π : $L(^3\text{He}, d) = 5$ from 0 ⁺ . Shell-model calculations and systematics strongly support this as an h _{11/2} proton state. $T_{1/2}$: weighted average of 4.16 min 4 (1973Bi06), 4.0 min 1 (1973Bo13), 4.5 min 2 (1971Ar31), 4.3 min 1 (1969Ch32), 4.3 min 2 (1964Ma19 , 1962Ma14). $\% \alpha$: weighted average of 0.020 4 (1973Bi06) and 0.025 5 (1964Ma19). Other: <0.03 (1967Go32).
100.75 6	3/2 ⁺	0.45 ns 5	A I	J^π : $L(^3\text{He}, d) = 2$ from 0 ⁺ ; 100.7γ M1 to 1/2 ⁺ . $T_{1/2}$: from cey(t) in ^{149}Dy ε decay (4.2 m) (1978Ma19).
206.92 7	5/2 ⁺	≤0.2 ns	A I	J^π : $L(^3\text{He}, d) = 2$ from 0 ⁺ ; 106.2γ M1 to 3/2 ⁺ ; 253.6γ M1 from 7/2 ⁺ ; d _{5/2} proton state. $T_{1/2}$: from cey(t) in ^{149}Dy ε decay (4.2 m) (1978Ma19).
460.48 7	7/2 ⁺		A I	J^π : 359.6γ E2, ΔJ=2 to 3/2 ⁺ ; $L(^3\text{He}, d) = (4)$ from 0 ⁺ ; g _{7/2} proton state.
689.32 7	7/2 ⁻		A I	J^π : 653.6γ E2, ΔJ=2 to 11/2 ⁻ ; 1376.0γ M1 from 7/2 ⁻ .
741.64 7	5/2 ⁺		A I	J^π : 741.7γ E2 to 1/2 ⁺ , 640.8γ M1+E2 to 3/2 ⁺ .
754.92 9	5/2 ⁺		A	J^π : 754.8γ E2 to 1/2 ⁺ .
822.35 [#] 16	15/2 ⁻		B E GH J	J^π : 786.7γ ΔJ=2, E2 to 11/2 ⁻ ; no transitions to J ≤ 7/2; band assignment.
825.12 8	9/2 ⁻		A	J^π : 789.4γ M1 to 11/2 ⁻ , 135.7γ M1 to 7/2 ⁻ .
837.16 8	5/2 ⁺		A	J^π : 736.4γ M1 to 3/2 ⁺ , 376.6γ M1 to 7/2 ⁺ .

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Adopted Levels, Gammas (continued) ^{149}Tb Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
840.73 [#] 11	13/2 ⁻	A GH	J ^π : 805.0γ M1+E2 to 11/2 ⁻ ; 288.3γ from 15/2 ⁺ cannot have Mult=M2 since it would require an isomeric T _{1/2} for 1129 level, which is unlikely.
844.15 8	7/2 ⁺	A	J ^π : 637.3γ M1+E2 to 5/2 ⁺ ; 137.9γ M1 from 9/2 ⁺ .
869.72 10	5/2 ⁺	A i	J ^π : 769.0γ M1 to 3/2 ⁺ ; 1195.6γ E1 from 7/2 ⁻ .
872.45 9	(11/2) ⁻	A i	J ^π : 836.7γ M1+E2 to 11/2 ⁻ ; 31.7γ to 13/2 ⁻ mostly likely have Mult=M1; 1201.8γ from 7/2 ⁻ has Mult=M1 or E2 based on ce data; 11/2 ⁻ from Shell-model calculations by 2019MeZX in ^{149}Dy ε decay (4.2 m).
952.89 7	3/2 ⁻	A I	J ^π : 952.9γ E1 to 1/2 ⁺ ; 924.0γ M1 from 5/2 ⁻ .
970.42 9	7/2 ⁺	A	J ^π : 869.7γ E2 to 3/2 ⁺ , 509.9γ M1 to 7/2 ⁺ ; 871.2γ E1 from 9/2 ⁻ .
982.04 8	(9/2) ⁺	A	J ^π : 775.1γ E2 to 5/2 ⁺ , 521.6γ M1 to 7/2 ⁺ ; 491.6γ from (11/2) ⁻ .
1049.24 13	(5/2 ⁺)	A I	J ^π : 1049.2γ to 1/2 ⁺ ; possible ε feeding from 7/2 ⁻ parent in ^{149}Dy .
1088.55 10	5/2 ⁻	A	J ^π : 987.8γ E1 to 3/2 ⁺ ; 753.2γ E1 or E2 from 9/2 ⁻ .
1120.09 11	(7/2) ⁺	A	J ^π : 913.2γ (E2(+M1)) to 5/2 ⁺ ; 721.5γ E1 from 9/2 ⁻ ; 945.4γ E1 from 7/2 ⁻ .
1129.13 ^{&} 16	15/2 ⁺	E GH J	J ^π : 306.8γ ΔJ=0, E1 to 15/2 ⁻ .
1133.61 14	(9/2,11/2) ⁺	A	J ^π : 1097.8γ E1 to 11/2 ⁻ ; 708.0γ from 9/2 ⁻ .
1183.86 9	9/2 ⁻	A	J ^π : 1148.2γ M1 to 11/2 ⁻ , 494.6γ M1 to 7/2 ⁻ .
1189.07 10	(7/2) ⁻	A	J ^π : 728.6γ E1 to 7/2 ⁺ , 1153.3γ (E2) to 11/2 ⁻ , 982.2γ to 5/2 ⁺ .
1205.36 11	(9/2) ⁺	A	J ^π : 745.0γ M1+E2 to 7/2 ⁺ , 1169.5γ to 11/2 ⁻ .
1205.95 14	(7/2,9/2) ⁻	A	J ^π : 380.8γ M1 to 9/2 ⁻ ; ε feeding from 7/2 ⁻ parent in ^{149}Dy .
1250.68 10	5/2 ⁻	A	J ^π : 1150.0γ E1 to 3/2 ⁺ , 561.4γ M1 to 7/2 ⁻ .
1272.72 10	(9/2) ⁺	A	J ^π : 812.2γ M1 to 7/2 ⁺ , 1237.1γ (E1) to 11/2 ⁻ .
1381.92 8	7/2 ⁻	A	J ^π : 1174.9γ E1 to 5/2 ⁺ , 692.7γ M1+E2 to 7/2 ⁻ ; pure M3 for 1346.3γ to 11/2 ⁻ is ruled out by ce data from ^{149}Dy ε decay.
1381.96 [#] 18	19/2 ⁻	B E GH J	J ^π : 559.6γ E2, ΔJ=2 to 15/2 ⁻ ; band assignment.
1420.55 11	(9/2) ⁻	A	J ^π : 576.4γ and 960.0γ E1 to 7/2 ⁺ , 548.1γ M1 to (11/2) ⁻ .
1426.13 9	9/2 ⁻	A	J ^π : 1390.3γ M1 to 11/2 ⁻ ; allowed ε feeding from 7/2 ⁻ .
1454.68 [#] 27	(17/2) ⁻	H	J ^π : 325.7γ to 15/2 ⁺ and 613.7γ to 13/2 ⁻ .
1461.20 10	(5/2,7/2) ⁻	A	J ^π : 1254.3γ E1 to 5/2 ⁺ , 771.8γ to 7/2 ⁻ , 1000.8γ to 7/2 ⁺ .
1473.75 9	(11/2) ⁻	A	J ^π : 1438.0γ M1 to 11/2 ⁻ , 648.7γ M1 to 9/2 ⁻ ; 11/2 ⁻ from shell-model predictions by 2019MeZX in ^{149}Dy ε decay (4.2 m).
1487.58 15	(7/2,9/2) ⁺	A	J ^π : 505.5γ M1 to (9/2) ⁺ , 517.1γ (M1) to 7/2 ⁺ .
1492.74 12	(7/2,9/2,11/2) ⁺	A	J ^π : 348.9γ E1 from 9/2 ⁻ .
1508.52 10	(7/2) ⁻	A	J ^π : 1301.6γ E1 to 5/2 ⁺ , 683.3γ (M1) to 9/2 ⁻ .
1568.89 [#] 28	(15/2) ⁻	H	J ^π : 439.3γ to 15/2 ⁺ , 746.9γ to 15/2 ⁻ , and 728.4γ to 13/2 ⁻ ; member of a quasiparticle structure.
1591.06 ^{&} 25	(17/2 ⁺)	GH	J ^π : 461.9γ to 15/2 ⁺ and 768.7γ 15/2 ⁻ ; member of a quasiparticle structure.
1631.88 19	(3/2,5/2) ⁻	A	J ^π : 245.1γ M1 from 5/2 ⁻ ; 1531.0γ to 3/2 ⁺ .
1672.72 [#] 20	23/2 ⁻	B E GH J	J ^π : 290.8γ E2, ΔJ=2 to 19/2 ⁻ ; band assignment.
1697.52 14	9/2 ⁻	A	J ^π : 1661.7γ M1+E2 to 11/2 ⁻ ; allowed ε feeding from 7/2 ⁻ parent in ^{149}Dy .
1728.36 8	5/2 ⁻	A	J ^π : 1627.6γ E1 to 3/2 ⁺ , 346.3γ M1 to 7/2 ⁻ .
1735.43 11	(7/2) ⁻	A	J ^π : 1274.9γ E1 to 7/2 ⁺ , 1699.6γ to 11/2 ⁻ , 1528.6γ to 5/2 ⁺ .
1776.61 10	7/2 ⁻	A	J ^π : 1316.1γ E1 to 7/2 ⁺ , 1087.3γ M1 to 7/2 ⁻ , 1569.8γ E1 to 5/2 ⁺ ; 1740.9γ to 11/2 ⁻ cannot have Mult=M3 based on ce data, which rules out 5/2 ⁻ .
1804.07 30	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	A	J ^π : 1343.6γ (M1,E2) to 7/2 ⁺ , 1597γ to 5/2 ⁺ ; ε feeding from 7/2 ⁻ parent in ^{149}Dy .
1813.20 [#] 20	21/2 ⁻	E GH	J ^π : 140.6γ E2(+M1), ΔJ=1 to 23/2 ⁻ , 431.2γ D, ΔJ=1 to 19/2 ⁻ .
1841.62 8	9/2 ⁻	A	J ^π : 1805.8γ M1+E2 to 11/2 ⁻ , 997.5γ E1 to 7/2 ⁺ .
1852.03 14	(7/2) ⁻	A	J ^π : 1645.1γ E1 to 5/2 ⁺ , 1162.6γ M1 to 7/2 ⁻ , 1816.4γ to 11/2 ⁻ .
1867.81 ^{&} 18	19/2 ⁺	E GH J	J ^π : 738.8γ E2, ΔJ=2 to 15/2 ⁺ ; 485.5γ to 19/2 ⁻ .
1876.89 7	5/2 ⁻	A	J ^π : 1776.2γ E1 to 3/2 ⁺ , 1416.4γ E1 to 7/2 ⁺ , 1187.5γ M1 to 7/2 ⁻ .
1879.13 ^{&} 34	(17/2 ⁺)	H	J ^π : 750.0γ to 15/2 ⁺ ; member of a quasiparticle structure.
1883.08 8	(9/2) ⁻	A	J ^π : 1422.6γ E1 to 7/2 ⁺ , 1057.9γ M1 to 9/2 ⁻ , 1010.6γ M1 to (11/2) ⁻ .
1928.15 16	(7/2 ⁻ , 9/2 ⁻)	A	J ^π : 1239.0γ (M1) to (9/2 ⁻), 1084γ to 7/2 ⁺ .

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Adopted Levels, Gammas (continued) ^{149}Tb Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
1953.13 9	9/2 ⁻		A	J ^π : 1263.8γ M1 to 7/2 ⁻ , 1917.4γ E2(+M1) to 11/2 ⁻ , 1080.6γ M1 to (11/2) ⁻ .
1986.44 19	(3/2 ⁻ , 5/2, 7/2 ⁻)		A	J ^π : 1033.2γ to 3/2 ⁻ , 1297.2γ to 7/2 ⁻ .
2014.72 14	(9/2) ⁻		A	J ^π : 1142.2γ M1 to (11/2) ⁻ , 1189.6γ (M1+E2) to 9/2 ⁻ ; possible allowed ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2026.31 10	(7/2) ⁻		A	J ^π : 1565.8γ E1 to 7/2 ⁺ , 600.2γ (M1) to 9/2 ⁻ , 937.8γ (M1) to 5/2 ⁻ .
2065.36 7	7/2 ⁻		A	J ^π : 2029.6γ E2 to 11/2 ⁻ , 1858.4γ E1 to 5/2 ⁺ .
2074.21 10	7/2 ⁻		A	J ^π : 2038.5γ E2 to 11/2 ⁻ , 1867.3γ E1 to 5/2 ⁺ .
2117.14 20	(5/2 ⁻ , 7/2 ⁻)		A	J ^π : 1910.2γ (E1) to 5/2 ⁺ ; ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2157.97 14	(7/2) ⁻		A	J ^π : 731.6γ M1 to 9/2 ⁻ , 1288.5γ to 5/2 ⁺ .
2161.07 13	(9/2) ⁻		A	J ^π : 1471.7γ M1 to 7/2 ⁻ , 1288.5γ (M1) to (11/2) ⁻ , 1320.4γ to 13/2 ⁻ .
2260.33 19	(7/2 ⁻ , 9/2)		A	J ^π : 2224.3γ to 11/2 ⁻ , 1278.5γ to (9/2) ⁺ ; ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2302.89@ 24	(27/2) ⁻		B E GH J	J ^π : 630.3γ E2, ΔJ=2 to 23/2 ⁻ .
2350.00& 21	23/2 ⁺		E GH J	J ^π : 482.2γ E2, ΔJ=2 to 19/2 ⁺ ; 536.7γ D, ΔJ=1 to 21/2 ⁻ .
2352.29 19	(7/2 ⁻ , 9/2)		A	J ^π : 2316.4γ to 11/2 ⁻ , 1891.8γ to 7/2 ⁺ ; ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2368.7& 4	(21/2 ⁺)		H	J ^π : 986.8γ to 19/2 ⁻ and 500.8γ to 19/2 ⁺ ; member of a quasiparticle structure.
2452.52 25	(9/2) ⁻		A	J ^π : probable ε feeding from 7/2 ⁻ parent in ^{149}Dy ; 2416.7γ to 11/2 ⁻ ; 9/2 ⁻ from shell-model predictions by 2019MeZX in ^{149}Dy ε decay.
2486.59 25	(5/2, 7/2, 9/2 ⁺)		A	J ^π : probable ε feeding from 7/2 ⁻ parent in ^{149}Dy ; 2279.6γ to 5/2 ⁺ .
2492.25& 31	(21/2 ⁺)		H	J ^π : 624.4γ to 19/2 ⁺ , 1110.3γ 19/2 ⁻ ; member of a quasiparticle structure.
2516.33 24	(7/2) ⁻		A	J ^π : 1428.0γ to 5/2 ⁻ , 2309.3γ to 5/2 ⁺ , 2480.6γ to 11/2 ⁻ .
2518.52& 23	(27/2) ⁺	2.4 ns 2	E GH J	μ=4.9 12 (1990Ad02, 2020StZV) J ^π : 168.5γ E2, ΔJ=2 to 23/2 ⁺ ; 215.6γ E1, ΔJ=0 to (27/2) ⁻ . T _{1/2} : from (^{10}B , 3nγ). μ: from g-factor=0.33 8 by the integral PAD method using a T _{1/2} =2.6 ns 2 (1990Ad02), and corrected with the adopted T _{1/2} =2.4 ns 2. 1989Ra17 compilation quotes +6.5 27 from the 1987 annual report of Institute of Nuclear Studies (Tokyo), probably an earlier result from 1990Ad02.
2547.46 27	(5/2, 7/2 ⁺)		A	Other possible configuration=πh _{11/2} ⊗vf _{7/2} ⊗vi _{13/2} (1994Me12). J ^π : 2446.5γ to 3/2 ⁺ , 2087.3γ to 7/2 ⁺ ; probable ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2566.08 29	(7/2 ⁻ , 9/2)		A	J ^π : 2530.5γ to 11/2 ⁻ , 2105.4γ to 7/2 ⁺ ; probable ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2573.43 29	(7/2 ⁻ , 9/2)		A	J ^π : 2537.6γ to 11/2 ⁻ , 2113.0γ to 7/2 ⁺ ; probable ε feeding from 7/2 ⁻ parent in ^{149}Dy .
2588.60 13	(5/2, 7/2)		A	J ^π : from shell-model predictions by 2019MeZX in ^{149}Dy ε decay (4.2 m).
2661.42 29	(9/2) ⁻		A	J ^π : probable ε feeding from 7/2 ⁻ parent in ^{149}Dy ; 2625.6γ to 11/2 ⁻ ; 9/2 ⁻ from shell-model predictions by 2019MeZX in ^{149}Dy ε decay (4.2 m).
2664.19@ 31	(25/2) ⁻		B GH	J ^π : 361.3γ M1, ΔJ=1 to (27/2) ⁻ ; member of a quasiparticle structure.
2666.95& 26	(25/2 ⁺)		H	J ^π : 148.3γ to (27/2) ⁺ , 316.7γ to 23/2 ⁺ , 994.3γ to 23/2 ⁻ .
2762.78@ 30	(25/2) ⁻		H	J ^π : 412.5γ to 23/2 ⁺ , 1090.0γ (D), ΔJ=(1) to 23/2 ⁻ and 460.3γ to (27/2) ⁻ .
2812.85& 25	(29/2) ⁺		E GH J	J ^π : 294.3γ M1+E2, ΔJ=1 to (27/2) ⁺ , 510.1γ E1, ΔJ=1 (27/2) ⁻ . Other possible configuration=πh _{11/2} ⊗vf _{7/2} ⊗vi _{13/2} (1994Me12).
3142.02 26	(31/2) ⁺		E GH J	J ^π : 329.2γ M1+E2, ΔJ=1 to (29/2) ⁺ , 623.4γ E2, ΔJ=2 to (27/2) ⁺ . Configuration=πh _{11/2} ⊗vf _{7/2} ⊗vi _{13/2} (1991La17, 1994Me12).
3527.22 30	(33/2) ⁺		E GH J	J ^π : 385.2γ M1, ΔJ=1 to (31/2) ⁺ ; 715γ to (29/2) ⁺ .

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Adopted Levels, Gammas (continued)

¹⁴⁹ Tb Levels (continued)				
E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
3603.38 29	(31/2 ⁻)		E H J	Configuration= $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes (3^-$ in ¹⁴⁶ Gd) (1991La17). Other possible configuration= $\pi h_{11/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}$ (1994Me12). J ^π : 1300.5γ (Q), ΔJ=(2) to (27/2) ⁻ ; 461.3γ to (31/2) ⁺ . Possible configuration= $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^-$ in ¹⁴⁶ Gd) $\otimes (3^-$ in ¹⁴⁶ Gd)) (1991La17). This configuration involves coupling of two octupole phonons.
3990.6 4			H	J ^π : 387.2γ to (31/2 ⁻) suggests (31/2,33/2,35/2).
4061.4 4			E H	J ^π : 534.5γ to (33/2) ⁺ suggests (33/2,35/2,37/2).
4107.3 ^a 4	(31/2 ⁺)		E	J ^π : 356.2γ (Q), ΔJ=(2) from (35/2) ⁺ .
4208.46 ^a 28	(33/2) ⁺		E GH J	J ^π : 1395.5γ (E2), ΔJ=(2) to (29/2) ⁺ ; 681.8γ M1 to (33/2) ⁺ .
4463.46 ^a 29	(35/2) ⁺		E GH J	J ^π : 254.9γ M1+E2, ΔJ=1 to (33/2) ⁺ ; 1321.6γ (E2), ΔJ=2 γ to (31/2) ⁺ .
4674.00 ^a 29	(37/2) ⁺		E GH J	J ^π : 1146.7γ E2, ΔJ=2 (33/2) ⁺ ; 210.6γ E2(+M1) to (35/2) ⁺ .
4923.39 ^a 33	(39/2) ⁺		E GH J	J ^π : 460.0γ E2, ΔJ=2 to (35/2) ⁺ ; 249.4γ M1+E2, ΔJ=1 to (37/2) ⁺ . Other possible configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12). J ^π : 224.9γ M1+E2, ΔJ=1 to (39/2) ⁺ ; 474.2γ Q, ΔJ=2 to (37/2) ⁺ .
5148.2 ^a 4	(41/2) ⁺		E GH J	Other possible configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12). J ^π : 583.8γ D, ΔJ=1 to (37/2) ⁺ ; 454.3γ Q, ΔJ=2 from (43/2) ⁻ .
5258.1 4	(39/2 ⁻)		E	Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2}^2$ (1994Me12). J ^π : 695.6γ E1, ΔJ=1 to (39/2) ⁺ .
5618.9 ^b 5	(41/2) ⁻		E	J ^π : 564.1γ E1, ΔJ=1 to (41/2) ⁺ ; 93.6γ M1, ΔJ=1 to (41/2) ⁻ .
5712.4 ^b 4	(43/2) ⁻		E	J ^π : 586.9γ E2, ΔJ=2 to (41/2) ⁺ .
5735.1 4	(45/2) ⁺		E	J ^π : 818.1γ D, ΔJ=1 to (41/2) ⁺ ; 146.2γ (E1), ΔJ=(1) from (45/2) ⁻ .
5966.2 5	(43/2 ⁺)		E	Configuration= $\pi h_{11/2}^2 \otimes \pi g_{7/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12). J ^π : 877.3γ D, ΔJ=1 (41/2) ⁺ ; 195.9γ M1+E2, ΔJ=(1) from (45/2) ⁻ .
6025.3 ^c 6	(43/2) ⁻		E	J ^π : 399.6γ M1, ΔJ=1 to (43/2) ⁻ ; 377.0γ E1, ΔJ=(0) to (45/2) ⁺ .
6112.3 ^b 5	(45/2) ⁻		E	J ^π : 486.0γ E1, ΔJ=(0) to (45/2) ⁺ .
6221.0 ^c 5	(45/2) ⁻		E	J ^π : 180.0γ and 288.0γ M1+E2, ΔJ=1 to (45/2) ⁻ .
6400.7 ^c 6	(47/2) ⁻		E	J ^π : 567.6γ and 676.3γ E1, ΔJ=1 to (45/2) ⁻ .
6788.6 6	(47/2) ⁺		E	Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (1994Me12). J ^π : 238.6γ M1, ΔJ=(1) from (49/2) ⁺ ; 762.2γ to (45/2) ⁻ .
6874.4 6	(47/2) ⁺		E	J ^π : 712.1γ E1, ΔJ=1 to (47/2) ⁻ .
7112.9 6	(49/2) ⁺		E	Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}$ (1994Me12). J ^π : 793.5γ D, ΔJ=1 to (47/2) ⁻ .
7194.3 7	(49/2)		E	J ^π : 546.7γ M1+E2, ΔJ=1 to (49/2).
7741.1 8	(51/2)		E	J ^π : 1188.2γ (Q), ΔJ=(2) to (47/2) ⁺ .
7976.5 ^d 7	(51/2 ⁺)		E	J ^π : 873γ M1(+E2), ΔJ=1 from (53/2) ⁺ ; 935γ to (49/2) ⁺ .
8048.5 9	(51/2) ⁺		E	J ^π : 1134.5γ E2, ΔJ=2 to (49/2) ⁺ .
8247.5 ^d 7	(53/2) ⁺		E	J ^π : 540.1γ D, ΔJ=(1) γ to (51/2).
8281.2 9	(53/2)		E	J ^π : 757.2γ E2, ΔJ=2 to (51/2 ⁺).
8733.7 ^d 9	(55/2 ⁺)		E	J ^π : 849.7γ E2, ΔJ=2 from (57/2) ⁺ ; 945.8γ D to (51/2 ⁺).
8922.1 7	(53/2) ⁺		E	J ^π : 464.5γ E2, ΔJ=2 to (55/2 ⁺).
9197.2 10	(59/2 ⁺)		E	J ^π : 946γ to (53/2) suggests (53/2,55/2,57/2).
9227.5? 9			E	J ^π : 289.0γ from (57/2) ⁺ suggests (53/2,55/2,57/2).
9482.6? 8			E	J ^π : 1524.1γ E2, ΔJ=2 to (53/2) ⁺ .
9771.6 7	(57/2) ⁺		E	Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}$ (1994Me12). J ^π : 184.1γ E2, ΔJ=2 to (57/2) ⁺ .
9955.7 9	(61/2) ⁺	4.0 ns 2	E	Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2}^2 \otimes \nu h_{9/2} \otimes \nu i_{13/2} \otimes \nu d_{3/2}^{-2}$ (1994Me12). T _{1/2} : from ce(K)(t) in (³¹ P,4nγ) (1991Me04,1994Me12). J ^π : 987γ to (59/2 ⁺) suggests (59/2,61/2,63/2).
10184.2? 14			E	J ^π : 1044.9γ ΔJ=2, E2 to (61/2) ⁺ .
11000.7 10	(65/2) ⁺		E	Configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}^2 \otimes \nu d_{3/2}^{-2}$ (1994Me12).
11177.2? 17			E	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Tb Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
11204.7 ^e 11	(67/2) ⁻	E	J ^π : 204.0γ ΔJ=1, E1 to (65/2) ⁺ .
12152.4 ^e 12	(71/2) ⁻	E	J ^π : 947.7γ ΔJ=2 to (67/2) ⁻ .
13118.2 ^e 13	(75/2) ⁻	E	J ^π : 965.8γ ΔJ=(2) to (71/2) ⁻ .
x ^f	J1	F	
740.10+x ^f 20	J1+2	F	
1534.80+x ^f 28	J1+4	F	
2381.9+x ^f 4	J1+6	F	
3281.3+x ^f 5	J1+8	F	
4234.8+x ^f 5	J1+10	F	
5242.0+x ^f 5	J1+12	F	
6302.7+x ^f 6	J1+14	F	
7416.9+x ^f 7	J1+16	F	
8586.1+x ^f 7	J1+18	F	
9810.7+x ^f 8	J1+20	F	
11089.5+x ^f 8	J1+22	F	
12424.0+x ^f 9	J1+24	F	
13815.1+x ^f 9	J1+26	F	
15259.3+x ^f 10	J1+28	F	
y ^g	J2	F	
646.20+y ^g 30	J2+2	F	
1343.6+y ^g 4	J2+4	F	
2091.8+y ^g 4	J2+6	F	
2890.8+y ^g 5	J2+8	F	
3741.3+y ^g 6	J2+10	F	
4643.3+y ^g 6	J2+12	F	
5597.4+y ^g 7	J2+14	F	
6603.7+y ^g 7	J2+16	F	
7662.5+y ^g 7	J2+18	F	
8774.2+y ^g 8	J2+20	F	
9938.7+y ^g 8	J2+22	F	
11156.6+y ^g 8	J2+24	F	
12428.0+y ^g 9	J2+26	F	
13753.0+y ^g 9	J2+28	F	
15131.7+y ^g 9	J2+30	F	
16565.2+y ^g 10	J2+32	F	
18052.9+y ^g 10	J2+34	F	
19594.8+y ^g 11	J2+36	F	
z ^h	J3	F	
786.00+z ^h 30	J3+2	F	
1623.4+z ^h 4	J3+4	F	
2514.0+z ^h 5	J3+6	F	
3455.0+z ^h 5	J3+8	F	
4447.7+z ^h 6	J3+10	F	
5491.6+z ^h 6	J3+12	F	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Tb Levels (continued)

E(level) [†]	J^π [‡]	XREF	E(level) [†]	J^π [‡]	XREF
6587.4+z ^h 7	J3+14	F	11977.0+u ⁱ 11	J4+22	F
7735.8+z ^h 7	J3+16	F	13382.4+u ⁱ 12	J4+24	F
8935.8+z ^h 8	J3+18	F	14832.9+u ⁱ 12	J4+26	F
10187.8+z ^h 8	J3+20	F	v ^j	J5	F
11490.8+z ^h 8	J3+22	F	803.7+v ^j 4	J5+2	F
12847.6+z ^h 9	J3+24	F	1657.1+v ^j 5	J5+4	F
u ⁱ	J4	F	2564.9+v ^j 6	J5+6	F
824.0+u ⁱ 5	J4+2	F	3523.2+v ^j 6	J5+8	F
1701.4+u ⁱ 7	J4+4	F	4532.9+v ^j 7	J5+10	F
2633.3+u ⁱ 8	J4+6	F	5593.6+v ^j 7	J5+12	F
3619.0+u ⁱ 8	J4+8	F	6706.3+v ^j 8	J5+14	F
4656.6+u ⁱ 8	J4+10	F	7873.1+v ^j 8	J5+16	F
5744.9+u ⁱ 9	J4+12	F	9092.8+v ^j 9	J5+18	F
6884.9+u ⁱ 9	J4+14	F	10364.6+v ^j 10	J5+20	F
8077.9+u ⁱ 9	J4+16	F	11692.3+v ^j 11	J5+22	F
9322.9+u ⁱ 10	J4+18	F	13075.5+v ^j 12	J5+24	F
10622.9+u ⁱ 10	J4+20	F			

[†] From a least-squares fit to γ -ray energies where available.[‡] For high-spin ($J > 13/2$) states, membership in a quasiparticle multiplet structure (as identified by band or sequence labels) is also used as an argument for J^π assignment.# Seq.(K): $\pi h_{11/2} \otimes \nu f_{7/2}^2$ multiplet. Assignment from 1991La17.@ Seq.(L): $\pi h_{11/2} \otimes \nu h_{9/2} \otimes \nu f_{7/2}$ multiplet. Assignment from 1991La17.& Seq.(M): $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^- \text{ in } ^{146}\text{Gd})$ multiplet. Assignment from 1991La17.^a Band(A): $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2}^2$ multiplet. Band assignment from 1991La17 and 1994Me12.^b Band(B): $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$. Band assignment from 1994Me12.^c Band(C): $\pi h_{11/2}^2 \otimes \pi g_{7/2}^{-1} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$. Band assignment from 1994Me12.^d Band(D): $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$. Band assignment from 1994Me12.^e Band(E): Multi-quasiparticle band. Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}^{+2} \otimes \nu d_{3/2}^{-2}$ (1994Me12).^f Band(F): SD-1 band. Q(intrinsic)=15.3 2 (1998Kh09). Intruder configuration= $\pi 6^3 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1}$ (1998Kh09).^g Band(G): SD-2 band. Q(intrinsic)=15.8 +4-3 (1998Kh09). Intruder configuration= $\pi 6^3 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=-1/2 \text{ or } \nu 5/2[642], \alpha=-1/2)^{-1}$ (1998Kh09).^h Band(H): SD-3 band. Q(intrinsic)=16.4 +3-4 (1998Kh09). Intruder configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-1} \otimes \nu 7^1 \otimes \nu 1/2[651]^{-1}$ (1998Kh09).ⁱ Band(I): SD-4 band. Q(intrinsic)=16.0 +6-5 (1998Kh09). Intruder configuration= $\pi 6^4 \otimes \pi 6_3^{-1} \otimes \nu 7^1 \otimes \nu 1/2[642]^{-1}$ (1998Kh09).^j Band(J): SD-5 band. Band from 1998Kh09.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\ddagger$	$\alpha^\#$	Comments
100.75	3/2 ⁺	100.7 1	100	0.0	1/2 ⁺	M1		2.153 31	B(M1)(W.u.)=0.0152 +19-15
206.92	5/2 ⁺	106.2 1	100	100.75	3/2 ⁺	M1		1.849 26	B(M1)(W.u.)≥0.032
460.48	7/2 ⁺	253.6 1	100 3	206.92	5/2 ⁺	M1+E2	0.5 +3-4	0.152 11	
		359.6 2	9.6 12	100.75	3/2 ⁺	E2		0.0362 5	
689.32	7/2 ⁻	653.6 1	100	35.75	11/2 ⁻	E2		0.00745 10	
741.64	5/2 ⁺	534.7 1	42 8	206.92	5/2 ⁺	M1(+E2)	0.4 4	0.0216 28	
		640.8 1	30.4 8	100.75	3/2 ⁺	M1+E2	1.1 +4-3	0.0109 11	
		741.7 1	100 8	0.0	1/2 ⁺	E2		0.00555 8	
754.92	5/2 ⁺	654.1 2	100 15	100.75	3/2 ⁺	(M1)		0.01393 20	
		754.8 2	68 4	0.0	1/2 ⁺	E2		0.00533 7	
822.35	15/2 ⁻	786.7 2	100	35.75	11/2 ⁻	E2		0.00486 7	E_γ : weighted average of 786.8 2 from ($^{10}\text{B}, 3\text{n}\gamma$) and 786.6 2 from ($^7\text{Li}, 2\text{n}\gamma$).
825.12	9/2 ⁻	135.7 1	1.28 9	689.32	7/2 ⁻	M1		0.921 13	
		789.4 1	100 4	35.75	11/2 ⁻	M1		0.00875 12	
837.16	5/2 ⁺	376.6 2	3.4 6	460.48	7/2 ⁺	M1		0.0570 8	
		736.4 1	100 3	100.75	3/2 ⁺	M1		0.01038 15	
		837.1 3	12.5 25	0.0	1/2 ⁺	[E2]		0.00423 6	
840.73	13/2 ⁻	805.0 1	100	35.75	11/2 ⁻	M1+E2	0.8 +4-3	0.0069 8	E_γ : other: 804.8 2 from ($^7\text{Li}, 2\text{n}\gamma$).
844.15	7/2 ⁺	637.3 1	100	206.92	5/2 ⁺	M1+E2	≈0.8	≈0.01215	
869.72	5/2 ⁺	662.8 1	83 3	206.92	5/2 ⁺	M1+E2	0.65 25	0.0116 10	
		769.0 3	100 6	100.75	3/2 ⁺	M1		0.00933 13	
		870.0 4	27 6	0.0	1/2 ⁺				
872.45	(11/2) ⁻	31.7 3	1.5 6	840.73	13/2 ⁻				
		836.7 3	100.0 15	35.75	11/2 ⁻	M1+E2	≈1.1	≈0.00575	
952.89	3/2 ⁻	852.2 3	16 5	100.75	3/2 ⁺	E1		1.62×10 ⁻³ 2	
		952.9 1	100.0 21	0.0	1/2 ⁺	E1		1.30×10 ⁻³ 2	
970.42	7/2 ⁺	509.9 2	22 6	460.48	7/2 ⁺	M1		0.0261 4	
		763.5 1	15.3 6	206.92	5/2 ⁺	M1		0.00950 13	
		869.7 2	100.0 22	100.75	3/2 ⁺	E2		0.00389 5	
982.04	(9/2) ⁺	137.9 1	4.7 4	844.15	7/2 ⁺	M1		0.880 12	
		521.6 1	8.9 8	460.48	7/2 ⁺	M1		0.02462 34	
		775.1 2	100 11	206.92	5/2 ⁺	E2		0.00502 7	
1049.24	(5/2 ⁺)	842.3 3	69 15	206.92	5/2 ⁺				
		1049.2 2	100 15	0.0	1/2 ⁺				
1088.55	5/2 ⁻	399.4 2	9.0 11	689.32	7/2 ⁻				
		987.8 2	100 11	100.75	3/2 ⁺	E1		1.22×10 ⁻³ 2	
1120.09	(7/2) ⁺	913.2 3	100	206.92	5/2 ⁺	(E2+(M1))	>1.2	0.0040 5	
1129.13	15/2 ⁺	288.3 2	13.5 13	840.73	13/2 ⁻	[E1]		0.01830 26	E_γ : weighted average of 288.0 5 from ($^{10}\text{B}, 3\text{n}\gamma$) and 288.4 2 from ($^7\text{Li}, 2\text{n}\gamma$).
									I_γ : from ($^7\text{Li}, 2\text{n}\gamma$). Other: 10.7 from ($^{10}\text{B}, 3\text{n}\gamma$).
		306.8 1	100 3	822.35	15/2 ⁻	E1		0.01566 22	E_γ : from ($^7\text{Li}, 2\text{n}\gamma$). Others: 306.7 2 from ($^{10}\text{B}, 3\text{n}\gamma$); 308.8 1 from ($\alpha, 6\text{n}\gamma$) is discrepant.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult. [‡]	δ [‡]	α [#]	Comments
Mult.: $\Delta J=0$ from $\gamma(\theta, \text{pol})$ in $(^{10}\text{B}, 3n\gamma)$ and $(\alpha, 6n\gamma)$. I_γ : from $(^7\text{Li}, 2n\gamma)$. Other: 100 from $(^{10}\text{B}, 3n\gamma)$.									
1133.61	$(9/2, 11/2)^+$	1097.8 2	100	35.75	$11/2^-$	E1		1.00×10^{-3}	1
1183.86	$9/2^-$	358.6 3	14 3	825.12	$9/2^-$				
		494.6 1	100 3	689.32	$7/2^-$	M1		0.0282	4
		1148.2 3	13.1 19	35.75	$11/2^-$	M1		0.00354	5
1189.07	$(7/2)^-$	499.9 3	15 3	689.32	$7/2^-$				
		728.6 1	85 4	460.48	$7/2^+$	E1		2.20×10^{-3}	3
		982.2 2	31 5	206.92	$5/2^+$	[E1]		1.23×10^{-3}	2
		1153.3 2	100 8	35.75	$11/2^-$	(E2)		2.16×10^{-3}	3
1205.36	$(9/2)^+$	223.3 2	35 7	982.04	$(9/2)^+$	(M1)		0.2305	33
		361.2 3	12 5	844.15	$7/2^+$				
		745.0 2	46 5	460.48	$7/2^+$	M1+E2	1.3 +41-7	0.0072	17
		998.6 3	33 5	206.92	$5/2^+$				
		1169.5 3	100 16	35.75	$11/2^-$	[E1]		0.000907	13
1205.95	$(7/2, 9/2)^-$	380.8 2	42.9 22	825.12	$9/2^-$	M1		0.0554	8
		1170.1 3	100 18	35.75	$11/2^-$	(M1, E2)		0.0027	6
1250.68	$5/2^-$	297.7 3	63 12	952.89	$3/2^-$				
		561.4 1	83 6	689.32	$7/2^-$	M1		0.02043	29
		1043.7 2	100 17	206.92	$5/2^+$	(E1)		1.10×10^{-3}	2
		1150.0 3	32 4	100.75	$3/2^+$	E1		0.000930	13
1272.72	$(9/2)^+$	812.2 1	78 7	460.48	$7/2^+$	M1		0.00816	11
		1237.1 2	100 19	35.75	$11/2^-$	(E1)		0.000849	12
1381.92	$7/2^-$	131.2 2	6.0 10	1250.68	$5/2^-$	M1		1.013	15
		293.4 2	9.1 16	1088.55	$5/2^-$	(M1)		0.1103	16
		556.7 2	32 5	825.12	$9/2^-$	(M1)		0.02087	29
		692.7 1	94.5 16	689.32	$7/2^-$	M1+E2	≈ 0.7	≈ 0.01024	
		921.0 5	<11.5	460.48	$7/2^+$				
		1174.9 1	100 8	206.92	$5/2^+$	E1		0.000902	13
		1346.3 3	7.9 20	35.75	$11/2^-$	(E2)		1.62×10^{-3}	2
1381.96	$19/2^-$	559.6 1	100	822.35	$15/2^-$	E2		0.01089	15
1420.55	$(9/2)^-$	548.1 1	100 4	872.45	$(11/2)^-$	M1		0.02171	30
		576.4 2	55 4	844.15	$7/2^+$	E1		0.00360	5
		960.0 3	26 9	460.48	$7/2^+$	E1		1.29×10^{-3}	2
		1384.7 & 3	83 & 15	35.75	$11/2^-$	(M1)		2.32×10^{-3}	3
1426.13	$9/2^-$	553.9 3	3.5 15	872.45	$(11/2)^-$				
		601.2 3	7.5 20	825.12	$9/2^-$	(M1)		0.01720	24
		736.8 2	24 3	689.32	$7/2^-$				

Mult.: (M1, E2) from ce data in ^{149}Dy ε decay (4.2 m), with pure M3 unlikely; E2 from level scheme.
 E_γ : weighted average of 559.7 2 from $(^{10}\text{B}, 3n\gamma)$ and 559.6 1 from $(^7\text{Li}, 2n\gamma)$.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	δ ‡	α #	Comments
1426.13	9/2 ⁻	1390.3 1	100.0 15	35.75	11/2 ⁻	M1		2.30×10 ⁻³ 3	
1454.68	(17/2 ⁻)	325.7 3	75 50	1129.13	15/2 ⁺				
		613.7 4	100 50	840.73	13/2 ⁻				
1461.20	(5/2,7/2) ⁻	372.6 2	10 3	1088.55	5/2 ⁻				
		508.5 2	35 8	952.89	3/2 ⁻				
		706.4 3	15 3	754.92	5/2 ⁺				
		771.8 3	33 8	689.32	7/2 ⁻				
		1000.8 4	4.7 25	460.48	7/2 ⁺				
		1254.3 2	100 6	206.92	5/2 ⁺	E1		0.000838 12	
1473.75	(11/2) ⁻	267.7 2	26 4	1205.95	(7/2,9/2) ⁻	M1,E2		0.115 26	
		491.6 2	18 9	982.04	(9/2) ⁺				
		601.2 3	50 12	872.45	(11/2) ⁻	(M1)		0.01720 24	
		633.2 3	27 9	840.73	13/2 ⁻				
		648.7 2	47 9	825.12	9/2 ⁻	M1		0.01422 20	
		784.0 5	10 4	689.32	7/2 ⁻				
		1438.0 2	100 9	35.75	11/2 ⁻	M1		2.15×10 ⁻³ 3	
1487.58	(7/2,9/2) ⁺	505.5 3	100 15	982.04	(9/2) ⁺	M1		0.0267 4	
		517.1 3	65 29	970.42	7/2 ⁺	(M1)		0.02517 35	
1492.74	(7/2,9/2,11/2) ⁺	219.9 3	46 15	1272.72	(9/2) ⁺				
		359.3 3	90 40	1133.61	(9/2,11/2) ⁺	(M1)		0.0645 9	
		511.1 5	100 30	982.04	(9/2) ⁺				
1508.52	(7/2) ⁻	526.6 3	9.2 19	982.04	(9/2) ⁺				
		537.8 2	11.3 25	970.42	7/2 ⁺				
		683.3 3	21 5	825.12	9/2 ⁻	(M1)		0.01249 18	
		819.3 3	20 5	689.32	7/2 ⁻	(M1)		0.00799 11	
		1301.6 1	100 4	206.92	5/2 ⁺	E1		0.000811 11	
		1472.7 4	3.1 15	35.75	11/2 ⁻				
1568.89	(15/2 ⁻)	439.3 4	8 8	1129.13	15/2 ⁺				
		728.4 4	21 8	840.73	13/2 ⁻				
		746.9 5	100 21	822.35	15/2 ⁻				
1591.06	(17/2 ⁺)	461.9 3	100 10	1129.13	15/2 ⁺				
		768.7 4	52 14	822.35	15/2 ⁻				
1631.88	(3/2,5/2) ⁻	877.1 4	58 20	754.92	5/2 ⁺				
		1425.1 4	100 33	206.92	5/2 ⁺				
		1531.0 4	85 17	100.75	3/2 ⁺				
1672.72	23/2 ⁻	290.8 1	100	1381.96	19/2 ⁻	E2		0.0686 10	E_γ : weighted average of 290.7 2 from (¹⁰ B,3n γ) and 290.8 1 from (⁷ Li,2n γ).
1697.52	9/2 ⁻	223.6 2	14 4	1473.75	(11/2) ⁻	(M1)		0.2297 33	
		825.4 5	2.3 12	872.45	(11/2) ⁻				
		857.0 3	9 4	840.73	13/2 ⁻				
		872.4 3	40 7	825.12	9/2 ⁻				
		1008.3 3	25 5	689.32	7/2 ⁻				
		1661.7 3	100 4	35.75	11/2 ⁻	M1+E2	0.8 4	0.00147 11	

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$	Comments
1728.36	$5/2^-$	346.3 2	3.9 8	1381.92	$7/2^-$	M1		0.0710 10	
		477.8 2	6.2 8	1250.68	$5/2^-$	M1		0.0308 4	
		544.6 3	1.7 4	1183.86	$9/2^-$				
		973.4 2	10.0 15	754.92	$5/2^+$	(E1)		1.25×10^{-3} 2	
		986.8 2	16.7 15	741.64	$5/2^+$	E1		1.22×10^{-3} 2	
		1039.1 2	22.8 18	689.32	$7/2^-$	(E2)		0.00267 4	
		1521.4 1	100 8	206.92	$5/2^+$	E1		0.000784 11	
		1627.6 1	53.1 8	100.75	$3/2^+$	E1		0.000802 11	
		863.5 4	2.5 10	872.45	$(11/2)^-$				
		910.3 4	4.0 15	825.12	$9/2^-$				
1735.43	$(7/2)^-$	1046.2 3	4.3 6	689.32	$7/2^-$				
		1274.9 1	100.0 15	460.48	$7/2^+$	E1		0.000825 12	
		1528.6 4	1.6 5	206.92	$5/2^+$				
		1699.6 4	3.5 10	35.75	$11/2^-$				
		823.6 4	14 6	952.89	$3/2^-$	[E2]		0.00439 6	
1776.61	$7/2^-$	1034.9 3	13 3	741.64	$5/2^+$	[E1]		1.12×10^{-3} 2	
		1087.3 2	58 3	689.32	$7/2^-$	M1		0.00403 6	
		1316.1 1	100 4	460.48	$7/2^+$	E1		0.000805 11	
		1569.8 2	38 3	206.92	$5/2^+$	E1		0.000790 11	
		1740.9 3	12.1 21	35.75	$11/2^-$	[E2]		1.14×10^{-3} 2	
		1343.6 3	100 25	460.48	$7/2^+$	(M1,E2)		0.0021 4	
1804.07	$(5/2^+, 7/2^+, 9/2^+)$	1597 1	72 29	206.92	$5/2^+$				
		140.6 2	56 6	1672.72	$23/2^-$	E2(+M1)	>1	0.783 20	E_γ : weighted average of 140.3 5 from ($^{10}\text{B}, 3n\gamma$) and 140.6 2 from ($^7\text{Li}, 2n\gamma$). I_γ : from ($^7\text{Li}, 2n\gamma$). Other: 38 13 from ($^{31}\text{P}, 4n\gamma$).
1813.20	$21/2^-$	431.2 1	100 6	1381.96	$19/2^-$	D			E_γ : weighted average of 431.2 5 from ($^{10}\text{B}, 3n\gamma$) and 431.2 1 from ($^7\text{Li}, 2n\gamma$). I_γ : from ($^7\text{Li}, 2n\gamma$). Other: 100 25 from ($^{31}\text{P}, 4n\gamma$). Mult., δ : $\delta(Q/D)=+0.05$ 2 from $\gamma(\theta)$ in ($^{10}\text{B}, 3n\gamma$); $\Delta J=1$ from DCO in ($^7\text{Li}, 2n\gamma$).
1841.62	$9/2^-$	348.9 1	3.28 18	1492.74	$(7/2, 9/2, 11/2)^+$	E1		0.01141 16	
		353.9 3	1.3 4	1487.58	$(7/2, 9/2)^+$	(E1)		0.01102 16	
		367.8 1	8.3 3	1473.75	$(11/2)^-$	M1		0.0606 9	
		421.0 3	1.2 3	1420.55	$(9/2)^-$				
		568.9 1	3.7 3	1272.72	$(9/2)^+$	E1		0.00370 5	
		635.6 3	4.0 5	1205.95	$(7/2, 9/2)^-$				
		636.3 3	4.8 8	1205.36	$(9/2)^+$	[E1]		0.00292 4	
		657.8 2	1.16 21	1183.86	$9/2^-$				
		708.0 3	1.12 18	1133.61	$(9/2, 11/2)^+$				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$	Comments
1841.62	$9/2^-$	721.5 1	3.34 21	1120.09	(7/2) ⁺	E1		2.25×10^{-3} 3	
		753.2 3	3.6 4	1088.55	5/2 ⁻	(E2)		0.00536 8	Mult.: E1 or E2 from ce data in ^{149}Dy ε decay (4.2 m); E2 from level scheme.
		859.7 2	13.5 16	982.04	(9/2) ⁺	(E1)		1.59×10^{-3} 2	
		871.2 2	27 3	970.42	7/2 ⁺	E1		1.55×10^{-3} 2	
		969.4 3	0.8 3	872.45	(11/2) ⁻				
		997.5 1	15.1 11	844.15	7/2 ⁺	E1		1.20×10^{-3} 2	
		1001.2 4	0.46 16	840.73	13/2 ⁻				
		1016.5 4	1.4 4	825.12	9/2 ⁻				
		1152.3 2	4.8 4	689.32	7/2 ⁻	(M1)		0.00351 5	
		1381.3 3	1.8 4	460.48	7/2 ⁺				
		1805.8 1	100 5	35.75	11/2 ⁻	M1+E2	1.1 +8-5	0.00127 10	
		1110.4 4	19 6	741.64	5/2 ⁺				
		1162.6 2	32 8	689.32	7/2 ⁻	M1		0.00344 5	
		1391.9 4	22 9	460.48	7/2 ⁺				
1852.03	$(7/2)^-$	1645.1 2	100 6	206.92	5/2 ⁺	E1		0.000806 11	
		1816.4 4	22 9	35.75	11/2 ⁻				
		276.7 3	4 2	1591.06	(17/2 ⁺)				
1867.81	$19/2^+$	485.5 5	10 3	1381.96	19/2 ⁻				
1876.89	$5/2^-$	738.7 1	100 4	1129.13	15/2 ⁺	E2		0.00560 8	E_γ : other: 738.7 2 from ($^{10}\text{B}, 3n\gamma$).
		148.4 3	1.53 10	1728.36	5/2 ⁻				
		245.1 3	1.0 3	1631.88	(3/2, 5/2) ⁻	M1		0.1789 26	
		415.5 3	3.13 18	1461.20	(5/2, 7/2) ⁻	M1		0.0441 6	
		495.0 3	0.43 26	1381.92	7/2 ⁻				
		693.0 3	0.30 10	1183.86	9/2 ⁻				
		788.3 3	1.2 4	1088.55	5/2 ⁻				
		827.6 2	1.16 16	1049.24	(5/2 ⁺)				
		906.7 2	1.7 4	970.42	7/2 ⁺	(E1)		1.43×10^{-3} 2	
		924.0 1	3.48 16	952.89	3/2 ⁻	M1		0.00596 8	
		1039.8 2	14.0 10	837.16	5/2 ⁺	[E1]		1.11×10^{-3} 2	
		1121.9 1	7.02 18	754.92	5/2 ⁺	E1		0.000967 14	
		1135.2 1	13.7 8	741.64	5/2 ⁺	E1		0.000949 13	
		1187.5 2	3.28 20	689.32	7/2 ⁻	M1		0.00328 5	
1879.13	$(17/2^+)$	1416.4 2	2.29 18	460.48	7/2 ⁺	E1		0.000782 11	
		1670.0 1	5.4 3	206.92	5/2 ⁺	E1		0.000813 11	
		1776.2 1	100 4	100.75	3/2 ⁺	E1		0.000845 12	
		750.0 3	100	1129.13	15/2 ⁺				
		409.4 1	6.0 10	1473.75	(11/2) ⁻				
		422.0 4	2.0 10	1461.20	(5/2, 7/2) ⁻				
		457.0 1	6.9 8	1426.13	9/2 ⁻	M1		0.0345 5	
		501.1 2	9.0 10	1381.92	7/2 ⁻	M1		0.0273 4	
		699.3 2	5.5 6	1183.86	9/2 ⁻				
1883.08	$(9/2)^-$								

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$
1883.08	(9/2) ⁻	794.5 3	9.1 22	1088.55	5/2 ⁻			
		901.0 1	13.6 8	982.04	(9/2) ⁺	(E1)		1.45×10 ⁻³ 2
		912.8 3	37 7	970.42	7/2 ⁺	[E1]		1.41×10 ⁻³ 2
		1010.6 1	100 9	872.45	(11/2) ⁻	M1		0.00481 7
		1042.1 4	1.5 5	840.73	13/2 ⁻			
		1057.9 1	82.2 13	825.12	9/2 ⁻	M1		0.00431 6
		1193.7 2	10.2 8	689.32	7/2 ⁻	M1		0.00324 5
		1422.6 1	82.2 13	460.48	7/2 ⁺	E1		0.000782 11
		1847.3 2	8.3 9	35.75	11/2 ⁻			
		501.8 3	33 12	1426.13	9/2 ⁻			
1928.15	(7/2 ⁻ , 9/2 ⁻)	1084 1	<12	844.15	7/2 ⁺			
		1103.2 3	100 12	825.12	9/2 ⁻			
		1239.0 4	29 12	689.32	7/2 ⁻	(M1)		0.00297 4
		1467.6 3	82 18	460.48	7/2 ⁺	(E1)		0.000780 11
		1892.4 4	22 4	35.75	11/2 ⁻			
		479.5 4	2.1 7	1473.75	(11/2) ⁻			
1953.13	9/2 ⁻	769.3 2	6.1 18	1183.86	9/2 ⁻	(M1)		0.00932 13
		819.6 3	4.9 18	1133.61	(9/2, 11/2) ⁺	[E1]		1.74×10 ⁻³ 2
		1080.6 1	59.5 12	872.45	(11/2) ⁻	M1		0.00409 6
		1109.2 3	9.9 11	844.15	7/2 ⁺			
		1128.0 3	5.2 10	825.12	9/2 ⁻			
		1263.8 1	51.8 18	689.32	7/2 ⁻	M1		0.00284 4
		1492.7 3	3.5 12	460.48	7/2 ⁺			
		1917.4 1	100.0 12	35.75	11/2 ⁻	E2(+M1)	>1.3	0.00112 6
		1033.2 4	27 14	952.89	3/2 ⁻			
		1231.5 3	100 24	754.92	5/2 ⁺			
1986.44	(3/2 ⁻ , 5/2, 7/2 ⁻)	1297.2 4	54 22	689.32	7/2 ⁻			
		1779.8 4	82 35	206.92	5/2 ⁺			
		553.6 3	43 19	1461.20	(5/2, 7/2) ⁻			
		588.6 4	37 19	1426.13	9/2 ⁻			
2014.72	(9/2) ⁻	1032.6 3	43 12	982.04	(9/2) ⁺			
		1142.2 3	100 11	872.45	(11/2) ⁻	M1		0.00359 5
		1173.9 4	86 25	840.73	13/2 ⁻			
		1189.6 3	93 14	825.12	9/2 ⁻	(M1+E2)		0.0026 6
		1325.0 4	43 12	689.32	7/2 ⁻			
		1979.5 4	28 7	35.75	11/2 ⁻			
		517.4 3	37 17	1508.52	(7/2) ⁻	(M1)		0.02513 35
		565.3 2	37 10	1461.20	(5/2, 7/2) ⁻			
2026.31	(7/2) ⁻	600.2 2	45 17	1426.13	9/2 ⁻	(M1)		0.01727 24
		937.8 2	36 9	1088.55	5/2 ⁻	(M1)		0.00575 8
		1044.3 3	25 12	982.04	(9/2) ⁺			
		1056 1	10 5	970.42	7/2 ⁺			
		1188.9 3	100 10	837.16	5/2 ⁺	(E1)		0.000888 12

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)							
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\alpha^\#$
2026.31	$(7/2)^-$	1201.3 3	<33	825.12	$9/2^-$	(M1)	0.00319 4
		1284.7 3	25 8	741.64	$5/2^+$		
		1565.8 2	61 8	460.48	$7/2^+$	E1	0.000790 11
		1819.3 3	82 17	206.92	$5/2^+$		
2065.36	$7/2^-$	188.5 1	7.1 7	1876.89	$5/2^-$	M1	0.367 5
		337.1 2	4.3 12	1728.36	$5/2^-$		
		556.8 2	8.1 16	1508.52	$(7/2)^-$	(M1)	0.02086 29
		577.8 2	6.3 8	1487.58	$(7/2,9/2)^+$	(E1)	0.00358 5
		683.7 3	5.0 16	1381.92	$7/2^-$	(M1)	0.01248 18
		859.6 4	3.1 12	1205.95	$(7/2,9/2)^-$		
		860.1 2	29 5	1205.36	$(9/2)^+$	(E1)	1.59×10^{-3} 2
		876.2 3	8.1 16	1189.07	$(7/2)^-$		
		881.4 2	13.6 12	1183.86	$9/2^-$	M1	0.00669 9
		945.4 2	9.0 8	1120.09	$(7/2)^+$	E1	1.32×10^{-3} 2
		1083.4 2	27.9 8	982.04	$(9/2)^+$	(E1)	1.03×10^{-3} 1
		1095.0 2	12.3 6	970.42	$7/2^+$	E1	1.01×10^{-3} 1
		1195.6 2	26.4 8	869.72	$5/2^+$	E1	0.000882 12
		1221.2 1	21.4 8	844.15	$7/2^+$	E1	0.000861 12
		1228.2 1	18.3 8	837.16	$5/2^+$	E1	0.000855 12
		1240.1 3	5.0 12	825.12	$9/2^-$	M1	0.00296 4
		1323.7 1	41.5 23	741.64	$5/2^+$	E1	0.000802 11
		1376.0 1	25.1 8	689.32	$7/2^-$	M1	2.35×10^{-3} 3
		1604.8 3	2.0 8	460.48	$7/2^+$		
		1858.4 1	31.0 8	206.92	$5/2^+$	E1	0.000875 12
		2029.6 1	100 8	35.75	$11/2^-$	E2	1.04×10^{-3} 1
2074.21	$7/2^-$	197.2 3	5 3	1876.89	$5/2^-$		
		648.0 4	5.1 15	1426.13	$9/2^-$		
		986.0 4	12 5	1088.55	$5/2^-$		
		1092.3 5	7 4	982.04	$(9/2)^+$		
		1201.8 3	<12	872.45	$(11/2)^-$	(E2)	2.00×10^{-3} 3
		1204.5 2	20 3	869.72	$5/2^+$	(E1)	0.000874 12
		1236.9 3	32 8	837.16	$5/2^+$	(E1)	0.000849 12
		1248.9 3	5.1 18	825.12	$9/2^-$		
		1384.7 &a 3	28 & 7	689.32	$7/2^-$	(M1)	2.32×10^{-3} 3
		1613.8 2	23.5 24	460.48	$7/2^+$	E1	0.000799 11
		1867.3 3	100 3	206.92	$5/2^+$	E1	0.000878 12
		2038.5 2	37.1 18	35.75	$11/2^-$	E2	1.03×10^{-3} 1
2117.14	$(5/2^-, 7/2^-)$	1427.9 5	18 9	689.32	$7/2^-$		
		1910.2 2	100 12	206.92	$5/2^+$	(E1)	0.000895 13
2157.97	$(7/2)^-$	697.0 5	25 15	1461.20	$(5/2, 7/2)^-$		
		731.6 2	100 8	1426.13	$9/2^-$	M1	0.01055 15
		974.5 4	41 15	1183.86	$9/2^-$	(E2)	0.00306 4

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	α #	Comments
2157.97	(7/2) ⁻	1288.5 @ 3	<81	869.72	5/2 ⁺	[E1]	0.000818 11	
		1332.9 4	25 10	825.12	9/2 ⁻			
		1468.7 3	66 15	689.32	7/2 ⁻	(M1+E2)	0.00173 33	
		1697.4 3	29 7	460.48	7/2 ⁺			
2161.07	(9/2) ⁻	972.2 2	65 12	1189.07	(7/2) ⁻	(E2)	0.00307 4	
		1027.1 3	24 9	1133.61	(9/2,11/2) ⁺			
		1288.5 @ 3	<47	872.45	(11/2) ⁻	(M1)	0.00272 4	
		1320.4 4	27 5	840.73	13/2 ⁻			
		1471.7 2	100 9	689.32	7/2 ⁻	M1	2.05×10 ⁻³ 3	
		1700.7 4	18 6	460.48	7/2 ⁺			
		2125.3 3	50 9	35.75	11/2 ⁻	D,E2		
2260.33	(7/2 ⁻ ,9/2)	1278.5 3	100 31	982.04	(9/2) ⁺			
		1387.9 3	62 31	872.45	(11/2) ⁻			
		2224.3 3	100 23	35.75	11/2 ⁻			
2302.89	(27/2) ⁻	630.3 2	100	1672.72	23/2 ⁻	E2	0.00813 11	E_γ : weighted average of 630.4 2 from (¹⁰ B,3n γ) and 630.2 2 from (⁷ Li,2n γ).
2350.00	23/2 ⁺	482.2 2	100 6	1867.81	19/2 ⁺	E2	0.01600 22	E_γ : weighted average of 482.2 2 from (¹⁰ B,3n γ) and 482.3 2 from (⁷ Li,2n γ). I_γ : from (⁷ Li,2n γ) and (³¹ P,4n γ). E_γ, I_γ : from (⁷ Li,2n γ). Other: $I_\gamma=25$ 6 from (³¹ P,4n γ).
		536.7 3	23 3	1813.20	21/2 ⁻	D		
		677.2 2	12 4	1672.72	23/2 ⁻			
2352.29	(7/2 ⁻ ,9/2)	1527.3 3	100 23	825.12	9/2 ⁻			
		1891.8 3	98 14	460.48	7/2 ⁺			
		2316.4 3	98 21	35.75	11/2 ⁻			
2368.7	(21/2 ⁺)	500.8 5	22 11	1867.81	19/2 ⁺			
		986.8 5	100 33	1381.96	19/2 ⁻			
2452.52	(9/2 ⁻)	1627.5 4	47 28	825.12	9/2 ⁻			
		2416.7 3	100 20	35.75	11/2 ⁻			
2486.59	(5/2,7/2,9/2 ⁺)	2026.2 4	100 40	460.48	7/2 ⁺			
		2279.6 3	68 20	206.92	5/2 ⁺			
2492.25	(21/2 ⁺)	624.4 5	100 38	1867.81	19/2 ⁺			
		1110.3 3	100 38	1381.96	19/2 ⁻			
2516.33	(7/2 ⁻)	1428.0 5	29 16	1088.55	5/2 ⁻			
		2309.3 3	100 10	206.92	5/2 ⁺			
		2480.6 5	24 7	35.75	11/2 ⁻			
2518.52	(27/2) ⁺	168.5 2	29 4	2350.00	23/2 ⁺	E2	0.409 6	B(E2)(W.u.)=7.1 10 E_γ : weighted average of 168.4 5 from (¹⁰ B,3n γ) and 168.5 2 from (⁷ Li,2n γ). I_γ : unweighted average of 22.4 21 from (³¹ P,4n γ), 34.3 18 from (⁷ Li,2n γ), and 30.9 15 from (α ,6n γ).
		215.6 1	100 3	2302.89	(27/2) ⁻	E1	0.0386 5	B(E1)(W.u.)=6.6×10 ⁻⁶ +7-6

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$	Comments
E_γ : weighted average of 215.3 2 from (¹⁰ B,3n γ) and 215.6 1 from (⁷ Li,2n γ). I_γ : from (⁷ Li,2n γ). Others: 100 6 from (³¹ P,4n γ) and 100 5 from (α ,6n γ). Mult.: $\Delta J=0$ from $\gamma(\theta)$ in (¹⁰ B,3n γ) and (α ,6n γ). B(M2)(W.u.)=0.046 +10-9									
2518.52	(27/2) ⁺	845.6 ^a 3	6.6 12	1672.72	23/2 ⁻	[M2]		0.01937 27	
2547.46	(5/2,7/2 ⁺)	2087.3 5	40 20	460.48	7/2 ⁺				
		2340.5 5	100 40	206.92	5/2 ⁺				
		2446.5 4	90 20	100.75	3/2 ⁺				
2566.08	(7/2 ⁻ ,9/2)	2105.4 4	100 35	460.48	7/2 ⁺				
		2530.5 4	41 17	35.75	11/2 ⁻				
2573.43	(7/2 ⁻ ,9/2)	2113.0 4	100 35	460.48	7/2 ⁺				
		2537.6 4	41 17	35.75	11/2 ⁻				
2588.60	(5/2,7/2)	2128.1 1	100	460.48	7/2 ⁺				
2661.42	(9/2 ⁻)	1789.0 4	100 22	872.45	(11/2) ⁻				
		2625.6 4	47 16	35.75	11/2 ⁻				
2664.19	(25/2) ⁻	361.3 2	100	2302.89	(27/2) ⁻	M1		0.0635 9	E_γ : weighted average of 361.0 5 from (¹⁰ B,3n γ) and 361.4 2 from (⁷ Li,2n γ). Mult.: some E2 admixture is possible from DCO in (⁷ Li,2n γ) and $\gamma(\theta,\text{pol})$ ($\Delta J=1$) in (¹⁰ B,3n γ).
2666.95	(25/2 ⁺)	148.3 4	33 13	2518.52	(27/2) ⁺				
		316.7 5	21 13	2350.00	23/2 ⁺				
		994.3 2	100 17	1672.72	23/2 ⁻				
2762.78	(25/2 ⁻)	412.5 5	33 22	2350.00	23/2 ⁺				
		460.3 5	67 22	2302.89	(27/2) ⁻				
		1090.0 3	100 33	1672.72	23/2 ⁻	(D)			
2812.85	(29/2) ⁺	294.3 1	100 2	2518.52	(27/2) ⁺	M1+E2	0.9 2	0.090 5	E_γ : weighted average of 294.3 2 from (¹⁰ B,3n γ) and 294.3 1 from (⁷ Li,2n γ). I_γ : from (⁷ Li,2n γ). Others: 100 4 from (³¹ P,4n γ) and 100 5 from (α ,6n γ).
		510.1 2	46 5	2302.89	(27/2) ⁻	E1		0.00471 7	E_γ : weighted average of 510.2 2 from (¹⁰ B,3n γ) and 509.9 3 from (⁷ Li,2n γ). I_γ : unweighted average of 40 3 from (³¹ P,4n γ), 37 6 from (⁷ Li,2n γ), and 54 3 from (α ,6n γ).
3142.02	(31/2) ⁺	329.2 1	100 2	2812.85	(29/2) ⁺	M1+E2	1.4 5	0.059 7	E_γ : weighted average of 329.4 2 from (¹⁰ B,3n γ) and 329.2 1 from (⁷ Li,2n γ). I_γ : from (⁷ Li,2n γ). Others: 100 5 from (³¹ P,4n γ) and (α ,6n γ).
		623.4 3	8 3	2518.52	(27/2) ⁺	E2		0.00834 12	I_γ : unweighted average of 15.8 18 from (³¹ P,4n γ), 8.6 29 from (⁷ Li,2n γ), and 5.1 10 from (α ,6n γ).
3527.22	(33/2) ⁺	385.2 2	100 4	3142.02	(31/2) ⁺	M1		0.0537 8	I_γ : others: $I_\gamma=100$ 5 from (³¹ P,4n γ) and (α ,6n γ). I_γ : weighted average of 9.8 25 from (³¹ P,4n γ) and 8.5 17 from (α ,6n γ).
		715 1	8.9 17	2812.85	(29/2) ⁺				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [‡]	$\delta^\ddagger$	$\alpha^\#$	Comments
3603.38	(31/2 ⁻)	461.3 4	19 8	3142.02	(31/2) ⁺				
		1300.5 2	100 11	2302.89	(27/2) ⁻	(Q)			
3990.6		387.2 3	100	3603.38	(31/2) ⁻				
4061.4		534.2 3	100	3527.22	(33/2) ⁺				
4107.3	(31/2 ⁺)	966	100	3142.02	(31/2) ⁺				
4208.46	(33/2) ⁺	681.8	25 6	3527.22	(33/2) ⁺	M1		0.01256 18	
		1066.2 3	21 5	3142.02	(31/2) ⁺	D+Q			I_γ : weighted average of 19 6 from (³¹ P,4n γ) and 22 5 from (α ,6n γ).
		1395.5 2	100 6	2812.85	(29/2) ⁺	(E2)		1.53×10^{-3} 2	E_γ : weighted average of 1395.8 5 from (¹⁰ B,3n γ) and 1395.5 2 from (⁷ Li,2n γ).
									I_γ : from (³¹ P,4n γ). Others: 100 20 from (⁷ Li,2n γ) and 100 10 from (α ,6n γ).
4463.46	(35/2) ⁺	254.9 2	100 10	4208.46	(33/2) ⁺	M1+E2		0.132 29	E_γ : weighted average of 254.7 5 from (¹⁰ B,3n γ) and 254.9 2 from (⁷ Li,2n γ).
									I_γ : from (α ,6n γ). Others: 100 11 from (³¹ P,4n γ) and 100 27 from (⁷ Li,2n γ).
		356.2 3	21 5	4107.3	(31/2 ⁺)	Q			
		1321.6 2	89 5	3142.02	(31/2) ⁺	(E2)		1.67×10^{-3} 2	E_γ : weighted average of 1321.6 5 from (¹⁰ B,3n γ) and 1321.6 2 from (⁷ Li,2n γ).
									I_γ : weighted average of 90 5 from (³¹ P,4n γ), 82 27 from (⁷ Li,2n γ), and 90 10 from (α ,6n γ).
4674.00	(37/2) ⁺	210.6 2	60 5	4463.46	(35/2) ⁺	E2(+M1)	>1.2	0.209 16	E_γ : weighted average of 210.5 5 from (¹⁰ B,3n γ) and 210.6 2 from (⁷ Li,2n γ).
									I_γ : weighted average of 58 5 from (³¹ P,4n γ), 57 22 from (⁷ Li,2n γ), and 63 7 from (α ,6n γ).
		465.5 2	22 3	4208.46	(33/2) ⁺	E2		0.01758 25	I_γ : weighted average of 22 3 from (³¹ P,4n γ) and 25 5 from (α ,6n γ).
		1146.7 2	100 3	3527.22	(33/2) ⁺	E2		2.19×10^{-3} 3	E_γ : weighted average of 1146.7 5 from (¹⁰ B,3n γ) and 1146.7 2 from (⁷ Li,2n γ).
									I_γ : from (³¹ P,4n γ). Others: 100 14 from (⁷ Li,2n γ) and 100 5 from (α ,6n γ).
4923.39	(39/2) ⁺	249.4 2	100 4	4674.00	(37/2) ⁺	M1+E2	1.6 +10-5	0.128 10	E_γ : weighted average of 249.1 5 from (¹⁰ B,3n γ) and 249.4 2 from (⁷ Li,2n γ).
									I_γ : from (³¹ P,4n γ). Others: 100 38 from (⁷ Li,2n γ) and 100 5 from (α ,6n γ).
									δ : from ce data and $\gamma\gamma$ (DCO) in (³¹ P,4n γ). Other: +0.09 4 from $\gamma(\theta)$ in (¹⁰ B,3n γ).
		460.0 3	26 2	4463.46	(35/2) ⁺	E2		0.01815 26	I_γ : weighted average of 27 2 from (³¹ P,4n γ) and 22 5 from (α ,6n γ).
5148.2	(41/2) ⁺	224.9 3	100 6	4923.39	(39/2) ⁺	M1+E2	1.1 3	0.187 11	E_γ : weighted average of 224.7 5 from (¹⁰ B,3n γ) and 224.9 3 from (⁷ Li,2n γ).
									I_γ : from (³¹ P,4n γ).

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. ‡	$\delta^\ddagger$	$\alpha^\#$	Comments
5148.2	(41/2) ⁺	474.2	34 3	4674.00	(37/2) ⁺	Q			
5258.1	(39/2) ⁻	583.8	100 17	4674.00	(37/2) ⁺	D			
		1197	67 17	4061.4					
5618.9	(41/2) ⁻	695.6	100	4923.39	(39/2) ⁺	E1		2.42×10 ⁻³ 3	
5712.4	(43/2) ⁻	93.6	9 2	5618.9	(41/2) ⁻	M1		2.66 4	
		454.3 2	39 5	5258.1	(39/2) ⁻	Q			
		564.1	100 9	5148.2	(41/2) ⁺	E1		0.00377 5	
5735.1	(45/2) ⁺	586.9 1	100	5148.2	(41/2) ⁺	E2		0.00967 14	
5966.2	(43/2) ⁺	254	100 14	5712.4	(43/2) ⁻	D			
		818.1	36 9	5148.2	(41/2) ⁺	D			
6025.3	(43/2) ⁻	877.3	100	5148.2	(41/2) ⁺	D			
6112.3	(45/2) ⁻	146.2	14 3	5966.2	(43/2) ⁺	(E1)		0.1082 15	
		377.0	75 13	5735.1	(45/2) ⁺	E1		0.00947 13	Mult.: E1 from ce data and ΔJ=(0) from DCO.
		399.6	100 6	5712.4	(43/2) ⁻	M1		0.0488 7	
6221.0	(45/2) ⁻	195.9	26 4	6025.3	(43/2) ⁻	M1+E2	0.9 +11-6	0.292 31	
		486.0	100 7	5735.1	(45/2) ⁺	E1		0.00525 7	Mult.: E1 from ce data and ΔJ=(0) from DCO.
6400.7	(47/2) ⁻	180.0	62 8	6221.0	(45/2) ⁻	M1+E2	1.3 +18-6	0.360 28	
		288.0	100 15	6112.3	(45/2) ⁻	M1+E2	1.1 +10-5	0.091 13	
6788.6	(47/2) ⁺	567.6	45 5	6221.0	(45/2) ⁻	E1		0.00372 5	
		676.3	100 5	6112.3	(45/2) ⁻	E1		0.00257 4	
6874.4	(47/2) ⁺	762.2	100	6112.3	(45/2) ⁻				
7112.9	(49/2) ⁺	238.6	24 5	6874.4	(47/2) ⁺	M1		0.1925 27	
		324.1	100 7	6788.6	(47/2) ⁺	M1		0.0846 12	
		712.1	38 5	6400.7	(47/2) ⁻	E1		2.31×10 ⁻³ 3	
7194.3	(49/2)	793.5	100	6400.7	(47/2) ⁻	D			
7741.1	(51/2)	546.7	100	7194.3	(49/2)	M1+E2	1.4 1	0.0150 4	
7976.5	(51/2) ⁺	1188.2	100	6788.6	(47/2) ⁺	(Q)			
8048.5	(51/2) ⁺	935	100	7112.9	(49/2) ⁺				
8247.5	(53/2) ⁺	1134.5	100	7112.9	(49/2) ⁺	E2		2.24×10 ⁻³ 3	
8281.2	(53/2)	540.1	100	7741.1	(51/2)	D			
8733.7	(55/2) ⁺	757.2	100	7976.5	(51/2) ⁺	E2		0.00529 7	
8922.1	(53/2) ⁺	873	93 14	8048.5	(51/2) ⁺	M1(+E2)		0.0054 15	
		945.8	100 14	7976.5	(51/2) ⁺	D			
9197.2	(59/2) ⁺	463.5	100	8733.7	(55/2) ⁺	E2		0.01778 25	
9227.5?		946 ^a	100	8281.2	(53/2)				
9482.6?		255.0 ^a	100	9227.5?					
9771.6	(57/2) ⁺	289.0 ^a	10 3	9482.6?					
		849.7	100 6	8922.1	(53/2) ⁺	E2		0.00410 6	
		1524.1	84 6	8247.5	(53/2) ⁺	E2		1.34×10 ⁻³ 2	
9955.7	(61/2) ⁺	184.1	100	9771.6	(57/2) ⁺	E2		0.303 4	B(E2)(W.u.)=10.9 6
10184.2?		987 ^a		9197.2	(59/2) ⁺				
11000.7	(65/2) ⁺	1044.9	100	9955.7	(61/2) ⁺	E2		0.00264 4	

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)

$E_i(\text{level})$	J_i^π	E_γ [†]	L_γ [†]	E_f	J_f^π	Mult. [‡]	α [#]
11177.2?		993 ^a		10184.2?			
11204.7	(67/2) ⁻	204.0	100	11000.7	(65/2) ⁺	E1	0.0446 6
12152.4	(71/2 ⁻)	947.7	100	11204.7	(67/2) ⁻	Q	
13118.2	(75/2 ⁻)	965.8	100	12152.4	(71/2 ⁻)	Q	
740.10+x	J1+2	740.1 2	100	x	J1		
1534.80+x	J1+4	794.7 2	100	740.10+x	J1+2		
2381.9+x	J1+6	847.1 3	100	1534.80+x	J1+4		
3281.3+x	J1+8	899.4 2	100	2381.9+x	J1+6		
4234.8+x	J1+10	953.5 2	100	3281.3+x	J1+8		
5242.0+x	J1+12	1007.2 2	100	4234.8+x	J1+10		
6302.7+x	J1+14	1060.7 3	100	5242.0+x	J1+12		
7416.9+x	J1+16	1114.2 2	100	6302.7+x	J1+14		
8586.1+x	J1+18	1169.2 3	100	7416.9+x	J1+16		
9810.7+x	J1+20	1224.6 2	100	8586.1+x	J1+18		
11089.5+x	J1+22	1278.8 3	100	9810.7+x	J1+20		
12424.0+x	J1+24	1334.4 3	100	11089.5+x	J1+22		
13815.1+x	J1+26	1391.1 3	100	12424.0+x	J1+24		
15259.3+x	J1+28	1444.2 4	100	13815.1+x	J1+26		
646.20+y	J2+2	646.2 3	100	y	J2		
1343.6+y	J2+4	697.4 2	100	646.20+y	J2+2		
2091.8+y	J2+6	748.2 2	100	1343.6+y	J2+4		
2890.8+y	J2+8	799.0 2	100	2091.8+y	J2+6		
3741.3+y	J2+10	850.5 3	100	2890.8+y	J2+8		
4643.3+y	J2+12	902.0 2	100	3741.3+y	J2+10		
5597.4+y	J2+14	954.1 3	100	4643.3+y	J2+12		
6603.7+y	J2+16	1006.3 2	100	5597.4+y	J2+14		
7662.5+y	J2+18	1058.8 2	100	6603.7+y	J2+16		
8774.2+y	J2+20	1111.7 2	100	7662.5+y	J2+18		
9938.7+y	J2+22	1164.5 3	100	8774.2+y	J2+20		
11156.6+y	J2+24	1217.9 2	100	9938.7+y	J2+22		
12428.0+y	J2+26	1271.4 2	100	11156.6+y	J2+24		
13753.0+y	J2+28	1324.9 2	100	12428.0+y	J2+26		
15131.7+y	J2+30	1378.7 2	100	13753.0+y	J2+28		
16565.2+y	J2+32	1433.5 3	100	15131.7+y	J2+30		
18052.9+y	J2+34	1487.7 3	100	16565.2+y	J2+32		
19594.8+y	J2+36	1541.9 4	100	18052.9+y	J2+34		
786.00+z	J3+2	786.0 3	100	z	J3		
1623.4+z	J3+4	837.4 3	100	786.00+z	J3+2		
2514.0+z	J3+6	890.6 2	100	1623.4+z	J3+4		
3455.0+z	J3+8	941.0 2	100	2514.0+z	J3+6		
4447.7+z	J3+10	992.7 3	100	3455.0+z	J3+8		
5491.6+z	J3+12	1043.9 2	100	4447.7+z	J3+10		
6587.4+z	J3+14	1095.8 2	100	5491.6+z	J3+12		
7735.8+z	J3+16	1148.4 2	100	6587.4+z	J3+14		

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Tb})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π
8935.8+z	J3+18	1200.0 3	100	7735.8+z	J3+16	13382.4+u	J4+24	1405.4 4	100	11977.0+u	J4+22
10187.8+z	J3+20	1252.0 2	100	8935.8+z	J3+18	14832.9+u	J4+26	1450.5 4	100	13382.4+u	J4+24
11490.8+z	J3+22	1303.0 3	100	10187.8+z	J3+20	803.7+v	J5+2	803.7 4		v	J5
12847.6+z	J3+24	1356.7 4	100	11490.8+z	J3+22	1657.1+v	J5+4	853.4 3		803.7+v	J5+2
824.0+u	J4+2	824.0 ^a	100	u	J4	2564.9+v	J5+6	907.8 3		1657.1+v	J5+4
1701.4+u	J4+4	877.4 4	100	824.0+u	J4+2	3523.2+v	J5+8	958.3 2		2564.9+v	J5+6
2633.3+u	J4+6	931.9 4	100	1701.4+u	J4+4	4532.9+v	J5+10	1009.7 2		3523.2+v	J5+8
3619.0+u	J4+8	985.7 3	100	2633.3+u	J4+6	5593.6+v	J5+12	1060.7 2		4532.9+v	J5+10
4656.6+u	J4+10	1037.6 2	100	3619.0+u	J4+8	6706.3+v	J5+14	1112.7 3		5593.6+v	J5+12
5744.9+u	J4+12	1088.3 3	100	4656.6+u	J4+10	7873.1+v	J5+16	1166.8 3		6706.3+v	J5+14
6884.9+u	J4+14	1140.0 2	100	5744.9+u	J4+12	9092.8+v	J5+18	1219.7 4		7873.1+v	J5+16
8077.9+u	J4+16	1193.0 2	100	6884.9+u	J4+14	10364.6+v	J5+20	1271.8 4		9092.8+v	J5+18
9322.9+u	J4+18	1245.0 3	100	8077.9+u	J4+16	11692.3+v	J5+22	1327.6 5		10364.6+v	J5+20
10622.9+u	J4+20	1300.0 3	100	9322.9+u	J4+18	13075.5+v	J5+24	1383.2 5		11692.3+v	J5+22
11977.0+u	J4+22	1354.0 3	100	10622.9+u	J4+20						

[†] From ¹⁴⁹Dy ε decay (4.2 m) ([2019MeZX](#)) for transitions from low-spin levels ($J \leq 13/2$) and from (⁷Li,2n γ) (with ΔE_γ) or (³¹P,4n γ) (without ΔE_γ) for transitions from high-spin levels, unless otherwise noted. Transitions from SD-band levels are from (²⁷Al,6n γ).

[‡] From ce data in ¹⁴⁹Dy ε decay (4.2 m) for transitions from low-spin levels ($J \leq 13/2$); from ce data and $\gamma\gamma(\text{DCO})$ in (³¹P,4n γ) (and/or $\gamma(\theta, \text{pol})$ in (¹⁰B,3n γ) and ($\alpha, 6\text{n}\gamma$), and $\gamma\gamma(\text{DCO})$ in (⁷Li,2n γ), where available) for transitions from high-spin levels, unless otherwise noted. For Mult=M1+E2 only available from ¹⁴⁹Dy ε decay (4.2 m), δ is deduced by the evaluators from $\alpha(\text{K})\text{exp}$ and/or $\alpha(\text{L})\text{exp}$ using the BrIccMixing code.

[#] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

@ Multiply placed.

& Multiply placed with intensity suitably divided.

