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NUCLEAR SCIENCE COMMITTEE

WORKING PARTY ON THE PHYSICS OF PLUTONIUM RECYCLING AND INNOVATIVE FUEL CYCLES

# EVALUATION OF $^{242}$PU DATA FOR THE INCIDENT NEUTRON ENERGY RANGE 0.1 - 6 MEV

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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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*The primary objective of NEA is to promote co-operation among the governments of its participating countries in furthering the development of nuclear power as a safe, environmentally acceptable and economic energy source.*

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- *developing exchanges of scientific and technical information particularly through participation in common services;*
- *setting up international research and development programmes and joint undertakings.*

*In these and related tasks, NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has concluded a Co-operation Agreement, as well as with other international organisations in the nuclear field.*

## FOREWORD

The OECD/NEA Nuclear Science Committee has set up a Working Party on Physics of Plutonium Recycling and Innovative Fuel Cycles. It deals with the status and trends of physics issues related to plutonium and minor actinides recycling with respect to both the back-end of the fuel cycle and the optimal utilisation of plutonium.

The results of the studies carried out have been consolidated in the series of reports entitled "Physics of Plutonium Recycling".

Several important recommendations were reached; among these the following:

- the calculational methods have to take into account cross section resonance shielding, and should include mutual shielding, over the whole energy region for the fuel and cladding nuclides and the major fission products,
- sufficient quality of basic nuclear data is needed, in particular for $^{238}$U and the plutonium isotopes, but also for higher actinides and fission products,
- multiple recycling of plutonium with high burnup can have limitations due to considerations such as the build-up of $^{238}$Pu and $^{242}$Pu or the existence of positive reactivity feedback effects on complete coolant voiding at high plutonium contents or the increase of the build-up of higher actinides.

$^{242}$Pu has been identified as one of the nuclides for which improved data is needed. While in a first recycle MOX the content of $^{242}$Pu is typically around 4%, it is about 20% in the fifth recycle when operating a PWR in self-generation recycle mode. The improved data is required for innovative fuel cycle studies.

The present report describes a contribution to an improved cross section data set for $^{242}$Pu. It covers the range from the unresolved resonance region (10 keV) to the (n,2n) reaction threshold (~6 MeV). The resolved resonance energy range is the subject of greatest interest for LWRs, but unfortunately no new measurements have been carried out for almost 20 years. It is therefore not possible to much improve data in that energy range by re-analysing available data from previous experiments.

The higher energy part studied in this work is of importance for reactivity void effects because the spectrum of the voided configuration is very hard. It is also important for fast reactor applications, be they loaded with MOX, metal fuel or inert matrix. Particular effort has been devoted to improving the fission cross section.

The JEF co-ordination group has approved the inclusion of this data into the JEFF-3 evaluated nuclear data file.

## *ACKNOWLEDGEMENT*

*We wish to express appreciation for the financial contribution the Government of Japan has provided for this study.*

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**Abstract**

*This report presents the models and the procedures used for the calculation of the quantities required by Files 3, 4 and 5 of ENDF-6 for $^{242}Pu$. These quantities are the integrated cross sections for the total, fission, scattering and gamma-capture reactions and the angular and energy distributions of the scattered neutrons for the incident neutron energies 0.01 ÷ 6 MeV.*

*The direct mechanism was treated with the coupled-channel method using a deformed optical potential defined by a set of actinide region parameters established by the authors. For the compound nucleus calculations, a new HRTW version of the statistical model extended to describe the fission at subbarrier energies was used. To describe the continuous part of the transition states spectrum, analytical expressions have been established. The energy distributions of the scattered neutrons have been calculated with an authors' version of the Los Alamos model.*

*The agreement of the calculations with the existing experimental data is good.*

**Introduction**

This report describes the models, the procedures and the parameters used to calculate the neutron cross sections *(n,n), (n,n'), (n,f), (n,γ)* of $^{242}$Pu in the energy range 0.01 ÷ 6 MeV, as well as the corresponding angular and energy distributions.

With the exception of the fission cross section, the experimental data for $^{242}$Pu in this energy range are scarce: only one set of data for the total cross section between 0.7 ÷ 20 MeV, some experimental points for gamma capture up to 80 KeV and a few differential scattering cross sections. This is the reason that we attempted to establish a theoretical framework which could be used for the calculations of all the neutron cross sections.

The neutron interaction with $^{242}$Pu in this energy range takes place through direct and compound nucleus mechanisms.

For this heavy deformed nucleus, the elastic channel is strongly coupled with the other possible channels in the process and the direct mechanism has to be treated with the coupled channel method. For the direct calculations we used the code ECIS95 which provides the total cross section, the direct scattering differential and integrated cross sections to the levels considered coupled and the neutron transmission coefficients needed in compound nucleus calculations.

Concerning the compound nucleus mechanism, a statistical treatment was used for fission, neutron elastic and inelastic scattering, and radiative capture cross sections calculations. The *(n,2n)* decay channel is not open in this energy range (the threshold energy for this process is about 6.336 MeV) and the second chance fission has not been taken into account, which could determine a slight underestimation of the fission cross section at the upper limit of the energy range considered. All of the compound nucleus calculations have been performed with our statistical code which also includes the possibility of subbarrier fission calculations.

The input data required in the actual calculations were determined starting either from experimental data (e.g. the level distance at the neutron binding energy), or from procedures proved in our previous calculations to be valid for many actinides (the case of the parameters defining the optical potential or the level densities). Whenever possible, we tried to use the general procedures which are valid for more than one nucleus.

**Direct model**

Through analysing the deformed neutron optical potential, both phenomenological and microscopic [Ta65], [Sa86], [Je77], [La82], [La83], [La86], [Yo86] it was discovered that the microscopic models respond better to almost all the physical constraints. In order to avoid the inherent difficulties of microscopic model calculations, we established a general procedure to obtain an equivalent phenomenological optical potential. This procedure [Tu94], [Vl96], valid in the actinide region, was used to obtain the parameters of the following potential:

$$V_{opt} = -Vf(r,R_0,a_0) + 4ia_D W_D \frac{d}{dr} f(r,R_D,a_D) + \left(\frac{\hbar}{2m_\pi}\right)^2 2\vec{s}\vec{l}\, V_{sl} \frac{1}{r}\frac{d}{dr} f(r,R_{sl},a_{sl}) \qquad (1)$$

in which (using standard notations) the form factor is of Woods-Saxon type and the angular dependence of $R$, $R_D$, and $R_{sl}$ is taken of the same form according to the collective nature of the target nucleus considered rotational:

$$R_k = R_{0k}(1+\beta_2 Y_{20}(\theta) + \beta_4 Y_{40}(\theta)) \qquad R_{0k} = r_k A^{1/3} \qquad (2)$$

with $k = 0, D, sl$.

The only parameters entering in (1) which have to be established for each nucleus are the deformation parameters $\beta_2$, $\beta_4$.

Applying this procedure in the particular case of $^{242}$Pu, we obtained for the parameters defining (1) the relations:

$$\begin{aligned} V &= 45.965970 - 0.57E + 0.020E^2 \\ W_D &= 2.367984 + 0.40E + 0.001E^2 \\ V_{sl} &= 6.0 \end{aligned} \qquad (3)$$

$$\begin{aligned} r_0 &= 1.256 \qquad & a_0 &= 0.62 \\ r_D &= 1.260 \qquad & a_D &= 0.58 \\ r_{sl} &= 1.120 \qquad & a_{sl} &= 0.50 \end{aligned} \qquad (4)$$

where $E$ is the incident neutron energy in the laboratory system expressed in MeV, and the reduced radii and the diffusivities are expressed in fermi.

Combining the structure models results [Hod81], [Go72], [Mo95] and the constraints imposed by the agreement of the calculations with the experimental data we found the following values for the deformation parameters:

$$\beta_2 = 0.218 \qquad \beta_4 = 0.046 \qquad (5)$$

The levels which have been considered coupled in the present calculations are the first five levels of the fundamental rotational band ($0^+$, $2^+$, $4^+$, $6^+$, $8^+$).

The direct model calculations have been done with ECIS95 [Ra95], [Ra94] in a version adapted by us to run on PC.

## Compound nucleus model

The cross sections for the reactions which occur through the compound nucleus mechanism are:

$$\sigma_{\alpha\alpha'}^{NC}(E) = \sum_{J\Pi} \sigma_{\alpha}^{NC}(E, J\Pi) P_{\alpha'}(E, J\Pi) \tag{6}$$

In this relation $\sigma_{\alpha}^{NC}(E, J\Pi)$ represents the compound nucleus cross section for a specific spin J and parity $\Pi$ of the compound nucleus:

$$\sigma_{\alpha}^{NC}(E, J\Pi) = \pi \lambda_{\alpha}^{2} g_{\alpha}^{J} \sum_{lj} T_{\alpha lj}(E, J\Pi) \tag{7}$$

In our case, $T_{\alpha lj}$ are the neutron transmission coefficients provided by ECIS. The reduced wave length for the entry channel $\lambda_{\alpha}$ used in the statistical code and also in ECIS has the expression:

$$\frac{1}{\lambda_{\alpha}} = k_{\alpha} = 0.2187342 \frac{M_T \sqrt{m_n}}{M_T + m_n} \sqrt{E}$$

with $M_T$, $m_n$ representing the target respective neutron mass in atomic mass units (Table 1). The statistical factor $g_{\alpha}^{J}$ in this particular case is expressed as:

$$g_{\alpha}^{J} = \frac{2J+1}{2(2I_{\alpha}+1)}$$

where $I_{\alpha}$ is the target spin. $P_{\alpha'}(E,J\Pi)$ represents the probability of a specific neutron induced reaction namely fission, neutron emission or radiative transitions.

The usual statistical model formalism for average neutron cross sections does not take into account any effects of intermediate structure. This will be quite correct for superbarrier energies. However, for this nucleus, at excitation energies below or close to the barrier top, the existence of intermediate structure due to class II states, may considerably change the average neutron cross sections with respect to the predictions of the simple statistical model.

After the absorption of the neutron by the target, the compound nucleus is populated in class I states. From these states it can decay by neutron emission, gamma transition, direct fission, or can suffer a shape change by a transition to a class II state (absorption in the isomeric well). The fraction absorbed in the isomeric well can decay by fission (penetrating the outer barrier), by radiative transition to the isomeric state (which in this paper is neglected) or by another change of shape (returning to a class I state after penetrating the inner barrier). The fraction returned in the class I state is divided again and the process continues indefinitely. The probability of each of the above processes represents the sum of an infinite series [Bj80]. Considering the effect of coupling between the states of the two wells and averaging over a class II resonance [Ba74], the probabilities for each process are [Vl94]:

$$P_f(E,J\Pi) = \frac{T_{dir}(E^*,J\Pi)}{T_{dir}(E^*,J\Pi) + T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)} + \frac{T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)}{T_{dir}(E^*,J\Pi) + T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)}\frac{1}{a} \tag{8}$$

$$P_{n_i}(E,J\Pi) = \frac{\sum_{l'j'} T_{n_i,l',j'}(E_i,J\Pi)}{T_{dir}(E^*,J\Pi) + T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)}\left(1-\frac{1}{a}\right) \tag{9}$$

$$P_\gamma(E,J\Pi) = \frac{T_\gamma(E^*,J\Pi)}{T_{dir}(E^*,J\Pi) + T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)}\left(1-\frac{1}{a}\right) \tag{10}$$

with:

$$a = \left(1 + b^2 + 2b\, cth\left(\frac{T_A(E^*,J\Pi) + T_B(E^*,J\Pi)}{2}\right)\right)^{1/2}$$

$$b = \frac{\left[T_{dir}(E^*,J\Pi) + T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi)\right]\left[T_A(E^*,J\Pi) + T_B(E^*,J\Pi)\right]}{T_{abs}(E^*,J\Pi)\; T_B(E^*,J\Pi)} \tag{11}$$

and the excitation energy in the compound nucleus $E^*$:

$$E^* = B_n + E\frac{M_T}{M_T + m_n} \tag{12}$$

At excitation energies close to the top of the barrier the vibrational component of the class II states becomes completely damped and practically the whole flux transmitted through the inner barrier is absorbed in the second well and re-emitted in the fission channel by transmission through the outer barrier. In this case $T_{dir} \rightarrow 0$, $T_{abs} \rightarrow T_A$ and the fission probability has the more usual form [Ba74a]:

$$P_f(E,J\Pi) = \frac{1}{a} = \left(1 + b^2 + 2b\, cth\left(\frac{T_A(E^*,J\Pi) + T_B(E^*,J\Pi}{2}\right)\right)^{-1/2} \tag{13}$$

with:

$$b = \frac{\left[T_{part}(E.J\Pi) + T_\gamma(E^*,J\Pi)\right]\left[T_A(E^*,J\Pi) + T_B(E^*,J\Pi)\right]}{T_A(E^*,J\Pi)\; T_B(E^*,J\Pi)}$$

The scattering (9) and gamma-decay (10) probabilities are modified correspondingly.

For superbarrier excitation energies the class II widths exceed the distance between them and $cth((T_A+T_B)/2) \to 1$; in this case one obtains the usual form in the statistical models for the decay probabilities and the corresponding cross sections:

$$P_f(E,J\Pi) = \frac{1}{a} = \frac{1}{1+b} = \frac{T_f(E^*,J\Pi)}{T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi) + T_f(E^*,J\Pi)} \tag{14}$$

$$T_f(E^*,J\Pi) = \frac{T_A(E^*,J\Pi)\,T_B(E^*,J\Pi)}{T_A(E^*,J\Pi) + T_B(E^*,J\Pi)}$$

$$P_{n_i}(E,J\Pi) = \frac{\sum_{l'j'} T_{n_i,l'j'}(E_i,J\Pi)}{T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi) + T_f(E^*,J\Pi)} \tag{15}$$

$$P_\gamma(E,J\Pi) = \frac{T_\gamma(E^*,J\Pi)}{T_{part}(E,J\Pi) + T_\gamma(E^*,J\Pi) + T_f(E^*,J\Pi)} \tag{16}$$

The transmission coefficients entering the above equations are briefly described in the next sections.

Introducing the relations (14) ÷ (16) for the decay probabilities in (6), one obtains the cross sections calculated in the well-known Hauser-Feshbach formalism [Ha52].

In the HRTW model [Ho75], [Ho80] the relation (6) becomes:

$$\sigma_{\alpha\alpha'}^{NCfl}(E) = \sum_{J\Pi} \sigma_\alpha^{NCfl}(E,J\Pi) P_{\alpha'}^{fl}(E,J\Pi) \tag{17}$$

The compound nucleus cross section $\sigma_\alpha^{NCfl}(E,J\Pi)$ and the probabilities $P_{\alpha'}^{fl}(E,J\Pi)$ have similar significance as in (6); the only difference is the replacement in the above equations of the neutron transmission coefficients $T_{n_ilj}(E_i,J\Pi)$ by the quantities $V_{n_ilj}(E_i,J\Pi)$ and in the expression (15) the sum $\sum_{l'j'} T_{n_i,l'j'}(E_i,J\Pi)$ at the numerator passes in $\sum_{l'j'} V_{n_i,l'j'}(E_i,J\Pi)\left[1+\delta_{n_1lj,n_il'j'}(G_{n_1lj}-1)\right]$

For the $m$-th iteration $V_{n_i,l'j'}(E_i,J\Pi)$ have the expression:

$$V_{n_ilj}^{(m)}(E_i,J\Pi) = \frac{T_{n_ilj}(E_i,J\Pi)}{1 + \frac{V_{n_ilj}^{(m-1)}(E_i,J\Pi)}{T_\gamma(E^*,J\Pi) + V_{part}^{(m-1)}(E,J\Pi)}\left(1-\left(\frac{1}{a}\right)^{(m-1)}\right)\left(G_{n_1lj}-1\right)} \tag{18}$$

where $G_{n_1lj}$ is calculated as in [Ho75] and $V_{part}(E,J\Pi)$ is defined by a relation similar to (20) from the next section.

A generalisation of HRTW model is obtained by replacing in (8) ÷ (10) the neutron transmission coefficients $T_{n_ilj}(E_i,J\Pi)$ by $V_{n_ilj}(E_i,J\Pi)$.

Our code GIGFG (used in [De94]) in its new version [Vl96a] calculates all the compound nucleus cross section in the frame of this generalised HRTW model. In function of excitation energy, the code adopts automatically the appropriate form of the decay probabilities allowing a smooth passage from the deep subbarrier excitation energies up to superbarrier energies.

***Neutron transmission coefficients***

The transmission coefficients for neutron emission $T_{part}(E,J\Pi)$ are subdivided into two parts:

$$T_{part}(E,J\Pi) = T_{part}^{dis}(E,J\Pi) + T_{part}^{cont}(E,J\Pi) \tag{19}$$

The first term describes the emission of neutrons to discrete low-lying states $i$ of the target nucleus:

$$T_{part}^{dis}(E,J\Pi) = \sum_{i} \sum_{lj} T_{n,lj}(E_i, J\Pi)\delta(\Pi\Pi_i,(-1)^l) \tag{20}$$

with:

$$E_i = E - \varepsilon_i \frac{M_T + m_n}{M_T} \tag{21}$$

where $\varepsilon_i$ is the excitation energy of the final state and the factor $\delta(\Pi\Pi_p(-1)^l)$ serves for parity conservation. We have considered 19 discrete levels up to $E_{cont}$ = 1.152 MeV presented in Table 1.

To describe the continuous level spectrum situated above the last discrete level a level density function must be used. The second term of (19) is then given by:

$$T_{part}^{cont}(E,J\Pi) = \sum_{I=|J-j|}^{J+j} \int_{E_{cont}}^{E\frac{M_T}{M_T+m_n}} \sum_{lj} T_{n,lj}(E - \varepsilon\frac{M_T+m_n}{M_T}, J\Pi)\rho(\varepsilon, I\Pi_i)\delta(\Pi\Pi_i,(-1)^l)d\varepsilon \tag{22}$$

We tested many level density formulae in order to find the one most appropriate for the heavy, deformed nuclei.

For example, we tested the different Ignatyuk formulae [Ig73], [Ig75], [Ig85] in which the dependence of the shell effects on the excitation energy, the contribution of the collective motions in the nucleus and residual correlation interactions are included. However neither of these versions gave better results at equilibrium deformation for the energy range of interest in this evaluation than the well known Gilbert-Cameron formula [Gi65] which was finally adopted:

$$\rho^{GC}(E,I\Pi) = \rho(E)\rho(I\Pi) \tag{23}$$

$$\rho(E) = \begin{cases} \rho^{CT}(E) = \frac{1}{T}\exp\left(\frac{E-E_0}{T}\right) & E \le E_m \\ \rho^{FG}(E) = \frac{\exp\left(2\sqrt{a(E-\Delta)}\right)}{12\sqrt{2}a^{1/4}(E-\Delta)^{5/4}\sigma} & E \ge E_m \end{cases} \tag{24}$$

$$\rho(J\Pi) = \frac{2I+1}{4\sigma^2}\exp\left[-\frac{(I+1/2)^2}{2\sigma^2}\right] \tag{25}$$

Starting from the average level spacings for *s*-wave resonance $D_{exp}(B_n, I\Pi)$ [An89] and using the relation:

$$\rho(B_n, J\Pi) = \frac{1}{D_{\exp}(B_n, J\Pi)}$$

we extracted the level density parameter $a$. Using this parameter, the pairing energy $\Delta$ [Gi65] and the following relation for the matching energy:

$$E_m = 2.5 + \frac{150}{M_T} + \Delta \tag{26}$$

the other parameters for Gilbert Cameron level density formula have been determined using the relations:

$$\frac{1}{T} = \sqrt{\frac{a}{E_m - \Delta}} - \frac{3}{2(E_m - \Delta)} \tag{27}$$

$$\sigma^2 = 0.0888 A_T^{2/3} \sqrt{a(E-\Delta)} \tag{28}$$

$$E_0 = E_m - T\ln(T\rho^{FG}(E_m)) \tag{29}$$

All these parameters are given in Table 1.

### *Gamma-decay transmission coefficients*

For the calculation of the total radiative width, all of the states in the compound nucleus have been included in the continuum contribution described by a Gilbert-Cameron function (23) ÷ (25). As usual, only electric dipole transitions were taken into account ($l = 1$). Hence the total transmission coefficient for radiative capture is written as:

$$T_\gamma(E^*, J\Pi) = \sum_{J_k=|J-1|}^{J+1} \left( \int_0^{E^*} f(\varepsilon)\rho^{GC}(E^*-\varepsilon, J_k, \Pi_k)\delta(\Pi\Pi_k, -1)\, d\varepsilon \right) \tag{30}$$

The spectral factor $f(\varepsilon)$ was calculated in the formalism of the giant resonance model with only one resonance (the results obtained by our introducing two resonances are not significantly different):

$$f(\varepsilon) = C_\gamma \frac{\varepsilon^4}{(E_\gamma^2 - \varepsilon^2)^2 + \Gamma_\gamma^2 \varepsilon^2} \tag{31}$$

where:

$$E_\gamma = \frac{85}{A_{NC}^{1/3}} \; (MeV) \tag{32}$$

and $\Gamma_\gamma$ is taken from empirical data. The constant $C_\gamma$ is deduced from the normalisation:

$$T_\gamma(B_n, J\Pi) = 2\pi \frac{\Gamma_{\exp}(B_n, J\Pi)}{D_{\exp}(B_n, J\Pi)}$$

The value of $\Gamma_{exp}(B_n, J\Pi)$ was determined from the normalisation of the calculated gamma-decay cross section to the experimental data at 50 KeV neutron incident energy while $D_{exp}(B_n, J\Pi)$ was taken from [An89]. All the parameters needed for gamma-decay calculations are given in Table 2.

The relation (30), representing the total transmission coefficient for gamma-decay, is valid when the emission of subsequent gamma rays is the only way to release the residual compound nucleus excitation energy after the first γ-quantum is emitted. In fact, after the first emission of γ-rays, the nucleus excitation energy may also be released through neutron emission *(n,γn')* or fission *(n,γn')*. The *(n,γn')* process is possible only if the excitation energies of the compound states populated by primary gamma-rays are larger than the neutron binding energy. The *(n,γf)* reaction occurs practically for that part of the γ-ray spectrum which populates the compound nucleus in states lying above the corresponding fission barrier. Therefore, when calculating the neutron capture cross section, it is necessary to take into account the competitive processes *(n,γn')*, *(n,γf)*, *(n,γγ)* [Vl86].

Because the average energy of the first emitted γ-rays is about 1 MeV, and in our case, $V_A - B_n \approx 1\ MeV$, the effect of *(n,γf)* and *(n,γn')* reactions occurs for incident neutron energies higher than 1 MeV. But at these energies, the neutron capture cross section $\sigma_{n\gamma}$ calculated with (30) is rather small against fission and inelastic cross sections and consequently the contribution of *(n,γf)*, *(n,γn')* processes is small relative to the corresponding cross sections. The important effect in this case is the drastic decrease of the neutron capture cross section. For instance, at 3 MeV neutron incident energy, the increase of the inelastic cross section due to *(n,γn')* reaction is of 5%, the increase of fission cross section due to *(n,γf)* reaction is of 1.7%, and the corresponding decrease of neutron capture cross section is of 72.4%.

In conclusion, for the present case the competing processes through gamma-decay cascades are important mainly for the calculation of neutron capture cross section.

### *Transmission coefficients for fission*

*Fission barriers*

The fundamental fission barrier is described in the present calculation by a complex potential.

The real part, *V(q)*, consists of three parabolas smoothly joined to represent a double-humped fission barrier along a one-dimensional static fission path in the deformation space:

$$V(q) = V_f \pm \frac{1}{2}\mu\omega_f^2 (q - q_f)^2 \tag{33}$$

where the plus sign applies for $f = 2$ (isomeric well) and the minus sign for $f = 1,3$ (inner (A), respectively outer (B) barrier). The mass parameter $\mu$ is assumed to be independent of the value of $q$ and has the dimension of the moment of inertia while $q$, the deformation parameter is dimensionless; $\hbar\omega_f$ represents the curvature parameters and $q_f$ the locations of the extremes on the deformations axis. The potential *V(q)* is taken to be zero at $q = 0$. In the above equation $V_f$ represents the maxima ($V_A$, $V_B$ for $f = 1,3$) respectively minima ($V_{II}$ for $f = 2$) of the potential associated with the fundamental state. The parameters of the fundamental barrier considered in this paper to be the most appropriate are given in Table 3.

The imaginary part of the potential, *W(q,E)*, is introduced in the region of the isomeric well to take into account the damping of the vibrational states. For the present calculations we chose a parabolic shape with respect to the deformation parameter $q$ and a magnitude increasing with the energy:

$$W(q,E) = -w(E)\,\big(E - V(q)\big) \tag{34}$$

The parameter *w(E)*, chosen to fit the width of the resonances and to be consistent with physical values for the transmission coefficients at higher energies, has the following energy dependence:

$$w(E) = \begin{cases} \exp(60E - 7.5) & E < 0.07015\,MeV \\ 0.032E + 0.035 & E \geq 0.07015\,MeV \end{cases} \tag{35}$$

Above the fundamental fission barrier there are other barriers characterised by the quantum numbers *K, J,Π*; these are the transitional states which represent the fission channels. For the nucleus $^{243}$Pu they represent rotational states built on vibrational or intrinsic states having the energies:

$$E_f(KJ\Pi) = V_f + \varepsilon_f(K\Pi) + \left(\frac{\hbar^2}{2\Im}\right)_f \big(J(J+1) - K(K+1)\big) \tag{36}$$

where $\varepsilon_f(K\Pi)$ are the energies of the rotational band-head above the fundamental state $V_f$ and $(\hbar^2/2\Im)_f$ are the inertial parameters. Their values are given in Table 3. This relation was also used for $K = 1/2$ neglecting the coupling term.

With each of these fission channels a complex potential similar to that for the fundamental state is associated. The imaginary part (34) remains the same, but in $V(q)$ from (33) the energies of the fundamental state $V_f$ are replaced with the energies of the transitional states $E_f(KJ\Pi)$ given by (36).

The double-humped fission barriers described above (associated each to a fission channel) preserve their individuality up to certain excitation energies $E_{cf}$ (dynamically chosen as the energy of the higher rotational level). For energies higher than $E_{cf}$ the transition states are described by density functions.

*Density functions at the saddle points*

As direct experimental information does not exist for the densities which describe the transitional states above $E_{cf}$, theoretical models should be used.

It is known that, at least at low excitation energies (several MeV), the nuclear shape has a very important influence on the level densities of the nucleus. The single particle spectrum obtained from microscopic calculations depends on the nucleus deformation. The collective excitations built on these single particle states, considered as band-heads, depend on the degree of symmetry in the nuclear system. Hence the transitional state densities depend on the nucleus deformation.

Calculations of the deformation potential energy, using the Strutinsky theory, indicate that at the outer barrier, axial symmetry without $R$ symmetry shapes are energetically favoured. In this case, a level density enhanced with a factor $2\sigma_\perp^2$ at each excitation energy with respect to the level density of the spherical symmetry shape is expected ($\sigma_\perp$ is the spin dependence parameter related to the perpendicular moment of inertia of the nucleus).

For the inner barrier, the Strutinsky calculation generally indicates that axial symmetry is lost but reflection symmetry is retained. In this case the nucleus can rotate about the three principal axes of the ellipsoidal shape. Considering only time reversal symmetry and parity invariance, the enhancement factor with respect to the level density of spherical symmetry shape is expected to be $(\pi/2)^{1/2}\sigma_{/\!/}\sigma_\perp^2$ at each excitation energy ($\sigma_{/\!/}$ is the spin dependence parameter related to the parallel moment of inertia of the nucleus).

Studying the trends of the energy dependence of the level densities at the saddle points in the range 1 ÷ 10 MeV existing in literature for different actinide nuclei, it is discovered that they can be approximated by a constant temperature function:

$$\rho_{A,B}(\varepsilon, J\Pi) = C_{A,B}(\varepsilon)(2J+1)\exp\left(-\frac{(2J+1)^2}{8\sigma^2_{m(A,B)}}\right)\exp\left(\frac{\varepsilon - E_{0(A,B)}}{T_{A,B}}\right) \tag{37}$$

The temperatures $T_{A,B}$ can be either inferred from microscopic calculations or considered as input parameters. Choosing the last option we determined the values given in Table 3.

The factors $C_{A,B}(\varepsilon)$ – which take into account the difference in single particle densities and in collective enhancements due to different shape symmetries – have the following expressions:

$$C_{A,B}(\varepsilon) = C_{A,B}(1-0.01\varepsilon) \qquad (38)$$

$$C_A = \sqrt{\frac{\pi}{2}}\frac{\sigma_{mA}}{4T_A\sigma_m^2} \qquad C_B = \frac{1}{2T_B\sigma_m^2}$$

where $\sigma_m$ and $\sigma_{m(A,B)}$ are the spin cut-off factors at the matching energy, corresponding to the equilibrium deformation and to the saddle points deformations respectively.

Using the level density parameter $a$, the temperatures corresponding to the saddle points $T_{A,B}$ and applying the relations (27) ÷ (29) the parameters entering the relations (37) and (38) are calculated.

The density defined by (37) describes the transitional states for excitation energies higher than about 1 MeV. It should be mentioned that in the energy range from 0 to about 1 MeV, $C_{A,B}(\varepsilon)$ has a strong dependence on energy, from relatively high values decreasing asymptotically to the values given by (38). In our particular case, it was not necessary to take into account this dependence because discrete transitional states have been used up to about 1 MeV.

