

27  
250715  
7/27/77

MASTER

UCID- 17504

# Lawrence Livermore Laboratory

MEASUREMENT OF THE NEUTRON-INDUCED FISSION CROSS-SECTION OF  $^{243}\text{Am}$   
RELATIVE TO  $^{235}\text{U}$  FROM 0.1 MeV TO 30 MeV

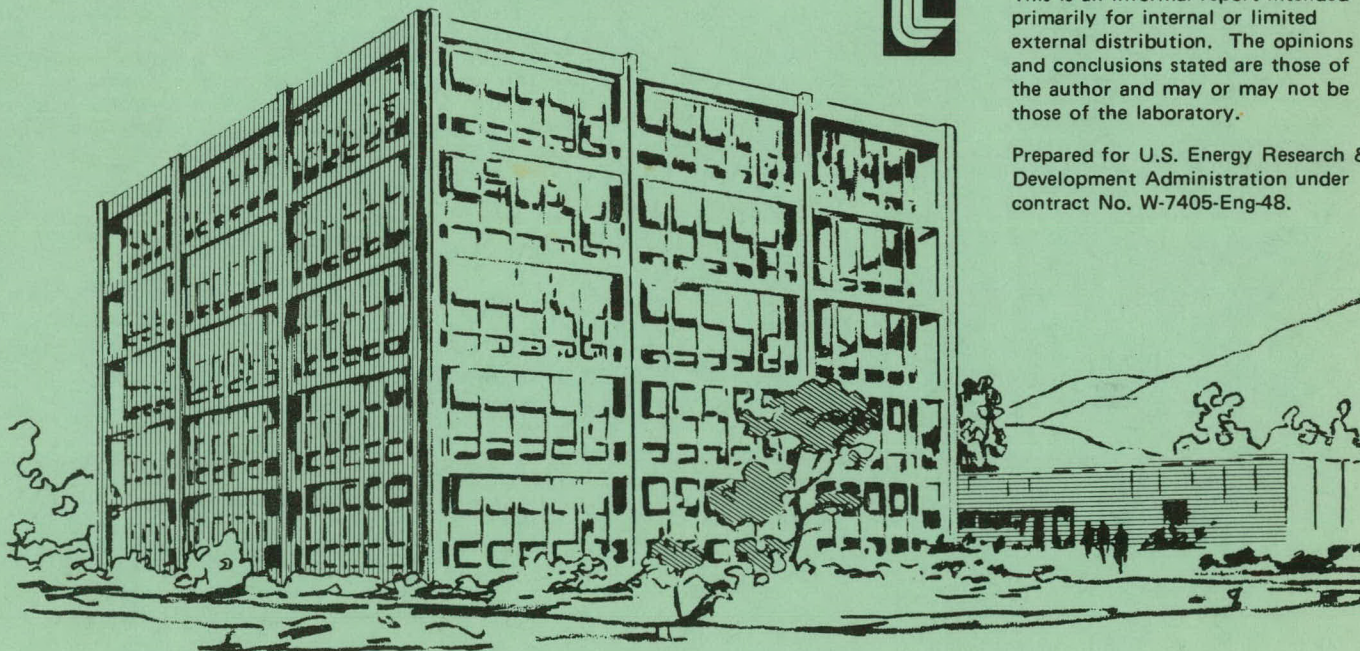
J. W. Behrens

July 7, 1977



This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the laboratory.

Prepared for U.S. Energy Research & Development Administration under contract No. W-7405-Eng-48.



DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

## **DISCLAIMER**

**This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.**

## **DISCLAIMER**

**Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.**

MEASUREMENT OF THE NEUTRON-INDUCED FISSION CROSS-SECTION OF  $^{243}\text{Am}$   
RELATIVE TO  $^{235}\text{U}$  FROM 0.1 MeV TO 30 MeV

ABSTRACT

Continuing our studies of fission cross-section ratios at Lawrence Livermore Laboratory, we have measured the  $^{243}\text{Am}/^{235}\text{U}$  fission cross-section ratio from 0.1 MeV to 30 MeV. Using the threshold method, we obtained a value of  $1.429 \pm 0.037$  for the average cross-section ratio from 1.75 to 4.00 MeV.

