JAERI-M
7568

NEANDC(J)-53/AL
INDC(JAP)-39/G

COMPILATION OF MEASURED CAPTURE CROSS SECTIONS FOR JENDL-FISSION PRODUCT NUCLEAR DATA FILE

March 1978

by Hiroyuki MATSUNOBU* and Takashi WATANABE**

日本原子力研究所
Japan Atomic Energy Research Institute

Compilation of Measured Capture Cross Sections for JENDL Fission Product Nuclear Data File

Hiroyuki MATSUNOBU* and Takashi WATANABE**

Fission Product Nuclear Data Working Group
Japanese Nuclear Data Committee
Tokai Research Establishment, JAERI

(Received January 31, 1978)

The status of experimental data of neutron capture cross section is reviewed on 38 fission product (FP) nuclides important for fast reactor calculations. Experimental data are compiled for 24 of the 38 FP nuclides in the energy region above 1 keV.

Appendix I gives outlines of the experiments (neutron energy, number of data points, cross section, neutron source, experimental method, standard cross section, β- and γ-ray data etc.) in tables. Appendix II illustrates the compiled data of neutron capture cross section in figures.

This work was made as a part of evaluation work of Fission Product Nuclear Data Working Group of Japanese Nuclear Data Committee. The authors were supported under the contract with JAERI.

Keywords : Fission Products, Data Compilation, Experimental Data, Neutron Capture Cross Section, Graphs, Tables

---

* Sumitomo Atomic Energy Industries, Ltd.

** Kawasaki Heavy Industries, Ltd.

JENDL用・核分裂生成物核データ・ファイル作成のための中性子捕獲断面積測定データの収集

日本原子力研究所東海研究所シグマ研究委員会
松延広幸*・渡部　隆**

（1978年1月31日受理）

本報告書は核分裂生成物（FP）核種の中性子捕獲断面積データ収集の結果をまとめたものである。高速炉の燃焼過程で炉心反応度に大きな影響を与える重要FP（Fisson Product）38核種の中で，高速エネルギー領域の中性子捕獲断面積が測定されている24核種に就て，実験データの現状がレビューされている。なお，付録に，実験の主な内容（中性子エネルギー，測定点数，断面積，中性子源，測定方法，標準断面積値，β線およびγ線データ等）が核種毎にテーブル形式で与えられ，また，収集された中性子捕獲断面積データが核種毎にグラフで示されている。

本作業は，シグマ研究委員会・核データ専門部会・FP核データワーキンググループの作業の一環として，核データセンターからの委託調査として行なわれた。

*　住友原子力工業（株）技術部
**　川崎重工業（株）原子力技術部

Contents

目　　次

1. Introduction

The importance and needs of fission product (FP) nuclear data are rising more and more in the whole fields relating to nuclear power. Responding to these demands, evaluation work of the FP nuclear data for fast reactors has been powerfully performed in JNDC (Japanese Nuclear Data Committee) over several years. Capture cross section is one of the most important FP nuclear data. Accordingly, as a part of this evaluation work, compilation of the experimental data on capture cross section was required in order to examine the systematic trends of mass number and energy dependences of capture cross section, and to increase the reliability of evaluation.

In this compilation work, the experimental capture data in keV and MeV range were surveyed for 100 FP nuclides which selected according to the order of contribution to the capture effect in fast reactor cores. As a result of compilation work, many experimental data were collected for about 50 nuclides. The compiled data were plotted in the figures, and used to normalize the capture cross section obtained by theoretical calculation.

The FP nuclear data evaluated in the present work were compiled in JENDL-1 (Japanese Evaluated Nuclear Data Library, Version 1) which has been completed recently. This document gives a description of compilation of the measured capture cross sections performed in order to prepare the fission product nuclear data file for JENDL-1.

In Section 2, the procedure of data compilation is briefly described. In Section 3, the FP nuclides compiled in this document are shown on the basis of the classification of FP nuclides. In Section 4, the status of the experimental capture data is described for the compiled nuclides. In Section 5, a description on the contents of Tables attached in Appendix I is given. In the last Section 6, some remarks are given for preparation of this document.

Appendix I consists of the above Tables, the abbreviations used in these Tables, and the experimental references. In Appendix II, the Figures of capture cross section are shown for 24 FP nuclides.

2. Procedure of literatures and data compilation

Survey on the measurements of capture cross section for FP nuclides was done using CINDA 76/77[1] and its Supplement 76/77[2], and the recent literatures. The contents of measurements were surveyed for the collected literatures over the following items.

neutron energy and its resolution, neutron source, accelerator, method of the measurement, used detector, standard cross section, flux monitor, measured or used β-and γ-ray data and their branching ratio, and measured cross section

The used standard cross section or monitor reaction cross section, and the branching ratio of the decay mode by β and/or γ decay are especially important quantities, because the discrepancies between the cross sections measured by different experimenters might be caused by the differences of these quantities.

The measured capture cross section data were compiled on the basis of the collected literatures and the recent NEUDADA.
In a few cases, the data plotted in the figures of BNL-325, Supplement[3], or the numerical data described in the comments of CINDA 76/77 were compiled when the numerical data are not given in the original papers and NEUDADA, or the original papers could not be obtained.
There are some differences between the original data and NEUDADA on neutron energy and capture cross section in a few nuclides. It is supposed that the original data were revised when they were compiled in NEUDADA. Then, in such a case, the data compiled in NEUDADA were adopted in present compilation.

3. FP nuclides compiled in this document

The FP nuclides are classified into some categories according to their contribution to the capture effect in burn up of fast reactor. This classification is given by S. Iijima[4]. In this document, 38 important FP nuclides classified into "Class I" to "Class III" were picked up, and their experimental capture data in keV and MeV range were searched by the procedure as mentioned in the previous section.

In addition, the capture effect by these 38 nuclides occupies about 93% of that by the whole FP nuclides. As the result of survey, the 38 nuclides were divided as follows.

	Nuclides with the Exptl. Data	No Data Nuclides
Class I	^{97}Mo, ^{99}Tc, ^{103}Rh, ^{105}Pd, ^{133}Cs, ^{149}Sm	^{101}Ru, ^{107}Pd, ^{135}Cs, ^{147}Pm, ^{151}Sm
Class II	^{95}Mo, ^{98}Mo, ^{100}Mo, ^{102}Ru, ^{104}Ru, ^{109}Ag, ^{141}Pr, ^{150}Nd ^{153}Eu	^{93}Zr, ^{103}Ru, ^{129}I, ^{131}Xe, ^{132}Xe, ^{143}Nd, ^{145}Nd
Class III	^{96}Zr, ^{108}Pd, ^{127}I, ^{139}La, ^{142}Ce, ^{146}Nd, ^{148}Nd, ^{147}Sm ^{152}Sm	^{106}Ru, ^{155}Eu

Although a report[5)] on measurement of the capture cross section has been published for ^{147}Pm in the energy range 20 eV to 10 keV, yet the numerical data have not been published. On the 24 nuclides with the measured capture cross section, Tables showing the contents of the experiments and Figures of their capture cross sections were prepared, and attached in Appendix I and II, respectively.

4. Status of the compiled experimental data

As mentioned in the previous section, the measured capture cross section data were obtained for 24 nuclides from among 38 important nuclides. Although, many data were collected in this compilation, most of the collected data concentrate on ^{98}Mo, ^{100}Mo, ^{103}Rh, ^{127}I, ^{133}Cs, ^{139}La, ^{141}Pr, and ^{153}Eu. The data for these nuclides are very abundant and distribute densely over the energy range from eV to MeV. However, it is noticed that there are large discrepancies among the data measured by different experimenters for these nuclides. Particularly, remarkable systematic discrepancies are observed over the wide energy range for the data of ^{98}Mo, ^{100}Mo, ^{127}I, ^{133}Cs, and ^{153}Eu.

Next, there are some data in the limited energy range for ^{95}Mo, ^{97}Mo, ^{99}Tc, ^{105}Pd, ^{108}Pd, ^{109}Ag, ^{148}Nd, ^{150}Nd, ^{147}Sm, and ^{149}Sm. It is also pointed out that there are remarkable systematic discrepancies among the data of ^{109}Ag in the energy range from 10 to 150 keV. The data of ^{96}Zr, ^{102}Ru, ^{104}Ru, ^{142}Ce, ^{146}Nd, and ^{152}Sm are poor and obtained for only three to nine energy points.

Generally speaking, the data for most of the nuclides exist most abundantly in the energy range around 25 keV. However, it is pointed out that the discrepancies among the data are also most remarkable around 25 keV, as shown in the attached Figures. It is necessary to investigate the cause of these discrepancies and to examine the reliability of the data in order to use these data in evaluation or as a normalization point of calculated cross section.

In this compilation, many new data are collected for 15 nuclides. These new data have been published after 1973 in which FP Nuclear Data Panel[6] was held at Bologna. The recent measurements for Mo-isotopes have been performed by A. R. de L. Musgrove et al.[7] in the energy range from 1 to 90 keV in 1976. Their data show good agreement with the data by Kapchigashev et al.[8] for ^{95}Mo and ^{97}Mo, although they deviate from the latter data in some energy intervals for ^{98}Mo and ^{100}Mo. The 25 keV data for ^{98}Mo and ^{100}Mo have been also presented by R. P. Anand et al.[9] in 1974. Their data are in agreement with the data by Musgrove et al. and Kapchigashev et al. for ^{98}Mo, while the data for ^{100}Mo are considerably lower than those by Musgrove et al. R. P. Anand et al. presented also the 25 keV data for ^{104}Ru. Their data show good agreement with the 24 keV data by Murty et al.[10] and Macklin et al.[11] R. W. Hockenbury et al[12] presented a number of data in the energy range from thermal to 300 keV for ^{103}Rh, ^{105}Pd, and ^{153}Eu in 1975. The abundant data for ^{103}Rh have been also presented by C. Le Rigoleur et al.[13] in the same energy range as Hockenbury et al. in 1975. The first measurements for ^{105}Pd have been performed by R. L. Macklin[14], and Hockenbury et al. in 1975. The data by Macklin show the maximum and minimum values around 2.6 keV.

The recent measurements in keV region for ^{127}I have been performed by N. Yamamuro et al.[15] at 23.7 keV and K. Rimawi[16] at 24.3 keV in 1975. Both data show very good agreement. The measurements in MeV region have been done by J. Vuletin et al.[17] at 14.4 MeV and F. Rigaud et al.[18] at 14.6 MeV in 1974, and by O. Schwerer et al.[19] at 14 MeV in 1976. Their data are in agreement with mutually within the experimental errors. Yamamuro et al. presented also the 24 keV data for ^{133}Cs in 1976. Their data are consistent with the data by Popov and Shapiro[20] (1962), and show a lower value than the data by Kompe[21] (1969). Vuletin et al., Rigaud et al., and Schwerer et al. presented also the 14 MeV data for ^{141}Pr, for ^{103}Rh and ^{139}La, and for ^{139}La and ^{142}Ce, respectively.

The most recent measurements for ^{147}Sm, ^{149}Sm, and ^{153}Eu have been performed by B. N. Kononov et al.[22] in the energy range from 5.5 to 342.5 keV in 1977. Their data for ^{147}Sm and ^{149}Sm show considerably higher values than the data by Macklin[23] at 30 keV. Their data for ^{153}Eu show also systematically higher values than the data by Konks and Fenin[24], Hockenbury et al., and M. C. Moxon et al.[25] However, they are in good agreement with the values derived from the data by Czirr[25] for natural Eu and ^{151}Eu. The data by Moxon et al. show the lowest values compared with other data in the energy range from 0.1 to 400 keV, but are in agreement with the data by Konks and Fenin, and Hockenbury et al. within the experimental errors.

5. Description on the attached Tables (Appendix I)

The main contents of the measurements on capture cross section are given for 24 FP nuclides in the Tables attached in Appendix I. The items and contents described in the Tables for each nuclide are as follows.

Column 1 : Reference

The literatures cited in the present compilation are given in chronological order by the abbreviations combinning the year in which the experiment was done and the name of the leading author. These abbriviations are given in

"Experimental References" of Appendix I.

Column 2 : Energy

The energy range in which the measurement was performed is given in keV unit. The energy resolution is also shown if it was given by the author.

Column 3 : N

This means the number of data points measured.

Column 4 : Measured Cross Section

The measured capture cross section is given in milli-barn unit. The error of cross section is also shown if it was given by the author. However, they are omitted in case of many data points more than 5 points existing.

Column 5 : Neutron Source

The neutron source is shown in the form of radioactive material, or nuclear reaction and/or accelerator used.

Column 6 : Method

The method of measurement is shown with the detectors used.

Column 7 : Standard or Flux Monitor

The standard cross section which was used in relative measurement, or the reaction cross section which was used in determination of the absolute value of neutron flux is given in milli-barn unit with the nuclear reaction form. The reaction form is omitted in some cases, if it is (n,γ) reaction.

Column 8 and 9 : Thermal Cross Section

These columns are only used in case of "double-ratio comparison" technique applied in activation measurement. The thermal cross sections of the standard and target (sample) nuclides are given in barn unit in Column 8 and 9 respectively.

Column 10 : Comments

Appropriate information which is not given in the previous columns is described in this column. Especially, the data

on β-ray and/or γ-ray emitted from the residual nucleus, and their branching ratio are important in order to compare and renormalize the cross sections obtained by various methods and techniques.

In this Table, many abbreviations are used for the simplicity, and in order to give many information. Explanation on these abbreviations is given in the annexed papers of Appendix I.

6. Remarks

This document was prepared as a preliminary one in order to investigate the compiled experimental data and methods, and to promote the evaluation work of the FP nuclear data for JENDL-1. Accordingly, it is expected that this is not complete, but includes considerable defects. The revision of this document will be done in the next step of evaluation work. At the next step, the format of Tables and the abbreviations used in Tables will be modified to be more complete, effective and simple.

The purpose of this document is to clarify the status and problems of the experimental data, and to provide the subject matter of data evaluation.

Acknowledgement

The authors wish to cordially thank Dr. S. Iijima for his advice, discussion, and encouragement for this work. They are grateful to Dr. A. Asami and Prof. N. Yamamuro for their discussion and comments on the details of experiments. They are also indebted to Mr. T. Yoshida for introduction of a new literature on nuclear data evaluation, and to Mr. T. Nakagawa for his effort on retrieval of the data file.

References

1) CINDA 76/77 : An Index to the literature on microscopic neutron Data. Vol. 1 and 2, By the International Atomic Energy Agency, Vienna (1976)

2) CINDA 76/77 Supplement 1 : An Index to the literature on microscopic neutron Data. By the International Atomic Energy Agency, Vienna (1976)

3) BNL-325,Suppl.: Neutron Cross Sections : BNL-325, 2nd Edition, Suppl. No. 2
Vol. II A, Z = 21 to 40,
Vol. II B, Z = 41 to 60, and
Vol. II C, Z = 61 to 87, (1966)

4) Iijima, S. : IAEA Second Advisory Group Meeting on Fission Product Nuclear Data.
Petten, Netherlands, 5-9 September 1977
Review Paper No. 9:
Status of Fast Neutron Reaction Cross-Sections of Fission Products

5) Beery, J. G. and Codding, Jr., J. W. : Bull. Am. Phys. Soc. 13, 1391 (1968)

6) IAEA-169 : Fission Product Nuclear Data [FPND]
Vol. I, II, and III
Proceedings of a Panel on Fission Product Nuclear Data.
Organized by the IAEA, Bologna, 26-30 November 1973

7) A. R. de L. Musgrove et al. : See Experimental References ·99)

8) Kapchigashev et al. : 〃 〃 〃 ·27)

9) R. P. Anand et al. : 〃 〃 〃 ·89)

10) Murty et al. : 〃 〃 〃 ·84)

11) Macklin et al. : 〃 〃 〃 ·1)

12) R. W. Hockenbury et al. : 〃 〃 〃 ·93)

13) C. Le Rigoleur et al. : 〃 〃 〃 ·94)

14) R. L. Macklin : 〃 〃 〃 ·95)

15) N. Yamamuro et al. : 〃 〃 〃 ·97)

16) K. Rimawi et al. : 〃 〃 〃 ·96)

17) J. Vuletin et al. : 〃 〃 〃 ·92)

18) F. Rigaud et al. : 〃 〃 〃 ·90)

19) O. Schwerer et al. : 〃 〃 〃 ·100)

20) Popov and Shapiro : 〃 〃 〃 ·23)

21) Kompe : 〃 〃 〃 ·60)

22) B. N. Kononov et al. : 〃 〃 〃 ·102)

23) Macklin : See Experimental References ·30)

24) Konks and Fenin : 〃 〃 〃 ·35)

25) M. C. Moxon et al. : 〃 〃 〃 ·98)

Appendix I : Tables

(Table 1 ∿ Table 24)

Contents of the Experimental Method and
Data Compiled for 24 Important FP Nuclides

Table 1 ^{96}Zr

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	22	Sb-Be	ACT NaI (Tℓ)	^{127}I 820			1 γ/dis.
58 Perkin	14500	1	≤4	T(d,n)	ACT GM	$^{27}Aℓ(n,\alpha)$			
59 Lyon	195±50	1	7±2	RdTh-D_2O	ACT NaI (Tℓ)	^{115}In 195			1 γ/dis ^{97}Nb 0.66 MeVγ
63 Macklin	30	1	40±12		M-R				
69 Schuman	2 and 25 2 25	2	 79±8 21	Fe Filter		$Au^{197}\sigma_{n\gamma}$ 4800 690			$T_{1/2}$=17hr

Table 2 ^{95}Mo

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
64 Kapchigashev	0.03∿46	47			Pb-SDTS				no documentation NEUDADA data
76 Musgrove	3∿90	19*		(γ, n)	TOF C_6F_6 SC	Li (n,α)			ORELA *Averaged Value

Table 3 ^{97}Mo

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
64 Kapchigashev	0.028∿61	60			Pb-SDTS				
76 Musgrove	3∿90	23*		(γ, n)	TOF C_6F_6 SC	Li (n,α)			ORELA *Averaged Value

Table 4-1 ^{98}Mo

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	209±21	Sb-Be	ACT NaI(Tl)	I^{127} 820			0.72 γ/dis
58 Booth	25 (20)	1	390±120 (130)	Sb-Be	ACT DRC NaI(Tl), PROP	I^{127} 820	5.5 (6.2)	0.45 (0.15)	6.7hr β-γ ( )BNL-325 2nd
59 Vervier	25	1	415±98*	Sb-Be	ACT DRC GM	Au^{197} 1065 In^{115} 825	98.8 155	0.45	* average by different standards
59 Lyon	195±50	1	30±6	RdTh-D_2O	ACT NaI(Tl)	In^{115} 195			
62 Furr	25	1	140±70			I^{127} 780			
63 Kapchigashev	0.005∿31	63			Pb-SDTS Sc				
67 Petö	3000±200	1	10.6±6	300keV Cascade Generator D(d,n)	ACT GM	Au^{197} 35.2			$T_{1/2}$ = 6.7hr

Table 4-2 ^{98}Mo (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
68 Stupegia	36∿2644	28		^{7}Li(p,n) T(p,n)	ACT NaI(Tl), PROP	U^{235}(n,f) White-Hughes			
68 Hasan	24	1	110±15	Sb-Be	ACT β detec-tor	I^{127} 820			
69 Devbenko	1∿3000	16		T(p,n) VDG	ACT DRC	U^{235}(n,f) Davey's data	577.1	0.15	
70 Chaturvedi	24±3	1	121.5	Sb-Be	ACT NaI(Tl)	Au^{197} 640±25			6th Table of Isotope Table of ICC α-β-γ ray spec-troscopy 2(,65)
73 Murty	24±5	1	252±38	Sb-Be	ACT 4πγ by NaI(Tl)	Li^{6}(n,α)			6th ed. TI
74 Rimawi	24	1	115±10						
74 Anand	25±5	1	116±7		ACT DRC NaI(Tl)	I^{127}(n,γ)* 832±26	6.12±0.12	0.130± 0.006	142.7keVγ: ^{99m}Tc * 441 keV γ $T_{1/2}$=66.7 hr

Table 4-3 ^{99}Mo (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
76 Musgrove	3∿90	20*		(γ, n)	TOF C_6F_6 SC	$Li^6(n,\alpha)$			ORELA *Averaged value
77 Rimawi	24.3	1	125±25						

Table 5-1 ^{100}Mo

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	38±8	Sb-Be	ACT NaI(Tl)	I^{127} 820			1.0 γ/dis
58 Pasechnik	2500 3100 4000	3	6.3±1.2 5.6±1.0 4.5±0.7	D(d,n)	ACT	I^{127} 51 44 37			
58 Leipunsky	25 200 2700 4000	4	112±3 51.6±2.1 6.5±0.7 3.9±0.4	Sb-Be T(p, n) D(d, n)	ACT DRC GM	I^{127} 820 400 U^{238} σf 47 23	BNL-325 (1958)	BNL-325 (1958)	
58 Kononov	25	1	112±3	Sb-Be	ACT DRC	I^{127} 820	BNL-325	BNL-325	
59 Vervier	25	1	148±39	Sb-Be	ACT DRC	Au^{197} 1065 In^{115} 825	98.8 155	0.2 0.2	
59 Lyon	195±50	1	27±6	RdTh-D_2O	ACT NaI(Tl)	In^{115} 195			1.0γ/dis Tc^{100}
59 Johnsrud	400∿6200	24		Li(p,n) T(p,n) D(d,n)	ACT DRC NaI(Tl)	U^{235}(n,f) Allen-Henkel	584	0.2	
60 Tolstikov	30∿2100	18		T(p,n) VDG	ACT	$U^{235}\sigma_{nf}$ <1000keV I^{127}(Bame's)	 5.6	0.2 0.2	graph Data:NEUDADA

Table 5-2 ^{100}Mo (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
60 Weston	4 7 10 15 25 40 60 80 150	9	350 207 175 129 97 69 47 41 30	Li(p,n) VDG	ACT	Mo^{100} Johnsrud's data			flux $B^{10}F_3$ $\sigma n\alpha=642/\sqrt{E}$ b $\sigma_s=2.43$ b
62 Furr	25	1	109±50			I^{127} 780			
63 Kapchigashev	0.005∿31	39			Pb-SDTS SC				
64 Tostikov	5 15 60 82 120 140 150 160	8	430 200 54 39 37 34 29 30	Li(p,n) VDG	ACT	Mo^{100} 33.9 at 138 keV			
73 Murty	24	1	131±20	Sb-Be	ACT NaI(Tl)	$I^{127}\sigma_{n\gamma}$ 832±26			6th TI
74 Annand	25±5	1	84±5		ACT DRC NaI(Tl)	$I^{127}\sigma_{n\gamma}$ 832±26	6.12±0.12	0.199± 0.003	307keVγ:Tc^{101} $T_{1/2}$=14.6 min

Table 5-3 ^{100}Mo (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
76 Musgrove	3∿90	19*			TOF SC	Li(n,α)			ORELA *Averaged value

Table 6 ^{99}Tc

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
73 Chou	0.001∿50	70		T(d,n) VDG Fast Chopper	SDTS PROP	BF_3			Use Calibrated Source
73 Qaim	14700±300	1	9±2		ACT Ge(Li)				

Table 7 ^{102}Ru

Reference	Energy (KeV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	386±39	Sb-Be	ACT NaI(Tℓ)	^{127}I 820			0.9 γ/dis.
59 Lyon	195±50	1	190±25	RdTh-D_2O	ACT NaI(Tℓ)				0.9 γ/dis.
69 Schuman	2	1	830±80	Fe Filter	ACT	Au^{197} 4800			0.88 γ/dis.
73 Murty	24±5	1	350±42	Sb-Be	ACT NaI(Tℓ)	^{127}I 832			6th TI for decay data

