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# ESTIMATION OF COVARIANCES OF $^{10}B$, $^{11}B$, $^{55}Mn$, $^{240}Pu$ AND $^{241}Pu$ NEUTRON NUCLEAR DATA IN JENDL-3.2

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# Estimation of Covariances of $^{10}B$, $^{11}B$, $^{55}Mn$, $^{240}Pu$ and $^{241}Pu$ Neutron Nuclear Data in JENDL-3.2

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Covariances of nuclear data have been estimated for 5 nuclides contained in JENDL-3.2. The nuclides considered are $^{10}B$, $^{11}B$, $^{55}Mn$, $^{240}Pu$, and $^{241}Pu$, which are regarded as important for the nuclear design study of fast reactors. The physical quantities for which covariances are deduced are cross sections, resolved and unresolved resonance parameters, and the first order Legendre-polynomial coefficient for the angular distribution of elastically scattered neutrons. The covariances were estimated by using the same methodology that had been used in the JENDL-3.2 evaluation in order to keep a consistency between mean values and their covariances. The least-squares fitting code GMA was used in estimating covariances for reactions of which JENDL-3.2 cross sections had been evaluated by taking account of measurements. Covariances of nuclear model calculations were deduced by the KALMAN system. The covariance data obtained were compiled in the ENDF-6 format, and will be put into the JENDL-3.2 Covariance File which is one of JENDL special purpose files.

Keywords: Covariance, Nuclear Data, JENDL-3.2, $^{10}B$, $^{11}B$, $^{55}Mn$, $^{240}Pu$, $^{241}Pu$, Cross Section, Resonance Parameter, Angular Distribution

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# JENDL-3.2 に収納されている中性子核データ $^{10}B$、$^{11}B$、$^{55}Mn$、$^{240}Pu$、$^{241}Pu$ の共分散の推定

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JENDL-3.2 に収納されている 5 核種の核データの共分散を推定した。対象となった核種は高速炉の核設計研究で重要な、$^{10}B$、$^{11}B$、$^{55}Mn$、$^{240}Pu$ 及び $^{241}Pu$ である。共分散が求められた物理量は、断面積、分離・非分離共鳴パラメータ及び弾性散乱における 1 次のルジャンドル展開係数である。共分散推定においては、JENDL-3.2 の評価に用いられたのと同じ方法が用いられた。JENDL-3.2 で与えられている反応断面積が実験値を基に求められた場合は、最小自乗フィッティングコード GMA を用い共分散を推定した。一方、理論計算値の共分散は KALMAN システムにより計算した。ここで得られた共分散データは ENDF-6 フォーマットでファイル化され、JENDL 特殊目的ファイルの 1 つである JENDL-3.2 共分散ファイルに収納される。

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# 1. Introduction

Uncertainties in nuclear data are needed not only to estimate margins in design and safety of nuclear facilities, but also to adjust group constants by considering critical experiments. The Nuclear Data Center of the Japan Atomic Energy Research Institute (JAERI) has been involved in preparing the integrated group cross section library promoted by the Power Reactor and Nuclear Fuel Development Corporation (PNC).

In the present work, we estimated the covariances of nuclear data for $^{10}$B, $^{11}$B, $^{55}$Mn, $^{240}$Pu, and $^{241}$Pu contained in JENDL-3.2. As for $^{240,241}$Pu, the physical quantities for which covariances were estimated are cross sections, resolved and unresolved resonance parameters, and the 1$^{st}$ order Legendre-polynomial coefficient for the elastic angular distributions of neutrons. The covariances of the total, elastic scattering and capture cross sections of $^{10,11}$B were obtained together with those of the (n,$\alpha$) reaction cross section of $^{10}$B. The uncertainties in the resolved resonance parameters of $^{55}$Mn were analyzed by considering available experimental data.

Covariances were estimated on the basis of the same methods which had been taken in the JENDL-3.2 evaluation[1]. The least-squares fitting code GMA[2], which was developed at the Argonne National Laboratory, was applied to estimate covariances when the JENDL-3.2 data had been obtained by fitting to available experimental data. In cases where the JENDL-3.2 data are based on nuclear model calculations, the code system KALMAN[3], which was developed at Kyushu University, was used to deduce uncertainties in model parameters. Then, the covariances of the model calculations were obtained by using the law of error propagation. On the KALMAN system, one can get covariances of cross sections and angular distributions of emitted neutrons calculated from nuclear model codes.

In JENDL-3.2, the fission cross sections of $^{240}$Pu and $^{239}$Pu were obtained by the simultaneous evaluation[4] which took account of absolute and ratio measurements. The simultaneous evaluation yielded covariances as well as average cross sections although the covariances were not compiled into JENDL-3.2. In the present work, we adopted the results obtained by the simultaneous evaluation without any modification.

In this report, we describe the methods of covariance estimation taken for each nuclide together with the results obtained.

# 2. Boron-10

Covariances were estimated for the total, elastic scattering, capture, and (n,α) reaction cross sections. The evaluated cross sections in JENDL-3.2 were obtained in part from R-matrix calculations. However, in the present work, all the covariances were obtained on the basis of measurements, since it is now impossible to estimate the covariances from the uncertainties in the R-matrix parameters.

## 2.1 Covariances of Total Cross Section

Below 1.2 MeV, the covariances of the total cross section were constructed from those of the elastic scattering cross section and of the capture cross section, which will be described in the following subsections. The GMA code was applied to estimate the covariances above 1.2 MeV. Error information for each measurement is given as follows:

Tsukada and Tanaka[5] $E_n = 3.2 \sim 5.1$ MeV
Total errors are given in the data. A systematic error of 2.2% was obtained.

Auchampaugh et al.[6] $E_n = 1 \sim 14$ MeV
Statistical errors are given in the data. A systematic error of 1.7% was obtained.

Fossan et al.[7] $E_n = 3.3 \sim 15.4$ MeV
Statistical errors are given in the data. A systematic error of 3% was assumed.

Bockelman et al.[8] $E_n = 20$ keV $\sim 3.4$ MeV
Statistical errors are given in the data. A systematic error of 2% was obtained.

Nereson[9] $E_n = 2.8 \sim 9.7$ MeV
Total errors are given in the data. A systematic error of 3% was assumed.

Becker and Barschall[10] $E_n = 4.4 \sim 8.6$ MeV
Statistical errors are given in the data. A systematic error of 3% was assumed.

Cook and Bonner[11] $E_n = 14 \sim 18$ MeV
Statistical errors are given in the data. A systematic error of 3% was assumed.

Figure 1 show the estimated result above 1.2 MeV.

## 2.2 Covariances of Elastic Scattering Cross Section

Above 1.2 MeV, the elastic scattering cross section was evaluated by subtracting the non-elastic cross section from the total cross section. Therefore, the covariances of the elastic scattering cross section were made from those of the total, capture, and (n,$\alpha$) reaction cross sections. Below 1.2 MeV, the covariances were estimated from three sets of measurements[12-14]. Error information for each measurement is given as follows:

Lane et al.[12] $E_n$ = 5 keV ~ 2.2 MeV
Statistical errors are given in the data. A systematic error of 5% was obtained.
Asami and Moxon[13] $E_n$ = 0.5 ~ 130 keV
Total errors are given in the data. A systematic error of 1% was obtained.
Willard et al.[14] $E_n$ = 550 keV ~ 1.5 MeV
Errors are not given. Large systematic and statistical errors of 10% were assumed.

The standard deviation of the thermal cross section was taken from the compilation of Mughabghab et al.[15] Figure 2 shows the standard deviation below 1 MeV.

## 2.3 Covariances of Capture Cross Section

In JENDL-3.2, an 1/v curve was drawn up to 20 MeV after being normalized to the measurement of Bartholomew et al.[16] at the thermal energy. There are no other experimental data available. A relative standard deviation of 40%, which was deduced from the data of Bartholomew et al., was employed in the whole energy region with full correlation. The standard deviation of the capture cross section is shown in Fig. 3.

## 2.4 Covariances of (n,$\alpha$) Reaction Cross Section

In JENDL-3.2, the (n,$\alpha$) reaction cross section consists of two components, i.e., (n,$\alpha_0$) and (n,$\alpha_1$) reactions, which lead to the ground state and the first excited state, respectively. The GMA code was applied to estimate the covariances of each reaction cross-section. Then, the covariances of the total (n,$\alpha$) cross section were given as a sum of the two components.

1) $(n,\alpha_0)$ Reaction

The covariances were estimated from four sets of measurements[17-20]. Error information for each measurement is given as follows:

Sealock and Overley[17] $E_n = 0.2 \sim 1.3$ MeV

Statistical errors are given in the data. A systematic error of 12% was obtained.

Olson and Kavanagh[18] $E_n = 8 \sim 780$ keV

Statistical errors are given in the data. A systematic error of 5% was obtained.

Davis et al.[19] $E_n = 220$ keV $\sim 7.9$ MeV

Total errors are given in the data. A systematic error of 10% was assumed.

Sellem[20] $E_n = 14$ MeV

Statistical errors are given in the data. A systematic error of 11% was obtained.

The estimated standard deviation is shown in Fig. 4.

2) $(n,\alpha_1)$ Reaction

The covariances were estimated from five sets of measurements[19,21-23]. Error information for each measurement is given as follows:

Schrack et al.[21] $E_n = 10 \sim 100$ keV

The experiment was carried out with Ge(Li) and NaI detectors. In the present work, the data measured with a Ge(Li) detector were taken into account. Total errors are given in the data. A systematic error of 2% was obtained.

Davis et al.[19] $E_n = 220$ keV $\sim 7.9$ MeV

Total errors are given in the data. A systematic error of 10% was obtained.

Nellis et al.[22] $E_n = 50$ keV $\sim 5$ MeV, 14.8 MeV

The data at 14.8 MeV were taken into account. Total errors are given in the data. A systematic error of 5.6% was obtained.

Schrack et al.[23] $E_n$ = 200 keV ~ 4 MeV

Total errors are given in the data. A systematic error of 1.6% was obtained.

The (n,$\alpha_1$) reaction mainly contributes to the thermal (n,$\alpha$) cross section. The standard deviation of the thermal (n,$\alpha_1$) cross section was taken from the relative error (0.2%) of the (n,$\alpha$) cross section estimated by Mughabghab et al.[15] The estimated standard deviation is shown in Fig. 5.

## 3. Boron-11

Covariances were estimated for the total, elastic scattering, and capture cross sections. The evaluated cross sections in JENDL-3.2 were obtained in part from R-matrix calculations. However, in the present work, all the covariances were obtained on the basis of measurements, since it is now impossible to estimate the covariances from the uncertainties in the R-matrix parameters.

### 3.1 Covariances of Total Cross Section

The GMA code was applied to estimate the covariances from the following experimental data:

Auchampaugh et al.[6] $E_n$ = 1 ~ 14 MeV

Statistical errors are given in the data. A systematic error of 1.7% was obtained.

Cabe and Cance[24] $E_n$ = 80 keV ~ 7.3 MeV

Total errors are given in the data. Systematic errors of 3% and 2 % were obtained in the energy regions for 80 keV – 1.2 MeV and 1.2 MeV – 7 MeV, respectively.

Lane et al.[25] $E_n$ = 0.3 ~ 2 MeV

Statistical errors are given in the data. A systematic error of 3% was assumed.

Mooring et al.[26] $E_n$ = 13 ~ 500 keV

No error is given. A statistical error of 1% and a systematic error of 3% were assumed.

Figure 6 shows the estimated standard deviation.

### 3.2 Covariances of Elastic Scattering Cross Section

In JENDL-3.2, the elastic scattering cross section was obtained by subtracting the non-elastic cross section from the total cross section. From the viewpoints of cross-section values, the covariances of the elastic scattering cross section can be made from those of the total and capture cross sections. The standard deviation thus obtained is shown in Fig. 7.

### 3.3 Covariances of Capture Cross Section

There are two sets of experimental data available for covariance estimation:

| | |
|---|---|
| Imhof et al.[27] | $E_n$ = 140 keV ~ 2.3 MeV |
| Statistical errors are given in the data. | A systematic error of 50% was obtained. |
| Mooring and Segel[28] | $E_n$ = 4 ~ 36 keV |
| Statistical errors are given in the data. | A systematic error of 10% was assumed. |

The average cross section obtained from the GMA code was found to deviate systematically from the JENDL-3.2 evaluation. Thus, considering this fact, the standard deviation estimated from the GMA code was multiplied by two. The uncertainty at the thermal energy was taken from the relative error (60%) given by Mughabghab et al.[15] Full correlation was considered in the low energy region where the cross section exhibits an 1/v shape. The standard deviation thus obtained is shown in Fig. 8.

## 4. Manganese-55

The standard deviations of resolved resonance parameters were estimated in the present work.

### 4.1 Standard Deviations of Resonance Parameters at Negative Energy

In JENDL-3.2, the two negative resonances at –5.1 and –2.4 keV determine thermal cross sections. The uncertainties in the width parameters ($\Gamma_n$ and $\Gamma_\gamma$) were obtained so as to reproduce the error bands of the thermal cross sections ($\sigma_n$ = 2.2±0.2 b and $\sigma_\gamma$ = 13.3±0.2 b) recommended by Mughabghab et al.[15] The relative standard deviations for $\Gamma_n$ and $\Gamma_\gamma$ thus obtained are 10% and 4%, respectively.

### 4.2 Standard Deviations of Resonance Parameters below 3 keV

In JENDL-3.2, the parameters of the resonances at 337, 1098, 1658, and 2327 eV were determined on the basis of the data measured by Macklin[29], which were not available in the JENDL-2 evaluation. The 1658 eV resonance does not exist in JENDL-2.

The standard deviations of the resonance energies and of the neutron widths for the 337-eV and 1098-eV resonances were derived from the work of Garg[30], while those of the capture widths for the same resonances were taken from the values obtained by Macklin[29].

As for the 1658-eV resonance, relative errors were assumed, i.e., 0.1% for the resonance energy, 10% for the neutron width, and 30% for the capture width by considering uncertainties in other resonances, since the errors were not given in Ref. 29.

The standard deviation of the energy for the 2327-eV resonance was taken from the compilation of Mughabghab et al.[15], whereas those of the neutron and capture widths were taken from the values obtained by Macklin.

### 4.3 Standard Deviations of Other Resonance Parameters

The standard deviations of other resonance parameters above 3 keV were taken from the compilation of Mughabghab et al.[15] Most of the standard deviations for the p-wave capture width were calculated from the capture area, $2g\Gamma_n\Gamma_\gamma/(\Gamma_n + \Gamma_\gamma)$, given in Ref. 15.

Standard deviations of resonance parameters thus obtained are given in Table 1, where ER is the resonance energy, GN the neutron width, GG the capture width, L the orbital angular momentum, J the total angular momentum, and D- the relative error of each parameter.

# 5. Plutonium-240

Covariances were obtained for the total, inelastic scattering, (n,2n), (n,3n), (n,4n), fission and capture cross sections, resolved and unresolved resonance parameters, and the 1st order Legendre coefficient for the elastic angular distribution. The covariances of the elastic scattering cross section, which was evaluated by subtracting the non-elastic cross section from the total cross section in JENDL-3.2, were constructed from those of other cross sections.

## 5.1 Covariances of Resolved Resonance Parameters

The standard deviations of the resolved resonance parameters had been obtained by Nakagawa and Shibata[31)]. In the present work, the errors of the 1.057 eV resonance were modified by considering the difference between the data measured by Spencer et al.[32)] and the values given in JENDL-3.2. The estimated errors for this resonance are 0.3 meV for the neutron width, 2.1 meV for the capture width, and $6.0\times10^{-3}$ meV for the fission width. The correlation coefficient between the neutron and capture widths for the resonance was calculated from the errors of the total, neutron and capture widths given by Spencer et al., being a value of −0.96. The estimated standard deviations are given in Table 2, where ER stands for the energy, GN the neutron width, GG the capture width, GF the fission width, L the orbital angular momentum, J the total angular momentum, and D- the relative standard deviation of each parameter.

## 5.2 Covariances of Unresolved Resonance Parameters

Unresolved resonance parameters are given in the energy region from 4 to 40 keV in JENDL-3.2. These parameters were calculated using the ASREP code[33)] based on the strength-function model. The covariances of the parameters were also obtained from the ASREP code on the KALMAN system[3)]. We took account of the same experimental data that had been used in the JENDL-3.2 evaluation. Table 3 gives the estimated covariances of the level spacing, neutron strength functions, capture widths, and fission widths.

Figures 9 and 10 show the standard deviations of the total and capture cross sections, respectively.

### 5.3 Covariances of Total Cross Section

The GMA code was applied to estimate the covariance from the following sets of measurements:

Smith et al.[34] $E_n$ = 120 keV ~ 1.5 MeV

Total errors are given in the data. A systematic error of 3% was obtained.

Poenitz et al.[35] $E_n$ = 48 keV ~ 4.8 MeV

Total errors are given in the data. A systematic error of 1.2% was obtained.

Poenitz et al.[36] $E_n$ = 1.8 ~ 21 MeV

Total and systematic errors are given in the data. A systematic error of 0.93% was obtained.

The estimated result is shown in Fig. 11.

### 5.4 Covariances of (n,2n), (n,3n), and (4n) Reaction Cross Sections

The cross sections for the (n,2n), (n,3n) and (n,4n) reactions were evaluated by nuclear model calculations in JENDL-3.2. However, the parameters required as input to the model code are no longer available. Moreover, there exists no experimental data available for error estimation. Therefore, in the present work, we used the following rule obtained by Oh[37] :

| Cross section σ (mb) | Standard deviation (%) |
|---|---|
| $500<\sigma$ | 5 |
| $100\leq\sigma\leq500$ | 10 |
| $1\leq\sigma\leq100$ | 15 |
| $\sigma<1$ | >25 |

Strong correlation was assumed in the whole energy range.

### 5.5 Covariances of Fission Cross Sections

The covariances of the fission cross section were obtained by the simultaneous evaluation[4] in the energy region above 100 keV. Figure 12 shows the standard deviation obtained.

### 5.6 Covariances of Inelastic Scattering and Capture Cross Sections

The statistical model code CASTHY[38] was used to estimate the covariances by using the KALMAN system. The uncertainties in the model parameters were derived by fitting to the measurements of Smith et al.[34] for the inelastic scattering and to those of Hockenbury et al.[39] and Weston et al.[40] for the capture reaction. The initial values of the optical model parameters are given as follows:

| | | |
|---|---|---|
| $V = 40.6 - 0.05 \times E_n$ MeV | $W_s = 6.5 + 0.15 \times E_n$ MeV | $V_{so} = 7.0$ MeV |
| $r_0 = 1.32$ fm | $r_s = 1.38$ fm | $r_{so} = 1.32$ fm |
| $a = 0.47$ fm | $b = 0.47$ fm | $a_{so} = 0.47$fm. |

The estimated standard deviation of the capture cross section is shown in Fig. 13.

### 5.7 Covariances of Elastic Angular Distribution

The optical model code ELIESE-3[41] was used to estimate the covariance of the 1st order Legendre coefficient for the elastic angular distribution. The uncertainties in the optical model parameters were obtained by considering the experimental data on the total cross section mentioned in Sect. 5.3. The relative standard deviation is shown in Fig. 14.

## 6. Plutonium-241

Covariances were obtained for the total, inelastic scattering, (n,2n), (n,3n), (n,4n), fission and capture cross sections, resolved and unresolved resonance parameters, and the 1st order Legendre coefficient for the elastic angular distribution. The covariances of the elastic scattering cross section, which was evaluated by subtracting the non-elastic cross section from the total cross section in JENDL-3.2, were constructed from those of other cross sections.

### 6.1 Covariances of Resolved Resonance Parameters

Derrien[42] analyzed the resonance parameters at –0.1225 eV and 0.2647 eV with the Reich-Moore formula. The covariances of the parameters for the two resonances were obtained by Derrien, and they were adopted in the present work.

### 6.2 Covariances of Unresolved Resonance Parameters

Unresolved resonance parameters are given in the energy region from 0.3 to 30 keV in JENDL-3.2. The covariances of the parameters were obtained by the ASREP code on the KALMAN system, and they are listed in Table 4. The standard deviations of the fission and capture cross sections are shown in Figs. 15 and 16, respectively.

### 6.3 Covariances of Total Cross Section

The ELIESE-3 code was used to calculate the covariances with the optical model parameters and their covariances which had been obtained in the covariance estimation[43] of $^{239}$Pu, since there are no experimental data available for $^{241}$Pu.

### 6.4 Covariances of (n,2n), (n,3n), and (n,4n) Reaction Cross Sections

The JENDL-3.2 evaluation is based on nuclear model calculations. However, the parameters required as input to the model code are no longer available. Moreover, experimental data on these reactions are very scarce, and it is impossible to determine the covariances experimentally. Therefore, we used the rule of Oh[37], which was also applied to the $^{240}$Pu(n,2n), (n,3n) and (n,4n) reactions.

### 6.5 Covariances of Fission Cross Sections

The covariances of the fission cross section above 30 keV were obtained by the simultaneous evaluation, and the result is shown in Fig. 17.

### 6.6 Covariances of Inelastic Scattering and Capture Cross Sections

The statistical model code CASTHY was used to estimate the covariances by using the KALMAN system. The uncertainties in the model parameters were derived by fitting to the capture cross sections which were calculated from the $\alpha$-values measured by Weston and Todd[44] as well as the fission cross sections in JENDL-3.2. The initial values of the optical model parameters are given as follows:

| | | |
|---|---|---|
| $V = 40.72 - 0.05 \times E_n$ MeV | $W_s = 6.78 + 0.29 \times E_n$ MeV | $V_{so} = 7.0$ MeV |
| $r_0 = 1.32$ fm | $r_s = 1.357$ fm | $r_{so} = 1.32$ fm |
| $a = 0.47$ fm | $b = 0.47$ fm | $a_{so} = 0.47$fm. |

The estimated standard deviation of the capture cross section is shown in Fig. 18.

