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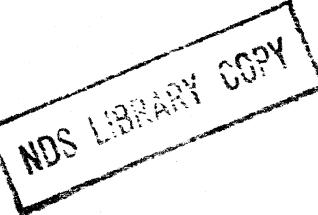
# Atomic Energy of Canada Limited

## FISSION PRODUCT DATA FOR THERMAL REACTORS

### PART I - CROSS SECTIONS

by

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Chalk River, Ontario

December 1969

Revised January 1972

AECL-3037

Part I

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A B S T R A C T

Part I is a compilation and evaluation of cross section measurements for all fission products with half-lives exceeding  $\sim 5$  h in the mass range 76 to 165. Resonance integrals, 2200 m/s cross sections and reactor spectrum cross sections are included. Resonance integrals computed from resonance parameters are included in the resonance data if available. A set of recommended cross sections and resonance integrals is also given for use in the FISSPROD data library.

APPLIED MATHEMATICS BRANCH  
Chalk River Nuclear Laboratories  
December, 1969

AECL-3037  
Part I

AECL-3037

Données relatives aux produits de fission pour les réacteurs thermiques

I<sup>ère</sup> Partie - Sections efficaces

par W.H. Walker

Résumé

Cette I<sup>ère</sup> Partie est une compilation et une évaluation de mesures de sections efficaces pour tous les produits de fission dont les demi-vies excèdent  $\sim 5$  h dans l'intervalle des masses allant de 76 à 165. Des intégrales de résonance, des sections efficaces de 2200 m/s et des sections efficaces de spectre sont incluses. Les intégrales de résonance calculées à partir de paramètres de résonance sont incluses dans les données de résonance, si elles sont disponibles. Des séries de sections efficaces et d'intégrales de résonance sont recommandées pour la bibliothèque des données FISSPROD.

L'Energie Atomique du Canada, Limitée

Chalk River, Ontario

Décembre 1969

The second printing has been corrected on pp. 10, 20, 25, 38, 50, 61 and 69. In addition an experimental result has been added on p.45.

Some results available since the original affect the recommended values. These are measurements of the  $^{96}\text{Zr}$  cross section by Ricabarra et al (Can J Phys.48, 2362/70), Fulmer et al (Nucl Sec Eng 46, 314 (1971) and Santry and Werner (to be published) and the results of mass spectrometric measurements reported by Higatsberger (SGAE G-14/1969). The new recommended values are:

<u>Nuclide</u>	<u><math>\sigma^0</math> (barns)</u>	<u>I (barns)</u>
40-Zr-96	0.020	4.8 <sup>1</sup>
62-Sm-147	60	no change
62-Sm-148	3.6	25
64-Gd-154	no change	300
64-Gd-156	no change	no change
66-Dy-160	62	975
66-Dy-161	580	1000 <sup>2</sup>
66-Dy-162	160	2450 <sup>2</sup>
66-Dy-163	no change	no change <sup>2</sup>

<sup>1</sup> The large ratio of  $I/\sigma^0$  implies that the main resonance, at 300 eV, is p-wave.

<sup>2</sup> The two measured values are very different. Recommended value is from resonance parameters.

1. INTRODUCTION

1.1 Estimates of Fission Product Absorption at Chalk River

There has been a continuing interest at Chalk River in accurate estimates of fission product absorption dating back to 1951 (Hurst), then proceeding to the inclusion of  $\beta$ -decay hold-up and secondary (capture) products (Walker, 1956), the representation of fission product capture by pseudo-fission products (Hurst (1957); Hurst et al (1958)) and the inclusion of epithermal absorption (Walker, 1960). The last report and two subsequent extensions (Walker, 1962, 1964) presented tabulations of both yields and cross sections, but also calculated yields for fixed pseudo-fission product cross sections. With the acquisition of the G-20 computer at Chalk River it was felt that a more detailed fission product representation was possible which could be used to check experimental results as well as the range of validity of various simplified representations such as the pseudo-fission products.

This program, FISSPROD, was originally prepared in 1963 and has now been written up (Lane, 1969). It has been tested regularly in the interval using an interim set of yields and cross sections based primarily

on the 1964 compilation (Walker). The purpose of the present compilation and evaluation is to present a definitive and well-documented set of data for FISSPROD which may be useful to others. The review covers yields from mass 76 to 160 for both thermal and fast neutron fission and cross sections and resonance integrals of the nearly 200 fission products with half-lives greater than about 5 hours that are treated specifically in FISSPROD.

#### 1.2 $\beta$ -Decay, Isomeric Transitions and Neutron Capture

There is little similarity between the nuclide concentrations of the fission fragments formed in the fission process itself and the nuclide concentrations found in reactor fuel near the end of its life. The fragments are almost all radioactive, with a most probable charge 3-4 units from the most stable charge for a given mass and a negligible probability of being stable. These undergo a "chain" of  $\beta$ -decays that transform them to long-lived or stable nuclides, and many of these subsequently capture a neutron. Only those transmutations involving the capture of a neutron are reviewed here. Of the remaining data, half-lives are taken from the "Table of Isotopes" (Lederer et al (1967)) and branching ratios

from Cenacchi's 1968 review of fission product data.

The nuclides and transmutations included in FISS-PROD are shown schematically in Fig. 1 and cross sections and resonance integrals are listed in Table 1. Several compilations and evaluation of cross section data have appeared since work on the FISSPROD library began and have been very useful as a check on the completeness of the data. These are:

(a) CINDA

A bibliographic listing which includes references for the types of data of interest here. Some of the references given in the present survey do not appear in CINDA, and some given there are not included here, the usual reason being that if a result has appeared more than once in the literature it is given only once in Table 1 (usually with its most recent reference). Also values from progress reports are omitted unless their inclusion is essential to a satisfactory evaluation.

(b) BNL-325, 2nd Edition, Supplement 2 (1964-66)

An extensive coverage of new thermal cross section and resonance parameter data with thorough documentation.

It does not cover the fission products completely since it is a supplement, but many entries in the 2nd edition and supplement 1 are included in supplement 2 for comparison with more recent results. Only a few resonance integral measurements are covered.

(c) Twenty-Two Hundred Meter per Second Neutron Absorption Cross Sections

A compilation by Goldman et al (1969) which gives a complete list of evaluated thermal cross sections from hydrogen to fermium. Its purpose is to present in one report, and at the same time to up-date, all BNL-325 thermal cross sections. References are given for the measurements on which each cross section evaluation is based.

(d) A Compilation of Nuclear Data on the Thermal Fission Products of  $U^{233}$ ,  $U^{235}$  and  $Pu^{239}$

This survey by Cenacchi (1968) includes the fission product decay chains in the diagrammatic form used by Katcoff (1960) with revised branching ratios and half-lives, and a set of yields, half-lives, thermal cross sections and resonance integrals taken from a variety of earlier compilations supplemented by the results of more recent measurements.

2. PRESENTATION OF DATA

2.1 Figure 1 (p. 93)

This "chart of the nuclides" indicates by arrows the  $\beta$ -decays, isomeric transitions and capture transmutations included in the FISSPROD library or program. The chart differs significantly from the standard representation in its treatment of short-lived isomers ( $T_{\frac{1}{2}} \lesssim 5$  hours), indicated in the chart by brackets. These do not appear in the FISSPROD library but are included in the program by assuming that they decay promptly by  $\beta$ -emission to the ground state of the daughter. Thus any branching which may occur in the decay of a short-lived isomer must be taken into account by modifying the production modes. For example, suppose a metastable state that is short-lived (and therefore omitted from the FISSPROD library) undergoes only isomeric decay. Because the program assumes that it  $\beta$ -decays instead, it is necessary for the purposes of FISSPROD calculations to make the effective cross section to the metastable state zero, while that to the ground state is equal to the sum of the cross sections to the ground and metastable states. As far as the calculations are concerned this metastable isomer is never formed,

so that its omission does not introduce any significant error in the calculation. Branching ratios which differ from 100% and 0% are discussed in the description of Table 1 under the heading "Columns 3 - 6".

2.2 Table 1 (pp 19-88)

Table 1 lists all fission products, including metastable isomers, from mass 76 to 165 having half-lives greater than  $\sim$  5 hours. In addition many of the short-lived nuclides with  $T_{\frac{1}{2}} < 5$  hours are included with their half-life and branching ratio (but without a cross section assignment) to clarify the choice of partial cross sections and simplify the problem of following capture/decay sequences.

The contents of the table are described below by columns:

Column 1 ("Reference")

Heading      Each nuclide is identified by an entry in the reference column of the form

Z - chemical symbol - A i ( $T_{\frac{1}{2}}$ )

where    i = m for metastable state  
          i = g for ground state

or is omitted where only the ground state is of interest.  $T_{\frac{1}{2}}$  is the half-life of radioactive nuclei in seconds (s), minutes (m), hours (h), days (d) or years (y).

References	Numbered entries are in order of date of publication. The journal notation follows CINDA usage for the more common journals, but is written out more fully for others (e.g., En Nucleare for Energia Nucleare). Report numbers are those given on the title page. The originating laboratories are listed in CINDA. Data from four conferences are also included, viz.
	PIC-1 - the 1955 Geneva Conference on the peaceful uses of Atomic Energy
	PIC-2 - the 1958 Geneva Conference
	Paris - the proceedings of the 1966 IAEA Conference on Nuclear Data for Reactors held in Paris (2 vols.)
	NBS Spec. Publ. 299 - the 1968 Washington Conference on Neutron Cross Sections and Technology (2 vols.).
Resonance Parameters	Indicates values of the thermal contribution and resonance integrals calculated from published resonance parameters. The reference BNL-325 alone indicates the five-part 2nd supplement to the 2nd edition (1964-1966). Earlier versions of BNL-325 are indicated by a bracketed date. Other sources are indicated by journal reference without authors.

Column 2 ("Method")

Entries here indicate the general method used to obtain the data. These are:

Act	By activation using either $\beta$ - or $\gamma$ -counting, with or without cadmium-shielded samples.
Crys Spec	From total cross section measurement at 2200 m/s using a crystal spectrometer.

Mass Spec	From mass spectrometric comparison of irradiated and unirradiated samples.
Pile Osc	From pile oscillator comparison of the unknown absorber to a standard. Thermal and epithermal absorption can be differentiated by measurements in neutron fluxes with different epithermal components.
Pulsed n	From rate at which neutrons injected in a pulse in a volume containing the unknown absorber disappear.
React	From reactivity measurements using change in critical height or period of a calibrated test reactor.
t of f	From total cross section measurement at 2200 m/s using a fast chopper.

Columns 3-6 (Cross Sections and Resonance Integrals)

The Westcott convention (Westcott et al, 1958) is used throughout with modified notation.

- Cross Section  $\hat{\sigma}$  effective cross section in a flux given by  $nv_0$ . ( $n$  is the total neutron density and  $v_0 = 2200$  m/s)
- $\hat{\sigma}$  the cross section at 2200 m/s
- $g\hat{\sigma}$  the  $nv_0$  cross section in a Maxwellian flux. Although cadmium difference values include the contribution of the epithermal spectrum below the cadmium cutoff, this is small compared to  $g\hat{\sigma}$  if there are no resonances near the Cd cutoff energy. These measurements are therefore designated as  $g\hat{\sigma}$  in the table since in practice the difference between  $\sigma_{th}$  and  $g\hat{\sigma}$  is much smaller than the errors.

$g$  is a function of  $T$ , where the latter is not usually specified accurately in the experiment. For a  $1/v$  absorber  $g = 1$  for all  $T$ .

I The reduced resonance integral, that is with the  $1/v$  component subtracted, taken over the whole epi-Maxwellian spectrum.

RI The resonance integral above the cadmium cutoff. The latter is assumed to be 0.55 eV unless otherwise indicated.

Subscripts	ab Absorption (from oscillator, reactivity time-of-flight and crystal spectrometer measurements, where the two latter are total cross sections corrected for scattering). ac Activation c Capture (from mass spectrometer measurements). t Total (absorption & scattering from time-of-flight and crystal spectrometer measurements).
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Isomers	(m) indicates cross section to metastable or (g) ground state respectively.
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An asterisk beside  $g$  or  $m$  ( $g^*$  or  $m^*$ ) indicates an effective cross section where a short-lived isomeric state formed in capture decays by both isomeric transition to the ground state and  $\beta$ -emissions. The total cross section  $\sigma(g) + \sigma(m)$  has to be reapportioned to take account of the fact that FISSPROD assumes that short-lived nuclides decay by  $\beta$ -emission only. The new cross sections are designated as  $\sigma(g^*)$  and  $\sigma(m^*)$  and  $\sigma(g^*) + \sigma(m^*) = \sigma(g) + \sigma(m)$ . For example, consider  $\text{Ge}^{76}$ , with  $g\sigma_{ab}(m) = 0.10$  b and  $g\sigma_{ab}(g) = 0.06$  b. Since  $\text{Ge}^{77m}$  has a half-life of 54 s it is not included in the data library, and the program assumes 100% decay to  $\text{As}^{77g}$ . Because 24% of  $\text{Ge}^{77m}$  decays isomerically to  $\text{Ge}^{77g}$  the  $\text{Ge}^{76}$  absorption cross sections must be corrected to give effective values for use in FISSPROD -

$$g\sigma_{ab}(g^*) = 0.06 + 0.24 \times 0.10 \text{ b} = 0.08_4 \text{ b};$$

$$\text{similarly } g\sigma_{ab}(m^*) = 0.07_6 \text{ b}.$$

Resonance  
Parameter  
Calculations

$\Delta\sigma_{ab}$ ,  $I_{ab}$  and  $I_{ab-unr}$  are calculated from published resonance parameters for the range of resonant energies indicated in the comments column. The computer program uses approximate formulae for  $\Delta\sigma_{ab}$  and  $I_{ab}$  derived on the assumption that the resonance energy is above the cadmium cut-off. The formulae are

$$\Delta\sigma_{ab} = \sum_i 4.09 g_i \Gamma_{ni} \Gamma_{\gamma i} \left(1 + \frac{2kT}{E_{ri}}\right) E_{ri}^{-5/2}$$

$$I_{ab} = \sum_i \frac{4090 g_i \Gamma_{ni} \Gamma_{\gamma i}}{\Gamma_i^2 E_{ri}^2} \left\{ 1 - \frac{.002}{\pi} \frac{\Gamma_i}{E_{ri}} \sqrt{\frac{\mu kT}{E_{ri}}} \right\}$$

where

$g_i$  is the statistical weight factor of the  $i$ th level.

$\Gamma_{ni}$  is the neutron partial width of the  $i$ th level, in meV.

$\Gamma_{\gamma i}$  is the radiative partial width of the  $i$ th level in meV.

$$\Gamma_i = \Gamma_{ni} + \Gamma_{\gamma i}$$

$E_{ri}$  is the neutron energy at the peak of the  $i$ th resonance in eV.

$kT$  is the mean energy of thermal neutrons in eV.

and

$\mu kT$  is the effective cut-off for the  $1/E$  epithermal spectrum. (here  $\mu$  is assumed equal to 5).

The expression for  $\Delta\sigma_{ab}$  is an approximation to the Breit-Wigner cross section at 2200 m/s and that for  $I_{ab}$  is adapted from an expression originally derived by Story (1957).

$I_{ab-unr}$  is the estimated contribution to  $I$  of unresolved resonances. The derivation assumes equal level spacing and s-wave capture only, the two assumptions

introducing errors of opposite sign which tend to cancel. A comparison between an earlier estimate using the same equation (Walker, 1960) and more recent results where more level parameters are available indicates that the formula tends to overestimate the unresolved contribution. It is assumed that the error in  $I_{ab-unr}$  is not greater than the estimated value.

When data from 3 or more levels are available the level spacing and reduced neutron width are deduced from the listed parameters. When only 1 or 2 levels are known a strength function is assigned, but if no levels are assigned to the nuclide  $I_{ab-unr}$  is assumed to be zero.  $I_{ab-unr}$  is obtained by integration over the energy range from the last resolved level to infinity, except where energies assigned to resonances of other isotopes measured in the same experiment indicate a wider energy coverage, from which it is inferred that there are no unidentified peaks over this range and the lower energy limit is raised accordingly.

Columns 7, 8 ("Ratios")

Ratios of  $I/g^\circ$  deduced from cadmium ratio measurements and  $\sigma(g)/\sigma(m)$  are listed here. All ratios are measured by activation so no subscript is included.

Column 9 ("Comments")

Renormalization    Most cross sections have been measured relative to some standard. Where the cross section of the standard is quoted

the measured cross sections have been renormalized to the values given below.

Standard	Value in Barns				
	$\frac{\sigma}{ab}$	$\frac{\Delta\sigma}{ab}$	$\frac{I}{ab}$	$\frac{RI}{ab}$	$\frac{I/\sigma}{}$
Harwell B(oron)	771				
B	759				
Co <sup>59</sup>	37.2		58.5	75	
Eu		4400			
Gd		49000			
Ho	64				
Au <sup>197</sup>	98.8		1513	1558	15.3

Other Corrections-The activation results of Seren et al (PR 72, 888) were corrected for natural abundance, half-life and decay scheme in addition to normalizing to the new standard.

-The cadmium ratio results of Harris et al (PR 72, 11) were corrected for resonance self-shielding when sufficient information on sample size was provided, and were also renormalized to the new standard.

- Other comments are intended to be self-explanatory.

#### Recommended Values (Columns 3-6)

The values recommended are obtained using the following guide lines unless there is a comment in the last column indicating a preferred value or another procedure.

- (1) If results are in reasonable agreement a weighted average is estimated, weighting inversely as the stated error.
- (2) If one value diverges markedly from the remainder it is assumed to be a flyer and is omitted in taking the average.
- (3) Since values of  $\Delta\sigma_{ab}^o$  are estimated only for real levels ( $E_r \geq 0.5$  ev) and take no account of the contribution of virtual levels it is not used in averaging, but serves only as a check (all measured thermal values should be  $\geq \Delta\sigma_{ab}^o$ ).
- (4) If  $\sigma_{ab}$  from a time-of-flight or crystal spectrometer measurement is significantly greater than all integral values and if it is obtained using an oxide sample, it is assumed that it is in error due to water contamination or small-angle scattering.
- (5) If measured integral values of I or RI are significantly less than I calculated from resonance parameters it is assumed to be a self-shielded value, (unless sufficient data is provided to indicate otherwise) and omitted in taking the average.
- (6) If only a measured upper limit is available the recommended value is half the upper limit rounded off (upwards) to the same number of significant figures.
- (7) If no measured thermal data is available, but resonance integrals give a value of  $\Delta\sigma_{ab}^o$ , then the recommended  $\sigma_{ab}$  is based on the latter. A comparison of  $\sigma_{ab}$  with  $\Delta\sigma_{ab}^o$  indicates that the ratio of the two varies from less than unity to  $\sim 10^3$ , with median values of 1 to 4 and average values from 1-10 depending on the magnitude of  $\Delta\sigma_{ab}^o$ . The two recommended values listed below are chosen to be roughly mid-way between median and average value.

Nuclide	Sr <sup>87</sup>	Pd <sup>105</sup>
Calculated $\Delta\delta_{ab}$	10.7	2.2
Recommended $\delta_{ab}$	40	10

- (8) If no data at all are available the recommended values are estimates based on the  $\delta_{ab}$  and  $I_{ab}$  values for nuclides in the same mass range, divided according to whether they are even Z-even N, even Z-odd N, or odd Z. As in the case discussed above values cover a wide range with a bias towards smaller values so that the median is significantly less than the average. The recommended values lie between these two. Most "unknowns" are radioactive, and in this case, the choice of  $\delta_{ab}$  is not important if  $\delta_{ab}\phi \ll \lambda$ . Only in the high mass range, do the average and median values become significant by this criterion, with a value of  $\sim 50,000$  b for even Z, odd N nuclei, and  $\sim 2000$  b for odd Z nuclei. The nuclei of interest are 47-h Sm<sup>153</sup>, 18-h Gd<sup>159</sup>, 15-d Eu<sup>156</sup> and 15.2-h Eu<sup>157</sup>. For the first three nuclides  $\sigma\phi \approx \lambda$  if  $\phi \approx 10^{14}$  n/cm<sup>2</sup> s and the "average" cross section is used.

