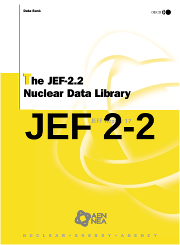

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R-MATRIX ANALYSIS OF THE ^{241}Pu NEUTRON CROSS-SECTIONS IN THE ENERGY RANGE THERMAL TO 300 eV

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RESUME :

Ce rapport décrit les résultats des travaux d'analyse des sections efficaces neutroniques expérimentales de ^{241}Pu dans le domaine des résonances résolues effectués à ORNL en utilisant le code multiniveaux-multivoies SAMMY. Les paramètres des résonances ont été obtenus dans le domaine d'énergie 0 eV à 300 eV. La liste des paramètres de résonances est donnée, de même que quelques propriétés statistiques de ces paramètres. Des comparaisons tabulées et graphiques entre les sections efficaces expérimentales et calculées sont faites. Les résultats de l'analyse sont disponibles à la banque de données de l'AEN dans le format ENDF/B-V et seront utilisés dans les bibliothèques de données évaluées JEF2 et ENDF/B-VI.

ABSTRACT :

The report is a description of the analysis of the ^{241}Pu neutron cross-sections in the resolved resonance region at ORNL using the multilevel-multichannel Reich-Moore code SAMMY. The resonance parameters were obtained in the energy range 0 eV to 300 eV. The table of the resonance parameters is given with some statistical properties of the parameters. Tabulated and graphical comparison between the experimental data and the calculated cross-sections are given. The results are available in ENDF/B-V format and will be used in the evaluated data library JEF2 and ENDF/B-VI.

I - INTRODUCTION

The most recent complete review of the ^{241}Pu resonance parameters is that given in Ref. 1. It was shown that a satisfactory set of resonance parameters describing with accuracy the cross-sections in the resonance region had not yet been obtained. An attempt to improve the Reich-Moore type resonance parameters obtained at SACLAY in 1976 has been made recently by *H. DERRIEN et al. (2) by using the Bayesian code SAMMY for the* analysis of KOLAR total cross-sections (3), BLONS fission cross-sections (4), and WESTON fission cross-sections (5). The problems encountered by WESTON et al. (12) when evaluating the ^{241}Pu cross-sections *for ENDF/B-V were not solved. It was concluded that a* satisfactory evaluation of the ^{241}Pu resonance region would require at least a precise transmission measurement with thicker samples than those used by KOLAR et al. Unfortunately, such transmission measurements are not foreseen for the moment and one should try to extract more informations from existing data. It happens that transmission measurements were performed in 1973 by HARVEY et al. (13) on a 78 m flight path with samples cooled down at liquid nitrogen temperature ; the thickest sample was 0.0114 at/b, seven times thicker than the one used by KOLAR et al. In the present paper, a new analysis of the ^{241}Pu resonance region is described. This new analysis is based on the 1973 HARVEY et al. high resolution transmission data which allow the resolved resonance range to be extended up to 300 eV.

The content of this paper is organized as follows. Section II describes the experimental data base analysed. In section III informations on the methods and assumptions of the analysis are given. The properties of the resonance parameters obtained are described in section IV. The calculated average cross-sections are shown in section V, and are compared to the experimental data and to some previous evaluations.

II - THE EXPERIMENTAL DATA BASE

At least eight sets of experimental fission cross-sections are available in the resolved resonance region (4-11). A comparison of the average cross-sections obtained from these experiments is found in WESTON et al. publication (5). This comparison shows that large discrepancies exist among the experimental data, even in the low energy range not far from the usual thermal normalization range. The reasons for such large discrepancies (as much as 20 %) are not well known. It is not possible to include all the data in a SAMMY fit without having some informations on the experimental parameters which could be at the origin of the severe discrepancies. In the present work three sets of data have been choosen : MIGNECO et al. data (7), BLONS et al. data (4) and WESTON et al. data (5). MIGNECO measurements (sample at room temperature) and BLONS measurements (sample at liquid nitrogen temperature) were performed with a resolution good enough for the separation of most of the resonances up to about 300 eV incident neutron energy. WESTON data could be analysed up to about 100 eV. WAGEMANS and DERUYTER data (6) have also been chosen for the analysis in the thermal energy range and for accurate normalization of other data. The experimental characteristics of the fission data are given in Table I.

The transmission measurements performed by HARVEY et al. in 1973 (13) have been recently reanalysed and were available for the present work. Two series of measurements were performed with samples cooled down at liquid nitrogen temperature on a 78 m flight path, the first series in the energy range 0.3 eV to 312 eV and the second series in the energy range 10 eV to several keV. The experimental conditions of the measurements are given in Table I. The high quality of the resolution allows an accurate determination of the neutron widths at least up to 300 eV. YOUNG et al. (14) and SIMPSON et al. (15) data are the only total cross-sections available in the thermal energy range ; they were included in the present fits for the thermal range. KOLAR et al. (3) total cross-sections, which were used in a previous analysis (2), were not included in the present fits.

The only experimental capture cross-sections available are those of WESTON et al. (5), obtained from a simultaneous measurement of the fission and the absorption. The fission cross-sections were normalized on ENDF/B-IV in the energy range 0.02 eV to 0.03 eV and the absorption cross-sections were normalized to the absorption cross-section inferred from KOLAR et al. total data. It was expected when starting the present analysis that a more accurate normalization should be obtained by using HARVEY et al. transmission data and that the inconsistencies mentioned by WESTON et al. (12) should disappear.

Finally, the resonance parameters were obtained in the energy range thermal to 300 eV from the experimental data base shown on Table V.

III - METHODE OF ANALYSIS

III.1 - Resonance spins

The Reich-Moore formalism and the method of analysis used in SAMMY are widely described elsewhere (16). The knowledge of the spin of each resonance and the number of open fission channels in each spin state is required. All the resonances in the energy range analysed were considered as s-wave resonances. The ^{241}Pu nucleus spin and parity is $5/2^+$ and the s-wave resonances are 2^+ or 3^+ resonances. One find in the litterature only one measurement for the determination of ^{241}Pu resonance spins. The measurement was performed by SAUTER et al. (17) ; the spin was obtained for only 3 resonances : $J=2^+$ at 13.4 eV and 17.8 eV, and $J=3^+$ at 14.7 eV. Nevertheless, some informations on the average 2^+ and 3^+ fission widths could be obtained by considering the thresholds of the corresponding fission channels. The lowest 2^+ channel pertains to the rotational band built on the fondamental of the ^{242}Pu compound nucleus. This fission channel is completely open and the corresponding average fission width, $\langle \Gamma f \rangle = \langle D \rangle / 2\pi$, could be relativement important. Some other 2^+ channels could exist in the transition spectrum : γ and double γ vibrations or combination of

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bending and mass asymmetry modes (18) ; the threshold of these 2^+ fission channels are not known, but they are probably above the neutron binding energy and the corresponding fission widths should be relatively small. Adding these contributions to the main open channel contribution results in a quite large total fission width for the 2^+ resonances ; the 2^+ average total fission width could be as large as 500 meV. The 3^+ transition states are also present in the γ vibration mode and in the combination of bending and mass asymmetry modes just above a 2^+ transition state. There is no completely open 3^+ fission channel. Therefore, one should assume that the average fission widths of the ^{241}Pu s-wave resonances are characterized as follows :

- one 2^+ open fission channel, and several 2^+ fission channels open to a small extent, leading to a quite large average 2^+ fission width ;

- no 3^+ open fission channel, and several 3^+ fission channel open to a small extent, leading to a significantly smaller average 3^+ fission width.

Consequently, the ^{241}Pu multilevel-multichannel analysis could be started by considering two groups of resonances : one containing the wide resonances, another containing the narrower resonances. In the progress of the analysis, some changes could be made in the groups to obtain the best fit of the cross-sections. At the end of the analysis one could expect that the majority of the resonances in the first group are 2^+ resonances (large average fission width) and that the majority of the resonances of the second group are 3^+ resonances (smaller value of the average fission width). This kind of analysis was already performed by BLONS and DERRIEN (19) in 1976, leading to the values of 595 meV and 87 meV for the possible average fission width of the 2^+ and 3^+ resonances, in the incident neutron energy range 5 eV to 105 eV. In the present evaluation, the results obtained by BLONS and DERRIEN were used as prior informations for SAMMY. In the energy range 100 eV to 300 eV the splitting of the resonances in two groups is more difficult, because the number of multiplets increase with the incident neutron energy and there is little chance that the spin assignments could be correct.

III.2 - Renormalization and residual background correction parameters

The discrepancies found in the experimental cross-sections, particularly in the fission cross-sections, could be due to a large number of experimental effects : normalization, background corrections, detector efficiency etc... . SAMMY allows a search on the normalization and background corrections ; these correction parameters should account for all the experimental effects. They are needed to obtain an unique set of resonance parameters for the description of all the experimental data analysed. The cross-sections to be kept in the evaluated data files are those calculated from the resonance parameters with the corresponding covariance file. The covariance file contains all the informations for the calculation of the systematic errors due to the experimental effects in the measured cross-sections.

It is difficult to separate the systematic errors due to the normalization and background corrections from those due to the choice of the scattering radius and of the contribution of the resonances external to the energy range analysed, particularly in the transmission data. Since HARVEY et al. transmission data were taken with very small experimental background and a normalization accuracy probably better than 1 %, very small variations were allowed on the transmission normalization and residual background correction parameters in the SAMMY fits ; satisfactory fits were obtained with a scattering radius of 9.50 f and with 9 fictitious resonances (4 negative energy resonances and 5 resonances above 300 eV) for the contribution of the external range. For the fission cross-sections large variations on the normalization and residual background corrections were needed, since the discrepancies among the input experimental data are important. Table II shows an example of correction parameters obtained in a preliminary simultaneous fit of the HARVEY transmissions and WESTON; BLONS and MIGNECO not renormalized fission data, in the energy range 2 eV to 20 eV. WESTON data needed small residual background correction and a quite large normalization adjustment ; BLONS and MIGNECO data needed a larger background correction varying strongly with energy. In the energy range 20 eV to 300 eV, the cross-sections obtained from a preliminary fit of BLONS and MIGNECO data with large normalization and background corrections (Table III) agree with WESTON data within 1.5 % on average (Table IV) ; that is a strong indication that WESTON data are cleaner than BLONS and MIGNECO data at least above 20 eV incident neutron energy.

III.3 - DOPPLER and resolution parameters

BLONS data were obtained with a sample cooled down at liquid nitrogen temperature. The effective temperature of 102 K and the resolution parameters are found in ref. 4. MIGNECO and WESTON data were taken at room temperature and the corresponding effective temperature is about 300°K ; the resolution parameters are found in ref. 5 and ref. 7.

HARVEY transmission data were taken with samples cooled down at liquid nitrogen temperature. Only few informations are available on the exact temperature of the samples. The best way to find the effective temperature corresponding to each sample was to perform a shape analysis on some isolated resonances or group of resonances at various energy ranges. For the thin and the medium samples reasonable fits were obtained with an effective temperature of 101° ± 20°K. But, the resolution of the thick sample transmission data appeared to be less good and that for both series of measurements (low energy and high energy). The experimental conditions of the experiments being the same for all the samples, the difference in the resolution should be due to different temperature of the samples. As a matter of fact, the shape analysis of the isolated resonances in the thick sample gave Tef = 272° ± 30°K. Such differences in the sample temperature have not been explained, since the experiments were performed in the same runs by translating the samples in the same cryostat. Nevertheless, using Tef = 101°K for the thin and medium samples and Tef = 272°K for the thick sample give consistent results from separate analysis of the data.

One other important parameter for the analysis of the transmission data is the shape of the resolution function. The lithium glass of the detector used in the transmission measurements produces an exponential tail in the resolution function by scattering a large fraction of the incident neutrons (20). The exponential tail is characterized by a half-life τ varying with the energy of the neutron incident. The parameter τ was also checked by a shape analysis of some isolated resonances ; the value of τ (μs) = 1.5/ $\sqrt{E(eV)}$ was found, corresponding to 150 ns at 100 eV and 47 ns at 1 keV.

III.4 - Schema of the analysis

The analysis was performed separately in the 6 energy ranges given in Table V. The totality of the resonances were used in each energy interval, but the Bayes equations were solved only for the resonance parameters of the energy range analysed. The correlation matrices were obtained in each energy range. Table V shows the experimental data analysed in each energy range. The energy range 0.001 eV to 3 eV was specially considered to obtain calculated 2200 m/s cross section values in agreement with the proposed ENDF/B-VI standard values (21).

IV - THE PROPERTIES OF THE RESONANCE PARAMETERS

A number of 245 resonances were used for the description of the cross-sections in the energy range thermal to 300 eV including 4 bound levels and 5 resonances in the energy range above 300 eV. The parameters of the 9 resonances external to the range analysed have no other physical meaning that to represent the tail contribution of all the bound levels and of all the resonances

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above the incident neutron energy of 300 eV, in such a way that no file 3 contribution is needed in the evaluated data file. The resonance parameters are listed on Table VI. In the following some statistical properties of the parameters are presented.

IV.1 - The level spacing

Due to the small value of the average level spacing and to a quite large value of the average total width ($\langle\Gamma\rangle/\langle D\rangle$ larger than 0.4), the resonance overlapping is important. Therefore, one should expect that a large number of small resonances could not be seen in the experimental data and that some of the large cross-section picks could correspond to unresolved multiplets, both effects increasing with the incident neutron energy when the resolution width increases. The spacing stairstep histogram is shown on fig. 1. The observed average level spacing is 1.15 eV, 1.25 eV and 1.45 eV in the energy range 0 eV to 100 eV, 100 eV to 200 eV and 200 eV to 300 eV respectively, showing a loss of 25 % of the levels in the energy range 200 eV to 300 eV compared to the energy range 0 eV to 100 eV. The number of multiplets is increasing rapidly above 200 eV incident neutron energy. For this reason, the evaluation of the statistical properties of the parameters from the set of identified resonances should be limited to the energy range up to 200 eV.

One should note that an abnormal large spacing of 5.5 eV was observed in the previous sets of resonance parameters (19). This anomaly disappears in the present data by the fact that two small resonances were identified at 54.27 eV and 55.90 eV in HARVEY transmission data.

IV.2 - The neutron widths and the s-wave strength function

The integral distribution of the reduced neutron widths, $2g\Gamma_n^\circ$, of the 167 resonances identified in the energy range 0 eV to 200 eV is shown on fig. 2. The distribution could be hardly represented by a Porter-Thomas distribution without considering that an important fraction of small $2g\Gamma_n^\circ$ values is missing in the experimental data sample. The Porter-Thomas distribution displayed on the figure was normalized to 220 resonances, assuming that 53 resonances with $2g\Gamma^{\circ}$ values smaller than 0.10 x 10^{-3} ($eV^{1/2}$) are missing in the set of identified resonances ; the corresponding average reduced neutron width is 0.216 x 10^{-3} ($eV^{1/2}$) giving a s-wave strength function value of 1.188 x 10^{-4} and a corrected average level spacing of 0.91 eV, which is 24 % smaller than the one observed in the low energy range of the transmission data. The agreement between the experimental data and the Porter- Thomas distribution for the large values of $2g\Gamma n^{\circ}$ is not good, suggesting that the number of unresolved multiplets could be large even in the low energy part of the cross-sections, and the corrected value of the average level spacing could be lower than 0.90 eV.

Fig. 3 shows the cumulative stairstep histogram of the reduced neutron widths. One observes strong fluctuations in the slope of the histogram corresponding to strong fluctuations in the local values of the strength function. The strength function values calculated in 6 energy intervals are given on Table VII. A particularly large value is observed in the energy range 200 to 250 eV which is about twice the value observed in the energy range 100 eV to 150 eV. Not more than 40 % difference could be expected from the usual Porter-Thomas fluctuations of the neutron widths. Comparisons with other results (2,3,22) obtained from the analysis of KOLAR et al. (3) total cross-sections are also shown on Table VII ; the strength function obtained by BLONS et al. (22) from a single level analysis in the energy range thermal to 150 eV is 5 % smaller than the value obtained in the present work, when the value obtained by KOLAR et al. (3) is 7 % larger in the energy range 10 eV to 50 eV.

The strength function calculated from the neutron widths of the 236 resonances identified in the energy range 0 to 300 eV is (1.23 $\pm$ 0.11) x 10^{-4}. The error is the sampling error. This value should not be to much affected by the existence of a large number of unresolved multiplets, since the parameters obtained by the SAMMY shape analysis are representative of the total area of the multiplets.

IV.3 - The fission widths

The integral distribution of the total fission widths of the 236 resonances identified in the energy range 0 to 300 eV is given on fig. 4. The theoretical distribution drawn on the figure is a χ^2 distribution, $P(\nu,x)$, with $\nu=1$ and normalized to 270 values. There is no evidence, from the shape of the distribution, of two families of resonances with very different average fission widths. The average total fission width of the 236 resonance is 460.4 meV. The spin 2^+ was assigned to 129 resonances and the spin 3^+ to 107 resonances with average fission widths of 690 meV and 270 meV respectively. The corresponding effective number of fission channels is 2.0 for the 2^+ states and 1.2 for the 3^+ states, in agreement with the assumption made above on the number of open or partially open fission channels. But, at least above 100 eV incident neutron energy, these results could not be taken too seriously, since that there is very little chance that the spin assignments could be correct.

In the 0 eV to 100 eV energy range the results obtained by BLONS et al. Reich-Moore analysis (19) of KOLAR total and BLONS fission cross-sections were used as input in the present SAMMY analysis. Only few modifications were obtained and the average fission widths are the same than those obtained by BLONS et al. An attempt was made by BLONS et al. to obtain the parameters of the 2^+ and 3^+ fission channels. Their results should be kept for the evaluation of the statistical properties of the fission channels (see Ref. 19).

IV.4 - The capture widths

The capture widths have been obtained for 33 resonances in the energy range 0 eV to 50 eV. The average value, evaluated from the well isolated narrow resonances, is 34.90 meV, in agreement with the value of 36 ± 1 meV calculated by M.S. MOORE (23). One should note that the capture widths obtained in the energy range 0 to 20 eV (30.08 meV on average) are significantly smaller than those obtained in the energy range 20 to

50 eV (40.1 meV on average). That could be due to an experimental effect related to the sample temperature in the low energy and/or the high energy transmission runs ; the difficulties for the evaluation of an accurate DOPPLER width could be at the origin of large errors in the determination of the total width of the resonances.

A comparison between the capture widths obtained in this work and those given by BLONS et al. (22) in the energy range 17 eV to 34 eV is shown on Table VIII. BLONS et al. values were obtained from a multilevel Breit-Wigner analysis of KOLAR total and BLONS fission cross-sections. The capture widths were also obtained by KOLAR et al. from a Breit-Wigner analysis of GEEL transmission and fission data (3). Some of the values are shown on Table VIII. They are much larger than those obtained in the present work and in BLONS analysis.

A constant value of 40 meV was used for all the resonances in the energy range above 50 eV.

IV.5 - The covariance matrices

The partial correlation matrices were obtained for the 6 energy ranges analysed. Table IX and Table X show parts of the covariance matrices obtained in the energy range 0.4 eV to 20 eV and 200 eV to 300 eV. On these examples one sees that only the short range correlations from resonance to resonance are important. Consequently a reasonably accurate full correlation matrix could be obtained by assembling the 6 partial matrices. If the resonances are sorted by increasing energy only the elements near the diagonal should be kept.

