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RESEARCH ESTABLISHMENT

LUCAS HEIGHTS RESEARCH LABORATORIES

VALENCY EFFECTS IN COMPOUND NUCLEUS LEVEL SPACINGS

by

J.L. COOK
E.K. ROSE

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ABSTRACT

It is shown that nuclides whose proton or neutron numbers lie within three units of a magic number have a level density parameter that is very strongly correlated with the Myers-Swiatecki shell correction to the mass formula. Using this correlation, 93 level densities are calculated from only two adjustable constants, in a semi-empirical fashion.

It is shown that since weaker correlations exist in five regions of the periodic table, intermediate and heavy nuclides which lie between the strong correlation ranges also give satisfactory fits, thus making a twelve-parameter fit overall.

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VALENCE; COMPOUND NUCLEI; ENERGY-LEVEL DENSITY; MAGIC NUCLEI; MASS FORMULAE; CORRELATIONS; ENERGY LEVELS

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1. INTRODUCTION

Knowledge of the average level spacing between resonances of a compound nucleus has important applications in astrophysics, reactor physics and fission physics. Until now the most suitable formula has come from the evaluation of Gilbert and Cameron [1965] shell and pairing corrections carried out by Cook, Ferguson and Musgrove [1967], and modified by Rose and Cook [1977]. Wapstra and Gove [1971] published a thorough evaluation of neutron binding energies which was used by Rose and Cook, together with experimental values of the level spacing tabulated by Gyulassy and Perkins [1972], Mughabghab and Garber [1973] and Musgrove [1976], to re-evaluate the Gilbert-Cameron parameters.

Unfortunately, the Gilbert-Cameron theory requires many parameters in the form of shell and pairing corrections which, for about 300 values, requires about 200 constants to be fitted. In this report it is shown that there is a strong correlation between the Myers and Swiatecki [1966] shell correction to the semi-empirical mass formula and the level density mass parameter, which permits accurate calculation of level densities for 93 spherical nuclides in terms of only two adjustable parameters. The physical significance of the level density parameters is discussed fully in Lang [1966].

2. GILBERT-CAMERON THEORY

The densities of states of spin J at an energy E above the ground state were derived by Gilbert and Cameron as

$$\rho(E,J) = \frac{\sqrt{\pi}\,\exp\{2(aU)^{\frac{1}{2}}\}\,(2J+1)\exp\{-(J+\frac{1}{2})^2/2\sigma^2\}}{24\,a^{\frac{1}{4}}\,U^{\frac{5}{4}}\,(2\pi)^{\frac{1}{2}}\sigma^3} \qquad (1)$$

U is the effective excitation energy, given as

$$U = E-\Delta E \quad ,$$

where ΔE is the nucleon pairing energy which is fixed at the Green and Edwards [1953] value:

$$\left.\begin{aligned} \Delta E \text{ (odd-odd)} &= 0 \\ \Delta E \text{ (even-odd)} &= 11\, A^{-\frac{1}{2}} \\ \Delta E \text{ (even-even)} &= 22\, A^{-\frac{1}{2}} \end{aligned}\right\} \qquad (2)$$

where A is the compound nucleus mass number.

The spin cutoff parameter σ was determined by Gilbert and Cameron to be

$$\sigma^2 = 0.0888(aU)^{\frac{1}{2}}\, A^{\frac{2}{3}} \quad . \qquad (3)$$

More recent estimates [Gardner 1980] give the constant coefficient of 0.146. This agrees with the result of Lang [1966]. The quantity a is the level density parameter, which Gilbert and Cameron assumed to be

$$a/A = \alpha\, S(Z,N)+\beta \quad , \qquad (4)$$

where α and β are constant and S(Z,N) is the shell correction to the semi-empirical mass formula. Cameron [1958] used the relationships

$$S(Z,N) = S(Z)+S(N)$$

$$\Delta E = P(Z)+P(N) \qquad (5)$$

and worked out tables of S(Z), S(N), P(Z) and P(N) which fitted the measured masses. This treatment gives many adjustable parameters, but interpolation to unmeasured values is hazardous. Figure 1 shows the scatter of experimental a/A values with compound nucleus mass number A.

3. THE MYERS-SWIATECKI SHELL CORRECTIONS

A theoretical derivation of the shell correction was given by Myers and Swiatecki [1966]. They found the expressions

$$\text{(i)} \qquad S(Z,N) = C\left[\frac{F(N)+F(Z)}{(\frac{1}{2}A)^{\frac{2}{3}}} - cA^{\frac{1}{3}}\right] \quad , \qquad (6)$$

with

$$\text{(ii)} \qquad F(X) = \int_0^X [q(n) - n^{\frac{2}{3}}]dn \quad ,$$

$$\text{(iii)} \qquad q(n) = \frac{3}{5} \frac{M_i^{\frac{5}{3}} - M_{i-1}^{\frac{5}{3}}}{M_i - M_{i-1}} \quad \text{for } M_{i-1} < n < M_i \quad .$$

The M_i are the magic numbers 14,28,50,82,126,184 and 258 for both Z and N. The values of constants C and c are

$$C = 5.8 \text{ MeV} \quad , \quad c = 0.26 \quad . \tag{7}$$

For deformed nuclides, one replaces S by $S_o[\ 1+\ell nS/S_o]$, where S_o is the Myers-Swiatecki spherical limit.

On examining the data compiled by Rose and Cook [1977] at the neutron binding energy, a correlation was naturally found between the calculated a/A from the experimental values of $\langle D \rangle = 1/\rho$ and the Myers-Swiatecki shell correction for those nuclides with either Z or N within three units of any of the magic numbers M_i. The correlation coefficient was 0.903 between a/A and S(Z,N) for these valency nuclides, 93 of which have been measured. The Myers-Swiatecki shell corrections were then applied to S(Z,N) and a correlation coefficient of 0.365 was calculated for the remaining 107 nuclides. Green's pairing correction for ΔE was used. The relationship (Equation 4) for these others, most of which were deformed nuclei, was therefore rejected.

For the valency nuclides, a linear fit gives

$$a/A = (0.01018 \pm 0.00036)S(Z,N) + (0.12746 \pm 0.00050) \quad . \tag{8}$$

The experimental values for a/A and the fitted values are shown in Appendix A. Errors obtained by including the experimental errors for $\langle D \rangle$ are also presented. Figures 2 to 7 show the variation of experimental a/A with S(Z,N) for each group together with the fitted line $\alpha S(Z,N) + \beta$.

For neutron reactions, the proper excitation energy is given by

$$E = E_n + B \quad , \tag{9}$$

where E_n is the kinetic energy of the neutron and B is the neutron binding energy. The kinetic energy was assumed to be about one half of the last

resolved resonance energy and the binding energies were obtained from Wapstra and Gove [1971]. Since formula (1) applied to both parities, only one parity prevails at low energies, so for s-waves

$$\langle\rho\rangle = \frac{1}{\langle D\rangle} = \frac{1}{2} \sum_{J=I-\frac{1}{2}}^{J=I+\frac{1}{2}} \rho(U,J) \quad , \tag{10}$$

where I = the target nucleus spin. The recalculated values of <D> are given in Appendix B together with the experimental value.

One can perceive from the coefficients in Table 1 that for group 5, whose nuclides can be read off the group numbers in Appendix B, a constant value of a/A is quite acceptable as a fit. This happens to be the range for the most strongly deformed nuclei; when S(Z,N) assumes values well away from magic numbers, the correlation is lost.

The overall situation regarding the possibility of using a broader group structure to reduce the number of parameters is presented in Table 2. Here we postulate that in the weaker correlation ranges, a satisfactory fit is achieved by replacing the linear dependence with a constant average value of a/A. The value of χ^2/n is given at each stage and it is apparent from the table that the new scheme is the optimum one for satisfactory predictions of <D>. The group structures are summarised in Table 3.

With regard to the calcium isotopes, which make up the second group, it was found that these light isotopes departed from the strong correlation expected near the semi-magic number 20; in reality it should be expected that the Fermi gas model would be unreliable in this range.

In the case of fission product data, which is the ultimate purpose of this study, there is no need to be concerned about isotopes in this range, so the fit to group 2 would never be needed. Our rigorous statistical analysis reveals that five semi-empirical constants are required to fit about two hundred for intermediate and heavy nuclides. This is a satisfactory result for the prediction of unmeasured values of the level spacing.

4. CONCLUSION

A satisfactory overall fit to measured values of the level spacing is obtained with twelve adjustable parameters. The 93 nuclides with valency 3 or less are very well fitted with just two adjustable constants. The purpose in carrying out these fits was to reduce the number of degrees of freedom from the large number required for a Gilbert and Cameron type of theory. Extrapolations and interpolations to unmeasured values of $\bar{D}$, such as are required in astrophysics and reactor physics, can serve as a check on Gilbert and Cameron values and probably provide more reliable results.

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TABLE 1

COEFFICIENTS FOR $a/A = \alpha S(Z,N)+\beta$

Group	Number of nuclides (n)	α	$\Delta\alpha$	β	$\Delta\beta$	χ^2/n	C_R
1	93	0.01018	0.00036	0.12746	0.00050	0.92	0.89
2	3	-0.01028	0.02135	0.18438	0.03641	0.04	-0.52
3	9	0.02976	0.01703	0.08391	0.02873	0.09	0.91
4	14	0.05209	0.01513	0.01041	0.02568	0.31	0.78
5	56	0.00631	0.00288	0.11319	0.00496	1.04	0.18
6	22	0.07947	0.04179	-0.03514	0.06008	0.45	0.53

TABLE 2

χ^2/n VALUES AS A FUNCTION OF GROUP STRUCTURE

Group	Nuclear Range	n	$\alpha S+\beta$ Fit	a/A Fit	5 Groups	4 Groups		3 Groups		2 Groups
1	all spherical 4-181	93	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
2	1-3	3	0.04	0.12	0.12	0.12				
3	35-46	9	0.08	0.42			0.89		0.89	
					0.95			2.30		
4	56-71	14	0.31	1.16		2.34				80.0
5	111-167	56	1.03	1.12	1.12		1.12			
									1.0	
6	182-204	22	0.45	0.62	0.62	0.62	0.62	0.62		
		197								
7										

7 omitted owing to high χ^2 in a/A fit.

Groups 5 and 6 only marginally worse for a/A fit.

$\alpha S+\beta$ fits to 6 regions still best.

For deformed nuclides 6-group structure is such that each group lies between magic numbers in either Z or N or both.

TABLE 3
DEFORMED GROUP STRUCTURE

Group	Magic Number Range for Z	Magic Number Range for N' = N+1
2	$14 < Z \leq 28$	$14 < N' \leq 28$
3	$28 < Z \leq 50$	$28 < N' \leq 50$
4	$28 < Z \leq 50$	$50 < N' \leq 82$
5	$50 < Z \leq 82$	$82 < N' \leq 128$