*Transmission coefficients for fission*

According to the last sub-sections, the total transmission coefficients through the inner and outer barriers, respectively, consist of the contributions of the discrete and the continuous parts of the fission channels spectrum:

$$T_{A,B}(E^*,J\Pi) = \sum_{K\leq J} T_{A,B}(E^*,KJ\Pi) + \int_{E_{c(A,B)}}^{\infty} \frac{\rho_{A,B}(\varepsilon,J\Pi)d\varepsilon}{1+\exp\left(\frac{2\pi}{\hbar\omega_{A,B}}(E^*-V_{A,B}-\varepsilon)\right)} \qquad (39)$$

The direct fission appears only for subbarrier excitation energies, occurring only through discrete channels:

$$T_{dir}(E^*,J\Pi) = \sum_{K\leq J} T_{dir}(E^*,KJ\Pi) \qquad (40)$$

The absorption in the isomeric well occurs through all fission channels. In full K-mixing model all the discrete channels with the same $J\Pi$ contribute irrespective of their $K$ value to the total absorption coefficient. The continuum fission channels contribute at higher excitation energies where the class II vibrational states are completely damped and consequently the direct fission disappears and the whole flux which penetrates the inner barrier is absorbed in the second well. Hence the absorption coefficient has the expression:

$$T_{abs}(E^*,J\Pi) = \sum_{K\leq J} T_{abs}(E^*,KJ\Pi) + \int_{E_{cA}}^{\infty} \frac{\rho_A(\varepsilon,J\Pi)d\varepsilon}{1+\exp\left(-\frac{2\pi}{\hbar\omega_A}(E^*-V_A-\varepsilon)\right)} \qquad (41)$$

The coefficients $T_{A,B}(E^*,KJ\Pi)$, $T_{dir}(E^*,KJ\Pi)$ and $T_{abs}(E^*,KJ\Pi)$ were calculated as in [VI94].

## Results for integrated cross sections and angular neutron distributions

The parameters of the optical potential used in ECIS have been computed applying the same procedure which was proved to be appropriate for other actinide nuclei of different types (even-even, odd-odd, odd A) in the energy range 0.01 - 20 MeV [Vl96]. It is possible that a slight variation of these optical potential parameters could improve the agreement of the calculated total cross section with only one set of experimental data (Figure 1), but the other cross sections would not necessarily be correct. That is why we maintained confidence in our procedure; our attitude was confirmed by the results subsequently obtained for the neutron cross sections.

Next, our efforts have been concentrated on reproducing as faithfully as possible the trend demonstrated by the experimental fission cross section. The neutron binding energy in $^{243}$Pu being lower than the fundamental fission barrier, we generalised the statistical HRTW model to include the effect of vibrational class II states; that is, the subbarrieric structure of the fission probability. The fundamental fission barrier parameters and the discrete transitional states have been established starting from the microscopic models [Bo72], [Ba74], using our previous experience with $^{239}$Pu [Si96] and the graphical facilities of our programme. The fundamental fission barrier parameters are in good agreement with the existing statistic [Ba74], [Ba74a], [Ly74], [Bj80], [Br73], [Br80], [Bh90].

For the calculation of the transitional state densities – one of the most delicate aspects in fission calculation – we arrived at a formula which takes into account the collective enhancements corresponding to the nucleus shape symmetries at the saddle points. This method was previously tested with good results for different type of actinides (even-even, odd-odd, odd A). The only input parameters in this case are the temperatures at the saddle points, however our calculations showed that they are rather close to the temperature corresponding to the equilibrium deformation, thus restricting the range of choices. This method is, in some ways, similar to Lynn's procedure [Ly74], [Bj80] above 1 MeV but it has the advantage that almost all the parameters involved are calculated using the same analytical expression for the whole energy range of interest here. The fission cross section obtained in this calculation averages practically all the experimental data obtained by different laboratories as can be seen in Figure 2a and Figure 2b in different scales.

The agreement of the total and fission cross sections with the experimental data and the selfconsistent character of our calculations lead us to believe that the other cross sections are also correct. Means for confirmation include the good fits of differential scattering cross sections (Figures 3-5) which are very sensitive tests, and the comparison with the bulk of experimental data from low energy of gamma-decay cross section (Figure 6). It should be noted that all the experimental data produced in Figures 1-6 were provided by NEA Data Bank.

These agreements proved the adequacy of the direct and compound nucleus calculations in which, whenever possible, the input parameters have been computed in a general and consistent way. This has been proven in previous calculations to be valid for different types of actinides in this energy range.

In conclusion, using the coupled channel method for the direct interaction, a generalised HRTW model for the compound nucleus interaction and our input parameters, a good agreement of the calculated cross sections with the existing experimental data has been obtained. Furthermore, due to the selfconsistency of the calculation the experimentally unknown cross sections should also be correct.

These results have been used to build the files MF=3 and MF=4 in ENDF-6 format.

*File 3 – Reaction cross sections*

The values of the integrated cross sections *(n,total)*, *(n,Elastic)*, *(n,Inelastic)*, *(n,fission)*, *(n,n')* on the first 18 discrete levels, *(n,n' continuum)*, *(n,γ)* in ENDF-6 format are presented in graphical form in Appendix A and in tabular form in Appendix B.

*File 4 – Angular distributions of secondary particles*

The file MF=4 of $^{242}$Pu contains the angular distributions of the elastically scattered neutrons (MT=2) and of the inelastically scattered neutrons on the first 18 discrete levels (MT=51 ÷ 68).

The angular distributions are expressed according to the ENDF-6 Formats Manual (Oct. 1991) as normalised probability distributions $f(\mu,E)$ defined by:

$$f(\mu,E) = \frac{2\pi}{\sigma_s(E)}\sigma(\mu,E) = \sum_{l=0}^{NL}\frac{2l+1}{2}a_l(E)P_l(\mu) \tag{42}$$

where:

- $E$ is the energy of incident neutron in the laboratory system;
- $\mu = cos(\theta)$, $\theta$ is the scattered angle in the centre of mass system;
- $\sigma_s(E)$ is the scattering cross section at energy $E$ for a particular reaction type (MT);
- $\sigma(\mu,E)$ is the differential scattering cross section in units of barns per steradian;
- $l$ is the order of the Legendre polynomial;
- $NL$ is the highest order Legendre polynomial;
- $a_l$ is the $l^{th}$ Legendre polynomial coefficient ($a_0 = 1$).

The file MF=4 provided in this evaluation contains the Legendre polynomial coefficients $a_l(E)$ tabulated as function of the incident neutron energy. The proof that the specific file format was respected is the fact that the PREPRO codes run correctly [Cu94].

Appendix C contains, as an example of Legendre polynomial coefficients, the $a_l(E)$ for MT=2, MT=51, and MT=52 in tabular form. Appendix C also contains some examples of angular distribution plots from MT=2, 51.

**Energy distributions of secondary particles**

No measurements are available for the induced fission neutron energy spectra of $^{242}$Pu. Therefore, the evaluation must be performed using theoretical models.

The current status of the theoretical descriptions of the prompt fission neutron spectrum $N(E,E_n)$ ($E_n$ is the incident neutron energy and $E$ is the scattered neutron energy) has been reviewed by D. Madland [Ma92], [Ma96]. The Los Alamos model, the Dresden model, the Dresden version of the Los Alamos model and the Hauser-Feshbach statistical model were analysed and it seems that, at the present time, the Los Alamos model has the best predictive power and requires the minimal input.

On the other hand, it is recommended in ENDF-6 Formats Manual (version of Oct. 1991), as a rule, to use the simplest law that would accurately represent the data.

For these reasons we adopted the Los Alamos model with the assumption that the cross section for the inverse process of compound nucleus formation $\sigma_c(\varepsilon)$ is constant. The dependence of $\sigma_c(\varepsilon)$ on the centre-of-mass neutron energy $\varepsilon$ was however taken into account by a numerical simulation as in [Ma96].

The input quantities in this model are:

- the average kinetic energy/nucleon $E_f^L$ of the average light fission fragment;
- the average kinetic energy/nucleon $E_f^H$ of the average heavy fission fragment;
- the maximum temperature $T_m$ of the fission fragments.

The current limitations in calculating $N(E,E_n)$ include the insufficient knowledge of these quantities.

As a criterion for verifying the adequacy of the input parameters, we used the spontaneous fission neutron spectrum for $^{242}$Pu from [Be69], which is the only available set of experimental data we know of. In [Be69], considering the Maxwellian spectrum representation and plotting $N_{Maxw}(E)/E^{1/2}$ versus $E$, for energies up to about 6 MeV, the value $T_{Maxw}$ = 1.21 ± 0.7 MeV was obtained for the Maxwell temperature parameter. Using this value and the relationship between $T_{Maxw}$ and the average prompt fission multiplicity $\overline{\nu}_p$ [Ho71]:

$$T_{Maxw}(E_n) = 0.353 + 0.510\sqrt{1+\overline{\nu}_p} \tag{43}$$

we obtained the average prompt fission multiplicity $\overline{\nu}_p = 1.82^{+0.48}_{-0.44}$.

Next, we calculated the prompt fission energy spectrum $N_s(E)$ for the spontaneous fission and the average prompt fission multiplicity of $^{242}$Pu using our version of the Los Alamos model with our input quantities. The value of the average prompt fission multiplicity $\overline{\nu}_p$ = 2.15 was obtained. Fitting the $N_s(E)/E^{1/2}$ versus $E$ by linear regression, the equivalent Maxwell temperature $T_{maxw}$= 1.269 MeV was obtained. Both these values are in agreement with those obtained above from the experimental values from [Be69].

Examples of neutron energy spectra calculated with these input parameters for the incident neutron energies $E_n$ = 0.01 MeV and $E_n$ = 5 MeV are presented in Figure 7. The ratios between these spectra and the corresponding Maxwell representations (calculated with the formulae from [Ho71], [Ho77]) are given in Figure 8.

These results (as well as those not shown) seem to be in agreement with the general trends of those given for other nuclei in [Ma92], [Ma96]. Consequently, we consider that our input parameters are adequate.

All the calculations have been performed with the code SPECTRUM [Vl96b], which allows simultaneous calculations of the neutron spectrum with the Los Alamos model and the Maxwell model based on the relations given in [Ho71], [Ho77].

The energy distribution of the neutrons scattered to a continuum of levels is represented by the evaporation spectrum. The nuclear temperature $\theta$ is a function of incident neutron energy $E_n$ as follows:

$$\theta = 0.401123\, MeV \qquad U \le E_n \le E_m \tag{44}$$

$$\frac{1}{\theta} = \sqrt{\frac{a}{E_n - \Delta} - \frac{3}{2(E_n - \Delta)}} \qquad E_n > E_m$$

where $U$ = 1.1568 MeV is the threshold energy corresponding to the last discrete level. The level density parameter $a$, the pairing energy $\Delta$ and the matching energy $E_m$ which enter in the Gilbert Cameron formula, are given in Table 1.

**File 5**

For the fission neutron spectrum (LF=12), the input quantities: $E_f^L, E_f^H$ and $TM(E_n)$ in the energy range considered in this work (0.01 ÷ 6 MeV) are given in MT=18 and 19 (bear in mind that the process *(n,n'f)* has been neglected). The energy values, for which $TM(E_n)$ is given, permit linear interpolation.

For the neutron evaporation spectrum (LF=9) the input quantities $U$ and $\theta(E_n)$ are given in MT=91, for energies $E_n$ which permit linear interpolation for $\theta(E_n)$.


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**Table 1. Parameters of the target nucleus $^{242}$Pu needed for elastic and inelastic cross sections calculation**

$m_n$ = 1.008665 amu $M_T$ = 242.0587373 amu

Discrete levels (used in eq. 21)

| | Present work | | Ref. [Le78] | |
|---|---|---|---|---|
| No. | IΠ | $\varepsilon_i$ (MeV) | IΠ | $\varepsilon_i$ (MeV) |
| 1 | 0+ | 0.0000 | 0+ | 0.0000 |
| 2 | 2+ | 0.0445 | 2+ | 0.0445 |
| 3 | 4+ | 0.1472 | 4+ | 0.1472 |
| 4 | 6+ | 0.3059 | 6+ | 0.3059 |
| 5 | 8+ | 0.5176 | 8+ | 0.5176 |
| 6 | 10+ | 0.7790 | 10+ | 0.7790 |
| 7 | 1- | 0.7800 | 1- | 0.7800 |
| 8 | 3- | 0.8320 | 3- | 0.8320 |
| 9 | 1- | 0.8650 | | 0.8650 |
| 10 | 5- | 0.9270 | 5- | 0.9270 |
| 11 | 0+ | 0.9560 | (0+) | 0.9560 |
| 12 | 2+ | 0.9950 | (2+) | 0.9950 |
| 13 | 3- | 1.0190 | 3- | 1.0190 |
| 14 | 4+ | 1.0400 | | 1.0400 |
| 15 | 4- | 1.0640 | (4-) | 1.0640 |
| 16 | 12+ | 1.0870 | 12+ | 1.0870 |
| 17 | 2+ | 1.1020 | (2+) | 1.1020 |
| 18 | 5- | 1.1220 | (5-) | 1.1220 |
| 19 | 2- | 1.1520 | (2-) | 1.1520 |

Level density parameters (used in eq. 24)

$E_{cont}$ = 1.152 MeV $\Delta$ = 1.11 MeV $E_m$ = 4.22968 MeV

$B_n$ = 6.30968 MeV $D_{exp}$ = 1.2 eV a = 27.58925 MeV$^{-1}$

T = 0.40112 MeV $\sigma_m$ = 5.65665 $E_0$ = -0.11265 MeV

**Table 2. Parameters of the compound nucleus $^{243}$Pu at the equilibrium deformation needed for gamma-decay cross section calculation (used in eq. 30-31)**

$M_{NC}$ = 243.061998 amu $\Delta$ = 0.61 MeV $E_m$ = 3.72713 MeV

$B_n$ = 5.03400 MeV $D_{exp}$ = 13.5 eV a = 29.84438 MeV$^{-1}$

T = 0.38270 MeV $\sigma_m$ = 5.77564 $E_0$ = -0.66414 MeV

$\Gamma_{exp}$ = 22.6 meV $\Gamma_\gamma$ = 4 MeV

**Table 3. Parameters of the compound nucleus $^{243}$Pu needed in fission cross section calculation**

$V_A$ = 6.035 MeV  $V_{II}$ = 2.027 MeV  $V_B$ = 5.54 MeV  (used in eq. 33)

$\hbar\omega_A$ = 0.81 MeV  $\hbar\omega_{II}$ = 0.825 MeV  $\hbar\omega_B$ = 0.52 MeV

$(\hbar^2/2\Im)_A$ = 5 KeV  $(\hbar^2/2\Im)_{II}$ = 3 KeV  $(\hbar^2/2\Im)_B$ = 2 KeV  (used in eq. 36)

Rotational band heads (the energies are expressed in MeV) (used in eq. 36)

| No. | KΠ | $\varepsilon_A$(KΠ) | $\varepsilon_{II}$(KΠ) | $\varepsilon_B$(KΠ) | No. | KΠ | $\varepsilon_A$(KΠ) | $\varepsilon_{II}$(KΠ) | $\varepsilon_B$(KΠ) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.5 + | 0.000 | 0.000 | 0.000 | 28 | 3.5 - | 0.130 | 0.540 | 0.550 |
| 2 | 0.5 + | 0.000 | 0.025 | 0.050 | 29 | 0.5 + | 0.130 | 0.540 | 0.600 |
| 3 | 0.5 - | 0.025 | 0.125 | 0.100 | 30 | 4.5 + | 0.130 | 0.540 | 0.600 |
| 4 | 3.5 - | 0.025 | 0.100 | 0.050 | 31 | 0.5 + | 0.150 | 0.095 | 0.110 |
| 5 | 0.5 - | 0.050 | 0.025 | 0.100 | 32 | 1.5 + | 0.150 | 0.280 | 0.000 |
| 6 | 1.5 - | 0.050 | 0.025 | 0.100 | 33 | 0.5 - | 0.175 | 0.195 | 0.160 |
| 7 | 1.5 + | 0.050 | 0.025 | 0.150 | 34 | 1.5 - | 0.175 | 0.380 | 0.050 |
| 8 | 2.5 + | 0.050 | 0.025 | 0.150 | 35 | 0.5 - | 0.200 | 0.095 | 0.160 |
| 9 | 2.5 - | 0.050 | 0.000 | 0.050 | 36 | 1.5 - | 0.200 | 0.095 | 0.160 |
| 10 | 4.5 - | 0.050 | 0.000 | 0.050 | 37 | 1.5 + | 0.200 | 0.095 | 0.210 |
| 11 | 1.5 + | 0.050 | 0.000 | 0.100 | 38 | 2.5 + | 0.200 | 0.095 | 0.210 |
| 12 | 5.5 + | 0.050 | 0.000 | 0.100 | 39 | 0.5 - | 0.200 | 0.280 | 0.050 |
| 13 | 0.5 + | 0.060 | 0.400 | 0.196 | 40 | 2.5 - | 0.200 | 0.280 | 0.050 |
| 14 | 1.5 + | 0.070 | 0.150 | 0.580 | 41 | 0.5 + | 0.200 | 0.280 | 0.100 |
| 15 | 2.5 + | 0.080 | 0.540 | 0.500 | 42 | 3.5 + | 0.200 | 0.280 | 0.100 |
| 16 | 0.5 - | 0.085 | 0.500 | 0.246 | 43 | 1.5 + | 0.450 | 0.500 | 0.670 |
| 17 | 1.5 - | 0.095 | 0.250 | 0.630 | 44 | 3.5 + | 0.470 | 0.500 | 0.630 |
| 18 | 2.5 - | 0.105 | 0.640 | 0.550 | 45 | 1.5 - | 0.475 | 0.600 | 0.720 |
| 19 | 0.5 - | 0.110 | 0.400 | 0.246 | 46 | 3.5 - | 0.495 | 0.600 | 0.680 |
| 20 | 1.5 - | 0.110 | 0.400 | 0.246 | 47 | 0.5 - | 0.500 | 0.500 | 0.720 |
| 21 | 1.5 + | 0.110 | 0.400 | 0.296 | 48 | 2.5 - | 0.500 | 0.500 | 0.720 |
| 22 | 2.5 + | 0.110 | 0.400 | 0.296 | 49 | 0.5 + | 0.500 | 0.500 | 0.770 |
| 23 | 0.5 - | 0.120 | 0.150 | 0.630 | 50 | 3.5 + | 0.500 | 0.500 | 0.770 |
| 24 | 2.5 - | 0.120 | 0.150 | 0.630 | 51 | 2.5 - | 0.520 | 0.500 | 0.680 |
| 25 | 0.5 + | 0.120 | 0.150 | 0.680 | 52 | 4.5 - | 0.520 | 0.500 | 0.680 |
| 26 | 3.5 + | 0.120 | 0.150 | 0.680 | 53 | 1.5 + | 0.520 | 0.500 | 0.730 |
| 27 | 1.5 - | 0.130 | 0.540 | 0.550 | 54 | 5.5 + | 0.520 | 0.500 | 0.730 |

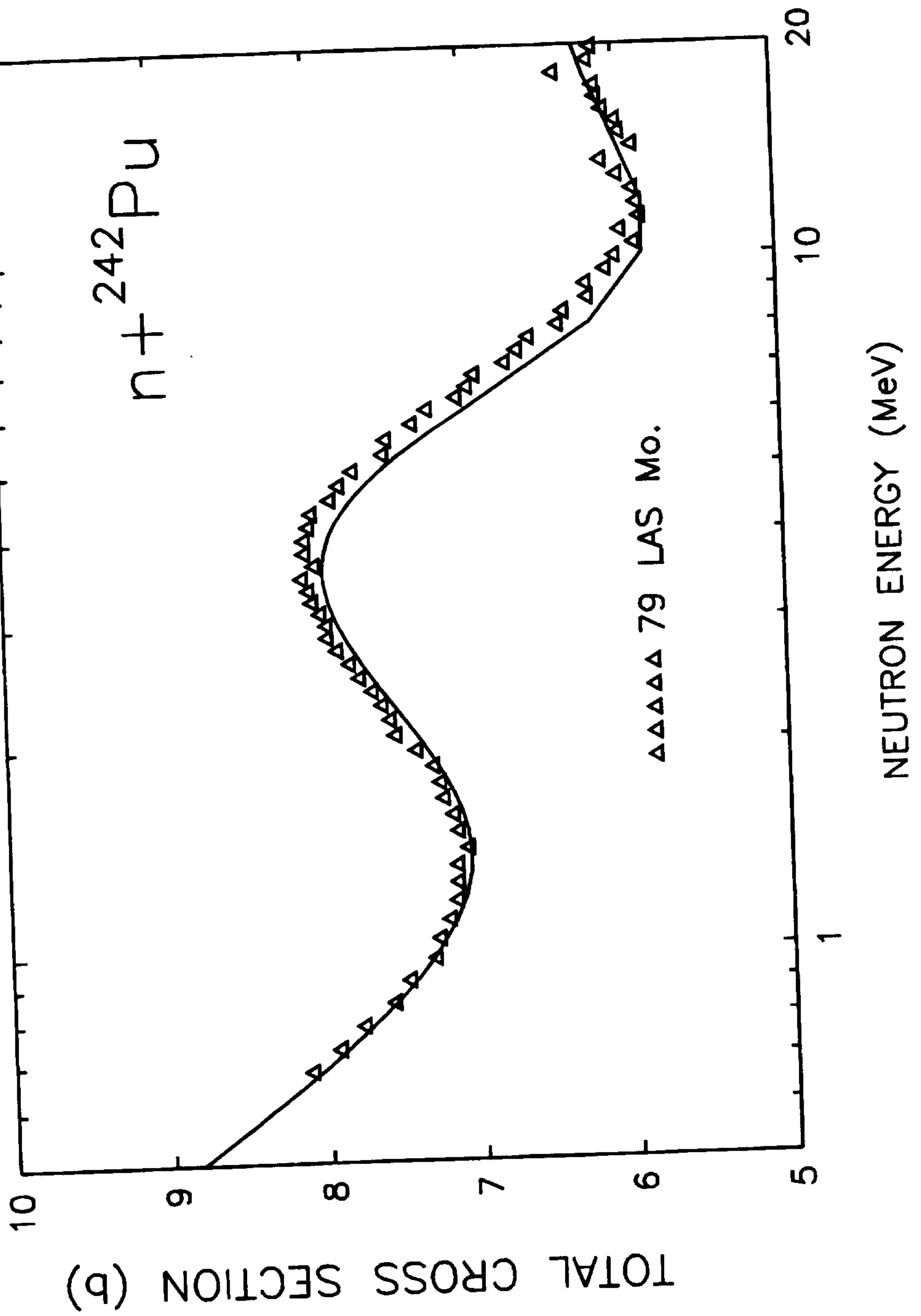
Temperatures used in eq. 37, 38

$T_A$ = 0.412 MeV
$T_B$ = 0.417 MeV

# APPENDIX A

## *Figures*

Figure 1



n + ²⁴²Pu
79 LAS Mo.
NEUTRON ENERGY (MeV)
TOTAL CROSS SECTION (b)
5
6
7
8
9
10
1
10
20

Figure 2a

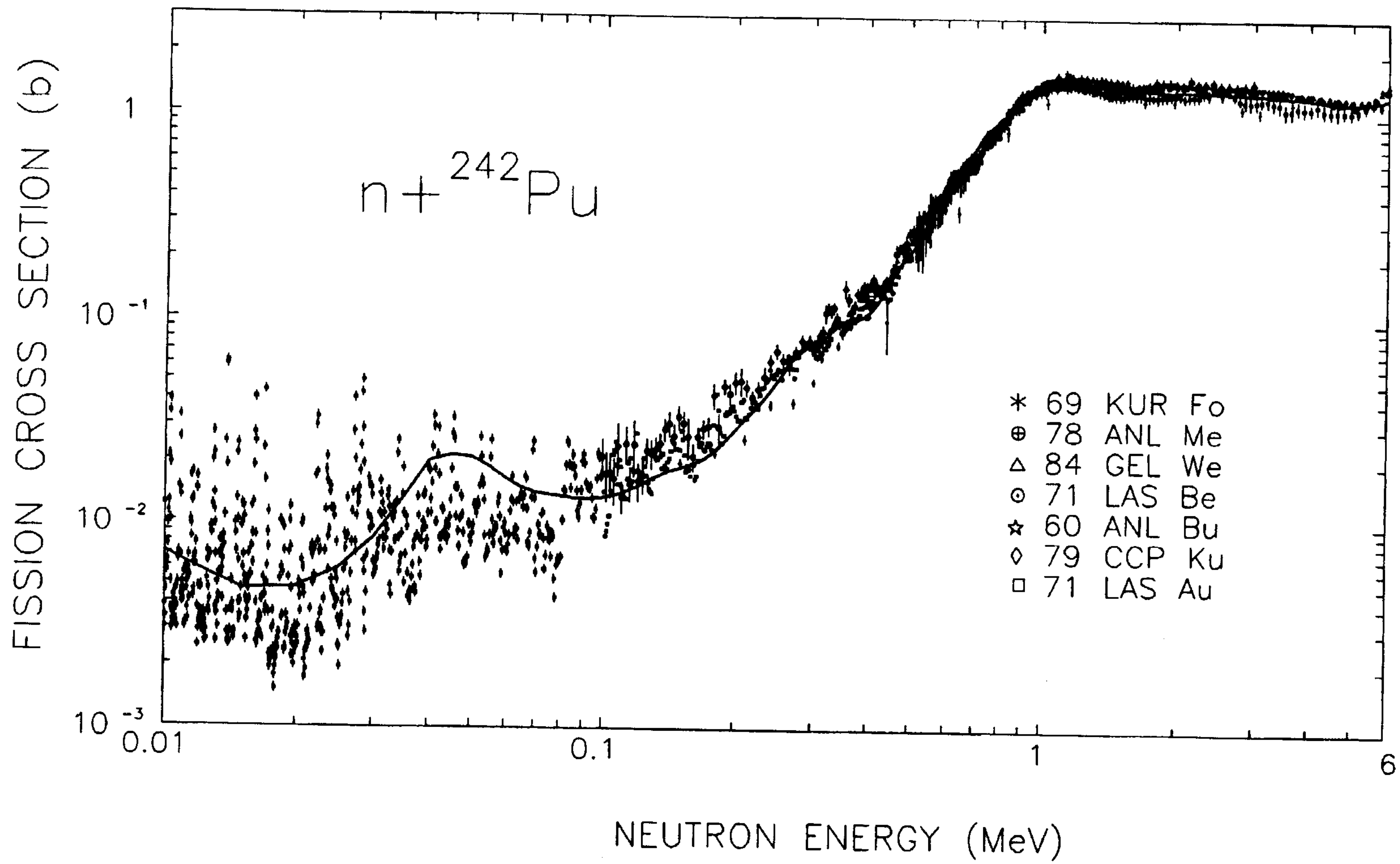

n+$^{242}$Pu
FISSION CROSS SECTION (b)
NEUTRON ENERGY (MeV)
1
10 -1
10 -2
10 -3
0.01
0.1
1
6
* 69 KUR Fo
⊕ 78 ANL Me
△ 84 GEL We
⊙ 71 LAS Be
☆ 60 ANL Bu
◇ 79 CCP Ku
□ 71 LAS Au

**Figure 2b**

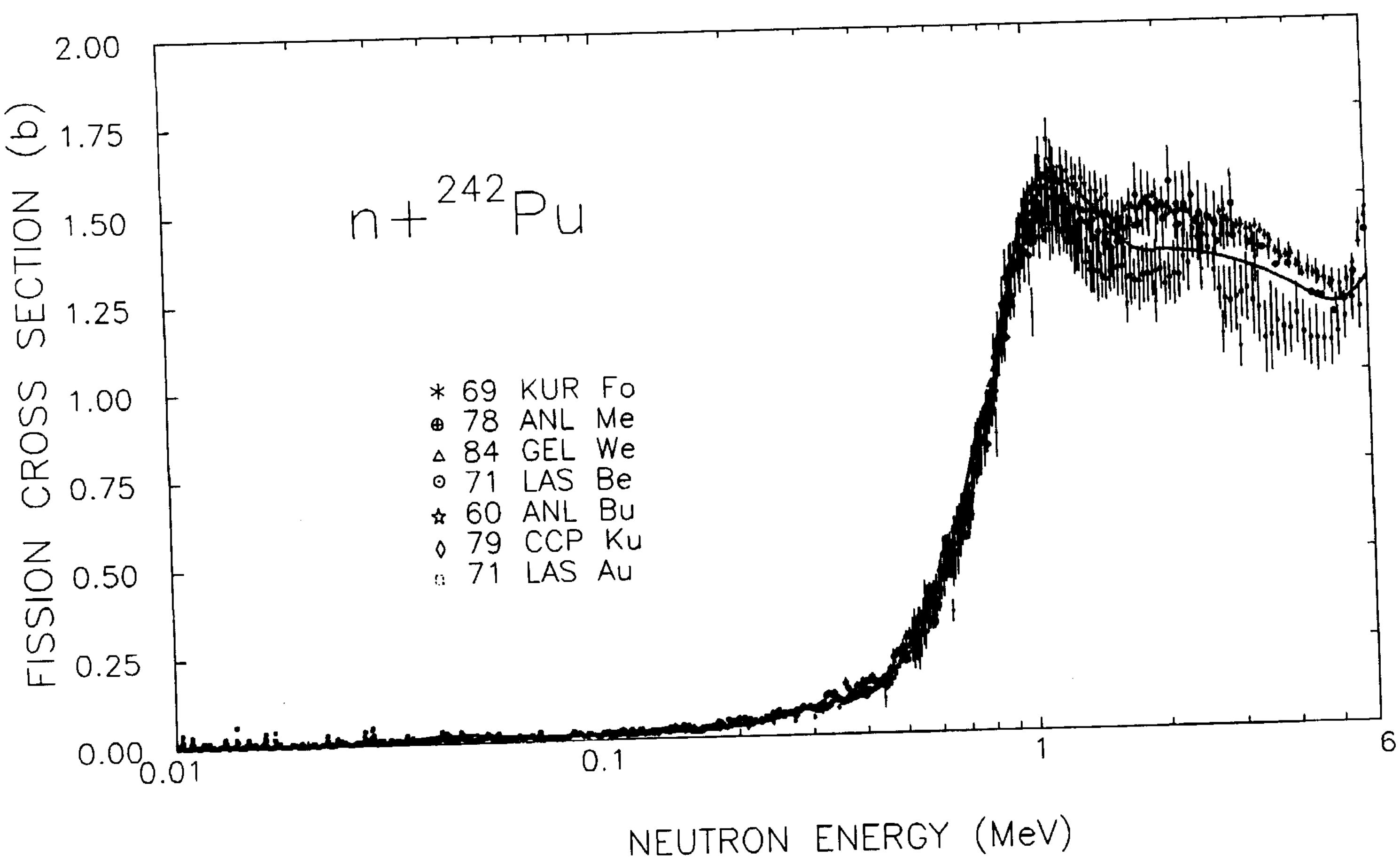

n+ 242Pu
FISSION CROSS SECTION (b)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.01
0.1
1
6
NEUTRON ENERGY (MeV)
69 KUR Fo
78 ANL Me
84 GEL We
71 LAS Be
60 ANL Bu
79 CCP Ku
71 LAS Au

