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ENDF/B-IV DOSIMETRY FILE

Edited by B.A. MAGURNO



April 1975

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NATIONAL NEUTRON CROSS SECTION CENTER

BROOKHAVEN NATIONAL LABORATORY

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INTRODUCTION

The Dosimetry File ⁽¹⁾ issued as part of the ENDF/B-IV Library contains thirty-six reactions in twenty-six isotopes. Each isotope in the ENDF/B-IV Library starts with a brief description of the data and methods used in that particular evaluation (File I). The purpose of this report is to present, where feasible, a more detailed description, summarizing those evaluations that appear on the Dosimetry File.

The Dosimetry File evolved as a consequence of the Task Force assembled at Battelle Northwest by the Normalization and Standards Subcommittee of the Cross Section Evaluation Working Group (CSEWG) to review the cross section sets used for dosimetry purposes in the Inter-laboratory LMFBR Reaction Rate (ILRR) Program. From the list of necessary dosimetry materials prepared by the Task Force, all reactions already included in the ENDF/B General Purpose Library (with subsequent updating) were to be extracted and placed on the Dosimetry File. All other reactions on the list were assigned to Task Force members for evaluation. The "Table of Contents" of this volume lists all the reactions from the Task Force list, name and affiliation of the authors of each evaluation, the particular reaction assigned, and the Material (MAT) Number.

There are several different types of entries in the ensuing pages:

Documentation for threshold reactions (other than fission), which were evaluated by Task Force Members and whose Atomic Number $2 \le 90$, contains a description of the evaluation by the authors, references used, and a series of graphs displaying the experimental data and the evaluated curve in discrete energy regions. Immediately following each evaluation is a reproduction of the data file as it appears on the Dosimetry File and a single curve over the entire energy region plotted from the evaluation on the Dosimetry File.

Documentation for threshold reactions, which were taken from the ENDF/B-IV General Purpose Library and whose $2 \le 90$, contains an extracted porcion of the Summary Documentation⁽²⁾ (found in ENDF-201), and the original report is identified. These reactions are followed (as above) with a reproduction of the data on the Dosimetry File and a single plot of the reaction over the entire energy range.

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Documentation for exoergic reactions, which were evaluated by Task Force members and whose $Z \le 90$, contains a description of the evaluations by the authors and the references used. Following each evaluation is a reproduction of the data on the Dosimetry File and a plot of the data. For convenience, experimental data from the CSISRS⁺ Library outside of the resolved reconance energy region is plotted on the curve. The references for the experimental data sets are included.

Decumentation for excergic reactions (including Threshold Fission), which were taken from the ENDF/B-IV General Purpose Library and whose $Z \leq 90$ contains an extracted portion of the Summary Documentation⁽²⁾ (ENDF-201), and the original report is identified. These reactions are followed by a reproduction of the data on the Dosimetry File, a single plot of the reaction and the experimental data (outside of the Resolved Resonance Energy Region) and the references from CSISRS.

Documentation for reactions whose Z > 90 was considered too complex (e.g. the relationship between ${}^{\sigma}_{f}$, ${}^{\sigma}_{}$ and $\overline{\nu}$) to extract. Since all reactions with Z > 90 are from the ENDF/B-IV General Purpose Library, the reader in need of detailed information is directed to ENDF-201⁽²⁾. In place of summary documentation, File 1 from the ENDF/B-IV General Purpose Library is included here. As in the cases above, a reproduction of the data from the Dosimetry File, a plot of the data, experimental points outside the resolved energy region, and references for the experimental data are included.

In the case of 235 U(n,f), the portion of the curve from ~10 keV-20 MeV is enlarged and included as a separate page.

Because of extenuating circumstances, not all the reactions included here were renormalized to ENDF/B-IV. Those that were not are identified with ENDF/B-III in the Documentation Titles. The reactions include: $3^{22}S(n,p)$, $5^{54}Fe(n,p)$, $5^{56}Fe(n,p)$, $^{115}In(n,n')$, $^{58}Ni(n,p)$.

+ Cross Section Information Storage & Retrieval System(CSISR) Maintained at the National Neutron Cross Section Center.

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Appendix I contains a table of derived parameters, i.e. the Resonance Integral of the excergic reactions and the 250 U Fission Spectrum Average Cross Sections (T = 1.32) of all reactions on the file.

For additional information concerning the evaluated files, as well as corresponding experimental data, contact:

National Neutron Cross Section Center Brookhaven National Laboratory Upton, New York 11973

⁽¹⁾ENDF/B-IV Dosimetry File; Tape 412, issued January 1975

(a) ENDF/B Summary Documentation ENDF-201 - BNL 17541, June 1975

Acknowledgements

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In projects of this nature, the support and encouragement of the individual authors over and above the initial contributions of their manuscripts is necessary and even critical in order to produce a final product. My thanks are extended to all. Special mention is due to L. Stewart of Los Alamos Scientific Laboratory for her efforts in proofreading and criticism of the manuscripts.

Thanks are also extended to all the BNL personnel involved; particularly R. Kinsey of the National Neutron Cross Section Center for directing and C. Brewster and A. Fuoco for producing the graphic portions of this report, and to the Photography and Graphic Arts Division for production of the final pages.

Finally, I wish to recognize and acknowledge the unflagging interest and encouragement shown this project by both P. Hemmig of the U.S. Energy Research Division Administration and S. Pearlstein of the National Neutron Cross Section Center.

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²³ Na(n,Y)	6156	N. C. Paik & T. A. Pitterle	WARD	14
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⁴⁶ Ti(n,p)	6421	B. A. Magurno	BNL	51
⁴⁷ Ti(n,np)	6422	B. A. Magurno	BNL	54
⁴⁷ Ti(n,p)	6422	B. A. Magurno	BNL	54
⁴⁸ Ti(n,np)	6423	B. A. Magurno	BNL	56
⁴⁸ Ti(n,p)	6423	B. A. Magurno	BNL.	56
⁵⁵ Mn(n,2n)	6197	B. A. Magurno & H. Takahashi	BNL	70
⁵⁴ Fe(n,p)	6417	R. E. Schenter	HEDL	74
⁵⁶ Fe(n,p)	6410	N. D. Dudey & R. Kennerley	ANL	80
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⁶³ Cu(n,a)	6411	H. Alter	A.I.*	130
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²³⁸ U(n,f)	6262	See ENDF-201 ⁺		22 9
²³⁸ U(n, _Y)	6262	See ENDF-201 ⁺		22 9
²³⁷ Np(n,f)	6263	See ENDF-201 ⁺		245
²³⁹ Pu(n,f)	6264	See ENDF-201 ⁺		265

*Present Address: U. S. Energy Research Development Administration, Washington D.C. 20045

**Present Address: Brookhaven National Laboratory, Upton, New York 11973

⁺ENDF/B Summary Documentation - ENDF-201 BNL 17541, June 1975

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Total Helium Production Cross Section for Neutron-Induced Reactions on ⁶Li for ENDF/B-IV L. Stewart and G.M. Hale Los Alamos Scientific Laboratory Theoretical Division - January 1975

Below 10 MeV, the following reactions produce alpha particles from neutron interactions with 6 Li:

Reaction	<u>Q (MeV)</u>	Threshold (MeV)
⁶ Li(n,t)α	+4.785	-
⁶ Li(n,n'd)α	-1.472	1.717
⁶ Li(n,2np)a	-3.697	4.313

In the alpha-production Jata that were provided for the Version IV dosimetry file only the ${}^{6}Li(n,t)\alpha$ contribution differs from the Version III dosimetry file. The (n,t) data below 2 MeV are based on the coupled-channel R-matrix analysis by Hale, Dodder, Young, and Stewart that were included in the general purpose Version IV file. The analysis included experimental data for the total and the (n,t) cross sections and various differential cross section measurements for n + ${}^{6}Li$ and α + t elastic scattering, as described in the File 1 comments of the Version IV data.

The (n,n'd) and (n,2np) cross sections are the same as were provided for the Version III dosimetry files and are based on smooth curves through the available experimental data. These data are compared with the Version III evaluation and with experimental

- 1 -

data in Figs. 1 and 2. Note that the dosimetry data for the (n,n'd) and (n,2np) reactions are lower and higher, respectively, than the Version III evaluation. This remark also applies for the Version IV evaluation, which is the same as Version III for the (n,n'd) and (n,2np) reactions.







Figure 2

- 2 -

3-LI- 6 LASL EV	AL-NOV73 HALE,NISLEY AND YOUNG	
DIS	T-1974	
SURCOMMITTEE 12	73. SUPPLIED BY P.G.YOUNG LASI	
DATA TABLE BELOW IS	THE TOTAL HELIUM PRODUCTION CROSS	
SECTION OF LI-6	, FOR CONVENIENCE IT IS LISTED AS	
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BELOW 1.2 MEY BY HALE	DODDER, YOUNG AND STEWART AT LASL JAN 74	
THE NEW DATA RESULT	FROM & COUPLED-CHANNEL R. MATRIX ANALYSIS	
THAT IS DESCRIBED IN '	THE GENERAL FILE.	
RES.PAR. MEE2 MT=1	51 SCATTERING RADIUS ONLY.	
SMOOTH CROSS SECTIO	N MF=3 MT=107(IE N, T ALPHA ONLY)	
BELOW 1.2 MEV BASED	DN REMATRIX ANALYSIS DESCRIBED UNDER MT=1	
ALTHOUGH THE DATA OF	REF 13 WERE NOT EXPLICITLY INCLUDED IN	
RESULTS OF REF 14 AN	3 15 WHICH WERE INCLUDED. IN ADDITION THE	
EVALUATED (N.ALPHA)	ROSS SECTION AGREES WELL WITH THE	
VERSION IN EVALUATION	N OF B-10(N, ALPHA) CROSS SECTION AND THE	
RATIO MEASUREMENT OF	REF, 18, THE (N, ALPHA) BETWEEN 2 AND 15	
KERN AND KREGER DATA	(REF.s)BETWEEN 15 AND 13 MEV.	
REFER	RENCES	
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1970, P153.		i. P
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19. E.T.JURNEY, LASL. PR	IVATE COMMUNICATION, (1973).	2 Martin Carlos
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⁶Li(n,t)

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<u>Yr.</u>	Lab	<u>Author</u>	References
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74	ANL	Poenitz	Priv. Comm. (1974)
73	HAR	Coates	Priv. Comm. (1973)
72	CAD	Fort, et al.	EANDC-(E)-148 (1972)
72	HAR	Clements, et al.	AERE-R-7075 (1972)
67	RBZ	Rendic, et al.	ZFK- <u>130</u> , 143 (1967)
67	ALD	Cox, et al.	J. Nuc. En. <u>21</u> , 271 (1967)
66	ALD	Barry	Conf. Neutron Cross Sections and Tech., Washington D.S. Voll <u>I</u> , 763 (1966)
65	FOA	Conde, et al.	Ark. Fiz. <u>29</u> , 45 (1965)
65	FOA	Schwartz, et al.	Nuc. Phys. <u>63</u> , 593 (1965)
61	CCP	Mikailina, et al.	Sov. Prog. Nuc. Phys. p.185 (1961)
60	HAM	Bormann, et al.	Zeit. Nat. /A <u>15</u> , 200 (1960)
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59	NWU	Pardo, et al.	Bull. Am. Phys. Soc. <u>4</u> , 218 (1959)
59	RIC	Gabbard, et al.	Phys. Rev. <u>114</u> , 201 (1959)
59	LAS	Bame, et al.	Phys. Rev. <u>114</u> , 1580 (1959)
59	ORL	Murray, et al.	Phys. Rev. <u>115</u> , 1707 (1959)
58	NRD	Kern, et al.	Phys. Rev. <u>112</u> , 926 (1958)
57	CCP	Elpidinskii, et al.	At. En./Supp 5, 75 (1957)
56	LAS	R ibe	Phys. Rev. <u>103</u> , 741 (1956)
56	CCP	Gorlov, et al.	Dok. <u>111</u> , 791 (1956)
54	LAS	Frye, Jr.	Phys. Rev. <u>93</u> , 1086 (1954)
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Total Helium Production Cross Section From $n + {}^{10}B$

Interactions for ENDF/B-IV P.G. Young and G.M. Hale Los Alamos Scientific Laboratory Theoretical Division - January 1975

Below 10 MeV, the following reactions produce helium from neutron interactions in $^{10}{\rm B}\text{:}$

	Reaction	Q (masses) <u>MeV</u>	Laboratory <u>Threshold (MeV)</u>
(1)	$10_{B(n,\alpha_{o})}^{7}$ Li	+2.792	-
(2)	$10_{B(n,\alpha_{1})}^{7}$ Li*(478 keV)	+2.314	-
(3)	¹⁰ _{B(n,n'a)} ⁶ Li	-4.461	4.907
(4)	$10_{B(n,t2\alpha)}$	+0.324	-
(5)	$10_{B(n,n'd2\alpha)}$	-5.933	6.526
(6)	$10_{B(n,2np2\alpha)}$	-8.158	8.974

The total helium production cross section was derived by summing the cross sections from reactions (1)-(3) plus twice the sums of reactions (4)-(6). The data for reactions (1), (2), and (4)were taken directly from the Version IV evaluation. Below 1 MeV reactions (1) and (2) are based on a coupled-channel R-matrix analysis, ¹ and reaction (4) on a single-channel analysis. The experimental data included in the analyses are referenced in the File 1 comments of the Version IV evaluation. Above 1 MeV, reac-

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G.M. Hale, P.G. Young, and R.A. Nisley, "R-Matrix Analysis of the n + 10B System at Low Energies," Trans. Am. Nucl. Soc. <u>18</u>, 327 (1974).

tions (1), (2), and (4) are based on smooth curves through experimental data, as outlined in the File 1 comments.

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The contributions from reactions (3) and (5) were also obtained from the Version IV evaluation by summing the appropriate discrete (n,n') cross sections to particle unstable final states, as indicated by LR flags. Reaction (6), which was not included in the Version IV evaluation because of its small magnitude, was estimated from the measurements of Mather² at 14 MeV.

^{2.} D.S. Mather and L.F. Pain, "Measurement of (n,2n) and (n,3n) Cross Sections at 14 MeV Incident Energy," AWRE report 047/69 (1969).

5-8 - 10 LASL EVAL-NOV73 HALE, NISLEY AND YOUNG DIST 1974 ACCEPTED FOR DOS, FILE BY NORMALIZATION AND STANDARDS SUBCOMITTEE 12/73, SUPPLIED BY P.G.YOUNG LASL PERTINENT HOLLORITH FROM GENERAL FILE FOLLOWS, (MAT 1273) MT=151 EFFECTIVE SCATTERING RADIUS = 0,40937E=12 CM MF#3 ----- SMOOTH CROSS SECTION-----THE 2200 M/8 CROSS SECTION ARE AS FOLLOWS, MT=107 SIGMA =3836,5 BARNS MT=113 SIGMA =0,000566 BARNS MT=780 SIGMA =240.51 BARNS MT#781 SIGMA #3596,0 BARNS (N,ALPHA) CROSS SECTION (GENERAL FILE ONLY) NT#107 0 TC 20 MEV, SUM OF MT=780,781 113 (N.TZALPHA) CROSS SECTION Ø TO 2,3 MEV, BASED ON A SINGLE-LEVEL FIT TO RESONANCE MT=113 MEASURED AT 2 MEY BY DA61, ASSUMING L=0 INCOMING NEUTRONS AND L=2 OUTGOING TRITONS, 2.3 TO 20 MEV, SMOOTH CURVE THROUGH MEASUREMENTS OF FR56 AND WY58, FOLLOWING GENERAL SHAPE OF DA 61 MEASUREMENT FROM 4 TO 9 MEV. (N, ALPHAD) CROSS SECTION MT=780 Ø TO 1 MEV, CALCULATED FROM THE R-MATRIX PARAMETERS DESCT BED FOR MT=1.EXPERIMENTAL (N;ALPHAD) DATA INPUT TO THE FIT WERE THOSE OF MASS AND DAS1, IN ADDITION, THE ANGULAR DISTRIBUTIONS OF VA72 FOR THE INVERSE REACTION WERE INCLUDED IN THE ANALYSIS, 1 TO 20 MEV, BASED ON DA61 MEASUREMENTS, WITH SMOOTH EXTRA-POLATION FROM B TO 20 MEV, DA61 MEASUREMENT ABOVE APPROXIMATELY 2 MEV WAS RENORMALIZED BY FACTOR OF 1.4. 781 (N,ALPHA1) CROSS SECTION 0 TO 1 MEV. CALCULATED FROM THE R-MATRIX PARAMETERS DESCRIBED FOR MT+1,EXPERIMENTAL (N,ALPHA1) DATA INCLUDED MT=781 IN THE FIT ARE THOSE OF FR72, 1 TO 20 MEY, SMOOTH CURVE THROUGH MEASUREMENTS OF DA61 AND NE70, WITH SMOOTH EXTRAPOLATION FROM 15 TO 20 MEV. THE DA61 DATA ABOVE APPROXIMATELY 2 MEY WERE RENORMALIZED BY A FACTOR OF 1.4. DATA TABLE BELOW IS THE TOTAL HELIUM PHODUCTION CROSS SECTION OF B-10, FOR CONVENIENCE IT IS LISTED AS MT#107.THE CROSS SECTION IS COMPOSED OF SIX REACTIONS, Ϊ»Ε, B-10(N, ALPHA0)LI-7 MT=780 8-10(N, ALPHA1)LI-7+(478 KEV) MT=781 B-10(N:NPRIME ALPHA)LI-6 MT=113 AND TWICE THE SUM OF B-10(N, T2ALPHA) B-10(N,NPRIME D 2ALPHA) B-10(N,2NP2ALPHA)

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BOHCN-14

(N, ALPHA) Meutron Cross Section

ENDF/B MATERIAL ND. 5273



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Evaluation of Soáium-23 Neutron Capture Cross Section Data for the ENDF/B V-III File*† by N.C. Paik and T.A. Pitterle Westinghouse Advanced Reactors Division Waltz Mill Site P.O. Box 158 Madison, Pennsylvania 15663

This report describes the evaluation of neutron cross sections of Na-23, material number 1156, for the ENDF/B File. Cross sections were evaluated between 10^{-5} eV and 15 MeV.† Experimental data available up to March 1971 were included in the evaluation.

The total cross section of sodium has been re-evaluated for the ENDF/B library in the neutron energy range from 100 eV to 15 MeV. The measurement of the total cross section for neutron energies above 600 eV and below 40 keV at the Nevis Laboratory, Columbia University⁽²⁾ verifies a spin assignment of J=1 for the 2.85 keV resonance and a neutron width of about 410 eV. The data indicates that the width of the resonance is wider than the earlier measurements by Garg⁽³⁾, and more in agreement with the measurements of Moxon⁽⁴⁾ and Lynn.⁽⁵⁾ The peak value of the resonance is

*Work performed under AEC Contract AT(30-1)-4210.

 $^{+}$ Data extrapolated to 20 MEV at NNCSC and carried over to Version IV.

This report extracted from ENDF/B Summary Documentation ENDF 201 BNL 17541 (May 1973).

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within the statistical uncertainty of the theoretical value, which is 380 barns for a resonance with J=1.

Resonance parameters are given in Table 1. Yamamuro's⁽⁶⁾ measured value of 0.47 eV for Γ_{γ} of the 2.85 keV resonance has been used in the present evaluation. Parameters for resonances at 7.53, 35.4, 53.0, 114.7, 129.5, and 139.1 keV were estimated from data by Moxon⁽⁴⁾, Hockenbury⁽⁷⁾, and Ribon⁽⁸⁾ with particular emphasis on the capture areas measured by Hockenbury.⁽⁷⁾ The parameters for the 53.0 keV resonance, for instance, are Moxon's values with Hockenbury's Γ_{γ} data.

The scattering radius was chosen to provide a good agreement between calculation for the 2.85 keV resonance at energies above the resonance with measured data from the Nevis Laboratory. ⁽²⁾ Background cross sections are given in File 3 to improve agreement between calculated and measured data below 1.50 keV. The resolved resonance range is defined to be from 600 eV to 150 keV. Below 600 eV the total cross section is based on the data of Columbia⁽²⁾ and of Joki.⁽⁹⁾

The sodium capture cross section between 100 eV and 200 keV is based primarily on the resonance parameter evaluation and in agreement with the capture areas measured by Hockenbury. $^{(7)}$ The radiation width for the 2.85 keV resonance, which dominates Na capture cross section, is 0.47 eV $^{(6)}$ compared to 0.33 eV for the ENDF/B Version 1 evaluation. Integral testing $^{(10)}$ of this capture cross section change of sodium indicated that the eigenvalue calculation of a fast reactor system with a power reactor spectrum is

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Resonance Energy, keV	J	1	Γn,eV	Γγ,eV
2.85	1	D	410	0.47
7.53	1	1	0.012	1.5
35.4	3	1	0.86	0.76
53.0	2	1	1200	1.48
114.7	2	0	11.0	2.72
129.5	3	1	0.374	1.5
139.1	2	1	3.33	1.5

Table 1 Resonance Parameters in ENDF/B Version III Sodium Evaluation

not significantly affected (0.01% Δk change for $\Gamma\gamma$ = 0.33 eV).

Above 200 keV and below 100 eV, the capture cross section of the Version I sodium evaluation $^{(1)}$ was retained for the present evaluation.

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L VALUI NUMBER SPIN S	OF RESONANCE Cattering Len	S Ø.	0 2 .0000E+00						
INDEX	ENERGY (EY)	J VALUE	TOTAL	REBONANCE WIDT NEUTRON	THS (EV) Radiation	F15\$10N			
1 2	2,8570F+03 1,1470E+05	1.0000E+00 2.0000E+00	4.1047E+02 1.3720E+01	4.1000E+02 1.1000E+01	4.7000E-01 2.7200E+00	0,0040E+00 7,0040E+00			
L VALUE									
INDEX	ENERGY (EV)	J VALUE	TOTAL	NEUTRON	RADIATION	FISSION			
1 2 3	7,5300E+03 3,5400E+04 5,3000E+04	1,0000E+00 3.0000E+00 2.0000E+00	1,5120E+00 1.6200E+00 1.2015E+03	1,2000E-02 8,6000E-01 1,2000E+03	1,5000E+00 7,6000E+01 1,4000E+00	0,00005+00 0,00005+00 0,00005+00			
4	1.2950E+05 1.3910E+05	3.0000E+00 2,0000E+00	1.8740E+00 4.8302E+00	3,7400E=01 3,3300E+00	1.5000E+00 1.5000E+00	# 0000E+00			
2001UH-23				(N,GAMMA) Neutron Gross Section			ENDF/8 MATERIAL NO. 0156		
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6 11	1,000000+01 5,000000+01	2.6868E-81 1.2188F-82	2,000000-03 2, 2,000000-01 1,	8998E-81 5, 8998E-81 5,	78085+81 1.21 58885+81 1.21	182-81 1.8	3075-02 3.34005-01 4,00005-02 4,24705-01 8905-03 8,49405-02 1,00005-01 2,68605-02 9995-03 8,40965-03 3 08905-03 8,10005-03		
10	4.0000E+02 1.0000E+02	7.9000E-23 2.9000E-04	5.88982+82 7 1.58985+83 2	8000E-83 6, .0000E-84 1,	000000402 7.7	3002-03 6.0 DBE-04 1.6	000E+02 0.0000E+00 9,5000E+03 0,0000E+00 000E+05 6.65000E+00 1.7200E+05 7.0000E+04		
20 31	1.8300E+05 2.6000E+05	8.0000E-84 6.8000E-04	1.9880E+05 8 3.8800E+05 7	6000E-04 2	2000E+05 8.0	002-04 2.3 002-04 3.5	000E+05 7.0000E+04 2,4000E+05 6,9000E+04 000E+05 3.6000E+04 4,2000E+05 2.5000E+04		
36	4.5380E+05 6.6880E+05	2.4000E-04 3.5000E-04	4,5800E+05 2 7,5000E+05 3	4478E-04 4	7080E+05 2.5	882-84 5.5	000E+05 3.3000E=04 6.0000E=05 3.5000E=04 004E+05 2.4000E=04 1.0000E+06 2.3000E=34		
46 51	4.0000E+06 1.5000E+07	1.6000E-04 2.3000E-04	4,58882:*86 1 2,08882:*87 2	60P8E=04 8, 4541E=04	0000E+06 1.7	000E-04 1,1	500E+07 1-8000E=04 1,3300E+07 2,0088E=04		

RESONANCE DATA Resonance parameters

1 RESOLVED SINGLE-LEVEL BREIT-HIGNER PARAMETERS

ENDFIG MATERIAL NO. 4156

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Evaluation of the ²⁷Al(n,p)²⁷Mg and ²⁷Al(n,a)²⁴Na Cross Sections* for ENDF/B-IV P.G. Young and D.G. Foster, Jr. Los Alamos Science Laboratory Theoretical Division March '72

The Version III ENDF/B cross sections for the ${}^{27}Al(n,p){}^{27}Mg$ and ${}^{27}Al(n,\alpha){}^{24}Na$ reactions were examined with the aim of implementing several improvements for standards use. The suggested revisions are described below and in the accompanying figures, where the recommended Version IV data are compared to experimental results as well as to other evaluations.

$\frac{27}{A1(n,p)}$ $\frac{27}{Mg}$

The only change suggested for the Version III ENDF/B (n,p) cross section (Yo72) is for neutron energies below 4 MeV. At these energies the data were modified to correspond more closely to the Henkel (He54) and Grundl (Gr67) measurements, which are in good agreement. The recommended curve from threshold to 7 MeV is compared to the available measurements in Fig. 1. The energy dependence of the curve below 3 MeV is represented by an $\ell = 0$ penetrability function for the outgoing p + 27 Mg channel. From 4 to 7 MeV the recommended curve is based on a composite of the available measurements (Ba65, Ca62, Gr67, He54).

^{*}Submitted to Normalization and Standards Subcommittee March 1972. This evaluation has since been incorporated into the ENDF/B-IV general purpose library.

The recommended curve is compared to the available activation measurements from 7 to 13 MeV in Fig. 2, and from 13 to 20 MeV in Fig. 3. It should be noted that the data of Ferguson (Fe67), which are substantially lower than the evaluation, are relative data that have been normalized to a value of 55 mb near 13 MeV. Similarly, absolute data were obtained at only one energy (50 mb at 14.4 MeV) in the Gabbard measurement (Ga62), and the remaining points were normalized to that value. Therefore, since the preponderance of experimental results near 14 MeV suggests a substantially higher (n,p) cross section, the evaluation was chosen to approximately follow the measurements of Mani (Ma60), resulting in an evaluated cross section of 77 mb at 14.1 MeV.



Figure 1

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Figure 2





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$27_{A1(n,\alpha)}^{24}$ Na

The recommended curve for the (n,α) cross section was changed somewhat from the ENDF/B-III values to better agree with the experimental data of Butler (Bu63), Liskien (Li66), and Paulsen (Pa65). The new curve is compared to the experimental data from threshold to 9 MeV in Fig. 4. The energy dependence of the curve below 6 MeV is approximated by an $\ell = 0$ penetrability function for the $\alpha + {}^{24}$ Na channel. The results from 6 to 13 MeV and from 13 to 20 MeV are shown on linear scales in Figs. 5 and 6. It is interesting to note that if the measurements of Tewes (Te60) are renormalized by a factor of 1.37, very good agreement is obtained with the Butler data (Bu63). The recommended curve has a value of 124 mb at 14.1 MeV.



Figure 4

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Figure 6

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ō	3.85846+8	6 3.5617E=15	3.90002+0	2.8838E-14	3,9588E+8	6 1.7762F-13	4.00006+0	5 8.35005-13	4,8500E+0	6 3,6743E-12
11	4.100000+0	6 1.4222E-11	4.1500F+8	5 4.8419E-11	4.20006-0	6 1.45986-19	4.2502E+0	5 4.8965E-18	4.30002+0	6 1.0758E-09
10	4.35000.00	6 2.42636-89	4.40000+0	5.9608E+89	4,458866+8	6 1.29316-88	4.50000+0	5 2.6786E+08	4.55666-6	5,29696-38
21	4.6090E+0	6 1.0000E-07	4.65886+8	6 1.8328E+07	4.7080E+8	6 3.25282+87	4.75000+0	5 3.5938E-87	4.80006-0	6 9.3200E-07
26	4.8500E+0	6 1.5162E+86	4.98005+8	5 2.4187F+86	4.95066+0	6 3.74828-86	5.00006+0	5.6900E+06	5.1000E+0	6 1.2464E=05
31	5.20866+0	6 2.5580E-85	5.38885+8	4.92425+85	5.48086+0	6 9.82882-85	5.50006.+0	6 1.5003E-04	5.6880E+8	6 2.6500E-04
36	5.700000+0	6 4.2700E+04	5.88886+8	6 4.6780F-84	5.92086+8	6 1.01868-83	6.00006+0	6 1.4900F-03	6.1000E+0	6 2.1400E-03
41	6.288¥E+8	6 2.9988E-83	6.36886+6	6 4.0088F+83	6.4004E+8	6 5.1400E-03	6.50000.+0	6 4.5400E+03	6.6888E+0	6 8.2000E-03
46	6.78885+8	6 9.8780E-83	6.88885+8	6 1.1ABBF-82	6.986RE+8	6 1.37897-82	7.88885.0	6 1,59005-02	7.2880E+0	6 2.0100E-02
51	7.488WE+0	6 2.5000E-02	7.68005+0	5 3.0000F-02	7.08006+8	6 3.54882-82	8.00001.+0	6 4.1300E-02	8.2000E+0	6 4.7188E=02
56	8.48886.+8	6 5.3300E-02	8.48885+8	5.9288F +82	8.820AF+E	6 6.4088F+82	9.00005+0	6 7.02005-02	9.2000E+0	6 7.5188E-02
61	9.48896+8	6 7.9788E-82	9.40005+0	6 B. 3688F-82	9.8000E+0	6 8.7788E#82	1.00006+0	7 9.1288E+02	1.85886+8	7 9.9612E-02
44	1.18886+8	7 1.07506-01	1.15600+0	7 1.14035-01	1.20000-0	7 1.21207+01	1.25000.00	7 1.26845+81	1.30000.00	7 1.2880E-01
71	1.33886+8	7 1.27946+01	1.49805+8	7 1.24705-01	1.45885+8	7 1.1936F-81	1.50000.00	7 1.12905+01	1.55886+8	7 1.05216-01
76	1.68686+8	7 9.70005-02	1.48005+0	7 8 84865-82	1.70805+8	7 7.94698+62	1.75886+0	7 7.11875-02	1.80000048	7 4.37885-82
	1.65865+6	7 5.45376.82	1.08005+8	7 4 00005002	1.05666.+8	7 4.34378+82	2.0000040	7 3.88005-02		

INTERPOLATION LAW BETWEEN ENERGIES Range description range description 1 to 3 y linear in x 3 to 39 LN y linear in x

REACTION Q VALUE -3.1310E+06 EV

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ALUHINUM-27

(NIALPHA) NEUTRON CROSS SECTION ENDF/B MATERIAL NO, 0193

RANGE DESCRIPTION 39 to 84 y Linear in X

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Evaluation of the ³²S(n,p)³²P Reaction for ENDF/B-III N.D. Dudley and Robert Kennerley Argonne National Laboratory

The literature examined in this review includes all references in CINDA 71 and its Supplements. Four experiments have reported $^{32}S(n,p)$ cross sections near the reaction threshold of 1.6 MeV. All used the activation technique and measured relative to a flux monitor. The beta counting of the sulphur pellets appears to be the weakest portion of these measurements because of self absorption and self-scattering of beta particles in the relatively thick sulphur targets.

The four data sets are shown in Fig. 1. Klema and Hanson measured relative to a uranium fission chamber. Neither the isotopic composition nor the uranium cross sections are stated so renormalization of their results is not possible. Lüscher measured relative cross sections and normalized to Klema and Hanson. Hurlimann and Huber calibrated a Hornyack button relative to H(n,p)then measured ${}^{32}S(n,p)$ relative to the calibrated Hornyack detector. Allen et al. measured relative to a ${}^{238}U(n,f)$ chamber and

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we have renormalized their data to the ENDF/B-III ²³⁸U(n,f) cross sections. The structural detail as seen both by Lüscher and Hurlimann-Huber is well reproduced with the exception of a 20-50 keV difference in the neutron energy scale. We have chosen to increase the neutron energy scale of Hurlimann-Huber by 20 keV between 2.2 to 2.9 MeV and 50 keV for data greater than 3.0 MeV although this is not shown on the data plotted in Fig. 1. With the exception of the 2.25 and 2.55 MeV energy region, the agreement between the four experiments is reasonably good.

After renormalization of the Allen et al. data, good agreement is obtained with Klema and Hanson from 3.4 to 5.8 MeV. From 5.8 to 9.6 MeV data are only available from Allen. Between 10.4 to 11.6 Santry and Butler have data relative to the Allen data at lower energy. We have renormalized the Santry and Butler values relative to the renormalized Allen data. From 13 to 15 MeV, Allen measured the cross section absolutely by the associated alpha particle technique. Santry and Butler measured relative to Allen from 12.5 to 20.3 MeV by normalization at 14.50 MeV. Both measurements seem acceptable without any renormalization.

Eight individual measurements are reported between 14.0 and 14.8 MeV. These data have large scatter but, in general, are consistent (on the average) with both Allen and Santry and Butler. These data are shown in Fig. 2 with error bars attached. Above 15 MeV our evaluation follows the Santry and Butler data.

- 36 -



Figure 2

- 37 -

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Because ${}^{32}S(n,p)$ has been extensively used as a cross section reference reaction, we feel aduitional measurements from threshold to 20 MeV are required. The cross section situation for ${}^{32}S(n,p)$ is not satisfactory for its use as a standard. Our evaluation consists of a "best" curve and is shown as the solid line in Fig. 1 and 2. An evaluation by J. Spaepen is also shown and is similar to ours up to 15 MeV.

References

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SULFUR-32

NEUTRON CROSS SECTION

ENDE/8 MATERIAL NO. 6487

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REACTION & VALUE -9.27506+85 EV

INTERPOLATION LAW BETWEEN ENERGIES Range description 1 to 71 y linear in x

ENERGY CROSS SECTION EV DARVS 2.2007 20 1.2004 2.2007 2004 2.200 L. 2757.485 5.7228.52 L. 7728.56 5.7228.52 L. 7728.56 5.7228.52 J. 4087.566 1.0878.42 J. 4087.577 3.0887.47 J. 4087.577 3.0887.77 J. 4087.77 J. 408 ENERGY CROSS SECTION 1.180% -00 2 -0.0% 2.000% -0.0% 2.00 SECTION CF055 ENERGY

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Evaluation of the ⁴⁵Sc(n,y)⁴⁶Sc Reaction* for ENDF/B-IV B.A. Magurno and S.F. Mughabghab National Neutron Cross Section Center

Brookhaven National Laboratory

Because of the importance of ⁴⁵Sc in dosimetry applications and its use as a filter to produce a "monoenergetic" neutron beam at 2.0 keV an accurate knowledge of the cross sections is required. In another study⁽¹⁾ an analysis and evaluation of the total cross section in the thermal and resonance region was presented. That study is extended here to include the capture cross section from the thermal region to 20 MeV.

The only capture cross section data sets (other than thermal) available at the time of this evaluation were those of Romanov⁽²⁾ (average cross sections as function of energy) Perkin⁽³⁾, Csikai⁽⁴⁾, and Booth.⁽⁵⁾ This lack of data caused almost complete dependence on a multilevel Breit-Wigner calculation using the code RESEND⁽⁶⁾ for the thermal and resonance region cross section evaluation.

As a starting point, the resonance parameters recommended in BNL-325 (1973) were adopted. Since the spin and parity of the ground state of the target nucleus are $7/2^{-}$, s-wave neutron capture by Sc-45 forms compound states with spins and parities 3^{-}

- 42 -

^{*}Research supported by U.S. Energy Research and Development Administration.

and 4^{-} . The spins of the resonances below 10 keV were not determined. In addition, thermal capture γ ray spectra measurements of Bolotin⁽⁷⁾ and Delang et al.⁽⁸⁾ give some, but inconclusive, indication that the spin of the bound level is possibly 3. This is based on the observation of a primary transition to a low lying state at 142 keV with spin and parity 1⁻ and the lack of transitions to several low lying states with possible spin and parity of 5+. It must be pointed out that at the start of the evaluation, thermal neutron polarization data which is important in shedding light on the coherent and incoherent cross sections and the spin of the bound level, were not available.

The total cross section in the energy range 3-10 keV was calculated and compared with the experimental data. The spin of the resonances at 3.24, 4.27, 6.59, 7.92, 8.90, 11.7 keV were found to be 3,4,3,4,3,4 respectively. With such a choice for the spins, several attempts were made to reproduce the minimum at 2.0 keV on the assumption that the spin of the bound level is 3. However, the best fit in the region of the minimum in the total cross section was achieved by adopting a spin 4 for the bound level.

With the aid of the resonance parameters determined from σ_t the partial cross sections can be calculated. Of particular interest is the comparison of the calculated thermal cross sections with the experimental cross section recommended in BNL-325⁽⁹⁾ and more recently reported results of Dilg.⁽¹⁰⁾ As can be seen (Table I) the results are in excellent agreement.

- 43 -

		Table I		
	0.0253	eV	18.8 e	I
	BNL-325	ENDF/B-IV Evaluation	Dilg.	ENDF/B-IV Evaluation
σ _t (b)	50.5 ± 1.0	50.6	22.03 ± 0.25	21.7
σ _γ (Ъ)	26.5 ± 1.0	26.9	(1.01)	0.9
σ <mark>s(</mark> b)	24 ± 2	23.7	21.0	20.8

The average data set of Romanov⁽²⁾ (to 40 keV) and the Booth⁽⁵⁾ datum (20 keV) were not used since they fell inside the resolved energy region. The data of Perkin⁽³⁾ (.15-15 MeV) and C´sikai⁽⁴⁾ (15 MeV) were used as guides for extending the capture cross section from 0.1 MeV (upper end of the resolved energy region) to 20 MeV. The evaluation is a smooth curve approximating the data of Perkin and Csikai.

References

 $m_{1}=m_{1}+2\pi$

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1AL ND. 6415		IGNER PARAKETERS		F155101	9°50305+6	9.6500E+29	1.000E+20	8. 2040T+C0	0.00001+20 0.00001+200	0.00005+10	9, PBJBE+ AB	9.0000EF+30	9,9840E+29	3,80365+70 	9.9848E+49	P. 6640E+09	7.98007+00 - 09407-00	30+33880 4	9.90400+90 1.90400+90	9, 9940E+00	9,88865+98 - 22225-00	7.0000E+00	99436499.4	3,8848E+82 5 2648E+82	0.9040F+00	A, BB08E+07	R+ 0000E+99	9. 80.000 + 70 6. 60 4.01 + 70		5,9840E+7.0	A, 8848E+A8	9,9800E+00 - 9846F+00	Janan L
ENDE/B MATER Ance data E Parameters		LEVEL BREIT-4		THS (EV) Raciation	3.790PE=01	3,80885-81 1.54085-31	1.5000E+00	1.50005+08	1.56805+00	1.5600E+00	1.5000E+00	1.5000E+09 1 =000E+00	1, 5603E+00	1.50005+60	1.50000+00	1.50026+00	1.5556F+03 1.5556F+03	1.500PE+80	1.50000+00 	1.50005+00	1.50005+00	1.500PE+00	1.5CCDE+00	1.50005+00	1.5600E+00	1.50005+00	1.50005-00	1.5000E+00	1.40005400	1.5000E+00	1. 5400E+90	1.50005+00	1,50005.50
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	.4ND!UM-45 .900PE+00 1		0 57 57	*OTAL	3.4003E+01	7.P360E+01	7.450RE+01	1.6150E+C2	2.015PE+22	6.150AE+01	6.1500F+01	6.1500F+02	6,1500E+01	9.14605+01	1.0150E+62	5.715¢E+02	1.4120E+02 2.8150E+02	1.3130E+C2	1.1170E+02	1.7040E+D2	4.81585+02	1.6150E+02	5.4760E+02	1. N558E-02	2,17586+02	1,6410E+82	5.2518[+82	1.6416F+02	1.69316+03	4.1040E+02	3.52406+02	1.5120E+02 9.5040F+02	50 . Janat 7
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	MS (EV) Padiation	3,8#8#5=81 3,8#8#5=81
	RESONANCE MIDI NEUTRON	7.6006-03 7.28006-02
10000C+00	TOTAL	3.8768E-01 3.2288E-01
	J VALUE	4,88865+88 3,88865+88
	ENERGY (EV)	4.5584E+02 1.0194E+03
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6	3,7440E+0	5 1.2921E#02	4,61306+0	1,1611E-02	5,6825E+0	5 1,0238 <u>e</u> -02	7.0000E+05	8.00005-03	8,0000E+05	7.9000E-03
11	9.000WF+0	5 7,2000E-03	1,000000+00	6,5000E=03	2,33000 +00	2.20205-03	2.0103E+06	1.97276-03	2.9242E+00	1.80476-03
16	3.276#E+B	6 1,6833E∍03	3.6700E+00	1.6000E-03	4,2839E+84	5 1,5341P-03	5.0000E+06	1.500000-03	6,3246E+06	1.4750E-03
21	8.9684F.+8	6 1.5000E-03	1.47000+07	1.80FØE+03	2,00000040	1,90000-03				

SCANDIUM-45 Interpolation Law Between Energies Range Description 1 to 3 y Linear in X (N,GAMMA) Neutron cross Section

RANGE DESCRIPTION 3 TO 23 LN Y LINEAR IN LN X ENDF/B MATERIAL NO. 6415

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REFERENCES FOR EXPERIMENTAL DATA

⁴⁵Sc(n,Y)

<u>Yr.</u>	Lab	<u>Author</u>	References
67	DEC	Csikai, et al.	Nuc. Phys./A <u>95</u> , 229 (1967)
65	LEB	Romanov, et al.	Yad. Fiz. <u>1</u> , 229 (1965)
63	ALD	Perkin	J. Nuc. En. <u>17</u> , 349 (1963)
58	LRL	Booth, et al.	Phys. Rev. <u>112</u> , 226 (1958)

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An Evaluation of the (n,p) and (n,np) Reactions

of the Isotopes of Titanium for ENDF/B-IV

B.A. Magurno

NNCSC

Brookhaven National Laboratory

Threshold detectors generally use elemental titanium rather than isotopically enriched samples necessitating the evaluation of all the (n,p), (n,np), (n,pn) and (n,d) reactions of the major contributing isotopes separately. 49 Ti and 50 Ti will not be dealt with here since they are both approximately 5% abundant and have small cross sections. The (n,np), (n,pn) and (n,d) reactions will be lumped together and hereafter called (n,np). The energy range will be divided into three regions. Region I is that of threshold to 7 MeV. Region II, 7 to 12 MeV and Region III, 12-20 MeV.

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$\frac{46}{\text{Ti}(n,p)}$ 46 Sc.

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The 46 Ti(n,p) 46 Sc reaction is useful as a dosimetry material because of its long half life and simple mode of decay (i.e. 83.8 days, 0.89 MeV γ). This cross section is considered one of the primary reaction necessary in the ILRR program.⁽¹⁾ Until recently the only data sets available in Region 1 were those of Ghorai⁽²⁾ and Lukic.⁽³⁾ Ghorai's data was taken on the 3-MeV Dynamitron at Auburn University and measured relative to 27 Al (n,p) 27 Mg of Grundl.⁽⁴⁾ Lukic, on the 4-MeV Van De Graaff of the University of Florida, measured relative to 56 Fe(n,p) 56 Mn⁽⁵⁾,

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 ${}^{27}\text{Al}(n,\alpha){}^{24}\text{Na}^{(6)}$ and ${}^{58}\text{Ni}(n,p){}^{58}\text{Co.}^{(7)}$ These data, however, where widely scattered and had cross section errors of the order of 20%. Smith⁽⁸⁾ has since measured the cross section from 3-6 MeV on the ANL Fast Neutron Generator with accuracies of about 6%, using enriched ${}^{235}\text{U}$ in a fission chamber for $\text{E}_{n} \lesssim 3$ MeV and enriched ${}^{238}\text{U}$ for higher energies. This data set alone was used as input for the evaluation from 3-6 MeV. From threshold (1.62 MeV) to 3 MeV (no data available) Slavic⁽⁹⁾ from Knolls Atomic Power Laboratory supplies "guidance" with model calculations.

Region II has no available data. Smith of ANL, however, is extending the measurement (above) to 10 MeV. If these cross sections being measured are higher than the present evaluation, they may help to solve the discrepancy between 235 U fission spectrum averaged cross section calculated from above (10.2 mb) and the presently, accepted integral cross section⁽¹⁰⁾ (12.3 mb).

Region III (12-20 MeV) has several data sets measured as a function of energy. Liskien⁽¹⁾ accounted for the possibility of competing reactions in the text (i.e. ${}^{47}\text{Ti}(n,np){}^{46}\text{Sc}$) but apparently did not correct the data. Bormann's⁽¹²⁾ cross section measurements are available but very little information regarding the experiment accompany the results. The best data available, using isotopically enriched samples and correcting for completing reactions are those of Pai.⁽¹³⁾ The six 14 MeV experiments (Table 1) range from 203 mb to \sim 520 mb making their contribution to the evaluation minimal.

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The model calculation of Slavic, the data of Smith, Pai (heavily weighted), Liskien, and Bormann were used as input to $SPLINE^{(14)}$, a cubic spline⁽¹⁵⁾ fitting program which generated the evaluated ${}^{46}Ti(n,p){}^{46}Sc$ ENDF/B-IV cross section curve.

⁴⁷Ti,(n,p)⁴⁷Sc,⁴⁷Ti(n,np)⁴⁶Sc.

 47 Ti(n,p) is an excergic reaction with an apparent threshold of ~ 0.5 MeV. It is considered a secondary reaction in the ILRR program.⁽¹⁾ The data by Smith⁽⁸⁾ with that of Armitage⁽¹⁶⁾ were the determining factors in the evaluation of Region I. As in 46 Ti, Ghorai's data were deemed too high. The data of Gonzales⁽¹⁷⁾ seem to be of different shape and magnitude compared to the other experiments (see curve-3) and were ignored for this evaluation.

As in 46 Ti(n,p) 46 Sc Region II has no data available but measurements by D.L. Smith are underway.

Region III has only one data set as a function of energy, that of Pai.⁽¹³⁾ The 14 MeV measurements of Cross,⁽¹⁸⁾ Allan⁽¹⁹⁾ and Hillman⁽²⁰⁾ are in general agreement with Pai, while those of Levkovski⁽²¹⁾ and Poularikis⁽²²⁾ are high.

The data of Smith, Armitage, Ghorai, Pai, Hillman, Allan, Cross, were used as input to SPLINE and the cross section curve was generated.

47Ti(n,np)⁴⁵Sc was merely a connection of points as supplied by Pai since this is the only information available.



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 48 Ti(n,p) is considered a secondary reaction in the ILRR⁽¹⁾ program. It has the smallest cross section of the titanium isotopes construed as important in the program, but the highest abundance (\sim 74%).

The data in Region I are sparse, consisting of a few points measured by Smith, ${}^{(8)}$ Lukic, ${}^{(3)}$ and Ghoral. ${}^{(2)}$ See 46 Ti (np) above. All the available data sets in this Region were used as input.

As in the above reports Region II has no data but measurements to 10 MeV are underway by D.L. Smith of ANL.

In Region III Gabbard ⁽²³⁾ measured the relative cross section as a function of energy on the U of Kentucky Electrostatic Accelerator, and then normalized to his own absolute measurements at 12.98, 13.75 and 16.60 MeV. Vonach ⁽²⁴⁾ measured the relative cross section as a function of energy and normalized to ²⁷Al(n, α) ²⁴Na = 111.5 mb at 14.7 MeV. Bormann's ⁽¹²⁾ data was available but not the details of the experiments. The data of Bormann, Vonach, Pai and Gabbard were used as input to SPLINE along with those of Smith, Ghorai and Lukic. The resulting curve was not renormalized since the 14.8 MeV value was approximately the same as that derived from a weighted average of the 14 MeV experiments. (See Table II). i.e. 66 mb.

The 48 Ti(n,np) 47 Sc, as in the case of 47 Ti described above, was determined by connecting the values indicated by Pai. ${}^{(13)}$

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Figure 6

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	Table 1	I
E(MeV)	σ(mb)	Reference
14.0	203 ± 21	D.L. Allen, Nuc. Phy. <u>24</u> , 274 (1961).
14.0	240 ± 40	Bayhurst and Prestwood, in <u>Fast Neutron Physics</u> , Part II, Interscience Publ., N.Y. London (1963). Chapter V by Ribe.
14.5	268 ± 30	W.G. Cross and H.L. Pai, Private Comm. to M.D. Goldberg (1963).
14.7	324 ± 30	D.R. Koehler and W.L. Al- ford, J. Nucl. En. <u>18 A/B</u> , 81 (1964).
14.8	230 ± 50	V.N. Levovskii et al., Yad Fiz <u>10</u> , 44 (1969). Trans. in Sov. J. Nucl. Phys. <u>10</u> , 25 (1969).
14.8	∿ 520	A. Poularikas and R.W. Fink, Phys. Rev. <u>115</u> , 989 (1959).
	Table II	
14.0	61 ± 10	Bayhurst & Prestwood, Fast Neutron Physics, Part II Interscience Publ., N.Y. London (1963) Chapter V by Ribe.
14.5	55 ± 11	Hillman, Nuc. Phys. <u>37</u> , 78 (1962).
14.5	93 ± 33	Paul & Clark, Can. J. Phys. <u>31</u> , 267 (1953).
14.7	55	Koehler et al., J. Nuc. Energy <u>18</u> , 81 (1964).
14.7	80 ± 4	Crumpton, J. Inorganic & Nuc. Chem. <u>31</u> , 3727 (1966).
14.8	70 ± 6	Prasad et al., Nuova Cim. <u>3A</u> , 467 (1971).
14.8	58 ± 8	Poularikis et al., P.R. <u>115</u> ,
		303 (17 33).

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NEUTRON CROSS SECTIONS

INDEX, ENERGY CROSS SECTION
ENERGY

TITANIUM-46

REACTION Q VALUE -1,5849E+86 EV INTERPOLATION LAH BETHEEN ENERGIES RANGE DESCHIPTION 1 TO 31 V LINEAR IN X (N,P) Neutron cross section ENDETH HATERIAL NO. 6421





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TITANLUM-47

(N,N') P NEUTRON CROSS SECTION

ENDE/8 HATERIAL NO. 6422

REACTION & VALUE -1,0460E+07 EV

INTERPOLATION LAW BETHEEN ENERGIES Range description 1 70 16 y line4r in x

NEUTRON CROSS SECTIONS NEUTRON CROSS SECTIONS INDEX, ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CMOSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION EV 9ARMS EV 9ARMS EV 9ARMS EV 9ARMS 1 1,0680Fe07 6,0702Fe20 1,1453Fe07 1.5995-07 1,2227E+07 2,35508F-05 1,300Fe07 8,02026Fe04 1,3508Fe07 6,7455-23 6 1,4200Fe07 1,9265Fe07 1,4708Fe07 4.3200F-02 1,5200Fe07 0,6217F-02 1,5607E-07 9,1274E-02 1,6080E+07 1,1308F-01 11 1,6433Fe07 1,72045E-01 1,0807E+07 4.3200F-02 1,5200Fe07 0,6217F-02 1,5607E-07 9,1274E-02 1,6080E+07 1,6069F-01 12 2,0000E+07 1,8045E-01 1,0807E+07 1,373E-01 1,7300Fe07 1,4300F-01 1,6200E+07 1,5436Fe081 1,9108E+07 1,6669F-01

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TITANIUM-47

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(11,P) Neutron CPOSS Section

ENDF/8 MATERIAL VO. 6422

	20	-	_	-	•	•						
	ROSS SECTI Rabns	1.3803E-P4	3.70005-03	6.3632E-23	3.26545-02	3.9000E-32	7.1820E-02	1.2789E-01	1.25005-01	1.2144E-01	7.21951-02	
	ENERGY C	, 8666E+05	.31201+06	. 69885-86	4967E+06	1.85006+06	1.4480E+06	0.6667E+06	27006+37	.5433E+07	.82005+07	
	OSS SECTION Aars	.4800E-25	.10625-03	.66065-03	.3520F-02	4376E-22 3	63922-02	.24005-01 6	27956-01	.0745E-01	.00001-02	•
	ENERGY CRI	9.14026-05 2	1.25002+06 3	1.562#E+06 3	2.4232E+26 3	2.9167E+26 3	4.053PE+06 6	8.9427E+26 1	1.1802E+07 1	1.4867E+07 1	1.7333E+07 6	
	GSS S¢CTIUN B≜RNS	. 30905-06	.21175-03	.10005-03	50-11-84.	.89935-32	.84M0F-02	10595-01	.26855-71	.1300E-01	47425-02	
	ENERGY CH EV	7,7607E+05 1	1,1900ۥ06 2	1,4302E+06 3	2.2207Evi6 2	2,7933E+26 3	3,660ge+g6 5	6.9433E+06 1	1, 0900E+07 1	1.4300[+27 1	1,6867E+07 8	I
	IOSS SECTION BARNS	20-30-00	.22PBE-03	.35506-03	. 3764E-02	.02005-02	.27065-02	.2704E-02	.29085-01	.,1776E-01	.9842E-02	.50006-02
IES	ENERGY CA Ev	6,3880E+05 1	1.13PBE+06 1	1,39PBE+06 3	2.0200E+06 2	2.6520E+06 3	3,4567E+26 5	5,8867E+06 9	1.00005-67 1	1.3767E+07 1	1.6433E+07 8	2,000005+07 6
SETHEEN ENERC Metion Vear 15 x	ICNS Ross Section Rarns		7077E-04	5.6243E-03	L.1000E-02	5,1243E-02	.6135Ea02	7.6500E-02	L.2905E-01	L,2184E=01	.50005-02	6.7155E-92
LATION LAH E Ge descr 52 y Lin	CROSS SECTI ENENGY CF EV	5.0200E+05 E	1.03465+00	1,3500F+06 0	1,8280F+06 1	2.5734E+B6	3,25335+06 4	4.8300F+06 7	9,3333E+86 1	1.3233E+07	1.6800F+07 5	1,91806+87 4
TNTERPC RAN 1 TG	NEUTRON INPEX,	-1	Ð	1	- 9	2	9¢	E	36	41	4	5

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NEUTRON CROSS SECTIONS INNEX, ENERGY CROSS SECTION EV PARNS EV PARNS EV BARNS 1 1.1680E+07 M.R000E/-/8 1.2643E+07 4.0849E-03 1.366*E+07 8.600%E-23 1.4247E+07 1.302E+02 1.46R0E+07 1.4800E-02 6 1.349#F+07 1.7464E_02 1.6000F+07 2.5000F+02 1.6652E+07 4.0612F-02 1.7320E+07 5.4000E+02 1.8400E+07 6.2515E+02 1 1.950#E+07 9.4000E+02 2.00070E+07 9.80070E+02

INTERPOLATION LAW BETWEEN ENERGIES Range description 1 to 12 y linear in x

REACTION & VALUE -1.1446E+86 EV

TITANJUH-48

(N,N') P NEUTRON CROSS SECTION ENDEZE MATERIAL NO. 6423

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ENDF/B MATERIAL ND. 6423 (N.P) Neutron Cross Section REACTION Q VALUE -3,20006-00 EV Interpolation Law Esthern Energies Range description 1 to 20 y Linear In V 7174N1UM-48

	ENERGY CROSS SE. TÍON Ev Barns 190315-00 5.93695-05 440365-06 5.88086-05	.3100E+06 7.5227E-03 .3733E+07 6.3815E-02 .70M0E+87 9.1000E-02
	ENERGY CROSS SECTION ENERGY CROSS SECTION 4.74026-00 3.10005-05 4 5.54356-06 4.28605-04 5	7.420RE+00 4.5537E+03 0 1.3200E+07 6.0008E-72 1 1.6267E+07 5.7072E+02 1
	ENERGY CROSS SECTION EV BRNS 4.230816-00 8.8183 4.230816-00 8.71275-96	6,53886+80 2,558886483 1,18676+87 4,51526-82 1,55336+87 0,27346-82 2,88886+87 4,86887-82
	ENERGY CROSS SECTION EV BARNS 3.76086-06 3.10086-06 5.31086-06 2.48086-04	6,23335+80 1,77355+83 1,95335+87 2,74815+82 1,48805+87 6,65885-92 1,86675+87 4,23915-82
1 TO 28 Y LINEAR IN X	NEUTRON CROSS SECTIONS Index, Enemgy Cross Section Jacks (20008-400 Jacks Jabuse-400 5.00076-400 1.98336-40	11 5,9367E+06 1,0938E+03 16 9,2604E+26 1,2808E+02 21 1,567E+07 6,9915E+02 26 1,78356+07 4,9634E=02 26 1,78356+07 4,9634E=02

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Evaluation of the ⁵⁵Mn(n,2n)⁵⁴Mn Cross Section for ENDF/B-IV B.A. Magurno and H. Takahashi* NNCSC Brookheven National Laboratory

The 55 Mm(n,2n) 54 Mm cross section was one of the reactions to be supplied by the Cross Section F⁻⁻ uation Working Group (CSEWG) for the Interlaboratory LMFBR Reaction Rate Program (ILRR). This reaction was later incorporated into a complete isotopic evaluation for ENDF/B-IV by H. Takahashi. The description of the evaluation (below) was extracted from the final report.⁽¹⁾

The (n,2n) activation cross section of Mn^{55} in the neutron range from 12.6 to 19.6 MeV has been measured by Menlove et al.⁽²⁾ and A. Paulsen, and H. Liskien.⁽³⁾ The other data for the cross sections were obtained either at one energy around 14 MeV or measured over the fission neutron spectrum.⁽⁴⁾

Paulsen and Liskien's data are about 15% higher than the Menlove data and also show small fluctuations. The Paulsen and Liskien experiment was performed by using a proton recoil telescope to measure the absolute flux, and the Menlove data are obtained from the ratio measurements to the U²³⁵ fission cross section.

These cross sections were evaluated by comparing these with the results calculated by using the nuclear model codes GRØGI-III and THRESH.⁽⁶⁾

*Now at Tokyo Institute of Technology.

+Submitted to the normalization and standards subcommittee Oct. 1973. This evaluation has since been incorporated into the ENDF/E-IV General Purpose File.

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1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -



There are no experimental data near the threshold energy, (Q= -10.225 MeV) and GRØGI-III code cannot treat the discrete excited level, so that the cross sections near the threshold were carefully evaluated by using the transmission coefficients obtained from optical model calculations.

References

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NEUTRON CROSS SECTION3 INDEX, ENERGY CROSS SECTION EV BARNS EV BARNS EV BARNS EV BARNS EV BARNS EV BARNS 1 1,0413E+07 8,0700E+00 1.0413E+07 2.3203E+10 1.0007E+07 1.7294F+02 1.0803E+07 4.091E+02 1.1000E+07 8.0900E+02 1 1.333E+07 1.553E+00 1.1067E+07 2.3203E+10 1.0007E+07 1.7294F+02 1.0803E+07 4.090E+02 1.1000E+07 8.0900E+02 11 1.3000E+07 6.3000E+01 1.333E+07 0.0621E+01 1.3067E+07 7.3236F+01 1.4300E+07 7.0900E+01 1.433E+07 7.0979E+01 12 1.4607E+07 6.2275E+01 1.5000E+07 8.4200E+01 1.5533E+07 8.5752E+01 1.5667E+07 8.7003E+01 1.0000E+07 8.6000E+01 22 1.6607E+07 8.4000E+01 1.7333E+07 9.0001E+01 1.8000E+07 9.0000E+01 1.8030E+01 1.9333E+07 8.7075E+01 26 2.0000E+07 8.4000E+01

INTERPOLATION LAW BETWEEN ENERGIES Range Description 1 to 26 y Linear in X

REACTION & VALUE -1,8224E+87 EV

MANGANESE-55

DIRECT(N,2N) Neutron cross section

ENDEZB MATERIAL NO. 6197

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Evaluation of the ⁵⁴Fe(n,p)⁵⁴Mn Reaction For ENDF/B-III Dosimetry File R.E. Schenter - August 1973 Hanford Engineering and Development Laboratory

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus papers describing recent measurements by Smith and Meadows and Paulsen and Widera. Fig. 1-5 show the evaluation made (solid curve) together with available experimental data and some previous evaluations. Below 2.5 MeV Smith and Meadows and Paulsen and Widera values were used directly (Fig. 1-2). Between 2.5 and 6.0 MeV Smith and Meadows results were directly used (Fig. 3). Smith and Meadows results were normalized relative to the ENDF/B-III ²³⁵U fission cross section. Above 6.0 MeV a smooth "eye-guide" curve was constructed (Fig. 4-5) which fell between previous evaluations (6-13 MeV) and numerous experimental results (13-17 MeV).





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Figure 3



Figure 4

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1.	Smith and Meadows Trans. Am. Nucl. Soc. <u>16</u> , 1 (1973).
2.	Paulsen and Widera, EANDC (E) 150U, 1972.
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(N,P) Neutron Cross Section

ENDF/B MATERIAL ND. 6417

REACTION & VALUE	6,8000E+05	ΕV							
INTERPOLATION LAH Range des 1 to 101 ln	BETHEEN ENER Cription V Linear in X	agies (
NEUTROM CROSS BEC Innex, Enemgy Even	TIONS Cross Section Dabas	H ENERGY C	ROSS SECTION	ENERGY C	ROSS SECTION	ENERGY	ROSS SECTION	ENERGY	ROSS SECTION
1 1.2584E+06	1.00005-05	1.3752E+06	9.50F0E-05	1.5007E+06	3 8 8 8 5 - 8 4 5 4 5 4 5 4 5 5 6 8 5 5 6 8 5 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	EV 1.625PE+06	94RNS 1.16666-23	EV 1.738PE+06	BARNS 5.98005-23
6 1.75805-06	4.3000E-03	1.98085+86	7,45605-03	1,9792E+86	1.27865-02	2.1813E+06	2.62005-82	2.21076-06	3.72005-92
16 3.1674E+06	1.45005-01	3.38585+86	1.97005-01	5,5705+06	7.4538F=92	2.792BE+B5	1.00075-01	2,98505+06	1.32205-01 5 1100
21 3.998ME-06	2.4900E=01	4.14006-06	2,62PBE-01	4.1830E+06	3.16865-91	4.38505+06	3.96685-61	4.58775+86	2.5100L-01 3.3300F-01
26 4.5878F+86	3.6100E=01	4.795@E+@6	3.67695-01	4.7960E+06	3.64885-31	4.89575+96	3.83005-01	4.99605+26	4.2900E-01
	- STRUE - ST	5.0378E+06	3.8980E-01	5 13785+60	4.4600F-01	5.1990E+06	3.8900E-01	5,2380E+06	4.36205-01
41 5,7550F486	5,19886=01	5.84985+86	4.78785161 5.44685161	5.8566F+86	4.92885-81	9.4387E+86	4.74005+01	5.63805+06	5.1108E-01
46 6,250HF+06	5.36665-61	6.50002-06	5,52005-01	6.7500E+06	5.65885-01	7. BEBE-86	5.7380E-81	7.25005+06	5.8200E-01
51 7,5000E+36 EA A 7604E+36	5,8680E=01 6	7.7508£+86	5.69PBE-01	8,8887E+86	5.9486F-01	6.2500E+06	5.90005-01	8.5880E+06	5.8980E-01
61 1.000HF+07	5.64805.41	1.02505-07		1.05005+07	9.40865-81	V.5000E+96	5.7300E-01 5.40435-01	9.7508E+06	5.70205-01
66 1,1250F+07	5.2200E.01	1.15066-07	5,1280E-01	1.17506+07	5.02005-01	1.2000E+07	4.93005-01	1.22505+07	4.6000F-01
71 1.2598E=07	4.70006-01	1.27586+07	4.5680E-01	1,3080E+07	4.4200F-01	1.3250E+07	4.25005-01	1.3500E+07	4.0600E-01
		1.40005+07	3.65505-01	1.42505+07	3.4588F-01	1.4500E+07	3.25085-01	1.4750E+07	3.07005-01
		14+30424.1	2,7590E=01	1 2207E+E7	2,62985-91	1.5750E+07	2.46005-01	1.6000E+07	2.3280E-P1
		1,65/0E + 07	Z.1000Eaul	1.6739E+8/	2,02001-01	1.7000E+07	1.92005-01	1,725AE+07	1.84505-01
10-1100/11 11 04 1 91000/01	1,7000teut	1,77505-07	1.70A05-01	1.8-3046-67	1.65365-61	1.82505+07	1.6008E-01	1.8586E+@7	1.5600E-01
141 2.00046+07	1.4100E-01	1,9840E • 0 /	1 <i>4-39464</i> ''	1,925 <i>7</i> E • 87	1.460BE-n1	1.9587E+07	1.44005-01	1.9750E+07	1.42885-81

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Evaluation of the ⁵⁶Fe(n,p)⁵⁶Mn Cross Sections for ENDF/B-III

N. D. Dudey and Robert Kennerley

Argonne National Laboratory

The literature examined in this review includes all references in CINDA 71 and its supplements plus some very recent measurements near the reaction threshold. All reference cross sections have been renormalized to ENDF/B-III cross sections and weighted least-squares fitting routines were used to systematize the evaluations.

Virtually all measurements on 56 Fe used the activation technique to determine 56 Mn in activated natural iron samples. As a result, the 57 Fe(n,np+d) and 58 Fe(n,t) cross section contributions to 56 Mn are included in the measurements. For dosimetry purposes, elemental iron is usually used, so the evaluated cross sections are appropriate for this application. It should be recognized however, that this evaluation is not strictly 56 Fe(n,p). Chittenden¹ has measured the 57 Fe(n,np) cross sections at 14.8 MeV to be 6.1 mb. From this result it can be concluded that below about 15 MeV contributions to the 56 Mn activity are negligible (<0.3%) but above 15 MeV they may be more significant.

The evaluation approach is largely based upon a subjective analysis of the experimental technique. From this analysis a weighting factor was assigned to each of the reported results. The next step was to relate all relative measurements to ENDF/B-III

- 80 -

cross sections if a monitor reaction was used. Santry and Butler² measured relative to the ³²S(n,p) reaction. The measurement was renormalized to the evaluation of ³²S (submitted to the task force working group) which was essentially relative to the ²³⁸U(n,f) reaction. Liskien and Paulsen⁽³⁾ essentially measured relative to H(n,p) and no renormalization was necessary. Grundl⁽⁴⁾ and Meadows⁽⁵⁾ measured relative to ²³⁸U(n,f) and both sets of data were renormalized to ENDF/B-III. Cuzzocrea⁽⁶⁾ reports a number of measurements for ⁵⁶Fe and several other cross sections including ²⁷Al(n, α) between 13.7 and 14.7 MeV. In general, all of their results were high; a flux calibration problem was assumed and their ⁵⁶Fe data was renormalized by relating their ²⁷Al(n, α) results to the revised evaluation of ²⁷Al provided by P.G. Young. Hemingway⁽⁸⁾ reported ⁵⁶Fe results by the associated alpha particle technique so no renormalization was necessary.

Fourteen individual measurements (9-22) are reported for the energy region 14-15 MeV. Bormann (23) has measured relative 56 Fe cross sections and normalized to a value of 112.5 at 14.1 MeV. Similarly, Terrell and Holm (24) normalized their relative data to a value of 110 mb at 14.3 MeV. All data between 13.5 and 15 MeV were fit, weighted according to an in house assessment, to obtain renormalization values for Bormann and Terrell-Holm. The renormalization values were 110.3 and 108.8, respectively.

Bresesti⁽²⁵⁾ and Fabry⁽²⁶⁾ both measured a number of spectrum averaged cross section ratios in a thermal neutron induced 235 U fission spectrum. Bresesti assumed a cross section shape for 56 Fe

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based upon Liskien-Paulsen and Santry-Butler and determined the magnitude based upon integral ratios and an assumed fission spectrum. Fabry did essentially the same, except he allowed the shapes to vary in an ill-defined way to essentially measure 56 Fe relative to 6 other cross sections including 235 U(n,f). An adjustment to Fabry's 56 Fe data was made by renormalizing his reported 235 U(n,f) data to the ENDF/B-III evaluation.

Finally, all renormalized cross sections were weighted according to a subjective analysis and least squares fit to obtain the evaluated excitation function. Figures 1 and 2 show all the renormalized data together with the evaluated curve. The evaluated cross sections are tabulated in Table I using an energy grid such that a linear interpolation between points will result in a negligible error. In Fig. 3 a comparison is shown of this evaluation to those of Kanda and Nakasima⁽²⁷⁾ and the SAND-II evaluated library.⁽²⁸⁾ All three evaluations are very similar up to about 15 MeV where SAND-II begins to deviate significantly.

On the basis of this evaluation, it is felt that the shape of the excitation function is established with considerable confidence and the magnitude of the cross sections seems to be established to within about ±5%. For dosimetry applications to LMFBR-type neutron spectra, no further experimental work would seem necessary.

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INULA	ENERGY	CHUSS SECTION	FUENDI CHOSS SERVICA	ENERGI	CHUDAS SECTION	CNERGY	CH023 2501104	ENCHOT	CRUSS SECTA
	ΕV	PARNS	EV BARNS	Ev	BAHNS	EΥ	BARNS	EV	FARNS
1	2,970-E+06	6.000BE+00	3.000000+06 1.10000-07	3,100°E+0	6 1,5000E-07	3,2002E+00	5 2.1000E-27	3.300FL+06	2.95226-27
6	3.40000.000	4,2000E-07	3.50000 .00 6.20000-07	3.6000E+2	6 9.8000E-07	3,7000E+00	1.5000E-86	3,800000+06	2.5020E-85
11	3,90000.000	4.400PE-06	4.0000F+06 8.0000E-06	4,100*E+C	6 1,2000F-05	4.2008E+00	2.90202-05	4.3020L+06	5.6800E-25
10	4.40005+06	9.30A0E-05	4.50000-06 1.50000-04	4,6000E+0	6 2.38005-04	4.7002E+00	3.7578E-84	4.80205.00	5,5580[-04
21	4,9000[+06	8.A000E.04	5.000%E+86 1.2300E-03	5,1000E+0	6 1.7080F-03	5.200PE+0	2.1400E-P3	5,3000E+P6	3.25000-73
26	5,400000+00	5 4.5000E-03	5,50002+06 5.80002-03	5,60001E+0	6 7,1600F-03	5,80:00+0	5 1.0170E+02	6.0009E+86	1.32006-02
31	6.2000E+86	1.6400E-02	6.4000E+06 1.9800E-02	6.6003E+8	6 2,312887-02	6.3280E+0	2.64085+82	7,000000+06	2,96635-02
36	7.5060F+06	3,7200E=02	8 80000 -86 4.40000 -02	8.5000E+0	6 5,8488F-82	9.000PE+0	5.6730E-02	9,50000100	6.3378E-02
41	1,000000+07	7.0600E-02	1,05006+07 7,87006-02	1,100000+0	7 8,72001-22	1.15002+0	7 9.5620E+92	1,2000E+07	1.0300E-01
<6	1,22005+07	1,96000=01	1,2400E+87 1,0A00E-01	1,2607E+0	7 1,10926-91	1.2808E+0	1.12005-01	1,300000+07	1,13000-01
51	1.3100F+07	7 1.13000.01	1.3200E+07 1.1400E-01	1,3300E+0	7 1.1400F=01	1,3400E+0	7 1.1400E-01	1,3500E+07	1,14000-01
56	1,3680F+87	7 1,1300E#01	1,38000007 1,13000-01	1,39002+0	7 1,12005-01	1.4100E+D	7 1,11006-01	1,42885+27	1,10000-01
41	1.43000+07	1,0900E-01	1.440000+07 1.060000-01	1,4500E+0	7 1.0700E-01	1.4603E+0	7 1.0400E-01	1.4702E+07	1.0400E-01
66	1,48000.+07	1.0200E-01	1.49996+87 1.91786-81	1,500PE+0	7 9,94005-02	1.5580E+0	7 9.0700E-02	1,6000E-07	8,1827E-02
71	1,65846+87	7 7.62005.02	1,70005-007 6,92005-02	1,75888.+8	7 6,35005-02	1.89945+9	5.8920E-82	1.85085+07	5.479.82-02
76	1,9000E+0	7 5.130hE=72	1.9500E+07 4.9208E-02						

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NEUTRON CROSS SECTIONS INDEX. FNEMGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION

INTERPOLATION LAH BETHEEN ENERGIES Range Discription 1 To 77 y Linear in X

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REACTION Q VALUE -2,9550E+26 EV

1R0%-56

(N,P) NEUTRON CROSS SECTION

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ENDF/8 MATERIAL NO. 6418



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Evaluation of the ⁵⁸Fe(n,γ)⁵⁹Fe Reaction For ENDF/B-IV Dosimetry File R.E. Schenter - October 1973 Hanford Engineering and Development Laboratory

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus the theoretical calculations of Green et al. The thermal value of 1.18 taken from Fabry et al. Resolved resonance parameters for both s and p waves were obtained from Hockenbury et al, and were put into File 2. Above 32 keV the cross section is described in File 3 using the results of a Hauser Feshbach calculation made with the NCAP code of Schmittroth. For these calculations the Moldauer Optical Potential was used with $\Gamma_{\gamma} = 0.200$ and $D_{obs} = 22860$ eV. The NCAP results were lowered 10% to give better agreement with integral results from CFRMF reported by Rogers and Millsap. No microscopic capture measurements above 20 keV have been reported for this isotope.

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ENGENA MATERIAL NO. 6418

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NC1.035 \$5040 ND4.73N

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Evaluation of ${}^{59}Co(n,\gamma){}^{60}Co$, ${}^{59}Co(n,2n){}^{58}Co$, ${}^{59}Co(n\alpha){}^{56}Mn$. For ENDF/B-IV

T.J. Krieger, (BNL), A.B. Smith, D.L. Smith (ANL) and J.D. Jenkins (ORNL)

The present evaluation of Co-59 (n, y) for ENDF/B IV consists of two parts, an evaluation below 100 KeV by T.J. Krieger, Brookhaven National Laboratory, and one above 100 KeV by A.B. Smith and D.L. Smith, Argonne National Laboratory.

A. $\frac{59}{Co(n,\gamma)}$ evaluation below 100 KeV, T.J. Kreiger, BNL.

The Resonance region has been extended from 10^{-5} eV -36 keV in ENDF/B-III to 10^{-5} eV - 100 keV for ENDF/B-IV. However, the list of resonances extends to 119 keV. There is no unresolved region. Care has been taken to tie in smoothly with the evaluation above 100 keV.

The resonance parameters were taken from the recently published new edition of the BNL 325 compilation (Ref. 1) with the following modifications:

(1) The effective scattering radius R' was increased from 5.3f (Ref. 1) to 6.8f in order to improve the fit of the total cross section between resonances with the data of J. Garg et al. (Ref. 2).

(2) The change in R' mentioned above entailed a change in the bound state parameters. These are determined by fitting to the experimental values (Ref. 1) of the thermal scattering and

- 92 -

thermal capture cross sections and of the coherent scattering amplitude.

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(3) Unknown J-values wore assigned the values 3 or 4 at random, an attempt being made to keep the level density proportional to 2J+1.

(4) To improve the fit with the data of Ref. 2, a few resonances in Ref. 1 were eliminated completely and some in the high energy region were shifted slightly.

(5) Unknown gamma widths (for resonances between 13.92 keV and 90 keV) were assigned the value $\Gamma\gamma=0.48$ eV. Above 90 KeV gamma width was increased to 1.55 eV in order to improve the fit to capture data and to smooth the tie-in with the evaluation above 100 keV.

Using the resonance parameters of Ref. 1 with the above modifications, Breit-Wigner multi-level calculations were performed and compared with the data of Ref. 2. The fit was generally very good. However, for further improvement, a small background contribution (no larger than ±1b below 95 KeV) to the elastic scattering cross section was introduced in selected energy regions of File 3. The capture cross section was not assigned a File 3 background contribution.

The thermal (0.0253 eV) cross section calculated from Files 2 and 3 follows:

Thermal capture cross section = 37.22 barns This value is within the limits given in Ref. 1. The resonance capture integral (lower limit = 0.5 eV) calcu-

- 93 -

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lated from File 2 is 76.7 barns which is within the limits given in Ref. 1.

B. $\frac{59}{\text{Co-evaluation 0.1 - 20 MeV, A.B. Smith and D.L. Smith, ANL.*}}{\text{The (n, <math>\gamma$) Reaction

The cross sections for this process have been measured by activation and by prompt gamma ...y detection techniques. There is a metastable state in the residual ⁶⁰Co nucleus but the isomer ratio has been determined at a number of incident energies by Paulsen⁽⁶⁾ and thus the total (n,γ) cross section can be reasonably deduced using activation techniques. Johnsrud et al.⁽⁷⁾ have determined the isomer activation cross section at a number of energies up to ~ 2.0 MeV. Their results have been corrected to obtain the total (n,γ) cross section using the isomer ratios of Paulsen. Paulsen has measured the (n,γ) cross sections at approximately 2.0, 6.0 and 14 MeV. The Johnsrud et al. and Paulsen measurements are in agreement in the region of overlap near 2.0 MeV. Rigaud et al.⁽⁸⁾ determined a 14.8 MeV cross section from observation of prompt gamma-ray emission. Their value is only about half that of Paulsen but both are small (< 2.5mb).

The available experimental information is sparse but it does provide reasonable guidance for the present evaluation illustrated in Fig. 1. The evaluation follows the small structure near 0.5 MeV reported in Ref. 7. The interpolation from measurements at 6.0 to those at 14.0 MeV is essentially linear with little slope. The available experimental information seems to preclude any ap-*Extracted from P.T. Guenther et al. (Ref. 3).

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Figure 1

preciable giant resonance behavior between 2.0 and 14.0 MeV. Above 14 MeV the evaluation slowly increases. Such a behavior is qualitatively consistent with a small contribution from direct capture. The evaluation compromises between measured results near 14.0 MeV. The evaluation has some uncertainties but the cross sections are generally small and as a consequence creditable errors will not seriously influence most applications.

The present (n, y) evaluation is grossly different from that of ENDF, MAT-1118 as illustrated in Fig. 1. No experimental evidence justifying the ENDF-III result over much of the energy range could be found.

The (n,2n) Reaction

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The product nucleus, ⁵⁸Co, has an isomeric state which, fortunately, decays primarily by internal conversion. Thus, with reasonable care, activation methods have been used to give good results.

The available experimental information was divided into three sets. The first of these was judged most reliable by experimental

- 95 -

error, detail and consistency, both internally and with other selected sets. In this first group were the results of Cabe et al.⁽⁹⁾, Granger and Longneve⁽¹⁰⁾, Bormann et al. (omitting the lowest energy points)⁽¹¹⁾, Wenusch et al.⁽¹²⁾, Bormann et al.⁽¹³⁾, Wenusch and Vonach⁽¹⁴⁾, Paulsen and Liskien⁽¹⁵⁾, and Coodwin and Carter⁽¹⁶⁾. The second set of data was given less consideration in the evaluation and consisted of the results of Decowski et al.⁽¹⁷⁾, Weigold et al.⁽¹⁸⁾, and Jeronymo et al.⁽¹⁹⁾. The third set of data, consisting of the results of Refs. 20 to 23, was not accepted for this evaluation due to large discrepancies with the body of available information and/or large uncertainties. In some instances the values of the third set were not reasonably consistent with systematics (24) and/or were obviously much too small. The experimental information of all three sets is summarized in Fig. 2.

Giving most weight to the first data group (above) and, particularly, that of Ref. 15 (as it is detailed and of high



Figure 2

precision) a curve was constructed through the measured values. This curve is representative of experimental values as shown in Fig. 2 and was used in the present evaluation. The choice of this curve was subjective. However, more logical approaches may be deceptive in this instance as some data, reported with the highest precision, are obviously in error. Furthermore, some merit should be given to demonstrated reliability of particular laboratories and/or methods. These are subjective judgments.

Apparently due energies of the emitted neutrons have not been measured. Therefore, we assume an evaporation distribution with a temperature somewhat "softer" than that of the (n,n') process. The present evaluation and that of ENDF, MAT-1118 are compared in Fig. 2. There is not a great deal of difference though the present evaluation clearly is more descriptive of measurements at lower energies.

C. ⁵⁹Co (na) ⁵⁶Mn evaluation, J.D. Jenkins, ORNL.

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Several sets of consistent data exist for this reaction. The ENDF/B Version III (MAT 1118) representation follows the general shape of the data at energies above 8 MeV but does not represent the experimental shape below that energy. It is evident from Fig. 3 that the ENDF/B straight line representation from 6.5 to 8 MeV can be improved upon.

Bresesti et al. (Ref. 5) have evaluated this reaction cross section and their evaluation appears on Figs. 3 and 4. It appears to follow the data more closely in the lower energy range and re-

- 97 -



Figure 3

produces the experimental threshold at ~ 5 MeV while the ENDF/B evaluation is zero up to 5.5 MeV. At higher energies the Bresesti evaluation and ENDF/B Version III evaluations are similar.

The evaluation of Bresesti et al., therefore is adopted to represent this reaction and replaces the current evaluation of 59 Co(n, α) for ENDF/B Version IV.

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HEUTRON CROSS SECTIONS INDEX, ENEMGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION EV BARNS EV BARNS EV BARNS EV BARNS 1 1.06405407 0.00005400 1.10005407 2.00005407 1.15005401 1.20005407 3.00005401 1.25305407 4.00005401 6 1.30005407 5.00005401 1.35005407 5.00005407 3.40005401 1.40005401 1.40005407 7.50005401 11 1.70005407 7.50005501 1.80005407 6.20005401 1.90005407 8.10005407 8.10005407 8.00005401 11 1.70005407 7.50005501 1.80005407 8.20005401 1.90005407 8.10005407 8.00005401 8.00005401

INTERPOLATION LAH BETHEEN ENERGIES Range Description 1 to 14 y linear in x

REACTION & VALUE -1.8461E+87 EV

COBALT-59

DIRECT(N,2N) NEUTRON CROSS SECTION ENDEVE MATERIAL NO. 6199



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ENDETH MATERIAL NO. 4199 RESONANCE DATA Resonance parameters

RESOLVED MULTILEVEL BREIT-WIGNER PARAMETERS

COBALT-39

				RESONANCE WID	THS (EV)	
INDEX	ENERGT (EV)	J VALUE	TOTAL	NEUTRON	RADIATION	FISSION
1	-5,210#E+02	3,0000E+05	5.6150E+01	4.7670E+81	4,8080E+81	7,884gE+28
2	1,32046+02	4,0000E+00	5,6080E+ <i>30</i>	5.1200E+00	4,3#888848481	7,0000E+00
3	1,3880E+83	3.8000E+08	4,8568E-81	5.6 98 8E-83	4,8888E-81	A, 5888E+08
- 4	2,850WE+83	4,8880E+08	5,8580E-01	1.05096-91	4.8000E-01	8, 88 48E+08
5	3,9880E+#3	3,8008E+08	5,7288E-01	4,8808E-82	4,8080E-J1	8,88482+28
6	4,322WE+83	4.8008E+80	1,10486+02	1,1008[+82	4.888 9 8 - 81	8 .88 086E+88
7	5,015ME+03	3,90000+20	6,5288E+82	\$,5100E+#2	1. 840 9E+00	#3+38k# # ,#
6	6, 368 0E+03	4.0000E+00	2,2?80E+68	2.0000E+80	2,2380E-81	7 .0008E +00
9	8, <i>0980</i> E+03	3.00002+00	3,73#0E+01	3,7888E+81	3,840¥E-81	# .2845E+ 28
10	8,758¥E+83	4,00000.00	1.1400E+00	A,2000E-01	3,2000E-01	A,0000E+00
11	9,6904E+#3	3,000000+00	3.2680E+08	2,7089E+88	5,6900E+81	N . 0000E +20
12	1,8784E+84	4.00002+00	6.5538E+81	6,4988E+81	6,3###E=#1	7 .0008E+00
13	1,1879E+84	3.0000E+80	2.7588E+88	2,5000E+00	2,9000E=01	7 .0000E +20
- 14	1,326#E+#4	4,000E+80	2.1658E+81	2,100DE+01	6,5080E#01	3'B#48E+08
12	1.56406+04	3,000000+00	7.4578E+01	7.4100E+81	4,7080E+81	N, 3848E+88
10	1.092#E+04	4,00002+00	1,6752E+82	1,65986+82	5,2000E=01	8.8848E+38
17	1,9754E+84	4,000000+00	3.286BE+88	2.8900E+80	4,8000E=01	5' 998BE+68
10	2.1948E+B4	2.00001.00	7,4543E+82	7,4388E+82	4,8888E-91	8.6998E+58
19	2,2510E+84	4,000000+00	2,5348E+#2	9.53DEE+82	4, 80 20E-01	A' ABABE+66
28	2,440*E+84	3.00001+00	3,60402+82	3,600#E+#2	4,8888E+81	s'nnalt.c
21	2,515#E+84	4.00002+00	1,8448E+82	1.84DBE+82	4,8083E-81	N, UDISE+20
22	2,7429E484	4,90000.+00	2,2488E+01	2,3000E+81	4,80000-01	5, 8848E+C0
23	2,73702484	4.00000.00	1,7040E+02	1.70000002	4,80000-001	2.004#E.00
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22	3 01101+04	4.00001+00	3,2740E+02	3,2708E+02	4.80001001	9,96980+68
20	3,13002004	3,90002+00	1,99401+02	1,22005482	4,80002.081	N'NAABE-ER
27	3 99345 94	4,29001+00	0,00002+00	8,49002+08	4,89505-01	8'58ABE+65
20	3,2/3-10-04		1.42486+82	1,42002+02	4,63001001	**************************************
24	3 451 ME + 04		4,44801-01	A,48001481 A 98800.481	4.80001431	
30	3 40000.04	3,0000C+00	0.10505-05	7,70801+00	4 Baser - B1	
31	3 49445.04	x ,000000+00	2.4040L-82	2,4000L+02		
11	4 03545-04	3 44465.484	2,04402-01	2,00002.001	4.88886.91	***********
33	4 84785.84	4 40045-04	2./~	5,70005001		110408E*CP
	4 14895.84		3,0030108	3,20001000		710049L409
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17	4.34105.84	1 90886.00	3,100001400	2. / UUUL + UU	4 43665-54	
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4, 64,886 • 62 6, 73,866 • 62 6, 73,866 • 62 74,466 • 62 74,766 •	2.2540562 9.4990598 9.4990598 2.2940598598 2.2940598598 2.29400598 2.2940598 2.2940598 2.294059	22+3854. 22+36565. 23+36565.
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72	MOL	Deworm
67	GEL	Paulsen
66	GEL	Vaninbroukx
65	FAR	Carre'
63	ORL	Macklin, et al.
61	BUC	Stephanescu, et
61	ANL	Meadows, et al.
61	ORL	Gibbons, et al.
60	MUN	Wolf

FAR

BNL

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et al.