In the case of Sm<sup>153</sup> a significant capture rate would decrease the equilibrium concentration of Sm<sup>153</sup> and enhance the yield of Sm<sup>154</sup> ( $g\delta_{ab} = 5$ b) relative to Eu<sup>153</sup> ( $\delta_{ab} = 450$  b); a significant difference between yields measured using high and low flux irradiations might be expected. Unfortunately the only measurement of this kind (Bidinosti et. al. (1958)) did not extend past mass 152. Comparison of other yield measurements give conflicting results or are inconclusive because of lack of information on irradiation conditions.

For Gd<sup>159</sup> the yield is so small (zero in FISSPROD) that the effect will not be significant.

In the case of Eu<sup>156</sup>, the decay product is Gd<sup>156</sup> ( $g\sigma_{ab} = 1.4$  b) while capture yields Gd<sup>157</sup> ( $\sigma_{ab} = 264,000$  b). Eu<sup>156</sup> is formed not only as a "primary" fission product but also from capture by Eu<sup>155</sup> ( $\Delta \sim 4,000$  b). The possibility that Eu<sup>156</sup> has a 2,000 b cross section therefore represents a significant uncertainty in neutron absorption in high flux reactors.

The "recommended" cross sections are:

TYPE	MASS, A								
	77	90	100	110	120	130	140	150	160
even-even				1.0b				3.0b	
even-odd	30b		5.0b		50b		50 kb		
odd Z	1.0b	5.0b	100b	10b	15b	30b	2 kb		

These appear inside brackets in Table 1 in the appropriate column. In view of the uncertainty in these values they are assumed to be reactor spectrum cross sections ( $\hat{\sigma}_{ab}$ ) and no estimate of the resonance integral is made.

### 2.3 Table 2 (pp 89-92)

Table 2 is a listing of the FISSPROD nuclide table.

Following the identifier (A,Z,E) (E=0 indicates a ground state, E=1 a metastable isomer)  $g\sigma(m)$  (or  $\hat{\sigma}(m)$ ),  $I(m)$ ,  $g\sigma(g)$  (or  $\hat{\sigma}(g)$ ) and  $I(g)$  are given in barns, and then the

decay constants for isomeric transition to the ground state (no change in Z) and for  $\beta$ -decay ( $Z \rightarrow Z+1$ ) to the isomeric and ground states. The latter are in units of  $10^{10} \text{ s}^{-1}$  ( $\lambda^*$ ) so that, for a flux of  $10^{14} \text{ n/cm}^2 \text{ s}$ ,  $\lambda^*/\phi$  is in barns and the listed values can be compared directly with cross sections. This permits a quick estimate of the relative importance of neutron capture and  $\beta$ -decay for any nuclide. The letter U following a thermal cross section or resonance integral indicates that the cross section is unknown and the value is the estimated one given in brackets in Table 1. In the FISSPROD program neutron absorption by nuclides with "U" thermal cross sections is summed separately from that for nuclides with known cross sections. One of the control parameters in FISSPROD permits all the cross sections of the "U" group to be increased or decreased by a common factor. Note that the large "unknowns" (estimated as 2,000 b or greater) do not have the "U" and therefore are independent of the parameter controlling the magnitude of the "U" cross sections. These are listed in the yield table with an indicator which assigns them to a "large unknown cross section" group.

### 3. ACKNOWLEDGEMENTS

I would like to thank Dr. Norman Holden of Knolls Atomic Power Laboratory for a careful revue of the original version of Table 1 which resulted in the elimination of many errors.

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TABLE 1 - FISSION PRODUCT DECAY AND CROSS SECTION DATA

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
32-Ge-76	Ffile osc	$g_{ab}^{\sigma}$	0.36 ± 0.07					Au std.
1. Pomerance, PR 88, 412 (52)	act	$\hat{g}_{ac(m)}$	0.137±0.011					$R_{cd}(CO) = 10(r/T_0) \approx 0.05$
2. Lyon, Eldridge, PR 107, 1056 (57)	act	$\hat{g}_{ac(g)}$	0.006					
3. des Mateosian, Goldhaber PR 108, 766 (57)	act	$g_{ac(m)}^{\sigma}$	0.087±0.015					By Cd diff. $R_{cd} = 3.25$ for both isomers. Yield of Ge-77g corrected for IT
4. Weigmann ZP 167, 549 (62)	act	$g_{ac(g)}^{\sigma}$	0.076±0.015					
5. Mannhart, Vonach ZP 210, 13 (68)	act	$g_{ac(m)}^{\sigma}$	0.12 ± 0.03					
Resonance Parameters BNL-325		$g_{ac(m)}^{\sigma}$	0.086±0.009			$\hat{g}(g)/\hat{g}(m)$	0.51±0.03	For $E_n > 3$ kev
					$I_{ab}$	0.060±0.006		
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RECOMMENDED		$g_{ab}^{\sigma}$	0.10	$I_{ab(m)}$	0.6			Res. int. estimated from $R_{cd}$ of ref. 3 assuming $r/T_0 = 0.06$ (Brookhaven reactor core)
		$g_{ab}^{\sigma}$	0.06	$I_{ab(g)}$	0.4			
		$g_{ab}^{\sigma}(g^*)$	0.08	$I_{ab(g^*)}$	0.52			
32-Ge-77m (54 s, IT 24%)								Not included in FISSPROD
32-Ge-77 (11.3 hr)		$\hat{g}_{ab}$	(30)					No cross section data available
33-As-77 (38.7 hr)		$\hat{g}_{ab}$	(30)					No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>34-Se-77</u>								
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	42 ± 4					Au std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	1.26±0.13	$I_{ab}$	13.4±1.3			
<u>RECOMMENDED</u>								
<u>34-Se-78</u>								
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	0.4±0.4					Au std.
2. Hans et al NP <u>20</u> , 183 (60)	act	$g_{ac}^o(m)$	0.12±0.04					
3. Kramer, Wahl NSE <u>22</u> , 376 (65)	act	$g_{ac}^o(m)$	0.36±0.04					Au std. $R_{cd}(Au)=3.6$ ( $r/T/T_o=0.21$ ) $I/g_o^o$ from $R_{cd}(Se-78)$
4. Weigmann ZP <u>167</u> , 549 (62)	act	$g_{ac}^o(m)$	0.40±0.04					
5. Mannhart, Vonach ZP <u>210</u> , 13 (68)	act	$g_{ac}^o(m)$	0.251±0.025					Au std.
6. Ricabarra et al CJP <u>46</u> , 2473 (68)	act	$\Delta_{ab}^o$	0.3±0.1	$I_{ab}$	6 ± 2			Resolved res., 380 to 9880 eV; max. contrib. from 380 eV (98%)
Resonance parameters BNL-325				$I_{ab-unr}$	0.1			
<u>RECOMMENDED</u>								
<u>34-Se-79m</u> (3.9 m, IT 100%)								
		$g_{ab}^o$	0.4		4.3			Assuming $g_o^o(g)/g_o^o(m) \sim 0.1$
								Not included in FISSLPROD

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>34-Se-79</u> (6.5 x 10 <sup>4</sup> yr.)		$\Delta \sigma_{ab}$	(30)					No cross section data available.
<u>34-Se-80</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\frac{g\sigma}{\sigma_{ac}}(g)$	0.46±0.10					Renormalized
		$\frac{\Delta \sigma}{\sigma_{ac}}(m)$	0.034±0.007					Renormalized
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act							
3. Pomerance PR <u>88</u> , 412 (52)	file osc	$g\sigma_{ab}$	0.61±0.06					Au std.
4. Apers et al JINC <u>5</u> , 23 (57)	act					$\frac{\sigma(m)}{\sigma(g)}$	0.130±0.004	
5. Keisch PR <u>129</u> , 769 (63)	act					$\frac{\sigma(m)}{\sigma(g)}$	0.21±0.01	
6. Bishop et al NP <u>60</u> , 241 (64)	act					$\frac{\sigma(m)}{\sigma(g)}$	0.130±0.013	Epithermal ratio, 0.19
7. Mannhart, Vonach ZP <u>210</u> , 13 (68)	act					$\frac{\sigma(m)}{\sigma(g)}$	0.129±0.007	Epithermal ratio, 0.29
8. Ricabarra et al CJP <u>46</u> , 2473 (68)	act					$I/g\sigma$	2.29±0.02	Au std.
Resonance parameters BNL-325								
RECOMMENDED								
		$\Delta \sigma_{ab}$	0.5±0.2	$I_{ab}$	0.5±0.2			
		$g\sigma_{ab}$	0.58	$I_{ab-unr}$	0.06			
				$I_{ab}$	1.3			

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1

Resolved res., 1965 to  
11850 ev; max. contrib.  
from 1965 ev (53%)

REFERENCE	METHOD	THERMAL		RESONANCE		SYMB.	RATIOS VALUE	COMMENTS
		SYMB.	VALUE	SYMB.	VALUE			
<u>34-Se-82</u>								
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^{\sigma}$	$2.1 \pm 1.5$					Au std.
2. Mannhart, Vonach ZP <u>210</u> , 13 (68)	act	$g_{ac}^{\sigma(m+q)}$	$0.045 \pm 0.005$					
Resonance parameters BNL-325		$\Delta g_{ab}^{\sigma}$	$0.04 \pm 0.02$	$I_{ab}$	$0.08 \pm 0.04$			Resolved res., 6580 to 26550 ev; max. contrib. from 6580 (60%)
<u>RECOMMENDED</u>								
<u>35-Br-81</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{g}_{ac}^{(g*)}$	$2.2 \pm 0.4$					Renormalized
2. Reynolds PR <u>79</u> , 789 (50)	mass spec	$\hat{g}_c^{\sigma}$	$\sim 1.7$					Rel. to Br-79 assuming $\hat{g}_c^{(Br)} = 8$ b
3. Lyon NSE <u>8</u> , 378 (60)	act	$\hat{g}_{ac}^{(g*)}$	4.1					$R_{cd}(Co) = 10(x/T_0)^{-0.05}$
4. Emery JINC <u>27</u> , 903 (65)	act	$g_{ac}^{(g*)}$ $g_{ac}^{(m+q)}$	$3.23 \pm 0.20$ $\sim 3.6$	$RI\{\hat{g}^{(g*)}\}$ $RI\{m+q\}$	$41.3 \pm 1$ $\sim 43.5$			
5. Ricabara et al CJP <u>46</u> , 2473 (68)	act	$\Delta g_{ab}^{\sigma}$	$1.9 \pm 0.2$	$I_{ab}$	$43 \pm 7$	$I/g_0^{\sigma}$	$21.0 \pm 0.4$	Au std.
Resonance parameters BNL-325				$I_{ab-unr}$	9			Resolved res., 100 to 205 ev; max. contrib. from 100 ev (60%)
<u>RECOMMENDED</u>								
<u>35-Br-82m</u> (6.2m, IT, 97%)								
								Not included in FISSPROD



REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>36-Kr-84</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	<2					
2. Kondaiah et al NP A120, 329 (68)	act	$g_{ab}^o(m)$	0.090±0.013					
Resonance parameters BNL-325 (60)		$\Delta \sigma_{ab}^o$	0.08±0.02	$I_{ab}$	3.1±0.8			
				$I_{ab-unr}$	5.3			
RECOMMENDED								
		$g_{ab}^o(m^*)$	0.07	$I_{ab}(m)$	6			
		$g_{ab}^o(g^*)$	0.03	$I_{ab}(g)$	2			
<u>36-Kr-85m</u> (4.4 hrs; IT 23%)								
<u>36-Kr-85</u> (10.76 yr)								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	<15					
RECOMMENDED								
		$\Delta \sigma_{ab}^o$	8					
<u>36-Kr-86</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	<2					
Resonance parameters BNL-325 (60)		$\Delta \sigma_{ab}^o$	~0	$I_{ab}$	~0			No resonances assigned to this isotope
RECOMMENDED								
		$g_{ab}^o$	1	$I_{ab}$	0			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u><b><math>^{37}\text{-Rb-85}</math></b></u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\Delta_{\text{ac}}$	0.7±0.14					
2. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta_{\text{ac}}$	1.0					Renormalized
3. Keisch PR <u>129</u> , 769 (63)	act	$g_{\text{ac}}^{\circ}$	0.51±0.04					$R_{\text{Cd}}(\text{Co})=10(\tau_{\text{r}}/\tau/T_0 \approx 0.05)$
4. Para, Bettini En Nucléare <u>14</u> , 228 (67)	act	$g_{\text{ac}}^{\circ}$	0.45±0.04					
5. Sims, Juhnke JINC <u>29</u> , 2853 (67)	act	$g_{\text{ac}}^{\circ}$	0.396±0.005	$I_{\text{ac}}$	24.7±1.7			Co std.
6. Ricabarra et al CJP <u>47</u> , 2031 (69)	act	$\Delta_{\text{ab}}^{\circ}$	0.14±0.02	$I_{\text{ab}}$	2.5±0.3	$I/g^{\circ}$	15.9±0.5	Au std.
Resonance parameters BNL-325				$I_{\text{ab-unr}}$	0.07			
<u><b><math>^{37}\text{-Rb-86}</math></b></u> (18.7 d)								
RECOMMENDED		$g_{\text{ab}}^{\circ}$	0.42	$I_{\text{ab}}$	7			No cross section data available
<u><b><math>^{37}\text{-Rb-87}</math></b></u> ( $5 \times 10^{10}$ yr)								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{\text{ac}}^{\circ}$	0.12±.025					
Resonance parameters BNL-325		$\delta_{\text{ab}}$	0.13±0.03	$I_{\text{ab}}$	2.3±0.5			Resolved res., 267 to 8550 eV; max. contrib. from 378 eV (80%)
RECOMMENDED		$g_{\text{ab}}^{\circ}$	0.12	$I_{\text{ab}}$	2.3			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>38-Sr-86</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^{\sigma}(m)$	1.3±0.25					Renormalized
2. Lyon et al NSE <u>8</u> , 378 (60)	act	$\Delta_{ac}^{\sigma}(m)$	1.73					$R_{cd}(Co)=10(r/T/T_0 \approx 0.05)$
3. Hans et al NP <u>20</u> , 183 (60)	act	$g_{ac}^{\sigma}(m)$	0.8±0.25					Au std.
4. Kramer, Wahl NSE <u>22</u> , 376 (65)	act	$g_{ac}^{\sigma}(m)$	1.0±0.1					$R_{cd}(Au)=3.6(r/T/T_0 \approx 0.021)$
5. Para, Bettini En. Nuclaire <u>14</u> , 228 (67)	act	$g_{ac}^{\sigma}(m)$	0.94±0.05					$I/g_{ac}^{\sigma}$ from $R_{cd}$ (Se-86)
6. Mannhart, Vonach ZP <u>210</u> , 13 (68)	act	$g_{ac}^{\sigma}(m)$	0.81±0.04					
Resonance parameters								
		$\Delta_{ab}^{\sigma}$	0.6±0.1	$I_{ab}$	2.7±0.5			Resolved res., 590 to 4480 eV; max. contrib. from 590 eV (85%)
				$I_{ab-unr}$	0.24			
RECOMMENDED								
		$g_{ab}^{\sigma}$	1.0	$I_{ab}$	3.0			It is assumed that $\sigma(g)/\sigma(m) \sim 0.1$ and that all Sr-87m decays by IT. (FISSPROD cannot deal with electron conversion)
<u>38-Sr-87m</u> (2.83 hr; IT 99.3%; EC 0.7%)								
<u>38-Sr-87</u>								
Resonance parameters BNL-325								
		$\Delta_{ab}^{\sigma}$	10.7±1.4	$I_{ab}$	98±13			Resolved res., 3.56 to 3700 eV; max. contrib. from 3.56 eV (97%).
				$I_{ab-unr}$	0.5			
RECOMMENDED								
		$g_{ab}^{\sigma}$	40	$I_{ab}$	1.00			Not included in FISSPROD

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>38-Sr-88</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}$	$(4.5 \pm 1.1) 10^{-3}$					
2. Roy et al CJC <u>36</u> , 731 (58) also PIC-2 <u>16</u> , 54 (58)	act	$\hat{\sigma}_{ac}$	$(5.8 \pm 0.6) 10^{-3}$					
Resonance Parameters BNL-325		$\hat{\sigma}_{ab}^o$	$\sim 0$	$I_{ab}$	$0.06 \pm 0.01$	$I_{ab-unr}$	$< 0.01$	Resolved res., 2780 to 23800 eV; max. contrib. from 2780 eV (65%)
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RECOMMENDED		$\hat{\sigma}_{ab}^o$	0.005	$I_{ab}$	0.06			
<u>38-Sr-89</u> (52 d)								
1. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$\hat{\sigma}_{ac}$	$0.42 \pm 0.04$					Supersedes CJP <u>35</u> , 1215(57)
RECOMMENDED		$\hat{\sigma}_{ab}^o$	0.42					
<u>38-Sr-90</u> (28.1 yr)								
1. Zeisel Acta Phys Aust <u>23</u> , 223 (66)	act	$\hat{\sigma}_{ac}$	$0.8 \pm 0.5$					
RECOMMENDED		$\hat{\sigma}_{ab}^o$	0.8					
<u>38-Sr-91</u> (9.67 hr)								
		$\hat{\sigma}_{ab}^o$	(5)					No cross section data available

REFERENCE	METHOD	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	RATIOS	COMMENTS
<u>39-Y-89</u>									
1. Bothe Z. Natf. <u>1</u> , 179 (46)	act	$g_{ac}^o(g^*)$	1.3						Ho std.
2. Seren et al PR <u>72</u> , 888 (47)	act	$\Delta_{ac}^o(g^*)$	$1.3 \pm 0.25$						Renormalized
3. Harris et al PR <u>79</u> , 11 (50)	act								
4. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g_{ab}^o$	$1.44 \pm 0.15$						Renormalized
5. Benoist et al JPR <u>12</u> , 584 (51)	pile osc	$g_{ab}^o$	$1.25 \pm 0.20$						
6. Rustad et al NYO-GEN-72-28, 64 (64)	t of f	$\delta_{ab}^o$	$1.28 \pm 0.01$						
Resonance parameters BNL-325		$\Delta_{ab}^o$	0.01	$I_{ab}$	$0.09 \pm 0.03$	$I_{ab-unr}$	0.03		
RECOMMENDED		$g_{ab}^o$	1.28	$I_{ab}$	0.3				
<u>39-Y-90</u> (64.0 hr)									
1. Smith, Reeder JCP <u>23</u> , 2108 (55)	act	$\Delta_{ac}^o$	<6.5						
RECOMMENDED		$\Delta_{ac}^o$	4						
<u>39-Y-91</u> (58.8 d)									
1. Milton, Grummitt CJP <u>38</u> , 1690 (60)	act	$\Delta_{ac}^o$	$1.4 \pm 0.3$						
RECOMMENDED		$\Delta_{ac}^o$	1.4						