**Figure 3**

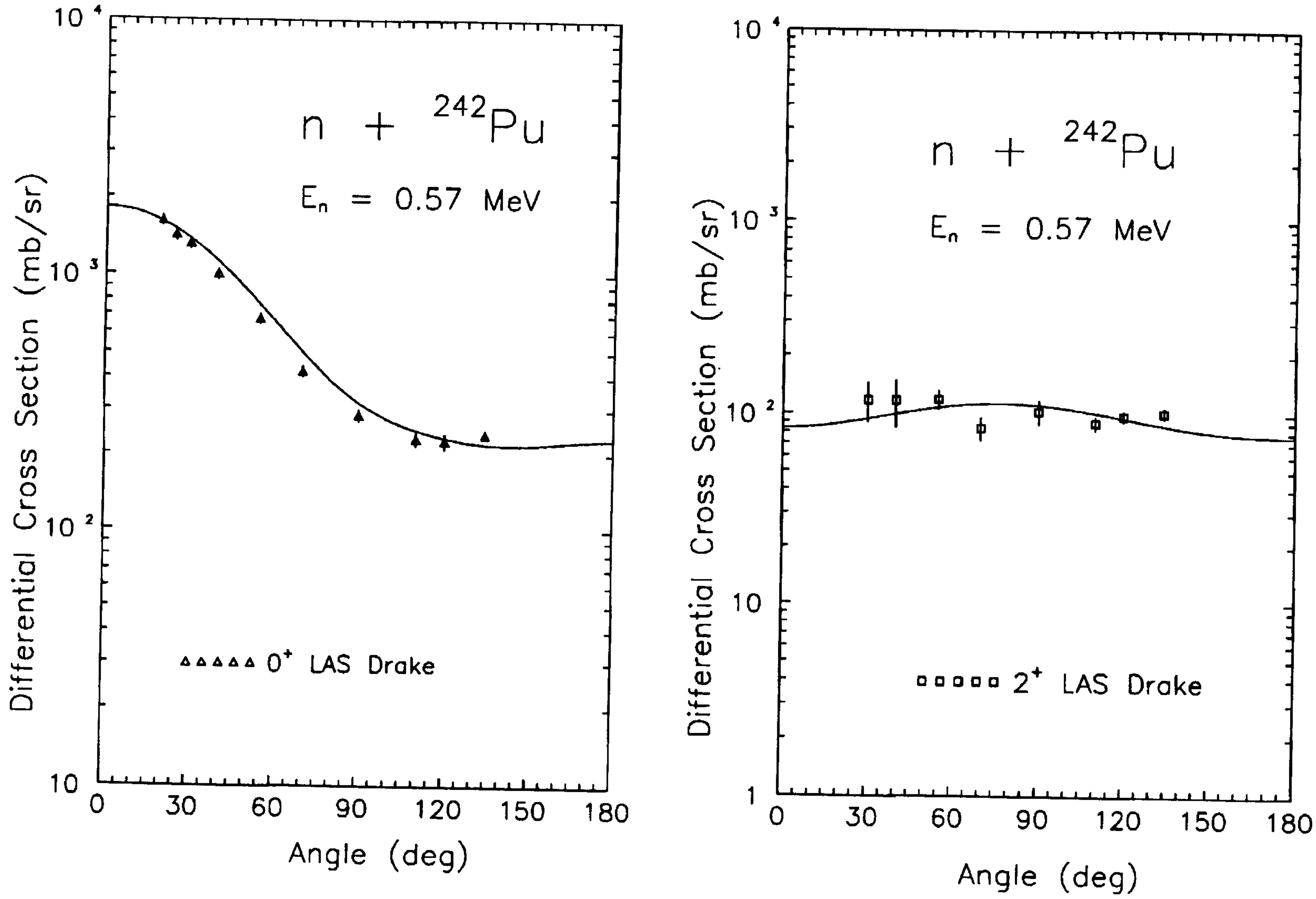

n + $^{242}$Pu
$E_n$ = 0.57 MeV
0$^+$ LAS Drake
Differential Cross Section (mb/sr)
Angle (deg)
n + $^{242}$Pu
$E_n$ = 0.57 MeV
2$^+$ LAS Drake
Differential Cross Section (mb/sr)
Angle (deg)

**Figure 4**

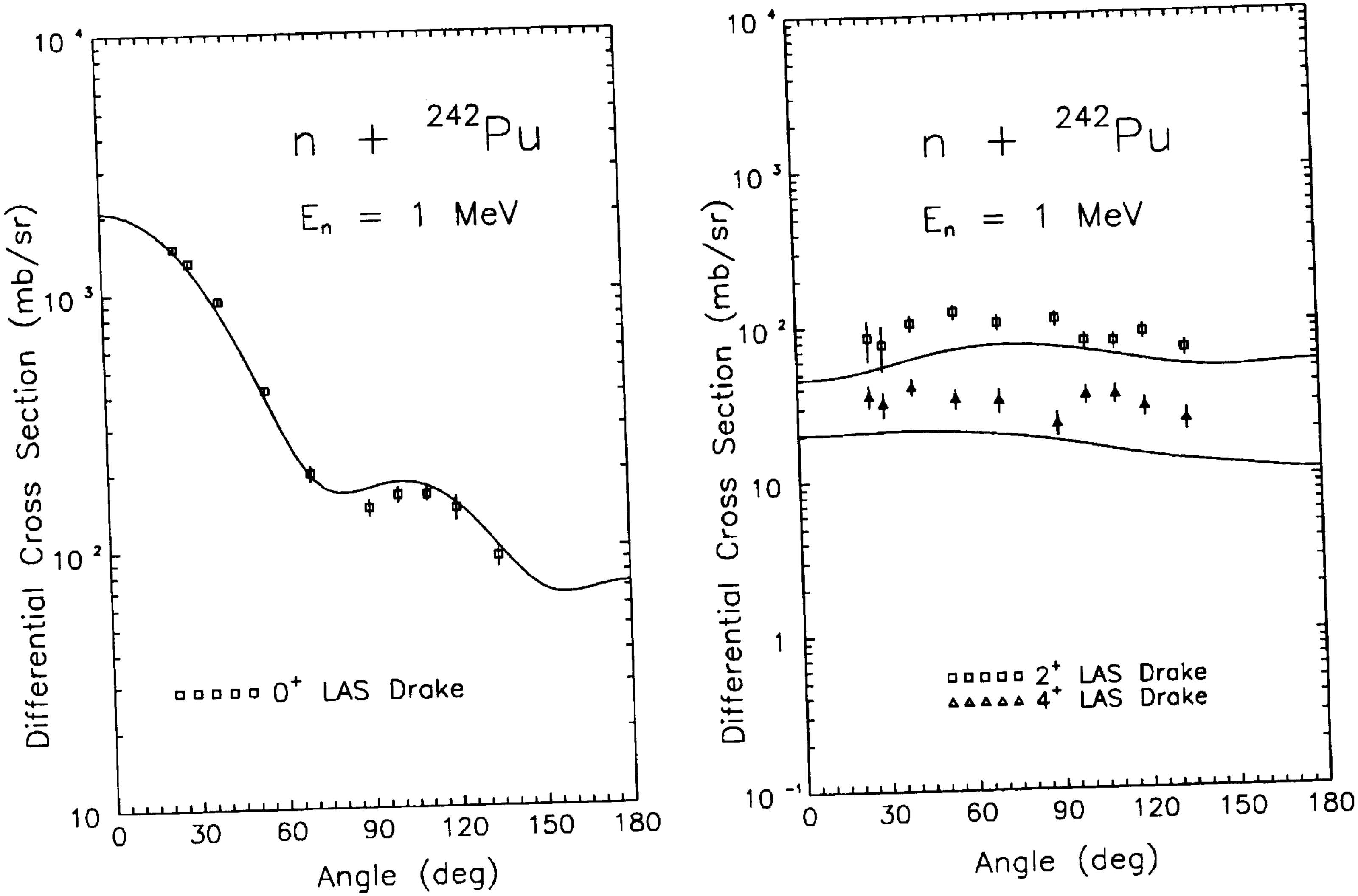
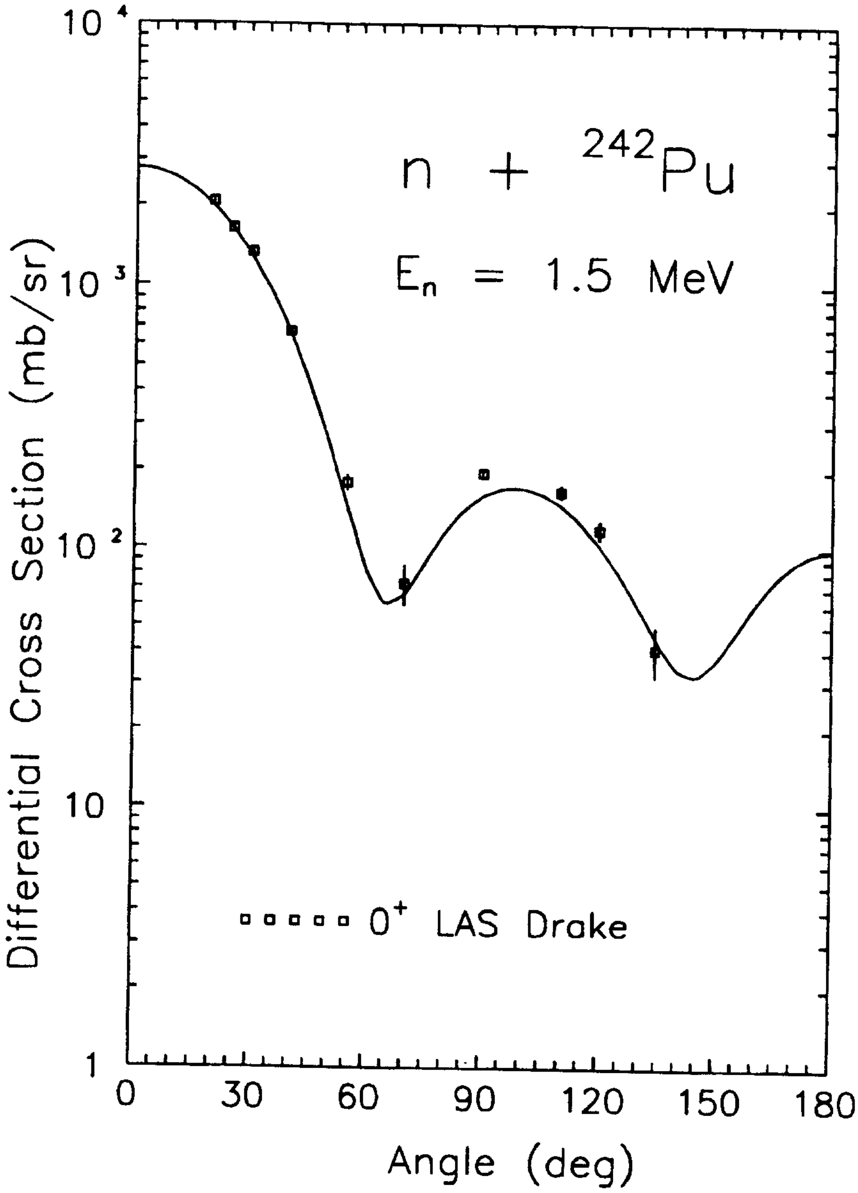
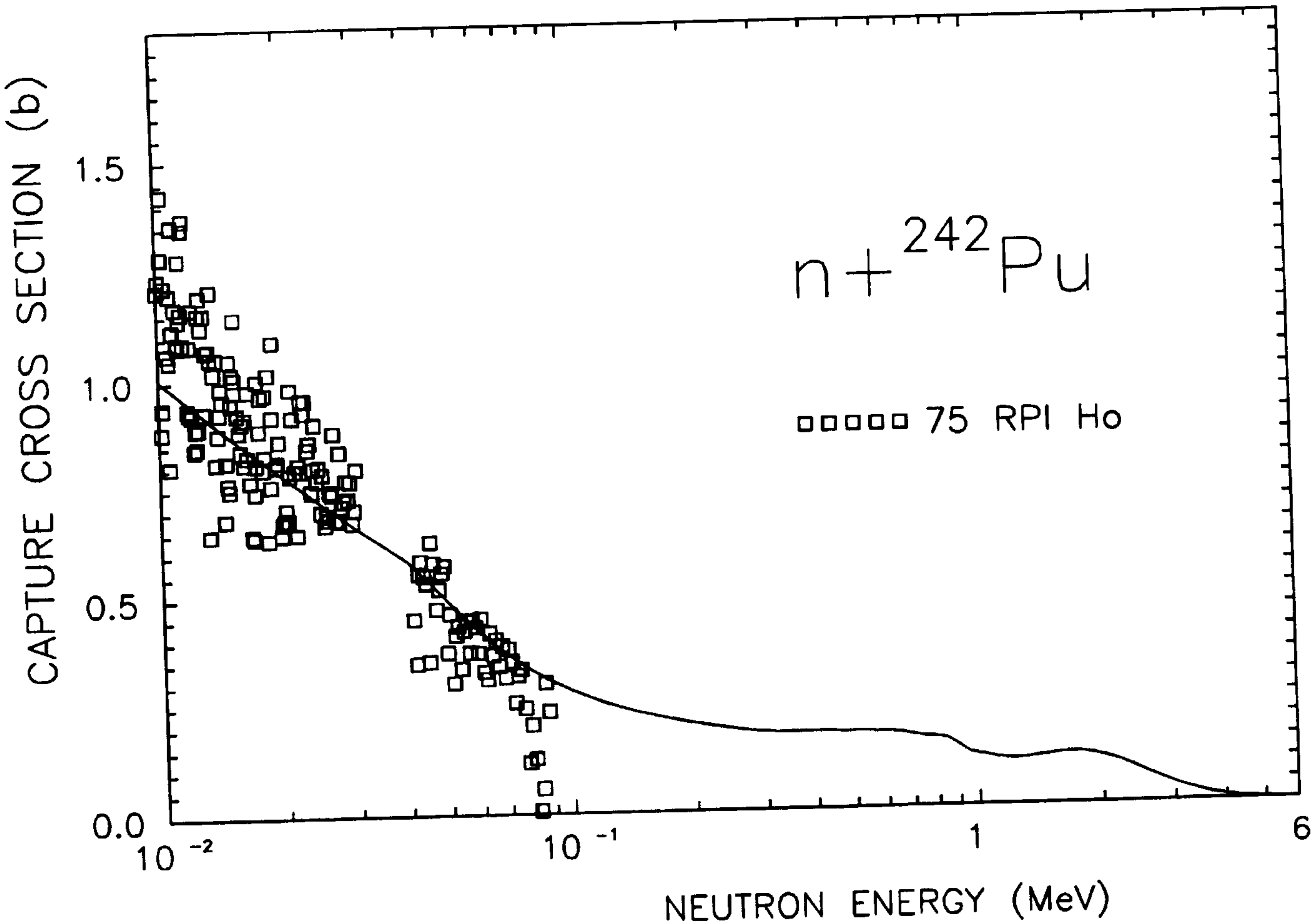

n + $^{242}$Pu
$E_n$ = 1 MeV
0$^+$ LAS Drake
Differential Cross Section (mb/sr)
Angle (deg)
n + $^{242}$Pu
$E_n$ = 1 MeV
2$^+$ LAS Drake
4$^+$ LAS Drake
Differential Cross Section (mb/sr)
Angle (deg)

**Figure 5**



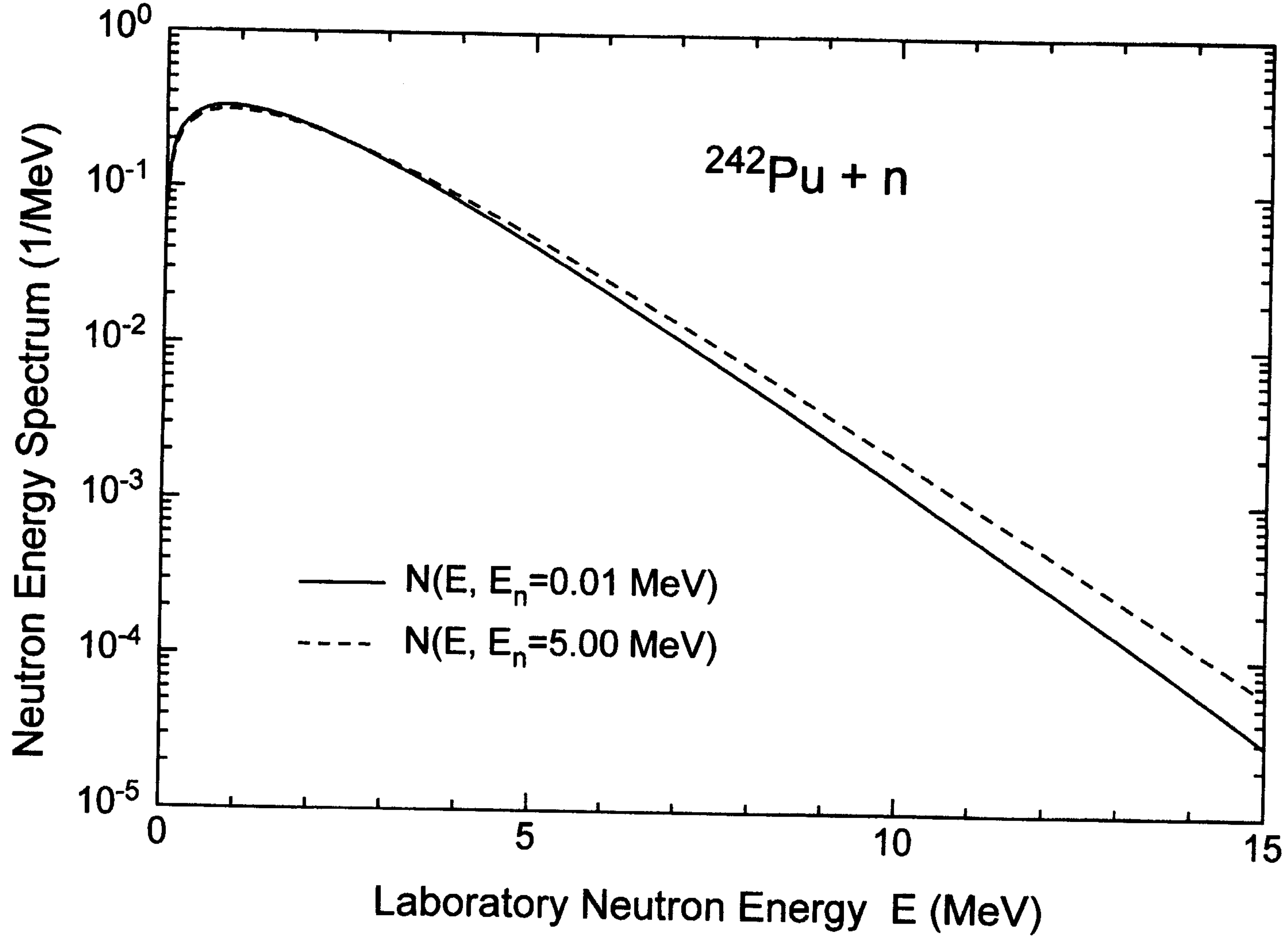
10 ⁴
10 ³
10 ²
10
1
0
30
60
90
120
150
180
Angle (deg)
Differential Cross Section (mb/sr)
n + 242Pu
En = 1.5 MeV
0+ LAS Drake

**Figure 6**



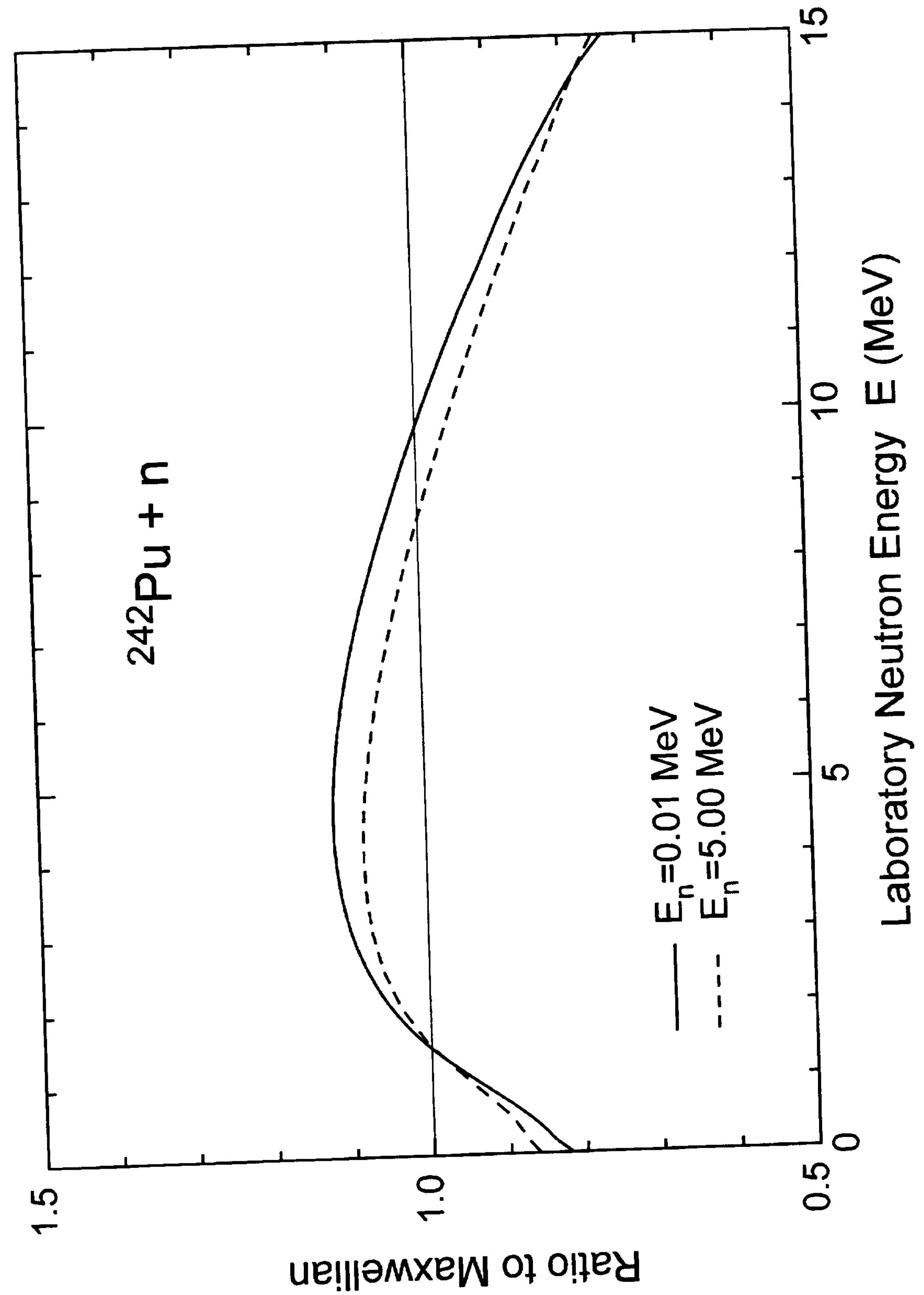
CAPTURE CROSS SECTION (b)
1.5
1.0
0.5
0.0
$n+^{242}Pu$
75 RPI Ho
$10^{-2}$
$10^{-1}$
1
6
NEUTRON ENERGY (MeV)

**Figure 7**



10^0
10^-1
10^-2
10^-3
10^-4
10^-5
0
5
10
15
Neutron Energy Spectrum (1/MeV)
Laboratory Neutron Energy E (MeV)
242Pu + n
N(E, En=0.01 MeV)
N(E, En=5.00 MeV)

Figure 8



$^{242}$Pu + n
$E_n$=0.01 MeV
$E_n$=5.00 MeV
Ratio to Maxwellian
Laboratory Neutron Energy E (MeV)
0.5
1.0
1.5
0
5
10
15

