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AVERAGE NEUTRON TOTAL CROSS SECTIONS IN THE UNRESOLVED ENERGY RANGE FROM ORELA HIGH-RESOLUTION TRANSMISSION MEASUREMENTS

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ABSTRACT

Average values of the neutron total cross sections of ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu have been obtained in the unresolved resonance energy range from high-resolution transmission measurements performed at ORELA in the past two decades. The cross sections were generated by correcting the effective total cross sections for the self-shielding effects due to the resonance structure of the data. The self-shielding factors were found by calculating the effective and true cross sections with the computer code SAMMY for the same Doppler and resolution conditions as for the transmission measurements, using an appropriate set of resonance parameters. Our results are compared to results of previous measurements and to the current ENDF/B-VI data.

1. INTRODUCTION

Over the past two decades high-resolution neutron transmission measurements of ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu[1,2] were performed at the Oak Ridge Electron Linear Accelerator (ORELA) with the aim of determining the resonance parameters up to neutron energies much higher than available in the current Evaluated Data Libraries. The SAMMY[3] analyses of these data allowed the extension of the resolved resonance range to 0.6 keV for ^{233}U,[4,5] to 2.25 keV for ^{235}U,[6] to 20 keV for ^{238}U,[7] and 2.5 keV for ^{239}Pu.[8,9] The transmission measurements were performed up to several hundred keV. Because of the small experimental background and the accurate evaluation of the transmission normalization coefficients, the systematic uncertainties for the transmission data were generally less than 1%. Average effective total cross sections could be obtained from the transmission data with high accuracy in the unresolved energy range, leading to the true average total cross sections after corrections for the resonance self-shielding effect. Some results have already been published.[10,11,12]

The aim of the present report is to present the updated results of the analyses in the unresolved resonance region, with the tables of the final values of the average total cross sections. Section 2 of the report provides some details concerning the method of evaluating the self-shielding corrections. The results are presented in Section 3. The cross sections are compared with the results of measurements by Poenitz et al.[13,14] in Section 4. The conclusion emphasizes the importance of these experimental data for the evaluation of the neutron cross sections in the unresolved resonance and the higher energy ranges.

2. THE SELF-SHIELDING CORRECTIONS

The Doppler-broadened total cross section $\sigma_\Delta(E)$, at neutron energy E, is obtained from the neutron transmission T(E) of a sample of thickness *n* by the relation

$$T(E) = \exp[-n\sigma_\Delta(E)] \, , \tag{1}$$

where the cross section is given in barns (b) and *n* in atoms/b. However, the transmission of the neutrons though the sample cannot be measured at the precise energy E, but is instead an average over the experimental resolution. The quantity that is really measured is

$$T(E) = \int R(E-E')\exp[-n\sigma_\Delta(E')]\, dE' \, , \tag{2}$$

where R is the experimental resolution function.

Via the inversion of Eq. (1), one obtains the so-called effective total cross section:

$$\sigma_{eff}(E) = -(1/n) \ln [T(E)] \, . \tag{3}$$

The effective total cross section is smaller than the true Doppler-broadened cross section for the same experimental resolution. The difference is small if there is little fluctuation of the cross sections over the width of the resolution function, or if the thickness of the sample is so small that $\exp[-n\sigma_\Delta(E)]$ can be approximated by $1-n\sigma_\Delta(E)$ at all energies. The difference between the effective total cross section and the true total cross section is the self-shielding effect in the transmission measurement.

Direct mathematical derivation of the self-shielding effect is hardly feasible. Since the effect decreases with sample thickness, the true cross section could be obtained by extrapolating to zero sample thickness the variation of the effective cross section measured for several sample thicknesses. However, the accuracy of this method is limited by the fact that the cross sections measured with thin samples involve large uncertainties because of the relation $d\sigma = (-1/n)dT/T$. It is more convenient to calculate the effective cross sections and the corresponding true cross sections, using the same experimental conditions as for the experimental data, from a Monte Carlo–generated sample of resonance parameters having the same statistical properties as those obtained by analyzing the resolved resonance region, or from the sample of resonances itself shifted to the higher energy ranges. The calculations can be performed by the Reich-Moore computer code SAMMY; SAMMY calculates T(E) from the relation (2), the corresponding effective total cross section from the relation (3), and the true cross sections from the relation

$$\sigma_{R,\Delta}(E) = \int \sigma_{\Delta}(E') \, R(E-E') \, dE' \, . \tag{4}$$

The self-shielding effect is obtained from the comparison between the calculated $\sigma_{eff}(E)$ and $\sigma_{R,\Delta}(E)$.

The calculations have been performed for the nuclides presented in this report. For all these nuclides the variation of the self-shielding correction factors versus neutron energy, for cross sections averaged over an energy interval containing a large number of resonances, has roughly a linear behavior in the log-log representation, and could therefore be approximated by a relation of the form

$$\ln C = A + B \ln E \, , \tag{5}$$

where C is the relative correction and E the neutron energy.

As an example, the ^{238}U self-shielding factors calculated for the experimental conditions of the Harvey transmission measurements[1] (three sample thicknesses), are shown on Fig. 1. The calculations were performed in four energy ranges with resonance parameters obtained by shifting the ENDF/B-VI resonance sample to the energy ranges 10–20 keV, 20–30 keV, 50–60 keV, and 90–100 keV, respectively. The effective and true cross sections were calculated for each time-of-flight channel of the transmission experiments. The self-shielding factors for cross sections averaged over energy ranges containing a large number of resonances can then be obtained. The values shown in Fig. 1 correspond to averaging energy intervals of 2.5 keV. As shown in the figure, the fluctuations on the correction for cross sections averaged over 2.5-keV intervals are on the order of 25% of the correction. This method of correction therefore gives an estimate of the self-shielding uncertainties for the true total cross sections.

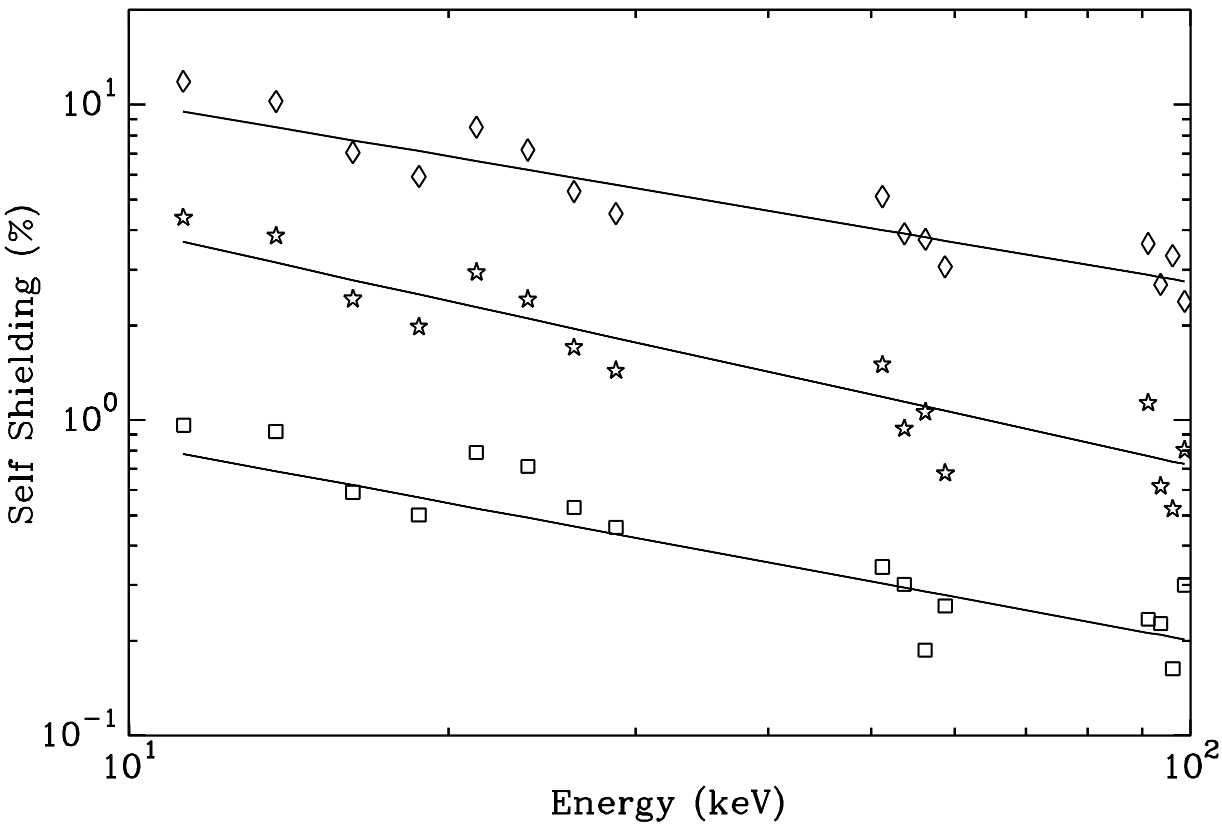

Fig. 1. Variations of the self-shielding corrections vs neutron energies for the ^{238}U thick sample (◊), the medium sample (☆), and the thin sample (□). The similarities among the various energy intervals are due to the fact that the calculations were performed with a similar sample of resonance parameters (the shifted ENDF/B-VI sample).

Figure 2 shows ^{238}U average experimental effective total cross sections vs the sample thickness at neutron energies of 10.26, 25.26, 31.26, and 50.26 keV, respectively. The true total cross sections, averaged over the three samples and obtained by applying the self-shielding corrections calculated by SAMMY, are shown at zero sample thickness. They are consistent with a linear extrapolation to zero thickness from the effective cross sections of the three different sample thicknesses. It is obvious from this figure that the extrapolation method would give larger uncertainties because of the large uncertainties on the effective cross sections for the thin sample.

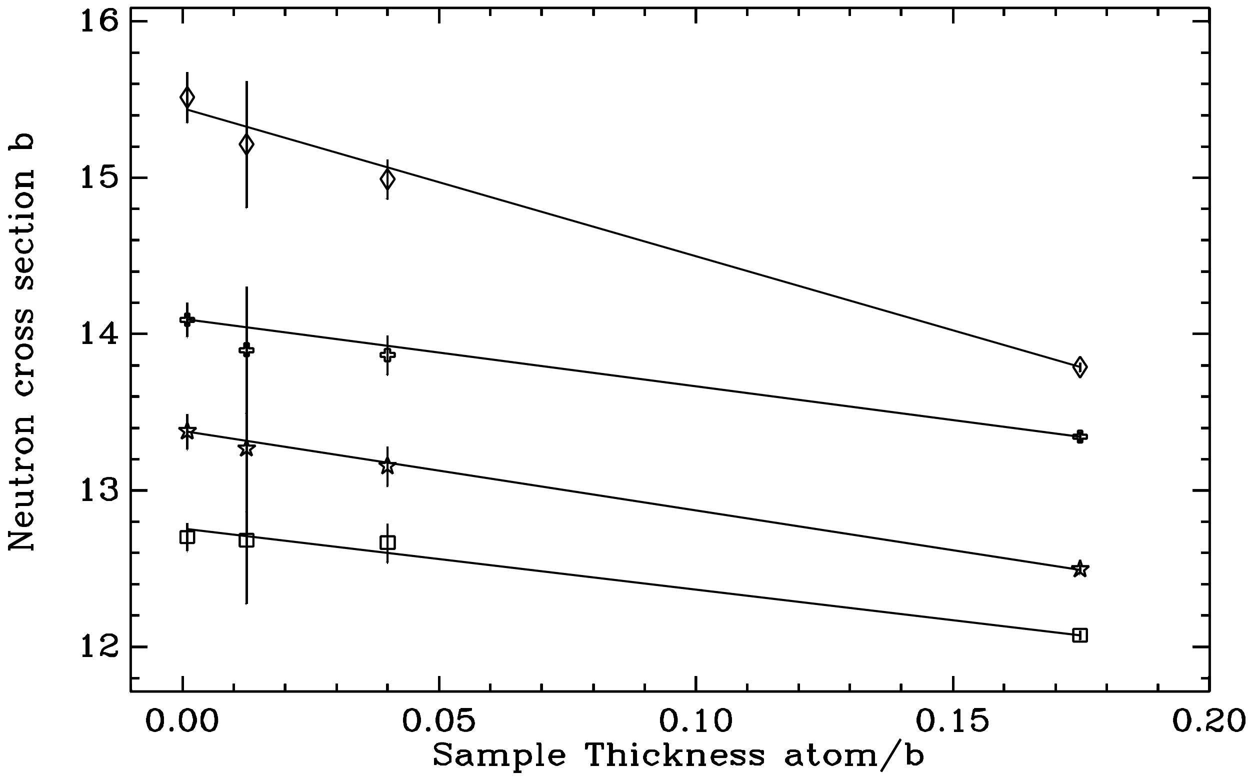

Fig. 2. Variation of the average effective total cross section vs the sample thickness in the ^{238}U Harvey transmission experiments at four neutron energies (10.26, 25.26, 31.26, and 50.26 keV from the upper curve to the lower curve, respectively). The values at zero thickness are the true cross sections obtained from the calculated self-shielding corrections (Appendix 1, Table A1.4).

3. THE AVERAGE TOTAL CROSS SECTIONS

3.1 ^{238}U DATA

The average effective total cross sections were obtained from the high resolution transmission measurements of J. A. Harvey[1] for sample thicknesses of 0.17482, 0.03996, and 0.01235at/barn. In the energy range 10 keV to 100 keV the self-shielding correction factors could be approximated by the following relations, obtained from Fig. 1:

$$\ln C = -0.966 - 0.572 \ln E \quad \text{for the thick sample} \quad (6)$$
$$\ln C = -1.503 - 0.745 \ln E \quad \text{for the medium sample} \quad (7)$$
$$\ln C = -3.344 - 0.623 \ln E \quad \text{for the thin sample} \quad (8)$$

where C is the relative correction and E is the neutron energy in keV.

The cross sections, averaged over 500-eV energy intervals, are given in Appendix 1, Tables A1.1, A1.2, and A1.3 for the thick sample, the medium sample, and the thin sample, respectively. The cross sections obtained by averaging the three sample true cross sections, weighted by the square of the inverse of the total absolute uncertainties, are given in Appendix 1, Table A1.4, with an accuracy $\leq$1%. Recent

SAMMY resonance analysis of the experimental transmission in the energy range from 10 keV to 20 keV obtained a set of resonance parameters, allowing the representation of the experimental average effective cross sections within 1% accuracy.[7] The true average cross sections calculated with these parameters are compared with the corrected effective cross sections in Table 1. The agreement is particularly good and confirms the accuracy of the method of correction, except at 12.76, 14.76, 17.26, and 17.76 keV, where the self-shielding correction is underestimated by 2% to 4% due to the presence of several resonances with neutron widths larger than 1 eV in the corresponding energy range. At higher energies the effect of large resonances on the accuracy of the self-shielding correction should be less important, and the accuracies given in Table A1.4 are probably reasonable. Table 2 compares the ratio of the true total cross sections of the thin and medium samples to the true total cross sections of the thick sample, averaged over 10-keV energy intervals. The data from the medium sample and the thick sample are in very good agreement. The thin sample gives values 1–2% lower at higher energies, due to larger systematic uncertainties.