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>39-Y-93</u> (10.2 hr)		$\hat{\sigma}_{ab}$	(5.0)					No cross section data available
<u>40-Zr-90</u>								Au std.
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	$0.10 \pm 0.07$	$RI_{ab}$	$0.19 \pm 0.03$			
2. Kachigashhev ANL-TRANS-168 (64)		$\Delta\sigma_{ab}$	0.02	$I_{ab}$	$0.15 \pm 0.04$			Resolved res., 3840 to 7900 eV; max. contrib. from 3840 eV (45%)
Resonance parameters BNL-325				$I_{ab-unr}$	0.06			
RECOMMENDED		$g_{ab}^o$	0.10	$I_{ab}$	0.15			
<u>40-Zr-91</u>								Au std.
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	$1.58 \pm 0.13$	$RI_{ab}$	$5.0 \pm 1.5$			
2. Feiner TANS <u>2</u> , 121 (59)	pile osc			$RI_{ab}$	$7.3 \pm 0.8$			
3. Kachigashhev ANL-TRANS-168 (64)		$\Delta\sigma_{ab}$	$0.3 \pm 0.1$	$I_{ab}$	$6.8 \pm 1.7$			Resolved res., 182 to 2730 eV; max. contrib. from 293 eV (60%)
Resonance parameters BNL-325				$I_{ab-unr}$	0.9			
RECOMMENDED		$g_{ab}^o$	1.6	$I_{ab}$	6.5			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>40-Zr-92</u>								
1. Pomerance PR <u>88</u> , 412 (52) Resonance parameters BNL-325	pile osc	$g_{ab}^o$	$0.26 \pm 0.08$	$I_{ab}$	$0.43 \pm 0.11$			Au std. Resolved res., 1860 to 6880 eV; max. contrib. from 1860 eV (40%)
RECOMMENDED				$I_{ab-unr}$	0.11			
<u>40-Zr-93</u> ( $1.5 \times 10^6$ yr)								
1. BNL-325 (58) Resonance parameters BNL-325 (58)	act	$\hat{g}_{ac}$	< 4	$I_{ab}$	22			Unpubl. ORNL data Unpubl. ORNL data. Single resonance at 110 eV.
RECOMMENDED		$\hat{g}_{ab}$	2		22			
<u>40-Zr-94</u>								Original assignment Zr-92
1. Seren et al PR <u>72</u> , 888 (47) 2. Pomerance PR <u>88</u> , 412 (52) 3. Lyon NSE <u>8</u> , 378 (60) Resonance parameters BNL-325	act	$\hat{g}_{ac}$	$0.4 \pm 0.2$					$R_{cd}(Co) = 10(\tau/\tau_0/T_0 \approx 0.05)$ Resolved res., 2260 to 7100 eV, max. contrib. from 2260 eV (75%)
RECOMMENDED		$g_{ab}^o$	$0.08 \pm 0.04$	$I_{ab}$	$0.20 \pm 0.05$	$I_{ab-unr}$	0.06	
		$\hat{g}_{ac}$	0.075					
		$\Delta g_{ab}^o$	0.02					
		$g_{ab}^o$	0.07	$I_{ab}$	0.26			

REFERENCE	METHOD	SYMB.	THEMAL VALUE	SYMB.	RESONANCE VALUE	SYMB.	RATIOS VALUE	COMMENTS
<u>40-Zr-95</u> (65d)		$\hat{\sigma}_{ab}$	(5)					No cross section data available
<u>40-Zr-96</u>								Original assignment Zr-94
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}$	$0.3 \pm 0.1$	RI <sub>ac</sub>	<10			
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act							
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^0$	$0.1 \pm 0.1$					
4. Lyon NSE <u>8</u> , 378 (60)	act	$\hat{\sigma}_{ac}$	$0.054 \pm 0.005$					
Resonance parameters BNL-325		$\Delta_{ab}^0$	$0.18 \pm 0.05$	I <sub>ab</sub>	$5.6 \pm 1.4$			
				I <sub>ab-unr</sub>	0.3			
RECOMMENDED		$g_{ab}^0$	0.2	I <sub>ab</sub>	6.0			
<u>40-Zr-97</u> (17.0 hr)		$\hat{\sigma}_{ab}$	(5)					No cross section data available
<u>41-Nb-95</u> (35d)								
1. Halperin, Stoughton, ORNL-3488, 9 (63)	act	$\hat{\sigma}_{ac}$	< 7					
RECOMMENDED		$\hat{\sigma}_{ab}$	4					
<u>41-Nb-96</u> (23.4 hr)		$\hat{\sigma}_{ab}$	(5)					No cross section data available



REFERENCE	METHOD	SYMB.	THermal VALUE	SYMB.	RESONANCE VALUE	SYMB.	RATios VALUE	COMMENTS
<u>42-Mo-98</u>								
1. Seren et al PR 72, 888 (47)	act	$\Delta_{ac}$	0.4±0.1					Renormalized
2. Pomerance PR 88, 412 (52)	pile osc	$g_{ab}^o$	0.4±0.4					Au std.
3. Dahlberg et al JNE 14, 53 (60)	act	$g_{ac}^o$	0.18±0.02					Au std.
4. Lyon NSE 8, 378 (60)	act	$\Delta_{ac}$	0.58					$R_{cd}(Co)=1.0 \quad (\tau/T_o \approx 0.05)$
5. Cabell JINC 21, 1 (61)	act	$g_{ac}^o$	0.136±0.003	$I_{ac}$	6.69±0.13	$I/g_o^o$	(49)	Au std.
6. Kachigashhev, Popov AE 15, 120 (63)	spectr			$I_{ab}$	6.3			
7. Baumann DP-817 (63)	act					$I/g_o^o$	56±6	Au std.
8. Sims, Juhnke JINC 29, 2853 (67)	act	$g_{ac}^o$	0.136±0.006	$I_{ac}$	7.10±0.42			Co std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	0.3±0.1	$I_{ab}$	7.9±2.5			Resolved res., 1.2 to 3300 ev; max. contrib. from 467 ev (43%)
				$I_{ab-unr}$	0.7			
RECOMMENDED		$g_{ab}^o$	0.14	$I_{ab}$	8.0			

NOTE: The ratio  $I/g_o^o$  of ref. 3 was obtained from a Cd ratio measurement and corrected for the known deviation of the epithermal spectrum from  $1/E$ . This ratio has been given most weight in determining the recommended value of  $I_{ab}$ . All recent thermal cross sections are significantly smaller than  $\Delta_{ab}^o$  from parameters. Agreement would be reasonable if all  $\Gamma_\gamma$  were made smaller by a factor of two, bringing  $\langle I_{ab} \rangle$  in line with values reported by Huyn et al (Nuclear Data for Reactors I, 559 (IAEA, Paris, 1966)) for other Mo isotopes. The corresponding decrease in  $I_{ab}$  would be about 25%.

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>42-Mo-99</u> (67 hr, 87% to Tc-99m)	$\hat{\Delta}_{ab}$	(5)						No cross section data available
<u>42-Mo-100</u>								Renormalized
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\Delta}_{ac}$	$0.45 \pm 0.10$	RI <sub>ac</sub>	< 10			
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act							
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^0$	$0.5 \pm 0.5$					Au std.
4. Cabell JNE <u>A12</u> , 172 (60)	act	$g_{ac}^0$	$0.199 \pm 0.005$	RI <sub>ac</sub>	$3.84 \pm 0.20$			Au std. (~3% res.)
5. Kachigashhev, Popov AE <u>15</u> , 120 (63)	spectr			RI <sub>ab</sub>	$1.32 \pm 0.20$			self-shielding
6. Baumann DB-817 (63)	act					$I/g_a^0$	$20.8 \pm 0.5$	Au std.
7. Ricabarra et al CJP <u>47</u> , 2031 (69)	act	$\Delta g_{ab}^0$	$0.3 \pm 0.1$	$I_{ab}$	$6.8 \pm 2.3$	$I/g_a^0$	$18.7 \pm 0.7$	Au std.
Resonance parameters BNL-325				$I_{ab-unr}$	1.5			Resolved res., 97 to 1670 eV; max. contrib. from 364 eV (84%)
RECOMMENDED		$g_{ab}^0$	0.20	$I_{ab}$	3.9			

NOTE: The uncertainty in  $\langle \Gamma_\gamma \rangle$  noted for Mo-98 also applies here, except that the effect on Lab of halving  $\Gamma_\gamma$  would be greater (~40%). The B filter measurements reported in ref. 6 indicate the possible presence of a higher energy resonance making a significant contribution to Lab.

REFERENCE	METHOD	THERMAL			RESONANCE			RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>43-Tc-99m (6.0 hr, IT 100%)</u>										
43-Tc-99 (2.1x10 <sup>5</sup> yr)		$\Delta_{ab}^o$	(5)							No cross section data available
1. Pomerance ORNL-1975, 31 (56)	pile osc	$g_{ab}^o$	19±2							Au std.
2. Pattenden PIC-2 16, 44 (58)	crys spec	$g_{ab}^o$	24.8±2.0							
3. Tattersall et al JNE Al2, 32 (60)	pile osc	$g_{ab}^o$	16±7	$I_{ab}$	60±20					Harwell B and Au std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	18.6	$I_{ab}$	176±30					Resolved res., 5.6 to 195 ev; max. contrib. from 5.6 ev (80%)
				$I_{ab-unr}$	20					
RECOMMENDED		$g_{ab}^o$	22	$I_{ab}$	200					
<u>44-Ru-100</u>										
1. Halperin et al ORNL-3832, 4 (65)	mass spec	$g_{C}^o$	5.84	$RI_C$	11.4					No resonances assigned to this isotope
Resonance parameters BNL-325		$\Delta_{ab}^o$	~ 0	$I_{ab}$	~ 0					
RECOMMENDED		$g_{ab}^o$	5.8	$I_{ab}$	9					
<u>44-Ru-101</u>										
1. Halperin et al ORNL-3832, 4 (65)	mass spec	$g_{C}^o$	5.23	$RI_C$	79.1					
Resonance parameters BNL-325		$\Delta_{ab}^o$	2.4±0.2	$I_{ab}$	66±4					Resolved res., 15.7 to 460 ev; max. contrib. from 15.7 ev (50%)
RECOMMENDED		$g_{ab}^o$	5.2	$I_{ab-unr}$	9					
				$I_{ab}$	76					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>44-Ru-102</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}$	$1.2 \pm 0.2$	$I_{ac}$	$4.7 \pm 0.7$	$I/g_a^o$	(3.1)	Renormalized
2. Katcoff, Williams JINC <u>7</u> , 194 (58)	act	$g_a^o_{ac}$	$1.5 \pm 0.2$	$RI_{ac}$	$4.14$	$I/g_a^o$	(3.4)	$I_{ac}$ deduced from quoted Cd diff.
3. Lantz ORNL-3832, 6 (65)	act	$g_a^o_{ac}$	1.23	$RI_{ac}$		$I/g_a^o$	$3.22 \pm 0.02$	Au std.
4. Ricabarra et al CJP <u>47</u> , 2031(69)	act	$\Delta g_{ab}^o$	$0.14 \pm 0.01$	$I_{ab}$	$5.4 \pm 0.4$	$I/g_a^o$	$3.22 \pm 0.02$	One resolved res. at 200 ev
Resonance parameters BNL-325								
RECOMMENDED								
<u>44-Ru-103</u> (39.6 d)		$\hat{\sigma}_{ab}$	1.3	$I_{ab}$	4.2			No cross section data available
<u>44-Ru-104</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}$	$0.7 \pm 0.4$	$RI_{ac}$	$< 10$			Renormalized
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act	$g_a^o_{ac}$	0.47	$RI_{ac}$	4.6			
3. Lantz, ORNL-3679, 11 (64)	act	$\Delta g_{ab}^o$	$\sim 0$	$I_{ac}$	$\sim 0$			No resonances assigned to this isotope
Resonance parameters BNL-325								
RECOMMENDED								
<u>44-Ru-105</u> (4.44 hr)		$g_a^o_{ab}$	0.47	$I_{ab}$	4.4			Double capture in Ru <sup>104</sup>
1. Sharma Nuovo Cim <u>17</u> , 687 (60)	act	$g_a^o_{ac}$	$0.30 \pm 0.03$					Renormalized to $\sigma(Ru-104) = 0.47$
RECOMMENDED								
		$g_a^o_{ab}$	0.30					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>44-Ru-106</u> (1.0 yr)								
1. Werner, Eastwood NSE <u>21</u> , 20 (65)	act	$g_{ac}^o$	$0.146 \pm 0.04$	$I_{ac}$	$2.03 \pm 0.60$			
RECOMMENDED		$g_{ab}^o$	0.15	$I_{ab}$	2.0			
<u>45-Rh-103</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^o$	$1.49 \pm 20$			$I/g^o$	5.0	Renormalized
2. Harris et al PR <u>79</u> , 11 (50)	act							Corrected for resonance self-shielding
3. Harris et al PR <u>80</u> , 342 (50)	pile osc	$\Delta_{ab}^o$	184					B std.
4. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g_{ab}^o$	$156 \pm 8$					Au std.
5. Cummins AERE R/R 2333 (57)	pile osc	$g_{ab}^o$	$1.47 \pm 1$					Harwell B std.
6. Rose et al PIC-2 <u>16</u> , 34 (58)	pile osc	$g_{ab}^o$	$1.47 \pm 5$					Harwell B std.
7. Fuketa, Otomo JAERI-1009 (60)	pile osc	$g_{ab}^o$	$1.64 \pm 11$					In std.
8. Walker, Copley CJP <u>44</u> 1985 (66)	act					$I/g^o$	$7.8 \pm 0.3$	
Resonance parameters BNL-325								Resolved res., 1.26 to 492 eV; max. contrib. from 1.26 eV (98%)
RECOMMENDED		$g_{ac}^o$	150	$I_{ab-unr}$	13			Use with Westcott $g^-$ values ( $g(20^\circ\text{C}) = 1.023$ )

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>45-Rh-105</u> (35 hr)								
1. Cuninghame et al JINC <u>24</u> , 1009 (62)	mass spec	$\Delta_{\text{C}}^{\text{o}}$	$\geq 1.8 \pm 10^4$					
2. Glendenin et al BAPS <u>9</u> , 179 (64)	act	$\Delta_{\text{ac}}^{\text{(m)}}$	$(60 \pm 12) 10^2$					Act. in CP5 reactor; Co std.
3. Glendenin, Schmitt NSE <u>20</u> , 298 (64)	act	$\Delta_{\text{ac}}^{\text{(g)}}$	$(149 \pm 21) 10^2$					Act. in TRIGA reactor; Co std.
4. Halperin et al ORNL-3994, 2 (66)	mass spec	$\Delta_{\text{ac}}^{\text{(g)}}$	$(137 \pm 15) 10^2$					Act. in TRIGA reactor; Co std.
5. Glendenin, Griffin NSE <u>29</u> , 147 (67)	act	$g_{\text{C}}^{\text{o}}$ $g_{\text{ac}}^{\text{(m)}}$	$(144 \pm 15) 10^3$ $(57 \pm 12) 10^2$	$\text{RI}_{\text{C}}$	$(1.67 \pm 30) 10^2$			Thermal spectrum ( $R_{\text{cd}}(\text{Au}) = 47$ )
<hr/>								
RECOMMENDED		$g_{\text{ab}}^{\text{o}}$	17000	$\text{RI}_{\text{ab}}$	17000			
<u>46-Pd-104</u>								
Resonance parameters BNL-325		$\Delta_{\text{ab}}^{\text{o}}$	0	$I_{\text{ab}}$	0			No resonances assigned to this isotope
<hr/>								
RECOMMENDED		$\Delta_{\text{ab}}^{\text{o}}$	(1.0)					
<u>46-Pd-105</u>								
Resonance parameters BNL-325		$\Delta_{\text{ab}}^{\text{o}}$	$2.2 \pm 0.2$	$I_{\text{ab}}$	$6.5 \pm 6$			Resolved res., 12 to 152 eV; max. contrib. from 13.2 eV (43%)
<hr/>								
RECOMMENDED		$g_{\text{ab}}^{\text{o}}$	(10)	$I_{\text{ab}}$	85			
<u>46-Pd-106</u>								
1. Lantz et al ORNL-3679, 10 (64)	mass spec	$g_{\text{C}}^{\text{o}}$	$0.29 \pm 0.03$	$\text{RI}_{\text{C}}$	$5.73 \pm 0.57$			
Resonance parameters BNL-325 (60)		$\Delta_{\text{ab}}^{\text{o}}$	$0.22 \pm 0.07$	$I_{\text{ab}}$	$5.5 \pm 1.3$			One resolved res. 287 eV
RECOMMENDED		$g_{\text{ab}}^{\text{o}}$	0.3	$I_{\text{ab}}$	5.6			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>46-Pd-107</u> (7x10 <sup>6</sup> yr)		$\Delta_{ab}$	(5)					No cross section data available
<u>46-Pd-108</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^o$	11.6±2.3					Renormalized
2. Meister Z Naturf <u>13a</u> , 820 (58)	act	$g_{ac}^o$	9.3±0.7					
3. Sehgal et al NP <u>12</u> , 261 (59)	act	$g_{ac}^o$	14.3±2.0					
4. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta_{ac}^o$	13.5					
Resonance parameters BNL-325		$\Delta_{ab}^o$	7.0±1.7	$I_{ab}$	210±50			
				$I_{ab-unr}$	30			
RECOMMENDED		$g_{ab}^o$	10	$I_{ab}$	240			
<u>46-Pd-109</u> (13.5 hr)		$\Delta_{ab}$	(5)					No cross section data available
<u>46-Pd-110</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^o(g)$	0.44±0.10					Renormalized
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act	$g_{ac}^o(m)$	<0.05					
3. Sehgal et al NP <u>12</u> , 261 (59)	act	$g_{ac}^o(g)$	0.19±0.03					
		$g_{ac}^o(m)$	0.037±0.006					
4. Mangal, Gill NP <u>41</u> , 372 (63)	act	$\Delta_{ab}^o$	0.25±0.08	$I_{ab}$	6.0±0.6			
5. Namboodiri et al JINC <u>28</u> , 1 (66)	act	$g_{ab}^o$	0.3	$I_{ab}$	6.0			
Resonance parameters BNL-325 (60)								
RECOMMENDED		$\Delta_{ab}$	(1.0)					
<u>46-Pd-112</u> (21 hr)								No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>47-Ag-109</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{\sigma}^o(m)$ $g_{\sigma}^o(g)$ $g_{\sigma}^o(g)$	$2.6 \pm 0.5$ 96±20					Renormalized
2. Harris et al PR <u>79</u> , 11 (50)	act							Renormalized
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{\sigma}^o$ $g_{\sigma}^o$ $g_{\sigma}^o$	$87 \pm 7$					Corrected for res. self-shielding
4. Seengal Ind.J.Phys. <u>31</u> 630 (57)	act							Au std.
5. Tattersall et al JNE <u>A12</u> 32 (60)	pile osc	$g_{\sigma}^o$ $g_{\sigma}^o$ $g_{\sigma}^o$	$113.5 \pm 13$ $92.5 \pm 2.0$	$I_{ab}$	$1870 \pm 200$			Harwell B and Au stds.
6. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta(m)$ $g_{\sigma}^o(m)$ $g_{\sigma}^o(g)$	$5.78$ $3.2 \pm 0.4$ $89 \pm 4$					Rcd (Co)=1.0( $r/r_0 \approx 0.05$ )
7. Keisch PR <u>129</u> , 769 (63)	act							
8. Bresesti et al JINC <u>29</u> , 2477 (67)	act	$g_{\sigma}^o(m)$ $\Delta^o$	$4.98 \pm 0.47$ $89 \pm 4$	$I_{ac}(m)$ $I_{ab}$ $I_{ab-unr}$	$77.7 \pm 2.1$ $1400 \pm 30$ $13$	$I(m)/g_{\sigma}^o(m)$ $I(m)/g_{\sigma}^o(m)$ $I(m)/g_{\sigma}^o(m)$	$16.1 \pm 0.4$ $(15.6)$	Au std.
9. Sims, Juhnke JINC <u>30</u> , 349 (68)	act							
Resonance parameters BNL-325								
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RECOMMENDED								
		$g_{\sigma}^o$ $g_{\sigma}^o$	92 3	$I_{ab}$ $I_{ab}(m)$	1450 50			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>47-Ag-110m</u> (253 d, IT 1.3%)								
1. Hart, Graham CJP <u>41</u> , 1321 (63)	act	$\Delta \sigma_{ac}$	82±11					Co std.
RECOMMENDED		$\Delta \sigma_{ab}$	82					
<u>47-Ag-111</u> (7.5 d)								
1. Druschel, Halperin ORNL-3994, 7 (66)	act	$g^o_{ac}$	3.2±2.0	$I_{ac}$	105±20			
RECOMMENDED		$g^o_{ab}$	3	$I_{ab}$	100			
<u>48-Cd-110</u>								
1. Baldock et al ORNL-3994, 1 (66)	mass spec	$\Delta \sigma_c$	11±1					
Resonance Parameters BNL-325		$\Delta \sigma_{ab}$	0.8±0.3	$I_{ab}$	31±6			One resolved res. at 90 eV
RECOMMENDED		$g^o_{ab}$	10	$I_{ab}$	6			
<u>48-Cd-111</u>								
1. Baldock et al ORNL-3994, 1 (66)	mass spec	$\Delta \sigma_c$	24.3±3					
Resonance Parameters BNL-325		$\Delta \sigma_{ab}$	0.6±0.1	$I_{ab}$	36±4			Resolved res., 27.7 to 234 eV; max. contrib. from 27.7 eV (53%)
RECOMMENDED		$g^o_{ab}$	23	$I_{ab}$	11			
					47			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>48-Cd-112</u>								
1. Baldock et al ORNL-3994, 1 (66)	mass spec	$\hat{\sigma}_c$	$2.2 \pm 0.5$					
Resonance parameters BNL-325		$\Delta\hat{\sigma}_{ab}$	$0.10 \pm 0.0$	$I_{ab}$	$8 \pm 2$			Two resolved res. at 67 and 227 ev; max. contrib. from 67 ev (60%)
				$I_{ab-unr}$	9			
RECOMMENDED		$\hat{\sigma}_{ab}$	2	$I_{ab}$	17			
<u>48-Cd-113</u>								
BNL-325 (66) data is used for the 2200 m/s cross section of Cd, except that Meadows has re-evaluated the data of Meadows and Whalen, obtaining $\hat{\sigma}_{ab}(Cd) = 2484$ b (NSE 31, 152 (68)). The value recommended for Cd-113 is based on $\hat{\sigma}_{ab}(Cd) = 2445$ b, assuming no significant contribution from other isotopes and a natural abundance for Cd-113 of 12.26%.								
RECOMMENDED		$\hat{\sigma}_{ab}$	19,940					Use with Westcott g and s values (ABCL-1101)