Ailloud, et al.

Deutsch, et al.

REFERENCES FOR EXPERIMENTAL DATA

⁵⁹Co(n,Y)

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COBALT-39

NEUTRON CROSS SECTIONS NELINGEN LUGSS SECTIONS INDEX, ENEMONY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION ENERGY CROSS SECTION EV BARNS EV BARNS EV BARNS EV BARNS EV BARNS 1 1,000ME-05 0,000EE-00 1,0000E-00 0,0000E+00 0,000E+05 0,000E+05 0,000E+02 0,200E+02 0,200 EV BARNS 1.0070E+80 8.0070E+88 5.0080E+85 9.0080E+83 1.2500E+86 7.6880E+83 11 9,0000005858,400000003 16 2,50000003,30000003 21 2,00000071,90000003 2,588#E+86 3,3888E+83 4.0000E+86 2.5000E+83 6.0000E+86 2.00002-03 1.0000E+07 1.7000E-03 1,4002E+07 1,5000E-74

> Z. für Phys. <u>205</u>, 226 (1967) Nuc. Sci. & Eng. 24, 87 (1967)

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Phys. Rev. 83, 1059 (1951)

INTERPOLATION LAW BETWEEN ENERGIES RANGE DESCRIPTION 1 TO 21 Y LINEAR IN X

(N,GAMMA) NEUTRON CROSS SECTION

ENDE/8 MATERIAL NO. 6199



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EWERGY CADSS SECTION EWERGY CROSS SECTION EWERGY CROSS SECTION EV PARKS EV BARKS EV BARKS EV BARKS 7,000014486 3,50075403 1,10001497 2,10001402 1,30001497 2,10001402 1,30001497 2,12001402 1,70001497 2,12001402 1,90001407 1,27001402 RNS ENDF/B HATERIAL NO. 6199 6.588888.486 2.09388.483 9.89888.486 1.21888.482 1.35988.487 2.45888.482 1.45988.487 2.46888.482 1.87988.487 1.37888.482 6,88865-86 1,86987-83 8,98865-86 1,86987-83 1,316665-87 2,98865-83 1,89865-87 2,98865-82 1,89865-87 2,98865-87 1,89865-87 1,928867-87 (N,ALPHA) NEUTRON CROSS SECTION 9.59765484 4.20785484 0.0075454 7.20785643 1.27466497 2.76056482 1.27426497 2.00706548 1.47325487 1.77985482 INTERPOLATION LAN BETHEEN ENERGIES Range description 1 to 20 y linear in X MEACTION & VALUE 3.1704E+85 EV C084LT-59

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There are extensive data on the (n,2n) cross-section of ⁵⁸Ni from its threshold of 12.415 MeV to 20 MeV. The most extensive data covering a wide range are by Paulsen and Liskien and by Bormann et al.² Paulsen determined the (n,2n) cross-section from 12,98 to 19.6 MeV by the activation method and the measurement of the annihilation radiation with an accuracy of about 7%. The activation experiments of Bormann measured the gamma and positron activities with a NaI(Tl) detector and a $\gamma-\gamma$ coincidence spectrometer and have a comparable accuracy and extend from 12.95 to 19.6 MeV. As can be seen from Fig. 1, though these two sets of data are in good agreement with one another below 16 MeV, they diverge above this energy with the Paulsen data being larger by as much as 12% or approximately two standard deviations. Two other data sets which extend up to 20.0 MeV; one by Prestwood and Bavhurst³ and the other by Jeronymo et al.⁴. Prestwood and Bayhurst counted the 57 Ni ß particles and used 238 U fission cross-sections to monitor the neutron flux. These data agree with the general trend of other measurements up to about 14.0 MeV; above this energy

^{*}Extracted from "Neutron and Gamma Ray Production Cross-Sections for Nickel" BNL 50435 October 1974 M.R. Bhat.

they are higher giving 77.4 mb at 19.8 MeV. These cross-sections were considered too high and were not included in the evaluation. The Jeronymo data obtained by measuring the gamma rays following the decay of ⁵⁷Ni give a cross-section of about 40 mb at 20 MeV and are considered too low to merit consideration (not shown in Fig. 1). The data of Lu and Fink⁵ at 14.4 MeV and Cross et al.⁶ at 14.5 MeV are higher than other data at this energy. The data of Csikai⁷ (not shown) between 13.56 and 14.71 MeV appear to be higher than other measurements and also show a peculiar trend at variance with other experiments (see the plot in Ref. 8 p. 28-58-4) and were not considered in the evaluation. Other data sets shown in the plot are by Temperley and by Barrall et al. 10-12Temperley measured the annihilation radiation from the decay of ⁵⁷Ni and the data are in good agreement with other measurements in the energy region 13.72 to 14.79 MeV. Barrall and co-workers obtained 30.9 ± 2.0 mb at 14.5 ± .2 MeV, 33.4 ± 2.0 mb at 14.6 ± 1.2 MeV, and 36.0 ± 3.0 mb and 14.8 MeV in good agreement with other data sets. Rayburn¹³ measured the (n, 2n) cross-section as 34.2 ± 2.6 mb at $14.4 \pm .3$ MeV based on 63 Cu (n,2n) = 503 mb. In the ENDF/B-III MAT = 1085 evaluation this cross-section is found to be 533 mb. Therefore, a renormalized value of 36.2 ± 2.7 mb is obtained which is slightly higher than other data at this energy. Preiss and Fink¹⁴ obtained 52 \pm 5 mb at 14.8 \pm .9 MeV using 6j Cu (n,2n) = 556 mb as the standard cross-section; this value appears to be too high. Bramlett and Fink 15 obtain 31.6 ± 4.0 mb at \$\$.7 ± .2 after their value is renormalized to

- 109 -

 27 Al (n, α) = 116.1 mb, and is a little on the low side. In addition, Glover and Weigold's¹⁶ measurements follow the general trend of other data except for the last two points at 14.77 MeV and 14.88 MeV. Some of these data were not plotted in Fig. 1 for fear of cluttering up the diagram. After considering all these data, a smooth curve was drawn through these data points with the curve following the general trend of the Bormann data at higher energies and lies lower than the Paulsen measurements and higher than the Bormann data. In Fig. 1 the dashed line shows the (n,2n) cross-section as calculated using the code THRESH¹⁷ which uses systematies of nuclear data to calculate the various (n, particle) cross-sections.



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 NEWITRON CROSS SECTIONS
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JNTERPOLATION LAW BETWEEN ENERGIES Range description 1 to 17 v linear in X

REACTION & VALUE -1.2223E+07 EV

NICKEL->8

DIRECT(N, 24) NEUTRON CROSS SECTION ENDEZE MATERIAL ND. 6419



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A. 5

Evaluation of the ⁵⁸Ni(n,p)⁵⁸Co Reaction for ENDF/B-III Dosimetry File R.E. Schenter - August 1973 Hanford Engineering and Development Laboratory

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus papers describing recent measurement. by Smith and Meadows and Paulsen and Widera. Fig. 1-5 show the evaluation made (solid curve) together with available experimental data and some previous evaluations. Below 6.0 MeV Smith and Meadows values were directly used (Figs. 1-3). Smith and Meadows results were normalized relative to the ENDF/B-III ²³⁵U fission cross section. Above 6.0 MeV a smooth "eye-guide" curve was constructed (Figs. 4-5) which fell between previous evaluations and numerous experimental results.



Figure 2



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Figure 5

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NICKEL-28			NEUTRON	CROSS SECTI	10		NUF/8 4ATERIA	1L ND. 6419	
REACTION Q VALUE	3,9472E+Ø5	EV							
INTERPOLATION LAN Range des 1 to 168 ln	I BETLEEN ENER Icription Y Linear In X	ĜIES							
NEUTRON CROSS SEC INDEX, ENEMGY	TIONS SECTION	ENERCY C	HOSS SECTION	ENERGY CR	DSS SECTION	C ACOCA	8055 SEFTINK	, VI010	0000 SECTION
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1 3.82845485 A 5.60845465	1.90005-05	3,5898E+85	7.34565-66	4 .09055-05 4		4.5662E+05	1.38086-06	5, 82375 - 25	3.20236-36
11 8.3600F+05	3.83985-04	8.72405+05		o.yemeress o o.yemeress o		7.97692695	50-342295 - 62	7.24805485	8.8362E-25
16 1,1388F+05	3,5605E+03	1.27605-86	5.54646-03	1.48785+06 1	15345-92			1.47785.404	004/00/00.V
21 1,7054F+06	1 2,3871E+02	1,8838E-86	2.63705-02	1,98495.86 3	-5144F-A2	2.035.6-36	3.62135-02	2,10695-06	56-355.4
	7.300JE-02	2,2938E+66	1.00.01-01	2 414PE - D0 8	1, 39495-22	2.50576+06	1.10336-01	2.61585+86	1.84315-81
76 2.02405406	1.41425-01	2,513NF•80	1.55465-01	2,6549E+20 1	18-18440°	2.87635.86	1.62485-01	2.98485+86	1.74525-81
41 3.03106.06	1.8655E=01	3.88285+86	2.02905-01	2.18745400 2 3.18745405	14-J1092.	5.MC635+86	1.5956F-21	3.81585-86	1.74525-01
46 3,1584F+86	2.1062E-01	3.183PE-26	2.04425-01	3.20805-30 2	20055-81	3.21505-36	2.34795-81	3.2350F-66	1.000745-61 3.75635-21
51 3.2410F+84	2.3871E-01	3,28685+86	2.3269E=01	3, 3128E+06 2	21005-81	3.31376+26	2.33695-01	3.3357E-26	2.15645-01
10 0101010100	2.3169E-01	3.3788E+86	2.28685-81	3.4110E+E6 2	.42725-01	3.41505-06	2.4573E-01	3,436£5+86	2.33695-P1
	2 700/9L301	3.4850E+00	2.7381E-01	3.51485+86 2	. 6284F • F1	3.54005+06	2.7682E-01	3,56485+86	2.9686.41
71 3.64605+86	2.8284E_01	0, 01 - 10 - 00 - 00 - 00 - 00 - 00 - 00	2,4550L761		12.44.61		2.89865-01	3,64185086	1.71895-01
76 3 7660F+86	3.1092E-01	3.79385+86	3,19955-01		51845-81	3.8178Fe86	10-34044 - S	3, 74205 -056	
61 3.8674F+06	1 3.7511E=01	3.8940E-06	3,31985-01	3,9062-66 3	61875-01	3.91825-06	3.47036-01	3.94365+66	3.47635-81
R0 3,9609E+06	2,2496Ea01	3,96985-26	3.81135-01	0.99485486.0	1.50045-01	4. FUBBE-06	3.59265+01	0192E -06	3,3786E-01
74 11/01/00 05 4.42105404		1.16185-86	3,40 71 5-01	4.21286.00 4	19-101-01	4.31985-86	4.11225-01	4.35985+86	4,02195-B1
1#1 5,1020F+06	19-35E+6 +	5.13805+00	4.64385-81	5.19305-26 4	73480-61	01 0VE-06	4.5435541	6, 44081.086	4.72485-81
100 5,295#F+06	5.0048E-81	5.3738E+86	5.1553E-01	5.48946+26.5	19235-61	5,68186+86	5.95775-01	5.77305+06	19-39995. .
111 5.6784F+06	, 5,8874E=01	6.8888E+85	6.12#0E-01	6.2500E+86 6	19-3081-91	6.5003E+06	6.2300F=01	6,756AE+86	6.3000-01
110 / BUDULAUS +21 5.25005-04		/.25886+86	6.4300E~D1	7.5085E+06 6	-4988P-81	7.758BE-06	6.5288E-81	8. FERBE+66	6.57885-81
126 9,50006-06	6.9988E-01	9.7588F+86	0.00005-01 6.54855-01	0,734955400 0 1.666465407 6		9.00005-96	6.6200E-01	9.25855455	6.51985-01 4 10001-01
131 1.0750E-07	6,3988E-61	1.16605+07	6.21FBE-01	1,12505-67 6	99991-91	1.15000000	5.93665-61	1.17586+67	5.7884F-81
136 1.20005+07	5,55886-81	1,2250E • 07	5.38885-81	1,25926+07 5	10-3000-UT	1.27586+87	4.95605-81	1.38665+87	4.7588E-01
		1.3500E+07	4.25005-01	1.37596+07 4	. 0556F-01	1.40005+77	3.82095-01	1,4258E+87	3,65#BE-81
	10-100/- 0		J. J27085-01	1.79665.67		1.3253E+87	3.02055-01	1.5588E+87	2,66005-01
1.70005 407	2.2700F-01	1000001	2.040#1-01 7	7 /3630C2011	10-10000	1.058PE+87	2.43885-81	1,67585+87	2,34666+81
161 1.8250E+07	1.9788E-01	1.85805+07	104806-01	1.1730FE90/ 2		1./7505+87	2.07005-01	1, deset 407	2,02485-01
146 1.95805+87	1.89865-81	1.07505+07				7. 7000£ . 6	1 0- 30 <i>0</i> 14'1	1.42301-11	1,90505-01



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⁶⁰Ni(n,p)⁶⁰Co Reaction for ENDF/B-IV*
 M. R. Bhat
 NNCSC

Brookhaven National Laboratory

The most extensive data on the 60 Ni(n,p) cross section from 5.76 to 19.55 MeV are by Paulsen and Liskien. ${}^{1-4}$ In these experiments the induced activity was measured by γ - γ coincidence counting and the efficiency of the coincidence spectrometer determined from calibrated radioactive sources whose activities were known to ±0.5%. The errors vary from 7-10% except for a few points where they are larger, up to 16%. The measurements of Cross et. al.⁵ at 14.5, MeV when renormalized to an 27 Al (n, α) cross section of 118.6 mb (MAT = 1135 ENDF/B-III), give 186 mb and a later result⁶ by the same authors is 165 mb; both appear to be too high compared to the Paulsen and Liskien data. Allan⁷ determined the (n,p) cross section by measuring it at 120° to the neutron beam using photographic emulsion plates and multiplying by 4 π the observed differential cross section. He obtained a value of 134 ± 9 mb at 14 MeV in good agreement with Liskien and Paulsen. How-

^{*}Extracted from "Neutron and Gamma Ray Production Cross Sections for Nickel" BNL 50435 October 1974, M.R. Bhat.

evern, this technique has given results widely at variance with others. Storey et, al. $\frac{8}{1000}$ have determined the (n,p) cross section to be 158 ± 32 mb at 14.1 MeV which appears to be rather high commared to the general trend of the other data. Hemingway 9 obtained a cross section of 129 ± 16 mb at 14.7 ± 0.2 MeV using $\frac{56}{Fe(n,p)}$ $\frac{56}{Mn} = 97.8$ mb as a standard. This is to be compared with 104 mb recommended for the standard in the evaluation (MAT-6410) in ENDF/B-IV dosimetry files. This implies a 6% upward renormalization of the Hemingway value to give 137 mb. Levkovskii et. al. 10 have measured the (n,p) cross section to be 130 ± 40 mb which again is higher than the general trend of the Liskien -Paulsen data. The data not considered in this evaluation are by Preiss et. al. 11 (cross section to metastable state only) March et. al.¹² (too low) and Allan¹³ (highly discrepant). In looking at all the available data it is unfortunate that there are no data from the threshold energy to 5.75 MeV, hence the rising part of the curve was drawn similar to the $\frac{58}{Ni}$ (n,p) cross section curve (after suitably shifting it for differences in the Q-values) and smoothly joined to a curve drawn through the experimental data at higher energies. The trend of the curve in this energy region is mainly determined by the Paulsen and Liskien data, as shown in Fig. 1.

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Figure 1

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NEUTRON	CROSS SECTIONS				
INDEX,	ENERGY CROSS SECTION	ENERGY CROSS SECTION	ENERGY CHOSS SECTION	ENERGY CROSS SECTION	ENERGY CROSS SECTION
	EV BARNS	EV BARNS	EV BARNS	EV BARNS	EY BARNS
1	2,3846E+06 0,0000E+00	4.50002+06 1.00002-03	5,000ec+06 4,00000-03	5.50002+06 1.50000-02	6.0000E+26 3.1500E-02
6	6.5000E+06 4.5000E+02	7.0000E+06 6.3000E-02	7,50000=00 7,90000=02	8.000PE+26 9.4000E-02	8.5000E+06 1.1700F-01
11	9,0000E+06 1,3500E>01	9.5000E+06 1.50P0E-01	1,00005+07 1,60000-01	1,0500E+07 1,6600E+01	1.100000+07 1.64000-01
16	1,19866+87 1,57886+81	1,20005+07 1,47805-01	1,258862+87 1,42882-81	1.30005+07 1.40005-01	1.3580F+87 1.3508E-21
21	1,4000F+07 1,3000E=01	1.4500E+07 1.2180E+01	1,5000E+07 1,1000E-01	1.5500E+07 1.0000E+01	1.6200E+07 9.3000E+02
2 p	1.650°E+07 8.6000E+02	1.7000E+07 8.1000E=02	1,75045+07 7,65005-02	1.80000.07 7.20000-02	1.0500E+07 6.8000E-02
31	1,9880F+87 4.5888E+02	1.9580E+07 6,2078E-02	2,00005+07 5,00007+02		•••

(N,P) Neutron Cross Section ENDF/8 HATERIAL NO. 6420

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NICKEL-00

REACTION Q VALUE -2,0411E+06 EV

INTERPOLATION LAW BETHEEN ENERGIES Range description 1 to 33 y Linear in X



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⁶³Cu(n,γ); (n,α) Reactions for ENDF/B-IV H. Alter* Atomics International March 1972

Introduction

Evaluated data sets for 63 Cu (n, γ) and (n, α) reactions contained in the ENDF/B-III and SAND files were reviewed, compared and where possible, intercompared with measured data. Specific sources were: for ENDF/B, Tape #303, MAT #1085, release date 1/21/72; for SAND, the National Neutron Cross Section Center at BNL provided the reviewer with data decks for the required neutron reactions. In addition, the NNCSC also provided a CSISRS listing of measured data for the two reactions in 63 Cu.

Review Procedure

All data sets were independently graphically displayed and respective data sets were then overlayed so that differences could be visually interpreted (e.g., Fig. 1-3 the (n,γ) cross sections). (n,γ) Cross Section

Below 1 eV the data from the ENDF/B and SAND libraries are essentially identical. Above 1 eV the data sets diverge with the SAND data being lower in magnitude. The ENDF/B data in the resolved resonance region is more highly resolved than that in the

^{*} Present Address: U. S. Energy Research Development Administration, Washington, D.C. 20045.

SAND library. To further analyze the data in the energy region 10 eV to 30 keV, both sets of data were group averaged (group width equal to 0.5 lethargy units) weighting with a 1/E spectrum. Results are given in Table 1. The group constants based on the ENDF/B parameters were obtained analytically using the File 2 resonance parameters. The SAND data did not have parameters, therefore the related group constants were obtained by numerical





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integration. To be assured that this comparison was valid, the ENDF/B resonance parameters were used to generate the (n,γ) line shape and these data were then numerically integrated.

Agreement between the analytic calculation and the numerical integration is generally quite good except at the first few resonance peaks. The differences in group constants (ENDF/B vs SAND) are apparent and can easily be related back to the energy dependent cross section data.

In Table 2 calculated resonance integrals for 63 Cu (n, γ) are compared with a number of reported measurements. In a recent compilation of resonance integrals, M.K. Drake* gives for 63 Cu a value of 5.1 ± 0.2b. A recent compilation of values for resonance integral cross sections, given in "Neutron Fluence Measurements", Technical Report Series #107, IAEA, Vienna 1970, range from 4.2 to 5.1 barns. These values are given for various cutoff energies. Generally the reported data agree reasonably well with ENDF/B-III.

Above 30 keV experimental data, supplied by the NNCSC, are plotted on the overlay ENDF/B and SAND cross section curves (e.g. Fig. 4-5). Resolution of the discrepant data in this energy region requires a more extensive effort than that currently applied for this task force review. One notes however, that the magnitude of the cross section in this region is generally less than 120 mb.

Based on this review, MAT #1085 (ENDF/B-III) is accepted to 30 keV and above 1.8 MeV. Between 30 keV and 1.8 MeV, at least squares fit of the data in (Fig. 4-5) is utilized, and

* Private communication, M.K. Drake to E. Ottewitte, 1970.



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Figure 5

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joined to MAT #1085^{*} (insufficient data does not permit high confidence in the evaluation above 30 keV).

(n,a) Cross Section

The SAND file (n, α) cross section data were obtained from the NNCSC, and overlayed with the ENDF/B data for energies greater than v5.5 MeV. The SAND (n, α) data extends from .0001 eV to v18 MeV.

In Fig. 6, experimental values of the (n,α) cross section supplied by the NNCSC and also obtained from a brief review of the literature are plotted against the overlay ENDF/B and SAND curves. Generally, the measured values fall between the two evaluated curves.

In Table 3, calculated values for the fission spectrum averaged (n,α) reaction are given. Results are given for both the Cranberg and Watt representations of the fission spectrum.

In Table 4, both measured and calculated values of this quantity are given. These values are all within a factor of ~ 2 of each other.

* Data extrapolated from 15-20 Mev at NNCSC January 1974.



Note: Cross section represents production of ⁶⁰Co 10.5-min metastote as well as g.s. Cross section does not include the (n,na) process.

Figure 6

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Figure 7

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Paulsen (Nukleonik <u>10</u>, 91) quotes a value of 0.34 \pm 0.04 for the (n, α) reaction integrated over a Watt spectrum. Taking measured differential cross sections, (eliminating the data points at 10.17 and 10.98 MeV as he suggested) and calculating the fission spectrum average using the Watt representation the following results are obtained:

<u>ΔΕ</u>	<u>σ(mb)</u>
5.5 - 15.0 MeV	0.343
5.5 - 19.55 MeV	0.344

This result, when compared to the calculated quantities in Table 3, falls between the ENDF/B value 0.298 and the SAND value 0.442.

From the review of the 63 Cu (n, α) reaction one concludes that neither of the evaluated sets is adequate. The spectrum averaged quantity using the ENDF/B data is consistently lower than the same quantity using the SAND data. This is consistent with the respective sets of evaluated data. The value of 0.356 mb quoted in BNWL-1312 does not appear to be consistent with the same spectrum averaged quantity, 0.490 mb, calculated for this review. The reason for this discrepancy is not known at this time. Therefore, for ENDF/B-IV the Paulsen data, (Nukleonik, <u>8</u>, 315 (1966); <u>10</u>, 91 (1967), and Nucl. Phy. <u>63</u>, 393 (1965) with the points 10.17 and 10.98 omitted, are to be adopted.

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Table	1
Table	×.

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Comparison of ENDF/B-III and SAND ⁶³Cu Capture Cross Section for

10 eV ≤ E ≤ 25 KeV

Group Boundary ^E L	ENDF/B (Barns)	ENDF/B (Barns)	SAND (Barns)
$(\Delta u = 0.5)$	(Analytic Solution)	(Numerical	Integration)
24.788 kev			
15.034	0.109	0.110	0.081
9.1188	0.192	0.193	0,152
5.5308	0.243	0.246	1.265
3.3546	0.226	0.228	0.626
2.0347	0.721	0.730	0.096
1.2341	0.143	0.145	0.592
748.52 eV	0.046	0.046	0.007
454.	5.337	5.400	3.438
275.36	0.046	0.046	0.013
167.02	0.043	0.043	0.009
101.30	0.053	0.052	0.011
61.442	0.067	0.067	0.018
37.267	0.090	0.090	0.030
22.603	0.121	0.121	0.051
13.710	0.162	0.161	0.088

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T.ble 2				
Comparison of Calculated and				
	Measured	Resonance Integrals	for ⁶³ Cu(n,γ)	
		(Calculated: $E_c = 0$.	5 ev)	- <u></u>
ENDF/B		SAND	BNWL-1312	
		(BARNS)		
5.35		4.79	4.64	
		(MEASURED)		
Measured Value (b)	Cutoff Energy, H (ev)	c Remarks	I _w , Ad- justed to E= 0.5 ev In- cluding 1/v(b)	Ref.
4.4	0.52	1/v included	4.4	1
3.09±0.15	0.5	No 1/v, restored using $\sigma_{a2200}^{=4.5}$ b	5.11±0.2	2
3.17±0.18	0.62	No 1/v, restored using $\sigma_{a2200}^{-4.5}$ b	4.99±0.2	3
4.2±0.2	0.62	5 mil foil	5.3±0.2	- 4

1. R. Macklin and H. Pomerance, 5, 96 (1955).

 R. Dahlberg, K. Jirlow and E. Johansson, J. Nucl. Energy AB, <u>14</u>, 53 (1961).

- 3. N.P. Baumann, DP 817 (1963).
- 4. L. Anderson, Health Physics, <u>10</u>, 315 (1964).

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Table 3 Comparison of Calculated Values for the Fission Spectrum Averaged ⁶³Cu (n, a) Reaction

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(MILLIBARNS) DATA SPECTRUM ENERGY_INTERVAL RESULT ENDF/B CRANBERG 5.5 - 15.0 MeV 0.274 ENDF/B WATT 5.5 - 15.0 MeV 0.298 SAND CRANBERG 5.5 - 15.0 MeV 0.408 5.5 - 15.0 MeV 0.442 SAND WATT 10^{-9} - 15 SAND CRANBERG MeV 0.455 10⁻⁹- 15 WATT MeV 0.490 SAND 10⁻¹⁰-18 BNWL-1312 WATT MeV 0.356

CRANBERG: $f(E) = 0.453 \exp(-E/0.965) \sinh(2.29 E)^{\frac{1}{2}}$ WATT: $f(E) = 0.484 \exp(-E) \sinh(2E)^{\frac{1}{2}}$

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Table 4

Fission- Spectrum Averaged			
XSC (mb)	Basis	Reference	Year
.76	Empirical estimate	Roy, Hawton CRC-1003	1962
.72	Measurement relative to 0.60 mb for 27Al (n,a) ²⁴ Na	R.S. Rochlin, Nucle- onics <u>17</u> , 54	1959
.54±.07	Measurement relative to 101 mb for ⁵⁸ Ni (n,p) 58 _{Co}	R. Nílssm, Neutron Dosimetry, VII, 275	1 963
.42	Measurement relative to 0.57 mb for $^{27}A1$ (n, α) ^{24}Na	C.H. Hogg, L.D. Weber Symposium on Rad. Eff. on Metals and Neut. Dos., 133 (ASTM)	1963
.36 ±. 04	Measurement relative to 65 mb for 32 S (n,p) 32 p	R.L. Ritzman, et al. Ibid, 141	1963
.45±.05	Measurement relative to 76 mb for ⁵⁴ Fe (n,p) 54Mn	D.M. Ciare, W.H. Martin J. Nucl. En. <u>18</u> , 703	1964
.52±.04	Measurement relative to (1) 63 mb for ${}^{32}S(n,p)$ 32p (2) 0.63 mb for ${}^{27}A1$ (n, α) ${}^{56}Mn$ (3) 1.04 mb for ${}^{56}Fe(n,p)$	A. Fabry EANDC (E) 66U	1965
. 44	Measurement relative to 90.6 mb for ⁵⁸ Ni (n,p) 58 _{Co}	(Grenoble) EANDC (E) 57U	1965
. 382	Integration of an evaluated curve	Sov. J. At. E. <u>25</u> , 1251	1968
.34±.04	Integration of an evaluated curve (over Watt spectrum)	Paulsen, Nukleonik <u>10</u> , 91	1967
.356	Integration of evaluated curve (over Watt spectrum)	BNWL-1312	1 9 70

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1 RESOLVED MULTILEVEL BREIT-KIGNER PARAMETERS

--- 3.0000E+04

L VALUE	6
NUMBER OF REDONANCES	28
SPIN SCATTERING LENGTH (A+)-+	0.00006+00

				RESONANCE WID'	THS (EV)	
INDEX	ENERGY (EV)	J VALUE	TCTAL	NEUTRON	RADIATION	FISSION
1	-3,06905+02	2,00006+00	5,10305+00	▲.5530E+00	5.5000E=01	9,00006+20
2	5,777VE+02	2.00000-00	1,4100E+C0	8.6600E-01	5.5000E-01	8.000EF+20
3	2,0600E+03	1,000000+00	4.4050E+01	4.3500E+01	5.50C0E=01	8.00005+20
4	2,6600E+03	2.00002.000	5.0500E+00	4.50000+00	5.5000E-01	9.00000-00
5	4,860 <i>0</i> E+03	1.000FE+00	1.4550E+01	1.40005+01	5.50000-01	8.0000f+00
6	5,3900F+03	2.000000-00	4.0550E+01	4.0000E+01	5.5000E=01	8.0000.00
7	5.82005+03	2.0000E+00	1,0950E+01	1.04005+01	5.5000E-01	8.0000F+00
8	7.6400E+03	2,00005+00	7.3500E+00	A. 8000E+00	5.50000001	3.00005+00
9	7,9400E+03	2,00086-00	8.9550E+01	8.0000E+01	5.5 m. 8E - 81	0.02005+00
10	9,20005+03	2,0009E+00	3.715PE+01	3.6600E+01	5.5020E=01	8.00005+00
11	9 ,93 00F •03	1.000000+00	8.7558E+01	A.7000E+01	5.5000E+01	A. 8000F+00
12	1.08505+04	2,0000E+00	5.8550E+01	5.8000E+01	5.50006-01	A. 8000F+20
13	1,2540E+04	1,0000E+00	2.35506+01	2.32888.001	5.5000E-01	A 4000F+30
1,4	1,3170F+04	2,000086+00	6.655ØE+01	6.6800E+01	5.50000-01	0.00405+00
15	1.3700F+04	2,0000E+00	3.9993E+01	3.9440E+81	5.5000E-01	8.8200F+08
16	1,4900E+04	2,0000E+00	2.83106+01	2.7760E+01	5.5000E+01	8.00205+30
17	1,5600E+04	2,0000E+00	1.8230E+01	1.7480E+01	5.5020E-01	A.0608F+00
18	1,61002+04	2,000PE+00	1.1590E+01	1.1040E+01	5.5000E-01	3.00005+00
19	1,7880E+Ø4	1,0000E+00	1,3355E+02	1.33000+02	5.5000E-01	A. 8000F+00
20	1.81205.04	1.0000E+00	1.3355E+02	1.3300E+02	5.5800E-01	8.00005+30
21	2,1040E+04	1,000000+000	2.0055E+02	2,00000:+02	5.5000E-01	7.000DE+00
22	2,125 <i>5</i> F+Ø4	2.000DE+00	1.2055E+02	1,20005+02	5.5000E+01	A 02005+00
23	2,28205+04	2,000ef + 00	1.1255E+02	1.12005+02	5.5000E=01	A.0000F+00
24	2,4800F+04	2.0000E+00	6.0950E+01	6.0400E+01	5.5000E-01	8 82005+20
25	2,560PE+04	2.000000-00	1.6615E+02	1.6560E+02	5.5200E-21	4.000RF+40
26	2,6500E+84	2,0000E+00	9.735ØE+@1	9.68000:01	5.5220E-01	8.02025+00
27	2,0200E.+04	1.0000E-00	6,9210E+01	6,3662E+01	5.5000E-01	A. 0000E+20
28	2,9300E+04	1.00006+00	3,72656+02	3.2230E+02	5,5080E-01	A. 0000E-10

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(A,GAMMA) Neutron Cross Section

ENDF/8 HATERIAL ND. 6411

REACTION	G VALUE	7,9154E+Ø6	EV							
INTERPOLA Range 1 to	TION LAN DESI	BETHEEN ENER Cription T Linear IN L	GIES N X							
NEUTRON C TNDEX.	ROSS SEC Energy Ev	TLONS CROSS SECTION TARNS	ENERGY (CROSS SECTION BARNS	ENERGY C Ev	ROSS SELTION BARNS	ENERGY	CROSS SECTION Parne	ENERGY	ROSS SECTION
	0000E-05 1265E-01	2.2626E+02 9.9640E-01	1.00 <i>PC</i> E-04 1.00A&E+00	7.1506-01 7.11506-01	5,0007E-04 5,5007E+00	3.19885+81 2.95985-P1	1.20205-03 1.0005-01	2.2626E+01 2.1410E-01	2.53886-02	4,4977E+88
19 19 19 19	00005+04	9.0000E-03 6.4000F-03	1.0000E+02 2 0000F+02	1.3090E-02	5.00005+02	2,90001-02	1.9000E-03	3.80365-02	5.00006-03	6.2023F-32
12	4000F+04	0.21485-02	3.69955+04	6.9754E-02	3, 3888E+24	5.9435F-F2	4.2.02E+04	5.7943E+02	3.20005.024 4.25005.24	6,3626E-02 5.6188F-82
	5700F+04 7500F+04	5.4518E-02 4.4301F-02	4.7522E+94 4.00000-104	5.27465-02	5.90005-24	5,11435-92	5.2503E+84	4.94845-92	5.50305-04	4.79826-82
12	26905 +84	3.86975.02	7.60005-04	3.6811E-02	0. J0005+24		6.67395-84 8.48035-84	4.10365-62 3.35815-02	6.980RE+04	4.83745-22 1 31345-02
6 .	20005+04	3.08485-02	9.60005.04	2,96255-02	1.0000E-05	2.86275-02	1.850/E+P5	2.7434E-02	1.10006-05	2.62965-02
	40+ 30025	2.26385-02	1.68005+05	2.4642E502 2.240AF-02	1.27505+05	2,39556-92 2,34556-92	1.35395.05	2.3387E-02	1.4250E+05	2.2727E-02
• • •	0000E+05	2.40595-02	2.10665-05	2.45085-02	2.20005-05	2.4649F-02	2.30000-05	2.51765-02	2.4002E-05	6.3780E-02 7.5488F-02
	5580E • 85	2.5755E-02	2.7000E+05	2.66075-02	2.8000E+05	20-41209.2	3. P00.2 - 05	2.59985-02	3.20005-05	2.59795-82
12	500 DE + 02	2.20825-82	4,75985+05	2.10765-02	5.000AE+05	2.4620F-02	5.2500E+05	2.3491E+02	4.250RE+25	2.3167F-82 . 75345-82
8 2	75005-05	1.6347E-P2	6,00AFE+05	1.5240E=02	6.3588E-25	1.4093E-02	6.600CE+05	1.300E-02	6.9888E+05	1.24425-22
1.0	20005+05	1.1122F=02	7.60005-05	1.12795-02	8.00005+05	1.12885-02 	8.4000E+25	1.11895-02	8.52685+05	1.11706-72
1	30806+86	9.18945-03	1.4006-05	6.67465-03	1.50005-00	0.3008F 03	1.40005 +04	20-30-00 T	1.20005486 1 70095484	09430041°5
	8800E+86	7.41235-03	2,00405+06	7.00005-03	2.50005+20	6.3626F-03	3.00095+86	5.84175-03	3.5928E+26	5.4014E-23
		0.704VL-00	4 500 PE + 00	5, 0AA1E-03	5.888.85 .66	4.97305-03	5.523CE+06	4.8689E-03	6.000FE+06	A.7738E-23
			49+34690. /	4 48195 - 83	7-50005-00	00-14000° *	8.99965-96	4.14235-03	8,500AE+86	3,9881E~23
110	1.5005 407		9.3000rE+00	3.6667E-83	1.00005-27	3.5268P-93	1.85a0E+07	3.3936E-03	1.1002E+07	3.2667E-03
121 1.	40005-07	2,73775+03	1.45925+67	2.66775-03	1.5000E+27	c.97326-03 2.66886-03	1.34335+87 2.8P07E+07	2.8482E-83 2.1000E+83	1.359PE+27	2.8103E+23

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(Å,ÅLPHÅ) Neutron Cross Section

ENDF/3 MATERIAL NO. 0411

EACTION D VALUE 2.7149E+DD EV							
VTERPOLATION LAW BETWEEN ENERGIES Paange description 1 to 59 y Lineap IN X							
UTTON CROSS SECTIONS VEEX, EVENEY CROSS SECTION 16 5/2608E+80 3.0005E-84 5.7500E 80 5.936 6 5/2608E+80 3.0005E-84 5.7500E+84 1.970 11 9.7209E+80 1.652(E-07 9.2500E+04 1.970 12 1.7209E+80 1.652(E-07 1.07050E+04 1.970 14 1.7209E+80 1.5615E27 1.07050E+07 3.950 14 1.7209E+80 1.3015E27 1.07050E+07 3.950 14 1.7209E+80 1.3015E27 1.07050E+07 3.950 14 1.7209E+807 2.9480E-82 1.4576E+87 2.930 14 1.6520E+87 2.4982E+82 1.4576E+87 2.930 14 1.6520E+87 2.4565E+82 1.4576E+87 2.930 14 1.6520E+87 2.4565E+82 1.4576E+87 2.930 14 1.6520E+87 2.4565E+82 1.4576E+87 2.930 14 1.6520E+87 2.4565E+82 1.45762E+7 2.948 14 1.6520E+87 2.4565E+82 1.45762E+7 2.948 14 1.6520E+87 2.4565E+82 1.45762E+7 2.948 14 1.6520E+87 2.4565E+82 1.45762E+7 2.948 14 1.6520E+87 2.4565E+82 1.45762E+7 2.4565E+72 2.4555E+72 2	SEC 710% E SEC 710% E SEC 710% E SE 782 91,52 SE 782 91,52 SE 782 11,54 SE 782 11,54 SE 782 11,54 SE 782 11,64 SE 783 11,6	0 0 0 0 0 0 0 0 0 0 0 0 0 0	R055 85 85 85 85 85 85 85 85 85 85 85 85 8	Ekrage 6.2562 6.2562 6.2562 6.2562 6.2562 6.2562 6.2532 6.2532 6.2532 6.2532 1.1.2535 6.637 1.1.2535 7.2555 7.2535 7.2555 7.2555 7.2555 7.2555 7.2555 7.2555 7.2555 7.2555 7.25557 7.25577 7.25577 7.255777 7.2557777777777	R055 SEC 1 0 14.450 SEC 1 0 14.550 SEC 1 0	ENEROY 6.50000 6.50000 7.758000 9.80000 9.80000 9.80000 1.275000 1.275000 1.27500 8.87 1.27500 1.27500 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.175000 1.17500000000000000000000000000000000000	R05S SEC 110 6 57566 51 5 57566 52 1 80902 52 1 80902 52 1 80902 52 1 80902 52 1 1005 52 1 105 52

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REFERENCES FOR EXPERIMENTAL DATA

⁶³ Cu	<u>(n,Y)</u>		
<u>Yr.</u>	Lab	Author	References
70	DEB	Diksic, et al.	Acta Phys. Hun. <u>28</u> , 257 (1970)
69	FEI	Dovbenko, et al.	INDC 260, 11 (1969)
68	MUA	Hasan, et al.	Nuov. Cim./B <u>58</u> , 402 (1968)
68	UKR	Zaikin, et al.	At. En. <u>25</u> , 526 (1968)
67	MOL	Pinancelli, et al.	EANDC-(E)-76, 1 (1967)
66	FEI	Tolstikov, et al.	At. En. <u>21</u> , l (1966)
59	LVN	Vervier	Nuc. Phys. <u>9</u> , 569 (1959)
59	ORL	Lyon, et al.	Phys. Rev. <u>114</u> , 1619 (1959)
58	LRL	Booth, et al.	Phys. Rev. <u>112</u> , 226 (1958)
57	ORL	Macklin, et al.	Phys. Rev. <u>107</u> , 504 (1957)

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The ⁶⁵Cu(n,2n) ⁶⁴Cu Reaction for ENDF/B-IV P. F. Rose * Atomics International May 3, 1972

1

I Introduction

The 65 Cu(n,2n) 64 Cu reaction has been re-evaluated for the ENDF/B-files using a combination of selected experimental data and a semi-empirical technique for fitting the data at energies above 15 MeV. An estimate of the (n,3n) reaction was also obtained as a result of the analysis.

II Theory

لفاصف المراجع

The theoretical approach of S. Pearlstein⁽¹⁾ was utilized. Pearlstein's estimate of the (n,2n) cross-section was based upon the expression

$$\sigma_{n,2n} = \sigma_{ne} X \frac{\sigma_{n,M}}{\sigma_{ne}} X \frac{\sigma_{n,2n}}{\sigma_{n,M}}$$
(1)

where σ_{ne} is the non-elastic cross-section and $\sigma_{n,M}$ is the sum of the neutron emission cross-sections. Pearlstein obtained the ratio $\sigma_{n,M} / \sigma_{ne}$ as an empirical fit to nuclear data.

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Pearlstein obtained the energy dependent ratio $\sigma_{n,2n} / \sigma_{n,M}$ from statistical compound nucleus theory. His final working equation is:

*Presently at Brookhaven National Laboratory.

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$$\frac{\sigma_{n,2n}}{e^{p^{1/2}}} = 1 - \frac{e^{p^{1/2}} \left[(1 - \frac{1}{s}) p^{\frac{3}{2}} (3 - \frac{1}{s}) p + 6p^{1/2} - 6 \right] + 6 - \frac{p}{s}}{e^{p^{1/2}} \left[-2 (\frac{p}{s}) + 6(\frac{p}{s}) - 6 \right] + 6 - \frac{p}{s}}$$
(2)

in which $p = 4a S_n$, $S=S_n/E_n$, and a is the familar level density parameter of the residual nucleus (2,N). If the threshold for the occurrence of the (n,3n) reaction is overlapped by the neutron energies, the (n,3n) cross-section is calculated with $p=4aS_{2n}$ and $S=S_{2n}/E_n$. For this case the cross-section using S_n is for the sum of the (n,2n) and (n,3n) cross-sections. Equation 2 was used for the evaluation of the ${}^{65}Cu(n,2n) {}^{64}Cu}$ reaction at energies above 15 MeV.

III Experimental

In evaluating the 65 Cu(n,2n) 64 Cu reaction four sets of data, representing the major amount of experimental information, were selected for the analysis. Individual experimental points (notably around 14 Mev) were not included in the analysis and, where measurements were repeated, the latest experiment was used.

The oldest experiment used were that of R. J. Prestwood and B. P. Bayhurst⁽²⁾. The data was partly normalized relative to the fission cross-section of U^{238} (3 highest energies, Circa 1961). The lower energy points, however, were obtained absolutely. The errors quoted in the article are inferred from theoretical considerations and are not experimental errors.

A. Paulsen and H. Liskien⁽³⁾ measured an absolute excitation

- 144 -

function between 12.6 and 19.6 Mev. The measurement (1965) is based upon a neutron flux determination by detection of recoil protons. The quoted uncertainty is \pm 8% with energy uncertainties between + 0.11 to 0.47 Mev.

In 1966, D. C. Santry and J. P. Butler⁽⁴⁾ presented data for a complete excitation function between 10 and 20 Mev. This was measured by activation relative to the $S^{32}(n,p)P^{32}$ cross-section. The uncertainty of the sulphur cross-section and angular neutron intensity are included in the quoted uncertainty of <u>+</u> 8%. Santry and Butler quote a fission average (n,2n) cross-section of 0.251 <u>+</u> 0.018 mb.

A series of measurements have been reported by M. Bormann and co-authors. Bormann's 1963 data⁽⁵⁾ shows prominent (n,3n) competition. M. Bormann and B. Lammers⁽⁶⁾ have re-measured the (n,2n) cross-section (1969). This latter measurement is in agreement with the other experiments, and does not show the prominent reduction of cross-section near 20 Mev which the earlier measurement indicates. The earlier data was not used in the present evaluation.

IV Results

Fig. 1 shows the experimental data and the evaluated curve. The evaluated curve was obtained from a least squares spline fit of the experimental data below 15 Mev, and by a parametric fit of the data above 15 Mev using the formalulism of equation (2).

An effective value of S_{2n} was introduced in order to adequately fit the experimental data at the higher energies. An

- 145 -



Figure 1

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upward shift of the (n,3n) reaction threshold is supported by Lu⁽⁷⁾ and has been discussed in an article by Hankla and Fink⁽⁸⁾. Table 1 summarizes the parameters used to obtain the evaluated curve.

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Table 1 Parameters for 65 Cu (n,2n)	⁶⁴ Cu Re	action
Parameter		Value
on,m	1.081	barns
a	6.0	MeV^{-1}
S _n	10.1	MeV
S _{2n}	18.1	MeV
S _{2n} effective	k9.0	Mev

Values for the (n,3n) reaction were also obtained from the theoretical fit as described in Section II.

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8. A. K. Hankla and R. W. Fink, Nucl. Phys. A180, 157 (1971).

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 MEUTRON CROSS SECTIONS

 INDEX,
 ENERGY CROSS SECTION
 ENERGY CROSS SECTION

INTERPOLATION LAW BETHEEN ENERGIES RANGE DESCRIPTION 1 TO 45 T LINEAR IN X

REACTION Q VALUE -9.9100E+06 EV

COPPER-05

NEUTRON CROSS SECTIONS

DIRECT(N,2N) NEUTRON CROSS SECTION

ENDETH HATERIAL NO. 6412

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The ¹¹⁵In(n,n')^{115m}In Reaction for ENDF/B-III

R. Sher Stanford University

May 4, 1972

$\frac{115}{\ln(n,n')} \ln_{n, E} = 335 \text{ Kev, } T_{1/2} = 4.5 \text{ hours}$

Several measurements exist (1-4,4a) of the energy-dependence of the cross section for excitation of the 4.5 hour, 335 keV isomeric state in ¹¹⁵In by neutron inelastic scattering. There is also a calculation by Gardner⁽⁵⁾, and some 14-MeV measurements.⁽⁶⁻⁸⁾

Ebel and Goodman⁽¹⁾ did relative measurements up to about 1.8 MeV, using an anthracene crystal for detection of the 335-keV gamma rays. They subsequently normalized their results to those of Martin et al.⁽²⁾ at 0.88 MeV.

Martin et al.⁽²⁾ measured the cross section up to 5 MeV, using a 1-1/2" x 2" NaI crystal for gamma-ray detection. They measured the neutron intensity with a long counter which had been calibrated with a Ra-Be source known to $\pm 5\%$. They consider their data above 4 MeV suspect since the neutron angular distribution may have been in doubt, the neutron energy changing rapidly with angle in this region. For the gamma counting they assumed an internal conversion coefficient of 0.98, and a β branching ratio of 6%. The presently accepted value of the internal conversion coefficient is 0.90; this results in a 5% change in the cross sections. Menlove et al.⁽³⁾ used various reactions in a Van de Graaff Accelerator to cover the energy range from threshold to 8 MeV, and from 12 to about 19.5 MeV. Gamma-ray counting on 3" x 3" and 4" x 4" Nal crystals was employed. The cross section was determined relative to the fission cross section of ²³⁵U in this energy region; the fission counter efficiency was calibrated at thermal energy. At 12.7 and 12.9 MeV the ²⁷Al(n, α) cross section was used for calibration. Menlove et al. used BNL-325 values of σ_f (²³⁵U); in the present report these have been replaced by ENDF-B-III values; the resulting change in the ¹¹⁵In(n,n') cross sections is of the order of 5-10% in the energy region between 2 and 8 MeV.

Grench & Menlove⁽⁴⁾ used gamma-ray counting on a calibrated 4" x 4" NaI crystal, and determined the cross section relative to that of ¹⁹⁷Au(n, γ)¹⁹⁸Au. For the ¹⁹⁷Au(n, γ) alues they used the 1966 evaluation of Vaughn and Grench.⁽¹¹⁾ These results have been renormalized to a later (1971) evaluation of Vaughn and Grench⁽¹²⁾, and the new values, together with those of Martin et al., are shown in Fig. 1 and 2. Butler and Santry^(4a) have made measurements from 0.8 to 6 MeV relative to a calibrated long counter, and at higher energies, calibrated against the ³²S(n,p)³²P cross section. These data are plotted in Fig. 2 as read off a curve prepared by Dudey and Kennerley; the original data are not available in published form.

In the 14 MeV region there are measurements by Heertje et al. $^{(6)}$ and Barrall et al. $^{(7,8)}$ Heertje et al. obtained 81.0 ± 5.6

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mb at 14.6 MeV, normalized to the 56 Fe(n,p) cross section of 117 mb. Apparently this result was later revised to give a value for 115 In (n,n') of 55 ± 8 mb. ${}^{(9)}$ Barrall, Holmes, and Silbergeld ${}^{(7)}$ report a value of 67 ± 7 mb at 14.6 MeV, and Barrall, Silbergeld, and Gardner ${}^{(8)}$ report a value of 69 ± 5 mb at 14.8 MeV.

Gardner⁽⁵⁾ has calculated this cross section from 2 to \sim 10 MeV. These are absolute calculations, and the results are plotted as the dashed curve in Fig. 2. (The calculation does not include precompound nucleus evaporation.)

Gardner's calculations are about 10% higher than the measurements of Menlove, but support the relatively constant cross section from 4 to 8 MeV. There is other supporting evidence for this in older measurements of Cohen⁽¹⁰⁾ and a broad-spectrum experiment of Heertje.⁽⁶⁾ Below 4 MeV, all the experiments are in reasonably good agreement. The 14 MeV points of Heertje et al.⁽⁶⁾ and Barrall et al.^(7,8) are also in good agreement with Menlove's data. Most of these data are shown on Fig. 2.

Discussion

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In Fig. 1 the low energy data, from threshold to about 2 MeV, are plotted. The data of Ebel and Goodman⁽¹⁾ and Martin et al.⁽²⁾ have been slightly renormalized to account for the more recent value of the gamma rays per disintegration constant mentioned above. The data of Menlove et al.⁽³⁾ and Grench and Menlove⁽⁴⁾ have been renormalized to ENDF-B III values of the reference cross sections, $\sigma_{f}(^{235}U)$ and $\sigma_{n,\gamma}(^{197}Au)$, respectively. The recommended curve has been faired through the ensemble of points. The in-

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flection at 1.2-1.4 MeV is believed to be real; a similar behavior seems to be present in the cross section for excitation of the 0.91 MeV gamma ray at about the same energy.⁽¹³⁾

Above 2 MeV, the data are shown in Fig. 2, with the same renormalization as mentioned above. The recommended curve from 2 to 8 MeV is faired through the points of Menlove et al.⁽³⁾ and Butler and Santry^(4a); as has been noted, the data of reference (2) are suspect above 4 MeV. Gardner's calculation⁽⁵⁾, while $\sim 10\%$ higher than the measurements, further supports the relative flatness out to 8 MeV. Gardner's calculations are stated to have an uncertainty of at least the order of 10%, so there is no essential conflict between the calculations and the experimental data.

At higher energies, the recommended curve is faired through the available data which, in the neighborhood of 14.6-14.8 MeV, are all in reasonably good agreement. From 8 to 12 MeV, the curve is simply a guess designed to join the lower and higher energy regions smoothly. Neither experimental nor calculational data exist between 10 and 12 MeV.

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13. BNL-325, 2nd Ed., Supplement No. 2, Vol. IIB.

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NEUTRON	CROSS SEC	T 1 0 N 5								
INDEX.	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION
	E۲	BARNS	EV	BARNS	EV	BARNS	EV	BARNS	٤v	BARNS
1	3.3790E+85	0,9000L+00	4.000000+05	1.2500E=03	5.00042+05	3,75000-03	6.000PE+05	8.00005-03	7.0000E.05	1.4020E-02
6	8,00005+05	2.3500E-02	9.000006+05	3.70886-02	1,00000+00	5,9000E-02	1.10000.06	8.20005-02	1.20005+00	1.01000-01
11	1,30000 + 06	1,1600E-01	1.400000-06	1.36F0E-01	1,50002 +00	1,67005-01	1,600020.06	1.89005-01	1.0000E+00	2.3200E-01
16	2.000000+06	2.6000E-01	2,2500E+06	2.80P0E-01	2.500RE+06	2,92005-01	2.7502E+06	3.05005-01	3.0000E+06	3.1000E-01
21	3,25802+86	3.1460E-01	3.50000:+00	3.16PDE-01	3,7500E+00	3,1800E-D1	4.00002+06	3.19005-01	4.25001-00	3.2000E-01
26	4,50002.06	3.2100E=01	4.7500E+06	3.20405-01	5,000000+00	3,19000-01	5,50000+06	3.16002-01	6.0800E+00	3.1300E-01
31	7,0000E+06	3,0200E-01	8.00000-+06	2.87705-01	9.00000-000	2.74002-01	9.2502E+06	2.71005-01	9,5000E+06	2.65000-01
36	9,7580E+86	2,60000-01	1.000000007	2.53886-01	1.10000+07	2.96888-01	1.2000E+07	1.41005-01	1.2500E+0	1.1500E-P1
41	1,3004E+07	9,2000E-02	1,3500E+07	7.80A0E-02	1,4000E+07	6,60000-02	1,4250E+07	6.30002-02	1.4500E+07	6.1000E-02
46	1,4750E+07	6,0000E=02	1.56000+07	5.90002-02	1.6000E+07	5.70001-02	1.7000E+07	5.65001-02	1.8000E+07	5.6800E-02
51	1,9880E+87	5.500DE-02	2.00000.07	5.40006-02						

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REACTION Q VALUE 3.3500E+05 EV INTERPOLATION LAW BETWEEN ENERGIES RANGE DESCRIPTION 1 TO 52 Y LINEAR IN X

INDIUM-115

INELASTIC Neutron cross section

ENDETS MATERIAL NO. 6406



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Evaluation of $^{115}In(n,\gamma)^{116}In$ For ENDF/B-IV

F. Schmittroth

Hanford Engineering and Development Laboratory

The evaluation of the $^{115}In(n,\gamma)^{116m}In$ metastable reaction described here is primarily for use in dosimetry. Emphasis was placed on File 2 (MT=151, resolved resonance parameters) and File 3 (MT=102, smooth capture cross sections).

Two metastable states exist for ¹¹⁶In, a 54.2 min. state at 0.126 MeV and a shc-ter-lived state (2.2 sec) at 0.289 MeV that decays isomerically to the 54.2 min. state. Therefore, the metastable capture described here includes both isomeric states.

Resonance Parameters

The evaluation of resonance parameters is based on the new BNL resonance parameters.¹ Since the *k*-values for these resonances are not given, s- and p- waves were assigned by a ~robability method² based on the neutron widths. Although this method is poor compared to more direct experimental evidence, assignments were unambiguous for most resonances. Typical probabilities for a particular p wave resonance were either less than 0.01 or greater than 0.80 so that a clean separation was obtained. On this basis, the number of s-wave resonances, N(E), up to an energy, E, was plotted as a function of energy. Numerical fitting procedures gave an average s-wave spacing.

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 D_{obs} , of (11.0 ± 0.7) eV. Also, since an inspection of the graph showed that resonances were being missed above 1 keV, the resolvedresonance range was terminated at that point. Except for the few cases where J-values were known, a value of J=4.5 was assigned for both s- and p-wave resonances. This unphysical value is appropriate for a ground state spin of $I_0=9/2$ for ¹¹⁵In and provides a clue that the numbers are evaluated and not measured. A weighted average of radiation widths gives an average value of $\Gamma_{\gamma}=(77 \pm 5)$ mV. Because, as described below, capture to the ¹¹⁶In isomeric states accounts for 79% of the total, all radiation widths were reduced by this factor.

Smooth Cross Sections

Above 1 keV, a standard Hauser-Feshbach calculation with width-fluctuation corrections³ was performed for the isomeric capture cross section. By varying the ratio, Γ_{γ}/D_{obs} , the calculation was adjusted to an experimental value of 0.2 barns at an incident energy of 0.85 MeV. For the keV range, the primary data considered were from the work of Grench and Menlove⁴ and Ryves et al.⁵ Other data given consideration included measurements by \cos^6 and earlier work by Menlove et al.⁷

Other details required for the calculations include inelastic levels⁸ taken from the compilation of Bass et al. Collective and direct capture were estimated by a phenomenological model for MeV energies.

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Below 1 keV, a small "1/v" component was entered in File 3 to give a thermal cross section of 161 barns when added to the resonance contributions. Holden and Walker⁹ recommend 41, 70 and 91 barns for the thermal cross sections leading to the ground state, and the first and second metastable states in 116 In, respectively (the total isomeric capture is 70 + 91=161 barns). Since the resonance parameters gave a thermal cross section of 157.09 barns, only 3.91 barns had to be added as the "1/v" component. Notice that the thermal isomeric to ground state cross section ratio is equal to 161/(161+41)=0.80. In the vicinity of 700 keV, this same ratio is close to 0.78; therefore a reduction of 0.79 for the capture widths was chosen for the resolved resonance parameters.

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ENDEVE HATERIAL NO. 6416

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INCIUM-119

RESONANCE DATA Resonance Parameters

ISOTOPE	NDIUH-115
FRACTIONAL ABUNDANCE	1.000000.00
NUMBER OF ENERGY RANGES	4

RESOLVED SINGLE-LEVEL BREIT-HIGNER PARAMETERS

ENERGY RANGE NUMBER	1
LOWER ENERGY LIMIT (EV)	1.20096-05
UPPER ENERGY LIMIT (FV1	1.00345.03
NUCLEAR SPIN	4.5800E+00
NUMBER OF L STATES	5-2000t-01

L VALUE	Ø
NUMBER OF REDONANCES	89
SPIN SCATTERING LENGTH (A+)	9.00005+00

				RESONANCE WID	THS (EV)	
INDEX	ENERGY (EV)	J VALUE	TOTAL	NEUTRON	RADIATION	F155104
1	1,45702+00	5.0000E+00	5,9916E-82	3,03642-03	5.6582E-02	2.0000E+00
2	3.86005.00	4.0000E+00	6.4344E-02	3.5444E-04	6.3998E+02	2,02005-20
3	9,12005.000	5,0000E+00	6.4773E-02	1.5727E-83	6.3200E-22	2.00005+70
4	1 21805+81	4,52282+88	1.10716-01	1,12005-84	1.1060E-01	2.88085+28
5	2,273°F+01	4.500PE+00	6.5030E-02	1,04005-03	6,3990E-B2	7.80006+79
6	2,30805+01	4,50006+00	6,4143E-02	1.18002-03	6,2963E+02	2,28386+98
7	3,96805.001	4.52002+00	6,4848E-82	A. 8988E-83	6,0040E-02	A,00005-00
8	4,63601.01	4.50006+00	6,32235-02	2.60000-04	6,2963E=02	2.08005+20
9	4,814#F+01	4.50006+00	7.17086-02	6,0000E-04	7.11C0E-02	7,0000E+20
10	6.3000F+01	4.5000ۥ00	7.58906-02	8,4000[-84	7,5050E-02	7 BB995E+28
11	6,9500[+01	4.5000E+30	6,3363E-02	4.09082-04	6,2¥63E+Ø2	7,0000E+PP
12	8,0870F•01	4,5209E+09	5,6800E-02	1.50002-03	5,5320E•02	7,0000E+90
13	8,3280F+01	4,500AE+00	6,4270E-02	6.6000E-03	5,7670E-02	7,88385+28
14	9,4340E+81	4,5000E+00	7,40000-02	2,9000E-03	7.1120E-02	*,00002+02
15	1.258YE #02	4,5000E+00	5,515PE-02	3,8008[+03	5.1350E-02	2,0200E+C0
16	1,3281E+02	4,50006+00	1.476PE-01	5,4000[-03	1.4220E=01	A.0000E+2R
17	1,50276+02	▲,5002E+00	7.1750E-32	▲. 6000F-03	6.715°E=02	7,000ØE+0A
18	1,646/F+02	4.5002E+00	8,2780E-32	1.80005.02	6,4780E-62	7,3000E+30
19	1,680°E+02	4.5000E+00	6,5063E-02	2.1000F-03	6.2963E+Ø2	8,0003E+N0
22	1,7792[+02	4,5000E+00	6.62002-02	3,0200E≠03	6.3200E=02	0,000BE+20
21	1,869°E+02	4,5000E+00	9.9000E-02	2.00005+02	7.9000E=02	2.20005+20
22	2,05605+02	4,500AE+00	8,5963E-02	2,3000E-02	6,2963E+02	2.0203E+82
23	2,118°E.02	4,5008E+88	6,3483E-02	3.2000E-04	6,2963E+B2	9,0000E+0P
24	2,24Ø3F+Ø2	4,5000E+00	7,94Ø0E-02	3.20000-02	4.7400E=02	A,0000E+00
25	2,2681F+02	4,5000E+00	6,4283E-Ø2	1,3200E-03	6,2963E∋@2	7,8000E+CA
26	2,5017E+02	4,5000F+00	1.2715E-01	6,0003E-02	6.7150E+02	0.0000E+00
27	2.66905.02	4,5000E+00	6,6963E-02	4,00002-03	6,2963E=#2	9.9000E+00
28	2,88842+02	4.500RE+00	8,2963E-02	2.00000-02	6,2¥63E=02	P.0000E+00
29	2,94335.+02	4.5000E+00	1,0696E-01	4,4Ø00E-02	6,2963E-82	0,0000E+C0
30	3,1949E+02	4.500DE+00	7,7963E-62	1.50000-02	6.2¥63E=02	7,0000C+CC
31	3,3988E+Ø2	4.5000E+00	6.48632-02	1.9000E-03	6.2963E-02	a,8080E+80
32	3,54138+02	4,50002+00	6.9243E-02	6,2800E-03	6.2963E=82	7,00005+00
33	3.6210E=02	4.50006-00	7.38435-02	1,Ø880E-02	6,2963E≠02	4.0000E+70
34	3,7094E+02	4,5000E+00	6.9863E-32	6.900DE-03	6.296JE-02	A.0000E+00
35	3,8297E+Ø2	4.5000E+00	6.4183E-02	1.220AE-03	6.2963E-82	2.2000€+2N
36	3.84205.002	4.50000-00	6,8823E-02	5.8600F-03	6.2963E+#2	9,0800F+30
37	4.62326.+82	4.5ØUAE+00	9,4363E-02	3.1400E+02	6.2963E=02	A,0000E+30
38	4.115¢E+02	4,5000E+00	9,43632-02	3.1400E-02	6. <u>2</u> 963E=02	2,0000E+00

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5	1,1443E+02	4,5000E+80	6.3067E-02	1.0400E-04	6.2963E-82	a'0046E+00
6	1,2071E+02	4,50000+00	6,2975E-02	8,0800E-06	6,2963E-82	A,8030E+08
7	1,4404E+02	4,50000+08	6,3189E-82	1.4680E-04	6,2963E-82	A.0000E+20
9	1.45705+02	4.5080E+08	6.3023E-02	6.0000F-25	6.29635-82	4.08000-00
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17	2,76778.+82	4.50000.00	6.3099E-02	1.36020-04	6.2963E-02	8,8888C+P8
18	2.82246.02	4,50802+08	6,3149E-02	1.86002-04	6.2963E-82	a.8839E+P#
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42	8,08635+02	4,5000E+00	6.3863E-02		6,2963E+82	A.8888E+28
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INTERPOLATION LAW BETWEEN ENERGIES Range description 1 to 37 ln y linear in ln x

REACTION Q VALUE 6.5980E+86 EV

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ENDF/8 MATERIAL NO. 6416

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REFERENCES FOR EXPERIMENTAL DATA

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<u>Yr.</u>	Lab	Author	References			
73	KOS	Peto	Act. Phys. Ac. Sci. Hung. 33,363 (1973)			
71	WWA	Brzosko, et al.	Acta Phys. Pol/B <u>2</u> , 489 (1971)			
68	LOK	Grench et al.	Phys. Rev. <u>165</u> , 1298, (1968)			
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66	KFK	Poenitz	EANDC (E) - 66, 5, (1966)			
64	ANL	Cox	Phys. Rev./B, <u>133</u> , 378 (1964)			
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The ¹²⁷I(n,2n)¹²⁶I Cross-Section for ENDF/B-IV

R. Sher

Stanford University

May 1, 1972

$\frac{127}{I(n,2n)}$ 126 I, Q = -9.15 + 0.20 MeV, E_{th} = 9.23 + 0.20 MeV

Relative cross sections for this reaction have been measured from 13.2 Mev to 18 Mev⁽¹⁾ and from 12.4 Mev to 18.3 Mev⁽²⁾. In addition, there are a number of measurements at single energies in the vicinity of 14.6 Mev,⁽³⁻⁶⁾ and calculated cross-section curves by Pearlstein⁽⁷⁾ and Gardner⁽⁸⁾. Several measurements of crosssections averaged over a broad neutron spectrum also exist^(9,10). 1 - 2 - 5 - 5 - 5

In reference (1), a thin tritium target was bombarded by 3 MeV deuterons. The cross-section values were normalized relative to $\sigma^{27}Al(n,\alpha)^{24}Na = 107\ 107\ \pm\ 5$ mb at 15.21 Mev. NaI counting of ^{126}I decay gammas was employed with assumed branching ratios of 29% for the 386 keV gamma ray and 33% for the 667 keV gamma ray. Presently accepted values⁽⁹⁾ for these branching ratios are 34% and 33%, respectively; the present values would lower the reported cross-sections by 62/67 = 0.925.

In reference (2), a NaI crystal was used as a combination target and detector. In addition to relative counting, σ_{rel} was also based on the angular distribution of (d,t) neutrons, known at the time to \pm 10%. The relative cross-sections were normalized at 14.1 MeV in a separate experiment using a Cockroft-Walton

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generator and monitoring the neutron flux to \pm 5% by means of the associated alpha particles.

In reference (3), the cross-section at 14.5 Mev was determined by beta-counting, with an uncertainty of \pm 35%. In reference (4), gamma counting was used, and the cross section was determined at 14.6 + 0.2 Mev relative to $\sigma^{27} Al(n,\alpha)^{24} Na = 120.7$ mb. The value obtained was 1.66 ± 0.15 barns. In reference (5), gamma counting was used, and the neutron flux was determined with a proton recoil telescope. The neutron energy was 14.8 ± 0.2 Mev. The crosssection obtained was 1.67 + 0.09 barns. In reference (6), the cross-section was determined at 14.7 Mev relative to $\sigma^{27}A1(n,\alpha)^{24}$ Na = 112 mb. Gamma-ray counting with a NaI crystal was used. Chemical separation was employed to remove Sb resulting from $127_{I(n,\alpha)}$ Sb. The efficiency of the NaI crystal was determined using Heath's curves, and a graphical spectrum-peeling procedure was used. The cross-section obtained was 1.64 ± 0.15 barns. However, the ${}^{27}A1(n,\alpha)$ cross-section used for normalization seems low, and should be 120 mb; this would raise the 127I(n,2n) crosssection to 1.76 ± 0.16 barns.

Pearlstein's calculated cross-sections⁽⁷⁾ are relative; he normalized to a neutron emission cross-section, $\sigma_{nM} = 1.380$ barns, which makes the peak (n,2n) cross-section around 14.5 MeV have a value of about 1.3 barns. Gardner's calculation⁽⁸⁾ is absolute, and gives a peak (n,2n) cross-section at 16 MeV of 1.65 barns, and a value at 14.7 MeV of 1.59 barns.

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It is seen that measurements up to 1968 give a peak (n,2n)cross-section at \sim 14.5 MeV of \sim 1.3 barns; measurements since 1968 give a peak cross-section \sim 1.7 barns. There are no obvious explanations for this discrepancy. The later measurements are favored on two grounds, however. First, they <u>are</u> more recent; second, Gardner's calculations, which are absolute in the sense that they are not normalized to any assumed cross-sections, favor the higher values.

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In Fig. 1, the data of references (1), (2), (4-6), are compared with Gardner's calculated curve. The experimental data of (1) and (2) have been renormalized at 14.1 Mev to agree with Gardner's curve. Gardner's curve extends to 17 Mev; the region from 17-20 Mev has been calculated by Pearlstein's method, normalized to Gardner's value at 17 Mev.

There are two measurements of the average cross-section in a fission spectrum (9,10). These (0.647 mb, 1.62 mb) differ by more than a factor of two, and therefore are of no help in normalizing the differential cross-section curve. The recommended curve (Gardner's calculation) yields an average cross-section in a Watt spectrum of 1.1 mb, which is close to the average of the two measured values.

The recommended curve for ENDF-B-IV is that in Fig. 1 (solid curve).

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Figure 1

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	1.388001+0	1.45001.000	1.3200E+0	7 1.5139E+00	1,340#E+07	1,5431P+00	1.3607E+07	1.56845+90	1.3800E+07	1.59056+00
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DIRECT(N,2N) NEUTRON CROSS SECTION

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¹⁹⁷Au(n,γ)¹⁹⁸Au Reaction for ENDF/B-IV* M.D. Goldberg and S.F. Mughabghab Brookhaven National Laboratory

The capture cross section in the ENDF/B-IV File below 2 keV is represented by the resonance parameters. In the energy region, 2-10 keV, the capture cross section was calculated by using the average resonance parameters specified in File 2 and the code $AVRAGE-4^{(1)}$ which follows the method of Lane and Lynn⁽²⁾ and applies width fluctuation corrections as discussed in their paper. This calculated curve is shown in Fig. 1 compared with the avail-



Figure 1

*Extracted from "Evaluated Neutron Cross Sections of ¹⁹⁷Au" BNL 50439 (ENDF-215) 74, S.F. Mughabghab et al.

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able data in this range and with the ENDF/B-III valves between 1 and 6 keV. (The curve above 10 kev is the same as that of Fig. 4.)

For neutron energies greater than 25 keV, a reassessment of the gold capture cross section is required because of the availability of new measurements and because of a reevaluation of the 235 U cross section for ENDF/B-IV. Fig. 2 shows the new 235 U fission cross section between 25 and 100 keV. It can be immediately seen that there is considerable structure in this cross section, with fluctuations of as much as 10% or more within a kilovolt or so. Thus, its use as a standard is quite compromised unless the neutron energy and neutron energy spread are well known and accounted for. In Fig. 3 this cross section is "smeared out" by averaging points in groups of ten (effective "resolution" \sim 5 keV) and compared to a similar curve for the 235 U fission cross section in ENDF/B-III. This plot indicates an average change in the absolute value of the cross section of 5-15%.

Since it would seem that a fluctuating cross section subject to substantial renormalization, does not make a very reliable



Figure 2

Figure 3

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standard, it was decided to perform the gold capture re-evaluation with data not involving ²³⁵U fission standardization. This follows the procedure adopted by Carlson⁽³⁾ and by Poenitz⁽⁴⁾ in evaluations presented at the 1970 EANDC Normalization and Standards Conference held at Argonne National Laboratory and follows the most recent recommendations of the Normalization and Standards Subcommittee of CSEWG (July 1973). Due to an abundance of excellent recent experiments, it was also arbitrarily decided that only data measured since 1960 would be considered.

The capture cross between 10-100 keV is shown in Fig. 4. The following data sets were were plotted: (1) Czirr et al.⁽⁵⁾ (2) LeRigoleur et al.⁽⁶⁾ (3) Fricke et al.⁽⁷⁾ (4) Kompe⁽⁸⁾ (5) Poenitz et al.⁽⁹⁾ (6) Belanova et al.⁽¹⁰⁾ (7) and Bergvist.⁽¹¹⁾ The data of Spitz et al.⁽¹²⁾ Moxon et al.⁽¹³⁾ and Bilpuch et al.⁽¹⁴⁾ were not used.

The capture cross section between 100-1000 keV is shown in Fig. 5. Data sets of Refs. 6-10 were plotted, plus the data sets of Barry. (15)

Inspection of Figs. 4 and 5 show that the various data sets are in quite good agreement with each other within the quoted

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errors. There is a general tendency for the data of Fricke et al.⁽⁷⁾ (Fig. 4) and Barry⁽¹⁵⁾ (Fig. 5) to be higher than others and for the data of Bergvist⁽¹¹⁾ to be lower; but all are never more than about two standard deviations from the mean. The one point of Belanova et al.⁽¹⁰⁾ is about three standard deviations low. The evaluated eye-guide in Figs. 4 and 5 was drawn with no explicit weight factors for the various experiments.

For the region above 1 MeV, the only one significant new contribution is that of Lindner, (16) These data should be considered preliminary until published and were measured relative to 235U. but the lack of measured fluctuations in the ²³⁵U fission cross section at these high energies made it worthwhile to see what the new data indicated for gold capture. Fig. 6 shows two independently normalized data sets from Lindner⁽¹⁶⁾ between 0.5 and 3 MeV. The curve between 0.5 and 1 MeV is that of Fig. 5 and above 1 MeV is that of ENDF/B-III. The data up to 2.2 MeV are in excellent agreement with the old evaluation. The two higher energy points are low by about 15% and 20% respectively. It was felt that it was not worthwhile to give these points sufficient weight to seriously distort the ENDF/B-III curve, which represents the best curve through all previous measurements. An added inducement for not trying a serious reassessment of all of the data above 1 MeV was the implications of the effect noted by Devaney. (17) Devaney points out the importance of a multiple reactions correction for reaction cross section measurements above approximately 100 keV. The correction is particularly important for

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Figure 6

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المتينيو الم radiative capture, even with fairly thin samples. The relevance of this effect to specific gold capture experiments is unknown, but should be determined before the higher energy gold capture data are reevaluated again.

In conclusion, the evaluated curve of ENDF/B-III between 1 and 20 MeV, which included the evaluation of Vaughn and Grench (1.8)(1.0 - 5.2 MeV) and that of Bogart (27) above 5.2 MeV, are adopted for ENDF/B-IV.

It is of interest to calculate the fission spectrum averages of the capture and other reaction cross sections and compare them with experimental measurements. For this purpose, a Maxwellian ²⁵²Cf fission spectrum of characteristic temperature 1.39 MeV and represented by

 $\phi(E) = C \sqrt{E} e^{-E/T}$

was used. (C is a normalizing constant.) The calculated fission spectrum average of the ENDF/B-IV (n, γ) reaction of gold is 81.8 mb. This number is to be compared with an experimental value of 53.5 ± 2.3 mb measured by Pauw and Aten.⁽¹⁹⁾ Since the capture section in the whole energy range 0.100-1.5 MeV is believed to be known to better than 18%, the source of this discrepancy could be due to either the measurement and/or the inadequacy of representing the fission spectrum by a Maxwellian form at low energies. The ²³⁵U fission spectrum average measurements of Fabry⁽²⁰⁾ shed some light on the former explanation. Fabry obtains a value of 88.0 ± 4.5 mb for ¹⁹⁷Au(u, γ)¹⁹⁸Au reaction. With a characteristic temperature T = 1.32 MeV for ²³⁵U, we obtain a fission spectrum

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average of 84.9 mb which is within the stated error of Fabry. (20)

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After the completion of the evaluation of the capture cross section of Au, it was found that two points had been inadvertently omitted from consideration. Both were measured with the same technique at the National Physical Laboratory in England. At 25 keV, Ryves et al. $^{(21)}$ measured a value of 640 ± 25 mb. This is in excellent agreement with the value of 648 mb read from Fig. 4. At 966 keV, Robertson et al. $^{(22)}$ measured a value of 96.2 ± 2.0 mb. This value is approximately 12% higher than the value at this energy from Fig. 5. No changes were made as a result of this discrepancy for the reasons noted above regarding the Devaney $^{(17)}$ multiple reaction correction effect. In addition the following data sets become available at the time of the writing of the report:

(1) Poenitz⁽²³⁾ data in the energy range 400 - 3500 keV. This is an absolute measurement carried out by a large liquid scintillator for the detection of prompt capture gamma rays. The Grey Neutron Detector, the Black Neutron Detector and a ⁶Li-glass detector were employed to measure and monitor the neutron flux.

(2) Macklin et al.⁽²⁴⁾ data in the energy range from 3 to 550 keV. In this measurement a scintillation detector and a 6 Li neutron monitor were used. The efficiency of the detector was normalized to the 4.9 eV gold resonance by the saturation method. The 6 Li neutron cross section of Uttley, slightly modified, was adopted.

(3) Rimawi and Chrien⁽²⁵⁾ using the iron filtered beam,

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measured the neutron capture cross section of Gold at 24.5 keV by the activation method. Assuming a ${}^{10}B(n,\alpha\gamma)^7Li$ cross section of 3.487 b and a total reaction cross section of 5.9175 b for ${}^{10}B$, they obtained a total capture cross section for ${}^{197}Au$ of 0.630 ± 0.006 b. The error indicated is only statistical and does not include the uncertainly in the normalization. These new measurements were plotted and compared with the ENDF/B-IV capture cross section in the pertinent energy regions. Good agreement is noted between the new measurements and the evaluated ENDF/B IV capture cross section.

Finally, it may be noted that preliminary results of the capture cross section of gold between 100 keV and 500 keV were reported by Fort⁽²⁶⁾ in a progress report. A $4\pi\beta\gamma$ detector was used to detect the induced activities. The data is not available at this time. Fort, however, made a comparison between his data and those of LeRigoleur and found reasonable agreement between the two measurements. These new data sets will be considered in the evaluation of the Au(n, γ) cross-section for ENDF/B-V.