Table 8 ^{104}Ru

Reference	Energy (KeV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	211±21	Sb-Be	ACT NaI (Tℓ)	^{127}I 820			1.0 γ/dis. 730 KeV γ
58 Perkin	14500	1	13.6±2.7	T(d,n)	ACT GM	$^{27}Aℓ(n,\alpha)$			
59 Lyon	195±50	1	28±5	RdTh-D_2O	ACT NaI (Tℓ)	^{115}In 195			1.0 γ/dis. 723 KeV γ
66 Gray	14700	1	2.5±0.5	T(d,n) C-W	ACT NaI (Tℓ)	$^{63}Cu(n,2n)$ 507 Aℓ(n,α) 82			NDS for decay data
66 Chaubey	24	1	80±10	Sb-Be	ACT GM	^{127}I 820			NDS for decay data
67 Petö	3000	1	19.8±4	D(d,n) Cascade Generator	ACT GM	BF_3 Anth.SC			Calibration $^{31}P(n,p)$ 74±6 mb NDS('61) for decay data
69 Schuman	2	1	890±80	Fe Filter		^{197}Au 4800			
73 Murty	24±5	1	204±25	Sb-Be	ACT NaI(Tl)	$^{127}I(n,\gamma)$ 832			
74 Anand	25±5	1	181±78		ACT DRC	$^{127}I(n,\gamma)$ 832±26	6.12±0.12	0.47±0.20	263 keV γ $T_{1/2}$=4.44 hr

Table 9-1 ^{103}Rh

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 Pasechnik	2500	6	54.6±4.5 g 9.8±1.9 m	D(d,n)	ACT	$I^{127}\sigma_{n\gamma}$ 51			^{104g}Rh :44 Sec ^{104m}Rh :4.7 min
	3100		43.5±3.2 g 8.9±1.4 m			44			
	4000		34.6±2.7 g 7.7±1.1 m			37			
63 Isakov	0.002∿200	many			Pb-SDTS				Preliminary results
60 Diven	175±25	7	416	VDG	SC-T	$U^{235}\sigma_a$			
	250±50		339			σ_f Allen-Henkel			
	400±90		186±19			σ_c Diven			
	600±75		129						
	800±66		94						
	900±63		84						
	1000±60		81						
60 Weston	3~200	15		Li(p,n) VDG	ACT	^{103}Rh Diven(p.c.)			
61 Block	0.2~8	57		T(p,n) VDG $^{7}Li(p,n)$	TOF SC-T	$^{10}BF_3$			
61 Gibbons	65	1	540	T(p,n) $^{7}Li(p,n)$ VDG	TOF SC-T	^{115}In 448			
62 Popov	0.0039~34	96		T(d,n)	SDTS				
62 Furr	25	1	640±220	Sb-Be	ACT	^{127}I 780			

Table 9-2 ^{103}Rh (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 Csikai	14670	1	10.57 g 3.23 m		ACT				
63a Macklin	30 65	2	850 540	T(p,n) VDG	TOF SC-T	$I^{115}\sigma_{n\gamma}$ 763 448			See also 61 Gibbons
63 Moxon	0.1∿27	664		LINAC	TOF MR	B^{10}			
64 Cox	138∿1688	42		Li(p,n) VDG	ACT SC	$U^{235}\sigma_f$ Allen-Henkel		σ_g: 140 σ_m: 12.8	
65 Pönitz	7.8 30 64	3	84±4.2 m 110±5.5m 162±8.1m		ACT				Standard= Ratio σ_m/σ_g
66 Chaubey	24	1	455±45 g 55±25 m	Sb-Be	ACT GM	$I^{120}\sigma_{n\gamma}$ 820		NDS	$T_{1/2}$ { g: 42Sec m: 4.4min
67 Csikai	14700	1	14±3	T(d,n) Cascade generator	ACT GM NaI(Tl)	$Al^{27}\sigma_{np}$ 72		NDS	
67 Macklin	70±19 125±23 150±21 182±21	4	708.1±25.7 415.5±15.9 353.3±26.3 336.7±23.3	Li^7(p,n) VDG	TOF SC	Ta $8100E^{-0.697}$ E; kev B^{10}-NaI			

Table 9-3 ^{103}Rh (Continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
67 Petö	3000±200	1	20.8±4	D(d,n) Cascade Generator	ACT GM	$Al^{27}\sigma_{np}$ 2.5 $B^{10}F_3$ Anth. SC		NDS('61)	$T_{1/2}$=4.4min
69 Schuman	2	1	∿130 m ∿11000 g	Fe Filter		$Au^{197}\sigma_{n\gamma}$ 4800			
70 Fricke	1∿1000	95		LINAC	TOF SC-T	$B^{10}F_3$ He^3			
70 Tromp	25	1	69	MTR-Fe Filter	ACT	$Au^{197}\sigma_{n\gamma}$ 640			
71 Rigaud	14060	1	0.75±0.2	T(d,n)	TOF NaI(Tl)				
72 Lakshmana	25±5	1	45±6 m 600±90 g	Sb-Be	ACT NaI(Tl)	$I^{127}\sigma_{n\gamma}$ 832			
72 Kantele	14500	1	2		ACT				
73 Petö	4500	1	5.7±0.7		ACT				Isomer ratio
73a Petö	14700	1	4.0±0.4		ACT GM				

Table 9-4 ^{103}Rh (Continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
74 Rigaud	14600±300	1	<2	T(d,n) ELA		$Al^{27}\sigma_{np}$ 68.6			
75 Hockenbury	63∿297	566 10*		LINAC	TOF SC-T	B^{10}-NaI			* Averaged Value
75Le Rigoleur	15∿300	207 23*		VDG	TOF SC	B^{10}-NaI Li glass SC			* Averaged Value

Table 10 ^{105}Pd

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
75 Macklin	2.618 2.665	2	94 12900		TOF SC				ORELA
75 Hockenbury	0.002∿200	562		RPI LINAC	TOF SC	b^{10}-NaI			normalized to transmission data 55.2 eV Res.

Table 11 ^{108}Pd

Reference	Energy (KeV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	540±60	Sb-Be	ACT NaI (Tℓ)	^{127}I 820			0.0463 γ/dis. 89 KeV γ
58 Booth	20	1	580±200	Sb-Be	ACT DRC NaI (Tℓ)	^{127}I 820	5.5	12	
59 Lyon	25 195	2	290±35 77±8	Sb-Be RdTh-D_2O	ACT NaI (Tℓ)	^{127}I 820 ^{115}In 195			0.046 γ/dis.
60 Weston	3~700	12		Li(p,n) VDG	ACT	^{108}Pd 540			Relative
66 Chaubey	24	1	185±15	Sb-Be	ACT GM	^{127}I 820			NDS for decay data $T_{1/2}$= 4.8m +13.5h
68 Chaubey	24	1	26±6 m 159±16 g	Sb-Be	ACT GM	^{127}I 820			$T_{1/2}$= 4.8m 13.5h
72a Lakshmana	25±5	1	15±2 m 185±30 g	Sb-Be	ACT NaI (Tℓ)	JP/A5, 1262 ('72)			

Table 12 ^{109}Ag

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
60 Weston	2∿200	16		Li(p,n) VDG	ACT				
62 Furr	25	1	1620±480	Sb-Be	ACT	^{127}I 780			
65 Pönitz	7.8,30,64 7.8 30 64	3	 50 m 40 m 60 m		ACT	Au^{197}			Data : NEUDADA
66 Kononov	30∿170	18		T(p,n) C-W	TOF SC-T	$^{10}B(n,\alpha)$			
66 Chaubey	24	1	690±60	Sb-Be	ACT GM	^{127}I 820			$T_{1/2}$=24s NDS for decay data
70 Murty	25	1	15±1.5		ACT	I^{127} 832			
72 Siddapa	25±5	1	75±10 m	Sb-Be	ACT NaI(Tl)	$I^{127}\sigma_{n\gamma}$ 832			6th ed TI σ^m

Table 13-1 ^{127}I

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	820±60	Sb-Be	ACT NaI(Tl)				0.172γ/dis. 455 kev γ Calibrated Source
58 Leipunsky	2700 4000	2	47±2 23±1	D(d,n) Cascade Generator	ACT DRC	U^{238} σ_f 59.3 33.3	BNL-325 ('58)	BNL-325 ('58)	
58 Perkin	14500	1	2.5±0.5	T(d,n)	ACT GM	Al^{27} σ_α			
58 Belanova	25±4 220±20 830±40	3	1097±39 314±42 101±40	Sb-Be Na-D_2O Na-Be	RG-TRANS BF_3				60 Belanova : 990mb at 24 keV AE 8, 549('60)
59 Bame	20∿1000	31		Li^7 (p,n) T(p,n) VDG	ACT NaI(Tl)	fission chamber			0.94γ/dis. I^{128} 0.06γ/dis. Te^{128}
59 Gabbard	25∿506	9			SC				
59 Lyon	195±50	1	175±15	RdTh-D_2O	ACT NaI(Tl)	In^{115} 195			
59 Johnsrud	150∿5500	28		Li(p,n) T(p,n) ELA	ACT DRC NaI(Tl)	U^{235} σ_f Allen-Henkel	584	5.6	

Table 13-2 ^{127}I (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
60 Weston	5∿150	14		VDG	ACT	I^{127} 820			
60 Schmitt	24±2.2	1	885±90	Sb-Be	Shell Trans.				BNL-325 2nd Ed. abs. Status=2
60 Diven	400±90	1	176±15		SC-T	U^{235} σ_a 1500			
61 Gibbons	9.5∿169	47		Li^7(p,n) T(p,n) VDG	TOF SC-T	$In^{115}\sigma_{n\gamma}$ (30 kev) 763 (65) 448 (167) 258			normalized to a curve of In(n,γ) In(n,γ):normalized to $\sigma_{n,\alpha}$ (^{10}B) & σ_a(^{235}U)
61 Block	0.2∿8	38		T(p,n) Li(p,n) VDG	TOF SC-T	$B^{10}F_3$			
61 Stavisskii	20∿2500	55		T(p,n) VDG	ACT DRC GM	$U^{235}\sigma_{nf}$ Hughes	582	5.6	
62 Furr	25	1	635±180		ACT				
62 Popov	0.01∿50	73		T(d,n)	Pb-SDTS				
63a Macklin	30±7 65±20	2	733 440	T(p,n) VDG	SC-T	$In^{115}\sigma_{n\gamma}$ 763 448			

Table 13-3 ^{127}I (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 Borbely	2600±120	1	28.3±6.0		ACT				Data: NEUDADA
64 Cox	180∿1680	30		$Li^7(p,n)$ VDG	RCT NaI(Tl) 4π	U^{235} σ_f Allen-Henkel	6.22 ($I^{127}\sigma_{n\gamma}$)		450 keV-γ relative to thermal value, renormalized to $\sigma_f(^{235}U)$
65 Stavisskii	30 100	2	660±70 800±130		ACT Shell Trans	Pu^{239}			
65 Robertson	24	1	832±26	Sb-Be Calibrated	ACT Cs-I				
67 Macklin	125±23 150±21 182±21	3	234.7±17.4 183.6±28.8 202.5±28.1	$Li^7(p,n)$ VDG	TOF SC	B^{10}-NaI			
67 Petö	3000±200	1	31.8±6	D(d,n) Cascade Generator	ACT GM	$^{31}P(n,p)74$ $B^{10}F_3$ Anth. SC			
68 Dinter	14000	1	1.09±0.08	T(d,n)	NaI(Tl)	ZnS(Ag)			
68 Qaim	15000	1	7.2±1.2		ACT	Al $\sigma_{n\alpha}$			Data: 74Vuletin
68 Colditz	2900±200	1	42.8±5.0		ACT	In			Data : NEUDADA
70 Majumder	14800±80	1	2.74±0.2	T(d,n)	ACT	$Cu^{63}\sigma_{n,2n}$ 530±25			
70 Chaturvedi	24±3	1	638	Sb-Be	ACT NaI(Tl)	Au^{197}640			6th TI for decay data

Table 13-4 ^{127}I (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
71 Brzosko	400	1	150 g 67±5 m		TOF				NEUDADA
72 Kantele	14500	1	0.9±0.3		ACT				
73 Lakosi	830	1	77±11 (109±15)*	Na-Be	ACT	$Au^{197}(n,\gamma)$			* INDC(HUN)-11/L
73 Petö	4500	1	95±19		ACT				
74 Vuletin	14400	1	1.2±0.1	T(d,n)	ACT Ge(Li)				
74 Rigaud	14600	1	<1.38±0.35	T(d,n) Electro-static Accele-rator	ACT	$Al^{27}(n,p)$ 68.6			
75 Yamamuro	23.7	1	760±20	Ta(γ,n) LINAC Fe Filter	TOF C_6F_6SC	$B^{10}(n,\alpha\gamma)$ Sowerby			
75 Rimawi	24.3±0.2	1	767±50	Fe Filter	ACT Ge(Li)	$B^{10}(n,\alpha)$ σ_t=5917.5 $\sigma_{n\alpha}$=3487.5			
76 Schwerer	14000	1	1.12±0.25		ACT Ge(Li)				

Table 14-1 ^{133}Cs

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
58 Booth	20	1	90±45 *m* 1000±330 *g*	Sb-Be	ACT DRC β counter NaI(Tl)	$^{127}I(n,\gamma)$ 820±60	$^{127}I(n,\gamma)$ 5.5±0.5	$^{133}Cs(n,\gamma)$ 26±4.94 for ^{134g}Cs (2.3 yr) 17±4 mb for ^{134m}Cs (3.1 hr)	β & γ En & $\sigma_{n\gamma}$:data compiled in NEUDADA
62 Popov	0.001∿40	92		T(d,n)	TOF Pb-SDTS SCINT, PROP-C				Norm. of $\sigma_{n\gamma}$: RP of 3 lowest levels & group of levels at $\bar{E}$ ∿ 100 eV
63 Borbely	2600	1	6.3±1.2		ACT(ABS)				Data:NEUDADA
67 Tolstikov	142∿1230	8	*m*	T(p,n) VDG	ACT DRC EW-β	$^{235}U(n,f)$ Davey's eval.('66)	$^{235}U(n,f)$ 577.1±0.9 BNL-325 '65	$^{133}Cs(n,\gamma)$ 2.6±0.2 BNL-325'66	Production of 2.9 hr ^{134m}Cs $\sigma^m_{n\gamma}/\sigma^g_{n\gamma}$ are given $\sigma_{n\gamma}$:NEUDADA
69 Schuman	2	1	330±30*m* 2430±200*g*	Fe-FILT-N	ACT	$^{197}Au(n,\gamma)$ 4800			128keV-γ:14%, 2.895 hr 796+802keV-γ: 98%, 2046 yr γ
69 Kompe	10∿150	72		$^{7}Li(p,n)$ VDG	TOF LIQ-SCINT-T, NaI-crystal	$^{197}Au(n,\gamma)$* 596±12 at 30keV, $^{10}B(n,\alpha)$, $^{6}Li(n,\alpha)$			* $\sigma_{n\gamma}$ of Au was determined relative to $\sigma_{n\alpha}$ of ^{10}B & ^{6}Li

Table 14-2 ^{133}Cs (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		comments
							Standard	Target	
70 Qaim	14800±300	1	7.1±1.1 1.82±0.28 *m* 5.3±1.4 *g*	T(d,n)	ACT NaI(Tl)	$^{27}Al(n,\alpha)$ 121			127 keV-γ:*m* 796 keV-γ:*g* 6th TI
71 Brzosko	400	1	60±15 *m* 150 *g*		TOF(ABS)				Data:NEUDADA
71a Rigaud	14060±10	1	1.51±0.42*	T(d,n) ELST- ACLTR	TOF NaI(Tl)				* integrated- $\sigma_{n\gamma}$,cf.72Buda- pest,p.220('72)
73 Murty	24±5	1	56±7 *m*	Sb-Be	ACT(ABS) NaI(Tl)	$^{127}I(n,\gamma)$ 832±26			γ 6th TI
76 Yamamuro	24	1	580±35	Fe-FILT-N KUR- LINAC	TOF C_6F_6- SCINT	$^{10}B(n,\alpha\gamma)$ sowerby's data			γ

Table 15-1 ^{139}La

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns) Standard	Thermal C.S. (barns) Target	Comments
57 Macklin	24	1	50±7	Sb-Be	ACT NaI(Tl)	$^{127}I(n,\gamma)$ 820±60			1.60 MeV-γ, 0.882γ/dis. ^{127}I: 455 keV-γ, 0.172γ/dis.
58 Perkin	145000	1	1.48±0.148	T(d,n)	ACT EW·G-M	$^{27}Al(n,\alpha)$			β
58 Booth	20	1	50±13	Sb-Be	ACT DRC, βcounter NaI(Tl)	$^{127}I(n,\gamma)$ 820±60	$^{127}I(n,\gamma)$ 5.5±0.5	$^{139}La(n,\gamma)$ 8.4±1.68	β&γ, 40.2 hr En & $\sigma_{n\gamma}$: data compiled in NEUDADA
59 Lyon	195±50	1	10±2	RdTh-D_2O	ACT NaI(Tl)	In(n,γ) 54 min 195±10			1.60 MeV-γ, 0.88γ/dis. ^{115}In:1.28MeV-γ, 0.848γ/dis.
59 Johnsrud	150∿2000 166 460 620 2000	4	 16 5.9 6.2 5.25	Li(p,n): 0.15∿0.6MeV T(p,n): 0.6∿2.5MeV D(d,n): 2.5∿6.2MeV ELST-GEN, Pu-Be:THR-N	ACT DRC	$^{235}U(n,f)$ Allen & Henkel '58	$^{235}U(n,f)$ 584	$^{139}La(n,\gamma)$ 8.2±0.8	815 keV-γ 1596 keV-γ 40.2 hr
60 Wille	14800±800	1	1.1±0.2	T(d,n) C-W	ACT β PROP·C LONG·C	$^{63}Cu(n,2n)$: 519 $^{65}Cu(n,2n)$: 1020			β, 40±2 hr Rev. Mod.Phys. 30,585 ('58) and others

Table 15-2 ^{139}La (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
63a Macklin	30 and 65 30±7 65±20	2	 55±10 18±3	Li(p,n) T(p,n) ORNL-VDG	TOF LIQ·SCIN -T	In(n,γ) 30keV:763 65keV:448			γ
63 Konks	0.04∿40	66		^{7}Li(p,n) Sb-Be (24 keV)	ACT & TSG Pb-SDTS				Normalization: RP(73.5 eV) of ^{139}La RP of W,Au,Ta DATA : NEUDADA
65 Cuzzocrea	14000±400	1	3.6±0.6		ACT	Cu(n,2n)			DATA : NEUDADA
66 Chaubey	24	1	50±10	Sb-Be	ACT EW-β	^{127}I(n,γ) 820±60			β, NDS & others
67 Csikai	14700	1	1.4±0.3	D(t,n) CASCD-GEN	ACT EW·G-M, $^{10}BF_3$-LC NaI(Tl)	^{27}Al(n,α) 117			β, NDS mon. reac. : α
67 Petö	3000±200	1	4.6±0.7	D(d,n) CASCD-GEN	ACT EW·G-M SCINT, $^{10}BF_3$, NaI(Tl)	^{197}Au(n,γ) 35±3			β
67 Cuzzocrea	14000±200	1	1.9±0.4	T(d,n)	ACT (ABS) G-M	^{63}Cu(n,2n): 469±10 ^{65}Cu(n,2n): 919±30			β, NDS β^+/K=(2.73± 0.27)%: PR 142, 725 ('66)
68 Stupegia	11.2∿1997	19		^{7}Li(p,n): 150∿1MeV T(p,n): 1∿3MeV	ACT EWPC, NaI	^{235}U(n,f) (93.27%) White'65			β & γ, σ of impurities included in ^{235}U: Hughes et al. ('60)

Table 15-3 ^{139}La (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
69 Schuman	2	1	230±20	Fe-FILT-N	ACT	$^{197}Au(n,\gamma)$ 4800			1596 keV-γ:96% 40.22 hr
70 Chaturvedi	24±3	1	13	Sb-Be	ACT NaI(Tl)	$^{197}Au(n,\gamma)$ 640±25			γ, TICC ('63) 6th TI
70 Zaikin	200∿5900	21		$^{7}Li(p,n)$ T(p,n) D(d,n) ELST-ACLTR	ACT β-counter	$^{235}U(n,f)$			β ratio of activities with fast and thermal neutrons
71a Rigaud	14060±10	1	1.35±0.40*	T(d,n) ELST-ACLTR	TOF NaI(Tl)				* integrated $\sigma_{n\gamma}$ cf. 72Budapest p. 220 ('72)
72 Holub	14400	1	2.4±0.2		ACT				Data:NEUDADA
74 Rigaud	14600±300	1	0.7±0.3	T(d,n) ESLT-ACLTR	ACT Ge(Li)	$^{27}Al(n,p)$ 68.6±1.4 at 14.1 MeV			γ
76 Schwerer	14600±200	1	1.01±0.10	T(d,n) C-W	ACT(ABS) NaI(Tl) Ge(Li)	$^{27}Al(n,\alpha)$ 114.2±1.37			1596 keV-γ 40.2 hr

Table 16 ^{142}Ce

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	425±43	Sb-Be	ACT NaI(Tl)	$^{127}I(n,\gamma)$ 820±60			290 keV-γ, 0.426γ/dis. ^{127}I: 455 keV-γ, 0.172γ/dis.
58 Perkin	14500	1	≤7.5*	T(d,n)	ACT EW·G-M	$^{27}Al(n,\alpha)$			β, *upper limit
59 Lyon	195±50	1	22±5	RdTh-D_2O	ACT NaI(Tl)	In(n,γ) (54 min) 195±10			290 keV-γ, 0.43γ/dis. ^{115}In: 1.28 MeV-γ, 0.848γ/dis.
66 Chaubey	24	1	525±50	Sb-Be	ACT EW-β	$^{127}I(n,\gamma)$ 820±60			β NDS & others
67 Petö	3000±200	1	33.4±6	D(d,n)	ACT EW·G-M SCINT, $^{10}BF_3$ NaI(Tl)	$^{32}S(n,p)$ 111±10			β
73 Siddappa	23±5	1	63±10	Sb-Be	ACT(ABS) NaI(Tl)	$^{127}I(n,\gamma)$ 836±26			4π-geom. γ 6th TI
74 Anand	25±5	1	21±2	Sb-Be, BARC-Reactor for THR-N	ACT DRC NaI(Tl)	$^{127}I(n,\gamma)$ 832±26	$^{127}I(n,\gamma)$ 6.12±0.12	$^{142}Ce(n,\gamma)$ 0.95±0.05	293keV-γ, 33hr ^{127}I: 441 keV(2^+)-γ
76 Schwerer	14600±200	1	1.11±0.17	T(d,n) C-W	ACT (ABS) NaI(Tl) Ge(Li)	$^{27}Al(n,\alpha)$ 114.2±1.37			293.3 keV-γ 33.7 hr

Table 17-1 ^{141}Pr

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	155±15	Sb-Be	ACT NaI(Tl)	$^{127}I(n,\gamma)$ 820±60			1.59 MeV-γ, 0.041γ/dis. ^{127}I: 455 keV-γ, 0.172γ/dis.
58 Pasechnik	2500∿4000 2500 3100 4000	3	 8.6±0.4 7.1±0.3 6.3±0.2	D(d,n) ELST-GEN	ACT	$^{127}I(n,\gamma)$ 51 44 37			β, 19.1 hr
58 Perkin	14500	1	3.33±0.333	T(d,n)	ACT EW·G-M	$^{27}Al(n,\alpha)$			β
58 Booth	20	1	180±40	Sb-Be	ACT DRC β counter, NaI(Tl)	$^{127}I(n,\gamma)$ 820±60	$^{127}I(n,\gamma)$ 5.5±0.5	$^{141}Pr(n,\gamma)$ 11.2±0.605	β & γ, 19.1hr En & $\sigma_{n\gamma}$: data compiled in NEUDADA
59 Lyon	24 and 195 24 195±50	2	 155±15 38±4	RdTh-D_2O	ACT NaI(Tl)	$^{115}In(n,\gamma)$ (54 min) 195±10			1.59 MeV-γ, 0.04γ/dis. ^{115}In: 1.28 MeV-γ, 0.848γ/dis.