**Figure 9. Major neutron 0 Kelvin cross-sections**

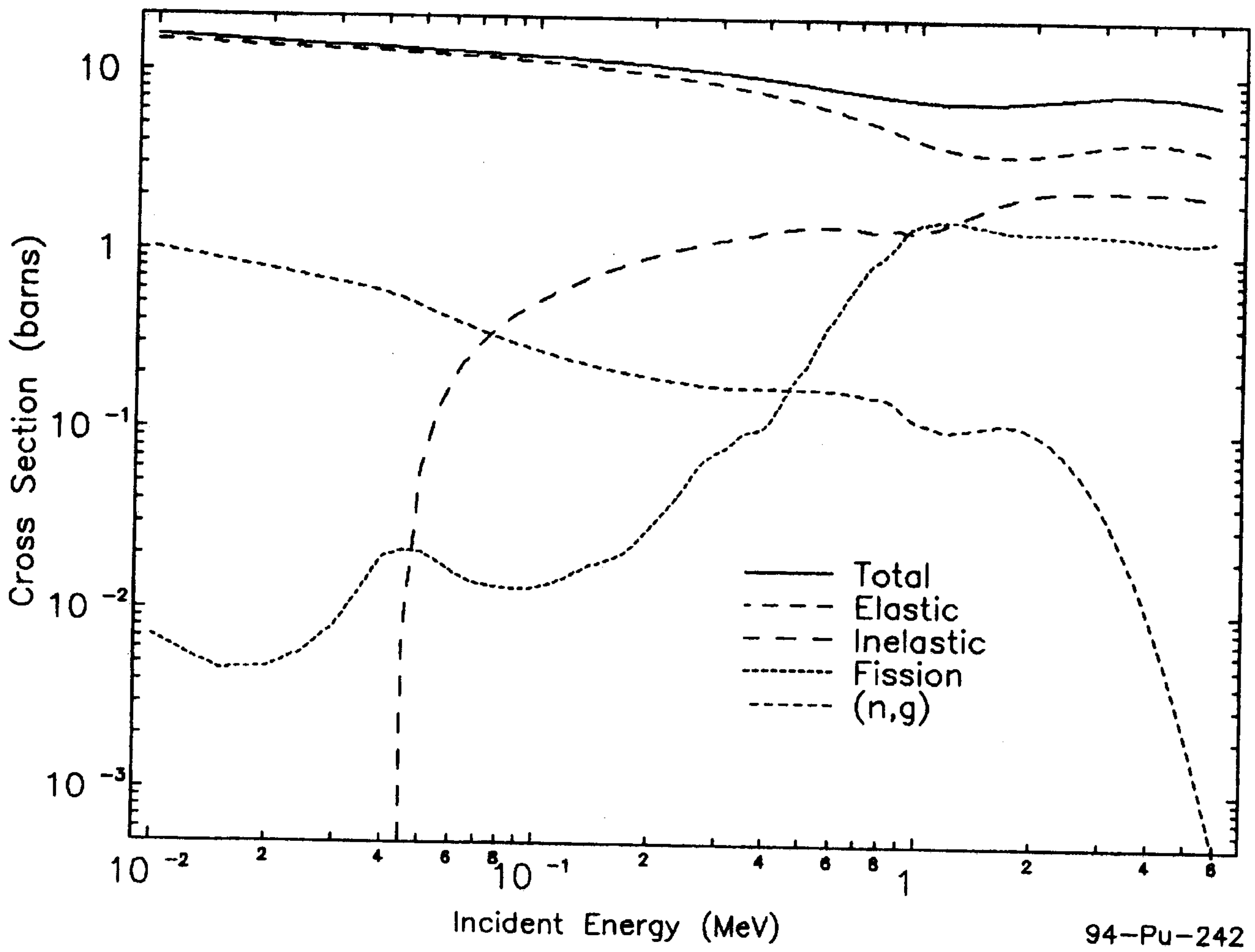


Figure 10. (n,n) levels – 0 Kelvin cross-sections

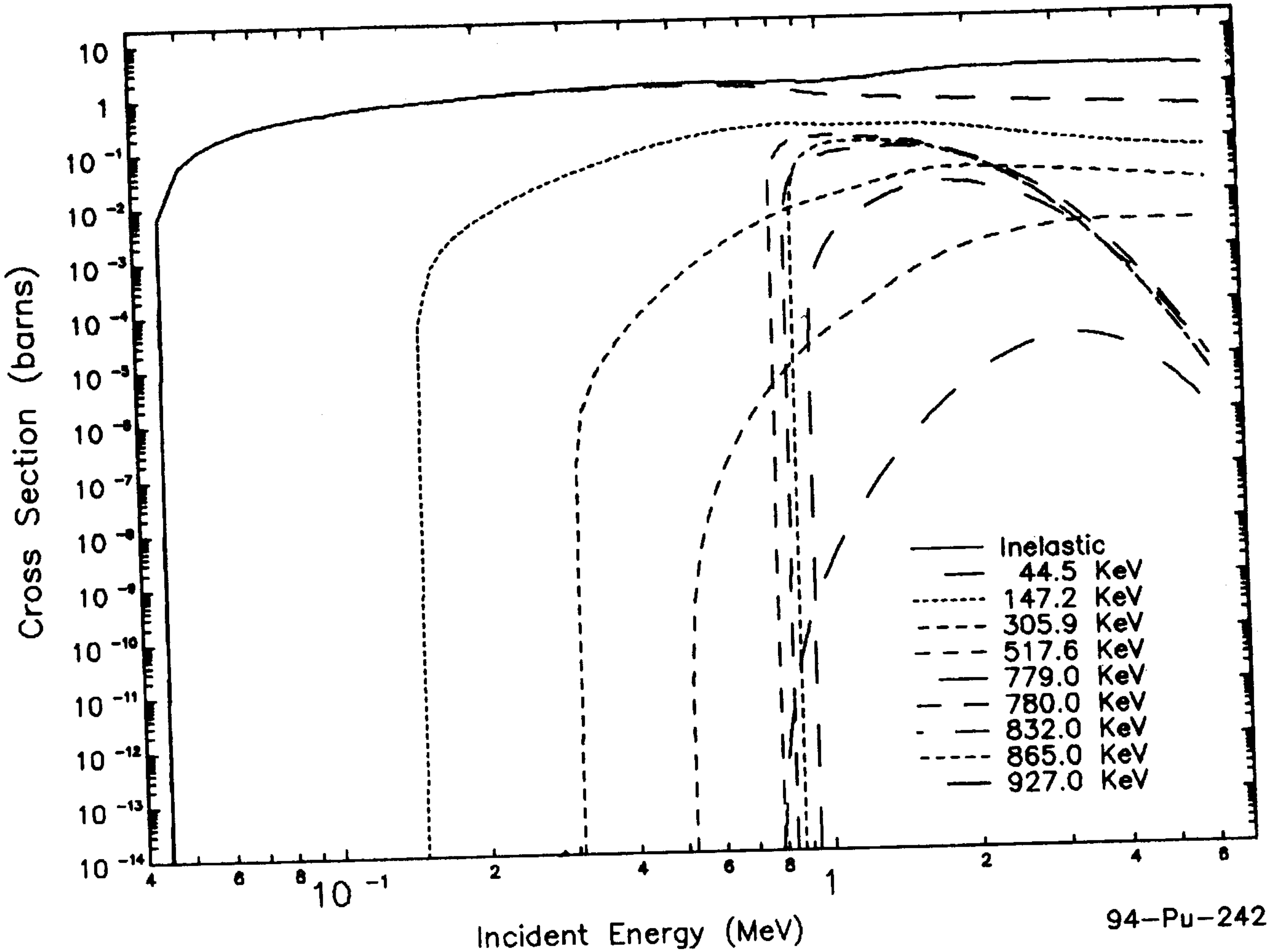


**Figure 11. (n,n) levels – 0 Kelvin cross-sections**

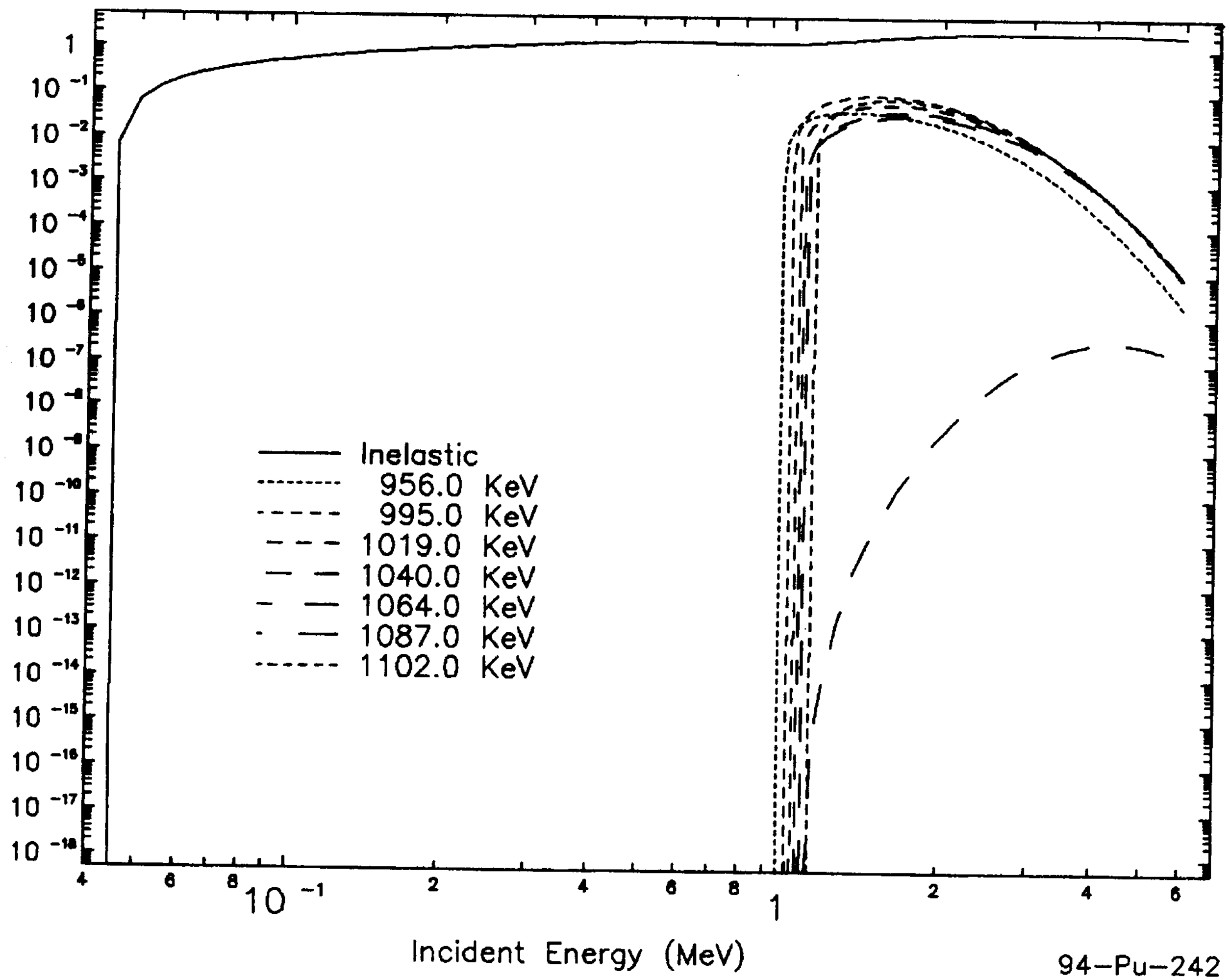


**Figure 12. (n,n) levels – 0 Kelvin cross-sections**

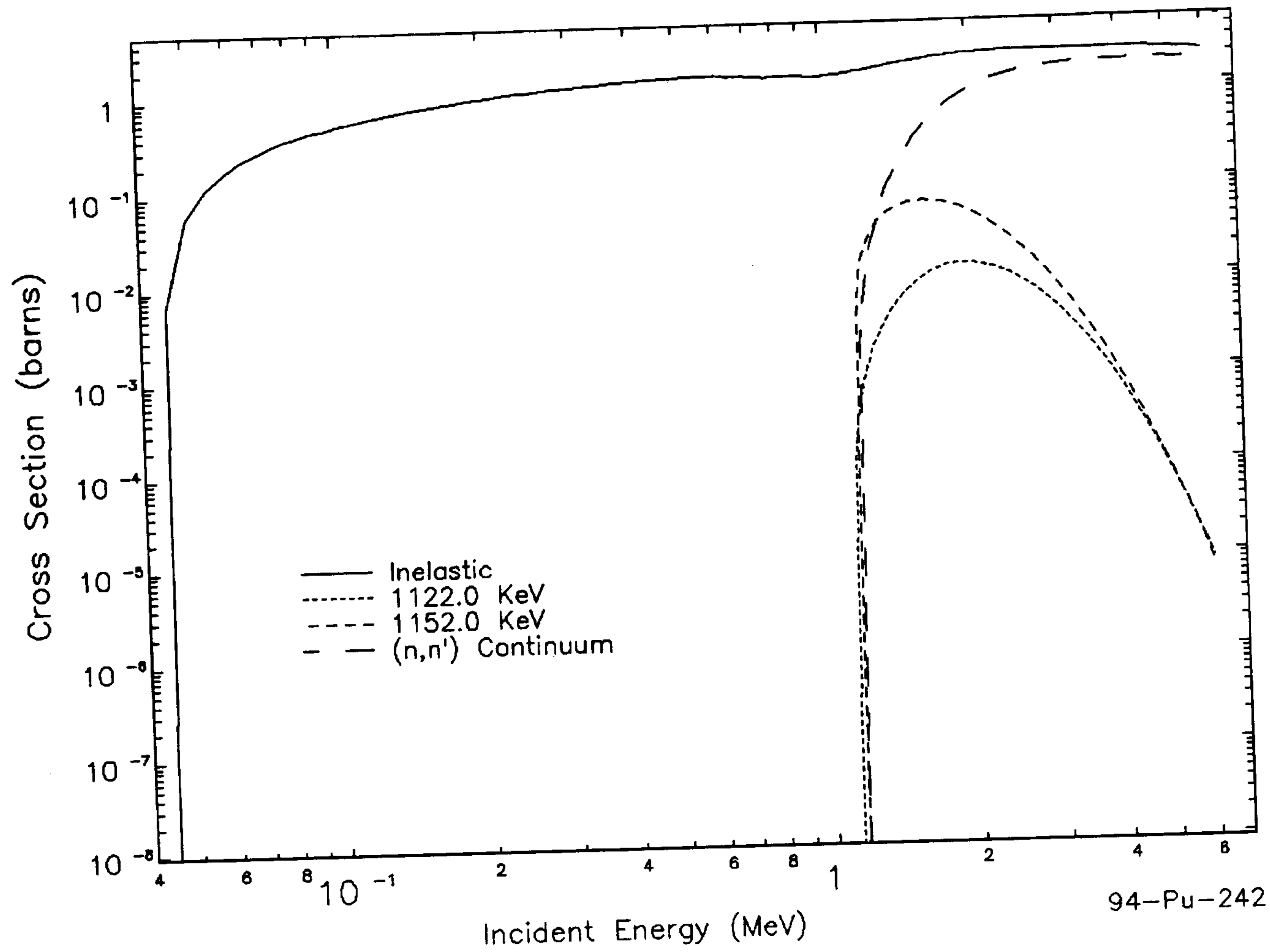


**Figure 13. (n,elastic) – Emitted neutron angular distributions**
Reconstructed from 2 Legendre coef. in the CM system at E = 10.000 keV

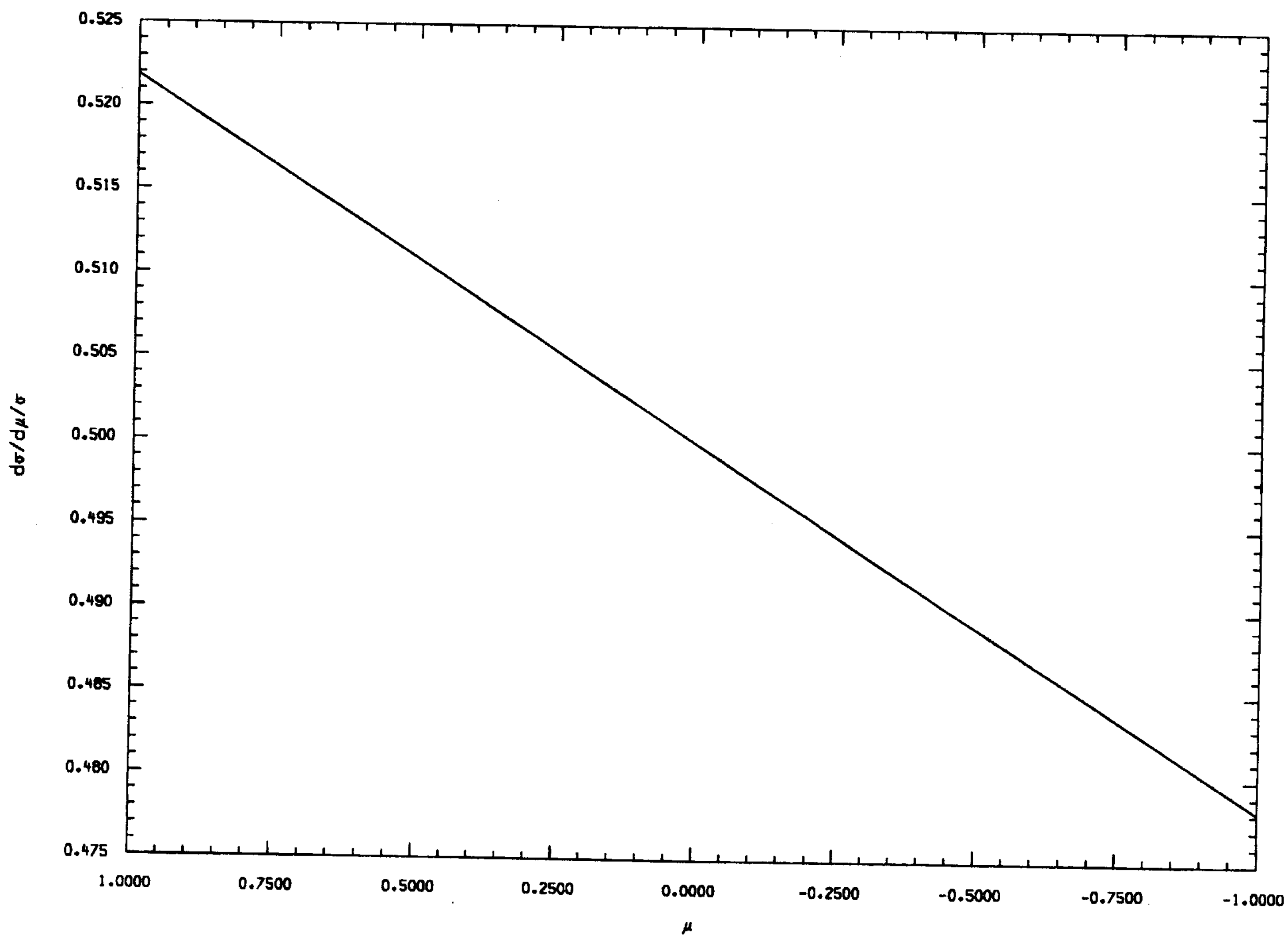


**Figure 14. (n,Elastic) – Emitted neutron angular distributions**
Reconstructed from 11 Legendre coef. in the CM system at E = 2.0000 MeV

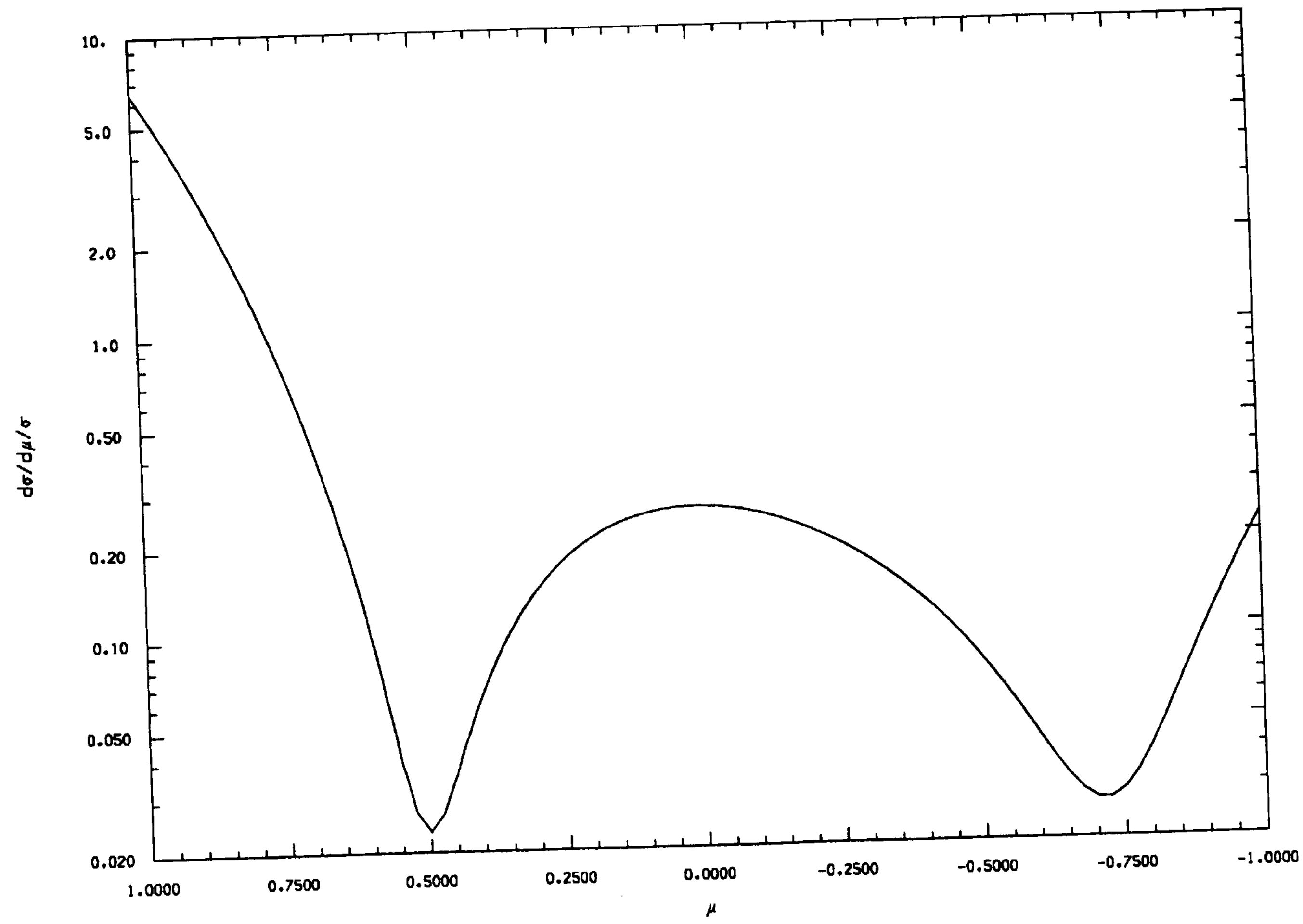


**Figure 15. (n,Elastic) – Emitted neutron angular distributions**
Reconstructed from 15 Legendre coef. in the CM system at E = 6.0000 MeV

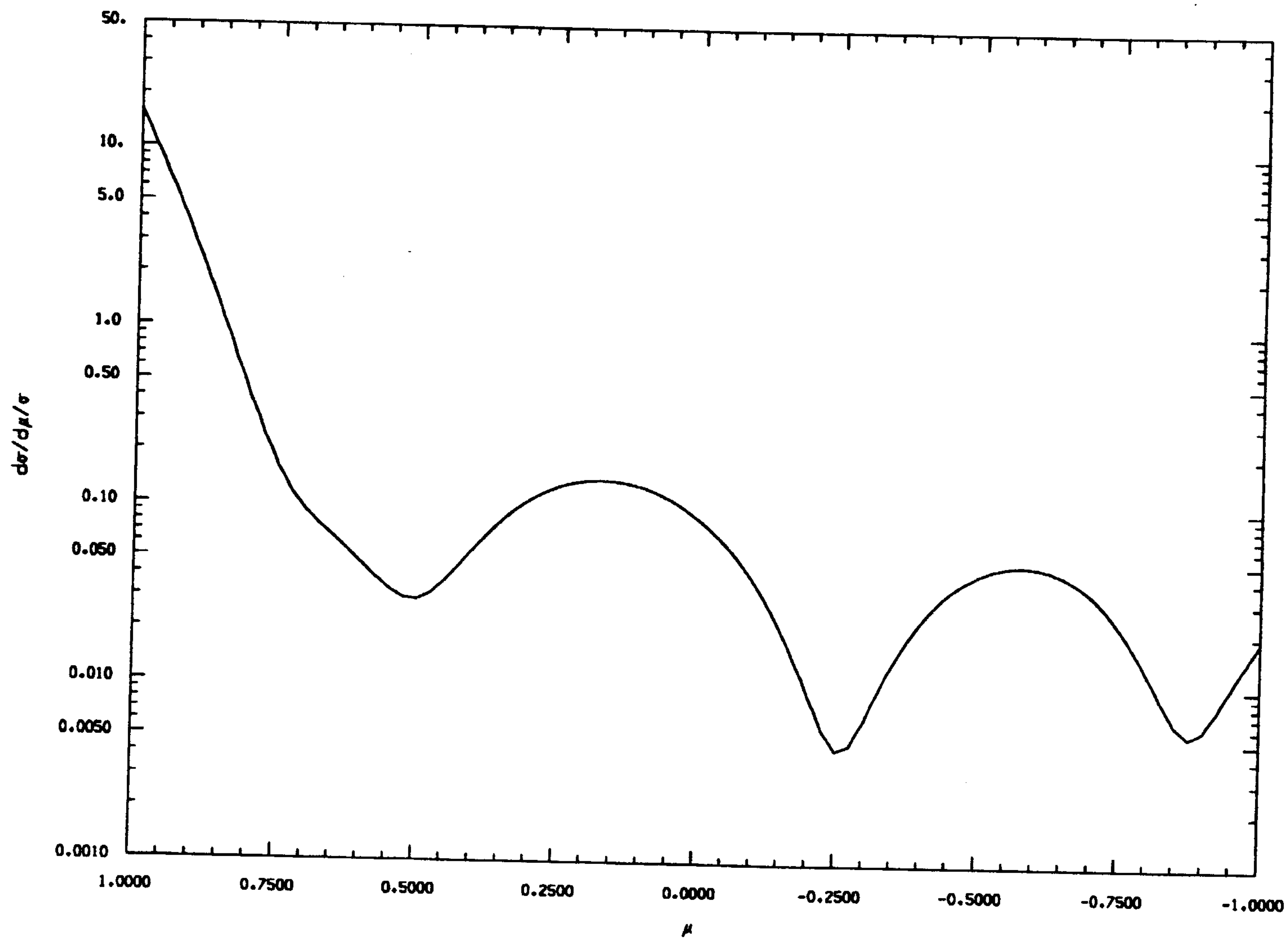


**Figure 16. (n,n') 1-st level – Emitted neutron angular distributions**
Reconstructed from 11 Legendre coef. in the CM system at E = 2.0000 MeV

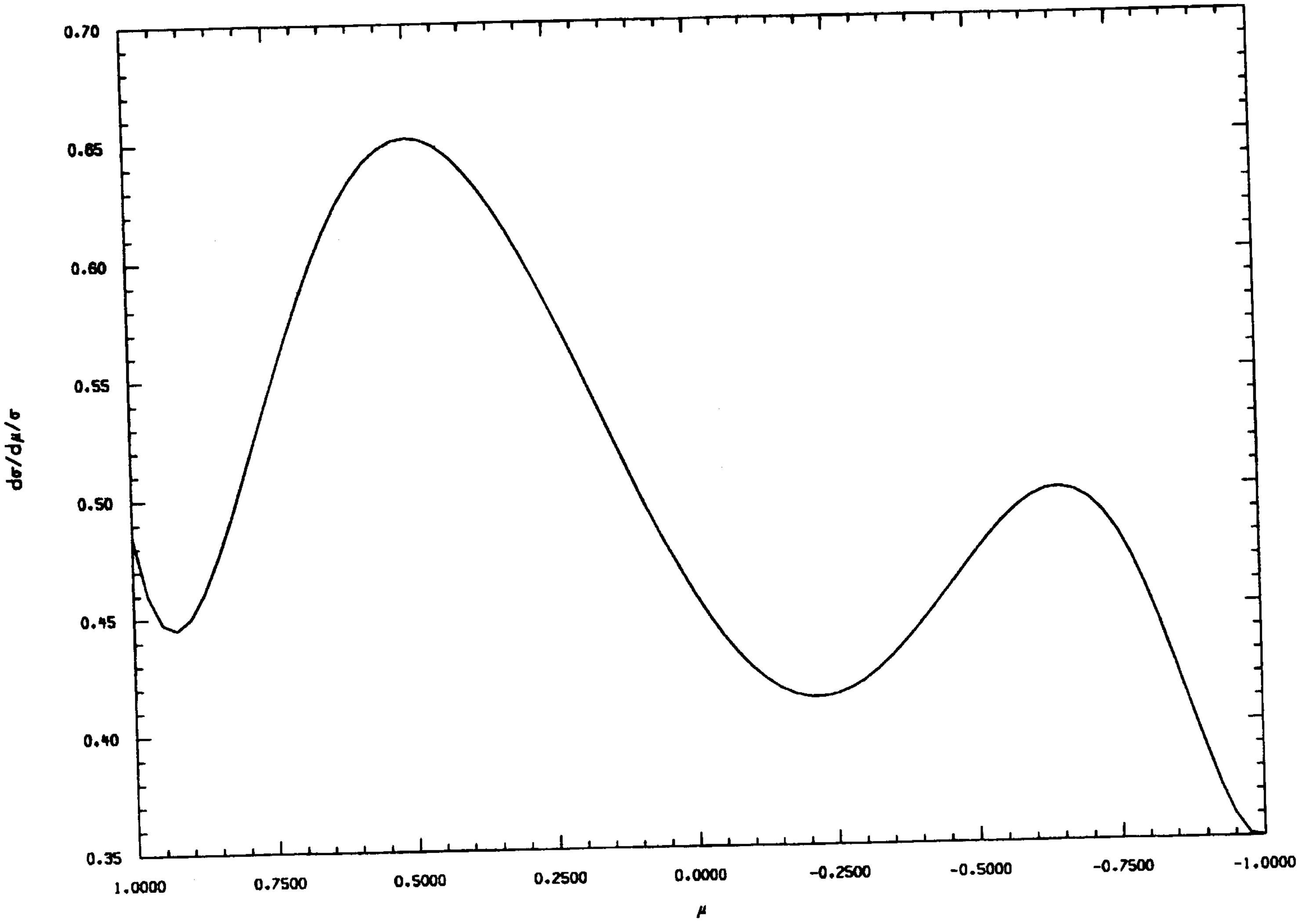
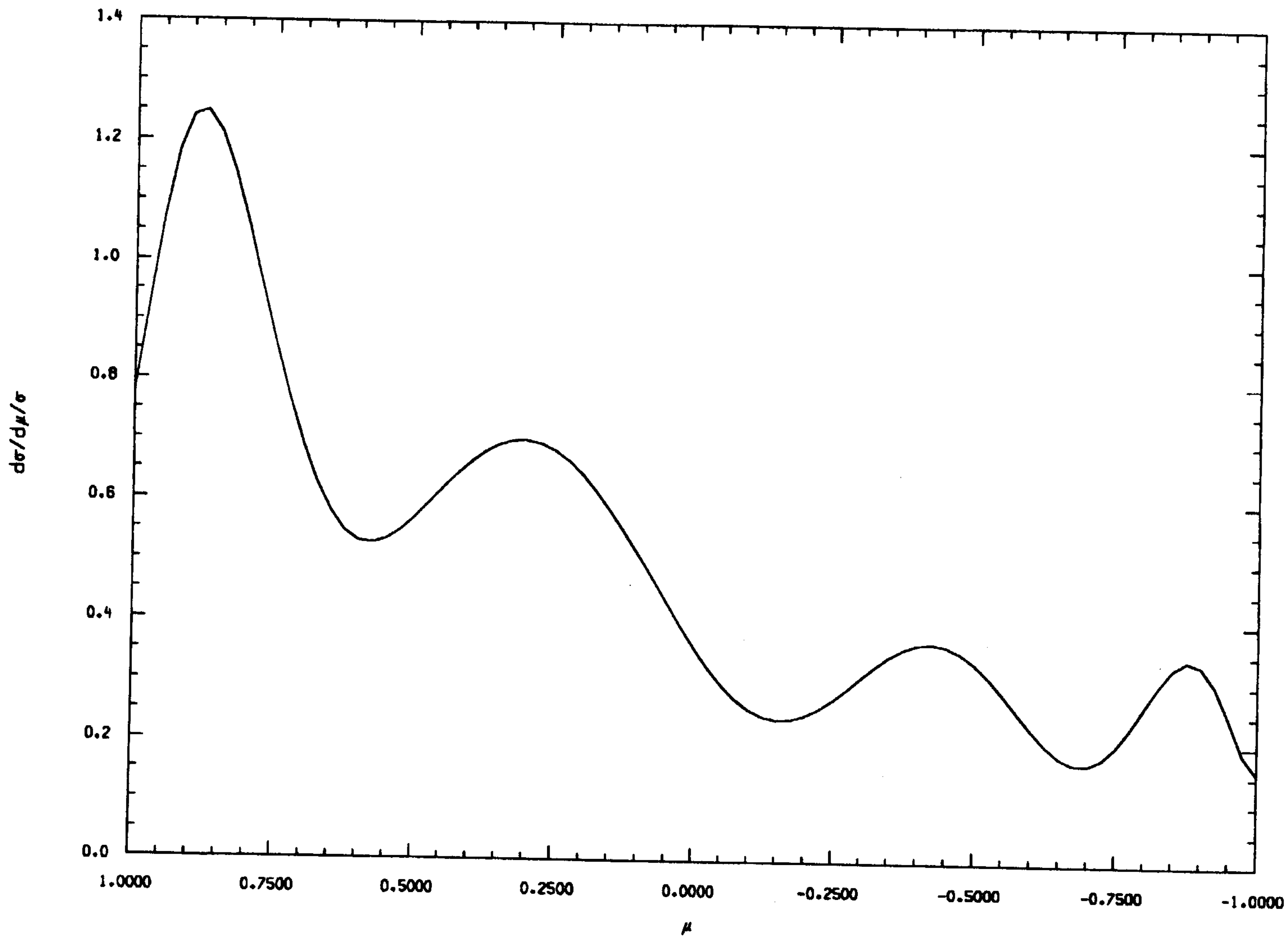


**Figure 17. (n,n') 1-st level – Emitted neutron angular distributions**
Reconstructed from 15 Legendre coef. in the CM system at E = 6.0000 MeV