Table 1. Comparison between the average true total cross sections of ^{238}U obtained from the experimental effective cross sections corrected for the calculated self-shielding effects (Exp.) and those calculated directly by SAMMY from the resonance parameters (Cal.)

E (keV)	Cross section (b)		Percentage deviation
	Exp.	Cal.	
10.26	15.514±0.163	15.744	1.5
10.76	14.891±0.156	14.876	-0.1
11.26	14.367±0.151	14.242	-0.9
11.76	14.749±0.150	14.76	0.1
12.26	14.846±1.148	15.018	1.2
12.76	16.131±0.151	16.704	3.6*
13.26	15.445±0.146	15.526	1.2
13.76	15.046±0.143	14.96	-0.6
14.26	14.640±0.139	14.702	0.4
14.76	15.084±0.140	15.472	2.6*
15.26	15.382±0.139	15.532	1
15.76	14.622±0.134	14.86	1.6
16.26	14.148±0.131	14.098	-0.4
16.76	13.838±0.128	13.974	1
17.26	15.771±0.135	16.444	4.3*
17.76	16.603±0.137	17.268	4.0*
18.26	15.578±0.133	15.57	-0.1
18.76	14.505±0.127	14.278	-1.6
19.26	14.033±0.124	13.84	-1.4
19.76	12.772±0.118	12.755	-0.1
10–20	14.893±0.150	15.032	0.9

*Asterisks indicate values for which agreement is poor, due to several very large resonances in the corresponding energy intervals.

Table 2. Comparison between the total cross sections of ^{238}U averaged over 10-keV energy intervals: (a) ratio of thin sample to thick sample cross sections; (b) ratio of medium sample to thick sample cross sections

Energy range (keV)	(a)*	(b)**
10–20	1.0036	1.0119
20–30	1.0016	1.0091
30–40	0.9965	1.0052
40–50	0.9935	1.0037
50–60	0.9945	1.0043
60–70	0.9935	1
70–80	0.993	1.0019
80–90	0.9868	1.0069
90–100	0.987	1.0048

*Uncertainties = 3%.
**Uncertainties = ~1%.

3.2. ^{239}Pu DATA

Detailed information concerning the ^{239}Pu data is found in Ref. 10. The effective total cross sections were obtained from the high-resolution transmission measurements performed at ORELA by J. A. Harvey et al.,[1] for sample thicknesses of 0.00646 at/barn, 0.01825 at/barn and 0.07471 at/barn. In the energy range 2 keV to 10 keV, the true values of the average total cross section were obtained by extrapolating to zero sample thickness the effective total cross sections obtained from the three samples. Above 10 keV the average total cross sections were obtained from the thick sample data, applying the method described in Section 2. The self-shielding correction was calculated by the relation

$$\ln C = -1.050 - 0.945 \ln E , \qquad (9)$$

where C is the relative correction and E is the neutron energy in keV.

The corrected average total cross sections are given in Table A2.1 in Appendix 2. In the energy range 2.5 keV to 10 keV the uncertainties are mainly due to the method of extrapolation. In the energy range above 10 keV the uncertainties are those due to the self-shielding correction (about 20% uncertainty in the correction). The statistical uncertainties are negligible. The systematic uncertainty (not given in the table), due to the uncertainties on the normalization coefficient in the transmission experiments and on the evaluation of the background, is about 0.17 b at all energies (about 1% on the experimental transmission of the thick sample).

3.3. ^{233}U DATA

High-resolution transmission measurements were performed by Guber et al.[2] at ORELA in the neutron energy range up to 500 keV with a sample thickness of 0.0119 at/b. The average total cross sections were obtained in the energy range from 0.4 keV to 500 keV from the analysis of the experimental effective cross sections. The self-shielding corrections were performed by the relation

$$\ln C = -3.811-0.8524 \ln E \, , \qquad (10)$$

where C is the relative value of the correction and E is the neutron energy in keV. This correction was applied in the energy range above 1.5 keV. Below 1.5 keV, a constant correction of (1.5±0.5)% was used.

The corrections were small because of the small value of the sample thickness. Moreover, compared to the other nuclides in the same mass region, the ratio of the average width of the s-wave resonances to their average spacing is large, which reduces the fluctuations of the cross section in the unresolved energy range and therefore reduces the self-shielding effect.

The average cross sections are given in Table A3.1 in Appendix 3. The uncertainties shown in the table are the statistical uncertainties. The uncertainties due to the self-shielding correction, about 30% of the correction, are small (less than 0.5% of the cross section at low energies and negligible at high energies). The systematic uncertainty on the experimental transmission was about 0.7%, which corresponds to a systematic uncertainty of about 0.6 b on the total cross section at all energies.

3.4. ^{235}U DATA

The average effective total cross sections were obtained from the high-resolution transmission experiments performed by J. A. Harvey et al.[1] at ORELA with a sample thickness of 0.0328 at/b. More details on the analysis are given in Ref. 11. The self-shielding correction was performed with the following relation:

$$\ln C = -2.792 -1.165 \ln E \, , \qquad (11)$$

where C is the relative correction, and E the neutron energy in keV. The correction was about 3% at 2 keV and negligible above 30 keV.

The average cross sections in the energy range 2 to 320 keV are given in Table A4.1 in Appendix 4. The uncertainties shown in the table are the statistical uncertainties (a), the systematic uncertainties (b) and the total uncertainties (c).

4. COMPARISON WITH OTHER EXPERIMENTAL AND EVALUATED DATA

Average experimental total cross section data for ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu are scarce and not reliable in the neutron energy range below 40 keV. Above that energy, accurate data are available from the transmission measurements performed by Poenitz et al.[13,14] at Argonne National Laboratory's Fast Neutron Generator. The resonance self-shielding corrections obtained by these researchers from Monte Carlo calculations were smaller than 1% for ^{233}U, ^{235}U and ^{239}Pu, and about 7% at 40 keV for ^{238}U; the uncertainties for the correction were assumed to be 20% of the correction. The accuracy of the Poenitz data is in general better than 2%. The results of the present work are compared with the Poenitz data and with ENDF/B-VI evaluated data in Figs. 3–6 for ^{233}U, ^{235}U, ^{238}U, and ^{239}Pu, respectively. The results of a SAMMY statistical model fit are also shown in the figures.

In the energy range 40 keV to 300 keV, the ^{233}U ORNL data agree with the 1983 Poenitz data within 1% and are smaller than 1981 Poenitz data by about 2%. The ENDF/B-VI evaluation is in agreement with the experimental data in the energy range above 30 keV; between 1 keV and 30 keV ENDF/B-VI is on average 3% larger. For ^{235}U, the Poenitz data are, on average, 0.4% smaller than the ORNL data; the agreement with ENDF/B-VI evaluation is good above 40 keV; at lower energies ENDF/B-VI is 1.7% larger on average. In the energy range 40 keV to100 keV, the ^{238}U ORNL data are about 1.7% smaller than Poenitz results; the ENDF/B-VI data agree with ORNL in the energy range near 25 keV, and are 0.3% smaller at 10 keV and 1.7% larger at 100 keV. In the energy range 45 keV to 500 keV, the ^{239}Pu Poenitz data are on average 1.2% larger than the present results. The Poenitz measurements were performed at 14 energy points in this energy range, and only 4 values disagree with the present results (the cross sections at 92, 297, 350, and 401 keV, which are 5% larger); above 3 keV, the ENDF/B-VI evaluation is systematically larger by 2.4% on average.

The measurements of the average total cross sections of ^{235}U and ^{239}Pu were also performed by Uttley[15,16] at the Harwell Linear Electron Accelerator (UK). The Uttley ^{235}U data are, on average,10% larger than the present results in the energy range 20 keV to 300 keV. A possible explanation for this disagreement with the ORNL measurements may be that Uttley used samples with 81.2% ^{235}U enrichment in his measurements. However, the disagreement cannot be explained as an error in the corrections for the other isotopes, since that disagreement would have been far smaller than 10%. It is more likely that the data compiled for the EXFOR file were not corrected at all for the isotopic contributions; this neglected correction could explain differences of 5 to 10%. The ^{239}Pu data of Uttley are 2 to 3% smaller than the present results below 30 keV and agree within 1% above 40 keV.

A measurement of the total cross section of ^{239}Pu was also performed by Cabe et al.[17] in the energy range above 150 keV. The data of Cabe are 10% larger than the present results at 160 keV and 3% larger at 500 keV.

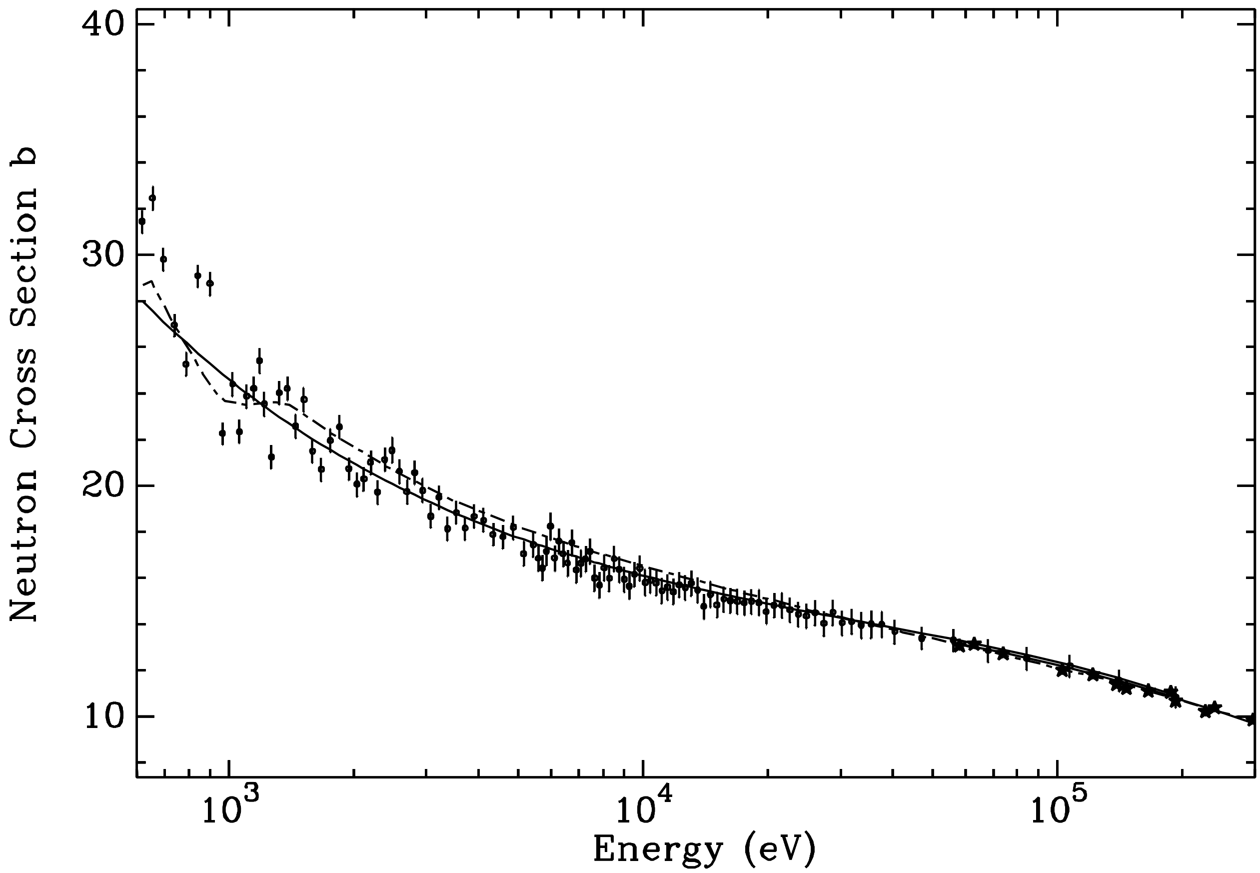

Fig. 3. Average ^{233}U total cross sections in the energy range from 600 eV to 300 keV. The circles are the present results; the stars are the Poenitz data. The solid line is an example of a SAMMY statistical model fit; the dashed line represents the ENDF/B-VI evaluation.

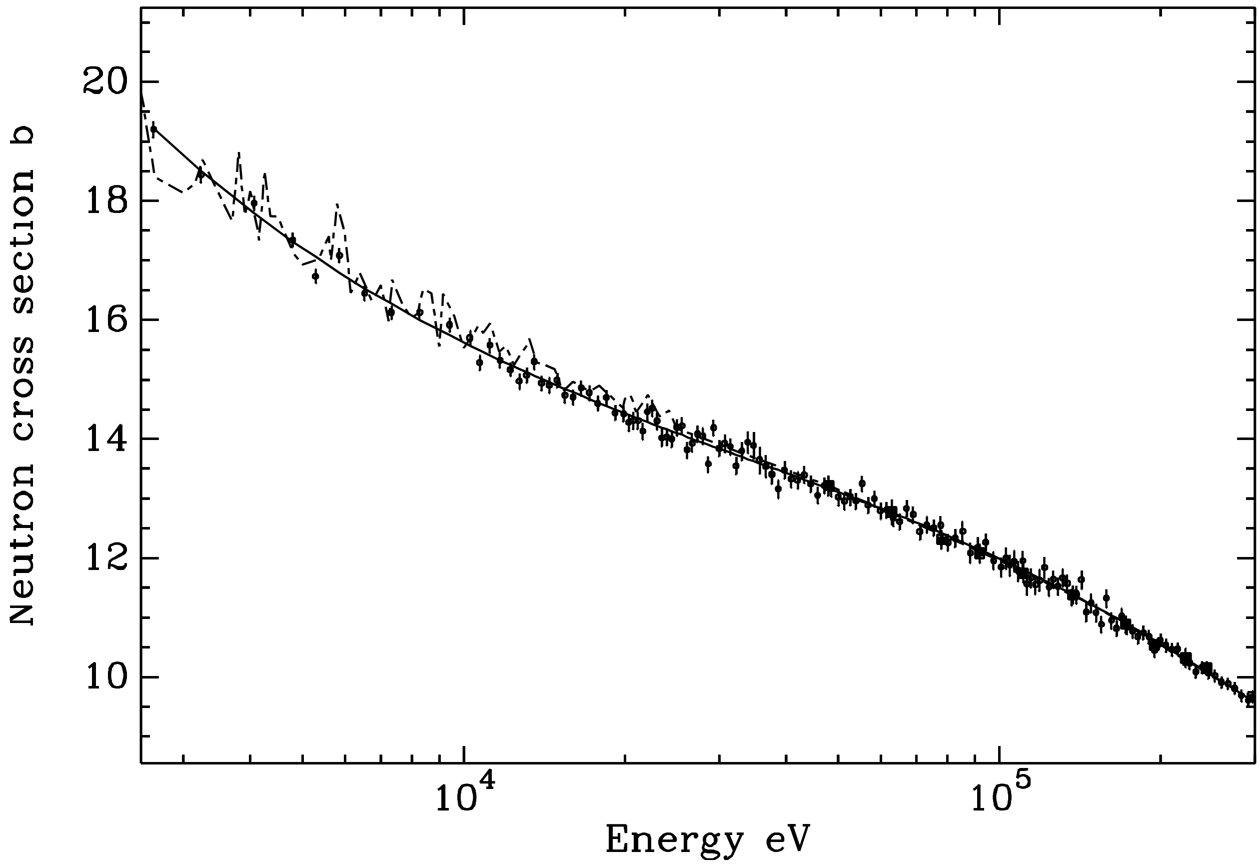

Fig. 4. Average ^{235}U total cross section in the energy range from 2.5 keV to 300 keV. The circles represent the present results; the black squares are the Poenitz data. The solid line is an example of a SAMMY statistical model fit; the dashed line represents the ENDF/B-VI evaluation.

