JAERI 1183

JAERI 1183

Average Level Spacings and the Nuclear Level Density Parameter

August 1969

日本原子力研究所

Japan Atomic Energy Research Institute

日本原子力研究所は，研究成果，調査結果などを JAERI レポートとして，つぎの4種に分けそれぞれの通し番号を付し，不定期に刊行しております．

1.	研究報告	まとまった研究の成果あるいはその一部における重要な結果の報告	JAERI 1001–
2.	調査報告	総説・展望・調査の結果などをまとめたもの	JAERI 4001–
3.	年　　報	研究・開発その他の活動状況などの報告	JAERI 5001–
4.	資　　料	施設の概要や手引きなど	JAERI 6001–

このうち既刊分については「JAERI レポート一覧」にタイトル・要旨をまとめて掲載し，また新刊レポートは「研究成果要旨集」(隔月刊)で逐次紹介しています．

これらのリスト・研究報告書の入手および複写・翻訳などのご要求は，日本原子力研究所技術情報部（茨城県那珂郡東海村）に申しこんでください．

Japan Atomic Energy Research Institute publishes the nonperiodical reports with the following classification numbers:

1. JAERI 1001– Research reports
2. JAERI 4001– Survey reports and reviews
3. JAERI 5001– Annual reports
4. JAERI 6001– Manuals etc.

Requests for the above publications, and reproduction and translation should be addressed to Division of Technical Information, Japan Atomic Energy Research Insitute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan

編集兼発行　日本原子力研究所
印　　刷　科学図書印刷株式会社

JAERI 1183

正　誤　表

ページ	行　な　ど	誤	正
2	式（5a），（5b）	$\hbar'$	$\hbar$
〃	式（6）		
〃	下から3行目		
3	式（8）の下2行目	numaer	number
〃	3節3行目	odserved	observed
5	上から26行目	appears only the	appears only at the
9	表 1, ColumnⅡ，上から3番目	3.5×10^{3} b)	3.0×10^{3} b)
14	表 2, 見出し	Fricson	Ericson
17	表 2, 右から2番目の column, 上から9番目	$18.34\pm^{0.37}_{0.31}$	$18.30\pm^{0.37}_{0.31}$
18	表 2, 右から2番目の column, 下から12番目	$18.20\pm^{0.38}_{9.31}$	$18.20\pm^{0.38}_{0.31}$
19	表 2, 一番左の column, 上から8番目	$^{239}_{44}Pu_{145}$	$^{239}_{94}Pu_{145}$
22	1行目	slow weutrons is plotted varsus the neutron egergy	slow neutrons is plotted versus the neutron energy
28	上の図	$^{103}R+n$	$^{103}Rh+n$
29	下，左図	$^{134}C_s+n$	$^{133}C_s+n$
41	下，右図	$^{244}C_m+n$	$^{243}C_m+n$

Average Level Spacings and the Nuclear Level Density Parameter

Summary

The average level spacing D_0 was computed with neutron resonance capture data summarized in BNL-325, and compared with those given by several authors. The values thus fixed with reliability were plotted versus the neutron number to see the systematic behavior of the D_0. The less reliable or ambiguous group of the D_0's was then fixed by taking the systematics into consideration. It was also decided from the systematics that the error involved in the D_0's would be at most of the order of a factor of two.

The level density parameter a was calculated with the fixed value of the level spacing D_0. The effect of an alternative choice of the level density formula or the moment of inertia on a was discussed and its dependence on the nuclear radius parameter was studied as well.

May 1969

HIROSHI BABA and SUMIKO BABA
Division of Radioisotope Production
Radioisotope Center
Japan Atomic Energy Research Institute

平均準位間隔と核準位密度定数

要　旨

今までに与えられている平均準位間隔 D_0 の値を参照しつつ，BNL-325 にまとめられた共鳴吸収のデータを用いて，D_0 の値を系統的に定めることを試みた．求めた値のうち充分信頼しうる値であると認められるものについて全体的な傾向を求め，それを利用して信頼性の少いデータまたは数値的に疑義の存在する結果の検討を行ない，最も確からしい値を定めた．そのばあいに用いた系統性は，D_0 の値に見込まれるべき誤差が，2,3 の例外を除き高々ファクター 2 の程度であることを示している．

上記の手続きで約 190 核種について求めた D_0 の値から，それぞれの核種に対する核準位密度定数 a の値を求めた．a の計算にさいしては，用いる準位密度式およびその角運動量依存項に含まれる慣性能率には，二，三通りの選択の余地が残されているので，それらの選び方如何で a がどのように影響を受けるかを検討した．同時にそれとは別に核半径パラメーター r_0 に対する a の依存性をも調べた．

1969 年 5 月

日本原子力研究所　東海研究所
製造部 製造技術課
馬　場　　宏
馬　場　澄　子

Contents

目　　次

1. Introduction

The neutron resonance capture can be directly connected to the nuclear level density paramater when one accepts a level density formula based on the Fermi gas model. In that sense it is the most fundamental information for the statistical theory of the nucleus. Many papers[1-16] have estimated the average level spacing D_0 of the nucleus from rather irregularly locating resonance peaks to deduce the level density parameter's. One, however, finds at the first glance that various values are assigned to D_0 even when the same source of data, namely BNL-325[17,18], are used. Recently, the more improved data became available, which were summarized in BNL-325, 2nd edition, Supplement No. 2[19] (from now on, the literature shall be referred to as Ref. II and the Supplement No. 1[18] as Ref. I). There the compiled data are consistently evaluated and classified into three groups, consisting of well established (henceforce denoted as class A in this note), of not well established but consistent (class B), and of inconsistent or doubtful (class C) sets of resonance parameters. This, therefore, seems to be the best source of the information for the level spacing D_0 available at the present.

Recently, a new level density formula has been derived[20] by introducing a stepwise function based on the Nilsson single particle level structure as the single particle level density. It was found that the formal identity is obtained between it and the well-known formula, $\rho(E) \propto e^{2\sqrt{aE}}/E^{5/4}$, derived from the Fermi gas model with an equi-distant spacing approximation, if the level density parameter is defined by

$$a = a_0 + \chi(A, Z, E), \qquad (1)$$

instead of a constant a_0. Here χ is a function not only of the nucleonic mass A and charge Z but also of the excitation energy E. This function χ at a given E-value gives systematic deviations, often attributed to the shell effect, from the average behavior a_0 of the level density parameter proportinal to the mass number A. Agreement of Eq. (1) with those empirically deduced from the neutron resonance capture data was found to be quite satisfactory.

At this stage, it was felt necessary to re-evaluate the experimentally obtained the D_0's by utillizing the resonance data best known to us. This was performed in this note not only by compiling several authers' values of D_0 but also by computing the D_0's from BNL-325, mostly from Supplement No. 2, the 2 nd edition.

2. Theoretical Treatment

The average level spacing is computed by fitting the first N observed levels, by least sqares, to the formula

$$E_n = E_0 + nD_0, \quad n = 1, \cdots\cdots, N \qquad (2)$$

where E_0 and the average spacing D_0 are parameters to be determined and E_n is the energy of nth observed level. In cases where only a few levels have been observed and a well defined region $E_i \leq E_n \leq E_f$ has been searched, one may add to the Eq. (2) one or both of the equations

$$\left.\begin{aligned}\frac{1}{2}(2E_i-E_1)&=\frac{1}{2}E_0\\ \frac{1}{2}(2E_f-E_N)&=\frac{1}{2}E_0+\frac{1}{2}(N+1)D_0\end{aligned}\right\}. \tag{2a}$$

These are to assume that the lower and upper limits, E_i and E_f, of the searched interval occur, on the average, midway between levels.

On the assumption that no levels have been missed or wrongly attributed to the nucleus studied, the expected error in the average value D_0 of the spacing between levels is given by the estimated variance

$$\sigma_D^2=\beta_{DD}(N-2)^{-1}\sum_n(E_n-E_0-nD)^2 \tag{3}$$

where β_{DD} is an appropriate weighting factor. The quoted errors for D_0 in the Table 1 are $\pm\sigma_D$ defined by Eq. (3) with $\beta_{DD}=1$. The variance is an underestimate, because it takes no account of the possibility of missed or wrongly assigned levels and the errors included in the energy values of observed levels.

The inverse value D_0^{-1} of the average spacing thus fixed represents the density of the nuclear levels of the compound nucleus at an excitation energy E and with a given value of the spin j. The binding energy B_n of the neutron gives with a good approximation the excitation energy E of the compound nucleus, except for a few nuclides in which the low lying levels are extremely rare and therefore higher levels are necessarilly included in the analysis.

For the spin I of the target nucleus, one finds

$$\left.\begin{aligned}D_0^{-1}&=\frac{1}{2}\rho\left(E,\ j=\frac{1}{2}\right) && \text{for } I=0\\ D_0^{-1}&=\frac{1}{2}\left[\rho\left(E,\ I+\frac{1}{2}\right)+\rho\left(E,\ I-\frac{1}{2}\right)\right] && \text{for } I\neq 0\end{aligned}\right\} \tag{4}$$

where $\rho(E, j)$ is the spin-dependent level density at the excitation energy E and with the spin j. Since initial state has a well-defined parity, the observed levels have only one of the two possible parities. This introduces the factor 1/2 in the right hand side of Eq. (4). For a few cases where the l value of neutrons is different from zero, the necessary alterations are to be added.

Of many modifications of the level density formula, two formulas derived by Ericson[21] and by Lang and LeCouteur[22] are the most frequently used. According to them the spin-dependent level density formula is given by either

$$\rho(E,j)=\frac{\hbar^3}{12\sqrt{8}}(2j+1)\exp\left[-\frac{j(j+1)}{2\sigma^2}\right]\frac{a^{1/2}\exp\{2\sqrt{aU}\}}{\mathcal{I}^{3/2}U^2} \tag{5a}$$

or

$$\rho(E,j)=\frac{\hbar^3}{12\sqrt{8}}(2j+1)\exp\left[-\frac{j(j+1)}{2\sigma^2}\right]\frac{a^{1/2}\exp\{2\sqrt{aU}\}}{\mathcal{I}^{3/2}(U+t)^2}\ , \tag{5b}$$

respectively, where σ is the so-called spin cut-off parameter and t, the nuclear thermodynamic temperature. σ is related to the nuclear moment of inertia $\mathcal{I}$ by the equation[23]

$$\sigma^2=\frac{\mathcal{I}t}{\hbar^2}\ . \tag{6}$$

$\hbar$ is the Planck's constant divided by 2π. Two different formulas (5a) ane (5b) are derived by virtue of slightly different saddle point approximations. The answer to the question which formula is more preferable is to be found by comparing them with the observations. The

nuclear temperature T is given by

$$\frac{1}{T}=\frac{1}{t}-\frac{2}{U} \tag{7a}$$

or

$$\frac{1}{T}=\frac{1}{t}-\frac{2}{U+t} \tag{7b}$$

which corresponds to either Eq. (5a) or (5b), respectively.

The quantity U appearing in Eqs. (5a) and (5b) is introduced to treat the pairing effect and is called the 'effective excitation energy'. It is related to the excitation energy E by[1,24]

$$U=E+\Delta \tag{8}$$

Here Δ is a negative term representing the pairing energy of the last two protons when the proton number Z is even, of the last two neutrons when the neutron numaer N is even, and the sum of both pairing energies for even-even nuclei; Δ is zero for odd-odd nuclei.

3. Procedure

Most resonance data were taken from Ref. II. Reference I was used only when no resonance data were found in the former. The average spacing D_0 was calculated by using Eq. (2) for all nuclides for which two or more resonance levels are odserved in the energy region below 200 keV*. In a few cases where D_0 was evaluated with even higher excited levels, the excitation energy was taken as the sum of the neutron binbing energy and the mean energy of the lowest and the highest resonance level.

In order to choose a reasonable set of the resonance levels out of the three classes of data, namely, class A (denoted as 'recommended' in Ref. II), class B (written with bold-faced characters), and class C (written with thin-faced characters), the total number of the levels was plotted versus the incident neutron energy whenever ten or more levels are listed. This graph is expected to give a linear slope whose reciprocal value is equal to the level spacing D_0 if the Fermi gas model is valid, since the excitation energy and therefore the nuclear temperature are practically constant in such a short energy range.

The levels of class A alone were first plotted to see the linearity in the slope. By means of this procedure it was concluded that for quite a few nuclides class B levels, at least a part of them, ought to be included to obtain the linear slope. In order to avoid ambiguity intruding into the results as much as possible an appropriate energy region was chosen for the computation so that almost all levels observed in that region were of class A, when the number of levels used was sufficient to give a reliable value for D_0. Stepwise plots of the total number of levels versus neutron energy are given in the appendix for about 100 nuclides. The number of levels of class A only is depicted with a solid line and that of class A plus class B and sometimes even class C with a dotted line.

The additional condition (2a) was not used in this analysis. Instead, the justification of the values obtained or the choice of the more reasonable one from two significantly different

* The energy limit 200 keV was rather arbitrarily chosen from the consideration that an additional excitation of the nucleus by less than 100 keV as an average would be negligible compared with the neutron binding energy.

given values was done by virtue of the systemasics found in D_0 (cf. Fig. 1) in the cases where only a few levels are observed and besides no consistent values are available in the literatures.

Errors quoted were calculated by using Eq. (3) except for the cases where not more than two resonances are listed. For such exceptional nuclides, the error in the D_0's unless otherwise quoted in the table was taken as a factor of two by taking the systematical behavior of the D_0 into consideration.

In the calculation of the level density parameter a, both Eqs. (5a) and (5b) were used in combination with Eq. (4). The neutron binding energy B_n was taken from Wapstra's table[25,26] and the pairing energy Δ was from Cameron's table[4]. In a few cases where the upper limit of the energy region used to fix D_0 exceeding 200 keV, the excitation energy was set equal to B_n plus the mean energy between the lowest and the highest level used.

As the moment of inertia appearing in the spin cut-off parameter σ, either that of a rigid body $\mathcal{I}_{\text{rigid}}$ or an effective moment of inertia equal to $0.7\mathcal{I}_{\text{rigid}}$ was considered. In either case, $\mathcal{I}$ is proportional to the square of the nuclear radius parameter r_0 through the relation

$$\mathcal{I}_{\text{rigid}}=\frac{2}{5}mr_0^2A^{5/3} \qquad (9)$$

where m is the nucleonic mass and A, the mass number of the nucleus of interest. The r_0-dependence of a was studied. The a-values listed in the sixth column of Table 2 were computed by using Ericson's formula, Eq. (5a), with $r_0=1.5\times10^{-13}$ cm ; that is, 1.5 fermis and $\mathcal{I}_{\text{rigid}}$. In the last column of the same table given are those based on Lang-LeCouteur level density with $r_0=1.5$ fermis and $\mathcal{I}_{\text{rigid}}$.

4. Results and Discussion

The computed values of D_0 are given in columns designated as VIII and IX of Table 1 with compilation of data determined by several authors as well through columns I to VII. The first and second columns give the compound nucleus and the target spin I, respectively. The number in a parenthesis which appears in column I, VIII, or IX represents the number of resonances used to fix D_0. The last column IX supplies the values of D_0 computed with Ref. II (the data were obtained with resonances of mostly class A nuclei otherwise denoted with alphabetical capitals in the parenthesis). The tenth column VIII gives those obtained by using Ref. I. For a few nuclides whose D_0 values are given without errors in the column IX were obtained with only two levels. The errors involved are, however, expected from the systematics mentioned below not to exceed a factor of two except for ^{75}Se and ^{244}Cm.

Now that enough number of data for D_0 has become available, we are in the position to find by means of a set of reliable data the systematics in trends of D_0 versus the neutron number N and in turn to tell within a factor of two whether a given uncertain value is reasonable or not, or which is more reasonable when two significantly different values are found in Table 1*. Table 2 gives thus finally fixed values of D_0 in the fifth column with the target spin, the neutron binding energy, and the pairing energy as well in the second, third, and

* According to this procedure, alternatives were chosen for ^{32}P, ^{41}Ca, ^{51}Cr, ^{55}Cr, ^{113}Cd, ^{116}Sn, ^{136}Xe, ^{163}Dy, and ^{169}Yb. For ^{20}F, ^{40}K, and ^{153}Sm the two or more values different to one another were found equally likely so that the average of them was taken. Furthermore, it was concluded that the expected errors were to be at most a factor of two for all nuclei except for the above mentioned two, ^{75}Se and ^{244}Cm.

forth columns, respectively.

In the computation of the level density parameter a from thus fixed level spacing D_0, there are a few alternative choices involved; namely, either Ericson or Lang-LeCouteur level density formula and either the rigid-body or a non-rigid-body moment of inertia. Furthermore, the nuclear radius parameter r_0 appears as an adjustable parameter in the calculation. It was found that either level density formula does not give a significantly different value for a to each other; the difference between the two was mostly 1 or 2 %. As is seen in Fig. 2, their differences become significant only in light nuclei.

Figuer 2 also shows the dependence of a on r_0. It was found that the ratio of the level density parameters of two nuclei remains constant while r_0 changes in the range of interest except for a few light target nuclei with high spins such as ^{50}V. Non-rigid-body moment of inertia is equivalent to that of the rigid-body $\mathcal{I}_{\text{rigid}}$ with an appropriate r_0-value, as long as it is given by the latter multiplied by a certain constant. Open circles in Fig. 2 represent a with a non-rigid-body moment of inertia defined as $0.7\,\mathcal{I}_{\text{rigid}}$[27,28] for $r_0=1.5$ fermis.

By cosidering that the derivation of the level density formula based on the Fermi gas model is equivalent to the use of the square well nuclear potential, 1.5 fermis was chosen for r_0 in the final computation of the a's. The last two columns of Table 2 gives the computed values of a with errors deduced from those contained in D_0; one based on Ericson level density and the other on Lang-LeCouteur level density. The former group of a-values is plotted versus mass number A of the compound nucleus in Fig. 3.

One may find that a shows dips near the closed shells; this is particularly clear in three regions around $N=50$, $N=82$, and $N=126$ and $Z=82$. This observation will be understood by rather directly connecting to the so-called shell effect. This is more clearly seen in Fig. 4 where a-values are plotted versus the neutron number N. One tentatively discerns two types of suppression in a-values near the closed shell. That is, one of them is of short-ranged nature that appears only the very edge of the shell and the other is a long-ranged effect extending a rather broad region around closed shells; $N=50$, 82, and 126. It is possible to find the reason why large dips existing at closed shells above were not found at closed shells below 50, if one attributes these large dips to the existence of sub-shells with low-level densities in the proximity of such closed shells as 50, 82, and 126. One may conclude that the energy gap at the shell edge only results in a small dip of the short-ranged nature.

5. Summary

Level spacings D_0 were computed from BNL-325[18,19], and compared with those compiled by several authors[1-16]. Well-established values of D_0 were plotted versus the neutron number to see systematic trends of the D_0 which in turn were used to determine uncertain D_0. It was also concluded from the systematics that the errors involved in the determination would not exceed a factor of two, except for two nuclides ^{75}Se and ^{244}Cm.

It was then attempted to deduce the level density parameter a from thus fixed values of D_0. The effect on the a's of two alternatives of the level density formula, namely, by Ericson and by Lang and LeCouteur was examined and was found to be immaterial.

Suppression of the level density was found near the closed shells that may be understood in connection with the shell effect.