# APPENDIX B

## *Tables of cross-sections for MF=3*

Projectile is NEUTRON
Target in GROUND State
Target is FISSIONABLE

E(level) = 0.0000E+00 eV

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

File # 3
Reaction Cross Section

| Section (MT) | Reaction Type | Reaction Q-value | Intermediate Q-value | Energy Points (NP) | Energy range (eV) from | to | Interp. Regions (NR) |
|---|---|---|---|---|---|---|---|
| 1 | (n,Total) | 0.0000E+00 | 0.0000E+00 | 148 | 1.0000E+04 | 6.0000E+06 | 1 |
| 2 | (n,Elastic) | 0.0000E+00 | 0.0000E+00 | 148 | 1.0000E+04 | 6.0000E+06 | 1 |
| 4 | (n,Inelastic) | 0.0000E+00 | -4.4500E+04 | 142 | 4.4685E+04 | 6.0000E+06 | 1 |
| 18 | (n,fission) | 2.0136E+08 | 2.0136E+08 | 148 | 1.0000E+04 | 6.0000E+06 | 1 |
| 19 | (n,f) | 2.0136E+08 | 2.0136E+08 | 148 | 1.0000E+04 | 6.0000E+06 | 1 |
| 51 | (n,n') 1-st level | 0.0000E+00 | -4.4500E+04 | 142 | 4.4685E+04 | 6.0000E+06 | 1 |
| 52 | (n,n') 2-nd level | 0.0000E+00 | -1.4720E+05 | 126 | 1.4781E+05 | 6.0000E+06 | 1 |
| 53 | (n,n') 3-rd level | 0.0000E+00 | -3.0590E+05 | 110 | 3.0717E+05 | 6.0000E+06 | 1 |
| 54 | (n,n') 4-th level | 0.0000E+00 | -5.1760E+05 | 91 | 5.1976E+05 | 6.0000E+06 | 1 |
| 55 | (n,n') 5-th level | 0.0000E+00 | -7.7900E+05 | 64 | 7.8225E+05 | 6.0000E+06 | 1 |
| 56 | (n,n') 6-th level | 0.0000E+00 | -7.800E+05 | 64 | 7.8325E+05 | 6.0000E+06 | 1 |
| 57 | (n,n') 7-th level | 0.0000E+00 | -8.3200E+05 | 59 | 8.3547E+05 | 6.0000E+06 | 1 |
| 58 | (n,n') 8-th level | 0.0000E+00 | -8.6500E+05 | 56 | 8.6860E+05 | 6.0000E+06 | 1 |
| 59 | (n,n') 9-th level | 0.0000E+00 | -9.2700E+05 | 51 | 9.3086E+05 | 6.0000E+06 | 1 |
| 60 | (n,n') 10-th level | 0.0000E+00 | -9.5600E+05 | 50 | 9.5998E+05 | 6.0000E+06 | 1 |
| 61 | (n,n') 11-th level | 0.0000E+00 | -9.9500E+05 | 48 | 9.9915E+05 | 6.0000E+06 | 1 |
| 62 | (n,n') 12-th level | 0.0000E+00 | -1.0190E+06 | 46 | 1.0232E+06 | 6.0000E+06 | 1 |
| 63 | (n,n') 13-th level | 0.0000E+00 | -1.0400E+06 | 45 | 1.0443E+06 | 6.0000E+06 | 1 |
| 64 | (n,n') 14-th level | 0.0000E+00 | -1.0640E+06 | 44 | 1.0684E+06 | 6.0000E+06 | 1 |
| 65 | (n,n') 15-th level | 0.0000E+00 | -1.0870E+06 | 43 | 1.0915E+06 | 6.0000E+06 | 1 |
| 66 | (n,n') 16-th level | 0.0000E+00 | -1.1020E+06 | 42 | 1.1066E+06 | 6.0000E+06 | 1 |
| 67 | (n,n') 17-th level | 0.0000E+00 | -1.1220E+06 | 41 | 1.1267E+06 | 6.0000E+06 | 1 |
| 68 | (n,n') 18-th level | 0.0000E+00 | -1.1520E+06 | 40 | 1.1568E+06 | 6.0000E+06 | 1 |
| 91 | (n,n') continuum | 0.0000E+00 | 12.2520E+06 | 40 | 1.1568E+06 | 6.0000E+06 | 1 |
| 102 | (n,g) | 5.0342E+06 | 5.0342E+06 | 148 | 1.0000E+04 | 6.0000E+06 | 1 |

(n,Total)
Reaction Cross Section

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 148 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0000E+04 | 1.5425E+01 | 1.5000E+04 | 1.4750E+01 | 2.0000E+04 | 1.4339E+01 | 2.5000E+04 | 1.4048E+01 | 3.0000E+04 | 1.3824E+01 |
| 6 | 3.5000E+04 | 1.3640E+01 | 4.0000E+04 | 1.3482E+01 | 4.5000E+04 | 1.3221E+01 | 5.0000E+04 | 1.3094E+01 | 5.5000E+04 | 1.2979E+01 |
| 11 | 6.0000E+04 | 1.2872E+01 | 6.5000E+04 | 1.2772E+01 | 7.0000E+04 | 1.2678E+01 | 7.5000E+04 | 1.2589E+01 | 8.0000E+04 | 1.2504E+01 |
| 16 | 8.5000E+04 | 1.2422E+01 | 9.0000E+04 | 1.2343E+01 | 9.5000E+04 | 1.2267E+01 | 1.0000E+05 | 1.2194E+01 | 1.1000E+05 | 1.2053E+01 |
| 21 | 1.2000E+05 | 1.1919E+01 | 1.3000E+05 | 1.1791E+01 | 1.4000E+05 | 1.1667E+01 | 1.5000E+05 | 1.1576E+01 | 1.6000E+05 | 1.1461E+01 |
| 26 | 1.7000E+05 | 1.1350E+01 | 1.8000E+05 | 1.1242E+01 | 1.9000E+05 | 1.1137E+01 | 2.0000E+05 | 1.1035E+01 | 2.1000E+05 | 1.0936E+01 |
| 31 | 2.2000E+05 | 1.0838E+01 | 2.3000E+05 | 1.0743E+01 | 2.4000E+05 | 1.0651E+01 | 2.5000E+05 | 1.0560E+01 | 2.6000E+05 | 1.0471E+01 |
| 36 | 2.7000E+05 | 1.0385E+01 | 2.8000E+05 | 1.0300E+01 | 2.9000E+05 | 1.0217E+01 | 3.0000E+05 | 1.0136E+01 | 3.1000E+05 | 1.0056E+01 |
| 41 | 3.2000E+05 | 9.9782E+00 | 3.4000E+05 | 9.8271E+00 | 3.5000E+05 | 9.7539E+00 | 3.6000E+05 | 9.6823E+00 | 3.8000E+05 | 9.5433E+00 |
| 46 | 3.9000E+05 | 9.4759E+00 | 4.0000E+05 | 9.4099E+00 | 4.1000E+05 | 9.3453E+00 | 4.2000E+05 | 9.2820E+00 | 4.3000E+05 | 9.2200E+00 |
| 51 | 4.4000E+05 | 9.1593E+00 | 4.5000E+05 | 9.0999E+00 | 4.6000E+05 | 9.0417E+00 | 4.7000E+05 | 8.9847E+00 | 4.8000E+05 | 8.9289E+00 |
| 56 | 4.9000E+05 | 8.8743E+00 | 5.0000E+05 | 8.8208E+00 | 5.1000E+05 | 8.7684E+00 | 5.2000E+05 | 8.7172E+00 | 5.3000E+05 | 8.6671E+00 |
| 61 | 5.4000E+05 | 8.6180E+00 | 5.5000E+05 | 8.5701E+00 | 5.6000E+05 | 8.5231E+00 | 5.7000E+05 | 8.4772E+00 | 5.8000E+05 | 8.4322E+00 |
| 66 | 5.9000E+05 | 8.3883E+00 | 6.0000E+05 | 8.3454E+00 | 6.1000E+05 | 8.3034E+00 | 6.2000E+05 | 8.2623E+00 | 6.3000E+05 | 8.2222E+00 |
| 71 | 6.4000E+05 | 8.1830E+00 | 6.5000E+05 | 8.1447E+00 | 6.6000E+05 | 8.1073E+00 | 6.7000E+05 | 8.0708E+00 | 6.8000E+05 | 8.0351E+00 |
| 76 | 6.9000E+05 | 8.0003E+00 | 7.0000E+05 | 7.9663E+00 | 7.1000E+05 | 7.9331E+00 | 7.2000E+05 | 7.9007E+00 | 7.3000E+05 | 7.8692E+00 |
| 81 | 7.4000E+05 | 7.8384E+00 | 7.5000E+05 | 7.8084E+00 | 7.6000E+05 | 7.7791E+00 | 7.7000E+05 | 7.7506E+00 | 7.8000E+05 | 7.7229E+00 |
| 86 | 7.9000E+05 | 7.6958E+00 | 8.0000E+05 | 7.6695E+00 | 8.1000E+05 | 7.6439E+00 | 8.2000E+05 | 7.6190E+00 | 8.3000E+05 | 7.5947E+00 |
| 91 | 8.4000E+05 | 7.5711E+00 | 8.5000E+05 | 7.5482E+00 | 8.6000E+05 | 7.5260E+00 | 8.7000E+05 | 7.5044E+00 | 8.8000E+05 | 7.4834E+00 |
| 96 | 8.9000E+05 | 7.4630E+00 | 9.0000E+05 | 7.4433E+00 | 9.2000E+05 | 7.4056E+00 | 9.4000E+05 | 7.3702E+00 | 9.6000E+05 | 7.3372E+00 |
| 101 | 9.8000E+05 | 7.3063E+00 | 1.0000E+06 | 7.2775E+00 | 1.0200E+06 | 7.2508E+00 | 1.0400E+06 | 7.2261E+00 | 1.0600E+06 | 7.2033E+00 |
| 106 | 1.0800E+06 | 7.1824E+00 | 1.1000E+06 | 7.1633E+00 | 1.1200E+06 | 7.1459E+00 | 1.1400E+06 | 7.1302E+00 | 1.1600E+06 | 7.1161E+00 |
| 111 | 1.1800E+06 | 7.1036E+00 | 1.2000E+06 | 7.0925E+00 | 1.2500E+06 | 7.0712E+00 | 1.3000E+06 | 7.0580E+00 | 1.3500E+06 | 7.0522E+00 |
| 116 | 1.4000E+06 | 7.0530E+00 | 1.4500E+06 | 7.0596E+00 | 1.5000E+06 | 7.0714E+00 | 1.5500E+06 | 7.0876E+00 | 1.6000E+06 | 7.1076E+00 |
| 121 | 1.6500E+06 | 7.1309E+00 | 1.7000E+06 | 7.1569E+00 | 1.7500E+06 | 7.1852E+00 | 1.8000E+06 | 7.2152E+00 | 1.8500E+06 | 7.2466E+00 |
| 126 | 1.9000E+06 | 7.2791E+00 | 1.9500E+06 | 7.3123E+00 | 2.0000E+06 | 7.3459E+00 | 2.2000E+06 | 7.4799E+00 | 2.4000E+06 | 7.6054E+00 |
| 131 | 2.6000E+06 | 7.7155E+00 | 2.8000E+06 | 7.8066E+00 | 3.0000E+06 | 7.8770E+00 | 3.2000E+06 | 7.9258E+00 | 3.4000E+06 | 7.9531E+00 |
| 136 | 3.6000E+06 | 7.9596E+00 | 3.8000E+06 | 7.9465E+00 | 4.0000E+06 | 7.9155E+00 | 4.2000E+06 | 7.8685E+00 | 4.4000E+06 | 7.8076E+00 |
| 141 | 4.6000E+06 | 7.7349E+00 | 4.8000E+06 | 7.6524E+00 | 5.0000E+06 | 7.5622E+00 | 5.2000E+06 | 7.4659E+00 | 5.4000E+06 | 7.3654E+00 |
| 146 | 5.6000E+06 | 7.2623E+00 | 5.8000E+06 | 7.1579E+00 | 6.0000E+06 | 7.0537E+00 | | | | |

(n,Elastic)
Reaction Cross Section

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 148 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0000E+04 | 1.4410E+01 | 1.5000E+04 | 1.3875E+01 | 2.0000E+04 | 1.3552E+01 | 2.5000E+04 | 1.3327E+01 | 3.0000E+04 | 1.3152E+01 |
| 6 | 3.5000E+04 | 1.3005E+01 | 4.0000E+04 | 1.2878E+01 | 4.5000E+04 | 1.2659E+01 | 5.0000E+04 | 1.2527E+01 | 5.5000E+04 | 1.2391E+01 |
| 11 | 6.0000E+04 | 1.2259E+01 | 6.5000E+04 | 1.2134E+01 | 7.0000E+04 | 1.2013E+01 | 7.5000E+04 | 1.1897E+01 | 8.0000E+04 | 1.1785E+01 |
| 16 | 8.5000E+04 | 1.1679E+01 | 9.0000E+04 | 1.1579E+01 | 9.5000E+04 | 1.1482E+01 | 1.0000E+05 | 1.1385E+01 | 1.1000E+05 | 1.1199E+01 |
| 21 | 1.2000E+05 | 1.1021E+01 | 1.3000E+05 | 1.0851E+01 | 1.4000E+05 | 1.0689E+01 | 1.5000E+05 | 1.0568E+01 | 1.6000E+05 | 1.0418E+01 |
| 26 | 1.7000E+05 | 1.0272E+01 | 1.8000E+05 | 1.0131E+01 | 1.9000E+05 | 9.9942E+00 | 2.0000E+05 | 9.8612E+00 | 2.1000E+05 | 9.7320E+00 |
| 31 | 2.2000E+05 | 9.6064E+00 | 2.3000E+05 | 9.4841E+00 | 2.4000E+05 | 9.3645E+00 | 2.5000E+05 | 9.2474E+00 | 2.6000E+05 | 9.1331E+00 |
| 36 | 2.7000E+05 | 9.0218E+00 | 2.8000E+05 | 8.9144E+00 | 2.9000E+05 | 8.8095E+00 | 3.0000E+05 | 8.7073E+00 | 3.1000E+05 | 8.6131E+00 |
| 41 | 3.2000E+05 | 8.5147E+00 | 3.4000E+05 | 8.3228E+00 | 3.5000E+05 | 8.2305E+00 | 3.6000E+05 | 8.1412E+00 | 3.8000E+05 | 7.9695E+00 |
| 46 | 3.9000E+05 | 7.8856E+00 | 4.0000E+05 | 7.8023E+00 | 4.1000E+05 | 7.7195E+00 | 4.2000E+05 | 7.6372E+00 | 4.3000E+05 | 7.5552E+00 |
| 51 | 4.4000E+05 | 7.4745E+00 | 4.5000E+05 | 7.3948E+00 | 4.6000E+05 | 7.3164E+00 | 4.7000E+05 | 7.2394E+00 | 4.8000E+05 | 7.1643E+00 |
| 56 | 4.9000E+05 | 7.0908E+00 | 5.0000E+05 | 7.0188E+00 | 5.1000E+05 | 6.9475E+00 | 5.2000E+05 | 6.8782E+00 | 5.3000E+05 | 6.8062E+00 |
| 61 | 5.4000E+05 | 6.7338E+00 | 5.5000E+05 | 6.6617E+00 | 5.6000E+05 | 6.5910E+00 | 5.7000E+05 | 6.5224E+00 | 5.8000E+05 | 6.4563E+00 |
| 66 | 5.9000E+05 | 6.3924E+00 | 6.0000E+05 | 6.3294E+00 | 6.1000E+05 | 6.2661E+00 | 6.2000E+05 | 6.2021E+00 | 6.3000E+05 | 6.1382E+00 |
| 71 | 6.4000E+05 | 6.0753E+00 | 6.5000E+05 | 6.0136E+00 | 6.6000E+05 | 5.9533E+00 | 6.7000E+05 | 5.8942E+00 | 6.8000E+05 | 5.8360E+00 |
| 76 | 6.9000E+05 | 5.7786E+00 | 7.0000E+05 | 5.7216E+00 | 7.1000E+05 | 5.6650E+00 | 7.2000E+05 | 5.6090E+00 | 7.3000E+05 | 5.5539E+00 |
| 81 | 7.4000E+05 | 5.5007E+00 | 7.5000E+05 | 5.4496E+00 | 7.6000E+05 | 5.4009E+00 | 7.7000E+05 | 5.3542E+00 | 7.8000E+05 | 5.3089E+00 |
| 86 | 7.9000E+05 | 5.2562E+00 | 8.0000E+05 | 5.2063E+00 | 8.1000E+05 | 5.1578E+00 | 8.2000E+05 | 5.1097E+00 | 8.3000E+05 | 5.0620E+00 |
| 91 | 8.4000E+05 | 5.0150E+00 | 8.5000E+05 | 4.9670E+00 | 8.6000E+05 | 4.9192E+00 | 8.7000E+05 | 4.8698E+00 | 8.8000E+05 | 4.8184E+00 |
| 96 | 8.9000E+05 | 4.7697E+00 | 9.0000E+05 | 4.7225E+00 | 9.2000E+05 | 4.6333E+00 | 9.4000E+05 | 4.5520E+00 | 9.6000E+05 | 4.4794E+00 |
| 101 | 9.8000E+05 | 4.4132E+00 | 1.0000E+06 | 4.3545E+00 | 1.0200E+06 | 4.3003E+00 | 1.0400E+06 | 4.2489E+00 | 1.0600E+06 | 4.2024E+00 |
| 106 | 1.0800E+06 | 4.1559E+00 | 1.1000E+06 | 4.1126E+00 | 1.1200E+06 | 4.0709E+00 | 1.1400E+06 | 4.0333E+00 | 1.1600E+06 | 4.0088E+00 |
| 111 | 1.1800E+06 | 3.9734E+00 | 1.2000E+06 | 3.9414E+00 | 1.2500E+06 | 3.8660E+00 | 1.3000E+06 | 3.8108E+00 | 1.3500E+06 | 3.7653E+00 |
| 116 | 1.4000E+06 | 3.7293E+00 | 1.4500E+06 | 3.6999E+00 | 1.5000E+06 | 3.6781E+00 | 1.5500E+06 | 3.6624E+00 | 1.6000E+06 | 3.6525E+00 |
| 121 | 1.6500E+06 | 3.6467E+00 | 1.7000E+06 | 3.6460E+00 | 1.7500E+06 | 3.6488E+00 | 1.8000E+06 | 3.6559E+00 | 1.8500E+06 | 3.6659E+00 |
| 126 | 1.9000E+06 | 3.6793E+00 | 1.9500E+06 | 3.6951E+00 | 2.0000E+06 | 3.6782E+00 | 2.2000E+06 | 3.7813E+00 | 2.4000E+06 | 3.8968E+00 |
| 131 | 2.6000E+06 | 4.0113E+00 | 2.8000E+06 | 4.1159E+00 | 3.0000E+06 | 4.2048E+00 | 3.2000E+06 | 4.2749E+00 | 3.4000E+06 | 4.3251E+00 |
| 136 | 3.6000E+06 | 4.3554E+00 | 3.8000E+06 | 4.3666E+00 | 4.0000E+06 | 4.3601E+00 | 4.2000E+06 | 4.3377E+00 | 4.4000E+06 | 4.3009E+00 |
| 141 | 4.6000E+06 | 4.2517E+00 | 4.8000E+06 | 4.1918E+00 | 5.0000E+06 | 4.1229E+00 | 5.2000E+06 | 4.0468E+00 | 5.4000E+06 | 3.9651E+00 |
| 146 | 5.6000E+06 | 3.8793E+00 | 5.8000E+06 | 3.7908E+00 | 6.0000E+06 | 3.7011E+00 | | | | |

(n,Inelastic)
Reaction Cross Section

Intermediate State Q-value -4.4500E+04 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 142 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.4685E+04 | 0.0000E+00 | 4.5000E+04 | 6.8234E-03 | 5.0000E+04 | 6.0476E-02 | 5.5000E+04 | 1.2248E-01 | 6.0000E+04 | 1.8229E-01 |
| 6 | 6.5000E+04 | 2.3743E-01 | 7.0000E+04 | 2.8772E-01 | 7.5000E+04 | 3.3487E-01 | 8.0000E+04 | 3.7925E-01 | 8.5000E+04 | 4.1816E-01 |
| 11 | 9.0000E+04 | 4.5103E-01 | 9.5000E+04 | 4.8233E-01 | 1.0000E+05 | 5.1486E-01 | 1.1000E+05 | 5.7673E-01 | 1.2000E+05 | 6.3204E-01 |
| 16 | 1.3000E+05 | 6.8295E-01 | 1.4000E+05 | 7.2996E-01 | 1.5000E+05 | 7.6461E-01 | 1.6000E+05 | 8.0545E-01 | 1.7000E+05 | 8.4379E-01 |
| 21 | 1.8000E+05 | 8.7968E-01 | 1.9000E+05 | 9.1324E-01 | 2.0000E+05 | 9.4467E-01 | 2.1000E+05 | 9.7424E-01 | 2.2000E+05 | 1.0021E+00 |
| 26 | 2.3000E+05 | 1.0282E+00 | 2.4000E+05 | 1.0525E+00 | 2.5000E+05 | 1.0750E+00 | 2.6000E+05 | 1.0959E+00 | 2.7000E+05 | 1.1158E+00 |
| 31 | 2.8000E+05 | 1.1351E+00 | 2.9000E+05 | 1.1542E+00 | 3.0000E+05 | 1.1729E+00 | 3.1000E+05 | 1.1852E+00 | 3.2000E+05 | 1.2024E+00 |
| 36 | 3.4000E+05 | 1.2339E+00 | 3.5000E+05 | 1.2491E+00 | 3.6000E+05 | 1.2644E+00 | 3.8000E+05 | 1.2949E+00 | 3.9000E+05 | 1.3092E+00 |
| 41 | 4.0000E+05 | 1.3224E+00 | 4.1000E+05 | 1.3344E+00 | 4.2000E+05 | 1.3451E+00 | 4.3000E+05 | 1.3547E+00 | 4.4000E+05 | 1.3633E+00 |
| 46 | 4.5000E+05 | 1.3712E+00 | 4.6000E+05 | 1.3785E+00 | 4.7000E+05 | 1.3856E+00 | 4.8000E+05 | 1.3928E+00 | 4.9000E+05 | 1.4003E+00 |
| 51 | 5.0000E+05 | 1.4077E+00 | 5.1000E+05 | 1.4144E+00 | 5.2000E+05 | 1.4180E+00 | 5.3000E+05 | 1.4217E+00 | 5.4000E+05 | 1.4235E+00 |
| 56 | 5.5000E+05 | 1.4236E+00 | 5.6000E+05 | 1.4227E+00 | 5.7000E+05 | 1.4219E+00 | 5.8000E+05 | 1.4219E+00 | 5.9000E+05 | 1.4230E+00 |
| 61 | 6.0000E+05 | 1.4243E+00 | 6.1000E+05 | 1.4248E+00 | 6.2000E+05 | 1.4235E+00 | 6.3000E+05 | 1.4209E+00 | 6.4000E+05 | 1.4171E+00 |
| 66 | 6.5000E+05 | 1.4128E+00 | 6.6000E+05 | 1.4079E+00 | 6.7000E+05 | 1.4028E+00 | 6.8000E+05 | 1.3975E+00 | 6.9000E+05 | 1.3920E+00 |
| 71 | 7.0000E+05 | 1.3861E+00 | 7.1000E+05 | 1.3794E+00 | 7.2000E+05 | 1.3722E+00 | 7.3000E+05 | 1.3648E+00 | 7.4000E+05 | 1.3580E+00 |
| 76 | 7.5000E+05 | 1.3524E+00 | 7.6000E+05 | 1.3480E+00 | 7.7000E+05 | 1.3446E+00 | 7.8000E+05 | 1.3416E+00 | 7.9000E+05 | 1.3563E+00 |
| 81 | 8.0000E+05 | 1.3651E+00 | 8.1000E+05 | 1.3707E+00 | 8.2000E+05 | 1.3741E+00 | 8.3000E+05 | 1.3748E+00 | 8.4000E+05 | 1.3755E+00 |
| 86 | 8.5000E+05 | 1.3751E+00 | 8.6000E+05 | 1.3721E+00 | 8.7000E+05 | 1.3722E+00 | 8.8000E+05 | 1.3758E+00 | 8.9000E+05 | 1.3733E+00 |
| 91 | 9.0000E+05 | 1.3682E+00 | 9.2000E+05 | 1.3530E+00 | 9.4000E+05 | 1.3374E+00 | 9.6000E+05 | 1.3269E+00 | 9.8000E+05 | 1.3281E+00 |
| 96 | 1.0000E+06 | 1.3330E+00 | 1.0200E+06 | 1.3474E+00 | 1.0400E+06 | 1.3649E+00 | 1.0600E+06 | 1.3842E+00 | 1.0800E+06 | 1.3952E+00 |
| 101 | 1.1000E+06 | 1.4090E+00 | 1.1200E+06 | 1.4228E+00 | 1.1400E+06 | 1.4395E+00 | 1.1600E+06 | 1.4448E+00 | 1.1800E+06 | 1.4634E+00 |
| 106 | 1.2000E+06 | 1.4865E+00 | 1.2500E+06 | 1.5536E+00 | 1.3000E+06 | 1.6106E+00 | 1.3500E+06 | 1.6750E+00 | 1.4000E+06 | 1.7298E+00 |
| 111 | 1.4500E+06 | 1.7891E+00 | 1.5000E+06 | 1.8383E+00 | 1.5500E+06 | 1.8991E+00 | 1.6000E+06 | 1.9450E+00 | 1.6500E+06 | 1.9935E+00 |
| 116 | 1.7000E+06 | 2.0287E+00 | 1.7500E+06 | 2.0676E+00 | 1.8000E+06 | 2.0935E+00 | 1.8500E+06 | 2.1239E+00 | 1.9000E+06 | 2.1422E+00 |
| 121 | 1.9500E+06 | 2.1664E+00 | 2.0000E+06 | 2.2122E+00 | 2.2000E+06 | 2.2590E+00 | 2.4000E+06 | 2.2884E+00 | 2.6000E+06 | 2.3056E+00 |
| 126 | 2.8000E+06 | 2.3143E+00 | 3.0000E+06 | 2.3171E+00 | 3.2000E+06 | 2.3163E+00 | 3.4000E+06 | 2.3131E+00 | 3.6000E+06 | 2.3084E+00 |
| 131 | 3.8000E+06 | 2.3027E+00 | 4.0000E+06 | 2.2964E+00 | 4.2000E+06 | 2.2899E+00 | 4.4000E+06 | 2.2832E+00 | 4.6000E+06 | 2.2744E+00 |
| 136 | 4.8000E+06 | 2.2617E+00 | 5.0000E+06 | 2.2445E+00 | 5.2000E+06 | 2.2226E+00 | 5.4000E+06 | 2.1959E+00 | 5.6000E+06 | 2.1647E+00 |
| 141 | 5.8000E+06 | 2.1289E+00 | 6.0000E+06 | 2.0887E+00 | | | | | | |

(n,fission)
Reaction Cross Section

Reaction Q-value 2.0136E+08 eV
Intermediate State Q-value 2.0136E+08 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 148 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0000E+04 | 7.0587E-03 | 1.5000E+04 | 4.6477E-03 | 2.0000E+04 | 4.7622E-03 | 2.5000E+04 | 5.8780E-03 | 3.0000E+04 | 8.2436E-03 |
| 6 | 3.5000E+04 | 1.2992E-02 | 4.0000E+04 | 1.9879E-02 | 4.5000E+04 | 2.1345E-02 | 5.0000E+04 | 2.0887E-02 | 5.5000E+04 | 1.8685E-02 |
| 11 | 6.0000E+04 | 1.6465E-02 | 6.5000E+04 | 1.4881E-02 | 7.0000E+04 | 1.4069E-02 | 7.5000E+04 | 1.3764E-02 | 8.0000E+04 | 1.3501E-02 |
| 16 | 8.5000E+04 | 1.3315E-02 | 9.0000E+04 | 1.3229E-02 | 9.5000E+04 | 1.3256E-02 | 1.0000E+05 | 1.3408E-02 | 1.1000E+05 | 1.4101E-02 |
| 21 | 1.2000E+05 | 1.5286E-02 | 1.3000E+05 | 1.6716E-02 | 1.4000E+05 | 1.7981E-02 | 1.5000E+05 | 1.8758E-02 | 1.6000E+05 | 1.9596E-02 |
| 26 | 1.7000E+05 | 2.0858E-02 | 1.8000E+05 | 2.2882E-02 | 1.9000E+05 | 2.5713E-02 | 2.0000E+05 | 2.9113E-02 | 2.1000E+05 | 3.2673E-02 |
| 31 | 2.2000E+05 | 3.6279E-02 | 2.3000E+05 | 4.0371E-02 | 2.4000E+05 | 4.5472E-02 | 2.5000E+05 | 5.1723E-02 | 2.6000E+05 | 5.8644E-02 |
| 36 | 2.7000E+05 | 6.5228E-02 | 2.8000E+05 | 7.0552E-02 | 2.9000E+05 | 7.4272E-02 | 3.0000E+05 | 7.7018E-02 | 3.1000E+05 | 7.9754E-02 |
| 41 | 3.2000E+05 | 8.3587E-02 | 3.4000E+05 | 9.3790E-02 | 3.5000E+05 | 9.8089E-02 | 3.6000E+05 | 1.0064E-01 | 3.8000E+05 | 1.0271E-01 |
| 46 | 3.9000E+05 | 1.0480E-01 | 4.0000E+05 | 1.0886E-01 | 4.1000E+05 | 1.1520E-01 | 4.2000E+05 | 1.2366E-01 | 4.3000E+05 | 1.3389E-01 |
| 51 | 4.4000E+05 | 1.4554E-01 | 4.5000E+05 | 1.5825E-01 | 4.6000E+05 | 1.7152E-01 | 4.7000E+05 | 1.8458E-01 | 4.8000E+05 | 1.9677E-01 |
| 56 | 4.9000E+05 | 2.0795E-01 | 5.0000E+05 | 2.1883E-01 | 5.1000E+05 | 2.3068E-01 | 5.2000E+05 | 2.4512E-01 | 5.3000E+05 | 2.6345E-01 |
| 61 | 5.4000E+05 | 2.8561E-01 | 5.5000E+05 | 3.1040E-01 | 5.6000E+05 | 3.3589E-01 | 5.7000E+05 | 3.6022E-01 | 5.8000E+05 | 3.8188E-01 |
| 66 | 5.9000E+05 | 4.0100E-01 | 6.0000E+05 | 4.1968E-01 | 6.1000E+05 | 4.4067E-01 | 6.2000E+05 | 4.6531E-01 | 6.3000E+05 | 4.9227E-01 |
| 71 | 6.4000E+05 | 5.2052E-01 | 6.5000E+05 | 5.4909E-01 | 6.6000E+05 | 5.7774E-01 | 6.7000E+05 | 6.0633E-01 | 6.8000E+05 | 6.3501E-01 |
| 76 | 6.9000E+05 | 6.6401E-01 | 7.0000E+05 | 6.9387E-01 | 7.1000E+05 | 7.2497E-01 | 7.2000E+05 | 7.5691E-01 | 7.3000E+05 | 7.8874E-01 |
| 81 | 7.4000E+05 | 8.1886E-01 | 7.5000E+05 | 8.4610E-01 | 7.6000E+05 | 8.7026E-01 | 7.7000E+05 | 8.9193E-01 | 7.8000E+05 | 9.1249E-01 |
| 86 | 7.9000E+05 | 9.2457E-01 | 8.0000E+05 | 9.4014E-01 | 8.1000E+05 | 9.5823E-01 | 8.2000E+05 | 9.7898E-01 | 8.3000E+05 | 1.0029E+00 |
| 91 | 8.4000E+05 | 1.0275E+00 | 8.5000E+05 | 1.0551E+00 | 8.6000E+05 | 1.0858E+00 | 8.7000E+05 | 1.1163E+00 | 8.8000E+05 | 1.1464E+00 |
| 96 | 8.9000E+05 | 1.1804E+00 | 9.0000E+05 | 1.2162E+00 | 9.2000E+05 | 1.2891E+00 | 9.4000E+05 | 1.3560E+00 | 9.6000E+05 | 1.4100E+00 |
| 101 | 9.8000E+05 | 1.4471E+00 | 1.0000E+06 | 1.4741E+00 | 1.0200E+06 | 1.4889E+00 | 1.0400E+06 | 1.4996E+00 | 1.0600E+06 | 1.5049E+00 |
| 106 | 1.0800E+06 | 1.5214E+00 | 1.1000E+06 | 1.5326E+00 | 1.1200E+06 | 1.5447E+00 | 1.1400E+06 | 1.5509E+00 | 1.1600E+06 | 1.5582E+00 |
| 111 | 1.1800E+06 | 1.5635E+00 | 1.2000E+06 | 1.5616E+00 | 1.2500E+06 | 1.5478E+00 | 1.3000E+06 | 1.5317E+00 | 1.3500E+06 | 1.5058E+00 |
| 116 | 1.4000E+06 | 1.4861E+00 | 1.4500E+06 | 1.4618E+00 | 1.5000E+06 | 1.4446E+00 | 1.5500E+06 | 1.4145E+00 | 1.6000E+06 | 1.3972E+00 |
| 121 | 1.6500E+06 | 1.3778E+00 | 1.7000E+06 | 1.3692E+00 | 1.7500E+06 | 1.3567E+00 | 1.8000E+06 | 1.3547E+00 | 1.8500E+06 | 1.3477E+00 |
| 126 | 1.9000E+06 | 1.3500E+00 | 1.9500E+06 | 1.3460E+00 | 2.0000E+06 | 1.3527E+00 | 2.2000E+06 | 1.3493E+00 | 2.4000E+06 | 1.3441E+00 |
| 131 | 2.6000E+06 | 1.3363E+00 | 2.8000E+06 | 1.3266E+00 | 3.0000E+06 | 1.3157E+00 | 3.2000E+06 | 1.3040E+00 | 3.4000E+06 | 1.2915E+00 |
| 136 | 3.6000E+06 | 1.2782E+00 | 3.8000E+06 | 1.2640E+00 | 4.0000E+06 | 1.2491E+00 | 4.2000E+06 | 1.2336E+00 | 4.4000E+06 | 1.2181E+00 |
| 141 | 4.6000E+06 | 1.2049E+00 | 4.8000E+06 | 1.1961E+00 | 5.0000E+06 | 1.1926E+00 | 5.2000E+06 | 1.1949E+00 | 5.4000E+06 | 1.2032E+00 |
| 146 | 5.6000E+06 | 1.2174E+00 | 5.8000E+06 | 1.2375E+00 | 6.0000E+06 | 1.2635E+00 | | | | |