Table 17-2 ^{141}Pr (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
59 Johnsrud	165∿2000 165 175 234 2000	4	 36 36 18 15.8	Li(p,n): 0.15∿0.60MeV T(p,n) 0.60∿2.5MeV D(d,n) 2.6∿6.2MeV ELST-GEN Pu-Be: THR-N	ACT DRC ^{235}U·FC NaI(Tl)	^{235}U(n,f)	^{235}U(n,f) 584	^{141}Pr(n,γ) 10±3	510∿798keV-γ, 19.2 hr
60 Wille	14800±800	1	2.1±1.0	T(d,n) C-W	ACT β PROP·C LONG·C	^{63}Cu(n,2n): 519 ^{65}Cu(n,2n): 1020			β, 19±1 hr Rev.Mod.Phys. 30, 585 ('58) and others
61 Gibbons	11.5∿161 30±7 65±20	49 1 1	 115±11.5 59±5.9	^{7}Li(p,n): 7∿70 keV T(p,n): 20∿170 keV ORNL-VDG	TOF LIQ·SCINT -T ϕ_n: ^{10}B-NaI	In(n,γ)* 760±50 450±40			*$\sigma_{n\gamma}$(In): rel. to ($\sigma_{nf}+\sigma_{n\gamma}$) of ^{235}U above 100 keV $\sigma_{n\gamma}$(In): rel. to $\sigma_{n,\alpha\gamma}$ of ^{10}B below 140 keV
63a Macklin	30 and 65 30±7 65±20	2	 115 59	^{7}Li(p,n) T(p,n) ORNL-VDG	TOF LIQ-SCINT -T	In(n,γ) 30keV:763 65keV:448			γ

Table 17-3 ^{141}Pr (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 Bramlitt	14700±200	1	2.3±1.1	T(d,n) C-W	ACT EWPC NaI(Tl)	$^{27}Al(n,\alpha)$ 114			β:100% 19.1hr 1.57 MeV-γ,
64 Konks	0.022∿40	73		$^{7}Li(p,n)$ Sb-Be (24 keV)	ACT & TSG Pb-SDTS γ-PC				norm. of $\sigma_{n\gamma}$: RP(85 eV) of ^{141}Pr RP of Br,Ta,W DATA:NEUDADA
65 Stupegia	187∿2460	25			ACT				DATA:NEUDADA
65 Cuzzocrea	14000±400	1	6.25±0.15		ACT	Cu(n,2n)			Data:NEUDADA
66 Chaubey	24	1	100±15	Sb-Be	ACT EW-β	$^{127}I(n,\gamma)$ 820±60			β NDS & others
67 Csikai	14700 13400∿15000	1 7	3.0±0.3	T(d,n) CASCD-GEN	ACT EW·G-M, NaI(Tl) ϕ_n: $^{10}BF_3$-LC & α-DTCTR				β, NDS mon. reac.:α
67 Petö	3000±200	1	12.2±2.4	D(d,n)	ACT EW·G-M SCINT, $^{10}BF_3$ NaI(Tl)	$^{31}P(n,p)$ 74±6			β
67 Cuzzocrea	14000±200	1	2.6±0.5	T(d,n)	ACT (ABS) G-M	$^{63}Cu(n,2n)$: 469±10 $^{65}Cu(n,2n)$: 919±30			β, NDS $\beta^+/K=(2.73\pm0.27)$% : PR 142,725 ('66)

Table 17-4 ^{141}Pr (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
68 Stupegia	145∿2457	24		$^{7}Li(p,n)$: 0.15∿1MeV T(p,n): 1∿3MeV	ACT EWPC,NaI	$^{235}U(n,f)$ (93.27%) White '65			β & γ σ of impurities included in ^{235}U: Hughes et al. ('60)
70 Diksić	3000±200	1	0.29±0.05*m* 10.9±0.9*g*	D(d,n) CASCD-GEN	ACT EW·G-M NaI(Tl)	$^{31}P(n,P)$ 74±6			β, NDS
70 Majumder	14800±80	1	2.19±0.31	T(d,n)	ACT	$^{27}Al(n,\alpha)$ 116±8			β , 19.2 hr
70 Chaturvedi	24±3	1	82	Sb-Be	ACT NaI(Tl)	$^{197}Au(n,\gamma)$ 640±25			γ TICC ('63) 6th TI
70 Zaikin	84∿5900	30		$^{7}Li(p,n)$ T(p,n) D(d,n) ELST-ACLTR	ACT βcounter	$^{235}U(n,f)$			β ratio of activities with fast and thermal neutrons
72 Holub	14400	1	2.3±0.3		ACT				Data:NEUDADA
74 Vuletin	14400	1	2.7±0.5		ACT (ABS) Ge(Li)	known reactions			ϕ_n was determined from the known monitor reactions

Table 18 ^{146}Nd

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
70 Thirumala	25	1	89±10	Sb-Be	ACT NaI(Tl)				γ
72 Thirumala	25±5	1	68±23	Sb-Be (Ra-α-Be for THR-N)	ACT DRC NaI(Tl)	$^{127}I(n,\gamma)$ 832	$^{127}I(n,\gamma)$ 6.17±0.2	$^{146}Nd(n,\gamma)$ 1.8±0.6	530 keV-γ 11 day
73 Siddappa	23±5	1	120±18	Sb-Be	ACT (ABS) NaI(Tl)	$^{127}I(n,\gamma)$ 836±26			4π-geom. γ 6th TI

Table 19 ^{148}Nd

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
59 Johnsrud	175∿2500	14		Li(p,n) 0.15∿0.60MeV T(p,n) 0.60∿2.5MeV D(d,n) 2.6∿6.2MeV ELST-GEN Pu-Be:THR-N	ACT DRC, ^{235}U·FC NaI(Tl)	^{235}U(n,f) Allen and Henkel '58	^{235}U(n,f) 584	^{148}Nd(n,γ) 3.7±1.2	118 keV-γ 2.0 hr
68 Hasan	24	1	165±35	Sb-Be	ACT	^{127}I(n,γ) 820			NDS Rev. Mod. Phys 30, 585 ('58) 1.9 hr
70 Thirumala	25	1	195±20	Sb-Be	ACT NaI(Tl)				γ
72 Thirumala	25±5	1	388±144	Sb-Be (Ra-α-Be for THR-N)	ACT DRC NaI(Tl)	^{127}I(n,γ) 832	^{127}I(n,γ) 6.17±0.2	^{148}Nd(n,γ) 3.7±1.2	Half life: 1.9 hr Saturation activity
73 Siddappa	23±5	1	253±40	Sb-Be	ACT(ABS) NaI(Tl)	^{127}I(n,γ) 836±26			4π-geom. γ 6th TI

Table 20 ^{150}Nd

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
59 Johnsrud	175∿2500	14		Li(p,n): 0.15∿0.60MeV T(p,n) 0.60∿2.5MeV D(p,n) 2.6∿6.2MeV ELST-GEN Pu-Be: THR-N	ACT DRC ^{235}U·FC NaI(Tl)	$^{235}U(n,f)$ Allen and Henkel '58	$^{235}U(n,f)$ 584	$^{150}Nd(n,\gamma)$ 3.0±1.5	118 keV-γ 12.0 min
68 Hasan	24	1	125±25	Sb-Be	ACT	$^{127}I(n,\gamma)$ 820			NDS Rev.Mod.Phys. 30, 585 ('58) 12 min
70 Thirumala	25	1	85±9	Sb-Be	ACT NaI(Tl)				γ
72 Thirumala	25±5	1	85±19	Sb-Be (Ra-α-Be for THR-N)	ACT DRC NaI(Tl)	$^{127}I(n,\gamma)$ 832	$^{127}I(n,\gamma)$ 6.17±0.2	$^{150}Nd(n,\gamma)$ 1.5±0.2	half life: 12 min saturation activity

Table 21 ^{147}Sm

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 b Macklin	30±7	1	1173±192	$^{7}Li(p,n)$ ORNL-VDG	TOF M-R				γ
66 Fenner	0.01	1	960±100b		mass spect.				
77 Kononov	5.5∿342.5	75			TOF LIQ-SCINT	$^{10}B(n,\alpha\ \gamma)$ $^{196}Au(n,\gamma)$*			*$\sigma_{n\gamma}$=596mb at 30 keV

Table 22 ^{149}Sm

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
63 b Macklin	30±7	1	1622±279	$^{7}Li(p,n)$ ORNL-VDG	TOF M-R				γ
77 Kononov	5.5∿342.5	75			TOF LIQ-SCINT	$^{10}B(n,\alpha\gamma)$ $^{196}Au(n,\gamma)$*			*$\sigma_{n\gamma}$=596mb at 30 keV

Table 23 ^{152}Sm

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S. (barns)		Comments
							Standard	Target	
57 Macklin	24	1	668±100	Sb-Be	ACT NaI(Tl)	$^{127}I(n,\gamma)$ 820±60			105 keV-γ; 0.357γ/dis. ^{127}I: 455 keV-γ, 0.172γ/dis.
59 Lyon	195±50	1	150±20	RdTh-D_2O	ACT NaI(Tl)	$^{115}In(n,\gamma)$ (54 min) 195±10			105 keV-γ, 0.357γ/dis. ^{115}In: 1.28 MeV-γ, 0.848γ/dis.
63b Macklin	30±7	1	411±71	$^{7}Li(p,n)$ ORNL-VDG	TOF M-R				γ
66 Chaubey	24	1	575±60	Sb-Be	ACT EW-β	$^{127}I(n,\gamma)$ 820±60			β NDS & others
67 Petö	3000±200	1	44.2±6.6	D(d,n) CASCD-GEN	ACT EW·G-M SCINT, $^{10}BF_3$ NaI(Tl)	$^{197}Au(n,\gamma)$ 35.2±3			β
71 Bensch	24∿974 24 138 264 974	4	 569±45.5 307±36.8 195±15.6 122±15.3	PHOTO-N	ACT ABS				
73 Lakosi	830	1	130±25	Na-Be	ACT NaI(Tl)	$^{197}Au(n,\gamma)$ 100			γ

Table 24-1 ^{153}Eu

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
64a Konks	0.0008∿42	88							The data was adopted from BNL-325, 2nd. Suppl. ('66)
68 Konks	0.001∿40	86		SDT-N in Pb	TOF GAS-DIS-PC SCINT				Norm. of $\sigma_{n\gamma}$: RP of low-lying levels & other elements
68 Harlow	0.025∿10			NUCL-EXPL	TOF M-R				Norm. of $\sigma_{n\gamma}$: ^{151}Eu data of Konks & Fenir ('64) Data: Fig. 3
70 Czirr*	0.2∿12.5	98		LRL-LINAC	TOF LIQ-SCINT				* The measurement was performed for ^{151}Eu & nat.Eu. Norm. of $^{151}\sigma_{n\gamma}$ & $^{nat}\sigma_{n\gamma}$: ^{151}Eu resonance at 7.44 eV was used for Eu. $\sigma_{n\gamma}$ of ^{153}Eu was derived from the data for ^{151}Eu & nat. Eu.

Table 24-2 ^{153}Eu (continued)

Reference	Energy (keV)	N	Measured Cross Section (mb)	Neutron Source	Method	Standard or Flux Monitor (mb)	Thermal C.S.(barns)		Comments
							Standard	Target	
75 Hockenbury	6.3∿300	566		RPI-LINAC	TOF LIQ-SCINT-T ^{10}B-NaI				Norm. of $\sigma_{n\gamma}$: RP of ^{153}Eu E_0=31.3 eV $2g\Gamma n$=2.28meV, Data:NEUDADA
76 Moxon	0.1∿100	27*		HAR-LINAC nat. U & n-booster	TOF M-R	$^{10}B(n,\alpha)$			γ * Averaged Values
77 Kononov	5.5∿342.5	75			TOF LIQ-SCINT	$^{10}B(n,\alpha\gamma)$ $^{196}Au(n,\gamma)$*			*$\sigma_{n\gamma}$=596 mb at 30 keV

Abbreviations used in Table (Appendix I)

Column 1 Reference

References of abbreviations used in this column are given in Experimental References.

Column 4 Measured Cross Section

m	:	Cross section to the meta-stable state
g	:	Cross section to the ground state

Column 5 Neutron Source

BARC	:	Bhabha Atomic Research Centre, Trombay
CASCD-GEN	:	Cascade generator
C-W	:	Cockcroft-Walton type accelerator
ELA, or ELST-ACLTR	:	electrostatic accelerator
ELST-GEN	:	electrostatic generator
Fe-FILT-N	:	Fe-filtered neutron
HAR	:	Harwell, AERE
KUR	:	Kyoto University Research Reactor Institute
LINAC	:	electron linear accelerator
LRL	:	Lawrence Radiation Laboratory
nat. U	:	natural uranium
n-booster	:	neutron booster
NUCL EXPL	:	underground nuclear explosion
ORELA	:	Oak Ridge Electron Linear Accelerator
ORNL	:	Oak Ridge National Laboratory
PHOTO-N	:	Photo-neutron
RPI	:	Rensselaer Polytechnic Institute
SDT-N	:	slowing-down-time neutron
THR-N	:	thermal neutron
VDG	:	Van de Graaf accelerator

Column 6 Method

(ABS)	:	absolute measurement
ACT	:	activation method (technique)
Anth. SC	:	anthracene scintillation counter
$^{10}BF_3$-LC	:	$^{10}BF_3$ long counter
^{10}B-NaI	:	^{10}B-NaI detector
C_6F_6-SCINT	:	C_6F_6 scintillator
DRC	:	double-ratio comparison
EW·G-M	:	end-window G-M counter
EW·PC	:	end-window proportional counter
EW·β	:	end-window β counter
GAS-DIS-PC	:	gas-discharge proportional counter
Ge(Li)	:	Ge(Li) spectrometer
G-M, GM	:	Geiger-Müller counter
LIQ-SCINT	:	liquid scintillator
LIQ-SCINT-T or SC-T	:	liquid scintillation tank
LONG·C	:	long counter
M-R	:	moxon-Rae counter
NaI	:	NaI crystal (scintillator)
NaI(Tl)	:	NaI(Tl) crystal, (scintillation γ-spectrometer)
Pb-SDTS	:	Pb slowing-down-time spectrometer
PROP-C, or PROP	:	proportional counter
SCINT, or SC	:	scintillation counter

TOF	:	time of flight method (technique)
TSG,or RG-TRANS	:	transmission sphere geometry(ring geometry)
^{235}U·FC	:	^{235}U fission counter (chamber)
α-DTCTR	:	α particle detector
β-counter	:	β-ray counter
β-PROP·C	:	β-ray proportional counter
γ-PC	:	γ-ray proportional counter
ϕ_n	:	Neutron flux (beam)

Column 7 Standard or Flux Monitor

Allen & Henkel ('58)	:	Allen, W. D. and Henkel, R. L. : Prog. Nucl. Ener., Ser. I, Vol II (1958)
Anth. SC	:	anthracene scintillation counter
Davey's data or Davey's eval.'66	:	Davey, W. : Nucl. Sci. Eng. 26, 149 (1966)
Diven '58	:	Diven, B. C., Terrell., J., and Hemmendinger, A. : Phys. Rev. 109, 144 (1958)
Diven (p.c.)	:	This is cited in [60 Weston] as " private communication" from Diven and Terrell.
Hughes, or Hughes et al. '60	:	Hughes, D. J., Magurno, B. A., and Brussel, M. K. : Neutron Cross Sections, BNL-325, 2nd Edition (1960)
Johnsrud	:	Johnsrud, A. E., Silbert, M. G., and Barschall, H. H. : Phys. Rev. 116, 927 (1959)
JP/A5, 1262('72)	:	Lakshmana Rao,A.and Rama Rao,J.: Jour. Phys.A5, 1262(1972)
Li glass SC	:	Li glass scintillation counter
Sowerby, or Sowerby's data	:	Sowerby, M. G., Patrick, B. H., Uttley, C. A., and Diment, K. M. : Proc. Symp. Neutron-Standards and Flux Normalization. AEC Symposium Series 23, p. 151 (1970)
White's σ_f, or White '65	:	White, P. : Jour. Nucl. Ener. A/B 19, 325 (1965)

Column 8 & 9 Thermal Cross Section

BNL-325 '58	:	Neutron Cross Section, BNL-325, 2nd Edition (1958)
BNL-325 '65	:	Neutron Cross Section, BNL-325, 2nd Edition Suppl. No. 2, Vol. III (1965)
BNL-325 '66	:	Neutron Cross Section, BNL-325, 2nd Edition Suppl. No. 2, Vol. II B (1966)

Column 10 Comments

BNL-325, 2nd, Suppl. ('66)	:	BNL-325, 2nd Edition, Suppl. No. 2, Vol II C (1966)
72 Budapest, p. 220 ('72)	:	Irigary, J. L., Rigaud, F., Petit, G. Y., Longo, G., and Saporetti, F. : Conference on Nuclear Structure and Study with Neutrons. Budapest, p. 220 (1972)
Data : Fig. 3	:	The measured cross sections are plotted in Fig. 3 of the original paper.
Data:NEUDADA	:	This means that the data were adopted from NEUDADA, because the literature didn't be obtained in present work, or the numerical data are not given in the original paper.
En	:	neutron energy
En & $\sigma_{n\gamma}$:data compiled in NEUDADA	:	This means that En and $\sigma_{n\gamma}$ were adopted from NEUDADA, because the original values of En and $\sigma_{n\gamma}$ were revised when the data were compiled in NEUDADA.

^{151}Eu data of Konks & Fenin('64)	:	Konks, V. A. and Fenin, Yu. I. : Conference on Interaction of Neutrons with Nuclei. Dubna, Report No. 1845 (1964) [64a Konks]
4π-geom. γ	:	4π-geometry gamma-counting technique
Hughes et al.('60)	:	Hughes, D. J., Magurno, B. A., and Brussel, M. K. : Neutron Cross Sections, BNL-325, 2nd Edition (1960)
integrated $\sigma_{n\gamma}$	:	(n,γ) cross section integrated over the energy of emitted γ-ray
mon. reac. : α	:	This means that α particles were measured as a monitor reaction.
NDS	:	Nuclear Data Sheet, compiled by K. Way et al. : National Academy of Sciences, National Research Council, Washington 25, D. C.
Norm.	:	normalization
ORELA	:	Oak Ridge Electron Linear Accelerator
PR 142, 725('66)	:	Grissom, J. T., Koehler, D. R., and Alford, W. L. : Phys. Rev., 142, 725 (1966)
Relative	:	relative measurement
Rev. Mod. Phys.: 30, 585 ('58)		Strominger, D., Hollander, J. M., and Seaborg, G. T. : Rev. Mod. Phys. 30, 585 (1958) ; Nuclear Data Cards (National Research Council, Washington 25, D. C.)
RP	:	resonance parameter
T 1/2	:	half life
6th TI	:	Lederer, C. M., Hollander, J. M., and Perlman, I : Table of Isotopes, Sixth Edition, (1967)
TICC,or Table of ICC	:	Sliv, L. A. and Band, I. M. : Table of I. C. C., Alpha-Beta-and Gamma-Ray Spectroscopy, Vol. 2, p. 1638 (1963)
upper limit	:	This means that the measured cross section is the upper limit only due to insufficient yield.
β	:	β-ray counting
γ	:	γ-ray counting
σ_g	:	capture cross section to the ground state
σ_m	:	capture cross section to the meta-stable state

Experimental References

1) 57 Macklin : Macklin, R. L., Lazar, N. H., and Lyon, W. S. : Phys. Rev. 107, 504 (1957)

2) 58 Belanova : Belanova, T. S. : Sov. Phys. JETP 34, 397 (1958)

3) 58 Booth : Booth, R., Ball, W. P., and MacGregor, M. H. : Phys. Rev. 112, 226 (1958)

4) 58 Kononov : Kononov, V. N., Stavisskii, Yu. Ya., and Tolstikov, V. A. : Atomnaya Energiya 5, 564 (1958) (English Translation : Jour. Nucl. Ener. A11, 46(1959)

5) 58 Leipunsky : Leipunsky, A. I., Kazachkovsky, O. D., Artyukhov, G. Y., Baryshnikov, A. I., Belanova, T. S., Galkov, V. N., Stavissky, Y. Y., Stumbur, E. A., and Sherman, L. E. : 2nd International Conference on the Peaceful Uses of Atomic Energy. Geneva, Vol. 15, p. 50 (1958)

6) 58 Pasechnik : Pasechnik, M. V., Barchuk, I. F., Totsky, I. A., Strizhak, V. I., Korolov, A. M., Hofman, Y. V., Lovchikova, G. N., Koltynin, E. A., and Yankov, G. B.: 2nd International Conference on the Peaceful Uses of Atomic Energy. Geneva, Vol. 15, p. 18 (1958)

7) 58 Perkin : Perkin, J. L., O'connor, L. P., and Coleman, R. F.: Proc. Phys. Soc. 72, 505 (1958)

8) 59 Bame : Bame, S. J. and Cubitt, R. L. : Phys. Rev. 113, 256 (1959)

9) 59 Gabbard : Gabbard, F., Davis, R. H., and Bonner, T. W. : Phys. Rev. 114, 201 (1959)

10) 59 Isakov : Isakov, A. I., Popov, Yu. P., and Shariro, F. L.: Conference on the Peaceful Uses of Atomic Energy. Tashkent, USSR, Vol. 1, p. 64 (1959) (English Translation : AEC-TR-6398 (1964))

11) 59 Johnsrud : Johnsrud, A. E., Silbert, M. G., and Barshall, H. H.: Phys. Rev. 116, 927 (1959)

12) 59 Lyon : Lyon, W. S. and Macklin, R. L. : Phys. Rev. 114, 1619 (1959)

13) 59 Vervier : Vervier, J. F. : Nucl. Phys. 9, 569 (1959)

14) 60 Diven : Diven, B. C., Terrell, J., and Hemmendinger, A. : Phys. Rev. 120, 556 (1960)

15) 60 Schmitt : Schmitt, H. W. and Cook, C. W. : Nucl. Phys. 20, 202 (1960)

16) 60 Tolstikov : Tolstikov, V. A. and Stavisskii, Yu. Ya : AEC-TR-4680 (1960)

17) 60 Weston : Weston, L. W., Seth, K. K., Bilpuch, E. G., and Newson, H. W. : Ann. Phys. 10, 477 (1960)

18) 60 Wille : Wille, R. G., and Fink, R. W. : Phys. Rev. 118, 242 (1960)

19) 61 Block : Block, R. C., Slaughter, G. G., Weston, L. W. and Vonderlage, F. C. : EANDC Conference on Time of Flight Methods. Saclay, p. 203 (1961)

20) 61 Gibbons : Gibbons, J. H., Macklin, R. L., Miller, P. D., and Neiler, J. H. : Phys. Rev. 122, 182 (1961)