REFERENCE	METHOD	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	RATIOS	COMMENTS
<u>48-Cd-114</u>									
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}^{(m)}$	0.14±0.03						Renormalized
		$\hat{\sigma}_{ac}^{(g)}$	1.0±0.2						
2. Pearlstein, Milligan NSE <u>26</u> , 281 (66)	act	$g_{ac}^0(m)$	0.036±0.007	$RI(g_{ac})$	23.3±2.0				
		$g_{ac}^0(g)$	0.300±0.015						
		$\Delta\hat{\sigma}_{ab}$	0.17±0.05	I <sub>ab</sub>	9.6±2.6				
Resonance parameters BNL-325				I <sub>ab-unr</sub>	6.2				One resolved res. at 120 ev
<u>48-Cd-115m</u> (43 d, no IR)									
RECOMMENDED									
		$g_{ab}^0(m)$	0.04	I <sub>ab</sub> (m)	3				
		$g_{ab}^0(g)$	0.30	I <sub>ab</sub> (g)	20				
		$\hat{\sigma}_{ab}$	(5)						
<u>48-Cd-115</u> (2.23 d)									No cross section data available
<u>48-Cd-116</u>									
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}^{(m)}$	1.3±0.3	$RI_{ac}(m)$	< 10				Renormalized
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act	$g_{ac}^0(g)$	<0.008						
3. Mangal, Gill NP <u>36</u> , 542 (62)	act	$g_{ac}^0(m+g)$	0.077±0.013						
4. Decat, delMarmol Rad. Acta <u>6</u> , 29 (66)	act	$\Delta\hat{\sigma}_{ab}$	0	I <sub>ab</sub>	0				
Resonance parameters									No resonances assigned to this isotope
RECOMMENDED									
		$g_{ab}^0$	0.8	I <sub>ab</sub>	0				

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS SYMB.	VALUE	COMMENTS
		SYMB.	VALUE	SYMB.	VALUE			
49-In-115 (Absorption by Naturally-Occurring In)								
1. Pomerance PR 83, 641 (51)	pile osc	$g_0^o$ <sub>ab</sub>	199±10					Au std.
2. Cummins, Spurway AERE R/M-100 (57)	pile osc	$g_0^o$ <sub>ab</sub>	197±3					Harwell B std.
3. Tattersall et al JNE A12, 30 (60)	pile osc	$g_0^o$ <sub>ab</sub>	196±2	$I_{ab}$	3600±350			Harwell B and Au stds.
4. Fuketa, Otomo JAERI-1009 (60)	pile osc	$g_0^o$ <sub>ab</sub>	196±7					
5. Meadows, Whalen NSE 9, 132 (61)	pulsed n	$g_0^o$ <sub>ab</sub>	198±2					
6. Scoville et al TANS 5, 378 (62)	react.			$RI_{ab}$	3300±850			
7. Huttel, Liewers Kernenergie 6, 336 (63)	pile osc	$g_0^o$ <sub>ab</sub>	198.3±1.1					B std. Reported $g_0^o$ <sub>ab</sub> ; $g = 1.017$ assumed.
8. Vidal CEA-R2486 (64)	pile osc	$g_0^o$ <sub>ab</sub>	197.5±0.9	$I_{ab}^{(In)}$	3140±70			
Weighted mean of measurements					$3210±170$			
Contribution of In-115		$g_0^o$ <sub>ab</sub>	205.8±1.0	$I_{ab}$	3340±170			Assuming, for In-113, nat. abund.=4.28%, $g_0^o$ <sub>ab</sub> =11 b., $I_{ab} = 270$ b.
Resonance parameters BNL-325		$\Delta g_0^o$ <sub>ab</sub>	205.6±6	$I_{ab}$	3170±60			Assuming $g=1.017$ . Resolved res., 1.46 to 95 ev, max. contrib. from 1.46 ev(97%)
RECOMMENDED		$g_0^o$ <sub>ab</sub>	206	$I_{ab}$	3340			Use with Westcott g factor

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
49-In-115 (ACTIVATION of $^{54}\text{Mn}$ In-116m)								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{\text{ac}}^{\circ}$	144±14					Renormalized
2. Harris et al PR <u>79</u> , 11 (50)	act							
3. Sehgal Ind. J. Phys. <u>31</u> , 630 (57)	act	$g_{\text{ac}}^{\circ}$	135±10					
4. Myasishcheva et al JNE <u>5</u> , 230(57)	act	$g_{\text{ac}}^{\circ}$	162±10					
5. Meister Z.Naturf <u>13a</u> , 820 (58)	act	$g_{\text{ac}}^{\circ}$	157.6±4.4					
6. Walker et al CJP <u>38</u> , 57 (60)	act							Au std; corrected for non 1/E spectrum.
7. Jacks DP-608 (61)	act							
8. Brown et al TANS <u>5</u> , 376 (62)	act							
9. Walker, Jarvis AECL-1625 (62)	act							
10. Beckurts et al NSE <u>17</u> , 329 (63)	act	$g_{\text{ac}}^{\circ}$	162.7±2					
11. Jozefowicz Nukleonika <u>8</u> , 437 (63)	act	$g_{\text{ac}}^{\circ}$	157±6					
12. Baumann DP-817 (63)	act							
13. Stavisskii, Sherman Sov. A.E. <u>19</u> , 120 (65)	act	$g_{\text{ac}}^{\circ}$	155±15					
14. Ricabarra et al CJP <u>46</u> , 2473 (68)	act							
Weighted Mean		$g_{\text{ac}}^{\circ}$	157±1					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>50-Sn-116</u>		$\Delta\sigma_{ab}^o$	0.24±0.08	$I_{ab}$	14.8±1.5			
Resonance parameters BNL-325				$I_{ab-unr}$				Resolved res., 111 to 3400 eV; max. contrib. from 111 eV (90%)
RECOMMENDED		$g_{ab}^o$	(0.25)*	$I_{ab}$	15			
<u>50-Sn-117</u>		$\Delta\sigma_{ab}^o$	0.15±0.05	$I_{ab}$	9.9±0.9			
Resonance parameters BNL-325				$I_{ab-unr}$	2.5			Resolved res., 1.3 to 995 eV; max. contrib. from 38.8 eV (35%)
RECOMMENDED		$g_{ab}^o$	(1.4)*	$I_{ab}$	12			
<u>50-Sn-118</u>		$\hat{\sigma}_{ac}^o(m)$	.05±.01					
1. Seren et al, PR 22, 888 (47)	act.	$g_{ac}^o(m)$	~0.01					Renormalized to $T_1=250$ eV
2. Mihelich, Hill PR 72, 743 (50)	act.	$\Delta\sigma_{ab}^o$	0.11±0.04	$I_{ab}$	4.8±1.2			Resolved res., 45.8 to 770 eV; max. contrib. from 45.8 eV (30%)
Resonance parameters BNL-325				$I_{ab-unr}$	3.4			
RECOMMENDED		$g_{ab}^o(m)$	0.02	$I_{ab}(m)$	0.2			
		$g_{ab}^o(g)$	(0.8)*	$I_{ab}(g)$	8			
<u>50-Sn-119m</u> (250 d; IT, 100%)		$\hat{\sigma}_{ab}^o$	(5.0)					No cross section data available
RECOMMENDED		$\Delta\sigma_{ab}^o$	0.03±0.01	$I_{ab}$	2.1±0.2			
<u>50-Sn-119</u>				$I_{ab-unr}$	1.4			Resolved res., 6.2 to 948 eV; max. contrib. from 223 eV (20%)
Resonance parameters BNL-325								
RECOMMENDED		$g_{ab}^o$	(1.2)*	$I_{ab}$	3.5			

\* Thermal cross sections for Sn<sup>116</sup> and Sn<sup>118</sup> are based on an assumed value of 40 for the cross section ratio for the formation of low and high spin isomers,  $\sigma_{1/2}/\sigma_{11/2}$  and  $\sigma_{3/2}/\sigma_{11/2}$ , based on available data for Cd, Sn and Te isomeric cross sections. Assuming also a cross section of about 1 b for Sn<sup>114</sup>, the contribution to  $\sigma_{elec}$  (=0.63 b) from all even Sn isotopes is 0.33 b. The capture  $\gamma$ -ray yields of Groshev et al, JNE AL2, 57 (60) indicate that the three odd A isotopes make nearly equal contributions to  $\sigma_{elec}$ . Thus  $a_{117} \delta_{117} \sim a_{119} \delta_{119} \sim \frac{1}{3} (.63b - .33b) \sim .1$  b. On the basis of calculated values of  $\Delta\sigma_{ab}$  all  $g_{ab}^o$  would be ~ 1.0 b.

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>50-Sn-120</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}(g)$	0.22±0.04					Renormalized
Resonance parameters BNL-325		$\Delta\sigma_{ab}$	~ 0	I <sub>ab</sub>	0.8±0.1			Resolved res., 365 to 953 eV; max. contrib. from 427 eV (55%)
RECOMMENDED				I <sub>ab-unr</sub>	0.7			
<u>50-Sn-121m</u> (76 yr)								
		$\hat{\sigma}_{ab}$	~ 0					It is assumed that $\sigma(m)/\sigma(g) < 0.1$ and $\sigma(m)$ can be neglected.
		$g^0_{ab}(g)$	0.2	I <sub>ab</sub>	1.5			
<u>50-Sn-121</u> (27 hr)								
		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>50-Sn-122</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}(m)$	0.30±0.06					Renormalized
2. Sunyar, Goldhaber, PR <u>76</u> , 189 (49)	act			I <sub>ac</sub>	<10			
3. Mangal, Gill NP <u>41</u> , 372 (63)	act	$g^0_{ac}(m)$	0.206±0.031					
4. Tilbury, Kramer NSE <u>31</u> , 545 (68)	act	$g^0_{ac}(m)$	0.15±0.02	I <sub>ab</sub>	0.55±0.06			Au std.
Resonance parameters BNL-325		$\Delta\sigma_{ab}$	0.02	I <sub>ab-unr</sub>	0.05			Resolved res., 107 to 6850 eV; max. contrib. from 107 eV (50%)
RECOMMENDED								
		$g^0_{ab}(m)$	0.18	I <sub>ab</sub>	0.6			
		$g^0_{ab}(g)$	0.001					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>50-Sn-123m</u> (40 m; no IT)								Not included in FISSPROD
<u>50-Sn-123</u> (125 d)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>50-Sn-124</u>								Renormalized
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}^m$	$0.50 \pm 0.10$					Renormalized
		$\hat{\sigma}_{ac}^g$	$0.14 \pm 0.03$					
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act							
3. Mangal, Gill NP <u>41</u> , 372 (63)	act	$g_{ac}^m$	$0.125 \pm 0.019$	$I_{ac}$	$<10$	$\hat{\sigma}(g)/\hat{\sigma}(m+g)$	$0.0310 \pm 0.0168$	Au std.
4. Tilbury, Kramer NSE <u>31</u> , 545 (68)	act	$g_{ac}^m$	$0.13 \pm 0.02$					
Resonance parameters BNL-325		$\Delta g_{ab}$	$0.16 \pm 0.05$	$I_{ab}$	$10.7 \pm 0.6$			Resolved res., 62 to 950 eV; max. contrib. from 62 eV (99.5%)
				$I_{ab-unr}$	0.3			
RECOMMENDED		$g_{ab}^m$	0.13	$I_{ab}(m)$	9			
		$g_{ab}^g$	0.004	$I_{ab}(g)$	0.03			
<u>50-Sn-125 m</u> (9.7 m, no IT)								Not included in FISSPROD
<u>50-Sn-125</u> (9.4 d)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>50-Sn-126</u> ( $\sim 10^6$ y)		$\hat{\sigma}_{ab}$	(50)					No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>51-Sb-121</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}^{(g*)}$	6.6±1.3					Renormalized
2. Harris et al PR <u>79</u> , 11 (50)	act							
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	5.9±0.5					Corrected for resonance self-shielding
4. Sehgal et al NP <u>122</u> , 261 (59)	act	$g_{ac}^{o(m)}$	0.19±0.03					Au std.
5. Lyon NSE <u>8</u> , 378 (60)	act	$g_{ac}^o(g*)$	7.0±0.7					
6. der Mateosian, Sengal PR <u>125</u> , 1615 (62)	act	$g_{ac}^o(g)$	6					Au std.
7. Kardon, Kiss KFKI Kozle <u>14</u> 85 (66)	act							
8. Orvini, Maxia Energia Nucleare <u>14</u> , 541 (67)	act	$g_{ac}^o(g*)$	6.1±0.25					
Resonance parameters BNL-325								
RECOMMENDED								
<u>51-Sb-122m</u> (4.2 m; IT, 100%)								
		$g_{ab}^o$	6.2	$I_{ab}$	200			Not included in FISSPROD

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>51-Sb-122</u> (2.80 d; EC, 3%)		$\Delta \sigma_{ab}$	(10)					No cross section data available, 100% $\beta$ -decay is assumed in FISSPROD.
<u>51-Sb-123</u>								
1. der Mateosian et al PR <u>72</u> , 1271 (47)	act	$\Delta \sigma_{ac}^m$	$\sim 0.03$					Production of 1.3 m activity
2. Seren et al PR <u>72</u> , 888 (47)	act	$\Delta \sigma_{ac}^{g*}$	$2.6 \pm 0.5$					Production of 60 d activity
3. Harris et al PR <u>79</u> , 11 (50)	act					$I/g_J^0$	$\sim 63$	Corrected for resonance self-shielding
4. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_J^0_{ab}$	$4.1 \pm 0.3$					Au std.
5. Plummer TANS <u>10</u> , 226 (67)	act	$g_J^0_{ac}^{g*}$	$3.1 \pm 0.6$					
6. Orvini, Maxia Energia Nucleare <u>14</u> , 541 (67)	act	$g_J^0_{ac}^{g*}$	$4.03 \pm 1.16$					
7. Sims, Juhnke JINC <u>30</u> , 349 (68)	act	$g_J^0_{ac}^{g*}$	$4.44 \pm 0.09$	$I_{ac}$	$139.3 \pm 3.9$			
8. Ricabarra et al CJP <u>47</u> , 2031 (69)	act	$\Delta g_{ab}$	$2.7 \pm 0.8$	$I_{ab}$	$110 \pm 20$	$I/g_J^0$	$24.5 \pm 1.8$	Au std.
Resonance parameters BNL-325				$I_{ab-unr}$	12			Resolved res., 216 to 192 eV; max. contrib. from 21.6 ev (90%)
RECOMMENDED		$g_J^0_{ab}$	4.2	$I_{ab}$	130			Production of 1.3m Sb-124m is taken to be negligible.