IV.6 - Conclusions on the average resonance parameters

The important number of missed level renders difficult the determination of accurate values of the average resonance parameters. However, the following values could be used as starting values for statistical model calculations in the unresolved region :

s-wave level spacing	$<D> = 0.83 \pm 0.08$ eV
s-wave strength function	$So = (1.23 \pm 0.09) \times 10^{-4}$
radiative width	$<\Gamma\gamma> = (36 \pm 6)$ meV
total fission width	$<\Gamma f>_{2+} = (600 \pm 100)$ meV
	$<\Gamma f>_{3+} = (100 \pm 20)$ meV

The proposed level spacing is 9 % lower than the lowest estimate of 0.90 eV obtained from the examination of the neutron width distribution in the energy range 0 eV to 200 eV. This correction of 9 % is meant to take into account the effect of the unresolved multiplets and was given by BLONS and DERRIEN in ref. 19.

V - THE CROSS-SECTIONS

V.1 - The thermal range

Special care was taken for the analysis of the thermal range. First, one should reproduce by the resonance parameters the 2200 m/s cross-sections proposed with very high accuracy by the ENDF/B-VI standard evaluation group (21) ; second, one should try to explain the discrepancy on the 0.26 eV resonance capture cross-section found by WESTON et al. (12). For this purpose, a consistent SAMMY fit was performed in the energy range 0.001 eV to 3 eV, using as input all the parameters obtained by fitting the higher energy ranges and by varying only the parameters of the 0.26 eV resonance and the parameters of the bound levels. The experimental data base (see Table V) was renormalized in the energy range 0.02 eV to 0.03 eV to be consistent with the new standard values at 0.0253 eV.

A preliminary fit, including all the selected experimental data, has shown some inconsistencies between WAGEMANS and WESTON fission data. When WAGEMANS and WESTON data are normalized to the same value in the energy range 0.02 to 0.03 eV, there is a disagreement of 2.5 % over the energy range 0.02 eV to 0.45 eV (326.0 b. eV for WAGEMANS and 334.2 b. eV for WESTON). The origin of this discrepancy can be seen on fig. 5. The shape of WESTON data deviates from the shape of WAGEMANS data in the energy range below 0.03 eV and a consistent normalization cannot be obtained by using the energy range 0.02 to 0.03 eV. WAGEMANS data have the expected 1/v shape ; that is not the case for WESTON data. WESTON data should be normalized on WAGEMANS data in the energy range above 0.05 eV ; WESTON data should not be taken into account in the energy range below 0.05 eV (see Table XII).

The final SAMMY fit included only YOUNG (14) and SIMPSON (15) total cross-sections and WAGEMANS fission cross-sections. The results of the fit are shown in fig. 8. The 2200 m/s cross-sections obtained are given in Table XI. They are in very good agreement with the proposed standard values. The calculated capture cross-sections are shown in fig. 6 and fig. 7 ; the same deviation in shape is observed on WESTON experimental capture data ; like the fission data, they should be normalized over the 0.26 eV resonance and not in the energy range 0.02 eV to 0.03 eV. The renormalized SEPPI (24) fission cross-sections are also shown in fig. 8. They agree quite well with the calculated cross-sections.

The cross-section values integrated over the energy ranges 0.02 eV to 0.03 eV and 0.02 eV to 0.45 eV are shown in Table XII. Renormalizing WESTON absorption on the absorption inferred from SIMPSON total cross-section in the energy range 0.05 to 0.45 eV and WESTON fission on WAGEMANS fission in the same energy range, results in capture cross-sections in agreement with the calculated values. This renormalization process leads to 1.6 % decrease in the 1978 WESTON fission and to 10 % decrease in the 1978 WESTON capture over the 0.26 eV resonance.

The deep in the fission cross-section observed at 2 eV in WESTON experimental data (fig. 6 and 10) is due to a strong interference effect between a small resonance at 1.735 eV and the large resonance at 5.81 eV. The resonance at 1.735 eV was not given in previous data sets.

V.2 - The resolved resonance region

Table XIII, taken from WESTON et al. (5), is an illustration of the large discrepancies existing in the ^{241}Pu experimental fission data. Therefore a consistent fit of the data could not be obtained without allowing large local normalization or residual background corrections in most of the experimental data. The problem of the renormalization of the data was also considered by WAGEMANS et al. (6) who have shown (Table XIV) that a quite good agreement can be obtained, in the energy range below 50 eV, between WAGEMANS, BLONS and MIGNECO if the normalization is performed in the energy range 12 eV to 20 eV on an integral value of 1350 b.eV corresponding to an average cross-section of 1024 b in the 0.02 eV to 0.03 eV thermal normalization range (i.e. 1012.7 b at 0.0253 eV). WESTON data renormalized on WAGEMANS data over the 0.26 eV resonance, as stated above, gives 1349 b.eV in the 12 eV to 20 eV energy range. The value calculated from the resonance parameters is 1342 b.eV at only 0.5 % from WAGEMANS normalization value.

Table XV shows the average fission cross-sections in 17 energy intervals in the incident neutron energy range 3 eV to 300 eV. WESTON data renormalized on WAGEMANS data are compared to the values calculated from the resonance parameters. The agreement is excellent.

Table XVI shows the capture cross-sections and the α values in the neutron energy range 10 eV to 300 eV. The α values calculated from the resonance parameters are compared to WESTON experimental values. The calculated values are on average 14.3 % smaller ; the discrepancies are very large (20 % to 60 %) in the regions where the capture cross-sections are small. The experimental capture data were included in the SAMMY fits only in the energy range 3 eV to 20 eV (fig. 11) and a correction of 15 % was obtained on the normalization. The large $\Gamma\gamma$ values obtained for the broad resonances at 5.81 eV and 9.62 eV suggest that an important experimental background could also remains in the experimental capture data. The absorption cross-sections were normalized by WESTON to values inferred from KOLAR et al. total cross-sections in the energy range 5 eV to 50 eV. It has been shown (2) that KOLAR total cross-sections could be too large and therefore WESTON absorptions could also be too large. Renormalizing WESTON absorptions on the absorptions inferred from HARVEY transmission data should remove the discrepancy on the capture and α values.

Fig. 9 to fig. 15 provide a detailed graphical comparison between the results of several measurements and the corresponding quantities as computed from the resonance parameters. The curves represent the calculated data ; the crosses or the vertical bars (error bars) represent the experimental values. Fig. 10 shows WESTON, BLONS and MIGNECO fission cross-sections in the energy range 0.3 eV to 20 eV ; WESTON and BLONS data were displaced by 2 and 1 decades respectively for clarity of the display. Fig. 9 shows HARVEY transmission data in the same energy range ; the medium and thin samples data were displaced by 0.25 and 0.5 respectively.

Fig. 11 shows WESTON fission and capture in the energy range 0.3 eV to 20 eV.

Fig. 12 and fig. 13 show the data in the energy range 45 eV to 73 eV and 73 eV to 100 eV. The upper part of the figure represents the total cross-sections obtained from HARVEY thick sample transmission displaced by 3 decades. The other curves represent MIGNECO fission multiplied by 10, WESTON fission, and BLONS fission multiplied by 0.1.

Fig. 14 and fig. 15 show the data in the energy range 200 eV to 250 eV and 250 eV to 300 eV. The upper part of the figure represents the total cross-sections obtained from HARVEY thick sample transmission displaced by 3 decades. The other curves represent BLONS fission multiplied by 10, MIGNECO fission, and WESTON fission multiplied by 0.1

The resonances of the isotope impurities (239 Pu, 240 Pu, 242 Pu, 241 Am) were not removed from the figures.

VI - CONCLUSIONS

As it stands the present analysis is a great improvement over previous evaluations in that it includes HARVEY and SIMPSON high resolution transmission data which were not available before. A consistent representation of the transmission and of MIGNECO, BLONS and WESTON fission cross-sections was obtained by allowing local renormalization and residual background corrections on the experimental fission cross-sections. A part for the thermal region, WESTON fission data has proved to be more reliable than MIGNECO and BLONS data, particularly for the experimental background corrections. Similar conclusions were also obtained in ^{239}Pu and ^{235}U evaluations (27, 28). A careful examination of WESTON capture and fission data in the thermal region below 0.05 eV has shown that a part of the difficulties encountered by WESTON in a previous evaluation (12) was due to the deviation of the cross-sections from the values obtained by WAGEMANS et al. It has also been shown that WESTON absorption data should be renormalized on the absorption inferred from HARVEY et al. transmission data.

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References	Main characteristics and normalization method
MIGNECO et al. (1969)	σ_f normalized to $\int_{4.65\ eV}^{10\ eV} \sigma_f(E)\frac{dE}{E}=193.6$ b (Hennies[25]) ; Linac measurement 30.617 m flight path ; liquid scintillation detector uncorrected for 0.87 % ^{239}Pu contamination
BLONS et al. (1969)	σ_f normalized to the values of $\sigma_0\Gamma_f$ for the 15.95 and 16.66 eV resonances as given by Stehn et al.[26]; Linac measurement, 10.89 m flight path ; gaseous scintillator ; uncorrected for 0.87 % ^{239}Pu contamination.
BLONS et al. (1971)	σ_f normalized to $\int_{20\ eV}^{70\ eV} \sigma_f(E)dE=2367.5$ b.eV (James[9]) ; Linac measurement 10.89 and 50.07 m flight path, gaseous scintillator, uncorrected for 0.87 % ^{239}Pu contribution.
WAGEMANS et al. (1976)	σ_f normalized to σ_f^0 = (1015 $\pm$ 7) b by a linear least-squares fit of $\sigma_f\sqrt{E}$ from 0.02481 to 0.02586 eV ; Linac measurement, 8.1 m flight path ; silicon surface-barrier detectors.
WESTON et al. (1978)	σ_f normalized between 0.02 eV and 0.03 eV to ENDF/B-IV ; Linac measurement ; 20 m and 85 m flight path ; liquid scintillator detector.
HARVEY et al. (1973)	Transmission measurements of 3 samples : 5.19×10^{-4}, 2.27×10^{-3} and 1.12×10^{-2} at/b at liquid nitrogen temperature ; Linac measurement ; 78.30 m flight path ; best nominal resolution 0.40 ns/m. Two series of measurement with different filters for low and high energy range.

TABLE I

Experimental characteristics of the data analysed

	Normalization correction	Background correction at		
		3 eV	9 eV	20 eV
Medium sample	1.000 ± 0.001		0.0012	
Thick sample	1.005 ± 0.001		0.0018	
Thin sample	1.001 ± 0.001		0.0030	
WESTON	1.057 ± 0.004	- 0.42 b	- 0.25 b	- 0.27 b
BLONS	1.013 ± 0.003	- 3.32 b	- 1.08 b	- 0.07 b
MIGNECO	1.037 ± 0.002	- 0.49 b	- 1.41 b	2.26 b

TABLE II

Example of normalization and background corrections obtained in a SAMMY correlated fit of HARVEY transmissions and the not renormalized WESTON, BLONS and MIGNECO fission data in the energy range 2 eV to 20 eV. The 5.7 % correction on WESTON data should decrease to less than 3 % after a correct normalization of the data at thermal energy. The corrections should be applied to the experimental data in the following way :

$$\sigma_{cor} = (\sigma_{exp.} - \text{Background})/\text{normalization}$$

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Energy range (eV)	BLONS (4)		MIGNECO (7)	
	NORM	BACK	NORM	BACK
20 - 40	0.977	- 1.00	0.974	- 1.07
45 - 100	0.949	- 2.70	0.978	- 1.28
100 - 200	0.903	- 0.83	0.906	1.83
200 - 300	0.922	- 1.11	0.852	2.58

TABLE III

Normalization corrections (NORM) and average background corrections in barns (BACK) obtained in a correlated SAMMY fit of BLONS and MIGNECO fission data in the energy ranges 20 eV to 300 eV. The corrections should be applied to the experimental data in the following way :

$$\sigma_{cor} = (\sigma_{exp.} - BACK)/NORM$$

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Energy range (eV)	Calculated fission	WESTON (5) EXP	BLONS (4)		MIGNECO (7)	
			COR	EXP	COR	EXP
20 - 40	66.60	67.98	67.28	64.74	67.06	64.25
50 - 100	40.81	40.54	41.20	36.40	41.82	39.62
100 - 200	26.26	26.60	26.29	22.91	25.55	24.98
200 - 300	28.28	28.83	28.92	25.85	27.58	26.08

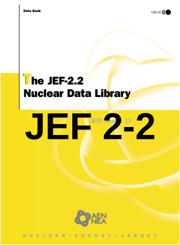
TABLE IV

Averaged fission cross-sections (barns) in the energy range 20 eV to 300 eV. The calculated values were obtained from a correlated SAMMY fit of BLONS and MIGNECO data with large normalization and background correction (The correction values are given in Table III). The experimental (EXP) and the experimental corrected values (COR) are given for BLONS and MIGNECO.

Energy range	Experimental data
0.001 eV - 3 eV	YOUNG et al. Total (14) SIMPSON et al. Total (15) SEPPI et al. Fission (24) WAGEMANS et al. Fission (6) WESTON et al. Fission and capture (5)
0.3 eV - 20 eV	HARVEY et al. Transmissions (13) BLONS et al. Fission (4) MIGNECO et al. Fission (7) WESTON et al. Fission and capture (5)
20 eV - 45 eV 45 eV - 100 eV	HARVEY et al. Transmissions (13) BLONS et al. Fission (4) MIGNECO et al. Fission (7) WESTON et al. Fission (5)
100 eV - 200 eV 200 eV - 300 eV	HARVEY et al. Transmissions (13) BLONS et al. Fission (4) MIGNECO et al. Fission (7)

TABLE V

Experimental data used as input in SAMMY in the 6 energy ranges analysed.



-5.9534E+01	4.4501E+01	5.9613E+02	4.1526E+02	4.2980E+01	0	0	0	0	0	2
-5.5795E+00	3.6438E+01	2.2888E+00	1.6481E+03	1.5760E+01	0	0	0	0	0	1
-1.4048E+00	1.9251E+01	1.5130E-03	-1.8713E+01	3.6942E-01	0	0	0	0	0	1
-1.2249E-01	5.1072E+01	1.3973E-02	1.5468E+01	5.0123E-01	0	0	0	0	0	1
2.6639E-01	3.2555E+01	4.3713E-02	-7.8042E+01	4.8130E-01	1	1	1	1	1	1
1.7350E+00	4.0000E+01	2.0798E-03	6.8219E+01	2.7418E+02	0	0	0	0	0	2
4.2519E+00	3.0731E+01	5.7561E-01	2.6803E+01	0.0000E+00	0	0	0	0	0	1
4.5823E+00	3.1280E+01	4.7835E-01	-1.9686E+01	1.2489E+02	0	0	0	0	0	2
5.8107E+00	6.3570E+01	2.7728E+00	-1.1390E+03	2.1007E+02	0	0	0	0	0	2
6.9322E+00	3.0250E+01	6.1947E-01	-1.0442E+02	4.5173E-01	0	0	0	0	0	1
8.6145E+00	2.9325E+01	7.7938E-01	8.1770E-01	6.0040E+01	0	0	0	0	0	1
9.6208E+00	3.9289E+01	5.9155E-01	2.0009E+02	1.7131E+00	0	0	0	0	0	2
9.9226E+00	8.8500E+01	1.8935E+00	8.6900E+02	2.9278E-01	0	0	0	0	0	2
1.2793E+01	3.0553E+01	8.7576E-01	-2.3286E+02	4.4892E-01	0	0	0	0	0	2
1.3430E+01	3.3765E+01	2.3820E+00	3.6897E-04	2.2959E+01	0	0	0	0	0	1
1.4754E+01	2.8977E+01	7.6085E+00	7.3749E+01	2.8291E+01	0	0	0	0	0	2
1.5987E+01	4.0000E+01	1.7456E+00	-4.3441E+02	8.3513E+00	0	0	0	0	0	2
1.6674E+01	2.4641E+01	1.0735E+00	2.0644E+02	1.5440E+00	0	0	0	0	0	1
1.7853E+01	3.6041E+01	2.8250E+00	5.9507E-01	1.8731E+01	0	0	0	0	0	1
1.8269E+01	4.0000E+01	1.3010E-01	-3.2455E+01	1.5573E-01	0	0	0	0	0	1
2.0720E+01	3.8056E+01	3.4529E-01	1.2483E+01	4.5453E+01	0	0	0	0	0	1
2.1921E+01	3.2884E+01	9.9690E-02	-1.2066E+01	0.0000E+00	0	0	0	0	0	1
2.2995E+01	4.4463E+01	8.0627E-01	2.1114E+02	3.2203E+01	0	0	0	0	0	1
2.3679E+01	4.1864E+01	5.7370E-01	4.0304E+02	-5.7001E+00	0	0	0	0	0	2
2.4103E+01	4.2440E+01	1.1466E+00	-3.3662E+01	-5.9771E+01	0	0	0	0	0	1
2.4529E+01	4.0000E+01	2.0506E-01	4.4557E+02	0.0000E+00	0	0	0	0	0	2
2.6429E+01	3.4507E+01	5.4046E+00	1.1160E+01	2.6810E+02	0	0	0	0	0	2
2.7437E+01	4.0000E+01	2.0992E-01	-4.9285E+02	0.0000E+00	0	0	0	0	0	2
2.8857E+01	4.0230E+01	5.5605E+00	4.9228E+02	1.2118E+02	0	0	0	0	0	2
2.9567E+01	3.8537E+01	7.2007E-01	-1.8319E+00	-1.6947E+02	0	0	0	0	0	2
3.1021E+01	3.7298E+01	2.1206E+00	0.0000E+00	-2.6136E+02	0	0	0	0	0	1
3.3403E+01	4.3736E+01	1.8527E-01	7.3123E+01	6.4594E+01	0	0	0	0	0	1
3.3813E+01	4.2121E+01	3.1847E-01	0.0000E+00	1.0133E+02	0	0	0	0	0	1
3.4932E+01	3.9298E+01	3.1106E+00	-1.1177E+03	3.2651E+02	0	0	0	0	0	2
3.5049E+01	4.0000E+01	3.3368E-01	8.9681E+00	9.6819E+00	0	0	0	0	0	1
3.6287E+01	4.0000E+01	6.1151E-02	4.7236E+00	3.1157E+01	0	0	0	0	0	1
3.7637E+01	3.9666E+01	4.4292E-01	2.2375E+01	8.5867E+02	0	0	0	0	0	2
3.8173E+01	3.6798E+01	3.1090E-01	-1.3385E+01	7.0306E+01	0	0	0	0	0	1
3.8480E+01	4.0000E+01	3.0000E-02	0.0000E+00	1.0000E+01	0	0	0	0	0	1
3.9404E+01	3.9435E+01	1.3803E+00	6.2841E+01	1.1612E+02	0	0	0	0	0	1
3.9909E+01	4.7948E+01	1.4842E+00	8.9779E+01	0.0000E+00	0	0	0	0	0	1
4.0307E+01	4.0752E+01	2.6427E+00	-9.9627E+02	-1.6643E+01	0	0	0	0	0	2
4.2818E+01	4.0000E+01	2.3240E-01	1.8520E+02	0.0000E+00	0	0	0	0	0	1
4.3478E+01	3.0000E+01	2.3072E-01	0.0000E+00	2.9321E+01	0	0	0	0	0	1
4.6570E+01	3.8523E+01	1.2538E+00	0.0000E+00	-2.4613E+02	0	0	0	0	0	1
4.7348E+01	3.9219E+01	1.2233E-01	8.1896E+01	1.3750E+02	0	0	0	0	0	1
4.8103E+01	4.2366E+01	7.2587E+00	-2.7692E+02	2.0683E+02	0	0	0	0	0	2
5.0405E+01	4.0341E+01	5.2617E-01	1.5884E+01	3.1031E+02	0	0	0	0	0	1
5.2343E+01	4.0000E+01	5.3285E-02	3.2000E+01	0.0000E+00	0	0	0	0	0	2
5.4270E+01	4.0000E+01	3.0000E-02	-1.5000E+01	0.0000E+00	0	0	0	0	0	1
5.5900E+01	4.0000E+01	3.5491E-02	0.0000E+00	1.5000E+01	0	0	0	0	0	1
5.7230E+01	4.0000E+01	3.2000E-02	5.0000E+00	0.0000E+00	0	0	0	0	0	1
5.7950E+01	4.0000E+01	2.1600E-01	1.5000E+02	0.0000E+00	0	0	0	0	0	2
5.8137E+01	4.0000E+01	1.2388E+00	1.5410E+02	-3.5723E+02	0	0	0	0	0	2
5.9459E+01	4.0000E+01	2.5839E+00	-6.5939E+01	4.4740E+02	0	0	0	0	0	2
6.0559E+01	4.0000E+01	3.6376E+00	1.2963E+02	-5.6766E+00	0	0	0	0	0	1
6.0231E+01	4.0000E+01	1.3042E+00	4.1309E+00	4.5689E+02	0	0	0	0	0	2
6.2258E+01	4.0000E+01	7.1471E+00	-5.3532E+02	1.4106E+02	0	0	0	0	0	2
6.4430E+01	4.0000E+01	8.5714E-02	0.0000E+00	3.1000E+01	0	0	0	0	0	1
6.5729E+01	4.0000E+01	4.5506E+00	2.4073E+02	5.2475E+00	0	0	0	0	0	1
6.6615E+01	4.0000E+01	2.5477E+00	-3.5949E+00	-1.3361E+02	0	0	0	0	0	1
6.8283E+01	4.0000E+01	1.0944E+00	4.3959E+01	0.0000E+00	0	0	0	0	0	1