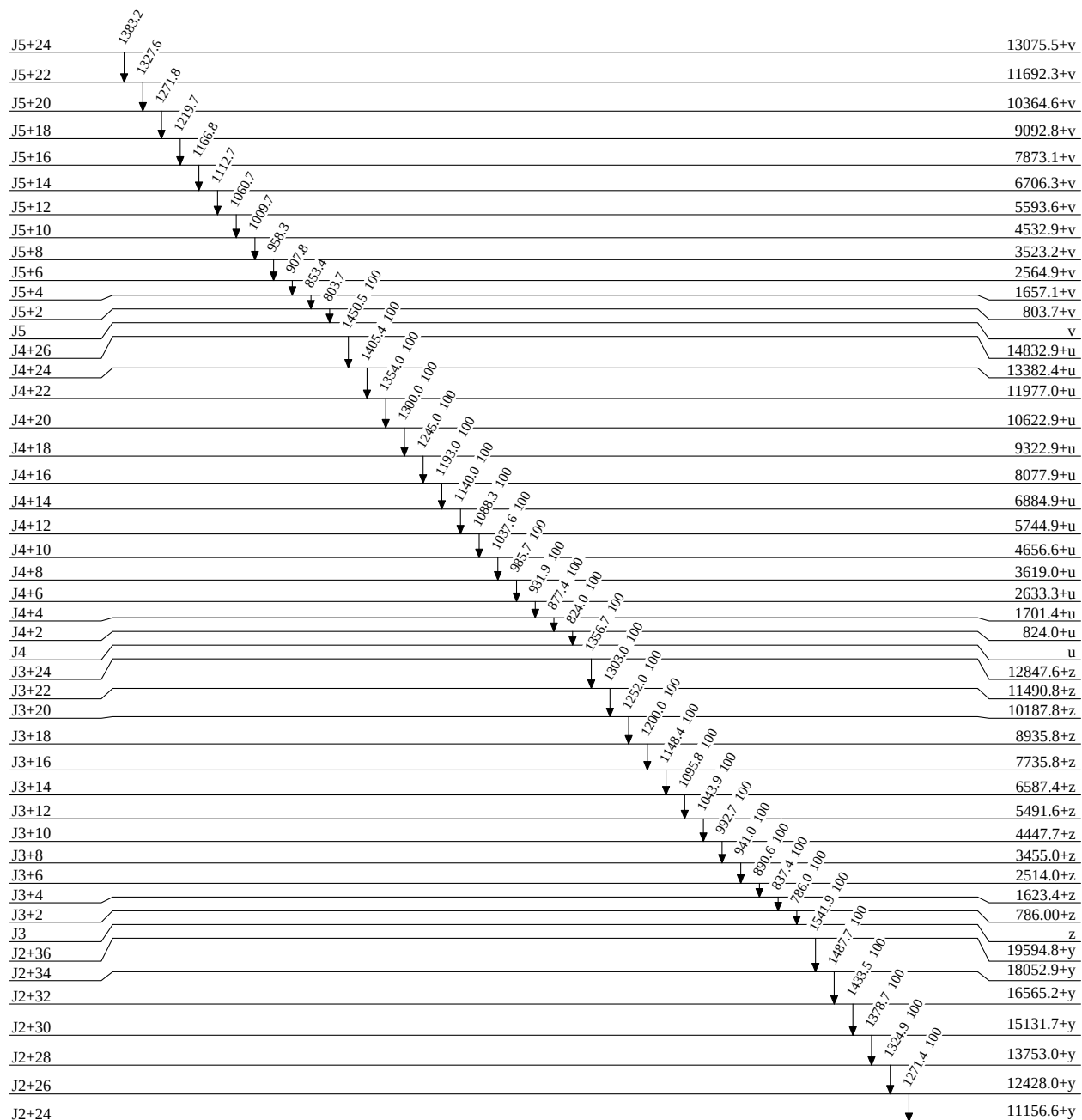
^a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

1/2⁺

0.0

4.12 h 3

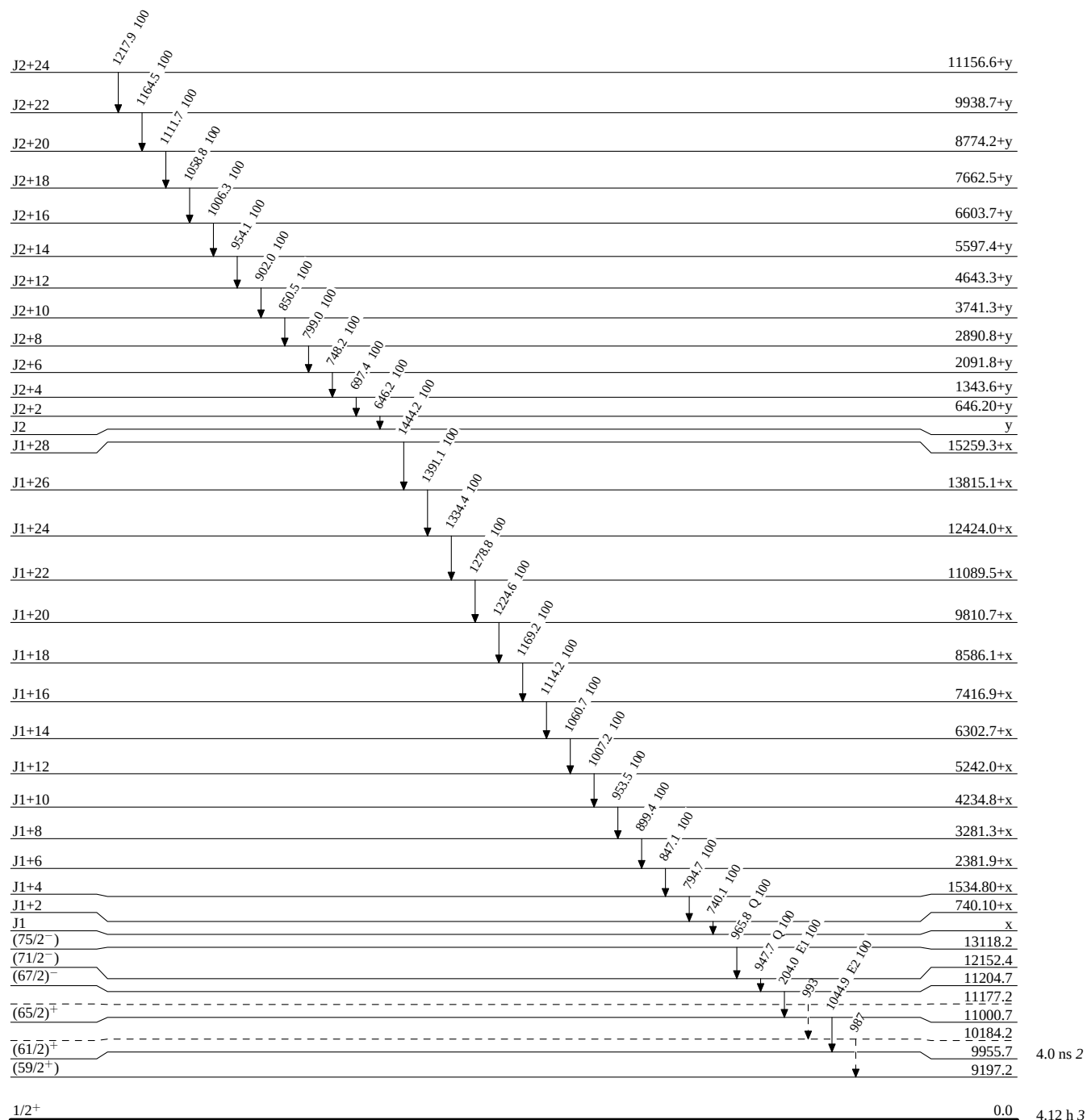
¹⁴⁹Tb₈₄

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

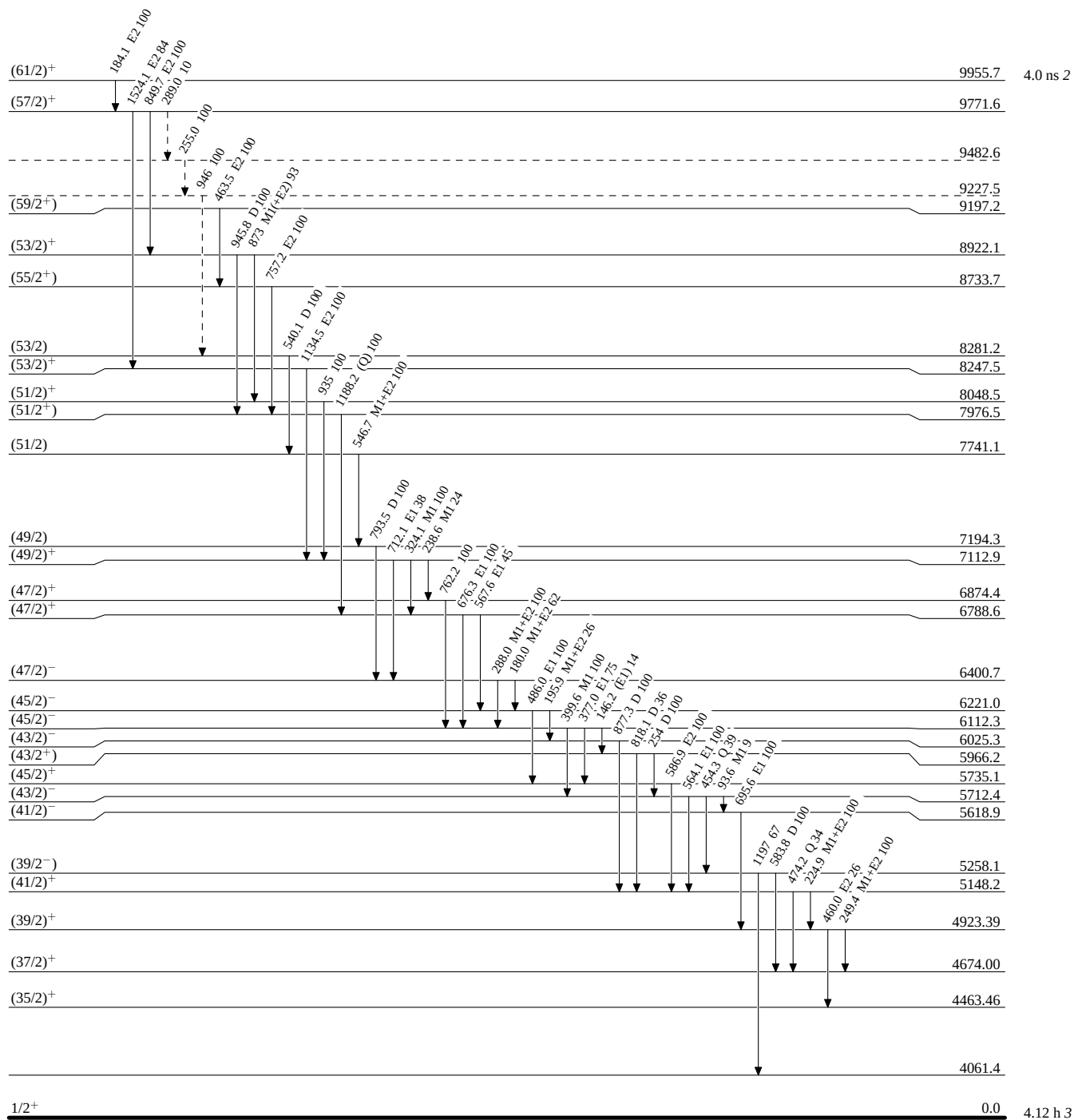
-----► γ Decay (Uncertain)


Adopted Levels, Gammas

Legend

Level Scheme (continued)

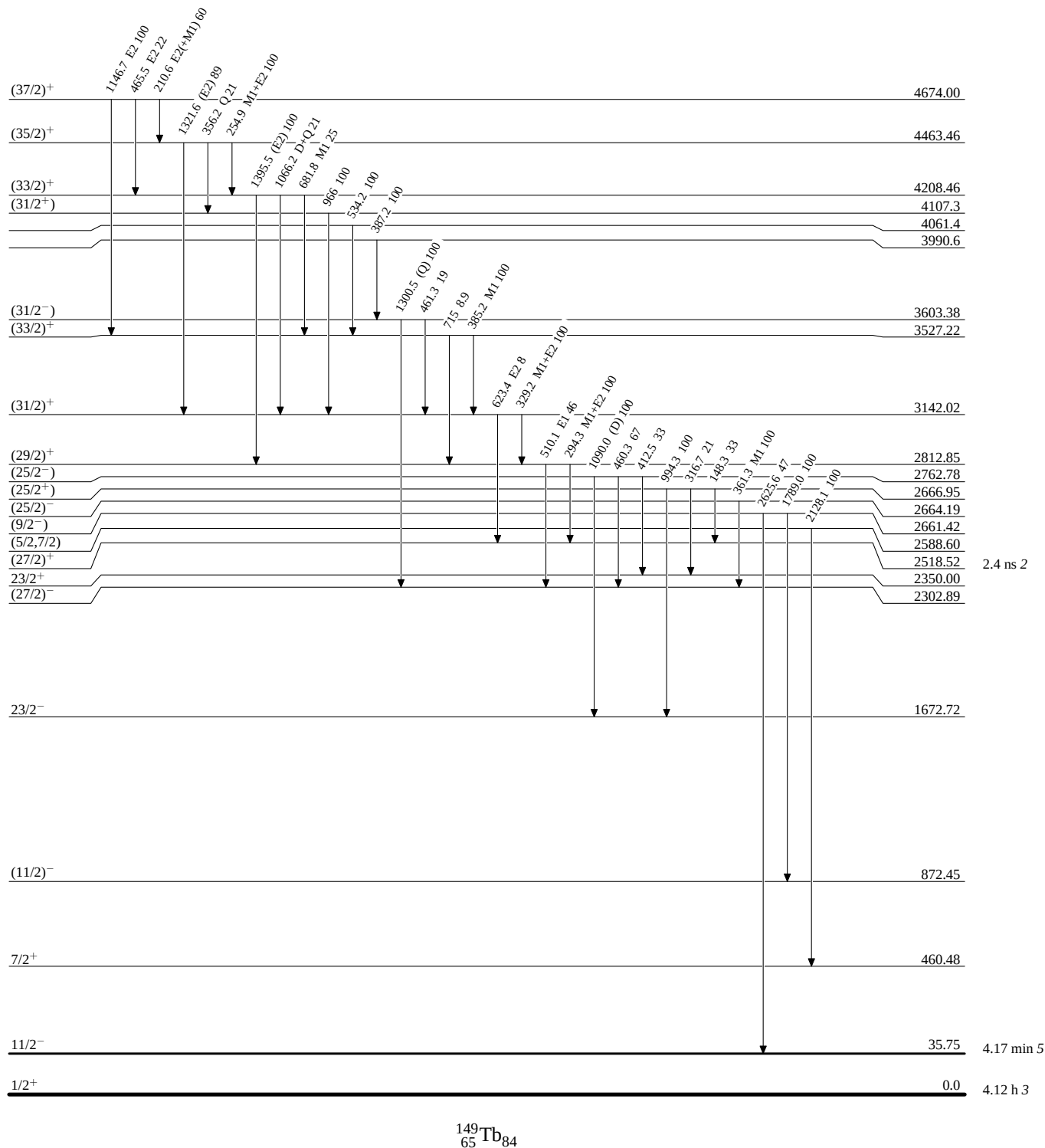
Intensities: Relative photon branching from each level

 - - - - - $\rightarrow$ γ Decay (Uncertain)


Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



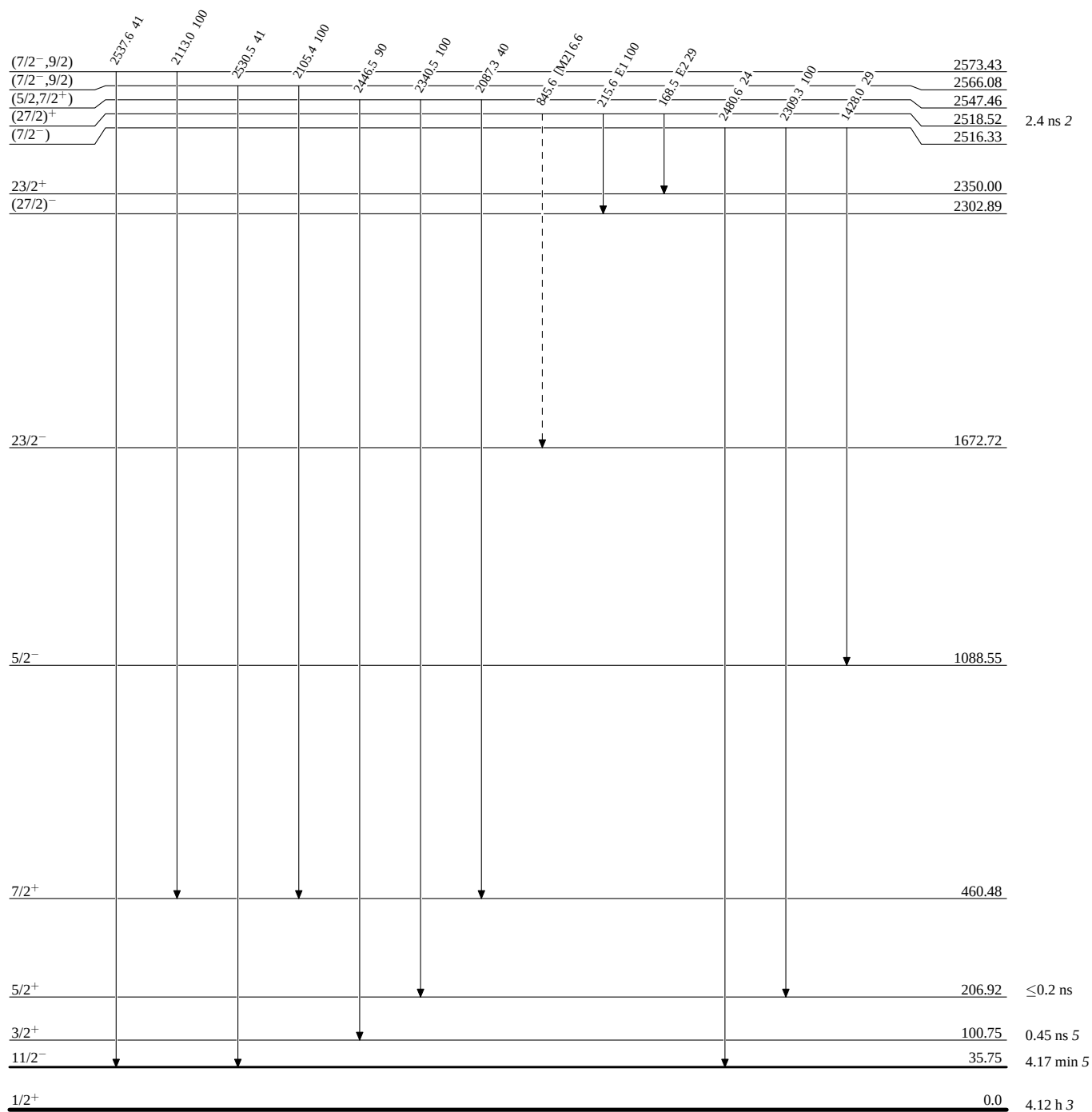
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

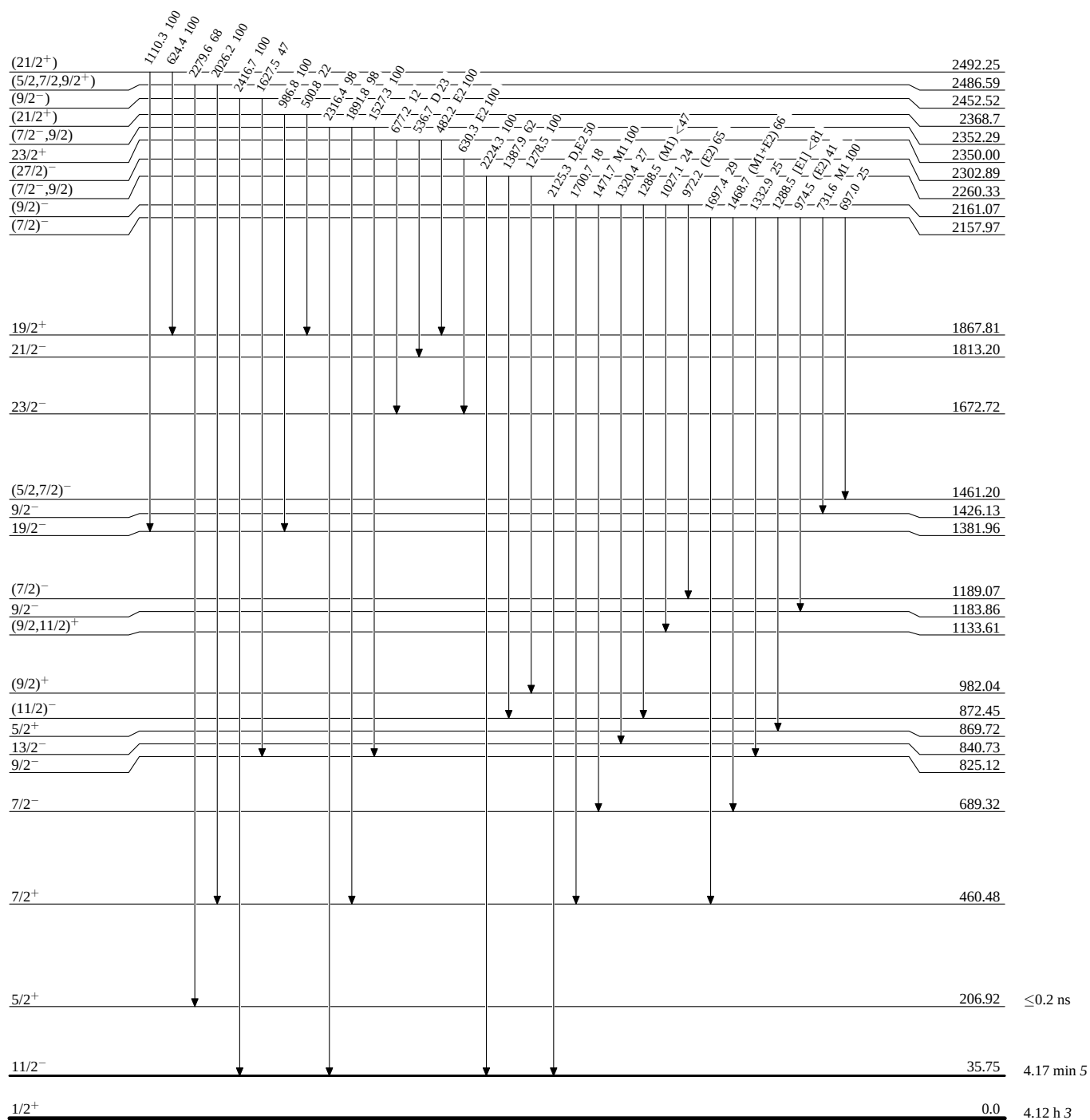
-----► γ Decay (Uncertain)



¹⁴⁹Tb₈₄

Adopted Levels, Gammas
Level Scheme (continued)

Intensities: Relative photon branching from each level



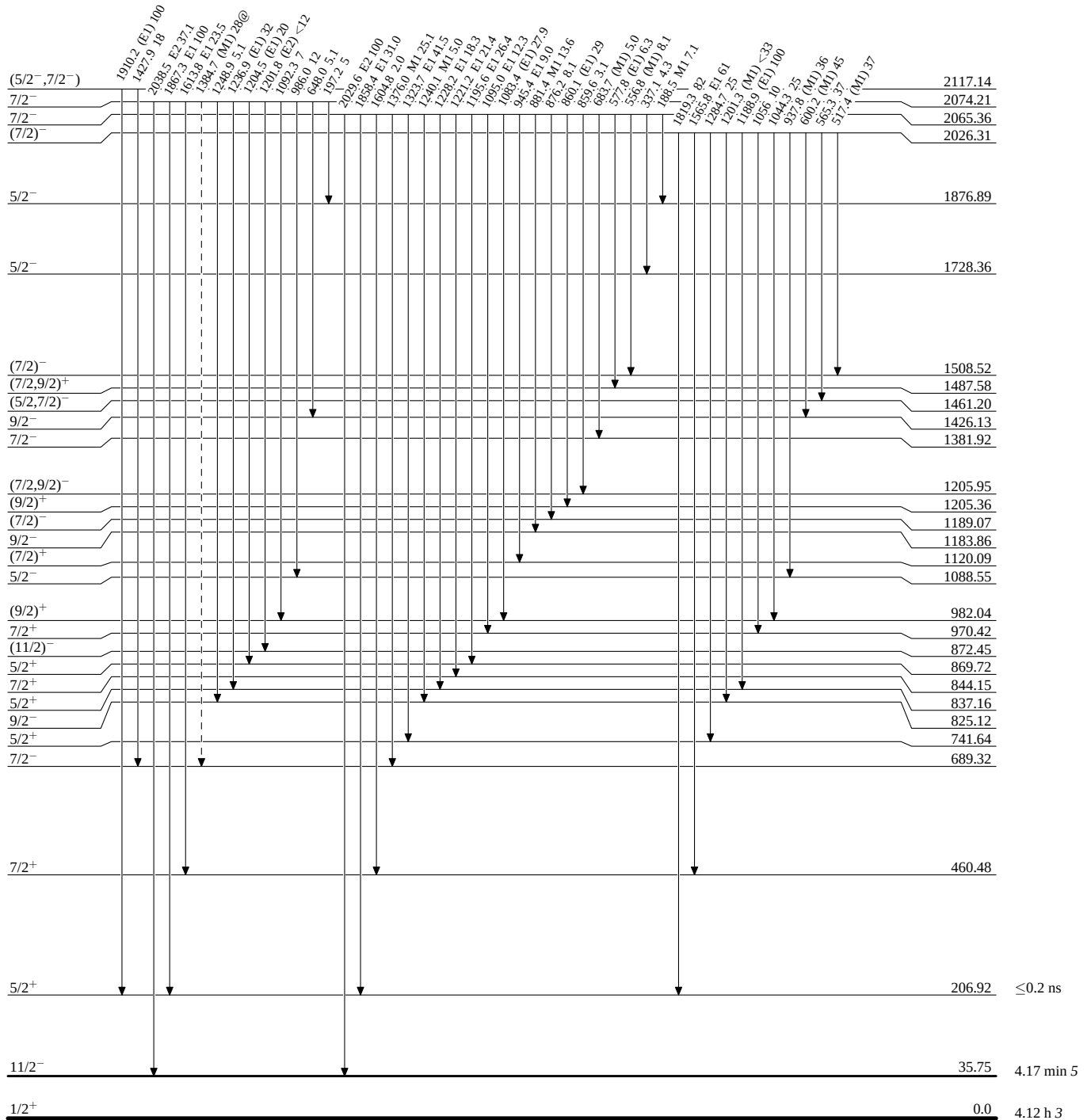
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

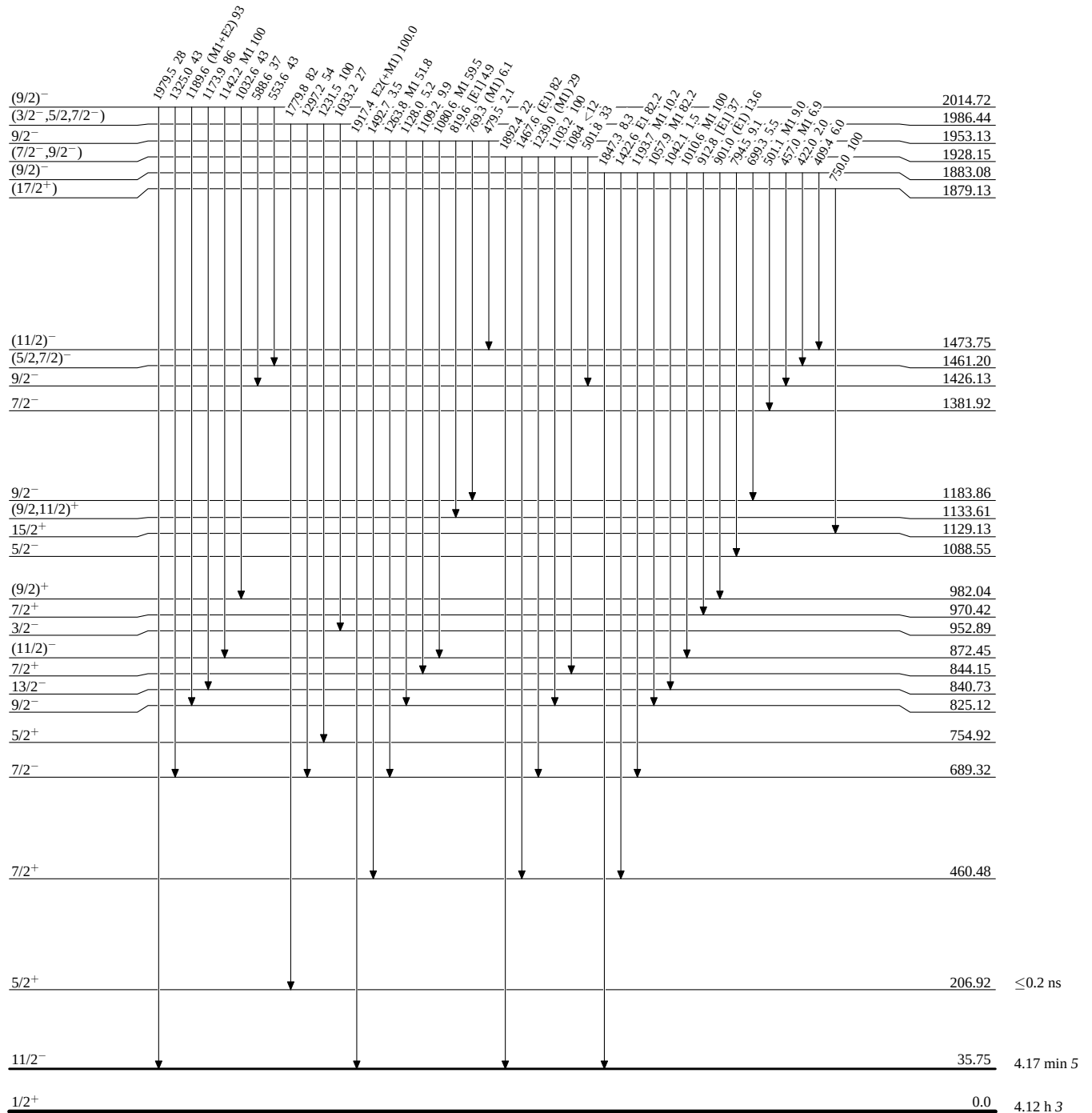
-----► γ Decay (Uncertain)



Adopted Levels, Gammas

Level Scheme (continued)

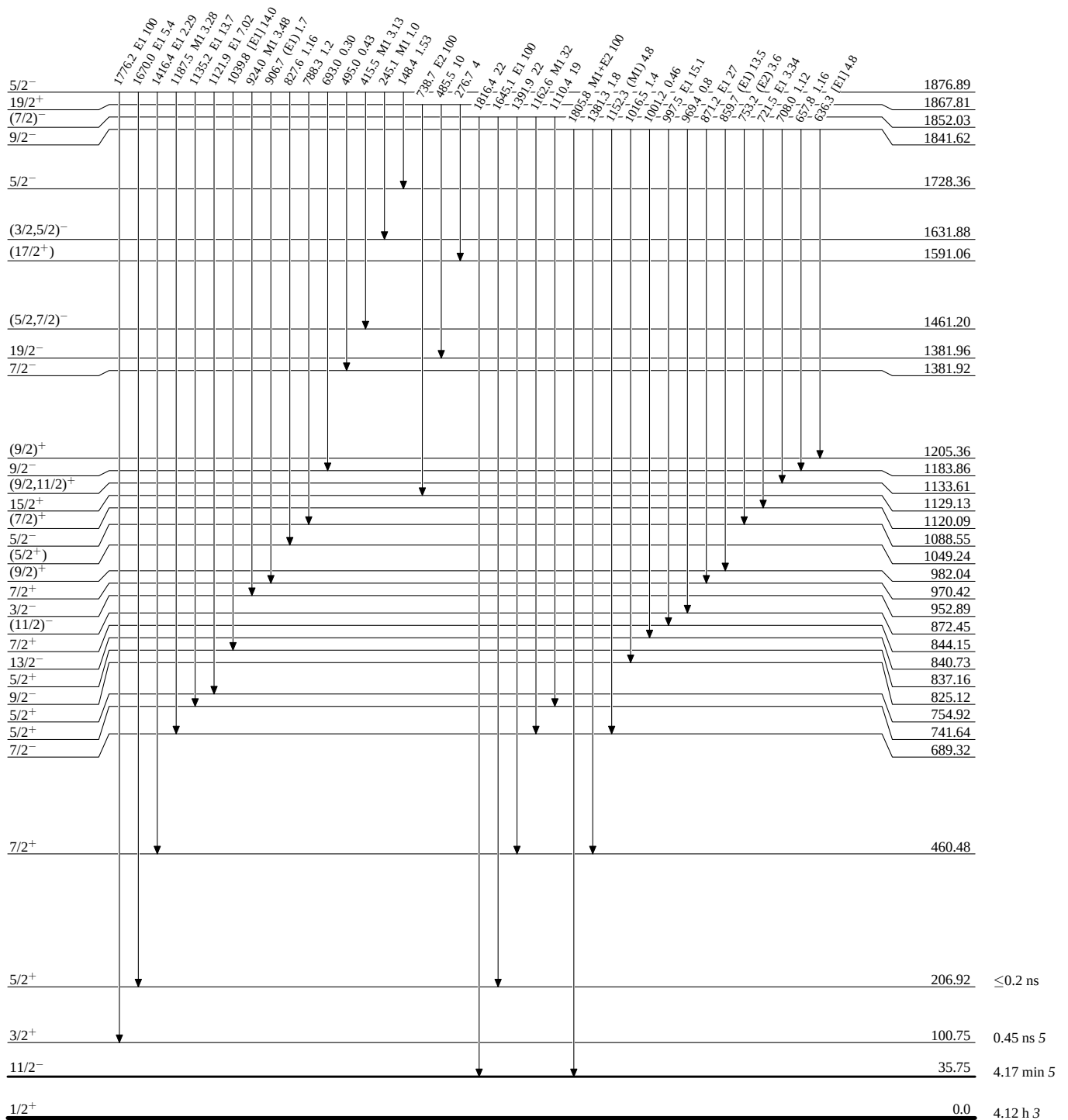
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



Adopted Levels, Gammas

Level Scheme (continued)

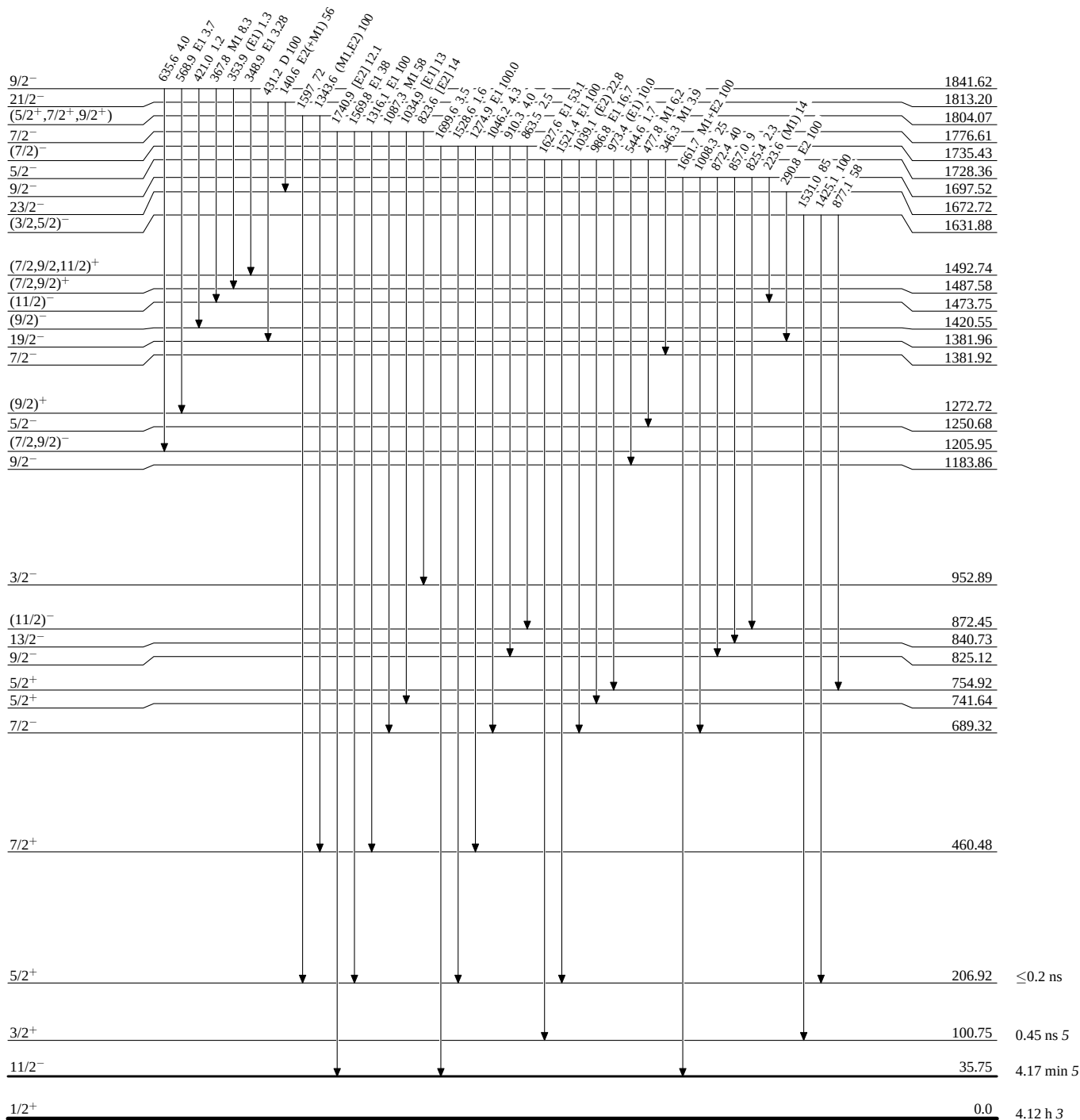
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



Adopted Levels, Gammas

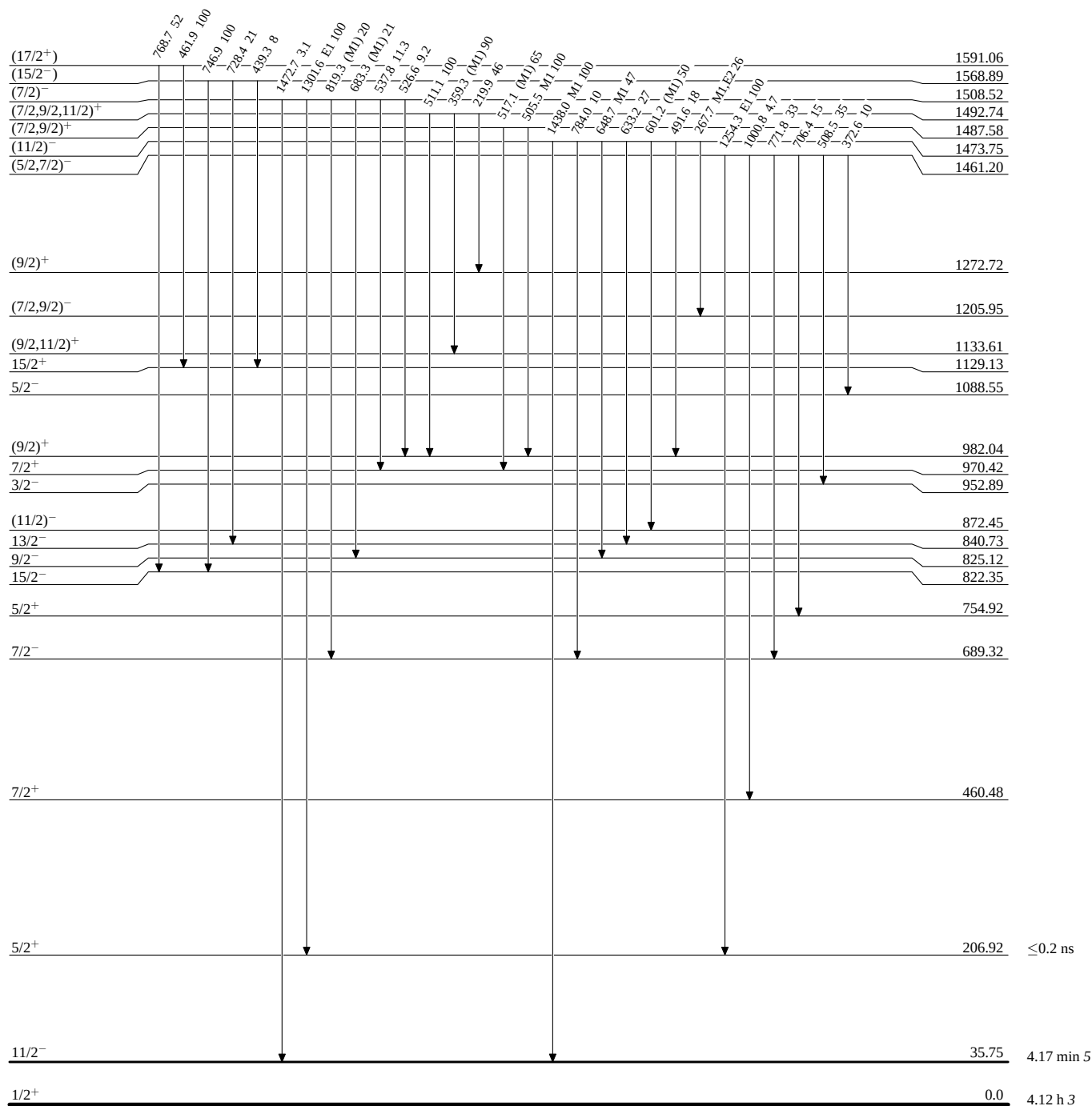
Level Scheme (continued)

Intensities: Relative photon branching from each level
 @ Multiply placed: intensity suitably divided



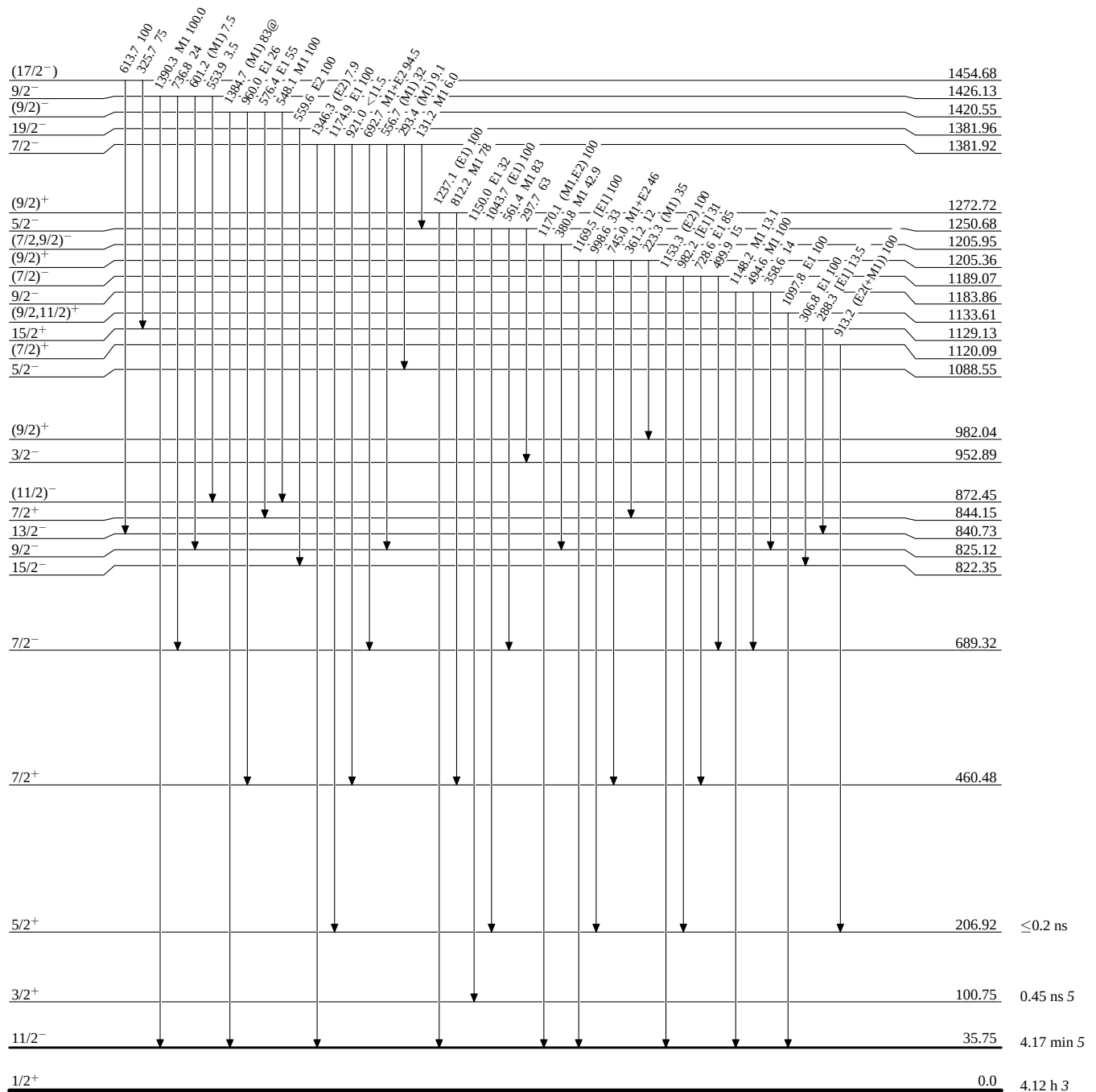
Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

 $^{149}_{65}\text{Tb}_{84}$

Adopted Levels, Gammas**Level Scheme (continued)**

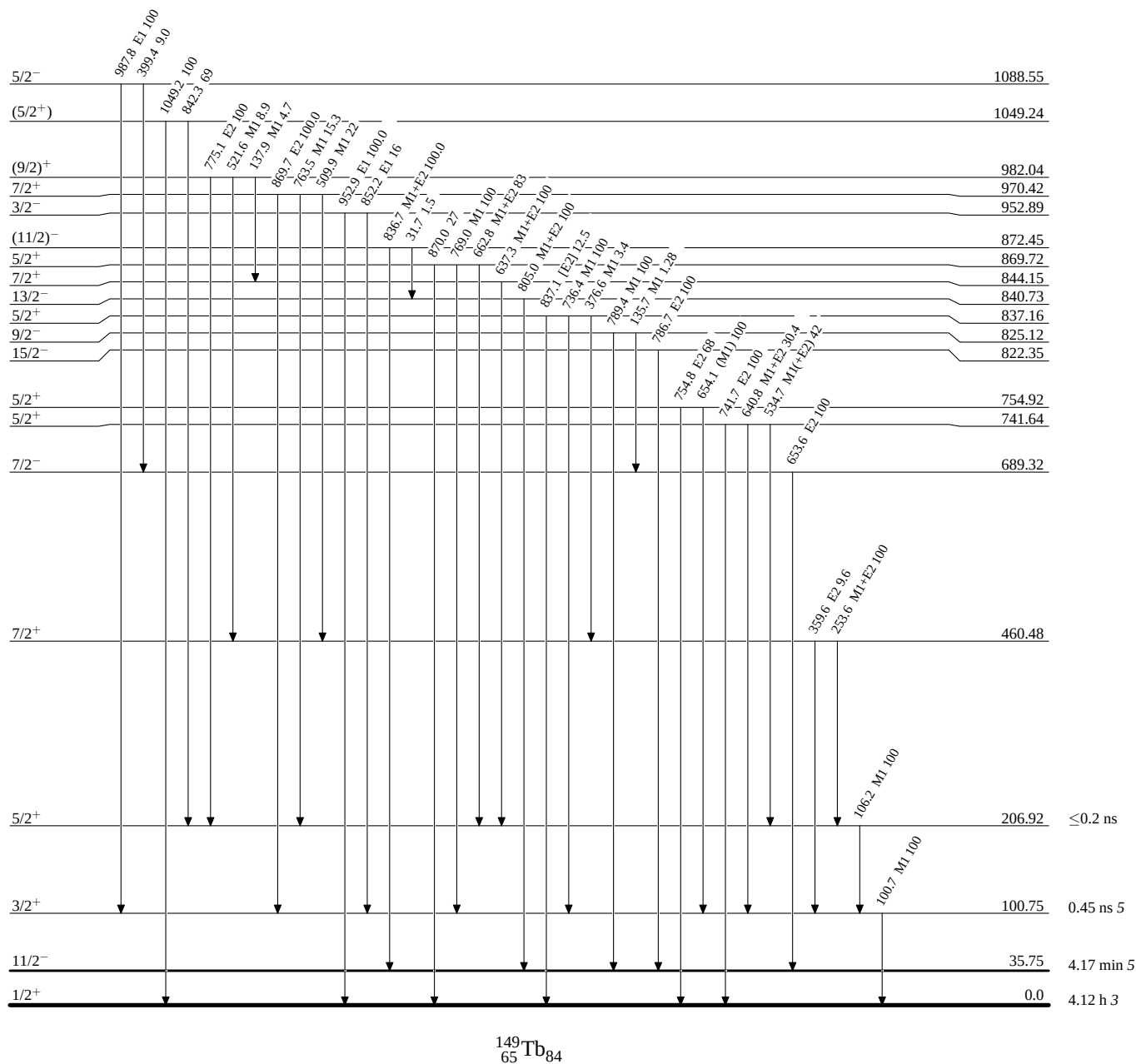
Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



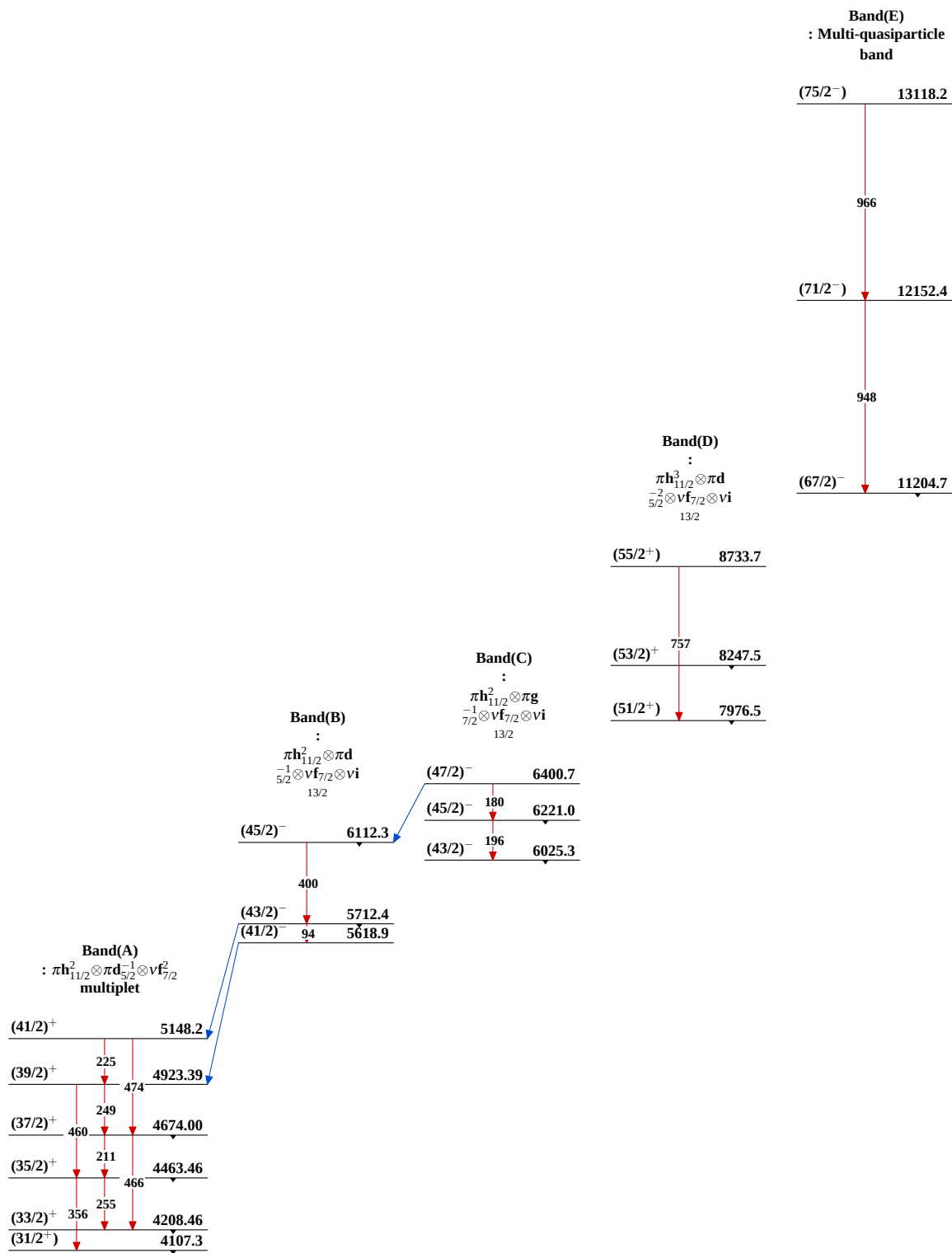
Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level

@ Multiply placed: intensity suitably divided

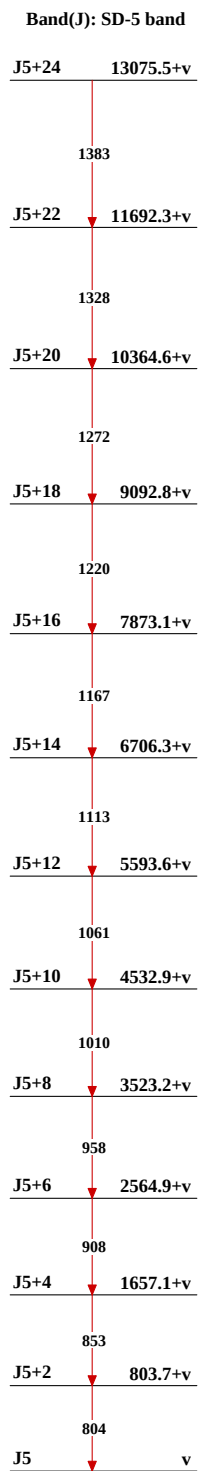


Adopted Levels, Gammas

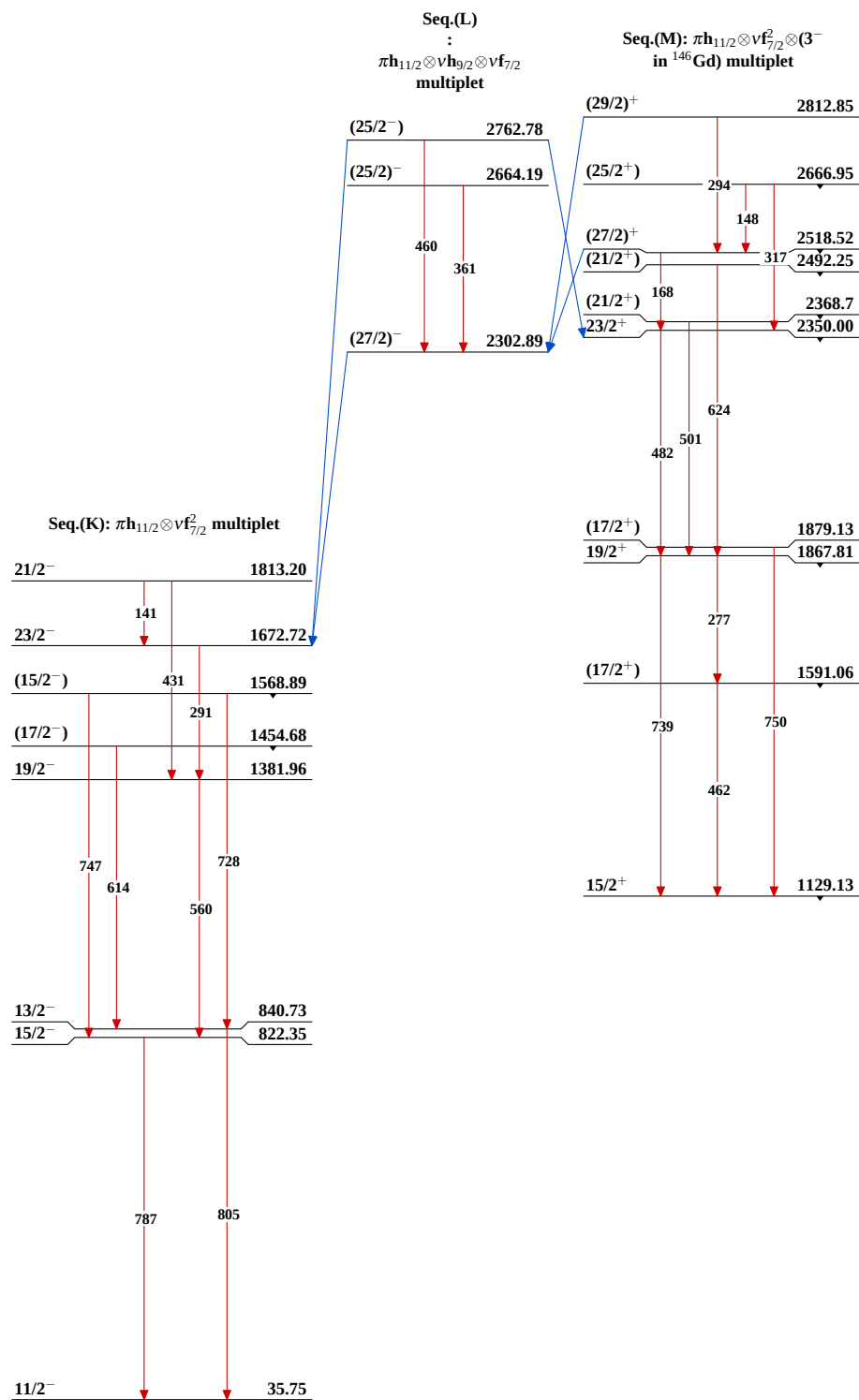


Adopted Levels, Gammas (continued)

		Band(I): SD-4 band	
	J4+26	14832.9+u	
	J4+24	145013382.4+u	
	J4+22	140511977.0+u	
	J4+20	135410622.9+u	
	J4+18	13009322.9+u	
	J4+16	12458077.9+u	
	J4+14	11936884.9+u	
	J4+12	11405744.9+u	
	J4+10	10884656.6+u	
	J4+8	10383619.0+u	
	J4+6	9862633.3+u	
	J4+4	9321701.4+u	
	J4+2	877824.0+u	
	J4	824u	
		Band(H): SD-3 band	
	J3+24	12847.6+z	
	J3+22	135711490.8+z	
	J3+20	130310187.8+z	
	J3+18	12528935.8+z	
	J3+16	12007735.8+z	
	J3+14	11486587.4+z	
	J3+12	10965491.6+z	
	J3+10	10444447.7+z	
	J3+8	9934455.0+z	
	J3+6	9412514.0+z	
	J3+4	8911623.4+z	
	J3+2	837786.00+z	
	J3	786z	
		Band(G): SD-2 band	
	J2+36	19594.8+y	
	J2+34	154218052.9+y	
	J2+32	148816565.2+y	
	J2+30	143415131.7+y	
	J2+28	1379143413753.0+y	
	J2+26	132512428.0+y	
	J2+24	127111156.6+y	
	J2+22	12189938.7+y	
	J2+20	11648774.2+y	
	J2+18	11127662.5+y	
	J2+16	10596603.7+y	
	J2+14	10065597.4+y	
	J2+12	9544643.3+y	
	J2+10	9023741.3+y	
	J2+8	8502890.8+y	
	J2+6	7992091.8+y	
	J2+4	7481343.6+y	
	J2+2	646646.20+y	
	J2	646y	
		Band(F): SD-1 band	
	J1+28	15259.3+x	
	J1+26	144413815.1+x	
	J1+24	139112424.0+x	
	J1+22	133411089.5+x	
	J1+20	12799810.7+x	
	J1+18	12258586.1+x	
	J1+16	11697416.9+x	
	J1+14	11146302.7+x	
	J1+12	10615242.0+x	
	J1+10	10074234.8+x	
	J1+8	9543281.3+x	
	J1+6	8472381.9+x	
	J1+4	7951534.80+x	
	J1+2	740740.10+x	
	J1	740x	

Adopted Levels, Gammas (continued)

 $^{149}_{65}\text{Tb}_{84}$

Adopted Levels, Gammas (continued)



^{149}Dy ε decay (4.2 min) 2019MeZX

Parent: ^{149}Dy : $E=0$; $J^\pi=7/2^-$; $T_{1/2}=4.2$ min 2; $Q(\varepsilon)=3795$ 9; $\% \varepsilon + \% \beta^+$ decay=100

^{149}Dy - J^π , $T_{1/2}$: From ^{149}Dy Adopted Levels.

^{149}Dy - $Q(\varepsilon)$: From 2021Wa16.

2019MeZX (also 1993MeZX, 1992MeZX, 1990MeZY): ^{149}Dy source was produced via $\text{Gd}(^3\text{He}, \text{xn})$ with $E(^3\text{He})=240$ MeV and separated using Orsay ISOCELE II on-line mass separator. γ rays were detected with Ge detectors and conversion electrons were detected with a broad-range 2π -deflection magnetic electron selector combined with a Si(Li) spectrometer. Measured E_γ , I_γ , $\gamma\gamma$ -coin, $E(\text{ce})$, $I(\text{ce})$. Deduced levels, J , π , conversion coefficients, γ -ray multipolarities, decay branching ratios, $\log ft$. Comparisons with shell-model calculations.

Others:

1990Sa32: γ , $\gamma\gamma$, $\gamma(t)$, $Q(\varepsilon)$ (from $\beta^+\gamma$). 76 γ rays reported. Hahn-Meitner-Institut in Berlin.

1981ZuZZ: γ , $\gamma\gamma$. 52 γ rays reported. JINR.

1975To03: γ , $\gamma\gamma$. Only the most intense 11 γ rays reported. ORNL.

2003Li42: fully-ionized atoms of ^{149}Dy g.s. detected but no half-life measured. Predicted $T_{1/2}=40$ min, since $\% \varepsilon=0$.

γ : 1978Ma19, 1974La28.

ce, γ ce(t): 1978Ma19.

β : 1985Al30, 1985Al13. β branches reported to the following levels: 300 (2%), 700 (1%), 900 (2.7%), 1100 (1.3%), 1840 (85%), 2500 (3.1%), 2800 (2.1%), 3000 (1.9%), 3300 (0.7%).

$\beta^+\gamma$ coin: 1984Ve16.

$Q(\varepsilon)$: 1993Al03 (total γ absorption), 1991Ke11 (β^+ spectra), 1990Sa32, 1984Al36, 1985Al30, 1985Al13.

β -strength functions: 1985Al30 (also 1985Al13). Theory: 1984Al31.

$T_{1/2}$ (^{149}Dy isotope): 1993Al03, 1975To03, 1974La28, 1973Bi06, 1959To27, 1958To27.

Total decay energy deposit of 3857 keV 67 calculated by RADLIST code is in general agreement with expected value of 3793 keV 9, indicating the completeness of the decay scheme.

 ^{149}Tb Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0.0	$1/2^+$	4.12 h 3	
35.75 8	$11/2^-$	4.17 min 5	$\% \varepsilon + \% \beta^+ = 99.978$ 4; $\% \alpha = 0.022$ 4 Decay modes from the Adopted Levels.
100.75 7	$3/2^+$	0.45 [#] ns 5	
206.91 7	$5/2^+$	≤ 0.2 [#] ns	
460.49 8	$7/2^+$		
689.32 8	$7/2^-$		
741.64 7	$5/2^+$		
754.92 9	$5/2^+$		
825.12 9	$9/2^-$		
837.16 9	$5/2^+$		
840.71 11	$13/2^-$		
844.16 9	$7/2^+$		
869.72 10	$5/2^+$		J^π : ($7/2^+$) in Table I of 2019MeZX could be a typo.
872.46 9	$(11/2)^-$		
952.89 8	$3/2^-$		
970.45 9	$7/2^+$		
982.05 9	$(9/2)^+$		
1049.24 14	$(5/2^+)$		
1088.55 10	$5/2^-$		
1120.09 12	$(7/2)^+$		
1133.61 15	$(9/2, 11/2)^+$		
1183.86 10	$9/2^-$		
1189.09 10	$(7/2)^-$		
1205.37 12	$(9/2)^+$		
1205.95 14	$(7/2, 9/2)^-$		J^π : ($9/2^-, 11/2^-$) from 2019MeZX.

Continued on next page (footnotes at end of table)

^{149}Dy ε decay (4.2 min) [2019MeZX](#) (continued) ^{149}Tb Levels (continued)

E(level) [†]	J^π [‡]	Comments
1250.68 10	5/2 ⁻	
1272.73 10	(9/2) ⁺	
1381.92 9	7/2 ⁻	
1420.55 11	(9/2) ⁻	
1426.13 9	9/2 ⁻	
1461.26 9	(5/2,7/2) ⁻	
1473.75 9	(11/2) ⁻	J^π : 11/2 ⁻ from shell-model prediction in 2019MeZX .
1487.59 15	(7/2,9/2) ⁺	
1492.75 12	(7/2,9/2,11/2) ⁺	
1508.52 10	(7/2) ⁻	
1631.88 20	(3/2,5/2) ⁻	
1697.49 11	9/2 ⁻	
1728.36 8	5/2 ⁻	
1735.44 11	(7/2) ⁻	
1776.61 10	7/2 ⁻	
1804.1 3	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	
1841.63 8	9/2 ⁻	
1852.03 14	(7/2) ⁻	
1876.88 7	5/2 ⁻	
1883.08 8	(9/2) ⁻	
1928.15 17	(7/2 ⁻ , 9/2 ⁻)	
1953.13 9	9/2 ⁻	
1986.44 20	(3/2 ⁻ , 5/2, 7/2 ⁻)	J^π : (3/2 ⁻ , 5/2) in 2019MeZX .
2014.73 14	(9/2) ⁻	
2026.32 10	(7/2) ⁻	
2065.37 7	7/2 ⁻	
2074.22 9	7/2 ⁻	
2117.14 20	(5/2 ⁻ , 7/2 ⁻)	
2157.98 14	(7/2) ⁻	
2161.04 14	(9/2) ⁻	
2260.33 19	(7/2 ⁻ , 9/2)	
2352.30 19	(7/2 ⁻ , 9/2)	
2452.5 3	(9/2 ⁻)	
2486.59 25	(5/2, 7/2, 9/2 ⁺)	
2516.33 24	(7/2 ⁻)	
2547.5 3	(5/2, 7/2 ⁺)	
2566.1 3	(7/2 ⁻ , 9/2)	
2573.4 3	(7/2 ⁻ , 9/2)	
2588.60 13	(5/2, 7/2)	
2661.4 3	(9/2 ⁻)	

[†] From a least-squares fit to γ -ray energies.[‡] From the Adopted Levels. Values from this study are as noted or given under comments if different. The adopted assignments are from shell-model predictions by [2019MeZX](#) if no other arguments are given in the Adopted Levels.# Adopted values from (ce) γ (t) in [1978Ma19](#).

^{149}Dy ε decay (4.2 min) 2019MeZX (continued) ε, β^+ radiations

E(decay)	E(level)	$I\beta^+$ #	$I\varepsilon$ #	Log ft	$I(\varepsilon + \beta^+)^{\dagger\#}$
(1134 9)	2661.4		0.047 9	6.8 1	0.047 9
(1206 9)	2588.60		0.02 1	7.2 2	0.02 1
(1222 9)	2573.4		0.041 12	6.9 1	0.041 12
(1229 9)	2566.1		0.041 12	6.9 1	0.041 12
(1248 9)	2547.5		0.069 15	6.7 1	0.069 15
(1279 9)	2516.33		0.089 12	6.6 1	0.089 12
(1308 9)	2486.59		0.084 23	6.7 1	0.084 23
(1343 9)	2452.5		0.053 13	6.9 1	0.053 13
(1443 9)	2352.30	0.000169 25	0.130 15	6.56 6	0.130 15
(1535 9)	2260.33	0.00099 22	0.34 7	6.2 1	0.34 7
(1634 9)	2161.04	0.0063 6	1.07 9	5.76 5	1.08 9
(1637 9)	2157.98	0.0041 5	0.69 8	5.95 6	0.69 8
(1678 9)	2117.14	0.00116 16	0.153 20	6.63 6	0.154 20
(1721 9)	2074.22	0.0166 12	1.72 9	5.60 3	1.74 9
(1730 9)	2065.37	0.105 6	10.4 3	4.82 3	10.5 3
(1769 9)	2026.32	0.0144 14	1.17 10	5.79 5	1.18 10
(1780 9)	2014.73	0.0099 11	0.76 8	5.98 5	0.77 8
(1809 9)	1986.44	0.0032 8	0.22 5	6.5 1	0.22 5
(1842 9)	1953.13	0.068 3	3.92 7	5.30 2	3.99 7
(1867 9)	1928.15	0.0086 10	0.44 5	6.26 6	0.45 5
(1912 9)	1883.08	0.20 1	8.4 3	5.00 3	8.6 3
(1918 9)	1876.88	0.431 21	18.0 6	4.68 3	18.4 6
(1943 9)	1852.03	0.012 1	0.44 4	6.30 5	0.45 4
(1953 9)	1841.63	0.415 20	15.1 5	4.77 3	15.5 5
(1991 9)	1804.1	0.0037 9	0.12 3	6.9 1	0.12 3
(2018 9)	1776.61	0.058 3	1.65 7	5.76 3	1.71 7
(2060 9)	1735.44	0.090 4	2.23 6	5.65 3	2.32 6
(2067 9)	1728.36	0.32 2	7.8 4	5.11 3	8.1 4
(2098 9)	1697.49	0.074 5	1.62 10	5.80 4	1.69 10
(2163 9)	1631.88	<0.003	<0.05	>7.4	<0.05
(2287 9)	1508.52	0.068 7	0.86 8	6.15 5	0.93 9
(2302 9)	1492.75	<0.004	<0.05	>7.4	<0.05
(2307 9)	1487.59	<0.002	<0.03	>7.7	<0.03
(2321 9)	1473.75	<0.004	<0.05	>7.4	<0.05
(2334 9)	1461.26	0.026 7	0.29 8	6.6 1	0.32 9
(2369 9)	1426.13	0.185 11	1.90 10	5.84 4	2.08 11
(2374 9)	1420.55	0.103 8	1.05 8	6.10 4	1.15 9
(2413 9)	1381.92	0.170 12	1.57 11	5.94 4	1.74 12
(2522 9)	1272.73	0.029 9	0.21 6	6.9 1	0.24 7
(2544 9)	1250.68	0.080 12	0.55 8	6.4 1	0.63 9
(2589 9)	1205.95	0.080 21	0.50 13	6.5 1	0.58 15
(2590@ 9)	1205.37	0.03 3	0.19 16	6.9 4	0.22 19
(2606 9)	1189.09	0.067 11	0.40 7	6.6 1	0.47 8
(2611 9)	1183.86	0.078 12	0.46 7	6.54 7	0.54 8
(2661 9)	1133.61	<0.008	<0.04	>7.6	<0.05
(2675@ 9)	1120.09	<0.03	<0.2	>7.0	<0.2
(2706 9)	1088.55	0.08 3	0.39 14	6.6 2	0.47 17
(2746 9)	1049.24	0.02 1	0.07 3	7.4 2	0.09 4
(2813 9)	982.05	<0.1	<0.5	>6.6	<0.6
(2825 9)	970.45	0.1 1	0.6 3	6.5 3	0.7 4
(2842@ 9)	952.89	0.041 19	0.16 7	7.1 $\ddagger$ 2	0.20 9
(2923@ 9)	872.46	0.08 6	0.26 19	6.9 $\ddagger$ 4	0.34 25
(2925 9)	869.72	0.096 21	0.32 7	6.8 1	0.42 9
(2951 9)	844.16	0.13 4	0.40 11	6.71 13	0.53 15

Continued on next page (footnotes at end of table)

^{149}Dy ε decay (4.2 min) 2019MeZX (continued) ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+$ [#]	$I\varepsilon$ [#]	Log ft	$I(\varepsilon + \beta^+)$ ^{†#}
(2954@ 9)	840.71	<0.02	<0.06	>7.5	<0.08
(2958 9)	837.16	0.06 4	0.18 14	7.1 4	0.24 18
(2970 9)	825.12	1.8 1	5.7 4	5.56 4	7.5 5
(3040 9)	754.92	<0.032	<0.088	>7.4	<0.12
(3053 9)	741.64	0.2 1	0.5 3	6.6 3	0.7 4
(3106 9)	689.32	0.2 1	0.6 4	6.6 3	0.8 5
(3335 9)	460.49	<0.2	<0.4	>6.8	<0.6
(3694@ 9)	100.75	<0.9	<3	>7.7 ^{1u}	<4

[†] Deduced by evaluators from $I(\gamma + \text{ce})$ balance at each level.

[‡] Too low for suggested J^π change. There may be other γ transitions feeding this level.

[#] Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

γ(¹⁴⁹Tb)

I_γ normalization: Listed intensities of γ rays are per 100 decays.

I_γ(γ[±])=9.0 9 (**1981ZuZZ**). This gives a total β⁺ branch of ≈4.5% which is consistent with the present level scheme.

The ce data given under comments are from **2019MeZX**, unless otherwise noted.

E _γ [†]	I _γ ^{†b}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	δ [#]	α ^c	Comments
31.7 3	0.07 3	872.46	(11/2) ⁻	840.71	13/2 ⁻	M1		2.153 31	E _γ ,I _γ : others: 100.8 2, with I _γ =17.8 (1990Sa32); 100.8 1, with I _γ =14.9 (1975To03); 100.8 4, with I _γ =14.8 (1981ZuZZ). Mult.: α(K)exp=1.80 20, α(L)exp=0.28 4 (2019MeZX); from α(K)exp/α(L)exp=5.5 15, δ(E2/M1)<0.98 (1978Ma19).
100.7 1	15.3 8	100.75	3/2 ⁺	0.0	1/2 ⁺				
106.2 1	8.3 2	206.91	5/2 ⁺	100.75	3/2 ⁺	M1		1.849 26	E _γ ,I _γ : others: 106.2 2, with I _γ =10.1 7 (1990Sa32); 106.3 1, with I _γ =7.6 4 (1975To03); 106.4 4, with I _γ =7.7 7 (1981ZuZZ). Mult.: α(K)exp=1.54 16, α(L)exp=0.21 5 (2019MeZX); from α(K)exp/α(L)exp=5 2 (1978Ma19), δ(E2/M1)<1.4.
131.2 2	0.052 9	1381.92	7/2 ⁻	1250.68	5/2 ⁻	M1		1.013 15	Mult.: α(K)exp=1.0 3.
135.7 1	0.148 10	825.12	9/2 ⁻	689.32	7/2 ⁻	M1		0.921 13	E _γ ,I _γ : other: 135.7 5, with I _γ =0.18 5 (1990Sa32). Mult.: α(K)exp=1.05 20.
137.9 1	0.127 10	982.05	(9/2) ⁺	844.16	7/2 ⁺	M1		0.880 12	Mult.: α(K)exp=1.1 3.
148.4 2	0.178 12	1876.88	5/2 ⁻	1728.36	5/2 ⁻	M1		0.367 5	E _γ ,I _γ : other: 188.3 5, with I _γ =0.11 7 (1990Sa32). Mult.: α(K)exp=0.38 8.
188.5 1	0.183 18	2065.37	7/2 ⁻	1876.88	5/2 ⁻				
197.2 3	0.035 22	2074.22	7/2 ⁻	1876.88	5/2 ⁻	(M1) ^a		0.2305 33	E _γ : other: 223.7 5, with I _γ =0.29 7, placed from 2065 level in 1990Sa32 . Mult.: α(K)exp≈0.193 20.
219.9 3	0.046 15	1492.75	(7/2,9/2,11/2) ⁺	1272.73	(9/2) ⁺				
223.3 2	0.20 4	1205.37	(9/2) ⁺	982.05	(9/2) ⁺	(M1) ^a		0.2297 33	Mult.: α(K)exp≈0.193 20.
223.6 2	0.12 3	1697.49	9/2 ⁻	1473.75	(11/2) ⁻	(M1) ^a		0.1789 26	Mult.: α(K)exp=0.20 5.
245.1 3	0.12 3	1876.88	5/2 ⁻	1631.88	(3/2,5/2) ⁻	M1		0.152 11	E _γ ,I _γ : others: 253.6 2, with I _γ =8.1 6 (1990Sa32); 253.4 1, with I _γ =7.4 8 (1975To03); 253.3 4, with I _γ =7.2 7 (1981ZuZZ). Mult.: α(K)exp=0.125 12, α(L)exp=0.020 2.
253.6 1	6.78 20	460.49	7/2 ⁺	206.91	5/2 ⁺	M1+E2	0.5 +3-4	0.115 26	Mult.: α(K)exp=0.08 4.
267.7 2	0.087 14	1473.75	(11/2) ⁻	1205.95	(7/2,9/2) ⁻	M1,E2		0.1103 16	Mult.: α(K)exp=0.10 5.
293.4 2	0.079 14	1381.92	7/2 ⁻	1088.55	5/2 ⁻	(M1)			
297.7 3	0.22 4	1250.68	5/2 ⁻	952.89	3/2 ⁻				
337.1 2	0.11 3	2065.37	7/2 ⁻	1728.36	5/2 ⁻				
346.3 2	0.15 3	1728.36	5/2 ⁻	1381.92	7/2 ⁻	M1		0.0710 10	Mult.: α(K)exp=0.09 3.

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)γ(¹⁴⁹Tb) (continued)

E _γ [†]	I _γ ^{†b}	E _i (level)	J _i ^π	E _f	J _f ^π	Mult. [#]	δ [#]	α ^c	Comments
348.9 1	0.252 14	1841.63	9/2 ⁻	1492.75	(7/2,9/2,11/2) ⁺	E1		0.01141 16	Mult.: α(K)exp<0.014.
353.9 3	0.10 3	1841.63	9/2 ⁻	1487.59	(7/2,9/2) ⁺	(E1)		0.01102 16	Mult.: α(K)exp<0.020.
358.6 3	0.15 3	1183.86	9/2 ⁻	825.12	9/2 ⁻				E _γ ,I _γ : other: 358.9 5, with I _γ =0.29 7 (1990Sa32).
359.3 3	0.09 4	1492.75	(7/2,9/2,11/2) ⁺	1133.61	(9/2,11/2) ⁺	(M1) ^{&}		0.0645	
359.6 2	0.65 8	460.49	7/2 ⁺	100.75	3/2 ⁺	E2 [@]		0.0362 5	E _γ ,I _γ : others: 359.8 5, with I _γ =0.45 9 (1990Sa32); 359.4 4, with I _γ =0.59 6 (1981ZuZZ, unplaced). Mult.: α(K)exp≈0.033 3.
361.2 3	0.07 3	1205.37	(9/2) ⁺	844.16	7/2 ⁺				
367.8 1	0.64 2	1841.63	9/2 ⁻	1473.75	(11/2) ⁻	M1		0.0606 9	Mult.: α(K)exp=0.056 6.
372.6 2	0.047 16	1461.26	(5/2,7/2) ⁻	1088.55	5/2 ⁻				
376.6 2	0.081 14	837.16	5/2 ⁺	460.49	7/2 ⁺	M1		0.0570 8	Mult.: α(K)exp=0.08 4.
380.8 2	0.313 16	1205.95	(7/2,9/2) ⁻	825.12	9/2 ⁻	M1		0.0554 8	E _γ ,I _γ : other: 381.4 5, with I _γ =0.32 9 (1990Sa32). Mult.: α(K)exp=0.057 8.
399.4 2	0.117 14	1088.55	5/2 ⁻	689.32	7/2 ⁻				
409.4 1	0.139 23	1883.08	(9/2) ⁻	1473.75	(11/2) ⁻				
415.5 1	0.365 21	1876.88	5/2 ⁻	1461.26	(5/2,7/2) ⁻	M1		0.0441 6	Mult.: α(K)exp=0.035 6.
421.0 3	0.093 23	1841.63	9/2 ⁻	1420.55	(9/2) ⁻				
422.0 4	0.046 23	1883.08	(9/2) ⁻	1461.26	(5/2,7/2) ⁻				
457.0 1	0.159 17	1883.08	(9/2) ⁻	1426.13	9/2 ⁻	M1		0.0345 5	Mult.: α(K)exp=0.046 20.
477.8 2	0.24 3	1728.36	5/2 ⁻	1250.68	5/2 ⁻	M1 [@]		0.0308 4	Mult.: α(K)exp≈0.030 6.
479.5 4	0.035 12	1953.13	9/2 ⁻	1473.75	(11/2) ⁻				
491.6 2	0.06 3	1473.75	(11/2) ⁻	982.05	(9/2) ⁺				
494.6 1	1.07 3	1183.86	9/2 ⁻	689.32	7/2 ⁻	M1 [@]		0.0282 4	E _γ ,I _γ : others: 494.6 5, with I _γ =1.0 3 (1990Sa32); 494.6 4, with I _γ =0.89 9 (1981ZuZZ, unplaced). Mult.: α(K)exp=0.025 3.
495.0 3	0.05 3	1876.88	5/2 ⁻	1381.92	7/2 ⁻				
499.9 3	0.058 12	1189.09	(7/2) ⁻	689.32	7/2 ⁻				
501.1 2	0.208 23	1883.08	(9/2) ⁻	1381.92	7/2 ⁻	M1 [@]		0.0273 4	Mult.: α(K)exp≈0.028 8.
501.8 3	0.056 20	1928.15	(7/2 ⁻ ,9/2 ⁻)	1426.13	9/2 ⁻				
505.5 3	0.139 21	1487.59	(7/2,9/2) ⁺	982.05	(9/2) ⁺	M1		0.0267 4	Mult.: α(K)exp=0.037 18.
508.5 2	0.17 4	1461.26	(5/2,7/2) ⁻	952.89	3/2 ⁻				
509.9 2	0.70 17	970.45	7/2 ⁺	460.49	7/2 ⁺	M1 [@]		0.0261 4	Mult.: α(K)exp≈0.028 10.
511.1 5	0.10 3	1492.75	(7/2,9/2,11/2) ⁺	982.05	(9/2) ⁺				
517.1 3	0.09 4	1487.59	(7/2,9/2) ⁺	970.45	7/2 ⁺	(M1) ^a		0.02517 35	Mult.: α(K)exp≈0.033 15.
517.4 3	0.09 4	2026.32	(7/2) ⁻	1508.52	(7/2) ⁻	(M1) ^a		0.02513 35	Mult.: α(K)exp≈0.033 15.
521.6 1	0.24 2	982.05	(9/2) ⁺	460.49	7/2 ⁺	M1		0.02462 34	E _γ ,I _γ : other: 521.8 5, with I _γ =0.30 9 (1990Sa32). Mult.: α(K)exp=0.028 10.
526.6 3	0.069 14	1508.52	(7/2) ⁻	982.05	(9/2) ⁺				
534.7 1	1.0 2	741.64	5/2 ⁺	206.91	5/2 ⁺	M1(+E2)	0.4 4	0.0216 28	E _γ ,I _γ : others: 534.8 5, with I _γ =1.14 18 (1990Sa32); 534.7 4, with I _γ =0.74 7 (1981ZuZZ). Mult.,δ: α(K)exp=0.018 2.
537.8 2	0.085 19	1508.52	(7/2) ⁻	970.45	7/2 ⁺				

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)

$\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	α ^c	Comments
544.6 3	0.068 16	1728.36	5/2 ⁻	1183.86	9/2 ⁻				
548.1 1	0.468 19	1420.55	(9/2) ⁻	872.46	(11/2) ⁻	M1		0.02171 30	E_γ, I_γ : other: 548.2 5, with $I_\gamma=0.75$ 7 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.018$ 4.
553.6 3	0.07 3	2014.73	(9/2) ⁻	1461.26	(5/2,7/2) ⁻				
553.9 3	0.07 3	1426.13	9/2 ⁻	872.46	(11/2) ⁻				
556.7 2	0.28 4	1381.92	7/2 ⁻	825.12	9/2 ⁻	(M1) ^a		0.02087 29	E_γ, I_γ : others: 556.9 5, with $I_\gamma=0.43$ 11 (1990Sa32); 556.8 4, with $I_\gamma=1.33$ 13 (1981ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}\approx 0.019$ 5.
556.8 2	0.21 4	2065.37	7/2 ⁻	1508.52	(7/2) ⁻	(M1) ^a		0.02086 29	Mult.: $\alpha(K)\text{exp}\approx 0.019$ 5.
561.4 1	0.289 21	1250.68	5/2 ⁻	689.32	7/2 ⁻	M1		0.02043 29	Mult.: $\alpha(K)\text{exp}=0.021$ 7.
565.3 2	0.091 23	2026.32	(7/2) ⁻	1461.26	(5/2,7/2) ⁻				
568.9 1	0.284 19	1841.63	9/2 ⁻	1272.73	(9/2) ⁺	E1		0.00370 5	Mult.: $\alpha(K)\text{exp}<0.007$.
576.4 2	0.255 18	1420.55	(9/2) ⁻	844.16	7/2 ⁺	E1		0.00360 5	Mult.: $\alpha(K)\text{exp}<0.005$.
577.8 2	0.162 19	2065.37	7/2 ⁻	1487.59	(7/2,9/2) ⁺	(E1)		0.00358 5	Mult.: $\alpha(K)\text{exp}<0.013$ gives (E1,E2); E1 from level scheme.
588.6 4	0.06 3	2014.73	(9/2) ⁻	1426.13	9/2 ⁻				
600.2 2	0.11 4	2026.32	(7/2) ⁻	1426.13	9/2 ⁻	(M1) ^a		0.01727 24	Mult.: $\alpha(K)\text{exp}\approx 0.020$ 5.
601.2 3	0.15 4	1426.13	9/2 ⁻	825.12	9/2 ⁻	(M1) ^a		0.01720 24	Mult.: $\alpha(K)\text{exp}\approx 0.020$ 5.
601.2 3	0.17 4	1473.75	(11/2) ⁻	872.46	(11/2) ⁻	(M1) ^a		0.01720 24	Mult.: $\alpha(K)\text{exp}\approx 0.020$ 5.
633.2 3	0.09 3	1473.75	(11/2) ⁻	840.71	13/2 ⁻				
635.6 3	0.31 4	1841.63	9/2 ⁻	1205.95	(7/2,9/2) ⁻				Mult.: see comment for 636.3 γ .
636.3 3	0.37 6	1841.63	9/2 ⁻	1205.37	(9/2) ⁺	[E1]		0.00292 4	Mult.: $\alpha(K)\text{exp}=0.0104$ 10 gives M1 or E2, but inconsistent with level scheme. However, it would be consistent with the level scheme if the $\alpha(K)\text{exp}$ was for the 635.6 γ .
637.3 1	2.94 11	844.16	7/2 ⁺	206.91	5/2 ⁺	M1+E2 [@]	≈ 0.8	≈ 0.01215	E_γ, I_γ : others: 637.3 3, with $I_\gamma=3.7$ 5 (1990Sa32); 637.2 4, with $I_\gamma=3.0$ 3 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}\approx 0.0104$ 10.
640.8 1	0.73 2	741.64	5/2 ⁺	100.75	3/2 ⁺	M1+E2	1.1 +4-3	0.0109 11	E_γ, I_γ : other: 641.0 5, with $I_\gamma=0.55$ 13 (1990Sa32). Mult., δ : $\alpha(K)\text{exp}=0.0091$ 8.
648.0 4	0.035 10	2074.22	7/2 ⁻	1426.13	9/2 ⁻				
648.7 2	0.16 3	1473.75	(11/2) ⁻	825.12	9/2 ⁻	M1		0.01422 20	Mult.: $\alpha(K)\text{exp}=0.014$ 3.
653.6 1	9.1 4	689.32	7/2 ⁻	35.75	11/2 ⁻	E2 [@]		0.00745 10	E_γ, I_γ : others: 653.7 4, with $I_\gamma=9.5$ 8 (1990Sa32); 653.6 1, with $I_\gamma=8.9$ 9 (1975To03); 653.2 4, with $I_\gamma=8.9$ 9 (1981ZuZZ) for a composite line. Parent level not proposed in 1981ZuZZ; 653.2 γ placed from 755 level. Mult.: $\alpha(K)\text{exp}\approx 0.0068$ 5.
654.1 2	0.81 12	754.92	5/2 ⁺	100.75	3/2 ⁺	(M1) ^{&}		0.01393 20	E_γ, I_γ : other: 653.7 4, with $I_\gamma=1.62$ 22 (1990Sa32); 653.2 4, with $I_\gamma=8.9$ 9 (1981ZuZZ) for a composite line. See also 653.6 γ from 689 level. Mult.: $\alpha(K)\text{exp}\approx 0.0068$ 5 gives (M1,E2); M1 preferred by level scheme.
657.8 2	0.089 16	1841.63	9/2 ⁻	1183.86	9/2 ⁻				
662.8 1	0.531 16	869.72	5/2 ⁺	206.91	5/2 ⁺	M1+E2	0.65 25	0.0116 10	E_γ, I_γ : other: 662.9 5, with $I_\gamma=0.50$ 13 (1990Sa32). Mult., δ : $\alpha(K)\text{exp}=0.0098$ 8.

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	α ^c	Comments
683.3 3	0.16 4	1508.52	(7/2) ⁻	825.12	9/2 ⁻	(M1) ^a		0.01249 18	Mult.: $\alpha(\text{K})\text{exp}\approx 0.013$ 2.
683.7 3	0.13 4	2065.37	7/2 ⁻	1381.92	7/2 ⁻	(M1) ^a		0.01248 18	Mult.: $\alpha(\text{K})\text{exp}\approx 0.013$ 2.
692.7 1	0.822 14	1381.92	7/2 ⁻	689.32	7/2 ⁻	M1+E2 [@]	≈ 0.7	≈ 0.01024	E_γ, I_γ : others: 692.6 5, with $I_\gamma=0.46$ 16 (1990Sa32); 692.9 4, with $I_\gamma=0.74$ 7 (1981ZuZZ, unplaced). Mult., δ : $\alpha(\text{K})\text{exp}\approx 0.0087$ 8.
693.0 3	0.035 12	1876.88	5/2 ⁻	1183.86	9/2 ⁻				
697.0 5	0.05 3	2157.98	(7/2) ⁻	1461.26	(5/2, 7/2) ⁻				
699.3 2	0.127 14	1883.08	(9/2) ⁻	1183.86	9/2 ⁻				
706.4 3	0.071 14	1461.26	(5/2, 7/2) ⁻	754.92	5/2 ⁺				
708.0 3	0.086 14	1841.63	9/2 ⁻	1133.61	(9/2, 11/2) ⁺				
721.5 1	0.257 16	1841.63	9/2 ⁻	1120.09	(7/2) ⁺	E1		2.25×10^{-3} 3	Mult.: $\alpha(\text{K})\text{exp}<0.0037$.
728.6 1	0.331 16	1189.09	(7/2) ⁻	460.49	7/2 ⁺	E1		2.20×10^{-3} 3	Mult.: $\alpha(\text{K})\text{exp}<0.0035$.
731.6 2	0.197 16	2157.98	(7/2) ⁻	1426.13	9/2 ⁻	M1		0.01055 15	Mult.: $\alpha(\text{K})\text{exp}=0.010$ 2.
736.4 1	2.40 7	837.16	5/2 ⁺	100.75	3/2 ⁺	M1 [@]		0.01038 15	E_γ, I_γ : others: 736.4 3, with $I_\gamma=2.6$ 3 (1990Sa32); 736.5 1, with $I_\gamma=2.9$ 5 (1975To03) for a composite line; 736.6 4, with $I_\gamma=2.8$ 3 (1981ZuZZ). Mult.: $\alpha(\text{K})\text{exp}\approx 0.0089$ 7.
736.8 2	0.48 6	1426.13	9/2 ⁻	689.32	7/2 ⁻				
741.7 1	2.40 20	741.64	5/2 ⁺	0.0	1/2 ⁺	E2		0.00555 8	E_γ, I_γ : others: 741.8 3, with $I_\gamma=2.53$ 18 (1990Sa32); 741.7 1, $I_\gamma=2.6$ 4 (1975To03); 741.9 4, with $I_\gamma=2.3$ 3 (1981ZuZZ). Mult.: $\alpha(\text{K})\text{exp}=0.0050$ 5.
745.0 2	0.26 3	1205.37	(9/2) ⁺	460.49	7/2 ⁺	M1+E2	1.3 +41-7	0.0072 17	Mult., δ : $\alpha(\text{K})\text{exp}=0.0060$ 13.
753.2 2	0.28 3	1841.63	9/2 ⁻	1088.55	5/2 ⁻	(E2)		0.00536 8	Mult.: $\alpha(\text{K})\text{exp}=0.0029$ 15 gives E1, E2; E2 from level scheme.
754.8 2	0.55 3	754.92	5/2 ⁺	0.0	1/2 ⁺	E2		0.00533 7	E_γ, I_γ : others: 754.5 5, with $I_\gamma=1.19$ 9 (1990Sa32, probably doublet); 754.8 4, with $I_\gamma=0.59$ 6 (1981ZuZZ). Mult.: $\alpha(\text{K})\text{exp}=0.0052$ 9.
763.6 1	0.48 2	970.45	7/2 ⁺	206.91	5/2 ⁺	M1		0.00950 13	E_γ, I_γ : other: 763.4 5, with $I_\gamma=0.37$ 11 (1990Sa32). Mult.: $\alpha(\text{K})\text{exp}=0.0080$ 5.
769.0 3	0.64 4	869.72	5/2 ⁺	100.75	3/2 ⁺	M1 [@]		0.00933 13	Mult.: $\alpha(\text{K})\text{exp}\approx 0.0079$ 6.
769.3 2	0.10 3	1953.13	9/2 ⁻	1183.86	9/2 ⁻	(M1) ^{&}		0.00932 13	
771.8 3	0.16 4	1461.26	(5/2, 7/2) ⁻	689.32	7/2 ⁻				
775.1 2	2.7 3	982.05	(9/2) ⁺	206.91	5/2 ⁺	E2		0.00502 7	E_γ, I_γ : other: 775.4 3, with $I_\gamma=6.4$ 5 (1990Sa32); 775.3 1, with $I_\gamma=5.2$ 5 (1975To03); 775.4 4, with $I_\gamma=5.2$ 6 (1981ZuZZ); all the three intensities seem too high. Mult.: $\alpha(\text{K})\text{exp}=0.0047$ 7.

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ †	I_γ † ^b	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	$\delta^\#$	α^c	Comments
784.0 5	0.035 12	1473.75	(11/2) ⁻	689.32	7/2 ⁻				
788.3 3	0.14 4	1876.88	5/2 ⁻	1088.55	5/2 ⁻				
789.4 1	11.58 40	825.12	9/2 ⁻	35.75	11/2 ⁻	M1 @		0.00875 12	E_γ, I_γ : others: 789.4 2, with $I_\gamma=13.9$ 10 (1990Sa32); 789.4 1, $I_\gamma=9.7$ 10 (1975To03); 789.5 4, with $I_\gamma=9.6$ 10 (1981ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}\approx 0.0079$ 5.
794.5 3	0.21 5	1883.08	(9/2) ⁻	1088.55	5/2 ⁻				
805.0 1	0.54 3	840.71	13/2 ⁻	35.75	11/2 ⁻	M1+E2	0.8 +4-3	0.0069 8	Mult., δ : $\alpha(K)\text{exp}=0.0059$ 6.
812.2 1	0.248 21	1272.73	(9/2) ⁺	460.49	7/2 ⁺	M1		0.00816 11	Mult.: $\alpha(K)\text{exp}=0.0067$ 8.
819.3 3	0.15 4	1508.52	(7/2) ⁻	689.32	7/2 ⁻	(M1) ^a		0.00799 11	Mult.: $\alpha(K)\text{exp}=0.0063$ 25 for 819.3+819.6 doublet gives M1(+E2), $\delta<1.5$.
819.6 3	0.08 3	1953.13	9/2 ⁻	1133.61	(9/2,11/2) ⁺	[E1] ^a		1.74×10^{-3} 2	Mult.: $\alpha(K)\text{exp}=0.0063$ 25 for 819.3+819.6 doublet gives M1(+E2), $\delta<1.5$, but E1 required from level scheme.
823.6 4	0.10 4	1776.61	7/2 ⁻	952.89	3/2 ⁻				
825.4 5	0.02 1	1697.49	9/2 ⁻	872.46	(11/2) ⁻				
827.6 2	0.135 19	1876.88	5/2 ⁻	1049.24	(5/2) ⁺				
836.7 1	4.84 7	872.46	(11/2) ⁻	35.75	11/2 ⁻	M1+E2 @	≈ 1.1	≈ 0.00575	E_γ, I_γ : other: 836.7 3, with $I_\gamma=5.3$ 4 (1990Sa32). Mult.: $\alpha(K)\text{exp}\approx 0.0048$ 4. E_γ, I_γ : other: 836.8 4, with $I_\gamma=3.7$ 4 (1981ZuZZ).
837.1 3	0.30 6	837.16	5/2 ⁺	0.0	1/2 ⁺				
842.3 3	0.09 2	1049.24	(5/2) ⁺	206.91	5/2 ⁺				
852.2 3	0.15 5	952.89	3/2 ⁻	100.75	3/2 ⁺	E1		1.62×10^{-3} 2	Mult.: $\alpha(K)\text{exp}<0.002$.
857.0 3	0.08 3	1697.49	9/2 ⁻	840.71	13/2 ⁻				
859.6 4	0.08 3	2065.37	7/2 ⁻	1205.95	(7/2,9/2) ⁻				
859.7 2	1.04 12	1841.63	9/2 ⁻	982.05	(9/2) ⁺	(E1) ^a		1.59×10^{-3} 2	E_γ, I_γ : others: 859.5 5, with $I_\gamma=1.07$ 18 (1990Sa32); 860.4 4, with $I_\gamma=1.77$ 19 (1981ZuZZ); for a composite line. Mult.: $\alpha(K)\text{exp}\approx 0.0016$ 2.
860.1 2	0.75 13	2065.37	7/2 ⁻	1205.37	(9/2) ⁺	(E1) ^a		1.59×10^{-3} 2	Mult.: $\alpha(K)\text{exp}\approx 0.0016$ 2. E_γ, I_γ : 1990Sa32 and 1981ZuZZ report composite line at 859.5 and 860.4, respectively.
863.5 4	0.05 2	1735.44	(7/2) ⁻	872.46	(11/2) ⁻				
869.7 2	3.13 7	970.45	7/2 ⁺	100.75	3/2 ⁺	E2 @		0.00389 5	E_γ, I_γ : others: 869.6 3, with $I_\gamma=2.7$ 3 (1990Sa32); 870.4 4, with $I_\gamma=3.1$ 3 (1981ZuZZ) for a composite line. Mult.: $\alpha(K)\text{exp}=0.0038$ 7.
870.0 4	0.17 4	869.72	5/2 ⁺	0.0	1/2 ⁺				
871.2 2	2.08 21	1841.63	9/2 ⁻	970.45	7/2 ⁺	E1 @		1.55×10^{-3} 2	E_γ, I_γ : other: 871.5 3, with $I_\gamma=3.2$ 4 (1990Sa32). Mult.: $\alpha(K)\text{exp}\approx 0.0019$ 4. I_γ : $I_\gamma=2.8$ 3 (1990Sa32), 3.2 (1981ZuZZ) for a composite line.
872.4 3	0.35 6	1697.49	9/2 ⁻	825.12	9/2 ⁻	&			

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
E_γ †	I_γ † ^b	E_i (level)	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	α ^c	Comments
876.2 3	0.21 4	2065.37	7/2 ⁻	1189.09	(7/2) ⁻				
877.1 4	0.035 12	1631.88	(3/2,5/2) ⁻	754.92	5/2 ⁺				
881.4 2	0.35 3	2065.37	7/2 ⁻	1183.86	9/2 ⁻	M1		0.00669	Mult.: $\alpha(K)\text{exp}=0.0074$ 16.
901.0 1	0.313 19	1883.08	(9/2) ⁻	982.05	(9/2) ⁺	(E1)		1.45×10^{-3} 2	E_γ, I_γ : other: 900.9 5, with $I_\gamma=0.23$ 9 (1990Sa32). Mult.: $\alpha(K)\text{exp}<0.0023$.
906.7 2	0.20 4	1876.88	5/2 ⁻	970.45	7/2 ⁺	(E1)		1.43×10^{-3} 2	E_γ, I_γ : others: 906.9 5, with $I_\gamma=0.41$ 11 (1990Sa32); 906.2 4, with $I_\gamma=0.30$ 3 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}<0.003$.
910.3 4	0.08 3	1735.44	(7/2) ⁻	825.12	9/2 ⁻				
912.8 3	0.86 16	1883.08	(9/2) ⁻	970.45	7/2 ⁺	[E1] ^a		1.41×10^{-3} 2	E_γ, I_γ : other: 912.9 5, with $I_\gamma=0.68$ 13 (1990Sa32). Mult.: $\alpha(K)\text{exp}\approx 0.0033$ 6 for 912.8+913.2 doublet gives E2(+M1), $\delta>1.2$, but E1 required by level scheme.
913.2 3	0.53 16	1120.09	(7/2) ⁺	206.91	5/2 ⁺	(E2(+M1)) ^a	>1.2	0.0040 5	E_γ, I_γ : others: 913.1 5, with $I_\gamma=0.95$ 16 (1990Sa32); 913.1 4, with $I_\gamma=0.59$ 6 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}\approx 0.0033$ 6 for 913.2+912.8 doublet gives E2(+M1), $\delta>1.2$;
921.0 5	<0.1	1381.92	7/2 ⁻	460.49	7/2 ⁺				
924.0 1	0.406 19	1876.88	5/2 ⁻	952.89	3/2 ⁻	M1		0.00596 8	Mult.: $\alpha(K)\text{exp}=0.0053$ 6.
937.8 2	0.087 21	2026.32	(7/2) ⁻	1088.55	5/2 ⁻	(M1)		0.00575 8	Mult.: $\alpha(K)\text{exp}=0.0049$ 24.
945.4 2	0.233 21	2065.37	7/2 ⁻	1120.09	(7/2) ⁺	E1		1.32×10^{-3} 2	E_γ, I_γ : other: 945.5 5, with $I_\gamma=0.23$ 7 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.0013$ 5.
952.9 1	0.97 2	952.89	3/2 ⁻	0.0	1/2 ⁺	E1		1.30×10^{-3} 2	Mult.: $\alpha(K)\text{exp}=0.0015$ 2.
960.0 3	0.12 4	1420.55	(9/2) ⁻	460.49	7/2 ⁺	E1		1.29×10^{-3} 2	E_γ, I_γ : other: 960.2 5, with $I_\gamma=0.16$ 5 (1990Sa32). Mult.: $\alpha(K)\text{exp}<0.0011$.
969.4 3	0.06 2	1841.63	9/2 ⁻	872.46	(11/2) ⁻				
972.2 3	0.22 5	2161.04	(9/2) ⁻	1189.09	(7/2) ⁻	(E2) ^a		0.00307 4	Mult.: $\alpha(K)\text{exp}=0.0020$ 4 for 972.2+973.4974.5 triplet gives E2 or E1, the latter within 2σ uncertainty.
973.4 2	0.39 6	1728.36	5/2 ⁻	754.92	5/2 ⁺	(E1) ^a		1.25×10^{-3} 2	E_γ, I_γ : other: 973.5 5, with $I_\gamma=0.48$ 13 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.0020$ 4 for 973.4+972.2+974.5 triplet gives E2 or E1, the latter within 2σ uncertainty; E1 required from level scheme.
974.5 4	0.08 3	2157.98	(7/2) ⁻	1183.86	9/2 ⁻	(E2) ^{&}		0.00306 4	Mult.: $\alpha(K)\text{exp}=0.0020$ 4 for 973.4+972.2+974.5 triplet gives E2 or E1, the latter within 2σ uncertainty.
982.2 2	0.12 2	1189.09	(7/2) ⁻	206.91	5/2 ⁺	[E1]		1.23×10^{-3} 2	Mult.: $\alpha(K)\text{exp}=0.0028$ 14 gives D or E2; E1 preferred by level scheme. (E2) given in Table 1 of 2019MeZX could be a typo.
986.0 4	0.08 3	2074.22	7/2 ⁻	1088.55	5/2 ⁻				
986.8 2	0.65 6	1728.36	5/2 ⁻	741.64	5/2 ⁺	E1		1.22×10^{-3} 2	E_γ, I_γ : other: 986.2 5, with $I_\gamma=0.73$ 14 (1990Sa32). Mult.: $\alpha(K)\text{exp}=1.0\text{E}-3$ 3.
987.8 2	1.30 14	1088.55	5/2 ⁻	100.75	3/2 ⁺	E1		1.22×10^{-3} 2	Mult.: $\alpha(K)\text{exp}=0.0012$ 3.
997.5 1	1.16 8	1841.63	9/2 ⁻	844.16	7/2 ⁺	E1 [@]		1.20×10^{-3} 2	E_γ, I_γ : others: 997.6 3, with $I_\gamma=1.71$ 25 (1990Sa32); 997.3 4, with $I_\gamma=0.74$ 7 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=0.0012$ 2.