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>51-Sb-124m</u> (93 s, IT 80%)								Not included in FISSPROD
<u>51-Sb-124</u> (60 d)								
1. Courtemanche et al CJP <u>44</u> , 2956 (66)	act	$\hat{\sigma}_{ac}$	$6.5 \pm 1.5$					
RECOMMENDED		$\hat{\sigma}_{ab}$	6.5					
<u>51-Sb-125</u> (2.7 Y; 20% to Te-125m)		$\hat{\sigma}_{ab}$	(10)					No cross section data available
<u>51-Sb-126</u> (12.5 d)		$\hat{\sigma}_{ab}$	(10)					No cross section data available
<u>51-Sb-127</u> (93 hr; 16% to Te-127m)		$\hat{\sigma}_{ab}$	(10)					No cross section data available
<u>51-Sb-128m</u> (9 hr; no IT)								Not included in FISSPROD

REFERENCE	METHOD	THERMAL			RESONANCE			RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>52-Te-122</u>										
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	$2.8 \pm 0.9$							Au std.
Resonance parameters BNL-325		$\Delta g_{ab}^o$	$2.4 \pm 0.8$	$I_{ab}$	$61 \pm 20$					Resolved res., 73 to 455 eV; max. contrib. from 73 eV (90%)
RECOMMENDED										
<u>52-Te-123</u>										
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	$406 \pm 30$							Au std.
Resonance parameters BNL-325		$\Delta g_{ab}^o$	$410 \pm 25$	$I_{ab}$	$5420 \pm 330$					Resolved res., 2.33 to 364 eV; max. contrib. from 2.33 eV (98%)
RECOMMENDED										
<u>52-Te-124</u>										
1. Hill PR <u>76</u> , 333 (49)	act	$\sigma_{ac}^{(m)}$	$\sim 5$							Rel. to $\sigma_{(Te-130)} = 0.008$ b
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	$6.5 \pm 1.3$							Au std.
3. Gvodez, Khazov JETP <u>2</u> , 439 (59)	act	$\sigma_{ac}^{(m)}$	$0.040 \pm 0.025$							Rel. to $\sigma_{(Hf-180)} = 10$ b
Resonance parameters BNL-325		$\Delta g_{ab}^o$	$\sim 0$	$I_{ab}$	$\sim 0$					No resonances assigned to this isotope
RECOMMENDED										
		$g_{ab}^o$	6.5							
		$g_{ab}^{(m)}$	0.04							

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>52-Te-125m</u> (53 d, IT 100%)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>52-Te-125</u>								
1. Pomerance PR <u>88</u> , 412 (52) Resonance parameters BNL-325	pile osc	$g_{ab}^o$	1.55±0.16	$I_{ab}$	13.1±1.3	$I_{ab-unr}$	4.7	Au std. Resolved res., 26.3 to 517 eV; max. contrib. from 26.3 eV (23%)
RECOMMENDED		$g_{ab}^o$	1.5	$I_{ab}$	18			
<u>52-Te-126</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}(g)$	0.80±0.16					Renormalized
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$\hat{\sigma}(m)_{ac}$	0.09±0.02					Renormalized
3. Mangal, Gill NP <u>36</u> , 542 (62)	act	$g_{ab}^o$	0.77±0.19					
4. Keisch PR <u>129</u> , 769 (63)	act	$g_{ac}^o(g)$	1.03±.15					
Resonance parameters BNL-325		$\Delta\hat{\sigma}_{ab}$	0.35±0.10	$I_{ab}$	8.5±2.0	$I_{ab-unr}$	1.4	One resolved res. at 200 eV
RECOMMENDED		$g_{ab}^o(m)$	0.1	$I_{ab}$	1	$I_{ab}(g)$	9	
		$g_{ab}^o(g)$	0.9					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>52-T<sub>e</sub>-127m</u> (109 d; IT>9%)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>52-T<sub>e</sub>-127</u> (9.4 hr)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>52-T<sub>e</sub>-128</u>								Renormalized
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}^{(m)}$	0.016±0.003					
		$\hat{\sigma}_{ac}^{(g)}$	0.13±0.03					Renormalized
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	0.3±0.3					
3. Mangal, Gill NP <u>36</u> , 542 (62)	act	$g_{ac}^o(g)$	0.178±0.027					
4. Bishop et al NP <u>60</u> , 241 (64)	act	$g_{ac}^o(m)$	0.016±0.001	$RI_{ac}^{(m)}$	$0.0774\pm 0.0040$			
5. Maxia et al NSE <u>35</u> , 88 (69)	act	$g_{ac}^o(g)$	0.200±0.008	$RI_{ac}^{(n)}$	$1.48\pm 0.09$			
		$\Delta g_{ab}^o$	~ 0	$I_{ab}$	~ 0			No resonances assigned to this isotope
Resonance parameters BNL-325								
RECOMMENDED								
		$g_{ab}^o(m)$	0.015	$I_{ab}^{(m)}$	0.08			
		$g_{ab}^o(g)$	0.20	$I_{ab}^{(g)}$	1.5			
<u>52-T<sub>e</sub>-129m</u> (34 d; IT, 64%)		$\hat{\sigma}_{ab}$	(50)					No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>52-Te-130</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_a^0(g)$ $\hat{\sigma}_{ac}^{(m)}$	0.21±0.04 $< 0.008$					Au std.
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^0$	0.5±0.25					
3. Mangal, Gill NP <u>36</u> , 542 (62)	act	$g_a^0(g)$	0.161±0.024					
4. Sehgal PR <u>128</u> , 761 (62)	act	$g_a^0(g)$	0.27±0.06					
5. Namboodiri JINC <u>28</u> , 1 (66)	act			$\hat{\sigma}_{(m)} / \hat{\sigma}(g)$	0.15±0.03			
6. Ricabarra et al CJP <u>46</u> , 2473 (68)	act			$\hat{\Lambda}_{(m)} / \hat{\Lambda}(g)$	0.056±0.003			
Resonance Parameters BNL-325		$\Delta_{ab}^0$	0.01	$I_{ab}$	0.17±0.17			
				$I_{ab-unr}$	0.01			
RECOMMENDED		$g_{ab}^0(m)$ $g_{ab}^0(g)$	0.02 0.20	$I_{ab}(m)$ $I_{ab}(g)$	0.04 0.36			No cross section data available
<u>52-Te-131m</u> (30 hr; IT 18%)		$\hat{\sigma}_{ab}^0$	(50)					No cross section data available
<u>52-Te-132</u> (78 hr)		$\hat{\sigma}_{ab}^0$	(50)					No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>53-1-127</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^o$	6.25±1.25					Renormalized
2. Harris et al PR <u>79</u> , 11 (50)	act	$\Delta_{ab}^o$						Corrected for resonance self-shielding
3. Harris et al PR <u>80</u> , 342 (50)	pile osc	$\Delta_{ab}^o$	9.9					B std.
4. Colmer, Littler Phil. Soc. <u>A63</u> , 1175 (50)	pile osc	$\Delta_{ab}^o$	8.0±0.4					Harwell B std.
5. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g_{ab}^o$	6.4±0.3					Au std.
6. Spivak et al PIC-1 <u>5</u> , 91 (55)	pile osc							
7. GrimeLand PR <u>86</u> , 937 (58)	act	$g_{ac}^o$	5.7					
8. Klimentov, Griaev JNE <u>9</u> , 20 (59)	react.							
9. Tattersall et al JNE <u>A12</u> , 32 (60)	pile osc	$g_{ab}^o$	6.6±0.3	$I_{ab}$	106±12			
10. Meadows, Whalen NSE <u>9</u> , 132 (61)	pulsed n	$\Delta_{ab}^o$	6.22±0.15					Harwell B and Au stds.
11. Józefowicz Nukleonika <u>8</u> , 437 (63)	act	$g_{ac}^o$	5.96±0.20					Mn std.
12. Robertson NP <u>71</u> 417 (65)	act	$g_{ac}^o$	6.17±0.20					
13. Stavisskii, Sherman Sov. AE <u>19</u> , 1210 (65)	act	$g_{ac}^o$	5.6±0.3					
14. Ricabarra et al CJP <u>46</u> , 2473 (68)	act	$\Delta_{ab}^o$	2.7±0.7	$I_{ab}$	143±15			Au std.
Resonance Parameters								Resolved res., 20.5 to 299 eV; max. contrib. from 37.8 ev (30%)
RECOMMENDED		$g_{ab}^o$	6.2	$I_{ab}$	150			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>53-I-128</u> (25.0m; EC 6%, $\beta^-$ 94%)								I-128 is not listed in FIISPROD. The program assumes 100% $\beta$ -decay (can not handle electron conversion). Since I-128 is formed only by capture in I-127, and both decay products have $\alpha$ , this assumption results in a negligible error
<u>53-I-129</u> (17 M yr)								
1. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$g^0_{ac}$	$27.5 \pm 2$	$RI_{ac}$	$36 \pm 4$			co std.
2. Block et al NSE <u>8</u> , 112 (60)	t of f	$g^0_{ab}$	$31 \pm 4$					
3. Pattenden et al NSE <u>17</u> , 371 (63)	t of f	$g^0_{ab}$	$28.0 \pm 2.0$					
Resonance Parameters BNL-325		$\Delta g^0_{ab}$	$0.13 \pm 0.03$	$I_{ab}$	$10 \pm 2$			Resolved res., 72.4 to 153 eV; max. contrib. from 72.4 eV (45%)
				$I_{ab-unr}$	12			
RECOMMENDED		$g^0_{ab}$	28	$I_{ab}$	23			
<u>53-I-130</u> (12.4 hr)								
1. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$\hat{g}^0_{ac}$	$18 \pm 3$					
RECOMMENDED		$\hat{g}^0_{ab}$	18					
<u>53-I-131</u> (8.05 d; 99.4% to $\chi e-131g$ )								
1. Kennett, Thode JINC 5, 253 (58)	mass spec.	$\hat{g}^0_{ac}$	$51 \pm 40$					
2. Halperin, Druschel ORNL-3488, 15 (63)	act	$g^0_{ac}$	$\sim 0.7$	$RI_{ac}$	$\sim 8$			
RECOMMENDED		$g^0_{ab}$	1	$I_{ab}$	8			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>53-I-133</u> (21 hr; 97% to Xe-133g)		$\Delta \sigma_{ab}$	(15)					No cross section data available
<u>53-I-135</u> (6.7 hr; 27% to Xe-135m)		$\Delta \sigma_{ab}$	(15)					No cross section data available
<u>54-Xe-128</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	< 5					Au std.
2. Tilbury, Kramer NSE <u>31</u> , 545 (68)	act	$g^0_{ab}(m)$	0.43±0.10					
Resonance parameters Paris I, 119 (66)		$\Delta \sigma$	≤ 1.6	$I_{ab}$	≤ 110			237 ev res. Isotope assignment uncertain.
RECOMMENDED		$g^0_{ab}(m)$	0.4			10		
		$g^0_{ab}(g)$	4.0			100		
<u>54-Xe-129m</u> (8.0 d; IT 100%)		$\Delta \sigma_{ab}$	(50)					No cross section data available
<u>54-Xe-129</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	45±15					Au std.
Resonance parameters Paris I, 119 (66)		$\Delta \sigma_{ab}$	8.0±0.3	$I_{ab}$	220 <sup>4</sup>			
RECOMMENDED		$g^0_{ab}$	40	$I_{ab}$	3.3			
					220			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>54-Xe-130</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\hat{\sigma}_c$	< 5					
2. Tilbury, Kramer NSE <u>31</u> , 545 (68)	act	$g_0^o(m)_{ab}$	$0.34 \pm 0.08$					Au std.
3. Kondaiah et al NP <u>A120</u> , 329 (68)	act	$g_0^o(m)_{ab}$	$0.495 \pm 0.170$					
Resonance parameters Paris I, 119 (66)		$\Delta_0^o_{ab}$	$\leq .25$	$I_{ab}$	$\leq 14$			228 ev res. Isotope assignment uncertain.
RECOMMENDED								
		$g_0^o(m)_{ab}$	0.4	$I_{ab}(m)$	1			
		$g_0^o(g)_{ab}$	4	$I_{ab}(g)$	12			
<u>54-Xe-131m</u> (11.8 d; IT, 100%)		$\hat{\sigma}_{ab}$	(50)					No cross section data available
<u>54-Xe-131</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\hat{\sigma}_c$	$120 \pm 15$					
Resonance parameters Paris I, 119 (66)		$\Delta_0^o_{ab}$	$66 \pm 3$	$I_{ab}$	$827 \pm 40$			Resolved res., 14.4 to 283 ev; max. contrib. from 14.4 ev (97%)
RECOMMENDED				$I_{ab-unr}$	5			
		$g_0^o_{ab}$	100*	$I_{ab}$	830			

\* Irradiations of ref. 1 in NRX. Assuming  $r/T/T_0 = 0.025$  and  $I_{ab} = 830$  b then  $g_0^o_{ab} = 120 - (2/\sqrt{\tau})(.025)(830) = 97$  b

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>54-Xe-132</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta_{\text{C}}$	< 5					
2. Tilbury, Kramer NSE <u>31</u> , 545 (68)	act	$g_{\text{ac}}^{\delta(\text{m})}$	0.53±0.10					Au std.
3. Kondaiah et al NP <u>A120</u> , 329 (68)	act	$g_{\text{ac}}^{\delta(g)}$	0.05±0.02					Au std.
Resonance parameters Paris I, 119 (66)		$g_{\text{ac}}^{\delta(\text{m})}$	0.03±0.005					
RECOMMENDED		$g_{\text{ab}}^{\delta(g)}$	0.415±0.045					
		$\Delta_{\text{ab}}^{\delta}$	0.01	$I_{\text{ab}}$	0.45±0.03			
				$I_{\text{ab-unr}}$	2.2			
<u>54-Xe-133m (2.26 d, IT, 100%)</u>								
<u>54-Xe-133 (5.27 d)</u>								
1. Kennett, Thode JINC 5, 253 (58)	mass spec	$\Delta_{\text{C}}$	188±89					
RECOMMENDED		$\Delta_{\text{ab}}$	190					
								No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>54-Xe-134</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	< 5					
2. Kondaiah et al NP <u>A120</u> , 329 (68)	act	$g_0^o(m)_{ac}$	0.0030					
		$g_0^o(g)_{ac}$	0.265±0.020					
Resonance parameters Paris I, 119 (66)		$\Delta \sigma_{ab}$	0.23±0.06	$I_{ab}$	4.3±1.0			
				$I_{ab\_unr}$	2.2			
<u>54-Xe-135m</u> (16m; IT, 100%)								
		$\Delta \sigma_{ab}$	(50)					
		$g_0^o(m)_{ab}$	0.003	$I_{ab}(m)$	0.1			
		$g_0^o(g)_{ab}$	0.26	$I_{ab}(g)$	6			
								No cross section data available
<u>54-Xe-135</u> (9.16 h)								
<u>54-Xe-136</u>								
1. Macnamara, Thode PR <u>80</u> , 296 (50)	mass spec	$\Delta \sigma_c$	< 5					
2. Bresetti et al JINC <u>27</u> , 1175 (65)	act	$g_0^o_{ac}$	0.281±0.028					
3. Kondaiah et al NA <u>A120</u> , 329 (68)	act	$g_0^o_{ac}$	0.130±0.015					
Resonance parameters Paris I, 119 (66)		$\Delta \sigma_{ab}$	~ 0					
		$g_0^o_{ab}$	0.2	$I_{ab}$	0			
RECOMMENDED								
								No resonances assigned to this isotope

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>55-CS-133</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\hat{\sigma}_{ac}$	31±6					Renormalized
2. Harris et al PR <u>90</u> , 342 (50)	pile osc	$\hat{\sigma}_{ab}$	38.3					B Std.
3. Pomerance PR <u>83</u> , 643 (51)	pile osc	$g_{ab}^o$	30±1.5					Au Std.
4. Cummins AERE R/R 2333 (57)	pile osc	$g_{ab}^o$	28.3±1.0					Harwell B Std.
5. Bayly et al JINC <u>5</u> , 259 (58)	act	$\hat{\sigma}_{ac}$	30.4±1.7					
6. Bidinosti et al PIC-2 <u>15</u> , 459 (58)	mass spec	$\hat{\sigma}_c$	40					
7. Klimentov, Griazev JNE <u>9</u> , 20 (59)	pile osc			$R\Gamma_{ab}$	169±28			
8. Tattersall et al JNE <u>A12</u> , 32 (60)	pile osc			$I_{ab}$	490±80			Au std.
9. Lyon NSE <u>8</u> , 378 (60)	act	$\hat{\sigma}_{ac}$	47.2					
10. Eiland et al KAPL-2000-11, III-30 (60)	act	$g_{ac}^o$	27.1±2	$R\Gamma_{ac}$	400±25			
11. Baerg, Bartholomew CJC <u>38</u> , 2528 (60)	act	$g_{ac}^o$	30.4±0.8	$I_{ac}$	445±25			
12. Brown et al JNE <u>A13</u> , 141 (61)	act	$g_{ac}^o$	33.4±0.6	$I_{ac}$	355±50			
13. Vidal CEA-R-2486 (64)	pile osc			$I_{ab}$	450±15			
14. Sims, Juhnke JINC <u>30</u> , 349 (68)	act	$g_{ac}^o$	29.2±2.3	$I_{ac}$	479±19			
Resonance parameters BNL-325		$\Delta g_{ab}^o$	16±3	$I_{ab}$	360±30			Resolved res., 5.9 to 470 ev; max. contrib. from 5.9 ev (8%)
RECOMMENDED		$\hat{\sigma}_{ab}$	29.5	$I_{ab}$	450			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>55-Cs-134</u> (2.05 yr)								
1. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$\Delta \sigma_{ac}$	140±12					Co std.
RECOMMENDED		$\Delta \sigma_{ab}$	140					
<u>55-Cs-135</u> ( $2 \times 10^6$ yr)								
1. Cocking et al NRDC-107 (58)	t of f	$\sigma_{ab}$	<20					
2. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$g_0^{\sigma}_{ac}$	8.9±0.5	RI <sub>ac</sub>	62±2			Co std.
RECOMMENDED		$g_0^{\sigma}_{ab}$	8.9	I <sub>ab</sub>	58			No cross section data available
<u>55-Cs-136</u> (13 d)								
<u>55-Cs-137</u> (30 yr)								
1. Stupergia JNE <u>A12</u> , 16 (60)	act	$\Delta \sigma_{ac}$	0.1110±0.033					
RECOMMENDED		$\Delta \sigma_{ab}$	0.11					
<u>56-Ba-134</u>								
1. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_0^{\sigma}_{ab}$	2±2					Au std.
2. Hans et al NP <u>20</u> , 183 (60)	act	$g_0^{\sigma}(m)_{ac}$	< 0.05					
3. Mangal, Gill NP <u>41</u> , 372 (63)	act	$g_0^{\sigma}(m)_{ac}$	0.158±0.024					
Resonance parameters BNL-3225		$\Delta g_{ab}$	0.36±0.10	I <sub>ab</sub>	9.7±2.4			One resolved res. at 57.2 ev
RECOMMENDED		$g_0^{\sigma}_{ab}$	2	I <sub>ab</sub>	10			From spin assignments for 135m and 135g it is expected that $g(g)/g(m) \sim 10$ .

