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NUCLEAR STRUCTURE REFERENCES CODING MANUAL

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INFORMATION ANALYSIS CENTER REPORT

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Contents

I. Introduction

This manual is intended as a guide to Nuclear Structure References (NSR) compilers. The basic conventions followed at the National Nuclear Data Center (NNDC), which are compatible with the maintenance and updating of and retrieval from the Nuclear Structure References (NSR) file, are outlined.

In Sec. II, the structure of the NSR file such as the valid record identifiers, record contents, text fields as well as the major TOPICS for which <KEYWORDS> are prepared are ennumerated. Relevant comments regarding a new entry into the NSR file, assignment of <KEYNO >, generation of <SELECTRS> and linkage characteristics are also given in Sec. II. In Sec. III, a brief definition of the Keyword abstract is given followed by specific examples; for each TOPIC, the criteria for inclusion of an article as an entry into the NSR file as well as coding procedures are described. Authors submitting articles to Journals which require Keyword abstracts should follow the illustrations in Sec. III. The scope of the literature covered at NNDC, the categorization into Primary and Secondary sources etc. is discussed in Sec. IV. Useful information regarding permitted character sets, recommended abbreviations etc. is given under Sec. V as Appendices.

II. Structure of the NSR File

The NSR file * originated at the Nuclear Data Project (NDP) as a program for systematic evaluation of Nuclear Strcuture data. Each entry in this computer master file is characterized and uniquely identified by a Keynumber, Topic and Keywords. It has been used since 1969 to produce bibliographic citations for special topics; in particular periodic additions to the file are retrieved and published as the "Recent References" issues of the Nuclear Data Sheets. In October 1980, the maintenance and updating of the NSR file became the responsibility of NNDC at Brookhaven National Laboratory. The basic contents of the NSR file remained unchanged as a result of the transfer to NNDC. The file uses the ADSEP+ format with logical records initiated by a ten character identifier. The file contains 80 character physical records with the start of each logical record coinciding with the beginning of a physical record.

The legal record identifiers are:

<KEYNO > - Reference keynumber

<HISTORY > - Administrative record (new)

<CODEN > - Standard form reference

<REFRENCE> - Free text reference

<AUTHORS > - Author names

<TITLE > - Reference title

<KEYWORDS> - Keyword abstract

<SELECTRS> - Indexing parameter list

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*W.B. Ewbank, "The Nuclear Structure References (NSR) File," ORNL-5397 (1978).

+A.A. Brooks, "An Automated Data Set Editing Program," CTC-34 (1970)

Only these record types appear in the file and they appear in the above order. Only one record of each type appears in the file for each reference, except for <KEYWORDS> and <SELECTRS> which will be repeated for each major category (i.e., NUCLEAR REACTIONS, NUCLEAR STUCTURE, etc.) under which the reference is indexed.

A. <KEYNO >

The record contents are unchanged. The keynumber has six characters. The first two, the publication year; the second two, the first two letters of the first author's last name; and the final two a unique identifier (2 digits for a Primary reference or 2 letters for a Secondary reference). The only change is that the keynumbers are upper case as shown in example below.

76LA03 - Primary

76LAZY - Secondary

For an initial entry prepared in the "compiled" mode (see <HISTORY > record below) the keynumber will have five characters. The first four have the same significance as above. The last character is P for Primary source, S for Secondary source. Thus in the update input file the record would be

<KEYNO > 76LAP

or <KEYNO > 76LAS

The program which updates the NSR data base will assign the complete keynumber for the reference.

B. <HISTORY >

This is a new record. It contains a single character code followed by a date in the form YYMMDD.

The possible codes are:

A - added

M - modified

D - deleted

C - compiled (for use by NSR compilers preparing a new entry)

Examples: <HISTORY >A800211 New reference entry after update of NSR data base

<HISTORY >M791122 Modified reference entry

<HISTORY >D800101 Deleted reference entry

<HISTORY >C840101 New reference entry prepared for NSR data base update

C. <CODEN >

The record contents are essentially unchanged. The field consists of a reference-type code of not more than 70 characters terminating with a blank. The short form of the reference then follows.

The permitted reference types are:

JOUR - Journal

CONF - Conference

REPT - Report

BOOK - Book

PC - Private Communication

THESIS - Thesis

PREPRINT - Preprint

The only change is the introduction of the code JOUR for journal. Previously there was no reference type code preceding the CODEN for a journal. For Primary sources (Journals) the <CODEN > format is standard. A list of Journals scanned at NNDC together with the internationally approved <CODEN > is attached (Sec. V Appendix C). A typical <CODEN > entry given below:

<CODEN >JOUR PRVCA 18 424

represents an article from Phys. Rev. C18, Page 424.

For Secondary sources except when the reference type is JOUR, the format depends on the reference type. Typical <CODEN> entries are considered in sequence below:

JOUR: Abstracts of Physical Society meetings and Theses are coded under this category:

<CODEN >JOUR CODEN # #,#,First Author's Last name

Example: <CODEN >JOUR BAPSA 18 720,KK12,Nawrocki

Volume No. Page No. Abstr. No.

Example: <CODEN >JOUR DABBB 41,4162,Liu

Volume No. Page No.

CONF: Generally all contributed papers with new data are coded. Invited talks and reviews are inclued only if they discuss new data relevant to NSR.