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ ^{†b}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	α^c	Comments
998.6 3	0.19 3	1205.37	(9/2) ⁺	206.91	5/2 ⁺			
1000.8 4	0.023 12	1461.26	(5/2,7/2) ⁻	460.49	7/2 ⁺			
1001.2 4	0.035 12	1841.63	9/2 ⁻	840.71	13/2 ⁻			
1008.3 3	0.22 4	1697.49	9/2 ⁻	689.32	7/2 ⁻			
1010.6 1	2.30 21	1883.08	(9/2) ⁻	872.46	(11/2) ⁻	M1 @	0.00481 7	E_γ, I_γ : others: 1010.7 3, with $I_\gamma=2.69$ 20 (1990Sa32); 1010.3 4, with $I_\gamma=2.21$ 22 (1981ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}\approx 0.0042$ 3.
1016.5 4	0.11 3	1841.63	9/2 ⁻	825.12	9/2 ⁻			
1027.1 3	0.08 3	2161.04	(9/2) ⁻	1133.61	(9/2,11/2) ⁺			
1032.6 3	0.07 2	2014.73	(9/2) ⁻	982.05	(9/2) ⁺			
1033.2 4	0.023 12	1986.44	(3/2 ⁻ , 5/2, 7/2 ⁻)	952.89	3/2 ⁻			
1034.9 3	0.093 22	1776.61	7/2 ⁻	741.64	5/2 ⁺			
1039.1 2	0.89 7	1728.36	5/2 ⁻	689.32	7/2 ⁻	(E2) ^a	0.00267 4	Mult.: $\alpha(K)\text{exp}\approx 0.00215$ 20 for 1039.1+1039.8 doublet suggests dominant E2. E_γ, I_γ : line is unresolved in 1990Sa32 and 1981ZuZZ.
1039.8 2	1.63 12	1876.88	5/2 ⁻	837.16	5/2 ⁺	[E1] ^a	1.11×10^{-3} 2	E_γ, I_γ : others: $E_\gamma=1040.1$ 3, $I_\gamma=3.05$ 23 (1990Sa32); $E_\gamma=1039.4$ 4, $I_\gamma=2.5$ 3 (1981ZuZZ) for a composite line. Mult.: $\alpha(K)\text{exp}\approx 0.00215$ 20 for 1039.1+1039.8 doublet suggests dominant E2, but level scheme requires E1.
1042.1 4	0.035 12	1883.08	(9/2) ⁻	840.71	13/2 ⁻			
1043.7 2	0.35 6	1250.68	5/2 ⁻	206.91	5/2 ⁺	(E1) @	1.10×10^{-3} 2	Mult.: $\alpha(K)\text{exp}\approx 0.0020$ 7 suggests E2 or E1 (within 1.5σ); E1 from level scheme.
1044.3 3	0.06 3	2026.32	(7/2) ⁻	982.05	(9/2) ⁺			
1046.2 3	0.086 12	1735.44	(7/2) ⁻	689.32	7/2 ⁻			
1049.2 2	0.13 2	1049.24	(5/2 ⁺)	0.0	1/2 ⁺			
1056 1	0.023 12	2026.32	(7/2) ⁻	970.45	7/2 ⁺			
1057.9 1	1.89 3	1883.08	(9/2) ⁻	825.12	9/2 ⁻	M1	0.00431 6	E_γ, I_γ : others: 1058.0 5, with $I_\gamma=1.91$ 14 (1990Sa32); 1057.7 4, with $I_\gamma=1.62$ 16 (1981ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}=0.0041$ 4.
1080.6 1	0.975 19	1953.13	9/2 ⁻	872.46	(11/2) ⁻	M1	0.00409 6	E_γ, I_γ : others: 1080.4 5, with $I_\gamma=1.02$ 9 (1990Sa32); 1078.9 4, with $I_\gamma=1.18$ 12 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=0.0038$ 4.
1083.4 [‡] 2	0.72 [‡] 2	2065.37	7/2 ⁻	982.05	(9/2) ⁺	(E1)	1.03×10^{-3} 1	E_γ, I_γ : other: 1083.2 5, with $I_\gamma=0.71$ 13 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.0015$ 5.
1084 1	<0.02	1928.15	(7/2 ⁻ , 9/2 ⁻)	844.16	7/2 ⁺			
1087.3 2	0.420 19	1776.61	7/2 ⁻	689.32	7/2 ⁻	M1	0.00403 6	E_γ, I_γ : other: 1087.3 5, with $I_\gamma=0.50$ 13 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.0039$ 4.
1092.3 5	0.05 3	2074.22	7/2 ⁻	982.05	(9/2) ⁺			
1095.0 2	0.317 16	2065.37	7/2 ⁻	970.45	7/2 ⁺	E1	1.01×10^{-3} 1	E_γ, I_γ : other: 1095.2 5, with $I_\gamma=0.30$ 7 (1990Sa32). Mult.: $\alpha(K)\text{exp}<0.0013$.
1097.8 2	0.32 2	1133.61	(9/2,11/2) ⁺	35.75	11/2 ⁻	E1	1.00×10^{-3} 1	Mult.: $\alpha(K)\text{exp}<0.0013$.
1103.2 3	0.170 20	1928.15	(7/2 ⁻ , 9/2 ⁻)	825.12	9/2 ⁻			

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)

γ(¹⁴⁹Tb) (continued)

E_γ [†]	I_γ ^{†b}	E_i (level)	J_i^π	E_f	J_f^π	Mult. [#]	α^c	Comments
1109.2 3	0.162 18	1953.13	9/2 ⁻	844.16	7/2 ⁺			
1110.4 4	0.045 13	1852.03	(7/2) ⁻	741.64	5/2 ⁺			
1121.9 1	0.819 21	1876.88	5/2 ⁻	754.92	5/2 ⁺	E1	0.000967 14	E_γ, I_γ : other: 1121.5 4, with $I_\gamma=0.44$ 5 (1981ZuZZ), unplaced. Mult.: $\alpha(K)\text{exp}=0.0011$ 3.
1128.0 3	0.085 16	1953.13	9/2 ⁻	825.12	9/2 ⁻			
1135.2 1	1.60 9	1876.88	5/2 ⁻	741.64	5/2 ⁺	E1	0.000949 13	E_γ, I_γ : others: 1135.5 5, with $I_\gamma=0.52$ 13 (1990Sa32) is in severe disagreement; 1134.7 4 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=1.0\text{E}-3$ 3.
1142.2 3	0.162 17	2014.73	(9/2) ⁻	872.46	(11/2) ⁻	M1	0.00359 5	E_γ, I_γ : other: 1142.6 5, with $I_\gamma=0.18$ 5 (1990Sa32). Mult.: $\alpha(K)\text{exp}=0.0037$ 9.
1148.2 3	0.14 2	1183.86	9/2 ⁻	35.75	11/2 ⁻	M1	0.00354 5	Mult.: $\alpha(K)\text{exp}=0.0034$ 11.
1150.0 3	0.113 13	1250.68	5/2 ⁻	100.75	3/2 ⁺	E1	0.000930 13	Mult.: $\alpha(K)\text{exp}<0.0011$.
1152.3 2	0.37 3	1841.63	9/2 ⁻	689.32	7/2 ⁻	(M1) ^a	0.00351 5	E_γ, I_γ : others: 1152.3 5, with $I_\gamma=0.43$ 16 (1990Sa32); 1252.3 4, with $I_\gamma=0.74$ 7 (1981ZuZZ, unplaced) for a composite line. Mult.: $\alpha(K)\text{exp}\approx 0.0023$ 3.
1153.3 2	0.39 3	1189.09	(7/2) ⁻	35.75	11/2 ⁻	(E2) ^a	2.16×10^{-3} 3	E_γ, I_γ : other: 1152.3 4, with $I_\gamma=0.74$ 7 (1981ZuZZ) for a composite line, unplaced. Mult.: $\alpha(K)\text{exp}\approx 0.0023$ 3.
1162.6 2	0.075 18	1852.03	(7/2) ⁻	689.32	7/2 ⁻	M1	0.00344 5	Mult.: $\alpha(K)\text{exp}=0.0050$ 25.
1169.5 3	0.57 9	1205.37	(9/2) ⁺	35.75	11/2 ⁻	[E1] ^a	0.000907 13	Mult.: $\alpha(K)\text{exp}\approx 0.0017$ 3 for 1169.5+1170.1 doublet suggests M1,E2, but level scheme requires E1.
1170.1 3	0.73 13	1205.95	(7/2,9/2) ⁻	35.75	11/2 ⁻	(M1,E2) ^a	0.0027 6	Mult.: $\alpha(K)\text{exp}\approx 0.0017$ 3 for 1169.5+1170.1 doublet suggests M1,E2, consistent with that expected from level scheme. $I_\gamma=0.04$ 3 for a 1170.9γ (1990Sa32).
1173.9 4	0.14 4	2014.73	(9/2) ⁻	840.71	13/2 ⁻			E_γ : other: 1170.9 5 with $I_\gamma=0.05$ 4 from 1990Sa32.
1174.9 1	0.87 7	1381.92	7/2 ⁻	206.91	5/2 ⁺	E1 [@]	0.000902 13	E_γ, I_γ : others: 1175.2 5, with $I_\gamma=0.98$ 18 (1990Sa32); 1174.3 4, with $I_\gamma=1.18$ 12 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}\approx 1.0\text{E}-3$ 3.
1187.5 2	0.382 23	1876.88	5/2 ⁻	689.32	7/2 ⁻	M1	0.00328 5	E_γ, I_γ : others: 1187.7 5, with $I_\gamma=0.46$ 18 (1990Sa32); 1189.0 4, with $I_\gamma=0.89$ 9 (1981ZuZZ) for a composite line. Mult.: $\alpha(K)\text{exp}=0.0029$ 4.
1188.9 3	0.243 24	2026.32	(7/2) ⁻	837.16	5/2 ⁺	(E1) ^a	0.000888 12	Mult.: $\alpha(K)\text{exp}\approx 0.0013$ 4 suggests E1 or E2; E1 from level scheme.
1189.6 3	0.150 23	2014.73	(9/2) ⁻	825.12	9/2 ⁻	(M1+E2) ^a	0.0026 6	E_γ, I_γ : others: 1189.9 5, with $I_\gamma=0.30$ 13 (1990Sa32); 1189.0 4, with $I_\gamma=0.89$ 9 (1981ZuZZ) for a composite line. Mult.: $\alpha(K)\text{exp}\approx 0.0013$ 4.
1193.7 2	0.234 17	1883.08	(9/2) ⁻	689.32	7/2 ⁻	M1	0.00324 5	E_γ, I_γ : others: 1193.7 5, with $I_\gamma=0.23$ 11 (1990Sa32); 1194.2 4, with $I_\gamma=1.03$ 10 (1981ZuZZ) for a composite line. Mult.: $\alpha(K)\text{exp}=0.0036$ 12.
1195.6 2	0.68 2	2065.37	7/2 ⁻	869.72	5/2 ⁺	E1	0.000882 12	E_γ, I_γ : others: 1195.7 5, with $I_\gamma=0.68$ 16 (1990Sa32); 1194.2 4, with $I_\gamma=1.03$ 10 (1981ZuZZ, unplaced) for a composite line. Mult.: $\alpha(K)\text{exp}=7.0\times 10^{-4}$ 20.

¹⁴⁹Dy ε decay (4.2 min) ²⁰¹⁹MeZX (continued)

$\gamma(^{149}\text{Tb})$ (continued)								
E_γ [†]	I_γ ^{†b}	E_i (level)	J_i^π	E_f	J_f^π	Mult. [#]	α^c	Comments
1201.3 ^d 3	0.06 ^d 2	2026.32	(7/2) ⁻	825.12	9/2 ⁻	(M1)	0.00319 4	Mult.: $\alpha(K)\text{exp}=0.0029$ 9.
1201.8 ^d 3	0.06 ^d 2	2074.22	7/2 ⁻	872.46	(11/2) ⁻	(E2) ^a	2.00×10^{-3} 3	Mult.: $\alpha(K)\text{exp} \approx 0.0029$ 9 gives (M1,E2); E2 from level scheme. Mult.: (M1) given in Table I of ²⁰¹⁹ MeZX could be a typo, since the final $J^\pi=9/2^-$ for 872 level is incorrect, which should be 11/2 ⁻ instead, as given earlier in Table I for that level.
1204.5 2	0.134 19	2074.22	7/2 ⁻	869.72	5/2 ⁺	(E1)	0.000874 12	Mult.: $\alpha(K)\text{exp}=0.0012$ 7.
1221.2 1	0.552 21	2065.37	7/2 ⁻	844.16	7/2 ⁺	E1	0.000861 12	E_γ, I_γ : others: 1221.3 5, with $I_\gamma=0.75$ 16 (¹⁹⁹⁰ Sa32); 1220.0 4, with $I_\gamma=0.89$ 9 (¹⁹⁸¹ ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}=7.0 \times 10^{-4}$ 20.
1228.2 1	0.472 20	2065.37	7/2 ⁻	837.16	5/2 ⁺	E1	0.000855 12	E_γ, I_γ : others: 1228.4 5, with $I_\gamma=0.59$ 14 (¹⁹⁹⁰ Sa32); 1227.5 4, with $I_\gamma=0.74$ 7 (¹⁹⁸¹ ZuZZ). Mult.: $\alpha(K)\text{exp}=1.0\text{E}-3$ 3.
1231.5 3	0.085 20	1986.44	(3/2 ⁻ , 5/2, 7/2 ⁻)	754.92	5/2 ⁺	(E1) ^a	0.000849 12	E_γ, I_γ : other: 1237.3 5, with $I_\gamma=0.23$ 9 (¹⁹⁹⁰ Sa32); 1235.9 4, with $I_\gamma=0.59$ 6 (¹⁹⁸¹ ZuZZ, unplaced) for a composite line. Mult.: $\alpha(K)\text{exp} \approx 1.0\text{E}-3$ 4.
1236.9 2	0.22 5	2074.22	7/2 ⁻	837.16	5/2 ⁺			
1237.1 2	0.32 6	1272.73	(9/2) ⁺	35.75	11/2 ⁻	(E1) ^a	0.000849 12	Mult.: $\alpha(K)\text{exp} \approx 1.0\text{E}-3$ 4. E_γ, I_γ : other: 1235.9 4, with $I_\gamma=0.59$ 6 (¹⁹⁸¹ ZuZZ) for a composite line, unplaced.
1239.0 4	0.05 2	1928.15	(7/2 ⁻ , 9/2 ⁻)	689.32	7/2 ⁻	(M1) ^{&}	0.00297 4	Mult.: $\alpha(K)\text{exp} \approx 0.0035$ 12.
1240.1 3	0.13 3	2065.37	7/2 ⁻	825.12	9/2 ⁻	M1 [@]	0.00296 4	Mult.: $\alpha(K)\text{exp} \approx 0.0035$ 12.
^x 1246.8 4	0.30 7							E_γ, I_γ : from ¹⁹⁸¹ ZuZZ only.
1248.9 3	0.035 12	2074.22	7/2 ⁻	825.12	9/2 ⁻	E1	0.000838 12	E_γ, I_γ : others: 1254.5 5, with $I_\gamma=0.75$ 14 (¹⁹⁹⁰ Sa32); 1253.5 4, with $I_\gamma=0.89$ 9 (¹⁹⁸¹ ZuZZ). Mult.: $\alpha(K)\text{exp}=6.0 \times 10^{-4}$ 20.
1254.3 [‡] 2	0.49 [‡] 3	1461.26	(5/2, 7/2) ⁻	206.91	5/2 ⁺			
1263.8 1	0.85 3	1953.13	9/2 ⁻	689.32	7/2 ⁻	M1	0.00284 4	E_γ, I_γ : others: 1263.4 5, with $I_\gamma=0.64$ 7 (¹⁹⁹⁰ Sa32); 1263.8 4, with $I_\gamma=1.03$ 10 (¹⁹⁸¹ ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}=0.0025$ 3.
1274.9 [‡] 1	2.00 [‡] 3	1735.44	(7/2) ⁻	460.49	7/2 ⁺	E1	0.000825 12	E_γ, I_γ : other: 1274.7 5, with $I_\gamma=2.6$ 4 (¹⁹⁹⁰ Sa32); 1274.4 3, $I_\gamma=2.7$ 6 (¹⁹⁷⁵ To03); 1274.5 4, with $I_\gamma=2.7$ 3 (¹⁹⁸¹ ZuZZ). Mult.: $\alpha(K)\text{exp}=8.0 \times 10^{-4}$ 10.
1278.5 3	0.13 4	2260.33	(7/2 ⁻ , 9/2)	982.05	(9/2) ⁺	[E1] ^a	0.000818 11	Mult.: $\alpha(K)\text{exp} \approx 0.0020$ 5.
1284.7 3	0.06 2	2026.32	(7/2) ⁻	741.64	5/2 ⁺			
1288.5 ^d 3	0.12 ^d 4	2157.98	(7/2) ⁻	869.72	5/2 ⁺	(M1) ^a	0.00272 4	Mult.: $\alpha(K)\text{exp} \approx 0.0020$ 5.
1288.5 ^d 3	0.12 ^d 4	2161.04	(9/2) ⁻	872.46	(11/2) ⁻	E1	0.000811 11	E_γ, I_γ : others: 1301.8 5, with $I_\gamma=0.98$ 20 (¹⁹⁹⁰ Sa32); 1301.2
1297.2 4	0.046 19	1986.44	(3/2 ⁻ , 5/2, 7/2 ⁻)	689.32	7/2 ⁻			
1301.6 1	0.75 3	1508.52	(7/2) ⁻	206.91	5/2 ⁺			

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ ^{†b}	E_i (level)	J_i^π	E_f	J_f^π	Mult. [#]	α^c	Comments
1316.1 1	0.73 3	1776.61	7/2 ⁻	460.49	7/2 ⁺	E1	0.000805 11	4, with $I_\gamma=0.59$ 6 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=7.1\times 10^{-4}$ 15. E_γ, I_γ : others: 1316.3 5, with $I_\gamma=0.62$ 14 (1990Sa32); 1314.6 4, with $I_\gamma=0.74$ 6 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=8.5\times 10^{-4}$ 25.
1320.4 4	0.093 16	2161.04	(9/2) ⁻	840.71	13/2 ⁻			
1323.7 1	1.07 6	2065.37	7/2 ⁻	741.64	5/2 ⁺	E1@	0.000802 11	E_γ, I_γ : other: 1323.8 5, with $I_\gamma=1.28$ 5 (1990Sa32). Mult.: $\alpha(K)\text{exp}\approx 7.7\times 10^{-4}$ 15.
1325.0 4	0.07 2	2014.73	(9/2) ⁻	689.32	7/2 ⁻			
1332.9 4	0.05 2	2157.98	(7/2) ⁻	825.12	9/2 ⁻			
1343.6 3	0.069 17	1804.1	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	460.49	7/2 ⁺	(M1,E2)	0.0021 4	Mult.: $\alpha(K)\text{exp}=0.002$ 1.
1346.3 3	0.069 17	1381.92	7/2 ⁻	35.75	11/2 ⁻	(E2)	1.62×10^{-3} 2	Mult.: (M1,E2) from $\alpha(K)\text{exp}=0.002$ 1; E3 is possible but less likely, and pure M3 is ruled out; E2 from level scheme.
1376.0 1	0.647 21	2065.37	7/2 ⁻	689.32	7/2 ⁻	M1	2.35×10^{-3} 3	E_γ, I_γ : others: 1376.0 5, with $I_\gamma=0.68$ 23 (1990Sa32); 1375.8 4, with $I_\gamma=0.89$ 9 (1981ZuZZ, unplaced). Mult.: $\alpha(K)\text{exp}=0.0025$ 5.
1381.3 3	0.14 3	1841.63	9/2 ⁻	460.49	7/2 ⁺			
1384.7 ^e 3	0.39 ^e 7	1420.55	(9/2) ⁻	35.75	11/2 ⁻	(M1) ^a	2.32×10^{-3} 3	E_γ, I_γ : other: 1385.0 4, with $I_\gamma=0.89$ 9 (1981ZuZZ) for a composite line, unplaced. Mult.: $\alpha(K)\text{exp}\approx 0.0020$ 3.
1384.7 ^{ef} 3	0.19 ^e 5	2074.22	7/2 ⁻	689.32	7/2 ⁻	(M1) ^a	2.32×10^{-3} 3	E_γ, I_γ : others: 1384.9 5, with $I_\gamma=0.23$ 11 (1990Sa32); 1385.0 4, with $I_\gamma=0.89$ 9 (1981ZuZZ, unplaced) for a composite line. Mult.: $\alpha(K)\text{exp}\approx 0.0020$ 3.
1387.9 3	0.08 4	2260.33	(7/2 ⁻ , 9/2)	872.46	(11/2) ⁻			
1390.3 1	2.00 3	1426.13	9/2 ⁻	35.75	11/2 ⁻	M1	2.30×10^{-3} 3	E_γ, I_γ : other: 1389.6 4, with $I_\gamma=2.21$ 22 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=0.0020$ 2.
1391.9 4	0.05 2	1852.03	(7/2) ⁻	460.49	7/2 ⁺			
1416.4 2	0.267 21	1876.88	5/2 ⁻	460.49	7/2 ⁺	E1	0.000782 11	Mult.: $\alpha(K)\text{exp}<6.0\times 10^{-4}$.
1422.6 1	1.89 3	1883.08	(9/2) ⁻	460.49	7/2 ⁺	E1	0.000782 11	E_γ, I_γ : others: 1422.7 5, with $I_\gamma=2.7$ 4 (1990Sa32); 1422.1 4, with $I_\gamma=3.1$ 3 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=6.0\times 10^{-4}$ 10.
1425.1 4	0.06 2	1631.88	(3/2, 5/2) ⁻	206.91	5/2 ⁺			
1427.9 5	0.023 12	2117.14	(5/2 ⁻ , 7/2 ⁻)	689.32	7/2 ⁻			
1428.0 5	0.017 9	2516.33	(7/2) ⁻	1088.55	5/2 ⁻			
1438.0 2	0.34 3	1473.75	(11/2) ⁻	35.75	11/2 ⁻	M1	2.15×10^{-3} 3	Mult.: $\alpha(K)\text{exp}=0.0022$ 4.
1467.6 3	0.14 3	1928.15	(7/2 ⁻ , 9/2 ⁻)	460.49	7/2 ⁺	(E1) ^a	0.000780 11	Mult.: $\alpha(K)\text{exp}\approx 9\times 10^{-4}$ 4 for 1467.6+1468.7 doublet suggests D or E2; E1 from level scheme.
1468.7 3	0.13 3	2157.98	(7/2) ⁻	689.32	7/2 ⁻	(M1+E2) ^a	0.00173 33	Mult.: $\alpha(K)\text{exp}\approx 9\times 10^{-4}$ 4 for 1467.6+1468.7

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX (continued)

$\gamma(^{149}\text{Tb})$ (continued)									
E_γ [†]	I_γ ^{†b}	E_i (level)	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	α^c	Comments
									doublet suggests D or E2; M1+E2 from level scheme.
1471.7 2	0.34 3	2161.04	(9/2) ⁻	689.32	7/2 ⁻	M1		2.05×10 ⁻³ 3	Mult.: $\alpha(K)\text{exp}\approx 0.0021$ 4.
1472.7 4	0.023 11	1508.52	(7/2) ⁻	35.75	11/2 ⁻				
1492.7 3	0.058 20	1953.13	9/2 ⁻	460.49	7/2 ⁺				
1521.4 1	3.90 30	1728.36	5/2 ⁻	206.91	5/2 ⁺	E1		0.000784 11	E_γ, I_γ : others: 1521.0 5, with $I_\gamma=3.9$ 5 (1990Sa32); 1520.9 4, with $I_\gamma=5.6$ 6 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=5.0\times 10^{-4}$ 5.
1527.3 3	0.044 10	2352.30	(7/2 ⁻ , 9/2)	825.12	9/2 ⁻				
1528.6 4	0.031 9	1735.44	(7/2) ⁻	206.91	5/2 ⁺				
1531.0 4	0.051 10	1631.88	(3/2, 5/2) ⁻	100.75	3/2 ⁺				
1565.8 2	0.148 19	2026.32	(7/2) ⁻	460.49	7/2 ⁺	E1		0.000790 11	Mult.: $\alpha(K)\text{exp}<8.0\times 10^{-4}$.
1569.8 2	0.28 2	1776.61	7/2 ⁻	206.91	5/2 ⁺	E1		0.000790 11	E_γ, I_γ : other: 1569.9 5, with $I_\gamma=0.37$ 13 (1990Sa32). Mult.: $\alpha(K)\text{exp}=4.5\times 10^{-4}$ 15.
1597 1	0.05 2	1804.1	(5/2 ⁺ , 7/2 ⁺ , 9/2 ⁺)	206.91	5/2 ⁺				
1604.8 3	0.051 21	2065.37	7/2 ⁻	460.49	7/2 ⁺				
1613.8 2	0.160 16	2074.22	7/2 ⁻	460.49	7/2 ⁺	E1		0.000799 11	Mult.: $\alpha(K)\text{exp}<5.0\times 10^{-4}$.
1627.5 4	0.017 10	2452.5	(9/2) ⁻	825.12	9/2 ⁻				
1627.6 1	2.07 3	1728.36	5/2 ⁻	100.75	3/2 ⁺	E1		0.000802 11	Mult.: $\alpha(K)\text{exp}=4.5\times 10^{-4}$ 4.
1645.1 2	0.233 14	1852.03	(7/2) ⁻	206.91	5/2 ⁺	E1		0.000806 11	Mult.: $\alpha(K)\text{exp}=4.0\times 10^{-4}$ 20.
1661.7 1	0.87 3	1697.49	9/2 ⁻	35.75	11/2 ⁻	M1+E2	0.8 4	0.00147 11	E_γ, I_γ : other: 1661.5 4, with $I_\gamma=0.74$ 7 (1981ZuZZ). Mult., δ : $\alpha(K)\text{exp}=0.00114$ 8.
1670.0 1	0.63 3	1876.88	5/2 ⁻	206.91	5/2 ⁺	E1		0.000813 11	E_γ, I_γ : others: 1670.3 5, with $I_\gamma=0.70$ 16 (1990Sa32); 1671.0 4, with $I_\gamma=0.59$ 6 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=4.5\times 10^{-4}$ 8.
1697.4 3	0.058 13	2157.98	(7/2) ⁻	460.49	7/2 ⁺				
1699.6 4	0.07 2	1735.44	(7/2) ⁻	35.75	11/2 ⁻				
1700.7 4	0.06 2	2161.04	(9/2) ⁻	460.49	7/2 ⁺				
1740.9 3	0.088 15	1776.61	7/2 ⁻	35.75	11/2 ⁻	[E2]		1.14×10 ⁻³ 2	Mult.: $\alpha(K)\text{exp}=1.0\text{E}-3$ 6 gives M1, E2 or E3; E2 from level scheme.
1776.2 1	11.66 50	1876.88	5/2 ⁻	100.75	3/2 ⁺	E1		0.000845 12	E_γ, I_γ : others: 1776.5 5, with $I_\gamma=11.7$ 8 (1990Sa32); 1776.5 2, $I_\gamma=11.7$ 18 (1975To03); 1776.2 4, with $I_\gamma=11.7$ 12 (1981ZuZZ). Mult.: $\alpha(K)\text{exp}=3.8\times 10^{-4}$ 3.
1779.8 4	0.07 3	1986.44	(3/2 ⁻ , 5/2, 7/2 ⁻)	206.91	5/2 ⁺				
1789.0 4	0.032 7	2661.4	(9/2) ⁻	872.46	(11/2) ⁻				
1805.8 1	7.69 40	1841.63	9/2 ⁻	35.75	11/2 ⁻	M1+E2	1.1 +8-5	0.00127 10	E_γ, I_γ : others: 1806.0 5, with $I_\gamma=7.6$ 6 (1990Sa32); 1806.2 3, $I_\gamma=9.5$ 14 (1975To03);

¹⁴⁹Dy ε decay (4.2 min) **2019MeZX** (continued)

γ(¹⁴⁹Tb) (continued)

$E_\gamma^\dagger$	$I_\gamma^{\dagger b}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	$\delta^\#$	α^c	Comments
									1806.2 4, with $I_\gamma=9.4$ 10 (1981ZuZZ , unplaced). Mult., δ : $\alpha(K)\text{exp}=9.0\times 10^{-4}$ 6.
1816.4 4	0.05 2	1852.03	(7/2) ⁻	35.75	11/2 ⁻				
1819.3 3	0.20 4	2026.32	(7/2) ⁻	206.91	5/2 ⁺				
1847.3 2	0.19 2	1883.08	(9/2) ⁻	35.75	11/2 ⁻				
1858.4 1	0.80 2	2065.37	7/2 ⁻	206.91	5/2 ⁺	E1		0.000875 12	E_γ, I_γ : other: 1858.6 5, with $I_\gamma=1.18$ 22 (1990Sa32). Mult.: $\alpha(K)\text{exp}=4.4\times 10^{-4}$ 12.
1867.3 1	0.68 2	2074.22	7/2 ⁻	206.91	5/2 ⁺	E1		0.000878 12	E_γ, I_γ : other: 1867.5 5, with $I_\gamma=0.57$ 14 (1990Sa32). Mult.: $\alpha(K)\text{exp}=2.9\times 10^{-4}$ 8.
1891.8 3	0.043 6	2352.30	(7/2 ⁻ , 9/2)	460.49	7/2 ⁺				
1892.4 4	0.038 6	1928.15	(7/2 ⁻ , 9/2 ⁻)	35.75	11/2 ⁻				
1910.2 2	0.131 15	2117.14	(5/2 ⁻ , 7/2 ⁻)	206.91	5/2 ⁺	(E1)		0.000895 13	Mult.: $\alpha(K)\text{exp}=4.0\times 10^{-4}$ 20.
1917.4 1	1.64 2	1953.13	9/2 ⁻	35.75	11/2 ⁻	E2(+M1)	>1.3	0.00112 6	E_γ, I_γ : others: 1917.1 5, with $I_\gamma=1.57$ 13 (1990Sa32); 1917.6 4, with $I_\gamma=1.62$ 16 (1981ZuZZ , unplaced). Mult., δ : from $\alpha(K)\text{exp}=7.2\times 10^{-4}$ 5; E2 given in Table 1 of 2019MeZX .
1979.5 4	0.046 11	2014.73	(9/2) ⁻	35.75	11/2 ⁻				
2026.2 4	0.05 2	2486.59	(5/2, 7/2, 9/2 ⁺)	460.49	7/2 ⁺				
2029.6 1	2.58 20	2065.37	7/2 ⁻	35.75	11/2 ⁻	E2		1.04×10 ⁻³ 1	Mult.: $\alpha(K)\text{exp}=6.1\times 10^{-4}$ 5. E_γ, I_γ : other: 2030.3 4, with $I_\gamma=2.36$ 24 (1981ZuZZ), unplaced.
2038.5 2	0.252 12	2074.22	7/2 ⁻	35.75	11/2 ⁻	E2		1.03×10 ⁻³ 1	Mult.: $\alpha(K)\text{exp}=6.6\times 10^{-4}$ 13.
2087.3 5	0.012 6	2547.5	(5/2, 7/2 ⁺)	460.49	7/2 ⁺				
2105.4 4	0.029 10	2566.1	(7/2 ⁻ , 9/2)	460.49	7/2 ⁺				
2113.0 4	0.029 10	2573.4	(7/2 ⁻ , 9/2)	460.49	7/2 ⁺				
2125.3 3	0.17 3	2161.04	(9/2) ⁻	35.75	11/2 ⁻	D,E2			Mult.: $\alpha(K)\text{exp}=4.0\times 10^{-4}$ 20.
2128.1 1	0.02 1	2588.60	(5/2, 7/2)	460.49	7/2 ⁺				
2224.3 3	0.13 3	2260.33	(7/2 ⁻ , 9/2)	35.75	11/2 ⁻				
2279.6 3	0.034 10	2486.59	(5/2, 7/2, 9/2 ⁺)	206.91	5/2 ⁺				
2309.3 3	0.058 6	2516.33	(7/2 ⁻)	206.91	5/2 ⁺				
2316.4 3	0.043 9	2352.30	(7/2 ⁻ , 9/2)	35.75	11/2 ⁻				
2340.5 5	0.030 12	2547.5	(5/2, 7/2 ⁺)	206.91	5/2 ⁺				
2416.7 3	0.036 7	2452.5	(9/2 ⁻)	35.75	11/2 ⁻				
2446.5 4	0.027 6	2547.5	(5/2, 7/2 ⁺)	100.75	3/2 ⁺				
2480.6 5	0.014 4	2516.33	(7/2 ⁻)	35.75	11/2 ⁻				
2530.5 4	0.012 5	2566.1	(7/2 ⁻ , 9/2)	35.75	11/2 ⁻				
2537.6 4	0.012 5	2573.4	(7/2 ⁻ , 9/2)	35.75	11/2 ⁻				
2625.6 4	0.015 5	2661.4	(9/2 ⁻)	35.75	11/2 ⁻				

[†] All values are taken from the most complete study by **2019MeZX** for internal consistency, unless otherwise noted. Values are also available from **1990Sa32** for

¹⁴⁹Dy ε decay (4.2 min) [2019MeZX](#) (continued)

$\gamma(^{149}\text{Tb})$ (continued)

76 transitions, but are much less complete than those in [2019MeZX](#); they are given under comments where available, with intensities being renormalized by the evaluators relative to $I\gamma(1776.2\gamma)=11.66$ in [2019MeZX](#) from original values relative to $I\gamma(100.7\gamma)=100$. The $I\gamma(100.7\gamma)$ is not chosen as the normalization reference due to the poorly-known efficiency curve within the low energy range. Values from [1981ZuZZ](#) are considered as preliminary and are not listed.

[‡] Transition observed only in coincidence spectra ([2019MeZX](#)).

[#] From the Adopted Gammas. Assignments are from or supported by α data in [2019MeZX](#), which are given under comments where available. For Mult=M1+E2 only available from ¹⁴⁹Dy ε decay (4.2 m), adopted δ is deduced by the evaluators from $\alpha(K)\text{exp}$ and/or $\alpha(L)\text{exp}$ using the BrIccMixing code.

@ α data for strongest component of a complex Tb line ([2019MeZX](#)).

& α data for weak component of a complex Tb line ([2019MeZX](#)).

^a α data for component of a complex Tb line ([2019MeZX](#)).

^b Absolute intensity per 100 decays.

^c Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^d Multiply placed with undivided intensity.

^e Multiply placed with intensity suitably divided.

^f Placement of transition in the level scheme is uncertain.

^x γ ray not placed in level scheme.

¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

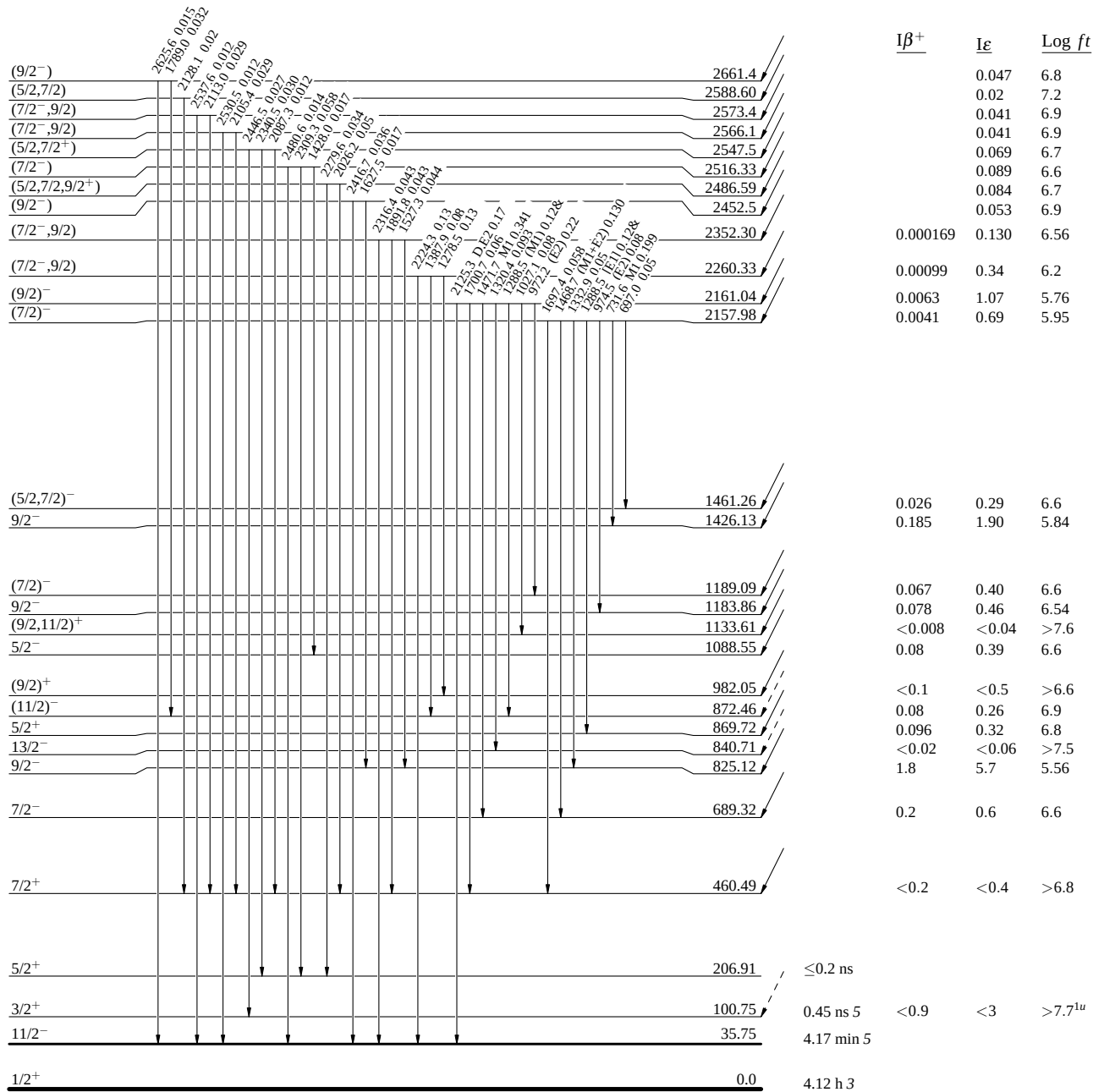
Decay Scheme

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}

7/2⁻ 0 4.2 min 2
Q_ε=3795.9
¹⁴⁹Dy₈₃



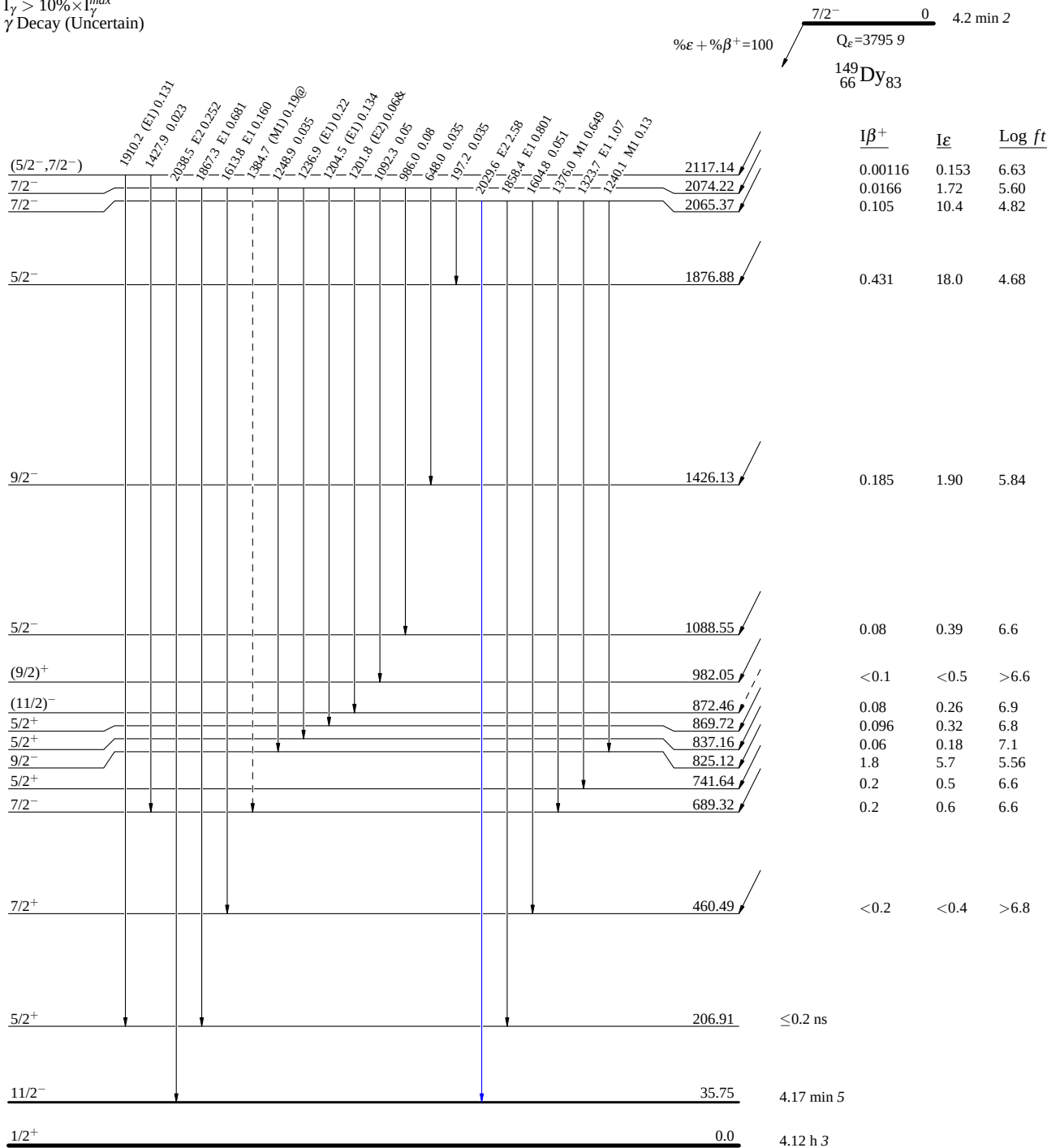
¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - - γ Decay (Uncertain)



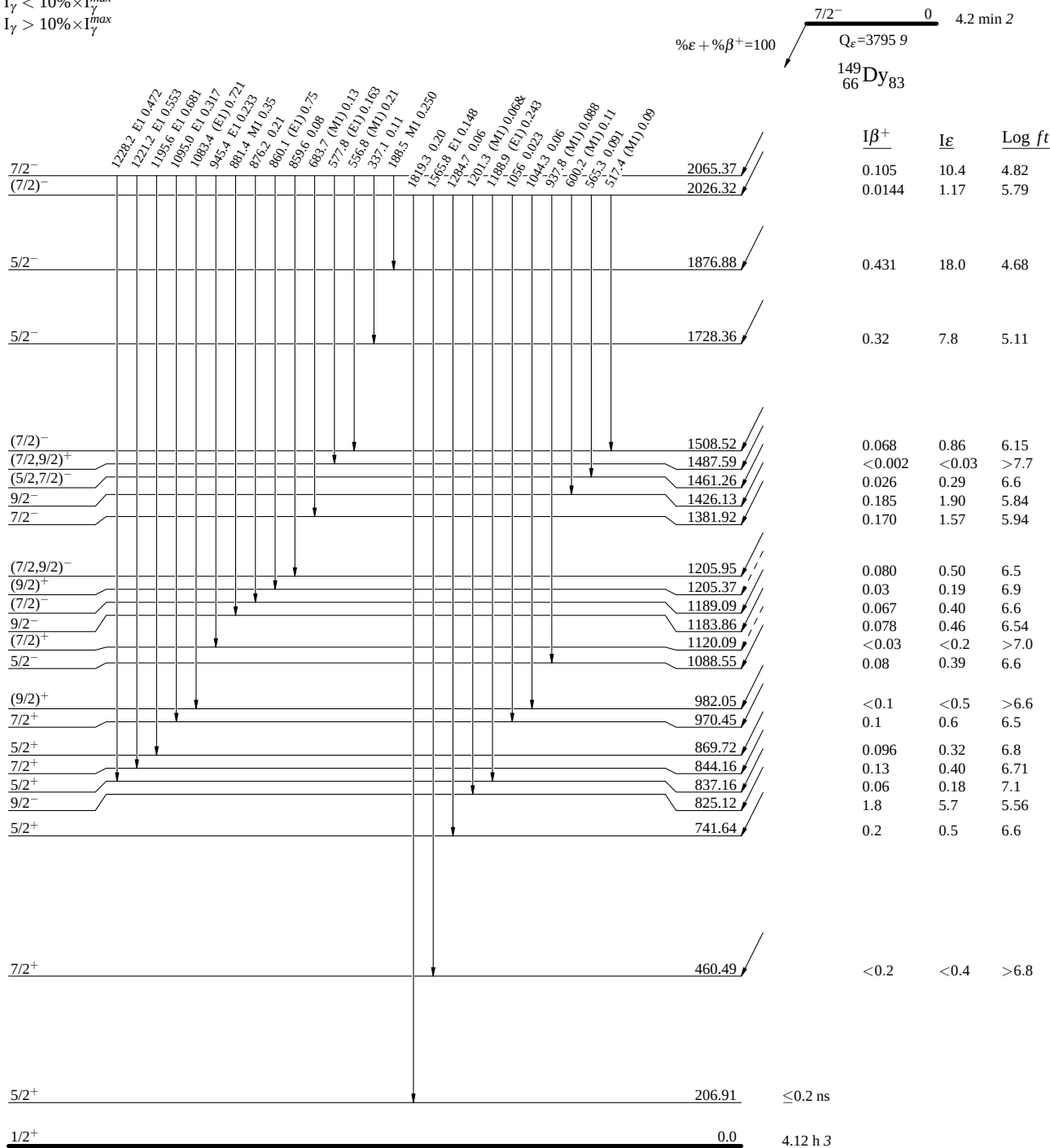
¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}



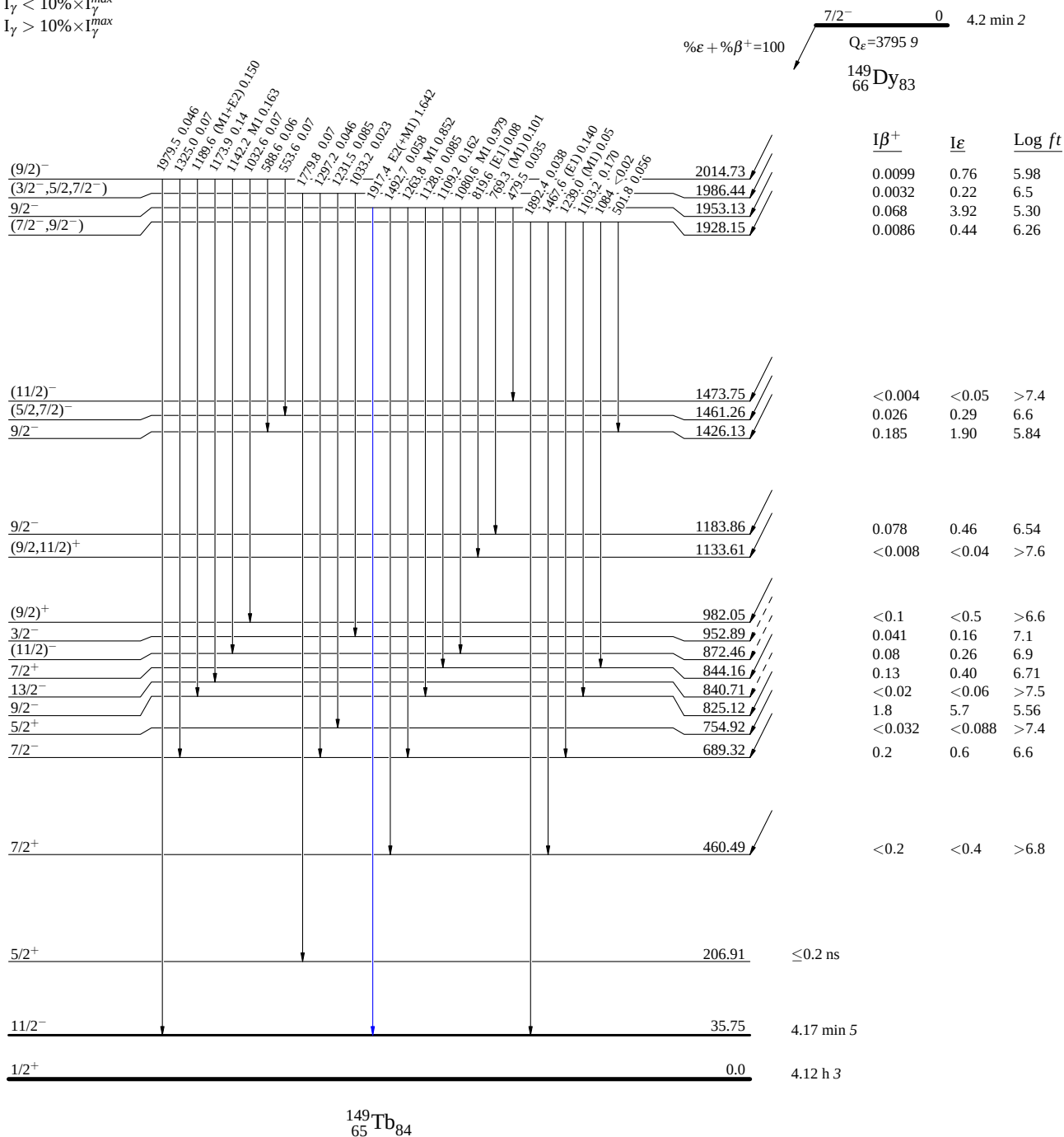
^{149}Dy ε decay (4.2 min) 2019MeZX

Decay Scheme (continued)

Intensities: $I_{\gamma+ce}$ per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- $I_{\gamma} < 2\% \times I_{\gamma}^{\max}$
— $I_{\gamma} < 10\% \times I_{\gamma}^{\max}$
— $I_{\gamma} > 10\% \times I_{\gamma}^{\max}$



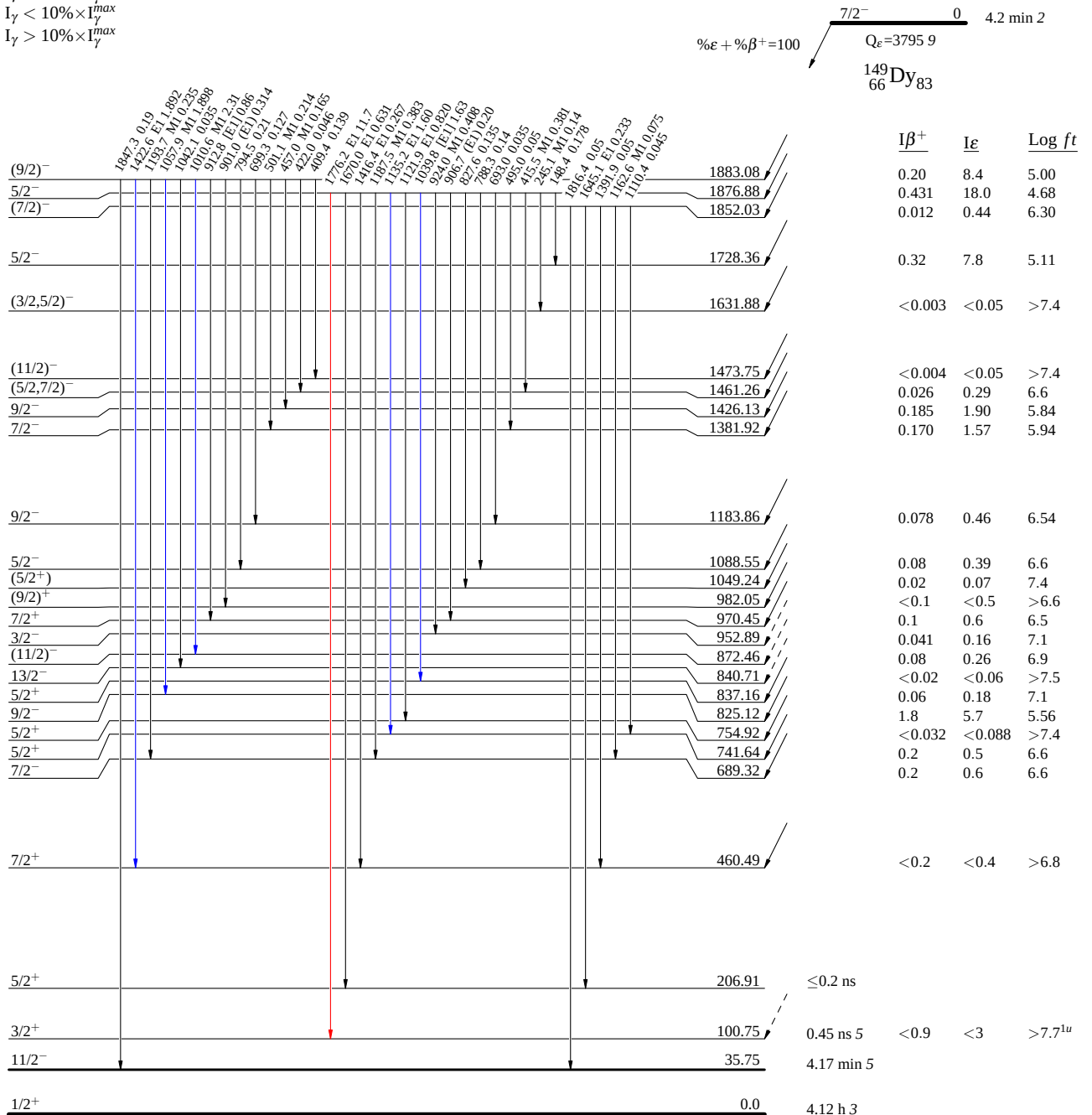
¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}



¹⁴⁹Tb₈₄

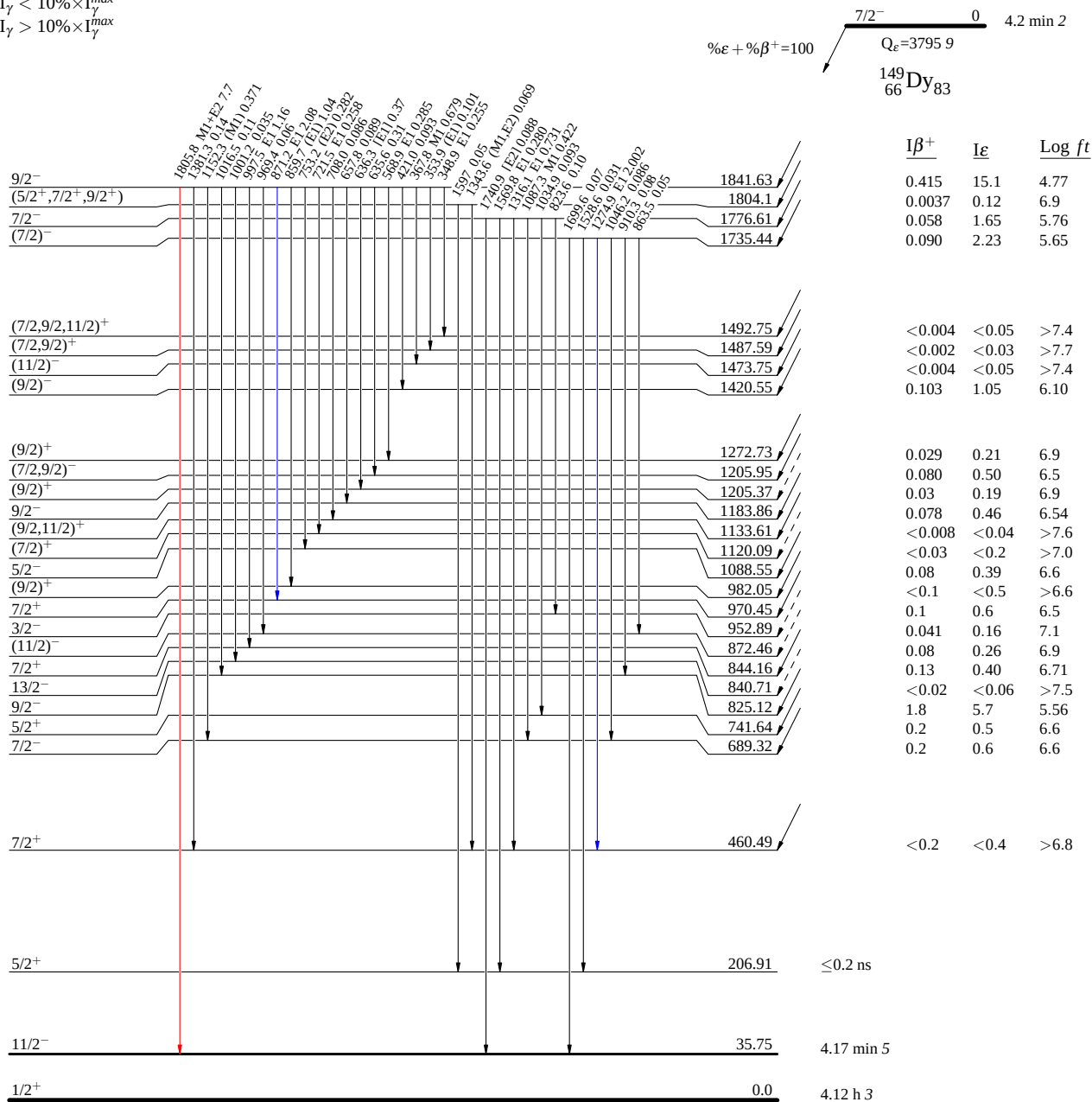
¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}



¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

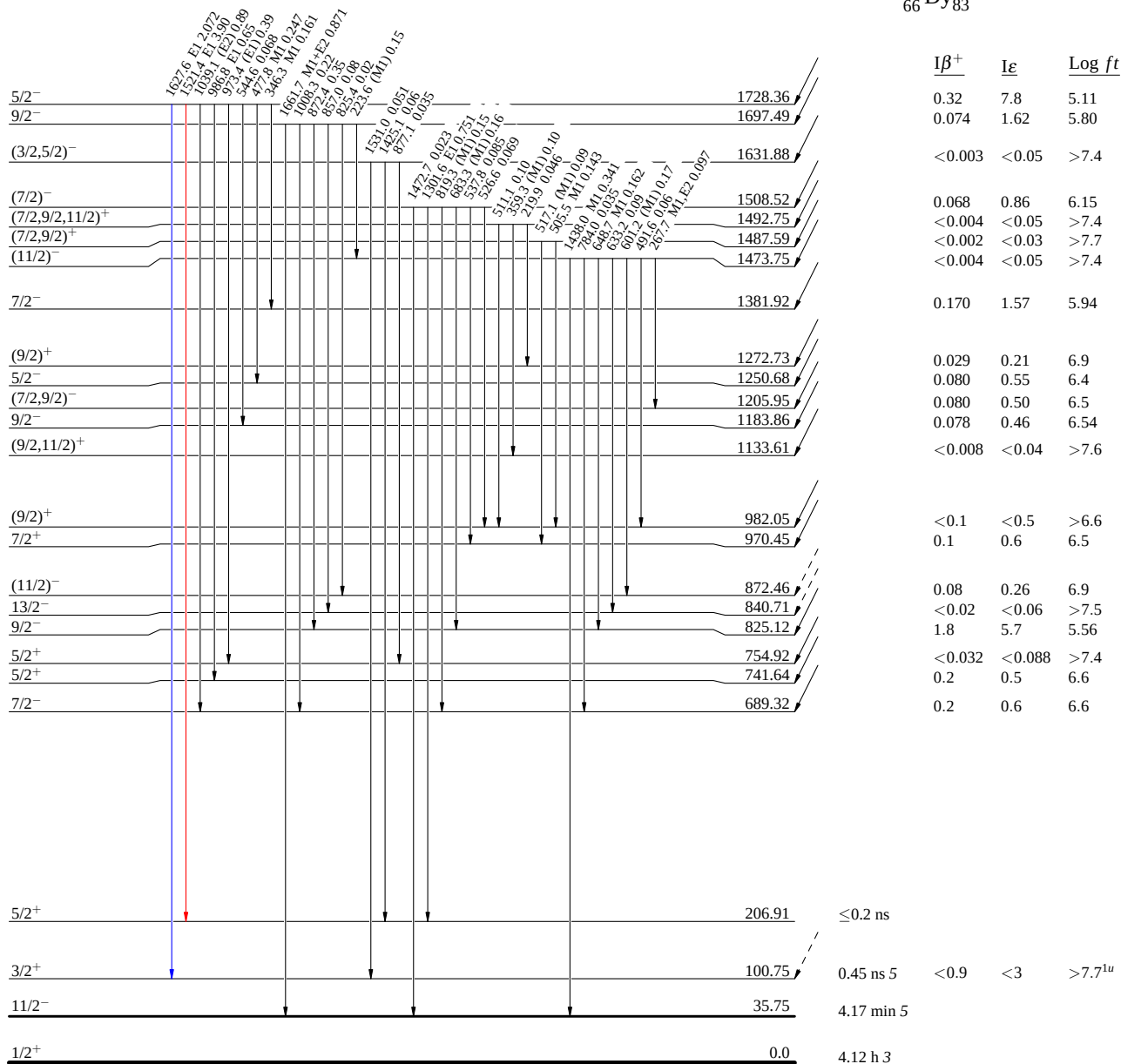
Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}

7/2⁻ 0 4.2 min 2
Q_ε=3795.9
¹⁴⁹Dy₈₃



¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

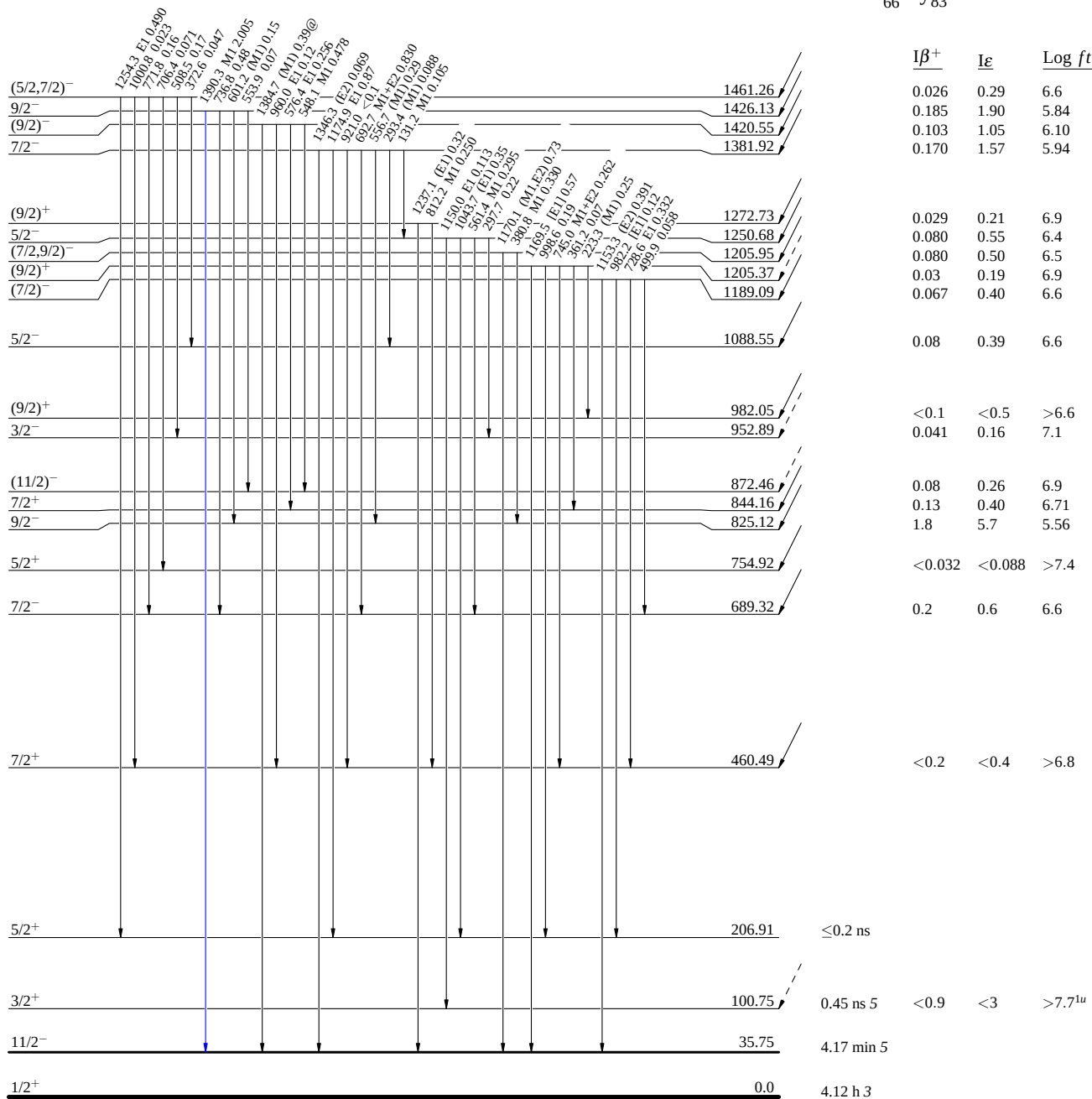
Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}

¹⁴⁹Dy₈₃
7/2⁻ 0 4.2 min 2
Q_ε=3795.9
%ε + %β⁺=100



¹⁴⁹Dy ε decay (4.2 min) 2019MeZX

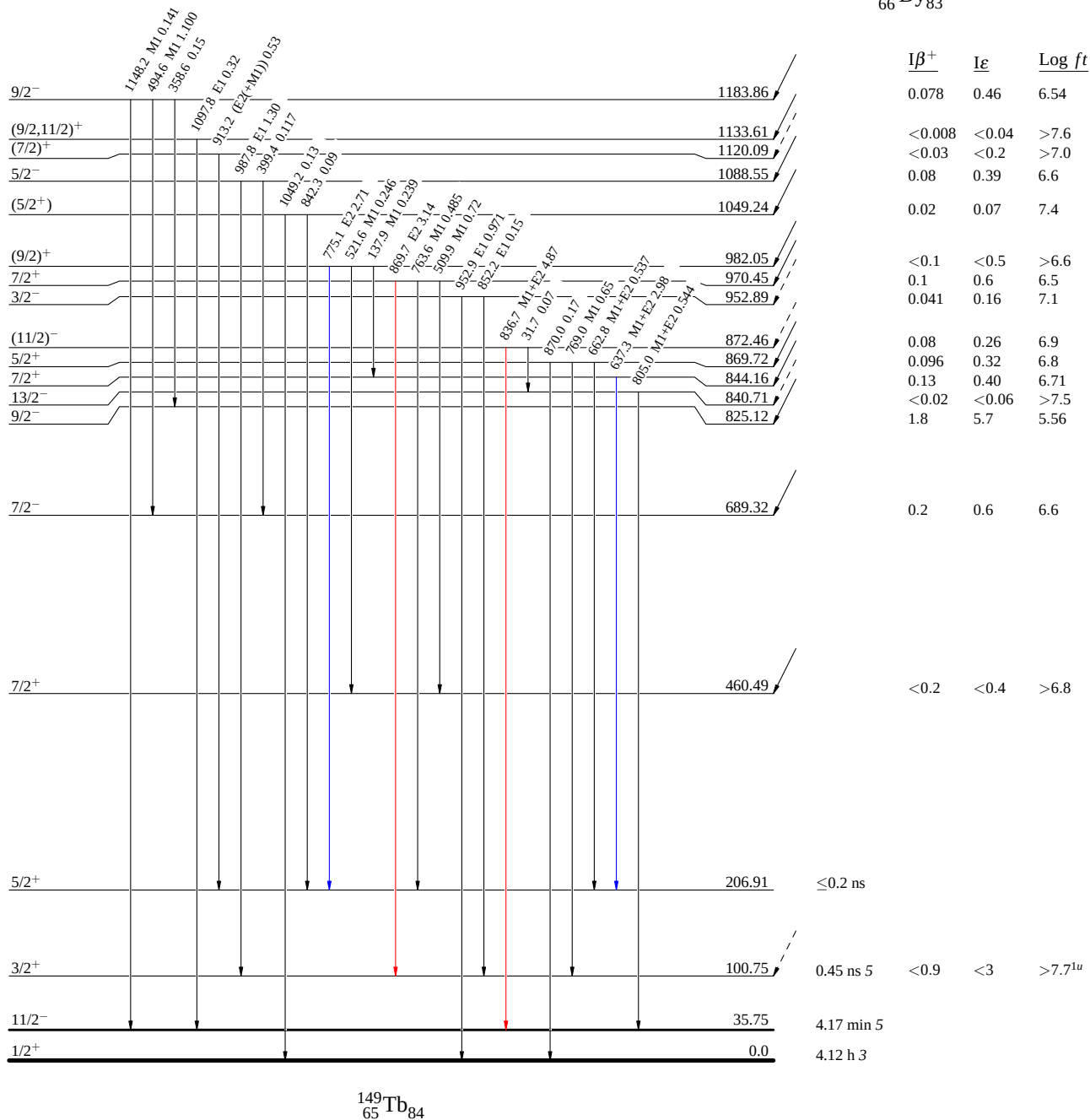
Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}

7/2⁻ 0 4.2 min 2
Q_ε=3795.9
¹⁴⁹Dy₈₃
66



¹⁴⁹Tb₈₄

^{149}Dy ε decay (0.490 s) [1993KlZZ,1988Ba02](#)

Parent: ^{149}Dy : $E=2661.94$ 34; $J^\pi=(27/2)^-$; $T_{1/2}=0.490$ s 15; $Q(\varepsilon)=3795$ 9; $\% \varepsilon + \% \beta^+$ decay=0.7 3

^{149}Dy -E, J^π , $T_{1/2}$: From ^{149}Dy Adopted Levels.

^{149}Dy -Q(ε): From [2021Wa16](#).

^{149}Dy - $\% \varepsilon + \% \beta^+$ decay: From estimated $\% \varepsilon + \% \beta^+$ branch $\approx 0.7\%$ 3 ([1988Ba02](#)); for bare atom ([2003Li42](#)) $\% \varepsilon = 0$.

[1993KlZZ](#): Measured E_γ , I_γ , $\gamma\gamma$; analyzed Gamow-Teller decay.

[1988Ba02](#): Source produced by $^{90}\text{Zr}(^{64}\text{Zn},n4p)$ and $^{89}\text{Y}(^{64}\text{Zn},n3p)$; measured E_γ , I_γ , decay characteristics.

[2003Li42](#): decay of fully-ionized atom; ^{149}Dy isomer nuclei produced in fragmentation of ^{209}Bi projectile at 900 MeV/nucleon; separated with fragment separator (FRS) and stored in the cooler ring (ESR) at GSI. Measured half-life of fully ionized ^{149}Dy .

 ^{149}Tb Levels

E(level) [†]	J^π [‡]	$T_{1/2}$	Comments
35.75 8	11/2 ⁻	4.17 min 5	$\% \varepsilon + \% \beta^+ = 99.978$ 4; $\% \alpha = 0.022$ 4 Energy, $T_{1/2}$ and decay modes from the Adopted Levels.
822.3 3	15/2 ⁻		
1381.9 5	19/2 ⁻		
1672.5 6	23/2 ⁻		
2302.9 6	(27/2) ⁻		
2663.9 7	(25/2) ⁻		

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_\gamma = 0.3$ keV.

[‡] From the Adopted Levels.

 ε, β^+ radiations

E(decay)	E(level)	$I\beta^+$ [†]	$I\varepsilon$ [†]	Log ft	$I(\varepsilon + \beta^+)$ [†]
(3793 9)	2663.9	0.3 1	0.4 2	4.3 3	0.7 3

[†] Absolute intensity per 100 decays.

 $\gamma(^{149}\text{Tb})$

E_γ [†]	I_γ ^{†#}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	$\alpha^@$	Comments
290.6	120	1672.5	23/2 ⁻	1381.9	19/2 ⁻	E2	0.0688 10	$\% I_\gamma = 0.84$ 36
361.0	120	2663.9	(25/2) ⁻	2302.9	(27/2) ⁻	M1	0.0637 9	$\% I_\gamma = 0.84$ 36
559.6	100	1381.9	19/2 ⁻	822.3	15/2 ⁻	E2	0.01089 15	$\% I_\gamma = 0.70$ 30
630.4	100	2302.9	(27/2) ⁻	1672.5	23/2 ⁻	E2	0.00812 11	$\% I_\gamma = 0.70$ 30
786.5	120	822.3	15/2 ⁻	35.75	11/2 ⁻	E2	0.00486 7	$\% I_\gamma = 0.84$ 36

[†] From [1993KlZZ](#). Full details of this study are not available.

[‡] From the Adopted Gammas.

For absolute intensity per 100 decays, multiply by 0.007 3.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

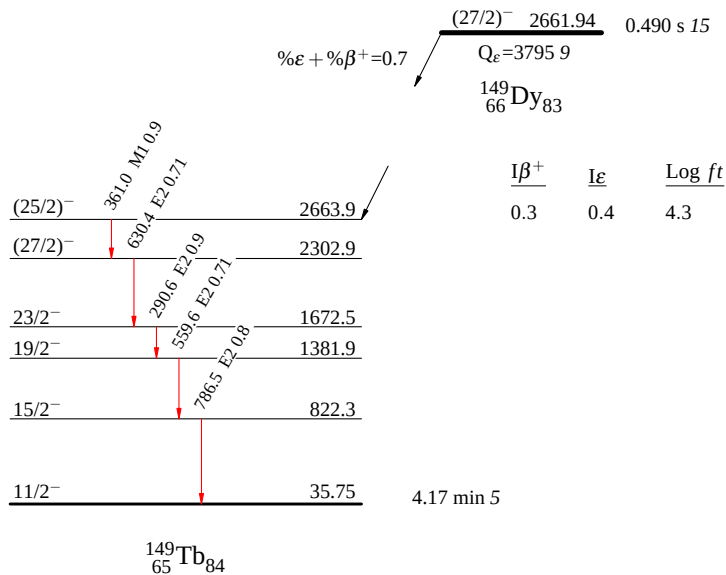
^{149}Dy ε decay (0.490 s) 1993K1ZZ,1988Ba02

Decay Scheme

 Intensities: $I_{(\gamma+ce)}$ per 100 parent decays

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
 —→ $I_\gamma < 10\% \times I_\gamma^{max}$
 —→ $I_\gamma > 10\% \times I_\gamma^{max}$



^{153}Ho α decay (2.01 min) 1974Sc19

Parent: ^{153}Ho : $E=0.0$; $J^\pi=11/2^-$; $T_{1/2}=2.01$ min 3; $Q(\alpha)=4052$ 4; $\% \alpha$ decay=0.051 25

^{153}Ho - $J^\pi, T_{1/2}$: From ^{153}Ho Adopted Levels in the ENSDF database (August 2020 update).

^{153}Ho - $Q(\alpha)$: From 2021Wa16.

^{153}Ho - $\% \alpha$ decay: Deduced from the $K\alpha_1$ X-ray and γ -ray intensities (1974Sc19).

1974Sc19: source produced in $^{147}\text{Sm}(^{10}\text{B}, 4n)$ reaction with $E=53$ MeV beam from the Oak Ridge isochronous cyclotron (ORIC).

Measured $E\alpha$, $I\alpha$, $I(K\alpha \text{ x-ray})$, $E\gamma$, $I\gamma$. Deduced α decay branching ratio.

Other measurements: 1971To01, 1978AfZZ, 1988To13.

See also ^{153}Ho α decay (9.3 min).

1964Ma10 have tentatively assigned a 27-min α activity to ^{153}Ho as a precursor of an observed 5-d activity assumed to be ^{145}Eu .

This assignment has not been adopted by the evaluators.

 ^{149}Tb Levels

<u>E(level)</u>	<u>J^π</u>	<u>$T_{1/2}$</u>	<u>Comments</u>
35.75 8	11/2 ⁻	4.17 min 5	$\% \epsilon + \% \beta^+ = 99.978$ 4; $\% \alpha = 0.022$ 4 Energy, J^π , $T_{1/2}$ and decay modes from the Adopted Levels.

 α radiations

<u>$E\alpha$</u>	<u>E(level)</u>	<u>$I\alpha^\ddagger$</u>	<u>HF[†]</u>	<u>Comments</u>
3909 5	35.75	100	0.5 3	$E\alpha$: weighted average of 3910 5 (1974Sc19) and 3905 10 (1978AfZZ). Other: 1988To13.

[†] The nuclear radius parameter $r_0(^{149}\text{Tb})=1.565$ 11 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in 2020Si16.

[‡] For absolute intensity per 100 decays, multiply by 0.00051 25.

¹⁵³Ho α decay (9.3 min) 1974Sc19

Parent: ¹⁵³Ho: E=68.7 3; J ^{π} =1/2⁺; T_{1/2}=9.3 min 5; Q(α)=4052 4; % α decay=0.18 8

¹⁵³Ho-E, J ^{π} , T_{1/2}: From ¹⁵³Ho Adopted Levels in the ENSDF database (August 2020 update).

¹⁵³Ho-Q(α): From 2021Wa16.

¹⁵³Ho-% α decay: Deduced from the K α_1 X-ray and γ -ray intensities (1974Sc19).

1974Sc19: source produced in ¹⁴⁷Sm(¹⁰B,4n) reaction with E=45 and 53 MeV beam from the Oak Ridge isochronous cyclotron (ORIC). Measured E α , I α , I(K α x-ray), E γ , I γ . Deduced α decay branching ratio.

Other measurements: 1978AfZZ, 1971To01, 1968Go13, 1967Ha34, 1963Ma17.

See also ¹⁵³Ho α decay (2.0 min).

1964Ma10 have tentatively assigned a 27-min α activity to ¹⁵³Ho as a precursor of an observed 5-d activity assumed to be ¹⁴⁵Eu.

This assignment has not been adopted by the evaluators.

¹⁴⁹Tb Levels

<u>E(level)</u>	<u>J^{π}[†]</u>	<u>T_{1/2}[†]</u>
0.0	1/2 ⁺	4.12 h 3

[†] From the Adopted Levels.

α radiations

<u>Eα</u>	<u>E(level)</u>	<u>Iα[‡]</u>	<u>HF[†]</u>	<u>Comments</u>
4010 5	0.0	100	3.3 15	E α : weighted average of 4011 5 (1974Sc19), 4008 10 (1978AfZZ) and 4010 5 (1968Go13).

[†] The nuclear radius parameter r₀(¹⁴⁹Tb)=1.565 11 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in 2020Si16.

[‡] For absolute intensity per 100 decays, multiply by 0.0018 8.

$^{122}\text{Sn}(^{31}\text{P},4n\gamma)$ 1994Me12

1994Me12 (also 1990MeZU,1991Me04): two measurements were performed. In the first one of gamma spectroscopy, E=150 MeV beam was produced from the Strasbourg MP Tandem accelerator and target was isotopically enriched ^{122}Sn on a lead backing. γ rays were detected with the Chateau de Cristal multi-detector array consisting of 12 Compton-suppressed Ge detectors surrounding a 38-BaF₂ sum-energy and multiplicity filter. Measured E_γ , I_γ , $\gamma\gamma$ -coin, $\gamma\gamma(\theta)$ (DCO at 90° and 33°). In the second measurement of electron spectroscopy, E=140 and 150 beams were from the MP Tandem in Orsay. Targets were 1 mg/cm² ^{122}Sn . γ rays were detected with a Ge detector and an array of 8 BaF₂ crystals and conversion electrons were detected with a cooled Si(Li) detector. Measured E_γ , I_γ , E(ce), I(ce), ce- γ -coin, ce(t). Deduced levels, J, π , $T_{1/2}$, configurations, band structures, conversion coefficients, γ -ray multipolarities, mixing ratios. Comparison with theoretical calculations. The author also mention a measurement of electron spectroscopy using $^{134}\text{Ba}(^{19}\text{F},4n\gamma)$ at E=90 MeV but no data are given. The 61/2⁺ isomer at 9955 and four levels above the isomer were studied by 1991Me04 in ($^{31}\text{P},4n\gamma$). Level scheme interpretation (1994Me12) in terms of deformed independent particle model.

Other:

1990CoZW: $^{121}\text{Sb}(^{28}\text{Si},f)$ E=344 MeV: (fragment)(particle) coin.

 ^{149}Tb Levels

E(level) [†]	J $\pi^{\ddagger}$	$T_{1/2}$	Comments
35.75@ 8	11/2 ⁻	4.17 min 5	% ϵ +% β^+ =99.978 4; % α =0.022 4 Energy, J π , $T_{1/2}$ and decay modes from the Adopted Levels.
822.3@ 3	15/2 ⁻		
1129.0& 4	15/2 ⁺		
1382.3@ 4	19/2 ⁻		
1672.8@ 5	23/2 ⁻		
1813.6 5	21/2 ⁻		
1868.0& 5	19/2 ⁺		
2303.1@ 5	27/2 ⁻		
2350.2& 5	23/2 ⁺		
2518.7& 5	27/2 ⁺	2.4 ns 2	$T_{1/2}$: from the Adopted Levels.
2812.8& 6	29/2 ⁺		
3141.8& 6	31/2 ⁺		
3526.9& 6	33/2 ⁺		
3603.1@ 12	31/2 ⁻		
4061.6 7			
4107.1 7	(31/2 ⁺)		
4208.4 ^a 6	33/2 ⁺		
4463.2 ^a 6	35/2 ⁺		
4673.9 ^a 6	37/2 ⁺		
4923.3 ^a 6	39/2 ⁺		Other possible configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12).
5148.1 ^a 6	41/2 ⁺		Other possible configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12).
5257.9 6	39/2 ⁻		Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2}^2$ (1994Me12).
5618.8 ^b 7	41/2 ⁻		
5712.4 ^b 6	43/2 ⁻		
5735.1 7	45/2 ⁺		
5966.1 7	(43/2 ⁺)		Configuration= $\pi h_{11/2}^2 \otimes \pi g_{7/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ (1994Me12).
6025.2 ^c 7	43/2 ⁻		
6112.2 ^b 7	45/2 ⁻		
6220.9 ^c 7	45/2 ⁻		
6400.7 ^c 7	47/2 ⁻		

Continued on next page (footnotes at end of table)

$^{122}\text{Sn}(^{31}\text{P},4n\gamma)$ **1994Me12** (continued) ^{149}Tb Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
6788.5 7	47/2 ⁺		Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (1994Me12).
6874.3 7	47/2 ⁺		
7112.8 7	(49/2) ⁺		Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}$ (1994Me12).
7194.2 7	49/2		
7740.9 8	51/2		
7976.5 [#] 7	(51/2) ⁺		
8048.5 10	(51/2) ⁺		
8247.4 [#] 7	53/2 ⁺		
8281.1 8	53/2		
8733.7 [#] 8	55/2 ⁽⁺⁾		
8922.1 8	(53/2) ⁺		
9197.2 9	59/2 ⁽⁺⁾		
9227.6? 8			
9482.6? 8			
9771.7 8	57/2 ⁺		Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}$ (1994Me12).
9955.8 8	61/2 ⁺	4.0 ns 2	T _{1/2} : from ce(K)(t) (1991Me04 , 1994Me12). Configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2}^2 \otimes \nu h_{9/2} \otimes \nu i_{13/2} \otimes \nu d_{3/2}^{-2}$ (1994Me12).
10184.2? 13			
11000.7 9	65/2 ⁺		Configuration= $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}^2 \otimes \nu d_{3/2}^{-2}$ (1994Me12).
11177.2? 17			
11204.7 ^d 9	67/2 ⁻		
12152.4 ^d 10	71/2 ⁽⁻⁾		
13118.2 ^d 10	75/2 ⁽⁻⁾		

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_\gamma = 1$ keV for E_γ values quoted as near to keV and 0.3 keV otherwise.

[‡] As proposed by **1994Me12** based on measured $\gamma\gamma$ (DCO), ce data, and known assignments of low-lying states. The assignments are the same in the Adopted Levels, except that several are placed in parentheses, where strong arguments seem lacking.

[#] Configuration = $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ multiplet (**1994Me12**).

@ Band(A): Band based on 11/2⁻. Configuration = $\pi h_{11/2} \otimes \nu f_{7/2}^2$ (**1994Me12**).

& Band(B): Band based on 15/2⁺. Configuration = $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (**1994Me12**).

^a Band(C): Band based on 33/2⁺. Configuration = $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2}^2$ (**1994Me12**).

^b Band(D): Band based on 41/2⁻. Configuration = $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (**1994Me12**).

^c Band(E): Band based on 43/2⁻. Configuration = $\pi h_{11/2}^2 \otimes \pi g_{7/2}^{-1} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (**1994Me12**).

^d Band(F): Band based 67/2⁻, multi-qp band. Configuration = $\pi h_{11/2}^{+3} \otimes \pi d_{5/2}^{-2} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes \nu i_{13/2}^{+2} \otimes \nu d_{3/2}^{-2}$ (**1994Me12**).

¹²²Sn(³¹P,4n γ) **1994Me12 (continued)** $\gamma(^{149}\text{Tb})$

γ -ray assignments in the level scheme are from $\gamma\gamma$ -coin data of **1994Me12** built on previous work of **1991La17** and **1979Si19**. Above 5148 level, all levels are from **1994Me12**.

For DCO measurements, the gating transition is generally $\Delta J=2$, E2, in which case $\text{DCO}\approx 1$ suggests $\Delta J=2$, quadrupole and for $\Delta J=0$, dipole; $\text{DCO}>1$ suggests $\Delta J=1$, dipole or dipole+quadrupole.