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1	2,7364[+82	2.85224.48	1,#4286-81	4,28886-53	1,85220+81	1.5548[-55
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28	3,2#5#[+82	2. 22 #20.28	1.74486-21	4,5422[-82	1,34880-81	21589856+25
21	3,31846+85	7-55552-98	2.00000000	1.24695-05	1.34826+51	2155326456
22	3,55246+82	2.2222L+28	1,44286-01	3.42855-65	1.25226921	2155936+55
23	3,72742+22	5' 5558E-56	1.44686-51	8.426522-85	1.84256+51	**********
24	3,7510E+82	1.00071-20	1.4397[-01	1.34535-85	1,34871-71	2*55782+55
22	3,81286+85	7.00066.488	3.00186-85	\$.1102E-82	1.53E%FeBJ	2498450-55
79	•, #####1.0#2	2.20001-00	1.04855-21	7,88882-82	1.44541481	**********
	4,46861462	1.54551.65	4.268s[-21	7.8006[-#1	1,36666.961	**************************************
	4 38947-83	7.855FL+6P	1,/6841-31	8,20501-02	1,14255481	
	4 89845-62	/	4,74851-21	3,25581-61	1.36666.41	
	4 44846-83	1.86666.088	1,0/061-01	7,/6861+66 9,99887-47	1.36666-61	**************************************
		3 33495.38	1.06241-21	2./5051.002	1,34600-01	
	5 48446-87			4 38887-83	1 1 1 1 1 1 1 1 1 1 1 1	
	5 78125487	3	1.00000-01	*.J###EF##		#.22285.45
	1.40426.47		3 42225-31	47825.81	1 13225 421	7.22285472
	5.47841.482		1 A0875-11	1.58881-82	1 14925-21	2.22486459
12	4.82845+82	3.82425.28	1 41000-01	3.24886	1.4508[421	3.82485
	A. 17765 aP2	2.42925.28	3 34385-41	1 48885-82	1 43926+81	2.88285412
	6.2484F LR2		72025-21	4.88821-87	1 21825+81	3.28285.02
	4.264#5=32	3 82385.28	1 47975-91	1 26625.02	* ********	3. 4285-02
41	4.34785+62	2.88386484	4.32821-91	4.88825-21	1.44286+21	2.26285+=8
42	6.5874[+87	1.28771.48	1.38486-71	A.48886.83	1.24886+81	7.88420+>8
43	4.85945 .82	1.26226-08	1.37366+21	1.33825-82	1.24826+81	2.08485-28
44	4,9584E+82	1.78782-88	8.32226-21	6.6702E-#1	1.43886.+21	8.88225-02
45	4,14846+82	2.82286.+28	4.88286-01	7.34885-81	1,44220+21	*. 88482-28
46	7,15846.42	2.22885-28	2. 15886-21	1.15880-81	1,70981-81	7.88685+22
47	7,38446+82	2.88880.+68	1.32486-01	6.288825-83	1.24886+81	2,28488+28
48	7.59946-82	1.289000-28	5.01200-21	4,27882-21	1.54220-01	218848C+28

1

44	7,73841#22	2.2242[-22	*.77271-21	4.7982[+21	1.2924[-41	
	7. 84346 427	2.32026.00	3 42985. 24	+ 78828 . PL	1 44226 421	3. 38281 =22
	7 84 845 - 83			44.777		
			1.17441-51			
42	8,1354(+#2		1.44881-21	2.222242-22	1.24241-21	
43	\$.:*540+82	2.26486-88	3.608888-81	2.32222.42	1.94246-81	
	6 34941		* ******	6 91225-21		
			1./###L-21	2.20061-02		
4.8	8,7976[+22	7.7842(-48	1.778826-21	2.346"[+#2	2.37846475	*********
	9.22445+22	3.22421428	5.40275-21	4.11472-81	1.49275+81	* .2238[*22
	5.41.361.422	1.82088.08	2.48921-21	1.24225-25	1 4182[+41	2.24422428
	8 8 3 / 8 - 4 3	3 37437 - 43			1 4325 - 31	
		2.24361-44		7.32**1.***		
62	*,@#14[-27	7.88486+42	2.44832-21	1,2184(-21	1.67275-41	P. FESE(*?E
#1	•.•••**	2.22428-42	e.9827[-21	4.98885-21	1.54876-71	**********
42	2 22245 - 23		1.25121 - #1	1 32226-23	1 24276+31	>
P •	1,8434(+83		4,19886-21	4.19661.463		3,88426+28
*5	2,263+6+23	7.78481+48	1.38482-21	********	1,24246421	,242 8 2-22
	1.477/8+23		4.54221	3.47827.21	1.24246-41	
		1 38435	4 5 7 7 8	4 74221 . 21	44925-21	3. 22222
**	1111111111			2.26661-66		
# #	1,1287[+82	7.88671-88	1.0127[-23	2.78785-82	1,34870+21	**********
21	1.1354(+21	7.83825 .02	4.87471	7.398881.81	1.91286-21	a. ####################################
		3 72075.80			34768 + 31	
.:						
74	1,19301+63	6	•.36821-21	8.44441-47		**********
*3	1,2\$745+23	7.8282{-08	3.42826-21	7.48282-81	1.442/1-81	
74	1,2147(+83	2.22222.22	1.51888-21	3.28888{-22	1.2424(+)1	*,********
75	1.22346+43	1.20421-08	7.82821-31	4.42225.21	1.44275+21	1.224225+22
	24545481	22237.22		4 13225-21	* ********	3. 32439
		3.55.51.555	8. * # Z*L-Z;			*********
	1,20041-83	5.85555.45	1.34886-21	1.76441-82	1.24846481	*********
**	1.318/6+83	2.22225-22	3.77226-21	2.5377[~21	1,2427(+21	*.224224***
42	1.32445+43	1.22422-22	6.42921 - 21	7.24225-21	1.3427[+21	7.22222C+22
	11446.421				34771 . 71	2.22282.4.2
* c	2,37441463			7. 46661 465	1.20641-41	
*1	1,3947(+23	7.22425-72	1.32876-21	7.4272(-22	1.14241-81	
94	2,34775+23	1.122821-88	3.41828+21	7.47225-21	1.24242+21	
	1.34996+23	2.20028-02	* . ****** ***	1.78825-82	1.142/[+21	*********
	1 434/5-23		44.437	* A* 777 - **	1 14921 - 21	
	2.42841483	1.00041.448	3.70206-21	4.2176(-2.		
	1,4727[+23	7.23825-22	4.12826-21	2,7:286-81	1.338/0-25	2,22422422
	1,4\$945483	2.88882(-02	1.+1280-21	3.7 <u>2</u> 28E-82	1.2424[+21	
82	1.47436+23	. 82125	2 84227-21	+ +22221-21	1 34226-21	
	1 49746481	5 99495		* * 14 27 - 22		1.222254.23
	1,76171.61			7.64001485		C128481-24
• 3	1,5324(+23	7.25426+62	1.7482[+21	*.2222(-22	1.24246-01	3 .22421 =22
	1,5523(+23	7.27725-28	3.77226-2:	2.5778[-21	1.9424[-21	
	1.54597.473		* 14227-21	+ 24225-92	1 34221+21	9.22202422
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117	**********	4.44421-68	1.9388[-21	₹, ₹ ₹₹₹₹+₽₽	7.3et.r.s.	* . # # # # E E * 2 #
	1,4144[+#3	2.2778[-48	2,4722[-21	1.49202-21	1.1488[-81	*********
	1.44176+23	2.72/2[-/2	2.44226-21	1.78886.01	1.24885+21	*. ****1 ****
	1 44441 - 7 3	2 88821.18	3 37827.41		1 10225 021	7.82285.72
14.			1.14141-21			P148461-14
194	2,00342483	1.66451+68	2.74876-21	1.34#6(+7:	2,24341.482	**********
193	1,7264[+23	2.22722-22	3.94886-21	2,7878[-8]	1,3477[+25	3 .2 242C-22
1.94	1.72128+#3	2.22222(+22	1.41270.001	3.78886.22	1.24276.21	9.722225+52
1.85	1.13445+23	2.22421.42	4.24225.0	1.13887	34246.45	
	1 79436 421	3 97296.24	A A4997			
		C. 64461.48				C166461 "F6
197	1,736J[+8]	2.28481.488		7.89882.42.	1,247/[-21	F1224824+54
128	1,81146+83	1.38286+42	2,2834[-21	*.****[-*2	1,2427(+21	» , \$#\$#[-78
109	1.8211[+#3	2.3222(+22	1.38222-01	1.42821-22	1.24271+21	*.2842[+22
	1.13745.11		3 12981.00	4 44921		*

111	**************************************	1.68461.488	2,77886.088	2138965488	1.87841-01	x, x448[•23
112	1,86846,483	2,222225+25	2.1888[-\$1	8,4#83[~83	1,24225+81	7 ,88 48(+28
113	1.88346+83	1.888886-82	3.51286-21	2.27886-81	1.2428[-81	8.88685+22
194	1.89336+83	2.222224.22	1.27721+21	9.72226.23	3.34221.01	9.22421
	1.01307-03	1.12225.74	3 42927	* *******	* *7926 **	
11	******	5.44448L • ##	8.74841-81	7.24661.481	2.3684C.41	**********
117	7,44945483	2,22921-22	¥.7787[-21	7,]488{~#%	1,44871-81	**********

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NEUTRO	N CROS> SE	CTIONS								
INDEX.	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION	ENERGY	CHOSS SECTION	ENERGY	CROSS SECTION	ENERGY	CROSS SECTION
•	E۲	#ARN5	Ē V Š	94#45	€v	91444	F۲	9484S	£٧	918NC
1	1,808+F+0	5 8.00081+70	5.956.6.03	50+36+59.9	2,00091.00	3 4,13485-22	3.20276+23	3 1.90205-22	4.23276+23	3,41326-22
6	5.00000+0	3 8.2240E-02	6.38876+33	1,21020-01	7.70076.0	3 1,31436-61	8.27076+73	3 1.20235-21	0.65556+5	1.32546+71
11	1,000000.00	4 1.03186+01	1.22026+24	1,22485+88	1,10006+5	4 1,14795-83	1.20276+24	1.03256+65	1.35556+54	, 0.9223E+21
10	1,42005+0	4 9.25001-01	1,58888.00	. 8.9r#8E-81	7.00046-5	4 8.52225-21	1.723.6+24		1.00020+24	. 7,92885-21
57	1,93845+8	4 7,70086-01	5.54435.5	7.35#86-01	2,18005+8	4 1.19986-97	5.59345+5	4 6.98275-21	5.35656+64	L 4,8258E-81
20	2,40000.00	4 6,4480EJP1	5.56655.64	\ &.52 ₽ 8€+81	5.49046.5	4 9.32556-51	5.155.16+5-	4 6.23296-21	5.96866+5	15-36262.6 1
31	5,99845+5	4 5.97000+01	3,88886.+04	5.84P8E-01	3.20005-00	4 7.56788-8:	3,43226+3	4 5.48225+21	3.46555.+5	s 9.36696-51
36	3,808×E+2	4 5.1250E.Pl	4.00022-01	5.81786-81	4,29095+6	4 4,89006-71	4,4/202+2	4.79326-31	4.69565.4	4.69226+51
41	4,8084E+8	4 4,59006.01	5.88806+84	4,49886-21	2.59966.5	4 4,40825-81	3.4/275+24	4.31552-67	2.00001.05	4.23026-21
46	5,808VE+#	4 4.1708E-31	6.86666.9	4,3888E-81	012005545	4 3,92806-91	7.7037E+3	4 3.72925-01	7.58285+84	1 3.5752E+?1
51	8,000×E+£	4 3.4100E±01	8,58826+24	4 3,30085-81	2+34886+C	4 3,2600E-71	0.9555549	4 3.20556-61	1.85555+6	3.13226-21
56	1,138#E+0	5 J.0700E-01	1,20806+2	5 3.0108E-81	1,30566+5	5 2,95005-01	7141556+5	5 2.98725-01	1.255551+5	9 2,83725-21
61	1.63846+8	5 2.7980E+01	1,78866+8	5 2.73#ØE+Ø1	1,00006+8	> 2.0000E-01	1.95536+5	5 2.4228E+01	5.9555F+5	3 2,57526-21
66	2,10846+8	5 2.9100E-01	2.20405+0	3 2.45886-71	5-29646+3	5 2,4 <u>1986-61</u>	5.4254E+5	5 5-35-96+51	2.5238E+8	5 2,32726-21
71	5.00895.0	5 2.2500E-01	2,78886+8	3 2.20 00 5-01	514964515	2.19962-51	5.85926+9	5 2.12256-31	3.555556.5	2.20256-11
76	3,250#E+6	5 1.4888E+81	3.44665.6	5 1.4 40 00-01	2.49666+5	5 1.81000-01	3.03556+5	5 1.71/25-01	4,26536+5	5 1.45726+71
61	4,2004E+8	5 1.6000EJ21	4.48P8E+8	5 1.54P8E-81	4,60656+5	> 1,46286-#1	4.02226+5	5 1.43725-01	2.5565F+6	5 3.42226-21
86	5,20046+8	5 1.3500E=81	5,480CE+8	5 1,31486-81	2,06056+9	5 1,28080-81	2.0505605	5 1.23286-21	9.35856.6	1 26225-51
91	6,5880E+2	5 1.1100E-71	7.000026+8	5 1.04096-21	7,50086+0	1,20200-21	9.5453E+S	5 9.50200-72	8.56555+6	9 0.08005-55
96	9, 96 94E+2	5 8.9888E+P2	0.5669E+6	5 8.7000E-02	7'5484E+S	6 8,44525-55	1.12026+0	6 6.17325-52	1.20276.42	6 7,9538[-22
101	1,30846-0	6 7.7538E-P2	1,4868E+8	5 7.5208E-22	1,50066+9	0 7,26185-62	1.07772+2	6 6.98PEE=22	1.72201+2	6 9.6P18E-26
196	1,84946+0	6 6.36898282	1.96655+6	6 6.84ADE-82	5.56895.9	P 2'11 RE-85	5+12556+5	6 5.38626-92	5.56856+6	5.95625-72
111	2.308#E+8	6 4.7380E+P2	2,48006.0	6 4.42986-02	2.50070+3	A 4,39020-22	2.673FE+7	9 3.96052-65	5.11596.6	1 3.3572E-27
110	2,880+1+0	5 3,3100E+P2	5.05465+5	5 3.27 PBE- 02	3.58856+6	0 2,04005-72	3,22876+6	6 2.40225+22	3.02021.02	6 2.1923E-cc
171	3,600000-00	6 1.09866.082	3.88666.6	5 1.8778E-82	4,60665+5	0 1,780HE-72	4.20006.0	6 1.71226-22	4,42021-0	6 1.00025-22
120	4.6984E+8	0 1.A1P8E-02	4.88856+8	1.37885-82	> . NOBOE . 6	0 1,7400 <u>0</u> -P2	2.54555.+3	6 1.52725-62	2.45365.45	6 1.49020-02
131	0,0004E+8	6 1.43000-02	9.86666+6	6 1.27P0E-02	1.0006E+6	7 1,16086-32	1.24946+9	7 9.9222[+0]	2.66551.6	7 9.78288-23

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REACTION & VALUE 6,4978E+80 EV

GOL7-19/

(N,GAMMA) NEUTPON CROSS SECTION ENDEVE MATERIAL NO. 6283

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REFERENCES FOR EXPERIMENTAL DATA

¹⁹⁷Au(n, Y) References Yr. Lab Author 72 FEI Chelnakov, et al. Jad. Fiz. Iss. 13, 6 (1972) 71 GA Fricke, et al. Third Conf. Neutron Cross Sections & Tech., Knoxville, Tenn. Vol. 1, 252 (1972) 71 Third Conf. Neutron Cross Sec-LRL Nagle, et al. tions & Tech., Knoxville, Tenn. Vol. <u>11</u>, 251 (1971) 71 Phys. Lett/B 36, 557 (1971) LAS Drake, et al. Acca Phys. Pol/B 2, 489 (1971) 71 WWA Brzosko, et al. 69 KFK Копре Nuc. Phys. / A 133, 513 (1969) J. Nuc. En. 22, 191 (1968) 68 GA Friesenhahn, et al. J. Nuc. En. 21, 797 (1967) 67 DEB Peto, et al. ORL Macklin, et al. Phys. Rev. 159, 1007 (1967) 67 Fast Reactor Phys. Symp. 67 KFK Poenitz Karlsruhe, Vol <u>I</u>, 67 (1967) KFK J. Nuc. En. <u>20</u>, 825 (1966) 66 Poenitz 66 KFK Poenitz Int. Conf. Nuc. Phys. Paris Vol I, 295 (1966) 65 MUA Chaubey, et al. Nuc. Phys. <u>66</u>, 267 (1965) EANDC-(US) /y, 72 (1965) LOK Grench, et al. 65 65 GA Friesenhahn, et al. GA-6832 (1965) Nuc. Phys. <u>69</u>, 37 (1965) 65 LOK Harris, et al. 64 GA Haddad, et al. Nuc. Inst. & Meth. 36, 125 (1964) 64 ANL Phys. Rev./B 133, 378 (1964) Cox 64 ALD Barry J. Nuc. En. 18, 491 (1964) Ark. Fiz. 23, 425 (1963) 63 FOA Bergqvist Macklin, et al 63 ORL Nuc. Phys. <u>43</u>, 353 (1963) 63 LEB Konks, et al. Zhur Ex. & Theor. Fiz. 46, 80 (1963)

REFERENCES FOR EXPERIMENTAL DATA

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²³²Th Cross Section Evaluation for ENDF/B-IV*,** W.A. Wittkopf

Babcock & Wilcox

²³²Th Cross Sections Below 50 keV

Capture Cross Sections in the Sub-resonance Region (0.001 to 10 eV)

The capture cross section of ²³²Th in the thermal and nearthermal energy range deviates substantially from 1/v behavior; this is due to the large contribution from resonance levels whose energies are less than the neutron separation threshold. From 4.0 eV to approximately 10 eV, the capture cross-section profile is dominated by the 21.78 eV resonance level; this profile, however, is essentially unaffected by Doppler broadening even at normal reactor fuel temperatures. Thus, 10.0 eV was chosen as the cut-off between the sub-resonance and resolved resonance regions.

For any E in the sub-resonance region, the value of $\sigma_{n\gamma}(E)$ can be computed by summing contributions from the various positive and negative energy resonance levels. In this study, these contributions have been obtained with the single-level, Breit-Wigner formula corrected for Doppler-broadening:

$$\sigma_{n,\gamma}(E) = \sum_{i} \sigma_{o}^{i} \sqrt{\frac{E_{i}}{E}} \psi(x,\theta)$$

*This report is extracted from a draft copy of BAW-317.

^{**}This 232 Th evaluation is a version II set updated at the NNCSC to meet the specifications of version JV.

where

$$\sigma_{0}^{i} = \frac{2.6038 \times 10^{6}}{E_{i}} \quad \frac{A+1}{A} \quad g_{i} \quad \left(\frac{\Gamma_{n}^{0,i} \Gamma_{\gamma}^{i}}{\sqrt{E_{i} \Gamma_{n}^{0,i} + \frac{\Gamma_{\gamma}^{i}}{\gamma}}} \right)^{2}$$

At E = 0.253 eV, the first 32 positive levels in 232 Th contribute 0.44 barns. Parameters for these levels were taken from Reference 1.

If
$$\sigma_{n,Y}$$
 (0.0253 eV) = 7.4 ± 0.1 barns

is the preferred experimental value⁽¹⁾, then 6.96 barns must be attributed to the negative energy levels and the remaining positive energy resonances. In this evaluation, the remaining contributions were attributed to a single negative energy level at -7 eV (first negative levels would be expected at approximately -2 and -14 eV). With $\Gamma_n^0 = 0.0321 \times 10^{-2}$ (eV) and $\Gamma_{\gamma} = 0.0259$ eV, this fiducial level contributes 6.96 barns to the 2200 m/sec capture cross section, and, this model therefore, will produce the preferred value of $\sigma_{n\gamma}(0.0253 \text{ eV})$ for 232 Th.

The Resolved Resonance Energy Region (10 eV to 3.94 keV)

From 10 eV to 3.006 keV, parameters for the resolved resonances in ²³²Th are the recommended values given in Reference 1. The remaining parameters (last resolved resonance appears at 3.931 keV) were obtained from measurements reported by Garg, et al. ⁽²⁾ The capture width was taken as constant, $\Gamma_{\gamma} = 0.0259$ eV. All levels were taken as s-wave ($\ell = 0$) levels (none were identi-

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fied as p-wave or "doubtful"). These parameters were used in the single-level, Breit-Wigner formula.

The Unresolved Resonance Region (3.94 keV to 50 keV)

Unresolved resonance parameters for Th-232 are given in Table 2. The s-wave parameters are identical to those used by Sehgal⁽³⁾ in his recent study of the thorium resonance integral and were deduced from the resolved resonance data. The p-wave strength function was selected such that calculated, infinitely-dilute, capture cross sections would agree well with experimental values reported in Reference⁽¹⁾. The calculations were performed with the ERIC-2⁽⁴⁾ code and comparison of the calculated and experimental capture cross sections was made over an energy range extending from 10 keV to 200 keV (the unresolved region cut-off, however, was taken at 50 keV). For these calculations, the $\ell = 1$ strength function was assumed constant and independent of J, and the average level spacing assumed proportional to $(2J + 1)^{-1}$; the mean reduced neutron width can then be computed from

$$\overline{\Gamma}_{n}^{0}(E) = S_{\ell}\overline{D}_{\ell,j}E v_{\ell}$$

where

ъ. .

$$S_{1} = \text{strength function}$$

$$v_{\ell} = \text{penetration factor}$$

$$= 1 \text{ for } \ell = 0$$

$$= \frac{x^{2}}{1+x^{2}} \text{ for } \ell = 1; x = 0.00191 \sqrt{E}$$

The neutron level widths were assumed to be distributed in a chi-squared distribution with one degree of freedom (v = 1). For $S_1 = 1.20 \times 10^{-4}$, the calculated and measured cross sections are in good agreement; sources for the measured data are given in Reference 1. The Harwell data is given greater weight than that of Sehgal⁽³⁾, resulting in a lower p-wave strength function. The ERIC-2 calculations utilized 100 "narrow" groups and a potential scattering cross section of 12.0 bas is.

4

	<u>Table 2</u>											
	Unresolved	Resonance	Parameters fo	or ²³² Th								
	l = 0		٤	= 1								
	J = 1/2	·	J = 1/2	J = 3/2								
D	12.95 ev		12.95	1.475								
se	0.73×10^{-4}		1.20×10^{-2}	1.20×10^{-4}								
г ү	0.0259 ev		0,0259	0.0259								

The Radiative Capture Cross Section (.05-15 MeV)*

From 0.05 MeV to 0.12 MeV a smooth curve is drawn to connect with the value given by the solid line of Reference 1. From 0.12 MeV to 15 MeV the solid line of Reference 1 was used. This gives the (n,γ) cross section tabulated in File 3.

The Fission Cross Section*

The fission cross section up to 10 MeV was taken from the work of Davey⁽⁵⁾ who made an evaluation of the fission cross section up to MeV. From 10 MeV to 15 MeV the fission cross section given by the solid line of Reference 1 was used. The fission cross section thus obtained is tabulated in File 3.

References

- 1. J.R. Stehn, et al., BNL-235, 2nd Ed., Sup. 2, Vol. III (1965).
- J.B. Garg, J. Rainwater, J.S. Petersen and W.W. Havens, Jr., Phys. Rev. <u>134</u>, B895 (1964).
- 3. B.R. Sehgal, Private Communication to D. Roy and A. Livolsi (1966).
- 4. H.M. Sumner, AEEW-R-323, (April 1964).
- 5. W.G. Davey, Nuc. Sci. Engr, <u>26</u>, 149 (1966).

*The cross sections were extrapolated to 20 MeV at the NNCSC.

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ENDEZA MATERIAL NO. 6296

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RESONANCE DATA RESONANCE PAPAMETERS

THOP10M-232

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				RESONANCE HID	THS (EV)	
1NDEX	ENERGY (EV)	J VALŲE	TOTAL	NEUTRON	RADIATION	FISSION
1	-5.1280F+88	5.00005-01	2.82046-02	4.28485-03	2 AAB2E+62	9.2030F+22
2	8.34005+00	5.0020E-01	2.59005-02	2.58000-07	2 5922E+22	2.88825+55
3	1.31106+01	5.000PE-01	2.5902E-02	2.00000 07	2.5922E+82	
4	2,178¢E+01	5.0000E-01	2,79000-02	2.0000E-03	2,592PE=P2	*,0000C+20
5	2,3450E+01	5.0200E-0 <u>1</u>	2.9640E-32	3,7400E-P3	2,5928E=82	A, 30 J85+P0
6	3.69008.01	5.0000E-01	2,59016-32	. a508c-06	2,5928E+02	7,2000E+12
7	3.8200E-01	5.0002E-01	2.59616-32	6.30000-07	2,5900E=32	*,8238E+32
, B	4.10000+01	5.0000E-01	2.5901E-02	5,00000-07	2,5900E=02	P P B C B E + 2 B
12	5 9444F+01	- 00000-01	2.54021-02	1.70000-00	2.59802.02	2.20/02+00
11	6.9130F+01	5.2000E-21	A 79025-02	4 22005-02	2,37606472	2.20.000000
12	9.01005.01	5.00020-01	2.59056-02	5.00000-06	2.590PE-02	2.00205+20
13	9.80000.021	5,000000-01	2.5904E-02	A.0000E-06	2,5938E=#2	2,00005+20
2.4	1,03646.+02	5.0000E-01	2,5936E-02	6.00005-06	2,5928E-#2	2,00005+20
15	1.12876+02	5.280PE-21	3.830PE-32	1.24005-02	2,59686=#2	2,000005+20
15	1,2075E+02	5,0000E-01	4.6420E-02	2.0500E-02	2,5900E=02	0,20JBE+20
14	1.20106+02	5.000000-01	2.5982E-02	8.0000E-25	2,590FE=02	7,78025.02
19	1.45905+02	5 0000E-01	2.7-001-02	A 00000-05	2,39600-02	3.20305-12
żβ	1.543/E+02	5.0000E-01	2.60205-02	20005-04	2.59000002	2.40205+30
21	1,78206+02	A.0000E-01	8.5900E-32	6.8008E-82	2.5920E=02	P. 8842E+P8
22	1,92606+02	7,0000E-01	4,0900E-02	1,5000[-02	2,590PE-22	* , #BUBE+CB
23	1.962/E+02	5.0000E-0 <u>1</u>	2.6230E-02	3,3000E-64	2,5908E+02	2.90005+29
24	1,9930E+02	5,0000E-01	3.69000-02	1,10000-02	2,590PE=02	7,0000E+70
25	2,2110[+02	5.00220-21	5.5400E-02	2,95000-02	2.5900E=02	A .00005+70
20	2,71401+02	5.00000-01	5.6902E-C2	3,160KE+02	2,59806=02	7.0000E+00
28	2.85706+02	5.0002F-01	5.5100E-02	2.02005-02	2.5900E+02	3.0000E+20
29	3.0540E+02	5.00000-01	5.2900E-C2	2.70001=22	2.5988E-02	8.0000F+00
30	3,28905+02	5.0003E-31	9.7900E-C2	7,20005-02	2.5900E+02	7.0000E+20
31	3,41806+02	5.00000-01	6.3400E-22	3,7500E-02	2.5900E-02	A • 6696E + 56
32	3.6510F+02	5,00000-01	5.1900E-02	2.60000-02	2,5900E=02	A . 00005+00
33	3,003FE#02	5,00000-01	5.19001-02	2.69.005-02	2,51001202	2,20005+20
	4.20805+02	5,000000-01	3.5/00L-02	4 00000-02	2,39000-02	
36	4.5430E+02	5.0000E-01	2.7100F-02	4.20005-03	2 5900E-02	0.00000+30
37	4.6250E+02	5.00000-01	8.7900E-02	A 2000E-02	2,5900E-02	7,00005.00
38	4.887VE+02	5.0000E-01	8.3900E-02	5.80000-02	2,590°E-02	* . 2808E+28
30	5.1050E • 02	5,000PE-01	3.020PE-02	4,30002-03	2,5982E+02	2,70005+00
46	2.5820E+02	5,000000-01	4.9400E-02	1,4500E-02	2,5920E=02	9.00085+00
42	5 40305402	5,000ft+01	2.0980L-02	0.00001-07	2.5900E=02	3.3030C+20
43	5.78205+02	5.0000E-01	2.83005-02	2.40005-03	2 59005=02	2.00005+20
44	5.98208+02	5,0000E-01	3,5400E-02	. 5200E-23	2.5900E=02	P.PROBE .CO
45	6,1790E+02	5,00000-01	3,0200E-02	A,3000E-23	2,5900E-02	A.0000E+20
46	6,5674E+02	5,0000E-01	7,0900E-C2	A,5000E-02	2 590PE+02	7.0000E+20
47	6.6920E+02	5,00000-01	4,69000-02	2.10006-02	2.590KE-02	05+38008 • 30
40	0 / 7 ZUL 402	00001-01	2,2/901-01	2.0200(+01 5.02005 03	2.59000-02	5 6 6 6 6 6 F + C F
80	7.04105+02	5.0000E-01	3.89005-02	1.30005-02	2 SOUDE=02	2.00005+00
51	7.12996.+02	5.09006-01	5.592ØE-02	3.00000-02	2.5907E+32	7.00000+00
52	7.4090E+02	5.0000t-01	2,25906-01	2.00000-01	2,5920L-02	0.00005+00
53	7.7870E+02	5.00000-01	3,72002-02	1,130RE-02	2.5900E-02	2,06985+96
- 24	6,04302+02	5.00000-01	2.1090E-01	1.85000-01	2.59802-02	A.0000E+00
	8,21306+02	5.000000-01	2.6900E-02	1,00000-03	2.59000002	P.0000E+00
	8 308NC+83	5,0000C-01	3 48005-02	2,7000L+02	2.39001-02	4.00000-+00
58	8.64585+02	4.00005-01	3.94005+02	1.35005-02	2 59005002	3.000002+30
59	8,90206+02	5.0000E-01	5.9900E-02	3,4000E-02	2.59006-02	P 00005+20
60	9,86502+82	5.0000E-01	2.8000E-02	2,1000E-03	2,5963E-02	H. 0000E+20
61	9,4340E+02	5.0000E-01	6.7900E-02	4,2000E-02	2,5900E-02	P. 0000E+PP
62	Y.6280E+02	5,00000-01	3.2100E-02	A.2000E-03	2,5900E-02	96496+30
63	A 04862*03	7,0000t-01 = 0000t-04	5.690ME-02	3.1000E-32	2.59601-02	4 10000E+00
25	1.0105603	-,00001-01 -,00005-01	1 45005-01	C.000001-02	2.3700L702 2.5700L702	3.00000L+00
66	1.03936+03	5.0000E-01	3.6900E-02	1.100BF-02	2.5900E-02	8.0000F+00
67	1,0650E+03	5.0000E-01	3 P900E-02	5.0000E-03	2,5900E-02	P.0000E+00
68	1,0772E+03	5.0000E-01	3,4900E-02	9.00005-03	2,3900E-02	A, PEUDE+CB
69	1,0930E+03	5.0000E-01	2,85002-02	2.6000E-03	2.59006-02	1.00V0E+C0

78	1.1180E+03	5.82086-01	4.89886+82	2.30001-02	2.5988E+02	3.000aF+20
71	1,11476+03	5,56076-81	2.86000-02	2.70000-03	2.598882+22	A, 2868E+38
72	1,12822+03	5,0000E-01	2,9210E-02	3.3100E-03	2,590PE=P2	9.00005-20
73	1,139#E+03	5,000gE-01	3,9980E-82	1,4000E+02	2.5900E+02	# .00 08E+20
74	1,190°E+83	5,8000E-0 <u>1</u>	4,5908E-02	2.0000E-02	2.5980E+22	7,7808E+08
75	1,1943E+83	5,800BE-01	3.1800E-02	5.9000E+03	2.5900E+P2	09+32665 ,9
70	1,20446+03	5.0000E-01	2.7300E-02	1.4000E-03	2,5900E-02	3,000FE+50
	1,22706+03	5.0000L-01	5,8980E-82	2,5000E-02	2,5400E-02	7,8008E+30
78	1,24312+93	5.00001-01	4.14806-02	1.550000-02	2,59886-82	C.2000C+7P
	1 24076403	5.0000L-01	1,15906-01	9,0000t=02	2.39600-02	7 88385+28
	1 20215-03	7.0000L-01 8.0000L-01	4.4980L-82	1.40001-02	2,34001-02	A BOODL-YD
	1 30165+03	5.0000FL-01	4 30895-82	N 4000L-02	2.34001402	1.8636C+00
	1 33475483	5 0650C-01	3 86335-02	3.000000000	2.370000000	9.88305+70
44	1.34565+83	5.0000C-01	2 47445-02	B 43705-04	2.370000-00	3.88495+28
85	1.35406+03	5.68886+81	9.21845-02	6.42545-82	2 89205-02	7.88386+27
86	1.35996.03	5.00000-01	3,83256+02	4.42526 .83	2.59005-02	3.00405+20
87	1.3779E+83	5,0000E-01	6.4876E-02	3.8976E-02	2.59806-82	8.38465+38
Ă8	1,3871E+03	5.000000-01	2.81356-02	2.2346E-03	2.59886+82	3.78085+78
89	1,3977E+03	5,000000-01	1,19366-01	♦,3465E-02	2,59886-82	8.88485+28
08	1,4173E+03	5.0000E-01	2,6578E-02	6,7765E-04	2.5920E=02	3 .0008E+ 28
91	1,4266£+Ø3	5.0000E-3 <u>1</u>	1.01445-01	7.55418-02	2,59886-62	9 ,80,085 +65
42	1,4337E+Ø3	9 .0080 E-31	5,88426-02	1,29426-02	2,5988E=82	7 ,8008E+ 20
43	1,5092E+03	9.8888E-01	2.86196-02	2.71946-23	2,598PE-02	* *\$908E+6 0
04	1,5184E+03	9.0000E-0 <u>1</u>	1,58396-81	<u>1</u> .3249E-01	2,5900E=02	7.8000E+30
05	1,5241E+#3	5,0000E-01	1.5864E-81	1,32746-01	2.5920E=02	a ,80486 •08
95	1,5754E+Ø3	3.0680E-01	3.2210E-02	6,31020-03	2.590PE-0?	7,8808E+CP
37	1,20105403	5.0000E-01	3.8024E-22	1.2724E-02	2.5480E=02	7,20086+08
	1,70916+03	7.0006L-01	2.85211+01	2,54116-01	5.2400F-05	0,000E+20
	1 43002/2403	7.000021-01 8 #3005-0-	0.773/L-22	4,403/E-82	2,9400L=02	7,020000+20
160	1,03002003	5,000000-01	3.89332-61	3.03436461	2,37800-02	> 0600E+0E
112	1 44145-03	5,00000E-01 6 0000E-01	0,43796-22	3,04/91-22	2.59686.02	2.00CVE+70
103	1.67706+03	5.8800F-0+	4.43325-02	1.84325-02	2 59235=#2	2.28/05-20
1.84	1.70525+03	5.00205-21	2.96165+02	3.71656-83	2.59225-02	3.20405+20
105	1.719/E+03	5.8888E-81	5.5758E-C2	2.98586-02	2.59285-42	*. 88385 +. 8
17.6	1.7290E+03	5.2000E-31	2.74396-62	1.53056-03	2.5403E+22	2.30.05+70
197	1,7397E+93	5.000PE-01	3.2157E-02	6.2565E-23	2.5988E-22	5.00000.00
198	1,7467E+83	5.00025-01	5.26466-02	2.6746E.22	2.5987E+22	1.88085+29
189	1,762/E+03	5,00075-01	1.05672-01	7,9771E-22	2.5900E=22	7 .00005+20
110	1.8P32E+03	5.000025-01	9.3843E-C2	4.7943E-02	2.5900E-02	7.28025+30
111	1,8119E+03	3.000000-01	6.2PB9E-C2	3.6180[-#2	2,59000-72	9.0000E+78
112	1,82446+03	5.0000E-01	9.4241E-32	A.8341E-82	2.5422E=22	7,90J05+20
113	1,8481E+03	5.0000E-01	2.8479E-22	2.5794E-83	2.54826-82	7.8040E+28
114	1,8539E+03	.00000-01	6.0346E-02	3,4446E-P2	2.5932E-22	100362+55
1127	1,80176+03	5,00001-01	5,35136-62	2.7013E-02	2.5902E-72	7.78425+20
119	1.900000-03	5.000000-01	1.131/6-51	A.71905-82	2.59021+02	5 58062+56
11/	1 05125-03	5,000FC-01	4.39136-02	1.00131-02	2,79862462	**************************************
119	1.97126+03	5.00000-01 5.00000-01	1 00175-01	4 44275 -01	2.37000-02	7,20,435,472
128	1.98826+03	5.00000-01	A.1571F+02	3.56715-02	2 59005+02	2.24306+22
121	2.00526+03	5.00000-01	1.15466-01	A. 9559F-02	2.5928E+82	7.28/05-77
122	2.8347E+83	5.0000E-01	2.85265-22	2.78657-03	2.5988E-82	2.28385+22
123	2,95108+03	5.000PE-01	4.26595-02	1.6759E-02	2,59206-02	2.0000E+22
124	2,06175+03	5.00026-01	7,1306E-C2	s.5406E-02	2.5984E-02	3,8008E+28
125	2,0734E+03	.0000E-0	3,1365E-02	5,40482-03	2,5988E+22	* ,82865 +20
125	2.078¥E+03	5,30095-01	3,9578E-02	1,36786-02	2,59886+82	5,280BE+28
127	2,116/E+03	5.0000E-01	9,9512E-02	7.36125-82	2.59000-02	7. 20355 +20
125	2,1474E+03		9.07766-62	A.4876E-02	2.5900E=02	2.56952+58
129	2,102*E*Ø3	5,000000-01	1.0962E-01	37036-02	2.5988E+B2	5-59582+56
1.50	2 19705+03	5,000000-01	7,72391-62	- 10091-02 4 48705 00	2.59046#82	*********
172	2.21595+03	5.0000E-01	3 29415-02	7 04185-02	2.3*600-02	7,800001.000
133	2.22225+23	5.2000F-01	8 24485-02	5 A5A8C-02	2 89076=02	3.38385405
134	2.27835+83	5.8000E-01	3.49535-02	9.00316-03	2.59825+02	
135	2.27621.03	5.000PE-01	5,4526E-02	2.86261-02	2.5988E-82	*.28085+75
136	2,286/E+Ø3	5.2000E-01	2.45872-01	2,19975-01	2.5928E-02	*.********
137	2.3212E+03	9.0000E-01	3,12292-22	5,2997[-03	2,59886-82	*,7838C+20
138	2.3361E+Ø3	5.0000E-01	1,12006-01	0.70005-02	2, 598 8E-82	2+3#6#E+72
139	2,3520E+03	5.0000E-01	5.2577E-C2	2.66775-82	2.59005-02	9:•3888£•28
140	2,30176+03	5.00001-01	3.076PE-02	4,85995-83	2.59006=02	2,30086+00
1 1	2.3/402403	COODE-01	1.7387E-01	7.79/10-02	2.5928E=02	******
144	2,30102+83	5.0000L-01	3,2/336-22	e, H325E+03	5.24605465	P . 78485 + 10
143	2 44 845 403	7.00001-0 <u>1</u> 6 00001-01	2,8034L-82	2.93375-23	2,59886382	7428082+29
145	2.43046-03	5.8008F-01	3 1116-02	A115c-01	2,57501-52	
146	2.4561F+03	5.0000F-01	1.69625+01	1.43727-01	2.59225=02	3.883 499
147	2,4917E+83	5.0000E-01	3.08925+02	4.99175-03	2.59276-02	7.084#5.**
148	2,5087E+03	5.8000E-01	2,7633E-01	2.56435-01	2.59886-62	7. CRUME + 22
149	2,5267E+83	5.0000E-01	7.113ME-02	.52386-82	2.59686-02	7,20485+20
150	2,5534E+03	5.0000E-01	2,284PE-01	2,82586-81	2.59286+82	7.08485+20
151	2,5691E+83	5.00002-01	6,13822-62	3,54886-82	2.59876+72	*,#84 <u>85</u> +28
152	2,6117E+83	5.200FE-01	1,5366E-01	1.2776E-81	2.59086-82	7,00485+70
153	2.6233E+03	7.8000E-01	3,2746E-22	6,1462[-03	2,59806382	2 EBABE+68
154	2.8342E+03	5,0000E-01	2,82526-01	2.5062E-21	2,5922E-92	*.2690E+26
172	C107481485	7.0000L-01	2.8470E-02	7,5758[-03	2.54886082	
170	2.477.46.487	7.000000-01 6.00000-04	3.376FL*F1	0.07/01+01 0 31370-47	2.5VE0L072	7 - F2085 + 78
188	2. AAR1F+03	5. AAAAF-01	1 83475-04	313/t-E3	2.37542 <i>462</i> 2 80825-63	1.88085428
159	2.71205+83	5.0000F-01	1.56115-01	1.30216-01	5.2700C-42	「うらいらてしてどて
140	2.72108+83	5.0000001	3.32046-02	7.30395-03	2.59226-22	2.28485+20
161	2.7332E+83	5.000000-01	2.8730E-01	2.61405-01	2.59871-22	*
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142	2,74748+03	5,222PE-01	3.46111-22	P.9107E-93	2,5922E+22	2.2208E+72	
144	2.773#F+C3	3.0000E-01	2.07271-02 7.8589F-22	5.26595-22	2.59225-22	>.28885+79	
165	2.74235+83	3.880PE-01	1.42146-01	1.10205-81	2.5988E+82	* . # # # # # * * * * * * * * * * * * *	
146	2,815*E+83	9,0000E-01	4 71241-02	2.12246-22	2.59226+22	2,88095+7P	
147	2,8327E+03	5,28896-81	5,2512E-22	2.60125-22	2.59225+22	», <u>28886+</u> 28	
148	2,8527E+03	5.8808E-01	1.75456-01	1,49556-21	5.26-32	2.657565.45	
149	2,8820[+03	7,00001-01 1 00001-01	3.00395-02	1,27385-22	2.59026-22	7,78286~28	
171	2 01405-03	9,000000-01 9,00000-01	3, 34875-03	9 55745-03	2.34601-62	3.22225492	
172	2.9472E+03	5.00000-01	1.P198E+P1	7.62036-22	2.99886+82	.28425+72	
173	2. 4554E+03	5.8000E-01	5.47128-02	2.00156-02	2.59226+82	9.22325+22	
174	2,9451E+83	5.80000-81	4,7236E-22	1.6336[-22	2.5922E+22	21+3293214	
175	2,9781[+83	5.0020E-01	3,57236-22	.8238[-83	2.59326-22	3,82485+28	
176	5.0899E+03	5.00706-01	5.43266-22	2,84286-22	2.5922E+P2	3,22085+78	
17/	3.80001.003	20001-01 	3, 37201-22	7.12/26-23	2,54561-22	3,26685	
179	3.02706.03	5.22422-01	1.99235-21	1.73336-21	2.59285=82	*. #2d#5+?P	
180	3,83936+23	5,02000-01	6.4491E-22	3.85916+02	2.59226=22	7.22422+22	
101	3,8497E+83	5.00000-01	3.58426-22	0,94035-23	2,592FE=22	2,2838E+22	
182	3,06816+03	5.80000-01	5.63256-22	3,24250-82	2,5922E=62	2,2888E+28	
183	3,0811E+03	5.00000-01	7.32826-82	4.71825-22	2,59886-22	5.5896E+15	
184	3.182	5.38866-01	2.00825-82	2.78925-23	2.59726+22	•, #2025 • 77	
102	3,107-6463	5.000000-01	7.439/1-22	3.347/E+CC	2,37001-02	7.23205.423	
187	3.15206-23	9.2028E-41	3.92875-01	5.64976-81	2.59226-22	> #2085+22	
185	3,16302.03	5.00008-21	4.38995-22	7999E-22	2.59276+82	51+38635.4	
149	3,1871E+83	5,00000-01	9,64682-22	7,85685-82	2,59226+82	24-39685.4	
198	3,2370E+B3	5,8888E-01	1.27832-01	1.21935-21	2.59226+22	2.28962+55	
101	3.22926.83	9,8248E-81	3.7266E-22	1.13662-82	2,59226-82	*15598E+55	
192	3,24216+83	7,2255t-01 8 18285-31	3.7288E-22	1.13885-82	2,59281422	3,78486+72	
104	3.2470F+23	5.28088-01	A. #1985-02	3.42985-22	2.49286.222	2.22492+28	
	3,206#E+23	5.2822E-#1	3.72376-21	1.44472-21	2.59285+22	* . FE425 +78	
196	3,316¥E+83	5,38285-81	2.8788E-32	2.87965-23	25+35902,5	1,20485-72	
197	3,3381E+23	5.882 0 0-21	8.3627E-22	5.77872-82	2,5922E+22	2,28585+72	
108	3,34800 + 23	5.3200E-01	1.7948E-81	44525-81	2,59226+22	· * \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	
104	3,3/1-6+03	7.88681-01	2.00231-23	7.98326-83	2,39266-22	7,45CBE+75	
241	3.4+2/5+23	9.888881-81 9.88888-81	1.4 10 24 -81	8.82825-22	2,37601002	3.22205078	
2#2	3.42106+23	4.28885-81	3.4674E-07	# 7742E-23	2.5922E+22	********	
2#3	3,42846+83	*,288228;	6.7474E-C?	4.15745-82	2.50226.72	7, #2686 + 22	
284	3,443/E+03	16-39595.4	7.28476-22	4.6947E-82	2.59285-22	2, 2342C +72	
285	3,47106-83	9.8078E-81	3,536RE-82	2.9462E-02	5-2256-55	7,72025.77	
200	3,4414146.63	7,000001-01 1 000001-01	3.//101-22	1,10101-02	2.37271-07	7175655+27	
288	3 54625+23	5.08845-81	2 82885-02	38676-83	2.77606072	3,22485422	
209	3.57548+83	5.000FE-71	3.7858E-22	1.19586+82	2.49276+22	31+34545+78	
218	3,5927E+23	5.38EEE-01	4,74788-22	2.15785-82	2 . 49286 - 82	21+28685+22	
221	3,61876.83	5.804PE-81	1.#7#2E-21	A.1118E-32	2,5+226+22	2 ,25985+5 5	
212	3,622-6-03	5,2888621	5,5003E-22	3.20935-22	2.59286+82	2.22425.425	
21.3	3 44976483		4.39031-22	4 24115-22	2.57771-72		
2.5	3.47306+83	5. 28285-81	A 5284F.82	# .#39AF.22	2 69226482	9.77207.77	
2.6	3.49225+83	N. 20221-91	5.82826-82	3.23826-/2	2.59226+22	7.22325.47	
217	3 72746 .83	5.28200-81	5.51256-22	2.92255-22	2.59282+22	*, *******	
228	3,72326+83	5.00286-81	2.49476-21	7.44876-81	2.59226+22	1.22586.428	
219	3,732+{+#3	7.28286-21	8.49856-65	A.1295E-82	2,59226-22	*,78386+29	
278	3,74347+83	7.2828521 8 38285.21	4,18116-82	1.59110-82	2.59226482	7,288885+77 9,88885+77	
222	3.74445+21		2961-82 4.24.4577	2.44145-23	2.346425422		
223	3.81095+23	5.27926-21	4.32231-12		2.5+246+22	1.22221.22	
274	3,82516+83	5.22221-21	2. \$376-21	7.16475-01	2,99228-22	5 . 28585 . · 7	
275	3.84746+23	4.28286-81	5.77:36-27	2.48130-22	2.59275+77	******	
276	3,647'E+23	4.2877E-71	6.6324E-72	4.24245.22	5.24242+55	24-2292314	
277	3.00435.023	78581-21 78581-21	4,45871+22 3 75445	5,50778+72	2.59241422	フィアスタルビーフで カ・ファイルアメカフ	
229	3.43126+83	4.28986-01	1.09248-23	A.2.36E-72	2.54276-#2		

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THOR10H~232			RESONA	ONANCE DATA NCE PARAMETI	ERS				
ISOTOPE PRACTIONAL ABUNDA NUMBER OF ENERGY	NGE	IORIUM-232 .0080E+99 2							
ENERGY HANGE NUMB LOHER ENERGY LIM Uppen Energy Lim Nuclar Spin Effective Scatter Number of L State	BER	2 3.9400E+03 3.0000E+04 3.0000E+04 9.0004E+00 9.9074E=01 2	UNRESOLVED S	INGLE-LEVEL	9RE1T-WIGNER	PARAMETERS	1		
L VALUE	E9	9 1							
		AVI	ERAGE RESONAN	CE WIDTHS (EV)				
LEVEL SPACING	J-VALUE DEG	OF FREEDOM	NEU'. ON	RADIATI	ON				
1.7080E+01	5.0000E-01	1,6000E+00	1.2417E-03	2,59000	-82				
L VALUE	 ES=	1 2							
		۸v	ERAGE RESONAN	CE HIDTHS (EV)				
LEVEL SPACING	J-VALUE DEG	OF FREEDOM	NEUTRON	PADIATI	0N				
1.7000E+81 8.9000E+84	5.8000E-01 1.3000E+80	1,00096+00 1,00796+00	2.0400E-83 1.2009E-03	2,590ØE 2,590ØE	-82 -82				
THORIUM-232			NEUTRON	FISSION CROSS SECT	1 O N		ENDF/8 MATERIA	L NO. 6296	
REACTION Q VALUE	1,8440E+08	EV							
INTERPOLATION LA Range de 1 to 32 y	W BETWEEN ENER Scription Linear in X	G1E\$							
NEUTRON CROSS SE INDEX, ENERGY EV 1 1.20008-00 1 3.00040-00 1 3.00040-00 2 7.20040-00 2 1.7.20040-00 2 1.00040-0 3 1.50040-0 3 1.50040-0	CTIONS CROSS SECTION MARNS 6 0,00000-01 6 1,30000-01 6 1,30000-01 6 1,40000-01 6 3,60000-01 7 2,83000-01 7 4,15000-01	ENERGY C EV 1.30000000 3.5000000 5.8000000 5.8000000 1.1000000 1.1000000 2.000000	ROSS SECTION BARNS 1.0000:-02 7.2000:02 1.3900:02 1.3900:01 2.0200:01 5.3203:00 5.3203:00	ENERGY C Ev 1,35072+006 2,00002+06 4,0002+06 5,0002+06 1,20002+07	ROSS SECTION BARNS 2.00000002002 1.12000001 1.43080001 1.43080001 2.01000001 2.01000001	ENERGY EV 1.4000E+06 2.2000E+06 4.5000E+06 6.3000E+06 1.3000E+07	CROSS SECTION BARNS 6.00002-02 1.22002-01 1.45002-01 2.40002-01 3.20002-01 3.20002-01	ENERGY EV 1.5508E+86 2.5008E+86 5.0808E+86 5.0808E+86 1.4088E+87	CROSS SECTION BARNS 8.000000-02 1.00000-01 1.44000-01 3.20000-01 2.90000-01 3.60000-01

ENDEZE MATERIAL NO. 6296

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²³² Th(n, f) References <u>Lab</u> Author YR, 71 LAS Muir, et al. Third Conf. Neutron Cross Sections and Tech., Knoxville Tenn. Vol <u>I</u>, 292 (1971) EANDC-(J)-19, 37 (1970) 70 KTO Kobayashi, et al. 69 STF Barrall, et al. AFWL-TR-68-134 (1969) Behkami, et al. Nuc. Phys./A 118, 65 (1968) 68 ANL Health Phys. 13, 654 (1967) 67 NRD Rago, et al. 63 CCP Pankratov At. En. 14, 177 (1963) Priv. Comm. (1961) 61 KYU Katase 61 BET Babcock Priv. Comm. (1961) CCP At. En. 9, 339 (1960) 60 Pankratov, er al. 58 CCP Protopopov, et al. At. En. 4, 190 (1958) 58 CCP Kalanin, et al. Second Peaceful Uses At. En. Conf. Geneva Vol <u>16</u>, 136 (1958) 57 LAS Henkel LA-2122 (1957) 56 HAR Uttley, et al. AERE-NP/R-1996 (1956)

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ENJEVA MATERIAL NO. 6296

REACTION & VALUE	4,7804E+06 E				
INVERPOLATION LAN B Pange Descr 2 to 27 LN Y 332 to 332 Y LIN	ETHEEN ENERG IPTION Linear in Ln Ear in X	IES Панле Х 277 то 299	DESCRIPTION 9 v Linear in X	AAVGT DESCRIPTION 299 to 332 LM Y LINFAR	וא דע א
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1 1,88806-05 3		EV 94245-04 1.1862542	52 1.24025-24 1.06455-02	EV 94445 1.42025-34 1.220405+02	EV 04845
6 1,6000E-04 B	4547 +81	2.0002E-34 8.4902E+0	2.20075-04 6.06925+31	2.4007E=84 7.66825+P1	2,53022-24 7,45865+61
11 Z. GRUNE - 04 / 15 Z. ARIOF - 04 / 0	. 30736+01 . 26786+01	2,800225-04),0903540 1.40885-04 4 00785-0	01 0.00000-04 0.05050-01 01 4.00000-04 9.02040+00	3,2203E-04 0.64775-01 4 22355-24 5 704274-01	3.40205.74 5.44245.42
21 4,6800E-84 5	13946.41	. 3000E-04 5.4218E-0	1 5,88866-84 5,31225-91	5.2007E-P4 5.2098E+01	
70 9. 600000-04 9. 44 5 500000-04 5	.0194E+81	5,800805-04 4,93215+0 	01 6.8030E-04 4.8492E+01	6.2337E-24 4.7773E+E1	14-3156- * * * - 328- * *
	3063E+31	,.80,0E-04 4.2527E+0	31 8 20005-04 4 19925-91 31 8 20005-04 4 19925-91	7,20025+04 4,42655+01 8.20025+04 4,14765-01	7,48875474 4,36625421 8,48887444 4 70307491
41 8.6230F-84 4 44 0 44045-84 4	. 75005.01	3.8600E+84 4.0776E+0	01 9.000221-04 0.05895+01	9.20026-24 3.91566-01	9.40005-04 3.87375+01
51 1,68806-83 K	9684E+01	L. 8000E-03 2.7964E+0	11 1. MOORESCO J. /2005 471 31 2. MOORESO 2. 65465 481	1.20035403 3.42815401 2.28035403 2.53005401	1,4080E-03 3,1734E+01 0 40005-03 0 4038E-01
10 2.5300E-03 2		2.6899E-03 2.3277E+0	31 2. ABBPE+83 2. 24295+21	3. 59076-03 7.16676-01	3,20075-03 2,29775-01
		3.6000E=03 1.9775E+0 6.40005=03 1 7467F+0	1 0.70000-00 1.92467+91 11 6.80001-01 1 7+467+91	4.00000000 1.07570401 6.00000000 1.07570401	4,2020E-03 1,8324E-21
71 5,4804E-03 1	41355-01	5.000FE-03 1.56A3E-0	11 5.68895-03 1.5567F+01	6.88805-83 1.53245-21	3.60006 -03 1.04446.01 6.20006 -03 4. 50546.01
76 6,4388E-83 1	.46165+01	5.6803E-83 1.45ARE-0	11 6.8000E+03 1.43715+21	7.0000E-03 1.4163E+01	7,2000E-03 1.3964E+21
11 / * 40 40 4 1	.3773E-01	7.6000E-03 1.350AE+0 2.4000E-03 4 2474E+0	11 7,8000E+03 1,34145+01 81 8 80047-01 1 34245+01	8.0230E-03 1.3244E+R1	8.2000E-03 1.3080E-31
	22115-01	9. 6000E+03 1.24H3E+0	1 9.8000F-03 1.10585+01		9,20005.03 1,23445421
46 1,4000E-02 9	• 9892E+ 88	1.6000E+02 9.3372E+P	10 1.8000E-02 8.75675+30	2.8007E-02 8.3392E-00	2.00000-02 7.94526+40
171 A. 400005-02 A	.00141-00 .56375-69	2.53005-02 7.40005-0 2 40005-03 4 14:540	00 2.6000E-02 7.25785-90 20 1.6000E-02 6.12515-90	2.8000E-02 7.0272E+00	3.23266-02 A.78396+08
111 4,20995-02 5	.78835-98	4 4 8 4 8 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4		0.0700E=02 0.020E+70 4.8000E=03 5.3070F+70	4.070001-172 5.0536E+30 5.00305-02 5.2555-00
116 5.2000E182 4 101 5 2000E182 4	11156-00	5.4000E-02 5.0122E+0	30 5, AUDAE-02 4, 9183F + 90	5.8007E=02 4.9293E+02	6.PB20E-02 4.7446E+02
124 0.000000 4 126 7.76665-62 4		0.40PVE+02 4.5873E+0 7.48P2F+02 4.25A6F+0	00 0.60005-02 4.51457-00 30 7.63035-02 4.10137-00	6.8888E-22 4.4438E+28 7 88885482 4.4435488	7.0000E-02 4.3767E-02 - 32335-02 - 22025-23
131 8.2998E-82 4	02625+00	1.4002E-02 3.9751E+0	10 8,4000E-C2 3,92581+20	9.0000E-02 3.8781E-00	0.00005-02 4.07425-00 9.00005-02 3.03205-00
	78745-88	9,48885-82 3,74425+8 , 48885-81 7 4.225+8	30 9,6000E+02 3,7223r+30	9.80005-02 3.66165-00	1.00025-61 3.62225-00
146 2,2684E+81 2	33985-90	2.48885-81 2.22465-8	00 1.00005-01 7.00705 00 2.53065-01 2.15685+95	1.80005-81 2.62365-80 2.40065.04 2.40345-00	2,00006-01 2,47146-08
	.94565+80	3.2000E-01 1.5737E+0	3. 4000E-01 1. 80341+00	3.6837E-01 1.7425E+20	3.8000E-01 1.6545E+02
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140 0.868KE-81 1	24625+58	5.2000E-01 1.2100E-0		0.00075-01 1.10545-00	0,00005-01 1.27565-00 6.50005-01 1.14055-00
	.11735+80 81285+80	7.20005-01 1.09475-0 1 56605-01 1.09475-0	30 7,4000E-01 1,0730r+R0 11 8 400+0141 8 1/31-014	7.60005-01 1.05225+00	7.80005-01 1.03215+00
9 10-39000 6 101	15936-31	9.2000E-01.9.1026F-0		9.63005-01 4.50005-01 0	8.880001-01 9.42136-01 0 60001-01 6 111101
	. 92316-81	1.2860E+80 7.33A2E+0	31 1,400KE-00 6,4224F-P1	1.60075+00 5.69155-01	1.6720E+00 5.4631E-01
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	44576+81	5.88985+ 8 6 2.29825-8	01 0.00005400 0.00075701 01 4.000055600 2.14565461	4.2000E+30 2.7955E+01 4.2000E+30 2.9440E-01	3,4000E+00 2.6105E-01 4 4000E+04
	. 8397E-B1	*.8##0E+08 1.75#4E-0	31 5.PBBBE-80 1.669BF-81	5.20006+00 1.59476-01	5.48885488 1.52645-81
211 0.479254071 244 5.4640540	19135-91	5.68985+88 1.46435-8	31 5.8888E+20 1.4671F+01	6.9203E+02 1.3546E-01	6.288FE+60 1.3863E-01
271 7.2684E400 1	11945-01	0.00705-00 1.2715-0 7.48685-08 - 00875-0	01 0.000075-00 1.18477-01 11 7.48487400 84047-01	D.8584E+C0 1.17175-01 7 42277175 1 1.17175-01	7,0000E+00 1,1495E-01
226 7,83236-80 1	10-31650.	7.97995-88 1.05145-0		1.000000000000000000000000000000000000	7.83005-00 1.05025-01
231 8,20005+60 1	.24881-82 4	3.2024E+00 1.2566E-0	31 8,2344E+00 1,43/6E-01	8.2574E-00 1.7153F-01	A.27445+80 2.12445-01
276 8,2874E+DB 2	.71665-01	3,2974E+08 3.5938E+0	31 8,3854E+80 4,71384-01	8.3119E+00 6.3061E-01	8,3174E+60 8,4965E-01

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8.3348E-00	8.3413F+02	8.34345 A0	A AGATATION		0.7238E+MC	8.67755.02	9.60305+22	7.44305-03			2.40005-23	3.600PE.03	5.80305-04			1. 200PE + 35	2.75305+05	7.5000E+03	1. BUDDE - DA				
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1.97485+00	3.13685-00	1.97736+00	3.51265-01			9.81215-02	9.14105-02	6.71P0E-02	1. AAFOT-01		2.33505-01	2.78405-01	0. POPOE - 00	3.33695-01		10-10492.2	1.84805-01	1.79005-01	1.6370E-01	7 SOCREGO		4.Y080E+03	
8.3298E-00	8 . 3 4 P 0 1 4 0 9	6.3502E+04	6.3676F+8P	8 4456F+00		9.78 71E •89	9.28885.00	1.00005.01	1.86405-03		Control + Bo	3.85665 + 63	4.0200E+03	6.08605+04			2.25046+05	6,5888E+85	9, JAAAE + 85	1. ABABE - C.6		7,2700F=6/	
1.15925+00	4.P4P3E+BQ	č.3981€•08	4,69896a61	1.4924F - 01		10-14-24.2	9.1468[-82	8,78605-82	1.4000E-01	Laste C		Z.7P00E-01	8,900FE+60	3.378RE+A1	2 37805 81		Te-30814'1	1, A D D D E = 31	1,67 88 5-01	1.7.865-81			
8,3224E • 00	6,336 F • BQ	8,34745+68	8,3746E+80	8.4226F+80			9,19356 + 88	9. 8110E • C.R	9.0504E-62			2 . GF BUCE + 0.3	3,94846+03	7,88845+04	1.00845			0 . BUBUE 485	8 • 30005 • 85	1.40845+86			
12	2	11	250	241			271	276	241		2		2	1	A B Y		1	210	126	326			







(P)#

REFERENCES FOR EXPERIMENTAL DATA

²³²Th(n,Y)

<u>Yr.</u>	<u>Lab</u>	Author	References
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71	LRL	Nagle, et al.	Third Conf. Neutron Cross Sec- tions & Tech., Knoxville, Tenn. Vol <u>II</u> , 259 (1971)
64	ORL	Gibbons	Priv. Comm. (1964)
63	ANL	Stupegia, et al.	J. Imorg. & Nuc. Chem. <u>25</u> , 627 (1963)
63	HAR	Moxon, et al.	T.R.D.W.P/R-8 (1963)
63	CCP	Tolstikov, et al.	At. En. 15, 414 (1963)
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61	CCP	Stavisskii, et al.	At. En. 10, 508 (1961)
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920 U-235 LASL,AI EVAL-MAR74 L.STEWART, H.ALTER, R.HUNTER DIST-1974 P.C. TO NORMALIZATION AND STANDARDS SUBCOMMITTEE MARCH 1974 PERTINENT HOLLORITH FROM GENERAL FILE FOLLOWS (MAT 1261) ALL REFERENCES CARRIED OVER FROM GENERAL FILE

PRINCIPAL EVALUATORS- L.STEWART LASL, H.ALTER AI, R.HUNTER LASL CONTRIBUTING EVALUATORS

NU-BAR--B.R. LEONARD BNW, L. STEWART AND RAY HUNTER LASL, HUMMEL ANL, F.P.YIELDS-AR.SCHENTER HEDL, FISSION PROD. SUBCOMMITTEE DELAYED NEUTRON DATA--H.HUMMEL ANL RADIOACTIVE DECAY DATA--C.W.REICH ANC RESOLVED RESONANCE DATA--J.R. SMITH ANC: R. GWIN, R. PEELE, AND G.DESAUSSURE DRNL

SMOOTH DATA

THERMAL RANGE C.LUBITZ KAPL; J.MARDY BAPL; 3,R.LEONARD BNW 82 EV ~25 KEV-#R.GWIN; G.DESAUSSURE ORNL; R.BLOCK RPI; J.R. SMITH ANG 25 KEV-1 MEV A.GARLSON NBS. W.POENITZ ANL, L.STEWART LASL; H.ALTER 1 MEV-20 MEV-~R.HUNTER; L.STEWART LASL, H.ALTER 1NELASTIC SCAT-~L.STEWART; R.HUNTER LASL SECONDARY NEUTRON DIST.--L.STEWART; R.HUNTER LASL GAMMA PRODUCTION=-R.HUNTER, L.STEWART LASL

EVALUATIONS WILL BE DESCRIBED AND REFERENCED IN---TBD---

BASES FOR EVALUATIONS

CURRENT FILE 1 COMMENTS ARE RELATIVE TO EVALUATION BETWEEN 25 KEV AND 20 MEV, ADDITIONAL FILE 1 COMMENTS ARE TO BE PROVIDED KAPL AND BAPL (DATA BELOW 1,0 EV), ORNL AND BNL WILL PROVIDE COMMENTS FOR UNRESOLVED ENERGY REGION-82,0 EV TO 25 KEV. ALL ADDITIONAL FILE 1 COMMENTS ARE TO BE FORWARDED TO STEWART WHO WILL COORDINATE AND SET UP NEW FILE 1 COMMENT FIELDS.

MF = 2

RESOLVED RESONANCE REGION RESOLVED RESONANCE REGION REMAINS UNCHANGED FROM ENDF/B-3, ANC PEPDRY BY J.R.S: 11TH APPROPRIATE REFERENCE---TBD,

UNRESOLVED RESONANCE REGION COMMENTS ON EVALUATION IN THIS REGION WILL BE PROVIDED BY ORNL (PEELLE) AND BNL (BHAT)

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MF = 3

SMOOTH DATA

THERMAL DATA===COMMENTS---TBD.

1 EV TO A2 EV COMMENTS---TBD- J.R. SMITH 82 EV TO 25 KEV COMMENTS---TBD- PEELLE, BHAT 25 KEV TO 100 KEV

100KEV TO 1 MEV---FISSION CROSS SECTION TAKEN AS CURVE SUGGESTED BY U-235 TASK FORCE AND CSEWG STANDARDS AND NORMALIZATION SUBCOMMITTEE. IN THIS ENERGY REGION DATA TAKEN FROM REFERENCES 1 THROUGH 9. DATA OF REF.4 SZABO (71) RAISED BY 1.04. BETWEEN 1 AND 6 MEV CURVE DRAWN THROUGH DATA OF REFERENCES 3. 5. AND 7 THROUGH 11. WITH HEAVY WEIGHT GIVEN TO REF. 11. ABOVE 6 MEV CURVE DRAWN THROUGH DATA OF REFERENCES 7. 8. 12 AND 13. DATA OF REFS. 12 AND 13 NORMALIZED TO 2.152 BARNS AT 14.0 MEV.-=-ALPHA CURVE BETWEEN 10 KEV AND 10 MEV BASED ON REFERENCES 1 AND 14 THROUGH 19 AS RECOMMENDED BY U-235 TASK FORCE. ABOVE 1 MEV ALPHA CURVE SMOOTHLY EXTRAPOLATED TO 20 MEV.---CAPTURE CROSS SECTION DERIVED AS THE PRODUCT OF THE FISSION CROSS SECTION WITH ALPHA---ABOVE 0.5 MEV TOTAL CROSS SECTION TAKEN FROM SPLINE FIT TO DATA OF REFERENCES 20 AND 21. BETWEEN 25 KEV AND 0.5 MEV A SMOOTH CURVE WAS FIT TO THE TOTAL CROSS SECTION OF ENDF/B-3.

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25. DRAKE, D.M., HOPKINS, J.C., YOUNG, C.S. AND CONDE, H., NSE 40, 290 (1970)
26. NELLIS, D.O., AND MORGAN, I.L., ORD-2791-17 (1966). ALSO BUCHANAN, P.S., ORO-2791-28 (1969)

	ERROR FILE		
REACTION	ENERGY RANG	E	ESTIMATED ERROR
			(IN PERCENT)
FISSION	25 KEV TO 1.0 M	EV	4
FISSION	1.0 MEV TO 1,5	MEV	5
FISSION	1.5 MEV TO 2.0	MEV	3
FISSION	2.0 MEV TO 5.0	MEV	4
FISSION	5.0 MEY TO 6.0	MEÝ	7
FISSION	6.0 MEV TO 20 M	EV	10
ALPHA	25 KEV TO 1.0 M	ĒV	10
TOTAL	0.5 MEV TO 20 M	EV	2

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URANIUM-235		ENDER OF CONTENTS	ND, 6261
	DATA TYPE	GENERAL INFORMATION Reaction	CARDS
	GENERAL INFORMATION	COMMENTS	119
	RESONANCE PARAMETERS Neutron cross Section	TABLE OF CONTENTS Resonance Data F15510n	3 871 273

	ENDF/B MATERIAL NO. 6261
35	RESONANCE DATA
	RESONANCE PARAMETERS
URAN1UM-235	
NDANCE 1.0000E+00	
SY RANGES 2	
UMBER 1	RESOLVED SINGLE-LEVEL BREIT-HIGNER PARAMETERS
IMIT (FV) 1.0000E+00	
MIT (FV) 8.2000F+01	

URANIUM-23

ISOTOPE-----FRACTIONAL AUUN NUMBER DF ENERG

L VALUE	0
NUMBER OF RESONANCES	130
SPIN SCATTERING LENGTH (A+)-+	8.000PE+00

				RESONANCE WIC	THS (EV)	
INDEX	ENERGY (EV)	J VALUE	TOTAL	NEUTRON	RADIATION	FISSION
1	-1,49805+88	3,50002+80	2,37682-01	3.6820E-03	2,70000-02	2,0700E-01
2	2.9000E-01	3.5000E+00	1.35000-01	3.0157E-06	3.6000E-02	9.98d8E+02
3	1,140000+00	3,50000+00	1.50826-01	1.5161E-85	3.4600E-02	1 16206-01
4	2,0350E+00	3,5000E+00	4,46966-02	7.6685E-86	3.4874E-82	9.814@E=03
5	2,92805+88	3.5000E+00	2.2000E-01	4.8530E-06	2.8688E+82	2.00000-01
6	3.1470E+00	3,50000-00	1.39615-01	2.24856-85	3.3218E-82	1.0637E-21
7	3,6990E+00	3,5000E+00	8.4379E+82	4.5594E-05	3.3696E-02	9.0637E-02
8	4.84845+82	3,5000E+00	3.95926-82	6.03526-05	3.5945E+82	3.587ØE-03
9	5,448#E+00	3,5000E+08	9.0120E-02	3.3611E-06	6.0000E-02	3.0117E-02
19	5,600000000	3,50202+00	6.4192E-81	3.3319E-05	2.0000E-02	6.2189E-01
11	6,2100E+00	3,5000E+00	2.30900-01	6.3795E-05	4,3469E-02	1.87362-01
12	6,382₽E+ØØ	3,5000E+08	4,4788E-02	2.6834E-24	3,4972E=82	9,548gE-03
13	7,0770E+00	3,5000E+00	6.3934E-02	1.20002-04	3.5574E-02	2.8233E-22
14	8,7810E+00	3,5000E+00	1.2329E-01	1.1234E-03	3.1170E-32	9,10302-02
15	9,2860E+00	3.5000E+00	1.1076E-01	1.6364E-04	3.5620E-02	7.50000-22
16	9,7300E.00	3,5000E+00	2.69856-01	5.3028E-03	3.2000E-02	7,3700E-01
17	1,018°E •01	3,5000E+00	1.0056E-01	4.1898E-05	3.8000E=02	6.2530E-02
18	1,080000.001	3,5000E+00	9.3589E-01	9.3332E-05	6.7088E+B2	A.6800E-01
19	1,1060E+01	3.50006+00	4,7277E-02	6,2744E-84	4,9488E-82	4,2500E-03
20	1,2390E+01	3,5000£+00	6.3262E-02	1,20225-03	3,4500E-02	2,7500E-02
21	1,2861E+01	3,5000E+00	1.19556-01	5.3076E+05	3.3500E-02	A.6000E-02
22	1.327>E+81	3,5000E+00	1.5144E-01	3.9350E-05	2,8688E+82	1.22000-01
53	1,3700E+01	3,5000E+00	1,2394E-01	3,7013E-05	3.8488E+82	9.3500E-02
24	1,3996E+Ø1	3,5000E+00	4,9654E-01	5,3723E-Ø4	2.60000-02	4.7800E-01
25	1,4544E+81	3,5020E+00	5,6215E-82	1.1517E-04	3,5208E-02	2.0900E-02
26	1,5406E+01	3.500ØE+ØØ	7,8837E-02	2,3707E-04	3.5300E-02	4,33026-02
27	1,608°E+01	3,5000E+00	5,0361E-02	3,6099E=04	3,1383E-82	1,8617E-02
58	1,6667E+01	3,5000E+00	1,3327E-01	2,7300E-04	3,2105E=02	1.00895-01
29	1,80526+01	3,5000E+00	1.6038E-01	3,8451E-Ø4	3.5000E-02	1,25006-01
30	1,8960E•Ø1	3.5000E+00	1,0512E-01	1,15822-04	5,00000-02	5,5000E-02
31	1,9297E+Ø1	3.5000E+00	9.8194E-02	3,1936E-Ø3	3,4621E-02	6,0179E-02
32	2,0130E+01	3.5000E+00	2.4009E-01	6,7714E , 05	1.3910E-02	2,2609E-01
33	2,02006.+01	3,5000E+00	5,0013E-02	1,3034E-05	4,9280E-02	7,2000E-04
34	2,06106+01	3.50006+00	8.41916-02	1.9117E-04	4,0485E-02	4,3515E-02
35	2.1072E+01	3,5000E+00	7.35Ø3E-Ø2	1,5027E-03	4.ø342E+02	3,16586-02
36	2,2939E+01	3,5000E+00	7.5436E-Ø2	A,3584E-04	3,2670E-02	4,235ØE-02
37	2,3412E+Ø1	3,5000E+00	3,2204E-02	7.03722-04	2.6500E-02	5.0000E-C3
38	2,362YE+01	3.5000E+00	2.2586E-Ø1	8,5577E-04	4,3000E-02	1.8200E-01
39	2,4249E+01	3.5000E+00	5.82&8E-Ø2	2,68352-04	3.10000002	2.70000-02

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40	2.4370E+01	3.5000E-00	1.2215E-21	1,4958E-24	3.5063E-82	4,58082-22
41	2,5200E+01	3,50000+00	8.5268E-21	6,70245-04	2.5-00E-02	- 256BE-21
42	2,5594E+01	3,5000E+00	3,8556E-21	5,6455E-24	2,5220E=02	3,62402-21
43	2,6480E+01	3,50000+00	1,9248E-21	a,7599E-04	3,2000E-22	1,50426-21
44	2.674#E+Ø1	3,5000E+30	2,5229E-01	8,5685E-05	3,2JØ2E-22	2,20005-21
45	2.7149F+81	3,5000E+00	1.1559E-01	8.51392-05	4.20805-22	7,35206-02
46	2.7790E+01	3.5000E+00	1.2267E-01	6.74475-24	3.20000-02	8,80206-02
47	2.8290[+01	3,500000-00	6.5031E-02	3,1164E-05	4.20205-02	2,50405-22
48	2.8351E+01	3.5000E+00	1.49195-31	1.88541-04	3.1700E=02	1.17JEE-01
49	2.871#F+01	3.50000-000	1.38045+01	4.50097-25	5.00000002	8.200BE-22
58	2.9444F+01	3.50201+00	A 1177E-22	4.7744F-04	3 7422F+22	2.40005-22
51	3.25901-01	3.50005+00	1 55235-01	2.27325-04	4 58945+82	1.0990F-21
52	3.08665.01	1.50005.00	5 45125-02	8 32356-04	3 52495+02	1.87316-22
	3 20705-01	3 500005-20	0 08035-02	4 82335-03	3 77245+02	4.02745-02
84	3 35205+01	3 500000-00	5 A850C-02	4 85055-03	3 48415-02	3.31305-22
85	3 43725401	3 50000-00	9 72835-02	0 25275-23	4 31605-02	18405-02
	3 48505-01	3,5000E+00	1 14105-01	4 29775-23	3 82475-82	7.47535-02
÷2	3 54876+01	1.53205+00	1 03505-01	3 50045-03	3 4025-02	A. 45985-22
R.A	3 53005+01	3 50005-00	A 01875~01	4 56755-03	4 44005-02	4.52605-01
	3 44005-31	3 50205-00	1 54015400	1 19045-04	4 03005-22	1.50000-00
	3 74005-01	3. 50205+00	1 54325+00	4 44385-04	4 04205-22	1.50000+00
41	3 83845-01	3 80005.00	7 78745-00	7 75020-04	4 01015-02	3.45815-01
42	3 04105+01	3,50002-00	0 550342-01	3 52335-03	3 44885-02	8.85125-02
43	3 00005+01	3 500005+00	1 B004E-01	2 14375-04	3 14775-02	4.46825-01
4.4	4 06305+01	3,500000-00	2 00705-01	5 80205-04	3 43235-02	4.74682-01
45	4 13545+01	3 500000-00	4 48445-04	A AAH 35-24	4 83005-02	4.20000-01
44	A 1900E+01	3 90000-00	45025-01	9 3301 - 04	3 00075-02	1.34305-01
47	4 18735-04	3.5000E-00	4 10115-00	4 23285-03	2 89515-82	1.12405-02
	4 33305-01	3.700000-000	4.1000L-02	4 47225-04	4 67405-02	0.47695-02
40	4 34005+01	3,500002+00	1.43492-01		4,02402402	4 44785-02
	4 19045 .0-	3,00002.00	0,1345L*02	3,92101009	4.40221-02	1 100/ BL-22
70	4 78045-01	3,70001+00	/. 6/54L-02	7,344¥£+84	4,3000L-02	21-1CDF-25
/1	4 1870F-01	3,3000L+00	1,10201-01	2,00Y0E-04	4,1030L-02	0107091-02 0 10600-00
12	4 44495.401	3,300000+00	2.00341-01	3.424/1.04	1,73071-02	5135641-61
73	4,48002.001	3.50001+00	1./D841-01	8,3000L-04	4,59/0L-02	1.29026-21
74	44501.001	3,700000+00	5.3370E 01	7.5/002-04	3.8/341-02	5,0420E-31
72	4,57901-01	3.30000.000	1,3419E-01	1.8/911-04	4,886/1982	9131931-02
70	4.67YPL=01	3.50001+00	1.5280E-01	8.0305E-04	3.7000E-02	150BE-21
77	4,7011E=01	3.5000L+00	1,3994E-01	9,3059E=04	4 282 BE 82	4,700BE+55
70	4,79702+01	3.50002+00	9.3988E-02	9.8834E-24	4,5710E-02	4,72985-82
79	4.6300L+01	3,500001+00	1.0077E-81	7.7694E=04	2.4/171-02	1 4020E-01
80	4.00000001	3.30000-000	0.7091E-22	6, YD011 - D4	2,54311402	3193091-62
	4 04185401	3,50000-00	4 104 35-03	4 01305-03	4 00000-02	2120001-11
	5 01045-01	3 50000-00	5 43835-02	1 1585 - 04	3 4 9 0 4 5 - 3 2	9.90435-02
	5 04655401	3. BB00F.00	7 59445-92	8 43455-04	3 30305-02	4.20706-22
	5.07805+01	3.50000+00	3 384 05-84	4.89555-04	3 00000-02	3.00005-01
0.4	5 10405401	3.50000-00	1 88845-04	3 B4485-03	5 19745-02	.33/35 2
17	5.14305-01	3.50000-00	7 43445-02	3.45695-04	3 34545-82	4-05445-02
	5.22218+01	3.50006+00	3 63845-01	2.80765-03	3 10005-02	3.30405-21
89	5.3438F+81	3.50000+00	1.35546-01	5.37295-24	3.34635-02	1.01545-01
90	5.4132E+01	3.50006+00	1.50216-01	P.1410F-04	4.40005-02	1.06005-01
91	5.5064E+01	3.50000.00	1.1117E-01	3.1685E-03	4.8539Ec82	5.9461E-02
92	5,5849E+01	3.50000.00	2.51350-01	2.35496-03	3.8719E-02	2.1028E-01
93	5,6078E+01	3,5000E+00	1,9079E-01	7,8624E-04	3.8000E-02	1,6000E-21
94	5,64986+01	3,50006+00	1,19926-61	4,92085-93	3.9167E-82	7,58535-02
95	5,780#E+01	3,50002+00	2,2113E-81	1,12526-03	3,5220E=02	1.85306-21
96	5.8868E+01	3,50006+00	6.5354E-02	1,35396+03	3.2315E-82	3,16856-72
97	5.8474E+01	3,50000+00	1.3633E-21	1.3328E-03	3.3000E+02	1.020RE-21
98	5,9760E+01	3,50006-00	2,5527E-21	2.70575-04	4,20002-02	2,13006-01
99	6,0188E+01	3,50006+00	2,5513E+21	1.1265E-03	3,4000E-02	2,2000E-01
160	6.0837E=01	3,50000000	1.20465-01	A,6253E-84	3.0000E+02	9,008005-02
101	6.1130E+01	3.50000+00	1.25365-01	3.62785.24	4.000005-02	8.50005-02
102	6,1570E+01	3,5000E+00	5.3023E-01	2.25281-84	3.00002-02	5,08485-71
103	6.1900E+01	3.50000 +20	5.30176-01	1.70735-04	3.000000=02	5,20205-21
104	6.240NE+01	3,5000E+00	4.62265-21	2.6163E-84	6.2J22E-82	4,7000E-31
105	6,3020E+01	3.5000E+00	2.4209E-01	9.0896E-05	4.0000E-02	2.00JPE-01
100	6.3320E+01	3,5000E+20	2.5010E-01	. 8289E-84	5.0200E=22	2.03000-71
107	6,3690E+01	3,5000E+00	6.2107E-01	1.0744E-03	6.20002-02	5,6848E-71
108	6,4300E+01	3,500000+20	4.7545E-02	1.2447E-03	3.9320E=22	7.3020E-23
109	6.5800E+01	3,5000E+00	9.6423E-72	4.2327E-04	5. 200E-02	4 60-0E-22
110	6.6402E+01	3.500000+00	8.9449E-02	4.49485-04	4.52222-32	4.4800F-22
111	6.7247E+01	3.500000+00	9.00A1E-02	8.0938E-05	4.1000E=02	4 9808E -22
112	6.8440E+81	3,500000+00	2.5004E-01	3.70412-05	5.0020E-32	2.88086-01
113	6,8530E+01	3.5000E+20	1.60112-21	1.0836E-04	6.0020E=32	1,000000-21
114	6 9293E+B1	3.50000-00	2.00720-01	7.1538E-04	4.08282-02	1.68086-21
115	7,2404F+01	3.500025-00	1.72726-01	\$.7156E-03	5.00000-02	1,20002-01
110	7,0750E+01	3.50000-00	2.3741E-01	2,4091E-03	3,50000=02	2.000000-11
117	7,1410E+01	3.50006+00	1.60296-01	2.9136E-04	4.00025-02	1.2000E-01
118	7,2398E+01	3,5000E+00	1.38615-01	2,61156-03	3.1000E-02	1.0500E-C1
119	7,2910E+01	3.5000E+70	3,6037E-01	3.6717E-04	4.000000-02	3,2000E-21
120	7,4544E+01	3,5000E-20	1.01676-01	P.7287C-03	3.8480E-82	4.0937E-P2
121	7,5178E+01	3.5000E+00	2,90895-01	8.8833E-04	5.0000E-02	2.4000E-01
122	/,5541E+01	3,50000+00	2,3336E-Ø1	1.30216-03	3.20005-02	2.0000E-21
123	/ 6750E+01	3,500000-00	1,1611E-01	1.0/320-04	3.6000E-02	H.0000E-02
124	7,7492E+01	3,5000E+00	1.12998-01	9,8081E-04	. 0000E=02	7.70000-12
122	/ 811/E+01	3.5000E+00	1, 022E-01	1,2245E-03	- 7000E-02	1,000000-21
120	7.9674E+01	3.3000E+00	1,29796-01	/,0007E-04	4,40021-02	017000E-02
127	0.037/L+01	3.5000L+00	1./-84E-01	0,3071E=04	-, 0000L-02	1,34008-01
120	8 18005×04	3.500000.000	1.02041-01	1,07036-03	4 . 10000 -02	* 910000E=62
124	0,3370L401	3,30000.000	1,102/1-01	1,1/031-03	-, 8000L-02	0:7100L°C4
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u	IRAN SUH-235			RESDIAN	ENTERN HATER.	AL NO. 6261
150TOP PRACTI Sumber	DNAL ANUNDANCI	E 1.8 YGES	10H-235 808E+08 2	4520417CE	PARARLTERS	
ENERGY LDHER JPPER NUCLEA EPFECT NUMBER	MANGE NUMBER- ENERGY LIMIT ENERGY LIMIT (SPIN IVE BCATTERING OF L STATES-	(EV) 8.2 (EV) 2.5 (EV) 2.5 (EV) 2.5 (EV) 9.5	2 JVR 8986 • 81 9886 • 84 9886 • 88 9888 • 88 9888 • 88 9 • 98 2	ESDLVED SINGL	E-LEVEL BAETA	:CAE& \$4119AE+E3\$
L VALU NUHBER	ETT J STATES-		8 2			
			DEGREES OF	FREEDON USED	IN THE MICTH	UISTRIBUTION
		J=VALUE 3.70000-88	CONPETITIVE 8.ESECE.SE	NEUTRON 1.8822E+28	#AD1A410% #.####E+2#	F15510% 2.4878E+22
			446	RAGE RESONANC	E AIDTHS (EV)	
INDEX	ENERGY (EV) N. 2888F-01	LEVEL SPACING	G COMPETITIVE	NEUTRON 9.321ac-25	RADIATION 1.52822-82	F155;0N
2	8,6>886-81	1.28886.+28	8.00001-02	8,4466[-25	3.50002-02	3,48966-21
4	9,52888+81	1.30000-00	P.8868E+28	8.73180-25	3.556862-62	2.4598[-3:
5	1,0#8#E+82 1,108#E+82	1.0000E-02 1.0000E-00	8,3882E+88 8,38238;482	9,9434E-29 8,6628E-29	3.5787[-22	8,4628E-22 1,3229E-21
7	1,2088E+82 1,8080E+82	1.00088-20 1.00088-20	2.8889E+88 3.8888F+98	1,8427E-24 9.8358E-25	3.5288E-82 3.5288E-82	2,99465-21 2,49195-31
9 19	2,4488E+82	1.38886-88	2.8832E+32	1,31816-24	3,92292-92	3,46952-01
11	2,68682	1.86886-84	8.88882.82	8,3538E-25	3,5288[-22	7.53582-21
13	3.84846-82	1.20002-30	8.888££+E£	8,84122-25	3.520PE-02	3.28330-71
15	3,34886.82	1.00000-00	3.36665.35	#,#1#2E-25	3.92002-22	1.0560[-7]
10 17	3,4788E+82 3,6#88E+82	1,3000E+88 1,2800E+09	8.8888C+88 P.8838C+88	8,4284E-25 8,9227E-25	3,5000E-82 3.520#E-82	3,4234E-21 3,5757E+21
1.	4,5088E+#2 5,2888E+#2	1,8808E+C2 1,8808E+82	8,888%E+88 8,888%E+88	0,3835E-25 1,1974E-24	3.52080-22 3.52086-22	4.8869E-01 5.81497-81
20	5.67886+82	1.86886+88	8.000E-02	1,1742E-84	3.52040-82	1,8843[+02
22	6,288FE+82	1.00002-20	8.28882.47	1,20292-24	3.52006-22	4,55386-2;
23	6,4088E+82	1.2000E+82	0,0000E+02	1,19685-54	3.52886-85	1,47216-21
29	0,5468E+85	1.2038E-88 1.8880E-88	8.8888£+88 8.8888£+88	1,8641E-24 8,6759E-25	3.55000E-82	3.2731E+C: 4.2857E+?1
27	7,1000E+02 7,20085+02	1.0000E+00 1.0000E+00	8.0808C+38	9,86282-25	3.5888E-82 3.5888E-82	6.4322E-71 4.1452F+21
29	7,48885+82	1.00000.00	8.08035-36	1.33786-24	3.50881-82	1.98282+01
31	7,78882+82	1.488862+22	84+33828.9	1.0512E-24	3.52400-22	3,98236-7
33	0,1900E+02	1.00020E-20	2.0002E+00 2.0002E+00	1,0188E-24	3.57882L-62 3.5728E-82	2.1179E-01
34 35	9,9898E+82 1,8858E+83	1,38886.+38 1,88886.+88	P.000CE+D0 D.000DE+20	1,8497E+24 1,1193E-24	3.5808E-82 3.5800E-22	1.J7265-31 J.J829E-21
36	1,10000-03	1.8908E+80	P. 8388E+8P	1,21426-24	3,58006+62	5,35892-21
38	1,39646+83	1.88885.38	2.20002-00	9.85646-25	3.58886-82	5.03012-21
40	1.43#46+83	1.00000-20	P. 8888E+82	1,3656E-24	3.57006-82	2.47346-61
42	1,40200-03	1.3002(-00	₽, 0 9082+88	1,1221E-24 1,1391E-84	3.50006-62	8,3319E-21 8,2734E-21
43 44	1,4800E+83 1,5480E+83	1,2008E+28 1.0008E+00	P.8007E -80 7.8008E-00	6,4021E-25 7,2650E-25	3,5 *00 E-#2 3,5 *00 E-#2	1,0471E-71 1,9349E-J1
45	1,5450E+83	1.00000+20	0,00005+00	8,61445-85	3,50000-22	4,26642-21
47	1,70886+83	1.00000-00	L	9,5854E-25	3.58886-72	5, J74JE-81
49	1,91000-03	1.00006+20	0.00000.00	1,12395-84	3.5080[-82	4,35766-21
51	2,1#8#E+83	1.000001.00	₽,8208€+08 ₽,8208€+08	1,87745-24	3.5888E-65	2,9444E-01 2,9599E-01
52 53	2,3440E+83 2,5440E+83	1.2008E+80 1.2008E+80	8, 88 922 - 88 8,88922 - 88	9,0730E-25 9,0107E-25	3,5000E-62 3,5000E-62	5,1077E-01 5,4209E-01
54 55	2,78F0E+93 3,268#F+#3	1.0000E-00 1.0000E-00	0,0000E+00	8.4788E+85 9.8738F+25	3,52002-82	5,3117E-81
	3.34PAE+03	1.00000.00	6.0006-08	•,338+E-25	3,50002-82	6,5952E-21
58	3.77PAE+03	1.00001-00	C	9,26662-45	3.54882-32	8,3354E-81
59 68	4,10P8E+83 4,30P8E+83	1,9000E+83 1,0000E+80	8,8888E*8C 8,8886E*8C	9,7037E-25 1,1861E-04	3.5888E-82 3.5888E-82	3.08542-01 0.03920-01
A1 A2	4,4908E+83 4.88005+83	1,0000E+00 1,0000F+00	P	9,8061E-25	3.50000-02	5,25636-01
43	4,99982+83	1.00000-00	8,8880[+00	8,55792-85	3.58006-82	5,83672+01
65	5,1488E+83	1.00001+80 1.0000E+80	0,5009E+88	8,3758E-85	3.5000E-02	0,8117E-81 9,9989E-01
64	5,2400E+g3	1,00800-00	0,00002+80	8,8393E-85	3.50000-02	3,78946-01