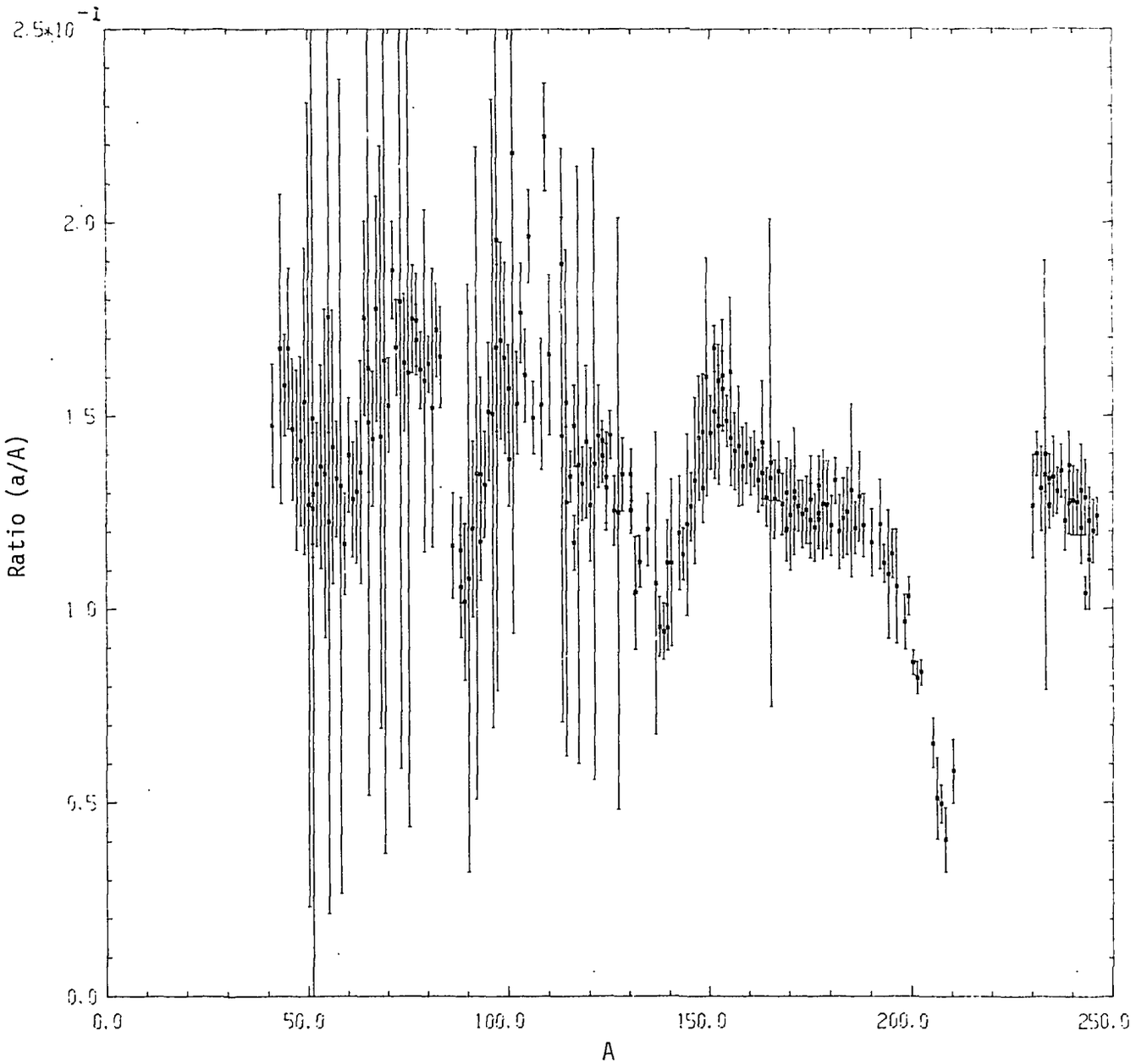

FIGURE 1. SCATTER OF EXPERIMENTAL a/A VALUES WITH COMPOUND NUCLEUS MASS NUMBER A

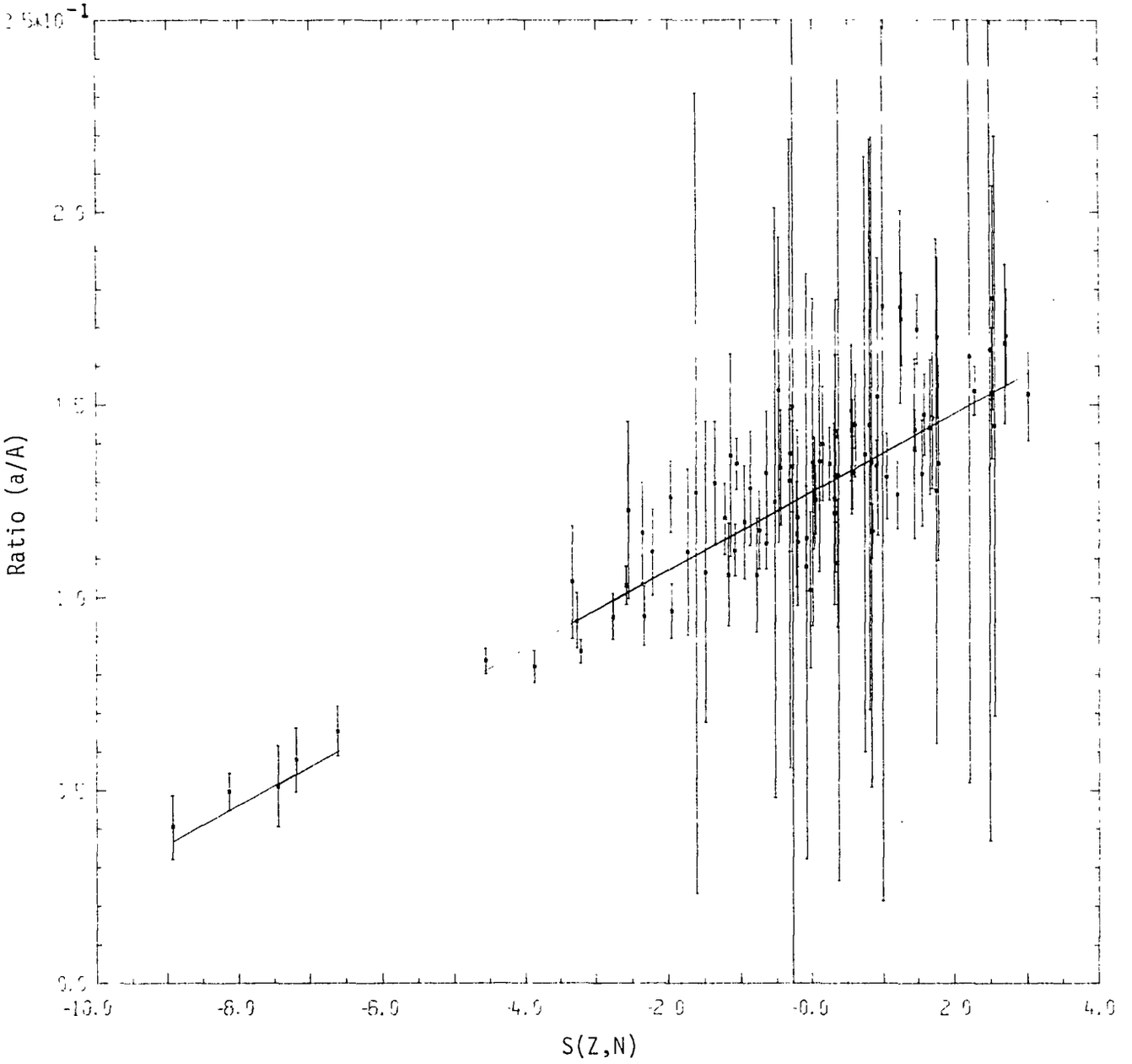

FIGURE 2. VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP I

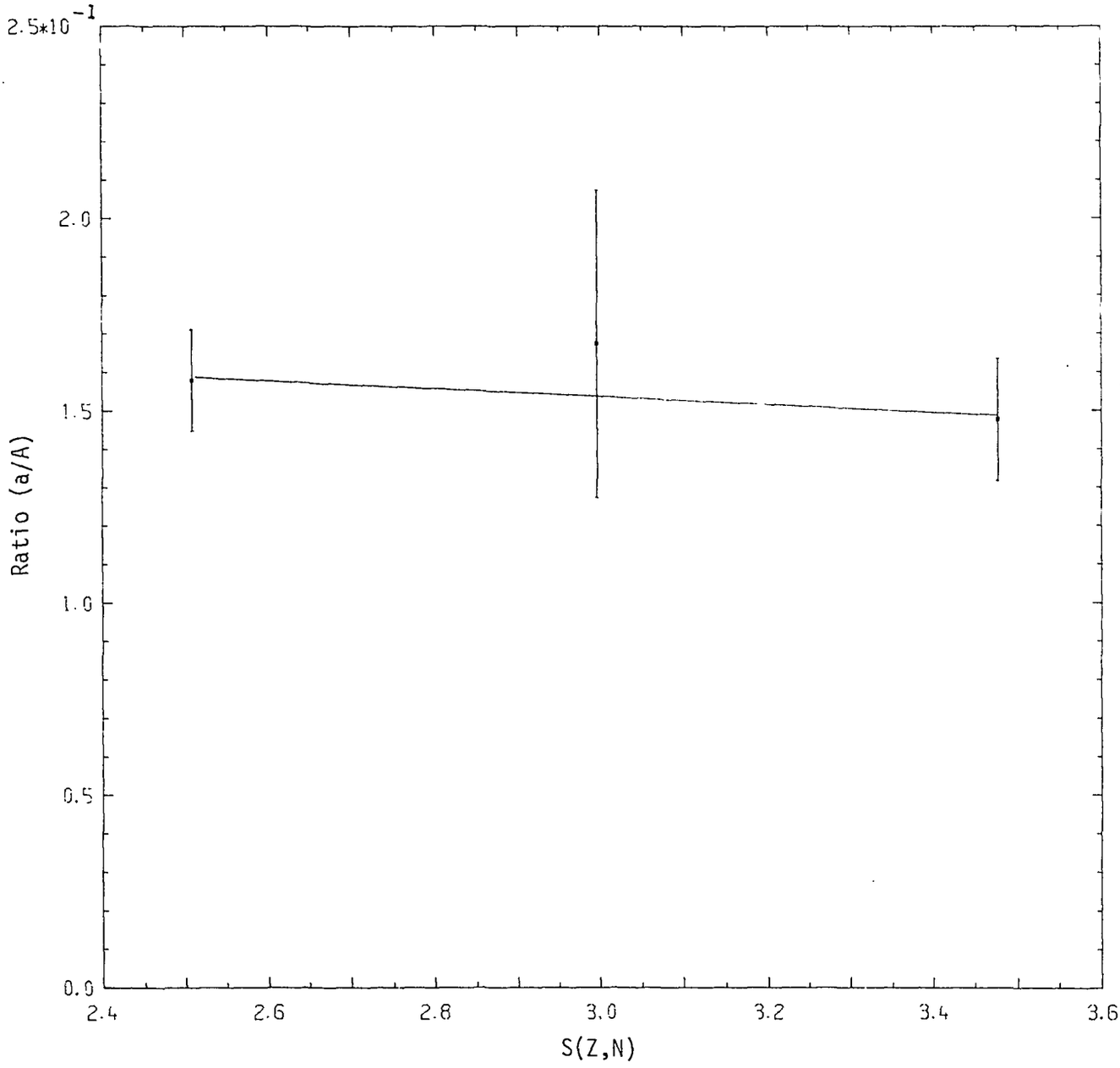

FIGURE 3. VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP 2

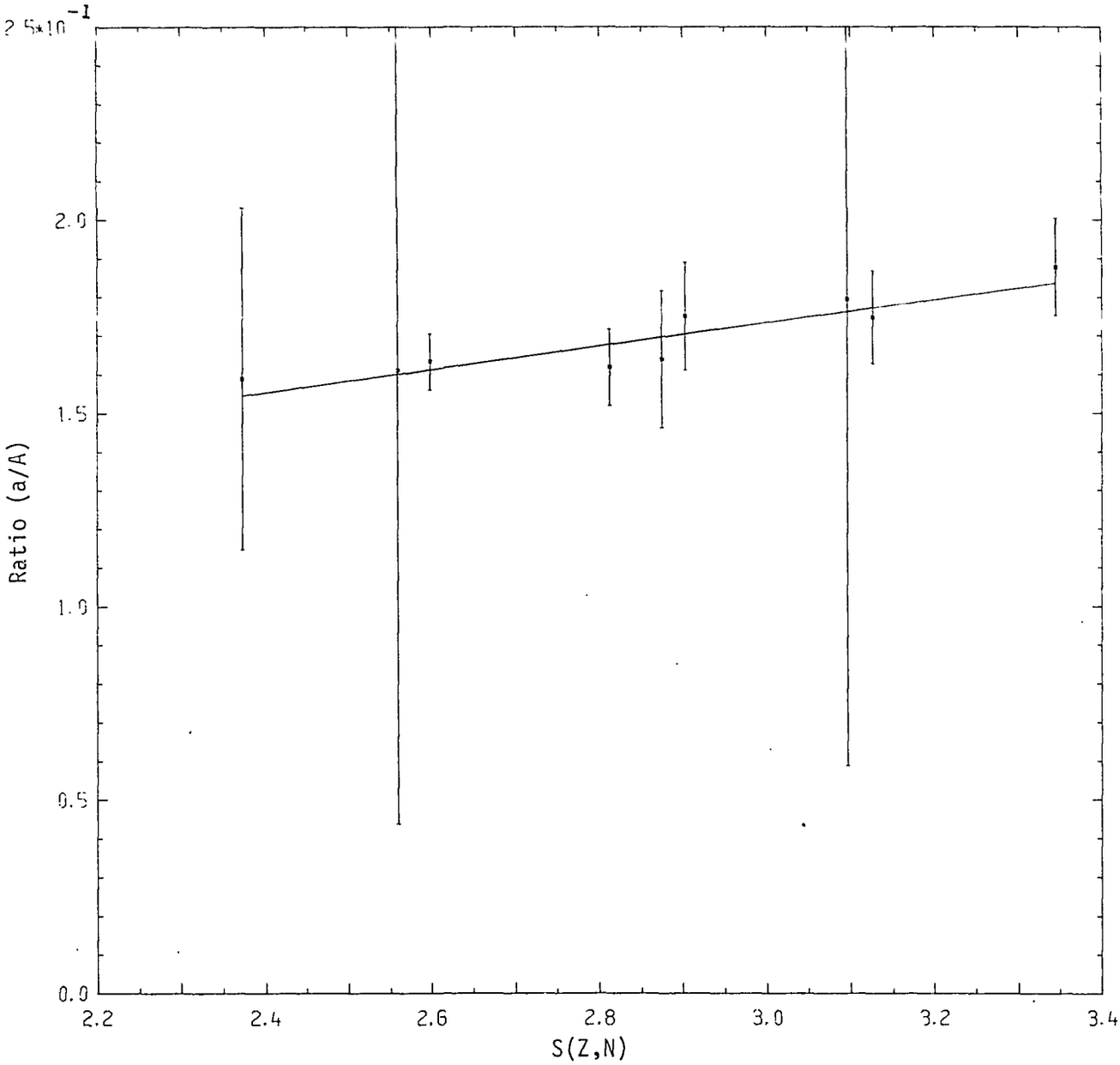

FIGURE 4 . VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP 3

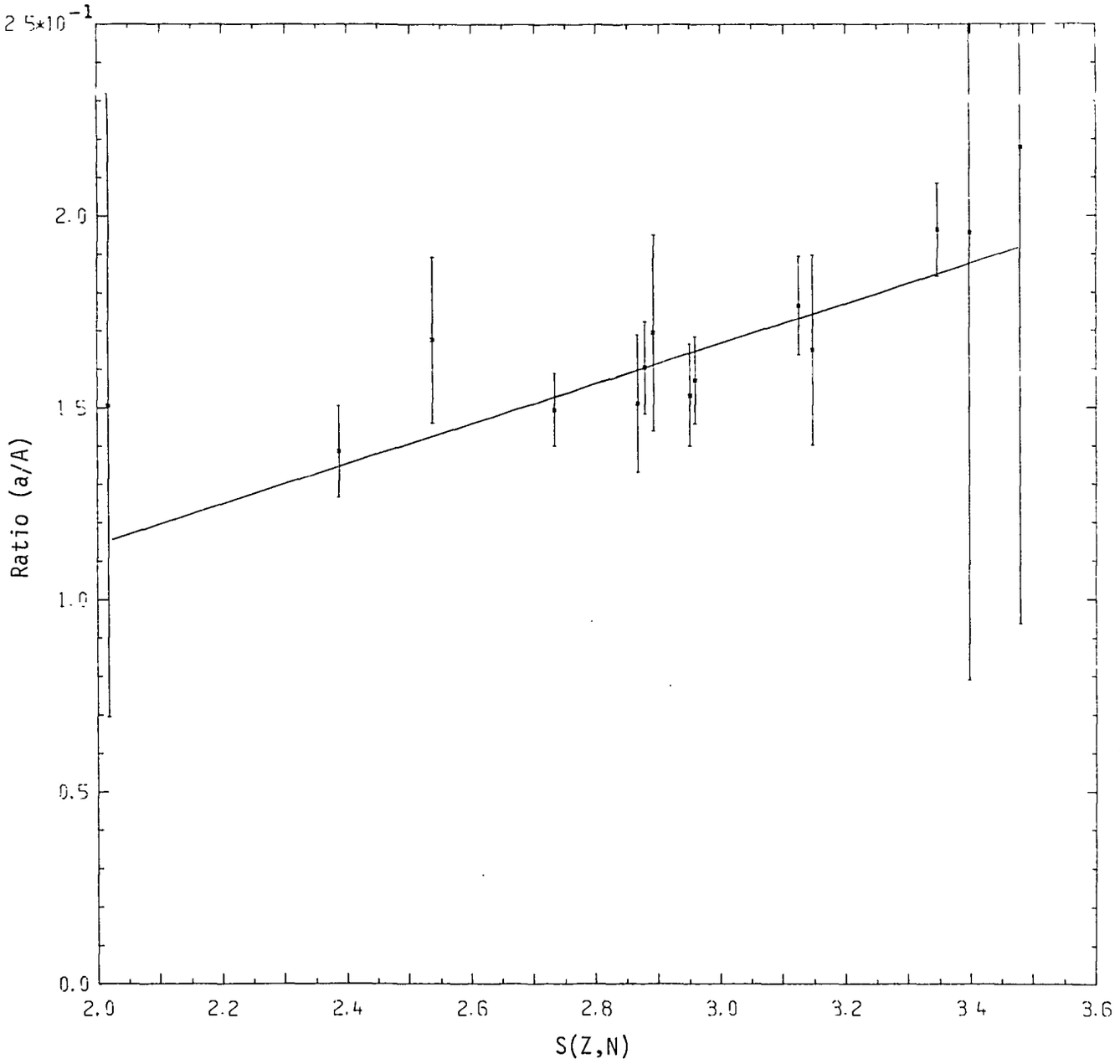

FIGURE 5. VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP 4

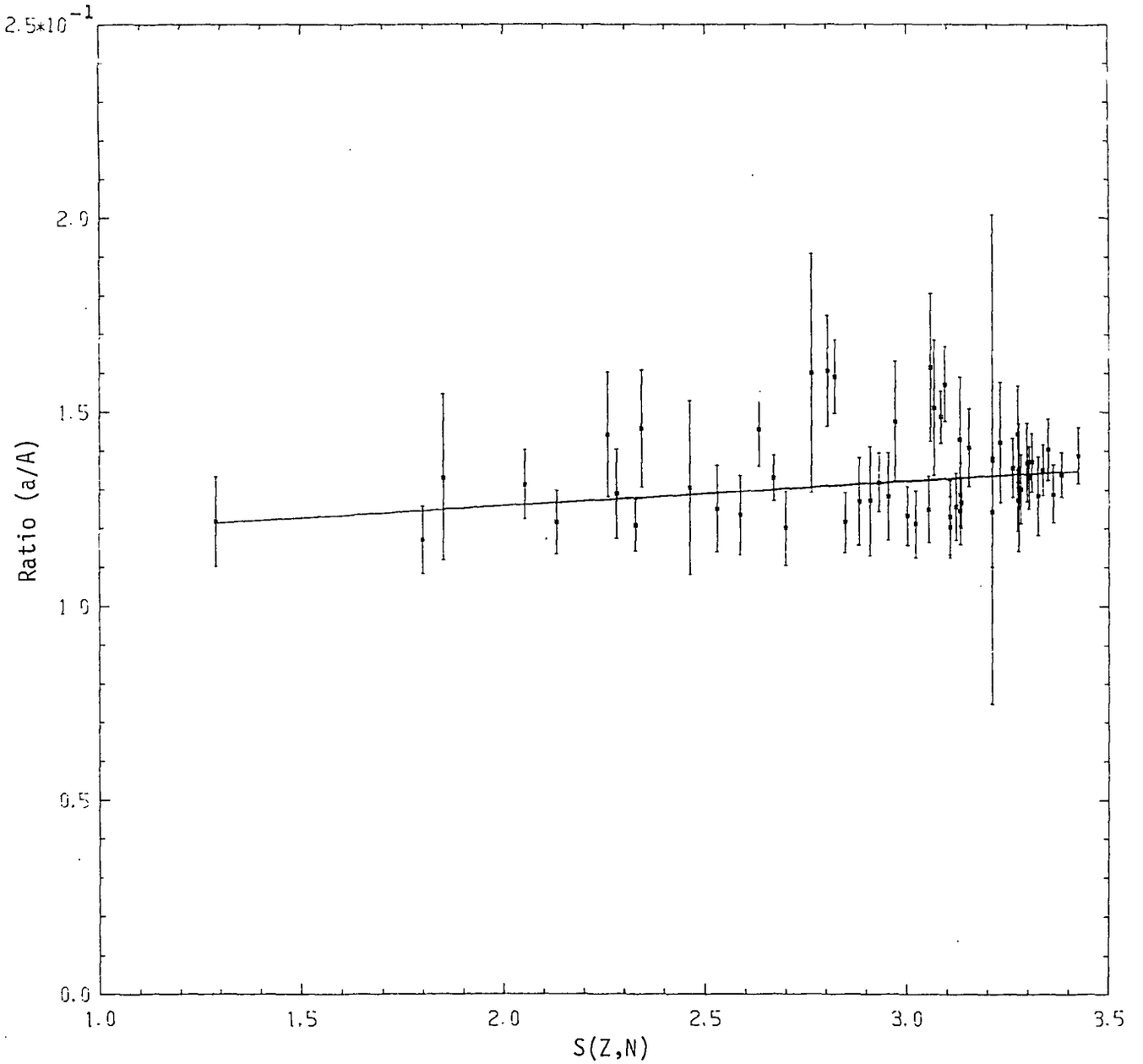

FIGURE 6. VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP 5

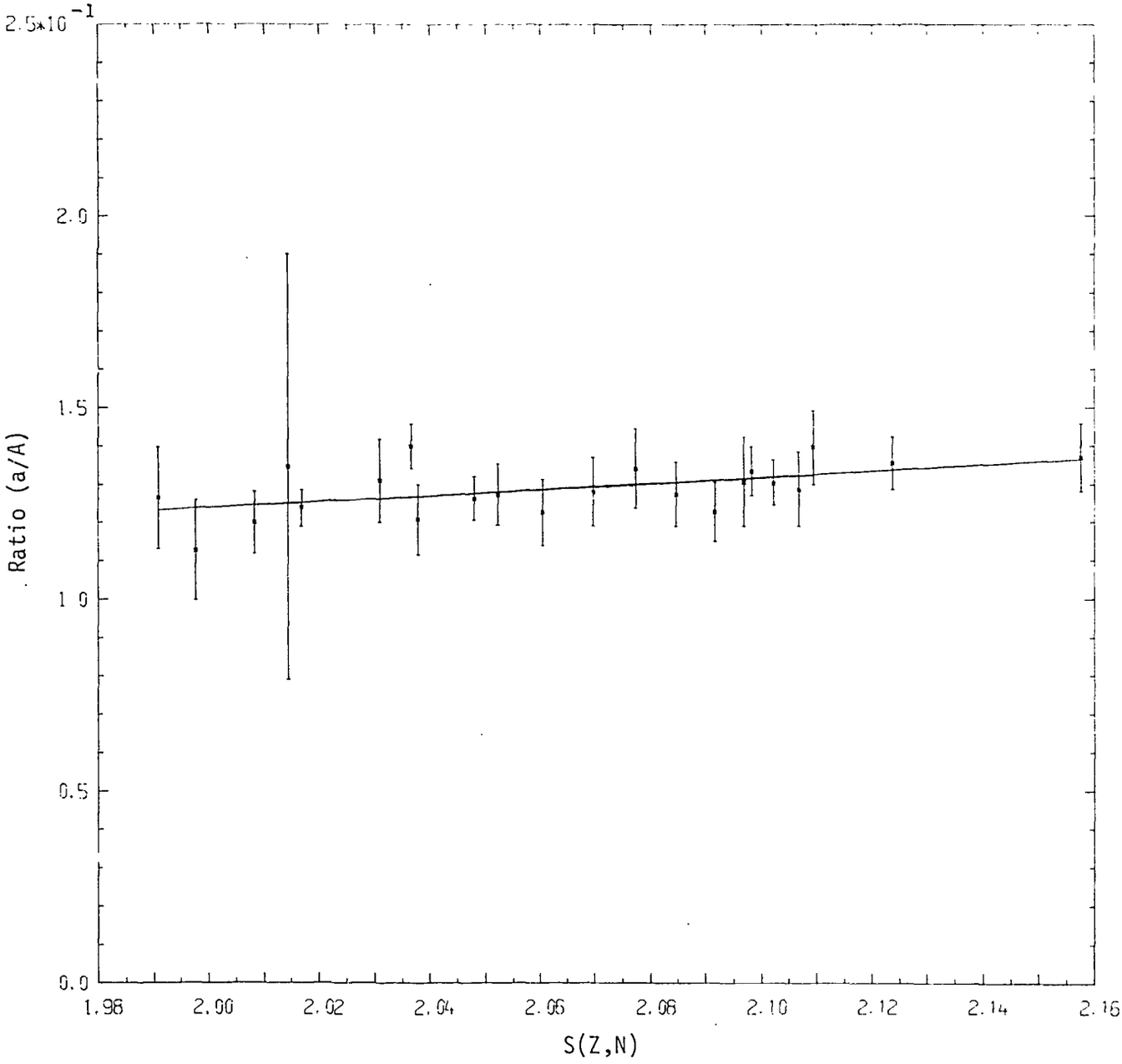

FIGURE 7. VARIATION OF EXPERIMENTAL a/A WITH S(Z,N) AND FITTED LINE α S(Z,N) + β, GROUP 6

APPENDIX A

FITTED VALUES OF DENSITY PARAMETER

Nuclide	$\bar{D}_{expt}$	$\Delta\bar{D}_{expt}$	$\bar{D}_{calc}$	a/A	Δ(a/A)	$\chi^2(\bar{D})$
20CA 40	4.450E-02	2.400E-02	4.453E-02	1.476E-01	1.594E-02	1.391E-06
20CA 42	2.870E-02	2.500E-02	2.870E-02	1.673E-01	3.998E-02	3.326E-09
20CA 43	3.180E-03	1.600E-03	3.199E-03	1.579E-01	1.323E-02	1.358E-04
20CA 44	3.300E-02	2.000E-02	3.316E-02	1.674E-01	2.371E-02	6.301E-05
21SC 45	2.020E-03	1.400E-03	2.035E-03	1.465E-01	1.830E-02	1.098E-04
22TI 46	2.930E-02	2.200E-02	2.945E-02	1.386E-01	2.322E-02	4.896E-05
22TI 47	2.360E-03	1.800E-03	2.381E-03	1.434E-01	2.175E-02	1.318E-04
22TI 48	2.100E-02	1.900E-02	2.102E-02	1.538E-01	3.962E-02	6.801E-07
22TI 49	5.650E-03	5.800E-03	5.691E-03	1.271E-01	1.039E-01	5.096E-05
22TI 50	8.380E-02	9.680E-02	8.388E-02	1.495E-01	1.526E-01	6.606E-07
23 V 50	2.610E-03	1.300E-03	2.635E-03	1.261E-01	9.304E-03	3.615E-04
23 V 51	5.140E-03	3.300E-03	5.139E-03	1.323E-01	1.601E-02	3.262E-08
24CR 50	2.010E-02	1.300E-02	2.013E-02	1.297E-01	1.615E-02	5.676E-06
24CR 52	2.590E-02	2.100E-02	2.603E-02	1.369E-01	2.639E-02	3.978E-05
24CR 53	7.380E-03	7.300E-03	7.424E-03	1.351E-01	4.254E-02	3.907E-05
24CR 54	2.460E-02	3.300E-02	2.463E-02	1.755E-01	1.544E-01	9.844E-07
25MN 55	2.280E-03	2.100E-03	2.292E-03	1.420E-01	3.537E-02	3.058E-05
26FE 54	1.830E-02	1.500E-02	1.837E-02	1.227E-01	2.300E-02	1.911E-05
26FE 56	2.000E-02	1.200E-02	2.012E-02	1.338E-01	1.502E-02	9.748E-05
26FE 57	8.360E-03	9.640E-03	8.416E-03	1.319E-01	1.052E-01	3.390E-05
27CO 59	1.310E-03	8.300E-04	1.318E-03	1.398E-01	1.478E-02	9.697E-05
28NI 58	1.970E-02	1.200E-02	1.969E-02	1.169E-01	1.317E-02	1.979E-07
28NI 60	2.120E-02	1.300E-02	2.121E-02	1.284E-01	1.487E-02	1.254E-06
28NI 61	2.910E-03	1.500E-03	2.914E-03	1.303E-01	1.835E-02	6.779E-06
