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UPDATE OF THE EVALUATION OF THE CROSS SECTION OF THE NEUTRON DOSIMETRY REACTION $^{103}Rh(n,n')^{103m}Rh$

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Update of the evaluation of the cross section of the neutron-dosimetry reaction $^{103}Rh(n,n')^{103m}Rh$

A. Pavlik, M.M.H. Miah[1], B. Strohmaier and H. Vonach
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Abstract: On the occasion of a new measurement of the excitation function of the reaction $^{103}Rh(n,n')^{103m}Rh$ in the energy range between 5.69 and 12.0 MeV performed at the present institute in collaboration with the PTB Braunschweig, the cross section of this reaction, which is part of the International Reactor Dosimetry File (IRDF-90), was re-evaluated. Whereas the energy range of the evaluation, namely from threshold to 20 MeV, was kept unchanged with respect to IRDF-90, the underlying data base was extended by the experiment mentioned as well as by another measurement, and revised with regard to judgement and normalization of older data in the light of recent information. Based on the experimental data upgraded in this way, new model calculations were carried out, which in the energy region 14 - 20 MeV served to supplement the experimental cross sections for this evaluation. The cross sections and their uncertainties were evaluated in energy groups with widths of 0.2 to 1.0 MeV, and the relative correlation matrix of the evaluated cross sections at the different energies was calculated. The results presented here supersede the corresponding values published in Physics Data 13-5 and included to the IRDF-90.

1. Introduction

The excitation function for the reaction $^{103}Rh(n,n')^{103m}Rh$ was first evaluated at the Institut für Radiumforschung und Kernphysik der Universität Wien (IRK) in the energy region from threshold (40 keV) to 20 MeV in 1980 [1]. In the energy ranges 6.5 to 12.5 MeV and beyond 17 MeV this evaluation was based entirely on the results of nuclear model calculations. For an updated version of the evaluation of neutron-dosimetry cross sections [2], also meant for inclusion in the International Reactor Dosimetry File (IRDF-90) [3], the recommended cross sections for the reaction $^{103}Rh(n,n')^{103m}Rh$ were taken over unchanged, as no new measurements could be retrieved from EXFOR [4] in early 1990. In 1993, two of the present authors started a precision measurement of the $^{103}Rh(n,n')^{103m}Rh$ cross section in collaboration with the PTB Braunschweig. A short description of this experiment with preliminary results was presented at the Gatlinburg Conference in 1994 [5], a more complete report is available now [6] and will be published shortly [7]. - Apart from this measurement, another experiment between 3.74 and 5.18 MeV incident neutron energy, presented by Wu et al. [8] at the Mito

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Conference in 1988 and included to EXFOR [4] in 1990 was added to the experimental data base.

The new experiment [5,6,7] covers the energy range 5.69 to 12.0 MeV and triggered off a critical review of the ^{103}Rh(n,n')^{103m}Rh cross sections which had been measured previously and formed the data base for the evaluation in 1980 [1]. Consequently, also the reaction model calculations which had been part of the previous evaluation [1,2] were repeated as both the experimental ^{103}Rh(n,n')^{103m}Rh excitation function to be reproduced and the features adopted for the reaction models required some revision. The reaction model calculations were extended to comprise the major neutron-induced reactions on ^{103}Rh for which experimental data existed in a consistent theoretical description [9].

The present evaluation was carried out applying the procedures adopted previously for evaluations at the IRK [1,2,10]. The experimental data underlying the evaluation, together with short summaries of newly included data sets as well as considerations regarding the older data sets, are presented in Sec. 2. The nuclear reaction model calculations used for extension of the evaluation beyond 14 MeV are discussed in Sec. 3. In Sec. 4, the evaluation and its results are described. In Sec. 5 we present the relative covariance matrix of the evaluated group cross sections and in Sec. 6 the integral cross section in the ^{252}Cf fission neutron spectrum.

2. Experimental data base

A literature search was performed using the bibliographical index CINDA [11] and the EXFOR data library [4]. In addition, the proceedings of recent international nuclear data conferences were also checked for relevant papers. The deadline for the literature search was the end of the year 1994. Beside the already mentioned experiments performed in collaboration between IRK and PTB Braunschweig (*Miah 95*) and by Wu et al. (*Wu 88*) no additional data sets for inclusion in the data base were identified.

The most important information on all experimental papers is summarized in Table 1. Two entries appear for the papers *Santry 74*, *Barnard 78*, and *Paulsen 80*. These authors had used two different methods to determine the neutron fluence. According to the evaluation procedures applied (see Ref. 10, Sec. II.), these papers were split into two parts for further processing. For experiments which are based on the measurement of the characteristic K x rays of Rh following the highly internally converted isomeric decay of ^{103m}Rh the value of 0.0766 ± 0.0014 [12] for the number of K x rays emitted per decay and a half-life of 56.114 ± 0.020 min [13] were adopted as standards.

A number of original values given for the cross sections or their uncertainties had to be renormalized according to the general procedures outlined in Ref. 10, Sec. II. Some obviously erroneous data points had to be rejected from the final data base. As the recommended values for decay data and reference cross sections have been changed

since 1980 renormalizations done by Strohmaier et al. [1] had to be revised in several cases. A critical review of all available data sets showed that corrections significantly different from those carried out in 1980 should be applied to the experiments *Santry 74* and *Paulsen 80*. In the following paragraphs we describe all renormalization procedures in detail.

Nagel 66 and *Kimura 69*: Both data sets had already been rejected in the course of the work of Strohmaier et al. [1] due to strong deviations from all other measurements.

Pazsit 72: In this experiment both K x rays and γ rays from the ^{103m}Rh decay were measured. A renormalization due to changes in the decay scheme was not performed as no value for the fluorescence yield used by Pazsit et al. in the analysis of their data was given in the paper. Their result was, however, normalized in order to refer to the evaluated value of the reference cross section (^{27}Al(n,α)^{24}Na) as given by Wagner et al. [2].

Santry 74: Santry and Butler had calibrated their x ray detector by a conversion electron - x ray coincidence experiment using a chemically purified ^{103m}Rh source. In this way, the "detector efficiency" (given by the number of detected x rays per ^{103m}Rh decay) was measured. With this technique the measurement became independent of conversion coefficients and fluorescence yields. On the other hand, it was possible to measure the x ray emission probability comparing the measured "detector efficiency" with an efficiency value determined independently from x ray absorption coefficients. An x ray emission probability of 0.0697 ± 0.0028 was determined this way which is about 9 % lower than the standard value used for this evaluation. According to our judgement this discrepancy stems most probably from a too low detector efficiency measured in the coincidence experiment. Therefore, we decided to apply a renormalization factor of 0.9099 to all data points of *Santry 74* and keep the relative uncertainties as given in the original papers.

The cross section data measured relative to the ^{32}S(n,p)^{32}P cross section (*Santry 74A*) were not corrected for changes in the reference cross section as we think the used reference cross sections are a better choice than using the cross section values recommended in ENDF/B-VI. (See the detailed discussion in Ref. 2, p. 10.) As the uncertainty of the reference cross section is not included in the errors given, an uncertainty of ± 5% was added quadratically in order to obtain the total error.