21) 61 Stavisskii : Stavisskii, Yu. Ya., Tolstikov, V. A., and Kononov, V. N. : Atomnaya Énergiya 10, 158 (1961) (English Translation : Jour. Nucl. Ener. A/B 16, 326 (1962))

22) 62 Furr* : Furr, A. K. Div. of Tech. Inform. Ext., AEC Report, TID-16059 (1962)

23) 62 Popov : Popov, Yu. P. and Shapiro, F. L. : Sov. Phys. JETP 15, 683 (1962)

24) 63 Borbely* : Borbely, et al. : Central Research Institute of Physics, Academy of Sciences (Hungary), KFKI-1467/F (1963)

25) 63 Bramlitt : Bramlitt, E. T. and Fink, R. W. : Phys. Rev. 131, 2649 (1963)

26) 63 Csikai : Csikai, J., Bacsó, J., and Daróczy, A. : Nucl. Phys. 41, 316 (1963)

27) 63 Kapchigashev : Kapchigashev, S. V. and Popov, Yu. P. : Atomnaya Énergiya 15, 120 (1963) (English Translation : Sov. Jour. Atom. Ener. 15, 808 (1964))

28) 63 Macklin : Macklin, R. L., Inada, T., and Gibbons, J. H. : Bull. Am. Phys. Soc. 8, 81 (1963)

29) 63a Macklin : Macklin, R. L., Gibbons, J. H. and Inada, T. : Phys. Rev. 129, 2695 (1963)

30) 63b Macklin : Macklin, R. L., Gibbons, J. H., and Inada, T. : Nature 197, 369 (1963)

31) 63 Moxon : Moxon, M. C. and Rae, E. R. : Nucl. Inst. Meth. 24. 445 (1963)

32) 64 Cox : Cox, S. A. : Phys. Rev. B133, 378 (1964)

33) 64 Kapchigashev* : Kapchigashev, S. V. and Popov, Yu. P. : Conference on Interaction of Neutrons with Nuclei. Dubna, Report No. 1845, p. 104 (1964)

34) 64 Konks : Konks, V. A., Popov, Yu. P., and Shapiro, F. L. : Sov. Phys. JETP 19, 59 (1964)

35) 64a Konks* : Konks, V. A. and Fenin, Yu. I. : Conference on Interaction of Neutrons with Nuclei. Dubna, Report No. 1845, p. 100 (1964)

36) 64 Tolstikov : Tolstikov, V. A., Kolesov, V. E., Dovbenko, A. G., and Stavisskii, Yu. Ya. : Atomnaya Énergia 17, 505 (1964) (English Translation : Sov. Jour. Atom. Ener. 17, 1272 (1965))

37) 65 Cuzzocrea* : Cuzzocrea, P. : Private Communication, NEUDADA (1965)

38) 65 Pönitz* : Pönitz, W. P. : Karlsruhe Progress Report : ARB·BER-19 (1965)

39) 65 Robertson : Robertson, J. C. : Nucl. Phys. 71, 417 (1965)

40) 65 Stavisskii : Stavisskii, Yu. Ya et al. Atomnaya Energiya 19, 292 (1965) (English Translation : Sov. Jour. Atom. Ener. 19, 1210 (1965))

41) 65 Stupegia : Stupegia, D. C., Schmidt, M., Keedy, C. R., and Madson, A. A. : Argonne National Laboratory Report Series: ANL-7132, p. 31 (1965)

42) 66 Chaubey : Chaubey, A. K. and Sehgal, M. L.: Phys. Rev. 152, 1055 (1966)

43) 66 Fenner* : Fenner et al.: European-American Nuclear Data Committee Documents: EANDC(UK) 75S (1966), (NEUDADA)

44) 66 Gray : Gray, P. R., Zander, A. R., and Ebrey, T. G. : Nucl. Phys. 75, 215 (1966)

45) 66 Kononov : Kononov, V. N., Stavisskii, Yu. Ya., Csistozvonov, S. R., and Shorin, V. S. : 1st IAEA Conference on Nuclear Data for Reactors. Paris, Vol. 1, p. 469 (1966)

46) 67 Csikai : Csikai, J.,Petö, G., Buczkó, M., Miligy, Z., and Eissa, N. A. : Nucl. Phys. A95, 229 (1967)

47) 67 Cuzzocrea : Cuzzocrea, P., Notarrigo, S., and Perillo, E. : Nuovo Cimento B52, 476 (1967)

48) 67 Macklin : Macklin, R. L. and Gibbons, J. H. : Phys. Rev. 159, 1007 (1967)

49) 67 Petö : Petö, G., Miligy, Z., and Hunyadi, I. : Jour. Nucl. Ener. 21, 797 (1967)

50) 67 Tolstikov : Tolstikov, V. A., Koroleva, V. P., Kolesov, V. E., and Dovbenko, A. G. : Atomnaya Énergiya 23, 566 (1967) (English Translation : Sov. Jour. Atom. Ener. 23, 1347 (1967))

51) 68 Chaubey : Chaubey, A. K. and Sehgal, M. L. : Nucl. Phys. A117, 545 (1968)

52) 68 Colditz* : Colditz et al.: Oesterr. Akad. Wiss. Math. and Naturw. Anzeiger 105, 236 (1968)

53) 68 Dinter : Dinter, H. : Nucl. Phys. A111, 360 (1968)

54) 68 Harlow : Harlow, M. V., Schelberg, A. D., Tatro, L. D., Warren, J. H., and Glass, N. W. : 2nd Conference on Nuclear Cross Sections and Technology. Washington D. C., p.837 (1968)

55) 68 Hasan : Hasan, S. S., Chaubey, A. K., and Sehgal, M. L.: Nuovo Cimento B58, 402 (1968)

56) 68 Konks : Konks, V. A., Popov, Yu. P., and Fenin, Yu. I. : Sov. Jour. Nucl. Phys. 7, 310 (1968)

57) 68 Qaim* : Qaim, S. M. et al. Jour. Inorg. Nucl. Chem. 30, 2577 (1968)

58) 68 Stupegia : Stupegia, D. C., Schmidt, M., Keedy C. R., and Madson, A. A. : Jour. Nucl. Ener. 22, 267 (1968)

59) 69 Dovbenko : Dovbenko, A. G., Kolesov, V. E., Koroleva, V. P., and Tolstikov, V. A. : Atomnaya Énergiya 26, 67 (1969) (English Translation : Sov. Jour. Atom. Ener. 26, 82 (1969))

60) 69 Kompe : Kompe, D. : Nucl. Phys. A133, 513 (1969)

61) 69 Schuman : Schuman, R. P. : AEC, Washington Reports to the NCSAG, WASH-1127, p. 72 (1969)

62) 70 Chaturvedi : Chaturvedi, S. N. and Prasad, R. : Nuclear Physics and Solid Physics Symposium. Madurai, Vol. 2, p. 615 (1970)

63) 70 Czirr : Czirr, J. B. : Lawrence Radiation Laboratory Report, UCRL-50804 (1970)

64) 70 Dicsic : Dicsic, M., Strohal, P., Petö, G., Bornemisga-Pauspertl, P., Hunyadi, I., and Károlyi, J. : Acta Phys. Acad. Sci. Hung. 28, 257 (1970)

65) 70 Fricke : Fricke, M. P., Lopez, W. M., Friesenhahn, S. J., Carlson, A. D., and Costello, D. G. : 2nd IAEA Conference on Nuclear Data for Reactors. Helsinki, Vol. 2, p. 265 (1970)

66) 70 Majumder : Majumder, M. : Indian Jour. Phys. 44, 204 (1970)

67) 70 Murty : Murty, M. S., Siddappa, K., and Rao, J. R. Nuclear Physics and Solid Physics Symposium. Madurai, Vol. 2, p. 29 (1970)

68) 70 Qaim : Qaim, S. M. : Jour. Inorg. Nucl. Chem. 32, 1799 (1970)

69) 70 Thirumala : Thirumala Rao, B. V., Rama Rao, J., and Kondaiah, E. : Nuclear Physics and Solid Physics Symposium. Madurai, Vol. 2, p. 25 (1970)

70) 70 Tromp : Tromp, R. L. : Reports of Idaho Nuclear Corp. : IN-1407, p.31 (1970)

71) 70 Zaikin : Zaikin, G. G., Korzh, I. A., Pasechnik, M. V. : and Sklyar, N. T. :
Ukrainskij Fiziceskij Zurnal 16, 1205 (1970)
(English Translation : INDC(CCP)-15, p. 52 (1971)

72) 71 Bensch : Bensch, F. and Ledermann, H. :
EANDC(OR) 105 L, p. 1 (1971)

73) 71 Brzosko* : Brzosko, et al. :
Acta Physica Polonica Section B2, 489 (1971)

74) 71 Rigaud : Rigaud, F., Irigaray, J. L., and Petit, G. Y. :
Nucl. Phys. A173, 551 (1971)

75) 71a Rigaud : Rigaud, F., Irigaray, J. L., Petit, G. Y., Longo, G., and Saporetti, F. :
Nucl. Phys. A176, 545 (1971)

76) 72 Holub* : Holub, E., et al. :
Inst. Rudjer Boskovic Reports : LNS-4-72 (1972)

77) 72 Kantele* : Kantele et al.
Physics Letters B39, 625 (1972)

78) 72 Lakshmana : Lakshmana Rao, A. and Rama Rao, J. :
Phys. Rev. C6, 572 (1972)

79) 72a Lakshmana : Lakshmana Rao, A. and Rama Rao, J. :
Lettere al Nuovo Cimento 5, 1025 (1972)

80) 72 Siddappa : Siddappa, K., Murty, M. S., and Rama Rao, J. :
Jour. Phys. A5, 877 (1972)

81) 72 Thirumala : Thirumala Rao, B. V., Rama Rao, J., and Kondaiah, E. :
Jour. Phys. A5, 468 (1972)

82) 73 Chou : Chou, J.-C. and Werle, H. :
Jour. Nucl. Ener. 27, 811 (1973)

83) 73 Lakosi : Lakosi, L. and Beresh, A. :
Conference on Neutron Physics. Kiev,
Vol. 4, p. 312 (1973)

84) 73 Murty : Murty, M. S., Siddappa, K., and Rama Rao, J. :
Jour. Phys. Soc. Japan 35, 8 (1973)

85) 73 Petö* : Petö, G. et al.
Acta Phys. Acad. Sci. Hung. 33, 363 (1973)

86) 73a Petö : Petö, G. and Csikai, I. :
Conference on Neutron Physics. Kiev,
Vol. 3, p. 78 (1973)

87) 73 Qaim : Qaim, S. M. :
Jour. Inorg. Nucl. Chem. 35, 3669 (1973)

88) 73 Siddappa : Siddappa, K., Murty, M. S., and Rama Rao, J. :
Nuovo Cimento 18A, 48 (1973)

89) 74 Anand : Anand, R. P., Bhattacharya, D., Jhingan, M. L., and Kondaiah, E. :
17th Nuclear and Solid State Physics Symposium.
Bombay, Vol. 2, p. 101 (1974)

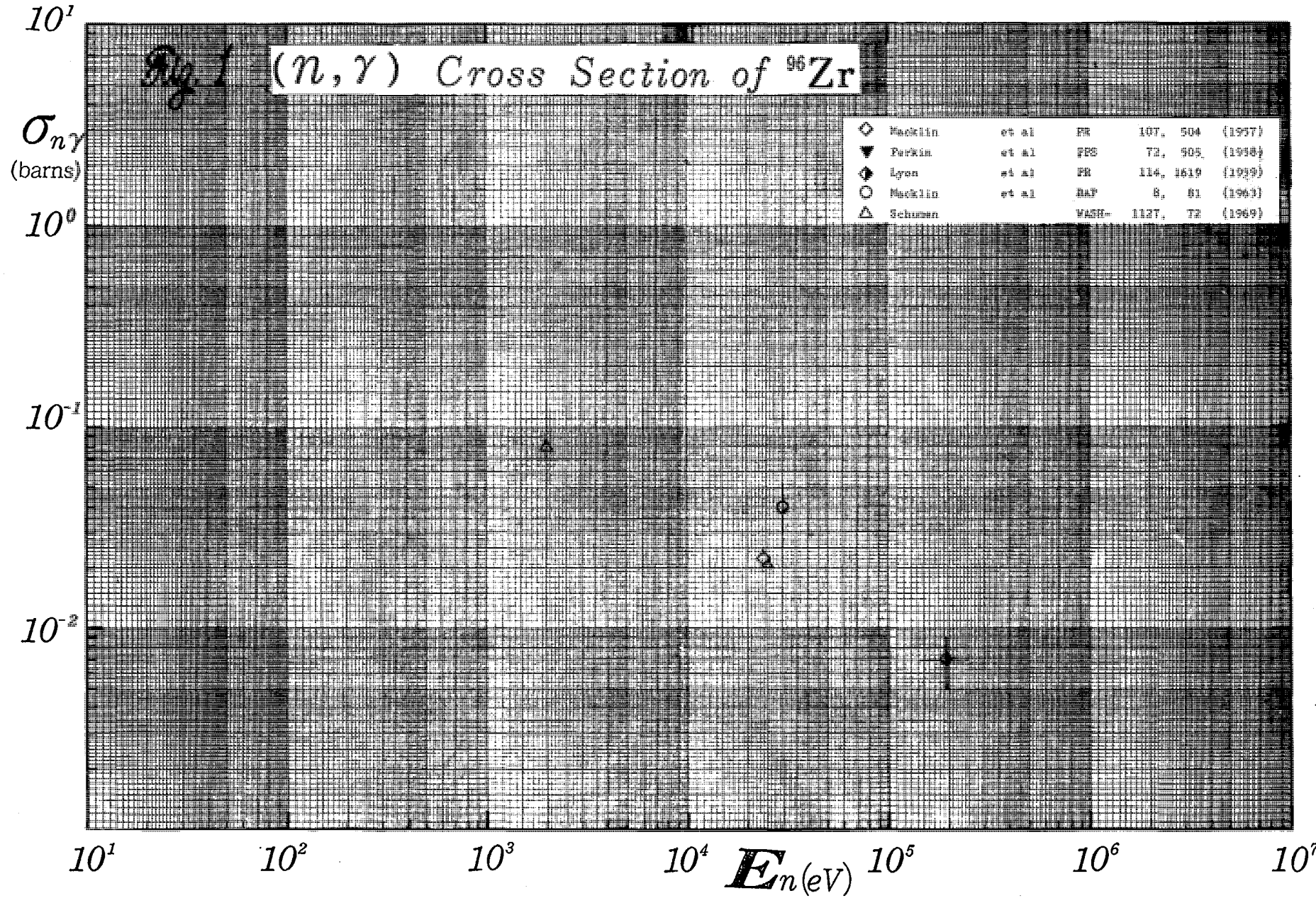


Fig. 1 (n, γ) Cross Section of 96Zr
Macklin et al PR 107, 504 (1957)
Perkin et al PRS 72, 905 (1958)
Lyon et al PR 114, 1619 (1959)
Macklin et al NuP 6, 81 (1963)
Schumann WASH- 1127, 72 (1969)
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
10⁵
10⁶
10⁷
En(eV)

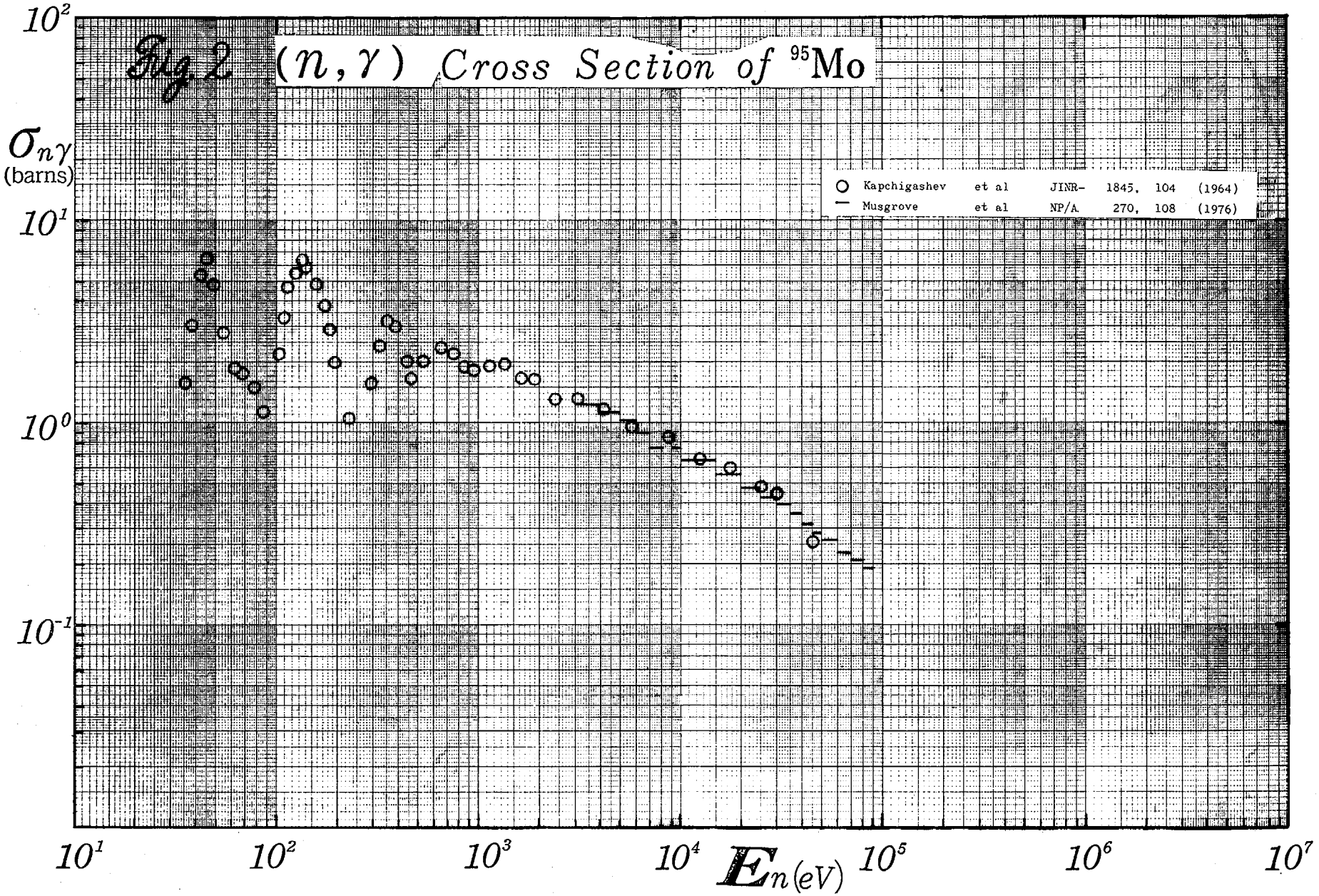


Fig.2 (n,γ) Cross Section of 95Mo
σnγ (barns)
10^2
10^1
10^0
10^-1
10^1
10^2
10^3
10^4
10^5
10^6
10^7
En(eV)
Kapchigashev et al JINR- 1845, 104 (1964)
Musgrove et al NP/A 270, 108 (1976)

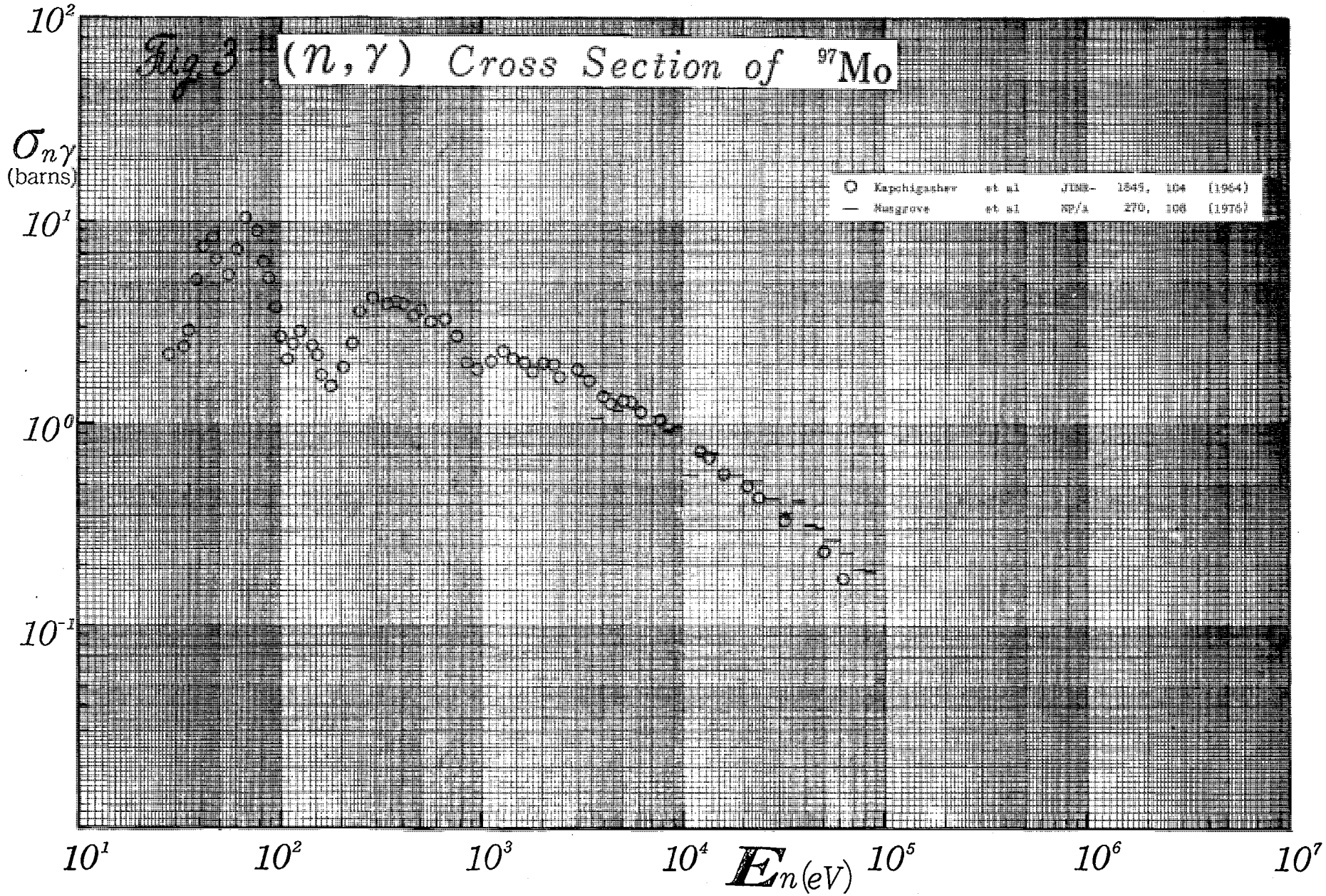


Fig.3 (n, γ) Cross Section of 97Mo
σnγ (barns)
10²
10¹
10⁰
10⁻¹
10¹
10²
10³
10⁴
10⁵
10⁶
10⁷
En(eV)
Kapchigashev et al JINR- 1845, 104 (1964)
Musgrove et al NP/A 270, 108 (1976)