(n,f)
Reaction Cross Section

Reaction Q-value 2.0136E+08 eV
Intermediate State Q-value 2.0136E+08 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 148 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0000E+04 | 7.0587E-03 | 1.5000E+04 | 4.6477E-03 | 2.0000E+04 | 4.7622E-03 | 2.5000E+04 | 5.8780E-03 | 3.0000E+04 | 8.2436E-03 |
| 6 | 3.5000E+04 | 1.2992E-02 | 4.0000E+04 | 1.9879E-02 | 4.5000E+04 | 2.1345E-02 | 5.0000E+04 | 2.0887E-02 | 5.5000E+04 | 1.8685E-02 |
| 11 | 6.0000E+04 | 1.6465E-02 | 6.5000E+04 | 1.4881E-02 | 7.0000E+04 | 1.4069E-02 | 7.5000E+04 | 1.3764E-02 | 8.0000E+04 | 1.3501E-02 |
| 16 | 8.5000E+04 | 1.3315E-02 | 9.0000E+04 | 1.3229E-02 | 9.5000E+04 | 1.3256E-02 | 1.0000E+05 | 1.3408E-02 | 1.1000E+05 | 1.4101E-02 |
| 21 | 1.2000E+05 | 1.5286E-02 | 1.3000E+05 | 1.6716E-02 | 1.4000E+05 | 1.7981E-02 | 1.5000E+05 | 1.8758E-02 | 1.6000E+05 | 1.9596E-02 |
| 26 | 1.7000E+05 | 2.0858E-02 | 1.8000E+05 | 2.2882E-02 | 1.9000E+05 | 2.5713E-02 | 2.0000E+05 | 2.9113E-02 | 2.1000E+05 | 3.2673E-02 |
| 31 | 2.2000E+05 | 3.6279E-02 | 2.3000E+05 | 4.0371E-02 | 2.4000E+05 | 4.5472E-02 | 2.5000E+05 | 5.1723E-02 | 2.6000E+05 | 5.8644E-02 |
| 36 | 2.7000E+05 | 6.5228E-02 | 2.8000E+05 | 7.0552E-02 | 2.9000E+05 | 7.4272E-02 | 3.0000E+05 | 7.7018E-02 | 3.1000E+05 | 7.9754E-02 |
| 41 | 3.2000E+05 | 8.3587E-02 | 3.4000E+05 | 9.3790E-02 | 3.5000E+05 | 9.8089E-02 | 3.6000E+05 | 1.0064E-01 | 3.8000E+05 | 1.0271E-01 |
| 46 | 3.9000E+05 | 1.0480E-01 | 4.0000E+05 | 1.0886E-01 | 4.1000E+05 | 1.1520E-01 | 4.2000E+05 | 1.2366E-01 | 4.3000E+05 | 1.3389E-01 |
| 51 | 4.4000E+05 | 1.4554E-01 | 4.5000E+05 | 1.5825E-01 | 4.6000E+05 | 1.7152E-01 | 4.7000E+05 | 1.8458E-01 | 4.8000E+05 | 1.9677E-01 |
| 56 | 4.9000E+05 | 2.0795E-01 | 5.0000E+05 | 2.1883E-01 | 5.1000E+05 | 2.3068E-01 | 5.2000E+05 | 2.4512E-01 | 5.3000E+05 | 2.6345E-01 |
| 61 | 5.4000E+05 | 2.8561E-01 | 5.5000E+05 | 3.1040E-01 | 5.6000E+05 | 3.3589E-01 | 5.7000E+05 | 3.6022E-01 | 5.8000E+05 | 3.8188E-01 |
| 66 | 5.9000E+05 | 4.0100E-01 | 6.0000E+05 | 4.1968E-01 | 6.1000E+05 | 4.4067E-01 | 6.2000E+05 | 4.6531E-01 | 6.3000E+05 | 4.9227E-01 |
| 71 | 6.4000E+05 | 5.2052E-01 | 6.5000E+05 | 5.4909E-01 | 6.6000E+05 | 5.7774E-01 | 6.7000E+05 | 6.0633E-01 | 6.8000E+05 | 6.3501E-01 |
| 76 | 6.9000E+05 | 6.6401E-01 | 7.0000E+05 | 6.9387E-01 | 7.1000E+05 | 7.2497E-01 | 7.2000E+05 | 7.5691E-01 | 7.3000E+05 | 7.8874E-01 |
| 81 | 7.4000E+05 | 8.1886E-01 | 7.5000E+05 | 8.4610E-01 | 7.6000E+05 | 8.7026E-01 | 7.7000E+05 | 8.9193E-01 | 7.8000E+05 | 9.1249E-01 |
| 86 | 7.9000E+05 | 9.2457E-01 | 8.0000E+05 | 9.4014E-01 | 8.1000E+05 | 9.5823E-01 | 8.2000E+05 | 9.7898E-01 | 8.3000E+05 | 1.0029E+00 |
| 91 | 8.4000E+05 | 1.0275E+00 | 8.5000E+05 | 1.0551E+00 | 8.6000E+05 | 1.0858E+00 | 8.7000E+05 | 1.1163E+00 | 8.8000E+05 | 1.1464E+00 |
| 96 | 8.9000E+05 | 1.1804E+00 | 9.0000E+05 | 1.2162E+00 | 9.2000E+05 | 1.2891E+00 | 9.4000E+05 | 1.3560E+00 | 9.6000E+05 | 1.4100E+00 |
| 101 | 9.8000E+05 | 1.4471E+00 | 1.0000E+06 | 1.4741E+00 | 1.0200E+06 | 1.4889E+00 | 1.0400E+06 | 1.4996E+00 | 1.0600E+06 | 1.5049E+00 |
| 106 | 1.0800E+06 | 1.5214E+00 | 1.1000E+06 | 1.5326E+00 | 1.1200E+06 | 1.5447E+00 | 1.1400E+06 | 1.5509E+00 | 1.1600E+06 | 1.5582E+00 |
| 111 | 1.1800E+06 | 1.5635E+00 | 1.2000E+06 | 1.5616E+00 | 1.2500E+06 | 1.5478E+00 | 1.3000E+06 | 1.5317E+00 | 1.3500E+06 | 1.5058E+00 |
| 116 | 1.4000E+06 | 1.4861E+00 | 1.4500E+06 | 1.4618E+00 | 1.5000E+06 | 1.4446E+00 | 1.5500E+06 | 1.4145E+00 | 1.6000E+06 | 1.3972E+00 |
| 121 | 1.6500E+06 | 1.3778E+00 | 1.7000E+06 | 1.3692E+00 | 1.7500E+06 | 1.3567E+00 | 1.8000E+06 | 1.3547E+00 | 1.8500E+06 | 1.3477E+00 |
| 126 | 1.9000E+06 | 1.3500E+00 | 1.9500E+06 | 1.3460E+00 | 2.0000E+06 | 1.3527E+00 | 2.2000E+06 | 1.3493E+00 | 2.4000E+06 | 1.3441E+00 |
| 131 | 2.6000E+06 | 1.3363E+00 | 2.8000E+06 | 1.3266E+00 | 3.0000E+06 | 1.3157E+00 | 3.2000E+06 | 1.3040E+00 | 3.4000E+06 | 1.2915E+00 |
| 136 | 3.6000E+06 | 1.2782E+00 | 3.8000E+06 | 1.2640E+00 | 4.0000E+06 | 1.2491E+00 | 4.2000E+06 | 1.2336E+00 | 4.4000E+06 | 1.2181E+00 |
| 141 | 4.6000E+06 | 1.2049E+00 | 4.8000E+06 | 1.1961E+00 | 5.0000E+06 | 1.1926E+00 | 5.2000E+06 | 1.1949E+00 | 5.4000E+06 | 1.2032E+00 |
| 146 | 5.6000E+06 | 1.2174E+00 | 5.8000E+06 | 1.2375E+00 | 6.0000E+06 | 1.2635E+00 | | | | |

(n,n') 1-st level
Reaction Cross Section

Intermediate State Q-value -4.4500E+04 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 142 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.4685E+04 | 0.0000E+00 | 4.5000E+04 | 6.8234E-03 | 5.0000E+04 | 6.0476E-02 | 5.5000E+04 | 1.2248E-01 | 6.0000E+04 | 1.8229E-01 |
| 6 | 6.5000E+04 | 2.3743E-01 | 7.0000E+04 | 2.8772E-01 | 7.5000E+04 | 3.3487E-01 | 8.0000E+04 | 3.7925E-01 | 8.5000E+04 | 4.1816E-01 |
| 11 | 9.0000E+04 | 4.5103E-01 | 9.5000E+04 | 4.8233E-01 | 1.0000E+05 | 5.1486E-01 | 1.1000E+05 | 5.7673E-01 | 1.2000E+05 | 6.3204E-01 |
| 16 | 1.3000E+05 | 6.8295E-01 | 1.4000E+05 | 7.2996E-01 | 1.5000E+05 | 7.6455E-01 | 1.6000E+05 | 8.0478E-01 | 1.7000E+05 | 8.4225E-01 |
| 21 | 1.8000E+05 | 8.7707E-01 | 1.9000E+05 | 9.0941E-01 | 2.0000E+05 | 9.3948E-01 | 2.1000E+05 | 9.6744E-01 | 2.2000E+05 | 9.9347E-01 |
| 26 | 2.3000E+05 | 1.0176E+00 | 2.4000E+05 | 1.0397E+00 | 2.5000E+05 | 1.0598E+00 | 2.6000E+05 | 1.0782E+00 | 2.7000E+05 | 1.0953E+00 |
| 31 | 2.8000E+05 | 1.1116E+00 | 2.9000E+05 | 1.1275E+00 | 3.0000E+05 | 1.1429E+00 | 3.1000E+05 | 1.1516E+00 | 3.2000E+05 | 1.1650E+00 |
| 36 | 3.4000E+05 | 1.1885E+00 | 3.5000E+05 | 1.1995E+00 | 3.6000E+05 | 1.2104E+00 | 3.8000E+05 | 1.2317E+00 | 3.9000E+05 | 1.2412E+00 |
| 41 | 4.0000E+05 | 1.2495E+00 | 4.1000E+05 | 1.2566E+00 | 4.2000E+05 | 1.2623E+00 | 4.3000E+05 | 1.2670E+00 | 4.4000E+05 | 1.2707E+00 |
| 46 | 4.5000E+05 | 1.2737E+00 | 4.6000E+05 | 1.2761E+00 | 4.7000E+05 | 1.2782E+00 | 4.8000E+05 | 1.2803E+00 | 4.9000E+05 | 1.2825E+00 |
| 51 | 5.0000E+05 | 1.2846E+00 | 5.1000E+05 | 1.2859E+00 | 5.2000E+05 | 1.2841E+00 | 5.3000E+05 | 1.2826E+00 | 5.4000E+05 | 1.2794E+00 |
| 56 | 5.5000E+05 | 1.2748E+00 | 5.6000E+05 | 1.2696E+00 | 5.7000E+05 | 1.2645E+00 | 5.8000E+05 | 1.2603E+00 | 5.9000E+05 | 1.2570E+00 |
| 61 | 6.0000E+05 | 1.2539E+00 | 6.1000E+05 | 1.2499E+00 | 6.2000E+05 | 1.2442E+00 | 6.3000E+05 | 1.2374E+00 | 6.4000E+05 | 1.2299E+00 |
| 66 | 6.5000E+05 | 1.2219E+00 | 6.6000E+05 | 1.2138E+00 | 6.7000E+05 | 1.2055E+00 | 6.8000E+05 | 1.1972E+00 | 6.9000E+05 | 1.1887E+00 |
| 71 | 7.0000E+05 | 1.1798E+00 | 7.1000E+05 | 1.1704E+00 | 7.2000E+05 | 1.1605E+00 | 7.3000E+05 | 1.1506E+00 | 7.4000E+05 | 1.1413E+00 |
| 76 | 7.5000E+05 | 1.1330E+00 | 7.6000E+05 | 1.1258E+00 | 7.7000E+05 | 1.1195E+00 | 7.8000E+05 | 1.1135E+00 | 7.9000E+05 | 1.1000E+00 |
| 81 | 8.0000E+05 | 1.0895E+00 | 8.1000E+05 | 1.0791E+00 | 8.2000E+05 | 1.0682E+00 | 8.3000E+05 | 1.0565E+00 | 8.4000E+05 | 1.0422E+00 |
| 86 | 8.5000E+05 | 1.0274E+00 | 8.6000E+05 | 1.0118E+00 | 8.7000E+05 | 9.9336E-01 | 8.8000E+05 | 9.7307E-01 | 8.9000E+05 | 9.5388E-01 |
| 91 | 9.0000E+05 | 9.3502E-01 | 9.2000E+05 | 8.9907E-01 | 9.4000E+05 | 8.6760E-01 | 9.6000E+05 | 8.4219E-01 | 9.8000E+05 | 8.2161E-01 |
| 96 | 1.0000E+06 | 8.0540E-01 | 1.0200E+06 | 7.9090E-01 | 1.0400E+06 | 7.7732E-01 | 1.0600E+06 | 7.6711E-01 | 1.0800E+06 | 7.5376E-01 |
| 101 | 1.1000E+06 | 7.4305E-01 | 1.1200E+06 | 7.3130E-01 | 1.1400E+06 | 7.2182E-01 | 1.1600E+06 | 7.0827E-01 | 1.1800E+06 | 6.9903E-01 |
| 106 | 1.2000E+06 | 6.9270E-01 | 1.2500E+06 | 6.8240E-01 | 1.3000E+06 | 6.7298E-01 | 1.3500E+06 | 6.6461E-01 | 1.4000E+06 | 6.5836E-01 |
| 111 | 1.4500E+06 | 6.5133E-01 | 1.5000E+06 | 6.4574E-01 | 1.5500E+06 | 6.4016E-01 | 1.6000E+06 | 6.3482E-01 | 1.6500E+06 | 6.2811E-01 |
| 116 | 1.7000E+06 | 6.2211E-01 | 1.7500E+06 | 6.1505E-01 | 1.8000E+06 | 6.0874E-01 | 1.8500E+06 | 6.0166E-01 | 1.9000E+06 | 5.9543E-01 |
| 121 | 1.9500E+06 | 5.8867E-01 | 2.0000E+06 | 5.8442E-01 | 2.2000E+06 | 5.6099E-01 | 2.4000E+06 | 5.4240E-01 | 2.6000E+06 | 5.2738E-01 |
| 126 | 2.8000E+06 | 5.1471E-01 | 3.0000E+06 | 5.0348E-01 | 3.2000E+06 | 4.9315E-01 | 3.4000E+06 | 4.8340E-01 | 3.6000E+06 | 4.7404E-01 |
| 131 | 3.8000E+06 | 4.6495E-01 | 4.0000E+06 | 4.5605E-01 | 4.2000E+06 | 4.4732E-01 | 4.4000E+06 | 4.3876E-01 | 4.6000E+06 | 4.3041E-01 |
| 136 | 4.8000E+06 | 4.2233E-01 | 5.0000E+06 | 4.1459E-01 | 5.2000E+06 | 4.0722E-01 | 5.4000E+06 | 4.0025E-01 | 5.6000E+06 | 3.9368E-01 |
| 141 | 5.8000E+06 | 3.8749E-01 | 6.0000E+06 | 3.8162E-01 | | | | | | |

(n,n') 2-nd level
Reaction Cross Section

Intermediate State Q-value -1.4720E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 126 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.4781E+05 | 0.0000E+00 | 1.5000E+05 | 6.4174E-05 | 1.6000E+05 | 6.6733E-04 | 1.7000E+05 | 1.5405E-03 | 1.8000E+05 | 2.6078E-03 |
| 6 | 1.9000E+05 | 3.8324E-03 | 2.0000E+05 | 5.1896E-03 | 2.1000E+05 | 6.8049E-03 | 2.2000E+05 | 8.6086E-03 | 2.3000E+05 | 1.0612E-02 |
| 11 | 2.4000E+05 | 1.2807E-02 | 2.5000E+05 | 1.5192E-02 | 2.6000E+05 | 1.7770E-02 | 2.7000E+05 | 2.0535E-02 | 2.8000E+05 | 2.3486E-02 |
| 16 | 2.9000E+05 | 2.6631E-02 | 3.0000E+05 | 2.9981E-02 | 3.1000E+05 | 3.3573E-02 | 3.2000E+05 | 3.7341E-02 | 3.4000E+05 | 4.5403E-02 |
| 21 | 3.5000E+05 | 4.9647E-02 | 3.6000E+05 | 5.4023E-02 | 3.8000E+05 | 6.3191E-02 | 3.9000E+05 | 6.7965E-02 | 4.0000E+05 | 7.2830E-02 |
| 26 | 4.1000E+05 | 7.7743E-02 | 4.2000E+05 | 8.2666E-02 | 4.3000E+05 | 8.7601E-02 | 4.4000E+05 | 9.2495E-02 | 4.5000E+05 | 9.7384E-02 |
| 31 | 4.6000E+05 | 1.0229E-01 | 4.7000E+05 | 1.0725E-01 | 4.8000E+05 | 1.1232E-01 | 4.9000E+05 | 1.1750E-01 | 5.0000E+05 | 1.2279E-01 |
| 36 | 5.1000E+05 | 1.2813E-01 | 5.2000E+05 | 1.3343E-01 | 5.3000E+05 | 1.3857E-01 | 5.4000E+05 | 1.4346E-01 | 5.5000E+05 | 1.4806E-01 |
| 41 | 5.6000E+05 | 1.5239E-01 | 5.7000E+05 | 1.5654E-01 | 5.8000E+05 | 1.6066E-01 | 5.9000E+05 | 1.6490E-01 | 6.0000E+05 | 1.6925E-01 |
| 46 | 6.1000E+05 | 1.7363E-01 | 6.2000E+05 | 1.7788E-01 | 6.3000E+05 | 1.8189E-01 | 6.4000E+05 | 1.8559E-01 | 6.5000E+05 | 1.8899E-01 |
| 51 | 6.6000E+05 | 1.9212E-01 | 6.7000E+05 | 1.9508E-01 | 6.8000E+05 | 1.9797E-01 | 6.9000E+05 | 2.0081E-01 | 7.0000E+05 | 2.0355E-01 |
| 56 | 7.1000E+05 | 2.0614E-01 | 7.2000E+05 | 2.0859E-01 | 7.3000E+05 | 2.1093E-01 | 7.4000E+05 | 2.1329E-01 | 7.5000E+05 | 2.1575E-01 |
| 61 | 7.6000E+05 | 2.1833E-01 | 7.7000E+05 | 2.2103E-01 | 7.8000E+05 | 2.2378E-01 | 7.9000E+05 | 2.2592E-01 | 8.0000E+05 | 2.2812E-01 |
| 66 | 8.1000E+05 | 2.3020E-01 | 8.2000E+05 | 2.3212E-01 | 8.3000E+05 | 2.3384E-01 | 8.4000E+05 | 2.3427E-01 | 8.5000E+05 | 2.3454E-01 |
| 71 | 8.6000E+05 | 2.3463E-01 | 8.7000E+05 | 2.3417E-01 | 8.8000E+05 | 2.3314E-01 | 8.9000E+05 | 2.3187E-01 | 9.0000E+05 | 2.3033E-01 |
| 76 | 9.2000E+05 | 2.2678E-01 | 9.4000E+05 | 2.2327E-01 | 9.6000E+05 | 2.2057E-01 | 9.8000E+05 | 2.1897E-01 | 1.0000E+06 | 2.1828E-01 |
| 81 | 1.0200E+06 | 2.1770E-01 | 1.0400E+06 | 2.1698E-01 | 1.0600E+06 | 2.1691E-01 | 1.0800E+06 | 2.1528E-01 | 1.1000E+06 | 2.1494E-01 |
| 86 | 1.1200E+06 | 2.1402E-01 | 1.1400E+06 | 2.1357E-01 | 1.1600E+06 | 2.1132E-01 | 1.1800E+06 | 2.1038E-01 | 1.2000E+06 | 2.1047E-01 |
| 91 | 1.2500E+06 | 2.1200E-01 | 1.3000E+06 | 2.1361E-01 | 1.3500E+06 | 2.1439E-01 | 1.4000E+06 | 2.1541E-01 | 1.4500E+06 | 2.1514E-01 |
| 96 | 1.5000E+06 | 2.1488E-01 | 1.5500E+06 | 2.1397E-01 | 1.6000E+06 | 2.1280E-01 | 1.6500E+06 | 2.1014E-01 | 1.7000E+06 | 2.0745E-01 |
| 101 | 1.7500E+06 | 2.0362E-01 | 1.8000E+06 | 1.9991E-01 | 1.8500E+06 | 1.9532E-01 | 1.9000E+06 | 1.9102E-01 | 1.9500E+06 | 1.8608E-01 |
| 106 | 2.0000E+06 | 1.8241E-01 | 2.2000E+06 | 1.6311E-01 | 2.4000E+06 | 1.4619E-01 | 2.6000E+06 | 1.3215E-01 | 2.8000E+06 | 1.2080E-01 |
| 111 | 3.0000E+06 | 1.1171E-01 | 3.2000E+06 | 1.0442E-01 | 3.4000E+06 | 9.8501E-02 | 3.6000E+06 | 9.3624E-02 | 3.8000E+06 | 8.9526E-02 |
| 116 | 4.0000E+06 | 8.6020E-02 | 4.2000E+06 | 8.2980E-02 | 4.4000E+06 | 8.0323E-02 | 4.6000E+06 | 7.7995E-02 | 4.8000E+06 | 7.5956E-02 |
| 121 | 5.0000E+06 | 7.4170E-02 | 5.2000E+06 | 7.2603E-02 | 5.4000E+06 | 7.1217E-02 | 5.6000E+06 | 6.9973E-02 | 5.8000E+06 | 6.8832E-02 |
| 126 | 6.0000E+06 | 6.7757E-02 | | | | | | | | |

(n,n') 3-rd level
Reaction Cross Section

Intermediate State Q-value -3.0590E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 110 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.0717E+05 | 0.0000E+00 | 3.1000E+05 | 1.5327E-07 | 3.2000E+05 | 1.4302E-06 | 3.4000E+05 | 6.1690E-06 | 3.5000E+05 | 9.6232E-06 |
| 6 | 3.6000E+05 | 1.3949E-05 | 3.8000E+05 | 2.6923E-05 | 3.9000E+05 | 3.5959E-05 | 4.0000E+05 | 4.7127E-05 | 4.1000E+05 | 6.0583E-05 |
| 11 | 4.2000E+05 | 7.6791E-05 | 4.3000E+05 | 9.6085E-05 | 4.4000E+05 | 1.1868E-04 | 4.5000E+05 | 1.4488E-04 | 4.6000E+05 | 1.7494E-04 |
| 16 | 4.7000E+05 | 2.0915E-04 | 4.8000E+05 | 2.4785E-04 | 4.9000E+05 | 2.9143E-04 | 5.0000E+05 | 3.4031E-04 | 5.1000E+05 | 3.9505E-04 |
| 21 | 5.2000E+05 | 4.5620E-04 | 5.3000E+05 | 5.2367E-04 | 5.4000E+05 | 5.9781E-04 | 5.5000E+05 | 6.7846E-04 | 5.6000E+05 | 7.6523E-04 |
| 26 | 5.7000E+05 | 8.5784E-04 | 5.8000E+05 | 9.5612E-04 | 5.9000E+05 | 1.0603E-03 | 6.0000E+05 | 1.1709E-03 | 6.1000E+05 | 1.2885E-03 |
| 31 | 6.2000E+05 | 1.4138E-03 | 6.3000E+05 | 1.5469E-03 | 6.4000E+05 | 1.6875E-03 | 6.5000E+05 | 1.8354E-03 | 6.6000E+05 | 1.9901E-03 |
| 36 | 6.7000E+05 | 2.1514E-03 | 6.8000E+05 | 2.3187E-03 | 6.9000E+05 | 2.4916E-03 | 7.0000E+05 | 2.6689E-03 | 7.1000E+05 | 2.8500E-03 |
| 41 | 7.2000E+05 | 3.0348E-03 | 7.3000E+05 | 3.2240E-03 | 7.4000E+05 | 3.4190E-03 | 7.5000E+05 | 3.6231E-03 | 7.6000E+05 | 3.8384E-03 |
| 46 | 7.7000E+05 | 4.0664E-03 | 7.8000E+05 | 4.3066E-03 | 7.9000E+05 | 4.5585E-03 | 8.0000E+05 | 4.8193E-03 | 8.1000E+05 | 5.0894E-03 |
| 51 | 8.2000E+05 | 5.3693E-03 | 8.3000E+05 | 5.6591E-03 | 8.4000E+05 | 5.9174E-03 | 8.5000E+05 | 6.1859E-03 | 8.6000E+05 | 6.4623E-03 |
| 56 | 8.7000E+05 | 6.7359E-03 | 8.8000E+05 | 7.0006E-03 | 8.9000E+05 | 7.2539E-03 | 9.0000E+05 | 7.4947E-03 | 9.2000E+05 | 7.9367E-03 |
| 61 | 9.4000E+05 | 8.3279E-03 | 9.6000E+05 | 8.7115E-03 | 9.8000E+05 | 9.1339E-03 | 1.0000E+06 | 9.6136E-03 | 1.0200E+06 | 1.0132E-02 |
| 66 | 1.0400E+06 | 1.0640E-02 | 1.0600E+06 | 1.1155E-02 | 1.0800E+06 | 1.1601E-02 | 1.1000E+06 | 1.2109E-02 | 1.1200E+06 | 1.2653E-02 |
| 71 | 1.1400E+06 | 1.3254E-02 | 1.1600E+06 | 1.3670E-02 | 1.1800E+06 | 1.4194E-02 | 1.2000E+06 | 1.4807E-02 | 1.2500E+06 | 1.6502E-02 |
| 76 | 1.3000E+06 | 1.8360E-02 | 1.3500E+06 | 2.0167E-02 | 1.4000E+06 | 2.2062E-02 | 1.4500E+06 | 2.3797E-02 | 1.5000E+06 | 2.5525E-02 |
| 81 | 1.5500E+06 | 2.7139E-02 | 1.6000E+06 | 2.8705E-02 | 1.6500E+06 | 2.9940E-02 | 1.7000E+06 | 3.1091E-02 | 1.7500E+06 | 3.1912E-02 |
| 86 | 1.8000E+06 | 3.2663E-02 | 1.8500E+06 | 3.3101E-02 | 1.9000E+06 | 3.3500E-02 | 1.9500E+06 | 3.3625E-02 | 2.0000E+06 | 3.3864E-02 |
| 91 | 2.2000E+06 | 3.3097E-02 | 2.4000E+06 | 3.1658E-02 | 2.6000E+06 | 3.0156E-02 | 2.8000E+06 | 2.8831E-02 | 3.0000E+06 | 2.7714E-02 |
| 96 | 3.2000E+06 | 2.6752E-02 | 3.4000E+06 | 2.5884E-02 | 3.6000E+06 | 2.5064E-02 | 3.8000E+06 | 2.4268E-02 | 4.0000E+06 | 2.3484E-02 |
| 101 | 4.2000E+06 | 2.2714E-02 | 4.4000E+06 | 2.1963E-02 | 4.6000E+06 | 2.1240E-02 | 4.8000E+06 | 2.0552E-02 | 5.0000E+06 | 1.9909E-02 |
| 106 | 5.2000E+06 | 1.9312E-02 | 5.4000E+06 | 1.8762E-02 | 5.6000E+06 | 1.8255E-02 | 5.8000E+06 | 1.7782E-02 | 6.0000E+06 | 1.7336E-02 |