### 6.7 Covariances of Elastic Angular Distribution

The optical model code ELIESE-3 was used to estimate the covariance of the $1^{st}$ order Legendre coefficient for the elastic angular distribution. The uncertainties in the optical model parameters were obtained by considering the experimental data on the total cross section of $^{239}$Pu as mentioned in Sect. 6.3. The relative standard deviation is shown in Fig. 19

## 7. Concluding Remarks

Covariances of nuclear data were estimated for $^{10}$B, $^{11}$B, $^{55}$Mn, $^{240}$Pu, and $^{241}$Pu contained in JENDL-3.2. The quantities of which covariances were obtained are cross sections, resolved and unresolved resonance parameters, and the $1^{st}$ order Legendre coefficient for the elastic angular distribution of neutrons. The uncertainty in the Legendre coefficient was estimated in order to calculate an uncertainty in an average cosine of elastic-scattering angles.

In covariance estimation, we used the same methodology that had been taken in the JENDL-3.2 evaluation in order to keep a consistency between mean values and their covariances. The covariances of fission cross sections were taken from the simultaneous evaluation which had been performed in the JENDL-3.2 evaluation.

The results obtained were compiled in the ENDF-6 format, and will be put into the JENDL-3.2 Covariance File which is one of the JENDL special purpose files managed by the JAERI Nuclear Data Center. The data are also used in making the integrated group cross-section library promoted by the PNC.

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Table 1 Resonance parameters of Mn-55 and their relative standard deviations

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) |
|---|---|---|---|---|---|---|---|
| -5.10E+03 | 0.00E+00 | 0 | 3 | 3.17E+02 | 1.00E+01 | 2.65E+00 | 4.00E+00 |
| -2.40E+03 | 0.00E+00 | 0 | 2 | 2.76E+02 | 1.00E+01 | 2.65E+00 | 4.00E+00 |
| 3.37E+02 | 2.96E-01 | 0 | 2 | 2.20E+01 | 2.27E+00 | 3.10E-01 | 6.45E+00 |
| 1.10E+03 | 1.82E-01 | 0 | 3 | 1.54E+01 | 3.25E+00 | 3.12E-01 | 3.85E+00 |
| 1.66E+03 | 1.00E-01 | 0 | 2 | 5.19E-01 | 1.00E+01 | 2.81E-01 | 3.00E+01 |
| 2.33E+03 | 2.15E-01 | 0 | 3 | 3.95E+02 | 2.53E+00 | 3.40E-01 | 3.82E+01 |
| 4.00E+03 | 2.00E-01 | 1 | 1 | 1.24E-03 | 1.13E+01 | 7.44E-02 | 3.00E+01 |
| 4.30E+03 | 2.09E-01 | 1 | 2 | 4.61E-03 | 5.21E+00 | 4.38E-01 | 3.00E+01 |
| 4.94E+03 | 2.02E-01 | 1 | 3 | 7.99E-01 | 1.00E+01 | 2.90E-01 | 4.48E+00 |
| 6.33E+03 | 9.48E-02 | 1 | 2 | 2.78E-01 | 3.96E+00 | 3.54E-01 | 7.80E+00 |
| 6.96E+03 | 8.62E-02 | 1 | 4 | 1.46E-02 | 7.53E+00 | 3.50E-01 | 3.00E+01 |
| 7.10E+03 | 8.45E-02 | 0 | 2 | 3.98E+02 | 2.01E+00 | 1.03E+00 | 7.77E+00 |
| 8.82E+03 | 7.94E-02 | 0 | 3 | 3.70E+02 | 3.24E+00 | 8.20E-01 | 9.76E+00 |
| 9.79E+03 | 8.17E-02 | 1 | 1 | 1.40E-02 | 7.14E+00 | 3.64E-01 | 3.00E+01 |
| 1.06E+04 | 8.48E-02 | 1 | 2 | 5.18E-02 | 3.47E+00 | 3.79E-01 | 3.00E+01 |
| 1.09E+04 | 8.26E-02 | 1 | 2 | 2.90E-01 | 6.90E+00 | 3.40E-01 | 1.05E+01 |
| 1.16E+04 | 8.60E-02 | 1 | 2 | 8.00E-02 | 3.75E+00 | 3.69E-01 | 2.68E+01 |
| 1.27E+04 | 7.88E-02 | 1 | 3 | 1.30E+00 | 7.69E+00 | 3.23E-01 | 1.08E+01 |
| 1.47E+04 | 8.16E-02 | 1 | 2 | 1.15E-01 | 2.61E+00 | 4.11E-01 | 1.54E+01 |
| 1.49E+04 | 8.03E-02 | 1 | 2 | 4.30E-01 | 4.65E+00 | 3.47E-01 | 5.87E+00 |
| 1.62E+04 | 8.04E-02 | 1 | 2 | 8.45E-01 | 6.63E+00 | 3.59E-01 | 4.41E+00 |
| 1.77E+04 | 8.46E-02 | 1 | 2 | 8.40E-02 | 5.71E+00 | 3.68E-01 | 3.00E+01 |
| 1.78E+04 | 8.43E-02 | 0 | 3 | 1.10E+01 | 2.09E+01 | 7.40E-01 | 4.32E+00 |
| 1.80E+04 | 8.34E-02 | 0 | 2 | 6.50E+01 | 7.69E+00 | 4.70E-01 | 4.26E+00 |
| 1.88E+04 | 8.51E-02 | 1 | 2 | 1.72E+00 | 1.40E+01 | 3.64E-01 | 4.49E+00 |
| 1.91E+04 | 8.37E-02 | 1 | 3 | 9.69E-03 | 1.75E+01 | 3.55E-01 | 3.00E+01 |
| 2.02E+04 | 8.41E-02 | 1 | 2 | 4.30E-01 | 4.65E+00 | 3.46E-01 | 6.59E+00 |
| 2.05E+04 | 8.30E-02 | 1 | 2 | 4.60E-03 | 4.35E+01 | 4.00E-01 | 3.00E+01 |
| 2.08E+04 | 8.16E-02 | 1 | 2 | 3.48E-01 | 5.46E+00 | 3.73E-01 | 8.84E+00 |
| 2.09E+04 | 8.15E-02 | 0 | 3 | 9.34E+02 | 6.42E+00 | 7.10E-01 | 1.13E+01 |
| 2.23E+04 | 8.51E-02 | 1 | 2 | 7.70E-02 | 5.19E+00 | 3.70E-01 | 3.00E+01 |
| 2.26E+04 | 8.39E-02 | 1 | 3 | 1.20E+00 | 1.17E+01 | 3.00E-01 | 6.00E+00 |
| 2.37E+04 | 8.45E-02 | 0 | 3 | 2.88E+02 | 6.94E+00 | 4.05E-01 | 1.23E+01 |
| 2.44E+04 | 8.19E-02 | 1 | 3 | 1.70E+00 | 5.88E+01 | 2.90E-01 | 5.86E+00 |
| 2.57E+04 | 8.17E-02 | 1 | 2 | 1.17E-01 | 6.15E+00 | 4.00E-01 | 3.00E+01 |
| 2.59E+04 | 8.10E-02 | 1 | 2 | 4.00E+00 | 2.50E+01 | 4.30E-01 | 3.26E+01 |
| 2.65E+04 | 8.31E-02 | 0 | 2 | 1.32E+02 | 7.58E+00 | 4.27E-01 | 9.37E+00 |
| 2.70E+04 | 8.15E-02 | 0 | 3 | 4.20E+02 | 9.52E+00 | 9.80E-01 | 5.51E+00 |
| 2.83E+04 | 8.49E-02 | 1 | 2 | 9.80E-02 | 7.14E+00 | 3.50E-01 | 3.00E+01 |
| 2.87E+04 | 8.35E-02 | 1 | 2 | 1.70E+00 | 1.41E+01 | 3.64E-01 | 4.62E+00 |
| 3.03E+04 | 8.25E-02 | 0 | 2 | 1.49E+01 | 1.68E+01 | 4.30E-01 | 1.63E+01 |
| 3.17E+04 | 8.21E-02 | 1 | 2 | 2.60E-01 | 7.69E+00 | 4.62E-01 | 2.11E+01 |
| 3.17E+04 | 8.19E-02 | 1 | 3 | 4.80E-02 | 1.67E+01 | 4.00E-01 | 3.00E+01 |
| 3.23E+04 | 8.36E-02 | 1 | 3 | 6.67E-01 | 1.44E+01 | 3.35E-01 | 9.25E+00 |
| 3.24E+04 | 8.33E-02 | 1 | 1 | 2.40E-01 | 4.17E+00 | 8.60E-02 | 9.30E+00 |
| 3.33E+04 | 8.40E-02 | 1 | 2 | 1.01E+01 | 5.56E+00 | 3.64E-01 | 1.10E+01 |
| 3.49E+04 | 8.31E-02 | 1 | 2 | 1.37E-01 | 1.75E+01 | 3.83E-01 | 3.00E+01 |
| 3.52E+04 | 8.23E-02 | 1 | 2 | 2.60E-01 | 1.92E+01 | 4.62E-01 | 3.00E+01 |
| 3.53E+04 | 8.22E-02 | 0 | 3 | 1.37E+03 | 1.46E+01 | 1.42E+00 | 2.96E+01 |
| 3.55E+04 | 8.45E-02 | 0 | 2 | 1.32E+03 | 7.58E+00 | 1.36E+00 | 3.46E+01 |
| 3.65E+04 | 8.21E-02 | 1 | 2 | 7.30E+00 | 8.22E+00 | 3.55E-01 | 1.13E+01 |

Table 1 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) |
|---|---|---|---|---|---|---|---|
| 4.09E+04 | 8.31E-02 | 1 | 2 | 1.01E+01 | 3.27E+01 | 5.10E-01 | 9.80E+00 |
| 4.09E+04 | 8.31E-02 | 0 | 3 | 4.54E+02 | 1.10E+01 | 7.90E-01 | 1.01E+01 |
| 4.10E+04 | 8.29E-02 | 1 | 2 | 2.98E-01 | 1.54E+01 | 4.56E-01 | 3.00E+01 |
| 4.11E+04 | 8.27E-02 | 1 | 3 | 1.99E-01 | 1.81E+01 | 3.64E-01 | 3.00E+01 |
| 4.39E+04 | 8.44E-02 | 1 | 2 | 1.20E+01 | 5.00E+01 | 8.30E-01 | 9.64E+00 |
| 4.40E+04 | 8.40E-02 | 1 | 2 | 6.00E+00 | 6.67E+01 | 4.52E-01 | 8.42E+00 |
| 4.53E+04 | 8.38E-02 | 1 | 3 | 3.90E-01 | 1.54E+01 | 2.30E-01 | 6.09E+00 |
| 4.69E+04 | 8.31E-02 | 0 | 2 | 2.02E+01 | 4.16E+01 | 5.50E-01 | 1.09E+01 |
| 4.76E+04 | 8.40E-02 | 0 | 3 | 2.10E+01 | 5.71E+01 | 1.70E-01 | 1.00E+01 |
| 4.83E+04 | 8.27E-02 | 1 | 3 | 4.30E-01 | 1.40E+01 | 3.96E-01 | 1.81E+01 |
| 5.11E+04 | 8.41E-02 | 1 | 3 | 4.70E+00 | 9.36E+01 | 3.40E-01 | 1.01E+01 |
| 5.25E+04 | 8.39E-02 | 1 | 3 | 1.05E+00 | 3.43E+01 | 3.41E-01 | 1.60E+01 |
| 5.28E+04 | 8.33E-02 | 1 | 3 | 1.40E-02 | 7.14E+01 | 4.00E-01 | 3.00E+01 |
| 5.34E+04 | 8.43E-02 | 0 | 2 | 1.18E+02 | 1.69E+00 | 5.00E-01 | 1.00E+01 |
| 5.42E+04 | 8.30E-02 | 1 | 2 | 1.00E+01 | 3.00E+01 | 5.00E-01 | 1.00E+01 |
| 5.46E+04 | 8.43E-02 | 0 | 3 | 2.10E+01 | 5.71E+01 | 5.00E-01 | 1.00E+01 |
| 5.65E+04 | 8.31E-02 | 1 | 3 | 1.82E+00 | 3.96E+01 | 3.35E-01 | 9.73E+00 |
| 5.72E+04 | 8.40E-02 | 1 | 2 | 4.10E-02 | 6.34E+01 | 3.06E-01 | 3.00E+01 |
| 5.73E+04 | 8.37E-02 | 1 | 2 | 4.10E-01 | 2.44E+01 | 4.59E-01 | 3.00E+01 |
| 5.74E+04 | 8.37E-02 | 0 | 3 | 5.57E+02 | 8.98E+00 | 5.60E-01 | 5.00E+01 |
| 5.75E+04 | 8.35E-02 | 0 | 2 | 5.18E+02 | 6.37E+00 | 4.30E-01 | 9.30E+00 |
| 5.81E+04 | 8.26E-02 | 1 | 2 | 1.20E+00 | 4.17E+01 | 6.60E-01 | 1.06E+01 |
| 5.96E+04 | 8.39E-02 | 1 | 3 | 4.60E-01 | 3.48E+01 | 3.43E-01 | 3.00E+01 |
| 5.98E+04 | 8.36E-02 | 0 | 2 | 6.24E+02 | 8.01E+00 | 7.60E-01 | 1.32E+01 |
| 6.02E+04 | 8.30E-02 | 1 | 3 | 5.50E-01 | 2.55E+01 | 3.52E-01 | 2.26E+01 |
| 6.03E+04 | 8.29E-02 | 1 | 4 | 5.00E-02 | 4.00E+01 | 1.01E+00 | 3.00E+01 |
| 6.10E+04 | 8.36E-02 | 1 | 3 | 2.60E-02 | 6.15E+01 | 3.60E-01 | 3.00E+01 |
| 6.16E+04 | 8.27E-02 | 1 | 3 | 8.60E-01 | 5.81E+01 | 4.00E-01 | 1.00E+01 |
| 6.20E+04 | 8.39E-02 | 0 | 2 | 2.02E+01 | 4.11E+01 | 4.80E-01 | 1.04E+01 |
| 6.43E+04 | 8.39E-02 | 0 | 3 | 9.26E+02 | 2.16E+01 | 1.60E+00 | 1.00E+01 |
| 6.46E+04 | 8.36E-02 | 1 | 3 | 9.09E-02 | 2.64E+01 | 3.47E-01 | 3.00E+01 |
| 6.58E+04 | 8.37E-02 | 0 | 2 | 5.00E+01 | 5.00E+01 | 3.55E-01 | 1.01E+01 |
| 6.59E+04 | 8.34E-02 | 1 | 3 | 2.10E-01 | 2.86E+01 | 3.43E-01 | 3.00E+01 |
| 6.66E+04 | 8.41E-02 | 0 | 3 | 2.19E+02 | 1.60E+01 | 5.30E-01 | 9.43E+00 |
| 6.74E+04 | 8.31E-02 | 1 | 3 | 2.60E-01 | 1.54E+01 | 3.36E-01 | 2.73E+01 |
| 6.77E+04 | 8.28E-02 | 0 | 2 | 6.00E+01 | 4.17E+01 | 6.20E-01 | 9.68E+00 |
| 6.88E+04 | 8.28E-02 | 1 | 3 | 2.90E-01 | 2.76E+01 | 3.69E-01 | 3.00E+01 |
| 6.96E+04 | 8.34E-02 | 0 | 3 | 2.60E+01 | 4.62E+01 | 4.25E-01 | 9.41E+00 |
| 6.99E+04 | 8.30E-02 | 0 | 2 | 8.64E+02 | 1.97E+01 | 1.60E+00 | 1.25E+01 |
| 6.99E+04 | 8.29E-02 | 1 | 2 | 6.50E-02 | 6.15E+01 | 3.73E-01 | 3.00E+01 |
| 7.00E+04 | 8.29E-02 | 1 | 4 | 1.50E-01 | 5.33E+01 | 9.29E-01 | 3.00E+01 |
| 7.09E+04 | 8.33E-02 | 1 | 3 | 2.90E-01 | 2.76E+01 | 3.69E-01 | 3.00E+01 |
| 7.12E+04 | 8.43E-02 | 0 | 2 | 2.18E+01 | 6.42E+00 | 5.70E-01 | 2.11E+01 |
| 7.19E+04 | 8.35E-02 | 0 | 3 | 3.40E+01 | 2.94E+01 | 6.50E-01 | 1.00E+01 |
| 7.23E+04 | 8.30E-02 | 1 | 1 | 1.20E-01 | 1.67E+01 | 4.80E-01 | 3.00E+01 |
| 7.30E+04 | 8.36E-02 | 0 | 2 | 1.68E+02 | 1.49E+01 | 4.90E-01 | 4.29E+01 |
| 7.40E+04 | 8.38E-02 | 1 | 3 | 1.40E-01 | 2.86E+01 | 4.11E-01 | 3.00E+01 |
| 7.41E+04 | 8.37E-02 | 0 | 2 | 1.40E+01 | 2.14E+01 | 6.35E-01 | 2.36E+01 |
| 7.42E+04 | 8.36E-02 | 0 | 3 | 8.74E+02 | 1.37E+01 | 4.70E-01 | 4.26E+01 |
| 7.46E+04 | 8.32E-02 | 1 | 2 | 6.70E-02 | 3.88E+01 | 4.03E-01 | 3.00E+01 |
| 7.55E+04 | 9.01E-02 | 1 | 4 | 4.00E-02 | 5.00E+01 | 5.60E-01 | 3.00E+01 |

Table 1 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) |
|---|---|---|---|---|---|---|---|
| 7.75E+04 | 8.39E-02 | 1 | 2 | 1.78E+01 | 1.91E+01 | 5.90E-01 | 2.03E+01 |
| 7.83E+04 | 8.30E-02 | 0 | 2 | 5.00E+01 | 3.40E+01 | 4.55E-01 | 1.10E+01 |
| 7.93E+04 | 8.32E-02 | 0 | 3 | 5.00E+01 | 4.60E+01 | 3.40E-01 | 1.03E+01 |
| 8.13E+04 | 8.24E-02 | 1 | 4 | 3.20E-01 | 1.06E+02 | 4.88E-01 | 3.00E+01 |
| 8.15E+04 | 8.35E-02 | 0 | 2 | 3.96E+02 | 1.06E+01 | 8.00E-01 | 1.75E+01 |
| 8.16E+04 | 8.34E-02 | 1 | 4 | 2.40E-01 | 5.00E+01 | 4.25E-01 | 3.00E+01 |
| 8.25E+04 | 8.36E-02 | 1 | 4 | 2.90E-01 | 3.45E+01 | 4.66E-01 | 3.00E+01 |
| 8.35E+04 | 8.38E-02 | 0 | 3 | 3.40E+01 | 2.94E+01 | 4.80E-01 | 1.04E+01 |
| 8.39E+04 | 8.34E-02 | 1 | 4 | 4.10E-01 | 3.41E+01 | 5.72E-01 | 3.00E+01 |
| 8.42E+04 | 8.32E-02 | 1 | 2 | 4.60E-01 | 1.30E+01 | 4.56E-01 | 1.80E+01 |
| 8.48E+04 | 8.37E-02 | 1 | 3 | 1.22E+00 | 8.20E+01 | 3.40E-01 | 2.97E+01 |
| 8.50E+04 | 8.35E-02 | 1 | 4 | 6.60E+00 | 4.55E+01 | 8.55E-01 | 9.36E+00 |
| 8.50E+04 | 8.35E-02 | 0 | 2 | 8.64E+02 | 1.97E+01 | 3.80E-01 | 7.89E+01 |
| 8.53E+04 | 8.33E-02 | 1 | 4 | 6.00E-02 | 1.00E+02 | 4.10E-01 | 3.00E+01 |
| 8.61E+04 | 8.36E-02 | 1 | 4 | 2.55E+00 | 2.98E+01 | 4.28E-01 | 2.18E+01 |
| 8.63E+04 | 8.34E-02 | 0 | 3 | 1.89E+02 | 1.22E+01 | 3.70E-01 | 2.16E+01 |
| 8.65E+04 | 8.32E-02 | 1 | 3 | 1.80E+01 | 1.11E+01 | 4.30E-01 | 8.36E+00 |
| 8.66E+04 | 8.32E-02 | 1 | 2 | 1.20E-01 | 5.00E+01 | 3.80E-01 | 3.00E+01 |
| 8.72E+04 | 8.37E-02 | 1 | 2 | 3.40E-01 | 1.76E+01 | 4.48E-01 | 3.00E+01 |
| 8.88E+04 | 8.34E-02 | 1 | 2 | 1.20E+01 | 2.50E+01 | 5.40E-01 | 1.02E+01 |
| 8.97E+04 | 8.36E-02 | 1 | 3 | 6.90E+00 | 5.51E+01 | 3.42E-01 | 6.16E+00 |
| 9.14E+04 | 8.32E-02 | 0 | 3 | 6.90E+01 | 2.90E+01 | 7.70E-01 | 1.04E+01 |
| 9.15E+04 | 8.31E-02 | 0 | 2 | 6.00E+01 | 3.33E+01 | 6.90E-01 | 1.23E+01 |
| 9.21E+04 | 8.36E-02 | 1 | 3 | 7.49E+00 | 5.07E+01 | 4.26E-01 | 3.66E+00 |
| 9.38E+04 | 8.32E-02 | 1 | 3 | 6.20E-01 | 2.90E+01 | 3.49E-01 | 2.10E+01 |
| 9.53E+04 | 8.29E-02 | 1 | 3 | 6.40E+00 | 6.41E+01 | 3.81E-01 | 6.33E+00 |
| 9.68E+04 | 8.37E-02 | 0 | 2 | 2.40E+02 | 2.50E+01 | 4.00E-01 | 2.00E+01 |
| 9.84E+04 | 8.34E-02 | 1 | 3 | 1.47E+01 | 9.52E+00 | 4.23E-01 | 8.58E+00 |
| 9.88E+04 | 8.30E-02 | 1 | 2 | 2.40E-01 | 3.33E+01 | 4.46E-01 | 3.00E+01 |
| 9.90E+04 | 8.28E-02 | 0 | 3 | 7.46E+02 | 3.08E+01 | 1.10E+00 | 1.36E+01 |
| 9.93E+04 | 8.36E-02 | 1 | 3 | 2.90E-01 | 4.14E+01 | 3.69E-01 | 3.00E+01 |
| 1.00E+05 | 8.30E-02 | 1 | 1 | 2.80E-01 | 2.14E+01 | 2.98E-01 | 3.00E+01 |
| 1.00E+05 | 8.36E-02 | 1 | 2 | 4.60E-01 | 2.17E+01 | 4.56E-01 | 3.00E+01 |
| 1.04E+05 | 8.35E-02 | 0 | 2 | 1.30E+02 | 3.54E+00 | 1.75E+00 | 5.71E+00 |
| 1.05E+05 | 8.38E-02 | 1 | 3 | 3.40E+00 | 1.76E+01 | 1.80E-01 | 4.44E+01 |
| 1.05E+05 | 8.37E-02 | 1 | 2 | 2.14E+01 | 6.54E+00 | 5.35E-01 | 3.00E+01 |
| 1.05E+05 | 8.35E-02 | 0 | 2 | 2.20E+03 | 1.91E+01 | 1.22E+00 | 3.29E+00 |
| 1.07E+05 | 8.32E-02 | 1 | 2 | 2.40E+01 | 2.08E+01 | 6.50E-01 | 1.08E+01 |
| 1.08E+05 | 8.34E-02 | 0 | 2 | 4.92E+02 | 2.03E+01 | 1.70E+00 | 1.18E+01 |
| 1.09E+05 | 8.35E-02 | 1 | 2 | 3.60E+01 | 1.11E+01 | 7.20E-01 | 1.11E+01 |
| 1.10E+05 | 8.30E-02 | 1 | 3 | 3.60E-01 | 2.78E+01 | 3.60E-01 | 3.00E+01 |
| 1.10E+05 | 8.35E-02 | 0 | 2 | 1.20E+02 | 2.75E+01 | 4.60E-01 | 1.52E+01 |
| 1.11E+05 | 8.32E-02 | 1 | 2 | 2.60E-01 | 3.08E+01 | 4.62E-01 | 3.00E+01 |
| 1.11E+05 | 8.37E-02 | 1 | 2 | 1.20E+01 | 2.50E+01 | 6.10E-01 | 9.84E+00 |
| 1.11E+05 | 8.35E-02 | 0 | 3 | 3.60E+03 | 2.58E+01 | 2.40E+00 | 2.08E+01 |
| 1.12E+05 | 8.34E-02 | 1 | 3 | 2.10E+00 | 9.52E+01 | 3.63E-01 | 1.21E+01 |
| 1.12E+05 | 8.32E-02 | 1 | 2 | 1.20E+01 | 2.50E+01 | 5.80E-01 | 1.03E+01 |