Santry and Butler had used different neutron production reactions (^{7}Li(p,n)^{7}Be, T(p,n)^{3}He, D(d,n)^{3}He and T(d,n)^{4}He) for different (overlapping) energy regions in their experiment. The cross sections for neutron energies above 8 MeV measured with the D(d,n)^{3}He source reaction had been corrected for activation of the Rh samples by deuterium-breakup neutrons. The correction factors given in *Santry 74* were replaced by correction factors estimated in the recent IRK/PTB experiment [5,6]. With these corrections we found the decision made in the course of the 1980 evaluation to disregard the data points measured with the D(d,n)^{3}He source reaction no longer justified. These data now show reasonable agreement with the (also corrected, see below) data of Paulsen et al. (*Paulsen 80*) as well as with the recent results (*Miah 95*). On the other hand, the excitation function measured with the T(p,n)^{3}He source reaction exhibits a nearly

vanishing slope for neutron energies between 2.5 and 6 MeV. In this way, it deviates from the results given in *Paulsen 80* in shape as well as in magnitude. Around 6 MeV, where both neutron producing reactions were used, disagreement exists between the cross sections measured with the $D(d,n)^3He$ and the $T(p,n)^3He$ source reaction. This had already been noted in the 1980 evaluation; however, the fact that owing to the renormalization to the new value of the x ray emission probability the part from the $D(d,n)^3He$ source reaction is confirmed by the data of *Paulsen 80* and *Miah 95* for neutron energies greater than about 6 MeV now suggests to disregard all data points measured with the $T(p,n)^3He$ source reaction at neutron energies above 2.5 MeV from the data sets *Santry 74A* and *Santry 74B*.

Pazsit 75: The cross section results were renormalized in order to refer to the x ray emission probability given in Ref. 12 and the reference cross section ($^{115}In(n,n')^{115m}In$) recommended by ENDF/B-VI [14]. The uncertainties were adjusted accordingly.

Barnard 78: The cross section values given in the original paper remained unchanged. The uncertainties of the data set *Barnard 78A* had already been increased in the course of the work of Strohmaier et al. [1] to account for the uncertainties of the reference cross section.

Paulsen 80: The calibration of their x ray detector is finally based on an absolute measurement of the activity of a ^{103m}Rh source by Vaninbroukx using liquid scintillation counting techniques [15]. This absolute measurement was also used to determine the K x ray emission probability in the isomeric decay of ^{103m}Rh by calibrating the x ray detector conventionally using standard reference sources. The K x ray emission probability of 0.0843 ± 0.0013 reported by Vaninbroukx and Zehner [16] is about 10 % higher than the standard value used in the present evaluation. Like in the case of *Santry 74* we think that the discrepancy in the x ray emission probability stems from the absolute activity measurement on which the detector calibration for the cross section measurement is based. Therefore, we decided to apply a renormalization factor of 1.1005 to all cross sections from the data sets *Paulsen 80A* and *Paulsen 80B* and keep the relative uncertainties. With these corrections we now achieve good agreement within the uncertainty limits of the data given by *Santry 74*, *Paulsen 80* and *Miah 95*, which are now based on the same value of the K x ray emission probability.

The cross section curve measured in the experiment *Paulsen 80B* shows unrealistically high values at neutron energies above 14 MeV, probably caused by activation due to background neutrons of lower energy. Therefore, we rejected the data points at 15.0 MeV, 16.0 MeV, and 16.7 MeV and decided to use the results of the model calculations only in the energy range 15 to 20 MeV.

Wu 88: Wu et al. stated their results to be tentative and preliminary in their paper published in 1988, as higher accuracy might be achieved by further calibration measurements of their x ray detector. In 1990 these tentative data have become available in the EXFOR data library and to our knowledge no final results were ever published. As the uncertainty of the detector calibration is included in the final cross section uncertainty

given by Wu et al. we accepted this data set for our evaluation without further renormalizations. As no information on the decay parameters used is given in the paper of Wu et al. we could not decide if a normalization with respect to the x ray emission probability might be necessary.

Miah 95: No normalization procedures were applied to the data given in this paper.

In Fig. 1, all accepted and renormalized data points are displayed. Here, the tag *Strohmaier 95* indicates the results of the model calculations described in the following section. In Fig. 2, the same data are shown on an expanded scale in the energy range from 0 to 6 MeV.

3. Nuclear model calculations

Due to the features of the experimental data base, the 1980 evaluation [1,2] of the ^{103}Rh(n,n')^{103m}Rh excitation function included statistical model calculations in the energy regions 6.0 - 13.5 MeV and 16.0 - 20.0 MeV. The parameters of the model calculations were adjusted to reproduce the experimental values in the 14 - 15 MeV range.

For the updated evaluation [2] performed for the IRDF-90 [3], we checked not only the status of the experimental data, but also that of the calculations supplementing the evaluations. At that time, part of the parameters or information entering the ^{103}Rh(n,n')^{103m}Rh calculations appeared to be not quite to the state of the art. E.g., refined measuring techniques had yielded more comprehensive and more reliable data on low-lying levels and their γ-decay than had been available in 1980, optical-model analyses of neutron differential cross sections on ^{103}Rh had resulted in optical potentials appropriate especially for this nuclide, and the use of a pairing correction in preequilibrium-model particle-hole state densities is now common. - Also, with regard to γ-ray strength functions, prescribing the ratios of strengths of radiation of all multipole types to that of E1 radiation at the neutron binding energy may attribute too much strength to radiation of multipole types other than E1 at small γ-ray energies, if the strength function for E1 is derived from a giant-dipole resonance, but for the other multipole types is assumed energy independent according to the Weisskopf model. However, as in the 1980 calculations no reactions competing with ^{103}Rh(n,n')^{103m}Rh were considered, these possible deficiencies were evidently alleviated by an appropriate choice of the rest of the parameters, as the calculated excitation function described the accepted experimental data very well. Therefore, in connection with the evaluation update for Refs. 2 and 3, it was decided not to redo the calculations as long as no esssential changes in the data base occurred.

When this was the case in 1994, model calculations were carried out again, superior to the older ones as the improvements mentioned above were considered, and aiming at a consistent description of the experimental cross sections for the (n,2n), (n,3n), (n,p) and (n,α) reactions up to 30 MeV together with the (n,n')^m reaction.

The details of the choice of the model parameters are discussed in Ref. 9. The main changes with respect to the 1980 calculations are the use of the coupled-channel optical model together with a neutron optical potential adjusted individually for ^{103}Rh [17] for generating the neutron transmission coefficients in the incoming channels. In the outgoing neutron channels, the same optical potential with an increased imaginary part was used in single-channel mode. For charged particles, the spherical optical model was applied with the global optical potentials of Mani et al. [18] for protons and of Huizenga and Igo [19] for α-particles.

In the exciton model, we used a pairing shift in the particle-hole state densities and an exciton-number dependent matrix element in the internal transition rates.

The level schemes and decay properties were updated on the basis of Nuclear Data Sheets [13,20]. For determining the γ-ray strength functions, a giant dipole model was applied for E1 as well as M1 radiation, with normalization factors chosen such as to achieve agreement with the corresponding strength function values compiled in Ref. 21.

The resulting excitation functions, also for the other reactions considered, are displayed in Ref. 9. For the ^{103}Rh(n,n')^{103m}Rh reaction, the excitation function as evaluated from all accepted experimental data is well described by the theoretical result in the energy regions from threshold to 2 MeV and between 6 and 14 MeV. In Ref. 9, the calculation overestimates the experimental evaluation in the energy range 2 - 6 MeV, where the latter has a shape problem. This has meanwhile been solved by omission of part of the data points measured with the T(p,n)^{3}He source reaction of the set *Santry 74B* as expounded in Sec. 2. The overshoot of the experimental values over the theoretical ones above 14 MeV in Fig. 1 of Ref. 9 is due to the inclusion of the data points of *Paulsen 80B* in this energy range which were rejected for the present evaluation.

The influence of the model calculations on the evaluation is reduced with respect to the 1980 version [1,2,3] as the theoretical curve is used between 14 and 20 MeV only.

