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MEASUREMENT OF THE NEUTRON FISSION AND CAPTURE CROSS SECTIONS FOR ^{233}U IN THE ENERGY REGION 0.4 TO 1000 eV*

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ABSTRACT

The neutron capture cross section and fission cross section for ^{233}U have been measured simultaneously in the neutron energy range from 0.4 to 1000 eV. The data are presented in graphical, tabular, and integral form. Comparisons with previously published data, using similar and different methods, are given.

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INTRODUCTION

The neutron fission and capture cross sections of ^{233}U are of paramount importance in the design of breeder reactors utilizing the thorium- ^{233}U cycle. Since the breeding ratio in such reactors is not large (~ 1.07),¹ it is of great economic importance to know the fraction of the neutrons produced by fission which are lost to capture in ^{233}U . Cross sections as a function of neutron energy are important because different reactor designs may have appreciably different neutron energy distributions.

The important feature of the present experiment is that capture and fission cross sections are measured simultaneously in the same neutron flux with the same detector, and thus have the same neutron energy resolution. Previous measurements in the same neutron energy region for ^{233}U consist of total and fission cross sections, as well as η . They did not, however, yield a consistent set of cross sections to the accuracy desired by reactor designers.² The present data, in conjunction with other measurements, yield a more accurate set of cross sections for ^{233}U in the neutron energy range 0.4 to 1000 eV even though the desired accuracy is not attained in the capture cross section.

EXPERIMENTAL PROCEDURE

The techniques used for this experiment were essentially the same as those reported³ for measurements with ^{235}U . The major differences were in the design of the fission chamber and associated electronics,⁴ the method of monitoring the neutron flux, and the data-acquisition equipment.⁵

The linear accelerator⁶ at Remnselaer Polytechnic Institute was used as a neutron source. For the measurements reported the linac was operated

with a 0.25- μ sec burst of electrons with a peak current of approximately 1.6 A and a repetition rate of 240 pulses/sec. The neutron moderator was a 1-in.-thick, 6-in.-diam polyethylene disk. The electron target was offset with respect to the neutron moderator and drift tube so that the neutron collimators prevented direct line of sight from the detectors to the electron target. The neutron beam was collimated to a 2.5-in. diameter by a series of B_4C collimators stationed along the neutron drift tube.

Neutron beam filters, such as Cd, Co, Na, and ^{238}U , could be remotely inserted across the neutron beam path at approximately midway of the neutron drift tube. Cadmium was used throughout this experiment to cut off neutrons below about 0.4 eV. The absence of neutrons below 0.4 eV allowed a higher neutron burst rate than could otherwise have been used and also allowed the constant background of the detectors to be measured in a time region in which there was no neutron flux. The cobalt and sodium filters also remained in the neutron beam path and absorbed or scattered all neutrons that corresponded to their resonance energies of ~ 130 and ~ 2850 eV respectively. These filters allowed background measurements during the neutron time-of-flight interval without perturbing the flux too severely. The ^{238}U filter, with its several black resonances below 100 eV, allowed further background measurements on alternate "runs." These background measurements during the time-of-flight interval were necessary to determine neutron-associated backgrounds.

A large liquid scintillator tank⁷ was used to detect both capture and fission events occurring in a fission chamber containing 1 g of ^{233}U , which was located in the center of the tank. The scintillator tank detected capture and fission events via the associated prompt gamma rays. The scintillator tank and fission chamber, shown in Fig. 1, were located in the

Fig. 1. Liquid Scintillator Tank and Fission Chamber.

25-meter flight station. Coincidence events between the tank and fission chamber were fission events with very low background. Anticoincidence events yielded capture events plus background plus those fission events which were undetected by the fission chamber.

The neutron beam traversed the tank through a 7-in.-diam cylindrical tube and impinged on the fission chamber. The tube was lined with a 2-cm-thick ^6LiH liner to reduce the number of neutrons scattered into the liquid scintillator as well as minimize the effect of slow neutrons returning to the fission chamber from the liquid scintillator.

The fission chamber,⁴ detailed in Fig. 2, consisted of 21 plates of 0.005-in. aluminum coated on both sides with 0.5 mg/cm^2 of ^{233}U to a diameter of 3 in. The two end plates were coated on only one side. The plates were flashed with zinc ($\sim 0.4 \text{ mg/cm}^2$) to facilitate electroplating the ^{233}U , and were spaced so that the active thickness of the fission chamber was 1.25 in. Every other plate was electrically isolated and had a separate connector. Because of the high alpha decay rate of the ^{233}U , ten amplifiers were used with the fission chamber. The fast amplifiers, which are discussed elsewhere,⁴ were modifications of the fast current amplifier designed by Rush et al.⁵

The relative flux through the fission chamber was measured by a parallel-plate BF_3 chamber, which was placed 1 meter in front of the scintillation tank so that all neutrons traversed the BF_3 chamber before traversing the scintillation tank and the fission chamber. The BF_3 chamber was 1.25 in. in total thickness and 5 in. in outer diameter and was filled with 1 atm of BF_3 enriched to 96% in ^{10}B . The time jitter of the BF_3 chamber was measured to be approximately 100 nsec, and the efficiency of

Fig. 2. ^{233}U Fission Chamber.

the chamber for detecting a $^{10}\text{B}(n,\alpha)$ event was approximately 75% for the 3.0-in.-diam incident neutron beam.

A schematic diagram of the electronic system is shown in Fig. 3. A major part of the complexity in this experiment results from recording all correlated data simultaneously. As a result, a large part of the possible errors due to electronic drifts and changing beam conditions was cancelled.

INTERPRETATION OF DATA

The time-of-flight spectrum of fission events presented few problems in interpretation. The background due to the alpha pile-up rate of ~ 3000 counts/sec in the fission chamber was negligible because of the coincidence between the fission chamber and the scintillator tank. Another background, probably due to neutrons that were appreciably off energy with respect to their time of flight because of collisions with collimators and structural materials, was only approximately 1%. This background was subtracted by an interpolation between the background measurements provided by the Cd, Co, Na, and ^{238}U filters.

The time-of-flight spectrum from the neutron monitor (BF_3 chamber) had a constant background of $\sim 0.3\%$ due to electronic noise and a time-dependent background of $\sim 0.2\%$ due to off-energy neutrons. The constant background was derived from the time region where the cadmium filter had stopped all neutrons, and the time-dependent background was derived from the background measurements provided by the ^{238}U , Co, and Na filters. A correction was applied to the data to account for the neutrons absorbed by the neutron monitor. This correction was 4% at 1 eV and had a $1/v$ energy dependence. The energy dependence of the neutron flux derived from the neutron monitor

was $E^{-0.97}$ exclusive of neutron filter effects. Figure 4 shows the typical absolute flux per microsecond multiplied by $E^{\frac{1}{2}}$ vs neutron energy.

Interpretation of the time-of-flight spectrum of the anticoincidence events presented many more problems than that of the fission events or the neutron monitor events because of the poorer signal-to-background ratio. Figure 5 shows the anticoincidence count rate vs neutron energy, which has been corrected only to correspond to constant time channels. The data shown in Fig. 5 were taken with Cd, ^{238}U , and Co filters in the neutron beam. The ^{238}U filter was used in alternate runs. The fission chamber used to obtain the time-dependent background shown in Fig. 5 was identical to the chamber normally used except that it contained no ^{233}U .

The total constant background was derived from the count rate below the cadmium cutoff and was simply subtracted from the data. This background consisted of the ambient background of the scintillator with the accelerator off plus the background due to the ^{233}U sample plus a neutron-associated background, which was due to activation of materials surrounding the scintillator tank and long-lived fission products from the ^{233}U sample.

The time-dependent backgrounds at the ^{238}U resonance energies and at the cobalt resonance were determined by these black filters. The anticoincidence backgrounds at other neutron energies were determined with the time-of-flight spectrum taken with a fission chamber containing no ^{233}U . The anticoincidence background from the "blank chamber" was consistent with the energy dependence of the background derived from the black filters up to 130-eV cobalt resonance. The time-dependent background shows shallow

Fig. 4. Neutron Flux Per Microsecond Versus Neutron Energy.

Fig. 5. Foreground and Background Count Rates in the Scintillator Tank in Anticoincidence with the Fission Chamber.

minima at the black resonances which are due to the lack of neutrons at these energies.

After the fission events and the anticoincidence events were corrected for the dead time of the analyzer, the background events, and the small amount of resonance self-protection ($\sim 3\%$ maximum), three problems remained: determination of the relative efficiency of the scintillator tank for detecting capture and fission events, determination of the efficiency of the fission chamber for detecting fission events, and absolute normalization of the data. The relative efficiency of the scintillator tank for detecting capture fission events and the efficiency of the fission chamber could have been determined³ approximately with pulse-height spectra from the tank, but in practice this method does not yield sufficient accuracy. Therefore, these parameters were derived from a normalization of the data, as discussed in "Data Normalization."

Calculations to estimate the effect of neutron scattering in the aluminum plates of the fission chamber and subsequent absorption in the ^{233}U were carried out. The preliminary results were reasonable except that, after this scattering correction was made, the resulting capture-plus-fission cross sections below 3 eV were inconsistent with the total cross sections of Pattenden and Harvey⁹ that were used for normalization. Because of this inconsistency, these corrections were not carried out on the reported data. Since only $\sim 3\%$ of the neutron flux was scattered by the aluminum in the fission chamber, this correction would be appreciable only in low cross sections which were adjacent to high-peak cross sections. In most cases a scattering correction would be within uncertainties due to other causes.

DATA NORMALIZATION

The reported cross sections are based on the energy dependence of the $^{10}\text{B}(n,\alpha)$ cross section in the energy range of concern having an $E_n^{-\frac{1}{2}}$ neutron energy dependence. This energy dependence is commonly accepted¹⁰ over the energy range presently considered.

In the thin sample approximation, the relationship between the cross sections and the coincidence and anticoincidence rate measured can be expressed as

$$\sigma_f(E) = \frac{N}{\phi(E)} F(E) \quad (1)$$

$$\sigma_c(E) = \frac{N}{\phi(E)} [(S - C) A(E) - CF(E)] \quad (2)$$

where $F(E)$ is the measured fission rate in coincidence, $A(E)$ is the anti-coincidence rate, N is a constant normalization factor, $\phi(E)$ is the relative flux as measured by the flux monitor, S is the ratio of the efficiency of the scintillator tank for fission events and capture events, and C is the product of S and the probability of the fission chamber coincidence circuitry for not detecting a fission event.

Since our experiments did not determine the three unknowns in the above equations, N , S , and C , with sufficient accuracy, these constants were determined using the total cross sections of Pattenden and Harvey.⁹ The total cross section is the sum of fission, capture, and scattering cross sections. For present purposes the scattering cross section^{11,12} could be approximately represented by a constant 12.5 barns over the energy range of consideration. Since the ratio of fission to capture varies

considerably from resonance to resonance in ^{233}U and since the quoted accuracy of the absolute values of the Pattenden and Harvey total cross sections is $< 1\%$, the three unknowns in Eqs. 1 and 2 could be determined with good accuracy. The shape and area of the resonances at 1.78 and 2.30 eV were used predominantly to determine the parameters; however, the effects upon the other resonances were closely observed. The resonances at 1.78 and 2.30 eV were chosen because the first one is a predominantly fission resonance and the second one is approximately half capture and half fission. Also, these resonances are in a region of high accuracy for both the present results and those of Pattenden and Harvey.

Figure 6 shows the corresponding fit to the total-cross-section data, which was derived from the above procedure. When it is realized that the neutron energy resolution of the total-cross-section data becomes somewhat poor near the upper end of Fig. 6, the fit between the present data and the total-cross-section data is good. The overall normalization factor, N , in Eqs. 1 and 2 was determined to the accuracy of the absolute values of the Pattenden and Harvey total cross sections. Since a good fit was obtained between the energy variation of the two sets of data, the additional constants, S and C , in Eq. 2 were determined with good accuracy. The value of S obtained by the above procedure was 1.11; the value of C was 0.432, which means that 39% of the fission events were not detected by the fission chamber coincidence circuitry.

Fig. 6. The Total Cross Section Computed from the Present Data Fitted to the Data of Pattenden and Harvey.

EXPERIMENTAL DATA PARAMETERS

Table 1 summarizes the experimental parameters involved in the data. The effect of the permanent filters, cadmium and cobalt, was negligible up to the 89-eV resonance in cadmium because the neutron energy resolution of the flux monitor data was sufficient to correct for the flux depressions due to the small cadmium resonances at lower neutron energies. The data in the region of the cobalt resonance (100-161 eV) have been deleted. At 89 eV and above the small resonances of cadmium affect the shape of the data slightly, but the data in these energy regions have not been deleted since integral values over these energy regions yield approximately correct results. In experimental runs in which the ^{238}U background filter resonances affected the data, the data in these energy regions were suppressed before they were averaged.

The time channel widths were changed as a function of energy to conserve data channels and to cover as large an energy range as possible with good resolution.⁵ The criterion for channel-width changes was that there must be approximately eight channels per doppler width up to 60 eV.

The neutron energy scale of the present data is also normalized to that of Pattenden and Harvey.⁹ For the present experiment the neutron flight path was not known with sufficient accuracy to yield a more precise neutron energy scale.

The effective resolution at any neutron energy can be derived from the burst width, moderator thickness, fission-chamber thickness, and time channel width. The time channels had sharp cutoffs since the time-of-flight clock measured time intervals with a ± 2.5 -nsec accuracy. The net

Table 1. Experimental Parameters for the ORNL-RPI Simultaneous
Measurements of σ_c and σ_f for ^{233}U

Flight path	25.45 ± 0.05 m	Sample areal density	5.47×10^{-5} atoms/b
Moderator	Polyethylene	Sample weight	0.968 ± 0.002 g
Moderator thickness	2.54 cm	Sample effective thickness	3.2 ± 0.1 cm
Sample composition	U_3O_8	Sample isotopic composition	$(9.999 \pm 0.005)\%$
Sample temperature	$25 \pm 5^\circ\text{C}$		
Neutron burst width	250 nsec		
Repetition rate	240 pulses/sec		
Permanent filters	Cd, Co, Na		
Background filters	^{238}U		

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Energy Region (eV)	<u>Time Channel Widths</u>	
	<u>Number of Channels</u>	<u>Channel Width (μsec)</u>
0.399-0.789	83	10.24
0.793-1.396	100	5.12
1.401-3.112	200	2.56
3.119-6.498	250	1.28
6.509-12.096	300	0.64
12.110-27.270	550	0.32
27.295-1051	1607	0.16
1052-1286	17	0.32

instrumental resolution was small compared with the doppler width of the resonances up to approximately 20 eV.

EXPERIMENTAL UNCERTAINTIES

The experimental uncertainties involved in the type of measurement reported here are exceedingly difficult to evaluate. Uncertainties can be attributed to statistics, to normalization, to systematic errors, and, possibly, to the sample.

The statistical errors in the data can be approximately expressed as follows:

$$\text{fractional error in } \sigma_f = 1/(\phi \sigma_f)^{\frac{1}{2}},$$

$$\text{fractional error in } \sigma_c = \left\{ \sigma_c + 2C \sigma_f + \left[(8000 + 2100 E^{0.41})(S-C) \right] / \phi \right\}^{\frac{1}{2}} / \sigma_c [\phi(S-C)]^{\frac{1}{2}},$$

where $\phi = 20 W E^{0.53}$ below 100 eV and one-half this value above 100 eV, and W is the channel width in microseconds, given in Table 1. The constants S and C have values of 1.11 and 0.432, respectively, and their meaning has been discussed under the section "Data Normalization." In the above equations neutron energies are in eV and both cross sections are in barns.