References

1) NEWTON T. D.: *Can. J. Phys.* **34**, 804 (1956).
2) STOLOVY A. and HARVEY J. A.: *Phys. Rev.* **108**, 353 (1957).
3) GOOD W. M., NEILER J. H. and GIBBONS J. H.: *Phys. Rev.* **109**, 926 (1958).
4) CAMERON A. G. W.: *Can. J. Phys.* **36**, 1040 (1958).
5) JACKSON H. E. and BOLLINGER L. M.: *Phys. Rev.* **124**, 1142 (1961).
6) ERBA E., FACCHINI U., and SAETTA MENICHELLA E.: *Nuovo Cimento* **20**, 1237 (1961).
7) GIBBONS J. H., MACKLIN R. L., MILLER P. D. and NEILER, J. H.: *Phys. Rev.* **122**, 182 (1961).
8) NEWSON H. W., GIBBONS J. H., MARSHAK H., BILPUCH E. G., ROHRER R. H. and CAPP P.: *Ann. Phys.* **14**, 346 (1961).
9) BILPUCH E. G., SETH K. K., BOWMAN C. D., TABONY R. H., SMITH R. C. and NEWSON H. W.: *Ann. Phys.* **14**, 387 (1961).
10) COTÉ R. E., BOLLINGER L. M. and THOMAS G. E.: *Phys. Rev.* **134**, B 1047 (1964).
11) BOWMAN C. D., BILPUCH E. G. and NEWSON H. W.: *Ann. Phys.* **17**, 319 (1962).
12) BENZI V. and BORTOLANI M. V.: *Nuovo Cimento* **38**, 216 (1965).
13) DESJARDINS J. S., ROSEN J. L., HAVENS W. W. JR., and RAINWATER J.: *Phys. Rev.* **120**, 2214 (1960).
14) GARG J. B., RAINWATER J., PETERSEN J. S. and HAVENS W. W. JR., : *Phys. Rev.* **134**, B 985 (1964).
15) BOWMAN C. D., AUCHAMPAUGH G. F. and FULTZ S. C.: *Phys. Rev.* **130**, 1482 (1963).
16) GILBERT A. and CAMERON A. G. W.: *Can. J. Phys.* **43**, 1446 (1965).
17) HUGHES D. J. and HARVEY J. A.: Neutron Cross Sections, BNL-325 (1955), Brookhaven National Laboratory; HUGHES D. J. and SCHWARTZ R. B.: ibid, Second Edition (1958), Brookhhaven National Laboratory.
18) HUGHES D. J., MAGURNO B. A. and BRUSSEL M. K. : Neutron Cross Sections, BNL-325, Second Edition, Supplement No. 1 (1960), Brookhaven National Laboratory.
19) STEHN J. R., GOLDBERG M. D., MAGURNO B.A. and WIENER-CHASMAN R.: Neutron Cross Sections, BNL-325, Second Edition, Supplement No. 2, Vol. I (1964), Brookhaven National Laboratory; GOLDBERG M. D., MUGHABGHAB S. F., MAGURNO B. A. and MAY V. M.: ibid, Vol. II A (1966), BNL; GOLDBERG M. D., MUGHABGHAB S. F., PUROHIT S. N., MAGURNO B, A. and MAY V. M.: ibid, Vol. II B, C (1966), BNL; STEHN J. R., GOLDBERG M. D., WIENER-CHASMAN R., MUGHABGHAB S. F., MAGURNO B. A. and MAY V. M. · ibid, Vol. III (1965), BNL.
20) BABA H.: to be published.
21) ERICSON T.: *Adv. in Phys.* **9**, 425 (1960).
22) LANG J. M. B. and LECOUTEUR K. J.: *Proc. Phys. Soc.* **A 67**, 586 (1954).
23) ERICSON T. and STRUTINSKI V.: *Nucl. Phys.* **8**, 285 (1958).
24) ERICSON T.: *Nucl. Phys.* **6**, 62 (1958).
25) EVERLING F., KÖNIG L. A., MATTAUCH, J. H. E. and WAPSTRA, A. H.: *Nucl. Phys.* **18**, 529 (1960).
26) MATTAUCH J. H. E., THIELE W. and WAPSTRA A. H.: *Nucl. Phys.* **67**, 1 (1965).
27) GADIOLI E. and IORI I.: Report INFN/BE 66/11 (unpublished); *Nuovo Cimento* **B 51**, 100 (1967).
28) GADIOLI E· and ZETTA L.: *Phys. Rev.* **167**, 1016 (1968).

Table 1. Compiled average level spacings D_0 computed from the neutron resonance capture data. First and second solumns give the compound nucleus and the target spin, respectively. Columns designated with I to VII represent average level spacings deduced by several authors and those computed in this note using Ref. I and II are tabulated in columns VIII and IX.

The numbers given in parentheses in columns I, VIII, and IX represent the number of levels used to fix D_0. Resonance levels only in the neutron energy range below 200 keV are used except for ^{24}Na, ^{53}Cr, and ^{209}Pb.

C. N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{20}F	1/2$^+$	$(85.1\pm1.6)\times10^3$ (8)		110×10^3 a)	50×10^3 a)					$(28\pm12)\times10^3$ (4)
^{24}Na	3/2$^+$	$(72.9\pm2.7)\times10^3$ (14)		150×10^3 a)	201×10^3 a)				$(66\pm15)\times10^3$ (15)	
^{25}Mg	0$^+$				346×10^3 a)				$(170\pm10)\times10^3$ (3)	
^{28}Al	5/2$^+$	$(48.8\pm1.5)\times10^3$ (17)		60×10^3 a)	4×10^3 a)					$(26\pm7)\times10^3$ (8)
^{32}P	1/2$^+$	$(21.05\pm0.49)\times10^3$ (18)		50×10^3 a)						
^{33}S	0$^+$									$(87\pm5)\times10^3$ (3)
^{36}Cl	3/2$^+$		~500 a)	10×10^3 a)			13.3×10^3 a)			$(40\pm29)\times10^3$ (6)
^{38}Cl	3/2$^+$				27.8×10^3 a)		13.3×10^3 a)			$(37\pm8)\times10^3$ (6)
^{40}K	3/2$^+$		10×10^3 b)		11.2×10^3 a)		10×10^3 a)		6×10^3 (2)	
^{42}K	3/2$^+$		10×10^3 b)				10×10^3 a)		10×10^3 (2)	
^{41}Ca	0$^+$				19.5×10^3 a)	$(50\pm10)\times10^3$ a)	$(49\pm10)\times10^3$ a)			$(25\pm8)\times10^3$ (4)
^{44}Ca	7/2$^-$							$(4\pm0.8)\times10^3$		$(2.9\pm0.5)\times10^3$ (13, C)
^{45}Ca	0$^+$					55×10^3 a)	60×10^3 a)			$(55\pm15)\times10^3$ (5, AC)
^{46}Sc	7/2$^-$	$(1.89\pm0.14)\times10^3$ (5)		2×10^3 a)			2.2×10^3 a)			$(1.6\pm0.3)\times10^3$ (5)
^{47}Ti	0$^+$						$(30\pm6)\times10^3$ a)			$(45\pm15)\times10^3$ (4)
^{48}Ti	5/2$^-$									$(2.82\pm0.70)\times10^3$ (20)
^{49}Ti	0$^+$					30×10^3 a)	$(22\pm4)\times10^3$ a)			$(20\pm5)\times10^3$ (14)
^{50}Ti	7/2$^-$									$(3.6\pm0.9)\times10^3$ (10)
^{51}Ti	0$^+$						$(123\pm50)\times10^3$ a)			$(18\pm6)\times10^3$ (8, C)
^{51}V	6$^+$				1.26×10^3 a)					$(2.61\pm0.45)\times10^3$ (16)
^{52}V	7/2$^-$	$(2.18\pm0.21)\times10^3$ (4)		2×10^3 a)			3.3×10^3 a)	$(3.7\pm0.4)\times10^3$		$(4.39\pm0.53)\times10^3$ (20)
^{51}Cr	0$^+$						30×10^3 a)			$(19\pm8)\times10^3$ (5, C)
^{53}Cr	0$^+$				29×10^3 a)		$(44\pm8)\times10^3$ a)			$(46\pm7)\times10^3$ (9)
^{54}Cr	3/2$^-$									$(3.2\pm1.1)\times10^3$ (10, B)
^{55}Cr	0$^+$						38×10^3 a)			$(48\pm37)\times10^3$ (3, B)
^{56}Mn	5/2$^-$	$(2.58\pm0.90)\times10^3$ (4)		2×10^3 a)		2100^{+1550}_{-625} c)	3.3×10^3 a)			$(2.97\pm0.63)\times10^3$ (42)
^{55}Fe	0$^+$					27×10^3 a)	$(25\pm4)\times10^3$ a)			$(21\pm4)\times10^3$ (9)

C. N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{57}Fe	0^+				23.2×10^3 a)	23×10^3 a)	$(29\pm4)\times10^3$ a)			$(21\pm4)\times10^3$ (10)
^{58}Fe	$1/2^-$									$(5.9\pm1.5)\times10^3$ (5)
^{60}Co	$7/2^-$	$(3.73\pm0.54)\times10^3$ (3)		3×10^3 a)			2.5×10^3 a)	$(2.5\pm0.5)\times10^3$		$(1.53\pm0.30)\times10^3$ (52)
^{59}Ni	0^+				25.7×10^3 a)	29×10^3 a)	29×10^3 a)	$(24\pm3)\times10^3$		$(21\pm6)\times10^3$ (9)
^{61}Ni	0^+				22×10^3 a)	26×10^3 a)	29×10^3 a)	$(21\pm3)\times10^3$		$(21\pm4)\times10^3$ (10)
^{62}Ni	$3/2^-$									$(2.3\pm0.4)\times10^3$ (19, B)
^{64}Cu	$3/2^-$				1.4×10^3 a)			$(1\pm0.15)\times10^3$		$(1.06\pm0.14)\times10^3$ (21)
^{66}Cu	$3/2^-$				1.99×10^3 a)			$(1.7\pm0.4)\times10^3$		$(1.17\pm0.24)\times10^3$ (17)
^{65}Zn	0^+				1.85×10^3 a)					$(3.4\pm0.9)\times10^3$ (5, AB)
^{67}Zn	0^+							$(6.5\pm1.0)\times10^3$		$(5.6\pm1.9)\times10^3$ (6)
^{68}Zn	$5/2^-$				690×10^3 a)					720 ± 190 (4)
^{69}Zn	0^+									20×10^3 (2)
^{70}Ga	$3/2^-$				300 a)					320 ± 90 (8, AB)
^{72}Ga	$3/2^-$				205 a)		204 ± 69 b)			190 ± 50 (4)
^{71}Ge	0^+							$(1.0\pm0.2)\times10^3$		$(2.0\pm0.8)\times10^3$ (18, B)
^{73}Ge	0^+						2090 ± 944 b)	$(3.0\pm1.0)\times10^3$		$(3.9\pm1.5)\times10^3$ (10, B)
^{74}Ge	$9/2^+$							77 ± 9		
^{75}Ge	0^+									$(8.5\pm4.7)\times10^3$ (3, B)
^{77}Ge	0^+									$(8.0\pm0.8)\times10^3$ (4, B)
^{76}As	$3/2^-$	108.3 ± 3.6 (9)	90 a)				91 ± 17 b)	87 ± 8		87.3 ± 11.4 (47)
^{75}Se	0^+		~200 a)							200 (2)
^{77}Se	0^+							$(1.5\pm0.35)\times10^3$		$(1.2\pm0.6)\times10^3$ (5)
^{78}Se	$1/2^-$				393 a)		393 ± 86 b)	140 ± 20		150 ± 40 (10)
^{79}Se	0^+							$(3.3\pm0.5)\times10^3$		$(4.5\pm1.0)\times10^3$ (9, B)
^{81}Se	0^+				1.5×10^3 a)			$(3.3\pm0.8)\times10^3$	$(1.6\pm0.6)\times10^3$ (3)	
^{83}Se	0^+									$(6.9\pm1.1)\times10^3$ (4, B)
^{80}Br	$3/2^-$		45 a)		40 b)		51 ± 17 b)	55 ± 10		61 ± 13 (7)
^{82}Br	$3/2^-$				34 a)		52 ± 17 b)	65 ± 15		52 ± 14 (3)
^{86}Rb	$5/2^-$		1.0×10^3 b)		833 a)	$(1\pm0.5)\times10^3$ b)	900 ± 70 b)			$(1.1\pm0.2)\times10^3$ (6, B)
^{88}Rb	$3/2^-$		1.7×10^3 b)		1.18×10^3 a)	$(2\pm1)\times10^3$ b)	1183 ± 246 b)			$(1.8\pm0.6)\times10^3$ (6, B)
^{85}Sr	0^+									350 ± 120 (10, B)
^{87}Sr	0^+		4×10^3 b)			$(6\pm4)\times10^3$ b)				$(2.1\pm1.0)\times10^3$ (9, B)

C. N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{88}Sr	$9/2^+$		~400 a)			$(6\pm4)\times10^3$ b)				210 ± 80 (15, B)
^{89}Sr	0^+		15×10^3 b)			$(55\pm19)\times10^3$ ($l=0$) b) $(16\pm3)\times10^3$ ($l=1$) a, b)				$(12\pm2)\times10^3$ (19, B)
^{90}Y	$1/2^-$		3.5×10^3 b)		4.85×10^3 a)	$(2\pm0.5)\times10^3$ a,b)	4375 ± 475 b)			$(1.6\pm0.4)\times10^3$ (11)
^{91}Zr	0^+							$(4.5\pm0.8)\times10^3$		$(3.3\pm0.8)\times10^3$ (5)
^{92}Zr	$5/2^+$							290 ± 40		250 ± 50 (12)
^{93}Zr	0^+							$(1.3\pm0.3)\times10^3$		$(3.4\pm1.1)\times10^3$ (7)
^{95}Zr	0^+							$(2.5\pm0.4)\times10^3$		$(3.3\pm0.9)\times10^3$ (4)
^{97}Zr	0^+									$(1.1\pm0.3)\times10^3$ (6)
^{94}Nb	$9/2^+$	37.5 ± 3.7 (7)	42.5 a)		160 b)			55 ± 5		26.0 ± 4.6 (76)
^{96}Mo	$5/2^+$	209.5 ± 33.0 (4)	~200 a)				218 ± 95 b)	100 ± 20		100 ± 40 (14)
^{97}Mo	0^+									$(1.2\pm0.5)\times10^3$ (4)
^{98}Mo	$5/2^+$	175.5 ± 18.0 (4)	~200 a)				169 ± 31 b)	140 ± 30		120 ± 60 (9)
^{99}Mo	0^+									790 ± 740 (9, AB)
^{101}Mo	0^+									400 ± 75 (5)
^{100}Tc	$9/2^+$	13.81 ± 1.60 (5)		14 a)			24 ± 6 b)	21 ± 3	26 ± 5 (9)	
^{100}Ru	$5/2^+$									200 (2, AB)
^{102}Ru	$5/2^+$						24 b)	17 ± 3		15 ± 4 (7)
^{104}Rh	$1/2^-$		~75 a)				29 ± 4 b)	35 ± 4		10.3 ± 2.0 (46)
^{106}Pd	$5/2^+$						13 ± 4 b)	13.3 ± 1.7		11.1 ± 1.7 (14)
^{108}Ag	$1/2^-$	19.4 ± 7.5 (4)	27.5 a)		24 b)		12 ± 7 b)	31 ± 6		50 ± 12 (14)
^{110}Ag	$1/2^-$	16.13 ± 0.85 (6)	17.5 a)				21 ± 6 b)	22 ± 4		19.1 ± 3.8 (34)
^{112}Cd	$1/2^+$		34 a)	33 ± 10 b)			27 ± 5 b)			34 ± 6 (7)
^{113}Cd	0^+		~230 a)	80^{+50}_{-20} b)						200 (2)
^{114}Cd	$1/2^+$		30.5 a)	27 ± 7 b)			36 ± 11 b)			27 ± 3 (9)
^{114}In	$9/2^+$	7.15 ± 0.60 (7)	7 a)				7 ± 2 b)	6.5 ± 1.5	7.1 ± 1.2 (7)	
^{116}In	$9/2^+$	7.5 ± 0.7 (8)	7 a)		9.0 b)		7 ± 2 b)	6.5 ± 1.0		9.5 ± 2.4 (11)
^{113}Sn	0^+	153 ± 43 (2)		150 a)				25 ± 7		140 ± 50 (7, B)
^{115}Sn	0^+							150 ± 50		320 ± 90 (6, BC)
^{116}Sn	$1/2^+$							50 ± 20		180 ± 80 (4, C)
^{117}Sn	0^+	137 ± 71 (2)		150 a)				180 ± 50		250 ± 40 (8, ABC)
^{118}Sn	$1/2^+$	54.0 ± 5 (5)	70 a)				55 ± 18 b)	25 ± 5		65 ± 15 (8)
^{119}Sn	0^+	240 ± 120 (2)		300 a)				180 ± 50		730 ± 180 (6)

C. N.	I	I		II		III		IV		V		VI		VII		VIII		IX	
^{120}Sn	$1/2^+$	140±47	(2)			150	a)					160±79	b)	30±8				62±21	(6)
^{121}Sn	0^+																	240±50	(6)
^{122}Sb	$5/2^+$	14.25±0.39	(7)	15	a)	12±3	b)	22	b)			14±2	b)					13±2	(14)
^{124}Sb	$7/2^+$	31.29±0.96	(3)	35	a)	29^{+17}_{-11}	b)					28±1	b)					30±13	(6)
^{123}Te	0^+																	130±10	(6, AB)
^{124}Te	$1/2^+$			15	a)							39±19	b)	22±8				33±9	(12)
^{126}Te	$1/2^+$											66±18	b)	60±5				46±11	(10)
^{131}Te	0^+									(3.5±0.6)×10^3 a, b)				(5.5±0.8)×10^3				5.7±1.2	(21, BC)
^{128}I	$5/2^+$	11.68±0.73	(7)					13.4	b)			13.3	b)	13.3±0.7				19±5	(11)
^{130}I	$7/2^+$							17.56	a)			18±6	b)	27±5				21±6	(5)
^{132}Xe	$3/2^+$											31±1	b)	25±10		31±1	(3)		
^{136}Xe	$3/2^+$			≃500	a)														
^{134}Cs	$7/2^+$	21.45±0.55	(12)	21	a)							21±3	b)	18.5±0.5				20.7±4.7	(24)
^{136}Ba	$3/2^+$	35.4±11.4	(3)	35	a)							49±10	b)	50±8				35±9	(14)
^{137}Ba	0^+									>1×10^3	b)							(3.8±2.8)×10^3	(3)
^{138}Ba	$3/2^+$																	460±250	(3)
^{139}Ba	0^+									(10±4)×10^3 a, b)		10625±4231	b)			(9.6±3.4)×10^3	(9)		
^{139}La	5^-																	41±6	(10)
^{140}La	$7/2^+$	1000±700	(1)	≃500	a)													110±20	(28, C)
^{141}Ce	0^+									(3±1)×10^3	b)								
^{143}Ce	0^+									(1±0.2)×10^3	b)								
^{142}Pr	$5/2^+$	112.8±4.6	(9)			110	a)	120	b)			64±13	b)	90±5				83.8±12.1	(51)
^{144}Nd	$7/2^-$													40±10				19±9	(7)
^{146}Nd	$7/2^-$			25	a)									22±4				25±9	(5)
^{148}Pm	$7/2^+$							5.37	a)			5.3±1.6	b)	42±6		5.7±1.5	(9)		
^{148}Sm	$7/2^-$			7	a)							8±2	b)	7.7±1.2				7.9±1.3	(13)
^{150}Sm	$7/2^-$			3.3	a)							4±0.6	b)	2.8±0.3				3.22±0.53	(26)
^{151}Sm	0^+																	24	(2)
^{152}Sm	$5/2^-$, $7/2^-$							1.3	a)			1.3±0.5	b)	1.3±0.25		1.3±0.5	(5)		
^{153}Sm	0^+													45±15				80	(2)
^{152}Eu	$5/2^+$			0.60	a)							0.87±0.14	b)	0.65±0.09				0.72±0.14	(21)
^{154}Eu	$5/2^+$			1.2	a)									1.25±0.09				1.3±0.4	(9)

C. N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{156}Gd	$3/2^-$		2.1 a)					1.80±0.15		1.99±0.32 (26)
^{157}Gd	0^+							33±6		75±19 (5, AB)
^{158}Gd	$3/2^-$		14.5 a)	2 a)				5.5±1.2		6.1±1.6 (13)
^{160}Tb	$3/2^+$	5.052±0.115 (16)		2.7 a)	2.0 b)			5.0±0.6		4.30±0.78 (25)
^{162}Dy	$5/2^+$		1.15 a)					2.20±0.15		2.55±0.38 (27)
^{163}Dy	0^+		≃200 a)					42±6		220±80 (4)
^{164}Dy	$5/2^-$		5 a)					9±1		9.6±1.6 (10)
^{166}Ho	$7/2^-$	5.754±0.142 (15)		7.5 a)	3.0 b)			6.1±4		5.67±0.74 (45)
^{163}Er	0^+									7.1±1.2 (9, AB)
^{165}Er	0^+									17±5 (4)
^{167}Er	0^+									47±7 (13, AB)
^{168}Er	$7/2^+$							3.0±0.5		4.0±0.4 (25)
^{169}Er	0^+									100±30 (5, B)
^{170}Tm	$1/2^-$	6.81±0.25 (15)	7.5 a)		3.5 b)			7.1±1.0		6.6±1.3 (18)
^{169}Yb	0^+		≃30 a)							20 (2)
^{172}Yb	$1/2^-$							8.7±0.8		7.2±1.7 (26)
^{174}Yb	$5/2^-$							12±2		7.8±1.0 (21)
^{177}Yb	0^+									250±60 (10, AB)
^{176}Lu	$7/2^+$	2.65±0.11 (14)	3.5 a)		1.5 b)			3.3±0.3	3.61±0.62 (16)	
^{177}Lu	7^-	1.05±0.55 (2)	1.5 a)					2.1±0.15	2.37±0.27 (21)	
^{177}Hf	0^+									41±12 (16)
^{178}Hf	$7/2^-$	2.946±0.36 (12)	4.5 a)					3.8±0.4		3.2±0.7 (48)
^{179}Hf	0^+							32±8		55±8 (11)
^{180}Hf	$9/2^-$	3.595±0.125 (26)		8 a)				5.6±0.5		5.8±0.5 (39)
^{181}Hf	0^+							125±40		140±30 (7)
^{181}Ta	8^+		≃1.5 a)							
^{182}Ta	$7/2^+$	3.921±0.203 (10)	4.5 a)		4.3 b)		4.35 c)			4.33±0.51 (75)
^{183}W	0^+		50 a)					50±12		56±8 (11)
^{184}W	$1/2^-$	19.6±0.9 (3)	15 a)					12.5±0.8		15.8±2.0 (27)
^{185}W	0^+							130±30		93±19 (14)
^{187}W	0^+				75 a)					87±10 (9)
^{186}Re	$5/2^+$		3 a)					3.8±0.8		3.2±0.6 (19)