TABLE VI

^{241}Pu resonance parameters — Energy (eV), capture width (meV), neutron width (meV), fission width (meV) channel 1, fission width (meV) channel 2 are given. The flag in the last column indicates the angular momentum of the resonance : 1 for 3^+ resonances and 2 for 2^+ resonances

6.9249E+01	4.0000E+01	9.3420E-01	0.0000E+00	2.2164E+01	0	0	0	0	0	1
7.1670E+01	4.0000E+01	8.4000E-02	-4.7000E+01	0.0000E+00	0	0	0	0	0	1
7.2279E+01	4.0000E+01	2.0050E+00	1.1556E+02	2.7032E+02	0	0	0	0	0	2
7.3937E+01	4.0000E+01	4.4904E-01	1.3265E+01	0.0000E+00	0	0	0	0	0	1
7.5869E+01	4.0000E+01	4.0815E+00	7.9636E+01	0.0000E+00	0	0	0	0	0	1
7.7127E+01	4.0000E+01	3.2346E+00	0.0000E+00	-1.1319E+01	0	0	0	0	0	1
7.7323E+01	4.0000E+01	3.1427E+00	6.5172E+02	1.1852E+03	0	0	0	0	0	2
8.0205E+01	4.0000E+01	4.3212E+00	0.0000E+00	6.2625E+01	0	0	0	0	0	1
8.1212E+01	4.0000E+01	8.4689E-02	1.5058E+03	0.0000E+00	0	0	0	0	0	2
8.1564E+01	4.0000E+01	1.5229E+01	8.1160E+02	-2.3493E+02	0	0	0	0	0	2
8.3217E+01	4.0000E+01	5.5179E+00	-7.6190E-02	4.9530E+01	0	0	0	0	0	2
8.4201E+01	4.0000E+01	2.8134E-01	4.2938E+02	0.0000E+00	0	0	0	0	0	1
8.5401E+01	4.0000E+01	2.0586E+00	0.0000E+00	1.0335E+02	0	0	0	0	0	1
8.5688E+01	4.0000E+01	1.9746E+00	1.2737E+02	0.0000E+00	0	0	0	0	0	1
8.5867E+01	4.0000E+01	4.9733E+00	-1.0254E+03	-3.0069E+01	0	0	0	0	0	2
8.6975E+01	4.0000E+01	5.4234E+00	0.0000E+00	6.1435E+01	0	0	0	0	0	1
8.8036E+01	4.0000E+01	1.9548E+00	2.2849E+02	1.1789E+01	0	0	0	0	0	2
8.8854E+01	4.0000E+01	4.7336E-01	0.0000E+00	-1.5825E+03	0	0	0	0	0	1
8.9283E+01	4.0000E+01	3.7873E+00	2.7846E+00	1.0072E+03	0	0	0	0	0	2
9.0713E+01	4.0000E+01	1.4123E+00	-2.6697E+00	-2.8258E+02	0	0	0	0	0	1
9.1600E+01	4.0000E+01	8.0000E-02	0.0000E+00	2.5000E+01	0	0	0	0	0	2
9.2542E+01	4.0000E+01	2.2525E-01	2.5000E+00	0.0000E+00	0	0	0	0	0	2
9.3739E+01	4.0000E+01	2.8811E-01	-6.7650E+01	0.0000E+00	0	0	0	0	0	1
9.5470E+01	4.0000E+01	1.2900E+00	9.1173E+00	4.1516E+02	0	0	0	0	0	2
9.6028E+01	4.0000E+01	4.4058E-01	-1.0173E+01	1.5109E+01	0	0	0	0	0	1
9.6599E+01	4.0000E+01	4.7422E-01	3.3492E+02	4.5966E+00	0	0	0	0	0	2
9.7569E+01	4.0000E+01	5.1160E-01	1.1193E+01	-2.5946E+02	0	0	0	0	0	1
9.8358E+01	4.0000E+01	7.3385E+00	1.9618E+02	-7.6655E+00	0	0	0	0	0	1
9.9732E+01	4.0000E+01	2.3423E+00	4.2738E+02	2.0478E+01	0	0	0	0	0	1
1.0082E+02	4.0000E+01	1.4256E+00	5.2731E+02	2.8381E+02	0	0	0	0	0	2
1.0152E+02	4.0000E+01	1.1372E+00	-6.2843E+01	-3.1662E+00	0	0	0	0	0	1
1.0243E+02	4.0000E+01	2.8914E+00	1.2112E+03	6.0862E+00	0	0	0	0	0	2
1.0362E+02	4.0000E+01	1.1056E+00	2.3548E+00	3.0330E+01	0	0	0	0	0	1
1.0798E+02	4.0000E+01	1.2657E+00	7.5449E+01	1.0757E+01	0	0	0	0	0	1
1.0912E+02	4.0000E+01	1.9443E+00	2.8649E+02	-1.2439E+02	0	0	0	0	0	1
1.0934E+02	4.0000E+01	4.4820E-01	3.5218E+02	9.0786E+01	0	0	0	0	0	2
1.1045E+02	4.0000E+01	3.7100E-01	5.2537E+02	1.8330E+02	0	0	0	0	0	1
1.1319E+02	4.0000E+01	8.7137E-01	-6.1756E+01	1.6912E+01	0	0	0	0	0	2
1.1494E+02	4.0000E+01	2.6339E-01	5.0000E+01	5.0000E+01	0	0	0	0	0	1
1.1560E+02	4.0000E+01	2.1531E-01	1.5400E+02	1.0000E+02	0	0	0	0	0	1
1.1722E+02	4.0000E+01	5.1637E+00	2.5929E+02	1.6009E+02	0	0	0	0	0	2
1.1906E+02	4.0000E+01	1.6670E-01	6.9615E+01	4.8592E+01	0	0	0	0	0	1
1.2025E+02	4.0000E+01	2.6024E-01	1.7975E+00	-3.7160E+02	0	0	0	0	0	1
1.2143E+02	4.0000E+01	6.3661E-02	8.7585E+02	1.3526E+02	0	0	0	0	0	2
1.2226E+02	4.0000E+01	5.2394E+00	3.7832E+02	1.7741E+02	0	0	0	0	0	1
1.2230E+02	4.0000E+01	1.5836E+00	1.6197E+02	1.0611E+01	0	0	0	0	0	2
1.2339E+02	4.0000E+01	3.9375E+00	4.7987E+01	1.8204E+01	0	0	0	0	0	2
1.2396E+02	4.0000E+01	1.7372E+00	4.7723E+02	8.0775E+02	0	0	0	0	0	2
1.2596E+02	4.0000E+01	1.8081E-01	4.9801E+02	0.0000E+00	0	0	0	0	0	1
1.2616E+02	4.0000E+01	2.8372E-01	2.5413E+02	5.9263E+01	0	0	0	0	0	1
1.2616E+02	4.0000E+01	2.2034E+00	1.1490E+03	3.7038E-01	0	0	0	0	0	2
1.2855E+02	4.0000E+01	6.0649E+00	2.0143E+00	4.9997E+01	0	0	0	0	0	2
1.3010E+02	4.0000E+01	1.6507E+00	3.0803E+02	6.5995E+00	0	0	0	0	0	1
1.3077E+02	4.0000E+01	1.2913E+01	7.0941E+01	-1.1799E+00	0	0	0	0	0	2
1.3308E+02	4.0000E+01	2.7208E+00	7.8552E+02	5.0340E+00	0	0	0	0	0	1
1.3370E+02	4.0000E+01	6.6441E+00	4.6927E+01	1.7265E+00	0	0	0	0	0	2
1.3474E+02	4.0000E+01	4.0375E+00	1.8336E+03	3.0693E+00	0	0	0	0	0	1
1.3664E+02	4.0000E+01	1.5053E+00	-2.3982E+01	1.0011E+00	0	0	0	0	0	2
1.3832E+02	4.0000E+01	3.4896E+00	3.0101E+02	8.0574E+01	0	0	0	0	0	1
1.4024E+02	4.0000E+01	7.6890E+00	1.0061E+02	5.6752E+00	0	0	0	0	0	2
1.4217E+02	4.0000E+01	1.7303E+01	1.2835E+01	1.7691E+02	0	0	0	0	0	2
1.4505E+02	4.0000E+01	1.4398E+00	1.7109E+02	2.8130E+02	0	0	0	0	0	1

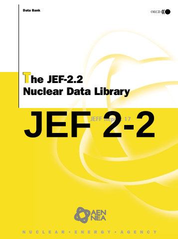
TABLE VI (continued)

1.4616E+02	4.0000E+01	8.6744E+00	5.0221E+01	1.5393E+02	0	0	0	0	0	2
1.4692E+02	4.0000E+01	1.6647E+00	9.8021E+02	1.1126E+01	0	0	0	0	0	1
1.4896E+02	4.0000E+01	2.8809E+00	7.2015E+01	4.6803E+01	0	0	0	0	0	2
1.5010E+02	4.0000E+01	6.8563E+00	4.2378E+02	1.2693E+02	0	0	0	0	0	2
1.5020E+02	4.0000E+01	7.5566E-02	5.0599E+01	9.8585E-01	0	0	0	0	0	1
1.5104E+02	4.0000E+01	4.5720E+00	3.0008E+02	1.7820E+02	0	0	0	0	0	2
1.5245E+02	4.0000E+01	1.3232E+00	5.8656E+02	2.0632E+02	0	0	0	0	0	1
1.5368E+02	4.0000E+01	7.4159E+00	3.8502E+00	3.5159E+02	0	0	0	0	0	1
1.5548E+02	4.0000E+01	2.5802E+00	1.4707E+02	1.7139E+01	0	0	0	0	0	2
1.5633E+02	4.0000E+01	3.5000E-01	1.0000E+02	0.0000E+00	0	0	0	0	0	1
1.5733E+02	4.0000E+01	4.8068E-01	4.5000E+02	0.0000E+00	0	0	0	0	0	2
1.5898E+02	4.0000E+01	6.2255E+00	2.1704E+02	-3.1068E+01	0	0	0	0	0	2
1.5952E+02	4.0000E+01	1.7138E+00	4.9276E+01	2.3035E+00	0	0	0	0	0	2
1.6066E+02	4.0000E+01	2.6504E+00	7.7059E+00	2.2788E+02	0	0	0	0	0	1
1.6168E+02	4.0000E+01	2.0000E-01	2.5000E+01	2.5000E+01	0	0	0	0	0	1
1.6276E+02	4.0000E+01	2.8032E+00	-4.2467E+02	8.5067E+02	0	0	0	0	0	2
1.6461E+02	4.0000E+01	3.1649E+00	-4.0013E-01	6.4431E+02	0	0	0	0	0	1
1.6558E+02	4.0000E+01	8.3658E-01	2.7757E+02	-1.5348E+02	0	0	0	0	0	2
1.6612E+02	4.0000E+01	2.0000E-01	5.0000E+01	5.0000E+01	0	0	0	0	0	1
1.6716E+02	4.0000E+01	6.7970E-01	1.5734E+01	1.6961E+01	0	0	0	0	0	1
1.6784E+02	4.0000E+01	4.7387E-01	5.0000E+01	5.0000E+01	0	0	0	0	0	2
1.6869E+02	4.0000E+01	3.8765E+00	4.3959E+00	2.1910E+02	0	0	0	0	0	2
1.6974E+02	4.0000E+01	1.4105E+00	3.6234E+01	4.9283E+02	0	0	0	0	0	1
1.7136E+02	4.0000E+01	2.0000E-01	2.0000E+01	0.0000E+00	0	0	0	0	0	1
1.7299E+02	4.0000E+01	4.4415E-01	1.3555E+02	3.5761E+01	0	0	0	0	0	1
1.7422E+02	4.0000E+01	1.0856E+01	6.4361E+00	1.1686E+02	0	0	0	0	0	1
1.7500E+02	4.0000E+01	8.1328E+00	5.6939E+01	-5.5989E+00	0	0	0	0	0	1
1.7584E+02	4.0000E+01	1.7095E+01	1.3453E+02	1.8729E+03	0	0	0	0	0	2
1.7714E+02	4.0000E+01	1.3381E+00	2.5837E+01	-9.2249E+01	0	0	0	0	0	1
1.7782E+02	4.0000E+01	1.5000E-01	1.0000E+02	0.0000E+00	0	0	0	0	0	1
1.7884E+02	4.0000E+01	1.4265E+00	-1.7506E+02	1.9770E+02	0	0	0	0	0	2
1.8000E+02	4.0000E+01	1.2920E+00	1.3070E+02	3.8897E+02	0	0	0	0	0	2
1.8287E+02	4.0000E+01	8.2870E+00	1.1810E+02	6.5557E+00	0	0	0	0	0	1
1.8355E+02	4.0000E+01	3.4837E+00	2.6199E+02	1.1563E+02	0	0	0	0	0	2
1.8473E+02	4.0000E+01	2.0000E-01	1.0000E+02	0.0000E+00	0	0	0	0	0	1
1.8732E+02	4.0000E+01	9.7768E-01	-1.4690E+01	7.3512E+01	0	0	0	0	0	2
1.8900E+02	4.0000E+01	1.9952E+00	7.8556E+01	1.5114E+01	0	0	0	0	0	1
1.8971E+02	4.0000E+01	2.4772E+00	1.1120E+02	1.0164E+01	0	0	0	0	0	1
1.9038E+02	4.0000E+01	1.1078E+01	4.2572E+01	1.2724E+03	0	0	0	0	0	2
1.9278E+02	4.0000E+01	7.9878E-01	8.2345E+02	3.9803E+01	0	0	0	0	0	1
1.9292E+02	4.0000E+01	1.1354E+01	8.1468E+02	-1.8484E+01	0	0	0	0	0	2
1.9555E+02	4.0000E+01	1.8876E-01	1.3777E+02	0.0000E+00	0	0	0	0	0	1
1.9590E+02	4.0000E+01	1.4506E+01	1.2913E+02	-4.1114E+02	0	0	0	0	0	1
1.9700E+02	4.0000E+01	9.1076E-01	5.0000E+00	0.0000E+00	0	0	0	0	0	1
1.9746E+02	3.9434E+01	1.1808E+01	1.8511E+03	3.4505E+01	0	0	0	0	0	2
1.9800E+02	4.2316E+01	3.7072E+00	2.1625E+02	-1.5672E+01	0	0	0	0	0	1
1.9940E+02	4.0000E+01	1.9141E+01	1.6373E+03	-2.1571E-02	0	0	0	0	0	2
2.0078E+02	4.0000E+01	7.5900E-01	8.1824E+01	-5.4259E+00	0	0	0	0	0	1
2.0274E+02	4.0000E+01	3.1325E+01	-1.4006E+02	2.8345E+01	0	0	0	0	0	2
2.0593E+02	4.0000E+01	6.5802E+00	3.1079E+01	-1.1208E+02	0	0	0	0	0	1
2.0751E+02	4.0000E+01	2.7030E+00	-2.0037E+01	6.8618E-01	0	0	0	0	0	1
2.0945E+02	4.0000E+01	6.4392E+00	1.2927E+03	4.9384E+00	0	0	0	0	0	2
2.1044E+02	4.0000E+01	1.8372E+00	1.8004E+02	6.1036E+01	0	0	0	0	0	1
2.1194E+02	4.0000E+01	8.2147E+00	6.1583E+02	3.4417E+02	0	0	0	0	0	2
2.1334E+02	4.0000E+01	1.3325E-01	3.5000E+00	0.0000E+00	0	0	0	0	0	1
2.1459E+02	4.0000E+01	5.8856E+00	-3.0443E+02	5.8292E-01	0	0	0	0	0	1
2.1755E+02	4.0000E+01	2.4803E+01	2.6702E+03	-3.8419E+00	0	0	0	0	0	2
2.1760E+02	4.0000E+01	1.7257E+01	1.6619E+03	5.4582E+00	0	0	0	0	0	1
2.1914E+02	4.0000E+01	5.3684E+00	1.0209E+02	-2.1049E+02	0	0	0	0	0	2
2.1945E+02	4.0000E+01	6.1298E+00	9.0942E+03	1.4436E+01	0	0	0	0	0	2
2.2126E+02	4.0000E+01	5.0155E-01	5.1336E+01	0.0000E+00	0	0	0	0	0	1
2.2190E+02	4.0000E+01	4.1998E+00	5.2700E+02	6.4328E+02	0	0	0	0	0	2

TABLE VI (continued)