47	4.23286.+23		8.98881.88	4.3884f+25	1. 12225 -22	5.35397+21
	5 3622[8. 28925 .02	4.23995-29	1.94826+22	4.41187-21
	4 44 88 43			8 43451-24	1.42221-22	1.12828-8
	4 43497-93		S		\$1221.17	
			*, *** *****			
	7./*******		7,8846[088		3124446-42	3 43 4 4 4 4 4 4
- 15	3.44646.46		\$. ** *******		1.70076-#2	
73			7.8787[488		1.2. Wet +55	
	E		1.1111(411	2 4 6 8 5 37 - 6 4	3-24667-64	3.6613(**)
73	4.43721-27	2.48486+22	1.27250+20	0.21226-42	3.34841+22	4,38931-01
78	6.6477L-23	:	1.11111.14	8,28756-45	3-24445-75	4,42412+51
,,	7,26921+33	1.4858(+82	A. 简单作为有的	4,54980-53	3-24546+65	3.83485-71
7 R	7,3###[-83	1.2822[-92	\$\$\$\$ <u>\$</u> \$\$\$2 <u>7</u> *88	8,34:20-25	3.97246+85	3,38476+21
	#.1678[+#3	<u></u>	*********	0,1247[-25	3.9888[-83	2.00922001
#2	8,3478(-8)	2.288886.98	2.28372+27	<u>,,?+63</u> E-04	3.92826-53	1,45587+21
41	1,5###C+#J	1. #8888 [+72	7.22271+27	;;;;;;	3.38886-22	2.76425-01
#2	8,74986-82	2.06221-22	2.228225+27	1.1569[-24	3,58886+28	2.00225-21
43	9.86781.83	1.00000000000	2.22275+22	7,93256-05	3.94846-22	4.577:5+71
#4	5,26481-83	1.02221+20	2.24222-22	2,84520-64	3-94886+22	3, 53241-01
85	: 24866+24	1.02221+02	1.22275+25	1.42426-75	3.57220-22	2.8:751-0:
	1.14781484	1.222221+22	2.22221.22	1.82105-24	3.97876-22	3.489:2+2:
47	7886-84		2.22225.22	4.87841-25	1.572220-22	2.36637+21
	1.1.9221.+24		0.00001.02	1.12925-64	3.92222-22	5.18486.21
	24726-24		2.24225+22	4.91745+65	3.52221-22	2.42346+21
	71806 +24		2.22225.22	1.21.04[+24	1.52221-22	2.03:27-0
	22001-24	. 18226 . 82	3. 22221 . 22	8.28725+25	1.57221+22	2.17587+2
	27821-24		2.22225.22		1.52281-22	2.0:567-2
• 3	33696+84		2.22225422		1.50226-22	5.18985-24
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			e,64441+66		1 64745-11	
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111	2,20761-60			9199-21-27	3.3467502	
117	2,36886.484	1.86861.92		**********	3.37641462	
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81	2, 46, 721, 84	2.488681.472	* . 2 4 8 4 [+ 27	**********	3.3.4.2.466	5.45C3[***
115	2,44781.484	1.88681.82	*. *********	ティアノをふしておう	1 42337	24 99 181 96 3
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J-VALUE CONFCT-TULE CURRER RADIATION Fiss A.BBBE-BB P.BBBE-BB A.BBBE-BB A.BBBBE-BB A.BBBE-BB A.BBBE-BB <th>1101</th>	1101
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2 0.3986-01 1.9886-02 0.8086-02 1.0386-02 1.0886-02 0.8986 3 0.1886-01 1.8886-02 0.8886-02 0.8886-02 0.8986 5 1.9486-02 1.8886-02 0.8886-02 0.8886-02 0.8986 5 1.9486-02 1.8886-02 0.8886-02 0.9868-02 0.9886-02 0.9886-02 0.4446 6 1.9486-02 1.8886-02 0.8886-02 0.9886-02	JN: -01
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<pre>X1 7,74PE-02 1.0808E-08 0.P20E-00 1.0512E-04 3.508E-02 1.0502E X2 8,04PE-06 1.0808E-08 7,080E-00 8,2053E-02 1.0200E X3 9,14PE-06 1.080E+08 7,080E-00 8,2053E-02 3.508E-02 1.020E X4 9,04PE-06 1.000E+08 7,080E00 1.010E-04 3.508E-02 1.020E X5 1.0405E-03 1.000E+08 7,080E00 1.2142E-04 3.508E-02 1.020E X5 1.0405E-03 1.000E+08 7,080E00 1.2142E-04 3.508E-02 1.020E X5 1.0405E-03 1.000E+08 7,0808E-08 1.2142E-04 3.508E-02 1.020E X5 1.0405E-03 1.000E+08 7,0808E-08 1.2142E-04 3.508E-02 1.0316E X5 1.0405E-03 1.000E+08 7,0808E-08 1.2142E-04 3.508E-02 1.0316E X5 1.0405E-03 1.000E+08 7,0808E-08 1.020E-02 1.23508E-02 1.0316E X5 1.0405E-03 1.000E+08 7,0808E-08 1.020E-04 3.508E-02 2.001E X5 1.0405E-03 1.000E+08 7,0808E-08 1.020E-04 3.508E-02 3.040EE 44 1.4408E-03 1.000E+08 0.0808E-02 1.1351E-04 3.5088E-02 3.040EE 42 1.400E-03 1.000E+08 0.0808E-02 1.1351E-04 3.5088E-02 3.040EE 42 1.400E-03 1.000E+08 0.0808E-02 1.1351E-04 3.5088E-02 3.040EE 42 1.400E-03 1.000E+08 0.0808E-02 0.0402E-05 3.5208E-02 3.2326E 43 1.400E-03 1.000E+08 0.0808E-02 0.0402E-05 3.5208E-02 3.2326E 44 1.590E-03 1.000E+08 0.0808E-02 0.0402E-05 3.5208E-02 2.0424E 45 1.559E-03 1.0008E-02 7.0208E-08 7.0808E-02 3.0208E-02 2.0404E 46 1.590E-03 1.0008E-02 7.0208E-08 7.0208E-02 3.0508E-02 2.0404E 46 1.590E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.5088E-02 2.0404E 47 1.0008E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.0508E-02 2.0404E 40 1.590E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.0508E-02 2.0404E 40 1.590E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.0508E-02 2.0404E 41 1.0008E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.0508E-02 2.0404E 41 1.0008E-03 1.0008E-02 7.0208E-08 9.4008E-02 3.0508E-02 2.0404E 42 2.0404E-03 1.0008E-02 7.0208E-08 9.4074E-05 3.5808E-02 2.0404E 41 0.0108E-03 1.0008E-02 7.0208E-08 9.4074E-05 3.5808E-02 2.0404E 42 2.0408E-03 1.0008E-02 7.0208E-08 9.4074E-05 3.5808E-02 2.0404E 42 2.0408E-03 1.0008E-02 7.0208E-00 9.4074E-05 3.5808E-02 2.0404E 42 2.0408E-03 1.0008E-02 7.0208E-00 9.4074E-05 3.5808E-02 2.0404E 42 3.000E-03 1.0008E-02 7.0208E-02 9.0508E-02 3.5808E-02 2.0404E</pre>	-82
32 8,8472+86 1.80000+30 0,00000+00 1.20000+20 1.20000+20 1.20000+20 1.20000+20 1.20000+20 1.20000+20 1.20000+20 1.20000+20 1.210000+20 1.22000+20<	81
<pre>14 9,04026-02 1.0002E-02 0,00020E-02 3,00020E-02 1.02760 15 1.0052E-03 1.0002E-02 0,0000E-02 1.2142E-04 3.5002E-02 2.0037E 15 1.0206E-03 1.0002E-02 0,0000E-02 1.2142E-04 3.5002E-02 2.0037E 15 1.0206E-03 1.0002E-02 0,0000E-02 1.0256E-02 3.5002E-02 2.0142E 15 1.04002E-03 1.0002E-02 0,0000E-02 1.0556E-04 3.5002E-02 2.0142E 14 1.4002E-03 1.0002E-02 0,0000E-02 1.0556E-04 3.5002E-02 2.0142E 14 1.4002E-03 1.0002E-02 0,0200E-02 1.0556E-04 3.5002E-02 2.0142E 14 1.4002E-03 1.0002E-02 0,0200E-02 1.0556E-04 3.5000E-02 1.02372E 14 1.4002E-03 1.0002E-02 0,0200E-02 1.1356E-04 3.5002E-02 3.0146E 14 1.4002E-03 1.0002E-02 0,0200E-02 1.1351E-04 3.5002E-02 3.02146E 14 1.4002E-03 1.0002E-02 0,0200E-02 0,4021E-05 3.5002E-02 3.02146E 15 1.5002E-03 1.0000E-02 0,0000E-02 0,1351E-04 3.5002E-02 0,2439E 14 1.5002E-03 1.0000E-02 0,0000E-02 0,1351E-04 3.5002E-02 0,2439E 15 1.5002E-03 1.0000E-02 0,0000E-02 0,0002E-05 3.52002E-02 0,2439E 15 1.5002E-03 1.0000E-02 0,0000E-00 0,4021E-05 3.52002E-02 0,2439E 15 1.5002E-03 1.0000E-02 0,00002E-02 0,0402E-04 3.50002E-02 1.4221E 16 1.5002E-03 1.0000E-02 0,0000E-00 0,4021E-05 3.52002E-02 1.4221E 16 1.5002E-03 1.0000E-02 0,0000E-00 0,4021E-05 3.52002E-02 2.0538E 16 1.5002E-03 1.0000E-02 0,0000E-00 0,4274E-05 3.52002E-02 2.0538E 16 1.0000E-02 0,0000E-00 0,0730E-02 3.50002E-02 2.0508E 17 2.0000E-03 1.0000E-02 0,0000E-00 0,0730E-02 3.50002E-02 1.0274EE 15 2.0000E-03 1.0000E-02 0,0000E-00 0,0730E-02 3.5000E-02 2.0404E 15 3.0000E-03 1.0000E-02 0,0000E-00 0,0730E-02 3.5000E-02</pre>	-01 -01
<pre>16 1.1000E-03 1.0000E-20 P.0000E-00 1.2142E-4 3.5200E-22 2.0337E 17 1.2200E-03 1.0000E-20 P.2000E-02 3.5200E-22 1.0316 18 1.4000E-03 1.0000E-22 P.2000E-02 1.0446E-25 3.5200E-22 2.0141E 14 1.400E-03 1.0000E-20 0.2000E-02 1.0446E-24 3.5200E-22 3.0146E 14 1.400E-03 1.0000E-20 0.2000E-02 1.121E-24 3.5200E-22 3.0146E 14 1.400E-03 1.0000E-20 0.2000E-02 1.1221E-24 3.5200E-22 3.0146E 15 1.400E-03 1.0000E-20 0.2000E-02 1.1221E-24 3.5200E-22 3.0146E 15 1.400E-03 1.0000E-20 P.2000E-02 1.1221E-24 3.5200E-22 3.02450E 15 1.550E-03 1.0000E-20 P.2000E-00 0.4021E-25 3.5200E-22 8.2459E 15 1.550E-03 1.0000E-22 P.2000E-00 0.4021E-25 3.5200E-22 8.2459E 14 1.500E-23 1.0000E-22 P.2000E-00 0.4221E-25 3.5200E-22 8.2459E 14 1.5000E-23 1.0000E-22 P.2000E-00 0.4221E-25 3.5200E-22 1.421E 15 1.2100E-03 1.0000E-22 P.2000E-00 0.4274E-25 3.5200E-22 2.2633E 14 1.9000E-03 1.0000E-22 P.2000E-00 0.4274E-25 3.5200E-22 2.2603E 15 2.2000E-03 1.0000E-20 P.2000E-00 1.0774E-24 3.5200E-22 2.2024E 15 2.2000E-03 1.0000E-20 P.2000E-00 1.0774E-25 3.5200E-22 2.2024E 15 2.2000E-03 1.0000E-20 P.2000E-00 1.0774E-25 3.5200E-22 2.2024E 15 2.2000E-03 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.0744E 15 2.2000E-03 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.0744E 15 2.2000E-03 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.0744E 15 2.2000E-03 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.02744E 15 3.2000E-23 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.02744E 15 3.2000E-03 1.0000E-20 P.2000E-00 0.0730E-25 3.5200E-22 1.02744E 15 3.2000E-03 1.0000E-20 P.2000E-02 0.060555 3.5200E-22 3.0500E-22 2.2056E 15 3.2000E-03 1.0000E-20 P.2000E-02 0.0606E-25 3.5200E-22 3.0500E-22 2.2056E 1.0000E-23 1.0000E-20 P.2000E-02 0.0606E-25 3.5200E-22 3.0500E-22 2.2056E 1.0000E-23 1.0000E-20 P.2000E-02 0.0730E-25 3.5200E-22 3</pre>	-22
<pre>1. 1. 24 PE - 03 1. 20 PE - 00 7. 20 DE - 02 7. 35 PE - 25 3. 38 DE - 22 2. 34 PE - 25 3. 38 DE - 22 2. 34 PE - 25 3. 38 DE - 22 3. 44 PE - 26 3. 1. 20 PE - 27 7. 20 DE - 27 7. 20</pre>	-21
<pre>1,40001+03 1,00001+02 P,20001+02 1,04461-24 3,50001+02 1,037461 41 1,40001+03 1,00001+02 0,00001+02 1,12210-24 3,50001+02 3,3200 41 1,40001+03 1,00001+02 0,00001+02 1,12210-24 3,50001+02 3,3200 43 1,40001+03 1,00001+02 0,00001+02 0,42010+02 3,50001+02 0,23326 44 1,54001+03 1,00001+02 0,00001+02 0,42010+02 3,50001+02 1,4221 45 1,55000+03 1,000001+02 0,000001+02 0,42010+02 3,500001+02 1,4221 46 1,54001+03 1,000001+02 0,000001+02 0,42010+02 3,500001+02 1,4221 47 1,400001+03 1,000001+02 0,000001+02 0,42741-02 3,500001+02 1,4221 46 1,54001+03 1,000001+02 0,000000 0,42741-02 3,500001+02 1,4221 47 1,400001+03 1,00000000 0,000000 0,42741-02 3,500001+02 1,4221 48 1,94001+03 1,000000000 0,000000 0,42741-02 3,500001+02 1,4231 49 1,94001+03 1,000000000 0,000000 0,42741-02 3,500001+02 1,40370 49 1,94001+03 1,000000000 0,000000 0,42741-02 3,500000000 1,077410 51 2,10000000000 0,0000000 0,42741-02 3,500000000 1,077400000000 0,000000000000 0,0000000000</pre>	01
41 1.49866-83 1.80866-80 6.80806-80 1.12216-24 3.53806-22 3.4396 42 1.4986-83 1.80806-80 8.80806-82 1.1316-24 3.53806-22 3.4396 43 1.4986-83 1.80806-80 8.80806-82 1.4316-25 3.53806-22 8.4396 44 1.54986-83 1.80806-82 9.80806-82 6.46216-25 3.53886-22 8.4396 45 1.55966-83 1.80806-82 9.80806-82 8.6584-25 3.58882-82 2.7717 46 1.59862-83 1.00806-22 9.20826-80 9.42746-25 3.58082-82 2.56354 47 1.99862-83 1.00806-22 9.20826-80 9.42746-85 3.58082-82 2.38484 48 1.99862-83 1.00806-80 9.20826-80 9.42746-85 3.58082-82 2.93244 53 2.09846-83 1.00806-80 9.007362-85 3.58082-82 2.93244 54 2.19846-83 1.00806-80 9.07362-85 3.58082-82 2.93484 53 2.09846-83 1.00806-80 9.07362-85 3.58082-82 2.93484 52	01 01
43 1,4000000000000000000000000000000000000	-01
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 46 1.5%#EC-83 1.0880E-22 0.280%C-82 1.0105C-24 3.528E-72 2.5717E 47 1.7%#EC-83 1.0880E-22 0.280%C-82 1.0554C-25 3.5280E-72 2.5633E 48 1.9%#EC-83 1.0808E-22 0.2808C-80 9.4274E-25 3.5280E-22 2.6233E 49 1.9%#EC-83 1.0808E-28 0.2808C-80 1.0774E-24 3.5380E-22 1.0524E 58 2.0498E-83 1.0808E-28 0.2808C-80 1.0774E-25 3.5288E-22 1.0524E 59 2.0548E-83 1.0808E-28 0.2808C-80 9.4274E-25 3.5288E-22 1.0524E 53 3.24#EC-83 1.0808E-28 0.2808C-80 9.4372E-25 3.5288E-22 1.7222E 54 3.25##8E-83 1.0808E-28 0.2808E-80 9.4372E-25 3.5288E-22 1.7222E 55 3.24#EC-83 1.0808E-28 0.2808C-80 9.4372E-25 3.5288E-22 2.4468E 55 3.24#EC-83 1.0808E-28 0.2808C-80 9.8045E-25 3.5288E-22 2.4468E 56 3.39##E-83 1.0808E-28 0.2808C-80 9.8045E-25 3.5288E-22 2.4468E 56 3.39##E-83 1.0808E-28 0.2808C-80 9.8045E-25 3.5288E-22 2.4468E 57 3.44#EC-83 1.0808E-28 0.2808C-80 9.8045E-25 3.5288E-22 2.4468E 58 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-25 3.5288E-22 2.4469E 59 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-25 3.5288E-22 3.469E 59 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-25 3.5288E-22 3.469E 59 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-22 3.5288E-22 1.194E 59 4.1498E-83 1.0808E-28 0.28080E-80 9.7839E-22 3.5288E-22 1.194E 59 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-22 3.5288E-22 1.194E 59 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-22 3.5288E-22 1.06457E 50 4.1498E-83 1.0808E-28 0.2808C-80 9.7839E-22 3.5288E-22 1.06537E 50 4.1498E-83 1.0808E-28 0.2808C-88 9.753E-25 3.5288E-22 1.06537E 50 4.1498E-83 1.0808E-28 0.2808E-82 9.1578E-25 3.5288E-22 1.9578E 50 5.1098E-83 1.0888E-88 0.4888E-88 9.6342E-25 3.5288E-22 1.9578E 50 5.2098E-83 1.0	-1
48 1.000000-03 1.000000-02 0.20000-00 0.42746-05 3.50000-02 2.43570 49 1.000000-03 1.000000-02 0.20000-00 1.2300-04 3.50000-02 2.43570 49 1.000000-03 1.000000-00 0.20000-00 1.077400 3.50000-02 1.077410 51 2.00000000 1.000000-00 0.20000-00 1.0774000 3.50000-02 1.072410 52 2.0000000 0.20000-00 0.07300-25 3.50000-02 1.072410 52 2.0000000 0.20000-00 0.07300-25 3.50000-02 1.072410 53 2.00000000 0.20000-00 0.07300-25 3.50000-02 2.05500 54 2.70000000 0.20000-00 0.03000-25 3.50000-02 2.05500 55 3.20000000 0.20000-00 0.8000000 0.83300-02 3.50000-02 2.05500 56 3.200000-03 1.000000-02 0.20000-00 0.80000-02 3.50000-02 2.040600 57 3.40000-03 1.000000-02 0.000000-02 0.80000-02 3.50000-02 3.60000-02 3.60000-02 3.60000-02	-01 01
<pre>1. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.</pre>	61
1 2.1988-83 1.08806-82 7.82826-80 8.51826-83 3.58086-82 1.78248 *2 2.58486-83 1.08886-82 7.82826-80 0.07366-25 3.58086-82 1.72028 *3 2.58486-83 1.08886-82 0.28086-82 0.6137-25 3.58086-82 2.45786 *4 2.70866-83 1.08886-82 0.28086-80 0.67286-82 3.58086-82 2.45586 *5 3.29486-83 1.08086-80 0.20876-80 0.47286-85 3.58086-82 2.44698 *6 3.10886-83 1.08086-80 0.20876-80 0.43196-25 3.58086-82 2.44698 *6 3.29486-83 1.08086-80 0.20876-80 0.35396-82 2.44698 *7 3.44896-83 1.08086-80 0.9086-80 9.70376-25 3.58086-82 2.11948 *9 4.14986-83 1.08286-80 0.9086-80 9.70376-25 3.58086-82 2.62767 *6 4.34986-83 1.08286-80 4.30886-80 9.4041-85 3.58086-82 1.61577 *6 4.40886-83 1.08286-82 7.90286-83 3.58086-82 1.95786-83 <td< th=""><th>21</th></td<>	21
 *3 2.5%#86:#3 1.0288:20 8.0288:20 9.6137:-25 3.5808:E-22 2.7144 *4 2.70#8:#03 1.0288:20 9.0288:20 9.6137:-25 3.5808:E-22 2.0558 *5 3.20#8:#03 1.0088:20 9.0288:20 9.6139:20 3.5808:E-22 2.04698 *5 3.20#8:#03 1.0088:20 9.0288:20 9.6139:20 3.5808:E-22 2.04698 *7 3.40#0:#03 1.0088:20 9.0288:20 9.6339:25 3.5808:E-22 2.04698 *7 3.40#0:#03 1.0808:20 9.0288:20 9.73508:E-25 3.5808:E-22 2.04698 *8 3.7508:E-23 1.0808:20 9.0808:20 9.2666:-25 3.5808:E-22 2.04698 *8 3.7508:E-23 1.0808:20 9.0808:20 9.2666:-25 3.5808:E-22 2.0144:E *9 4.3090:+03 1.0808:20 9.0808:20 9.2666:-25 3.5808:E-22 2.0144:E *9 4.3090:+03 1.0808:20 9.0808:20 9.2666:-25 3.5808:E-22 2.0144:E *1 4.4090:+03 1.0808:20 9.0808:20 9.737:-25 3.5808:E-22 2.0142:E *4 4.4090:+03 1.0808:20 9.0808:20 9.737:-25 3.5808:E-22 2.0270: *4 4.4090:+03 1.0808:20 9.0808:20 9.1576:-25 3.5208:E-22 1.0427:E *4 4.4090:+03 1.0808:20 9.0808:20 9.1576:-25 3.5208:E-22 1.0573:E *4 4.9090:+03 1.0808:20 9.0208:20 9.1576:-25 3.5208:E-22 1.0573:E *4 4.9090:+03 1.0808:20 9.0208:20 9.1576:-25 3.5208:E-22 1.0543:E *4 5.9090:+03 1.0808:20 9.0008:20 9.1576:20 3.5208:E-22 1.0428: *5 5.1090:E-03 1.0808:20 9.0008:20 9.8775:25 3.5808:20 1.0448:20 9.1576:20 9.1578:20 3.5208:20 1.0448:20 9.1578:20 3.5208:20 1.0448:20 9.1578:20 3.5208:20 1.0448:20 9.1578:20 3.5208:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9.1578:20 3.5808:20 1.0448:20 9	81 81
55 3,2000000000000000000000000000000000000	·21 01
3.300000000000000000000000000000000000	- 11
58 3.73P8E+83 1.0P2E+02 0.000000 0.20000000 0.2006E-23 3.520000-02 2.1118E 59 4.10P2E+03 1.02020000 0.00000000000000000000000000	01
A8 4.34406±403 1.04046±408 0.98062±408 1.1061±244 3.55062±-72 3.21965 A1 4.44076±03 1.06725±72 3.20662±628 9.6941±-25 3.55062±-72 3.21965 A2 4.84076±03 1.06726±72 3.2062±628 9.6941±-25 3.52062±72 1.65736 A3 4.9476±63 1.06726±72 7.2027±02 0.55755±25 3.52062±72 1.94425 A3 4.9470±63 1.06726±72 7.9027±02 6.55755±25 3.52082±72 1.94425 A4 5.947042±03 1.04282±72 7.9027±02 8.55755±25 3.52082±72 1.94425 A5 5.947042±03 1.04082±702 7.9207±02 8.35755±25 3.52082±72 1.44425 A5 5.14082±703 1.10802±702 7.2007±02 8.7795±25 3.52082±22 1.46635± A6 5.22046±783 1.10802±702 7.2028±07 8.7795±25 3.52082±22 1.96425± A7 5.22046±783 1.04025±702 8.6292±72 3.62820±72 1.94425± A5 5.22046±783 1.04025±702 8.7927±742 8.7795±25 3.52804±72<	21 21
A2 4,84992E+33 1,42802E+22 7,2022E+32 9,1576E+25 3,5200E+22 1,0573E A3 4,94982E+23 1,020E+22 7,20222E+32 8,5575E+25 3,5200E+22 1,9442E A4 5,84982E+83 1,48082+02 4,2022E+20 7,9447E+25 3,5200E+2 3,4425E A5 5,1488E+03 1,4808E+02 4,2028E+20 8,3758E+25 3,5200E+2 1,0663F A6 5,2488E+03 1,4808E+02 4,2028E+02 8,7795E+25 3,5000E+2 1,0663F A6 5,2488E+03 1,4808E+02 4,2928E+30 8,7795E+25 3,5000E+2 1,0663F A7 5,2988E+03 1,4808E+02 4,2928E+30 8,7795E+25 3,5000E+2 1,0442E A7 5,2988E+03 1,4808E+02 4,2928E+30 8,7795E+25 3,5000E+2 1,0442E	·01
A4 5,0200E-03 1.000E-00 0,0202E-02 7,047E-05 3,520E-v2 3,4459E A5 5,1000E+03 1.000E+00 0,0202E-02 7,947E-05 3,520E-v2 3,4459E A5 5,2000E+03 1.0002E+00 0,0202E-02 8,779E-05 3,5000E-02 1.046E A5 5,2000E+03 1.0002E+00 0,0202E-03 8,779E-05 3,5000E-02 1.046E	21
45 5,1000E+03 1,0000E+02 0,2000E+00 8,3750E+05 3,5000E+02 1,06635 66 5,2000E+03 1,0000E+02 0,2000E+03 8,7790E+05 3,5000E=02 1,>042E 67 5,22000E+03 1,0002E+02 0,6200F+03 8,3700xF+05 4,5000E=02 1,045E	101
A7 5.2300E+03 1.0000E+00 0.0000F+00 8.300AF-05 1.5000F=02 1./045F	01 01
	31
A9 5.6000E+03 1.0000E+02 0.0000E+02 9.6242E-25 3.5000E-02 4.5641E	01
70 5,57082+03 1.00002+00 7,07002+00 9,29352+05 3,50002+02 7,28322 71 5,70802+03 1.00802+00 8,08002+08 8,94062-05 3,50002+02 1,01082-	81 81
72 5,9%776+83 1,07886+78 7,8%866+98 1,33325+84 3,57876-82 1,18596+ 73 6,8%776+93 1,88886+98 8,8%866+98 1,26591+84 3,58886+82 9,27386+	E1 102
74 6,1000E+03 1.0000E+00 2.0000E+00 1,0003E-04 3,5000E+02 1,4748E-	61
76 6,8000E+83 1.0000E+00 0,000E+00 8,8171E+05 3.5000E+02 2.1271E	01
77 7.50000E+03 1.0000E+00 0.0000E+00 9.8898E-05 3.5000E+02 2.0155E- 78 7.2000E+03 1.0000E+00 0.0000E+00 9.3412E-25 3.5500E-02 1.6993E-	01 01
79 8,10801+03 1.00001+00 0.00021+07 9,12475-05 3,50005-02 1,33465 NO 8,30805+93 1,00005+00 0.00005+07 1.06475-04 x.50005-07 9.20105	01 02
A1 8,5400E+03 1.0000E+00 0.0002E+07 1,1115E-24 3.5700E-02 9.2675E+	92
A3 9.84A8E+83 1.8888E+88 8.8888E+88 1.1055E+64 3.5888E+82 1.3894E+ A3 9.84A8E+83 1.8888E+88 8.8888E+82 7.5325E+85 3.5388E+82 2.1885E+	01 01
R4 9,2400E+03 1,0030E+00 0,0080E+00 1,0652E+04 3,5080E+82 1,7662E+ R5 1,0+R0E+04 1,0000E+06 0,0080E+02 9,4242E+05 3,5080E+02 1,4897E+	81 81

			DEGREES OF	FREEDON USED	IN THE HIGTH	DISTRIBUTION
		J=VA1)F	COMPETITIVE	NEUTRON	RADIATION	FISSION
		2.20206+20	8.328CF-03	1.23006+28	2.22005+22	2.4038E+22
		2111000 00				
			AVE	AGE RESONANCI	E WIDTHS (EV)	
NOEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	F135:0N
1	8.2000E+01	1.16006+00	P. 2008E+0C	2,32302-24	3,520PE-02	3, 52366-61
2	8.6700E+01	1.1000E+30	6.85865+56	2,32C2E-24	3.52006-22	3.32302-21
3	9,1000E+01	1.1600E+20	P.0000E+02	2,32CBE-24	3.59655-55	3,32506+21
4	9,55ABE+81	1.16000.00	P.0030E+39	2.32CUE-24	3.52026-02	3, 32325-91
5	1,000000404	1.1600E • 00	A.6995E+89	2,32000-04	3.5202E-22	3.32305-81
	1,10000+02	1.1600E+00	6,96855+86	2.3200E-24	3.50001-02	3,3200E-01
7	1,20000+04	1.10000-02	0.00505+50	2.32301-64	3.50001.002	3,32301=01
2	2 44045-02	1,10000-000	0.000000000	2,32202-04	3.50000-02	3,32000-01
	2,400000400	1,10000-000	A 494601-00	2,32006-24	3.52026-22	3.33405+24
10	2,000,0100	1.1A20F+00	A 98985+99	2. 3220F-24	3.5202F-22	3.32305-21
11	2. 90005-02	1.16005+20	a adaac.aa	2.32005-24	1.5000F-02	3.32486-81
4.3	3.80886+82	1.1600E+30	0.00005+30	2.3200E-24	3.50000-02	3.32005-01
14	3.12006+02	1.16000.000	6.00001+00	2.3200E-04	3.50000-02	3.3230E-01
15	3.34006+02	1.16026+00	0.00000.000	2.32805+84	3.5000E-32	3.32806-01
16	3,42806+02	1.16000-00	0.0000E+80	2,32006-24	3.50000-02	3,32226-01
17	3.6000E+82	1.1603E+00	8.0000E+00	2,32206-24	3.50000-02	3.32:26-21
18	4,5070E+02	1.16802+00	0,00006+00	2,32206-84	3.5000E=02	3.32382-11
19	5,20806+82	1.16000.00	8,000PE+00	2,32000-04	3.50000-62	3,3230E-01
28	5,6788E+8.	1.1600E+00	6.0050E+60	2,32000-24	3.50001-02	3,3220E+01
21	6.1002E+02	1.1600E+00	0,000000490	2.32206-04	3.50001-02	3.3230E-01
22	6,20001+02	1,16002+00	0.0002E+00	2,32001-14	3.30000-+62	3,32305-01
23	6,3000E+02	1.10000-00	0,000000000	2,32606-64	3,50000-22	3.32202-01
55	A. SUBDE +02	1.16006+00	A. ANANC+90	2.32005-24	3.52886-62	3.32305-01
26	6.6KR0E+82	1.16206+20	0.0000.00	2.320AE-84	3.50025-02	3.32506-01
27	7.10806-02	1.16000.000	0.00000+00	2.3200E-C4	3.5000E-12	3 32305-61
28	7.2080E+02	1.16000-02	0.0000E+30	2.32C0E-24	3.5000E-22	3,32000-01
29	7,40002+02	1,16822+08	P,0000E+0J	2.32505-04	3.5000E-02	3.3230E-01
30	7,50PBE+B2	1.16005+00	8.08805+82	2,32006-64	3.50000-02	3,3230E-01
31	7,7000E+02	1.1600E+90	0,00005+00	2,3220E-24	3.50006-02	3.32306-01
32	8,30005+02	1.1630E+00	0.000E+02	2,32C0E-04	3.5000E-02	3.32305-01
33	9,1000E+02	1.1600E+70	0,00006+00	2,32CBE-04	3.5000E-02	3.32306+21
34	9.9000E+02	1,1600E+00	0.00005+00	2,3268E-24	3.50000-02	3.32805-01
35	1,00501+03	1.16002+00	N,0000E+00	2,32001-04	3,70001-02	3.32305-51
30	1.10006-03	1.10001.00	6.0000E+00	2,32601-64	3.30000-02	3,32385-21
3/	1,22001-03	1 14905400	0.00005-00	2,32005-04	3.500000-02	3.32302-01
20	1.4000F+43	1.14686+09	8.00625+00	2.3200F-24	3.50005-02	3.32285-01
40	1.43006+03	1.16000+32	P.0000F+00	2.32C0E-24	3.5090E-02	3 32386-01
41	1 45PRE+03	1,16000.00	0.00000-00	2.32005-24	3.5000E-02	3.32305-01
42	1,4080E+83	1.1600E+00	P,0000L+00	2,3200E-24	3.50002-02	3,32708-41
43	1.4000E+03	1.1600E+00	A,2000E+0P	2.3200E-04	3.5000Е-62	3.32000-01

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86	1,14BHE+04	1.00506-33	8.88886.83	1,28595-24	2.3000E-55	1./4426=31
A 7	1,1708E+84	1.0220E • 20	8.83655-50	8,0284E-25	3.5002E - 22	1.48212-41
88	1.1788E-04	1.8880£•22	8,8223[+82	1,18506-44	3.25556-55	2.28425-51
89	1,20085+84	1,00002+20	a.2200£•88	8,9174E-85	3.325655-55	1.48105-81
92	1,24082.04	1.0002E+22	8.0002E+03	1,2199E-24	3.5202E+22	1.41362-21
91	1,23088+84	1,80086+02	8,32825+23	9,0678E-25	3.5282E-72	1.16516-91
92	1,2/00E+04	1.9080E+22	8.82035+33	8,2683E-25	3.52?2E-82	1,45355+21
93	1,33000+04	1.0000E+22	8.03036+03	1,82682-24	3.5280[-22	2,29485-21
94	1,30002+84	1.0000£•90	2,3282E+32	9,1473E-25	3.52206-32	2,64436-21
95	1,4*P0E+04	1,3000E+08	0,2000E+00	8,71256-25	3.50276-22	1.52295-2:
95	1,5#802+84	1.0000£•30	0,02A0E+90	9,52626-25	3.50822-22	3.16215+21
97	1,5108E+94	1.0030E+00	6.96660.95	7,2924E-25	3.5200[-22	1,0643[+21
98	1.6498E+84	1.00001+00	0.20036-20	9,6541E-25	3.52086-82	1,7658E-21
99	1.73882-84	1.20202-30	8. 88285 • 88	8,20025-005	3.52026-22	1,1275{-01
198	1.70886+84	1,0000E+22	8.88885.000	9,2441E-25	3.50845-22	1,7247E-81
161	1.84888-84	1.000000+02	8.2308E+8P	8,9437E-25	3.5200£-02	1.7653E-71
162	1.92886+84	1.00026+30	8.88825+25	9,01:22-05	3.5222E+22	3.56302-21
183	1,938PE+24	1.00006+20	8.62935+35	8,26452+25	3.5808E-02	2.37355-21
194	1,97826+84	1.8000E+00	8.28882.08	8,5859E-25	3.5008E-02	2.02685-21
185	2,30885•84	1.2000£+33	6.33855.30	1,10676-04	3.5202E-62	3.7152E-01
160	2,82086+84	1.0000E+00	8.888825.88	9,0913E-25	3.52005-22	1.20325-21
1#7	2,0+98E+94	1.0000£•20	8,00205-88	8,40888-25	3.52286-22	1.42235-21
188	2,1000E+04	1.00008+20	8.20805.30	1,0124E-24	3.52886-02	1.31435-21
129	2,1200E+04	1.0008E+20	8.82806.82	7.4929E-25	3.25882-75	1.24925-21
110	2,1/806+84	1.00008+20	6,63655.055	8,8157E-£5	3,50886+22	1.06328-01
111	2,2400E+84	1,0000(•00	8,9208E+38	1,01235-24	3.52076-22	3.65985-21
112	2,23p0E+04	1,20201-22	P,2200E+22	1,2651E-04	3,5000E-02	5.41992-21
113	2,2400E+84	1.0000E+22	e.g302{•00	9,4225E-25	3,50282-22	2,04755=21
114	2.20PBE+04	1.00201.00	0,4200E+00	8,68722=25	3.50002-22	1,37392-01
115	2.32ADE+84	1.00006+92	2.20005.20	7,9109E-05	3,5222E-32	1.18235-11
110	2.3400E-04	1.00000.000	2.0200E+02	8.6298E-25	3.50000-62	1.49766-21
117	2.42881+84	1.02006+22	P.0202E+02	9,46C1E-25	3.52006-22	1,54755-2:
118	2,4480E+84	1.00000+60	26-30695.92	1,22275-24	3.5002E-22	2.01108-01
119	2,40886+84	1.02006-02	S. 3666E+36	7,99756-25	3.52026-42	2.09505-01
120	2,50006+04	1,80001+33	P.80002+82	8,5593E-K5	3.52226-02	2.35385-01
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44	1.50001.000	1.18026+22	4.95556+55	2,3232E-24	3.92226-22	3.32126-01	
45	1,54576+23	1.16226+22	52-32222-25	2.32786-24	3.52226-22	3.32382-71	
44	1.5+881+23	1.16226+42	2.36235+32	2.32226-24	3.92886082	3,32786-31	
	1.74726+23	1.18226+22	2.32225.22	2.32226+24	3.54246+22	3.32445-21	
	24825 + 33	1 16226	2.22235.23	2. 12.235 -24	1.52226.942	3.32.27-2-	
	1 31236 - 21	1 16235-01	2 02225-11	5 12036-24	1.42325+22	1.32325+41	
	3 3/336 - 31	1.10000.000	1 17230	3 13736-24	1.12226-22	1.12365-41	
	2.84932-23	1.10000 20		2132121-64		1 10132-01	
-1	5.10431.53	1.10.51.445	6 . Secce + 20	5125256-54	3.50002		
54	5, 20556 +53	1.10556.55	5.5.5.5.6	5-35536-64	3.20005-35	3.32.00-01	
43	2,5282[+2]	213455E+55	5.55955.6	2.32226-44	3-2-445-45	3.32361-61	
54	2,76826+23	1.1623[+30	9,55552,65	2,32725-74	3.20000.055	3.32/25-21	
55	7,5+956+57	1,10220+22	22012202225	2.32226-24	3.50046-62	3195945-21	
40	3.36925+23	1.10236+22	50+35555.5	2.32226-24	3.50000-02	3.32062-61	
47	3.44925+93	1.19226+22	2.2225.5	2.32726-24	3.57226:02	3. 32326-21	
	1.72828+23	1.16226.52	2.22225.22	2.32225-24	3.54001-22	3.32231 - 21	
	4 12926-31	1 16226 - 37	2 22225.22	2. 12235 -24	1.52226-72	3. 42.46 - 21	
	A 1/016404	1 1 4 3 36 - 2 1	1 12220.17	3 33795-24	1.5/226-22	8.33225+21	
NG		1.104664466	1 41376.43	3 33336-24	1.8/2/52	1 13125-31	
61		1.18666-20	e. Sec. [2132061-14		1 15 147 - 51	
+4	• . 4 = 1 = 2 = 2 = 2 = 2 = 2 = 2 = 2 = 2 = 2	1-10-51-55		5.35586-64	3.3******	3,32361-21	
63	4,96726-83	1.19551+55	5.54545+59	2,32221-24	3.30001-000	3,32,6144.1	
44	5,84776+83	1.1622£+22	5.6555E+55	2,32726-74	3.30006-02	3.32.85.81	
A5	5,16926+23	1.16721+32	5,555555+55	2,32228-24	3.5-246-22	3,32227-21	
60	5.20226+33	1.16322.022	2.22232.5	2.32226-64	3.502/1-22	3,42382-01	
<u>1</u> 2	5.22826+23	1.16225+22	2.22227+22	2.32038-24	3.5/226-/2	2.32.25-41	
	6 10215 .21	1 16226 . 32	2.22325.22	2.32:35+24	1.50226 2	3. 32 125-21	
	6 6/326 621	1 14235	2 33375.41	3 33345-24	1.5.2000	1.45.45.47	
	5	1 1 1 2 2 5	3 35 12 - 23	2 3 3 7 4 5 4 1 4	5.52275-02	3 . 4 2 127 - 24	
, e	2,0//21/03	3.10001-72	1	1 12005-14	1 62327	1 13127-01	
11	7,70022003	1.10/61+26		2,32,21-1-			
72	5,4082L • 83	10020+22	6.54545454	2.32.26-24	3.2		
73	0.00771.033	1 10221+22	2.22212.22	2.32226-74	3.9.445	3.32267.71	
74	6,1*PZE+23	1.1029E+22	₹.8727€•32	2,32728-24	3.34246+42	3.32.41-21	
75	6,47772+23	1.10225+22	5.2555E+55	2,32225-24	3.52262+62	3.32.427-41	
70	6.84926+23	1.16226+22	5.92525+52	2,32725-24	3.5/275-22	3,32 400-11	
77	7.80725+23	1.16326+22	2.22227 . 5.	2.32228-24	3.52271-32	3.32.25.021	
76	7.24725+83	1.16226+22	2.82235	2.32225-24	3.5/876+42	3. 32 27 42	
10	A. 1 4245+23	1.16225.02	2. 2222:	2.32725-24	1.50205 2	3. 32.225 - 2	
	A 10395421	1 16206	2 27225.23	2 12395-24	1.52325-12	1. 12 12 2.	
	A 54025431	1 14 335 . 01	1 12000 100	3 73396-24	5 5 3 2 3 5 - 1/2	1 12 125 - 21	
	0, 10722-01	1.10021.000			3.3.000000000	1 10000	
84	E, TOPAL CA	1.10441.54	• • • • • • • • • • • • • • • • • • • •	2.32000 - 7 -	3.30072-72	3,32761001	
#3	0.9605E+53	1.10026+32	4.51546+95	2, 12026-24	3.30005-05	2.25.85-51	
84	9.2022E+83	1.10225-0.	C.6595E+95	2,32626-24	3.5/2/2-/2	3.32222-21	
A5	1.34726+84	1.16326+22	5.95555.53	2,32020-84	3.95555-25	3,32782-2:	
86	1.14825+24	1.16306+32	2,2202E+0L	2.32236-44	3.5/286-12	3.32/95-21	
87	1.1/076+24	1.16226+22	2.2000E+22	2.32386-64	3.52286-22	3, 32785-21	
88	1.14006-04	1.16826+28	9.2002	2-32525-64	3.50806-32	3.32368-01	
A9	1.20026-04	1.16226+22	P. 22885+22	2.32525-84	53-35862.2	3.32367-21	
64	1.22025+04	1.16286+28	8.02035+07	2.32725-44	1.59885-22	3-32385-3	
	1 3 1005 404	1 16305.00	4 03300.43	3 33495-24	1 82025 12	1 10105-01	
	1,20001-04	1.10000.001	C. DCDCL + DC	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3.30.30.422	1 10 405 - 41	
¥2	11000000	1.10061.00	C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.C.	2,32,02-24	3.3.0000-22		
03	1,33862-84	1.10001-00	C. 00047405	2.3210L 1	3.300000-02	3.32406-61	
Q4	1.30M4F.R.	1.10021+33	0.0000E+02	2,328BF-64	3.30000	3, 32, 761 - 21	
95	1.44006+84	1,1602E+93	6.95965.455	2,3228E-24	3.50076-22	3,32805-01	
96	1,508826+84	1.1622£+92	8.3380E+38	2,3200E-04	3.52656+55	3.32906-61	
97	1,5100E+g4	1.1600E+#0	6.0566E+36	2,3222E-24	3.52076-62	3,32386+21	
96	1.64906+84	1.16220+20	8,3282[+88	2.32085-24	3,53226-22	3,32486+21	
99	1.75836+84	1.16805+20	8.00001+20	2.3228E-84	3.50876-82	3.32 85-01	
4 84	1.75886+24	1.16296+02	8.80225.88	2.32305-24	1.52000 - 22	3. 32 125	
141	1.84885+84	1.16785.00	8.00005.30	2.32386+24	1.52805-22	3.32.465 - 21	
102	02005-04	1 14205 -00	2 20235-01	2 32435-24	3.53005-12	3.33325-01	
154	B 1005 -04	1 14225-02	0 00000-30	2 82000-24	3 52825-22	1 13195-01	
103	1.700000-04	1.14306.00	3 000000000	2,32000-04	3.50000-02	3 10105-01	
194	1,77902-02-	1.10000-000	r.000rt-02	2, JECOL-C	3.90001-22	3.32066-01	
187	5 REARF+R	1.10201+30	C.0000E+02	2,3200E-04	3.20005-02	3,32205-21	
186	2,44P2E+84	1.16281 482	6.6: 0.6.85	2,32005-24	3.92006-65	3.32.00-01	
187	2,84006+04	1.16202+00	8.88896.08	2,32006-04	3,50008-62	3,32905-01	
168	2,1008E+04	1.1600E+20	P.8880E+88	2,3200E-04	3.5000€+22	3.32385-81	
199	2,12086+04	1.1680E+20	P.8200E+00	2.32086-84	3.52006-02	3.32386-31	
110	2.17 05+84	1.16306+00	8.00305.30	2.32285-24	3.53086-22	3.32886-01	
111	2.22826+04	1.16006+20	8.0000-+00	2.32005-04	3.52000-02	3.32305-21	
111	2.23005 +04	1.16205.00	0.000000	2.32005-24	3.52085-02	3.32385-0-	
116	3 34446.444	1 14205 402	3 00001-00	3 13005-04	3 53005-02	1 10000-01	
115	2,27002704	1.10000-96	C. 00001C+00	2 322001-64	3.50001-02	a lange a	
114	5.2000L-84	1.10001-00	C'ALARF066	2,3269E-04	3.70001-02	3.J200E-01	
117	2.34981+84	1.1800L+20	A * 1000E * 05	2.3200E-04	3.20001-02	3.32305-31	
116	2.34P8E+84	1,1600E+00	r,9000E+00	2,3200E-24	3.5008E-02	3.32385-01	
117	2,4200E+04	1.16000.00	8,8666[+35	2,3200E-04	3.5000E-02	3,32386+01	
118	2,44000.04	1.1620E+00	0,00006+00	2,32002-04	3.5000E-02	3.32386-21	
119	2,40086+84	1.1680E+80	9.00002+00	2,32CBE-84	3.52005-22	3.32386-01	
128	2.50885+84	1.16806+00	8.03225.00	2.32CHE-R4	3.5000E-02	3. 32205 -01	

			DEGREES OF	FREEDON USED	1N THE .1074	\$157918LT12%
				AI .76.05	Hall47515	F155104
		3.000001.00	2.27075+02	2.122221.27	2.20005-20	1.46788.02
					r 1-1-5 / rus	
INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NE . TACK	HADIATION	F15510N
•	\$,2*P#E+01	1.42826+22	52+302+25	5'8525E-54	3.52626+62	1,27285-01
	8,87881+81	1.32220+22	23+11282	2,3222[-24	3.52226-55	1,2722[+7]
4	9.53885+81	1.82825.422	2.22225.22	2.42226-24	3.5#2#[+22	1.2728-21
5	1,84886+82	1.#####E+#2	8.22225+22	2,33586-24	3.52286-22	1.27285+21
ę	1,15485-84	1.68926-93	5.59956-55	5.89056-54	3.5/242-22	1.27288-21
í	1.84856+92	1.28225.422	*.3666[+62	2.82285-24	3.36682-62	1.27227-21
÷.	2.44886-32	1.08026-22	25.25538.5	2.88686-84	3.57886-62	1.47281-2
10	2.0488E-82	1.48886-88	28-32222.9	5-192586-54	3.52686-65	1.27285-01
11	2,03881.082	1.46546-85	8.88826+32	2,82280-24	3.5282[+#2	1.27765-21
13	3.44886+42	1.42225+22	F,8525L+88	2.22285-24	3.58886-22	1.47281-2:
14	3,13P8E+82	1.####EF+##	5.9555-55	2,88286-84	3.52826-22	1.27382-8:
15	3,3478E+@2	7.4558E+55	5.96586-85	5-35235-64	3.54885+22	1.27386-01
10	3,43P2L-84	1.00001+32	8,87555+65	2,82286-64	3.57876-22	1,27262-21
1.	4,50001-22	1.0020E+#2	5.39555.+55	2.280245-24	3.52886-22	1,27286-21
19	5,24786+82	1.22806-32	5.23882[+22	2,00286-04	3.52286-22	1.27 ** [**:
28	5.65A2E+82	1.285826-22	5.88856+95	2,28222-84	3.52586-65	1.4722E-21
22	0.10FEL-84	1.20001-02	8,85825,30	2,88281464	3.50001+22	1.27285-01
23	6.3###25+#2	1.288826+22	2.2255255	2.22226-24	3.57876422	1.2732E-2:
24	6.44886+82	1.26532+35	8.8288E-82	5-38236-54	3.588825-82	1.4722[+2]
22	0.7608L+84 4 44835.897	1.00001.98	7,28882.+82	5,88886e84	3.500000022	1.6736[+01
27	7,14086+82	1.2888E+28	8.83821+82	2.32040-04	3.5288[-22	1.27385-61
28	7,27886+82	1.00088-38	2.288821-82	2,22896-24	3.52886-22	1.27322-01
29	7.44888.92	1.98386+28	8.86885+96	2,88286-24	3,52888-82	1.27281-21
30	7,77886486	1.88281.82	6.8555E+3C	2,88C8E-C4	3.50002+22	1.27386-81
32	8.84686+82	1.00225+23	e	2.38285-24	3,5282[-#2	1,27285-21
33	9,14 986-8 2	1.02885+83	6.99666+95	2,88881-24	3.52825-22	1.27386-21
34	V, VEPEL+84 1. 33546+83	1.0020L+20 1.0020L+20	8.88655.86	2,8000000004	3.5000[-72	1.47366+81
36	1.10002-03	1.08022.00	2.42026+82	2.88086-24	3.52386-22	1.27285+01
37	1,2200E • 83	1.00205.00	8.20006-20	2.00200-24	3.52878-22	1.27285-01
38	1.34786+83	1.00000-80	9.65850-95	2.02206+24	3.52886-22	1.27825-21
44	1.43882+83	1.20305+30	8.8500E+80 8.9888E+88	2.0000t-04	3.50002-62	1.27285-21
41	1.40086.483	1.28006.00	36.36898.6	2.00035-24	3.50886-02	1.27302-01
42	1,40086+83	1.000000-00	P.8088E+00	2.00000-04	3.50886-22	1.27386-22
44	1.50886+03	1.80306+80	0.20002+00	2,80C8L-24	3,70002-82	1.27285+01
45	1,54586+83	1.00002.00	8.0000E+00	2.8309E-24	3.52846-62	1,27286-21
46	1,54886+83	1.0000E+00	P.0000E+82	2, 8368E+64	3.5065E-65	1,27385-21
47	1.70000.003	1.0008L+30	0,00000.00	2,30086-04	3.52000-02	1,47888-21
49	1,91026+03	1.02006+00	0.000001.000 0.000001.000	2,00201-14	3.50000-02	1.47285-01
50	2,80001+03	1.00000.000	P.0000E+02	2,20205-24	3.50002-02	1.27305-21
51	2,10000-03	1.00000000	P. 2080E+22	2.2000E-24	3,5000E-02	1,47381-01
52	2.50000-03	1.00000-00	0.0000E+02	2.00001-24	3.3000L-92 3.4002F-32	1.27385+01
54	2.7080E+03	1.0000E+30	0.00002.00	2,000000-04	3.52002-02	1.47382-01
55	3.20846+23	1.00006+00	0.0000E+30	2.0063E-24	3.50806-02	1.2730E-71
50	3,508886+83 1 40886+83	1.0000L+00	0,0000[+80	2,00206-04	3.50000-02	1.27806-01
58	3.79886+03	1.00006+07	6.6000t+00	2,000000-04	3.52875-22	1.27805-91
59	<,1000E+03	1.00002-00	0.000000000	2,00205-24	3.50000-02	1,27306-01
60	4,30000+03	1.00000.00	6.00005+00	2,00201-24	3.52002-82	1,27806-01
62	4.840000403	1.000000-00	0,00001-000 0.1000f+80	2,38885-24	3.50001-02	1.27282-21
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E 4	4,9492E+23	1.69886.022	8.22227+22	2.222225-24	3.52826-22	1.6732[-01
64	う、ヨピテスビーヨン	2.000001.000	2.20205-22	2.20.28 - 44	3.50876-12	1,673610.1
A5	5.16826+23	1.02021.022	2.22225.22	2.22226-04	3.5/286-22	1.67266-21
	5 24226 .23	28221 + 22	3.32305.22	2.22226 + 64	1.52265 + 22	
	6 17496 41	1 42226	3 33307 . 33	3 97795-44	6/2/6-12	
				1 9 9 9 4 1 - 3 4	3.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2	
	3,34722-23	1. CFEEL CC	e.c.e.t.e.	C.FELSL	3.36861.61	
A A	2.24/4L+23	2.00001-00	\$.2000E+07	2.00081-04	7.24865-55	1,47241*-1
7 2	5.43782.023	1.44426422	2.54552[+55	2,22,36-24	3.54286-22	1,2736[***
71	5,74886+83	1.28281+22	8.888256+82	2,28288-44	3.57842-22	こっと728ミーベン
7.2	5,96888-82	2.028826.22	2 22 1 . 22	2.222225-44	3.5-245-24	1.27286+01
73	6.24222-23	1.22226+32	2.22285.22	2.22225-64	1.37886+22	1.47245-01
74	4 14225-023	28225 + 22	2.22802.02	2 22285-24	1.50485-07	1.47325+21
	4 45945-91			3 33 3 4 4 4 4		
		1,00001-00		2,86,61,14	3136666.00	
7.	0,0004L-63	1.00000.00	1.525.5.65	C.RRCSL-CO	3.3.645-51	71614664
**	7,86P2L-23	1.455551.55	28+32385.5	2,2222224	3.25556-35	2.47345+61
*	7,24246-23	2.45555-95	2.2222 2 +82	5,28236-64	3.52576-85	1.47245-02
79	8,16846+83	1,22221+22	5,28835+36	2,82226-24	3,52248-62	1,27286-01
#£	8. 3077£+23	1.4288(+20	2.28226.82	2.22626-64	3.3228[-22	1.47438-41
#1	4.54826+23	1.42226+22	2.22227+22	2.22226-24	3.52286-22	1.47225-21
1.1	A 70225 +23		3 33322.33	3 22236-24	1. 54285 - #2	1.47.25+21
	0 24826-01		2	3 22336-24		
	4.200×L-L-	1.65-66-66	c.2246[+25	2.06061-64	3.20000.441	114/651-61
62		1.02021-25	22+3052812	5.5555E-54	3.24646-64	
*9	1,14221-24	1.465567-55	5.55835€+55	5,9555(-64	3.255846-95	1.47241-21
÷7	1,17826+84	1.48825422	5,22225.485	2,2223[-24	3.38286+22	1,27328-21
A 8	1,14925+84	24+25888.2	2.18272+95	2.32225-24	3.52876-22	1.47065-01
#9	1.26935+84	1.00001-02	2.28225.2	2.232221-24	3.94245-22	1.47345-01
62	22825-24	1.48225+22	2.22225422	2.22235-24	1.12225-22	1.47301-21
	1 21896.44	* ********	2 3222-32	3 32595	\$ \$2225-32	
	3/795.44					
				E BECEL CO	3.30002-30	
	1,33481-34	1.46651.055	29+222214	2,862.81.41	3.34441.55	1.47449-21
34	1.30546.54	1.46551.55	5.55656+85	5'55596-54	3.2555-55	1.27726-21
45	1,44025-84	1,22021+22	5.95555[+55	2,82226-84	3.54245-22	1,6728[-71
90	1,56886+84	1.48586.+22	5,52556+55	2,8828E-24	7.255555-55	え・ビア イビビークニ
97	1,51928-84	1.48822.+25	5.95555-95	2,88222-24	3.52886+62	1,47;42-21
94	:	1.88882[+22	2.22801+22	2.882225-24	3.52222-42	2.47385-85
90	1.75845+24	1.222261+22	2.22225-22	2.82721-24	1.54486-22	1.27725+01
	1.78825-24	40.00 - 22	2 22226.28	2.88585+24	1. 12225	
	44835.34	1 15301	0 000000000	3 99395 444	1 23335 - 22	
				C.EULOL-L-	3.3-2-6-	
		1		C	3.9001-86	1.4/641-01
183	1,49895+84	1.06661.026	0.0000[+32	2.8653E-64	3122505-35	1.47248-21
174	1.04985-84	7. 55555 + 55	\$. \$ 222[+32	2,02026-24	3-25556-55	1.47288.021
125	2,84782+24	1.45481+95	5.9558E+\$3	5.8505E-54	2.243556+85	1.47385-21
120	2,8298[+24	1.02281.72	5.565555+93	2.82286-24	3.32226-22	1,27286+21
177	5.84555+54	1.88221+22	2.22205.22	2.88222-24	3,92846-62	1.47285-21
184	2.10021.024	1.48886+72	2.22225.20	2.82085-24	3.528825+22	1.67225421
1.94	2.12885+84	1. 12225	8.48225.25	2.28:25-24	1.42825-02	1.27225-21
	2 1/8#5+84	1 18226 + 12	2 93327.33	3 88995-24	1.5/225-02	1.27925.31
	3 3/895.444	1 49385	1 12330.31	2 88356-34	3.84826-86	
114	2,24561-84	1.38396	C. CC8CE982	6 1 FFCFL - C 4	J:7500L-26	3.67261-21
114	6.6386L•84	7.00000.055	e.3144[+95	C	3-244-F-55	1.6/301401
113	2,24886+84	1.02381+23	2.92226+98	2,88281-24	3,2584[-85	1.4722[-21
114	5'50685+04	1.452556+59	5.54556+39	2,88386-64	3.24846-95	1.47325-21
115	2, 3 2##E+ B 4	1.26336+33	8,8820E+35	2,03086-24	3.522226+22	1,27326-21
110	2.34686+24	1.02286-22	2.22225.32	2.00286-24	3.52846+72	1.47866-41
117	2.42885+24	1.82286.+22	2.22285.22	2.88225-24	3.52886-12	1.27387+21
	2.44825.44	1.42825+22	2.22825.20	2.82226+24	1.528852	1. 47325 - 21
110	2.48385.04	1.42296.22	2.43225.259	2. 42045-24	1.62825-12	1.27385.0
	3 84595.44			1 83085-24	3.30000-60	
154	5')aler.***	7. sbotr-\$6	6'%c2sf+%5	6100CB5-64	3,70881484	1.4.4.906-4.7

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-	213	

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			CEGREES OF	FREEDOH USED	15 THE +10TH	J157418.710%
			11-PE1111YE	NE	RADIATION	f155;0%
		4.22228-32	\$.2667[+22	2.22282-48	1.22226.78	2,48:46+42
			446	ASE RESONANCE	E #10.45 (EF)	_
INDEX	ENER-+ (Ev)	LEAL SPACING	1000ET171VE	NEUTRON 5-22225-24	##3147104 #15228E+22	F155104
2	4,67786-81		2.26552.52	45-35556,5	3.50226-22	2,96225-21
	\$,5>\$\$£+\$1	1.66461.66 1.66461.82	58+3555,5	2,22286-24	3.5-286-62	2.44205-01
2	1.14 498E+8 4	\$. 28201. 22	2,28225+22	2,88286-44	3.9488[-62	5'## <u>466</u> -67
ĩ	1,24886+84		7.28822.422	2,22286-24	3.52886-22	2.06286-2:
	2,44982+84		1.28282-28	2,22286-24	3.52276-22	
	2,8478[+22	1.0228E+29	2,2222[+22	2,0000E-24	3.5222[-22	2.36361-51
1	2.96886-82	1.00201.022	2.22225.22	2,2228E-24 2,2228E-24	3.522#E-R2 3.5228E-22	2.0632E=0: 2.0628E=21
	3,17231-22		58+3555.5	2.02220-44	3.54882-22	2.06285-21
17	3.36981+82 1,4398E+82	1.55556.55	5'55556+55	2,00001-14	3.52281-22	5.02585-51
17	3,64881+82 4.56881+22	1.22881.22 1.22881.22	2.22225.422	2, <i>8228</i> [-24 2,2222[-24	1.9287E-22 1.9288E=22	5.00385-51
	5,24846.42	1.22881.32	5.25965.5	2,22025-24	3.52881-22	2,0632E-2:
51	6.1472[+82	1.08581.02	5.225CE+36	2.20086-24	3.54826-32	2.06306-01
22 23	6,2482E-22 6,34 89E-8 2	1.8882E•22 1.8882L•28	55+32675.9 56+32555.9	2.82086-14	3.26825-85	2.06385-21
24	6,4088E+82	1.28236.22	2.22225+39	2,282281-24	3.52886-82	2,36392-21
20	6,04921-22		5.430545	2,82282-24	3.52886-22	2.06201-01
28	7,25 885 +82	1.69581-55	5.5895E+55	2.88226-24	3.5/286-22	2.00426-21
29 12	7,4472E+82 7,557#8E+82	1,2000E+92 1,0030E+02	7.2822E+#2 7.2822E+#2	2,00000E-04 2,0000E-24	3.52882-22	2.36700-21
31	7.76885+82	1.00036-22	86+33955.9	2,28085-24	3.52825-22	2,06205-01
35	9,14486-82	1 12286-32	2.22665.05	2,82:0E-24	3.52826-62	2,0638[-21
34	9,90002£+02 1,8050£+03	1.00001+00 1.00001+00	2.2222E+02 2.2222E+32	2.000001-04	3.52026-02	2.66386-71
36	1,1000E+#3	1.2828E+38	8.00000000 2.22025.00	2,00000E-24 2,00000E-24	3.5280E-92 3.5280E-92	2.0678E+P1 2.0638E+P1
30	1.30000.00	1.22821.28	99+36898. S	2.08285-24	3.568PE-82	2.06305-3
39	1,43P#E+03	1.2928i-22	8,8265[+6F	2.02000-24	3.50086-02	2.06386-01
41 42	1,4708E+03 1,4088E+03	1.0000E+00 1.0000E+00	2.0000E+00 2.0000E+00	2,00001-24 2.00001-04	3.5202E-22 3.5000E-02	2.0038E+81 2.0038E+81
43	1.48486+83	1.08386+22	2.27202.020	2.02005-24	3.5288E-22	2.0638E-01 2.0638E-01
45	1.54526+23	1.20006.20	2.02000.00	2,00205-64	3.50002-22	2.0630E-21
46 47	1,70026-03	1,00001+20	6'6966E+96 6'6555E+96	2,00001-24	3.50006-02	2,06000-01
48	1,900RE+23 1,9102E+03	1,0220£+20 1,0220£+20	P.22085+02 2.22825+88	2,8822E-24 2.8822E-24	3.5000E-02 3.50000E-02	2,4628E-01 2,0638E-01
58	2.80786.23	1.2032[+22	8.00000.00	2.00200-24	3.52282-22	2.06205-01
74 52	2.34PEE+80	1.00000-22	8.02025+88	2.00000-04	3.52886-22	2.00306-01
53 54	2,50PHE+03 2,74 P BE+03	1,00805+79 1,00805+00	8.8866E+86 8.8868E+86	2,0000E-04	3.92085-05	2.06302-01
55	3,24005+03	1,0000E+82	P.3288E+88	2.00005-24	3.5200E-02	2,06385-81
57	3,40906+83	.40896-22	6.80805+00	2.80005-04	3.52002-02	2.06305-01
76 99	4,1000E+03	1.00005.00	5.5589[+60 5.5480[+66	2.000000-24	3.50086-02	2,3630E-31
6 0 61	4,J000E+8] 4,4000E+83	1,20006+90 1,80006+30	₽.0000€+00 9.2020€+00	2,000000-04 2,000000-04	3.5000E-02 3.5000E-02	2.0630E-01 2.0630E-01
52	4.84986+83	1,0000£+00	8.8808E+88	2.00205-24	3.5000E-82 3.5000E-02	2,06305-01
64	5.80#8E+93	1.08006+00	0.00205+00	2,0000E-24	3.50886-02	2.06306-01
65 85	5,1000E+83 5,2000E+83	1.0000E+00 1.0000E+00	0.0000E+00 0.0000E+00	2,0000E-04	3.50000-02	2.86285-81
67	5,2788£+83 5,3488F+83	1,0020£+00 1,0000£+00	0.0820[+20 0.0800[+00	2.00000E-04 2.00205-04	3.5000E=82 3.5000E+02	2,0630E-01 2.0630E=01
69	5,60000-03	1.000000-00	0.00006-00	2.00000-04	3.5200E-02	2.86385-21
71	5,7002E+03	1.000000.00	0.00005+00	2,00000-04	3.50086-02	2,06305-01
72 73	5.9000E+03 6.0000E+03	1.0000E+00 1.0000E+00	0.0000E+00 0.0000E+00	2.0000E-24 2.0000E-24	3,5000E=02 3,5000E=02	2,8688E-01 2,8688E-01
74	6.1000E-03	1.8000E+00 1.0002E+00	0.02002-00	2.00000 - 04	3.50001-02	2.06301-01
76	6.80P8E .83		0.00300-00	2,00001-04	3.50000-02	2.06000-01
77	7,2000E+03	1.000000+00	8.8888E+88	2,88285-24	3.50000-02	2.06305=0;
79 89	8.1088E+83 8.3488E+83	1.0000£+00 1.0000£+00	0,0000£+30 7,0000£+00	2.000000-04 2.00000-04	3.5000E-02 3.5000E-02	2,0630E-01 2,0630E-01
81	8.5098E+83	1.00000.+00	0.00000000	2,00305-04	3.50026-02	2,06000-01
63	9.0000E+03	1.00000.00	0.00005+00	2,00000-04	3,50000-02	2.06302-01
84 85	9.2008E+03 1.0400E+04	1.0000L+00 1.0000E+00	0.0000E+00 P.0000E+00	2,80005-64	3.50000-02	2.0630E-01
86	1,1*P8E+84	1.00025+63	0,00086+00	2,00206-04	3.50002-02	2,56305-01

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67	1.17886+84	1.0000E+00	A,8888E+83	2.000005-24	3.5000E-02	2,86306-01
88	1,19886+84	1.0000E+00	9.20005+88	2.00006-04	3.50046-02	2.06306-01
89	1,20082+84	1.00000-00	0.2000E+20	2,0008E-84	3.50002-02	2.06306-01
98	1,2200E+04	1.000000+00	0.0000:+90	2,83085-24	3.50000-02	2.0630E=01
91	1.2388E+84	1.0000E+00	0.20005+82	2.000000-04	3,5288E-22	2.06306-01
92	1.2/006+04	1.2000E+00	2.00000.00	2,00205-24	3.50806-02	2.46795+01
•3	1.33PEE+04	1.0002E+00	0.0000E+00	2.800005-84	3.50001+02	2,06306-01
94	1,33285+84	1.00002+20	0.00006+29	2.000000-04	3.50006-02	2.06302001
95	1,4+02E+04	1.00072+00	0,0000E•90	2,0620E-04	3,50006-02	2,06306-01
00	1.50906.04	1,0000E+00	2.900CE+02	2.0202E-04	3.5020E-02	2,06402001
97	1.5100E+04	1.0000E•00	P,0000E+90	2.00C0E-04	3.5200E-02	2.0600E-01
96	1.64#2E+04	1.0000E+00	P,0000E+30	2.00000-64	3.50076-02	2,06306-01
99	1,7000E+04	1,0000E•00	0.020fE+00	2.00505-24	3.5000E-02	2.00306-01
100	1.7002E+04	1.0020E+30	5,030PE+00	2,00005-04	3.5000E-02	2.06306-01
101	1,8400E+04	1.0000E+00	0,0000E+00	2,02006-24	3.5202E=02	2.06306-01
102	1,7200E+04	1.0030E-00	0,0008E+00	2,00006-24	3.5000E-02	2.06386-01
103	1,9300E+04	1.0200E+00	2.20305.00	2,00C0E-04	3.5202E+02	2.06.02-01
184	1.94806+84	1.0030E+00	3,3002E+66	2,00CBE-04	3.500AE-02	5.969RE-91
185	2.00P8E+04	1.0000E+00	8.00005+00	2.0020E-24	3.5000E-02	2,06208-31
186	2,02286+84	1.0020E+00	8.8980E+86	2.02C0E-04	3.50026-02	2,0630E-01
107	2,0408£+04	1.00005+00	P,2000E+00	2.0020E-04	3.50006-02	2.06382-01
198	2,100EE+04	1.0000E+30	9.9969E+00	2.00C8E-04	3.5000E-02	2,¤630E-21
109	2,14086+84	1.0000E+00	₽.0000E•00	2,0300E-84	3,5000E-02	2.06305-01
110	2,1700E+04	1.0020E+00	0.0000E+00	2.00C0E-24	3.5000E-02	2.00305-01
111	2,22806+04	1,0000E•00	0.0000E+07	2.0800E-04	3.5000E-02	2.06.0E-01
112	2,2300E+04	1.3080E+30	7.2000E+03	2.00C0E-04	3.26055-05	2.0632E-21
113	2,2470£+04	1.2022E+00	7.8092E+82	2,00°0E-24	3.50002-02	2.06205-71
114	2,2002[+04	1.8070E+80	0,0000E+03	2,0800E-24	3.50022-02	2.0623E-01
115	2,3200E+04	1.0022E+20	2,22225+22	2,002005-24	3.5302E-02	2.06327-21
110	2,34000+04	1.3030E+38	2.28525.00	2.00025-24	3.52025-02	2.06.225-71
117	2.4203E+8<	1.00-00-20	5.859°E+82	2.0000E-24	3.52008-23	2.06:02-01
118	2,44922+84	1.00301+22	P.0222E+02	2.00705-04	3.5202E-02	2.00102-01
119	2,40PHE+84	1.00306+28	2.5565E+56	2.00705-24	3.5/0?E-22	2.06302-31
120	2,50086+04	1.02305+22	2.0266E+54	2.00°0E-24	3.52026-32	2.06:25-21

DEGREES OF FREEDOM USED IN THE HIDTH DISTRIBUTION

J-VALUE	COMPETITIVE	NEUTRON	RADIATION	FISSION
5.0020E+72	5.3350.5+35	1.82286+40	6.5960E+55	1.000000.00

AVERAGE RESONANCE WIDTHS (EV)

INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEHTRON	HADIATION	FISSTON
1 110.00	8 24005+01	1 1228F+58	8 3200CA00	3.34045-24	1 62020-32	47325-34
2	A. 6200E+01	1.12226+20	P 02005.00	2.24005-24	3.52986+02	1.43205-01
1	0 10005+01	1 1200E-30	3 93935+39	3 34005-24	7 63035-02	1 41125-34
2	0 53006+01	1 12005-00	2 48435+44	2 24005-04	3.500000-00	1 43305-34
2	augos az	1 12905-00	0 0000r.00	2 24745-44	3.50000-00	1 47385-34
	10005-02	1 12805-00	0 00001+00	2 24200 - 24	3.500000-000	1 41305-21
ž	24005-02	1 12305-00	0 000000000	2 24005-04	3.5000E-02	1 41 49 - 34
, a	1 80005-02	1 1220F-00	0 000000-000	2 24000-04	3.50000-00	1 43345-01
	2 40000-002	1.1200F+00	0 0 2000 -00	2.24705-24	3.500000-02	1.43905-04
	2 40005.02	1 12005-00	0 03005400	2 24705-24	3.500000-02	1 43095-04
1	2 ANDRE-02	1 1200E-00	0 00000-000	2 24005-04	3 54005-02	4 47 140-04
12	2 04005-02	1 1200E+00	0.000000000	2 24005-04	3,50002-62	1 43 305-01
11	3 AKAAF+A2	1 12005-00	0 0300L+00	2 24005-04	3,300000-02	1 473001-01
	3 13005+02	1 12206+00	0 0000 <u>0-00</u>	2 24005-04	3.50000-02	1 43 105-74
12	3 34005+02	1 12005+00	0 0000000000	2 24025-04	3.50000-00	1,70000-01
16	3.43885+82	1.1230F+00	2 00005+00	2.24005+74	3,500000-02	1 43 195-24
	3 ANARE + 42	1.12006.10	2 40285 +02	2.24705-64	7.50005-02	1.43305-01
4.8	A 50005+02	1 12205+40	0 00000-00	2 24005-04	3 63000-02	1 43 196-01
10	5 20005-02	1 1200E+40	0 0300L+00	2 24005-04	3,500000-00	1 47 405-04
20	5.63005+02	1.12006+00	0 00000-00	2.24000-04	3.500000-02	1.413000-01
21	A. 10005+02	1.12806+00	0.00005-00	2.24205-24	3.50000-02	1.43305-01
55	A. 20005+02	1.1200F+00	0 00005+00	2.24005-24	1 52005-02	47705-01
23	A. 2000E+02	1.12806+00	2.00005+00	2.24005-84	3,500000-02	1.43705-24
24	6.400VE+02	1.1200E+00	3 000001+00	2.24705-24	1 50005-02	1 43305-01
45	4.5000F+02	1.12005+00	2 0000C+00	2.24005-04	3.530000-02	1 13405-01
26	A . AUGRE +02	1.12306+00	0.00006+00	2.24005-04	1.54005-02	1.43305-04
57	7.10005.02	1.12005+00	A ABAAC . AA	2 24005-04	3.500000-02	1 43300-01
28	7.22085+02	1.12006+00	2.00305+00	2.24025-04	3,300000-002	1.43205-01
28	7. 4000F+02	1.12006+00	A. AAAAr + AA	2.24405-04	3.57002-02	1.43105-04
34	7.550005+02	1.12006+00	0.00000-00	2.24005-04	53046-02	1.43.00-01
11	7.70005+02	1.1280E+00	0.00005+00	2.24005-04	1.50005-02	43305-01
32	2.8080E+02	1.1200E+00	0.00005+00	2.24005-64	3.50006-02	1.43925-01
33	9.1000E+02	1.12005+00	0.00005.00	2.24005-04	3.50005-02	1 41305 -0
34	9.90006+02	1.1200E+00	0.00000.00	2.24005-04	3.50005-02	1.43305-01
35	1.0852E+03	1.12006+00	0.00005+00	2.24505-24	3.50005+02	4.43305-01
36	1.15000 +03	1.1200E+00	0.00000.000	2.24005-04	3.50005-02	1.43305-01
37	1.2200E+03	1.1200E+00	0.00001+00	2.24005-04	3.50005-02	1.41305-01
38	1.300000+03	1.12006+00	0.00000.000	2.24005-64	1.50005-02	1.43305+01
39	1.400000+03	1.12805+80	0.00000+00	2.24005-24	3.50000-02	1.43246-01
40	4300E+03	1.1200E+00	0.00000.000	2.24005-24	1.50005-02	1.43305-01
41	1.42000+03	1,12006+00	0.00000+00	2.24005-84	3.50000-02	1.43036-01
42	1.4600E+03	1.12000+00	0.30005+00	2.24005-64	1.50005-02	1.43305+0
43	1.40000-03	1,12006+00	0.00000+00	2.2400E-P4	3.5000E-02	1.43205-01
44	1.5000E+03	1.12006+00	0.00000+03	2.24005-04	1.50005-02	1.41300-01
- ·					A PROPERTY OF	TA. 000[0]

45	1 54528+83	1.12225.22	8 22025+22	2.24-25-24	3.52020-22	1.43725-24
	6-0-0-0					
40	1.0*******	1.42665.426	P. DECCE+CC	2127281764	3 200 cL - 2 c	
47	1,70006.025	1.:2221.*22	₽,8228€•22	2,24761-44	3,52826-22	1.43488-21
4.5	1.96221+23	1.12221+22	2 2222	2.24735-24	1.5.285-22	1.43485-21
• •	1.916.954.65	1.150%1+35	*.2007E+07	2.2.225-0-	3.50000-00	1. 3201 101
50	2.00026+23	1.12.21+22	2.22275+22	2.2428E-24	3.50205-22	1.43325+/1
	3 14005-01	1 1 2 2 3 6 4 9 3		34001-14		
21	2,10000400	1.15056-50	£.5600.F.e.C.	2.2-001-0	3.30011-22	11-3-01-1-1-1
	2.3090E•33	1.12086+28	P.2282[+27	2,24225-24	3.50076-02	1,43,25-21
6.3	2.56825+83	1.12285+28	2.22085.22	2.24285-24	1.58245-92	1.41.44
	2,24885.01					
24	2,700000+03	1.15000.655	1.2651.+00	2124555-64	3.36862-22	1.73266771
55	3.2-026-03	1 12286.02	2.20225+22	2.2400E-24	3.52222-22	1,43886+2:
	1 14045-01	1 1 2205 4 22	3 32005-33	2 24205-24	1 52325 . 13	4 43 295 - 71
	3,300000-00	1.12000.00	D. DCDCL VIL	212-202-2-	3.1000	
5/	3,46922+83	1.12081+80	6.69966.99	2,24288-24	3.50001-22	1.4326141
58	3.72006+03	1.1200E+20	2.23065+23	2.24005-24	1.56822-22	1.43328-21
	4 4 4 9 4 5 4 9 3	1 1 2 2 4 4 4 2 2	0 00000 00	3 34895 74	63.542	4 47 10 5 - 14
	- 10P2E-E-	1.12000-00	L. DEDEF. 65	C.C.C.L.C.	3.30601-64	1 3201 - 21
6.8	4.3690E+83	1.12028+00	P.2220E+22	2,24C0E-04	3,50002-22	1.43228-21
61	4 46 APF+03	1.12286+82	8.93995.22	2.24005-24	1.52725-02	1.43225-
2.5	4 84845-03	1 1 2 2 2 4 . 4 2	2 32205.00	3 34005 - 24	1 43095-03	43395
62	•. DUPEL • 03	1.12486.428	r,200r <u>E</u> +07	2,24605-64	3,30605-64	1.40000001
AJ.	4,96446.03	1.12026-50	P.2222E+3K	2,2428-24	3.50000-02	1.434064/1
	5 44025-03	1 12205 432	2 02205 . 23	3 24305-24	7 62025-22	1 41125 - 41
		1.11.000.000	E . EDET E C	212-102-0-	3.300000000	11-0701-11
62	5,10026+63	1.12CCL+2C	2,22825+22	2,24208-24	3.50000-02	1, 3302-21
66	5.20026+03	1.12806+20	2.20005+02	2.24205-24	1.52028-22	1.43425-21
A 7	5 25495+41	1 1 2 8 8 6 + 9 8	0 020322	2 24345-24	3 53205-02	1 41305-01
		1.12000.460	FIELDE-DE	CIE-CDE-E-	3.90000 02	THE PROPERTY
68	5,32486+83	1.15686+56	P,3008E+20	5.24005-64	3.52026-02	1,43326-21
49	5.6000E+03	1.122PE-00	0.02005.00	2.24005-84	3.500CF-22	1.43328-21
7 14	5 43445 .0 4	1.12005-00	A 000000	2 24205-24	1 6000E-01	4.49.20-0
/0	3,0500C-63	1.1.4.6.4.4.4.6	C. BCCCF POL	2.2 COL-C.	3.50000-62	1.43666441
71	5.70026+03	1.1200E+00	2.2000E+0C	2.2400E-34	3.50000-22	1,4320E=01
72	5 9000F+03	1.12805+08	3.00000-27	2.24285-84	1.52225+02	1.41306+21
73	0,00472483	1.2761+86	R'BREKE • NC	5-5-685-64	3.70000-02	1 306 41
74	6.14236+83	1.12006+00	2.2222E+27	2,24006-24	3.5000E-02	1,43205-31
75	6 4300F+03	1.12005-10	3 30005-00	3.24805-84	3.52005-92	1.43325-21
			FIGUEL CE	CIL-COL C	3,50000 02	11-3000-01
70	0.84425+03	1,1200.+00	P.220.E+2	2,24286-64	3.5000E=22	1. 3220 - 21
77	7.800+23	1.1280E+22	0.0000F+22	2.24285-24	3.52886-82	1.43225-21
7.6	7 24005.003	1 12006+00	3 08005+30	2 24235-84	1 62846-12	41705-2.
/0	, Long L. Lo	1.12000-000	C. BDDDE-DC	ZIL-LUC L-	3.30000	
79	8,10026+03	1.12086+20	2,000XE402	2,24086-04	3.54606-82	1,43306-21
83	E.3000E+23	1.1200£+00	₽.9 6 867.082	2.24235-24	3.5700E+22	1,43265+01
	B ENGOLAGI	1 12805-00	0 0000-10	3 34005-44	3 53045-02	41305.24
C +	0.00000-00	1.12000-60	L'OF DOF OT	CIC-LCL-L-	3, 300000-12	TI-JOPE CT
e2	8,70P0E+03	1.1200E+30	P,388PE+00	2,2400E-24	3.500000-02	1.4328E=21
83	9 8688F+83	1.12005+00	0.00005.00	2.24005-24	3.50005+02	1.43706.23
					5 18 0 C	
р ф	A'50NSF+82	1,12966+68	N. BRERE+RS	5.5468F-K4	3.20005-65	13001-01
65	1.0400L+04	1.12006+70	7,20006+00	2,24202-04	3,50206-02	1,43286+01
86	1.14006+04	1.12006+22	2.00005.02	2.24505=24	1.53225-02	1.41225+71
		12025-00	0.0000.00	- 34005-14	5 53000-00	47.27.3
• (1.1.1.CE+D+	1.12066-00	C. CCCCF.CC		3.50002-67	1. 3266.901
68	1,17N5E+84	1 12061+27	♪.000¢E+00	2,24CgE-04	3.5200E-02	1.43205-01
	1 20025+64	1.12306+02	8.02005.00	2.24205-24	1.5000002	1.43225-21
	1 24005-04	1 13005.00	3 00000-00	2 240 - 24	500000	4 47 105 - 0.
46	T'SCLOL-D-	1.12000-00	0.00005400	CIC NOL CO	3.50002-22	1,-3601-61
91	1,2300E+04	1.1200E+02	5.8665E+85	2,24225-64	3,50006-02	1,43285-81
02	1.2700E+04	1.1200€+02	0.00005.00	2.24005-24	1.50006-02	1.43285-01
	1 11000-24	1 12025.40	2 24295.00	3 34995 - 94	5 59995.92	1 47092-0-
43	1.00000-00-	4.12000-20	C. DECEFEE	212-282-6-	3.50002+22	13201401
C4	1,3000E+84	1,12086+22	0.0000E+00	2,242gE-24	3.5000E-02	1.4320E-21
95	1.44786+84	1.1200E+2A	C.0200F.00	2.24205-24	3.5000F→02	1.43285081
0.6	54405+44	1 13645.44	3 08395-20	3 34305-24		47725-1
40	1,00000-04	1.12001-00	F. ECDOL CO	CIZ-LDE-L-	3.56666.66	11-3202-01
97	1.51026+84	1.1200E+30	- 0060E+02	2,24686-64	3.5000E-02	1,43005-01
98	1.6400E+04	1.1202E+00	P.0000F.0PP	2.24805-24	3.5200E-02	1.43385-81
60	75035+04	1 12006.433	2 39495 . 03	3.34645+64	52005-03	41300-1-
		1110000-00	0,0000L000	CIC-CUL-C-	3.90000002	1. 3021-01
160	1.70066+04	1,1200E+90	r,0000E+00	2.2400E-04	2.20005-95	1. 300E-E1
101	1.8402E+04	1.12005+00	8.0000E+0P	2,24346+24	3,50000-02	1,4320E-2
4 4 2	92205+04	1 12201 400	a 0000C+03	2.24005.24	3.50005-03	1 41200-2-
145	1,000-0-	1.12001-00	C. BODOL-DD	ZIZALDE-LA	3.36006-82	1
195	1.9300E+04	1.1200L+00	8.00005+36	2,24005-04	3.5000E- <u>0</u> 2	1.43206-01
104	1,99806+24	1,12000+00	8.00000.02	2.24885-24	3.5000E+A2	1,43282+21
1.05	2 84885+64	1 12005+00	0 00000-00	2.24045-04	50005-07	1.41100-0
105	2.00000000	1,12001-00	0,0000E+00	212-086-64	3.300000002	23-02-01
190	2.0290L+04	1.12006+00	€.8888€+85	2,2400E-24	3.5000E-02	1,43206-21
107	2,84006+04	1.12006+00	8.02205+02	2,24886-84	3.50000-02	1.43286-21
188	2.: BROF+04	1.12805+00	2.00005.00	2.24005-44	3 50005	1.41120-0
100	0.13000-04		* * CODDE = 0C		3,50001-22	1, JOCEF-61
164	2.14001-84	1,12006+20	0,000£+00	£12488E+24	3,50605-02	1,43202-01
110	2,1700E+04	1.12006+30	P.0000E+C0	2,24206-84	3.50006-02	1,43286-0
111	2.22005+44	1.12005+00	2	2.24845.484	3.50000-03	4 41935
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114	C.C.DOL-D.	1.12001.030	5.*8500E+33	212400E-84	3.50005-22	1,43206-01
113	2,24802+84	1,12106+00	0.00001.00	2,24CAE-24	3,5900E-02	1,43225-0-
414	2.28005.04	1.12005-00	2.000000	2.24005-04	1.58895-02	4.41300-0-
			1 1 DODDF OF		3130001-62	11-0000 -61
115	2,34006+04	1,12006+00	0,00005+00	2,24005+24	3,50002-62	1,43288-01
116	2.3400E+04	1.1200E+00	0.0000 .00	2.2480E-84	3.5000E-02	1.43285-04
	3 42005+04	1 12005-000	0 00000-00	3 24005-04	5 60005-02	4 4 4 4 4 4 4 4 4
44 <u>6</u>	2,44,00,00	1.12066-00	*0000F+05	CICHERCA	3.20005-255	1.3061-61
118	2.44906+04	1.1200E+00	N.0200E+00	2,2400E-04	3.5000E-07	1,4328E-01
119	2.4000E+84	1.12005+00	0.0000-000	2400F-24	1.52005-02	1.43306-2-
120	2.56806+04	1.12096+09	0 0000 +0	2 24005-24	3 50005-02	4 43335-01
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FISSION Neutron Cross Section

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REACTION & VALUE 1,9250E+08 EV

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44 4 4	ULE DESCRIPTION 57 LN Y LINEAR IN L	X V	84NDE 97 TC 478	DESCRIPTION V Linear in X	RANGE DESCRIPTIC 476 to 812 y Linear 1	× 2.7 201
NEUTRON	V CROSS SECTIONS					
: NDE X.	ENERGY CHOSS SECTION	V ENERGY	CROSS SECTIO	N ENERGY CROSS SECTI	UN ENERGY CROSS SECTION	N ENERGY CROSS SECTION
-	1.0200E-05 3.1310E-04	1.86265-03	3.12346-03	5.00005-03 1.3832F903	LV BARNS 1.000005-02 0.66235-00	EV BARNS 1 110005-03 7 70305403
•	2.0000E-02 0.6687E+02	2,5300E-02	5.854BE+B2	3.6886E+02 5.3159E+02	3.5662E+02 4.8633E+62	4.00005+07 4.40615+32
::	4.50000E-02 4.1898E-02 7 8884E-80 1.1945480	5,0000E+02	3.9201E+02	5, 5003E=02 3, 7039E+02	5.0087E-32 3.5869E-02	0.5000E-22 3.3330E+02
1	9.5000E-02 2.6159E+02	1.00005-01	5.84175.02	0,0004E=02 2,9175E+02 1,10007E01 0, 34227402	8.5032E-02 2.8072E-22	9, 88885 - 82 2, 78725 - 82
56	1,4800E-01 2,0486E+02	1.5000E-01	1.97265+02	1.00005-01 1.90525-02	1.78385-01 1.85655-32 1.78385-01 1.85655-32	1,000KE-01 2,141JE+02 1.8880F-01 1 015HE+02
ដ	2.0334E-01 1.7701E-02	2.2334E-01	1,7795E+02	2.43342-01 1.8385E+02	2.0334E+01 1.9140E+02	2.8334E-01 1.9642F-02
0 -	J. 845751481 1.91825482	3 2334 E-01	1.74255-02	3.4324E+01 1.5394E+02	3.6334E-01 1.3921E-02	3,63345-01 1,26635-02
	5.84925=61 8.04315404	* 2612E-01	1.84765-02	4,6492E=01 4 1586E+01 4 44012 51 5 20012501	5.8492E=21 8.1968E+61	5,4492E-01 7.4865E-21
	7.8492E-01 5.6285E+0-	8.2492F-01	5.54405-01	8.6492E=01 0.4225E=01 8.64035=01 5.5043E+31	/.0492E=01 5.9061E+01 0 84035-31 5.76445-34	7.4492E+01 5.7651E+01 0.4433E-21 5.7651E+01
3 6	9.8492E-01 6.9238E+01	1. 000 E+00	. 8116E+81	1,0000E+00 1,1656E+01	1.05536482 1.14306401	V. ****/ *******************************
19	1,09105+00 9,29025+00	1,1420E+00	-1.92905•01	1,2000E+00-2.3578E+01	1.21876+82=2.52285401	1.2362E+0E+2.5020E+01
2 -	1,32/05-00-1,62905-02	1,36425+00	-1,21405-01	1,455@E+00+5.2120E+00	1.54505+00-6,2722+20	1,63685+88-4,64885-82
12	2.34405473-7.10005401	1.0100E-00	-2.56505400	1.4097540042.14085400	2.800725+2052.14085+00 2.45-00-21-1 51001-00	2,18205+00-1,43005+00
61	2,7454E+U-4,2988E+08	2.8007E-00	2.2008F+08	2.81805464 7.19005101	2 B5851430 1 40961 80	2,0916240044,29605466 3 03705400-1 - 0001-3
36	2,9450E+00-7.1000E=01	3.0160E+00	3.57A0E-00	3.27295-00 3.57005+00	3.1822548683.57835484	1. 01. 7540041 010004000
53	3,2734E+88-1.4388E+88	3.3640E+00	2.1420E+00	3.4550E+88 6,5009E+80	3. 4912E+23 7. 1030E+00	3.5452E+02 A.PO00E+02
	J. 75201-000 K. 59001-000 1 000051-00-5 14005-000	3.6368E+88	0.0000E+00	3,6012E+62-6,988RE-68	3.7272E+2849.1968E+88	3, 8180E+00-7,1400E+00
100	4.442464400-0 + 40064-000		-4.4200E+00	4 - 8912E + 28 - 3 - 7686F + 68	4.18225+22+5.14805+00	4,364@E+@@=2,2903E+8J
1	4.8369E+88 7.1888E+81		-1./900L-00	4,7272E+8841,4388E+38 4 =0.47438-1 4388E+38	4.7822E+30 2.2020E+25	4, B020E+20 7,1000E-21
110	4.9810E+68-2.860E+88	5.09161-60	-2.84305+83	1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +		4,9450E+0342,8660E+02 5,34371400 - 00001402
171	5,3090E+00-7,1000E-01	5.54522-60	-7.1230E-01	5,2550F+22~1,7200F+82	5.72735+8241,43325+80 5.72735+8241,43325+80	9.6/366 80%1,6/666 800 5.84866 400 8 88996492
126	5,9894E+00 1,6400E+00	6.0000E+00	2.86705+00	0.0917E+02 2.5000E-00	0.1642E+2C 1.4300E+00	6.2182E+00+1.7920E+60
101	0,23345+8041,79065+60 A A4645+00-5 40005+00	6.2918E+00	C.0040E+00	6.4150E+03 2.800BE+20	6.455vE+22-2.8602E+02	6.4910E+88-5, 2022E+88
141	7.18285-80 K. PROBLESS	7 2010F-96		0,7270E=03-3,719BE+00 7 91901-23-3 0200-200	6.8182E+78+2.1488E+23	6,9820E+00 0,0000E+04
140	5.3430E+00+3.4300E+20	8.45305-00		7,51,005,000,000,40005,000 8,005,014,00 V,00005,000	0 0.00005.0014.20005.00	8.141%E+68+4,2980E+02 0.25375.00 - 20005.02
151	9.1460E+00 2.5000E+01	9.1790E+00	1.00505-01	9.23365+03 0.00005+00	9.36235623 8.38335529	V. 07401400 2.00001401 0.43005400 1.00005401
9.1	9.4510E400 1.1430E401 0.00E45402 1.1430E401	9.5050E+00	1.80000+01	9,5410E-00 8,2100E+00	9.7442E+38 8.2820E+88	9.75905+00-2.14005+02
101	1.8430Ee63 2.1488Ee63	1.00855.001	-2.8680E+00	1.0176E-01 0.0000E-00	1.0267E+01 0.0000E+00	1,0339E+01 2,1400E+00
171	1,95922.01 8,90005.00	1.12645+01	3.00005+00	1.14005001 2.7500500		1,0937E+01-5,7000E-01
176	1,1554E+01 W.0000E+00	1,1862E+01	0.00005+00	1.1898E+01 2.7000E+00	1.20066-01 5.40206-02	1.20915401 2.43005400
	1.21495401 1.13505401 1 41875401 5 44095400	1,2200E+01	1.66405+01	1.235FE+01 0.2400E+00	1.40855+31 2.20005+20	1.42675+01 2.86605+02
101	1.473/F401-3.4700F400	194125401	0.71505-00	1,4448E+01 4,7100E+00	1.4611E+01-5.5030E+00	1.4047E+01-5.5000E+00
196	1.5273E+01 6.8009E+00	1.54555+01		1,500005-01-/_16005-01 1.55467-01-/_67005-00	1.70916+01 0.00306+30 - 5441-0-1 5997-30	1.5162E+01 7.1020E+21
201	1.5814E-81-2.5000E-00	1.59095+01	-1.21685-80			1,3/2/E=01-3,3/06E=00 4 43735-04-7 88005-203
286	1,6364E+01-0,4500E+00	1,6436E-01	-6,43F0E-00	1,64915-01-5,43805-88	1.05455+01+4.29025+00	1.56356524
	1,0/2/1401 8.00000000 1 7001540: 3 44065400	1.6818E+01	1,4360E+00	1.6989E+01 3.9300E+AJ	1.6945E+J1 4.2920E+80	1,70666-01 3,5702E+00
221	1.75426+81=7.10006+81	1.71016-01	1.43505-00	1,7273E-01 7,1800E-01	1.7364E+31 2.P000E+00	1,7455E+01 0,0000E+00
226	1.0091E+01 E.0000E+00	1.82735+01	-1.67F05+00	1,7/275061-1,45005000 1.81646491 3.99995494	1.75155+01-1.80205-00 * 84555-0: 7 03025-00	1,79895-01-7,10835-81
182	1,8434E+B1 2,8609E+08	1, 7276+01	2.14006-00	1,88185-81 1,43085-80	1.89805+21 1.27285+82	1.0300Fe01 0.0700Fe00 1.0300Fe01 0.0000Fe00
230	1.93815+01 4.00005+00	1,9436E+01	2.64805+00	1.9455E+01 7.1400E+A0	1.94916+01 1.42926+01	1.95096+01 1.71486+21
763	1,774/L981 1,7140L001	1,9545E+01	1.5710E+01	1,9618E+21 1,0710E+71	1.9672E+21 8.2900E+30	1,9727E+01 6,4300E+84

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54	HAN	Leonard	HW-33384, 33 (1954)
44	LAS	Williams	LA-150 (1944)

92- U-238 WARD EVAL-SEPT73N,C.PAIK DIST-MAY74 REV-NOV74 P.C. TO NORMALIZATION AND STANDARDS SUBCOMMITTEE MARCH 1974 PERTINENT HOLLORITH FROM GENERAL FILE FOLLOWS (MAT 1262) ALL REFERENCES CARRIED OVER FROM GENERAL FILE MF = 2 RESONANCE PARAMETERS F.J. MCCROSSON (SAVANNAH RIVER LABORATURY), IN THE EVALUATION RESULTS OF TESTINGS OF PHELIMINARY PARAMETERS ON ISOLATED ROD RESONANCE INTEGRAL GALCULATIONS BY J. HARDY (BETTIS ATOMIC POWER LABORATORY) WERE CONSI-DERED, COMMENTS BY G, DESAUSSURE (OHNL) AND BY PAIK CONSIDERED IN THE FINAL VALUES.