28NI 62	2.850E-02	2.400E-02	2.855E-02	1.354E-01	2.881E-02	4.135E-06
28NI 64	2.750E-02	1.700E-02	2.764E-02	1.485E-01	1.826E-02	6.856E-05
29CU 63	7.200E-04	5.600E-04	7.242E-04	1.754E-01	2.499E-02	5.748E-05
29CU 65	1.230E-03	8.600E-04	1.237E-03	1.441E-01	1.752E-02	5.815E-05
30ZN 64	3.190E-03	3.200E-03	3.200E-03	1.624E-01	1.105E-01	9.442E-06
30ZN 66	3.400E-03	2.780E-03	3.414E-03	1.778E-01	2.904E-02	2.373E-05
30ZN 67	5.060E-04	5.060E-04	5.069E-04	1.445E-01	7.534E-02	2.927E-06
30ZN 68	9.150E-03	1.294E-02	9.166E-03	1.642E-01	1.273E-01	1.607E-06
31GA 69	3.190E-04	1.800E-04	3.191E-04	1.527E-01	1.219E-02	6.124E-07
31GA 71	3.810E-04	2.000E-04	3.808E-04	1.677E-01	1.246E-02	6.248E-07
32GE 70	9.740E-04	4.800E-04	9.773E-04	1.876E-01	1.270E-02	4.773E-05
32GE 72	2.320E-03	3.000E-03	2.322E-03	1.795E-01	1.209E-01	6.937E-07
32GE 73	7.180E-05	5.300E-05	7.205E-05	1.638E-01	1.783E-02	2.251E-05
32GE 74	5.850E-03	6.600E-03	5.869E-03	1.610E-01	1.173E-01	8.147E-06
32GE 76	6.020E-03	2.130E-03	6.037E-03	1.696E-01	9.117E-03	6.419E-05
33AS 75	7.440E-05	4.500E-05	7.441E-05	1.750E-01	1.391E-02	3.878E-08
34SE 76	9.330E-04	4.700E-04	9.352E-04	1.746E-01	1.202E-02	2.219E-05
34SE 77	1.140E-04	5.700E-05	1.147E-04	1.618E-01	9.885E-03	1.612E-04
34SE 78	2.600E-03	2.500E-03	2.608E-03	1.590E-01	4.430E-02	1.071E-05
34SE 80	4.110E-03	3.800E-03	4.130E-03	1.521E-01	3.597E-02	2.882E-05
35BR 79	5.120E-05	1.940E-05	5.133E-05	1.633E-01	7.124E-03	4.620E-05
35BR 81	3.470E-05	2.000E-05	3.470E-05	1.721E-01	1.216E-02	2.825E-08
37RB 85	2.010E-04	1.500E-04	2.009E-04	1.164E-01	1.366E-02	4.168E-07
37RB 87	2.570E-03	1.710E-03	2.581E-03	1.152E-01	1.363E-02	4.191E-05
38SR 87	2.740E-04	2.100E-04	2.747E-04	1.058E-01	1.326E-02	1.010E-05
38SR 88	4.160E-02	3.340E-02	4.124E-02	1.018E-01	2.023E-02	4.995E-05

(Continued)

Nuclide	$\bar{D}_{expt}$	$\Delta\bar{D}_{expt}$	$\bar{D}_{calc}$	a/A	Δ(a/A)	$\chi^2(\bar{D})$
39 Y 89	3.150E-03	3.700E-03	3.166E-03	1.079E-01	7.596E-02	1.848E-05
40ZR 90	5.690E-03	4.900E-03	5.689E-03	1.207E-01	2.265E-02	7.325E-08
40ZR 91	3.360E-04	3.700E-04	3.372E-04	1.351E-01	8.436E-02	1.137E-05
40ZR 92	3.560E-03	3.100E-03	3.577E-03	1.346E-01	2.529E-02	2.969E-05
40ZR 94	1.810E-03	1.300E-03	1.814E-03	1.509E-01	1.789E-02	1.018E-05
40ZR 96	6.870E-04	6.900E-04	6.869E-04	1.956E-01	1.167E-01	3.791E-08
41NB 93	1.050E-04	7.500E-05	1.053E-04	1.322E-01	1.389E-02	1.918E-05
42MO 92	2.560E-03	1.480E-03	2.564E-03	1.175E-01	1.015E-02	5.602E-06
42MO 95	5.090E-05	5.400E-05	5.092E-05	1.506E-01	8.121E-02	1.329E-07
42MO 96	4.280E-04	3.400E-04	4.289E-04	1.676E-01	2.157E-02	6.658E-06