(n,n') 4-th level
Reaction Cross Section

Intermediate State Q-value -5.1760E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 91 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5.1976E+05 | 0.0000E+00 | 5.2000E+05 | 1.3195E-11 | 5.3000E+05 | 3.4630E-10 | 5.4000E+05 | 1.3584E-09 | 5.5000E+05 | 3.4526E-09 |
| 6 | 5.6000E+05 | 7.1704E-09 | 5.7000E+05 | 1.2970E-08 | 5.8000E+05 | 2.1840E-08 | 5.9000E+05 | 3.5528E-08 | 6.0000E+05 | 5.3014E-08 |
| 11 | 6.1000E+05 | 7.8813E-08 | 6.2000E+05 | 1.1117E-07 | 6.3000E+05 | 1.5319E-07 | 6.4000E+05 | 2.0556E-07 | 6.5000E+05 | 2.6989E-07 |
| 16 | 6.6000E+05 | 3.4989E-07 | 6.7000E+05 | 4.4554E-07 | 6.8000E+05 | 5.5984E-07 | 6.9000E+05 | 6.9498E-07 | 7.0000E+05 | 8.5392E-07 |
| 21 | 7.1000E+05 | 1.0406E-06 | 7.2000E+05 | 1.2546E-06 | 7.3000E+05 | 1.5047E-06 | 7.4000E+05 | 1.7903E-06 | 7.5000E+05 | 2.1137E-06 |
| 26 | 7.6000E+05 | 2.4774E-06 | 7.7000E+05 | 2.8844E-06 | 7.8000E+05 | 3.3363E-06 | 7.9000E+05 | 3.8392E-06 | 8.0000E+05 | 4.3960E-06 |
| 31 | 8.1000E+05 | 5.0191E-06 | 8.2000E+05 | 5.7102E-06 | 8.3000E+05 | 6.4757E-06 | 8.4000E+05 | 7.3149E-06 | 8.5000E+05 | 8.2342E-06 |
| 36 | 8.6000E+05 | 9.2345E-06 | 8.7000E+05 | 1.0320E-05 | 8.8000E+05 | 1.1493E-05 | 8.9000E+05 | 1.2755E-05 | 9.0000E+05 | 1.4110E-05 |
| 41 | 9.2000E+05 | 1.7091E-05 | 9.4000E+05 | 2.0179E-05 | 9.6000E+05 | 2.3527E-05 | 9.8000E+05 | 2.7149E-05 | 1.0000E+06 | 3.1075E-05 |
| 46 | 1.0200E+06 | 3.5390E-05 | 1.0400E+06 | 4.0188E-05 | 1.0600E+06 | 4.5537E-05 | 1.0800E+06 | 5.1372E-05 | 1.1000E+06 | 5.7802E-05 |
| 51 | 1.1200E+06 | 6.4960E-05 | 1.1400E+06 | 7.2554E-05 | 1.1600E+06 | 7.9329E-05 | 1.1800E+06 | 8.8095E-05 | 1.2000E+06 | 9.7951E-05 |
| 56 | 1.2500E+06 | 1.2769E-04 | 1.3000E+06 | 1.6239E-04 | 1.3500E+06 | 2.0416E-04 | 1.4000E+06 | 2.5500E-04 | 1.4500E+06 | 3.1099E-04 |
| 61 | 1.5000E+06 | 3.7542E-04 | 1.5500E+06 | 4.4524E-04 | 1.6000E+06 | 5.2415E-04 | 1.6500E+06 | 6.0695E-04 | 1.7000E+06 | 6.9696E-04 |
| 66 | 1.7500E+06 | 7.8659E-04 | 1.8000E+06 | 8.8264E-04 | 1.8500E+06 | 9.7645E-04 | 1.9000E+06 | 1.0759E-03 | 1.9500E+06 | 1.1710E-03 |
| 71 | 2.0000E+06 | 1.2692E-03 | 2.2000E+06 | 1.6461E-03 | 2.4000E+06 | 1.9921E-03 | 2.6000E+06 | 2.3005E-03 | 2.8000E+06 | 2.5689E-03 |
| 76 | 3.0000E+06 | 2.7960E-03 | 3.2000E+06 | 2.9768E-03 | 3.4000E+06 | 3.1065E-03 | 3.6000E+06 | 3.1852E-03 | 3.8000E+06 | 3.2188E-03 |
| 81 | 4.0000E+06 | 3.2177E-03 | 4.2000E+06 | 3.1948E-03 | 4.4000E+06 | 3.1628E-03 | 4.6000E+06 | 3.1324E-03 | 4.8000E+06 | 3.1106E-03 |
| 86 | 5.0000E+06 | 3.1005E-03 | 5.2000E+06 | 3.1019E-03 | 5.4000E+06 | 3.1116E-03 | 5.6000E+06 | 3.1248E-03 | 5.8000E+06 | 3.1357E-03 |
| 91 | 6.0000E+06 | 3.1388E-03 | | | | | | | | |

(n,n') 5-th level
Reaction Cross Section

Intermediate State Q-value -7.7900E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 64 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.8225E+05 | 0.0000E+00 | 7.9000E+05 | 2.1837E-14 | 8.0000E+05 | 1.5591E-13 | 8.1000E+05 | 5.7112E-13 | 8.2000E+05 | 1.4867E-12 |
| 6 | 8.3000E+05 | 3.2070E-12 | 8.4000E+05 | 6.1899E-12 | 8.5000E+05 | 1.1089E-11 | 8.6000E+05 | 1.8440E-11 | 8.7000E+05 | 3.1561E-11 |
| 11 | 8.8000E+05 | 4.9314E-11 | 8.9000E+05 | 7.1619E-11 | 9.0000E+05 | 1.0195E-10 | 9.2000E+05 | 2.0458E-10 | 9.4000E+05 | 3.6658E-10 |
| 16 | 9.6000E+05 | 5.9532E-10 | 9.8000E+05 | 8.9294E-10 | 1.0000E+06 | 1.3323E-09 | 1.0200E+06 | 2.0039E-09 | 1.0400E+06 | 2.8906E-09 |
| 21 | 1.0600E+06 | 4.0337E-09 | 1.0800E+06 | 5.4733E-09 | 1.1000E+06 | 7.2857E-09 | 1.1200E+06 | 9.5607E-09 | 1.1400E+06 | 1.2365E-08 |
| 26 | 1.1600E+06 | 1.5397E-08 | 1.1800E+06 | 1.9491E-08 | 1.2000E+06 | 2.4549E-08 | 1.2500E+06 | 4.3843E-08 | 1.3000E+06 | 7.2414E-08 |
| 31 | 1.3500E+06 | 1.1376E-07 | 1.4000E+06 | 1.7431E-07 | 1.4500E+06 | 2.5695E-07 | 1.5000E+06 | 3.6983E-07 | 1.5500E+06 | 5.1587E-07 |
| 36 | 1.6000E+06 | 7.0844E-07 | 1.6500E+06 | 9.4756E-07 | 1.7000E+06 | 1.2493E-06 | 1.7500E+06 | 1.6023E-06 | 1.8000E+06 | 2.0311E-06 |
| 41 | 1.8500E+06 | 2.5148E-06 | 1.9000E+06 | 3.0881E-06 | 1.9500E+06 | 3.7151E-06 | 2.0000E+06 | 4.4113E-06 | 2.2000E+06 | 7.9496E-06 |
| 46 | 2.4000E+06 | 1.2351E-05 | 2.6000E+06 | 1.7018E-05 | 2.8000E+06 | 2.1216E-05 | 3.0000E+06 | 2.4266E-05 | 3.2000E+06 | 2.5774E-05 |
| 51 | 3.4000E+06 | 2.5664E-05 | 3.6000E+06 | 2.4103E-05 | 3.8000E+06 | 2.1514E-05 | 4.0000E+06 | 1.8382E-05 | 4.2000E+06 | 1.5118E-05 |
| 56 | 4.4000E+06 | 1.2035E-05 | 4.6000E+06 | 9.3362E-06 | 4.8000E+06 | 7.1017E-06 | 5.0000E+06 | 5.3218E-06 | 5.2000E+06 | 3.9434E-06 |
| 61 | 5.4000E+06 | 2.8968E-06 | 5.6000E+06 | 2.1134E-06 | 5.8000E+06 | 1.5333E-06 | 6.0000E+06 | 1.1072E-06 | | |

(n,n') 6-th level
Reaction Cross Section

Intermediate State Q-value -7.8000E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 64 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.8325E+05 | 0.0000E+00 | 7.9000E+05 | 2.5808E-02 | 8.0000E+05 | 4.2669E-02 | 8.1000E+05 | 5.6305E-02 | 8.2000E+05 | 6.8409E-02 |
| 6 | 8.3000E+05 | 7.8805E-02 | 8.4000E+05 | 8.8058E-02 | 8.5000E+05 | 9.6293E-02 | 8.6000E+05 | 1.0339E-01 | 8.7000E+05 | 1.0904E-01 |
| 11 | 8.8000E+05 | 1.1335E-01 | 8.9000E+05 | 1.1702E-01 | 9.0000E+05 | 1.1999E-01 | 9.2000E+05 | 1.2436E-01 | 9.4000E+05 | 1.2751E-01 |
| 16 | 9.6000E+05 | 1.3033E-01 | 9.8000E+05 | 1.3253E-01 | 1.0000E+06 | 1.3479E-01 | 1.0200E+06 | 1.3659E-01 | 1.0400E+06 | 1.3758E-01 |
| 21 | 1.0600E+06 | 1.3859E-01 | 1.0800E+06 | 1.3787E-01 | 1.1000E+06 | 1.3723E-01 | 1.1200E+06 | 1.3537E-01 | 1.1400E+06 | 1.3424E-01 |
| 26 | 1.1600E+06 | 1.3161E-01 | 1.1800E+06 | 1.2981E-01 | 1.2000E+06 | 1.2847E-01 | 1.2500E+06 | 1.2633E-01 | 1.3000E+06 | 1.2295E-01 |
| 31 | 1.3500E+06 | 1.1895E-01 | 1.4000E+06 | 1.1506E-01 | 1.4500E+06 | 1.1024E-01 | 1.5000E+06 | 1.0571E-01 | 1.5500E+06 | 1.0093E-01 |
| 36 | 1.6000E+06 | 9.6026E-02 | 1.6500E+06 | 9.0404E-02 | 1.7000E+06 | 8.5093E-02 | 1.7500E+06 | 7.9285E-02 | 1.8000E+06 | 7.3918E-02 |
| 41 | 1.8500E+06 | 6.8254E-02 | 1.9000E+06 | 6.3137E-02 | 1.9500E+06 | 5.7885E-02 | 2.0000E+06 | 5.4192E-02 | 2.2000E+06 | 3.7006E-02 |
| 46 | 2.4000E+06 | 2.4617E-02 | 2.6000E+06 | 1.6051E-02 | 2.8000E+06 | 1.0302E-02 | 3.0000E+06 | 6.5316E-03 | 3.2000E+06 | 4.1034E-03 |
| 51 | 3.4000E+06 | 2.5607E-03 | 3.6000E+06 | 1.5904E-03 | 3.8000E+06 | 9.8450E-04 | 4.0000E+06 | 6.0809E-04 | 4.2000E+06 | 3.7502E-04 |
| 56 | 4.4000E+06 | 2.3108E-04 | 4.6000E+06 | 1.4260E-04 | 4.8000E+06 | 8.8289E-05 | 5.0000E+06 | 5.4894E-05 | 5.2000E+06 | 3.4282E-05 |
| 61 | 5.4000E+06 | 2.1506E-05 | 5.6000E+06 | 1.3549E-05 | 5.8000E+06 | 8.5710E-06 | 6.0000E+06 | 5.4426E-06 | | |

(n,n') 7-th level
Reaction Cross Section

Intermediate State Q-value -8.3200E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 59 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.3547E+05 | 0.0000E+00 | 8.4000E+05 | 5.0094E-03 | 8.5000E+05 | 1.0667E-02 | 8.6000E+05 | 1.5780E-02 | 8.7000E+05 | 2.0684E-02 |
| 6 | 8.8000E+05 | 2.5047E-02 | 8.9000E+05 | 2.8983E-02 | 9.0000E+05 | 3.2744E-02 | 9.2000E+05 | 3.9210E-02 | 9.4000E+05 | 4.4665E-02 |
| 11 | 9.6000E+05 | 4.9569E-02 | 9.8000E+05 | 5.4172E-02 | 1.0000E+06 | 5.8421E-02 | 1.0200E+06 | 6.1982E-02 | 1.0400E+06 | 6.5124E-02 |
| 16 | 1.0600E+06 | 6.8240E-02 | 1.0800E+06 | 7.0022E-02 | 1.1000E+06 | 7.2476E-02 | 1.1200E+06 | 7.3580E-02 | 1.1400E+06 | 7.4678E-02 |
| 21 | 1.1600E+06 | 7.5044E-02 | 1.1800E+06 | 7.5966E-02 | 1.2000E+06 | 7.7059E-02 | 1.2500E+06 | 8.0135E-02 | 1.3000E+06 | 8.2275E-02 |
| 26 | 1.3500E+06 | 8.3484E-02 | 1.4000E+06 | 8.4437E-02 | 1.4500E+06 | 8.4253E-02 | 1.5000E+06 | 8.3919E-02 | 1.5500E+06 | 8.2921E-02 |
| 31 | 1.6000E+06 | 8.1626E-02 | 1.6500E+06 | 7.9227E-02 | 1.7000E+06 | 7.6760E-02 | 1.7500E+06 | 7.3460E-02 | 1.8000E+06 | 7.0261E-02 |
| 36 | 1.8500E+06 | 6.6442E-02 | 1.9000E+06 | 6.2882E-02 | 1.9500E+06 | 5.8900E-02 | 2.0000E+06 | 5.5835E-02 | 2.2000E+06 | 4.1146E-02 |
| 41 | 2.4000E+06 | 2.9138E-02 | 2.6000E+06 | 2.0006E-02 | 2.8000E+06 | 1.3406E-02 | 3.0000E+06 | 8.8152E-03 | 3.2000E+06 | 5.7148E-03 |
| 46 | 3.4000E+06 | 3.6656E-03 | 3.6000E+06 | 2.3325E-03 | 3.8000E+06 | 1.4753E-03 | 4.0000E+06 | 9.2901E-04 | 4.2000E+06 | 5.8296E-04 |
| 51 | 4.4000E+06 | 3.6488E-04 | 4.6000E+06 | 2.2839E-04 | 4.8000E+06 | 1.4325E-04 | 5.0000E+06 | 9.0139E-05 | 5.2000E+06 | 5.6927E-05 |
| 56 | 5.4000E+06 | 3.6089E-05 | 5.6000E+06 | 2.2967E-05 | 5.8000E+06 | 1.4668E-05 | 6.0000E+06 | 9.3999E-06 | | |

(n,n') 8-th level
Reaction Cross Section

Intermediate State Q-value -8.6500E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 56 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| | 8.6860E+05 | 0.0000E+00 | 8.7000E+05 | 8.2212E-03 | 8.8000E+05 | 2.4219E-02 | 8.9000E+05 | 3.4306E-02 | 9.0000E+05 | 4.2617E-02 |
| 6 | 9.2000E+05 | 5.5638E-02 | 9.4000E+05 | 6.5899E-02 | 9.6000E+05 | 7.4412E-02 | 9.8000E+05 | 8.1512E-02 | 1.0000E+06 | 8.7912E-02 |
| 11 | 1.0200E+06 | 9.3432E-02 | 1.0400E+06 | 9.7897E-02 | 1.0600E+06 | 1.0191E-01 | 1.0800E+06 | 1.0417E-01 | 1.1000E+06 | 1.0606E-01 |
| 16 | 1.1200E+06 | 1.0664E-01 | 1.1400E+06 | 1.0751E-01 | 1.1600E+06 | 1.0694E-01 | 1.1800E+06 | 1.0685E-01 | 1.2000E+06 | 1.0698E-01 |
| 21 | 1.2500E+06 | 1.0780E-01 | 1.3000E+06 | 1.0694E-01 | 1.3500E+06 | 1.0506E-01 | 1.4000E+06 | 1.0291E-01 | 1.4500E+06 | 9.9653E-02 |
| 26 | 1.5000E+06 | 9.6423E-02 | 1.5500E+06 | 9.2768E-02 | 1.6000E+06 | 8.8846E-02 | 1.6500E+06 | 8.4123E-02 | 1.7000E+06 | 7.9574E-02 |
| 31 | 1.7500E+06 | 7.4463E-02 | 1.8000E+06 | 6.9683E-02 | 1.8500E+06 | 6.4555E-02 | 1.9000E+06 | 5.9887E-02 | 1.9500E+06 | 5.5046E-02 |
| 36 | 2.0000E+06 | 5.1652E-02 | 2.2000E+06 | 3.5517E-02 | 2.4000E+06 | 2.3748E-02 | 2.6000E+06 | 1.5552E-02 | 2.8000E+06 | 1.0021E-02 |
| 41 | 3.0000E+06 | 6.3747E-03 | 3.2000E+06 | 4.0161E-03 | 3.4000E+06 | 2.5120E-03 | 3.6000E+06 | 1.5630E-03 | 3.8000E+06 | 9.6900E-04 |
| 46 | 4.0000E+06 | 5.9924E-04 | 4.2000E+06 | 3.6994E-04 | 4.4000E+06 | 2.2814E-04 | 4.6000E+06 | 1.4089E-04 | 4.8000E+06 | 8.7297E-05 |
| 51 | 5.0000E+06 | 5.4312E-05 | 5.2000E+06 | 3.3939E-05 | 5.4000E+06 | 2.1302E-05 | 5.6000E+06 | 1.3428E-05 | 5.8000E+06 | 8.4984E-06 |
| 56 | 6.0000E+06 | 5.3988E-06 | | | | | | | | |

(n,n') 9-th level
Reaction Cross Section

Intermediate State Q-value -9.2700E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 51 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.3086E+05 | 0.0000E+00 | 9.4000E+05 | 8.7567E-05 | 9.6000E+05 | 3.1473E-04 | 9.8000E+05 | 5.8560E-04 | 1.0000E+06 | 9.0653E-04 |
| 6 | 1.0200E+06 | 1.2717E-03 | 1.0400E+06 | 1.6692E-03 | 1.0600E+06 | 2.0886E-03 | 1.0800E+06 | 2.5200E-03 | 1.1000E+06 | 2.9735E-03 |
| 11 | 1.1200E+06 | 3.4459E-03 | 1.1400E+06 | 3.9655E-03 | 1.1600E+06 | 4.3930E-03 | 1.1800E+06 | 4.8888E-03 | 1.2000E+06 | 5.4068E-03 |
| 16 | 1.2500E+06 | 6.8111E-03 | 1.3000E+06 | 8.3410E-03 | 1.3500E+06 | 9.8336E-03 | 1.4000E+06 | 1.1348E-02 | 1.4500E+06 | 1.2718E-02 |
| 21 | 1.5000E+06 | 1.4039E-02 | 1.5500E+06 | 1.5207E-02 | 1.6000E+06 | 1.6299E-02 | 1.6500E+06 | 1.7077E-02 | 1.7000E+06 | 1.7736E-02 |
| 26 | 1.7500E+06 | 1.8081E-02 | 1.8000E+06 | 1.8335E-02 | 1.8500E+06 | 1.8296E-02 | 1.9000E+06 | 1.8209E-02 | 1.9500E+06 | 1.7870E-02 |
| 31 | 2.0000E+06 | 1.7595E-02 | 2.2000E+06 | 1.5128E-02 | 2.4000E+06 | 1.2148E-02 | 2.6000E+06 | 9.2672E-03 | 2.8000E+06 | 6.7927E-03 |
| 36 | 3.0000E+06 | 4.8252E-03 | 3.2000E+06 | 3.3451E-03 | 3.4000E+06 | 2.2757E-03 | 3.6000E+06 | 1.5256E-03 | 3.8000E+06 | 1.0108E-03 |
| 41 | 4.0000E+06 | 6.6365E-04 | 4.2000E+06 | 4.3250E-04 | 4.4000E+06 | 2.8018E-04 | 4.6000E+06 | 1.8095E-04 | 4.8000E+06 | 1.1679E-04 |
| 46 | 5.0000E+06 | 7.5440E-05 | 5.2000E+06 | 4.8809E-05 | 5.4000E+06 | 3.1644E-05 | 5.6000E+06 | 2.0562E-05 | 5.8000E+06 | 1.3392E-05 |
| 51 | 6.0000E+06 | 8.7408E-06 | | | | | | | | |

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

(n,n')10-th level
Reaction Cross Section

Intermediate State Q-value -9.5600E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 50 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.5998E+05 | 0.0000E+00 | 9.6000E+05 | 8.2674E-04 | 9.8000E+05 | 9.5465E-03 | 1.0000E+06 | 1.5370E-02 | 1.0200E+06 | 2.0392E-02 |
| 6 | 1.0400E+06 | 2.4749E-02 | 1.0600E+06 | 2.8575E-02 | 1.0800E+06 | 3.1790E-02 | 1.1000E+06 | 3.4344E-02 | 1.1200E+06 | 3.6451E-02 |
| 11 | 1.1400E+06 | 3.8468E-02 | 1.1600E+06 | 3.9321E-02 | 1.1800E+06 | 4.0159E-02 | 1.2000E+06 | 4.1046E-02 | 1.2500E+06 | 4.2730E-02 |
| 16 | 1.3000E+06 | 4.3190E-02 | 1.3500E+06 | 4.2924E-02 | 1.4000E+06 | 4.2314E-02 | 1.4500E+06 | 4.1109E-02 | 1.5000E+06 | 3.9809E-02 |
| 21 | 1.5500E+06 | 3.8286E-02 | 1.6000E+06 | 3.6625E-02 | 1.6500E+06 | 3.4651E-02 | 1.7000E+06 | 3.2751E-02 | 1.7500E+06 | 3.0639E-02 |
| 26 | 1.8000E+06 | 2.8671E-02 | 1.8500E+06 | 2.6578E-02 | 1.9000E+06 | 2.4680E-02 | 1.9500E+06 | 2.2720E-02 | 2.0000E+06 | 2.1425E-02 |
| 31 | 2.2000E+06 | 1.4879E-02 | 2.4000E+06 | 1.0070E-02 | 2.6000E+06 | 6.6586E-03 | 2.8000E+06 | 4.3091E-03 | 3.0000E+06 | 2.7376E-03 |
| 36 | 3.2000E+06 | 1.7140E-03 | 3.4000E+06 | 1.0619E-03 | 3.6000E+06 | 6.5318E-04 | 3.8000E+06 | 3.9992E-04 | 4.0000E+06 | 2.4422E-04 |
| 41 | 4.2000E+06 | 1.4896E-04 | 4.4000E+06 | 9.0851E-05 | 4.6000E+06 | 5.5548E-05 | 4.8000E+06 | 3.4116E-05 | 5.0000E+06 | 2.1064E-05 |
| 46 | 5.2000E+06 | 1.3076E-05 | 5.4000E+06 | 8.1606E-06 | 5.6000E+06 | 5.1186E-06 | 5.8000E+06 | 3.2257E-06 | 6.0000E+06 | 2.0417E-06 |

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

(n,n')11-th level
Reaction Cross Section

Intermediate State Q-value -9.9500E+05 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 48 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9.9915E+05 | 0.0000E+00 | 1.0000E+06 | 2.2373E-03 | 1.0200E+06 | 1.4999E-02 | 1.0400E+06 | 2.5559E-02 | 1.0600E+06 | 3.5179E-02 |
| 6 | 1.0800E+06 | 4.3794E-02 | 1.1000E+06 | 5.1824E-02 | 1.1200E+06 | 5.8607E-02 | 1.1400E+06 | 6.4726E-02 | 1.1600E+06 | 6.9121E-02 |
| 11 | 1.1800E+06 | 7.3457E-02 | 1.2000E+06 | 7.7672E-02 | 1.2500E+06 | 8.6622E-02 | 1.3000E+06 | 9.2466E-02 | 1.3500E+06 | 9.6103E-02 |
| 16 | 1.4000E+06 | 9.8510E-02 | 1.4500E+06 | 9.8971E-02 | 1.5000E+06 | 9.8741E-02 | 1.5500E+06 | 9.7519E-02 | 1.6000E+06 | 9.5604E-02 |
| 21 | 1.6500E+06 | 9.2376E-02 | 1.7000E+06 | 8.8998E-02 | 1.7500E+06 | 8.4673E-02 | 1.8000E+06 | 8.0462E-02 | 1.8500E+06 | 7.5601E-02 |
| 26 | 1.9000E+06 | 7.1072E-02 | 1.9500E+06 | 6.6143E-02 | 2.0000E+06 | 6.2614E-02 | 2.2000E+06 | 4.4969E-02 | 2.4000E+06 | 3.1197E-02 |
| 31 | 2.6000E+06 | 2.1072E-02 | 2.8000E+06 | 1.3921E-02 | 3.0000E+06 | 9.0299E-03 | 3.2000E+06 | 5.7738E-03 | 3.4000E+06 | 3.6523E-03 |
| 36 | 3.6000E+06 | 2.2922E-03 | 3.8000E+06 | 1.4304E-03 | 4.0000E+06 | 8.8910E-04 | 4.2000E+06 | 5.5113E-04 | 4.4000E+06 | 3.4101E-04 |
| 41 | 4.6000E+06 | 2.1114E-04 | 4.8000E+06 | 1.3108E-04 | 5.0000E+06 | 8.1676E-05 | 5.2000E+06 | 5.1095E-05 | 5.4000E+06 | 3.2097E-05 |
| 46 | 5.6000E+06 | 2.0245E-05 | 5.8000E+06 | 1.2820E-05 | 6.0000E+06 | 8.1487E-06 | | | | |

(n,n')12-th level
Reaction Cross Section

Intermediate State Q-value -1.0190E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 46 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0232E+06 | 0.0000E+00 | 1.0400E+06 | 7.3874E-03 | 1.0600E+06 | 1.2910E-02 | 1.0800E+06 | 1.7589E-02 | 1.1000E+06 | 2.2191E-02 |
| 6 | 1.1200E+06 | 2.6135E-02 | 1.1400E+06 | 2.9732E-02 | 1.1600E+06 | 3.2779E-02 | 1.1800E+06 | 3.5800E-02 | 1.2000E+06 | 3.8686E-02 |
| 11 | 1.2500E+06 | 4.5322E-02 | 1.3000E+06 | 5.0557E-02 | 1.3500E+06 | 5.4563E-02 | 1.4000E+06 | 5.7914E-02 | 1.4500E+06 | 6.0062E-02 |
| 16 | 1.5000E+06 | 6.1754E-02 | 1.5500E+06 | 6.2656E-02 | 1.6000E+06 | 6.3090E-02 | 1.6500E+06 | 6.2431E-02 | 1.7000E+06 | 6.1505E-02 |
| 21 | 1.7500E+06 | 5.9722E-02 | 1.8000E+06 | 5.7852E-02 | 1.8500E+06 | 5.5320E-02 | 1.9000E+06 | 5.2874E-02 | 1.9500E+06 | 4.9961E-02 |
| 26 | 2.0000E+06 | 4.7706E-02 | 2.2000E+06 | 3.6043E-02 | 2.4000E+06 | 2.6008E-02 | 2.6000E+06 | 1.8141E-02 | 2.8000E+06 | 1.2324E-02 |
| 31 | 3.0000E+06 | 8.1986E-03 | 3.2000E+06 | 5.3655E-03 | 3.4000E+06 | 3.4678E-03 | 3.6000E+06 | 2.2201E-03 | 3.8000E+06 | 1.4111E-03 |
| 36 | 4.0000E+06 | 8.9205E-04 | 4.2000E+06 | 5.6160E-04 | 4.4000E+06 | 3.5250E-04 | 4.6000E+06 | 2.2117E-04 | 4.8000E+06 | 1.3902E-04 |
| 41 | 5.0000E+06 | 8.7641E-05 | 5.2000E+06 | 5.5442E-05 | 5.4000E+06 | 3.5202E-05 | 5.6000E+06 | 2.2433E-05 | 5.8000E+06 | 1.4346E-05 |
| 46 | 6.0000E+06 | 9.2042E-06 | | | | | | | | |

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(n,n')13-th level
Reaction Cross Section

Intermediate State Q-value -1.0400E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 45 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0443E+06 | 0.0000E+00 | 1.0600E+06 | 1.4275E-03 | 1.0800E+06 | 3.7332E-03 | 1.1000E+06 | 6.0817E-03 | 1.1200E+06 | 8.6408E-03 |
| 6 | 1.1400E+06 | 1.1177E-02 | 1.1600E+06 | 1.3454E-02 | 1.1800E+06 | 1.5692E-02 | 1.2000E+06 | 1.7934E-02 | 1.2500E+06 | 2.3247E-02 |
| 11 | 1.3000E+06 | 2.7958E-02 | 1.3500E+06 | 3.1811E-02 | 1.4000E+06 | 3.5211E-02 | 1.4500E+06 | 3.7769E-02 | 1.5000E+06 | 3.9883E-02 |
| 16 | 1.5500E+06 | 4.1450E-02 | 1.6000E+06 | 4.2643E-02 | 1.6500E+06 | 4.2987E-02 | 1.7000E+06 | 4.3080E-02 | 1.7500E+06 | 4.2495E-02 |
| 21 | 1.8000E+06 | 4.1788E-02 | 1.8500E+06 | 4.0535E-02 | 1.9000E+06 | 3.9287E-02 | 1.9500E+06 | 3.7626E-02 | 2.0000E+06 | 3.6364E-02 |
| 26 | 2.2000E+06 | 2.8910E-02 | 2.4000E+06 | 2.1848E-02 | 2.6000E+06 | 1.5857E-02 | 2.8000E+06 | 1.1126E-02 | 3.0000E+06 | 7.5938E-03 |
| 31 | 3.2000E+06 | 5.0720E-03 | 3.4000E+06 | 3.3329E-03 | 3.6000E+06 | 2.1637E-03 | 3.8000E+06 | 1.3920E-03 | 4.0000E+06 | 8.8942E-04 |
| 36 | 4.2000E+06 | 5.6539E-04 | 4.4000E+06 | 3.5799E-04 | 4.6000E+06 | 2.2635E-04 | 4.8000E+06 | 1.4322E-04 | 5.0000E+06 | 9.0802E-05 |
| 41 | 5.2000E+06 | 5.7714E-05 | 5.4000E+06 | 3.6790E-05 | 5.6000E+06 | 2.3524E-05 | 5.8000E+06 | 1.5088E-05 | 6.0000E+06 | 9.7057E-06 |