PRELIMINARY RESULTS

We measured the fission cross section of  $^{243}\text{Am}$  relative to that of  $^{235}\text{U}$ , using ionization fission chambers at the Lawrence Livermore Laboratory's 100-MeV electron linear accelerator. The time-of-flight technique was used to measure the cross-section ratio as a function of neutron energy over the range 1 keV to 30 MeV. Using the threshold method,<sup>1,2</sup> we obtained a value of  $1.429 \pm 0.037$  for the average cross-section ratio from 1.75 to 4.00 MeV. We made this measurement at the 15.7-m time-of-flight station. Further details of our experimental method appear in Ref. 1.

Figures 1 and 2 show and Table 1 lists our preliminary data for the  $^{243}\text{Am}/^{235}\text{U}$  fission cross-section ratio from 0.1 MeV to 30 MeV. The lines shown in Figs. 1 and 2 were obtained by using files of evaluated fission cross sections.<sup>3</sup>

The Cross Section Evaluation Working Group (CSEWG) responsible for the upcoming ENDF/B-V evaluations requested this brief report. We plan a more complete and formal presentation of this measurement.

NOTICE  
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.



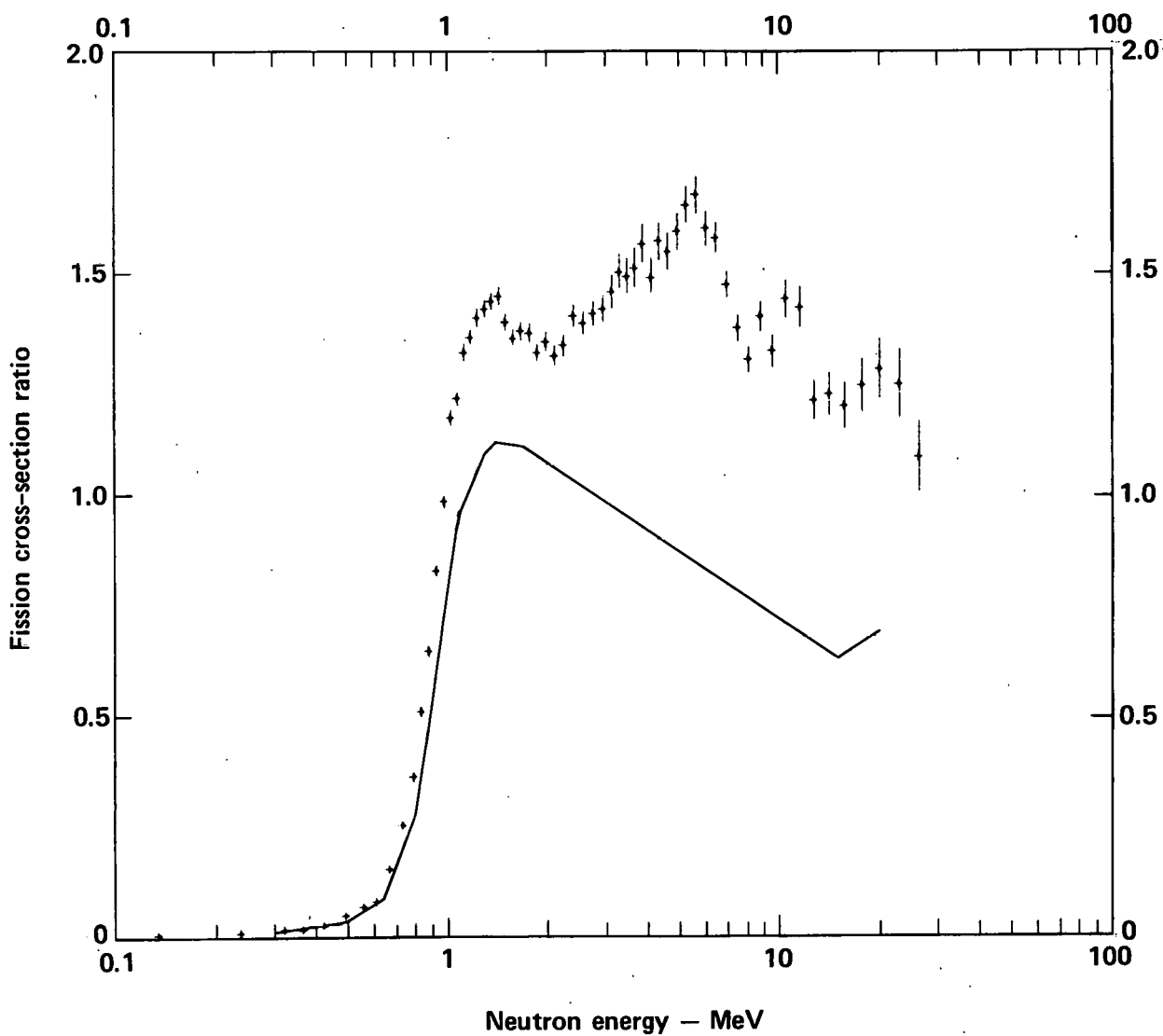


Fig. 1. Ratio of  $^{243}\text{Am}$  to  $^{235}\text{U}$  fission cross sections in the energy range 0.1 to 30 MeV. The line denotes the  $^{243}\text{Am}/^{235}\text{U}$  ratio obtained by using the ENDF/R-TV fission cross-section files.