C.N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{188}Re	5/2$^+$		7.5 a)					5.5±1.0		6.4±1.9 (12)
^{188}Os	1/2$^-$									14±6 (4, AB)
^{190}Os	3/2$^-$			5.1±1.2 b)						5.0±1.1 (12)
^{192}Ir	3/2$^+$		≃3.5 a)					3.3±0.3		3.2±0.7 (16)
^{194}Ir	3/2$^+$		≃3.5 a)					7.7±0.6		8.5±1.3 (13)
^{196}Pt	1/2$^-$	24.7±7.4 (3)	35 a)					16±1		19.3±3.6 (30)
^{198}Au	3/2$^+$	33.9±8.2 (3)	30 a)		17.1 a)		16.8 c)	16±1		15.8±2.3 (61)
^{199}Hg	0$^+$		≃100 a)					83±28		100±30 (5)
^{200}Hg	1/2$^-$		≃50 a)					59±10		84±18 (6)
^{201}Hg	0$^+$							(1.3±0.5)×10^3		(1.3±0.1)×10^3 (6)
^{202}Hg	3/2$^-$							90±25		110±20 (7)
^{204}Tl	1/2$^+$	(5.0±3.78)×10^3 (1)		1×10^3 a)		2±1 b)		(2.0±0.8)×10^3		(2.2±0.3)×10^3 (7, AB)
^{206}Tl	1/2$^+$					10±3 b)		(10±3)×10^3		(19±7)×10^3 (4, B)
^{207}Pb	0$^+$	(4.73±1.30)×10^3 (5)		25×10^3 a)		≃70 (l=0) 40±15 (l=1) b)		(57±12)×10^3		(24±4)×10^3 (9, B)
^{208}Pb	1/2$^-$					19±6 (l=0) 70±30 (l=1) b)		(50±10)×10^3		(22±7)×10^3 (7, AB)
^{209}Pb	0$^+$	(18.3±0.6)×10^3 (3)		400×10^3 a)		>350 (l=0) 70±30 (l=1) b)				(110±40)×10^3 (8)
^{210}Bi	9/2$^-$	(3.42±2.73)×10^3 (3)	7×10^3 b)	40×10^3 a)				(6.9±0.7)×10^3		(5.42±0.62)×10^3 (27)
^{233}Th	0$^+$	15.1±2.3 (6)	20 a)				17.5±0.7 d)			12.4±1.1 (122)
^{232}Pa	3/2$^-$							0.45±0.07		0.443±0.065 (21)
^{234}Pa	3/2$^-$							0.86±0.12		1.03±0.15 (15)
^{233}U	0$^+$							7.6±1.5		14.2±3.6 (14)
^{234}U	5/2$^+$	0.973±0.026 (9)	0.55 a)					0.91±0.09		0.993±0.076 (28)
^{235}U	0$^+$	15.1±1.3 (7)		17 a)				13.0±0.8		18.0±7.3 (20)
^{236}U	7/2$^-$	0.871±0.026 (15)	0.65 a)				0.64 e)	0.65±0.03		0.63±0.13 (77)
^{237}U	0$^+$	15.7±1.6 (6)		17 a)				14.5±1.5		27±9 (14)
^{239}U	0$^+$	17.71±0.62 (11)	20 a)				17.7±0.7 d)			18.1±2.3 (81)
^{238}Np	5/2$^+$		0.65 a)					0.58±0.06		0.720±0.079 (18)
^{239}Pu	0$^+$									16±5 (7, B)
^{240}Pu	1/2$^+$	2.49±0.41 (7)	3 a)					2.6±0.1		2.3±0.6 (14)
^{241}Pu	0$^+$		20 a)					10.0±1.0		14±2 (9)
^{242}Pu	5/2$^+$							1.3±0.1		1.17±0.17 (20)
^{242}Am	5/2$^-$	0.4275±0.0406 (7)		0.43 a)				0.43±0.06		0.578±0.093 (15)

C. N.	I	I	II	III	IV	V	VI	VII	VIII	IX
^{244}Am	$5/2^-$				1. 462 a)			1. 25±0. 15		1. 5±0. 3 (11, B)
^{244}Cm	$5/2^+$							12. 6±3. 3		20±6 (15, B)

I) Newton[1] (1956), the number in a parenthesis gives the number of resonances used to fix D_0.

IIa) Stolovy *et al.*[2] (1957) ; IIb) Good *et al.*[3] (1958)

IIIa) Cameron.[4] (1958) ; IIIb) Jackson *et al.*[5] (1961)

IVa) Erba *et al.*[6] (1961) ; IVb) Gibbons *et al.*[7] (1961)

Va) Bilpuch *et al.*[9] (1961) ; Vb) Newson *et al.*[8] (1961) ; Vc) Coté *et al.*[10] (1964)

VIa) Bowman *et al.*[11] (1962) ; VIb) Benzi *et al.*[12] (1965) ; VIc) Desjardins *et al.*[13] (1960) ; VId) Garg *et al.*[14] (1964) : VIe) Bowman *et al.*[15] (1963)

VII) Gilbert *et al.*[16] (1965)

VIII) Computed from BNL-325, 2nd edition, Supplement No. 1[18] (1960), the number in a parenthesis gives the number of resonances used to fix D_0.

IX) Computed from BNL-325, 2nd edition, Supplement No. 2[19] (1966), the number in a parenthesis gives the number of resonances used to fix D_0.

The resonance levels used were mostly of class A (see text) unless otherwise denotod with an alphabetical capital in the same parenthesis. More than one capital given at the same time signify that the levels assigned to these classes equally contribute in the computation of D_0.

Table 2. Determined level spacing D_0 and deduced level density parameter a_{obs}. The first and second columns give the compound nucleus and the target spin. The orbital angular momentum of the incident neutron is zero unless otherwise denoted with a cross in the first column. The third column represents neutron binding energy unless otherwise associated with an asterisk ; the latter gives an effective excitation energy, the sum of the neutron binding energy and the mean value of the lowest and the highest resonance level used to fix D_0. The neutron binding energy is taken from Wapstra's papers.[25,26] The forth column gives the pairing energy given by Cameron.[41] The fifth column is for the finally determined D_0 by considering systematics (see text). From the systematics it was concluded that errors contained in D_0 did not exceed a factor of two except for ^{75}Se and ^{244}Cm. The listed errors are the deviations calculated with Eq. (3) as long as they result in deviations not more than a factor of two. D_0-values without errors were obtained from only two resonances. The last two columns give values of the level density parameter computed by using two different level density formulas by Ericson and by Lang and LeCouteur, respectively, and with $r_0=1.5$ fermis and Eqs. (6) and (9).

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)		a_{obs} (MeV^{-1}) Ericson	a_{obs} (MeV^{-1}) Lang-LeCouteur
$^{20}_{9}F_{11}$†	1/2+	6.5973		$\left(55^{+55}_{-28}\right)\times10^3$	e)	$3.94^{+0.54}_{-0.49}$	$4.19^{+0.54}_{-0.49}$
$^{24}_{11}Na_{13}$†	3/2+	7.45*		$(66\pm15)\times10^3$	f)	$3.55^{+0.17}_{-0.13}$	$3.77^{+0.17}_{-0.13}$
$^{25}_{12}Mg_{13}$†	0+	7.3289	2.10	$(170\pm10)\times10^3$		4.18 ± 0.05	4.51 ± 0.05
$^{28}_{13}Al_{15}$†	5/2+	7.7307		$\left(26^{+26}_{-13}\right)\times10^3$		$4.18^{+0.51}_{-0.48}$	$4.39^{+0.51}_{-0.48}$
$^{32}_{15}P_{17}$	1/2+	7.9365		$(21.0\pm0.5)\times10^3$	g)	5.33 ± 0.02	5.56 ± 0.02
$^{33}_{16}S_{17}$	0+	8.6413	1.54	$(87\pm5)\times10^3$		5.16 ± 0.05	$5.41^{+0.05}_{-0.04}$
$^{36}_{17}Cl_{19}$	3/2+	8.5765		$\left(40^{+29}_{-20}\right)\times10^3$		$4.42^{+0.48}_{-0.36}$	$4.63^{+0.48}_{-0.36}$
$^{38}_{17}Cl_{21}$	3/2+	6.110		$(37\pm8)\times10^3$		$5.66^{+0.22}_{-0.18}$	$5.95^{+0.22}_{-0.18}$
$^{40}_{19}K_{21}$	3/2+	7.8015		10^4	e)	$5.95^{+0.59}_{-0.56}$	$6.18^{+0.59}_{-0.56}$
$^{42}_{19}K_{23}$	3/2+	7.537		10^4		$6.18^{+0.61}_{-0.58}$	$6.42^{+0.61}_{-0.58}$
$^{41}_{20}Ca_{21}$	0+	8.364	1.51	$(50\pm10)\times10^3$	h, i)	$6.19^{+0.20}_{-0.16}$	$6.46^{+0.20}_{-0.16}$
$^{44}_{20}Ca_{24}$	7/2−	11.135	2.92	$(2.9\pm0.5)\times10^3$		$6.74^{+0.17}_{-0.14}$	$6.94^{+0.17}_{-0.14}$
$^{45}_{20}Ca_{25}$	0+	7.420	1.51	$(55\pm15)\times10^3$		$6.95^{+0.33}_{-0.24}$	$7.25^{+0.33}_{-0.24}$
$^{46}_{21}Sc_{25}$	7/2−	8.7666		$(1.6\pm0.3)\times10^3$		$7.73^{+0.19}_{-0.15}$	$7.95^{+0.19}_{-0.15}$
$^{47}_{22}Ti_{25}$	0+	8.8754	1.73	$(45\pm15)\times10^3$		$6.41^{+0.36}_{-0.25}$	$6.67^{+0.36}_{-0.25}$
$^{48}_{22}Ti_{26}$	5/2−	11.6280	3.02	$(2.82\pm0.70)\times10^3$		$6.70^{+0.24}_{-0.19}$	$6.91^{+0.24}_{-0.19}$
$^{49}_{22}Ti_{27}$	0+	8.1460	1.73	$(20\pm5)\times10^3$		$7.79^{+0.30}_{-0.23}$	$8.08^{+0.30}_{-0.23}$
$^{50}_{22}Ti_{28}$	7/2−	10.945	3.20	$(3.6\pm0.9)\times10^3$		$7.02^{+0.27}_{-0.20}$	$7.24^{+0.27}_{-0.20}$
$^{51}_{22}Ti_{29}$	0+	6.379	1.73	$(18\pm6)\times10^3$		$9.93^{+0.56}_{-0.39}$	$10.32^{+0.56}_{-0.39}$
$^{51}_{23}V_{28}$	6+	11.0545	1.47	$(2.61\pm0.45)\times10^3$		$6.64^{+0.16}_{-0.13}$	$6.60^{+0.16}_{-0.13}$
$^{52}_{23}V_{29}$	7/2−	7.309		$(4.39\pm0.53)\times10^3$		$7.20^{+0.12}_{-0.11}$	$7.43^{+0.12}_{-0.11}$
$^{51}_{24}Cr_{27}$	0+	9.270	1.44	$(19\pm8)\times10^3$		$6.94^{+0.49}_{-0.31}$	$7.16^{+0.49}_{-0.31}$
$^{53}_{24}Cr_{29}$	0+	8.17*	1.44	$(46\pm7)\times10^3$		$6.92^{+0.16}_{-0.13}$	$7.20^{+0.16}_{-0.13}$
$^{54}_{24}Cr_{30}$	3/2−	9.721	2.76	$(3.2\pm1.1)\times10^3$		$8.17^{+0.44}_{-0.30}$	$8.43^{+0.44}_{-0.30}$
$^{55}_{24}Cr_{31}$	0+	6.254	1.44	$\left(48^{+37}_{-24}\right)\times10^3$		$8.68^{+0.89}_{-0.70}$	$9.06^{+0.89}_{-0.70}$
$^{56}_{25}Mn_{31}$	5/2−	7.270		$(2.97\pm0.63)\times10^3$		$7.82^{+0.24}_{-0.19}$	$8.07^{+0.24}_{-0.19}$
$^{55}_{26}Fe_{29}$	0+	9.299	1.45	$(21\pm4)\times10^3$		$7.00^{+0.19}_{-0.15}$	$7.24^{+0.19}_{-0.15}$

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)		a_{obs} (MeV^{-1}) Ericson	Lang-LeCouteur
$^{57}_{26}Fe_{31}$	0^+	7.642	1.45	$(21\pm4)\times10^3$		$8.33^{+0.23}_{-0.19}$	$8.62^{+0.23}_{-0.19}$
$^{58}_{26}Fe_{32}$	$1/2^-$	10.042	2.91	$(5.9\pm1.5)\times10^3$		$8.19^{+0.30}_{-0.23}$	$8.45^{+0.30}_{-0.23}$
$^{60}_{27}Co_{33}$	$7/2^-$	7.491		$(1.53\pm0.30)\times10^3$		$8.35^{+0.22}_{-0.18}$	$8.58^{+0.22}_{-0.18}$
$^{59}_{28}Ni_{31}$	0^+	9.003	1.37	$(21\pm6)\times10^3$		$7.30^{+0.31}_{-0.23}$	$7.54^{+0.31}_{-0.23}$
$^{61}_{28}Ni_{33}$	0^+	7.821	1.37	$(21\pm4)\times10^3$		$8.27^{+0.23}_{-0.18}$	$8.56^{+0.23}_{-0.18}$
$^{62}_{28}Ni_{34}$	$3/2^-$	10.600	2.81	$(2.3\pm0.4)\times10^3$		$8.16^{+0.19}_{-0.15}$	$8.40^{+0.19}_{-0.15}$
$^{64}_{29}Cu_{35}$	$3/2^-$	7.916		$(1.06\pm0.14)\times10^3$		$8.90^{+0.15}_{-0.12}$	$9.14^{+0.15}_{-0.12}$
$^{66}_{29}Cu_{37}$	$3/2^-$	7.060		$(1.17\pm0.24)\times10^3$		$9.65^{+0.26}_{-0.21}$	$9.91^{+0.26}_{-0.21}$
$^{65}_{30}Zn_{35}$	0^+	7.988	1.09	$(3.4\pm0.9)\times10^3$		$10.02^{+0.36}_{-0.27}$	$10.29^{+0.36}_{-0.27}$
$^{67}_{30}Zn_{37}$	0^+	7.052	1.09	$(5.6\pm1.9)\times10^3$		$10.59^{+0.53}_{-0.37}$	$10.90^{+0.53}_{-0.37}$
$^{68}_{30}Zn_{38}$	$5/2^-$	10.203	2.61	720 ± 190		$9.42^{+0.33}_{-0.25}$	$9.66^{+0.33}_{-0.25}$
$^{69}_{30}Zn_{39}$	0^+	6.503	1.09	20×10^3		$9.76^{+0.89}_{-0.85}$	$10.10^{+0.89}_{-0.85}$
$^{70}_{31}Ga_{39}$	$3/2^-$	7.642		320 ± 90		$10.66^{+0.37}_{-0.28}$	$10.90^{+0.37}_{-0.28}$
$^{72}_{31}Ga_{41}$	$3/2^-$	6.520		190 ± 50		$12.76^{+0.41}_{-0.31}$	$13.05^{+0.41}_{-0.31}$
$^{71}_{32}Ge_{39}$	0^+	7.415	1.36	$(2.0\pm0.8)\times10^3$		$11.98^{+0.69}_{-0.45}$	$12.28^{+0.69}_{-0.44}$
$^{73}_{32}Ge_{41}$	0^+	6.786	1.36	$(3.9\pm1.5)\times10^3$		$12.10^{+0.70}_{-0.45}$	$12.45^{+0.69}_{-0.45}$
$^{74}_{32}Ge_{42}$	$9/2^+$	10.197	2.83	77 ± 9	j)	$12.28^{+0.16}_{-0.14}$	$12.51^{+0.16}_{-0.14}$
$^{75}_{32}Ge_{43}$	0^+	6.485	1.36	$\left(8.5^{+4.7}_{-4.3}\right)\times10^3$		$11.58^{+1.02}_{-0.62}$	$11.94^{+1.02}_{-0.61}$
$^{77}_{32}Ge_{45}$	0^+	6.030	1.36	$(8.0\pm0.8)\times10^3$		$12.54^{+0.16}_{-0.15}$	$12.94^{+0.16}_{-0.15}$
$^{76}_{33}As_{43}$	$3/2^-$	7.326		87.3 ± 11.4		$12.81^{+0.18}_{-0.16}$	$13.06^{+0.18}_{-0.16}$
$^{75}_{34}Se_{41}$	0^+	8.026	1.42	200^{+600}_{-100}		$14.46^{+1.00}_{-1.88}$	$14.75^{+0.99}_{-1.89}$
$^{77}_{34}Se_{43}$	0^+	7.415	1.42	$(1.2\pm0.6)\times10^3$		$13.04^{+0.99}_{-0.56}$	$13.35^{+0.99}_{-0.56}$
$^{78}_{34}Se_{44}$	$1/2^-$	10.491	2.87	$(150\pm40)\times10^3$		$12.61^{+0.39}_{-0.29}$	$12.86^{+0.39}_{-0.29}$
$^{79}_{34}Se_{45}$	0^+	6.972	1.42	$(4.5\pm1.0)\times10^3$		$11.98^{+0.35}_{-0.28}$	$12.32^{+0.35}_{-0.28}$
$^{81}_{34}Se_{47}$	0^+	6.714	1.42	$(1.6\pm0.6)\times10^3$	f)	$14.03^{+0.73}_{-0.49}$	$14.38^{+0.73}_{-0.49}$
$^{83}_{34}Se_{49}$	0^+	5.990 b)	1.42	$(6.9\pm1.1)\times10^3$		$13.26^{+0.28}_{-0.24}$	$13.67^{+0.28}_{-0.24}$
$^{80}_{35}Br_{45}$	$3/2^-$	7.879		61 ± 13		$12.69^{+0.29}_{-0.23}$	$12.93^{+0.29}_{-0.23}$
$^{82}_{35}Br_{47}$	$3/2^-$	7.597		52 ± 14		$13.33^{+0.40}_{-0.30}$	$13.57^{+0.40}_{-0.30}$
$^{86}_{37}Rb_{49}$	$5/2^-$	8.637		$(1.1\pm0.2)\times10^3$		$8.66^{+0.19}_{-0.16}$	$8.87^{+0.19}_{-0.16}$
$^{88}_{37}Rb_{51}$	$3/2^-$	6.135		$(1.8\pm0.6)\times10^3$		$10.98^{+0.52}_{-0.36}$	$11.28^{+0.52}_{-0.36}$
$^{85}_{38}Sr_{47}$	0^+	8.482	1.20	350 ± 120		$13.11^{+0.54}_{-0.37}$	$13.37^{+0.54}_{-0.37}$
$^{87}_{38}Sr_{49}$	0^+	8.437	1.20	$(2.1\pm1.0)\times10^3$		$11.04^{+0.77}_{-0.45}$	$11.30^{+0.77}_{-0.45}$
$^{88}_{38}Sr_{50}$	$9/2^+$	11.100	2.47	210 ± 80		$10.08^{+0.51}_{-0.33}$	$10.29^{+0.50}_{-0.34}$
$^{89}_{38}Sr_{51}$	0^+	6.393	1.20	$(12\pm2)\times10^3$		$15.05^{+0.30}_{-0.25}$	$15.41^{+0.30}_{-0.25}$
$^{90}_{39}Y_{51}$	$1/2^-$	6.869		$(1.6\pm0.4)\times10^3$		$11.08^{+0.35}_{-0.27}$	$11.35^{+0.35}_{-0.27}$
$^{91}_{40}Zr_{51}$	0^+	7.194	1.00	$(3.3\pm0.8)\times10^3$		$11.93^{+0.37}_{-0.28}$	$12.23^{+0.37}_{-0.28}$
$^{92}_{40}Zr_{52}$	$5/2^+$	8.640	1.62	250 ± 50		$12.05^{+0.28}_{-0.23}$	$12.31^{+0.27}_{-0.23}$