42MO 97	2.620E-05	2.300E-05	2.630E-05	1.695E-01	2.553E-02	1.974E-05
42MO 98	1.430E-03	1.168E-03	1.429E-03	1.650E-01	2.475E-02	1.978E-07
42MO100	2.800E-04	4.200E-04	2.891E-04	2.180E-01	1.243E-01	1.148E-07
43TC 99	2.750E-05	1.600E-05	2.757E-05	1.571E-01	1.126E-02	2.095E-05
44RU 99	4.110E-05	2.700E-05	4.115E-05	1.386E-01	1.195E-02	3.186E-06
44RU101	2.230E-05	1.500E-05	2.242E-05	1.532E-01	1.327E-02	6.460E-05
44RU102	3.770E-04	2.100E-04	3.784E-04	1.767E-01	1.291E-02	4.207E-05
44RU104	2.070E-04	1.400E-04	2.077E-04	1.963E-01	1.215E-02	4.948E-05
45RH103	3.380E-05	2.100E-05	3.386E-05	1.604E-01	1.202E-02	8.398E-06
46PD105	1.270E-05	7.000E-06	1.274E-05	1.494E-01	9.420E-03	3.812E-05
47AG107	2.770E-05	2.200E-05	2.775E-05	1.529E-01	1.699E-02	5.058E-06
47AG109	1.900E-05	1.600E-05	1.908E-05	1.657E-01	2.061E-02	2.272E-05
48CD113	2.360E-05	9.200E-06	2.360E-05	1.535E-01	6.314E-03	1.167E-07
49IN113	2.650E-05	2.800E-05	2.658E-05	1.275E-01	6.540E-02	9.080E-06
49IN115	1.080E-05	6.500E-06	1.081E-05	1.474E-01	1.044E-02	3.240E-06
50SN112	1.270E-04	1.400E-04	1.274E-04	1.448E-01	7.408E-02	9.783E-06
50SN114	2.840E-04	1.160E-04	2.848E-04	1.342E-01	6.478E-03	4.944E-05
50SN115	1.440E-04	7.200E-05	1.443E-04	1.170E-01	7.107E-03	2.306E-05
50SN116	4.260E-04	4.900E-04	4.262E-04	1.372E-01	7.721E-02	1.982E-07
50SN117	5.220E-05	3.500E-05	5.233E-05	1.324E-01	9.520E-03	1.845E-05
50SN118	4.750E-04	3.900E-04	4.764E-04	1.431E-01	1.972E-02	1.294E-05
50SN119	8.300E-05	6.500E-05	8.304E-05	1.269E-01	1.452E-02	4.801E-07
50SN120	8.910E-04	9.700E-04	8.935E-04	1.374E-01	8.165E-02	6.616E-06
51SB121	1.370E-05	7.700E-06	1.370E-05	1.447E-01	1.330E-02	3.610E-07
51SB123	2.510E-05	1.700E-05	2.509E-05	1.340E-01	1.184E-02	2.508E-07
52TE122	1.890E-04	6.300E-05	1.891E-04	1.434E-01	5.399E-03	3.056E-06
52TE123	2.920E-05	2.300E-05	2.931E-05	1.314E-01	1.115E-02	3.246E-05
52TE124	2.420E-04	9.100E-05	2.420E-04	1.450E-01	6.348E-03	8.452E-08
52TE125	5.750E-05	3.400E-05	5.777E-05	1.254E-01	8.940E-03	6.490E-05
52TE126	1.160E-03	1.640E-03	1.162E-03	1.247E-01	7.644E-02	1.175E-06
52TE130	5.680E-03	4.300E-03	5.677E-03	1.041E-01	1.450E-02	4.625E-07
53 I127	1.370E-05	8.200E-06	1.373E-05	1.348E-01	9.500E-03	1.163E-05
53 I129	1.620E-05	7.250E-06	1.619E-05	1.346E-01	6.693E-03	1.484E-06
54XE129	3.520E-05	1.570E-05	3.519E-05	1.254E-01	6.088E-03	4.429E-07
54XE131	6.720E-05	3.360E-05	6.747E-05	1.122E-01	6.731E-03	6.297E-05
55CS133	2.060E-05	1.300E-05	2.060E-05	1.205E-01	9.388E-03	8.470E-08
56BA135	6.630E-05	6.600E-05	6.656E-05	1.067E-01	3.905E-02	1.563E-05
56BA136	2.630E-03	1.470E-03	2.642E-03	9.529E-02	7.770E-03	6.156E-05

(Continued)