2.2455E+02	4.0000E+01	3.9955E+00	1.6487E+02	-1.4004E+03	0	0	0	0	0	2
2.2468E+02	4.0000E+01	4.0000E-01	-7.1000E+00	0.0000E+00	0	0	0	0	0	1
2.2588E+02	4.0000E+01	4.1518E+00	2.4026E+02	-2.1505E+02	0	0	0	0	0	1
2.2715E+02	4.0000E+01	8.3502E-02	-1.2168E+02	8.3057E+01	0	0	0	0	0	2
2.2807E+02	4.0000E+01	1.5925E+01	6.7704E+00	1.0237E+01	0	0	0	0	0	2
2.2903E+02	4.0000E+01	2.0158E+00	6.5542E+02	1.8034E+01	0	0	0	0	0	1
2.2987E+02	4.0000E+01	1.3577E+01	4.6828E+02	7.7497E+00	0	0	0	0	0	2
2.3075E+02	4.0000E+01	1.8668E+00	6.1331E+02	-1.0465E-01	0	0	0	0	0	1
2.3157E+02	4.0000E+01	6.7338E+00	5.9989E+02	2.2897E+02	0	0	0	0	0	2
2.3326E+02	4.0000E+01	3.0720E+01	1.5543E-02	1.5260E+01	0	0	0	0	0	1
2.3463E+02	4.0000E+01	3.1702E+00	-3.0184E+00	2.9788E+01	0	0	0	0	0	1
2.3599E+02	4.0000E+01	4.1112E+00	1.7782E+01	2.3740E+02	0	0	0	0	0	2
2.3749E+02	4.0000E+01	5.2508E-01	7.5958E+00	-1.1423E+01	0	0	0	0	0	1
2.3836E+02	4.0000E+01	3.5856E+00	7.7420E+00	2.5877E+02	0	0	0	0	0	2
2.4096E+02	4.0000E+01	1.1184E+01	8.8259E+00	-4.6808E+02	0	0	0	0	0	2
2.4342E+02	4.0000E+01	1.0177E+01	9.9553E+02	6.0045E+02	0	0	0	0	0	1
2.4386E+02	4.0000E+01	1.2067E+01	1.0064E+00	1.7569E+02	0	0	0	0	0	2
2.4488E+02	4.0000E+01	5.4886E+00	2.0351E+01	-4.0455E+02	0	0	0	0	0	1
2.4678E+02	4.0000E+01	2.1153E+00	2.0142E+02	3.3081E+01	0	0	0	0	0	2
2.4858E+02	4.0000E+01	1.4269E+01	5.6023E-01	5.0571E+01	0	0	0	0	0	1
2.4959E+02	4.0000E+01	5.7276E+00	3.3260E-01	1.8284E+01	0	0	0	0	0	2
2.5051E+02	4.0000E+01	8.3271E-01	2.2018E+02	-9.2669E+01	0	0	0	0	0	1
2.5300E+02	4.0000E+01	2.0166E-01	1.0259E+02	-3.9122E+02	0	0	0	0	0	2
2.5519E+02	4.0000E+01	4.4357E+00	3.2262E+01	4.2125E+02	0	0	0	0	0	1
2.5655E+02	4.0000E+01	2.6472E+00	4.1521E+02	-7.2855E+01	0	0	0	0	0	2
2.5835E+02	4.0000E+01	2.1040E+01	-9.9422E+00	1.4325E+02	0	0	0	0	0	1
2.5983E+02	4.0000E+01	7.0023E+00	1.7373E+01	-4.6547E+02	0	0	0	0	0	2
2.6355E+02	4.0000E+01	5.7017E-01	-2.5962E+03	1.5229E+02	0	0	0	0	0	2
2.6378E+02	4.0000E+01	2.0185E+00	6.0852E+01	7.6374E+02	0	0	0	0	0	1
2.6405E+02	4.0000E+01	3.3482E-01	8.0143E+01	-2.1985E+02	0	0	0	0	0	2
2.6646E+02	4.0000E+01	2.2616E+00	-2.6796E+01	1.3773E+02	0	0	0	0	0	1
2.6813E+02	4.0000E+01	2.9280E+00	1.2988E+02	9.3012E+02	0	0	0	0	0	2
2.6948E+02	4.0000E+01	4.2666E-01	5.0000E+00	0.0000E+00	0	0	0	0	0	1
2.7012E+02	4.0000E+01	1.3153E+01	-4.6590E+01	-2.4461E+03	0	0	0	0	0	2
2.7160E+02	4.0000E+01	1.0613E+01	-3.8025E+02	-3.9369E+01	0	0	0	0	0	1
2.7402E+02	4.0000E+01	1.8432E+00	7.7295E+00	2.7628E+02	0	0	0	0	0	1
2.7586E+02	4.0000E+01	3.3789E+00	-5.7250E+01	2.9239E+02	0	0	0	0	0	2
2.7705E+02	4.0000E+01	1.3844E+01	7.5966E+01	-7.7794E+02	0	0	0	0	0	1
2.7844E+02	4.0000E+01	6.6870E+00	1.1167E+03	1.0374E+02	0	0	0	0	0	2
2.8006E+02	4.0000E+01	1.6970E+00	1.6760E+02	-1.1074E+02	0	0	0	0	0	1
2.8150E+02	4.0000E+01	7.5812E-01	1.5898E+02	1.4970E+02	0	0	0	0	0	1
2.8400E+02	4.0000E+01	5.9322E+00	3.8351E+01	-1.8106E+03	0	0	0	0	0	1
2.8432E+02	4.0000E+01	1.4899E+01	-6.0205E+02	1.3075E+01	0	0	0	0	0	2
2.8550E+02	4.0000E+01	4.0623E+00	-7.2513E+00	-7.9431E+01	0	0	0	0	0	1
2.8713E+02	4.0000E+01	4.8746E+00	7.4873E+00	1.0631E+02	0	0	0	0	0	2
2.8840E+02	4.0000E+01	2.4185E-01	1.2687E+00	-1.0028E+01	0	0	0	0	0	1
2.9029E+02	4.0000E+01	9.7975E+00	-9.4840E+02	4.7285E+02	0	0	0	0	0	2
2.9094E+02	4.0000E+01	1.1631E+00	2.2146E+02	-1.8034E+02	0	0	0	0	0	1
2.9345E+02	4.0000E+01	2.1988E+00	-3.1367E+02	1.3776E+02	0	0	0	0	0	1
2.9434E+02	4.0000E+01	3.1056E+00	5.9747E+01	-1.8142E+02	0	0	0	0	0	1
2.9688E+02	4.0000E+01	3.8605E+00	-3.4673E+01	2.1220E+01	0	0	0	0	0	2
2.9751E+02	4.0000E+01	1.3565E+01	-1.5275E+02	9.7854E+01	0	0	0	0	0	1
2.9784E+02	4.0000E+01	4.1098E+00	2.1183E+01	-7.7921E+01	0	0	0	0	0	2
2.9912E+02	4.0000E+01	7.4600E+00	1.6999E+02	1.7695E+02	0	0	0	0	0	2
3.0017E+02	4.0000E+01	3.6539E+00	-3.8442E+02	9.9195E+01	0	0	0	0	0	1
3.0178E+02	4.0000E+01	1.7654E+01	2.9913E+02	7.2215E+01	0	0	0	0	0	2
3.0411E+02	4.0000E+01	8.8321E-01	3.1051E+02	4.6242E+02	0	0	0	0	0	1
3.2000E+02	4.0000E+01	1.8786E+01	2.8127E+02	3.5850E+02	0	0	0	0	0	1
4.0000E+02	4.0000E+01	4.3967E+02	6.4308E+02	5.4664E+02	0	0	0	0	0	2

TABLE VI (continued)



Energy range (eV)	Present work	Previous ORNL (2)	BLONS (22)	KOLAR (3)
0-50	1.312	1.354	1.282	
50-100	1.117	1.043	1.059	
100-150	0.913		0.850	
150-200	1.296			
200-250	1.775			
250-300	1.054			
12.8 - 50.4	1.334	1.339	1.304	1.441
0-300	1.232			

<u>TABLE VII</u>

The s-wave strength function in several energy ranges. The values are multiplied by 10^4.

Resonance energy (eV)	Present work	BLONS (22)	KOLAR (3)
0.26	32.6		
4.28	30.7		
4.58	31.3		
6.93	30.2		
8.61	29.3		
12.79	30.6		
13.63	33.8		
14.75	29.0		
16.67	24.6		
17.85	36.0	45	43
20.72	38.1	33	46
22.99	44.5	46	66
24.10	42.4	41	51
26.43	34.5	38	50
31.02	37.3	54	54
38.17	36.7		
39.40	39.4		
39.90	47.9		

TABLE VIII

Capture widths (meV) for some well isolated resonances

			26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
27	3.0857E-04	.000	-3	100																							
28	0.5749	.017	-5	2	100																						
29	1.5752E-02	.007	-6	-5	-38	100																					
30	7.3692E-05	.200	0	1	0	0	100																				
31	0.4956	.022	9	-6	-29	-34	0	100																			
32	1.0450E-03	.000	2	-1	1	1	0	1	100																		
33	1.635	.066	-4	1	3	3	0	-5	0	100																	
34	8.5012E-03	.008	-2	3	-2	0	0	-4	-37	5	100																
35	3.284	.016	1	1	-4	-3	0	0	-27	-29	31	100															
36	0.2684	.174	0	6	1	1	0	0	4	2	5	-1	100														
37	3.6774E-04	.000	-3	0	3	1	0	-4	1	1	-4	-4	-10	100													
38	0.6071	.017	-3	1	3	1	0	-3	2	-1	2	0	7	8	100												
39	1.9951E-02	.007	-8	1	5	8	0	-9	3	4	4	-1	-1	1	-38	100											
40	9.2857E-02	.156	0	-1	0	-1	0	-2	19	3	6	8	-7	-17	9	-3	100										
41	0.4442	.024	10	1	-7	-7	0	13	1	-5	1	1	5	2	-4	-38	-16	100									
42	1.8378E-03	.000	0	0	0	0	0	0	0	-2	7	9	1	3	11	2	20	3	100								
43	2.6385E-03	.020	0	-1	1	0	0	0	-18	-2	-1	-1	-11	-14	-18	-8	-7	-20	-9	100							
44	3.256	.100	1	-1	0	-1	0	3	-26	-3	-3	-2	-5	-13	-9	-8	0	-16	8	54	100						
45	3.1558E-02	.203	0	1	0	0	0	0	0	0	1	1	1	5	0	1	2	0	-12	2	0	100					
46	1.0838E-02	.006	2	0	0	0	0	1	-1	0	2	1	0	0	0	0	0	0	0	-1	-1	0	100				
47	1.3868E-04	.067	0	1	-1	-1	0	-1	1	0	-4	-2	0	0	-1	-1	-1	0	0	0	1	0	-57	100			
48	7.311	.107	0	1	0	1	0	1	-4	0	8	6	0	-1	1	0	-2	2	1	5	3	0	-49	33	100		
49	13.52	.049	3	-1	-1	-2	0	0	4	-1	-11	-7	1	0	-3	-2	0	-1	-2	-2	0	0	-1	44	52	100	
50	6.3684E-04	.000	3	0	1	1	0	3	-4	0	5	4	0	-1	0	-1	-1	2	1	1	1	0	21	-12	4	8	100
51	0.8496	.027	-9	2	7	6	0	-11	0	6	1	-3	0	3	5	8	0	-11	0	-1	-3	0	0	1	-1	1	-15
52	3.3925E-03	.007	-5	0	0	1	0	-4	5	1	-7	-7	0	1	0	3	0	-3	-1	0	0	0	-22	22	2	9	-69
53	1.542	.078	-2	-1	-1	-2	0	-5	14	-1	-26	-20	1	2	-3	0	1	-5	-4	-4	-3	-1	-25	24	-9	18	-36
54	1.446	.012	5	0	-4	-4	0	9	-9	-3	16	14	-1	-3	0	-6	-2	11	2	5	5	1	2	0	14	-3	-17
55	3.1318E-03	.001	5	1	2	3	0	0	-6	1	10	7	0	0	2	3	-1	-1	2	2	2	0	22	-18	8	-2	44
56	8.7552E-03	.003	-1	1	2	6	0	-2	1	1	-2	-4	-2	1	1	5	-2	-2	1	5	4	0	3	1	4	7	23
57	11.10	.010	-2	-2	-2	-4	0	-2	16	-2	-31	-22	0	1	-4	-3	2	-2	-4	-3	-2	-1	-19	17	-20	10	-36
58	8.626	.041	1	3	2	3	0	2	-16	2	32	22	-1	-1	5	2	-3	4	4	6	4	1	23	-16	18	-6	46
59	1.8023E-03	.000	-1	-1	0	-1	0	0	1	0	-2	-1	0	0	0	-1	0	0	0	0	0	0	-4	3	1	2	-5
60	1.4766E-02	.025	-10	1	1	3	0	3	-1	0	2	1	1	0	1	1	-2	1	1	2	2	0	11	-11	3	-9	16
61	7.988	.040	-10	0	1	2	0	3	-1	0	2	1	0	0	0	0	-1	2	1	2	2	0	9	-9	4	-8	14
62	0.3535	.206	0	0	0	0	0	0	1	0	-1	-1	0	0	0	0	0	0	0	0	0	0	1	-2	-2	2	2
63	2.6739E-03	.000	7	0	-2	-3	0	-4	2	0	-4	-2	0	0	-1	-1	2	-2	-1	-4	-3	0	-13	13	-5	12	-18
64	1.3958E-02	.007	0	-1	1	2	0	1	-4	1	8	3	-1	0	2	2	-2	2	1	4	3	0	-8	5	3	-3	-9
65	9.122	.010	0	0	1	1	0	1	-6	1	11	7	-1	-1	2	0	-2	2	1	3	2	0	-5	2	4	-4	-5
66	6.0753E-02	.208	-1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	1	-2	-1	1	2
67	1.0592E-03	.000	-3	1	-1	4	0	1	9	0	-18	-13	0	1	-1	1	-1	-2	-1	2	2	0	-1	-1	2	1	2
68	2.502	.082	-4	2	-6	2	0	0	0	2	0	-1	0	1	2	3	0	-4	0	0	-1	0	1	-2	0	-1	1
69	5.0052E-03	.006	3	10	-13	3	-1	-17	-5	1	10	3	-5	1	2	3	-2	-2	1	5	4	0	-3	2	4	-4	0
70	3.399	.015	6	7	-6	-4	0	-13	-4	-1	6	4	-3	0	-1	-2	-1	2	1	5	3	0	-4	4	1	-1	-2
71	8.5524E-02	.191	0	0	2	1	0	2	-1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	-1	-1	1	-1
72	5.4468E-04	.000	-2	-2	0	1	0	-5	1	1	-4	-2	1	1	1	2	0	-3	0	0	0	0	-3	2	0	7	-4
73	0.4532	.016	-12	1	6	8	0	-12	2	5	-1	-6	1	4	6	12	-1	-15	0	0	-3	0	0	-1	0	-1	0
74	3.5271E-02	.005	-6	0	3	7	0	-7	-1	3	1	-3	1	2	1	8	-1	-7	0	1	0	0	0	-1	0	-2	0
75	1.929	.026	1	6	-7	-6	0	-6	-17	0	35	25	-2	-2	2	-3	-1	7	3	1	1	0	2	-1	9	-9	3
76	2.069	.073	4	-7	3	2	0	11	16	-2	-34	-23	3	1	-4	-1	0	0	-3	0	1	0	-1	0	-8	7	0

TABLE IX

Part of the correlation matrix obtained in the energy range 0.3 eV to 20 eV SAMMY fit. The standard deviations on parameters are also given in column 2 and 3 of the Table (absolute and relative values). The parameter numbers are given in line 1 and column 1 (see Table IX bis).

SPIN GROUP NUMBER 1 WITH SPIN= 3.0, ABUNDANCE= 1.0000, AND G-FACTOR=0.5833

ENERGY (EV)	GAMMA-GAMMA (MILLI-EV)	GAMMA-CHANNEL 1 L=0 SPIN=3.0 (MILLI-EV)	GAMMA-CHANNEL 2 L=0 SPIN=0.0 (MILLI-EV)	GAMMA-CHANNEL 3 L=0 SPIN=0.0 (MILLI-EV)
5.74390E-01(1)	4.7200E+01	7.7498E-04(2)	0.0000E+00	0.0000E+00
1.05650E+00(3)	3.3716E+01(4)	1.4668E-01(5)	0.0000E+00	0.0000E+00
1.26967E+00(6)	4.8900E+01	2.7352E-03(7)	0.0000E+00	0.0000E+00
1.92029E+00(8)	4.4600E+01	1.0824E-03(9)	0.0000E+00	0.0000E+00
2.67680E+00(10)	2.7324E+01(11)	8.6554E-02(12)	0.0000E+00	0.0000E+00
4.28194E+00(13)	3.0731E+01(14)	5.7561E-01(15)	2.6803E+01(16)	0.0000E+00
6.93218E+00(17)	3.0250E+01(18)	6.1947E-01(19)	-1.0442E+02(20)	4.5173E-01(21)
8.61452E+00(22)	2.9325E+01(23)	7.7938E-01(24)	8.1770E-01(25)	6.0040E+01(26)
1.34305E+01(27)	3.3765E+01(28)	2.3820E+00(29)	3.6897E-04(30)	2.2959E+01(31)
1.66739E+01(32)	2.4641E+01(33)	1.0735E+00(34)	2.0644E+02(35)	1.5440E+00(36)
1.78530E+01(37)	3.6041E+01(38)	2.8250E+00(39)	5.9507E-01(40)	1.8731E+01(41)
1.82689E+01(42)	4.0000E+01	1.3010E-01(43)	-3.2455E+01(44)	1.5573E-01(45)

SPIN GROUP NUMBER 2 WITH SPIN= 2.0, ABUNDANCE= 1.0000, AND G-FACTOR=0.4167

ENERGY (EV)	GAMMA-GAMMA (MILLI-EV)	GAMMA-CHANNEL 1 L=0 SPIN=2.0 (MILLI-EV)	GAMMA-CHANNEL 2 L=0 SPIN=0.0 (MILLI-EV)	GAMMA-CHANNEL 3 L=0 SPIN=0.0 (MILLI-EV)
1.73500E+00(46)	4.0000E+01	2.0798E-03(47)	6.8219E+01(48)	2.7418E+02(49)
4.58233E+00(50)	3.1280E+01(51)	4.7835E-01(52)	-1.9686E+01(53)	1.2489E+02(54)
5.81069E+00(55)	6.3570E+01	2.7728E+00(56)	-1.1390E+03(57)	2.1007E+02(58)
9.62075E+00(59)	3.9289E+01	5.9155E-01(60)	2.0009E+02(61)	1.7131E+00(62)
9.92260E+00(63)	8.8500E+01	1.8935E+00(64)	8.6900E+02(65)	2.9278E-01(66)
1.27925E+01(67)	3.0553E+01(68)	8.7576E-01(69)	-2.3286E+02(70)	4.4892E-01(71)
1.47537E+01(72)	2.8977E+01(73)	7.6085E+00(74)	7.3749E+01(75)	2.8291E+01(76)
1.59871E+01(77)	4.0000E+01	1.7456E+00(78)	-4.3441E+02(79)	3.3513E+00(80)

TABLE IX bis

Identification of the variable parameters in the energy range 0.3 eV to 20 eV SAMMY fit ; to be used for the interpretation of Table IX.