Table 2 Resonance parameters of Pu-240 and their ralative standard deviations

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| -9.85E+00 | 5.00E-02 | 0 | 0.5 | 1.14E-02 | 0.00E+00 | 3.24E-02 | 3.00E+01 | 0.00E+00 | 0.00E+00 |
| 1.06E+00 | 1.89E-01 | 0 | 0.5 | 2.32E-03 | 5.60E+00 | 3.24E-02 | 6.48E+00 | 6.00E-06 | 1.00E+01 |
| 2.05E+01 | 4.89E-02 | 0 | 0.5 | 2.65E-03 | 3.40E+00 | 3.22E-02 | 1.09E+01 | 2.60E-04 | 1.02E+00 |
| 3.83E+01 | 5.22E-02 | 0 | 0.5 | 1.73E-02 | 2.89E+00 | 2.94E-02 | 9.52E+00 | 1.16E-05 | 6.98E+00 |
| 4.16E+01 | 4.80E-02 | 0 | 0.5 | 1.55E-02 | 9.68E+00 | 3.30E-02 | 6.06E+00 | 3.76E-06 | 2.50E+01 |
| 6.67E+01 | 6.04E-02 | 0 | 0.5 | 5.00E-02 | 6.00E+00 | 3.10E-02 | 6.45E+00 | 2.71E-05 | 2.99E+00 |
| 7.28E+01 | 5.50E-02 | 0 | 0.5 | 2.10E-02 | 9.52E+00 | 3.20E-02 | 6.25E+00 | 1.05E-04 | 1.44E+00 |
| 9.08E+01 | 5.00E-02 | 0 | 0.5 | 1.28E-02 | 7.81E+00 | 2.95E-02 | 3.00E+01 | 8.93E-06 | 1.85E+01 |
| 9.25E+01 | 6.49E-02 | 0 | 0.5 | 3.20E-03 | 3.13E+00 | 2.95E-02 | 3.00E+01 | 6.25E-05 | 9.84E+00 |
| 1.05E+02 | 6.67E-02 | 0 | 0.5 | 4.30E-02 | 4.65E+00 | 3.55E-02 | 5.63E+00 | 5.11E-06 | 2.14E+01 |
| 1.22E+02 | 8.22E-02 | 0 | 0.5 | 1.45E-02 | 1.03E+01 | 2.95E-02 | 3.00E+01 | 4.44E-05 | 5.48E+00 |
| 1.31E+02 | 7.65E-02 | 0 | 0.5 | 1.90E-04 | 1.58E+01 | 3.00E-02 | 3.00E+01 | 2.24E-04 | 5.71E+01 |
| 1.35E+02 | 7.39E-02 | 0 | 0.5 | 1.80E-02 | 1.11E+01 | 2.95E-02 | 3.00E+01 | 2.72E-05 | 8.74E+00 |
| 1.52E+02 | 6.58E-02 | 0 | 0.5 | 1.44E-02 | 1.04E+01 | 2.95E-02 | 3.00E+01 | 3.07E-04 | 1.40E+00 |
| 1.63E+02 | 6.15E-02 | 0 | 0.5 | 9.00E-03 | 6.67E+00 | 2.95E-02 | 3.00E+01 | 5.56E-06 | 7.69E+01 |
| 1.70E+02 | 5.88E-02 | 0 | 0.5 | 1.51E-02 | 9.93E+00 | 2.95E-02 | 3.00E+01 | 1.34E-04 | 2.66E+00 |
| 1.86E+02 | 1.08E-01 | 0 | 0.5 | 1.62E-02 | 1.23E+01 | 2.95E-02 | 3.00E+01 | 9.88E-06 | 3.43E+01 |
| 1.92E+02 | 1.04E-01 | 0 | 0.5 | 3.00E-04 | 1.33E+01 | 3.00E-02 | 3.00E+01 | 1.22E-04 | 1.00E+02 |
| 2.00E+02 | 1.00E-01 | 0 | 0.5 | 1.00E-03 | 1.00E+01 | 2.95E-02 | 3.00E+01 | 1.29E-04 | 2.86E+01 |
| 2.39E+02 | 8.36E-02 | 0 | 0.5 | 1.31E-02 | 8.40E+00 | 2.95E-02 | 3.00E+01 | 4.49E-05 | 1.16E+01 |
| 2.61E+02 | 7.68E-02 | 0 | 0.5 | 2.32E-02 | 5.17E+00 | 3.20E-02 | 9.38E+00 | 1.01E-04 | 4.73E+00 |
| 2.87E+02 | 6.97E-02 | 0 | 0.5 | 1.25E-01 | 8.00E+00 | 3.00E-02 | 6.67E+00 | 3.84E-04 | 1.17E+00 |
| 3.05E+02 | 6.56E-02 | 0 | 0.5 | 7.40E-03 | 6.76E+00 | 2.95E-02 | 3.00E+01 | 7.14E-05 | 1.47E+01 |
| 3.19E+02 | 6.28E-02 | 0 | 0.5 | 6.20E-03 | 6.45E+00 | 2.95E-02 | 3.00E+01 | 1.35E-04 | 9.83E+00 |
| 3.21E+02 | 6.24E-02 | 0 | 0.5 | 1.97E-02 | 1.12E+01 | 2.95E-02 | 3.00E+01 | 5.53E-05 | 1.04E+01 |
| 3.38E+02 | 5.91E-02 | 0 | 0.5 | 7.40E-03 | 6.76E+00 | 2.95E-02 | 3.00E+01 | 5.49E-06 | 1.00E+02 |
| 3.46E+02 | 5.78E-02 | 0 | 0.5 | 1.77E-02 | 1.02E+01 | 2.95E-02 | 3.00E+01 | 1.41E-04 | 5.12E+00 |
| 3.64E+02 | 5.50E-02 | 0 | 0.5 | 3.25E-02 | 4.00E+00 | 3.50E-02 | 8.57E+00 | 2.58E-05 | 2.18E+01 |
| 3.72E+02 | 5.38E-02 | 0 | 0.5 | 1.47E-02 | 8.84E+00 | 2.95E-02 | 3.00E+01 | 4.30E-05 | 1.96E+01 |
| 4.05E+02 | 4.94E-02 | 0 | 0.5 | 1.08E-01 | 4.63E+00 | 2.95E-02 | 3.00E+01 | 4.65E-04 | 1.40E+00 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 4.19E+02 | 4.77E-02 | 0 | 0.5 | 7.10E-03 | 8.45E+00 | 2.95E-02 | 3.00E+01 | 6.15E-05 | 2.61E+01 |
| 4.46E+02 | 6.73E-02 | 0 | 0.5 | 2.20E-03 | 9.09E+00 | 3.00E-02 | 3.00E+01 | 2.08E-04 | 2.41E+01 |
| 4.50E+02 | 4.45E-02 | 0 | 0.5 | 1.97E-02 | 1.12E+01 | 2.95E-02 | 3.00E+01 | 3.95E-05 | 2.28E+01 |
| 4.66E+02 | 4.29E-02 | 0 | 0.5 | 3.40E-03 | 1.18E+01 | 2.95E-02 | 3.00E+01 | 2.51E-04 | 1.48E+01 |
| 4.73E+02 | 4.23E-02 | 0 | 0.5 | 4.80E-03 | 8.33E+00 | 2.95E-02 | 3.00E+01 | 0.00E+00 | 0.00E+00 |
| 4.94E+02 | 4.05E-02 | 0 | 0.5 | 8.60E-03 | 8.14E+00 | 2.95E-02 | 3.00E+01 | 9.33E-05 | 1.95E+01 |
| 4.99E+02 | 6.00E-02 | 0 | 0.5 | 1.93E-02 | 7.25E+00 | 2.51E-02 | 3.00E+01 | 1.08E-04 | 8.94E+00 |
| 5.14E+02 | 5.83E-02 | 0 | 0.5 | 3.10E-02 | 7.10E+00 | 3.60E-02 | 1.11E+01 | 6.69E-05 | 1.39E+01 |
| 5.26E+02 | 7.60E-02 | 0 | 0.5 | 4.04E-03 | 7.43E+01 | 2.95E-02 | 3.00E+01 | 0.00E+00 | 0.00E+00 |
| 5.31E+02 | 7.54E-02 | 0 | 0.5 | 7.00E-04 | 5.71E+01 | 2.95E-02 | 3.00E+01 | 4.60E-04 | 4.10E+01 |
| 5.46E+02 | 5.49E-02 | 0 | 0.5 | 3.10E-02 | 7.10E+00 | 2.95E-02 | 3.00E+01 | 3.91E-05 | 2.25E+01 |
| 5.53E+02 | 5.42E-02 | 0 | 0.5 | 2.02E-02 | 1.14E+01 | 2.95E-02 | 3.00E+01 | 2.13E-04 | 5.93E+00 |
| 5.66E+02 | 5.30E-02 | 0 | 0.5 | 3.15E-02 | 5.40E+00 | 2.95E-02 | 6.78E+00 | 2.04E-04 | 5.14E+00 |
| 5.84E+02 | 8.56E-02 | 0 | 0.5 | 1.14E-03 | 5.26E+01 | 2.95E-02 | 3.00E+01 | 7.00E-05 | 1.92E+01 |
| 5.97E+02 | 3.35E-02 | 0 | 0.5 | 5.75E-02 | 4.35E+00 | 3.35E-02 | 5.97E+00 | 4.50E-05 | 1.87E+01 |
| 6.08E+02 | 3.29E-02 | 0 | 0.5 | 2.27E-02 | 6.17E+00 | 2.32E-02 | 3.00E+01 | 2.11E-05 | 5.00E+01 |
| 6.32E+02 | 3.16E-02 | 0 | 0.5 | 1.33E-02 | 9.76E+00 | 2.32E-02 | 3.00E+01 | 4.40E-04 | 2.05E+01 |
| 6.37E+02 | 3.14E-02 | 0 | 0.5 | 1.16E-02 | 1.03E+01 | 2.32E-02 | 3.00E+01 | 1.70E-04 | 3.53E+01 |
| 6.65E+02 | 3.01E-02 | 0 | 0.5 | 1.97E-01 | 4.06E+00 | 2.32E-02 | 3.00E+01 | 4.80E-04 | 1.04E+01 |
| 6.79E+02 | 2.95E-02 | 0 | 0.5 | 2.60E-02 | 6.91E+00 | 2.32E-02 | 3.00E+01 | 7.80E-04 | 1.03E+01 |
| 7.12E+02 | 4.21E-02 | 0 | 0.5 | 1.33E-03 | 4.50E+01 | 2.32E-02 | 3.00E+01 | 8.00E-04 | 8.13E+01 |
| 7.43E+02 | 4.04E-02 | 0 | 0.5 | 1.01E-03 | 6.94E+01 | 2.32E-02 | 3.00E+01 | 3.00E-03 | 8.00E+01 |
| 7.50E+02 | 4.00E-02 | 0 | 0.5 | 6.82E-02 | 4.99E+00 | 2.32E-02 | 3.00E+01 | 1.27E-02 | 7.48E+00 |
| 7.59E+02 | 3.95E-02 | 0 | 0.5 | 6.06E-03 | 1.48E+01 | 2.32E-02 | 3.00E+01 | 1.42E-03 | 4.15E+01 |
| 7.78E+02 | 3.85E-02 | 0 | 0.5 | 1.20E-03 | 6.67E+01 | 2.32E-02 | 3.00E+01 | 1.00E-01 | 1.00E+02 |
| 7.82E+02 | 3.84E-02 | 0 | 0.5 | 2.80E-03 | 3.57E+01 | 2.32E-02 | 3.00E+01 | 1.45E+00 | 2.76E+01 |
| 7.91E+02 | 3.79E-02 | 0 | 0.5 | 2.39E-02 | 5.85E+00 | 2.32E-02 | 3.00E+01 | 1.25E-02 | 3.20E+00 |
| 8.11E+02 | 3.70E-02 | 0 | 0.5 | 2.14E-01 | 4.67E+00 | 2.32E-02 | 3.00E+01 | 1.16E-02 | 8.62E+00 |
| 8.20E+02 | 3.66E-02 | 0 | 0.5 | 1.10E-02 | 5.00E+01 | 2.32E-02 | 3.00E+01 | 1.10E-03 | 1.82E+00 |
| 8.46E+02 | 3.55E-02 | 0 | 0.5 | 1.02E-02 | 9.82E+00 | 2.32E-02 | 3.00E+01 | 9.30E-04 | 1.51E+01 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 8.55E+02 | 3.51E-02 | 0 | 0.5 | 4.80E-02 | 5.21E+00 | 2.32E-02 | 3.00E+01 | 3.00E-04 | 1.67E+01 |
| 8.77E+02 | 3.42E-02 | 0 | 0.5 | 1.39E-02 | 9.35E+00 | 2.32E-02 | 3.00E+01 | 9.60E-04 | 1.35E+01 |
| 8.92E+02 | 3.37E-02 | 0 | 0.5 | 9.43E-02 | 4.77E+00 | 2.32E-02 | 3.00E+01 | 1.32E-03 | 6.82E+00 |
| 9.04E+02 | 3.32E-02 | 0 | 0.5 | 2.19E-02 | 6.83E+00 | 2.32E-02 | 3.00E+01 | 6.70E-04 | 1.19E+01 |
| 9.09E+02 | 3.30E-02 | 0 | 0.5 | 7.90E-02 | 5.06E+00 | 2.32E-02 | 3.00E+01 | 6.00E-05 | 6.67E+01 |
| 9.15E+02 | 3.28E-02 | 0 | 0.5 | 3.60E-02 | 6.11E+00 | 2.32E-02 | 3.00E+01 | 5.60E-04 | 1.25E+01 |
| 9.44E+02 | 3.18E-02 | 0 | 0.5 | 1.23E-01 | 4.48E+00 | 2.32E-02 | 3.00E+01 | 3.20E-04 | 1.56E+01 |
| 9.58E+02 | 3.13E-02 | 0 | 0.5 | 7.15E-02 | 4.90E+00 | 2.32E-02 | 3.00E+01 | 1.90E-04 | 2.63E+01 |
| 9.71E+02 | 3.09E-02 | 0 | 0.5 | 8.04E-02 | 4.98E+00 | 2.32E-02 | 3.00E+01 | 4.10E-04 | 1.22E+01 |
| 9.79E+02 | 3.06E-02 | 0 | 0.5 | 7.20E-03 | 2.08E+01 | 2.32E-02 | 3.00E+01 | 1.10E-03 | 2.27E+01 |
| 1.00E+03 | 2.99E-02 | 0 | 0.5 | 9.81E-02 | 5.10E+00 | 2.32E-02 | 3.00E+01 | 1.12E-03 | 7.14E+00 |
| 1.02E+03 | 3.91E-02 | 0 | 0.5 | 5.00E-03 | 3.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.04E+03 | 3.84E-02 | 0 | 0.5 | 1.26E-02 | 1.51E+01 | 2.32E-02 | 3.00E+01 | 1.13E-03 | 1.77E+01 |
| 1.05E+03 | 3.83E-02 | 0 | 0.5 | 4.00E-03 | 4.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.07E+03 | 3.73E-02 | 0 | 0.5 | 1.09E-01 | 5.03E+00 | 2.32E-02 | 3.00E+01 | 3.10E-04 | 1.61E+01 |
| 1.10E+03 | 3.64E-02 | 0 | 0.5 | 8.42E-02 | 1.01E+01 | 2.32E-02 | 3.00E+01 | 2.50E-04 | 2.00E+01 |
| 1.12E+03 | 4.48E-02 | 0 | 0.5 | 2.60E-03 | 6.15E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.13E+03 | 3.54E-02 | 0 | 0.5 | 4.94E-02 | 6.07E+00 | 2.32E-02 | 3.00E+01 | 7.00E-04 | 1.14E+01 |
| 1.13E+03 | 3.53E-02 | 0 | 0.5 | 6.74E-03 | 2.97E+01 | 2.32E-02 | 3.00E+01 | 6.00E-04 | 4.17E+01 |
| 1.14E+03 | 3.50E-02 | 0 | 0.5 | 4.06E-02 | 6.90E+00 | 2.32E-02 | 3.00E+01 | 1.20E-04 | 3.33E+01 |
| 1.16E+03 | 3.45E-02 | 0 | 0.5 | 2.21E-02 | 9.94E+00 | 2.32E-02 | 3.00E+01 | 2.80E-04 | 2.50E+01 |
| 1.19E+03 | 3.37E-02 | 0 | 0.5 | 1.57E-01 | 5.09E+00 | 2.32E-02 | 3.00E+01 | 3.00E-04 | 2.00E+01 |
| 1.19E+03 | 3.36E-02 | 0 | 0.5 | 1.15E-01 | 5.22E+00 | 2.32E-02 | 3.00E+01 | 3.40E-04 | 1.76E+01 |
| 1.21E+03 | 3.31E-02 | 0 | 0.5 | 6.29E-02 | 6.04E+00 | 2.32E-02 | 3.00E+01 | 1.30E-04 | 3.85E+01 |
| 1.23E+03 | 3.26E-02 | 0 | 0.5 | 1.00E-02 | 2.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.24E+03 | 3.23E-02 | 0 | 0.5 | 1.13E-02 | 1.96E+01 | 2.32E-02 | 3.00E+01 | 5.90E-04 | 2.71E+01 |
| 1.26E+03 | 3.19E-02 | 0 | 0.5 | 7.69E-02 | 5.98E+00 | 2.32E-02 | 3.00E+01 | 1.79E-03 | 7.26E+00 |
| 1.28E+03 | 3.12E-02 | 0 | 0.5 | 4.30E-03 | 4.88E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.30E+03 | 3.08E-02 | 0 | 0.5 | 2.45E-01 | 5.10E+00 | 2.32E-02 | 3.00E+01 | 1.47E-03 | 6.80E+00 |
| 1.33E+03 | 3.01E-02 | 0 | 0.5 | 3.69E-01 | 5.01E+00 | 2.32E-02 | 3.00E+01 | 8.40E-04 | 7.14E+00 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 1.35E+03 | 3.72E−02 | 0 | 0.5 | 2.60E−02 | 1.19E+01 | 2.32E−02 | 3.00E+01 | 4.70E−04 | 1.91E+01 |
| 1.35E+03 | 4.44E−02 | 0 | 0.5 | 8.30E−03 | 3.01E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.36E+03 | 4.40E−02 | 0 | 0.5 | 7.38E−03 | 4.06E+01 | 2.32E−02 | 3.00E+01 | 7.00E−04 | 5.71E+01 |
| 1.38E+03 | 3.63E−02 | 0 | 0.5 | 6.46E−02 | 6.97E+00 | 2.32E−02 | 3.00E+01 | 1.10E−03 | 9.09E+00 |
| 1.39E+03 | 4.32E−02 | 0 | 0.5 | 1.42E−02 | 1.98E+01 | 2.32E−02 | 3.00E+01 | 5.00E−03 | 4.00E+00 |
| 1.40E+03 | 4.28E−02 | 0 | 0.5 | 5.24E−03 | 5.92E+01 | 2.32E−02 | 3.00E+01 | 2.00E+00 | 1.00E+01 |
| 1.41E+03 | 4.26E−02 | 0 | 0.5 | 1.09E−03 | 2.29E+02 | 2.32E−02 | 3.00E+01 | 1.50E+00 | 1.33E+01 |
| 1.43E+03 | 3.51E−02 | 0 | 0.5 | 3.66E−02 | 1.01E+01 | 2.32E−02 | 3.00E+01 | 5.30E−03 | 1.89E+00 |
| 1.43E+03 | 3.50E−02 | 0 | 0.5 | 1.51E−02 | 1.98E+01 | 2.32E−02 | 3.00E+01 | 1.60E−03 | 1.88E+01 |
| 1.45E+03 | 3.45E−02 | 0 | 0.5 | 6.36E−02 | 8.18E+00 | 2.32E−02 | 3.00E+01 | 3.42E−03 | 7.89E+00 |
| 1.46E+03 | 3.42E−02 | 0 | 0.5 | 2.11E−02 | 1.57E+01 | 2.32E−02 | 3.00E+01 | 2.71E−03 | 1.55E+01 |
| 1.48E+03 | 4.73E−02 | 0 | 0.5 | 9.25E−03 | 3.25E+01 | 2.32E−02 | 3.00E+01 | 1.70E−03 | 3.53E+01 |
| 1.54E+03 | 3.25E−02 | 0 | 0.5 | 1.01E−01 | 6.04E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.55E+03 | 3.23E−02 | 0 | 0.5 | 1.57E−01 | 5.49E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.56E+03 | 3.20E−02 | 0 | 0.5 | 1.15E−01 | 6.97E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.58E+03 | 3.17E−02 | 0 | 0.5 | 1.26E−01 | 6.02E+00 | 2.32E−02 | 3.00E+01 | 5.10E−04 | 1.18E+01 |
| 1.61E+03 | 3.73E−02 | 0 | 0.5 | 3.49E−02 | 1.12E+01 | 2.32E−02 | 3.00E+01 | 1.12E−03 | 1.25E+01 |
| 1.62E+03 | 3.70E−02 | 0 | 0.5 | 2.86E−02 | 1.29E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.64E+03 | 3.65E−02 | 0 | 0.5 | 1.07E−01 | 6.54E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.66E+03 | 3.61E−02 | 0 | 0.5 | 6.39E−02 | 8.14E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.69E+03 | 3.55E−02 | 0 | 0.5 | 3.29E−02 | 1.31E+01 | 2.32E−02 | 3.00E+01 | 1.07E−03 | 1.40E+01 |
| 1.72E+03 | 3.48E−02 | 0 | 0.5 | 8.35E−02 | 8.03E+00 | 2.32E−02 | 3.00E+01 | 2.16E−03 | 7.41E+00 |
| 1.74E+03 | 3.45E−02 | 0 | 0.5 | 2.50E−02 | 1.72E+01 | 2.32E−02 | 3.00E+01 | 8.30E−04 | 1.93E+01 |
| 1.76E+03 | 3.40E−02 | 0 | 0.5 | 5.17E−02 | 9.29E+00 | 2.32E−02 | 3.00E+01 | 6.50E−04 | 1.38E+01 |
| 1.77E+03 | 4.52E−02 | 0 | 0.5 | 9.80E−03 | 5.10E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.78E+03 | 3.37E−02 | 0 | 0.5 | 4.91E−01 | 5.09E+00 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 1.84E+03 | 3.80E−02 | 0 | 0.5 | 1.26E−01 | 7.16E+00 | 2.32E−02 | 3.00E+01 | 1.07E−02 | 1.19E+01 |
| 1.85E+03 | 3.78E−02 | 0 | 0.5 | 3.44E−02 | 1.60E+01 | 2.32E−02 | 3.00E+01 | 4.15E−03 | 1.33E+01 |
| 1.87E+03 | 3.74E−02 | 0 | 0.5 | 7.75E−02 | 9.04E+00 | 2.32E−02 | 3.00E+01 | 4.91E−03 | 7.94E+00 |
| 1.90E+03 | 3.68E−02 | 0 | 0.5 | 2.09E−01 | 5.97E+00 | 2.32E−02 | 3.00E+01 | 3.00E−03 | 3.33E+00 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 1.92E+03 | 3.65E-02 | 0 | 0.5 | 3.59E-02 | 1.70E+01 | 2.32E-02 | 3.00E+01 | 7.00E-02 | 1.43E+00 |
| 1.94E+03 | 4.65E-02 | 0 | 0.5 | 1.98E-03 | 1.01E+01 | 2.32E-02 | 3.00E+01 | 2.20E+00 | 2.73E+01 |
| 1.94E+03 | 4.63E-02 | 0 | 0.5 | 8.10E-03 | 6.17E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 1.94E+03 | 5.00E-02 | 0 | 0.5 | 7.94E-03 | 6.11E+01 | 2.32E-02 | 3.00E+01 | 1.80E-03 | 2.22E+01 |
| 1.95E+03 | 3.59E-02 | 0 | 0.5 | 8.26E-02 | 9.20E+00 | 2.32E-02 | 3.00E+01 | 6.30E-03 | 1.59E+00 |
| 1.96E+03 | 3.58E-02 | 0 | 0.5 | 2.61E-01 | 6.13E+00 | 2.32E-02 | 3.00E+01 | 2.50E-02 | 8.00E-01 |
| 1.97E+03 | 3.55E-02 | 0 | 0.5 | 6.80E-02 | 1.10E+01 | 2.32E-02 | 3.00E+01 | 1.80E-03 | 5.56E+00 |
| 1.99E+03 | 3.51E-02 | 0 | 0.5 | 1.15E-01 | 8.30E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.00E+03 | 3.50E-02 | 0 | 0.5 | 5.60E-03 | 7.14E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.02E+03 | 3.47E-02 | 0 | 0.5 | 5.25E-02 | 1.43E+01 | 2.32E-02 | 3.00E+01 | 2.64E-03 | 1.10E+01 |
| 2.02E+03 | 3.46E-02 | 0 | 0.5 | 5.55E-02 | 1.35E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.03E+03 | 3.44E-02 | 0 | 0.5 | 1.01E-01 | 9.36E+00 | 2.32E-02 | 3.00E+01 | 9.79E-03 | 7.87E+00 |
| 2.06E+03 | 3.89E-02 | 0 | 0.5 | 6.85E-02 | 1.10E+01 | 2.32E-02 | 3.00E+01 | 5.73E-03 | 8.90E+00 |
| 2.08E+03 | 3.84E-02 | 0 | 0.5 | 9.88E-02 | 9.62E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.11E+03 | 4.74E-02 | 0 | 0.5 | 1.37E-02 | 4.01E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.15E+03 | 5.11E-02 | 0 | 0.5 | 1.44E-02 | 4.87E+01 | 2.32E-02 | 3.00E+01 | 2.28E-03 | 4.39E+01 |