Nuclide	$\bar{D}_{expt}$	$\Delta\bar{D}_{expt}$	$\bar{D}_{calc}$	a/A	Δ(a/A)	$\chi^2(\bar{D})$
56BA137	3.080E-04	1.720E-04	3.085E-04	9.407E-02	7.152E-03	9.145E-06
56BA138	1.120E-02	6.500E-03	1.122E-02	1.117E-01	1.106E-02	1.248E-05
57LA138	4.060E-05	2.100E-05	4.086E-05	9.511E-02	5.852E-03	1.484E-04
57LA139	2.650E-04	2.400E-04	2.652E-04	1.118E-01	2.164E-02	4.612E-07
58PR141	6.530E-05	5.200E-05	6.557E-05	1.195E-01	1.477E-02	2.725E-05
60ND142	1.190E-03	5.300E-04	1.195E-03	1.141E-01	6.678E-03	8.104E-05
60ND143	3.300E-05	3.100E-05	3.316E-05	1.218E-01	2.355E-02	3.202E-06
60ND144	7.630E-04	4.000E-04	7.629E-04	1.266E-01	8.863E-03	4.415E-08
60ND145	1.770E-05	1.600E-05	1.772E-05	1.332E-01	2.141E-02	2.410E-06
60ND146	4.740E-04	3.500E-04	4.741E-04	1.442E-01	1.608E-02	4.907E-08
60ND148	2.580E-04	2.400E-04	2.585E-04	1.600E-01	3.086E-02	3.697E-06
60ND150	2.470E-04	1.900E-04	2.474E-04	1.510E-01	1.741E-02	4.855E-06
61PM147	4.990E-06	3.900E-06	5.010E-06	1.457E-01	1.507E-02	2.749E-05
62SM147	7.580E-06	4.500E-06	7.593E-06	1.313E-01	8.905E-03	8.290E-06
62SM149	2.800E-06	1.700E-06	2.811E-06	1.456E-01	9.680E-03	4.136E-05
62SM151	1.350E-06	1.100E-06	1.354E-06	1.475E-01	1.546E-02	1.373E-05
62SM152	5.550E-05	3.900E-05	5.549E-05	1.569E-01	9.628E-03	3.994E-08
62SM154	1.230E-04	8.200E-05	1.231E-04	1.441E-01	1.237E-02	5.926E-07
63EU151	9.559E-07	5.600E-07	9.559E-07	1.591E-01	9.470E-03	2.477E-06
63EU153	1.450E-06	6.700E-07	1.452E-06	1.486E-01	6.685E-03	1.210E-05
64GD152	1.490E-05	1.100E-05	1.490E-05	1.603E-01	1.439E-02	2.380E-09
64GD154	1.330E-05	1.100E-05	1.330E-05	1.614E-01	1.906E-02	7.631E-08
64GD155	1.980E-06	1.300E-06	1.982E-06	1.479E-01	9.993E-03	2.105E-06
64GD156	4.930E-05	3.900E-05	4.938E-05	1.420E-01	1.550E-02	3.770E-06
64GD157	5.850E-06	3.800E-06	5.853E-06	1.369E-01	1.015E-02	5.925E-07
64GD158	1.010E-04	5.200E-05	1.009E-04	1.402E-01	7.956E-03	1.344E-06
64GD160	1.760E-04	7.600E-05	1.699E-04	1.388E-01	7.202E-03	1.998E-06
65TB159	3.750E-06	2.100E-06	3.764E-06	1.370E-01	7.562E-03	4.620E-05
66DY161	2.800E-06	1.600E-06	2.812E-06	1.331E-01	8.031E-03	5.704E-05
66DY162	6.670E-05	3.900E-05	6.692E-05	1.350E-01	6.632E-03	5.613E-05
66DY163	7.970E-06	4.200E-06	7.999E-06	1.288E-01	7.423E-03	4.836E-05
66DY164	1.670E-04	6.300E-05	1.669E-04	1.337E-01	5.694E-03	2.739E-06
67HO165	3.690E-06	2.500E-06	3.691E-06	1.283E-01	1.011E-02	2.155E-07
68ER162	1.320E-05	1.100E-05	1.321E-05	1.428E-01	1.615E-02	6.524E-07
68ER164	2.580E-05	2.800E-05	2.582E-05	1.377E-01	6.300E-02	3.443E-07
68ER166	3.850E-05	2.000E-05	3.860E-05	1.355E-01	7.671E-03	2.481E-05
68ER167	4.720E-06	2.700E-06	4.733E-06	1.271E-01	7.970E-03	2.481E-05
68ER168	1.060E-04	6.100E-05	1.064E-04	1.300E-01	8.920E-03	3.853E-05
68ER170	1.590E-04	1.300E-04	1.591E-04	1.304E-01	1.637E-02	1.937E-07
69TM169	8.390E-06	7.300E-06	8.401E-06	1.243E-01	1.417E-02	2.269E-06
70YB168	5.870E-05	3.390E-05	5.867E-05	1.263E-01	7.938E-03	1.042E-06
70YB170	3.860E-05	2.200E-05	3.873E-05	1.287E-01	8.179E-03	3.707E-05
70YB171	8.890E-06	4.500E-06	8.922E-06	1.266E-01	6.599E-03	5.171E-05
70YB172	7.190E-05	4.300E-05	7.201E-05	1.244E-01	8.740E-03	6.975E-06
70YB173	7.430E-06	4.500E-06	7.429E-06	1.255E-01	8.638E-03	8.018E-08
70YB174	1.780E-04	1.100E-04	1.786E-04	1.228E-01	9.560E-03	2.694E-05
70YB176	2.160E-04	1.200E-04	2.163E-04	1.248E-01	8.531E-03	6.525E-06
71LU175	3.610E-06	2.300E-06	3.614E-06	1.210E-01	8.648E-03	3.598E-06
71LU176	2.370E-06	1.400E-06	2.370E-06	1.231E-01	7.726E-03	1.861E-10
72HF174	2.190E-05	1.600E-05	2.192E-05	1.281E-01	1.139E-02	1.967E-06

(Continued)

Nuclide	$\bar{D}_{expt}$	$\Delta\bar{D}_{expt}$	$\bar{D}_{calc}$	a/A	Δ(a/A)	$\chi^2(\bar{D})$
72HF176	3.170E-05	1.700E-05	3.171E-05	1.317E-01	7.656E-03	1.444E-07
72HF177	3.170E-06	2.600E-06	3.181E-06	1.270E-01	1.407E-02	1.842E-05
72HF178	6.670E-05	4.700E-05	6.683E-05	1.269E-01	1.135E-02	7.540E-06
72HF179	5.730E-06	3.300E-06	5.730E-06	1.215E-01	7.787E-03	1.097E-08
73TA181	4.090E-06	2.800E-06	4.096E-06	1.200E-01	9.621E-03	4.341E-06
74 W180	1.430E-05	6.400E-06	1.432E-05	1.331E-01	5.931E-03	7.973E-06
74 W182	6.040E-05	4.100E-05	6.059E-05	1.234E-01	1.031E-02	2.105E-05
74 W183	1.270E-05	9.300E-06	1.273E-05	1.251E-01	1.123E-02	1.233E-05
74 W184	6.700E-05	6.200E-05	6.699E-05	1.305E-01	2.227E-02	1.047E-08
74 W186	1.140E-04	7.900E-05	1.141E-04	1.289E-01	1.163E-02	1.116E-06
75RE185	3.170E-06	1.700E-06	3.170E-06	1.209E-01	6.734E-03	1.247E-09
75RE187	4.420E-06	2.700E-06	4.423E-06	1.215E-01	8.202E-03	9.444E-07
76OS189	5.050E-06	3.300E-06	5.062E-06	1.171E-01	8.592E-03	1.250E-05
77IR191	2.960E-06	2.300E-06	2.966E-06	1.218E-01	1.165E-02	7.282E-06
77IR193	1.090E-05	9.900E-06	1.090E-05	1.089E-01	1.661E-02	4.231E-09
78PT194	8.060E-05	4.630E-05	8.057E-05	1.142E-01	6.370E-03	5.739E-07
78PT195	1.690E-05	1.500E-05	1.695E-05	1.058E-01	1.472E-02	1.252E-05
79AU197	1.600E-05	1.600E-05	1.600E-05	9.661E-02	7.031E-03	1.756E-07
80HG198	7.880E-05	3.520E-05	7.879E-05	1.031E-01	4.985E-03	1.019E-07
80HG199	9.400E-05	3.130E-05	9.395E-05	8.608E-02	3.120E-03	2.530E-06
80HG200	1.080E-03	4.400E-04	1.082E-03	8.214E-02	4.204E-03	1.708E-05
80HG201	8.320E-05	2.950E-05	8.325E-05	8.360E-02	3.361E-03	3.030E-06
81TL205	5.680E-03	5.680E-03	5.681E-03	5.110E-02	1.060E-02	7.243E-08
82PB204	3.100E-03	2.000E-03	3.112E-03	6.533E-02	6.386E-03	3.519E-05
82PB206	2.050E-02	1.200E-02	2.056E-02	4.967E-02	4.886E-03	2.236E-05
82PB207	3.450E-02	2.900E-02	3.464E-02	4.051E-02	8.279E-03	2.245E-05
83BI209	4.080E-03	3.000E-03	4.083E-03	5.806E-02	8.340E-03	1.230E-06
90TH229	9.670E-07	8.000E-07	9.685E-07	1.265E-01	1.327E-02	3.626E-06
90TH230	1.180E-05	5.200E-06	1.182E-05	1.400E-01	5.820E-03	1.530E-05
90TH232	2.430E-05	1.500E-05	2.429E-05	1.397E-01	9.678E-03	3.354E-07
91PA231	5.440E-07	4.100E-07	5.451E-07	1.310E-01	1.087E-02	7.222E-06
91PA233	8.340E-07	4.200E-07	8.355E-07	1.334E-01	6.333E-03	1.317E-05
92 U232	4.480E-06	5.500E-06	4.492E-06	1.344E-01	5.550E-02	4.990E-06
92 U233	7.180E-07	3.500E-07	7.182E-07	1.264E-01	5.803E-03	3.508E-07
92 U234	1.070E-05	7.400E-06	1.072E-05	1.341E-01	1.048E-02	6.636E-06
92 U235	6.440E-07	3.100E-07	6.451E-07	1.304E-01	5.928E-03	1.253E-05
92 U236	1.290E-05	6.400E-06	1.292E-05	1.356E-01	6.814E-03	1.116E-05
92 U238	2.200E-05	1.300E-05	2.201E-05	1.370E-01	8.875E-03	5.608E-07
93NP237	7.240E-07	4.500E-07	7.245E-07	1.227E-01	7.710E-03	1.049E-06
94PU238	7.580E-06	4.600E-06	7.589E-06	1.272E-01	8.023E-03	4.069E-06
94PU239	2.410E-06	1.600E-06	2.411E-06	1.279E-01	8.971E-03	2.723E-07
94PU240	1.630E-05	1.000E-05	1.634E-05	1.274E-01	8.508E-03	1.758E-05
94PU241	9.900E-07	7.600E-07	9.899E-07	1.306E-01	1.176E-02	3.137E-08
94PU242	2.110E-05	1.400E-05	2.113E-05	1.287E-01	9.786E-03	3.823E-06
95AM241	6.610E-07	4.700E-07	6.612E-07	1.208E-01	9.265E-03	1.346E-07
95AM243	7.010E-07	4.700E-07	7.010E-07	1.227E-01	8.598E-03	9.129E-09
96CM243	1.760E-06	1.500E-06	1.760E-06	1.127E-01	1.306E-02	1.048E-07
96CM244	1.460E-05	9.100E-06	1.462E-05	1.200E-01	8.112E-03	6.008E-06
96CM245	3.080E-06	1.300E-06	3.087E-06	1.239E-01	4.903E-03	2.549E-05