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>56-Ba-135m</u> (28.7 hr; IT, 100%)								Formed only by capture in Ba-134. Not included in PISSPROD
<u>56-Ba-135</u>								
1. Pomerance PR <u>88</u> , 412 (52) Resonance parameters BNL-3255	pile osc	$g^0_{ab}$ $\Delta g^0_{ab}$	5.8±0.8 2.1±0.2	$I_{ab}$ $I_{ab-unr}$	90±5 9			Au Std. Resolved res., 24.4 to 466 eV; max. contrib. from 24.4 ev (36%)
RECOMMENDED		$g^0_{ab}$	5.8	$I_{ab}$	100			
<u>56-Ba-136</u>								
1. Pomerance PR <u>88</u> , 412 (52) Resonance parameters BNL-3255	pile osc	$g^0_{ab}$ $\Delta g^0_{ab}$	0.4±0.4 0.36±0.06	$I_{ab}$ $I_{ab-unr}$	16.4±1.6 1			Two resolved res., 102 and 511 eV; max. contrib. from 102 ev (94%)
RECOMMENDED		$g^0_{ab}$	0.4	$I_{ab}$	17			
<u>56-Ba-137</u>								
1. Pomerance PR <u>88</u> , 412 (52) Resonance parameters BNL-3255		$g^0_{ab}$ $\Delta g^0_{ab}$	5.1±0.4 0.05	$I_{ab}$ $I_{ab-unr}$	1.6±0.3 0.3			Au std. Resolved res., 419 to 1346 eV; max. contrib. from 419 ev (65%)
RECOMMENDED		$g^0_{ab}$	5.1	$I_{ab}$	2			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>56-Ba-138</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_0^o$ <sub>ac</sub>	$0.5 \pm 0.1$					
2. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act			$R_I$ <sub>ab</sub>	$<1.0$			Renormalized
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_0^o$ <sub>ab</sub>	$0.71 \pm 0.10$					
4. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta_0^o$ <sub>ac</sub>	$0.23$					Au Std.
5. Kramer, Walhl NSE <u>22</u> , 376 (65)	act	$g_0^o$ <sub>ac</sub>	$0.36 \pm 0.04$					$R_{cd}(\text{Co}) = 10(r/\pi/T_o \approx 0.05)$
6. Ricabarra et al CJP <u>48</u> , 2473 (68)	act					$I/g_0^o$	$0.561 \pm 0.004$	
Resonance Parameters BNL-325								
RECOMMENDED								
<u>56-Ba-140 (12.8 d)</u>								
1. Eastwood et al PIC-2 <u>16</u> , 54 (58)	act	$\Delta_0^o$ <sub>ac</sub>	$\sim 12$					
2. Halperin et al ORNL-4164, 1 (67)	act	$g_0^o$ <sub>ac</sub>	$1.57 \pm 0.03$	$R_I$ <sub>ac</sub>	$13.6 \pm 1.4$			
RECOMMENDED								
		$g_0^o$ <sub>ab</sub>	$1.6$	$I_{ab}$	$1.3$			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>57-1a-139</u>								
1. Bothe, Z.Naturf. <u>1</u> , 179 (46)	act	$g^0_{ac}$	<10					Ho Std.
2. Seren et al PR <u>72</u> , 888 (47)	act	$\Delta^0_{ac}$	$8.4 \pm 1.7$					Renormalized
3. Harris et al PR <u>80</u> , 342 (50)	pile osc	$\Delta^0_{ab}$	9.6					B Std.
4. Benoist et al J.Phys.Rad. <u>12</u> , 584 (51)	pile osc	$g^0_{ab}$	$8.35 \pm 0.10$					
5. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g^0_{ab}$	$9.2 \pm 0.4$					
6. Spivak et al PIC-1 <u>5</u> , 91 (55)	pile osc			RI <sub>ab</sub>	$5.5 \pm 2$			
7. Cummins AERE R/R-2333 (57)	pile osc	$g^0_{ab}$	9.0					Harwell B Std.
8. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta^0_{ac}$	8.1					$R_{cd}(Co)=10(n/T_0/T_o \approx 0.05)$
9. Konks et al ANL-TRANS-168 (64)	react			RI <sub>ab</sub>	$14.0 \pm 0.9$			
10. O'Brien et al ORNL-3994, 4 (66)	act	$g^0_{ac}$	$9.2 \pm 0.5$	RI <sub>ab</sub>	$11.2 \pm 0.6$			
11. Rogers, Scoville TANS <u>10</u> , 259 (67)	react			RI <sub>ab</sub>	$19 \pm 1$			Au Std.
Resonance parameters BNL-325								
		$\Delta^0_{ab}$	$0.18 \pm 0.05$	I <sub>ab</sub>	$9.6 \pm 1.0$			Two resolved res., 0.75 and 72.4 eV; max. contrib. from 72.4 eV (97%)
				I <sub>ab-unr</sub>	10.8			
RECOMMENDED		$g^0_{ab}$	9.0	I <sub>ab</sub>	11			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>57-La-140</u> (40.2 hr)								
1. O'Brien et al ORNL-3994, 4 (66)	act	$g_0^o$ <sub>ac</sub>	$2.7 \pm 0.3$	RI <sub>ac</sub>	$6.9 \pm 4$			
RECOMMENDED		$g_0^o$ <sub>ab</sub>	2.7	I <sub>ab</sub>	70			
<u>58-Ce-140</u>								
1. Bothe Z.Naturf. <u>1</u> , 179 (46)	act	$g_0^o$ <sub>ac</sub>	<0.6					Ho Std.
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_0^o$ <sub>ab</sub>	$0.66 \pm 0.06$					Au Std.
3. Lantz et al NSE <u>20</u> , 302 (64)	act	$g_0^o$ <sub>ac</sub>	$0.59 \pm 0.06$	RI <sub>ac</sub>	$0.48 \pm 0.05$			
4. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g_0^o$ <sub>ac</sub>	$0.54 \pm 0.04$	RI <sub>ac</sub>	$0.49 \pm 0.05$			Au Std.
5. Ricabarra et al CJP <u>46</u> , 2473 (68)	act					I/g <sub>0</sub> <sup>o</sup>	$0.412 \pm 0.03$	Au Std.
RECOMMENDED		$g_0^o$ <sub>ab</sub>	0.59	I <sub>ab</sub>	0.24			
<u>58-Ce-141</u> (33 d)								
1. Lantz et al NSE <u>20</u> , 302 (64)	mass spec	$\sigma_c^{\wedge}$	$29 \pm 3$					
RECOMMENDED		$\sigma_{ab}^{\wedge}$	29					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>58-Ce-142</u>								
1. Bothe Z.Naturf. <u>1</u> , 179 (46)	act	$g_0^{\circ}$ <sub>ac</sub>	1.4					Ho Std.
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_0^{\circ}$ <sub>ab</sub>	$0.65 \pm 0.06$					Au Std.
3. Yaffe et al CJC <u>34</u> , 1023 (56)	act	$\hat{g}_0^{\circ}$ <sub>ac</sub>	$0.98 \pm 0.05$					Co Std.
4. Lyon NSE <u>8</u> , 378 (60)	act	$\hat{g}_0^{\circ}$ <sub>ac</sub>	0.91					$R_{cd}(\text{Co}) = 10(r/T_o \approx 0.05)$
5. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g_0^{\circ}$ <sub>ac</sub>	$0.94 \pm 0.09$	RI <sub>ac</sub>	$1.6 \pm 0.2$			Au Std.
6. Ricabarra et al CJP <u>46</u> , 2473 (68)	act					I/g <sup>o</sup>	$0.748 \pm 0.005$	Au Std.
RECOMMENDED								
<u>58-Ce-143</u> (33 hr)								
1. Roy, Yaffe CJC <u>34</u> , 238 (56)	act	$\hat{g}_0^{\circ}$ <sub>ac</sub>	$6.0 \pm 0.7$					
RECOMMENDED								
<u>58-Ce-144</u> (284 d)								
1. Lantz NSE <u>13</u> , 289 (60)	act	$g_0^{\circ}$ <sub>ac</sub>	$1.00 \pm 0.10$	RI <sub>ac</sub>	$2.60 \pm 0.26$			
RECOMMENDED								
		$g_0^{\circ}$ <sub>ab</sub>	1.0	I <sub>ab</sub>	2.2			

REFERENCE	METHOD	THERMAL			RESONANCE			RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
59-Pr-141										
1. Bothe Z.Naturf <u>1</u> , 179 (46)	act	$g_{ac}^o$	17							Hg Std.
2. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^o$	10.1±2.0							Renormalized
3. Harris et al PR <u>79</u> , 11 (50)	act									
4. Pomerance PR <u>88</u> , 641 (51)	pile osc	$g_{ab}^o$	11.6±0.6							Au Std.
5. Spivak et al PIC-1 <u>5</u> , 91 (55)	pile osc									
6. Cummins AERE R/R 2333 (57)	pile osc	$g_{ab}^o$	11.4±0.2							
7. Eiland et al KAPL-2000-11, III-30 (60)	act	$g_{ac}^o$	9.2±1.0							
8. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta_{ac}^o$	10.9							
9. Zimmerman et al NP <u>A95</u> , 683 (67)	crys spec	$\Delta_{ab}^o$	11.5±1.0							
Resonance parameters BNL-325		$0.8\pm0.2$		$I_{ab}$	$12\pm2$					Resolved res., 50.5 to 957 eV; max. contrib. from 235 eV (30%)
				$I_{ab-unr}$	2.8					
RECOMMENDED		$g_{ab}^o$	11	$I_{ab}$	13					
59-Pr-142 (19.2 hr)										
1. Smith, Reeder JCP <u>23</u> , 2108 (55)	act	$\Delta_{ac}^o$	20±3							Co std.
RECOMMENDED		$\Delta_{ab}^o$	20							

REFERENCE	METHOD	SYMB.	THEMAL VALUE	SYMB.	RESONANCE VALUE	SYMB.	RATIOS VALUE	COMMENTS
<u>59-Pr-143 (13.6 d)</u>								
1. Eastwood et al PR-2 <u>16</u> , 54 (58)	act	$\hat{\sigma}_{ac}$	126±14					Co Std.
2. Roy, Roy CJP <u>37</u> , 907 (59)	act	$g_{ac}^o$	90±10	RI <sub>ac</sub>	190±25			Co Std.
RECOMMENDED								
<u>59-Pr-145 (6.0 hr)</u>								
		$\hat{\sigma}_{ab}$	(30)					No cross section data available
<u>60-Nd-142</u>								
1. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\hat{\sigma}_c$	<12					
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	19.3±2.0					Au Std.
3. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\hat{\sigma}_c$	13±5					Rel. to $\hat{\sigma}_{(Nd)}$ = 48 b
4. Cabell, Wilkins JINC <u>30</u> , 897 (68)	mass spec	$g_c^o$	18.66±0.73					Co Std.
Resonance parameters JINR-P3-3564 (67)								
		$\Delta g_{ab}^o$	0.02	I <sub>ab</sub>	0.2			Resolved res., 1685 to 9990 ev; max. contrib.
				I <sub>ab-unr</sub>	0.02			from 1685 ev (40%)
RECOMMENDED								
		$g_{ab}^o$	18.7	I <sub>ab</sub>	0.2			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>60-Nd-143</u>								
1. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\Delta \hat{g}_C^o$	240					
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^o$	304±24					Au Std.
3. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\Delta \hat{g}_C^o$	334±12					Rel. to $\Delta \hat{g}_C^o$ (Nd) = 48 b
4. Hay, Pattenden NRDC-113 (59)	crys spec	$g_{ab}^o$	343±20					Av. of earlier data (NRDC-103, JNE <u>7</u> , 199 (58), PIC-2 <u>16</u> , 44 (58) TNCC(UK) -20 (57))
5. Tattersall et al JNE <u>Al2</u> , 32 (60)	pile osc	$g_{ab}^o$	338±10	$I_{ab}$	<50			Harwell B Std.
6. Fehr, Hansen KAPL-2000-12 (60)	react.	$\Delta \hat{g}_{ab}^o$	202±25					Quoted for use with nv. Here corrected for use with nv.
7. Cabeill, Wilkins JINC <u>30</u> , 897 (68)	mass spec	$g_C^o$	316.2±8.6					Co Std.
Resonance Parameters BNL-325 and JINR P3-3364 (67)		$\Delta g_{ab}^o$	2.6±0.8	$I_{ab}$	56±3			Resolved res., 56 to 840 ev; max. contrib. from 56 ev (33%)
RECOMMENDED		$g_{ab}^o$	325	$I_{ab}$	60			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
60-Nd-144								
1. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\Delta_{\text{C}}$	<15					Au Std.
2. Pomerance PR <u>88</u> , 41.2 (52)	pile osc	$g_{\text{ab}}^{\text{o}}$	5.0±0.6					
3. Walker, Thode PR <u>90</u> , 447 (53)	mass spec		<6					
4. Cabell, Wilkins JINR <u>30</u> , 897 (68)	mass spec	$\Delta_{\text{C}}$	3.56±0.30					Co Std.
Resonance parameters JINR-P3-3564 (67)		$\Delta_{\text{ab}}^{\text{o}}$	2.0±0.6	$I_{\text{ab}}$	3.4±0.8			Resolved res., 374 to 3570 ev; max. contrib. from 374 ev (70%)
RECOMMENDED		$g_{\text{ab}}^{\text{o}}$	3.6	$I_{\text{ab}}$	3.6			
60-Nd-145								
1. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\Delta_{\text{C}}$	<30					Au Std.
2. Pomerance PR <u>88</u> , 41.2 (52)	pile osc	$g_{\text{ab}}^{\text{o}}$	54±4					
3. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\Delta_{\text{C}}$	37±6					Rel. to $\Delta_{\text{C}}(\text{Nd}) = 48$ b
4. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\Delta_{\text{ab}}^{\text{o}}$	51±3					
5. Tattersall et al JNE <u>A12</u> , 32 (60)	pile osc	$g_{\text{ab}}^{\text{o}}$	49.5±1.5					Harwell B Std.
6. Cabell, Wilkins JINR <u>30</u> , 897 (68)	mass spec	$g_{\text{C}}$	41.2±0.7	$I_{\text{C}}$	240±35			Co Std.
Resonance parameters BNL-325 and JINR P3-3564 (67)		$\Delta_{\text{ab}}^{\text{o}}$	10±5	$I_{\text{ab}}$	250±50			Resolved res., 4.4 to 660 ev; max. contrib. from 4.4 ev (50%)
RECOMMENDED		$g_{\text{ab}}^{\text{o}}$	45	$I_{\text{ab}}$	250			

REFERENCE	METHOD	SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	RATIOS	COMMENTS
<u>60-Nd-146</u>									
1. Bothe Z.Naturf. <u>1</u> , 179 (46)	act	$g_{ac}^0$	1.8						No Std.
2. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\Delta_c^0$	<20						
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^0$	$10.2 \pm 0.8$						
4. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\Delta_c^0$	<9						
5. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g_{ac}^0$	$1.3 \pm 0.1$	RI <sub>ac</sub>	$3.0 \pm 0.3$				Au Std.
6. Mowatt, Walker EANDC (Can) -38, 4 (68)	act	$g_{ac}^0$	$1.8 \pm 0.3$						Rel. to $g_0^0$ (Nd-148)=2.54
Resonance parameters JINR P3-3564 (67)		$\Delta_{ab}^0$	$0.14 \pm 0.03$	$I_{ab}$	$1.6 \pm 0.2$				Resolved res., 360 to 4026 ev; max. contrib. from 360 ev (48%)
RECOMMENDED									
<u>60-Nd-147</u> (11.1 d)									
1. Bothe Z.Naturf. <u>1</u> , 179 (46)	act	$\Delta_{ab}^0$		$(50)$					No cross section data available
2. Hess et al PR <u>76</u> , 300 (49)	mass spec	$g_{ac}^0$							
3. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g_{ab}^0$							
4. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\Delta_c^0$							Au Std.
5. Ruiz et al TANS <u>7</u> , 270 (64)	act	$g_{ac}^0$	$3.4 \pm 1.0$						Au Std.
6. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g_{ac}^0$	$2.54 \pm 0.18$	RI <sub>ac</sub>	$18.7 \pm 0.5$				Au Std.
Resonance parameters JINR P3-3564 (67)		$\Delta_{ab}^0$	$2.5 \pm 0.2$	RI <sub>ac</sub>	$14 \pm 2$				Resolved res., 155 to 3010 ev, max. contrib. from 155 ev (67%)
RECOMMENDED									
		$g_{ab}^0$	2.5	$I_{ab}$	20				

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>60-Nd-150</u>								
1. Hess et al PR <u>76</u> , 300 (49)	mass spec	$\hat{\sigma}_c^o$	< 45					
2. Pomerance PR <u>88</u> , 412 (52)	pile osc	$g\delta_{ab}^o$	3.0±1.5					Au std.
3. Walker, Thode PR <u>90</u> , 447 (53)	mass spec	$\hat{\sigma}_c^o$	< 12					
4. Sehgal et al NP <u>12</u> , 261 (59)	act	$g\delta_{ac}^o$	1.5±0.2					
5. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g\delta_{ac}^o$	1.0±0.2	RI <sub>ac</sub>	14±14			Au std.
Resonance Parameters JINR P3-3564 (67)		$\Delta\delta_{ab}^o$	0.3±0.1	I <sub>ab</sub>	14±1.5			Resolved res., 79 to 3840 ev; max. contrib. from 79 ev (63%)
RECOMMENDED								
<u>61-Pm-147</u> (2.65 yr)								
1. Inghram et al PR <u>72</u> , 85 (47)	act	$\hat{\sigma}_{ac}^o(g)$	60					
2. Gorshkov et al JNE II <u>8</u> , 69 (58)	mass spec	$\hat{\sigma}_c^o$	90±20					
3. Harvey et al PIC-2 <u>16</u> , 150 (58)	t of f	$g\delta_{ab}^o$	180±30					
4. Bidinosti et al PIC-2 <u>15</u> , 459 (58)	mass spec	$\hat{\sigma}_c^o$	200±50					
5. Schuman, Berreth NSE <u>12</u> , 519 (62)	act	$g\delta_{ac}^o(m)$	111±11	RI <sub>ac</sub> (m)	1520±230			
		$g\delta_{ac}^o(g)$	124±13	RI <sub>ac</sub> (g)	1700±250			
6. Fenner, Large JINC <u>29</u> , 2147 (67)	mass spec	$g\delta_c^o(m)$	73±7	RI <sub>c</sub> (m)	720±200			
		$g\delta_c^o(g)$	83±8	RI <sub>c</sub> (g)	800±250			
		$\hat{\sigma}_T^o$	212±9	I <sub>ab</sub>	2300±260			
7. Kirovac et al NBS Spec. Publ. <u>299</u> , 687 (68)	t of f	$g\delta_{ac}^o(m)$	72±3.0					Assumed $\sigma_{\text{rot}}/\sigma_{\text{tot}} = 8b$ in resonance
8. Mowatt, Walker (to be published)	act	$g\delta_{ac}^o(g)$	84±10					Co std; $r/T/T_0 = 0.003$
Resonance Parameters of ref. 3 & 7		$\Delta\delta_{ab}^o$	88±10	I <sub>ab</sub>	2090±130			Resolved res., 1.04 to 115 ev; max. contrib. from 5.4 ev (80%)
RECOMMENDED								
		$g\delta_{ab}^o(m)$	80	I <sub>ab</sub> (m)	1050			
		$g\delta_{ab}^o(g)$	90	I <sub>ab</sub> (g)	1150			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>61-Pm-148m</u> (40.6 d; IT, 7%)								
1. Schuman, Berreth NSE <u>12</u> , 51.9 (62)	act	$\hat{\sigma}_{ac}$	$(29 \pm 5) 10^3$					Mainly thermal
2. Fenner, Large JINC <u>29</u> , 2147 (67)	mass spec	$\hat{\sigma}_c$	$(22 \pm 2.5) 10^3$					Co std.
RECOMMENDED		$\hat{\sigma}_{ab}$	24000					
<u>61-Pm-148g</u> (5.4 d)								
1. Schuman, Berreth NSE <u>12</u> , 51.9 (62)	act	$\hat{\sigma}_{ac}$	$(3 \pm 2) 10^3$					Mainly epi-Cd
RECOMMENDED		$\hat{\sigma}_{ab}$	3000					
<u>61-Pm-149</u> (53 hr)								
1. Kondurov et al JNE <u>20</u> , 814 (66)	act	$\hat{\sigma}_{ac}$	1700 $\pm$ 300					
2. Mowatt, Walker NBS Spec. Pub. 299, 1291 (68)	depl.	$\hat{\sigma}_{ab}$	10000 $\pm$ 400					
RECOMMENDED		$\hat{\sigma}_{ab}$	1400					
<u>61-Pm-151</u> (28 hr)								
1. Mowatt, Walker NBS Spec. Pub. 299, 1291 (68)	depl.	$\hat{\sigma}_{ab}$	<700					
RECOMMENDED		$\hat{\sigma}_{ab}$	400					

