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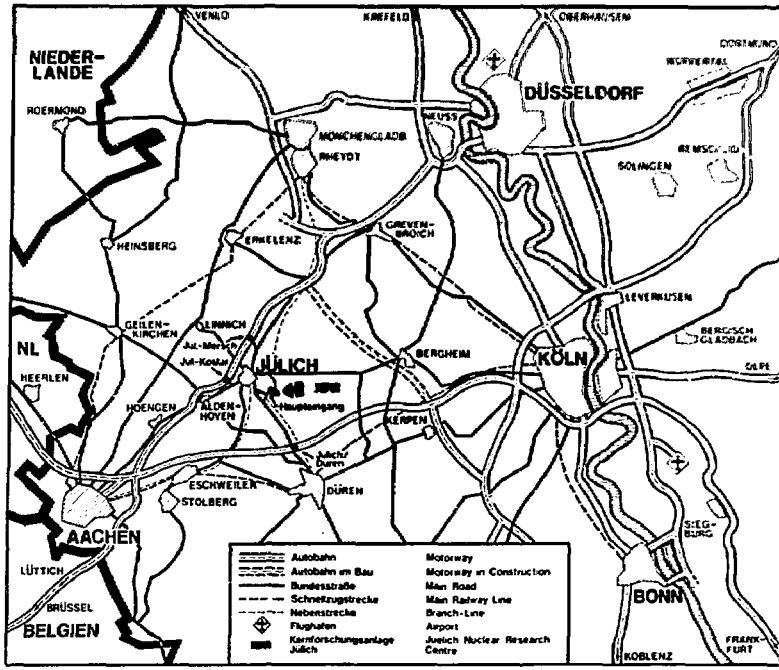

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Summary of Neutron Scattering Lenghts

by

L. Koester [1], H. Rauch [2], M. Herkens [3], K. Schröder [3]

[1] Reaktorstation Garching, D-8046 Garching

[2] Atominstitut der Österreichischen Universitäten, A-1020 Wien

[3] Zentralbibliothek der Kernforschungsanlage Jülich GmbH, D-5170 Jülich

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ABSTRACT

All available neutron-nuclei scattering lengths are collected together with their error bars in a uniform way.
Bound scattering lengths are given for the elements, the isotopes and the various spin-states. They are discussed in the sense of their use as basic parameters for many investigations in the field of nuclear and solid state physics. The data bank is available on magnetic tape too. Recommended values and a map of these data serve for an uncomplicated use of these quantities.

1. Introduction

The scattering length of the neutron-nucleus system is the basic quantity which describes the strength and the character of the interaction of low energy neutrons with the individual nuclei. The values vary very irregularly from one nucleus to an other due to their strong dependence on the details of the nuclear structure.

Low energy neutrons are an important tool for the investigation of the static and dynamic properties of condensed matter and they can also be used for a detailed investigation of the interaction of the neutron as an elementary particle with its surrounding. Therefore, the scattering lengths are of fundamental interest for condensed matter and nuclear physics research as well.

First measurements of this quantity have been done by Fermi in 1947 and since this time many advanced techniques have been developed for precise measurements. Most of them are based on neutron optical phenomena where the coherent scattering length is the quantity of interest, while for a theoretical interpretation the spin and isospin dependent scattering lengths are needed. These values can be obtained only by a combination of at least two measurable quantities like the coherent scattering length, the free scattering cross section, the incoherent scattering cross section or the nuclear polarization dependent cross section.

In the past various tables of scattering lengths are given in the literature where we refer to the tables given by Shull and Wollan 1951, Wilkinson et al. 1961, Turchin 1965, Gurevich and Tarasov 1968, Shull 1971, AIP 1972, Bacon 1972, Mughabghab and Garber 1973, Willis 1973, Bacon 1975, NDS 1976, Koester 1977, Dorner and Comes 1977, Hoshino et al. 1978. The aim of this summary is to collect all available data of neutron-nuclei scattering lengths in a uniform way together with their error bars as they are quoted in the original literature. This allows a critical estimate of the reliability of the different values. Recommended values are given according to the best possible criterions available to the authors.

The definitions of the relevant quantities included into the data tables are given in chapter 2 and the basic principles of measurement are explained in chapter 3. All tabulated values of chapter 4 correspond to bound scattering lengths due to the nuclear interaction. Second order effects due to the electromagnetic interaction are discussed in chapter 2 and in more detail by Koester 1977 and Rauch 1979. The refinement of the experimental methods justify the optimism to get more precise values in the future especially in the regime of spin-dependent scattering lengths.

The authors ask all readers to inform them about all new experimental values, data not included in the tables, mistakes and errors and about suggestions about the data representation and the layout of the summary.

2. Basic Relations

Low energy neutrons are scattered isotropically within the center-of-mass system, which indicates that no orbital momentum is involved in the scattering process ($\ell = 0$). This fact is equivalent to the statement that the range of interaction is much smaller than the wave lengths of the neutrons. This enables within Born approximation and ordinary scattering theory the introduction of a point like interaction in the form of the Fermi-pseudopotential (Fermi 1936)

$$(2.1) \qquad V(\vec{r}) = \frac{2\pi\hbar^2}{\mu} a\, \delta(\vec{r})$$

where $\mu = m_n \cdot m_k / (m_n + m_k)$ is the reduced mass between the neutron (m_n) and the nucleus (m_k). a is the *free scattering length* which is related to the scattering amplitude f_0 of the scattered spherical wave by $f = -a$. This definition is chosen to get for an infinite repulsive potential the relation $a = R$ where R is the radius of this potential. The small wave-length dependence of f_0 can be written by the effective-range (r_{eff}) approximation and yields (e.g. Blatt et al. 1949)

$$(2.2) \qquad \frac{1}{f_0} = k' \operatorname{ctg} \delta_0 = -\frac{1}{a}\left(1 - k^2 \frac{r_{eff}}{2} |a|\right)$$

where k' ($= 2\pi/\lambda'$) is the wave number in the center-of-mass system and δ_0 is the phase shift of the scattered wave. From equ. (2.2) follows the definition

$$(2.3) \qquad -a = \lim_{k' \to 0} \frac{tg\, \delta_0}{k'} \simeq \lim_{k' \to 0} \frac{\sin \delta_0}{k'} \simeq \lim_{k' \to 0} \frac{\delta_0}{k'}$$

A comparison with the Breit-Wigner formalism allows a separation into a potential and a resonance scattering length

$$(2.4) \qquad a = a_p + a_r = a_p + \sum_r \frac{\Gamma_n^r}{2k'[(E' - E_r) + i\,\frac{\Gamma}{2}]}$$

where the summation has to be taken over all resonances of the neutron-nucleus system. Γ_n is the neutron and Γ the total level width, E_r the resonance energy and E' the neutron energy in the center-of-mass system. The resonance properties for slow neutron reactions ($|E' - E_r| \gg \Gamma_n$, $\Gamma \ll E_r$, $E' \ll E_r$ and $\Gamma_n \propto k'$) allow in

many cases a simplification to

$$(2.5) \qquad a = a_p - \sum_r \frac{\Gamma_n^r}{2k' E_r}$$

For the potential scattering length a_p the potential scattering radius R' can be taken which follows from an analysis of the resonance cross section (e.g. Seth et al. 1958, Pineo et al. 1974). No rigorous calculation of the scattering length using equ. (2.4) is possible because the complete set of resonance parameters are unknown in most cases at least for $E_r < 0$ (below binding energy) and deviations from the Breit-Wigner behavior exist. Attempts for an 'a priori' calculation exist for light nuclei where few-body calculations are possible (e.g. Alt et al. 1975, Kharchenko et al. 1976) or to nuclei near closed shells where microscopic shell-model calculations can be done (e.g. Normand 1977). According to the strong spin dependence of nuclear forces the scattering lengths for the two interaction channels I + 1/2 and I - 1/2 (I ... nuclear spin) are a_+ and a_-, respectively. Therefore, a spin dependent scattering length is defined as

$$(2.6) \qquad a_{eff} = \frac{I+1}{2I+1} a_+ + \frac{I}{2I+1} a_- + \frac{2(a_+ - a_-)}{2I+1} \vec{I}\,\vec{s}_n$$

where $\vec{s}_n$ is the neutron spin and $(I+1)/(2I+1) = g_+$ and $I/(2I+1) = g_-$ are the statistical weight factors for the interaction with I + 1/2 and I - 1/2 for an unpolarized scattering experiment. Absorption is described by a complex interaction potential and therefore by a complex scattering length

$$(2.7) \qquad a = a' - i\, a''$$

where $a'' = \sigma_a/2\lambda$ which follows from the definition of the reaction cross section (Bacon 1975, chapter 5, Felcher et al. 1975). In this notation σ_a includes inelastic and incoherent scattering processes. For most nuclei a" is much smaller than a'. Experiments are carried out usually with an assemble of nuclei within a target at position R_i. For thermal neutrons the nuclei look rather fixed within their surrounding and therefore the neutron-nucleus center-of-mass systems coincide with the laboratory system ($k' \to k$, $\lambda' \to \lambda$), which favours the introduction of a

bound scattering length b related to a 'strongly' bound nucleus

$$(2.8) \qquad b = a\,\frac{m_n + m_k}{m_k} = a\,\frac{A+1}{A}$$

where A is the nucleus/neutron-mass ratio. A discussion about 'strongly' and 'rigidly' bound systems is given by Sears 1978. In this sense we write the interaction potential in the form

$$(2.9) \qquad V(\vec{r}) = \sum_i \frac{2\pi\hbar^2}{m_n}\, b_{eff}\, \delta(\vec{r} - \vec{R}_i)$$

This enables the definition of an average interaction potential $\langle V\rangle$ or of a mean phase shift for scattering $\langle\delta_0\rangle$ and therefore of a mean or a coherent scattering length $\langle b\rangle = b_c$, which reads for an unpolarized system

$$(2.10) \qquad b_c = \frac{I+1}{2I+1}\, b_+ + \frac{I}{2I+1}\, b_-$$

The variance of these quantities $(\langle(\Delta V)^2\rangle,\ \langle(\Delta\delta_0)^2\rangle = (\langle\delta_0^2\rangle - \langle\delta_0\rangle^2))$ defines the incoherent scattering length b_i

$$(2.11) \qquad b_i^2 = \frac{I(I+1)}{(2I+1)^2}\,(b_+ - b_-)^2$$

If various isotopes or elements with isotopic (element) abundances ρ_i are present a further averaging procedure has to be done which yields for the coherent scattering length of this element or compound

$$(2.12) \qquad b_c = \sum_i \rho_i\,(g_{i+}\, b_{+-} + g_{i-}\, b_{i-}) = \sum_i \rho_i\, b_{ci}$$

The volume average of the interaction potential (2.9) gives the mean potential $\overline{V}$ seen by the neutron within the target

$$(2.13) \qquad \overline{V} = \frac{2\pi\hbar^2}{m_n}\, N\, b_c$$

where N is the particle density. This quantity is independent of the internal structure of the sample. Predicted correction factors due to the internal structure are of the order of b_c/d (d ... mean particle distance) (e.g. Ekstein 1953, Dietze 1978) and are not verified experimentally up till now. Elementary calculation of

the behavior of the free particle at a potential step yields the index of refraction, which is defined as the ratio of the wave numbers inside (K) and outside the potential $\bar{V}$

$$(2.14) \qquad n = \frac{K}{k} = \sqrt{1 - \frac{\bar{V}}{E}}$$

which simplifies for thermal neutrons ($E \gg \bar{V}$) and low absorption to

$$(2.15) \qquad n \simeq 1 - \lambda^2 \frac{Nb_c}{2\pi}$$

The magnetic moment μ of the neutron causes additional interaction between the neutron and the magnetic and electric field produced by the nucleus and the electrons of the atom. The range of these interaction ($\sim$Å) is comparable to the wave length of thermal neutrons and therefore the related scattering effects are momentum (angular) dependent and can be described by suitable form factors f(Q) (normalized to f(0) = 1), where Q is the momentum transfer ($Q = 2k \sin \Theta/2$, Θ ... scattering angle).
The magnetic interaction with magnetic atoms or ions has the potential $V_m = -\mu \vec{\sigma} \vec{B}(\vec{r})$ where $\vec{\sigma}$ are the Pauli spin matrices and $\vec{B}(\vec{r})$ is the magnetic induction within the magnetic atom or ion. This leads to a magnetic scattering length (Halpern et al. 1939, Marshall et al. 1971)

$$(2.16) \qquad p(\vec{Q}) = -\frac{\gamma e^2}{m_e c^2} f_m(\vec{Q}) \langle\vec{S}\rangle (\vec{\sigma}\vec{q})$$

where γ is the magnetic moment of the neutrons in units of the nuclear magneton, m_e the electron mass, $\langle\vec{S}\rangle$ the mean magnetization of the magnetic atom and $\vec{q} = \hat{h} - (\hat{h}\hat{e})\hat{e}$ is the magnetic interaction vector expressed in unit vectors $\hat{h}$ in direction of $\langle\vec{S}\rangle$ and $\hat{e}$ in direction of $\vec{Q}$. $f_m(\vec{Q})$ is the magnetic atom form factor given by the unpaired electrons of the magnetic atom or ion. Only the mean potential, which is determined by the magnetic induction B within the sample influences the scattering length for the forward direction where we get for the both spin states

$$(2.17) \qquad p(0) = \mp \frac{\mu\, m_n B}{2\pi N \hbar^2}$$

For ferromagnetic samples p is of the same order of magnitude like b_c. Small contributions exist for para- and diamagnetic substances if they are within a magnetic field H where B in equ. (2.17) has to be replaced by $H(1 + 4\pi\chi)$ and where χ is the magnetic susceptibility.
An electromagnetic interaction arises from the movement of the magnetic dipol through the electric field of the atom in the form of a spin-orbit and the Foldy term (Schwinger 1948, Foldy 1955)

$$(2.18) \qquad V_{em} = \frac{\mu\hbar\vec{\sigma}}{m_n c}(\vec{E}\times\vec{k}) - \frac{\hbar\mu}{2m_n c}\vec{\nabla}\vec{E}$$

which yields the following contribution to the scattering lengths (e.g. Koester 1977, Marshall et al. 1971, Squires 1978)

$$(2.19) \qquad b_{em} = -i\,\frac{m_e}{m_n}\left(\frac{\gamma e^2}{m_e c^2}\right) Z\,(1 - f(\vec{Q}))\ \mathrm{ctg}\frac{\Theta}{2}\,(\vec{\sigma}\vec{n}) -$$

$$- \frac{m_e}{2m_n}\left(\frac{\gamma e^2}{m_e c^2}\right) Z\,(1 - f(\vec{Q}))$$

$f(\vec{Q})$ is the atom form factor of the whole electron cloud, which is known from X-ray diffraction. $\vec{n}$ is a unit vector perpendicular to the scattering plane. The spin-orbit contribution is imaginary and rather small and is not considered further. The last term is the Foldy term which gives a contribution of $b_F = -1.468 \times 10^{-3}$ fm per electron charge and which could be verified experimentally (e.g. Koester et al. 1976). Due to the compensation of nuclear and electronic charge b_{em} becomes zero for the forward direction. To get the scattering length b_N of a nucleus due to its nuclear force and Coulomb field one has to add the nuclear and Foldy term

$$(2.20) \qquad b_N = b_c - Z\,b_F$$

and the scattering length b_a of the whole atom is

$$(2.21) \qquad b_a = b_c - Z\,b_F\,(1 - f(\vec{Q}))$$

Further contributions are discussed in the literature (e.g. Koester 1977, Rauch 1979) but they are of no interest for this

summary because they are very small and often the experimental verification is still missing.

For measurements at $Q \neq 0$ beside the Foldy contribution the Debye-Waller correction e^{-W} due to the thermal cloud has to be considered ($b_c \rightarrow b_c\ e^{-W}$, e.g. Bacon 1975).

3. Methods of Measurement

There are a great variety of methods for the determination of coherent scattering lengths because all collective interaction effects are influenced by this quantity. The standard methods are based on Bragg diffraction or on classical neutron optics, where the index of refraction causes the measurable effect. In the former case the scattering length at a certain momentum transfer Q is measured while in the second one the measurement is performed at or near to Q = 0 and therefore the Debye-Waller factor and most of the electromagnetic terms have no influence. More and more interest arises for spin-dependent scattering lengths, which are obtained from a combination (denoted by m in the data table) of the coherent scattering length with the free cross section, or the incoherent cross section or with the data from a nuclear polarization dependent study. Within the various subsections exertion is given to refere to a standard and a rather new publication of this field as a further guide for more detailed information. Schematic drawings should indicate the principles of the measuring procedure and some basic formulas should give the connection between the measurable quantity and the coherent scattering length.

3.1 Bragg Diffraction (BD)

A great majority of coherent scattering lengths are determined from the Bragg intensities of monochromatic neutrons scattered on polycrystalline samples (Shull and Wollan 1951). Such an arrangement is shown schematically in Fig. 3.1.

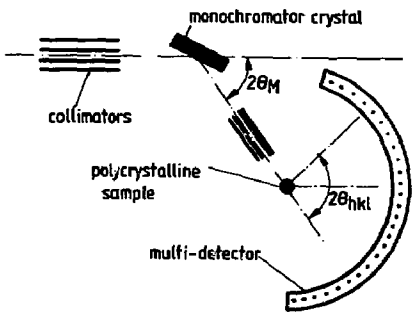


Fig. 3.1: Arrangement for the measurement of Bragg intensities from polycrystals. (The position-sensitive detector can be replaced by a single detector rotated around the sample.)