APPENDIX B

FITTED a/A VALUES AND CORRESPONDING

RECALCULATED DENSITY PARAMETERS

Nuclide	N'= N+1	Group	S(Z,N')	$(a/A)_{expt}$	(a/A) fitted	$\chi^2(a/A)$	$\bar{D}_{exp}$	$\Delta\bar{D}_{exp}$	$\bar{D}_{MIN}$	$\bar{D}_{MAX}$	$\bar{D}_{calc}$	$\chi^2(\bar{D})$
20CA 41	21	2	3.477E+00	1.476E-01	1.487E-01	4.782E-03	4.450E-02	2.400E-02	2.050E-02	6.850E-02	4.269E-02	5.704E-03
20CA 42	23	2	2.997E+00	1.673E-01	1.536E-01	1.181E-01	2.870E-02	2.500E-02	3.700E-03	5.370E-02	4.692E-02	5.312E-01
20CA 43	24	2	2.508E+00	1.579E-01	1.586E-01	3.170E-03	3.180E-03	1.600E-03	1.580E-03	4.780E-03	3.100E-03	2.530E-03
20CA 44	25	1	1.752E+00	1.674E-01	1.453E-01	1.136E+00	3.300E-02	2.000E-02	1.300E-02	5.300E-02	7.265E-02	3.930E+00
21SC 45	25	1	1.674E+00	1.465E-01	1.445E-01	1.145E-02	2.020E-03	1.400E-03	6.200E-04	3.420E-03	2.235E-03	2.351E-02
22TI 46	25	1	1.427E+00	1.386E-01	1.420E-01	2.170E-02	2.930E-02	2.200E-02	7.300E-03	5.130E-02	2.542E-02	3.105E-02
22TI 47	26	1	5.271E-01	1.434E-01	1.329E-01	2.333E-01	2.360E-03	1.800E-03	5.600E-04	4.160E-03	3.952E-03	7.827E-01
22TI 48	27	1	-4.825E-01	1.538E-01	1.226E-01	6.206E-01	2.100E-02	1.900E-02	2.000E-03	4.000E-02	7.771E-02	8.908E+00
22TI 49	28	1	-1.626E+00	1.271E-01	1.109E-01	2.424E-02	5.650E-03	5.800E-03	0.0	1.145E-02	1.319E-02	1.689E+00
22TI 5	29	1	-2.840E-01	1.495E-01	1.246E-01	2.660E-02	8.380E-02	9.680E-02	0.0	1.806E-01	2.054E-01	1.578E+00
23 V 50	28	1	-1.975E+00	1.261E-01	1.074E-01	4.069E+00	2.610E-03	1.300E-03	1.310E-03	3.910E-03	6.421E-03	1.998E+01
23 V 51	29	1	-6.464E-01	1.323E-01	1.209E-01	5.100E-01	5.140E-03	3.300E-03	1.840E-03	8.440E-03	9.755E-03	1.408E+00
24CR 52	27	1	-1.368E+00	1.297E-01	1.135E-01	9.967E-01	2.010E-02	1.300E-02	7.100E-03	3.310E-02	4.502E-02	3.675E+00
24CR 52	29	1	-1.153E+00	1.369E-01	1.157E-01	6.423E-01	2.590E-02	2.100E-02	4.900E-03	4.690E-02	6.886E-02	4.185E+00
24CR 53	30	1	-7.541E-03	1.351E-01	1.274E-01	3.303E-02	7.380E-03	7.000E-03	3.800E-04	1.438E-02	1.069E-02	2.117E-01
24CR 54	31	1	9.734E-01	1.755E-01	1.374E-01	6.117E-02	2.460E-02	3.300E-02	0.0	5.760E-02	9.583E-02	4.660E+00
25MN 55	31	1	3.265E-01	1.427E-01	1.307E-01	1.009E-01	2.280E-03	2.100E-03	1.800E-04	4.380E-03	3.965E-03	6.441E-01
26FE 54	29	1	-2.568E+00	1.227E-01	1.013E-01	8.666E-01	1.830E-02	1.500E-02	3.300E-03	3.330E-02	5.863E-02	7.227E+00
26FE 56	31	1	-4.586E-01	1.338E-01	1.228E-01	5.326E-01	2.000E-02	1.200E-02	8.000E-03	3.200E-02	3.395E-02	1.352E+00
26FE 57	32	1	3.627E-01	1.319E-01	1.312E-01	5.009E-05	8.360E-03	9.640E-03	0.0	1.800E-02	8.728E-03	1.455E-03
27CO 59	33	1	1.418E-01	1.398E-01	1.289E-01	5.463E-01	1.310E-03	8.300E-04	4.800E-04	2.140E-03	2.336E-03	1.528E+00
28NI 58	31	1	-2.372E+00	1.169E-01	1.033E-01	1.058E+00	1.970E-02	1.200E-02	7.700E-03	3.170E-02	4.206E-02	3.471E+00
28NI 60	33	1	-8.666E-01	1.284E-01	1.186E-01	4.313E-01	2.120E-02	1.300E-02	8.200E-03	3.420E-02	3.443E-02	1.036E+00
28NI 61	34	1	-3.222E-01	1.303E-01	1.242E-01	1.118E-01	2.010E-03	1.500E-03	5.100E-04	3.510E-03	2.814E-03	2.870E-01
28NI 62	35	1	9.682E-02	1.354E-01	1.284E-01	5.892E-02	2.850E-02	2.400E-02	4.500E-03	5.250E-02	3.910E-02	1.951E-01
28NI 64	37	1	5.444E-01	1.485E-01	1.330E-01	7.222E-01	2.750E-02	1.700E-02	1.050E-02	4.450E-02	5.237E-02	2.140E+00
29CU 63	35	1	1.225E+00	1.754E-01	1.399E-01	2.013E+00	7.200E-04	5.600E-04	1.600E-04	1.280E-03	3.550E-03	2.554E+01
29CU 65	37	1	1.651E+00	1.441E-01	1.443E-01	1.153E-04	1.230E-03	8.600E-04	3.700E-04	2.090E-03	1.225E-03	3.564E-05
30ZN 64	35	1	2.196E+00	1.624E-01	1.498E-01	1.296E-02	3.190E-03	3.200E-03	0.0	6.390E-03	5.726E-03	6.251E-01
30ZN 66	37	1	2.521E+00	1.778E-01	1.531E-01	7.194E-01	3.400E-03	2.780E-03	6.200E-04	6.180E-03	9.656E-03	5.064E+00
30ZN 67	38	1	2.542E+00	1.445E-01	1.533E-01	1.369E-02	5.060E-04	5.060E-04	0.0	1.012E-03	3.185E-04	1.573E-01
30ZN 68	39	1	2.480E+00	1.642E-01	1.527E-01	8.114E-03	9.150E-03	1.294E-02	0.0	2.209E-02	1.471E-02	1.844E-01
31GA 69	39	1	3.035E+00	1.527E-01	1.580E-01	1.905E-01	3.190E-04	1.800E-04	1.390E-04	4.990E-04	2.412E-04	1.867E-01
31GA 71	41	1	2.734E+00	1.677E-01	1.550E-01	1.036E+00	3.810E-04	2.000E-04	1.810E-04	5.810E-04	7.008E-04	2.557E+00
32GE 70	39	3	3.344E+00	1.876E-01	1.834E-01	1.061E-01	9.740E-04	4.800E-04	4.940E-04	1.454E-03	1.168E-03	1.634E-01
32GE 72	41	3	3.095E+00	1.795E-01	1.760E-01	8.347E-04	2.320E-03	3.000E-03	0.0	5.320E-03	2.690E-03	1.519E-02
32GE 73	42	3	2.873E+00	1.638E-01	1.694E-01	9.908E-02	7.180E-05	5.300E-05	1.880E-05	1.248E-04	5.327E-05	1.922E-01
32GE 74	43	3	2.559E+00	1.61 E-01	1.601E-01	6.677E-05	5.850E-03	6.600E-03	0.0	1.245E-02	6.118E-03	1. 47E-03
32GE 76	45	1	1.466E+00	1.696E-01	1.424E-01	8.904E+00	6.020E-03	2.130E-03	3.890E-03	8.150E-03	1.910E-02	3.769E+01
33AS 75	43	3	2.952E+00	1.753E-01	1.763E-01	1.164E-01	7.440E-05	4.500E-05	2.940E-05	1.194E-04	9.492E-05	2.080E-01
34SE 76	43	3	3.125E+00	1.746E-01	1.769E-01	3.842E-02	9.330E-04	4.700E-04	4.630E-04	1.403E-03	8.384E-04	4.249E-02
34SE 77	44	3	2.811E+00	1.618E-01	1.676E-01	3.476E-01	1.140E-04	5.700E-05	5.700E-05	1.710E-04	8.297E-05	2.964E-01
34SE 78	45	3	2.373E+00	1.590E-01	1.545E-01	1.006E-02	2.600E-03	2.500E-03	1.000E-04	5.100E-03	3.222E-03	6.190E-02
34SE 8.	47	1	9.039E-01	1.521E-01	1.367E-01	1.840E-01	4.110E-03	3.800E-03	3.100E-04	7.910E-03	8.761E-03	1.498E+00
35BR 79	45	3	2.598E+00	1.633E-01	1.612E-01	8.473E-02	5.120E-05	1.940E-05	3.180E-05	7.060E-05	1.125E-04	1.125E-01
35BR 81	47	1	1.240E+00	1.721E-01	1.401E-01	6.932E+00	3.470E-05	2.000E-05	1.470E-05	5.470E-05	2.160E-04	8.216E+01
37RB 85	49	1	-2.213E-01	1.164E-01	1.252E-01	4.208E-01	2.010E-04	1.500E-04	5.100E-05	3.510E-04	1.071E-04	3.917E-01
37RB 87	51	1	-8.285E-02	1.152E-01	1.266E-01	6.964E-01	2.570E-03	1.710E-03	8.600E-04	4.280E-03	1.323E-03	5.316E-01
38SR 87	50	1	-1.186E+00	1.058E-01	1.154E-01	5.187E-01	2.740E-04	2.100E-04	6.400E-05	4.840E-04	1.321E-04	4.564E-01
38SR 88	51	1	-3.648E-02	1.318E-01	1.271E-01	1.568E+00	4.100E-02	3.340E-02	7.600E-03	7.440E-02	1.004E-02	8.592E-01

(Continued)