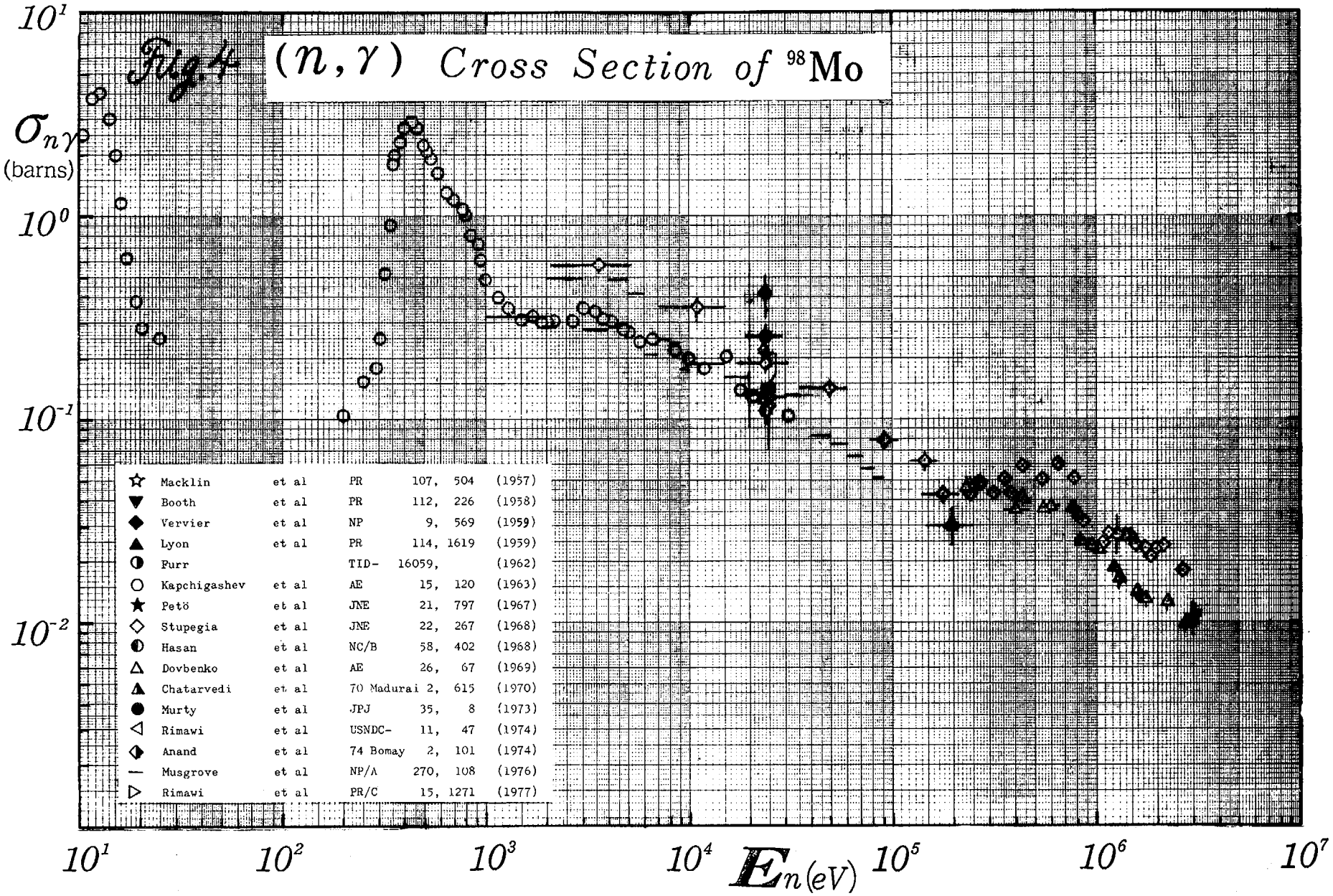


Fig.4 (n,γ) Cross Section of 98Mo
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
10⁵
10⁶
10⁷
En(eV)
Macklin et al PR 107, 504 (1957)
Booth et al PR 112, 226 (1958)
Vervier et al NP 9, 569 (1959)
Lyon et al PR 114, 1619 (1959)
Furr TID- 16059, (1962)
Kapchigashev et al AE 15, 120 (1963)
Petö et al JNE 21, 797 (1967)
Stupegia et al JNE 22, 267 (1968)
Hasan et al NC/B 58, 402 (1968)
Dovbenko et al AE 26, 67 (1969)
Chatarvedi et al 70 Madurai 2, 615 (1970)
Murty et al JPJ 35, 8 (1973)
Rimawi et al USNDC- 11, 47 (1974)
Anand et al 74 Bomay 2, 101 (1974)
Musgrove et al NP/A 270, 108 (1976)
Rimawi et al PR/C 15, 1271 (1977)

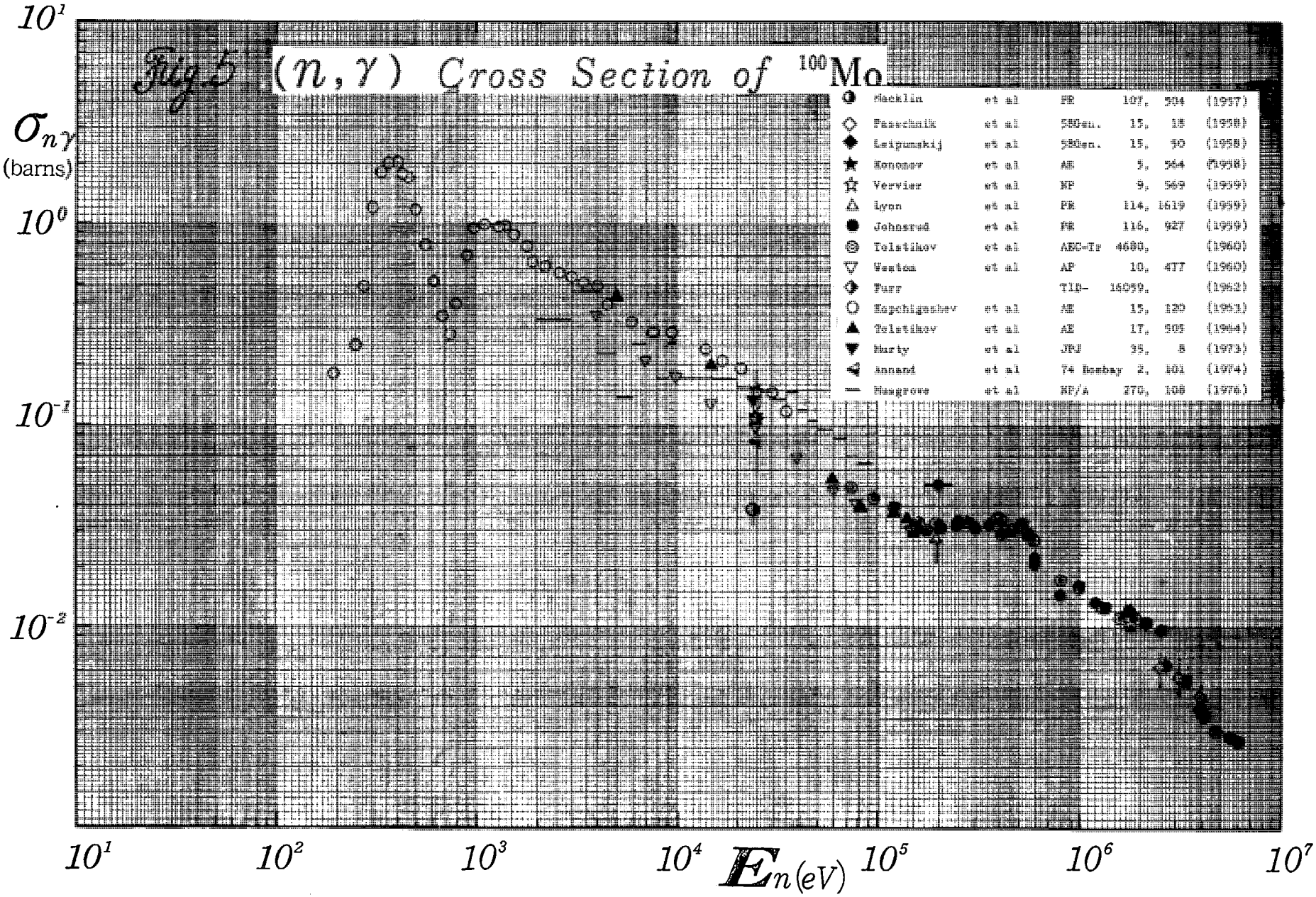
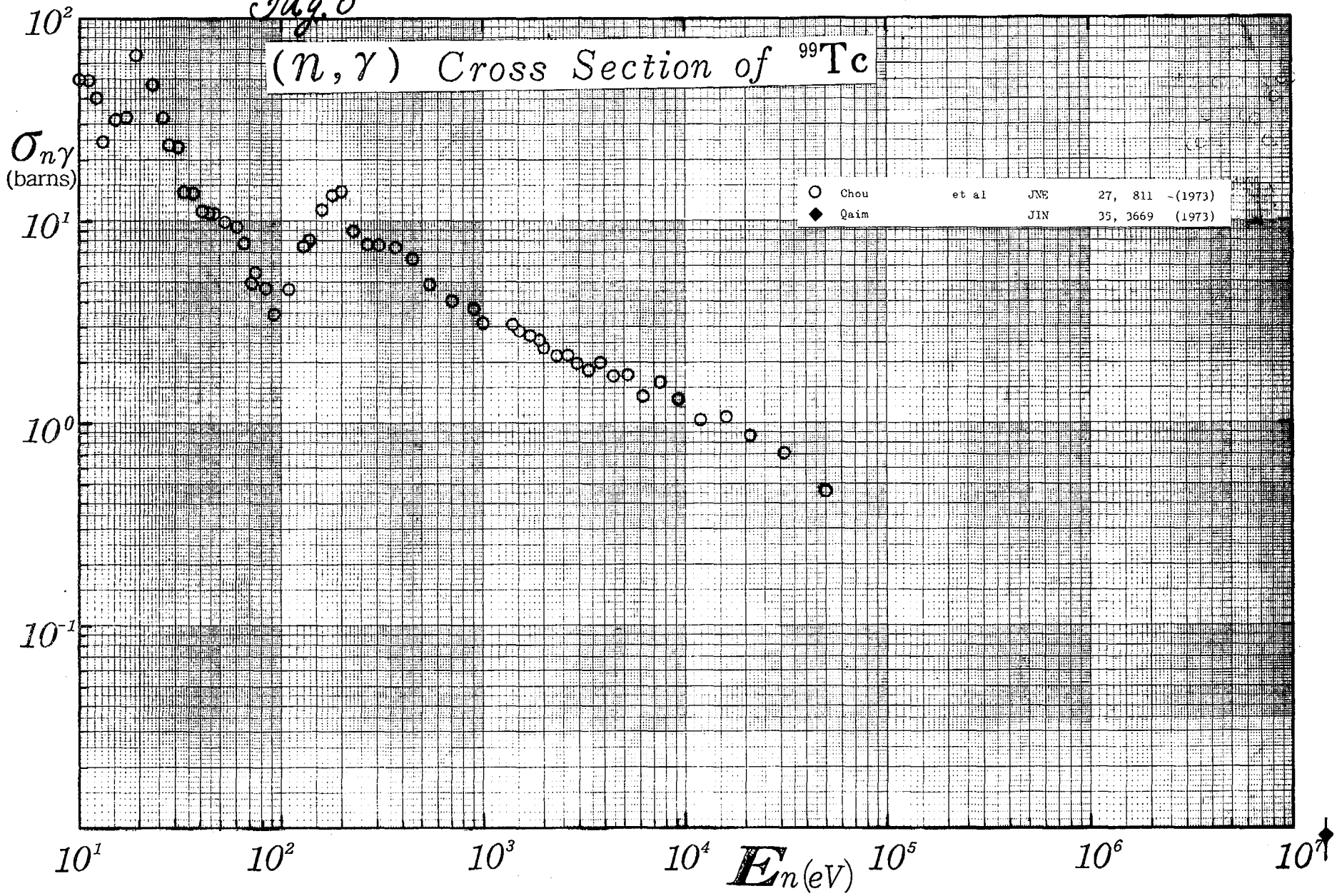


Fig.5 (n, γ) Cross Section of 100Mo
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
10⁵
10⁶
10⁷
En(eV)
Macklin et al PR 107, 504 (1957)
Panchenko et al SOJen. 15, 18 (1958)
Leipunskij et al SOJen. 15, 90 (1958)
Konomov et al AE 5, 544 (1958)
Vervier et al NP 9, 569 (1959)
Lyon et al PR 114, 1619 (1959)
Johnsrud et al PR 116, 927 (1959)
Tolstikov et al AEC-Tr 4680, (1960)
Weston et al AP 10, 477 (1960)
Furr TID- 16059, (1962)
Kapchigashev et al AE 15, 120 (1963)
Tolstikov et al AE 17, 505 (1964)
Marty et al JNJ 35, 8 (1973)
Annard et al T4 Bombay 2, 101 (1974)
Musgrove et al NP/A 270, 108 (1976)

Fig. 6


(n, γ) Cross Section of 99Tc
σnγ (barns)
10²
10¹
10⁰
10⁻¹
10¹
10²
10³
10⁴
10⁵
10⁶
10⁷
En(eV)
Chou et al JNE 27, 811 (1973)
Qaim JIN 35, 3669 (1973)

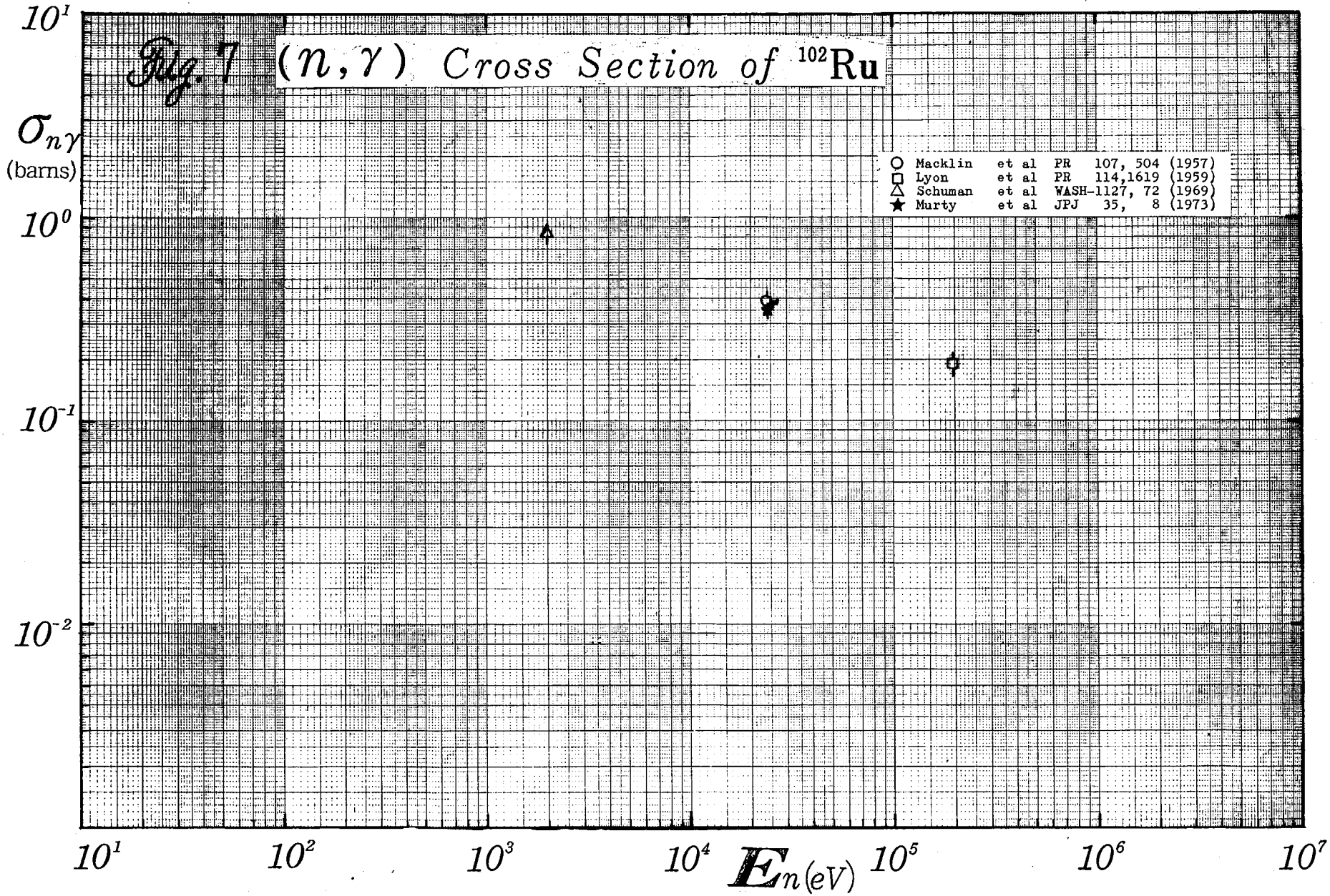


Fig. 7 (n,γ) Cross Section of 102Ru
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
En(eV)
10⁵
10⁶
10⁷
Macklin et al PR 107, 504 (1957)
Lyon et al PR 114,1619 (1959)
Schuman et al WASH-1127, 72 (1969)
Murty et al JPJ 35, 8 (1973)

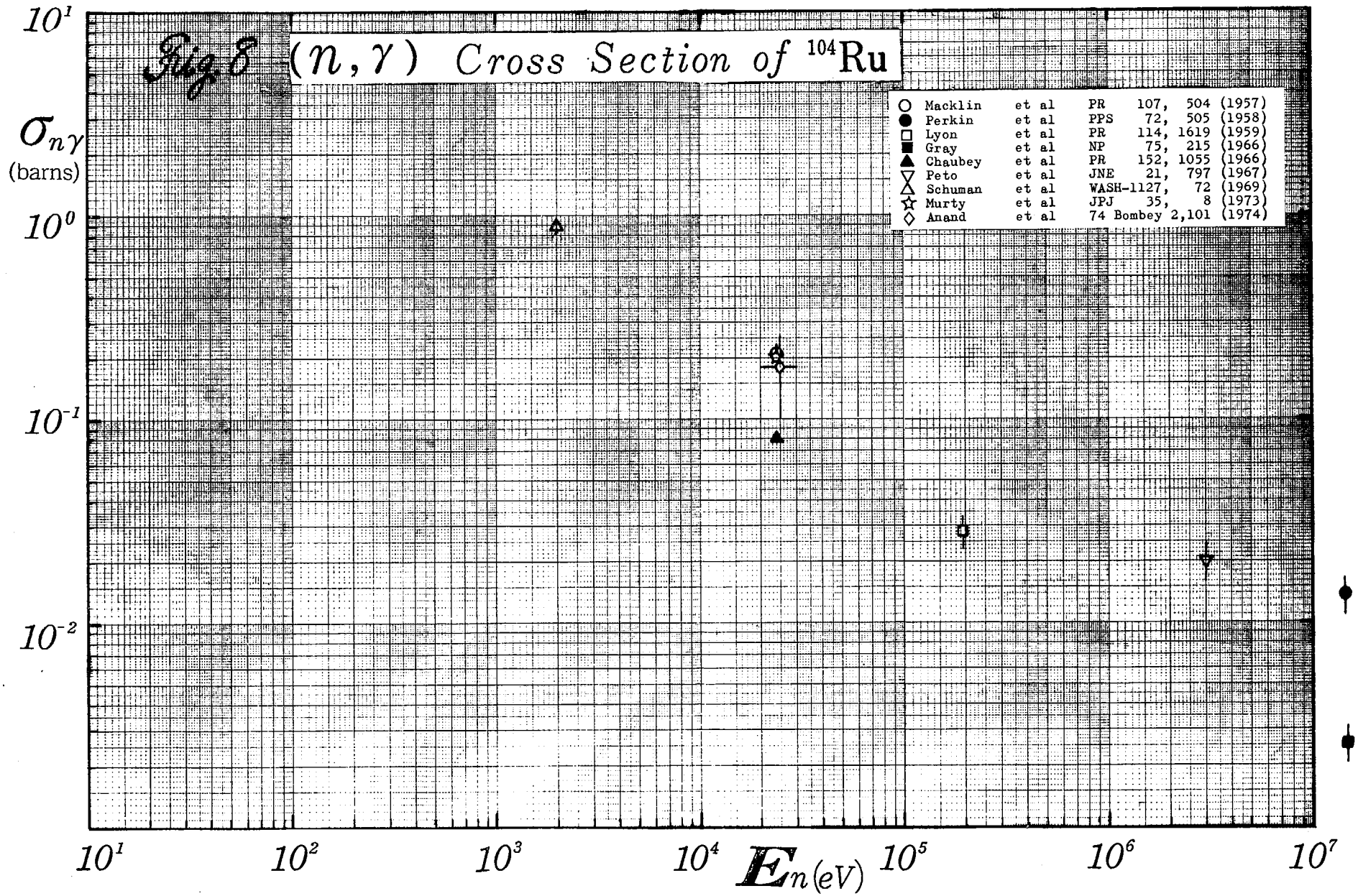


Fig. 8 (n, γ) Cross Section of 104Ru
○ Macklin et al PR 107, 504 (1957)
● Perkin et al PPS 72, 505 (1958)
□ Lyon et al PR 114, 1619 (1959)
■ Gray et al NP 75, 215 (1966)
▲ Chaubey et al PR 152, 1055 (1966)
▽ Peto et al JNE 21, 797 (1967)
△ Schuman et al WASH-1127, 72 (1969)
☆ Murty et al JPJ 35, 8 (1973)
◇ Anand et al 74 Bombey 2,101 (1974)
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
En(eV)
10⁵
10⁶
10⁷