For cylindrical samples the intensity of the various Bragg diffraction lines is given as (e.g. Bacon 1975):

$$(3.1) \qquad \frac{P_{hkl}}{P_0} = \frac{\lambda^3 V j N_c^2 F_{hkl}^2}{8\pi r \sin\Theta_{hkl} \sin 2\Theta_{hkl}} e^{-2W_{hkl}} A_{hkl}$$

where V is the sample volume, r the distance to the detector, j the multiplicity of the lattice plane, N_c the number of unit cells per unit volume, Θ_{hkl} the scattering angle, $\exp(-2W_{hkl})$ the Debye-Waller factor, A_{hkl} the absorption factor and $F_{hkl} = \Sigma b_r \exp[-2\pi i(uh + vk + wl)]$ the structure factor of the unit cell with atomic positions at u, v, w (in units of the cell dimensions). For monoatomic lattices the geometrical structure factor can be separated and the intensity becomes proportional to b_c^2. Due to various extinction effects the accuracy is limited to about ± 1%. In some cases the scattering length has been extracted from single crystal scattering experiments (e.g. Cooper et al. 1972), but the extinction problem is even more serious in this case but the intensity is much higher.

3.2 Total Reflection (TR)

In the mirror-reflection technique a monochromatic or filtered beam of slow neutrons is reflected from the plane surface of a mirror. The principal advantage of this method lies in the direct connection between the critical angle Θ_c and the mean coherent scattering length b_c of the mirror material:

$$(3.2) \qquad \Theta_c = \lambda \sqrt{\frac{Nb_c}{\pi}}$$

The measured scattering length is an average over the atoms of the mirror and is independent of the crystalline state and of the temperature diffuse scattering. The Debye-Waller factor is unity. Since the critical angles are small and the wave-length distribution in the beam can never be known exactly, the accuracy is restricted to the order of $\pm 10^{-2}$ $\Delta b/b$ for absolute determinations and $\pm 10^{-3}$ $\Delta b/b$ for relative determinations (Dickinson,

Passel and Halpern 1962). All kinds of plane mirrors and interfaces are suitable for the reflection measurements.

3.3 Gravity Refractometer (GR)

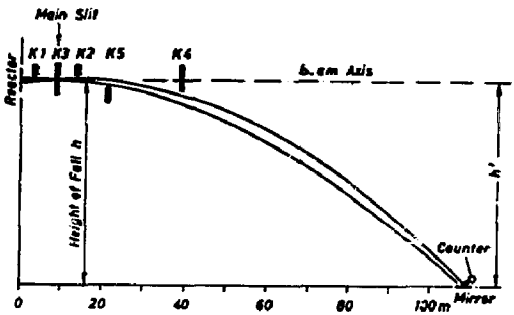


Fig. 3.2: Principle of the neutron-gravity refractometer (after Koester, 1965)

In the gravi.. refractometer (Fig. 3.2) by Maier-Leibnitz (1962) and Koester (1965) the fact is used that in the gravitational field freely falling neutrons gain an energy $mg_f h$ which is of the same magnitude as the potential energy $\langle V \rangle = 2\pi\hbar^2 m_i^{-1} N b_c$ of neutrons in matter containing N atoms cm^{-3}. m is the gravitational mass and m_i the inertial mass of the neutron, g_f denotes the effective gravitational acceleration acting on the free neutron, and h is the height of fall. A falling neutron beam (or neutron wave) is reflected from a horizontal mirror if $mg_f h$ is smaller than $\langle V \rangle$; otherwise the neutrons can penetrate the mirror. The critical height for total reflection is reached (with $m = m_i$) at h_c according to

$$mg_f h_c = 2\pi\hbar^2 m^{-1} N b_c \tag{3.3}$$

The mean scattering density $\overline{Nb_c}$ of the mirror substance is directly proportional to the critical fall height, which is the only quantity to be measured. All other quantities are very well known fundamental constants. Thus a very high accuracy for the scattering density becomes possible. In practice, uncertainties of only $(\pm 1 - \pm 3) \times 10^{-4}$ $\Delta b/b$ for the scattering length could be obtained (Koester and Nistler 1975). This good accuracy can be

obtained only for liquid mirrors with a high content of the element under investigation.

3.4 Christiansen-Filter Technique (CF)

Small-angle scattering of neutrons by mixtures of powders with liquids (Christiansen 1884) can be used as an indicator for a balance method, where the scattering does not arise when the scattering densities Nb_c of powder and liquid are equal. In this technique a well-collimated beam of cold neutrons passes through the filter. The unscattered part is completely stopped by an absorber placed in front of the neutron counter, so that only the scattered part is detected. In this arrangement (Fig. 3.3) the point of balance

(3.4) $$Nb_c(\text{liquid}) = Nb_c(\text{powder})$$

can be experimentally found by changing the scattering density of the liquid phase and by measuring the disappearance of the scattering (Koester and Knopf 1971).

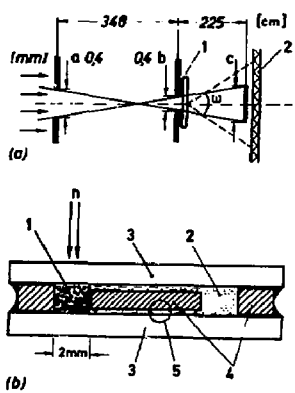


Fig. 3.3: Experimental set-up for Christiansen-filter measurements.
a) Beam collimation; a, b slits; c stopper, 1 filter, 2 neutron counter
b) cross-cut of the Christiansen filter; 1 powder, 2 liquid, 3 glass, 4 spacer, 5 liquid split, d = 1 or 0.5 mm (after Koester et al., 1977)

Liquids of various scattering densities over a wide Nb range are prepared by mixing different parts of two compounds of very different Nb_c-values (e.g. H_2O/D_2O) which themselves can be determined very exactly in the gravity refractometer. The Christiansen-filter technique is also applicable to filters of thin wires in liquids or of powders in gases under various

pressures. The method is useful and reliable for determinations of scattering lengths with medium accuracy to within $\pm 1 \times 10^{-3}$ and 1×10^{-2} $\Delta b/b$. It is particularly applicable to small amounts of separated isotopes since the filters can be kept rather small (Koester et al. 1977). This method can be combined with the small angle scattering technique as described in chapter 3.5 (Bader et al. 1980).

3.5 Small Angle Scattering (SA)

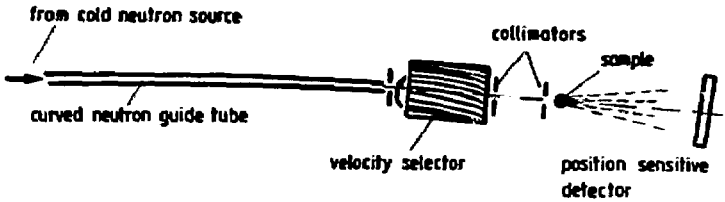
Diffraction, refraction and reflection occure to the neutron beam if it traverses an inhomogeneous material, which cause a broadening of the beam profile (Weis 1951). The various regimes are characterised by the phase shift of the neutron wave within one particle or precipitate ($\phi = k(1-n)\delta$, δ ... diameter of the particle). In the refraction range ($\phi \gg 2\pi$) the broadening of the beam can be written as

$$H^2 - H_0^2 = N^2 b_c^2 \lambda^4 r / 4\pi^2 \qquad (3.5)$$

where H_0 is the half width without sample and $r \simeq D/\bar{\delta}$ the mean number of traversed particles within a sample of thickness D. For smaller particles (precipitates) where diffraction is predominant ($\phi \ll 2\pi$) the broadening is much smaller than in the refraction range and independent of b_c

$$H^2 - H_0^2 \simeq 12\lambda^2/\pi^2\delta^2 \qquad (3.6)$$

For b_c measurements larger particles are often embeded into an other substance (solid, liquid or gaseous) and the relative index of refraction between particle and substrate is measured. In this case various geometric factors are cancelled and higher accuracy can be achieved. In any case the particle size distribution and multiple processes hinder an unequivocal interpretation of data. The measurements can be performed with a standard neutron small angle camera using long wave length neutrons (Fig. 3.4) or a non dispersive double crystal arrangement with perfect crystals and an extreme high angular resolution (Fig. 3.4).



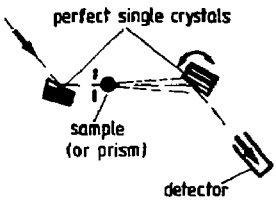


Fig. 3.4: Sketch of small angle scattering arrangements using long wave neutrons and long flight paths (above) or a non dispersive double crystal arrangment (left).

3.6 Prism Refraction (PR)

A prism with an apex angle α deflects the neutron beam as

$$(3.7) \qquad \delta = 2(1-n)\,\mathrm{tg}\,\frac{\alpha}{2} = (Nb_c\lambda^2/\pi)\,\mathrm{tg}\,\frac{\alpha}{2}$$

which is usually in the order of sec of arc and which can be measured with a non dispersive double-crystal arrangement with perfect crystals as shown in Fig. 3.4 (Shull et al. 1967). In certain cases rather high accuracies for a b_c determination could be achieved (e.g. Schneider et al. 1970).

3.7 Transmission (TM)

A collimated neutron beam (neutron energy E) is attenuated in material (atomic mass A) by absorption and scattering. The total scattering cross section σ_S per atom as obtained from transmission experiments with neutrons of an energy in the electron volt region can be expressed in terms of the free scattering cross section σ_0 at "zero energy" as

$$(3.8) \qquad \sigma_S(E) = \sigma_0[1 + \delta\sigma_S(E)/\sigma_0 + \sigma_{LS}(E)/\sigma_0 + \sigma_B(A,E)/\sigma_0]$$

The energy dependent correction terms in the bracket are due to neutron resonance scattering $\delta\sigma_S(E)$, Schwinger scattering

(Obermair 1967, Lovesey 1969), and solid state binding effects (Wick 1951, Placzek 1952, Binder 1970). For epithermal neutrons and other than very light nuclei and nuclei without resonances in the eV-region the sum of the corrections is in the order of one part to 10^3 or 10^4. Within the region of this uncertainty the scattering cross section is independent of the neutron energy:

$$\sigma_S(E) = \sigma_0 \tag{3.9}$$

The free cross section is related to the bound coherent nuclear scattering lengths $b_{N,c}$ and $b_{N,i}$ according to

$$\sigma_0 = \frac{4\pi}{(1+A)^2}(b_{N,c}^2 + b_{N,i}^2) \tag{3.10}$$

where A denotes the nucleus/neutron mass ratio. Thus, the amount of the nuclear scattering length can be obtained from the measured free scattering cross section if the incoherent cross section is zero or is known.
In suitable cases the transmission method is capable of a high accuracy for the determination of absolute values of nuclear scattering lengths (e.g. Dilg 1971, Waschkowski et al. 1976). The experimental arrangement corresponds to a simple transmission geometry but detectors sensitive to epithermal neutrons have to be used (Fig. 3.5).

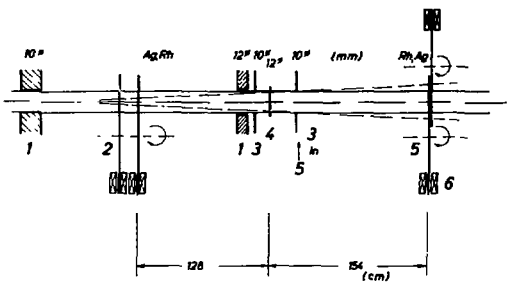


Fig. 3.5: Arrangement for transmission measurements with rotating resonance detectors. 1 shield, 2 detectors as monitor, 3 slit, 4 sample, 5 detectors, 6 β-counter (after Waschkowski et al. 1976)

3.8 Dynamical Diffraction (DD)

Dynamical-diffraction phenomena appear in perfect single crystals due to the interference of the forward and diffracted beam within the crystal. Within the two-beam approximation and for symmetrical

Laue-geometry the reflected intensity of a slab shaped crystal of thickness t can be written in an angular scale as (e.g. Rauch et al. 1978)

$$(3.11) \qquad P(y) = \frac{\sin^2[(\pi t/\Delta_0)\sqrt{1+y^2}]}{1+y^2}$$

with $$y = \frac{(\Theta_B - \Theta)\pi \sin 2\Theta_B}{b_c N \lambda^2}$$

$$\Delta_0 = \frac{\pi \cos \Theta_B}{b_c' N \lambda}$$

where $\Theta_B - \Theta$ is the deviation of the beam from the exact Bragg condition and N the particle density. b_c' include the Debye-Waller factor and electro-magnetic contributions which are Q-dependent (equ. 2.19) and which have to be taken into account for precise measurements.
The Pendellösung oscillation can be observed with a higher accuracy by the measurement of the intensity distribution within the Borrmann-fan when a narrow entrance slit is used in front of the perfect crystal. Within spherical wave theory the intensity of the diffracted beam is for the symmetrical Laue-case given as a function of the lateral distance x from the center of the Borrmann-fan in the form

$$(3.12) \qquad P(\Gamma) = \frac{\sin^2[(\pi t/\Delta_0)\sqrt{1-\Gamma^2} + \pi/4]}{\sqrt{1-\Gamma^2}}$$

with $$\Gamma = \frac{y}{\sqrt{1+y^2}} = \frac{x}{t \operatorname{tg} \Theta_B}$$

Intensity oscillations occur near $\Gamma \sim 0$ $(x \sim 0)$ as a function of t or of λ, which are shown in Fig. 3.6 together with the experimental arrangement (Shull 1968). Rather accurate b_c-determinations can be achieved with this method (Shull et al. 1972), but only materials where perfect crystals are available can be investigated by means of this method.

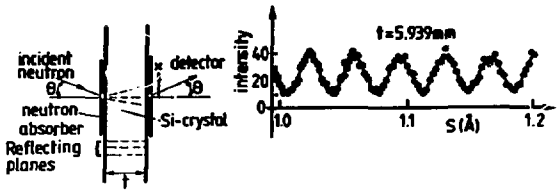


Fig. 3.6: Experimental arrangement and characteristic Pendellösung oscillation near $\Gamma \sim 0$ (after Shull 1968)

3.9 Neutron Interferometry (IN)

This technique uses the dynamical diffraction phenomena to split and to overlap two widely separated beams (Rauch et al. 1974). Monolithic silicon crystals are used to provide the required stability of the lattice planes (Fig. 3.7).

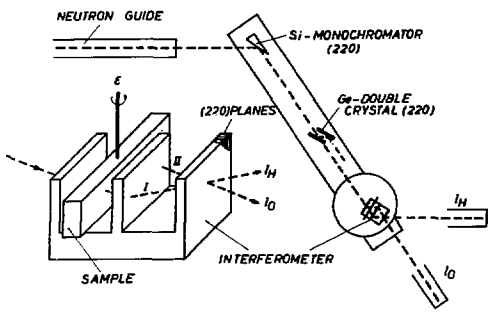


Fig. 3.7: Sketch of the experimental arrangement for neutron interferometric measurements (after Rauch et al. 1978)

A material introduced into the coherent beams produces a phase shift $\varphi = k(1-n)\Delta D$, where ΔD is the path difference of the beams I and II within the material. Due to this phase shift the intensity behind the interferometer is modulated according to

$$(3.13) \qquad I = \frac{I_0}{2}[1 + \cos(2\pi\Delta D/D_\lambda)]$$

and where b_c can be determined via the measurement of the λ-thickness $D_\lambda = 2\pi/(\lambda N b_c)$. Samples can be used in solid, liquid or gaseous form (e.g. Bauspiess et al. 1978, Kaiser et al. 1979). For such measurements an accurate λ-determination is needed too.

3.10 Nuclear Polarization (NP)

According to the spin-dependent interaction potential (chapter 2) the neutron scattering length of a nucleus depends on the relative orientation of the neutron ($\vec{s}_n$) and nucleus spin ($\vec{I}$) in the sense (equ. 2.6)

$$(3.14) \qquad b = b_c + b_i \vec{s}_n \vec{I}$$

$$b_c = \frac{I+1}{2I+1} b_+ + \frac{I}{2I+1} b_-$$

$$b_i = \frac{2(b_+ - b_-)}{2I+1}$$

A coherent average <b> over an assemble of nuclei gives the polarization-dependent coherent scattering length (e.g. Lushchikov et al. 1970)

$$(3.15) \qquad b_c^r = b_c + b_i I \vec{P}_n \vec{f}_n/2$$

where the neutron polarization is $\vec{P}_n = 2\langle\vec{s}_n\rangle$ and the nucleus polarization $\vec{f}_n = \langle\vec{I}\rangle/I$. For Bragg scattering the relevant structure factors have to be added and for a transmission measurement with absorbing nuclei the spin dependence of the absoprtion cross section has to be accounted

$$(3.16) \qquad \sigma_a = [(1 + I \vec{P}_n \vec{f}_n)\sigma_a^+ + I(1 - \vec{P}_n \vec{f}_n)\sigma_a^-]/(2I+1)$$

and for magnetic substances additional terms appear (Schermer 1963). In analogy to the magnetic scattering a pseudo-magnetic induction B_p can be defined for a sample with spin-dependent nuclear interaction (Abragam 1972, Abragam et al. 1973).

$$(3.17) \qquad B_p = -4\pi N \hbar c\, b_i f_n/(2e\gamma)$$

where γ is the neutron magnetic moment expressed in nuclear magnetons and N is the particle density. Spin precession and spin-echo effects can be observed due to this "B_p-field" which yield information about b_i and therefore about the spin-dependent part $b_+ - b_-$ of the scattering lengths (e.g. Glättli et al. 1979).