| 2.18E+03 | 3.67E-02 | 0 | 0.5 | 8.56E-02 | 9.93E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.20E+03 | 3.64E-02 | 0 | 0.5 | 1.30E-01 | 8.08E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.24E+03 | 3.57E-02 | 0 | 0.5 | 3.41E-02 | 2.20E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.26E+03 | 3.55E-02 | 0 | 0.5 | 1.35E-01 | 8.18E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.28E+03 | 3.51E-02 | 0 | 0.5 | 4.27E-01 | 6.09E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.29E+03 | 3.93E-02 | 0 | 0.5 | 2.09E-01 | 8.15E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.30E+03 | 5.21E-02 | 0 | 0.5 | 1.72E-02 | 4.07E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.33E+03 | 3.86E-02 | 0 | 0.5 | 3.66E-02 | 2.05E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.35E+03 | 3.83E-02 | 0 | 0.5 | 3.16E-02 | 2.53E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.37E+03 | 3.80E-02 | 0 | 0.5 | 2.41E-01 | 7.05E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.37E+03 | 5.00E-02 | 0 | 0.5 | 9.74E-03 | 0.00E+00 | 2.95E-02 | 3.00E+01 | 2.00E-04 | 8.50E+01 |
| 2.39E+03 | 3.77E-02 | 0 | 0.5 | 1.87E-02 | 4.01E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.41E+03 | 3.74E-02 | 0 | 0.5 | 2.51E-02 | 2.99E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.42E+03 | 3.73E-02 | 0 | 0.5 | 6.49E-02 | 1.39E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 2.43E+03 | 3.70E-02 | 0 | 0.5 | 2.05E-01 | 7.32E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.46E+03 | 3.66E-02 | 0 | 0.5 | 2.56E-02 | 3.32E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.47E+03 | 3.64E-02 | 0 | 0.5 | 4.55E-02 | 1.76E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.49E+03 | 3.62E-02 | 0 | 0.5 | 2.12E-02 | 4.01E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.52E+03 | 3.97E-02 | 0 | 0.5 | 1.10E-01 | 1.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.54E+03 | 3.94E-02 | 0 | 0.5 | 2.88E-01 | 6.96E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.55E+03 | 3.92E-02 | 0 | 0.5 | 7.97E-02 | 1.51E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.58E+03 | 3.88E-02 | 0 | 0.5 | 4.77E-02 | 1.99E+01 | 2.32E-02 | 3.00E+01 | 4.80E-04 | 2.92E+01 |
| 2.64E+03 | 3.79E-02 | 0 | 0.5 | 4.26E-01 | 9.86E+00 | 2.95E-02 | 3.00E+01 | 5.22E-03 | 2.47E+01 |
| 2.65E+03 | 3.77E-02 | 0 | 0.5 | 3.66E-02 | 2.20E+01 | 2.32E-02 | 3.00E+01 | 1.45E-02 | 2.04E+01 |
| 2.69E+03 | 3.71E-02 | 0 | 0.5 | 3.45E-01 | 7.54E+00 | 2.32E-02 | 3.00E+01 | 1.64E-01 | 1.10E+01 |
| 2.72E+03 | 3.68E-02 | 0 | 0.5 | 4.07E-02 | 2.46E+01 | 2.32E-02 | 3.00E+01 | 5.29E-03 | 1.74E+01 |
| 2.74E+03 | 3.65E-02 | 0 | 0.5 | 1.77E-01 | 1.02E+01 | 2.95E-02 | 3.00E+01 | 1.74E-03 | 2.01E+01 |
| 2.75E+03 | 3.64E-02 | 0 | 0.5 | 1.02E-01 | 1.27E+01 | 2.32E-02 | 3.00E+01 | 1.12E-02 | 9.85E+00 |
| 2.82E+03 | 3.90E-02 | 0 | 0.5 | 4.14E-02 | 2.41E+01 | 2.32E-02 | 3.00E+01 | 1.98E-03 | 1.82E+01 |
| 2.84E+03 | 3.87E-02 | 0 | 0.5 | 1.57E-01 | 1.02E+01 | 2.32E-02 | 3.00E+01 | 6.90E-04 | 1.59E+01 |
| 2.86E+03 | 3.85E-02 | 0 | 0.5 | 2.73E-02 | 4.03E+01 | 2.32E-02 | 3.00E+01 | 2.81E-03 | 3.02E+01 |
| 2.88E+03 | 3.82E-02 | 0 | 0.5 | 3.00E-02 | 4.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.90E+03 | 3.80E-02 | 0 | 0.5 | 6.00E-02 | 2.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.91E+03 | 3.79E-02 | 0 | 0.5 | 1.15E-01 | 1.22E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.94E+03 | 3.74E-02 | 0 | 0.5 | 1.32E-01 | 1.14E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.97E+03 | 3.71E-02 | 0 | 0.5 | 8.50E-02 | 1.59E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.98E+03 | 4.03E-02 | 0 | 0.5 | 1.08E-01 | 1.85E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.99E+03 | 4.02E-02 | 0 | 0.5 | 1.25E-02 | 6.40E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 2.99E+03 | 4.01E-02 | 0 | 0.5 | 5.60E-02 | 2.05E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 3.00E+03 | 3.99E-02 | 0 | 0.5 | 7.65E-02 | 1.70E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 3.02E+03 | 3.98E-02 | 0 | 0.5 | 1.17E-01 | 1.54E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 3.03E+03 | 3.96E-02 | 0 | 0.5 | 2.10E-02 | 5.24E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 3.05E+03 | 3.93E-02 | 0 | 0.5 | 4.70E-02 | 3.19E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 3.08E+03 | 3.90E-02 | 0 | 0.5 | 1.28E-01 | 1.48E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 3.09E+03 | 3.89E−02 | 0 | 0.5 | 3.50E−02 | 4.86E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.11E+03 | 3.86E−02 | 0 | 0.5 | 3.85E−02 | 3.64E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.17E+03 | 4.10E−02 | 0 | 0.5 | 2.25E−01 | 1.02E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.19E+03 | 4.07E−02 | 0 | 0.5 | 3.49E−01 | 1.00E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.24E+03 | 4.02E−02 | 0 | 0.5 | 7.20E−02 | 2.08E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.27E+03 | 3.98E−02 | 0 | 0.5 | 1.34E−01 | 1.49E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.33E+03 | 3.90E−02 | 0 | 0.5 | 1.45E−02 | 6.90E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.42E+03 | 4.09E−02 | 0 | 0.5 | 3.45E−02 | 3.48E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.46E+03 | 4.05E−02 | 0 | 0.5 | 6.80E−02 | 1.99E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.47E+03 | 4.04E−02 | 0 | 0.5 | 3.44E−01 | 1.02E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.49E+03 | 4.01E−02 | 0 | 0.5 | 6.50E−02 | 2.08E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.56E+03 | 3.94E−02 | 0 | 0.5 | 9.10E−02 | 1.70E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.57E+03 | 3.92E−02 | 0 | 0.5 | 1.62E−01 | 1.23E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.60E+03 | 3.89E−02 | 0 | 0.5 | 2.85E−02 | 4.74E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.66E+03 | 4.10E−02 | 0 | 0.5 | 2.93E−01 | 1.02E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.67E+03 | 4.09E−02 | 0 | 0.5 | 5.45E−02 | 3.49E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.70E+03 | 4.05E−02 | 0 | 0.5 | 5.10E−02 | 3.33E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.72E+03 | 4.03E−02 | 0 | 0.5 | 6.00E−02 | 3.33E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.80E+03 | 4.21E−02 | 0 | 0.5 | 1.01E−01 | 2.28E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.84E+03 | 4.16E−02 | 0 | 0.5 | 7.60E−02 | 2.63E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.85E+03 | 4.15E−02 | 0 | 0.5 | 9.80E−02 | 2.04E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.87E+03 | 4.13E−02 | 0 | 0.5 | 4.60E−02 | 4.13E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.90E+03 | 4.10E−02 | 0 | 0.5 | 2.09E−01 | 1.29E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.92E+03 | 4.08E−02 | 0 | 0.5 | 1.63E−01 | 1.41E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.95E+03 | 4.05E−02 | 0 | 0.5 | 9.20E−02 | 2.28E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.98E+03 | 4.28E−02 | 0 | 0.5 | 1.02E−01 | 2.16E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 3.99E+03 | 4.26E−02 | 0 | 0.5 | 2.90E−02 | 6.21E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 4.03E+03 | 4.22E−02 | 0 | 0.5 | 1.09E−01 | 1.93E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 4.08E+03 | 4.16E−02 | 0 | 0.5 | 1.20E−01 | 1.92E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |
| 4.10E+03 | 4.15E−02 | 0 | 0.5 | 2.57E−01 | 1.09E+01 | 2.95E−02 | 3.00E+01 | 2.20E−04 | 7.73E+01 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 4.12E+03 | 4.12E-02 | 0 | 0.5 | 4.97E-01 | 8.05E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.13E+03 | 4.11E-02 | 0 | 0.5 | 6.70E-02 | 3.43E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.15E+03 | 4.10E-02 | 0 | 0.5 | 2.65E-01 | 1.09E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.16E+03 | 4.09E-02 | 0 | 0.5 | 8.90E-02 | 2.70E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.20E+03 | 4.28E-02 | 0 | 0.5 | 4.38E-01 | 9.82E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.22E+03 | 4.26E-02 | 0 | 0.5 | 6.80E-02 | 3.09E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.27E+03 | 4.22E-02 | 0 | 0.5 | 1.59E-01 | 1.70E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.29E+03 | 4.20E-02 | 0 | 0.5 | 3.16E-01 | 1.30E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.33E+03 | 4.16E-02 | 0 | 0.5 | 3.02E-01 | 1.16E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.38E+03 | 4.11E-02 | 0 | 0.5 | 8.20E-02 | 3.66E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.39E+03 | 4.10E-02 | 0 | 0.5 | 3.20E-02 | 7.50E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.40E+03 | 4.32E-02 | 0 | 0.5 | 7.80E-02 | 3.21E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.42E+03 | 4.30E-02 | 0 | 0.5 | 6.10E-02 | 3.93E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.43E+03 | 4.29E-02 | 0 | 0.5 | 4.70E-02 | 4.68E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.46E+03 | 4.26E-02 | 0 | 0.5 | 1.02E-01 | 2.65E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.57E+03 | 4.16E-02 | 0 | 0.5 | 2.20E-01 | 2.05E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.59E+03 | 4.14E-02 | 0 | 0.5 | 5.26E-01 | 1.14E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.60E+03 | 4.13E-02 | 0 | 0.5 | 7.50E-02 | 4.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.62E+03 | 4.33E-02 | 0 | 0.5 | 2.62E-01 | 2.40E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.65E+03 | 4.30E-02 | 0 | 0.5 | 1.49E-01 | 3.02E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.72E+03 | 4.24E-02 | 0 | 0.5 | 5.10E-01 | 1.47E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.75E+03 | 4.21E-02 | 0 | 0.5 | 2.45E-01 | 2.04E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.76E+03 | 4.21E-02 | 0 | 0.5 | 5.60E-02 | 5.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.77E+03 | 4.20E-02 | 0 | 0.5 | 1.50E-02 | 1.00E+02 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.77E+03 | 4.19E-02 | 0 | 0.5 | 2.20E-02 | 9.09E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.78E+03 | 4.18E-02 | 0 | 0.5 | 3.40E-02 | 7.35E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.79E+03 | 4.17E-02 | 0 | 0.5 | 1.33E-01 | 2.56E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.81E+03 | 4.36E-02 | 0 | 0.5 | 1.72E-01 | 2.03E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.82E+03 | 4.35E-02 | 0 | 0.5 | 6.30E-02 | 3.97E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.89E+03 | 4.29E-02 | 0 | 0.5 | 5.90E-02 | 4.58E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |

Table 2 (continued)

| ER(EV) | D-ER(%) | L | J | GN(EV) | D-GN(%) | GG(EV) | D-GG(%) | GF(EV) | D-GF(%) |
|---|---|---|---|---|---|---|---|---|---|
| 4.96E+03 | 4.24E-02 | 0 | 0.5 | 2.91E-01 | 1.89E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.97E+03 | 4.23E-02 | 0 | 0.5 | 1.58E-01 | 3.16E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 4.99E+03 | 4.41E-02 | 0 | 0.5 | 9.20E-02 | 3.80E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.07E+03 | 4.34E-02 | 0 | 0.5 | 5.09E-01 | 9.82E+00 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.11E+03 | 4.30E-02 | 0 | 0.5 | 9.30E-02 | 3.76E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.13E+03 | 4.29E-02 | 0 | 0.5 | 4.20E-02 | 7.14E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.15E+03 | 4.27E-02 | 0 | 0.5 | 5.00E-02 | 7.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.16E+03 | 4.26E-02 | 0 | 0.5 | 4.00E-02 | 7.50E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.19E+03 | 4.24E-02 | 0 | 0.5 | 3.13E-01 | 1.76E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.22E+03 | 4.41E-02 | 0 | 0.5 | 1.63E-01 | 2.45E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.25E+03 | 4.38E-02 | 0 | 0.5 | 5.24E-01 | 1.34E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.28E+03 | 4.36E-02 | 0 | 0.5 | 1.40E-01 | 3.21E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.30E+03 | 4.34E-02 | 0 | 0.5 | 2.70E-01 | 1.67E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.33E+03 | 4.31E-02 | 0 | 0.5 | 2.03E-01 | 2.46E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.35E+03 | 4.30E-02 | 0 | 0.5 | 1.53E-01 | 3.27E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.37E+03 | 4.29E-02 | 0 | 0.5 | 7.00E-02 | 5.71E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.39E+03 | 4.45E-02 | 0 | 0.5 | 8.40E-02 | 5.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.42E+03 | 4.43E-02 | 0 | 0.5 | 2.55E-01 | 1.96E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.49E+03 | 4.37E-02 | 0 | 0.5 | 5.00E-02 | 8.00E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.50E+03 | 4.36E-02 | 0 | 0.5 | 8.70E-02 | 4.60E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.51E+03 | 4.36E-02 | 0 | 0.5 | 3.55E-01 | 1.97E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.52E+03 | 4.53E-02 | 0 | 0.5 | 1.72E-01 | 2.62E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.54E+03 | 4.51E-02 | 0 | 0.5 | 5.82E-01 | 1.55E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.57E+03 | 4.49E-02 | 0 | 0.5 | 7.58E-01 | 1.19E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.59E+03 | 4.47E-02 | 0 | 0.5 | 2.07E-01 | 2.90E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.62E+03 | 4.45E-02 | 0 | 0.5 | 6.20E-02 | 8.06E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.68E+03 | 4.40E-02 | 0 | 0.5 | 1.06E-01 | 4.72E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |
| 5.69E+03 | 4.39E-02 | 0 | 0.5 | 9.10E-02 | 5.05E+01 | 2.95E-02 | 3.00E+01 | 2.20E-04 | 7.73E+01 |

Table 3 Covariances of unresolved resonance parameters for Pu-240

| Parameter | Error(%) | Correlation coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $D_0$ | 6.4 | 1.000 | | | | | | | |
| $S_0$ | 7.9 | 0.556 | 1.000 | | | | | | |
| $S_1$ | 15.2 | 0.704 | 0.163 | 1.000 | | | | | |
| $\Gamma_\gamma(s)$ | 9.6 | 0.445 | 0.241 | -0.101 | 1.000 | | | | |
| $\Gamma_\gamma(p)$ | 8.4 | 0.372 | 0.346 | -0.007 | 0.062 | 1.000 | | | |
| $\Gamma_f(1/2^+)$ | 23.9 | 0.355 | 0.208 | -0.027 | 0.411 | 0.381 | 1.000 | | |
| $\Gamma_f(1/2^-)$ | 16.6 | 0.058 | 0.042 | -0.009 | 0.075 | 0.081 | -0.082 | 1.000 | |
| $\Gamma_f(3/2^-)$ | 15.8 | 0.143 | 0.105 | -0.025 | 0.183 | 0.219 | -0.190 | -0.060 | 1.000 |

The symbols are defined as follows:

$D_0$: s-wave level spacing,

$S_0$: s-wave neutron strength-function,

$S_1$: p-wave neutron strength-function

$\Gamma_\gamma(s)$: s-wave capture width,

$\Gamma_\gamma(p)$: p-wave capture width,

$\Gamma_f(1/2^+)$: s-wave fission width with $J^\pi=1/2^+$,

$\Gamma_f(1/2^-)$: p-wave fission width with $J^\pi=1/2^-$,

$\Gamma_f(3/2^-)$: p-wave fission width with $J^\pi=3/2^-$.