In this case normalization involved the determination of three constants from a fit to previously measured total cross sections, as is discussed under "Data Normalization." The estimated error in this procedure is 1% for the fission cross section and 1% of the sum of the capture-plus-fission cross section for the capture cross section. These uncertainties are not significantly affected by the quoted accuracy of the total cross section.

The systematic errors on the fission capture cross sections are estimated to be approximately the same as those given for the normalization uncertainties with the addition of a constant 2-b uncertainty. This 2-b uncertainty is due to the accuracy with which backgrounds could be subtracted.

The ^{233}U sample used in the experiment was of very high isotopic purity, as indicated in Table 1. The fission chamber was constructed of high-purity aluminum to prevent additions to the capture cross section from other elements. Despite these precautions, there appears to be a resonance in the capture cross section at 11.8 eV, which is apparently not due to ^{233}U . Except for this resonance, it is estimated that errors due to sample impurities are small.

Therefore the total nonstatistical errors are estimated to be 1.5% ± 2 b for the fission cross section and 1.5% of $(\sigma_c + \sigma_f)$ ± 2 b for the capture cross section. Above 89 eV, these fission cross-section errors do not apply in the vicinity of cadmium resonances unless the data are averaged over intervals that are wide compared with cadmium resonance widths. Due to difficulties in understanding the background, the quoted capture cross-section values above 130 eV could become systematically high. The background at 130 eV was understood; however, at 2850 eV where a black sodium resonance was in the neutron beam, background measurements were inconsistent. This uncertainty is included in the error estimates above. Since this particular experiment was not basically designed to reach 2850 eV, this energy region was not investigated with sufficient detail to resolve the inconsistency in the background measurements.

EXPERIMENTAL RESULTS

Results of the present measurements are plotted in Figs. 7-10 and tabulated in the appendix. The capture cross sections are plotted on an expanded scale relative to the fission cross sections because of their lower average values. The wide variation of the ratio of capture to fission from resonance to resonance is obvious. A large part of the capture resonance integral comes from a relatively small fraction of the resonances. This could be important in nondilute reactor systems.

The statistical accuracy of the data decreases with neutron energy because of the decreases in time channel widths. The data could be averaged to obtain better statistical accuracy with poorer neutron energy resolution.

COMPARISON WITH PREVIOUS DATA

The present measurement of the fission cross section can be compared with that of Nifenecker¹³ which extends from 1.75 to 62.6 eV. Figure 11 is a comparison of the present fission cross-section results with those of Nifenecker up to 30 eV. For this figure we have taken the liberty of multiplying Nifenecker's neutron energy scale by a factor of 0.984 in order to align the energy scales. The agreement is good except that our data show deeper minima between resonances and slightly higher average values (see Table 2). Above 30 eV our data have better neutron energy resolution than those of Nifenecker so that average cross sections give a more meaningful comparison. The agreement between our data and the data of Moore et al.,¹⁴ shown in Fig. 12, is similar to our agreement with Nifenecker's data except the data of Moore et al. tend to have even lower average values.

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Fig. 7. Fission and Capture Cross Sections of ^{233}U from 0.4 to 25 eV Neutron Energy.

ORNL-DWG 66-10724

Fig. 8. Fission and Capture Cross Sections of ^{233}U from 25 to 50 eV Neutron Energy.

Fig. 9. Fission and Capture Cross Sections of ^{233}U from 50 to 100 eV Neutron Energy.

Fig. 10. Fission and Capture Cross Sections of ^{233}U from 150 to 1000 eV Neutron Energy.

Fig. 11. Comparison of the Fission Cross Section of Nifenecker with the Present Results.

Table 2. Comparison of Resonance Integrals for ^{233}U
Over GAM ($\frac{1}{4}$ Lethargy) Intervals

$$\int_{E_1}^{E_2} \sigma_f \frac{dE}{E} \approx \sum_1 \frac{\sigma_{f_i}}{E_i} \frac{(E_{i+1} - E_{i-1})}{2} \quad (b)$$

$$\int_{E_1}^{E_2} \sigma_c \frac{dE}{E} \quad (b)$$

GAM Intervals (eV)		ORNL-RPI Results (1966)			ORNL-RPI Results (1966)		
		Nifenecker ^a	Moore <u>et al.</u> ^b	Brooks <u>et al.</u> ^c	Results (1966)	Brooks <u>et al.</u> ^c	
0.414- 0.532	33.34		34.20	35.14	3.08	3.64	
0.532- 0.683	30.50		31.47	32.29	2.77	2.84	
0.683- 0.876	28.84		29.53	30.84	2.80	2.12	
0.876- 1.125	34.76		35.54	37.17	3.19	3.11	
1.125- 1.445	56.61		54.63	53.87	6.15	6.38	
1.445- 1.855	138.23		140.54	139.95	27.48	25.41	
1.855- 2.382	97.56	97.63	92.02	95.55	34.93	30.40	
2.382- 3.059	14.55	13.18	17.19	15.22	5.39	6.04	
3.059- 3.927	26.14	23.11	25.82	25.54	4.33	5.45	
3.927- 5.043	20.41	17.92	19.86	20.07	1.15	1.84	
5.043- 6.475	22.10	19.92	20.83	22.07	2.91	2.02	
6.475- 8.313	35.09	33.44	31.55	30.98	9.40	10.73	
8.313- 10.675	30.48	28.43	25.85	28.59	5.04	6.36	
10.675- 13.706	27.61	26.98	23.17		4.20		
13.706- 17.599	18.99	19.30	16.36		4.11		
17.599- 22.597	32.47	30.87	23.21		5.03		
22.597- 29.014	16.76	17.53	15.12		1.26		
29.014- 37.254	15.18	15.54	11.77		1.23		
37.254- 47.834	6.78	7.27	5.90		0.71		
47.834- 61.419	11.29	10.91	8.23		1.25		
61.419- 78.862	9.77		7.14		1.38		
78.862- 101.258	8.74		6.51		2.03		
101.258- 130.016			8.09				
130.016- 166.940			4.70				
166.940- 214.351	5.82		4.07		0.75		
214.351- 275.227	5.51		4.59		1.15		
275.227- 353.391	5.42		4.51		0.87		
353.391- 453.755	3.65		3.77		0.83		
453.755- 582.621	3.54		2.80		1.34		
582.621- 748.085	3.84		3.17		1.16		
748.085- 960.541	3.26				0.92		
960.541-1223.335	2.44				0.89		

a. H. Nifenecker, J. Phys. Radium **25**, 877 (1964); energy scale multiplied by 0.984 for comparison purposes.

b. M. S. Moore, L. G. Miller, and O. D. Simpson, Phys. Rev. **118**, 714 (1964); energy scale multiplied by 0.9964 for comparison purposes.

c. F. D. Brooks, E₁ and Neutron Cross Sections of Pu²³⁹ and U²³³, AERE-M-1709 (1966).

Fig. 12. Comparison of the Fission Cross Section of Moore et al. with the Present Results.

Above 20 eV the highest resolution data available on the fission cross section are those of Bergen et al.¹⁵ These data are unique in that a single-pulse device was used as a neutron source. Figures 13 and 14 show a comparison with the present data from 20 to 100 eV. The absolute value of the data of Bergen et al.¹⁵ was renormalized as indicated in the figures for comparison of the relative shapes of the fission cross sections. No adjustment in energy scale was necessary. The agreement in relative shape of the two cross sections is reasonable except that our data indicate a smaller negative slope with increasing neutron energy. (Note that the normalization in Fig. 13 differs from that in Fig. 14.) The disagreement in slope and in absolute value is not understood. The disagreement in slope could possibly explain the difference in absolute values.

A comparison of the present data with the fission and capture cross sections of Brooks et al.¹⁶ up to 11 eV is shown in Fig. 15. Although there are systematic differences in the two sets of data, as can be seen in Fig. 15, the integrated cross sections are in good agreement. The overall agreement is good considering the different techniques used. Using the same ^{233}U sample, Brooks et al. measured the fission cross section via the fission neutrons and simultaneously measured the total cross section; they calculated the capture cross section using an assumed scattering cross section.

The most accurate comparisons of data are those made with partial resonance integrals. When the data are integrated over an appreciable neutron energy range, statistical and resolution effects become small. Table 2 is a comparison of resonance integrals of the fission cross section

Fig. 13. Comparison of the Fission Cross Section of Bergen et al. with Present Results.

Fig. 14. Comparison of Fission Cross Section of Bergen et al. with Present Results.

Fig. 15. Comparison of the Fission and Capture Cross Section of Brooks *et al.* with the Present Data.

in $1/4$ lethargy (GAM) units. The most apparent difference between our present data and other data is that our data tend to have higher average fission cross sections at higher neutron energies.

If the fission cross-section data of Moore et al.¹⁴ or of Nifenecker¹³ are used in conjunction with the available total cross-section and scattering cross-section data to compute the capture cross section, the resulting values are appreciably higher than those of our measurements.

Table 3 is a comparison of resonance integrals for the overlapping neutron energy ranges of present and previous measurements. The agreement (2%) with Brooks et al. on the capture integral is considered quite satisfactory considering that the two measurements were made with very different techniques.

The value of η can also be derived from the present measurements using the value of $\bar{\nu}$ measured by other experimenters.¹⁷ These calculated values of η can be compared with direct measurements of η .^{18,19} Figure 16 is a comparison of the presently derived η values and those of Smith et al.¹⁸ The agreement is probably within experimental errors except for that portion of the Smith et al. data affected by the ^{234}U impurity.

Complete resonance integrals for capture and fission from 0.5 eV to 10 MeV can be calculated using the present data up to 1000 eV and previously published values²⁰ from 1000 eV to 10 MeV. In Table 4 a comparison is given of the resonance integrals as calculated from the present data and the directly measured resonance integrals. The calculated fission resonance integral is in agreement with the majority of the integral measurements but is lower than their average value. The differential

Table 3. Comparison of Partial Resonance Integrals for ^{233}U

$$\int_{E_1}^{E_2} \sigma \frac{dE}{E} \approx \sum_i \frac{\sigma_i}{E_i} \frac{E_{i+1} - E_{i-1}}{2}$$

E_1 (eV)	E_2 (eV)	Resonance Integrals		Ratio
		ORNL-RPI Measurements	Other Measurements	
<u>Total Cross Sections</u>				
0.414	101.0	914 ^a	904 (Pattenden <u>et al.</u> ^b)	1.011
0.414	101.0	914 ^a	912 (Moore <u>et al.</u> ^c)	1.002
0.414	10.7	717 ^a	713 (Brooks <u>et al.</u> ^d)	1.006
<u>Fission Cross Sections</u>				
0.414	748.1	757 ^e	712 (Moore <u>et al.</u> ^c)	1.063 ^e
0.414	10.7	569	567 (Brooks <u>et al.</u> ^d)	1.004
1.86	61.4	375	362 (Nifenecker ^f)	1.036
<u>Capture Cross Sections</u>				
0.414	10.7	108	106 (Brooks <u>et al.</u> ^d)	1.02

a. Calculated from $\sigma_T = \sigma_f + \sigma_c + 12.5$ b.

b. N. J. Pattenden and J. A. Harvey, Nucl. Sci. Eng. 17, 404 (1963).

c. M. S. Moore et al., Phys. Rev. 118, 714 (1964).

d. F. D. Brooks et al., Eta and Neutron Cross Sections of Pu²³⁹ and U²³³, AERE-M-1709 (1966); also private communication.

e. Moore's fission integral from 101.26 to 166.94 eV was used to fill in a gap in the ORNL-RPI data.

f. H. Nifenecker, J. Phys. (Paris) 25, 877 (1964).

Fig. 16. Comparison of η Values of Smith et al. with Those Computed from Present Measurements.

Table 4. Comparison of ^{233}U Resonance Integrals,

$$\int_{E_1}^{E_2} \sigma_i \frac{dE}{E}, \text{ Above } 0.5 \text{ eV}$$

	Fission Integrals (b)	Capture Integrals (b)	Epithermal α
<u>From Differential Data</u>			
ORNL-RPI, 0.5 - 961 eV	735 $\pm$ 15	140 $\pm$ 13	
Snidow ^a evaluation, 961 - 10^7 eV	34 $\pm$ ~3	5 $\pm$ ~0.5	
0.5 - 10^7 eV	769 $\pm$ 16	145 $\pm$ 13	0.188 $\pm$ 0.017
<u>From Integral Measurements, > 0.5 eV</u>			
Conway and Gunst ^b	771 $\pm$ 49	135 $\pm$ 8	0.175 $\pm$ 0.006
Esch ^c	821 $\pm$ 59	144 $\pm$ 8	0.175 $\pm$ 0.008
Halperin et al. ^d	865 $\pm$ 40	147 $\pm$ 7	0.171 $\pm$ 0.017

a. N. L. Snidow, Neutron Cross Sections for U-233, BAW-393-5 (1966).

b. D. E. Conway and S. B. Gunst, "Integral Measurements of the Epithermal Neutron Capture-to-Fission Cross-Section Ratios of ^{233}U and ^{235}U ," to be published in Nuclear Science and Engineering.

c. L. J. Esch, Trans. Am. Nucl. Soc. 7, 272 (1964); also from information presented by F. Feiner at American Nuclear Society Conference on Reactor Physics in the Resonance and Thermal Regions, San Diego, 1966.

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data give improved accuracy on the fission resonance integral because of the accuracy with which the flux can be measured with a pulsed or mono-energetic neutron source. The differential data give less accuracy on the capture resonance integral because of the neutron-associated backgrounds involved. If it is desirable to renormalize the present differential capture cross-section data to agree with a certain capture resonance integral, adding or subtracting a constant cross section rather than renormalizing by a multiplicative factor should be considered. This procedure is recommended because an error due to the misinterpretation of the background level is considered more likely than an error in absolute normalization.

CONCLUSIONS

The goal of this experimental program was to provide neutron capture and fission capture cross sections for ^{233}U that would meet the needs of reactor designers and that would be useful for obtaining multilevel nuclear parameters. The basic plan of the program was to measure the fission and capture cross sections simultaneously and to normalize, and thus constrain, the data to the best total cross section available for ^{233}U . The present data significantly improve the overall knowledge of the fission and capture cross sections in the energy range 0.4 to 1000 eV.

The accuracy of the fission cross section in this energy range is essentially the 2% requested²⁰ by reactor designers, but the accuracy of the capture cross section falls short of the requested 1 to 5%, depending on the neutron energy. The accuracy of the present data, however, is such that in thermal reactors the major uncertainties due

to the ^{233}U cross sections are dominated by the uncertainties at neutron energies below 0.5 eV.¹

The accuracy of the present fission and capture cross sections up to ~ 25 eV is such that a more constrained multilevel fit should be possible. Since the capture cross section has a small degree of resonance interference compared with that related to the fission and total cross sections, it should increase significantly the uniqueness of a multilevel fit. A multilevel fit of the fission cross section should be possible above 25 eV; however, the statistical accuracy of the capture cross section above 25 eV is such that it could be used only as a guideline.