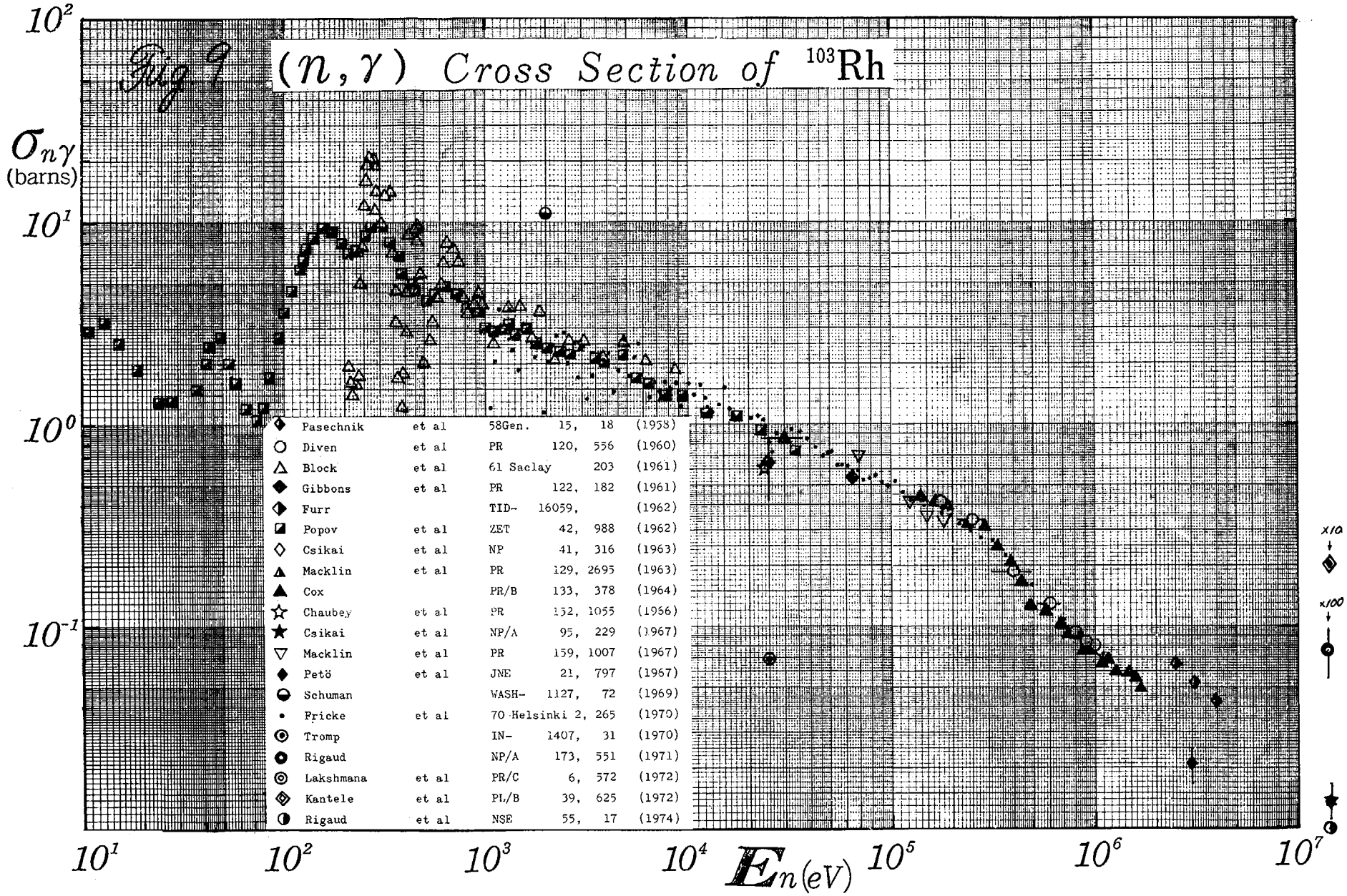


Fig. 9
(n, γ) Cross Section of 103Rh
σnγ (barns)
10^2
10^1
10^0
10^-1
10^1
10^2
10^3
10^4
En(eV)
10^5
10^6
10^7
Pasechnik et al 58Gen. 15, 18 (1958)
Diven et al PR 120, 556 (1960)
Block et al 61 Saclay 203 (1961)
Gibbons et al PR 122, 182 (1961)
Furr TID- 16059, (1962)
Popov et al ZET 42, 988 (1962)
Csikai et al NP 41, 316 (1963)
Macklin et al PR 129, 2695 (1963)
Cox PR/B 133, 378 (1964)
Chaubey et al PR 152, 1055 (1966)
Csikai et al NP/A 95, 229 (1967)
Macklin et al PR 159, 1007 (1967)
Petö et al JNE 21, 797 (1967)
Schuman WASH- 1127, 72 (1969)
Fricke et al 70 Helsinki 2, 265 (1970)
Tromp IN- 1407, 31 (1970)
Rigaud NP/A 173, 551 (1971)
Lakshmana et al PR/C 6, 572 (1972)
Kantele et al PL/B 39, 625 (1972)
Rigaud et al NSE 55, 17 (1974)
×10
×100

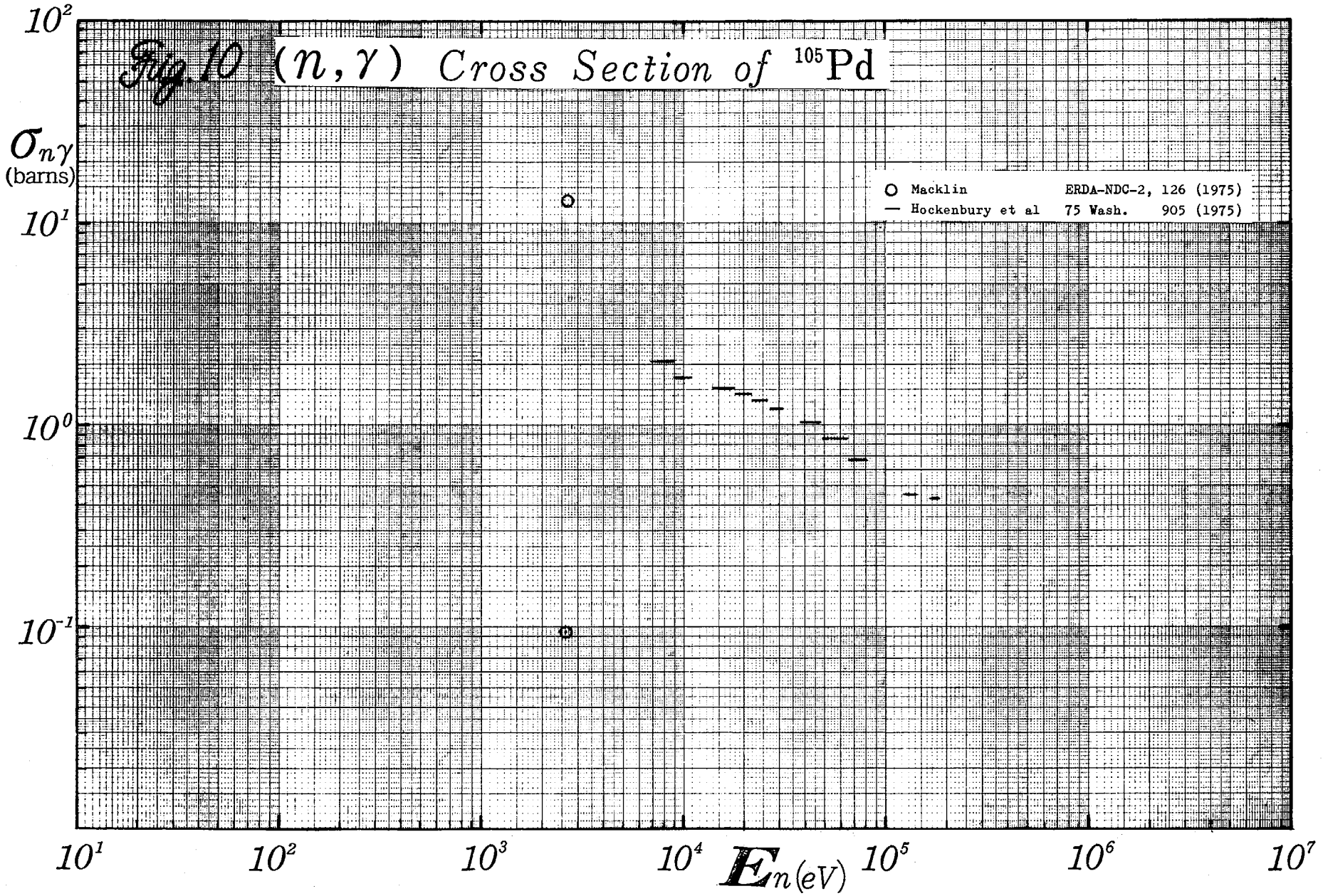


Fig.10 (n,γ) Cross Section of 105Pd
σnγ (barns)
10²
10¹
10⁰
10⁻¹
O Macklin ERDA-NDC-2, 126 (1975)
— Hockenbury et al 75 Wash. 905 (1975)
10¹
10²
10³
10⁴
En(eV)
10⁵
10⁶
10⁷

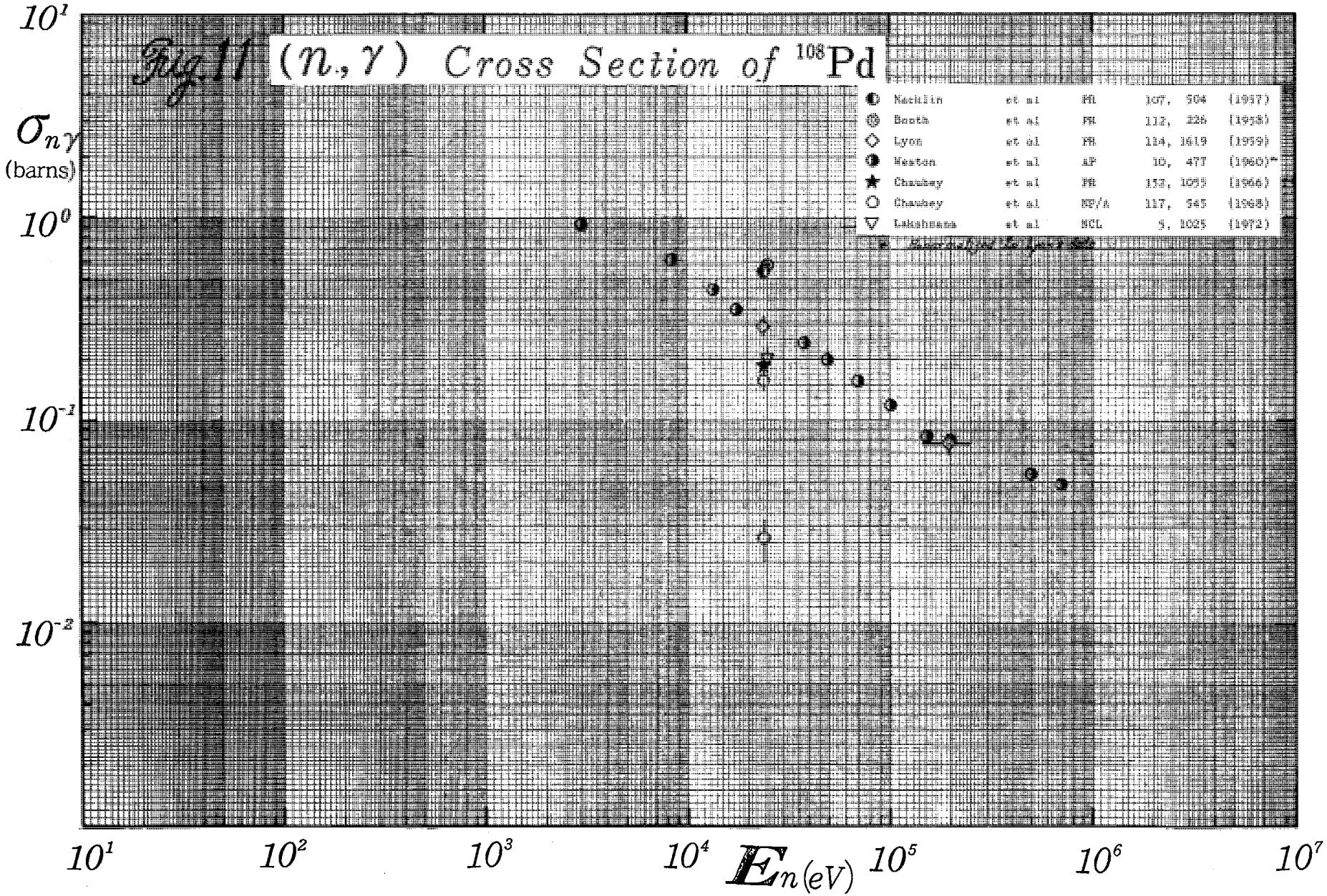


Fig.11 (n, γ) Cross Section of 108Pd
Macklin et al PR 107, 504 (1957)
Booth et al PR 112, 226 (1958)
Lyon et al PR 114, 1619 (1959)
Weston et al AP 10, 477 (1960)
Chaubey et al PR 152, 1055 (1966)
Chaubey et al NP/A 117, 545 (1968)
Takahasma et al NCL 5, 1025 (1972)
σnγ (barns)
10¹
10⁰
10⁻¹
10⁻²
10¹
10²
10³
10⁴
En(eV)
10⁵
10⁶
10⁷

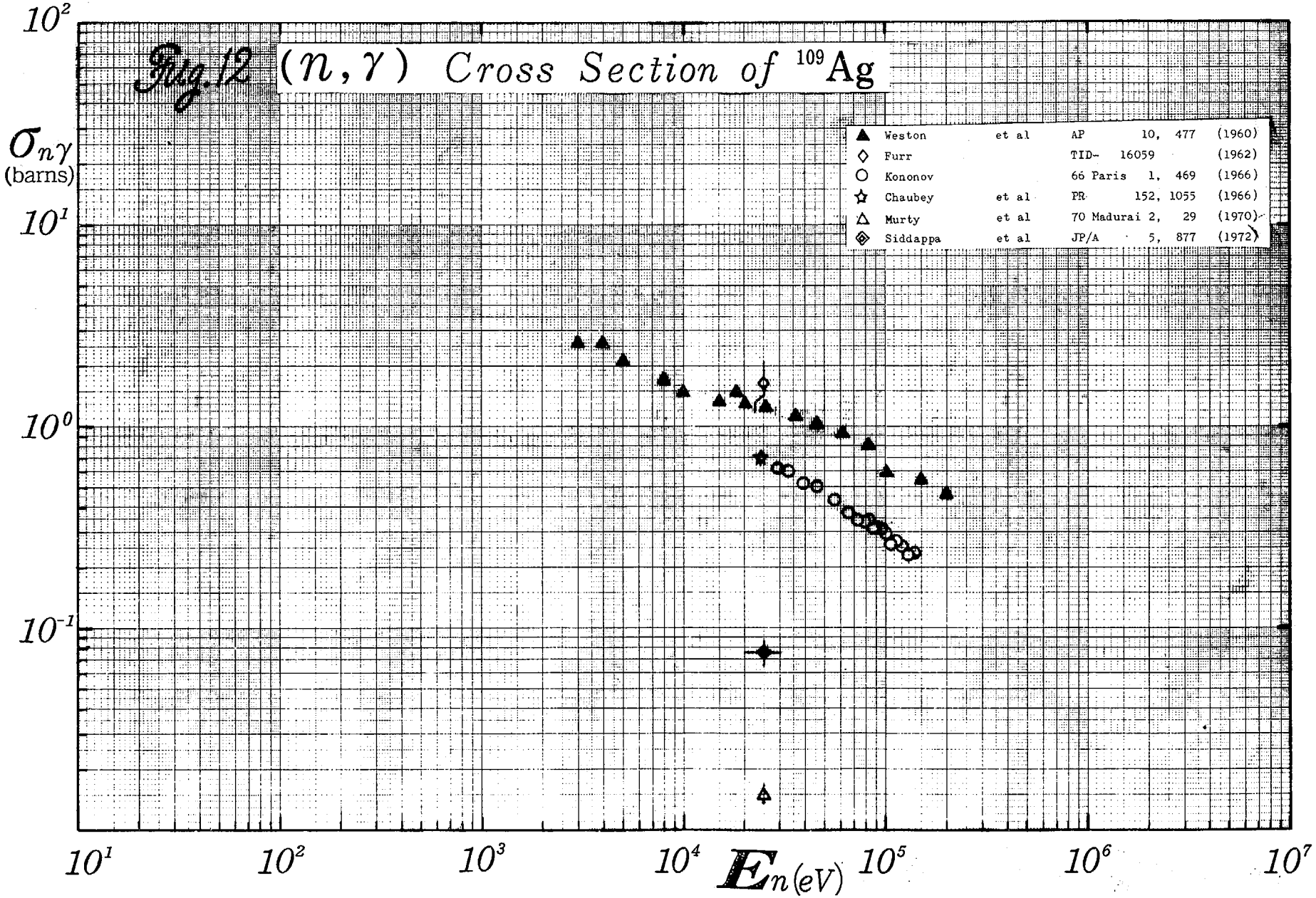
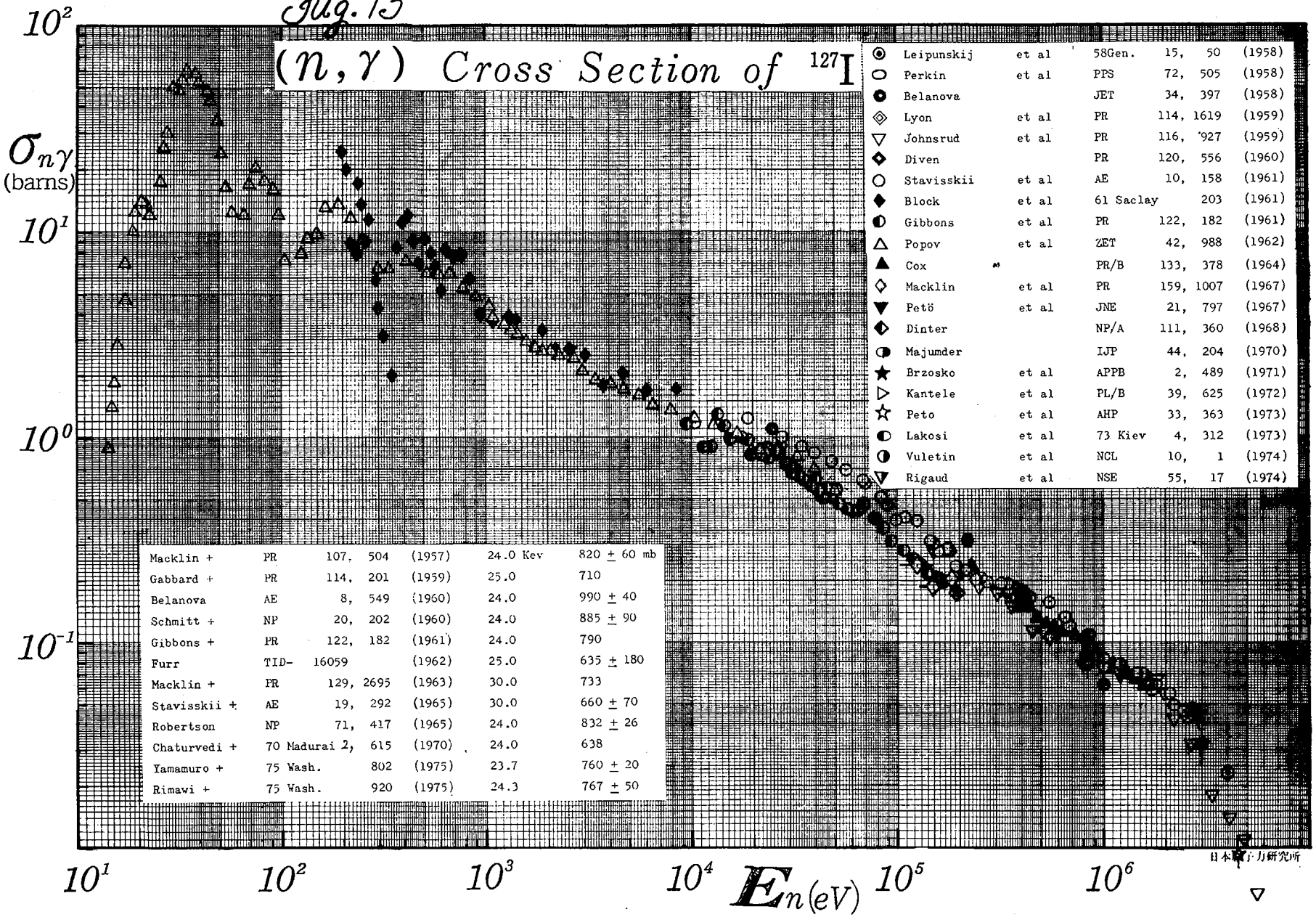


Fig.12 (n,γ) Cross Section of 109Ag
σnγ (barns)
10^2
10^1
10^0
10^-1
10^1
10^2
10^3
10^4
10^5
10^6
10^7
En(eV)
Weston et al AP 10, 477 (1960)
Furr TID- 16059 (1962)
Kononov 66 Paris 1, 469 (1966)
Chaubey et al PR 152, 1055 (1966)
Murty et al 70 Madurai 2, 29 (1970)
Siddappa et al JP/A 5, 877 (1972)

Fig. 13


(n, γ) Cross Section of 127I
σnγ (barns)
10^2
10^1
10^0
10^-1
10^1
10^2
10^3
10^4
10^5
10^6
En(eV)
Leipunskij et al 58Gen. 15, 50 (1958)
Perkin et al PPS 72, 505 (1958)
Belanova JET 34, 397 (1958)
Lyon et al PR 114, 1619 (1959)
Johnsrud et al PR 116, 927 (1959)
Diven PR 120, 556 (1960)
Stavisskii et al AE 10, 158 (1961)
Block et al 61 Saclay 203 (1961)
Gibbons et al PR 122, 182 (1961)
Popov et al ZET 42, 988 (1962)
Cox PR/B 133, 378 (1964)
Macklin et al PR 159, 1007 (1967)
Petö et al JNE 21, 797 (1967)
Dinter NP/A 111, 360 (1968)
Majumder IJP 44, 204 (1970)
Brzosko et al APPB 2, 489 (1971)
Kantele et al PL/B 39, 625 (1972)
Peto et al AHP 33, 363 (1973)
Lakosi et al 73 Kiev 4, 312 (1973)
Vuletin et al NCL 10, 1 (1974)
Rigaud et al NSE 55, 17 (1974)
Macklin + PR 107, 504 (1957) 24.0 Kev 820 ± 60 mb
Gabbard + PR 114, 201 (1959) 25.0 710
Belanova AE 8, 549 (1960) 24.0 990 ± 40
Schmitt + NP 20, 202 (1960) 24.0 885 ± 90
Gibbons + PR 122, 182 (1961) 24.0 790
Furr TID- 16059 (1962) 25.0 635 ± 180
Macklin + PR 129, 2695 (1963) 30.0 733
Stavisskii + AE 19, 292 (1965) 30.0 660 ± 70
Robertson NP 71, 417 (1965) 24.0 832 ± 26
Chaturvedi + 70 Madurai 2, 615 (1970) 24.0 638
Yamamuro + 75 Wash. 802 (1975) 23.7 760 ± 20
Rimawi + 75 Wash. 920 (1975) 24.3 767 ± 50
x10
日本原子力研究所