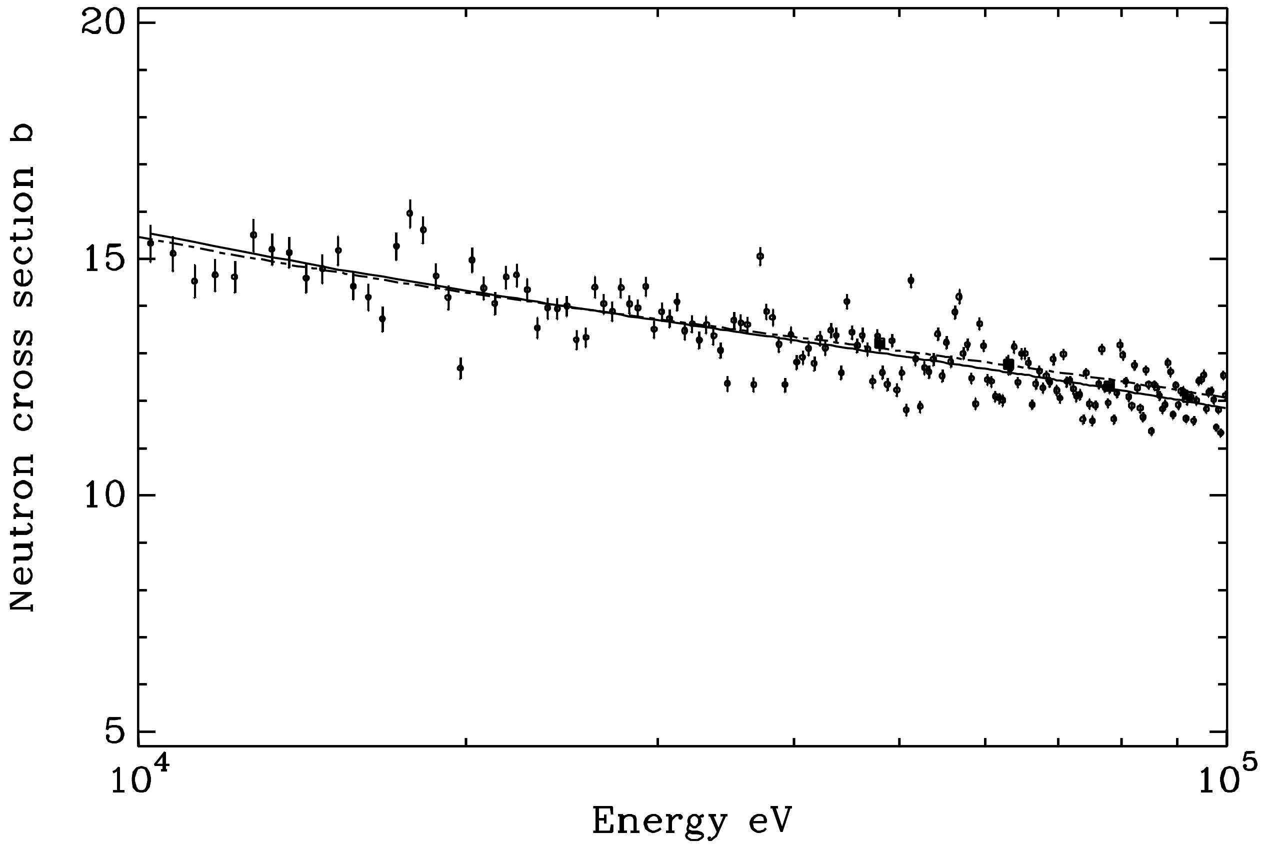

Fig. 5. Average ^{238}U total cross section in the energy range from 10 keV to 100 keV. The circles represent the present results from all three samples, averaged over the sample thicknesses; the dark squares are the Poenitz data. The solid line is an example of a SAMMY statistical model fit; the dashed line represents the ENDF/B-VI evaluation.

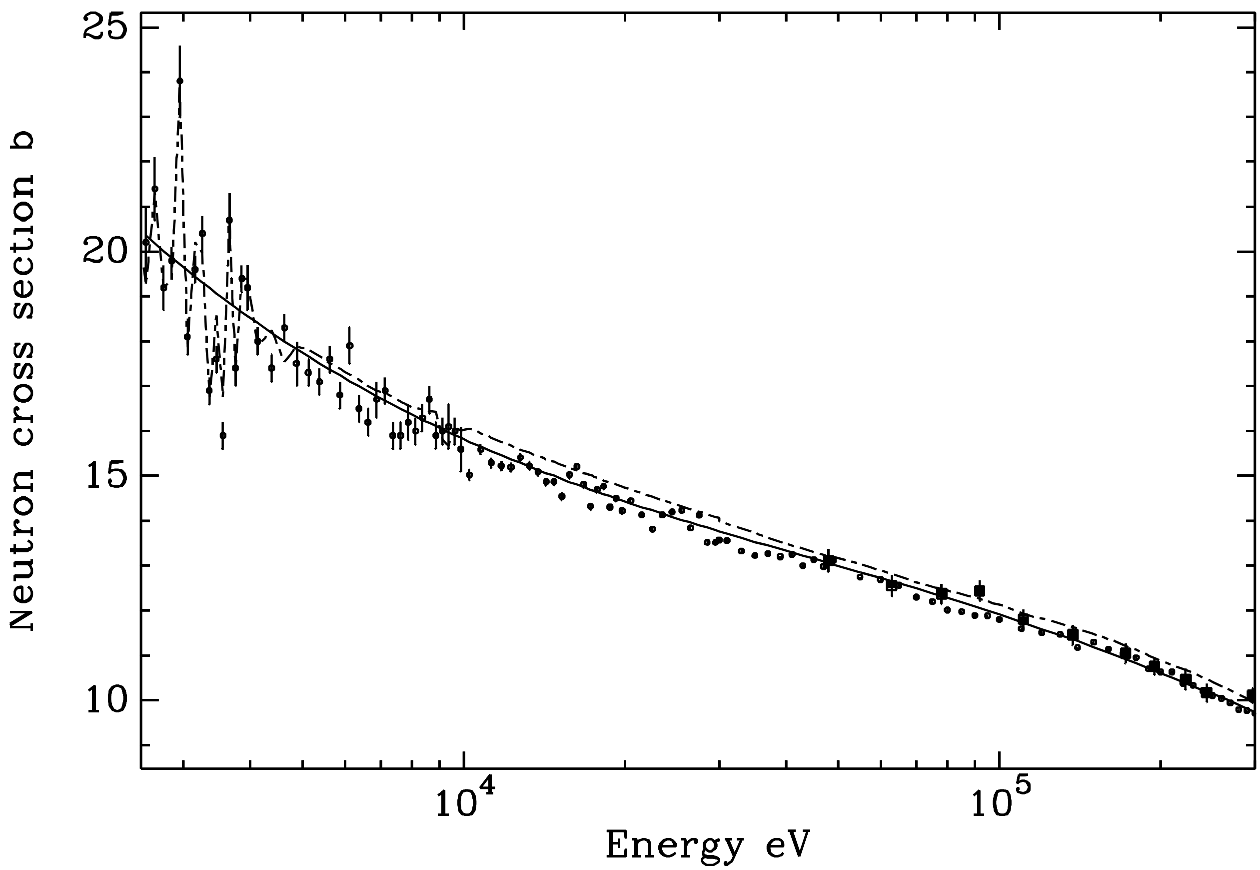

Fig. 6. Average ^{239}Pu total cross section in the energy range from 2.5 keV to 500 keV. The circles represent the present results; the dark squares are the Poenitz data. The solid line is an example of a SAMMY statistical model fit; the dashed line represents the ENDF/B-VI evaluation.

5. CONCLUSION

Accurate average total neutron cross sections are needed for neutron data evaluation in the unresolved resonance energy range and at higher energies. The optical model analysis of the experimental data allows the determination of the optical model parameters which are essential for the prediction of other cross sections, particularly those for which experimental data are missing or are known with very poor accuracy. For nuclei as important as those included in the present work, the determination of the optical model parameters relied, in the past, on experimental total cross sections in energy ranges above 40 keV, which is the lower energy limit of measurements by Poenitz et al. Below 40 keV the data were scarce and known with very poor accuracy. The present data confirm the accuracy of the Poenitz data and are an essential low-energy complement of the database for optical model analysis. It is also expected that statistical model analysis of the present data will allow accurate determination of the p-wave and d-wave neutron strength functions and confirmation of the value of the s-wave strength function obtained from analysis of the resonance parameters; preliminary results have already been published.[12]

Comparison of the present results with the ENDF/B-VI total cross sections has shown discrepancies not consistent with the accuracies of the experimental data. The discrepancies can be as large as 3%. It is likely that these discrepancies cannot be removed by an adjustment of the effective scattering radius only. An adjustment of the strength function could also be necessary, and such an adjustment could result in large variations in the reaction cross sections. New evaluations are needed, particularly in the unresolved resonance range, to take into account the new, accurate total cross sections.

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APPENDIX 1. AVERAGE ^{238}U TOTAL CROSS SECTIONS

Table A1.1. Total ^{238}U cross sections from the 0.17482 at/b sample

The data were averaged in energy intervals of 500 eV; σ_{eff} is the average effective total cross section; σ_{true} is the cross section corrected for the self-shielding effect; *a* is the uncertainty due to self-shielding correction; *b* is the statistical uncertainty; c is the systematic uncertainty; *d* is the total uncertainty. The cross sections are in barns.

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
10260.	13.789	15.330	0.385	0.035	0.029	0.388
10760.	13.638	15.117	0.370	0.013	0.029	0.371
11260.	13.143	14.528	0.346	0.008	0.029	0.347
11760.	13.293	14.656	0.341	0.009	0.029	0.342
12260.	13.298	14.626	0.332	0.010	0.029	0.333
12760.	14.130	15.506	0.344	0.010	0.029	0.345
13260.	13.879	15.198	0.330	0.009	0.029	0.331
13760.	13.846	15.132	0.322	0.008	0.029	0.323
14260.	13.377	14.592	0.304	0.008	0.029	0.305
14760.	13.586	14.794	0.302	0.012	0.029	0.304
15260.	13.963	15.179	0.304	0.008	0.029	0.305
15760.	13.288	14.422	0.284	0.008	0.029	0.285
16260.	13.102	14.198	0.274	0.008	0.029	0.276
16760.	12.691	13.734	0.261	0.008	0.029	0.262
17260.	14.128	15.268	0.285	0.009	0.029	0.287
17760.	14.794	15.967	0.293	0.009	0.029	0.295
18260.	14.489	15.618	0.282	0.008	0.029	0.284
18760.	13.596	14.639	0.261	0.008	0.029	0.262
19260.	13.192	14.187	0.249	0.007	0.029	0.250
19760.	11.811	12.687	0.219	0.007	0.029	0.221
20260.	13.955	14.975	0.255	0.008	0.029	0.257
20760.	13.415	14.381	0.242	0.007	0.029	0.243
21260.	13.128	14.060	0.233	0.007	0.029	0.235
21760.	13.663	14.620	0.239	0.008	0.029	0.241
22260.	13.708	14.654	0.236	0.008	0.029	0.238
22760.	13.437	14.351	0.229	0.007	0.029	0.231
23260.	12.690	13.542	0.213	0.007	0.029	0.215
23760.	13.088	13.956	0.217	0.007	0.029	0.219
24260.	13.090	13.947	0.214	0.007	0.029	0.216
24760.	13.155	14.006	0.213	0.007	0.029	0.215
25260.	12.495	13.294	0.200	0.007	0.029	0.202
25760.	12.550	13.342	0.198	0.007	0.029	0.200
26260.	13.554	14.399	0.211	0.007	0.029	0.213

Table A1.1 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
26760.	13.232	14.048	0.204	0.007	0.029	0.206
27260.	13.091	13.890	0.200	0.007	0.029	0.202
27760.	13.568	14.387	0.205	0.007	0.029	0.207
28260.	13.253	14.044	0.198	0.007	0.029	0.200
28760.	13.178	13.956	0.195	0.007	0.029	0.197
29260.	13.623	14.419	0.199	0.007	0.029	0.201
29760.	12.775	13.513	0.185	0.007	0.029	0.187
30260.	13.131	13.883	0.188	0.008	0.029	0.190
30760.	13.003	13.740	0.184	0.007	0.029	0.187
31260.	13.344	14.093	0.187	0.007	0.029	0.190
31760.	12.770	13.480	0.178	0.007	0.029	0.180
32260.	12.919	13.630	0.178	0.007	0.029	0.180
32760.	12.596	13.283	0.172	0.007	0.029	0.174
33260.	12.912	13.610	0.175	0.007	0.029	0.177
33760.	12.695	13.375	0.170	0.007	0.029	0.173
34260.	12.410	13.069	0.165	0.008	0.029	0.167
34760.	11.747	12.366	0.155	0.008	0.029	0.157
35260.	13.024	13.704	0.170	0.008	0.029	0.173
35760.	12.981	13.653	0.168	0.008	0.029	0.171
36260.	12.946	13.611	0.166	0.008	0.029	0.169
36760.	11.744	12.342	0.150	0.007	0.029	0.152
37260.	14.333	15.057	0.181	0.008	0.029	0.183
37760.	13.228	13.891	0.166	0.008	0.029	0.168
38260.	13.110	13.761	0.163	0.007	0.029	0.166
38760.	12.575	13.195	0.155	0.007	0.029	0.158
39260.	11.760	12.335	0.144	0.006	0.029	0.147
39760.	12.773	13.394	0.155	0.007	0.029	0.158
40260.	12.228	12.818	0.147	0.007	0.029	0.150
40760.	12.330	12.920	0.148	0.007	0.029	0.150
41260.	12.516	13.111	0.149	0.008	0.029	0.152
41760.	12.210	12.786	0.144	0.008	0.029	0.147
42260.	12.730	13.327	0.149	0.008	0.029	0.152
42760.	12.535	13.118	0.146	0.007	0.029	0.149
43260.	12.890	13.485	0.149	0.007	0.029	0.152
43760.	12.797	13.384	0.147	0.007	0.029	0.150
44260.	12.043	12.592	0.137	0.007	0.029	0.140
44760.	13.491	14.102	0.153	0.007	0.029	0.155
45260.	12.872	13.451	0.145	0.007	0.029	0.148
45760.	12.609	13.172	0.141	0.007	0.029	0.144