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult.#	δ^a	$\alpha^\&$	Comments
93.6	2.0 5	5712.4	43/2 ⁻	5618.8	41/2 ⁻	M1		2.66 4	$\alpha(\text{L})\text{exp}=0.38$ 14; $\text{DCO}=1.8$ 5
140.7	1.5 5	1813.6	21/2 ⁻	1672.8	23/2 ⁻	E2(+M1)	>1	0.781 20	$\alpha(\text{K})\text{exp}=0.46$ 12; $\text{DCO}=1.9$ 6
146.2	2.2 5	6112.2	45/2 ⁻	5966.1	(43/2 ⁺)	(E1)		0.1082 15	$\alpha(\text{K})\text{exp}=0.14$ 4; $\text{DCO}=1.6$ 3
168.5	11 1	2518.7	27/2 ⁺	2350.2	23/2 ⁺	E2		0.409 6	$\alpha(\text{K})\text{exp}=0.31$ 5; $\text{DCO}=1.1$ 2
180.0	8 1	6400.7	47/2 ⁻	6220.9	45/2 ⁻	M1+E2	1.3 +18-6	0.360 28	$\alpha(\text{K})\text{exp}=0.27$ 4; $\text{DCO}=1.3$ 2
184.1	25 2	9955.8	61/2 ⁺	9771.7	57/2 ⁺	E2		0.303 4	$\alpha(\text{K})\text{exp}=0.20$ 2; $\text{DCO}=1.0$ 1
195.9	3.6 5	6220.9	45/2 ⁻	6025.2	43/2 ⁻	M1+E2	0.9 +11-6	0.292 31	$\alpha(\text{K})\text{exp}=0.23$ 4; $\text{DCO}=2.2$ 6
204.0	21 1	11204.7	67/2 ⁻	11000.7	65/2 ⁺	E1		0.0446 6	$\alpha(\text{K})\text{exp}=0.035$ 7; $\text{DCO}=1.7$ 3
211.1	22 2	4673.9	37/2 ⁺	4463.2	35/2 ⁺	E2(+M1)	>1.2	0.207 16	$\alpha(\text{K})\text{exp}=0.14$ 3; $\text{DCO}=1.4$ 2
215.8	49 3	2518.7	27/2 ⁺	2303.1	27/2 ⁻	E1		0.0385 5	$\alpha(\text{K})\text{exp}=0.025$ 8; $\text{DCO}=1.1$ 1
									$\Delta J=0$ transition.
225.0	35 2	5148.1	41/2 ⁺	4923.3	39/2 ⁺	M1+E2	1.1 3	0.187 11	$\alpha(\text{K})\text{exp}=0.15$ 1; $\text{DCO}=1.5$ 1
238.6	5 1	7112.8	(49/2 ⁺)	6874.3	47/2 ⁺	M1		0.1925 27	$\alpha(\text{L})\text{exp}=0.044$ 20; $\text{DCO}=2.0$ 5
249.6	48 2	4923.3	39/2 ⁺	4673.9	37/2 ⁺	M1+E2	1.6 +10-5	0.128 10	$\alpha(\text{K})\text{exp}=0.10$ 1; $\text{DCO}=1.4$ 1
254	11.0 15	5966.1	(43/2 ⁺)	5712.4	43/2 ⁻	D		0.0252	$\text{DCO}=1.4$ 2
									Mult.: $\Delta J=0$ transition. Mult=(E1) in 1994Me12 .
255.0 ^a	1.5 5	9482.6?		9227.6?					$\alpha(\text{K})\text{exp}=0.075$ 14
									Mult.: $\alpha(\text{K})\text{exp}$ is for 255.0+255.2 doublet. 1994Me12
									conclude that DCO is consistent with dominant dipole for stronger (255.2) line, while the total conversion coefficient is that for an E2 transition, but according to the level scheme it is consistent with M1+E2 for the 255.2 γ and E1 for the 255.0 γ .
255.2	19 2	4463.2	35/2 ⁺	4208.4	33/2 ⁺	(M1+E2)		0.132 29	$\text{DCO}=1.6$ 2
									Mult.: D+Q from DCO, M1(+E2) in 1994Me12 . Intensity balance at 4463 level favors M1+E2.
288.0	13 2	6400.7	47/2 ⁻	6112.2	45/2 ⁻	M1+E2	1.1 +10-5	0.091 13	$\alpha(\text{K})\text{exp}=0.074$ 12; $\text{DCO}=1.5$ 2
289.0 ^a	1.5 5	9771.7	57/2 ⁺	9482.6?					
290.5	83 2	1672.8	23/2 ⁻	1382.3	19/2 ⁻	E2		0.0689 10	$\alpha(\text{K})\text{exp}=0.065$ 10; $\text{DCO}=1.1$ 2
294.2	53 2	2812.8	29/2 ⁺	2518.7	27/2 ⁺	M1+E2	0.9 2	0.090 5	$\alpha(\text{K})\text{exp}=0.075$ 5; $\text{DCO}=1.5$ 2
306.7	13 1	1129.0	15/2 ⁺	822.3	15/2 ⁻	E1		0.01567 22	$\alpha(\text{K})\text{exp}=0.013$ 3; $\text{DCO}=1.3$ 2
									$\Delta J=0$ transition.
324.1	21.0 15	7112.8	(49/2 ⁺)	6788.5	47/2 ⁺	M1		0.0846 12	$\alpha(\text{K})\text{exp}=0.082$ 10; $\text{DCO}=1.6$ 2
329.0	57 3	3141.8	31/2 ⁺	2812.8	29/2 ⁺	M1+E2	1.4 5	0.059 7	$\alpha(\text{K})\text{exp}=0.048$ 5; $\text{DCO}=1.4$ 1
356.2	4 1	4463.2	35/2 ⁺	4107.1	(31/2 ⁺)	Q			$\text{DCO}=0.8$ 2

¹²²Sn(³¹P,4nγ) **1994Me12** (continued)

γ(¹⁴⁹Tb) (continued)

E _γ [†]	I _γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Mult.#	δ@	α&	Comments
377.0	12 2	6112.2	45/2 ⁻	5735.1	45/2 ⁺	E1		0.00947 13	α(K)exp<0.01; DCO=1.8 2 ΔJ=0 transition.
385.1	41 2	3526.9	33/2 ⁺	3141.8	31/2 ⁺	M1		0.0538 8	α(K)exp=0.052 7; DCO=1.7 1
399.6	16 1	6112.2	45/2 ⁻	5712.4	43/2 ⁻	M1		0.0488 7	α(K)exp=0.050 8; DCO=1.4 2
431.4	4 1	1813.6	21/2 ⁻	1382.3	19/2 ⁻				
454.3	8.5 10	5712.4	43/2 ⁻	5257.9	39/2 ⁻	Q			DCO=1.0 1
460.0	13 1	4923.3	39/2 ⁺	4463.2	35/2 ⁺	E2		0.01815 25	α(K)exp=0.014 4; DCO=0.9 1
463.5	8 1	9197.2	59/2 ⁽⁺⁾	8733.7	55/2 ⁽⁺⁾	E2		0.01778 25	α(K)exp=0.012 3; DCO=1.2 2
465.4	8 1	4673.9	37/2 ⁺	4208.4	33/2 ⁺	E2		0.01759 25	α(K)exp=0.013 3; DCO=1.1 2
474.2	12 1	5148.1	41/2 ⁺	4673.9	37/2 ⁺	Q			DCO=1.1 1.
482.2	16 1	2350.2	23/2 ⁺	1868.0	19/2 ⁺	E2		0.01600 22	α(K)exp=0.015 3; DCO=1.0 1
486.0	14 1	6220.9	45/2 ⁻	5735.1	45/2 ⁺	E1		0.00525 7	α(K)exp=0.005 2; DCO=1.6 2 ΔJ=0 transition.
509.5	21.0 15	2812.8	29/2 ⁺	2303.1	27/2 ⁻	E1		0.00472 7	α(K)exp<0.005; DCO=1.5 2
534.8	2.7 10	4061.6		3526.9	33/2 ⁺				
536.7	4 1	2350.2	23/2 ⁺	1813.6	21/2 ⁻	D			DCO=2.2 7
540.1	9 1	8281.1	53/2	7740.9	51/2	D			DCO=1.9 7
546.7	10 1	7740.9	51/2	7194.2	49/2	M1+E2	1.3 +10-5	0.0154 25	α(K)exp=0.013 2; DCO=1.4 3
560.0	87 2	1382.3	19/2 ⁻	822.3	15/2 ⁻	E2		0.01087 15	α(K)exp=0.0094 8; DCO=1.0 1
564.1	22 2	5712.4	43/2 ⁻	5148.1	41/2 ⁺	E1		0.00377 5	α(K)exp=0.0037 10; DCO=1.5 2
567.6	9 1	6788.5	47/2 ⁺	6220.9	45/2 ⁻	E1		0.00372 5	α(K)exp=0.004 1; DCO=1.5 3
583.8	6 1	5257.9	39/2 ⁻	4673.9	37/2 ⁺	D			DCO=1.8 5 ΔJ=0 transition.
586.9	25.0 15	5735.1	45/2 ⁺	5148.1	41/2 ⁺	E2		0.00967 14	α(K)exp=0.0095 12; DCO=1.1 1
623.2	9 1	3141.8	31/2 ⁺	2518.7	27/2 ⁺	E2		0.00835 12	α(K)exp=0.005 2; DCO=1.0 3
630.2	81 2	2303.1	27/2 ⁻	1672.8	23/2 ⁻	E2		0.00813 11	α(K)exp=0.0064 7; DCO=1.0 1
676.3	20 1	6788.5	47/2 ⁺	6112.2	45/2 ⁻	E1		0.00257 4	α(K)exp=0.0025 6; DCO=1.5 3
681.8	4 1	4208.4	33/2 ⁺	3526.9	33/2 ⁺	M1		0.01256 18	α(K)exp=0.011 3; DCO=1.2 5 ΔJ=0 transition.
695.6	16 1	5618.8	41/2 ⁻	4923.3	39/2 ⁺	E1		2.42×10 ⁻³ 3	α(K)exp=0.0036 15; DCO=1.5 2
712.1	8 1	7112.8	(49/2) ⁺	6400.7	47/2 ⁻	E1		2.31×10 ⁻³ 3	α(K)exp=0.0036 15; DCO=1.3 2
714	4 1	3526.9	33/2 ⁺	2812.8	29/2 ⁺				
738.9	16 1	1868.0	19/2 ⁺	1129.0	15/2 ⁺	E2		0.00560 8	α(K)exp=0.0042 7; DCO=1.3 3
757.2	9 1	8733.7	55/2 ⁽⁺⁾	7976.5	(51/2 ⁺)	E2		0.00529 7	α(K)exp=0.0044 11; DCO=1.1 2
762.2	5.5 10	6874.3	47/2 ⁺	6112.2	45/2 ⁻				
786.5	100	822.3	15/2 ⁻	35.75	11/2 ⁻	E2		0.00486 7	α(K)exp=0.0042 8; DCO=1.0
793.5	6 1	7194.2	49/2	6400.7	47/2 ⁻	D			DCO=1.4 3
818.1	4 1	5966.1	(43/2 ⁺)	5148.1	41/2 ⁺	D			DCO=1.5 3
849.7	15.5 10	9771.7	57/2 ⁺	8922.1	(53/2 ⁺)	E2		0.00410 6	α(K)exp=0.0030 6; DCO=0.9 2
873	6.5 10	8922.1	(53/2 ⁺)	8048.5	(51/2 ⁺)	M1(+E2)	<0.6	0.0064 4	α(K)exp=0.006 2 M1 in 1994Me12 .
877.3	7 1	6025.2	43/2 ⁻	5148.1	41/2 ⁺	D			DCO=1.5 3
935	2.5 5	8048.5	(51/2 ⁺)	7112.8	(49/2 ⁺)				

¹²²Sn(³¹P,4n γ) **1994Me12** (continued)

$\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [#]	α ^{&}	Comments
945.8 ^a	7 1	8922.1	(53/2 ⁺)	7976.5	(51/2 ⁺)	D		DCO=1.4 2 See also comment for 947.7 γ .
946 ^a	2.0 5	9227.6?		8281.1	53/2			Mult.: see comment for 947.7 γ .
947.7	16 1	12152.4	71/2 ⁽⁻⁾	11204.7	67/2 ⁻	Q		DCO=0.8 2; $\alpha(\text{K})\text{exp}=0.005$ 1 $\alpha(\text{K})\text{exp}$ for 945.8 γ +946 γ +947.7 γ . If 947.7 γ is E2 ($\Delta J=2$ suggested by DCO), then the other two may be $\Delta J=1$, M1.
965.8	11 1	13118.2	75/2 ⁽⁻⁾	12152.4	71/2 ⁽⁻⁾	Q		DCO=0.9 2 DCO for 965.8 γ +966 γ .
966	3 1	4107.1	(31/2 ⁺)	3141.8	31/2 ⁺			DCO=0.9 2 DCO probably for 965.8+966 doublet. Mult.: Q given by 1994Me12 inconsistent with level scheme. $\Delta J=(0)$ transition.
987 ^{‡a}		10184.2?		9197.2	59/2 ⁽⁺⁾			
993 ^{‡a}		11177.2?		10184.2?				
1044.9	31 1	11000.7	65/2 ⁺	9955.8	61/2 ⁺	E2	0.00264 4	$\alpha(\text{K})\text{exp}=0.0026$ 4; DCO=0.86 15
1066.8	3 1	4208.4	33/2 ⁺	3141.8	31/2 ⁺			
1134.5	30 1	8247.4	53/2 ⁺	7112.8	(49/2) ⁺	E2	2.24×10^{-3} 3	$\alpha(\text{K})\text{exp}=0.0024$ 4; DCO=0.86 12
1146.6	38 1	4673.9	37/2 ⁺	3526.9	33/2 ⁺	E2	2.19×10^{-3} 3	$\alpha(\text{K})\text{exp}=0.0019$ 2; DCO=0.8 1
1188.2	8 1	7976.5	(51/2 ⁺)	6788.5	47/2 ⁺	(Q)		DCO=1.3 4 Mult=Q in 1994Me12 .
1197	4 1	5257.9	39/2 ⁻	4061.6				
1300	6.0 15	3603.1	31/2 ⁻	2303.1	27/2 ⁻			
1321.3	17 1	4463.2	35/2 ⁺	3141.8	31/2 ⁺	(E2)	1.67×10^{-3} 2	$\alpha(\text{K})\text{exp}<0.002$; DCO=0.8 1 E2 in 1994Me12 .
1395.6	16 1	4208.4	33/2 ⁺	2812.8	29/2 ⁺	(E2)	1.53×10^{-3} 2	$\alpha(\text{K})\text{exp}<0.002$; DCO=0.96 14 E2 in 1994Me12 .
1524.1	13 1	9771.7	57/2 ⁺	8247.4	53/2 ⁺	E2	1.34×10^{-3} 2	$\alpha(\text{K})\text{exp}=0.0012$ 2; DCO=0.9 1

[†] From **1994Me12**.

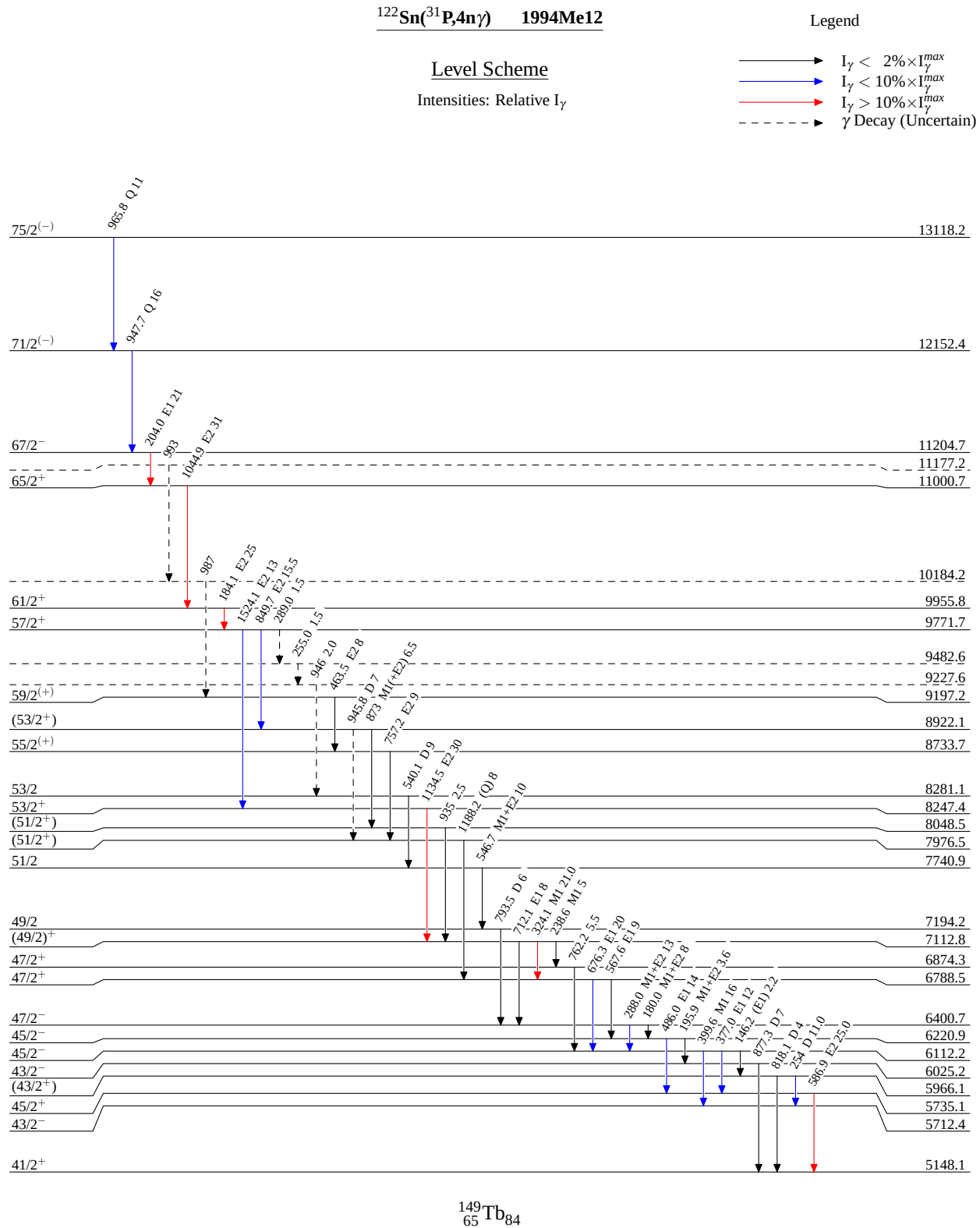
[‡] From the scheme in Fig.5 of **1994Me12**, not listed in Table 1.

[#] From $\gamma\gamma(\text{DCO})$ and ce data in **1994Me12**, given under comments.

@ From **1994Me12**. The uncertainties and some of the δ values have been deduced by the evaluators from $\alpha(\text{K})\text{exp}$ values of **1994Me12**.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

^a Placement of transition in the level scheme is uncertain.



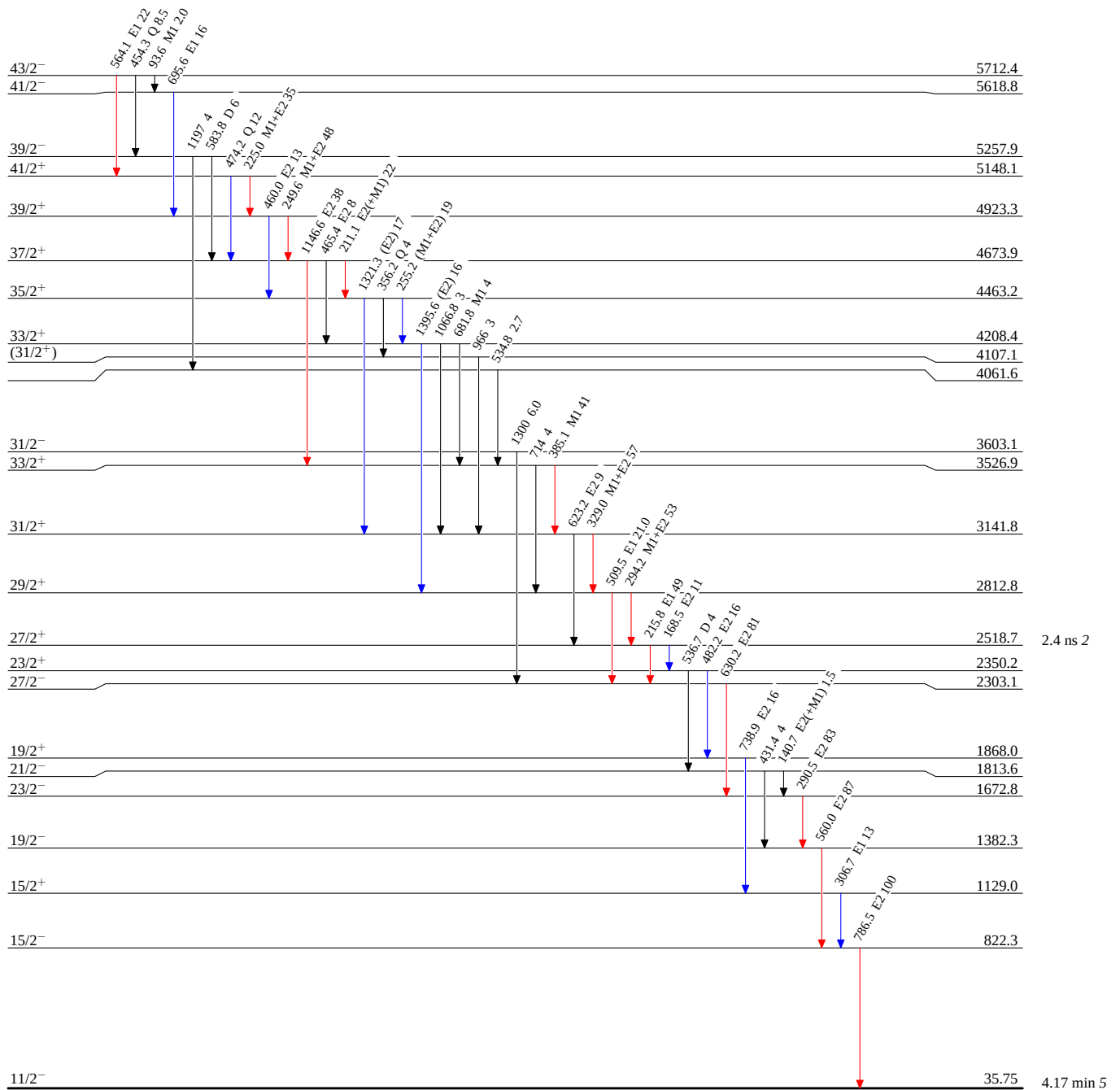
$^{122}\text{Sn}(^{31}\text{P}, 4n\gamma)$ 1994Me12

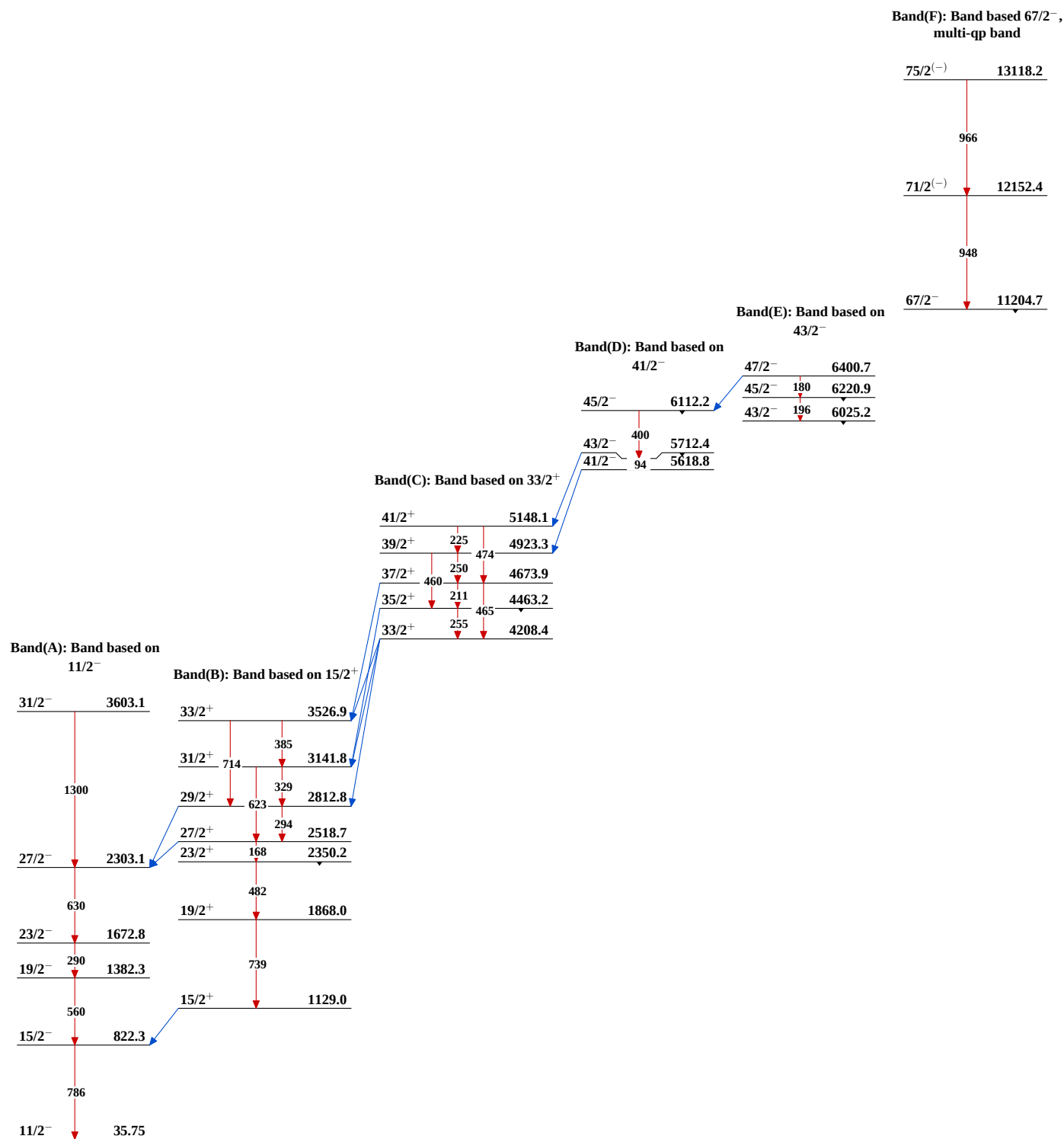
Level Scheme (continued)

Intensities: Relative I_γ

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{149}\text{Tb}_{84}$

$^{122}\text{Sn}(^{31}\text{P}, 4n\gamma)$ 1994Me12


$^{128}\text{Te}(^{27}\text{Al},6n\gamma):\text{SD}$ 1998Kh09

Also includes $^{124}\text{Sn}(^{31}\text{P},6n\gamma)$ from 2002By01.

1998Kh09: E=150 MeV ^{27}Al beam was produced from the 88-inch cyclotron at LBNL. Target was 1 mg/cm² ^{128}Te evaporated onto a 15 mg/cm² gold foil. γ rays were detected with the Gammasphere spectrometer with 95 operational Ge detectors. Measured γ , $\gamma\gamma$ -coin, $\gamma\gamma\gamma$ -coin, Doppler-shift attenuation. Deduced levels, J, super- deformed (SD) band structures, quadrupole moments, configurations. Five SD bands deduced.

2002By01: $^{124}\text{Sn}(^{31}\text{P},6n\gamma)$ E=167 MeV from the VIVITRON accelerator of the Institut de Recherches Subatomiques in Strasbourg. γ rays were detected with the EUROBALL IV array. Measured population of SD bands relative to that of levels in the first potential well.

All data are from 1998Kh09.

 ^{149}Tb Levels

$\sigma(\text{SD bands})/\sigma(\text{normal bands})=2.0 \pm 3$ (2002By01), interpreted as enhanced population in the reaction used.

E(level)	J^π	E(level)	J^π	E(level)	J^π	E(level)	J^π
$x^\ddagger$	J1	2890.7+y [#] 5	J2+8	3454.9+z [@] 5	J3+8	10622.9+u ^{&} 9	J4+20
740.1+x [‡] 2	J1+2	3741.2+y [#] 6	J2+10	4447.5+z [@] 6	J3+10	11976.9+u ^{&} 10	J4+22
1534.8+x [‡] 3	J1+4	4643.2+y [#] 6	J2+12	5491.4+z [@] 7	J3+12	13382.3+u ^{&} 11	J4+24
2381.9+x [‡] 5	J1+6	5597.3+y [#] 7	J2+14	6587.2+z [@] 7	J3+14	14832.8+u ^{&} 11	J4+26
3281.3+x [‡] 5	J1+8	6603.6+y [#] 7	J2+16	7735.6+z [@] 7	J3+16	v ^a	J5
4234.8+x [‡] 5	J1+10	7662.4+y [#] 8	J2+18	8935.6+z [@] 8	J3+18	803.6+v ^a 4	J5+2
5242.0+x [‡] 6	J1+12	8774.1+y [#] 8	J2+20	10187.6+z [@] 8	J3+20	1657.0+v ^a 5	J5+4
6302.7+x [‡] 7	J1+14	9938.6+y [#] 8	J2+22	11490.6+z [@] 9	J3+22	2564.8+v ^a 6	J5+6
7416.9+x [‡] 7	J1+16	11156.5+y [#] 9	J2+24	12847.3+z [@] 10	J3+24	3523.1+v ^a 7	J5+8
8586.1+x [‡] 8	J1+18	12427.9+y [#] 9	J2+26	u ^{&}	J4	4532.8+v ^a 7	J5+10
9810.7+x [‡] 8	J1+20	13752.8+y [#] 9	J2+28	824.0+u ^{&}	J4+2	5593.5+v ^a 7	J5+12
11089.5+x [‡] 8	J1+22	15131.5+y [#] 9	J2+30	1701.4+u ^{&} 5	J4+4	6706.2+v ^a 8	J5+14
12423.9+x [‡] 9	J1+24	16565.0+y [#] 10	J2+32	2633.3+u ^{&} 6	J4+6	7873.0+v ^a 8	J5+16
13815.0+x [‡] 9	J1+26	18052.7+y [#] 10	J2+34	3619.0+u ^{&} 7	J4+8	9092.7+v ^a 9	J5+18
15259.2+x [‡] 10	J1+28	19594.6+y [#] 11	J2+36	4656.6+u ^{&} 7	J4+10	10364.5+v ^a 10	J5+20
y [#]	J2	z [@]	J3	5744.9+u ^{&} 8	J4+12	11692.1+v ^a 11	J5+22
646.2+y [#] 3	J2+2	786.0+z [@] 3	J3+2	6884.9+u ^{&} 8	J4+14	13075.3+v ^a 12	J5+24
1343.6+y [#] 4	J2+4	1623.3+z [@] 5	J3+4	8077.9+u ^{&} 8	J4+16		
2091.7+y [#] 5	J2+6	2513.9+z [@] 5	J3+6	9322.9+u ^{&} 9	J4+18		

[†] Proposed by 1998Kh09 based on band assignments.

[‡] Band(A): SD-1 Band. Q(intrinsic)=15.3 2 (1998Kh09). Intruder configuration= $\pi 6^3 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=+1/2)^{-1}$ (1998Kh09).

[#] Band(B): SD-2 Band. Q(intrinsic)=15.8 +4-3 (1998Kh09). Intruder configuration= $\pi 6^3 \otimes \nu 7^1 \otimes (\nu 1/2[651], \alpha=-1/2 \text{ or } \nu 2[642], \alpha=-1/2)^{-1}$ (1998Kh09).

[@] Band(C): SD-3 Band. Q(intrinsic)=16.4 +3-4 (1998Kh09). Intruder configuration= $\pi 6^4 \otimes \pi 1/2[301]^{-1} \otimes \nu 7^1 \otimes \nu 1/2[651]^{-1}$ (1998Kh09).

[&] Band(D): SD-4 Band. Q(intrinsic)=16.0 +6-5 (1998Kh09). Intruder configuration= $\pi 6^4 \otimes \pi 6_3^{-1} \otimes \nu 7^1 \otimes \nu 1/2[642]^{-1}$ (1998Kh09).

^a Band(E): SD-5 Band. Band from 1998Kh09.

$^{128}\text{Te}(^{27}\text{Al},6\text{n}\gamma):\text{SD}$ **1998Kh09 (continued)** $\gamma(^{149}\text{Tb})$

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π
646.2 3	0.31 5	646.2+y	J2+2	y	J2
697.4 2	0.97 3	1343.6+y	J2+4	646.2+y	J2+2
740.1 2	0.42 4	740.1+x	J1+2	x	J1
748.2 2	1.00 2	2091.7+y	J2+6	1343.6+y	J2+4
786.0 3	0.75 6	786.0+z	J3+2	z	J3
794.7 2	0.65 4	1534.8+x	J1+4	740.1+x	J1+2
799.0 2	1.02 2	2890.7+y	J2+8	2091.7+y	J2+6
803.7 4		803.6+v	J5+2	v	J5
824.0 ‡	0.57 4	824.0+u	J4+2	u	J4
837.4 3	0.93 5	1623.3+z	J3+4	786.0+z	J3+2
847.1 3	1.00 9	2381.9+x	J1+6	1534.8+x	J1+4
850.5 3	1.05 2	3741.2+y	J2+10	2890.7+y	J2+8
853.4 3		1657.0+v	J5+4	803.6+v	J5+2
877.4 4	0.93 7	1701.4+u	J4+4	824.0+u	J4+2
890.6 2	1.02 4	2513.9+z	J3+6	1623.3+z	J3+4
899.4 2	1.02 9	3281.3+x	J1+8	2381.9+x	J1+6
902.0 2	1.05 3	4643.2+y	J2+12	3741.2+y	J2+10
907.8 3		2564.8+v	J5+6	1657.0+v	J5+4
931.9 4	1.00 4	2633.3+u	J4+6	1701.4+u	J4+4
941.0 2	1.00 4	3454.9+z	J3+8	2513.9+z	J3+6
953.5 2	1.01 8	4234.8+x	J1+10	3281.3+x	J1+8
954.1 3	1.03 2	5597.3+y	J2+14	4643.2+y	J2+12
958.3 2		3523.1+v	J5+8	2564.8+v	J5+6
985.7 3	1.00 4	3619.0+u	J4+8	2633.3+u	J4+6
992.7 3	1.01 4	4447.5+z	J3+10	3454.9+z	J3+8
1006.3 2	0.98 2	6603.6+y	J2+16	5597.3+y	J2+14
1007.2 2	0.98 8	5242.0+x	J1+12	4234.8+x	J1+10
1009.7 2		4532.8+v	J5+10	3523.1+v	J5+8
1037.6 2	1.07 5	4656.6+u	J4+10	3619.0+u	J4+8
1043.9 2	1.00 4	5491.4+z	J3+12	4447.5+z	J3+10
1058.8 2	1.00 2	7662.4+y	J2+18	6603.6+y	J2+16
1060.7 3	1.00 8	6302.7+x	J1+14	5242.0+x	J1+12
1060.7 2		5593.5+v	J5+12	4532.8+v	J5+10
1088.3 3	1.04 4	5744.9+u	J4+12	4656.6+u	J4+10
1095.8 2	1.00 4	6587.2+z	J3+14	5491.4+z	J3+12
1111.7 2	1.02 2	8774.1+y	J2+20	7662.4+y	J2+18
1112.7 3		6706.2+v	J5+14	5593.5+v	J5+12
1114.2 2	1.02 7	7416.9+x	J1+16	6302.7+x	J1+14
1140.0 2	1.02 3	6884.9+u	J4+14	5744.9+u	J4+12
1148.4 2	1.00 4	7735.6+z	J3+16	6587.2+z	J3+14
1164.5 3	0.96 2	9938.6+y	J2+22	8774.1+y	J2+20
1166.8 3		7873.0+v	J5+16	6706.2+v	J5+14
1169.2 3	0.95 7	8586.1+x	J1+18	7416.9+x	J1+16
1193.0 2	1.00 3	8077.9+u	J4+16	6884.9+u	J4+14
1200.0 3	0.98 6	8935.6+z	J3+18	7735.6+z	J3+16
1217.9 2	0.94 2	11156.5+y	J2+24	9938.6+y	J2+22
1219.7 4		9092.7+v	J5+18	7873.0+v	J5+16
1224.6 2	0.77 6	9810.7+x	J1+20	8586.1+x	J1+18
1245.0 3	0.98 4	9322.9+u	J4+18	8077.9+u	J4+16
1252.0 2	0.87 5	10187.6+z	J3+20	8935.6+z	J3+18
1271.4 2	0.82 2	12427.9+y	J2+26	11156.5+y	J2+24
1271.8 4		10364.5+v	J5+20	9092.7+v	J5+18
1278.8 3	0.68 5	11089.5+x	J1+22	9810.7+x	J1+20
1300.0 3	0.79 6	10622.9+u	J4+20	9322.9+u	J4+18
1303.0 3	0.65 5	11490.6+z	J3+22	10187.6+z	J3+20
1324.9 2	0.60 2	13752.8+y	J2+28	12427.9+y	J2+26

Continued on next page (footnotes at end of table)

$^{128}\text{Te}(^{27}\text{Al},6n\gamma):\text{SD}$ **1998Kh09** (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π
1327.6 5		11692.1+v	J5+22	10364.5+v	J5+20
1334.4 3	0.49 5	12423.9+x	J1+24	11089.5+x	J1+22
1354.0 3	0.51 4	11976.9+u	J4+22	10622.9+u	J4+20
1356.7 4	0.32 5	12847.3+z	J3+24	11490.6+z	J3+22
1378.7 2	0.54 2	15131.5+y	J2+30	13752.8+y	J2+28
1383.2 5		13075.3+v	J5+24	11692.1+v	J5+22
1391.1 3	0.41 3	13815.0+x	J1+26	12423.9+x	J1+24
1405.4 4	0.43 5	13382.3+u	J4+24	11976.9+u	J4+22
1433.5 3	0.29 2	16565.0+y	J2+32	15131.5+y	J2+30
1444.2 4	0.13 1	15259.2+x	J1+28	13815.0+x	J1+26
1450.5 4	0.33 5	14832.8+u	J4+26	13382.3+u	J4+24
1487.7 3	0.21 3	18052.7+y	J2+34	16565.0+y	J2+32
1541.9 4	0.10 2	19594.6+y	J2+36	18052.7+y	J2+34

 † Relative intensities within each band (**1998Kh09**). ‡ Placement of transition in the level scheme is uncertain.

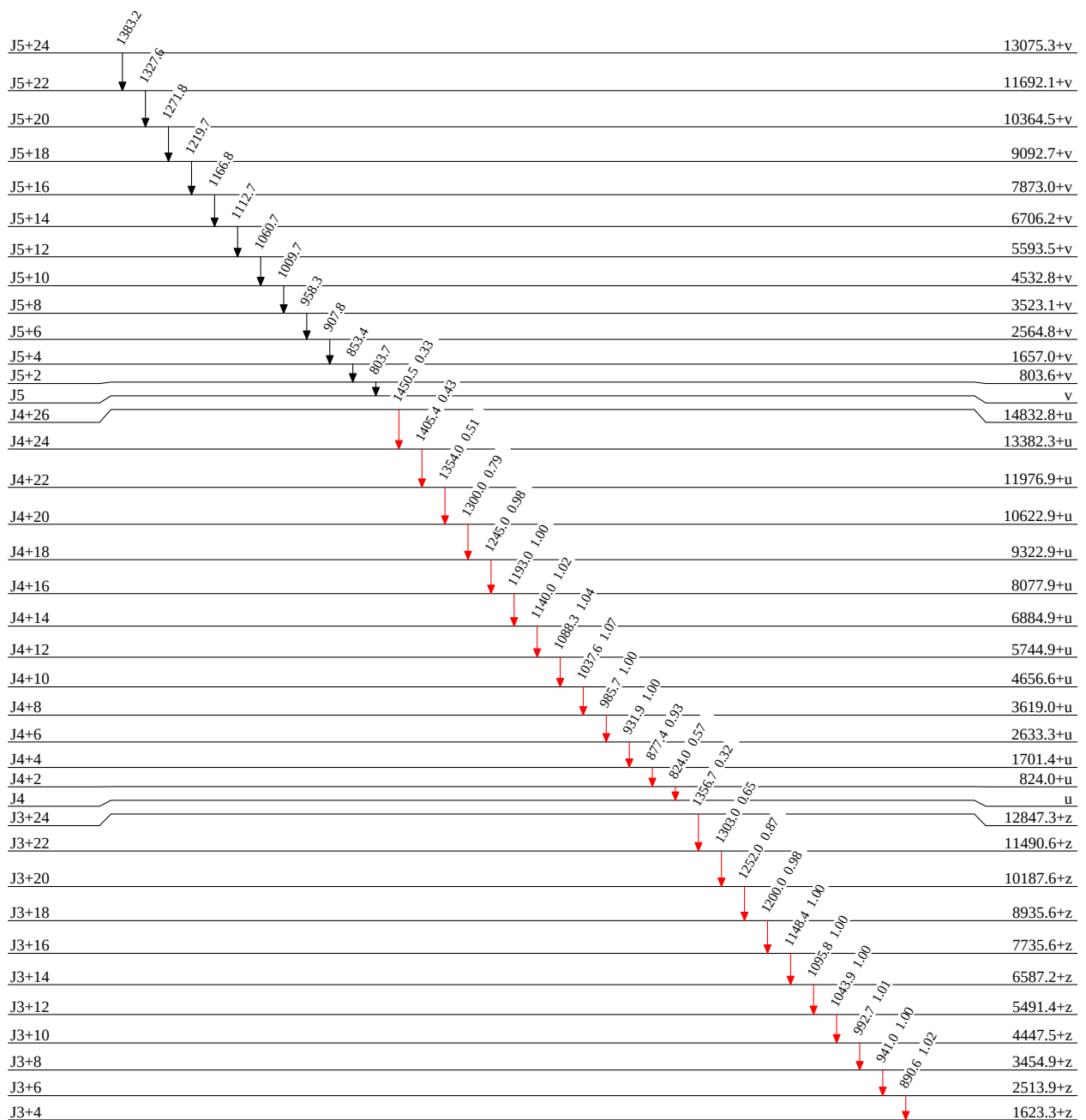
$^{128}\text{Te}(^{27}\text{Al},6n\gamma):\text{SD}$ 1998Kh09

Legend

Level Scheme

Intensities: Relative I_γ

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\max}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\max}$
 $\cdots\cdots\cdots\longrightarrow$ γ Decay (Uncertain)

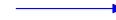


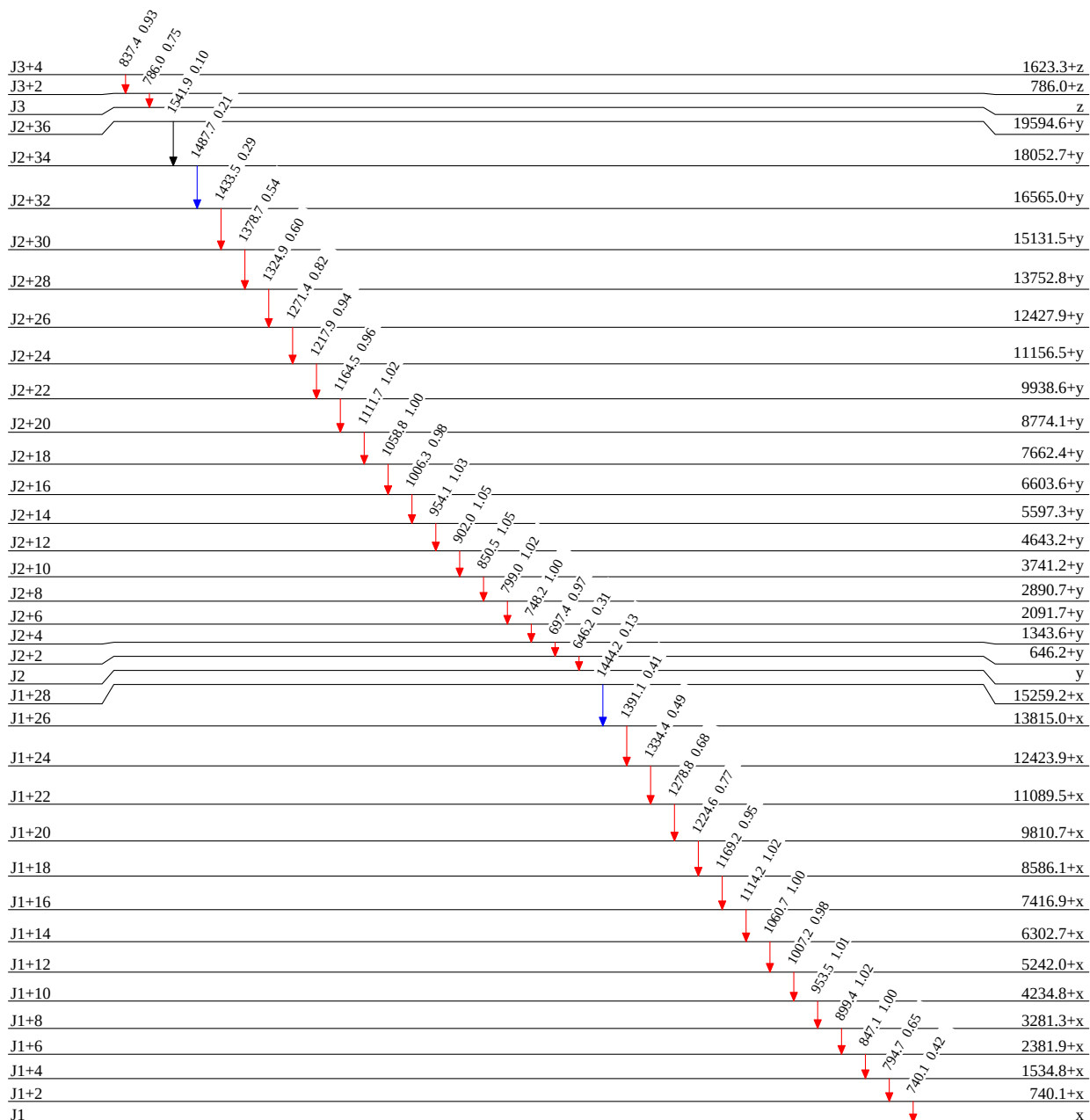
$^{128}\text{Te}(^{27}\text{Al},6n\gamma):\text{SD}$ 1998Kh09

Level Scheme (continued)

Intensities: Relative I_γ

Legend

-  $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{149}_{65}\text{Tb}_{84}$

$^{128}\text{Te}(^{27}\text{Al},6n\gamma):\text{SD}$ 1998Kh09

Band(D): SD-4 Band

J4+26	14832.8+u
J4+24	145013382.3+u
J4+22	140511976.9+u
J4+20	135410622.9+u
J4+18	13009322.9+u
J4+16	12458077.9+u
J4+14	11936884.9+u
J4+12	11405744.9+u
J4+10	10884656.6+u
J4+8	10383619.0+u
J4+6	9862633.3+u
J4+4	9321701.4+u
J4+2	877824.0+u
J4	824u

Band(C): SD-3 Band

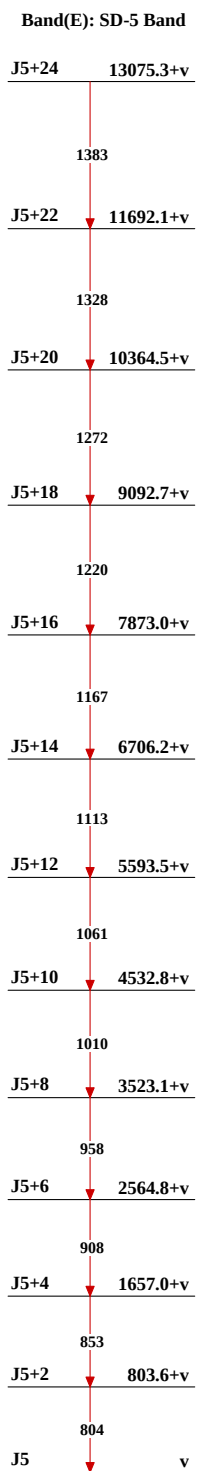
J3+24	12847.3+z
J3+22	135711490.6+z
J3+20	130310187.6+z
J3+18	12528935.6+z
J3+16	12007735.6+z
J3+14	11486587.2+z
J3+12	10965491.4+z
J3+10	10444447.5+z
J3+8	9933454.9+z
J3+6	9412513.9+z
J3+4	8911623.3+z
J3+2	837786.0+z
J3	786z

Band(B): SD-2 Band

J2+36	19594.6+y
J2+34	154218052.7+y
J2+32	148816565.0+y
J2+30	143415131.5+y
J2+28	137914341752.8+y
J2+26	132512427.9+y
J2+24	12711156.5+y
J2+22	12189938.6+y
J2+20	11648774.1+y
J2+18	11127662.4+y
J2+16	10596603.6+y
J2+14	10065597.3+y
J2+12	9544643.2+y
J2+10	9023741.2+y
J2+8	8502890.7+y
J2+6	7992091.7+y
J2+4	7481343.6+y
J2+2	646646.2+y
J2	646y

Band(A): SD-1 Band

J1+28	15259.2+x
J1+26	144413815.0+x
J1+24	139112423.9+x
J1+22	133411089.5+x
J1+20	12798810.7+x
J1+18	12258586.1+x
J1+16	11697416.9+x
J1+14	11146302.7+x
J1+12	10615242.0+x
J1+10	10074234.8+x
J1+8	9543281.3+x
J1+6	8992381.9+x
J1+4	8471534.8+x
J1+2	795740.1+x
J1	740x

$^{128}_{\text{Te}}(^{27}_{\text{Al}}, 6n\gamma): \text{SD}$ 1998Kh09 (continued)

 $^{149}_{65}\text{Tb}_{84}$

$^{142}\text{Nd}(^{10}\text{B}, 3\text{n}\gamma)$ 1979Si19

Also includes $^{141}\text{Pr}(^{12}\text{C}, 4\text{n}\gamma)$ from 1990Ad02.

1979Si19: E=46-54 MeV ^{10}B beams were produced from the McMaster University FN tandem accelerator. Targets were self-supporting metal foils of 99% enriched ^{142}Nd , in thickness of 1.5 mg/cm² for conversion electron measurements and 5 mg/cm² for γ measurements. γ rays were detected with Ge(Li) detectors and conversion electrons were detected with the online orange β -ray spectrometer. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma(\text{lin pol})$, $E\beta$, $I\beta$. Deduced levels, J , π , band structure, conversion coefficients, γ -ray multipolarities, mixing ratios.

1990Ad02: E=80 MeV ^{12}C beam was produced from the SF cyclotron of Institute for Nuclear Study, University of Tokyo. Targets were self-supporting foils of natural Pr with thickness of 10 to 20 mg/cm². γ rays were detected with Ge detectors. Measured $E\gamma$, $I\gamma$, $\gamma(\theta, \text{H})$, $\gamma(\text{t})$, $\gamma\gamma$ -coin, $T_{1/2}$, g-factor.

 ^{149}Tb Levels

E(level) [†]	J^π [‡]	$T_{1/2}$	Comments
35.75 [#] 8	11/2 ⁻	4.17 min 5	$\% \epsilon + \% \beta^+ = 99.978$ 4; $\% \alpha = 0.022$ 4 Energy, J^π , $T_{1/2}$ and decay modes from the Adopted Levels.
822.6 [#] 2	15/2 ⁻		
841.3 [#] 5	13/2 ⁻		Level and J^π based on data in the Adopted Levels.
1129.3 [@] 3	15/2 ⁺		
1382.3 [#] 3	19/2 ⁻		
1673.0 [#] 4	23/2 ⁻		
1813.4 [#] 5	21/2 ⁻		
1868.1 [@] 4	19/2 ⁺		
2303.3 [#] 4	27/2 ⁻		
2350.3 [@] 4	23/2 ⁺		
2518.8 [@] 4	27/2 ⁺	2.5 ns 2	$T_{1/2}$: weighted average of 2.6 ns 2 (1990Ad02) and 2.1 ns 4 (1979Si19). g factor=0.33 8 (1990Ad02) (integral PAD method). J^π : (25/2) ⁻ in the Adopted Levels.
2664.3 7	25/2 ⁻ , 29/2 ⁻		
2813.3 [@] 4	29/2 ⁺		
3142.7 [@] 5	31/2 ⁺		
3528.2 [@] 5	(33/2) ⁺		
4209.3 ^{&} 6	33/2 ⁺		
4464.2 ^{&} 6	35/2 ⁺		
4674.8 ^{&} 6	37/2 ⁺		
4923.9 ^{&} 8	39/2 ⁺		
5148.6 ^{&} 10	41/2 ⁺		

[†] From a least-squares fit to γ -ray energies.

[‡] As proposed by 1979Si19 based on measured $\gamma(\theta)$, $\gamma(\text{lin pol})$, ce data, band assignment and known assignments of low-lying states. Assignments in the Adopted Levels are almost the same, except that several spins are placed in parentheses due to lack of strong arguments.

[#] Band(A): $\Delta J=2$ band, based on 11/2⁻. Band assignment from 1979Si19.

[@] Band(B): Band based on 15/2⁺. Band assignment from 1979Si19.

[&] Band(C): $\Delta J=1$ band, based on 33/2⁺ Band assignment from 1979Si19.

$^{142}\text{Nd}(^{10}\text{B}, 3n\gamma)$ **1979Si19 (continued)** $\gamma(^{149}\text{Tb})$

POL(exp) under comments (same as pol) are experimental polarization from counting rate asymmetry

$\Delta=(N_{\parallel}-N_{\perp})/(N_{\parallel}+N_{\perp})$ with respect to the reaction plane, and POL(AD) the polarization deduced from

angular distribution coefficients A_2 and A_4 assuming pure multipole and no parity change, with

$\text{POL(AD)}=[3A_2+1.25A_4]/[2-A_2+0.75A_4]$. So for the ratio of POL(exp)/POL(AD), positive values indicate no parity change (like M1 or E2) while negative values indicate parity change (like E1) (**1979Si19**). Uncertainties in A_2 and A_4 are statistical only.

$E_{\gamma}^{\dagger}$	$I_{\gamma}^{\dagger}$	$E_i(\text{level})$	J_i^{π}	E_f	J_f^{π}	Mult. ‡	$\delta^{\#}$	Comments
140.3 5	3.0	1813.4	21/2 ⁻	1673.0	23/2 ⁻	D+Q		$A_2=-0.16$ 2; $A_4=+0.17$ 3
168.4 5	9.7	2518.8	27/2 ⁺	2350.3	23/2 ⁺	E2		$A_2=+0.27$ 3; $A_4=-0.05$ 4; pol=+0.39 9 $\delta(\text{O/Q})=-0.02$ 5. POL(AD)=+0.44 7, POL(exp)/POL(AD)=+0.89 28.
210.5 5	5.3	4674.8	37/2 ⁺	4464.2	35/2 ⁺	D+Q		$A_2=-0.26$ 3; $A_4=+0.06$ 4
215.3 2	32.9	2518.8	27/2 ⁺	2303.3	27/2 ⁻	E1		$A_2=+0.29$ 2; $A_4=0.00$ 1; pol=-0.52 3 $\delta(\text{M2/E1})=+0.21$ 5, which gives unacceptable B(M2)(W.u.) as compared to RUL(B(M2)(W.u.)=1. POL(AD)=+0.53 3, POL(exp)/POL(AD)=-0.98 8.
224.7 5	4.6	5148.6	41/2 ⁺	4923.9	39/2 ⁺	D		$A_2=-0.21$ 3; $A_4=+0.08$ 4 $\delta(\text{Q/D})=0.00$ 10.
249.1 5	8.2	4923.9	39/2 ⁺	4674.8	37/2 ⁺	D+Q	+0.09 4	$A_2=-0.14$ 3; $A_4=+0.03$ 3
254.7 5	5.3	4464.2	35/2 ⁺	4209.3	33/2 ⁺	D		$A_2=-0.06$ 4; $A_4=0.00$ 5
288.0 5	1.5	1129.3	15/2 ⁺	841.3	13/2 ⁻			Placement from Adopted Gammas. 1979Si19 place this transition from a 3816 level, which is not reported in other studies.
290.7 2	68.1	1673.0	23/2 ⁻	1382.3	19/2 ⁻	E2		$A_2=+0.28$ 1; $A_4=-0.14$ 1; $\alpha(\text{K})_{\text{exp}}=0.055$ 6; pol=+0.42 2. $\delta(\text{Q/O})=-0.05$ 2. POL(AD)=+0.39 2, POL(exp)/POL(AD)=+1.08 7.
294.3 2	28.8	2813.3	29/2 ⁺	2518.8	27/2 ⁺	M1		$A_2=-0.25$ 1; $A_4=-0.02$ 2; $\alpha(\text{K})_{\text{exp}}=0.092$ 10; pol=-0.31 4 $\delta(\text{Q/D})=0.00$ 2.
306.7 2	14.0	1129.3	15/2 ⁺	822.6	15/2 ⁻	E1		POL(AD)=-0.35 5, POL(exp)/POL(AD)=+0.89 18. $A_2=+0.26$ 2; $A_4=-0.04$ 2; $\alpha(\text{K})_{\text{exp}}=0.011$ 2; pol=-0.48 5 $\delta(\text{Q/D})=+0.14$ 5.
329.4 2	35.0	3142.7	31/2 ⁺	2813.3	29/2 ⁺	M1		POL(AD)=+0.39 4, POL(exp)/POL(AD)=-1.23 16. $A_2=-0.12$ 1; $A_4=-0.02$ 2; pol=-0.24 4
361.0 5	5.0	2664.3	25/2 ⁻ , 29/2 ⁻	2303.3	27/2 ⁻	M1+E2		POL(AD)=-0.21 3, POL(exp)/POL(AD)=+1.14 24. $A_2=-0.20$ 5; $A_4=+0.10$ 6; pol=-0.37 25
385.5 2	20.0	3528.2	(33/2) ⁺	3142.7	31/2 ⁺	M1		POL(AD)=-0.21 8, POL(exp)/POL(AD)=+1.8 12. $A_2=-0.31$ 3; $A_4=+0.02$ 2; $\alpha(\text{K})_{\text{exp}}=0.059$ 6 $\delta(\text{Q/D})=-0.04$ 3.
431.2 5	7.0	1813.4	21/2 ⁻	1382.3	19/2 ⁻	D+Q	+0.05 2	$A_2=-0.18$ 4; $A_4=+0.02$ 4
482.2 2	10.5	2350.3	23/2 ⁺	1868.1	19/2 ⁺	E2		$A_2=+0.18$ 2; $A_4=-0.06$ 2; pol=+0.26 9 $\delta(\text{O/Q})=-0.07$ 3. POL(AD)=+0.35 5, POL(exp)/POL(AD)=+0.75 30.
510.2 2	20.0	2813.3	29/2 ⁺	2303.3	27/2 ⁻			
559.7 2	78.2	1382.3	19/2 ⁻	822.6	15/2 ⁻	E2		$A_2=+0.25$ 1; $A_4=-0.12$ 1; $\alpha(\text{K})_{\text{exp}}=0.0084$ 10; pol=+0.43 3 $\delta(\text{Q/O})=-0.05$ 2.
630.4 2	56.6	2303.3	27/2 ⁻	1673.0	23/2 ⁻	(Q)		POL(AD)=+0.39 2, POL(exp)/POL(AD)=+1.10 9.
738.7 2	12.1	1868.1	19/2 ⁺	1129.3	15/2 ⁺	E2		$A_2=+0.25$ 2; $A_4=-0.03$ 2 $A_2=+0.31$ 4; $A_4=-0.16$ 5; pol=+0.38 15

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$^{142}\text{Nd}(^{10}\text{B}, 3\text{n}\gamma)$ **1979Si19** (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
786.8 2	100	822.6	15/2 ⁻	35.75	11/2 ⁻	E2	$\delta(\text{O/Q})=-0.05$ 7. POL(AD)=+0.32 5, POL(exp)/POL(AD)=+1.19 49. $A_2=+0.25$ 1; $A_4=-0.12$ 2; pol=+0.35 7 $\delta(\text{Q/O})=-0.07$ 3. POL(AD)=+0.38 2, POL(exp)/POL(AD)=+0.92 19.
1146.7 5	8.6	4674.8	37/2 ⁺	3528.2	(33/2) ⁺	Q	$A_2=+0.29$ 4; $A_4=-0.09$ 5
1321.6 5	5.4	4464.2	35/2 ⁺	3142.7	31/2 ⁺	Q	$A_2=+0.33$ 7; $A_4=-0.18$ 10
1395.8 5	7.0	4209.3	33/2 ⁺	2813.3	29/2 ⁺	Q	$A_2=+0.27$ 5; $A_4=-0.09$ 7

[†] From **1979Si19**. Based on a general statement in **1979Si19** that the uncertainty in energy is 0.2 keV for strong lines and 0.5 keV for weak lines, the evaluators have assigned uncertainties as follows: $\Delta E_\gamma=0.2$ keV if $I_\gamma \geq 10$ and 0.5 keV otherwise.

[‡] From ce, $\gamma(\theta)$ and $\gamma(\text{lin pol})$ data in **1979Si19**, given under comments.

[#] From $\gamma(\theta)$ in **1979Si19**.

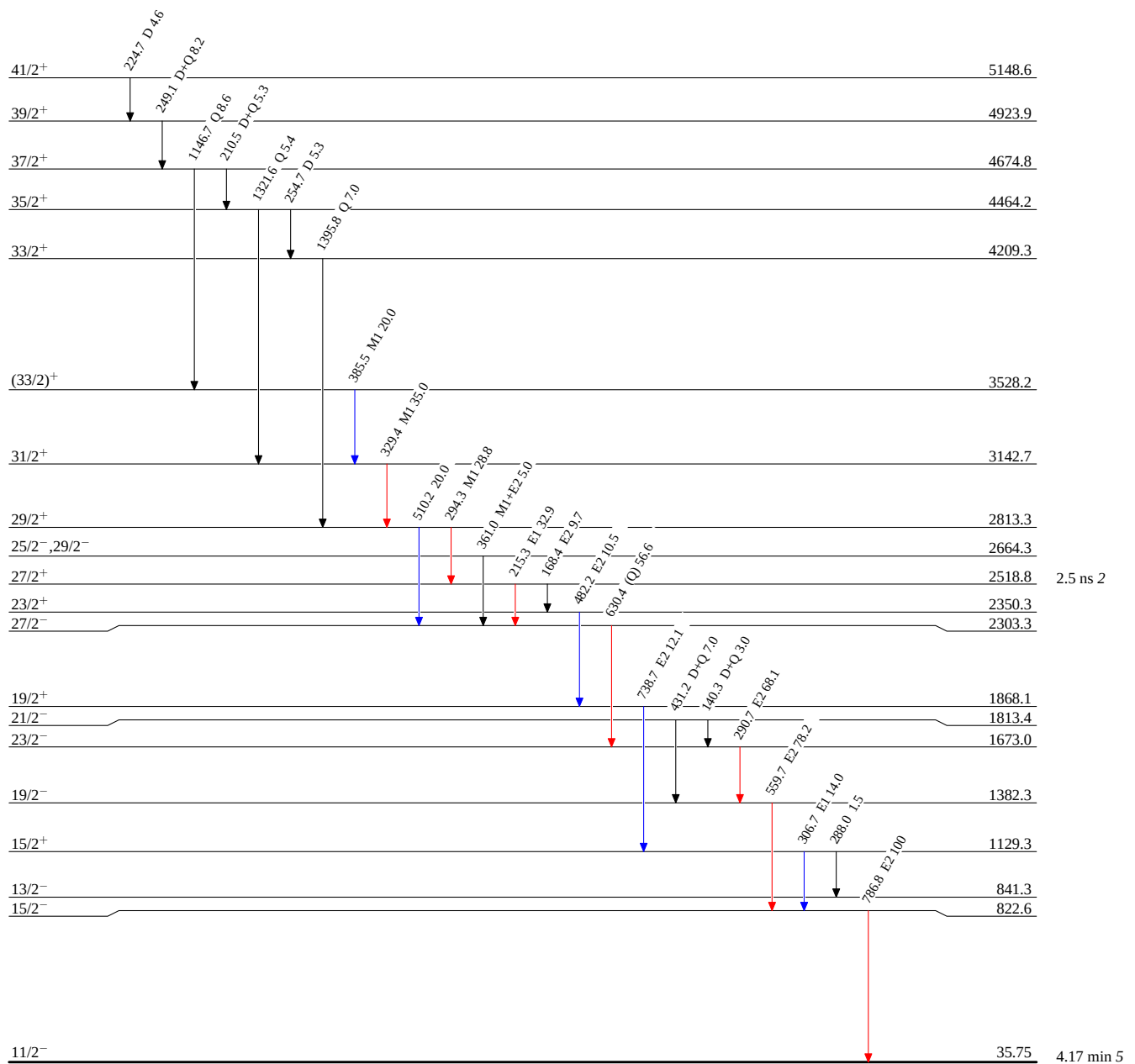
$^{142}\text{Nd}(^{10}\text{B}, 3\text{n}\gamma)$ 1979Si19

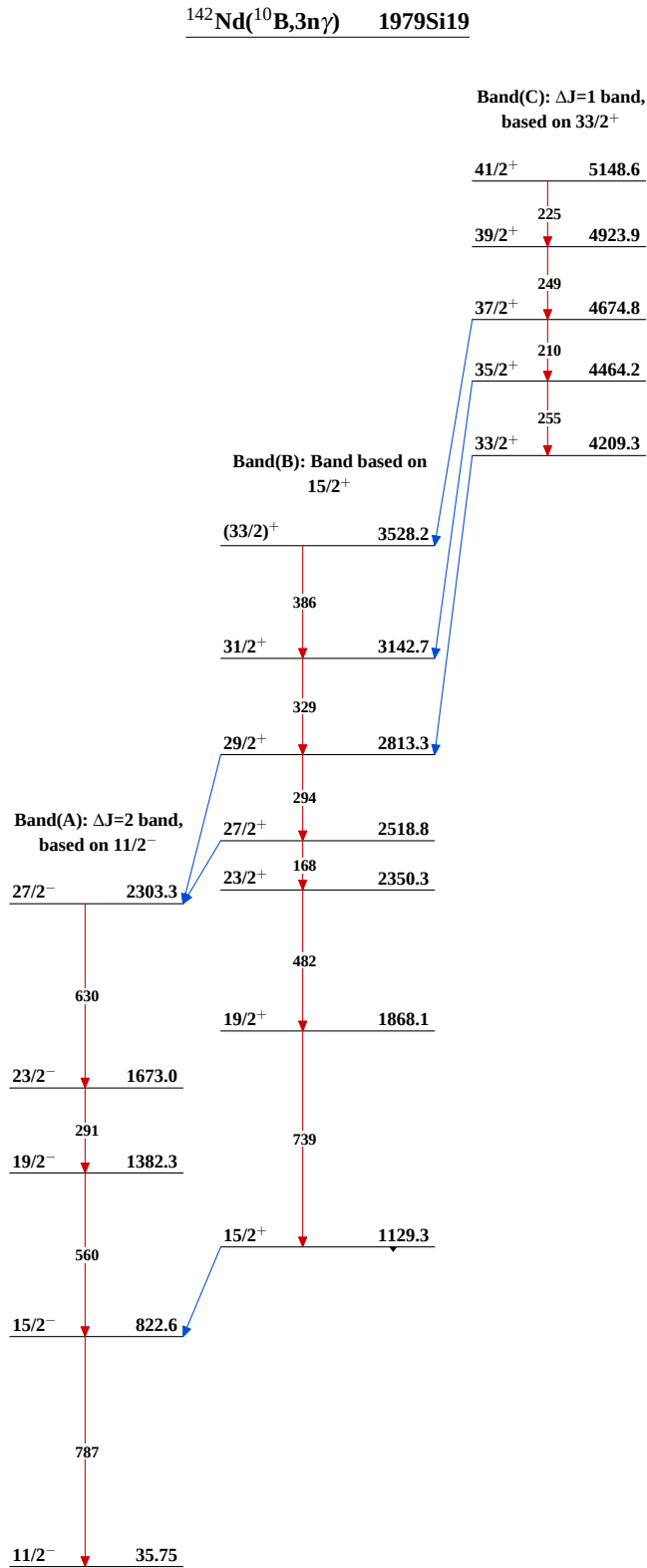
Level Scheme

Intensities: Relative I_γ

Legend

- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

 $^{149}_{65}\text{Tb}_{84}$



$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ 1991La17

1991La17: E=32 MeV ^7Li beam was produced from the Tandem accelerator at Cologne University. γ rays were detected with the Osiris multidetector array consisting of 12 Compton-suppressed Ge detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(\text{DCO})$. Deduced levels, J, π , γ -ray multipolarities. Comparisons with theoretical calculations. 1991La17 also report data on $^{151}\text{Eu}(\alpha, 6n\gamma)$.

 ^{149}Tb Levels

E(level) [†]	J π [‡]	T _{1/2}	Comments
35.75 [#] 8	11/2 ⁻	4.17 min 5	% ϵ +% β^+ =99.978 4; % α =0.022 4 Energy, J π , T _{1/2} and decay modes from the Adopted Levels.
822.3 [#] 2	15/2 ⁻		
840.7 [#] 2	13/2 ⁻		
1129.1 ^{&} 2	15/2 ⁺		
1382.0 [#] 2	19/2 ⁻		
1454.7 [#] 3	(17/2 ⁻)		
1568.9 [#] 3	(15/2 ⁻)		
1591.0 ^{&} 3	(17/2 ⁺)		
1672.7 [#] 2	23/2 ⁻		
1813.21 [#] 21	21/2 ⁻		
1867.8 ^{&} 2	19/2 ⁺		
1879.1 ^{&} 4	(17/2 ⁺)		
2302.9 [@] 3	27/2 ⁻		
2350.0 ^{&} 2	23/2 ⁺		
2368.7 ^{&} 4	(21/2 ⁺)		
2492.2 ^{&} 4	(21/2 ⁺)		
2518.5 ^{&} 3	27/2 ⁺		
2664.3 [@] 4	25/2 ⁻		
2667.0 ^{&} 3	25/2 ⁽⁺⁾		
2762.8 [@] 3	25/2 ⁽⁻⁾		
2812.8 ^{&} 3	29/2 ⁺		
3142.0 3	31/2 ⁺		Configuration= $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (1991La17).
3527.3 3	33/2 ⁺		Configuration= $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes (3^- \text{ in } ^{146}\text{Gd})$ (1991La17).
3603.4 3	31/2 ⁻		Possible configuration= $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^- \text{ in } ^{146}\text{Gd}) \otimes (3^- \text{ in } ^{146}\text{Gd})$ (1991La17). This configuration involves coupling of two octupole phonons.
3990.6 5			
4061.5 5			
4208.4 ^a 3	33/2 ⁺		
4463.4 ^a 3	35/2 ⁺		
4674.0 ^a 3	37/2 ⁺		
4923.4 ^a 4	39/2 ⁺		
5148.3 ^a 5	41/2 ⁽⁺⁾		

[†] From least-squares fit to γ -ray energies.

[‡] As given in 1991La17, based on their $\gamma(\theta)$ data in $(\alpha, 6n\gamma)$, $\gamma\gamma(\theta)(\text{DCO})$ data in $(^7\text{Li}, 2n\gamma)$ and pol data for selected transitions. Some of the assignments in 1991La17 are from theoretical predictions. The assignments are the same in the Adopted Levels, except that several are placed in parentheses there as strong arguments seem lacking.

[#] Seq.(B): $\pi h_{11/2} \otimes \nu f_{7/2}^2$ multiplet.

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$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ **1991La17** (continued) ^{149}Tb Levels (continued)

@ Seq.(C): $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu h_{9/2}$ multiplet.

& Seq.(D): $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^- \text{ in } ^{146}\text{Gd})$ multiplet.

^a Band(A): $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2}^2$ multiplet.

 $\gamma(^{149}\text{Tb})$

DCO values given under comments are from **1991La17**. The gating transition is generally $\Delta J=2$, E2, in which case $\text{DCO} \approx 1$ suggests $\Delta J=2$, quadrupole; $\text{DCO} \approx 2.0$ suggests $\Delta J=1$, dipole; $\text{DCO} > 1$ suggests $\Delta J=1$, dipole+quadrupole.

E_γ †	I_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	Comments
140.6 2	3.0 3	1813.21	21/2 ⁻	1672.7	23/2 ⁻	(D+Q)	DCO=1.40 15
148.3 4	0.8 3	2667.0	25/2 ⁽⁺⁾	2518.5	27/2 ⁺		
168.5 2	5.7 3	2518.5	27/2 ⁺	2350.0	23/2 ⁺	Q	DCO=0.86 9
210.6 2	0.8 3	4674.0	37/2 ⁺	4463.4	35/2 ⁺		
215.6 1	16.6 4	2518.5	27/2 ⁺	2302.9	27/2 ⁻	D	DCO=0.89 5 Mult.: DCO is also consistent with D, $\Delta J=0$; polarization data from ($\alpha, 6n\gamma$) also in 1991La17 indicates E1.
224.9 3	0.5 2	5148.3	41/2 ⁽⁺⁾	4923.4	39/2 ⁺		
249.4 2	0.8 3	4923.4	39/2 ⁺	4674.0	37/2 ⁺		
254.9 2	1.1 3	4463.4	35/2 ⁺	4208.4	33/2 ⁺		
276.7 3	0.4 2	1867.8	19/2 ⁺	1591.0	(17/2 ⁺)		
288.4 2	2.1 2	1129.1	15/2 ⁺	840.7	13/2 ⁻		A 288.0 γ was placed from a 3816 level by 1979Si19 in ($^{10}\text{B}, 3n\gamma$). 288.0 γ reported by 1994Me12 in ($^{31}\text{P}, 4n\gamma$) deexcites 6400.4 level.
290.8 1		1672.7	23/2 ⁻	1382.0	19/2 ⁻	Q	DCO=0.92 5
294.3 1	14.7 3	2812.8	29/2 ⁺	2518.5	27/2 ⁺	(D+Q)	DCO=1.68 15
306.8 1	15.6 4	1129.1	15/2 ⁺	822.3	15/2 ⁻		
316.7 5	0.5 3	2667.0	25/2 ⁽⁺⁾	2350.0	23/2 ⁺		
325.7 3	0.3 2	1454.7	(17/2 ⁻)	1129.1	15/2 ⁺		
329.2 1	10.5 2	3142.0	31/2 ⁺	2812.8	29/2 ⁺		
361.4 2	2.3 2	2664.3	25/2 ⁻	2302.9	27/2 ⁻	(D+Q)	DCO=1.32 25
385.2 2	4.8 2	3527.3	33/2 ⁺	3142.0	31/2 ⁺		
387.2 3	2.0 2	3990.6		3603.4	31/2 ⁻		
412.5 5	0.3 2	2762.8	25/2 ⁽⁻⁾	2350.0	23/2 ⁺		
431.2 1	5.4 3	1813.21	21/2 ⁻	1382.0	19/2 ⁻	D	DCO=2.1 3
439.3 4	0.2 2	1568.9	(15/2 ⁻)	1129.1	15/2 ⁺		
460.0 3		4923.4	39/2 ⁺	4463.4	35/2 ⁺		
460.3 5	0.6 2	2762.8	25/2 ⁽⁻⁾	2302.9	27/2 ⁻		DCO=1.0 4
461.3 4	0.5 2	3603.4	31/2 ⁻	3142.0	31/2 ⁺		
461.9 3	2.1 2	1591.0	(17/2 ⁺)	1129.1	15/2 ⁺		
465.7 3		4674.0	37/2 ⁺	4208.4	33/2 ⁺		
482.3 2	8.0 5	2350.0	23/2 ⁺	1867.8	19/2 ⁺	Q	DCO=0.89 11
485.5 5	1.0 3	1867.8	19/2 ⁺	1382.0	19/2 ⁻		
500.8 5	0.2 1	2368.7	(21/2 ⁺)	1867.8	19/2 ⁺		
509.9 3	5.4 9	2812.8	29/2 ⁺	2302.9	27/2 ⁻	(D+Q)	DCO=1.95 24
534.2 3	0.9 2	4061.5		3527.3	33/2 ⁺		
536.7 3	1.8 2	2350.0	23/2 ⁺	1813.21	21/2 ⁻	(D+Q)	DCO=1.8 3
559.6 1	76.3 9	1382.0	19/2 ⁻	822.3	15/2 ⁻	Q	DCO=1.07 3
613.7 4	0.4 2	1454.7	(17/2 ⁻)	840.7	13/2 ⁻		
623.5 3	0.9 3	3142.0	31/2 ⁺	2518.5	27/2 ⁺		
624.4 5	0.8 3	2492.2	(21/2 ⁺)	1867.8	19/2 ⁺		
630.2 2	33.1 7	2302.9	27/2 ⁻	1672.7	23/2 ⁻	Q	DCO=1.05 5
677.2 2	1.0 3	2350.0	23/2 ⁺	1672.7	23/2 ⁻		

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$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ **1991La17** (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
715 1		3527.3	33/2 ⁺	2812.8	29/2 ⁺		
728.4 4	0.5 2	1568.9	(15/2 ⁻)	840.7	13/2 ⁻		
738.7 1	10.1 4	1867.8	19/2 ⁺	1129.1	15/2 ⁺	Q	DCO=1.14 7
746.9 5	2.4 5	1568.9	(15/2 ⁻)	822.3	15/2 ⁻		
750.0 3	1.7 2	1879.1	(17/2 ⁺)	1129.1	15/2 ⁺		
768.7 4	1.1 3	1591.0	(17/2 ⁺)	822.3	15/2 ⁻		
786.6 2	100 8	822.3	15/2 ⁻	35.75	11/2 ⁻	Q	DCO=1.03 3
804.8 2	3.0 4	840.7	13/2 ⁻	35.75	11/2 ⁻		
845.6 [#] 3	1.1 2	2518.5	27/2 ⁺	1672.7	23/2 ⁻	[M2]	This γ ray reported only by 1991La17 is suspect since the expected $I_\gamma=3.2$ should have been detected by 1994Me12 .
986.8 5	0.9 3	2368.7	(21/2 ⁺)	1382.0	19/2 ⁻		
994.3 2	2.4 4	2667.0	25/2 ⁽⁺⁾	1672.7	23/2 ⁻		
1090.0 3	0.9 3	2762.8	25/2 ⁽⁻⁾	1672.7	23/2 ⁻	(D)	DCO=2.0 9
1110.3 3	0.8 3	2492.2	(21/2 ⁺)	1382.0	19/2 ⁻		
1146.7 2	1.4 2	4674.0	37/2 ⁺	3527.3	33/2 ⁺		
1300.5 2	2.7 3	3603.4	31/2 ⁻	2302.9	27/2 ⁻	(Q)	DCO=1.05 23
1321.6 2	0.9 3	4463.4	35/2 ⁺	3142.0	31/2 ⁺		
1395.5 2	1.5 3	4208.4	33/2 ⁺	2812.8	29/2 ⁺		

[†] From **1991La17**. Energies are from results of both this study and $^{151}\text{Eu}(\alpha, 6n\gamma)$ by **1991La17**, mostly from this study with the superior detection sensitivity.

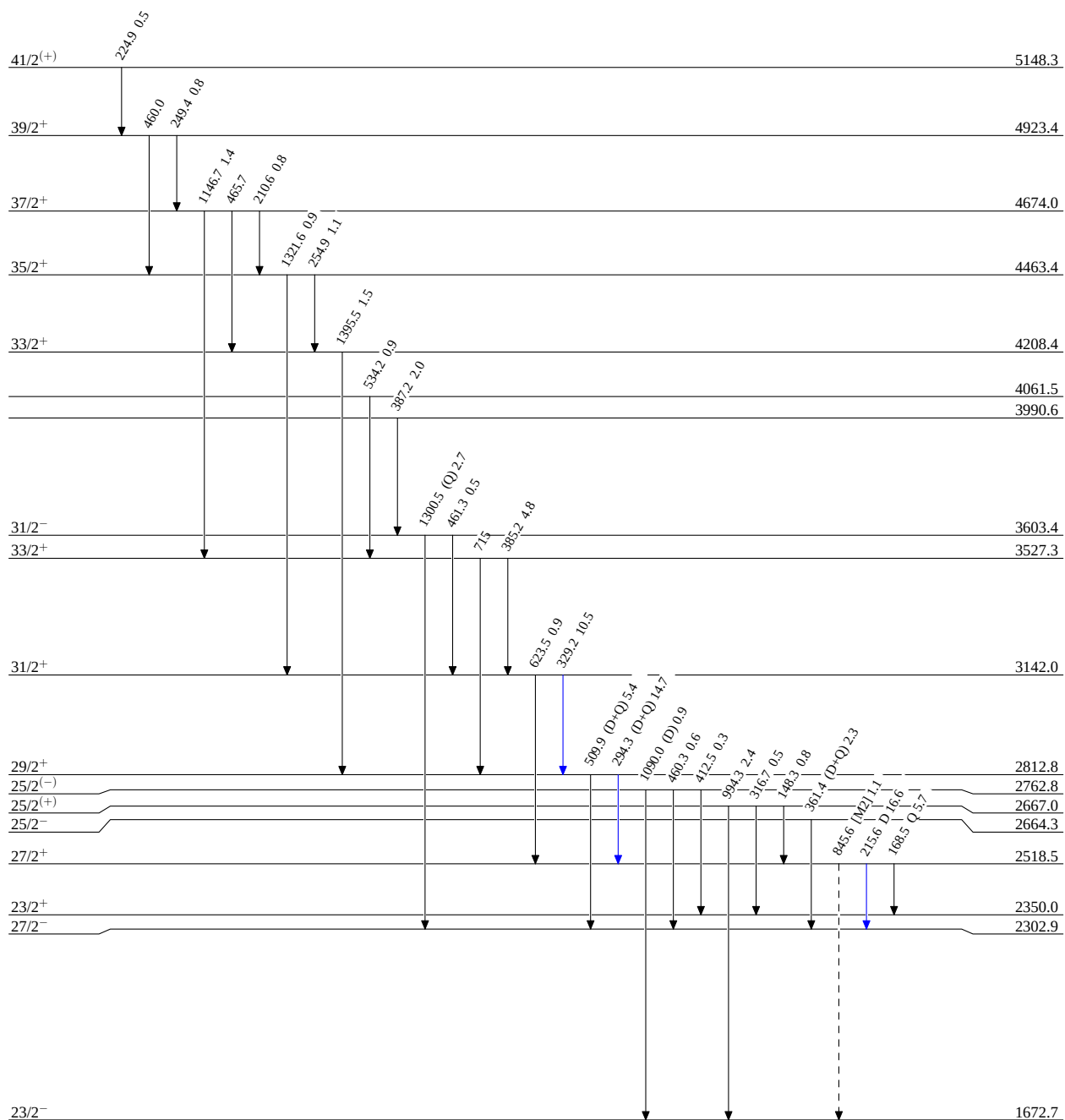
[‡] Deduced from DCO data in **1991La17**.

[#] Placement of transition in the level scheme is uncertain.

Legend

Intensities: Relative I_γ

- $I_\gamma < 2\% \times I_\gamma^{max}$
 $I_\gamma < 10\% \times I_\gamma^{max}$
 $I_\gamma > 10\% \times I_\gamma^{max}$
 γ Decay (Uncertain)

 $^{149}_{65}\text{Tb}_{84}$

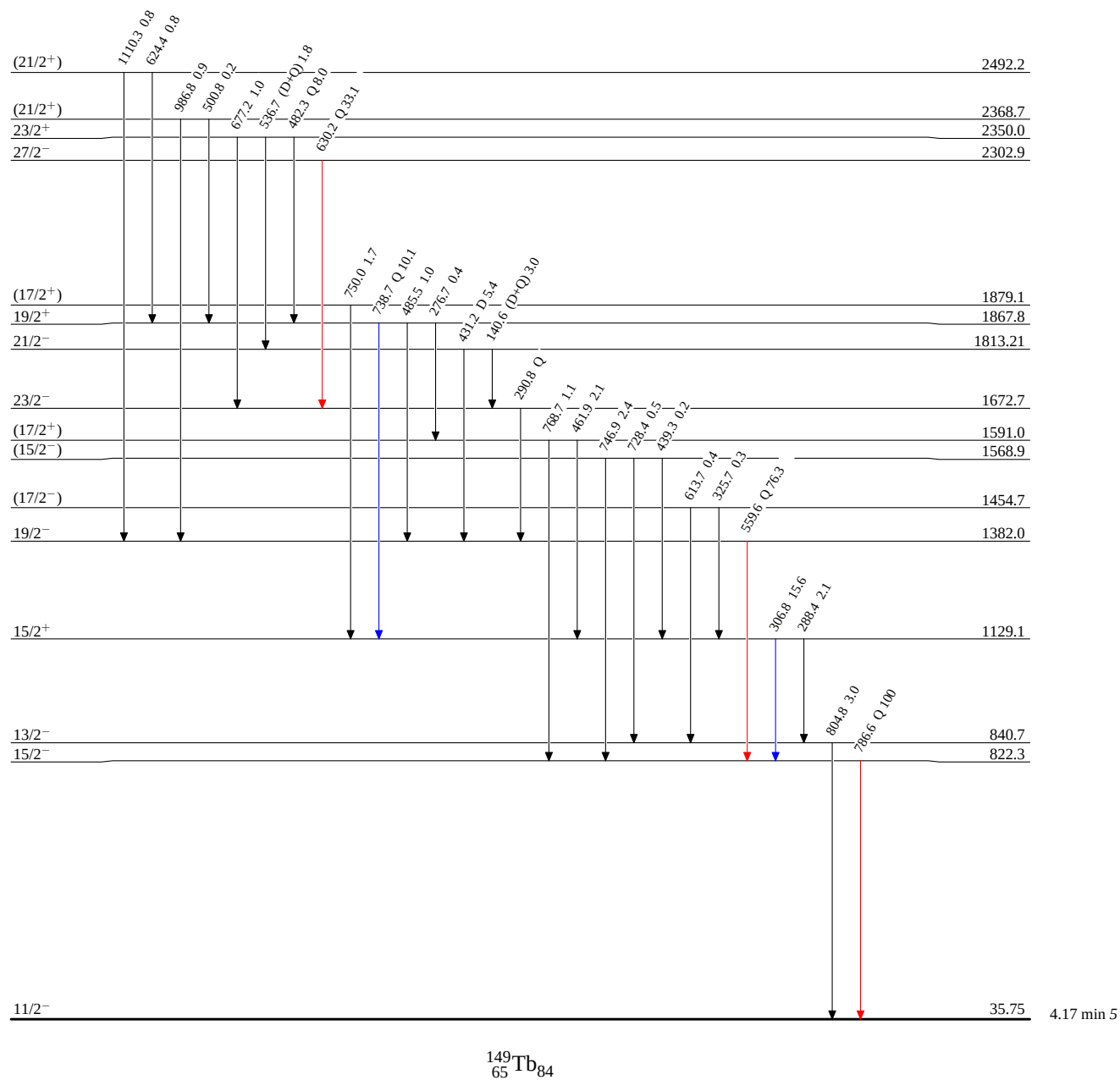
$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ 1991La17

Level Scheme (continued)

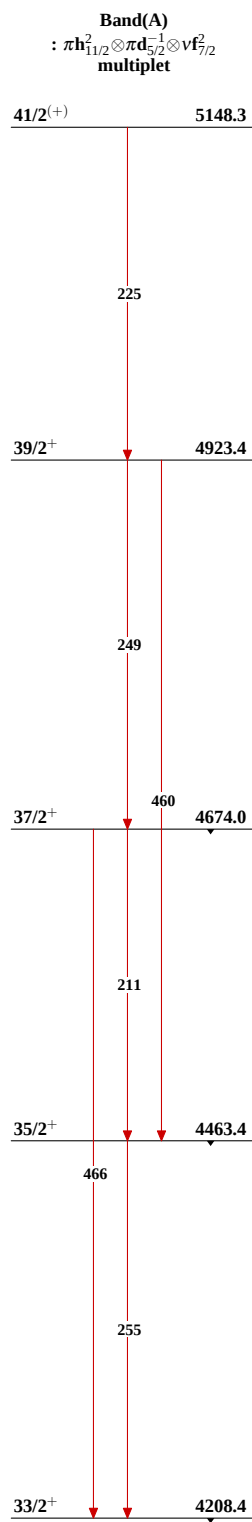
Intensities: Relative I_γ

Legend

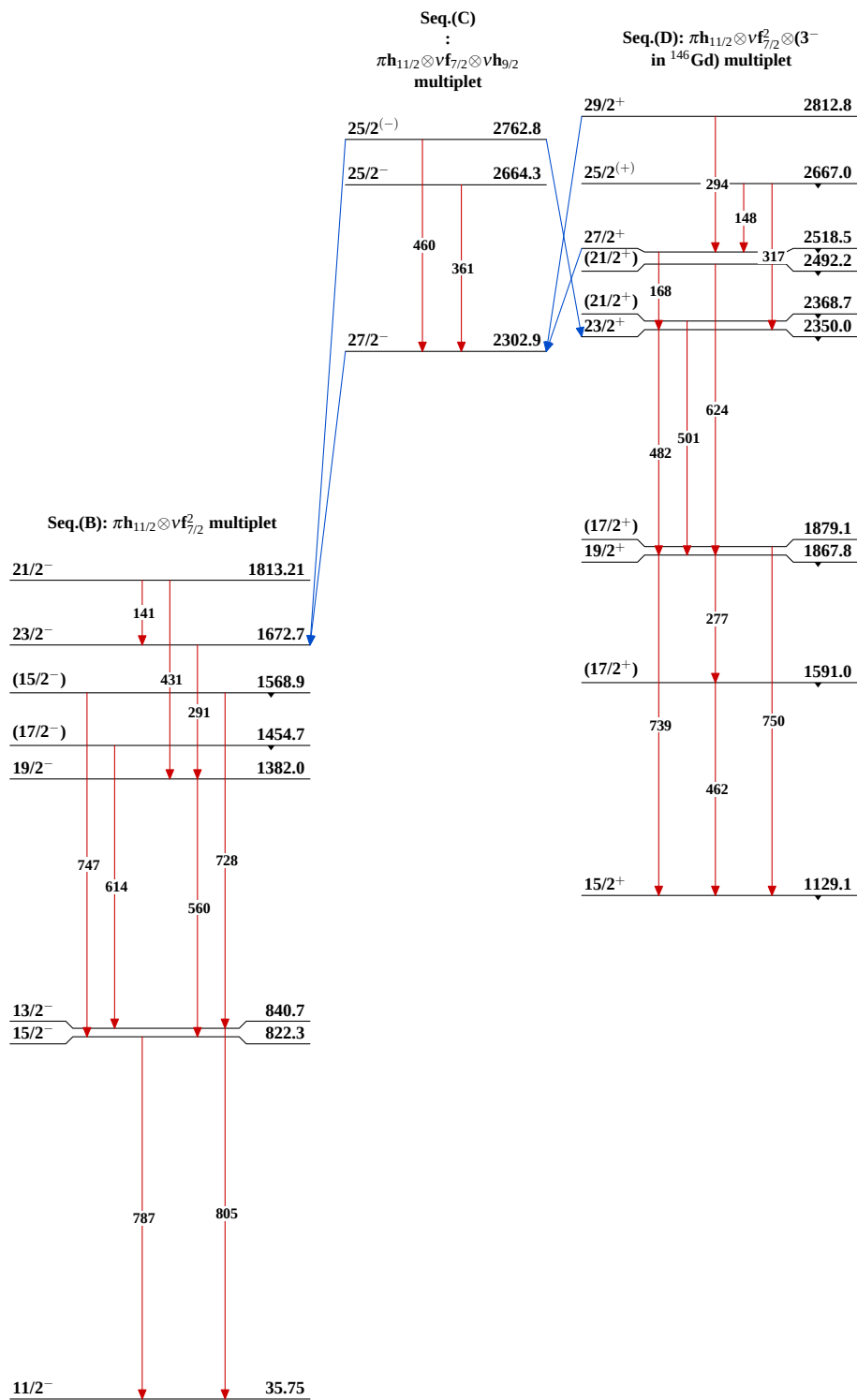
- $\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



$^{144}\text{Sm}(^7\text{Li}, 2n\gamma) \quad 1991\text{La17}$



$^{149}_{65}\text{Tb}_{84}$

$^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ 1991La17 (continued)


$^{151}\text{Eu}(\alpha, 6n\gamma)$ 1991La17

1991La17: E=78 MeV alpha beam was produced from the Julich Cyclotron. γ rays were detected with Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma(\text{lin pol})$, $\gamma\gamma(t)$. Deduced levels, J , π , $T_{1/2}$, γ -ray multipolarities. Comparisons with theoretical calculations. 1991La17 also report data on $^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$. See 1977K1ZP for an earlier report by the same group.

 ^{149}Tb Levels

E(level) [†]	$J^{\pi\ddagger}$	$T_{1/2}$	Comments
35.75 [#] 8	11/2 ⁻	4.17 min	% ϵ +% β^+ =99.978 4; % α =0.022 4 Energy, J^π , $T_{1/2}$ and decay modes from the Adopted Levels.
822.4 [#] 2	15/2 ⁻		
1129.2 [@] 3	15/2 ⁺		
1382.0 [#] 2	19/2 ⁻		
1672.8 [#] 3	23/2 ⁻		
1867.8 [@] 3	19/2 ⁺		
2303.0 3	27/2 ⁻		Member of $\pi h_{11/2} \otimes \nu h_{9/2} \otimes \nu f_{7/2}$ multiplet (1991La17).
2350.1 [@] 3	23/2 ⁺		
2518.6 [@] 3	27/2 ⁺	2.4 ns 2	$T_{1/2}$: from the Adopted Levels.
2812.9 [@] 3	29/2 ⁺		
3142.1 4	31/2 ⁺		Configuration= $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu i_{13/2}$ (1991La17).
3527.4 4	33/2 ⁺		Configuration= $\pi h_{11/2} \otimes \nu f_{7/2} \otimes \nu h_{9/2} \otimes (3^- \text{ in } ^{146}\text{Gd})$ (1991La17).
3603.5 4	31/2 ⁻		Possible configuration= $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^- \text{ in } ^{146}\text{Gd}) \otimes (3^- \text{ in } ^{146}\text{Gd})$ (1991La17). This configuration involves coupling of two octupole phonons.
4208.5 ^{&} 4	33/2 ⁺		
4463.5 ^{&} 4	35/2 ⁺		
4674.1 ^{&} 4	37/2 ⁺		
4923.5 ^{&} 4	39/2 ⁺		
5148.4 ^{&} 5	(41/2) ⁺		

[†] From least-squares fit to γ -ray energies.

[‡] As given in 1991La17, based on $\gamma(\theta)$ and pol data, the latter for selected transitions, combined with association with bands and sequences. Assignments in the Adopted Levels are the same, except that many are placed in parentheses as strong arguments seem lacking.

[#] Seq.(B): $\pi h_{11/2} \otimes \nu f_{7/2}^2$ multiplet. Sequence from 1991La17.

[@] Seq.(C): $\pi h_{11/2} \otimes \nu f_{7/2}^2 \otimes (3^- \text{ in } ^{146}\text{Gd})$ multiplet. Sequence from 1991La17.

[&] Band(A): $\pi h_{11/2}^2 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2}^2$ multiplet. Band from 1991La17.

 $\gamma(^{149}\text{Tb})$

A_2 , A_4 and pol data are from $(\alpha, 6n\gamma)$ in 1991La17, with pol from counting rate asymmetry

$2(N_{\perp} - N_{\parallel}) / (N_{\perp} + N_{\parallel})$, with respect to the beam direction. The polarization for a pure multipole transition can

be determined from the angular distribution coefficients A_2 and A_4 using $\text{pol(ad)} = [3A_2 + 1.25A_4] / [2 - A_2 + 0.75A_4]$ if no parity change (1979Si19). So positive value of $\text{pol}/\text{pol(ad)}$ indicates no parity change (like M1 or E2) and negative value indicates parity change (like E2). DCO data are also reported by 1991La17 using $^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$. See that dataset for details.