<CODEN >CONF Location held(Subject),P#,First Author's last name

Example: <CODEN >CONF Studsvik(n,Gamma Spectroscopy),P403,Bohm

If the Reference was a contributed paper from Proceedings of the Conference published separately from Invited Talks:

Example: <CODEN >CONF Tokyo(Nuclear Structure) Proc,P403,Bohm

If the Reference was from the Contributions to the Conference published separately from Invited Talks:

Example: <CODEN >CONF Tokyo(Nuclear Structure) Contrib,P403,Bohm

If conference Proceedings had a Report Code assigned:
Example: <CODEN >CONF Leysin Vol2 P1093, CERN-70-30

Note: The above example also illustrates how multi-volumed sources are coded. The Vol# appears immediatly before the page specificiation.

Conferences on Nuclear Spectroscopy and Nuclear Structure held in the USSR
Example: <CODEN >CONF Erevan,P71,Burmistov

REPT:

<CODEN >REPT CODE-#,P#,First Author's last name

Example: <CODEN >REPT INDC(CCP)-164/1,P9,Skarastov

If References are from Annual Reports of Labortories without specific code number:

Example: <CODEN >REPT Univ. Arkansas Nucl. Chem. Ann. Rept. ,P4,Kantele

If Reference is taken from Annual Reports of Laboratories with assigned code:

Example: <CODEN >REPT MSUCL 1978 Annual,P50,Daly

BOOK:

<CODEN >BOOK Title/Abbreviated Title, Publisher

Example: <CODEN >BOOK Table of Isotopes, 7th Ed., John Wiley and Sons

PC:

<CODEN >PC First Author's initials separated by 1 space followed by last name

Example: <CODEN >PC E Spejewski

If Private Communication was dated:

Example: <CODEN >PC E Spejewski,5/28/80

If Private Communication was quoted by another reference already in NSR file:

Example: <CODEN >PC E Spejewski,quoted by 81P002

If quoted Private Communication was dated:

Example: <CODEN >PC E Spejewski,quoted by 81P002 5/13/81

THESIS:

<CODEN >THESIS Author's initials separated by 1 space followed by last name,Affiliation

Example: <CODEN >THESIS W Roney,Univ New Mexico

If Thesis has been assigned a Report Number:

Example: <CODEN >THESIS W Roney,Univ New Mexico,LA-4198

If Thesis abstract is published in Dissertation Abstracts

Example: <CODEN >THESIS W Roney,Univ New Mexico,DABBB 32 2339

Volume No. Page No.

PREPRINT:

Preprints included in NSR file generally have a code number like reports.

Example: <CODEN >PREPRINT PPP/4-81,Ajzenberg-Selove

If preprint has no code number but is dated and author's name is available, then <CODEN > will be as in example given below.

Example: <CODEN >PREPRINT Ajzenberg-Selove, M/D/Y

D. <REFRENCE>, <AUTHORS >, <TITLE >

These are free text fields with no changes in structure or content. All primary references must have these three records. They can exceed 70 characters. The <REFRENCE> field for Primary sources is standardized. For the <CODEN > example given above (Sec. IIC), this will be

<REFRENCE>Phys.Rev. C18, 424 (1980)

If an Erratum is published for this Reference in a subsequent issue of the Journal the entry will be modified as:

<REFRENCE>Phys.Rev. C18, 424 (1980); Erratum Phys.Rev. C19, 530 (1981)

For the Russian Journals for which English Translations are available this information is included in the <REFRENCE> field. A list of the Journal CODEN together with the modification to the <REFRENCE> field is given below. The modification follows the original information in this field as in the case of an Erratum discussed above.

CODEN	Add to <REFRENCE> field	Vol#	Pge#	(year)
YAFIA	; Sov.J.Nucl.Phys.	,	(	)
PZETA	; JETP Lett.(USSR)	,	(	)
AENGA	; Sov.At.Energy	,	(	)
ZETFA	; Sov.Phys.JETP	,	(	)
FECAA	; Sov.J.Part.Nucl	,	(	)
UFNAA	; Sov.Phys.Usp.	,	(	)

eg: YAFIA ; Sov.J.Nucl.Phys. 45, 123 (1980)

Exception

		Vol#	Iss.#	pge#	(year)
IANFA	; Bull.Acad.Sci.USSR, Phys.Ser.	42,	No.11,	14	(1978)

For Secondary sources classified as JOUR, the format is standard. For all the others it is nonstandard. The <REFRENCE> fields for the examples discussed in the <CODEN> section (Sec. IIC) are considered in sequence.

JOUR:

CODEN:BAPSA

<REFRENCE>Bull. Am. Phys. Soc. 18, No.4, 720, KK12 (1980)

Issue Number

CODEN:DABBB

<REFRENCE>Diss. Abst. Int. 41B, 4162 (1980)

CODEN:PHCAA

<REFERENCE>Phys. Can. 33, No.3, p.9, CF9 (year)

CONF:

<REFRENCE>Intern. Conf. Neutron Capture Gamma-Ray Spectroscopy, Studsvik, p.403 (1969)

<REFRENCE>Proc. Intern. Conf. Nucl. Struc., Tokyo, p.403 (1969)

If Editors and Publishers are mentioned then before p.# in example above in <REFRENCE> field add:

, A. Arima, K. Ogata Eds., Plenum Press, New York, p.403 (year)

Editors Publishers location year published

If conference date is different from actual date of publication of proceedings, then use the following format:

<REFRENCE>Proc. Intern. Conf. Nucl. Struct., Tokyo (1969), A. Arima, K. Ogata, Eds., Plenum Press, New York, p. 403 (1970)