A sketch of such an arrangement is shown in Fig. 3.8. The achievement of sufficient nuclear polarization is the most difficult part of such investigations.

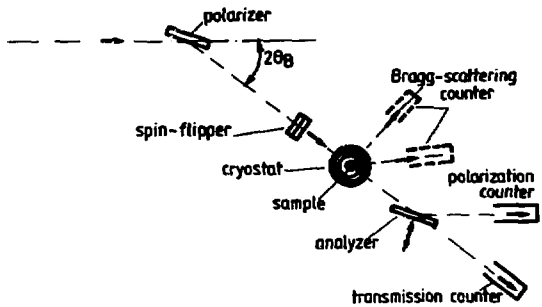


Fig. 3.8: Experimental arrangement for the measurements of spin-dependent scattering lengths

3.11 High Energy Experiments (HE)

Potential and resonance scattering determine the phase shift and therefore the scattering length at low energy (chapter 2). Detailed analysis of the resonance cross section yield information about the potential scattering radius R' (e.g. Stieglitz et al. 1971), but contributions to the resonance part arise from energy levels below the binding energy for which the resonance parameters are unknown in many cases. Therefore the separation of the potential and resonance part is rather difficult and optical model calculations can help in certain cases only (e.g. Koester et al. 1978).

For the understanding of nuclear forces the scattering lengths between the elementary particles neutron-proton, proton-proton and neutron-neutron are of central interest (e.g. Henley 1969). From those quantities only the neutron-neutron scattering length cannot be measured directly due to the leak of suitable neutron targets. As a compensation one uses nuclear reactions with a dominant neutron-neutron interaction in the exit channel as

(3.18) $n + D \rightarrow 2n + p$

$\pi^- + D \rightarrow 2n + \gamma$

The first reaction requires the measurement of all kinematical quantities of the reaction products and an analysis based on three body models, which can be solved approximately only (Faddeev-equation, Watson-Migdal model). A schematic view of a proper experimental arrangement using time-of-flight analysis and coincidence technique is shown in Fig. 3.9 (Breunlich et al. 1974).

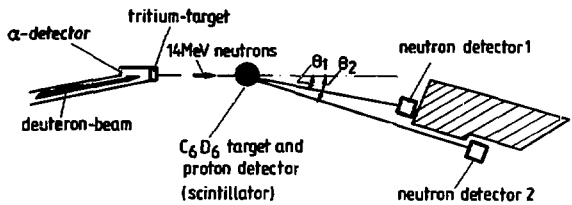


Fig. 3.9: Experimental arrangement for the measurement of the neutron-neutron interaction (after Breunlich et al. 1974)

The π^--D-reaction has the advantage that only the neutrons appear as hadrons in the final state but nevertheless theoretical uncertainties of the model limit the accuracy to about 3% (e.g. Gabioud et al. 1979).
The available values for the singlet scattering lengths, which according to Pauli principle are the only relevant quantities for comparison, indicate

(3.19) $b_{nn} \sim b_{pp} \geq b_{np}$

From this relation a charge dependence and a charge symmetry of nuclear forces can be deduced, but more precise values are needed for a final decision (e.g. Kühn 1976).

4. Discussion

All together 928 values of neutron scattering lengths taken from 339 different references are collected. 338 values are listed as recommended values in Appendix B and are given separately in a map of neutron scattering lengths (Figure 4.1). This map can be obtained as a colored wall map with dimensions of 84x60 cm and it gives an overview about the known data for the various nuclei. The accuracy of the data is very different and a statistical evaluation of the accuracy of the recommended values is given in Table 4.1 in a semidecimal scheme.

Table 1: Number of recommended neutron scattering lengths data with error bars ($\frac{\Delta b}{b}$) between certain limits

	b_c	b_+	b_-	$b_+ - b_-$
$\frac{\Delta b}{b} < 0.0001$	1	0	0	0
$0.0001 \leq \frac{\Delta b}{b} \leq 0.0005$	11	1	1	0
$0.0005 \leq \frac{\Delta b}{b} \leq 0.001$	9	0	0	0
$0.001 \leq \frac{\Delta b}{b} \leq 0.005$	40	4	2	0
$0.005 \leq \frac{\Delta b}{b} \leq 0.01$	36	3	2	1
$0.01 \leq \frac{\Delta b}{b} \leq 0.05$	105	12	15	4
$0.05 \leq \frac{\Delta b}{b} \leq 0.1$	16	7	8	7
$0.1 \leq \frac{\Delta b}{b} \leq 0.5$	7	4	3	13
$0.5 \leq \frac{\Delta b}{b}$	1	0	0	2

Most data have error bars in the range between 1 and 5%. More precise values are known only for nuclei where the neutron physics requirements can be fulfilled to perform a precision measurement as indicated in chapter 3 and samples of sufficient purity and sizes are available. Strong efforts have to be made in future to obtain all neutron scattering lengths with sufficient accuracy. More precise values would especially be needed

for spin dependent scattering lengths where due to the recent successes in nuclear orientation further results can be expected.

An updating of the values is scheduled for every year and, therefore, all authors are cordially asked to inform us about new values of neutron scattering lengths.

Many authors gave us their unpublished data for inclusion in the data bank which is gratefully acknowledged.

Figure 4.1 is available as a colored wall chart with dimensions of 84x60 cm and a price of AS 420,--/DM 60,--/US$ 25,-- from

H.Bittermann
c/o Atominstitut der Österr.Universitäten
Schüttelstraße 115
A-1020 Wien

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6.1 Data Description

6.1.1 Record Layout

Digit Position	Meaning
1 - 2	ordinal number, right justified
3 - 4	element designation, left justified exception: ' N' for neutron
5 - 7	mass number, right justified (only given for nuclides)
8	empty
9 - 10	logical record number (from 00 to 99)
11	card number (from 0 to 5)
12 - 13	empty
14 - 70	data
71 - 80	unique identifier, right justified

The meaning of the digit position 14 - 70 depends on the card number:

card number 0:	free-form text
14 - 41	free-form text or empty
42 - 70	empty
card number 1:	B(FM)
card number 2:	B+(FM)
card number 3:	B-(FM)
card number 4:	B+(FM) - B-(FM)
14 - 21	real part of the measured value (decimal point at digit position 17)
22 - 24	empty
25 - 31	error value of the real part (decimal point at digit position 27)
32 - 33	empty
34 - 41	imaginary part of the measured value (decimal point at digit position 37)
42 - 44	empty
45 - 51	error value of the imaginary part (decimal point at digit position 47)
52 - 70	empty

The coordinates of the measured value can have a sign digit; for a coordinate which is not given the value of zero should be assumed. The error values do not have sign digits and indicate the absolute maximum error. If a coordinate is not given the error value belonging to it is also missing. Be careful: a missing error value in the case of a given coordinate should not be taken as zero! If a value is not given, blanks are inserted at the corresponding positions.

card number 5:	Bibliographical References
14 - 15	method, left justified
16 - 35	reference, left justified
36 - 37	year of publication
38 - 53	author, left justified ('+' at digit position 53 means: et al.)
54 - 55	commentary number, right justified
56	sign for "recommended value" ('+' or empty)
57 - 70	empty

6.1.2 Sorting

The data set is an accumulation of logical records.

a) Free-form Text Records

This sort of logical records consists only of one physical record with the card number 0 and always has the logical record number 00. For each element and nuclide exists one or none free-form text record. The blanks in the text only serve to improve the appearance since the free-form text is divided into groups of seven characters each by the printing program.

b) Data Records

A data record consists of at least two and no more than four physical records; it contains at least one, but no more than three measured values (if a (B+(FM) - B-(FM)) value is present then neither a (B+(FM)) value nor a (B-(FM)) value may be given). Moreover, every data record includes a physical record with bibliographical references.

The logical records are sorted in ascending sequence of the ordinal number, the isotopes of an element in the ascending order of the mass number, the pure element appearing first. The logical records for an element or a nuclide are headed by the free-form text record - if existing -, the data records then follow, subdivided into two groups:

1. records without a (B+(FM) -B-(FM)) value and
2. records with a (B+(FM) - B-(FM)) value.

In each group the data records are classified in descending sequence of the year of publication.

All physical records belonging to a logical record are sorted according to the ascending sequence of the card number and have the same unique identifier.

6.2 Program Description

The following programs are required to build up and maintain the presented data inventory:

6.2.1 RAINDAT

This program serves for the acquisition of inputs. In the conversational mode enquiries are made about the individual fields, they are formally checked and assembled into a logical record. Each logical record receives an unique identifier depending on a start number entered at the beginning.

6.2.2 RAINKOR

In the conversational mode corrections are acquired by specifying the logical record to be corrected through the unique identifier and the correction itself by indicating the fields to be corrected and the new field contents. The insertion and clearing of fields as well as the deletion of logical records is also possible in this process. The field contents entered are checked for format errors.

6.2.3 RAEXEKOR

The corrections acquired with RAINKOR are carried out on the data inventory, keeping the old version. The corrections are examined for logical errors by comparing the correction and the logical record to be corrected, and by checking the logical record after correction has taken place. The sequence of logical records remains unchanged.

6.2.4 RASORT

The data are sorted according to the criteria defined in Data Description 2.). This is necessary after corrections have been carried out with RAEXEKOR as well as for filing inputs which have been acquired with RAINDAT. The two functions can be carried out in the same procedure.
Hereby updating is completed and the new version of the data inventory can be copied onto tape or can be punched out as a card deck.

6.2.5 RAPRINT

The total list (see Appendix A) and the "recommended values" (see Appendix B) are now generated and output onto paper or film. At the same time the expanded total list completed by the unique identifier is printed to allow correction.

6.2.6 RASPEC

This is an evaluation program which processes the data inventory according to diverse criteria; it primarily checks the precision of the measured values.

Copies of the data bank (as card deck or tape etc.) and further information about the programs are available by KFA-Zentralbibliothek.

NEUTRON SCATTERING LENGTHS

APPENDIX A. DATA COLLECTION

UPDATED: 15.12.1981

-NUCLIDE-	- B(FM)	- - B+(FM)	- - B-(FM)	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME -	C.	R.
0- N- 1 (T1/2= 10.6 MIN. 1=1/2)	-33.2 (.8)		-33.2 (.8)	HE	NP/A367.157	81	KULKARNI	*	
	-37.0 (1.0)		-37.0 (1.0)	HE	PRL 42.1508	79	GABCOUD	*	
	-33.8 (1.2)		-33.8 (1.2)	HE	PL/B80.187	79	WITSCH	*	*
	-32.6 (1.2)		-32.6 (1.2)	HE	NP/A322.109	79	SOUKUP	*	
	-26.6 (7.0)		-26.6 (7.0)	HE	NP/A304.51	78	OHEL	*	
	-35.0 (8.1)		-35.0 (8.1)	HE	NP/A304.51	78	OHEL	*	
	-35.0		-35.0	HE	77ZUERICH	77	ALDER	*	
	-46.4 (7.2)		-46.4 (7.2)	HE	PR/C16.97	77	WRIGHT	*	
	-33.2 (1.1)		-33.2 (1.1)	HE	SJPN6.139	76	KUEHN		
	-33.4 (2.6)		-33.4 (2.6)	HE	NP/A 254.241	75	SALTER	*	
	-32.6 (2.0)		-32.6 (2.0)	HE	NP/A231.13	74	ZEITNITZ	*	
	-32.0 (2.4)		-32.4 (2.4)	HE	NP/A221.269	74	BREUNLICH	*	
	-35.0 (1.0)		-35.0 (1.0)	HE	SNP16.700	73	SHKYLYAREVSKII		
	-32.4 (2.4)		-32.4 (2.4)	HE	PL/B44.68	73	JEREMIE	*	
	-36.6 (4.0)		-36.6 (4.0)	HE	NP/A215.277	73	SHIRATO	*	
	-50. (6.)		-50. (6.)	HE	SNP 14.157	72	SANKOV	*	
	-30. (2.)		-30. (2.)	HE	NP/A 183.640	72	KUEHN	*	
	-32.0 (2.4)		-32.0 (2.4)	HE	72ROME	72	BREUNLICH		
	-33.6 (5.0)		-33.6 (5.0)	HE	NP/A193.610	72	DROPMANN		
	-32.2 (1.8)		-32.8 (1.8)	HE	72LOS ANGELES 117	72	ZEITNITZ	*	
	-32.8 (2.6)		-32.8 (2.6)	HE	72LOS ANGELES 112	72	SALTER	*	
	-29.0 (1.6)		-29.0 (1.6)	HE	PRL28.1656	72	ZEITNITZ	*	
	-46.0 (8.0)		-46.0 (8.0)	HE	SNP15.234	72	SKORODUMOV	*	
	-43.4 (2.4)		-43.4 (2.4)	HE	NP/A190.284	72	STRICKER	*	
	-32. (2.)		-32. (2.)	HE	NP/A 173.261	71	GROETZSCHEL	*	
	-46.0 (3.4)		-46.0 (3.4)	HE	NP/A 158.278	70	LUNKE	*	
	-31.0 (2.2)		-31.0 (2.2)	HE	BAP 15.22	70	ASSIMAKOPOULOS	*	
	-32.8 (5.0)		-32.8 (5.0)	HE	NP/A149.449	70	ZEITNITZ	*	
	-34.0 (1.0)		-34.0 (1.0)	HE	PR/C1.1365	70	GROSS	*	
	-32.4 (4.4)		-32.4 (4.4)	HE	NP/A136.446	69	GRASSLER	*	

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
0- N- 1 (CONT.)	-32.2 (2.0)		-32.2 (2.0)	HE	PRL 16.105	66	BAUMGARTNER	*	
	-32.8 (2.6)		-32.8 (2.6)	HE	PRL14.318	65	HADDOCK	*	
1-H	-3.64 (.02)			IN	ZP/A302.323	81	HAMMERSCHMIED	*	
	-3.741 (.004)			IN	UNPUBL.VIE	79	GRANZER	*	
	-3.7409(.0011)			GR	ZP/A272.189	75	KOESTER	*	*
	-3.733 (.004)			TM	PR/C12.1432	75	CALLERAME	*	
	-3.74 (.02)			TR	PR126.632	62	DICKINSON	*	
	-3.7 (.6)			BD	PC53.303	57	WORSHAM	*	
	-3.80 (.05)			TM	PRS/A230.19	55	SQUIRES	*	
	3.80 (.05)			TR	PR90.1125	53	STEWART	*	
	-4.0 (.2)			BD	PR81.527	51	SHULL	*	
	-3.78 (.02)			TR	PR84.1160	51	BURGY	*	
	-3.75 (.03)			TR	PR77.291	50	HUGHES	*	
	-3.9 (.1)			BD	PR73.842	48	SHULL	*	
	-3.95 (.12)			TR	PR72.1147	47	SUTTON	*	
	-3.9			TR	PR71.666	47	FERMI	*	
1-H - 1 (99.985 %, I=1/2)	-3.64 (.03)	10.96 (.03)	-47.41 (.03)	IN	ZP/A291.231	79	KAISER	*	
	-3.7423(.0012)	10.817 (.005)	-47.420 (.014)	TM	UNPUBL.MUN	79	KOESTER	*	*
	-3.7409(.0011)	10.855 (.006)	-47.531 (.016)	GR	PR/C11.103	75	DILG	*	
	-3.733 (.003)	10.825 (.014)	-47.436 (.022)	TM	PR/C12.1423	75	CALLERAME	*	
		10.835 (.010)	-47.471 (.026)	TM	PR/C9.1392	74	LONON	*	
	-3.740 (.003)	10.828 (.010)	-47.54 (.30)	TR	PRL27.956	71	KOESTER	*	
	-3.756 (.009)	10.810 (.012)	-47.456 (.026)	TM	RMP40.672	68	HOUK	*	
	-3.720 (.002)	10.98 (.04)	-47.8 (.1)	GR	ZP198.187	67	KOESTER		
	-3.74 (.02)	10.80 (.04)	-47.34 (.06)	TR	PR126.632	62	DICKINSON	*	