Continued on next page (footnotes at end of table)

$^{151}\text{Eu}(\alpha, 6n\gamma)$ **1991La17** (continued) $\gamma(^{149}\text{Tb})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
168.5 2	10.3 5	2518.6	27/2 ⁺	2350.1	23/2 ⁺	Q	$A_2=+0.20$ 2; $A_4=-0.09$ 2; $\text{pol}=+0.01$ 10
210.6 2	7.6 8	4674.1	37/2 ⁺	4463.5	35/2 ⁺	M1	$A_2=-0.17$ 2; $A_4=+0.03$ 3; $\text{pol}=-0.34$ 19
215.6 1	33.3 17	2518.6	27/2 ⁺	2303.0	27/2 ⁻	(E1)	$A_2=+0.30$ 1; $A_4=+0.06$ 1; $\text{pol}=+0.45$ 7 Positive sign in 1991La17 for pol is inconsistent with $\Delta J=0$, E1; as positive sign either indicates $\delta(M2/E1)>0.8$ or so, which is unlikely from RUL for M2. E1 in 1991La17 .
224.9 3	9.5 10	5148.4	(41/2) ⁺	4923.5	39/2 ⁺	D+Q	$A_2=+0.09$ 2; $A_4=+0.09$ 3
249.4 2	14.3 7	4923.5	39/2 ⁺	4674.1	37/2 ⁺	M1	$A_2=-0.12$ 1; $A_4=-0.01$ 2; $\text{pol}=-0.11$ 10
254.9 2	7.0 7	4463.5	35/2 ⁺	4208.5	33/2 ⁺	M1	$A_2=-0.09$ 3; $A_4=-0.01$ 4; $\text{pol}=-0.64$ 24
290.8 1	71 4	1672.8	23/2 ⁻	1382.0	19/2 ⁻	E2	$A_2=+0.22$ 1; $A_4=-0.11$ 1; $\text{pol}=+0.24$ 2
294.3 1	39.7 20	2812.9	29/2 ⁺	2518.6	27/2 ⁺	M1	$A_2=-0.25$ 1; $A_4=-0.05$ 1; $\text{pol}=-0.38$ 6
306.8 1	16.6 9	1129.2	15/2 ⁺	822.4	15/2 ⁻	E1	$A_2=+0.21$ 2; $A_4=-0.06$ 2; $\text{pol}=-0.48$ 14
329.2 1	39.1 20	3142.1	31/2 ⁺	2812.9	29/2 ⁺	M1	$A_2=-0.17$ 1; $A_4=-0.06$ 1; $\text{pol}=-0.23$ 8
385.2 2	23.6 12	3527.4	33/2 ⁺	3142.1	31/2 ⁺	M1	$A_2=-0.28$ 1; $A_4=-0.06$ 2; $\text{pol}=-0.30$ 12
460.0 3	3.2 7	4923.5	39/2 ⁺	4463.5	35/2 ⁺	(Q)	$A_2=+0.23$ 8; $A_4=-0.06$ 12
465.7 3	3.0 6	4674.1	37/2 ⁺	4208.5	33/2 ⁺		
482.3 2	10.7 6	2350.1	23/2 ⁺	1867.8	19/2 ⁺	(Q)	$A_2=+0.18$ 2; $A_4=-0.03$ 3
509.9 3	21.5 11	2812.9	29/2 ⁺	2303.0	27/2 ⁻		
559.6 1	83 4	1382.0	19/2 ⁻	822.4	15/2 ⁻	E2	$A_2=+0.21$ 1; $A_4=-0.10$ 1; $\text{pol}=+0.23$ 8
623.5 3	2.0 4	3142.1	31/2 ⁺	2518.6	27/2 ⁺		
630.2 2	62 3	2303.0	27/2 ⁻	1672.8	23/2 ⁻	Q	$A_2=+0.23$ 1; $A_4=-0.12$ 1
715 1	2.0 4	3527.4	33/2 ⁺	2812.9	29/2 ⁺		
738.7 1	12.3 6	1867.8	19/2 ⁺	1129.2	15/2 ⁺	(Q)	$A_2=+0.18$ 3; $A_4=-0.03$ 5
786.6 2	100 5	822.4	15/2 ⁻	35.75	11/2 ⁻	(Q)	$A_2=+0.22$ 1; $A_4=-0.10$ 1
1066.2 3	1.5 3	4208.5	33/2 ⁺	3142.1	31/2 ⁺	D+Q	$A_2=-0.63$ 23; $A_4=+0.21$ 34
1146.7 2	12.0 6	4674.1	37/2 ⁺	3527.4	33/2 ⁺	Q	$A_2=+0.30$ 4; $A_4=-0.14$ 6
1300.5 2	5.1 5	3603.5	31/2 ⁻	2303.0	27/2 ⁻	(Q)	$A_2=+0.35$ 9; $A_4=-0.11$ 13
1321.6 2	6.3 7	4463.5	35/2 ⁺	3142.1	31/2 ⁺	Q	$A_2=+0.23$ 8; $A_4=-0.30$ 12
1395.5 2	6.8 7	4208.5	33/2 ⁺	2812.9	29/2 ⁺	(Q)	$A_2=+0.31$ 8; $A_4=-0.12$ 12

[†] From **1991La17**. Based on a general statement of $\approx 5\%$ for well-resolved transitions by **1991La17**, uncertainties in intensities are assigned by the evaluators as follows: 5% for $I_\gamma \geq 10$, 10% for $I_\gamma \geq 5$, and 20% otherwise. Energies are from results of both this study and $^{144}\text{Sm}(^7\text{Li}, 2n\gamma)$ by **1991La17** (mostly from the latter with the superior detection sensitivity).

[‡] Deduced from $\gamma(\theta)$ and $\gamma(\text{pol})$ in **1991La17**.

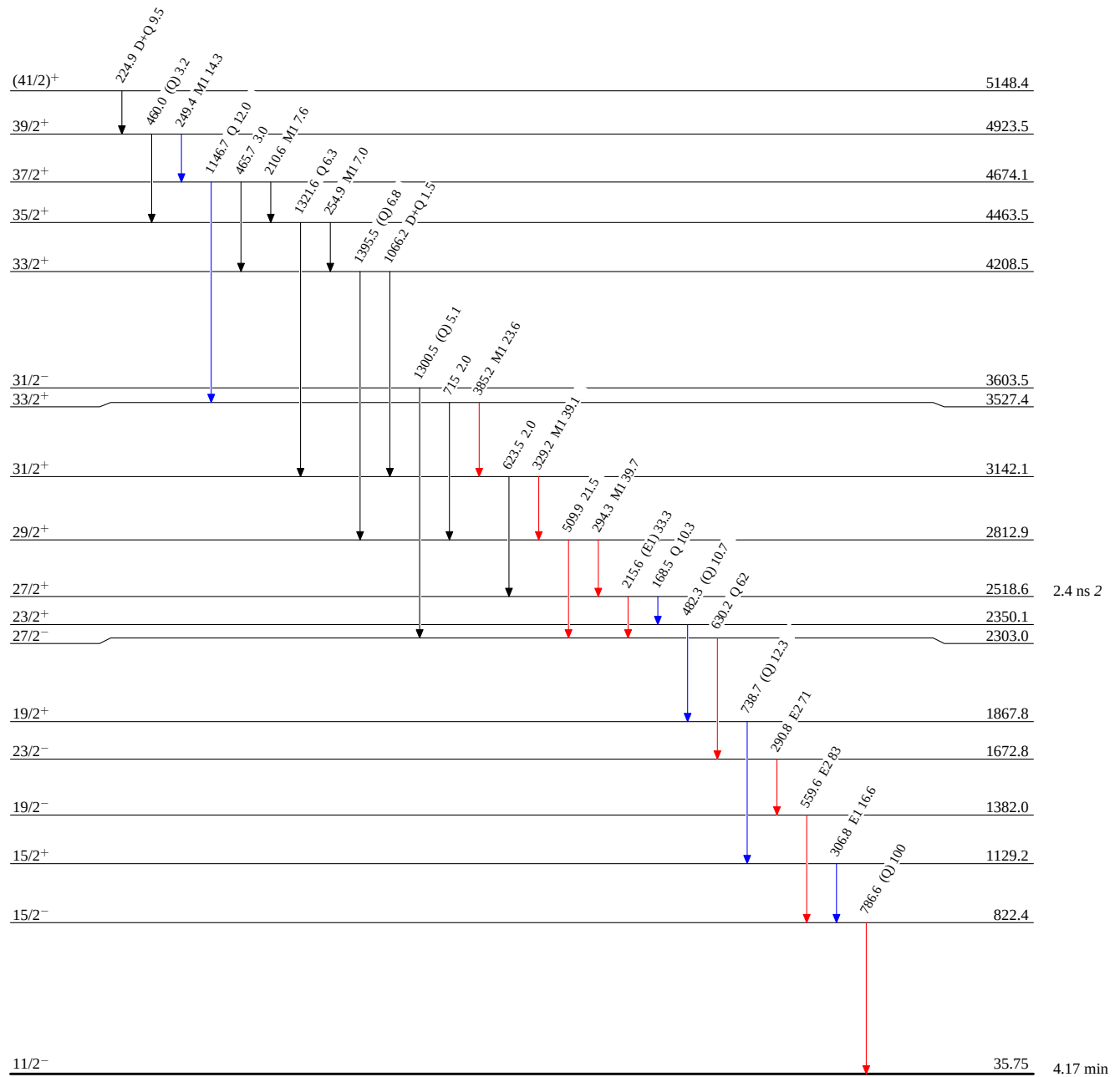
$^{151}\text{Eu}(\alpha, 6n\gamma)$ 1991La17

Level Scheme

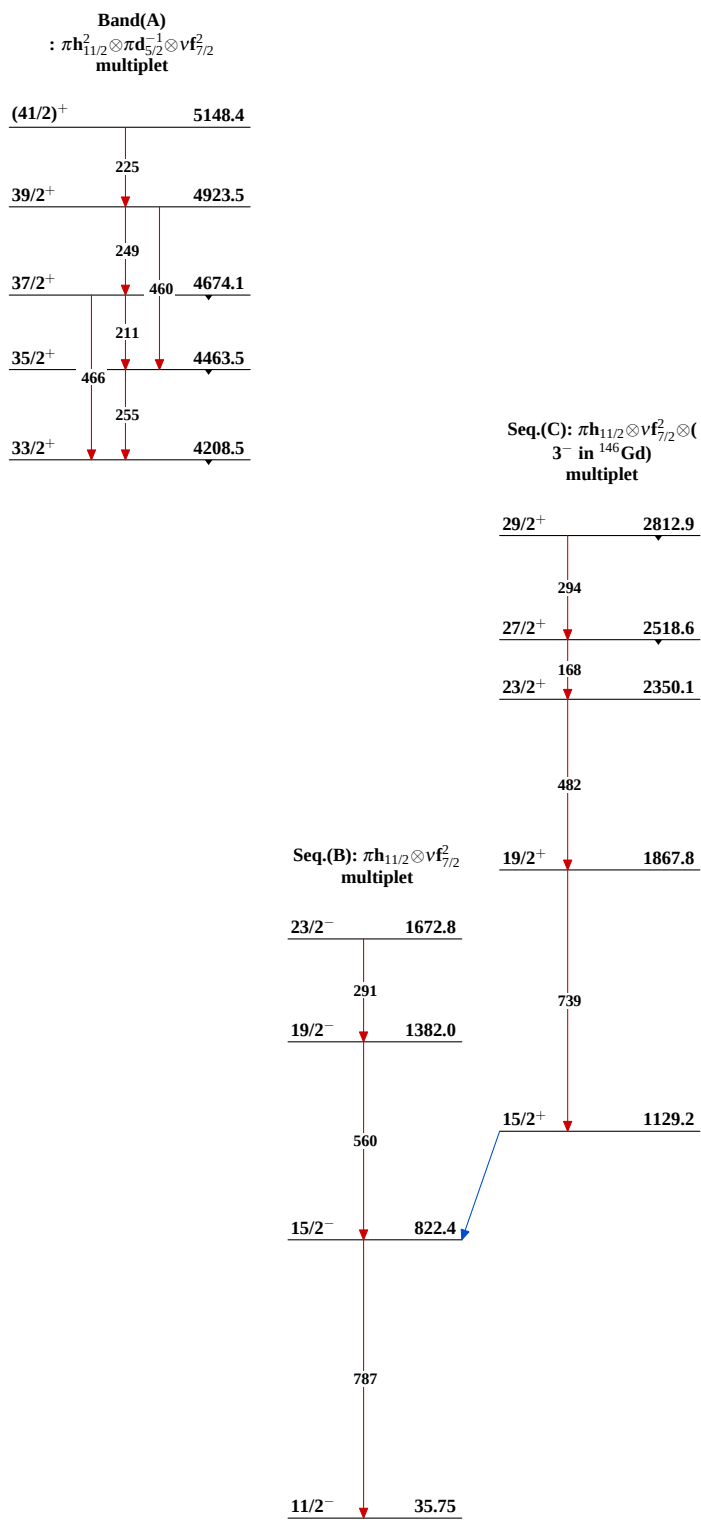
Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
— $I_\gamma < 10\% \times I_\gamma^{\max}$
— $I_\gamma > 10\% \times I_\gamma^{\max}$



$^{151}\text{Eu}(\alpha,6n\gamma)$ **1991La17**



$^{149}_{65}\text{Tb}_{84}$

$^{148}\text{Gd}(^3\text{He},\text{d})$ 1990Ma68

1990Ma68: E=30 MeV ^3He beam was produced from the MP Tandem accelerator of the Technical University of Munich. Target was $\approx 30 \mu\text{g}/\text{cm}^2$ ^{148}Gd on a $50 \mu\text{g}/\text{cm}^2$ carbon backing. Reaction products were momentum-analyzed with the Q3D magnetic spectrometer (FWHM=13.5 keV) and detected with a multi-wire proportional counter backed by a plastic scintillator. Measured $\sigma(\theta)$ (10° to 55°). Deduced levels, L-transfers, spectroscopic factors from DWBA analysis. Absolute cross sections accurate to 40%.

 ^{149}Tb Levels

E(level)	L	(2J+1)S	Comments
0	0	3.1 5	Proton orbit= $s_{1/2}$. $d\sigma/d\Omega(55^\circ)=145 \mu\text{b}/\text{sr}$ 4.
36 [†]	5	22 3	Proton orbit= $h_{11/2}$. $d\sigma/d\Omega(55^\circ)=88 \mu\text{b}/\text{sr}$ 3.
101 [†]	2	6.1 9	Proton orbit= $d_{3/2}$. $d\sigma/d\Omega(55^\circ)=132 \mu\text{b}/\text{sr}$ 3.
207 [†]	2	3.6 5	Proton orbit= $d_{5/2}$. $d\sigma/d\Omega(55^\circ)=89 \mu\text{b}/\text{sr}$ 3.
460 [†]	(4)	1.9 6	Proton orbit= $g_{7/2}$. L: 4 or 5, but L=4 is consistent with γ to $3/2^+$. $d\sigma/d\Omega(55^\circ)=11 \mu\text{b}/\text{sr}$ 2.
689 [†]			$d\sigma/d\Omega(55^\circ)=6 \mu\text{b}/\text{sr}$ 1.
742 [†]			$d\sigma/d\Omega(55^\circ)=10 \mu\text{b}/\text{sr}$ 1.
870 [‡] 2			$d\sigma/d\Omega(55^\circ)=13 \mu\text{b}/\text{sr}$ 1.
950 [‡] 3			$d\sigma/d\Omega(55^\circ)=19 \mu\text{b}/\text{sr}$ 2.
1048 [‡] 4			$d\sigma/d\Omega(55^\circ)=3 \mu\text{b}/\text{sr}$ 1.

[†] Rounded values from the Adopted Levels.

[‡] 1990Ma68 used energies of lower levels (101,207,461) from γ -ray studies to determine energy of this level.

Adopted Levels, Gammas

$Q(\beta^-) = -6048$ 13; $S(n) = 7906$ 12; $S(p) = 4446$ 15; $Q(\alpha) = 2808$ 22 (2021Wa16)

$Q(\varepsilon) = 3795$ 9, $Q(\varepsilon p) = 1286$ 9, $S(2n) = 19641$ 13, $S(2p) = 6915$ 9 (2021Wa16).

Other measurements:

Mass measurement (Penning-trap method): 2000Be42 (also 2001Bo59, 1997Be63).

Half-life of fully-ionized atom in its isomeric state at 2661 keV has been measured by separating the nuclei produced in fragmentation of ²⁰⁹Bi projectile and storing these nuclides in the cooler ring (ESR) at GSI. Measured $T_{1/2} = 11$ s 1 as compared to 0.490 s 15 for the neutral atom (2003Li42). In the same experiment decay of the bare atom in its g.s. was detected but half-life could not be measured.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for 15 references dealing with nuclear structure theory.

High-spin part of the level scheme is based on results from 1996Gu17 in ¹²²Sn(³²S,5n γ) and 2002Go06 in ¹⁴¹Pr(¹⁶O,p7n γ).

Configuration assignments to low-spin levels from 1994Me13 in ¹⁴⁹Ho ε decay.

¹⁴⁹Dy Levels

Possible SD structure exists in ¹⁴⁹Dy, as deduced by 2000Ap01 from a weak continuum, with a total SD intensity of 1.8% 5, in a ridge in the $\gamma\gamma$ -coin matrix in ¹²⁰Sn(³⁴S,5n γ) reaction. However, no discrete SD band structure has yet been found in this experiment; with an upper limit of population of 0.9% relative to the intensity of the relevant reaction channel.

Cross Reference (XREF) Flags

A	¹⁴⁹ Ho ε decay (21.0 s)	F	¹²² Sn(³² S,5n γ)
B	¹⁴⁹ Ho ε decay (56 s)	G	¹³⁶ Ce(¹⁶ O,3n γ)
C	¹⁴⁹ Dy IT decay (0.490 s)	H	¹⁴¹ Pr(¹⁶ O,p7n γ)
D	¹⁵³ Er α decay (37.1 s)	I	¹⁵² Gd(α ,7n γ)
E	¹²⁰ Sn(³² S,3n γ)		

E(level) [†]	J ^{π} #	T _{1/2}	XREF	Comments
0.0	7/2 ⁻	4.2 min 2	ABCDEFGH	$\% \varepsilon + \% \beta^+ = 100$ $\mu = -0.119$ 7 (1989Ra17,2019StZV) $Q = -0.62$ 5 (1989Ra17,2021StZZ) Evaluated rms charge radius = 5.06 fm 24 (2013An02). Evaluated difference in charge radius: $\delta \langle r^2 \rangle (^{148}\text{Dy}, ^{149}\text{Dy}) = +0.119$ fm ² 13 (2013An02). J^π : $f_{7/2}$ neutron state (1994Me13); allowed ε feeding to 5/2 ⁻ levels (1728, 1876) levels and 9/2 ⁻ level (1841) in ¹⁴⁹ Tb. $T_{1/2}$: weighted average of 4.2 min 2 (1993Al03), 4.1 min 2 (1975To03), 4.6 min 4 (x ray(t)) and 5.1 min 9 (α (t)) (1973Bi06). Other: 8 min 2 (1958To27,1959To27). $T_{1/2}$: decay of fully-ionized atoms (where $\% \beta^+ = 100$) was detected by 2003Li42; but half-life could not be measured since it is too long compared to the storage times possible in their experiment. With $\% \varepsilon = 0$, predicted $T_{1/2}$ of bare atom is 40 min 5 (2003Li42). μ, Q : 1989Ra17 compilations quotes μ and Q from Neugart et al. (priv. comm. 1987) who used collinear laser-spectroscopic technique. The same values are quoted by 2019StZV and 2021StZZ.
1034.60 20	(3/2 ⁻)		B	J^π : probable $p_{3/2}$ neutron state (1994Me13).
1073.23 9	(13/2 ⁺)	12.5 ns 15	A C EFGH	J^π : E3 1073.2 γ to 7/2 ⁻ ; probable member of configuration = $\nu f_{7/2} \otimes (3^-$ in ¹⁴⁸ Dy) multiplet (1994Me13,1980Da18). This state is also mixed with $i_{13/2}$ neutron state (1980Da18). $T_{1/2}$: from $\gamma\gamma$ (t) in (¹⁶ O,3n γ) (1980Da18). Other: 13 ns 3 in (1976St01).
1090.73 12	(9/2 ⁻)		A	J^π : probable $h_{9/2}$ neutron state (1994Me13); allowed $\varepsilon + \beta^+$ transition from (11/2 ⁻) parent.
1406.70 28	(1/2 ⁺)		B	J^π : probable member of configuration = $\nu f_{7/2} \otimes (3^-$ in ¹⁴⁸ Dy) multiplet

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{149}Dy Levels (continued)					
E(level) [†]	J ^π #	T _{1/2}	XREF	Comments	
1501.0 4	(3/2 ⁺)		B	(1994Me13).	
1572.80 35	(3/2 ⁺)		B	J ^π : probable d _{3/2} neutron hole state (1994Me13).	
1583.64 14	(11/2 ⁻)		A F H	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (3^-$ in ^{148}Dy) multiplet (1994Me13).	
1626.3 5	(5/2 ⁺)		B	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (3^-$ in ^{148}Dy) multiplet (1994Me13).	
1663.45 16	(9/2 ⁺)		A	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (3^-$ in ^{148}Dy) multiplet (1994Me13); evidence of $\varepsilon + \beta^+$ feeding from (11/2 ⁻) parent.	
1703.71 20	(11/2 ⁺)		A	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (3^-$ in ^{148}Dy) multiplet (1994Me13); 630.3γ M1(+E2) to (13/2 ⁺).	
1712.79 18	(9/2 ⁻)		A	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (2^+$ in ^{148}Dy) multiplet (1994Me13).	
1727.5 6	(1/2)		B	J ^π : either of 1727.5 and 1775.6 levels could be p _{1/2} or s _{1/2} neutron hole state (1994Me13).	
1775.6 5	(1/2)		B	J ^π : see comment for 1727.5 level.	
1782.21? 30	(7/2 ⁺)		A	J ^π : probable member of configuration= $\nu f_{7/2} \otimes (3^-$ in ^{148}Dy) multiplet (1994Me13).	
2165.82 28	(9/2,11/2,13/2) ⁺		A	J ^π : M1(+E2) 462.1γ to (11/2 ⁺).	
2251.84 13	(17/2) ⁺		C EFGHI	J ^π : E2 1178.6γ to (13/2 ⁺). Configuration= $\pi h_{11/2} \otimes \pi s_{1/2} \otimes \nu f_{7/2}$ (1983JuZY) or configuration= $\nu f_{7/2} \otimes (5^-$ in ^{148}Dy) (1980Da18).	
2291.74 22	(11/2 ⁻ ,13/2 ⁻) [@]		A	J ^π : 1218.5γ to (13/2 ⁺).	
2312.22 30	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2312.2γ to 7/2 ⁻ .	
2321.19 24	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2321.2γ to 7/2 ⁻ .	
2358.0 6	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 694.5γ to (9/2 ⁺).	
2402.44 31	(11/2 ⁻ ,13/2 ⁻) [@]		A	J ^π : 1329.2γ to (13/2 ⁺).	
2409.18 22	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2409.1γ to 7/2 ⁻ .	
2466.23 29	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2467.4γ to 7/2 ⁻ ; evidence of $\varepsilon + \beta^+$ feeding from (11/2 ⁻) parent.	
2487.23 19	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2487.2γ to 7/2 ⁻ .	
2550.44 17	(21/2) ⁺		C EFGHI	J ^π : E2 298.6γ to (17/2 ⁺). Configuration= $\pi h_{11/2} \otimes \pi d_{3/2} \otimes \nu f_{7/2}$ (1983JuZY) or configuration= $\nu f_{7/2} \otimes (7^-$ in ^{148}Dy) (1980Da18).	
2607.08 26	(11/2 ⁻) [@]		A	J ^π : 1534.0γ to (13/2 ⁺), 2607.0γ to 7/2 ⁻ .	
2660.94 34	(27/2) ⁻	0.490 s 15	C EFGHI	%IT=99.3 3; % ε +% β^+ =0.7 3 J ^π : E3 110.5γ to (21/2 ⁺). T _{1/2} : from γγ(t) and γ(t) in ^{149}Dy IT decay. For fully-ionized $^{149}\text{Dy}^{66+}$, T _{1/2} =11 s 1 (2003Li42). %IT from % ε +% β^+ =0.7 3 in 1988Ba02. Configuration= $\pi h_{11/2}^2 \otimes \nu f_{7/2}$ (1983JuZY) or configuration= $\pi h_{11/2}^2 \otimes (10^+$ in ^{148}Dy) (1980Da18). For fully-ionized atom, % ε =0 (2003Li42).	
2718.5? 4	(9/2 ⁻ ,11/2 ⁻) [@]		A	J ^π : 2718.5γ to 7/2 ⁻ .	
2728.64 32	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻) [@]		A	J ^π : 1637.9γ to (9/2 ⁻).	
2771.0 6	(1/2 ⁺ ,3/2 ⁺)		B	J ^π : probable member of configuration= $\pi h_{11/2} \otimes \nu h_{9/2} \otimes \pi s_{1/2}$ multiplet (1994Me13); possible allowed β feeding from (1/2 ⁺) parent.	
2788.6 5	(1/2 ⁺ ,3/2 ⁺)		B	J ^π : probable member of configuration= $\pi h_{11/2} \otimes \nu h_{9/2} \otimes \pi s_{1/2}$ multiplet (1994Me13); possible allowed β feeding from (1/2 ⁺)	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Dy Levels (continued)

E(level) [†]	J ^π #	T _{1/2}	XREF	Comments
				parent.
2789.17 22	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 1125.7γ to (9/2 ⁺), 1698.5γ to (9/2 ⁻); evidence of ε+β ⁺ feeding from (11/2 ⁻) parent.
2827.32 19	(11/2 ⁻)		A	J ^π : 1753.4γ to (13/2 ⁺), 2827.4γ to 7/2 ⁻ ; allowed ε+β ⁺ transition from (11/2 ⁻) parent; probable member of configuration=πh _{11/2} ² ⊗νh _{9/2} multiplet (1994Me13).
2882.79 23	(11/2 ⁻ , 13/2 ⁻) [@]		A	J ^π : 1809.7γ to (13/2 ⁺).
2938.1 6	(1/2 ⁺ , 3/2 ⁺)		B	J ^π : probable member of configuration=πh _{11/2} ⊗νh _{9/2} ⊗πs _{1/2} multiplet (1994Me13).
2980.40 25	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 2980.3γ to 7/2 ⁻ .
3014.2? 4	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 3014.2γ to 7/2 ⁻ .
3049.5 4	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻) [@]		A	J ^π : 1958.8γ to (9/2 ⁻).
3079.14 14	(11/2 ⁻)		A	J ^π : 3079.1γ to 7/2 ⁻ , 2006.0γ to (13/2 ⁺); allowed ε+β ⁺ transition from (11/2 ⁻) parent; probable member of configuration=πh _{11/2} ² ⊗νh _{9/2} multiplet (1994Me13).
3129.54 20	(11/2 ⁻) [@]		A	J ^π : 3129.5γ to 7/2 ⁻ , 2056.2γ to (13/2 ⁺).
3180.04 23	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻) [@]		A	J ^π : 2089.3γ to (9/2 ⁻).
3202.54 29	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 3202.5γ to 7/2 ⁻ .
3312.55 30	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻) [@]		A	J ^π : 2221.4γ to (9/2 ⁻); 1729.0γ to (11/2 ⁻).
3348.65 32	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻) [@]		A	J ^π : 2257.9γ to (9/2 ⁻).
3362.8 4	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 3362.8γ to 7/2 ⁻ .
3490.41 25	(9/2 ⁻ , 11/2 ⁻) [@]		A	J ^π : 3490.3γ to 7/2 ⁻ .
3645.1 4	(29/2 ⁺)		EFGHI	J ^π : ΔJ=1, E1 984.2γ to (27/2 ⁻). Configuration=πh _{11/2} ² ⊗νf _{7/2} ⊗(3 ⁻ in ^{148}Dy) (1983JuZY, 1980Da18).
3885.1 5	(31/2 ⁺)		EFGHI	J ^π : ΔJ=1, (M1) 240.0γ to (29/2 ⁺).
4084.4 6	(33/2 ⁺)		EFGHI	J ^π : ΔJ=1, (M1) γ to (31/2 ⁺).
5222.3 [‡] 6	(35/2 ⁺)		EFGHI	J ^π : ΔJ=(2) 1336.9γ to (31/2 ⁺).
5477.5 [‡] 6	(37/2 ⁺)		EFGHI	J ^π : E2, ΔJ=2 1393.2γ to (33/2 ⁺), (M1) γ to (35/2 ⁺).
5747.5 [‡] 6	(39/2 ⁺)		EFGHI	J ^π : (M1) 270.0γ to (37/2 ⁺).
5929.2? 7			G I	
6177.6 [‡] 6	(41/2 ⁺)		EFGHI	J ^π : (M1) γ to (39/2 ⁺); ΔJ=2 γ to (37/2 ⁺).
6328.3 8			F H	
6677.8 7			F H	
6891.1 7			F H	
6918.7 7	(41/2 ⁺)		EFGHI	J ^π : from 741.1γγ(DCO) in (^{32}S , 5nγ).
7156.5 7	(41/2 ⁺)		F H	J ^π : from 479.2γγ(DCO) in (^{32}S , 5nγ).
7241.4 7			FGHI	
7409.6 6	(43/2 ⁺)		EFGHI	J ^π : from γγ(DCO) in (^{32}S , 5nγ).
8044.6? 11			H	
8270.6? 11			H	
8519.6 12	(49/2 ⁺)	28 ns 2	EF HI	μ=+10.0 15 (2003Wa28, 2020StZV) J ^π : from systematics of N=83 isotones, see figure 4 of 2002Go06 in $^{141}\text{Pr}(^{16}\text{O}, \text{p}7\text{n}\gamma)$. The location of this isomer proposed by 2002Go06 is still tentative due to tentative connections of the 28-ns isomer with the low-lying levels. T _{1/2} : γγ(t); weighted average of 29 ns 3 (1979Ha29), 36 ns 8 (1980Da18), 25 ns 5 (1980Ja16) and 28 ns 3 (1981Ha17). Other: 50 ns 15 (1976St01). See $^{152}\text{Gd}(\alpha, 7\text{n}\gamma)$ dataset. μ: from TDPAD (2003Wa28) using pulsed ^{132}Xe beam. Configuration=πh _{11/2} ² ⊗ν(f _{7/2} , h _{9/2} , i _{13/2} , d _{3/2} ⁻² o) gives calculated g=0.46 (2002Go06).

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Dy Levels (continued)

<u>E(level)[†]</u>	<u>J^π#</u>	<u>XREF</u>
9115.0 13	(51/2) &	F H
9409.3 14	(53/2) &	F H
9782.4 14	(53/2) &	F H
10238.7 14	(55/2) &	F H
11200.8 15		H
11905.0 15		F H
11951.2 15	(57/2) &	F H
12209.4 15		F H
12555.3 15	(57/2) &	F H
12753.1 15	(59/2) &	F H
12812.4 16		F H
13088.2 16	(61/2) &	F H
13115.3 16		F H
13727.8 17		H
13949.3 17		H

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_{\gamma}=0.3$ keV for E_{γ} values quoted to tenth of a keV and 1 keV otherwise where not given. Absolute energies of levels above 7410.5 remain uncertain due to tentative connections of the 28-ns isomer with the low-lying levels.

[‡] Member of configuration= $\pi h_{11/2}^3 \otimes \pi d_{5/2}^{-1} \otimes \nu f_{7/2}$ by 1983JuZY in ($\alpha, 7n\gamma$) and ($^{16}\text{O}, 3n\gamma$). The $d_{5/2}$ proton orbital could be $g_{7/2}$ also (1983JuZY).

From shell-Model predictions and systematics (1994Me13) for levels with $J \leq 13/2$, unless otherwise noted.

@ Probable member of configuration= $\pi h_{11/2}^2 \otimes \nu h_{9/2}$ multiplet (1994Me13). Possible β feeding from $(11/2^-)$ parent suggests $(9/2, 11/2, 13/2)$.

& Tentative assignments based on $\gamma\gamma(\theta)$ (DCO) data in $^{122}\text{Sn}(^{32}\text{S}, 5n\gamma)$ (1996Gu17); spins proposed by 1996Gu17 have been adjusted upwards by two units due to revised J^{π} for the 28-ns isomer.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Dy})$

$E_i(\text{level})$	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.	δ	α &	Comments
1034.60	(3/2 ⁻)	1034.6 2	100	0.0	7/2 ⁻				
1073.23	(13/2 ⁺)	1073.2 1	100	0.0	7/2 ⁻	E3 [#]		0.00557 8	B(E3)(W.u.)=45 +6-5 E _γ : weighted average of 1073.1 2 from ¹⁴⁹ Ho ε decay (21.1 s), 1073.2 1 from ¹⁴⁹ Dy IT decay (0.490 s), 1073.2 3 from (³² S,3nγ), and 1073.2 2 from (α,7nγ).
1090.73	(9/2 ⁻)	1090.4 3	100	0.0	7/2 ⁻				
1406.70	(1/2 ⁺)	372.1 2	100	1034.60	(3/2 ⁻)	E1 [#]		0.01017 14	
1501.0	(3/2 ⁺)	94.3 3	100	1406.70	(1/2 ⁺)	M1(+E2) [#]	<0.7 [‡]	2.92 10	
1572.80	(3/2 ⁺)	166.1 2	100	1406.70	(1/2 ⁺)	M1(+E2) [#]	<1.5 [‡]	0.52 4	
1583.64	(11/2 ⁻)	511 2	12 4	1073.23	(13/2 ⁺)				
		1583.7 2	100 2	0.0	7/2 ⁻				
1626.3	(5/2 ⁺)	591.7 5	100	1034.60	(3/2 ⁻)	(E1) [‡]		0.00356 5	
1663.45	(9/2 ⁺)	590.1 5	13 4	1073.23	(13/2 ⁺)				
		1663.4 2	100 2	0.0	7/2 ⁻				
1703.71	(11/2 ⁺)	613.0 2	18 4	1090.73	(9/2 ⁻)				
		630.3 5	100 15	1073.23	(13/2 ⁺)	M1(+E2) [‡]	<2.5 [‡]	0.0131 35	
1712.79	(9/2 ⁻)	1712.9 2	100	0.0	7/2 ⁻				
1727.5	(1/2)	692.9 6	100	1034.60	(3/2 ⁻)				
1775.6	(1/2)	741.0 5	100	1034.60	(3/2 ⁻)				
1782.21?	(7/2 ⁺)	1782.2 ^a 3	100	0.0	7/2 ⁻				
2165.82	(9/2,11/2,13/2) ⁺	462.1 3	100 26	1703.71	(11/2 ⁺)	M1(+E2) [‡]	<1.0 [‡]	0.032 4	
		1092.6 4	87 44	1073.23	(13/2 ⁺)				
2251.84	(17/2 ⁺)	1178.6 1	100	1073.23	(13/2 ⁺)	E2 [#]		2.18×10 ⁻³ 3	E _γ : from (α,7nγ). Other: 1178.6 3 from (³² S,3nγ).
2291.74	(11/2 ⁻ ,13/2 ⁻)	1218.5 2	100	1073.23	(13/2 ⁺)				
2312.22	(9/2 ⁻ ,11/2 ⁻)	2312.2 3	100	0.0	7/2 ⁻				
2321.19	(9/2 ⁻ ,11/2 ⁻)	1230.4 4	27 11	1090.73	(9/2 ⁻)				
		2321.2 3	100 11	0.0	7/2 ⁻				
2358.0	(9/2 ⁻ ,11/2 ⁻)	694.5 6	100	1663.45	(9/2 ⁺)				
2402.44	(11/2 ⁻ ,13/2 ⁻)	1329.2 3	100	1073.23	(13/2 ⁺)				
2409.18	(9/2 ⁻ ,11/2 ⁻)	1318.5 3	100 4	1090.73	(9/2 ⁻)				
		2409.1 3	30 6	0.0	7/2 ⁻				
2466.23	(9/2 ⁻ ,11/2 ⁻)	1375.2 3	100 6	1090.73	(9/2 ⁻)				
		2467.4 ^a 6	15 6	0.0	7/2 ⁻				
2487.23	(9/2 ⁻ ,11/2 ⁻)	1396.5 2	70 8	1090.73	(9/2 ⁻)				
		2487.2 3	100 7	0.0	7/2 ⁻				
2550.44	(21/2 ⁺)	298.6 1	100	2251.84	(17/2 ⁺)	E2 [#]		0.0654 9	E _γ : from (α,7nγ).
2607.08	(11/2 ⁻)	1534.0 5	28 10	1073.23	(13/2 ⁺)				

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Dy})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	$\alpha^\&$	Comments
2607.08	(11/2 ⁻)	2607.0 3	100 10	0.0	7/2 ⁻			
2660.94	(27/2 ⁻)	110.5 3	100	2550.44	(21/2 ⁺)	E3 [#]	27.6 6	B(E3)(W.u.)=0.325 14 E _γ : weighted average of 110.4 3 from (³² S,3nγ) and 110.8 4 from (α,7nγ).
2718.5?	(9/2 ⁻ ,11/2 ⁻)	2718.5 ^a 4	100	0.0	7/2 ⁻			
2728.64	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1637.9 3	100	1090.73	(9/2 ⁻)			
2771.0	(1/2 ⁺ ,3/2 ⁺)	1736.4 6	100	1034.60	(3/2 ⁻)			
2788.6	(1/2 ⁺ ,3/2 ⁺)	1754.0 5	100	1034.60	(3/2 ⁻)			
2789.17	(9/2 ⁻ ,11/2 ⁻)	1125.7 2	100 5	1663.45	(9/2 ⁺)			
		1698.5 4	75 7	1090.73	(9/2 ⁻)			
2827.32	(11/2 ⁻)	1114.8 3	8.4 13	1712.79	(9/2 ⁻)			
		1736.6 5	100 21	1090.73	(9/2 ⁻)			
		1753.4 4	16 4	1073.23	(13/2 ⁺)			
		2827.4 3	58 2	0.0	7/2 ⁻			
2882.79	(11/2 ⁻ ,13/2 ⁻)	1791.9 3	58 6	1090.73	(9/2 ⁻)			
		1809.7 3	100 14	1073.23	(13/2 ⁺)			
2938.1	(1/2 ⁺ ,3/2 ⁺)	1531.4 5	100	1406.70	(1/2 ⁺)			
2980.40	(9/2 ⁻ ,11/2 ⁻)	1889.7 3	75 13	1090.73	(9/2 ⁻)			
		2980.3 4	100 18	0.0	7/2 ⁻			
3014.2?	(9/2 ⁻ ,11/2 ⁻)	3014.2 ^a 4	100	0.0	7/2 ⁻			
3049.5	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1958.8 4	100	1090.73	(9/2 ⁻)			
3079.14	(11/2 ⁻)	1415.6 3	27 3	1663.45	(9/2 ⁺)			
		1495.5 2	84 2	1583.64	(11/2 ⁻)			
		1988.4 2	100 4	1090.73	(9/2 ⁻)			
		2006.0 5	12 5	1073.23	(13/2 ⁺)			
		3079.1 3	32 3	0.0	7/2 ⁻			
3129.54	(11/2 ⁻)	1545.9 2	100 8	1583.64	(11/2 ⁻)			
		2056.2 5	21 12	1073.23	(13/2 ⁺)			
		3129.5 4	28 6	0.0	7/2 ⁻			
3180.04	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	2089.3 2	100	1090.73	(9/2 ⁻)			
3202.54	(9/2 ⁻ ,11/2 ⁻)	2111.8 3	100 19	1090.73	(9/2 ⁻)			
		3202.5 6	58 23	0.0	7/2 ⁻			
3312.55	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1729.0 3	100 10	1583.64	(11/2 ⁻)			
		2221.4 6	98 39	1090.73	(9/2 ⁻)			
3348.65	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	2257.9 3	100	1090.73	(9/2 ⁻)			
3362.8	(9/2 ⁻ ,11/2 ⁻)	3362.8 4	100	0.0	7/2 ⁻			
3490.41	(9/2 ⁻ ,11/2 ⁻)	2399.7 3	100 18	1090.73	(9/2 ⁻)			
		3490.3 4	79 15	0.0	7/2 ⁻			
3645.1	(29/2 ⁺)	984.2 2	100	2660.94	(27/2 ⁻)	E1 ^{#@}	1.29×10 ⁻³ 2	E _γ : weighted average of 984.0 3 from (³² S,3nγ) and 984.3 2 from (α,7nγ).
3885.1	(31/2 ⁺)	240.0 3		3645.1	(29/2 ⁺)	(M1) [#]	0.2060 30	E _γ : from (α,7nγ) and (³² S,3nγ). Mult.: also supported by γ(θ) in (α,7nγ) and γγ(DCO) in (³² S,5nγ), with ΔJ=1.

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Dy})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	$\alpha\&$	Comments
4084.4	(33/2 ⁺)	199.5 3	100	3885.1	(31/2 ⁺)	(M1) ^{#@}	0.342 5	E_γ : weighted average of 199.6 3 from (³² S,3n γ) and 199.4 3 from (α ,7n γ).
5222.3	(35/2 ⁺)	1138.2 1336.9 3	33 5 100 7	4084.4 3885.1	(33/2 ⁺) (31/2 ⁺)	(Q)		E_γ : weighted average of 1336.8 3 from (³² S,3n γ) and 1337.2 4 from (α ,7n γ). Mult.: from $\gamma(\theta)$ in (α ,7n γ), with $\Delta J=(2)$.
5477.5	(37/2 ⁺)	255.2 2	51 5	5222.3	(35/2 ⁺)	(M1) [#]	0.1744 25	E_γ : weighted average of 255.7 3 from (³² S,3n γ) and 255.0 2 from (α ,7n γ).
		1393.2 3	100 7	4084.4	(33/2 ⁺)	E2	1.61×10^{-3} 2	I_γ : others: 107 30 from (¹⁶ O,3n γ), ≈ 33 from (α ,7n γ). E_γ : weighted average of 1393.0 3 from (³² S,3n γ) and 1393.7 5 from (α ,7n γ).
5747.5	(39/2 ⁺)	270.0 2	100 7	5477.5	(37/2 ⁺)	(M1) [#]	0.1498 21	I_γ : others: 100 10 from (¹⁶ O,3n γ), 100 22 from (α ,7n γ). E_γ : weighted average of 270.1 3 from (³² S,3n γ) and 270.0 2 from (α ,7n γ).
5929.2?		525.4	28.9 22	5222.3	(35/2 ⁺)			E_γ : from (α ,7n γ).
6177.6	(41/2 ⁺)	451.7 248.4 ^a	100	5477.5 5929.2?	(37/2 ⁺)			E_γ : from (α ,7n γ).
		430.3 2	100 7	5747.5	(39/2 ⁺)	(M1) [#]	0.0437 6	E_γ : weighted average of 430.2 3 from (³² S,3n γ) and 430.3 2 from (α ,7n γ).
		699.8 3	23 5	5477.5	(37/2 ⁺)			E_γ : from (³² S,3n γ).
6328.3		580.8	100	5747.5	(39/2 ⁺)			
6677.8		930.5	100	5747.5	(39/2 ⁺)			
6891.1		213.0		6677.8				
		1143.5		5747.5	(39/2 ⁺)			E_γ : placement from 2002Go06 in (¹⁶ O,p7n γ); a 1143.6 γ placed to feed the 13116 level by 1996Gu17 in (³² S,5n γ).
6918.7	(41/2 ⁺)	741.1 3	100	6177.6	(41/2 ⁺)			E_γ : from (³² S,3n γ).
7156.5	(41/2 ⁺)	479.2	100 25	6677.8				
		1408.9	18 5	5747.5	(39/2 ⁺)			
7241.4		350.0	32 7	6891.1				
		1064.1	100 17	6177.6	(41/2 ⁺)			
7409.6	(43/2 ⁺)	168.1	10.3 9	7241.4				
		253.3	15 3	7156.5	(41/2 ⁺)			
		491.1	100 6	6918.7	(41/2 ⁺)			
		1231.8 3	55 6	6177.6	(41/2 ⁺)	(D,E2) [#]		E_γ : from (³² S,3n γ).
8044.6?		635 ^a		7409.6	(43/2 ⁺)			
8270.6?		861 ^a		7409.6	(43/2 ⁺)			
8519.6	(49/2 ⁺)	249 ^a		8270.6?				
		475 ^a		8044.6?				249 γ and 475 γ from ¹⁴¹ Pr(¹⁶ O,p7n γ) only.
9115.0	(51/2)	595.4	100	8519.6	(49/2 ⁺)			
9409.3	(53/2)	294.2	100	9115.0	(51/2)			
9782.4	(53/2)	667.5	100	9115.0	(51/2)			

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Dy})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π
10238.7	(55/2)	456.5	100 13	9782.4	(53/2)	12753.1	(59/2)	848.2	100 20	11905.0	
		829.3	63 13	9409.3	(53/2)	12812.4		603.1		12209.4	
11200.8		962.1		10238.7	(55/2)			861.0		11951.2	(57/2)
11905.0		704.2	100	11200.8		13088.2	(61/2)	335.1	100	12753.1	(59/2)
11951.2	(57/2)	750.4	100	11200.8		13115.3		303.1	100	12812.4	
12209.4		1008.6	100	11200.8		13727.8		613		13115.3	
12555.3	(57/2)	1354.3		11200.8				915		12812.4	
12753.1	(59/2)	197.7	70 8	12555.3	(57/2)	13949.3		834		13115.3	
		543.7	80 20	12209.4				1137		12812.4	
		802.0		11951.2	(57/2)						

[†] From ¹⁴⁹Ho ε decay ([1994Me13](#)) up to the 3490 level and from (³²S,5n γ) ([1996Gu17](#)) and/or (¹⁶O,p7n γ) ([2002Go06](#)) above this energy. Exceptions are high-spin levels of 2251.8, 2550.4 and 2660.9 keV, which decay by single γ rays, and for which source dataset of E_γ values are specified in comments.

[‡] From ce data in ¹⁴⁹Ho ε decay ([1994Me13](#)).

[#] From ce data in (¹⁶O,3n γ) ([1980Da18](#)).

[@] Also supported by $\gamma(\theta)$ in (α ,7n γ) and $\gamma\gamma(\text{DCO})$ in (³²S,5n γ), with $\Delta J=1$ for dipole or $\Delta J=2$ for quadrupole where applicable.

[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

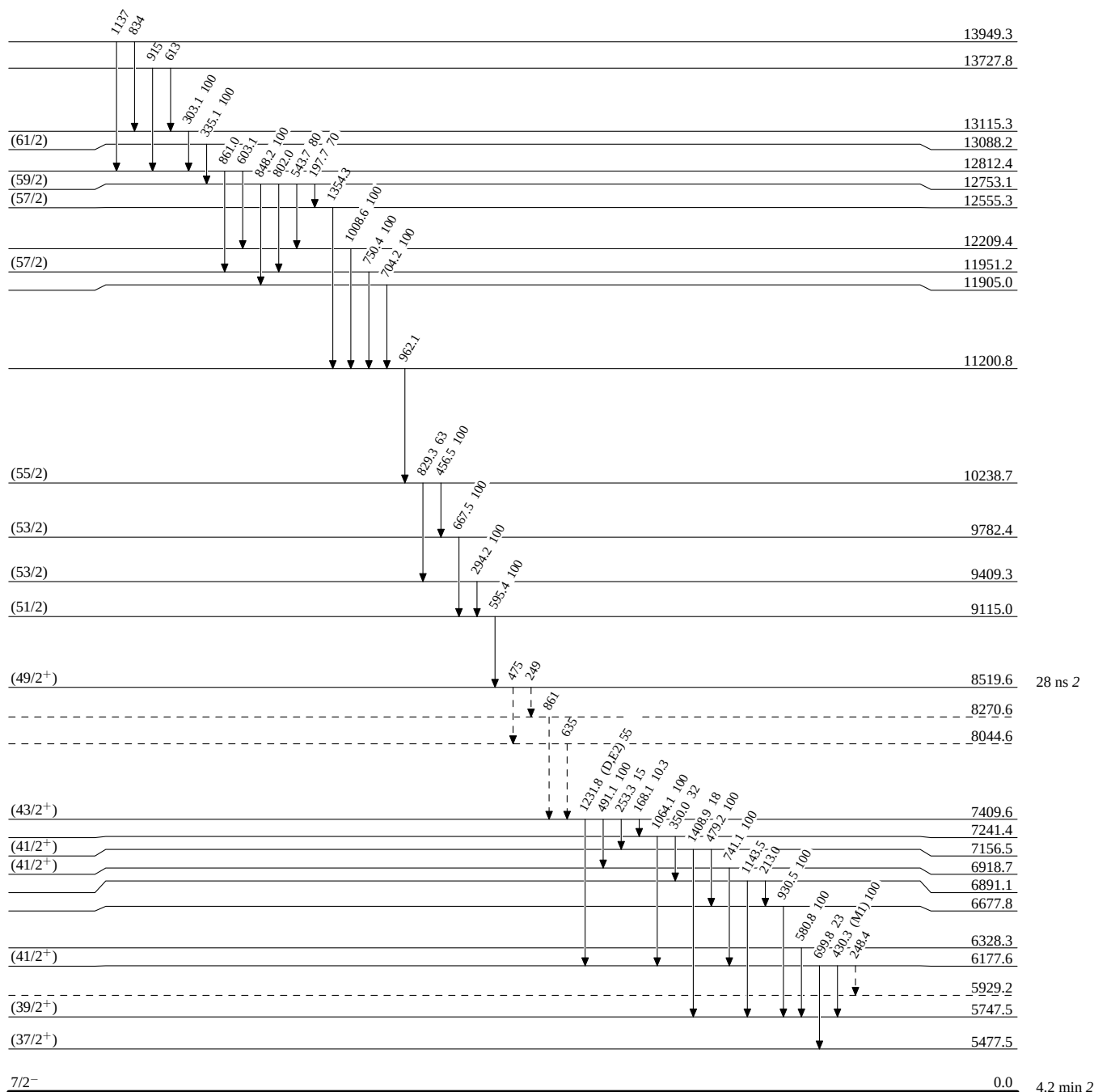
^a Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)


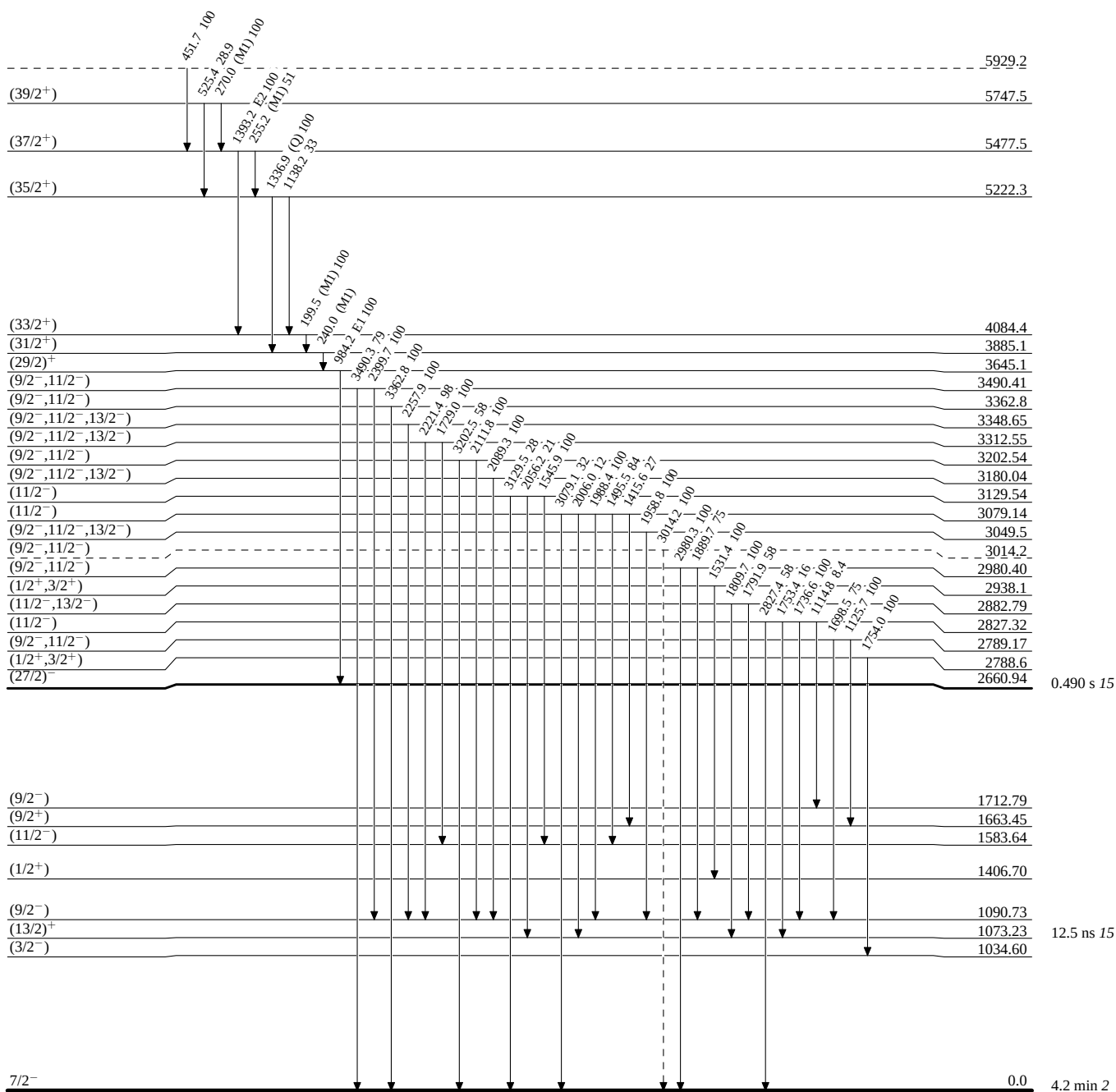
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



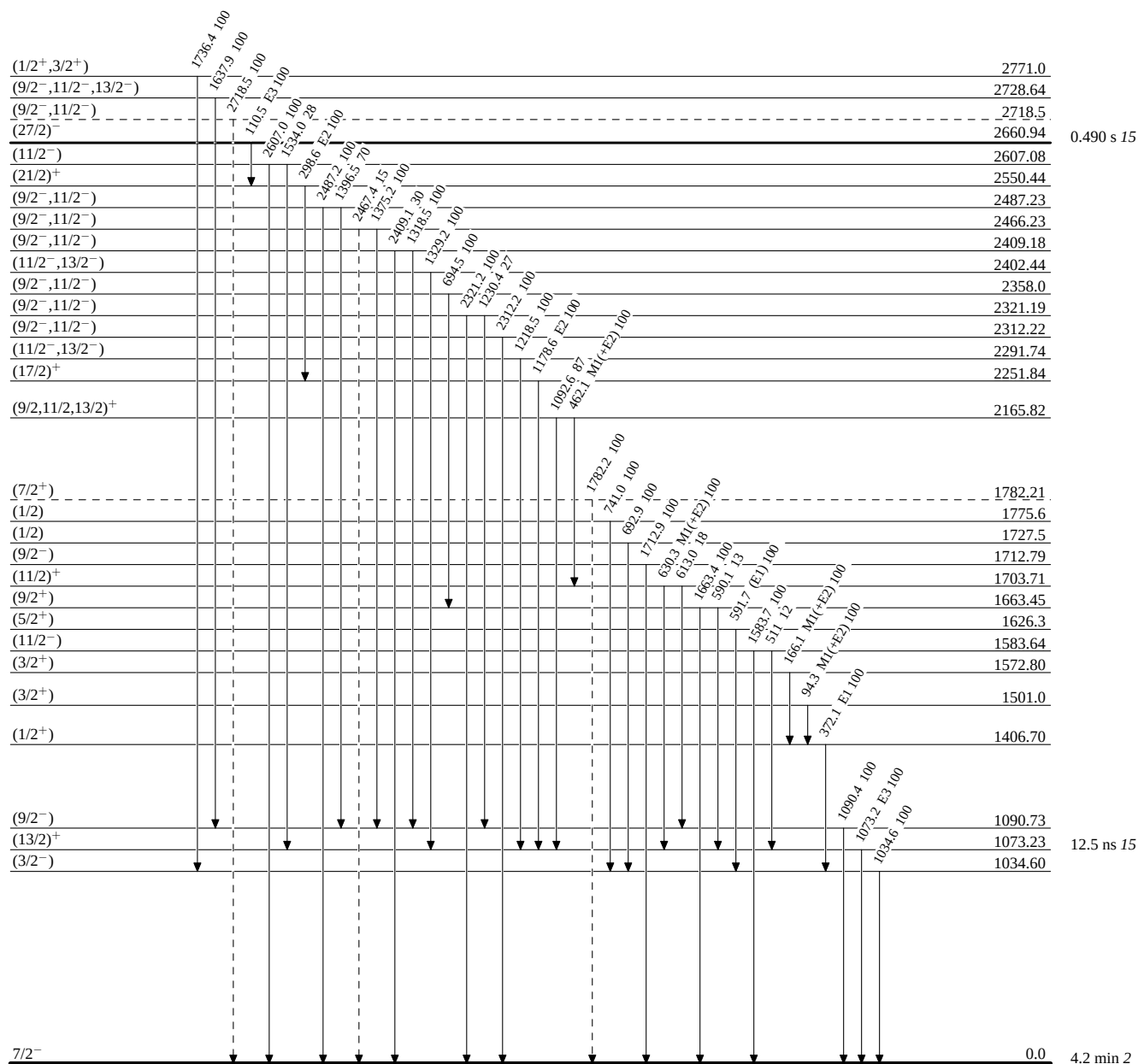
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



¹⁴⁹Ho ε decay (21.0 s) [1994Me13,1990AlZH](#)

Parent: ¹⁴⁹Ho: E=0.0; J^π=(11/2⁻); T_{1/2}=21.0 s 2; Q(ε)=6048 13; %ε+%β⁺ decay=100

¹⁴⁹Ho-J^π, T_{1/2}: From ¹⁴⁹Ho Adopted Levels.

¹⁴⁹Ho-Q(ε): From [2021Wa16](#).

[1994Me13](#) (also [1989Me13](#)): ¹⁴⁹Ho ions were produced via fusion-evaporation reactions with 5.4 MeV/nucleon ⁵⁸Ni beam on ^{94,95}Mo targets at ISOLDE, GSI, separated by the GSI online separator and deposited on a transport tape. The γ- and x-rays were detected with a planar and two coaxial Ge(Li) detectors. Measured E_γ, I_γ, I(x-ray), γγ-coin, γ(x-ray)coin, γ(t). Deduced levels, J, π, parent T_{1/2}, conversion coefficients, γ-ray multiplicities, GT strengths. Comparisons with TAGS spectrum in [1990AlZU](#), and with theoretical calculations. Configurations are suggested for all the levels reported in this decay.

[1990AlZH](#) (also [1993Al03](#), [1991AlZY](#), [1990AlZU](#), [1990AlZJ](#)): measured total-absorption gamma spectrum (TAGS); deduced I(ε+β⁺) feedings and β-strength functions.

Others:

γ, γγ: [1979To01](#) (three γ rays reported), [1982Ba75](#) (two γ rays reported), [1987ElZZ](#).

T_{1/2} (¹⁴⁹Ho): [1979To01](#), [1982Ba75](#), [1993Al03](#).

Q(ε): [1993Al03](#) (from total γ absorption), [1991Ke11](#) (β⁺γ), [1984HaZD](#) (ε/β⁺), [1983Al06](#) (β⁺, γ).

For the decay scheme, high-resolution γ-ray study in [1994Me13](#) gives total decay energy deposit of 5610 keV 260 as compared to the expected value of 6048 keV 13. TAGS data in [1990AlZH](#) suggests that ≈25% of I(ε+β⁺) intensity above 1070 keV is missing discrete γ-ray data, but much of this missing intensity seems collected in the γ-ray intensity of the 1090.7-keV γ ray, as the transition intensity balance at the 1090.7-keV level gives apparent I(ε+β⁺) feeding of 59% versus 33% from TAGS data.

¹⁴⁹Dy Levels

The decay scheme is mainly from [1994Me13](#), with pseudo-levels added from TAGS data, where no high-resolution γ-ray data are available in [1994Me13](#).

E(level) [†]	J ^π @	T _{1/2} @	E(level) [†]	J ^π @
0.0	7/2 ⁻	4.2 min 2	1583.60 14	(11/2 ⁻)
855? [‡] 14			1663.45 16	(9/2 ⁺)
884? [‡] 14			1703.73 20	(11/2 ⁺)
912? [‡] 14			1712.80 18	(9/2 ⁻)
941? [‡] 14			1738 [‡] 14	
969? [‡] 14			1782.21? 30	(7/2 ⁺)
1073.31 9	(13/2) ⁺		1795 [‡] 14	
1090.74 12	(9/2 ⁻)		1824 [‡] 14	
1197 [‡] 14			1853 [‡] 14	
1226? [‡] 14			1881 [‡] 14	
1254? [‡] 14			1910 [‡] 14	
1283 [‡] 14			1938 [‡] 14	
1311? [‡] 14			1967 [‡] 14	
1340? [‡] 14			1995 [‡] 14	
1368? [‡] 14			2023 [‡] 14	
1397? [‡] 14			2052? [‡] 14	
1425 [‡] 14			2081 [‡] 14	
1454 [‡] 14			2109 [‡] 14	
1482 [‡] 14			2138 [‡] 14	
1511 [‡] 14			2165.86 28	(9/2,11/2,13/2) ⁺
1539 [‡] 14			2223 [‡] 14	

Continued on next page (footnotes at end of table)

^{149}Ho ε decay (21.0 s) [1994Me13,1990AlZH](#) (continued) ^{149}Dy Levels (continued)

E(level) [†]	J ^π @	E(level) [†]	E(level) [†]
2252 [‡] 14		3591 [‡] 14	4760 [‡] 14
2291.81 22	(11/2 ⁻ , 13/2 ⁻)	3620 [‡] 14	4788 [‡] 14
2312.22 30	(9/2 ⁻ , 11/2 ⁻)	3648 [‡] 14	4817 [‡] 14
2321.19 24	(9/2 ⁻ , 11/2 ⁻)	3677 [‡] 14	4845 [‡] 14
2358.0 6	(9/2 ⁻ , 11/2 ⁻)	3705 [‡] 14	4874 [‡] 14
2402.51 31	(11/2 ⁻ , 13/2 ⁻)	3734 [‡] 14	4902 [‡] 14
2409.18 22	(9/2 ⁻ , 11/2 ⁻)	3762 [‡] 14	4931 [‡] 14
2466.24 29	(9/2 ⁻ , 11/2 ⁻)	3791 [‡] 14	4959 [‡] 14
2487.24 19	(9/2 ⁻ , 11/2 ⁻)	3819 [‡] 14	4988 [‡] 14
2537 [‡] 14		3848 [‡] 14	5016 [‡] 14
2565 [‡] 14		3876 [‡] 14	5045 [‡] 14
2594 [‡] 14		3905 [‡] 14	5073 [‡] 14
2607.10 26	(11/2 ⁻)	3933 [‡] 14	5102 [‡] 14
2651 [‡] 14		3962 [‡] 14	5130 [‡] 14
2679 [‡] 14		3990 [‡] 14	5159 [‡] 14
2718.5? 4	(9/2 ⁻ , 11/2 ⁻)	4019 [‡] 14	5187 [‡] 14
2728.65 32	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻)	4047 [‡] 14	5216 [‡] 14
2789.18 22	(9/2 ⁻ , 11/2 ⁻)	4076 [‡] 14	5244 [‡] 14
2827.34 19	(11/2 ⁻)	4104 [‡] 14	5273 [‡] 14
2882.83 23	(11/2 ⁻ , 13/2 ⁻)	4133 [‡] 14	5301 [‡] 14
2907 [‡] 14		4161 [‡] 14	5330 [‡] 14
2936 [‡] 14		4190 [‡] 14	5358 [‡] 14
2964 [‡] 14		4218 [‡] 14	5387 [‡] 14
2980.41 25	(9/2 ⁻ , 11/2 ⁻)	4247 [‡] 14	5415? 14
3014.2? 4	(9/2 ⁻ , 11/2 ⁻)	4275 [‡] 14	5444? 14
3049.6 4	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻)	4304 [‡] 14	5472 [‡] 14
3079.13 14	(11/2 ⁻)	4332 [‡] 14	5501 [‡] 14
3129.52 20	(11/2 ⁻)	4361 [‡] 14	5529 [‡] 14
3180.05 23	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻)	4389 [‡] 14	5558 [‡] 14
3202.55 29	(9/2 ⁻ , 11/2 ⁻)	4418 [‡] 14	5586 [‡] 14
3249 [‡] 14		4446 [‡] 14	5615 [‡] 14
3277 [‡] 14		4475 [‡] 14	5643? 14
3312.52 30	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻)	4503 [‡] 14	5672? 14
3348.66 32	(9/2 ⁻ , 11/2 ⁻ , 13/2 ⁻)	4532 [‡] 14	5700 [‡] 14
3362.8 4	(9/2 ⁻ , 11/2 ⁻)	4560 [‡] 14	5729 [‡] 14
3392 [‡] 14		4589 [‡] 14	5757 [‡] 14
3420 [‡] 14		4617 [‡] 14	5786 [‡] 14
3449 [‡] 14		4646 [‡] 14	5814 [‡] 14
3490.42 25	(9/2 ⁻ , 11/2 ⁻)	4674 [‡] 14	5843 [‡] 14
3534 [‡] 14		4703 [‡] 14	5871 [‡] 14
3563 [‡] 14		4731 [‡] 14	

[†] From a least-squares fit to γ -ray energies, except for the pseudo-levels, which are taken from TAGS data in [1990AlZH](#).[‡] Pseudo-level from TAGS data in [1990AlZH](#); uncertainty is from bin width of 28.5 keV in the analysis of TAGS data.# No excited states in ^{149}Dy have been reported below 1034 keV in any of the decays or reactions, thus this pseudo-level and associated weak $I(\varepsilon+\beta^+)$ feeding is treated by evaluators as questionable.

@ From the Adopted Levels.

^{149}Ho ε decay (21.0 s) **1994Me13,1990AlZH** (continued) ε, β^+ radiations

E(decay)	E(level)	I_{ε}^a	$I(\varepsilon + \beta^+)^{\dagger a}$	Comments
(177 19)	5871	0.003	$\ddagger$	
(205 19)	5843	0.003	$\ddagger$	
(234 19)	5814	0.010	$\ddagger$	
(262 19)	5786	0.018	$\ddagger$	
(291 19)	5757	0.021	$\ddagger$	
(319 19)	5729	0.011	$\ddagger$	
(348 19)	5700	0.008	$\ddagger$	
(376 ^b 19)	5672?		#	$I(\varepsilon) = -0.005\%$.
(405 ^b 19)	5643?		#	$I(\varepsilon) = -0.002\%$.
(433 19)	5615	0.004	$\ddagger$	
(462 19)	5586	0.013	$\ddagger$	
(490 19)	5558	0.016	$\ddagger$	
(519 19)	5529	0.009	$\ddagger$	
(547 19)	5501	0.008	$\ddagger$	
(576 19)	5472	0.002	$\ddagger$	
(604 ^b 19)	5444?		#	$I(\varepsilon) = -0.001\%$.
(633 ^b 19)	5415?		#	$I(\varepsilon) = -0.002\%$.
(661 19)	5387	0.005	$\ddagger$	
(690 19)	5358	0.013	$\ddagger$	
(718 19)	5330	0.021	$\ddagger$	
(747 19)	5301	0.016	$\ddagger$	
(775 19)	5273	0.013	$\ddagger$	
(804 19)	5244	0.005	$\ddagger$	
(832 19)	5216	0.010	$\ddagger$	
(861 19)	5187	0.017	$\ddagger$	
(889 19)	5159	0.023	$\ddagger$	
(918 19)	5130	0.025	$\ddagger$	
(946 19)	5102	0.018	$\ddagger$	
(975 19)	5073	0.004	$\ddagger$	
(1003 19)	5045	0.009	$\ddagger$	
(1032 19)	5016	0.005	$0.005^{\ddagger}$	
(1060 19)	4988	0.022	$0.022^{\ddagger}$	
(1089 19)	4959	0.014	$0.014^{\ddagger}$	
(1117 19)	4931	0.029	$0.029^{\ddagger}$	
(1146 19)	4902	0.041	$0.041^{\ddagger}$	
(1174 19)	4874	0.046	$0.046^{\ddagger}$	
(1203 19)	4845	0.050	$0.050^{\ddagger}$	
(1231 19)	4817	0.042	$0.042^{\ddagger}$	
(1260 19)	4788	0.038	$0.038^{\ddagger}$	

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^{149}Ho ε decay (21.0 s) **1994Me13,1990AlZH (continued)** ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+$ ^a	$I\varepsilon$ ^a	$I(\varepsilon + \beta^+)^\dagger$ ^a
(1288 19)	4760		0.021	0.021 [‡]
(1317 19)	4731		0.022	0.022 [‡]
(1345 19)	4703		0.037	0.037 [‡]
(1374 19)	4674		0.043	0.043 [‡]
(1402 19)	4646		0.041	0.041 [‡]
(1431 19)	4617		0.035	0.035 [‡]
(1459 19)	4589		0.050	0.050 [‡]
(1488 19)	4560		0.051	0.051 [‡]
(1516 19)	4532		0.063	0.063 [‡]
(1545 19)	4503		0.056	0.056 [‡]
(1573 19)	4475		0.071	0.071 [‡]
(1602 19)	4446		0.074	0.074 [‡]
(1630 19)	4418		0.071	0.071 [‡]
(1659 19)	4389	0.001	0.083	0.084 [‡]
(1687 19)	4361	0.001	0.103	0.104 [‡]
(1716 19)	4332	0.001	0.112	0.113 [‡]
(1744 19)	4304	0.001	0.128	0.129 [‡]
(1773 19)	4275	0.00123	0.105	0.106 [‡]
(1801 19)	4247	0.002	0.114	0.116 [‡]
(1830 19)	4218	0.001	0.096	0.097 [‡]
(1858 19)	4190	0.002	0.114	0.116 [‡]
(1887 19)	4161	0.002	0.100	0.102 [‡]
(1915 19)	4133	0.002	0.095	0.097 [‡]
(1944 19)	4104	0.003	0.110	0.113 [‡]
(1972 19)	4076	0.003	0.115	0.118 [‡]
(2001 19)	4047	0.004	0.128	0.132 [‡]
(2029 19)	4019	0.004	0.121	0.125 [‡]
(2058 19)	3990	0.005	0.134	0.139 [‡]
(2086 19)	3962	0.007	0.178	0.185 [‡]
(2115 19)	3933	0.010	0.213	0.223 [‡]
(2143 19)	3905	0.011	0.220	0.231 [‡]
(2172 19)	3876	0.011	0.206	0.217 [‡]
(2200 19)	3848	0.011	0.195	0.206 [‡]
(2229 19)	3819	0.014	0.224	0.238 [‡]
(2257 19)	3791	0.016	0.232	0.248 [‡]
(2286 19)	3762	0.018	0.250	0.268 [‡]
(2314 19)	3734	0.019	0.241	0.260 [‡]
(2343 19)	3705	0.021	0.253	0.274 [‡]
(2371 19)	3677	0.022	0.247	0.269 [‡]

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^{149}Ho ε decay (21.0 s) **1994Me13,1990AlZH (continued)** ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+{}^a$	$I\varepsilon^a$	Log $ft^{\&}$	$I(\varepsilon + \beta^+)^{\dagger a}$	Comments
(2400 19)	3648	0.027	0.273		0.300 ‡	
(2428 19)	3620	0.033	0.312		0.345 ‡	
(2457 19)	3591	0.027	0.239		0.266 ‡	
(2485 19)	3563	0.047	0.394		0.441 ‡	
(2514 19)	3534	0.047	0.374		0.421 ‡	
(2558 13)	3490.42	0.1 1	0.6 1	5.4	0.7 1	$I(\varepsilon + \beta^+)$: 0.417% for 3477 14; 0.457% for 3505 14 from TAGS data (1990AlZH).
(2599 19)	3449	0.06	0.41		0.467 ‡	
(2628 19)	3420	0.07	0.41		0.477 ‡	
(2656 19)	3392	0.08	0.47		0.552 ‡	
(2685 13)	3362.8	0.06 2	0.3 1	5.7	0.4 1	$I(\varepsilon + \beta^+)$: 0.643% for 3363 14 from TAGS data (1990AlZH).
(2699 13)	3348.66	0.08 2	0.4 1	5.6	0.5 1	$I(\varepsilon + \beta^+)$: 0.743% for 3335 14 from TAGS data (1990AlZH).
(2736 13)	3312.52	0.1 1	0.7 2	5.4	0.8 2	$I(\varepsilon + \beta^+)$: 0.802% for 3306 14 from TAGS data (1990AlZH).
(2771 19)	3277	0.15	0.68		0.827 ‡	
(2799 19)	3249	0.16	0.73		0.893 ‡	
(2845 13)	3202.55	0.08 2	0.3 1	5.7	0.4 1	$I(\varepsilon + \beta^+)$: 1.043% for 3221 14 from TAGS data (1990AlZH).
(2868 13)	3180.05	0.2 1	0.7 1	5.4	0.9 1	$I(\varepsilon + \beta^+)$: 1.143% for 3192 14; 1.119% for 3164 14 from TAGS data (1990AlZH).
(2919 13)	3129.52	0.28 4	1.0 2	5.3	1.3 2	$I(\varepsilon + \beta^+)$: 1.160% for 3135 14 from TAGS data (1990AlZH).
(2969 13)	3079.13	1.1 1	3.9 2	4.69 2	5.0 2	$I(\varepsilon + \beta^+)$: 1.290% for 3078 14; 1.213% for 3106 14 from TAGS data (1990AlZH).
(2998 13)	3049.6	0.1 1	0.4 1	5.7	0.5 1	$I(\varepsilon + \beta^+)$: 1.258% for 3050 14 from TAGS data (1990AlZH).
(3034 ^{b} 13)	3014.2?	0.045 12	0.14 4	6.2	0.18 5	$I(\varepsilon + \beta^+)$: 1.220% for 3021 14 from TAGS data (1990AlZH).
(3068 13)	2980.41	0.2 1	0.6 1	5.5	0.8 1	$I(\varepsilon + \beta^+)$: 1.187% for 2993 14 from TAGS data (1990AlZH).
(3084 19)	2964	0.33	0.92		1.251 ‡	
(3112 19)	2936	0.36	0.96		1.324 ‡	
(3141 19)	2907	0.43	1.10		1.526 ‡	
(3165 13)	2882.83	0.37 3	0.93 7	5.4	1.3 1	$I(\varepsilon + \beta^+)$: 1.629% for 2878 14 from TAGS data (1990AlZH).
(3221 13)	2827.34	2.1 3	4.8 6	4.7 1	6.9 9	$I(\varepsilon + \beta^+)$: 1.661% for 2793 14; 1.768% for 2822 14; and 1.743% for 2850 14 from TAGS data (1990AlZH) for a total of 5.2%.
(3259 13)	2789.18	0.63 3	1.4 1	5.22 3	2.0 1	$I(\varepsilon + \beta^+)$: 1.562% for 2764 14 from TAGS data (1990AlZH).
(3319 13)	2728.65	0.351 14	0.71 3	5.5	1.06 4	$I(\varepsilon + \beta^+)$: 1.144% for 2708 14; 1.284% for 2736 14 from TAGS data (1990AlZH), probably corresponds to feeding to 2728.6 and 2718.5 levels.
(3330 ^{b} 13)	2718.5?	0.074 23	0.15 5	6.2	0.22 7	$I(\varepsilon + \beta^+)$: see comment for feeding to the 2728.6 level.
(3369 19)	2679	0.32	0.60		0.920 ‡	
(3397 19)	2651	0.34	0.61		0.952 ‡	
(3441 13)	2607.10	0.3 1	0.4 1	5.8	0.7 1	$I(\varepsilon + \beta^+)$: 0.950% for 2622 14 from TAGS data (1990AlZH).
(3454 19)	2594	0.34	0.59		0.930 ‡	
(3483 19)	2565	0.34	0.55		0.894 ‡	
(3511 19)	2537	0.40	0.64		1.042 ‡	
(3561 13)	2487.24	0.60 4	0.90 6	5.5	1.5 1	$I(\varepsilon + \beta^+)$: 1.077% for 2480 14; 0.964% for 2508 14 from TAGS data (1990AlZH).
(3582 13)	2466.24	0.82 8	1.2 1	5.4 1	2.0 2	$I(\varepsilon + \beta^+)$: 1.135% for 2451 14 from TAGS data (1990AlZH).
(3639 13)	2409.18	0.72 4	0.98 6	5.5	1.7 1	$I(\varepsilon + \beta^+)$: 1.112% for 2423 14 from TAGS data (1990AlZH).

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^{149}Ho ε decay (21.0 s) **1994Me13,1990AlZH** (continued) ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+{}^a$	$I\varepsilon{}^a$	$\text{Log } ft^{\&}$	$I(\varepsilon + \beta^+)^{\dagger a}$	Comments
(3646 13)	2402.51	0.094 17	0.13 2	6.4	0.22 4	$I(\varepsilon + \beta^+)$: 1.047% for 2394 14 from TAGS data (1990AlZH).
(3690 13)	2358.0	0.057 18	0.073 22	6.6	0.13 4	$I(\varepsilon + \beta^+)$: 0.863% for 2366 14 from TAGS data (1990AlZH).
(3727 13)	2321.19	0.54 9	0.66 11	5.7	1.2 2	$I(\varepsilon + \beta^+)$: 0.850% for 2337 14 from TAGS data (1990AlZH).
(3736 13)	2312.22	0.3 1	0.4 1	5.9	0.7 1	$I(\varepsilon + \beta^+)$: 0.613% for 2309 14 from TAGS data (1990AlZH).
(3756 13)	2291.81	0.21 2	0.24 3	6.1	0.45 5	$I(\varepsilon + \beta^+)$: 0.504% for 2280 14 from TAGS data (1990AlZH).
(3796 19)	2252	0.16	0.18		0.345 $\ddagger$	
(3825 19)	2223	0.16	0.18		0.343 $\ddagger$	
(3882 13)	2165.86	0.2 1	0.2 1	6.2	0.4 1	$I(\varepsilon + \beta^+)$: 0.177% for 2166 14; 0.192% for 2195 14 from TAGS data (1990AlZH).
(3910 19)	2138	0.05	0.05		0.102 $\ddagger$	
(3939 19)	2109	0.005	0.005		0.010 $\ddagger$	
(3967 19)	2081	0.011	0.011		0.022 $\ddagger$	
(3996 ^b 19)	2052?				#	$I(\varepsilon + \beta^+) = -0.083\%$.
(4025 19)	2023				$\ddagger$	
(4053 19)	1995	0.10	0.09		0.193 $\ddagger$	
(4081 19)	1967	0.14	0.12		0.262 $\ddagger$	
(4110 19)	1938	0.16	0.13		0.290 $\ddagger$	
(4138 19)	1910	0.19	0.15		0.341 $\ddagger$	
(4167 19)	1881	0.19	0.14		0.333 $\ddagger$	
(4195 19)	1853	0.16	0.12		0.275 $\ddagger$	
(4224 19)	1824	0.17	0.12		0.290 $\ddagger$	
(4253 19)	1795	0.17	0.12		0.292 $\ddagger$	
(4266 ^b 13)	1782.21?	0.11 2	0.22 4	8.1 ^{1u}	0.33 6	$I(\varepsilon + \beta^+)$: 0.305% for 1767 14 from TAGS data (1990AlZH). For first-forbidden unique transition, $\log f^{1u}t$ should be >8.5.
(4310 19)	1738	0.24	0.17		0.411 $\ddagger$	
(4335 13)	1712.80	1.0 1	0.68 4	5.8	1.7 1	$I(\varepsilon + \beta^+)$: 0.622% for 1710 14 from TAGS data (1990AlZH).
(4344 13)	1703.73	0.60 12	0.40 8	6.0	1.0 2	$I(\varepsilon + \beta^+)$: 0.532% for 1681 14 from TAGS data (1990AlZH).
(4385 13)	1663.45	1.3 1	0.86 8	5.68 4	2.2 2	$I(\varepsilon + \beta^+)$: 0.702% for 1653 14 from TAGS data (1990AlZH).
(4464 13)	1583.60	1.3 1	0.75 8	5.8 1	2.0 2	$I(\varepsilon + \beta^+)$: 0.728% for 1596 14; 0.844% for 1568 14; and 0.697% for 1624 14 or a total of 2.3% from TAGS data (1990AlZH).
(4509 19)	1539	0.47	0.27		0.744 $\ddagger$	
(4537 19)	1511	0.38	0.21		0.593 $\ddagger$	
(4566 19)	1482	0.14	0.08		0.222 $\ddagger$	
(4594 19)	1454	0.027	0.014		0.041 $\ddagger$	
(4623 19)	1425	0.010	0.006		0.016 $\ddagger$	
(4651 ^b 19)	1397?				#	$I(\varepsilon + \beta^+) = -0.162\%$.

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¹⁴⁹Ho ϵ decay (21.0 s) **1994Me13,1990AlZH (continued)**

ϵ, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+{}^a$	$I\epsilon^a$	$\text{Log } ft^{\&}$	$I(\epsilon+\beta^+)^{\dagger a}$	Comments
(4680 ^b 19)	1368?				#	$I(\epsilon+\beta^+) = -0.177\%$.
(4708 ^b 19)	1340?				#	$I(\epsilon+\beta^+) = -0.123\%$.
(4737 ^b 19)	1311?				#	$I(\epsilon+\beta^+) = -0.068\%$.
(4765 19)	1283	0.16	0.07		0.233 [‡]	
(4794 ^b 19)	1254?				#	$I(\epsilon+\beta^+) = -0.016\%$.
(4822 ^b 19)	1226?				#	$I(\epsilon+\beta^+) = -0.261\%$.
(4851 19)	1197	0.22	0.10		0.316 [‡]	
(4957 13)	1090.74	24 4	9.5 14	4.8 1	33 5	$I(\epsilon+\beta^+)$: 1.885% for 1169 14; 4.208% for 1140 14; 6.949% for 1112 14; 8.571% for 1083 14; 7.120% for 1055 14; 4.633% for 1026 14; 1.584% for 998 14; or a total of 35% in a peak between 1000-1170 keV, centered around 1085 keV from TAGS data (Table 4 and Fig. 9) in 1990AlZH , likely corresponds to $I(\epsilon+\beta^+)$ feeding to primarily the 1091 and a minor fraction to 1073 level. 1994Me13 , in their Fig. 7b is compared their deduced feeding of 59% 2 from high-resolution γ -ray data in 1994Me13 to that in Fig. 9 of 1990AlZH in TAGS data, which showed that $I(\epsilon+\beta^+)$ feeding to the 1091 level from high-resolution γ -ray data was about half of that in the TAGS data in 1990AlZH . Based on TAGS data, evaluators assign 33% 5 feeding to the 1091 level, where uncertainty of 15% is arbitrary. For the 1073 level, $I(\epsilon+\beta^+)$ feeding is from high-resolution γ -ray data.
(4975 13)	1073.31	1.1 3	0.46 11	6.1	1.6 4	$I(\epsilon+\beta^+)$: see comment for $I(\epsilon+\beta^+)$ feeding of 1090.7 level from TAGS data in 1990AlZH and comparison with high-resolution data in 1994Me13 .
(5079 ^b 19)	969?	0.39	0.14		0.534 [@]	
(5107 ^b 19)	941?	0.39	0.14		0.532 [@]	
(5136 ^b 19)	912?	0.27	0.09		0.363 [@]	
(5164 ^b 19)	884?	0.25	0.09		0.340 [@]	
(5193 ^b 19)	855?	0.16	0.05		0.208 [@]	

[†] Based on γ -intensity balance from high-resolution data in **1994Me13**, when γ -ray data are available, and TAGS data in **1990AlZH**, when no γ -ray data are available. Exception is for 1090.7 level, where comparison between the two sets of data is used and $I(\epsilon+\beta^+)$ feedings is assigned from TAGS data, as the value from these data is about half as compared to that from high-resolution γ -ray data. From high-resolution γ -ray data, $I(\epsilon+\beta^+)$ feedings of $\geq 2\%$ are considered by evaluators as fairly reliable, when compared to corresponding values from TAGS data. Weaker feedings ($< 2\%$) are considered as upper limits as these can be affected by missing γ rays from higher levels. Summed $I(\epsilon+\beta^+)$ feeding for all the levels (including pseudolevels) listed here is 100.8%, whereas above the 3490 level (highest known level from high-resolution γ -ray data), total feeding from TAGS data adds to 7.3%.

[‡] Intensity per 100 decays from TAGS data in **1990AlZH**, with a bin width of 28.5 keV. In Table 4 of **1990AlZH**, listed intensities are per 100,000 decays of ¹⁴⁹Ho.

Negative (non-physical) intensity from TAGS data in **1990AlZH**.

@ No excited states in ¹⁴⁹Dy have been reported below 1034 keV in any of the decays or reactions, thus this feeding to a pseudolevel is treated by evaluators as questionable. Total $I(\epsilon+\beta^+)$ feeding from TAGS data in **1990AlZH** adds to 2.0% in the excitation range of 840-980 keV.

& For $I(\epsilon+\beta^+)$ feedings $< 2\%$, values are treated as lower limits as the decay scheme from high-resolution γ -ray data is incomplete.

^{149}Ho ε decay (21.0 s) **1994Me13,1990AlZH (continued)**

ε, β^+ radiations (continued)

^a Absolute intensity per 100 decays.

^b Existence of this branch is questionable.

¹⁴⁹Ho ε decay (21.0 s) **1994Me13,1990AlZH (continued)**

$\gamma(^{149}\text{Dy})$

I γ normalization: **1994Me12** provide photon intensities per 1000 decays, with statistical uncertainties as well as those from spectral complexity. Evaluators divide I γ values in **1994Me12** by a factor of 10. Methodology of measuring absolute γ intensities is not described in **1994Me13**.

E γ [†]	I γ ^{†&}	E i (level)	J $^{\pi}_i$	E f	J $^{\pi}_f$	Mult. [@]	δ [@]	α ^a	Comments
462.1 3	0.23 6	2165.86	(9/2,11/2,13/2) ⁺	1703.73	(11/2) ⁺	M1(+E2)	<1.0	0.032 4	Mult., δ : from $\alpha(\text{K})\text{exp}=0.029$ 6.
511 2	0.52 [‡] 15	1583.60	(11/2 ⁻)	1073.31	(13/2) ⁺				
590.1 5	0.45 [‡] 15	1663.45	(9/2 ⁺)	1073.31	(13/2) ⁺				
613.0 2	0.19 4	1703.73	(11/2) ⁺	1090.74	(9/2 ⁻)				
630.3 5	1.04 15	1703.73	(11/2) ⁺	1073.31	(13/2) ⁺	M1(+E2)	<2.5	0.0131 35	Mult., δ : from $\alpha(\text{K})\text{exp}=0.011$ 3.
694.5 6	0.13 [‡] 4	2358.0	(9/2 ⁻ ,11/2 ⁻)	1663.45	(9/2 ⁺)				
1073.3 1	6.37 7	1073.31	(13/2) ⁺	0.0	7/2 ⁻	E3		0.00557 8	E γ : weighted average of 1073.1 2 (1994Me13) and 1073.3 1 (1979To01). Other: 1073.2 (1982Ba75). I γ : others: I(1073 γ)/I(1091 γ)=13 1/100 (1979To01), 15/100 (1982Ba75). E γ : weighted average of 1090.7 2 (1994Me13) and 1090.1 1 (1979To01). Other: 1090.8 (1982Ba75). I γ : quoted uncertainty of $\approx 0.2\%$ in 1994Me13 is unrealistically low; it has been increased by a factor of 10 by the evaluators.
1090.4 3	74.4 15	1090.74	(9/2 ⁻)	0.0	7/2 ⁻				
1092.6 4	0.2 [‡] 1	2165.86	(9/2,11/2,13/2) ⁺	1073.31	(13/2) ⁺				
1114.8 3	0.32 5	2827.34	(11/2 ⁻)	1712.80	(9/2 ⁻)				
1125.7 2	1.15 5	2789.18	(9/2 ⁻ ,11/2 ⁻)	1663.45	(9/2 ⁺)				
1218.5 2	0.45 5	2291.81	(11/2 ⁻ ,13/2 ⁻)	1073.31	(13/2) ⁺				
1230.4 4	0.26 11	2321.19	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)				
1318.5 3	1.30 5	2409.18	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)				
1329.2 3	0.22 4	2402.51	(11/2 ⁻ ,13/2 ⁻)	1073.31	(13/2) ⁺				
1375.2 3	1.76 10	2466.24	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)				
1396.5 2	0.61 7	2487.24	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)				
1415.6 3	0.53 5	3079.13	(11/2 ⁻)	1663.45	(9/2 ⁺)				
1495.5 2	1.65 4	3079.13	(11/2 ⁻)	1583.60	(11/2 ⁻)				
1534.0 5	0.15 5	2607.10	(11/2 ⁻)	1073.31	(13/2) ⁺				
1545.9 2	0.90 7	3129.52	(11/2 ⁻)	1583.60	(11/2 ⁻)				
1583.6 2	4.48 7	1583.60	(11/2 ⁻)	0.0	7/2 ⁻				Other: E γ =1583.6 2, I(1583.6 γ)/I(1091.0 γ)=9 2 /100 (1979To01).
1637.9 3	1.06 4	2728.65	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)				
1663.4 2	3.53 7	1663.45	(9/2 ⁺)	0.0	7/2 ⁻				
1698.5 4	0.86 8	2789.18	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)				
1712.9 2	1.97 4	1712.80	(9/2 ⁻)	0.0	7/2 ⁻				
1729.0 3	0.41 4	3312.52	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1583.60	(11/2 ⁻)				

¹⁴⁹Ho ε decay (21.0 s) [1994Me13,1990AlZH](#) (continued)

$\gamma(^{149}\text{Dy})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^{\ddagger\&}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1736.6 5	3.8 [‡] 8	2827.34	(11/2 ⁻)	1090.74	(9/2 ⁻)	E _γ : 1736.8 in Fig. 4 of 1994Me13 .
1753.4 [#] 4	0.60 [‡] 15	2827.34	(11/2 ⁻)	1073.31	(13/2 ⁺)	
1782.2 ^b 3	0.33 6	1782.21?	(7/2 ⁺)	0.0	7/2 ⁻	
1791.9 3	0.46 5	2882.83	(11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)	
1809.7 3	0.79 11	2882.83	(11/2 ⁻ ,13/2 ⁻)	1073.31	(13/2 ⁺)	
1889.7 3	0.34 6	2980.41	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)	
1958.8 4	0.47 7	3049.6	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)	
1988.4 2	1.97 8	3079.13	(11/2 ⁻)	1090.74	(9/2 ⁻)	
2006.0 5	0.23 9	3079.13	(11/2 ⁻)	1073.31	(13/2 ⁺)	
2056.2 5	0.19 11	3129.52	(11/2 ⁻)	1073.31	(13/2 ⁺)	
2089.3 2	0.87 7	3180.05	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)	
2111.8 3	0.26 5	3202.55	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)	
2221.4 6	0.40 16	3312.52	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)	
2257.9 3	0.46 7	3348.66	(9/2 ⁻ ,11/2 ⁻ ,13/2 ⁻)	1090.74	(9/2 ⁻)	
2312.2 3	0.70 7	2312.22	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2321.2 3	0.97 11	2321.19	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2399.7 3	0.39 7	3490.42	(9/2 ⁻ ,11/2 ⁻)	1090.74	(9/2 ⁻)	
2409.1 3	0.39 8	2409.18	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2467.4 ^{#b} 6	0.26 11	2466.24	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2487.2 3	0.87 6	2487.24	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2607.0 3	0.53 5	2607.10	(11/2 ⁻)	0.0	7/2 ⁻	
2718.5 ^b 4	0.22 7	2718.5?	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
2827.4 3	2.20 8	2827.34	(11/2 ⁻)	0.0	7/2 ⁻	
2980.3 4	0.45 8	2980.41	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
3014.2 ^b 4	0.18 5	3014.2?	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
3079.1 3	0.62 6	3079.13	(11/2 ⁻)	0.0	7/2 ⁻	
3129.5 4	0.25 5	3129.52	(11/2 ⁻)	0.0	7/2 ⁻	
3202.5 6	0.15 6	3202.55	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
3362.8 4	0.44 7	3362.8	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	
3490.3 4	0.31 6	3490.42	(9/2 ⁻ ,11/2 ⁻)	0.0	7/2 ⁻	

[†] From [1994Me13](#), unless otherwise noted.

[‡] Estimated from $\gamma\gamma$ -coin spectra ([1994Me13](#)).

[#] Poor fit in level scheme, deviation is ≈ 0.8 keV.

@ From ce data in [1994Me13](#), given under comments. The same values are given in the Adopted Gammas.

& Absolute intensity per 100 decays.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies,

¹⁴⁹Ho ε decay (21.0 s) [1994Me13,1990AlZH](#) (continued)

$\gamma(^{149}\text{Dy})$ (continued)

assigned multipolarities, and mixing ratios, unless otherwise specified.

^b Placement of transition in the level scheme is uncertain.