The parameter variations which had been performed in 1980 to derive uncertainties of the calculated cross sections were not repeated for the new choice of parameters. Instead, we retained the relative uncertainties of the 1980 calculations [1,2,3] for the 1995 results.

4. Evaluation and results thereof

All accepted experimental data points as well as the results of the model calculation included in the data base are listed in Table 2. For each data point the following quantities are given:

- the average neutron energy, the energy spread (half-width at half maximum) and the uncertainty of the average neutron energy;
- the cross section value and uncertainty as given by the authors;

- an indication which renormalization procedures had been applied, and finally,
- the renormalized cross section and its uncertainty.

The neutron energy spread and the uncertainty of the average neutron energy, which were not reported in several papers, were estimated according to the experimental conditions.

For the evaluation procedure, the energy range between 0.1 and 20.0 MeV was divided into 31 groups. The widths of these groups are based on the density of the data points, the shape of the excitation function and the average neutron energy resolution in the respective group. The results of the evaluation, i.e., the cross section averages over the individual groups and their uncertainties are listed in Table 3. The last column of the table gives the ratios of the external to the internal errors, indicating good agreement amongst the data. In Fig. 3, the results of the present evaluation are compared with those of the previous one [1,2,3]. There is an essential increase in magnitude of the newly evaluated excitation function compared to the preceding edition in the plateau and the descending part, viz. between 2 and 12 MeV, which is plausible from the revision of the data base used previously and the effect of the newly added data set from the IRK/PTB collaboration. In Fig. 4, we compare the evaluated $^{103}Rh(n,n')^{103m}Rh$ cross sections with those of the nuclear reaction-model calculations. The overall agreement is quite satisfactory, with a slight deviation remaining between 2 and 4 MeV incident neutron energy.

5. Relative covariance matrix

Relative correlation coefficients and co-variances between the cross sections in the energy groups used in the evaluation were computed for the excitation function of the $^{103}Rh(n,n')^{103m}Rh$ reaction. The correlation coefficients were derived from the quantities B_{nnk}, the average correlation coefficients within each data set k (see Ref. 10, Sec. II.2.). Estimates of these coefficients B_{nnk} are compiled in Table 4 for all included data sets which contain more than one data point; in case of measurements they were based on the information on experimental uncertainties relevant in the respective works.

Table 4: Average relative correlation coefficients B_{nnk} assumed for the various data sets.

Reference	B_{nnk}
Santry 74A	0.30
Santry 74B	0.65
Pazsit 75	0.40
Barnard 78A	0.70
Barnard 78B	0.70
Paulsen 80A	0.71
Paulsen 80B	0.97
Wu 88	0.80
Miah 95	0.50
Strohmaier 95	0.95

Whereas in the 1980 evaluation the elements of the covariance matrix in the higher-energy part of the excitation function, where model calculations entered the evaluation, were derived from the results of the cross-section

variations according to a procedure described in Sec. II.1.2. of Ref. 1, in the present work, all covariance-matrix elements were computed from correlation coefficients throughout the energy region. The B_{nnk} value for the theoretical calculation was assumed to be 0.95, expressing nearly full correlation between the calculated cross sections in different energy groups.

The relative covariance matrix for the reaction $^{103}Rh(n,n')^{103m}Rh$ is given in Table 5.

6. Comparison of spectrum averaged cross sections in the ^{252}Cf fission neutron spectrum

The evaluated excitation function for the reaction $^{103}Rh(n,n')^{103m}Rh$ was used for calculating a fission spectrum average, $\langle\sigma\rangle$, in the neutron spectrum of ^{252}Cf for comparison with measured values of this quantity. For the description of the Cf neutron spectrum, we used the evaluation of Mannhart [22]. The experimental cross sections $\langle\sigma\rangle$ were again converted to a common value of 0.0766 ± 0.0014 [12] for the number of K x rays per decay of ^{103m}Rh. In the case of the result of Pazsit et al. [23], renormalization for the cross sections of the neutron flux monitor reaction was performed, too, using the evaluated value for the spectrum-averaged cross section of the monitor reaction $^{115}In(n,n')^{1115m}In$ given by Mannhart [24]. In Table 6, the integral cross section calculated from the present evaluation is given together with various experimental values. The uncertainty of $\langle\sigma\rangle$ computed from the evaluated excitation function is made up of the uncertainties of the ^{252}Cf neutron spectrum and those of the evaluated cross sections taking into account the correlations between the data for the different energy groups. As can be seen from Table 6, the discrepancy between the experimental values of $\langle\sigma\rangle$ is increased by the renormalization. Our calculated result is a fair reproduction of the mean value of the measured $\langle\sigma\rangle$ data.

Table 6: Calculated average $^{103}Rh(n,n')^{103m}Rh$ cross section in the ^{252}Cf neutron spectrum compared with experimental data for $\langle\sigma\rangle$.

$\langle\sigma\rangle_{orig}$ [mb]	$\langle\sigma\rangle_{renorm}$ [mb]	Origin	1st author, yr	Ref.
647 ± 70	621 ± 67	exp.	Kirouac 74	[25]
757 ± 53	741 ± 39	exp.	Pazsit 75	[23]
739 ± 22	813 ± 26	exp.	Lamaze 88	[26]
750 ± 27		calc.	Pavlik 95	this work

Table 1: Summary of experiments for the reaction $^{103}Rh(n,n')^{103m}Rh$.

Energy range [MeV]		Nr. of data points	Average accur. [%]	Method	Flux, reference cross section	Ref.	Nr.
14.20	14.20	2		Act., NaI, x rays	$^{65}Cu(n,2n)$ 945 mb, $^{56}Fe(n,p)$ 109 mb	Nagel 66	210
0.18	4.60	18		Act., NaI, x rays	Calculated from prot. or deut. beam current	Kimura 69	209
14.70	14.70	1		Act., Si(Li), x rays	$^{27}Al(n,\alpha)$ 114 ± 4 mb	Pazsit 72	203
4.80	14.74	33		Act., NaI, x rays	$^{32}S(n,p)$ excitation function	Santry 74A	201
0.12	6.00	46		Act., NaI, x rays	Calibrated long counter	Santry 74B	202
2.70	14.80	2		Act., Si(Li), x rays	$^{115}In(n,n')$ 340 ± 30 mb; 63 ± 6 mb	Pazsit 75	207
0.55	1.50	10		Inel. scatt. neutr. in liq. sc.	Carbon elastic scattering	Barnard 78A	205
1.10	1.93	8		Inelast. γ with Ge(Li)	$^{92}Zr(n,n'\gamma)$ and $^{94}Zr(n,n'\gamma)$	Barnard 78B	206
0.20	6.10	62		Act., NaI, x rays	Rel. exc. fct., norm. to n-p scatt. at 1.8 MeV	Paulsen 80A	204
3.00	16.70	5		Act., NaI, x rays	Rel. exc. fct., norm. to Paulsen 80A	Paulsen 80B	208
3.74	5.18	9	9.7	Act., Si(Li), x rays	Proton recoil telescope	Wu 88	212
5.69	12.00	14	4.6	Act., Si(Li), x rays	$^{238}U(n,f)$, ENDF/B-VI	Miah 95	213
14.14	19.79	15		Model calculation	Code "STAPRE"	Strohmaier 95	214

Table 2: Cross section data for the reaction $^{103}Rh(n,n')^{103m}Rh$.