Table 4 Covariances of unresolved resonance parameters for Pu-241

| Parameter | Error(%) | Correlation coefficients | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $D_0$ | 10.6 | 1.000 | | | | | | | | | | |
| $S_0$ | 9.6 | 0.940 | 1.000 | | | | | | | | | |
| $S_1$ | 12.7 | 0.227 | 0.158 | 1.000 | | | | | | | | |
| $\Gamma_\gamma(s)$ | 10.0 | 0.209 | 0.083 | -0.048 | 1.000 | | | | | | | |
| $\Gamma_\gamma(p)$ | 14.4 | 0.057 | 0.060 | -0.047 | -0.062 | 1.000 | | | | | | |
| $\Gamma_f(2^+)$ | 13.7 | 0.009 | -0.001 | -0.015 | 0.266 | 0.006 | 1.000 | | | | | |
| $\Gamma_f(3^+)$ | 12.1 | 0.014 | 0.008 | -0.034 | 0.574 | 0.006 | -0.120 | 1.000 | | | | |
| $\Gamma_f(1^-)$ | 14.6 | -0.002 | -0.002 | 0.002 | 0.003 | 0.001 | 0.000 | 0.000 | 1.000 | | | |
| $\Gamma_f(2^-)$ | 14.6 | -0.014 | -0.015 | 0.011 | 0.018 | 0.010 | -0.002 | -0.002 | 0.000 | 1.000 | | |
| $\Gamma_f(3^-)$ | 14.5 | -0.016 | -0.017 | 0.012 | 0.019 | 0.011 | -0.002 | -0.002 | 0.000 | -0.003 | 1.000 | |
| $\Gamma_f(4^-)$ | 14.6 | -0.014 | -0.015 | 0.011 | 0.017 | 0.010 | -0.001 | -0.001 | 0.000 | -0.002 | -0.002 | 1.000 |

The symbols are defined as follows:

$D_0$: s-wave level spacing, $S_0$: s-wave neutron strength-function, $S_1$: p-wave neutron strength-function,
$\Gamma_\gamma(s)$: s-wave capture width, $\Gamma_\gamma(p)$: p-wave capture width, $\Gamma_f(2^+)$: s-wave fission width with $J^\pi = 2^+$,
$\Gamma_f(3^+)$: s-wave fission width with $J^\pi = 3^+$, $\Gamma_f(1^-)$: p-wave fission width with $J^\pi = 1^-$, $\Gamma_f(2^-)$: p-wave fission width with $J^\pi = 2^-$,
$\Gamma_f(3^-)$: p-wave fission width with $J^\pi = 3^-$, $\Gamma_f(4^-)$: p-wave fission width with $J^\pi = 4^-$.

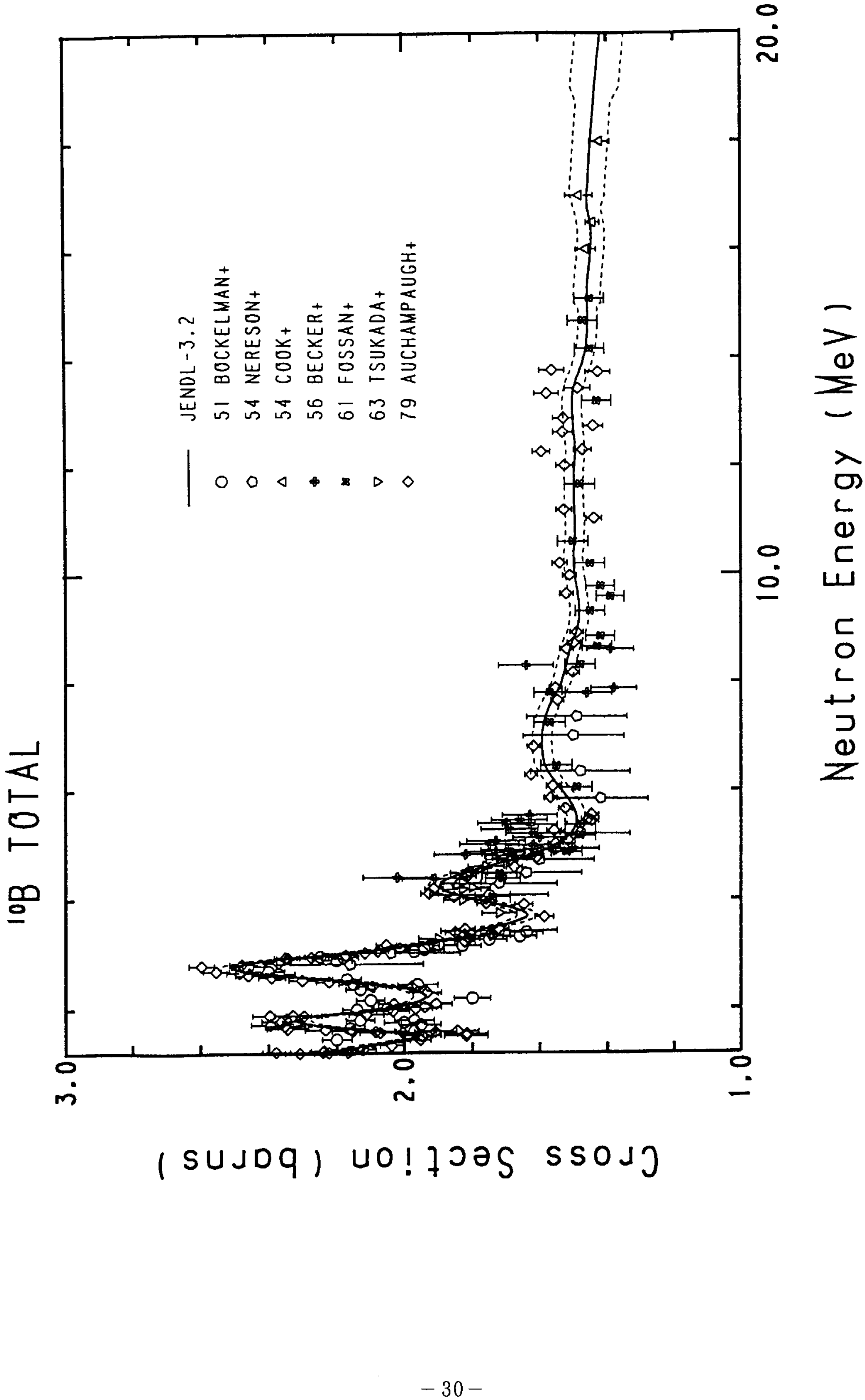


Fig. 1 Total cross section of $^{10}$B above 1.2 MeV.

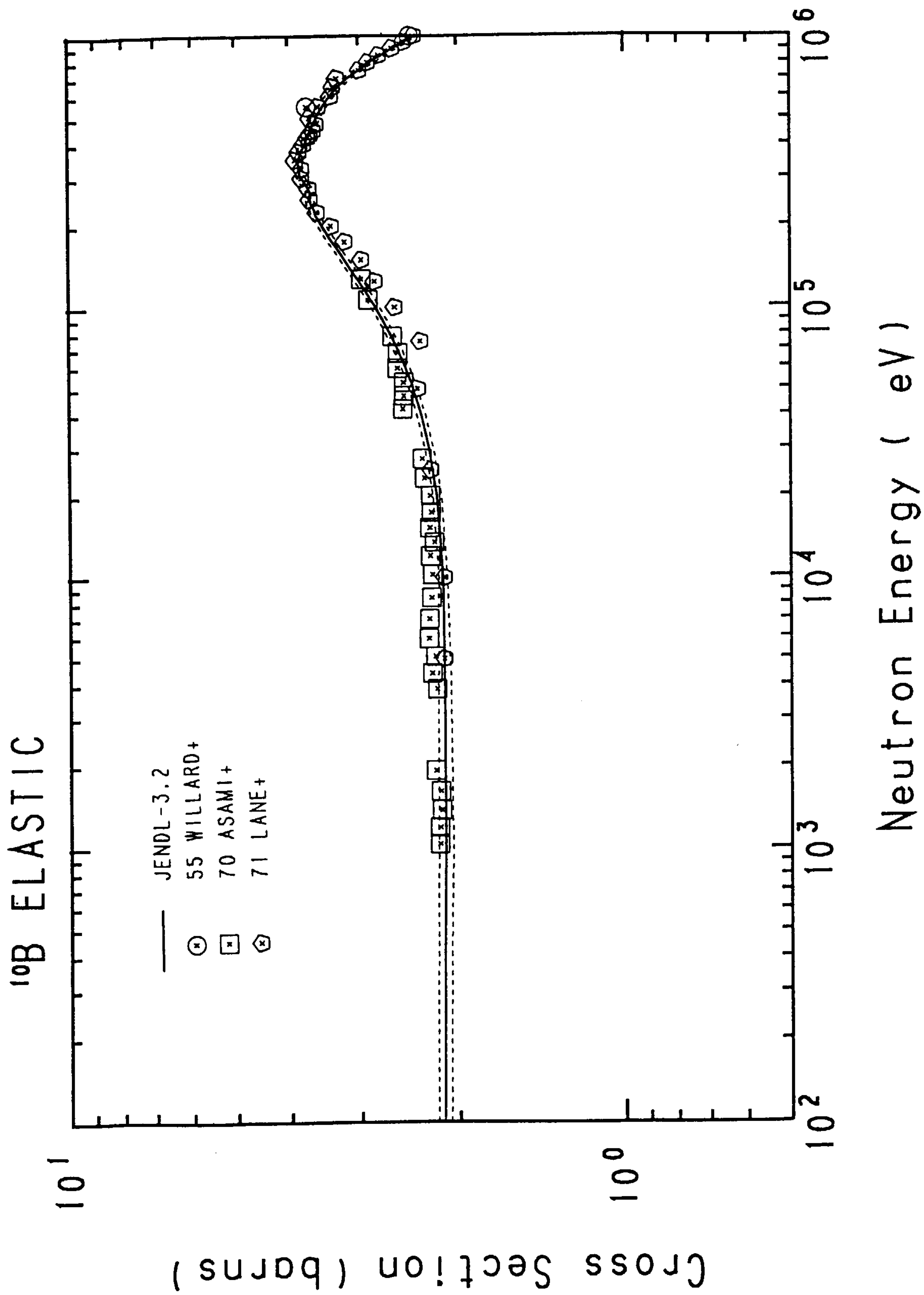


Fig. 2 Elastic scattering cross section of $^{10}B$ below 1 MeV.

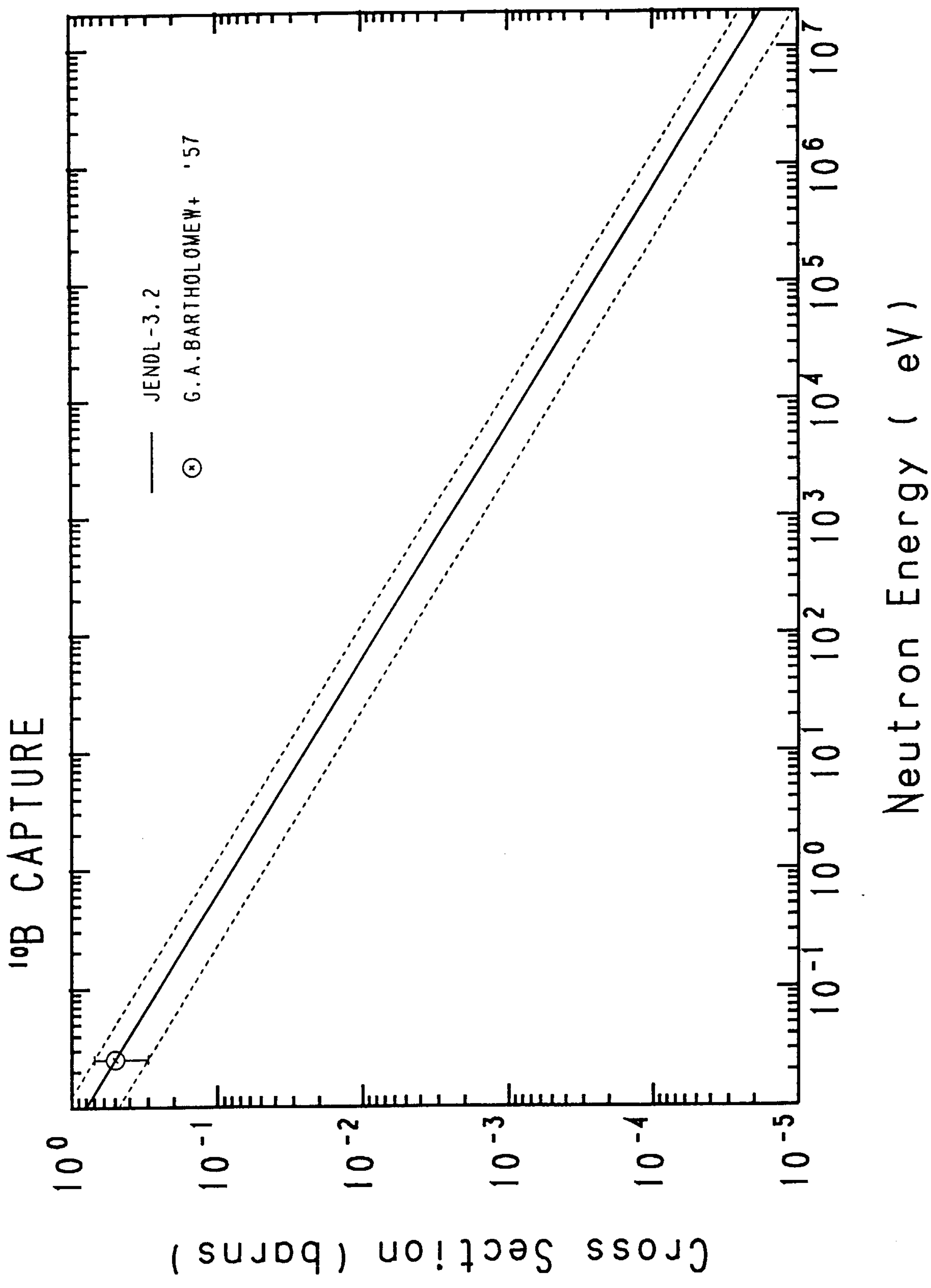


Fig. 3 Neutron capture cross section of $^{10}$B.

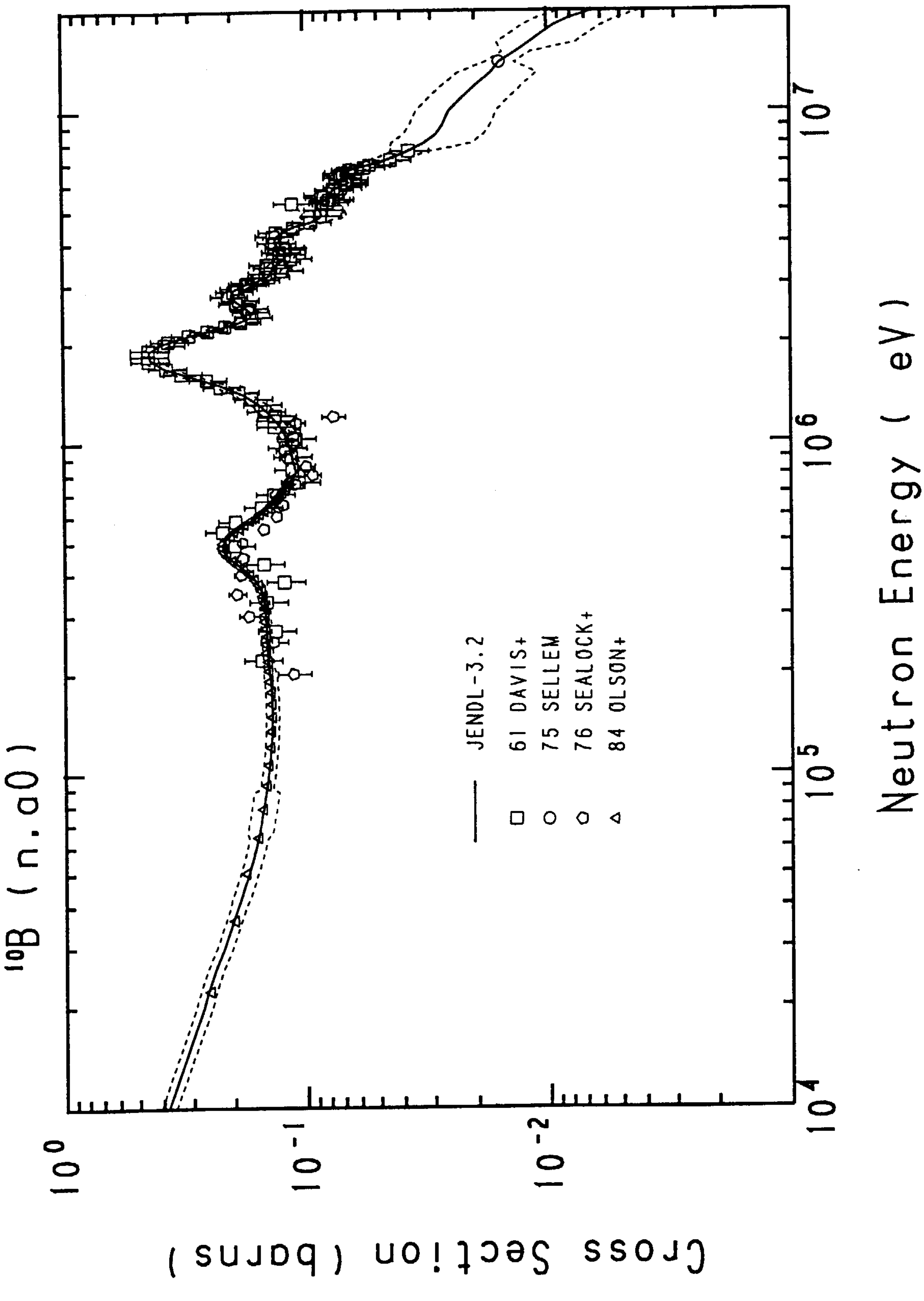


Fig. 4 $(n,\alpha_0)$ reaction cross section of $^{10}$B above 10 keV.

