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LUCAS HEIGHTS**

**INTERPOLATIVE FORMULAE FOR AVERAGE NUCLEAR LEVEL SPACING  
AND TOTAL RADIATION WIDTH**

by

**A.R. de L. MUSGROVE**

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ABSTRACT

The free gas model formula for nuclear level densities was used to interpolate unknown level spacings. The level density parameter was fitted semi-empirically to give good fits to all experimentally measured level spacings.

A formula for total radiation width is given which relates this quantity to the mass number, the average level spacing and the excitation energy. Compound nuclei which have a long-lived isomeric state were found to have, on average, a radiation width 25 percent less than for non-isomeric compound nuclei. No correlation between radiation widths and neutron strength function was observed within the limits of accuracy of the experimental data, contrary to some previous suggestions.

Tables of calculated and measured resonance parameters are given for target nuclei in the range  $60 < A < 203$ . The calculated 30 keV capture cross section is compared with measured and semi-empirical data (Allen et al. 1970) and with the calculated values of Benzi and Reffo (1969).

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## 1. INTRODUCTION

Knowledge of the average resonance parameters for a large number of nuclides is necessary for applications in astrophysics, reactor physics and fission physics. In many cases no data are available owing to the extremely short lifetimes of the nuclides involved, and it has been estimated that more than 50 percent of fission product capture cross sections have not, and in general cannot, be measured. Capture cross sections at about 30 keV are required for the stable nuclei to test the theory of slow nucleosynthesis (s-process) in stellar interiors (Burbidge et al. 1957). Many nuclides of vital importance to the theory have no measured cross section in this region (Fowler 1968) and semi-empirical estimates are usual (Allen et al. 1970).

A number of cross section estimates made by Musgrove (1969) with interpolated low energy resonance parameters are in disagreement with the values required by the s-process theory (Allen et al. 1970). Thus a complete re-appraisal of the method of interpolating the resonance parameters seems desirable.

The parameters required to calculate statistical cross sections in the kilovolt region are the average level spacing  $\langle D \rangle$ , the average radiation width  $\Gamma_\gamma$ , and the neutron strength functions  $S_0$ ,  $S_1$  and  $S_2$  for s-, p-, and d-wave neutron capture.

As far as can be determined from the existing data on the strength functions,  $S_0$ ,  $S_1$  and  $S_2$  are reasonably systematic functions of mass number over a broad range, although small scale fluctuations undoubtedly occur. The s-wave neutron strength function, for example, appears to decrease with increasing  $A$  for even- $A$  isotopes of the same element (Mughabghab et al. 1970, Shakin 1963).

The keV capture cross section is relatively independent of this quantity, however, and unfortunately this is the only strength function for which reasonably reliable experimental data exist.

The p-wave cross section, on the other hand, is strongly dependent on the p-wave strength function and it is thus important to have reasonable estimates of the p-wave strength function for measured cross sections before interpolating. A difficulty arises here, since it is implicitly assumed in most analyses of keV capture cross sections that the p- and d-wave neutron strength functions are independent of the total angular momentum  $J$ . Because of the strong spin-orbit coupling in the nuclear shell model potential, these higher  $\ell$ -wave strength functions could be quite strongly dependent on  $J$  and this fact has led Lynn (1968) to reject p-wave determinations made from analyses of the kilovolt capture cross section. The remaining values are too few to be useful and do not indicate how the  $J$  dependence can be taken into account in practical calculations. Musgrove (1970a) has recently refitted all available keV capture cross sections, and the p-wave strength functions extracted from this procedure are used below to interpolate unknown values.

Capture by d-wave neutrons can usually be ignored below about 100 keV, but important contributions appear to be made for nuclei with  $A < 70$  (Musgrove 1969, Allen and Musgrove 1970, Bird et al. 1969). Interpolated values are again based on the values extracted from capture cross section fitting (Musgrove 1970a).

Measured values of the total radiation width are quite few as a number of authors are content to assume that all isotopes of the same element have equal radiation widths. Moreover, the error in this parameter is rarely less than 20 percent, owing to experimental uncertainty and the fact that frequently a determination is made on a single resonance. Unknown radiation widths have, in the past, been interpolated linearly between measured values.

The average level spacing ought to be the easiest parameter to determine experimentally, but here again data are often poor for important nuclides. Musgrove (1970b) showed that in order to obtain an estimate to better than 20 percent at least ten levels should be taken. In many cases fewer than this number have been observed. In addition, as new data become available, previously 'accepted' values for this parameter can alter dramatically. It is therefore desirable to re-appraise interpolated data continuously as new measurements are made, and a system of computer codes has been prepared at the A.A.E.C. for this purpose.

The neutron capture cross section is a sensitive function of the radiative strength function  $S_\gamma = \langle \Gamma_\gamma \rangle / \langle D \rangle$ . Therefore, even when these parameters are 'known', an error of about 40 per cent can be expected in this important ratio. Musgrove (1970a), in attempting to fit the known radiative capture cross sections, sometimes found the value of this ratio indicated by the low energy data had to be considerably adjusted.

Present theoretical models for calculating nuclear level spacings and radiation widths are unable to give agreement with measured values to within a factor of 2-3, and are therefore of little direct use for calculating unknown values of  $\langle D \rangle$  and  $\Gamma_\gamma$ . At the A.A.E.C., semi-empirical methods are used to obtain good fits to the measured data on  $\langle D \rangle$  and  $\Gamma_\gamma$ . To do this an empirical correction factor is required, which happens to be a reasonably smoothly varying function of Z or N.

## 2. THE LEVEL SPACING FORMULA

To obtain the systematics of nuclear level spacings we use the free gas model of the nucleus as given by Gilbert and Cameron (1965). At an energy E above the ground state, the density of states (of both parities) of spin J, is given by:

$$\rho(E, J) = \frac{\sqrt{\pi}}{12} \cdot \frac{\exp(2\sqrt{aU})}{a^{1/4} U^{5/4}} \cdot \frac{(2J + 1) \exp(-(J + \frac{1}{2})^2 / 2\sigma^2)}{2\sqrt{2\pi} \sigma^3} \quad (1)$$

Since actual nuclei have important interaction energies which depress their ground states below those of the corresponding gases, an effective excitation energy U, measured from the conceptual ground state of the gas, is used in Equation 1 in place of the nuclear excitation energy E. If the ground state of the gas is approximated by the reference mass of odd-odd nuclei, then U is given by:

$$U = E - \Delta, \quad (2)$$

where  $\Delta$  is the nucleon pairing energy. This correction removes even-odd effects from the level density parameter 'a' in Equation 1, which is related to the density of single particle states at the Fermi energy. The level density parameter increases with mass number A, but dips significantly in the vicinity of magic number nuclei. Gilbert and Cameron (1965) found an empirical linear relation between the ration a/A and the shell corrections of Cameron's (1957) mass formula for deformed and undeformed nuclei.

The variable  $\sigma$  is the spin cut-off parameter and is related to the nuclear moment of inertia and the nuclear temperature. Gilbert and Cameron give:

$$\sigma^2 = 0.0888 (aU)^{1/2} A^{2/3} \quad (3)$$

Although it is an improvement over earlier fits, Gilbert and Cameron's formulation still leads to an average deviation factor from experiment of about 1.7. Cook et al. (1967) re-evaluated the pairing and shell corrections of this formula in order to fit all available level spacings but the separation into pairing and shell corrections is ambiguous and leads to uncertainties in interpolation. Furthermore, the treatment of deformation by Gilbert and Cameron is rather unsatisfactory since the shell corrections do not take deformation into account explicitly.

It is therefore preferable to see whether the correlation between level density parameter and shell correction found by Gilbert and Cameron (1965) exists for the deformed shell function derived by Myers and Swiatecki (1966, 1968) in their semi-empirical mass formula. This contains an explicit formulation for the behaviour of the shell function with ground state deformation.

The pairing correction in Equation 2 was taken to be:

$$\Delta = \begin{cases} 11/\sqrt{A} & \text{for odd-A nuclei} \\ 22/\sqrt{A} & \text{for even-even nuclei} \\ 0 & \text{for odd-odd nuclei} \end{cases} \quad (4)$$

and this was found to account for most even-odd effects in the level density parameter.

The level density parameter required to fit the experimental level spacings was then fitted to the following form:

$$a = (x_1 + x_2 S_d + x_3 S_d^2 + x_4 S_d^3) (1 + x_5 \theta + x_6 \theta^2) x A^{x_7} \quad , \quad (5)$$

where  $S_d$  is the Myers-Swiiatecki deformed shell function:

$$S_d = S(Z,N) \exp(-\theta^2) (1 - 2\theta^2) \quad , \quad (6)$$

and  $\theta$  is the calculated ground state deformation parameter.

The best fit to the level density parameter was found by a non-linear least squares fitting procedure which yielded the following values for the adjustable constants in Equation 5:

$$\begin{aligned} x_1 &= 0.3354 & x_5 &= -0.7344 \\ x_2 &= 0.0197 & x_6 &= 8.2310 \\ x_3 &= 1.220 \times 10^{-3} & x_7 &= 0.8055 \\ x_4 &= 1.775 \times 10^{-4} & & \end{aligned}$$

At this stage, most of the experimental values were given to within a factor of two, but the deviations from the calculated values appeared to be systematically related to shell structure. These were not removed by increasing the number of parameters in Equation 5 and an empirical correction factor had to be introduced into the deformed shell function in order to obtain agreement with experiment. The correction factor was subdivided into separate proton and neutron contributions and the new shell function used in Equation 5 became:

$$S_d' = S_d + R(Z) + R(N) \quad . \quad (7)$$

Values of  $R(Z)$  and  $R(N)$  are given in Table 1. As a function of  $Z$  or  $N$  they exhibit quite similar features, particularly near closed shells, and apart from a number of scattered points are reasonably smooth functions. Naturally, it is impossible to assign an error to values interpolated using this formula but overall an error of  $\pm 50$  percent might be sufficiently large. Experimental values are given by this formula to within an average range of  $\pm 10$  percent.

### 3. SEMI-EMPIRICAL FORMULA FOR TOTAL RADIATION WIDTH

A theoretical expression connecting the average total radiation width with the level spacing and the excitation energy was given by Blatt and Weisskopf(1952):

$$\langle \Gamma_\gamma \rangle = \text{Constant} \times A^{2/3} \langle D(E_B) \rangle \int_0^{E_B} \frac{E^3 dE}{\langle D(E_B - E) \rangle} \quad (8)$$

where E1 transitions were the only ones considered.  $\langle D(E_B) \rangle$  is the average level spacing of capturing states at the neutron separation energy, while  $\langle D(E_B - E) \rangle$  is the average spacing of levels to which electric dipole transitions can occur.

It is well known that Equation 8 does not give good predictions of nuclear capture widths (Kinsey and Bartholomew 1954, Lynn 1968) and is frequently out by an order of magnitude. An empirical fit to the observed radiation widths of the form:

$$\langle \Gamma_\gamma \rangle = k A^x \langle D(E_B) \rangle^y E_B^z \quad (9)$$

has therefore been attempted. As a first guess for the parameters, a linear least squares fit was made and these values were further iterated in a non-linear fitting routine to obtain the final best fitting parameters. Although Equation 9 was able to give a good overall fit to the data, even-odd effects were observed. Moreover, when the data were separated into two groups with  $A < 130$  and  $A > 130$ , the parameters obtained for each group separately were quite different from each other and from those obtained in the overall fit.

A rather better fit was obtained by using the effective excitation energy  $U$  (Equation 2) in place of  $E_B$  in Equation 9. No difference in the parameters obtained for the two separate groups was then found. However Equation 9 appeared to over-estimate the radiation width for nuclei which form a long-lived isomeric state after radiative decay, with a compensating underestimation for the radiation width of non-isomeric compound nuclei. When these two groups were fitted separately, no difference in the exponentiating parameters of Equation 9 was found. However the multiplying constant  $k$  was found to be approximately 25 percent greater for non-isomeric compound nuclei than for isomeric compound nuclei. The best fitting parameters were found to be:

$$\left. \begin{aligned} k &= \begin{array}{l} 1.13 \times 10^{-3} \text{ for isomeric nuclei} \\ 1.43 \times 10^{-3} \text{ for non-isomeric nuclei} \end{array} \\ x &= 0.02 \\ y &= 0.21 \\ z &= 2.08 \end{aligned} \right\} \quad (10)$$

where  $\Gamma_\gamma$  and  $\langle D \rangle$  are measured in eV and  $E_B$  is in MeV.

Systematic deviations still occur between predicted and calculated values and these were removed by the introduction of a smooth empirical multiplying constant  $f(Z)$  of  $Z$ , so that the total radiation width is now given by:

$$\Gamma_\gamma = k f(Z) A^{0.02} \langle D(E_B) \rangle^{0.21} U^{2.08} \quad (11)$$

Values for  $f(Z)$  are given in Table 2. Equation 11 gives an average deviation of  $\pm 20$  percent from measured values.

There has been a suggestion in the literature (Cameron 1959) that total radiation width could be dependent on the s-wave neutron strength function. Mughabghab and Chrien (1970) noticed a strong correlation for the dysprosium isotopes, which occur close to a peak in the strength function.

We have used Equations 9 and 10 to correct the observed radiation widths for excitation energy and shell effects and in Figure 1 we give a plot of the ratio  $\Gamma_\gamma(\text{expt})/\Gamma_\gamma(\text{calc})$  versus the s-wave neutron strength function. For each element the results have been normalised such that the lowest mass number isotope has a strength function of unity and the ratio of experimental to calculated radiation width is also unity. Overall, it is clear that there is no evidence for the postulated correlation, although we also find a positive correlation for the Dy isotopes. For  $^{162}\text{Dy}$  we do not find the radiation width 'anomalous' (Mughabghab and Chrien 1970) in terms of the prediction of Equation 9. It is interesting to note that the energy dependence of the radiation width given by Equation 11 is:

$$\Gamma_\gamma(U) \propto U^{2.5} \exp(-0.42 \sqrt{aU})$$

This predicts a slow increase of radiation width with increasing energy for small values of  $aU$  and a slow decrease with energy for large values of  $aU$ .