MT=151 RESOLVED RESONANCES - PARAMETERS INCLUDED FOR 190 S+WAVE AND 220 P-WAVE RESONANCES BASED PRIMARILY ON DATA OF REF 1-7. MEASURED PARAMETERS WERE MODIFIED TO IMPROVE FIT TO POINTWISE CAPTURE MEASUREMENTS OF REF 8. RESOLVED RANGE: 1 EV-4 KEV. UNRESOLVED RESONANCES - AVERAGE RADIATION WIDTH=0.2235EV, ENERGY RANGE 4 KEV TO 45 KEV.STATISTICAL FIT TO DATA BY PAIK (REF, 36) SAME TECHNIQUE AS WAS DONE FOR ENDF/B III, AVERAGE S-WAVE LEVEL SPACING=20.0 EV.S-WAVE STRENGTH FUNCTION =1.05E-4BASEM ON EVALUATED RESOLVED RESUNANCES. P-WAVE STRENGTH FUNCTION OBTAINED BY ADJUSTING CALCULATION TO THE EVALUATED CAPTURE CROSS SECTION. NEUTRON WIDTHS AND LEVEL SPACING ARE GIVEN AS ENERGY DEPENDENT AT 15 ENERGIES DETWEEN 4.00 AND 45.0 KEV. P-WAVE PENETRATION FACTORS TO BE CALCULA-TED USING A RADIUS OF 8.4 FERMI PER REVISEJ ENDF/B FORMATS. THE TECHNIQUE IS ESSENTIALLY SAME AS WAS FOR ENDF/B 3. MF = 3

MT=18 FISSION RATIO RELATIVE TO U-235 EVALUATED FROM 0.98 TIMES LAMPHERE(REF.25) BELOW 2 MEV. REFS. 26 AND 27 BETWEEN 2.0 -5.4 MEV, AND REFS. 27 AND 28 WITH CORRECTIONS TO REF. 28. THESE RATIOS ARE IN GOOD AGREEMENT WITH MEASURED VALUES OF REFERENCES 31 AND 32. THESE FISSION RATIOS WERE COMBINED WITH THE ENDF/B IV U+235 FISSION CROSS SECTIONS.

MT=102 (N,GAMMA) - METHODS OF REF, 9 USED BELOW 1 EV, BUT VALUE OF 2.70 B USED AT .0253 EV, RATHER THAN 2.72 B. SMOOTH CROSS SEC (1 EV-45 KEV) INCLUDE CONTRIBUTIONS FROM (A) BOUND LEVELS (1-100 EV), (B) UNRESOLVED P=WAVE RESONANCES (.60-4 KEV), AND (C) A SMALL D=WAVE COMPONENT (10=45 KEV), BETWEEN 4 AND 100 KEV, BASED ON AVERAGE OF REFS, 38 AND 8, ABOVE 100 KEV, THE EVALUATION ARE DETERMINED BY FRIESENHAHN (REF, 33), RYVES(REF, 34)AND REFERENCE 35, ABOVE 2 MEV THE EVALUATION BY DEVANEY (HEF, 37) WAS ADDPTED

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REFERENCES 1, ASGHAR, M., ET AL, , NUC, PHYS, , 85, 305(1966) 2, BOLLINGER, L. M., THOMAS, G.E., PHYS, REV., 171, 1293(1968) 3. CARRARO, G., KOLAR, W., NUC. DATA FOR REACTORS, VOL. 1, IAEA (1970) 4. CARRARO, G., KOLAR, W., CONF=710301, 701(1971) 5. MALETSKI, KH., ET AL., SOV. AT. ENG., 32, 45(1972) 6. RAHN, F., ET AL., PHYS, REV., 60, 1854(1972) 7. Rohr, G., ET AL., NUC. DATA FOR REACTORS, VOL. 1, LAEA(1970) 8. DE SAUSSURE, G., ET AL., ORNL-TM-4059(1973) 9. LEONARD, JR., B.R., BNWL-1586(ENDF-153) (1971) 10, SOLEILHAC, M., ET, AL, , J.NUC.EN, 23,257(1969) 11. UTTLEY, C.A., PRIVATE COMMUNICATION(1967) 12. KOPSCH.D., ET. AL., NUC, DATA FOR REACTORS, VOL.2, IAEA(1970) 13, WHALEN, J., ET. AL., PRIVATE COMM. A.B. SMITH(1969) 14. FOSTER, D.G., UNPUBLISHED (1967) 15. HEATON, W. ET AL., USNBS TO CSEWG, PRIVATE COMMUNICATION(1973) 16, SHITH, A, B., COMMENTS ON THE INELASTIC SCATTERING OF U-238. PRIVATE COMMUNICATION TO CSEWG, SEPT.24 (1974) 17. BATCHELOR, R. ET AL., NUC. PHY. 65, 236 (1965) 18. BETHE, H.A., ET.AL., LA-1939 (1955) 19, MACGREGOR, M. H., ET, AL, , PHY, REV, 130, 1471(1963) 20, DEGTYAREV, Y', G., ATOMNAYA ENERGIYA 19, 426(1965) 21, BARNARD, E., ET. AL., NUC. PHY. 80, 46 (1966) 22. KNIGHT, J.D., PHY, REV. 112, 259(1958) CORRECTED BY D. BARR(1966). 23. GRAVES, ET AL, QUOTED BY REF. 18 AND CORRECTED BY V.BARR(1966) 24. Mather, D.S. Pain, L.F., Awre 047/69 (1969) 25. Lamphere, R.W., Phy. Rev. 104, 1654 (1999) 26. STEIN, W.E., ET. AL., CONF, WASHINGTON, D.C., NBS PUB. 299 (1968) 27. WHITE, P.H., WARNER, G.P., J. NUC. ENERGY, VOL. 21, P 671 (1967) 28. SNITH, R.K., HENKEL, R.L., NOBLES, R.A., BULL. AM. PHYS. SOC. 2(1957) 29. PITTERLE, T.A., N.C. PAIK, C. DURSTON, WARD-4218-1(1970) 30, BNL-400, THIRD EDITION, VOL. 2(1970) 31, MEADOWS, J.W., NUCL, SCI. ENG. 49, 310 (1972) 32. POENITE AND R.J.ARMANIJ.NUCL.ENERGY 26,483(1972) 33. FRIESENHAHN, S.J. ET AL., GA-10194, JUNE (1970) 34, RYVES, T, B, ET AL,, NATIONAL PHYSICAL LABORATORY, ENGLAND, PRIVATE COMMUNICATION WITH W-ARD (1972) 35. MENLOVE AND W.P. POENITE, NUCL. SCI. ENG. 33,24 (1968) 36. PAIK, N.C., ET AL., WARD-XS-3845-2, JULY, 1973 37. DEVANEY, J.J., NUCL.SCI. ENG. 51,272-277(1973) 38. MOXON,M.C., AERE=R6074 (1969) AND PRIVATE COMM.(1971)

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URANIUM-238

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ENDF/B MATERIAL NG. 6262 Resonance data Resonance parameters

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ENERGY RANGE NUMBER	1
LOWER ENERGY LIMIT (EV) 1.0000E+	ē g
UPPER ENERGY LIMIT (EV) 4.0000E-	23
AUCLEAR SPIN B.DBBPE+	20
SPIN SCATTERING LENGTH (APT-2 9,18401-4)	21

RESOLVED SINGLE-LEVEL BREIT-HIGNER PARAMETERS

L VALU	E		e			
NUMBER	OF REDONANCE	S	190			
SPIN S	CATTERING LEN	GTH (A-) 8	.000PE+20			
				RESONANCE HIC	THS (EV)	
INDEX	ENERGY (EV)	J VALUE	TOTAL	NEUTRO'	RADIATION	FISSION
	6 45845-38		0.7.495-40	• BOOR 01	3 64795-83	a.092ac.au
-		5,00001-01	2,71000-02	1,500000-03	2,50202-22	0 03405-00
Ę	2,09002001	5,000000-01	3.500EE-02	8.00001-03	2.00001-02	0 00 00 0 00 00
3	5.00002.001	5,000000-01	5./100L-02	3.11001-02	2.80001-02	8,0000E+66
2	8 8740E+01	5 0000E-01		2,55000C+02	2.350000000	3.00405+10
í.	1 01546+02	S 0000C-01	0 70 305 - 02	7 100000-02	2 42295 = 02	3.00001-23
7	1 14805402	5.0000E-01	5 17705-02	3.82785-82	2 35005=02	3.00405+30
é	1 45405402	S 00005-01	3 43625-02	B 00000-34	2 350000000	3.02405.33
õ	1.49205402	5.00005-01	2 40000-02	3.40005-03	2 35005-02	3.20405+23
10	1.89685+82	9.0000F-01	1 03725-01	4 A9005-01	2 47005-02	3.00405+23
11	2.08405+02	5.00005-01	7 85005-02	5 50905-02	2 35006-02	3.000000.30
12	2.372VE 02	5.0000E-01	5.26105-02	2.91186-02	2.35086+82	**#8¢8F*22
13	2.7360E+02	5.000000-01	5.0100F-02	2.70005-02	2.3100E-02	3.0000F+22
14	2.910PE+02	5.00006-01	4.00005-02	4.6980F-02	2.31026-02	3.20 JAF+00
15	3.1120E+02	5.0000E-01	2.46005-02	1.10005-03	2.3582E-22	3.02005+38
16	3.477#E+02	5.0000E-01	1.07105-01	8.36007-02	2.3500E+02	2.28025+23
17	3.76806+02	9.0000E-01	2.47685-02	4.26805-03	2.3502E-02	2.00005+03
18	3.974#E+Ø2	5.00000-01	3.1602F-02	A. 4000F -03	2.5202E-22	2.00000002
19	4.10206+02	5.0000E-01	4.32005-02	2.06001-02	2.20285=82	A. 2000F+72
20	4.3370E+02	5.0000E-01	3.3480F-02	•.9800F-03	2.35086+02	8.290KF+20
21	4.5410E+02	5.0000E-01	2.39605-02	4.6000F-04	2.3502E=02	0.0000F+22
22	4.6280E+02	5.0000E-01	2.90005-02	5.50001-03	2.3500E-02	2.0000:+20
23	4.7830E+02	5.0000E-01	2.7300E-02	3.8000F-03	2.35086-82	P.8340E+20
24	5.183PE+02	5.0000E-01	7.6800F-02	5.16005-02	2.44:2E-02	8.88485+38
25	5.3520E+02	5.0000E-01	7.85085-02	4.70005-02	2.3508E+02	2.20085+20
26	5.5590E+22	5.0002E-01	2.43000-02	A. 20001 -04	2.3580E+02	2.00025.10
27	5.7990E+02	5.0000E-01	6.760ØE-02	4.4100F-02	2.35006-02	8.00005+20
28	5.9480E+02	5.0000E-01	1.08200-01	8.5100F-02	2.3102E-#2	9.00005+00
29	6.1980E+02	5.0000E-01	5.6500E-02	3.30000-02	2.3500E-02	A.0000E+22
30	6.2850E+02	5.0000E-01	3.0200E-22	6.7000E-03	2.3502E-02	A . 0000E + 20
31	0.6110E+02	5.0000E-01	1.6070E-01	1.3560E-01	2.5100E-02	3,00005+20
32	6,9290E+02	5.0000E-01	6.7980E-82	4.3800E-02	2.410VE-02	7,70002-08
33	7.0800E+02	5.0000E-01	4.7000E-02	2.10005-02	2.6000E+02	3,30086+38
34	7.21406+82	5.0000E-01	2.59080-02	1.20005-03	2.30000-02	1.20005-33
35	7.3250E+02	5.00006-01	2.68008-22	2.5000E-03	2.3500E+02	7.00005-20
36	7.6500E+02	5,0000E-01	3.1122E-02	7.6200E-03	2.3500E-02	0.0000E+02
37	7,7930E+02	5,02025-01	2.55000-02	2,00000-03	2.3500E-02	3,20205+23
38	7.90702+02	5.0000E-01	3. 20305-02	6,5300E-03	2.35046-02	6,2008E+28
39	6,2150E+02	5,00002-01	9, P020E-22	6.60000-02	2,40226-02	2:+39982+55
48	8.5060E .02	5.0000E-01	7.8100E-22	5.5100E-02	2,30005-32	2,20005+30
41	6.5610E+02	5,0000E-01	1,8638E-01	8.27000-02	2,36225-62	3,00002+22
42	8.6680E+02	5.0203E-01	2,9200E-02	5,70000-03	2,35088-02	7,00002+20
43	9.0450E+02	5.0000E-01	7.8800E-02	5.2000E-02	2.680KE=22	6,00405+:0
44	9,24505+82	5,0000E-01	3.7400E-02	1.39005-02	2,37828=02	2:20002:00
45	¥,3668E+Ø2	5,0000E-01	1.60200-01	1.36600-01	2,36002-02	5+000RE+56
46	9,58046+02	5.0000E~01	2.1310E-01	1.9040E-01	2.2702E-02	7,00002+00
47	9,9140E+02	5,0000E-01	4.2000E-01	3.90000-01	3.80005-02	2,0000E+20
48	1,011°E+03	5,0000E-01	2,5090E-02	1,5900E-03	2.3530E-62	0,00005+35
49	1,0229E+03	5,0000E-01	3,18002-02	8.3000E-03	2,35000=02	2,00405+20
50	1,0294E-03	5,0000E-01	2,6000E-02	2.50086-03	2,3522E•02	0.+0000E+C0
51	1,8545E+83	5,0000E-01	1.1250E-01	8.9000E-02	2,3500E-02	5,50986+39
52	1,8990E+03	5,0000E-0 <u>1</u>	3,9000E-02	1.70005-02	2.20006-02	3 • 66 8 GE + 5 9
53	1.108YE+03	5,0000E-01	5.0502E-02	2.7000E-02	2,35001-02	P,0000E+20

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54	1.1311E+23	5,2222E-01	2.6522E-22	3.26005-23	2,35246+62	1 20065-23
55	1.14045-23	9.22286-21	2.4352F-21	2.2220E-21	2.35265-22	* * 2000E * 7 ð
	1 14775441	6 22.25-21	3 22036-92	52225-03	2 33245-22	2.210070.0
		5 1000E	9 16935-02	4 33435.13	3 75 725 - 73	3.94245412
- 24	1,1/002+23	7.864EL-01	0,35000-02	C. CDCCL-02	2.3.0000000	
58	1,19+76+23	9.8070i-01	1,12526-21	8.9020E-22	2.32001202	2.25965.50
	1.21116+23	9.20025-01	3.26225-22	9.2282E-03	2.3588E=02	1,22426-24
6.0	1.24475+23	5.22025-21	3 23526-21	2.82325-21	2.35826=02	•.28285•.2
	1 344 86 - 91		4 31925-23	3 31 795 - 93	3 . 3975 . 22	9.22445+72
e 1	1,20000-003	5.660FE-01		2.21001-02	E. TODEL-DE	
÷2	1.2727E+23	9.2202E-01	5.7522E-22	5.4605-05	2.3520t+02	7.22082+20
63	1,2981E+23	5.000000-21	2.8222E-22	4,50005-03	2.3>2*€*22	*********
	1 31635-23	5 20125-81	2 75226-22	4 2020F-03	2.35246+02	7.20005+28
				4 43335 31	3 36 386 - 33	1 21425417
07	1,332/1+23	5.06001-01	2,71001-00	1.000000-03	2,30000000	100000-00
60	1,39326+03	5,02021-01	2.2552E-C1	1.06306-01	2,35241-22	
67	1.42546+03	5.00206-41	9.35222-22	7.2200E-02	2.3584E-22	2.23085+28
6.8	1.4194E+23	5.22386-01	3.25286-02	.22222 - 23	2.352PE=22	8. * 3866 * . 8
40	4 4 7 7 4 - 0 3		6 61925-73	3 91925-93	3	2.22405+22
		8 82105-24	6075-07	AU117 - 75	3 36436 433	1.24405+02
10	1.44376483	5,55C61-01	1705E UZ	1.20001-02	2.35606462	THEEDELTIN
71	1,473*E+03	5.2222E-01	1,40521-21	1.22006-01	2.35946-82	2.500E-20
72	1.52236+23	9.2202E-¢1	2.6352E-21	2.40001-01	2,35036-02	* .00 00E+30
7.3	1.53366+83	5.0888E-21	2.39225-02	4.20005-24	2 35286-82	1.30405+*8
	1 64435-013	B 0230F-21	3 75925-93	4 88885-81	3 35285-82	2.24445+22
	1,9402003		2.77661-12		2.320000-00	20405-10
75	1,50001-23	5,80001-01	2.0424L-22	- 000CL-03	2.37201-02	100005-00
76	1,597>E+23	9.2280E-21	3.78526-21	3.5500E-01	2.3528E+22	2,2340E+C3
77	1.62208+03	9.2222E-41	9.35222-22	7.0000E-02	2.3300E=02	*,20005+20
78	1.43746403	9.22425-21	7 35225-22	5.0000F-02	2 35285-42	2.000005+23
	1 444 16 - 01		01835-01	4 70005-31	3 15 345 - 42	1.03/06+23
	1.00102-00	J. DEDIC-01	1,43966-61			
8 C	1,00031-63	5,00001-01	1,17586-81	7.2000L-22	C. 300CL-02	
81	1,7294E+23	5,2200E-31	1.12226-21	8,42086-82	2.84846-82	7,38485+38
82	1.72246.83	5.28286-01	3.85226-22	1.52026-22	2.3580E+82	7,20005+20
	766/5-01		1 12205-21	25025-01	2 74075-02	4.22105+72
				4 70027 04	3 75045-03	3.344074-9
84	1,70216003	7.000000-01	0.435Et-81	B./0001-01	C. 3700L-02	C100001-20
85	1,7957E=#3	5.2202E-21	2.65226-22	3,20006-23	2.3788E-22	7,3000E+22
80	1,807¥E+03	5.000000-01	3.89865-22	1.4508E-22	2,30000-02	A,8000E+30
87	1.84576+03	5.32526-31	3.6528E-22	1.30000-02	2.3500E+02	2,20025+30
	1 84845483	5 2040F-01	3 42485-22	9 7000F-23	2 3502F-02	2.84005+78
	1,000-1-00	8 20725 - 3.		. 70005-01	2 26035-02	1.04405400
	1,0/0-0-03	5.00000-01	2.02000-02	2.70000-00	2.30000-02	
e 9	1,992 1.003	9.00FEL-01	2.3255-55	3.00000-02	2.37202-01	
91	1,9167E+23	5,0000E-01	4,84225-72	2.4902E-22	2.3>226+02	51 5898E+55
92	1,9534E+03	5,0000E-21	2.72236-62	3.70000-03	2.350000+02	7,9000E+70
93	1.96805-23	5.00226-01	6.95286-21	6.7000E-01	2.5000E+02	7.28486.72
94	1.97435+23	5.00000-01	5 23526-21	5.0002F-01	2 350MF-02	2.28485+28
	2 03305+03	8 3040E-21	3 38695-01	3 15005-01	3 35045-43	3.30.405.000
	2.02202.003	3,0000C-01	2,30900-01	2,10001-01	2,37600-02	0.0000000000
90	5'85A0F+R3	7.8000E-01	8.470KL-C2	0.10002-02	2.35602-62	N100001 - 00
•7	2,07846+83	5,0000E-0 <u>1</u>	2,6522E-02	3,30006-03	2,3380E~82	3.9000E+23
98	2,80816+83	5.0000£-01	5.P500E-02	2.70005-02	2,3>00[-02	A,3000E+22
99	2.09546+03	5.8088€-£1	4.65026-22	2.30001-02	2.35002-02	3,000000.000
192	2.123 PF + 23	5.22222-21	2 67225-22	3.22825-23	2 15226-22	2.22/25+22
	2 14455-23	5 20.405 - 41		4 20305 02	2.35050-02	1 04465-00
101			0.55241-22	P.20000-02	2.39600-02	110000L+.0
104	2.1524L+M3	9.0000L-01	2,03522-01	2.4200E-21	2.35846-92	2,3000E-73
103	<.136-E+03	5.22221-21	6,4352E-21	6.2007[=0]	2.3088E-85	7,20005+/0
184	2,22806+03	5.0220E-21	1.43501-21	1.22322-31	2.3>206-02	8.00020+20
105	2.21706+23	5.20225-21	2.75221-22	4.22025-23	2.35226-22	8.20025+28
126	2 2-145-43	8 90205-21	3 52035-03	52025-13	3 75025 - 02	4. 29/05 - 22
	1 DEARC . 33				2.32000-00	
107	29842403	5.00000-01	1.00001-01	FIOLECT-CC	2,37205-02	ALCODELACE
190	2,20/01-03	7.00001-01	2,33926-21	2.10006-01	2,35206-02	7,20002-70
129	2,281/F+03	5,82801-81	1,58522-21	1.3>00E-21	2.3>22E+62	8100486+38
110	2,3157E+03	5.3000E-01	4.4522E-22	2.1020E-02	2.35226+22	8.00465.28
111	2.33905+03	5.0222E-21	3. 32245-22	9.50005-23	2 3-22/5-42	3. 34225 . 23
	2 15285+23	5 0040F-01	7 25 125 - 22	4 70005-33	3 30205 023	3.04.05.40
111	3 356 15 - 03	8 04405 - 21	- 45-00C-02		2,30000-02	A1000000-20
113	2,33356 03	5.06000-01	0. 9001-12	0,10001-02	2,35605-02	N. 000001 . 60
11.	2.391 E+03	9.0000L-21	4.9-00E-22	2.00000-02	2,3502E-02	3,000RE+56
115	2.418°E+83	5.8800E-01	2.81005-02	4.6800E-23	2.3>80E+82	2.000CE+00
116	2.425/E+Ø3	5.2000€-01	1.56505-01	1.3500E-01	2.35005-02	a.0000F+30
117	2.44526+83	5.000CE-0	2.18505-01	1.95005-01	2 35005 .02	2.20005.30
118	2.45405+03	5.2020F-21	4 25105-22	90005-02	2 15025-02	3.00005.00
	2 48845.01		1 11805-71	A ARAA5 43	3 26025-03	9.000000000
	3 500 (5 .03		1.11900-01	0.000000000	2.37666-62	ALDOODE TOD
- 20	2 540'L+03	J.0600L-01	3./202F-05	1,-0001-02	C. 337.01 - 82	• 0000E • 20
121	C, 34/61 - 83	7.0000L-01	5./350E-21	7.3600E-01	2.35286-02	7.0000E+20
122	2,558>E+03	3,0000E-01	2,5352E-01	2.3000E-01	2.3503E-02	A.0940E.60
123	2,579¥E+Ø3	5,3000E-01	3,5350E-01	3.3008E-81	2.3000Ec22	7.080025+00
124	2,59675+03	5,00005-01	6.9352E-C1	6.7000E-01	2.35805-02	8.0000F+00
125	2 41915-23	5 00UDE-01	4 85035-92	4 50005-03	3 75975-03	1 14 445 . 44
1.74	2 434 20 44	5 3040E	3 77345-22		2.32000-02	
120	2.831.1.403	5,00002-01	2, 00000-82	3.7000E-03	2,30000-02	4 0000F+AD
12/	2.0/13-03	5.20061-01	2.03501-01	5.4KD0F-01	5.3286Fa65	3,2000E+C0
120	2.6950E+03	5.0000E-01	4,25006-02	1.9060E-22	2.3500E-02	0.000BE+30
129	2,716⊐E+Ø3	5.2200E-01	1,68502-01	1.45022-01	2.3>00E=02	2,0000E+C0
138	2,7324E+03	5.0000E-01	2.5322E-02	1.80000-03	2.3580E+22	2.98005.00
131	2.749/6+83	5.0000E-01	6.85005-02	4.50025-22	2.35205-02	8.28005.20
112	2.76165-03	5.0000F-04	4.66005-02	3.31025-02	3 14005-02	1.000000-00
	2 78645-07	B 30405-0-	3 54005-02	1 31 995 45	2,37000-02	""""""""""""""""""""""""""""""""""""""
133	21/0000000	J. 000001-01	3.300Kt-22	1.21001-02	C. 37601-02	**E0E0E+30
13	C.8834E+83	7,0008E-01	3.1>02E-02	8.00K0E-63	2.32036-02	7.80085+20
135	ć,828⊬E+03	5.0000E-01	4,12306-32	1.75005-02	2.3500€-02	7,000025+20
136	2.8641E+#3	5,0000E-01	1,98526-01	1,75005-01	2,3500€+02	7.00002+30
137	5.895545+83	5,0000E-01	5.7350E-01	5,5000E-01	2.35836-82	2.00005.20
138	2.89646+03	5.0000E-01	3.85005-62	1.50005-02	2.358HF-02	9.90005.07
1 1 0	2.01305-01	5.0000F-0+	5 45005-00	10005-02	2 14005-02	0.00.00.00
	2 06575-07	5 00000-01	45000-62		2,3/0°C-02	***********
148	6, Y77/L+D3			C.1000E-02	C. 37001-02	v.0000E+30
141	<,9658E+03	5,0000E-01	2,0000E-C2	3.3000E+03	2,358VE+02	6+9609E+56
142	2,9863E+23	5.0000E-01	2.9000E-02	5.5000[-03	2,3000E+02	*•0800E+00
143	3,00246+03	5.00000-01	1.4050E-01	1.1700E-01	2,35000-02	9,0000E+00
144	3,01516+03	5.02026-01	2.51506-02	1.6500E-03	2.350BE-02	.000000.00
145	3.02756+03	5.0000E-01	1.46506-04	1.25005-01	2.3500F-#2	A. AKNA5 • 10
146	3.04256+03	5.0000E-01	2.7000F-02	3.50005-03	2 39005-02	3.58405.30

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				RESONANCE HIC	THS (EV)	
INDEX	ENERGY (EV)	J VALUE	TOTAL	NEUTRON	RADIATION	FISSION
1	1,0220E+01	9.0000E-01	2.35g2E-g2	1.5600E-06	2.35000002	7.22406+20
2	1,95006+01	5.0020E-01	2,35016-02	1.000005-00	2.3503E-02	P. 3080E+20
3	4,5190E+01	5,0000E-01	2.3501E-62	1,00205-06	2.35000-02	2.200005+28
4	4,95002+01	5,0000E-01	2,35016-02	6.00000-07	2.35886-82	P. 3048E+28
5	6,3540E+01	5,0000E-01	2.3500E-02	5.5000E-06	2.3502E=02	2,000KE+08
6	8.3970E+01	5.000000-01	2.3506E-02	6.3000E-06	2.3500E-02	A. 6000E+CB
7	8,9190E=01	5.0000E-01	2.3592E-02	9.00000-05	4.3500E-02	0.20025+20
8	9.1000E+01	9,0000E-01	2.3506E-02	6.2000E-06	2.35286-02	8.0042E+00
9	9.3300E+01	5,00008-01	2.35056-02	5.00000 -00	2.35886-82	7.0000E+20
19	9,8200E+01	5,0000E-01	2,3508E-02	8,0000E-06	2.3500E+02	8.00002+23
11	1,11486+02	5,0000E-01	2,3518E-02	1,00002-05	2.352VE-02	0.00005+20
12	1,2160f+32	5,0000E-01	2.35065-02	6.0000E-06	2,3500E+02	P. PBURE-28
13	1,2430E+02	5.0000E-01	2,3516E-02	1.60000-05	2,3502E=02	8,000BE+30
14	1,3330E+02	5,0000E-01	2.35136-02	1,30005-05	2.3500E=A2	3.0000E+30
15	1,52406+02	5,0000E-01	2,3537E-02	3,70002-05	2.350°E=02	3,88086+28
16	1,5892E+02	5,0000E-01	2.3512E-02	1.2000E-05	2 350°E-02	7,0000E+30
17	1,7310E+02	5,0000E-01	2,35376-22	3,0000E-05	2,3000E=02	7,00002+10
18	1,964#E+02	5.0002E-01	2,35306-02	3,00006-05	2,35086<02	A.6968E+68
19	2.005°E+02	5.0000E-01	2.3540E-02	4,090ee-05	2,3502E-02	A,2000E+20
20	2,03000002	5.000000-01	2,35286-02	2.0000[-05	2,3500E-02	7,0000E+00
21	2,1500E+02	5,0000E-01	2,35416-02	4,10002-05	2.3500E+02	A,0040E+00
22	2,1880£+02	5.0000E-01	2,3530E-02	5,0000E+05	2.3500E=02	7,08¢0E+00
23	2,3990E+02	5,0000E-01	2,35506-02	5.0000E-05	2,3500Eə02	3,00006+20
24	2.42505+02	5,00000-01	2,3656E-02	1.5600E-04	2,35082=82	7,0000E+00
25	2,3390E+02	9,0000E-0 <u>1</u>	2,36808-02	1,0000E-04	2.3508E=82	8,0000E+00
26	2.5760E+12	9,0000E-01	2,3525E-02	2,50000-05	2.3508E-02	9°5698E+66
27	2,6390E+02	9.0000E-01	2.3730E-02	2,30006-04	2,3500E-02	7,00406+00
58	2,7580E+02	5,0000E-01	2.3649E-02	1,40005-04	2.35006-02	A.8040E+20
29	2,82306+02	5,0000E-01	2.36100-02	1.10002-04	2,35000-02	3,000000+00
30	2,93006+02	9,00005-01	2,3550E-02	5,00002-05	2,3500E-02	A,0000E+20
31	3,94396+92	9.0000E-01	2,3520E-02	2.0000E+05	2,3000E=02	0,00002+00
35	3,228°E+02	9,0000E-01	2.3545E-02	4,5000E-05	2.3500E=02	9.0000E+30
33	3,31302+02	5,0002E-0 <u>1</u>	2,3550E-02	9,0000E-05	2,3900E-02	9 •0000E +60
34	3,3700E+02	5,0000E-01	2.3610E-02	1.10002-04	2,3500E-02	P.0000£+00
35	3,5180E+02	5,0002E-01	2.3700E-02	2.00000-04	2,3500E-02	₩,00%0£+00
36	3,5470E+02	5,0000E-01	2,3530E-02	3,0000E-05	5,32066-05	8,0000E+38
37	3,664#E+Ø2	9.0000E-01	2,3524E-02	2.4000E-05	2,3500E-02	A.0000E+00
38	3.7370E+02	3.0000E-01	2.35406-02	4.00000-05	2.3500E-02	2 0000F+CB

186	3.9134F+03	5.2800E-01	1.1350E-
189	3,9390E+03 3,9537E+03	5.0020E-01 5.0000E-01	1,5350C- 1,3252E-

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147	3,05816-03	5.000000-01	5.55006-02	3.20005-02	2.35686-82	9.20002.+78
140	5.1080F+83	5.28086-01	2.13586-81	1.98835-01	2.3584E-82	8.28085+25
149	3,132°E+03	5,3088E-01	3.15006-02	8.00025-03	2.35236-92	8.02425+22
1.50	3,1481E+03	5.00002-01	9.8500E-02	7.5000F-82	2.32805-02	8.88487+28
151	3,1682Fo£3	5,82826-01	3.55086-02	1.20005-02	2.35885+02	2.20405+28
152	3.1770E+03	5.0022E-81	9.75025-02	7 40005-22	2 35845-02	2.30005.20
153	3,1881E+03	5.8028E-01	1.23525-01	8.0000F-82	2.3500E+02	3. 80405+00
154	3.28448+83	3.8202E-01	9.65081-22	7.30005-02	2.35826-82	2.284485+30
155	3,217#E+03	5.8808E-01	3.15006-02	6.22025-23	2.3520E+02	8.00425.02
156	3,22446+83	5.2002E-01	5.65486-02	3.32006-02	2.35836+82	3.00001+02
157	3,24816.+83	5.0000E-01	5.15000-02	2.6000F-02	2.3500E-02	2.00025+23
158	3.27201.03	5.2000E-01	3.15086-22	A.2020E-03	2.35606+02	2.00446+00
159	3.2782E+03	5.000000-01	2.58526-21	2.35886-01	2.35805-82	2.00445+28
168	3,2952E+03	5,000005-01	3.15288-22	A.0220E-23	2.3082E-#2	2.28485+22
181	3.31836+83	5.0000E-01	1.46525+21	1.23025-01	2.35885-82	2.80885+28
162	3,3204E+03	5,0202E-01	1.2652E-21	1.0300E-01	2.3502E+02	2.80085+28
163	3,332YE+03	5,0000E-01	9,3508E-22	7.20025-22	2.3568E-02	2.00000-00
164	3.3540E=03	5.0002E-01	1.3152E-21	1.2800E-41	2.3522E-02	×.9660E+23
165	3,3683E+03	5,0000E-01	3.80g2E-02	4500E-02	2.3500E-02	3 BEARE . 68
166	3.427¥E+65	9.0020E-01	2,1350E-01	1,98886-81	2,350°E-02	A, 80865+00
167	3,4 <u>1</u> 7/E+Ø3	5,0000E-01	2.76288-22	A.1000E-03	2,3500E-02	2.20485+38
168	3,4353E+03	5,00008-01	3,7350E-01	3,50000-01	2,350000-02	2.26265+65
169	3,4563E•#3	5.00020-01	5,23526-01	5.00006-01	2,35828-22	3,80306+23
170	3,484JE+Ø3	9,000000-01	1,28522-01	1,0500E-01	2,35021-02	6,86966+56
171	3,4933E+03	5,0000E-01	3,2900E-02	9.4000E-03	2.300×E-02	3,22625+28
172	3,5264E+03	5,0000E-01	2.8500E-22	5.000PE-03	2.3008E-02	5'656RE+56
175	3,560>E+03	9,0002F-01	2.4350E-01	2.20006-31	2.3520E-02	7.00d2E+00
174	3.572/E+03	9.0000E-01	3.5350E-31	3.30086-01	2,350805=62	2+26995+56
175	3,5933E+03	9.2002E-01	6.35g2E-g2	▲.00022-02	2,3500E-¥2	0125555+56
176	3.6210E+23	5,0000E-01	4,35g0E-g2	2.00005-02	2.35£2E-Ø2	2,2338E+36
177	3,62836+83	5,800BE-01	4,4350E- <u>0</u> 1	4,2000[-01	2,35025-02	A 2808E+30
178	3,6710E+03	5,000225-01	3,1400E-02	7.9000E-03	2.3500E+02	9.559962+58
179	3,69201+83	5.0000E-01	3.4350E-01	3.2000E-01	2.3520E • 62	5.666BE+30
180	3.71572.003	5.28281-01	1.03586-61	8.00006-02	2.3582E-92	9.8898E+66
181	3,73726403	5.00006-01	2,1850E-01	1.95022-21	2,35805082	4 . 66 8 5 E + 5 B
182	3,7830E+63	9.00001-01	9.5520E-C2	7.20006+02	2.3500E-02	1 1 80 4 E + 6 0
183	3.78001.003	5.2202E-01	3.73522-01	3,50000-01	2,35221-62	A 2002E+20
164	3.83031.003	5.0000E-01	3,4500E-02	1.10002-02	2,358KE+65	3 6696E+58
182	3,870"L+83	5,00001-0 <u>1</u>	5,1850E-01	4.9500E-01	2,3500E=02	4,0000E+02
167	3 001 15-03	5.00021-01 6.00001-31	1. V350E-21	1.7000E-01	5.3265F-05	7.00025+20
100	3 04345403	5.0000L-01	2.93501-21	2.70001-21	2.30000-02	**************************************
100	1 02046 + 03	7.0000E-01	1.10001-01	A.02005-25	2.33201-02	NICCONF.65
407	3,73701403	7.00000L-01	1,00001-01	1.36601-61	2,37641-62	10000E+28
148	3,99371463	2.00001-01	1.34586-81	1.04085-01	2.3760L-62	NIDEORE+OF

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1,5590E+03 1,3790E+03	1 59592-03	1.54805-03	1,53505+03	1.52705483	1.51000+03	1.5050E+03	1,48765403	1,44702+93	- 4230E - 83	1,41685-83	1,30902-03	1 38602+03	1.36002+03	1,3250E+03	1,31205	1 99%5-03	1.04545+63	1,26305403	1.26002+03	1,2510E-03	1.23306-03	1 31001-024	1,2010E+03	1 10502+01	1 15906 +83	1.15506.03	1,11905-03	1,10306+03	1.09406-03	1,00106+03	1,07402+03	1.07106+03	1.04807+03		1.03106-03	1.00406-03	9.856BE+02	9.76802-02	9,62302.02	9,43102-82	9,3230E+b2	20-34560	A 08485-82	6,60202-02	8,4698E+82	8,32406+82	0.0000E-02	7.87402-02	7 54806-82	7.43296.02	7.34882482	7,29406+82	7 13906+02	0.9750E-02	6.8820E+92	6 B110E-02	0,07092402	6.3250E-92	6.2489E+92	6.1478E+82	5,84792-82	5 59545-92	5,42386-92	5.23206.02			4,64886+92	A. 4848E-82	4.3970E+#2	4,13592-82	4.97602+02	4.9859546462	
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19-30900 19-30900	00000-01	0000E-01	ta-309.00	10-30000 To	999965-91 99966-91	000025-01	0000E-01		0000E-01	00000E-01	00002-01	Te-30490	20020-101	000000-01	10-30900	0000E-01		10-10-00	00005-01	16-33000	09966-91			10-30080	2802E-91	20036-01		00001-01	00002-01	00000-31	0000E-41	60000-01	00000-01		0000E-41	80086-01	3000E-01	50305-31 10-10000		16-32339	19-3660	19-30200	10-30200	10-10-00-00-00-00-00-00-00-00-00-00-00-0	10-30405	10-30080	88888E-81	00000-01	06-986-91	10-33050	99996-91 19-36696	10-3396	10-38008	20406-01 20006-01	10-3000	10-389.00	101-101-00 101-101-00	00002-01	10-30406	10-30460 10-30460	19-1005-01	16-30+05	10-3496	00000E-01			10-30400	0040E-01	18-3888	10-3690 10-3690	0000E-01	19-300m0 113000	
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4/80E-82 3688E-82	1050E-02	3570E-02	41005-02	46886-82	41005-02	11005-02	39500-02	20-3000-02	36005-02	1500E-02	36885-82	41896-02	14000-02	37002-02	38882-82	38000-02	39385-82		37002-02	4402E-22	41025-02	40000-02	34901-02	3700E-02	4308E-02	43885-82	17195-92	2005-02	19995-22	1588E-82	12005-22	37846-32	45085-82		A	37186-62	38925-02	13496-02	20-201-02	42202-02	37886-62	47020-02	42305-02	36502-22	43882-32	36602-22	33225-62	30002-22	30502-32	306025-02	30502-02	1500E-02	37502-22	37482-82 41887-82	28-38661	35686-82	43885-82	36686-02	43886-02	30400102	30285-02	35985-82	36685-82	37782-82	36286182	30202-02	36882-02	35605-02	39196-92	201305-02	36882-00	35486-67	
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00086-04	5988E-84	50-30000 50-300000	00022-04	10005-03		00000-04	100000	00000-04	0000E-94	00000E+03	000000-04	00005-04			00002-04	2000E-04	00000104		2200E-04	00000-04	02005-04			-0-38800	000005-04	29998F-84	36697-84		30000-03	BR00E-03	02002-04	000025-04	00005-23		00000	10022-04	9698E-34	22020-04		00002-24	00000-24	20005-03	30000-34		DODDE-04	6000E-04			50000-04	20002-24		0000E-03	50000-04		00000-25	50-30000	1000F - 04	8008E-04	00000-04	40000104		58-30996	63000-04	70006-04	299985-94	200001-04	90906-04	50-39008	100001124		00002-04	505-1-205 2020 2020 2020 2020 2020 2020 2020	1100T 05
~	S N	NN	N.	<u>.</u>	N. N	-	2	<u>م</u> ب	e.			N	N :	<u>م</u> د	N,	N	<u>.</u>	••	<u>،</u> د	~	N	N. 1	v	Ņ	10	N	N.	'n	Ň	N	Ņ	N	N	•:	. n	N	N	~:	<u>.</u>	N	~	~!	N .	-	•••	N	N	v p	N	•	N.N	Ņ	<u>.</u>	N N	-	N	N 1	, N	•	<u>.</u>		, n.	e.)	N	N,	•••	N	N	N.:	<u>م</u> د	N,	<u>.</u>	ა
35005-02	35025-02	330000002	35005-02	31966-82	15865-82 2001-2085	35800-02	35005-02	35005-02	20053005E	350000000	35066-02	3-000-02	35000000	1005-02	35025-02	35025-02	35202=02	34085-42	35201 -02	2005-02	3502E=82	3502E=02		32005-02	35285-22	35005-02	35025-02	30000000	39655955	3-005-02	32995-65	35295-82	39995-92	3502E+82	33806-02	32695-35	35202-02	3356-52	3200000000	33000-42	35095-02	29-306-62	3500000000	3100E-02	35000-22	35002-02	35892-82	35666-62	3300E=02	35000-02	330000002	35050-02	32055-02	35066-02	35666+82	290530055	350000000000000000000000000000000000000	35000-02	35006-02	32025+02		33855-82	350 dE=02	35000-02	35000102	330000000000000000000000000000000000000	20-3005	35695-82	35000-02	32005-02	39866-02	35005+92	
5	-		3	9	•	-	5	9.9	2	2	a sa	2	39.5		1.1	62	5			2	5	9			2	9	2		2	<u>,</u>	2	2		5		2	2	<u>.</u>	9	3	3	de l		2	-	2	2	12		2	93	2	2	-	9	5			3	-	•		9		2	• •		2	•		2		
000000000000000000000000000000000000000	1848E+87	0260E+30	0002E+30	00485+02	000000000000000000000000000000000000000	00:00:+30	00436400	00407+20 00-13000	80+30P00	80-300-00	99495+99 99495+99	0000E+00	8648E+98	00+300000	33438098	00+30400	9949E+23	00000000000000000000000000000000000000	00-00-00 03-38000	20405+20	00-36-00	09465-00		95495+19 76495+19	29955E+25	0 3+30 00 B	000000000000000000000000000000000000000	9649F + 29	02+30002	92+39990	00-30-50	8998E+28	25-30090	20000E+20	8004147478	20000-00	20+37020	20025-28	30-125-56 33-53700	60000-20	03-00 - 20	96+36068	09432+29	0210F+30	86+38 <u>6</u> 688	9049E+09	00406+28	8849F+98	03+389.00	22+30700	0040F+20	00-50000	69496+39	2040E+22	86+38P38	88496+98	004EE+00	014100-100	04 - 30 P & 30	40+38766	00-10-00 00-10-00	024300-50	00+33990	94+38986	9949E+90	000000000000000000000000000000000000000		00+34064	00-30000		00-30-90	000000-00	JUNUL + DE

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132	1,59108*03	5.00002-01	2.5:22E-22	1.60000-03	2.3520E=d2	1,0000E+20
135	1.014-1.03	5,22PGE-01	2.3900E-62	4.00085-24	2.3500E-02	1 . 88285 . 65
134	1,646#F#23	5.00000-01	2.3598E-82	1.00026-04	2,3528E•82	2,00206+28
13	1.673°E+83	5,2000E-0 <u>1</u>	2.3700E-02	2.00006-04	2,3502E+02	2,30005+27
130	1,6820E+03	5.080000-01	2.3922E-22	1.72282-04	2,350dE-02	2,28485+28
137	1,69606-83	5.2020E-01	2.4000E-02	5.6200E-04	2.3500E-02	2,8008E+P8
136	1,7190E+03	5,00000-01	2.4128E-82	6.2200E-24	2.35886=82	2.0000E+22
139	1.729#E+03	5.22687-01	2.36226-22	1.0000E-04	2.358BE=#2	8.26491+22
140	1,73682+#3	5,02008-01	2.37026-02	2.000000-24	2.35286+82	3.28485.23
141	1,745#E+#3	5.22021-01	2.55028-02	2.00001-03	2.3508E-02	1.20205+20
142	1.7664E+03	5.00005-01	2 42021-02	5.00005-04	2 35886-82	8.80J0E+08
1.1	1 77546-91	5 20225.24	2 45075-00	4 97295-03	2 3-025-02	2 22/05 . 10
	834 5 403		2, 40,000 -22	5 24325 24	2,396-65-62	
	80046401	5 3 3 4 0 C - 0 1	2	7. (U/ C L - L - L - L - L - L - L - L - L - L	2,37646442	3 38/85-03
	1 81446-04	5 24/25-24	2,	14246 24	2.326-62	7 72 / 0 - 1 7
	1,03-01-03		2, 3262 22	A	2.35202-62	
14/	1.03301-63	5.22022-01	2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2	2.26662	2.3764222	
140	1.86866+63	5,2KK2E-K1	2.5-22L-22	.8882F-83	2.3524E=82	
149	1,89306+63	5.00001-01	2,54281-22	1,9868E-23	2.30201-82	
154	1,91301+03	2.28565-51	2,8528E-22	5,20005-03	2,35826-82	5 . 96 95E + 65
151	1,92506+83	5,3222E-0 <u>1</u>	2.51001-02	1.60826-83	2.3502E-02	2,26<85,38
152	1,9330E+B3	5.0 <i>°°</i> 00E-81	2.36226-02	1.6669E-64	2,35225+22	- 26985+35
153	1.942¢F+03	5,20222-21	2,4522£-22	1.02906-03	2.3:02E-82	5.55956+55
154	1,9840E+83	5.20PRE-01	2.43K9E-22	e.0233E-24	2.3>24E+22	2.2802 +72
155	1,992¢E+B3	5.00702-01	2.47228-82	1.20206-03	2.35808-22	2,26955+15
150	2,02046+63	5,22026-01	2.42026-02	5,32222-24	2.30845082	20225 8
157	2,04046+03	5,20002-01	2.55226-22	2.26885-63	2 30246=02	2,20082.52
158	2.0512F • 03	5.2228E-01	2.51221-22	1.6282E-23	2.3582E=22	2,22282+22
159	2.2536E+23	5.20005-01	2.3988F - 22	4.68286-24	2.3082E #82	1.28685+72
160	2.38026+23	. 22022-01	2.58225-02	2.38825-23	2.3024E-22	2,26665+22
161	2.12305+83	5.22005-01	2.63025-02	2. AK22F -73	2.3-20E+02	7.20405 . 9
62	2.11406.2	5.02005-21	2.470.27-02	1 28225 21	2.35226-22	2.22225
163	2. 7205+01	5.22005-01	2.57200	2.22225-23	2.30225+00	226-5+22
144	2 142/5-04	5 30205.21	5 44095-00	0 00000 04	3 35025 12	3 39205 . 3
145	2 23725403	5,000000-01 5 38200-01	2 10705-02	4 70000-04	2,30000-02	3.34446470
	2 20525-03	5.00000-01	2.37/02-02	A 52000 01	0 16025-000	a 22 Agra - 2
100	2,29000-003	5,50000-01	2.00201-02	·	2.33600-62	C.C.C.C.C C
10/	2.30-00-03	5.000rt-01	2.1201-02	0,26062-64	2.33000-02	**************************************
100	2.32/01-03	5.00000-01	2.4302E-22	6.06565+64	2.35866-82	
169	2,30041.463	5.00C0L-01	2.7500E-32	A, EKEKL-KJ	2,352KF+FS	2.55055.55
176	2,38561+85	5.00000-01	2,45286-22	E.BEE-E.S	2.3502E+82	7,28¢8E+28
171	2,39051483	5,20221-01	2.7202E-22	3.7000E-03	2,35261.022	5'5506E+55
174	2,48246.83	5,20001-01	2,7202E-22	3.7000E-03	2,35651-62	- 28072+28
173	2.41846+03	5.2000E-01	2.45006-02	1.00000-03	2.352VE ##2	2.55965+56
174	2,43605+03	5.0000E-01	2,4500E-02	1.00000-03	2.3502E-02	*.8848E •72
175	2,5200E+23	5.0000E-01	2.6680[-22	3.10000-03	2.308KE-82	*,20406+00
175	2,52602+23	5.0003E-01	2,45g8E-22	1.00000-23	2,3500E+02	2,28,66,58
177	2,62605.003	5.0000E-01	2,6100E-02	2.60000-03	2.35826-32	5.5678E+58
178	2.61905-03	5.8828E-21	2.61228-22	2.62005-03	2.35026-02	5.5698E+56
179	2,6356E+@3	5.0000E-01	2.61g8E-02	2,60000-23	2.3520E-02	2.86085+38
189	2.6480E+23	5.80002-21	2.43286-82	8.22802-24	2.3522E=#2	5+5556E+55
181	2.6582E+Ø3	5.0000E-01	2,72025-62	3,50002-03	2.3522E-02	1.220BE+20
182	2,68106+03	5.20000-01	2.5620E-02	2.10205-23	2.3500L+02	5-9609E+55
183	2,72106+83	5.0000L-01	2.5528E-82	5.56005-03	2,35241-92	6 1 B B B B E + 7 3
184	2,7740E+03	5,00001-01	2.5500E-02	2.00000-03	2.308622	A'SOOKE-OR
185	2,7980E+03	5.0000E-01	2.9500E-02	6,0°00E-03	2.350°E-02	
186	2,8110E+03	5.3000E-01	2.9500E-02	6.0000E-03	2,35006-92	5.60055+56
187	2,84506+03	5,2200E-01	2.5600E-02	2.1000E-03	2,3502E-02	7.282BE+66
188	2,9070E+03	5.0000E-01	2.3900E-02	4.0000E-04	2,3500C-02	2.0643E•27
189	2,9180E+03	5.0000E-01	2,9500E-C	6,00002-03	2,3500E+22	A.0240E+20
108	2,92305.03	9,0000E-01	3,1502E-C'	8,0007E-03	2,3500E-02	2+200025+20
191	2,94502+03	5,00002-01	2,5700E-03	2.2002E-03	2.350°E.+02	7,2848E+28
192	3,07305+03	5,00002-01	2.46000-02	1,10000-03	2.35000-32	7,00005+20
193	3,0810E+03	5.0000E-01	2.57081-02	2.2000E-03	2.35086=02	2.00406+33
194	3.89805+83	5.0000E-01	2.7500E-02	4.0000E-03	2.3580E=82	8.0000E+20
195	3,2370E+83	5,000000-01	2.52005-02	1.50025-03	2.35000+02	8.00000.003
195	3.26508+03	5 0002E-01	3.15026+32	A.0000F-03	2.35025-02	0.00005+00
197	3.34046+03	5.0000E-01	2.95005-02	6.2000F-03	2.35288-42	2.20005+20
198	3.34705+23	5.0000E-01	2.64005-02	2.98001-03	2.3500E-02	2.20005+00
100	3 36605+03	5.00005-01	2 46005-02	1 10005-03	2 35205=02	2.20425.10
200	3.37706-03	8.00005-01	1 05445-42	1 0U001-01	2 35075=02	0.00005-30
201	3 30005-03	5 0000C-01	3.1.2000-02	1 0000C-03	2 34845-43	0.00 AAC+00
202	3 470/11.01	5.00000-01	3 47085-82	1 20000L-03	2 33005-02	5.00000L+00
2023	3 63746-03	5.00000 - C1	2, 47000-02	1,20001-03	2,33200-02	7 000000-00
203	3,30/21-03 3 5/04F-03	5,0000C+01 B 0000C+01	2.03001-02	2,00001+03	2,37000-02	A 4030517.0
205	5 5410C-07	5 00-10C-01	<	3.00001-03	2.330000-02	* # # # # # # # # # # # # # # # # # # #
202	3 54405403	5.0000L-01	2 47005-02	1.20002-03	2 38005-03	8.00J0C+00
202	3 44005-03	5 0000C+01	217/601762	1,20000-03	2,30000002	**************************************
201	3 44105-03		2,0000E-02	3,0000E-03	2,37001-02	- 00000L-00
200	2 47000 - 03		2.07001-02	1.00001-03	2,3900L-02	8,00000L*88
207	3 48 10C .07	2.0000L-01	3,2700L-02	9.0000L+03	6.3300C-02	A AQUAR
410	3 44005.03	5,0000t-01	2.0700L-02	3.00001-03	2.370°L=02	- , 0000E+70
411	3 40145.07	5,0000L-01	2,03001402	3.00005E=03	2.3900L-02	
212	3 742ME-07	,0000t-01	2. 9001-02	- DDDDL-E3	2,33002-02	0 00 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
214	3 70005-07	2.0000C-01	2 45005-02	3 000000-00	2,3900L-02 2 350PC-02	
217	3 00705-07		2.02001-02		C.JJD-L-62	C. 00005.700
217	1 00/01 01 003		2.77001-02	5.00001-03	2,37002702	* # # # # # # # # # # # # # # # # # # #
210	3,020PE003	5,0000C-01	5.92801-82	0,0000E=03	2.37201-02	010000E-00
41 /	3 00000 003	5,000000-0 <u>1</u> 8 00000-0-	3,7500E-02	1,20001-02	2.37002602	* 10000L*/0
<10 0.10	3.920PL#03	2 0000L-01	1.43501-01	1,20001-01	C. 3760L 02	
217	3 00005403		2.00002-02	3,0000L-03	2,37692982	00000LT00
220	9'AAMmF403	2.000005-01	5.0700L+02	5,00006-03	C. 370-L-02	**********

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U ^I TSOTOPI	RANIUM-238		UM=238	RESONAN Resonance	ENOF/8 MATER Ce data Parameters	(AL NO, 6262
PRACTI	ONAL ABUNDANCE Of Energy Ran	GES 1.00	00E-00 2			
ENERGY LOWER 1 UPPER 1 NUCLEAT OFFECT NUMBER	RANGE NUMBER- ENERGY LIMIT (ENERGY LIMIT (Spin ive scattering of L States	EV) 4.00 EV) 4.50 RADIUS-9 9.18	2 UNR 00E+03 00E+04 00E+00 40E-01 2	ESOLVED SINCL	E-LEVEL BREIT	-MIGNER PARAMETERS
L VALUE NUMBER	DF J STATES		Ø 1			
			DEGREES OF	FREEDCH USED	IN THE WIDTH	UISTRIBUTION
		J-VALUE 5.0023E-31	COMPETITIVE P.0000E+00	NEUTRON 1,8000E+80	RADIATION 0.0000E+00	F15510N 0.00005+00
			AVE	RAGE RESONANCE	E WIDTHS (EV)	
INDEX 12 34 56 78 910 11	ENERGY (EV) + 02006+03 + 50706+03 5 5006+03 5 5006+03 1 50006+03 1 50006+03 1 20006+04 1 50006+04 2 50006+04 2 50006+04	LEVEL SPACING 2.280026.01 1.99596.01 1.99596.01 1.99206.01 1.98006.01 1.98006.01 1.97106.01 1.96106.01 1.9466.01 1.9446.01 1.9446.01	COMPETITIVE 0.03002.000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000 0.00006.0000000000	NEUTRON 2,1000E-23 2,0074E-03 2,0016E-03 2,0014E-03 2,0014E-03 2,0052E-03 2,0695E-03 2,0695E-03 2,0695E-03 2,0695E-03 2,0695E-03 2,0695E-03 2,0612E-03	RADIATION 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02 2.3508E-02	FISSION 0.2030E-20 0.2020E-200 0.2020E
12 13 14 15	3,50726+04 4,90826+04 4,50906+04	1.87202+01 1.87202+01 1.87502+01 1.85902+01	8,90905+90 8,90905+90 9,00905+90	2,09441-03 1,9866E-03 1,9687E+03 1,9519E=03	5.3200E-05 5.3200E-05 5.3200E-05 5.3200E-05	0.4020E+00 0.4020E+00 0.4020E+00
L VALUE NUMBER	DF j STATES		1 2			
			DEGREES OF	FREEDCH USED	IN THE WIDTH	DISTRIBUTION
		J-VALUE 5.00000=01	COMPETITIVE 0.0300E+00	NEUTRON 1,0000E+00	RADIATION 0.0000E+00	FISSION 2.2022E+00
			AVE	AGE RESONANCE	WIDTHS (EV)	
INDEX 1 2 3 4 5 6 7 8 9 10 11 12 13	ENERGY (EY) 4. Suprate+83 4. Suprate+83 5. Suprate+83 6. Suprate+83 6. Suprate+83 8. Suprate+84 1. Suprate+84 1. Suprate+84 1. Suprate+84 2. Suprate+84 2. Suprate+84 3. S	LEVEL SPACING 2.0002-01 1.9905-01 1.9905-01 1.9005-01 1.9005-01 1.9005-01 1.9005-01 1.9005-01 1.9405-01 1.9405-01 1.9405-01 1.9205-01 1.9005-01 1.9005-01 1.9005-01	COMPET 17 IVE P. 2202 - 20 P. 2402 - 20 P. 2402 - 20 P. 2002 - 20 P. 2005 - 20 P	NEUTRON 3.02696-03 3.14072-03 3.2424E-03 3.2473E-03 2.9739E-03 3.02072-03 3.02072-03 3.0204E-03 2.9362E-03 2.9362E-03 2.9362E-03 2.9351E-03 2.9951E-03	RA01ATION 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02 235086-02	F15510N C.0030F+00 0.4200F+00 P.0030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00 0.4030F+00
12 13 14 15	3,00082+04 3,50082+04 4,00002+04 4,50002+04	1.9090L~01 1.8920E+01 1.8750E+01 1.8590E+01	0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00	2,8398E-43 2,7951E-03 2,8279E-03 2,9299E-03	2.3500E-02 2.3500E-02 2.3500E-02 2.3500E-02 2.3500E-02	6.48965+66 6.48365+66 6.48365+66 6.48365+66 6.48365+66 6.48365+66 6.48365+66

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02+30-00-3	20-35845.0	23 3 2223	00-10000.5	10+32100-1	20+30802.7
04+30200'0	2135006-65	1,76135-23	00+30000'0	16+39594.1	\$0+300AG'9
80+3828p'2	2,5588-02	E2-35282'T	00•300A9.0	10+35600.1	\$ 0+300a5'S
94+38586.5	2.35885-62	1'1305E-63	20+34002*0	1,9972E+01	- 0+ 300AC +
0"+30202'3	20-32052.5	1,0622E-23	66+39666.9	10+35968'1	FØ+30000'+
NOISSI	NJITAIGAR	NORTUBN	SVITIT39M03	TEAET SAVELAS	(AB) ANKENS
	(A3) SHIGI4	AGE RESONANCE	93VA		
66+36262.5	80+30465-6	12+30365.2	58+30500°s	88+3838c'T	
NOISSIA	NOILVIOVH	NEWTHDA	34111134H03	30194=0	
501108181510	HITCH THE NI	13sn настани	10 SJ38030		

03+30636.6	5.35806-02	£9-36999°T	66+36698.9	10+36820'1	•Ø•38885'+	57
2.48205+20	2° 3200E-05	1°2256E-63	00-30000.0	1.02965+81	*0+38400'*	¥1
66+30504.0	5°3206F-05	1,53496-23	06+30000.0	10+30620'l	3. 50885+84	51
8'98366+65	26-39045-52	23-3+655 T	00+30009°0	16+358+6*1	\$0+30000 S	15
83+38280'8	5.3500E-62	1 94175-23	80•30000°0	10+39/50.1	5'20686+0+	17
69-36566.53	21-3005-55	1101246-53	00-33000'0	18+35/98'1	2* BOUGE+64	đ٦
85+38580.5	24-3986-62	1,69926-23	00+30000'a	10+36940'3	*Ø+39885'T	6
84+38584.5	20-39965-85	24-34546-63	00+30000'0	12+3+290'1	*0+388AZ'T	8
05+30646.9	29-30045.5	1,70226-23	00+30000.0	18+35784,1	*Ø+30000'T	4
66+30684.9	20-30065'2	23-31515'1	00+30000'O	10+35690'T	FØ+38805'9	9
02+30-00-0	2.35006-02	1.63316-63	00+30000'0	10+3/160.1	50+30895'4	5
0*+30202*0	213-3006512	1,76135-83	00+30000'0	18+36268'1	50+30006'9	
30+38280'2	2,5588-02	E2-35284'T	00.30049.0	10+35660 1	\$0+300a4'5	2
8.48285.48	2.35085-62	1 1205E-63	20+30002°0	1,89725+01	* 0 + 300AS +	Š
8"+38282'3	20-32092-05	1,0622E-23	68+33686.9	10+35868'1	FØ+30490 *	ĩ
N015513	NJITAIGAR	NONTURN	COMPETITIVE	TEAER SHACING	(43) ANEBN3	X 3 ÛN Î

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NEUTRON CROSS SECTIONS					
INDEX.	ENERGY CRUSS SECTION	ENERGY CROSS SECTION	ENERGY CHOSS SECTION	I ENERGY CROSS SECTION	ENERGY CROSS SECTION
	LV 444NG	EV BARNS	EV BARNS	EV GARNS	EV BARNS
1	1,000002-05 0,00002+00	8.507CE+03 0.0070E+00	1,00000404 8,76026+25	2.0000E+04 8.7068E+05	3,0000E+04 8,7000E+05
	1,0000E+94 4,0000E+05	5.0004E+04 4.2048E-05	6,0000E+04 4.0200F-05	7.0000E+C4 4.0000E-05	8.0000L+04 4.0000E-05
11	V. DDDDE+D4 4.9000E-05	1,00006405 4,00006-05	3,000%6+05 7,00005-05	4.000000-05 1.22200-04	5.0000E+05 2.3400E-04
10	5,7500E+05 5,6600E-04	6.10PPE+05 1.2400E-03	7.0000E+25 1,3400E-03	7.5000E+05 1.9650F+03	8.00001+05 3.1160F=03
21	8,50005+05 5,87102-03	8,90002-05 8,71602-03	9,2000E.00 1.2785E-02	9.500000+05 1.63020+02	9.70005+05 1.40935+02
20	1,00005+06 1,61705+02	1,0502E+06 1,8119E-02	1,1000E+06 2,3500F-02	1.15005+26 3.48925-62	1.20005+04 4.04915-02
31	1,25006+06 4,25996-02	1,30006+06 5,77256-02	1.35000.00 9.32895-02	1.40806+06 1.51235+01	1.4502F+0A 2.2857F=01
36	1,500000+06 2,93871-01	1.600000+06 3.82280-01	1.70025+06 4.36935-01	1.80305+24 4.81445+01	1.9000E+04 E 1340C-01
41	2,00002.006 5,35082-01	2,10205 +06 5,45195-01	2.5000F+66 5.5480F-81	2.75005+04 5.49805=01	3.2002F+04 8 4100F-21
40	3,10002+06 5,41261-01	3,50000+06 5,54830-01	4.00000+00 5.65800-01	4.50000-004 5.63365-01	3.00000+04 B 54445-01
51	5,200%c+06 5,5955E+01	5.40000+00 5.62615-01	5.50000+06 5.65510-01	5 80005+04 4 0 1545-01	
56	6,2000E+06 7,2316L-01	6.50000+06 8.35+70-01	5.8000C+06 H.9700C=21	7 00005+04 9 30005-01	3 30005+04 5 83005-01
61	7,5000E+06 9,7800E+01	8.000000+006 9.90000-01	A. 25001+06 9 94005-01	A 50025+04 1 20305400	7,2000C+06 4,3700E+01
66	9,0000E-06 9,9200E-01	9.25205+06 9.87705-01	9.50000-00 9.80000-01	9 75335-0- 9 77905-01	5./7002+06 9.9/002+01
71	1.05000007 9.78000-01	1.10000.007 9 8.000-01	1.15000-07 9 87000-01	1 20075-03 0 05005-01	1,00000007 9,74000001
70	1.3000E+07 1.0480E+00	1.35005+07 1 00005+00	1.40000407 1 14000400	1.666666467 4.436666-01	1.250 1.07 1.01900.000
81	1.550-2.07 1.29925+00	1.4000-407 4 3:37-400	1.45000407 1 3405400	1,73000-07 1,21000-00	1.34101-07 1.23992-00
86	1.8400E+67 1.3237F+00	1 85005+07 4 30005+00	1 00000107 1 00700400	1./DERL=0/ 1.J=J81-00	1,/2001-07 1,33381+86
•		1199005-01 1198505-00	114005540/ 1.29/05400	1,42005+0/ 1:3/485+00	2,00001+07 1,43501+00

INTERPOLATION LAW BETWEEN ENERGIES Range deschiption 1 to 90 y Linear in X

REACTION & VALUE 1,9488E+38 EV

URAPIUM-236

FISSION NEUTRON CROSS SECTION

ENDEVB MATERIAL NO. 6262





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- 239 -

REFERENCES FOR EXPERIMENTAL DATA

³³⁸U(n,f)

<u>Yr.</u>	Lab	Author	References
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63	CCP	Pankratov	At. En. <u>14</u> , 177 (1963)
61	KYU	Katase	Priv. Comm. (1961)
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57	LAS	Smith, et al.	Bull. Am. Phys. Soc. <u>2</u> , 196 (1957)
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57	HAR	Allen, et al.	Proc. Phys. Soc./A <u>70</u> , 573 (1957)
56	ORL	Lamphere	Phys. Rev. <u>104</u> , 1654 (1956)
5 6	SAC	Ballini, et al.	Priv. Comm. Netter (1956)
56	HAR	Uttley, et al.	AERE NP/R-1996 (1956)

ENDF/B MATERIAL NO. 6262

(N,GAMMA) Veutron Cross Section

URAN: 1 UM-238

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REACTION Q VALUE 4.0044E+06 EV

SECTION CROSS ENERGY × IN LN RANGE DESCRIPTION 214 to 263 LN Y LINEAR CROSS SECTION 1.1300E-01 1.1200E-01 BARNS 1,10095+06 ENERGY SS SECTION BARNS EV CROSS × DESCRIPTION Y LINEAR IN 3 CROSS SECTION RANSE 166 To 214 ENERGY BETHEEN ENERGIES INTERPOLATION LAW BETWEEN ENERGIES Range description 1 to 186 Ln y Linear in Ln x HEUTAON CASSS STOTIONS INTER'N CASSS STOTIONS INTER'N CASSS STOTIONS EEV CASSS STOTIONS STOTIONS

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	2,20006+06 4,30006-02 5,20006+06 8,37086-02 1,00006+07 2,00706-03
	2.80005.06 5.10205-02 4.80085-06 1.33005-02 9.00085-03 2.49085-03
	1.80046+00 6.00006-02 3.00006+00 1.05006-02 0.00006+00 3.170001-02 2.000006+07 4.70106-04
	1.59885+86 8.00885-82 1.59885=86 8.00885-82 7.88885=86 4.14885-82 7.48885=86 4.14885-83 1.48985=87 1.08885-83
·	1,40006.000 8,75006-02 2,50006-02 6,20006-00 9,48006-02 1,20006-07 1,37006-03 1,20006-07
	8008 5415 5515 5515 5515 5515 5515 5515 551


REFERENCES FOR EXPERIMENTAL DATA

²³⁸U(n,Y)

<u>Yr.</u>	<u>Lab</u>	<u>Author</u>	References
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б 0	LAS	Diven, et al.	Phys. R.v. <u>120</u> , 556 (1960)
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45	CAV	Broda, et al.	BR-574 (1945)

93-NP-237 ANCILASL EVAL-JUN73 J.R.SMITH (ANC), W.E.STEIN (LASL) DIST-MAY74 P.C. TO NORMALIZATION AND STANDARDS SUBCOMMITTEE MARCH 1974 PERTINENT HOLLORITH FROM GENERAL FILE FOLLOWS (MAT 1263) ALL REFERENCES CARRIED OVER FROM GENERAL FILE 237-NEPTUNIUM EVALUATED JUNE 1973 BY J.H. SMITH (AFROJET NUCLEAR CO) AND W.E.STEIN (LDS ALAMOS) THE BASIC CHANGES FROM THE VERSION III EVALUATION ARE: 1. A NEW FISSION EVALUATION BY W.E.STEIN, FROM 40 KEV TO 20 MEV. 2. NEW RESONANCE PARAMETERS, BOTH RESOLVED AND UNRESOLVED 3. REVISED CAPTURE CROSS SECTIONS. 4. RENORMALIZED (N,2N)AND (N,3N) DATA. 5. READJUSTMENT OF THE INELASTIC CROSS SECTIONS TO ACCOMMODATE THE ABOVE CHANGES. FILES I, IV, AND V AND THE LOW ENERGY POINTWISE DATA IN FILE III ARE UNCHANGED. CROSS SECTION VALVES AT E=0,0253 EV ARE: 186.63 BARNS TOTAL 17,51 BARNS SCATTER CAPTURE 169,10 BARNS 16.63 MILLIBARNS FISSION BELOW 0,3 EV THE FISSION CHOSS SECTION IS GIVEN BY MT=18 THE SAME POINTWISE FILE THAT WAS USED IN VERSION III. THE FISSION CROSS SECTION AT 0.9253 EV IS 16.63 MB. ABOVE 40 KEV THE FISSION CROSS SECTION HAS BEEN REEVALUATED BY W.E.STEIN, THE EVALUATION FOLLOWED WHITE ET AL (14) FROM 40 TO 505 KEV, KLEMA(15) (RENORM) TO 1,0 MEV, STEIN(16), 1,0 TO 4,5 MEV, AND PANKRATOV (17), 4,5 TO 20 MEV, NORMALIZED TO WHITE AND WARNER(18), THE ESTIMATED ERRORS IN THE FISSION "ROSS SECTION ARE AS FOLLOWS: ENERGY RANGE STANDARD ERROR (MEV) (PER CENT) RES, RANGE 51 0.040<E<0.505 10 0,505 5 Ø,505<E',0 10 1,0<E<5,4 3 5,4<E-14.1 10 14,1 4 14,1<E<20,0 10 +++ REFERENCES +++ 1. G.E.HANSEN, QUOTED IN R.B.LEACHMAN, P/665, PROC 2ND UN CONF ON PUAE (1958) 2. B.D.KUZMINOV ET AL. SOV JOURN AT ENERGY VOL 4, P250 (1958) 3. V.I.LEBEDEV, V.I.KALASHNIKOVA, SOV JOURN AT ENERGY

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VOL 10, F 4. L.D.GORDEE V108, P783 5. N.E.HOLDEN 6. R.S.IYER E P439, IAEA 7. G.P.FORD A 8. D.PAYA, TH D-ORXAY (1) 9. E.PENNING 10. R.C.BLOCK, 11. D.T.GOLDMA 12. S.PEARLSTE 13. J.H.LANDRU 14. P.H.WHITE IAEA, SAL2 15 E.O.KLEMA, 16. W.E.STEIN 17. V.M. PANKR P.197 (196 18. P.H.WHITE P671 (1967 19 J.J.NAGLE KNOXVILLE 20 J.TERRELL 1AEA, VIEN	2357 (1961) VA, G,N.SMIRI (1957) CHART OF T) TAL, PHYS AN CHART OF T) TAL, PHYS AN CHART OF T) TAL, PHYS AN SURG (1965) PHYS REV VOL ETAL, CONF-7 (1971) PHYS & CHEM NA (1965)	ENKIN, SOV HE NUCLIDES ND CHEM OF RE, LA-1997 SITY OF PAR COMMUNICATION NUCL SOC, V ENGR, VOL -74262 (19 ND CHEM OF 72, P88 (660303, P62 IRN ATOMIC ER, J NUCL 210301, V1, OF FISSION	JOURN AT ENERGY, , 11TH ED (1973) FISSION, VOL 1, (1956) IS-SOUTH, CENTER ON OL 7, P84 (1964) 23, P238(1965) 72) FISSION, P219, 1947) 3, WASHINGTON 1966 ENERGY, VOL 14, ENERGY VOL 21, P259, , VOL2, P3,			
NEPTUN) UM-237	ATA TYPE	ENG TABLE OF CONTEN GENERAL INFORMAT	DF/8 MATEPIAL NO. 0263 IS ION Reaction Cards			
GENERA RESDNA NEU + 90 N	L INFORMATION NCE PADAMETERS CROSS SECTION	ŢĂĬ	COMMENTS 78 JLE OF SUNTENTS 3 RESONANCE DATA 995 FISSIUN 129			
NEPTUNINM-237 ISOTOPE FHACTIONAL ABUNDANCE NUMBER OF ENERGY RANCES-	NEPTUNIUH-233 1.0029E+02 2	EN RESONANC RESONANCE P	DF/B MATERJAL NO, 6263 E 2º1a Araméteus			
ENERGY RANGE NUMBER 1 950LVED SINGLE-LEVEL BREIT-HIGHER PARAMETERS LONER ENERGY LIMIT (EV) 1.8000E-02 UPPER ENERGY LIMIT (EV) 1.3000E-02 NUCLEAR SPIN						
L VALUE						
INDEX ENERGY (EV)	VALUE TOTAL	RESONANCE HICTHS NEUTRUN R.	(EV) ADIATION FISSION			
1 -2,5000E+00 2,50 2 -2,2200E+01 2,50 4 1,3200E+00 2,50 5 1,4300E+00 2,50 6 1,9700E+00 2,50 7 3,6600E+00 2,50 8 4,2600E+00 2,50 8 4,2600E+00 2,50 9 4,6600E+00 2,50	00E+08 4.8057E-02 02E+08 3.2041E-02 02E+08 3.924E-02 02E+08 3.9641E-02 02E+08 4.0346E-02 02E+08 4.1216E-02 02E+08 4.1216E-02 02E+08 4.1216E-02 02E+08 4.1216E-02 02E+08 3.7526E-02 02E+08 3.7526E-02	N.9546E_03 3 3.7693E_05 3 3.255WE_05 3 3.7340E_05 3 4.4501E_04 4 1.6562E_05 4 2.4401E_04 4 2.4401E_04 4 3.4591E_05 3 3.4391E_05 3	2008E+02 2:17.00E-26 2008E-02 3:500E-06 9008E-02 1:2408E-76 9008E-02 3:4908E-76 8208E+02 0:8008E-77 1208E+02 7:3008E-26 1408E-02 3:7108E-86 7508E-02 1:0008E-76 5788E+02 5:0008E-77			