¹⁴⁹Ho ε decay (21.0 s) 1994Me13,1990AlZH

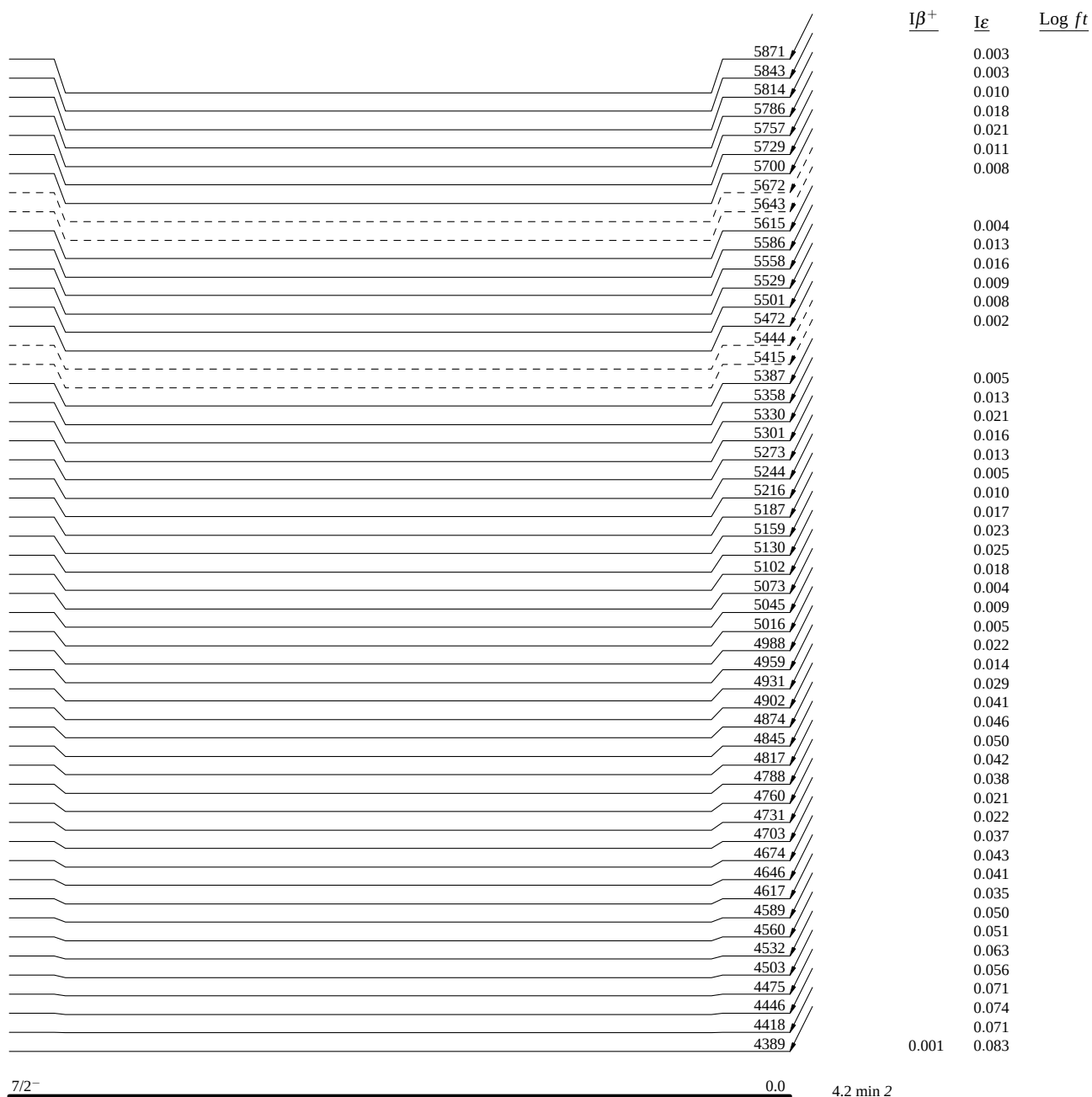
Decay Scheme

Legend

Intensities: I_(γ+ce) per 100 parent decays

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}

(11/2⁻) 0.0 21.0 s 2
Q_ε=6048 13
%ε + %β⁺=100
¹⁴⁹Ho₈₂
67



¹⁴⁹Dy₈₃
66

¹⁴⁹Ho ε decay (21.0 s) 1994Me13,1990AlZH

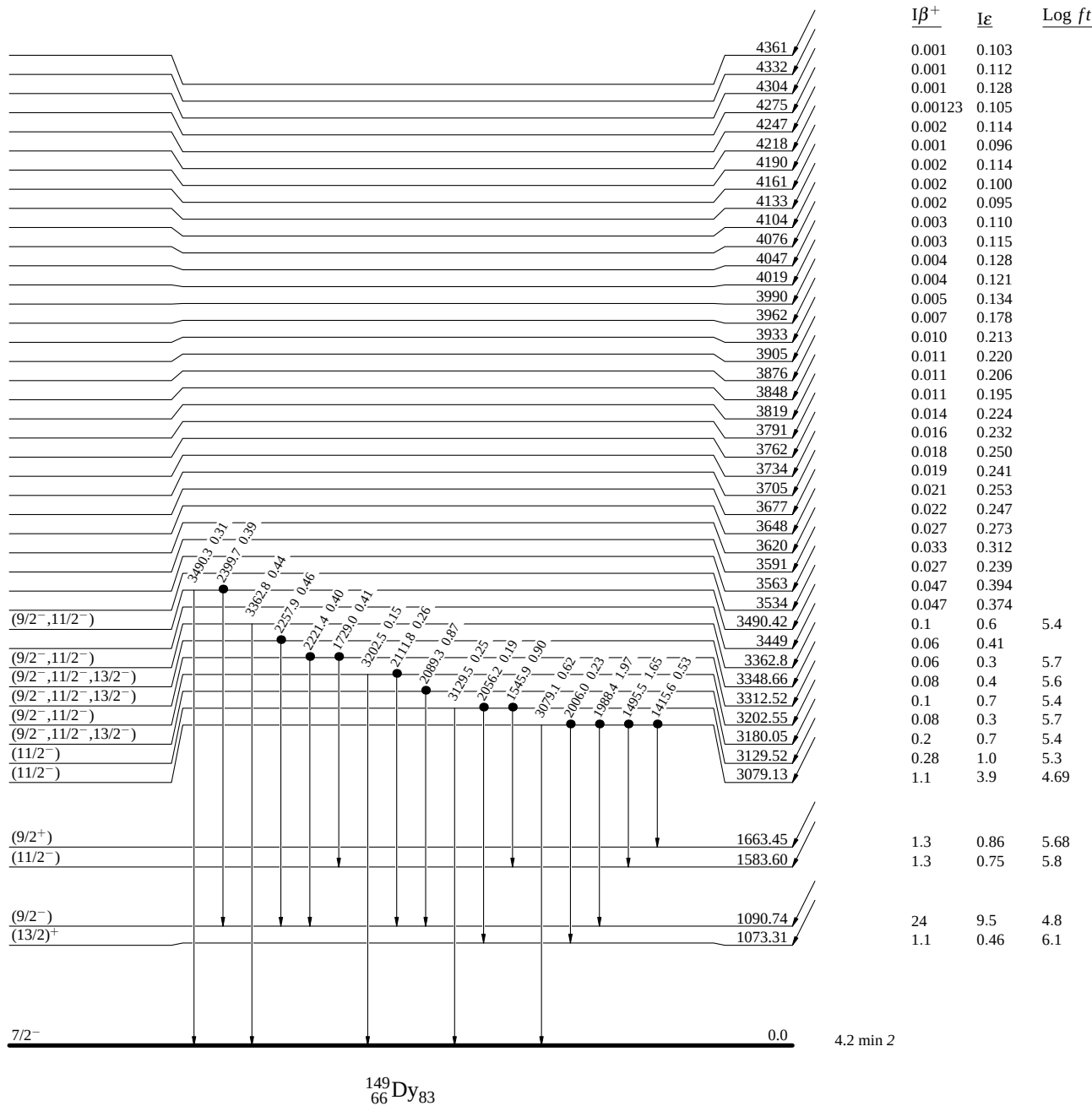
Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence

(11/2⁻) 0.0 21.0 s 2
Q_ε=6048 13
¹⁴⁹Ho₈₂



¹⁴⁹Ho ε decay (21.0 s) 1994Me13,1990AlZH

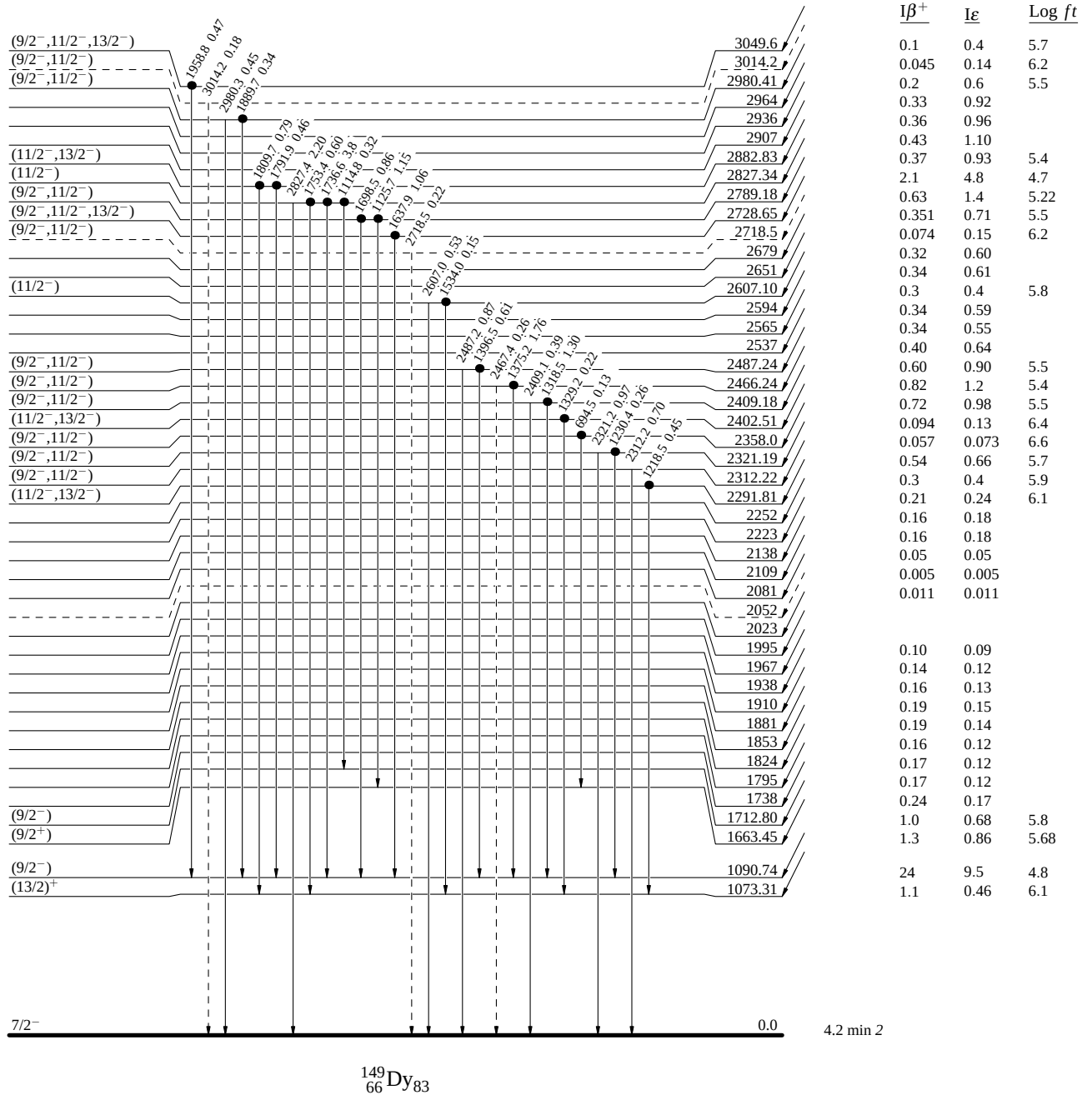
Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays

(11/2⁻) 0.0 21.0 s 2
Q_e=6048 13
%ε + %β⁺=100
¹⁴⁹Ho₈₂
67



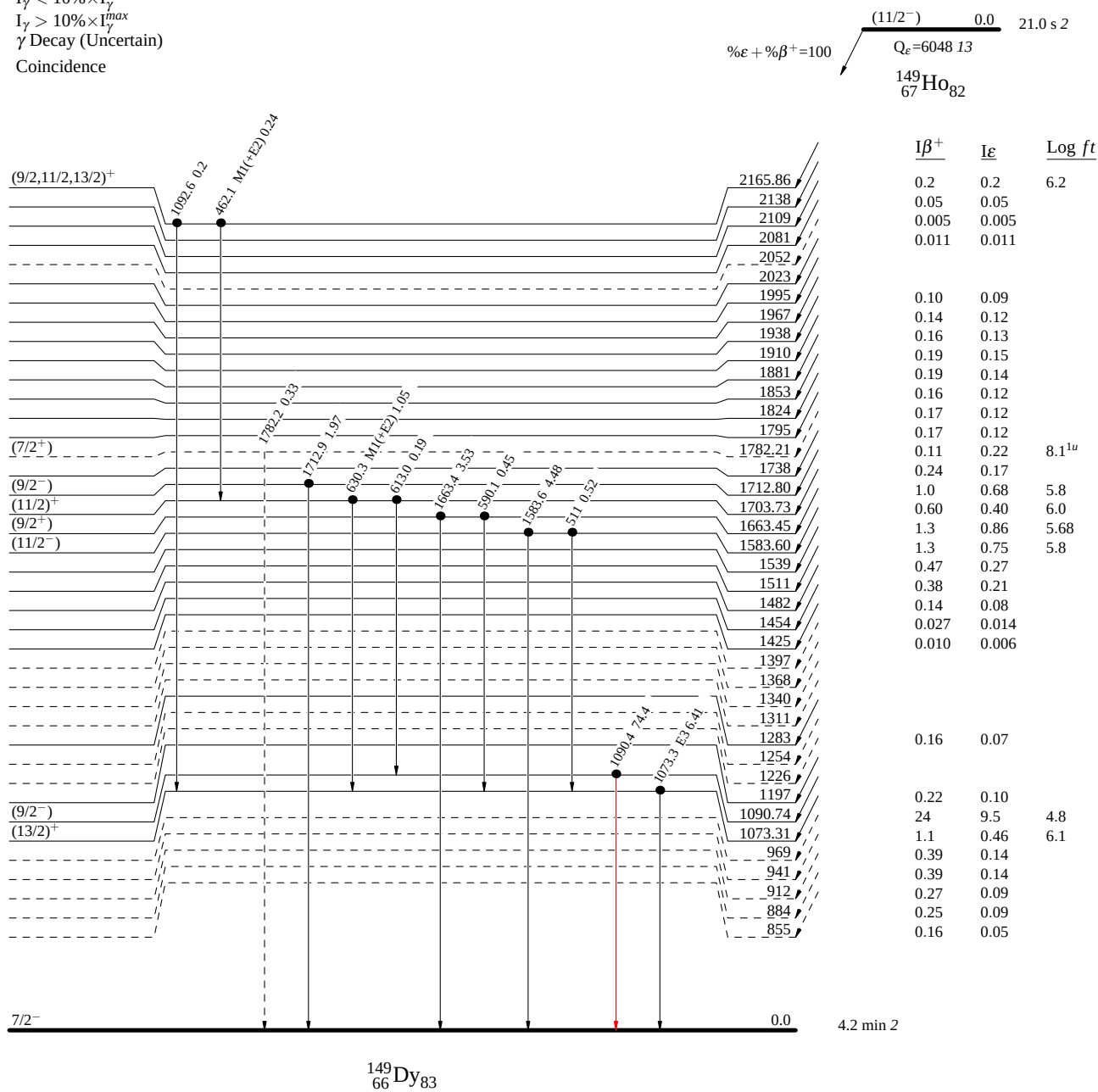
¹⁴⁹Ho ε decay (21.0 s) 1994Me13,1990AlZH

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- - - - -→ γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_(γ+ce) per 100 parent decays



^{149}Ho ε decay (56 s) 1994Me13

Parent: ^{149}Ho : $E=48.8$ 2; $J^\pi=(1/2^+)$; $T_{1/2}=56$ s 3; $Q(\varepsilon)=6048$ 13; $\% \varepsilon + \% \beta^+$ decay=100

^{149}Ho -E, J^π , $T_{1/2}$: From ^{149}Ho Adopted Levels.

^{149}Ho -Q(ε): From 2021Wa16.

1994Me13 (also 1989Me13): ^{149}Ho ions were produced via fusion-evaporation reactions with 5.4 MeV/nucleon ^{58}Ni beam on ^{94}Mo and ^{95}Mo targets at ISOLDE, GSI, separated by the GSI online separator and deposited on a transport tape. The γ - and x-rays were detected with a planar and two coaxial Ge(Li) detectors. Measured E_γ , I_γ , $I(\text{x-ray})$, $\gamma\gamma$ -coin, $\gamma(\text{x-ray})$ -coin, $\gamma(\text{t})$. Deduced levels, J , π , parent $T_{1/2}$, conversion coefficients, γ -ray multipolarities, GT strengths. Comparisons with theoretical calculations. Configurations are suggested for all levels reported in this decay.

Other:

1988ToZW: measured $T_{1/2}$ of ^{149}Ho isomer:

Total decay energy deposit of 6102 keV 140 calculated by RADLIST code is in agreement with expected value of 6098 keV 13.

However the decay scheme is considered as incomplete since a significant β feedings may have missed detection in view of a large gap of about 3 MeV between $Q(\varepsilon)$ value and the highest known populated level at 2938.

 ^{149}Dy Levels

<u>E(level)[†]</u>	<u>J^π[‡]</u>	<u>$T_{1/2}$[‡]</u>	<u>E(level)[†]</u>	<u>J^π[‡]</u>	<u>E(level)[†]</u>	<u>J^π[‡]</u>
0.0	$7/2^-$	4.2 min 2	1572.8 4	$(3/2^+)$	2771.0 7	$(1/2^+, 3/2^+)$
1034.6 2	$(3/2^-)$		1626.3 6	$(5/2^+)$	2788.6 6	$(1/2^+, 3/2^+)$
1406.7 3	$(1/2^+)$		1727.5 7	$(1/2)$	2938.1 6	$(1/2^+, 3/2^+)$
1501.0 5	$(3/2^+)$		1775.6 6	$(1/2)$		

[†] From a least-squares fit to γ -ray energies.

[‡] From the Adopted Levels.

 ε, β^+ radiations

<u>E(decay)</u>	<u>E(level)</u>	<u>$I\beta^+$ [‡]</u>	<u>$I\varepsilon$[‡]</u>	<u>Log ft[†]</u>	<u>$I(\varepsilon + \beta^+)$^{†‡}</u>	<u>Comments</u>
(3159 13)	2938.1	1.0 3	2 1	5.4	3 1	
(3308 13)	2788.6	6 2	13 4	4.7 2	19 6	
(3326 13)	2771.0	9 2	19 3	4.5 1	28 5	
(4321 13)	1775.6	0.9 6	0.6 4	6.2	1.5 10	
(4369 13)	1727.5	4 1	2 1	5.7	6 2	
(4471 [#] 13)	1626.3	3 1	1 1	5.9	4 2	Log ft : too low for $\Delta J=2$, $\Delta\pi$ =no transition.
(4524 13)	1572.8	3 1	1 1	5.9	4 1	
(4596 13)	1501.0	8 3	5 2	5.4 2	13 5	
(4690 13)	1406.7	4 4	2 2	>5.5	6 6	
(5062 13)	1034.6	12 7	5 3	5.5 3	17 9	

[†] $I(\varepsilon + \beta^+)$ are from γ intensity balance at each level. Most of the β feedings should be treated as upper limits and correspondingly, the log ft values as lower limits since the decay scheme is considered incomplete by the evaluators. Exception is made for β feedings for the 1034.6, 1501.0, 2771.0 and 2788.6 level, where feedings of $\geq 10\%$ can be realistic, and where uncertainties for log ft values are given.

[‡] Absolute intensity per 100 decays.

[#] Existence of this branch is questionable.

¹⁴⁹Ho ε decay (56 s) **1994Me13** (continued) $\gamma(^{149}\text{Dy})$

I γ normalization: **1994Me12** provide photon intensities per 1000 decays, with statistical uncertainties as well as those from spectral complexity. Evaluators divide I γ values in **1994Me12** by a factor of 10. Methodology of measuring absolute γ intensities is not described in **1994Me13**.

E_γ [†]	I_γ ^{†@}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	δ [‡]	α ^{&}	Comments
94.3 3	3.2 12	1501.0	(3/2 ⁺)	1406.7	(1/2 ⁺)	M1(+E2)	<0.7	2.92 10	Mult.: $\alpha(\text{L})\text{exp}=0.59$ 16.
166.1 2	2.7 [#] 5	1572.8	(3/2 ⁺)	1406.7	(1/2 ⁺)	M1(+E2)	<1.5	0.52 4	Mult.: $\alpha(\text{K})\text{exp}=0.47$ 13.
372.1 2	25.3 15	1406.7	(1/2 ⁺)	1034.6	(3/2 ⁻)	E1		0.01017 14	Mult.: $\alpha(\text{K})\text{exp}=0.0080$ 16.
591.7 5	3.8 [#] 14	1626.3	(5/2 ⁺)	1034.6	(3/2 ⁻)	(E1)		0.00356 5	Mult.: $\alpha(\text{K})\text{exp}<0.005$.
692.9 6	5.5 [#] 14	1727.5	(1/2)	1034.6	(3/2 ⁻)				
741.0 5	1.5 10	1775.6	(1/2)	1034.6	(3/2 ⁻)				
1034.6 2	99.7 20	1034.6	(3/2 ⁻)	0.0	7/2 ⁻	[E2]		0.00284 4	
1531.4 5	3.0 [#] 12	2938.1	(1/2 ⁺ , 3/2 ⁺)	1406.7	(1/2 ⁺)				
1736.4 6	28 [#] 5	2771.0	(1/2 ⁺ , 3/2 ⁺)	1034.6	(3/2 ⁻)				
1754.0 5	19 [#] 6	2788.6	(1/2 ⁺ , 3/2 ⁺)	1034.6	(3/2 ⁻)				

[†] From **1994Me13**.

[‡] From ce data in **1994Me13**, given under comments. The same values are given in the Adopted Gammas.

[#] Estimated from $\gamma\gamma$ spectra (**1994Me13**).

@ Absolute intensity per 100 decays.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

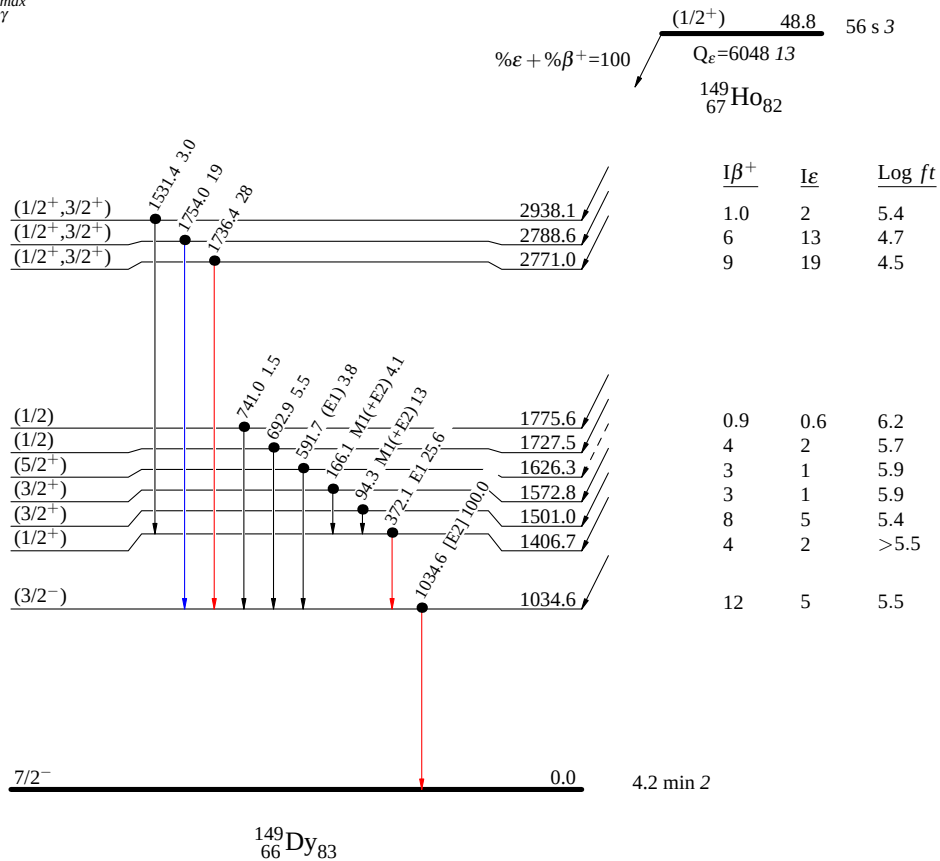
¹⁴⁹Ho ε decay (56 s) 1994Me13

Decay Scheme

Intensities: I_(γ+ce) per 100 parent decays

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}
- Coincidence



¹⁴⁹Dy IT decay (0.490 s) [1980Da18](#),[1976St08](#),[1980Ja16](#)

Parent: ¹⁴⁹Dy: E=2661.2 5; J^π=(27/2)⁻; T_{1/2}=0.490 s 15; %IT decay=99.3 3

¹⁴⁹Dy-E: 2660.94 34 in the Adopted Levels.

¹⁴⁹Dy-J^π, T_{1/2}: From the Adopted Levels.

¹⁴⁹Dy-%IT decay: from %ε+%β⁺=0.7 3 ([1988Ba02](#)).

[1980Da18](#) (also [1983JuZY](#)): ¹⁵²Gd(α,7nγ) E=106 MeV, this measurement updates and extends that by [1976St08](#) at the same laboratory; measured Eγ, Iγ, γγ-coin, γ(θ), γγ(θ), γ(t), γγ(t). ¹³⁶Ce(¹⁶O,3nγ) E=92 MeV ¹⁶O beam from the Emperor Tandem at the MPI Heidelberg on >99% enriched ¹³⁶Xe target (in oxide form); measured conversion electrons with a solenoid spectrometer. Deduced levels, J, π, isomer T_{1/2}, configurations, conversion coefficients, γ-ray multipolarities, transition strengths. Systematics of neighboring isotones. See also the ¹⁵²Gd(α,7nγ) dataset for additional data.

[1976St08](#) (also [1976St01](#)): ¹⁵²Gd(α,7nγ) E=106 MeV α beam was produced from the Julich cyclotron. Target was 1.2 mg enriched (>99.6%) ¹⁵²Gd on a 500 μg/cm² mylar backing. γ rays were detected with two Ge(Li) detectors. Measured Eγ, Iγ, γγ-coin, γ(θ), γγ(θ), γ(t), γγ(t). Deduced levels, J, π, isomer T_{1/2}, γ-ray multipolarities. [1976St08](#) extends the measurement of [1976St01](#) and determines T_{1/2}, spin and parity of the isomer.

[1980Ja16](#): ¹⁴⁴Sm(¹²C,Xγ) E=70-130 MeV ¹²C beam from the Grenoble variable-energy cyclotron. Measured Eγ, γγ-coin, γ(t) with a Ge(Li) and a NaI detector. Deduced isomer T_{1/2}.

Others:

[2003Li42](#): ¹⁴⁹Dy isomer nuclei produced in fragmentation of ²⁰⁹Bi beam at 900 MeV/nucleon; separated in flight with the fragment separator (FRS) and stored in the cooler ring (ESR) at GSI. Measured half-life of fully-ionized isomeric state at 2661 keV.

See [1988Ba02](#) (also [1987BaZV](#)) and [1993KlZZ](#) for ε decay of this isomer.

¹⁴⁹Dy Levels

E(level)	J ^π [†]	T _{1/2} [†]	Comments
0.0	7/2 ⁻	4.2 min 2	
1073.2 1	(13/2) ⁺		
2251.81 15	(17/2) ⁺		
2550.4 2	(21/2) ⁺		
2661.2 5	(27/2) ⁻	0.490 s 15	T _{1/2} : adopted value from weighted average of 0.500 s 30 (1976St08), 0.510 s 10 (1980Ja16), 0.47 s 1 (1987BaZV). Other: for fully-ionized atom, T _{1/2} =11 s 1 (2003Li42). Configuration=πh _{1/2} ² ⊗νf _{7/2} (1976St08 , 1980Da18).

[†] From the Adopted Levels.

¹⁴⁹Dy IT decay (0.490 s) [1980Da18](#),[1976St08](#),[1980Ja16](#) (continued)

$\gamma(^{149}\text{Dy})$									
E_γ †@	I_γ #&	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	α^a	$I_{(\gamma+ce)}$ &	Comments
110.8 4	3.52 8	2661.2	(27/2) ⁻	2550.4	(21/2) ⁺	E3	27.3 7	100	%I γ =3.50 7 I γ : for fully-ionized atom, I γ ≈100 per 100 decays of the isomer with T _{1/2} =11 s 1 (2003Li42); since internal conversion is not allowed for bare atoms. I γ : relative intensity≈3. Mult.: $\alpha(\text{L})_{\text{exp}}$ =13 5 (1980Da18), 16 4 (1987BaZV). %I γ =93.20 29 A ₂ =0.00 2; A ₄ =-0.04 3 (1976St01); $\alpha(\text{K})_{\text{exp}}$ =0.049 7 (1980Da18) I γ : relative intensity=83 8 (1980Da18). Mult.: $\alpha(\text{K})_{\text{exp}}$ and $\gamma(\theta)$. %I γ =98.75 30 A ₂ =+0.01 3; A ₄ =+0.02 4 (1976St01); $\alpha(\text{K})_{\text{exp}}$ =0.0046 5 (1980Da18) I γ : relative intensity=100 (1980Da18). Mult.: from $\alpha(\text{K})_{\text{exp}}$. %I γ =99.08 30 A ₂ =+0.01 3; A ₄ =-0.03 4 (1976St01); $\alpha(\text{K})_{\text{exp}}$ =0.0017 3 (1980Da18) I γ : relative intensity=91 9 (1980Da18). Mult.: from $\alpha(\text{K})_{\text{exp}}$ and $\gamma\gamma(\theta)$. (298.6 γ)(1178.6 γ)(θ): A ₂ =+0.05 7 (1976St01).
298.6 1	93.86 8	2550.4	(21/2) ⁺	2251.81	(17/2) ⁺	E2	0.0654 9	100	
1073.2 1	99.446 8	1073.2	(13/2) ⁺	0.0	7/2 ⁻	E3	0.00557 8	100	
1178.6 1	99.782 3	2251.81	(17/2) ⁺	1073.2	(13/2) ⁺	E2	2.18×10 ⁻³ 3	100	

† From [1980Da18](#). The same data are also presented in ¹⁵²Gd(α ,7n γ) dataset.

‡ From ce data, $\gamma(\theta)$ and $\gamma\gamma(\theta)$ in [1980Da18](#) and $\gamma(\theta)$ in [1976St01](#). The same multipolarities are adopted in the Adopted Gammas. The same $\gamma(\theta)$ and $\gamma\gamma(\theta)$ are also presented in ¹⁵²Gd(α ,7n γ) dataset.

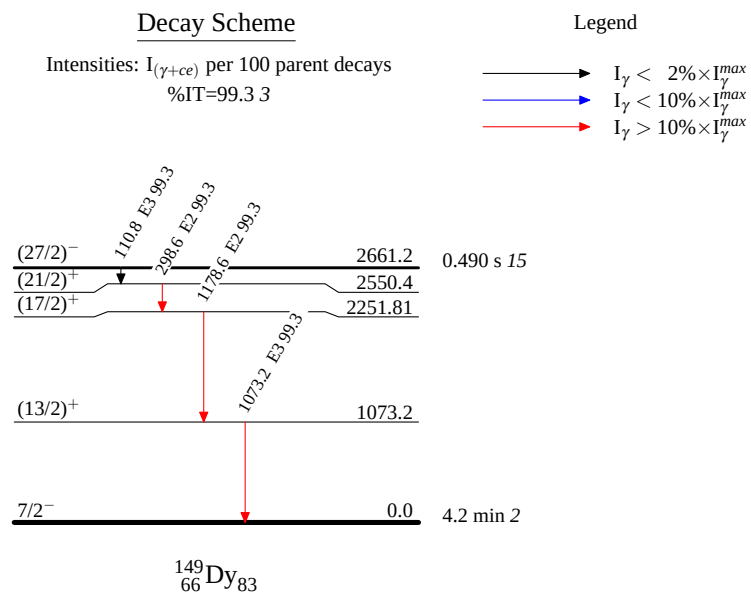
Deduced by evaluators from assumed I(γ +ce)=100 and theoretical α from BrIcc.

@ From a least-squares fit to γ -ray energies.

& For absolute intensity per 100 decays, multiply by 0.993 3.

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^{149}Dy IT decay (0.490 s) 1980Da18,1976St08,1980Ja16



¹⁵³Er α decay (37.1 s) [1996Pa01](#),[1982Bo04](#),[1982De11](#)

Parent: ¹⁵³Er: E=0.0; J π =(7/2⁻); T_{1/2}=37.1 s 2; Q(α)=4802.4 14; % α decay=53 3

¹⁵³Er-J π , T_{1/2}: From ¹⁵³Er Adopted Levels in the ENSDF database (August 2020 update).

¹⁵³Er-Q(α): From [2021Wa16](#).

¹⁵³Er-% α decay: 53% 3 from [1977Ha48](#). Deduced by comparison of I α of parent and daughter in equilibrium. Other measurement: 38 +19-7 ([1974To07](#)); 95 +5-20 from [1963Ma18](#) seems discrepant.

[1996Pa01](#): ¹⁰⁶Cd, ¹¹²Sn(⁵⁸Ni,X) with E=300 MeV and 329 MeV ⁵⁸Ni, respectively, from the Daresbury Laboratory Nuclear Structure Facility. Measured E α .

[1982Bo04](#)(also [1973BoXW](#)): spallation of uranium, thorium, gold and tantalum targets with 5 GeV proton from the LBNL Bevatron. Measured E α , T_{1/2}.

[1982De11](#): 245-300 MeV ⁶³Cu ions on silver, cadmium, indium and tin targets. Measured E α .

[1980Da09](#): spallation of Ho, Tm, Ta, Re and Au targets with 480-MeV proton from the cyclotron at TRIUMF. Measured E α , T_{1/2}.

[1963Ma18](#): ¹⁴²Nd(¹⁶O,5n) E=75-151 MeV ¹⁶O beam from the Berkeley heavy-ion accelerator (HILAC). Measured E α , T_{1/2}, branching ratio.

[1970To16](#): ¹⁵⁶Dy(³He,6n) E=97.3 MeV and ¹⁶²Er(³He, α 8n) E=101.2 MeV from the Oak Ridge isochronous cyclotron (ORIC). Measured E α , T_{1/2}.

[1974To07](#): ¹⁴⁷Sm(¹²C,6n) E=118 MeV from ORIC. Measured E α , γ - and x-rays. Deduced branching ratio.

[1977Ha48](#): spallation of Ta targets with 600-MeV proton from the CERN synchro-cyclotron. Measured E α , T_{1/2}, branching ratio.

[1978AfZZ](#): α emitter was produced with 1 GeV proton from the synchro-cyclotron of Leningrad Nuclear Physics Institute (LNPI) at USSR. Measured E α , T_{1/2}.

[1979Ho10](#) (also [1981HoZM](#)): Ag, Pd, Rh(⁵⁸Ni,X) with E=276 MeV beam from the UNILAC at GSI. Measured E α .

Others: [1996Pa01](#), [1988To13](#), [1988KaZK](#), [1987Bl14](#).

¹⁴⁹Dy Levels

E(level)	J π	T _{1/2}	Comments
0.0	7/2 ⁻	4.2 min 2	J π , T _{1/2} : from the Adopted Levels.

α radiations

E α	E(level)	I $\alpha^{\ddagger}$	HF †	Comments
4518 [#]				E α : The 4518-keV α group was reported by 1980Da09 and was assigned to ¹⁵³ Er from their measured T _{1/2} =35.1 s 20. This α group was not observed by 1979Ho10 nor by 1974To07 , and appears unlikely to belong to the ¹⁵³ Er α decay since it would populate a level in the daughter at 157 keV, and such a level does not exist in ¹⁴⁹ Dy.
4674 2	0.0	100	1.25 8	E α : Weighted average of 4674 4 (1996Pa01), 4671 keV 3 (1982Bo04), 4676 keV 2 (1982De11), 4674 keV 10 (1979Ho10 , 1981HoZM), 4671 3 (1978AfZZ), 4675 keV 10 (1977Ha48), 4670 10 (1970To16), and 4675 keV 20 (1963Ma18). Others: 4671 (1988To13), 4670 (1987Bl14), 4673 and 4676 (1980Da09).

[†] The nuclear radius parameter r₀(¹⁴⁹Dy)=1.558 10 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in [2020Si16](#).

[‡] For absolute intensity per 100 decays, multiply by 0.53 3.

[#] Existence of this branch is questionable.

$^{120}\text{Sn}(^{32}\text{S},3n\gamma)$ 1981Ha17

1981Ha17: E=145 MeV ^{32}S beam was produced from the Chalk River MP Tandem Van de Graaff. Target was $\approx 2 \text{ mg/cm}^2$ ^{120}Sn on a lead backing. γ rays were detected with Ge(Li) and NaI(Tl) detectors. Measured $E\gamma$, $\gamma\gamma$ -coin, $\gamma(t)$, excitation functions. Deduced levels.

Also includes the following measurements:

1980Ja16: $^{144}\text{Sm}(^{12}\text{C},\alpha 3n\gamma)$ E=70-130 MeV. Measured γ , $\gamma\gamma$, $\gamma(t)$ for isomers; delayed γ -multiplicity.

1979Ha29: ($^{12}\text{C},X\gamma$) E=70, 80, 101, 120 MeV on targets of ^{139}La , ^{141}Pr , ^{142}Nd , ^{144}Nd , ^{146}Nd , ^{144}Sm , ^{148}Sm , ^{150}Sm , ^{152}Gd , ^{154}Gd . Measured γ , $\gamma(t)$, isomers; 11 delayed γ rays reported; average γ multiplicity.

Level scheme is from the Adopted Levels, Gammas, based on results from **1980Da18** up to 3885 level and from **1983JuZY** above that in ($\alpha,7n\gamma$), which is a substantial revision of a tentative scheme proposed by **1981Ha17** in this study. The order of the 741 γ -491 γ cascade tentatively proposed in **1981Ha17**, resulting an intermediate level at 6669, has been reversed based on later studies by **1996Gu17** in $^{122}\text{Sn}(^{32}\text{S},5n\gamma)$ and **2002Go06** in $^{141}\text{Pr}(^{16}\text{O},p7n\gamma)$, resulting an intermediate level at 6919, instead.

 ^{149}Dy Levels

E(level) [†]	J^π [‡]	$T_{1/2}$	Comments
0.0	7/2 ⁻		
1073.2 3	13/2 ⁺		
2251.8 5	17/2 ⁺		
2550.4 6	21/2 ⁺		
2660.8 6	27/2 ⁻	0.490 s 15	$T_{1/2}$: from the Adopted Levels.
3644.8 7			
3884.8 8			
4154.9 8			E(level): this level corresponds to the 5747 level in the Adopted Levels.
4585.1 9			E(level): this level corresponds to the 6177 level in the Adopted Levels.
5076.0 9			E(level): this level corresponds to the 7409 level in the Adopted Levels.
5817.0 9			E(level): this level corresponds to the 6918 and 7409 level in the Adopted Levels.
7153.8 10			E(level): this level corresponds to the 5221 level in the Adopted Levels.
7210.0 10			E(level): this level corresponds to the 5477 level in the Adopted Levels.
7409.5 10	45/2,47/2,49/2	28 ns 3	E(level): this isomer corresponds to the 8520 level in the Adopted Levels. $T_{1/2}$: weighted average of 29 ns 3 (1979Ha29), 25 ns 5 (1980Ja16) and 28 ns 3 (1981Ha17).

[†] From a least-squares fit to γ -ray energies.

[‡] As given by **1981Ha17**. See the Adopted Levels for assignments for levels above 3.5 MeV excitation.

 $\gamma(^{149}\text{Dy})$

E_γ [†]	$E_i(\text{level})$	J^π_i	E_f	J^π_f	Comments
110.4 3	2660.8	27/2 ⁻	2550.4	21/2 ⁺	Mult=E3 in Adopted Gammas.
199.5 3	7409.5	45/2,47/2,49/2	7210.0		This γ placed from 4084 level in the Adopted dataset.
240.0 3	3884.8		3644.8		
255.7 3	7409.5	45/2,47/2,49/2	7153.8		This γ placed from 5477 level in the Adopted dataset.
270.1 3	4154.9		3884.8		This γ placed from 5747 level in the Adopted dataset.
298.6 3	2550.4	21/2 ⁺	2251.8	17/2 ⁺	
430.2 3	4585.1		4154.9		This γ placed from 6177 level in the Adopted dataset.
491.0 3	5076.0		4585.1		This γ placed from 7409 level in the Adopted dataset.
741.1 3	5817.0		5076.0		This γ placed from 6918 level in the Adopted dataset.
984.0 3	3644.8		2660.8	27/2 ⁻	
^x 1006					E_γ : from 1979Ha29 only.
1073.2 3	1073.2	13/2 ⁺	0.0	7/2 ⁻	Mult=E3 in Adopted Gammas.
1178.6 3	2251.8	17/2 ⁺	1073.2	13/2 ⁺	
1231.8 3	5817.0		4585.1		This γ placed from 7409 level in the Adopted dataset.
1336.8 3	7153.8		5817.0		This γ placed from 5221 level in the Adopted Levels.
1393.0 3	7210.0		5817.0		This γ placed from 5477 level in the Adopted Levels.

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$^{120}\text{Sn}(^{32}\text{S},3\text{n}\gamma)$ [1981Ha17](#) (continued)

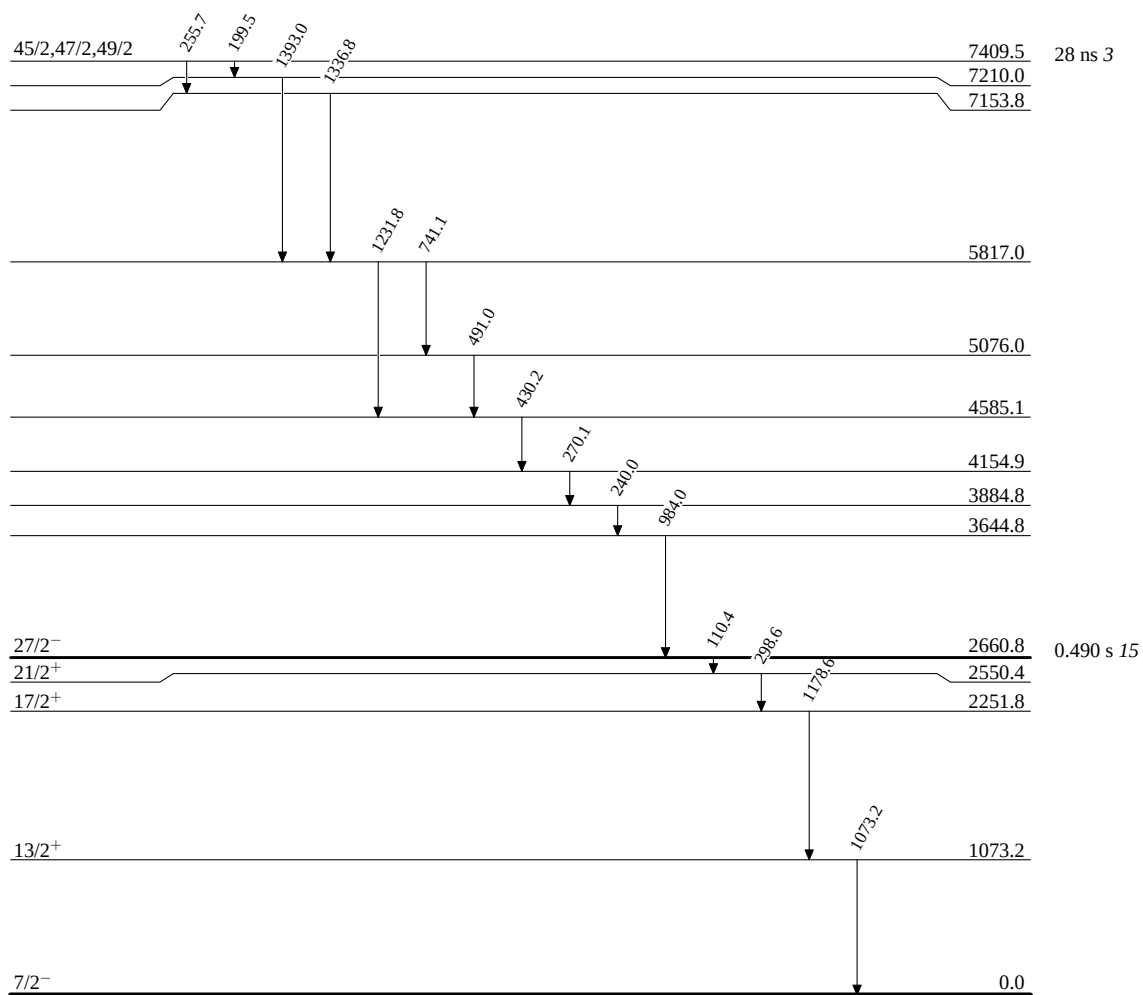
$\gamma(^{149}\text{Dy})$ (continued)

[†] From [1981Ha17](#), unless otherwise stated. Placements of γ rays above 3.9 MeV excitation are different from those in the Adopted dataset, as noted in comments.

^x γ ray not placed in level scheme.

$^{120}\text{Sn}(^{32}\text{S},3n\gamma)$ 1981Ha17

Level Scheme


 $^{149}_{66}\text{Dy}_{83}$

$^{122}\text{Sn}(^{32}\text{S},5\text{n}\gamma)$ 1996Gu17

1996Gu17: E=163 MeV ^{32}S beam was produced at the Nuclear Science Centre, New Delhi. Target was 1.4 mg/cm² enriched tin on a 25 mg/cm² lead backing. γ rays were detected with the Gamma Detector Array (GDA) consisting of 7 n-type Compton-suppressed HPGe detectors with a 14-element BGO multiplicity filter. Measured $E\gamma$, $I\gamma$, $\gamma\gamma(\text{DCO})$. Deduced levels, J, π , configurations, γ -ray multiplicities. Comparisons with shell-model calculations.

Other:

2000Ap01: $^{120}\text{Sn}(^{34}\text{S},5\text{n}\gamma)$. Measured $\gamma\gamma$, search for SD structures.

1983Wa07: report data on continuous γ -ray spectra (average energy, multiplicity and multipolarity), $\gamma(\theta)$, $\gamma\gamma$ for transitions feeding the high-spin isomer at 7410.

Possible SD structure exists in ^{149}Dy as deduced (**2000Ap01**) from a weak continuum (with a total SD intensity of 1.8% 5) in a ridge in the $\gamma\gamma$ coin matrix in $^{120}\text{Sn}(^{34}\text{S},5\text{n}\gamma)$ reaction. However, no discrete SD band structures have been found in this experiment; with an upper limit of population of 0.9% relative to the intensity of the relevant reaction channel.

 ^{149}Dy Levels

E(level) [†]	J π @	T _{1/2} ^a	Comments
0.0	7/2 ⁻		
1073.0 3	13/2 ⁺	12.5 ns 15	
1584.0 3	(11/2 ⁻)		
2251.8 5	17/2 ⁺		
2550.8 6	21/2 ⁺		
2661.8 6	27/2 ⁻	0.490 s 15	
3646.7 7	29/2 ⁺		
3886.5 8	31/2 ⁺		
4086.1 8	33/2 ⁺		
5224.3 8	35/2 ⁺		
5479.5 8	37/2 ⁺		
5749.5 8	39/2 ⁺		
6179.6 8	41/2 ⁺		
6330.4 9			
6680.0 9			
6893.4 9			
6921.4? 9	41/2 ⁺		
7158.8 9			
7243.7 9			J π : 41/2 ⁺ given for 1064.1 γ in Table I of 1996Gu17 .
7412.2 9	43/2 ⁺		
7412.2+x [‡]	(45/2 ⁻)	28 ns 2	E(level): x assumed as 80 (1996Gu17); but in 2002Go06 two tentative cascades have been proposed, defining the isomer at 8520 (see the Adopted Levels), implying x=1108. J π : (49/2 ⁺) in the Adopted Levels.
8007.6+x [‡]	(47/2) ^{&}		J π : negative parity given in Table 1 of 1996Gu17 .
8301.9+x [‡]	(49/2) ^{&}		
8674.9+x [‡]	(49/2) ^{&}		
9131.3+x [‡]	(51/2) ^{&}		
9835.4+x [#]			
9881.7+x [#]	(53/2) ^{&}		
10139.8+x [#]			
10485.8+x [#]	(53/2) ^{&}		
10683.6+x [#]	(55/2) ^{&}		
10742.8+x [#]			
11018.7+x [#]	(57/2) ^{&}		
11045.9+x [#]			
12162.3+x [#]	(61/2)		E(level): this level is not included in the Adopted Levels, as the level proposed by

Continued on next page (footnotes at end of table)

¹²²Sn(³²S,5nγ) **1996Gu17** (continued)

¹⁴⁹Dy Levels (continued)

E(level) [†]	J ^π @	T _{1/2} ^a	Comments
			1996Gu17 from the placement of 1143.6γ, which has been placed from the 6893 level by 2002Go06 in (¹⁶ O,p7nγ), with the latter being adopted.

[†] From a least-squares fit to γ-ray energies, assuming ΔEγ=0.3 keV.

[‡] Value of x=1108 gives a corresponding level in the Adopted Levels.

Additional 962 keV should be added above 9131+x level to get a corresponding level in the Adopted Levels; **2002Go06** in ¹⁴¹Pr(¹⁶O,p7nγ) report an intermediate 962.1γ connecting 9131.3+x level and all levels above.

@ Proposed by **1996Gu17** based on measured γγ(DCO) with the underlying assumption that spin increases monotonically with excitation energy along the most intense pathways. Most listed values, except as indicated, are the same as in the Adopted Levels with the difference that many are placed in parentheses there due to lack of strong arguments.

& For corresponding levels in the Adopted Levels, J^π values are higher by 2 units of spin.

^a From the Adopted Levels.

γ(¹⁴⁹Dy)

DCO ratios are expected to be 0.8≤R_{DCO}≤1.20 with the lower limit for the mixed E2-M1 transitions, the upper limit for the possible ΔJ=0 transitions, and a typical value of 1.0 for a pure dipole; R_{DCO}≈0.6 for a stretched quadrupole transition (**1996Gu17**). However, in Table I of **1996Gu17**, some transitions have inconsistent R_{DCO} ratios and ΔJ values, according to the authors' statement above. No multipolarities are given by **1996Gu17** and none have been deduced by the evaluators from R_{DCO}, as no gating transitions were stated by **1996Gu17**.

E _γ [†]	I _γ [†]	E _i (level)	J _i ^π	E _f	J _f ^π	Comments
x		7412.2+x	(45/2 ⁻)	7412.2	43/2 ⁺	
111.0		2661.8	27/2 ⁻	2550.8	21/2 ⁺	Mult=E3 in Adopted Gammas. E _γ : 110.9 in Fig. 1 of 1996Gu17 .
168.1	3.4 3	7412.2	43/2 ⁺	7243.7		DCO=1.00 6
197.7	3.5 4	10683.6+x	(55/2)	10485.8+x	(53/2)	DCO=0.84 7
199.6	33.0 20	4086.1	33/2 ⁺	3886.5	31/2 ⁺	DCO=1.08 4
213.0		6893.4		6680.0		
239.8	78 5	3886.5	31/2 ⁺	3646.7	29/2 ⁺	DCO=0.98 3
253.3	5.0 10	7412.2	43/2 ⁺	7158.8		DCO=0.84 8
254.9	21.0 20	5479.5	37/2 ⁺	5224.3	35/2 ⁺	DCO=0.95 4
269.8	45 3	5749.5	39/2 ⁺	5479.5	37/2 ⁺	DCO=0.94 2
294.2	8.0 10	8301.9+x	(49/2)	8007.6+x	(47/2)	DCO=0.92 7
299.0		2550.8	21/2 ⁺	2251.8	17/2 ⁺	
303.1	5.0 10	11045.9+x		10742.8+x		DCO=0.88 12
335.1	17.0 10	11018.7+x	(57/2)	10683.6+x	(55/2)	DCO=0.86 5
350.0	1.9 4	7243.7		6893.4		E _γ : 350.3 in Fig. 1 1 of 1996Gu17 .
430.3	44 3	6179.6	41/2 ⁺	5749.5	39/2 ⁺	DCO=0.99 4
456.5	8.0 10	9131.3+x	(51/2)	8674.9+x	(49/2)	DCO=0.66 11
479.2	4.0 10	7158.8		6680.0		DCO=1.08 13
491.1	33.0 20	7412.2	43/2 ⁺	6921.4?	41/2 ⁺	DCO=1.00 4
525.4	13.0 10	5749.5	39/2 ⁺	5224.3	35/2 ⁺	DCO=0.94 11
543.7	4.0 10	10683.6+x	(55/2)	10139.8+x		DCO=1.67 21
580.8	3.0 10	6330.4		5749.5	39/2 ⁺	
595.4	28.0 20	8007.6+x	(47/2)	7412.2+x	(45/2 ⁻)	DCO=1.17 5
603.1		10742.8+x		10139.8+x		E _γ : 602.8 in Fig. 1 of 1996Gu17 .
667.5	7.0 10	8674.9+x	(49/2)	8007.6+x	(47/2)	DCO=1.16 15

Continued on next page (footnotes at end of table)

$^{122}\text{Sn}(^{32}\text{S},5n\gamma)$ **1996Gu17** (continued) $\gamma(^{149}\text{Dy})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
700.3	10.0 20	6179.6	41/2 ⁺	5479.5	37/2 ⁺	DCO=1.06 9
704.2	10.0 10	9835.4+x		9131.3+x	(51/2)	DCO=1.19 8
742.1	23.2 20	6921.4?	41/2 ⁺	6179.6	41/2 ⁺	DCO=1.20 5
750.4	9.0 10	9881.7+x	(53/2)	9131.3+x	(51/2)	DCO=1.28 14
802.0		10683.6+x	(55/2)	9881.7+x	(53/2)	
829.3	5.0 10	9131.3+x	(51/2)	8301.9+x	(49/2)	DCO=1.60 24
848.2	5.0 10	10683.6+x	(55/2)	9835.4+x		
861.0		10742.8+x		9881.7+x	(53/2)	
930.5	3.0 10	6680.0		5749.5	39/2 ⁺	DCO=1.2 3
984.9	100.0 20	3646.7	29/2 ⁺	2661.8	27/2 ⁻	DCO=0.96 3
1008.6	5.0 10	10139.8+x		9131.3+x	(51/2)	DCO=1.07 17
1064.1	6.0 10	7243.7		6179.6	41/2 ⁺	DCO=0.7 3
1073.0		1073.0	13/2 ⁺	0.0	7/2 ⁻	Mult=E3 in Adopted Gammas.
1138.2	15.0 20	5224.3	35/2 ⁺	4086.1	33/2 ⁺	DCO=0.89 9
1143.6	3.0 10	12162.3+x?	(61/2)	11018.7+x	(57/2)	DCO=1.5 4
E _γ : placed from the 6893 level by 2002Go06 in ($^{16}\text{O},p7n\gamma$), which is recommended in the Adopted Levels, Gammas dataset.						
1178.8		2251.8	17/2 ⁺	1073.0	13/2 ⁺	
1232.5	18.0 20	7412.2	43/2 ⁺	6179.6	41/2 ⁺	DCO=1.18 7
1337.7	45 3	5224.3	35/2 ⁺	3886.5	31/2 ⁺	DCO=0.89 6
1354.3	6.0 20	10485.8+x	(53/2)	9131.3+x	(51/2)	DCO=0.9 3
E _γ : 1353.3 in Table I of 1996Gu17 .						
1393.5	41 3	5479.5	37/2 ⁺	4086.1	33/2 ⁺	DCO=1.80 6
1408.9	0.7 2	7158.8		5749.5	39/2 ⁺	
1584.0		1584.0	(11/2 ⁻)	0.0	7/2 ⁻	

[†] From **1996Gu17**.

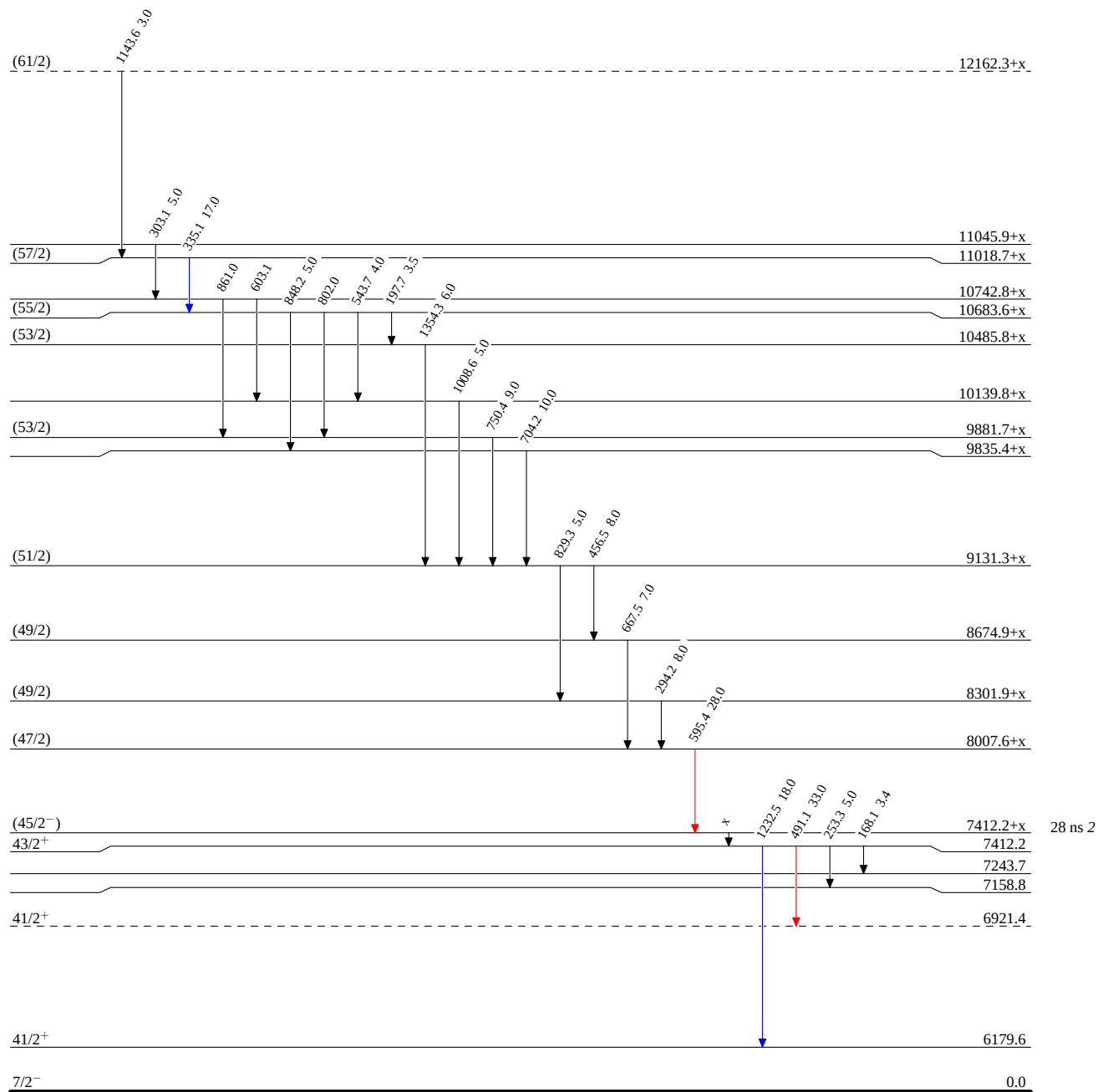
$^{122}\text{Sn}(^{32}\text{S},5n\gamma)$ 1996Gu17

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



$^{149}_{66}\text{Dy}_{83}$

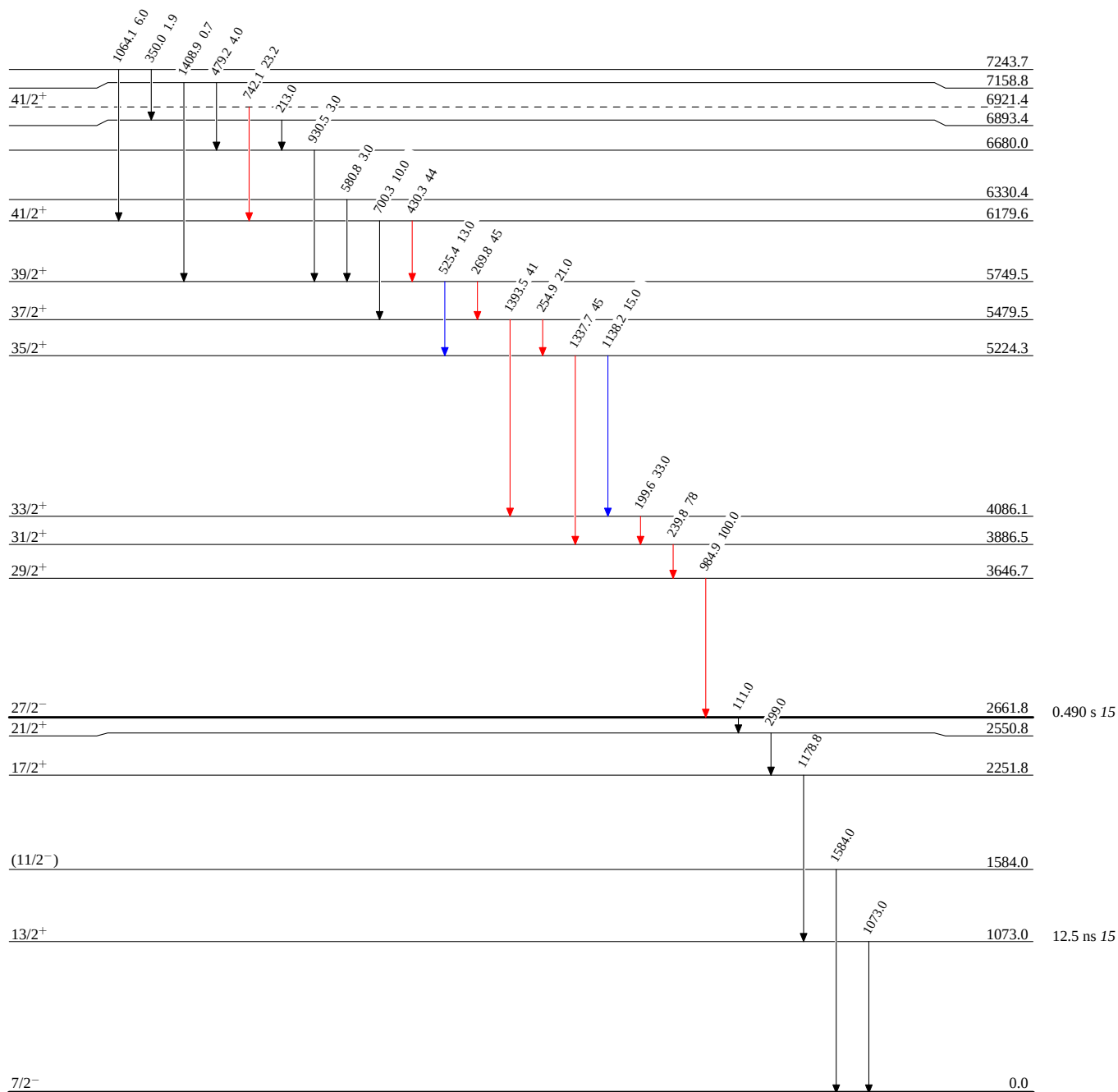
¹²²Sn(³²S,5nγ) 1996Gu17

Level Scheme (continued)

Intensities: Relative I_γ

Legend

- I_γ < 2% × I_γ^{max}
- I_γ < 10% × I_γ^{max}
- I_γ > 10% × I_γ^{max}



¹⁴⁹Dy₈₃

$^{136}\text{Ce}(^{16}\text{O},3n\gamma)$ 1980Da18,1983JuZY

1980Da18 (also 1983JuZY): E=92 MeV ^{16}O beam from the Emperor Tandem at the MPI Heidelberg on >99% enriched ^{136}Xe target (in oxide form); measured conversion electrons with a solenoid spectrometer. Deduced levels, J, π , isomer $T_{1/2}$, configurations, conversion coefficients, γ -ray multiplicities, transition strengths. Systematics of neighboring isotones. See also the $^{152}\text{Gd}(\alpha,7n\gamma)$ dataset for additional data from this work.

Level scheme is based on results from 1980Da18 up to 3885 level and from 1983JuZY above that, which is a substantial revision of a tentative scheme proposed by 1981Ha17 in $^{120}\text{Sn}(^{32}\text{S},3n\gamma)$. However, details of the results from 1983JuZY are not available. The order of the 741 γ -491 γ cascade tentatively proposed in 1981Ha17, resulting an intermediate level at 6669, has been reversed based on later studies by 1996Gu17 in $^{122}\text{Sn}(^{32}\text{S},5n\gamma)$ and 2002Go06 in $^{141}\text{Pr}(^{16}\text{O},p7n\gamma)$, resulting an intermediate level at 6919, instead.

 ^{149}Dy Levels

E(level) [†]	J π [‡]	T _{1/2}	Comments
0.0	7/2 ⁻		
1073.20 20	13/2 ⁺	12.5 ns 15	T _{1/2} : from $\gamma\gamma(t)$ (1980Da18). Other: 13 ns 3 in (1976St01).
2251.81 23	17/2 ⁺		
2550.41 25	21/2 ⁺		
2661.2 5	27/2 ⁻	0.490 s 15	T _{1/2} : from the Adopted Levels.
3645.5 5	29/2 ⁺		
3885.5 6	(31/2 ⁺)		J π : 1980Da18 give 31/2.
4084.9 7	(33/2 ⁺)		
5222.8 7	(35/2 ⁺)		
5478.0 7	(37/2 ⁺)		
5747.9 7	(39/2 ⁺)		
5929.6? 7			
6178.0 7	(41/2 ⁺)		
6919.1 8			
7242.2? 8			
7410.0 8	(43/2 ⁺)		

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E\gamma=0.3$ keV where not available.

[‡] As given in 1980Da18 for levels below 4 MeV, based on $\gamma(\theta)$ data in 1980Da18 and 1976St08, and ce data in ($^{16}\text{O},3n\gamma$) study by 1980Da18. Above 3.8 MeV, excitations, the assignments are from the Adopted Levels.

 $\gamma(^{149}\text{Dy})$

E $_{\gamma}$ [†]	I $_{\gamma}$ [†]	E $_i$ (level)	J $^{\pi}_i$	E $_f$	J $^{\pi}_f$	Mult. [†]	α ^{&}	Comments
110.8 4		2661.2	27/2 ⁻	2550.41	21/2 ⁺	E3	27.3 7	$\alpha(K)\text{exp}=22\ 7$ (1976St08); $\alpha(L)\text{exp}=13\ 5$ (1980Da18) $\alpha(L)\text{exp}=16\ 4$ (1987BaZV), from comparison with 298.6 γ intensity.
167.8 [#]		7410.0	(43/2 ⁺)	7242.2?				
199.4 [‡] 3	50 10	4084.9	(33/2 ⁺)	3885.5	(31/2 ⁺)	(M1) [@]	0.342 5	
240.0 3	80 20	3885.5	(31/2 ⁺)	3645.5	29/2 ⁺	(M1) [@]	0.2060 30	
248.4 [#]		6178.0	(41/2 ⁺)	5929.6?				
255.0 [‡] 2	32 9	5478.0	(37/2 ⁺)	5222.8	(35/2 ⁺)	(M1) [@]	0.1748 25	
270.0 [‡] 2	42 4	5747.9	(39/2 ⁺)	5478.0	(37/2 ⁺)	(M1)	0.1498 21	$\alpha(K)\text{exp}=0.080\ 15$ (1980Da18) $\delta(E2/M1)>0.8$ from $\alpha(K)\text{exp}$ in (1980Da18); 1983JuZY assign M1.
298.6 1	80 8	2550.41	21/2 ⁺	2251.81	17/2 ⁺	E2	0.0654 9	$\alpha(K)\text{exp}=0.049\ 7$ (1980Da18)
430.3 [‡] 2	18 6	6178.0	(41/2 ⁺)	5747.9	(39/2 ⁺)	(M1) [@]	0.0437 6	

Continued on next page (footnotes at end of table)

$^{136}\text{Ce}(^{16}\text{O},3n\gamma)$ **1980Da18,1983JuZY (continued)** $\gamma(^{149}\text{Dy})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [†]	α ^{&}	Comments
451.7 [#]		5929.6?		5478.0	(37/2 ⁺)			
491.0 [#]		7410.0	(43/2 ⁺)	6919.1				
525.1 [#]		5747.9	(39/2 ⁺)	5222.8	(35/2 ⁺)			
699.8 [#]		6178.0	(41/2 ⁺)	5478.0	(37/2 ⁺)			
741.1 [#]		6919.1		6178.0	(41/2 ⁺)			
984.3 2	78 8	3645.5	29/2 ⁺	2661.2	27/2 ⁻	E1	1.29×10^{-3} 2	$\alpha(K)\text{exp}=0.0011$ 2 (1980Da18)
1064.2 [#]		7242.2?		6178.0	(41/2 ⁺)			
1073.2 2	100	1073.20	13/2 ⁺	0.0	7/2 ⁻	E3	0.00557 8	$\alpha(K)\text{exp}=0.0046$ 5 (1980Da18)
1137.8 [#]		5222.8	(35/2 ⁺)	4084.9	(33/2 ⁺)			
1178.6 1	95 10	2251.81	17/2 ⁺	1073.20	13/2 ⁺	E2	2.18×10^{-3} 3	$\alpha(K)\text{exp}=0.0017$ 3 (1980Da18)
1231.8 [#]		7410.0	(43/2 ⁺)	6178.0	(41/2 ⁺)			
1337.2 [‡] 4	35 6	5222.8	(35/2 ⁺)	3885.5	(31/2 ⁺)			
1393.7 [‡] 5	30 3	5478.0	(37/2 ⁺)	4084.9	(33/2 ⁺)	E2	1.61×10^{-3} 2	$\alpha(K)\text{exp}=0.0011$ 4 (1980Da18) Mult.: from $\alpha(K)\text{exp}$.

[†] From **1980Da18**, unless otherwise stated. Multipolarities are determined based on ce data and intensities are obtained in-beam (1 μs pulse) (**1980Da18**).

[‡] Unplaced in **1980Da18** and placed by **1983JuZY**.

[#] From **1983JuZY** only.

@ From ce data of **1983JuZY**. Details of $\alpha(K)\text{exp}$ values are not available.

& Total theoretical internal conversion coefficients, calculated using the BrIcc code (**2008Ki07**) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

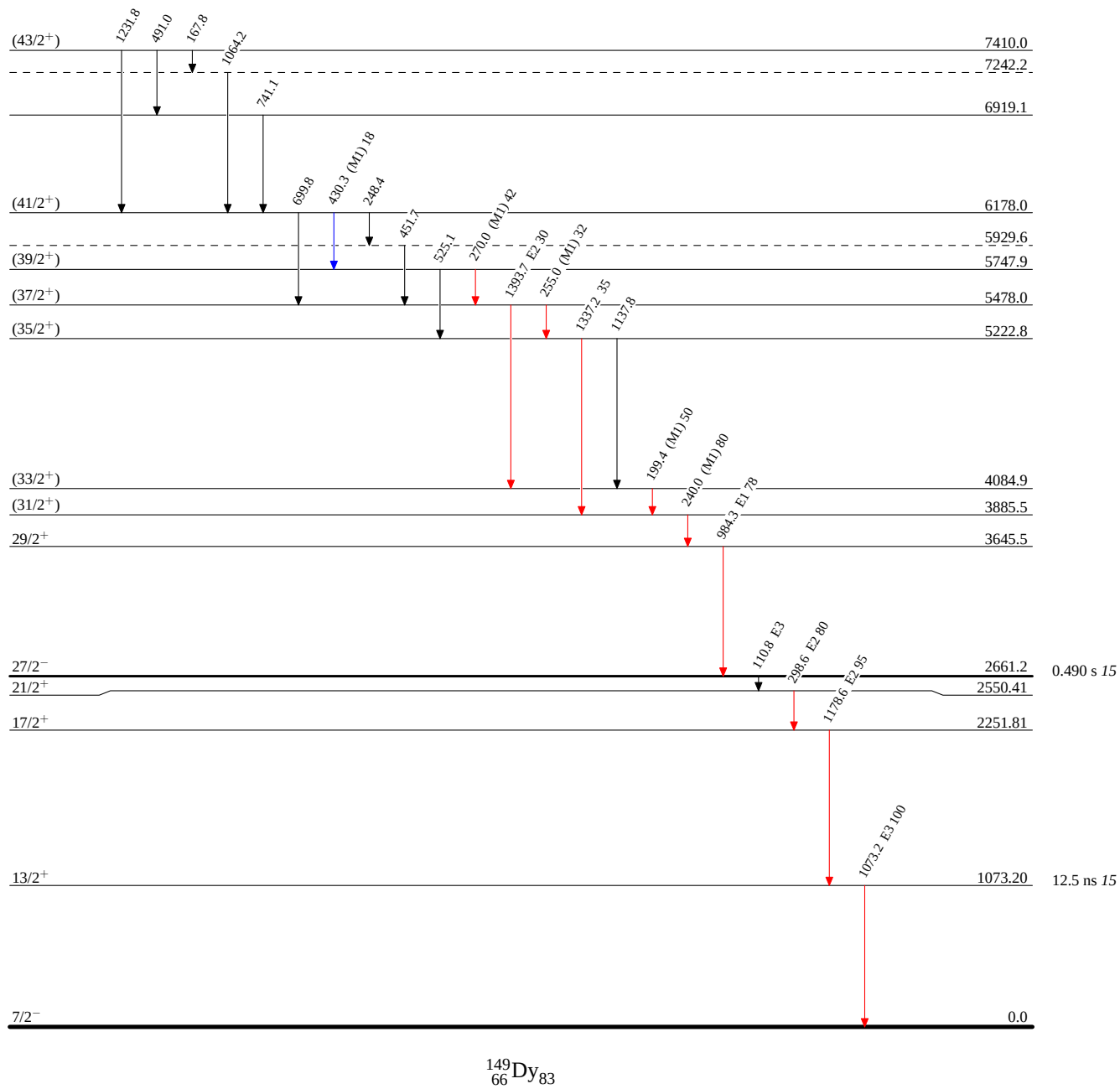
¹³⁶Ce(¹⁶O,3n γ) 1980Da18,1983JuZY

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$


¹⁴⁹Dy₈₃

$^{141}\text{Pr}(^{16}\text{O},\text{p}7\text{n}\gamma)$ 2002Go06

2002Go06: E=165 MeV ^{16}O beam was produced from the cyclotron of the Center for Nuclear Study, University of Tokyo. Target was 9.4 mg/cm² self-supporting natural Pr. γ rays were detected with an array of five (BGO) Compton-suppressed HPGe detectors. Measured E_γ , I_γ , $\gamma\gamma$ -coin, $\gamma\gamma(t)$. Deduced levels, J, π . Systematics of neighboring isotones.

2003Wa28: Mg($^{132}\text{Xe},\text{xny}$) E=7.0 MeV/nucleon. Measured delayed E_γ , $\gamma(\theta,\text{H},t)$; time-differential PAC method; deduced g factor of (49/2⁺) isomer at 8522 keV.

 ^{149}Dy Levels

E(level) [†]	J π [#]	T _{1/2} [‡]	Comments
0.0	7/2 ⁻		
1073.0 3	13/2 ⁺	12.5 ns 15	
1584.0 3	(11/2 ⁻)		
2251.8 5	17/2 ⁺		
2550.8 6	21/2 ⁺		
2661.7 6	27/2 ⁻	0.490 s 15	
3646.6 7	29/2 ⁺		
3886.5 8	31/2 ⁺		
4086.0 8	33/2 ⁺		
5224.2 8	35/2 ⁺		
5479.4 8	37/2 ⁺		
5749.5 8			
6179.6 8	39/2 ⁺		J π : (41/2 ⁺) in the Adopted Levels.
6330.3 9			
6679.9 9			
6893.1 9			
6921.3? 9	41/2 ⁺		
7158.7 9			
7243.7 9			
7412.1 9	43/2 ⁺		
8047.1? 12			
8273.1? 12			
8522.1 13	(49/2 ⁺)	28 ns 2	g=+0.41 6 (2003Wa28) g: TDPAD method (2003Wa28) with a pulsed ^{132}Xe beam; 984.9 γ and 1393.5 γ used for measurement. Configuration= $\pi h_{11/2}^2 \otimes \nu(f_{7/2} h_{9/2} i_{13/2} d_{3/2}^{-2} 0)$ gives calculated g=0.46.
9117.6 14			
9411.9 14			
9784.9 14			
10241.3 14			
11203.4 14			
11907.6 15			
11953.8 15			
12212.0 15			
12557.9 15			
12755.7 15			
12814.8 15			
13090.8 15			
13117.8 15			
13730.3 16			
13951.8 16			

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_\gamma=0.3$ keV for E_γ values quoted to tenth of a keV, 1 keV otherwise.

[‡] From the Adopted Levels.

[#] As given by 2002Go06. The assignments are the same as in the Adopted Levels, except that several have been placed in parentheses as strong arguments are lacking. Exception for J π assignment of 6179.6 level is noted. For levels above 8522, see the Adopted Levels for tentative J π assignments.

$^{141}\text{Pr}(^{16}\text{O,p7n}\gamma)$ **2002Go06 (continued)** $\gamma(^{149}\text{Dy})$

E_γ †	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
110.9	2661.7	27/2 ⁻	2550.8	21/2 ⁺	Mult=E3 in Adopted Gammas.
168.1	7412.1	43/2 ⁺	7243.7		
197.7	12755.7		12557.9		
199.6	4086.0	33/2 ⁺	3886.5	31/2 ⁺	
213.0	6893.1		6679.9		
239.8	3886.5	31/2 ⁺	3646.6	29/2 ⁺	
249 ^{‡#}	8522.1	(49/2 ⁺)	8273.1?		
253.3	7412.1	43/2 ⁺	7158.7		
254.9	5479.4	37/2 ⁺	5224.2	35/2 ⁺	
269.8	5749.5		5479.4	37/2 ⁺	
294.2	9411.9		9117.6		
299.0	2550.8	21/2 ⁺	2251.8	17/2 ⁺	
303.1	13117.8		12814.8		
335.1	13090.8		12755.7		
350.3	7243.7		6893.1		
430.3	6179.6	39/2 ⁺	5749.5		
456.5	10241.3		9784.9		
475 ^{‡#}	8522.1	(49/2 ⁺)	8047.1?		
479.2	7158.7		6679.9		
491.1	7412.1	43/2 ⁺	6921.3?	41/2 ⁺	
525.4	5749.5		5224.2	35/2 ⁺	
543.7	12755.7		12212.0		
580.8	6330.3		5749.5		
595.4	9117.6		8522.1	(49/2 ⁺)	
602.8	12814.8		12212.0		
613 [‡]	13730.3		13117.8		
635 ^{‡#}	8047.1?		7412.1	43/2 ⁺	
667.5	9784.9		9117.6		
700.3	6179.6	39/2 ⁺	5479.4	37/2 ⁺	
704.2	11907.6		11203.4		
742.1	6921.3?	41/2 ⁺	6179.6	39/2 ⁺	
750.4	11953.8		11203.4		
802.0	12755.7		11953.8		
829.3	10241.3		9411.9		
834 [‡]	13951.8		13117.8		
848.2	12755.7		11907.6		
861 ^{‡#}	8273.1?		7412.1	43/2 ⁺	
861.0	12814.8		11953.8		
915 [‡]	13730.3		12814.8		
930.5	6679.9		5749.5		
962.1 [‡]	11203.4		10241.3		
984.9	3646.6	29/2 ⁺	2661.7	27/2 ⁻	
1008.6	12212.0		11203.4		
1064.1	7243.7		6179.6	39/2 ⁺	
1073.0	1073.0	13/2 ⁺	0.0	7/2 ⁻	Mult=E3 in Adopted Gammas.
1137 [‡]	13951.8		12814.8		
1138.2	5224.2	35/2 ⁺	4086.0	33/2 ⁺	
1143.5	6893.1		5749.5		
1178.8	2251.8	17/2 ⁺	1073.0	13/2 ⁺	
1232.5	7412.1	43/2 ⁺	6179.6	39/2 ⁺	
1337.7	5224.2	35/2 ⁺	3886.5	31/2 ⁺	
1354.3	12557.9		11203.4		

Continued on next page (footnotes at end of table)

¹⁴¹Pr(¹⁶O,p7nγ) **2002Go06 (continued)**

γ(¹⁴⁹Dy) (continued)

<u>E_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>
1393.5	5479.4	37/2 ⁺	4086.0	33/2 ⁺
1408.9	7158.7		5749.5	
1584.0	1584.0	(11/2 ⁻)	0.0	7/2 ⁻

[†] **2002Go06** seem to quote most values from **1996Gu17**, where levels in ¹⁴⁹Dy were populated in ¹²²Sn(³²S,5nγ) reaction. As indicated, energies of nine gamma rays are from **2002Go06**, that were not reported by **1996Gu17** in ¹²²Sn(³²S,5nγ).

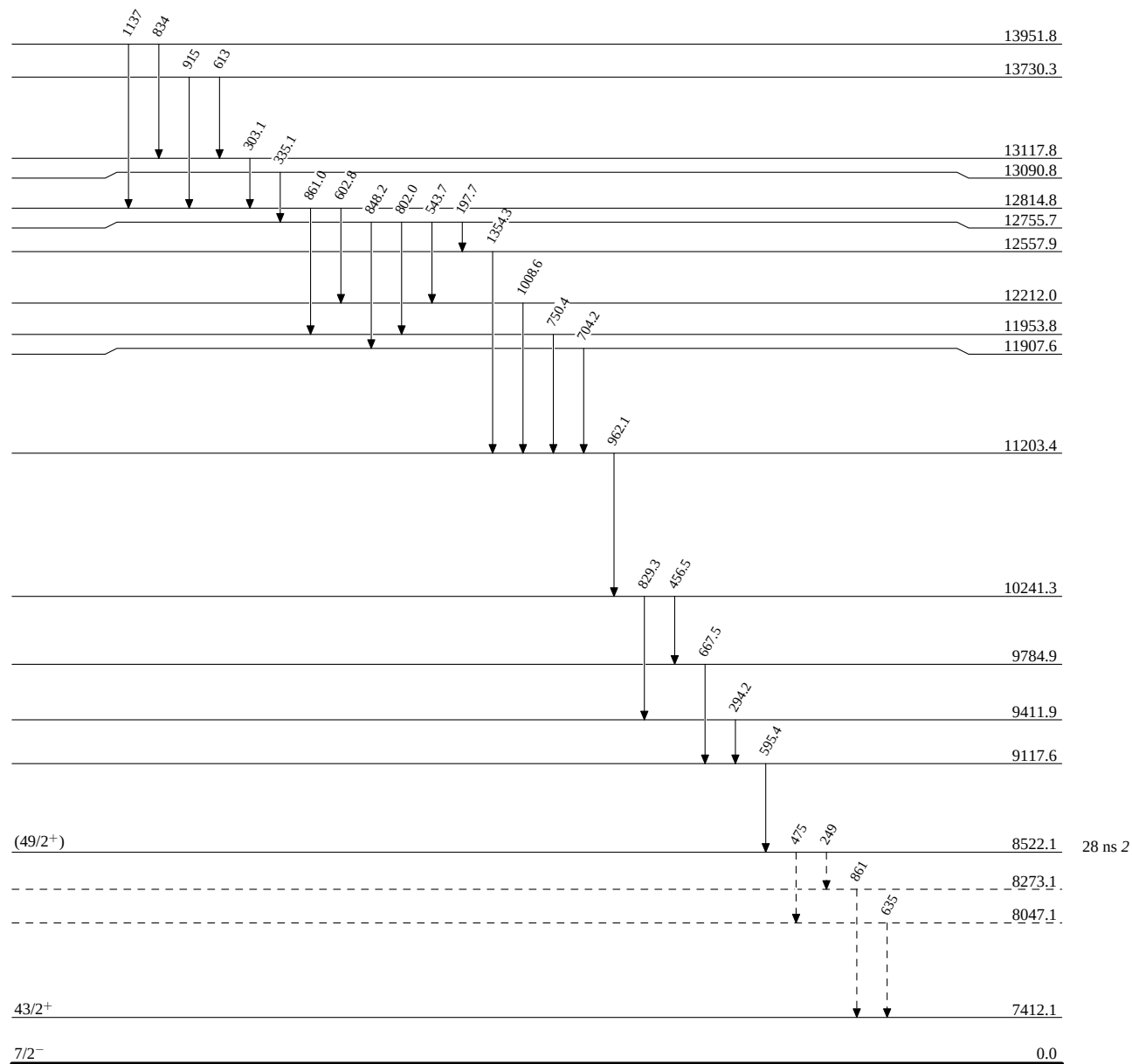
[‡] From **2002Go06** only; not reported in **1996Gu17** in ¹²²Sn(³²S,5nγ).

[#] Placement of transition in the level scheme is uncertain.

$^{141}\text{Pr}(^{16}\text{O},\text{p}7\text{n}\gamma)$ 2002Go06

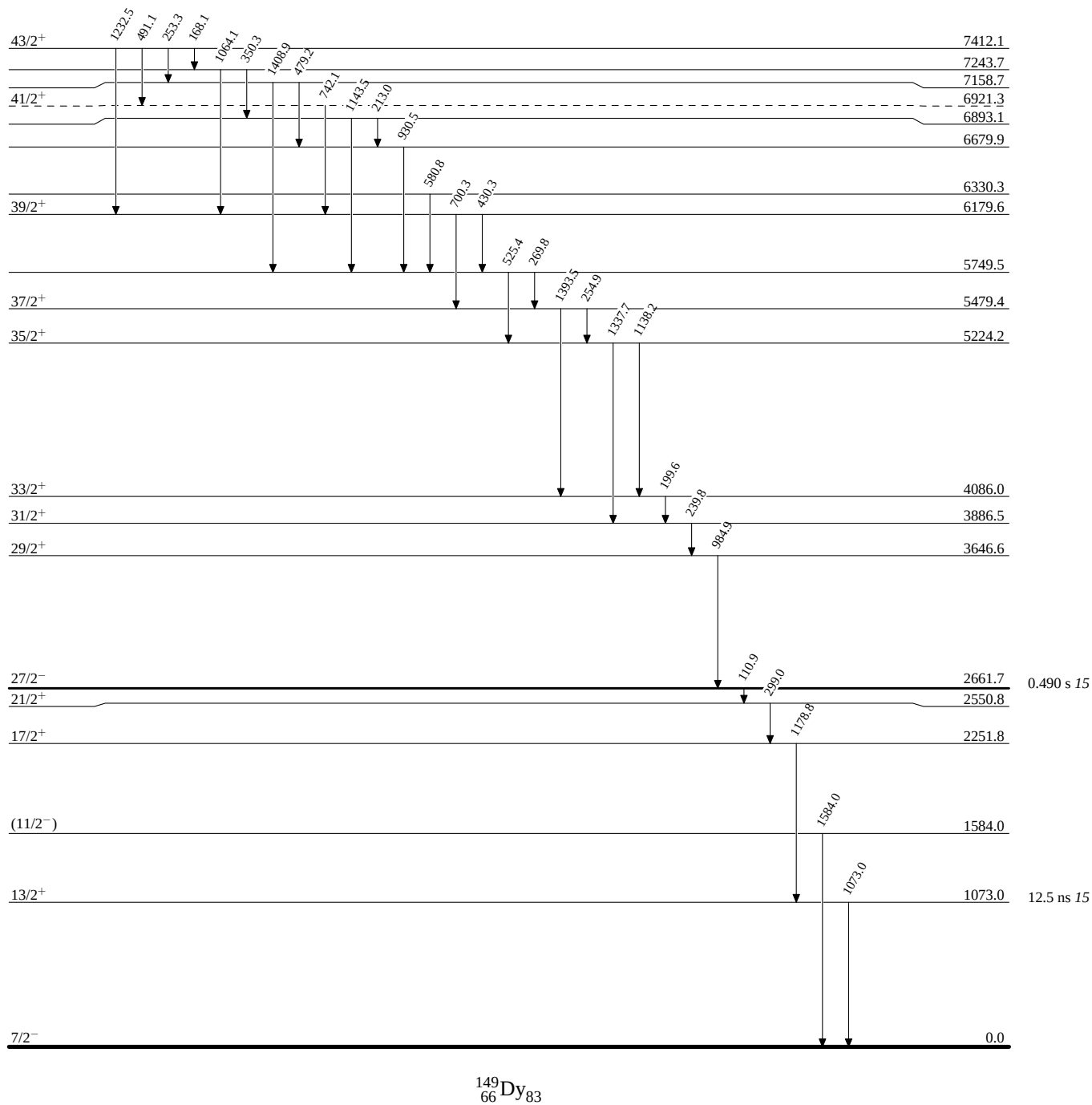
Legend

Level Scheme

 -----> γ Decay (Uncertain)

 $^{149}_{66}\text{Dy}_{83}$

$^{141}\text{Pr}(^{16}\text{O},\text{p}7\text{n}\gamma)$ 2002Go06

Level Scheme (continued)



$^{152}\text{Gd}(\alpha,7n\gamma)$ 1980Da18,1983JuZY

1980Da18 (also 1983JuZY): $^{152}\text{Gd}(\alpha,7n\gamma)$ E=106 MeV, this measurement updates and extends that by 1976St08 at the same laboratory; measured E_γ , I_γ , $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$, $\gamma(t)$, $\gamma\gamma(t)$. $^{136}\text{Ce}(^{16}\text{O},3n\gamma)$ E=96 MeV ^{16}O beam from the Emperor Tandem at the MPI Heidelberg on >99% enriched ^{136}Xe target (in oxide form); measured conversion electrons with a solenoid spectrometer. Deduced levels, J, π , isomer $T_{1/2}$, configurations, conversion coefficients, γ -ray multiplicities, transition strengths. Systematics of neighboring isotones. See also the $^{152}\text{Gd}(\alpha,7n\gamma)$ dataset for additional data.

1976St08 (also 1976St01): $^{152}\text{Gd}(\alpha,7n\gamma)$ E=106 MeV α beam was produced from the Julich cyclotron. Target was 1.2 mg enriched (>99.6%) ^{152}Gd on a 500 $\mu\text{g}/\text{cm}^2$ mylar backing. γ rays were detected with two Ge(Li) detectors. Measured E_γ , I_γ , $\gamma\gamma$ -coin, $\gamma(\theta)$, $\gamma\gamma(\theta)$, $\gamma(t)$, $\gamma\gamma(t)$. Deduced levels, J, π , isomer $T_{1/2}$, γ -ray multiplicities. 1976St08 extends the measurement of 1976St01 and determines $T_{1/2}$, spin and parity of the isomer.

Level scheme is based on results from 1980Da18 up to 3885 level and from 1983JuZY above that, which is a substantial revision of a tentative scheme proposed by 1981Ha17 in $^{120}\text{Sn}(^{32}\text{S},3n\gamma)$. However, details of the results from 1983JuZY are not available. The order of the 741 γ -491 γ cascade tentatively proposed in 1981Ha17, resulting an intermediate level at 6669, has been reversed based on later studies by 1996Gu17 in $^{122}\text{Sn}(^{32}\text{S},5n\gamma)$ and 2002Go06 in $^{141}\text{Pr}(^{16}\text{O},p7n\gamma)$, resulting an intermediate level at 6919, instead.

 ^{149}Dy Levels

E(level) [†]	J π [‡]	$T_{1/2}$	Comments
0.0	7/2 ⁻		
1073.20 20	13/2 ⁺	12.5 ns 15	$T_{1/2}$: from $\gamma(t)$ (1980Da18). Other: 13 ns 3 in (1976St01).
2251.81 23	17/2 ⁺		
2550.41 25	21/2 ⁺		
2661.2 5	27/2 ⁻	0.490 s 15	$T_{1/2}$: adopted value from weighted average of 0.500 s 30 (1976St08), 0.510 s 10 (1980Ja16), 0.47 s 1 (1987BaZV).
3645.5 5	29/2 ⁺		
3885.5 6	31/2		
4084.9 7	(33/2 ⁺)		
5222.8 7	(35/2 ⁺)		
5478.0 7	(37/2 ⁺)		
5747.9 7	(39/2 ⁺)		
5929.6? 7			
6178.0 7	(41/2 ⁺)		
6919.1 8			
7242.2? 8			
7410.0 8	(43/2 ⁺)		
7410.0+x	(49/2 ⁺)	39 ns 8	E(level): 1983JuZY suggest x<80. 8520 level in the Adopted Levels. $T_{1/2}$: weighted average of 36 ns 8 (1980Da18) and 50 ns 15 (1976St01).

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E_\gamma=0.3$ keV where not available.