Table A1.1 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
46260.	12.819	13.388	0.142	0.007	0.029	0.145
46760.	12.544	13.097	0.138	0.007	0.029	0.141
47260.	11.888	12.409	0.130	0.007	0.029	0.133
47760.	12.813	13.371	0.139	0.007	0.029	0.143
48260.	12.074	12.596	0.131	0.007	0.029	0.134
48760.	11.839	12.348	0.127	0.007	0.029	0.131
49260.	12.725	13.269	0.136	0.007	0.029	0.139
49760.	11.732	12.230	0.125	0.007	0.029	0.128
50260.	12.076	12.586	0.128	0.007	0.029	0.131
50760.	11.331	11.807	0.119	0.006	0.029	0.122
51260.	13.963	14.545	0.146	0.008	0.029	0.149
51760.	12.375	12.889	0.128	0.007	0.029	0.132
52260.	11.409	11.880	0.118	0.006	0.029	0.121
52760.	12.194	12.694	0.125	0.007	0.029	0.128
53260.	12.120	12.614	0.124	0.007	0.029	0.127
53760.	12.374	12.876	0.126	0.007	0.029	0.129
54260.	12.891	13.411	0.130	0.007	0.029	0.133
54760.	12.043	12.526	0.121	0.007	0.029	0.124
55260.	12.723	13.231	0.127	0.007	0.029	0.130
55760.	12.337	12.826	0.122	0.007	0.029	0.126
56260.	13.350	13.877	0.132	0.007	0.029	0.135
56760.	13.663	14.199	0.134	0.007	0.029	0.137
57260.	12.513	13.002	0.122	0.007	0.029	0.126
57760.	12.696	13.189	0.123	0.007	0.029	0.127
58260.	12.013	12.478	0.116	0.007	0.029	0.120
58760.	11.491	11.933	0.111	0.006	0.029	0.114
59260.	13.131	13.634	0.126	0.007	0.029	0.129
59760.	12.680	13.163	0.121	0.007	0.029	0.124
60260.	11.994	12.449	0.114	0.007	0.029	0.117
60760.	11.957	12.408	0.113	0.007	0.029	0.117
61260.	11.655	12.093	0.109	0.006	0.029	0.113
61760.	11.625	12.060	0.109	0.006	0.029	0.112
62260.	11.585	12.015	0.108	0.007	0.029	0.112
62760.	12.351	12.808	0.114	0.007	0.029	0.118
63260.	12.226	12.677	0.113	0.007	0.029	0.116
63760.	12.676	13.141	0.116	0.007	0.029	0.120
64260.	11.957	12.393	0.109	0.007	0.029	0.113
64760.	12.542	12.998	0.114	0.007	0.029	0.118
65260.	12.551	13.004	0.113	0.007	0.029	0.117

Table A1.1 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
65760.	12.355	12.799	0.111	0.007	0.029	0.115
66260.	11.510	11.923	0.103	0.007	0.029	0.107
66760.	11.930	12.355	0.106	0.007	0.029	0.110
67260.	12.195	12.628	0.108	0.007	0.029	0.112
67760.	11.854	12.273	0.105	0.007	0.029	0.109
68260.	12.100	12.526	0.107	0.007	0.029	0.111
68760.	11.978	12.398	0.105	0.007	0.029	0.109
69260.	12.445	12.879	0.109	0.007	0.029	0.113
69760.	11.809	12.220	0.103	0.007	0.029	0.107
70260.	11.653	12.056	0.101	0.007	0.029	0.105
70760.	12.553	12.985	0.108	0.007	0.029	0.112
71260.	11.994	12.406	0.103	0.009	0.029	0.107
71760.	12.014	12.425	0.103	0.007	0.029	0.107
72260.	11.847	12.251	0.101	0.007	0.029	0.105
72760.	11.698	12.095	0.099	0.007	0.029	0.103
73260.	11.733	12.129	0.099	0.007	0.029	0.103
73760.	11.230	11.608	0.094	0.007	0.029	0.099
74260.	12.180	12.588	0.102	0.007	0.029	0.106
74760.	11.549	11.934	0.096	0.007	0.029	0.101
75260.	11.204	11.576	0.093	0.007	0.029	0.098
75760.	11.522	11.904	0.095	0.007	0.029	0.100
76260.	11.961	12.356	0.099	0.007	0.029	0.103
76760.	12.680	13.096	0.104	0.008	0.029	0.108
77260.	11.898	12.288	0.097	0.008	0.029	0.102
77760.	11.581	11.959	0.094	0.010	0.029	0.099
78260.	11.975	12.364	0.097	0.014	0.029	0.102
78760.	11.246	11.610	0.091	0.009	0.029	0.096
79260.	11.781	12.161	0.095	0.008	0.029	0.099
79760.	12.770	13.180	0.103	0.008	0.029	0.107
80260.	12.561	12.963	0.100	0.008	0.029	0.105
80760.	12.021	12.405	0.096	0.007	0.029	0.100
81260.	11.713	12.085	0.093	0.007	0.029	0.098
81760.	11.531	11.896	0.091	0.007	0.029	0.096
82260.	12.365	12.755	0.098	0.008	0.029	0.102
82760.	11.898	12.271	0.093	0.008	0.029	0.098
83260.	11.486	11.846	0.090	0.007	0.029	0.095
83760.	11.305	11.658	0.088	0.007	0.029	0.093
84260.	12.269	12.651	0.095	0.008	0.029	0.100
84760.	11.976	12.347	0.093	0.008	0.029	0.097

Table A1.1 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
85260.	11.019	11.359	0.085	0.007	0.029	0.090
85760.	11.965	12.333	0.092	0.008	0.029	0.097
86260.	11.901	12.266	0.091	0.008	0.029	0.096
86760.	11.752	12.111	0.090	0.008	0.029	0.095
87260.	11.477	11.827	0.087	0.008	0.029	0.092
87760.	11.565	11.916	0.088	0.008	0.029	0.093
88260.	12.427	12.803	0.094	0.008	0.029	0.099
88760.	12.245	12.614	0.092	0.008	0.029	0.097
89260.	11.364	11.706	0.085	0.008	0.029	0.090
89760.	11.969	12.327	0.090	0.008	0.029	0.094
90260.	11.567	11.913	0.086	0.009	0.029	0.091
90760.	11.851	12.204	0.088	0.008	0.029	0.093
91260.	11.844	12.195	0.088	0.008	0.029	0.093
91760.	11.292	11.626	0.083	0.008	0.029	0.089
92260.	11.718	12.064	0.086	0.008	0.029	0.091
92760.	11.737	12.081	0.086	0.008	0.029	0.091
93260.	11.254	11.584	0.082	0.008	0.029	0.088
93760.	11.668	12.009	0.085	0.008	0.029	0.090
94260.	12.068	12.419	0.088	0.008	0.029	0.093
94760.	12.098	12.449	0.088	0.008	0.029	0.093
95260.	12.194	12.547	0.088	0.008	0.029	0.093
95760.	11.496	11.827	0.083	0.008	0.029	0.088
96260.	11.842	12.182	0.085	0.008	0.029	0.090
96760.	11.876	12.217	0.085	0.008	0.029	0.090
97260.	11.695	12.030	0.084	0.008	0.029	0.089
97760.	11.124	11.441	0.079	0.008	0.029	0.085
98260.	11.486	11.812	0.082	0.008	0.029	0.087
98760.	11.010	11.322	0.078	0.008	0.029	0.083
99260.	12.192	12.536	0.086	0.008	0.029	0.091
99760.	11.792	12.124	0.083	0.008	0.029	0.088

Table A1.2. Total ^{238}U cross sections from the 0.03996 at/b sample

The data were averaged in energy intervals of 500 eV; σ_{eff} is the average effective total cross section; σ_{true} is the cross section corrected for the self-shielding effect; *a* is the uncertainty due to self-shielding correction; *b* is the statistical uncertainty; *c* is the systematic uncertainty; *d* is the total uncertainty. The cross sections are in barns.

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
10260.	14.990	15.603	0.153	0.018	0.125	0.199
10760.	14.332	14.897	0.141	0.017	0.125	0.190
11260.	13.860	14.387	0.132	0.017	0.125	0.183
11760.	14.282	14.807	0.131	0.017	0.125	0.182
12260.	14.399	14.912	0.128	0.017	0.125	0.180
12760.	15.696	16.238	0.135	0.017	0.125	0.185
13260.	14.893	15.392	0.125	0.017	0.125	0.178
13760.	14.581	15.056	0.119	0.017	0.125	0.173
14260.	14.237	14.689	0.113	0.017	0.125	0.169
14760.	14.691	15.144	0.113	0.017	0.125	0.170
15260.	14.998	15.449	0.113	0.016	0.125	0.169
15760.	14.276	14.695	0.105	0.016	0.125	0.164
16260.	13.764	14.158	0.099	0.016	0.125	0.160
16760.	13.513	13.892	0.095	0.017	0.125	0.158
17260.	15.464	15.887	0.106	0.016	0.125	0.165
17760.	16.330	16.767	0.109	0.016	0.125	0.167
18260.	15.191	15.590	0.100	0.016	0.125	0.161
18760.	14.135	14.498	0.091	0.016	0.125	0.156
19260.	13.674	14.018	0.086	0.016	0.125	0.153
19760.	12.505	12.814	0.077	0.015	0.125	0.148
20260.	15.117	15.483	0.092	0.016	0.125	0.156
20760.	13.956	14.288	0.083	0.016	0.125	0.151
21260.	13.909	14.233	0.081	0.016	0.125	0.150
21760.	14.617	14.953	0.084	0.016	0.125	0.152
22260.	14.533	14.861	0.082	0.016	0.125	0.151
22760.	14.099	14.412	0.078	0.015	0.125	0.148
23260.	13.117	13.403	0.071	0.015	0.125	0.145
23760.	13.768	14.063	0.074	0.015	0.125	0.146
24260.	13.626	13.914	0.072	0.015	0.125	0.145
24760.	13.850	14.138	0.072	0.015	0.125	0.145
25260.	13.155	13.424	0.067	0.017	0.125	0.143
25760.	13.301	13.570	0.067	0.015	0.125	0.143
26260.	14.377	14.662	0.071	0.015	0.125	0.145
26760.	13.913	14.186	0.068	0.015	0.125	0.143
27260.	13.890	14.158	0.067	0.015	0.125	0.143

Table A1.2 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
27760.	14.330	14.604	0.068	0.015	0.125	0.144
28260.	13.930	14.192	0.065	0.015	0.125	0.142
28760.	13.763	14.018	0.064	0.015	0.125	0.141
29260.	14.204	14.464	0.065	0.016	0.125	0.142
29760.	13.217	13.456	0.060	0.015	0.125	0.140
30260.	13.688	13.932	0.061	0.018	0.125	0.141
30760.	13.710	13.952	0.060	0.015	0.125	0.140
31260.	13.866	14.107	0.060	0.015	0.125	0.140
31760.	13.202	13.429	0.057	0.015	0.125	0.138
32260.	13.486	13.716	0.057	0.015	0.125	0.139
32760.	13.114	13.335	0.055	0.016	0.125	0.138
33260.	13.515	13.739	0.056	0.016	0.125	0.138
33760.	13.000	13.213	0.053	0.017	0.125	0.137
34260.	12.737	12.944	0.052	0.017	0.125	0.137
34760.	12.422	12.622	0.050	0.018	0.125	0.136
35260.	13.812	14.032	0.055	0.018	0.125	0.138
35760.	13.543	13.756	0.053	0.018	0.125	0.137
36260.	13.535	13.746	0.053	0.018	0.125	0.137
36760.	12.366	12.557	0.048	0.017	0.125	0.135
37260.	15.430	15.665	0.059	0.017	0.125	0.139
37760.	13.570	13.775	0.051	0.017	0.125	0.136
38260.	13.648	13.852	0.051	0.016	0.125	0.136
38760.	12.781	12.970	0.047	0.016	0.125	0.135
39260.	12.008	12.184	0.044	0.015	0.125	0.134
39760.	13.298	13.491	0.048	0.016	0.125	0.135
40260.	12.494	12.673	0.045	0.015	0.125	0.134
40760.	13.045	13.231	0.046	0.016	0.125	0.135
41260.	13.018	13.202	0.046	0.018	0.125	0.135
41760.	12.690	12.867	0.044	0.018	0.125	0.134
42260.	13.251	13.434	0.046	0.018	0.125	0.135
42760.	12.956	13.134	0.045	0.017	0.125	0.134
43260.	13.370	13.552	0.046	0.017	0.125	0.134
43760.	13.246	13.425	0.045	0.016	0.125	0.134
44260.	12.452	12.619	0.042	0.016	0.125	0.133
44760.	14.132	14.319	0.047	0.016	0.125	0.135
45260.	13.337	13.513	0.044	0.016	0.125	0.134
45760.	12.969	13.138	0.042	0.016	0.125	0.133
46260.	13.354	13.527	0.043	0.016	0.125	0.134
46760.	12.935	13.101	0.042	0.016	0.125	0.133