NR.	E-NEUTR [MEV]	WIDTH [MEV]	ERR.CENTR [MEV]	X-SECT(ORIG) [MB]	ERR(ORIG) [MB]	CORR.APPL.	X-SECT(FIN) [MB]	ERR(FIN) [MB]	REF.
1	0.12	0.020	0.002	12.900	1.000	1)	11.738	0.910	SANTRY 74B
2	0.15	0.040	0.004	26.400	2.700	1)	24.021	2.457	SANTRY 74B
3	0.15	0.020	0.002	21.600	1.300	1)	19.654	1.183	SANTRY 74B
4	0.20	0.024	0.003	74.000	5.900	1)	81.437	6.515	PAULSEN 80A
5	0.20	0.020	0.002	40.500	3.000	1)	36.851	2.730	SANTRY 74B
6	0.22	0.040	0.004	43.100	3.000	1)	39.217	2.730	SANTRY 74B
7	0.25	0.020	0.002	63.100	3.100	1)	57.415	2.821	SANTRY 74B
8	0.25	0.026	0.003	103.000	7.400	1)	113.352	8.161	PAULSEN 80A
9	0.28	0.040	0.004	83.800	3.300	1)	76.250	3.003	SANTRY 74B
10	0.30	0.020	0.002	81.700	4.500	1)	74.339	4.095	SANTRY 74B
11	0.30	0.025	0.004	119.000	8.300	1)	130.960	9.167	PAULSEN 80A
12	0.30	0.030	0.003	94.500	5.400	1)	85.986	4.913	SANTRY 74B
13	0.35	0.040	0.004	100.000	6.000	1)	90.990	5.459	SANTRY 74B
14	0.35	0.021	0.003	124.000	9.300	1)	136.462	10.235	PAULSEN 80A
15	0.35	0.030	0.003	113.000	5.000	1)	102.819	4.550	SANTRY 74B
16	0.40	0.027	0.004	129.000	9.200	1)	141.964	10.124	PAULSEN 80A
17	0.40	0.040	0.004	123.000	6.000	1)	111.918	5.459	SANTRY 74B
18	0.40	0.030	0.003	122.000	6.000	1)	111.008	5.459	SANTRY 74B
19	0.41	0.030	0.003	135.00	10.000	1)	122.837	9.099	SANTRY 74B
20	0.45	0.040	0.004	131.000	6.000	1)	119.197	5.459	SANTRY 74B
21	0.45	0.020	0.003	146.000	7.000	1)	132.845	6.369	SANTRY 74B
22	0.46	0.020	0.003	144.000	7.000	1)	131.026	6.369	SANTRY 74B
23	0.50	0.030	0.003	146.000	7.000	1)	132.845	6.369	SANTRY 74B
24	0.50	0.058	0.005	151.000	9.100	1)	166.175	10.014	PAULSEN 80A
25	0.55	0.015	0.020	205.000	20.000	2)	205.000	20.000	BARNARD 78A
26	0.55	0.030	0.003	180.000	8.000	1)	163.782	7.279	SANTRY 74B
27	0.57	0.100	0.010	247.000	12.000	1)	224.745	10.919	SANTRY 74B
28	0.60	0.015	0.020	260.000	20.000	2)	260.000	20.000	BARNARD 78A
29	0.60	0.040	0.005	238.000	12.100	1)	261.919	13.316	PAULSEN 80A
30	0.65	0.030	0.003	300.000	14.000	1)	272.970	12.739	SANTRY 74B
31	0.70	0.030	0.003	379.000	18.000	1)	344.852	16.378	SANTRY 74B
32	0.70	0.069	0.005	368.000	16.900	1)	404.984	18.598	PAULSEN 80A
33	0.77	0.100	0.010	450.000	22.000	1)	409.455	20.018	SANTRY 74B
34	0.79	0.030	0.003	546.000	27.000	1)	496.805	24.567	SANTRY 74B
35	0.80	0.054	0.007	525.000	24.200	1)	577.763	26.632	PAULSEN 80A
36	0.90	0.030	0.003	622.000	27.000	1)	565.958	24.567	SANTRY 74B
37	0.90	0.098	0.008	593.000	27.300	1)	652.596	30.044	PAULSEN 80A
38	0.92	0.015	0.020	555.000	29.000	2)	555.000	44.000	BARNARD 78A
39	0.99	0.030	0.003	623.000	28.000	1)	566.868	25.477	SANTRY 74B
40	1.00	0.090	0.009	633.000	28.000	1)	575.967	25.477	SANTRY 74B
41	1.01	0.106	0.008	613.000	28.200	1)	674.607	31.034	PAULSEN 80A
42	1.02	0.015	0.020	593.000	29.000	2)	593.000	48.000	BARNARD 78A
43	1.10	0.015	0.020	606.000	35.000	2)	606.000	50.000	BARNARD 78A
44	1.10	0.030	0.003	505.000	76.000	NONE	505.000	76.000	BARNARD 78B
45	1.10	0.110	0.010	576.000	28.200	1)	633.888	31.034	PAULSEN 80A
46	1.15	0.030	0.003	673.000	30.000	1)	612.363	27.297	SANTRY 74B
47	1.15	0.015	0.020	619.000	29.000	2)	619.000	50.000	BARNARD 78A
48	1.18	0.030	0.003	533.000	80.000	NONE	533.000	80.000	BARNARD 78B
49	1.19	0.080	0.008	675.000	30.000	1)	614.182	27.297	SANTRY 74B
50	1.20	0.015	0.020	590.000	29.000	2)	590.000	48.000	BARNARD 78A
51	1.20	0.110	0.010	631.000	30.900	1)	694.415	34.005	PAULSEN 80A
52	1.30	0.015	0.020	643.000	29.000	2)	643.000	52.000	BARNARD 78A
53	1.30	0.030	0.003	585.000	88.000	NONE	585.000	88.000	BARNARD 78B
54	1.30	0.110	0.010	619.000	29.100	1)	681.209	32.024	PAULSEN 80A
55	1.35	0.030	0.003	706.000	106.000	NONE	706.000	106.000	BARNARD 78B
56	1.36	0.030	0.003	672.000	31.000	1)	611.453	28.207	SANTRY 74B
57	1.40	0.015	0.020	698.000	30.000	2)	698.000	56.000	BARNARD 78A
58	1.40	0.140	0.010	726.000	33.400	1)	798.963	36.757	PAULSEN 80A
59	1.50	0.080	0.008	747.000	33.000	1)	679.695	30.027	SANTRY 74B
60	1.50	0.015	0.020	605.000	35.000	2)	605.000	50.000	BARNARD 78A
61	1.50	0.030	0.003	607.000	91.000	NONE	607.000	91.000	BARNARD 78B
62	1.50	0.090	0.010	729.000	34.300	1)	802.264	37.747	PAULSEN 80A
63	1.55	0.030	0.003	668.000	100.000	NONE	668.000	100.000	BARNARD 78B
64	1.60	0.080	0.010	718.000	33.000	1)	790.159	36.316	PAULSEN 80A
65	1.70	0.030	0.003	714.000	107.000	NONE	714.000	107.000	BARNARD 78B

Table 2: Cross section data for the reaction $^{103}Rh(n,n')^{103m}Rh$ (contd.).