If the Reference was taken from Contributions to the International Conference then:

<REFRENCE>Contrib. Intern. Conf. Nucl. Struct., p.403 (1969)

If Conference Proceedings had a Report Code:

<REFRENCE>Proc. Intern. Conf. Prop. Nuclei, Leysin, Switzerland, Vol. 2, p.1093 (1970); CERN-70-30 (1970)

For Conferences held in the USSR on Nuclear Spectroscopy and Nuclear Structure:

<REFRENCE>Program and Theses, Proc. 19th Ann. Conf. Nucl. Spectrosc. Struct. At. Nuclei, Erevan, p.71 (1969)

REPT:

If a Report has code number assigned:

Example: <REFRENCE>INDC(CCP)-164/L, p.9 (1981)

If Reference is from Annual Reports of Laboratories without specific Code Number:

Example: <REFRENCE>Univ. Arkansas, Nucl. Chem. Res., Ann. Rept., p.4 (1963)

If Laboratories have specific code:

Example: <REFRENCE>Mich. State Univ. Cyclotron Lab. Ann. Rept., p.50 (1978)

where CODE MSUCL has been expanded in <REFRENCE> field

BOOK:

<REFRENCE>Title, Publisher, Address (year)

Example: <REFRENCE>Table of Isotopes, 7th Ed., John Wiley and Sons, Inc., Ne w York (1978)

PC:

Example: <REFRENCE>Priv. Comm. (1980)

If Private Communication was dated:

Example: <REFRENCE>Priv. Comm. (May 1980)

If Private Communication was quoted by another reference already in NSR file:

Example: <REFRENCE>Priv. Comm., quoted by 81P002 unpublished (1979)

THESIS:

<REFRENCE>Thesis, Affiliation (year)

Example: <REFRENCE>Thesis, Univ. New Mexico (1969)

If Thesis has been assigned Report Number:

Example: <REFRENCE>Thesis, Univ. New Mexico (1969); LA-4198 (1969)

If Thesis abstract is published in Dissertation Abstracts

Example: <REFRENCE>Thesis, Univ. New Mexico (1969); Diss. Abst. Int. 32B, 2229 (1969)

PREPRINT:

If PREPRINT has code number

<REFRENCE>CODE-# (year)

Example: <REFRENCE>PPP/4-81 (1981)

If there is no code number

Example: <REFRENCE>Priv. Comm. (1981)

E. <KEYWORDS>

The allowed major TOPICS are:

NUCLEAR REACTIONS

RADIOACTIVITY

NUCLEAR STRUCTURE

NUCLEAR MOMENTS

COMPILATION

ATOMIC PHYSICS

ATOMIC MASSES

The details for the preparation and coding of <KEYWORDS> are given in Sec. III.

F. <SELECTRS>

This field has been totally redesigned to improve processing and retrieval capability. It is an all upper case field with entries for each indexable parameter for the reference.

The format of each entry is as follows:

(parameter type):(parameter value);(link variable).

Entries are placed successively in the record separated by a single blank. The valid parameter types are:

N - Nuclide or element for which structure or decay information is presented.

T - Target nuclide or element in a reaction.

R - Reaction

S - Special subject or minor category

M - Measured quantity

D - Deduced quantity

C - Calculated quantity

X - Compiled or evaluated quantity

Z - Range of Z Z:12-24

A - Range of A A:13-29

Dictionaries of valid entries (parameter values) are available on request.

A typical <SELECTRS> field generated by the entry programme for Radioactive decay of ^{249}Cf may appear as

<SELECTRS>N249CF;A. M:G-SPECTRA; A. M:A-DECAY;A. N:245CM;B. D:T1/2;B.

where the link variable A is for the Parent nucleus for which measurements were made while B is for the Daughter nucleus whose properties were deduced.

Another example given below is generated when the angular distribution of outgoing protons is measured in the reaction $^{16}O(n,p)$

<SELECTRS>T:160;A. R:(N,P);A. M:DSIGMA,A.

G. The character sets used in the NSR file are given in Sec. V Appendix A.

III. Keywords

A. General

a) Definition: A miniabstract of essential information from publication. It is headed by a TOPIC and contains brief sentences describing what was measured/calculated/analyzed/compiled followed by what was deduced. Additional details such as experimental techniques, theoretical formalisms, etc., are given as comments at the end. The keywords string should terminate with a period. Specific punctuation rules should be followed. These rules are illustrated by examples under each topic in Sec. III B.

b) Recommended Abbreviations: The abbreviations and symbols used are given in the introduction and inside back cover of each Recent References issue of Nuclear Data Sheets. These are summarized in Sec. V, Appendix B.

c) General Keywords Format:

<KEYWORDS>PARAMETER 1 PARAMETER 2; PARAMETER 3; PARAMETER 4; PARAMETER 5. PARAM
ETER 6 PARAMETER 7.

PARAMETER 1: Topic Specification:

Major Topic: Example: NUCLEAR REACTIONS

Major Topic,Minor Topic: Example: ATOMIC PHYSICS, Mesic Atoms

PARAMETER 2: String of Nuclei investigated. This item is specified for all Topics. The delimiter ';' is used for all topics except NUCLEAR REACTIONS/ATOMIC PHYSICS. For these two cases PARAMETER 3 follows immediately without any punctuation mark.

PARAMETER 3: (projectile, outgoing particle),projectile energy, energy range, energy units. This parameter is specified only for NUCLEAR REACTIONS/ATOMIC PHYSICS entries.