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>62-Sm-147</u>								
1. Tattersall AERE R/R 2459 (58)	pile osc	$g^0_{ab}$	87±60					
2. Gorshkov et al JNE <u>I</u> I 8, 69 (58)	mass spec	$\Delta^0_c$	10000±50					
3. Fehr, Hansen KAPL-2000-12, I 33 (60)	react	$\Delta^0_{ab}$	306±34					
4. Tattersall et al JNE <u>A</u> 12, 32 (60)	pile osc			$I_{ab}$	<1350			
5. Fenner, Large JINC <u>29</u> , 2147 (67)	mass spec	$g^0_c$	50±3	$RI_c$	640±200			Co std.
6. Forman, White NSE <u>28</u> , 139 (67)	mass spec	$g^0_c$	75±11					$T_n = 127 \pm 13^\circ C$
Resonance parameters BNL-325		$\Delta^0_{ab}$	13±4	$I_{ab}$	500±50			Resolved res., 3.4 to 99 eV; max. contrib. from 3.4 eV (32%)
				$I_{ab-unr}$	100			
RECOMMENDED		$g^0_{ab}$	55	$I_{ab}$	600			
<u>62-Sm-148</u>								
1. Whitem AAEC/TM-443 (68)	mass spec	$g^0_c$	4.73±0.11					
Resonance parameters BNL-325		$\Delta^0_{ab}$	~ 0	$I_{ab}$	~ 0			No resonances assigned to this isotope.
RECOMMENDED		$g^0_{ab}$	4.7	$I_{ab}$	0			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS VALUE	COMMENTS
		SYMB.	VALUE	SYMB.	VALUE		
<u>62-Sm-149</u>							
1. Inghram et al PR <u>79</u> , 271 (50)	mass spec	$\hat{\sigma}_c$	$47 \times 10^3$				
2. Gorshkov et al JNE <u>II</u> 8, 69 (58)	mass spec	$\hat{\sigma}_c$	$\geq (58 \pm 9) 10^3$				
3. Tattersall et al AERE R/R 2459 (58)	pile osc	$\hat{\sigma}_{ab}$	$(42.3 \pm 0.7) 10^3$				Harwell B Std. Westcott g
4. Bidinosti et al PIC-2 <u>15</u> , 459 (58)	mass spec	$\hat{\sigma}_c$	$(42.4 \pm 0.2) 10^3$				Using Westcott g, s
5. Anikina et al PIC-2, 15, 446 (58)	mass spec	$\hat{\sigma}_{ab}$	$(49 \pm 8) 10^3$				
6. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\hat{\sigma}_T$	$(39.9 \pm 0.6) 10^3$				
7. Meadows, Whalen NSE <u>2</u> , 132 (61)	pulsed n	$\hat{\sigma}_{ab}$	$(68.8 \pm 0.35) 10^3$				
8. Aitken, Cornish JINC <u>17</u> , 6 (61)	mass spec	$\hat{\sigma}_{ab}$	$(42.3 \pm 1.2) 10^3$				
9. Sokolowski et al Nukleonik <u>6</u> , 245 (64)	pile osc t of f	$\hat{\sigma}_{ab}$	$(42.5 \pm 0.7) 10^3$				Using Westcott g, s. Also agrees with $\hat{\sigma}_{ab}$ of ref. 6 using appropriate g, s.
10. Albert et al Kernenergie <u>10</u> , 25 (67)	pile osc	$\hat{\sigma}_{ab}$	$(41.5 \pm 1.1) 10^3$				Using Westcott g, s. From $\hat{\sigma}_{ab}(\text{Sm})$ assuming nat ab. = 13.8%.
RECOMMENDED							From $\hat{\sigma}_{ab}(\text{Sm})$ assuming net ab. = 13.8%.
							Use with Westcott g, s values

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>62-Sm-150</u>								
1. Aitken, Cornish JINC <u>17</u> , 6 (61)	mass spec	$\Delta \sigma_c$	102±5					$r/\tau/\tau_0 = 0.0016$
2. Halperin et al TANS 5, 376 (62)	mass spec	$g^o_c$	98±10	$I_{ab}$	255±25			Co std.
Resonance parameters BNL-325		$\Delta g_{ab}^o$	6±1	$I_{ab}$	245±25			One resolved res. at 20.6 eV
				$I_{ab-unr}$	23			
<u>RECOMMENDED</u>								
<u>62-Sm-151</u> ( $\approx 87$ yr)								
1. Inghram et al PR <u>29</u> , 271 (56)	mass spec	$\Delta \sigma_c$	7200					
2. Melaika et al CJC <u>33</u> , 830 (55)	mass spec	$\Delta \sigma_c$	12000					B Std.
3. Bidinosti et al PIC-2 <u>15</u> , 459 (58)	mass spec	$\Delta \sigma_c$	13000±400					Co std.; NRX irrad ( $g + rs \sim 0.85$ )
4. Anikina et al PIC-2 <u>15</u> , 446 (58)	mass spec	$\Delta \sigma_c$	8000±1500					
5. Pattenden NSE <u>17</u> , 371 (63)	t off f	$g_{ab}^o$	15000±1800	$I_{ab}$	3300±700			Resolved res., 1.1 to 6.3 eV; max. contrib. from 1.1 eV (60%)
Resonance parameters NSE <u>17</u> , 371 (63).				$I_{ab-unr}$	750			
<u>RECOMMENDED</u>								
		$g_{ab}^o$	15000	$I_{ab}$	3100			Use with Westcott g, s values

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<b><u>62-Sm-152</u></b>								
1. Bothe Z. Naturf <u>1</u> , 179 (46)	act	$g_0^o$ <sub>ac</sub>	205					No Std.
2. Seren et al PR <u>72</u> , 888 (47)	act	$g_0^o$ <sub>ac</sub>	1.35±27					Renormalized
3. Sunyar, Goldhaber PR <u>76</u> , 189 (49)	act			$R_{I,ac}$	2400			Corrected for resonance self-shielding
4. Harris et al PR <u>79</u> , 11 (50)	act							
5. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\delta$ <sub>ab</sub>	200±6					
6. Tattersall et al JNE <u>AI2</u> , 32 (60)	pile osc			$I_{ab}$	2850±300			Au Std.
7. Walker, Green CJP <u>39</u> , 1184 (61)	act	$\delta$ <sub>ab</sub>	209±21					Au Std.
8. Bernabei et al NSE <u>12</u> , 63 (62)	crys spec	$g_0^o$ <sub>ac</sub>	209±9	$I_{ac}$	3070±100	$I/g_0^o$	(14.6)	Au Std.
9. Cabell JINC <u>24</u> , 749 (62)	act	$\Delta g_0^o$ <sub>ab</sub>	209±30	$I_{ab}$	2920±300			One resolved res. at 8.0 ev
Resonance parameters BNL-325								
<b>RECOMMENDED</b>								
<u>62-Sm-153</u> (47 hr)		$g_0^o$ <sub>ac</sub>	206	$I_{ab}$	3000			No cross section data available
<b><u>62-Sm-154</u></b>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_0^o$ <sub>ac</sub>	4.9±1.0					
Resonance parameter								
<b>RECOMMENDED</b>								
<u>62-Sm-156</u> (9.4 hr)		$\delta$ <sub>ab</sub>	(3.0)					No cross section data available

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>63-Eu-151</u>								
1. Bothe Z.Naturf <u>1</u> , 179 (46)	act	$\overset{\circ}{\sigma}_{ac}^{(m)}$	1700					Not included in FISSPROD
		$\overset{\circ}{\sigma}_{ac}^{(g)}$	3830					Ho Std.
2. Seren et al PR <u>72</u> , 888 (47)	act	$\overset{\circ}{\sigma}_{ac}^{(m)}$	1900±400					Ho Std.
3. Hayden et al PR <u>75</u> , 1500 (49)	mass spec	$\overset{\wedge}{\sigma}_c$	8800					$\beta$ -counting only. Corrected 25% for electron capt.
4. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\overset{\wedge}{\sigma}_{ab}$	7700±80					Eu Std.
5. Tattersall et al JNE <u>A12</u> , 32 (60)	pile osc	$\overset{\circ}{\sigma}_{ab}$	8840±90					Harwell B Std.
6. Hans et al NP <u>20</u> , 183 (60)	act	$\overset{\circ}{\sigma}_{ac}^{(m)}$	1700±300					
7. Jacks DP-608 (61)	act					$R_I/\overset{\circ}{\sigma}^0$	0.64±0.10	Au Std.
8. Keisch PR <u>129</u> , 769 (63)	act					$\overset{\circ}{\sigma}(m)/\overset{\circ}{\sigma}(g)$	0.56±0.04	
9. Rogers, Scoville TANS <u>10</u> , 259 (67)	react							
10. Albert et al Kernenergie <u>10</u> , 25 (67)	pile osc	$\overset{\circ}{\sigma}_{ab}$	9350±110					
11. Sims, Juhnke JINC <u>29</u> , 2671 (67)	act	$\overset{\wedge}{\sigma}_{ac}^{(m)}$	3080±90					Au Std.
		$\overset{\wedge}{\sigma}_{ac}^{(g)}$	4465±65					Au Std.
Resonance Parameters BNL-325								
				$I_{ab}$	1400			Resonances with $E_r > 1$ eV

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>63-Eu-152m</u> (9.3 hr; EC, 23%; $\beta^-$ 77%)								Not included in FISSLSPROD
<u>63-Eu-152</u> (12 yr; EC, 72%; $\beta^-$ 28%)								No included in FISSLSPROD
1. Hayden et al PR <u>75</u> , 1500 (49)	mass spec	$\Delta_{\text{C}}$	5400					Rel. to Eu
<u>63-Eu-153</u>								
1. Hayden et al PR <u>75</u> , 1500 (49)	mass spec	$\Delta_{\text{C}}$	406					Rel. to Eu
2. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\delta_{\text{ab}}$	448±16					
3. Tattersall et al JNE <u>A12</u> , 32 (60)	pile osc	$\eta_{\text{ab}}$	319±5	I <sub>ab</sub>	1280±100			Harwell B and Au Stds.
4. Rogers, Scoville TANS <u>10</u> , 259 (67)	react			RI <sub>ab</sub>	1833			
5. Sims, Juhnke JINC <u>29</u> , 2671 (67)	act	$\eta_{\text{ac}}$	639±7	RI <sub>ac</sub>	3887±62			Au Std.
Resonance parameters BNL-325		$\Delta_{\text{ab}}$	72	I <sub>ab</sub>	1200±120			Resolved res., 0.46 to 24 eV; max. contrib. from 2.46 eV (35%)
RECOMMENDED		$\delta_{\text{ab}}$	450	I <sub>ab-unr</sub>	350			
				I <sub>ab</sub>	1500			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>63-Eu-154</u> (8 yr) 1. Hayden et al PR <u>75</u> , 1500 (49)	mass spec	$\Delta \sigma_c$	1490					Eu Std.
RECOMMENDED		$\Delta \sigma_{ab}$	1500					
<u>63-Eu-155</u> (5 yr) 1. Hayden et al PR <u>75</u> , 1500(49) 2. Mowatt (private comm.)	mass spec depletion	$\Delta \sigma_c$ $\Delta \sigma_{ab}$	13400 4200					Eu Std. Preliminary
RECOMMENDED		$\Delta \sigma_{ab}$	4200					
<u>63-Eu-156</u> (15 d)		$\Delta \sigma_{ab}$	(2000)					No cross section data available
<u>63-Eu-157</u> (15.2 hr)		$\Delta \sigma_{ab}$	(2000)					No cross section data available
<u>64-Gd-154</u>								
1. Dobrozensky et al Paris I, 495 (66) 2. Gishanin et al Sov. J. At. En. <u>22</u> , 144 (67)	mass spec mass spec Resonance parameters INDC-260 E, 114 (68)	$\Delta \sigma_c$ $\Delta \sigma_c$ $\Delta \sigma_{ab}$	105±11 100±20 2.6±0.5	I <sub>c</sub> I <sub>ab-unr</sub>	303±31 180±15 34			$R_{cd}^{(Co)} = 7.88$ ( $r/T/T_0 \sim 0.07$ ) Resolved res., 11 to 244 eV; max. contrib. from 22.4 eV (45%)
RECOMMENDED		$\sigma_{ab}^o$	85	I <sub>ab</sub>	250			It is assumed that 15-20 b. of ref. 1 and 2 is epithermal

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>64-Gd-155</u>								
1. Lapp et al PR <u>71</u> , 745 (47)	mass spec	$\Delta \sigma_c$	69000					
2. Inghram et al PR <u>79</u> , 271 (50)	mass spec	$\Delta \sigma_c$	41000					
3. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\sigma_T$	66000±2000					
4. Tattersall et al AERE R/R <u>2459</u> (58)	pile osc	$g_{ab}^o$	49800±600					Harwell B Std.
5. Low, Shaltiel PR <u>115</u> , 424 (59)	mass spec	$\Delta \sigma_c$	94500					Gd Std.
RECOMMENDED								
		$\delta_{ab}$	66000					
<u>64-Gd-156</u>								
1. Dobrozemsky et al Paris I, 495 (66)	mass spec	$\Delta \sigma_c$	6.3±1.0	$I_c$	78±21			$R_{cd}(Co)=7.88 (\tau/\tau_0 \sim 0.07)$
2. Gishanin et al Sov.J.At.En. <u>22</u> , 144 (67)	mass spec	$\Delta \sigma_c$	11.5±7.2					
Resonance parameters INDC-260 E, 137 (68)								
		$\Delta \delta_{ab}^o$	1.4±0.3	$I_{ab}$	90±7			Resolved res., 33.1 to 982 ev; max. contrib. from 33.1 ev (50%)
				$I_{ab-unr}$	6			
RECOMMENDED								
		$g_{ab}^o$	1.4	$I_{ab}$	90			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>64-Gd-157</u>								
1. Lapp et al PR <u>71</u> , 745 (47)	mass spec	$\Delta \hat{g}_C$	240000					
2. Inghram et al PR <u>72</u> , 271 (50)	mass spec	$\Delta \hat{g}_C$	59500					
3. Pattenden PIC-2 <u>16</u> , 44 (58)	crys spec	$\hat{g}_T^o$	264000±4500					
4. Tattersall et al AERE R/R 2459 (58)	pile osc	$g_{ab}^o$	214000±2000					Harwell B Std.
5. Low, Shaltiel PR <u>115</u> , 424 (59)	mass spec	$\Delta \hat{g}_C$	224000					
RECOMMENDED								
<u>64-Gd-158</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$\Delta \hat{g}_{ac}$	~ 3					
2. Butement PR <u>75</u> , 1276 (49)	act	$\Delta \hat{g}_{ac}$	4.5					
3. Lyon NSE <u>8</u> , 378 (60)	act	$\Delta \hat{g}_{ac}$	3.89					
4. Mangal, Gill NP <u>41</u> , 372 (63)	act	$g_{ac}^o$	2.78±0.42					
Resonance parameters BNL-325								
Resolved res., 22.3 eV to 920 eV; max. contrib. from 22.3 eV (80%)								
RECOMMENDED								
		$\hat{g}_{ac}^o$	2.8	$I_{ab}$	60			
				$I_{ab-unr}$	5			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>64-Gd-159</u> (18.0 hr)		$\Delta_{ab}^o$	(50000)					No cross section data available
<u>64-Gd-160</u>								
1. Butement PR <u>75</u> , 1276 (49)	act	$\Delta_{ac}^o$	0.17					
2. der Mateosian et al ANL-4237	act	$\Delta_{ac}^o$	0.1					
3. Mangal, Gill NP <u>41</u> , 372 (63)	act	$g_{ac}^o$	0.77±0.11					
Resonance parameters INDC-260 E, 139		$\Delta_{ab}^o$	0.17±0.03	$I_{ab}$	5.7±0.8			Resolved res., 222 to 1425 eV; max. contrib. from 222 eV (55%)
RECOMMENDED		$g_{ab}^o$	0.8	$I_{ab-unr}$	1.7			
<u>65-Tb-159</u>								
1. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g_{ab}^o$	46±4					Au Std.
2. Alstad et al JINC <u>29</u> , 2155 (67)	act	$g_{ac}^o$	22±2	$RI_{ac}$	450±50			Au Std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	9.4±1.4	$I_{ab}$	330±30			Resolved res., 3.35 to 156 eV; max. contrib. from 11.1 eV (45%)
RECOMMENDED		$g_{ab}^o$	22	$I_{ab}$	420			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>65-Tb-160</u> (72,1 d)								
1. Smith et al JCP <u>25</u> , 502 (56)	act	$\Delta_{ac}^o$	600±100					Co Std.
RECOMMENDED		$\Delta_{ab}^o$	600					
<u>65-Tb-161</u> (6.9 d)		$\Delta_{ab}^o$	(2000)					No cross section data available
<u>66-Dy-160</u>								
1. House, Frost BAPS <u>2</u> , 337 (58)	pile osc	$\Delta_{ab}^o$	130±130					B Std.
2. Scoville, Fast NSE <u>18</u> , 400 (64)	react	$g_{ab}^o$	RI ab	1160±130				Au Std.
3. Scoville et al NSE <u>25</u> , 12 (66)	react	$g_{ab}^o$	55±9					Au Std.
Resonance parameters INDC-232 (USSR Data)		$\Delta_{ab}^o$	76±20	$I_{ab}$	1300±300			Resolved res., 1.88 to 85 ev; max. contrib. from 10.4 ev (48%)
RECOMMENDED		$g_{ab}^o$	60	$I_{ab}$	100			
<u>66-Dy-161</u>								
1. House, Frost BAPS <u>2</u> , 337 (58)	pile osc	$\Delta_{ab}^o$	680±40					B Std.
2. Danelyan et al Sov.AE <u>16</u> , 58 (64)	t of f	$g_{ab}^o$	580±50					
		$g_{ab}^o$	617±40					
3. Scoville, Fast NSE <u>18</u> , 400 (64)	react	$g_{ab}^o$	RI ab	1670±167				Au Std.
4. Scoville et al NSE <u>25</u> , 12 (66)	react	$g_{ab}^o$	583±95					Au Std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	43±6	$I_{ab}$	825±40			Resolved res., 2.72 to 73.5 ev; max. contrib. from 3.7 ev (30%)
RECOMMENDED		$g_{ab}^o$	600	$I_{ab}$	170			
				$I_{ab}$	1200			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>66-DY-162</u>								
1. House, Frost BAPS 3, 337 (58)	pile osc	$\Delta_{ab}^o$	240±30					B Std.
2. Danelyan et al Sov. AE <u>16</u> , 58 (64)	t of f	$g_{ab}^o$	140±40					
3. Scoville, Fast NSE <u>18</u> , 400 (64)	react	$\Delta_{ab}^o$	215±16					
4. Scoville et al NSE <u>25</u> , 12 (68)	react	$g_{ab}^o$	152±27					Au Std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	200±70	$I_{ab}$	2450±350			Resolved res., 5.5 to 655 eV; max. contrib. from 5.5 eV (96%)
RECOMMENDED								
<u>66-DY-163</u>								
1. House, Frost BAPS 3, 337 (58)	pile osc	$\Delta_{ab}^o$	220±50					B Std.
2. Danelyan et al Sov. AE <u>16</u> , 58 (64)	t of f	$g_{ab}^o$	120±50					
3. Scoville, Fast NSE <u>18</u> , 400 (64)	react	$\Delta_{ab}^o$	135±15					
4. Scoville et al NSE <u>25</u> , 12 (66)	react	$g_{ab}^o$	121±19					Au Std.
Resonance parameters BNL-325		$\Delta_{ab}^o$	140±20	$I_{ab}$	1810±150			Resolved res., 1.7 to 94 eV; max. contrib. from 1.7 eV (90%)
RECOMMENDED								
		$g_{ab}^o$	130	$I_{ab}$	1900			