NR.	E-NEUTR [MEV]	WIDTH [MEV]	ERR.CENTR [MEV]	X-SECT(ORIG) [MB]	ERR(ORIG) [MB]	CORR.APPL.	X-SECT(FIN) [MB]	ERR(FIN) [MB]	REF.
66	1.70	0.170	0.010	805.000	37.000	1)	885.902	40.718	PAULSEN 80A
67	1.80	0.180	0.010	817.000	29.400	1)	899.108	32.355	PAULSEN 80A
68	1.85	0.070	0.007	849.000	38.000	1)	772.505	34.576	SANTRY 74B
69	1.90	0.120	0.010	800.000	37.600	1)	880.400	41.379	PAULSEN 80A
70	1.93	0.030	0.003	622.000	93.000	NONE	622.000	93.000	BARNARD 78B
71	2.00	0.100	0.010	844.000	39.700	1)	928.822	43.689	PAULSEN 80A
72	2.10	0.180	0.010	867.000	39.900	1)	954.133	43.910	PAULSEN 80A
73	2.20	0.100	0.010	885.000	40.700	1)	973.943	44.790	PAULSEN 80A
74	2.30	0.140	0.010	916.000	44.000	1)	1008.060	48.422	PAULSEN 80A
75	2.40	0.170	0.010	927.000	42.600	1)	1020.160	46.881	PAULSEN 80A
76	2.50	0.160	0.010	898.000	41.300	1)	988.249	45.451	PAULSEN 80A
77	2.60	0.150	0.010	994.000	45.700	1)	1093.900	50.293	PAULSEN 80A
78	2.70	0.200	0.020	999.000	111.000	1)3)	941.957	66.530	PAZSIT 75
79	2.70	0.130	0.010	974.000	44.800	1)	1071.890	49.302	PAULSEN 80A
80	2.80	0.170	0.010	950.000	43.700	1)	1045.480	48.092	PAULSEN 80A
81	2.90	0.180	0.010	1059.000	47.700	1)	1165.430	52.494	PAULSEN 80A
82	3.00	0.190	0.020	1034.000	52.700	1)	1137.920	57.996	PAULSEN 80A
83	3.10	0.200	0.020	1039.000	50.900	1)	1143.420	56.015	PAULSEN 80A
84	3.20	0.210	0.020	1052.000	50.500	1)	1157.730	55.571	PAULSEN 80A
85	3.30	0.210	0.020	1000.000	51.000	1)	1100.500	56.125	PAULSEN 80A
86	3.40	0.220	0.020	1038.000	50.900	1)	1142.320	55.974	PAULSEN 80A
87	3.50	0.230	0.020	1049.000	51.400	1)	1154.420	56.566	PAULSEN 80A
88	3.60	0.240	0.020	1022.000	49.100	1)	1124.710	53.986	PAULSEN 80A
89	3.70	0.250	0.030	1031.000	50.500	1)	1134.620	55.596	PAULSEN 80A
90	3.74	0.130	0.013	1170.000	116.000	NONE	1170.000	116.000	WU 88
91	3.80	0.260	0.030	1075.000	51.600	1)	1183.040	56.785	PAULSEN 80A
92	3.90	0.270	0.030	1045.000	50.200	1)	1150.020	55.201	PAULSEN 80A
93	4.00	0.280	0.030	1077.000	50.600	1)	1185.240	55.706	PAULSEN 80A
94	4.07	0.140	0.014	1013.000	103.000	NONE	1013.000	103.000	WU 88
95	4.10	0.290	0.030	1094.000	51.400	1)	1203.950	56.585	PAULSEN 80A
96	4.13	0.120	0.012	1202.000	121.000	NONE	1201.000	121.000	WU 88
97	4.20	0.340	0.030	1140.000	69.500	1)	1254.570	76.529	PAULSEN 80A
98	4.28	0.110	0.011	1164.000	101.000	NONE	1164.000	101.000	WU 88
99	4.30	0.340	0.030	1250.000	73.800	1)	1375.630	81.162	PAULSEN 80A
100	4.37	0.160	0.016	1124.000	115.000	NONE	1124.000	115.000	WU 88
101	4.40	0.340	0.030	1122.000	70.700	1)	1234.760	77.789	PAULSEN 80A
102	4.50	0.340	0.030	1066.000	62.900	1)	1173.130	69.215	PAULSEN 80A
103	4.57	0.100	0.010	1243.000	122.000	NONE	1243.000	122.000	WU 88
104	4.60	0.340	0.030	1064.000	61.700	1)	1170.930	67.914	PAULSEN 80A
105	4.70	0.330	0.030	1139.000	66.100	1)	1253.470	72.701	PAULSEN 80A
106	4.76	0.060	0.006	1170.000	109.000	NONE	1170.000	109.000	WU 88
107	4.80	0.330	0.030	1080.000	63.700	1)	1188.540	70.123	PAULSEN 80A
108	4.90	0.330	0.030	1194.000	68.100	1)	1314.000	74.898	PAULSEN 80A
109	4.96	0.110	0.011	1135.000	117.000	NONE	1135.000	117.000	WU 88
110	5.00	0.320	0.030	1163.000	67.500	1)	1279.880	74.233	PAULSEN 80A
111	5.00	0.150	0.015	1231.000	55.000	1)2)	1120.090	75.106	SANTRY 74A
112	5.10	0.310	0.030	1164.000	72.200	1)	1280.980	79.421	PAULSEN 80A
113	5.18	0.050	0.005	1164.000	102.000	NONE	1164.000	102.000	WU 88
114	5.20	0.300	0.030	1017.000	59.000	1)	1119.210	64.914	PAULSEN 80A
115	5.30	0.290	0.030	1003.000	57.200	1)	1103.800	62.917	PAULSEN 80A
116	5.30	0.160	0.016	1204.000	48.000	1)2)	1095.520	70.057	SANTRY 74A
117	5.40	0.280	0.030	1136.000	62.500	1)	1250.170	68.759	PAULSEN 80A
118	5.50	0.270	0.030	1117.000	61.400	1)	1229.260	67.609	PAULSEN 80A
119	5.60	0.250	0.030	1259.000	71.800	1)	1385.530	78.975	PAULSEN 80A
120	5.69	0.104	0.020	1314.270	57.565	NONE	1314.270	57.565	MIAH 95
121	5.70	0.230	0.020	1150.000	62.100	1)	1265.580	68.341	PAULSEN 80A
122	5.80	0.210	0.020	1077.000	60.300	1)	1185.240	66.373	PAULSEN 80A
123	5.90	0.190	0.020	1111.000	60.000	1)	1222.660	66.024	PAULSEN 80A
124	5.94	0.130	0.013	1368.000	53.000	1)2)	1244.740	78.734	SANTRY 74A
125	6.00	0.150	0.010	1239.000	66.900	1)	1363.520	73.630	PAULSEN 80A
126	6.04	0.095	0.020	1295.560	47.158	NONE	1295.560	47.158	MIAH 95
127	6.10	0.110	0.010	1207.000	65.200	1)	1328.300	71.728	PAULSEN 80A
128	6.40	0.120	0.012	1478.000	56.000	1)2)	1344.830	84.367	SANTRY 74A
129	6.51	0.120	0.012	1433.000	57.000	1)2)	1303.890	83.308	SANTRY 74A
130	6.53	0.086	0.020	1311.540	48.789	NONE	1311.540	48.789	MIAH 95

Table 2: Cross section data for the reaction $^{103}Rh(n,n')^{103m}Rh$ (contd.).