#### 4. THE NEUTRON STRENGTH FUNCTIONS

It was assumed that neutron strength functions are smoothly varying functions of mass number. For s-wave neutrons the data compiled by Seth (1966) were used, with a few more recent values listed in CINDA (1969) and some fitted values from Musgrove (1970). The data were smoothed where possible to obtain a single value for each mass number.

For p- and d-wave strength functions the fitted values of Musgrove (1970), smoothly interpolated where necessary, were relied on to obtain again a single-valued, smoothly varying function of mass number. Table 3 lists the values of the s-, p- and d-wave neutron strength function used in the calculations.

## 5. TABULATED DATA

In Table 4 measured and calculated values have been compiled for the level spacing and radiation width for a large number of stable and unstable nuclei. The neutron binding energies were taken from Mattauch et al. (1965) and the ground state spins from the 1966 Chart of the Nuclides (Knolls Atomic Power Laboratory). A number of these spins have not been measured and have been estimated from systematics. Nuclides which are important fission products are marked with an asterisk, and the mode of formation of the stable nuclei by s-, r- or p-processes of nucleosynthesis is indicated. Nuclei forming a long-lived isomeric state upon decay from the compound nucleus are also shown (I). The nuclei are arranged according to target mass number and the s-, p- and d-wave strength functions assumed are given.

In Table 5, the 30 keV neutron capture cross section has been calculated by the method used by Musgrove (1969) with the parameters obtained in Table 4. Measured values are used where available. The calculated values are compared with the values, both experimental and semi-empirical, compiled by Allen et al. (1970) and also with the calculated values given by Benzi and Reffo (1969). The agreement among the three sets of values is in general reasonable, considering the probable errors in the calculated values. A full set of our calculated cross sections for fission products will be published elsewhere.

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TABLE 1

## SHELL CORRECTION PARAMETERS FOR LEVEL DENSITY LAW

N/Z	R(Z)	R(N)	N/Z	R(Z)	R(N)
28	-0.98	0.0	76	-1.33	1.20
29	-2.51	0.0	77	-0.30	1.23
30	-0.68	0.0	78	-0.27	0.49
31	-0.64	0.0	79	-0.77	1.03
32	0.66	0.0	80	0.13	-1.72
33	0.65	-0.96	81		-1.70
34	-1.07	0.0	82		-1.66
35	-0.44	0.36	83		-0.66
36	-0.20	0.40	84		-0.72
37	-0.05	0.46	85		1.00
38	-1.77	-2.85	86		-1.63
39	-1.44	-0.74	87		0.87
40	-1.04	0.0	88		-0.49
41	-1.11	0.99	89		1.93
42	0.08	-2.06	90		1.60
43	-0.34	-0.15	91		1.41
44	0.27	-0.19	92		1.80
45	-1.07	0.32	93		1.47
46	-0.26	1.00	94		1.29
47	0.66	1.83	95		1.90
48	1.38	0.50	96		0.19
49	0.92	-0.62	97		0.61
50	0.32	-0.72	98		-0.51
51	-0.62	-1.52	99		-0.02
52	-0.76	-1.48	100		0.10
53	0.14	-0.73	101		-0.15
54	0.51	-1.12	102		0.65
55	0.37	-1.78	103		-0.35
56	1.52	-1.19	104		1.87
57	1.28	0.92	105		0.33
58	0.56	0.25	106		-0.61
59	0.77	1.83	107		-0.33
60	0.70	-0.27	108		-1.36
61	-0.24	0.39	109		-1.85
62	1.82	0.50	110		-1.24
63	0.50	0.69	111		-2.06
64	-1.40	-2.14	112		-1.32
65	0.41	0.13	113		-0.90
66	-0.39	-2.77	114		-0.52
67	-0.39	1.23	115		0.28
68	-0.01	1.28	116		0.30
69	1.28	-0.76	117		-0.35
70	-1.22	-0.84	118		-0.27
71	1.28	2.09	119		0.49
72	-0.42	0.71	120		-0.55
73	-0.28	1.96	121		-0.70
74	0.12	0.62	122		0.19
75	0.28	1.18	123		0.0

TABLE 2

## RADIATION WIDTH CORRECTION FACTOR

Z	F(Z)	Z	F(Z)
21	1.20	52	0.55
22	1.00	53	0.83
23	0.69	54	1.00
24	1.47	55	1.06
25	1.47	56	0.66
26	1.41	57	0.43
27	1.66	58	0.57
28	1.30	59	0.38
29	1.05	60	0.67
30	1.32	61	1.06
31	1.19	62	0.67
32	0.71	63	1.74
33	2.30	64	1.03
34	1.45	65	1.46
35	1.58	66	1.15
36	1.00	67	1.36
37	0.67	68	0.73
38	0.54	69	1.04
39	0.29	70	0.82
40	0.81	71	1.45
41	0.54	72	1.31
42	1.03	73	0.91
43	1.10	74	0.71
44	1.21	75	1.17
45	0.78	76	1.24
46	0.89	77	1.08
47	1.06	78	0.81
48	0.53	79	1.28
49	0.75	80	1.70
50	0.64	81	1.61
51	0.74	82	9.95

TABLE 3

NEUTRON STRENGTH FUNCTIONS ( $\times 10^4$ ) USED IN CALCULATIONS

A	S0	S1	S2	A	S0	S1	S2
60	2.80	0.01	1.00	100	0.90	6.50	0.01
61	2.80	0.01	1.00	101	0.40	6.50	0.01
62	2.80	0.01	1.00	102	0.40	6.50	0.01
63	2.50	0.01	1.00	103	0.40	6.60	0.01
64	1.80	0.02	1.00	104	0.40	5.00	0.01
65	1.30	0.02	1.00	105	0.35	4.00	0.01
66	1.10	0.02	0.95	106	0.40	3.00	0.01
67	1.20	0.03	0.90	107	0.40	1.81	0.01
68	1.20	0.05	0.88	108	0.60	1.75	0.01
69	1.20	0.08	0.84	109	0.80	1.70	0.01
70	1.80	0.10	0.80	110	0.60	1.65	0.01
71	1.50	0.13	0.76	111	0.30	1.60	0.01
72	1.00	0.17	0.72	112	0.50	1.55	0.01
73	1.30	0.20	0.66	113	0.50	1.50	0.01
74	1.30	0.27	0.62	114	0.70	1.45	0.01
75	1.70	0.35	0.57	115	0.30	1.42	0.02
76	1.30	0.39	0.52	116	0.50	1.35	0.02
77	1.60	0.44	0.49	117	0.20	0.61	0.03
78	0.90	0.49	0.46	118	0.40	4.47	0.04
79	1.50	0.54	0.42	119	0.20	6.68	0.05
80	1.20	0.60	0.39	120	0.15	3.50	0.06
81	1.30	0.66	0.36	121	0.50	3.00	0.08
82	1.00	0.72	0.33	122	0.60	2.60	0.11
83	0.80	0.80	0.30	123	0.70	2.20	0.16
84	0.65	0.90	0.27	124	0.10	2.00	0.21
85	0.50	1.07	0.25	125	0.30	2.53	0.32
86	1.00	6.03	0.22	126	0.45	1.64	0.50
87	0.50	8.00	0.20	127	0.60	1.64	0.63
88	0.90	8.50	0.17	128	0.45	1.64	0.70
89	0.40	8.50	0.15	129	0.30	1.80	0.75
90	1.20	8.50	0.12	130	0.80	2.00	0.73
91	0.80	9.00	0.09	131	0.70	1.70	0.70
92	1.30	6.00	0.06	132	0.70	1.50	0.62
93	0.40	6.00	0.05	133	0.70	1.30	0.54
94	1.00	5.30	0.04	134	0.80	1.20	0.47
95	0.55	5.06	0.03	135	0.80	1.10	0.38
96	1.20	6.20	0.03	136	0.60	1.05	0.29
97	0.60	7.00	0.02	137	0.50	1.00	0.23
98	0.80	7.00	0.02	138	1.40	0.95	0.19
99	0.50	7.00	0.01	139	0.75	0.90	0.17

TABLE 3 (CONTINUED)

A	S0	S1	S2	A	S0	S1	S2
140	1.00	0.80	0.15	172	1.50	0.11	0.68
141	2.00	0.80	0.14	173	1.90	0.12	0.69
142	1.80	0.80	0.13	174	2.00	0.14	0.71
143	4.00	0.80	0.12	175	1.90	0.16	0.74
144	3.50	0.79	0.11	176	1.90	0.18	0.78
145	3.00	0.70	0.11	177	2.20	0.21	0.82
146	3.80	0.65	0.11	178	2.10	0.24	0.86
147	4.30	0.58	0.13	179	1.90	0.29	0.90
148	3.50	0.10	0.17	180	1.70	0.46	0.96
149	3.00	0.35	0.23	181	2.10	0.21	1.00
150	3.00	0.10	0.37	182	2.30	0.34	1.05
151	3.00	0.50	0.50	183	2.00	0.05	1.10
152	2.50	0.22	0.75	184	2.60	0.82	1.00
153	2.20	0.25	0.90	185	2.60	1.99	1.00
154	2.20	0.10	0.98	186	1.80	1.40	0.90
155	2.20	0.10	1.00	187	1.70	1.19	0.50
156	1.90	0.10	1.00	188	1.80	1.00	0.32
157	1.60	0.10	0.95	189	2.00	0.85	0.27
158	1.60	0.10	0.90	190	2.00	0.75	0.23
159	1.60	0.10	0.85	191	2.10	0.68	0.20
160	1.70	0.10	0.80	192	1.70	0.60	0.18
161	1.80	0.10	0.76	193	2.00	0.53	0.17
162	2.10	0.10	0.72	194	1.40	0.47	0.15
163	2.00	0.10	0.70	195	1.65	0.40	0.14
164	2.00	0.10	0.68	196	1.70	0.33	0.13
165	1.90	0.10	0.67	197	1.75	0.23	0.12
166	1.90	0.10	0.66	198	1.50	0.27	0.12
167	1.70	0.10	0.66	199	2.10	0.26	0.11
168	1.40	0.10	0.66	200	2.10	0.25	0.11
169	1.50	0.13	0.66	201	1.40	0.25	0.10
170	1.30	0.10	0.66	202	1.00	0.25	0.10
171	1.30	0.10	0.67	203	1.00	0.25	0.10

TABLE 4

## MEASURED AND CALCULATED NUCLEAR LEVEL SPACINGS AND RADIATION WIDTHS

COLUMN 1 : TARGET NUCLIDE CHARGE AND SYMBOL  
 COLUMN 2 : ASTERISK INDICATES FISSION PRODUCT  
 COLUMN 3 : FORMATION PROCESS BY S,R,P PROCESS OF NUCLEOSYNTHESIS  
 COLUMN 4 : (I) INDICATES ISOMERIC COMPOUND NUCLEUS  
 COLUMN 5 : NEUTRON SEPARATION ENERGY (MEV)  
 COLUMN 6 : GROUND STATE SPIN  
 COLUMN 7 : MEASURED LEVEL SPACING (EV)  
 COLUMN 8 : CALCULATED LEVEL SPACING (EV)  
 COLUMN 9 : MEASURED RADIATION WIDTH (EV)  
 COLUMN 10 : CALCULATED RADIATION WIDTH (EV)

MASS NUMBER							
60							<< S0= 2.80, S1= 0.01, S2= 1.00 >>
26FE		5.69	0.0		3.49D+04		4.06D-01
27CO		9.35	5.0		6.99D+02		7.59D-01
28NI		7.82	0.0	2.30D+04	2.30D+04		7.94D-01
29CU		11.71	2.0		4.22D+02		7.42D-01
61							<< S0= 2.80, S1= 0.01, S2= 1.00 >>
27CO	I	6.67	3.5		1.05D+03		4.55D-01
28NI		10.59	1.5		1.21D+03		6.42D-01
29CU		8.90	1.5		1.32D+03		6.96D-01
30ZN		12.61	1.5		1.51D+02		6.80D-01
62							<< S0= 2.80, S1= 0.01, S2= 1.00 >>
27CO	I	8.46	5.0		7.81D+02		4.83D-01
28NI		6.84	0.0		1.95D+04		5.48D-01
29CU		10.84	1.0		4.87D+02		6.40D-01
30ZN		9.17	0.0		2.60D+03		7.62D-01
63							<< S0= 2.50, S1= 0.01, S2= 1.00 >>
27CO	I	5.80	3.5		1.67D+03		3.75D-01
28NI		9.66	1.5		1.38D+03		5.14D-01
29CU	SX	7.92	1.5	1.00D+03	8.13D+02	5.10D-01	5.15D-01
30ZN		11.86	1.5		1.27D+02		5.62D-01
31GA		10.28	1.5		6.70D+01		5.69D-01

TABLE 4 (CONTINUED)