PARAMETER 4: specification of measured/calculated/analyzed/compiled quantities. A space precedes this Parameter specification.

PARAMETER 5: specification of deduced quantities of a general nature.

PARAMETER 6: specification of deduced Nuclear Properties. String of Nuclei followed by deduced ____.

PARAMETER 7: comments relevant to Experimental and/or Theoretical techniques.

All keywords must terminate with '.' as the delimiter. The 'typical entry' examples given in Sec. III B correspond exactly to the Keypunch input to the NSR file. Exactly 80 characters are allowed per line in the Keyword string; punctuation marks and blank spaces are also as shown in examples.

B. Specification of Topic, Inclusion Criteria, Coding Procedures, Typical Entries

Topic: NUCLEAR REACTIONS:

Inclusion Criteria

Hadron, light-, heavy-ion, electron, photon, meson induced reactions, fission are included. Projectile energy has to be within the nonrelativistic limit. For proton-induced reactions the upper limit for incident energy is set at 1 GeV.

Projectile energy or related quantities in keyword string can be specified in any of the following ways:

i) E = ---MeV; implies projectile energy was specified in the article in the laboratory frame.

ii) E(cm)= ---MeV; this is used when the researchers have quoted projectile energy in center-of-mass system.

iii) E = ---MeV/nucleon; this is used for heavy-ion reactions when in the article the laboratory energy is not specified anywhere in units of MeV.

iv) E at --- MeV/c; this notation is used when projectile momentum is specified.

v) E at rest; used for meson capture reactions.

vi) E>

E< are also used when energy range is only approximately defined in the article

E≈

vii) E = threshold ---MeV;

viii) E not given; used when the projectile energy is not specified anywhere in the article.

		E = reactor spectrum	
ix)	For neutron induced reactions	E = low	
		E = slow	can be used
		E = fast	
		E = thermal	
x)	For charged particle projectiles	E = tandem	can be used
		E = cyclotron	

Coding Procedure

i) under this topic a string of target nuclei may be included, as well as different reactions induced by a given projectile. The residual nuclei can also be included as a string.

<KEYWORDS>NUCLEAR REACTIONS {+12},{+13}C(d,d),(d,p),E=0.4-0.85 MeV; measured |s(E,|q); deduced optical-model parameters. {+13},{+14}C levels deduced S. E nriched targets. DWBA analysis.

Note:

The reaction string for given projectile energy is terminated by ',' The delimiter ';' is used to indicate that measured/calculated/analyzed/compiled quantities will follow. The delimiter ';' is used to separate a general deduction such as the determination of optical model parameters from any specific nuclear properties that may be deduced. The delimiter '.' which is the next punctuation mark in this example indicates that deductions regarding the nuclei $^{13,14}C$ will follow. Finally, the comment pertaining to experiment 'Enriched target' is separated from the theoretical procedure 'DWBA analysis' by a '.' as a delimiter.

ii) Different reactions used to reach a given set of final nuclei with measured and deduced quantities being the same should be coded as in the following:

<KEYWORDS>NUCLEAR REACTIONS {+117}Sn(|a,n),E=16,18,20 MeV; {+119}Sn(|a,n),E=18 MeV; {+114}Sn(|a,2n),E=22,24 MeV; {+116}Sn(|a,2n),E=22 MeV; {+106}Pd({+12}C,2n),E=58 MeV; {+110}Pd({+13}C,3n),E=40,45,49,52 MeV; {+110}Cd({+13}C,3n),E=52 MeV; measured |g|g-coin,|g(|q),|s(E|q). {+116},{+118},{+120},{+122}Te,{+120}Xe deduced levels,J,|p. Enriched targets,Ge(Li) detectors.

iii) Different reactions, different measured quantities; coding should be as given below.

<KEYWORDS>NUCLEAR REACTIONS {+12},{+13}C({+32}S,{+32}S),({+28}Si,{+28}Si),E=55-99 MeV; measured |s(|q=180{+0},E); {+12}C{+32}S,{+32}S),E=65-99 MeV; measured |s(|q). Parity dependent potential,optical model.

iv) Fission reactions are included in the following format.

<KEYWORDS>NUCLEAR REACTIONS {235}U(n,F),E=1-1000 eV; measured |s(E),fission fragment-fragment (|q).

Note: for proper indexing under the subject Fission, the word fission has to appear in the keyword string. The minor topic specification is no longer allowed for NSR entries.

v) Theoretical work on nuclear reactions is coded exactly like an experimental abstract except that measured is replaced by calculated. Deduced information is included if available

<KEYWORDS>NUCLEAR REACTIONS {+12}C({+6}Li,{+6}Li),({+6}Li,d),E=13 MeV; calcul ated |s(|q). Optical,DWBA models.

vi) NSR file entry program now automatically indexes residual nuclei in a nuclear reaction when the outgoing particles are fully specified. In cases where this is not possible, such as in the case of spallation, neutron, neutron plus charged particle evaporation reactions, residual nuclei will be indexed if the keyword string is written as shown in the example below.

NUCLEAR REACTIONS {+54}Fe({+58}Ni,X){+72}Zn/{+73}Zn/{+61}Fe/ +62 Fe, E = 108 MeV; measured residuals production|s. Activation technique

In the above example, the residual nuclei $^{70,73}Zn,^{61,62}Fe$ produced in the spallation reaction are specified just before the projectile energy part of Parameter 3 (P18) is specified. The delimiter '/' is used to allow the indexing program to pick out the residual nuclei in sequence.