NR.	E-NEUTR [MEV]	WIDTH [MEV]	ERR.CENTR [MEV]	X-SECT(ORIG) [MB]	ERR(ORIG) [MB]	CORR.APPL.	X-SECT(FIN) [MB]	ERR(FIN) [MB]	REF.
131	6.75	0.120	0.012	1406.000	63.000	1)2)	1279.320	85.893	SANTRY 74A
132	6.93	0.080	0.020	1320.810	46.492	NONE	1320.810	46.492	MIAH 95
133	7.25	0.100	0.010	1324.000	59.000	1)2)	1204.710	80.686	SANTRY 74A
134	7.47	0.100	0.010	1385.000	62.000	1)2)	1260.210	84.576	SANTRY 74A
135	7.58	0.072	0.020	1203.340	43.079	NONE	1203.340	43.079	MIAH 95
136	7.80	0.100	0.010	1393.000	63.000	1)2)	1267.490	85.454	SANTRY 74A
137	7.98	0.068	0.020	1247.200	44.280	NONE	1247.200	44.280	MIAH 95
138	8.51	0.080	0.008	1409.000	63.000	1)2)6)	1278.590	85.763	SANTRY 74A
139	8.55	0.065	0.020	1293.100	48.490	NONE	1293.100	48.490	MIAH 95
140	8.97	0.062	0.020	1220.600	44.180	NONE	1220.600	44.180	MIAH 95
141	9.02	0.080	0.008	1287.000	58.000	1)2)6)	1175.960	79.156	SANTRY 74A
142	9.55	0.060	0.020	1227.900	47.520	NONE	1227.900	47.520	MIAH 95
143	9.80	0.080	0.008	1309.000	59.000	1)2)6)	1212.140	81.597	SANTRY 74A
144	9.92	0.057	0.020	1195.400	49.850	NONE	1195.400	49.850	MIAH 95
145	10.03	0.080	0.008	1272.000	57.000	1)2)6)	1186.560	79.668	SANTRY 74A
146	10.50	0.080	0.008	1099.000	49.000	1)2)6)	965.781	64.699	SANTRY 74A
147	10.58	0.056	0.020	937.680	48.010	NONE	937.680	48.010	MIAH 95
148	10.75	0.080	0.008	1026.000	46.000	1)2)6)	885.945	59.498	SANTRY 74A
149	11.00	0.080	0.008	981.000	46.000	1)2)6)	838.787	57.497	SANTRY 74A
150	11.04	0.055	0.020	771.030	46.880	NONE	771.030	46.880	MIAH 95
151	11.42	0.054	0.020	720.900	49.020	NONE	720.900	49.020	MIAH 95
152	11.80	0.080	0.008	767.000	43.000	1)2)6)	599.909	45.065	SANTRY 74A
153	12.00	0.080	0.008	665.000	42.000	1)2)6)	500.887	40.348	SANTRY 74A
154	12.00	0.054	0.020	564.760	45.180	NONE	564.760	45.180	MIAH 95
155	12.10	0.080	0.008	718.000	47.000	1)2)6)	533.099	43.912	SANTRY 74A
156	12.60	0.080	0.008	546.000	49.000	1)2)6)	395.556	40.636	SANTRY 74A
157	13.00	0.180	0.006	398.000	37.400	1)	437.999	41.172	PAULSEN 80B
158	13.58	0.100	0.013	359.000	16.000	1)2)	326.654	21.879	SANTRY 74A
159	13.58	0.090	0.009	373.000	92.000	1)2)6)	254.544	64.060	SANTRY 74A
160	13.89	0.060	0.014	325.000	25.000	1)2)	295.717	27.131	SANTRY 74A
161	14.00	0.250	0.004	286.000	27.200	1)	314.743	29.900	PAULSEN 80B
162	14.14	0.001	0.001	260.700	14.562	8)	260.700	14.562	STROHMAIER 95
163	14.24	0.080	0.014	297.000	13.000	1)2)	270.240	17.958	SANTRY 74A
164	14.50	0.150	0.015	281.000	13.000	1)2)	255.682	17.417	SANTRY 74A
165	14.54	0.001	0.001	236.200	13.193	8)	236.200	13.193	STROHMAIER 95
166	14.70	0.150	0.030	280.000	25.000	9)	276.276	22.710	PAZSIT 72
167	14.74	0.200	0.020	272.000	12.000	1)2)	247.493	16.503	SANTRY 74A
168	14.80	0.200	0.020	216.000	26.000	1)3)	187.639	14.998	PAZSIT 75
169	14.94	0.001	0.001	216.200	12.076	8)	216.200	12.076	STROHMAIER 95
170	15.35	0.001	0.001	199.600	32.202	8)	199.600	32.202	STROHMAIER 95
171	15.75	0.001	0.001	185.700	29.960	8)	185.700	29.960	STROHMAIER 95
172	16.16	0.001	0.001	174.000	32.770	8)	174.000	32.770	STROHMAIER 95
173	16.56	0.001	0.001	163.900	30.868	8)	163.900	30.868	STROHMAIER 95
174	16.96	0.001	0.001	155.200	29.230	8)	155.200	29.230	STROHMAIER 95
175	17.37	0.001	0.001	147.500	30.174	8)	147.500	30.174	STROHMAIER 95
176	17.77	0.001	0.001	140.700	28.783	8)	140.700	28.783	STROHMAIER 95
177	18.17	0.001	0.001	134.700	28.659	8)	134.700	28.659	STROHMAIER 95
178	18.58	0.001	0.001	129.200	27.489	8)	129.200	27.489	STROHMAIER 95
179	18.98	0.001	0.001	124.300	26.447	8)	124.300	26.447	STROHMAIER 95
180	19.39	0.001	0.001	119.800	25.822	8)	119.800	25.822	STROHMAIER 95
181	19.79	0.001	0.001	115.800	24.959	8)	115.800	24.959	STROHMAIER 95

CORRECTION CODES:
1) CROSS SECTION RENORMALIZED TO PRESENT DECAY DATA (HALF-LIFE, BRANCHING RATIOS ETC.)
2) ERROR GIVEN IN PUBLICATION DID NOT INCLUDE ERROR OF REFERENCE CROSS SECTION.
3) CROSS SECTION RENORMALIZED TO ENDF/B-VI VALUES OF REFERENCE CROSS SECTION USED IN MEASUREMENT.
ERRORS TAKEN FROM THE ASSOCIATED FILE 33 INCLUDED IN FINAL ERROR.
4) CROSS SECTION RENORMALIZED TO ANGULAR DISTRIBUTION OF SOURCE NEUTRONS OF LISKIEN AND PAULSEN.
5) ERROR HAS BEEN REDUCED BY A FACTOR TWO OR THREE IN ORDER TO REPRESENT 1 STANDARD DEVIATION.
6) SPECIAL CORRECTION. SEE TEXT FOR DETAILS.
7) CROSS SECTION FROM MEASURED RELATIVE EXCIT. FUNCTION, NORMALIZED TO PRESENT EVALUATION.
8) CROSS SECTION FROM THEORETICAL CALCULATION.
9) RENORMALIZATION USING REFERENCE CROSS SECTION EVALUATED AT IRK, SEE PHYSICS DATA 13-5.

Table 3: Evaluated group cross sections for the reaction $^{103}Rh(n,n')^{103m}Rh$.

Energy group [MeV]	to [MeV]	Cross section [mb]	Error [mb]	Error [%]	Ratio $\Delta_{ext}/\Delta_{int}$
0.10	0.30	37.71	13.64	36.2	3.103
0.30	0.50	116.05	13.79	11.9	1.500
0.50	0.70	227.94	15.41	6.8	0.879
0.70	0.90	545.00	40.91	7.5	1.694
0.90	1.10	619.67	34.54	5.6	1.854
1.10	1.30	629.78	20.44	3.2	1.080
1.30	1.50	645.36	24.41	3.8	1.055
1.50	1.75	731.96	41.27	5.6	1.913
1.75	2.00	816.23	60.20	7.4	2.373
2.00	2.50	1009.32	47.33	4.7	0.552
2.50	3.00	1030.96	57.58	5.6	1.448
3.00	3.50	1148.88	57.14	5.0	0.592
3.50	4.00	1154.02	50.25	4.4	0.162
4.00	4.50	1208.80	59.50	4.9	0.901
4.50	5.00	1205.64	60.49	5.0	0.277
5.00	5.75	1219.33	40.90	3.4	1.100
5.75	6.50	1294.44	36.20	2.8	0.152
6.50	7.25	1303.72	41.30	3.2	0.339
7.25	8.00	1222.56	38.53	3.2	0.107
8.00	9.00	1267.73	41.01	3.2	0.140
9.00	10.00	1261.44	46.89	3.7	0.524
10.00	11.00	967.11	39.56	4.1	0.324
11.00	12.00	684.74	33.02	4.8	0.198
12.00	13.00	452.82	26.95	6.0	0.792
13.00	14.00	357.47	28.46	8.0	0.685
14.00	15.00	237.90	13.23	5.6	1.707
15.00	16.00	193.28	31.18	16.1	---*)
16.00	17.00	164.90	31.06	18.8	---*)
17.00	18.00	144.99	29.66	20.5	---*)
18.00	19.00	130.06	27.67	21.3	---*)
19.00	20.00	117.67	25.36	21.6	---*)

*) Not applicable (only data points from theoretical calculation in this energy group).