MASS NUMBER		64	<< S0= 1.80, S1= 0.02, S2= 1.00 >>				
28NI		6.10	0.0		2.83D+04		4.42D-01
29CU		9.91	1.0		5.02D+02		5.22D-01
30ZN	S	7.99	0.0	2.00D+03	2.45D+03	5.50D-01	5.17D-01
31GA		11.80	1.0		3.16D+01		5.02D-01
MASS NUMBER		65	<< S0= 1.30, S1= 0.02, S2= 1.00 >>				
28NI		8.99	2.5		6.02D+03		5.75D-01
29CU	SX	7.06	1.5	9.50D+02	1.15D+03	4.00D-01	4.02D-01
30ZN		11.04	2.5		9.83D+01		4.43D-01
31GA		9.12	1.5		4.49D+01		4.08D-01
32GE		12.55	1.5		1.59D+01		2.29D-01
MASS NUMBER		66	<< S0= 1.10, S1= 0.02, S2= 0.95 >>				
28NI		5.10	0.0		9.50D+04		3.52D-01
29CU		9.11	1.0		3.41D+03		6.41D-01
30ZN	SX	7.05	0.0	5.00D+03	4.20D+03	5.00D-01	4.60D-01
31GA		11.23	0.0		8.25D+01		5.49D-01
32GE		9.80	0.0		1.32D+02		2.61D-01
MASS NUMBER		67	<< S0= 1.20, S1= 0.03, S2= 0.90 >>				
29CU		6.19	1.5		3.42D+03		4.00D-01
30ZN	SX	10.20	2.5	6.70D+02	6.71D+02	5.00D-01	5.37D-01
31GA		8.28	1.5		8.51D+01		3.82D-01
32GE		12.18	2.5		9.33D+00		1.91D-01
MASS NUMBER		68	<< S0= 1.20, S1= 0.05, S2= 0.88 >>				
30ZN	SX I	6.50	0.0		1.03D+04		3.45D-01
31GA		10.32	1.0		2.66D+02		5.77D-01
32GE		8.60	0.0		3.13D+02		2.29D-01

TABLE 4 (CONTINUED)

MASS NUMBER		69		<< S0= 1.20, S1= 0.08, S2= 0.84 >>			
30ZN		9.20	0.5		1.03D+03		4.42D-01
31GA	SR I	7.64	1.5	3.00D+02	2.32D+02	2.10D-01	3.33D-01
32GE		11.53	2.5		8.05D+01		2.62D-01
33AS		9.19	2.5		9.25D+00		5.76D-01

MASS NUMBER		70		<< S0= 1.80, S1= 0.10, S2= 0.80 >>			
30ZN	R I	6.05	0.0		9.10D+03		2.81D-01
31GA		9.31	1.0		1.15D+02		3.80D-01
32GE	S I	7.42	0.0	1.33D+03	1.69D+03	1.62D-01	1.71D-01
33AS		11.64	4.0		1.94D+01		8.60D-01

MASS NUMBER		71		<< S0= 1.50, S1= 0.13, S2= 0.76 >>			
30ZN		8.69	0.5		4.10D+03		5.07D-01
31GA	SR I	6.52	1.5	2.00D+02	2.52D+02	3.00D-01	2.20D-01
32GE		10.75	0.5		7.22D+01		2.14D-01
33AS		8.40	2.5		3.44D+01		6.30D-01
34SE		12.20	2.5		8.21D+01		6.30D-01

MASS NUMBER		72		<< S0= 1.00, S1= 0.17, S2= 0.72 >>			
30ZN	*	5.50	0.0		2.91D+04		3.55D-01
31GA	*	9.23	3.0		2.34D+02		4.34D-01
32GE	* SR I	6.79	0.0	1.55D+03	1.23D+03	1.60D-01	1.42D-01
33AS		10.77	2.0		8.28D+00		6.01D-01
34SE	I	8.62	0.0		8.48D+02		4.64D-01

MASS NUMBER		73		<< S0= 1.30, S1= 0.20, S2= 0.66 >>			
31GA		6.15	1.5		8.16D+02		3.32D-01
32GE	* SR	10.20	4.5	1.24D+02	1.24D+02	1.97D-01	2.09D-01
33AS	I	8.00	1.5		2.03D+01		4.03D-01
34SE		12.11	0.5		3.92D+01		5.34D-01
35BR		10.01	1.5		1.45D+01		5.20D-01

TABLE 4 (CONTINUED)

MASS NUMBER 74 &lt;&lt; S0= 1.30, S1= 0.27, S2= 0.62 &gt;&gt;

32GE	* SR I	6.49	0.0	3.90D+03	3.03D+03		1.54D-01
33AS	I	10.25	2.0		4.10D+01		5.94D-01
34SE	P	8.03	0.0		6.29D+02		4.66D-01
35BR		12.10	1.0		5.60D+00		5.02D-01
36KR		10.10	0.0		1.18D+02		3.94D-01

MASS NUMBER 75 &lt;&lt; S0= 1.70, S1= 0.35, S2= 0.57 &gt;&gt;

32GE	I	9.45	0.5		3.16D+02		1.64D-01
33AS	* SR	7.33	1.5	6.00D+01	6.03D+01	5.34D-01	5.34D-01
34SE		11.16	2.5		1.00D+02		5.27D-01
35BR		9.25	1.5		9.57D+00		4.05D-01
36KR		13.15	0.5		7.59D+00		3.26D-01

MASS NUMBER 76 &lt;&lt; S0= 1.30, S1= 0.39, S2= 0.52 &gt;&gt;

32GE	* R	6.03	0.0	4.20D+03	6.27D+03		1.65D-01
33AS	* I	9.70	2.0		2.25D+01		4.61D-01
34SE	* S I	7.42	0.0	1.50D+03	1.95D+03	3.00D-01	3.65D-01
35BR	I	10.68	1.0		5.29D+01		4.77D-01
36KR		8.99	0.0		1.22D+02		3.02D-01

MASS NUMBER 77 &lt;&lt; S0= 1.60, S1= 0.44, S2= 0.49 &gt;&gt;

32GE	*	8.40	3.5		3.83D+02		1.55D-01
33AS	* I	6.91	1.5		1.26D+02		4.36D-01
34SE	* SR	10.49	0.5	1.40D+02	1.40D+02	4.00D-01	4.83D-01
35BR	I	8.28	1.5		4.47D+01		3.51D-01
36KR		11.87	2.5		2.69D+01		3.28D-01

MASS NUMBER 78 &lt;&lt; S0= 0.90, S1= 0.49, S2= 0.46 &gt;&gt;

33AS		9.01	2.0		4.26D+01		5.62D-01
34SE	* SR I	6.97	0.0	3.30D+03	2.65D+03	5.00D-01	3.70D-01
35BR	I	10.70	1.0		1.91D+01		3.88D-01
36KR	P I	8.38	0.0		3.89D+02		2.58D-01

TABLE 4 (CONTINUED)

MASS NUMBER		79		<< S0= 1.50, S1= 0.54, S2= 0.42 >>			
33AS		6.13	1.5		2.62D+02		5.02D-01
34SE *		9.90	1.5		1.27D+02		4.07D-01
35BR	R I	7.88	1.5	5.50D+01	4.84D+01	3.30D-01	3.31D-01
36KR		11.51	0.5		3.22D+01		3.16D-01
37RB		10.00	1.5		5.78D+00		1.82D-01

MASS NUMBER		80		<< S0= 1.20, S1= 0.60, S2= 0.39 >>			
34SE *	SR I	6.72	0.0	3.30D+03	3.11D+03		3.40D-01
35BR	I	10.16	1.0		2.08D+01		3.51D-01
36KR	P I	7.85	0.0		4.54D+02		2.28D-01
37RB	I	10.70	1.0		1.24D+01		1.51D-01

MASS NUMBER		81		<< S0= 1.30, S1= 0.66, S2= 0.36 >>			
34SE		9.26	0.5		9.72D+02		5.22D-01
35BR *	SR I	7.60	1.5	5.00D+01	5.63D+01	3.00D-01	3.01D-01
36KR		10.99	3.5		1.15D+01		2.27D-01
37RB	I	9.06	1.5		8.10D+00		1.26D-01

MASS NUMBER		82		<< S0= 1.00, S1= 0.72, S2= 0.33 >>			
34SE	R I	6.70	0.0		1.53D+04		4.68D-01
35BR *		9.59	5.0		6.19D+01		4.89D-01
36KR *	S I	7.47	0.0		6.06D+02		2.15D-01
37RB		11.08	1.0		4.44D+00		1.68D-01
38SR		9.18	0.0		2.13D+02		1.95D-01

MASS NUMBER		83		<< S0= 0.80, S1= 0.80, S2= 0.30 >>			
34SE		8.40	4.5		4.52D+03		5.51D-01
35BR	I	6.79	1.5		8.13D+02		4.28D-01
36KR *	SR	10.52	4.5		5.45D+01		2.82D-01
37RB	I	8.40	2.5		1.04D+01		1.13D-01
38SR		11.58	3.5		1.25D+01		1.44D-01

TABLE 4 (CONTINUED)

MASS NUMBER	84	<< S0= 0.65, S1= 0.90, S2= 0.27 >>					
34SE	5.00	0.0		9.90D+04			4.09D-01
35BR	9.02	1.0		6.92D+02			7.04D-01
36KR * SR I	7.12	0.0		4.96D+03			2.99D-01
37RB	10.48	2.0		1.67D+01			1.95D-01
38SR P I	8.48	0.0	4.00D+02	3.67D+02		2.05D-01	1.46D-01
39 Y I	11.52	4.0		3.34D+00			5.93D-02

MASS NUMBER	85	<< S0= 0.50, S1= 1.07, S2= 0.25 >>					
35BR	5.50	1.5		3.49D+03			4.75D-01
36KR *	9.85	4.5		4.34D+02			3.68D-01
37RB * SR I	8.64	2.5	7.20D+01	7.27D+01		1.78D-01	1.80D-01
38SR	11.52	4.5		3.62D+01			1.79D-01
39 Y I	9.51	0.5		1.75D+01			7.07D-02

MASS NUMBER	86	<< S0= 1.00, S1= 6.03, S2= 0.22 >>					
36KR * R	5.51	0.0		3.08D+04			2.89D-01
37RB *	9.94	2.0		1.22D+02			2.62D-01
38SR * S I	8.44	0.0	2.50D+03	2.47D+03		2.81D-01	2.13D-01
39 Y I	11.99	4.0		6.52D+00			7.51D-02
40ZR	9.69	0.0		7.15D+01			2.67D-01

MASS NUMBER	87	<< S0= 0.50, S1= 8.00, S2= 0.20 >>					
36KR	7.23	2.5		2.56D+03			2.20D-01
37RB * R	6.13	1.5	1.25D+03	1.22D+03			2.04D-01
38SR SX	11.10	4.5	3.00D+02	3.01D+02		2.12D-01	2.55D-01
39 Y I	9.20	0.5		1.98D+02			1.10D-01
40ZR	12.20	4.5		1.22D+01			2.50D-01

MASS NUMBER	88	<< S0= 0.90, S1= 8.50, S2= 0.17 >>					
36KR	5.90	0.0		6.67D+03			2.52D-01
37RB	7.71	2.0		4.10D+02			1.85D-01
38SR * SX	6.39	0.0	2.00D+04	2.11D+04		1.53D-01	2.11D-01
39 Y I	11.48	4.0		6.27D+01			1.10D-01
40ZR	9.14	0.0		8.86D+02			3.13D-01
41NB I	12.46	8.0		7.26D+00			1.57D-01

TABLE 4 (CONTINUED)

MASS NUMBER		89		<< S0= 0.40, S1= 8.50, S2= 0.15 >>		
36KR		5.20	2.5		1.43D+04	1.05D-01
37RB		5.12	1.5		1.04D+03	1.35D-01
38SR	*	7.79	2.5		2.21D+03	1.46D-01
39 Y	* SR I	6.87	0.5	2.00D+03	1.99D+03	9.70D-02
40ZR	I	12.00	4.5		8.14D+01	2.83D-01
41NB	I	9.77	4.5		4.38D+01	1.69D-01

MASS NUMBER		90		<< S0= 1.20, S1= 8.50, S2= 0.12 >>		
37RB		6.91	2.0		3.33D+02	1.35D-01
38SR	*	5.82	0.0		1.09D+04	1.47D-01
39 Y	* I	7.95	2.0		5.46D+02	7.25D-02
40ZR	* SX	7.19	0.0	6.01D+03	6.85D+03	1.17D-01
41NB	I	12.17	8.0		7.00D+01	2.40D-01
42MD	I	10.21	0.0		2.23D+02	3.88D-01

MASS NUMBER		91		<< S0= 0.80, S1= 9.00, S2= 0.09 >>		
37RB		5.21	1.5		8.75D+02	1.35D-01
38SR	*	7.31	2.5		1.36D+03	1.10D-01
39 Y	*	6.55	0.5		6.42D+02	8.80D-02
40ZR	* SR	8.64	2.5	6.46D+02	6.46D+02	4.28D-01
41NB	I	7.75	4.5		3.63D+02	1.63D-01
42MD		12.58	4.5		2.81D+01	4.14D-01

MASS NUMBER		92		<< S0= 1.30, S1= 6.00, S2= 0.06 >>		
38SR		4.60	0.0		4.40D+04	1.06D-01
39 Y		7.49	2.0		2.89D+02	6.97D-02
40ZR	* SR	6.75	0.0	3.00D+03	2.89D+03	1.41D-01
41NB	I	8.84	8.0		4.62D+02	1.69D-01
42MD	P I	8.05	0.0	2.40D+03	2.03D+03	3.64D-01
43TC	I	12.93	2.0		1.81D+01	4.23D-01

MASS NUMBER		93		<< S0= 0.40, S1= 6.00, S2= 0.05 >>		
38SR		7.44	2.5		9.88D+02	1.10D-01
39 Y	*	6.09	0.5		9.72D+02	8.25D-02
40ZR	*	8.20	2.5		3.52D+02	1.76D-01
41NB	SR I	7.21	4.5	1.22D+02	1.22D+02	1.12D-01
42MD		9.69	2.5		1.52D+02	2.99D-01
43TC	I	8.62	4.5		1.40D+02	3.39D-01

TABLE 4 (CONTINUED)

MASS NUMBER		<< S0= 1.00, S1= 5.30, S2= 0.04 >>					
39 Y		7.27	2.0		3.04D+02		6.58D-02
40ZR *	SR	6.47	0.0	4.00D+03	3.41D+03	1.51D-01	2.36D-01
41NB	I	8.51	6.0		9.59D+01		1.11D-01
42MO	PX	7.37	0.0	1.00D+03	1.03D+03		3.10D-01
43TC	I	9.98	2.0		6.50D+01		3.05D-01