10	5.7700[.00	2.50005+00	4 44585+12	4 21945-04	4 42245-92	4.56485-26
11	6.370×E+00	2.50000.00	3.81045-02	0.28791-25	3. A100F+22	9.60005-27
12	0.67846+88	2.58288+28	4.79235-82	1.16825-05	4.79886-02	1.1112F-05
13	7.18246+00	2.5000E+00	3 54115-02	7.77075-06	3.54602=02	2.78485-46
14	1.4100F+88	2.50255+20	3 08405+02	4 45915-84	3 07025=02	4.39005-24
15	8.3000F-00	2.50200+00	3 78085-02	0 06895-24	3 77075=02	0.70425-07
16	8.9700E+80	2.5082E+00	3.8529F+22	1.21025+04	3.64286+32	8.37405-66
17	2.300VE+00	2.500000-00	4.27225-92	5.22895.84	4.32EBF = 22	2.88405-17
10	1.82308+81	2.52005+00	3.81266-02	2.49485-05	3.81826.82	1.34285-26
19	1.06802+01	2.52206+20	3.6108E-22	5.05896-04	3.50226+22	.82085-26
20	1.08405+01	2.5888E+40	4.53416-22	8.8086F-04	4.4582E+82	A.1808F-27
21	1.18906.01	2.52825+23	4.38456-02	A.8482F-24	4. 3822F-22	3.28095-27
22	1.22845+01	2.52022+00	4.96445-02	A.25221-85	4.9600E-02	1.89085-26
23	1.26146+01	2.58685+68	4.22051-02	7.95865-64	4.13825542	.7000F - 07
24	1.31408+01	2.5888E+08	4.13228-22	1.9575E-05	4. 382E-82	2.24005-06
25	1,580°F+01	2,5000E+00	4.1484E-32	1.02105-04	4.1300E=02	1.94086-26
20	1,63805+01	2.5802E+00	4,9724E-02	9.2392E-24	4.8822E=82	4.98022-27
27	1,685°E+01	2.5000E+00	3.4644E-82	2,4301E-04	3.4488E=02	1,51/25-26
28	1.7020E+01	2.5J00E+62	4,1311E-22	5.7757E-86	4,1300E-02	4.92005-00
29	1.7590E+01	2.5300E+00	3.95852-02	1.84121-84	3,9403E=02	1,34¢0E-06
30	1,78908+01	2.5000£+00	4.1322E-02	1.8188E-65	4.1300E-02	3182225-66
31	1.8880E+01	2.5000E+00	4,1339E-C2	3.6499E-25	4,1302E=82	2,69485-86
32	1,912°E•01	2.5000E+00	4,82891-22	1.05826-04	4,8103E=02	2.940KE-C6
33	1,992°E•01	2.5000E+00	3,5878E-C2	7,49812-05	3,5000E=02	2,95086-26
34	2,039°E+01	2,50000.00	4,1735E∽32	1,12982-03	4,2000E-02	4,1202E-27
35	2,1090E+01	2.5000E+00	3,5418E-02	5,1618E-04	3,4900E-02	1.4708E-20
36	2,1300E•01	2,500BE-02	4,1332E-C2	2.3076E-05	4,1320E+02	8.563VE-06
37	2,2010E+01	2,50000+02	4.1561E-22	1.2601[-03	4, <u>e</u> 300e+02	T. 4200E-07
38	2,286°E+01	2.5888E+08	4,8050E-22	4.4784E+84	3,960°E=02	3.25485-66
39	2.3678E+01	2.5000E+00	4.1698E-82	1.69026-03	4,0223E=02	1.98482-27
42	2.3978E+01	2.5000£+00	6,89732-22	1,7087E-24	6,08000-02	2.6000E-26
41	2,4970E 01	2.50000.00	4.8713E-22	4.6897E-23	4.4188E-02	3.25 JEE-26
42	2,01846+81	2.50002+20	4,2288E-22	7,3895Ee04	3,98006-02	4+1190E-05
43	2,6540[+01	2.50020+00	4,4661E+02	2.84216-03	4,1020€=82	2,11986-05
44	2,70/08+01	2.5200E-30	4,13418-02	2,4454E-85	4.1320E=02	1,6370E-25
45	2,848°E+01	2.5000E+00	4,1449E-82	1.4622E-04	4.1500E-02	2,4400E-86
46	2,3924£+01	2.50005.00	4.1418E-82	1,0971E-04	4.1300E-82	8,3700E-26
47	2,9460E+01	2.50000+00	4.1425E-02	8.5758E-85	4.1380E-02	3.89906-05
46	3.0400E-01	2.50000+20	4,20396-02	3,7597E-03	3.8288E-82	7,9718E-05
49	3.0720E+01	2,500000400	5,34312-22	3,27015-04	5,3100E-02	4.12082-20
510	3 14545-01	2,500000000	3,02000-02	A 78201_05	4 . 1005 . 42	1.64/05-CA
	3.34185+01	2.50000.00	2 BPA2E-02	4.38135-24	2 7AP2F 42	4.3700F-06
53	3.30005+01	2.50000.400	A . 59A2F - 62	4.58226-04	6.5500E+02	4.18005-16
84	3.4470E+01	2.5000E+30	4.14936-02	1.8371E-E4	4.1328E-82	9.02006-26
55	3.5190E+01	2.5000E+00	3,7233E-02	3.2686E-84	3.6900E=02	5,71085-26
55	3.6360E+81	2.50206+00	6,8672E-02	1.59192-84	6,8500E+02	1,2768E+05
57	3.681°E+01	2.50006.00	4.1392E-02	7.2199E-85	4,1300E=02	2,02502-05
58	3,7140E+01	2.50006.00	4,64116-82	1,36026-03	4,4928E=02	1,5043E-24
	3,79201001	2,50001-00	4,1380E-02	6.4042E-85	4,13001402	1.37401-03
00	3 80305+01	2,52002+00	6.3710E-62	1.00704-03	6 EAAAE~#2	2.81345-24
42	3 02245-01	2 80305-00	A 70635-02	A 500AE-04	4 ARORF-42	4.32835-04
	3 00005+01	2.50006+00	7 80376-02	A ABOOL-04	7 37205+02	3.66/15-03
64	4.134VE+01	2.50000.000	3.98475-02	0.2600E-03	3.7400E-02	2.3742E-E4
65	4.2380E+01	2.50006+00	4.13992-22	9,04896-05	4.13882-82	8,68002-26
66	4,2810E+E1	2.52886.+20	4.1753E-02	1.1712E-04	4,1300E-02	3,3637E-64
67	4,3630E+81	2.50606+06	4,1995E-02	2,8997E-04	4.1784E-02	9,2280E-06
68	4,5790E+01	2,500BE+02	6.2568E-C2	4.8268E-84	6,21002-02	5,56¢ØE-06
69	4,6810E+01	2.5000E+00	4.22286-02	6.5064E-04	4,13002+02	2,69018-24
70	4,6340E+01	2.5000E+00	4.6774E-02	3.0701E-03	4.3720E-02	3.6400E-26
71	4.7310E+01	2.5000E+00	4.578 2-82	2.30985-03	4.33002=02	9,4090E 07
72	.8470E+01	2,50001+00	4.1422E-82	1.10000.004	4.1300E=02	1,21906-05
73	4.8780E-01	2.50000+00	4,1836E-02	5.3011E-64	4 19205=02	5,9748E-20
74	+,YODUL+01 5 01845-0+	2,30001+00	4,03936-02	D. BYELL-ES	-,1000L-02	214000L-00
/2	5 4600E+01	2,50001-00	4.0252L-02	0,72701-03 0 13005-05	4 .300C-02	711/50L-10 1.77305-05
77	5.21905-01	2,50005-00	4 16775-07	7,10001+00	4 13005-02	4. A3005-0A
78	5.26205+01	2.5K0AF+00	4.20075-02	7.02915-04	4.13205-02	4.35005-04
79	5.38305.01	2.500000.00	4.13805-02	A.18986-05	4.132BE-02	1.81205-05
68	5.38605+01	2.50000+80	4.1603F=02	3.86765-64	4. 300E-02	6 16006 - 26
81	5.4220F	2.50000.+00	4.14365-02	1.31076-04	4.1300E-02	A.9500F-04
82	5.5020F+01	2.50006+00	4 14385-02	3.16736-04	4 13005 = 42	2.13705-05
83	5.6038E+01	2.50000.00	1,09000-01	1.98945-03	1.07005-01	6.54000-06
84	5,8360E+01	2,5000E+00	4,1765E-02	4.62956-04	4,1380E-02	2.6300E-20
85	5,8400E+01	2,50000+00	4,1080E-82	2.94728-04	4,13888-82	1,11806-05
86	5,9490E+01	2.5000E+80	4.5011E-02	2,01002-03	4.3000E-02	1+2600E~06
87	5,0020C+01	2,5000E+00	4.5905E-02	2.69996-03	4,3200E+02	9,0600E-06
88	6,893NE+81	2,5000E+00	4,P631E-02	1.8297E-03	3,88001-02	1,2900E-06
89	0,10201+01	2.3000E+00	4.10202-02	5.2200E+04	13002-02	3,0300E-00
90	0,2400L401	2 JUDEL-DU	0.2203L-02	2.077/1-03	0.0100L-02	3:02001-00
02	6.39405+01	2.50000.+00	4.15815+02	9.75875-04	4.1300E-02	5.44005-00
ý3	6.4940E+01	2.50075+04	4.47125-02	1.00971-03	4.370 HE-02	2.29005-06
04	0.5680E+R1	2.50006+00	5.0552E -02	4,54985-23	4.6000E-02	2.5100E-06
95	6,7460E+01	.,5000E+00	4,39822-02	5.7798E-03	3,8200E-02	1,9100E-F6
96	6 7940E+01	2.5000E+00	4.5992E-82	2.3903E-03	4,3000E-02	1,3000E-06
97	6.8750E+01	2,50000.00	4,10622-02	3.5902E-04	4.1300E-02	3,3200E-06
98	7.0230E+01	2.5000E+00	6,8044E-02	2.1403E-03	6.5900E-02	3.7400E-00
99	7.0660E+01	2.58082+08	4,1805E-02	5,0015E-04	4,1302E-02	4,4300E-06
102	7,1180E+01	2.5008E+00	3601E-02	2.24496-03	9.1380L-82	1.34005-06
101	/,18402401 7 38405-0+	2,30006+00	4,39812+02	2.00021-03	-,1300L-02	7,40008-07
104	7.47645401	2,50000-+00	4.27725-32	4.47015-03	4.1300F-02	1.81005-004
4 # 4	7.45405-01	2.50000+00	4.18185-02	5.10255-04	4.13000-02	A 2300F -04
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	7	3 B0005-00	4 4 4 4 4 5 - 40	4 .0055 04	4 4 4 4 9 5 - 9 9	4 40405-04
1.0.2	7,35702-01	2. JUDDE - D.I	4.14/0L-02	1.10022-0	-,1300C-02	#1081EF-65
150	/,05386+81	5'20505+66	4,1489E-82	1,8034E-04	4. <u>5</u> 388E-82	2.22#BE-P6
187	7.6979E+01	2.58082+00	4.16765-02	3.74625-84	4.1302E-#2	1.8648F-06
1.44	7 89395-01	3 50006-00	7 87845-43	1 44085 -03	7 44925-92	1.41.48.45.484
190	, 0330EeD1	E. JDEDECED	1.0/311-02	2,44701493	1.03002492	11-1-00-00
189	7,9240E+01	2,9000E+08	9,4120E-82	2.5201E-03	5,1008E=#2	2.10095~07
178	8.0350F+01	2.500025+00	4.1446F=02	4.5687F_04	4.1300F-02	0.27MBF-06
	8 94945-94	5 53945-99				
111	0,00005-01	5,20001-00	4,1849E-82	9.4220E=04	4,138-E-82	3.0208E-80
112	8,1590E+01	2,500000+00	4.1723E-02	4.2002E-04	4.1JØ0E-02	2.600885~06
113	8.28906.001	2.28885+88	4 214 85-02	B 18155-04	4 1295-42	4-23445-04
	8 33045 . 0.	0 80005.00		0.101/2-0-		TEODE OU
11-	D'33A0F=01	5,20001.00	4,4412L-02	3.11036.003	*.130cL-02	1.27601-00
115	8.3780E+81	2.5000E+00	4.68516-02	9.5496E=03	4.1388Ec#2	4.1300E-06
116	8.54 90F+21	2.50805+00	A 48736-02	17935-03	A 30885-02	1.44485-24
	8 40795-04					
11/	0.00/DE-DI	2.30000-000	4.2140E+02	0.3490L-64	4'IODOF-85	313188F+60
118	8.6500E+01	2,50000+00	4,9022E-02	5.7198E-C3	4,33002=32	2,559882~86
119	8.7450F+01	2.58886+89	4 50005-02	1.49991-03	4 13885-02	1.20005-07
						STEDUCE
120	0,01301001	2.38082.00	4.2337E-02	1,05405-00	138PE-02	4,7300E~00
121	0,0000E+01	2,56985+68	4,3151E-02	1.84992-03	4.13000-02	1,30085-00
122	8.9430Fe81	2、56月月€+於月	5 12035-02	4.289AF-03	4 90005-02	1.82405-04
	0 88445-01	50005-00	6 48 9 7 5 - 00	4 93005 43	4 00000-00	
150		C. ODLOLYUD	2.4000L-62	4.9/99E=03		2453085-80
174	9,1320E+Ø1	2,50002+08	4.14666-02	1.57482-04	4.1300E-02	8,62056-80
125	9.1950E+01	2.5000E+00	4.18195-02	5.18146-84	4 4 3025+02	8.70MAF-04
4.7.4	9 37546.401	3 60405-08	4 44 85 - 62		4 . 7890 - 80	
120		2.000000000	1-AOF-D5	1.00/01-04	-,1380L-82	A*1000F-90
127	9.3369E+81	5'2008E+08	4,88032-02	1.80010-03	4,7000E-02	3:24#8E-86
128	9.4220F+81	2.5000E+00	4.16ABE-02	3.47885-04	4 1300F-02	S. 90085-07
120	9 81705-91		4 44485	- 3640c 04	4 . 3080	
12	7,03/DE 81	2,50002-00	4,1003F-BS	3.50405-04	4,1300L-92	8+7408E-80
130	9,6140E+01	2,500000+00	4.1368E-Ø2	5.4989E-05	4,13886-82	1.3468E-05
131	9.6410E+81	2.5888E+08	4.1641F=#2	3.49915-04	4.13665.082	1.14885-05
172	B 79205+81	3 64905-440	4 62410-40	8 4904C (17	4	
132	7.77202001	2.30001+00	0,74011-02	3.4/VDE-#3	0,10001-02	1.74885-80
133	9.840PE+01	5°2000E+08	7.7381E-02	2.3795E-23	7,5000.002	1,42000-26
134	9.8990E+01	2.500BE+88	4.14175=02	0.9494F_85	4 13005-02	1.729AF-05
1 75	9 04046-01	-	5 17.75-00	4 44495 41	4 08095-00	
1.5	2,20205401	2.300000000	2.1/43L-02	1,94006-63	. 49605	2.0200L-20
130	1,901YE+82	2,50800+00	5.8401E~02	5.3000E.03	5.318°E+02	1 24066-26
137	1.010JE+02	2.5008E+00	6.25125-82	9.40966-03	5.71805-42	3.38425-06
1 1 4	1 84625482	2 50805+00	4 35775-03	4 33045 33	4 4 4 9 9 5 - 9 3	
130	1,010-1-02	2,300000000	4,22336-82	1.26906-03	- 1300L-02	3.01006-96
137	1,0194E+02	5*28885+88	4,29716-02	1,6698E-23	4.13800-82	1.38#ØE+06
148	1.8217E+82	2.5000E+00	4.1685F-02	3.0018F-04	4.13885-02	5.11005-06
141	1 01705+02	0 53995-99	4 28425-42		4 1095-00	2 BAMAE - DA
			", E PBEE "BE	1,97022-00	-110000-02	210INBC-60
144	1.94526+82	2,20001+00	4,1047E-82	3.3942E-04	4.13006-02	6.8709E-96
143	1.05156+02	2.5000E+00	7.96885+02	2.1783F-23	7.75005-02	9.60005-06
144	1.05705+82	5 5840F+88	4 44000-00	7 38480 03	4 44005-00	38495-95
				3.20002-03	-,11002-02	1,33-01-93
142	1.0/021-02	5.20005+00	4.1023E-02	9,1311E-04	4,13002-82	1,82005-05
146	1,037¥E+82	2.5000E+00	4.21196-02	8.1356E-04	4.1300E-02	5.86886-86
147	1.09126+02	2.58886+88	4 35015-02	2 28985-03	4 1025-02	8.49495-97
	1 10346-00	- 59495-89	4 36.05-00			
1.40	1,10306-02	2.30001-00	4,2912E-02	1.2044E-03	4.1300E302	1.51006-20
149	1,105°E+02	2,5000E+00	4.23926-02	1.08946-03	4.1300E-02	2.230BE-06
150	1.10966+02	2.500AE+00	4.43715-02	3.06956-03	4 1 1005-02	1.30405-04
1 11	1 11716403	3 50005-00	4 45 900 - 00	1 17416 61	4 4 4 4 4 5 - 5 5	A BAMAD
		2,200000000		3.2/015-03	4.13000.002	1.21005-00
152	1,12226+02	2,50001+00	4,17175-02	3,98316-04	4,13002-62	1,8620E-05
153	1.1333E+02	2.50002.408	4.25196-02	1.21846-03	4.43886+82	A. ROBOF-DA
184	1 13715+02	5 59995-00	4 54945-93	4 28954 23	4	4 44405 - 54
				-,2772L-83	12055-05	= [+ + PBF + 9 D
152	1.14736402	5'2868F+68	4,3>116+62	2,2097E-03	4.130°E=02	1,76405-00
150	1,1340E+82	2,5000E+00	4.1811E-02	4.9750E-04	4. 300E-02	1.3728105
157	1.15796+02	2.5000F+00	4 34025-02	9 0757C-03	4 30HE-00	
				2.0/2/2400	12002002	213078L-63
120	1110/02/02	5,20005+00	4.1/72E-02	#.3979E-04	4.13006-02	3,2070E-P5
159	1,17628+02	2,50000+00	4.33698-02	2.0205E-03	4.1307E-02	4.8880E~05
140	1.19876+82	2.50000+00	4.37745-03	1 23945-03	4 . 1005-02	4.4.436-03
	1 10445-000	- #Gage.20		1,20701-00	- 10001002	1,10,31,03
101	7'TA40FeR5	5.2000C+00	4.3459E-02	7.49/QE=04	- 1300E-02	1.4090E-03
162	1,2010E+62	2,50000-00	4,17766-02	3,2548E-04	4.1308E-02	1,50915-64
163	1.21905+02	2.5000E+00	4 17221-03	1.50085-04	4 1.1005-02	7.17906-05
	1 03705.00	5 BOUGE - 07			4 4046-62	
4.5	A.23/91-02	2,50002-00		- 0303L+04	- 138CF-65	912000F-02
167	1.25016.402	5°2005F+08	4,27482-32	1,20986-03	9,130°E-02	3,01402-25
160	1.256°E+#2	2.5000E+00	4.4015E-02	2,70965-03	4.1300E-02	5,72002-06
147	1.24206+02	2.5000F+30	4 30605-00	1 74015-03	4 . 1005	0.41005-74
407					-,10001-02	410700C-00
180	1,27141.+02	5'2000F+08	4.1829E-02	>.0000E-04	+,130≤E-02	2.81306-05
169	1.275#E+#2	2.5000E+80	4.1715E-02	4.0763E-04	4.1300E-02	7.75086-06
176	1 20415402	2 5000F.00	4 22415-02	0 49485 -04	4 4 4 9 5 - 4 3	
110	*151445485	* * > = > = = = = = = = = = = = = = = =		******	-,10000-02	1111005-93

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ENDEVE VATERIAL NO. 6263 Resonance Data Resonance Parameters

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NEP-UN10H-237	
ISOTOPE	NEPTUNIUH+237 1.8288E+28
"UNBER OF ENLAGY RANGES	2
ENERGY RANGE NUMBER	2
LOWER ENERGY LIMIT (EV)	1.3000E+02
UPPER ENERGY LIMIT (EV)	4.20225+24
NUCLEAR SPIN	2.50006.00
EFFECTIVE SCATTERING RADIUS-+	9.141PE-01
NUMBER OF L STATES	2

UNRESOLVED SINGLE-LEVEL BREIT-HIGHER PARAMETERS

NUMBER OF J STATES 2 2

DEGREES OF FREEDOM USED IN THE HIGTH DISTRIBUTION COMPETITIVE NEUTRON RADIATION FISSION P.88886+88 1,88386+28 8,88882+88 1,88285+88 J⇒VALUE 2.0000E+00

P. 2200E + 20	1.	6000E+20	6.0302E+6	1,48025
AVER	AGE	RESONANCE	WIDTHS LEV	13

TAUL	AF SQUER HOF	MIDING	

					~*********	
INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	FISSION
	30005402	1 32985+40	9 99-101-00	1.12645-74	4. 22325-03	5.430-5-24
5	1 08901-04	1 00306-00	0 00000-00	1.11875-24	4.03886-42	3.07.85-04
-		1 00000 .00		11111076-04	33955-02	3.07102-24
	2.00101-01	1.00000490	6.0000E.0c	1,10/91-6	4.00001-02	2.06311-20
1	5-21557+85	1,00001+00	N. 50005+60	1,11026=04	4.00005-02	A. TA52F
5	2.4000E+02	1.0000F.+02	0.00005.00	1,10026-04	4.000PE-02	1,38435-25
6	2,4¥001+02	1,00226+00	P,0000E+20	1,1114E-04	A,8298E+22	1,49356-24
7	2.540BE+84	1.000066+00	0.22205.00	1.10802-04	4,0000E-22	3,15921-26
8	2.700BE+04	1.000000+20	0.02291.00	1.1112E-#4	4.0300E-22	1.1138E+04
ŏ	2.8808F+02	1.00001+00	8.00000.000	1.13636-24	4. 2 2 4 8 F = V 2	3.34165-24
	3 34005+02	1 80006.00	a 3000c.aa	1 11125-24	4.67985-02	0. 48555-26
10	7 40000-02	1 33331 - 43	a agage.ga	4 4 9 9 4 5 - 1/4	4 43441 . 43	7 6.035-34
11	3.40002-02		N. 2000 - 00	1.10000-00	4.0000L-22	3.00732-20
14	3.0/P01-02	1.00001.00	N*8888E+88	1,11476-64	4.00000-02	2.20/42-04
13	3.7700E+04	1.00000.+00	N'BRANE+30	1.10081-04	4.00005-02	3.06531-76
14	4.14005+02	1.0000E+00	0.0000E+00	1,11415-84		1.*8216*84
15	4,24006+02	1.0000E•00	0,0000[+00	1,1090i-04	4,3000E-22	4,174pE-26
16	4,6888E+82	1,000000+00	0,0000£•00	1,11246-84	4,0000E-02	1.20906-24
17	4.7800E+02	1.0000E+00	2.00005.000	1,10916-64	4.20002-02	4.434-E-36
18	5.41096+02	1.000000-000	8.00005.00	1.11256-84	A. 6888E-42	4.92845+83
	5.51005-02	1 00005.00	0.0000-00	1.10035-24	4.02005-02	4.80235+04
54	5 71055-02	1 00001+00	2 00000-00	1.11176-04	4.00005-02	A. VOORE-DE
~	5 91005-02	1 00000-00		1 10045-04	4 03000-02	4 94705-04
<u><u></u></u>	5,01901+04	1,00000.000	P. 20001000	1.10940-0-	4,000000000	0 04305-04
22	D D JUNE DE	1.00000-000	0,000000000	1,11020-04		2
23	6,0300E+62	1,00000 +00	0,000E+00	2,10941-64	4. CODDE - 62	5.3310E-06
24	7.0200E+02	1.0000E+00	0,00006+00	1,11326-84	4.0200E-02	1.4373E-04
25	7,1200E+02	1.60006+00	0,0000E+80	1.1094E-04	4.0000E-02	5.5511E-26
26	7.8788E+82	1.0000E+00	0,00005•00	1,11506-84	4.000FE=02	2.1128E=#4
27	7.9793E+02	1.000000.00	0.00000.00	1,10936-04	4.0000E-02	5,9191E-J6
28	8.54806+02	1.0000E+00	0.00021.023	1.11776-24	4.83886-82	3.13736-24
29	8.6988E+02	1.00000.000	0.00000-00	1.18925-84	4.20025-42	6.41918-24
30	9.41875-82	1.0000E+05	0.00005+00	1.10935-24	4.9308E-02	1.07425-24
T 1	0 51005+02	1.00006+00	0 0000-400	1.10015-24	4.00001-42	6.54986 .04
12	an445+03	1 40005+00	a adaacaa	1.11645-04	4.02005-02	2.54195-44
32	1,000000-00	4 80000-400	0.0000E-00	1 10005-04	4 00000-02	1.70145-06
33	1,01701-00	1.00000-30	6.0000F+00	1.10921-04	4,00002-02	1, 0041-05
3	1.0<201.03	1.00000-000	0.00005+00	1.11001-04	4.00001-02	44-3411-63
32	1.03201-03	1.00001+00	6.0000E+00	1.1090E-K4	4.00000-02	0.00306-06
36	1,00506+03	1.00001+00	0.0000E+00	1,1128E+24	4.00000-02	1.41326-3.
37	1.0920E+03	1.0000E+00	6,00000000	1.10965-04	*.0000E-02	3,249; 2485
38	1,1410E+03	1,0000E+00	0,00006+00	1,11826+84	4.0000E-02	3.5439E-44
39	1,1310E+03	1,0000E+00	8,0000£+00	1,10876-04	4.0000E-02	7,23616+06
40	1.1¥98E+Ø3	1,0002E+00	0.0000E+00	1,11066-04	4.00000-02	5,1452E -85
	1.20905+03	1.000000+00	0.00025.00	1.10845-84	4.20036-02	7.72116-26
42	1.23085+83	1. HODDE . 00	0.00005+00	1.11656-24	4.20005-02	3.01275-04
	1 24905+01	1.00005+00	0 0000-400	1.10835-24	4.00001-02	7.63235-04
	27705+01	1 00001-00	0 000000	1 11745-24	A 00000-02	1 30116-04
	1.27302403	1.00000-000	2.0000E-00	1 10005-04	4,00000C-pc	7 70445-04
- 5	1,20302003	1.000000-000	0,00001000	1 10020-04	4 400005-02	
40	1.34301-03	1.000000.000	0,60006000	1110725-04		2, 2300L -03
47	1,34306+04	1.00001.00	N. 66666E+66	1.1051E-04	4.8000L-02	7.9241E=06
48	1,3/60E+03	1,00001.000	0.0000E+00	1,1137E-04	4.8000E-02	2.2033E-24
49	1,3860E+03	1,00000+00	P,0000E+00	1,1078E-04	4.0000E-02	8.1419E-06
50	1,4290E+03	1.0000E+00	0,0000£•00	1,09672-04	4.02006-12	7.43458-85
51	1.4J90E+03	1.0000E+90	0,00000.00	1,10776-0-	4.00002-02	8,3214E-86
52	1.40986+85	1.8080E+80	8.08805+88	1,10872-24	4.20002-02	4.8745E+85
53	1.4700E+03	1.00000.000	P. 08005+00	1.10755-04	4.00000 -02	8.4257E-84
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	4 40005 403				4 00005-49	1 10485-00
54	1.44986+63	1.00000.000	0.0000E+00	1,10816-04	4.00000-02	3132005-63
55	1.5090E+03	1.0000E+00	0,0000E+02	1,10756-24	4.0000E-22	8,25426-06
56	1.5478E+03	1.00000+00	0.00005.00	1.1088E-24	4.0000E=02	6,3582E-05
87	1.5570E+03	1.02006+30	0.00005+00	1.10725-64	4.0000E+02	8.7129E-06
	5785-03	1 00005.000	0 50005.00	10045-04	4 00005-02	0.60385-08
20	1.3.602.00	1.00000.000	DINTEDE-00	1,10,00		
	1,20081+93	1.00001+00	5,099965+86	1,10711-64	4.0000E-Dr	0.013/5-00
610	1,64281+03	1,5902E+80	P.0000E+00	1,10716-04	4.0000E-02	1.76345-85
Å1	1.6320E+03	1.0000L+30	0.0000.00	1.1069E-04	4.0000E-02	8.95976-06
	4/415-01	1 40005-00	0 00000-04	1 10075-04	4.00005-02	1.24485-04
		1,0000000000	C BODDE OF	1110736-04	4 00935-03	0 10.25-04
63	1,00465-63	1.00001-00	N. 80000E+00	1,10070-0-	4.00002-02	7.12122-00
64	1,70406+83	1.0000E+00	0,00J0E+02	1,1117E-04	4.00000-02	1.9614E-04
65	1.7140E+Ø3	1.0000E+00	6.0000E+00	1.10665~04	4.0000E-02	9.21572-06
66	1.7340E+03	1.00021+20	2.00005.00	1.10A9E-84	4.0020E-02	9.7769E-05
	1 74405+04	1 . 00001 + 30	0 0000-100	1.18485-24	A. 0000Fe02	9.31315-04
	47005 . 01	1.00000-00	0.0000000000			7 5.745-0.
60	1.0/001-03	1.00000-00	0.0000E+00	1.12386-04	4.00000-62	/ O/
69	1,8000E+03	1.0002E+00	0.0000E+00	1,1059E~64	4.0000E-02	3 ,/290E=06
70	1.8760£+03	1,0000E+00	0.2000E+00	1.1082E-04	4,0000E-02	9.0610E-05
71	1.90A0E+03	1.00000+00	0.0000F+00	1.1056E-84	4.0000E-02	9.42775+06
43	1 92405-03	1 20206	0 00000-00	10775-84	4.000000-02	8.47145-06
16	1,72-22-20	1.000000.000	0,00001-00	1110776-04		
73	1.42405-02	1.00001-00	0.0000E+65	1,10566-6-	4.00001-02	A' 4A50F -00
74	1,997@E+Ø3	1.0000E+00	P,0000E+00	1,13695-64	4.0000E-02	7,0734E-05
75	2.0070E+03	1.00000-00	0.00205+20	1.1053E+04	4,0000E-02	1,01100-05
74	2 03035+03	1 00001-000	0 00005+00	1.10505-64	4.00005+02	3.43785-05
/0		1,0000~-00			4 00006-00	4 76335-94
	2,10132+83	1.00000-00	0.0000F+90	1,104/2-04	4.000000000	0.79022-00
78	2,12,8E+03	1.00001+33	0.0000E+00	1.1048E-64	4.0000E-02	1./7950-05
79	2.1760E+ØJ	1.00005+00	0.0000E+00	1.1043E-24	4.0000E-02	3,6970E+06
	2.1752E+03	1.00001+00	0.00025+00	1.10445-84	4.0000E-02	1.06205-05
	3 1 4506 401	1 90005-00	3 33395.30	10405-04	4 00005-02	4 74305-04
P1	2,10562-03	1.00000-00	0.00005-00	1.10421-04		
82	2,2140E+Ø3	1.0000E+00	0.0000E+00	1.1249E-64	4.00001-02	3,2384E-05
8.5	2.2247E+03	1.0000E+20	0.0000E+00	1.1046E-04	4.0000E-02	2,3640E-05
	2.22426+03	1.00801+00	0.00005+00	1.1064E-04	4.0000E-02	9.83996-05
	2 20445+01	1 9,4005+10	0 00000-00	10345-64	4.00005-02	1.00365.04
12	2,20,65,00	1.00000-00	0.00001-00	1.10381-04		1.090000-00
66	2,3050L+33	1.00001+00	8,00005+00	1,1039E-24	4.0000E-C2	1.9223E-05
87	2.3150E+03	1,0000E+00	P.0708£+00	1.1036E-24	4.0000E-02	5.4972E-06
à.A.	2.3360E+03	1.40006+40	0.20005.02	1.10336-64	4.0000E-02	1.1052E-0A
	3 13495+91	1 20205-12	8 88885+98	1 10325-04	4.00005-02	3. 43425 -04
	2.020000000	1.00000-20	P. BDBDE BD	1,10326	4,000,000	
92	5.2.465+83	1.00001-30	B'3986€+86	1,10366-04	4.00000-62	2D41F-62
91	2.4010E+0J	1,0000E+00	0.0000E+30	1.1030E-04	4.00006-02	2.2454E-06
02	2.423eE+03	1.00006+00	0.00000.000	1.12516-64	4.00000-62	8.78732-05
67	2 44495+03	1.00005+30	0 0000-00	1.10305-04	4.00005-02	1.30665-05
	0 48000-03	1100001-00	D. DDEDE CDD	1,10000-04		4 20805-04
94	5' 4000F+03	1.00002+00	L'GERRE+RR	1,10276-0	4.00001-62	D'SAONF-ND
o5	2,5168E+Ø3	1.0000E•20	2.0000E+00	1.10475-04	4.0000E-02	8,34422-05
96	2.5190E+Ø3	1.0000E+00	P.8000F+02	1.1026E-04	4.00006+02	1.85886-05
97	2.56406+03	1.000000.000	0.0000-00	1.10875-24	4.00005-02	1.31965-04
	2 41 105 403	1 20005-00	0 0000-00	10.05-04	4 00005-03	7 67755-04
	2.01322-03	1.00002.000	0.00005+00	1,10192-0-	4.00000-02	1.01/2E-00
99	2,00486483	1.00006+00	0.3006E+00	1,1020E-04	4.0000F-05	1.01325-05
100	2,7300L+03	1.0000E-00	6,0000E•00	1,105.E-04	4,0000E-02	1.59716-04
181	2,7570E+03	1,0000E+00	2.0000F+00	1.101 16-04	4.0000E-02	3.23386-04
102	2.7710E+03	1.20006+00	2.00005+00	1.10225=04	4 . 00006 - 02	5.82105-46
	0 01005401	1 90095.00	0,000000000			
185	2,01202-05	1.00092.00	0.00005+00	1,10036-04	4.00000-02	1.17734F-80
184	2,8-PEL-03	1.00001+00	0.00005+00	1,10946-04	4.00006-02	4./573E-05
185	2,8690E+01	1.0000E+20	0,0000E+00	1.1784E-04	4.00000-02	1.6145E-05
186	2.8¥88E+Ø3	1.0000£+00	0.00006.00	1.1124E-04	4.0000E-02	8.89475+05
	2.95885+03	1.00005+00	0 00005+00	1 100-5-04	4.00035-02	1.20105-01
1.07	7 410-5+43	1 49995 . 40		ITTEOIL		1, 10102-09
100	3104762-03	1.00000-00	L. DODDF - DD	11446-64	4.00005-02	2, 2043E-04
109	3,0000E+03	1.0000E+00	8.8888E+86	1,1078E-04	4.0000E+02	1,4265E-05
110	3,1318E+03	1.0000E+00	0,2000£+02	1,31166-84	4.00006-02	1,5903Ee04
111	3,1048E+Ø3	1,0000E+00	0.00001.00	1.10512-64	4.0000E-02	2.42215.08
112	3.19865+03	1.000000-000	0 0000 -00	1.11105-24	4.00005-42	1.43435-0-
115	1 1 1000-001	1 00000-00			4,000000-02	1.43032-04
113	3,20282083	1,00000-000	N. BBBBF+BB	1,10014-04	4.0000E-02	4,4000L203
114	J.2-781-03	1.00006+00	0.0000E+00	1,1100E-04	4.0000E-02	1.1060Ec04
115	3,3020E+05	1.0080E+00	0.0000f±00	1.10726-24	4.000E-02	1.4834E+05
116	3.3>60E+03	1.00002+00	0.00005+00	11085-24	4.00000-02	1.53965-04
	3.39306+93	1.0000F+00	0 00005+00	1 10735-04	4.00005-02	2.44725-08
11/	7 45865+83	4,000000-00		1110/20-04		2170/21-05
110	3,49842483	1.00000-000	0.00005-00	1.1098E-04	4.00000-02	1.4/13E-04
119	3.40801+83	1.00001.000	0,0000E+00	1,10716-04	4.0000E-02	3.2746E#Ø5
129	3,5470E+Ø3	1,9000E+00	0,0000E+00	1,10656-04	4.00002-02	1.4876E-05
121	3.6078E+03	1.0000E+00	0.0000.00	1.10745-04	4.00000-02	5.54956-04
1 2 2	3.64086+03	1.60005.00	A. AAAAAAA	1.10406-84	4.00005-02	2.30345-0-
	2 75445-44	4 80005-00		110021-04	4.00000-02	5,00372005
125	3,/2482403	1,00000-000	0.0000E+36	1.10966-04	4.0000E-02	1,72785-84
124	3,00402+03	1.0000E+00	0.0000E+00	1,1053E-24	4.00006-02	8,1295E-Øð
125	3,9108E+03	1.0000£+00	0,00006+00	1,1078E-04	4.00002-02	1,0531E-04
126	4.0278E+03	1.000000+00	0.000000	1.10526-64	4.0000F+#2	2.27255.04=
197	4.0768E+03	1.000000-000	A AAAAC	1 10405-84	4.00006-02	A 40075-07
	4 344 45 + 04	4 40005-00	· · · · · · · · · · · · · · · · · · ·	110020-04		0.799/L-05
159	4.0010F-00	T.0000F.00	0.0000E+00	1,10495-64	4.00005-022	+,0002E+05
129	4,300ØE+Ø3	1.0000E+00	0,0000E+00	1,1056E-04	4.0000E-02	7.9053E-05
130	4.4970E+03	1.0200E+00	0.8300E+00	1,10376-04	4.00000-02	2.10245-05
131	4.5728E+#3	1.00002+00	0.00000.00	1.18445-24	A. 2000F -02	2.12665-94
1 7 2	4 79405+04	1.20225-00	a aggdr	1 000-0-04	4.03905-42	3.5465F-7-
106	4 05465403	1 300001-00	D'DCCDF+DD	TIDAAOF	0000L-92	<*************************************
133	+, Y7+0L+ØJ	1.00005+80	K.0050E+00	1.101-6-84	4.0000E-02	1,0211E=04
134	4,3008E+04	1.00086+00	0,0000£+00	1,1062E=04	4,0000E-02	2,7916E-04
			-	-		

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	69-760//*6	78-780a8'¥	▶ 4-36961' I	00+30000.0	00+70000°T	FØ+30>F/'T
-	90+3/612'6	28-34000'F	1'T0996-04	00.30000.9	00+30000'T	2°-1148E+03
÷	FE-TETOA'T	28-30000'	1,11114	00+33000'0	J. 8000E+30	E3+30+02'T
	90-32121'6	28-38988'*	P2-34901'T	00+30000'0	00+30000*1	T'9849E+03
- 1	*8-38****T	23-30000.*	7'78636-54	00+30000,0	20+3000g°T	1,67405+03
	90-34656'8	20-38080'*	▶Ø-369ØT'T	00+30090,0	00•3000A°T	1,63286+03
	58-3+582"	20-36000'	* ∂-3ĭ∠Øĭ'ĭ	96+30000,9	00+3000a'T	1,68286+03
2	90-34518'8	2E-36666.	\$Z-31701,1	80+39090,0	00+3000e'T	50+300R6 T
·.	56-3659.9	23-36900**	1'76096-64	00+30000°a	00+30000'T	20+309/51
	99-3621/18	** 0000E+35	1,10725-24	90+30000°0	00+30000' <u>'</u>	20+30465 1
	60-32855 9	20-30000.	¥0-38801''	98+30860,9	08+30000' '	24785+247
	98-36+56*8	26-36000°*	►8-3620T'T	88+38888,8	00+39960,1	E8+38605 T
	3*25986-82	** 6690F - 95	*2-3T801 T	00+30000,9	00+36300'T	£0+3066+T
	90-3125.0	28-36888.4	v2-3540T T	RG+30000.9	00+30000°T	20+3007+1
	50-35+28*+	23-30000	1 1001E-54	06+30600.9	80•30000'T	CO-30001.1
	90-3+12; 9	20-30000 ·	+2-3420T T	00+30000.0	00+30000.1	E0+30064
	20-32-20-7	20-36030	*2-34960 T	00+10000.0	00+30000.1	E0+34654.1
	90-361+1.8	28-30000 *	2-30201.1	00+10000.0	80+30000	50+38465.1
	2.50335-84	20-30000	+2-32511.1	55+30500.0	00+30000.1	E0+30472.P
	7.92416=96	20-36000.	12 31001 1	00+30000.0	00+34000.1	F0+38222
	SU-39850 S	20-36000	PS-30001.1	00+30000°C	66+36466'i	50+30515 L
	90-3998/ 1	20-30000	*3-3C901-1	00+30000-0	00+30000	E0+34666
	3 2013E-94	20-30000.	92-39211°1	00+30000°0	00+30000 ·	19430E16
	AN-32520.7	20-39000	*/-JL80 · ·	40-30000 U	20. J0000 .	CA+388C2"I
	10-37510.2	20-30000	*0-38755 F	44-3-6000 0	00	NG-38642 T
	90-31-66-2	20-34000 *		44-30000 U	08.J0000'L	CR+106+1"T
	80-36271'U	22-2000011	-1-1/001'T	30+30000 a	00.J0000.I	1*1718F+R0
	100345bc10	20-30000	-2-17911'l	20+30003 4	00+30000.1	CO+ 14171*1
	63-3/6+c10	20-30000	*2-39601'T	88+36888*0	00+30000 T	7 0A50E+02
	###370T7'T	20-34640'	1,1120F-64	20+34000.0	00+10000'T	68+38588 T
	94-30500 9	22-34446'7	*2-3060T'T	30+30300'0	00+3000A'T	E0+30268*1
	60-3165-'P	4'03045-65	*2-383TT'T	6,68685+88	88+ 18880 - T-	1.82285+81
	50-3+40/11	27-30000'*	1'10056-64	00+ 10000 - 8	20+30000'T	20+30510 1
	21.2624E-84	28-39998.6	12-386374	00+30000'0	82+38888'1	50+30900 T
	98-38614 9	24-30000	1.10912-24	00+30000'0	00+7000e'î	20+380t£*6
	58-27+22-1	** 6000F-NS	¥7-3£60T'T	90+39990'J	1°9008 • 39008 • 7	20+3001+6
and the second se	98-31617'9	5%-30020°*	1,10056-64	00+30000'0	02+32000'T	20+300A9 9
	¥8-36755	₹ 5-3000 °*	70-344777	99+30000.9	0C+30030'T	20+30045 9
	90-31616 6	28-36030 . .	1,10036-64	58+32666.9	89+36886.r	58+38879.7
	+C-30711-2	55-36666.	¥2-30⊆TT T	00+34000.4	86+38899.1	20+30978.7
	97-32255'5	23-30050.4	*2-3*60T*T	34+70005.9	80+3000A'I	20+30021.7
	1.43736-84	28-30056	1.11326-04	98+39888.5	06+30036-1	20+10070 2
	90-30126.6	27-36053.	A3-34001.1	6N+30000-6	00+3004.	50+30054 A
	2.2470E-04	22-39900	11102E-24	60+30059.0	00+30606	20+30059 9
	98-36116 1	20=36856.	43-34001-1	00-30000.0	ND+30000	20-30010 9
	50-30C6A'9	51-35050.	*7-32111'L	34-34444.4	00+30000 ·	70-30416
	72-4EC0P.V	20-30000 P	*0" 3102 1 1	ac.Jagaa.	20+30000	20+10419'6
	20-34646.A	27-30000		10-30000 0	20 • 30000° T	28+7840/ 4
	AR# 38424.4		*/- 3*2TT*T	62430000 0	00+30000 T	70.30000'5
	94-30-07-1	23-32020	-1-10A01'T	10+3000° 4	00+30038'T	20+30442'*
	70-3772 L'Y	20-30000	HS_JTHTI'I	30+3ad20'4	60+30000'T	20+ TEHAT 'S
	10-31C40 1	79-3402019	7 ' T000L - C	88+ 70889 'S	88+38888*1	29+384//*2
	7/-J1549'1	24-34060		66+34468 * 4	00+30000°T	20+780/9 5
	90-10490'0	24-39062'7	*2-3980T'T	30+30002'0	00+30200°T	3.41.995.92
	Gualce04*4	24-30002**	#2+12111'T	88+3888*4	08+10000'T	78+30405'5
	90-10000	22-30000	*7-35BAT'T	00+30000'4	80+3880P'T	5*89996+85
	1.11201-54	20-30000 7	1'1175E-04	30.30009.3	00+30000'T	20+10004'2
	94-12461 -	22-34048 7	* 7-3090T'T	86+36819,9	80+3000e'T	2,59865+02
	10-16562'1	20-14002 7	*2-3*TTT*T	95+30000°B	88+30082'T	5*4A88E+85
	63-10-00-1	20-10000	7'T065E-64	00+30000'0	88+3880e'T	5 4969E+05
	60-3626T 4	20-34008'7	1.11026-84	00+30000'3	88+3888e'T	5'2700E+05
	90-3150e'Z	28-34000 **	T*7812E-35/01'T	88+38888.8	00+3003A'T	26+34946,5
	2101186-04	23-30000'*	\$2-34STT'T	66+30009.9	00+30020'T	7 680BE+05
	92-3165+16	4' 6909E-CS	*2-3*90T*I	50+30898°8	00+3000e'T	20+300a£'T
	NOISSIA	NOILVIOVE	NCHININ	3V111139H03	DATORAS 13431	(A3) A083N3

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47	1.744BE+03	1.000000+00	0.0000F+02	1,10656-04	4.0000E-02	S. 51316-88
Å8	1.8798E+03	1.000000+00	0.00000-00	1,12586-84	4.0003E-02	7.26745-04
19	1 AMOOF 03	1.20005+00	3. 48995+92	1.10506-64	4.02005-62	9.72905-06
70	4 89405+03	1.000000+00	0.00000.00	1.18626-84	4.20005-02	9.8610E-05
71	1 90405-03	1.000000-000	0 00005.00	1.10585-24	4.2300E-22	9.00775-04
-2	1 02405-03	1 20205-10	3 00000-32	1.13775-24	4.02005-02	8.47185+45
12	1,92-02-03	1 00001+00	7 43026-34	1 10545-24	4 04000-42	9.80765-04
73	1,93-02-03	1.700000400	7,00001-00 3 70001-00	1 18405-84	4.02205-02	7.07345-26
/ -	2,99,00,00	1.07000-00	7.000000000	1 10675-24	4 03000-13	1 21105-05
/2	2,00/01-03	1.05055400	r.0000E+00	1.10536-04	4 03035-49	3.01785-04
/8	2.03961.03	1,000000-00	r, coput - pr	1.10092-04	4.20000 22	4 /5102-04
<u></u>	2,10136-03	1.00022-20	F. CLODE + 01	1.104/6-04	4,000000-00	1 77050-04
78	2,14686,03	1.000000+00	N. 6000F+CC	1,10481-0	4,000000-00	1,7,7,7,20,7,07
79	2,12601+03	1,00000+00	P. BORNE+ED	1.10431-04	4,00000-02	3.44002-00
e Ø	2,1/506+03	1.02001+92	P, 2808E+87	1.1044E-24	4. ECHOE+12	1.00301-05
P1	2,1058E+83	1.22706+30	6.06065+65	1,10425-24	4.0000E-02	4.78205-00
₽¢	2,2140E+03	1.0000E+20	2.200PE+00	1,12496-64	4.650%E-62	3.23945-05
#J	2.22426+03	1.0602E+00	6.69005+66	1.1046E-24	4.0200E-22	2.36482.05
84	2,2>4%E+Ø3	1.06686+35	0.0200E+00	1.10645-04	4,20025-02	4.43898-85
85	2,2042E+03	1200E+30	P.0007[+0P	1.1236E-24	4.20065-02	1.09365-46
R\$	2,3050E+Ø3	1.4233E+32	P.2000C+00	1.1239E-24	4.02006-02	1,92030-25
87	2.3150E+03	1. <i>:</i> 000E+00	P.0000E+00	1,10386~24	4,0008E- 02	5.49722-06
86	2.J360L+05	1.2030L+80	2.23282.42	1,1033E~84	A.0000E-02	1.10528-06
- 9	2.3>80E+0j	1,30386+30	P. 2000E+00	1.10326-04	4.0200E-C2	3.33425=08
918	2.3/92E+0J	1.3038E+20	2.22005+22	1,10365-04	4.0000E-22	2.40416-05
01	2.44186+83	1.00002.00	0.0200F+02	1.10306-04	4.00002-02	2.24545-06
62	2.42326+83	1.200000+00	2.02005.02	1.1051E-84	4.2200E-02	8.78736-05
0.3	2.4468L+83	1.0000£+00	8.00005+04	1,10305-04	4,0000E-22	1.30665-25
04	2.40021+0.5	1.0800E+00	0.0000r+00	1.10275-04	4.00005-12	6.2930E-06
05	2 51695+0.5	1.20206+00	0 00005+00	1.10475-64	4.02005-02	8.34425+25
20	2 51946+03	20005+00	3 90005+00	1.10265-84	4.00001-02	1.85385-85
	2 55406+03	1.300000-00	0 00005+20	1.10575-84	4.27665-02	1.31755-04
	2 41 705 404	1 20005-00	0 00000-00	1 39105-84	4.03085-02	7.67755-06
	2 44495 493	1 20205-00	0.00000-00	1 10205-24	A . 00005 -02	1.01125-05
	2,30402403	1.000000-00	A 40000EVCC	1 10505-04	4.00000-02	1.30715-44
100	2,75001-05		r,00005+00	1 10000-04	4 99005-02	1 11185-04
101	2.73700-003	1,00000-000	0.0000E+00	1,10136-0-	A 0700E-02	5 AD10E-05
192	2,//10.000	1,00000-000	0.00001.000	1:10220-0-		3 93805-04
193	5,81565+83	1.50502+80	N. 00005+00	1,10036-64	4.50602-52	4 75775-04
104	5 Remotes 03	1.00001+90	0.0000E+00	1,1094E-64	4,00001-02	
200	5.80085+82	1.0000E+00	0.0000E+00	1.1084E-64	4.00002-02	1.01436-05
100	5'BABDE+0?	1.00002+00	5.0000E+83	1,11045-64	4.00001-02	5.094/E-05
107	2,9>80L+03	1.00001+00	0.00002000	1,10816-64	4,38002-82	1,20101-05
108	3,819PE+03	1.00006+30	9.0000E+90	1,11445-64	4.00001-02	2.7043E-04
169	3,00626-03	1.02026+28	8.02005+33	1,10785-64	4.00002-22	1.22955-25
118	3,1310E+03	1,0000E+00	P,3000E+00	1.1116E-64	4.0000E-62	1.2973E-04
111	3,104%E+Ø3	1.2000E+00	P.2000E+00	1,12816-04	4.950SE-65	3.42216-05
112	3,14805+05	1.0000E+00	0.30006+00	1.1110E-24	4.0000E-02	1.4353E-84
113	3,23282+83	1,20286+02	£,0000£+00	1,1081E-24	4.0000E-02	4,2650E-85
114	3,2490E+03	1.0070E+00	0.0300[+00	1,11002-04	4.0000E-02	1.1060E=04
115	3,3020E+03	1.0000E+00	7,00002+00	1,1072E-04	4.02005-02	1.4834E-05
116	3.3>60£+03	1.000000+00	0.0000E+0P	1,11C8E-24	4.00005-02	1,53966-04
117	3.3930E+03	1.0000E+00	8.00002+00	1,10726-04	4.00002-02	2,4672E=05
118	3.43986+83	1.00002.00	P.0000E+00	1.1898E-04	4.00005-02	1.2713E-04
119	3.4088E+05	1,00206+30	2.008000+00	1,10716-04	4.08008-62	3,2746E+05
100	3.54705+03	1.2000E+00	0.03005.00	1.18655-24	4.00001-02	1.08765.05
121	3 60705+0.5	1.00005+00	0.0000:.00	1.18745-24	4.00001-02	5.24956-05
1 2 2	3.69001+03	1.00002+00	0.00005.00	1.10625-84	4.00001-02	2.30346-05
123	3 73425+03	1.0000F+30	0.000000000	1.10065-84	4.00005-02	1.52785-04
104	3 85406+0.1	1.02005+00	0 02005+00	1.10535-24	4.00005-02	B.1205F-0A
1 2 5	3.01005+04	1.8600E+00	8.00006.00	1.10785-24	4.0280F - 17	1.05316-04
176	4.02705+03	1.20005.000	0.00705.00	1.10525-04	4.000000-07	2.27255-05
107	4 07486441	1 UBBOF.	0 00000000	1.19625-84	4.00005-003	6.40975-04
121	4 341454/3	1 33005.00	2 00001-00	1.10405-04	4.2000F - 42	4.66625-04
120	4 78446 -03	1,00001780	1. 00005+00	1 10845-04	4 00000-402	7.90836-24
124	- JOODE-03	1.00001-00	0,0000L+00	1110201-04	4 000000-02	3.10345-09
130	4 4 7 7 6 4 9 3	1.00001.00	C.0000F.000	1110372-24	4 BUDDE -02	2 1 2445-01
131	4.0/20E+03	1,00001+00	N. 6000F+66	1.10441-64	4.00000-02	2,12001-04
132	4,7942E+03	1,00001+00	N.6000E+06	1.00035-04	4.00002-02	2.21971-25
133	4,974ØE+Ø3	1.00002400	N. 9000E+00	1,10146-64	4.000000-02	1+02112-04
134	•, DOLDF.64	1.00000.000	6.0000E+00	1110055-64	4.00000-42	<+/*101+04

82+3820p'T NOISSIJ	AD111049 55+30059.5	1,000243800 1	7,0002402 Competitive	1*98086+38 1*88086+38
V017u6197210	NTOIN 3HT NI	0350 H003388	10 5330330	

94-72121 A	20.30000'*	2129435Fec4	aa+3aaa8',	88+38883*T	7*00+36+00*T	69
hasloshalt	20-3000019	-2-3C0-C'T	00-300a3'a	48-34440'7	00+10+/0*T	
Pd-1	10-30000	10-360b017			10, 30, 20, 1	70
	20-30000	P0-311VE'S	20-30000 0	00+10000	ED+ 30044 .	
10-37 2.1	20-38000.4	Y2 JAEVE	00-30000 0	00+30000	ED+ 300%A.	
- 90 - 34, - X - 9	20-30000.4	1.34346-84	00+10606.0	86+36666.1	EN+30882.1	62
20-30590,9	20-32000°*	1 3497E-54	03+30000.0	00+30000°T	20+308/511	86
90-3621/'0	4,8099 6 -82	1,34376-84	00+30000'0	66+30689.1	50+30/cs.T	26
50032850'9	28-3000.1	1,34576-04	00+30000°ø	88+38888.1	60-302-6°T	95
90-1696619	28-10000.4	1124476-54	88+38888'8	00+30000'1	C#+ 1868C 'T	66
64-3087010	79-700001		30.030000'0	88+38844'T	CR. 78645 1	
00-30002 1	70-30000		00+30000 0	00+30000 ·	10-3000y -	
20-378C0 8	20-30000					
FR-JEATS.A	20-16600.A	AS-18245.1	00-30600.6	00+30000	EN+ 18804	68
40-34156.8	50+35000.4	49=35445.1	00+30080.0	86+36884.1	ER¢ 380Et	1.30
24-32+20,7	\$9-3420 8 .≯	1 33105-64	08+30000.9	00+30000*1	1.45965+03	05
89-3614148	20-30006°*	1,34495-24	00+30000°0	06+30000''	1,38685+83	62
5'50226-04	20-30088'¥	7' 3271E-04	00+36300'0	00+30000*7	£0+309/£'T	81
90.31.24.1	20.3000010		00+30000'4	08+38000'L	C0+78525'I	11
60-300Catc	79-30900	50-320501T	00.300.0010	49+34444'T	CG+38CTC'7	
94.3058.44	24-30000		00+30000 0		10+30212 ·	
AN-10487.7	20-30000.7	10-J0775	00430000 0	00+30000	20+34126	
15106.5	20-18080.4	49-34465.1	00+20030.0	00+30000	EN+30575	
7,03235-86	20-30063	¥3-316¥C T	30+13390.0	00+30000°1	24436955.1	\$ P
3.8127E=84	20-39000.	1,35506-04	50+30000'a	00+30000'T	1 529905+02	2 *
1.22116-69	20-30003 *	1,34526-24	68+30000'U	00+30000'T	7°5000E+0;	1.4
60-176-1-0	28-300JA Y	1-34785-24	06+30000,0	00+10000'1	1°7880E+02	Ø •
94-370031/	28-30000	-1-19C+C'T	00+30048°a	08+38040'I	C#+7#Ic1'I	68
70-11712-2			20-30000 · 1	du- 30000 T	CG+JATAT'T	60
40-10542.5	20-38000	10-1-1-1	00-10000 0		10-30-2017	
20-17010.5	20-30000-4	A3-3AAA5.1	0.00000.0	00+3000P	0.30240	21
3-32212.1	23-30000'	1.24956-24	00+10000.0	98+30000.1	20+39260.1	92
61-30E 0 6,6	20-30000' '	1,34596-84	20+30000°0	00+30000'T	1.03206+03	52
\$8-3TOE+ *	20-30000	1124716-84	86+38880,8	20+30200°T	1,05206+03	*£
53-3+20/ T	22-30000'*	1,3462E-24	80•36888.8	00+30000''	\$0+30510°1	55
\$3=3420r12	20.4 30003.4	1 23455-94	00+30040°A	08×70000*C	1° 8999F+87	35
03-7446410	24-11000**	1-200RF -10	00+30000 · 0	68.30020'I	20+38416'6	ŤŸ
10-36475 1		3000017	ab-Jacadiu	a9-30-00'T	70-3447-4	ac
20-15476.1	50-10060	V3-319VE	007-30000 0		70-30010 0	
92-31612.0	50-10050.1	13-3CA46.1	00-30000-0	05+30407	SD+ JDEVA A	00
\$0-35751,5	50-30059° *	1.35655-84	90+30000.0	00+30900'I	20+300AS 9	85
92-31616'5	**0508E-65	1,34635-84	96•36095.0	20+3000s'T	20+30026.2	22
5'77586-8*	22-30020	1'32356-64	00+30990,0	00+30030'T	20+30478,7	92
QUESTICC'C	23-30000'7	7 24945-84	20+32020'a	20+30000°T	70+3007T°2	52
********	28-300.04'1	1-30TCC'T	88+36668 e	1.0000L+20	20+10420'2	54
0.3.7070.46	39.300000		30.30000.0	00. 30.000 · T	20.20009'0	5.2
45-39+55.8	CN-38080		age Jogga 1 1	28-30228 T	20-300X7 7	52
A9-307AC.S	51-36000.4	A9-14425	00-30000 0	00-10000		
90-30696'9	50-30003 V	*8-3***	96-38888.9	80+30885.r	20+30018.2	10
63-3800A'9	59-39006.4	¥3-326¥£'T	99+39000.9	00+30000''	20+30012 5	92
4'98536-50	**0000E-65	1,3463E-24	99+36866,9	39•30008'T	20•300TC S	61
67+3+8ZA'+	22-30000'*	1124776-84	50+30003.9	00+30000°T	20+300T*'S	8 L
9	20-30000 7	1124016-84	02+30020'0	7' N0 N0+ 700	4°19886+65	۲L
* A # 38 # 37 * T	28.30020.1	1 2288F - R	20+30000 0	48. JOAAA T	78+38899'*	9 T
90-30-(71-	77-30000		44. 19994 . N	88.38484 T	70. 304.2 .	έī
70-347C1 V	-1-30000		da.30000'u	00	20.338414	1
A0-31504.1	29-30000	12-11-092	00-10000 0	00-30800		
3,98935-76	26-39006.4	A3-3A2AE	20+10000.0	0 C + 3 0 0 0 1 . F	100+100/2 E	
▶Ø=3₽207°2	23+30000. .	1,35296-24	90+30000'V	00+30000'T	3.6/005+02	21
3,06935-06	22-34888,,	*3-3*5*£'I	a0+30090.6	00+30300°T	20+3008+12	11
62-36656'6	22-30000'*	1,34865-24	90+30000'a	38+30000°T	2°+3000£+2	ØT
92-306+015	22-70000 7	*7-386*5'T	30.38660°e	00+70000'T	5'8904E+05	6
1 7 7 7 0 F 4 9	22-30002.8	7-76995'T	00+30040*2	38+38832 · L	20+3849/ 2	A
02-37ACT **	22.20002	57-78-5C*T	0a+3aaa4*4	00.30000 T	28+384+6"2	7
	29-30000		200 3000000	00.10.00.T	20-30446*7	2
1.20151	CO- 19000	A9-34444		00.0000°	70.10.00	
21-35482.1	27-30000	1, 34405 - 64	00-10000.0	90+3000x.1	CO+ 10000 C	5
6'7653E-52	20-30082	1.34745-24	R0+70056.0	00¢30605 T	2.31006+02	,
5,80316-06	23-76868	1,34416-84	90-30008.6	00+30002'T	2 00066-05	5
#2-30T/0'F	29-30000.1	r2-30r≤£'ĭ	66•36668,9	00+300CC'T	7Ø+3Ø0p6'T	5
92+316E+ C	22-36032 *	1.34285-24	30+33066.9	00+3020e'T	1,30806+02	τ
NOISSIA	NULIVICYN	NONLOAN	3AILII 34HOD	TEAST 26VCINC	(A3) A983N3	XIONI
	1.7. 00.019		- 344			
	IV3) Rutatu :	20MAM6012 304				

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- 64	1,/#486+83	1.00001+00	5.88805+56	1,34916-64	4.00001-02	1.70141-04
65	1,7148E+93	1,0006E+82	0.000C+J0	1,3438E-04	4.0000E-82	9.2137E-06
66	1.734#E+#3	1,0 00# E+00	2.00000-00	1,34502-04	4,00082-02	9,77492-85
A7	1.7448F+83	1.000020+00	8.0000F+00	1.34236-84	4.200000-02	9.3181E-06
	1 47841 443	1 HORDEALD		1 14645-004	4.82865-02	7. 36745-04
	1,0,000,000	1.00002-00	P. BUDDE - BU	1,00042.04		. 70000-04
67	1,00005+83	1.00000+00	0.060 <i>2</i> 5+06	1.34516-04	4.80005-02	A.15485-80
7Ø	1,8¥68E+ØJ	1.000 <i>0</i> E+00	0,00002+00	1,3458E-84	4,00002-02	9,0618E-09
71	1.90686+83	1.00086.00	P.0000F-00	1.3428E-84	4.8090E-92	9.58775-06
	1 02455481	1 38995.40	8 3888-48	1 34445-84	A.88885.492	8.47185-05
/ 5			0,000000000			0 00000-00
73	1,93486+83	1.98685*88	6'6600E+06	1,34186-04	4.0.000.02	A' DASOF+00
74	1,99786+83	1.0000E+90	0.0000 <u>c</u> +00	<u>1,3434E-BA</u>	4.0000E+\$2	7.#734E-05
75	2.2078E+93	1.0000E+80	0.00000-000	1.3414E-04	4,888886-82	1.01188=05
76	2. 83985+03	1.000000+00	0.000000	1.34225-84	4.88888-42	3.83286-69
	3 14105-01	4 00006+00	4 44447 44	34045-04	4.88885-62	A. 75325-84
	2.1-1000	1,00000-00	C BEEDE OU	110-COL-CT		17012-00
75	5°7496E+83	1,00006+80	0,8000E+90	1.34086-04	4.00001-62	1.//921-05
79	2,1968E+#3	1.00001+00	0,0000{+80	1,34028-84	4,04885-52	3.09326-06
82	2.175#F+#3	1.00000E+00	8.0800-+88	1.34035-84	4.0000E-62	1.04106-05
	2 14545-43		0 0000-00	1.34015-84	4.88885-02	4.78285-04
24		1.00000-00	0,000000000			
82	2,2148E+83	1.08000-000	0.0002000	1,3-046-04	4.00005-62	9.33041-63
83	2,224#E+#3	1.0000E+00	0,00006+00	1,34056-04	4.8000E-02	2,3648E-85
84	2.2240E+83	1.00806+80	8.0680F.00	1.34276-04	4,0000E-02	9,d369E-05
	2 28485 483	1 #RBBRF+88	a annac.an	1.33045-24	4. HEREF=02	1.09765-04
	2,20402-00			33000-04		100010-00
80	5.30285-83	1.00002.00	5.0000F-00	1.33986-64	4.00000-02	1.72032-05
87	2,3150E+03	1.00000+00	8.86865+86	1.3394E-04	4.0000E-02	5.4772E-06
88	2.3368E+#3	1.0000E+30	F.0000E+00	1.33986-24	4.0008E-02	1,10526-06
	2 35885+43	1 000000-000	0.00000.00	1.33805-24	4.00065-62	3.33425-04
	2 3 3 9 9 9 9 9 7			77015-04	4 08085-00	0 40415-00
90	5.3.AMF+03	1.00000-00	6.0000E+00	1,33942-24	4,00000-52	2, -0415-03
91	2,4J10E+03	1.00001+20	6.0000E+05	1.3387E-04	4.00005-02	2,24646-86
92	2.42342-83	1,00002+00	0.00002:00	1,3412E-04	4.0208E-02	8,78736-05
03	2.4468F+83	1.000000+00	2.00005-00	1.33876-04	4.000PF-02	1.30665-05
	3 48485 483	1 00005-40	0.00000.00	33875-24	4 98685-33	4 20805-04
	2.40002-03	1,000000000	D, 00041+00	1.33632-64		0.27002-00
92	2.5100F+83	1.00000-000	N'8600E+86	1.34076464	4.00005-65	8,3442L-03
96	2,5398E+03	1.0000E+02	P.2000E+00	1,3381E-24	4,000PE-02	1.85986-05
07	2.5648F+33	1.000000+90	0.02005+00	1.34196+04	4.0000E-02	1.31965-04
	3 41 386 494	00006-00	0 0000-00	1 33775-84	4.00005-02	7.67755-04
	2,01362.003	1,000000000	F. 6000E+08	1,00/32-04		
99	5.00-66-63	1.00000-000	0.00005-00	1.33/92-0	4.00002-02	1.01321-05
108	2 7380E+03	1.000000+00	0.0000E+00	1.3416E-24	4.0000E-02	1.3971E=04
181	2.7978E+Ø3	1.00006+00	0.00005+03	1.33726-24	4,000886-62	3.2338E=25
1.62	2.771#F+#3	1.0000E+00	8.000000	1.33745-24	4.000000-02	5.02195-05
	0 41205-41	49445-49	0 0000-00	1 34545-24	4 BRRBL-42	7 97895-04
100	2,01202-83	1.00002.000	N. BODDE BD	1,34512-04	4.00000-02	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
184	2,8400E+03	1.00006+20	N.8000E+86	1,34041-04	4.00005-05	4,/3/32-05
105	2,8098E+23	1.0000E+00	2.000PE+00	1.3452E-04	4.00000-02	1.0145E+75
106	2.8Y88E+03	1.00000+20	2.50000-002	1.34766-64	4.0000E-22	8.59475-05
	2.95836+03	1 20005-00	3.00446+02	34445-24	4.02005-02	1 . 40105-36
100	7 91025-94	1 49995 - 99	1 00000 000	1.04060-#4	4 94996 - 42	0 50475-00
190	3.01466+03	1.00001+00	0.00005+00	1.35251-64	4-0000E-FZ	2.20435-64
109	3,0°80E+03	1.00001+20	8.0000E+00	1,3444E-24	-02	1.22655-25
110	3,1310E+03	1.0000E+00	8.02006+03	1.3491E-84	VZ	1.59335-04
111	3.10481+23	1.00000+00	0.0000.+00	1.3448E-04	4200E-02	3.42216 - 25
44.2	TIVANEADI	1 0000F+00	0 0000-00	1 34845-04	4.00005-02	4 . 4 1 4 15 - 14
	7 31365-00	4 40005 - 00	0 0000L-00	1 14405-24	4 03000-00	4 74400.00
115	3.23261-03	1.00000-000	r.000rE+00	1.34491-24		
114	3.2=90E+03	1.00000.000	r.0208€+00	1.34718-24	4.0000E-02	1.10000-04
115	3,3020E+03	1.0000E+00	0,000E+00	1,34376-04	4,00006-02	1.48346-05
116	3,3268E+83	1.0000E+70	P.0000F+02	1.3481E-24	4.0000L-02	1.53966-04
117	3 39385.03	1 WORDE	0 000004	34375-04	4.00005-02	2.44725-48
	3 43056 423		a addde.co	34405.04	· 00000 - 02	39.70
110	3.47082-03	1.00000.000	**************************************	1.34091-64	4.6000L-02	1.27131-24
119	3,40886+03	1,0000E+30	0,0000[•07	1,3436E-24	4.00002-02	3,27462-05
170	3,5470L+03	1.0000E+00	P.0000E+00	1.3429E-24	4,00081-02	1.08762+05
1 2 1	3. A#70F+03	1.00002.00	0.00005+00	1.34405-24	4.00085-02	5.54056-05
	1 49005447	1 0000F	A A00000	34345-94	4 00000-02	3 10145-0-
100	3.0.0002-03		0100005400	1.04206-64		2.003-0-05
123	3,/7482+03	1,00001+00	N.8000E+00	1,3467E-84	4.0000E-02	1.7278E-04
124	3,8040E+Ø3	1,000000+00	P,0000E+0P	1,3414E-84	4.00006-22	8,1295E-06
125	3.91 <i>08E+93</i>	1,00002+00	0.00006.00	1.3445E-04	4.0000E-22	1.0531E-04
126	4.0270E+03	1.00005+00	0.0000	1.34136-04	4.00005-02	2.27256-08
	4 0/601404	1 00005-00	0 00002+00	4 14065-04	A GUGGE -07	4 40015
121	-, D OBL - D 3	1.00000-000	1,0000F+00	1134235-84	- DUDUL - NZ	D. 799/E-03
128	4.3310L+03	1.00001+00	N 0000E+00	1.3409E-04	• .0000E • 02	0652E=05
129	4,3860E+Ø3	1,0000E+00	0,0000E+06	1,3418E-24	4.0000E-02	7,9053E-05
138	4.4978E+83	1.000000+00	0.0000	1.33956-24	4.20025-22	2.12345-84
1 3 1	A	1.000000+00	0.00305+00	1.34545.04	4.00085-02	2.12445-74
4 7 7	4 794454/1	1 00005.00	a addac.co	1 TTANE -04		2 5.050.00
104		1.00001.000	0.00005+00	1,00421-04		2. 197E-05
133	4,9240E+03	1.00001+00	P.8000£.00	1,3367E-04	4,00006-02	1.2115-04
134	4.8 YØE+04	1.0000£+00	0.0000F±20	1.3425E-04	4.000BE-02	2,7916E+04

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J=VALUE COMPETITIVE NEUTRON RADIATION F 2.000000000000000000000000000000000000	15510N 300E+00
2.0000E+00 0.0000E+00 1.0000E+20 0.0000E+00 1.00 AVERAGE RESONANCE WIDTHS (EV) INDEX ENERGY (EV) LEVEL SPACING COMPETITIVE NEUTRON RADIATION F: 1 1.3000E+02 1.0000E+00 0.0000E+00 1.3416-04 4.0000E+02 5.4 2 1.9000E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 2.00 4 2.3100E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 2.00 4 2.3100E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 1.01 5 2.4000E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 1.01 6 2.4000E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 1.01 6 2.4000E+02 1.0000E+00 0.0000E+00 1.3446-04 4.0000E+02 1.01 6 2.4000E+02 1.0000E+00 0.0000E+00 1.34460-4 4.0000E+02 1.01 6 2.7000E+02 1.0000E+00 0.0000E+00 1.3466-04 4.0000E+02 1.01 9 2.6000E+02 1.0000E+00 0.0000E+00 1.3466-04 4.0000E+02 1.01 9 2.6000E+02 1.0000E+00 0.0000E+00 1.3466-04 4.0000E+02 1.01 9 3.6000E+02 1.0000E+00 0.0000E+00 1.3456E-04 4.0000E+02 1.01 1 3.4000E+02 1.0000E+00 0.0000E+00 1.3456E-04 4.0000E=02 2.00 1 3.4000E+02 1.0000E+00 0.0000E+00 0.3520E-04 4.0000E=02 2.00 1 3.4000E+02 1.0000E+00 0.0000E+00 0.3520E-04 4.0000E=02 2.00 1 3.4000E+02 1.0000E+00 0.0000E+00 0.3520E-04 4.0000E=02 2.00 1 3.4000E+02 1.0000E+	330E+08
AVERAGE RESONANCE WIDTHS (EV) INDEX ENERGY (EV) LEVEL SPACING COMPETITIVE NEUTRON RADIATION FI 1 1,3008502 1.00005000 0.00005000 1.34205-24 4.00005000 5.4 2 1.00005000 0.00005000 1.34205-24 4.00005000 3.33 3 2.00005000 0.00005000 1.34415-04 4.00005000 3.33 4 2.3100500000 1.00005000 0.00005000 1.34415-04 4.00005000 2.400000000 5 2.400050000 1.00005000 0.00005000 1.34415-04 4.00005000 2.4000000000 6 2.440050000 1.00005000 0.00005000 1.344050000 4.000050000 1.4400000000000000000000000000000000000	
INDEX ENERGY (EV) LEVEL SPACING COMPETITIVE NEUTRON AAOLATION F: 1 1,30F8E-82 1.0080E-60 0.0000F-00 1,3426E-24 4.0000E-02 5,4 2 1,90F8E-92 1.0080E-90 0.0000F-80 1,3426E-24 4.0000E-02 2.00 4 2,31F8E-92 1.0000E-20 0.0000E-80 1,344E-24 4.0000E-02 2.00 4 2,31F8E-92 1.0000E-20 0.0000E-80 1,344E-24 4.0000E-02 2.00 5 2,40F8E-92 1.0000E-00 0.0000E-80 1,344E-24 4.0000E-02 1.00 6 2,40F8E-92 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-02 1.00 6 2,00F8E-92 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-02 3.00 9 2,00F8E-92 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,300FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 9.00 11 3,400FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-02 3.00 10 3,300FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 9.00 11 3,400FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-02 3.00 12 3.0000E-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,300FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,300FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,300FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,000FE-02 1.0000E-00 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 3,000FE-02 1.0000E-80 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 0.0000E-92 1.0000E-80 0.0000E-80 1,3458E-24 4.0000E-92 3.00 10 0.0000E-90 1.0000E-80 0.0000E-80 0.0000E-80 0.0000E-80 4.0000E-92 3.00 10 0.0000E-90 1.0000E-80 0.0000E-80 0.0000E-80 0.0000E-80 4.0000E-92 3.00 10 0.0000E-90 1.0000E-80 0.0000E-80 0.0000E-80 0.0000E-80 2.2288	
1 1.30785-02 1.00705-00 0.00705-00 1.34265-24 4.00705-02 5.4 2 1.00785-02 1.00705-00 0.0075-00 1.35465-04 4.07075-02 2.4 3 2.00785-02 1.00705-00 0.0075-00 1.34415-04 4.07075-02 2.6 4 2.31785-02 1.00705-05 0.00075-00 1.34415-04 4.07075-02 2.6 4 2.31785-02 1.00705-00 0.00075-00 1.34455-04 4.07075-02 2.1 5 2.40785-02 1.00705-00 0.00075-00 1.34455-04 4.07075-02 1.0 6 2.40785-02 1.00705-07 0.00075-00 1.34455-04 4.07075-02 1.0 6 2.40785-02 1.00705-07 0.08075-00 1.34455-04 4.07075-02 1.0 6 2.40785-02 1.00705-07 0.08075-00 1.34455-04 4.07075-02 1.0 7 2.50785-02 1.00705-07 0.08075-00 1.34455-04 4.07075-02 1.0 9 2.60785-02 1.00705-07 0.08075-00 1.34555-04 4.07075-02 9.0 1 3.30785-02 1.00705-07 0.08075-00 1.34555-04 4.07075-02 9.0 1 3.30785-02 1.00705-07 0.08075-00 1.34555-04 4.07075-02 9.0 1 3.40785-02 1.00705-07 0.08075-00 1.34555-04 4.070755-02 9.0 1 3.30755-02 1.00705-00 0.00075-00 1.34555-04 4.070755-02 9.0 1 3.30755-02 1.00705-00 0.00075-00 1.34555-04 4.070755-02 9.0 1 3.30555-02 1.00705-00 0.00075-00 1.34555-04 4.070755-02 9.0 1 3.30575-02 1.00705-00 0.00075-00 1.3555-02 4.00755-02 9.0 1 0.00555-00 0.00755-00 0.00075-00 0.00075-00 0.00075-00 0.00055-000 0.00055-000	SSION
2 1,99886.92 1.00006.90 0,00000.00 1.35406.04 4.00006.02 2.6 3 2,00986.92 1.00006.90 0,00000.00 1.34406.04 4.00006.02 2.6 4 2,31986.92 1.00006.90 0,00000.00 1.34406.04 4.00006.02 9.1 5 2,44986.92 1.00006.90 0,00000.00 1.34406.04 4.00006.02 1.4 6 2,44986.92 1.00006.90 0,00000.00 1.34406.04 4.00006.02 1.4 7 2,59000.92 1.00006.90 0,00000.00 1.3486.04 4.00006.02 1.4 7 2,59000.92 1.00006.90 0,00000.00 1.3486.02 3.1 8 2,70000.92 1.00000.00 0,00000.00 1.34850.04 4.00006.02 3.1 9 2,60000.02 1.00000.00 0,000000.00 1.34500.04 4.00006.02 3.4 10 3,30000.02 1.00000.00 0,00000.00 1.34500.04 4.00006.02 9.90 11 3,40000.02 1.00000.00 0,00000.00 1.34500.04 4.000000.09 9.0 11 3,40000.02 1.00000.00 0,00000.00 1.34500.04 4.00000.09 9.0 12 3.67000.02 1.00000.00 0,00000.00 1.34500.04 4.000000.09 9.0 12 3.67000.00000.00000.00 0,00000.00 1.34500.04 4.000000.09 9.0 12 3.67000.00000.00000.00000.00000000000000	571E-06
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5 2,440,85+82 1.30,005+80 0,00055+80 1.34495+84 4.00055+62 1.33 6 2,440,85+82 1.30,005+80 0,00055+80 1.34655+84 4.30055+82 1.24 7 2,540,642 1.480,005+80 0,023,05+80 1.34655+84 4.30055+82 1.34 8 2,740,65,82 1.480,05+80 0,023,05+80 1.346,55+84 4.00055+82 1.31 9 2,650,85+82 1.480,85+80 0,00055+80 1.346,55+84 4.00055+82 3.31 10 3,340,65+82 1.40,80,55+80 0,00055+80 1.346,55+84 4.00055+82 9.40 11 3,440,65+82 1.40,80,55+80 0,00055+80 1.346,55+84 4.00055+82 9.40 11 3,440,65+82 1.40,80,55+80 0,00,80,80,80 1.3346,55+84 4.00055+82 9.40 11 3,440,65+82 1.40,80,55+80 0,00,80,80,80 1.335,55+84 4.00055+82 9.40 11 3,440,65+82 1.40,80,55+80 0,00,80,50,60 1.335,55+84 4.00055+82 9.40 12 3,67,85+82 1.40,80,55+80 0,00,80,50,60 1.335,55+84 4.00055+82 2.428	232-05
6 2,44985.82 1,8085.88 C,00825.80 1,3485.24 4,30805.82 1,22 7 2,5485.42 1,8085.80 0,8385.80 1,3485.24 4,3085.02 3,1 6 2,70485.92 1,9885.90 0,8885.98 1,3485.24 4,0385.92 1,1 9 2,80985.92 1,0085.98 0,8885.98 1,34855.24 4,8885.92 3,3 13 33855.24 1,9855.98 0,9885.98 1,3485.24 4,8885.92 3,3 13 3,3485.24 1,9855.98 0,9885.98 1,3485.24 4,8885.92 3,9 14 3,44955.92 1,9885.98 0,9885.98 1,3485.24 4,9885.92 3,9 14 3,44955.92 1,9885.98 0,9885.98 1,3485.24 4,9885.92 3,9 14 3,44955.92 1,9885.98 0,9885.98 1,3455.24 4,9885.92 3,9 14 3,44955.92 1,9885.98 0,9885.98 1,3455.25 4,98855.92 3,98 14 3,44955.92 1,9885.98 0,98855.98 1,3455.25 4,98855.92 3,98 14 3,44955.92 1,9885.98 0,98855.98 1,3455.25 4,98855.92 3,98 14 3,44955.92 1,98855.98 0,98855.98 1,34555.98 4,98855.98 2,98 15 3,57855.98 0,9855.98 0,98855.98 0,98855.98 1,34555.98 1,98855.98 0,988555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,9885555.98 0,98855555.98 0,98855555.98 0,98855555.98 0,98855555.98 0,98855555.98 0,98855555.98 0,98855555.98 0,988555555.98 0,9855555.98 0,9855555555.98 0,9885555555555555.98 0,98855555555555555555555555555555555555	543E-05
7 2,5V986642 1,00086400 4,00208640 5,34485484 4,00086405 3,41 8 2,7048542 1,00086400 8,00086260 1,34585424 4,00086402 1,41 9 2,80486402 1,00886408 8,08086480 1,34585424 4,00886402 3,41 10 3,34985402 1,00886408 8,08086408 1,34585484 4,00885402 9,49 11 3,44985402 1,00886408 8,08085480 1,34585484 4,00885402 3,44 12 3,4708542 1,00885408 8,08085480 1,359544 4,00885402 3,44 12 3,4708542 1,00885408 8,08085480 1,359544 4,00885402 3,44 12 3,6708542 1,00885490 8,08085480 1,359544 4,00885402 3,44 12 3,6708542 1,00885490 8,08085480 1,359544 4,00885402 3,44 12 3,6708542 1,00885498 8,08085480 1,359544 4,00885402 3,44 14 3,49985402 1,00885498 8,08085480 1,359544 4,0088540 2,344 14 3,49985402 1,00885498 8,00885480 1,3595448 4,0088548 2,344 14 3,49985492 1,00885498 8,00885480 1,3595448 4,0088548 2,344 14 3,49985492 1,00885498 8,00885480 1,3595448 4,0088548 2,344 14 3,49985492 1,00885498 8,00885480 1,3595448 4,0088548 2,344 15 3,49985492 1,00885498 8,0088548 8,0085	9356-84
9 2,80986-02 1.00006-020 8,00026-00 1.34566-02 4.00086-02 3.4 10 3,30986-02 1.00006-00 8,00086-00 1.34666-02 9.9 11 3,40986-02 1.00006-00 8,00086-00 1.3456-04 4.00086-02 9.9 12 3,40986-02 1.00006-00 8,00086-00 1.3526-04 4.00086-02 3.6 12 3.60986-02 1.00006-00 8,00086-00 1.3526-04 4.00086-02 3.6	385-04
10 3,30000-02 1.00000-00 0,00000-00 1,34060-04 4,00000-02 9,40 11 3,40000-02 1.00000-00 0,00000-00 1,34940-04 4,00000-02 3.40 12 3.47000-02 1.00000-00 0,00000-00 1,3520-04 4,00000-02 2.40	365-86
11 3,400E+02 1.0000E+00 0.0000E+00 1.3454E-04 4.0000E+02 3.44 12 3.670E+02 1.0000E+00 0.0000F+00 1.3529E+04 4.0000E+02 2.44	55E-05
12 3.0/002402 1.00002400 0.00005000 1.3329244 4.00004442	193E-06
13 3 7708F+02 1 0000E+00 0 0007+00 1.3454F-24 4.0008E-02 3.60	153E-06
14 4,1998E+82 1.8888E+88 8,8808E+88 1,3521E-84 4,8888E-82 1,98	21E-04
15 4,2900E+02 1.0000E+00 0.0000E+00 1.3459E-04 4.0000E-02 4.13	746E-06
	998E+04
1/ 4,/5002+02 1.00002+00 9,00002+00 1.34512-04 4.00002-02 4.90	94E-05
10 5,5100E+02 1,0000E+00 2,0000E+00 1,3463E-04 4.6000E-02 4.60	23E-26
28 5,7188E+02 1,0088E+08 8,0088E+88 1,3492E-84 4.8888E-62 8,96	986-85
21 5,8100E+02 1.0000E+08 2.0000E+08 1.34(4E-04 4.0000E-02 4.94	479E-06
22 0.5500E-02 1.0000E-00 0.0000E-000 1.550E-04 4.0000E-02 5.5	3182-06
24 7.0200E+02 1.0002E+00 0.0000E+02 1.3510E-24 4.0000E-02 1.43	373E-04
75 7,14001+02 1.0000E+00 0.0000E+00 1.3464E-04 4.0300E-02 5.5	511E-06
26 7,8/001+02 1.00001+00 0,00000-00 1.35325-04 4.00005-02 2.13	L20E-04
28 8.5900E+02 1.0000E+00 0.0000E+00 1.3565E=04 4.0000E-02 3.1	173E-04
29 8.6400E+02 1.0000E+08 0.0000E+08 1.3462E-24 4.0008E+22 6.2	191E-06
30 9,4106±+82 1.0000€+00 0,0008E+00 1,3463E-84 4.0008E-02 1,37	742E-05
31 9,71005-66 1,00005-00 9,00005-00 1,35005-54 4,0005-66 0,30	1996-94
33 1,01501+03 1,0000E+00 6,2000E+00 1,3462E-04 4,0000E-02 1.75	324E - 05
34 1.0220E+03 1.0000E+00 0.0000E+00 1.3471E-04 4.0000E-02 4.43	91E-05
35 1,03201+03 1.00001+03 0.00002+00 1.34991-14 4.00001-02 6.00	305-06
37 1.0920L+03 1.0000E+00 0.0000F+00 1.3456E+24 4.0000E+02 3.54	978-05
38 3,1210E+03 1,0000E+00 0,0000E+00 1,3571E-04 4.0000E-02 3.54	39E=04
39 1,1310E+03 1,0000L-^^ 0,0000E+00 1,3456E-04 4,0000E-02 7.23	561E-06
	118-04
42 1,2300E+03 1.0000E+00 2.0000E+00 1.3550E+04 4.0000E-02 3.07	27E-84
43 1,2400E+03 1,0000E+00 0,0000E+00 1,3451E-04 4,0000E-02 7,03	235-26
44 1,2/301+03 1.00001470 0,00005400 1,32041-04 4,0000142 3,72 45 1,28305403 1.00005400 0,00005400 1.34405424 4,00005402 7,75	12E=04
46 1,3130E+03 1.0000E+00 0,000E+00 1,3462E-04 4.0000E-02 5,05	16E+05
47 1,3230E+03 1.2000L+00 0,0000E+00 1,3449E-04 4,0000E-02 7,92	41E-06
48 1,3/685-63 1,00006-600 0,00006-00 1,35176-64 4,00005-62 2.20	332004
90 1.4290E+03 1.0000E+00 0.000E+00 1.3310E+C4 4.0000E+02 7.53	452=05
11 1,4390E+03 1.0000E+00 0.0000E+00 1,3443E-04 4.0000E-02 8.32	14E-06
1.4000E+03 1.0000E+00 0.0000E+00 1.3455E+04 4.0000E+02 4.87	452-05
54 1.4990E+03 1.0000E+00 0.0000E+00 1.3449E-04 4.0000E-02 3.32	3/1=00 68E+85
55 1,5090E+03 1.0000E+00 P.0000E+00 1,3441E-04 4.0000E+02 8,55	452-06
56 1,547#E+03 1,0000E+00 0,0000E+00 1,3457E-04 4,0000E-02 6,35	72E-05
5/ 1,37/01+03 1,00001+00 2,0000E+00 1,34371-04 4,0000E+02 6,/1 48 1,57885+03 1,0000F+00 0,0000F+00 4,34475+04 4,0000F+02 4,4	246+06
59 1.5080E+03 1.0000E+00 0.0000E+00 1.3436E-04 4.0000E-02 8.51	37E-06
60 1.6220E+83 1.0000E+80 0.0800E+80 1.3437E+84 4.8800E-02 1.78	94E-05
41 1,6328E+03 1.0000E+00 0.0000E+00 1,3433E+24 4.0000E+02 8,95	572-06
A3 1.6040E+03 1.0000E+00 0.0000E+00 1.3432E+04 4.0000E+02 1.04	125-06