The present data add significantly to the accuracy of the ^{233}U fission resonance integral. The capture resonance integral derived from the digital data is consistent with integral measurements even though it is subject to a larger error.

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APPENDIX

TABULATION OF THE DATA

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
.399	5.871	141.253	.401	8.177	140.337	.404	2.265	138.744
.407	15.741	136.943	.410	5.852	137.202	.413	13.552	136.724
.416	16.302	140.559	.419	5.914	139.551	.422	17.187	140.043
.425	14.129	136.910	.428	12.988	135.745	.431	14.239	136.326
.435	16.326	138.032	.438	7.405	134.063	.441	15.970	133.298
.444	9.150	134.405	.448	7.548	133.917	.451	11.156	134.108
.455	13.579	133.090	.458	7.431	134.385	.461	12.210	134.066
.465	12.741	131.804	.469	16.820	132.640	.472	15.843	130.165
.476	11.049	133.081	.479	6.668	134.122	.483	20.619	133.072
.487	10.368	131.546	.491	15.484	132.284	.495	14.353	132.738
.499	9.042	132.065	.503	12.109	130.485	.507	10.229	130.725
.511	13.085	131.693	.515	11.962	129.551	.519	11.831	130.454
.523	10.764	126.631	.527	10.515	129.439	.532	7.368	130.042
.536	10.493	127.178	.540	8.010	129.105	.545	11.246	127.677
.549	11.088	127.431	.554	8.029	128.547	.559	14.659	124.468
.563	11.406	126.349	.568	9.056	124.895	.573	11.572	126.235
.578	11.435	123.510	.583	11.898	122.732	.588	14.504	125.196
.593	9.908	123.473	.598	10.323	122.297	.603	14.692	120.865
.608	12.723	119.725	.614	10.212	121.144	.619	9.592	121.179
.625	10.478	120.243	.630	11.843	118.934	.636	11.261	119.262
.641	13.037	117.852	.647	11.673	118.672	.653	11.893	117.120
.659	6.828	117.919	.665	12.218	115.851	.671	9.417	116.583
.677	12.999	115.780	.684	12.127	114.861	.690	13.028	115.554
.696	11.552	115.111	.703	15.191	115.411	.710	10.462	112.034
.716	9.126	113.546	.723	12.049	112.668	.730	11.435	113.568
.737	10.927	113.862	.744	13.369	113.144	.751	12.758	113.978
.759	12.409	113.643	.766	9.558	113.249	.774	9.265	113.200
.781	12.626	113.791	.789	11.199	114.354	.793	8.112	115.468
.797	11.688	114.990	.801	10.082	115.154	.805	12.442	115.214
.809	11.677	115.795	.813	11.338	116.137	.817	11.862	119.985
.821	10.989	117.088	.826	7.710	115.846	.830	9.414	116.510
.834	10.264	119.406	.838	9.813	118.968	.843	10.919	117.621
.847	9.917	119.346	.851	6.687	117.897	.856	13.483	117.821
.860	9.857	121.074	.865	9.695	120.489	.869	14.043	122.641
.874	11.258	120.484	.878	9.680	123.755	.883	14.573	120.720
.888	9.193	122.486	.892	10.889	121.828	.897	12.312	124.897
.902	7.909	124.161	.907	10.077	126.178	.911	16.639	123.942
.916	6.618	124.644	.921	12.630	125.599	.926	10.415	127.083
.931	14.373	125.608	.936	12.926	128.971	.941	10.805	127.085
.946	12.138	126.394	.952	14.769	129.348	.957	11.672	132.192
.952	12.446	131.554	.967	8.978	133.444	.973	16.076	133.299
.978	13.406	134.296	.984	12.603	134.275	.989	14.003	135.148
.995	9.575	136.471	1.000	13.125	137.132	1.006	12.153	137.057
1.011	13.637	140.613	1.017	15.126	139.785	1.023	12.783	143.222
1.029	13.796	143.970	1.035	13.126	142.673	1.040	13.999	144.412
1.046	15.293	146.949	1.052	13.196	148.315	1.058	17.133	149.723
1.065	13.280	151.874	1.071	10.409	150.643	1.077	14.024	153.721
1.083	14.025	154.880	1.090	14.190	157.329	1.096	13.417	158.464
1.102	12.418	159.401	1.109	11.382	163.442	1.115	14.116	160.459
1.122	15.608	165.183	1.129	17.911	166.584	1.135	12.615	168.881

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION		
1.142	15.131	169.850	1.149	16.235	174.358	1.156	14.390	175.067
1.153	15.195	175.575	1.170	16.386	179.162	1.177	16.804	181.994
1.184	17.959	183.263	1.191	18.009	184.165	1.199	17.694	185.105
1.206	19.077	189.333	1.214	18.419	193.161	1.221	21.926	196.465
1.229	20.262	199.803	1.236	18.516	203.513	1.244	19.562	204.431
1.252	20.386	207.528	1.260	19.866	211.956	1.268	21.838	215.576
1.276	23.669	219.651	1.284	24.158	220.501	1.292	23.278	226.451
1.300	20.945	231.753	1.308	20.466	238.248	1.317	26.137	239.080
1.325	28.895	243.166	1.334	24.639	250.442	1.343	24.544	254.795
1.351	29.530	257.783	1.360	32.323	264.317	1.369	32.519	266.683
1.378	32.515	274.455	1.387	34.970	277.705	1.396	37.911	282.527
1.401	41.493	282.967	1.406	37.012	289.002	1.410	36.290	294.436
1.415	39.743	299.979	1.420	34.450	301.882	1.424	38.186	303.516
1.429	46.057	298.957	1.434	44.048	306.995	1.439	42.825	311.523
1.444	44.091	315.000	1.448	44.005	319.234	1.453	39.130	324.411
1.458	46.911	323.029	1.463	49.873	326.442	1.468	47.668	329.537
1.473	48.806	332.676	1.478	52.225	333.166	1.483	45.101	338.254
1.488	53.368	345.638	1.493	53.026	350.065	1.498	57.774	347.835
1.503	56.547	351.731	1.509	56.841	355.234	1.514	59.717	360.486
1.519	58.548	362.360	1.524	65.876	370.536	1.530	62.413	373.357
1.535	62.615	382.080	1.540	65.288	388.604	1.546	67.121	386.252
1.551	68.874	389.364	1.556	73.621	390.462	1.562	72.987	397.335
1.567	73.580	407.059	1.573	81.148	403.903	1.578	82.312	412.186
1.584	85.654	416.165	1.589	86.295	423.402	1.595	86.379	426.425
1.601	87.502	437.058	1.606	87.640	447.059	1.612	94.800	450.653
1.618	100.858	452.643	1.624	101.637	467.594	1.629	99.186	475.764
1.635	106.582	488.990	1.641	110.353	498.209	1.647	112.559	507.278
1.653	112.351	524.190	1.659	119.419	539.712	1.665	125.885	556.003
1.671	127.757	569.797	1.677	134.745	588.504	1.683	144.786	609.171
1.689	142.465	626.152	1.695	147.319	660.060	1.701	155.121	673.183
1.708	155.370	697.717	1.714	161.002	719.857	1.720	162.235	737.369
1.726	168.266	766.327	1.733	173.104	783.607	1.739	173.502	799.074
1.746	172.896	818.516	1.752	179.241	831.188	1.759	180.329	847.138
1.765	176.638	853.825	1.772	173.595	854.664	1.778	168.919	854.180
1.785	168.541	855.904	1.792	169.698	847.899	1.798	159.496	838.349
1.805	163.847	822.043	1.812	156.705	802.520	1.819	148.634	789.665
1.826	143.906	765.421	1.832	140.966	740.613	1.839	134.512	723.119
1.846	129.568	693.324	1.853	129.869	666.291	1.860	116.040	650.437
1.868	112.865	615.082	1.875	105.456	595.674	1.882	98.721	578.410
1.889	95.404	546.978	1.896	91.782	535.090	1.904	87.197	505.994
1.911	79.473	485.645	1.919	78.686	469.564	1.926	72.118	455.181
1.933	73.897	432.811	1.941	70.732	416.723	1.949	62.797	405.614
1.956	60.533	391.930	1.964	59.343	377.477	1.972	59.298	363.634
1.979	54.728	351.811	1.987	57.813	344.216	1.995	55.119	334.109
2.003	55.507	324.154	2.011	52.577	314.245	2.019	54.106	310.030
2.027	48.508	297.366	2.035	51.716	291.034	2.043	53.080	289.357
2.051	47.049	284.218	2.059	51.293	281.631	2.068	50.695	273.316
2.076	55.948	269.129	2.084	52.331	269.227	2.093	53.611	268.229
2.101	56.217	266.839	2.110	58.898	268.822	2.119	61.693	268.789
2.127	56.445	271.538	2.136	68.983	277.510	2.145	76.962	280.190

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E (eV)	CAPTURE	FISSION	E (eV)	CAPTURE	FISSION	E (eV)	CAPTURE	FISSION
2.123	82,907	285,700	2.162	88,461	294,539	2.171	91,585	307,101
2.180	104,024	321,050	2.189	118,861	337,266	2.198	132,534	358,835
2.207	153,648	383,426	2.217	177,494	413,788	2.226	209,975	447,329
2.235	244,008	487,243	2.244	284,223	525,599	2.254	318,046	571,437
2.263	360,506	604,430	2.273	396,019	622,838	2.283	416,397	621,992
2.292	421,899	599,787	2.302	412,245	561,711	2.312	386,249	502,725
2.322	346,226	431,340	2.331	301,479	363,314	2.341	257,952	297,763
2.352	218,433	244,469	2.362	181,412	199,421	2.372	145,845	167,559
2.382	127,236	141,863	2.392	105,554	120,590	2.403	89,709	104,809
2.413	79,974	94,404	2.424	69,659	83,546	2.434	60,358	78,846
2.445	53,878	72,531	2.456	48,969	67,658	2.466	42,232	64,856
2.477	40,688	61,273	2.488	33,943	59,556	2.499	33,244	58,315
2.510	28,496	57,525	2.521	23,055	54,610	2.533	23,758	53,816
2.544	24,481	52,916	2.555	23,747	53,018	2.567	18,183	51,887
2.578	18,493	51,637	2.590	17,349	49,979	2.602	17,343	50,842
2.613	12,237	51,486	2.625	10,309	51,156	2.637	13,471	49,297
2.649	11,570	50,107	2.661	12,695	49,949	2.673	12,596	48,973
2.686	12,927	50,099	2.698	12,107	49,257	2.710	13,587	47,897
2.723	10,123	46,591	2.735	12,671	49,645	2.748	10,175	48,451
2.761	8,259	50,797	2.774	8,062	49,898	2.787	8,172	48,972
2.800	7,313	50,069	2.813	6,960	50,301	2.826	11,765	51,079
2.839	7,304	50,804	2.853	6,684	52,044	2.866	7,537	51,081
2.880	7,627	52,129	2.894	3,411	52,952	2.907	6,559	53,563
2.921	8,862	52,492	2.935	5,578	53,733	2.949	4,195	54,454
2.964	6,608	55,143	2.978	5,081	56,730	2.992	5,574	56,740
3.007	7,536	56,872	3.022	6,807	59,089	3.036	5,471	59,973
3.051	6,510	60,818	3.066	7,419	60,201	3.081	5,736	62,846
3.096	6,051	63,489	3.112	5,902	64,252	3.119	3,409	65,296
3.127	6,891	63,928	3.135	5,548	68,560	3.142	5,142	67,714
3.150	2,890	69,484	3.158	7,458	69,171	3.166	8,263	69,206
3.174	10,016	72,217	3.182	1,871	71,294	3.190	4,167	72,701
3.198	5,781	74,185	3.206	7,178	72,653	3.214	6,679	74,255
3.222	7,670	77,289	3.230	9,199	80,801	3.238	5,460	80,913
3.246	5,657	82,104	3.254	7,178	82,474	3.262	6,300	85,293
3.271	5,662	84,956	3.279	6,838	87,880	3.287	11,625	87,290
3.296	5,700	90,837	3.304	8,273	91,634	3.312	10,522	90,555
3.321	8,324	93,210	3.329	8,756	95,210	3.338	9,476	97,261
3.346	5,935	97,194	3.355	9,190	100,538	3.364	11,338	100,987
3.372	11,066	104,364	3.381	12,305	104,906	3.390	8,447	106,729
3.398	10,689	110,093	3.407	11,641	112,124	3.416	11,477	113,686
3.425	14,509	115,220	3.434	12,565	116,647	3.442	12,642	118,965
3.451	12,103	122,019	3.460	16,164	123,372	3.469	16,279	128,059
3.478	16,126	126,997	3.488	15,254	133,929	3.497	19,446	132,224
3.506	25,036	138,791	3.515	25,281	139,335	3.524	26,408	145,322
3.533	29,296	150,851	3.543	30,983	160,213	3.552	38,236	162,237
3.561	37,131	172,572	3.571	39,893	177,696	3.580	48,850	184,985
3.590	50,602	192,906	3.599	53,407	199,778	3.609	56,622	198,436
3.618	61,780	198,697	3.628	58,326	197,757	3.638	55,987	192,230
3.647	52,749	186,426	3.657	49,224	174,130	3.667	48,254	160,869
3.677	45,097	152,864	3.687	37,020	142,478	3.697	31,031	132,033