[‡] As given in 1980Da18 for levels below 4 MeV, based on $\gamma(\theta)$ data in 1980Da18 and 1976St08, and ce data in ($^{16}\text{O},3n\gamma$) study by 1980Da18. Above 4 MeV, excitations, the assignments are from the Adopted Levels.

 $\gamma(^{149}\text{Dy})$

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J π_i	E_f	J π_f	Mult. [‡]	α [@]	Comments
110.8 4	≈ 3	2661.2	27/2 ⁻	2550.41	21/2 ⁺	E3	27.3 7	Mult.: from $\alpha(L)\text{exp}$ in $^{16}\text{O},3n\gamma$ (1980Da18). I_γ : estimated from $\gamma\gamma$ -coin (1980Da18).
167.8 [#]		7410.0	(43/2 ⁺)	7242.2?				
199.4 3	20 6	4084.9	(33/2 ⁺)	3885.5	31/2	D		$A_2=-0.19$ 4; $A_4=-0.05$ 5 (1980Da18)
240.0 3	39 6	3885.5	31/2	3645.5	29/2 ⁺	D		$A_2=-0.20$ 5; $A_4=0.00$ 6 (1980Da18)
248.4 [#]		6178.0	(41/2 ⁺)	5929.6?				

Continued on next page (footnotes at end of table)

$^{152}\text{Gd}(\alpha,7n\gamma)$ **1980Da18,1983JuZY (continued)** $\gamma(^{149}\text{Dy})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ‡	Comments
255.0 2	≈ 6	5478.0	(37/2 ⁺)	5222.8	(35/2 ⁺)		I_γ : estimated from $\gamma\gamma$. $I_\gamma(255\gamma)/I_\gamma(1393\gamma)=1.07$ 30 in $(^{16}\text{O},3n\gamma)$ (1980Da18).
270.0 2	15 3	5747.9	(39/2 ⁺)	5478.0	(37/2 ⁺)	D	$A_2=-0.04$ 5; $A_4=-0.01$ 8 (1980Da18)
298.6 1	83 8	2550.41	21/2 ⁺	2251.81	17/2 ⁺		$A_2=0.00$ 2; $A_4=-0.04$ 3 (1976St01)
430.3 2	18 6	6178.0	(41/2 ⁺)	5747.9	(39/2 ⁺)		
451.7 [#]		5929.6?		5478.0	(37/2 ⁺)		
491.0 [#]		7410.0	(43/2 ⁺)	6919.1			
525.1 [#]		5747.9	(39/2 ⁺)	5222.8	(35/2 ⁺)		
699.8 [#]		6178.0	(41/2 ⁺)	5478.0	(37/2 ⁺)		
741.1 [#]		6919.1		6178.0	(41/2 ⁺)		
984.3 2	61 6	3645.5	29/2 ⁺	2661.2	27/2 ⁻	D	$A_2=-0.18$ 3; $A_4=0.00$ 4 (1980Da18)
^x 1006							E_γ : from 1979Ha29 only.
1064.2 [#]		7242.2?		6178.0	(41/2 ⁺)		
1073.2 2	100	1073.20	13/2 ⁺	0.0	7/2 ⁻		$A_2=+0.01$ 3; $A_4=+0.02$ 4 (1976St01)
							Mult=E3 in Adopted Gammas.
1137.8 [#]		5222.8	(35/2 ⁺)	4084.9	(33/2 ⁺)		
1178.6 1	91 9	2251.81	17/2 ⁺	1073.20	13/2 ⁺		$A_2=+0.01$ 3; $A_4=-0.03$ 4 (1976St01)
							(298.6 γ)(1178.6 γ)(θ): $A_2=+0.05$ 7 (1976St08).
1231.8 [#]		7410.0	(43/2 ⁺)	6178.0	(41/2 ⁺)		
1337.2 4	18 3	5222.8	(35/2 ⁺)	3885.5	31/2	(Q)	$A_2=+0.19$ 9; $A_4=-0.02$ 9 (1980Da18)
1393.7 5	18 4	5478.0	(37/2 ⁺)	4084.9	(33/2 ⁺)		

† From 1980Da18, unless otherwise stated. Intensities are obtained in-beam (1 μs pulse).

‡ Assigned by evaluators from $\gamma(\theta)$ data in 1980Da18.

[#] Reported by 1983JuZY only.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^x γ ray not placed in level scheme.

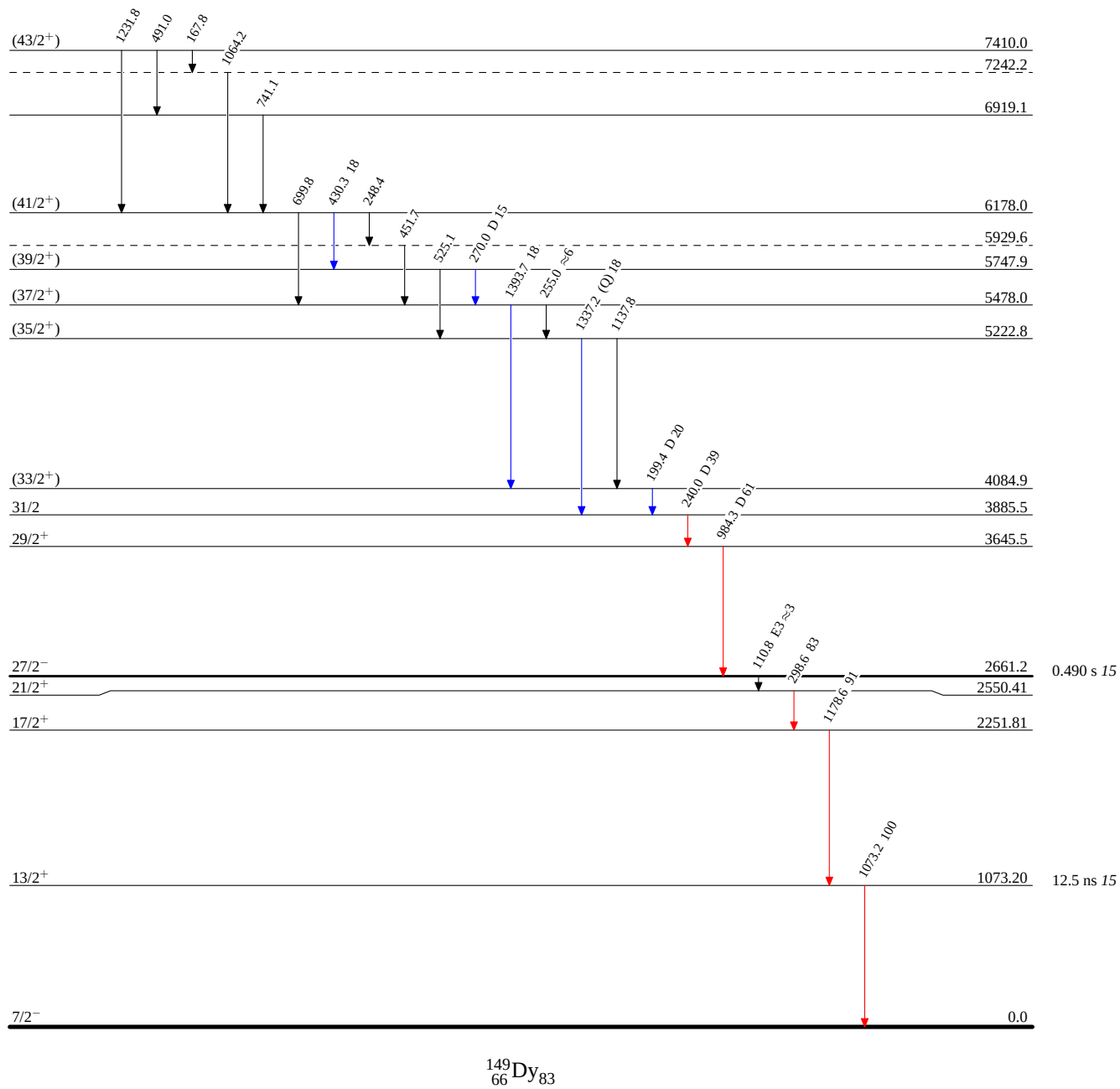
$^{152}\text{Gd}(\alpha,7n\gamma)$ 1980Da18,1983JuZY

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



$^{149}_{66}\text{Dy}_{83}$

Adopted Levels, Gammas

$Q(\beta^-) = -7900$ 30; $S(n) = 11730$ 80; $S(p) = 1075$ 12; $Q(\alpha) = 2.33 \times 10^3$ 11 [2021Wa16](#)

$Q(\varepsilon) = 6048$ 13, $Q(\varepsilon p) = 1602$ 15, $S(2n) = 22031$ 13, $S(2p) = 5481$ 14 ([2021Wa16](#)).

[2012Th13](#): deduced mass excess.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for nine references dealing with nuclear structure theory, and two for half-lives in radioactive decays.

¹⁴⁹Ho Levels

Band assignments are from [2010Ko12](#) in (⁴⁰Ar,p2n γ).

Cross Reference (XREF) Flags

A	¹⁴⁹ Er ε decay (4 s)	E	¹⁵³ Tm α decay (2.5 s)
B	¹⁴⁹ Er ε decay (9.6 s)	F	¹¹² Sn(⁴⁰ Ar,p2n γ)
C	¹⁵⁰ Tm εp decay:mixed	G	¹²¹ Sb(³² S,4n γ), ¹⁰⁶ Pd(⁵⁰ Ti,P6NG)
D	¹⁵³ Tm α decay (1.48 s)		

E(level) [†]	J π [‡]	T _{1/2}	XREF	Comments
0.0 ^e	(11/2 ⁻) ^c	21.0 s 2	A CD FG	$\% \varepsilon + \% \beta^+ = 100$ T _{1/2} : weighted average of 21.1 s 2 (1993Al03), 20.5 s 5 (1994Me13), 23 s 4 (1982Ba75), and 21 s 2 (1979To01). Configuration= $\pi h_{11/2}$.
48.8 2	(1/2 ⁺)	56 s 3	ABCDE	$\% \varepsilon + \% \beta^+ = 100$ T _{1/2} : from 1994Me13 . Others: 58 s 3 (1989Me13 , superseded by 1994Me13), 54 s 5 (1988ToZW). Configuration= $s_{1/2}$.
220.23 22	(3/2 ⁺)		ABCDE	J π : M1 171.5 γ to (1/2 ⁺). Configuraton= $\pi d_{3/2}$.
564.17 23	(5/2 ⁺)		ABCDE	J π : (M1) 343.9 γ to (3/2 ⁺). Configuration= $\pi d_{5/2}$.
1000.91 23	(7/2 ⁺)		BC	J π : (M1) 436.7 γ to (5/2 ⁺). Configuration= $\pi g_{7/2}$.
1171.08 [@] 7	[@]		B	
1183.71 [@] 20	[@]		B	
1277.11 [@] 10	(9/2 ⁻) [@]		B	
1380.09 ^f 10	(15/2 ⁺)		BC FG	J π : probable configuration= $\pi h_{11/2} \otimes (3^-$ in ¹⁴⁸ Dy) (1980Wi11) and systematics.
1415.0 4	(7/2 ⁺)		B	J π : 1194.5 γ to (3/2 ⁺), 413.0 γ to (7/2 ⁺); possible ε feeding from (11/2 ⁻) in ¹⁴⁹ Er.
1530.94 [@] 8	[@]		B	
1552.10 [@] 8	[@]		B	
1560.12 ^e 10	(15/2 ⁻) ^c		BC FG	
1601.9 [@] 5	[@]		B	
1648.91 [@] 10	[@]		B	
1706.92 [@] 20	[@]		B	
1735.31 [@] 20	[@]		B	
1765.80 [@] 10	[@]		B	
1797.30 23	(3/2 ⁺)		A	J π : probable allowed ε decay from (1/2 ⁺) in ¹⁴⁹ Er; configuration= $\pi s_{1/2} \otimes (2^+$ in ¹⁴⁸ Dy) (1989Fi01).
1828.9 [@] 3	[@]		B	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Ho Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
1997.46@ 18	@		B	
2024.3f 3	(19/2 ⁺)		FG	J ^π : probable configuration= $\pi h_{11/2} \otimes (5^-$ in ^{148}Dy) (1980Wi11).
2071.92@ 20	@		B	
2135.0@ 5	@		B	
2148.72@ 20	@		B	
2177.52@ 10	@		B	
2209.1 3	(9/2 ⁻) ^a		B	
2221.92@ 10	@		B	
2226.82 15	(9/2 ⁻) ^a		B	
2267.28 10	(9/2 ⁻) ^a		B	
2286.0 ^e 3	(19/2 ⁻) ^c		FG	
2297.3 5	(9/2 ⁻) ^a		B	
2317.62@ 20	@		B	
2321.71 10	(9/2 ⁻) ^a		B	
2326.82@ 20	@		B	
2367.9@ 11	@		B	
2381.32@ 20	@		B	
2407.3f 4	(23/2 ⁺)		FG	J ^π : probable configuration= $\pi h_{11/2} \otimes (7^-$ in ^{148}Dy) (1980Wi11).
2449.7 6	(9/2 ⁻) ^a		B	
2469.37 19	(9/2 ⁻) ^a		B	
2493.2 6	(9/2 ⁻) ^a		B	
2499.4?& 5	&		B	
2512.52@ 20	@		B	
2580.42@ 20	@		B	
2591.4@ 4	@		B	
2592.1 ^e 4	(23/2 ⁻) ^c		FG	
2607.41 10	(9/2 ⁻) ^a		B	
2633.3@ 4	@		B	
2677.0 5	(9/2 ⁻) ^a		B	
2714.8@ 3	@		B	
2735.9 ^e 5	(27/2 ⁻) ^c	59 ns 4	FG	T _{1/2} : from $\gamma\gamma(t)$ in ($^{32}\text{S}, 4n\gamma$) (1980Wi11).
2804.5?& 5	&		B	
2824.9 11	(9/2 ⁻) ^a		B	
2849.1g 6	(29/2, 31/2) ^d		F	
2851.2?& 11	&		B	
2901.7?& 4	&		B	
2913.9 11	(9/2 ⁻) ^a		B	
2935.7@ 6	@		B	
2939.3?& 9	&		B	
2965.5@ 3	@		B	
2977.8@ 3	@		B	
2992.3 3	(9/2 ⁻) ^a		B	
2996.63@ 24	@		B	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Ho Levels (continued)

E(level) [†]	J ^π [‡]	XREF
3000.9 11	(9/2 ⁻) ^a	B
3005.0 3	(9/2 ⁻) ^a	B
3049.0 @ 3	@	B
3061.0? & 9	&	B
3124.9 11	(9/2 ⁻) ^a	B
3174.9? & 5	&	B
3226.2? & 4	&	B
3263.1? & 3	&	B
3305.8? & 3	&	B
3325.2? & 4	&	B
3338.4? & 3	&	B
3536.3? & 8	&	B
3790 #	(1/2,3/2) ^b	A
3795.1? & 6	&	B
3828.3? & 12	&	B
3885.6? & 5	&	B
3931.2 ^h 7	(31/2,33/2) ^d	F
3990 #	(1/2,3/2) ^b	A
4003.2? & 4	&	B
4029.2 ^g 7	(33/2,35/2) ^d	F
4037.3? & 13	&	B
4086.4? & 5	&	B
4236.0? & 10	&	B
4240 #	(1/2,3/2) ^b	A
4330.6 ^h 7	(35/2,37/2) ^d	F
4386.0? & 7	&	B
4413.5 @ 3	@	B
4433.9? & 4	&	B
4441.4 @ 3	@	B
4470 #	(1/2,3/2) ^b	A
4552.5? & 8	&	B
4616.8? & 5	&	B
4622.4? & 3	&	B
4645.6? & 4	&	B
4652.1 @ 4	@	B
4661.68 @ 20	@	B
4676.7? & 4	&	B
4680.3 6	(31/2 ⁻) ^d	F
4699.68 @ 20	@	B
4706.1 @ 10	@	B

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) ^{149}Ho Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2}	XREF	Comments
4750.0?& 8	&		B	
4765.3 ^h 8	(39/2,41/2) ^d		F	
4820.9 ^g 7	(37/2,39/2) ^d		F	
4822.9?& 6	&		B	
4851.1?& 9	&		B	
4970 [#]	(1/2,3/2) ^b		A	
5050 [#]	(1/2,3/2) ^b		A	
5079.2@ 10	@		B	
5098.7@ 10	@		B	
5210.9 7	(35/2 ⁻) ^d		F	
5505.9 ^g 8	(39/2,41/2) ^d		F	
7.20×10 ³ ? 35		≥100 ns	G	1980Bo07 propose the following γ rays deexciting this isomer: 337, 436, 636, 648, 671, 777, 896. But no level scheme is proposed. T _{1/2} : from $\gamma(t)$ in ($^{50}\text{Ti},x\text{n}\gamma$) (1980Bo07).

[†] From a least-squares fit to γ -ray energies where available, assuming $\Delta E_{\gamma}=0.3$ keV, when uncertainty of E_{γ} is not stated.

[‡] From Shell-Model predictions and systematics, unless otherwise noted. Orbital configurations are given under comments.

[#] Level deexcites by proton emission (1989Fi01). No γ rays are known. The uncertainty is ≈ 50 keV.

@ Weakly populated level in ^{149}Er ε decay (9.6 s). Possible allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent and γ to (11/2⁻) g.s. suggests 9/2, 11/2, 13/2.

& Weakly populated uncertain level in ^{149}Er ε decay (9.6 s). Possible allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent and γ to (11/2⁻) g.s. suggests 9/2, 11/2, 13/2.

^a Probable allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent and γ to 7/2⁺ suggest 9/2, 11/2⁺. $J^{\pi}=(9/2^-)$ is supported by expected dominance of $h_{11/2}$ proton to $h_{9/2}$ neutron component in the β transitions (1989Fi01).

^b Evidence of allowed or first-forbidden ε feeding from (1/2⁺) parent.

^c Probable member of configuration= $\pi h_{11/2}^3$ (1980Wi11) in ($^{32}\text{S},4\text{n}\gamma$).

^d Proposed by 2010Ko12 in ($^{40}\text{Ar},p2\text{n}\gamma$), based on measured anisotropies, band assignments, and shell-model predictions.

^e Band(A): Band based on g.s.

^f Band(B): Band based on (15/2⁺).

^g Band(C): Band based on (29/2,31/2).

^h Band(D): Band based on (31/2,33/2).

 $\gamma(^{149}\text{Ho})$

E _i (level)	J _i ^π	E _γ [†]	I _γ [†]	E _f	J _f ^π	Mult.	α^a
220.23	(3/2 ⁺)	171.5 1	100	48.8	(1/2 ⁺)	M1@	0.566 8
564.17	(5/2 ⁺)	343.9 1	100 12	220.23	(3/2 ⁺)	(M1)@	0.0853 12
		515.4 ^b	<18	48.8	(1/2 ⁺)		
1000.91	(7/2 ⁺)	436.7 1	100 17	564.17	(5/2 ⁺)	(M1)@	0.0456 6
		780.7 1	69 29	220.23	(3/2 ⁺)		
1171.08		1171.0 1	100	0.0	(11/2 ⁻)		
1183.71		1183.7 2	100	0.0	(11/2 ⁻)		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{149}\text{Ho})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.	α^a
1277.11	(9/2 ⁻)	106.0 10	≈ 12	1171.08			
		1277.1 1	100 12	0.0	(11/2 ⁻)		
1380.09	(15/2 ⁺)	1380.1 1	100	0.0	(11/2 ⁻)	[M2]	0.00621 9
1415.0	(7/2 ⁺)	413.0 10	33 17	1000.91	(7/2 ⁺)		
		851.0 5	50 17	564.17	(5/2 ⁺)		
		1194.5 5	100 33	220.23	(3/2 ⁺)		
1530.94		359.9 1	17 4	1171.08			
		1530.9 1	100 11	0.0	(11/2 ⁻)		
1552.10		172.4 10	≈ 16	1380.09	(15/2 ⁺)		
		380.9 1	37 11	1171.08			
		1552.2 1	100 16	0.0	(11/2 ⁻)		
1560.12	(15/2 ⁻)	1560.1 1	100	0.0	(11/2 ⁻)		
1601.9		222.0 10	≈ 50	1380.09	(15/2 ⁺)		
		323.8 10	25 8	1277.11	(9/2 ⁻)		
		1602.0 10	100 33	0.0	(11/2 ⁻)		
1648.91		1648.9 1	100	0.0	(11/2 ⁻)		
1706.92		327.1 10	≈ 9	1380.09	(15/2 ⁺)		
		1706.9 2	100 12	0.0	(11/2 ⁻)		
1735.31		1735.3 2	100	0.0	(11/2 ⁻)		
1765.80		163.1 10	≈ 11	1601.9			
		1765.8 1	100 11	0.0	(11/2 ⁻)		
1797.30	(3/2 ⁺)	1233.0 ^b 10	≈ 6	564.17	(5/2 ⁺)		
		1577.9 3	28 8	220.23	(3/2 ⁺)		
		1748.4 1	100 11	48.8	(1/2 ⁺)		
1828.9		1828.9 3	100	0.0	(11/2 ⁻)		
1997.46		826.4 2	88 25	1171.08			
		1997.4 3	100 25	0.0	(11/2 ⁻)		
2024.3	(19/2 ⁺)	644.3 [‡]	100	1380.09	(15/2 ⁺)		
2071.92		2071.9 2	100	0.0	(11/2 ⁻)		
2135.0		2135.0 5	100	0.0	(11/2 ⁻)		
2148.72		2148.7 2	100	0.0	(11/2 ⁻)		
2177.52		2177.5 1	100	0.0	(11/2 ⁻)		
2209.1	(9/2 ⁻)	1208.5 5	60 20	1000.91	(7/2 ⁺)		
		2209.0 3	100 40	0.0	(11/2 ⁻)		
2221.92		2221.9 1	100	0.0	(11/2 ⁻)		
2226.82	(9/2 ⁻)	1225.8 2	75 25	1000.91	(7/2 ⁺)		
		2226.9 2	100 17	0.0	(11/2 ⁻)		
2267.28	(9/2 ⁻)	1267.9 5	57 29	1000.91	(7/2 ⁺)		
		2267.2 1	100 29	0.0	(11/2 ⁻)		
2286.0	(19/2 ⁻)	725.8 [‡]		1560.12	(15/2 ⁻)		
2297.3	(9/2 ⁻)	1295.0 10	50 25	1000.91	(7/2 ⁺)		
		2297.6 5	100 50	0.0	(11/2 ⁻)		
2317.62		2317.6 2	100	0.0	(11/2 ⁻)		
2321.71	(9/2 ⁻)	1045.6 10	20 10	1277.11	(9/2 ⁻)		
		1320.4 5	30 15	1000.91	(7/2 ⁺)		
		2321.7 1	100 15	0.0	(11/2 ⁻)		
2326.82		2326.8 2	100	0.0	(11/2 ⁻)		
2367.9		1367.0 10	≈ 7	1000.91	(7/2 ⁺)		
		2368.3 ^b 2	100 17	0.0	(11/2 ⁻)		
2381.32		2381.3 2	100	0.0	(11/2 ⁻)		
2407.3	(23/2 ⁺)	383.1 [‡]		2024.3	(19/2 ⁺)		
2449.7	(9/2 ⁻)	1448.8 5	100	1000.91	(7/2 ⁺)		
2469.37	(9/2 ⁻)	1468.1 5	100 50	1000.91	(7/2 ⁺)		
		2469.4 2	79 22	0.0	(11/2 ⁻)		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{149}\text{Ho})$ (continued)								
$E_i(\text{level})$	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α^a	Comments
2493.2	(9/2 ⁻)	1492.3 5	67 34	1000.91	(7/2 ⁺)			
		2491.9 ^b 5	100 50	0.0	(11/2 ⁻)			
2499.4?		2499.4 ^b 5	100	0.0	(11/2 ⁻)			
2512.52		2512.5 2	100	0.0	(11/2 ⁻)			
2580.42		2580.4 2	100	0.0	(11/2 ⁻)			
2591.4		2591.4 4	100	0.0	(11/2 ⁻)			
2592.1	(23/2 ⁻)	185.0 [‡]	28 [‡] 8	2407.3	(23/2 ⁺)	[E1] [#]	0.0617 9	
		306.0 [‡]	100 [‡] 11	2286.0	(19/2 ⁻)			
2607.41	(9/2 ⁻)	1605.0 10	≈13	1000.91	(7/2 ⁺)			
		2607.4 1	100 20	0.0	(11/2 ⁻)			
2633.3		2633.3 4	100	0.0	(11/2 ⁻)			
2677.0	(9/2 ⁻)	1676.1 4	100	1000.91	(7/2 ⁺)			
2714.8		2714.8 3	100	0.0	(11/2 ⁻)			
2735.9	(27/2 ⁻)	143.8 [‡]	100	2592.1	(23/2 ⁻)	(E2) [#]	0.755 11	B(E2)(W.u.)=1.89 +15-12
2804.5?		2804.5 ^b 5	100	0.0	(11/2 ⁻)			
2824.9	(9/2 ⁻)	1824.0 10	≈7	1000.91	(7/2 ⁺)			
		2824.9 ^b 4	100 29	0.0	(11/2 ⁻)			
2849.1	(29/2,31/2)	113.2 [‡]	100	2735.9	(27/2 ⁻)			
2851.2?		2851.2 ^b 11	100	0.0	(11/2 ⁻)			
2901.7?		2901.7 ^b 4	100	0.0	(11/2 ⁻)			
2913.9	(9/2 ⁻)	1913.0 10	≈27	1000.91	(7/2 ⁺)			
		2913.5 ^b 3	100 33	0.0	(11/2 ⁻)			
2935.7		2935.7 6	100	0.0	(11/2 ⁻)			
2939.3?		2939.3 ^b 9	100	0.0	(11/2 ⁻)			
2965.5		2965.5 3	100	0.0	(11/2 ⁻)			
2977.8		2977.8 3	100	0.0	(11/2 ⁻)			
2992.3	(9/2 ⁻)	1991.0 10	≈150	1000.91	(7/2 ⁺)			
		2992.3 3	100 50	0.0	(11/2 ⁻)			
2996.63		1581.6 2	100 43	1415.0	(7/2 ⁺)			
		2996.7 3	57 29	0.0	(11/2 ⁻)			
3000.9	(9/2 ⁻)	2000.0 10	≈100	1000.91	(7/2 ⁺)			
		3001.1 ^b 4	67 34	0.0	(11/2 ⁻)			
3005.0	(9/2 ⁻)	2004.0 10	≈133	1000.91	(7/2 ⁺)			
		3005.0 3	100 33	0.0	(11/2 ⁻)			
3049.0		3049.0 3	100	0.0	(11/2 ⁻)			
3061.0?		3061.0 ^b 9	100	0.0	(11/2 ⁻)			
3124.9	(9/2 ⁻)	2124.0 10	≈23	1000.91	(7/2 ⁺)			
		3125.3 ^b 3	100 33	0.0	(11/2 ⁻)			
3174.9?		3174.9 ^b 5	100	0.0	(11/2 ⁻)			
3226.2?		3226.2 ^b 4	100	0.0	(11/2 ⁻)			
3263.1?		3263.1 ^b 3	100	0.0	(11/2 ⁻)			
3305.8?		3305.8 ^b 3	100	0.0	(11/2 ⁻)			
3325.2?		3325.2 ^b 4	100	0.0	(11/2 ⁻)			
3338.4?		3338.4 ^b 3	100	0.0	(11/2 ⁻)			
3536.3?		3536.3 ^b 8	100	0.0	(11/2 ⁻)			
3795.1?		3795.0 ^b 6	100	0.0	(11/2 ⁻)			

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Adopted Levels, Gammas (continued) $\gamma(^{149}\text{Ho})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult.
3828.3?		3828.2 ^b 12	100	0.0	(11/2 ⁻)	
3885.6?		3885.5 ^b 5	100	0.0	(11/2 ⁻)	
3931.2	(31/2,33/2)	1082.0 [‡]	100	2849.1	(29/2,31/2)	D&
4003.2?		4003.1 ^b 4	100	0.0	(11/2 ⁻)	
4029.2	(33/2,35/2)	1180.0 [‡]	100	2849.1	(29/2,31/2)	Q&
4037.3?		4037.2 ^b 13	100	0.0	(11/2 ⁻)	
4086.4?		4086.3 ^b 5	100	0.0	(11/2 ⁻)	
4236.0?		4235.9 ^b 10	100	0.0	(11/2 ⁻)	
4330.6	(35/2,37/2)	399.4 [‡]	100	3931.2	(31/2,33/2)	Q&
4386.0?		4385.9 ^b 7	100	0.0	(11/2 ⁻)	
4413.5		4413.4 3	100	0.0	(11/2 ⁻)	
4433.9?		4433.8 ^b 4	100	0.0	(11/2 ⁻)	
4441.4		4441.3 3	100	0.0	(11/2 ⁻)	
4552.5?		4552.4 ^b 8	100	0.0	(11/2 ⁻)	
4616.8?		4616.7 ^b 5	100	0.0	(11/2 ⁻)	
4622.4?		4622.3 ^b 3	100	0.0	(11/2 ⁻)	
4645.6?		4645.5 ^b 4	100	0.0	(11/2 ⁻)	
4652.1		4652.0 4	100	0.0	(11/2 ⁻)	
4661.68		4661.6 2	100	0.0	(11/2 ⁻)	
4676.7?		4676.6 ^b 4	100	0.0	(11/2 ⁻)	
4680.3	(31/2 ⁻)	1944.3 [‡]	100	2735.9	(27/2 ⁻)	Q&
4699.68		4699.6 2	100	0.0	(11/2 ⁻)	
4706.1		4706.0 10	100	0.0	(11/2 ⁻)	
4750.0?		4749.9 ^b 8	100	0.0	(11/2 ⁻)	
4765.3	(39/2,41/2)	434.7 [‡]	100	4330.6	(35/2,37/2)	Q&
4820.9	(37/2,39/2)	791.7 [‡]	100	4029.2	(33/2,35/2)	Q&
4822.9?		4822.8 ^b 6	100	0.0	(11/2 ⁻)	
4851.1?		4851.0 ^b 9	100	0.0	(11/2 ⁻)	
5079.2		5079.1 10	100	0.0	(11/2 ⁻)	
5098.7		5098.6 10	100	0.0	(11/2 ⁻)	
5210.9	(35/2 ⁻)	530.6 [‡]	100	4680.3	(31/2 ⁻)	Q&
5505.9	(39/2,41/2)	685.0 [‡]	100	4820.9	(37/2,39/2)	D&

[†] From ^{149}Er ε decay (9.6 s) ([1989Fi01](#)), unless otherwise noted.

[‡] From ($^{40}\text{Ar},\text{p}2\text{n}\gamma$) ([2010Ko12](#)).

[#] From α deduced ([1980Wi11](#)) from intensity balance in ($^{32}\text{S},4\text{n}\gamma$).

@ From summed x-ray and γ -intensities in ^{149}Er ε decay (9.6 s).

& From γ anisotropy in ($^{40}\text{Ar},\text{p}2\text{n}\gamma$) ([2010Ko12](#)).

^a Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

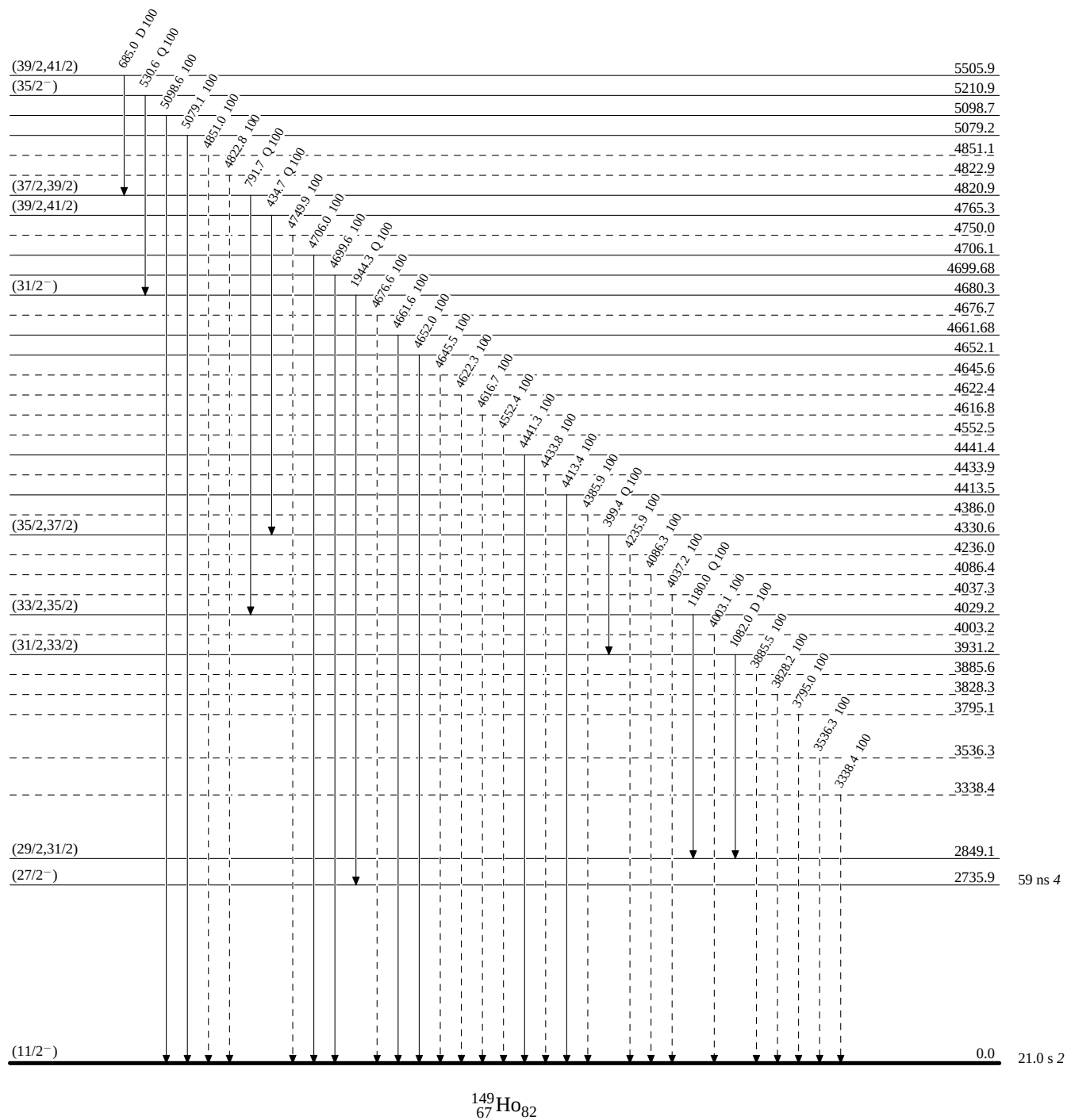
^b Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

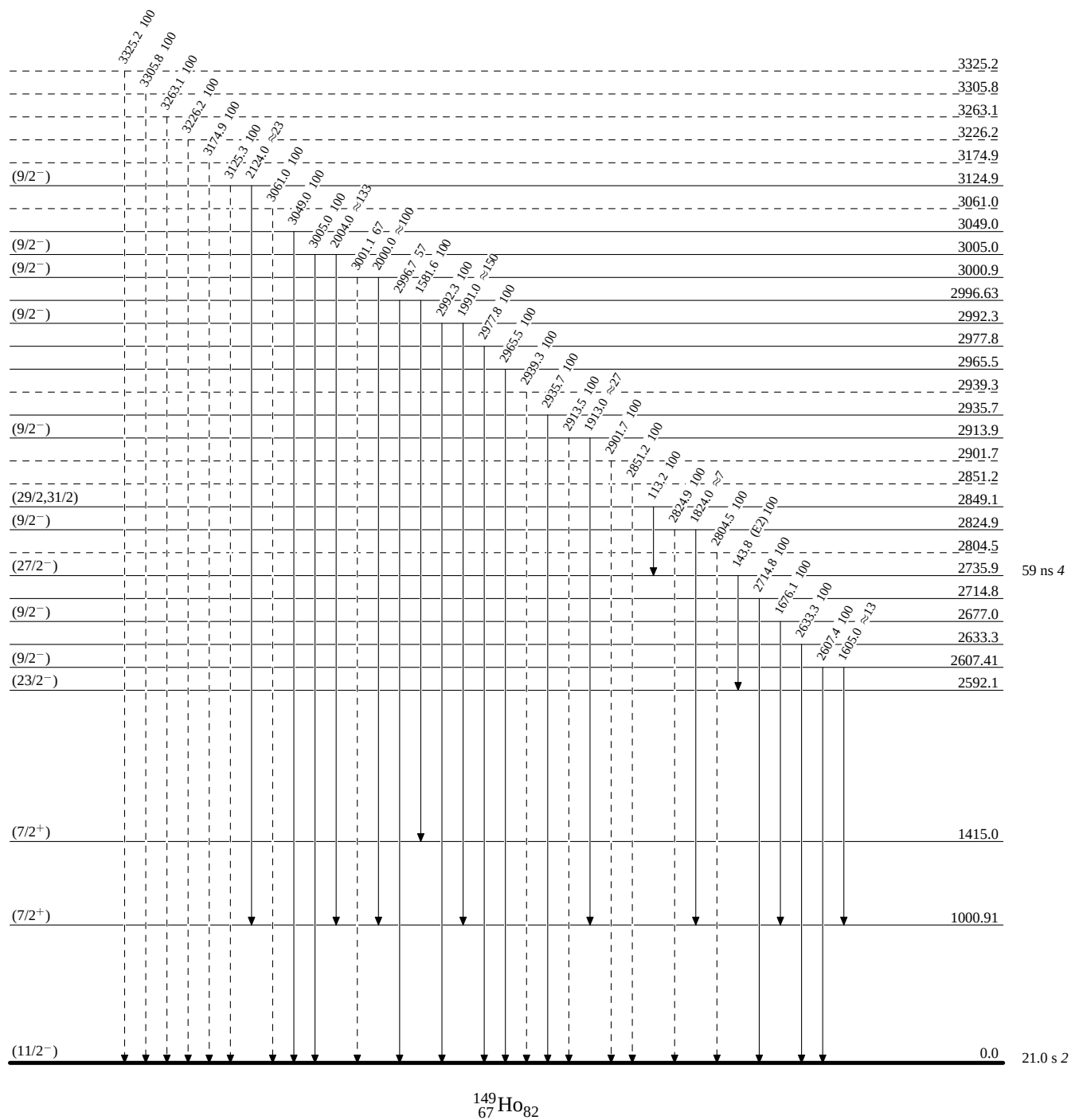
-----► γ Decay (Uncertain)

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

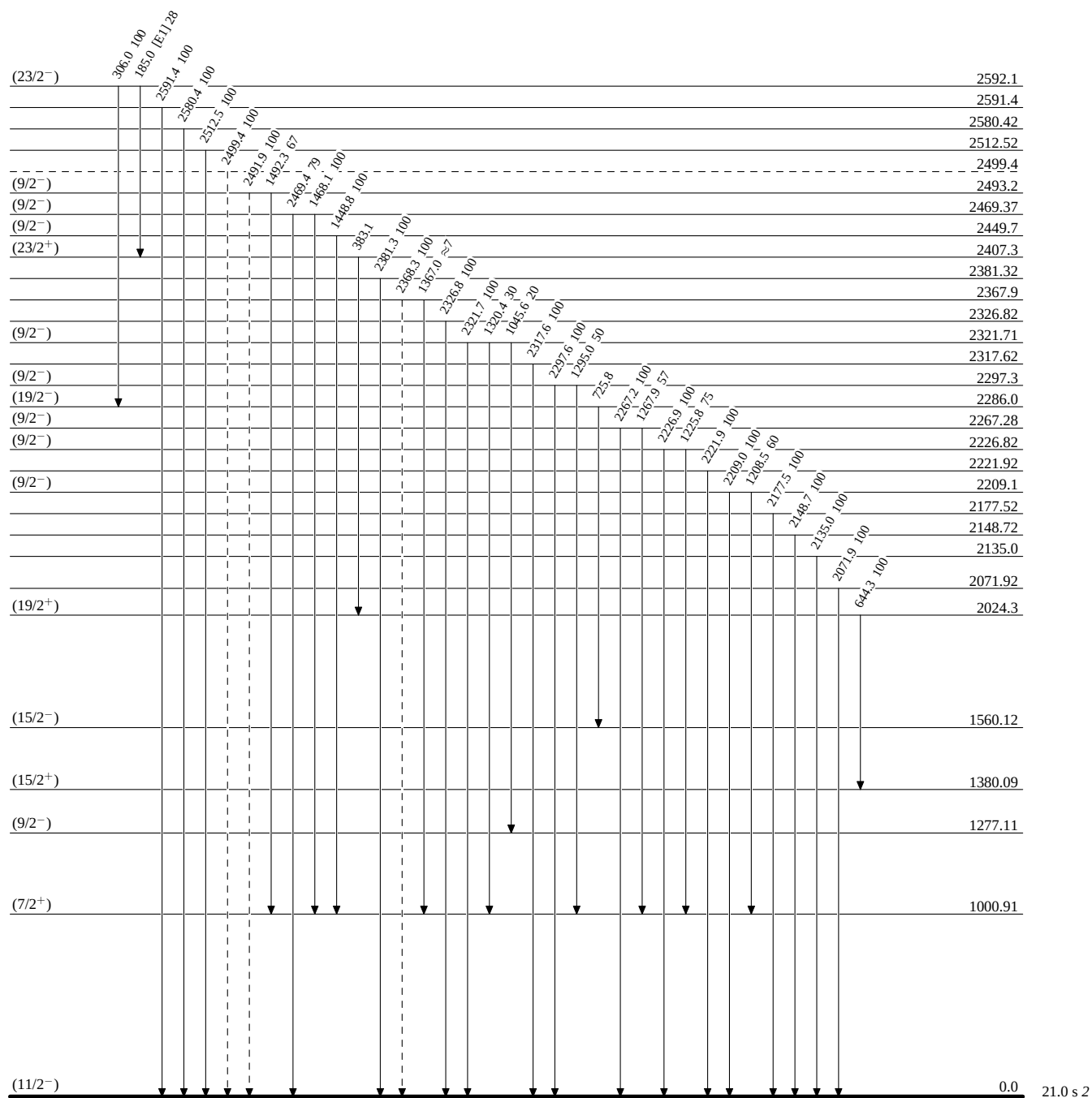
-----► γ Decay (Uncertain) $^{149}_{67}\text{Ho}_{82}$

Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

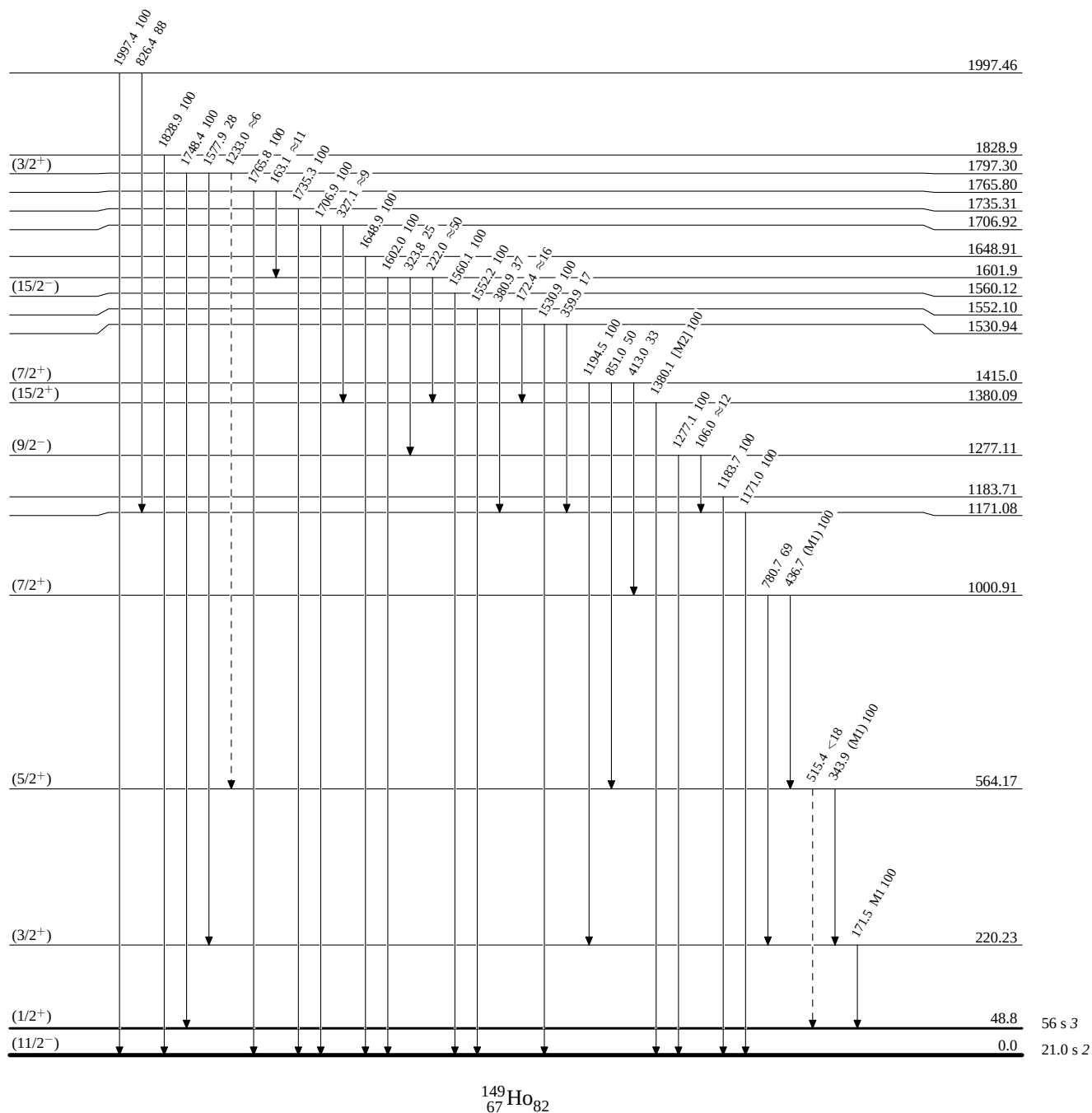
 - - - - - $\blacktriangleright$ γ Decay (Uncertain)

 $^{149}_{67}\text{Ho}_{82}$

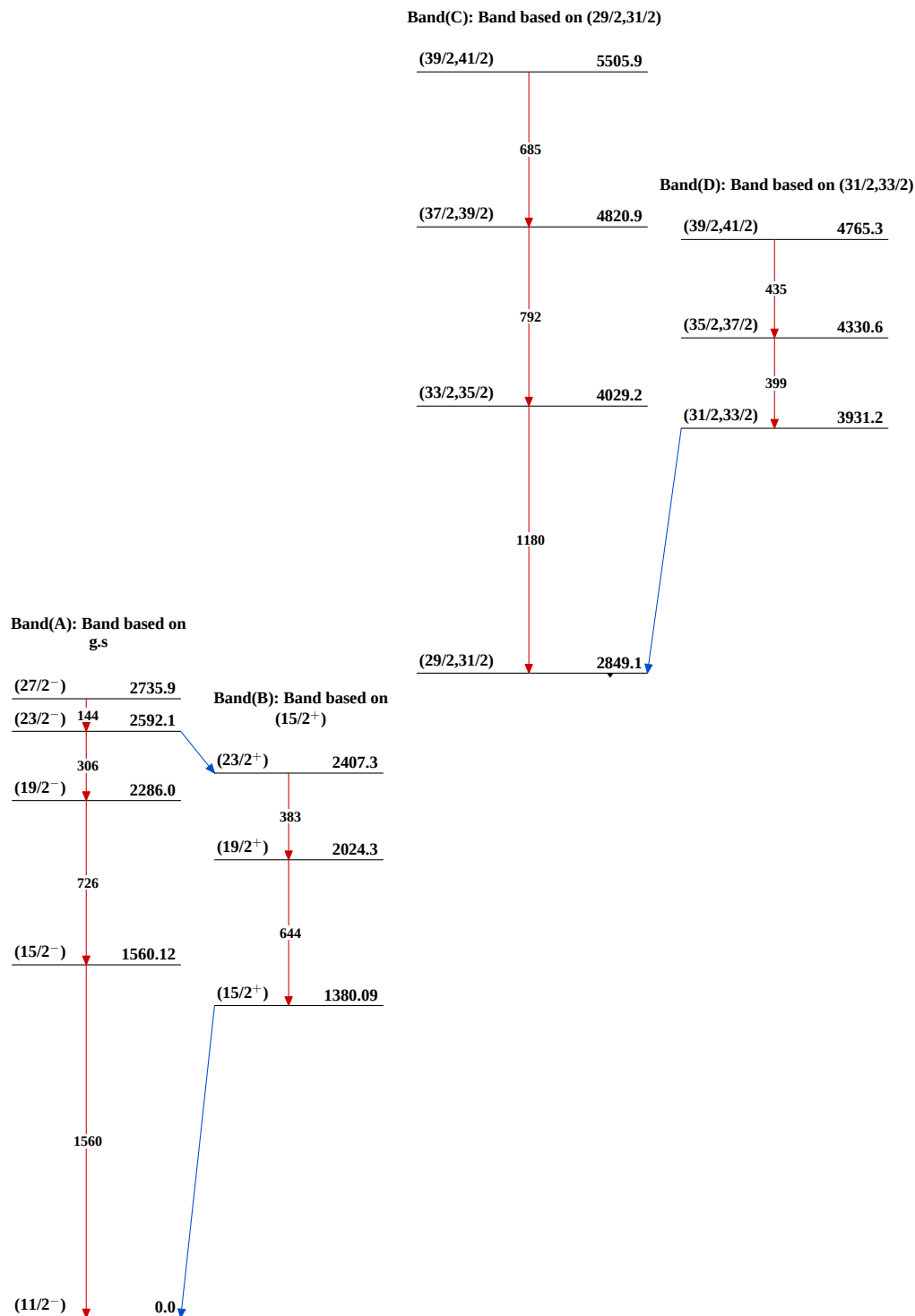
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

Adopted Levels, Gammas

^{149}Er ε decay (4 s) 1989Fi01

Parent: ^{149}Er : $E=0.0$; $J^\pi=(1/2^+)$; $T_{1/2}=4$ s 2; $Q(\varepsilon)=7900$ 30; $\%\varepsilon+\%\beta^+$ decay=100

^{149}Er - J^π , $T_{1/2}$: From ^{149}Er Adopted Levels of ^{149}Er , where value is taken from 1989Fi01.

^{149}Er - $Q(\varepsilon)$: From 2021Wa16.

1989Fi01: ^{149}Er ions were produced by the $^{94}\text{Mo}(^{58}\text{Ni}, 2\text{pn})$ reaction with 242 MeV (center of target) ^{58}Ni beam from the Lawrence Berkeley Laboratory SuperHILAC, separated with the OASIS facility online and collected on a moving tape of the counting station. γ rays were detected with a HPGe and two n-Ge detectors; charged particles were detected with a Si ΔE -E telescope on one side of the tape and a plastic scintillator on the other side. Measured $E\gamma$, $I\gamma$, $E(\text{x-ray})$, $I(\text{x-ray})$, $\gamma\gamma$ -coin, $\gamma(t)$, $E\beta$, β -delayed proton spectra. Deduced levels, J , π , parent $T_{1/2}$, decay branching ratios, $\log ft$.

Total decay energy deposit of 3722 keV 1525 calculated by RADLIST code is much lower than the expected value of 7900 keV 30, which indicates the incompleteness of the decay scheme.

 ^{149}Ho Levels

E(level)	J^π [‡]	$T_{1/2}$ [‡]	Comments
48.8 2	(1/2 ⁺)	56 s 3	$\%\varepsilon+\%\beta^+=100$
220.3 2	(3/2 ⁺)		
564.2 2	(5/2 ⁺)		
1797.4 3	(3/2 ⁺)		
3790 [†]	(1/2,3/2) [#]		E(level): E(p)=2653.
3990 [†]	(1/2,3/2) [#]		E(level): E(p)=2850.
4240 [†]	(1/2,3/2) [#]		E(level): E(p)=3105.
4470 [†]	(1/2,3/2) [#]		E(level): E(p)=3330.
4970 [†]	(1/2,3/2) [#]		E(level): E(p)=3830.
5050 [†]	(1/2,3/2) [#]		E(level): E(p)=3909.

[†] Level decays by proton emission to ^{148}Dy , γ deexcitation is not known. Level energy is $E(p)*[1+m_p/m(^{149}\text{Er})]+S(p)$, with E(p) from 1989Fi01 (given under comments) and $S(p)=1075$ 12 (2021Wa16); 1989Fi01 use $S(p)=1400$. The energy uncertainty is ≈ 50 keV.

[‡] From the Adopted Levels unless otherwise stated.

[#] 1989Fi01 assigned (1/2⁺, 3/2⁺), assuming allowed ε transition from (1/2⁺) parent.

 ε, β^+ radiations

E(decay)	E(level)	$I\beta^+$ [#]	$I\varepsilon$ [#]	$\log ft$ [†]	$I(\varepsilon+\beta^+)$ ^{†#}
(2850@ 30)	5050	≈ 0.08	≈ 0.37	≈ 5.0	≈ 0.45 [‡]
(2930@ 30)	4970	≈ 0.06	≈ 0.22	≈ 5.2	≈ 0.28 [‡]
(3430@ 30)	4470	≈ 0.03	≈ 0.05	≈ 6.0	≈ 0.08 [‡]
(3660@ 30)	4240	≈ 0.09	≈ 0.13	≈ 5.7	≈ 0.22 [‡]
(3910@ 30)	3990	≈ 0.076	≈ 0.084	≈ 5.9	≈ 0.16 [‡]
(4110@ 30)	3790	≈ 0.11	≈ 0.09	≈ 5.9	≈ 0.20 [‡]
(6103@ 30)	1797.4	<77	<16	>4.0	<93

[†] There is a gap of about 3 MeV between Q value and last known level at 5090, and the gamma rays are known up to 1797 level only. This suggests that the level scheme is incomplete, and most likely there are additional levels and associated γ transitions populated by the decay of 4-s ^{149}Er . For this reason, all feedings and associated $\log ft$ values should be treated as approximate.

[‡] From proton intensity (1989Fi01). Feeding does not include possible γ -ray deexcitation of the level.

[#] Absolute intensity per 100 decays.

@ Existence of this branch is questionable.

^{149}Er ε decay (4 s) 1989Fi01 (continued) $\gamma(^{149}\text{Ho})$

I_γ normalization: From $I(\gamma+\text{ce})(1748\gamma+171\gamma)=93$ 2, using $\% \varepsilon=7$ 2 (1989Fi01). There is no indication of ε feeding to 49 level; the level scheme is likely to be more complex than the one presented here, in view of the large $Q(\varepsilon)$ value (≈ 7.7 MeV) for ^{149}Er decay.

E_γ [†]	I_γ ^{†#}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	α [@]
171.5 1	7 3	220.3	(3/2 ⁺)	48.8	(1/2 ⁺)	M1	0.566 8
343.9 1	≈ 2	564.2	(5/2 ⁺)	220.3	(3/2 ⁺)	(M1)	0.0853 12
1233.0 & 10	≈ 2	1797.4	(3/2 ⁺)	564.2	(5/2 ⁺)		
1577.9 3	10 3	1797.4	(3/2 ⁺)	220.3	(3/2 ⁺)		
1748.4 1	36 4	1797.4	(3/2 ⁺)	48.8	(1/2 ⁺)		

[†] From 1989Fi01.

[‡] From the Adopted Gammas.

For absolute intensity per 100 decays, multiply by 2.0 2.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.

& Placement of transition in the level scheme is uncertain.

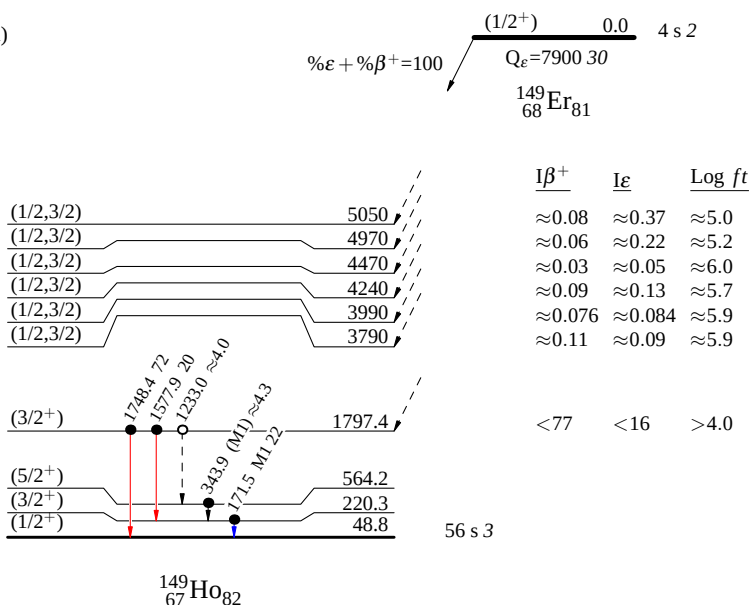
 ^{149}Er ε decay (4 s) 1989Fi01

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
- - - - - γ Decay (Uncertain)
- Coincidence
- Coincidence (Uncertain)

Decay Scheme

Intensities: $I_{(\gamma+\text{ce})}$ per 100 parent decays



^{149}Er ε decay (9.6 s) **1989Fi01**

Parent: ^{149}Er : $E=741.69\ 23$; $J^\pi=(11/2^-)$; $T_{1/2}=9.6\ \text{s}\ 6$; $Q(\varepsilon)=7900\ 30$; $\% \varepsilon + \% \beta^+ \text{ decay}=96.5\ 7$

^{149}Er - $E, J^\pi, T_{1/2}$: From ^{149}Er Adopted Levels.

^{149}Er - $Q(\varepsilon)$: From **2021Wa16**.

^{149}Er - $\% \varepsilon + \% \beta^+$ decay: $\% \text{IT}=3.5\ 7$ (**1989Fi01**).

1989Fi01: ^{149}Er ions were produced by the $^{94}\text{Mo}(^{58}\text{Ni}, 2\text{pn})$ reaction with 242 MeV (center of target) ^{58}Ni beam from the Lawrence Berkeley Laboratory SuperHILAC, separated with the OASIS facility online and collected on a moving tape of the counting station. γ rays were detected with a HPGe and two n-Ge detectors; charged particles were detected with a Si ΔE -E telescope on one side of the tape and a plastic scintillator on the other side. Measured $E\gamma$, $I\gamma$, $E(\text{x-ray})$, $I(\text{x-ray})$, $\gamma\gamma$ -coin, $\gamma(t)$, $E\beta$, β -delayed proton spectra. Deduced levels, J , π , parent $T_{1/2}$, decay branching ratios, $\log ft$. The 9.6-s and 4-s activities are mixed.

1985To11: same setup and reaction as **1989Fi01**, but with $E(^{58}\text{Ni})=262$ MeV at the center of target. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin. Deduced levels.

1984To07: $^{149\text{m}}\text{Er}$ ions were produced via $^{144}\text{Sm}(^{12}\text{C}, 7\text{n})$ with 155 MeV ^{12}C beam from the Lawrence Berkeley Laboratory 88-inch cyclotron. Measured β -delayed protons with a Si ΔE -E telescope, decay-time distribution. Deduced $T_{1/2}$. No γ decay from the isomer is reported.

1984ScZT, **1984ScZU**: source produced by $^{93}\text{Nb}(^{58}\text{Ni}, \text{xnp})$ $E=5$ MeV/nucleon. Measured γ , delayed protons.

Other: **1984ScZU** (also **1984ScZT**, **1985ZuZW**). Three γ rays reported at 171.0, 343.7 and 436.6.

Total decay energy deposit of 7246 keV $_{197}$ calculated by RADLIST code is somewhat lower than the expected value of 8339 keV $_{67}$, which indicates the incompleteness of the decay scheme.

 ^{149}Ho Levels

$E(\text{level})^\dagger$	$J^\pi^\#$	$T_{1/2}^c$	Comments
0.0	$(11/2^-)^a$	21.0 s 2	
48.82 22	$(1/2^+)^a$	56 s 3	$\% \varepsilon + \% \beta^+ = 100$
220.32 19	$(3/2^+)^a$		
564.25 19	$(5/2^+)^{ab}$		
1000.99 17	$(7/2^+)^a$		
1171.08 7	@		
1183.71 20	@		
1277.11 10	$(9/2^-)^{\&}$		
1380.10 10	$(15/2^+)^a$		
1415.0 3	$(7/2^+)^a$		
1530.94 8	@		
1552.10 8	@		
1560.11 10	$(15/2^-)^{ab}$		
1601.9 5	@		
1648.91 10	@		
1706.92 20	@		
1735.31 20	@		
1765.80 10	@		
1828.9 3	@		
1997.46 18	@		
2071.92 20	@		
2135.0 5	@		
2148.72 20	@		
2177.52 10	@		

Continued on next page (footnotes at end of table)

^{149}Er ε decay (9.6 s) **1989Fi01** (continued) ^{149}Ho Levels (continued)

E(level) [†]	J ^π #	E(level) [†]	J ^π #	E(level) [†]	J ^π #	E(level) [†]	J ^π #
2209.1 3	(9/2 ⁻)&	2633.3 4	@	3125.0 11	(9/2 ⁻)&	4441.4 3	@
2221.92 10	@	2677.1 5	(9/2 ⁻)&	3174.9?‡ 5	‡	4552.5?‡ 8	‡
2226.86 17	(9/2 ⁻)&	2714.8 3	@	3226.2?‡ 4	‡	4616.8?‡ 5	‡
2267.28 10	(9/2 ⁻)&	2804.5?‡ 5	‡	3263.1?‡ 3	‡	4622.4?‡ 3	‡
2297.3 5	(9/2 ⁻)&	2825.0 11	(9/2 ⁻)&	3305.8?‡ 3	‡	4645.6?‡ 4	‡
2317.62 20	@	2851.2?‡ 11	‡	3325.2?‡ 4	‡	4652.1 4	@
2321.72 10	(9/2 ⁻)&	2901.7?‡ 4	‡	3338.4?‡ 3	‡	4661.68 20	@
2326.82 20	@	2914.0 11	(9/2 ⁻)&	3536.3?‡ 8	‡	4676.7?‡ 4	‡
2368.0 11	@	2935.7 6	@	3795.1?‡ 6	‡	4699.68 20	@
2381.32 20	@	2939.3?‡ 9	‡	3828.3?‡ 12	‡	4706.1 10	@
2449.8 6	(9/2 ⁻)&	2965.5 3	@	3885.6?‡ 5	‡	4750.0?‡ 8	‡
2469.38 19	(9/2 ⁻)&	2977.8 3	@	4003.2?‡ 4	‡	4822.9?‡ 6	‡
2493.3 6	(9/2 ⁻)&	2992.3 3	(9/2 ⁻)&	4037.3?‡ 13	‡	4851.1?‡ 9	‡
2499.4?‡ 5	‡	2996.66 25	@	4086.4?‡ 5	‡	5079.2 10	@
2512.52 20	@	3001.0 11	(9/2 ⁻)&	4236.0?‡ 10	‡	5098.7 10	@
2580.42 20	@	3005.0 3	(9/2 ⁻)&	4386.0?‡ 7	‡		
2591.4 4	@	3049.0 3	@	4413.5 3	@		
2607.41 10	(9/2 ⁻)&	3061.0?‡ 9	‡	4433.9?‡ 4	‡		

[†] From a least-squares fit to γ -ray energies.

[‡] Weakly populated uncertain level in ^{149}Er ε decay (9.6 s). Possible allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent and γ to (11/2⁻) g.s. suggests 9/2, 11/2, 13/2.

As proposed in **1989Fi01**, unless otherwise noted. All values are consistent with those in the Adopted Levels.

@ Probable allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent suggests 9/2, 11/2, 13/2.

& Probable allowed or first-forbidden $\varepsilon+\beta^+$ feeding from (11/2⁻) parent and γ to 7/2⁺ suggest 9/2, 11/2⁺. $J^\pi=(9/2^-)$ is supported by expected dominance of $h_{11/2}$ proton to $h_{9/2}$ neutron component in the β transitions (**1989Fi01**).

^a From the Adopted Levels.

^b This J^π is inconsistent with $\log ft=6.2-6.4$ from (11/2⁻). Low $\log ft$ value may be due to unobserved γ transitions from higher levels.

^c From the Adopted Levels.

 ε, β^+ radiations

E(decay)	E(level)	$I\beta^+$ ‡	$I\varepsilon$ ‡	Log ft	$I(\varepsilon+\beta^+)^{\dagger\ddagger}$
(3543 30)	5098.7	≈ 0.053	≈ 0.087	≈ 6.2	≈ 0.14
(3563 30)	5079.2	≈ 0.054	≈ 0.086	≈ 6.2	≈ 0.14
(3791 [#] 30)	4851.1?	0.03 2	0.04 3	6.6 4	0.07 5
(3819 [#] 30)	4822.9?	0.03 2	0.04 3	6.6 4	0.07 5
(3892 [#] 30)	4750.0?	0.06 3	0.06 3	6.4 2	0.12 6
(3936 30)	4706.1	0.06 3	0.07 4	6.4 3	0.13 7
(3942 30)	4699.68	0.78 19	0.82 21	5.3 1	1.6 4

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^{149}Er ε decay (9.6 s) **1989Fi01** (continued) ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+$ ††	$I\varepsilon$ ††	Log ft	$I(\varepsilon + \beta^+)$ ††
(3965 [#] 30)	4676.7?	0.10 5	0.11 6	6.2 2	0.21 11
(3980 30)	4661.68	0.21 11	0.22 11	5.9 2	0.43 22
(3990 30)	4652.1	0.10 5	0.11 6	6.2 2	0.21 11
(3996 [#] 30)	4645.6?	0.10 6	0.11 6	6.2 2	0.21 11
(4019 [#] 30)	4622.4?	0.22 11	0.21 11	5.9 2	0.43 22
(4025 [#] 30)	4616.8?	0.05 3	0.04 2	6.6 3	0.09 5
(4089 [#] 30)	4552.5?	0.03 1	0.02 1	6.9 2	0.05 2
(4200 30)	4441.4	0.18 6	0.14 5	6.1 2	0.32 11
(4208 [#] 30)	4433.9?	0.12 6	0.09 5	6.3 2	0.21 11
(4228 30)	4413.5	0.24 12	0.19 10	6.0 2	0.43 22
(4256 [#] 30)	4386.0?	0.06 3	0.04 3	6.6 3	0.10 6
(4406 [#] 30)	4236.0?	0.03 2	0.02 2	7.0 4	0.05 4
(4555 [#] 30)	4086.4?	0.13 7	0.08 4	6.5 2	0.21 11
(4604 [#] 30)	4037.3?	0.02 1	0.01 1	7.3 3	0.03 2
(4639 [#] 30)	4003.2?	0.06 3	0.036 18	6.8 2	0.10 5
(4756 [#] 30)	3885.6?	0.3 3	0.2 1	6.2 4	0.5 4
(4813 [#] 30)	3828.3?	0.07 4	0.036 20	6.8 3	0.11 6
(4847 [#] 30)	3795.1?	0.14 7	0.07 4	6.6 2	0.21 11
(5105 [#] 30)	3536.3?	0.15 8	0.06 3	6.7 2	0.21 11
(5303 [#] 30)	3338.4?	0.24 8	0.08 3	6.6 2	0.32 11
(5317 [#] 30)	3325.2?	0.08 4	0.028 15	7.0 3	0.11 6
(5336 [#] 30)	3305.8?	0.12 6	0.040 20	6.9 2	0.16 8
(5379 [#] 30)	3263.1?	0.24 8	0.08 3	6.6 2	0.32 11
(5416 [#] 30)	3226.2?	0.16 8	0.05 3	6.8 2	0.21 11
(5467 [#] 30)	3174.9?	0.16 8	0.05 3	6.8 2	0.21 11
(5517 30)	3125.0	0.31 8	0.092 25	6.6 1	0.40 11
(5581 [#] 30)	3061.0?	0.08 5	0.022 13	7.2 3	0.10 6
(5593 30)	3049.0	0.42 17	0.12 5	6.5 2	0.54 22
(5637 30)	3005.0	0.59 9	0.16 2	6.3 1	0.75 11
(5641 30)	3001.0	0.42 9	0.12 2	6.5 1	0.54 11
(5645 30)	2996.66	0.9 3	0.26 9	6.1 2	1.2 4
(5649 30)	2992.3	0.86 16	0.24 4	6.2 1	1.1 2
(5664 30)	2977.8	0.25 9	0.068 23	6.7 2	0.32 11
(5676 30)	2965.5	0.17 9	0.045 23	6.9 2	0.21 11
(5702 [#] 30)	2939.3?	0.11 5	0.029 13	7.1 2	0.14 6
(5706 30)	2935.7	0.17 9	0.044 23	6.9 2	0.21 11
(5728 30)	2914.0	0.33 9	0.085 23	6.6 1	0.41 11
(5740 [#] 30)	2901.7?	0.17 9	0.043 23	6.9 2	0.21 11
(5791 [#] 30)	2851.2?	0.26 9	0.064 22	6.8 2	0.32 11
(5817 30)	2825.0	0.64 18	0.16 4	6.4 1	0.80 22
(5837 [#] 30)	2804.5?	0.09 5	0.022 12	7.2 3	0.11 6
(5927 30)	2714.8	0.35 18	0.08 4	6.7 2	0.43 22
(5965 30)	2677.1	0.5 3	0.1 1	6.5 3	0.6 4
(6008 30)	2633.3	0.17 9	0.038 20	7.0 2	0.21 11
(6034 30)	2607.41	1.5 3	0.32 7	6.1 1	1.8 4

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^{149}Er ε decay (9.6 s) **1989Fi01** (continued) ε, β^+ radiations (continued)

E(decay)	E(level)	$I\beta^+{}^\ddagger$	$I\varepsilon{}^\ddagger$	Log ft	$I(\varepsilon + \beta^+)^\ddagger$	Comments
(6050 30)	2591.4	0.44 18	0.10 4	6.6 2	0.54 22	
(6061 30)	2580.42	0.53 18	0.11 4	6.5 2	0.64 22	
(6129 30)	2512.52	0.71 18	0.15 4	6.4 1	0.86 22	
(6142 [#] 30)	2499.4?	0.27 9	0.054 19	6.9 2	0.32 11	
(6148 30)	2493.3	0.9 3	0.19 7	6.3 2	1.1 4	
(6172 30)	2469.38	2.2 7	0.45 15	6.0 2	2.7 9	
(6192 30)	2449.8	0.8 4	0.1 1	6.4 3	0.9 5	
(6260 30)	2381.32	0.5 3	0.10 6	6.6 3	0.6 4	
(6274 30)	2368.0	1.2 2	0.22 3	6.3 1	1.4 2	
(6315 30)	2326.82	1.0 4	0.19 8	6.4 2	1.2 5	
(6320 30)	2321.72	2.7 5	0.50 9	5.9 1	3.2 6	
(6324 30)	2317.62	1.4 3	0.26 6	6.2 1	1.7 4	
(6344 30)	2297.3	0.54 20	0.10 4	6.6 2	0.64 24	
(6374 30)	2267.28	1.0 3	0.18 5	6.4 1	1.2 3	
(6415 30)	2226.86	1.9 3	0.33 6	6.1 1	2.2 4	
(6420 30)	2221.92	1.28 20	0.22 3	6.3 1	1.50 23	
(6433 30)	2209.1	0.73 21	0.13 4	6.5 1	0.86 25	
(6464 30)	2177.52	1.7 3	0.29 6	6.2 1	2.0 4	
(6493 30)	2148.72	0.55 19	0.09 3	6.7 2	0.64 22	
(6507 30)	2135.0	0.37 19	0.06 3	6.9 2	0.43 22	
(6570 30)	2071.92	0.28 9	0.045 15	7.0 2	0.32 11	
(6644 30)	1997.46	1.4 3	0.22 4	6.3 1	1.6 3	
(6813 30)	1828.9	0.66 19	0.09 3	6.7 1	0.75 22	
(6876 30)	1765.80	4.0 4	0.55 6	6.0 1	4.5 5	
(6906 30)	1735.31	3.8 4	0.52 6	6.0 1	4.3 5	
(6935 30)	1706.92	3.6 4	0.49 6	6.0 1	4.1 5	
(6993 30)	1648.91	4.1 5	0.53 7	6.0 1	4.6 6	
(7040 30)	1601.9	1.6 4	0.20 6	6.4 1	1.8 5	
(7082 30)	1560.11	3.0 4	0.38 5	6.2 1	3.4 4	Log ft : too low for $\Delta J=(2)$, $\Delta\pi=\text{no}$. Apparent ε feeding is probably due to missing γ transitions to this level.
(7090 30)	1552.10	2.8 4	0.35 4	6.2 1	3.1 4	
(7111 30)	1530.94	5.2 6	0.65 8	5.9 1	5.9 7	
(7227 [#] 30)	1415.0	0.3 3	0.08 8	9.1 ^{1u} 5	0.4 4	
(7262 30)	1380.10	1.9 3	0.50 8	8.4 ^{1u} 1	2.4 4	
(7365 30)	1277.11	2.2 5	0.24 5	6.4 1	2.4 5	
(7458 30)	1183.71	0.58 20	0.061 21	7.0 2	0.64 22	
(7471 30)	1171.08	7.2 11	0.76 11	5.9 1	8.0 12	
(7641 [#] 30)	1000.99	<1.3	<0.29	>8.7 ^{1u}	<1.6	$I(\varepsilon + \beta^+)$: -0.3 19 from intensity balance.
(8077 [#] 30)	564.25	3.1 12	0.26 10	6.5	3.4 13	Log ft : too low for $\Delta J^\pi=3$. Apparent ε feeding is probably due to missing γ transitions to this level.
(8642 [#] 30)	0.0	<4	<0.2	>6.5	<4	$I(\varepsilon + \beta^+)$: from log $ft \geq 6.5$ (based on measured TAGS spectrum in 1985Al08) for a similar $(11/2^-)$ isomer in ^{147}Dy to $11/2^-$, 50.6 level in ^{147}Tb) ε transition, as also assumed by 1989Fi01 . For other $N=81$ isotones, $11/2^-$ isomer decay to $11/2^-$ daughter state, following are the log ft values, as given in the ENSDF database: 6.2 for ^{145}Gd isomer to ^{145}Eu decay, 6.5 for ^{143}Sm isomer to ^{143}Pm decay, and >6.9 for ^{141}Nd isomer to ^{141}Pr decay.

[†] Deduced from gamma-intensity balance at each level. There is a gap of about 3 MeV between Q value and last known level at 5098.7, which allows the possibility that there may be additional levels and associated γ transitions populated by ^{149}Er decay. For this reason, the decay scheme is considered incomplete; weak feedings (<0.5% or so) should be treated as upper limits and

^{149}Er ε decay (9.6 s) **1989Fi01** (continued) ε, β^+ radiations (continued)

associated log ft values as lower limits.

$\ddagger$ Absolute intensity per 100 decays.

Existence of this branch is questionable.

 $\gamma(^{149}\text{Ho})$

I_γ normalization: $\Sigma(I(\gamma+\text{ce})$ of γ rays to g.s.+49)=97.8 20; assuming $\%(\varepsilon+\beta^+)$ (to g.s.)<4% and $\%\varepsilon\text{p}=0.18$ 2 (**1989Fi01**).

Observed Ho X-ray intensities (relative to 100 for 1171 γ): $I(K\alpha_1 \text{ x-ray})=137$ 4, $I(K\alpha_2 \text{ x-ray})=242$ 5, $I(K\beta_2 \text{ x-ray})=70$ 15, $I(K\beta_1 \text{ x-ray})=21$ 2 (**1989Fi01**). A systematic uncertainty of 15% should be added to the statistical uncertainty given here, as stated by **1989Fi01**.

$I(\varepsilon)=510$ 40, $I(\beta^+)=550$ 140 (**1989Fi01**) relative to 100 for 1171 γ . Total ε is from K x-ray intensity and β^+ is from $\gamma^\pm$ intensity. $I(\text{delayed protons from 9.6 s and 4 s isomers})=5.2$ 6 (**1989Fi01**) relative to 100 for 1171 γ . **1989Fi01** estimate that 63% 7 of the protons are from the decay of the 4-s isomer and 37% 7 proton intensity is associated with 8.9-s isomer.

From singles and delayed proton intensities, $\varepsilon/\beta^+=0.83$ 4 (**1989Fi01**) for delayed proton decay.

$E_\gamma^\ddagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. ^d	α^f	Comments
106.0 10	$\approx 3^b$	1277.11	(9/2 ⁻)	1171.08				$\%I_\gamma \approx 0.32$
163.1 10	$\approx 4^b$	1765.80		1601.9				$\%I_\gamma \approx 0.43$
171.5 1	69 9	220.32	(3/2 ⁺)	48.82	(1/2 ⁺)	M1	0.566 8	$\%I_\gamma = 7.4$ 10 I_γ : total intensity from 9.6-s and 4-s isomers=76 9 (1989Fi01) out of which 3 is assigned to 4-s isomer. Mult.: $\alpha(K)\text{exp}=0.57$ 7, from summed x-ray and γ -ray intensity.
172.4 10	$\approx 3^b$	1552.10		1380.10	(15/2 ⁺)			$\%I_\gamma \approx 0.32$
222.0 10	$\approx 6^b$	1601.9		1380.10	(15/2 ⁺)			$\%I_\gamma \approx 0.64$
323.8 10	3^b 1	1601.9		1277.11	(9/2 ⁻)			$\%I_\gamma = 0.32$ 11
327.1 10	$\approx 3^b$	1706.92		1380.10	(15/2 ⁺)			$\%I_\gamma \approx 0.32$
343.9 1	67 8	564.25	(5/2 ⁺)	220.32	(3/2 ⁺)	(M1)	0.0853 12	$\%I_\gamma = 7.2$ 9 I_γ : total intensity from 8.9-s and 4-s isomers=69 8 (1989Fi01) out of which 2 1 is assigned to 4-s isomer. Mult.: $\alpha(K)\text{exp}(344\gamma+437\gamma)=0.14$ 3 consistent with M1 for both transitions. $\alpha(K)\text{exp}$ is deduced from summed x-ray and γ -intensity.
359.9 1	8 2	1530.94		1171.08				$\%I_\gamma = 0.86$ 22
380.9 1	7 2	1552.10		1171.08				$\%I_\gamma = 0.75$ 22
413.0 10	2 1	1415.0	(7/2 ⁺)	1000.99	(7/2 ⁺)			$\%I_\gamma = 0.21$ 11
436.7 1	42 7	1000.99	(7/2 ⁺)	564.25	(5/2 ⁺)	(M1)	0.0456 6	$\%I_\gamma = 4.5$ 8 Mult.: see comment for 343.9 γ .
515.4 $\ddagger g$	<12	564.25	(5/2 ⁺)	48.82	(1/2 ⁺)			$\%I_\gamma < 1.3$
780.7 $\#$ 1	29 12	1000.99	(7/2 ⁺)	220.32	(3/2 ⁺)			$\%I_\gamma = 3.1$ 13
826.4 2	7 2	1997.46		1171.08				$\%I_\gamma = 0.75$ 22
851.0 5	3 1	1415.0	(7/2 ⁺)	564.25	(5/2 ⁺)			$\%I_\gamma = 0.32$ 11
1045.6 10	4^b 2	2321.72	(9/2 ⁻)	1277.11	(9/2 ⁻)			$\%I_\gamma = 0.43$ 21
1171.0 1	100 10	1171.08		0.0	(11/2 ⁻)			$\%I_\gamma = 10.7$ 11
1183.7 2	6 2	1183.71		0.0	(11/2 ⁻)			$\%I_\gamma = 0.64$ 22
1194.5 $\#$ 5	6 2	1415.0	(7/2 ⁺)	220.32	(3/2 ⁺)			$\%I_\gamma = 0.64$ 22
1208.5 5	3 1	2209.1	(9/2 ⁻)	1000.99	(7/2 ⁺)			$\%I_\gamma = 0.32$ 11
1225.8 2	9 3	2226.86	(9/2 ⁻)	1000.99	(7/2 ⁺)			$\%I_\gamma = 0.96$ 32

Continued on next page (footnotes at end of table)

^{149}Er ε decay (9.6 s) **1989Fi01** (continued) $\gamma(^{149}\text{Ho})$ (continued)

E_γ [†]	I_γ ^{†e}	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
1267.9 5	4 2	2267.28	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.43 21
1277.1 1	26 3	1277.11	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =2.78 34
1295.0 10	2 1	2297.3	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.21 11
1320.4 5	6@ 3	2321.72	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.64 32
1367.0 10	≈0.8	2368.0		1000.99	(7/2 ⁺)	%I γ ≈0.086
1380.1 1	34 3	1380.10	(15/2 ⁺)	0.0	(11/2 ⁻)	%I γ =3.64 35
1448.8 5	8 4	2449.8	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.9 4
1468.1 5	14 7	2469.38	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =1.5 8
1492.3 5	4 2	2493.3	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.43 21
1530.9 1	47 5	1530.94		0.0	(11/2 ⁻)	%I γ =5.0 6
1552.2 1	19 3	1552.10		0.0	(11/2 ⁻)	%I γ =2.04 33
1560.1 1	32 3	1560.11	(15/2 ⁻)	0.0	(11/2 ⁻)	%I γ =3.43 35
1581.6 2	7 3	2996.66		1415.0	(7/2 ⁺)	%I γ =0.75 32
1602.0 & 10	12 4	1601.9		0.0	(11/2 ⁻)	%I γ =1.3 4
1605.0 10	≈2	2607.41	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.21
1648.9 1	43 5	1648.91		0.0	(11/2 ⁻)	%I γ =4.6 6
1676.1 4	6 3	2677.1	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ =0.64 32
1706.9 2	35 4	1706.92		0.0	(11/2 ⁻)	%I γ =3.7 5
1735.3 2	40 4	1735.31		0.0	(11/2 ⁻)	%I γ =4.3 5
1765.8 1	38 4	1765.80		0.0	(11/2 ⁻)	%I γ =4.1 5
1824.0 10	≈0.5	2825.0	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.054
1828.9 3	7 2	1828.9		0.0	(11/2 ⁻)	%I γ =0.75 22
1913.0 10	≈0.8	2914.0	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.086
1991.0 10	≈6	2992.3	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.64
1997.4 3	8 2	1997.46		0.0	(11/2 ⁻)	%I γ =0.86 22
2000.0 10	≈3	3001.0	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.321 %I γ ≈0.28
2004.0 10	≈4	3005.0	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.43
2071.9 2	3 1	2071.92		0.0	(11/2 ⁻)	%I γ =0.32 11
2124.0 10	≈0.7	3125.0	(9/2 ⁻)	1000.99	(7/2 ⁺)	%I γ ≈0.075
2135.0 ^a 5	4 2	2135.0		0.0	(11/2 ⁻)	%I γ =0.43 21
2148.7 2	6 2	2148.72		0.0	(11/2 ⁻)	%I γ =0.64 22
2177.5 1	19 3	2177.52		0.0	(11/2 ⁻)	%I γ =2.04 33
2209.0 3	5 2	2209.1	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =0.54 22
2221.9 1	14 2	2221.92		0.0	(11/2 ⁻)	%I γ =1.50 22
2226.9 2	12 2	2226.86	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =1.29 22
2267.2 1	7 2	2267.28	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =0.75 22
2297.6 5	4 2	2297.3	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =0.43 21
2317.6 2	16 3	2317.62		0.0	(11/2 ⁻)	%I γ =1.71 33
2321.7 1	20 3	2321.72	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =2.14 33
2326.8 2	11 4	2326.82		0.0	(11/2 ⁻)	%I γ =1.2 4
2368.3 ^g 2	12 2	2368.0		0.0	(11/2 ⁻)	%I γ =1.29 22
2381.3 2	6 3	2381.32		0.0	(11/2 ⁻)	%I γ =0.64 32
2469.4 2	11 3	2469.38	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =1.18 32
2491.9 ^g 5	6 3	2493.3	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =0.64 32
2499.4 ^g 5	3 1	2499.4?		0.0	(11/2 ⁻)	%I γ =0.32 11
2512.5 2	8 2	2512.52		0.0	(11/2 ⁻)	%I γ =0.86 22
2580.4 2	6 2	2580.42		0.0	(11/2 ⁻)	%I γ =0.64 22
2591.4 4	5 2	2591.4		0.0	(11/2 ⁻)	%I γ =0.54 22
2607.4 1	15 3	2607.41	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =1.61 33
2633.3 4	2 1	2633.3		0.0	(11/2 ⁻)	%I γ =0.21 11
2714.8 3	4 2	2714.8		0.0	(11/2 ⁻)	%I γ =0.43 21
2804.5 ^g 5	1.0 5	2804.5?		0.0	(11/2 ⁻)	%I γ =0.11 5
2824.9 ^g 4	7 2	2825.0	(9/2 ⁻)	0.0	(11/2 ⁻)	%I γ =0.75 22

Continued on next page (footnotes at end of table)

^{149}Er ε decay (9.6 s) **1989Fi01** (continued) $\gamma(^{149}\text{Ho})$ (continued)

$E_\gamma^\dagger$	$I_\gamma^{\dagger e}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Comments
2851.2 ^g 11	3 1	2851.2?		0.0 (11/2 ⁻)	%I γ =0.32 11	
2901.7 ^g 4	2 1	2901.7?		0.0 (11/2 ⁻)	%I γ =0.21 11	
2913.5 ^g 3	3 1	2914.0	(9/2 ⁻)	0.0 (11/2 ⁻)	%I γ =0.32 11	
2935.7 6	2 1	2935.7		0.0 (11/2 ⁻)	%I γ =0.21 11	
2939.3 ^g 9	1.3 5	2939.3?		0.0 (11/2 ⁻)	%I γ =0.14 5	
2965.5 3	2 1	2965.5		0.0 (11/2 ⁻)	%I γ =0.21 11	
2977.8 3	3 1	2977.8		0.0 (11/2 ⁻)	%I γ =0.32 11	
2992.3 3	4 2	2992.3	(9/2 ⁻)	0.0 (11/2 ⁻)	%I γ =0.43 21	
2996.7 3	4 2	2996.66		0.0 (11/2 ⁻)	%I γ =0.43 21	
3001.1 ^g 4	2 1	3001.0	(9/2 ⁻)	0.0 (11/2 ⁻)	%I γ =0.21 11	
3005.0 3	3 1	3005.0	(9/2 ⁻)	0.0 (11/2 ⁻)	%I γ =0.32 11	
3049.0 3	5 2	3049.0		0.0 (11/2 ⁻)	%I γ =0.54 22	
3061.0 ^g 9	0.9 5	3061.0?		0.0 (11/2 ⁻)	%I γ =0.10 5	
3125.3 ^g 3	3 1	3125.0	(9/2 ⁻)	0.0 (11/2 ⁻)	%I γ =0.32 11	
3174.9 ^g 5	2 1	3174.9?		0.0 (11/2 ⁻)	%I γ =0.21 11	
3226.2 ^g 4	2 1	3226.2?		0.0 (11/2 ⁻)	%I γ =0.21 11	
3263.1 ^g 3	3 1	3263.1?		0.0 (11/2 ⁻)	%I γ =0.32 11	
3305.8 ^g 3	1.5 7	3305.8?		0.0 (11/2 ⁻)	%I γ =0.16 8	
3325.2 ^g 4	1.0 5	3325.2?		0.0 (11/2 ⁻)	%I γ =0.11 5	
3338.4 ^g 3	3 1	3338.4?		0.0 (11/2 ⁻)	%I γ =0.32 11	
3536.3 ^g 8	2 1	3536.3?		0.0 (11/2 ⁻)	%I γ =0.21 11	
3795.0 ^g 6	2 1	3795.1?		0.0 (11/2 ⁻)	%I γ =0.21 11	
3828.2 ^g 12	1.0 5	3828.3?		0.0 (11/2 ⁻)	%I γ =0.11 5	
3885.5 ^g 5	5 3	3885.6?		0.0 (11/2 ⁻)	%I γ =0.54 32	
4003.1 ^g 4	0.9 4	4003.2?		0.0 (11/2 ⁻)	%I γ =0.10 4	
4037.2 ^g 13	0.3 2	4037.3?		0.0 (11/2 ⁻)	%I γ =0.032 21	
4086.3 ^g 5	2 1	4086.4?		0.0 (11/2 ⁻)	%I γ =0.21 11	
4235.9 ^g 10	0.5 3	4236.0?		0.0 (11/2 ⁻)	%I γ =0.054 32	
4385.9 ^g 7	0.9 5	4386.0?		0.0 (11/2 ⁻)	%I γ =0.10 5	
4413.4 3	4 2	4413.5		0.0 (11/2 ⁻)	%I γ =0.43 21	
4433.8 ^g 4	2 1	4433.9?		0.0 (11/2 ⁻)	%I γ =0.21 11	
4441.3 3	3 1	4441.4		0.0 (11/2 ⁻)	%I γ =0.32 11	
4552.4 ^g 8	0.5 2	4552.5?		0.0 (11/2 ⁻)	%I γ =0.054 22	
4616.7 ^g 5	0.8 4	4616.8?		0.0 (11/2 ⁻)	%I γ =0.09 4	
4622.3 ^g 3	4 2	4622.4?		0.0 (11/2 ⁻)	%I γ =0.43 21	
4645.5 ^g 4	2 1	4645.6?		0.0 (11/2 ⁻)	%I γ =0.21 11	
4652.0 4	2 1	4652.1		0.0 (11/2 ⁻)	%I γ =0.21 11	
4661.6 2	4 2	4661.68		0.0 (11/2 ⁻)	%I γ =0.43 21	
4676.6 ^g 4	2 1	4676.7?		0.0 (11/2 ⁻)	%I γ =0.21 11	
4699.6 2	15 3	4699.68		0.0 (11/2 ⁻)	%I γ =1.61 33	
4706.0 10	1.2 ^c 6	4706.1		0.0 (11/2 ⁻)	%I γ =0.13 6	
4749.9 ^g 8	1.1 5	4750.0?		0.0 (11/2 ⁻)	%I γ =0.12 5	
4822.8 ^g 6	0.7 4	4822.9?		0.0 (11/2 ⁻)	%I γ =0.07 4	
4851.0 ^g 9	0.7 4	4851.1?		0.0 (11/2 ⁻)	%I γ =0.07 4	
5079.1 10	$\approx$ 1.3 ^c	5079.2		0.0 (11/2 ⁻)	%I γ $\approx$ 0.14	
5098.6 10	$\approx$ 1.3 ^c	5098.7		0.0 (11/2 ⁻)	%I γ $\approx$ 0.14	

[†] From **1989Fi01**.[‡] Transition uncertain since a possible 514 line is masked by intense $\gamma^\pm$ line. Intensity quoted here is an upper limit (**1989Fi01**).

 ^{149}Er ε decay (9.6 s) [1989Fi01](#) (continued)

 $\gamma(^{149}\text{Ho})$ (continued)

Coin with 344 γ is inconsistent with this placement.

@ Contribution from ^{149}Ho ε decay subtracted by [1989Fi01](#).

& Coin with 171 γ , 344 γ , 437 γ is inconsistent with this placement.

^a Possible coin with 172 γ is inconsistent with this placement.

^b From $\gamma\gamma$ -coin.

^c From (x-ray) γ -coin.

^d From the Adopted Gammas. Supporting evidence from this study is given under comments, where available.

^e For absolute intensity per 100 decays, multiply by 0.107 4.

^f Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^g Placement of transition in the level scheme is uncertain.