Table A1.2 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
47260.	12.235	12.391	0.039	0.017	0.125	0.132
47760.	13.147	13.314	0.042	0.017	0.125	0.133
48260.	12.211	12.364	0.038	0.016	0.125	0.132
48760.	12.387	12.541	0.039	0.016	0.125	0.132
49260.	13.136	13.298	0.041	0.016	0.125	0.133
49760.	12.015	12.162	0.037	0.016	0.125	0.132
50260.	12.666	12.820	0.039	0.016	0.125	0.132
50760.	12.091	12.237	0.036	0.016	0.125	0.131
51260.	14.289	14.460	0.043	0.016	0.125	0.133
51760.	12.669	12.819	0.038	0.016	0.125	0.132
52260.	11.860	12.000	0.035	0.016	0.125	0.131
52760.	12.574	12.722	0.037	0.016	0.125	0.132
53260.	12.472	12.617	0.036	0.016	0.125	0.131
53760.	12.948	13.097	0.037	0.016	0.125	0.132
54260.	13.301	13.453	0.038	0.016	0.125	0.132
54760.	12.345	12.485	0.035	0.016	0.125	0.131
55260.	13.272	13.422	0.038	0.016	0.125	0.132
55760.	12.877	13.022	0.036	0.016	0.125	0.131
56260.	13.895	14.051	0.039	0.016	0.125	0.132
56760.	13.959	14.114	0.039	0.016	0.125	0.132
57260.	12.906	13.049	0.036	0.016	0.125	0.131
57760.	12.918	13.059	0.035	0.016	0.125	0.131
58260.	12.166	12.298	0.033	0.016	0.125	0.131
58760.	11.911	12.039	0.032	0.016	0.125	0.130
59260.	13.617	13.764	0.037	0.016	0.125	0.132
59760.	12.998	13.137	0.035	0.016	0.125	0.131
60260.	12.136	12.265	0.032	0.016	0.125	0.130
60760.	12.090	12.217	0.032	0.016	0.125	0.130
61260.	11.828	11.952	0.031	0.016	0.125	0.130
61760.	11.940	12.064	0.031	0.016	0.125	0.130
62260.	11.989	12.113	0.031	0.016	0.125	0.130
62760.	12.700	12.830	0.033	0.016	0.125	0.131
63260.	12.729	12.859	0.033	0.016	0.125	0.131
63760.	13.037	13.169	0.033	0.017	0.125	0.131
64260.	12.222	12.346	0.031	0.016	0.125	0.130
64760.	13.117	13.249	0.033	0.016	0.125	0.131
65260.	12.755	12.883	0.032	0.016	0.125	0.130
65760.	12.476	12.600	0.031	0.016	0.125	0.130
66260.	11.780	11.897	0.029	0.017	0.125	0.130

Table A1.2 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
66760.	12.405	12.526	0.030	0.017	0.125	0.130
67260.	12.471	12.593	0.030	0.017	0.125	0.130
67760.	12.216	12.335	0.030	0.017	0.125	0.130
68260.	12.435	12.556	0.030	0.017	0.125	0.130
68760.	12.371	12.490	0.030	0.017	0.125	0.130
69260.	12.703	12.824	0.030	0.017	0.125	0.130
69760.	12.081	12.195	0.029	0.017	0.125	0.130
70260.	12.028	12.142	0.028	0.017	0.125	0.130
70760.	12.765	12.885	0.030	0.017	0.125	0.130
71260.	12.230	12.345	0.029	0.021	0.125	0.130
71760.	12.298	12.412	0.029	0.017	0.125	0.130
72260.	11.927	12.037	0.028	0.017	0.125	0.129
72760.	11.992	12.103	0.028	0.017	0.125	0.129
73260.	11.907	12.016	0.027	0.017	0.125	0.129
73760.	11.608	11.714	0.026	0.017	0.125	0.129
74260.	12.563	12.677	0.028	0.017	0.125	0.130
74760.	11.766	11.872	0.027	0.017	0.125	0.129
75260.	11.451	11.553	0.026	0.017	0.125	0.129
75760.	11.948	12.055	0.027	0.017	0.125	0.129
76260.	12.385	12.495	0.028	0.017	0.125	0.129
76760.	13.010	13.125	0.029	0.018	0.125	0.130
77260.	12.073	12.179	0.027	0.019	0.125	0.130
77760.	12.096	12.202	0.026	0.024	0.125	0.130
78260.	12.338	12.445	0.027	0.033	0.125	0.132
78760.	11.701	11.803	0.025	0.024	0.125	0.130
79260.	12.079	12.184	0.026	0.020	0.125	0.130
79760.	13.160	13.273	0.028	0.019	0.125	0.130
80260.	12.769	12.878	0.027	0.019	0.125	0.130
80760.	12.211	12.315	0.026	0.018	0.125	0.129
81260.	11.915	12.016	0.025	0.018	0.125	0.129
81760.	11.665	11.763	0.025	0.018	0.125	0.129
82260.	12.602	12.707	0.026	0.018	0.125	0.129
82760.	12.094	12.195	0.025	0.019	0.125	0.129
83260.	11.722	11.819	0.024	0.019	0.125	0.129
83760.	11.574	11.670	0.024	0.018	0.125	0.129
84260.	12.512	12.615	0.026	0.019	0.125	0.129
84760.	12.250	12.350	0.025	0.019	0.125	0.129
85260.	11.238	11.330	0.023	0.019	0.125	0.129
85760.	12.195	12.294	0.025	0.019	0.125	0.129

Table A1.2 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
86260.	12.090	12.188	0.024	0.020	0.125	0.129
86760.	11.967	12.063	0.024	0.021	0.125	0.129
87260.	11.750	11.845	0.024	0.019	0.125	0.129
87760.	12.021	12.117	0.024	0.020	0.125	0.129
88260.	12.746	12.848	0.025	0.020	0.125	0.129
88760.	12.402	12.500	0.025	0.020	0.125	0.129
89260.	11.489	11.580	0.023	0.020	0.125	0.129
89760.	12.194	12.290	0.024	0.020	0.125	0.129
90260.	11.720	11.812	0.023	0.023	0.125	0.129
90760.	12.053	12.147	0.023	0.020	0.125	0.129
91260.	11.986	12.079	0.023	0.021	0.125	0.129
91760.	11.449	11.537	0.022	0.020	0.125	0.129
92260.	11.930	12.022	0.023	0.020	0.125	0.129
92760.	11.881	11.972	0.023	0.020	0.125	0.129
93260.	11.488	11.576	0.022	0.020	0.125	0.129
93760.	12.026	12.117	0.023	0.020	0.125	0.129
94260.	12.225	12.318	0.023	0.020	0.125	0.129
94760.	12.371	12.465	0.023	0.020	0.125	0.129
95260.	12.266	12.359	0.023	0.020	0.125	0.129
95760.	11.660	11.747	0.022	0.020	0.125	0.129
96260.	12.050	12.140	0.022	0.020	0.125	0.129
96760.	11.950	12.039	0.022	0.020	0.125	0.129
97260.	11.881	11.969	0.022	0.021	0.125	0.129
97760.	11.340	11.424	0.021	0.022	0.125	0.129
98260.	11.677	11.763	0.021	0.021	0.125	0.129
98760.	11.198	11.280	0.020	0.021	0.125	0.129
99260.	12.426	12.517	0.023	0.021	0.125	0.129
99760.	11.968	12.055	0.022	0.021	0.125	0.129

Table A1.3. Total ^{238}U cross sections from the 0.01235 at/b sample

The data were averaged in energy intervals of 500 eV; σ_{eff} is the average effective total cross section; σ_{true} is the cross sections corrected for the self shielding effect; *a* is the uncertainty due to self shielding correction; *b* is the statistical uncertainty; *c* is the systematic uncertainty; *d* is the total uncertainty. The cross sections are in barns.

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
10260	15.213	15.340	0.032	0.061	0.405	0.411
10760.	14.467	14.584	0.029	0.060	0.405	0.410
11260.	13.930	14.039	0.027	0.059	0.405	0.410
11760.	14.478	14.589	0.028	0.059	0.405	0.410
12260.	14.724	14.834	0.027	0.059	0.405	0.410
12760.	16.367	16.486	0.030	0.059	0.405	0.410
13260.	15.214	15.322	0.027	0.058	0.405	0.410
13760.	14.750	14.852	0.026	0.058	0.405	0.410
14260.	14.339	14.436	0.024	0.057	0.405	0.410
14760.	15.165	15.266	0.025	0.057	0.405	0.410
15260.	15.258	15.357	0.025	0.057	0.405	0.410
15760.	14.488	14.580	0.023	0.056	0.405	0.409
16260.	13.883	13.970	0.022	0.056	0.405	0.409
16760.	13.643	13.727	0.021	0.059	0.405	0.410
17260.	15.985	16.081	0.024	0.056	0.405	0.409
17760.	16.746	16.845	0.025	0.056	0.405	0.409
18260.	15.327	15.416	0.022	0.055	0.405	0.409
18760.	14.141	14.222	0.020	0.055	0.405	0.409
19260.	13.653	13.730	0.019	0.055	0.405	0.409
19760.	12.675	12.745	0.018	0.055	0.405	0.409
20260.	15.339	15.422	0.021	0.055	0.405	0.409
20760.	14.025	14.100	0.019	0.055	0.405	0.409
21260.	14.085	14.159	0.019	0.055	0.405	0.409
21760.	14.779	14.856	0.019	0.054	0.405	0.409
22260.	14.779	14.855	0.019	0.055	0.405	0.409
22760.	14.145	14.217	0.018	0.054	0.405	0.409
23260.	13.217	13.283	0.017	0.054	0.405	0.409
23760.	13.888	13.957	0.017	0.054	0.405	0.409
24260.	13.662	13.729	0.017	0.054	0.405	0.409
24760.	13.981	14.048	0.017	0.054	0.405	0.409
25260.	13.267	13.330	0.016	0.059	0.405	0.409
25760.	13.488	13.551	0.016	0.054	0.405	0.409
26260.	14.597	14.665	0.017	0.054	0.405	0.409
26760.	14.015	14.079	0.016	0.054	0.405	0.409
27260.	14.004	14.067	0.016	0.054	0.405	0.409

Table A1.3 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
27760.	14.442	14.506	0.016	0.054	0.405	0.409
28260.	13.996	14.058	0.015	0.054	0.405	0.409
28760.	13.863	13.924	0.015	0.054	0.405	0.409
29260.	14.370	14.432	0.016	0.055	0.405	0.409
29760.	13.180	13.237	0.014	0.054	0.405	0.409
30260.	13.559	13.617	0.014	0.063	0.405	0.410
30760.	13.839	13.897	0.015	0.054	0.405	0.409
31260.	13.899	13.956	0.014	0.054	0.405	0.409
31760.	13.174	13.228	0.014	0.054	0.405	0.409
32260.	13.607	13.662	0.014	0.055	0.405	0.409
32760.	13.085	13.138	0.013	0.056	0.405	0.409
33260.	13.687	13.742	0.014	0.057	0.405	0.409
33760.	12.919	12.970	0.013	0.059	0.405	0.409
34260.	12.714	12.764	0.012	0.062	0.405	0.410
34760.	12.658	12.708	0.012	0.063	0.405	0.410
35260.	13.893	13.946	0.013	0.065	0.405	0.410
35760.	13.650	13.703	0.013	0.063	0.405	0.410
36260.	13.526	13.577	0.013	0.064	0.405	0.410
36760.	12.471	12.517	0.012	0.060	0.405	0.409
37260.	15.692	15.751	0.015	0.059	0.405	0.409
37760.	13.534	13.584	0.012	0.060	0.405	0.409
38260.	13.683	13.733	0.013	0.057	0.405	0.409
38760.	12.647	12.693	0.011	0.056	0.405	0.409
39260.	12.010	12.053	0.011	0.055	0.405	0.409
39760.	13.363	13.411	0.012	0.056	0.405	0.409
40260.	12.477	12.521	0.011	0.055	0.405	0.409
40760.	13.163	13.209	0.012	0.057	0.405	0.409
41260.	13.221	13.267	0.012	0.064	0.405	0.410
41760.	12.622	12.666	0.011	0.065	0.405	0.410
42260.	13.293	13.339	0.011	0.063	0.405	0.410
42760.	12.943	12.987	0.011	0.061	0.405	0.410
43260.	13.296	13.341	0.011	0.060	0.405	0.409
43760.	13.209	13.253	0.011	0.059	0.405	0.409
44260.	12.464	12.506	0.010	0.058	0.405	0.409
44760.	14.184	14.231	0.012	0.058	0.405	0.409
45260.	13.366	13.410	0.011	0.058	0.405	0.409
45760.	12.906	12.949	0.011	0.058	0.405	0.409
46260.	13.347	13.390	0.011	0.057	0.405	0.409
46760.	12.898	12.939	0.010	0.057	0.405	0.409

Table A1.3 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
47260.	12.225	12.265	0.010	0.060	0.405	0.409
47760.	13.153	13.195	0.010	0.060	0.405	0.409
48260.	12.060	12.098	0.010	0.058	0.405	0.409
48760.	12.436	12.475	0.010	0.058	0.405	0.409
49260.	13.068	13.109	0.010	0.058	0.405	0.409
49760.	11.910	11.947	0.009	0.057	0.405	0.409
50260.	12.682	12.721	0.010	0.057	0.405	0.409
50760.	12.271	12.309	0.009	0.057	0.405	0.409
51260.	14.178	14.222	0.011	0.058	0.405	0.409
51760.	12.542	12.580	0.009	0.057	0.405	0.409
52260.	11.809	11.844	0.009	0.057	0.405	0.409
52760.	12.575	12.613	0.009	0.058	0.405	0.409
53260.	12.495	12.532	0.009	0.058	0.405	0.409
53760.	12.953	12.991	0.010	0.058	0.405	0.409
54260.	13.250	13.289	0.010	0.058	0.405	0.409
54760.	12.374	12.410	0.009	0.058	0.405	0.409
55260.	13.262	13.300	0.010	0.058	0.405	0.409
55760.	12.784	12.821	0.009	0.058	0.405	0.409
56260.	13.939	13.979	0.010	0.059	0.405	0.409
56760.	13.921	13.960	0.010	0.059	0.405	0.409
57260.	12.998	13.035	0.009	0.058	0.405	0.409
57760.	12.883	12.919	0.009	0.059	0.405	0.409
58260.	12.076	12.110	0.008	0.058	0.405	0.409
58760.	11.944	11.978	0.008	0.058	0.405	0.409
59260.	13.582	13.620	0.009	0.059	0.405	0.409
59760.	12.936	12.972	0.009	0.058	0.405	0.409
60260.	12.016	12.049	0.008	0.059	0.405	0.409
60760.	12.000	12.032	0.008	0.059	0.405	0.409
61260.	11.797	11.829	0.008	0.059	0.405	0.409
61760.	11.969	12.002	0.008	0.059	0.405	0.409
62260.	12.007	12.039	0.008	0.059	0.405	0.409
62760.	12.702	12.736	0.009	0.059	0.405	0.409
63260.	12.874	12.908	0.009	0.059	0.405	0.409
63760.	13.123	13.158	0.009	0.059	0.405	0.409
64260.	12.132	12.164	0.008	0.059	0.405	0.409
64760.	13.277	13.312	0.009	0.060	0.405	0.409
65260.	12.743	12.777	0.008	0.059	0.405	0.409
65760.	12.389	12.421	0.008	0.058	0.405	0.409
66260.	11.787	11.818	0.008	0.063	0.405	0.410

Table A1.3 (cont.)