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
3.707	31.132	123.235	3.717	28.869	114.558	3.727	21.965	108.456
3.737	18.348	100.172	3.747	17.119	93.593	3.757	17.996	92.855
3.767	11.239	86.309	3.777	10.857	81.491	3.788	16.125	78.376
3.798	12.264	75.685	3.808	6.986	73.793	3.819	12.015	69.270
3.829	7.357	66.849	3.840	10.545	65.423	3.850	10.009	64.924
3.861	7.730	64.467	3.871	6.701	63.268	3.882	5.874	57.451
3.893	5.091	58.973	3.903	7.339	59.610	3.914	2.928	57.919
3.925	5.529	57.690	3.936	3.318	56.738	3.947	7.576	55.337
3.958	7.029	53.801	3.969	4.536	54.521	3.980	4.135	53.432
3.991	2.860	52.324	4.002	5.774	54.071	4.013	4.979	53.451
4.025	6.612	53.094	4.036	3.310	54.065	4.047	1.749	53.460
4.059	2.772	52.815	4.070	4.038	53.398	4.082	5.557	53.777
4.093	3.943	54.101	4.105	1.558	54.320	4.117	3.850	54.891
4.128	2.158	56.684	4.140	5.510	56.130	4.152	3.548	56.278
4.164	2.534	57.569	4.175	2.443	56.303	4.187	4.720	59.515
4.199	2.345	58.075	4.211	6.214	60.151	4.224	5.358	59.635
4.236	5.717	61.177	4.248	3.530	61.641	4.260	4.485	63.468
4.272	4.094	67.059	4.285	3.751	66.142	4.297	3.134	68.231
4.310	3.768	69.753	4.322	4.358	70.609	4.335	3.963	72.445
4.347	3.394	72.065	4.360	6.636	75.084	4.373	2.013	77.703
4.386	5.311	78.891	4.399	5.661	79.034	4.411	5.253	81.398
4.424	3.814	85.415	4.437	5.545	86.401	4.451	3.823	87.133
4.464	2.353	90.098	4.477	5.041	88.216	4.490	5.717	90.341
4.504	3.065	93.561	4.517	7.248	94.074	4.530	3.686	98.468
4.544	5.571	101.199	4.557	7.139	100.125	4.571	4.971	100.967
4.585	3.999	106.071	4.598	4.970	103.415	4.612	2.567	107.263
4.626	4.530	107.222	4.640	3.151	109.222	4.654	7.580	108.803
4.668	6.317	108.124	4.682	6.871	110.243	4.696	5.643	109.077
4.711	3.248	110.718	4.725	3.229	110.698	4.739	3.217	109.616
4.754	6.907	108.118	4.768	3.365	109.467	4.783	5.585	106.402
4.798	10.727	107.125	4.812	4.568	106.963	4.827	3.692	105.318
4.842	5.147	104.704	4.857	6.647	102.890	4.872	3.689	101.627
4.887	6.639	100.294	4.902	6.564	97.412	4.917	4.667	98.597
4.932	4.451	96.701	4.948	5.526	93.967	4.963	5.937	92.607
4.979	5.155	91.900	4.994	4.241	87.666	5.010	4.762	88.329
5.026	4.439	87.122	5.041	7.688	83.570	5.057	2.835	81.869
5.073	2.129	81.849	5.089	5.644	78.203	5.105	6.677	79.190
5.121	7.151	74.630	5.138	6.344	75.849	5.154	5.799	74.593
5.170	3.634	71.178	5.187	4.083	70.126	5.203	5.457	69.308
5.220	5.014	67.936	5.237	4.409	68.509	5.253	4.653	66.849
5.270	1.496	64.977	5.287	3.482	64.208	5.304	5.300	61.918
5.321	2.137	63.596	5.338	3.995	62.280	5.356	5.101	60.818
5.373	5.244	59.255	5.390	2.103	59.514	5.408	3.737	58.637
5.426	2.574	59.477	5.443	4.338	58.352	5.461	5.548	59.416
5.479	3.362	58.764	5.497	5.381	58.198	5.515	4.185	59.080
5.533	3.604	59.024	5.551	7.727	60.183	5.570	8.878	60.945
5.588	7.445	62.925	5.607	3.410	64.719	5.625	7.725	66.372
5.644	7.106	68.611	5.663	6.907	74.839	5.681	10.924	79.336
5.700	11.176	82.755	5.719	9.443	86.912	5.739	11.315	91.791
5.758	12.380	96.704	5.777	13.357	103.319	5.797	14.629	109.828

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
5.816	11.869	118.927	5.836	11.497	119.698	5.856	13.615	120.201
5.875	11.831	119.982	5.895	11.299	117.227	5.915	11.485	116.008
5.936	9.255	114.340	5.956	13.481	110.549	5.976	10.831	107.231
5.997	7.659	105.809	6.017	11.938	103.173	6.038	12.647	100.431
6.059	10.926	101.288	6.080	11.813	97.558	6.101	15.952	96.371
6.122	10.414	97.292	6.143	10.435	97.761	6.164	8.681	100.698
6.186	16.821	99.597	6.207	10.766	100.181	6.229	11.108	103.680
6.251	12.995	105.623	6.273	12.169	107.015	6.295	14.463	105.901
6.317	13.727	111.661	6.339	14.901	112.677	6.361	13.323	117.012
6.384	17.532	118.914	6.406	19.732	126.925	6.429	18.770	131.864
6.452	21.812	140.796	6.475	22.186	148.182	6.498	27.983	160.217
6.509	31.349	164.762	6.521	29.366	176.697	6.533	33.973	179.093
6.544	35.417	184.462	6.556	39.034	194.233	6.568	41.512	202.790
6.580	41.336	213.932	6.591	42.451	229.389	6.603	44.519	239.376
6.615	51.427	251.606	6.627	59.110	280.797	6.639	62.113	292.951
6.651	68.240	317.767	6.663	72.224	350.670	6.675	87.460	369.456
6.687	99.568	403.056	6.699	115.947	441.964	6.711	126.802	487.024
6.723	148.958	515.898	6.736	156.622	565.541	6.748	177.744	600.359
6.760	197.116	635.443	6.772	199.475	655.302	6.785	213.455	665.854
6.797	207.742	672.855	6.809	216.030	659.458	6.822	212.296	630.070
6.834	200.542	592.071	6.847	186.421	532.217	6.859	172.402	490.093
6.872	158.341	421.089	6.884	131.298	376.782	6.897	115.006	333.118
6.910	90.682	288.927	6.923	92.950	250.648	6.935	80.268	217.665
6.948	68.359	193.836	6.961	49.128	177.339	6.974	51.488	158.286
6.987	45.254	134.794	6.999	40.504	128.297	7.012	39.666	110.314
7.025	37.264	106.602	7.038	35.259	97.865	7.051	27.625	92.071
7.065	23.485	86.556	7.078	24.224	79.258	7.091	22.686	73.214
7.104	17.404	71.120	7.117	19.016	67.189	7.131	17.492	65.997
7.144	19.278	57.392	7.157	15.127	59.960	7.171	18.702	54.860
7.184	13.875	52.834	7.198	11.511	54.278	7.211	9.239	52.190
7.225	14.521	48.921	7.238	10.078	48.653	7.252	14.858	45.603
7.265	12.942	48.105	7.279	9.303	44.126	7.293	21.929	43.856
7.307	10.923	44.616	7.321	13.928	44.945	7.334	9.966	45.420
7.348	13.986	45.799	7.362	11.177	46.782	7.376	13.404	48.827
7.390	13.362	51.086	7.404	12.276	51.745	7.418	11.728	52.792
7.432	11.833	52.963	7.447	11.801	53.836	7.461	10.836	53.520
7.475	10.901	52.397	7.489	11.106	52.131	7.504	11.622	50.553
7.518	8.928	50.545	7.533	7.451	46.729	7.547	7.891	45.630
7.561	10.698	46.097	7.576	5.597	42.571	7.591	6.813	42.116
7.605	6.525	40.865	7.620	3.148	39.412	7.635	3.206	38.188
7.649	4.204	36.757	7.664	4.074	35.298	7.679	5.140	35.597
7.694	3.027	35.287	7.709	4.903	34.074	7.724	3.550	31.854
7.739	4.788	31.411	7.754	0.049	30.701	7.769	2.710	30.041
7.784	2.590	29.115	7.799	5.230	30.001	7.815	4.593	30.759
7.830	2.166	29.194	7.845	6.445	28.561	7.861	3.003	29.445
7.876	1.531	28.746	7.891	1.572	29.542	7.907	4.044	28.057
7.922	2.444	28.024	7.938	2.328	27.137	7.954	1.568	28.467
7.969	2.339	27.974	7.985	0.689	28.312	8.001	3.656	26.498
8.017	1.518	26.083	8.033	0.144	27.697	8.049	0.968	26.906
8.065	0.269	27.511	8.081	3.313	27.108	8.097	2.753	27.549

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION		
8.113	2.730	27.776	8.129	.694	27.404	8.145	1.579	27.781
8.151	-.538	30.213	8.178	-.572	29.013	8.194	.759	28.472
8.210	.337	29.183	8.227	2.689	28.231	8.243	2.211	30.897
8.260	2.359	29.861	8.277	4.823	27.495	8.293	2.878	30.459
8.310	1.880	30.622	8.327	3.402	30.715	8.343	3.528	31.690
8.360	.764	31.266	8.377	.461	32.082	8.394	2.053	33.538
8.411	-.066	34.023	8.428	2.967	34.848	8.445	4.496	35.492
8.463	1.801	36.415	8.480	1.281	35.221	8.497	1.320	36.336
8.514	4.362	37.071	8.532	5.728	37.360	8.549	.755	38.812
8.567	3.996	38.702	8.584	2.564	39.806	8.602	7.744	39.019
8.619	3.860	42.050	8.637	5.479	41.455	8.655	6.458	40.397
8.673	4.689	40.832	8.691	6.470	41.527	8.709	6.651	40.308
8.726	4.326	39.522	8.745	7.267	37.495	8.763	5.339	37.007
8.781	4.343	35.999	8.799	5.816	34.702	8.817	5.592	34.191
8.836	3.734	32.512	8.854	6.230	32.964	8.872	4.456	32.815
8.891	5.423	30.957	8.909	4.235	32.294	8.928	8.396	33.200
8.947	6.340	33.114	8.965	6.153	34.367	8.984	7.395	36.223
9.003	10.011	37.809	9.022	6.529	41.333	9.041	6.052	43.345
9.060	8.561	47.106	9.079	12.590	50.881	9.098	7.300	57.975
9.117	12.473	60.223	9.137	11.195	67.158	9.156	7.716	71.441
9.175	9.771	73.933	9.195	12.507	76.458	9.214	11.382	76.597
9.234	15.327	75.034	9.253	10.248	75.313	9.273	10.156	75.607
9.293	5.939	73.781	9.313	8.255	70.074	9.332	9.738	68.200
9.352	7.082	65.649	9.372	6.451	65.903	9.393	6.657	64.335
9.413	3.986	62.641	9.433	5.655	60.406	9.453	7.174	61.253
9.473	8.591	60.928	9.494	7.965	59.774	9.514	6.355	59.344
9.535	6.135	59.449	9.555	5.540	61.208	9.576	7.615	60.635
9.597	9.144	63.721	9.618	8.989	63.366	9.639	9.629	62.964
9.659	9.377	65.272	9.680	8.165	67.164	9.702	9.479	66.013
9.723	10.817	69.131	9.744	10.822	69.364	9.765	11.065	74.157
9.786	12.547	76.451	9.808	11.544	77.405	9.829	11.450	79.007
9.851	11.496	84.776	9.873	10.275	86.869	9.894	16.634	91.928
9.916	12.264	98.147	9.938	16.379	103.881	9.960	17.960	111.030
9.982	22.573	115.653	10.004	21.304	125.581	10.026	25.457	133.745
10.048	25.254	151.063	10.071	25.449	166.960	10.093	30.502	186.001
10.115	38.790	209.119	10.138	41.694	240.794	10.160	48.460	273.374
10.183	56.078	301.530	10.206	66.718	345.908	10.229	72.254	389.973
10.251	76.562	423.549	10.274	84.032	458.268	10.297	90.684	478.966
10.321	94.674	503.786	10.344	93.402	510.420	10.367	92.320	506.747
10.390	86.407	492.014	10.414	84.975	466.322	10.437	81.893	432.183
10.461	69.736	388.442	10.485	61.689	340.185	10.508	53.938	300.134
10.532	44.662	261.990	10.556	37.472	235.034	10.580	34.030	195.798
10.604	31.337	175.576	10.628	24.393	156.003	10.653	19.592	144.358
10.677	19.915	128.588	10.701	16.279	119.656	10.726	14.444	111.213
10.750	13.141	103.710	10.775	9.810	100.699	10.800	10.129	98.833
10.825	9.323	93.203	10.850	9.390	92.690	10.875	9.931	86.355
10.900	6.115	87.107	10.925	7.448	83.875	10.950	9.133	85.654
10.975	5.844	84.507	11.001	4.710	80.484	11.026	7.774	84.319
11.052	6.029	84.719	11.078	3.748	84.966	11.104	6.728	86.022
11.129	9.737	82.481	11.155	6.156	87.610	11.181	8.331	88.676

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
11.208	9.191	89.783	11.234	6.388	93.264	11.260	11.941	91.875
11.287	8.396	93.407	11.313	10.304	91.790	11.340	12.240	86.804
11.367	11.024	82.900	11.393	9.022	74.044	11.420	8.977	72.497
11.447	6.557	67.941	11.474	6.888	61.160	11.502	10.880	60.134
11.529	9.790	56.257	11.556	9.172	56.965	11.584	8.130	57.719
11.611	6.467	57.176	11.639	10.287	57.991	11.667	15.011	56.393
11.695	17.373	58.667	11.723	22.886	58.360	11.751	25.615	60.797
11.779	31.577	56.581	11.807	32.112	58.633	11.836	32.029	60.721
11.864	28.136	62.509	11.893	29.836	60.713	11.921	23.360	58.959
11.950	15.650	60.907	11.979	15.377	61.285	12.008	11.042	62.226
12.037	11.003	63.948	12.066	10.244	64.249	12.096	6.826	66.595
12.110	6.465	62.215	12.125	7.662	69.986	12.140	8.124	69.921
12.155	11.968	70.932	12.170	7.882	68.903	12.184	10.823	71.978
12.199	9.786	72.391	12.214	7.235	74.870	12.229	7.558	76.745
12.244	7.332	76.464	12.259	11.791	79.775	12.274	10.401	81.723
12.289	11.330	84.122	12.304	14.069	87.194	12.319	11.749	91.874
12.334	13.409	95.609	12.349	11.505	101.976	12.365	7.964	106.083
12.380	18.095	106.989	12.395	15.540	113.549	12.410	13.265	121.718
12.426	17.376	130.411	12.441	15.492	137.552	12.456	16.634	143.884
12.472	17.756	155.476	12.487	21.410	162.816	12.502	20.996	173.478
12.518	23.606	183.205	12.533	22.796	193.295	12.549	23.038	212.748
12.564	25.802	223.139	12.580	27.152	236.637	12.596	30.154	253.680
12.611	33.303	272.453	12.627	31.365	291.548	12.642	40.243	303.708
12.658	42.302	314.556	12.674	42.313	338.998	12.690	46.643	345.941
12.706	48.357	358.939	12.721	53.180	366.609	12.737	51.050	369.529
12.753	49.762	371.703	12.769	53.807	368.867	12.785	53.495	360.053
12.801	47.257	343.561	12.817	44.974	333.347	12.833	41.268	306.816
12.849	39.743	284.246	12.865	40.054	264.703	12.881	36.772	239.768
12.897	34.003	222.334	12.914	27.374	204.732	12.930	24.341	186.469
12.946	22.249	167.254	12.962	22.964	150.001	12.979	20.747	139.896
12.995	22.387	125.544	13.011	16.402	119.039	13.028	16.102	106.665
13.044	14.063	99.828	13.061	16.649	91.203	13.077	11.720	84.136
13.094	15.943	79.644	13.110	12.626	79.071	13.127	12.829	73.255
13.144	14.094	68.572	13.160	12.894	64.164	13.177	13.781	63.486
13.194	8.720	66.559	13.210	11.874	63.151	13.227	10.967	60.643
13.244	8.849	60.657	13.261	13.488	61.987	13.278	13.101	61.755
13.295	10.119	65.572	13.312	11.924	64.701	13.329	15.102	65.788
13.346	14.488	69.308	13.363	17.207	71.480	13.380	16.292	71.241
13.397	17.779	71.703	13.414	15.630	75.590	13.431	16.475	76.419
13.448	18.013	74.767	13.466	19.619	76.156	13.483	18.495	76.666
13.500	18.135	78.367	13.517	18.384	82.138	13.535	17.814	84.768
13.552	17.561	89.275	13.570	17.099	93.133	13.587	21.731	95.329
13.605	18.373	99.378	13.622	20.901	103.962	13.640	20.503	104.662
13.657	14.515	110.897	13.675	13.959	108.488	13.693	11.922	108.267
13.710	14.683	105.994	13.728	14.408	99.095	13.746	9.060	97.248
13.764	6.756	92.430	13.782	10.204	82.420	13.799	11.111	79.614
13.817	6.176	73.985	13.835	9.018	66.082	13.853	6.389	64.352
13.871	6.560	57.841	13.889	5.883	54.034	13.908	4.718	48.098
13.926	6.617	45.864	13.944	6.753	42.019	13.962	2.541	40.821
13.980	6.397	37.240	13.999	5.850	36.074	14.017	3.037	35.374

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs...