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
1-H - 1 (CONT.)		10.8 (.1)	-49.8 (.1)	TM	SSGENEVA 2.81	55	NIKITIN	•	
	-3.80 (.05)	10.74 (.08)	-47.46 (.14)	TM	PRS/A230.19	55	SQUIRES	•	
	-3.78 (.02)	10.75 (.05)	-47.38 (.12)	TR	PRB4.1160	51	BURGY	•	
		B+ - B- = 58.2 (.4)		NP	JPR40.629	79	GLAETTLI	•	•
1-H - 2 (0.0149 %, I=1)	6.67 (.04)			IN	ZP/302.323	81	HAMMERSCHMIED	•	
	6.65 (.05)			CF	NEANDC/E-212U.64	80	KOESTER	•	
	6.55 (.08)	9.54 (.02)	0.57 (.25)	IN	ZP/A291.271	79	KAISER	•	
	6.706 (.023)			IN	UNPUBL.VIE	79	GRANZER	•	
	6.674 (.006)	9.53 (.03)	0.975 (.050)	M	EEN80.1	77	KOESTER		•
	6.674 (.006)			GR	ZN/A29.1284	74	NISTLER		
	6.672 (.007)	9.53 (.03)	0.98 (.060)	GR	PL36B.208	71	DILG	•	
		9.20 (.06)	0.22 (.05)	NP	SNP10.27	70	IVANENKO	•	
	6.51 (.02)			BD	ACR/B25.2442	69	COPPENS	•	
	6.70 (.05)			CF	ZP219.300	68	KOESTER	•	
	6.21 (.04)	9.20 (.06)	0.20 (.08)	TR	PR174.313	68	BARTOLINI	•	
		9.21 (.09)	0.17 (.10)	M	PL 824.562	67	VAN DERS	•	
		9.6	1.2	HE	PL9.339	64	WILLARD	•	
	6.77 (.08)			TR	BAP8.477	63	BARTOLINI	•	
	6.62 (.09)			TM	ZK118.149	63	GISSLER		
	6.6 (.5)			BD	PCS3.303	57	WORSHAM	•	
	6.74 (.18)	9.74 (.20)	0.86 (.20)	TM	SSGENEVA2.81	55	NIKITIN	•	
	6.4 (.2)			BD	PR81.527	51	SHULL	•	
	6.79 (.12)	9.57 (.09)	1.0 (.5)	M	CJP29.36	51	HURST	•	
1-H - 3 (T1/2= 12.26Y. I=1/2)	5.10 (.10)			IN	ZP/A302.323	81	HAMMERSCHMIED	•	•
	4.94 (.08)	4.94 (.30)	4.94 (.80)	M	ZP/A302.328	81	HAMMERSCHMIED	• 1B	•
	4.91 (.07)	4.80 (.12)	5.22 (.16)	M	PL/B91.200	80	SEAGRAVE	• 1A	
	4.87 (1.15)	4.94 (.66)	4.67 (2.00)	TM	PR/C22.384	80	PHILIPS	•	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
1-H - 3 (CONT.)	4.7 (.3)			SA	PR/C5.1952	72	DONALDSON	*	
	5.0 (.3)			SA	PR/C5.1952	72	DONALDSON	*	1
	5.1 (.3)			SA	THESIS.KIEV	72	KIRILYUK		
2-HE	3.18			CF	UNPUBL.MUN	80	MEIER		
	3.26 (.03)			IN	ZP/A291.231	79	KAISER	*	*
	3.11 (.02)			TN	NP/A133.410	69	RORER	*	
	2.99 (.07)			TN	JPR24.21	63	GENIN	*	
	3.0 (.2)			TR	PRB4.969	51	MCREYNOLDS		
2-HE- 3 (1.3E-4 %, I=1/2)	5.7 (.4)	4.5 (.3)	9.3 (.5) -1 5.925	TM	NP/A368.189	81	BAUMGARTNER	*	
		4.83 (.20)	8.73 (.43) -1 4.450 (.003)	TM	JINR.P3-80-550	80	ALFIMENKOV	*	
	5.74 (.07)	4.7 (.5)	8.8 (1.4) -1 5.925	IN	ZP/A 291.231	79	KAISER	*	*
	5.53 -1 1.48	4.3 (.7)	10.0 (.9) -1 5.925		JINR.P3-11024	78	FRANK		
		4.20	12.57	HE	KIEV-ITP-78-142E	78	KHARCHENKO		
	5.73 (.05)			IN	PL 71.321	77	KAISER	*	
	6.1 (.6)			TR	PRL 32.791	74	KITCHENS	*	
2-HE- 4 (100%, I=0)									
3-LI	-2.03 (.05)			CF	EENBO.1	77	KOESTER	*	*
	-2.13 (.02)			CF	UNPUBL.MUN	75	KOESTER	*	
	-1.94 (.05)			BD	JPCS 23.621	62	CALDER	*	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
3-LI (CONT.)	-1.8 (.1)			BD	PR81.527	51	SHULL	+	
	-5.9			BD	PR71.666	47	FERMI	+	
3-LI- 6 (7.5%, I=1)	1.87 (.05) -I 0.26	0.41 (.07)	4.81 (.06)	CF	UNPUBL.MUN	78	KOESTER	+	+
	2.15 (.15) -I 0.26	0.82 (.17)	4.81 (.07)	TM	NDR1.153	70	ASAMI	+	
	1.8 -I 0.26			BD	JPJ17.935	62	PETERSEN	+	
	7. (1.)			BD	PR81.527	51	SHULL	+	
		B+ - B- =	-3.8 (.5)	NP	PRL40.748	78	GLAETTLI	+	+
3-LI- 7 (92.5%, I=3/2)	-2.197 (.010)	-4.19	1.13	CH	UNPUBL.MUN	78	KOESTER	+	+
	-2.1			BD	JPJ17.335	62	PETERSEN	+	
	-2.1 (.1)			BD	ARN511.303	61	WILKINSON	+	
	-2.50 (.08)			BD	PR81.527	51	SHULL	+	
		B+ - B- =	-4.5 (.2)	NP	JPR40.529	79	GLAETTLI	+	+
		B+ - B- =	-4.5 (.2)	NP	PRL33.102	74	ROUBEAU	+	
4-BE- 9 (100%, I=3/2)	7.79 (.01)			TM	UNPUBL.MUN	78	WASCHKOWSKI	+	+
	7.74 (.10)			SO	ARN11.303	61	WILKINSON	+	
	7.57			TR	PR86.604	52	HARVEY	+	
	7.8 (.4)			BD	PR81.527	51	SHULL	+	
	8.9			TR	PR71.666	47	FERMI	+	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
S-8	5.35 (.06)			CF	EEN80.1	77	KOESTER	+	+
	5.40 (.04)			TR	PR138.B1116	65	DONALDSON	+	
	5.4 -1 0.21			BD	JPJ17.335	62	PETERSEN	+	
S-8 - 10 (19.4%, I=3)	0.00 (.22)	-3.9	5.2	CF	EEN80.1	77	KOESTER	+	$ +
	1.4 (.5) -1 1.06			SA	PR146.660	66	DONALDSON	+	
	0.8 (1.0)			TR	PR138.B1116	65	DONALDSON	+	
S-8 - 11 (80.2%, I=3/2)	6.658 (.020)	5.32	8.90	CF	UNPUBL.MUN	78	KOESTER	+	+
	6.1 (.2)			BD	ACR20.214	66	CRAVEN	+	
	6.53 (.35)			SA	PR146.660	66	DONALDSON	+	
	6.6 (.3)			TR	PR138.B1116	65	DONALDSON	+	
6-C	6.6484(.0013)			GR	ZP/A272.189	75	KOESTER	+	+
	6.648 (.004)			TM	PR/C3.1886	71	HOUK		
	6.648 (.005)			TM	ZN/A26.442	71	DILG	+	
	6.648 (.003)			GR	PRL27.956	71	KOESTER	+	
	6.648 (.004)			GR	ZP198.187	67	KOESTER		
	6.4 (.2)			BD	PRB1.527	51	SHULL	+	
	6.7			TM	PR71.666	47	FERMI	+	
6-C - 12 (98.89 %, I=0)	6.6535(.0014)			GR	ZP/A292.95	79	KOESTER	+	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
6-C - 13 (1.11%, I=1/2)	6.19 (.09)	4.8 (.5)	10.2 (1.6)	CF	ZP/A292.95	79	KOESTER	*	*
	6.0 (.2)			BD	PR85.491	52	KOEHLER	*	
		B+ - B- =	-1.2 (.2)	NP	JPR40.629	79	GLAETTLI	*	*
7-N	9.21 (.02)			BD	ACR/B35.2126	79	TAKUSAGAWA	*	*
	9.30 (.08)			IN	ZP/A291.231	79	KAISER	*	
	9.36 (.02)			CF	ZP/A277.77	76	KOESTER	*	
	9.25 (.04)			BD	JCP60.3866	74	KVICK	*	
	9.19 (11)			TR	PR138.B1116	65	DONALDSON	*	
	9.40 (.15)			BD	PR87.462	52	PETERSEN	*	
	8.5 (.3)			BD	PR81.527	51	SHULL	*	
	8.5			BD	PR83.88	51	GOLDSCHMIDT	*	
	8.9 (.7)			TR	PR84.969	51	MC-REYNOLDS		
	9.53 (.05)			TM	PR76.1750	49	MELKONIAN		
	8.7			TM	PR71.666	47	FERMI	*	
7-N - 14 (99.635 %, I=1)	9.37 (.02)	10.7 (.2)	6.5 (.3)	CF	ZP/A277.77	76	KOESTER	*	*
7-N - 15 (0.365% I=1/2)	6.44 (.03)	6.43 (.03)	6.48 (.03)	CF	ZP/A277.77	76	KOESTER	*	*
	6.5 (.2)			BD	ACR/A28.655	72	KUZNIEZ	*	
8-O	5.805 (.004)			M	ZP/A292.95	79	KOESTER	*	*
	5.83 (.05)			IN	ZP/A291.231	79	KAISER	*	
	5.830 (.002)			PD	ACR/A32.375	76	SCHNEIDER		

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
B-0 (CONT.)	5.801 (.006)			GR	ZN/A29.1284	74	NISTLER		
	5.804 (.007)			TM	PL/B35.208	71	DILG	+	
	5.80 (.05)			TR	PR138.B1116	65	DONALDSON	+	
	5.8 (.2)			BD	ACR 15.351	62	ROOF	+	
	5.81 (.20)			BD	PR81.527	51	SHULL	+	
	5.79 (.03)			TM	PR76.1750	49	MELKONIAN		
	6.1			TM	PR71.666	47	FERMI	+	
B-0 - 16 (99.756 %. I=0)	5.805 (.005)			M	ZP/A 292.95	79	KOESTER	+	+
B-0 - 17 (0.039% I=5/2)	5.62 (.45)			CF	ZP/A 292.95	79	KOESTER	+	
	5.78 (.15)			BD	AERE R 5770	68	VALENTINE		+
		B+ - B- =	0.35 (.12)	NP	NP/A IN PRINT	81	MALINOVSKI	+	+
B-0 - 18 (0.208% I=0)	5.84 (.07)			CF	ZP/A 292.95	79	KOESTER	+	+
	6.00 (.13)			BD	AERE R 5275	65	CONNOR	+	
F - 19 (100%. I=1/2)	5.654 (.012)	5.632 (.010)	5.767 (.010)	CF	ZP/A 292.95	79	KOESTER	+	+
	5.66 (.02)			GR	ZP/A 272.189	75	KOESTER	+	
	5.53 (.04)			TM	PR/C 10.2143	74	SINGH	+	
	5.603 (.011)	5.58 (.01)	5.72 (.01)	TM	ZN/A 29.1750	74	DILG		
	5.60 (.05			BD	JCP59.453	73	PETERSEN	+	
	5.79 (.17)			TR	PR174.313	68	BARTOLINI	+	
	5.74 (.09)			TR	BAP8.477	63	BARTOLINI	+	
	5.50 (.16)			BD	PR81.527	51	SHULL	+	
	6.0			TM	PR71.666	47	FERMI	+	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
9-F - 19 (CONT.)		B+ - B- =	-0.19 (.02)	NP	JPR 40.629	79	GLAETTLI	+	+
		B+ - B- =	-0.195 (.020)	NP	PRL 28.805	72	ABRAGAM	+	
10-NE	4.547 (.011)			CF	NEANDC/E-212U.64	80	KOESTER	+	+
	4.63 (.04)			IN	ZP/A 291.231	79	KAISER	+	
	4.60 (.03)			TM	NP/A 133.410	69	RORER	+	
	4.59 (.01)			TM	PR 148.1303	66	KROHN	+	
	4.6			BD	PR 111.1470	58	HENSHAW		
10-NE- 20 (90.5%, I=0)	4.631 (.006)			TM	PR 148.1303	66	KROHN	+	+
10-NE- 21 (0.27%, I=3/2)	6.66 (.19)			TM	PR 148.1303	66	KROHN	+	+
10-NE- 22 (9.2%, I=0)	3.87 (.01)			TM	PR 148.1303	66	KROHN	+	+
11-NA- 23 (100%, I=3/2)		6.42 (.04)	-1.00 (.06)	M	ZP/A 292.95	79	KOESTER	+	+
	3.63 (.02)			CF	ZN/A26.901	72	KOESTER	+	+
	3.5 (.2)			BD	PR 81.527	51	SKULL	+	
	3.6			BD	PR83.88	51	GOLDSCHMIDT		
	5.6			BD	PR71.666	47	FERMI	+	
		B+ - B- =	7.1 (.3)	NP	JPR 40.629	79	GLAETTLI	+	+
		B+ - B- =	7.1 (.3)	NP	JPRL 36.263	75	ABRAGAM	+	

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
12-MG	5.976 (.020)			CF	ZP/A 292.95	79	KOESTER +		
	5.975 (.004)			IN	NIM 157.495	78	BRUSPIESS +		+
	5.26 (.17)			BD	ACR/A 28.473	72	ABUL-KHAIL +		
	5.43 (.10)				THES.UNI.CARDIFF	71	JONES		
	5.16 (.06)			BD	ACR 16.834	63	SABINE +		
	4.8 (.2)			BD	ANL-6797.393	63	MUELLER +		
	5.2 (.1)			BD	ACR 5.684	52	BACON		
	4.4 (.3)			BD	PR 81.527	51	SHULL +		
	5.6			BD	PR71.666	47	FERMI +		
12-MG- 24 (78.9%, I=0)	5.49 (.18)			BD	ACR/A 28 .473	72	ABUL-KHAIL +		+
12-MG- 25 (10%, I=5/2)		4.6 (.4)	2.7 (.5)	M	ZP/A 292.95	79	KOESTER +		+
	3.62 (.14)			BD	ACR/A 28.473	72	ABUL-KHAIL +		+
12-MG- 26 (11.0%, I=0)	4.92 (.15)			BD	ACR/A 28.473	72	ABUL-KHAIL +		+
13-AL- 27 (100%, =5/2)		3.20 (.08)	3.80 (.12)	M	ZP/A 292.95	79	KOESTER +		+
	3.449 (.005)			IN	NIM 157.495	78	BRUSPIESS +		+
	3.447 (.005)			IN	76 GATLINBURG 2.1694	76	BRUSPIESS +		
	3.447 (.005)			IN	76 LOWEL 2.1027	76	RAUCH +		
	3.455 (.005)	3.70 (.03)	3.15 (.04)	TM	ZN/A 29.1750	74	DILG		
	3.449 (.009)			CF	ZN/A 28.391	71	KOESTER +		
	3.442 (.002)			TM	ZP 186.23	65	TRIFTSHAEUSER		
	3.5 (.2)			BD	PR 81.527	51	SHULL +		
		B+ - B- =	0.52 (.02)	NP	JPR 40.629	79	GLAETTLI +	13	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
13-AL- 27 (CONT.)		B+ - B- =	0.50 (.03)	NP	PRL 33.102	74	ROUBEAU	*	
14-SI	4.24 (.04)			CF	THESIS.VIE	80	BADER		
	4.1478(.0016)			PR	ACR/A32.375	78	SCHNEIDER		
	4.147 (.002)			PR	RSI 44.1594	73	SCHNEIDER		
	4.149 (.001)			DD	PRL 29.871	72	SHULL	*	*
	4.159 (.006)			CF	ZN/A 26.391	71	KOESTER	*	
	4.145 (.004)			TM	ZN/A 26.442	71	DILG	*	
	4.165 (.002)			DD	PRL 23.1585	68	SHULL		
	4.04 (.20)			TM	ZP 190.295	66	NIKLAUS	*	
	4.2 (1.2)			SA	PR 83.379	51	WEISS		
14-SI- 28 (92.2%, I=0)	4.106 (.006)			CF	ZP/A 289.399	79	KOESTER	*	*
14-SI- 29 (4.7%, I=1/2)	4.7 (.1)	4.09 (.15)	6.6 (.4)	CF	ZP/A289.399	79	KOESTER	* 14	*
14-SI- 30 (3.1%, I=0)	4.58 (.08)			CF	ZP/A 289.399	79	KOESTER	*	*
15-P - 31 (100%, I=1/2)	5.13 (.01)			CF	ZP/A 277.77	76	KOESTER	*	*
	5.3 (.2)			BO	ARK 11.303	61	WILKINSON	*	
	5.1			BO	PRS/A220.397	53	BACON	*	
	5.00 (.07)			BD	RECU-2277	52	LEVY	*	
		B+ - B- =	0.7	NP	UNPUBL-SAC	81	GLAETTLI	* 15	*