E (eV)	σ_{eff}	σ_{true}	*a*	*b*	*c*	*d*
66760.	12.449	12.481	0.008	0.061	0.405	0.410
67260.	12.490	12.522	0.008	0.061	0.405	0.409
67760.	12.269	12.301	0.008	0.060	0.405	0.409
68260.	12.485	12.517	0.008	0.061	0.405	0.410
68760.	12.365	12.397	0.008	0.061	0.405	0.409
69260.	12.704	12.736	0.008	0.061	0.405	0.409
69760.	12.118	12.148	0.008	0.060	0.405	0.409
70260.	11.975	12.005	0.007	0.061	0.405	0.410
70760.	12.652	12.683	0.008	0.062	0.405	0.410
71260.	12.067	12.097	0.007	0.076	0.405	0.412
71760.	12.257	12.287	0.008	0.062	0.405	0.410
72260.	11.865	11.895	0.007	0.061	0.405	0.410
72760.	11.993	12.022	0.007	0.061	0.405	0.410
73260.	11.773	11.802	0.007	0.063	0.405	0.410
73760.	11.774	11.803	0.007	0.062	0.405	0.410
74260.	12.625	12.655	0.008	0.062	0.405	0.410
74760.	11.740	11.768	0.007	0.063	0.405	0.410
75260.	11.535	11.563	0.007	0.061	0.405	0.409
75760.	11.989	12.018	0.007	0.062	0.405	0.410
76260.	12.388	12.417	0.007	0.062	0.405	0.410
76760.	12.892	12.922	0.008	0.065	0.405	0.410
77260.	11.899	11.927	0.007	0.069	0.405	0.411
77760.	12.052	12.080	0.007	0.090	0.405	0.415
78260.	12.198	12.226	0.007	0.121	0.405	0.423
78760.	11.817	11.844	0.007	0.086	0.405	0.414
79260.	12.048	12.076	0.007	0.073	0.405	0.411
79760.	13.168	13.198	0.008	0.068	0.405	0.411
80260.	12.795	12.824	0.007	0.068	0.405	0.411
80760.	12.164	12.192	0.007	0.066	0.405	0.410
81260.	11.779	11.806	0.007	0.067	0.405	0.410
81760.	11.642	11.669	0.007	0.066	0.405	0.410
82260.	12.561	12.589	0.007	0.068	0.405	0.411
82760.	12.154	12.182	0.007	0.067	0.405	0.410
83260.	11.631	11.657	0.007	0.068	0.405	0.411
83760.	11.473	11.499	0.006	0.069	0.405	0.411
84260.	12.376	12.404	0.007	0.069	0.405	0.411
84760.	12.194	12.221	0.007	0.069	0.405	0.411
85260.	11.267	11.292	0.006	0.069	0.405	0.411
85760.	12.036	12.063	0.007	0.071	0.405	0.411

Table A1.3 (cont.)

E (eV)	σ_{eff}	σ_{true}	***a***	***b***	***c***	***d***
86260.	12.027	12.053	0.007	0.072	0.405	0.411
86760.	11.906	11.933	0.007	0.076	0.405	0.412
87260.	11.745	11.771	0.006	0.072	0.405	0.411
87760.	12.016	12.042	0.007	0.073	0.405	0.411
88260.	12.783	12.810	0.007	0.073	0.405	0.411
88760.	12.451	12.478	0.007	0.073	0.405	0.411
89260.	11.332	11.356	0.006	0.072	0.405	0.411
89760.	12.076	12.102	0.006	0.073	0.405	0.411
90260.	11.625	11.650	0.006	0.081	0.405	0.413
90760.	12.011	12.037	0.006	0.073	0.405	0.411
91260.	11.947	11.973	0.006	0.075	0.405	0.412
91760.	11.447	11.471	0.006	0.072	0.405	0.411
92260.	11.844	11.869	0.006	0.071	0.405	0.411
92760.	11.949	11.974	0.006	0.073	0.405	0.411
93260.	11.566	11.591	0.006	0.072	0.405	0.411
93760.	12.007	12.032	0.006	0.073	0.405	0.411
94260.	12.154	12.179	0.006	0.072	0.405	0.411
94760.	12.343	12.369	0.006	0.073	0.405	0.411
95260.	12.154	12.179	0.006	0.073	0.405	0.411
95760.	11.660	11.684	0.006	0.072	0.405	0.411
96260.	12.097	12.121	0.006	0.074	0.405	0.412
96760.	11.868	11.892	0.006	0.073	0.405	0.411
97260.	11.772	11.796	0.006	0.077	0.405	0.412
97760.	11.312	11.335	0.006	0.081	0.405	0.413
98260.	11.577	11.601	0.006	0.077	0.405	0.412
98760.	11.284	11.307	0.006	0.076	0.405	0.412
99260.	12.390	12.415	0.006	0.076	0.405	0.412
99760.	12.150	12.174	0.006	0.075	0.405	0.412

Table A1.4. Total ^{238}U cross sections obtained by averaging the three sample values

The averages are weighted by the inverse of the square of the absolute uncertainties. The uncertainties given in the table are also absolute uncertainties. The cross sections (σ) and uncertainties(Δσ) are given in barns.

E (eV)	σ	Δσ	E (eV)	σ	Δσ	E (eV)	σ	Δσ
10260.	15.514	0.163	33260.	13.694	0.105	56260.	13.967	0.092
10760.	14.891	0.156	33760.	13.256	0.104	56760.	14.145	0.093
11260.	14.367	0.151	34260.	12.980	0.103	57260.	13.025	0.089
11760.	14.749	0.150	34760.	12.524	0.100	57760.	13.116	0.089
12260.	14.846	0.148	35260.	13.907	0.104	58260.	12.383	0.086
12760.	16.131	0.151	35760.	13.715	0.103	58760.	11.979	0.084
13260.	15.345	0.146	36260.	13.685	0.103	59260.	13.694	0.090
13760.	15.046	0.143	36760.	12.465	0.098	59760.	13.142	0.088
14260.	14.640	0.139	37260.	15.464	0.107	60260.	12.353	0.085
14760.	15.084	0.140	37760.	13.806	0.102	60760.	12.310	0.085
15260.	15.382	0.139	38260.	13.810	0.102	61260.	12.024	0.083
15760.	14.622	0.134	38760.	13.043	0.100	61760.	12.059	0.083
16260.	14.148	0.131	39260.	12.241	0.096	62260.	12.056	0.083
16760.	13.838	0.128	39760.	13.448	0.100	62760.	12.814	0.086
17260.	15.771	0.135	40260.	12.725	0.097	63260.	12.764	0.085
17760.	16.603	0.137	40760.	13.098	0.097	63760.	13.154	0.086
18260.	15.578	0.133	41260.	13.168	0.098	64260.	12.364	0.083
18760.	14.505	0.127	41760.	12.821	0.096	64760.	13.119	0.086
19260.	14.033	0.124	42260.	13.384	0.098	65260.	12.942	0.085
19760.	12.772	0.118	42760.	13.119	0.097	65760.	12.699	0.084
20260.	15.354	0.127	43260.	13.512	0.098	66260.	11.909	0.081
20760.	14.295	0.122	43760.	13.398	0.097	66760.	12.429	0.082
21260.	14.181	0.121	44260.	12.601	0.094	67260.	12.609	0.083
21760.	14.858	0.123	44760.	14.226	0.099	67760.	12.299	0.082
22260.	14.806	0.122	45260.	13.481	0.097	68260.	12.538	0.083
22760.	14.379	0.119	45760.	13.143	0.095	68760.	12.434	0.082
23260.	13.433	0.115	46260.	13.459	0.096	69260.	12.850	0.083
23760.	14.024	0.116	46760.	13.091	0.094	69760.	12.207	0.081
24260.	13.909	0.115	47260.	12.393	0.091	70260.	12.087	0.080
24760.	14.093	0.115	47760.	13.333	0.095	70760.	12.932	0.083
25260.	13.377	0.112	48260.	12.459	0.092	71260.	12.370	0.081
25760.	13.497	0.112	48760.	12.445	0.091	71760.	12.415	0.081
26260.	14.586	0.115	49260.	13.275	0.094	72260.	12.155	0.080
26760.	14.136	0.113	49760.	12.185	0.090	72760.	12.095	0.079
27260.	14.068	0.112	50260.	12.703	0.091	73260.	12.075	0.079
27760.	14.531	0.114	50760.	12.020	0.087	73760.	11.653	0.077
28260.	14.136	0.111	51260.	14.482	0.096	74260.	12.625	0.081
28760.	13.992	0.110	51760.	12.840	0.091	74760.	11.905	0.078
29260.	14.448	0.112	52260.	11.931	0.087	75260.	11.567	0.077
29760.	13.460	0.108	52760.	12.703	0.090	75760.	11.963	0.078
30260.	13.894	0.109	53260.	12.612	0.089	76260.	12.410	0.079
30760.	13.877	0.108	53760.	12.984	0.090	76760.	13.101	0.081
31260.	14.092	0.109	54260.	13.425	0.091	77260.	12.235	0.079
31760.	13.433	0.106	54760.	12.502	0.088	77760.	12.049	0.077
32260.	13.682	0.106	55260.	13.324	0.090	78260.	12.388	0.079
32760.	13.303	0.105	55760.	12.916	0.089	78760.	11.684	0.076

Table A1.4 (cont.)

E (eV)	σ	Δσ	E (eV)	σ	Δσ	E (eV)	σ	Δσ
79260.	12.166	0.077	86260.	12.232	0.076	93260.	11.582	0.072
79760.	13.217	0.081	86760.	12.089	0.075	93760.	12.044	0.073
80260.	12.925	0.080	87260.	11.831	0.074	94260.	12.378	0.074
80760.	12.365	0.078	87760.	11.987	0.074	94760.	12.452	0.074
81260.	12.051	0.077	88260.	12.819	0.077	95260.	12.473	0.074
81760.	11.842	0.076	88760.	12.570	0.076	95760.	11.798	0.072
82260.	12.731	0.079	89260.	11.872	0.073	96260.	12.167	0.073
82760.	12.241	0.077	89760.	12.307	0.075	96760.	12.150	0.073
83260.	11.830	0.075	90260.	11.872	0.073	97260.	12.004	0.072
83760.	11.657	0.074	90760.	12.180	0.074	97760.	11.433	0.070
84260.	12.629	0.078	91260.	12.149	0.074	98260.	11.791	0.071
84760.	12.344	0.076	91760.	11.593	0.072	98760.	11.310	0.069
85260.	11.348	0.073	92260.	12.044	0.073	99260.	12.526	0.073
85760.	12.310	0.076	92760.	12.043	0.073	99760.	12.104	0.072

APPENDIX 2. AVERAGE ^{239}Pu TOTAL CROSS SECTIONS

Table A2.1. Total ^{238}Pu cross sections in the energy range 2.5 to 500 keV

Data (σ) and uncertainties (Δσ) are given in barns

E (eV)	σ	Δσ	E (eV)	σ	Δσ	E (eV)	σ	Δσ	E (eV)	σ	Δσ
2550.	20.2	0.8	7875.	16.2	0.4	21500.	14.13	0.05	110000.	11.59	0.01
2650.	21.4	0.7	8125.	16.0	0.3	22500.	13.81	0.05	120000.	11.51	0.01
2750	19.2	0.5	8375.	16.3	0.3	23500.	14.13	0.05	130000.	11.46	0.01
2850	19.8	0.3	8625.	16.7	0.3	24500.	14.19	0.05	140000.	11.17	0.01
2950	23.8	0.8	8875.	15.9	0.3	25500.	14.23	0.05	150000.	11.29	0.01
3050	18.1	0.4	9125.	16.0	0.3	26500.	13.84	0.04	160000.	11.14	0.01
3150	19.6	0.3	9375.	16.1	0.5	27500.	14.12	0.04	170000.	11.03	0.01
3250	20.4	0.4	9625.	16.0	0.3	28500.	13.51	0.04	180000.	10.95	0.01
3350	16.9	0.3	9875	15.6	0.5	29500.	13.51	0.04	190000.	10.70	0.01
3450	17.6	0.3	10250.	15.02	0.11	30000.	13.57	0.04	200000.	10.63	0.01
3550	15.9	0.3	10750.	15.59	0.11	31000.	13.56	0.03	210000.	10.63	0.01
3650	20.7	0.6	11250.	15.29	0.11	33000.	13.32	0.03	220000.	10.38	0.01
3750.	17.4	0.4	11750.	15.22	0.10	35000.	13.22	0.03	230000.	10.33	0.01
3850.	19.4	0.3	12250.	15.19	0.10	37000.	13.27	0.03	240000.	10.20	0.01
3950.	19.2	0.5	12750.	15.41	0.10	39000.	13.20	0.02	250000.	10.10	0.01
4125.	18.0	0.3	13250.	15.23	0.09	41000.	13.25	0.02	260000.	10.04	0.01
4375.	17.4	0.3	13750.	15.09	0.09	43000.	13.00	0.02	270000.	9.94	0.01
4625.	18.3	0.3	14250.	14.87	0.08	45000.	13.13	0.02	280000.	9.79	0.01
4875.	17.5	0.5	14750.	14.87	0.08	47000.	12.98	0.02	290000.	9.77	0.01
5125.	17.3	0.3	15250.	14.54	0.08	49000.	13.11	0.02	300000.	9.71	0.01
5375.	17.1	0.3	15750.	15.03	0.08	55000.	12.74	0.02	325000.	9.44	0.01
5625.	17.6	0.3	16250.	15.21	0.07	60000.	12.69	0.02	350000.	9.30	0.01
5875.	16.8	0.3	16750.	14.81	0.07	65000.	12.56	0.02	375000.	9.16	0.01
6125.	17.9	0.4	17250.	14.32	0.07	70000.	12.30	0.02	400000.	8.87	0.01
6375.	16.5	0.3	17750.	14.69	0.07	75000.	12.20	0.02	425000.	8.89	0.01
6625.	16.2	0.3	18250.	14.77	0.07	80000.	12.01	0.02	450000.	8.72	0.01
6875.	16.7	0.4	18750.	14.30	0.06	85000.	11.97	0.02	475000.	8.51	0.01
7125.	16.9	0.3	19250.	14.50	0.06	90000.	11.89	0.02	500000.	8.33	0.01
7375.	15.9	0.3	19750.	14.22	0.06	95000.	11.88	0.02			
7625.	15.9	0.3	20500.	14.45	0.06	100000.	11.80	0.02			

APPENDIX 3. AVERAGE ^{233}U TOTAL CROSS SECTIONS

Table A3.1. Total ^{233}U cross sections in the energy range 0.4 to 800 keV

The cross sections (σ in barns) are the average values in the energy range E_1 eV to E_2 eV. The uncertainties (Δσ) are the statistical absolute uncertainties.