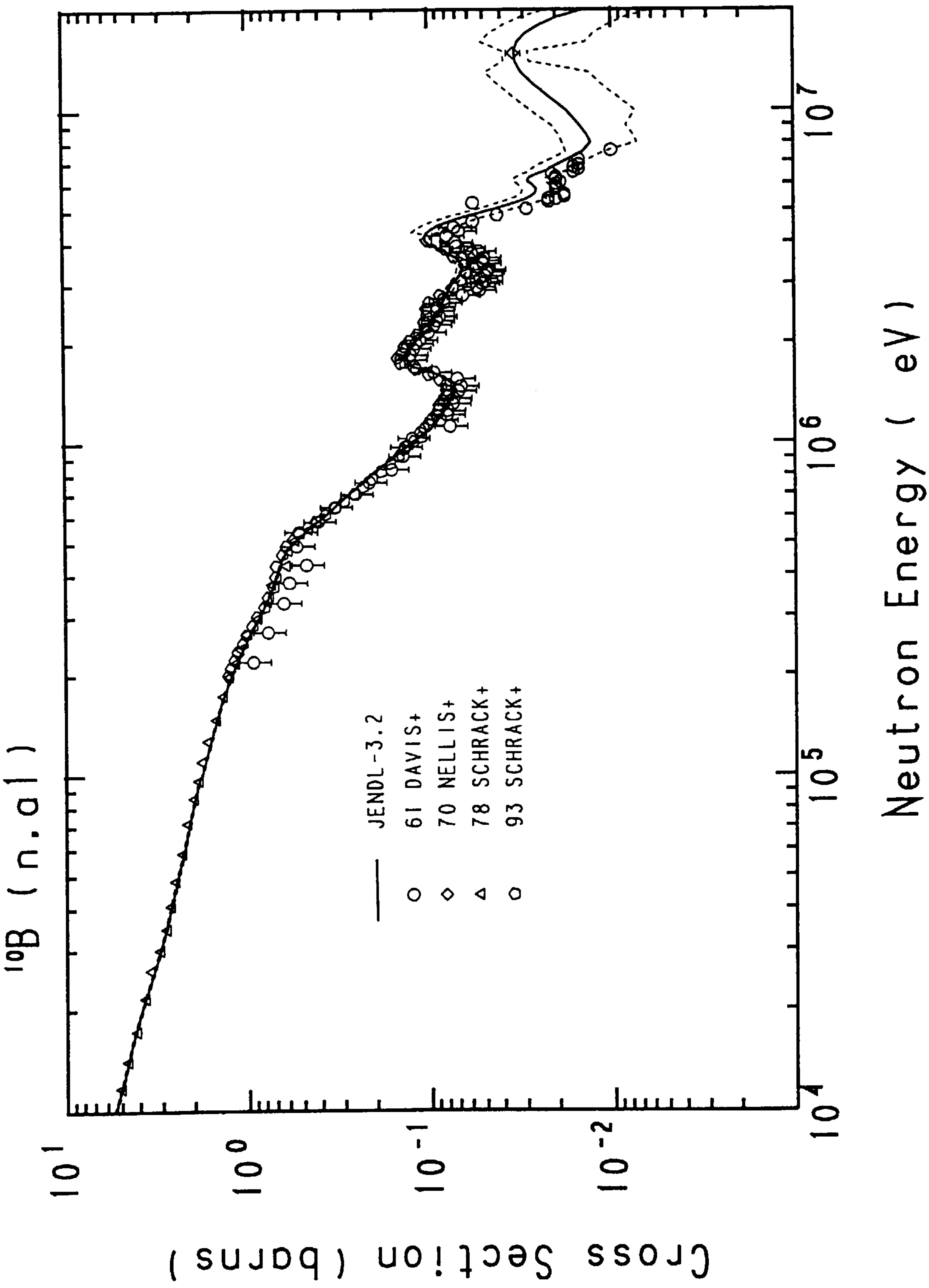


Fig. 5 $(n,\alpha_1)$ reaction cross section of $^{10}B$ above 10 keV.

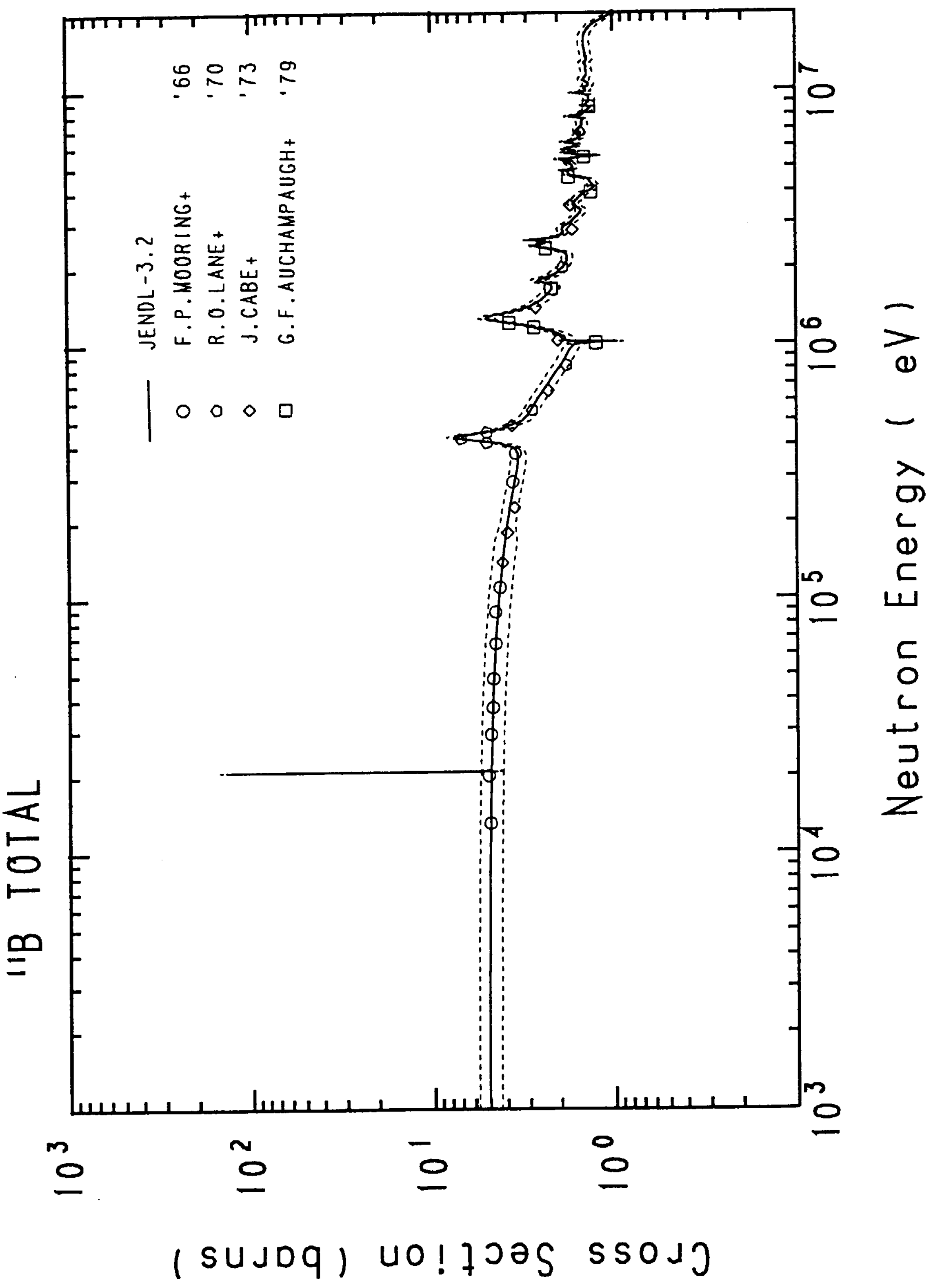


Fig. 6 Total cross section of $^{11}$B above 1 keV.

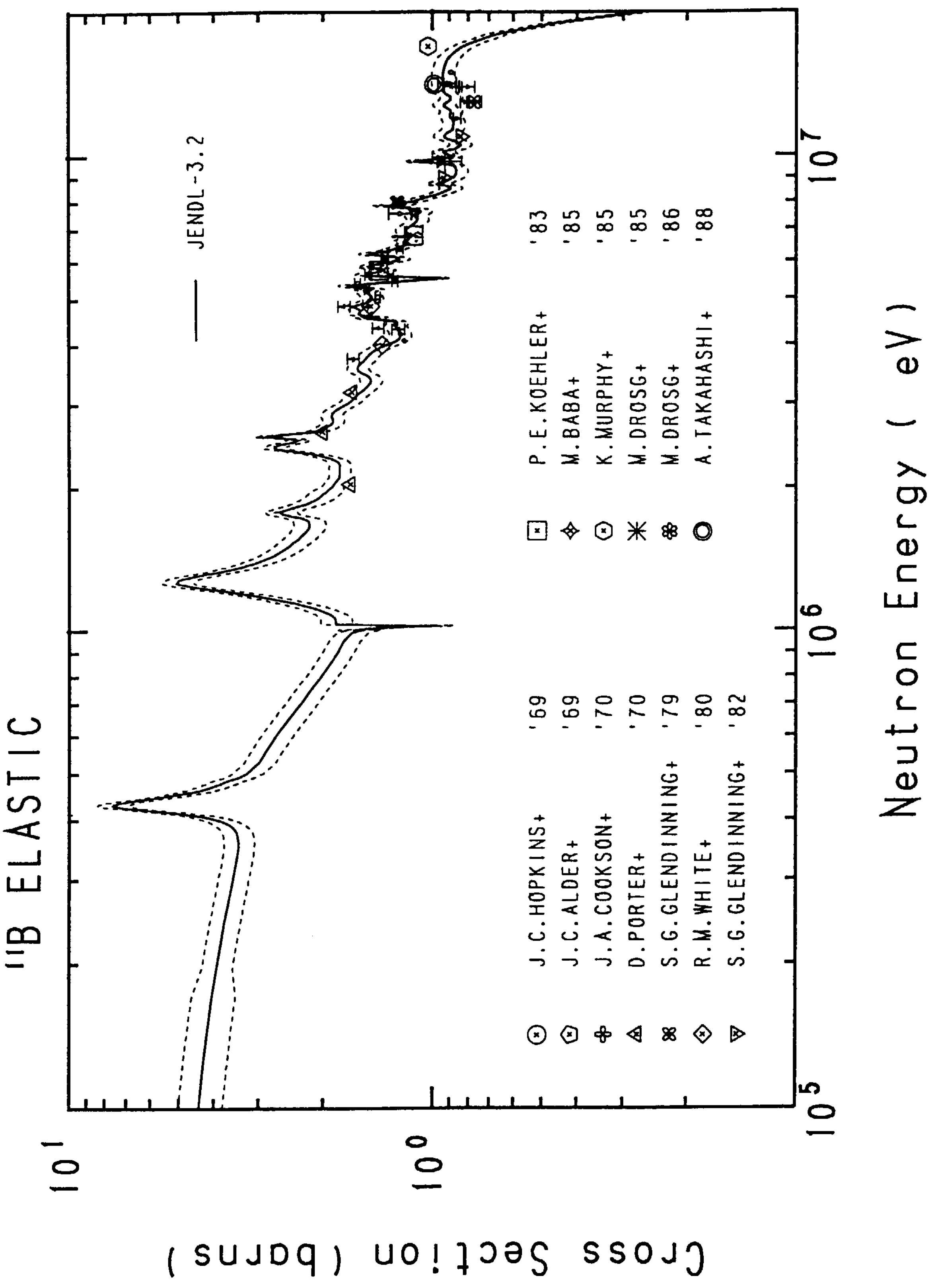


Fig. 7 Elastic scattering cross section of $^{11}$B above 100 keV.

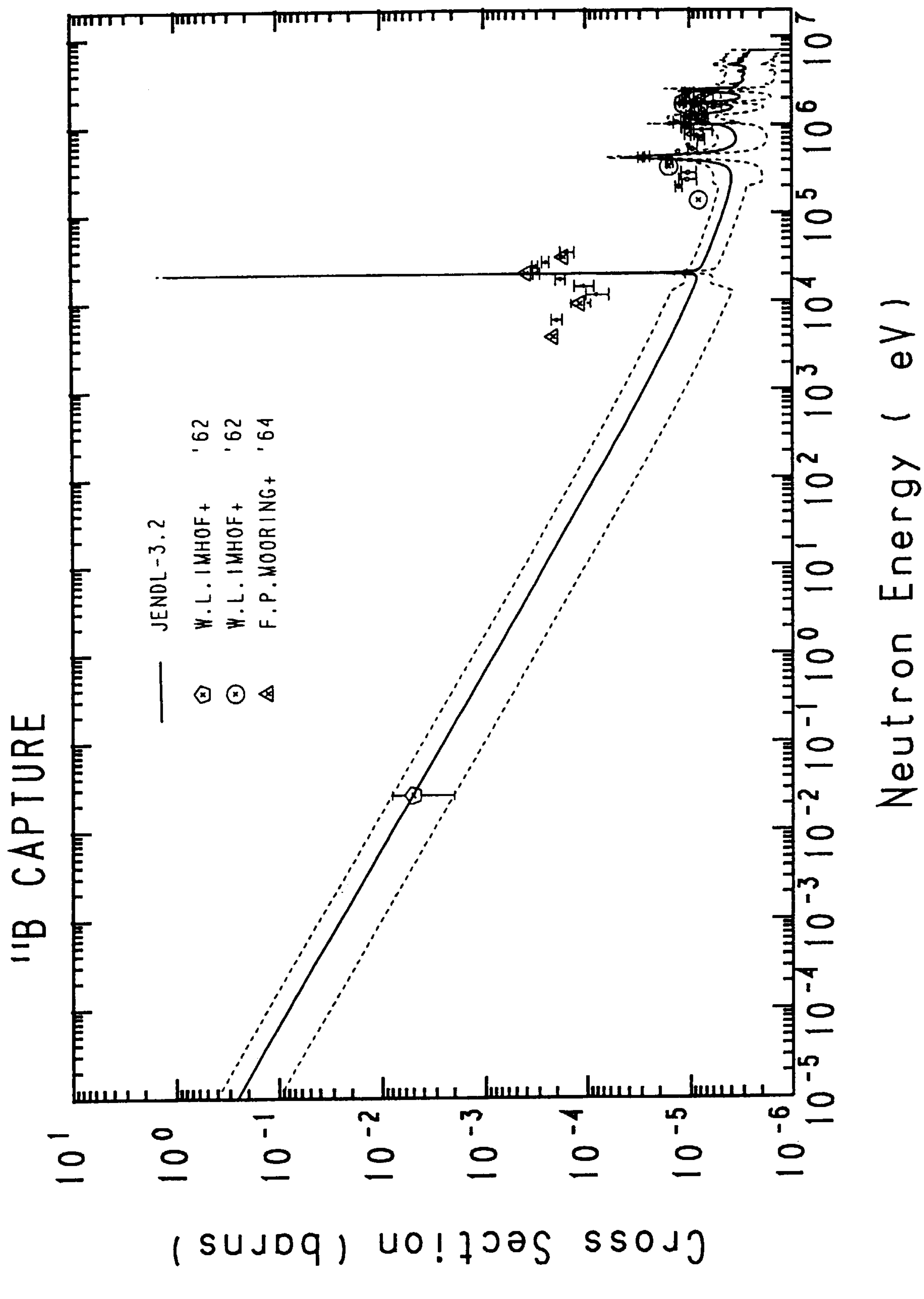


Fig. 8 Neutron capture cross section of $^{11}$B.

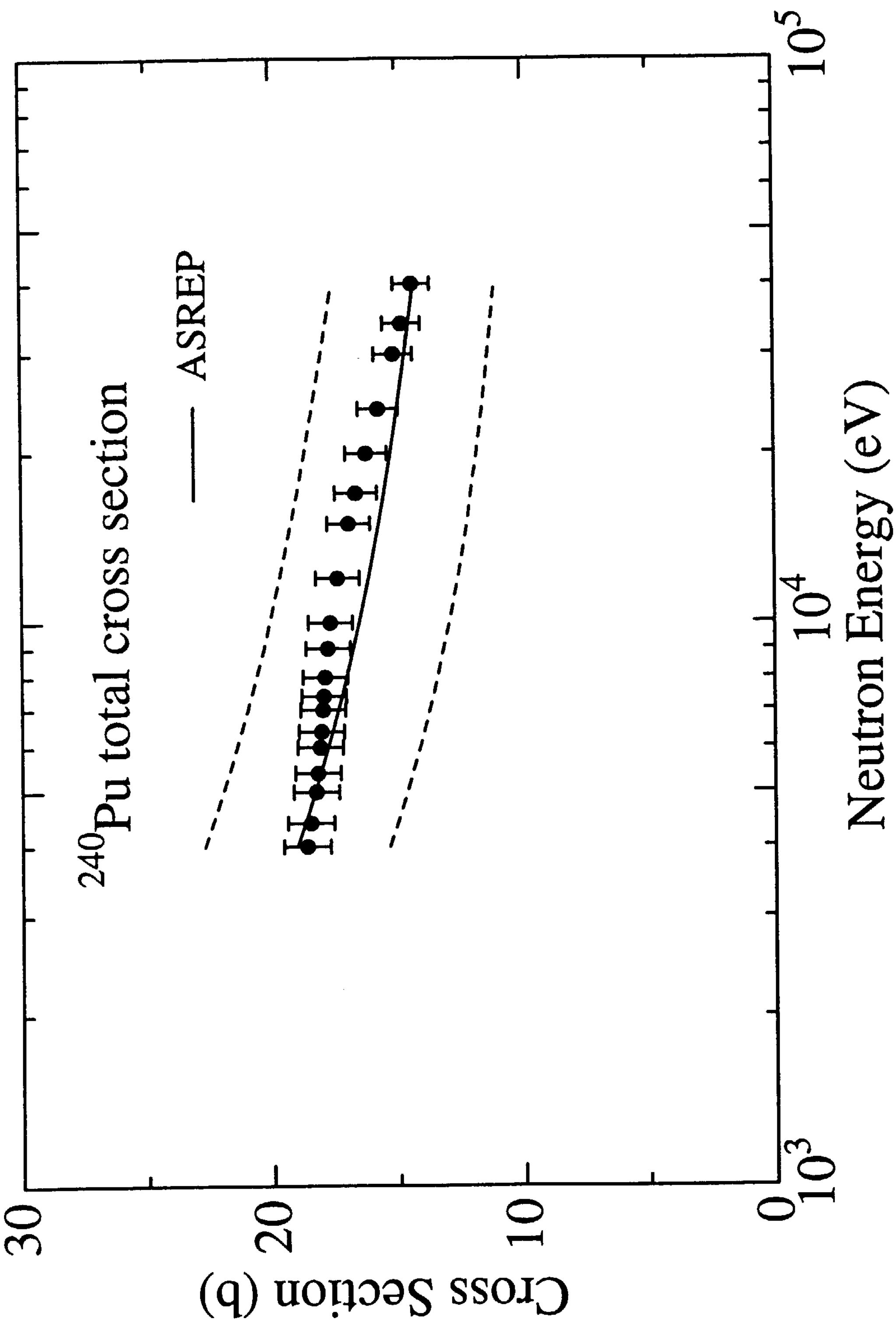


Fig. 9　Total cross section of $^{240}$Pu in the unresolved resonance region.

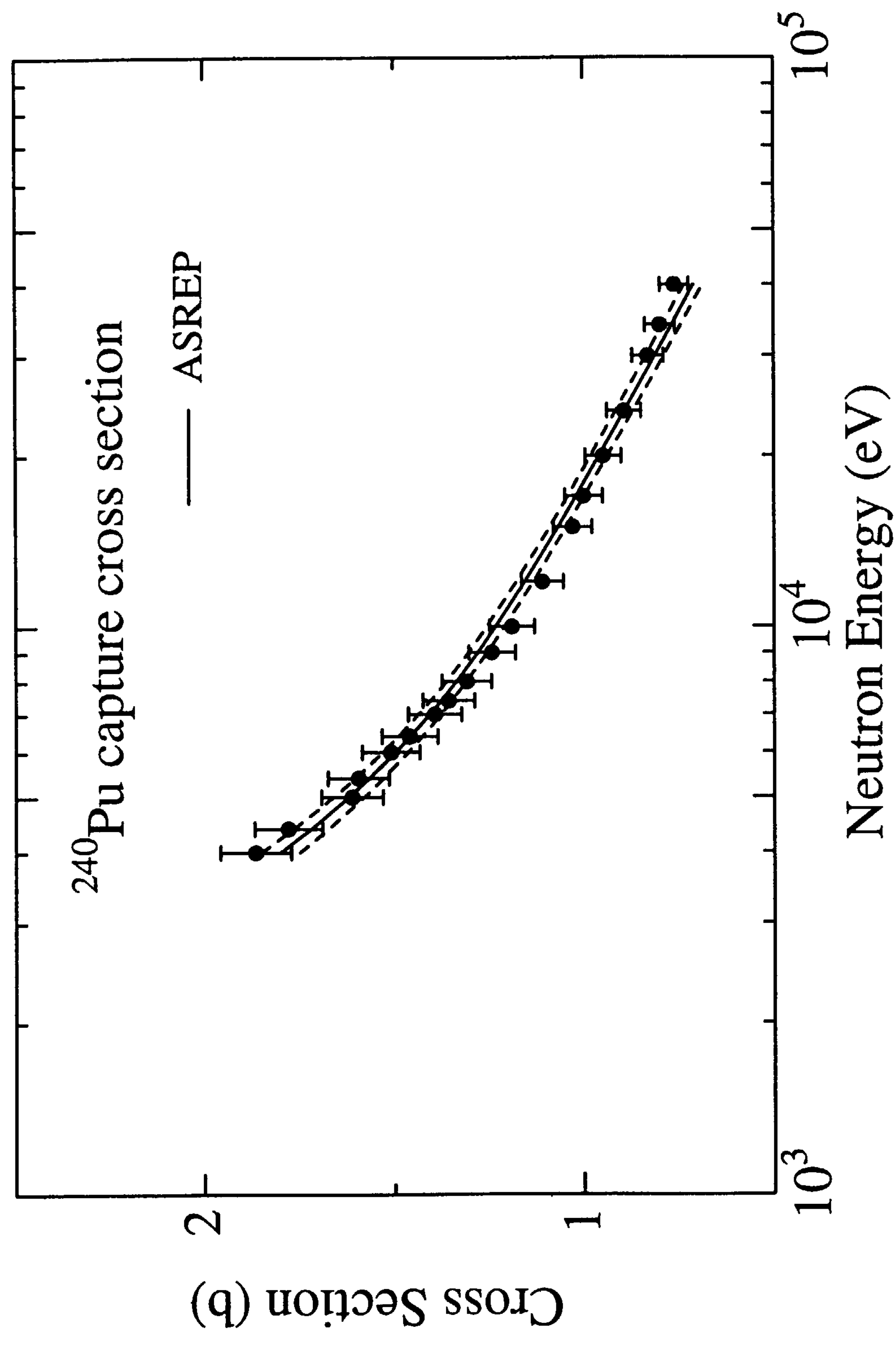


Fig. 10　Neutron capture cross section of $^{240}$Pu in the unresolved resonance region.