Table 5: Relative covariance matrix for the reaction $^{103}Rh(n,n')^{103m}Rh$.

Correlations given in %

GROUP NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	ENERGY GROUP [MeV]	to [MeV]
1	100	65	48	52	59	56	58	56	60	26	21	26	24	22	22	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.10	0.30
2		100	46	47	56	54	57	54	58	20	16	20	18	16	17	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30	0.50
3			100	45	64	62	62	63	47	29	24	29	26	25	25	12	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.70
4				100	58	57	46	56	62	62	50	62	56	53	53	26	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.70	0.90
5					100	66	63	66	60	41	33	41	37	35	35	17	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.90	1.10
6						100	65	68	63	41	33	41	37	34	35	17	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.10	1.30
7							100	65	58	24	19	24	21	20	20	10	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.30	1.50
8								100	62	40	32	40	36	33	34	17	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.50	1.70
9									100	45	36	45	40	38	38	19	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.75	2.00
10										100	57	71	64	60	61	30	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.00	2.50
11											100	57	52	48	49	24	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.50	3.00
12												100	64	60	61	30	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.00	3.50
13													100	73	73	40	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.50	4.00
14														100	74	41	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.00	4.50
15															100	41	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.50	5.00
16																100	46	36	36	36	36	35	35	34	9	7	0	0	0	0	0	5.00	5.75
17																	100	40	40	40	40	39	37	36	8	6	0	0	0	0	0	5.75	6.50
18																		100	45	45	46	44	42	41	9	7	0	0	0	0	0	6.50	7.25
19																			100	46	46	44	42	41	8	6	0	0	0	0	0	7.25	8.00
20																				100	46	44	42	41	8	7	0	0	0	0	0	8.00	9.00
21																					100	44	42	41	7	6	0	0	0	0	0	9.00	10.00
22																						100	42	41	10	8	0	0	0	0	0	10.00	11.00
23																							100	40	12	9	0	0	0	0	0	11.00	12.00
24																								100	12	10	0	0	0	0	0	12.00	13.00
25																									100	33	0	0	0	0	0	13.00	14.00
26																										100	56	56	56	56	56	14.00	15.00
27																											100	95	95	95	95	15.00	16.00
28																												100	95	95	95	16.00	17.00
29																													100	95	95	17.00	18.00
30																														100	95	18.00	19.00
31																															100	19.00	20.00

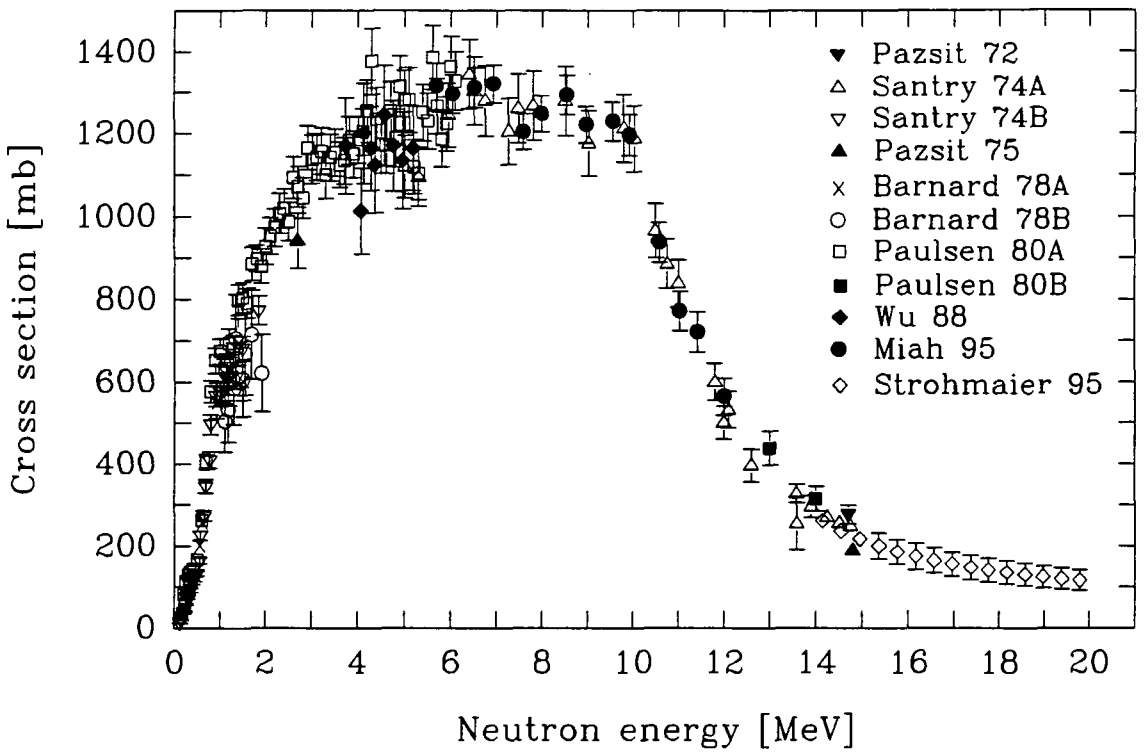

Fig. 1: Experimental cross section data for the reaction $^{103}Rh(n,n')^{103m}Rh$. (The displayed data points represent the renormalized cross sections and their effective 1 σ uncertainties.)