MASS NUMBER		<< S0= 0.55, S1= 5.06, S2= 0.03 >>					
39 Y		5.14	0.5		7.68D+02		5.52D-02
40ZR *		7.84	2.5		4.18D+02		1.62D-01
41NB *		6.93	4.5		1.11D+02		1.28D-01
42MO *	SR	9.16	2.5	8.20D+01	8.22D+01	2.56D-01	2.27D-01
43TC	I	7.88	4.5		5.20D+01		2.29D-01
44RU		10.12	2.5		1.23D+02		3.81D-01

MASS NUMBER		<< S0= 1.20, S1= 6.20, S2= 0.03 >>					
40ZR *	R	5.58	0.0	3.00D+03	2.93D+03	2.51D-01	1.53D-01
41NB	I	8.03	6.0		1.14D+02		1.01D-01
42MO *	S	6.82	0.0	1.20D+03	1.34D+03	1.60D-01	2.67D-01
43TC	I	9.45	2.0		2.98D+01		2.29D-01
44RU	P I	8.04	0.0		6.08D+02		3.22D-01

MASS NUMBER		<< S0= 0.60, S1= 7.00, S2= 0.02 >>					
40ZR *		7.15	0.5		1.02D+03		1.50D-01
41NB		5.97	4.5		8.59D+01		8.87D-02
42MO *	SR	8.64	2.5	9.30D+01	9.12D+01	1.87D-01	2.00D-01
43TC		7.35	4.5		6.05D+01		2.59D-01
44RU		10.25	2.5		3.17D+01		2.98D-01
45RH	I	9.54	0.5		6.72D+01		2.55D-01

MASS NUMBER		<< S0= 0.80, S1= 7.00, S2= 0.02 >>					
41NB	I	7.42	6.0		8.94D+01		7.94D-02
42MO *	SR	5.92	0.0	1.00D+03	1.01D+03	2.01D-01	1.81D-01
43TC	I	8.88	2.0		2.30D+01		1.88D-01
44RU	P	7.47	0.0		7.78D+02		3.61D-01
45RH	I	9.57	2.0		5.84D+01		1.93D-01

TABLE 4 (CONTINUED)

MASS NUMBER		99		<< S0= 0.50, S1= 7.00, S2= 0.01 >>			
41NB	I	5.30	4.5		1.14D+02		5.81D-02
42MD *		8.30	0.5		1.27D+02		1.92D-01
43TC *	SR	6.59	4.5	2.40D+01	2.36D+01		1.70D-01
44RU	SR	9.67	2.5		2.50D+01		2.44D-01
45RH		8.13	0.5		1.56D+02		2.76D-01
46PD		11.33	2.5		2.39D+01		2.70D-01

MASS NUMBER		100		<< S0= 0.90, S1= 6.50, S2= 0.01 >>			
42MD *	R	5.39	0.0	1.20D+03	1.20D+03	1.86D-01	1.48D-01
43TC		8.55	1.0		2.13D+01		2.14D-01
44RU *	S	6.81	0.0		1.95D+02		2.16D-01
45RH	I	9.89	2.0		1.83D+01		1.64D-01
46PD		8.73	0.0		4.20D+02		3.40D-01

MASS NUMBER		101		<< S0= 0.40, S1= 6.50, S2= 0.01 >>			
42MD		8.17	2.5		6.98D+01		1.63D-01
43TC	I	6.35	4.5		1.52D+01		1.13D-01
44RU *	SR	9.22	2.5	1.40D+01	1.38D+01	1.90D+00	1.91D-01
45RH	I	7.45	0.5		3.54D+01		1.33D-01
46PD		10.36	2.5		2.54D+01		2.18D-01

MASS NUMBER		102		<< S0= 0.40, S1= 6.50, S2= 0.01 >>			
43TC		8.40	1.0		2.84D+01		2.19D-01
44RU *	SR	6.25	0.0		2.64D+02		1.86D-01
45RH	I	9.31	1.0		1.07D+01		1.27D-01
46PD	P	7.61	0.0		1.73D+02		2.04D-01
47AG		10.32	5.0		6.62D+00		2.52D-01

MASS NUMBER		103		<< S0= 0.40, S1= 6.60, S2= 0.01 >>			
43TC		5.39	4.5		1.14D+02		1.55D-01
44RU *		8.89	2.5		2.30D+01		1.94D-01
45RH *	SR I	7.00	0.5	2.80D+01	2.73D+01	1.11D-01	1.11D-01
46PD		10.02	2.5		7.81D+00		1.57D-01
47AG	I	8.34	3.5		3.10D+00		1.37D-01

TABLE 4 (CONTINUED)

MASS NUMBER 104

&lt;&lt; S0= 0.40, S1= 5.00, S2= 0.01 &gt;&gt;

43TC		8.43	1.0		1.57D+01		1.95D-01
44RU * R		5.98	0.0		7.84D+02		2.10D-01
45RH		8.99	1.0		2.09D+01		1.71D-01
46PD * S I		7.09	0.0		9.47D+01		1.20D-01
47AG		10.06	5.0		1.56D+00		1.76D-01
48CD		8.46	0.0		4.96D+01		1.21D-01

MASS NUMBER 105

&lt;&lt; S0= 0.35, S1= 4.00, S2= 0.01 &gt;&gt;

44RU *		8.41	2.5		2.33D+01		1.68D-01
45RH * I		6.57	3.5		3.31D+01		1.01D-01
46PD * RX		9.55	2.5	1.33D+01	1.28D+01	1.55D-01	1.55D-01
47AG I		7.88	0.5		3.41D+00		1.25D-01
48CD		10.87	2.5		2.29D+00		8.98D-02

MASS NUMBER 106

&lt;&lt; S0= 0.40, S1= 3.00, S2= 0.01 &gt;&gt;

44RU *		5.45	0.0		1.31D+03		1.86D-01
45RH		8.56	1.0		1.84D+01		1.49D-01
46PD * SR I		6.53	0.0		4.63D+02		1.37D-01
47AG I		9.53	1.0		4.08D+00		1.50D-01
48CD P		7.93	0.0		2.35D+01		8.88D-02
49IN		10.94	7.0		1.58D+00		1.52D-01

MASS NUMBER 107

&lt;&lt; S0= 0.40, S1= 1.81, S2= 0.01 &gt;&gt;

44RU		8.10	2.5		1.16D+02		2.13D-01
45RH		6.20	3.5		3.91D+01		1.18D-01
46PD *		9.23	2.5		1.04D+01		1.35D-01
47AG SR I		7.28	0.5	1.18D+01	1.18D+01	1.32D-01	1.37D-01
48CD		10.33	2.5		3.01D+00		8.37D-02
49IN I		8.67	4.5		1.07D+00		8.44D-02

MASS NUMBER 108

&lt;&lt; S0= 0.60, S1= 1.75, S2= 0.01 &gt;&gt;

45RH I		8.15	1.0		1.01D+02		1.50D-01
46PD * SR I		6.15	0.0		5.79D+02		1.24D-01
47AG I		9.18	1.0		2.11D+00		1.20D-01
48CD P I		7.38	0.0		7.54D+01		7.57D-02
49IN I		10.51	7.0		1.77D+00		1.12D-01
50SN		8.40	0.0		7.04D+01		1.55D-01

TABLE 4 (CONTINUED)

MASS NUMBER 109

&lt;&lt; S0= 0.80, S1= 1.70, S2= 0.01 &gt;&gt;

45RH		5.81	3.5		7.70D+01		1.19D-01
46PD *		8.81	2.5		6.09D+01		1.74D-01
47AG *	SR	6.82	0.5	1.40D+01	1.18D+01	1.30D-01	1.57D-01
48CD	I	9.86	0.5		4.61D+00		6.44D-02
49IN	I	7.95	4.5		3.79D+00		9.19D-02
50SN		11.10	2.5		5.96D+00		1.41D-01

MASS NUMBER 110

&lt;&lt; S0= 0.60, S1= 1.65, S2= 0.01 &gt;&gt;

46PD *	R I	5.74	0.0		1.22D+03		1.23D-01
47AG	I	8.80	1.0		1.80D+01		1.71D-01
48CD *	S I	6.98	0.0		7.38D+01		6.60D-02
49IN	I	9.81	2.0		1.50D+00		9.27D-02
50SN		8.40	0.0		9.56D+01		1.66D-01

MASS NUMBER 111

&lt;&lt; S0= 0.30, S1= 1.60, S2= 0.0 &gt;&gt;

46PD		8.33	2.5		1.27D+02		1.75D-01
47AG *		6.44	0.5		2.90D+01		1.63D-01
48CD *	SR	9.40	0.5	3.40D+01	3.39D+01	1.00D-01	1.10D-01
49IN	I	7.90	4.5		2.26D+00		8.14D-02
50SN		11.08	2.5		2.49D+00		1.18D-01

MASS NUMBER 112

&lt;&lt; S0= 0.50, S1= 1.55, S2= 0.01 &gt;&gt;

46PD *		5.40	0.0		1.03D+03		1.29D-01
47AG	I	8.55	2.0		1.67D+01		1.58D-01
48CD *	SR I	6.54	0.0	1.25D+02	1.68D+02		6.30D-02
49IN	I	9.43	0.0		3.85D+01		1.68D-01
50SN	P I	7.74	0.0		1.29D+02		1.15D-01

MASS NUMBER 113

&lt;&lt; S0= 0.50, S1= 1.50, S2= 0.01 &gt;&gt;

46PD		7.80	2.5		2.56D+01		1.05D-01
47AG		6.45	0.5		1.12D+01		1.34D-01
48CD *	SR	9.05	4.5	2.27D+01	2.27D+01	1.00D-01	9.15D-02
49IN	I	7.31	4.5	6.00D+00	5.68D+00	8.60D-02	8.50D-02
50SN		10.32	0.5		4.75D+01		1.83D-01
51SB		8.51	2.5		3.01D+00		1.26D-01

TABLE 4 (CONTINUED)

MASS NUMBER 114      << S0= 0.70, S1= 1.45, S2= 0.01 >>

46PD		5.00	0.0		3.59D+03		1.38D-01
47AG	I	7.48	2.0		5.24D+00		9.02D-02
48CD * SR	I	6.14	0.0		1.48D+02		5.60D-02
49IN	I	9.03	1.0		2.61D+01		1.40D-01
50SN P	I	7.54	0.0	2.50D+02	1.86D+02		1.25D-01
51SB		10.79	2.0		4.51D+00		1.83D-01

MASS NUMBER 115      << S0= 0.30, S1= 1.42, S2= 0.02 >>

47AG		5.85	0.5		1.12D+02		1.77D-01
48CD *		8.69	0.5		8.43D+00		6.71D-02
49IN * SR	I	6.73	4.5	5.20D+00	5.74D+00	6.90D-02	6.95D-02
50SN * P		9.56	0.5		1.33D+02		1.87D-01
51SB	I	7.70	2.5		8.83D+00		1.01D-01

MASS NUMBER 116      << S0= 0.50, S1= 1.35, S2= 0.02 >>

48CD * R	I	5.76	0.0		9.52D+02		7.09D-02
49IN	I	8.80	1.0		3.15D+00		8.47D-02
50SN * S	I	6.94	0.0	2.48D+02	2.18D+02	5.60D-02	1.02D-01
51SB	I	9.67	2.0		1.80D+01		1.50D-01
52TE	I	7.73	0.0		8.89D+01		9.21D-02

MASS NUMBER 117      << S0= 0.20, S1= 0.61, S2= 0.03 >>

48CD		8.32	0.5		6.96D+01		9.33D-02
49IN	I	6.60	4.5		2.59D+01		9.36D-02
50SN * SR		9.33	0.5	2.00D+01	2.00D+01	1.16D-01	1.18D-01
51SB	I	7.46	2.5		6.07D+00		8.78D-02
52TE		10.65	0.5		2.53D+01		1.51D-01

MASS NUMBER 118      << S0= 0.40, S1= 4.47, S2= 0.04 >>

48CD		5.49	0.0		3.90D+02		6.61D-02
49IN	I	8.19	1.0		2.95D+01		1.15D-01
50SN * SR	I	6.48	0.0	1.10D+03	1.10D+03	1.64D-01	1.19D-01
51SB		9.60	6.0		1.45D+00		1.10D-01
52TE	I	8.11	0.0		2.84D+01		8.15D-02

TABLE 4 (CONTINUED)

MASS NUMBER 119            << S0= 0.20, S1= 6.68, S2= 0.05 >>

49IN	I	6.20	4.5		1.09D+01		6.86D-02
50SN * SR	I	9.11	0.5	9.40D+01	9.38D+01	1.49D-01	1.54D-01
51SB	I	7.00	2.5		3.50D+01		1.11D-01
52TE		10.28	0.5		3.55D+00		9.15D-02
53 I		8.00	2.5		7.68D-01		9.34D-02

MASS NUMBER 120            << S0= 0.15, S1= 3.50, S2= 0.06 >>

49IN	I	7.98	1.0		2.22D+01		1.02D-01
50SN * SR	I	6.18	0.0	3.60D+02	5.43D+02	1.00D-01	8.39D-02
51SB		9.25	1.0		1.76D+01		1.71D-01
52TE	P I	6.98	0.0		3.88D+02		9.87D-02
53 I	I	10.02	1.0		2.41D-01		7.43D-02

MASS NUMBER 121            << S0= 0.50, S1= 3.00, S2= 0.08 >>

49IN		5.70	4.5		3.66D+01		9.39D-02
50SN *		8.80	0.5		7.97D+01		1.37D-01
51SB * SR	I	6.80	2.5	1.40D+01	1.25D+01	8.50D-02	8.64D-02
52TE		10.06	0.5		1.99D+01		1.25D-01
53 I		8.28	2.5		1.81D+00		1.20D-01
54XE		11.60	0.5		1.69D-01		1.20D-01