E_1	E_2	σ	Δσ	E_1	E_2	σ	Δσ
430.612	451.931	23.852	0.076	1481.382	1516.446	23.060	0.118
451.931	474.872	24.314	0.075	1516.446	1552.770	24.403	0.120
474.872	499.606	29.992	0.080	1552.770	1590.415	20.661	0.115
499.606	526.324	28.463	0.078	1590.415	1629.445	22.335	0.116
526.324	552.318	29.207	0.082	1629.445	1669.930	20.047	0.113
552.318	567.558	25.216	0.103	1669.930	1711.943	21.378	0.118
567.558	583.437	28.415	0.108	1711.943	1755.561	23.932	0.117
583.437	599.993	29.158	0.108	1755.561	1800.868	19.976	0.112
599.993	617.263	27.185	0.105	1800.868	1847.952	20.856	0.113
617.263	635.290	35.712	0.116	1847.952	1896.906	24.239	0.116
635.290	654.118	31.763	0.111	1896.906	1947.832	21.436	0.113
654.118	673.795	33.178	0.112	1947.832	2000.837	20.032	0.112
673.795	694.374	30.730	0.106	2000.837	2038.064	19.754	0.137
694.374	715.911	28.902	0.103	2038.064	2076.341	20.372	0.138
715.911	738.465	25.025	0.098	2076.341	2115.706	20.856	0.137
738.465	762.102	28.905	0.102	2115.706	2156.200	19.741	0.135
762.102	786.893	26.756	0.099	2156.200	2197.869	21.023	0.136
786.893	812.913	23.780	0.095	2197.869	2240.758	21.001	0.137
812.913	840.245	30.332	0.102	2240.758	2284.914	20.141	0.136
840.245	868.979	27.867	0.098	2284.914	2330.388	19.302	0.134
868.979	899.213	28.491	0.099	2330.388	2377.234	21.437	0.137
899.213	931.052	29.022	0.099	2377.234	2425.506	20.814	0.136
931.052	964.614	22.450	0.091	2425.506	2475.264	21.413	0.137
964.614	1000.023	22.095	0.091	2475.264	2526.569	21.656	0.140
1000.023	1019.409	26.040	0.130	2526.569	2579.485	20.285	0.134
1019.409	1039.365	22.743	0.125	2579.485	2634.082	20.976	0.135
1039.365	1059.913	21.895	0.124	2634.082	2690.430	20.814	0.134
1059.913	1081.077	22.780	0.125	2690.430	2748.606	18.671	0.130
1081.077	1102.880	23.979	0.129	2748.606	2808.690	20.797	0.131
1102.880	1125.350	23.781	0.126	2808.690	2870.765	20.342	0.130
1125.350	1148.513	24.373	0.125	2870.765	2934.922	19.604	0.129
1148.513	1172.399	24.050	0.125	2934.922	3001.253	19.981	0.129
1172.399	1184.623	26.235	0.179	3001.253	3069.859	18.310	0.128
1184.623	1197.039	24.592	0.174	3069.859	3140.844	19.061	0.127
1197.039	1213.977	23.021	0.159	3140.844	3214.321	20.235	0.128
1213.977	1239.945	24.072	0.122	3214.321	3290.405	18.754	0.126
1239.945	1266.756	22.867	0.119	3290.405	3369.224	19.176	0.129
1266.756	1294.446	19.623	0.114	3369.224	3450.909	17.101	0.123
1294.446	1323.054	23.878	0.120	3450.909	3535.602	18.903	0.125
1323.054	1352.621	24.155	0.121	3535.602	3623.450	18.785	0.124
1352.621	1383.190	27.547	0.125	3623.450	3714.614	17.831	0.123
1383.190	1414.807	20.854	0.117	3714.614	3809.263	18.489	0.124
1414.807	1447.521	22.162	0.118	3809.263	3907.575	18.702	0.124
1447.521	1481.382	22.994	0.119	3907.575	4009.743	18.661	0.124

Table A3.1 (cont.)

E_1	E_2	σ	Δσ	E_1	E_2	σ	Δσ
4009.743	4115.971	19.113	0.124	8747.664	8871.426	16.270	0.185
4115.971	4226.477	17.908	0.123	8871.426	8997.834	15.943	0.183
4226.477	4341.494	18.081	0.122	8997.834	9126.963	15.937	0.182
4341.494	4461.271	17.706	0.121	9126.963	9258.891	15.728	0.183
4461.271	4586.072	18.240	0.122	9258.891	9393.701	15.582	0.182
4586.072	4716.187	17.332	0.120	9393.701	9531.477	16.065	0.181
4716.187	4851.917	18.344	0.120	9531.477	9672.305	16.254	0.178
4851.917	4993.592	18.025	0.120	9672.305	9816.279	15.957	0.180
4993.592	5141.564	16.985	0.118	9816.279	9963.492	16.888	0.183
5141.564	5296.214	17.102	0.118	9963.492	10114.040	15.764	0.180
5296.214	5457.946	17.306	0.119	10114.040	10268.027	15.854	0.181
5457.946	5518.806	17.576	0.197	10268.027	10425.559	16.035	0.180
5518.806	5580.688	16.772	0.195	10425.559	10586.742	15.756	0.179
5580.688	5643.618	16.933	0.196	10586.742	10751.693	15.980	0.179
5643.618	5707.618	16.468	0.195	10751.693	10920.529	15.582	0.179
5707.618	5772.713	16.397	0.194	10920.529	11093.374	15.434	0.178
5772.713	5838.929	17.544	0.198	11093.374	11270.355	15.476	0.177
5838.929	5906.290	16.790	0.403	11270.355	11451.605	15.232	0.175
5906.290	5974.823	18.663	0.273	11451.605	11637.265	15.980	0.176
5974.823	6044.557	17.813	0.197	11637.265	11827.475	15.405	0.176
6044.557	6115.518	16.652	0.193	11827.475	12022.387	15.409	0.175
6115.518	6187.736	17.066	0.193	12022.387	12222.156	15.609	0.175
6187.736	6261.241	18.534	0.195	12222.156	12426.948	15.784	0.174
6261.241	6336.063	16.653	0.193	12426.948	12636.930	15.878	0.172
6336.063	6412.235	16.521	0.192	12636.930	12852.277	15.304	0.172
6412.235	6489.789	17.559	0.194	12852.277	13073.180	16.039	0.177
6489.789	6568.759	16.866	0.192	13073.180	13299.826	15.508	0.175
6568.759	6649.179	16.411	0.191	13299.826	13532.417	15.424	0.174
6649.179	6731.084	18.435	0.195	13532.417	13771.164	15.531	0.173
6731.084	6814.512	16.619	0.190	13771.164	14016.284	14.401	0.172
6814.512	6899.500	16.755	0.190	14016.284	14268.010	15.131	0.173
6899.500	6986.089	15.941	0.188	14268.010	14526.576	15.354	0.172
6986.089	7074.318	17.006	0.191	14526.576	14792.236	15.215	0.171
7074.318	7164.229	16.267	0.190	14792.236	15065.250	14.584	0.171
7164.229	7255.865	16.765	0.189	15065.250	15345.893	15.095	0.172
7255.865	7349.271	16.861	0.189	15345.893	15634.453	15.089	0.171
7349.271	7444.492	16.760	0.189	15634.453	15931.229	15.097	0.170
7444.492	7541.576	17.574	0.190	15931.229	16236.535	14.924	0.170
7541.576	7640.572	16.127	0.192	16236.535	16550.703	15.124	0.169
7640.572	7741.529	15.874	0.191	16550.703	16874.078	14.949	0.175
7741.529	7844.501	15.782	0.190	16874.078	17207.025	15.023	0.166
7844.501	7949.541	15.586	0.191	17207.025	17549.926	14.845	0.165
7949.541	8056.705	16.292	0.191	17549.926	17903.176	15.000	0.166
8056.705	8166.051	16.582	0.190	17903.176	18267.199	15.055	0.165
8166.051	8277.637	16.058	0.188	18267.199	18642.443	14.919	0.164
8277.637	8391.527	15.925	0.192	18642.443	19029.367	14.993	0.164
8391.527	8507.784	16.774	0.189	19029.367	19428.467	14.865	0.162
8507.784	8626.473	16.889	0.187	19428.467	19840.250	14.460	0.162
8626.473	8747.664	16.485	0.186	19840.250	20265.268	14.616	0.162

Table A3.1 (cont.)

E_1	E_2	σ	Δσ	E_1	E_2	σ	Δσ
20265.268	20704.090	14.816	0.162	36581.344	37651.570	14.112	0.190
20704.090	21157.322	14.830	0.160	37651.570	38769.461	13.861	0.171
21157.322	21625.600	15.097	0.160	38769.461	39937.883	13.694	0.161
21625.600	22109.598	14.524	0.157	39937.883	43225.219	13.666	0.100
22109.598	22610.029	14.391	0.157	43225.219	46935.801	13.439	0.093
22610.029	23127.645	14.860	0.158	46935.801	51145.523	13.349	0.091
23127.645	23663.244	14.500	0.156	51145.523	55948.125	13.462	0.090
23663.244	24217.664	14.352	0.156	55948.125	61460.371	13.168	0.087
24217.664	24791.801	14.295	0.156	61460.371	67829.305	12.932	0.084
24791.801	25386.598	14.424	0.158	67829.305	75242.109	12.765	0.083
25386.598	26003.062	14.580	0.159	75242.109	83940.031	12.727	0.091
26003.062	26642.254	14.425	0.155	83940.031	94238.273	12.318	0.100
26642.254	27305.312	13.994	0.158	94238.273	106554.938	12.284	0.087
27305.312	27993.430	14.071	0.169	106554.938	121454.211	12.101	0.079
27993.430	28707.895	14.870	0.166	121454.211	139712.047	11.674	0.065
28707.895	29450.066	14.168	0.161	139712.047	162419.438	11.447	0.064
29450.066	30221.391	13.964	0.158	162419.438	191149.188	11.061	0.046
30221.391	31023.426	14.157	0.172	191149.188	228236.031	10.621	0.034
31023.426	31857.812	14.325	0.157	228236.031	277266.406	10.145	0.025
31857.812	32726.324	13.898	0.162	277266.406	343979.938	9.664	0.030
32726.324	33630.844	13.862	0.179	343979.938	438029.750	9.063	0.038
33630.844	34573.383	14.061	0.222	438029.750	576684.562	8.281	0.047
34573.383	35556.113	14.053	0.258	576684.562	793369.250	7.568	0.053
35556.113	36581.344	13.935	0.228				

APPENDIX 4. AVERAGE ^{235}U TOTAL CROSS SECTION

Table A4.1. Total ^{235}U cross section in the energy range 2 to 325 keV

The cross sections (σ in barns) were averaged in the energy range E_1 to E_2 ; *a*, *b*, *c* are the statistical, systematic, and total uncertainties, respectively. The uncertainties due to the self shielding corrections are not given in the table; they are smaller than 0.1% in the energy ranges above 10 keV.

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
2000.869	2181.508	20.053	0.024	0.166	0.168
2181.508	2387.761	19.815	0.024	0.159	0.161
2387.761	2624.710	19.781	0.024	0.153	0.155
2624.710	2898.763	18.629	0.023	0.143	0.144
2898.763	3218.090	18.335	0.023	0.137	0.139
3218.090	3593.243	18.540	0.023	0.135	0.137
3593.243	4038.035	18.023	0.023	0.130	0.132
4038.035	4570.833	17.900	0.023	0.128	0.130
4570.833	4791.162	17.756	0.037	0.126	0.131
4791.162	5027.813	16.930	0.038	0.122	0.128
5027.813	5282.442	16.708	0.038	0.121	0.127
5282.442	5556.916	16.752	0.038	0.120	0.126
5556.916	5853.351	16.924	0.037	0.121	0.126
5853.351	6174.154	17.247	0.057	0.122	0.134
6174.154	6522.072	16.618	0.037	0.119	0.125
6522.072	6900.249	16.272	0.037	0.117	0.123
6900.249	7312.298	16.104	0.037	0.116	0.122
7312.298	7762.390	16.145	0.036	0.116	0.122
7762.390	8255.354	15.929	0.037	0.115	0.121
8255.354	8796.812	16.321	0.036	0.117	0.122
8796.812	9393.342	15.905	0.036	0.115	0.120
9393.342	10052.674	15.929	0.036	0.115	0.120
10052.674	10264.043	15.818	0.065	0.114	0.132
10264.043	10482.150	15.576	0.065	0.113	0.131
10482.150	10707.283	15.119	0.065	0.112	0.129
10707.283	10939.750	15.437	0.065	0.113	0.130
10939.750	11179.868	15.660	0.064	0.114	0.130
11179.868	11427.980	15.483	0.064	0.113	0.130
11427.980	11684.445	15.253	0.065	0.112	0.130
11684.445	11949.640	15.394	0.064	0.113	0.129
11949.640	12223.969	15.218	0.064	0.112	0.129
12223.969	12507.852	15.115	0.064	0.112	0.129
12507.852	12702.639	14.968	0.079	0.111	0.136
12702.639	12902.008	14.966	0.078	0.111	0.136
12902.008	13106.111	14.984	0.080	0.111	0.137
13106.111	13315.096	15.161	0.078	0.112	0.136
13315.096	13529.119	15.396	0.078	0.112	0.137
13529.119	13748.344	15.204	0.078	0.112	0.136
13748.344	13972.939	14.824	0.078	0.110	0.135
13972.939	14203.086	15.065	0.078	0.111	0.136
14203.086	14438.966	14.821	0.079	0.110	0.136
14438.966	14680.770	14.987	0.077	0.111	0.135

Table 4.1 (cont.)