Topic: RADIOACTIVITY

Inclusion Criteria: γ-,β-,α-decay,delayed-particle emission, internal conversion, spontaneous fission related information is included. For a given nuclide, all possible decay modes are specified. If there is a string of nuclei, all nuclei with a given decay mode can be bunched together and the decay mode specified just before the last nuclide. This will result in proper indexing and economy of indexing variables

generated in the <SELECTRS> string. This is illustrated in the examples given below.

Coding Procedure: The items measured/calculated/analyzed/and deduced are separated by delimiters (punctuation marks) analogous to NUCLEAR REACTIONS entries

i) <KEYWORDS>RADIOACTIVITY {+62m}Co(β+),(EC); measured T{½},E|b,|b|g-coin,|g CP; deduced log ft,Q. {+62}Ni deduced levels,J,ICC. Ge(Li) detector.

Note: the delimiter ';' is used after Parent Nucleus specification while the delimiter '.' is used before Daughter Nucleus specification.

ii) Parent Nuclei should follow in a string after Topic is specified. Daughter nuclei should also follow in sequence if same quantities are deduced.

<KEYWORDS>RADIOACTIVITY {+230}Ra,{+230}Ac(|b{+-}); measured E|g,I|g,E|b; deduced log ft. {+230}Ac,{+230}Th deduced levels.

iii) Theoretical work under this topic is coded as:

<KEYWORDS>RADIOACTIVITY {+186}Re(|b{+-},(EC); {+188}Re,{+176m}Lu(|b{+-}); calculated log ft,|b-decay strength function.

iv) General deductions as well as Daughter Nuclear properties deduced:

RADIOACTIVITY {+227}Th(|a); measured |g|(q,H) in Ni,Co,Fe; deduced hyperfine fields . {+223 }Ra level deduced g.

v) Spontaneous Fission:

<KEYWORDS>RADIOACTIVITY {+252}Cf(SF); measured {$T_{1/2}$},(fragment) |g-coin.

vi) Coding with identification of method, reaction etc. used in producing activity.

<KEYWORDS>RADIOACTIVITY {+173}Lu(EC) [from Ta(p,X),E=1 GeV]; measured --etc.

<KEYWORDS>RADIOACTIVITY {+188}Au(EC),(|b{++}) [from on-line separator]; measured ---etc.

Topic: NUCLEAR STRUCTURE

Inclusion Criteria:

Any model calculation of levels, electromagnetic transition probabilities, multipole moments, nuclear form factors, giant resonance characteristics, nuclear systematics, binding energies, etc.

Coding Procedures:

i) <KEYWORDS>NUCLEAR STRUCTURE {+14},{+15}N,{+16},{+17},{+18}O; calculated single-particle binding energies. Hartree-Fock method,parity mixing.

ii) <KEYWORDS>NUCLEAR STRUCTURE {+106},{+108},{+110}Cd; calculated levels,B(|1). Pairing, quadrupole interaction.

Note: Nuclei are given in sequence following Topic specification and the delimiter ';' is used before "calculated". The delimiter ';' will be used after all calculated quantities have been specified and before any deduced items are enumerated. The comment statements regarding model, interactions etc. will follow after the delimiter '.'

iii) A definite mass or mass range specification can be use before delimiter ';' and after topic specification.

<KEYWORDS>NUCLEAR STRUCTURE A=42; calculated..... ; deduced.....

<KEYWORDS>NUCLEAR STRUCTURE A=42-48; calculated .....; deduced .....

Topic: NUCLEAR MOMENTS:

Inclusion criteria

Hyperfine structure, isotope shift, mesic X-rays, isomer shift information. Both experimental and theoretical articles are coded. The format is similar to RADIOACTIVITY entries.

Coding procedure:

i) <KEYWORDS>NUCLEAR MOMENTS {+131},{+132}Cs; measured hfs,a,b; deduced |m,quadrupole moment.

ii) <KEYWORDS>NUCLEAR MOMENTS {+144},{+148}Sm; measured muonic X-rays; deduced nuclear charge distribution parameters. {+144},{+148}Sm level deduced quad rupole moment.

Topic: COMPILATION

Inclusion Criteria: any evaluation of nuclear structure, radioactivity data.

Coding Procedure:

i) <KEYWORDS>COMPILATION A=16; compiled,evaluated structure data.

ii) <KEYWORDS>COMPILATION {+197}Ir,{+197}Pt; compiled,evaluated structure data.

Topic: ATOMIC PHYSICS

Inclusion Criteria: Mesic atoms, charged-particle induced X-ray emission, ionization probabilities etc.

Coding Procedure:

Format could be either as in NUCLEAR REACTIONS/RADIOACTIVITY/NUCLEAR MOMENTS.

i)<KEYWORDS>ATOMIC PHYSICS Pb(p,X),E=0.9-3 MeV; Dy(p,X),E=0.6-3 MeV; measure d Σ(L X-ray),I(L X-ray),production |s.

ii)<KEYWORDS>ATOMIC PHYSICS,Mesic Atoms {+181}Ta,{+209}Bi; calculated pionic s hifts,widths. Energy dependent optical potential.

Topic: ATOMIC MASSES

Inclusion Criteria:

A direct measurement, calculation or compilations of Atomic Masses are included.

Coding Procedure:

i) <KEYWORDS>ATOMIC MASSES {+3}H, {+3}He; measured mass difference. Mass spectrometer.

ii) <KEYWORDS>ATOMIC MASSES A=3-50; compiled, evaluated atomic mass data.