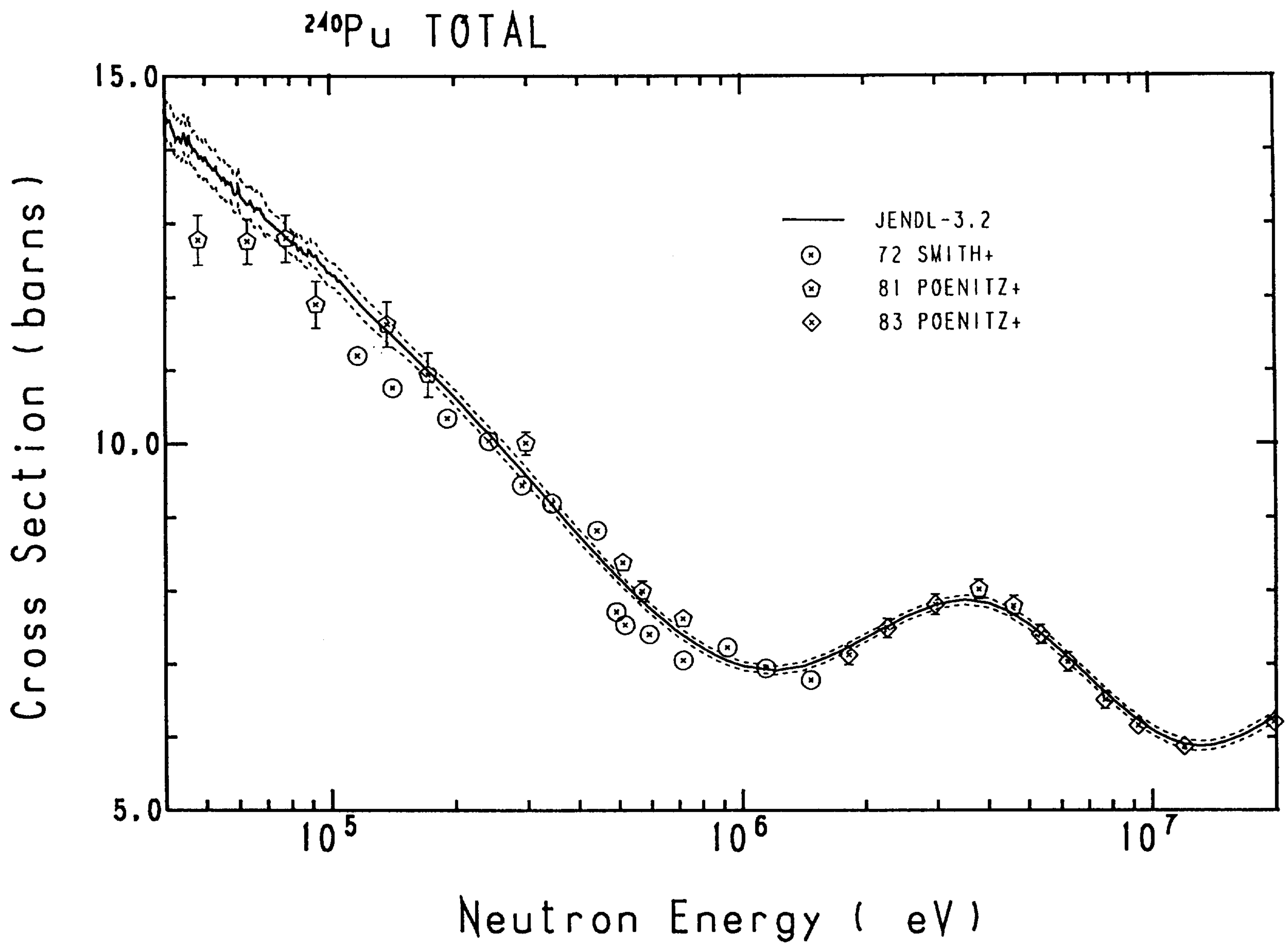


Fig. 11 Total cross section of $^{240}$Pu above 40 keV.

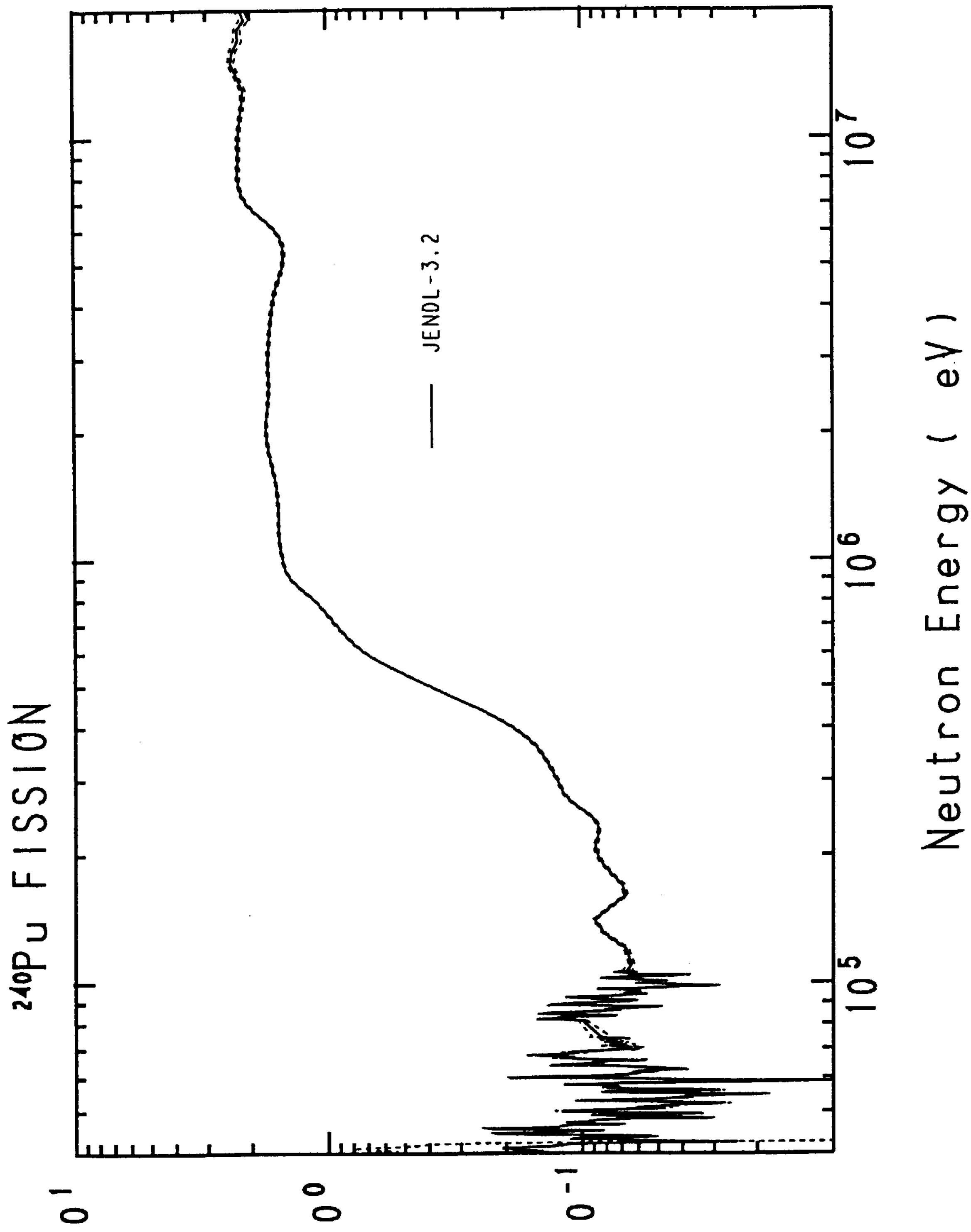


Fig. 12 Fission cross section of $^{240}$Pu above 40 keV.

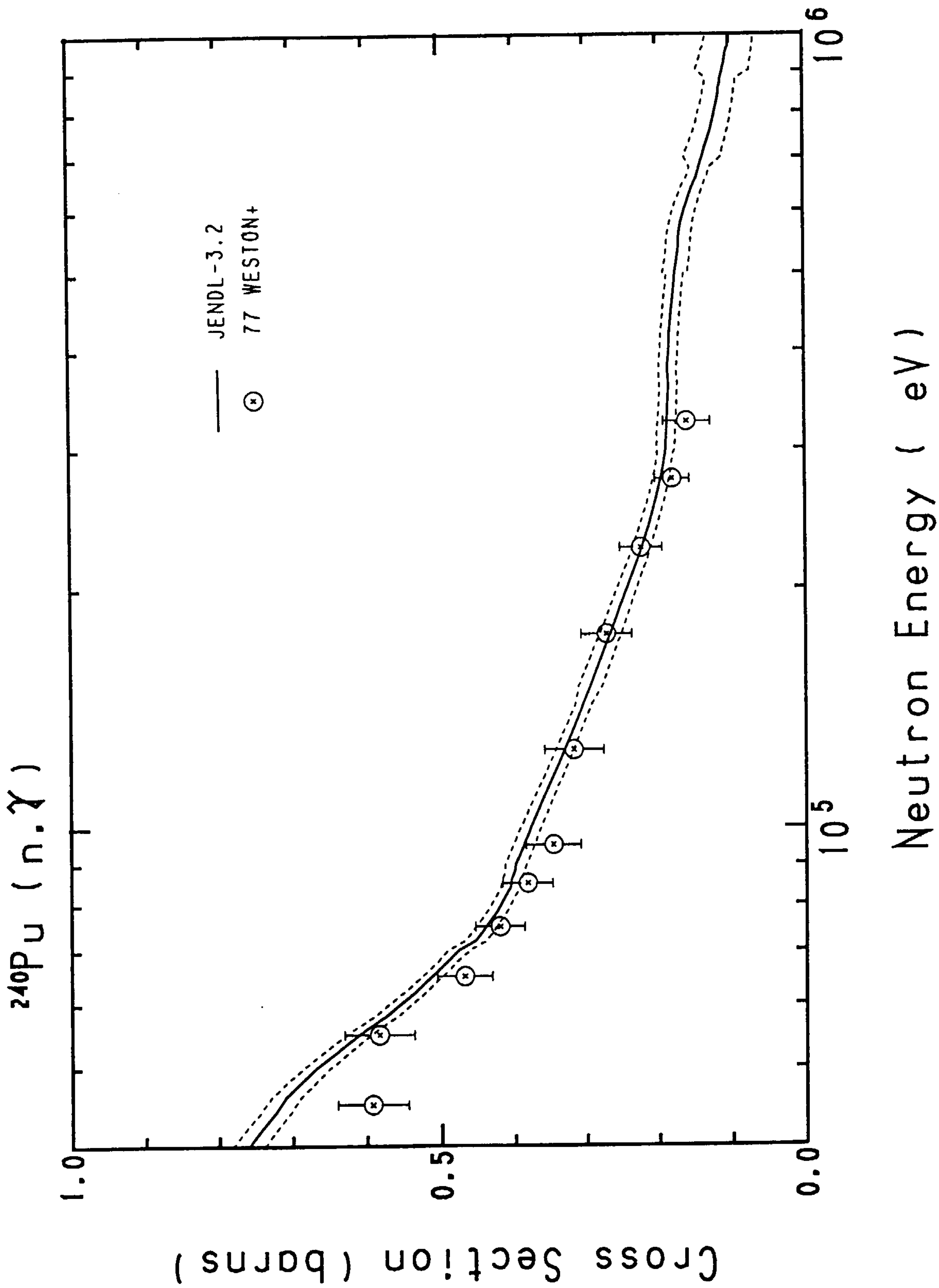


Fig. 13　Neutron capture cross section of $^{240}$Pu above 40 keV.

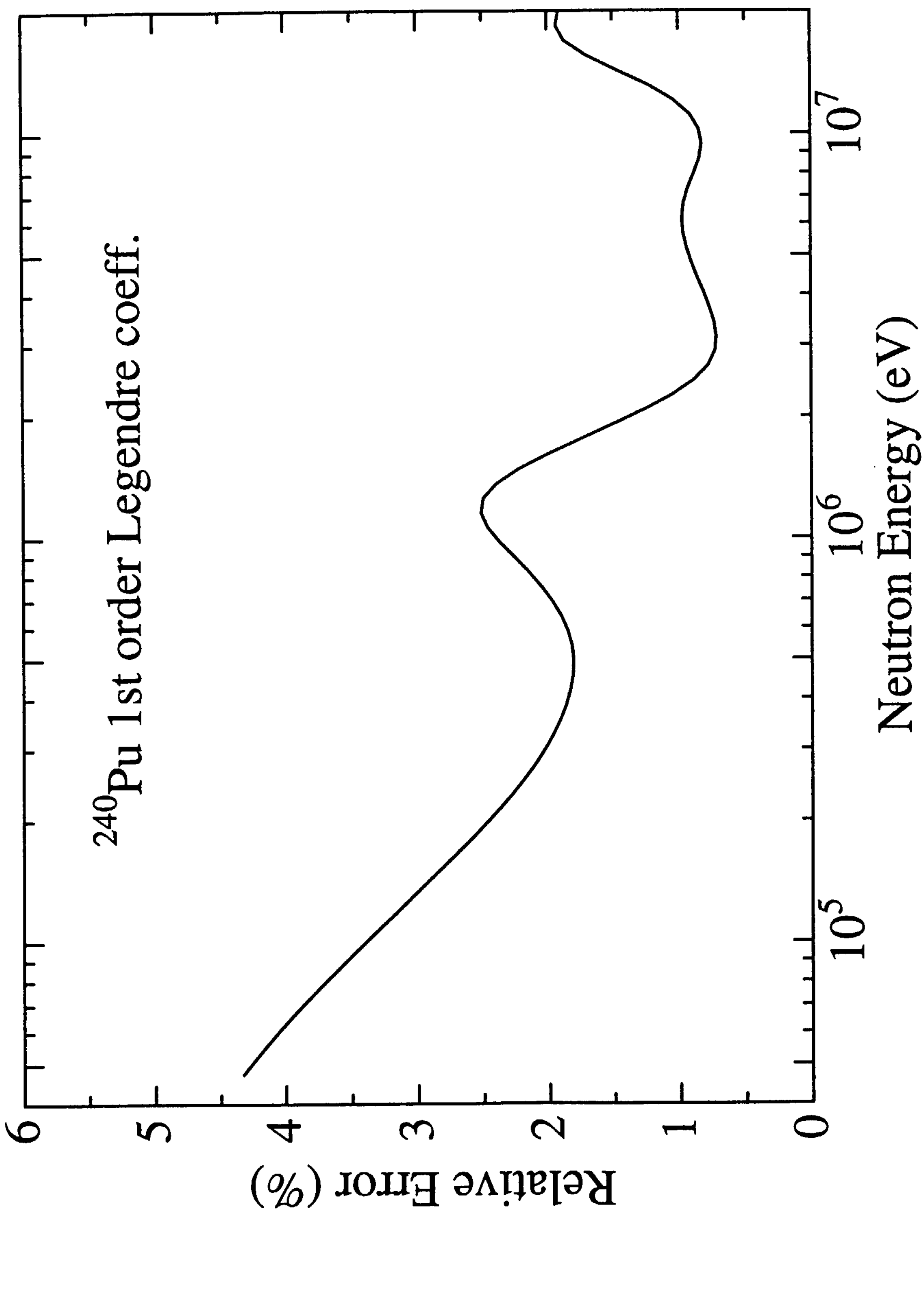


Fig. 14 Error of the 1st order Legendre-polynomial coefficient for $^{240}$Pu.

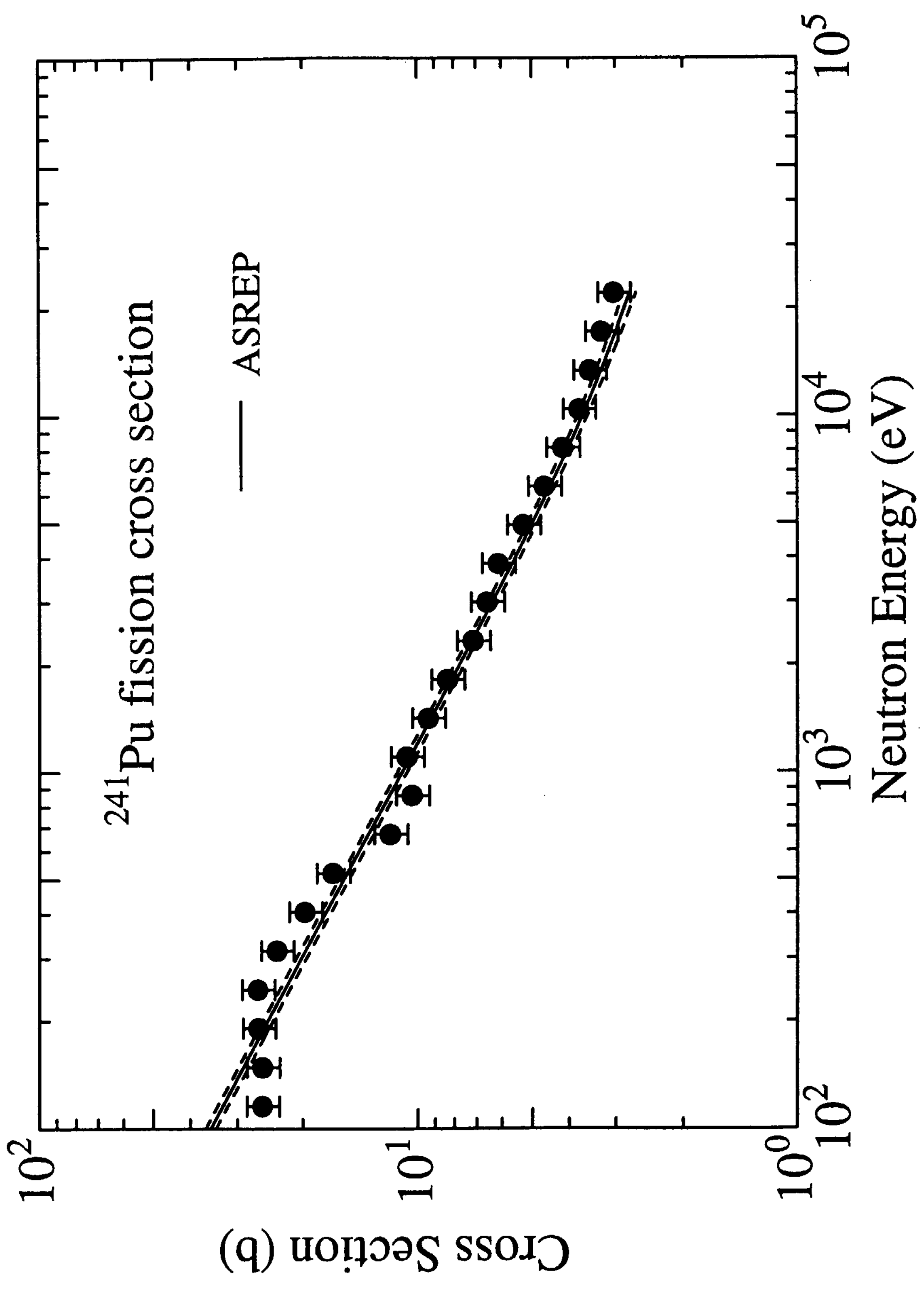


Fig. 15　Fission cross section of $^{241}$Pu in the unresolved resonance region.

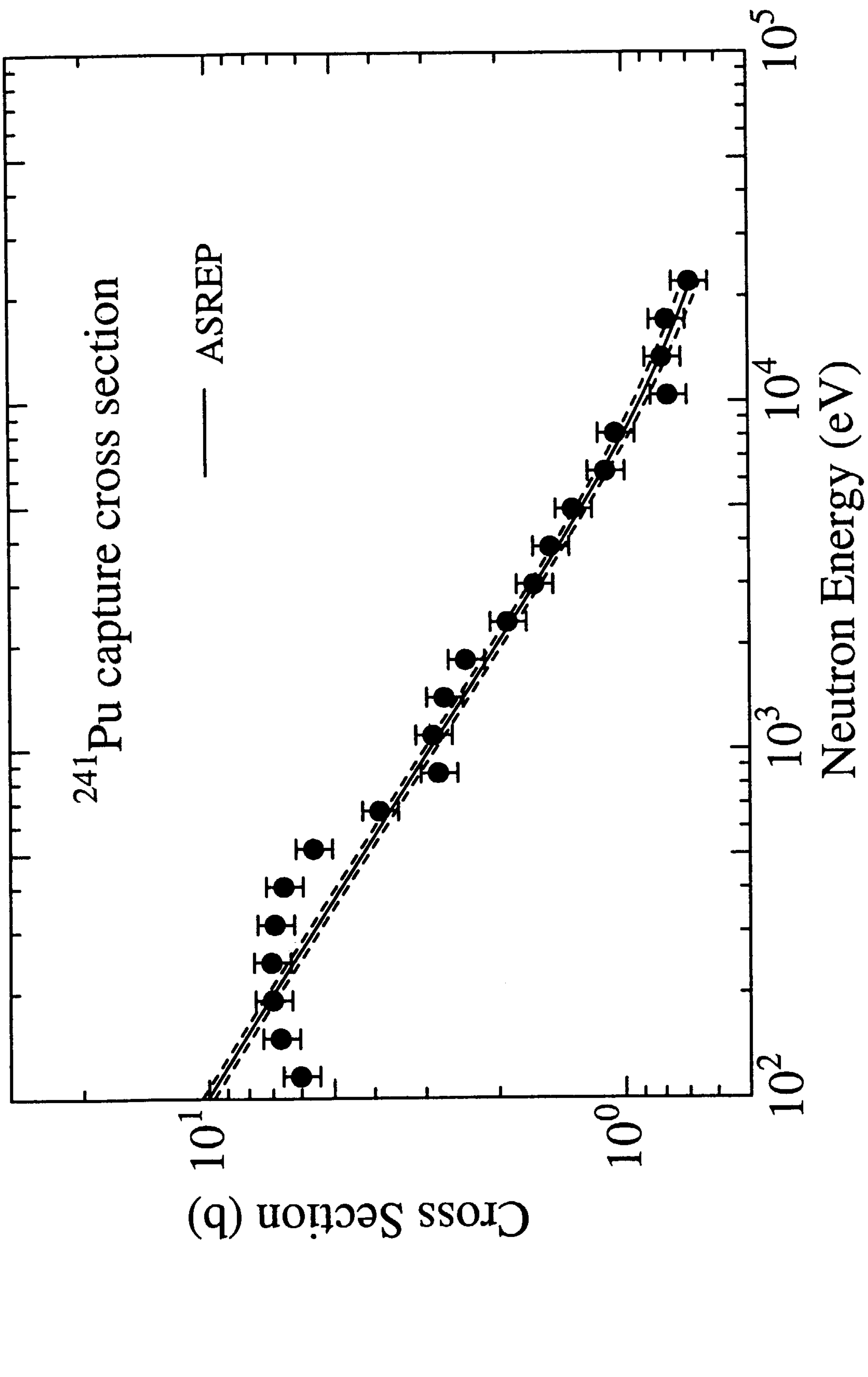


Fig. 16 Neutron capture cross section of $^{241}$Pu in the unresolved resonance region.