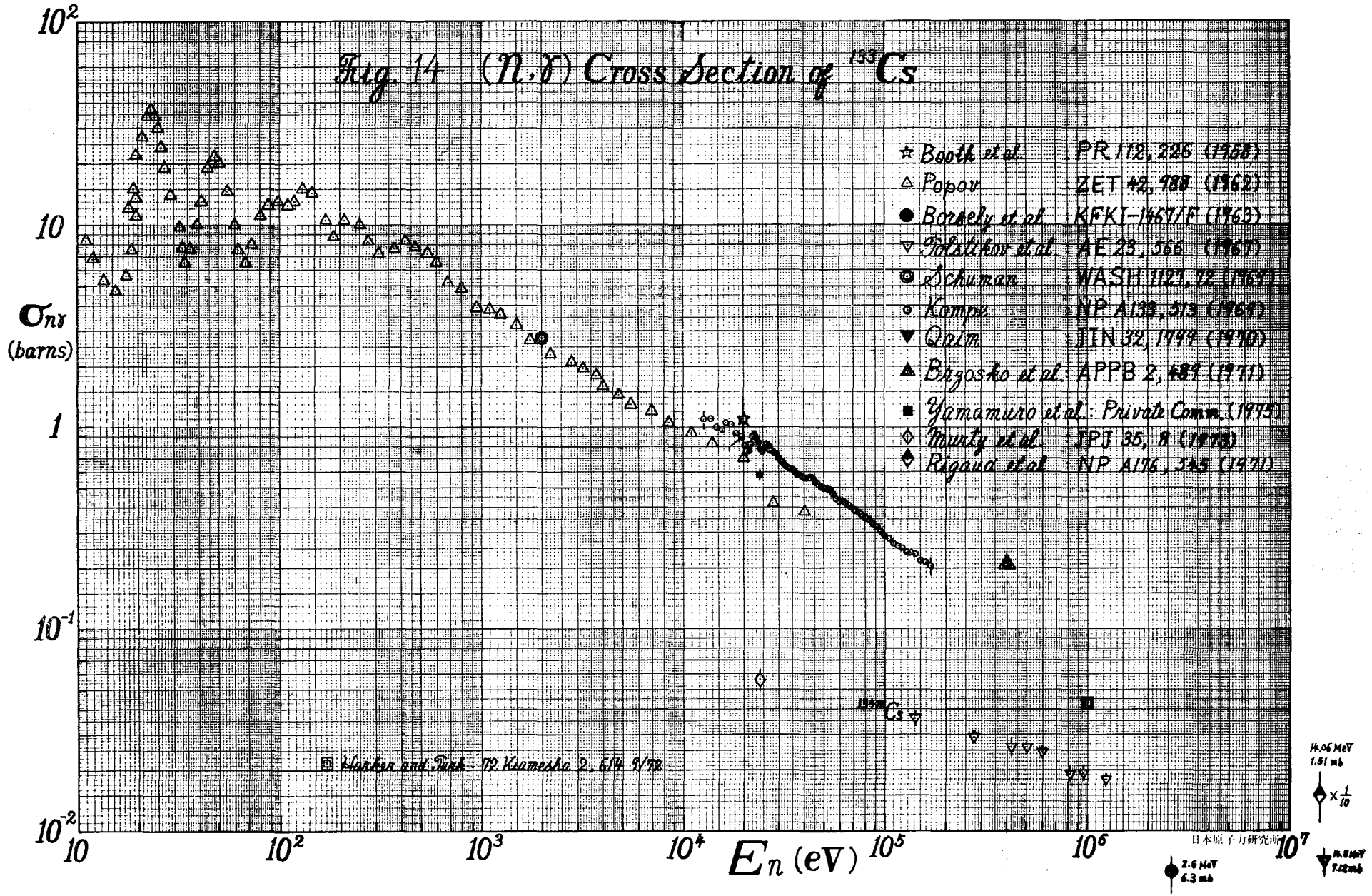


Fig. 14 (n,γ) Cross Section of ^{133}Cs

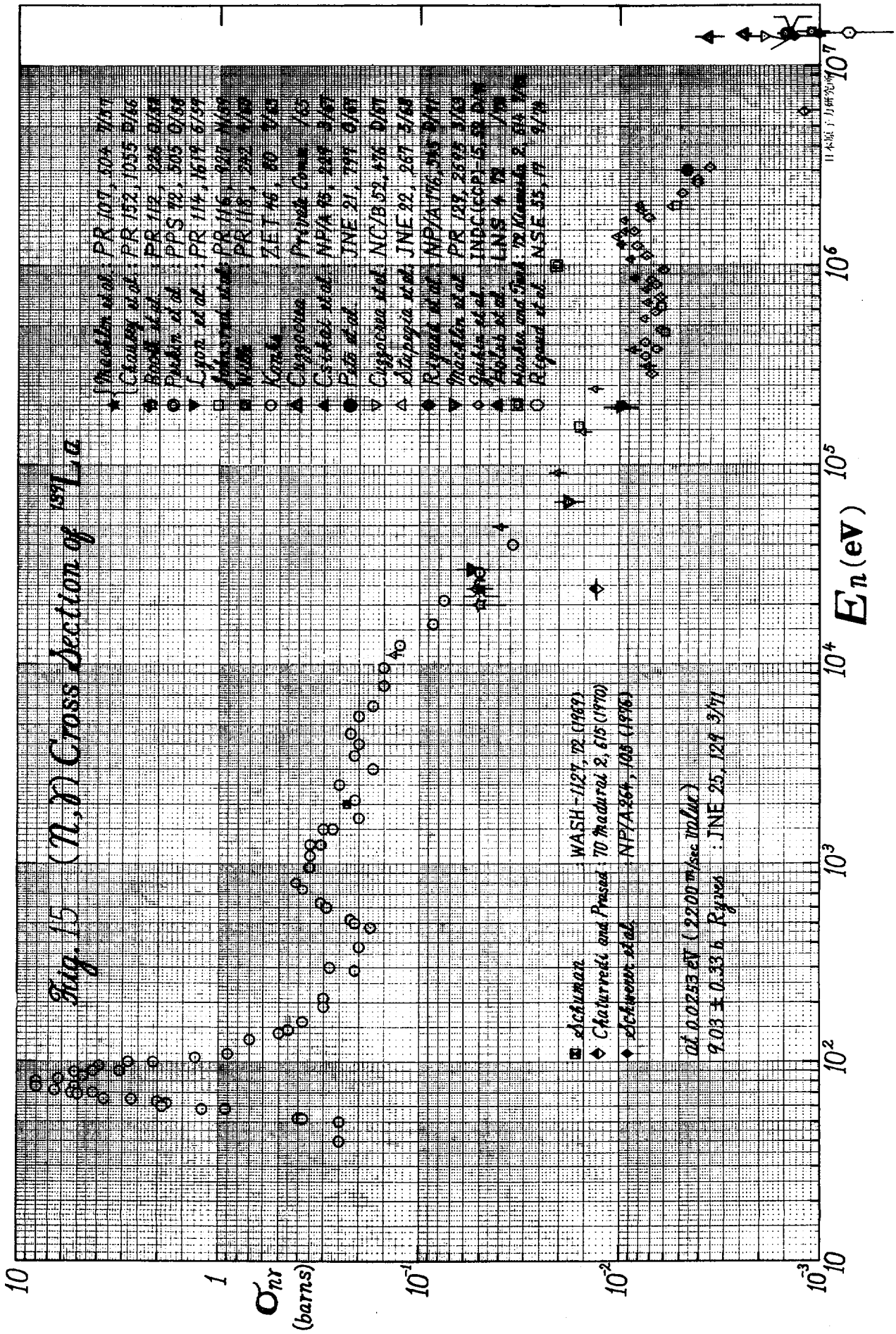


Fig. 15 (n, γ) Cross Section of 139La
Schwartz et al. : PR 107, 508 11/57
Cakouy et al. : PR 152, 1035 12/66
Rose et al. : PR 112, 226 11/58
Perkin et al. : PPS 72, 505 11/58
Lyon et al. : PR 114, 1619 6/59
Johnsrud et al. : PR 116, 1147 12/60
Wills : PR 116, 202 4/60
Kanda : ZETP 16, 80 1/63
Chipouchin : Private Comm. 1/65
Czirkos et al. : NP/A 95, 224 3/67
Pate et al. : JNE 21, 791 8/61
Chipouchin et al. : NC/B 52, 476 11/67
Alpopova et al. : JNE 22, 267 3/68
Rayeski et al. : NP/A 176, 385 11/71
Moxon et al. : PR 128, 2473 3/63
Gayles et al. : INDC(CCP)-5, 12 12/74
Abdel et al. : LNS 4 79 1/79
Mizuhira and Tsai : 72 Kinsaku 2, 84 1/79
Rigaud et al. : NSE 55, 77 8/74
Schuman : WASH-1127, 72 (1969)
Chaturvedi and Prasad : 70 Madural 2, 615 (1970)
Schwenk et al. : NP/A 264, 105 (1976)
at 0.0253 eV (2200 m/sec value)
9.03 ± 0.33 b Ryves : JNE 25, 129 3/71
σnr (barns)
En (eV)
10
1
10⁻¹
10⁻²
10⁻³
10
10²
10³
10⁴
10⁵
10⁶
10⁷

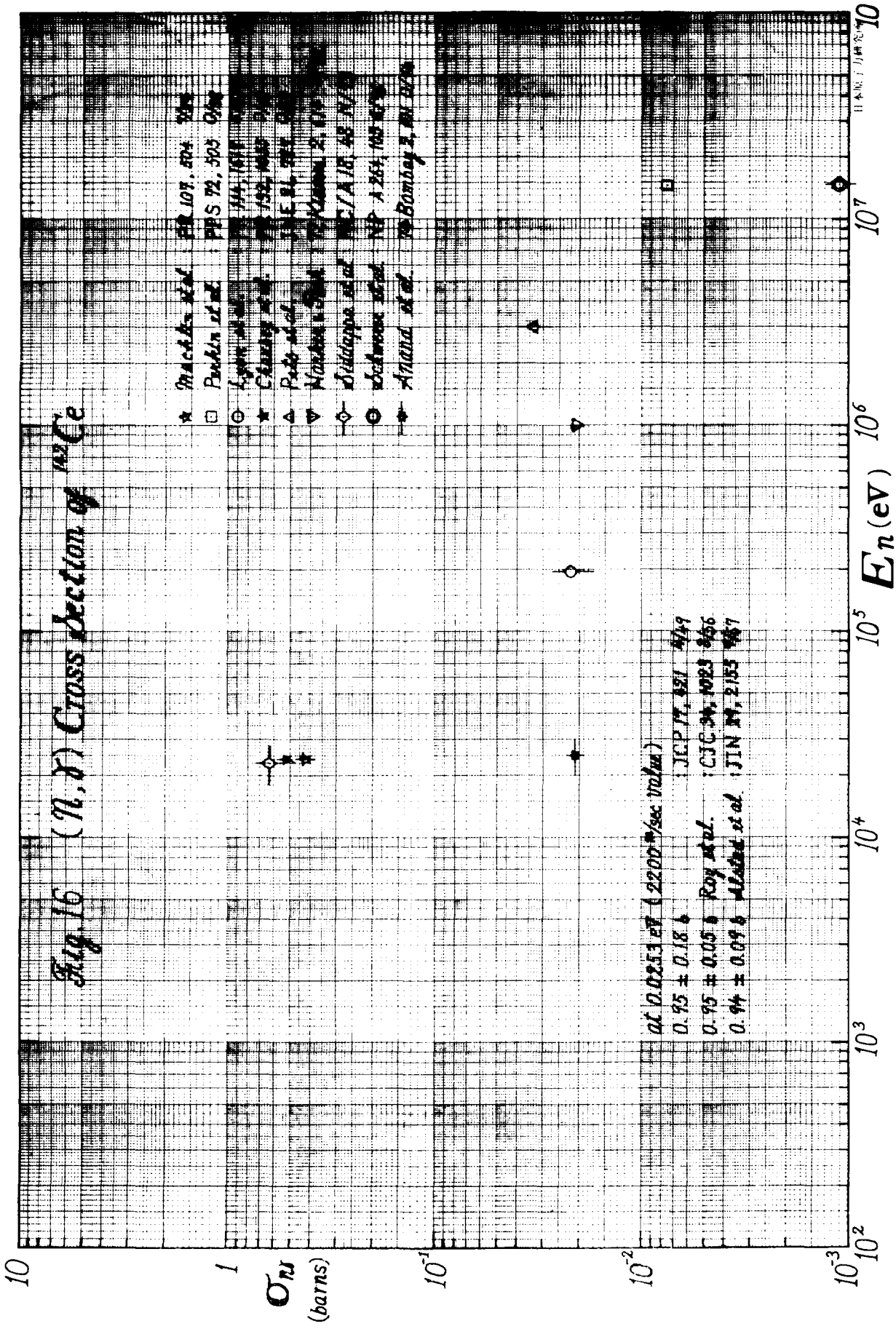


Fig. 16 (n, γ) Cross Section of 140Ce
Malitsky et al. : PR 107, 504 1957
Pushkin et al. : PPS 72, 503 1958
Lyon et al.
Chatterjee et al.
Poto et al.
Moxon et al.
Bilchenko et al.
Bochkarev et al.
Anand et al.
at 0.0253 eV (2200 m/sec value)
0.95 ± 0.18 b : JCP 17, 921 1949
0.95 ± 0.05 b : Roy et al. : CJC 34, 1023 1956
0.94 ± 0.09 b : Alabat et al. : JIN 17, 2153 1967
σnγ (barns)
En (eV)
10
1
10⁻¹
10⁻²
10⁻³
10²
10³
10⁴
10⁵
10⁶
10⁷
10⁸

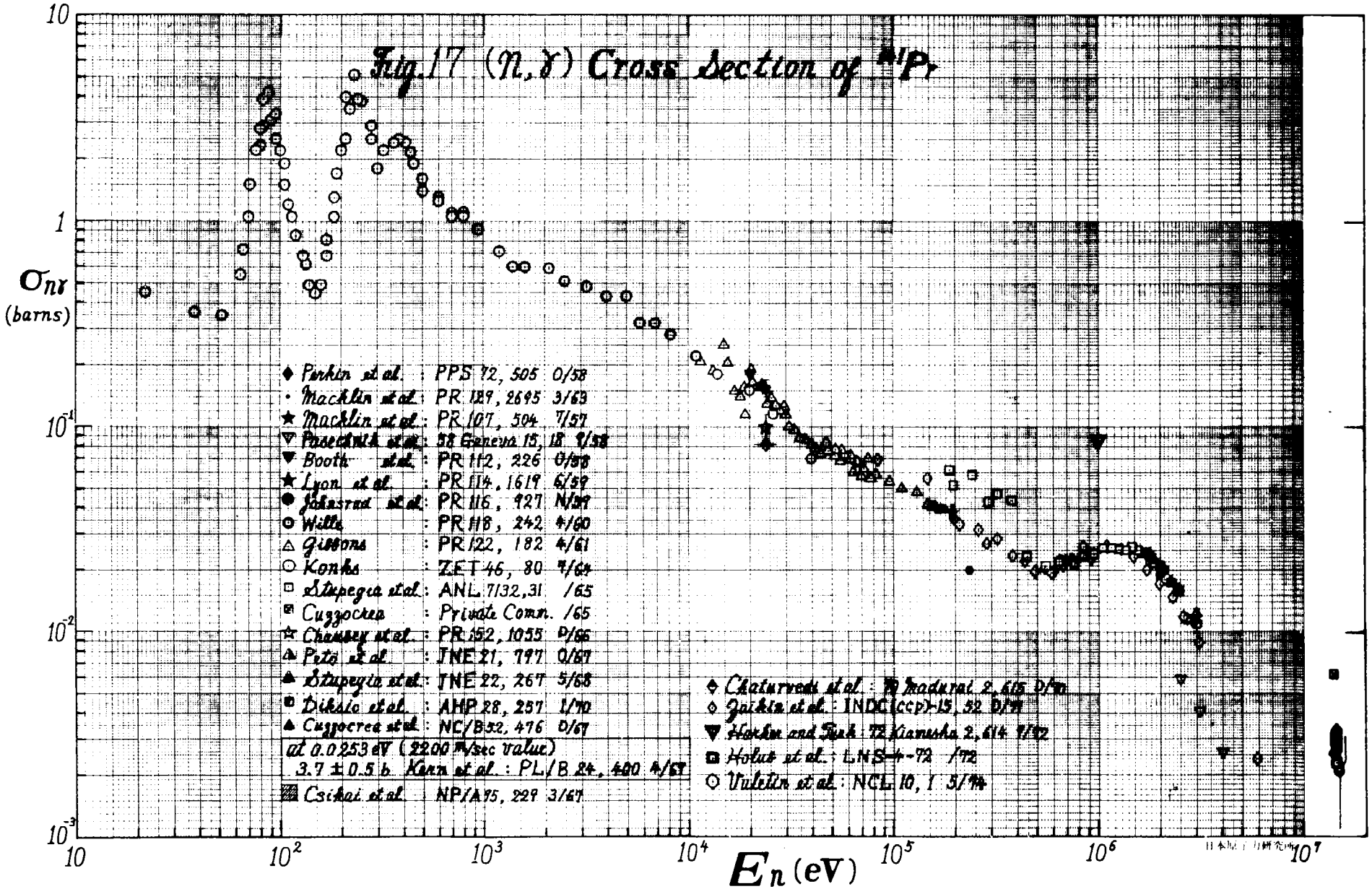


Fig.17 (n,γ) Cross Section of ⁴¹Pr
σnγ (barns)
En (eV)
10
1
10⁻¹
10⁻²
10⁻³
10
10²
10³
10⁴
10⁵
10⁶
10⁷
Perkin et al. : PPS 72, 505 0/58
Macklin et al. : PR 129, 2695 3/63
Macklin et al. : PR 107, 504 7/57
Poschitzki et al. : 58 Geneva 15, 18 9/58
Booth et al. : PR 112, 226 0/58
Lyon et al. : PR 114, 1619 6/59
Jakeman et al. : PR 116, 927 11/59
Wills : PR 118, 242 4/60
Gibbons : PR 122, 182 4/61
Konks : ZET 46, 80 7/64
Stupegia et al. : ANL 7132, 31 /65
Cuzzocrea : Private Comm. /65
Chaussey et al. : PR 152, 1055 0/66
Peto et al. : JNE 21, 797 0/67
Stupegia et al. : JNE 22, 267 5/68
Diksic et al. : AHP 28, 257 1/70
Cuzzocrea et al. : NC/B 52, 476 0/67
at 0.0253 eV (2200 m/sec value)
3.7 ± 0.5 b Kern et al. : PL/B 24, 400 4/67
Csikai et al. : NP/A 95, 229 3/67
Chaturvedi et al. : 70 Madurai 2, 615 0/70
Jaikin et al. : INDC(CCP)-15, 52 0/71
Harlan and Tsuk : 72 Kiamesha 2, 614 7/72
Holub et al. : LNS-4-72 /72
Vuletin et al. : NCL 10, 1 5/74

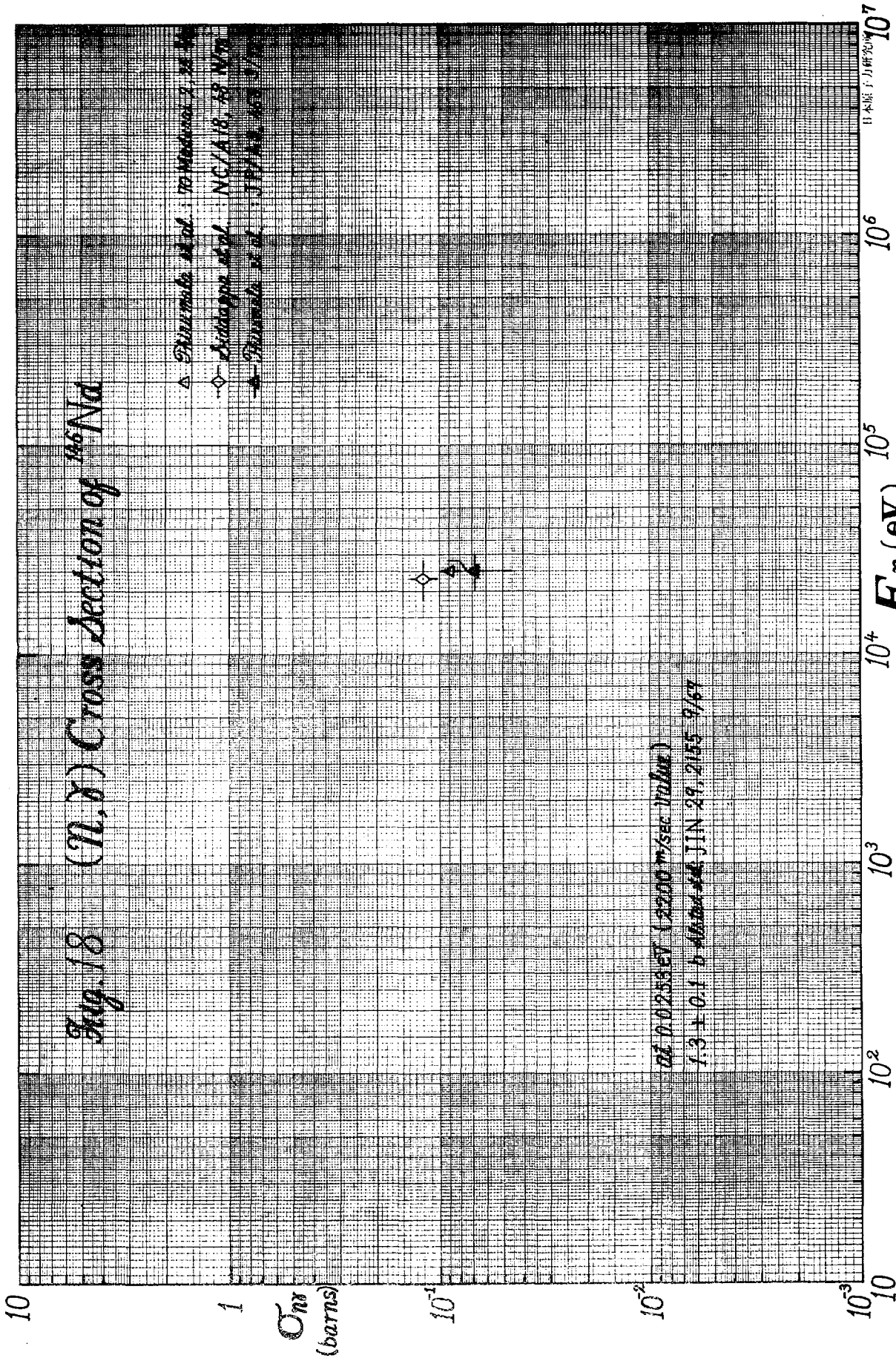


Fig. 18 (n, γ) Cross Section of 146Nd
Fujimoto et al.
Kikuchi et al. NC/A 18, 83 1963
Fujimoto et al. JPNS, 63
σ0 = 0.0253eV (2200 m/sec value)
1.3 ± 0.1 b Abbot et al. JIN 29, 2155 1967
σn (barns)
En (eV)
10
1
10⁻¹
10⁻²
10⁻³
10
10²
10³
10⁴
10⁵
10⁶
10⁷
日本原子力研究所

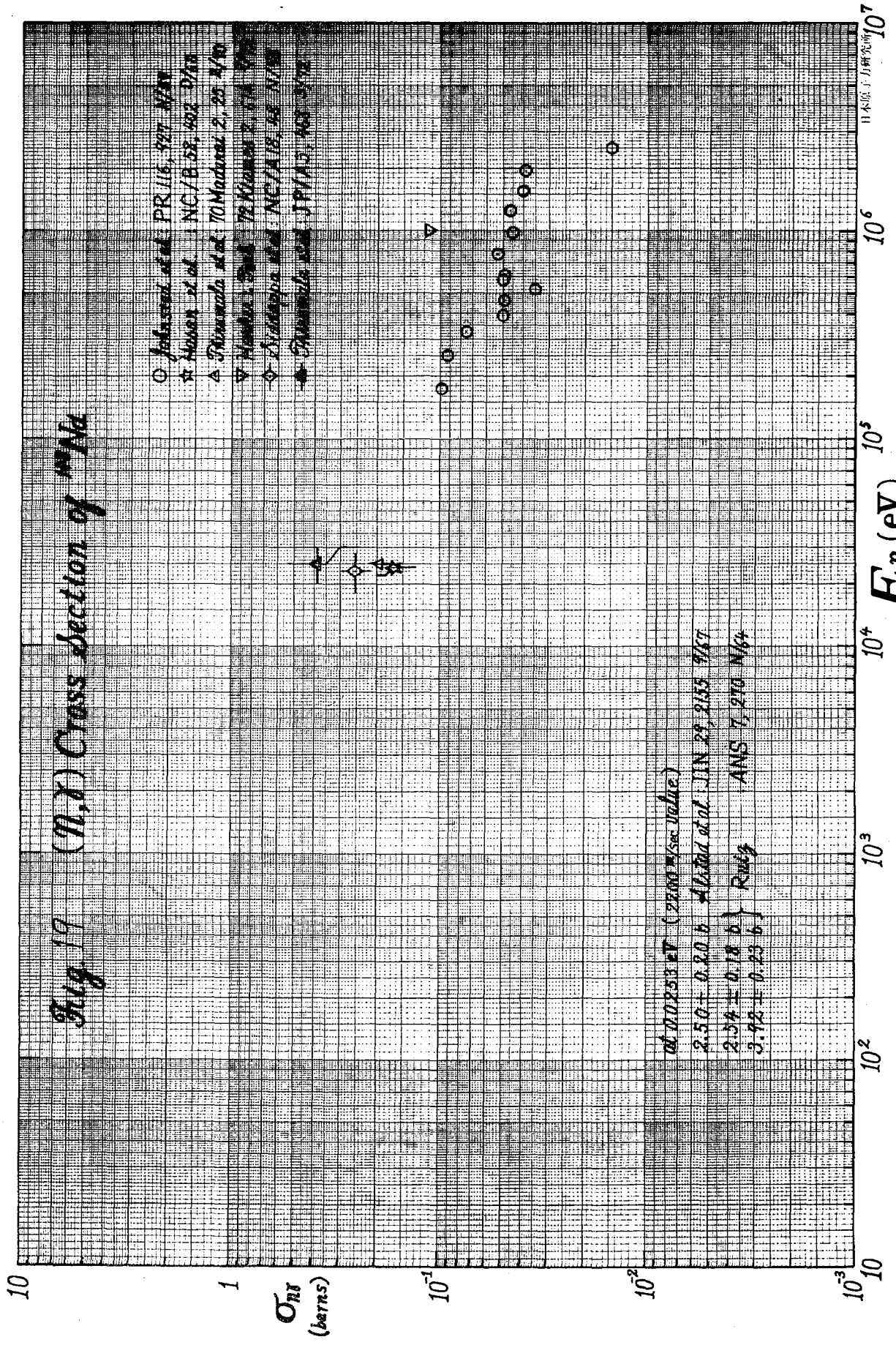


Fig. 19 (n,γ) Cross section of 23Na
Johnson et al. PR 116, 927 1/59
Lamer et al. NC/B 52, 402 2/68
Nimmala et al. TO Madison 2, 25 4/70
Hanna et al. TO Kiawah 2, 114 1/72
Kikuchi et al. NC/A 18, 48 11/70
Nemilov et al. JP/A5 408 3/72
σnγ (barns)
En (eV)
at 0.0253 eV (2200 m/sec Value)
2.50 ± 0.20 b
2.34 ± 0.18 b
3.42 ± 0.23 b
Allred et al. JIN 29, 2155 9/67
Rudy
ANS 7, 270 8/64
日本原子力研究所