MULTIPLE TOPIC KEYWORDING

Article may contain information on more than one topic.

For example a Nuclear Reaction studied, evidence for Radioactive Nuclei deduced and their properties investigated. Then the following will appear as one entry.

<KEYWORDS>NUCLEAR REACTIONS U,Th,Au,Ta(p,X),E=1 GeV; measured E|a,T{1/2} of spallation, fragmentation products; deduced reaction mechanism. Helium jet recoil product separation.

<KEYWORDS>RADIOACTIVITY {+150},{+151}Dy,{+152},{+152m}Ho(|a),(EC),(|b{++}) [from U,Th,Au,Ta(p,X),E=1 GeV]; measured E|a,T{1/2}. Helium jet recoil product separation.

IV. Literature Coverage

About 60-65 Journals from all parts of the world are scanned for information on major Topics of interest (Secs. II, III) and coded. These are the Primary sources. In addition, relevant information from Secondary sources such as Laboratory Reports, Conference Proceedings, Thesis etc. is also coded. A list of Journals and Reports routinely scanned at NNDC is given in Sec. V Appendix C.

V. Appendices

Appendix A: Character Sets to Be Used for Nuclear Structure References

The Nuclear Structure References file uses a part of the extended 8-BIT EBCDIC character set previously defined by ORNL Nuclear Data Project. Attached are three character sets which have been defined and avilable to recipients of the Nuclear Structure References file. Only those characters defined in the 8-BIT EBCDIC system are permitted. One new character, a superscript 'g' has been defined. Several unused or little used characters have been eliminated.

Two other sets are defined for users who do not have 8-BIT character capability on their computers. These are 7-BIT system with control characters to get superscripit, subscript and other nonstandard characters. This system is used internally at NNDC and is available in standard 8-BIT EBCDIC. Finally there is a 6-BIT system in which superscripting, subscripting and nonstandard characters are not allowed. The 8-BIT and 7-BIT systems are compatible and no information is lost translating from one to another. The 6-BIT system represents a degradation of the information in the file. The mapping from 7-BIT to 6-BIT is described later in this document.

Appendix A

EXTENDED EBCDIC SET

Decimal	Hexadecimal	Character	Decimal	Hexadecimal	Character
31	1F	$\tilde{\sim}$	135	87	g
33	21	κ	136	88	h
34	22	Γ	137	89	i
35	23	τ	140	8C	$\leq$
36	24	ϕ	142	8E	$+$ (superscript)
37	25	θ	145	91	j
40	28	σ	146	92	k
41	29	λ	147	93	ℓ
42	2A	ρ	148	94	m
43	2B	δ	149	95	n
44	2C	ε	150	96	o
45	2D	Δ	151	97	p
46	2E	Σ	152	98	q
53	35	^{m} (superscript)	153	99	r
54	36	^{g} (superscript)	154	9A	α
61	3D	$_{/}$ (subscript)	155	9B	β
64	40	(blank)	156	9C	γ
65	41	+	158	9E	$\pm$
75	4B	.	160	A0	$^{-}$ (superscript)
76	4C	<	161	A1	ν
77	4D	(	162	A2	s
78	4E	+	163	A3	t
92	5C	*	164	A4	u
93	5D	)	165	A5	v
94	5E	;	166	A6	w
96	60	-	167	A7	x
97	61	/	168	A8	y
107	6B	,	169	A9	z
108	6C	%	171	AB	μ
110	6E	>	172	AC	π
112	70	0	173	AD	[
113	71	1	174	AE	$\geq$
114	72	2	176	B0	0
115	73	3	177	B1	1
116	74	4 (numeral subscripts)	178	B2	2
117	75	5	179	B3	3 (numeral subscripts)
118	76	6	180	B4	4
119	77	7	181	B5	5
120	78	8	182	B6	6
121	79	9	183	B7	7
122	7A	:	184	B8	8
125	7D	'	185	B9	9
126	7E	=	189	BD	]
129	81	a	190	BE	≠
130	82	b	193-201	C1-C9	A-I
131	83	c	209-217	D1-D9	J-R
132	84	d	226-233	E2-E9	S-Z
133	85	e	240-249	F0-F9	0-9
134	86	f			

Appendix A

Extended 7-Bit ASCII Set

STANDARD AND #1 ALTERNATE CHARACTER SETS

Octal	XX0	XX1	XX2	XX3	XX4	XX5	XX6	XX7
04X	(blank)	!	" (overscore)	#	$	%	&	' (degree)
05X	(← |) →	* (times)	+	±	,	- ÷	.	/	0
06X	0	1	2	3	4	5	6	7
07X	8	9	:	; ‡	< ≤	= ≠	> ≥	? ≈
10X	@	A A	B B	C H	D Δ	E E	F Φ	G Γ
11X	H X	I I	J	K K	L Λ	M M	N N	O O
12X	P Π	Q Θ	R P	S Σ	T T	U ↑	V V	W Ω
13X	X Ξ	Y Ψ	Z Z	[[	↓ (back space)	]]	^ ↑	_ ↓
14X	` ξ	a α	b β	c η	d δ	e ε	f φ	g γ
15X	h χ	i ι	j	k κ	l λ	m μ	n ν	o ο
16X	p π	q θ	r ρ	s σ	t τ	u υ	v ϑ	w ω
17X	x ξ	y ψ	z ζ	begin (|)string	(|)set #1	end (|)string	set (~)#2	

Note: The leftmost character in each box is the standard character for the given octal number, the rightmost character is the alternate character for that octal number. Any character preceded by a |, (174 octal) is the representation for the alternate character. Superscripts and subscripts are denoted by enclosing the appropriate string in braces (octal 173, octal 175) with a + or - following the opening brace (octal 173). Superscript {+ ____} and subscript {- _____}.