NUCLIDE	D(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
16-S	2.847 (.001)			GR	ZN/A26.400	71	TRUESTEDT	*	*
	2.8 (.1)			BD	JAP 36.1088	65	MENYUK	*	
	3.1 (.2)			BD	PR 81.527	51	SHULL	*	
	2.8			BD	PR71.666	47	FERMI	*	
16-S - 32 (95%, I=0)	2.804 (.002)			CF	ZP/A289.399	79	KOESTER	*	*
16-S - 33 (0.74%, I=3/2)	4.74 (.19)			CF	ZP/A289.399	79	KOESTER	*	*
		B+ - B- =	3. (3.)	CF	78HARWELL	78	KOESTER	*	*
16-S - 34 (4.2%, I=0)	3.48 (.03)			CF	ZP/A289.399	79	KOESTER	*	*
16-S - 36 (0.013%, I=0)									
17-CL	9.59 (.07)			CF	ZP/A282.371	77	KOESTER	*	
	9.5792(.0008)			GR	ZP/A272.189	75	KOESTER	*	*
	9.580 (.002)			GR	PR27.956	71	KOESTER	*	
	9.54			BD	RCR/A25.391	69	NEUTR.DIFF.COMM.		
	9.633 (.006)			GR	ZP198.187	67	KOESTER		
	9.7			BD	PR83.88	51	GOLDSCHMIDT	*	
	9.9 (.2)			BD	PR81.527	51	SHULL	*	
	11.3			TM	PR71.666	47	FERMI	*	
17-CL- 35 (75.77%, I=3/2)	11.70 (.09)	16.3 (.2)	4.0 (.3)	CF	ZP/A282.371	77	KOESTER	*	*
	11.8			BD	UNPUBL.MIT	67	SHULL	*	

-NUCLIDE-	- B(FM)	- - B+(FM)	- - B-(FM)	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME -	C.
48-CD-110 (12.39 %. I=0)								
48-CD-111 (12.75 %. I=1/2)								
48-CD-112 (24.07 %. I=0)	7.4 (.2)			TM	RE27.1117	89	VERTEBNYI	*
48-CD-113 (12.36 %. I=1/2)	-8.0 -1 7.5			BD	JPR25.815	84	SMITH	
48-CD-114 (28.86 %. I=0)	6.4 (.2)			TM	RE27.1117	89	VERTEBNYI	*
48-CD-116 (7.58%. I=0)	7.1 (.2)			TM	RE27.1117	89	VERTEBENYI	*
49-IN	4.065 (.020) -1 0.054			CF	ZP/A297.86	80	KOESTER	*
49-IN-113 (4.28%. I=9/2)	5.39 (.06)			CF	ZP/A297.86	80	KOESTER	*
49-IN-115 (95.72 %. I=9/2)	4.00 (.03) -1 0.058	2.1 (.1)	6.4 (.4)	CF	ZP/A297.86	80	KOESTER	*
50-SN	6.228 (.004)			IN	NIM157.495	78	BRUGPIESS	*
	6.220 (.002)			IN	78GRTLINBURG2.1094	78	BRUGPIESS	*

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
19-K	3.67 (.02)			BD	ACR/A19.514	73	COOPER	+	+
	3.67 (.02)			BD	ZK135.316	72	COOPER	+	
	3.71 (.02)			CF	ZN/A27.901	72	KOESTER	+	
	3.70 (.04)			BD	ACR20.220	66	BROWN	+	
	3.4 (.2)			BD	ANL-6797-393	63	MUELLER	+	
	3.5 (.1)			BD	PR81.527	51	SHULL	+	
	3.5			TM	PR71.666	47	FERMI	+	
19-K - 39 (93.3%, I=3/2)	3.79 (.02)	6.06 (.03)	2.43 (.03)	CF	UNPUBL.MUN	79	KOESTER	+	+
	3.7 (.1)			BD	ANL-6797-393	63	MUELLER	+	
		B+ - B- = +3.0		NP	JPR40.629	79	GLAETTLI	+	+
19-K - 40 (0.012% ,I=4)									
19-K - 41 (6.7%, I=3/2)	2.58 (.06)	2.3[illegible] (.08)	2.64 (.07)	CF	UNPUBL.MUN	79	KOESTER	+	+
	3.08 (.02)			CF	ERNOC/E150.39	72	KOESTER	+	
20-CA	4.90 (.03)			CF	EENBO.1	77	KOESTER		+
	4.74 (.03)			BD	ACR/B25.787	69	LOOPSTRA	+	
	4.84 (.13)			BD	JCP35.1950	61	ATOJI		
	4.90 (.17)			BD	PR81.527	51	SHULL	+	
	7.9			BD	PR71.666	47	FERMI	+	
20-CA- 40 (96.94% I=0)	4.9 (.2)			BD	PR81.527	51	SHULL	+	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME -	C.	R.
20-CA- 42 (0.64%, I=0)									
20-CA- 43 (0.13%, I=7/2)									
20-CA- 44 (2.13%, I=0)	1.8 (.1)			BD	PR81.527	51	SHULL	+	+
20-CA- 46 (0.003% I=0)									
20-CA- 48 (0.18%, I=0)									
21-SC- 45 (100%, I=7/2)	12.1	6.7	19.0	NP	BAP 22.993	77	MARSHAK		
	12.29 (.11)	7.0 (.4)	19.1 (.5)	CF	UNPUBL.MUN	75	KOESTER	+	+
	12.15 (.13)	17.4	5.4	TM	ZN/A 29.1750	74	DILG		
	11.8 (.5)			BD	JP/C 57.535	53	LEVY	+	
		B+ - B- = -13.6	(.9)	NP	JPR 40.629	79	GLAETTLI	+	
		B+ - B- = -11.8		NP	UNPUBL.ORNL	79	KOEHLER	+	
		B+ - B- = -12.3		NP	BAP22.993	77	MARSHAK		+
		B+ - B- = -12.0	(.3)	NP	PRL 33.102	74	ROUBEAU	+	21
		B+ - B- = -15.5	(1.5)	TM	SNP1.159	65	ROMANOV	+	
22-TI	-3.438 (.002)			IN	NIM157.495	78	BAUSPIESS	+	+
	-3.37 (.02)			CF	EENBO.1	77	KOESTER		
	-3.4 (.2)			BD	PR118.797	60	SHULL	+	
	-3.8 (.2)			BD	PR81.527	51	SHULL	+	
	-3.56 (.30)			SA	PR83.379	51	WEISS		

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
22-TI- 46 (8.0%, I=0)	4.73 (.05)			CF	UNPUBL.MUN	80	KOESTER +		+
	4.8 (.2)			BD	PR118.797	60	SHULL +		
22-TI- 47 (7.5%, I=5/2)	3.49 (.12)	0.6 (.3)	7.6 (.4)	CF	UNPUBL.MUN	80	KOESTER +		+
	3.3 (.2)			BD	PR118.797	60	SHULL +		
22-TI- 48 (73.7%, I=0)	-5.84 (.02)			CF	UNPUBL.MUN	80	KOESTER +		+
	-5.8 (.2)			BD	PR118.797	60	SHULL +		
	-5.8			BD	JAP30.1323	59	GIOHU +		
22-TI- 49 (5.5%, I=7/2)	1.00 (.05)	5.5 (.3)	-4.8 (.3)	CF	UNPUBL.MUN	80	KOESTER +	22	+
	0.8			BD	PR118.797	60	SHULL +		
22-TI- 50 (5.3%, I=0)	5.93 (.08)			CF	UNPUBL.MUN	80	KOESTER +		+
	5.5			BD	PR118.797	60	SHULL +		
23-V	-0.38241 .00121			IN	NIM157.498	78	BRUSPIESS +	23	+
	-0.408 (.002)			IN	76LOWELL 2.1027	76	RAUCH +		
	-0.50 (.05)			BD	PR87.462	52	PETERSON +		
	-0.47 (.01)			TR	PR83.171	50	MCREYNOLDS +		
23-V - 50 (0.25%, I=6)									
23-V - 51 (99.75% I=7/2)	-0.414	5.11 (.28)	-7.52 (.22)	NP	BAP22.1246	77	MARSHAK	23	+
		5.06 (.12)	-7.60 (.12)	TH	ZN/A29.1750	74	DILG		

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME -	C.	R.
23-V - 51 (CONT.)		B+ - B- = +12.94		NP	JPR40.629	79	GLAETTLI	+	+
24-CR	3.635 (.007)			CF	ZP/A287.61	78	KOESTER	+	+
	3.532 (.010)			CF	ZN/A26.391	71	KOESTER	+	
	3.7 (.1)			BD	PR81.527	51	SHULL	+	
24-CR- 50 (4.35%, I=0)	-4.50 (.05)			CF	ZP/A287.61	78	KOESTER	+	+
24-CR- 52 (83.8%, I=0)	4.914 (.015)			CF	ZP/A287.61	78	KOESTER	+	+
	4.9			BD	ACR/A25.391	69	BACON	+	
24-CR- 53 (9.59%, I=3/2)	-4.20 (.03)	1.16 (.10)	-13.0 (.2)	CF	ZP/A287.61	78	KOESTER	+	+
24-CR- 54 (2.36%, I=0)	4.55 (.10)			CF	ZP/A287.61	78	KOESTER	+	+
25-MN- 55 (100%, I=5/2)	-3.73 (.02)	-2.21 (.05)	-5.84 (.07)	CF	EEN80.1	77	KOESTER		+
	-3.7 (.1)			BD	ARN11.303	61	WILKINSON	+	
	-3.3 (.2)			BD	PR81.527	51	SHULL	+	
	-4.4			TM	PR71.666	47	FERMI	+	
26-FE	9.45 (.02)			TM	ZN/A29.1750	74	DILG		

-NUCLIDE-	- B(FM)	- B+(FM)	- B-(FM)	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME	C.	R.
26-FE (CONT.)	9.54 (.06)			PR	PR/B3.830	71	SCHNEIDER	*	*
	9.16 (.13)			TR	RS133.916	62	BALLY	*	
	9.5			BD	JPJ17.3.1	52	SMULL	*	
	8.2			TR	PR71.666	47	FERMI	*	
26-FE- 54 (5.8%, I=0)	4.2 (.1)			BD	PRB1.527	51	SMULL	*	*
26-FE- 56 (91.7%, I=0)	10.1 (.2)			BD	PRB1.527	51	SMULL	*	*
26-FE- 57 (2.19%, I=1/2)	2.3 (.1)			BD	PRB1.527	51	SMULL	*	*
26-FE- 58 (0.31%, I=0)	15. (7.)			TR	FRM-124	77	WEBER	*	*
27-CO- 59 (100%, I=7/2)	2.78 (.04)	-2.92 (.06)	10.10 (.08)	CF	ZP271.201	74	KOESTER	*	
	2.50	-3.80 (.54)	10.6 (.7)	NP	PR185.961	69	JTO	*	
	2.50 (.03)			BD	PR/A136.195	64	MOON		*
	2.50	-3.5 (.2)	10.3 (.3)	TM	PR130.1907	63	SCHERMER		
	2.5			BD	PR110.1333	58	ROTH		
	2.8 (.1)			BD	PRB1.527	51	SMULL	*	
		B+ - B- = -12.5 (.4)		NP	JPR40.629	79	GLAETTLI	*	*
		B+ - B- = -13.8 (.5)		NP	PR/A135.584	65	SCHERMER		
28-NI	10.3 (.1)			BD	PRB1.527	51	SMULL	*	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
28-NI (CONT.)	16. (5.)			SA	PR83.979	51	WEISS		
	10.4			BD	PR79.395	50	KOEHLER	+	
	10.9			TR	PR71.666	47	FERMI	+	
28-NI- 58 (67.88 %, I=0)	14.4 (.1)				BNL325III.ED.	73	MUGHABGHAB	+	+
	15.0 (.5)			BD	PR 87.487	52	BERNSTEIN	+	
	14.8			BD	PR79.395	50	KOEHLER	+	
28-NI- 60 (26.23% I=0)	2.8 (.1)			BD	PR81.527	51	SHULL	+	+
	2.8			BD	PR79.395	50	KOEHLER	+	
28-NI- 61 (1.19%, I=3/2)	7.60 (.06)			BD	PR156.1225	67	SIDHU	+	+
28-NI- 62 (3.66%, I=0)	-8.7 (.2)			BD	ARN511.303	61	WILKINSON	+	+
	-8.5			BD	PR79.395	50	KOEHLER	+	
28-NI- 64 (1.08%, I=0)	-0.38 (.07)			BD	PR156.1225	67	SIDHU	+	+
29-CU	7.718 (.004)			IN	NIM157.495	78	BRUSPIESS	+	+
	7.6 (1.0)			TM	AKE30.62	77	KROPFF	+	
	7.689 (.006)			PR	ACR/A32.375	76	SCHNEIDER		
	7.61 (.03)			TM	ZN/A29.1750	74	DILG		
	7.63 (.04)			BD	BNL325.III.ED	73	MUGHABGHAB	+	
	7.58 (.05)			BD	ZK135.416	72	ZIGAN	+	
	7.50 (.15)			TM	ZP252.371	72	STEYERL		

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
29-CU (CONT.)	7.46 (.15)			TR	RS133.916	62	BALLY +		
	7.90 (.23)			TR	PR111.261	58	KEATING +		
	7.95 (.30)			TR	RS127.620	56	HEINDL +		
	7.6 (.3)			BD	PR81.527	51	SHULL +		
29-CU- 63 (69.1%, I=3/2)	6.72 (.15)			TR	PR111.261	58	KEATING +	+	
		B+ - B- =	0.45 (.05)	NP	JPR40.629	79	GLAETTLI +	+	
29-CU- 65 (30.9%, I=3/2)	11.09 (.19)			TR	PR111.261	58	KEATING +	+	
		B+ - B- =	3.7 (.2)	NP	JPR40.629	79	GLAETTLI +	+	
30-ZN	5.680 (.005)			IN	NIM157.495	78	BRUSPIESS +	+	
	5.73 (.04)			TM	ZN/A29.1750	74	DILG		
	5.70 (.02)			BD	ACR/A29.49	73	COOPER		
	5.69 (.03)			CF	UNPUBL.MUN	72	KOESTER +		
	5.7 (.1)			BD	ZMP16.820	65	FISCHER +		
	5.9 (.2)			BD	PR81.527	51	SHULL +		
	5.8			TR	PR71.666	47	FERMI +		
30-ZN- 64 (48.9%, I=0)	5.6 (.2)			BD	UNPUBL.MIT	67	SHULL	+	
30-ZN- 66 (27.8%, I=0)	6.3 (.2)			BD	UNPUBL.MIT	67	SHULL	+	
30-ZN- 67 (4.1%, I=5/2)									

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
30-ZN- 68 (18.6%, I=0)	6.7 (.2)			BD	UNPUBL.MIT	67	SHULL		*
30-ZN- 70 (0.62%, I=0)									
31-GA	7.3 (.2)			BD	SPCB.626	64	KONAKHOVICH +		
	7.2 (.1)			BD	PR131.2098	63	ARNOLD +		*
	7.3 (.3)			BD	KR18.786	63	KONAKHOVICH +		
31-GA- 69 (60%, I=3/2)									
31-GA- 71 (40%, I=3/2)									
32-GE	8.19291 .0017)			PR	RCR/A32.375	76	SCHNEIDER		*
	8.1858(.0036)			DD	ZN/A28.657	73	SHULL +		
	8.4 (.2)			BD	PR81.527	51	SHULL +		
32-GE- 70 (20.7%, I=0)	8.4 (.4)			TM	70 HELSINKI1.651	70	VERTEBNY +	32	*
32-GE- 72 (27.5%, I=0)	7.8 (.4)			TM	70 HELSINKI1.651	70	VERTEBNY +	32	*
32-GE- 73 (7.7% I =9/2)	2.8 (1.3)			TM	70 HELSINKI1.661	70	VERTEBNY +	32	*

-NUCLIDE-	- B(FM)	- - B+(FM)	- - B-(FM)	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME	- C. R.
32-GE- 74 (36.4%, I=0)	7.0 (.2)			TM	70 HELSINKI1.651	70	VERTEBNY +	32 +
32-GE- 76 (7.7%, I=0)								
33-AS- 75 (100%, I=3/2)	6.58 (.01)	6.04 (.05)	7.47 (.08)	CF	ZP/A296.43	80	KOESTER +	+
	6.73 (.02)			CF	EENBD.1	77	KOESTER	
	6.4 (.1)			BD	PR131.2098	63	ARNOLD +	
	6.3 (.2)			BD	PR81.527	51	SHULL +	
	6.0 (.3)			SR	PR83.379	51	WEISS +	
		B+ - B- =	-1.43 (.12)	NP	JPR40.629	79	GLAETTLI +	+
34-SE	7.970 (.009)			CF	ZP/A296.43	80	KOESTER +	+
	7.95 (.04)			CF	EENBD.1	77	KOESTER	
	8.10 (.05)			BD	RCG/R25.1233	71	KREBS-LARSEN +	
	8.6				RCG22.827	68	ANDRESEN	
	8.5			BD	ZRRC358.127	68	FUESS +	
	7.8			BD	PR153.558	67	COLOMINAS	
	8.9 (.3)			BD	PR81.527	51	SHULL +	
34-SE- 74 (0.9%, I=0)	0.8 (3.0)			CF	ZP/A296.43	80	KOESTER +	+
34-SE- 76 (9%, I=0)	12.2 (.1)			CF	ZP/A296.43	80	KOESTER +	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
34-SE- 77 (7.5%.I =1/2)	8.25 (.08)			CF	ZP/A296.43	80	KOESTER	+	+
34-SE- 78 (23.5%. I=0)	8.24 (.09)			CF	ZP/A296.43	80	KOESTER	+	+
34-SE- 80 (50%. I=0)	7.48 (.03)			CF	ZP/A296.43	80	KOESTER	+	+
34-SE- 82 (8.84%. I=0)	6.34 (.08)			CF	ZP/A296.43	80	KOESTER	+	+
35-BR	6.78 (.04)			CF	ZP/A301.215	81	KOESTER	+	
	6.79 (.02)			GR	ZP/A272.189	75	KOESTER	+	+
	6.70 (.04)			BD	ACR/A28.663	72	ATOJI	+	
	6.77 (.02)			CF	ZN/A27.901	72	KOESTER	+	
	6.7 (.2)			BD	PR81.527	51	SHULL	+	
	5.6			BD	PR71.666	47	FERMI	+	
35-BR- 79 (50.49 %. I=3/2)	6.79 (.07)			CF	ZP/A301.215	81	KOESTER	+	+
		B+ - B- = -2.3		NP	UNPUBL-SAC	81	GLAETTLI	+	+
		B+ - B- = -3.7		CF	ZP/A IN PRINT	81	KOESTER	+	
35-BR- 81 (49.31 %. I=3/2)	6.78 (.07)			CF	ZP/A301.215	81	KOESTER	+	+
		B+ - B- = 1.2		NP	UNPUBL-SAC	81	GLAETTLI	+	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD -	REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
36-KR	7.80 (.10)			CF	NERNDC/E-212U,64	80	KOESTER +		
	7.52 (.06)			IN	ZP/A291,231	79	KAISER +		
	7.85 (.02)			TM	PR/D8,1305	73	KROHN +		+
	7.91 (.15)			TR	PR/D8,1305	73	KROHN +		
	7.06 (.06)			TM	NP/A133,410	69	RORER +	36	
	7.83			TM	PR148,1303	66	KROHN +		
	7.68 (.19)			TR	PR102,1321	56	CROUCH +		
36-KR- 78 (0.35%, I=0)									
36-KR- 80									
36-KR- 82 (11.6%, I=0)									
36-KR- 83 (11.5%, I=9/2)									
36-KR- 84 (57.0%, I=0)									
36-KR- 86 (17.3%, I=0)									
37-RB	7.09 (.02)			CF	ZP/A301,215	81	KOESTER +		
	7.05 (.05)			BD	ILL-77CO2065	77	COPLEY		
	7.08 (.02)			CF	ZN/A27,901	72	KOESTER +		+
	6.85 (.10)			BD	ACR/A26,376	70	COPLEY		
	7.04 (.08)			BD	CR/B270,560	70	MERIEL		
	7.05 (.25)			BD	ACR/A26,377	70	WANG +		
	6.3			BD	JPR25,565	64	PICKART +		