Nuclide	N'= N+1	Group	S(Z,N')	$(a/A)_{expt}$	(a/A) fitted	$\chi^2(a/A)$	$\bar{D}_{exp}$	$\Delta\bar{D}_{exp}$	$\bar{D}_{MIN}$	$\bar{D}_{MAX}$	$\bar{D}_{calc}$	$\chi^2(\bar{D})$
39 Y 89	51	1	-8.194E-02	1.079E-01	1.266E-01	6.051E-02	3.150E-03	3.700E-03	0.0	6.850E-03	9.501E-04	3.535E-01
40ZR 90	51	1	-2.160E-01	1.207E-01	1.253E-01	4.117E-02	5.690E-03	4.900E-03	7.900E-04	1.059E-02	4.337E-03	7.628E-02
40ZR 91	52	1	8.202E-01	1.351E-01	1.358E-01	7.712E-05	3.360E-04	3.700E-04	0.0	7.060E-04	3.228E-04	1.266E-03
40ZR 92	53	1	1.760E+00	1.346E-01	1.454E-01	1.803E-01	3.560E-03	3.100E-03	4.600E-04	6.660E-03	2.000E-03	2.534E-01
40ZR 94	55	4	2.866E+00	1.509E-01	1.597E-01	2.409E-01	1.810E-03	1.300E-03	5.100E-04	3.110E-03	1.160E-03	2.499E-01
40ZR 96	57	4	3.397E+00	1.956E-01	1.674E-01	4.990E-03	6.870E-04	6.900E-04	0.0	1.377E-03	9.752E-04	1.745E-01
41NB 93	53	1	1.530E+00	1.322E-01	1.430E-01	6.065E-01	1.050E-04	7.500E-05	3.000E-05	1.800E-04	5.237E-05	4.924E-01
42MO 92	51	1	-7.401E-01	1.175E-01	1.199E-01	5.867E-02	2.560E-03	1.480E-03	1.080E-03	4.040E-03	2.182E-03	6.506E-02
42MO 95	54	4	2.018E+00	1.506E-01	1.555E-01	1.866E-01	5.090E-05	5.400E-05	0.0	1.049E-04	4.778E-04	6.259E+01
42MO 96	55	4	2.538E+00	1.676E-01	1.426E-01	1.335E+00	4.280E-04	3.400E-04	8.800E-05	7.680E-04	1.622E-03	1.232E+01
42MO 97	56	4	2.891E+00	1.695E-01	1.611E-01	1.109E-01	2.620E-05	2.300E-05	3.200E-06	4.920E-05	4.239E-05	4.952E-01
42MO 98	57	4	3.147E+00	1.650E-01	1.743E-01	1.426E-01	1.430E-03	1.168E-03	2.620E-04	2.598E-03	9.198E-04	1.908E-01
42MO100	59	4	3.479E+00	2.160E-01	1.916E-01	4.503E-02	2.800E-04	4.000E-04	0.0	6.800E-04	8.308E-04	1.896E+00
43TC 99	57	4	2.959E+00	1.571E-01	1.645E-01	4.334E-01	2.750E-05	1.600E-05	1.150E-05	4.350E-05	1.779E-05	3.680E-01
44RU 99	56	4	2.388E+00	1.386E-01	1.348E-01	9.911E-02	4.110E-05	2.700E-05	1.410E-05	6.810E-05	5.299E-05	1.938E-01
44RU101	58	4	2.951E+00	1.532E-01	1.641E-01	6.815E-01	2.230E-05	1.500E-05	7.300E-06	3.730E-05	1.144E-05	5.240E-01
44RU102	59	4	3.125E+00	1.767E-01	1.732E-01	7.085E-02	3.770E-04	2.100E-04	1.670E-04	5.870E-04	4.483E-04	1.153E-01
44RU104	61	4	3.346E+00	1.963E-01	1.847E-01	9.078E-01	2.070E-04	1.040E-04	1.030E-04	3.110E-04	3.556E-04	2.041E+00
45RH103	59	4	2.876E+00	1.604E-01	1.602E-01	2.567E-04	3.380E-05	2.100E-05	1.280E-05	5.480E-05	3.426E-05	4.845E-04
46PD105	60	4	2.733E+00	1.494E-01	1.528E-01	1.251E-01	1.270E-05	7.000E-06	5.700E-06	1.970E-05	1.023E-05	1.247E-01
47AG107	61	1	2.508E+00	1.529E-01	1.530E-01	1.878E-05	2.770E-05	2.200E-05	5.700E-06	4.970E-05	2.762E-05	1.441E-05
47AG109	63	1	2.681E+00	1.657E-01	1.548E-01	2.860E-01	1.900E-05	1.600E-05	3.000E-06	3.500E-05	3.759E-05	1.350E+00
48CD113	66	1	2.270E+00	1.535E-01	1.506E-01	2.215E-01	2.360E-05	9.200E-06	1.440E-05	3.280E-05	2.870E-05	3.069E-01
49IN113	65	1	1.729E+00	1.275E-01	1.451E-01	7.176E-02	2.650E-05	2.800E-05	0.0	5.450E-05	7.566E-06	4.632E-01
49IN115	67	1	1.570E+00	1.474E-01	1.434E-01	1.430E-01	1.080E-05	6.500E-06	4.300E-06	1.730E-05	1.413E-05	2.629E-01
50SN112	63	1	7.937E-01	1.448E-01	1.355E-01	1.549E-02	1.270E-04	1.400E-04	0.0	2.670E-04	2.352E-04	5.969E-01
50SN114	65	1	8.975E-01	1.342E-01	1.365E-01	1.278E-01	2.840E-04	1.160E-04	1.680E-04	4.000E-04	2.439E-04	1.197E-01
50SN115	66	1	8.373E-01	1.170E-01	1.360E-01	7.128E+00	1.440E-04	7.200E-05	7.200E-05	2.160E-04	3.459E-05	2.309E+00
50SN116	67	1	7.236E-01	1.372E-01	1.348E-01	9.599E-04	4.260E-04	4.900E-04	0.0	9.160E-04	4.968E-04	2.091E-02
50SN117	68	1	5.492E-01	1.324E-01	1.331E-01	5.185E-03	5.020E-05	3.000E-05	2.020E-05	8.020E-05	4.787E-05	6.046E-03
50SN118	69	1	3.142E-01	1.431E-01	1.307E-01	3.976E-01	4.750E-04	3.900E-04	8.500E-05	8.650E-04	1.027E-03	2.003E+00
50SN119	70	1	2.077E-02	1.269E-01	1.277E-01	2.448E-03	8.300E-05	6.500E-05	1.800E-05	1.480E-04	7.874E-05	4.290E-03
50SN120	71	1	-3.317E-01	1.374E-01	1.241E-01	2.665E-02	8.910E-04	9.700E-04	0.0	1.861E-03	2.734E-03	1.388E+00
51SB121	71	1	5.944E-01	1.447E-01	1.335E-01	7.065E-01	1.070E-05	7.700E-06	3.000E-06	1.840E-05	2.355E-05	2.784E+00
51SB123	73	1	-2.819E-01	1.347E-01	1.246E-01	6.360E-01	2.510E-05	1.700E-05	8.100E-06	4.210E-05	4.947E-05	2.055E+00
52TE122	71	1	1.444E+00	1.434E-01	1.422E-01	5.389E-02	1.890E-04	6.300E-05	1.260E-04	2.520E-04	2.151E-04	6.491E-02
52TE123	72	1	1.181E+00	1.314E-01	1.380E-01	3.473E-01	2.920E-05	2.000E-05	9.200E-06	4.920E-05	1.785E-05	3.221E-01
52TE124	73	1	5.630E-01	1.457E-01	1.332E-01	3.436E+00	2.420E-04	9.100E-05	1.510E-04	3.330E-04	5.128E-04	8.856E+00
52TE125	74	1	4.197E-02	1.254E-01	1.279E-01	7.919E-02	5.750E-05	3.400E-05	2.350E-05	9.150E-05	4.765E-05	8.386E-02
52TE126	75	1	-5.314E-01	1.247E-01	1.221E-01	1.220E-03	1.160E-03	1.640E-03	0.0	2.800E-03	1.385E-03	1.890E-02
52TE130	79	1	-3.329E+00	1.041E-01	9.358E-02	5.252E-01	5.680E-03	4.300E-03	1.380E-03	9.980E-03	1.234E-02	2.186E+00
53 I127	75	1	2.365E-01	1.348E-01	1.299E-01	2.659E-01	1.370E-05	8.200E-06	5.500E-06	2.190E-05	1.974E-05	5.429E-01
53 I129	77	1	-1.065E+00	1.346E-01	1.166E-01	7.231E+00	1.620E-05	7.250E-06	8.950E-06	2.345E-05	6.208E-05	4.004E+01
54XE129	76	1	3.063E-01	1.254E-01	1.306E-01	7.131E-01	3.520E-05	1.570E-05	1.950E-05	5.090E-05	2.350E-05	5.554E-01
54XE131	78	1	-1.094E+00	1.122E-01	1.163E-01	3.804E-01	6.720E-05	3.360E-05	3.360E-05	1.008E-04	4.808E-05	3.237E-01
55CS133	79	1	-1.239E+00	1.205E-01	1.149E-01	3.555E-01	2.060E-05	1.300E-05	7.600E-06	3.360E-05	3.242E-05	8.271E-01
56BA135	80	1	-1.497E+00	1.067E-01	1.122E-01	2.026E-02	6.630E-05	6.600E-05	3.000E-07	1.323E-04	4.130E-05	1.435E-01
56BA136	81	1	-2.360E+00	9.529E-02	1.034E-01	1.103E+00	2.630E-03	1.470E-03	1.160E-03	4.100E-03	1.367E-03	7.379E-01

(Continued)

Nuclide	N'= N+1	Group	S(Z,N')	$(a/A)_{expt}$	(a/A) fitted	$\chi^2(a/A)$	$\bar{D}_{exp}$	$\Delta\bar{D}_{exp}$	$\bar{D}_{MIN}$	$\bar{D}_{MAX}$	$\bar{D}_{calc}$	$\chi^2(\bar{D})$
56BA137	82	1	-3.267E+00	9.407E-02	9.421E-02	3.690E-04	3.080E-04	1.720E-04	1.360E-04	4.800E-04	3.048E-04	3.535E-04
56BA138	83	1	-2.235E+00	1.117E-01	1.147E-01	3.997E-01	1.120E-02	6.500E-03	4.700E-03	1.770E-02	1.725E-02	8.666E-01
57LA138	82	1	-2.768E+00	9.511E-02	9.929E-02	5.089E-01	4.060E-05	2.100E-05	1.960E-05	6.160E-05	2.718E-05	4.081E-01
57LA139	83	1	-1.743E+00	1.118E-01	1.097E-01	9.537E-03	2.650E-04	2.400E-04	2.500E-05	5.050E-04	3.094E-04	3.415E-02
59PR141	83	1	-9.500E-01	1.195E-01	1.178E-01	1.260E-02	6.530E-05	5.200E-05	1.330E-05	1.173E-04	7.435E-05	3.027E-02
60ND142	83	1	-6.455E-01	1.141E-01	1.209E-01	1.047E+00	1.190E-03	5.300E-04	6.600E-04	1.720E-03	7.345E-04	7.386E-01
60ND143	84	1	2.993E-01	1.218E-01	1.305E-01	1.366E-01	3.300E-05	3.100E-05	2.000E-06	6.400E-05	1.713E-05	2.621E-01
60ND144	85	1	1.185E+00	1.266E-01	1.395E-01	2.166E+00	7.630E-04	4.000E-04	3.630E-04	1.163E-03	3.274E-04	1.186E+00
60ND145	86	5	1.851E+00	1.332E-01	1.249E-01	1.519E-01	1.770E-05	1.600E-05	1.700E-06	3.370E-05	3.277E-05	8.871E-01
60ND146	87	5	2.259E+00	1.442E-01	1.275E-01	1.085E+00	4.740E-04	3.500E-04	1.240E-04	8.240E-04	1.333E-03	6.021E+00
60ND148	89	5	2.762E+00	1.600E-01	1.306E-01	9.052E-01	2.580E-04	2.400E-04	1.800E-05	4.980E-04	1.445E-03	2.445E+01
60ND150	91	5	3.065E+00	1.510E-01	1.325E-01	1.127E+00	2.470E-04	1.900E-04	5.700E-05	4.370E-04	7.722E-04	7.641E+00
61PM147	87	5	2.340E+00	1.457E-01	1.280E-01	1.392E+00	4.990E-06	3.900E-06	1.090E-06	8.890E-06	1.844E-05	1.189E+01
62SM147	86	5	2.052E+00	1.313E-01	1.261E-01	3.349E-01	7.580E-06	4.500E-06	3.080E-06	1.208E-05	1.137E-05	7.078E-01
62SM149	88	5	2.632E+00	1.456E-01	1.298E-01	2.667E+00	2.800E-06	1.700E-06	1.100E-06	4.500E-06	9.275E-06	1.451E+01
62SM151	90	5	2.971E+00	1.475E-01	1.319E-01	1.010E+00	1.350E-06	1.100E-06	2.500E-07	2.450E-06	4.512E-06	8.261E+00
62SM152	91	5	3.092E+00	1.569E-01	1.327E-01	6.314E+00	5.550E-05	3.000E-05	2.550E-05	8.550E-05	2.721E-04	5.213E+01
62SM154	93	5	3.273E+00	1.441E-01	1.338E-01	6.874E-01	1.230E-04	8.200E-05	4.100E-05	2.050E-04	2.448E-04	2.206E+00
63EU151	89	5	2.820E+00	1.591E-01	1.310E-01	8.784E+00	9.550E-07	5.600E-07	3.950E-07	1.515E-06	7.805E-06	1.496E+02
63EU153	91	5	3.082E+00	1.486E-01	1.326E-01	5.699E+00	1.450E-06	6.700E-07	7.800E-07	2.120E-06	4.981E-06	2.777E+01
64GD152	89	5	2.802E+00	1.603E-01	1.309E-01	4.196E+00	1.490E-05	1.100E-05	3.900E-06	2.590E-05	1.170E-04	8.616E+01
64GD154	91	5	3.057E+00	1.614E-01	1.325E-01	2.301E+00	1.300E-05	1.100E-05	2.000E-06	2.400E-05	9.817E-05	5.995E+01
64GD155	92	5	3.152E+00	1.469E-01	1.331E-01	6.066E-01	1.980E-06	1.300E-06	6.800E-07	3.280E-06	3.712E-06	1.776E+00
64GD156	93	5	3.230E+00	1.420E-01	1.336E-01	2.986E-01	4.930E-05	3.900E-05	1.030E-05	8.830E-05	9.076E-05	1.130E+00
64GD157	94	5	3.294E+00	1.369E-01	1.340E-01	8.512E-02	5.850E-06	3.800E-06	2.050E-06	9.650E-06	7.366E-06	1.593E-01
64GD158	95	5	3.346E+00	1.402E-01	1.343E-01	5.512E-01	1.010E-04	5.000E-05	5.100E-05	1.510E-04	1.521E-04	1.045E+00
64GD160	97	5	3.422E+00	1.388E-01	1.348E-01	3.060E-01	1.700E-04	7.600E-05	9.400E-05	2.460E-04	2.224E-04	4.759E-01
65TB159	95	5	3.307E+00	1.372E-01	1.341E-01	1.545E-01	3.750E-06	2.000E-06	1.750E-06	5.750E-06	4.768E-06	2.591E-01
66DY161	96	5	3.301E+00	1.331E-01	1.340E-01	1.383E-02	2.800E-06	1.600E-06	1.200E-06	4.400E-06	2.604E-06	1.502E-02
66DY162	97	5	3.335E+00	1.350E-01	1.342E-01	1.298E-02	6.670E-05	3.000E-05	3.670E-05	9.670E-05	7.475E-05	1.821E-02
66DY163	98	5	3.360E+00	1.288E-01	1.344E-01	5.765E-01	7.970E-06	4.200E-06	3.770E-06	1.217E-05	5.131E-06	4.571E-01
66DY164	99	5	3.379E+00	1.337E-01	1.345E-01	2.610E-02	1.670E-04	6.300E-05	1.040E-04	2.300E-04	1.577E-04	2.162E-02
67HO165	99	5	3.323E+00	1.283E-01	1.342E-01	3.341E-01	3.690E-06	2.500E-06	1.190E-06	6.190E-06	2.288E-06	3.146E-01
68ER162	95	5	3.131E+00	1.428E-01	1.330E-01	3.690E-01	1.320E-05	1.100E-05	2.200E-06	2.420E-05	2.821E-05	1.862E+00
68ER164	97	5	3.211E+00	1.377E-01	1.335E-01	4.543E-03	2.580E-05	2.800E-06	0.0	5.380E-05	3.975E-05	1.263E-01
68ER166	99	5	3.259E+00	1.355E-01	1.338E-01	4.830E-02	3.850E-05	2.000E-05	1.850E-05	5.850E-05	4.387E-05	7.201E-02
68ER167	100	5	3.273E+00	1.271E-01	1.339E-01	7.190E-01	4.720E-06	2.700E-06	2.020E-06	7.420E-06	2.730E-06	5.430E-01
68ER168	101	5	3.286E+00	1.300E-01	1.339E-01	1.947E-01	1.060E-04	6.100E-05	4.500E-05	1.670E-04	7.956E-05	1.879E-01
68ER170	103	5	3.275E+00	1.304E-01	1.339E-01	4.559E-02	1.590E-04	1.300E-04	2.900E-05	2.890E-04	1.238E-04	7.333E-02
69TM169	101	5	3.209E+00	1.243E-01	1.335E-01	4.184E-01	8.390E-06	7.000E-06	1.390E-06	1.539E-05	3.834E-06	4.236E-01
70YB168	99	5	3.106E+00	1.203E-01	1.328E-01	2.495E+00	5.870E-05	3.390E-05	2.480E-05	9.260E-05	2.103E-05	1.235E+00
70YB170	101	5	3.131E+00	1.267E-01	1.330E-01	2.750E-01	3.860E-05	2.200E-05	1.660E-05	6.060E-05	2.757E-05	2.515E-01
70YB171	102	5	3.134E+00	1.266E-01	1.330E-01	9.320E-01	8.890E-06	4.500E-06	4.390E-06	1.339E-05	5.222E-06	6.643E-01
70YB172	103	5	3.136E+00	1.244E-01	1.330E-01	9.543E-01	7.190E-05	4.300E-05	2.890E-05	1.149E-04	3.682E-05	6.654E-01
70YB173	104	5	3.120E+00	1.255E-01	1.329E-01	7.358E-01	7.430E-06	4.500E-06	2.930E-06	1.193E-05	4.175E-06	5.557E-01
70YB174	105	5	3.104E+00	1.228E-01	1.328E-01	1.086E+00	1.780E-04	1.100E-04	6.800E-05	2.880E-04	8.462E-05	7.207E-01
70YB176	107	5	3.053E+00	1.248E-01	1.325E-01	8.143E-01	2.160E-04	1.200E-04	9.600E-05	3.360E-04	1.232E-04	5.977E-01
71LU175	105	5	3.021E+00	1.210E-01	1.323E-01	1.692E+00	3.610E-06	2.300E-06	1.310E-06	5.910E-06	1.370E-06	9.488E-01
71LU176	106	5	2.999E+00	1.231E-01	1.321E-01	1.358E+00	2.370E-06	1.400E-06	9.700E-07	3.770E-06	1.080E-06	8.485E-01
72HF174	103	5	2.952E+00	1.281E-01	1.318E-01	1.052E-01	2.190E-05	1.600E-05	5.900E-06	3.790E-05	1.617E-05	1.284E-01