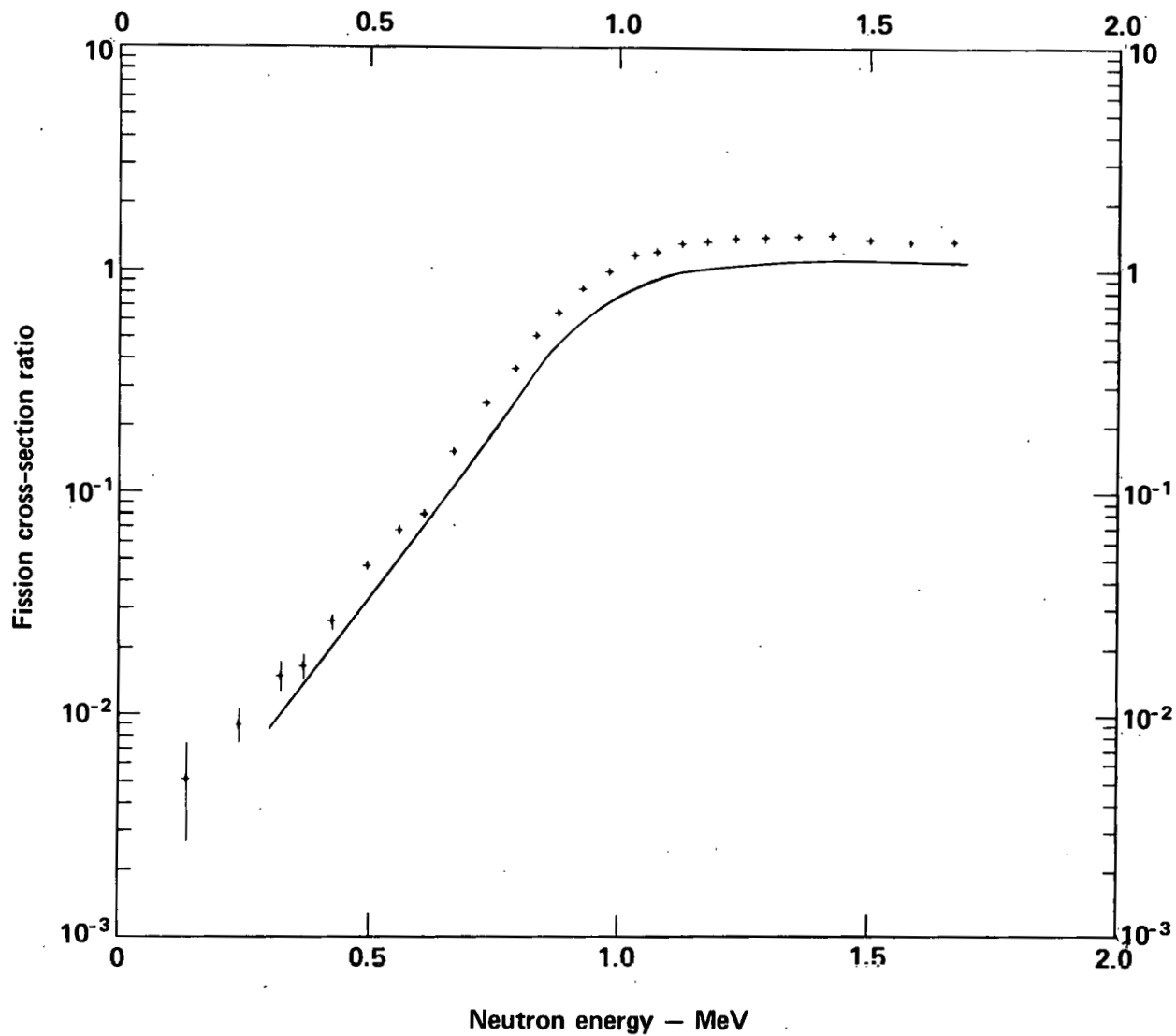


Fig. 2. Ratio of  $^{243}\text{Am}$  to  $^{235}\text{U}$  fission cross sections in the energy range 0.1 to 1.7 MeV. The line denotes the  $^{243}\text{Am}/^{235}\text{U}$  ratio obtained by using the ENDF/B-IV-evaluated fission cross-section files.