			76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
77	3.846	.172	-12	100																							
78	1.7478E-02	.000	-6	11	100																						
79	7.0853E-02	.039	16	12	24	100																					
80	2.760	.221	-2	3	20	10	100																				
81	26.48	.137	13	2	-49	15	0	100																			
82	9.9348E-03	.000	12	-10	-22	-6	-5	20	100																		
83	0.3962	.030	-2	4	-11	-28	0	-15	12	100																	
84	33.65	.187	-9	10	22	6	-8	6	-23	22	100																
85	46.47	.077	5	-6	-29	-29	6	-14	23	59	-58	100															
86	2.2961E-02	.000	7	-5	-3	6	0	5	4	-25	-11	-11	100														
87	9.5795E-02	.057	0	1	-6	-13	-2	-2	21	20	-1	9	-8	100													
88	28.46	.200	-1	2	0	-4	-1	0	6	6	-6	8	-29	30	100												
89	25.77	.195	-1	-1	-5	-9	0	0	-6	-1	4	-6	8	29	-12	100											
90	6.4414E-02	.087	2	2	-3	-5	0	-3	21	17	-9	17	0	33	-3	13	100										
91	6.8569E-02	.000	1	-3	-2	1	0	6	-7	-15	0	-12	0	-20	-6	-8	-21	100									
92	0.3651	.111	2	-1	-4	-2	0	-1	14	-8	-4	1	25	19	4	6	18	9	100								
93	10.58	.211	-1	1	1	-1	-1	2	-5	-4	-2	-2	8	0	1	-2	10	-18	1	100							
94	129.0	.088	2	0	-10	-18	0	-5	-9	9	-10	12	6	6	-4	10	-24	43	6	3	100						
95	1.4638E-02	.000	-1	1	3	2	1	2	-8	5	9	-5	-14	-4	1	-2	-6	-4	-27	13	8	100					
96	0.1679	.036	5	-2	-2	6	1	3	2	-7	-4	-3	-1	-7	-5	-1	-5	-28	-47	-13	-28	-18	100				
97	17.47	.220	1	-1	0	2	1	-1	-3	3	2	2	-6	2	1	3	-1	-25	-8	-2	-3	55	12	100			
98	33.08	.138	2	-1	1	4	0	2	4	-5	2	-6	-2	-5	-1	-4	-2	-17	-42	-2	-37	-34	79	-17	100		
99	4.3224E-02	.178	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	-4	-1	1	4	1	0	1	100	
100	4.0681E-02	.000	1	-1	0	3	0	2	3	-5	-2	-2	0	-5	-2	-2	-2	-3	-4	-2	-6	5	2	8	-2	-2	100
101	0.1251	.111	1	-1	-2	1	0	1	1	-5	-2	0	10	1	1	1	2	4	13	1	5	-4	7	0	5	9	-24
102	35.55	.178	0	0	0	0	-1	1	0	-3	-3	0	3	-2	-1	-1	0	1	1	-2	0	-2	7	3	2	1	-32
103	31.53	.186	0	-1	-2	-2	0	0	-2	-2	-1	0	2	-1	-1	0	-2	2	1	0	-3	1	3	1	3	1	-18
104	3.1115E-02	.000	-1	1	0	-3	0	-2	-5	7	5	2	-2	5	4	3	1	1	7	6	10	-4	-8	-8	-3	1	-20
105	9.3639E-02	.043	0	-1	0	4	1	1	-5	0	-1	1	-1	0	-1	0	2	-6	4	-2	-1	0	0	2	0	2	-19
106	44.31	.149	0	-1	0	2	1	0	-4	1	3	-1	-2	1	1	1	0	-1	2	1	-1	3	-2	-2	1	1	-23
107	25.86	.189	0	0	1	0	0	0	-6	1	0	1	-1	0	0	0	2	-6	1	-1	3	-4	-5	1	-3	0	-11
108	1.8151E-02	.000	0	-1	1	2	0	1	-6	1	2	-1	-3	0	1	0	1	-4	-1	1	1	2	-4	0	-2	0	-17
109	7.9328E-02	.025	0	-1	-2	1	0	1	3	-2	-3	1	4	-1	-1	0	-1	3	2	-1	-1	0	6	3	2	1	10
110	10.62	.182	0	0	0	1	0	1	-1	-2	-2	0	0	-1	-1	-1	0	-1	-1	-1	0	0	2	2	0	0	1
111	23.67	.141	1	-1	-2	0	0	1	-1	-2	-1	-1	1	-2	-1	0	-2	1	-2	0	-4	3	3	2	2	0	1
112	1.2634E-02	.000	-2	1	0	-3	0	-1	-2	4	3	1	-1	2	2	2	0	1	4	4	5	-3	-4	-3	-3	0	-3
113	0.5617	.043	-1	0	0	1	0	0	-1	1	0	0	-2	-1	0	-1	0	-2	0	0	-3	0	0	1	-1	0	0
114	19.55	.120	0	-1	-1	2	1	0	-1	0	4	-3	-2	0	1	0	-1	1	-1	2	-4	5	1	-1	2	0	-6
115	15.98	.166	1	0	1	2	0	1	-4	-1	-3	1	-1	-1	-1	-1	2	-7	-1	-2	3	-3	-3	3	-4	0	-5
116	3.4725E-02	.000	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
117	0.4985	.042	-1	1	0	0	0	-1	-1	3	0	1	0	-2	0	0	-2	2	2	1	0	-1	2	0	0	0	1
118	103.6	.056	-1	0	0	0	0	0	-1	1	1	0	0	-2	0	0	-2	2	1	1	-1	-1	1	0	0	0	1
119	6.308	.233	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
120	1.5919E-02	.000	1	-1	0	1	0	1	1	-2	0	-1	1	2	1	0	2	-2	1	0	0	0	0	1	0	1	0
121	0.4001	.018	0	0	-1	0	0	-1	0	3	0	1	1	1	0	0	1	0	4	0	0	-2	3	0	0	0	1

TABLE X

Part of the correlation matrix obtained in the energy range 200 eV to 300 eV SAMMY fit. The standard deviations on parameters are also given in column 2 and 3 of the table (absolute and relative values). The parameter numbers are given in column 1 and line 1 (see Table Xbis)

SPIN GROUP NUMBER 1 WITH SPIN= 3.0, ABUNDANCE= 1.0000, AND G-FACTOR=0.5833

ENERGY (EV)	GAMMA-GAMMA (MILLI-EV)	GAMMA-CHANNEL 1 L=0 SPIN=3.0 (MILLI-EV)	GAMMA-CHANNEL 2 L=0 SPIN=0.0 (MILLI-EV)	GAMMA-CHANNEL 3 L=0 SPIN=0.0 (MILLI-EV)
1.95868E+02(1)	4.1434E+01	1.3834E+01(2)	9.7972E+01(3)	-4.5750E+02(4)
1.97975E+02(5)	4.2316E+01	3.8421E+00(6)	1.6848E+02(7)	-3.9370E+01(8)
2.00765E+02(9)	4.0000E+01	6.9065E-01(10)	1.7436E+02(11)	-6.6644E+00(12)
2.05900E+02(13)	4.0000E+01	6.7763E+00(14)	3.4575E+01(15)	-1.5822E+02(16)
2.07498E+02(17)	4.0000E+01	2.8334E+00(18)	-2.5375E+01(19)	7.1649E-01(20)
2.10450E+02(21)	4.0000E+01	1.6518E+00(22)	1.7031E+02(23)	7.8267E+01(24)
2.14551E+02(25)	4.0000E+01	5.9128E+00(26)	-3.2334E+02(27)	6.4688E-01(28)
2.17556E+02(29)	4.0000E+01	1.9290E+01(30)	1.6075E+03(31)	5.2714E+01(32)
2.25877E+02(33)	4.0000E+01	4.3323E+00(34)	2.5484E+02(35)	-2.1297E+02(36)
2.33263E+02(37)	4.0000E+01	2.9326E+01(38)	3.9610E-02(39)	1.6721E+01(40)
2.34624E+02(41)	4.0000E+01	3.2999E+00(42)	-2.2628E+00(43)	3.4707E+01(44)
2.43353E+02(45)	4.0000E+01	1.0184E+01(46)	7.9892E+02(47)	9.4993E+02(48)
2.44919E+02(49)	4.0000E+01	4.7201E+00(50)	2.2056E+01(51)	-3.0528E+02(52)
2.48568E+02(53)	4.0000E+01	1.3885E+01(54)	2.8302E+00(55)	5.2321E+01(56)
2.55185E+02(57)	4.0000E+01	4.4782E+00(58)	3.3964E+01(59)	4.4677E+02(60)
2.58347E+02(61)	4.0000E+01	2.0676E+01(62)	-7.7728E+00(63)	1.4605E+02(64)
2.63764E+02(65)	4.0000E+01	1.8396E+00(66)	5.5364E+01(67)	5.8831E+02(68)
2.66467E+02(69)	4.0000E+01	2.2345E+00(70)	-3.0270E+01(71)	1.3389E+02(72)
2.69480E+02	4.0000E+01	3.9266E-01(73)	5.0000E+00	0.0000E+00
2.71590E+02(74)	4.0000E+01	1.0096E+01(75)	-3.5366E+02(76)	-2.2421E+01(77)
2.74073E+02(78)	4.0000E+01	1.8288E+00(79)	1.2464E+01(80)	1.9347E+02(81)
2.77040E+02(82)	4.0000E+01	1.3141E+01(83)	1.7962E+02(84)	-5.9995E+02(85)
2.80033E+02(86)	4.0000E+01	1.6759E+00(87)	1.4235E+02(88)	-1.3201E+02(89)
2.81500E+02	4.0000E+01	7.4008E-01(90)	1.5898E+02	1.4970E+02
2.83878E+02(91)	4.0000E+01	3.4756E+00(92)	5.0048E+01(93)	-1.4606E+03(94)
2.85543E+02(95)	4.0000E+01	4.6969E+00(96)	-7.9397E+01(97)	-2.3900E+02(98)
2.88400E+02	4.0000E+01	2.4324E-01(99)	1.2687E+00	-1.0028E+01
2.90994E+02(100)	4.0000E+01	1.1254E+00(101)	1.9940E+02(102)	-1.6916E+02(103)
2.93425E+02(104)	4.0000E+01	2.1867E+00(105)	-2.9736E+02(106)	1.3714E+02(107)
2.94347E+02(108)	4.0000E+01	3.1242E+00(109)	5.8327E+01(110)	-1.6747E+02(111)
2.97499E+02(112)	4.0000E+01	1.2996E+01(113)	-1.6237E+02(114)	9.6391E+01(115)

SPIN GROUP NUMBER 2 WITH SPIN= 2.0, ABUNDANCE= 1.0000, AND G-FACTOR=0.4167

ENERGY (EV)	GAMMA-GAMMA (MILLI-EV)	GAMMA-CHANNEL 1 L=0 SPIN=2.0 (MILLI-EV)	GAMMA-CHANNEL 2 L=0 SPIN=0.0 (MILLI-EV)	GAMMA-CHANNEL 3 L=0 SPIN=0.0 (MILLI-EV)
1.97444E+02(116)	3.9434E+01	1.1965E+01(117)	1.8420E+03(118)	2.7066E+01(119)
1.99447E+02(120)	4.0000E+01	2.2235E+01(121)	1.9328E+03(122)	-2.2174E-02(123)
2.02693E+02(124)	4.0000E+01	3.0163E+01(125)	-3.8215E+01(126)	1.2616E+02(127)
2.09255E+02(128)	4.0000E+01	6.6600E+00(129)	9.9392E+02(130)	2.8513E+02(131)
2.11846E+02(132)	4.0000E+01	7.6726E+00(133)	5.6918E+02(134)	3.0969E+02(135)
2.17633E+02(136)	4.0000E+01	1.9471E+01(137)	2.0413E+03(138)	-2.4501E+00(139)
2.19134E+02(140)	4.0000E+01	4.8904E+00(141)	1.0198E+02(142)	-1.4795E+02(143)
2.19084E+02(144)	4.0000E+01	4.9410E+00(145)	8.8706E+03(146)	1.2975E+01(147)
2.27836E+02(148)	4.0000E+01	2.0246E-01(149)	-1.9260E+02(150)	1.5062E+02(151)
2.28072E+02(152)	4.0000E+01	1.5072E+01(153)	6.4959E+00(154)	8.3976E+00(155)
2.29875E+02(156)	4.0000E+01	1.3146E+01(157)	4.5675E+02(158)	7.8766E+00(159)
2.31581E+02(160)	4.0000E+01	6.0006E+00(161)	4.3882E+02(162)	2.2855E+02(163)
2.35989E+02(164)	4.0000E+01	4.4297E+00(165)	1.6972E+01(166)	3.0616E+02(167)
2.38345E+02(168)	4.0000E+01	3.6882E+00(169)	2.5900E+01(170)	2.2391E+02(171)
2.40956E+02(172)	4.0000E+01	1.1023E+01(173)	1.4720E+01(174)	-4.5513E+02(175)
2.43834E+02(176)	4.0000E+01	1.3018E+01(177)	3.6419E+01(178)	1.6449E+02(179)
2.46793E+02(180)	4.0000E+01	2.2568E+00(181)	1.4354E+02(182)	3.2459E+01(183)
2.49587E+02(184)	4.0000E+01	5.4929E+00(185)	4.5941E+00(186)	1.2773E+01(187)
2.56605E+02(188)	4.0000E+01	2.6523E+00(189)	3.6226E+02(190)	-9.3728E+01(191)
2.59510E+02(192)	4.0000E+01	6.3320E+00(193)	6.4678E+01(194)	-3.1398E+02(195)
2.63550E+02	4.0000E+01	3.9111E-01(196)	-2.5962E+03	1.5229E+02
2.64192E+02(197)	4.0000E+01	3.3510E-01(198)	8.0643E+01(199)	-2.8026E+02(200)
2.68054E+02(201)	4.0000E+01	1.5433E+00(202)	1.8045E+02(203)	7.8908E+02(204)
2.69569E+02(205)	4.0000E+01	1.5176E+01(206)	-3.1063E+01(207)	-2.3241E+03(208)
2.75576E+02(209)	4.0000E+01	3.7926E+00(210)	-4.6169E+01(211)	3.2498E+02(212)
2.78410E+02(213)	4.0000E+01	6.5256E+00(214)	1.0763E+03(215)	1.1265E+02(216)
2.84311E+02(217)	4.0000E+01	1.5793E+01(218)	-5.0679E+02(219)	3.6650E+01(220)
2.87133E+02(221)	4.0000E+01	5.2175E+00(222)	2.0943E+01(223)	3.2074E+01(224)
2.90280E+02(225)	4.0000E+01	1.0029E+01(226)	-7.9894E+02(227)	6.6676E+02(228)
2.96344E+02(229)	4.0000E+01	3.3461E+00(230)	-3.4589E+01(231)	2.3555E+01(232)
2.97805E+02(233)	4.0000E+01	4.7692E+00(234)	3.3008E+01(235)	-1.1971E+02(236)

TABLE X bis

Identification of the variable parameters in the energy range 200 eV to 300 eV SAMMY fit ; to be used for the interpretation of Table X.

14130204

	Standard at 0.0253 eV (21) (Barn)	Energy range 0.02 to 0.03 eV (Barn)	Calculated at 0.0253 eV (Barn)
Fission	1012.68 ± 6.58	1023.9	1011.88 (-0.1 %)
Capture	361.29 ± 4.95	366.0	362.95 (+0.5 %)
Scattering	12.17 ± 2.62	12.2	11.16 (-9.1 %)
Total	1386.14 ± 8.64	1402.1	1386.0 (-0.0 %)

TABLE XI

^{241}Pu thermal cross-sections. Column 2 gives the average values in the energy range 0.02 eV to 0.03 eV corresponding to the standard values at 0.0253 eV. The calculated values are obtained from the resonance parameters at 0°K. The figures between parenthesis are the percentage deviation from the standard values.

References	Energy range 0.02 to 0.03 eV (barn)		Energy range 0.02 to 0.45 eV (barn.eV)		
	EXP 1	EXP 2	EXP 1	EXP 2	THE
YOUNG total (14)	1401.8		455.01		456.19
SIMPSON total (15)	1401.9		458.97		459.12
WAGEMANS fission(6)	1024.3		326.03		327.74
WESTON fission (5)	1024.9	999.9	334.18	326.03	327.80
WESTON capture (5)	366.2	338.8	137.43	127.74	126.49
SIMPSON absorption (15)	1389.7		453.77		453.92
WESTON absorption (5)	1391.1	1338.7	471.61	453.77	454.29
Scattering					5.20

TABLE XII

^{241}Pu cross-sections in the energy range below 0.45 eV. EXP 1 are the average experimental values (or the integral values) obtained when the data are normalized at 0.0253 eV on the standard data (21). EXP 2 are the experimental values obtained when WESTON fission and WESTON absorption are normalized on WAGEMANS fission and SIMPSON absorption respectively, in the energy range 0.02 eV to 0.45 eV. SIMPSON absorption was obtained by substracting the calculated scattering value to the total value. THE are the values calculated from the resonances parameters. They are in excellent agreement with EXP 2.

TABLE XIII
FISSION CROSS-SECTION INTEGRALS*

Energy Interval (eV)	Average Value (b.eV)	Ratio (Data/Average)										
		WESTON (Ref. 5)	WAGEMANS and DERUYTTER (Ref. 6)	BLONS (Ref. 4)		MIGNECO et al. (Ref. 7)	SIMPSON et al. (Ref. 8)	JAMES[b] (Ref. 9)		MOORE et al. (Ref. 10)		CARLSON and BEHRENS (Ref. 11)
3.0-4.9	350.8	1.048	1.029	0.991		1.021		1.020	1.002	0.899		
4.9-8.0	876.8	1.009	0.994	1.006		1.024		0.991	1.010	0.967		
8.0-9.0	237.6	1.017	1.010	0.992		0.997		1.026	0.958	1.040	0.930	1.006
9.0-12.0	311.1	1.028	1.001	0.975		1.029		0.973	1.076	1.031	0.971	0.942
12.0-14.0	284.8	0.995	1.018	0.960		1.007		0.988	1.007	1.052	0.992	
14.0-17.4	928.0	1.022	1.015	1.000		0.972		1.033	0.928	1.026	0.996	0.954
17.4-20.0	143.8	1.010	0.948	0.930		0.973		1.013	1.051	1.190	1.021	
20.0-25.0	232.2	1.035	1.010	0.937	1.044	1.027	0.881	0.968	1.077	1.000	1.070	
25.0-27.2	274.1	1.040	1.043	0.985	0.993	0.995	0.894	1.011		1.071	0.988	0.950
27.2-30.0	324.2	1.034	1.000	0.966	0.970	0.977	0.859	1.075		1.016	1.148	
30.0-36.1	326.3	1.055	1.034	0.986	0.982	0.988	0.988	1.104		1.005	1.068	0.993
36.1-44.0	254.8	1.116	1.070	0.989	0.993	0.953	0.810	0.998		1.084	1.040	
44.0-52.0	332.5	1.012	(1.002)	0.946	0.923		0.871	0.929		1.221	1.281	
50-60	173.1	1.010			0.921	0.971	0.930	1.170				
60-70	559.1	1.049			0.962	1.010	0.924	1.055				
70-80	278.3	0.925			0.982	1.039	1.111	1.032				
80-90	685.9	1.075			0.956	0.999	1.030	0.940				
90-100	279.2	0.973			0.980	0.992	1.024	1.121				
100-200	2660.	1.000			0.861	0.939	1.087	1.207				
200-300	2780.	1.037			0.930	0.938	1.146	1.056				
300-400	2129.	1.076			0.963	0.855	1.101	1.008				

Energy interval (eV)	WAGEMANS et al. (6)	BLONS et al. (4)	MIGNECO et al. (7)	Calculated value
3.0- 8.0	1216.3	1243.7	1276.4	1196.9
8.0 - 9.0	236.7	238.5	240.6	234.4
9.0 - 12.0	307.2	306.7	325.2	292.0
12.0 - 14.0	286.1	276.6	291.3	279.4
14.0 - 17.4	929.4	938.3	916.7	922.2
17.4 - 20.0	134.5	135.2	142.1	139.8
20.0 - 25.0	231.4	245.1	242.4	
25.0 - 27.2	282.1	275.2	277.0	
27.2 - 30.0	319.7	317.9	321.8	
30.0 - 36.1	330.8	324.0	327.5	
36.1 - 44.0	269.0	255.9	246.6	
44.0 - 52.0	328.8	310.8		
12 - 20	1350.0	1350.0	1350.0	1341.0

TABLE XIV

^{241}Pu fission integrals (b.eV) renormalized at σ_f (2200 m/s) = 1012.7 b via WAGEMANS et al. integral of 1350.0 b.eV in the energy range 12 eV to 20 eV. These data were taken from reference 6 with 1 % correction for normalization on the ENDF/B-VI standard at 2200 m/s. The values calculated from the resonance parameters are also given in the energy range 3 eV to 20 eV.