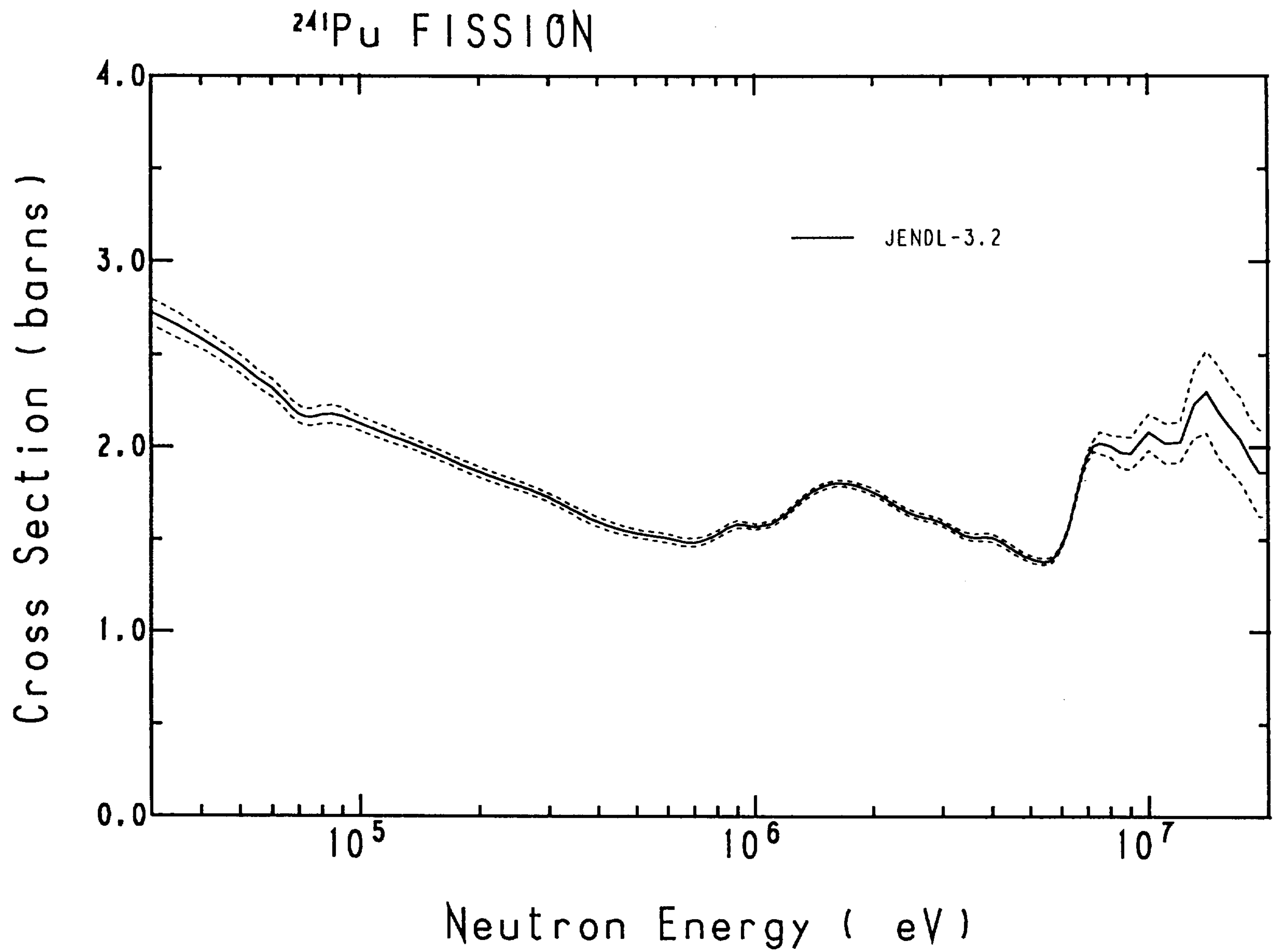


Fig. 17　Fission cross section of $^{241}$Pu above 30 keV.

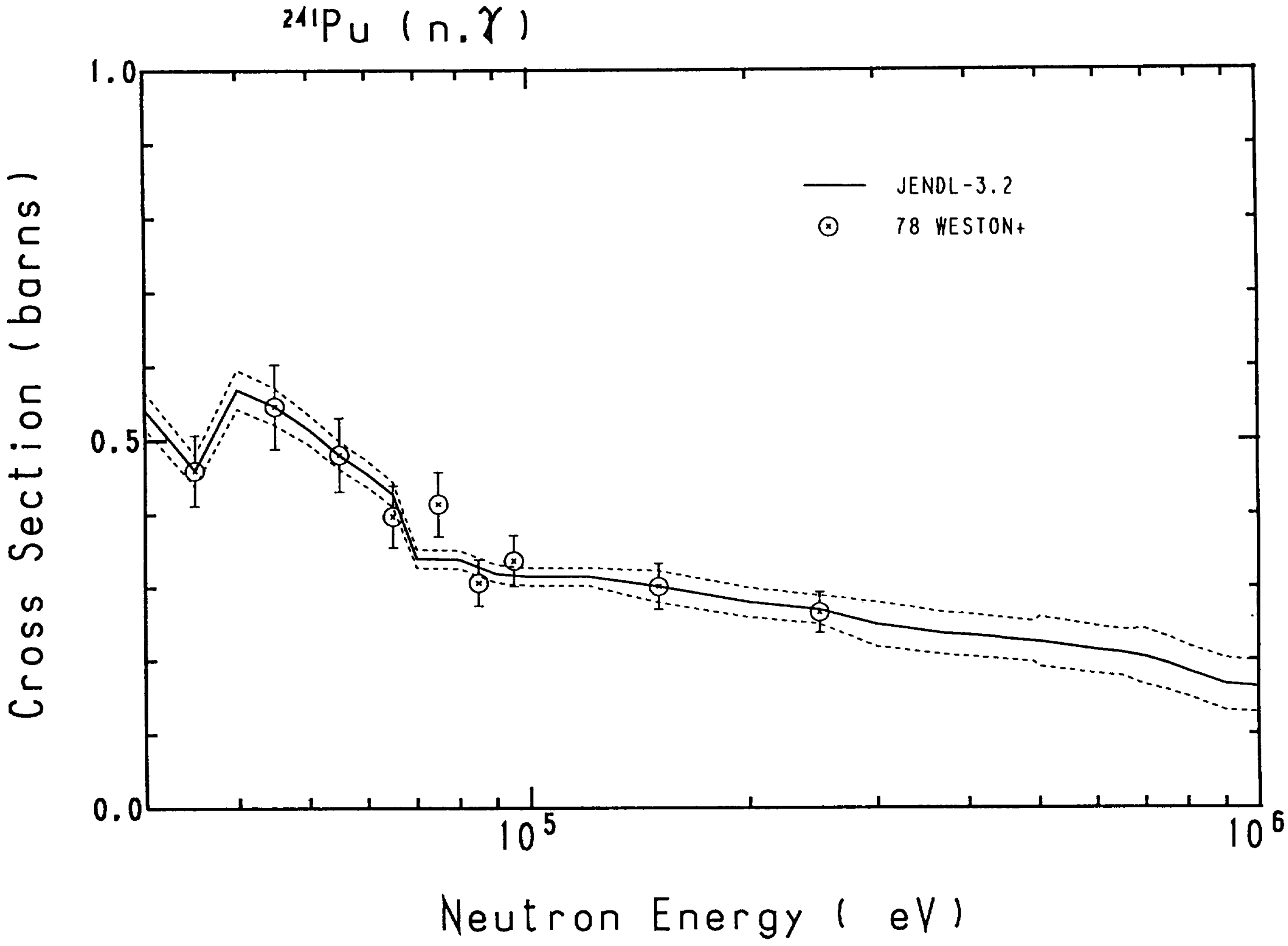


Fig. 18 Neutron capture cross section of $^{241}$Pu above 30 keV.

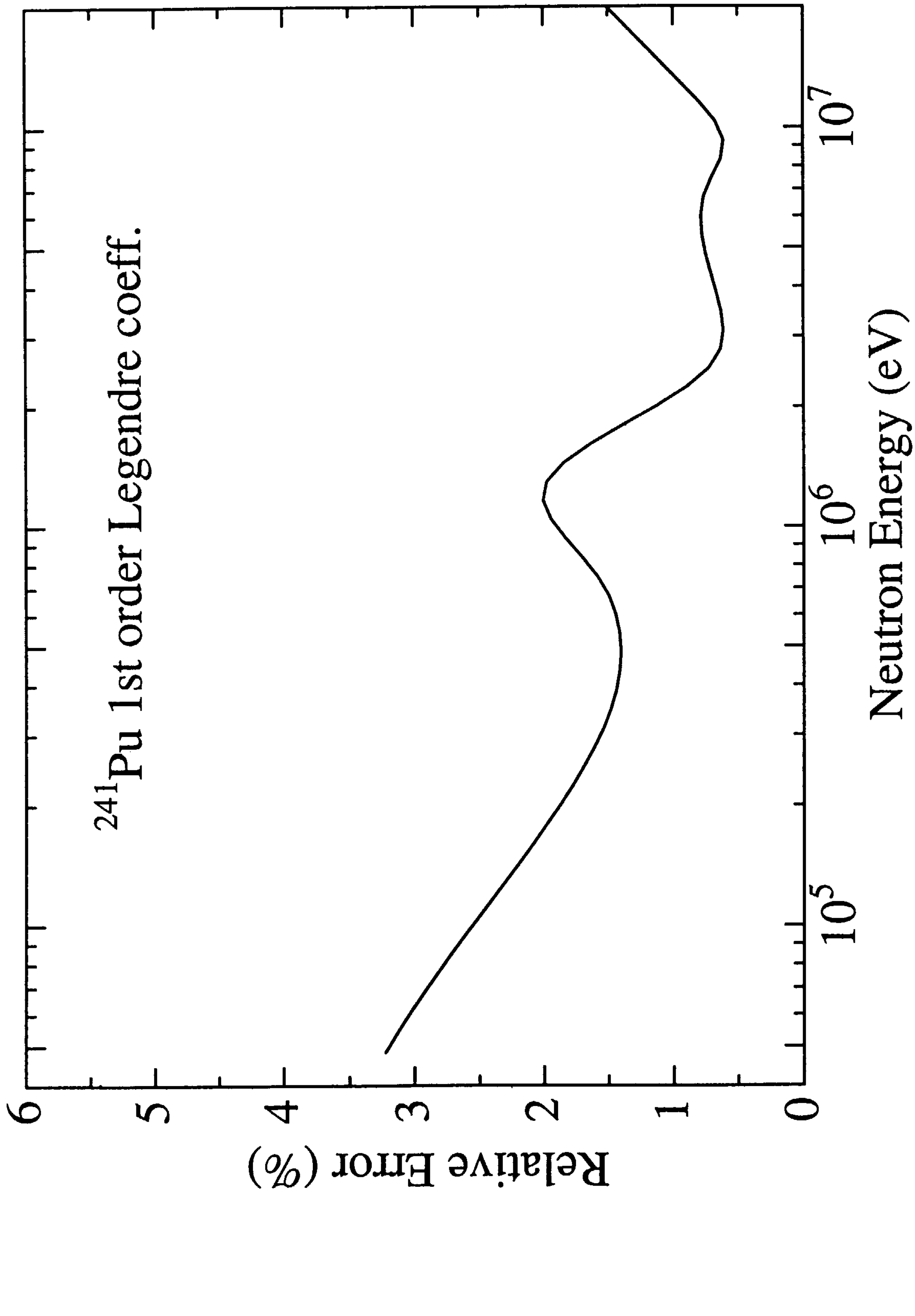


Fig. 19　Error of the 1$^{st}$ order Legendre-polynomial coefficient for $^{241}$Pu.

# 国際単位系 (SI) と換算表

**表 1　SI 基本単位および補助単位**

| 量 | 名　称 | 記　号 |
|---|---|---|
| 長　さ | メートル | m |
| 質　量 | キログラム | kg |
| 時　間 | 秒 | s |
| 電　流 | アンペア | A |
| 熱力学温度 | ケルビン | K |
| 物質量 | モル | mol |
| 光　度 | カンデラ | cd |
| 平面角 | ラジアン | rad |
| 立体角 | ステラジアン | sr |

**表 3　固有の名称をもつ SI 組立単位**

| 量 | 名　称 | 記号 | 他の SI 単位による表現 |
|---|---|---|---|
| 周波数 | ヘルツ | Hz | $s^{-1}$ |
| 力 | ニュートン | N | $m \cdot kg/s^2$ |
| 圧力，応力 | パスカル | Pa | $N/m^2$ |
| エネルギー，仕事，熱量 | ジュール | J | N·m |
| 工率，放射束 | ワット | W | J/s |
| 電気量，電荷 | クーロン | C | A·s |
| 電位，電圧，起電力 | ボルト | V | W/A |
| 静電容量 | ファラド | F | C/V |
| 電気抵抗 | オーム | Ω | V/A |
| コンダクタンス | ジーメンス | S | A/V |
| 磁束 | ウェーバ | Wb | V·s |
| 磁束密度 | テスラ | T | $Wb/m^2$ |
| インダクタンス | ヘンリー | H | Wb/A |
| セルシウス温度 | セルシウス度 | ℃ | |
| 光束 | ルーメン | lm | cd·sr |
| 照度 | ルクス | lx | $lm/m^2$ |
| 放射能 | ベクレル | Bq | $s^{-1}$ |
| 吸収線量 | グレイ | Gy | J/kg |
| 線量当量 | シーベルト | Sv | J/kg |

**表 2　SI と併用される単位**

| 名　称 | 記　号 |
|---|---|
| 分，時，日 | min, h, d |
| 度，分，秒 | °, ′, ″ |
| リットル | l, L |
| トン | t |
| 電子ボルト | eV |
| 原子質量単位 | u |

$1\ eV = 1.60218 \times 10^{-19}\ J$

$1\ u = 1.66054 \times 10^{-27}\ kg$

**表 4　SI と共に暫定的に維持される単位**

| 名　称 | 記　号 |
|---|---|
| オングストローム | Å |
| バーン | b |
| バール | bar |
| ガル | Gal |
| キュリー | Ci |
| レントゲン | R |
| ラド | rad |
| レム | rem |

$1\ Å = 0.1\ nm = 10^{-10}\ m$

$1\ b = 100\ fm^2 = 10^{-28}\ m^2$

$1\ bar = 0.1\ MPa = 10^5\ Pa$

$1\ Gal = 1\ cm/s^2 = 10^{-2}\ m/s^2$

$1\ Ci = 3.7 \times 10^{10}\ Bq$

$1\ R = 2.58 \times 10^{-4}\ C/kg$

$1\ rad = 1\ cGy = 10^{-2}\ Gy$

$1\ rem = 1\ cSv = 10^{-2}\ Sv$

**表 5　SI 接頭語**

| 倍数 | 接頭語 | 記　号 |
|---|---|---|
| $10^{18}$ | エクサ | E |
| $10^{15}$ | ペタ | P |
| $10^{12}$ | テラ | T |
| $10^{9}$ | ギガ | G |
| $10^{6}$ | メガ | M |
| $10^{3}$ | キロ | k |
| $10^{2}$ | ヘクト | h |
| $10^{1}$ | デカ | da |
| $10^{-1}$ | デシ | d |
| $10^{-2}$ | センチ | c |
| $10^{-3}$ | ミリ | m |
| $10^{-6}$ | マイクロ | μ |
| $10^{-9}$ | ナノ | n |
| $10^{-12}$ | ピコ | p |
| $10^{-15}$ | フェムト | f |
| $10^{-18}$ | アト | a |

（注）

1. 表 1 ― 5 は「国際単位系」第 5 版，国際度量衡局 1985 年刊行による。ただし，1 eV および 1 u の値は CODATA の 1986 年推奨値によった。
2. 表 4 には海里，ノット，アール，ヘクタールも含まれているが日常の単位なのでここでは省略した。
3. bar は，JIS では流体の圧力を表わす場合に限り表 2 のカテゴリーに分類されている。
4. EC 閣僚理事会指令では bar，barn および「血圧の単位」mmHg を表 2 のカテゴリーに入れている。

## 換　　算　　表

| 力 | N(=$10^5$ dyn) | kgf | lbf |
|---|---|---|---|
| | 1 | 0.101972 | 0.224809 |
| | 9.80665 | 1 | 2.20462 |
| | 4.44822 | 0.453592 | 1 |

粘　度　$1\ Pa \cdot s (N \cdot s/m^2) = 10\ P$（ポアズ）$(g/(cm \cdot s))$

動粘度　$1\ m^2/s = 10^4\ St$（ストークス）$(cm^2/s)$

| 圧力 | MPa(=10 bar) | $kgf/cm^2$ | atm | mmHg(Torr) | $lbf/in^2$(psi) |
|---|---|---|---|---|---|
| | 1 | 10.1972 | 9.86923 | $7.50062 \times 10^3$ | 145.038 |
| | 0.0980665 | 1 | 0.967841 | 735.559 | 14.2233 |
| | 0.101325 | 1.03323 | 1 | 760 | 14.6959 |
| | $1.33322 \times 10^{-4}$ | $1.35951 \times 10^{-3}$ | $1.31579 \times 10^{-3}$ | 1 | $1.93368 \times 10^{-2}$ |
| | $6.89476 \times 10^{-3}$ | $7.03070 \times 10^{-2}$ | $6.80460 \times 10^{-2}$ | 51.7149 | 1 |

| エネルギー・仕事・熱量 | J(=$10^7$ erg) | kgf・m | kW・h | cal（計量法） | Btu | ft・lbf | eV |
|---|---|---|---|---|---|---|---|
| | 1 | 0.101972 | $2.77778 \times 10^{-7}$ | 0.238889 | $9.47813 \times 10^{-4}$ | 0.737562 | $6.24150 \times 10^{18}$ |
| | 9.80665 | 1 | $2.72407 \times 10^{-6}$ | 2.34270 | $9.29487 \times 10^{-3}$ | 7.23301 | $6.12082 \times 10^{19}$ |
| | $3.6 \times 10^6$ | $3.67098 \times 10^5$ | 1 | $8.59999 \times 10^5$ | 3412.13 | $2.65522 \times 10^6$ | $2.24694 \times 10^{25}$ |
| | 4.18605 | 0.426858 | $1.16279 \times 10^{-6}$ | 1 | $3.96759 \times 10^{-3}$ | 3.08747 | $2.61272 \times 10^{19}$ |
| | 1055.06 | 107.586 | $2.93072 \times 10^{-4}$ | 252.042 | 1 | 778.172 | $6.58515 \times 10^{21}$ |
| | 1.35582 | 0.138255 | $3.76616 \times 10^{-7}$ | 0.323890 | $1.28506 \times 10^{-3}$ | 1 | $8.46233 \times 10^{18}$ |
| | $1.60218 \times 10^{-19}$ | $1.63377 \times 10^{-20}$ | $4.45050 \times 10^{-26}$ | $3.82743 \times 10^{-20}$ | $1.51857 \times 10^{-22}$ | $1.18171 \times 10^{-19}$ | 1 |

1 cal = 4.18605 J（計量法）
　　= 4.184 J　（熱化学）
　　= 4.1855 J　(15 °C)
　　= 4.1868 J（国際蒸気表）

仕事率　1 PS（仏馬力）
　　= 75 kgf·m/s
　　= 735.499 W

| 放射能 | Bq | Ci |
|---|---|---|
| | 1 | $2.70270 \times 10^{-11}$ |
| | $3.7 \times 10^{10}$ | 1 |

| 吸収線量 | Gy | rad |
|---|---|---|
| | 1 | 100 |
| | 0.01 | 1 |

| 照射線量 | C/kg | R |
|---|---|---|
| | 1 | 3876 |
| | $2.58 \times 10^{-4}$ | 1 |

| 線量当量 | Sv | rem |
|---|---|---|
| | 1 | 100 |
| | 0.01 | 1 |

（86 年 12 月 26 日現在）

ESTIMATION OF COVARIANCES OF $^{10}B$, $^{11}B$, $^{55}Mn$, $^{240}Pu$ AND $^{241}Pu$ NEUTRON NUCLEAR DATA IN JENDL-3.2