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
37-RB (CONT.)	8.5 (.1)			BD	ANL-6797-393	63	MUELLER	+	
	5.5 (.2)			BD	PRB1.527	51	SHULL	+	
37-RB- 85 (72.17 %, I=5/2)	7.07 (.10)			CF	ZP/A301.215	81	KOESTER	+	+
	7.0 (.4)			BD	ILL-77CD2065	77	COPLEY		
	8.3 (.1)			BD	ANL-6797-393	63	MUELLER	+	
	6.9			BD	ORNL-TM-3176	61	AGRON	+	
37-RB- 87 (27.83 %, I=3/2)	7.27 (.12)			CF	ZP/A301.215	81	KOESTER	+	+
	7.1 (.7)			BD	ILL-77CD2065	77	COPLEY		
38-SR	7.02 (.02)			CF	ZP/A301.215	81	KOESTER	+	+
	6.92 (.06)			BD	ZK135.316	72	COOPER	+	
	6.88 (.13)			BD	ACR/A27.622	71	COOPER	+	
	6.83 (.07)			BD	ACR/B25.787	69	LOOPSTRA	+	
	5.7 (.2)			BD	PRB1.527	51	SHULL	+	
38-SR- 84 (0.56%, I=0)									
38-SR- 86 (9.9%, I=0)	5.68 (.05)			CF	ZP/A301.215	81	KOESTER	+	+
38-SR- 87 (7%, I=9/2)	7.41 (.07)			CF	ZP/A301.215	81	KOESTER	+	+
38-SR- 88 (82.6%, I=0)	7.16 (.06)			CF	ZP/A301.215	81	KOESTER	+	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME	C.	R.
39-Y - 89 (100%, I=1/2)	7.75 (.02)	8.4 (.2)	5.8 (.5)	CF	ZP/A301.215	81	KOESTER	+	+
	7.75 (.02)			CF	EENBD.1	77	KOESTER		+
	7.65 (.07)			BD	ACR/A31.264	75	BONNET	+	
	7.1			BD	ACR19.679	65	VILLAIN		
	7.81 (.08)			BD	ACR19.679	65	PATON	+	
	7.71 (.02)			TM	NYO-GEN-72-28	64	RUSTADT	+	
	7.9 (.2)			BD	BMC(C185.267	62	FERT		
	8.16 (.70)			BD	SPC7.767	62	KUZMINOV	+	
	8.2 (.8)			BD	KRI7.948	62	KUZMINOV	+	
	7.86 (.17)			BD	JCP35.1950	61	ATOJI		
	8.0 (.1)			BD	ACR10.787	57	PRICE		
		B+ - B- = +2.6 (.7)		NP	JPR40.629	79	GLRETTLI	+	+
40-ZR	7.16 (.03)			CF	ZP/A301.215	81	KOESTER	+	+
	6.9			BD	ACR/B24.230	68	BURNS,	+	
	7.0 (.1)			BD	ANL-6797.393	63	MUELLER		
	6.4			BD	PRB3.88	51	GOLDSCHMIDT	+	
	6.2 (.2)			BD	PR81.527	51	SHULL	+	
40-ZR- 90 (51.48 %, I=0)	6.5 (.1)			CF	ZP/A301.215	81	KOESTER	+	+
40-ZR- 91 (11.23 %, I=5/2)	8.8 (.1)	7.9 (.2)	10.1 (.2)	CF	ZP/A301.215	81	KOESTER	+	+
		B+ - B- = -2.2 (.3)		NP	JPR40.629	79	GLRETTLI	+	+
		B+ - B- = 4.8 (.7)		NP	PRL33.102	74	ROUBEAU	+	

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
40-ZR- 92 (17.11 %, I=0)	7.5 (.2)			CF	ZP/A301.215	81	KOESTER	*	*
40-ZR- 93	5.5 (.1)			CF	ZP/A301.215	81	KOESTER	*	*
40-ZR- 94 (17.4%, I=0)	8.3 (.2)			CF	ZP/A301.215	81	KOESTER	*	*
40-ZR- 96 (2.8%, I=0)									
41-NB- 93 (100%, I=9/2)	7.054 (.003)			IN	NIM157.495	78	BRUSPIESS	*	*
	7.08 (.02)			IN	76LOWELL 2.1027	76	RAUCH	*	
	7.14 (.03)	7.06 (.04)	7.35 (.04)	TM	ZN/A29.1750	74	DILG		*
	7.11 (.04)			CF	ZN/A26.391	71	KOESTER	*	
	6.9 (.2)			BD	PRB1.527	51	SHULL	*	
		B+ - B- =	-0.28 (.02)	NP	JPR40.629	79	GLAETTLI	*	*
		B+ - B- =	-0.28 (.02)	NP	PRL33.102	74	ROUBEAU	*	
42-MO	6.76 (.16)			TM	AKE39.207	81	SALAMA	*	
	6.4 (.9)			TM	AKE31.42	78	KROPFF	*	
	6.95 (.07)			CF	EENBO.1	77	KOESTER		*
	6.4 (.2)			BD	PRB1.527	51	SHULL	*	
42-MO- 92 (15.48 %, I=0)									

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD -	REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
42-MO- 94 (9.1%, I=0)									
42-MO- 95 (15.72% I=5/2)									
42-MO- 96 (16.53% I=0)									
42-MO- 97 (9.5%, I=5/2)									
42-MO- 98 (23.78% I=0)									
42-MO-100 (9.6%, I=0)									
43-TC- 99 (T1/2= 2.1E5Y, I=9/2)	6.8 (.3)			BD	ANL-6794.393	63	MUELLER	+	+
44-RU	7.21 (.07)			CF	EEN80.1	77	KOESTER		+
	7.3 (.1)			BD	PRL11.303	61	WILKINSON	+	
	7.3 (.1)			BD	JAP30.1323	59	SIOMU	+	
44-RU- 96 (5.5%, I=0)									
44-RU- 98 (1.9%, I=0)									
44-RU- 99 (12.7%, I=5/2)									
44-RU-100 (12.6%, I=0)									

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
44-RU-101 (17.07% I=5/2)									
44-RU-102 (31.61% I=0)									
44-RU-104 (18.58% I=0)									
45-RH-103 (100%, I=1/2)	5.88 (.04)			CF	EEN80.1	77	KOESTER		*
	5.91 (.04)			BD	ACR18.905	65	SIDHU	*	
	5.85 (.05)			BD	PR/A134.1547	64	SHIRANE	*	
	5.7			TM	CJP31.432	53	BROCKHOUSE		
46-PD	5.1 (.2)			BD	AC/SA31.375	77	KREBS-LARSEN	*	
	6.0			BD	ACR20.587	66	ATOJI		
	5.91 (.06)			BD	PR140.A2003	65	CABLE	*	*
	5.9			BD	PHY26.744	60	BERGSMA	*	
	5.9 (.3)			BD	PC53.303	57	WORSHAM	*	
	6. (2.)			SA	PR83.379	51	WEISS		
46-PD-102 (1%, I=0)									
46-PD-104 (11%, I=0)									
46-PD-105 (22.53 %, I=5/2)									

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
46-PD-106 (27.33 %. I=0)									
46-PD-108 (26.71 %. I=0)									
46-PD-110 (11.8%. I=0)									
47-AG	5.923 (.007)			IN	UNPUBL.-ILL	81	KISCHKO		
	5.922 (.007)			IN	ZP/A IN PRINT	81	BONSE	+	
	5.97			CF	ZP/A297.85	80	KOESTER	+	
	5.923 (.006)			IN	NIM 157.495	78	BRUSPIESS	+	+
	6.02 (.02)			CF	DIPL.THES.MUN	75	WUNDERLICH		
	6.1 (.2)			80	PR 81.527	51	SMULL	+	
47-AG-107 (51.3%. I=1/2)	7.556 (.015)			IN	UNPUBL.-ILL	81	KISCHKO	+	
	7.555 (.011)	8.14 (.09)	5.8 (.3)	IN	ZP/A IN PRINT	81	BONSE	+	
	7.64 (.04) +(0.01	8.22 (.09)	5.9 (.2)	CF	ZP/A297.85	80	KOESTER	+	
	8.3 (.2)			80	PR 81.527	51	SMULL	+	
		B+ - B- =	2.3 (.3)	NP	JPR 40.629	79	GLAETTLI	+	+
47-AG-109 (48.2%. I=1/2)	4.166 (.016)			IN	UNPUBL.-ILL	81	KISCHKO	+	
	4.165 (.011)	3.24 (.08)	6.9 (.2)	IN	ZP/A IN PRINT	81	BONSE	+	
	4.19 (.03) -(0.025	3.27 (.08)	7.0 (.2)	CF	ZP/A297.85	80	KOESTER	+	+
	4.3 (.1)			80	PR 81.527	51	SMULL	+	
		B+ - B- =	-3.7 (.3)	NP	JPR 40.629	79	GLAETTLI	+	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
48-CD	3.8 -1 1.2			BD	JPJ17.935	62	PETERSEN	*	4B
	5.1 (.3)			BD	PR126.2262	62	ARNOLD	*	4B *
	4.9 (.2)			TR	RS133.916	62	BALLY	*	4B *
	5.8 (.3)			BD	PR124.1848	61	ARNOLD	*	4B
	4.4 (.4)			BD	PRL6.7	61	PETERSEN	*	4B
48-CD-106 (1.2%, I=0)									
48-CD-108 (0.9%, I=0)									
48-CD-110 (12.39 %, I=0)									
48-CD-111 (12.75 %, I=1/2)									
48-CD-112 (24.07 %, I=0)	7.4 (.2)			TM	AE27.1117	69	VERTEBNYI	*	*
48-CD-113 (12.36 %, I=1/2)	-8.0 -1 7.5			BD	JPR25.615	64	SMITH		*
48-CD-114 (28.86 %, I=0)	6.4 (.2)			TM	AE27.1117	69	VERTEBNYI	*	*
48-CD-116 (7.58%, I=0)	7.1 (.2)			TM	AE27.1117	69	VERTEBNYI	*	*
49-IN	4.065 (.020) -1 0.054			CF	ZP/A297.85	80	KOESTER	*	*

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
49-IN (CONT.)	4.08 (.04)			CF	EENBD.1	77	KOESTER		
	3.9 (.1)			BD	PR131.2098	63	ARNOLD	*	
	3.6 (.3)			BD	JAP30.1323	59	SIDHU	*	
49-IN-113 (4.28%, I=9/2)	5.39 (.06)			CF	ZP/A297.85	80	KOESTER	*	*
49-IN-115 (95.72 %, I=9/2)	4.00 (.03) -I 0.056	2.1 (.1)	6.4 (.4)	CF	ZP/A297.85	80	KOESTER	*	*
50-SN	6.2170(.0015)			GR	NEANDC.220V	78	KOESTER	*	
	6.228 (.004)			IN	NIM157.495	78	BRUSPIESS	*	*
	6.220 (.002)			IN	76GATLINBURG2.1094	76	BRUSPIESS	*	*
	6.220 (.002)			IN	76LOWELL 2.1027	76	RAUCH	*	
	6.1 (.1)			BD	PR81.527	51	SHULL	*	
50-SN-112 (1.0%, I=0)									
50-SN-114 (0.66%, I=0)									
50-SN-115 (0.35%, I=1/2)									
50-SN-116 (14.3%, I=0)	5.8 (.1)			BD	ACR23.868	67	KRY	*	*
50-SN-117 (7.61%, I=1/2)	6.40 (.25)			BD	ACR23.868	67	KRY		*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
50-SN-118 (24.03 %. I=0)	5.8 (.1)			BD	ACR23.868	67	KAY	+	+
50-SN-119 (8.58%. I=1/2)	6.00 (.25)			BD	ACR23.868	67	KAY	+	+
50-SN-120 (32.86 %. I=0)	6.4 (.1)			BD	ACR23.868	67	KAY	+	+
50-SN-122 (4.72%. I=0)	5.5 (.3)			BD	ACR23.868	67	KAY	+	+
50-SN-124 (5.94%. I=0)	5.9 (.2)			BD	ACR23.868	67	KAY	+	+
51-SB	5.641 (.012)			CF	ZN/A26.391	71	KOESTER	+	+
	5.4 (.1)			BD	PR131.2098	63	ARNOLD	+	
	5.4 (.1)			BD	PRB1.527	51	SHULL	+	
	5.6 (.3)			SR	PRB3.379	51	WEISS		
51-SB-121 (57.25 %. I=5/2)									
51-SB-123 (42.75 %. I=7/2)									
52-TE	5.8			BD	ACSA27.85	73	LINDQUIST	+	
	5.43 (.04)			CF	ZN/A26.391	71	KOESTER	+	+
	5.6 (.2)			TR	R5127.520	56	HEINDL	+	

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
52-TE-120 (0.09%, I=0)	5.3 (.5)			TR	RS127.620	56	HEINDL	*	*
52-TE-122 (2.4%, I=0)									
52-TE-123 (0.87%, I=1/2)	5.8 (.3)			TR	RS127.620	56	HEINDL	*	*
52-TE-124 (4.61%, I=0)	5.6 (.3)			BD	ARN11.303	61	WILKINSON	*	*
52-TE-125 (6.99%, I=1/2)	5.6 (.3)			BD	ARN11.303	61	WILKINSON	*	*
52-TE-126 (18.71 %, I=0)									
52-TE-128 (31.79 %, I=0)									
52-TE-130 (34.48 %, I=0)	5.7 (.3)			TR	RS127.620	56	HEINDL	*	*
53-J -127 (100%, I=5/2)	5.25 (.04)			BD	ACR/A28.663	72	ATOJI		
	5.28 (.02)			CF	ZN/A27.901	72	KOESTER	*	*
	5.2 (.2)			BD	PRB1.527	51	SHULL	*	
	3.6			BD	PR71.666	47	FERMI	*	
54-XE	4.69 (.04)			IN	ZP/A291.231	79	KAISER	*	
	4.80 (.07)			BD	JCP59.453	73	PETERSEN	*	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
54-XE (CONT.)	5.22 (.11)			TR	PR/DB.1305	73	KROHN	*	
	4.89 (.03)			BD	PR/DB.1305	73	KROHN	*	*
	4.87 (.10)			BD	NB.GS.COMP.211	63	BURNS		
	5.10 (.17)			TR	PR102.1321	56	CROUCH	*	
54-XE-124 (0.1%. I=0)									
54-XE-126 (0.09%. I=0)									
54-XE-128 (1.9%. I=0)									
54-XE-129 (26.14 %. I=1/2)									
54-XE-130 (3.3%. I=0)									
54-XE-131 (21.18 %. I=3/2)									
54-XE-132 (26.89 %. I=0)									
54-XE-134 (10.4%. I=0)									
54-XE-136 (8.9%. I=0)									
55-CS-133 (100%. I=7/2)	5.42 (.02)			CF	ZN/A27.901	72	KOESTER	*	*
	5.2 (.2)			BD	ZK134.308	71	CHADWICK	*	
	5.5 (.2)			BD	ACR/A27.494	71	COX	*	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
55-CS-133 (CONT.)	7.5			BD	ACR20.315	66	ZIVADINOVIC	+	
	4.9 (.2)			BD	PRB1.527	51	SKULL	+	
		B+ - B- =	+2.6 (.3)	NP	JPR40.629	79	GLAETTLI	+	+
56-BA	5.28 (.05)			CF	EEN80.1	77	KOEGTER		
	5.28 (.05)			BD	ACR135.316	72	COOPER	+	
	5.25 (.04)			BD	ZK135.316	72	COOPER	+	+
	5.30 (.15)			BD	ACR/B28.956	72	JACOBSEN		
	5.22 (.13)			BD	ACR/A27.622	71	COOPER	+	
	5.31 (.08)			BD	ACR/B25.787	69	LOOPSTRA	+	
	7.9			BD	PR71.666	47	FERMI	+	
56-BA-130 (0.1%, I=0)									
56-BA-132 (0.09%, I=0)									
56-BA-134 (2.4%, I=0)									
56-BA-135 (6.59%, I=3/2)									
56-BA-136 (7.81%, I=0)									
56-BA-137 (11.32 %, I=3/2)									
56-BA-138 (71.66 %, I=0)									