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)	a_{obs} (MeV^{-1}) Ericson	Lang-LeCouteur
$^{93}_{40}Zr_{53}$	0^+	6.750	1.00	$(3.4\pm1.1)\times10^3$	$12.62^{+0.56}_{-0.39}$	$12.95^{+0.56}_{-0.39}$
$^{95}_{40}Zr_{55}$	0^+	6.468	1.00	$(3.3\pm0.9)\times10^3$	$13.21^{+0.47}_{-0.35}$	$13.55^{+0.47}_{-0.35}$
$^{97}_{40}Zr_{57}$	0^+	5.575	1.00	$(1.1\pm0.3)\times10^3$	$17.06^{+0.59}_{-0.44}$	$17.47^{+0.59}_{-0.44}$
$^{94}_{41}Nb_{53}$	$9/2^+$	7.213		36.0 ± 4.6	$14.03^{+0.19}_{-0.16}$	$14.27^{+0.18}_{-0.17}$
$^{96}_{42}Mo_{54}$	$5/2^+$	9.156	1.92	100 ± 40	$13.04^{+0.67}_{-0.43}$	$13.29^{+0.67}_{-0.42}$
$^{97}_{42}Mo_{55}$	0^+	6.817	1.16	$(1.2\pm0.5)\times10^3$	$14.45^{+0.83}_{-0.52}$	$14.79^{+0.83}_{-0.53}$
$^{98}_{42}Mo_{56}$	$5/2^+$	8.642	2.39	120 ± 60	$14.39^{+1.03}_{-0.58}$	$14.68^{+1.03}_{-0.58}$
$^{99}_{42}Mo_{57}$	0^+	5.918	1.16	790^{+740}_{-395}	$17.26^{+1.27}_{-1.17}$	$17.65^{+1.28}_{-1.17}$
$^{101}_{42}Mo_{59}$	0^+	5.391	1.16	400 ± 75	$20.31^{+0.43}_{-0.36}$	$20.75^{+0.43}_{-0.36}$
$^{100}_{43}Tc_{57}$	$9/2^+$	6.596		26 ± 5 f)	$15.71^{+0.32}_{-0.26}$	$15.98^{+0.32}_{-0.27}$
$^{100}_{44}Ru_{56}$	$5/2^+$	9.671	2.51	200	$12.38^{+0.89}_{-0.86}$	$12.64^{+0.88}_{-0.86}$
$^{102}_{44}Ru_{58}$	$5/2^+$	9.216	2.50	15 ± 4	$16.75^{+0.47}_{-0.36}$	$17.02^{+0.48}_{-0.35}$
$^{104}_{45}Rh_{59}$	$1/2^-$	7.002		10.3 ± 2.0	$18.31^{+0.34}_{-0.27}$	$18.58^{+0.34}_{-0.27}$
$^{106}_{46}Pd_{60}$	$5/2^+$	9.548	2.78	11.1 ± 1.7	$17.24^{+0.26}_{-0.22}$	$17.51^{+0.26}_{-0.22}$
$^{108}_{47}Ag_{61}$	$1/2^-$	7.275		50 ± 12	$15.61^{+0.39}_{-0.30}$	$15.87^{+0.39}_{-0.30}$
$^{110}_{47}Ag_{63}$	$1/2^-$	6.824		19.1 ± 3.8	$17.93^{+0.35}_{-0.28}$	$18.21^{+0.35}_{-0.28}$
$^{112}_{48}Cd_{64}$	$1/2^+$	9.400	2.68	34 ± 6	$17.32^{+0.30}_{-0.25}$	$17.60^{+0.30}_{-0.25}$
$^{113}_{48}Cd_{65}$	0^+	6.538	1.38	200	$19.25^{+1.30}_{-1.25}$	$19.62^{+1.30}_{-1.26}$
$^{114}_{48}Cd_{66}$	$1/2^+$	9.048	2.67	27 ± 3	$18.48^{+0.19}_{-0.17}$	$18.78^{+0.19}_{-0.17}$
$^{114}_{49}In_{65}$	$9/2^+$	7.312		7.1 ± 1.2 f)	$16.66^{+0.27}_{-0.23}$	$16.90^{+0.27}_{-0.23}$
$^{116}_{49}In_{67}$	$9/2^+$	6.725		9.5 ± 2.4	$17.42^{+0.46}_{-0.35}$	$17.69^{+0.45}_{-0.35}$
$^{113}_{50}Sn_{63}$	0^+	7.743	1.32	140 ± 50	$16.82^{+0.69}_{-0.47}$	$17.12^{+0.69}_{-0.47}$
$^{115}_{50}Sn_{65}$	0^+	7.537	1.32	320 ± 90	$16.03^{+0.51}_{-0.38}$	$16.34^{+0.51}_{-0.38}$
$^{116}_{50}Sn_{66}$	$1/2^+$	9.563	2.61	50 ± 20 j)	$16.42^{+0.76}_{-0.49}$	$16.70^{+0.76}_{-0.49}$
$^{117}_{50}Sn_{67}$	0^+	6.941	1.32	250 ± 40	$17.80^{+0.30}_{-0.25}$	$18.13^{+0.30}_{-0.25}$
$^{118}_{50}Sn_{68}$	$1/2^+$	9.331	2.56	65 ± 15	$16.44^{+0.39}_{-0.31}$	$16.72^{+0.39}_{-0.31}$
$^{119}_{50}Sn_{69}$	0^+	6.481	1.32	730 ± 180	$17.16^{+0.49}_{-0.38}$	$17.53^{+0.49}_{-0.38}$
$^{120}_{50}Sn_{70}$	$1/2^+$	9.110	2.60	62 ± 12	$17.08^{+0.34}_{-0.27}$	$17.37^{+0.34}_{-0.27}$
$^{121}_{50}Sn_{71}$	0^+	6.182	1.32	240 ± 50	$20.11^{+0.46}_{-0.36}$	$20.50^{+0.46}_{-0.36}$
$^{122}_{51}Sb_{71}$	$5/2^+$	6.798		13 ± 2	$17.43^{+0.26}_{-0.22}$	$17.70^{+0.26}_{-0.22}$
$^{124}_{51}Sb_{73}$	$7/2^+$	6.432		30 ± 13	$16.62^{+0.89}_{-0.55}$	$16.90^{+0.89}_{-0.55}$
$^{123}_{52}Te_{71}$	0^+	6.943	1.04	130 ± 8	$18.43^{+0.11}_{-0.10}$	$18.75^{+0.11}_{-0.10}$
$^{124}_{52}Te_{72}$	$1/2^+$	9.408	2.28	33 ± 9	$16.95^{+0.47}_{-0.35}$	$17.22^{+0.47}_{-0.35}$
$^{126}_{52}Te_{74}$	$1/2^+$	9.092	2.24	46 ± 11	$17.04^{+0.41}_{-0.32}$	$17.32^{+0.41}_{-0.32}$
$^{131}_{52}Te_{79}$	0^+	5.895	1.04	$(5.7\pm0.8)\times10^3$	$14.81^{+0.25}_{-0.22}$	$15.19^{+0.25}_{-0.22}$
$^{128}_{53}I_{75}$	$5/2^+$	6.797		19 ± 5	$17.02^{+0.47}_{-0.35}$	$17.29^{+0.47}_{-0.35}$
$^{130}_{53}I_{77}$	$7/2^+$	6.498		21 ± 6	$17.20^{+0.53}_{-0.39}$	$17.48^{+0.53}_{-0.39}$

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)		a_{obs} (MeV^{-1}) Ericson	Lang-LeCouteur
$^{132}_{54}Xe_{78}$	$3/2^+$	8.933	2.11	31 ± 1		$16.87+0.05$	17.15 ± 0.05
$^{136}_{54}X_{82}$	$3/2^+$	7.885	1.65	500	k)	$13.96^{+1.01}_{-0.97}$	$14.26^{+1.01}_{-0.97}$
$^{134}_{55}Cs_{79}$	$7/2^+$	6.705		20.7 ± 4.7		$16.91^{+0.40}_{-0.31}$	$17.18^{+0.40}_{-0.31}$
$^{136}_{56}Ba_{80}$	$3/2^+$	9.230	2.18	35 ± 9		$16.37^{+0.44}_{-0.33}$	$16.64^{+0.44}_{-0.33}$
$^{137}_{56}Br_{81}$	0^+	6.950	1.13	$\left(3.8^{+2.8}_{-1.9}\right)\times10^3$		$13.72^{+1.03}_{-0.79}$	$14.04^{+1.03}_{-0.79}$
$^{138}_{56}Br_{82}$	$3/2^+$	8.540	1.67	460^{+250}_{-230}		$13.14^{+0.93}_{-0.57}$	$13.41^{+0.93}_{-0.56}$
$^{139}_{56}Br_{83}$	0^+	4.720	1.13	$(9.6\pm3.4)\times10^3$	f)	$17.59^{+0.93}_{-0.52}$	$18.11^{+0.93}_{-0.52}$
$^{139}_{57}La_{82}$	5^-	8.790	0.54	41 ± 6		$13.34^{+0.20}_{-0.16}$	$13.56^{+0.20}_{-0.16}$
$^{140}_{57}La_{83}$	$7/2^+$	4.998		110 ± 20		$18.34^{+0.37}_{-0.31}$	$18.66^{+0.37}_{-0.31}$
$^{141}_{58}Ce_{83}$	0^+	5.437	1.21	$(3.0\pm1.0)\times10^3$	l)	$17.93^{+0.80}_{-0.56}$	$18.37^{+0.80}_{-0.56}$
$^{143}_{58}Ce_{85}$	0^+	5.106	1.21	$(1.0\pm0.2)\times10^3$	l)	$21.47^{+0.50}_{-0.40}$	$21.95^{+0.50}_{-0.40}$
$^{142}_{59}Pr_{83}$	$5/2^+$	5.852		83.8 ± 12.1		$17.05^{+0.25}_{-0.22}$	$17.37^{+0.25}_{-0.22}$
$^{144}_{60}Nd_{84}$	$7/2^-$	7.830	2.03	19 ± 9		$19.38^{+1.15}_{-0.68}$	$19.70^{+1.14}_{-0.68}$
$^{146}_{60}Nd_{86}$	$7/2^-$	7.561	2.18	25 ± 9		$20.10^{+0.84}_{-0.57}$	$20.44^{+0.84}_{-0.57}$
$^{148}_{61}Pm_{87}$	$7/2^+$	5.917		5.7 ± 1.5	f)	$21.30^{+0.56}_{-0.42}$	$21.62^{+0.55}_{-0.42}$
$^{148}_{62}Sm_{86}$	$7/2^-$	8.142	1.90	7.9 ± 1.3		$19.87^{+0.31}_{-0.26}$	$20.16^{+0.31}_{-0.36}$
$^{150}_{62}Sm_{88}$	$7/2^-$	7.982	1.90	3.22 ± 0.53		$21.95^{+0.33}_{-0.28}$	$22.25^{+0.33}_{-0.28}$
$^{151}_{62}Sm_{89}$	0^+	5.609	1.15	24		$27.87^{+1.69}_{-1.63}$	$28.30^{+1.68}_{-1.64}$
$^{152}_{62}Sm_{90}$	$5/2^-, 7/2^-$	8.224	2.00	1.3 ± 0.5	f)	$23.67^{+0.92}_{-0.61}$	$23.97^{+0.92}_{-0.61}$
$^{153}_{62}Sm_{91}$	0^+	5.885	1.15	60 ± 20	e)	$24.62^{+0.89}_{-0.62}$	$25.02^{+0.89}_{-0.62}$
$^{152}_{63}Eu_{89}$	$5/2^+$	6.291		0.72 ± 0.14		$24.58^{+0.41}_{-0.34}$	$24.87^{+0.41}_{-0.34}$
$^{154}_{63}Eu_{91}$	$5/2^+$	6.385		1.3 ± 0.4		$23.24^{+0.68}_{-0.49}$	$23.53^{+0.68}_{-0.49}$
$^{156}_{64}Gd_{92}$	$3/2^-$	8.527	1.96	1.99 ± 0.32		$22.65^{+0.31}_{-0.27}$	$22.94^{+0.31}_{-0.27}$
$^{157}_{64}Gd_{93}$	0^+	6.348	0.99	75 ± 19		$22.05^{+0.57}_{-0.44}$	$22.40^{+0.57}_{-0.44}$
$^{158}_{64}Gd_{94}$	$3/2^-$	7.929	2.01	6.1 ± 1.6		$22.54^{+0.57}_{-0.43}$	$22.86^{+0.57}_{-0.43}$
$^{160}_{65}Tb_{95}$	$3/2^+$	6.400		4.30 ± 0.78		$21.85^{+0.36}_{-0.30}$	$22.14^{+0.36}_{-0.30}$
$^{162}_{66}Dy_{96}$	$5/2^+$	8.204	1.96	2.55 ± 0.38		$22.63^{+0.30}_{-0.25}$	$22.93^{+0.30}_{-0.25}$
$^{163}_{66}Dy_{97}$	0^+	6.253	0.91	42 ± 6	j)	$23.42^{+0.31}_{-0.27}$	$23.78^{+0.31}_{-0.27}$
$^{164}_{66}Dy_{98}$	$5/2^-$	7.657	1.97	9.6 ± 1.6		$21.88^{+0.35}_{-0.29}$	$22.21^{+0.35}_{-0.29}$
$^{166}_{67}Ho_{99}$	$7/2^-$	6.331		5.67 ± 0.74		$20.66^{+0.24}_{-0.21}$	$20.95^{+0.24}_{-0.21}$
$^{163}_{68}Er_{95}$	0^+	6.841	0.92	7.1 ± 1.2		$24.98^{+0.37}_{-0.31}$	$25.31^{+0.36}_{-0.31}$
$^{165}_{68}Er_{97}$	0^+	6.644	0.92	17 ± 5		$23.99^{+0.69}_{-0.50}$	$24.32^{+0.69}_{-0.50}$
$^{167}_{68}Er_{99}$	0^+	6.438	0.92	47 ± 7		$22.73^{+0.32}_{-0.27}$	$23.08^{+0.32}_{-0.27}$
$^{168}_{68}Er_{100}$	$7/2^+$	7.771	1.99	4.0 ± 0.4		$22.94^{+0.20}_{-0.18}$	$23.26^{+0.20}_{-0.19}$
$^{169}_{68}Er_{101}$	0^+	5.997	0.92	100 ± 30		$22.78^{+0.73}_{-0.53}$	$23.15^{+0.73}_{-0.53}$
$^{170}_{69}Tm_{101}$	$1/2^-$	6.386		6.6 ± 1.3		$22.58^{+0.40}_{-0.32}$	$22.88^{+0.40}_{-0.32}$
$^{169}_{70}Yb_{99}$	0^+	6.790	1.00	20		$23.57^{+1.36}_{-1.32}$	$23.90^{+1.36}_{-1.32}$

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)		a_{obs} (MeV^{-1}) Ericson	Lang-LeCouteur
$^{172}_{70}Yb_{102}$	$1/2^-$	8.140	2.06	7.2 ± 1.7		$23.38^{+0.51}_{-0.40}$	$23.69^{+0.51}_{-0.40}$
$^{174}_{70}Yb_{104}$	$5/2^-$	7.440	2.05	7.8 ± 1.0		$23.52^{+0.28}_{-0.24}$	$23.87^{+0.28}_{-0.24}$
$^{177}_{70}Yb_{107}$	0^+	5.530	1.00	250 ± 60		$23.13^{+0.60}_{-0.46}$	$23.55^{+0.60}_{-0.46}$
$^{176}_{71}Lu_{105}$	$7/2^+$	6.190		3.61 ± 0.62	f)	$22.09^{+0.34}_{-0.29}$	$22.39^{+0.34}_{-0.29}$
$^{177}_{71}Lu_{106}$	7^-	6.890	1.02	2.37 ± 0.27	f)	$23.31^{+0.24}_{-0.21}$	$23.60^{+0.24}_{-0.21}$
$^{177}_{72}Hf_{105}$	0^+	6.370	1.11	41 ± 12		$24.18^{+0.72}_{-0.52}$	$24.54^{+0.72}_{-0.52}$
$^{178}_{72}Hf_{106}$	$7/2^-$	7.620	2.13	3.2 ± 0.2		$24.62^{+0.13}_{-0.12}$	$24.96^{+0.13}_{-0.12}$
$^{179}_{72}Hf_{107}$	0^+	6.070	1.11	55 ± 8		$24.75^{+0.34}_{-0.29}$	$25.14^{+0.34}_{-0.29}$
$^{180}_{72}Hf_{108}$	$9/2^+$	7.330	2.08	5.8 ± 0.5		$24.03^{+0.19}_{-0.17}$	$24.37^{+0.19}_{-0.17}$
$^{181}_{72}Hf_{109}$	0^+	5.951	1.11	140 ± 30		$23.29^{+0.51}_{-0.41}$	$23.68^{+0.51}_{-0.41}$
$^{181}_{73}Ta_{108}$	8^+	7.640	0.97	1.5	k)	$21.82^{+1.25}_{-1.21}$	$22.08^{+1.24}_{-1.22}$
$^{182}_{73}Ta_{109}$	$7/2^+$	6.059		4.33 ± 0.51		$22.28^{+0.23}_{-0.21}$	$22.58^{+0.23}_{-0.21}$
$^{183}_{74}W_{109}$	0^+	6.187	1.23	56 ± 8		$24.85^{+0.33}_{-0.29}$	$25.23^{+0.33}_{-0.29}$
$^{184}_{74}W_{110}$	$1/2^-$	7.419	2.14	15.8 ± 2.0		$24.86^{+0.28}_{-0.25}$	$25.22^{+0.28}_{-0.25}$
$^{185}_{74}W_{111}$	0^+	5.748	1.23	93 ± 19		$25.61^{+0.53}_{-0.42}$	$26.03^{+0.53}_{-0.42}$
$^{187}_{74}W_{113}$	0^+	5.460	1.23	87 ± 10		$27.19^{+0.30}_{-0.27}$	$27.63^{+0.30}_{-0.27}$
$^{186}_{75}Re_{111}$	$5/2^+$	6.243		3.2 ± 0.6		$22.82^{+0.38}_{-0.32}$	$23.12^{+0.38}_{-0.32}$
$^{188}_{75}Re_{113}$	$5/2^+$	5.725		6.4 ± 1.9		$23.16^{+0.69}_{-0.50}$	$23.48^{+0.69}_{-0.50}$
$^{188}_{76}Os_{112}$	$1/2^-$	7.839	1.68	14 ± 6		$22.32^{+1.03}_{-0.65}$	$22.63^{+1.03}_{-0.65}$
$^{190}_{76}Os_{114}$	$3/2^-$	7.760	1.59	5.0 ± 1.1		$22.99^{+0.46}_{-0.37}$	$23.30^{+0.46}_{-0.37}$
$^{192}_{77}Ir_{115}$	$3/2^+$	6.150		3.2 ± 0.7		$23.94^{+0.47}_{-0.38}$	$24.25^{+0.47}_{-0.38}$
$^{194}_{77}Ir_{117}$	$3/2^+$	6.103		8.5 ± 1.3		$22.30^{+0.31}_{-0.26}$	$22.61^{+0.31}_{-0.26}$
$^{196}_{78}Pt_{118}$	$1/2^-$	7.929	1.59	19.3 ± 3.6		$21.43^{+0.37}_{-0.30}$	$21.73^{+0.37}_{-0.30}$
$^{198}_{79}Au_{119}$	$3/2^+$	6.497		15.8 ± 2.3		$20.24^{+0.27}_{-0.23}$	$20.53^{+0.27}_{-0.23}$
$^{199}_{80}Hg_{119}$	0^+	6.653	0.72	100 ± 30		$20.90^{+0.65}_{-0.47}$	$21.22^{+0.65}_{-0.47}$
$^{200}_{80}Hg_{120}$	$1/2^-$	8.026	1.33	84 ± 18		$18.20^{+0.38}_{-9.31}$	$18.48^{+0.38}_{-0.31}$
$^{201}_{80}Hg_{121}$	0^+	6.227	0.72	$(1.3\pm0.1)\times10^3$		$17.56^{+0.14}_{-0.13}$	$17.90^{+0.14}_{-0.13}$
$^{202}_{80}Hg_{122}$	$3/2^-$	7.760	1.62	110 ± 20		$17.94^{+0.33}_{-0.27}$	$18.25^{+0.33}_{-0.27}$
$^{204}_{81}Tl_{123}$	$1/2^+$	6.663		$(2.2\pm0.3)\times10^3$		$13.54^{+0.20}_{-0.17}$	$13.83^{+0.20}_{-0.18}$
$^{206}_{81}Tl_{125}$	$1/2^+$	6.524		$(19\pm7)\times10^3$		$10.98^{+0.57}_{-0.38}$	$11.27^{+0.57}_{-0.38}$
$^{207}_{82}Pb_{125}$	0^+	6.735	0.80	$(24\pm4)\times10^3$		$12.39^{+0.25}_{-0.21}$	$12.70^{+0.25}_{-0.21}$
$^{208}_{82}Pb_{126}$	$1/2^-$	7.375	1.61	$(22\pm7)\times10^3$		$11.84^{+0.52}_{-0.37}$	$12.16^{+0.52}_{-0.37}$
$^{209}_{82}Pb_{127}$†	0^+	4.37*	0.80	$(110\pm40)\times10^3$		$12.82^{+0.81}_{-0.54}$	$13.33^{+0.81}_{-0.54}$
$^{210}_{83}Bi_{127}$	$9/2^-$	4.599		$(5.42\pm0.62)\times10^3$		$13.81^{+0.20}_{-0.18}$	$14.20^{+0.21}_{-0.17}$
$^{233}_{90}Th_{143}$	0^+	4.956	0.80	12.4 ± 1.1		$34.06^{+0.26}_{-0.23}$	$34.52^{+0.26}_{-0.23}$
$^{232}_{91}Pa_{141}$	$3/2^-$	5.524		0.443 ± 0.065		$31.45^{+0.37}_{-0.31}$	$31.80^{+0.37}_{-0.31}$
$^{234}_{91}Pa_{143}$	$3/2^-$	5.122		1.03 ± 0.15		$31.46^{+0.38}_{-0.32}$	$31.83^{+0.38}_{-0.32}$