E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION		
14.035	4.663	32.947	14.054	4.803	29.952	14.072	5.095	28.572
14.090	6.170	28.356	14.109	7.859	25.951	14.127	2.395	25.583
14.146	5.588	24.225	14.165	5.380	23.528	14.183	4.459	22.166
14.202	3.093	22.984	14.221	3.520	22.290	14.239	6.684	19.493
14.258	4.470	19.375	14.277	5.095	20.229	14.296	6.008	18.053
14.315	5.922	17.347	14.334	7.051	18.588	14.353	3.090	17.780
14.372	5.415	16.811	14.391	5.856	16.842	14.410	3.397	16.084
14.429	5.715	15.138	14.448	6.920	15.137	14.467	2.941	15.949
14.486	2.681	15.480	14.506	3.126	14.540	14.525	4.725	13.762
14.544	3.105	14.369	14.564	5.145	14.469	14.583	6.491	13.951
14.603	3.555	13.850	14.622	7.260	12.492	14.642	3.649	15.077
14.661	5.254	13.879	14.681	3.054	14.767	14.701	5.200	13.969
14.720	4.095	13.691	14.740	6.284	13.768	14.760	7.784	13.750
14.780	7.036	14.559	14.800	10.092	15.401	14.819	6.586	15.614
14.839	6.613	16.056	14.859	11.362	16.365	14.879	9.286	18.545
14.899	8.099	19.696	14.920	10.071	21.571	14.940	14.938	22.027
14.960	17.782	25.379	14.980	16.091	27.289	15.000	18.355	32.808
15.021	20.541	36.418	15.041	19.469	43.156	15.061	23.361	49.409
15.082	27.717	57.337	15.102	34.669	72.460	15.123	36.705	86.261
15.143	47.853	106.848	15.164	53.612	127.214	15.185	54.665	149.488
15.205	62.133	171.183	15.226	67.922	189.743	15.247	71.542	215.081
15.268	74.954	227.937	15.289	80.033	229.690	15.309	78.742	223.914
15.330	73.015	224.747	15.351	66.777	210.087	15.372	67.705	199.990
15.393	58.014	194.524	15.415	55.637	174.266	15.436	48.746	159.993
15.457	45.763	146.615	15.478	41.731	136.650	15.499	39.525	122.444
15.521	31.526	114.850	15.542	27.276	106.942	15.564	22.953	99.451
15.585	21.738	92.356	15.607	20.092	88.326	15.628	14.086	83.331
15.650	12.910	87.266	15.671	10.733	83.953	15.693	12.009	82.201
15.715	9.926	81.953	15.737	9.555	79.786	15.758	8.967	82.375
15.780	6.817	84.485	15.802	9.689	83.599	15.824	6.933	89.722
15.846	6.348	94.791	15.868	11.082	96.249	15.890	7.520	103.406
15.912	12.301	104.423	15.935	10.144	112.460	15.957	13.712	116.819
15.979	11.676	124.968	16.001	12.690	128.775	16.024	12.221	138.252
16.046	15.565	141.399	16.069	14.110	152.838	16.091	18.492	155.317
16.114	18.712	160.547	16.136	21.416	164.295	16.159	16.625	163.971
16.182	15.120	170.027	16.205	16.339	167.086	16.227	22.918	161.879
16.250	19.418	164.191	16.273	19.826	164.911	16.296	23.735	162.317
16.319	24.436	163.465	16.342	26.475	171.512	16.365	29.734	175.432
16.388	30.377	182.615	16.412	30.936	195.966	16.435	29.990	199.210
16.458	36.466	197.274	16.481	37.254	197.588	16.505	40.384	196.733
16.528	35.539	192.611	16.552	35.623	180.909	16.575	31.867	171.036
16.599	28.271	145.753	16.622	25.556	124.937	16.646	24.650	108.713
16.670	19.326	92.439	16.694	16.431	82.123	16.718	16.012	68.328
16.741	11.261	59.556	16.765	9.837	52.774	16.789	9.659	45.934
16.813	7.013	45.075	16.838	8.286	38.422	16.862	8.910	34.744
16.886	6.416	31.616	16.910	6.633	28.216	16.934	6.663	27.331
16.959	6.583	26.358	16.983	5.189	26.220	17.008	6.549	23.609
17.032	4.817	24.117	17.057	2.459	24.109	17.081	4.821	21.664
17.106	5.987	21.782	17.131	5.277	20.721	17.156	3.664	20.925
17.180	4.594	20.555	17.205	3.672	20.012	17.230	3.176	20.524

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
17.255	3.455	20.096	17.280	4.379	20.966	17.306	5.754	19.814
17.331	5.139	19.773	17.356	5.445	19.000	17.381	7.001	19.838
17.407	3.360	22.346	17.432	5.062	20.070	17.457	5.659	20.385
17.483	2.723	20.869	17.508	2.606	23.865	17.534	5.311	22.868
17.560	4.164	23.951	17.585	4.148	27.556	17.611	6.865	28.677
17.637	8.573	31.290	17.663	7.398	33.913	17.689	8.229	37.419
17.715	6.934	42.854	17.741	14.169	45.704	17.767	15.786	55.412
17.793	12.288	62.620	17.820	14.924	69.892	17.846	21.145	76.850
17.872	23.927	85.085	17.899	16.069	92.470	17.925	17.209	90.907
17.952	19.284	87.763	17.978	16.776	82.771	18.005	17.301	78.033
18.032	14.923	71.499	18.058	13.072	67.150	18.085	12.077	63.194
18.112	12.430	58.348	18.139	12.768	57.389	18.166	10.673	55.469
18.193	9.477	57.716	18.220	12.170	59.615	18.247	10.205	63.474
18.275	12.390	63.706	18.302	12.417	71.378	18.329	11.716	75.657
18.357	12.065	80.916	18.384	14.909	85.096	18.412	13.713	88.982
18.439	14.373	93.150	18.467	17.800	92.919	18.495	18.263	93.625
18.523	21.218	91.974	18.551	21.056	94.386	18.578	21.428	99.866
18.606	24.012	110.291	18.635	25.838	121.281	18.663	29.844	136.921
18.691	30.258	155.908	18.719	34.759	187.125	18.747	35.406	211.974
18.776	46.234	237.776	18.804	42.332	264.979	18.833	47.841	283.849
18.861	45.277	297.460	18.890	50.589	299.217	18.919	48.892	292.084
18.947	36.984	284.141	18.976	36.227	253.222	19.005	29.955	224.907
19.034	24.981	201.647	19.063	27.536	179.764	19.092	18.745	158.006
19.121	21.452	137.293	19.151	20.573	125.342	19.180	15.266	108.444
19.209	19.377	97.307	19.239	19.659	85.301	19.268	19.568	79.069
19.298	17.039	73.083	19.327	19.141	70.509	19.357	14.395	63.176
19.387	9.437	62.219	19.417	9.072	57.634	19.447	5.945	54.301
19.477	6.568	53.156	19.507	6.436	51.529	19.537	5.850	48.329
19.567	2.916	46.503	19.597	1.860	46.453	19.628	3.246	46.717
19.658	6.894	44.232	19.689	3.551	45.637	19.719	3.784	45.022
19.750	4.726	44.748	19.780	2.073	43.573	19.811	6.886	43.037
19.842	3.234	42.907	19.873	7.991	43.271	19.904	4.086	45.524
19.935	6.150	47.789	19.966	7.942	46.470	19.997	6.584	46.306
20.028	6.949	47.864	20.060	1.529	52.374	20.091	5.548	53.534
20.123	8.630	55.623	20.154	6.550	57.127	20.186	8.203	60.016
20.218	12.497	64.646	20.249	7.876	76.290	20.281	8.161	76.688
20.313	13.541	87.435	20.345	14.940	95.046	20.377	15.856	106.591
20.409	21.584	116.623	20.442	20.028	124.965	20.474	16.124	135.024
20.506	16.760	137.939	20.539	17.810	135.750	20.571	21.870	134.116
20.604	19.263	131.794	20.637	16.777	118.720	20.669	18.225	107.740
20.702	15.194	99.467	20.735	16.347	87.574	20.768	15.717	77.823
20.801	13.504	72.759	20.835	9.301	72.833	20.868	9.172	65.730
20.901	12.687	60.147	20.935	11.561	58.591	20.968	6.773	59.638
21.002	9.993	57.940	21.035	9.876	57.650	21.069	4.591	56.029
21.103	6.243	60.777	21.137	12.777	57.579	21.171	5.267	61.585
21.205	3.242	61.958	21.239	6.900	69.257	21.273	9.146	68.959
21.307	9.147	73.195	21.342	9.619	78.198	21.376	7.753	86.588
21.411	12.582	92.957	21.445	10.927	98.803	21.480	14.094	109.009
21.515	19.887	117.295	21.550	19.442	129.214	21.585	20.378	146.482
21.620	26.104	170.022	21.655	35.329	195.898	21.690	39.133	219.910

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs.

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
21.726	50.685	241.709	21.761	55.191	266.043	21.797	62.066	282.768
21.832	61.210	281.159	21.868	54.945	281.823	21.904	50.463	276.085
21.939	46.562	264.140	21.975	41.100	262.206	22.011	39.607	270.576
22.047	41.011	286.353	22.084	46.417	313.987	22.120	45.934	333.710
22.156	47.502	366.167	22.193	46.432	405.143	22.229	55.010	432.001
22.266	56.441	418.932	22.303	48.784	410.294	22.340	47.982	392.476
22.376	40.499	360.638	22.413	34.293	320.774	22.451	32.391	284.595
22.488	22.791	253.775	22.525	16.639	233.997	22.562	16.651	203.194
22.600	15.406	182.174	22.637	10.689	170.963	22.675	10.543	153.796
22.713	9.646	142.216	22.751	7.648	132.884	22.789	6.979	126.774
22.827	8.458	118.533	22.865	7.012	110.667	22.903	3.677	108.615
22.941	6.192	102.097	22.980	6.102	95.108	23.018	4.408	88.293
23.057	2.181	87.540	23.096	2.919	80.903	23.134	5.457	76.498
23.173	3.692	71.900	23.212	5.160	67.571	23.252	4.948	67.474
23.291	2.805	63.177	23.330	4.520	65.061	23.369	8.392	65.753
23.409	5.886	66.727	23.449	6.500	70.823	23.488	10.315	71.699
23.528	3.568	83.594	23.568	6.052	82.325	23.608	8.111	85.908
23.648	3.801	88.531	23.688	3.167	90.378	23.729	4.286	86.011
23.769	1.535	84.695	23.810	4.296	84.270	23.850	4.397	76.066
23.891	4.365	72.289	23.932	2.894	69.395	23.973	2.560	68.042
24.014	3.302	65.077	24.055	1.909	61.643	24.096	3.718	57.365
24.137	6.288	53.066	24.179	2.670	54.807	24.220	5.350	51.895
24.262	4.453	48.679	24.304	2.495	49.036	24.346	1.956	47.308
24.388	1.989	45.410	24.430	3.299	43.024	24.472	.953	41.557
24.515	3.886	40.349	24.557	2.245	39.856	24.600	3.227	37.730
24.642	3.105	37.979	24.685	3.494	39.942	24.728	3.513	39.577
24.771	5.311	42.576	24.814	4.693	43.177	24.857	7.412	49.083
24.901	7.514	54.001	24.944	6.171	62.523	24.988	10.483	74.913
25.031	12.299	85.302	25.075	12.333	95.831	25.119	15.824	109.421
25.163	17.041	118.636	25.207	15.109	116.302	25.251	11.251	111.451
25.296	13.709	106.342	25.340	9.843	90.930	25.385	5.994	82.861
25.429	5.465	75.484	25.474	3.462	69.357	25.519	3.980	67.406
25.564	4.821	62.187	25.610	2.303	61.525	25.655	3.122	59.119
25.700	1.292	56.907	25.746	2.580	57.743	25.792	3.607	55.817
25.837	2.862	54.795	25.883	2.412	52.165	25.929	2.409	53.141
25.976	.647	51.871	26.022	.871	55.941	26.068	1.786	52.620
26.115	.332	53.656	26.161	3.367	51.480	26.208	1.832	54.641
26.255	4.990	54.219	26.302	2.202	56.472	26.349	6.878	56.532
26.397	9.259	60.805	26.444	5.451	66.751	26.492	12.394	69.112
26.539	12.286	70.321	26.587	12.692	67.281	26.635	8.010	64.111
26.683	5.987	56.310	26.731	4.135	52.495	26.780	3.761	44.650
26.828	1.813	45.683	26.877	3.410	38.723	26.925	.571	38.367
26.974	.616	35.254	27.023	.266	32.137	27.072	2.523	32.200
27.122	1.931	31.900	27.171	1.805	31.245	27.221	.851	32.315
27.270	3.535	31.595	27.295	6.295	30.446	27.320	6.780	31.908
27.345	2.525	34.599	27.370	2.365	36.686	27.395	2.366	32.382
27.420	1.017	32.239	27.445	.400	31.484	27.470	2.637	33.481
27.495	-1.639	34.554	27.521	.122	33.320	27.546	-2.426	37.034
27.571	-1.736	36.656	27.596	-1.939	38.219	27.622	2.735	36.404
27.647	4.112	35.943	27.673	2.640	38.523	27.698	3.498	37.864