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
57-LA	8.27 (.05)			CF	EEN80.1	77	KOESTER		*
	8.32 (.14)			BD	JCP35.1950	61	ATOJI		
	8.3 (.3)			BD	PR91.597	53	KOEHLER	*	
57-LA-138 (0.09%, I=5)									
57-LA-139 (99.91 %, I=7/2)		B+ - B- =	6.1 (.4)	NP	JPR40.629	79	GLAETTLI	*	*
		B+ - B- =	7.3 (.3)	NP	PRL33.102	74	ROUBEAU	*	
58-CE	4.8 (.2)			BD	AKF33.212	79	ADIB	*	
	4.83 (.04)			CF	EEN80.1	77	KOESTER		
	4.82 (.06)			BD	AERE-R-4939	65	VALENTINE	*	
	4.84 (.06)			BD	JCP35.1950	61	ATOJI		*
	4.6 (.2)			BD	PR91.597	53	KOEHLER	*	
58-CE-136 (0.19%, I=0)									
58-CE-138 (0.26%, I=0)									
58-CE-140 (88.48 %, I=0)	4.7 (.1)			BD	PR91.597	53	KOEHLER	*	*
58-CE-142 (11.07 %, I=0)	4.5 (.2)			BD	PR91.597	53	KOEHLER	*	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME	C.	R.
59-PR-141 (100%, I=5/2)	4.45 (.05)			CF	EEN80.1	77	KOESTER		+
	4.90 (.15)			BD	JET40.430	75	AKOPYAN	+	
	4.4 (.4)			BD	PR91.597	53	KOEHLER	+	
60-ND	7.80 (.07)			CF	EEN80.1	77	KOESTER		
	7.69 (.05)			BD	ACR/B31.2745	75	BUECHERLE	+	+
	7.5 (.1)			BD	JP/C6.725	73	SCHOBINGER	+	
	7.2 (.2)			BD	PR91.597	53	KOEHLER	+	
60-ND-142 (27.11 %, I=0)	7.7 (.3)			BD	PR91.597	53	KOEHLER	+	+
60-ND-143 (12.17 %, I=7/2)									
60-ND-144 (23.85 %, I=0)	2.4 (.1)				BNL325	73	MUGHABGHAB	+	+
	2.8 (.3)			BD	PR91.597	53	KOEHLER	+	
60-ND-145 (8.5%, I=7/2)									
60-ND-146 (17.22 %, I=0)	8.7 (.2)			BD	PR91.597	53	KOEHLER	+	+
60-ND-148 (5.7%, I=0)									
60-ND-150 (5.6%, I=0)									

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
61-PM-147 (T1/2= 2.62Y)	12.6 (.4)			CF	UNPUBL.ORNL	72	KOEHLER		+
62-SM									
62-SM-144 (3.1%, I=0)									
62-SM-147 (15%, I=7/2)									
62-SM-148 (11.2%, I=0)									
62-SM-149 (13.8%, I=7/2)									
62-SM-150 (7.4%, I=0)									
62-SM-152 (26.7%, I=0)	-5.0 (.6)			BD	PR91,597	53	KOEHLER	+	+
62-SM-154 (22.8%, I=0)	8. (1.)			BD	PR91,597	53	KOEHLER	+	+
63-EU	6.8 (.4)			BD	UNPUBL.ORNL	72	KOEHLER	+	
	6.0 (.4)			BD	PR126,2252	62	ARNOLD	+	+
	6.3 (.3)			BD	PR127,2101	62	NERESON	+	
	5.5 (.4)			BD	PR124,1848	61	ARNOLD	+	
	8.0 (.5)			BD	PR124,1848	61	ARNOLD	+	63

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	- REFERENCE -	YEAR	-AUTHOR'S NAME -	C.	R.
63-EU-151 (47.8%, I=5/2)									
63-EU-153 (52.8%, I=5/2)	8.13 (.12)			BD	UNPUBL.-ILL	81	KISCHKO	+	
	8.22 (.14)			IN	UNPUBL.-ILL	81	KISCHKO	+	+
	8.3 (.3)			BD	PRL27,741	71	ALS-NIELSEN	+	
64-GD	9.5 (.2)			BD	KKH8,302	75	WATANABE	+	
	11.5 (1.5)			BD	KKH8,125	75	WATANABE	+	
	9.5 (.4)			BD	KKH8,302	75	WATANABE	+	+
	14.0 (.5)			BD	KKH7,336	74	ISHIKAWA	+	
	15.0 (2.0)			BD	JAP35,1045	64	WILL	+	
64-GD-152 (0.2%, I=0)									
64-GD-154 (2.2%, I=0)									
64-GD-155 (14.9%, I=3/2)									
64-GD-156 (20.6%, I=0)									
64-GD-157 (15.7%, I=3/2)									
64-GD-158 (24.7%, I=0)									
64-GD-160 (21.7%, I=0)	9.15 (.05)			BD	JPR32,296	72	KOEHLER	+	
	9.15 (.05)			BD	PR /B5,997	72	MOON		+
	9.1 (.4)			BD	JAP38,1381	67	CHILD	+	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
65-TB-159 (100%, I=3/2)	7.28 (.04)			NP	THESIS.VIE	80	SCHNEIDER		
	7.38 (.03)			CF	EEN80.1	77	KOESTER		+
	7.35 (.10)			BD	SSC18.557	76	FUESS		
	7.6 (.2)			BD	PR131.1518	63	FELCHER	+	
	7.6 (.2)			BD	JCP35.1950	61	ATOJI		
	7.56 (.20)			BD	PR121.610	61	ATOJI		
		B+ - B- =	3.5 (1.4)	NP	JET42.397	76	AKOPYAN		+
66-DY	17.1 (.3)			CF	EEN80.1	77	KOESTER		
	16.9 (.4)			BD	PR174.1553	68	CHILD	+	+
	17.1 (.5)			BD	PSS2.K164	62	BETZL	+	
66-DY-156 (0.06%, I=0)									
66-DY-158 (0.1%, I=0)									
66-DY-160 (2.3%, I=0)	6.7 (.4)			BD	PR174.1553	68	CHILD	+	+
66-DY-161 (18.9%, I=5/2)	10.3 (.4)			BD	PR174.1553	68	CHILD	+	+
66-DY-162 (25.5%, I=0)				TM	TOMELS(NK11.661	70	VERTEBNI	+	
	-1.4 (.5)			BD	PR174.1553	68	CHILD	+	+
66-DY-163 (24.9%, I=5/2)	5.0 (.4)			BD	PR174.1553	68	CHILD	+	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
66-DY-164 (28.2%, I=0)	45.7 (.6)			TM	70HELSINKI 1.651	70	VERTEBNI	+	
	49.4 (.5)			BD	PR174.1553	68	CHILD	+	+
67-HO-165 (100%, I=7/2)	8.37 (.05)			NP	THESIS.VIE	80	SCHNEIDER		
	8.08 (.05)			BD	ACR/A35.818	79	BOUCHERLE	+	+
		7.0 (.4)	10.4 (.4)	NP	AIP18.411	74	LITTLE	+	+
	8.5 (.2)			BD	PR110.37	57	KOEHLER	+	
		B+ - B- =	-3.5 (.4)	NP	JPR40,529	79	GLRETTLI	+	+
		B+ - B- =	-2.94 (.15)	NP	UNPUBL.GRE	77	BOUCHERLE		
		B+ - B- =	-3.5 (.4)	NP	UNPUBL.GRE	77	BOUCHERLE		
		B+ - B- =	-3.6 (.4)	NP	PHY/B81.245	76	ABRAGAM	+	
		B+ - B- =	-3.4 (.3)	BD	AIP18.411	74	LITTLE	+	
		B+ - B- =	-3.4 (.4)	NP	JPR34.423	73	HERPIN	+	
68-ER	8.03 (.03)			CF	EENBD.1	77	KOESTER		+
	7.9 (.2)			BD	PR91.597	53	KOEHLER	+	
68-ER-162 (0.14%, I=0)									
68-ER-164 (1.6%, I=0)	9.8 (.7)			TM	70HELSINKI 1.661	70	VERTEBNY	+	+
68-ER-166 (33.4%, I=0)	12.3 (.6)			TM	70HELSINKI 1.661	70	VERTEBNY	+	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD -	REFERENCE -	YEAR -	AUTHOR'S NAME -	C.	R.
68-ER-167 (22.9%, I=7/2)									
68-ER-168 (27.0%, I=0)	10.2 (.5)			TM	70HELSINKI1.661	70	VERTEBNI	+	+
68-ER-170 (15%, I=0)	10.9 (.5)			TM	70HELSINKI 1.661	70	VERTEBNY	+	+
69-TM-169 (100%, I=1/2)	7.05 (.05)			CF	EEN80.1	77	KOESTER		+
	7.05 (.05)			BD	USNDC-3.25	72	LANDER	+	
	7.20 (.06)			BD	JCPS2.6431	70	ATOJI		
	6.9 (.2)			BD	PSS2.K164	62	BETZL	+	
	6.9 (.2)			BD	PR126.1672	62	KOEHLER	+	
	5.5			BD	ARN27.620	56	WILKINSON	+	
70-YB	12.6 (.6)			CF	EEN80.1	77	KOESTER		
	12.90 (.07)			BD	JCPS2.6430	70	ATOJI		+
	12.62 (.12)			BD	PR121.610	61	ATOJI	+	+
70-YB-168 (0.14%, I=0)									
70-YB-170 (3.0%, I=0)									
70-YB-171 (14.3%, I=1/2)									
70-YB-172 (21.9%, I=0)									

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
70-YB-173 (16.3%, I=5/2)									
70-YB-174 (31.8%, I=0)									
70-YB-176 (12.7%, I=0)									
71-LU	7.3 (.2)			BD	PR121.610	61	ATOJI		*
71-LU-175 (97.4%, I=7/2)									
71-LU-176 (2.6%, I=7)									
72-HF	7.77 (.14)			BD	PR121.610	61	ATOJI		*
	8.8			BD	ACR9.607	56	SIOHU	*	
72-HF-174 (0.18%, I=0)									
72-HF-176 (5.2%, I=0)									
72-HF-177 (18.5%, I=0)									
72-HF-178 (27.2%, I=0)									
72-HF-179 (13.8%, I=9/2)									

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
72-HF-180 (35.1%, I=0)									
73-TA	6.91 (.07)			CF	ZN/A26.391	71	KOESTER	+	+
	7.0 (.3)			BO	PR81.527	51	SHULL	+	
73-TA-180 (.0012%, I=0)									
73-TA-181 (99.98%, I=7/2)		B+ - B- =	-0.59 (.06)	NP	JPR40.629	79	BLRETTLI	+	73
		B+ - B- =	-0.59 (.06)	NP	PRL33.102	74	ROUBEAU	+	73 +
74-W	4.77 (.05)			CF	ZP219.300	69	KOESTER	+	+
	5.1 (.3)			BO	PR81.527	51	SHULL	+	
74-W -180 (0.13%, I=0)									
74-W -182 (26.3%, I=0)	8.33 (.14)			BO	YF10.328	69	ALEKSANDROV	+	+
74-W -183 (14.3%, I=1/2)	4.3 (.5)			BO	YF10.328	69	ALEKSANDROV	+	+
74-W -184 (30.7%, I=0)	7.59 (.09)			BO	YF10.328	69	ALEKSANDROV	+	+
74-W -186 (28.6%, I=0)	-1.19 (.05)			BO	PL/A72.361	79	ALEKSANDROV	+	74
	-1.19 (.05)			BO	YF10.328	69	ALEKSANDROV	+	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
75-RE	9.2 (.2)			BO	ARN11.303	61	WILKINSON	*	*
75-RE-185 (37.5%. I=5/2)									
75-RE-187 (62.5%. I=5/2)									
76-OS	10.7 (.2)			BO	ANL-6797.393	63	MUELLER	*	*
	10.8			BO	PR105.216	57	HEATON	*	
76-OS-184 (0.02%. I=0)									
76-OS-186 (1.6%. I=0)									
76-OS-187 (1.6%. I=1/2)									
76-OS-188 (13.3%. I=0)	7.8 (.3)			BO	ANL-6797.393	63	MUELLER	*	*
76-OS-189 (16.1%. I=3/2)	11.0 (.3)			BO	ANL-6797.393	63	MUELLER	*	*
76-OS-190 (26.4%. I=0)	11.4 (.3)			BO	ANL-6797.393	63	MUELLER	*	*
76-OS-192 (41%. I=0)	11.9 (.4)			BO	ANL-6797.393	63	MUELLER	*	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
77-IR	10.0			BD	PR131.1518	63	FELCHER	+	
	10.6 (.3)			BD	ANL6797.393	63	MUELLER	+	+
	3.6			BD	JAP30.1323	59	SIDHU	+	
77-IR-191 (37.4%, I=3/2)									
77-IR-193 (62.6%, I=3/2)									
78-PT	9.5 (.3)			BD	PR81.527		SHULL	+	+
78-PT-190 (0.01%, I=0)	9.			TM	SNP22.348	75	VERTEBNYI	+	+
78-PT-192 (1.78%, I=0)	9.9 (.5)			TM	SNP22.348	75	VERTEBNYI	+	+
78-PT-194 (32.9%, I=0)	10.55 (.08)			TM	SNP22.348	75	VERTEBNYI	+	+
78-PT-195 (33.8%, I=1/2)		B+ - B- =	-2.3 (.4)	NP	JPR40.629	79	GLAETTLI	+	+
78-PT-196 (25.3%, I=0)	8.89 (.08)			TM	SNP22.348	75	VERTEBNYI	+	+
78-PT-198 (7.2%, I=0)	7.8 (.1)			TM	SNP22.348	75	VERTEBNYI	+	+

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
79-AU-197 (100%, I=3/2)	7.63 (.06)			CF	EENBO.1	77	KOESTER		+
	7.66 (.02)			CF	DIPL.THES.MUN	74	WUNDERLICH		
	7.7 (.4)			BD	PRB1,527	51	SHULL	+	
		B+ - B- =	-3.5 (.3)	NP	JPR40,A29	79	GLAETTLI	+	+
80-HG	12.66 (.02)			GR	EENBO.1	77	KOESTER		+
	12.69 (.02)			TR	PR174,313	68	BARTOLINI	+	
	16.69 (.02)			GR	ZP182,328	65	KOESTER		
	12.67 (.06)			TR	BAPB,477	63	BARTOLINI	+	
	13.10 (.07)			TR	PRB2,560	51	HIBDON	+	
80-HG-196 (0.15%, I=0)									
80-HG-198 (10.1%, I=0)									
80-HG-199 (16.9%, I=1/2)									
80-HG-200 (23.1%, I=0)									
80-HG-201 (13.2%, I=3/2)									
80-HG-202 (29.7%, I=0)									
80-HG-204 (6.8%, I=0)									

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
81-TL	8.89 (.02)			CF	EENB0.1	77	KOESTER		*
	8.9			BD	PR105.216	57	HEATON	*	
	7.5 (.8)			BD	PR75.975	49	WINSBERG	*	
81-TL-203 (29.5%, I=1/2)									
81-TL-205 (70.5%, I=1/2)									
82-PB	9.4003(.0014)			GR	PRL36.1021	76	KOESTER	*	*
	9.39 (.05)			CF	ZN/A27.901	72	KOESTER	*	
	9.409 (.004)			TM	ZN/A26.442	71	DILG	*	
	9.40 (.01)			GR	ZP227.152	69	NUECKER		
	9.6 (.4)			BD	PR81.527	51	SHULL	*	
	4.8			BD	PR71.666	47	FERMI	*	
82-PB-204 (1.4%, I=0)									
82-PB-205 (24.1%, I=0)									
82-PB-207 (22.1%, I=1/2)		B+ - B- =	0.2 (.4)	NP	JPR40.629	79	GLAETTLI		*
82-PB-208 (52.4%, I=0)									
83-BI-209 (100%, I=9/2)	8.503 (.012)			IN	NIM157.495	78	BRUSPIESS	*	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
83-BI-209 (CONT.)	8.58 (.05)			IN	76GATLINBURG 2.1099	76	BRUSPIESS	+	
	8.580 (.008)			IN	76LOWELL 2.1027	76	RAUCH	+	
	8.5256(.0014)			TR	PRL36.1021	76	KOESTER	+	+
	8.530 (.005)			TM	ZN26.442	71	OILG	+	
	9.5239(.0019)			TR	ZP227.152	69	NUECKER		
	8.625 (.004)			TM	ZP186.23	65	TRIFTSHAEUSER		
	8.9 (.4)			BD	PR81.527	51	SHULL	+	
		B+ - B- =	0.44 (.09)	NP	JPR40.629	79	GLAETTLI	+	
85-AT									
86-RN									
87-FR									
88-RA-226 (T1/2= 1.62E3Y I=0)	10.0 (1.0)			TM	SNP14.1	72	KALABIN	+	+
90-TH-232 (100%. I=0)	10.52 (.06)			CF	EEN80.1	77	KOESTER		
	9.84 (.03)			TM	NP61.381	65	RAYBURN	+	+
	10.00 (.09)			BD	PRS/A274.122	63	WILLIS		
	9.8 (.1)			BD	ACR15.351	62	ROOF	+	