SIX-BIT ASCII SYSTEM

In this system the contents of the <REFERENCE>, <AUTHORS>, <TITLE>, and <KEYWORDS> records are the only records affected by the degradation from the 7-BIT to the 6-BIT character set.

The rules for this conversion are as follows:

1. All lower case goes to upper case.
2. All subscript numerals become standard numerals.
3. All superscript numerals become standard numerals.
4. All Greek letters are spelled out with a blank terminator if no blank, period, dash or similar follow the Greek character.
5. Superscript m and g become M- and G-, respectively.
6.] AP =

   → TO

   ≥ GE

   ≤ LE

   ± PM

   [(

   ])

   ≠ NE

   super +,-, +,-, respectively

APPENDIX B: Accepted symbols and Explanations

Symbol	Explanation
a,b,c	dipole, quadrupole, octupole hyperfine interaction constants
A	mass number A=Z+N
ABMR	atomic-beam magnetic resonance
B(λ)	reduced electromagnetic transition probability
CCBA	coupled-channels Born approximation
ce	conversion electron
cm	center of mass
CP	circular polarization
C^2S	one-nucleon spectroscopic strength for pickup, stripping reactions
d	(1) deuteron (2) day
DSA	Doppler shift attenuaion
DSD	direct-semidirect model
DWBA	distorted-wave Born approximation
DWIA	distorted-wave impulse approximation
E	(without subscript) energy of incoming particle in nuclear reaction
Eγ,Eα,Ep	(with subscript) energy of outgoing particles in nuclear reaction
Ed,Et,E(3He) etc.	
EC	electron capture
E1,E2,EL	electric dipole, quadrupole, 2(L)-pole
ENDOR	electron-nucleus double-resonance
EPR,ESR	electron paramagnetic, spin resonance

Symbol	Explanation
EWSR	energy-weighted sum rule
F	fission, fission fragment in a nuclear reaction
fragment	fission fragment, spallation reaction product
g	gyromagnetic ration
GDR	giant dipole resonance
GQR	giant quadrupole resonance
h	hour
H	magnetic field
HF	hindrance factor
HFB	Hartree-Fock-Bogoliubov
hfs	hyperfine structure
I	(with subscript) intensity
IAR	isobaric analog resonance
IAS	isobaric analog state
IB	internal bremsstrahlung
ICC	internal-conversion coefficient
IMPAC	ion implantation perturbed angular correlation technique
IT	isomeric transition
J	total angular momentum quantum number
K	projection of J on nuclear symmetry axis
K,L,M	K-, L-, M-shell internal conversion
K/L	K-, L-conversion electron ratio
L	(1) orbital angular momentum (2) multipolarity (3) L-transfer in stripping, pickup rections

Symbol	Explanation
m	minute
M1,M2,ML	magnetic dipole, quadrupole, 2 (L)-pole
ms	millisecond
N	neutron number, N = A-Z
NMR,NQR	nuclear magnetic, quadrupole resonance
P	(with or without suffix) polarization
PAC	perturbed angular correlation
$p\gamma(\theta)$	angular distribution of γ-rays with respect to a proton beam
$p\gamma(t)$	time distribution of phontons with respect to a pulsed proton beam
PWBA	plane-wave Born approximation
Q	(1) reaction energy (2) disintegration energy
Q(EC)	total disintegration energy in EC decay
Q(β)	total disintegration energy in β-decay
Qα	" " " " α-decay
rms	root-mean-square
RPA	random-phase approximation
s	second
S	Spectroscopic factor
SF	Spontaneous fission
t	(1) time (2) triton
T	(1) isotopic or isobaric spin (2) temperature
$T_{1/2}$	half-life
TDA	Tamm-Dancoff approximation
TDHF	time-dependent Hartree-Fock

Symbol	Explanation
tof	time-of-flight measurement
x	number of ejected particles as in (α, xn)
X	(1) X-ray (2) unspecified reaction product as in (α,X)
y	(1) year (2) number of ejected particles as in (α,xnyp)
z	number of ejected particles as in (^{12}C, xnypz α)
Z	atomic number, Z = A-N
α	α-particle
αγ,βγ,γγ	coincidences between particles 1 and 2
αγ(θ,H,t) βγ(θ,H,t) γγ(θ,H,t)	αγ-, βγ, γγ coincidences as function of angle, magnetic field, time
β_2, β_3,(βL)	quadrupole, octuple, 2^L-pole nuclear deformation parameter
Γ	total level width
Γγ,Γn,Γp	partial width for γ-, n-, p-emission
γ(θ,H,T)	γ -intensity as function of angle, magnetic field, temperature
γ-branching	relative γ-branching from a level
δ	multipole mixing ratios
θ	in-plane, out-of-plane angular dependence
λ	radiation multipolarity
μ	magnetic moment
ν	neutron shell-model configuration
π	(1) level parity (2) proton shell-model configuration
σ,σ(θ),σ(E)	cross section, angular-, energy-dependence
ω(K),ω(L)	K-, L-fluorescence yield