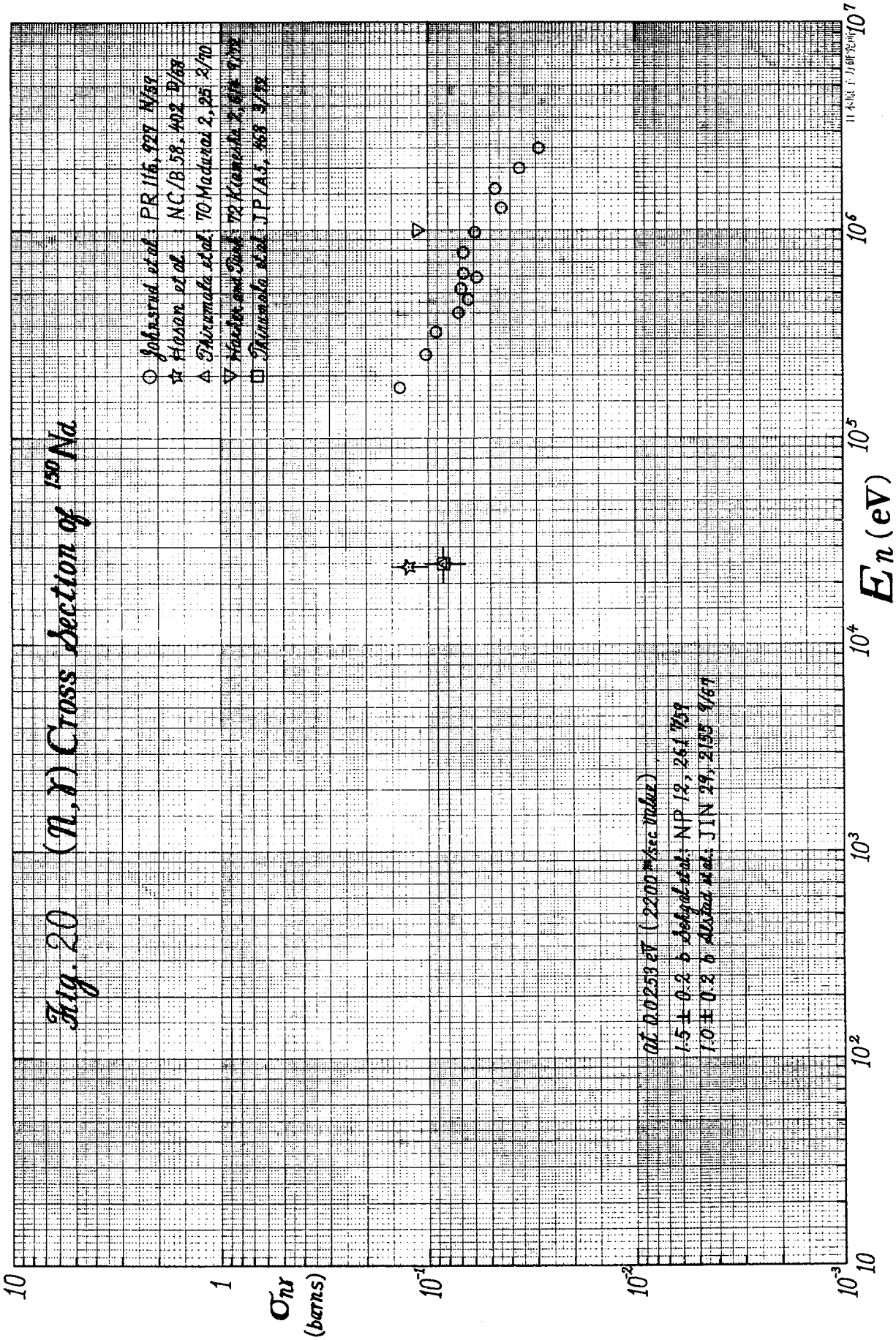


Fig. 20 (n, γ) Cross Section of 150Nd
Johnsrud et al. : PR 116, 927 11/59
Hasan et al. : NC/B 58, 402 2/69
Shiramada et al. : TO Madurai 2, 25 2/70
Hacken and Paul : TO Kiamida 2, 69 9/70
Shimoda et al. : JP/A.S. 468 3/72
at 0.0253 eV (2200 m/sec value)
1.5 ± 0.2 b Johnsrud et al. : NP 12, 261 7/59
1.0 ± 0.2 b Alstad et al. : JIN 29, 2195 9/67
σnγ (barns)
En (eV)
10
1
10⁻¹
10⁻²
10⁻³
10
10²
10³
10⁴
10⁵
10⁶
10⁷

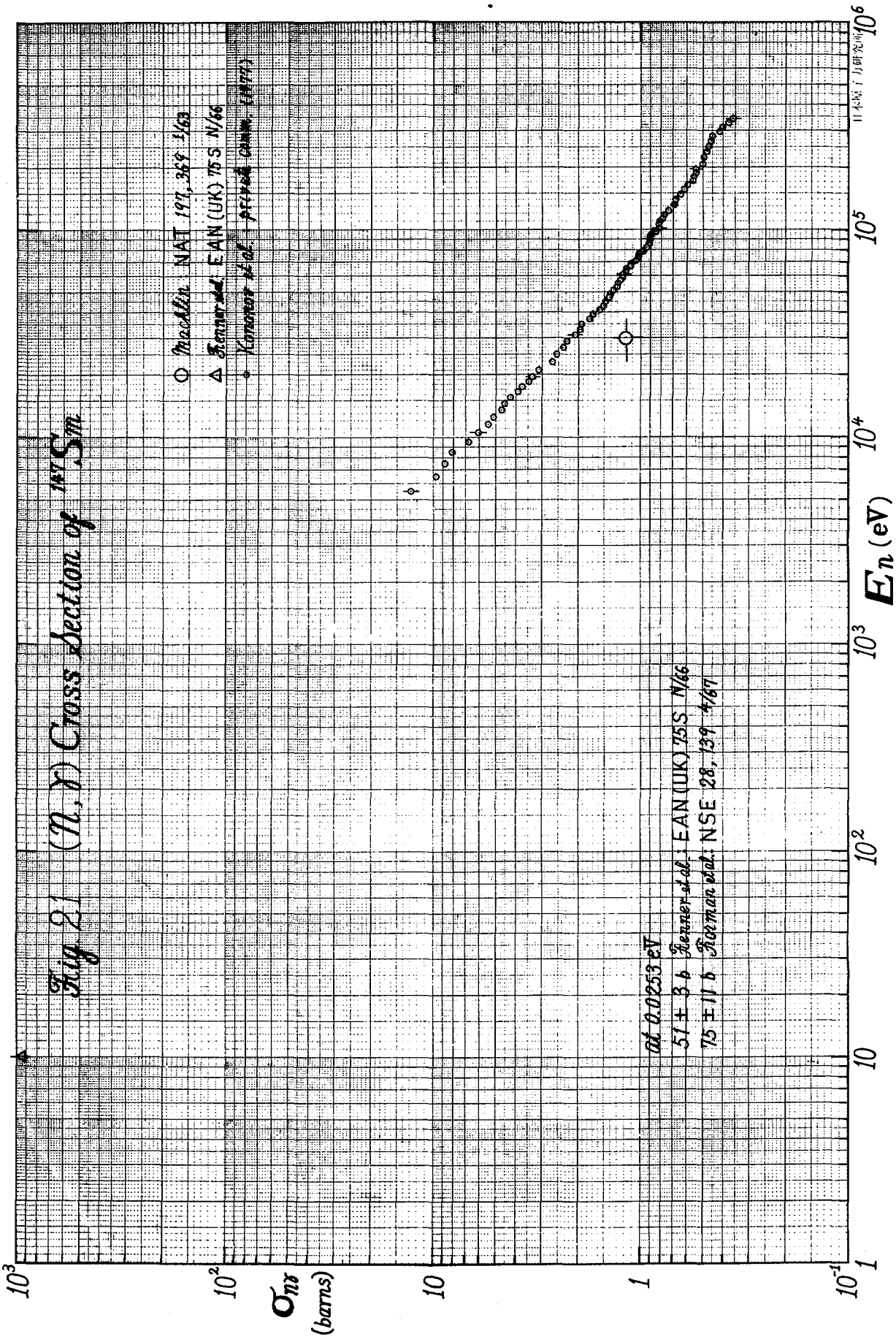


Fig. 21 (n, γ) Cross Section of 147Sm
○ Macklin NAT 127, 369 1/63
△ Renner et al. EAN (UK) 75 S N/66
Karaseva et al. private comm. (1977)
at 0.0253 eV
51 ± 3 b Renner et al. EAN (UK) 75S N/66
75 ± 11 b Ricman et al. NSE 28, 139 4/67
σnγ (barns)
En (eV)
10³
10²
10
1
10⁻¹
1
10
10²
10³
10⁴
10⁵
10⁶

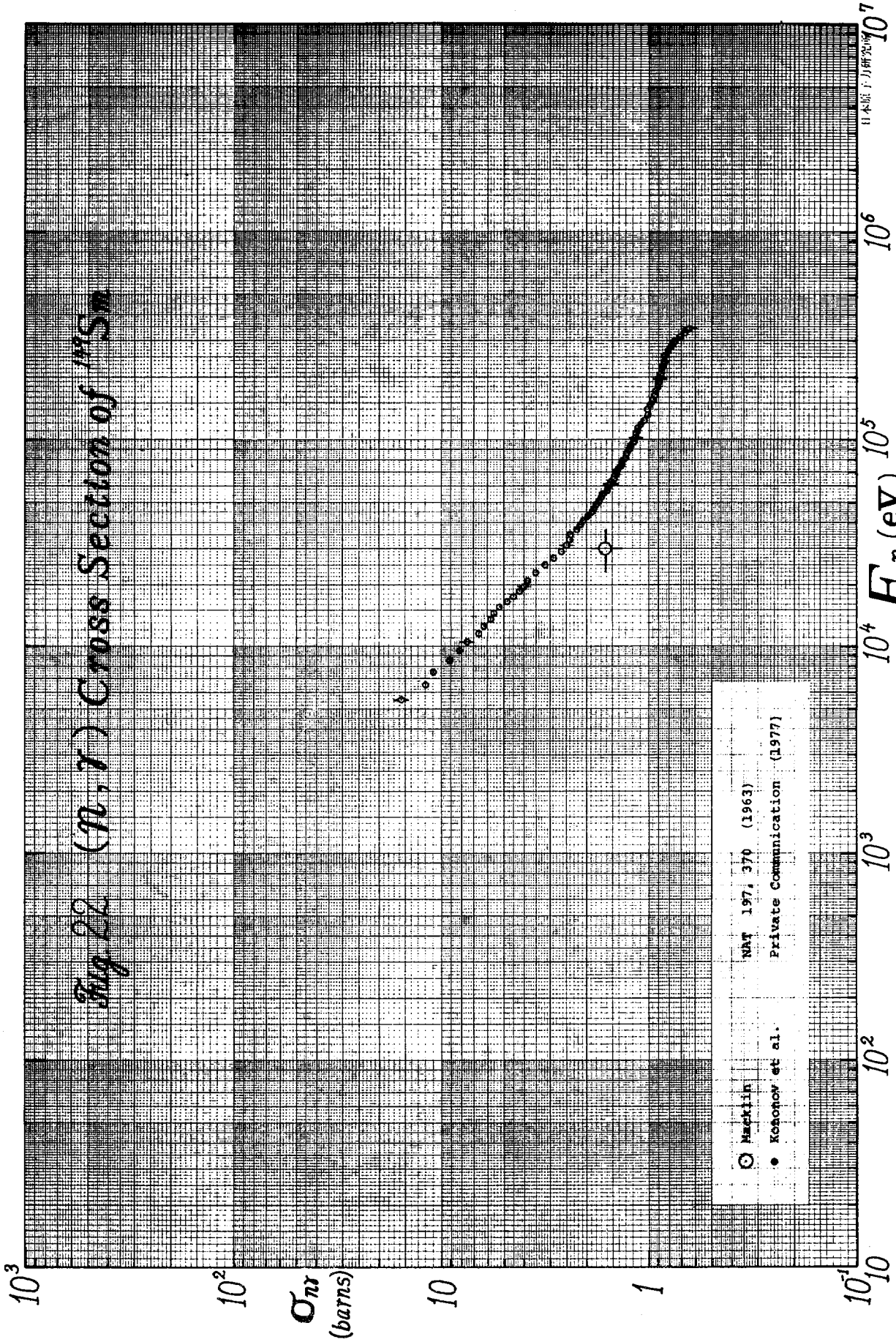


Fig. 22 (n, γ) Cross Section of 149Sm
Mackin NAT 197, 370 (1963)
Kononov et al. Private Communication (1977)
σnγ (barns)
En (eV)
10^3
10^2
10
1
10^-1
10
10^2
10^3
10^4
10^5
10^6
10^7

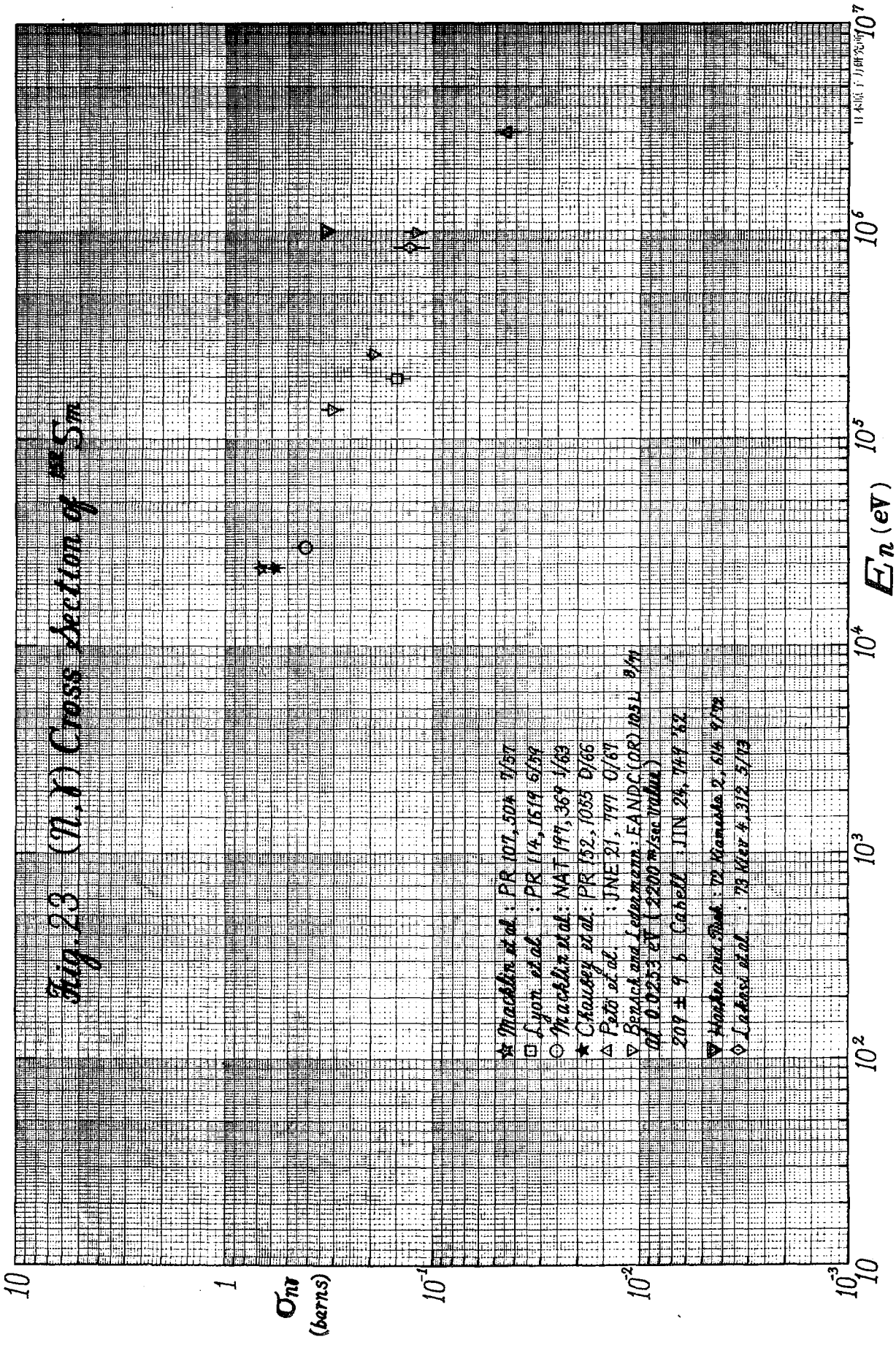


Fig.23 (n,γ) Cross Section of 149Sm
☆ Macklin et al. : PR 107, 504 7/57
□ Lyon et al. : PR 114, 1619 6/59
○ Macklin et al. : NAT 177, 369 1/63
★ Chaubey et al. : PR 152, 1053 10/66
△ Peto et al. : JNE 21, 797 10/67
▽ Benach and Lederman : EANDC(OR) 105L 8/69
at 0.0253 eV (2200 m/sec value)
209 ± 9 b Cabell : JIN 24, 747 '62
▼ Hacken and Stuart : 72 Kansas 2, 614 9/72
◇ Fukasi et al. : 73 Kiev 4, 312 5/73
σnγ (barns)
En (eV)
10
1
10^-1
10^-2
10^-3
10^2
10^3
10^4
10^5
10^6
10^7

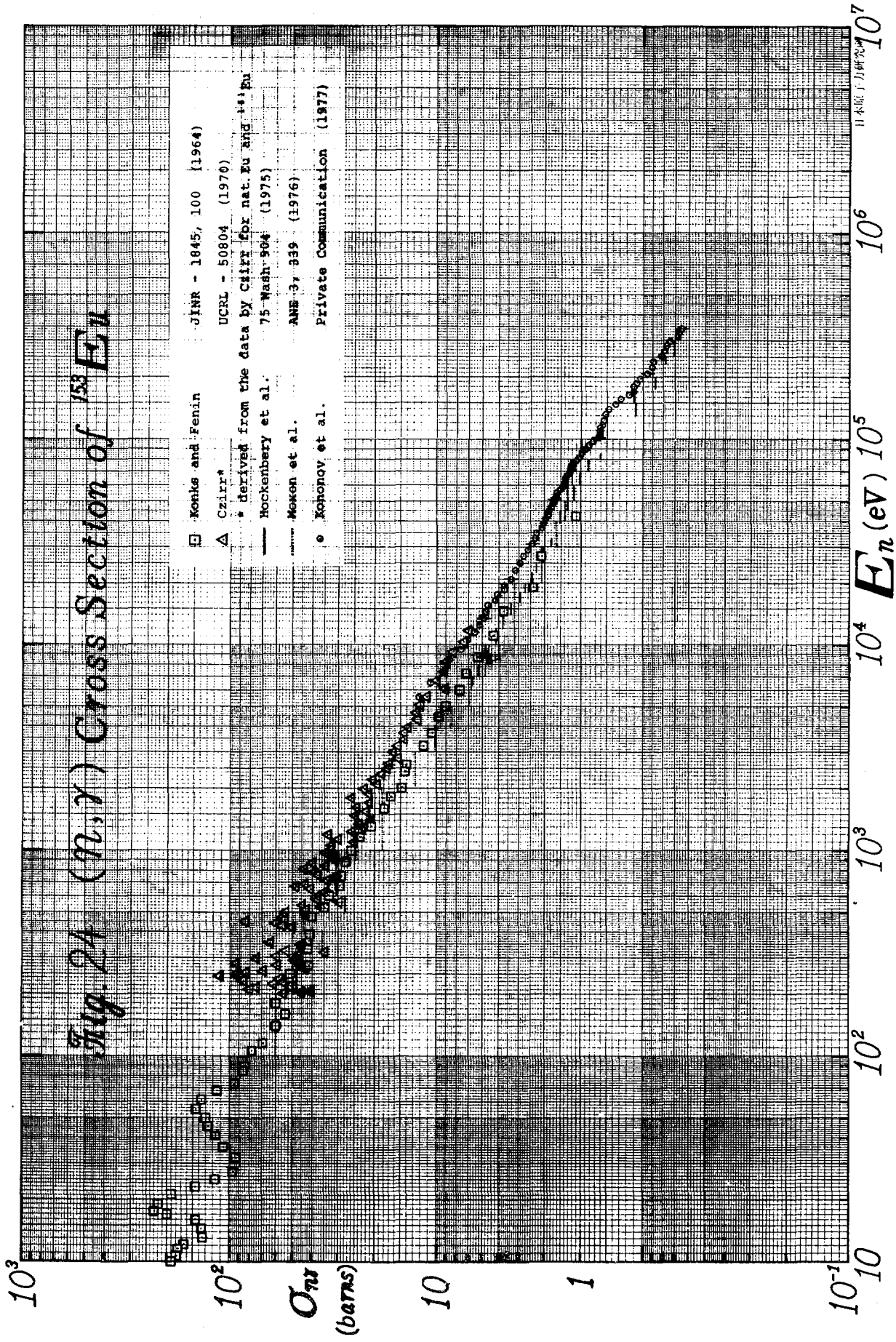


Fig. 24 (n, γ) Cross Section of 153Eu
Konks and Fenin JINR - 1845, 100 (1964)
Czirr* UCRL - 50804 (1970)
* derived from the data by Czirr for nat. Eu and 151Eu
Hockenbery et al. 75-Wash-904 (1975)
Moxon et al. ANE-3, 339 (1976)
Kononov et al. Private Communication (1977)
σnγ (barns)
En (eV)
10^3
10^2
10
1
10^-1
10
10^2
10^3
10^4
10^5
10^6
10^7

いばらき印刷納