MASS NUMBER 122            << S0= 0.60, S1= 2.60, S2= 0.11 >>

49IN	I	8.13	1.0		2.97D+01		1.13D-01
50SN * R	I	5.93	0.0		1.10D+03		9.61D-02
51SB *		8.98	2.0		8.83D+00		1.39D-01
52TE * SP	I	6.94	0.0	1.50D+02	1.20D+02		8.00D-02
53 I		9.73	1.0		2.26D+00		1.41D-01
54XE		7.60	0.0		5.99D+01		1.89D-01

MASS NUMBER 123            << S0= 0.70, S1= 2.20, S2= 0.16 >>

49IN		5.66	4.5		9.15D+01		1.12D-01
50SN *		8.51	0.5		1.71D+02		1.47D-01
51SB * R	I	6.43	3.5	2.80D+01	2.71D+01	9.00D-02	8.90D-02
52TE * SP		9.41	0.5	2.40D+01	2.40D+01		1.09D-01
53 I		7.59	2.5		7.69D-01		8.38D-02
54XE		10.50	0.0		5.60D+00		1.95D-01

TABLE 4 (CONTINUED)

MASS NUMBER 124      << S0= 0.10, S1= 2.00, S2= 0.21 >>

50SN * R I	5.77	0.0		2.76D+03		1.09D-01
51SB *	8.76	3.0		1.48D+01		1.46D-01
52TE * S I	6.60	0.0	3.00D+02	2.93D+02	8.10D-02	8.21D-02
53 I	9.63	2.0		8.56D-01		1.12D-01
54XE P I	7.61	0.0		5.71D+00		9.17D-02

MASS NUMBER 125      << S0= 0.30, S1= 2.53, S2= 0.32 >>

50SN * I	8.17	5.5		1.21D+02		9.73D-02
51SB *	6.12	3.5		9.27D+01		1.31D-01
52TE * SR	9.09	0.5	5.50D+01	5.49D+01	1.49D-01	1.20D-01
53 I	7.09	2.5		2.89D+00		9.61D-02
54XE	10.24	0.5		1.30D+00		1.35D-01
55CS	8.51	0.5		2.70D-01		1.09D-01

MASS NUMBER 126      << S0= 0.45, S1= 1.64, S2= 0.50 >>

50SN * I	5.64	0.0		5.24D+03		1.18D-01
51SB *	8.44	3.0		2.69D+01		1.52D-01
52TE * SR I	6.31	0.0	6.71D+02	9.36D+02	7.20D-02	8.74D-02
53 I	9.15	2.0		2.69D+00		1.27D-01
54XE P I	7.20	0.0		2.13D+01		1.06D-01
55CS	9.90	1.0		2.47D-01		1.18D-01
56BA	7.70	0.0		2.21D+00		6.47D-02

MASS NUMBER 127      << S0= 0.60, S1= 1.64, S2= 0.63 >>

50SN	7.87	5.5		5.70D+02		1.55D-01
51SB * I	6.07	3.5		1.74D+02		1.16D-01
52TE *	8.75	1.5		5.38D+01		1.08D-01
53 I * RX	6.80	2.5	1.59D+01	1.21D+01	1.27D-01	1.26D-01
54XE	9.64	0.5		5.23D+00		1.55D-01
55CS	7.81	0.5		7.25D-01		1.12D-01
56BA	10.71	0.5		2.16D-01		6.89D-02

MASS NUMBER 128      << S0= 0.45, S1= 1.64, S2= 0.70 >>

50SN I	5.60	0.0		1.28D+04		1.41D-01
51SB *	7.90	3.0		1.76D+02		1.94D-01
52TE * R I	6.12	0.0	2.55D+03	1.93D+03	1.17D-01	1.08D-01
53 I	8.87	1.0		7.38D+00		1.47D-01
54XE * S I	6.91	0.0		9.88D+01		1.33D-01
55CS	9.74	1.0		6.35D-01		1.39D-01
56BA I	7.99	0.0		1.15D+00		4.87D-02

TABLE 4 (CONTINUED)

MASS NUMBER 129				<< S0= 0.30, S1= 1.80, S2= 0.75 >>		
51SB	I	5.49	3.5		9.22D+02	1.34D-01
52TE *		8.38	1.5		2.47D+02	1.33D-01
53 I *	I	6.50	3.5	2.10D+01	2.71D+01	9.50D-02
54XE	RX	9.26	0.5		1.09D+01	1.64D-01
55CS		7.37	0.5		5.16D+00	1.50D-01
56BA		10.26	0.5		3.67D-01	6.93D-02
57LA		8.66	3.5		2.47D-02	2.78D-02

MASS NUMBER 130				<< S0= 0.80, S1= 2.00, S2= 0.73 >>		
52TE *	R I	5.90	0.0	5.50D+03	5.61D+03	7.80D-02
53 I *		8.58	5.0		1.48D+01	1.57D-01
54XE *	S I	6.60	0.0		2.65D+02	1.47D-01
55CS		9.24	1.0		1.60D+00	1.50D-01
56BA	P I	7.63	0.0		7.01D+00	6.41D-02
57LA		10.27	1.0		7.25D-02	4.05D-02

MASS NUMBER 131				<< S0= 0.70, S1= 1.70, S2= 0.70 >>		
52TE *		8.12	1.5		1.26D+04	2.81D-01
53 I *		6.35	3.5		7.23D+01	1.50D-01
54XE *	RX	8.93	1.5	2.50D+01	2.50D+01	1.78D-01
55CS		7.21	2.5		4.92D+00	1.42D-01
56BA		9.56	0.5		1.40D+00	7.68D-02
57LA		7.70	3.5		1.99D-01	3.37D-02
58CE		11.72	0.5		1.21D-01	6.65D-02

MASS NUMBER 132				<< S0= 0.70, S1= 1.50, S2= 0.62 >>		
52TE *	I	6.00	0.0		4.02D+05	2.99D-01
53 I		8.29	0.0		1.98D+03	4.07D-01
54XE *	SR I	6.53	0.0		5.93D+02	1.70D-01
55CS		9.04	2.0		4.30D+00	1.76D-01
56BA	P I	7.37	0.0		2.32D+01	7.60D-02
57LA		9.99	1.0		1.16D-01	4.20D-02
58CE		8.39	0.0		2.17D+00	6.87D-02

MASS NUMBER 133				<< S0= 0.70, S1= 1.30, S2= 0.54 >>		
52TE		5.40	1.5		1.48D+06	2.32D-01
53 I *		3.11	3.5		6.55D+04	1.42D-01
54XE *		8.46	1.5		4.10D+02	2.79D-01
55CS *	RX I	6.71	3.5	1.89D+01	1.85D+01	1.28D-01
56BA		9.25	1.5		4.34D+00	8.98D-02

TABLE 4 (CONTINUED)

MASS NUMBER 134		<< S0= 0.80, S1= 1.20, S2= 0.47 >>			
52TE		3.50	0.0	7.25D+05	1.04D-01
53 I		7.91	4.0	5.11D+03	4.46D-01
54XE	* R I	6.56	0.0	7.88D+03	2.97D-01
55CS	* I	9.05	4.0	3.43D+01	2.15D-01
56BA	* S I	7.20	0.0	7.43D+01	9.21D-02
57LA		9.72	1.0	7.73D-01	5.88D-02
58CE		7.76	0.0	1.24D+01	8.25D-02

MASS NUMBER 135		<< S0= 0.80, S1= 1.10, S2= 0.38 >>					
53 I *		3.70	3.5	1.20D+04	1.43D-01		
54XE *		7.88	1.5	3.55D+03	3.64D-01		
55CS *		6.61	3.5	3.28D+02	2.87D-01		
56BA	SR I	9.23	1.5	3.50D+01	3.49D+01	1.10D-01	1.10D-01
57LA		7.61	3.5	1.72D+00		5.18D-02	
58CE		9.99	1.5	1.56D+00		7.66D-02	

MASS NUMBER 136		<< S0= 0.60, S1= 1.05, S2= 0.29 >>			
53 I		4.60	2.0	7.95D+03	1.28D-01
54XE	* R	4.46	0.0	3.69D+04	1.97D-01
55CS *		8.61	4.0	2.72D+02	3.76D-01
56BA	* S I	6.95	0.0	9.50D+02	1.45D-01
57LA		9.32	1.0	1.17D+01	9.46D-02
58CE	P I	7.84	0.0	2.93D+01	8.02D-02

MASS NUMBER 137		<< S0= 0.50, S1= 1.00, S2= 0.23 >>			
54XE		5.55	1.5	5.12D+03	1.42D-01
55CS *		4.31	3.5	1.93D+03	1.71D-01
56BA	* SR	8.54	1.5	2.15D+02	1.66D-01
57LA		7.26	3.5	3.27D+01	8.72D-02
58CE		9.47	1.5	2.45D+01	1.20D-01
59PR		7.97	2.5	9.52D-01	4.45D-02

MASS NUMBER 138		<< S0= 1.40, S1= 0.95, S2= 0.19 >>					
54XE		4.32	0.0	9.56D+03	1.37D-01		
55CS		6.12	3.0	3.70D+02	1.78D-01		
56BA	* SR	4.72	0.0	8.60D+03	8.81D+03	1.11D-01	
57LA	P	8.79	5.0	3.00D+01	3.00D+01	1.00D-01	1.01D-01
58CE	P I	7.51	0.0	4.68D+02		1.30D-01	
59PR		9.83	1.0	5.03D+00		7.94D-02	

TABLE 4 (CONTINUED)

MASS NUMBER 139			<< S0= 0.75, S1= 0.90, S2= 0.17 >>		
55CS	4.14	3.5		4.46D+02	1.16D-01
56BA	6.24	3.5		4.60D+02	8.16D-02
57LA * SX	5.00	3.5	2.50D+02	2.57D+02	6.30D-02
58CE	9.04	1.5		1.17D+02	1.48D-01
59PR	7.67	2.5		1.80D+01	7.62D-02
60ND I	10.17	1.5		6.07D+00	9.98D-02

MASS NUMBER 140			<< S0= 1.00, S1= 0.80, S2= 0.15 >>		
56BA *	4.83	0.0		1.66D+03	8.41D-02
57LA *	6.78	4.0		4.84D+01	6.05D-02
58CE * SX	5.44	0.0	3.00D+03	3.03D+03	1.11D-01
59PR	9.39	1.0		2.40D+01	9.93D-02
60ND I	7.89	0.0		1.66D+02	1.39D-01

MASS NUMBER 141			<< S0= 2.00, S1= 0.80, S2= 0.14 >>		
56BA	5.93	3.5		4.71D+02	7.08D-02
57LA	5.13	3.5		3.56D+01	4.31D-02
58CE *	7.21	3.5		1.08D+02	7.91D-02
59PR * SR	5.85	2.5	7.50D+01	7.55D+01	5.90D-02
60ND	9.81	1.5		2.50D+01	1.56D-01
61PM	8.63	3.5		6.84D+00	2.22D-01

MASS NUMBER 142			<< S0= 1.80, S1= 0.80, S2= 0.13 >>		
57LA	6.32	2.0		7.36D+01	5.59D-02
58CE * R	5.11	0.0	1.00D+03	1.00D+03	7.50D-02
59PR *	7.32	2.0		2.53D+01	5.62D-02
60ND * S	6.10	0.0		7.81D+02	1.31D-01
61PM	9.77	1.0		2.16D+01	2.98D-01
62SM I	8.30	0.0		3.78D+01	1.15D-01

MASS NUMBER 143			<< S0= 4.00, S1= 0.80, S2= 0.12 >>		
57LA	4.59	3.5		3.32D+01	3.37D-02
58CE *	6.89	3.5		1.04D+02	6.95D-02
59PR *	5.77	3.5		1.06D+01	3.77D-02
60ND * SR	7.83	3.5	2.80D+01	2.79D+01	9.50D-02
61PM	6.66	3.5		2.77D+01	8.84D-02
62SM	10.46	1.5		3.80D+00	1.74D-01

TABLE 4 (CONTINUED)

MASS NUMBER 144			<< S0= 3.50, S1= 0.79, S2= 0.11 >>			
58CE *	4.65	0.0		9.81D+02		5.94D-02
59PR	6.93	0.0		1.13D+02		6.76D-02
60ND * SR	5.74	0.0		2.25D+02		8.72D-02
61PM	7.90	5.0		1.02D+01		1.55D-01
62SM P	6.76	0.0	1.45D+02	1.36D+02	6.00D-02	1.18D-01

MASS NUMBER 145			<< S0= 3.00, S1= 0.70, S2= 0.11 >>			
58CE	6.77	2.5		3.42D+01		5.26D-02
59PR *	5.17	2.5		1.13D+01		3.05D-02
60ND * SR	7.56	3.5	2.40D+01	2.43D+01	7.20D-02	7.82D-02
61PM	6.26	3.5		6.26D+00		1.12D-01
62SM	8.45	3.5		4.60D+00		7.46D-02
63EU	7.37	2.5		6.71D+00		2.61D-01

MASS NUMBER 146			<< S0= 3.80, S1= 0.65, S2= 0.11 >>			
59PR	6.95	0.0		2.15D+01		4.82D-02
60ND * SR	5.29	0.0		1.84D+02		6.84D-02
61PM	7.63	2.0		1.17D+01		1.48D-01
62SM	6.33	0.0		2.99D+01		7.28D-02
63EU	8.38	5.0		2.70D+00		2.22D-01
64GD	7.28	0.0		3.20D+02		2.57D-01

MASS NUMBER 147			<< S0= 4.30, S1= 0.58, S2= 0.13 >>			
59PR	5.17	3.5		3.26D+00		2.35D-02
60ND *	7.33	2.5		1.25D+01		6.29D-02
61PM * I	5.92	3.5	3.70D+00	3.73D+00	7.00D-02	7.04D-02
62SM * RX	8.14	3.5	4.00D+00	3.96D+00	8.20D-02	6.58D-02
63EU	6.86	2.5		1.45D+00		1.63D-01
64GD	9.06	3.5		1.06D+01		1.65D-01