Compound Nucleus	Target Spin	a) B_n (MeV)	c) $\|\Delta\|$ (MeV)	d) D_0 (eV)	a_{obs} (MeV^{-1}) Ericson	Lang-LeCouteur
$^{233}_{92}U_{141}$	0^+	5.879	0.81	14.2 ± 3.6	$28.74^{+0.68}_{-0.51}$	$29.12^{+0.68}_{-0.51}$
$^{234}_{92}U_{142}$	$5/2^+$	6.784	1.45	0.993 ± 0.077	$29.67^{+0.18}_{-0.17}$	$30.02^{+0.18}_{-0.17}$
$^{235}_{92}U_{143}$	0^+	5.267	0.81	18.0 ± 7.3	$31.31^{+1.34}_{-0.86}$	$31.74^{+1.34}_{-0.86}$
$^{236}_{92}U_{144}$	$7/2^-$	6.467	1.39	0.67 ± 0.13	$31.29^{+0.52}_{-0.42}$	$31.66^{+0.52}_{-0.42}$
$^{237}_{92}U_{145}$	0^+	5.304	0.81	27 ± 9	$30.14^{+1.02}_{-0.71}$	$30.57^{+1.01}_{-0.71}$
$^{239}_{92}U_{147}$	0^+	4.784	0.81	18.1 ± 2.3	$34.41^{+0.38}_{-0.34}$	$34.89^{+0.38}_{-0.34}$
$^{238}_{93}Np_{145}$	$5/2^+$	5.426		0.720 ± 0.079	$30.08^{+0.26}_{-0.24}$	$30.43^{+0.26}_{-0.24}$
$^{239}_{94}Pu_{145}$	0^+	5.616	0.69	16 ± 5	$29.28^{+0.88}_{-0.63}$	$29.67^{+0.88}_{-0.63}$
$^{240}_{94}Pu_{146}$	$1/2^+$	6.466	1.24	2.3 ± 0.6	$30.80^{+0.71}_{-0.54}$	$31.16^{+0.71}_{-0.54}$
$^{241}_{94}Pu_{147}$	0^+	5.413	0.69	14 ± 2	$30.66^{+0.38}_{-0.33}$	$31.06^{+0.38}_{-0.33}$
$^{242}_{94}Pu_{148}$	$5/2^+$	6.219	1.26	1.17 ± 0.17	$31.28^{+0.38}_{-0.33}$	$31.66^{+0.38}_{-0.33}$
$^{242}_{95}Am_{147}$	$5/2^-$	5.475		0.578 ± 0.093	$30.44^{+0.40}_{-0.34}$	$30.79^{+0.40}_{-0.34}$
$^{244}_{95}Am_{149}$	$5/2^-$	5.288		1.5 ± 0.3	$29.17^{+0.51}_{-0.41}$	$29.53^{+0.51}_{-0.41}$
$^{244}_{96}Cm_{148}$	$5/2^+$	6.720	1.27	20^{+6}_{-18}	$23.06^{+4.78}_{-0.51}$	$23.40^{+4.78}_{-0.51}$

a) Mattauch *et al.*[26] (1965), unless otherwise superscripted with b.

b) Wapstra[25] (1960)

c) Cameron[4] (1958)

d) Computed from Ref. II[19], unless otherwise superscripted with alphabetical characters.

e) An average among a few values.

f) Computed from Ref. I[18]

g) Newton[1] (1956)

h) Bilpuch *et al.*[9] (1961)

i) Bowman *et al.*[11] (1962)

j) Gilbert and Cameron[16] (1965)

k) Stolovy *et al.*[2] (1957)

l) Newson *et al.*[8] (1961)

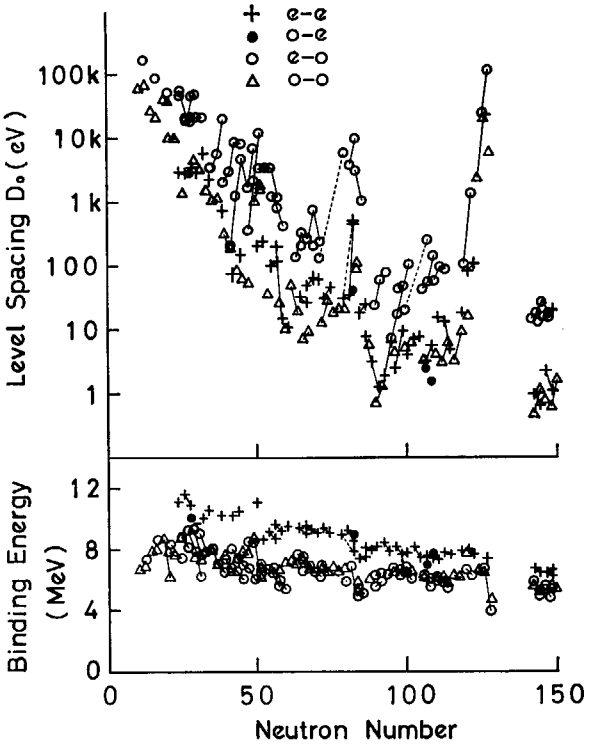


Fig. 1 Systematic behavior of the average level spacing versus neutron number and the neutron binding energy ; + for even-even, • for odd-even, ◦ for even-odd, and △ for odd-odd compound nuclei.

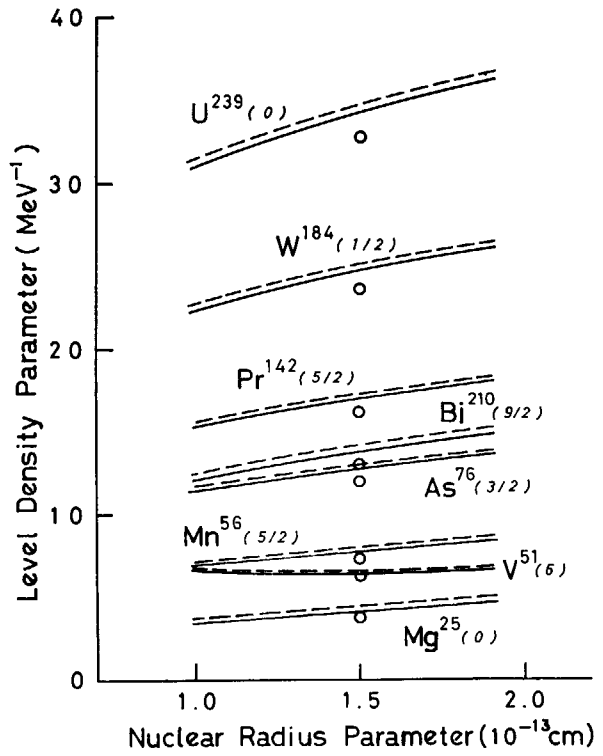


Fig. 2 Behavior of the level density parameter for several compound nuclei as the nuclear radius parameter r_0 changes. The solid line represents the level density parameter deduced with Ericson's level density formula and the rigid-body moment of inertia $\mathcal{I}_{rigid}$ and the broken line is for that obtained with Lang-Le Couteur level density and $\mathcal{I}_{rigid}$. Open circles give those obtained with Ericson's formula and a spin cut-off parameter computed with 0.7 $\mathcal{I}_{rigid}$.

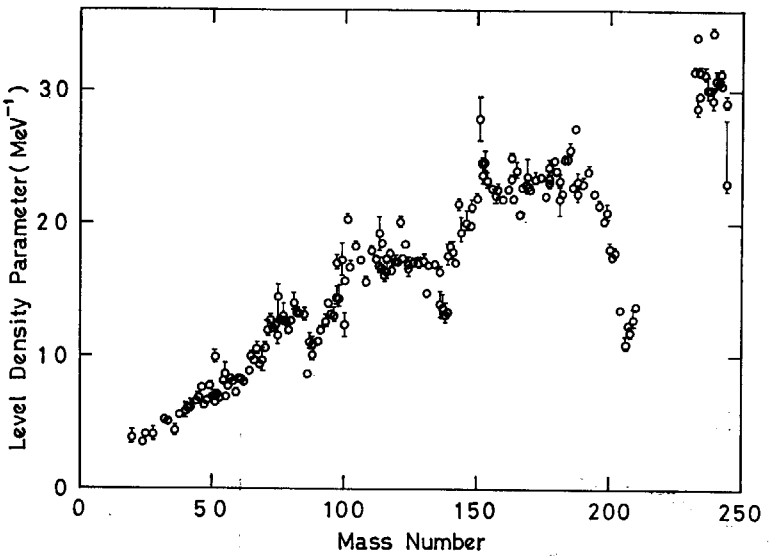


Fig. 3 Level density parameter plotted versus mass number A. Ericson's level density formula was used with rigid-body moment of inertia and $r_0 = 1.5$ fermis.

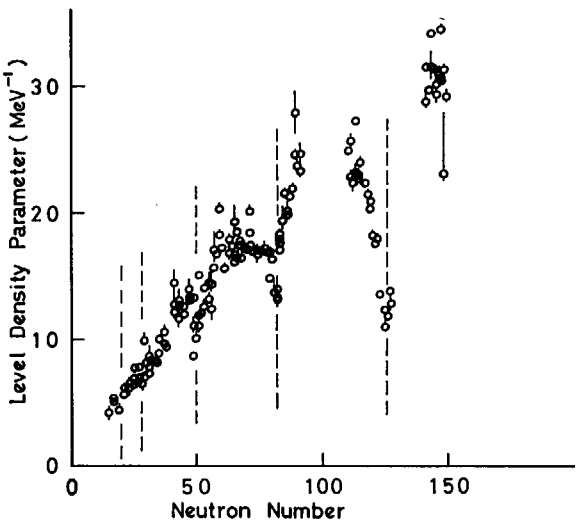
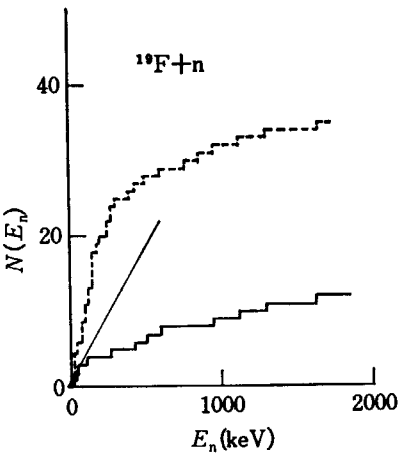
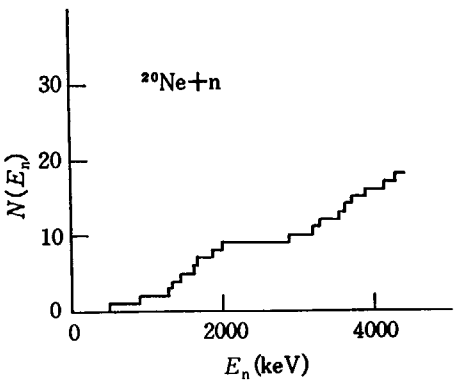


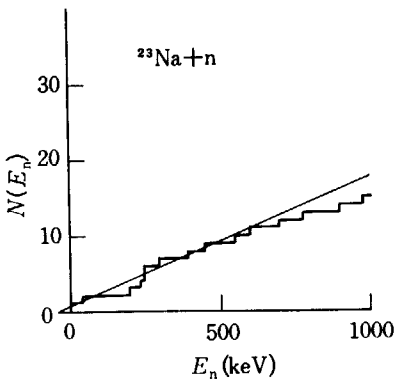
Fig. 4 Level density parameter versus neutron number. Broken lines show the position of the Magic Number.

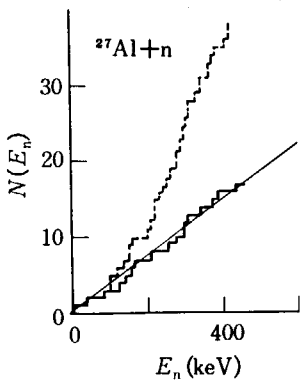
Appendix

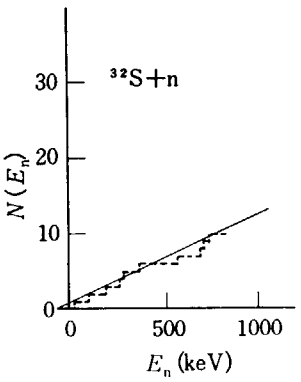
The total number of levels excited with slow weutrons is plotted varsus the neutron egergy. A solid line represents the total number of levels when only those belonging to class A are counted, and a dotted one gives that when levels of class B and sometimes even of class C are included.

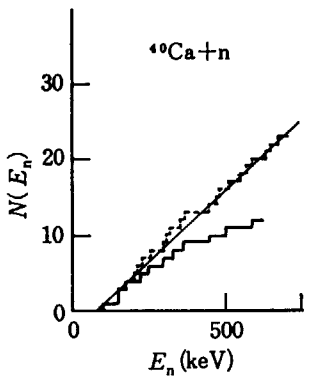


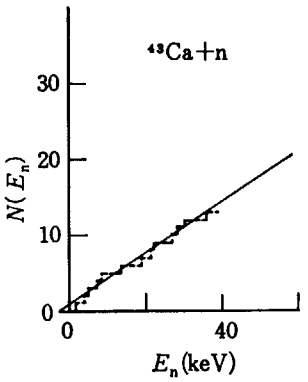


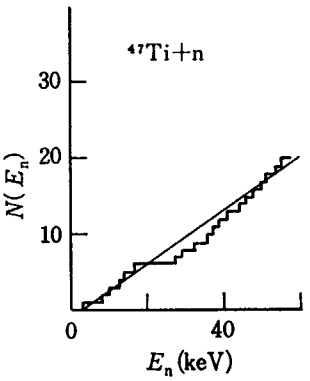


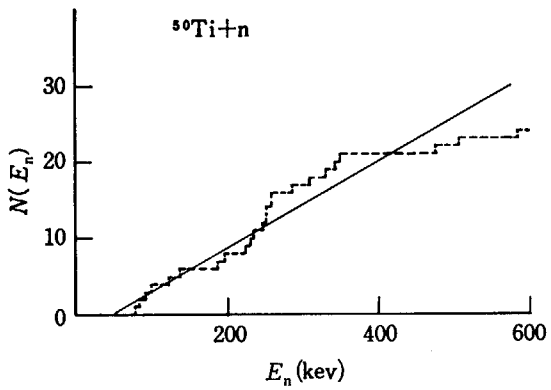


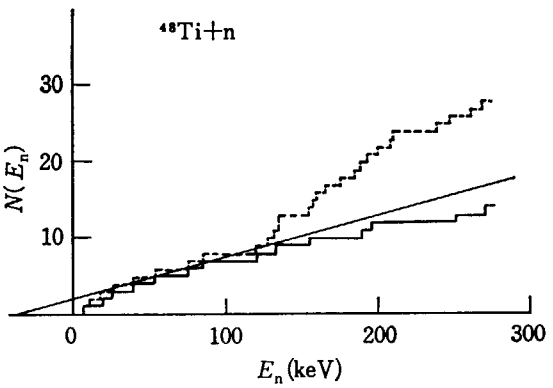


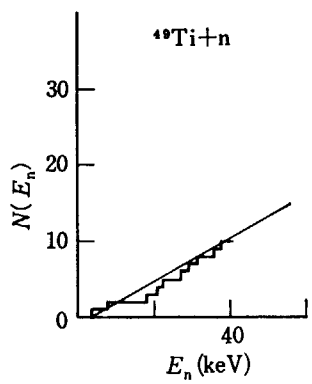

^{40}Ca+n
$N(E_n)$
E_n(keV)

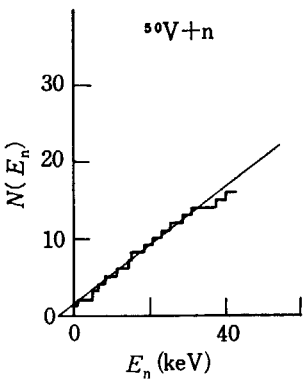

^{43}Ca+n
$N(E_n)$
E_n(keV)

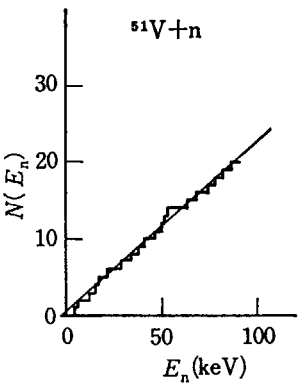

^{47}Ti+n
$N(E_n)$
E_n(keV)

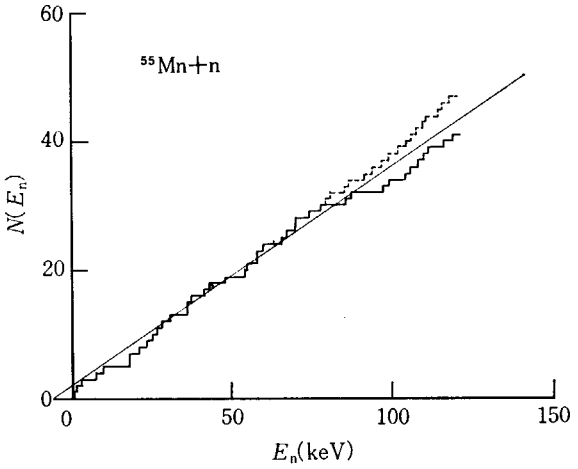

^{50}Ti+n
$N(E_n)$
E_n(kev)

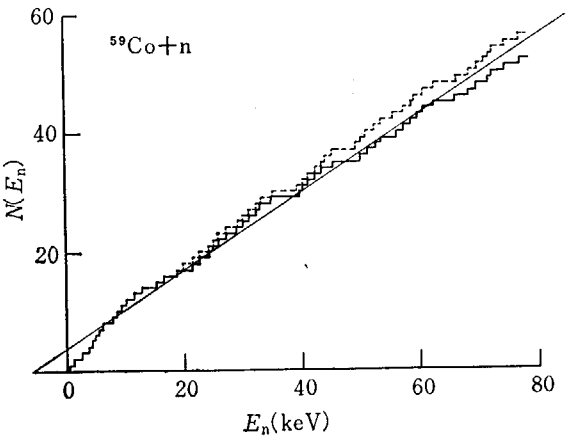

^{48}Ti+n
$N(E_n)$
E_n(keV)

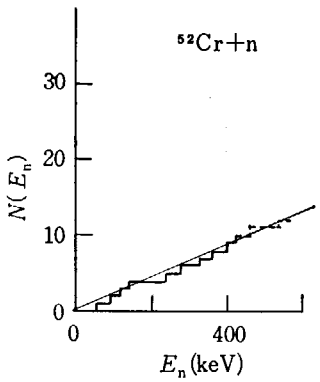

^{49}Ti+n
$N(E_n)$
E_n(keV)

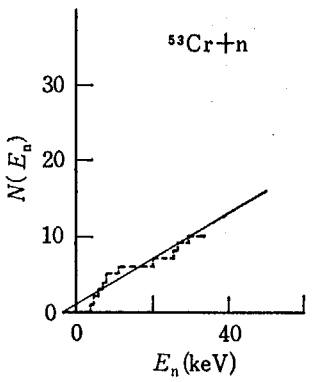

^{50}V+n
$N(E_n)$
E_n(keV)

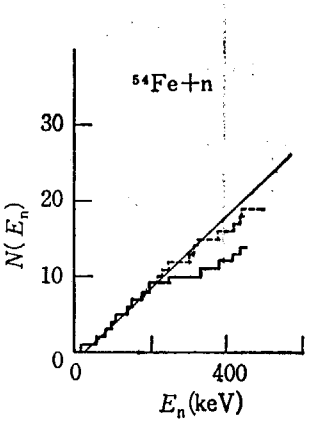

^{51}V+n
$N(E_n)$
E_n(keV)

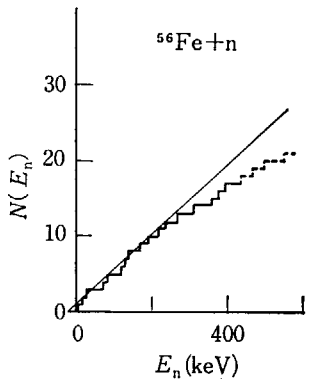

60
40
20
0
^{55}Mn+n
$N(E_n)$
0
50
100
150
E_n(keV)

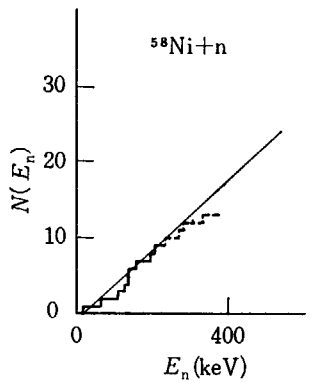

60
40
20
^{59}Co+n
$N(E_n)$
0
20
40
60
80
E_n(keV)

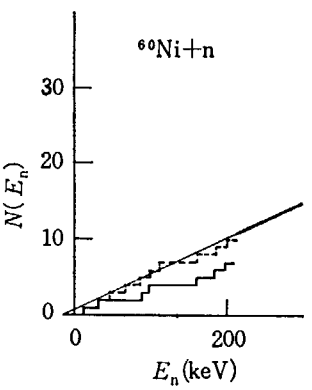

^{52}Cr+n
$N(E_n)$
30
20
10
0
0
400
E_n(keV)

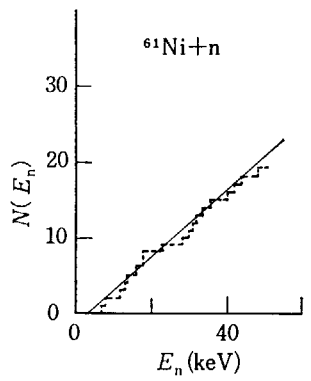

^{53}Cr+n
$N(E_n)$
30
20
10
0
0
40
E_n(keV)

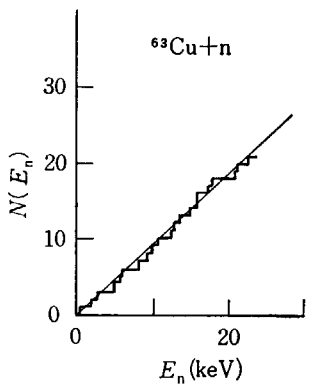

^{54}Fe+n
$N(E_n)$
30
20
10
0
0
400
E_n(keV)