Energy range (eV)	Average (5)	WESTON (5)	Caculated
3.0 - 4.9	350.8	361.6	359.2 (- 0.7 %)
4.9 - 8.0	876.8	870.0	836.7 (- 4.3 %)
8.0 - 9.0	237.6	237.9	234.4 (- 1.5 %)
9.0 - 12.0	311.1	313.6	292.0 (- 7.4 %)
12.0 - 14.0	284.8	279.3	279.4 (+ 0.0 %)
14.0 - 17.4	928.0	929.9	922.2 (- 0.8 %)
17.4 - 20.0	143.8	142.6	139.8 (- 2.0 %)
20.0 - 30.0	795.3	845.0	842.9 (- 0.2 %)
30.0 - 40.0	452.0	480.7	485.9 (+ 1.0 %)
40.0 - 50.0	390.9	426.0	408.9 (- 4.1 %)
50.0 - 60.0	173.1	171.8	175.5 (+ 2.2 %)
60.0 - 70.0	559.1	576.7	570.4 (- 1.1 %)
70.0 - 80.0	278.3	263.8	267.6 (+ 1.4 %)
80.0 - 90.0	685.9	715.2	722.0 (+ 1.0 %)
90.0 - 100.0	279.2	271.7	282.7 (+ 4.0 %)
100.0 - 200.0	2660.0	2621.0	2626.0 (+ 0.2 %)
200.0 - 300.0	2780.0	2791.3	2828.0 (+ 1.3 %)
3.0 - 300.0	12186.7	12298.1	12273.5 (- 0.2 %)

TABLE XV

^{241}Pu integral fission cross-sections calculated from the resonance parameters and compared to WESTON experimental data normalized to WAGEMANS data in the energy range 0.02 eV to 0.45 eV. The percentage deviations between WESTON and the calculated values are given. The average values are those obtained from all the experimental data appearing in Table XIII.

Energy range eV	Calculated capture	Calculated alpha	Experimental alpha (5)	Deviation %
10. - 20.	74.72	0.509	0.559	10.0
20. - 30.	15.46	0.183	0.213	16.4
30. - 40.	9.78	0.201	0.216	7.5
40. - 50.	5.45	0.133	0.184	38.0
50. - 60.	2.16	0.123	0.198	61.0
60. - 70.	12.90	0.226	0.279	23.0
70. - 80.	14.62	0.546	0.572	4.8
80. - 90.	22.89	0.317	0.337	6.3
90. - 100.	5.75	0.203	0.207	2.0
100. - 200.	5.87	0.226	0.268	18.6
200. - 300.	6.62	0.237	0.264	11.4
10. - 300.		0.244	0.279	14.3

TABLE XVI

^{241}Pu capture cross-sections and α values in the energy range 10 eV to 300 eV. The percentage deviations between the α values calculated from the resonance parameters and WESTON experimental values are given.

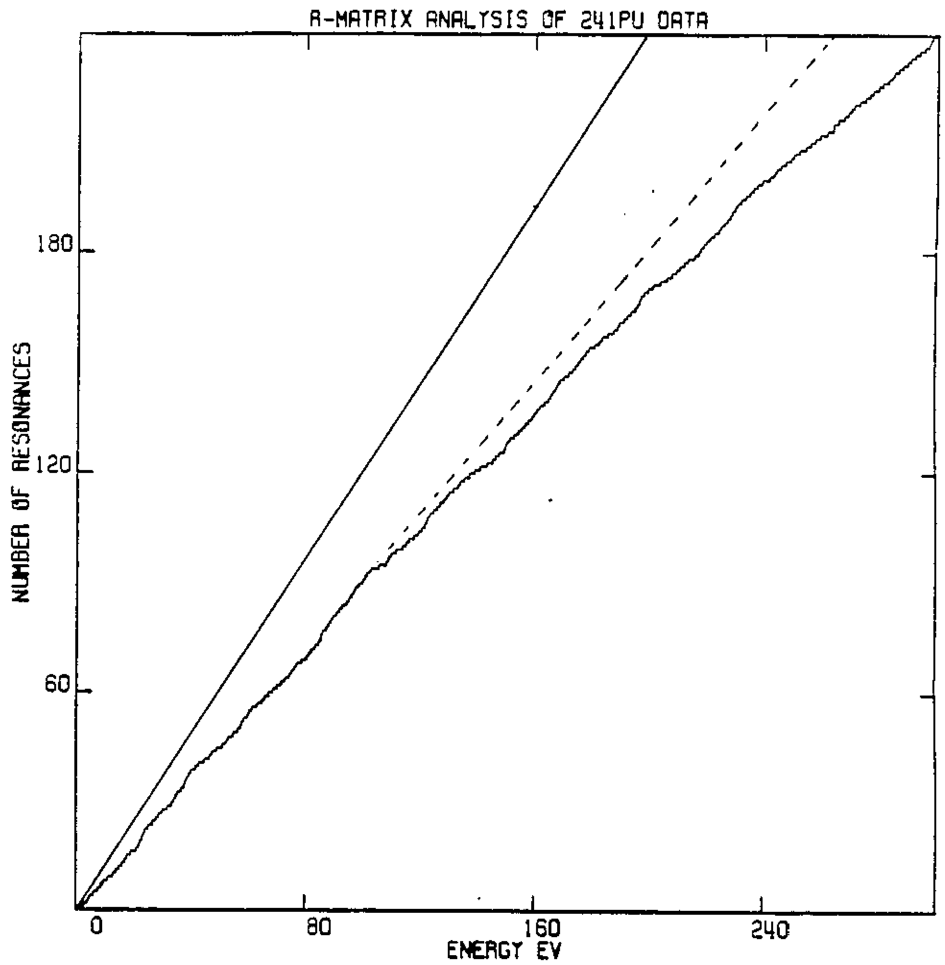


FIGURE 1

^{241}Pu spacing stairstep histogram – The dashed straight line corresponds to an average level spacing of 1.15 eV. The solid straight line corresponds to an average level spacing of 0.83 eV obtained in ref. 19 by Monte Carlo method showing that, even at 100 eV incident neutron energy, 27 % of levels could be missed. At 300 eV, 34 % of the levels could be missed.

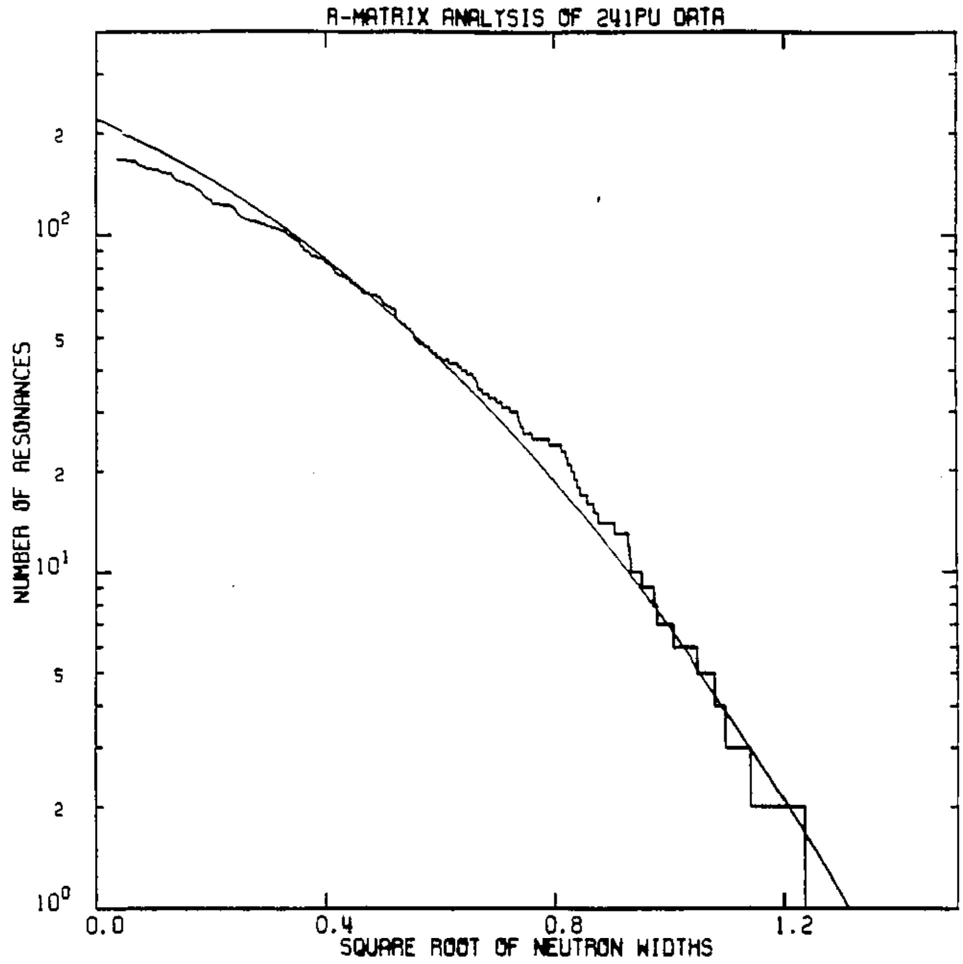


FIGURE 2

^{241}Pu integral distribution of the reduced neutron widths $2g\Gamma_n^o$ for the resonances identified in the energy range 0 eV to 200 eV. The curve is a Porter-Thomas distribution normalized to 220 resonances and to an average value of 0.216 x 10^{-3} $eV^{1/2}$.

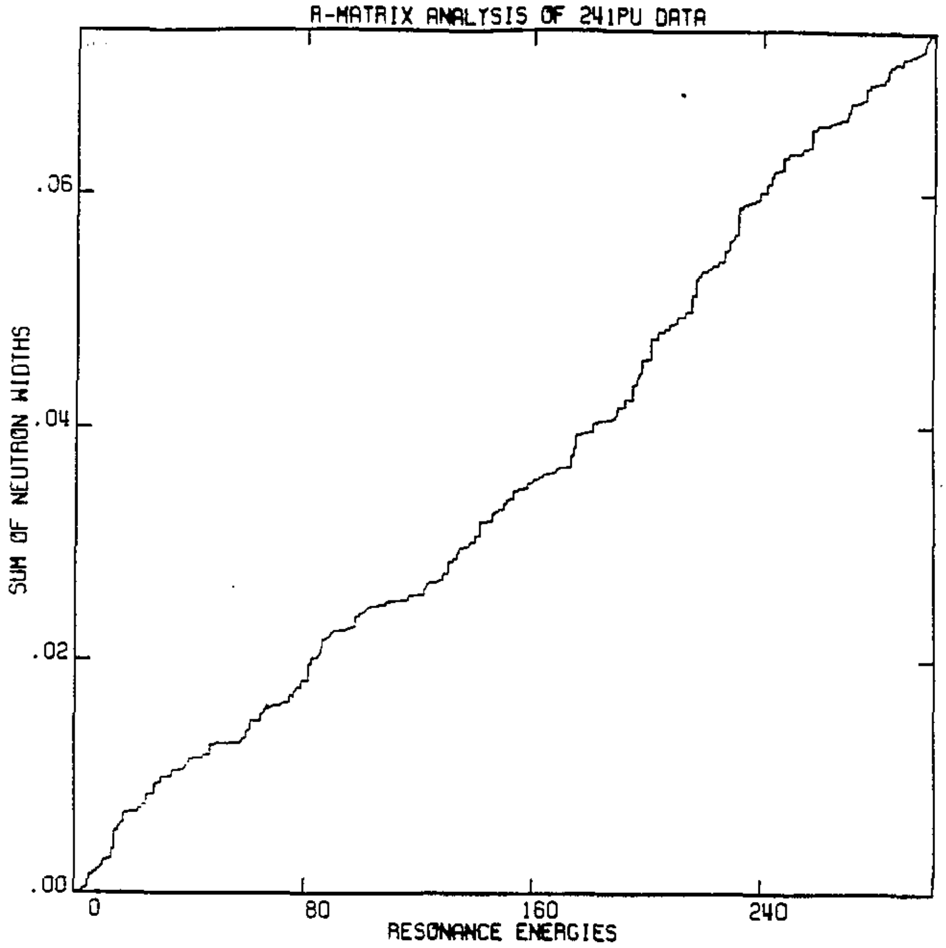


FIGURE 3

^{241}Pu cumulative stairstep histogram of the reduced neutron widths $2g\Gamma_n^0$.

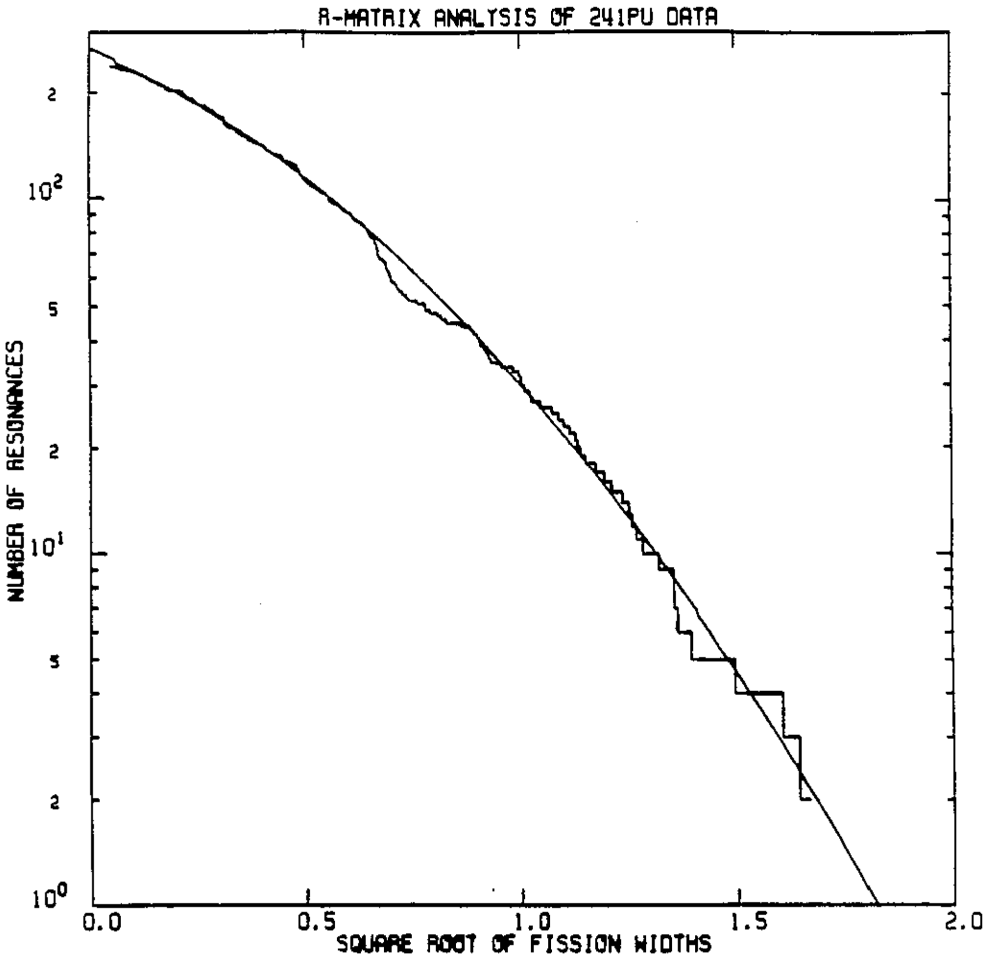


FIGURE 4

^{241}Pu integral distribution of the total fission widths for the resonances identified in the energy range 0 eV to 300 eV. The theoretical curve corresponds to a χ^2 distribution, P(ν,x), with ν=1 and normalized to 270 resonances and to an average fission width of 400 meV. The quite good agreement between the experimental distribution and the theoretical one is spurious, since the experimental distribution could be strongly distorded by the important number of missed levels and unresolved multiplets.

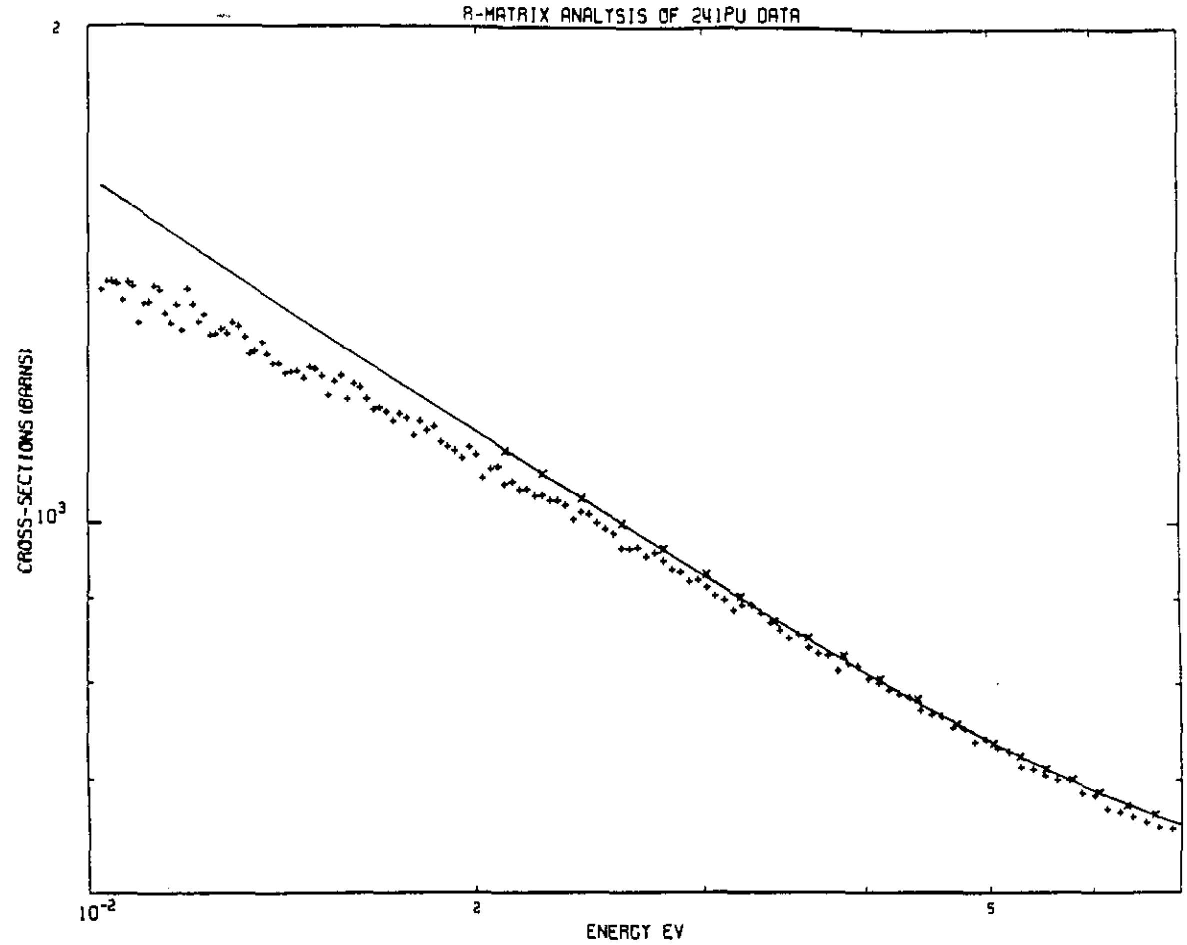


FIGURE 5

^{241}Pu fission cross-sections in the energy range 0.01 eV to 0.07 eV. The solid line represents the cross-sections calculated from the resonance parameters obtained by fitting WAGEMANS data (x). WESTON data (+), normalized on WAGEMANS data in the energy range 0.05 eV 0.45 eV, deviate strongly from the calculated values below 0.03 eV.