MASS NUMBER 148			<< S0= 3.50, S1= 0.10, S2= 0.17 >>			
60ND * R	5.04	0.0		1.38D+02		5.72D-02
61PM *	7.23	1.0		1.13D+01		1.30D-01
62SM * S	5.85	0.0	2.70D+01	2.35D+01	5.20D-02	5.89D-02
63EU	8.18	5.0		1.97D+00		1.97D-01
64GD	6.95	0.0		6.94D+01		1.68D-01
65TB I	8.80	3.0		1.65D+00		1.49D-01

TABLE 4 (CONTINUED)

MASS NUMBER 149

&lt;&lt; S0= 3.00, S1= 0.35, S2= 0.23 &gt;&gt;

60ND		7.33	2.5		2.85D+00		4.63D-02
61PM *		5.62	3.5		3.20D+00		7.76D-02
62SM * RX		7.98	3.5	1.70D+00	1.67D+00	6.00D-02	5.24D-02
63EU	I	6.49	2.5		1.17D+00		1.10D-01
64GD		8.72	3.5		9.33D+00		1.46D-01

MASS NUMBER 150

&lt;&lt; S0= 3.00, S1= 0.10, S2= 0.37 &gt;&gt;

60ND * R		5.41	0.0		1.01D+02		6.42D-02
61PM		7.85	1.0		1.07D+00		9.60D-02
62SM * S		5.61	0.0	1.90D+01	1.89D+01	5.50D-02	4.96D-02
63EU	I	7.93	4.0		1.08D+00		1.28D-01
64GD		6.52	0.0		7.82D+01		1.48D-01
65TB		8.62	3.0		1.17D+00		1.68D-01
66DY		7.46	0.0		1.75D+01		1.66D-01

MASS NUMBER 151

&lt;&lt; S0= 3.00, S1= 0.50, S2= 0.50 &gt;&gt;

61PM *		5.91	2.5		3.39D+00		8.72D-02
62SM *		8.22	3.5		1.99D-01		3.63D-02
63EU	RX I	6.29	2.5	7.00D-01	6.78D-01	1.04D-01	9.25D-02
64GD		8.51	1.5		8.46D+00		1.34D-01
65TB	I	7.02	1.5		7.52D-01		9.90D-02
66DY		9.49	3.5		1.78D+00		1.44D-01

MASS NUMBER 152

&lt;&lt; S0= 2.50, S1= 0.22, S2= 0.75 &gt;&gt;

61PM		7.59	1.0		1.40D+00		9.41D-02
62SM * SR		5.89	0.0	1.90D+01	1.91D+01	5.80D-02	5.59D-02
63EU		8.54	3.0		1.00D-01		1.17D-01
64GD	SP	6.48	0.0		3.90D+01		1.26D-01
65TB		8.81	3.0		3.44D-01		1.37D-01
66DY		7.13	0.0		1.57D+01		1.46D-01
67HD	I	9.28	7.0		7.81D-01		1.35D-01

MASS NUMBER 153

&lt;&lt; S0= 2.20, S1= 0.25, S2= 0.90 &gt;&gt;

62SM *		7.90	1.5		5.39D-01		4.04D-02
63EU * RX		6.39	2.5	9.40D-01	9.15D-01	1.11D-01	1.29D-01
64GD		8.61	1.5		1.92D+00		1.02D-01
65TB	I	7.06	1.5		2.75D-01		8.11D-02
66DY	I	9.37	1.5		1.33D+00		1.04D-01
67HD		8.08	3.5		1.75D-01		1.15D-01

TABLE 4 (CONTINUED)

MASS NUMBER 154			<< S0= 2.20, S1= 0.10, S2= 0.98 >>			
62SM * R	5.82	0.0	2.40D+01	2.29D+01	5.80D-02	5.72D-02
63EU *	8.19	3.0		1.54D-01		1.16D-01
64GD S	6.46	0.0		5.31D+01		1.34D-01
65TB	8.96	3.0		5.26D-02		9.59D-02
66DY	6.65	0.0		1.42D+01		1.21D-01

MASS NUMBER 155			<< S0= 2.20, S1= 0.10, S2= 1.00 >>			
62SM	7.26	1.5		2.66D+00		4.51D-02
63EU *	6.33	2.5		1.03D+00		1.29D-01
64GD * RX	8.53	1.5	1.90D+00	1.91D+00	1.10D-01	9.95D-02
65TB I	7.03	1.5		4.62D-01		8.96D-02
66DY	9.89	1.5		1.37D-01		9.36D-02

MASS NUMBER 156			<< S0= 1.90, S1= 0.10, S2= 1.00 >>			
62SM *	5.60	0.0		2.71D+01		5.35D-02
63EU *	7.55	1.0		1.26D+00		1.50D-01
64GD * RX	6.35	0.0	5.90D+01	6.21D+01	1.05D-01	1.32D-01
65TB	8.69	3.0		7.09D-02		9.53D-02
66DY P	6.83	0.0		1.50D+01		1.31D-01

MASS NUMBER 157			<< S0= 1.60, S1= 0.10, S2= 0.95 >>			
63EU *	5.70	2.5		2.26D+00		1.22D-01
64GD * RX	7.93	1.5	6.30D+00	6.33D+00	1.07D-01	1.06D-01
65TB I	6.79	1.5		6.82D-01		9.05D-02
66DY	8.84	1.5		5.52D-01		9.44D-02

MASS NUMBER 158			<< S0= 1.60, S1= 0.10, S2= 0.90 >>			
64GD * SR I	6.03	0.0	9.20D+01	8.37D+01	1.08D-01	1.01D-01
65TB	8.18	3.0		2.36D-01		1.07D-01
66DY P	6.85	0.0		1.45D+01		1.31D-01
67HO	9.09	5.0		5.29D-02		9.28D-02

TABLE 4 (CONTINUED)

MASS NUMBER 159      << S0= 1.60, S1= 0.10, S2= 0.85 >>

63EU		6.10	2.5		2.70D+00		1.46D-01
64GD *		7.38	1.5		2.67D+01		1.19D-01
65TB * RX		6.40	1.5	1.00D+00	9.80D-01	1.09D-01	1.10D-01
66DY		8.59	1.5		1.16D+00		1.03D-01
67HD		7.09	3.5		3.97D-01		1.04D-01

MASS NUMBER 160      << S0= 1.70, S1= 0.10, S2= 0.80 >>

64GD * R		5.65	0.0	3.00D+02	2.98D+02		1.40D-01
65TB *		7.67	3.0		1.05D+00		1.26D-01
66DY * S		6.45	0.0		2.18D+01		1.24D-01
67HD		8.95	5.0		9.74D-02		1.02D-01

MASS NUMBER 161      << S0= 1.80, S1= 0.10, S2= 0.76 >>

64GD		6.99	2.5		5.20D+01		1.18D-01
65TB * I		5.99	1.5		4.32D+00		1.03D-01
66DY * RX		8.20	2.5	2.90D+00	2.91D+00	1.14D-01	1.11D-01
67HD I		6.84	3.5		4.50D-01		7.85D-02
68ER		9.20	1.5		3.11D-01		5.93D-02
69TM I		7.83	0.5		9.87D-02		5.78D-02

MASS NUMBER 162      << S0= 2.10, S1= 0.10, S2= 0.72 >>

65TB I		7.37	3.0		2.47D+00		1.09D-01
66DY * RX		6.25	0.0	7.20D+01	6.22D+01	1.55D-01	1.49D-01
67HD I		8.40	1.0		1.08D+00		1.15D-01
68ER P		6.84	0.0	6.90D+00	7.92D+00		7.15D-02
69TM		9.46	2.0		1.64D-02		6.10D-02

MASS NUMBER 163      << S0= 2.00, S1= 0.10, S2= 0.70 >>

65TB		5.54	1.5		1.23D+01		1.38D-01
66DY * RX		7.66	2.5	9.60D+00	9.64D+00	1.09D-01	1.19D-01
67HD I		6.56	3.5		1.57D+00		9.36D-02
68ER		8.80	2.5		8.28D-01		6.52D-02
69TM		7.10	0.5		2.29D-01		7.13D-02

TABLE 4 (CONTINUED)

MASS NUMBER 164		<< S0= 2.00, S1= 0.10, S2= 0.68 >>					
66DY * RX I	5.64	0.0	2.00D+02	2.25D+02	5.50D-02	1.14D-01	
67HD	8.04	1.0		2.75D+00		1.61D-01	
68ER P	6.65	0.0	2.00D+01	2.35D+01		8.38D-02	
69TM	9.01	2.0		7.82D-02		7.58D-02	

MASS NUMBER 165		<< S0= 1.90, S1= 0.10, S2= 0.67 >>					
66DY	7.15	3.5		1.20D+01		1.04D-01	
67HD * SR I	6.33	3.5	3.20D+00	3.17D+00	1.00D-01	1.01D-01	
68ER	8.55	2.5		1.80D+00		7.14D-02	
69TM	7.17	0.5		5.73D-01		8.82D-02	
70YB	9.55	3.5		4.35D-01		7.91D-02	

MASS NUMBER 166		<< S0= 1.90, S1= 0.10, S2= 0.66 >>					
66DY	5.50	0.0		2.89D+02		1.46D-01	
67HD	7.29	0.0		1.53D+01		1.84D-01	
68ER RX I	6.44	0.0	4.90D+01	4.52D+01	8.80D-02	7.42D-02	
69TM	8.52	2.0		2.54D-01		8.56D-02	
70YB	6.88	0.0		2.77D+01		1.09D-01	

MASS NUMBER 167		<< S0= 1.70, S1= 0.10, S2= 0.66 >>					
67HD	5.47	3.5		1.22D+01		1.25D-01	
68ER RX	7.77	3.5	3.10D+00	3.20D+00	8.80D-02	6.24D-02	
69TM	6.95	0.5		1.21D+00		9.67D-02	
70YB	8.98	3.5		1.50D+00		8.79D-02	
71LU I	7.42	3.5		9.71D-02		7.19D-02	

MASS NUMBER 168		<< S0= 1.40, S1= 0.10, S2= 0.66 >>					
67HD	7.20	1.0		4.03D+00		1.35D-01	
68ER SR	6.00	0.0	1.25D+02	9.31D+01	8.10D-02	9.66D-02	
69TM	8.06	3.0		2.46D-01		7.48D-02	
70YB P I	6.79	0.0		4.48D+01		9.29D-02	
71LU	9.13	1.0		1.36D-01		1.23D-01	

TABLE 4 (CONTINUED)

MASS NUMBER 169

&lt;&lt; S0= 1.50, S1= 0.13, S2= 0.66 &gt;&gt;

67HD		5.09	3.5		2.32D+01		1.23D-01
68ER		7.19	0.5		1.68D+01		7.26D-02
69TM	RX	6.38	0.5	3.00D+00	2.99D+00	9.80D-02	9.80D-02
70YB		8.55	3.5		1.73D+00		8.01D-02
71LU		7.26	3.5		1.91D-01		1.00D-01

MASS NUMBER 170

&lt;&lt; S0= 1.30, S1= 0.10, S2= 0.66 &gt;&gt;

68ER	R	5.68	0.0		1.61D+02		8.94D-02
69TM		7.63	1.0		6.12D-01		7.99D-02
70YB	S	6.76	0.0	3.70D+01	4.83D+01		1.12D-01
71LU		8.71	1.0		1.53D-01		1.13D-01

MASS NUMBER 171

&lt;&lt; S0= 1.30, S1= 0.10, S2= 0.67 &gt;&gt;

68ER		6.95	0.5		1.13D+01		6.11D-02
69TM		6.35	0.5		3.27D+00		9.88D-02
70YB	RX	8.14	0.5	6.50D+00	6.52D+00	7.30D-02	9.34D-02
71LU	I	7.04	3.5		2.75D-01		8.03D-02

MASS NUMBER 172

&lt;&lt; S0= 1.50, S1= 0.11, S2= 0.68 &gt;&gt;

68ER		5.30	0.0		1.99D+02		7.89D-02
69TM		7.04	2.0		3.78D-01		5.98D-02
70YB	SR	6.48	0.0	6.20D+01	7.66D+01		1.13D-01
71LU		8.49	4.0		5.50D-02		8.62D-02

MASS NUMBER 173

&lt;&lt; S0= 1.90, S1= 0.12, S2= 0.69 &gt;&gt;

69TM		5.76	0.5		5.00D+00		8.82D-02
70YB	RX I	7.44	0.5	8.40D+00	8.45D+00	7.40D-02	6.16D-02
71LU		6.63	3.5		5.44D-01		1.03D-01

TABLE 4 (CONTINUED)

MASS NUMBER 174

&lt;&lt; S0= 2.00, S1= 0.14, S2= 0.71 &gt;&gt;

69TM		6.34	4.0		3.76D+00		7.58D-02
70YB	SR I	5.84	0.0	2.10D+02	1.28D+02		9.01D-02
71LU		7.80	1.0		1.30D-01		8.50D-02
72HF	P	6.91	0.0	2.50D+01	2.05D+01		1.74D-01

MASS NUMBER 175

&lt;&lt; S0= 1.90, S1= 0.16, S2= 0.74 &gt;&gt;

69TM		4.94	0.5		2.62D+01		9.08D-02
70YB	I	6.64	3.5		3.51D+01		6.12D-02
71LU	RX I	6.19	3.5	4.10D-01	6.32D-01	8.40D-02	6.68D-02
72HF		8.11	0.5		1.40D+00		1.08D-01
73TA		7.00	3.5		6.73D-01		7.60D-02

MASS NUMBER 176

&lt;&lt; S0= 1.90, S1= 0.18, S2= 0.78 &gt;&gt;