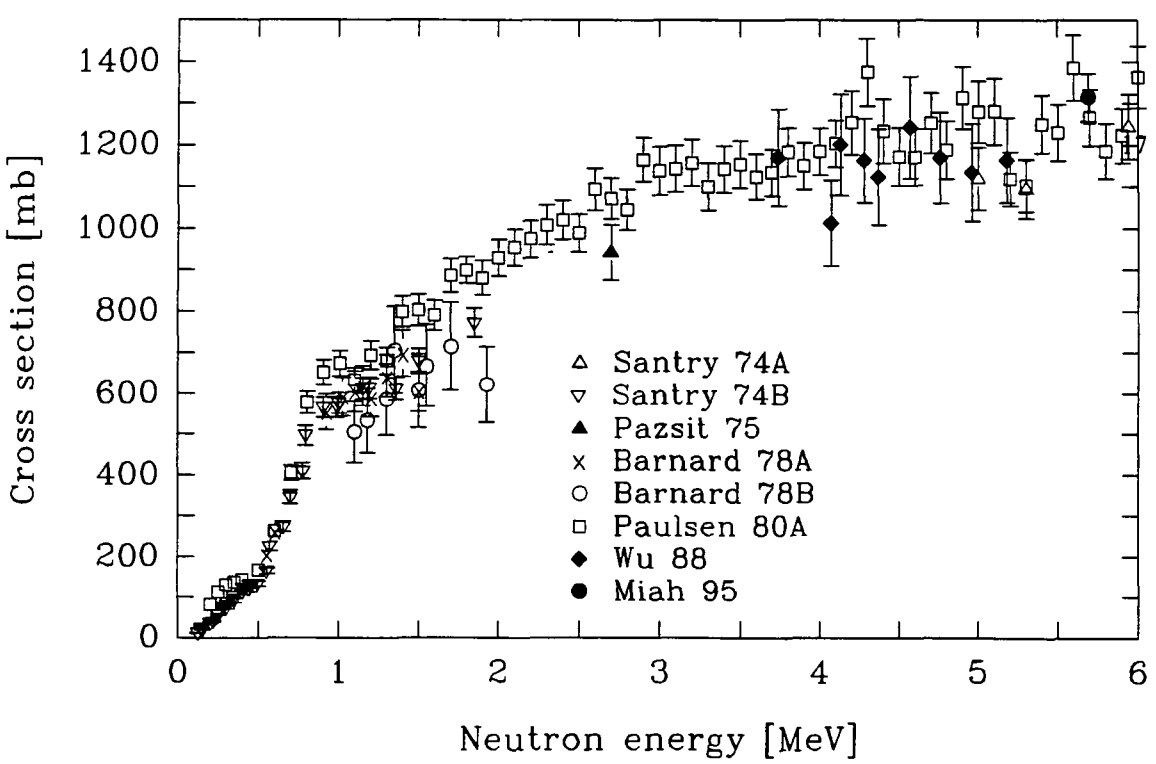

Fig. 2: Experimental cross section data for the reaction $^{103}Rh(n,n')^{103m}Rh$: expanded display of the energy range 0 - 6 MeV.

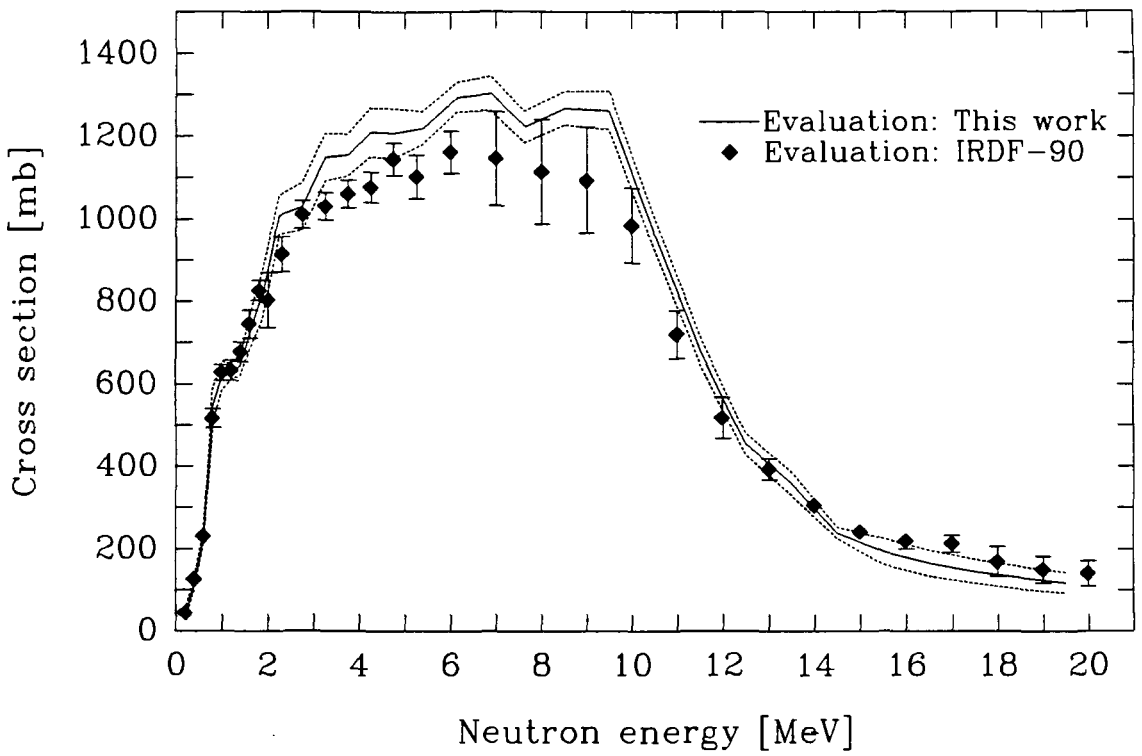

Fig. 3: Results of the present evaluation of the cross section for the reaction $^{103}Rh(n,n')^{103m}Rh$ compared to the previous evaluation reported in Ref. 2.

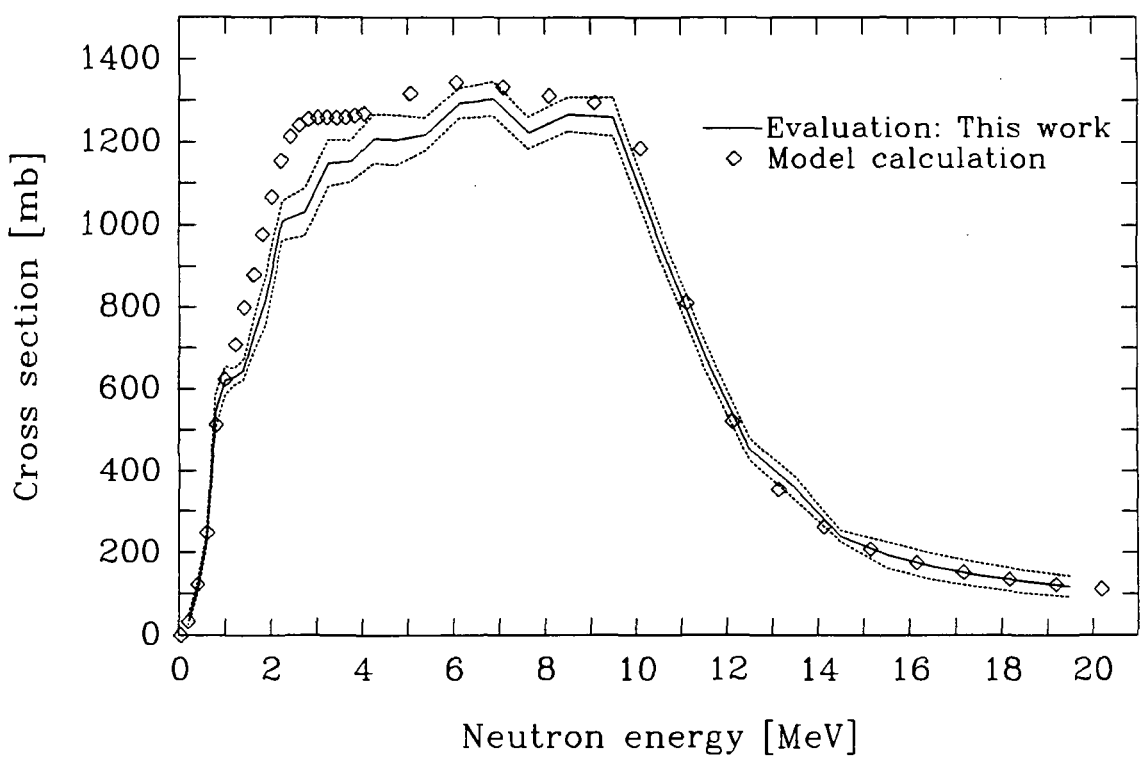

Fig. 4: The evaluated cross section for the reaction $^{103}Rh(n,n')^{103m}Rh$ compared with the results of model calculations [9].

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