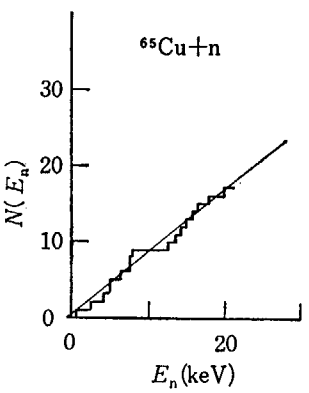

^{56}Fe+n
$N(E_n)$
30
20
10
0
0
400
E_n(keV)

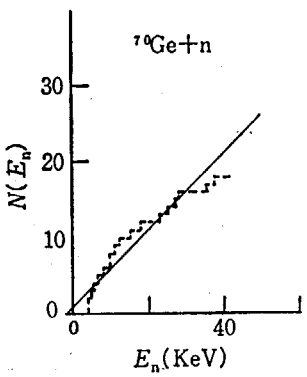

^{58}Ni+n
$N(E_n)$
30
20
10
0
0
400
E_n(keV)

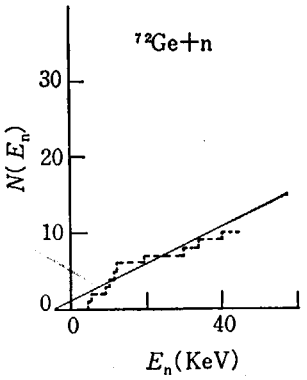

^{60}Ni+n
$N(E_n)$
30
20
10
0
0
200
E_n(keV)

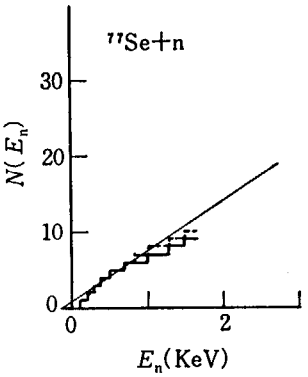

^{61}Ni+n
$N(E_n)$
30
20
10
0
0
40
E_n(keV)

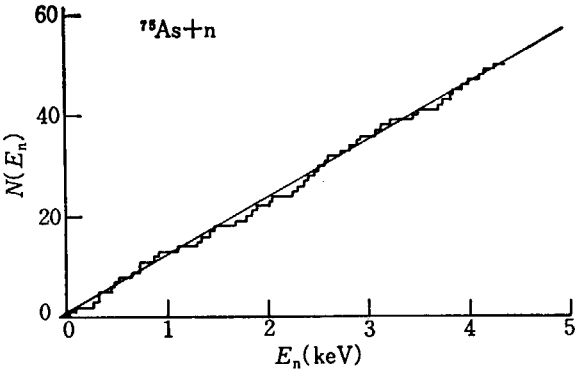

^{63}Cu+n
$N(E_n)$
30
20
10
0
0
20
E_n(keV)

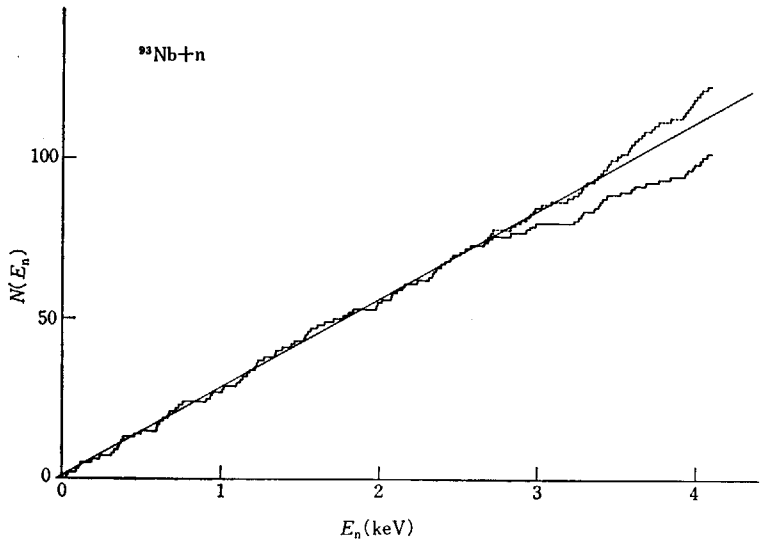

^{65}Cu+n
$N(E_n)$
30
20
10
0
0
20
E_n(keV)

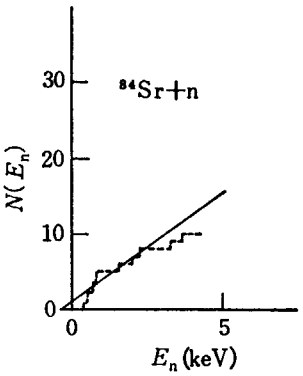

^{70}Ge+n
30
20
10
0
$N(E_n)$
0
40
E_n(KeV)

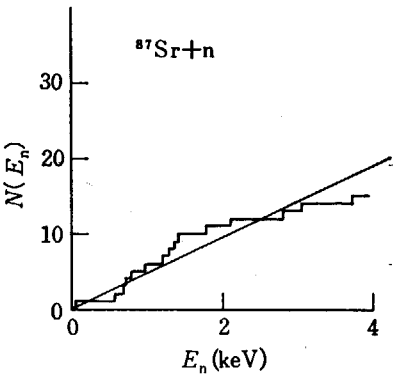

^{72}Ge+n
30
20
10
0
$N(E_n)$
0
40
E_n(KeV)

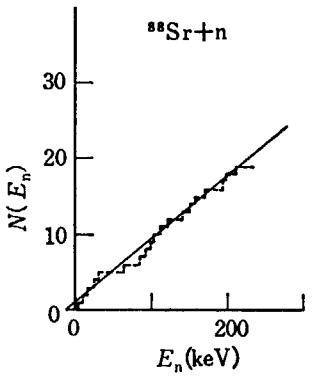

^{77}Se+n
30
20
10
0
$N(E_n)$
0
2
E_n(KeV)

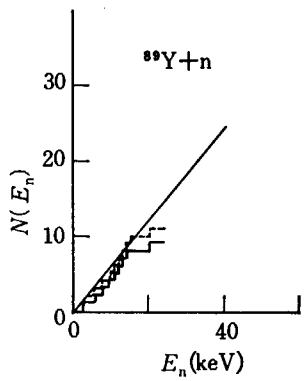

^{75}As+n
60
40
20
0
$N(E_n)$
0
1
2
3
4
5
E_n(keV)

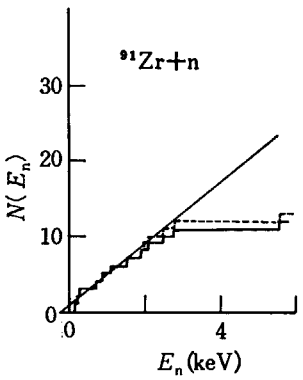

^{93}Nb+n
100
50
0
$N(E_n)$
0
1
2
3
4
E_n(keV)

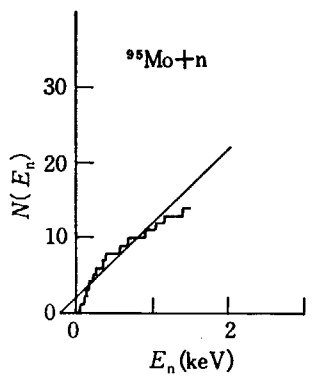

^{84}Sr+n
$N(E_n)$
E_n(keV)

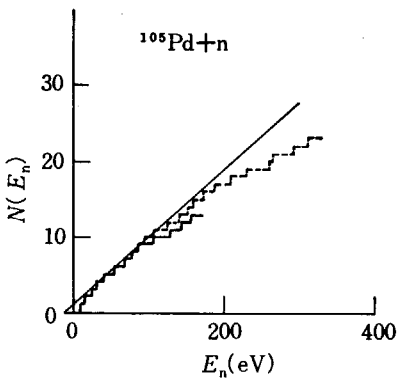

^{87}Sr+n
$N(E_n)$
E_n(keV)

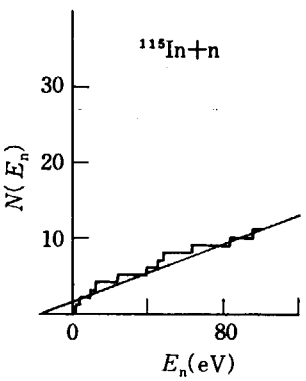

^{88}Sr+n
$N(E_n)$
E_n(keV)

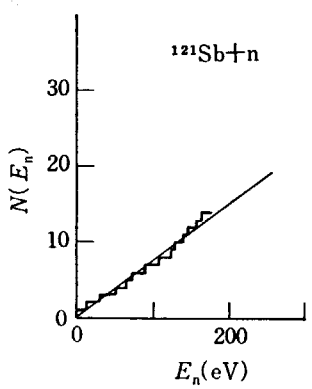

^{89}Y+n
$N(E_n)$
E_n(keV)

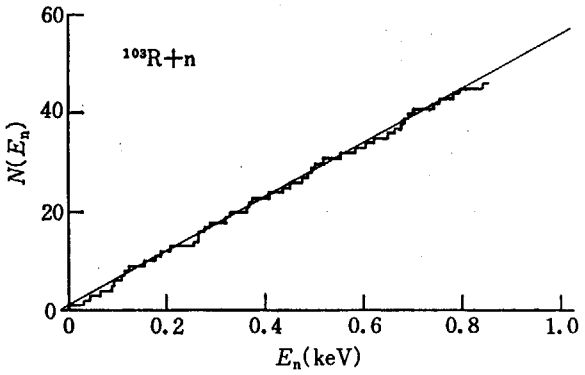

^{91}Zr+n
$N(E_n)$
E_n(keV)

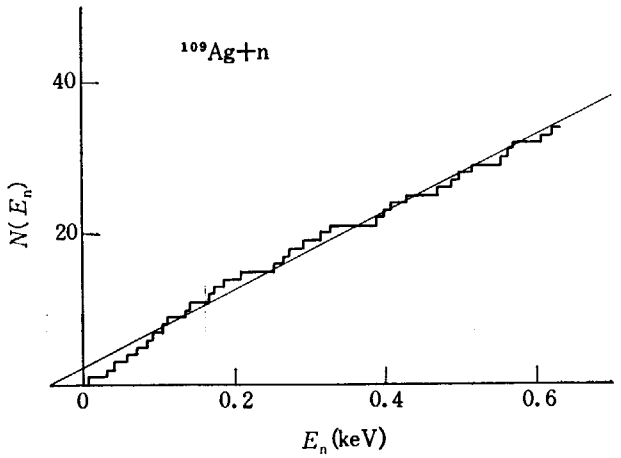

^{95}Mo+n
$N(E_n)$
E_n(keV)

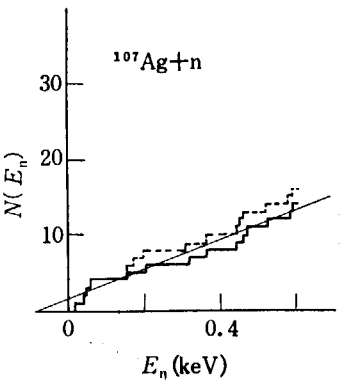

^{105}Pd+n
$N(E_n)$
E_n(eV)

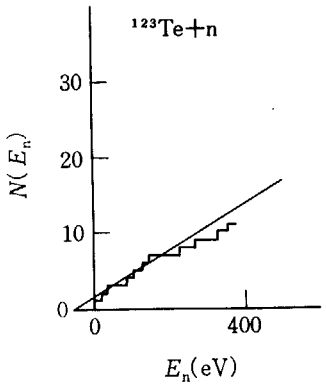

^{115}In+n
$N(E_n)$
E_n(eV)

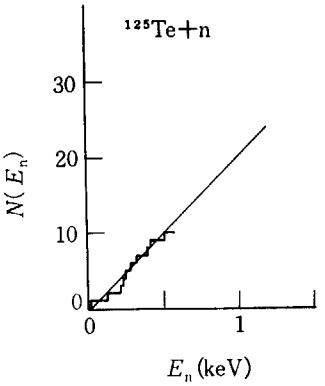

^{121}Sb+n
$N(E_n)$
E_n(eV)

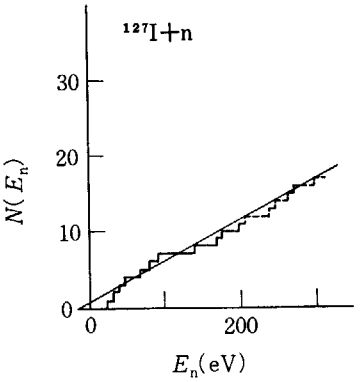

103R+n
60
40
20
0
N(En)
0
0.2
0.4
0.6
0.8
1.0
En(keV)

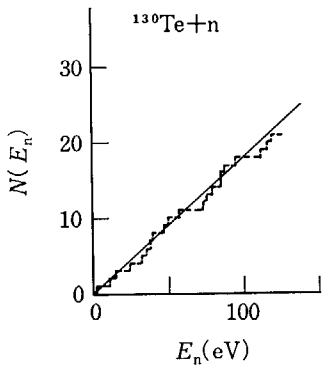

109Ag+n
40
20
N(En)
0
0.2
0.4
0.6
En(keV)

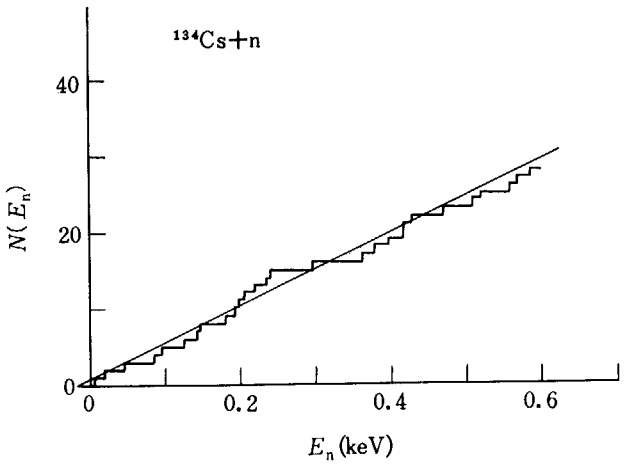

107Ag+n
30
20
10
N(En)
0
0.4
En(keV)

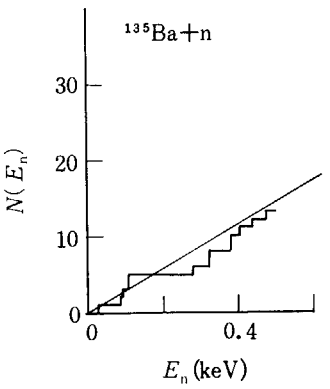

^{123}Te+n
$N(E_n)$
30
20
10
0
0
400
E_n(eV)

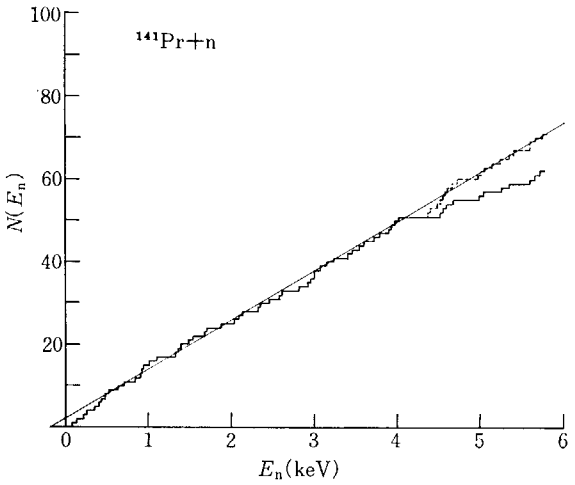

^{125}Te+n
$N(E_n)$
30
20
10
0
0
1
E_n(keV)

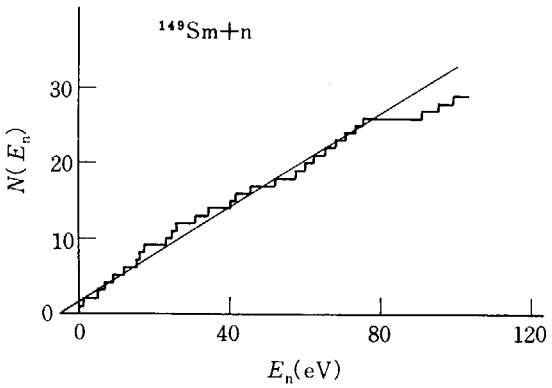

^{127}I+n
$N(E_n)$
30
20
10
0
0
200
E_n(eV)

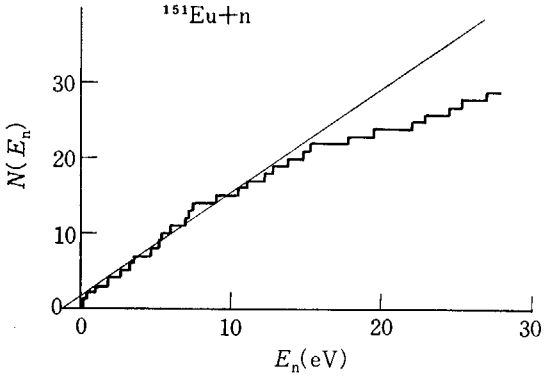

^{130}Te+n
$N(E_n)$
30
20
10
0
0
100
E_n(eV)

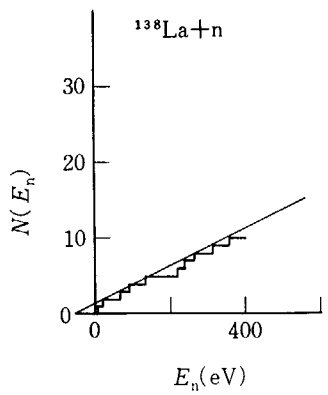

^{134}Cs+n
$N(E_n)$
40
20
0
0
0.2
0.4
0.6
E_n(keV)

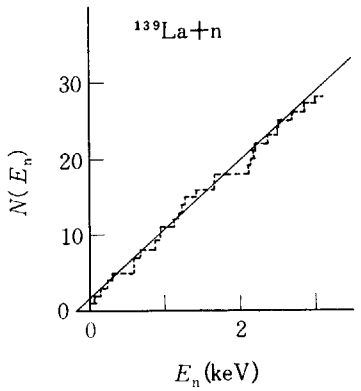

^{135}Ba+n
$N(E_n)$
30
20
10
0
0
0.4
E_n(keV)

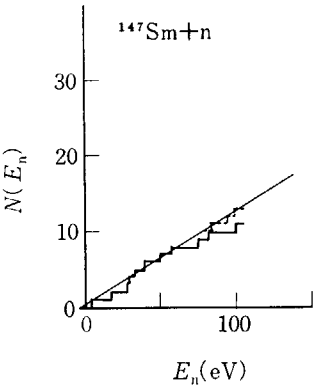

^{141}Pr+n
$N(E_n)$
E_n(keV)

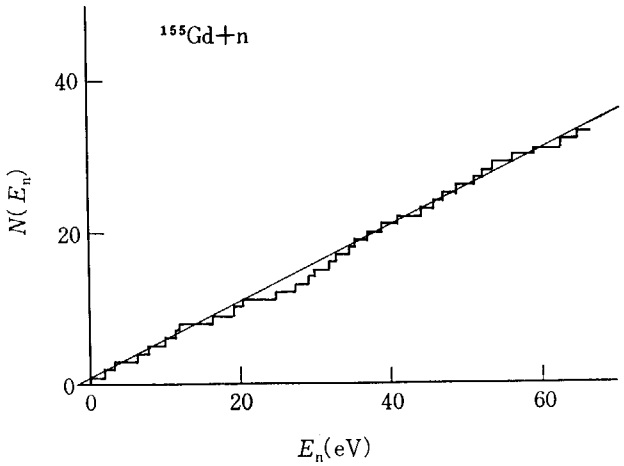

^{149}Sm+n
$N(E_n)$
E_n(eV)

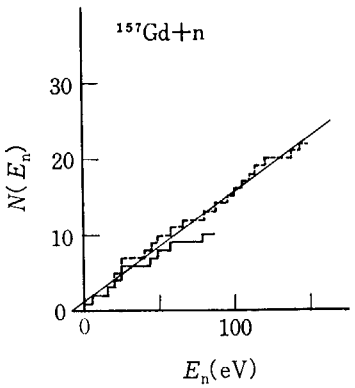

^{151}Eu+n
$N(E_n)$
E_n(eV)

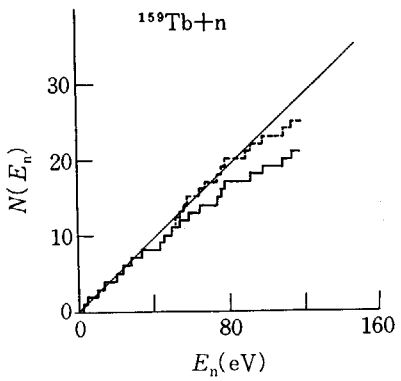

^{138}La+n
$N(E_n)$
E_n(eV)

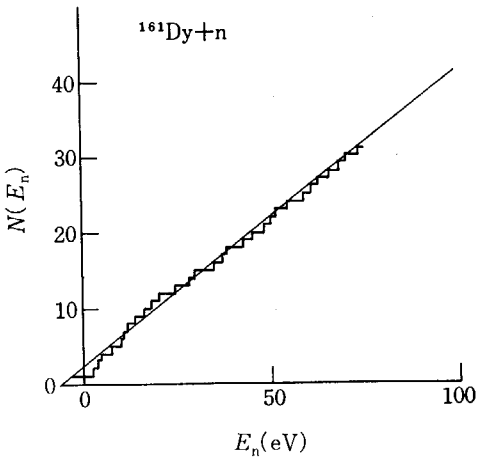

^{139}La+n
$N(E_n)$
E_n(keV)