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION		
27.723	1.861	39.683	27.749	2.024	41.516	27.774	4.060	41.451
27.800	1.721	39.161	27.826	2.394	43.456	27.851	4.675	43.232
27.877	1.420	46.591	27.903	2.600	49.091	27.928	2.376	46.208
27.954	2.189	46.555	27.980	2.961	49.282	28.006	1.923	51.499
28.032	2.483	52.942	28.058	4.684	55.224	28.084	3.794	55.223
28.110	2.894	57.850	28.136	9.749	56.705	28.162	7.306	62.661
28.188	9.441	63.278	28.214	7.002	64.912	28.240	7.588	63.710
28.267	11.794	61.504	28.293	11.142	60.455	28.319	5.774	57.518
28.345	9.753	54.636	28.372	8.097	55.426	28.398	5.296	53.451
28.425	1.480	53.845	28.451	6.446	54.511	28.478	5.860	60.529
28.504	7.500	56.932	28.531	5.555	66.243	28.557	6.234	67.475
28.584	4.204	68.183	28.611	4.447	75.868	28.638	7.846	77.029
28.664	3.740	85.490	28.691	8.427	89.129	28.718	6.240	93.575
28.745	4.271	99.617	28.772	3.052	107.208	28.799	11.713	106.186
28.826	1.949	118.345	28.853	5.669	121.734	28.880	7.507	123.091
28.907	6.676	130.048	28.934	9.730	127.885	28.961	9.538	131.317
28.989	7.460	132.869	29.016	6.939	129.117	29.043	4.324	129.626
29.071	7.209	118.965	29.098	4.062	114.597	29.125	9.789	104.678
29.153	8.598	93.653	29.180	9.296	91.387	29.208	2.929	88.245
29.235	8.566	76.814	29.263	6.830	73.297	29.291	6.279	70.877
29.318	6.632	66.169	29.346	3.952	64.280	29.374	5.091	60.121
29.402	8.748	59.151	29.430	8.875	57.309	29.458	8.815	56.336
29.485	5.428	55.453	29.513	12.380	52.416	29.541	4.487	51.033
29.570	10.106	46.456	29.598	7.945	39.552	29.626	6.759	37.041
29.654	4.054	33.676	29.682	2.522	29.532	29.710	4.277	26.573
29.739	4.559	24.957	29.767	5.157	22.913	29.795	4.620	22.815
29.824	1.149	22.989	29.852	4.254	23.007	29.881	7.226	23.445
29.909	1.898	22.727	29.938	1.118	23.613	29.967	2.771	25.097
29.995	4.687	26.075	30.024	2.969	26.610	30.053	7.714	27.887
30.081	2.951	28.972	30.110	1.108	30.530	30.139	1.505	31.564
30.168	4.575	33.247	30.197	3.122	31.974	30.226	4.490	35.728
30.255	3.577	38.980	30.284	1.136	42.113	30.313	7.015	44.248
30.342	3.302	47.170	30.372	3.600	47.176	30.401	3.546	53.993
30.430	2.271	58.510	30.459	6.391	58.711	30.489	3.528	67.363
30.518	6.554	73.594	30.548	7.912	73.975	30.577	8.494	79.905
30.607	9.540	81.615	30.636	10.640	82.848	30.666	9.963	81.364
30.696	16.425	74.621	30.725	11.326	76.185	30.755	11.202	70.186
30.785	9.931	61.592	30.815	11.154	58.165	30.845	8.618	54.692
30.875	11.818	45.545	30.905	6.635	46.298	30.935	4.480	41.589
30.965	5.870	40.691	30.995	8.172	42.810	31.025	9.450	41.694
31.055	6.272	46.882	31.085	7.373	48.112	31.116	4.092	51.950
31.146	2.039	55.041	31.176	1.617	55.404	31.207	3.855	58.745
31.237	5.191	58.489	31.268	4.658	58.460	31.298	4.020	61.174
31.329	4.428	61.255	31.360	2.912	62.715	31.390	6.015	60.039
31.421	2.196	61.488	31.452	4.490	63.286	31.483	3.051	62.718
31.513	2.124	63.945	31.544	5.322	64.442	31.575	2.686	67.856
31.606	4.647	72.620	31.637	6.303	77.004	31.668	8.722	76.520
31.700	7.566	87.346	31.731	13.478	92.162	31.762	12.772	100.597
31.793	13.270	106.767	31.825	14.982	112.817	31.856	15.508	123.617
31.887	23.513	124.076	31.919	18.825	123.984	31.950	19.619	123.509

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E(keV) CAPTURE		FISSION		E(keV) CAPTURE		FISSION		E(keV) CAPTURE		FISSION	
31.982	16.972	117.661	32.014	20.087	105.037	32.045	14.724	95.915			
32.077	17.546	85.792	32.109	13.245	75.182	32.140	12.515	65.153			
32.172	8.175	57.779	32.204	6.106	50.482	32.236	8.154	44.991			
32.268	5.108	38.754	32.300	6.144	37.305	32.332	4.678	35.891			
32.364	2.618	31.952	32.396	4.044	34.362	32.429	3.603	35.471			
32.461	-.043	36.107	32.493	4.647	36.542	32.526	2.952	38.738			
32.558	4.359	39.876	32.591	1.117	40.135	32.623	-.960	44.359			
32.656	.265	47.149	32.688	5.297	44.966	32.721	3.443	48.014			
32.754	2.719	51.786	32.786	.024	55.351	32.819	5.139	58.198			
32.852	4.993	54.676	32.885	2.509	60.036	32.918	4.396	60.876			
32.951	.420	59.298	32.984	4.514	62.811	33.017	.626	63.112			
33.050	.633	66.796	33.083	3.591	65.559	33.117	-.563	64.901			
33.150	-.241	64.374	33.183	2.846	65.870	33.217	-.608	62.765			
33.250	-.333	63.639	33.284	1.365	62.084	33.317	-1.370	64.622			
33.351	-2.213	65.234	33.384	6.729	62.554	33.418	-1.316	65.255			
33.452	-1.909	67.530	33.486	1.520	66.384	33.520	.669	66.414			
33.553	.747	69.347	33.587	-1.504	71.417	33.621	-2.279	73.561			
33.656	-.437	71.254	33.690	2.332	75.251	33.724	-.329	74.176			
33.758	3.950	74.867	33.792	-3.147	77.435	33.827	1.838	76.683			
33.861	-.538	79.743	33.895	1.247	80.801	33.930	-2.596	82.629			
33.964	-.970	83.462	33.999	-.506	87.427	34.034	-2.913	88.499			
34.068	-1.037	85.781	34.103	-2.874	94.409	34.138	3.874	91.917			
34.173	.069	92.605	34.208	3.250	91.278	34.243	3.057	93.426			
34.278	1.447	97.293	34.313	1.800	97.246	34.348	2.238	99.382			
34.383	.726	98.477	34.418	3.182	97.765	34.454	6.067	97.900			
34.489	3.468	95.974	34.524	6.233	90.129	34.560	1.236	89.419			
34.595	.980	85.209	34.631	4.972	80.336	34.666	2.091	73.043			
34.702	.203	70.407	34.738	7.977	63.849	34.774	.493	61.797			
34.809	4.208	55.566	34.845	3.121	56.784	34.881	.676	55.806			
34.917	.674	54.312	34.953	-2.455	58.085	34.989	.219	57.206			
35.026	.434	53.184	35.062	.160	58.904	35.098	-1.578	58.292			
35.134	-1.319	56.817	35.171	-.741	58.726	35.207	-.760	56.199			
35.244	-1.271	54.127	35.280	1.681	53.828	35.317	.509	51.045			
35.354	.104	54.514	35.390	2.633	48.925	35.427	.694	50.224			
35.464	4.062	48.311	35.501	-.958	46.871	35.538	2.505	48.330			
35.575	3.349	45.664	35.612	-1.530	43.199	35.649	-.189	43.908			
35.686	2.012	44.968	35.724	-.987	44.998	35.761	7.541	42.216			
35.798	1.955	40.510	35.836	5.369	40.101	35.873	5.021	39.917			
35.911	4.527	39.802	35.948	6.057	39.944	35.986	5.317	41.355			
36.024	6.557	39.132	36.061	6.471	36.637	36.099	8.661	40.928			
36.137	1.019	41.376	36.175	8.021	46.559	36.213	5.126	54.346			
36.251	14.000	58.922	36.289	13.823	61.722	36.328	16.120	69.500			
36.366	25.040	78.403	36.404	17.527	89.228	36.443	26.827	85.530			
36.481	20.900	85.853	36.520	23.077	82.279	36.558	14.536	74.187			
36.597	16.611	63.301	36.635	8.045	52.282	36.674	10.466	41.938			
36.713	4.983	39.477	36.752	1.894	33.285	36.791	4.565	32.392			
36.830	.856	26.616	36.869	.922	29.560	36.908	1.554	29.820			
36.947	1.546	30.117	36.986	3.004	32.853	37.026	.470	32.720			
37.065	3.553	36.184	37.104	2.507	40.630	37.144	1.001	41.019			
37.184	8.314	44.327	37.223	4.191	46.599	37.263	5.990	50.374			

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION			E(eV) CAPTURE FISSION		
37.303	3.041	52.574	37.342	6.496	54.116	37.382	2.676	59.356
37.422	3.407	54.386	37.462	6.026	50.284	37.502	2.148	49.963
37.542	.074	43.965	37.583	3.505	39.696	37.623	-1.528	35.867
37.663	3.539	29.785	37.704	3.042	25.665	37.744	1.506	22.746
37.785	5.353	20.081	37.825	1.617	19.962	37.866	2.877	16.367
37.907	2.352	16.483	37.947	1.858	16.455	37.988	3.044	15.018
38.029	1.108	14.061	38.070	-0.612	13.443	38.111	2.561	12.721
38.152	-0.528	13.398	38.193	.861	12.161	38.235	1.936	13.228
38.276	2.343	11.974	38.317	-1.317	13.041	38.359	-0.552	12.965
38.400	1.504	12.382	38.442	.763	12.950	38.484	1.892	11.834
38.525	3.001	13.851	38.567	.512	15.016	38.609	3.619	17.122
38.651	1.168	17.916	38.693	1.800	21.015	38.735	-1.571	21.217
38.777	-0.183	24.948	38.819	-0.493	28.036	38.862	.211	30.562
38.904	.163	32.723	38.946	1.527	36.986	38.989	3.689	34.290
39.031	1.189	38.595	39.074	4.441	39.865	39.117	1.437	42.648
39.159	1.475	41.507	39.202	4.446	46.954	39.245	2.804	44.168
39.288	1.351	44.285	39.331	.939	45.095	39.374	.614	49.621
39.417	2.271	46.682	39.461	.466	46.211	39.504	2.056	46.661
39.547	3.133	45.548	39.591	-0.589	44.182	39.634	1.961	46.102
39.678	4.147	45.218	39.722	1.565	43.892	39.765	5.037	44.993
39.809	.193	46.865	39.853	.393	44.363	39.897	.249	43.006
39.941	1.187	42.848	39.985	.961	43.181	40.029	2.641	43.667
40.074	1.505	41.663	40.118	1.661	43.197	40.162	5.258	43.317
40.207	.897	44.149	40.251	2.839	43.186	40.296	4.097	42.817
40.341	2.231	43.126	40.385	4.854	41.494	40.430	3.972	40.745
40.475	1.665	42.178	40.520	1.278	40.835	40.565	.504	40.161
40.610	4.166	38.445	40.656	6.540	38.602	40.701	5.105	38.629
40.746	4.250	38.708	40.792	5.024	41.351	40.837	4.360	44.529
40.883	9.909	44.806	40.929	9.393	45.148	40.974	9.275	42.613
41.020	10.266	38.317	41.066	6.223	37.449	41.112	9.749	28.907
41.158	6.728	24.244	41.204	.484	20.999	41.251	3.639	18.793
41.297	-0.346	15.948	41.343	3.173	14.110	41.390	1.179	13.405
41.436	1.634	14.079	41.483	-1.466	15.001	41.530	-0.929	14.450
41.576	-0.114	15.450	41.623	1.240	14.347	41.670	.573	15.275
41.717	-3.547	16.188	41.764	3.228	15.911	41.811	-0.643	16.896
41.859	.512	16.693	41.906	2.239	18.280	41.953	1.309	18.103
42.001	3.237	19.021	42.048	2.421	19.599	42.096	1.534	21.613
42.144	4.563	23.902	42.192	1.936	25.609	42.240	2.911	32.532
42.287	6.698	35.561	42.336	6.047	41.780	42.384	9.394	50.177
42.432	13.305	56.511	42.480	11.853	60.286	42.529	12.180	64.724
42.577	10.751	60.751	42.626	11.450	54.332	42.674	9.694	44.607
42.723	8.540	37.581	42.772	5.524	26.888	42.821	4.381	22.464
42.870	3.209	16.925	42.919	-0.911	15.997	42.968	1.044	15.227
43.017	-0.717	15.662	43.066	.523	14.543	43.116	2.580	17.606
43.165	3.461	19.555	43.215	1.991	23.508	43.264	2.640	27.025
43.314	3.909	29.141	43.364	6.247	29.491	43.414	5.437	32.193
43.464	2.983	29.458	43.514	3.914	26.926	43.564	1.293	22.908
43.614	2.619	19.404	43.665	1.433	16.641	43.715	-1.053	15.297
43.766	.568	13.559	43.816	-0.894	13.325	43.867	-0.107	13.190
43.918	2.895	13.990	43.969	-1.811	13.136	44.020	2.536	12.849

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION		
44.071	.556	13.750	44.122	1.173	12.897	44.173	.805	14.646
44.224	.647	16.015	44.276	-.034	16.683	44.327	-.112	16.952
44.379	.508	16.179	44.430	-.240	17.637	44.482	-.734	18.114
44.534	.667	16.336	44.586	-.063	16.455	44.638	1.491	16.837
44.690	1.560	15.147	44.742	-2.026	12.660	44.795	1.713	12.270
44.847	.663	12.748	44.899	.232	10.414	44.952	1.272	9.895
45.005	2.835	9.097	45.057	2.634	9.382	45.110	-.273	9.816
45.163	-.952	10.554	45.216	.903	9.600	45.269	3.728	8.478
45.323	1.002	8.567	45.376	-.643	9.713	45.429	3.408	8.502
45.483	-.521	8.768	45.537	-.093	8.382	45.590	1.808	9.094
45.644	2.945	9.559	45.698	5.621	12.574	45.752	8.498	15.552
45.806	9.001	19.965	45.860	8.323	24.545	45.914	11.805	29.672
45.969	10.930	34.477	46.023	10.985	37.607	46.078	15.365	32.760
46.133	8.826	30.116	46.187	4.403	26.744	46.242	6.763	22.712
46.297	3.846	19.361	46.352	3.037	17.863	46.407	1.267	19.015
46.463	.281	17.718	46.518	-.100	18.509	46.573	-.025	19.126
46.629	-.387	18.834	46.685	1.600	20.766	46.740	1.952	22.914
46.796	2.947	25.492	46.852	2.151	31.219	46.908	3.634	34.617
46.964	3.200	30.925	47.021	2.378	40.178	47.077	2.345	44.511
47.133	3.704	44.423	47.190	1.569	44.353	47.247	3.819	41.463
47.303	3.875	36.158	47.360	4.776	31.109	47.417	2.166	27.533
47.474	4.793	23.604	47.531	3.126	18.965	47.589	4.989	17.361
47.646	3.198	15.077	47.703	2.349	13.842	47.761	1.853	11.748
47.819	1.695	11.715	47.877	5.769	10.887	47.934	3.615	11.639
47.992	7.350	14.003	48.051	7.791	15.895	48.109	9.387	19.570
48.167	15.336	25.224	48.225	18.185	31.975	48.284	21.200	44.053
48.343	27.273	60.117	48.401	37.901	74.419	48.460	39.693	94.460
48.519	47.372	115.099	48.578	48.522	125.105	48.637	48.114	127.441
48.697	41.365	116.441	48.756	27.279	94.207	48.816	19.957	72.334
48.875	11.448	57.645	48.935	11.685	44.179	48.995	6.135	39.292
49.055	5.187	34.714	49.115	3.713	31.238	49.175	4.427	27.733
49.235	5.306	23.208	49.296	.217	22.700	49.356	.680	18.977
49.417	4.386	16.214	49.477	1.144	15.002	49.538	-.150	14.936
49.599	2.385	14.927	49.660	1.778	15.945	49.721	-.120	16.590
49.783	2.119	17.323	49.844	1.494	17.178	49.906	.513	18.921
49.967	1.098	20.842	50.029	2.026	20.597	50.091	3.173	21.764
50.153	2.746	23.589	50.215	-.595	25.799	50.277	1.886	23.313
50.339	-1.040	24.749	50.402	2.408	23.864	50.464	.369	23.962
50.527	2.296	22.823	50.590	-1.039	21.360	50.653	-.351	21.060
50.716	.022	22.122	50.779	.285	19.013	50.842	1.975	18.437
50.905	.669	18.020	50.969	1.280	16.582	51.032	2.081	16.094
51.096	-.196	15.697	51.160	.649	14.408	51.224	2.486	13.466
51.288	-3.530	12.348	51.352	1.805	11.050	51.416	2.139	10.184
51.481	.476	9.474	51.545	-2.060	10.399	51.610	.939	9.592
51.675	2.492	10.478	51.740	-.889	9.938	51.805	-1.024	12.019
51.870	-1.421	12.415	51.935	.029	12.388	52.001	2.129	11.636
52.066	-.158	12.121	52.132	1.488	11.500	52.198	1.823	11.373
52.264	-.935	10.621	52.330	3.061	11.298	52.396	.342	12.426
52.462	4.557	13.899	52.529	.926	16.285	52.595	2.841	19.911
52.662	2.990	23.601	52.729	4.630	30.414	52.795	4.440	39.047