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64	1.7040E+03	1.0000E+00	0.00006+00	1,34916-04	4,0200E-02	1.9614E-04
Ă5	1.71405+03	1.00000-000	0.00005-00	1.34386-24	4.02006-02	9.21575084
44	1.7.1485+03	1.00005-0.	0 0000L-00	1.34505-84	4.00005-02	9.77695-04
4.7	1 74495+03	1 00005-00	0,00002.00	1 14245-24	4 00000-02	9.31415-04
	1,7-02-03		0.00001.00	1,34201-04	4,00000-02	7 54745-00
60	1.0/066-03	1.000000+00	N. 00005.000	3.3004L-04	4.00001-02	/
69	1,80000.+03	1,00001+80	5.30005.00	1,34216-04	4.00001-02	A*15ABE=89
70	1,8¥68E+Ø3	1.0000E+00	8,00006+00	1,34502-04	4.00002-22	9.0610E-05
71	1,90606+03	1,0000E+00	0,00006+00	1,34286-84	4.00005-82	9.80775-06
72	1.9240E+03	1.0000E+00	0.0000E+00	1,3444E-84	4.03005-92	8.4718E-05
73	1.9340E+03	1.0000L+00	0.0000	1.341BE-04	4,0000E-02	9.89266-06
74	1.97786+03	1.00000E+00	8.48485+88	1.34345+04	4.00000-02	7.07345-05
75	2.82705+83	1.0000F+00	a adaacaa	1.34145-24	4.0000F-02	1.01105-05
76	2 31045403	1 00006-00	a agage	34255	4.02005-02	3.41786-04
/0	2,00,000,000	1.00000.000	0,00901000	1 74845-84	4,00000-02	4 78105-04
	2,10102-03	1,00000-00	6.0000F+00	1,34062-04	4.00000-02	0./DUEL-ro
78	2,12001+03	1.00002.000	0.0000E+06	1.34086-04	4.00005-02	1./795E-05
79	2,1>60E+03	1,0000E+00	0,0000E+00	1,3402E-04	4.0000E-02	3.09706-06
89	2,1758E+Ø3	1,3000E+00	0,000PE+00	1,3403E-24	4,00006+02	1,26201-05
81	2.159E+Ø\$	1.0000E+00	0.00000+000	1,34016-04	4.00006-02	4,/820E-06
82	2.2140E+03	1.0000£+00	P. 20205+20	1.34006-84	4.30005-02	3.53346-05
83	2.2240E+05	1.00000.+00	8.000000	1.34255-84	4.00005-02	2.36485-85
	2 23405+03	1 20005-00	B 0000C+00	1.34295-04	4.000000-002	9.43895-26
	2 28405+03	1 000001.00	a adade.da	1 33045-84	4 03085-02	1 1014-00
		1,000000.00		1.33442-04	4,000000-02	1 40335-00
	2.30526-03	1.00000.000	0,00005+00	1,33982-04	4,00001-02	1.72031-05
87	2,3150E+03	1,00001+00	6.00005+00	1,3394E+84	4.8000E-02	5.4972E-06
88	2.3362E 0 3	1.0000£+00	0.0000E+00	1,339ØE-24	4.0000E-g2	1.1092E-06
89	2,3>80E+Ø3	1.0000E+30	0.03006+60	1.3389E-24	4.0000E-02	3,3342E-06
90	2,3798E+Ø3	1.0000E+00	P.0000E+87	1,3394E-84	4.0200E+02	2,40416+05
91	2.4010E+03	1.0000E+00	0.0000F+20	1.33876-84	4.00032-02	2.24846-06
92	2.42386+83	1.20205+00	8.00001-02	1.34125-24	4.0200E-02	8.7873F+05
63	2.44405+03	1. 2000F+00	0 00000.400	1.33875+24	4.000000-02	1.38446.08
	2 44005-03	20005.00		1 73995-04	4,00000-00	4 30805-34
	2,4000000000	1,00002-00	0,00002-00	1,33832-04		UILYODL-DO
45	2.51602-03	1.00000-00	N. 8000F+00	1,3-672-0-	4,00000-02	0.34421-05
90	5.23485+83	1.00001+00	0,0000E+00	1,3381E-04	4.0000F=65	1.0558E-05
97	2,5040E+03	1,0000E+30	0.00006+00	1,3419E+64	4.00000-02	1,3196E+04
98	2,61302+03	1.00000+00	0,0000[+00	1,3373E-24	4.0000E-22	7.6775E-Ø6
99	2,6048E+Ø3	1.0000E+30	0.0000€.000	1.3375E-04	4,00006-02	1,61326-05
100	2.73PBE+03	1,0000E+00	8.00000.000	1.3416E-24	4,00006-02	1,59715-04
101	2.7978E+03	1.000000+00	8.0000.+00	1.3372E+04	4.0000E-02	3.23366-05
1.52	2.7/10F+03	1.000000.000	a.asaar.as	1.337AF+24	4.00086+02	5.02195-05
4.91	0 81005+03	1 00000-00	a agode. ad	1 34846-04	4 10000 -07	7 87505-04
103	2,01202-03	1.000000400	r,0000E400	1,34912404	4,0000E-02	1.7/372-05
100	2,04001403	1,00001-00	0.0000E+00	1,34041-04	4.00000-022	4.75/SE-05
182	5.00ANF+N2	1.00000+00	8.8000E+90	1,3452L-64	4.00001-22	1.01406-05
100	2.8×80E+03	1,0000E+00	0,0000E+00	1,3476E-04	4.0000E+02	8,3947E-05
107	2,9080E+Ø3	1.0000E+00	0.0000€+00	1,3448E-04	4.00086-02	1.20106-05
198	3.0190E+03	1.0200E+30	0,03066+00	1,35256+84	4.0000E-02	2,30436-04
109	3,8668E+83	1.80P0E+00	2.00005+00	1,3444E-04	4,00066-02	1,22655-05
110	3.1318E+83	1.82982+23	0.00005.00	1.34916-04	4.00000-02	1.59236-04
111	3.10425+83	1.00205+00	0.0000-00	1.34485-24	4.00000-02	3.42215-05
***	7 19805-83	1 00005-00	0 00005-00	4 34945-04	4 60685-02	4 41410-04
112	3 31246403	4 900001-00	0,0000E=00	1 3440C-04	4.00000-02	4 24405-04
110	3,23202783	1.00000-000	L'REREF.80	1 74945-04		
11	342798E983	1.00001.000	0.00X0E+06	1.34/11464	- 0000L-02	1.1000E-04
112	3.30201-03	1.06001.00	N.0E0NE+00	1,34372-24	4.0000E-22	1.4634E-05
110	3,37AØE+03	1.0000E+00	8,05005+00	1,3481E-04	4.00006-02	1,>396E-84
117	3,39306+03	1,0000E+00	0.0000£.00	1,3437E-04	4.00005-02	2,46726-05
118	3,4⊅00€+03	1.0000E+00	₽,0000E+00	1,3469E-84	4.0000E-02	1,2713E=04
119	3,4880E+03	1.0000E+00	0.00301+03	1,3436E=04	4,0000E-02	3.2746E-05
128	3.5470E+03	1.0000E+00	7.2000r+00	1.34295-04	4.00001-02	1.0876E-05
121	3.60706+03	1.0000F+00	0.0000.00	1.34405-04	4.20085-02	5.54955-08
1 22	3.6980F+0.5	1.00000 +00	0.20006403	1.3424F-84	4.0000F=42	3.30345-05
107	3 75446.407	• 0000C+00	1 0000000000	1 344-5-04	A 00000-02	. Koter_r.
125	3 94435473	1.000000-00	F . DODOE - DD	1 34440-04		A
12	3,00001.003	1,00001+00	F.0000E.000	1.34141-64	4 BECEL BZ	0.12976-06
122	3.91005-03	1.000000+00	0.0000E+00	1,34456-84	4.0000L-02	1,05312-04
126	4,0270E+03	1,3000E+00	0.0000£.00	1,3413E-04	4.0000E-02	2,2725E+05
177	4,0760E+03	1,0000E+00	0,0000E+00	1,34255-04	4.0000E-02	6.4997E-05
128	4,3310E+03	1.0000E+00	P,0000E+00	1,3409E-04	4.90082-02	4,6662E-05
129	4.3860E+93	1,00066+00	P.800000	1.3418E-04	4,0000E=02	7,98536-04
130	4.4970E+03	1.000000+00	0.0000-00	1.33951-04	4.0000E-02	2.10046-04
1 31	4.67205-03	1.00005.00	C.000000	1.34045-04	4.00005-07	2.12445-04
472	4.7940F+03	1.0000F137	a aaaar	1.11425-04	4.00001-02	2 54085-75
1 7 7	4 05452473	1 000005454	d dddde.dd	4 33495-04	4 00005-02	1 33115-05
133	4 00045-03	* MUQUE * 90	0.000rf=0c	11000/0-04		3, 22116 -04
134		7.00001-500	0.0000E+00	1,34235-64	**DDDDF=05	2,/V10L*04

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ingentations of Second Contraction

			DEGREES OF	FREEDOM USED	IN THE HIDTH	DISTRIBUTION
		JEVALUE	COMPETITIVE	NEUTRON	RADIATION	F15510N
		3.00006+00	P.8022F+02	1.000000+20	8.8283E+23	1.00206+02
			AVE	PAGE RESONANC	E WIDTHS (EV)	
INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	FISSION
1	1,3000E+02	1,0000E+00	0,00002.000	1,3428E-04	4,8000E-02	5,4391E-06
2	1.98886.02	1.0200E•00	0.0000E+00	1,354BE-84	4.02000-02	3,0718E-04
3	5.8008F+85	1.0000E+00	9.000E+00	1.34416-64	4.20005-82	2,00316-06
	2.40886402	1.000000400	0.00005+00	1.34405-24	4.00001-02	1.36435-08
6	2.49885+82	1.000000+00	0.00001-00	1.34885-84	4.0020F=02	1.29356-04
ī	2.59885+82	1.00095.00	8.888688	1.34485-84	4.2000E-02	3.1592E-06
8	2,7888E+82	1,00000.+00	8.08001.00	1,34856-24	4,00000-02	1,1138E-04
9	2,85 F #E+82	1.0000E+00	0,00306+00	1,3450E-24	4,0008E-02	3,3436E-Ø6
10	3.30886.02	1.0000E+00	0,00006+00	1,3486E-84	4.0008E-82	9,98556-05
11	3.40001+82	1,00001+00	0,0000E+00	1,3454E=04	4,06000-12	3,06936-06
14	3 77885+82	1.0000E+00	0,00001+00	1 34845-04	4 00000-02	3.84835-04
14	4.19826+02	1.000000+00	0.000000	1.3521 -24	4.00000-02	1.90215-04
15	4.29486+82	1.8000E+00	P.0000E+00	1.34592-84	4.00006-02	4,1746E=26
16	4,600000+02	1.0000E+00	0,0000E+00	1,3500E-24	4.00000-02	1,2090E-04
17	4,7888E+82	1.0000E+00	8.0000E+08	1,3461E-84	4.00082-02	4,4344E-06
18	5,4100E+02	1,0000E+00	0.000E+00	1,3477E-04	4.00000-02	4,9284E=25
10	5,71085402	1 90005-00	0 0000E+00	1 34005-24	4.00000-02	8 9000C-38
51	5.81885+82	1.000000+20	0.00005+00	1.34645-84	4.00000-02	4.94795-04
22	6.5388E+82	1.000000+00	8.00005+00	1.354AE-04	4.00000-02	2.54786+84
23	6,6388E+82	1.0000E+30	0.0000E+00	1,3464E-84	4.00000-02	5,3310E=06
24	7,9208E+82	1.0000E+00	0.0000E+00	1,3518E=04	4.0000E-02	1.4373E=04
25	7.12886+82	1.0000E+00	0.0000E+00	1.3464E-84	4.0000E-02	5,5511E-06
20	7.8/881+92	1.00001+00	0.00005+00	1.33328-64	4,00001-02	2,11286-04
24	A.5980E+92	1.000000-00	9.0300E+00	1.35485-24	4,00000-02	3,13735-04
29	8.6780E+82	1.00002+00	0.00000.00	1.3462E-24	4.0000E-02	6.2191E-2A
30	9.4180E+82	1.0000E+00	0.0000E+00	1.3463E-04	4.00000-02	1.0742E-05
31	9,510BE+02	1.0000E+00	0.2002E+20	1,346ØE-04	4.0000E+02	6,5490E-06
32	1.0060E+03	1.0000E+00	0.0300E+00	1,3542E-04	4,0000E-02	2.5629E-04
33	1,01506+03	1,0000E+00	0.000000.00	1,3462E-04	4.00006-02	1./034E-05
35	1,0120E+03	1.0000E+00	0.00005+00	1.34505-24	4.500000-62	4. 3416-05
36	1,00586+03	1,00000+00	0.0000F+00	1.34956-04	4.00000-02	1.41328-04
37	1,89286+83	1,8000E+00	0,00002+00	1,3466E-84	4,8888E-82	3.5497E-05
38	1,1210E+03	1,0000E+00	0,0000E+00	1,3571E-04	4.0000E-02	3,5439E=04
39	1,1310E+83	1,0000E+00	0.0000E.00	1,3456E-04	4.20006-02	7.2361E+Ø6
40	1,19906+03	1,00001+00	P,0000E+00	1.34785-24	4.000000-02	8,1452E=05
12	1.23085+03	1,0000E+00	0,0000E+CC	1,35595-84	4.000000-02	3.01275-04
43	1.24006+03	1.000000+00	0.0000F+00	1.34516-84	4.0000E-02	7.03235-06
44	1,2730E+03	1.00000.+00	0.00000.000	1,3564E-04	4.0000E-02	3.0073E=04
45	1,2030E+83	1.00225+00	9.0000E+00	1,3449E-84	4.00001-02	7.7846E-06
46	1,3138E+93	1.0000E+00	0.0000E+00	1,3462E-04	4.00000-02	5.0586E=45
47	1,32381+83	1.000000+90	8.000000.000	1.34496-04	4.0000E-02	7.92416-06
40	1.38486+03	1.000000-00	0.0000F+00	1 34485-04	4.00000-02	2,20331-04 8.14195-04
50	1.42986+03	1.000000+00	0.00005.00	1.33106-04	4.00000-02	7.03455-25
51	1,4398E-03	1.00000+00	0,0000E+00	1.34435-04	4.0000E-02	8.3214E+06
52	1,4000E+03	1.0000E • 00	0.0000E+00	1,3455E-84	4.00000-02	4,8745E-05
53	1,4708E+03	1.0000E+02	0.2000E+00	1,3441E-04	4.00001-02	8.4257E-06
54	1,47986+03	1.00001+00	8.0000E+00	1.34495-04	4.0000E-02	3,32685+05
52	1.54706+03	1.00000-00	0.0000F+00	1.34575-04	4.00002-02	0,7747L-00
57	1.5070E+03	1.0000E+00	0.00002-00	1.34376-04	4.0000E-02	6.7129F-0A
58	1,57885+03	1.0000E+00	0.0000E+00	1.34676-04	4,00000-02	9,69285-05
59	1,5880E+Ø3	1.00202+02	8.62865+83	1.3436E-24	4.20006-02	8,8137E-26
60	1,6220E+03	1.0000E+00	9.0000E •00	1.3437E-04	4.0000E+02	1.78546-25
61	1,00201+03	1.0000L+00	0.2098E+08	1.3433E-64	4.0000E-02	0.93378226
63	1.6040E+03	1.000000+00	2.00005.00	1.34328-84	4.00000-02	9.12125-04

64	1.70486+83	1.00226+30	0.0000E.02	1.34916-24	4.00005-02	1,96142-04
65	1.7148E+03	1.00801.00	9.00001.00	1.34386-24	4.0000L-62	9.2157E-36
66	1,7348E+03	1.00001.000	6.0666E+55	1.34596-64	4.30001-32	9.31 115-04
A8	1.870EE+85	1.00000.000	0.0000E+00	1,36646-24	4.03002-02	7.56745-24
69	1.6698E+03	1,29281.088	3,9888287	1.34216-84	4,02001-92	9.72985-46
78	1.8960E-83	1.02206+22	7,20092.00	1.34506-04	4.00001-02	9.06100-05
71	1,9000E+03	1.00001+00 1.0000f+00	8,3890E+80 0,8802C+90	1.34201-64	4.23086-22	8.47186-35
23	1.93486+83	1.00000-00	8.85836.+55	1.34186-84	4.8000E-22	9.09265-06
74	1,94726-03	1.00001+00	6.00005.00	1,34346-84	4.00005-02	7.4734E+05
75	2,00786+03	1.00301+30	0.0000E+00	1.34141-64	4.00002-02	3.83385+06
70	2.10125+03	1.30301+00	2.00000+00	1.34266-84	4.00005-02	6.75022-06
78	2,1488E+83	1.20000-00	0.0000E .00	1,34086-84	4,2000E-#2	1.77956-45
79	2,19682-83	1.00000+40	0.2000E+00	1,34026-24	4,00000-02	3.09202-06
88	2,1/586+03	1.0000L-00	0,0200E+00	1,34031-24	4.50001-02	4.78205-04
82	2.21406+03	1.0000E+00	P.2000E.00	1.34292-24	4.00001-02	3.5384E-P5
85	2,2248E+83	1.00000.+00	0.00002.00	1,34096-04	4.03082-02	2, 3648E=05
84	2.22406+03	1,2000E.00	0.00001-00	1.34276-04	4.000001-02	9.03392-05
27	5.5040F+83	1 00001-00	0,0000E+00	1.33045-24	4.00005-02	1.92/3/-05
47	2.3150E+03	1.00026-00	P.0000C+80	1,3394E-24	4.88886-02	5.49722-26
86	2,3368E+Ø3	1.00001+00	0,00000.00	1,33986-24	4.00002-02	1.10520-06
89	2,35826+83	1.0008E+40	F,0000E+00	1,33896+24	4,00001-02	3,33426-06
92	2.40105+03	1.00001.000	0.0000E=00 0.00080-000	1.3387E-04	4.000000-02	2,2464E#86
92	2.4238E+#3	1.0008E+00	0,20082.+82	1,3412E-24	4.00082-02	8.78736-05
43	2,4468E+83	1.00000+00	6.89995.88	1,33872-04	4.00000-02	1,30666=05
94	2,48882+83	1,3000E+00	R.0000E+00	1.33831-64	4.00000-02	B. 34425+85
96	2.5398E+03	1.0000E+20	5.0820E+80	1.3381E-84	4.00005-02	1.85686-85
97	2,504#E+#3	1.0000E+00	8.00005.00	1.341\$E-84	4.00002-02	1.5176E=04
98	2.61306+03	1.000000+00	0,20006+00	1,33738-04	4.000000-02	7.07752-06
142	2,00-02+03	1.000000-000	0.00001-00	1.34146-84	A. 3000E -02	1.5971E=04
101	2.79766+03	1.00086+00	0.00202.00	1.33726-24	4.20206-22	3-2338E-85
182	2,7718E+#3	1.0000E+00	8.00002-00	1,33766-04	4.00BBE+62	5,0219E=05
103	2,8120E+04	1,00005+00	0.00000.00	1.34518-04	4.00001-02	4.7873E=08
165	2.84986+83	1.20005+90	P.2266T+8G	1.34525 84	4.0000E-02	1.01455-05
100	2,8488E+03	1.0000E+00	0,2800E+80	1,34765-04	4.00000-02	8,8947E-85
187	2,99805+03	1.000000+00	0,000000+00	1,34486-04	4.00002-02	1,2010E=05
100	3.81981+83	1.00001+00	8,0000E+00	1.34445-04	4.000000-02	1.22650-05
110	3,1310E+03	1,00002-00	0,06006-00	1,3491E-J4	4.8888E-82	1,59235004
111	3,104BE+03	1.0000£+00	0,00000-00	1,3448E-84	4.0000E+02	3.4221E+05
112	3,1980E+03	1.00001+00	8.0000E+00	1,34646204	4.00000-02	1,93032-04
214	3.2498E+03	1.30021+00	0.00005+00	1.3471E-04	4.0000E-22	1.18502-04
115	3,3028E+03	1.00001+00	0.00002.00	1,3437E-84	4.00006-02	1.4834E=05
116	3,3568E+Ø3	1.00000400	0.00002+00	1,3481F 24	4,00002-02	1.>396E-84
117	3,39386+83 3 4500F+03	1,000000+00	0,0000€+00 0,0000€+00	1.34592-24	4.000000-02	1.27132-04
119	3.45805+83	1.000000+00	0.00000+00	1,34366-84	4.00001-02	3.27465-85
170	3.5478E+83	1.00002-00	8.00006-00	1.3429E-24	4.0000E-02	1.68765-25
121	3,6070E+03	1.0072L+00	8,00000.00	1,3440E-24	4.00008-02	5.24756-25
122	3.7240E+03	1.00002+00	F.0200[•00	1.3467E-24	4.00000-02	1.52766-04
124	3,8648E+83	1.00001.000	A.86895+84	1.3414E-84	4.0P80E-92	8.1275E-06
125	3,91000+03	1.800gE+30	0.00006+00	1,34452-24	4.00002-02	1.05515-04
120	4,02/02+03 4,0/606+03	1.20096496	0.0000L+00	1.34265-24	0000E-02	6.49375-05
128	4,33102-05	1.0000E+00	0,0000[+00	1,34868-84	4.80001-02	4.06625-25
129	4,3860E+03	1,2000E+30	8.0000.+00	1,34188-24	4.00076-02	7.90536-05
130	4,44782+85	1.00306+30	0.0000E+00	1,33958-0-	4.0000E-02	2,10341-05
131	4.744F+03	1.200000-+00	0,0000L+00 0,0000L+00	1.33676-24	4.200001-92	2.21955-04
133	4.95402+03	1.20005.00	0.00075+00	1 3367E-24	4.00001-12	1.02116-84
134	4 . 0090E + 04	1.00002.00	6.00005+00	1,34256-04	4.0000E-22	2,7916E-84

INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIN	F NEUTRON	RADIATION	F15510N
	1 14805+02	1. 4280F+20	0.0000.00	1.34285324	4.02005-02	5.43718-26
÷.	00001-02	1 40001-00	0 00000-00	1 15485-24	4. 28081 -02	3.27:85-64
•	1,70001-02	1,00000-00	0,000000000	1 744.5-94	10000	2 48415-84
3	2,00001-01	1.00000-00	E. CODDI - DE	1,34411-64		0 10035-25
4	2.310BE+02	1.00001+00	6.56666+65	1,34/4E-64	4.0000E-92	9.19231-15
5	2.40000-02	1.0000.+00	0.0000E+00	1,3449E-C4	4.6000E-02	1.30431-63
6	2,49886+82	1.02081+28	P.2888E+88	1.34886-24	4.69955-15	1.2935[+24
7	2.54006+02	1.3030E•00	0.0000E+00	1.3448E-P4	4.20006-22	3.15,228-06
A	2.700HF+22	1.000000+00	2.22025-00	1.34856-24	4.0000E-02	1.1138E-04
ē	2 AAB3E+02	1.00006+00	0.00000-000	1.34505-24	4.2308E-02	3.34865=26
	1 30005-02	1 20005400	3 0802:.00	1. 34845-24	A. 2222F - 92	9.9855F-05
10	3 44085 403	1,00000.000	a aaaac.aa	34845-04	4 99995-92	3.66235.34
11	3.42002-02	1.000000-000	0,0000000000	1.0494	4 34895-43	3 10745-04
14	3.0/ PBC-02	1.00060-00	0.00001-01	1.35246-04	4,00000-02	3 88575-74
13	3.//#01+02	1.00000.30	8.800CE+00	1,34201-14	4.00000-02	3,00002-20
14	4,1900E+02	1.00001.000	P.8066E+65	1,35216-64	4,00001-92	1.70211-04
17	4,297ØE+02	1.0000E+30	2.0880E+00	1,3459E-64	4.2200E-02	4.1740E-06
1.6	4.6800E+02	1.00006+00	0,00002:000	1,35C0E-24	4.00000+02	1.20926-04
17	4.7500E+02	1.00006+00	P. 2000E+20	1.34618-24	4,20081-02	4,4344E=26
18	5.41006+02	1.20006+02	0.00005+02	1.34776-24	4.00086-82	4,92845-05
10	5.5100F+02	1.00206+00	3.00005+00	1.34635-64	4.00000-02	4.50238-26
	5 71 8 85 + 0 7	1 00005+30	0 00005.00	1.34005-24	4.03065-02	8.99901-05
20	5 8104E+02	1 30005.00	0.000000000	14445-04	4.22005-02	4.94795-04
21			r.0000000000	1 78445-94	4 04006-02	3 34735-84
22	0.2340L+82	1.00000-000	0.00000.000	1,35 61		8 43.00-04
23	6.63P0E+02	1.05605+00	N'0300E+05	1.34046-64	4.00001-02	5 55 61 66
24	7.02M0E+02	1.00000.000	8.88855+85	1.3510E=K4	4.00075-02	1. 3736-04
25	7,1208E+E2	1.0000E+00	0,00006+00	1,3464E-24	4.00005-02	5,7511E-06
26	7,8700E+02	1.0000E+00	0.0000E+00	1,35326-01	4.0000E-02	2,11285-34
27	7.9708E+02	1.00006+00	0.00002+00	1.3463E-04	4.00006-02	5,9191E-06
28	8.5400E+02	1.00006+00	0.00000.000	1.3565E-Ø4	4.00000-02	3,13732=04
29	A.6V80E+82	1.000000+00	2.00001.00	1.34626-04	4.0000E-02	6.4191E=26
10	0 41305+02	1 02005-00	8.08000-00	1.34435-24	4.02005-02	1.07426-25
	A 51845-02	1 00005+00	0 00000-00	1 14445-04	4.00005-42	A. 54905-04
31	9,91000-00	1.00000-00	0,00001+00	1.04000-04	4 00005-02	2.54795-84
32	1,00000-003	1.00000-000	n.00001000	1.35.21-0-	4.00000000	70145-08
33	1,01501-05	1.00000.000	0.0000E+05	1.3.021-0	4.00001-02	4 47748-00
34	1,82201+03	1,00001+30	0.0000E+05	1,34716-04	4. CODDE-02	
35	1,0320E+03	1.00000+03	6.0000E+05	1,3459E-84	4,2000E-02	0,00301-00
36	1,8858E+83	1.00005+00	0.0000[+00	1,3495E-04	4.0000E-02	1,21325-04
37	1,0920E+03	1.0000E+#3	2,20006+00	1,3466E-24	4,0000E-02	3,24976-05
38	1.1210E+03	1,0000E+00	0.2000E+00	1.35716-04	4,0000E-02	3,54396-04
39	1.13188+83	1,00006+00	0.0000E+00	1.3456E-84	4,000000-02	7,23616-06
40	1.1998E • 63	1.000000+00	P.0000F+00	1.3478E-24	* . 2000E-02	6.14522-05
41	1 20086+23	1.00206+00	6.000000	1.34525-24	4.00000-02	7,52116-06
42	1 23885+03	1.00005+00	0.0000.00	1.35505-64	4.02085-02	3.01275-04
	1 24045+03	1 20205 404	0 03000.00	1.34515-24	4.00005-02	7.63235-84
	1 27105-01	1,00000-00	0.000000000	38445484	4 00005-02	3.50736+04
	1,2/300-00	1,00000-00	0,0000000000	1 34405-24	4 00000-02	7 78445-04
42	1.20301-03	1.00000-000	0.00005+00	1,24492-64		
40	1.31301-03	1.00000-00	9.0000E+00	1,34021-04	4,0000E-02	2.0200E 05
47	1,3230E+03	1.0000E+00	6.0000E+00	1,3449E-84	4.00005-92	7.9241E-86
48	1,37681+93	1,00306+90	8.08002.00	1.33172-04	4.00005-22	2.28335-84
49	1,386ØE+Ø3	1.000000+00	0.00000.00	1,34456-04	4.0000E-02	8.1419E-06
58	1.4298E+83	1.000000.00	£.0000E.00	1.3310E-04	4.00000-02	7.6345E-05
51	1.4398E+03	1.000000+00	P.0000E.00	1.3443E-24	4,0000E-02	8,3214E-Ø6
52	1.46886+83	1.0000E+00	0.08001.00	1.34555-04	4,0000E-02	4,87452-05
53	1.47886+83	1.000000+00	2.00001-00	1.3441E-04	4,00005-02	8.4257E-86
54	1.49986+43	1.000000.000	0.000000	1.34405-04	4.0000E-02	3,32686+85
85	58005+41	1.00005.00	0.00000-00	1.34415-94	A. 0000F-02	8.55456+94
	4 547054/3	1 20005-00		1 14810-04	4.00085-02	A. 35325-0-
20	1,04/00403	1,000001-00	D. 00001-00	1 74791-04	4 00000C-02	8.71795-04
24	1,55/01-03	T * 000 5 F • 00	5,0000E+00	1134371464	4,0000L-K2	0 40086-07
58	1,5/80E+23	1.00000.000	N, 8080E+88	1,34076-24	4.0000F-65	4.04201-05
59	1,5088E+Ø3	1,00006+00	0,0000E+00	1,34365-04	4.00005-22	0.0137E-06
60	1,6228E+03	1.00006+00	P.0000E+00	1,34376-84	4.0000E-02	1,78946-05
61	1,6428E+Ø3	1.00002+02	0,00006+00	1,3433E-84	4.00000.02	0.9557E-06
62	1,6740E+03	1.0000E+00	6.00000.00	1,3463E-04	4.00006-02	1.0448E=04
63	1,68406+03	1,0000E+00	P.0000E+00	1,3432E-04	4.0000E-02	9.12126-06
			-			

		DEGREES OF	FREEDON USED	IN THE HIDTH	DISTRIBUTION
	J-VALUE	COMPETITIVE	NEUTRON	HADIATION	F15510N
	4.0029E+00	0.20006+00	1.00000+20	C.CUBDE+CO	1.8832E+32
		AVE	AGE RESOVANCE	W107HS (EV)	
ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	F15510N
1.3080E+02	1.0000E+00	0.00002+00	1,3428E=24	4.0000E-62	5.4371E-26

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.4	1.7040F+03	1.000000+00	a.aaaac.aa	1.34916-64	4.00000-02	1.96145-74
65	1.71406-03	1.000000+00	2.22005+02	1.34386-84	4.0:000-02	9.41976-06
66	1,7340E+03	1.00000-20	0.20005+03	1,34592-84	4.20002-42	9,7769E+05
67	1,74485+03	1.00001.00	P. 2200E + 00	1,3428E-VA	4.00006=02	₽,3101E-06
88	1.8700E+03	1.02001+20	P.0000E+00	1,3664E-24	4.00002-02	7,5674E=04
69	1,88986+93	1.00086+30	9.2300E+20	1,34216.04	4.23222-02	9.7290E-E6
710	1,87686+03	1.0000E+20	0.00306+00	1.345ØE-04	4.0008E-02	9.0618E=05
71	1,94626+03	1.0000E+00	8,69905+99	1,3420E-24	4.22005-02	9.80772-06
72	1,92486+83	1.00001+00	6.6660E+88	1.34446-64	4.0000E-02	8.47186-25
73	1.93486483	1.000000.000	N*8900E+89	1,34181-04	4.00000-02	7 47345-44
76	1,97/86-63	1.20201-30	r.gagar.da	1.34341-04	4.00001-02	7.0/34E-03
77	2,00/02+03	1.00000-00	0,00000,000	1,34205-04	4.02005-82	1,01106-07
77	2.14136.03	1.30001.00	0.0000E-00	1.34041-24	4.02086-02	A. 75322-04
78	2.1282F+03	1.3020F+02	0.00000-00	1.34785-24	4.00000-02	1.77955-05
79	2.19686+23	1.000000-00	0.02305+02	1.34228-24	4.0200E-02	3.09086-06
82	2.1758E+23	1.0000E+00	7.00000+00	1.34035-24	4,02205-02	. 0638E-35
61	2,10526+83	1.00000-00	P,0000£+00	1,34018-84	4.2000E-02	4.78202-05
82	2,2140E+03	1.000000.00	9.0000E+30	1,34896-84	4,0200E-22	3,5354[-25
83	2,2240E+Ø3	1.0000E+00	8.22206.00	1.34855-84	4.0000E=02	2,56402-75
84	2,2348E+Ø3	1.0230E+00	2,00005+30	1.34278-24	4.000025-02	9.83892-05
R5	2,2840E+03	1.0000E+00	6.90605.99	1,3394E-24	4.0000E+K2	1,09362-66
86	2,3052E+03	1.000E-00	8,0000E-02	1,3398E-24	4.2700E-02	1.42336-05
87	2.3159E+03	1.8689E+80	6.900BE+99	1,33942-84	4.80000-02	5. 9726-26
88	2.3368E+#3	1.00001.000	0.00005-00	1.3390E-24	4.20000-02	1,18526-06
RY RY	2,37882+83	1.000000-000	6.0000E+06	1,33898-64	4,00000-02	3,33425-08
40	2,3,965,03	1,000001-000	C.0000E.000	1 11015-24	4,20002-22	2 24445-04
¥4		1.000000.000	0.0000E+00	34105-24	4,0000E-01	8 78735-98
0.1	2 44446-03	1.00000-00	0.0000E-09	1.33875-24	4.00000-02	1.30445-05
04	2.45845+03	1.000000-00	P 40005-00	1.33635-24	4.38005-02	A. 20805-04
05	2.5162F+93	1. HORDE+30	8.42485.44	1.34677-24	4.280025-02	8. J442F=85
96	2.53986+83	1.02002+00	3.28005.20	1.33816+24	4.0300E -02	1.85985-25
07	2.50405+03	1.0000E+30	0.00005+00	1.34196-84	4.0000E-02	1.51965-94
68	2.6138E+83	1,000000000	8.00005.00	1,3373E-84	4.00000-02	7.07756-06
99	2,6645E+03	1,30806+00	0,000000000	1,33752-84	4,00000-02	1.0132E-05
100	2,73P8E+03	1.0000E+00	0.00001+00	1,34162-84	4,0000E-K2	1.59718-04
101	2,757BE+B3	1.00001+00	0.000PE+00	1,33728-84	4,87985-92	3,23352-05
192	2,7718E+03	1,02006+00	P.0007E+80	1,33766-24	4.0030E-02	5,02190-05
193	2,8120E+Ø3	1,30002+00	0,00006+00	1,3451E-24	4.0000E-02	7,9739E-06
184	2.84P#E+03	1.2030E+00	0,00006+00	1,34646-04	4.60006-02	4,75732-05
1,05	2,8090E+03	1.00005+00	0.00000:+00	1.3452E-04	4.0000E-02	1,0145E-05
100	2,84886.03	1.00000-00	8,8680E+88	1.34766-04	4.0000E-02	0.09472-05
107	2,93H8E+03	1.00001+30	0,00005+80	1,34481-24	4,00001-02	1.40105-05
100	3.01901-03	1.00000-00	0.00001+00	1,37251-04	4,00000-02	2 20455-25
109	3,00002-03	1 22835.00	0.00002+00	1 340+5-24	4 000002-02	1 50030-04
419	3 16405403	1 000000-00	0,000001-00	1.34486-84	4.00005-02	1.42015-05
112	3.19885+03	1.300000+00	0.00001-00	1.34845-04	4.00086+22	1.43436-04
113	3.23286+03	1.00000E+00	0.00005.00	1.3440E-04	4.0000E-02	4.26606-05
114	3,24986+83	1,000006+00	0,00001.000	1 347 2-24	4,0000E-02	1.10595-04
115	3,3029E+03	1.2000E+00	8,000E+00	1,34375-84	4,00002-02	1.48345+85
110	3,3>60E+Ø3	1.02005+30	0.0000E+00	1,3481E-84	4,0000E-02	1,53962-04
117	3,3930E+Ø3	1.0000E+00	8.00001+00	1,3437E-04	4,00005-02	2,4672E=05
118	3,4500E+03	1.0000E+20	8,8980E•38	1,3469E-84	4.0000E-02	1.2713E-04
119	3,4080E+03	1.3000E+00	P.0000E.00	1,3436E-04	4.0000E+02	3.2746E-05
120	3,5476E+D3	1.0200E+20	0,0000E+00	1,34296-04	4.0000E-02	1.08765-05
121	3,09/01+03 7 49095-07	1.00001.000	8.0000E+30	1 34345-04	4,00001-02	3,7493E005
124	3 75405443	1,0000000	0.0000L+00	1.34695-04	4.000000-02	1.43786-24
124	3 86405+03	1.000000-000	0,00002+00 0,00002+00	1.34145-04	4.00000-02	1172/01-04
125	3.9100F+0.4	1.00202.00	0.0000c.00	1.34455-04	4.00005-02	1.25311-04
126	4.02706+03	1.0000E+60	0.00001-00	1.34135-04	4.00005-02	2.27255-04
127	4.07602+03	1.2000E+00	0.00005+00	1.34255-04	4.07306-02	6.49975-05
128	4,3310E+03	1.00000.00	5.0200.000	1.34096-64	4,2000E-02	4.06622-05
129	4,3860E+93	1,0020E+00	0.00000.000	1,3418E-04	4.00000-02	7.98532-25
130	4,4478E+83	1.0000E+00	0.0000E.02	1,3395E-04	4.00006-02	2,10345-05
131	4.6720E+83	1,0000E+00	8,0000E+00	1,34C4E-24	4.0000E-02	2,1266E-Ø4
132	4,7¥40E+03	1.0000:000	9,0308E+00	1.33426-24	4.0000E-02	2.71958=05
133	4,9948E+83	1.3000E+00	9.0000E+00	1,3367E-04	4.00002-92	1.02118-04
134	4,0008E+94	1,3000t+00	0.00000.000	1.34255-04	4.0000E-02	2.79168-04

NEP*UNIUM-237

۰. ۲ FISSION MEUTRON CROSS SECTION

ENDENB MATERIAL NG. 6263

AEACTION Q VALUE 2.0000€€08 EV

INTERPOLATION LAN BETWEEN ENERGIES Ravge description 1 70 154 Ln Y Lineam in Ln X 154 70 316 Y Lineam in X

KEUTRON CROSS SECTIONS Innex, energy cross section energy cross section energy cross section

NDEX.	ENEMSY	CROSS SECTION	ENERGY	CROSS SECTION	EVERCY (CROSS SECTION	ENFRGY C	ADSS SECTIAN		
	2	9 ARNS	E۷	BAPNS	E ر	SVATE	2	BARVS		
-	1,89245-05	1. C030E-30	1.2000E-34	2.7520E-01	1,42675-24	2.54765-21	1.0072E-24	2.38285-71	1.92026-24	2.24635-21
•	2,000001-04	2.13285=21	2.28885-04	2.03146-01	2.4032E-24	1.94475-01	2.53276-24	1.89395-21	2.00266-24	1.66826-71
	2,88886-84 2,00000 - 5	. 1,8000E-01	3,8888E-64	1.7388E-01	3.20375-04	1.68345-01	3.40326-24	1:+3295+21	3.6222E-24	1.58676-21
) -				1.53505-01	.22226-34	1.46855-71	4.40375-74	1.43465-21	4.62826-24	1.42295-71
::		10-100-0-1			2 32,07 0	1,51415-21	13-326.14 9	1.79435-02	5.62265-24	1.27PBE-21
C F	6.8200-04	1.15245-01	7 00005-04		2 20001-007	19-32/32.1	6.420°E - 34	1.18825-21	6.6227E-24	1,16995-71
96	7.88005-14	1. P754E-01	8.00365-04	1 - 3 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5	A. 200005-04	13-3/2111	1 4 2 2 2 E	1,12445+21	7.58205-74	1.68965-01
4	8.80205-24	1.01196.01	9.20005-04	1.20051-01	9.20001-24	9.80447-82	0.42355-24	2.2359E-01	0,6002t=04	1.52375-21
40	9.88005-04	9.5835E=02	1.63776-03	0.48415-02	1.20005-63	8.64985-02	1.48241-91	7.09025-22	1 40005-07	V.0839E*K<
51	1.88005-03	7.2388E-02	2.00005-03	6,6771E-22	2,200PE-03	6.3526E-02	2.40275-23	6.2754F=P2	2.5350F+03	
9	2,68885-83	5,6305E-02	2.8006E-03	5.6122E-02	3.00025-23	5.41595-62	3.22016-23	5.2381E-22	3.40005-03	5.21615-22
-1 -		4,9276E-02	3.8070E-03	4.79895-02	4 . 2000E-03	4.6644E-22	4.203PE-23	4.54705-02	4.46225-23	
27			4,80000 - 23	4.2393E-02	5.0000E-03	4,1491E-02	5,270%6=03	4,26415-22	5.3361E-23	4.02925-22
4 F	6.40005-03	3.63955-02	- 4000F-03	0.407/E=02		5,8396E=02	6.8882E-23	3.76725-02	6,220CE-23	3.70185-22
81	7.40001-03	3.3665F=02	7.40001-03				,	3.4088E •22	7.20005-03	3.4106E-C.2
90	8.40005-03	3.1476E-02	8.60005-03	3.10285-02		3 34485-32	0 00000-00	3.2.74E=02	8.20001.03	3.1843E=22
16	9,4800£-03	2.9552E#02	9.61 PDE-03	2,9212E=02	9.8085-03	2.88815-82	1.00001-000	0.85415-62 0.85415-62	. 2000E-02	2.79636-62 2.640.5
96	1.40012-02	2.3642E=02	1.63985-02	2.18915-02	1.82005-02	2,0435-22	2.80.00			73-3130/ Y
191	2.40045-02	1.71855 -02	2,5300E-02	1,66345-02	2.60005-02	1.63555-22	2.87075-22	1.56135-02	3.92905-02	10451-07
170	3.2004f62	1.43396-02	3,40006-02	1,37875-02	3,60006-02	1.32805-02	3.80075-02	1.20146-02	4.01201-02	1.23825-02
	- 2805 - 02	1,1982E=02	4,4000E-02	1,16655-02	4 . 6029E-02	1,12646-32	4.800F-32	1.29335-22	5.00201-02	1. 76265-22
	79-3499214	1.133/E=02	5,4000E=02	1.00455-02	5.6000E-02	9,86755-03	5,80,346-92	9.5637E=23	6.0000E-02	9.3724E-23
101	7 20015-002	50-107114 .	0.4000E-02	5.9336E-03	6,6000E=02	5.744E-83	6,80,30,E-02	6,5144E=23	7,00001-02	8.7.29E-75
	8.23015 02		20-3000-02	7.9935E-03	7.69865-62	7.83415-03	7,803PE+02	7.68145-03	8.00006-02	7. 3496-23
- P.	9.04526-02	6.8553F=83			20-300000	7.12047-05	8,87825-02	7.88295-23	9.22221-02	62-36188 Q
141	2.00045-01	6.3374E=23	1.20001-01		40001-01				9.000.02	
145	1.80045-01	3,95656-03	2.03005-01	3.64655-03	2 20005-01	0.1001100			1.000001-01	03-34/40°
151	2,53842-01	3.10092-03	2.60005-01	3.05285-03	2 50005 61	2.94365-03	3.80.05-0	2.8700F-01	1 00001-0	0.1442F
150	1.60045+04	6.9999.409	4.69061.04	0.00F0E+00	4. 0000E+04	1,17005-92	4.2730E+24		4.50035.0.	1.28385-22
1.01		1.2331E-02	5.00001+04	1.17005-02	5,985¢E+24	1,22875-02	6.838ME • 84	1., 7005-02	6.207.0E+04	1.24786-22
0 F	A BUOK COM	1 88015-000	- 23862 - 0	1.33485-02	7,68835+64	1.41.525-02	7.632VE+04	1.41765-72	5, COBOE - 04	1.46985-02
170	1.05001.05	1.79045-02	7.00001-0	1.01905-02	1,8000E+05	70-3001/T	1,03205+05	1.75295-32	1,03486+25	1,78456+02
101	1.597rE+05	2.13605-02		2 5.91 F. 02		1,5744F-02	1.90805-05	2.20005-02	1.5902E+05	2.12526-02
100	2.680KE+05	3.48616-02	2.69105+05	3.51935-02	5.000ar+05			4.7190E=82	2,50636+05	Z.9333E-02
191	3,59240+05	1,20005.01	C 0000E-02	1.51535-01	3.70605-25	1.54345-01		0.17505 -02 1.55345-01	0,0040E E	4.2/50E-02
196	4.0001 E-05	2,1000E-01	4,5000E+05	3.20005-01	4 7000E-05	5.7408F-01	5.00001+05	10-300CV +		
241	5,788E+05	7,0636E-01	6,0000E+05	8,00005-01	6.5000E-05	9.350CE-01	7,000,5+05	1.75005+00	7.50005405	
276	7.750%E*05	1,19625+00	8.0000E+05	1.24005+00	6.50001-05	1,32006+00	9.00026-05	1.35025-20	J. 5000E-05	1.45026+20
	1,00075464 3 46455444	- 1,4020F-00	1,20005+00	1.5500E+00	1,4000E+00	1,5900E+00	1.6000E+06	1.6200E+00	1.50201-06	1.6500E+03
010		. 4.100705+00	2,2000E+26	1,6980E+00	2,400055465	1,69588.02	2,6200E+06	1,70005-60	2.80006+06	1,69205+03
100	4.00005+06	1.55201460			3**0000=00	1,02305700	3.60005.95	1.68365+00	3,88886.86	1.5800E+00
234	5.00006+00	1.50506+00	5.20001-00			1, 15306-00	0.0100E - 26	1.52586+48	4.80205-86	1.51505+84
230	6.000VE+06	1.6000E+00	6.2000r+06				00.10000.4	1.5050L+00	3.8000C-06	1.54785-02
241	6.800#E.00	2,7880E+00	6.8578E+26	2.0083E+00	6.92735-06		0.0000L-000 7 98885484	1.90005-00	6.78981400 	2.07495+20
						12 JL_TT 4	0 A	6+1-c0L-PU	/*///////	2,1943L•06

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7.33305 - 86 2.19197 - 72 7.4027 - 86 2.138105 - 72 9.80267 - 86 2.138105 - 72 9.80267 - 86 2.13456 - 42 9.80267 - 86 2.13456 - 42 1.125757 2.34567 - 42 1.125757 2.34567 - 40 1.13487 - 72 2.99467 - 40 1.14867 - 72 2.99467 - 40 1.14867 - 72 2.99467 - 40 1.14867 - 72 2.99567 - 72 1.14867 - 72 1.148	
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REFERENCES FOR EXPERIMENTAL DATA

²³⁷Np(n,f)

<u>Yr.</u>	<u>Lab</u>	<u>Author</u>	<u>References</u>
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72	LAS	Jiacoletti, et al.	Nuc. Sci.&Eng. <u>48</u> , 412 (1972)
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67	ALD	White, et al.	J. Nuc. En. <u>21</u> , 67 (1967)
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63	CCP	Pankratov	At. En. <u>14</u> , 177 (1963)
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59	HAN	Leonard, et al.	Bull. Am. Phys. Soc. <u>4</u> , 31 (1959)
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47	LAS	Klema	Phys. Rev. <u>72</u> , 88 (1947)

94-PU-239 GE-BRO,LAS EVAL-MAR74 B.A.HUTCHINS, R.HUNTER, L.STEWART DIST-1974 REV-OCT74 P.C. TO NORMALIZATION AND STANDARDS SUBCOMMITTEE MARCH 1974 PERTINENT HOLLORITH FROM GENERAL FILE FOLLOWS (MAT 1264) ALL REFERENCES CARRIED OVER FROM GENERAL FILE

PRINCIPAL EVALUATORS = B.A. HUTCHINS (GE-BRO), R.H JNTER(LASL), L.STEWART(LASL), R.LABAUVE(LASL).

CONTRIBUTING EVALUATORS

NU-BAR->B.R.LEONARD,JR.(BNH LAB), THERMAL DATA TASK FORCE F.P.YIELDS-~R. 3CHENTER (HEDL), FIS AND DECAY PROD TASK FORCE DELAYED NEUTRONS-H. HUMMEL (ANL); COX (ANL) RADIOACTIVE DECAY=-C.W.REICH (ANC); R. GWIN (URNL); R. KINSEY (BNL

SMOOTH DATA

THERMAL RANGE--B, R, LEONARD(BNW LAB), THERMAL DATA TASK FORCE 1 EV - 1 MEV --F, SCHMITTROTH(HEDL), T.A.PITTERLE(WARD) G, DESAUSSURE (CRNL), W. PDENITZ (ANL) 1 MEV= 20 MEV--L, STEWART (LASL), R, HUNTER(LASL) INELASTIC SCAT--L, STEWART, R, HUNTER (LASL) SEC NEUT DISTRIBUTIONS-- L, STEWART, R, HUNTER (LASL) GAMMA-PROD-- R, HUNTER AND L, STEWART (LASL)

EVALUATIONS ARE DESCHIBED AND REFERENCED IN LNDF-199 (REF, 1)

MF = 2

RESOLVED RES.

PRIMARY DATA SOURCES ARE GWIN(7) FOR FISSION AND CAPTURE AND DERRIEN(8) FOR TOTAL, PARAMETERS (SLBW) GENERATED BY SMITH, KINSEY AND GARBER, ENERGY RANGE 1 EV TO 301 EV.

UNRESOLVED RES. PRIMARY DATA SOURCES ARE GWIN(9) AND WESTON (10), ENERGY-DEPENDENT SLOW PARAMETERS PROVIDE SECONDARY STRUCTURE IN FISSION, CAPTURE AND TOTAL CROSS SECTIONS, ENERGY RANGE 301 EV TO 25 KEV, INTERPOLATION SHOLLD BE ON CROSS SECTIONS.

MF = 3

SMOOTH DATA THERMAL DATA--ENERGY DEPENDENCE SAME AS VERSION 111. RENORMALIZATION OF FISSION AND CAPTURE TO 2200 M/SEC VALUES OF 741.7 AND 270.2 FROM 1973 LSQ ANALYSIS OF THERMAL DATA TASK FORCE(6).

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1 EV TO 25 KEV-SMOOTH CONTRIBUTIONS IN THE RESOLVED RANGE CHOSEN TO MAKE COMBINED RESONANCE AND SMOOTH FISSION AND CAPTURE CROSS SECTIONS CONSISTENT WITH GWIN(7) MEASUREMENTS, AND TOTAL WITH DERRIEN VALUES(8), SMOOTH DATA IN UNRESOLVED ONLY FOR INELASTIC SCATTERING AND MINOR ADJUSTMENTS AT RANGE BOUNDARIES. 25 KEV TO 1 MEV-STOTAL BASED ON MEASUREMENTS OF SMITH(11) AND HEATON(12), FISSION PRIMARILY BASED ON GHIN DATA(9) AND THAT OF PFLETSCHINGER(13), CAPTURE OBTAINED FROM ALPHA MEASUREMENTS OF GWIN(9), WESTON(10) AND HOPKINS(14), Inelastic levels adjusted for Low Lying Levels to partially COMPENSATE FOR INCLUSION IN THE ELASTIC CHANNEL. ELASTIC DETERMINED FROM BALANCE OF TOTAL. 1 MEV TO 20 HEV-SDATA BASED ON EVALUATION OF HUNTER(2), WITH FOLLOWING ADJUSTMENTS -1)FISSION TO CONFORM TO ENDF/B-IV U=235 FISSION AND INTEGRAL MEASUREMENTS 2)TOTAL TO AGREE BETTER WITH HEATON (12) 3)ELASTIC FOR BALANCE AND AGREE WITH UNITARITY, FIRST, SECOND, THIRU AND FOURTH CHANCE FISSION INCLUDED, WITH MT=18 BEING THE SUM. REFERENCES 1) PU-239 DATA EVALUATIONS FOR ENDF/B-IV, ENDF-199(TO BE ISSUED). 2) HUNTER, STEWART, HIRONS, LA-5172 (JUNE, 1973). 3) SOLEILAC, FREHAUT, GAURIAU, J. NUCL. ENG. 23 (1969). 4) FISSION PRODUCT DATA FOR ENDF/B-IV, R.E. SCHENTER (TO BE PUBLISHED), 5) DELAYED NEUTRON DATA FOR ENDF/B-IV, S, COX (TO BE PUBLISHED). 6) THERMAL NEUTRON DATA FOR ENDF/B-IV, J, STEHN (TO BE PUBLISHED). 7) GWIN, PRIVATE COMMUNICATION (1973). 8) DERRIEN, CN26/61, HELSINKI (1970). 9) GWIN, SILVER, INGLE, TRANS, AM, NUC, SOC, 15, 481 (1972), 10)WESTON, TODD, TRANS, AM, NUC, SOC,, 480 (1972). 11) SMITH, GUENTHER, WHALEN (1972). 12)HEATON, SCHWARTZ (1972). 13) FFLETSCHINGER, KAPPELER, NUC. SCI. AND ENG. 40 (1970). 14)HOPKINS, CIVEN, NUC, SCI. AND ENG. 12, 169 (1962). 15)COPPOLA, KNITTER, Z.PHYS. 232, 286 (1970) - 228,286 (1969). 16)KAMMERDIEMER, UCRLe51232 (1972). 17) BARNARD, FERGUSON, MCMURRAY, VAN HEERDEN, NUCL. PHYS. 71 (1965) 18)ZAMYATNIN, SAFINA, GUTNIKOVA, IVANNOVA, ATOMNAYA ENER. 4 (1958) 19)HUNTER, STEWART, LA-4001 (1972). 20)DRAKE, HOPKINS, YOUNG, CONDE, NUC. SCI. ENG. 40, (1970). 21)NELLIS, MORGAN, ORC-2791-17 (1966),

ENDE/B MATERIAL NO. 6264 Table of contents General information Reaction

PLUTONIUM#239	Ρ.	UTON	[VM#	239
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REACTION CARDS COMMENTS 120 TABLE OF CUNTENTS 3 RESONANCE DATA 617 FISSION 162

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GEMERAL INFORMATION Resonance parameters Neutron cross section

DATA TYPE

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PLUTDNIVH-239

ENDF/B MATERIAL NO. 6264 Resonance data Resonance parameters

ISOTOPE------PLUTONIUK-239 FRACTIONAL ABUNDANGE------ 1.2000E+00 NUMBER OF ENERGY R.NGES----- 2

ENERGY RANGE	NUMBER	1
LOWER ENERGY	LIM17 (EV)	1.000000-00
UPPER ENERGY	LIHIT (EV)-+++	3.0100E+02
NUCLEAR SPIN-		5.000000-01
SPIN SCATTERI	NG LENGTH (A+)	9.00946-01
NUMBER OF L S	TATES	1

RESOLVED SINGLE-LEVEL BREIT-HILNER PARAMETERS

INDEX ENERGY (EV) J VALUE TOTAL REDONANCE HIFTAS (EV) NEUTRON RADIATION 1 -2.2880E-81 A.8807E-02 5.4085E-81 A.7808E-82 4.8088E-82 5.4085E-82 4.8088E-82 5.4085E-82 4.8088E-82 5.4085E-82 4.8088E-82 5.4085E-82 4.8155-82 4.8255-82 5.1180825-88 1.9167-81 1.80825-82 1.8148-83 4.63225-82 5.9182-83 3.9198-82 5.9182-82 5.9182-83 3.9198-82 5.9182-82 5.9182-83 3.9198-82 5.9182-83 3.9198-82 5.9182-83 3.9198-82 5.9182-83 3.94982-82 5.9182-83 3.94982-82 5.9182-83 3.94982-82 5.9182-83 3.94782-82 5.9182-83 3.94782-82 5.9182-83 3.94782-82 5.9182-83 3.94782-82 5.9182-83 3.94782-82 5.9					120 200pe+02	S ø GTH {A-} Ø,	INANCE	RESO	CATT	NUMBER BPIN S
INDEX ENERGY UV JVALUE TOTAL NEUTRON Rapiation 1 -2.2880E-81 0.8800E-00 5.4005E-01 4.7800E-02 4.8008E-82 1 2 2.660E-01 0.8800E-00 5.4005E-02 2.200E-04 3.8008E-02 1 3 7.6139C+80 0.8000E-00 1.9017E-01 1.8006E-02 4.815E-02 4.822E-02 1.815E-02 4.822E-02 1.8002E-02 1.815E-03 4.422E-02 1.4422E-02 1.8002E-02 1.815E-03 3.6432E-02 1.8002E-02 1.8002E-02 1.815E-01 1.8002E-02 1.8002E-02 <th></th> <th></th> <th>(EV)</th> <th>RESONANCE HIT</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>			(EV)	RESONANCE HIT						
1 -2,2880E+81 9,880FE-00 5,4805E-01 4,7008E-05 4,808E-02 1 2 2,640E-01 3,8080E+08 9,9742E-02 2,208E-04 3,808E-02 4 4 1,804E+01 1,808E+08 1,9017E-01 1,806E+03 4,225E+02 1 5 1,109E+01 1,8080E+08 1,9017E-01 1,8046E+03 4,202E+02 1 6 1,4310E+01 1,8080E+08 1,8162E-01 5,9980E-08 3,998E-02 1 7 1,4455+01 1,8080E+08 1,8070E+02 1,7980E-03 3,648E+02 1 8 1,5470E+01 7,8080E+08 1,802E+02 1,7980E+03 3,8090E+02 1 1 1,5470E+01 1,8080E+08 1,7062+02 1,9780E+03 3,8090E+02 1 1 2,2050E+01 1,8080E+08 7,2243E+02 1,9780E+03 3,8090E+02 1 1 2,5250E+01 1,8080E+08 7,72443E+02 1,9180E+03 3,9080E+02 1 1 2,5352E+01 1,8080E+08 7,7072E+02 1,9180E+03 3,9090E+02 1 1 2,5352E+01 1,8080E+08 7,7072E+02 1,9180E+03 3,9070E+02 1 1 2,5352E+01 1,8080E+08 7,7072E+02 2,7208E+04 3,7457E+02 1 1 2,5352E+01 1,8080E+08 4,7241E+02 2,4180E+04 3,8070E+02 1 1 3,232E+021 1,8080E+08 4,7241E+02 2,4180E+04 3,8070E+02 1 1 4,4352E+01 1,8080E+08 4,7241E+02 2,4180E+04 3,8070E+02 1 1 4,4352E+01 1,8080E+08 4,7241E+02 2,4180E+04 3,8070E+02 1 1 4,4352E+01 1,8080E+08 4,7241E+02 2,4180E+04 3,8070E+02 1 1 4,435E+01 1,8080E+08 4,7247E+02 2,4180E+04 3,8070E+02 1 1 4,435E+01 1,8080E+08 4,7247E+02 2,4180E+03 3,9736E+02 1 1 4,435E+01 1,8080E+08 4,7247E+02 2,9270E+03 3,5735E+02 1 1 4,435E+01 1,8080E+08 4,7247E+02 2,9270E+03 3,5735E+02 1 1 4,7549E+01 1,8080E+08 4,7247E+02 2,9270E+03 3,5735E+02 1 2 4,7549E+01 1,8080E+08 4,7247E+02 3,7432E+03 5,9415E+02 3 2 5,2629E+01 1,8080E+08 4,7247E+02 3,8756E+03 3,5735E+02 1 2 5,2629E+01 1,8080E+08 4,7327E+02 4,8580E+03 3,7432E+02 1 2 5,2629E+01 1,8080E+08 4,7327E+02 4,8580E+03 3,7432E+02 1 2 6,5319E+01 1,8080E+08 4,5727E+02 4,8580E+03 3,7432E+02 1 2 6,5319E+01 1,8080E+08 4,5727E+02 4,8580E+02 3,7432E+02 1 3 7,559E+01 4,8080E+08 4,5276E+02 3,7482E+02 1 3 7,559E+01 4,8080E+08 4,5276E+02 3,7482E+02 1 3 7,559E+01 4,8080E+08 1,5276E+02 4,7580E+03 3,9480E+02 4 3 7,559E+01 4,8080E+08 1,5276E+02 4,7580E+02 3,759E+02 4 3 7,559E+01 4,8080E+08 1,5276E+02 1,7580E+02 3,759E+02 4 3 7,559E+01 4,8080E+08 5,5278E+02 4,7580E+02 3,7596E	FISSIO		RADIATION	NEUTRON	TOTAL	J VALUE	(EV)	RGT	ENE	INDEX
2 2,9400-91 3,04000-00 8,0507-02 2,22072-04 3,0000-02 4 4 1,09412-01 1,00001-00 6,0507-02 0,19007-04 4,0155-02 4 4 1,09412-01 1,00001-00 6,0517-02 1,0407-03 4,0425-02 1 5 1,1900-01 1,00001-00 6,0517-02 1,0407-03 4,0425-02 1 7 1,4407-01 1,00001-00 7,7443-01 2,12001-03 3,04402-02 1 7 1,4407-01 1,00001-00 7,7443-01 2,12001-03 3,04042-02 1 7 1,4407-01 1,00001-00 7,7443-01 2,12001-03 3,04042-02 1 7 1,4407-01 1,00001-00 7,7443-01 2,12001-03 3,04042-02 1 7 1,4071-01 1,00001-00 7,7443-01 2,12001-03 3,04042-02 1 7 1,2542-01 1,00001-00 7,7443-01 2,12001-03 3,04702-02 1 7 2,22050-01 1,00001-00 7,0272-02 2,72001-04 3,7572-02 1 7 2,22050-01 1,00001-00 4,70472-02 2,151372-03 3,04702-02 1 7 2,22050-01 1,00001-00 4,70472-02 3,14001-04 4,8105-02 9 15 3,34001-01 1,00001-00 4,7241-02 2,11001-04 4,8105-02 9 15 3,34001-01 1,00001-00 4,7241-02 2,14001-04 4,8105-02 9 15 4,4390-01 1,00001-00 4,07472-02 3,14702-03 5,03020-02 1 4,43900-01 1,00001-00 4,07472-02 3,147020-03 5,03020-02 1 4,43900-01 1,00001-00 4,07472-02 3,04702-03 4,0402-03 5,03020-02 1 4,53000-01 1,000000-00 4,07472-02 3,04702-03 4,0402-03 5,04302-02 1 5,02134-01 1,000000 4,00 4,07472-02 3,04702-03 4,04702-02 2 7 4,0709-01 0,00000-00 4,07472-02 3,04702-03 4,04702-02 2 7 4,0709-01 0,00000-00 4,05500-02 1,35002-03 4,35032-02 4 4,07000-01 1,000000-00 4,05500-02 1,35002-03 4,35032-02 4 7,0400000-00 1,055000-02 1,35002-03 4,35032-02 4 7,040000-00 1,020000-00 1,055000-02 1,35002-03 4,36032-02 4 7,040000-01 1,0000000 1,020000-00 1,35020-02 4,040000-03 4,50032-02 4 7,05000000 1,0200000 1,020000-03 4,50000-03 4,50020-03 4,50032-02 4 7,0500000 1,0200000 1,020000-00 1,35000-03 3,97100-03 3,970302-03 3,970302-02 3 7,0400000 1,0200000 1,0200000 1,0200000 1,02000000 1,02000000 1,02000000 1,02000000 1,02000000 1,020000000 1,020	, 3020E -	5	4.00000-02	4,7800E-25	5,40056-01	A.8887E+00	-61	20002	-2,2	1
3 7, 613%E+00 1, 080%E+00 1, 097 1, 1, 640%E+02 1, 1, 640%E+02 1, 790%E+03 3, 644%E+02 1, 790%E+03 3, 740%E+03 1, 790%E+03 3, 740%E+02 1, 790%E+02 4, 180%E+02 4, 744%E+02 1, 740%E+03 1, 790%E+02 4, 180%E+02 1, 740%E+03 3, 90%E+02 1, 740%E+03 1, 740%E+02 1, 740%E+03 1, 740%E+02 1, 740%E+02 1, 740%E+02 1, 740%E+03 1, 740%E+02	.98386-	4,	3.98886-82	2.42005-04	9,92426-22	0.0000E+00	-91	ABBE	2.9	2
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24 5,7554E+81 1,882E+82 5,053E+62 1,852E+82 4,502E+82 1 25 5,7092E+81 8,8826E+82 6,353E+62 1,852E+82 3,842E+82 1 25 5,7092E+81 8,8826E+82 6,4535E+62 1,852E+82 3,842E+82 1 26 5,9254E+83 1,88080E+82 6,4532E+82 4,5972E+82 3,842E+82 1 27 6,8774E+81 1,88080E+82 6,4532E+82 4,8972E+82 3,8423E+82 1 27 6,8774E+81 1,8808E+82 1,3307E+81 3,9718E+82 3,8293E+82 1 26 6,3104E+82 1,8208E+82 1,23307E+81 3,9718E+83 3,8283E+82 1 27 6,5554E+81 1.8208E+82 1,4533E+81 2,9212E+82 3,8293E+82 3,8283E+82 1 28 6,5794E+81 1.3208E+80 1,4533E+81 3,7040E+83 3,9482E+82 8 38 6,1404E+801 1,4533E+80 3,7040E+83 3,9482E+82 8 8 1,8534E+82 2 1,8548E+82 3,9482E+82 2 1,7548482 1,89382E+82 1,87482+82	ALSEC.		3 33425-02	4 35000-03	6 68605-02	1.0200F+00	-01	AARF	5 6	53
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38 6 57996E82 1.0820E-88 1.102E-82 6.8333E-82 31 7.4887E82 1.0826E-88 1.2639E-31 1.102E-82 6.8333E-82 31 7.4887E81 1.082E-88 1.201E82 3.2918E-82 3.2926E-82 3.2926E82 32 7.4987E481 1.082E-88 1.4212E82 3.2918E-82 3.755E22 8 33 8.1688E401 9.878E488 3.942E42848 3.7668E-82 3.9428E482 8 48 8.2558E481 7.828E488 3.9929E-82 3.7668E-82 3.9428E482 3.9438E482 3.9438E482 3.9438E482 3.9438E4	enanr-		3 02035-02	3.97105-03	1.33075-01	2.9929E+20	+01	550F	6.5	59
31 7.4887E481 1.6286E426 7.3291E-02 3.2918E-03 3.2906E422 1 32 7.4950E481 1.308E408 1.4513E41 2.8266E42 3.9948E423 33 8.1608E401 7.810E408 9.3746521 2.8266E42 3.9948E423 34 8.2658E401 7.812E408 1.2428E408 3.7968E-02 3.9948E422 35 8.11608E401 7.812E408 2.9542E488 3.9948E422 3.9948E422 35 8.2578E401 7.8088E408 2.9542E488 5.9188E423 3.9948E422 3.9948E422 36 6.5278E401 0.8888E448 2.9542E488 5.9188E428 3.9948E422 3.9948E4222 3.9948E4222 3.9948E4222 3.9948E4222 3.9948E4222	4887E-	ŝ.	6.231 JE-22	4.11925-02	1.26395-31	1.02025+00	•8:	790E	6.5	38
32 7,40505081 1,300500 9,374550 2,0124502 3,7054502 4 33 8,16005091 0,8,30500 9,3745501 2,0124502 3,008500 4 48 8,25505401 0,8,30500 9,3745501 3,7608503 3,908500 4 53 8,27105481 0,8020540 1,228548 3,7903503 3,908500 4 53 8,27105481 0,8020540 3,0920502 9,2708504 3,908500 2 53 8,27105481 0,8020540 2,3542548 8,0182502 3,908500 2 53 9,8754541 0,8020540 2,3542548 0,0182502 3,908500 2 53 9,8754541 1,8020540 5,7908502 7,5232502 3,90855402 3 54 9,5355401 1,8020540 5,7096502 7,7588502 3,8135402 2 54 9,54355481 1,80805540 5,5295652 7,7888502 3,8135402 2 40 9,5435581 1,80805540 5,5295502 7,7888502 3,3916572 4 41 9,6491481 1,8076540 5,7054502 1,9858502 4,2085622 1 42 1,8225442 7,8007540 4,77554502 1,3936522 4,2085622 1 43 1,8354582 1,28965540 4,5635502 4,8335523 3,5465572 1 44 1,8535682 1,28965540 4,5585522 4,8335562 3,356572 2 45 1,86754582 1,28965540 4,5585502 4,8335563 3,5465572 1 45 1,86574582 1,28965540 4,55854502 4,8535562 3,3568572 1 45 1,8535682 1,28965540 4,5585562 4,8535562 3,3568572 1 45 1,8535682 1,88965540 4,5585522 4,8535562 3,3568572 1 45 1,8535682 1,8895540 4,5585562 4,8535562 3,3568572 1 45 1,8535682 1,8895540 4,55854502 4,8535562 3,3568572 1 45 1,8535682 1,8895540 4,5585562 4,8535562 3,354562 3,3645572 1 45 1,85356420 1,8895540 4,5585420 2,354572 3,3645572 1 45 1,85356462 1,8895540 4,55854502 4,8535562 3,3545672 3,3645572 1 45 1,85356462 1,8895540 4,5585672 2,354672 3,3645572 1 45 1,85356462 1,8895540 4,5585672 2,354672 3,3545672 1 45 1,85356462 1,8895540 4,5585672 2,354672 3,3545672 1 45 1,853574562 1,8895540 6,7554572 2,354672 3,3545672 1 45 1,853574562 1,8895540 6,5755472 2,354672 3,3545672 1 45 1,853574562 1,8556676 6,37554572 1 45 1,853574562 1,855676 6,3755472 2 45 1,85574562 1,8555676 6,3755472 2 45 1,85574562 1,8555676 6,3755472 2 45 1,85574562 1,85557560 4,5558572 2 45 1,85574562 1,8555766 4,555	17045-		3.H296E=32	3.29105-03	7.32015-02	1. 00000+00	• 81	1887E	7.4	31
33 8,1600Ee01 9,378Ee00 9,378Ee01 3,7600Ee03 3,900Ee02 4 34 8,2550Ee01 7,607Ee03 3,900Ee02 4 3,900Ee02 4 35 8,270Ee01 0,802Ee02 4 3,900Ee02 4,902Ee02 4,902Ee02 3,900Ee02 3,900Ee02 3,900Ee02 3,900Ee02 3,900Ee02 3,900Ee02 4,902Ee02 4,902Ee02 3,900Ee02 3,900Ee02 4,902Ee02 4,902Ee02 4,902Ee02 3,900Ee02 3,900Ee02 3,900Ee02 4,202Ee22 4,202Ee22 2,202Ee22 41	7346E-		3.7654E+82	2.01265-02	1.4513F+81	1 300E+00	•01	950E	7.4	32
34 6,25556891 -01.425408 1,2425768 3,79025-03 3,5025762 35 6,27165481 0,8828540 3,9925-02 9,2988542 3,9025722 9,2988542 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9025722 3,9035722 3,9035722 3,9035722 3,9035722 3,9135722 4,913742 4,9055742 3,913572 4,913742 4,914722 4,914722 4,914722 4,914722 4,914722 4,9147222 1,9147242 <td< td=""><td>94092-</td><td>- A -</td><td>3.9468E+82</td><td>3.7600E-03</td><td>9.3746E-21</td><td>0.0:30E+00</td><td>•01</td><td>600E</td><td>8.1</td><td>33</td></td<>	94092-	- A -	3.9468E+82	3.7600E-03	9.3746E-21	0.0:30E+00	•01	600E	8.1	33
35 8,2714E+81 0,8882E+88 3,9926E+82 9,2988E+84 3,9482E+82 3,9482E+82 36 8,5774E+81 0,8882E+88 2,3542E+88 5,0182E+82 3,9485E+82 1 37 8,533E+81 1,8888E+88 2,3542E+88 5,0182E+82 3,9485E+82 1 38 9,8774E+81 1,8888E+88 5,7598E+82 1,7232E+82 3,9485E+82 1 39 9,8774E+81 1,8888E+88 5,7598E+82 1,7288E+82 1,813E+82 1 39 9,2988E+81 1,8888E+88 5,8278E+82 1,7888E+82 1,8582E+82 3,3416E+82 1 40 9,6338E+81 1,8888E+88 1,7888E+82 1,9850E+82 3,3416E+82 1 41 9,6332E+81 1,8888E+88 1,7888E+82 1,3491E+82 4,2482E+82 1 42 1,82276+82 7,8886E+88 4,7638E+82 1,7888E+82 3,35668E+72 1 43 1,8337E+82 1.8888E+88 4,7638E+82 1,8332E+83 3,5668E+72 1 44 1,83374882 1.8882E+88 4,7638E+82 3,8436E+82 3,5429E+22	28085.	- ÷.	3.9300E-02	3.7962F-23	1.24285+88	7.86 #2E+80	•01	ASPE	8.2	34
16 6.57/05-01 0.888/05-08 2.35/07-00 5.01827-02 3.90805-02 3.7 37 6.55375-001 1.08885-08 5.95285-02 7.52325-03 3.9085-02 1 39 9.7745-01 1.08885-08 5.75085-02 1.12085-02 3.8135-02 1 39 9.7745-01 1.08885-08 5.75085-02 1.12085-02 3.8135-02 1 39 9.27045-01 1.08885-08 5.75085-02 1.78085-02 3.8135-02 1 40 0.53355-01 1.088805-08 5.82785-02 7.78085-02 3.9165-02 1 41 9.64915-01 1.08825-02 1.9535-02 3.93165-02 4.2482	38385+	- 2,	3.9000E-02	9.2900E-04	3.99296-02	0.000025.00	+81	71 °E	8.2	35
37 6,5537E.01 1,0000E.00 5,0523E.02 7,5232E.03 3,0605E.02 1 3 9,0774E.01 1,0000E.00 5,700E.02 1,1206E.02 3,8138E.02 4 9,2980E.01 1,0000E.00 5,0278E.02 7,7000E.04 4,9724E.02 7 40 9,5430E.01 1,0000E.00 5,0455E.02 1,0850E.02 3,3016E.02 7 41 9,6491E.01 1,0000E.00 5,0455E.02 1,0850E.23 3,3016E.02 7 42 9,5430E.01 1,0000E.00 5,0455E.02 1,0850E.23 3,3016E.02 7 42 9,5430E.01 1,0000E.00 5,0455E.02 1,0850E.23 3,3016E.02 7 42 1,0225E.02 7,0000E.00 1,725E.02 1,3930E.22 4,2425E.02 1 42 1,0255E.02 1,0000E.00 4,5503E.02 4,8533E.03 3,605E.72 1 44 1,0555E.02 1,0000E.00 4,5503E.02 4,8533E.03 3,604E.02 1 45 1,0674E.02 1,0000E.00 4,5503E.02 3,3505E.72 3,644E.22 7	2078E+	2.	3.9300002	5.01820-02	2.3542E+00	0.00225+00	+01	270E	8.5	36
35 9,0774E+01 1,0000E+08 5,7706E-02 1,1200E-02 3,13E+02 - 39 9,2900E+081 1.0000E+08 5,0278E-02 7,7800E-08 4,9724E-02 7 40 0,5430E+081 1.0000E+08 5,0278E-02 7,7800E-08 4,9724E-02 7 41 0,6491E+081 1.0000E+08 5,0278E-02 1,9850E-23 3,3916E+72 - 41 0,6491E+081 7.0700E+08 6,0725E+28 1,3930E-22 4,2027E-02 - 42 1,0227E+082 1.0800E+08 4,7634E+02 1.6340E-03 3,5665E-72 1 43 1,0309C+082 1.0800E+08 4,7634E+02 1.6343E-03 3,5665E-72 1 44 1,053>F+082 1.0800E+08 4,7634E-02 3,5665E-72 1 4 3,5605E-72 1 45 1,0674F+082 1.0800E+08 4,7554E-02 3,5405E-72 3,5424E-22	2157E-	1.	3,9863E=02	7.52326-03	5.9523E-82	1.0000E+00	-01	537E	8,5	37
39 9,2980E021 1,8000E00 5,8278E02 7,7800E04 4,9724E02 7 40 9,5430E01 1,0000E00 5,8278E02 1,9850E02 3,3936E02 1 41 9,6491E081 1,0000E00 1,780E002 1,9850E02 4,2328E02 1 42 1,0229E02 7,0000E00 4,7534E02 1,3491E02 4,2407E02 4 31,0395602 1,8000E00 4,7534E02 1,0340E02 3,3606E72 1 44 1,0537E02 1,0000E00 4,5503E02 4,8033E02 3,3606E72 1 45 1,0674E02 1,0000E00 4,5503E02 4,8033E02 3,644E02 2	. 5922E -	- Na	3,8113E+R2	1.12985-02	5,7998E-02	1.0000E+00	+81	77₽E	9,0	35
40 9,5430E801 1.0000E-00 5.0465E-02 1.9850E-03 3.3916E+02 4 41 9,6491F+01 0.0000E+00 1.7095E+02 1.3936E+02 4.2000E+02 4 42 1,020256+02 1.0000E+00 6.07025E+02 1.3491E-02 4.2000E+02 4 43 1,0300E+02 1.0000E+00 4.7634E+02 1.6348E+03 3.9568E+02 1 44 1,0530F+02 1.0000E+00 4.5603E+02 4.8030E+03 3.9508E+02 4 45 1,0674F+02 1.0000E+00 4.5503E+02 4.0033E+03 3.959E+02 4 5.05074F+02 1.0000E+00 4.5503E+02 4.0033E+03 3.959E+02 4 45 1,0674F+02 1.0000E+00 4.5503E+02 4.0033E+03 3.959E+02 4 45 1,0674F+02 1.0000E+00 4.5503E+02 4.0034E+03 3.959E+02 4 45 1,0674F+02 1.0000E+00 4.5503E+02 4.0034E+03 3.959E+02 4 45 1,0074F+02 1.0000E+00 4.5503E+02 4.0034E+03 3.959E+02 4 45 1,0074F+00 1.0000E+00 4.5503E+02 4.0034E+03 3.959E+02 4 45 1,0074F+00 1.0000E+00 4.5503E+00 4.0034E+00 3.950E+00 4.0000E+00 4.0000E+0000E+00 4.0000E+00 4.0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+0000E+000E+000	.7908E~	7,	4.9724E+22	7.7800[-04	5.827BE-02	1.000000.00	•01	980E	9.2	39
41 9,6491F01 7.0730E-30 1,7295-62 1,33936-22 4,2025222 1 42 1,02295-02 7.02005-00 6,00255-20 1,34915-22 4,20252-22 5 43 1,03095-082 1.000025-00 4,75345-02 1.03402-23 3,54055-72 1 44 1,05395-082 1.000025-00 4,55035-02 4,80335-23 3,54045-22 4 45 1,06745-02 1.000025-00 4,55035-02 4,30335-23 3,54045-22 9	45841-	•.•	3.3916E-72	1,98505-23	5.0485E-02	1.00002+00	+01	i430E	9,5	40
42 1,02276+02 *.02076+00 6,00256+00 1,34916=02 4,20026-02 4 43 1,03076+00 1,00046+00 4,76346-02 1,63405-03 3,60686-72 1 44 1,05376+00 1,00066+00 4,56036-02 4,80306-03 3,60996-02 4 45 1,06746+00 1,00066+00 6,76546-00 0,354076-03 3,64146=02 7	64>BE+	1.	4.23835422	1.3936E-22	1.72096+00	2.0200E+30	•Ø1	491F	9,6	41
43 1,03076-02 1.000026-00 4.7634E-02 1.6340E-03 3.5668E-72 4 44 1,05376+02 1.000026+00 4.55035-02 4.8030E-03 3.6499E-22 4 45 1,06746+02 1.00006+00 6.7594E-02 0.3540E-03 3.6414E-02 7	9478E+	۴,	4.20836-22	1,34910=02	6,2225E+22	. BKA66+98	+02	1\$52E	1,0	42
44 1,053>F+02 1.0000E+00 4,5503E+02 4,8030E-03 3,6299E-32 4 45 1,0674E+02 1.0000E+00 6,7954E+02 0,3540E+03 3,6414E=02 2	0132E-	1.	3.5d68E-?2	1.6348E-23	4,7634E-02	1.304gE+88	• 8 2	3025	1,0	43
45 1.0674E+02 1.0000E+00 6.7954E+02 0.3540E+03 3.6414E=02 2	7818E-	- A 1	3.6299E-32	A,8038E-03	4,5803E-02	1.00000000	•82	153>E	1,0	44
	-39925	2.	3,6414E=02	0,35406-03	6.7954E-C2	1.0000E+00	+02	1674E	1,2	45
46 1,10445+82 7,0000E+40 4,4423E-02 1,4230E-03 3,2763E+02 1	22375-	1.	3,27632+02	1.4230€-03	4,4423E-82	2.8696E+98	+82	044F	1,1	46

	1 16235+02	a aawar	6 86441-02	4 4400C-04	3 03025-02	3.20AME-02
	1,19296.002		0.000		5,00000-00	01475-41
**	1,101-102	F.0C00E+00	2.00421-01	1,14211302	3.67/22-02	11110311
50	1,188¤£.•02	1.0000E+00	8.5354L-02	1.7354E-02	3,4043E>02	3,31975-32
	1 21035-02	2.0020F+20	8 75845-02	7.58405-93	3 49:25+02	4.108AE-32
		0 00005.00		78025 23	3 40025 -03	7 04405-03
24	1,23476402	*. CO2CE+0C	0,4384E-02	1.30421-03	2.40002-02	THE DOLL - 2
53	1.262'E+02	P.0000E+09	5,2178E-@2	5.3780E-03	3.5325E-22	1.14755-22
	1 27645-02	2. 2000F+00	5 19215-02	1.9212F+83	3 24228502	1.9578E-02
22					7	7 74405+22
	1.31*21*82	DE DE COD	3.01432-60		3.80901-02	3174002-00
56	1,338°E+02	1.000000+60	5,4569E-02	6.5090E-03	4,36321-22	4.37000-23
57	1.368VE+02	7.00025-00	1.3379E-01	1.2087E-02	4.1669E=02	7,9551E-02
	1 1035-03	9 99995 - 49	7 03045-03	5 0400F-04	3 04005-02	3.83385+70
20	1,34326.02	r.DEBPE-DD	3.42405-02	2, TODEL BU	5.90000002	
59	1,430°E+02	1.2000E+00	1,4353E-01	3,53102~03	2'9444F=05	5:3071L-02
62	1.4354E+02	1.00000+00	6.9547E-02	3.5470E-03	3,4800E-C2	3,12006-62
	1 44315 493	1 00305.00	4 48785-03		4	0.41 M0E - 03
°±	1.0001002		0,00302-62	8,20002-00	4.00000-000	
62	1.4739E+02	0.0C201.00	1,0°676°600	5.80106-03	4.40602+02	I BRODE - PR
63	1.4827E+02	C.0030E+30	1.50910-01	1.9110E-03	5,9037E-02	8.9903E-02
	1 49475092	2. 2020F+00	1.1179F-01	5.7920F+83	5.852BE-02	4.7472E-22
	1 54085400	0 00405-00	4 30465-00	4 08505-01	1 02085-02	9.00405+20
62	1,30702-02				3.40000002	EDDDE TE
66	1,570°E+02	0.3605F+00	6,1057E-21	2,8574E-02	4,80006=02	3.4000E-01
67	1.64526+02	1.000026+00	7.45601-02	2.8660E-02	3.8764E=02	7,1300E-03
4.8	1 47125-02	• FRADE - 00	0 85485-02	A 54805-03	3 0172F=02	8.38285-52
00	1,0/160-02	1,00000000	9.8340E-02	0,94002400		
64	1.70001+02		4,9720£-82	7,20005-04	3,53026-62	1+30186-65
72	1,70426.02	C,0000E+00	1.8141E-C1	2.4070E-03	6,000PE-P2	1,1900E-01
71	1.74305+02	0.00000+00	1.20165+02	1.595003	4.4.00E=02	9.56085-01
	1 74645-00		3 414 35 - 91	4 4000F-04	A	3.02005-21
74	1 / 9/02 02		2102L-21	1.17000-004	1.1.00	CIPPEDD - CI
73	1,7590E+02	1.00002+00	7,2129E-02	5°75ABE-83	4.8/4JL-02	2. 42275-02
74	1.7722E+02	1,00205+02	4.9612E-82	3.81000-03	3.9129E=22	6.8712E-23
	1 70005-07		E 81745-00	1 17105-03	4 0238F=02	4.47025-02
//	1,00000000	1.000000000	5.8371E-02	1.3/102-03		
70	1,830*1+62	1.000000+00	5,5801E-02	1.8010E-03	3.30731-02	7.0347E-02
77	1.85016-02	2.0003E+00	1.8361E+20	1.5937E-02	3.90C2E=32	1.7812E+20
78	1 85755+82	2.00205+20	3 97555-92	7.56005.94	3 G720F=22	2.00006+20
<u>/0</u>	1,057,02002	0 00000 . 30	3.1.902-02	00500 37	7 47446-00	
79	1,88275462	L. 00005 +00	2.00025-85	1.84205-03	3,83002-02	1150345-65
63	1.92645+22	C,0002E+00	6.6703E-02	4.70305-03	4,75906-02	1.44105-02
81	1.95326+02	2.0020E+00	5.11296-21	5.9526F-02	5.0438E+02	4.81345-21
- 2	1 04475+03	4 99495499	1 11075-24	4 04825-23	6 05315-02	4.64605-72
	1.0001002	1.05000000	1,119/2-21	H, YCOLE-DO		
P .3	1,99466+82	1.00001+00	1.36886-21	1.01816-02	4.8020L>22	7.72946-62
84	2.033#E+02	1.02026+00	7.09335-02	1.9530E-03	3.000000+32	3.20400-02
	2 41425-493	1 00005-00	8 20255-12	2 02596-93	2 41025-12	5.16285-02
	2,03011-02	1,00000-00	0,2722102	2.72502-00		
60	2,23971+62	P.0000E+00	2,98726-21	7.3/236-02	2.03//1-02	2.10-21-21
£7	2.0423E+02	P.0000E+00	1.9139E-01	1.3920E+03	3.0000E+62	1.60006-01
	2 09365-02	1 0000F+20	5 48415-02	A 8410E-03	4 2941Fu22	7.05905-23
	2.070000000	2 20225.00		4 07305 01	7 0 101 5 - 0 2	4 43775400
	2,11101.462	2.20000.+.0	1.15051-20	4,0/301-03	3,900IL-02	1113//2-20
98	2,1202E+02	A.0000E+00	1.50g3E+30	2,3220E+03	4,2000E-02	1,450BE+2D
31	2.13205+02	P.0002E+22	1.67955-21	1.65205.03	3.83958-02	1,27926-21
	2 4625492		4 14415-01	4 44325-83	4 95075-02	0.40405+53
	2.10,22,402		0.30002-62	8.00302-003		
a 3	2.14476+02	1.000000+00	0,00001-02	3.40801-03		21-1126-45
94	2.2023E+02	1,0020E+00	5.0608E-02	7,90806-23	3.1694E-02	1.12065-32
65	2.2310E+02	1.00000-000	5.9402F-02	3.90205-03	4.94916+82	4.00400-23
	3 34845+43	10005-00	4 45015-02	4 40101.03	7 02825 012	4.14105-72
40	2,200-0-02	1.000000000	0,77F1C-82	1.00101-00		1.5-101-00
97	2,27//E+02	5.9660F+66	8,09416+00	5.90045405	4.13001-02	- 02 BE 20
98	2.2789E+02	1.0P40E-00	6.5416E-22	1.9162E-03	4,1033E-02	2,24076-22
09	2.34408+02	1.000000+00	5.37A5F-02	+.1765F-02	3.7220E=82	5,22025-23
	2 394 15 492	4 9999F+99	1 02435-04	43405-03	1 000005-33	4.20405+22
100	2,32000002		I.BD.JE-EI	1,40401-00	3,00000002	HIDDDDE CE
101	2,34341+02		6.V967E-82	9.00001-00	3.91/71 - 22	3.1/41/4
102	2,390°E+02	1.0000E+20	7.29196-22	6.0192E-03	4,844>E=22	1+64252-72
1 0 3	2.42665+82	2.0030E+2.	2.41A0F-01	9.9200F-25	4.1522E+82	2,700000-71
104	2 43875473	00 ADE - 20	6 43365 03	7 12505-33	3 47025 -02	5.23686-12
1	2, 20, 102					
105	2,475°E+82	· . 0000E+00	V.108⊃E-82	2.00205-03	2,00071=02	1127715-C2
106	2,4887E+02	1.0200E+00	5,5344E-82	1.0244[-02	3,3494£202	5.ZU08E-73
107	2.5+20F+02	1.0202E+20	5.15632-22	4.08635-22	3.30556-02	7.74585-23
	2 545/5-22	. B220F-20	5.83225-23	3.42200-03	3.11746.02	2.37245-22
100	2,34310.400	1,00000000	1,03221-12		5 -1515-00	57400-12
109	2,500/1+02	1,00011+00	0,00001-02	1.02205-03	2.21276-05	612/795766
110	2.590°E+02	°,2008E•20	4.2148E+00	1.13962-02	3.9228E-72	3.9644E+2P
	2 59855+02	C.2828F+28	3 94515-02	4.51005-04	3.9222E482	2.32466+23
	3 49345-93	4 00205.20	1 00345-23	0 21425-04	3	2.00205+12
11.	C. DESPE - 62		3.99216-02		3,90000-02	
113	2,62788.+02		•.00952•20	7.22025-02	J.9000E=02	4120555+25
114	2.6274E+02	1.2020E+20	4,9295E-02	3,2950E-03	3,6014E-02	9,186 <u>86</u> -23
1.6	2.64205.002	2.20205+40	4.58221-02	1.820035	2.78056-02	1.61955-72
		4 30305.23		4 1000	5 .0005-02	5.52105-33
110	C. 04141 402		1,5-201-01	-,17702-03	,	1 JUNE 1
117	2,5947[+02	1.0000E+20	6,68926-22	4,8900[+83	3,2100E-02	5-26456-95
118	2.7264E+82	1,8888E+09	8.9223E+22	2,52231-02	3,3982E=82	3.8418E-72
1.0	2 74805.03	1 2020F+20	7 14845-01	8 84105-01	5 ANR0F - 0 2	A.50000-11
117					4 47346402	9 9 9 4 4 5 - 22
120	2,7557E+Ø2	1.0000E+00	1,71106-01	2.01/3E-02	+.0/J+L+02	1. 1200E - 22
121	2,77246+02	2.0020E+20	5,2998£+00	1.75461-02	.2000E⇒02	5.2400E+20
122	2.7952E+82	0.0000E+00	1.2783E-21	2.7332E+8?	4,9316E+22	5,11046-22
4 . 4	2 82075-02	4.39395.20	7 96091-07	1.060AF .02	4 73426+12	1.26585-12
123	A 10274L - C2	1.000000-00	7.70902-02	5,7072CB0C	4 #4005-00	7 0000C-14
124	2,00/32+82	r,0000c+00	3.4097E-01	A' #200F - 0 #	-, 6000L-02	STODARF-61
175	2,66002+02	0,0000E•00	7,0197L+00	3,0754[-02	3,9000E=02	A,9500E+20
126	2.92336+82	*.0000E+00	1.16496-01	1.3488E-02	4.8489E-82	5,45112-32
	2 04465 497		17475-00	1 74705-01	5 37496	2.52515-72
12/	5,40401402	1.000000.00	0,1/0/1-02			2172712-02
128	2.9860E+02	1.00001.00	6.8367E-C2	1.0007E-02	J.71096982	- 00361-02