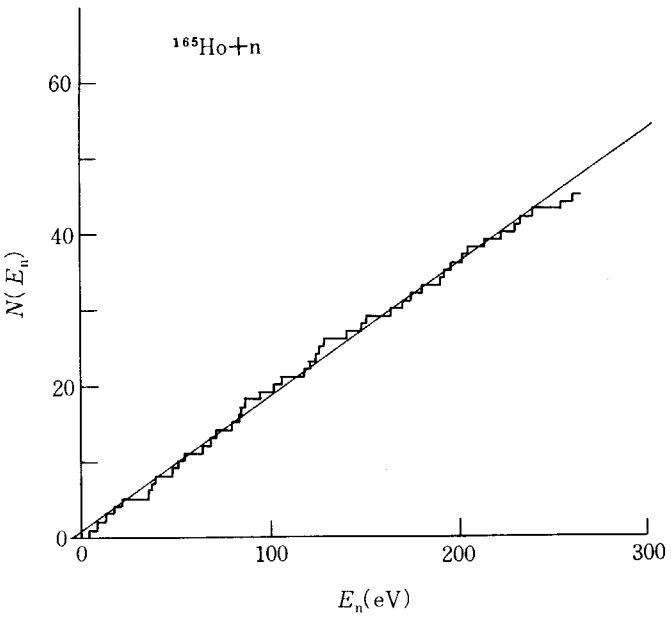

^{147}Sm+n
$N(E_n)$
E_n(eV)

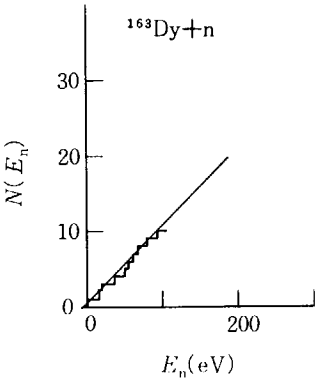

155Gd+n
N(En)
En(eV)
0
20
40
60

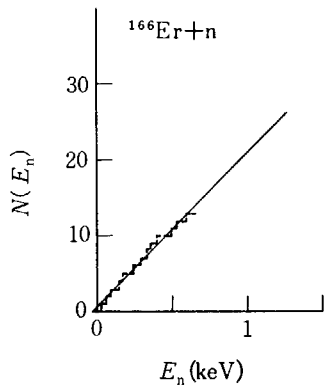

157Gd+n
N(En)
En(eV)
0
10
20
30
100

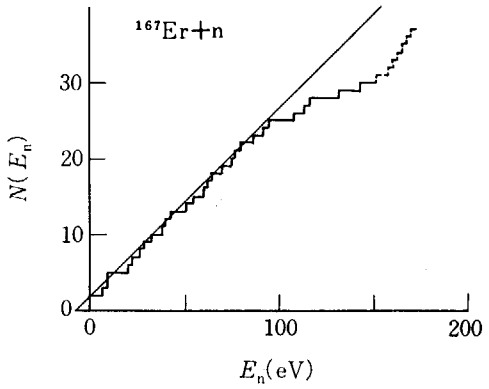

159Tb+n
N(En)
En(eV)
0
10
20
30
80
160

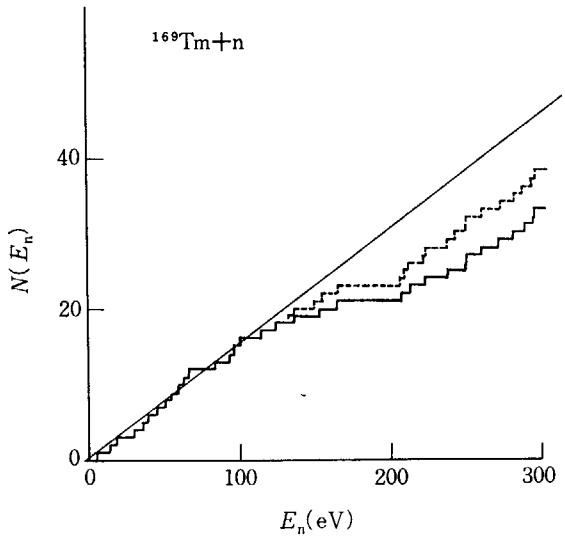

161Dy+n
N(En)
En(eV)
0
10
20
30
40
50
100

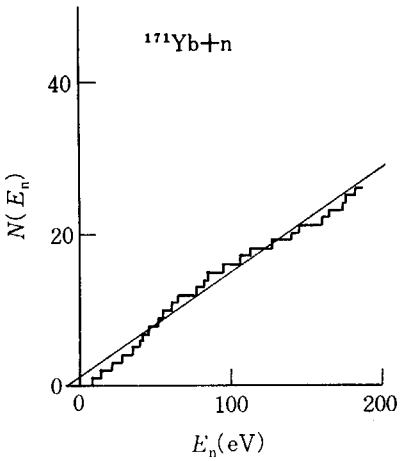

165Ho+n
N(En)
En(eV)
0
20
40
60
100
200
300

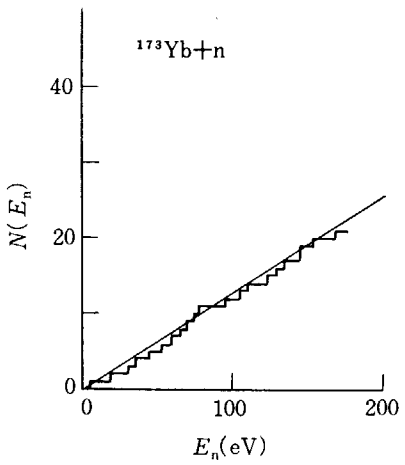

163Dy+n
N(En)
En(eV)
0
10
20
30
200

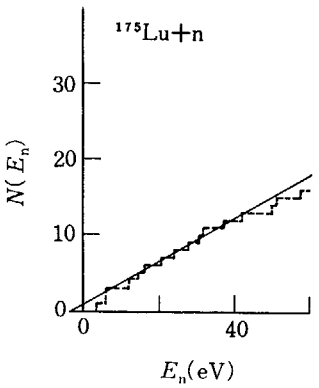

166Er+n
N(En)
30
20
10
0
0
1
En(keV)

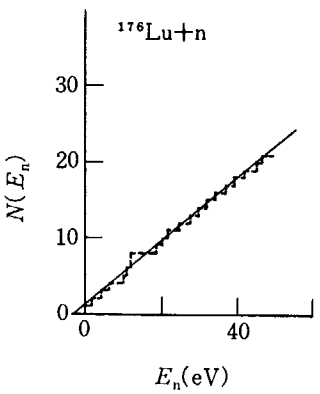

167Er+n
N(En)
30
20
10
0
0
100
200
En(eV)

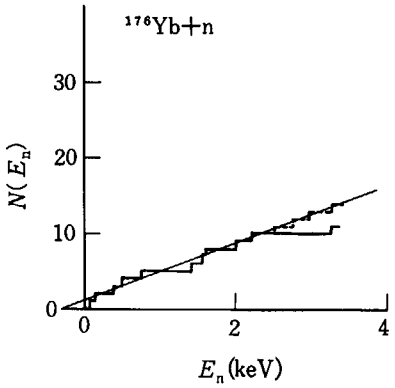

169Tm+n
N(En)
40
20
0
0
100
200
300
En(eV)

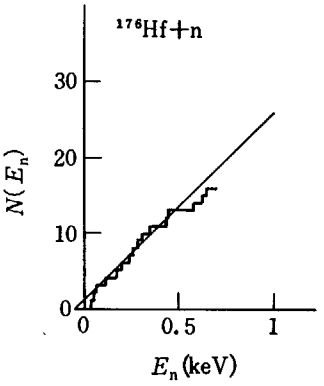

171Yb+n
N(En)
40
20
0
0
100
200
En(eV)

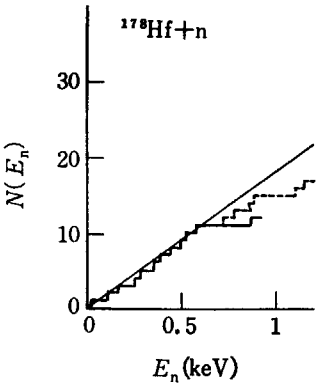

173Yb+n
N(En)
40
20
0
0
100
200
En(eV)

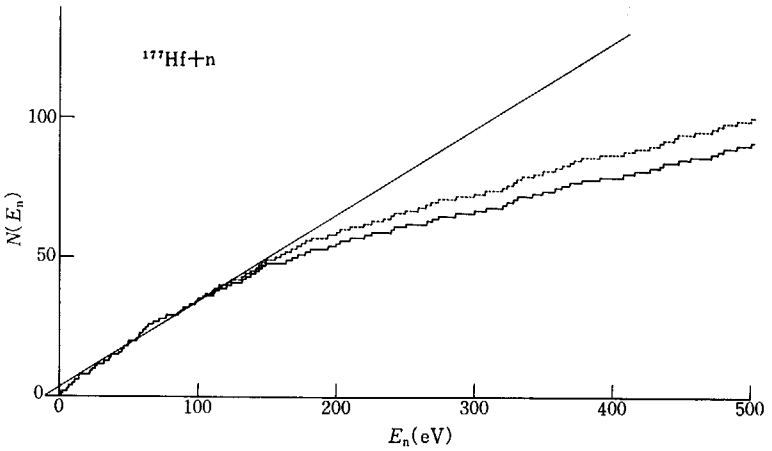

175Lu+n
N(En)
30
20
10
0
0
40
En(eV)

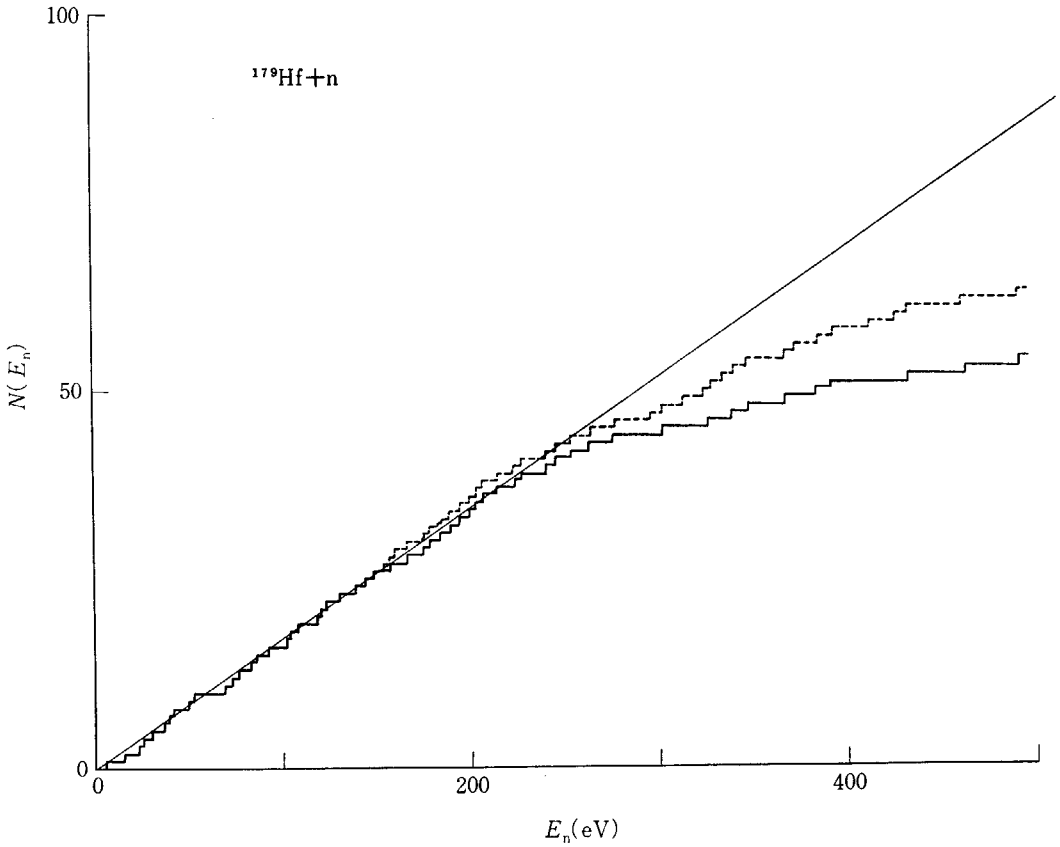

176Lu+n
N(En)
30
20
10
0
0
40
En(eV)

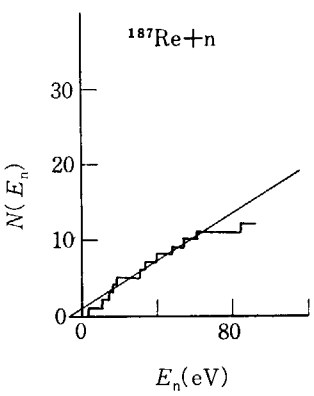

^{176}Yb+n
$N(E_n)$
30
20
10
0
0
2
4
E_n(keV)

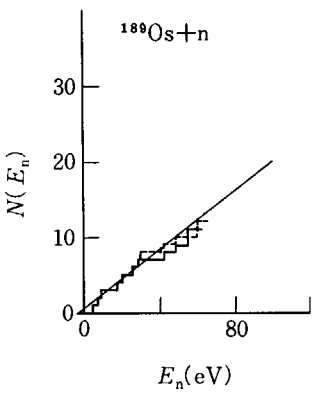

^{176}Hf+n
$N(E_n)$
30
20
10
0
0
0.5
1
E_n(keV)

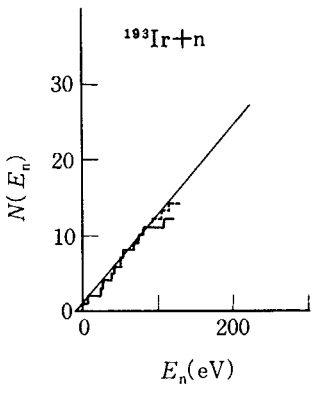

^{178}Hf+n
$N(E_n)$
30
20
10
0
0
0.5
1
E_n(keV)

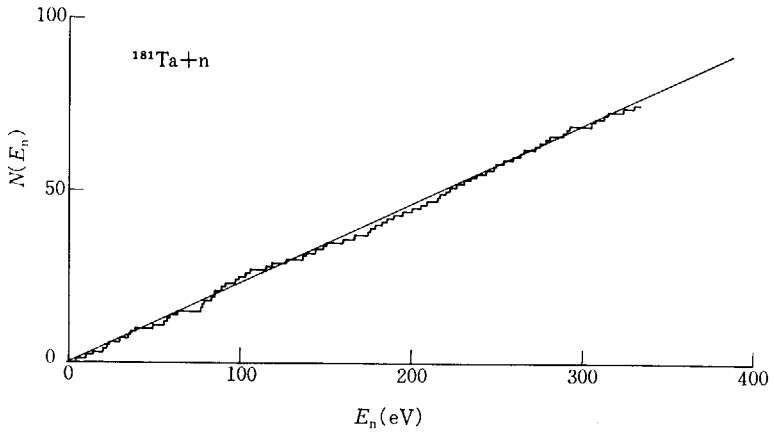

^{177}Hf+n
$N(E_n)$
100
50
0
0
100
200
300
400
500
E_n(eV)

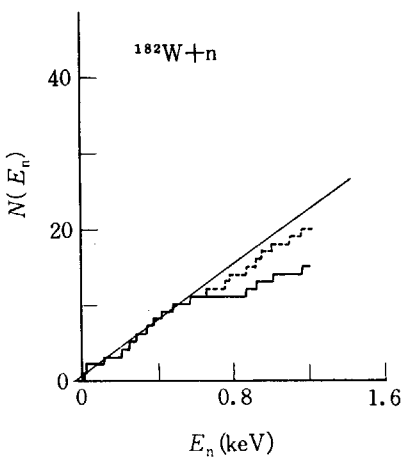

^{179}Hf+n
100
50
0
$N(E_n)$
0
200
400
E_n(eV)

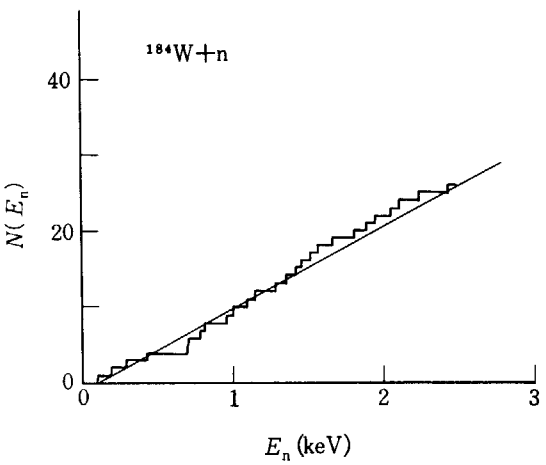

^{187}Re+n
30
20
10
0
$N(E_n)$
0
80
E_n(eV)

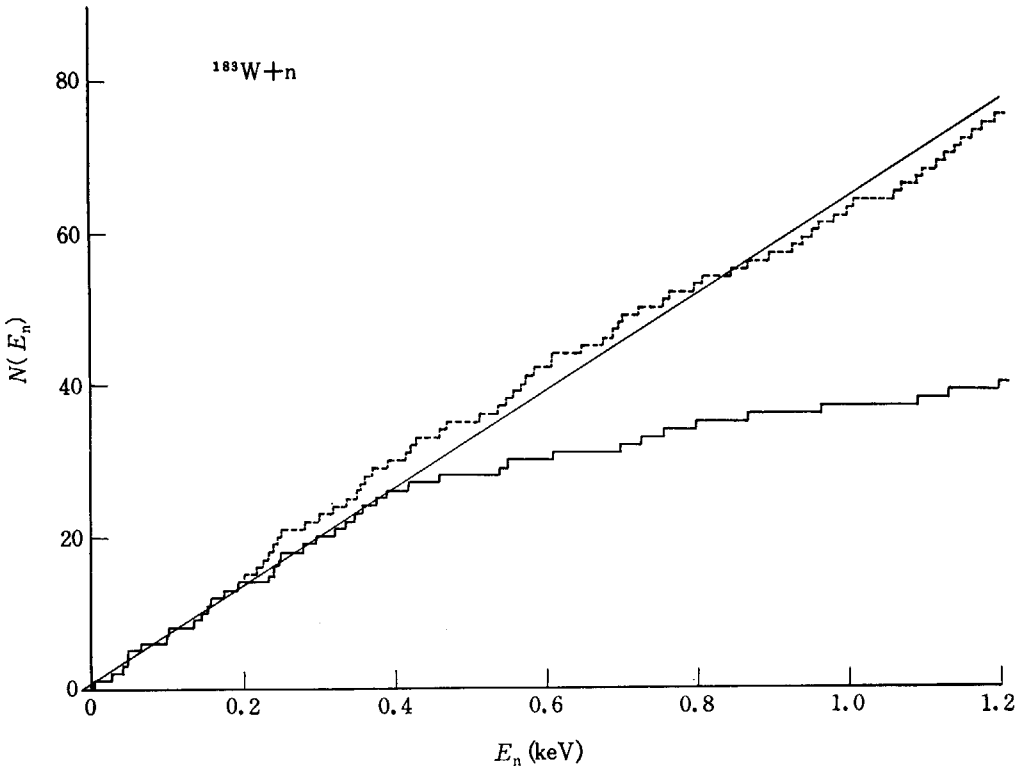

^{189}Os+n
30
20
10
0
$N(E_n)$
0
80
E_n(eV)

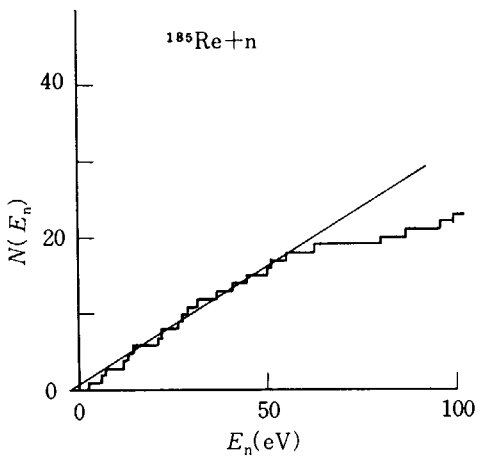

^{193}Ir+n
30
20
10
0
$N(E_n)$
0
200
E_n(eV)

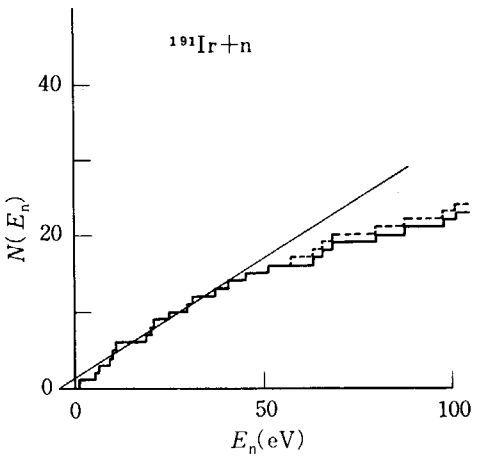

100
50
0
^{181}Ta+n
$N(E_n)$
0
100
200
300
400
E_n(eV)