APPENDIX C

Journals Scanned by the National Nuclear Data Center

CODEN	JOURNAL
AAFPA	Ann. Acad. Sci. Fenn., Ser. A VI
ADNDA	At. Data Nucl. Data Tables
AENGA	At. Energ.
ANPHA	Ann. Phys. (Paris)
ANPYA	Ann. Phys. (Leipzig)
ANEND	Ann. Nucl. Energy
APAHA	Acta Phys.
APASA	Acta Phys. Austr.
APNYA	Ann. Phys. (New York)
APOBB	Acta Phys. Pol. B
ASSBA	Ann. Soc. Sci. Brux. Ser. I
ATKEA	Atomkernenergie
ATKOA	ATOMKI Kozlem.
ATPLB	Acta Phys. Pol. A
AUJPA	Aust. J. Phys.
BAPSA	Bull. Amer. Phys. Soc.
BSRSA	Bull. Soc. Roy. Sci. Liege
CHDBA	C. R. Acad. Sci., Ser. B
CHJPA	Chin. J. Phys. (Peking)
CJPHA	Can. J. Phys.
CPHMA	Commentat. Phys. -Math.
CUSCA	Curr. Sci. (India)
CZYPA	Czech. J. Phys. B
DABBB	Diss. Abstr. Int., B
FECAA	Fiz. Elem. Chastits At. Yadra
FZKAA	Fizika
HPACA	Helv. Phys. Acta
HYIND	*Hyperfine Interactions*
IAAFA	Izv. Akad. Nauk Arm. SSR, Ser. Fiz.
IANFA	Izv. Akad. Nauk SSSR, Ser. Fiz.
IJARA	Int. J. Appl. Radiat. Isotop.
IJOPA	Indian J. Pure Appl. Phys.
IJPYA	Indian J. Phys.
INUCA	Inorg. Nucl. Chem. Lett.
IUZFA	Izv. Akad. Nauk Uzb. SSR, Ser. Fiz. -Mat. Nauk
IVUFA	Izv. Vyssh. Ucheb. Zaved., Fiz.
JINCA	J. Inorg. Nucl. Chem.
JNSTA	J. Nucl. Sci. Technol.
JOPQA	J. Phys. (Paris)
JPHGB	J. Phys. (London), G
JPQSA	J. Phys. (Paris), Suppl.
JPSLB	J. Phys. (Paris), Lett.
JUPSA	J. Phys. Soc. Jpn.
KDVSA	Kgl. Dan. Vidensk. Selsk., Mat. -Fys. Medd.
KURAA	Annu. Rep. Res. Reactor Inst., Kyoto Univ.
NCIAA	Nuovo Cim. A
NCLTA	Lett. Nuovo Cim.
NDSBA	Nucl. Data Sheets
NSENA	Nucl. Sci. Eng.
NUIMA	Nucl. Instrum. Methods
NUKLA	Nukleonika
NUPAB	Nucl. Phys. A
NUSBA	Nucl. Sci. Appl., Ser. B
PHBCD	Physica, B, C
PHCAA	Phys. Can.
PHSTB	Phys. Scr.

Journals Scanned by the National Nuclear Data Center

CODEN	JOURNAL
PHYAD	Physica, A
PLRAA	Phys. Rev. A
PLRBA	Phys. Rev. B
PPSSA	Proc. Nucl. Phys. Solid State Phys. Symp.
PRAMC	Pramana
PREAA	Proc. Roy. Soc. Edinburgh, Sect. A
PRLTA	Phys. Rev. Lett.
PRVCA	Phys. Rev. C
PTPKA	Progr. Theor. Phys.
PTPSA	Progr. Theor. Phys. Suppl.
PYLAA	Phys. Lett. A
PYLBB	Phys. Lett. B
PZETA	Pisma Zh. Eksp. Teor. Fiz.
RAACA	Radiochim. Acta
RAISA	Radioisotopes
RMXFA	Rev. Mex. Fiz.
RPHAA	Rev. Phys. Appl.
RRALA	Radiochem. Radioanal. Lett.
RRPQA	Rev. Roum. Phys.
SAPHD	S. Afr. J. Phys.
SCEFA	Stud. Cercet. Fiz.
UFZHA	Ukr. Fiz. Zh.
VMUFA	Vestn. Mosk. Univ., Fiz., Astron.
YAFIA	Yad. Fiz.
ZENAA	Z. Naturforsch. A
ZETFA	Zh. Eksp. Teor. Fiz.
ZPAAD	Z. Phys. A
ZPBBD	Z. Phys. B

Reports Scanned by the National Nuclear Data Center

CODE	REPORT
AECL	At. Energ. Canada Ltd. Prog. Rept.
ANL	Argonne Nat. Lab. Rept.
BNL	Brookhaven Nat. Lab. Rept.
INDC	Intern. Nucl. Data Committee Rept.
INS	Inst. Nucl. Studies, Tokyo
IPCR	Inst. Phys. Chem. Res. Rept., Japan
IPN	Inst. Phys. Nucl., Paris
ISN	Inst. Sci. Nucl., Grenoble
JINR	Joint Inst. Nucl. Res., Dubna
JUL-Spez	Inst. fur Kernphysik, Julich
JYFL	Univ. Jyvaskyla, Finland
LA	Los Alamos Sci. Lab. Rept.
LBL	Lawrence Berkeley Lab. Rept.
NEANDC	Nucl. Energ. Agency Nucl. Data Comm. Rept.
ORNL	Oak Ridge Nat. Lab. Rept.
UTTAC	Univ. Tsukuba Tandem Accelerator Center, Japan
ZFK	Zentralinstitut fur Kernforschung, Dresden