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION		
52.862	4.213	42.345	52.930	4.597	48.710	52.997	1.894	56.289
53.064	5.211	52.203	53.132	5.140	50.352	53.200	5.098	46.309
53.267	7.355	43.337	53.335	5.535	43.926	53.403	1.592	42.469
53.472	3.472	39.142	53.540	6.131	39.327	53.609	3.195	45.231
53.677	6.598	46.396	53.746	6.500	53.808	53.815	6.081	60.053
53.884	9.111	68.255	53.953	5.254	70.354	54.022	7.501	69.084
54.092	8.100	65.438	54.161	4.252	64.357	54.231	4.811	57.371
54.300	4.067	56.728	54.370	7.159	59.618	54.441	4.972	64.138
54.511	9.950	60.397	54.581	12.460	78.100	54.652	11.837	86.296
54.722	12.880	84.107	54.793	12.739	77.873	54.864	8.005	68.829
54.935	4.374	58.796	55.006	5.651	51.233	55.077	4.604	46.689
55.149	1.742	44.222	55.220	3.655	47.341	55.292	3.096	49.428
55.364	1.463	51.272	55.436	4.057	54.458	55.508	3.767	64.028
55.580	2.851	70.913	55.653	5.486	74.441	55.725	4.519	82.842
55.798	7.394	88.932	55.871	4.652	92.900	55.944	6.895	96.577
56.017	9.005	99.170	56.090	6.667	98.861	56.164	10.895	97.504
56.237	9.413	102.193	56.311	11.435	103.380	56.385	9.602	100.611
56.459	8.320	98.341	56.533	6.347	86.283	56.607	3.106	81.687
56.682	1.861	76.583	56.756	3.983	70.400	56.831	1.435	71.847
56.906	5.612	71.017	56.981	1.060	76.914	57.056	2.201	76.491
57.131	3.725	86.863	57.207	2.013	87.264	57.283	4.690	87.234
57.358	2.854	93.189	57.434	5.132	93.391	57.510	2.834	87.735
57.587	4.033	84.354	57.663	3.168	76.125	57.739	4.418	72.393
57.816	2.881	65.014	57.893	2.415	61.131	57.970	3.830	60.850
58.047	3.512	60.797	58.124	2.867	58.911	58.202	5.091	61.338
58.279	4.015	61.091	58.357	1.270	67.409	58.435	1.741	67.221
58.513	4.375	55.874	58.591	5.778	51.397	58.670	4.096	42.084
58.748	4.385	32.950	58.827	5.030	26.426	58.906	2.128	23.770
58.985	5.133	21.013	59.064	5.844	19.212	59.144	1.590	17.026
59.223	5.199	16.568	59.303	1.319	15.300	59.383	1.048	14.689
59.463	5.132	13.258	59.543	1.310	12.967	59.623	5.624	12.609
59.703	5.467	12.993	59.784	5.421	14.027	59.865	5.679	14.266
59.946	5.227	13.768	60.027	1.358	16.132	60.108	5.682	16.211
60.190	5.024	17.982	60.271	5.436	18.465	60.353	5.984	19.883
60.435	5.588	22.994	60.517	5.751	26.718	60.599	1.796	27.944
60.682	1.803	33.956	60.765	5.413	38.605	60.847	4.082	43.538
60.930	4.342	49.544	61.013	1.105	54.864	61.097	4.547	60.606
61.180	5.368	66.498	61.264	5.344	69.625	61.348	4.518	67.290
61.432	4.507	61.517	61.516	4.730	52.141	61.600	3.748	41.493
61.685	3.063	32.316	61.769	4.480	25.738	61.854	3.639	20.932
61.939	6.067	20.205	62.024	5.269	19.015	62.110	7.635	21.768
62.195	11.344	31.772	62.281	15.475	41.132	62.367	24.060	56.173
62.453	28.759	64.520	62.539	32.140	69.913	62.626	29.534	64.967
62.712	17.450	46.671	62.799	13.658	31.845	62.886	5.301	23.045
62.973	4.952	17.845	63.061	7.623	16.429	63.148	5.242	17.490
63.236	3.199	17.236	63.324	1.701	19.997	63.412	5.115	20.434
63.500	5.926	21.821	63.589	4.217	26.931	63.677	5.633	33.366
63.766	4.877	37.679	63.855	6.126	44.965	63.944	8.073	49.476
64.034	6.593	53.160	64.123	8.386	55.021	64.213	12.630	66.559
64.303	15.865	72.800	64.393	14.901	71.233	64.483	12.757	69.924

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION		
64.574	6.785	54.497	64.665	7.153	41.987	64.756	4.031	35.091
64.847	4.614	36.879	64.938	7.244	35.391	65.029	6.534	39.783
65.121	3.359	38.253	65.213	-3.070	33.101	65.305	3.394	30.635
65.397	.064	25.222	65.490	-2.373	25.095	65.582	.327	21.677
65.675	2.652	20.784	65.768	3.374	19.283	65.861	.380	18.963
65.955	-.568	18.953	66.048	1.041	19.224	66.142	3.649	20.284
66.236	3.814	19.525	66.330	2.738	20.024	66.425	2.208	17.825
66.520	5.427	14.893	66.614	-1.490	16.250	66.709	5.912	16.727
66.805	8.484	16.640	66.900	1.600	18.369	66.996	6.916	17.186
67.092	4.957	17.470	67.188	6.935	19.692	67.284	3.266	19.242
67.380	11.512	19.351	67.477	8.553	20.647	67.574	6.641	19.796
67.671	8.407	21.609	67.768	3.715	26.868	67.866	4.565	27.163
67.964	4.304	26.575	68.062	2.815	25.342	68.160	2.908	23.266
68.258	2.010	21.717	68.357	.355	22.799	68.455	2.813	24.075
68.554	3.191	26.301	68.654	-1.217	31.721	68.753	-.331	35.976
68.853	1.956	39.481	68.953	1.716	41.632	69.053	.822	46.388
69.153	1.130	48.890	69.254	1.899	47.818	69.354	2.121	47.141
69.455	-.256	46.258	69.556	2.281	45.384	69.658	2.503	47.230
69.759	5.389	49.586	69.861	1.907	54.031	69.963	2.998	57.862
70.066	2.411	58.220	70.168	4.666	59.367	70.271	8.963	54.929
70.374	3.477	46.753	70.477	1.683	34.270	70.581	1.246	25.202
70.684	.337	20.929	70.788	-1.053	17.414	70.892	.710	15.452
70.996	-.399	14.242	71.101	1.465	13.921	71.206	2.840	14.634
71.311	-.605	16.006	71.416	1.887	17.625	71.522	.757	19.824
71.627	2.003	21.059	71.733	-1.975	21.726	71.840	2.213	21.551
71.946	.994	22.442	72.053	2.464	21.202	72.160	-.372	21.974
72.267	1.650	21.051	72.374	3.539	21.424	72.482	1.364	20.476
72.590	4.296	20.908	72.698	3.566	22.619	72.806	4.346	24.653
72.915	11.301	32.120	73.024	14.501	39.615	73.133	18.558	58.084
73.242	27.193	78.420	73.352	37.731	91.584	73.461	34.397	98.036
73.571	28.834	102.382	73.682	13.657	104.643	73.792	12.717	108.851
73.903	7.403	122.479	74.014	13.072	117.412	74.125	9.011	101.963
74.237	8.349	87.234	74.349	6.787	67.645	74.461	5.972	52.712
74.573	4.573	48.348	74.686	4.643	46.503	74.799	5.514	51.417
74.912	8.384	58.026	75.025	9.062	68.171	75.139	11.957	78.633
75.252	13.280	93.641	75.367	12.054	102.937	75.481	16.317	106.459
75.596	11.220	88.309	75.711	8.126	63.653	75.826	5.045	42.415
75.941	2.192	27.566	76.057	1.533	22.160	76.173	1.143	19.151
76.289	-1.710	19.525	76.405	.015	20.090	76.522	.255	19.857
76.639	.116	19.300	76.756	1.345	19.690	76.874	.460	19.418
76.992	-2.369	18.674	77.110	-.413	18.707	77.228	-1.584	19.651
77.347	.053	23.243	77.466	2.088	21.823	77.585	.897	26.758
77.705	-.051	33.336	77.824	-.223	41.125	77.944	1.973	51.973
78.065	1.227	56.204	78.185	1.749	57.911	78.306	1.214	57.094
78.427	2.548	47.885	78.549	.986	38.503	78.670	2.071	37.017
78.792	3.414	33.691	78.915	2.197	35.389	79.037	2.591	34.943
79.160	.019	37.152	79.283	.695	40.107	79.406	2.574	46.949
79.530	1.960	56.042	79.654	1.479	59.863	79.778	4.251	59.604
79.903	2.957	53.456	80.028	1.558	41.940	80.153	2.305	32.522
80.278	3.002	24.290	80.404	-1.198	20.686	80.530	3.040	16.272

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION		
80.657	2.226	18.814	80.783	3.329	18.503	80.910	-2.218	17.881
81.037	.858	19.541	81.165	-1.879	22.545	81.293	-1.030	23.730
81.421	.512	27.880	81.549	1.549	29.254	81.678	3.431	31.099
81.807	5.460	33.532	81.936	1.740	36.276	82.066	3.468	39.813
82.196	7.297	40.187	82.326	11.465	57.763	82.457	23.427	65.659
82.538	39.714	72.074	82.719	52.813	78.600	82.851	65.479	72.620
82.982	43.809	50.571	83.115	13.708	27.011	83.247	6.015	14.950
83.380	.043	9.127	83.513	-1.941	9.370	83.646	-1.845	7.830
83.780	.327	6.596	83.914	.676	8.877	84.048	1.542	8.890
84.183	-.375	9.885	84.318	2.869	10.503	84.454	-.718	10.663
84.589	-2.644	12.082	84.725	-.398	14.155	84.862	-1.967	16.023
84.998	2.417	19.771	85.135	1.762	25.788	85.273	-.389	28.047
85.410	-.075	22.623	85.548	.590	18.774	85.687	-.869	14.632
85.825	.986	12.485	85.964	-.830	8.732	86.104	.692	9.241
86.243	.957	7.014	86.383	-1.280	7.008	86.524	-.299	8.179
86.664	1.691	8.796	86.805	1.118	10.754	86.947	3.958	12.465
87.089	2.942	13.914	87.231	-.418	12.775	87.373	-1.099	10.933
87.516	2.770	7.956	87.659	-.423	9.053	87.802	.864	8.965
87.946	1.116	10.162	88.090	-.948	13.894	88.235	3.453	18.080
88.380	2.840	26.820	88.525	11.337	37.658	88.671	9.124	52.837
88.817	8.425	64.632	88.963	7.068	40.501	89.110	4.134	20.926
89.257	7.279	15.751	89.404	3.460	16.929	89.552	10.673	22.763
89.700	5.329	30.943	89.849	7.980	40.575	89.998	14.200	60.742
90.147	24.757	95.153	90.297	43.219	129.093	90.447	61.190	163.891
90.597	65.388	66.938	90.748	46.789	129.442	90.899	23.646	69.173
91.050	6.666	39.652	91.202	3.520	26.784	91.355	-.296	22.620
91.507	1.773	19.577	91.660	-.157	18.083	91.814	-.797	18.353
91.967	-1.328	19.638	92.122	2.469	20.774	92.276	.747	22.783
92.431	.597	27.307	92.587	-.009	30.309	92.742	2.883	32.933
92.898	4.241	28.739	93.055	3.613	23.901	93.212	1.431	26.272
93.359	6.262	27.595	93.527	9.667	33.806	93.685	20.099	40.853
93.844	19.864	37.572	94.003	16.982	28.245	94.162	5.992	15.764
94.322	2.901	10.615	94.482	4.866	10.860	94.642	2.740	13.062
94.803	4.708	21.230	94.965	9.516	29.124	95.127	11.803	41.971
95.289	15.724	43.824	95.451	9.223	36.641	95.614	4.299	26.691
95.778	3.841	25.210	95.942	4.239	27.095	96.106	1.427	27.537
96.271	-.193	32.024	96.436	1.150	31.027	96.602	4.040	31.872
96.768	2.953	31.457	96.934	5.263	31.421	97.101	7.948	38.578
97.268	15.465	48.595	97.436	30.417	62.356	97.604	48.808	85.837
97.773	71.983	116.473	97.942	70.252	116.057	98.111	38.973	86.035
98.281	17.159	60.789	98.451	9.213	62.821	98.622	9.471	61.315
98.793	10.572	54.396	98.965	1.417	45.127	99.137	1.984	38.907
99.310	1.465	40.653	99.483	.601	41.550	99.656	2.930	46.252
99.830	6.489	48.100	100.005	3.060	52.529	100.179	-3.458	43.206
100.355	.935	31.613	100.531	-.483	20.548	100.707	-3.139	15.549
100.884	.752	12.736	101.061	-1.927	10.820	101.238	-.726	11.063
101.416	3.695	10.776	101.595	-5.487	10.322			