REFERENCE	METHOD	THERMAL		RESONANCE		RATIOS		COMMENTS
		SYMB.	VALUE	SYMB.	VALUE	SYMB.	VALUE	
<u>66-By-164</u>								
1. Bothe Z.Naturf <u>1</u> , 179 (46)	act	$g_{ac}^{\circ}(g^*)$	2870					Ho Std
2. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^{\circ}(g^*)$	2700±270					Renormalized
3. House, Frost BAPS <u>3</u> , 337 (58)	pile osc	$\sigma_{ab}^{\wedge}$	2870±50					B Std.
4. Sehgal et al NP <u>12</u> , 261 (59)	act	$g_{ab}^{\circ}$	2750±150					$T_n \equiv 0.0265$ eV
5. Jacks DP-608 (61)	act							
6. Sher et al NSE <u>11</u> , 369 (61)	crys spec	$\sigma_{ab}^{\circ}$	2700					Au Std. RI above 0.6 eV
7. Mangal, Gill NP <u>36</u> , 542 (62)	act	$g_{ac}^{\circ}(g)$	951±240					
8. Scoville, Fast NSE <u>18</u> , 400 (64)	react			RI <sub>ab</sub>	377±34			
9. Scoville et al NSE <u>25</u> , 12 (66)	react	$g_{ab}^{\circ}$	2600±410					
10. Albert, Schumann Kernenergie <u>10</u> , 306 (67)	act	$g_{ac}^{\circ}$	2390±70					
Resonance parameters BNL-325								
RECOMMENDED								
<u>67-Ho-165</u>								
1. Seren et al PR <u>72</u> , 888 (47)	act	$g_{ac}^{\circ}(g)$	58±12					Renormalized
2. Pomerance PR <u>83</u> , 641 (51)	pile osc	$g_{ab}^{\circ}$	67±3					Au Std.
3. Zimmerman et al NP <u>95</u> , 683 (67)	crys spec	$\sigma_{ab}^{\circ}$	61±3					$\sigma(E) \approx 1/v$ to 1 eV
4. Motz et al PR <u>155</u> , 1265 (67)	act	$\sigma_{ac}^{\circ(m)}$	3.5±0.5					to 1200 yr Ho <sup>165m</sup> ; rel to $\sigma_{ab}^{\circ}$ = 66.5 b
Resonance parameters BNL-325								
RECOMMENDED								
		$g_{ab}^{\circ}$	19±2	$I_{ab}$	630±30			Resolved res; 3.9 to 195 eV; max. contrib. from 3.9 eV (50%)
		$g_{ab-unr}^{\circ}$	63	$I_{ab-unr}$	55			
				Lab	700			

TABLE 2

FISSPROD NUCLIDE TABLE

<u>IDENTIFIER</u>		<u>CROSS SECTIONS AND RESONANCE INTEGRALS</u> (BARNS)				<u>DECAY CONSTANTS</u> (SEC <sup>-1</sup> × 10 <sup>10</sup> )		
<u>ELEM</u>	<u>A, Z, E</u>	<u>TO METASTABLE STATE</u>		<u>TO GROUND STATE</u>		<u>ISOMERIC TRANS.</u>	<u>β-DECAY TO</u> <u>METASTABLE STATE</u>	<u>GROUND STATE</u>
		<u>gσ</u>	<u>I</u>	<u>gσ</u>	<u>I</u>			
GE	76320	.08	.5	.08	.5			
GE	77320	.	.	30.00U	.		170400.	
AS	77330	.	.	30.00U	.		49800.	
SE	77340	.	.	42.	14.		.	
SE	78340	.	.	.4	4.		.	
SE	79340	.	.	30.00U	.		.	
SE	80340	.	.	.58	1.3		.	
BR	81350	.	.	2.4	50.		.	
SE	82340	.	.	.045	.09		.	
RR	82350	.	.	1.00U	.		54500.	
KR	82360	.	.	25.	190.		.	
KR	83360	.	.	200.	150.		.	
KR	84360	.07	6.	.03	2.0		.	
KR	85360	.	.	8.	.		20.4	
RB	85370	.	.	.42	7.		.	
KR	86360	.	.	1.	.		.	
R8	86370	.	.	1.00U	.		4290.	
SR	86380	.	.	1.	3.0		.	
RB	87370	.	.	.12	2.3		.	
SR	87380	.	.	40.00U	100.		.	
SR	88380	.	.	.005	.06		.	
SR	89380	.	.	.42	.		1543.	
Y	89390	.	.	1.28	.3		.	
SR	90380	.	.	0.8	.		7.82	
Y	90390	.	.	4.00	.		30000.	
ZR	90400	.	.	.1	.15		.	
SR	91380	.	.	5.00U	.		199000.	
Y	91390	.	.	1.4	.		1364.	
ZR	91400	.	.	1.6	6.5		.	
ZR	92400	.	.	.26	.5		.	
Y	93390	.	.	5.00U	.		189000.	
ZR	93400	.	.	2.	22.		.	
ZR	94400	.	.	.07	.26		.	
ZR	95400	.	.	5.00U	.		1234.	
NB	95410	.	.	4.	.		2290.	
MO	95420	.	.	14.5	100.		.	
ZR	96400	.	.	.2	6.0		.	
NB	96410	.	.	5.00U	.		82300.	
MO	96420	.	.	1.2	25.		.	
ZR	97400	.	.	5.00U	.		113300.	

MO	97420	.	.	2.2	15.	.	.
MO	98420	.	.	.14	8.0	.	.
MO	99420	.	.	5.00U	.	25000	3740.
TC	99431	.	.	5.00U	.	321000	.
TC	99430	.	.	22.	200.	.	.
MO	100420	.	.	.2	3.9	.	.
RU	100440	.	.	5.8	9.	.	.
RU	101440	.	.	5.2	76.	.	.
RU	102440	.	.	1.3	4.2	.	.
RU	103440	.	.	5.00U	.	2030.	.
RH	103450	.	.	150.	1100.	.	.
RU	104440	.	.	.47	4.4	.	.
PD	104460	.	.	1.00U	.	.	.
RU	105440	.	.	.3	.	434000.	.
RH	105450	.	.	17000.	17000.	55000.	.
PD	105460	.	.	10.00U	85.	.	.
RU	106440	.	.	.15	2.0	220.	.
PD	106460	.	.	.3	5.6	.	.
PD	107460	.	.	5.00U	.	.	.
PD	108460	.	.	10.	240.	.	.
PD	109460	.	.	5.00U	.	.	.
AG	109470	3.	50.	92.	1450.	142600.	.
PD	110460	.	.	.3	6.	.	.
AG	110471	.	.	82.	.	317.	.
CD	110480	.	.	10.	37.	.	.
AG	111470	.	.	3.	100.	10700.	.
CD	111480	.	.	23.	47.	.	.
PD	112460	.	.	1.00U	.	91700.	.
CD	112480	.	.	2.	17.	.	.
CD	113480	.	.	29000.	.	.	.
CD	114480	.04	3.	0.3	20.	.	.
CD	115481	.	.	5.00U	.	1866.	.
CD	115480	.	.	5.00U	.	36000.	.
IN	115490	.	.	206.	3340.	.	.
CD	116480	.	.	.08	.	.	.
SN	116500	.	.	0.25U	15.	.	.
SN	117500	.	.	1.40U	12.	.	.
SN	118500	.02	.2	0.8 U	8.	.	.
SN	119501	.	.	5.00U	.	321	.
SN	119500	.	.	1.20U	3.5	.	.
SN	120500	.	.	.2	1.5	.	.
SN	121501	.	.	50.00U	.	2.9	.
SN	121500	.	.	50.00U	.	71300.	.
SB	121510	.	.	6.2	200.	.	.
SN	122500	.18	.6	.001	.	.	.
SB	122510	.	.	10.00U	.	28700.	.
TE	122520	.	.	2.8	66.	.	.
SN	123500	.	.	50.00U	.	642.	.
SB	123510	.	.	4.2	130.	.	.
TE	123520	.	.	410.	5400.	.	.
SN	124500	.13	9.	.004	.03	.	.
SB	124510	.	.	6.5	.	1337.	.
IE	124520	.04	.	6.5	.	.	.
SN	125500	.	.	50.00U	.	8540.	.
SB	125510	.	.	10.00U	.	16	65.1
TE	125521	.	.	50.00U	.	1383	.
TE	125520	.	.	1.5	18.	.	.
SN	126500	.	.	1.00U	.	.	.
SB	126510	.	.	10.00U	.	6420.	.
IE	126520	.10	1.	.9	9.	.	.

SB	127510	.	.	10.00U	.		3310	17400.
TE	127521	.	.	50.00U	.	736	.	
IE	127520	.	.	50.00U	.			205000.
I	127530	.	.	6.2	150.			.
TE	128520	.015	.08	.2	1.5			.
XE	128540	.4	10.	4.	100.			.
TE	129521	.	.	50.00U	.	2360	.	.
I	129530	.	.	28.	23.			.
XE	129541	.	.	50.00U	.	10300	.	.
XE	129540	.	.	40.	220.			.
TE	130520	.02	.04	.20	.36			.
I	130530	.	.	18.	.			155300.
XE	130540	.4	1.	4.	12.			.
TE	131521	.	.	50.00U	.			64200.
I	131530	.	.	1.	8.0	60	9910.	.
XE	131541	.	.	50.00U	.	6800	.	.
XE	131540	.	.	100.	830.			24700.
TE	132520	.	.	1.00U	.			.
YE	132540	0.04	0.2	.45	2.4			.
T	133530	.	.	15.00U	.	7300	84300.	.
XE	133541	.	.	50.00U	.	35500	.	.
XE	133540	.	.	190.	.			15200.
CS	133550	.	.	29.5	450.			.
XE	134540	.003	.1	0.26	6.			.
CS	134550	.	.	140.	.			107.
BA	134560	.	.	2.	10.			.
I	135530	.	.	15.00U	.			77600 200000.
XE	135541	.	.	50.00U	.	7220000	.	.
XE	135540	.	.	3000000.	.			210000.
CS	135550	.	.	8.9	58.			.
BA	135560	.	.	5.8	100.			.
XE	136540	.	.	.2	.			.
CS	136550	.	.	15.00U	.			6170.
BA	136560	.	.	.4	17.			.
CS	137550	.	.	.11	.			7.32
BA	137560	.	.	5.1	2.0			.
BA	138560	.	.	.4	.2			.
LA	139570	.	.	9.0	11.			.
BA	140560	.	.	1.6	13.			6270.
LA	140570	.	.	2.7	70.			47900.
CE	140580	.	.	.59	.24			.
CE	141580	.	.	29.	.			2430.
PR	141590	.	.	11.	13.			.
CE	142580	.	.	.90	1.0			.
PR	142590	.	.	20.	.			100300.
ND	142600	.	.	18.7	.2			.
CE	143580	.	.	6.	.			58300.
PR	143590	.	.	100.	150.			5900.
ND	143600	.	.	325.	60.			.
CE	144580	.	.	1.	2.2			282.
ND	144600	.	.	3.6	3.6			.
PR	145590	.	.	30.00U	.			321000.
ND	145600	.	.	45.	250.			.
ND	146600	.	.	1.4	2.0			.
ND	147600	.	.	50.00U	.			7230.
PM	147610	80.	1050.	90.	1150.			82.9
SM	147620	.	.	55.	600.			.
ND	148600	.	.	2.5	20.			.
PM	148611	.	.	24000.	.			1980.
PM	148610	.	.	3000.	.			14860.

SM	148620	.	.	4.7	.		
PM	149610	.	.	1400.	.	36300.	.
SM	149620	.	.	69000.	.		
ND	150600	.	.	1.2	14.	.	.
SM	150620	.	.	100.	240.	.	.
PM	151610	.	.	400.	.	68800.	.
SM	151620	.	.	14200.	.	.	.
SM	152620	.	.	206.	3000.	.	.
SM	153620	.	.	2000.	.	41000.	.
EU	153630	.	.	450.	1500.	.	.
SM	154620	.	.	5.	.	.	.
EU	154630	.	.	1500.	.	27.5	.
GD	154640	.	.	85.	250.	.	.
EU	155630	.	.	4200.	.	44.	.
GD	155640	.	.	48600.	.	.	.
SM	156620	.	.	3.00U	.	205000.	.
EU	156630	.	.	2000.	.	5350.	.
GD	156640	.	.	1.4	90.	.	.
EU	157630	.	.	2000.	.	126700.	.
GD	157640	.	.	205000.	.	.	.
GD	158640	.	.	2.8	60.	.	.
GD	159640	.	.	2000.	.	107000.	.
TB	159650	.	.	22.	420.	.	.
GD	160640	.	.	.8	7.	.	.
TB	160650	.	.	600.	.	1113.	.
DY	160660	.	.	60.	1200.	.	.
TB	161650	.	.	2000.	.	11630.	.
DY	161660	.	.	600.	1200.	.	.
DY	162660	.	.	190.	2800.	.	.
DY	163660	.	.	130.	1900.	.	.
DY	164660	.	.	2700.	.	.	.
HO	165670	.	.	63.	700.	.	.
HO	166670	.	.	.	.	.	.

WALKER

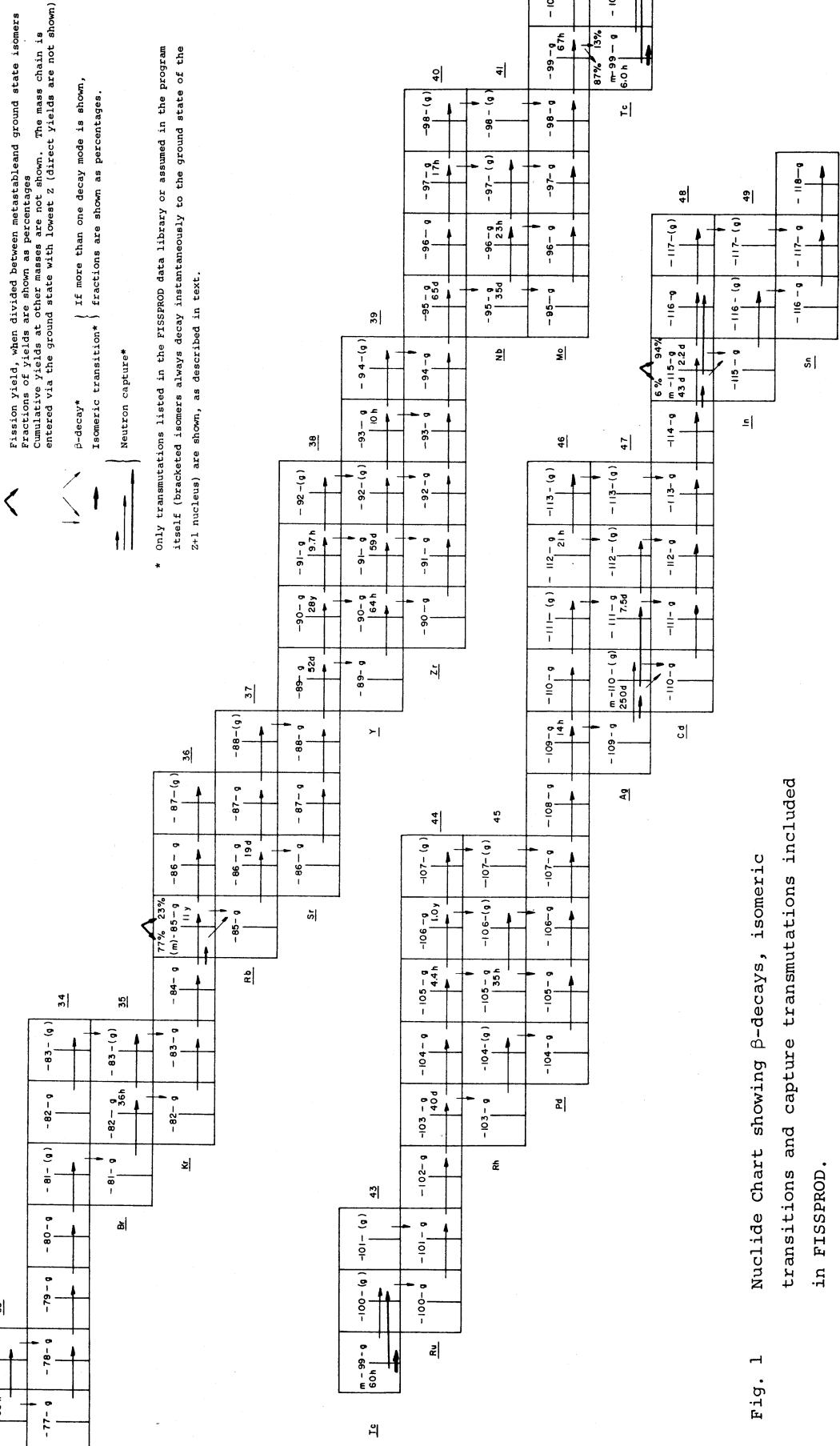
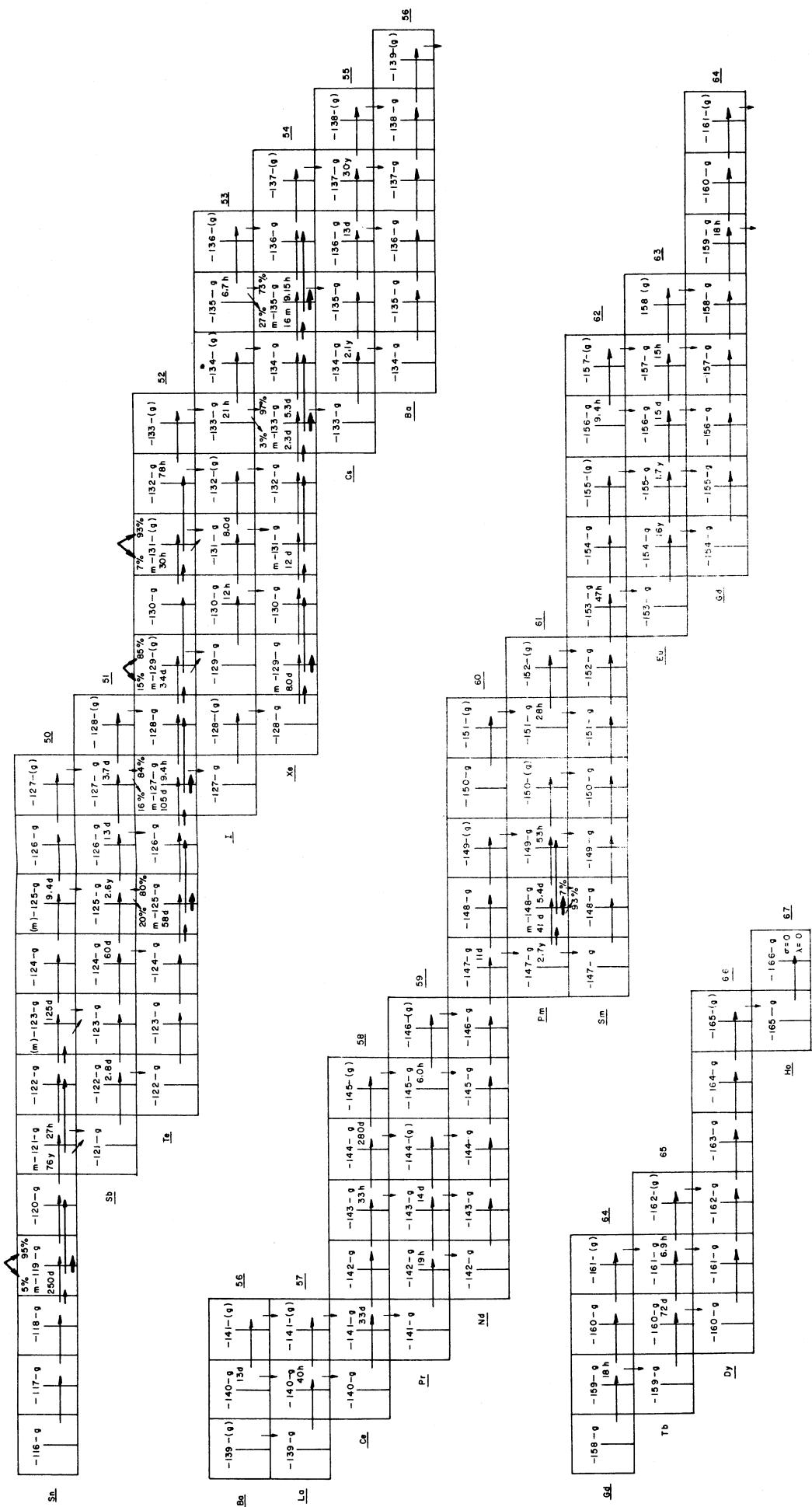


Fig. 1 Nuclide Chart showing  $\beta$ -decays, isomeric transitions and capture transmutations included in FISSPROD.



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