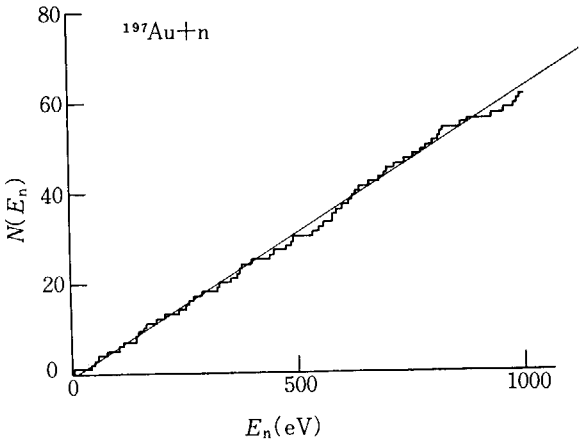

40
20
0
^{182}W+n
$N(E_n)$
0
0.8
1.6
E_n (keV)

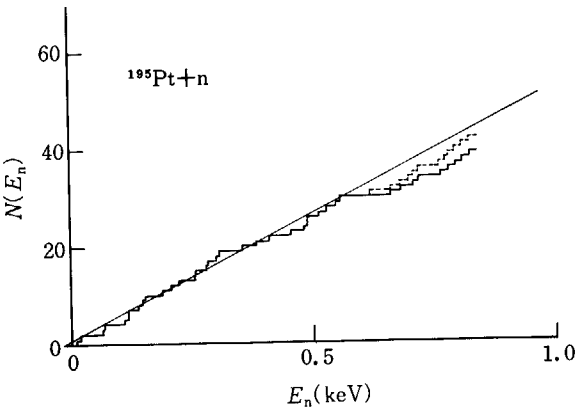

40
20
0
^{184}W+n
$N(E_n)$
0
1
2
3
E_n (keV)

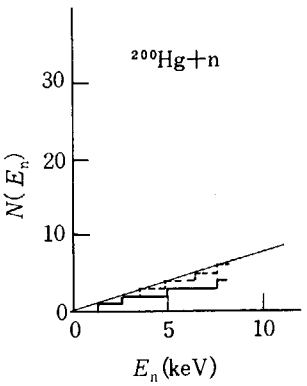

183W+n
80
60
40
20
0
N(En)
0
0.2
0.4
0.6
0.8
1.0
1.2
En (keV)

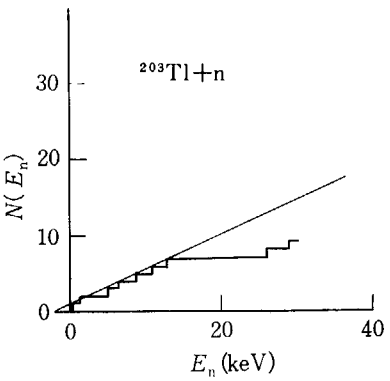

185Re+n
40
20
0
N(En)
0
50
100
En(eV)

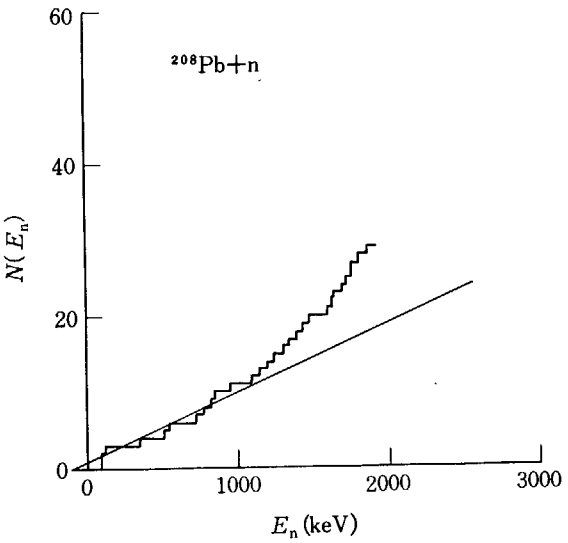

191Ir+n
40
20
0
N(En)
0
50
100
En(eV)

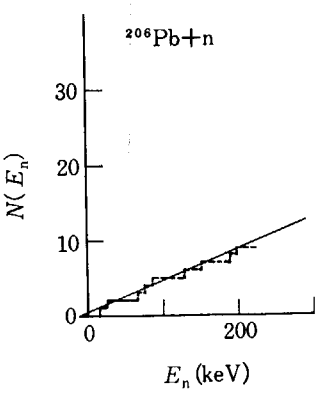

^{197}Au+n
$N(E_n)$
E_n(eV)
0
20
40
60
80
500
1000

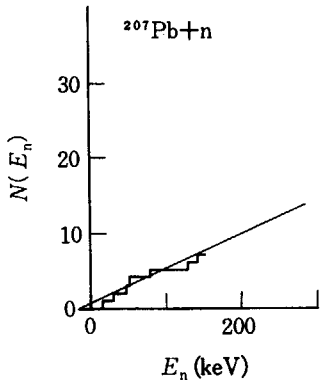

^{195}Pt+n
$N(E_n)$
E_n(keV)
0
20
40
60
0.5
1.0

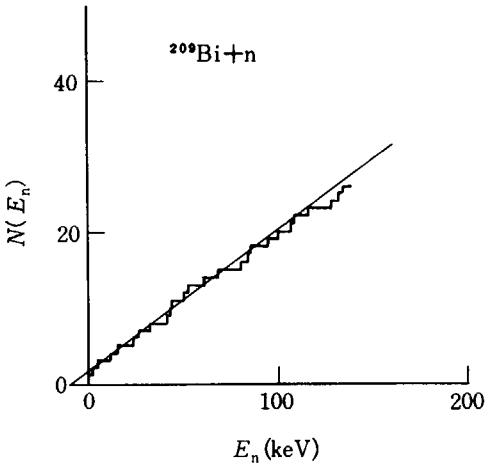

^{200}Hg+n
$N(E_n)$
E_n(keV)
0
10
20
30
5
10

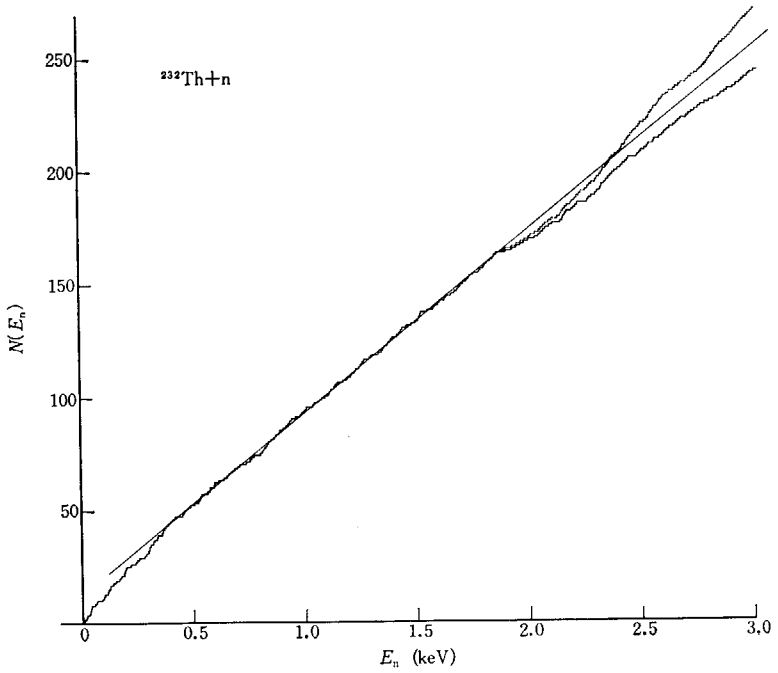

^{203}Tl+n
$N(E_n)$
E_n(keV)
0
10
20
30
20
40

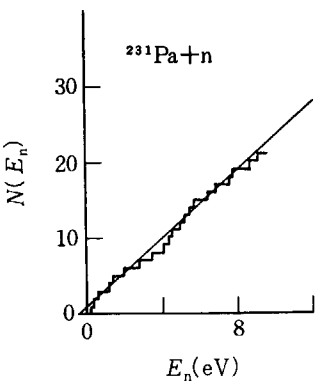

^{208}Pb+n
$N(E_n)$
E_n(keV)
0
20
40
60
1000
2000
3000

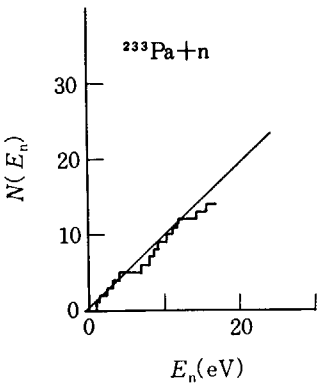

^{206}Pb+n
$N(E_n)$
E_n(keV)
0
10
20
30
200

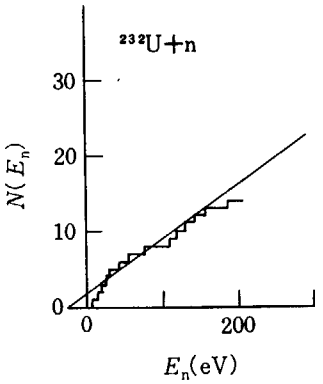

^{207}Pb+n
30
20
10
0
0
200
$N(E_n)$
E_n (keV)

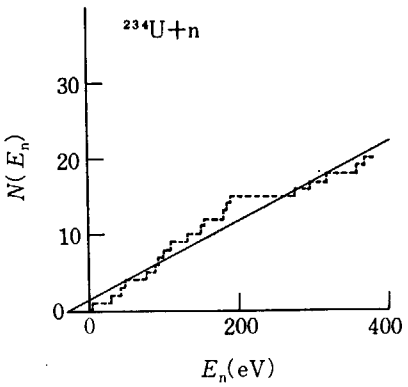

^{209}Bi+n
40
20
0
0
100
200
$N(E_n)$
E_n (keV)

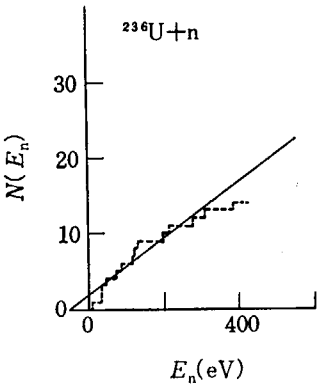

^{232}Th+n
250
200
150
100
50
0
0.5
1.0
1.5
2.0
2.5
3.0
$N(E_n)$
E_n (keV)

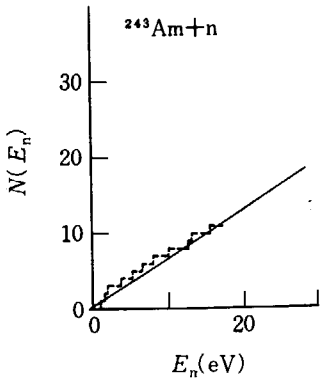

^{231}Pa+n
$N(E_n)$
30
20
10
0
0
8
E_n(eV)

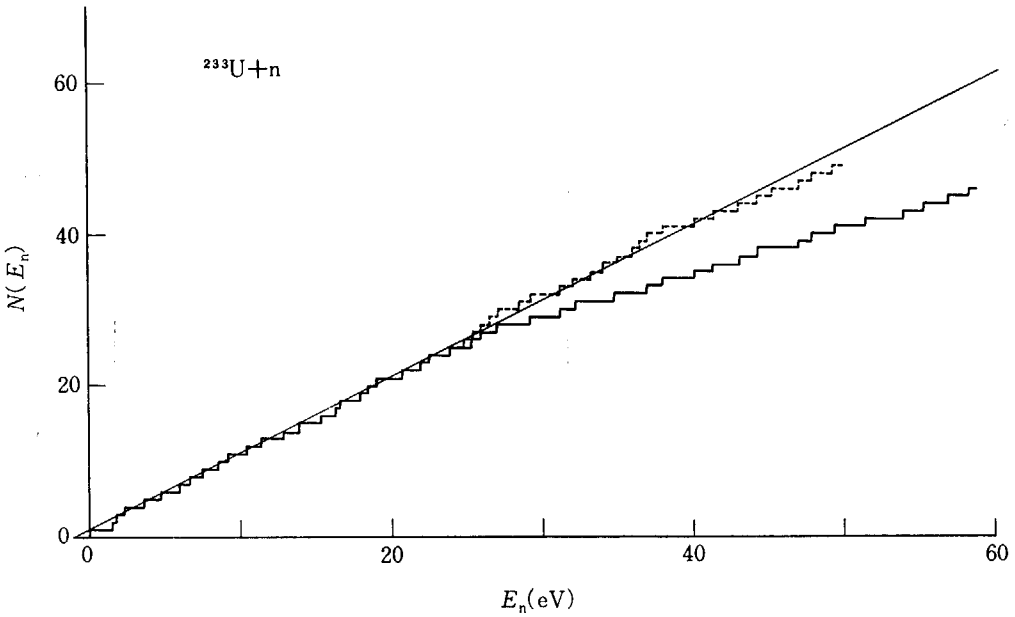

^{233}Pa+n
$N(E_n)$
30
20
10
0
0
20
E_n(eV)

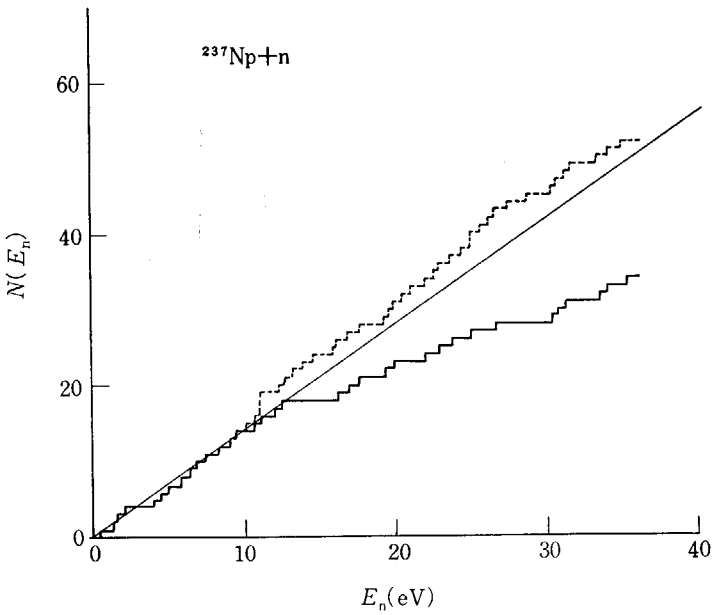

^{232}U+n
$N(E_n)$
30
20
10
0
0
200
E_n(eV)

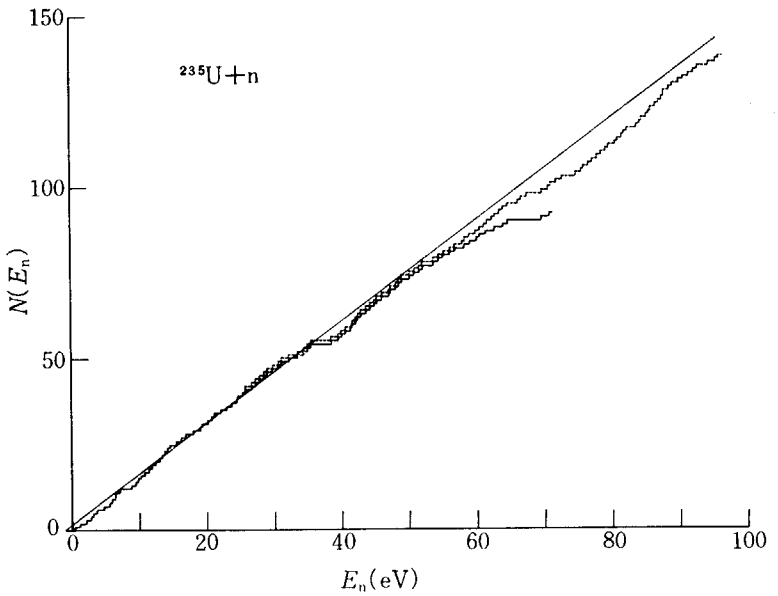

^{234}U+n
$N(E_n)$
30
20
10
0
0
200
400
E_n(eV)

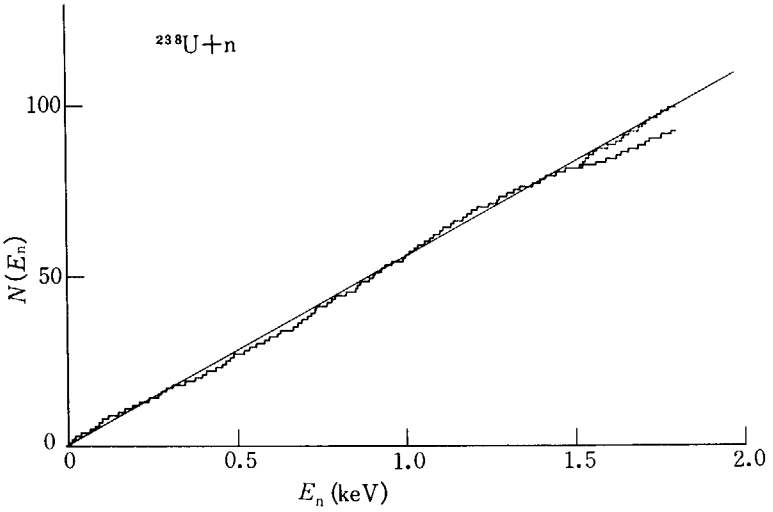

^{236}U+n
$N(E_n)$
30
20
10
0
0
400
E_n(eV)

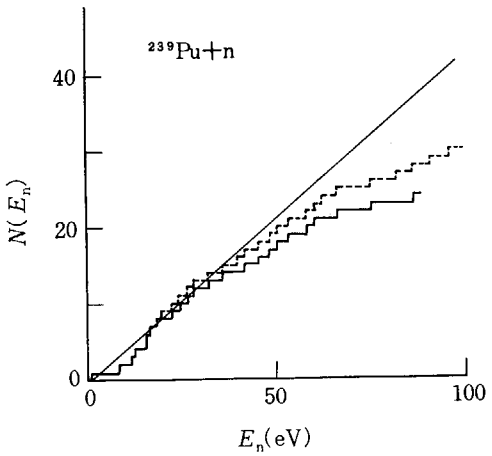

^{243}Am+n
$N(E_n)$
30
20
10
0
0
20
E_n(eV)

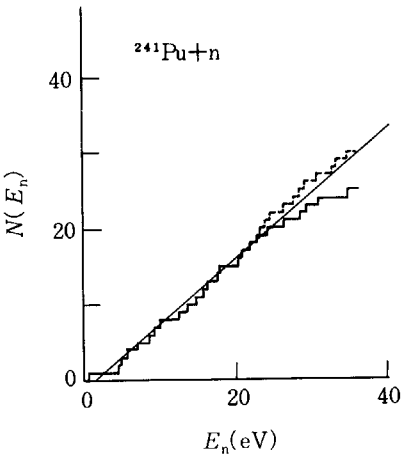

^{233}U+n
$N(E_n)$
E_n(eV)
0
20
40
60

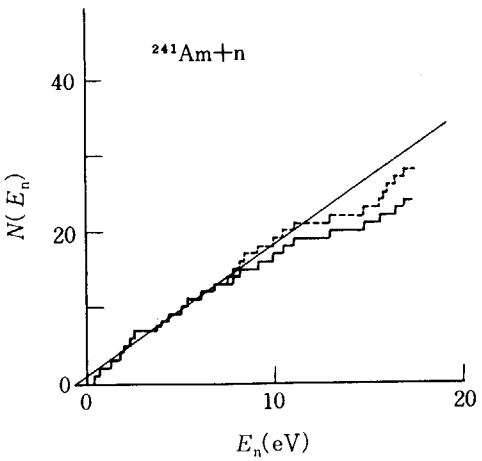

^{237}Np+n
$N(E_n)$
E_n(eV)
0
10
20
30
40
60

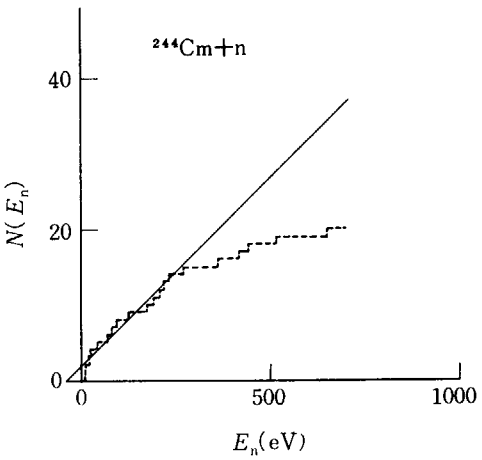

^{235}U+n
$N(E_n)$
E_n(eV)
0
20
40
60
80
100
50
150


^{238}U+n
100
50
0
$N(E_n)$
0
0.5
1.0
1.5
2.0
E_n (keV)


^{239}Pu+n
40
20
0
$N(E_n)$
0
50
100
E_n(eV)


^{241}Pu+n
40
20
0
$N(E_n)$
0
20
40
E_n(eV)


^{241}Am+n
40
20
0
$N(E_n)$
0
10
20
E_n(eV)


^{244}Cm+n
40
20
0
$N(E_n)$
0
500
1000
E_n(eV)