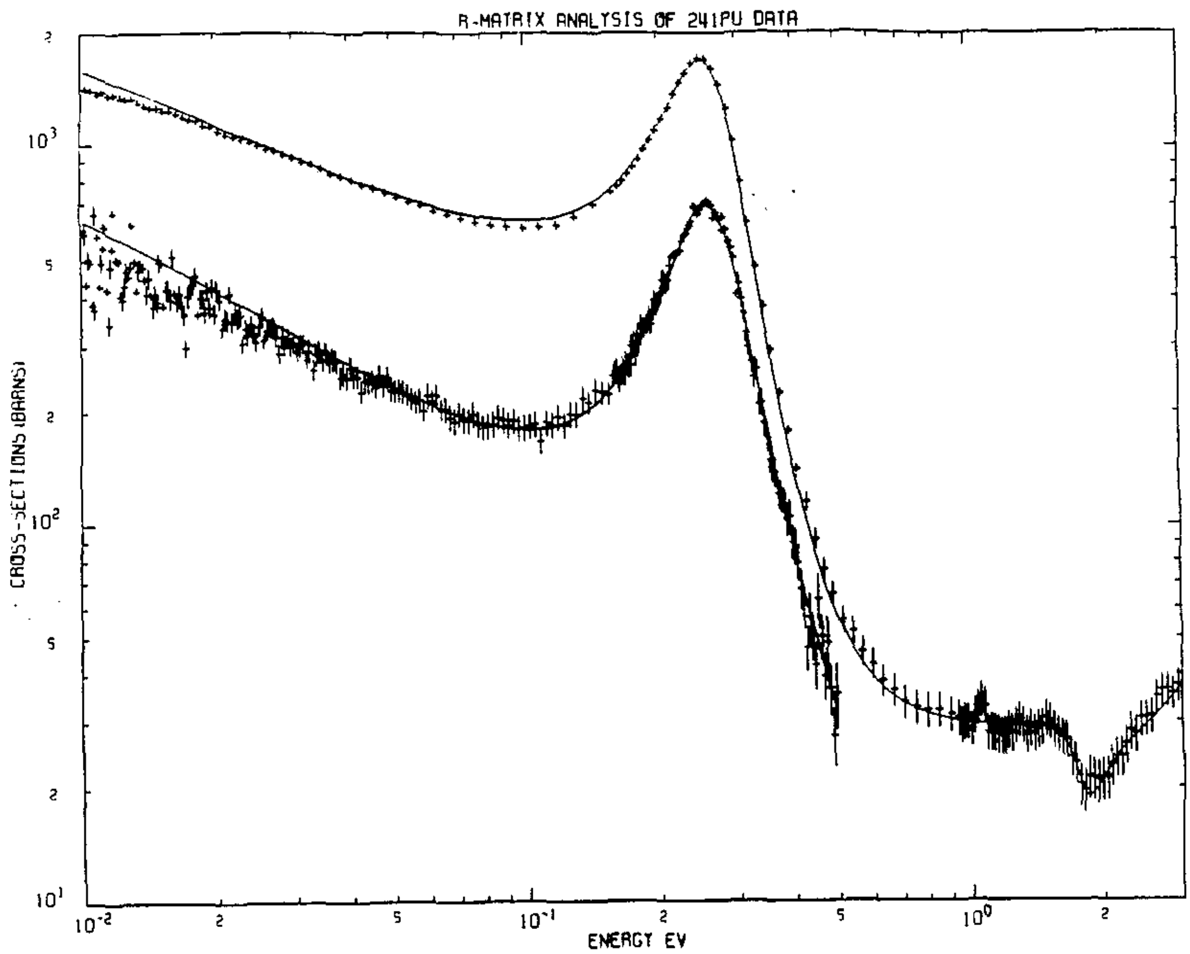


FIGURE 6

^{241}Pu fission and capture cross-sections in the energy range 0.01 eV to 3 eV. The curves represent the cross-sections calculated from the resonance parameters obtained by fitting WAGEMANS fission, YOUNG total and SIMPSON total. The experimental data are WESTON fission cross-sections normalized to WAGEMANS fission in the energy range 0.05 eV to 0.45 eV, and WESTON capture normalized via the absorption cross-sections inferred from SIMPSON total cross-section in the energy range 0.05 eV to 0.45 eV.

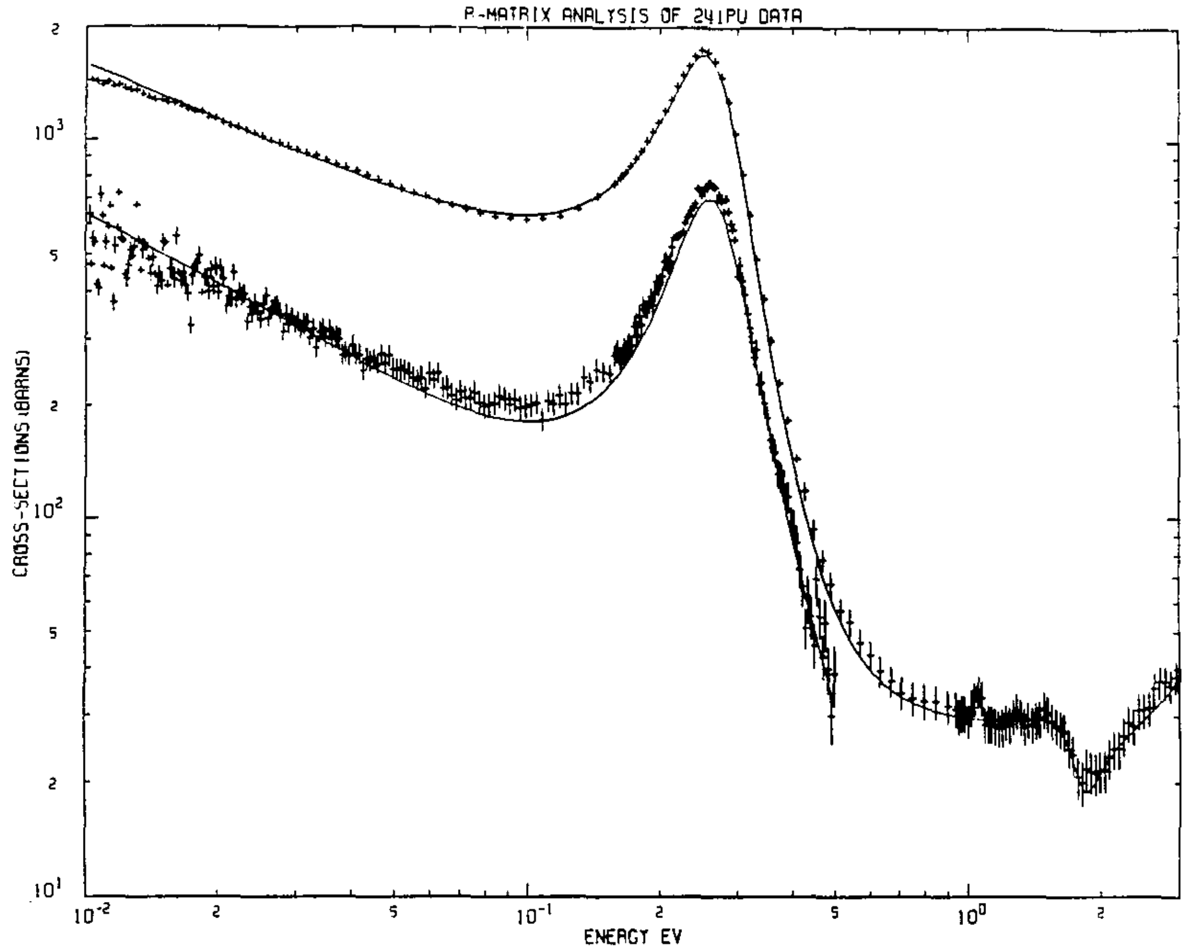


FIGURE 7

^{241}Pu fission and capture cross-sections in the energy range 0.01 eV to 3 eV. The curves represent the cross-sections calculated from the resonance parameters obtained by fitting WAGEMANS fission, YOUNG total and SIMPSON total. The experimental data are WESTON data normalized on the standard values between 0.02 eV and 0.03 eV. Note the deep in WESTON fission cross-section at 2 eV which is well represented by a strong interference effect between a small resonance at 1.735 eV and the broad resonance at 5.810 eV.

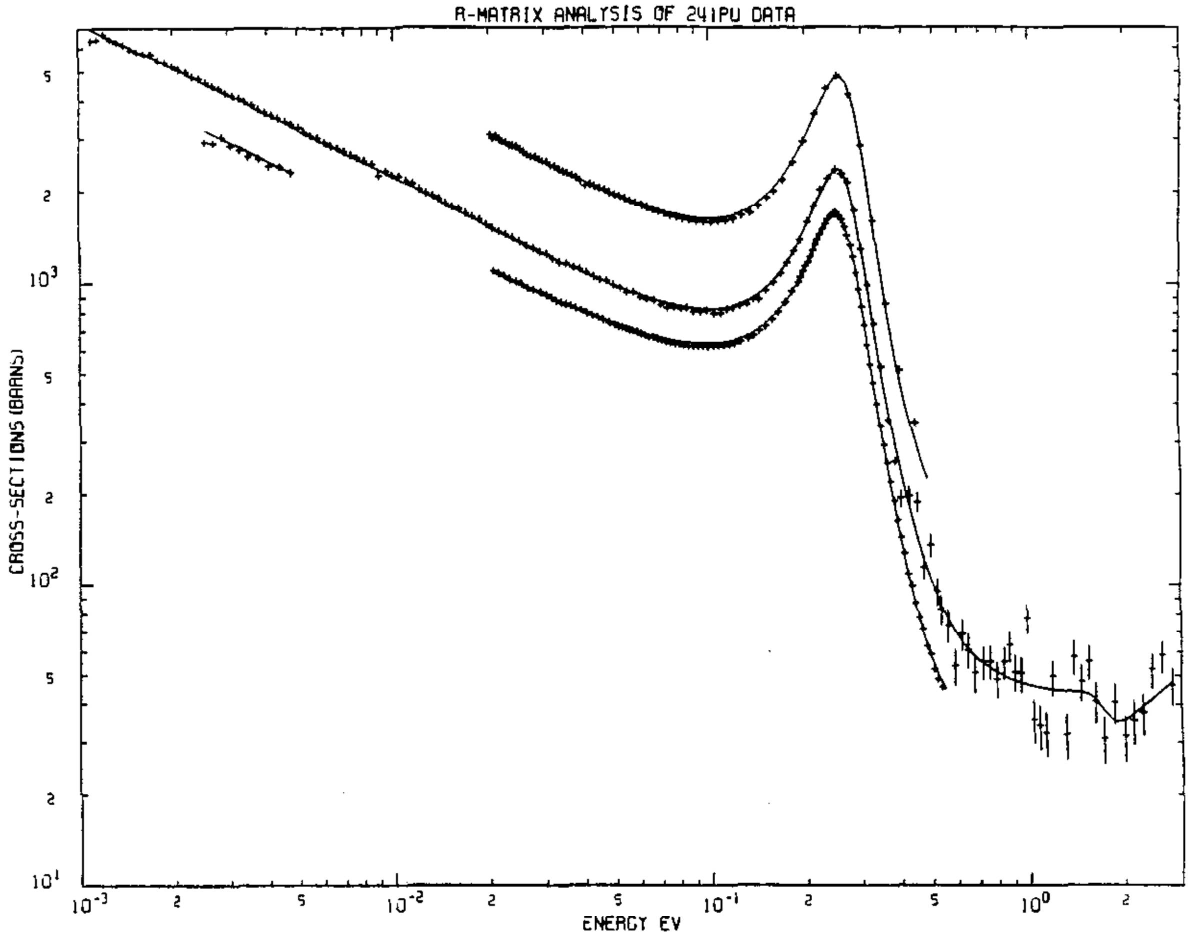


FIGURE 8

^{241}Pu fission and total cross-sections in the energy range 0.001 eV to 3 eV. The curves represent the cross-sections calculated from the resonance parameters. The experimental data are SIMPSON total cross-sections in the energy range 0.02 eV to 0.5 eV (displaced by one decade), YOUNG total cross-sections in the energy range 0.001 eV to 3 eV, WAGEMANS fission cross-sections in the energy range 0.02 eV to 0.5 eV and the renormalized SEPPI fission data in the energy range 0.002 eV to 0.006 eV

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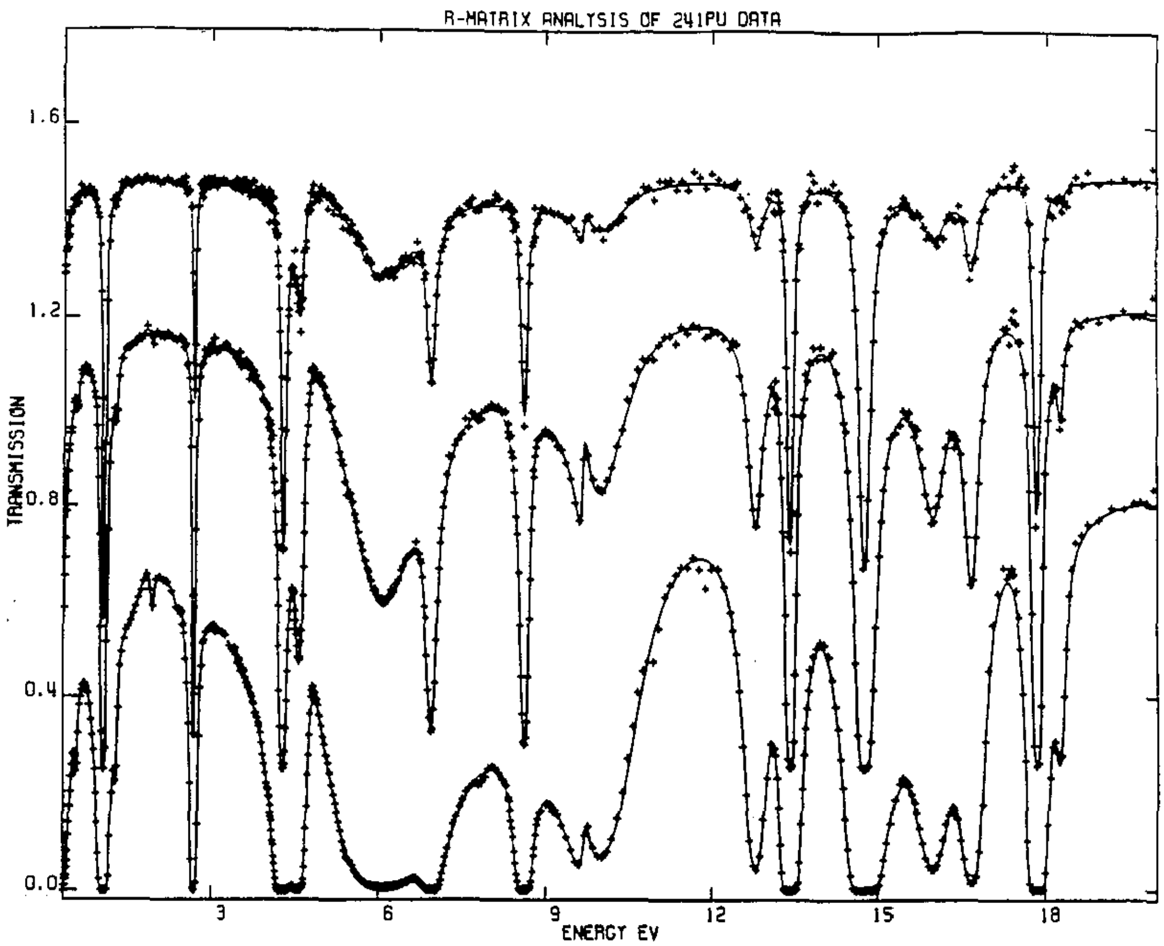

FIGURE 9

^{241}Pu transmission ratio in the energy range 0.3 eV to 20 eV. The experimental data (crosses) are the results of HARVEY et al. measurements of 5.19 x 10^{-4} at/b, 2.27 x 10^{-3} at/b and 1.12 x 10^{-2} at/b samples. The solid lines represent the values calculated from the resonance parameters. The data for the thin and medium samples are displaced by 0.25 and 0.5 respectively for clarity of the display. The resonances of the isotopes ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am were not removed from the data.

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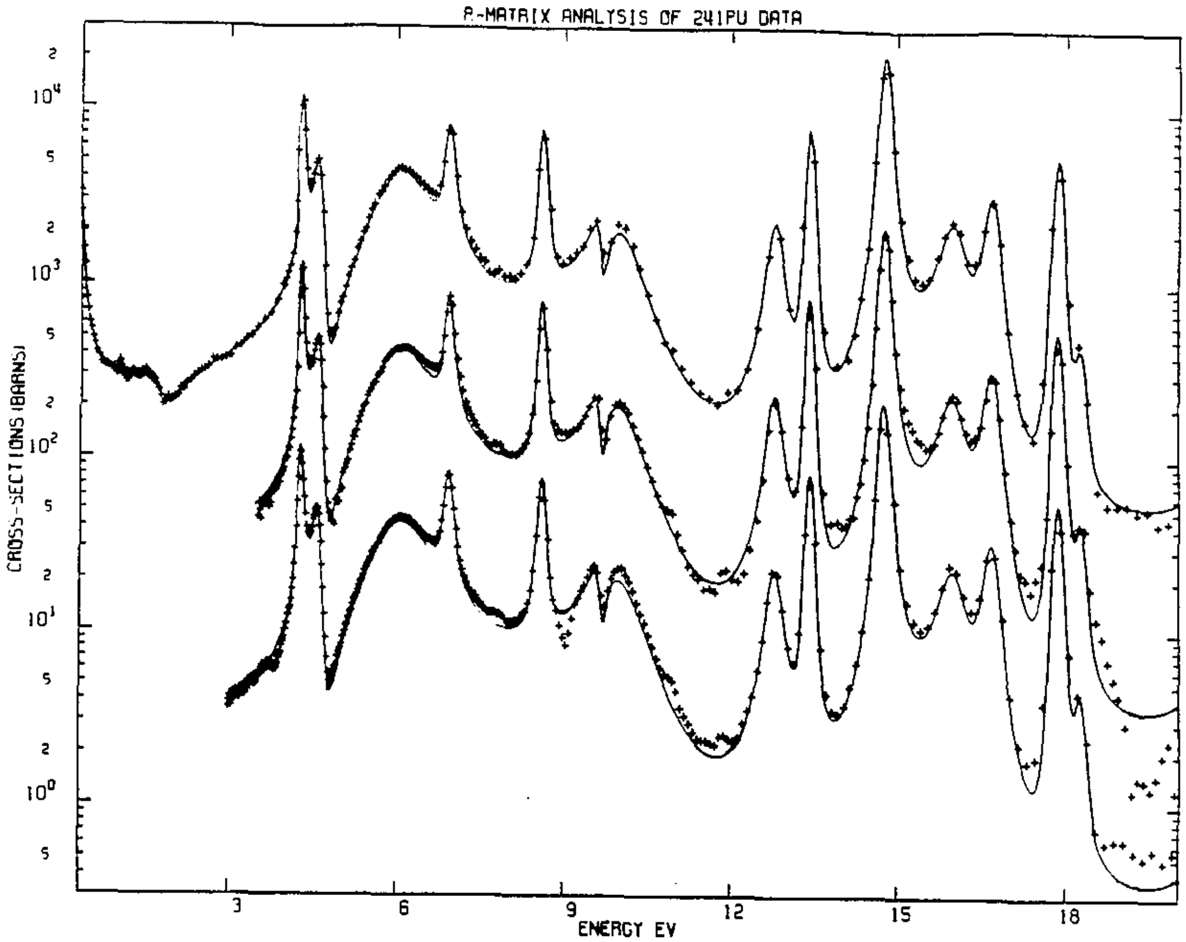


FIGURE 10

^{241}Pu fission cross-sections in the energy range 0.3 eV to 20 eV. The experimental data (crosses) are from WESTON et al. (multiplied by 10), BLONS et al. and MIGNECO et al. (multiplied by 0.1). The solid lines represent the cross-sections calculated from the resonances parameters.