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION			E (eV) CAPTURE FISSION		
161.117	2.116	14.123	161.475	.503	22.969	161.834	9.004	30.114
162.194	15.579	41.037	162.555	13.362	40.663	162.917	8.321	35.636
163.281	1.667	27.448	163.646	4.190	20.323	164.012	1.594	16.265
164.380	1.627	18.028	164.748	9.591	31.805	165.118	9.163	53.653
165.489	16.776	71.362	165.862	8.493	51.802	166.235	1.398	27.214
166.610	4.479	17.630	166.986	4.617	21.685	167.364	11.969	25.865
167.742	8.650	36.152	168.122	10.982	38.211	168.504	9.625	32.977
168.886	9.652	34.546	169.270	8.458	31.392	169.655	5.754	26.415
170.042	-1.328	21.530	170.430	7.612	16.124	170.819	2.938	17.579
171.209	1.641	22.541	171.601	2.550	23.580	171.994	.623	15.977
172.389	1.374	10.374	172.785	-1.623	11.836	173.182	.269	12.231
173.581	-2.059	14.114	173.981	.258	18.105	174.382	.839	20.107
174.785	4.521	27.192	175.189	2.936	33.873	175.595	2.769	32.511
176.002	5.909	23.113	176.410	3.456	14.672	176.820	.059	10.058
177.231	1.627	10.315	177.644	4.199	10.913	178.058	7.619	13.483
178.474	3.078	15.271	178.891	3.216	13.206	179.309	1.832	9.159
179.729	7.242	6.704	180.151	7.005	4.597	180.574	1.529	4.703
180.998	7.484	6.953	181.424	3.472	8.284	181.851	2.620	8.221
182.280	1.000	6.322	182.711	5.635	8.511	183.143	4.933	14.082
183.576	2.578	11.954	184.011	2.295	8.197	184.448	1.423	11.465
184.886	1.315	14.650	185.326	4.902	16.066	185.767	5.162	14.770
186.210	3.612	14.896	186.655	1.104	14.235	187.101	1.575	18.039
187.548	.880	25.661	187.998	3.527	33.056	188.449	1.912	32.580
188.901	3.029	32.046	189.355	4.237	39.532	189.811	1.369	52.247
190.269	2.794	49.461	190.728	2.592	48.321	191.188	7.563	48.798
191.651	1.889	41.059	192.115	1.393	28.066	192.581	1.080	21.396
193.048	-1.691	22.304	193.517	.433	21.142	193.988	2.898	18.376
194.461	2.342	15.515	194.935	-1.124	16.982	195.411	-1.569	19.264
195.889	.762	21.999	196.369	.925	25.862	196.850	4.239	31.852
197.333	9.914	32.956	197.818	7.898	41.089	198.305	9.068	37.663
198.794	5.124	22.633	199.284	2.980	24.576	199.776	2.097	21.464
200.270	3.009	19.869	200.766	3.928	24.145	201.263	2.420	19.945
201.763	1.819	24.219	202.264	2.191	38.157	202.767	5.405	28.368
203.273	1.892	12.168	203.780	.656	12.748	204.288	5.471	16.545
204.799	9.965	24.953	205.312	2.635	26.355	205.827	2.938	33.418
206.343	3.055	36.059	206.862	4.422	38.824	207.382	3.400	36.568
207.905	1.789	39.491	208.429	3.323	52.539	208.956	1.592	50.763
209.484	4.362	36.894	210.014	3.438	22.605	210.547	3.365	20.836
211.081	4.330	23.794	211.618	5.002	18.927	212.156	1.463	14.599
212.697	1.881	13.828	213.240	2.610	19.480	213.784	2.922	21.657
214.331	.617	18.351	214.880	2.488	17.119	215.431	.993	19.340
215.984	1.765	21.394	216.540	6.690	27.809	217.097	9.598	40.899
217.657	17.798	60.130	218.219	15.601	64.160	218.783	8.583	61.894
219.349	9.306	40.126	219.917	6.983	41.263	220.488	8.080	27.173
221.060	3.643	15.152	221.635	7.320	12.747	222.213	10.358	18.866
222.792	21.486	38.391	223.374	25.712	66.632	223.958	22.558	50.193
224.545	14.462	15.925	225.133	7.376	8.673	225.724	4.711	6.221
226.318	7.197	5.761	226.913	4.899	6.163	227.511	3.049	5.776
228.112	2.612	6.873	228.714	2.363	10.803	229.320	1.191	15.992
229.927	3.082	21.751	230.537	3.269	21.313	231.150	2.854	15.611

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
231.764	3.508	14.266	232.382	3.661	13.163	233.001	4.333	19.510
233.624	8.426	33.411	234.249	4.070	29.638	234.876	7.028	20.570
235.506	3.887	25.724	236.138	8.627	29.805	236.773	8.451	34.780
237.410	5.568	29.239	238.050	3.989	15.952	238.693	1.014	10.685
239.338	4.332	14.695	239.986	5.098	15.279	240.636	3.925	20.253
241.290	2.681	19.854	241.945	7.305	20.870	242.604	1.186	28.626
243.265	2.538	20.066	243.929	1.031	17.000	244.595	2.563	16.687
245.265	1.078	11.516	245.937	3.036	7.820	246.612	1.459	12.533
247.289	5.177	19.026	247.970	5.398	31.908	248.653	3.976	28.300
249.339	2.371	22.896	250.028	3.835	38.411	250.720	7.173	51.249
251.414	5.560	43.327	252.112	6.002	60.623	252.812	4.989	44.268
253.516	2.456	26.649	254.222	3.515	26.099	254.931	1.414	23.090
255.643	1.617	17.386	256.359	2.090	13.866	257.077	2.933	13.051
257.798	1.916	10.736	258.522	1.380	8.827	259.250	1.339	7.394
259.980	1.768	5.893	260.714	1.612	7.287	261.450	2.734	10.066
262.190	2.283	15.922	262.933	1.666	17.929	263.679	1.393	15.486
264.428	2.990	13.131	265.180	1.811	14.239	265.936	1.508	14.031
266.695	1.596	14.022	267.457	2.690	12.784	268.223	2.819	18.488
268.991	2.208	16.336	269.763	2.878	9.633	270.539	1.640	7.064
271.317	1.547	6.325	272.099	2.848	10.511	272.885	1.504	13.650
273.673	4.888	25.193	274.466	5.251	30.372	275.261	3.698	32.005
276.061	4.833	33.899	276.863	5.454	33.234	277.669	7.371	26.301
278.479	7.153	29.735	279.292	7.096	22.493	280.109	3.492	18.438
280.929	6.492	27.171	281.753	7.889	24.309	282.581	6.945	16.771
283.412	5.604	26.404	284.247	6.476	26.921	285.086	2.455	24.466
285.928	2.072	14.465	286.774	2.734	16.378	287.624	3.208	20.695
288.478	1.791	17.954	289.335	4.042	21.670	290.197	4.043	12.746
291.062	1.748	7.310	291.931	1.009	11.199	292.804	1.284	16.546
293.680	3.518	22.662	294.561	2.374	32.098	295.446	3.216	38.681
296.335	4.860	29.369	297.227	4.755	48.508	298.124	10.178	85.992
299.025	7.203	75.295	299.930	1.079	28.347	300.839	1.384	18.177
301.752	3.836	23.320	302.670	5.511	22.769	303.591	1.441	10.067
304.517	1.399	7.027	305.447	1.945	7.086	306.381	1.223	6.460
307.320	1.346	7.493	308.263	2.103	8.332	309.210	2.511	7.992
310.161	1.370	10.230	311.117	1.406	14.534	312.078	3.269	14.511
313.043	1.765	17.588	314.012	4.960	27.976	314.986	2.361	24.871
315.964	3.761	17.591	316.947	2.594	13.125	317.935	3.523	9.853
318.927	2.460	11.418	319.924	4.138	16.359	320.925	6.681	20.965
321.932	3.917	19.636	322.943	2.854	13.545	323.958	7.082	16.135
324.979	4.030	31.110	326.004	1.831	49.919	327.035	4.517	50.525
328.070	4.094	27.230	329.110	3.945	19.982	330.155	4.739	21.695
331.205	1.588	17.616	332.260	3.443	17.064	333.320	4.895	27.950
334.385	3.205	28.967	335.455	3.067	13.665	336.530	2.940	10.591
337.611	3.906	17.259	338.697	4.633	26.844	339.788	8.106	32.253
340.884	5.805	22.617	341.986	1.842	13.699	343.093	1.106	19.780
344.205	3.253	21.047	345.323	2.267	18.255	346.446	1.780	15.247
347.575	1.946	10.073	348.709	1.243	11.792	349.849	1.563	11.639
350.994	2.393	12.961	352.145	1.992	14.930	353.302	3.916	10.177
354.464	2.201	12.779	355.633	1.903	12.245	356.807	1.732	9.406
357.986	3.066	13.676	359.172	1.227	12.759	360.364	1.042	7.674

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNs

E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION			E (EV) CAPTURE FISSION		
361.561	7.509	5.172	362.764	4.153	10.268	363.974	4.705	21.755
365.189	4.299	32.166	366.411	2.621	45.530	367.639	4.354	40.331
368.873	3.383	22.789	370.113	2.967	21.436	371.359	3.832	35.822
372.612	7.859	48.079	373.871	2.851	32.659	375.137	5.283	35.850
376.409	6.276	20.187	377.687	4.743	12.948	378.972	2.218	9.221
380.263	3.079	6.980	381.561	2.202	10.954	382.866	6.167	21.550
384.178	2.799	25.205	385.496	5.776	21.162	386.821	6.371	12.716
388.153	10.248	11.131	389.492	8.523	15.864	390.837	10.142	19.848
392.190	7.711	10.279	393.550	5.550	7.625	394.916	7.004	15.617
396.290	5.453	21.830	397.671	2.710	16.121	399.060	2.685	8.750
400.455	1.911	8.483	401.858	.218	6.372	403.269	2.499	11.491
404.686	2.335	15.600	406.112	1.718	9.850	407.545	1.368	7.944
408.985	.874	7.348	410.433	2.115	7.057	411.889	2.198	7.702
413.352	2.053	7.373	414.824	.013	9.170	416.303	3.042	17.708
417.790	2.471	16.292	419.285	2.123	8.774	420.788	1.893	8.008
422.299	1.603	12.248	423.819	3.067	14.483	425.346	2.718	14.467
426.882	3.664	9.606	428.427	.479	12.093	429.979	1.895	7.313
431.540	.863	6.455	433.110	.900	6.249	434.688	3.003	9.452
436.275	4.910	17.450	437.870	2.198	16.146	439.475	3.450	11.835
441.088	1.793	8.249	442.710	2.792	6.955	444.341	1.912	6.765
445.981	4.378	11.966	447.630	4.383	19.636	449.288	4.547	9.629
450.956	2.082	6.307	452.632	1.515	4.753	454.319	2.711	5.342
456.014	.707	7.021	457.719	2.100	11.936	459.434	3.466	17.209
461.158	2.241	11.480	462.892	1.536	7.393	464.636	.955	10.086
466.390	3.226	15.751	468.154	2.379	15.688	469.928	3.080	13.507
471.711	3.640	11.770	473.505	1.748	10.829	475.310	4.138	15.740
477.124	2.740	18.515	478.949	2.925	14.297	480.785	2.540	17.097
482.631	5.034	21.952	484.488	2.002	17.434	486.355	2.784	14.672
488.233	3.223	18.065	490.122	4.288	26.382	492.023	2.048	12.269
493.934	4.175	13.404	495.856	4.472	14.395	497.790	2.705	9.230
499.735	3.494	7.592	501.691	2.214	11.509	503.659	5.101	18.869
505.639	3.787	14.414	507.630	4.263	15.817	509.633	4.419	12.456
511.648	5.586	12.007	513.674	5.513	13.745	515.713	6.712	14.361
517.764	8.674	15.030	519.828	4.668	22.610	521.903	6.254	20.301
523.991	6.006	13.200	526.092	4.766	11.395	528.206	1.556	16.001
530.332	4.880	17.874	532.471	4.114	14.867	534.623	3.434	13.911
536.788	2.722	17.890	538.966	3.690	17.919	541.157	3.707	11.271
543.362	3.815	7.947	545.580	6.591	13.928	547.812	4.196	26.044
550.058	13.966	16.529	552.318	5.831	9.125	554.591	6.056	8.259
556.879	6.821	8.704	559.180	8.550	12.234	561.497	11.531	15.643
563.827	13.436	9.910	566.172	12.838	14.194	568.532	14.013	17.035
570.906	13.646	15.769	573.295	12.560	15.743	575.700	9.068	17.407
578.119	5.035	7.884	580.554	6.240	10.023	583.004	5.002	15.694
585.470	6.983	18.742	587.952	8.508	15.623	590.449	7.979	17.325
592.962	5.634	16.856	595.491	6.383	13.228	598.037	5.661	7.180
600.599	5.460	9.040	603.177	3.845	7.072	605.772	3.741	7.086
608.384	4.939	14.198	611.013	5.222	23.828	613.658	4.071	14.611
616.321	5.515	16.046	619.002	4.460	16.899	621.700	2.494	11.851
624.415	6.069	13.645	627.149	4.940	24.416	629.900	5.536	25.426
632.670	5.326	32.399	635.458	6.242	23.005	638.264	5.742	20.754

TABULATION OF U-233 CAPTURE AND FISSION CROSS SECTIONS IN BARNS

E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION			E(EV) CAPTURE FISSION		
641.089	7.460	26.688	643.933	5.071	13.757	646.795	3.960	11.711
649.677	3.324	10.641	652.578	4.137	18.935	655.499	4.726	15.222
658.439	7.777	19.079	661.399	3.988	19.141	664.379	7.490	29.506
667.380	5.148	14.859	670.400	3.810	12.456	673.442	3.787	9.877
676.504	3.170	14.130	679.587	4.169	17.696	682.691	4.097	18.435
685.816	4.682	12.797	688.963	3.426	11.133	692.131	3.652	18.311
695.322	5.057	14.847	698.534	3.267	15.982	701.769	2.264	12.841
705.027	3.222	11.635	708.307	2.450	11.318	711.610	4.976	13.266
714.936	4.302	19.570	718.286	3.494	19.536	721.659	3.344	15.197
725.056	4.629	10.730	728.477	2.734	7.260	731.922	4.518	9.507
735.392	2.620	10.619	738.887	3.709	10.839	742.406	3.239	9.997
745.951	4.559	10.850	749.521	3.407	10.994	753.117	3.815	13.680
756.739	2.297	13.796	760.387	4.855	18.471	764.062	4.817	18.327
767.763	4.692	12.260	771.491	2.291	9.398	775.246	3.486	12.112
779.029	4.653	15.694	782.840	4.997	14.031	786.678	3.021	11.228
790.545	3.974	8.842	794.441	3.061	7.699	798.365	4.072	9.298
802.319	3.764	8.433	806.302	3.986	9.468	810.314	4.582	16.507
814.357	4.060	14.182	818.430	2.690	13.301	822.534	3.281	17.351
826.668	3.412	15.775	830.834	5.830	14.139	835.032	6.474	22.072
839.261	3.620	15.523	843.523	2.230	12.014	847.817	3.276	11.301
852.144	4.157	9.994	856.504	3.793	15.222	860.897	3.607	14.527
865.325	2.411	14.090	869.787	3.105	18.154	874.283	4.428	21.184
878.815	2.975	16.223	883.382	2.496	14.161	887.984	3.485	13.148
892.623	4.448	11.067	897.297	3.430	9.180	902.009	3.713	10.115
906.758	3.717	15.060	911.545	3.679	13.590	916.369	3.733	10.000
921.232	3.559	11.982	926.134	4.330	18.229	931.075	4.271	16.599
936.056	2.986	10.512	941.077	3.188	7.495	946.138	3.060	7.620
951.240	3.234	7.889	956.384	2.753	7.969	961.569	2.460	9.866
966.797	2.666	10.167	972.067	3.593	9.573	977.381	4.139	10.344
982.738	3.802	9.096	988.140	3.454	5.590	993.586	3.595	7.175
999.077	3.952	9.291	1004.614	2.641	14.647	1010.197	3.938	15.651
1015.827	4.370	7.300	1021.504	3.585	7.719	1027.229	3.734	8.526
1033.002	3.561	10.362	1038.823	2.900	9.250	1044.694	3.951	7.390
1050.615	3.299	6.410	1062.610	2.958	9.908	1074.810	3.357	9.837
1087.222	3.997	12.072	1099.850	4.160	9.094	1112.700	3.623	10.579
1125.776	4.428	7.995	1139.084	3.867	11.359	1152.629	3.093	10.206
1166.418	2.164	10.142	1180.455	4.035	11.475	1194.747	3.616	10.416
1209.300	4.134	10.373	1224.121	3.156	7.702	1239.216	3.289	10.713
1254.592	2.875	11.249	1270.256	3.664	7.985	1286.215	3.314	7.239

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