(n,n')14-th level
Reaction Cross Section

Intermediate State Q-value -1.0640E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 44 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0684E+06 | 0.0000E+00 | 1.0800E+06 | 2.9726E-03 | 1.1000E+06 | 5.6588E-03 | 1.1200E+06 | 7.9526E-03 | 1.1400E+06 | 1.0110E-02 |
| 6 | 1.1600E+06 | 1.1933E-02 | 1.1800E+06 | 1.3703E-02 | 1.2000E+06 | 1.5473E-02 | 1.2500E+06 | 1.9535E-02 | 1.3000E+06 | 2.3113E-02 |
| 11 | 1.3500E+06 | 2.6052E-02 | 1.4000E+06 | 2.8693E-02 | 1.4500E+06 | 3.0747E-02 | 1.5000E+06 | 3.2548E-02 | 1.5500E+06 | 3.3888E-02 |
| 16 | 1.6000E+06 | 3.5012E-02 | 1.6500E+06 | 3.5459E-02 | 1.7000E+06 | 3.5701E-02 | 1.7500E+06 | 3.5373E-02 | 1.8000E+06 | 3.4931E-02 |
| 21 | 1.8500E+06 | 3.4010E-02 | 1.9000E+06 | 3.3074E-02 | 1.9500E+06 | 3.1767E-02 | 2.0000E+06 | 3.0733E-02 | 2.2000E+06 | 2.4604E-02 |
| 26 | 2.4000E+06 | 1.8672E-02 | 2.6000E+06 | 1.3616E-02 | 2.8000E+06 | 9.6174E-03 | 3.0000E+06 | 6.6210E-03 | 3.2000E+06 | 4.4655E-03 |
| 31 | 3.4000E+06 | 2.9637E-03 | 3.6000E+06 | 1.9427E-03 | 3.8000E+06 | 1.2611E-03 | 4.0000E+06 | 8.1244E-04 | 4.2000E+06 | 5.2031E-04 |
| 36 | 4.4000E+06 | 3.3171E-04 | 4.6000E+06 | 2.1109E-04 | 4.8000E+06 | 1.3440E-04 | 5.0000E+06 | 8.5730E-05 | 5.2000E+06 | 5.4819E-05 |
| 41 | 5.4000E+06 | 3.5153E-05 | 5.6000E+06 | 2.2608E-05 | 5.8000E+06 | 1.4581E-05 | 6.0000E+06 | 9.4290E-06 | | |

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(n,n')15-th level
Reaction Cross Section

Intermediate State Q-value -1.0870E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 43 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0915E+06 | 0.0000E+00 | 1.1000E+06 | 7.4632E-19 | 1.1200E+06 | 2.0558E-16 | 1.1400E+06 | 1.3120E-15 | 1.1600E+06 | 4.1263E-15 |
| 6 | 1.1800E+06 | 1.1194E-14 | 1.2000E+06 | 2.2125E-14 | 1.2500E+06 | 1.4456E-13 | 1.3000E+06 | 6.3863E-13 | 1.3500E+06 | 2.2865E-12 |
| 11 | 1.4000E+06 | 5.7460E-12 | 1.4500E+06 | 1.3268E-11 | 1.5000E+06 | 2.7200E-11 | 1.5500E+06 | 5.1930E-11 | 1.6000E+06 | 9.1132E-11 |
| 16 | 1.6500E+06 | 1.5475E-10 | 1.7000E+06 | 2.5390E-10 | 1.7500E+06 | 4.0014E-10 | 1.8000E+06 | 6.1108E-10 | 1.8500E+06 | 9.2475E-10 |
| 21 | 1.9000E+06 | 1.3503E-09 | 1.9500E+06 | 1.8966E-09 | 2.0000E+06 | 2.5601E-09 | 2.2000E+06 | 7.8841E-09 | 2.4000E+06 | 1.8627E-08 |
| 26 | 2.6000E+06 | 3.8975E-08 | 2.8000E+06 | 6.9638E-08 | 3.0000E+06 | 1.0945E-07 | 3.2000E+06 | 1.5544E-07 | 3.4000E+06 | 2.0408E-07 |
| 31 | 3.6000E+06 | 2.5003E-07 | 3.8000E+06 | 2.8905E-07 | 4.0000E+06 | 3.1764E-07 | 4.2000E+06 | 3.3310E-07 | 4.4000E+06 | 3.3526E-07 |
| 36 | 4.6000E+06 | 3.2547E-07 | 4.8000E+06 | 3.0619E-07 | 5.0000E+06 | 2.8037E-07 | 5.2000E+06 | 2.5070E-07 | 5.4000E+06 | 2.1937E-07 |
| 41 | 5.6000E+06 | 1.8820E-07 | 5.8000E+06 | 1.5857E-07 | 6.0000E+06 | 1.3137E-07 | | | | |

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

(n,n')16-th level
Reaction Cross Section

Intermediate State Q-value -1.1020E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 42 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.1066E+06 | 0.0000E+00 | 1.1200E+06 | 7.9588E-03 | 1.1400E+06 | 1.6038E-02 | 1.1600E+06 | 2.3042E-02 | 1.1800E+06 | 2.9893E-02 |
| 6 | 1.2000E+06 | 3.6330E-02 | 1.2500E+06 | 5.0662E-02 | 1.3000E+06 | 6.1752E-02 | 1.3500E+06 | 6.9720E-02 | 1.4000E+06 | 7.5549E-02 |
| 11 | 1.4500E+06 | 7.9041E-02 | 1.5000E+06 | 8.1320E-02 | 1.5500E+06 | 8.2239E-02 | 1.6000E+06 | 8.2143E-02 | 1.6500E+06 | 8.0575E-02 |
| 16 | 1.7000E+06 | 7.8593E-02 | 1.7500E+06 | 7.5540E-02 | 1.8000E+06 | 7.2396E-02 | 1.8500E+06 | 6.8510E-02 | 1.9000E+06 | 6.4795E-02 |
| 21 | 1.9500E+06 | 6.0611E-02 | 2.0000E+06 | 5.7628E-02 | 2.2000E+06 | 4.1907E-02 | 2.4000E+06 | 2.9319E-02 | 2.6000E+06 | 1.9951E-02 |
| 26 | 2.8000E+06 | 1.3276E-02 | 3.0000E+06 | 8.6710E-03 | 3.2000E+06 | 5.5775E-03 | 3.4000E+06 | 3.5451E-03 | 3.6000E+06 | 2.2334E-03 |
| 31 | 3.8000E+06 | 1.3978E-03 | 4.0000E+06 | 8.7079E-04 | 4.2000E+06 | 5.4070E-04 | 4.4000E+06 | 3.3504E-04 | 4.6000E+06 | 2.0770E-04 |
| 36 | 4.8000E+06 | 1.2909E-04 | 5.0000E+06 | 8.0508E-05 | 5.2000E+06 | 5.0409E-05 | 5.4000E+06 | 3.1691E-05 | 5.6000E+06 | 2.0003E-05 |
| 41 | 5.8000E+06 | 1.2675E-05 | 6.0000E+06 | 8.0613E-06 | | | | | | |

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

(n,n')17-th level
Reaction Cross Section

Intermediate State Q-value -1.1220E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 41 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.1267E+06 | 0.0000E+00 | 1.1400E+06 | 1.1299E-04 | 1.1600E+06 | 3.1141E-04 | 1.1800E+06 | 5.4496E-04 | 1.2000E+06 | 8.2294E-04 |
| 6 | 1.2500E+06 | 1.6595E-03 | 1.3000E+06 | 2.6889E-03 | 1.3500E+06 | 3.8232E-03 | 1.4000E+06 | 5.0479E-03 | 1.4500E+06 | 6.2723E-03 |
| 11 | 1.5000E+06 | 7.5191E-03 | 1.5500E+06 | 8.7065E-03 | 1.6000E+06 | 9.8657E-03 | 1.6500E+06 | 1.0831E-02 | 1.7000E+06 | 1.1703E-02 |
| 16 | 1.7500E+06 | 1.2338E-02 | 1.8000E+06 | 1.2880E-02 | 1.8500E+06 | 1.3179E-02 | 1.9000E+06 | 1.3405E-02 | 1.9500E+06 | 1.3410E-02 |
| 21 | 2.0000E+06 | 1.3419E-02 | 2.2000E+06 | 1.2149E-02 | 2.4000E+06 | 1.0117E-02 | 2.6000E+06 | 7.9432E-03 | 2.8000E+06 | 5.9616E-03 |
| 26 | 3.0000E+06 | 4.3179E-03 | 3.2000E+06 | 3.0402E-03 | 3.4000E+06 | 2.0936E-03 | 3.6000E+06 | 1.4170E-03 | 3.8000E+06 | 9.4619E-04 |
| 31 | 4.0000E+06 | 6.2509E-04 | 4.2000E+06 | 4.0947E-04 | 4.4000E+06 | 2.6646E-04 | 4.6000E+06 | 1.7276E-04 | 4.8000E+06 | 1.1189E-04 |
| 36 | 5.0000E+06 | 7.2489E-05 | 5.2000E+06 | 4.7025E-05 | 5.4000E+06 | 3.0561E-05 | 5.6000E+06 | 1.9901E-05 | 5.8000E+06 | 1.2987E-05 |
| 41 | 6.0000E+06 | 8.4911E-06 | | | | | | | | |

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(n,n')18-th level
Reaction Cross Section

Intermediate State Q-value -1.1520E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 40 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.1568E+06 | 0.0000E+00 | 1.1600E+06 | 3.5480E-03 | 1.1800E+06 | 1.1132E-02 | 1.2000E+06 | 1.7043E-02 | 1.2500E+06 | 2.9639E-02 |
| 6 | 1.3000E+06 | 3.9678E-02 | 1.3500E+06 | 4.7503E-02 | 1.4000E+06 | 5.3496E-02 | 1.4500E+06 | 5.7509E-02 | 1.5000E+06 | 6.0507E-02 |
| 11 | 1.5500E+06 | 6.2342E-02 | 1.6000E+06 | 6.3292E-02 | 1.6500E+06 | 6.2976E-02 | 1.7000E+06 | 6.2215E-02 | 1.7500E+06 | 6.0482E-02 |
| 16 | 1.8000E+06 | 5.8559E-02 | 1.8500E+06 | 5.5920E-02 | 1.9000E+06 | 5.3319E-02 | 1.9500E+06 | 5.0233E-02 | 2.0000E+06 | 4.7998E-02 |
| 21 | 2.2000E+06 | 3.5562E-02 | 2.4000E+06 | 2.5141E-02 | 2.6000E+06 | 1.7219E-02 | 2.8000E+06 | 1.1522E-02 | 3.0000E+06 | 7.5709E-03 |
| 26 | 3.2000E+06 | 4.9031E-03 | 3.4000E+06 | 3.1390E-03 | 3.6000E+06 | 1.9920E-03 | 3.8000E+06 | 1.2557E-03 | 4.0000E+06 | 7.8751E-04 |
| 31 | 4.2000E+06 | 4.9203E-04 | 4.4000E+06 | 3.0662E-04 | 4.6000E+06 | 1.9109E-04 | 4.8000E+06 | 1.1937E-04 | 5.0000E+06 | 7.4816E-05 |
| 36 | 5.2000E+06 | 4.7073E-05 | 5.4000E+06 | 2.9737E-05 | 5.6000E+06 | 1.8861E-05 | 5.8000E+06 | 1.2008E-05 | 6.0000E+06 | 7.6720E-06 |

94-Plutonium-242 Material No. 9446 Sub-library No. 10 ENDF/B-VI

(n,n') continuum
Reaction Cross Section

Intermediate State Q-value -1.1520E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 40 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.1568E+06 | 0.0000E+00 | 1.1600E+06 | 9.4737E-09 | 1.1800E+06 | 1.8595E-03 | 1.2000E+06 | 5.5415E-03 | 1.2500E+06 | 2.2045E-02 |
| 6 | 1.3000E+06 | 4.3579E-02 | 1.3500E+06 | 8.5836E-02 | 1.4000E+06 | 1.2319E-01 | 1.4500E+06 | 1.8016E-01 | 1.5000E+06 | 2.2959E-01 |
| 11 | 1.5500E+06 | 2.9844E-01 | 1.6000E+06 | 3.5712E-01 | 1.6500E+06 | 4.3159E-01 | 1.7000E+06 | 4.9365E-01 | 1.7500E+06 | 5.6968E-01 |
| 16 | 1.8000E+06 | 6.3151E-01 | 1.8500E+06 | 7.0561E-01 | 1.9000E+06 | 7.6458E-01 | 1.9500E+06 | 8.3467E-01 | 2.0000E+06 | 9.1306E-01 |
| 21 | 2.2000E+06 | 1.1323E+00 | 2.4000E+06 | 1.3041E+00 | 2.6000E+06 | 1.4323E+00 | 2.8000E+06 | 1.5248E+00 | 3.0000E+06 | 1.5900E+00 |
| 26 | 3.2000E+06 | 1.6359E+00 | 3.4000E+06 | 1.6680E+00 | 3.6000E+06 | 1.6906E+00 | 3.8000E+06 | 1.7068E+00 | 4.0000E+06 | 1.7188E+00 |
| 31 | 4.2000E+06 | 1.7281E+00 | 4.4000E+06 | 1.7355E+00 | 4.6000E+06 | 1.7394E+00 | 4.8000E+06 | 1.7384E+00 | 5.0000E+06 | 1.7319E+00 |
| 36 | 5.2000E+06 | 1.7198E+00 | 5.4000E+06 | 1.7022E+00 | 5.6000E+06 | 1.6794E+00 | 5.8000E+06 | 1.6516E+00 | 6.0000E+06 | 1.6188E+00 |

(n,g)
Reaction Cross Section

Reaction Q-value 5.0342E+06 eV
Intermediate State Q-value 5.0342E+06 eV

Interpolation Law between Energies

| Range | Description |
|---|---|
| 1 TO 148 | Y LINEAR IN X |

CROSS SECTIONS

| Index | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns | Energy eV | Sigma Barns |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.0000E+04 | 1.0078E+00 | 1.5000E+04 | 8.7086E-01 | 2.0000E+04 | 7.8182E-01 | 2.5000E+04 | 7.1541E-01 | 3.0000E+04 | 6.6386E-01 |
| 6 | 3.5000E+04 | 6.2194E-01 | 4.0000E+04 | 5.8483E-01 | 4.5000E+04 | 5.3400E-01 | 5.0000E+04 | 4.8602E-01 | 5.5000E+04 | 4.4642E-01 |
| 11 | 6.0000E+04 | 4.1379E-01 | 6.5000E+04 | 3.8635E-01 | 7.0000E+04 | 3.6316E-01 | 7.5000E+04 | 3.4328E-01 | 8.0000E+04 | 3.2621E-01 |
| 16 | 8.5000E+04 | 3.1196E-01 | 9.0000E+04 | 3.0015E-01 | 9.5000E+04 | 2.8971E-01 | 1.0000E+05 | 2.8005E-01 | 1.1000E+05 | 2.6370E-01 |
| 21 | 1.2000E+05 | 2.5079E-01 | 1.3000E+05 | 2.4033E-01 | 1.4000E+05 | 2.3181E-01 | 1.5000E+05 | 2.2438E-01 | 1.6000E+05 | 2.1827E-01 |
| 26 | 1.7000E+05 | 2.1290E-01 | 1.8000E+05 | 2.0815E-01 | 1.9000E+05 | 2.0391E-01 | 2.0000E+05 | 2.0014E-01 | 2.1000E+05 | 1.9676E-01 |
| 31 | 2.2000E+05 | 1.9375E-01 | 2.3000E+05 | 1.9102E-01 | 2.4000E+05 | 1.8847E-01 | 2.5000E+05 | 1.8610E-01 | 2.6000E+05 | 1.8391E-01 |
| 36 | 2.7000E+05 | 1.8200E-01 | 2.8000E+05 | 1.8044E-01 | 2.9000E+05 | 1.7926E-01 | 3.0000E+05 | 1.7839E-01 | 3.1000E+05 | 1.7763E-01 |
| 41 | 3.2000E+05 | 1.7706E-01 | 3.4000E+05 | 1.7608E-01 | 3.5000E+05 | 1.7579E-01 | 3.6000E+05 | 1.7571E-01 | 3.8000E+05 | 1.7605E-01 |
| 46 | 3.9000E+05 | 1.7625E-01 | 4.0000E+05 | 1.7636E-01 | 4.1000E+05 | 1.7633E-01 | 4.2000E+05 | 1.7617E-01 | 4.3000E+05 | 1.7593E-01 |
| 51 | 4.4000E+05 | 1.7559E-01 | 4.5000E+05 | 1.7522E-01 | 4.6000E+05 | 1.7489E-01 | 4.7000E+05 | 1.7468E-01 | 4.8000E+05 | 1.7466E-01 |
| 56 | 4.9000E+05 | 1.7485E-01 | 5.0000E+05 | 1.7516E-01 | 5.1000E+05 | 1.7549E-01 | 5.2000E+05 | 1.7555E-01 | 5.3000E+05 | 1.7537E-01 |
| 61 | 5.4000E+05 | 1.7485E-01 | 5.5000E+05 | 1.7408E-01 | 5.6000E+05 | 1.7322E-01 | 5.7000E+05 | 1.7245E-01 | 5.8000E+05 | 1.7194E-01 |
| 66 | 5.9000E+05 | 1.7174E-01 | 6.0000E+05 | 1.7169E-01 | 6.1000E+05 | 1.7157E-01 | 6.2000E+05 | 1.7121E-01 | 6.3000E+05 | 1.7065E-01 |
| 71 | 6.4000E+05 | 1.6994E-01 | 6.5000E+05 | 1.6912E-01 | 6.6000E+05 | 1.6821E-01 | 6.7000E+05 | 1.6730E-01 | 6.8000E+05 | 1.6641E-01 |
| 76 | 6.9000E+05 | 1.6553E-01 | 7.0000E+05 | 1.6463E-01 | 7.1000E+05 | 1.6364E-01 | 7.2000E+05 | 1.6262E-01 | 7.3000E+05 | 1.6161E-01 |
| 81 | 7.4000E+05 | 1.6077E-01 | 7.5000E+05 | 1.6019E-01 | 7.6000E+05 | 1.5988E-01 | 7.7000E+05 | 1.5982E-01 | 7.8000E+05 | 1.5990E-01 |
| 86 | 7.9000E+05 | 1.5875E-01 | 8.0000E+05 | 1.5794E-01 | 8.1000E+05 | 1.5711E-01 | 8.2000E+05 | 1.5612E-01 | 8.3000E+05 | 1.5495E-01 |
| 91 | 8.4000E+05 | 1.5316E-01 | 8.5000E+05 | 1.5111E-01 | 8.6000E+05 | 1.4886E-01 | 8.7000E+05 | 1.4603E-01 | 8.8000E+05 | 1.4271E-01 |
| 96 | 8.9000E+05 | 1.3950E-01 | 9.0000E+05 | 1.3629E-01 | 9.2000E+05 | 1.3015E-01 | 9.4000E+05 | 1.2485E-01 | 9.6000E+05 | 1.2082E-01 |
| 101 | 9.8000E+05 | 1.1784E-01 | 1.0000E+06 | 1.1588E-01 | 1.0200E+06 | 1.1422E-01 | 1.0400E+06 | 1.1266E-01 | 1.0600E+06 | 1.1185E-01 |
| 106 | 1.0800E+06 | 1.0999E-01 | 1.1000E+06 | 1.0902E-01 | 1.1200E+06 | 1.0744E-01 | 1.1400E+06 | 1.0652E-01 | 1.1600E+06 | 1.0431E-01 |
| 111 | 1.1800E+06 | 1.0327E-01 | 1.2000E+06 | 1.0301E-01 | 1.2500E+06 | 1.0391E-01 | 1.3000E+06 | 1.0504E-01 | 1.3500E+06 | 1.0613E-01 |
| 116 | 1.4000E+06 | 1.0785E-01 | 1.4500E+06 | 1.0891E-01 | 1.5000E+06 | 1.1039E-01 | 1.5500E+06 | 1.1160E-01 | 1.6000E+06 | 1.1281E-01 |
| 121 | 1.6500E+06 | 1.1283E-01 | 1.7000E+06 | 1.1297E-01 | 1.7500E+06 | 1.1196E-01 | 1.8000E+06 | 1.1112E-01 | 1.8500E+06 | 1.0919E-01 |
| 126 | 1.9000E+06 | 1.0753E-01 | 1.9500E+06 | 1.0489E-01 | 2.0000E+06 | 1.0283E-01 | 2.2000E+06 | 9.0140E-02 | 2.4000E+06 | 7.6220E-02 |
| 131 | 2.6000E+06 | 6.2577E-02 | 2.8000E+06 | 5.0160E-02 | 3.0000E+06 | 3.9443E-02 | 3.2000E+06 | 3.0544E-02 | 3.4000E+06 | 2.3358E-02 |
| 136 | 3.6000E+06 | 1.7679E-02 | 3.8000E+06 | 1.3266E-02 | 4.0000E+06 | 9.8829E-03 | 4.2000E+06 | 7.3181E-03 | 4.4000E+06 | 5.3922E-03 |
| 141 | 4.6000E+06 | 3.9641E-03 | 4.8000E+06 | 2.9139E-03 | 5.0000E+06 | 2.1443E-03 | 5.2000E+06 | 1.5808E-03 | 5.4000E+06 | 1.1678E-03 |
| 146 | 5.6000E+06 | 8.6460E-04 | 5.8000E+06 | 6.4157E-04 | 6.0000E+06 | 4.7709E-04 | | | | |

All data sets requested have been processed.

# APPENDIX C

## *Legendre polynomials for MT=2, 51, 52*

| E(MeV) | $a_1$ | $a_2$ | $a_3$ | $a_4$ | $a_5$ | $a_6$ | $a_7$ | $a_8$ | $a_9$ | $a_{10}$ | $a_{11}$ | $a_{12}$ | $a_{13}$ | $a_{14}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | MT = 2 | | | | | | | |
| 0.01 | 0.1456E-01 | | | | | | | | | | | | | |
| 0.05 | 0.6532E-01 | 0.1769E-01 | 0.8077E-04 | 0.6260E-05 | | | | | | | | | | |
| 0.10 | 0.1231E+00 | 0.2896E-01 | 0.5421E-03 | 0.5502E-04 | | | | | | | | | | |
| 0.20 | 0.2141E+00 | 0.5678E-01 | 0.3643E-02 | 0.5104E-03 | | | | | | | | | | |
| 0.30 | 0.2791E+00 | 0.8824E-01 | 0.1071E-01 | 0.1703E-02 | 0.2325E-04 | 0.1078E-04 | | | | | | | | |
| 0.40 | 0.3256E+00 | 0.1202E+00 | 0.2226E-01 | 0.4039E-02 | 0.9183E-04 | 0.3832E-04 | | | | | | | | |
| 0.60 | 0.3932E+00 | 0.1797E+00 | 0.5934E-01 | 0.1410E-01 | 0.6857E-03 | 0.2527E-03 | | | | | | | | |
| 0.75 | 0.4361E+00 | 0.2209E+00 | 0.9881E-01 | 0.2843E-01 | 0.2124E-02 | 0.6962E-03 | 0.2538E-04 | 0.6231E-05 | | | | | | |
| 1.00 | 0.5073E+00 | 0.2898E+00 | 0.1817E+00 | 0.6931E-01 | 0.9015E-02 | 0.2460E-02 | 0.1748E-03 | 0.2727E-04 | | | | | | |
| 1.50 | 0.5918E+00 | 0.4112E+00 | 0.3192E+00 | 0.1870E+00 | 0.5034E-01 | 0.1456E-01 | 0.2093E-02 | 0.3408E-03 | | | | | | |
| 2.00 | 0.6762E+00 | 0.5132E+00 | 0.3973E+00 | 0.2875E+00 | 0.1197E+00 | 0.4124E-01 | 0.8962E-02 | 0.1816E-02 | 0.2610E-03 | 0.4500E-04 | | | | |
| 3.00 | 0.7975E+00 | 0.6377E+00 | 0.4924E+00 | 0.3848E+00 | 0.2341E+00 | 0.1116E+00 | 0.4097E-01 | 0.1291E-01 | 0.3059E-02 | 0.5490E-03 | 0.9646E-04 | 0.3070E-04 | | |
| 4.00 | 0.8490E+00 | 0.7067E+00 | 0.5666E+00 | 0.4427E+00 | 0.3045E+00 | 0.1731E+00 | 0.8564E-01 | 0.3822E-01 | 0.1319E-01 | 0.3302E-02 | 0.6941E-03 | 0.1389E-03 | | |
| 6.00 | 0.8686E+00 | 0.7495E+00 | 0.6409E+00 | 0.5227E+00 | 0.3986E+00 | 0.2721E+00 | 0.1716E+00 | 0.1134E+00 | 0.6693E-01 | 0.2948E-01 | 0.1020E-01 | 0.2805E-02 | 0.6147E-03 | 0.1657E-03 |
| | | | | | | | MT = 51 | | | | | | | |
| 0.05 | 0.5787E-02 | -.4256E-01 | -.1076E-05 | -.6794E-06 | | | | | | | | | | |
| 0.10 | 0.1413E-01 | -.4638E-01 | -.2525E-03 | -.3268E-04 | | | | | | | | | | |
| 0.20 | 0.2633E-01 | -.4115E-01 | -.1413E-02 | -.2058E-03 | | | | | | | | | | |
| 0.30 | 0.3125E-01 | -.4006E-01 | -.3084E-02 | -.2695E-03 | -.1409E-04 | -.1685E-05 | | | | | | | | |
| 0.40 | 0.3216E-01 | -.4066E-01 | -.4908E-02 | -.6144E-04 | -.4566E-04 | -.2176E-05 | | | | | | | | |
| 0.60 | 0.3080E-01 | -.4262E-01 | -.8917E-02 | 0.1006E-02 | -.1781E-03 | 0.3220E-04 | | | | | | | | |
| 0.75 | 0.2962E-01 | -.4416E-01 | -.1265E-01 | 0.1962E-02 | -.3151E-03 | 0.1829E-03 | -.7820E-05 | 0.2852E-05 | | | | | | |
| 1.00 | 0.3037E-01 | -.4948E-01 | -.2215E-01 | 0.2372E-02 | -.4116E-03 | 0.1329E-02 | -.6332E-04 | 0.2745E-04 | | | | | | |
| 1.50 | 0.2888E-01 | -.3682E-01 | -.2911E-01 | -.1488E-01 | 0.3211E-02 | 0.6857E-02 | -.5035E-03 | 0.4481E-03 | | | | | | |
| 2.00 | 0.5582E-01 | -.1673E-01 | -.2674E-01 | -.2823E-01 | 0.1532E-01 | 0.1042E-01 | -.7657E-03 | 0.2117E-02 | -.1389E-03 | 0.6104E-04 | | | | |
| 3.00 | 0.1688E+00 | 0.4226E-01 | 0.1447E-01 | 0.9971E-02 | 0.4857E-01 | -.3912E-02 | 0.2854E-02 | 0.6961E-02 | -.7153E-03 | 0.1150E-02 | -.1446E-04 | 0.2640E-04 | | |
| 4.00 | 0.2341E+00 | 0.7521E-01 | 0.4513E-01 | 0.3452E-01 | 0.5775E-01 | -.1356E-01 | -.4530E-02 | -.8115E-03 | 0.1109E-02 | 0.5081E-02 | -.2728E-03 | 0.2995E-03 | | |
| 6.00 | 0.2800E+00 | 0.7810E-01 | 0.7203E-02 | 0.1037E-01 | 0.8579E-02 | -.1593E-01 | -.3528E-01 | -.3814E-01 | 0.1053E-01 | 0.8095E-02 | -.1946E-02 | 0.5470E-02 | 0.5070E-03 | 0.2450E-03 |
| | | | | | | | MT = 52 | | | | | | | |
| 0.20 | 0.8412E-02 | -.1464E-01 | 0.4449E-03 | -.1543E-02 | | | | | | | | | | |
| 0.30 | 0.2069E-01 | -.4068E-02 | 0.8824E-03 | -.3071E-02 | -.9970E-05 | -.2954E-04 | | | | | | | | |
| 0.40 | 0.3073E-01 | -.1657E-02 | 0.9329E-03 | -.3310E-02 | -.1976E-04 | -.8546E-04 | | | | | | | | |
| 0.60 | 0.5078E-01 | -.2473E-02 | 0.5786E-04 | -.2792E-02 | -.7151E-05 | -.3238E-03 | | | | | | | | |
| 0.75 | 0.6786E-01 | -.5189E-02 | -.1668E-02 | -.2130E-02 | 0.6341E-04 | -.6220E-03 | -.4792E-05 | -.1996E-05 | | | | | | |
| 1.00 | 0.1068E+00 | -.1383E-01 | -.7841E-02 | -.7820E-03 | 0.4953E-03 | -.1298E-02 | -.2533E-04 | -.8250E-05 | | | | | | |
| 1.50 | 0.1370E+00 | -.5493E-01 | -.2136E-01 | 0.6240E-02 | 0.2409E-02 | -.2895E-02 | -.1073E-03 | -.3077E-04 | | | | | | |
| 2.00 | 0.1545E+00 | -.8517E-01 | -.1486E-01 | 0.2054E-01 | 0.2874E-02 | -.3927E-02 | 0.5919E-04 | -.8858E-04 | -.5480E-04 | -.3622E-05 | | | | |
| 3.00 | 0.2111E+00 | -.5174E-01 | 0.4357E-01 | 0.2585E-01 | -.8820E-02 | -.8770E-03 | 0.1248E-02 | -.1649E-02 | -.3373E-03 | 0.2096E-03 | -.2315E-04 | 0.1114E-04 | | |
| 4.00 | 0.2439E+00 | 0.3345E-02 | 0.4571E-01 | -.1540E-01 | -.1113E-01 | 0.6871E-02 | -.6247E-02 | -.4002E-02 | 0.1272E-02 | 0.4193E-03 | -.2955E-03 | 0.1260E-03 | | |
| 6.00 | 0.2656E+00 | 0.6755E-01 | 0.3630E-01 | -.3139E-01 | 0.1492E-01 | -.8786E-02 | -.2577E-01 | 0.2190E-01 | 0.8870E-02 | -.7986E-02 | -.7597E-03 | 0.1436E-02 | -.2478E-03 | 0.5753E-04 |

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