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
14680.770	14928.701	14.931	0.078	0.111	0.135
14928.701	15182.963	15.038	0.077	0.111	0.135
15182.963	15443.780	14.713	0.077	0.110	0.134
15443.780	15711.375	14.762	0.077	0.110	0.134
15711.375	15985.984	14.667	0.077	0.110	0.134
15985.984	16267.858	14.737	0.077	0.110	0.134
16267.858	16557.252	14.805	0.077	0.110	0.134
16557.252	16854.439	14.911	0.080	0.111	0.136
16854.439	17159.701	14.869	0.076	0.110	0.134
17159.701	17473.328	14.684	0.076	0.110	0.134
17473.328	17795.637	14.628	0.076	0.110	0.133
17795.637	18126.941	14.567	0.076	0.109	0.133
18126.941	18467.590	14.833	0.075	0.110	0.133
18467.590	18817.930	14.560	0.075	0.109	0.133
18817.930	19178.332	14.419	0.076	0.109	0.133
19178.332	19549.193	14.458	0.075	0.109	0.132
19549.193	19930.914	14.365	0.075	0.109	0.132
19930.914	20125.979	14.476	0.106	0.109	0.152
20125.979	20323.926	14.364	0.106	0.109	0.152
20323.926	20524.805	14.191	0.106	0.108	0.151
20524.805	20728.678	14.191	0.106	0.108	0.151
20728.678	20935.602	14.440	0.105	0.109	0.151
20935.602	21145.641	14.736	0.104	0.110	0.151
21145.641	21358.855	13.891	0.106	0.107	0.151
21358.855	21575.314	14.293	0.104	0.108	0.150
21575.314	21795.078	13.967	0.104	0.107	0.149
21795.078	22018.219	14.571	0.102	0.109	0.149
22018.219	22244.801	14.336	0.103	0.108	0.150
22244.801	22474.902	14.634	0.103	0.110	0.150
22474.902	22708.590	14.413	0.103	0.109	0.150
22708.590	22945.943	14.464	0.103	0.109	0.150
22945.943	23187.035	14.144	0.103	0.108	0.149
23187.035	23431.945	14.159	0.103	0.108	0.149
23431.945	23680.762	13.885	0.104	0.107	0.149
23680.762	23933.561	14.126	0.103	0.108	0.149
23933.561	24190.430	13.931	0.104	0.107	0.149
24190.430	24451.453	14.101	0.103	0.108	0.149
24451.453	24716.727	13.900	0.103	0.107	0.148
24716.727	24986.340	14.362	0.101	0.109	0.148
24986.340	25260.391	14.032	0.103	0.107	0.149
25260.391	25538.975	14.447	0.109	0.109	0.154
25538.975	25822.191	14.006	0.102	0.107	0.148
25822.191	26110.145	13.510	0.103	0.106	0.148
26110.145	26402.943	14.116	0.101	0.108	0.148
26402.943	26700.695	13.887	0.102	0.107	0.148
26700.695	27003.516	13.970	0.102	0.107	0.148
27003.516	27311.512	14.001	0.101	0.107	0.147
27311.512	27624.805	14.172	0.101	0.108	0.148
27624.805	27943.527	13.928	0.102	0.107	0.148

Table 4.1 (cont.)

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
27943.527	28267.795	14.169	0.101	0.108	0.148
28267.795	28597.742	13.670	0.102	0.106	0.147
28597.742	28933.496	13.479	0.103	0.106	0.147
28933.496	29275.197	14.376	0.100	0.109	0.148
29275.197	29622.992	14.001	0.103	0.107	0.149
29622.992	29977.020	13.780	0.102	0.107	0.147
29977.020	30337.434	13.902	0.105	0.107	0.150
30337.434	30704.383	13.991	0.126	0.107	0.165
30704.383	31078.031	13.863	0.103	0.107	0.148
31078.031	31458.545	13.820	0.104	0.107	0.149
31458.545	31846.090	13.923	0.105	0.107	0.150
31846.090	32240.842	13.751	0.108	0.106	0.152
32240.842	32642.971	13.349	0.114	0.105	0.155
32642.971	33052.684	14.157	0.119	0.108	0.161
33052.684	33470.148	13.438	0.133	0.105	0.170
33470.148	33895.578	13.899	0.149	0.107	0.183
33895.578	34329.172	13.998	0.177	0.107	0.207
34329.172	34771.133	14.322	0.209	0.108	0.235
34771.133	35221.691	13.453	0.236	0.105	0.258
35221.691	35681.063	13.461	0.228	0.105	0.251
35681.063	36149.477	13.830	0.197	0.107	0.224
36149.477	36627.176	13.504	0.178	0.106	0.207
36627.176	37114.406	13.580	0.154	0.106	0.187
37114.406	37611.430	13.364	0.141	0.105	0.176
37611.430	38118.500	13.451	0.133	0.105	0.170
38118.500	38635.898	13.169	0.124	0.104	0.162
38635.898	39163.898	13.150	0.119	0.104	0.158
39163.898	39702.797	13.537	0.114	0.106	0.155
39702.797	40252.898	13.418	0.112	0.105	0.154
40252.898	40814.512	13.367	0.110	0.105	0.152
40814.512	41387.961	13.295	0.115	0.105	0.156
41387.961	41973.586	13.586	0.116	0.106	0.157
41973.586	42571.723	13.020	0.114	0.104	0.154
42571.723	43182.742	13.393	0.109	0.105	0.151
43182.742	43807.008	13.400	0.107	0.105	0.150
43807.008	44444.906	13.303	0.105	0.105	0.148
44444.906	45096.852	13.190	0.105	0.105	0.148
45096.852	45763.234	13.051	0.104	0.104	0.147
45763.234	46444.508	13.061	0.103	0.104	0.146
46444.508	47141.102	13.223	0.101	0.105	0.145
47141.102	47853.492	13.208	0.104	0.105	0.147
47853.492	48582.152	13.070	0.100	0.104	0.144
48582.152	49327.578	13.263	0.099	0.105	0.144
49327.578	50090.301	13.128	0.099	0.104	0.144
50090.301	50713.285	12.919	0.111	0.104	0.152
50713.285	51347.965	12.989	0.110	0.104	0.151
51347.965	51994.633	12.925	0.110	0.104	0.151
51994.633	52653.598	13.287	0.108	0.105	0.151
52653.598	53325.172	12.767	0.109	0.103	0.150

Table 4.1 (cont.)

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
53325.172	54009.680	13.042	0.108	0.104	0.150
54009.680	54707.445	12.881	0.108	0.104	0.150
54707.445	55418.824	13.157	0.104	0.104	0.147
55418.824	56144.172	13.343	0.093	0.105	0.140
56144.172	56883.852	12.895	0.099	0.104	0.143
56883.852	57638.250	12.883	0.101	0.104	0.145
57638.250	58407.750	13.154	0.101	0.104	0.145
58407.750	59192.766	12.835	0.102	0.103	0.145
59192.766	59993.715	12.836	0.102	0.103	0.145
59993.715	60811.031	12.748	0.103	0.103	0.146
60811.031	61645.168	12.823	0.102	0.103	0.145
61645.168	62496.586	12.795	0.103	0.103	0.146
62496.586	63365.766	12.586	0.103	0.103	0.145
63365.766	64253.207	12.762	0.103	0.103	0.146
64253.207	65159.422	12.628	0.102	0.103	0.145
65159.422	66084.945	12.594	0.102	0.103	0.145
66084.945	67030.328	12.870	0.102	0.103	0.145
67030.328	67996.148	12.799	0.100	0.103	0.144
67996.148	68982.992	12.798	0.101	0.103	0.144
68982.992	69991.469	12.663	0.101	0.103	0.144
69991.469	71022.234	12.439	0.102	0.102	0.144
71022.234	72075.938	12.447	0.106	0.102	0.147
72075.938	73153.266	12.614	0.100	0.103	0.143
73153.266	74254.930	12.496	0.101	0.102	0.144
74254.930	75381.672	12.551	0.101	0.102	0.144
75381.672	76534.258	12.458	0.102	0.102	0.144
76534.258	77713.484	12.367	0.109	0.102	0.149
77713.484	78920.172	12.737	0.134	0.103	0.169
78920.172	80155.188	12.254	0.112	0.102	0.151
80155.188	81419.422	12.265	0.111	0.102	0.150
81419.422	82713.805	12.389	0.116	0.102	0.154
82713.805	84039.305	12.279	0.125	0.102	0.161
84039.305	85396.922	12.697	0.134	0.103	0.169
85396.922	86787.703	12.202	0.149	0.101	0.180
86787.703	88212.750	11.691	0.156	0.100	0.185
88212.750	89673.188	12.476	0.148	0.102	0.180
89673.188	91170.195	12.136	0.147	0.101	0.178
91170.195	92705.008	12.231	0.137	0.101	0.170
92705.008	94278.906	12.299	0.122	0.102	0.159
94278.906	95893.234	12.226	0.117	0.101	0.155
95893.234	97549.375	11.734	0.118	0.100	0.155
97549.375	99248.797	12.178	0.117	0.101	0.155
99248.797	100993.031	11.965	0.115	0.101	0.153
100993.031	101882.438	11.728	0.165	0.100	0.193
101882.438	102783.641	12.073	0.164	0.101	0.193
102783.641	103696.867	11.920	0.164	0.100	0.192
103696.867	104622.313	11.587	0.165	0.099	0.193
104622.313	105560.203	12.170	0.159	0.101	0.189
105560.203	106510.766	11.885	0.157	0.100	0.186

Table 4.1 (cont.)

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
106510.766	107474.219	11.999	0.153	0.101	0.183
107474.219	108450.813	12.139	0.151	0.101	0.182
108450.813	109440.781	11.418	0.151	0.099	0.181
109440.781	110444.359	12.006	0.146	0.101	0.177
110444.359	111461.828	11.899	0.146	0.100	0.177
111461.828	112493.398	11.538	0.173	0.099	0.199
112493.398	113539.359	11.590	0.149	0.099	0.179
113539.359	114599.984	11.916	0.138	0.100	0.171
114599.984	115675.539	11.424	0.141	0.099	0.172
115675.539	116766.313	11.333	0.139	0.099	0.170
116766.313	117872.578	11.772	0.149	0.100	0.179
117872.578	118994.656	11.691	0.146	0.100	0.177
118994.656	120132.828	11.556	0.168	0.099	0.195
120132.828	121287.398	11.879	0.168	0.100	0.196
121287.398	122458.703	11.800	0.142	0.100	0.174
122458.703	123647.055	11.618	0.130	0.100	0.164
123647.055	124852.797	11.408	0.130	0.099	0.163
124852.797	126076.250	11.556	0.124	0.099	0.159
126076.250	127317.781	11.730	0.119	0.100	0.155
127317.781	128577.750	11.543	0.121	0.099	0.157
128577.750	129856.516	11.512	0.117	0.099	0.153
129856.516	131154.438	11.559	0.116	0.099	0.153
131154.438	132471.953	11.777	0.114	0.100	0.152
132471.953	133809.406	11.664	0.113	0.100	0.151
133809.406	135167.203	11.489	0.114	0.099	0.151
135167.203	136545.781	11.327	0.117	0.099	0.153
136545.781	137945.563	11.359	0.121	0.099	0.156
137945.563	139366.984	11.525	0.123	0.099	0.158
139366.984	140810.484	11.250	0.132	0.098	0.165
140810.484	142276.531	11.736	0.132	0.100	0.166
142276.531	143765.609	11.529	0.135	0.099	0.168
143765.609	145278.172	11.165	0.138	0.098	0.169
145278.172	146814.750	11.015	0.139	0.098	0.170
146814.750	148375.813	11.093	0.135	0.098	0.167
148375.813	149961.938	11.387	0.132	0.099	0.165
149961.938	151573.609	11.222	0.132	0.098	0.165
151573.609	153211.406	10.947	0.124	0.098	0.158
153211.406	154875.922	10.864	0.122	0.097	0.156
154875.922	156567.688	10.907	0.122	0.097	0.156
156567.688	158287.344	11.472	0.130	0.099	0.163
158287.344	160035.469	11.176	0.140	0.098	0.171
160035.469	161812.734	10.885	0.124	0.097	0.158
161812.734	163619.781	11.016	0.111	0.098	0.148
163619.781	165457.250	10.700	0.106	0.097	0.144
165457.250	167325.844	10.935	0.101	0.098	0.140
167325.844	169226.313	11.047	0.098	0.098	0.138
169226.313	171159.313	10.998	0.095	0.098	0.136
171159.313	173125.625	10.877	0.093	0.097	0.135
173125.625	175126.031	10.807	0.089	0.097	0.132

Table 4.1 (cont.)

E_1 (eV)	E_2 (eV)	σ	*a*	*b*	*c*
175126.031	177161.313	10.868	0.086	0.097	0.130
177161.313	179232.281	10.682	0.084	0.097	0.128
179232.281	181339.781	10.737	0.082	0.097	0.127
181339.781	183484.688	10.620	0.080	0.097	0.125
183484.688	185667.875	10.733	0.077	0.097	0.124
185667.875	187890.266	10.754	0.075	0.097	0.123
187890.266	190152.781	10.729	0.074	0.097	0.122
190152.781	192456.438	10.625	0.072	0.097	0.120
192456.438	194802.219	10.505	0.070	0.096	0.119
194802.219	197191.141	10.389	0.069	0.096	0.118
197191.141	199624.281	10.615	0.069	0.097	0.119
199624.281	202102.750	10.629	0.072	0.097	0.121
202102.750	204627.656	10.639	0.077	0.097	0.124
204627.656	207200.203	10.439	0.072	0.096	0.120
207200.203	209821.563	10.442	0.071	0.096	0.119
209821.563	212492.969	10.485	0.067	0.096	0.117
212492.969	215215.781	10.552	0.063	0.096	0.115
215215.781	217991.219	10.389	0.061	0.096	0.114
217991.219	220820.719	10.405	0.058	0.096	0.112
220820.719	223705.672	10.215	0.058	0.095	0.112
223705.672	226647.563	10.272	0.057	0.096	0.111
226647.563	229647.844	10.194	0.054	0.095	0.110
229647.844	232708.109	10.068	0.053	0.095	0.109
232708.109	235829.969	10.108	0.052	0.095	0.108
235829.969	239015.078	10.148	0.051	0.095	0.108
239015.078	242265.156	10.182	0.050	0.095	0.108
242265.156	245582.000	10.182	0.049	0.095	0.107
245582.000	248967.453	9.954	0.049	0.095	0.107
248967.453	252423.391	10.102	0.049	0.095	0.107
252423.391	255951.781	9.946	0.048	0.095	0.106
255951.781	259554.703	9.924	0.051	0.095	0.108
259554.703	263234.250	9.909	0.049	0.095	0.107
263234.250	266992.625	9.951	0.048	0.095	0.106
266992.625	270832.063	9.829	0.049	0.094	0.106
270832.063	274754.906	9.791	0.051	0.094	0.107
274754.906	278763.625	9.829	0.053	0.094	0.108
278763.625	282860.750	9.724	0.057	0.094	0.110
282860.750	287048.875	9.660	0.060	0.094	0.111
287048.875	291330.719	9.730	0.062	0.094	0.113
291330.719	295709.125	9.482	0.060	0.093	0.111
295709.125	300187.000	9.534	0.060	0.094	0.111
300187.000	304767.375	9.569	0.060	0.094	0.111
304767.375	309453.375	9.520	0.061	0.094	0.112
309453.375	314248.313	9.436	0.064	0.093	0.113
314248.313	319155.625	9.483	0.072	0.093	0.118
319155.625	324178.813	9.529	0.105	0.094	0.141

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