ENDF/8 MATERIAL NO. 0264

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RESONANCE DATA Resonance parameters

PLUTONIUM-239

2	UNRESOLVED	STUPPER-TEALT	RAFILENIOUFA	NAKTHELEN2

ENERGY RANGE NUMBER	2
LOWER ENERGY LIMIT (EV)	3.010PE+02
NUCLEAR SPIN	2.500CE+04
EFFECTIVE SCATTERING RADIUS	9.0535E-01
NUMBER OF L STRIES	2

NUMBER OF J STATES----- 2

DEGREES OF FREEDOM USED IN THE KIDTH UISTRIBUTION

		J=VALUE	COMPETITIVE	NEUTRON	RAUIATION	+12213K
		8.0879E+80	8.200PE -00	1,000000-00	6.0683E+05	2.000000.00
			AVEP	AGE RESONANCE	MIDIHS (EV)	
TNDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	FISSION
1	3.0100F+02	A. 7800E+00	3.42005-00	1.2738F-23	4.1508E-02	2.08325+88
5	3.26005+02	8.7800F+00	0 00000.00	A. 81745-84	4.1688F-02	2.82225+22
ĩ	3 40801 402	8 7800E+00	0 00000-00	3.05445-84	4.16001-02	2.40225+03
	3 40000 402	5 7830EA00	0,000012400	1 07005-04	4.16000-02	3 80705+03
	3 84005-02	8 78285.48	0,00001,000	5 141 15-04	4 14985-02	2 40326433
-	3,000000000	0,70401-00	L * CCORF+RR	2:101/L-CA	4110505-02	2.000001000
2	4,07001-02	6./000L-00	0,000HE+06	0,041,100	4.10000-02	2.000000000
	4.30NEF-05	8./8¢01.000	0,09006+96	2,07191-64	4.10001-02	2.00000.000
	4.0003E+82	8./800L+00	0.0002E+00	2,0027144	4.10001-22	2.00201-05
9	4,920BE+82	8.7800L+00	P,8000E-00	6.6726 - 84	4.10086-02	2.00385.956
10	4,95885+82	8,7820E+00	8,00025+05	3.8876E-84	4.10666-65	5.98985+55
11	4,98082+02	8.7809E•@0	P.0000E+00	5.8314E-84	4.10046-02	2,60205.93
12	5.0100E+02	8.7800E+00	0.0000£•00	6.28632-84	4.1600E-02	2.88385+28
13	5.04682+02	8.7800E+00	0.00001+00	1,75926-23	4.16076-02	2.40205+32
14	5.40#ØE+82	8.7800E+03	8.8888E+88	2.06:3E-23	4.1602E-02	2.43386+22
15	5.50A0E+02	8.7800E+00	2.02201+00	1.7891E-23	4.1600E-02	2.00325+02
16	5.95026+82	8.7820£•00	0.00005+00	1.9010E-23	4.1600E-C2	2.00201.02
.7	6.0000E+02	8.78206+00	8.00005.00	9.491AE#24	4.1600E-02	2.02225+22
18	6.4000E+02	8.7820E+20	0.00006.00	7.43476=24	4.1688E=02	2.40327+22
10	7.25805+32	A. 7820E+80	8.00001+00	5.797AF-24	4.1600E-02	2.80325+20
20	7.750000+02	8.7800E+00	0.0000-00	9.3243E-24	4.1602E-22	2.00325+33
21	4 ANAAF+42	A 7820F+30	0 0000-100	1.43245-24	4.16025-02	2.00225+22
22	A 2308F+02	A 7800E+80	a a#aac+aa	A . 5270E -24	4.16001.002	2. 40305+00
	8 5000E+32	A 7800E-50	0 ataor.aa	2.84485+24	4.16885-02	2.88.385+03
	6 AMB6[AM2	A 78905+00	T. CCD0L+DD	2 88445-24	4 4 6000 -02	3 80305+23
			r.60001.00	2,00141-04		2.000002-00
25	0,70000-02	6.7000L+00	r.2000E+00	2,000/0-04	4.10000-02	2.02002-10
20	0,/////////////////////////////////////	8.78662.488	n. 5466F+66	0,00520-04	4,10000-02	2.06261 .00
2/	A.52MAE-05	0./00000000	N.8085E+86	8,/JY41-L4	4,10006-62	2.00000.000
28	V,/5HEL+02	8./800t+80	7.8680E+86	1.7049E-83	4,10002-02	5 OF 305 - 65
29	1.0-001+03	8.7822L • 02	7.2009E+02	9,28725684	4.1060E-02	2.06205.653
30	1,1000E+03	8.7872E + 00	0.000°E+00	9,366BE-84	4.10081-02	2.08361+18
31	1,2>00E+03	8.7800E-0J	P.2002E+02	8,2524E-24	4.10006-02	2.00385.055
32	1,2000E+03	8.7800E+20	P.0027[+00	3,64415-24	4.16881-82	5.05106+55
33	1.2700E+03	8.780£E+30	P. 2306E • 22	3,6465E-24	4.16075-82	2.8032**02

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34	1,2500E+03	9,78002+00	P.0000E+00	3.6474E-04	4.1600E-02	2,8000E+00
35	1,29006-03	6.7800E+00	8.20005+00	3.6468E-84	4,1600E-02	2,5078E+K0
36	1.30005-03	8, 800E+00	0.0000E+00	3.6449E-84	4.1600E-02	2,8030E+00
37	1.31006+03	6./600E+00	2.88886.488	3.64175-84	4.1600E-02	2.80385+02
78	1.32005+03	8.78295+00	A. AAAAr . AA	3.63735-84	4-16085-02	2.80005+00
10	1 33005+03	8.7800F+00	0.0000C+00	1.43195-84	4.14085-02	2.50385+00
37	1.36005+03	6 7820C+00	2 00002+00	3 43405-84	4 44000-02	2 36300-00
# (C	1.3-402-03	8.76002000	r.00001.000	3182492-04	10000-02	2,00001-00
41	1.33005-03	8,/800t•00	2,0000E+80	814405E+04	4.10000-02	5.05.985.08
42	1.3/PBE+03	8.7800E+00	0,0000[•00	3,55678-64	4.10000-02	2.08386+00
43	1.390ØE+03	8.7600E+00	0,3000E•30	3,49312-84	4.16BBE-22	2.8830E+02
44	1.4100E+03	8,7880E+00	P.0000E+00	3,4259E-04	4.1600E-02	2.08285088
45	1.43P8E+83	8.7800E+00	8.0000E+00	3.35492-24	4.1608E-02	2.00386+00
46	1.45886+83	8.7800E+00	0.00001.00	3.27978-04	4.168 E-#2	2.00000+00
47	1.470GE+03	A.7800E+00	0.0000.000	3.20015-04	4.160BF-02	2.00286+08
24	1.49085+03	A.7880F+00	0.60005.00	3.11595-04	4.16005-02	2.80385+80
40	1 51005+03	a 78805.40	0 00000.00	7 92475-94	4.16085-82	2.88385+88
	1,51055-00			0 01045-04	4,14000-02	2,000000000
70	1,33000-03	8.70020400	0.00005-00	2,73081-04	4.10002-02	2.0000L-00
51	1,5+006+03	8.7600L+20	9.9000E+00	2.00056-04	4.10001-02	2,08085+80
52	1,5000E+03	8.7800E•00	C.0000E=00	6,374ØE=24	4.1630E- <i>2</i> 2	2,5#30E+00
53	1,70000+03	8,7800E+00	0,0000£+00	9,4651E-04	A,1690E-82	2,68306+30
54	1.80005+03	8,780gE+00	0,0000E+00	9.7678E-04	4.1688E-82	2,8080E+00
55	1.6788E+83	8.7800E+80	8.00005+00	1.06952-03	4,1688E-82	2.000000+00
6A	1.900000+03	A.7800E+00	8.08985.09	3.96845+84	4.1600F+02	2.80205+00
	1.02885+83	A.7880F+00	0.08005.08	3.65345-24	4.16885-02	2.668895+04
	1 04645-43	8 78005400	a adaar.as	3 32805-04	4 44885-82	2 80335-00
20	1,74866-85	0.70000-000	0.000-2-00	SISCORE	I TOPPE-DE	21000000000
	1,92001+03	8.7800L+00	0,2820E+98	7,0433E-04	4.1000L-02	5'09886+88
68	2,100HE+03	8.7800E+00	0.00006+00	8,4514E-04	4.10000-02	2.0070E+00
61	2,2088E+83	8.78202+00	₽.0000E±00	9,0028E-04	4,1000E-02	2,30006+00
62	2,40086+03	8.7800E+00	0.000E+00	1,0488E-03	4,16000-02	2,40306+00
63	2,42685+83	8.788ØE+ØØ	0.00000-000	1.1868E-03	4,16001-02	2,60300+00
64	2.60888.+83	8,788ØE+ØØ	8.00005+80	9.8290E-84	4,16886-02	2.83285+80
45	2.62026+03	8.7800E+00	8.00005+00	4.4050E-04	4.16825-02	2.80201+80
44	2.64886+83	8.7880E+00	2.00005.00	4.32615-84	4.16025-02	2.80005+00
47	2. 46885+83	8.78805+80	0.00005.00	4.24825-84	4.16085-02	2.66386+80
	2 48805+63	8 78805.00	8 4949r.40	4 44005-04	4 44665-02	2 88300400
00	24000000000	0,70005-00	P. 20001.00	4,10992-04	4.10002-02	2,00001-00
67	2.70802.403	0./0001.00	N. 0000E+00	4,09011-64	4.10001-02	5.00305-03
70	2.72002+00	0./0001-00	0.00006-00	4,0118L-54	4,10001-02	5.00305+58
71	2,74882+83	6./0001+80	0,2000E+00	3,9339E-04	4.1080E-22	5 • 00 # 0E • 00
72	2,75846+03	8.760ØE+00	0.0000E+00	8,7917E-24	4.1000E-82	5'0558E+88
73	2.77588-83	8,7880E+#0	0,0000£•00	4.3775E-04	4.16006-02	2.8839E+88
74	2.80PEE+03	8,7800E+00	0,0000E+00	1,1017E-03	4,1688E-02	2.50386+00
75	2,9088E+03	8,78802+80	P.0000E+00	4.8996E-24	4.1600E-02	2.80306+22
75	3.0758E+03	8.78002+00	2.0000F+00	5.0271E-04	4.16001-02	2.80305+23
77	3.2508E+83	8.7688E+#R	0.00005+80	7.98885-24	4.16881-02	2.80305+03
78	3.7580F+03	A.7880F+09	8.00005+00	9.64575-04	4.16085-02	2.80000+444
	4 33495+93	8 78885-88	0.0000000000		4.16000-02	
	4 38065403	6 7800E-00		0 01745-04	4.140001-02	2.400001400
	4,/DEC+83	0,70002400	0.00005+00	9,03/45-64	4.10001-02	5.000001.00
81	5.2300E+03	0./0001+00	N,0000E+00	9,47722-04	4.1000E-02	2.00305.00
92	3,77P2L+83	9./800L+00	0,0000E+00	9.0362E-04	4.10005-02	2.0820E+03
83	6,27#ØE+Ø3	8.789Ø£+ØØ	6,00005+00	8,9375E-84	4.1002E-02	2.00386+30
84	6,7988E+03	8.7800E+00	2.0000[+00	8,0529E+C4	4.16822-82	5.95386+93
85	7,2780E+83	8.7800E+00	P.2000E.00	7,96536-24	4.1688E-22	2.80300+30
86	8.25882+83	8.78802+28	0.00000+00	8.8419E-24	4.16886-02	2.02305-03
87	A. 7288E+#3	8.7800E+00	8. 20001 .00	7.55241-84	4.1600F-02	2.80201+44
#.A	0.25885+83	8.7820F+50	0.05005.00	8.49415-94	4.16086-42	2.60206+44
	0.54005-03	8.78505489	0 000001-000	1 58.45-94	4 16685-07	2 40 200 - 00
	0 750000-003	A 7600L-00	0.00001-00	3 34445-24	4,10000-02	2,00002-00
48	*,/>POL +03	- 7000C -00	0,0000L •03	/ 34401-64	4.1000E-02	5100501-00
91	1,00001+24	8./800L+00	N.000NE+33	7,7887E-94	4.1000E-02	5.00306+33
92	1,50806+04	8,7820E+00	0.0009E+00	7.8440E -84	4.16002-02	2.06306+08
93	2.000000404	8,7800E+00	0,0000£+00	5.0864E-04	4.16986-02	2,00326+00
94	2.50F0E+04	8.7800E+00	P.0000E+00	2.829ØE-04	4.16000-02	2.00305+30
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			DECREES DF	FREEDOM USED	IN THE HIDTH	U15TR18.TION
		J-VALUE	COMPETITIVE	NEUTRON	RADIATION	FISSION
		1.02002+00	0.00005+00	1,000000+00	8.8088E+60	1.00306+22
			AVEF	AGE RESONANC	E WIGTHS (EV)	
INDEX	ENPRGY (EV)	EVEL SPACING	COMPETITIVE	NELTRON	RADIATION	FISSION
1	3.01005+02	3.11546+08	0.0000.00	4.5178F-84	4.1600E-52	1930E-02
2	3.20002-02	3.11546+20	8.0000.00	4.81745-24	4.1600E-22	3.6375E+P2
3	3.400000.002	3.1154E+28	0.00000:00	3.9544E-84	4.1600E-62	4.2973E-22
4	3,60000E+02	3.1194E+00	P.0000E+00	3,2799E-24	4.1600E-02	5,47386-02
5	3,80P8E+92	3.1154E+80	P.0000E+00	1,8314E-64	4,1600E-02	4,47296-02
6	4,84086+82	3.1154E+82	0,20002+00	2.3568E-24	4.1600E-02	9,99865-02
7	4.3KABE+02	3.1154E+00	P.8088E+88	2,05196-6	4.10002-02	2.04221-01
	4.600000-02	3,11941+80	0.0200E+02	2,00275-64	4.10002-02	2.07325201
	4,92001-02	3.1194L-88	8,86885+88	2,30776-04	4.10006-02	3.0/582-01
12	4,97886482	3.11746+80	0.00005+00	5,00/0L-C4	4,10001-02	2.700/1-01
11	4,90MBE+02	3.11241480	0.00005+00	5,0314E-C4	4,10000-02	4 87405-01
14	5 04985+82	3.11342480	6 48685-98	4.24105-24	4 16225-02	1,04155-01
13	5 46885+82	3 11545+00	0.00001-00	7.31485-84	4.16005-02	7.13495-22
	5.55005+02	3.1154F400	2.0200C+00	A.3481E-24	4.16885-02	2.15506+02
16	5.95005+02	3.11546+40	0.08005+00	6.7452F-E4	4.1600E-02	2.05146-82
17	6.8088E+42	3.1154E+00	8.4885+88	3.36885-24	4.1688E-22	6.52295-03
18	6.408#E+82	3.1154E+00	0.02006+80	2.6274E-24	4.1600E+02	7,85296-23
19	7.22886+82	3.1194E+88	8.02005+00	2.0572E-84	4,1600E-02	2,1544E-02
20	7,7588E+82	3.1194E+00	0.08002+02	3,30865-04	4.1688E-02	4,12*35-02
21	8.00F#E+02	3.1154E+38	0,00001+00	3,43242-24	4,1600E-02	9,9138E-82
22	8,25##E+#2	3.1194E•00	₽,9800E+00	2,31632-24	4.1689E-82	8.8579E-02
23	8,50P@E+@2	3,1154E+88	P.0000E+00	2,8615E-24	4,168PE-82	7,73246-02
24	8,6000E+02	3.1194E+00	8.0000E+00	2.8614E-24	4.16882-22	6,337E-22
25	8,7000E+02	3.11542+08	6,06005+80	2,90078-84	4.1000E-32	4,07196-02
20	6,/3F8E+02	3.1124L+HD	0.20005+00	2,30516-64	4,10001-22	1,/4901-02
2/	9,27702-92	3.11341480	r.8000E+08	5,10116-04	4,10001-622	4 331355-62
20	1 04005403	3.1194C+00	0,00001-00	3 24785-24	4 16000-02	5 34355-02
	1 10000-003	3 11545480	0,00001400	3,32345-04	4.14005-02	4.35365+83
11	22001+03	3.1154E+00	8.92885+88	2.92425-64	4.16285-82	1.98575-02
32	1.20886+83	3.1154E+80	P. 0000F+00	3.64416-84	4.1600E-02	5.07516-02
33	1.27886+83	3.1154E+28	P. 0000E+00	3,6469E=84	4.1600E-02	7.11602-02
34	1,20086.03	3.1154E+88	0.00000.00	3.6474E-84	4.1688E-62	8.89225-02
35	1,2460E+83	3.1194E+88	8.0000E+00	3,6468E-84	4.1600E-02	1,18955-01
36	1,30486+83	3.1194E+80	P.0000E+00	3,6449E-84	4,1600E-02	1,3854E-01
37	1,3188E+#3	3,1154E+88	0.00002-00	3,6417E-84	4.1688E-E2	1,7426E-01
38	1,3200E+03	3.1154E+00	H.8000E+00	3,6373E-24	4.16002-82	2.20355-81
39	1,3368E+03	3,1154E+80	Ø, 6660E+66	3,6317E-84	4.16##E-#2	2,8816E-81
48	1,34P0E+03	3,1154E+30	0,00006+00	3.62496-24	4.1000E-82	3.0171E-01
41	1,320001+83	3,1174L+00	0.96906+00	2.99718-04	4.10000 - 22	3, 4486+81
22	1,3/781-83	3,11241.00	0.00001000	3+7707L-24	4,1000L-82	2 70445-21
44	1 41000-03	3 11946-88	0,0000L+00	3.42805-04	4.10000-02	2.14775-01
25	1 41885483	3 11545-50	0.0000L-00	1.35465-24	4.16085-82	1.63000-0.
42	7140ber.405	0.11040400	1.000005.000	3133445464	H'TOPAC-ST	71-340F-67

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46	1.4080E+03	3.1154E+00	0.000°E+00	3,27976-04	4.1000E-02	1.23856-01
47	1,4700E+03	3.1154E+80	P.8000E.00	3.2001E-04	4.10006-02	9,21216-02
45	1.49886+83	3.1194E+00	0.0000.000	3.11576-64	4.10000-02	6.7136E-02
49	1.51005+03	3.1194E+00	0.0000.00	3.82687-84	4.16005-02	4.72545-02
	1 51045-03	1 115464.80	0 1000-00	3 93745-84	4 16975-92	3 18895-02
	1,50000-01	3.11346400		21750000-04	4110000-01	3 43476-02
51	1.5 102-03	3,11342+00	P. 000011-000	2.000015-04	4,10005-65	7 77745-47
52	1.5500E+03	3.1154E+20	5.989NE+88	2,2017L-64	4.10001-02	3./3/41-03
53	1.7000E+03	3,1174L+80	6.966SE+36	3.35856-64	4.10006-22	1.122/6-92
54	1.80PCE+03	3.1154E+20	P.0000E+20	3,4659E-24	4.100PE-22	2.41846-02
55	1,8>PCE+03	3.1194E+00	0,0000E=00	3,79476-24	4.10000-22	5.82326-22
56	1,9000E+03	3.1154E+00	0.0000[+82	3,9686E-24	4-1600E-02	5.12666-02
57	1,92PRE-03	3.1154E+00	2.2202E • 00	3,6536E-24	4.16002-02	3.5165E-02
58	1.94002+03	3.1154E+00	0.00000+30	3 32828-24	4.16006-02	2,15706+02
59	1.95005+03	3.11546+00	0.0000.00	2.49935-84	4.1500E-02	1.28485-23
4.0	2 14075+03	3.1154E+20	3 22005-02	2.9988F-24	4.16005-02	4.78565-83
	2 20005-43	7 11545400	0.00000-00	1 10445-04	4.14085-02	4.83200-03
55	2.20002.01	3.11742460		77445-74	4 16335-02	1 70000-000
<u>64</u>	2. 00000000	3.11742400	N. NCDCF+DC	31/2141-04	4,10000-02	3 34485-00
63	5 4508E-03	3.11541-00	0,000000000	4,21121-04	4,10000-02	3,01001-02
64	2,600000+03	3.1154E+00	N'8669E+96	3,48766-04	4.1000F-65	5,37226-03
65	2,52000 +03	3.1154E+00	0,06005+00	4,405BE-64	4.1000F-65	3,18756-02
66	2,6400E+63	3.1154E+00	8.0000E+00	4,3261E-04	4.10006-02	4.20205-02
67	2,6000E+03	3.1154E+00	0,00005+00	4,2482E-84	4.1600E-02	5,4745E-02
68	2,680BE+g3	3.1154E+00	0,2000E+03	4,16998-84	4,1600E-02	7,2973[+02
69	2,70986+83	3.1154E+00	2,0000E+00	4,0901E-84	4,1600E-22	9,19986-02
70	2.72P0E+23	3.1154£+00	0.00000.00	4.0118E-34	4.1600E-02	1.19936-01
71	2.74PBE+83	3.1154E+88	2.00001.00	3.9339E-84	4.1600E-22	1.56555-01
72	2.75886+83	3.11546+00	0.20025+00	3.1854F-24	4.16086-02	1.18856-01
7.5	2 77505+03	3.11546+58	A 38886.488	4.37755-24	4.16005-02	1.28215-01
74	2 84005 +03	3 11546+00	0 0000-00	3.98015-84	4.16005-02	3.54975-92
	3 84885-03	1 11845-00	a addac.aa	7 25845-24	4 16035-02	3 71307-92
7.5	2,90,80,90	3,11946400		7162646-64	4.10000-02	5 38 305-30
/9	3,0/902+03	3,115-6-00	0.00005-00	5,02/11-04	4.10000-02	5,05021-02
"	3,25002+03	3,11941+00	N. 9569E+80	5'0030F-54	4,10005-02	2+0050F+05
78	3,7902E+03	3,11946+88	8.3000E+38	3,4227E-24	4.1000E-02	2.03772-02
79	4,2908E+03	3.1194E+02	P.2000E+02	3,0270E-04	4.1000E-02	1.23796-02
80	4.75P0E+03	3.1194E+00	0.2000E+00	3.20676-04	4.1038E-02	2.43212-02
81	5,27886+83	3.11546+80	7.2808E+82	3,3550E-24	4.14002-22	1.05526-82
82	5,7580E+03	3.1154E+30	*.0202E+00	3.2062E-24	4.1602E-02	2.17326-02
83	6,2000E+03	3.1154E+00	2000E .00	3,1713E-04	4.1600E-02	2.06526-02
84	6.75PBE+83	3.1154E+00	0.0000F+02	2.8575E-04	4.1600E-V2	1.4612E-02
Å5	7.220066+03	3.1154E+50	0.00025.00	2.82635-24	4.1688E-#2	2.51555-02
66	8.25005+03	3.1154E+08	0.00000.00	3.13745-24	4.16005-02	3.6851F=02
	8.7508F+03	3.11945+00	9.00005-00	2.67915-24	4.16885-82	5.43585+82
8.8	9.23005+03	3.11546+02	2.0000.00	2.98215-24	4.1600F-02	1.23425+02
	9.5008F+03	3.1154E+98	2.03005+00	3.58145+24	4.16025-02	5.99785=03
60	0 75005.01	3 11545400	0 00000-00	3 40505-24	4.16005-07	5.80705-91
~ 5	1 02005-04	3 11845-00	. 'Deter	2 74375-04	4 14000-05	2 41285-02
	1 54045.00	3.11346400	0000E-00	21/03/1-64	4 44000 - 62	2101201-02
42	1,20005-0	3.11346482	N. 8000E+00	2.0331-04	- 1000E-K2	2103935-02
93	2,000085+84	3.1154L+80	2.000C+00	3-1587E-84	4.100CE-82	10E - 82
94	2,5000E+04	3.1154E+ØØ	P.0000E+00	3,12376-84	4.1600E-02	8,0830E=02

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INMEX CHERAVY LEVYL NULUE COUPETITIVE NULUE COUPE						à	
INNEX CECREES OF FREEDON USED 11 TVE LICH (151100 FISTI F							
INDEX EVEL SPACING COMPTINITY NUTTOR NUTTO			0.020030.0 31147.1	COMPETITIVE	1,0000E+00	940141104 2.220025-60	FISSIC
THNER CHERA-V (EV) LEVEL SPACING COMPETITIVE NEUTRON HADIATION HADIATION HADIATION HADIATION HADIATION HADIATION FISSI 1 1,2008E-822 8.7888E-882 8.7888E-882 8.7888E-882 1.7888E-82 1.8888E-82 1.7888E-82 1.8888E-82 1.7888E-82 1.8888E-82 1.8888				2 Y E F	AGE RESONANCE	HIDTHS (EV)	
1 1					10000000	1014110V	F13510
	INDEX	3.0102E+02	8.7800E+00		1,75686-23	4.16886-62	1,00000
3 3 3 4 4 1 6 1 1 6 1	NI	3,20006-02	8.78802+80	38+30898	1,75602-23	4.16886-82	1,20205
1 1	ŝ	3.40000+02	0.7800E+00	P. 2000E - 00	1,7560E-23	4.10000-22	1,00300
1 1	ه ال	3 82995+82	8.7888E-88	6.99997-999 6.99996-999	1.7560E-23	4.16000-02	1,00000
1 4.444085-822 4.70805-882 4.90805-82 <td>•</td> <td>4 04905-02</td> <td>8.7800E+00</td> <td>5+95935+99</td> <td>1.75602-23</td> <td>4.16886-82</td> <td>1.28995</td>	•	4 04905-02	8.7800E+00	5+95935+99	1.75602-23	4.16886-82	1.28995
11 4.907886-82 3.78886-88 3.78886-88 3.78886-88 3.78886-88 3.78886-88 3.78886-88 3.78886-88 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-83 4.6886-82 3.78886-88 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.6886-82 3.78886-83 4.88886-83 4.88886-83 4.6886-82 3.78886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88886-83 4.88		4.3000E+02	8.7800E+22	0.0000F-00	1.75686-83	4.16806-82	1.00000
11 4.99082-92 0.78082-98 1.75082-92 1.75082-92 12 5.84082-92 0.78082-98 1.95082-92 1.75082-92 13 5.84082-92 0.78082-98 1.95082-92 1.25082-92 14 5.84082-92 0.78082-98 1.95082-92 1.25082-92 14 5.84082-92 0.78082-98 1.95082-92 1.25082-92 15 5.59082-92 0.78082-98 1.95082-92 1.25082-92 1.25082-92 15 5.59082-92 0.78082-92 0.78082-92 1.25082-92 1.25082-92 1.25082-92 16 5.99782-92 0.78082-92 0.78082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.25082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92 1.26082-92	-00	4.92000-02	8.7880E-00	9 . 9999 E + 09	1.75686-63	4.1600E-02	1.2020E
11 1	10	4.95782+82	5.72002.00	9.8000E.00	1,7560E-03	4.16000-02	1.20300
1.1 3.5 4.64001-022 4.70001-020 1.70001-022 1.200001-022 1.20001-	12	5,01000-02	8.78202-00	0,00001-00	1,756@E-23	4-16086-02	1, 2020E
11 1	5	5,84986-82	8.78005-00	0.03005-00	1,7560E-03	4.16025-02	1,20306
117 6. JORGE-G2 6. JORGE-G2 1. JORGE-G2 1. JORGE-G2 117 6. JORGE-G2 6. JORGE-G2 1. JORGE-G2 1. JORGE-G2 1. JORGE-G2 118 7. JORGE-G2 6. JORGE-G2 1. JORGE-G2 1. JORGE-G2 1. JORGE-G2 1. JORGE-G2 119 7. JORGE-G2 6. JORGE-G2 1. JORGE-G2 1. JORGE-G2 1. JORGE-G2 1. JORGE-G2 221 8. JORGE-G2 6. JORGE-G2 1. JORGE-G2 <td>مر م هر ال</td> <td>5.55986+82</td> <td>8.7800E-00</td> <td>00+30000 20+30000</td> <td>1,75686-03</td> <td>4.15208-82</td> <td>1.00305</td>	مر م هر ال	5.55986+82	8.7800E-00	00+30000 20+30000	1,75686-03	4.15208-82	1.00305
117 0.48000-022 0.70000-022 0.70000-022 0.70000-022 129 7.29000-022 0.70000-020 0.70000-022 0.70000-022 129 7.29000-022 0.70000-020 0.70000-022 0.70000-022 129 7.79000-022 0.70000-020 0.70000-022 0.70000-022 0.70000-022 129 7.79000-022 0.70000-020 0.70000-022 0.70000-022 0.70000-022 0.70000-022 129 7.79000-022 0.70000-020 0.70000-021 0.70	11	29.3006.62	8.7800E+00	0.00000-000	1,7560E-23	4.1600E-02	1,20%E:
1 1	- 1 - 1	6.4000E+02	8.7800E+00	0.00000 000 0.00000 000	1,7568E-03	4.16000-02	1,0000E.
22 9,79986-92 0,78026-92 1,78026-92 1,78026-92 23 8,27986-92 0,78026-92 1,28036-92 1,28036-92 24 8,29986-92 0,78026-92 1,28036-93 1,25686-92 1,28036-92 25 8,78086-92 0,78026-92 1,28036-93 1,25686-92 1,28036-92 25 8,78086-92 0,78086-93 1,28086-93 1,25686-92 1,28036-92 26 8,78086-92 1,78086-93 1,28086-93 1,25686-92 1,28036 26 9,79886-92 8,78086-93 1,28086-93 1,25686-92 1,28086-92	5	7.25096+82	8.78000+00	0-3000E-03	1,7560E-03	4.1500E-02	1.3020E.
22 0.200000000000000000000000000000000000	• 69 • 10	7,750000+02	8,7820E+00	8,8839E+88	1,75602-03	4.1600E-02	1,0000E
2-3 8. 554974-82 4. 78082-80 7. 78082-80	2	8,22926+32	8.78882488	0.000000000	1,7560E-03	4.16202-22	1,0000E.
22 6. 700000-00 6. 700000-00 1.70000-00 23 6. 700000-00 6. 700000-00 1.70000-00 1.70000-00 24 6. 700000-00 6. 700000-00 1.70000-00 1.70000-00 25 6. 700000-00 6. 700000-00 1.70000-00 1.70000-00 26 6. 700000-00 6. 700000-00 1.70000-00 1.70000-00 26 1.700000-00 6. 700000-00 1.70000-00 1.70000-00 1.70000-00 27 1.70000-00 6. 700000-00 1.70000-00 1.70000-00 1.70000-00 1.70000-00 28 1.70000-00 6. 70000-00 1.70000-00 1.70000-00 1.40000-00 1.40000-00 30 1.20000-00 6. 70000-00 1.70000-00 1.70000-00 1.40000-00 1.400000-00 31 1.20000-00 6. 700000-00 1.75000-00 1.75000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 1.400000-00 <td>23</td> <td>8.5000002</td> <td>6,780E-00</td> <td>0.0000E-00</td> <td>1,75602-03</td> <td>4.160000-02</td> <td>1,20305</td>	23	8.5000002	6,780E-00	0.0000E-00	1,75602-03	4.160000-02	1,20305
22 0 2200000000000000000000000000000000000	3 N3 8 8	8,0000E-02	A. TAGGE+86	0.00007+00	1.7568E-03	4.16000-02	1,02385.
27 9,72888+82 6,78888-80 7,8888-80 1,75688-83 4,16088-82 1,26888-82 28 9,7888+82 8,78888-80 1,28888-82 4,26888-82 1,2688	3	8,7988E+02	8,78201-00	8.99996.99	1,7560E-23	4,1600E-02	1.0020E-
229 1.100000000000000000000000000000000000	27	9,23866+82	8.76882-38	0.0000E+00	1,75688-23	4.1600E-02	1.003074
31 1.2408E+03 8.7808E+08 7.6508E+03 1.258E+03 1.2608E+02	0 0 0	1.04000404	0.7000E-000	0.000000000000000000000000000000000000	1,75686-83	4.10005-22	1,36205-
31 1,22865-83 5.78065-862 7,08065-86 1,75585-23 4.10055-82 1,40055-82 32 1,22865-83 5.78065-86 7,08065-86 1,75585-23 4.10055-82 1,40025-82 33 1,22865-83 5.78065-86 7,08065-86 1,75585-23 4.10055-82 1,40025-82 34 1,22865-83 5.78065-86 7,08065-86 1,75585-23 4.10055-82 1,40026-82 35 1,22865-83 5.78085-86 8.180865-86 1,75585-23 4.10055-82 1,40026-82 36 1,3865-83 5.78085-86 8.180805-86 1,75585-23 4.10055-82 1,40026-82 37 1,31865-83 5.78085-86 8.180805-86 1,75585-23 4.10055-82 1,40026-82 38 1,34055-83 5.78085-86 8.175585-23 4.10055-82 1,40026-82 39 1,34055-83 5.78055-83 1,75585-23 4.10055-82 1,40026-82 39 1,34055-83 5.78055-83 1,75585-23 4.10055-82 1,40026-22 39 1,34055-83 <td>30</td> <td>1.10000.003</td> <td>8.7800E+00</td> <td>P 8387E+88</td> <td>1,75686-23</td> <td>4.16026-02</td> <td>1,20205</td>	30	1.10000.003	8.7800E+00	P 8387E+88	1,75686-23	4.16026-02	1,20205
3.4 1.2000-03 0.2000-02 0.2000-02 1.20	19	1.25896+83	78085-88	P. 0000E+00	1,75628-83	4.100000-02	1.00305
No. No. <td>54 55 64 N</td> <td>1.27000-00-</td> <td>0.70000-000</td> <td>889989898 899999999</td> <td>1,79686-83</td> <td>4.1600E-02</td> <td>1, 0000E-</td>	54 55 64 N	1.27000-00-	0.70000-000	889989898 899999999	1,79686-83	4.1600E-02	1, 0000E-
35 1,27868-83 8,7808-88 8,8808-80 1,26	4	1.2500E+03	8.7800E-00	60+30060 4	1,7550E-23	4.1600E-02	1.02302.
30 31 31 31 32 41 36 41 36 41 36 41 36 41 36<	19	1,29000-03			1.75606-83	4.16000-02	1.00300-
XB 1.3280E+03 0.7880E+08 7.0280E+02 1.3250E+23 1.4087E+03	5	1.318@E+03	8,7800E+00	P. 3088E+88	1,75682-23	4.1608E-02	1.30702-
39 1,33985+83 8,78886+88 8,82885+88 1,75685+83 4,16855+54 1,4885+84 48 1,34865+83 8,78886+88 8,8886+88 1,75685+83 4,16885+82 1,428285- 41 1,39865+83 8,78886+88 8,88865+88 1,75685+83 4,16885+82 1,428285- 42 1,37885+83 8,78886+88 8,88885+88 1,75685+83 4,16885+82 1,428285- 42 1,37885+83 8,78886+88 8,88885+88 1,75685+83 4,16885+82 1,428285- 42 1,37885+83 8,78886+88 8,88885+88 1,75685+83 4,16885+82 1,428285- 42 1,37885+83 8,78885+88 8,8885+88 1,75685+83 4,16885+82 1,428285- 42 1,3785+83 8,78885+88 8,8885+88 1,8885+88 1,75685+83 4,16885+82 1,428285- 42 1,3785+83 8,78885+88 8,8885+88 1,8885+88 1,75685+83 4,16885+82 1,428285- 42 1,3785+44 1,4485+4885+88 1,8885+88 1,75685+83 4,16885+84 1,4285+84 1,4485+84 1,4485+84 1,4485+84 1,4485+84 1,4485+84 1,4485+84 1,4485+84 1,4485+84	3	1.32886.83	0.75202-92	P.0203E.23	1,75686-63	4.16000-02	1.00300
41 1.3386+03 8.7886+08 8.88826+88 1.7568E+83 4.1688E+82 1.82885 42 1.33886+03 8.78886+88 8.88886+88 1.7568E+83 4.1688E+82 1.82885 42 1.37885+83 8.78886+88 8.88886+88 1.82885+88 1.7568E+83 4.16885+82	1 1 1 1 1 1	1.33885-83	0./8002.000		1,75605-63	4.16825-82	1.400001
42 1,3778E+83 8,7888E+88 8,2888E+88 1,7568E+83 4.1688E-82 1.4828E	: ;	1,35000+03	8,7800E+60	000-1000 - 00	1.7562E-03	4.1600E-02	1.20205-
	ñ	1,37P0E+03	8.78886-88	0.2209E-00	1,7562E-03	4.1600E-02	1.0000E

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44	1.4100E+03	8.7800E+90	P.2000E-00	1.75605-03	4.16806-02	1,00206-10
45	1.4380E+03	8.78886.08	0.0000-000	1.75685-83	4.1600F-02	1.08005+10
44	1 45885+83	8 7880F+00	3 38885+83	1.75445-01	4.16005-02	1.00706-13
	1 47405-43	A 7890E+00		75465-01		4 30400-40
• /	1447000400	0,/8002-00	N. BECEF+BE	1,79082-63	4.10000-65	1.00302-10
45	1.4480E+83	8.7800E+00	0.0000E+00	1,7560E-03	4.100FE-02	1,08386-18
49	1,5180E+03	8.7880E+00	0.6000E+80	1,7560E-03	4,160FE-22	1,00300-10
50	1.5388E+03	8.78886+00	0.00005.00	1.75605-03	4.1600E-P2	1.00206-13
81	1.54005+03	8.28805450	0 0000-00	1.75405-21	4.16085-07	1.20205-12
	4 85086401	8 76295+90		75405-01	44001-00	1 000000-10
25	1,55662-65	8.78882488	0.00001.00	1,79602-03	4.10000-02	1,00,001-10
22	1,70002+03	8,/600E+80	9.9000E+85	1,/560E-03	4.10201-02	1,000000010
54	1.80901+03	8.7800E+90	9.9000E+80	1,7560E-03	4.1600E-02	1.20306-10
55	1,8>00E+03	8,7809E+90	8.0000E+08	1,75602-03	4.1300E-02	1.00302-13
56	1.9000E+03	6.7808E+#0	0.00005+00	1.75688-23	4.16000-02	1.00302-10
57	1 92005+03	8.7829F+30	0 0000-+00	1.75605-83	4.16075-42	1.00305-10
	64305-01	8 78305-00		75405-07	44995-07	1 30500-10
20	1,77002-03	0.70562400	0.0000E+00	1,79000-03	4.10000-02	1.00301-13
59	1,97801+03	9.19565+88	0,000VE+00	1,7568E-#3	4.10001-22	1.00306-13
69	2,1000E+33	8,7820E+00	2,0000E+00	1.75602-23	4.1600E-02	1,00300-13
61	2,2000E+03	8.7800E+20	0,0000E+02	1.756ØE+03	4.1600E~02	1,20306-12
62	2.4¢90E+83	8.7800E+00	P.3000E+00	1.7560E-03	1.1600E~02	1.00306-10
43	2 43685+85	8.7880F+88	A 98985+98	1.75495-83	A. 1 ARRE -02	1. 30305-10
	2 49005-01	8 73895.68	1 49405.44	75405-93	4 14005 -07	4 40305-10
			0.0000000000	11/2002-03		1,000000-10
62	2,02002-03	8./800L+00	8.8000E+00	1,75686-63	4.100VL-02	1.00305-10
60	2.64PBE÷03	8,780BE+28	P,0000E+00	1,7560E-03	4.1089E-82	1.00306-10
67	2,60A0E+83	8,7800E+ØØ	0,0000E+90	1,7560E-03	4.1600E=g2	1.22306-10
68	2.680000-03	8,7800E+00	0.07396+00	1,75602-23	4.1600E-02	1.00305-10
69	2.70802+03	8.7880E+00	2.88.95+88	1.75686-83	4.1620E-02	1.00397-12
78	2.728FF+#3	5.7800F+60	0.0000488	1.75385-83	4.16885-82	1.82482-14
44	3 74885.483	A 78805+60	0 13000-000	4 75405-93	4 44085-03	40100-10
<u></u>	2,748.92400	0,70002080	0.30005-00	1,79092-03	A. TODOC-DE	1,000000-10
16	2,79882-83	0./0001-00	0.50005-00	1,/2086-03	4.10005-85	1.00006-10
73	2 7/50E+83	8.780BE+00	0,0005+99	1,756@E-03	4,1690E-02	1,00306-10
74	2.8##DE+83	8.7800E+00	₽,000E≠00	1,7560E-03	4,1600E~02	1,00306-10
75	2,9000E+03	8.7800E+80	2.00000+00	1,75606-03	4.160BE~02	1.00000-10
76	3.2750E+#3	8.7800E+40	7.0000-+00	1.75686-83	4.16086-62	1.00201+10
77	3 2508F+03	8 78005+00	0 0500-+00	1.75405-23	4.14985-02	1.40205-10
78	3 75885403	B 78895+60	3 08000-00	1 75405-03	4 16085-02	1 30205-10
	4 00000-00			1,70000-000		1,00000-10
1	20000-003	0./0001-00	0.0000E+00	1./2001-03	ALLOOPE DZ	1,00000-10
80	4,75082+03	8./800L+20	0.56565+68	1.750BL+63	4.100PE-02	1,00306-13
81	5,27808+33	8,7800E+00	6.0600€+09	1.756gE-03	4.160-E-02	1,0000E-10
82	5,75082+03	8,7800E+00	8,0020E+00	1.7568E=23	4.16001-02	1.00006-10
83	6.23P8E+03	8.7800E+80	2.00000.000	1.756@E+R3	4.16802-02	1.20305-10
84	5.7588F+83	8.7800Fe00	8.08005+80	1.75605-03	4.16885-82	1.30205-10
85	7 25646+43	A 7820F460	0 000000	1.75446-03	4.16085.02	1 40305-10
	A 30000-03	B 78005-00		75400-07	4 44095-02	1,000000-10
	0,20001003	0,/DUBL+80	r,00001000	1,75001-03	4,10000-022	1.00001-10
5/	0,/2001+03	0./CDUL+00	0.0000E+00	1,/20BE-03	4.10005-85	1,00305-12
85	9,27081+03	8,7800t+00	0,0000[+00	1,756ØE-23	4.1000E+02	1,00305-10
89	9,5000£+03	8.7500E+30	0.0000E+00	1,75602-03	4.16002-02	1.0000E-10
98	9.7500E+E3	8.7800E+80	P.0000E+00	1.75686-83	4.1600E-02	1.00300-12
•1	1.04000-04	5.780FE+00	0.3000-+00	1.75686-83	4.16000-02	1.00305-10
62	54005-04	6.7800F+00	0 0000-00	1.75405-23	4.16005-02	1.00305-10
10	3 86885.454	a 79005400	0 00001-00	1 75405-27	4 44005-02	4 40000-10
70	2,00701-04	0./000L-00	.,	11/2000-03	4.10001-22	1.00001-10
94	2.30061+84	8./8001+80	0.000PE•00	1,700ØE+03	4.10006-22	1.00306-73

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			DEGREES OF	FREEDON USED	IN THE WIDTH	UISTRIBUTION
		J-VALUE	COMPETITIVE	NEUTRON	HADIATION	FISSION
		1.00201.400	0 00000-00	2.00000+00	0.0000F+02	2.00205+00
		1,00000-00	0.000000000	2100000-00		
			AVE	RAGE RESONANC	E WIDTHS (EV)	
INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	FISSION
1	3.0100E+02	3.11546+00	0.00001+00	6.2328E-04	4,16886-62	1,00000+00
ž	3.20086+82	3,1194E+00	P.0000E+02	6 23E8E-24	4.1600E-02	1,00002+00
3	3,4008E+82	3,1194E+80	2,20001+00	6,23685-24	4.1600E-02	1,0030E+00
- 4	3.60PEE+02	3.1154E+00	0.00000+00	6,2328E-24	4.1600E-P2	1,20306+00
5	3,80996+02	3.1154E+80	0,00000.000	6,2328E-04	4.1600E-02	1,0020E+00
6	4,0490E+02	3.1194E+00	0,000000.00	6,23086-24	4.1600E-02	1.0030E+00
7	4,36886+82	3.1154E+00	P,2000E+00	6,23286-24	4,1600E-02	1.30706+00
8	4,6292E+82	3,1194E+80	P.2000E+22	6.2308E-24	4.1600E-02	1.00305+00
9	4,92#0E+02	3.1154E+00	0,00006+65	6,23086-04	4.1608E-22	1.00306+20
19	4 , 9582E+82	3,1154E+08	r.9020E=90	6.2328E-04	4.16002-02	1,40306+00
11	4,98002+02	3,11542+80	0.00002+85	6.2308E-04	4.1600E-02	1.80306+02
12	5,8198E+82	3.1154E+88	F.0000[+00	6.23C8E-24	4.1600E-32	1.20225-00
13	5,0400E+82	3.1154E+00	9.49962+98	6.2308E-04	4,1600E-22	1,20306+02
14	5,400BE+02	3.1154E+02	8.0003E+20	6.2328E-24	4,1000E-02	1,00302+00
15	5,5008+82	3,1154E+00	0.7000E+00	6.2328E-04	4.1000E-02	1.00305+86
16	5,95P8E+82	3.1154E+20	1.0530E+05	6,23C8E-24	4,1080E-22	1.0030E+00
17	8.000BE+02	3.154E-88	8.088.E+80	6.2323E-24	4,1088E-62	1.00000-00
18	6,40PBE+02	3 1194E+80	2.2000E+20	6,2328E-24	4.1000E-02	1.00205+02
19	7.2502E+82	3.1194E+00	5.8865[+85	6,2328E-24	4.1008E-22	1.00205+30
20	7.79HBE+82	11741476	P.8264E-96	6.2328E-K4	100CF-65	1.00501-00
21	5.0000E+02	3,1174E+92	P.20005+80	0.23P8L-C4	4.10006-62	1.00200-000
22	8.27001-02	3.1124.400	0,0000[+0P	0,23881-64	4.10001-02	1.05001-72
23	0.00FKE+62	3,11946400	8.86665.00	A 23200L-04	4 16225-22	1.000000000
55	8 70000-02	3 11846.00	6.000.F+00	4 33245.02	4 16325-02	1 10725-74
26	8 75005.02	3 11545 400	r,0cc01+0c	4 23745-24	4 16925-02	1.00002-00
57	6 27205+02	3 11545+00	P 0303r.30	A.23785+24	4.16895-92	1.49395+33
28	9 73995+42	3 11546+00	9 02225.30	A. 23285-24	4.16025-02	1.02285+30
50	1.24005+23	3.11346+09	3 00000.00	6.2328E-24	4.16025-02	1.38285+22
10	1.10005+03	3.11545+00	3 00000-00	A.23285-24	A. 1600E-42	1.48226+82
31	1.2582F+83	3.1154E+00	8.27285-92	6.2328F-24	4.16001-02	1.00305+00
32	1.20025+03	3.1154E+00	0.00201+02	6.2328E-84	4.1688E-02	1.000025 + 20
33	1.27006+03	3.1154E+00	0.0000.000	6.23CAE-24	4.16895-22	1.42392+22
34	1.20006+83	3.1154E+00	0.00000+00	6.2388E-24	4.16225-62	1.08-25.02
35	1.2"906.03	3.1154E+2P	2.00001+00	6,23C8E-24	4.16005-02	1.00202+20
36	1 75+03	3.1154E+00	8.8888E+80	6,23086-84	4.16882-82	1.00000 + 70
37	1 E+Ø3	3.1154E+80	7.08882.00	6,23086-84	4.16005-22	1.00306+00
38	1, ØE+Ø3	3.1154E+28	0.2288E+82	6,23:8E-24	4.1500E-62	1,00306+20
39	1,33006+83	3.1154E+00	0.0200E+02	6,23288-24	4.1600E=02	1,32306-00
40	1,34006+03	3.1154E+00	0.0000E+00	6,2308E-24	4.1600E-02	1,0000E+20
41	1,3>¢0E+03	3.1154E+00	8,00002+00	6.23C8E=24	4.1600E-02	1,00005+00
42	1,3708E+03	3.1154E+00	P.8863E+88	6.2328E-24	4,1600E-22	1.00305+00
43	1,39006+03	3.1154€+00	0.000E+00	6.23 28 E-24	4.16082-02	1.00306+00

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44	1.4108E+03	3.1154E+00	0.0000c+0P	6.23CaE-24	4,16026-22	1.4070E+78
45	1.43006+03	3,1154E+00	P.0000E+00	6.23C8E-24	4.1600E-02	1,803PE+80
46	1.45886+03	3,11546+00	8.00201-00	6.232AE+24	4.1600E-02	1.00336+00
47	1.47007+03	3.11346+00	P. 30001 - 33	A.2328E-84	4.16002-02	1.02225+20
49	1 49005 -03	3.11345+00	2 00005-00	A.2308F+84	4.16005-02	1.22.785+30
40	1 51005-03	3 11946400	3 adage + 40	A 23040-84	4 14085-02	
	53005403	7 11545.00	0.00001000	4 33746-84	4 16075-07	1 10305+30
20	1,55002-03	3.11946400	0,00005+00	0,23686-04		1,00200-00
51	1,5-001-03	3.11241+00	r,0000E.00	6,232BL-K	4.10002-02	1.00001-00
26	1,55001+03	3.11741400	0.0000E+00	0.23685-64	4.10000-02	1.0000000000
53	1.7007E+03	3.11746+00	N'86665+66	6.2378E-24	4.1000E-02	1.000000-00
54	1,8000E+03	3.1154E+ØØ	0.0000E+00	6,2308E-04	4.100PE-02	1.0030E+20
55	1,8>00E+03	3.1154E+8Ø	P,0000E+20	6.2326E-84	4.1600E-02	1.0030E+33
56	1.9000E+03	3.115•E+00	0,0600E+00	6,2328E-V4	4.1600E-02	1.0030E+00
57	1,9200E+Ø3	3,1154E+00	0,0089E+00	6,23086-24	4.1600E-02	1,00005+00
58	1,9400E+03	3.1154E+00	0.0360[•30	6,23286-04	4.1500E-02	1,8033E+80
59	1,97886+83	3.1194E+80	3.03005+80	6.2308E-24	4,15806-02	1,0000E+00
60	2.1000E+03	3.1154E+00	0.03001.02	6.2326E-24	4.1600E-02	1.00335+20
A1	2.2000E+03	3.1154E+00	0.0000.000	A.2308F-84	4.1600E-02	1.00205+20
	2 44005+03	3.1154F+00	2 0000-00	4.23245-24	4.14005-02	1.00205+00
	2 450000-03	3 11545400	0.000000000	4 23000-04	4 44005-03	1 20105-00
	2.47FEL+03	3.11946.00		0,23686-64	4,10000-02	1.000000-00
	2.0000000000	3.11946400	E'RRRRF+RR	0,23686-64	4,10000-62	1,00,000-000
62	5.0CMNE+03	3,11942-00	4.2000E+00	6.2328E-C	4.10202-02	1.00001-02
60	2.0 - PRE - 03	3,11241400	9.0000E+50	6,2328E-04	4.10001-022	1.00001.00
67	2.6002E+03	3.1194E+00	0,0000E+00	6,2308E-04	4.1000E-02	7*0030E+00
68	2,65006+03	3.1124E+89	7,0000E+02	6.2328E-24	4. <u>1</u> 600E-02	1.02306+00
69	2,7007E+03	3.1154E+00	8.0000E+00	6,2328E-24	4.1600E-02	1.0020E+73
78	2,72006+63	3.1154E+00	8.2000E+60	6.2328E-04	4,1600E-02	1.00306+00
71	2,74802+83	3.1154E+00	0.3520(**88	6.23CEE-24	4,1608E-02	1.80306+00
72	2.75000+03	3.1154E+00	2.30005+00	6.23285-24	4.1600E-02	1.00206+20
73	2.7750E+03	3.1194E+00	0.00005+00	6.23CAE-24	4.1602E-02	1.00205+20
74	2.8000F+03	3.1154E+00	2.00005-00	A.23085-24	4.1600F+02	.2039F+00
75	2.900000403	3.1104E+00	0.0000.400	A.2328F-84	4.1600F+02	2030F+42
7.6	3 3/505+03	3.1154++00	0 00000-00	A 21005-04	4.14005-02	10 205 + 22
<u></u>	1 21005+01	3 11545-00	0,00002-00	A 23085-24	4 46005-02	1 . 7305430
79	7 75025-03	3.11545+00	0,50001-00	4 37000-24	4 14025-02	1 30335-00
	3,75000-03		r . 000rt-00	0123681-64	4.10002-02	240000000000
79	4,2708E+03	3.11246-00	N 9000E+03	0.23595-64	4.10001-02	1.00305-00
86	4,7500E+03	3,1194E+00	P,0000E+00	6,23C8E-04	4,1600E-02	1,20306+00
81	2,220NE+03	3.11746+20	8.0009E+00	6,2328E-24	4.1000E-02	1.00306+30
A2	5,7500E+03	3,1134E+00	2.0000E+00	6,23C8E-04	4.1600E-02	1.0030E+03
83	6,2990E+03	3.1154E+00	P.0070E+00	8,23285-04	4.1600E-82	1,08306+90
84	6,7509E+03	3.11546+00	P.0000E+03	6,2308E-84	4.1600E-02	1,36386+80
85	7,2500E+03	3,1154E+00	9.2000E • 00	6.2308E-24	4.1600E-02	1.0020E+00
66	8.25PBE+03	3,1154E+g0	V.0000-+03	6.230AE-04	4.1600E-02	1.00205+00
87	8.75P0E+03	3.1154E+00	0.00000.00	5.23CAF-24	4.1600E-02	1.22305+80
AB	9.22025+83	3.1154E+00	0.0020-+00	A. 2308F-24	4.16905-02	. 22305+30
89	9.50000+43	3.11545+00	0.00005-00	6.2306F-P4	4.16005-02	4.46385+84
60	9.75005+03	3.11546+00	A 30000-00	4.23000-04	4.14005-02	1 00301-00
01	1 00005-04	3 11545409	0.00005-00	4 31785-24	4 44005-02	1,00001400
22	1 50095404	1 11545-00	1 0000E+00	4 27005-04	4.10002-02	1.000010000
42	2,000000404	3 11545-00		0123081-04	4.1000L-02	1.00001-03
43		3.117-1-20	0.0000E+00	0,23881-64	4.1080E-82	1.00305.00
<i>9</i> 4	2,76486+84	3,11746+80	9.6000E+05	6.23C8E-04	4.1000E-02	1.000000000

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			DEGREES CF	FREEDOM USED	IN THE WIDTH	DISTRIBUTION
		J-VALUE	COMPETITIVE	NELTRON	RADIATION	* 1551DN
		5.00005-80	BEBRF. 60	1,00000-00	6.00000-00	3,000002-00
			AVE	AGE RESONANCE	WIDTHS (EV)	
INDEX	ENERGY (EV)	LEVEL SPACING	COMPETITIVE	NEUTRON	RADIATION	FISSION
1	3.0100E • 02	2.11012+00	P. 2500E+02	4.2363E-04	4,1600E-02	1,000000-00
ž	3,20P8E+82	2.1181E+02	0,00005+00	4,2363E-24	4,16002-02	1,30325+20
3	3,4000E•02	2.1181E+30	0,0000E+00	4,2363E-04	4.1600E-02	1,30365+38
4	3.600#E+02	2.11016+00	P,0000E+00	4,2183E-04	4.1600E-02	1,36362+38
5	3,80000+02	2.1181E+#2	0,3000E+00	4,2363E-04	4.1600E-02	. «238E•38
6	4,8409E+82	2.1181E+00	P.8288E+38	4,2363E-84	4.1000E-02	1 00205+00
7	4,500000402	2,11016-22	E.8062E+08	4,2363E-24	4.10001-02	1.00.00.00
8	4,60001-02	2.1101E+00	6.9000E-00	4.23631-24	4.10002-02	1.06002.00
	4,92002-02	2,11016+00	5.0000E+00	4,23031-04	4.10002-02	1.00000-00
19	4,99001+02	2.11011+00	2.50005+00	4 27475-84	4.10002-02	1,05,001,00
11	8 9100E+02	2.11010-00	0.00001400	4 23475-24	4 16025-02	1.30385+30
14	5 34035-02	2.1101-00	0,00001000	4.23635-24	4.1628F+92	1.42225+20
	5.46005+02	2.11815+00	0.00005.00	4.2367-24	4.1602F-02	1.40325+02
13	5.5200F+02	2.11816+00	2.00005-00	4.236XF-84	4.1680E •02	1.00000:+00
16	5.9500E+02	2.11815+00	0.0000.00	4.2363E-24	4.1600E-02	1.000000+00
17	6.000786+02	2.1181E+22	8.0000F+00	4.2363E+24	4.1600E-02	1,88225+28
18	6.4000E+02	2.1181E+00	7.2000E+22	4,2363E+24	4.1600E-02	1.20101+02
19	7.2>000.002	2,11816+00	2.203PE+00	4,2363E-24	4,1500E-82	1,30201+00
20	7,7500E+02	2.1101E+00	0,000000+00	4,2363E-84	4,160000-02	1,00705+20
21	8,800020.02	2,1181E+38	8,8738E+88	4,23632-24	4.16082-22	1,40281+20
22	8,2700E+02	2.1181E+00	P.0068E+00	4,2363E-24	4.16000-02	1.48236+88
73	8.500BE+Ø2	2.1101E+20	P,0000E+00	4,23632-24	4.1600E-02	1,00205+00
24	3,600BE+82	2.1181E+00	0,3000E+00	4,2363E-24	4.1588E-82	1.00305+30
25	8,70pmE+02	2.11815+00	P.20202+02	4,2363E-24	4.1600E-02	1,00305+00
20	8,79008-22	2.1181E+02	0.000E+00	4,2363E-E4	4.10346+42	1.00305+02
27	9,27001-02	2,11416+88	N.500KE+06	4,23031-04	4 10606-22	1.00001-00
20	9,/JUNE+02	2,11011+20	0.0CC0E+0C	4 23475-24	14005-02	1,20000,000
79	1,04062403	2.1101-000	2.0000E+0r	4 23475-24	4.10000-02	1.20702.00
30	1.25005+03	2.11815+00	A . AAAAT + 3A	4.23635-24	4.160000-02	1.00325+32
32	1.2020E+03	2.11816+00	8.00225+40	4.23635-84	4.1600E-02	1.42286+30
33	1.270@E+03	2.115:E+00	9.20005+00	4.2363E-04	4.1600E-02	1.28386+78
34	1.20006+03	2.11B1E+00	0.2020F+00	4.2363E-24	4.1622E-02	1,62325+38
35	1.24006+23	2.1181E+00	P.0220E+00	4.23635-64	4.1680E-22	1.00306+00
36	1.30PRE+83	2.1181E+20	8.2282E+89	4,2363E-84	4,16852-92	1.22325+72
37	1,3100E+03	2.181E+22	P,2322E+92	4,2363E-84	4.16000-02	1.40385+20
38	1,3200E+03	2.11816+20	2,2000E+00	4,2363E-04	4.1622E-62	1.00385+03
39	1,3300E+03	2.1181E+#2	0,2007E+30	4,2363E-04	.1600E-22	1.40725+20
40	1,34986+03	2.11815+28	P,820PE+02	4,23635-04	4.1000E-02	1.06.25.022
41	1,37026+03	2.1181E+02	0.0202E+00	4.23632-24	4.1000E-02	1.62325438
42	1,5/0022+03	2.11811+20	N. 200KE+02	4,2303E-K4	4.10606-02	1,000001000
4.3	1'2ANBE+02	2.11011.000	R. RORNE+RB	+,2303E-F+	4.10005-02	1.000.005.008

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44	1.41006+83	2.1181E+00	0.00005+00	4.23636-24	4.1600E-02	1.00306+00
45	1.43006+03	2.11616+00	0.20005+20	4.23635-84	4.1600E-P2	1.00306+00
45	1.42005+03	2.1101E+00	0.00000+00	4.23635-84	A.1600E-02	1.00300.00
47	47025+03	2.1181E+80	9.0000-00	4.23635-04	4.1688E-62	1.00305+00
A.H.	1 44025+03	2.7181F+52	0.0000-000	4.23435-64	4.1600F-42	1.00305+33
40	51005+03	2 1181F+00	0 00000-000	A 23435-RA	4.16005-02	4.20705+00
50	1 51005+03	2 11815-00	a aggag_+ag	4 23435-04	4.16005-02	1.40335+00
	1 54005+03	2 118-5-00	3 20005+00	4.23435-84	4.16085-02	1.68205+88
51	1 55005+03	2.11815+00	0.00000-00	4.23435-24	4.16885-02	1.00305+00
61	1 70005-03	2 11816-00	a adoar+aa	4.23435-24	4.16875-02	1.20305+00
	1,00000-00	2 11815-00	D 000001-00	4 33432-04	4 16005-02	1 30336+00
22	1.000002-003	2,11010-000	C.0000E-00	4 23435-04	4.46000-02	1.40325+00
	1.03002.000	2 11815-00	0.00005+00	4 23435-04	4 160005-02	1 40306-00
20	1,70702703	2.11010400	0.00005-00	4 23435-04	4 16000-02	1.00300-00
24	1.92702-00	2.11815.00	0,00001+00	4 37475-84	4 16005-02	1 2010000000
20	1,94062403	2.11010-00	r,8000E400	4 27475-04	4.10000-00	4 30335400
27	1,99406403	2.11010-00	0.0000E+00	4 38485-04	4.16085-02	1 40305+00
00	2.10786-03	2.11016-00	0.0000E-00	4 22435-04	4.10000-02	1.00700-00
e1	5.500.00-03	2.11010-00	N, 0000E+00	4,23031-14	4,10000-02	1.000000-00
12	2.40005-03	2.11010-00	r,0000E+00	4123031-64	4,10002-62	1,40,300,400
63	2,43081+83	2.11012-00	8.5000E+00	4,23031-44	4.10002-02	1,00001-00
	2,00001-03	2.11016-00	1.5000E+00	4,23031-04	4.10000-02	1.00300-00
62	5'05NGF+D9	2,11010-00	4.00005.00	4,23032-04	4.10000-02	1.000000-900
60	5.0+M3F+M3	2,11,11,00	N.0000E-02	- 2303E-04	4.10000-02	1.00301-00
67	5.004.95.003	2.11010+00	0.00005+05	4,230JL-04	4.10002-22	1.00/05-00
00	2,00002-03	2.11012-00	0.00006-00	4.23031-04	4,10000-02	1.05301.00
67	2.70002+03	2.11016-00	N.0000E+00	4,23031-64	4,10000-02	1.00002-00
70	2.72001-93	2.11011-00	N. 0000E+00	4,23631-04	4.1000L-62	1.000000-000
71	2,74935403	2.1101.+00	0.0000E+00	4,2303E-04	4.10000-02	1.00001+20
72	2,75021+05	2.11016.00	N.0000E+00	4,23031-64	4.1000E-KZ	1.000000-000
73	2.77502+03	2.11011.00	N.0002E+00	4.23031-64	4.10006-02	1.00000-20
74	5.80081-83	2.11012+00	P. 0000E+00	4.23036-04	4.10001-02	1.000000000
75	5.40NBF-83	2.11016-00	0,00005+00	4,23031-64	4,10001-02	1.000065+00
20	3.0/201+03	2.11012-00	N, 0000E+00	4,2303E-64	4.10001-62	1.00306-00
77	3,20000-03	2.11016+80	N,0000E+00	4,2303L-54	4.10001-02	1,00305-00
78	3,72002-03	2.11010-00	0,00000000	4,2303L-E4	4.10001-02	1.00001-00
79	4.22MBE+03	2.11016-00	0.000000000	4,23031-04	4.10000-02	1.000000-000
80	4.7500E+03	2,1161E+00	0.0000E+00	4,23032-04	4,10901-02	1.00001-00
81	2.52MBE+02	2.11016+00	0,90005+00	4,2303E-64	4.10071-02	1.00005-00
82	5.7900E+03	2.11016+00	N.2000E+00	4,2363E-84	4.10005-02	1,0030E+00
83	6.22006+03	2.11011+00	0,00005+00	4.2303E-04	4,10001-02	1.00305-00
84	6,7500E+03	2.1101E+00	N.2000E-00	4,2363E-04	4.10006-02	1.00302+00
85	7.25081+03	2.11012+00	0.0000E+02	4,2303E-24	4.1060E-02	1.00306.00
86	8,27085+83	2.11-11-02	0.0000E+00	4,2303E-04	4.1000E-02	1.0002E+00
87	8.7900E+03	2,1101E+00	0.00005+00	4.2363E-84	4.1000E-02	1.0000E+00
88	A 5200E+02	2,11011480	N,0000E+00	4,2303C-04	4.1000E-02	1,0000000000
89	9,5000E+03	2.11011+00	0.00305+00	4,2363E-84	4.10005-02	1.00305+00
98	9,700E+@3	2.11716+00	0,0000[+00	4,2363E-24	4.1000E-02	1,00306+03
91	1,00086+04	2.11011+90	0,0000E+00	4,2363E-B4	4.1000E-02	1,000000+00
92	1,50H0E+04	2.1101E+00	0,0000E+00	4,23632-04	4.10006-02	1.0020E+00
93	2,0008E+04	2.1101E+00	0,0307E+09	4,2363E-04	4.1600E-02	1,00206+00
94	2.5000E+04	2,1181E+00	0.0000E+00	4,2363E-64	4.16002-92	1,00306+00

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REACTION & VALUE	1,98605+08	EV			
INTERPOLATION LA Range de 1 tc 470 y	H BETHEEN ENEK Scription Linear in X	961ES			
NEUTRON CROSS BE Index, Energy Ev	CTIONC CROSS SECTION BARNS	V ENERGY CROSS SECTION EV BARNS	ENERGY CHOSS SECTION Every Choss Section Every	EVERGY CROSS SECTION EV CROSS SECTION	ENERGY CROSS SECTION
1 1,00005-0 6 2,00005-0	5 3,6588E+04 3 2,5886E+23	5.0000E-05 1.6365E+04 3.0000E-03 2.1144E+03	1.0000E-04 1.1574E+04 4.0002E-03 1.6316E+03	5.0000E-34 5.1744E-03 5.0000E-03 1.6391F-03	1,8000E=03 3,6620E+23 A.8888F=01 - 2098E+23
11 7.0000E+0 16 1.2000E-0	3 1,3666E+03 2 1,0625E+03	8.0300tc03 1,2976t+03 1.3000r+02 1.02+5f+03	9.0000E-03 1.2243E+03 1.4000F-02 9.8410F+92	1.8000E-02 1.1623E+03	
21 1,7884E-0	2 8.0615E+02	1.0566-62 8.71736-62	1,90005-02 8,49365-92	2.0700E-22 8.2875E+02	1,000E-02 9.2294E+02 2.1008E-02 8.0972E+02
	2 6.8653E+02	Z.2500E-02 6.6079E-02	2,5000E-02 /.0029E+02 3,5000E-02 6.4158E+02	2.5383E-92 7.4178E+82 3.7588E-82 6.2217F+82	2.7500E+02 7.1412E+02 4.0030E403 4 0440E403
36 4,258965-8 41 5,58846-8	2 5,9050E+02 2 5,3329E+02	4,50002-02 5,75182+02 5.75005-02 5,24415+02	4,7500E-02 5,6394E+02 6.0000c-02 5,1494E+02	5.0°03E-02 5.5270E+02	
46 6,75846-8	2 4 99585472	7.00001-02 4.95691+02	7.25095-02 4.90385+32	7.5007E-02 4.8731E-02	0.700EL-02 9.8371E+52 7.750EL-02 4.8323E+02
50 9.2586E-0	2 4.71995+02	0.23662482 4.77242482 9.58685-82 4.78972482	8.5000E-02 4.7506£402 9.7500E-02 4.7097£402	8,7500E-02 4,7403E+02 1.0000F-01 4.7097F+02	9,000055-02 4,71995402 4 35005-04 4 70075402
61 1,1000E-0 A6 1.35EBF_6	1 4.7897E+02 1 4.364465+03	1.1500E-01 4.7301E+02 • • • • • • • • • • • • • • • • • • •	1.20025-01 4.76125402	1.25036-01 4.83236+02	1.32005-01 4.91405+22
71 1.64865-0	1 5.73136+02	1.6500E=01 5.9561E+02	1,73005-01 5.23175+02 1,73005-01 6.22175+02	1.75006-01 5.3737E+02 1.7500E-01 6.5364E+02	1.5500E-21 5.5270E402 1.8633E-01 4.8440F402
70 1.05995-0 A1 2.20565-0	1 7.24335482 1 1.14835483	1.90005-01 7.6826502 3.300044 4 7.555667	1.9502E-01 6.1321E+02	2,32006-01 3.73496+02	2.1007E-01 9.9098E+32
R6 2,70346-0	1 2.62256+03	2.666865-01 2.93415-03	2,90005-01 1,399/2-03 2,90005-01 3,09865-03	2.2000E-01 1.9012E-03 J.0000E-01 3.1037E-03	2.66681-81 2.27625+83 3.18895-01 2.94975+93
91 J. 20005-0 96 J.70005-0	1 2.61435+03 1 1.84105+03	J.2000E-01 2.2067E+03 J.2000E-01 2.2.2067E+03	3.1000E-01 1.81132+03 3.00005-01 7.41745-03	3.5200E-014997E-03	3.68026-01 1.23216-23
101 4.2000E-0	1 4.6893E+02	4.3000E-01 4.1172E+02	4.4002E-01 3.6165E-02	4.5303E=01 3.2079E+02	4.1000E-01 5.4759E+02 4.6600E-01 7.5816F+02
111 5,20005-7	1 2.02302+02 1 1.7266E+02	4.8000E+01 2,4213E+02 5.3000E+01 1.6030E+02	4,9000E-01 2,2271E+02 5.406ec-21 1.5+34c+43	5.0000E-01 2.0535E-02 5 53385-04 1 10045402	5.1200E+01 1.0309E+02
116 5,7084E-B	1 1 25666 82	5.80006-01 1.19536+82	5.9080E-01 1.1340E+02	6.2000E-01 1.0025E-02	0.1000E-01 1.0104E-02
126 6.7996E-8	1 7.86655+81	0.30006-01 9.17426+01 6.86006-01 7.54086+01	0.40805+01 8.83712+01 6.92665-01 7.36465401	6.500JE-01 5.448BE-01 7 000JE-04 7.0404E-02	6.6000E-01 8.1219E-01
131 7.20865-9 136 7.70865-0	1 6.6618E.01	7.3000E-01 6.4362E+01	7,4000E+01 6,2626E+01	7.53005-31 6.39915-01	7.4000E-01 5.9356E+01
141 8.2000E-0	1 5.12865+01	8.3000E=01 5.0366E+01	9.4000E-01 4.9549F+01	8.52035-01 3.42455-01 8.52035-01 4.51195-01	8.10005-01 5.28185-01 8.88085-01 4.77815-01
146 8.79985-9 191 9.26645-6	1 4.64846471 1 4.1784.421	8.8000E-01 4.5462E+01 0.18005-01 4 11425-01	5,98805-01 4,44415+01 0 43045-01 4 44415+01	9.0000E-01 4.3419E-01	9,1000E+01 4.2908E+01
136 9.7666E-0	1 3.9617E+01	9.4000E=01 3.7902E+01	9.92025-01 3.7107E+21	Υ.>000E+01 3.9843E+01 1.0000E+00 3.6472E+01	9.6000E-01 3.5924E-01 1.6860E-07 1.94A0F+01
161 C.BUBWE+0 166 1.2127E+0	0 1.1840E+01 1 3.5755E+02	4,000000-000 B.140000-000 1.42501-01 4.74701-000	3.98885+88 6.31885+88 1.51255+81 4.10275+84	6.4500E+00 4.7500E+00	9.00005+03+2.36135+00
171 2.66646+8	1 7.4645E-01	2.22506+81 2.34346-01	2,45035+01 6,87012-51	2.7250E+01 1.1664E+00	1.5700E*01 3.4995E*00 3.8888E*01-3.8201E*81
161 J. 9000E-0	1-3.6482E=01	4,1250E+01-1,7450E+00	6.000055+01-1.54647402 4.33005+21-1.546474000		3.8588E+01=3.5088E+01 4.447851484.4
196 5.81985.6	1-5,1925E+00 1-4.3115F-01	5,1500E+01-3,7067E+00 4 14004-01 - 3,7067E+00	5.30002+01-4,55252+00	5.45306+01+1.62256+01	5.800EE+01 3.7723E+08
196 6. 88B6E - 6	1 4.00505+00	0.0000E+01 3.5000E+00	0.439025401-0,40325400 7,10005-01 1,50435+00	0.0000E+01 2.3000E+00 7.5000F+01 3.2731F+00	6.70001+01 1.5000[+01 7 88885484
201 8.57505+0 206 1.00005+0	1 2.17356-00	9.2500E-01 1.4467E-00	9,72596+01 3,26666-01	1.02005+02-3.25455-01	1.855FE+02 1.1095E+00
211 1,2080E+0	2 8.21105-01	1.2250E+02 2.6155E+00	1.11665°6647/,18495°81 1.31755+82-2.83495+86	1.14755+02-2,14515+60 1.41005-03-4.43005-03	1.1750E+02 6.7379E+00 - 442EE+E22 - 2122-20
216 1.5150E+0	2 1.5696E+88	1.56756+82 3.37556+88	1.6200E+02 1.5292E+90	1.67755+02 2.19465+02	1,7350E+02 5.6725E+01
276 1,8954E+B	2-7.4685Ea01	1,73006+02 3,5241E-01 1.91085+02-6,97475-01	1.7775E+02-4,7563E+01 1.9254F+02-1,5489F+00	1.8057E+82 1.8867E+80 1 9728F+83-4 0378F+88	1,8508E+02 1,8631E+01
231 2.6554E=0	2-3.10055-00	2.0950E+62-7.7764E-61	2,1225E+02-7,464BE-01	2.15076+02 2.42856+38	2.813FE+82 9.6922E+80 2.1535E+8242.5972E+81
241 2,39256+B	2 2.42345,82	2,27686+82+1,2796E+88 2.4108E+82 1,7778F+88	2,33506+02 6,53806-01 2.43746+02+5,24206-01	2.3550E=02 4.2704E+00 2 4E=01402 4.2704E+00	2.37566+82 2.12986+88
				11111111111111111111111111111111111111	2,49352*02-5,6114E-02

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3.3 2.43976 exp 3.43976 exp 3.43946 exp 3.43946 exp 3.43946 exp 3.43946 exp 3.43946 exp 4.42946 e



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230 Pu(n,f)

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58	CRC	Bigham	Sacond Peaceful Uses of At. En. Conf. Geneva Vol <u>16</u> , 125 (1958)
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58	HAN	Seppi, et al.	KW 55879, 3 (1958)
57	LAS	Smith, et al.	Bull. Am. Phys. Soc. <u>2</u> , 196 (1957)
57	LAS	Henkel	LA-2114 (1957)
57	HAN	Leonard, et al.	HW-48893, 98 (1957)

REFERENCES FOR EXPERIMENTAL DATA

²³⁹Pu(n,f) cont'd

<u>Yr.</u>	Lab	Author	References
57	HAR	Allen, et al.	Proc. Phys. Soc./A <u>70</u> , 573 (1957)
56	ANL	Coté, et al.	Bull. Am. Phys. Soc. <u>1</u> , 187 (1956)
56	HAN	Leonard	Priv. Comm. (1956)
56	HAR	Richmond, et al.	J. Nuc.En. <u>2</u> , 177 (1956)
56	SAC	Netter, et al.	J. Phys. Rad. <u>17</u> , 565 (1956)
56	HAR	Uttley	AERE NP/R-1996 (1956)
55	SAC	Auslair	Int. Peaceful Uses of At. En. Conf. Geneva Vol <u>IV</u> , 235 (1955)
55	CCP	Adamchuk	Int. Peaceful Uses of At. En. Conf. Geneva Vol <u>IV</u> , 216 (1955)
51	CRC	Tunnicliffe	CRGP-458 (1951)
50	LAS	Nyer	LAMS-938 (1950)

APPENDIX I

Derived Parameters Compared With Integral Measurements

	Resonance Integral (barns)		U ²³⁵ Fission Spectrum Average	
Isotope/Reaction	Dosimetry File	BNL-325*	Dosimetry File (T=1.32) (mb)	FABRY** (mb)
⁶ Li(n,total He)	425.87		486.0	
¹⁰ B(n,total He)	1722.17	1722 ± 5	512.3	
²³ Na(n, y)	0.346	0.311 ± 0.010	0.291	
²⁷ A1(n,p)			4.222	4.0 ± 0.4
²⁷ Al(n,a)			0.801	0.73 ± 0.02
$32_{S(n,n)}$			63.87	69 + 2
45 _{Sc(n,γ)}	11.29	11.3 ± 1.0	5.879	07 - 2
⁴⁶ Ti(n,p)			10.24	12 ± 0.3
⁴⁷ Ti(n,p)			21.40	20.0 ± 2.0
⁴⁸ Ti(n,p)			0.194	0.32 ± 0.02
⁵⁵ Mn(n,2n)			0.367	0.25 ± 0.01
⁵⁴ Fe(n,p)			77.67	82.5 ± 2.0
⁵⁶ Fe(n,p)			1.145	1.07 ± 0.06
58 Fe(n,y)	1.58	1.19 ± 0.07	1.695	
⁵⁹ Co(n.2n)			0.262	
59 _{Co(n, y)}	76.67	75.5 ± 1.5	6,433	
⁵⁹ Co(n,a)			0.168	0.156 ± 0.006

*S.F. Mughabghat and D.I. Garber, Neutron Cross S ions, Vol. 1. Resonance Parameters, BNL-325, Brookhaven National Laboratory (1973).

**A. Fabry, "Evaluation of Microscopic Integral Cross Sections Averaged in a 235U Thermal Fission Neutron Spectrum (for 29 Nuclear Reaction Relevant to Neutron Dosimetry and Fast Reactor Technology)," BLG-465, Centre d'Erude de l'Energie Nucleaire (1972).

⁺All cross sections in this column have been normalized to U^{235} (n,f) = 1250 (chosen by A. Fabry. See reference above.)

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APPENDIX I (continued)

Derived Parameters Compared With Integral Measurements

	Resonance Integral (barns)		U ²³⁵ Fission Spectrum Average	
Isotope/Reaction	Dosimetry File		Dosimetry File (T=1.32) (mb)	FABRY** (mb)
⁵⁸ Ni (n, 2n)			4.9×10^{-3}	
58 _{N1(n,p)}			101.5	113 ± 3
⁶⁰ Ni(n,p)			2,658	
63 Cu(n,ÿ)	5.55	4.9 ± 0.4	11.01	10.1 ± 1.5
⁶³ Cu(n,α)			0.396	0.50 ± 0.05
⁶⁵ Cu(n,2n)			0.464	
¹¹⁵ In(n,n')	*		166.8	188 ± 4
¹¹⁵ In(n,γ)	3242.74	3300 ± 100	136.6	146 ± 5
¹²⁷ I(n,2n)			1.368	109 ± 0.05
197 _{Au(n, Y})	1564.70	1560 ± 40	84.92	88 ± 5
²³² Th(n,f)			69.01	83.0 ± 3.5
$232_{Th(n,\gamma)}$	85.58	85 ± 3	103.8	
235 _{U(n,f)}	282.00	275 ± 5	1243.2	1250+
238 _{U(n,f)}			295.4	328 ± 10
238 U(n,y)	277.53	275 ± 5	75.60	
²³⁷ Np(n,f)			1322.8	1370 ± 75
239 _{Pu(n,f)}	303.90	301 ± 10	1782.4	1859 ± 60

*S.F. Mughabghab and D.I. Garber, Neutron Cross Sections, Vol. 1. Resonance Parameters, BNL-325, Brookiaven National Laboratory (1973).

**A. Fabry, "Evaluation of Millscopic Integral Gross Sections Averaged in a 235U Thermal Fission Neutron Spectrum (for 29 Nuclear Reaction Relevant to Neutron Dosimetry and Fast Reactor Technology)," BLG-465, Centre d'Etude de l'Energie Nucleaire (1972).

+All cross sections in this column have been normalized to U^{235} (n,f) = 1250 (chosen by A. Fabry. See reference above.)

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APPENDIX 1 (continued)

Derived Parameters Compared With Integral Measurements

	Resonance Integral (barns)		U ²³⁵ Fission Spectrum Average	
Isotope/Reaction	Dosimetry File	BNL-325*	Dosimetry File (T=1.32) (mb)	FABRY** (mb)
58 _{N1(n,2n)}			4.9×10^{-3}	
58 _{N1(n,p)}			101.5	113 ± 3
60 _{Ni(n,p)}			2.658	
⁶³ Cu(π,γ)	5.55	4.9 ± 0.4	11.01	10.1 2 1.5
⁶³ Cu(n,a)			0.396	0.50 ± 0.05
⁶⁵ Cu(n,2n)			0.464	
¹¹⁵ In(n,n')			166.8	188 ± 4
115 _{In(K,Y})	3242.74	3300 ± 100	136.6	146 ± 5
¹²⁷ I(n,2n)			1.368	109 ± 0.05
197 Au(n,y)	1564.70	1560 ± 40	84.92	88 ± 5
232 _{Th(n,f)}			69.01	83.0 ± 3.5
$232_{Th(n,\gamma)}$	85.58	85 ± 3	103.8	
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**A. Fabry, "Evaluation of Microscopic Integral Cross Sections Averaged in a 235U Thermal Fission Neutron Spectrum (for 29 Nuclear Reaction Relevant to Neutron Dosimetry and Fast Reactor Technology)," BLG-465, Centre d'Etude de l'Energie Nucleaire (1972).

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