70YB	R I	5.53	0.0	2.84D+02	2.67D+02		8.43D-02
71LU	S I	6.89	7.0	2.00D+00	1.30D+00		8.93D-02
72HF	S	6.37	0.0	3.00D+01	2.93D+01		1.50D-01

MASS NUMBER 177

&lt;&lt; S0= 2.20, S1= 0.21, S2= 0.82 &gt;&gt;

70YB		6.25	3.5		8.70D+01		7.95D-02
71LU	I	5.87	3.5		1.43D+00		7.78D-02
72HF	RX I	7.62	3.5	2.40D+00	3.86D+00	6.00D-02	8.11D-02
73TA	I	6.87	3.5		4.76D-01		5.37D-02

MASS NUMBER 178

&lt;&lt; S0= 2.10, S1= 0.24, S2= 0.86 &gt;&gt;

71LU		6.98	7.0		1.52D+00		1.10D-01
72HF	SR I	6.07	0.0	5.70D+01	6.09D+01		1.21D-01
73TA		7.86	7.0		6.05D-01		7.52D-02

TABLE 4 (CONTINUED)

MASS NUMBER 179

<< S0= 1.90, S1= 0.29, S2= 0.90 >>

71LU		5.37	3.5		6.93D+00		1.14D-01
72HF	SR I	7.33	4.5	6.50D+00	7.54D+00		9.05D-02
73TA	I	6.78	3.5		7.32D-01		5.72D-02
74 W	I	8.40	3.5		6.74D-01		4.36D-02

MASS NUMBER 180

<< S0= 1.70, S1= 0.46, S2= 0.96 >>

72HF	SR	5.95	0.0	2.24D+02	1.48D+02	2.45D-01	1.94D-01
73TA	P I	7.64	8.0	1.50D+00	1.32D+00		6.74D-02
74 W	P I	6.95	0.0		9.01D+00		6.14D-02

MASS NUMBER 181

<< S0= 2.10, S1= 0.21, S2= 1.00 >>

72HF		6.58	0.5		6.77D+01		1.40D-01
73TA	SR I	6.06	3.5	4.10D+00	4.85D+00	6.50D-02	6.51D-02
74 W		7.99	4.5		1.61D+00		5.84D-02
75RE	I	7.20	2.5		2.68D-01		6.75D-02

MASS NUMBER 182

<< S0= 2.30, S1= 0.34, S2= 1.05 >>

72HF	I	5.16	0.0		5.22D+02		1.30D-01
73TA		6.86	3.0		3.46D+00		7.91D-02
74 W	SR I	6.19	0.0	5.00D+01	6.40D+01	5.50D-02	6.70D-02
75RE	I	8.18	7.0		3.00D-01		7.25D-02
760S	I	8.00	0.0		3.85D+00		1.25D-01

MASS NUMBER 183

<< S0= 2.00, S1= 0.05, S2= 1.10 >>

73TA		5.74	3.5		7.85D+00		8.44D-02
74 W	SR	7.42	0.5	1.11D+01	1.12D+01	1.12D-01	7.23D-02
75RE	I	6.66	2.5		1.44D+00		8.18D-02
760S		8.50	4.5		1.59D+00		1.20D-01

TABLE 4 (CONTINUED)

MASS NUMBER 184      << S0= 2.60, S1= 0.82, S2= 1.00 >>

73TA		6.60	3.0		4.84D+00		7.76D-02
74 W	SR I	5.75	0.0	1.69D+02	1.33D+02	9.20D-02	7.26D-02
75RE		7.81	3.0		5.06D-01		9.22D-02
76DS	P	6.81	0.0		5.09D+01		1.87D-01

MASS NUMBER 185      << S0= 2.60, S1= 1.99, S2= 1.00 >>

73TA		5.41	3.5		6.34D+00		7.13D-02
74 W		7.21	1.5		7.83D+00		6.24D-02
75RE	RX	6.24	2.5	2.30D+00	2.87D+00	7.30D-02	9.97D-02
76DS		8.30	0.5		6.40D+00		1.51D-01

MASS NUMBER 186      << S0= 1.80, S1= 1.40, S2= 0.90 >>

74 W	R	5.46	0.0	1.00D+02	1.13D+02	3.21D-02	7.27D-02
75RE		7.32	1.0		2.15D+00		1.08D-01
76DS	S	6.25	0.0		1.26D+02		1.85D-01
77IR	I	8.47	3.0		2.84D-01		7.19D-02

MASS NUMBER 187      << S0= 1.70, S1= 1.19, S2= 0.50 >>

74 W		6.61	1.5		1.26D+01		5.47D-02
75RE	RX I	5.73	2.5	3.60D+00	3.11D+00	9.10D-02	7.25D-02
76DS	SX	7.84	0.5	1.30D+01	1.25D+01		1.52D-01
77IR		6.62	1.5		2.47D+00		1.06D-01

MASS NUMBER 188      << S0= 1.80, S1= 1.00, S2= 0.32 >>

75RE	I	7.12	1.0		1.43D+00		7.32D-02
76DS	SR I	6.01	0.0		8.42D+01		1.22D-01
77IR	I	8.27	2.0		4.47D-01		7.50D-02
78PT		7.20	0.0		1.74D+01		1.11D-01

TABLE 4 (CONTINUED)

MASS NUMBER 189            << S0= 2.00, S1= 0.85, S2= 0.27 >>

75RE	I	5.67	2.5		1.79D+00		6.13D-02
76DS	RX I	7.77	1.5	4.90D+00	4.89D+00	9.50D-02	9.58D-02
77IR		6.29	1.5		2.96D+00		9.87D-02
78PT	I	8.68	0.5		2.47D+00		7.22D-02

MASS NUMBER 190            << S0= 2.00, S1= 0.75, S2= 0.23 >>

75RE		6.70	4.0		1.25D+00		7.83D-02
76DS	RX I	5.89	0.0		8.25D+01		1.16D-01
77IR	I	8.25	4.0		2.87D-01		6.80D-02
78PT	P	6.68	0.0		2.78D+01		1.03D-01
79AU		9.16	4.0		2.48D-01		1.26D-01

MASS NUMBER 191            << S0= 2.10, S1= 0.68, S2= 0.20 >>

76DS		7.63	0.5		1.16D+01		1.39D-01
77IR	RX I	6.15	1.5	2.90D+00	2.90D+00	7.50D-02	7.40D-02
78PT		8.36	1.5		1.90D+00		7.87D-02
79AU		7.07	1.5		2.42D+00		1.43D-01

MASS NUMBER 192            << S0= 1.70, S1= 0.60, S2= 0.18 >>

76DS	R	5.48	0.0		3.59D+02		1.69D-01
77IR	I	7.79	4.0		5.68D-01		6.89D-02
78PT	S I	6.29	0.0		4.06D+01		7.67D-02
79AU	I	8.43	4.0		6.09D-01		9.94D-02
80HG	I	7.52	0.0		1.23D+01		1.90D-01

MASS NUMBER 193            << S0= 2.00, S1= 0.53, S2= 0.17 >>

76DS		7.14	0.5		5.99D+01		1.65D-01
77IR	RX I	6.10	1.5	7.70D+00	7.72D+00	8.70D-02	8.95D-02
78PT		8.38	0.5		3.53D+00		9.04D-02
79AU		6.97	1.5		2.14D+00		1.35D-01
80HG	I	8.96	1.5		1.27D+00		1.43D-01

TABLE 4 (CONTINUED)

MASS NUMBER 194

&lt;&lt; S0= 1.40, S1= 0.47, S2= 0.15 &gt;&gt;

76DS		5.50	0.0		3.91D+02		1.73D-01
77IR		7.36	1.0		6.53D+00		1.28D-01
78PT	RX I	6.13	0.0		1.22D+02		9.10D-02
79AU	I	8.41	1.0		1.48D+00		1.19D-01
80HG	I	7.30	0.0		1.30D+01		1.80D-01
81TL	I	9.69	2.0		2.42D-01		1.42D-01

MASS NUMBER 195

&lt;&lt; S0= 1.65, S1= 0.40, S2= 0.14 &gt;&gt;

77IR		5.87	1.5		1.24D+01		1.16D-01
78PT	RX	7.93	0.5	1.77D+01	1.77D+01	1.10D-01	1.10D-01
79AU	I	6.67	1.5		9.11D+00		1.32D-01
80HG		8.81	0.5		2.99D+00		2.09D-01
81TL	I	7.21	0.5		3.91D+00		1.64D-01

MASS NUMBER 196

&lt;&lt; S0= 1.70, S1= 0.33, S2= 0.13 &gt;&gt;

77IR		6.91	1.0		3.18D+01		1.54D-01
78PT	RX I	5.85	0.0		2.11D+02		9.15D-02
79AU	I	8.08	2.0		4.57D+00		1.38D-01
80HG	P I	6.64	0.0		8.76D+01		2.16D-01
81TL	I	9.04	2.0		5.55D-01		1.44D-01
82PB	I	7.80	0.0		1.59D+01		1.29D+00

MASS NUMBER 197

&lt;&lt; S0= 1.75, S1= 0.23, S2= 0.12 &gt;&gt;

77IR		5.16	1.5		1.72D+02		1.54D-01
78PT		7.56	0.5		8.04D+01		1.34D-01
79AU	RX	6.50	1.5	1.37D+01	1.37D+01	1.72D-01	1.73D-01
80HG		8.63	0.5		1.12D+01		2.62D-01
81TL	I	7.37	0.5		9.80D+00		2.08D-01
82PB		9.63	2.5		1.03D+00		1.22D+00

MASS NUMBER 198

&lt;&lt; S0= 1.50, S1= 0.27, S2= 0.12 &gt;&gt;

78PT	R I	5.57	0.0		1.59D+03		1.24D-01
79AU		7.57	2.0		3.26D+01		2.27D-01
80HG	S I	6.65	0.0	9.80D+01	9.90D+01	1.30D-01	2.22D-01
81TL	I	9.01	2.0		2.13D+00		1.90D-01
82PB	I	7.65	0.0		6.60D+01		1.66D+00

TABLE 4 (CONTINUED)

MASS NUMBER 199			<< S0= 2.10, S1= 0.26, S2= 0.11 >>			
78PT		7.28 0.5		1.83D+02		1.45D-01
79AU		6.28 1.5		1.77D+02		2.76D-01
80HG	SX	8.03 0.5	8.20D+01	8.20D+01	3.00D-01	3.32D-01
81TL	I	6.67 0.5		2.93D+01		2.13D-01
82PB		8.90 2.5		1.06D+01		1.64D+00

MASS NUMBER 200			<< S0= 2.10, S1= 0.25, S2= 0.11 >>			
78PT		4.96 0.0		6.63D+03		1.60D-01
79AU		6.94 0.0		5.88D+02		3.41D-01
80HG	SR I	6.23 0.0	1.30D+03	1.31D+03	5.00D-01	3.28D-01
81TL	I	8.27 2.0		2.42D+01		2.61D-01
82PB	I	7.24 0.0		1.37D+02		1.70D+00

MASS NUMBER 201			<< S0= 1.40, S1= 0.25, S2= 0.10 >>			
79AU		6.02 1.5		5.83D+02		3.24D-01
80HG	SR	7.76 1.5	1.05D+02	1.05D+02	3.50D-01	3.21D-01
81TL	I	6.95 0.5		2.94D+02		3.76D-01
82PB	I	8.87 2.5		6.44D+01		1.89D+00

MASS NUMBER 202			<< S0= 1.00, S1= 0.25, S2= 0.10 >>			
79AU		7.13 2.0		1.12D+03		4.16D-01
80HG	SR	5.99 0.0		3.73D+03		4.73D-01
81TL		7.70 2.0		9.56D+01		3.74D-01
82PB	I	6.93 0.0		3.89D+03		3.11D+00

MASS NUMBER 203			<< S0= 1.00, S1= 0.25, S2= 0.10 >>			
80HG		7.50 2.5		8.84D+02		4.60D-01
81TL	SR	6.66 0.5	0.0	1.15D+03	6.50D-01	5.81D-01
82PB	I	8.24 2.5		2.98D+02		2.16D+00



TABLE 5

CALCULATED 30 KEV CAPTURE CROSS SECTIONS (MB) COMPARED WITH VALUES GIVEN IN TABLE II OF ALLEN ET AL. (1970) AND BENZI ET AL. (1969)

- \* : SEMI-EMPIRICAL ESTIMATES  
 ( ) : UNCERTAIN EXPERIMENTAL VALUE  
 ? : DISAGREEMENT WITH ISOTOPIC CROSS SECTIONS  
 # : CROSS SECTION DEDUCED FROM NATURAL AND/OR ISOTOPIC VALUES  
 \$ : ALTERNATIVE VALUE REQUIRED BY  $N_S\sigma(A)$  AND/OR  $N_R(A)$   
 R : RAPID PROCESS ONLY  
 S : SLOW PROCESS ONLY  
 P : PROTON RICH NUCLIDES  
 SX : DOMINANT S-PROCESS (>80%)  
 SR : COMPARABLE S AND R PROCESS CONTRIBUTIONS  
 RX : DOMINANT R-PROCESS (>80%)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
29CU NAT		47 ± 7		
29CU 63	SX	49 ± 14 (92)	#	38
29CU 65	SX	42 ± 7 (18)		34
30ZN NAT		41 ± 10		
30ZN 64	S	50*		41
30ZN 66	SX	40*		19
30ZN 67	SX	160*		54
30ZN 68	SX	23 ± 3		13
30ZN 70	R	16*		14
31GA NAT		115 ± 20		
31GA 69	SR	130 ± 30		60
31GA 71	SR	120 ± 30 (60)		117
32GE NAT		74 ± 7		
32GE 70	S	84*	75	34
32GE 72	SR	65*, 40 \$	63	36
32GE 73	SR	270*	339	126
32GE 74	SR	35 ± 20, 20 \$	40	21
32GE 76	R	53 ± 10	60	22
33AS 75	SR	490 ± 100	509	492
34SE NAT		94 ± 8		
34SE 74	P	160*	125	142
34SE 76	S	100*	154	70
34SE 77	SR	340*	553	273
34SE 78	SR	60*	184	62
34SE 80	SR	20 ± 12	32	49
34SE 82	R	36 ± 15	68	20
35BR NAT		600 ± 60		
35BR 79	R	600 ± 150	779	405
35BR 81	SR	460 ± 80	332	416