(Continued)

Nuclide	N'= N+1	Group	S(Z,N)	$(a/A)_{expt}$	(a/A) fitted	$\chi^2(a/A)$	$\bar{D}_{exp}$	$\Delta\bar{D}_{exp}$	$\bar{D}_{MIN}$	$\bar{D}_{MAX}$	$\bar{D}_{calc}$	$\chi^2(\bar{D})$
72HF176	105	5	2.929E+00	1.317E-01	1.317E-01	5.633E-05	3.170E-05	1.700E-05	1.470E-05	4.870E-05	3.185E-05	7.805E-05
72HF177	106	5	2.908E+00	1.276E-01	1.315E-01	1.047E-01	3.170E-06	2.600E-06	5.700E-07	5.770E-06	2.174E-06	1.466E-01
72HF178	107	5	2.880E+00	1.269E-01	1.314E-01	1.549E-01	6.670E-05	4.700E-05	1.970E-05	1.137E-04	4.721E-05	1.720E-01
72HF179	108	5	2.844E+00	1.215E-01	1.311E-01	1.524E+00	5.730E-06	3.300E-06	2.430E-06	9.030E-06	2.567E-06	9.186E-01
73TA181	109	5	2.698E+00	1.200E-01	1.302E-01	1.140E+00	4.090E-06	2.800E-06	1.290E-06	6.890E-06	1.683E-06	7.387E-01
74 W180	107	5	2.668E+00	1.331E-01	1.300E-01	2.699E-01	1.430E-05	6.400E-06	7.900E-06	2.070E-05	1.843E-05	4.172E-01
74 W182	109	5	2.585E+00	1.234E-01	1.295E-01	3.533E-01	6.040E-05	4.100E-05	1.940E-05	1.014E-04	3.702E-05	3.252E-01
74 W183	110	5	2.528E+00	1.251E-01	1.292E-01	1.321E-01	1.270E-05	9.300E-06	3.400E-06	2.200E-05	9.044E-06	1.546E-01
74 W184	111	5	2.460E+00	1.305E-01	1.287E-01	6.350E-03	6.700E-05	6.200E-05	5.000E-06	1.290E-04	7.672E-05	2.458E-02
74 W186	113	5	2.279E+00	1.289E-01	1.276E-01	1.358E-02	1.140E-04	7.900E-05	3.500E-05	1.930E-04	1.262E-04	2.402E-02
75RE185	111	5	2.326E+00	1.209E-01	1.279E-01	1.072E+00	3.170E-06	1.700E-06	1.470E-06	4.870E-06	1.711E-06	7.367E-01
75RE187	113	5	2.129E+00	1.215E-01	1.266E-01	3.867E-01	4.420E-06	2.700E-06	1.720E-06	7.120E-06	2.843E-06	3.411E-01
76OS189	114	5	1.798E+00	1.171E-01	1.245E-01	7.484E-01	5.050E-06	3.300E-06	1.750E-06	8.350E-06	2.581E-06	5.599E-01
77IR191	115	5	1.286E+00	1.218E-01	1.213E-01	1.676E-03	2.960E-06	2.300E-06	6.600E-07	5.260E-06	3.098E-06	3.578E-03
77IR193	117	1	3.439E-01	1.089E-01	1.310E-01	1.759E+00	1.090E-05	9.900E-06	1.000E-06	2.080E-05	1.470E-06	9.273E-01
78PT194	117	1	-2.172E-01	1.142E-01	1.253E-01	3.032E+00	8.060E-05	4.030E-05	4.030E-05	1.209E-04	3.140E-05	1.490E+00
78PT195	118	1	-7.825E-01	1.158E-01	1.195E-01	8.630E-01	1.690E-05	1.500E-05	1.900E-06	3.190E-05	4.541E-06	6.788E-01
79AU197	119	1	-1.974E+00	9.661E-02	1.074E-01	2.346E+00	1.600E-05	1.000E-05	6.000E-06	2.600E-05	5.283E-06	1.149E+00
80HG198	119	1	-2.604E+00	1.031E-01	1.010E-01	1.895E-01	7.880E-05	3.520E-05	4.360E-05	1.140E-04	9.730E-05	2.761E-01
80HG199	120	1	-3.227E+00	8.678E-02	9.462E-02	7.484E+00	9.400E-05	3.130E-05	6.270E-05	1.253E-04	3.713E-05	3.301E+00
80HG200	121	1	-3.882E+00	8.214E-02	8.795E-02	1.909E+00	1.080E-03	4.400E-04	6.400E-04	1.520E-03	5.987E-04	1.196E+00
80HG201	122	1	-4.569E+00	8.360E-02	8.096E-02	6.167E-01	8.320E-05	2.950E-05	5.370E-05	1.127E-04	1.118E-04	9.373E-01
81TL205	125	1	-7.495E+00	5.117E-02	5.156E-02	1.942E-03	5.680E-03	5.080E-03	6.000E-04	1.076E-02	5.316E-03	5.145E-03
82PB204	123	1	-6.624E+00	6.533E-02	6.005E-02	6.852E-01	3.100E-03	2.000E-03	1.100E-03	5.100E-03	5.999E-03	2.102E+00
82PB206	125	1	-8.135E+00	4.967E-02	4.467E-02	1.048E+00	2.050E-02	1.200E-02	8.500E-03	3.250E-02	4.188E-02	3.176E+00
82PB207	126	1	-8.935E+00	4.051E-02	3.652E-02	2.323E-01	3.450E-02	2.900E-02	5.500E-03	6.350E-02	6.487E-02	1.097E+00
83BI209	127	1	-7.205E+00	5.806E-02	5.413E-02	2.225E-01	4.080E-03	3.000E-03	1.080E-03	7.080E-03	6.481E-03	6.404E-01
90TH229	140	6	1.991E+00	1.265E-01	1.231E-01	6.595E-02	9.670E-07	8.000E-07	1.670E-07	1.767E-06	1.323E-06	1.980E-01
90TH23	141	6	2.036E+00	1.400E-01	1.267E-01	5.269E+00	1.180E-05	5.000E-06	6.800E-06	1.680E-05	3.438E-05	2.039E+01
90TH232	142	6	2.109E+00	1.397E-01	1.325E-01	5.515E-01	2.430E-05	1.500E-05	9.300E-06	3.930E-05	4.199E-05	1.391E+00
91PA231	141	6	2.031E+00	1.313E-01	1.263E-01	1.880E-01	5.440E-07	4.100E-07	1.340E-07	9.540E-07	8.433E-07	5.328E-01
91PA233	143	6	2.098E+00	1.334E-01	1.316E-01	8.207E-02	8.340E-07	4.200E-07	4.140E-07	1.254E-06	9.808E-07	1.222E-01
92 U232	141	6	2.014E+00	1.344E-01	1.249E-01	2.909E-02	4.480E-06	5.500E-06	0.0	9.980E-06	1.027E-05	1.107E+00
92 U233	142	6	2.048E+00	1.264E-01	1.276E-01	4.509E-02	7.180E-07	3.500E-07	3.680E-07	1.068E-06	6.411E-07	4.829E-02
92 U234	143	6	2.077E+00	1.341E-01	1.299E-01	1.567E-01	1.070E-05	7.400E-06	3.300E-06	1.810E-05	1.512E-05	3.562E-01
92 U235	144	6	2.102E+00	1.304E-01	1.319E-01	6.596E-02	6.440E-07	3.100E-07	3.340E-07	9.540E-07	5.636E-07	6.734E-02
92 U236	145	6	2.124E+00	1.356E-01	1.336E-01	8.219E-02	1.290E-05	6.400E-06	6.500E-06	1.930E-05	1.513E-05	1.213E-01
92 U238	147	6	2.157E+00	1.370E-01	1.363E-01	5.559E-03	2.200E-05	1.300E-05	9.000E-06	3.500E-05	2.317E-05	8.032E-03
93NP237	144	6	2.092E+00	1.227E-01	1.311E-01	1.177E+00	7.240E-07	4.500E-07	2.740E-07	1.174E-06	3.307E-07	7.640E-01
94PU238	145	6	2.052E+00	1.272E-01	1.279E-01	8.309E-03	7.580E-06	4.600E-06	2.980E-06	1.218E-05	7.114E-06	1.026E-02
94PU239	146	6	2.012E+00	1.279E-01	1.293E-01	2.343E-02	2.410E-06	1.600E-06	8.100E-07	4.010E-06	2.131E-06	3.046E-02
94PU240	147	6	2.084E+00	1.274E-01	1.305E-01	1.310E-01	1.630E-05	1.000E-05	6.300E-06	2.630E-05	1.260E-05	1.366E-01
94PU241	148	6	2.097E+00	1.306E-01	1.315E-01	5.200E-03	9.900E-07	7.600E-07	2.300E-07	1.750E-06	9.190E-07	8.738E-03
94PU242	149	6	2.107E+00	1.287E-01	1.323E-01	1.352E-01	2.110E-05	1.400E-05	7.100E-06	3.510E-05	1.572E-05	1.478E-01
95AM241	147	6	2.038E+00	1.208E-01	1.268E-01	4.143E-01	6.610E-07	4.700E-07	1.910E-07	1.131E-06	3.727E-07	3.764E-01
95AM243	149	6	2.060E+00	1.227E-01	1.286E-01	4.718E-01	7.010E-07	4.700E-07	2.310E-07	1.171E-06	4.015E-07	4.062E-01
96CM243	148	6	1.998E+00	1.127E-01	1.236E-01	7.018E-01	1.760E-06	1.500E-06	2.600E-07	3.260E-06	6.069E-07	5.909E-01
96CM244	149	6	2.038E+00	1.200E-01	1.244E-01	2.946E-01	1.460E-05	9.100E-06	5.500E-06	2.370E-05	9.833E-06	2.744E-01
96CM245	150	6	2.017E+00	1.239E-01	1.251E-01	6.293E-02	3.080E-06	1.300E-06	1.780E-06	4.380E-06	2.757E-06	6.185E-02