Table 1. Fission cross-section ratio of  $^{243}\text{Am}$  to  $^{235}\text{U}$ .

Neutron energy (MeV)	Ratio	Statistical uncertainty <sup>a</sup> (%)	Neutron energy (MeV)	Ratio	Statistical uncertainty <sup>a</sup> (%)
0.1349	0.0051	47.6	2.560	1.386	2.0
0.2395	0.0089	18.3	2.744	1.407	2.1
0.3226	0.0149	16.0	2.947	1.417	2.2
0.3684	0.0165	13.9			
0.4248	0.0262	9.1	3.135	1.456	2.6
			3.299	1.501	2.7
0.4951	0.0470	5.2	3.476	1.490	2.8
0.5600	0.0681	5.7	3.667	1.511	3.0
0.6107	0.0804	4.9	3.874	1.565	2.8
0.6685	0.1521	3.3			
0.7349	0.2535	2.5	4.100	1.489	2.8
			4.346	1.570	2.8
0.7915	0.3621	2.8	4.616	1.547	2.8
0.8329	0.5102	2.4	4.910	1.592	2.7
0.8777	0.6458	2.0	5.235	1.652	2.6
0.9261	0.8279	1.7			
0.9787	0.9830	1.6	5.592	1.675	2.6
			5.988	1.600	2.5
1.028	1.172	1.7	6.427	1.578	2.3
1.074	1.215	1.6	6.916	1.473	2.2
1.123	1.320	1.6	7.464	1.375	2.3
1.175	1.352	1.5			
1.231	1.397	1.5	8.080	1.304	2.4
			8.776	1.401	2.5
1.292	1.418	1.5	9.567	1.323	2.8
1.356	1.435	1.5	10.47	1.442	3.0
1.426	1.446	1.5	11.51	1.423	3.4
1.501	1.388	1.5			
1.582	1.351	1.6	12.71	1.212	3.8
			14.11	1.227	4.0
1.670	1.368	1.7	15.76	1.199	4.4
1.766	1.364	1.6	17.72	1.246	4.9
1.870	1.319	1.7	20.07	1.283	5.4
1.984	1.345	1.7			
2.108	1.313	1.8	22.93	1.249	6.3
			26.45	1.084	7.5
2.244	1.335	1.9	30.88	1.169	8.4
2.394	1.401	1.9			

<sup>a</sup>This indicates a counting error expressed as one standard deviation. Total errors may be estimated by combining the normalization error of 2.6% and the estimated overall systematic error of 2.0% with the counting errors in the table.

## REFERENCES

1. J. W. Behrens and G. W. Carlson, Nucl. Sci. Eng. 63, 250 (1977).
2. J. W. Behrens, *Determination of Absolute Fission Cross Section Ratios Using the Method of Threshold Cross Sections*, Lawrence Livermore Laboratory, Rept. UCRL-51478 (1973).
3. Evaluated Nuclear Data File/Format B - Version IV. This evaluation (ENDF/B-IV) originates at Brookhaven National Laboratory, Upton, N.Y.

CD/ml/mla



# NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research & Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately-owned rights.

# NOTICE

Reference to a company or product name does not imply approval or recommendation of the product by the University of California or the U.S. Energy Research & Development Administration to the exclusion of others that may be suitable.

Printed in the United States of America

Available from

National Technical Information Service

U.S. Department of Commerce

5285 Port Royal Road

Springfield, VA 22161

Price: Printed Copy \$ ; Microfiche \$3.00

Page Range	Domestic Price	Page Range	Domestic Price
001-025	\$ 3.50	326-350	10.00
026-050	4.00	351-375	10.50
051-075	4.50	376-400	10.75
076-100	5.00	401-425	11.00
101-125	5.50	426-450	11.75
126-150	6.00	451-475	12.00
151-175	6.75	476-500	12.50
176-200	7.50	501-525	12.75
201-225	7.75	526-550	13.00
226-250	8.00	551-575	13.50
251-275	9.00	576-600	13.75
276-300	9.25	601-up	*
301-325	9.75		

\* Add \$2.50 for each additional 100 page increment from 601 to 1,000 pages; add \$4.50 for each additional 100 page increment over 1,000 pages.