TABLE 5 (CONTINUED)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
36KR NAT		UNMEASURED		
36KR 78	P	250*, 500 \$	251	159
36KR 80	P	140*, 280 \$	222	146
36KR 82	S	80*, 200 \$	197	124
36KR 83	SR	225*, 670 \$	642	360
36KR 84	SR	28*, 60 \$	30	35
36KR 86	R	9*, 20 \$	9	8
37RB NAT		160 ± 20		
37RB 85	SR	215 ± 20	289	234
37RB 87	R	24 ± 4	27	36
38SR NAT		120 ± 40 ?		
38SR 84	P	330*	293	167
38SR 86	S	74 ± 7	82	75
38SR 87	SX	109 ± 9	127	118
38SR 88	SX	7 ± 3	26	6
39Y 89	SR	21 ± 4	23	17
40ZR NAT		25 ± 10		
40ZR 90	SX	12 ± 2	16	15
40ZR 91	SR	68 ± 8	80	120
40ZR 92	SR	34 ± 6	36	34
40ZR 94	SR	20 ± 2	30	27
40ZR 96	R	40 ± 12	28	58
41NB 93	SR	285 ± 30	262	143
42MO NAT		160 ± 20		
42MO 92	P	50*	33	98
42MO 94	PX	80*	67	178
42MO 95	SR	430 ± 50	336	393
42MO 96	S	90 ± 10	107	88
42MO 97	SR	350 ± 50	379	297
42MO 98	SR	150 ± 40, 110 \$	104	127
42MO100	R	100 ± 40	71	101
43TC 99	SR	800*		724
44RU NAT		(550)		
44RU 96	P	270 ± 60	293	284
44RU 98	P	300*	168	259
44RU 99	SR	1240*	699	919
44RU100	S	290*	181	506
44RU101	SR	1120*	902	2591
44RU102	SR	330 ± 50	348	352
44RU104	R	120 ± 60	155	155
45RH103	SR	900 ± 100	793	685

TABLE 5 (CONTINUED)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
46PD NAT		440 ± 40		
46PD102	P	320*	319	516
46PD104	S	270*	289	509
46PD105	RX	1130*	1221	834
46PD106	SR	230*	241	155
46PD108	SR	200 ± 60	188	110
46PD110	R	100 ± 30	156	59
47AG NAT		520 ± 100		
47AG107	SR	1150 ± 150	828	759
47AG109	SR	620 ± 50	897	775
48CD NAT		340 ± 50		
48CD106	P	210*	815	813
48CD108	P	210*	448	329
48CD110	S	210*	373	301
48CD111	SR	840*	610	367
48CD112	SR	210*	245	201
48CD113	SR	840*	631	377
48CD114	SR	200 ± 40	317	164
48CD116	R	220 ± 40	100	44
49IN NAT		760 ± 80		
49IN113		220 ± 70	920	
49IN115	SR	800 ± 100 #	761	613
50SN NAT		95 ± 15		
50SN112	P	180*	342	294
50SN114	P	130*	180	99
50SN115	P	550*	244	228
50SN116	S	100 ± 15	118	109
50SN117	SR	420 ± 30	416	337
50SN118	SR	63 ± 5	65	94
50SN119	SR	260 ± 40	293	351
50SN120	SR	40 ± 15	42	149
50SN122	R	23 ± 5, (165)	36	56
50SN124	R	23 ± 4, (180)	27	27
51SB NAT		490 ± 50		
51SB121	SR	740 ± 100	721	567
51SB123	R	440 ± 50	390	352
52TE NAT		97 ± 9, (204)		
52TE120	P	400*	280	139
52TE122	SP	270 ± 30	260	244
52TE123	SP	820 ± 30	769	584
52TE124	S	150 ± 20	145	131
52TE125	SR	430 ± 30	443	416
52TE126	SR	82 ± 8	74	65
52TE128	R	33 ± 5	25	33
52TE130	R	14 ± 2	13	13
53 I127	RX	760 ± 50	800	589

TABLE 5 (CONTINUED)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
54XE NAT		UNMEASURED		
54XE124	P	1200*	426	899
54XE126	P	800*	310	756
54XE128	S	300*	239	396
54XE129	RX	760*	572	843
54XE130	S	100*	189	243
54XE131	RX	250*	491	590
54XE132	SR	36*	116	141
54XE134	R	13*	60	27
54XE136	R	5*	9	5
55CS133	RX	700 ± 40	693	512
56BA NAT		61 ± 5		
56BA130	P	2000*	419	1166
56BA132	P	650*	305	644
56BA134	S	155*	202	353
56BA135	SR	315*	392	323
56BA136	S	37*	80	80
56BA137	SR	76*	106	114
56BA138	SR	8 ± 2, 5 #	6	10
57LA NAT		44 ± 4		
57LA138	P		393	321
57LA139	SX	44 ± 4, 48 #	40	42
58CE NAT		35 ± 5		
58CE136	P	100*	321	506
58CE138	P	30*	127	124
58CE140	SX	3 ± 3, 12 #	25	24
58CE142	R	360 ± 60, (450)	47	43
59PR141	SR	110 ± 20	139	110
60ND NAT		UNMEASURED		
60ND142	S	70*	38	82
60ND143	SR	425*	339	340
60ND144	SR	100*	92	153
60ND145	SR	600*	419	297
60ND146	SR	150*	138	141
60ND148	R	210 ± 80	169	86
60ND150	R	240 ± 150	361	116
62SM NAT		920 ± 50		
62SM144	P	120 ± 55	121	160
62SM147	RX	1150 ± 190	1236	1134
62SM148	S	260 ± 50	251	257
62SM149	RX	1620 ± 280	1687	1407
62SM150	S	370 ± 70	410	346
62SM152	SR	450 ± 50	496	403
62SM154	R	380 ± 60	448	297
63EU NAT		3350 ± 150		
63EU151	RX	3600 ± 500	2507	3204
63EU153	RX	2700 ± 300	2703	2388

TABLE 5 (CONTINUED)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
64GD NAT		940 ± 50		
64GD152	SP	500*	673	419
64GD154	S	520*	978	306
64GD155	RX	2280*	2168	1626
64GD156	RX	470*	634	236
64GD157	RX	2070*	1392	691
64GD158	SR	540 ± 70	526	175
64GD160	R	100 ± 30	369	97
65TB159	RX	2200 ± 200	1985	1901
66DY NAT		730 ± 40		
66DY156	P	870*	1011	717
66DY158	P	770*	967	703
66DY160	S	650*	694	522
66DY161	RX	2800 ± 300	2250	1177
66DY162	RX	470 ± 50	436	272
66DY163	RX	1600 ± 300	1357	544
66DY164	RX	180 ± 40	542	70
67HO165	SR	1250 ± 150, (2000)		1038
68ER NAT		750 ± 50		
68ER162	P	900*		823
68ER164	P	750*		419
68ER166	RX	560*		237
68ER167	RX	2000*		950
68ER168	SR	400*		118
68ER170	R	250 ± 30		107
69TM169	RX	1500 ± 200		1106
70YB NAT		600 ± 50		
70YB168	P	700*		253
70YB170	S	510*		323
70YB171	RX	1320*		550
70YB172	SR	380*		239
70YB173	RX	990*		522
70YB174	SR	275*		103
70YB176	R	200 ± 50		90
71LU NAT		1400 ± 300, (3700)		
71LU175	RX	1460 ± 110		2692
71LU176	S	250 ± 200		1338
72HF NAT		600 ± 50		
72HF174	P	800*		644
72HF176	S	640 ± 160		527
72HF177	RX	1100*		1006
72HF178	SR	370*		328
72HF179	SR	960*		697
72HF180	SR	290 ± 80		268

TABLE 5 (CONTINUED)

NUCLIDE		ALLEN ET AL	BENZI ET AL	THIS WORK
73TA NAT		800 ± 80		
73TA180	P			1422
73TA181	SR	800 ± 80 #		745
74 W NAT		290 ± 30		
74 W180	P	270*		760
74 W182	SR	260 ± 30		249
74 W183	SR	550 ± 50		550
74 W184	SR	180 ± 20		212
74 W186	R	220 ± 20		165
75RE NAT		1420 ± 100, (950)		
75RE185	RX	1530 ± 200, (2200)		1817
75RE187	RX	1570 ± 100, (780)		1292
76OS NAT		300 ± 40		
76OS184	P	400*		676
76OS186	S	330*		464
76OS187	SX	900*		979
76OS188	SR	275*		409
76OS189	RX	765*		1083
76OS190	RX	230*, (750)		366
76OS192	R	(200)		168
77IR NAT		1120 ± 200		
77IR191	RX	1900 ± 300 #		1229
77IR193	RX	600 ± 80		708
78PT NAT		470 ± 60		
78PT190	P	770*		642
78PT192	S	490*		400
78PT194	RX	310*		209
78PT195	RX	780*		503
78PT196	RX	160 ± 40		133
78PT198	R	185 ± 20		38
79AU197	RX	600 ± 50		635
80HG NAT		250 ± 60		
80HG196	P	360*		385
80HG198	S	250*, 125 #		247
80HG199	SX	630*		334
80HG200	SR	175*		114
80HG201	SR	450*		261
80HG202	SR	50 ± 15		53
81TL NAT		70 ± 5		
81TL203	SR	150 ± 50		92

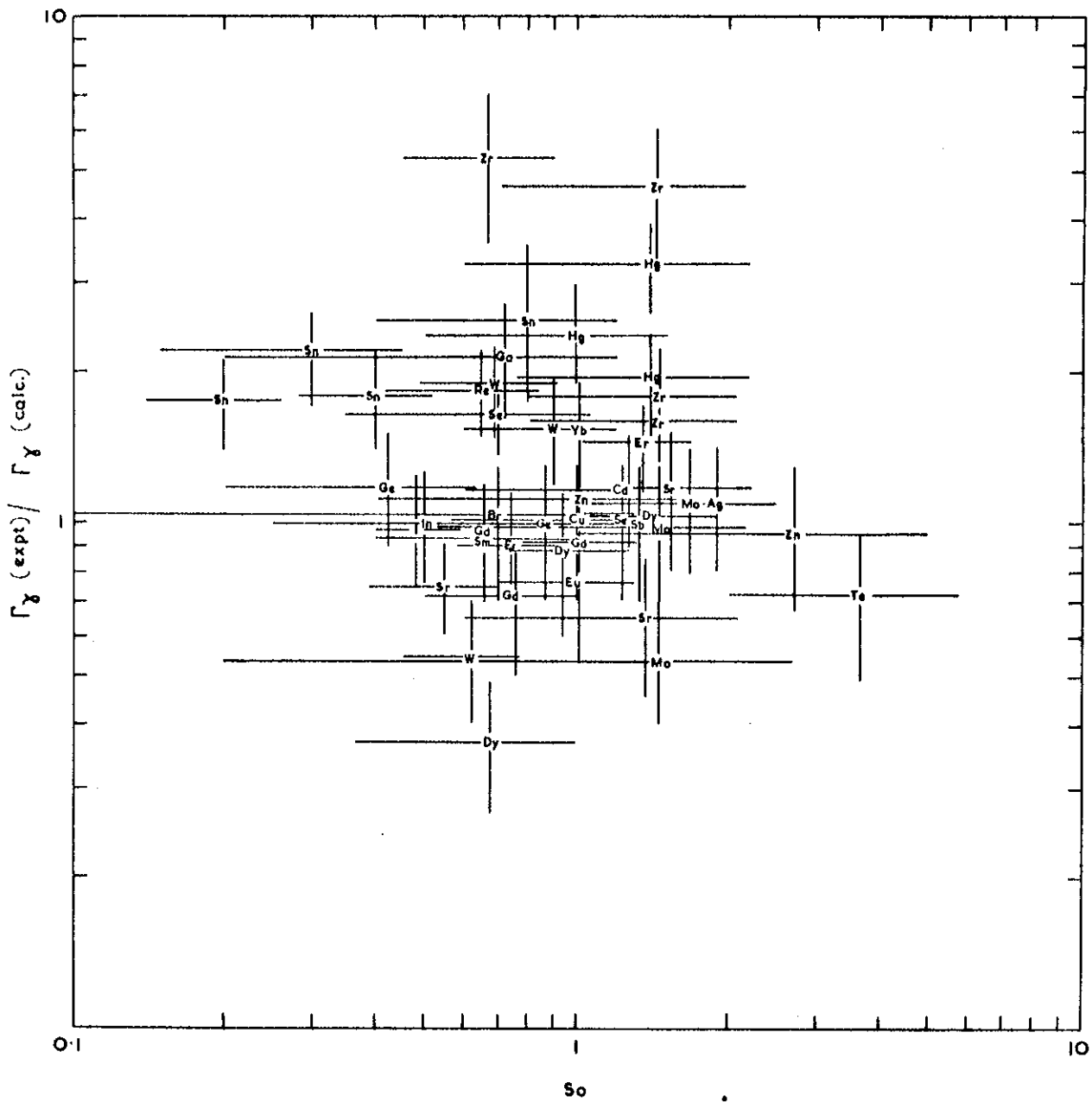


FIGURE 1. PLOT OF  $\Gamma_\gamma (\text{expt}) / \Gamma_\gamma (\text{calc.})$  v. s-WAVE NEUTRON STRENGTH FUNCTION