^{149}Er ε decay (9.6 s) $^{1989}\text{Fi01}$

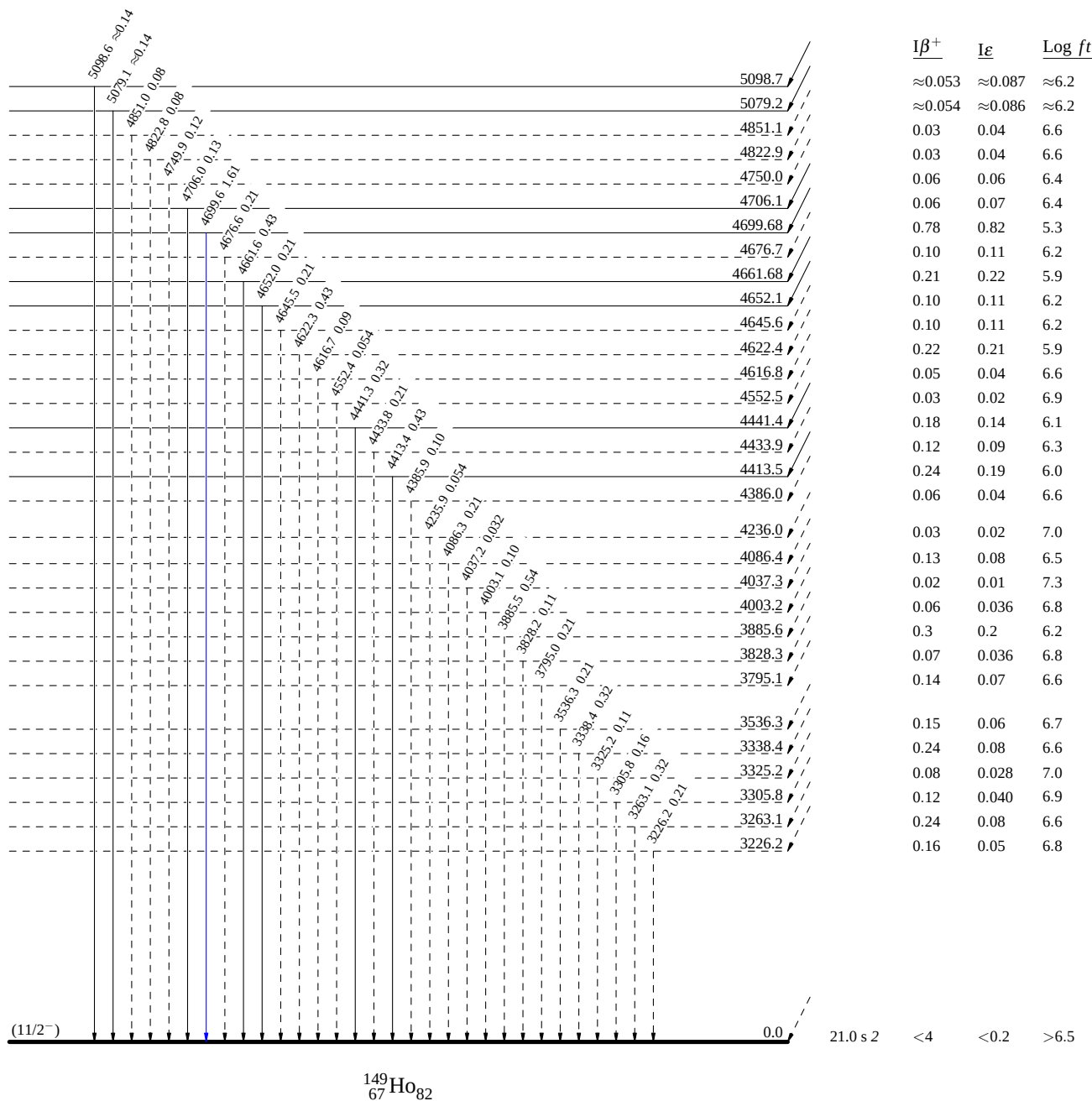
Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - γ Decay (Uncertain)

$(11/2^-)$ 741.69 9.6 s 6
 $Q_\varepsilon = 7900.30$
 $^{149}\text{Er}_{81}$



^{149}Er ε decay (9.6 s) 1989Fi01

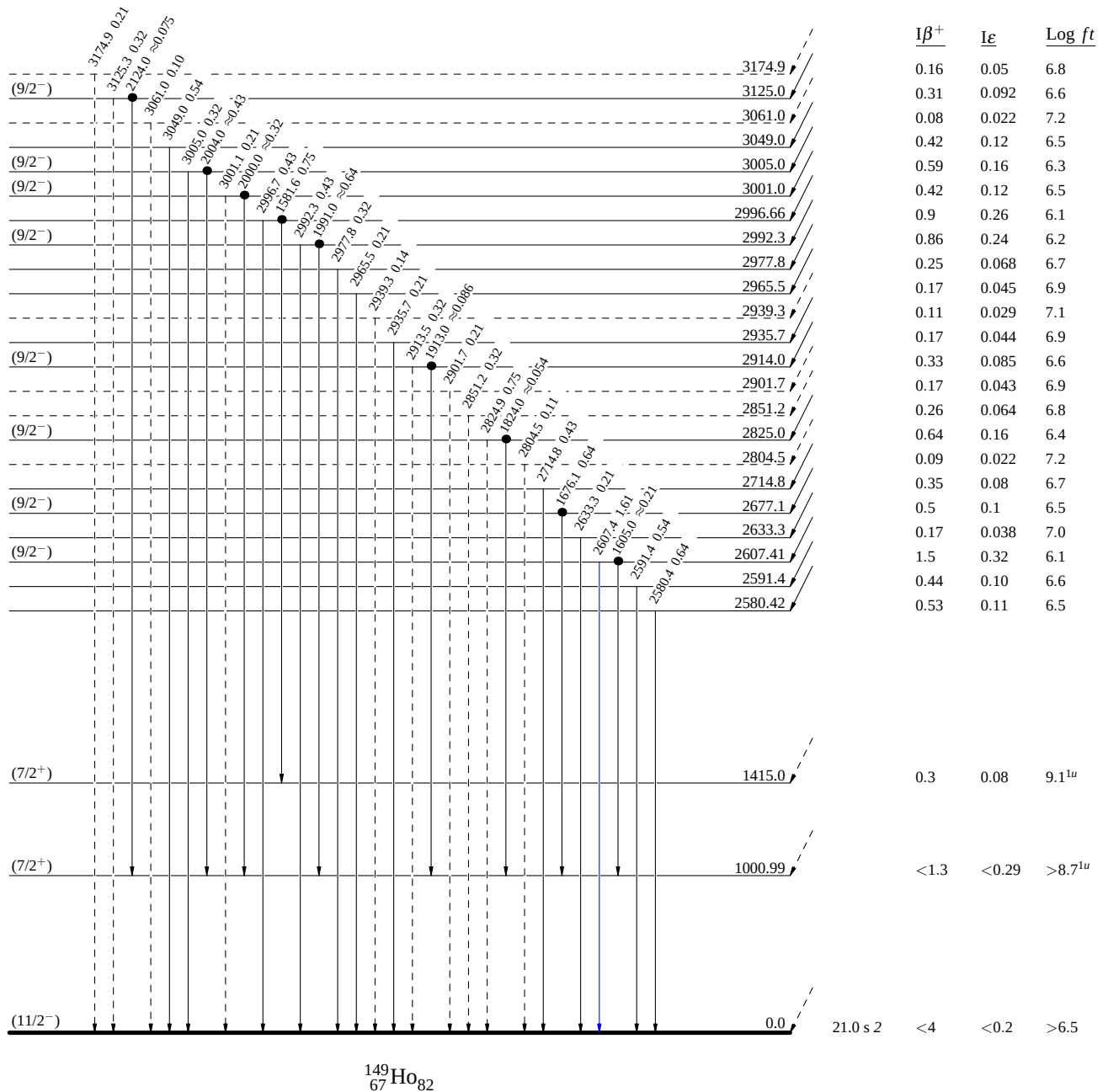
Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
- $I_\gamma < 10\% \times I_\gamma^{\max}$
- $I_\gamma > 10\% \times I_\gamma^{\max}$
- γ Decay (Uncertain)
- Coincidence

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

$(11/2^-)$ 741.69 9.6 s 6
 $Q_\varepsilon = 7900.30$
 $^{149}\text{Er}_{81}$
 $\% \varepsilon + \% \beta^+ = 96.5$



^{149}Er ε decay (9.6 s) 1989Fi01

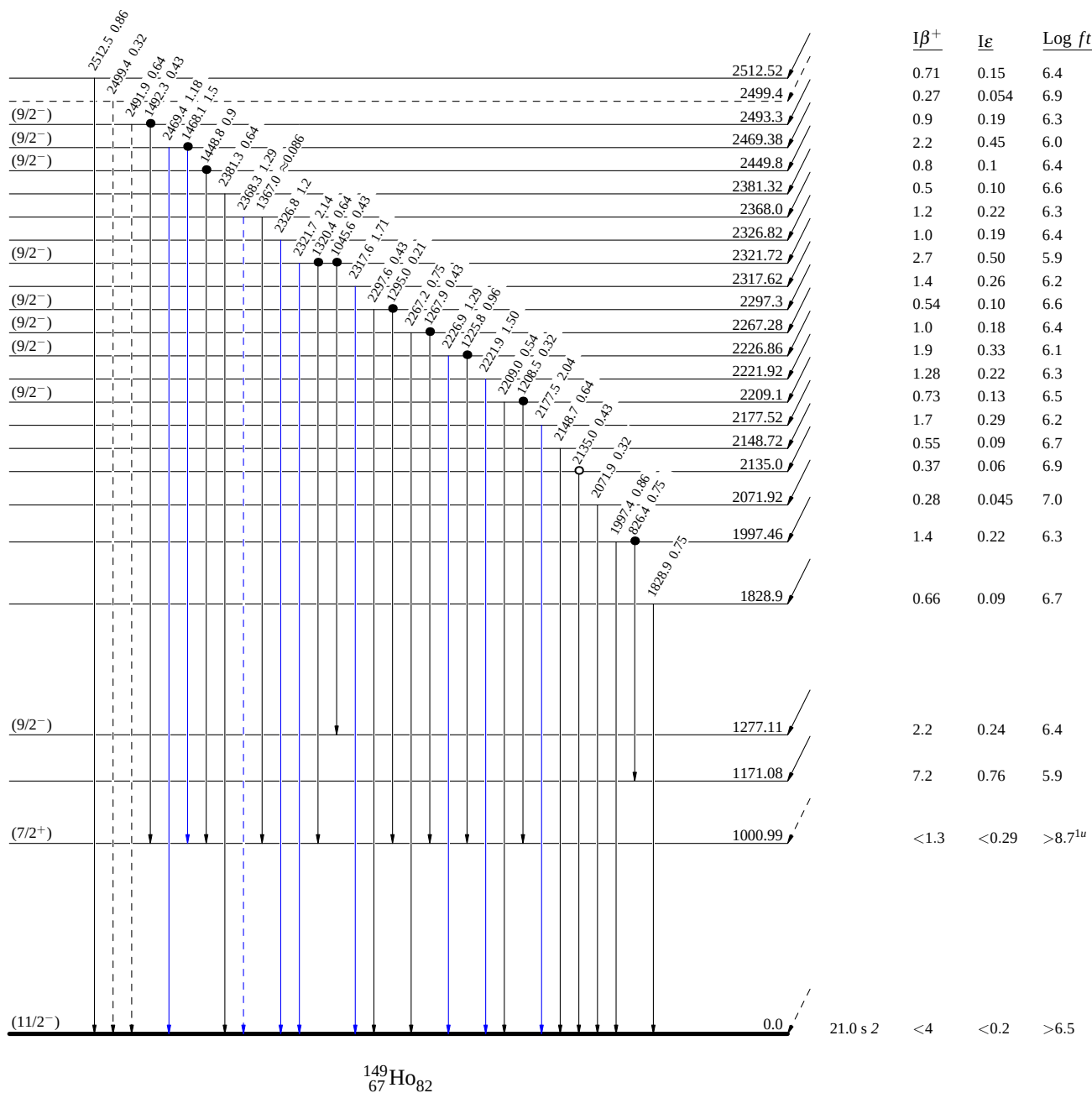
Legend

- $I_\gamma < 2\% \times I_\gamma^{\max}$
—→ $I_\gamma < 10\% \times I_\gamma^{\max}$
—→ $I_\gamma > 10\% \times I_\gamma^{\max}$
- - - - γ Decay (Uncertain)
● Coincidence
○ Coincidence (Uncertain)

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

$(11/2^-)$ 741.69 9.6 s 6
 $Q_\varepsilon = 7900.30$
 $^{149}\text{Er}_{81}$
 $\% \varepsilon + \% \beta^+ = 96.5$

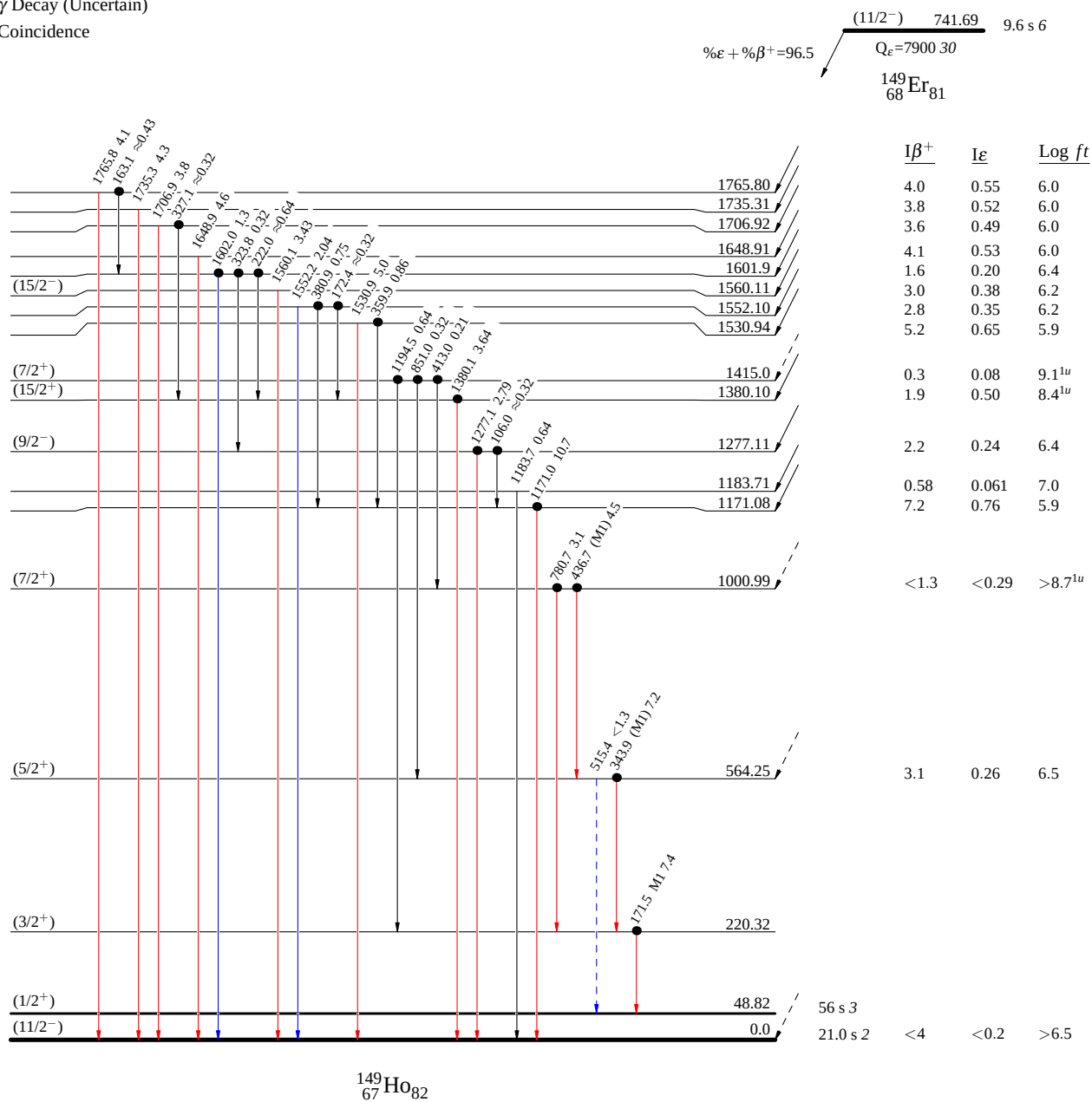


^{149}Er ε decay (9.6 s) 1989Fi01

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 —→ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 —→ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
 - - - - -→ γ Decay (Uncertain)
 • Coincidence

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

^{150}Tm εp decay:mixed 1988Ni02

Parent: ^{150}Tm : $E=0+x$; $J^\pi=(1^+)$; $Q(\varepsilon\text{p})=7870$ syst; $\%\varepsilon\text{p}$ decay=1.2 3

Parent: ^{150}Tm : $E=0+y$; $J^\pi=(6^-)$; $T_{1/2}=2.20$ s 6; $Q(\varepsilon\text{p})=7870$ syst; $\%\varepsilon\text{p}$ decay<1.2

$^{150}\text{Tm}(0+x)-J^\pi, T_{1/2}$: from 2021Ko07, where half-life of ≈ 3 s is from systematic trend.

$^{150}\text{Tm}(0+x)-Q(\varepsilon\text{p})$: 7870 200 (syst, 2021Wa16), J^π assignment is cited from 1988Ni02 by 2021Ko07.

$^{150}\text{Tm}(0+x)-\%\varepsilon\text{p}$ decay: $\%\varepsilon\text{p}=1.2 +2-4$ (1988Ni02) for the decay of both the states of ^{150}Tm , with authors' estimated 80% contribution from the (6^-) state and 20% from the (1^+) state.

$^{150}\text{Tm}(0+y)-Q(\varepsilon\text{p})$: 7870 200 (syst, 2021Wa16).

$^{150}\text{Tm}(0+y)-J^\pi, T_{1/2}$: From ^{150}Tm Adopted Levels in the ENSDF database (April 2013 update).

Includes decay of two states (6^- and 1^+). $T_{1/2}=2.20$ s for high-spin isomer but $T_{1/2}$ of low-spin state is not known. According to 2021Ko07 compilation, 1^+ is expected to be the g.s. of ^{150}Tm .

1988Ni02: ^{150}Tm ions were produced via $^{96}\text{Ru}(^{58}\text{Ni}, 3\text{pn})$ with $E=267$ MeV ^{58}Ni beam from the Lawrence Berkeley SuperHILAC, separated by the online mass separator OASIS, and implanted in a Mylar tape. Charged particles were detected with a Si ΔE -E telescope and a plastic scintillator; γ rays were detected with Ge detectors. Measured E_γ , $E(\text{x-ray})$, β -delayed protons, β^+ in singles and various coincidence modes. Deduced levels, β -delayed proton emission probabilities. Comparisons with theoretical calculations. Proton spectra measured from 2.5-7 MeV. The delayed proton decay is from both isomers; 1988Ni02 estimate that contribution to total proton spectra is $\approx 80\%$ from high-spin (6^-) isomer and $\approx 20\%$ from low-spin (1^+) isomer.

 ^{149}Ho Levels

$E(\text{level})^\dagger$	$J^\pi^\ddagger$	$T_{1/2}^\ddagger$	Comments
0	(11/2 ⁻)	21.0 s 2	$\%\varepsilon + \%\beta^+ = 100$
48.8	(1/2 ⁺)	56 s 3	
220.0	(3/2 ⁺)		
563.9	(5/2 ⁺)		
1000.8	(7/2 ⁺)		
1380	(15/2 ⁺)		
1560	(15/2 ⁻)		

† As given in 1988Ni02.

‡ From the Adopted Levels.

 $\gamma(^{149}\text{Ho})$

$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π
171.2	220.0	(3/2 ⁺)	48.8	(1/2 ⁺)
343.9	563.9	(5/2 ⁺)	220.0	(3/2 ⁺)
436.9	1000.8	(7/2 ⁺)	563.9	(5/2 ⁺)

† From 1988Ni02.

Delayed Protons (^{149}Ho)

$\%\varepsilon\text{p}=1.2 +2-4$ (1988Ni02) for the decay of both the states, but the main contribution is expected from the decay of the (6^-) state.

<u>$E(^{149}\text{Ho})$</u>	<u>$I(\text{p})^\dagger$</u>	<u>Comments</u>

¹⁵⁰Tm εp decay:mixed [1988Ni02](#) (continued)

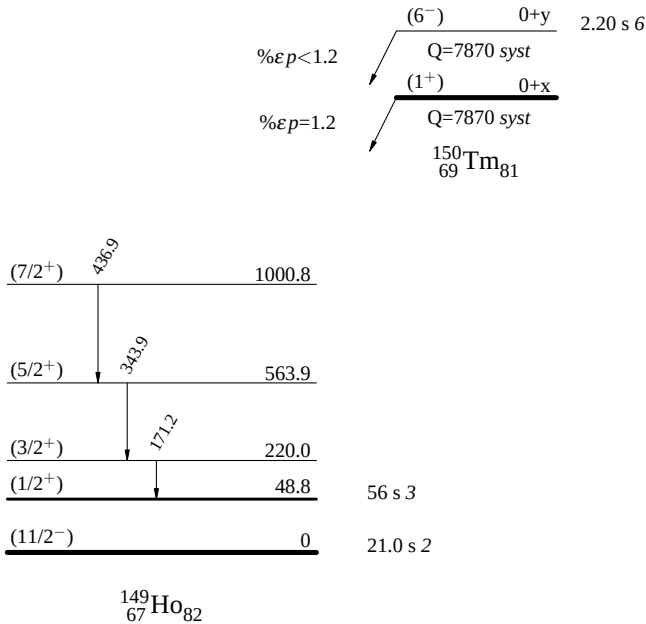
Delayed Protons (continued)

E(¹⁴⁹ Ho)	I(p) [†]	Comments
0	78 [‡] 5	Intensity/100 decays of mixed activities ≈ 0.94.
48.8		
220.0	6.5 24	Intensity/100 decays of mixed activities ≈ 0.078.
563.9	4.3 19	Intensity/100 decays of mixed activities ≈ 0.052.
1000.8	4.5 13	Intensity/100 decays of mixed activities ≈ 0.054.
1380	5.4 27	Intensity/100 decays of mixed activities ≈ 0.065.
1560	1.2 12	Intensity/100 decays of mixed activities ≈ 0.014.

[†] Intensities in percent of total proton intensity from [1988Ni02](#), with authors' estimated 80% contribution from the (6⁻) state and 20% from the (1⁺) state.
[‡] Combined for 0+49 levels.

^{150}Tm ϵp decay:mixed 1988Ni02

Decay Scheme



¹⁵³Tm α decay (1.48 s) **1988To13**

Parent: ¹⁵³Tm: E=0.0; J^π=(11/2⁻); T_{1/2}=1.48 s 1; Q(α)=5248.3 15; % α decay=91 3

¹⁵³Tm-J^π, T_{1/2}: From ¹⁵³Tm Adopted Levels in the ENSDF database (August 2020 update); no new references since this update.

Half-life in the ENSDF database is adopted from **1988ScZV**.

¹⁵³Tm-Q(α): From **2021Wa16**.

¹⁵³Tm-% α decay: From **1989Ko02**. Others: % α =95 +5-8 (**1981HoZM**, **1979Ho10**), 99 23 (**1989Wo02**), 80 10 (**1979Be52**), 90 +10-20 (**1977Ha48**).

1988To13 (also **1991To12**, **1989Ko02**): ¹⁵³Tm ions were produced with ⁹²Mo(⁶⁴Zn,3p) reaction with E=267 MeV (center of target) ⁶⁴Zn beam from the Lawrence Berkeley Laboratory SuperHILAC on 93.37% enriched ⁹²Mo foil target, followed by mass separation with the OASIS online facility, and collected in a moving table to a counting station. Charged particles were detected with a Si Δ E-E telescope and a plastic scintillator; γ rays were detected with Ge detectors. Measured E γ , I γ , E(α), I(α), $\alpha\gamma$ -coin. Deduced levels.

Others:

1996Pa01: measured E α .

1989Wo02: measured E α , % α branching.

1988ScZW: measured E α , T_{1/2}.

1982Bo04: measured T_{1/2}.

1982De11: measured E α .

1981HoZM, **1979Ho10**: measured E α , % α branching.

1980Da09: measured E α , T_{1/2}, production σ .

1979Be52, **1978AfZZ**: measured E α , % α branching.

1977Ha48: measured E α , T_{1/2}, % α branching.

1964Ma45: measured E α , T_{1/2}.

¹⁴⁹Ho Levels

E(level) [†]	J ^π [‡]	T _{1/2} [‡]	Comments
0.0	(11/2 ⁻)	21.0 s 2	
49.0	(1/2 ⁺)	56 s 3	% ϵ +% β^+ =100
220.4	(3/2 ⁺)		
564.4	(5/2 ⁺)		

[†] As given in **1988To13** based on E γ data.

[‡] From the Adopted Levels.

 α radiations

E α	E(level)	I α ^{†@}	HF [#]	Comments
4586 ^{‡&} 10	564.4	<0.0045	>48	
4902 ^{‡&} 15	220.4	<0.0018	>6.6×10 ³	
5109 2	0.0	100	1.23 5	E α : weighted average of 5112 5 (1996Pa01), 5111 2 (1982De11), 5103 3 (1982Bo04), 5109 5 (1981HoZM , 1979Ho10), 5106 10 (1978AfZZ), 5112 10 (1977Ha48), 5113 20 (1964Ma45). Others: 5104 (1980Da09), 1988To13 .

[†] From **1988To13**. I α (4586)/I α (5109+5096)=4.5×10⁻⁵ 5, I α (4902)/I α (5109+5096)=1.8×10⁻⁵ 4 (**1988To13**).

[‡] **1988To13** suggest that this peak is a doublet, with components from both the 1.48- and 2.5-s isomers; although transitions from 2.5-s, (1/2⁺) parent would be favored in view of low L value involved rather than much higher L value implied by the 1.48-s, (11/2⁻) parent.

[#] The nuclear radius parameter r₀(¹⁴⁹Ho)=1.5621 20 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in **2020Si16**.

Continued on next page (footnotes at end of table)

¹⁵³Tm α decay (1.48 s) 1988To13 (continued)

α radiations (continued)

@ For absolute intensity per 100 decays, multiply by 0.91 3.
& Existence of this branch is questionable.

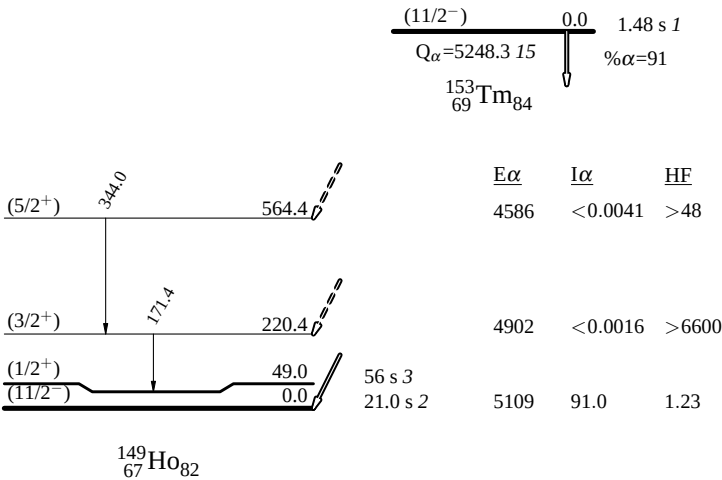
γ(¹⁴⁹Ho)

<u>E_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>
171.4	220.4	(3/2 ⁺)	49.0	(1/2 ⁺)
344.0	564.4	(5/2 ⁺)	220.4	(3/2 ⁺)

[†] From 1988To13. The γ rays are from the decay of either one of the activities of ¹⁵³Tm or both. However, (1/2⁺) parent would be favored in view of low L value involved rather than much higher L value implied by the 1.48-s, (11/2⁻) parent.

¹⁵³Tm α decay (1.48 s) 1988To13

Decay Scheme



^{153}Tm α decay (2.5 s) [1988To13](#)

Parent: ^{153}Tm : $E=43.2$ 2; $J^\pi=(1/2^+)$; $T_{1/2}=2.5$ s 2; $Q(\alpha)=5248.3$ 15; $\% \alpha$ decay=92 3

^{153}Tm -E, J^π , $T_{1/2}$: From ^{153}Tm Adopted Levels in the ENSDF database (August 2020 update); no new references since this update.

Half-life in the ENSDF database is adopted from [1988ScZV](#).

^{153}Tm - $Q(\alpha)$: From [2021Wa16](#).

^{153}Tm - $\% \alpha$ decay: $\% \alpha=92$ 3 ([1989Ko02](#)).

[1988To13](#) (also [1991To12](#),[1989Ko02](#)): ^{153}Tm ions were produced with $^{92}\text{Mo}(^{64}\text{Zn},3p)$ reaction with $E=267$ MeV (center of target) ^{64}Zn beam from the Lawrence Berkeley Laboratory SuperHILAC on 93.37% enriched ^{92}Mo foil target, followed by mass separation with the OASIS online facility, and collected in a moving table to a counting station. Charged particles were detected with a Si ΔE -E telescope and a plastic scintillator; γ rays were detected with Ge detectors. Measured E_γ , I_γ , $E(\alpha)$, $I(\alpha)$, $\alpha\gamma$ -coin. Deduced levels.

[1988ScZV](#): measured $E\alpha$, $T_{1/2}$.

 ^{149}Ho Levels

E(level)	$J^\pi^\dagger$	$T_{1/2}^\dagger$	Comments
49.0	(1/2 ⁺)	56 s 3	$\% \epsilon + \% \beta^+ = 100$
220.4	(3/2 ⁺)		
564.4	(5/2 ⁺)		

[†] From the Adopted Levels.

 α radiations

$E\alpha$	E(level)	$I\alpha^\dagger@$	HF [#]	Comments
4586 ^{‡&} 10	564.4	<0.0045	>135	
4902 ^{‡&} 15	220.4	<0.0018	>1.8×10 ⁴	
5096 4	49.0	100	1.9 2	$E\alpha$: 1988To13 quote value from 1988ScZV .

[†] From [1988To13](#). $I\alpha(4586)/I\alpha(5109+5096)=4.5\times 10^{-5}$ 5, $I\alpha(4902)/I\alpha(5109+5096)=1.8\times 10^{-5}$ 4 ([1988To13](#)). Values are relative to 100 for 5096 α .

[‡] [1988To13](#) suggest that this peak is a doublet, with components from both the 1.48- and 2.5-s isomers; although transitions from 2.5-s, (1/2⁺) parent would be favored in view of low L value involved rather than much higher L value implied by the 1.48-s, (11/2⁻) parent.

[#] The nuclear radius parameter $r_0(^{149}\text{Ho})=1.5621$ 20 is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides in [2020Si16](#).

@ For absolute intensity per 100 decays, multiply by 0.92 3.

& Existence of this branch is questionable.

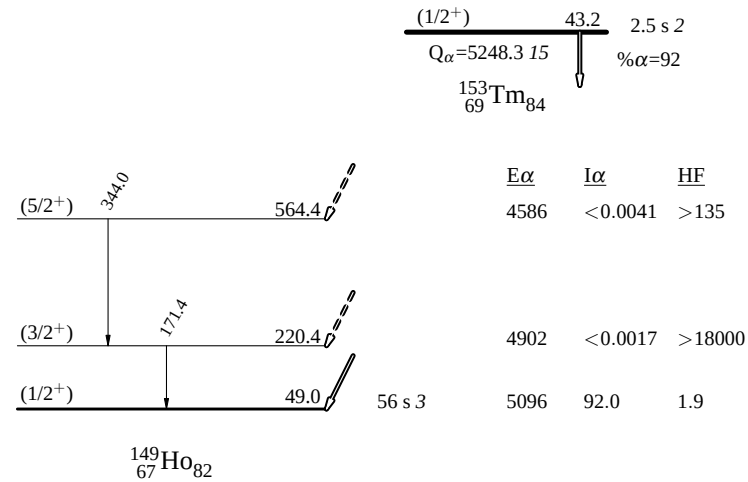
 $\gamma(^{149}\text{Ho})$

$E_\gamma^\dagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π
171.4	220.4	(3/2 ⁺)	49.0	(1/2 ⁺)
344.0	564.4	(5/2 ⁺)	220.4	(3/2 ⁺)

[†] From [1988To13](#). The γ rays are from the decay of either one of the activities of ^{153}Tm or both. However, (1/2⁺) parent would be favored in view of low L value involved rather than much higher L value implied by the 1.48-s, (11/2⁻) parent.

¹⁵³Tm α decay (2.5 s) 1988To13

Decay Scheme



¹¹²Sn(⁴⁰Ar,p2n γ) **2010Ko12**

Includes ¹¹⁴Sn(⁴⁰Ar,4np γ).

2010Ko12: E=200, 206 MeV ⁴⁰Ar beams were produced from the Heavy Ion Laboratory cyclotron of University of Warsaw. Target was metallic ¹¹²Sn (92% enriched) and ¹¹⁴Sn (86% enriched). γ rays were detected with the OSIRIS-II array consisting of 12 Compton-suppressed HPGe detectors. Measured E γ , I γ , $\gamma\gamma$ -coin, $\gamma(\theta)$, prompt and delayed γ in the in-beam and beam-off modes. Deduced levels, J, π , band structures, γ -ray multipolarities. Comparison with shell-model calculations.

¹⁴⁹Ho Levels

E(level) [†]	J π &	E(level) [†]	J π &	E(level) [†]	J π &	E(level) [†]	J π &
0.0 ^a	(11/2 ⁻)	2406.6 ^{#b} 4	(23/2 ⁺)	4028.6 ^c 7	(33/2,35/2)	5210.3 7	(35/2 ⁻)
1379.1 ^{#b} 3	(15/2 ⁺)	2591.6 ^{‡a} 4	(23/2 ⁻)	4330.0 ^{@d} 8	(35/2,37/2)	5505.3 ^c 8	(39/2,41/2)
1559.8 ^{‡a} 3	(15/2 ⁻)	2735.4 ^{‡a} 5	(27/2 ⁻)	4679.7 6	(31/2 ⁻)		
2023.4 ^{#b} 4	(19/2 ⁺)	2848.6 ^c 6	(29/2,31/2)	4764.7 ^{@d} 8	(39/2,41/2)		
2285.6 ^{‡a} 4	(19/2 ⁻)	3930.6 ^{@d} 7	(31/2,33/2)	4820.3 ^c 8	(37/2,39/2)		

[†] From a least-squares fit to γ -ray energies, assuming $\Delta E\gamma=0.3$ keV.

[‡] Member of configuration= $\pi h_{11/2}^3$.

[#] Member of configuration= $\pi h_{11/2}^3 \otimes \pi h_{11/2} \otimes \nu g_{7/2}^{-1}$.

[@] Member of configuration= $\pi h_{11/2}^3 \otimes \pi(h_{11/2}, d_{5/2}^{-1})$, if the sequence is 33/2⁺, 37/2⁺, 41/2⁺, ..

& Proposed by **2010Ko12**, based on measured anisotropies, band assignments, and shell-model predictions.

^a Band(A): Band based on g.s.

^b Band(B): Band based on (15/2⁺).

^c Band(C): Band based on (29/2,31/2).

^d Band(D): Band based on (31/2,33/2).

 $\gamma(^{149}\text{Ho})$

Anisotropy ratio R=W(25°)/W(90°), with mean uncertainty of R not exceeding 15%. The expected values are: 1.4 for the $\Delta J=2$, quadrupole transition, and 0.8 for $\Delta J=1$, dipole.

E γ [†]	I γ [†]	E _i (level)	J π _i	E _f	J π _f	Mult. [‡]	Comments
113.2	36 4	2848.6	(29/2,31/2)	2735.4 (27/2 ⁻)			R=1 (isotropic).
143.8	62 7	2735.4	(27/2 ⁻)	2591.6 (23/2 ⁻)			R=1 (isotropic).
185.0	18 5	2591.6	(23/2 ⁻)	2406.6 (23/2 ⁺)			R=1 (isotropic).
306.0	65 7	2591.6	(23/2 ⁻)	2285.6 (19/2 ⁻)			R=1 (isotropic).
383.1	25 5	2406.6	(23/2 ⁺)	2023.4 (19/2 ⁺)			R=1 (isotropic).
399.4	16.2 17	4330.0	(35/2,37/2)	3930.6 (31/2,33/2)	Q		R=1.30.
							E2 in 2010Ko12 .
434.7	27 3	4764.7	(39/2,41/2)	4330.0 (35/2,37/2)	Q		R=1.20.
							E2 in 2010Ko12 .
530.6	24.2 25	5210.3	(35/2 ⁻)	4679.7 (31/2 ⁻)	Q		R=1.45.
							E2 in 2010Ko12 .
644.3	30 5	2023.4	(19/2 ⁺)	1379.1 (15/2 ⁺)			R=1 (isotropic).
685.0	48 5	5505.3	(39/2,41/2)	4820.3 (37/2,39/2)	D		R=0.85.
725.8	100 10	2285.6	(19/2 ⁻)	1559.8 (15/2 ⁻)			R=1 (isotropic).
791.7	45 5	4820.3	(37/2,39/2)	4028.6 (33/2,35/2)	Q		R=1.45.
							E2 in 2010Ko12 .
1082.0	39 4	3930.6	(31/2,33/2)	2848.6 (29/2,31/2)	D		R=0.80.
1180.0	67 7	4028.6	(33/2,35/2)	2848.6 (29/2,31/2)	Q		R=1.16.
							E2 in 2010Ko12 .

Continued on next page (footnotes at end of table)

¹¹²Sn(⁴⁰Ar,p2nγ) [2010Ko12](#) (continued)

γ(¹⁴⁹Ho) (continued)

<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[‡]</u>	<u>Comments</u>
1379.1	43 5	1379.1	(15/2 ⁺)	0.0	(11/2 ⁻)		R=1 (isotropic).
1559.8	109 11	1559.8	(15/2 ⁻)	0.0	(11/2 ⁻)		R=1 (isotropic).
1944.3	38 4	4679.7	(31/2 ⁻)	2735.4	(27/2 ⁻)	Q	R=1.45. E2 in 2010Ko12 .

[†] From [2010Ko12](#), at E(⁴⁰Ar)=206 MeV.

[‡] From [2010Ko12](#) based on measured anisotropy ratios. For ΔJ=2 transitions, Q instead of E2 quoted in [2010Ko12](#) are adopted here by the evaluators, since electric or magnetic nature of a transition cannot be determined from anisotropy.

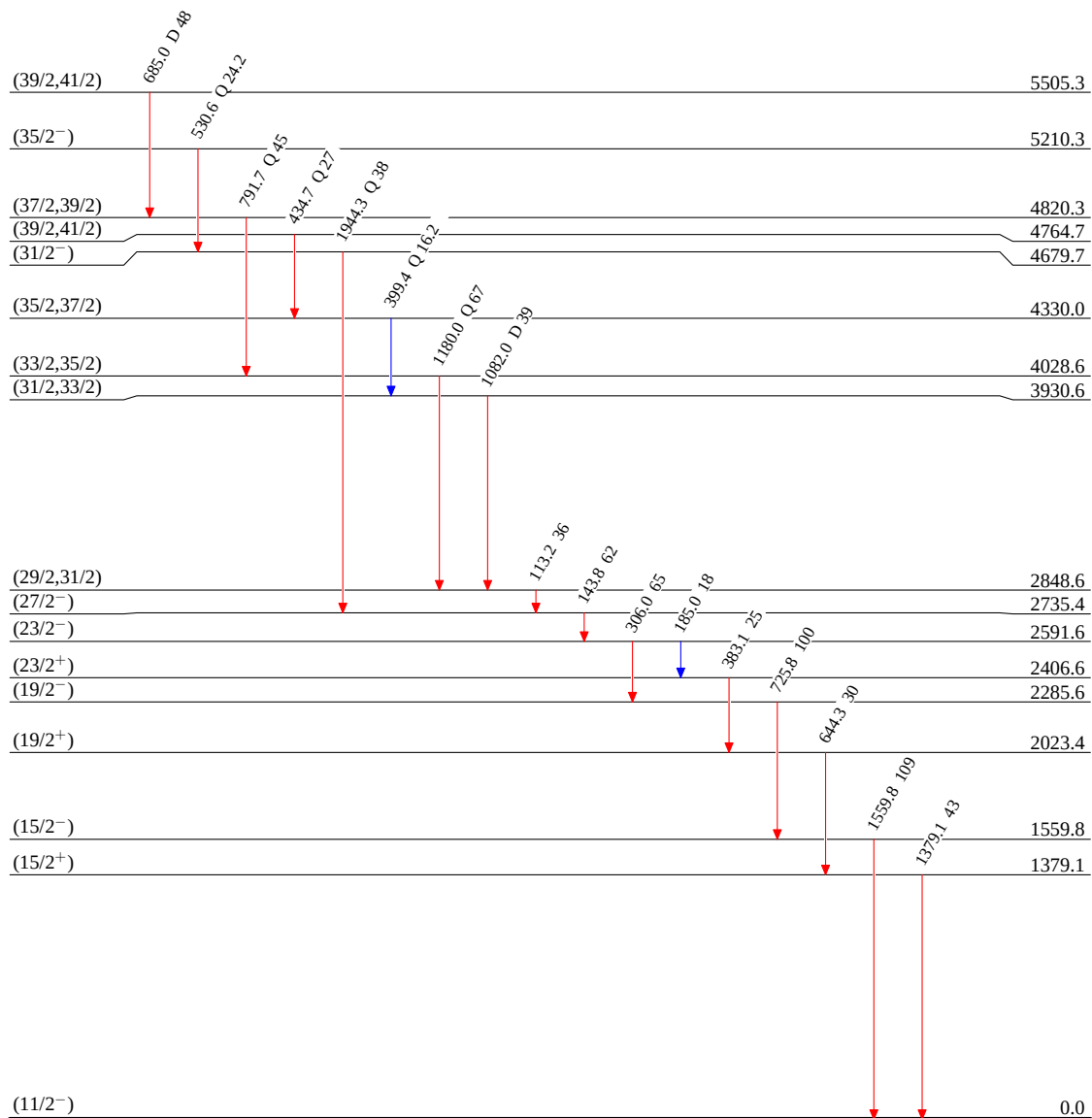
$^{112}\text{Sn}(^{40}\text{Ar,p}2\text{n}\gamma)$ 2010Ko12

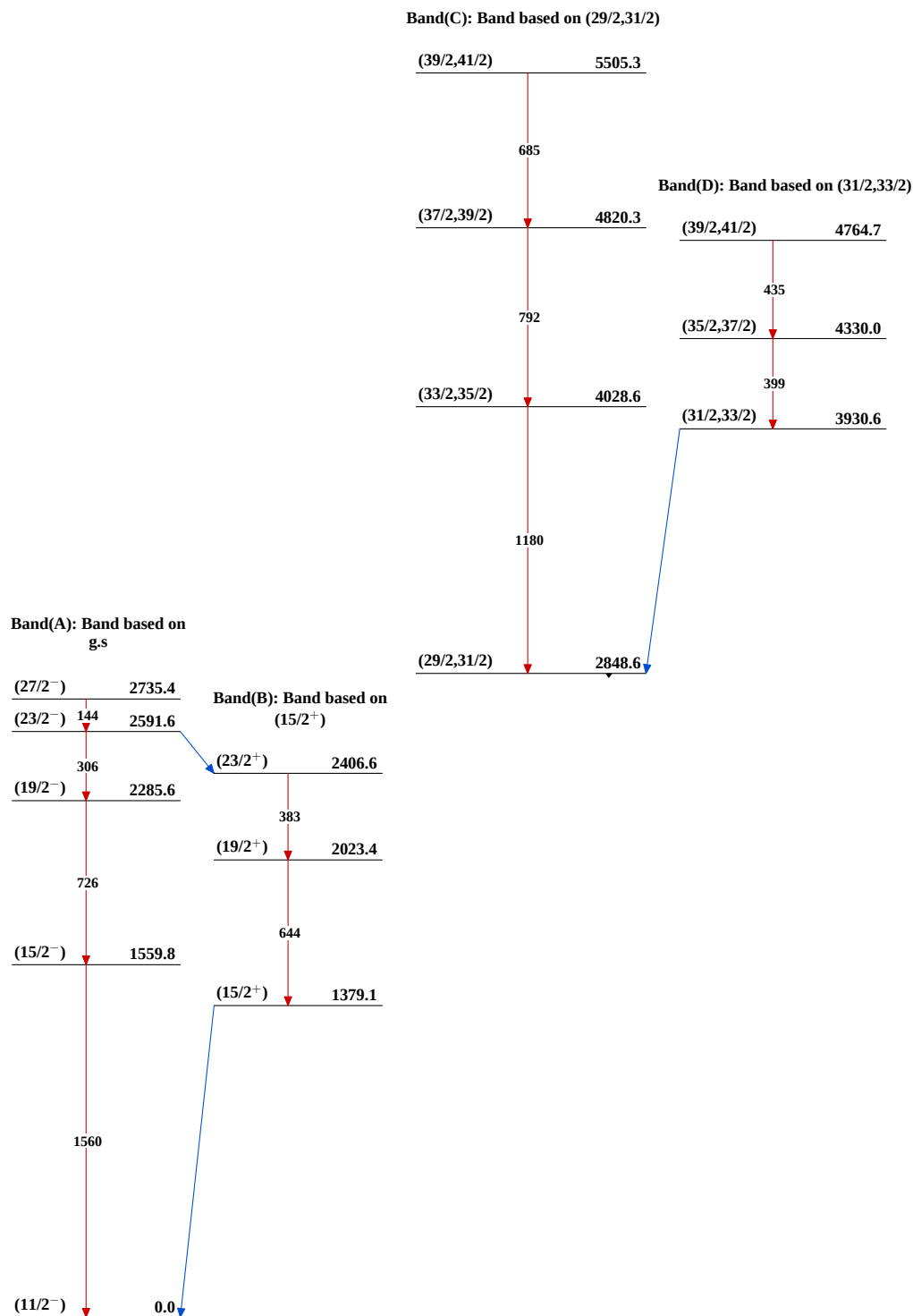
Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
- $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
- $I_\gamma > 10\% \times I_\gamma^{\text{max}}$



$^{112}\text{Sn}(^{40}\text{Ar},\text{p}2\text{n}\gamma)$ 2010Ko12


¹²¹Sb(³²S,4nγ), ¹⁰⁶Pd(⁵⁰Ti,p6nγ) 1980Wi11,1980Bo07

1980Wi11: ¹²¹Sb(³²S,4nγ) and ¹²²Te(³²S,p4nγ) E=155-180 MeV beam from the Argonne super-conducting linac booster.

Measured E_γ, γγ-coin, γγ(t), sum spectra with two NaI(Tl) and two Ge(Li) detectors. Two nanosecond isomers reported but data are given for the lower isomer (59 ns) only.

1980Bo07: ¹⁰⁶Pd(⁵⁰Ti,p6nγ); ¹⁰⁶Pd(⁶⁵Cu,xnypγ); ¹⁰⁰Mo(⁶⁵Cu,xnypγ), E=4.6 MeV/nucleon beams from the UNILAC at GSI.

Measured delayed γ. Two nanosecond isomers (45 ns and ≥100 ns) were assigned to ¹⁴⁹Ho or ¹⁵⁰Ho. Since none of these isomers is assigned to ¹⁵⁰Ho in a later work by the same group (1986Mc14), these are assumed to be in ¹⁴⁹Ho. The lower isomer is the same as reported by 1980Wi11.

Other:

1984ChZS: ²⁰⁸Pb(⁵⁸Ni,Xγ), ²⁰⁸Pb(⁶⁰Ni,Xγ) E=225-255 MeV. Measured E_γ, I_γ, γγ-coin. Deduced levels.

Level scheme is from 1980Wi11. In the absence of detailed γ-ray intensity information, the ordering of the transitions in the level scheme is guided by the theoretical interpretation of the level scheme in terms of one cascade defined by configuration=((π h_{11/2})⁺) and the other based on coupling of h_{11/2} proton state to 3⁻, 5⁻, 7⁻ states in ¹⁴⁸Dy (1980Wi11).

¹⁴⁹Ho Levels

E(level) [†]	J ^π [‡]	T _{1/2}	Comments
0.0	(11/2 ⁻)		
1380 1	(15/2 ⁺)		T _{1/2} : from γγ(t), 1980Wi11 indicate that this level has a half-life of a few nanoseconds.
1560 1	(15/2 ⁻)		
2025 1	(19/2 ⁺)		
2287 1	(19/2 ⁻)		
2409 1	(23/2 ⁺)		
2594 1	(23/2 ⁻)		
2738 2	(27/2 ⁻)	59 ns 4	T _{1/2} : from γγ(t) (1980Wi11). Other: 45 ns 20 (1980Bo07).
7.20×10 ³ 35		≥100 ns	T _{1/2} : from γ(t) (1980Bo07). 1980Wi11 mention a nanosecond isomer above the 59-ns isomer but no data are given.

[†] From E_γ data.

[‡] From the Adopted Levels.

γ(¹⁴⁹Ho)

E _γ [†]	I _γ [‡]	E _i (level)	J ^π _i	E _f	J ^π _f	Mult.	Comments
144		2738	(27/2 ⁻)	2594	(23/2 ⁻)	(E2) [@]	
185		2594	(23/2 ⁻)	2409	(23/2 ⁺)	(E1) [@]	
307 ^{&}	90	2594	(23/2 ⁻)	2287	(19/2 ⁻)		E _γ : 305 (1980Bo07).
^x 337 [#]	50						
384		2409	(23/2 ⁺)	2025	(19/2 ⁺)		
^x 436 [#]	60						
^x 636 [#]	100						
645		2025	(19/2 ⁺)	1380	(15/2 ⁺)		
^x 648 [#]	70						
^x 671 [#]	90						
727 ^{&}	100	2287	(19/2 ⁻)	1560	(15/2 ⁻)		
^x 777 [#]	90						
^x 896 [#]	60						
1380		1380	(15/2 ⁺)	0.0	(11/2 ⁻)		
1560		1560	(15/2 ⁻)	0.0	(11/2 ⁻)		

Continued on next page (footnotes at end of table)

$^{121}\text{Sb}(^{32}\text{S},4n\gamma), ^{106}\text{Pd}(^{50}\text{Ti},p6n\gamma)$ **1980Wi11,1980Bo07 (continued)**

$\gamma(^{149}\text{Ho})$ (continued)

† From **1980Wi11**, unless otherwise noted.

‡ From **1980Bo07**. Reaction is either $(^{50}\text{Ti},xn\gamma)$ or $(^{65}\text{Cu},xn\gamma)$.

Reported by **1980Bo07** only, assumed to be associated with the decay of the isomer at ≈ 7200 .

@ From total conversion coefficient deduced by **1980Wi11** from transition intensity balance, but neither the γ -ray intensities nor the conversion coefficients are provided by the authors.

& Also seen by **1980Bo07**.

^x γ ray not placed in level scheme.

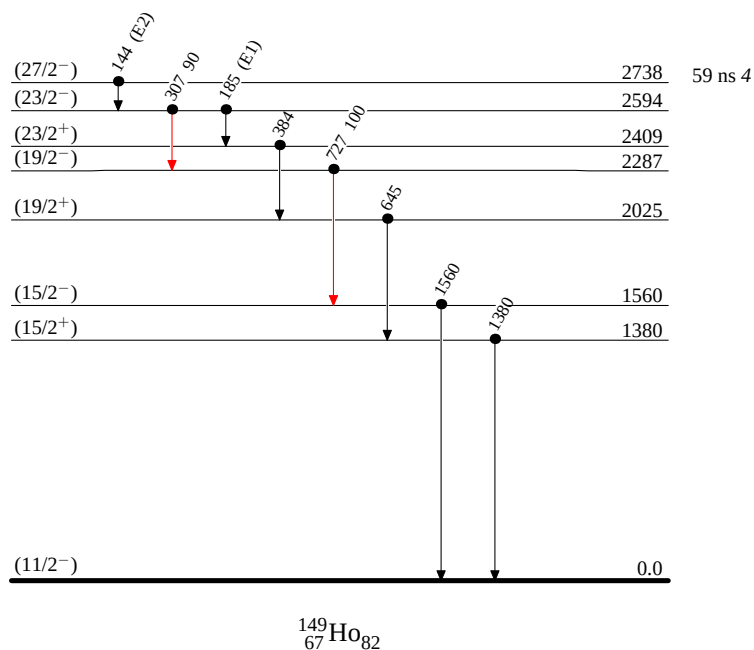
$^{121}\text{Sb}(^{32}\text{S},4n\gamma), ^{106}\text{Pd}(^{50}\text{Ti},p6n\gamma)$ **1980Wi11,1980Bo07**

Legend

Level Scheme

Intensities: Relative I_γ

$\longrightarrow$ $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
 $\longrightarrow$ $I_\gamma > 10\% \times I_\gamma^{\text{max}}$
 • Coincidence



Adopted Levels, Gammas

$Q(\beta^-) = -9800$ syst; $S(n) = 10334$ 30; $S(p) = 3040$ 90; $Q(\alpha) = 2076$ 29 [2021Wa16](#)

$\Delta Q(\beta^-) = 200$ (syst, [2021Wa16](#)).

$Q(\varepsilon) = 7900$ 30, $Q(\varepsilon p) = 6829$ 29, $S(2n) = 23280$ 50, $S(2p) = 4124$ 29 ([2021Wa16](#)).

From gross theory of β decay ([1973Ta30](#)), for ^{153}Yb $\% \varepsilon + \% \beta^+ \approx 50$, $\% \alpha$ is expected to be ≈ 50 . But no α decay of 4.2-s ^{153}Yb has been reported ([1978AfZZ](#), [1989Ko02](#)). Calculated partial $T_{1/2}(^{153}\text{Yb } \alpha \text{ decay}) = 10 \times 10^{7.5}$ s ([2019Mo01](#)) predicts negligible $\% \alpha$. Theoretical studies: consult the NSR database at www.nndc.bnl.gov for five references dealing with nuclear structure theory.

 ^{149}Er LevelsCross Reference (XREF) Flags

- A** ^{149}Tm ε decay (0.9 s)
B ^{149}Er IT decay (9.6 s)
C $^{92}\text{Mo}(^{60}\text{Ni}, 2\text{pn}\gamma)$

E(level) [†]	J^π [‡]	$T_{1/2}$ ^{&}	XREF	Comments
0.0	(1/2 ⁺)	4 s 2	ABC	$\% \varepsilon + \% \beta^+ = 100$; $\% \varepsilon p = 7$ 2 (1989Fi01) J^π : probable $s_{1/2}$ neutron state and systematics. $T_{1/2}$: from 1989Fi01 , γ -decay curves.
111.19 10	(3/2 ⁺)		ABC	J^π : 111.2 γ M1 to (1/2 ⁺) and 630.5 γ M4 from (11/2 ⁻); probable $d_{3/2}$ neutron state.
741.69 23	(11/2 ⁻)	9.6 s 6	ABC	$\% \varepsilon + \% \beta^+ = 96.5$ 7; $\% \text{IT} = 3.5$ 7; $\% \varepsilon p = 0.18$ 7 (1989Fi01) $T_{1/2}$: unweighted average of 8.9 s 2 from 1989Fi01 in IT decay, 10.8 s 6 (1984ScZT) and 9 s 1 (1984To07) from ^{149m}Er ε decay. J^π : probable $h_{11/2}$ neutron state and systematics.
907.37 18	(5/2 ⁺)		A	J^π : probable $d_{5/2}$ neutron state.
1066.17 21	(7/2 ⁻)		A	J^π : probable $f_{7/2}$ neutron state.
1482.9 4	(9/2 ⁻ , 11/2 ⁻)		A	J^π : probable ε feeding from (11/2 ⁻); 416.7 γ to (7/2 ⁻).
2311.5 3	(15/2 ⁻) [@]		C	
2478.8 3	(15/2 ⁺) [#]		C	
2542.1 3	(15/2 ⁺) [#]		C	
2611.0 3	(19/2 ⁺) [#]	0.61 μs 8	C	
2611.1+x	(21/2 ⁺) [#]		C	E(level): $x < 60$ (1987Br14).
2683.7+x?			C	
2864.10+x? 15			C	
3187.80+x 10	(23/2 ⁻) [@]		C	
3242.9+x 4	(27/2 ⁻) [@]	4.8 μs 2	C	

[†] From a least-squares fit to γ -ray energies.

[‡] Low spins ($\leq 11/2$) are from [1987To12](#) in ^{149}Tm ε decay and high spins ($\geq 11/2$) are from probable shell model configurations and analogy to ^{147}Dy ([1987Br14](#)) in $(^{60}\text{Ni}, 2\text{pn}\gamma)$.

[#] Member of configuration $= \pi h_{11/2}^4 \otimes \nu s_{1/2}^{-1}$ and configuration $= \pi h_{11/2}^4 \otimes \nu d_{3/2}^{-1}$ ([1987Br14](#)).

[@] Member of configuration $= \pi h_{11/2}^4 \otimes \nu h_{11/2}^{-1}$ ([1987Br14](#)).

[&] From $\gamma\gamma(t)$ in $(^{60}\text{Ni}, 2\text{pn}\gamma)$ ([1987Br14](#)), unless otherwise noted.

Adopted Levels, Gammas (continued)

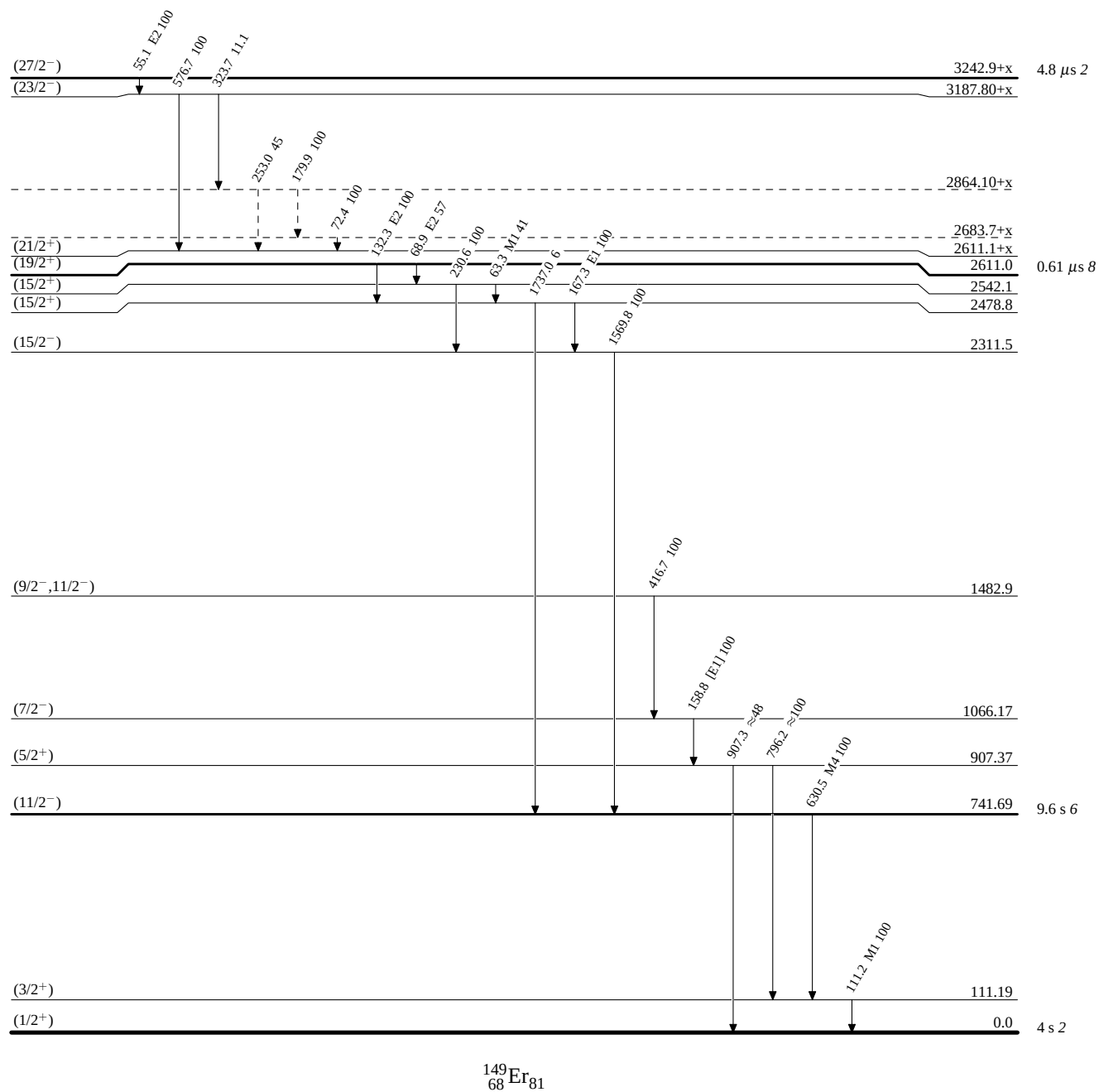
$\gamma(^{149}\text{Er})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^\dagger$	E_f	J_f^π	Mult. [#]	α ^{&}	Comments
111.19	(3/2 ⁺)	111.2 1	100	0.0	(1/2 ⁺)	M1 [@]	2.100 30	E_γ : weighted average of 111.3 1 (1987To02) from ^{149}Tm ε decay, 111.0 1 (1985To11) and 111.3 3 (1989Fi01) from IT decay.
741.69	(11/2 ⁻)	630.5 2	100	111.19	(3/2 ⁺)	M4 [@]	0.320 4	B(M4)(W.u.)=1.67 +37-35 E_γ : from IT decay.
907.37	(5/2 ⁺)	796.2 [‡] 2	≈ 100 [‡]	111.19	(3/2 ⁺)			
		907.3 [‡] 3	≈ 48 [‡]	0.0	(1/2 ⁺)			
1066.17	(7/2 ⁻)	158.8 [‡] 1	100	907.37	(5/2 ⁺)	[E1]	0.0953 13	
1482.9	(9/2 ⁻ , 11/2 ⁻)	416.7 [‡] 3	100	1066.17	(7/2 ⁻)			
2311.5	(15/2 ⁻)	1569.8 2	100	741.69	(11/2 ⁻)			
2478.8	(15/2 ⁺)	167.3 1	100 3	2311.5	(15/2 ⁻)	E1	0.0830 12	
		1737.0 3	6 1	741.69	(11/2 ⁻)			
2542.1	(15/2 ⁺)	63.3 2	41 2	2478.8	(15/2 ⁺)	M1	10.62 18	
		230.6 1	100 3	2311.5	(15/2 ⁻)			
2611.0	(19/2 ⁺)	68.9 1	57 3	2542.1	(15/2 ⁺)	E2	12.77 19	B(E2)(W.u.)=0.73 +11-9
		132.3 1	100 5	2478.8	(15/2 ⁺)	E2	1.051 15	B(E2)(W.u.)=0.049 +8-6
2683.7+x?		72.4 ^a 4	100	2611.1+x	(21/2 ⁺)			
2864.10+x?		179.9 ^a 2	100 6	2683.7+x?				
		253.0 ^a 3	45 6	2611.1+x	(21/2 ⁺)			
3187.80+x	(23/2 ⁻)	323.7 1	11.1 5	2864.10+x?				
		576.7 1	100 3	2611.1+x	(21/2 ⁺)			
3242.9+x	(27/2 ⁻)	55.1 3	100	3187.80+x	(23/2 ⁻)	E2	31.5 10	B(E2)(W.u.)=0.152 9

[†] From (^{60}Ni , 2pny), unless otherwise noted.[‡] From ^{149}Tm ε decay.[#] From ce data in (^{60}Ni , 2pny), unless otherwise noted.[@] From ce data in IT decay.[&] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multiplicities, and mixing ratios, unless otherwise specified.^a Placement of transition in the level scheme is uncertain.

Legend

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)



^{149}Tm ε decay (0.9 s) 1987To12

Parent: ^{149}Tm : $E=0.0$; $J^\pi=(11/2^-)$; $T_{1/2}=0.9$ s 2; $Q(\varepsilon)=9800$ syst; $\% \varepsilon + \% \beta^+$ decay=100

$^{149}\text{Tm}-Q(\varepsilon)$: 9800 200 (syst, 2021Wa16).

$^{149}\text{Tm}-T_{1/2}$: From $\gamma(t)$ in 1987To12.

1987To12: ^{149}Tm ions were produced from $^{94}\text{Mo}(^{58}\text{Ni}, p2n)$ with $E=259$ MeV ^{58}Ni beam from the Lawrence Berkeley Laboratory SuperHILAC, and mass separated with the OASIS facility online, and collected with a tape system to the counting station. Charged particles were detected with a Si ΔE -E telescope and a plastic scintillator; γ rays were detected with Ge detectors. Measured E_γ , I_γ , $E(\text{x-ray})$, $I(\text{x-ray})$, $\gamma\gamma$ -coin, $(\text{x-ray})\gamma$ -coin, β -delayed proton spectra, $\beta\gamma(t)$. Deduced levels, J , π , parent $T_{1/2}$.

The decay scheme is incomplete.

 ^{149}Er Levels

E(level)	$J^\pi^\dagger$	$T_{1/2}^\ddagger$	Comments
0.0	$(1/2^+)$	4 s 2	
111.3 1	$(3/2^+)$		
741.5	$(11/2^-)$	9.6 s 6	$\% \varepsilon + \% \beta^+ = 96.5$ 7; $\% \text{IT} = 3.5$ 7; $\% \varepsilon p = 0.18$ 7 1987To12 estimate that total feeding to this level (direct and indirect) is $\approx 70\%$.
907.4 2	$(5/2^+)$		
1066.2 2	$(7/2^-)$		
1482.9 4	$(9/2^-, 11/2^-)$		

† Tentative assignments from 1987To12; same in the Adopted Levels.

‡ From the Adopted Levels.

 $\gamma(^{149}\text{Er})$

The decay scheme has not been normalized due to insufficient information about the existence and placement of all the γ rays.

Assumption of $\approx 70\%$ decay to the 741 level (1987To12) would lead to a normalization factor (i.e. multiplication factor to obtain $I_\gamma/100$ decays) of 0.07. $\% \varepsilon p = 0.2 + 2 - 1$ (1987To12).

$E_\gamma^\dagger$	$I_\gamma^\ddagger$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. #	$\alpha^@$	Comments
111.3 1	100	111.3	$(3/2^+)$	0.0	$(1/2^+)$	M1	2.094 30	
158.8 1	175 35	1066.2	$(7/2^-)$	907.4	$(5/2^+)$	[E1]	0.0953 13	
416.7 3	150 50	1482.9	$(9/2^-, 11/2^-)$	1066.2	$(7/2^-)$			
$^x 437.4$ 2	≈ 100							
630.2		741.5	$(11/2^-)$	111.3	$(3/2^+)$	M4	0.320 4	I_γ : assuming 70% feeding to this level and $\% \text{IT} = 3.5$, $I_\gamma(630\gamma)(\text{absolute}) \approx 1.8$.
796.2 2	$\approx 250^\ddagger$	907.4	$(5/2^+)$	111.3	$(3/2^+)$			
907.3 3	$\approx 120^\ddagger$	907.4	$(5/2^+)$	0.0	$(1/2^+)$			
$^x 955.2$ 3	$\approx 120^\ddagger$							γ seen in $(\text{x ray})\gamma$ -coin only, not in coin with 111 γ .

† From 1987To02.

‡ From $\gamma\gamma$ -coin or $(\text{x-ray})\gamma$ -coin (1987To12).

From the Adopted Gammas.

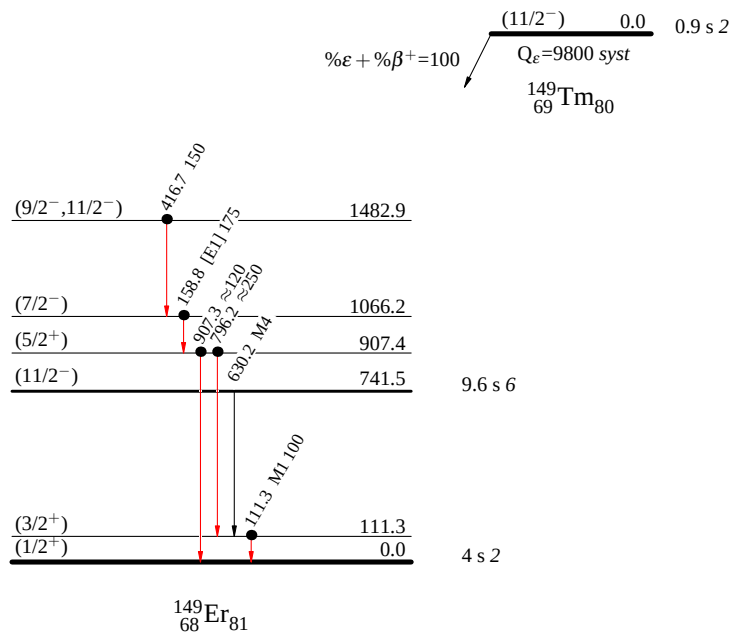
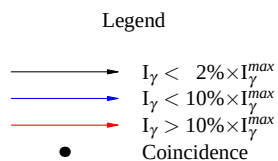
@ Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

^{x} γ ray not placed in level scheme.

^{149}Tm ϵ decay (0.9 s) 1987To12

Decay Scheme

Intensities: Relative I_γ



^{149}Er IT decay (9.6 s) [1989Fi01](#),[1985To11](#)

Parent: ^{149}Er : $E=741.69\ 23$; $J^\pi=(11/2^-)$; $T_{1/2}=9.6\ \text{s}\ 6$; %IT decay= $3.5\ 7$

^{149}Er - $E, J^\pi, T_{1/2}$: From the Adopted Levels.

^{149}Er -%IT decay: %IT= $3.5\ 7$, % $\varepsilon=96.5\ 7$ ([1989Fi01](#)). Other: %IT= 2.7 ([1985To11](#)).

[1989Fi01](#): $^{149\text{m}}\text{Er}$ ions were produced by the $^{94}\text{Mo}(^{58}\text{Ni}, 2\text{pn})$ reaction with 242 MeV (center of target) ^{58}Ni beam from the Lawrence Berkeley Laboratory SuperHILAC, separated with the OASIS facility online and collected on a moving tape of the counting station. γ rays were detected with a HPGe and two n-Ge detectors; charged particles were detected with a Si ΔE -E telescope on one side of the tape and a plastic scintillator on the other side. Measured E_γ , I_γ , $E(\text{x-ray})$, $I(\text{x-ray})$, $\gamma\gamma$ -coin, $\gamma(t)$, β -delayed proton spectra. Deduced levels, $T_{1/2}$, conversion coefficients, γ -ray multipolarities.

[1985To11](#): same setup and reaction as [1989Fi01](#), but with $E(^{58}\text{Ni})=262$ MeV at the center of target. Measured E_γ , I_γ , $E(\text{x-ray})$, $I(\text{x-ray})$, $\gamma\gamma$ -coin. Deduced levels, conversion coefficients, γ -ray multipolarities.

 ^{149}Er Levels

E(level)	J^π [†]	$T_{1/2}$ [†]	Comments
0.0	(1/2 ⁺)	4 s 2	
111.0 1	(3/2 ⁺)		E(level): from $E_\gamma=111.0\ 1$.
741.69 23	(11/2 ⁻)	9.6 s 6	E(level), $J^\pi, T_{1/2}$: from the Adopted Levels. Other: E(level)= $741.5\ 2$ from $630.5\gamma+111.0\gamma$; $T_{1/2}=8.9\ \text{s}\ 2$ from 1989Fi01 in this study.

[†] From the Adopted Levels.

 $\gamma(^{149}\text{Er})$

I_γ normalization: From $I(\gamma+\text{ce})(630.5\gamma)=100$ for per 100 decays through this branch.

E_γ	I_γ ^{†#}	$E_i(\text{level})$	J^π_i	E_f	J^π_f	Mult. [‡]	α [@]	Comments
111.0 1	12 2	111.0	(3/2 ⁺)	0.0	(1/2 ⁺)	M1	2.110 30	$\alpha(\text{K})_{\text{exp}}=1.82\ 11$ (1989Fi01); $\alpha(\text{K})_{\text{exp}}=1.8\ 2$ (1985To11) % $I_\gamma=1.10\ 31$ E_γ : from 1985To11 . Other: $111.3\ 3$ from 1989Fi01 .
630.5 2	29 3	741.69	(11/2 ⁻)	111.0	(3/2 ⁺)	M4	0.320 4	$\alpha(\text{K})_{\text{exp}}=0.27\ 3$ (1989Fi01); $\alpha(\text{K})_{\text{exp}}=0.3\ 1$ (1985To11) % $I_\gamma=2.7\ 5$ E_γ : from 1989Fi01 . Other: $630.5\ 3$ from 1985To11 . I_γ : 1989Fi01 give $I_\gamma=36$ but note that $I_\gamma=7\ 3$ belongs to a γ from ^{149}Ho decay. Other: $I(631\gamma)/I(111\gamma)=248\ 25/100$ (1985To11).

[†] From [1989Fi01](#), relative to 100 for 1171γ from ^{149}Er ε decay (9.6 s).

[‡] From ce data in [1989Fi01](#) and [1985To11](#). Assignments are adopted in the Adopted Gammas.

For absolute intensity per 100 decays, multiply by 0.091 21.

@ Total theoretical internal conversion coefficients, calculated using the BrIcc code ([2008Ki07](#)) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

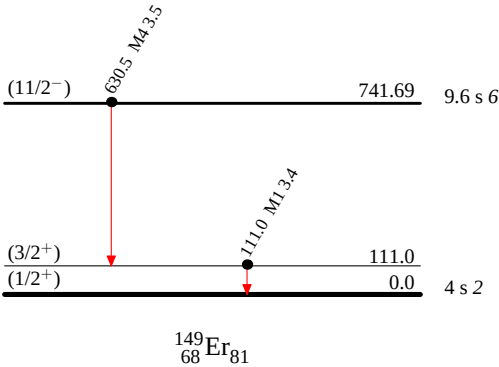
^{149}Er IT decay (9.6 s) 1989Fi01,1985To11

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
%IT=3.5 7

Legend

- $\longrightarrow$ $I_{\gamma} < 2\% \times I_{\gamma}^{max}$
- $\longrightarrow$ $I_{\gamma} < 10\% \times I_{\gamma}^{max}$
- $\longrightarrow$ $I_{\gamma} > 10\% \times I_{\gamma}^{max}$
- Coincidence



$^{92}\text{Mo}(^{60}\text{Ni}, 2\text{pn}\gamma)$ 1987Br14

1987Br14: E=255 MeV ^{60}Ni beam was produced from the Argonne Tandem Linac. Target was 1 mg/cm² ^{92}Mo foil. γ rays were detected with a small planar (LEPS) and three large Ge(Li) detectors. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(t)$. Deduced levels, J, π , $T_{1/2}$, conversion coefficients, γ -ray multiplicities.

Also includes the following reactions:

1995Ni10: $^{94}\text{Mo}(^{58}\text{Ni}, 2\text{pn}\gamma), E(^{58}\text{Ni})=250$ MeV from the ATLAS accelerator at ANL. Measured conversion electrons with two Hamamatsu Si p-i-n diodes and γ rays with a large Ge detector. Deduced conversion coefficients.

1984HoZN: $^{96}\text{Ru}(^{58}\text{Ni}, 4\text{pn}\gamma)$ at UNILAC. Measured $\gamma\gamma(t)$. Deduced isomer $T_{1/2}$.

1982No07: $^{94}\text{Mo}(^{58}\text{Ni}, 2\text{pn}\gamma)$ E=233-250 MeV from the Munich MP tandem. Measured $E\gamma$, $I\gamma$, $\gamma\gamma$ -coin, $\gamma\gamma(t)$ with Ge(Li) detectors. Deduced isomer $T_{1/2}$. A 2.5 μs isomer was reported and tentatively assigned to ^{149}Er through delayed γ rays at 64, 69, 132, 167, 393 and 1570. The 393 γ is not seen by **1987Br14**.

 ^{149}Er Levels

E(level) [†]	J π [‡]	$T_{1/2}$ [#]	Comments
0.0	(1/2 ⁺)		
111.3 10	(3/2 ⁺)		
741.6 15	(11/2 ⁻)		
2311.4 15	(15/2 ⁻)		
2478.7 15	(15/2 ⁺)		
2542.0 15	(15/2 ⁺)		
2610.9 15	(19/2 ⁺)	0.61 μs 8	$T_{1/2}$: from $\gamma\gamma(t)$ 1987Br14 .
2611.0+x	(21/2 ⁺)		E(level): x<60 (1987Br14).
2683.4+x?			
2864.00+x? 15			
3187.70+x 10	(23/2 ⁻)		
3242.8+x 4	(27/2 ⁻)	4.8 μs 2	$T_{1/2}$: other: 3.8 μs 3 (1984HoZN), 2.5 μs 9 (1982No07 , tentative).

[†] From a least-squares fit to γ -ray energies.

[‡] From **1987Br14**, based on systematics and shell-model configurations. The assignments are the same in the Adopted Levels.

[#] From $\gamma\gamma(t)$ in **1987Br14**.

 $\gamma(^{149}\text{Er})$

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J π _i	E_f	J π _f	Mult. [‡]	α [@]	Comments
55.1 3	3.5 12	3242.8+x	(27/2 ⁻)	3187.70+x	(23/2 ⁻)	E2	31.5 10	$\alpha(\text{L})\text{exp}=23$ 20 (1995Ni10); $\alpha(\text{M})\text{exp}=8$ 7 (1995Ni10); $\alpha(\text{exp})=26$ 9 (1987Br14)
63.3 2	6.6 3	2542.0	(15/2 ⁺)	2478.7	(15/2 ⁺)	M1	10.62 18	I_γ : from $\gamma\gamma$ -coin (1987Br14). $\alpha(\text{L})\text{exp}=1.2$ 7 (1995Ni10); $\alpha(\text{exp})=10.3$ 20 (1987Br14)
68.9 1	5.8 3	2610.9	(19/2 ⁺)	2542.0	(15/2 ⁺)	E2	12.77 19	$\alpha(\text{exp})=8.3$ to 12.3 (1987Br14). $\alpha(\text{L})\text{exp}=9.3$ 35 (1995Ni10); $\alpha(\text{M})\text{exp}=2.4$ 9 (1995Ni10); $\alpha(\text{exp})=14.8$ 27 (1987Br14)
72.4 ^{&} 4	≈ 1	2683.4+x?		2611.0+x	(21/2 ⁺)			$\alpha(\text{exp})=12.1$ to 17.4 (1987Br14). E_γ, I_γ : seen in $\gamma\gamma$ -coin only (1987Br14).
111.3		111.3	(3/2 ⁺)	0.0	(1/2 ⁺)	M1 [#]	2.094 29	
132.3 1	10.2 5	2610.9	(19/2 ⁺)	2478.7	(15/2 ⁺)	E2	1.051 15	$\alpha(\text{K})\text{exp}=0.51$ 15 (1995Ni10); $\alpha(\text{L})\text{exp}=0.6$ 2 (1995Ni10)
167.3 1	81 2	2478.7	(15/2 ⁺)	2311.4	(15/2 ⁻)	E1	0.0830 12	$\alpha(\text{K})\text{exp}=0.066$ 19 (1995Ni10); $\alpha(\text{K})\text{exp}<0.10$ (1987Br14)

Continued on next page (footnotes at end of table)

$^{92}\text{Mo}(^{60}\text{Ni}, 2\text{pn}\gamma)$ **1987Br14 (continued)** $\gamma(^{149}\text{Er})$ (continued)

E_γ [†]	I_γ [†]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [‡]	α [@]
179.9 ^{&} 2	4.9 3	2864.00+x?		2683.4+x?			
230.6 1	16.0 5	2542.0	(15/2 ⁺)	2311.4	(15/2 ⁻)		
253.0 ^{&} 3	2.2 3	2864.00+x?		2611.0+x	(21/2 ⁺)		
323.7 1	9.3 4	3187.70+x	(23/2 ⁻)	2864.00+x?			
576.7 1	84 2	3187.70+x	(23/2 ⁻)	2611.0+x	(21/2 ⁺)		
630.3		741.6	(11/2 ⁻)	111.3	(3/2 ⁺)	M4 [#]	0.320 4
1569.8 2	100 3	2311.4	(15/2 ⁻)	741.6	(11/2 ⁻)		
1737.0 3	5 1	2478.7	(15/2 ⁺)	741.6	(11/2 ⁻)		

[†] From 1987Br14.[‡] From ce data of 1995Ni10 and deduced $\alpha(\text{exp})$ by 1987Br14 from intensity balance, unless otherwise noted.[#] From the Adopted Gammas.[@] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ -ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.[&] Placement of transition in the level scheme is uncertain.

Adopted Levels

$Q(\beta^-) = -10610$ syst; $S(n) = 13250$ syst; $S(p) = -250$ syst; $Q(\alpha) = 2760$ syst [2021Wa16](#)

$\Delta Q(\beta^-) = 360$, $\Delta S(n) = \Delta S(p) = \Delta Q(\alpha) = 200$ (syst, [2021Wa16](#)).

$Q(\varepsilon) = 9800$ 200, $Q(\varepsilon p) = 6760$ 220, $S(2n) = 24110$ 200, $S(2p) = 2760$ 200 (syst, [2021Wa16](#)).

¹⁴⁹Tm isotope produced and identified by [1987To12](#).

¹⁵³Lu isomers with $h_{11/2}$ and $s_{1/2}$ orbitals have been identified from ¹⁵⁷Ta α decay ([1997Ir01](#)). It is possible that these isomers decay by α decay to ¹⁴⁹Tm. Gross theory of β decay ([1973Ta30](#)) predicts $\% \alpha \approx 70$, but calculations of [2019Mo01](#) give $T_{1/2}({}^{153}\text{Lu } \alpha \text{ decay}) = 10 \times 10^{16.67}$ s, suggesting negligible $\% \alpha$ decay.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for six references dealing with theoretical calculations of half-lives for radioactive decays and nuclear structure.

¹⁴⁹Tm Levels

E(level)	J ^π	T _{1/2}	Comments
0.0	(11/2 ⁻)	0.9 s 2	$\% \varepsilon + \% \beta^+ = 100$; $\% \varepsilon p = 0.2$ +2-1 (1987To12) J ^π : probable $h_{11/2}$ proton state and systematics of neighboring isotones. T _{1/2} : from 1987To12 , γ -decay curves.

Adopted Levels

$S(n)=11170$ syst; $S(p)=1850$ syst; $Q(\alpha)=3490$ syst [2021Wa16](#)

Estimated uncertainties ([2021Wa16](#)): $\Delta S(n)=500$, $\Delta S(p)=300$, $\Delta Q(\alpha)=360$.

$Q(\varepsilon)=10610$ 360, $Q(\varepsilon p)=10860$ 300, $S(2p)=1300$ 300 (syst,[2021Wa16](#)). $S(2n)=24870$ ([2019Mo01](#), theory).

Assignment is from ^{150}Lu proton decay studied by [2003Gi10](#), [2003Ro21](#), [2000Gi01](#), [1993Se04](#) and [1993Wo03](#). [2001Xu06](#) produced ^{149}Yb in $^{112}\text{Sn}(^{40}\text{Ca},3n)$ reaction at $E=232$ MeV and studied proton- γ coin. See also [2005Xu04](#) and [2006Xu07](#) from the same group as [2001Xu06](#), for some analysis of data.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for about 40 references dealing with theoretical calculations of half-lives for radioactive decays, and two for nuclear structure theory.

 ^{149}Yb LevelsCross Reference (XREF) Flags

- A** ^{150}Lu p decay (45 ms)
B ^{150}Lu p decay (43 μs)

<u>E(level)</u>	<u>J^π</u>	<u>$T_{1/2}$</u>	<u>XREF</u>	<u>Comments</u>
0	(1/2 ⁺)	0.7 s 2	AB	$\% \varepsilon + \% \beta^+ = 100$; $\% \varepsilon p > 0$ $\% \varepsilon p$: relative ε-delayed proton branching ratio to ^{148}Er g.s. is estimated (from statistical model calculations) as 78% and 75% for $J^\pi(^{149}\text{Yb g.s.})=1/2^+$ and $1/2^-$, respectively. From this value 2001Xu06 state that delayed proton branch to first 2^+ state in ^{148}Er is >25%. E(level): assignment as the ground state remains to be confirmed. J^π: ^{149}Yb (possibly the g.s.) is populated in the proton decay of ^{150}Lu through $L=5$ proton from $h_{11/2}$ proton orbital in ^{150}Lu and through $L=2$ proton from $d_{3/2}$ proton orbital in ^{150}Lu isomer. 2001Xu06 proposed $1/2$, 2005Xu04 suggested $1/2^+$ or and $1/2^-$, while 2006Xu07 assigned $1/2^-$ from structure calculations, with the assignment of the g.s. configuration=$\nu 1/2[521]$. Probable $s_{1/2}$ neutron state (2003Gi10) or $d_{3/2}$ state (2000Gi01). 2019Mo01 predict $\Omega(n)=1/2^-$. 2021Ko07 assigned ($1/2^+$) while noting that no $1/2^-$ g.s. or isomer state had been found for even Z, odd N in this region. $T_{1/2}$: from timing of (647γ)(2.5-6.4 MeV delayed protons) coin (2001Xu06, 2005Xu04). The 647γ is ground-state transition from first 2^+ state of ^{148}Er produced in εp decay of ^{149}Yb. It should be noted however that ^{148}Tm g.s. half-life is also 0.7 s 2 as determined by 1982No08 from ^{148}Tm ε decay to ^{148}Er.

¹⁵⁰Lu p decay (45 ms) 2000Gi01,2003Ro21

Parent: ¹⁵⁰Lu: E=0; J^π=(2⁺); T_{1/2}=45 ms 5; Q(p)=1269.6 23; %p decay=76 12

¹⁵⁰Lu-J^π: From 2001Fe05 and 2003Ro21, based on coupling of K^π=5/2⁻ proton (from h_{11/2} shell) to K^π=1/2⁻ neutron and oblate deformation of ≈-0.16 (Nilsson orbits are assigned for small oblate deformation).

¹⁵⁰Lu-T_{1/2}: Weighted average of 43 ms 5 (2003Ro21), 49 ms 5 (2000Gi01), and 35 ms 10 (1993Se04).

¹⁵⁰Lu-Q(p): From 2021Wa16. Nuclear Q value=1283 4 (2003Ro21, including screening correction).

¹⁵⁰Lu-%p decay: %p=76 12 for decay of ¹⁵⁰Lu g.s., estimated by evaluators from experimental half-life of 45 ms 5 and theoretical β-decay half-life of 189.7 ms (2019Mo01), with 50% uncertainty assigned to the theoretical value. Others: 68 6 (2003Ro21, from theoretical β-decay half-life of 155 ms from 1997Mo25); 70 4 (2000Gi01).

2000Gi01, 2003Gi10: ¹⁵⁰Lu isotope formed by ⁹⁶Ru(⁵⁸Ni,p3n) with E=292 MeV ⁵⁸Ni beam from the 25-MV tandem accelerator at ORNL, separated by the Recoil Mass Spectrometer and implanted into a double-sided silicon strip detector (DSSD). Measured proton energy and half-life. Isotopic assignment is based on cross section measurements and systematics arguments for proton decay probabilities near N=82.

2003Ro21: ¹⁵⁰Lu isotope was formed by ⁹⁶Ru(⁵⁸Ni,p3n) with E=297 MeV ⁵⁸Ni beam followed by separation in Fragment Mass Analyzer (FMA) at ANL and implantation in a DSSD. Measured proton energy and half-life.

Other: 1984HoZN: T_{1/2}≥10 ms.

Theory and J^π assignments: 2001Fe05.

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for additional more than 40 references for proton radioactivity calculations.

¹⁴⁹Yb Levels

E(level)	J ^π	T _{1/2}	Comments
0	(1/2 ⁺)	0.7 s 2	J ^π , T _{1/2} : from the Adopted Levels.

Protons (¹⁴⁹Yb)

E(p)	E(¹⁴⁹ Yb)	I(p)	L	Comments
1261 4	0	100	(5)	for proton decay. The L=(5) value implies that the E(p): from 1993Se04. Other: 1262.7 36 (1984HoZN). L: from comparison of experimental and calculated partial T _{1/2} for proton decay. The L=(5) value implies that the proton is emitted from h _{11/2} proton orbital in ¹⁵⁰ Lu.

^{150}Lu p decay (43 μs) [2003Gi10](#),[2003Ro21](#)

Parent: ^{150}Lu : $E=22\ 7$; $J^\pi=(1^-, 2^-)$; $T_{1/2}=43\ \mu\text{s}\ 7$; $Q(p)=1269.6\ 23$; %p decay=100

^{150}Lu -E: From difference between measured proton-decay energies of g.s. and this level.

^{150}Lu - J^π : $(1^-, 2^-)$ from [2001Fe05](#) and [2003Ro21](#), based on coupling of $K^\pi=3/2^+$ proton (from $d_{3/2}$ shell) to $K^\pi=1/2^-$ neutron (Nilsson orbits are assigned for small oblate deformation).

^{150}Lu - $T_{1/2}$: Weighted average of $52.5\ \mu\text{s} +130-87$ ([2003Ro21](#)) and $39\ \mu\text{s} +8-6$ ([2003Gi10](#)). Other: $30\ \mu\text{s} +95-15$ ([2000Gi01](#)).

^{150}Lu - $Q(p)$: From [2021Wa16](#). Nuclear Q value=1283 4 ([2003Ro21](#), including screening correction).

^{150}Lu -%p decay: %p=100 ([2003Ro21](#),[2000Gi01](#)); estimated from experimental and theoretical β -decay half-life of 155 ms ([1997Mo25](#)). Note that theoretical β -decay half-life is 189.7 ms in [2019Mo01](#).

[2000Gi01](#), [2003Gi10](#): ^{150}Lu isotope formed by $^{96}\text{Ru}(^{58}\text{Ni}, p3n)$ with $E=292\ \text{MeV}$ ^{58}Ni beam from the 25-MV tandem accelerator at ORNL, separated by the Recoil Mass Spectrometer and implanted into a double-sided silicon strip detector (DSSD). Measured proton energy and half-life. Isotopic assignment is based on cross section measurements and systematics arguments for proton decay probabilities near $N=82$.

[2003Ro21](#): ^{150}Lu isotope was formed by $^{96}\text{Ru}(^{58}\text{Ni}, p3n)$ with $E=297\ \text{MeV}$ ^{58}Ni beam followed by separation in Fragment Mass Analyzer (FMA) at ANL and implantation in a DSSD. Measured proton energy and half-life.

Theory and J^π assignments: [2001Fe05](#).

Theoretical studies: consult the NSR database at www.nndc.bnl.gov for about 40 references for proton radioactivity calculations.

 ^{149}Yb Levels

<u>E(level)</u>	<u>J^π</u>	<u>$T_{1/2}$</u>	<u>Comments</u>
0	$(1/2^+)$	0.7 s 2	$J^\pi, T_{1/2}$: from the Adopted Levels.

Protons (^{149}Yb)

<u>E(p)</u>	<u>E(^{149}Yb)</u>	<u>L</u>	<u>Comments</u>
1283 6	0	(2)	for proton decay. The $L=(2)$ value implies that the $E(p)$: weighted average of 1286 6 (2003Ro21) and 1277 8 (2003Gi10). Other: 1295 15 (2000Gi01). L : from comparison of experimental and calculated $T_{1/2}$ for proton decay. The $L=(2)$ value implies that the proton is emitted from $d_{3/2}$ proton orbital in ^{150}Lu .

Adopted Levels

$Q(\beta^-)=12170$ *calc*; $S(n)=13520$ *calc*; $S(p)=-1920$ 20; $Q(\alpha)=4890$ *calc* [2019Mo01,2022Au01](#)

$S(p)$: Measured by [2022Au01](#). Theoretical $S(p)=-1520$ ([2019Mo01](#)).

$Q(\beta^-), S(n), Q(\alpha)$: theoretical values from [2019Mo01](#). No Q values and particle-separation energies are given in [2021Wa16](#).

[2022Au01](#): ^{149}Lu isotope discovered by [2022Au01](#) from the observation of proton emission activity, attributed to the decay of

$11/2^-$ g.s state in ^{149}Lu based on the measured mass number and production channel of the recoiling nuclei. Reaction used was $^{96}\text{Ru}(^{58}\text{Ni}, 4np)$ with $E(^{58}\text{Ni})=310, 320$ MeV beams from the K130 cyclotron of University of Jyväskylä. Target was a $170 \mu\text{g}/\text{cm}^2$ thick layer of enriched ^{96}Ru on a beam-facing $150 \mu\text{g}/\text{cm}^2$ aluminum foil. Evaporation residues were separated using the Mass Analyzing Recoil Apparatus (MARA) according to mass-to-charge state ratios and time-of-flight, and implanted into a double-sided silicon strip detector (DSSD) consisting of 192×72 strips, with delayed γ rays detected using three broad-energy Ge detectors. Measured energy spectrum of protons from ^{149}Lu decay, (implants)(proton)-correlations, $T_{1/2}$ of ^{149}Lu decay, and proton-decay Q -value. Comparisons with theoretical calculations.

 ^{149}Lu Levels

<u>E(level)</u>	<u>J^π</u>	<u>$T_{1/2}$</u>	<u>Comments</u>
0	$(11/2^-)$	0.45 ms +17–10	%p=100 Only the proton decay has been observed. From theoretical $T_{1/2}(\beta)=0.121$ s and $T_{1/2}(\alpha)=102$ s (2019Mo01), proton decay is expected to be the dominant decay mode. J^π: proton transition from the decay of ^{149}Ho interpreted by 2022Au01 as $L(p)=5, \pi_{h11/2}$ from comparison of experimental proton-decay decay rate with theoretical predictions. From quasiparticle calculations, authors also concluded that ^{149}Lu nuclide was the most oblate-deformed proton emitter observed to date. $T_{1/2}$: measured by 2022Au01 from 14 (implant)(proton)-time correlated events.

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