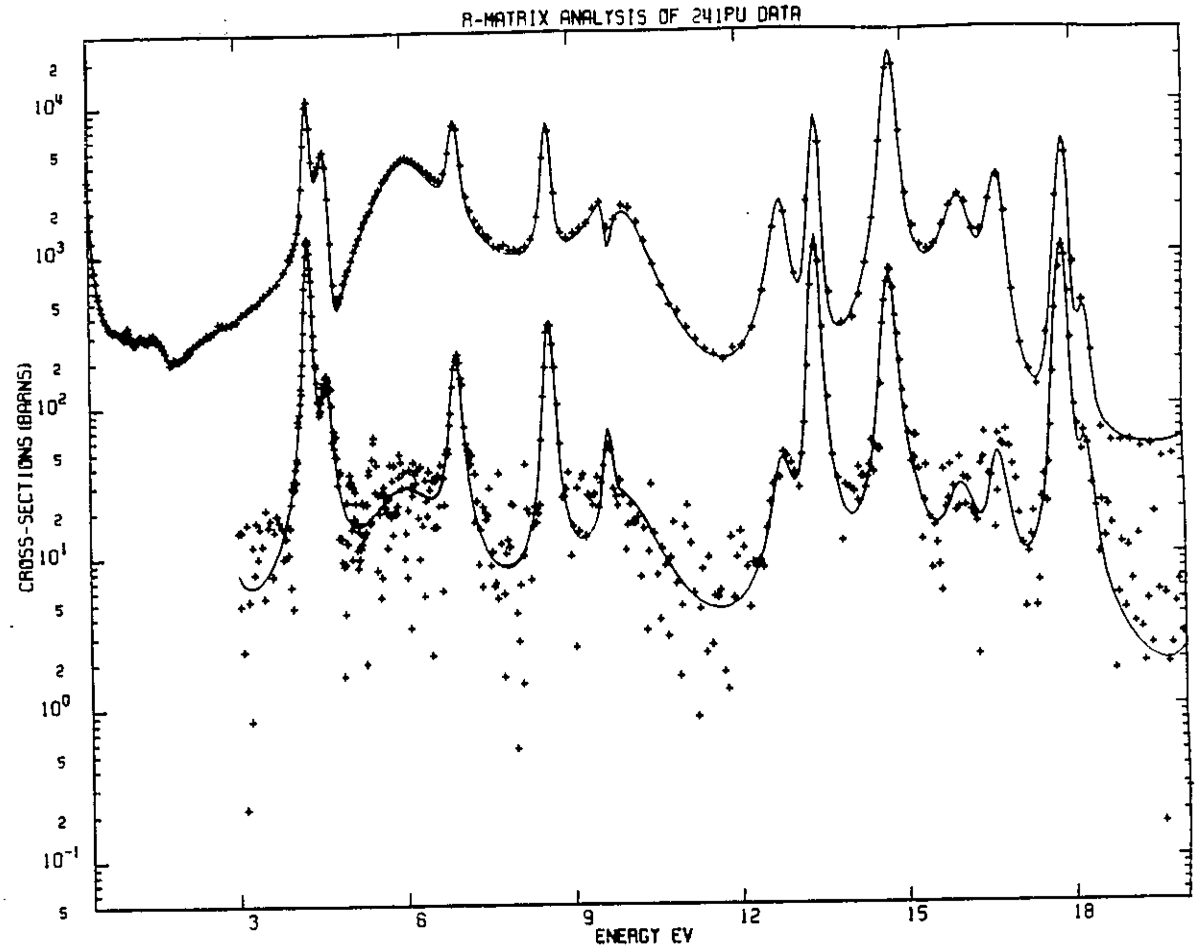


FIGURE 11

^{241}Pu fission and capture cross-sections in the energy range 0.3 eV to 20 eV. The experimental data are from WESTON et al. The solid lines represent the cross-sections calculated from the resonance parameters. The fission data were displaced by one decade for clarity of the display.

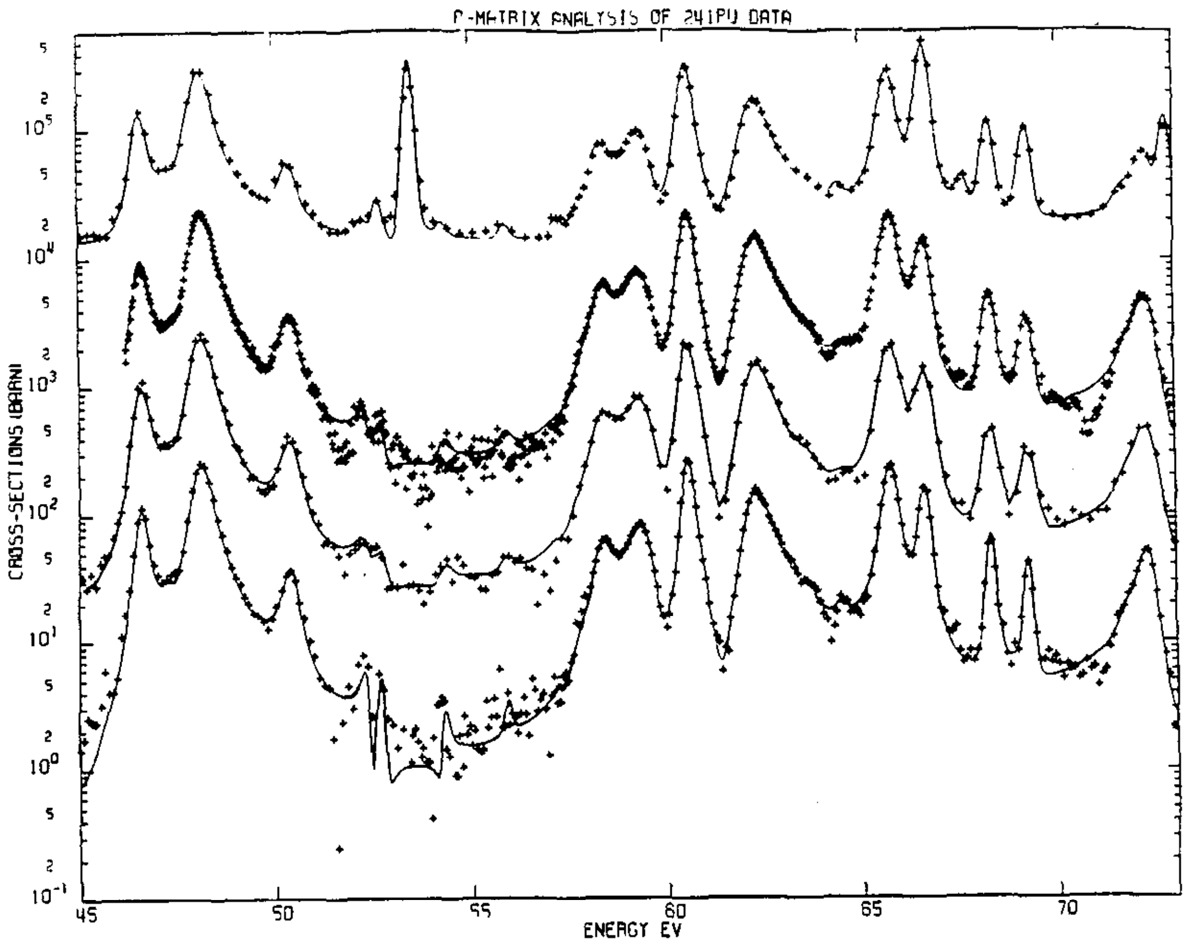


FIGURE 12

^{241}Pu cross-sections in the energy range 45 eV to 73 eV. The upper curves represent the total cross-sections obtained from HARVEY et al. thick sample transmission displaced by 3 decades. The other curves are MIGNECO et al. fission multiplied by 10, WESTON et al. fission and BLONS et al. fission multiplied by 0.1. The solid lines represent the cross-sections calculated from the resonance parameters.

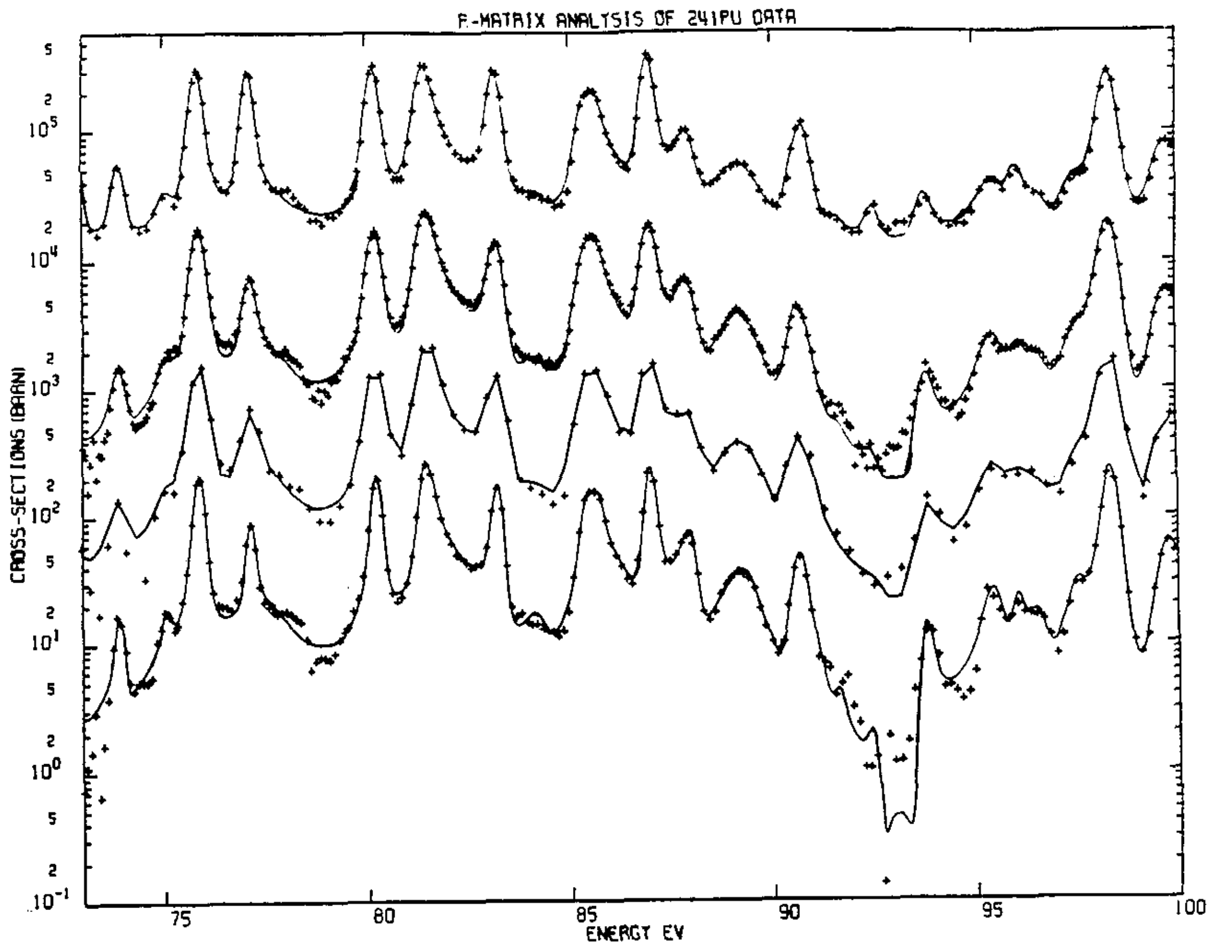


FIGURE 13

^{241}Pu cross-sections in the energy range 73 eV to 100 eV. The upper curves represent the total cross-sections obtained from HARVEY et al. thick sample transmission data displaced by 3 decades. The other curves are MIGNECO et al. fission multiplied by 10, WESTON et al. fission, BLONS et al. fission multiplied by 0.1. The solid lines represent the cross-sections calculated from the resonance parameters.

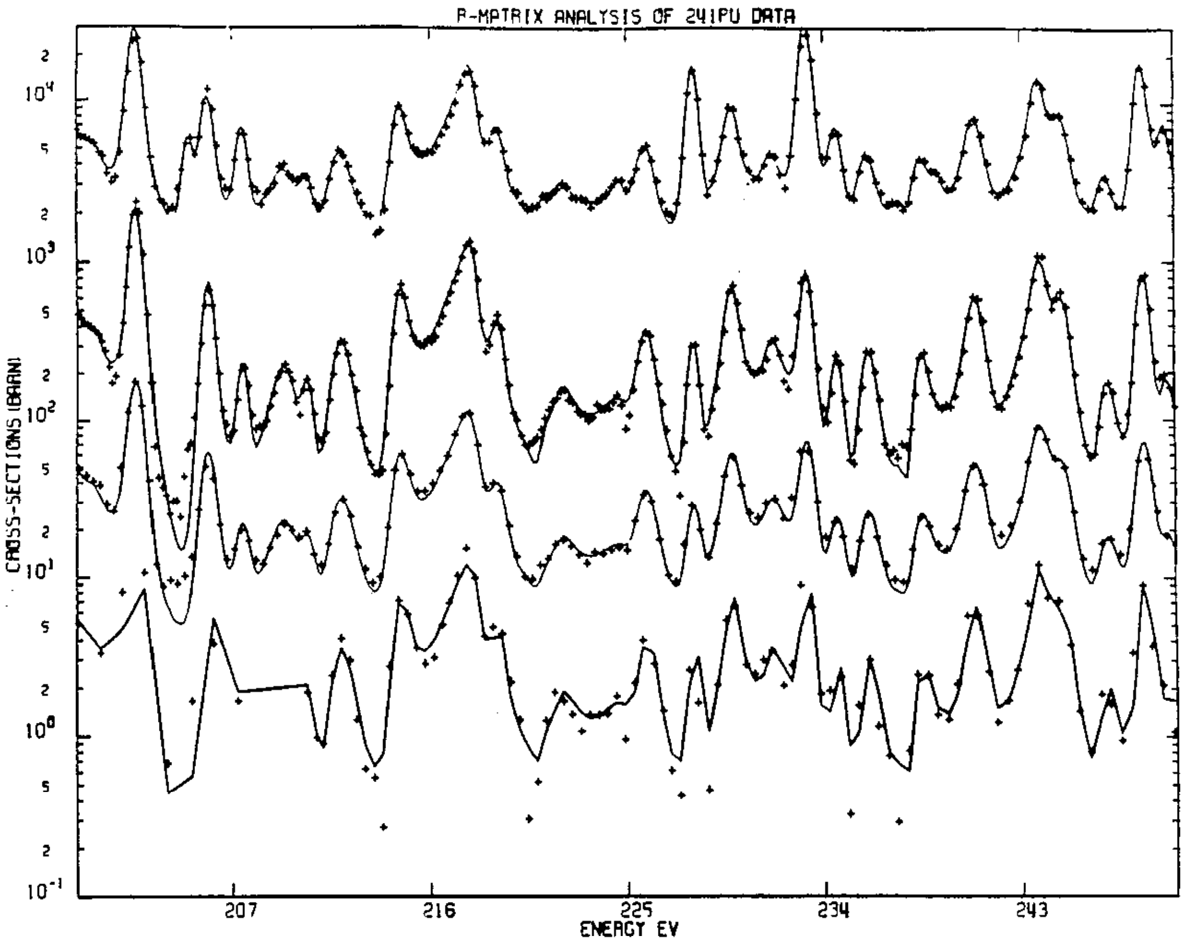
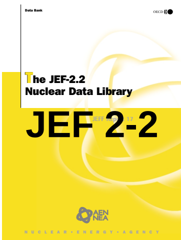


FIGURE 14

^{241}Pu cross-sections in the energy range 200 eV to 250 eV. The upper curves are the total cross-sections obtained from HARVEY et al. thick sample transmission data displaced by 3 decades. The other curves are BLONS et al. fission multiplied by 10, MIGNECO et al. fission and WESTON et al. fission multiplied by 0.1. The solid lines represent the cross-sections calculated from the resonance parameters.



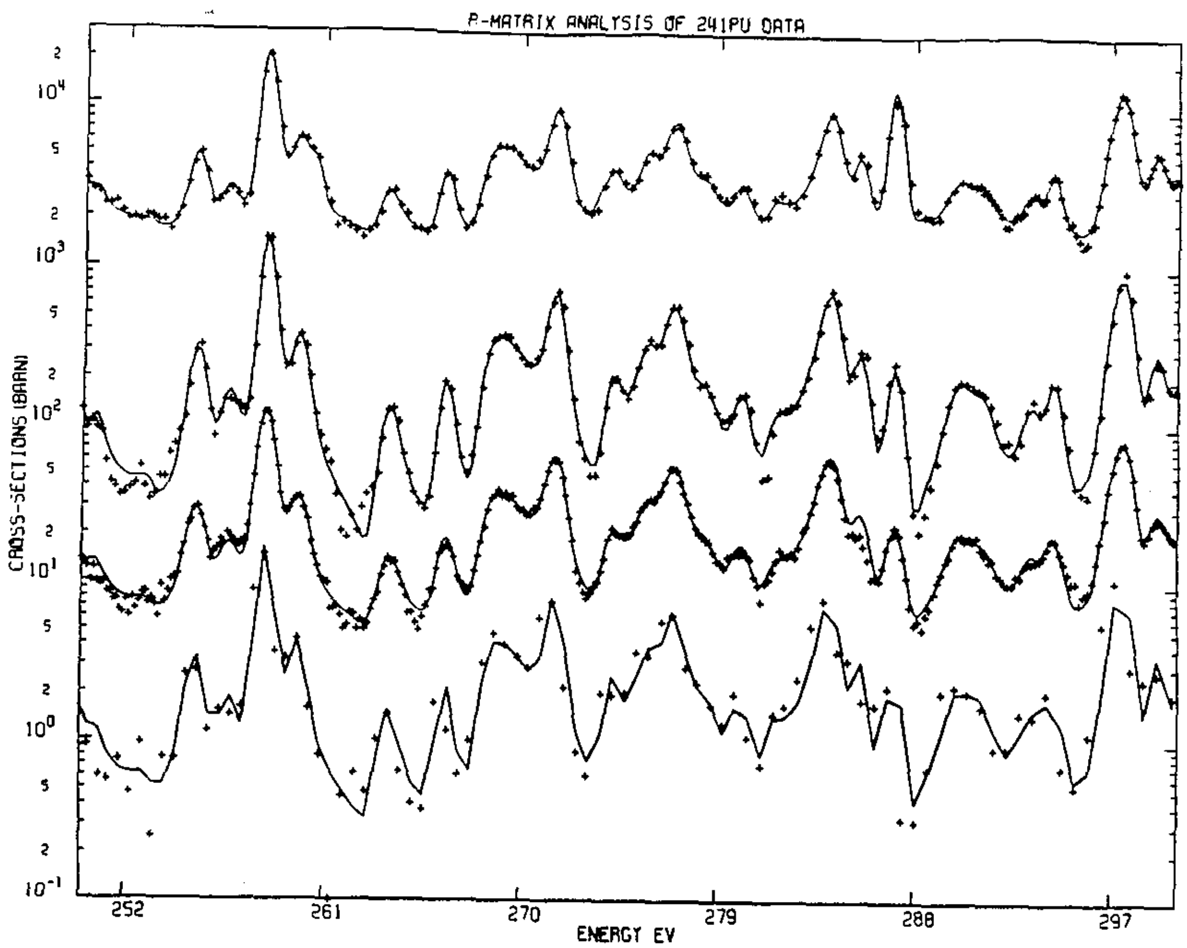


FIGURE 15

^{241}Pu cross-sections in the energy range 250 eV to 300 eV. The upper curves are the total cross-sections obtained from HARVEY et al. thick sample transmission data displaced by 3 decades. The other curves are BLONS et al. fission multiplied by 10, MIGNEC et al. fission and WESTON et al. fission multiplied by 0.1. The solid lines are the cross-sections calculated from the resonance parameters.