-NUCLIDE-	B(FM)	B*(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.	R.
90-TH-232 (CONT.)	10.66			TM	PR85.595	52	HIBDON	+	
	10.1 (.5)			BD	PR81.527	51	SHULL	+	
91-PA-231 (T1/2= 3.25E4 Y, I=3/2)	13. (2.)			BD	UNPUBL.HARWELL	73	WEDGEWOOD	+	
	9.1 (.3)			BD	UNPUBL.HARWELL	73	WEDGEWOOD	+	+
92-U	8.42 (.02)			BD	AERE-R9079	79	COOPER	+	+
	8.44 (.04)			BD	ZK149.337	79	COOPER	+	
	8.61 (.04)			CF	EEN80.1	77	KOESTER		
	8.52 (.09)			BD	UNPUBL.HARWELL	70	TAYLOR	+	
	8.36 (.03)			BD	UNPUBL.HARWELL	68	ROUSE	+	
	8.5 (.2)			BD	ACR20.587	66	ATOYI		
	8.50 (.06)			BD	PRS/A274.122	63	WILLIS		
	8.4 (.2)			BD	ACR15.951	62	ROOF	+	
	8.78 (.56)			BD	ICP35.1950	61	ATOYI		
92-U -234 (0.005% I=0)									
92-U -235 (0.72%, I=7/2)	9.8 (.6)			BD	ACR20.587	66	ATOJI		+
	9.8 (.6)			BD	PRS/A274.122	63	WILLIS		
92-U -238 (99.27% I=0)	8.63 (.04)			CF	UNPUBL.MUN	74	KOESTER		
	8.55 (.06)			BD	ACR20.587	66	ATOJI		+
	8.50 (.06)			BD	PRS/A274.122	63	WILLIS		

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD -	REFERENCE	- YEAR	-AUTHOR S NAME -	C.	R.
92-U -238 (CONT.)	8.4 (.5)			BD	ACR15.351	62	ROOF	+	
93-NP-237 (T1/2= 2.14E6Y I=5/2)	10.55 (.10)			BD	ACR/A30.667	74	HEATON	+	+
	10.57 (.15)			BD	PCS28.1649	67	COX	+	
	10.55 (.10)			BD	PCS28.1651	67	HEATON	+	
94-PU-239 (T1/2= 2.44E4 Y, I=1/2)	7.7 (.1)			BD	JNM34.281	70	GREEN		+
	7.5 (.3)			BD	ACR20.587	66	ATOJI		
	7.5 (.3)			BD	ACR15.351	62	ROOF	+	
94-PU-240 (T1/2= 6.54E3 Y, I=0)	3.5 (.1)			BD	ACR/B27.2284	71	LANDER	+	+
	3.8 (.2)			BD	JNM34.281	70	GREEN	+	
94-PU-242 (T1/2= 3.87E5 Y, I=0)	8.1 (.1)			BD	ACR/B27.2254	71	LANDER	+	+
95-AM-243 (T1/2= 7.37E3 Y, I=5/2)	8.3 (.2)			BD	JPRL40.335	79	BOEUF	+	+
	7.6 (.1)			BD	ACR/A30.667	74	MUELLER		
96-CM-244 (T1/2= 17.9Y, I=7/2)	9.5 (.3)			BD	PHY/BC86.31	77	FOURNIER	+	+
	7.0 (.2)			BD	ACR/A30.667	74	MUELLER	+	

ABBREVIATIONS USED IN COLUMN "METHOD"

BD	BRAGG - DIFFRACTION
CF	CHRISTIANSEN - FILTER
DD	DYNAMIC DIFFRACTION
GR	GRAVITY - REFRACTION
HE	HIGH ENERGY
IN	INTERFEROMETER
M	MANY METHODS
NP	NUCLEAR - POLARIZATION
PR	PRIM - REFRACTION
SA	SMALL - ANGLE - SCATTERING
TM	TRANSMISSION
TR	TOTAL REFLECTION

ABBREVIATIONS USED IN COLUMN "REFERENCE"

(/A. /B. /C MEANS SERIES A. B. C OF THE JOURNAL)

ACR	ACTA CRYSTALLOGRAPHICA
ACS	JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
ACSA	ACTA CHEMICA SCANDINAVICA
AE	AKTIEBOLAGET ATOMENERGIE. STOCKHOLM / STUDSVIK
AECU	USAEC REPORTS. DIV. TECH. INF., EXTINCT
AERE	AERE - HAREWELL REPORTS
AIP	ADVANCES IN PHYSICS
AKE	ATOMKERNENERGIE
ANL-	ARGONNE NATIONAL LABORATORY REPORTS
ARN	ANNUAL REVIEW OF NUCLEAR SCIENCE
BAP	BULLETIN OF THE AMERICAN PHYSICAL SOCIETY
BNL	BROOKHAVEN NATIONAL LABORATORY REPORTS
BMC	BULLETIN DE LA SOCIETE FRANCAISE DE MINERALOGIE ET DE CRISTALLOGRAPHIE
CJB	CANADIAN JOURNAL OF PHYSICS
CR	COMPTES RENDUS
EANDC	EUROPEAN - AMERICAN NUCLEAR DATA COMMITTEE
EEN	ERGEBNISSE DER EXAKTEN NATURWISSENSCHAFTEN
FRM	FORSCHUNGSREAKTOR MUENCHEN. REPORTS
76GATLINBURG	CONFERENCE ON NEUTRON SCATTERING. CONF-760601. ORNL
55GENEVA	FIRST INTERNATIONAL CONFERENCE ON PEACEFUL USES OF ATOMIC ENERGY. IAEA
70HARWELL	INTERNATIONAL CONFERENCE ON NEUTRON PHYSICS AND NUCLEAR DATA FOR REACTORS AND OTHER APPLIED PURPOSES
70HELSINKI	CONFERENCE ON NULEAR DATA REACTORS. IAEA
IAEA	INTERNATIONAL ATOMIC ENERGY AGENCY. VIENNA
ICP	APPLIED CHEMISTRY CORPORATION. IDAHO
ILL	INSTITUT LAUE-LANGEVIN. GRENOBLE
JAP	JOURNAL OF APPLIED PHYSICS
JCP	JOURNAL OF CHEMICAL PHYSICS
JET	SOVIET PHYSICS - JETP
JINR	JOINT INSTITUTE OF NUCLEAR RESEARCH. DUBNA
JNM	JOURNAL OF NUCLEAR MATERIALS
JP	JOURNAL OF PHYSICS
JPC	JOURNAL DE CHIMIE. PHYSIQUE ET DE PHYSICOCHIMIE
JPJ	JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN
JPR	JOURNAL DE PHYSIQUE
JPRL	JOURNAL DE PHYSIQUE LETTRES
JPRS	JOURNAL DE PHYSIQUE SUPPLEMENT
KKH	KAKURIKEN KENKYU HOKOKU (JAPAN)
KRI	KRISTALLOGRAFIYA
KIEV-ITP	ACADEMY OF SCIENCE UKRAINIAN SSR. INSTITUTE FOR THEORETICAL PHYSICS
72LOS ANGELES	INTERNATIONAL CONFERENCE ON FEW-PARTICLES. PR.CEE...NGS BY NORTH-HOLLAND AMET.
76LOWELL	INTERNATIONAL CONFERENCE ON INTERACTION NEUTRON NUCLEI. CONF-760715
MIT	MASS. INST. TECHN.
MUN	MUNICH

ABBREVIATIONS USED IN COLUMN "REFERENCE" (CONT.)

NEANDC	NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMISION
NB.GS.COMP.	NOBLE GAS COMPOUNDS
NDR	NUCLEAR DATA FOR REACTORS - IAEA
NIM	NUCLEAR INSTRUMENTS AND METHODS
NP	NUCLEAR PHYSICS
NYO-GEN	COLUMBIA UNIVERSITY, NEW YORK
ORNL	OAK RIDGE NATIONAL LABORATORY
PA	PHYSICS ABSTRACTS
PCS	PHYSICS AND CHEMISTRY OF SOLIDS
7SPETTEN	NEUTRON DIFFRACTION CONFERENCE RCN-REPORT
PHY	PHYSICA
PL	PHYSICS LETTERS
PR	PHYSICAL REVIEW
PRL	PHYSICAL REVIEW LETTERS
PRS	PROCEEDINGS ROYAL SOCIETY OF LONDON
RCN	REACTOR CENTRUM NEDERLAND
RSI	REVIEW OF SCIENTIFIC INSTRUMENTS
RMP	REVIEW OF MODERN PHYSICS
72ROME	SYMPOSIUM ON PRESENT STATUS AND NOVEL DEVELOPEMENTS IN THE MANY BODY PROBLEM, ROME 1972
SAC	CEN SACLEY
SJPN	SOVIET JOURNAL OF PARTICLE AND NUCLEI
SNP	SOVIET JOURNAL OF NUCLEAR PHYSICS
SPC	SOVIET PHYSICS - CRYSTALLOGRAPHY
SSC	SOLID STATE COMMISSION
USNDC	REPORTS TO NUCLEAR DATA COMMISION
VIE	VIENNA
YF	YADERNAYA FISIKA
ZAAC	ZEITSCHRIFT FUER ANORGANISCHE ALLGEMEINE CHEMIE
ZK	ZEITSCHRIFT FUER KRISTALLOGRAPHIE
ZMP	ZEITSCHRIFT FUER ANGEWANDTE MATHEMATISCHE PHYSIK
ZN	ZEITSCHRIFT FUER NATURFORSCHUNG
ZP	ZEITSCHRIFT FUER PHYSIK
77ZUERICH	INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS AND NUCLEAR STRUCTURE, BIRKHAUSER-VERLAG, BASEL-STUTTGART

MEANING OF NUMBERS IN COLUMN "C." (COMMENT)

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1 : CORRECTED FOR NEW B-VALUE OF 1-H - 2
1A: OBTAINED FROM SIGMA SCATT. AND THEORY
1B: OBTAINED BY A COMBINATION WITH PL/B9:.200 (1980)
2 : USE VALUE FOR 2-HE
5 : FOR B+(FM) AND B-(FM) THE VALUES 3.9 AND -5.2 ARE POSSIBLE TOO
13 : THE OTHER SIGN OF THE VALUE IS POSSIBLE TOO
14 : FOR B+(FM) AND B-(FM) THE VALUES 5.39 (.15) AND 2.8 (.4) ARE POSSIBLE TOO
15 : SMALLER THAN 0.7 FM
17 : SMALLER THAN 0.4 FM
21 : SIGN CHANGED
22 : FOR B+(FM) AND B-(FM) THE VALUES -3.5 (.2) AND 6.8 (.3) ARE POSSIBLE TOO
23 : USE VALUE FOR 23-V . WITHOUT CORRECTION FOR 23-V - 50
32 : CALCULATED FROM CROSS SECTION DATA
36 : CALCULATED FROM CROSS SECTION DATA
48 : VALUE DEPENDS ON LAMDA
63 : NON RESONANT CONTRIBUTION FOR LAMDA = 1.067 A
73 : WITHOUT CORRECTION FOR 73-TA-180
74 : CALCULATED FROM A 90.7% ENRICHED W -186 SAMPLE

NEUTRON SCATTERING LENGTHS

APPENDIX B, RECOMMENDED VALUES

UPDATED: 15.12.1981

EXTRACTED FROM A SUMMARY OF ALL AVAILABLE EXPERIMENTAL VALUES

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
0- N- 1 (T1/2= 10.6 MIN. I=1/2)	-33.8 (1.2)		-33.8 (1.2)	HE	PL/B80.187	79	WITSCH	+
1-H	-3.7409(.0011)			GR	ZP/A272.189	75	KOESTER	+
1-H - 1 (99.985 %. I=1/2)	-3.7423(.0012)	10.817 (.005)	-47.420 (.014)	TM	UNPUBL.MUN	79	KOESTER	+
		B+ - B- =	58.2 (.4)	NP	JPR40.629	79	GLAETTLI	+
1-H - 2 (0.0149 %. I=1)	6.674 (.006)	9.53 (.03)	0.975 (.060)	M	EEN80.1	77	KOESTER	
1-H - 3 (T1/2= 12.26Y. I=1/2)	5.10 (.10)			IN	ZP/A302.323	81	HAMMERSCHMIED	+
	4.94 (.08)	4.94 (.30)	4.94 (.80)	M	ZP/A302.328	81	HAMMERSCHMIED	+ 18
2-HE	3.26 (.03)			IN	ZP/A291.231	79	KAISER	+
2-HE- 3 (1.3E-4 %. I=1/2)	5.74 (.07)	4.7 (.5)	8.8 (1.4) -(5.925	IN	ZP/A 291.231	79	KAISER	+
2-HE- 4 (100%. I=0)								
3-LI	-2.03 (.05)			CF	EEN80.1	77	KOESTER	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
3-LI- 6 (7.5%. I=1)	1.87 (.05) -1 0.26	0.41 (.07)	4.81 (.06)	CF	UNPUBL.MUN	78	KOESTER	+
		B+ - B- =	-3.8 (.5)	NP	PRL40.748	78	GLRETTLI	+
3-LI- 7 (92.5%. I=3/2)	-2.197 (.010)	-4.19	1.13	CH	UNPUBL.MUN	78	KOESTER	+
		B+ - B- =	-4.5 (.2)	NP	JPR40.629	79	GLRETTLI	+
4-BE- 9 (100%. I=3/2)	7.79 (.01)			TM	UNPUBL.MUN	78	WASCHKOWSKI	+
5-B	5.35 (.06)			CF	EEN80.1	77	KOESTER	+
5-B - 10 (19.4%. I=3)	0.00 (.22)	-3.9	5.2	CF	EEN80.1	77	KOESTER	+ 5
5-B - 11 (80.2%. I=3/2)	6.658 (.020)	5.32	8.90	CF	UNPUBL.MUN	78	KOESTER	+
6-C	6.6464(.0013)			GR	ZP/A272.189	75	KOESTER	+
6-C - 12 (98.89 %. I=0)	6.6535(.0014)			GR	ZP/A292.95	79	KOESTER	+
6-C - 13 (1.11%. I=1/2)	6.19 (.09)	4.8 (.5)	10.2 (1.6)	CF	ZP/A292.95	79	KOESTER	+
		B+ - B- =	-1.2 (.2)	NP	JPR40.629	79	GLRETTLI	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME	C.
7-N	9.21 (.02)			BO	RCR/B36.2126	79	TAKUBSAWA	+
7-N - 14 (99.635 %. [=1)	9.37 (.02)	10.7 (.2)	6.5 (.3)	CF	ZP/A277.77	76	KOESTER	+
7-N - 15 (0.365% [=1/2)	6.44 (.03)	6.43 (.03)	6.48 (.03)	CF	ZP/A277.77	76	KOESTER	+
8-O	5.805 (.004)			M	ZP/A292.96	79	KOESTER	+
8-O - 16 (99.756 %. [=0)	5.805 (.005)			M	ZP/A 292.96	79	KOESTER	+
8-O - 17 (0.038% [=5/2)	5.78 (.15)			BO	RCRE R 5770	80	VALENTINE	
		B+ - B- =	0.36 (.12)	NP	NP/A IN PRINT	81	HALINOVSKI	+
8-O - 18 (0.208% [=0)	5.84 (.07)			CF	ZP/A 292.96	79	KOESTER	+
9-F - 19 (100%. [=1/2)	5.854 (.012)	5.832 (.010)	5.787 (.010)	CF	ZP/A 292.96	79	KOESTER	+
		B+ - B- =	-0.19 (.02)	NP	JPR 40.829	79	BLRETTLI	+
10-NE	4.547 (.011)			CF	NERNDC/E-212U.84	80	KOESTER	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
10-NE- 20 (90.5%, I=0)	4.531 (.006)			TM	PR 148.1303	66	KROHN	+
10-NE- 21 (0.27%, I=3/2)	6.66 (.19)			TM	PR 148.1303	66	KROHN	+
10-NE- 22 (9.2%, I=0)	3.87 (.01)			TM	PR 148.1303	66	KROHN	+
11-NA- 23 (100%, I=3/2)		6.42 (.04)	-1.00 (.05)	M	ZP/A 292.96	79	KOESTER	+
	3.63 (.02)			CF	ZN/A26.901	72	KOESTER	+
		B+ - B- =	7.1 (.3)	NP	JPR 40.629	79	GLRETTLI	+
12-MG	5.375 (.004)			IN	NIM 157.496	78	BRUSPIESS	+
12-MG- 24 (78.9%, I=0)	5.49 (.18)			BO	ACR/A 28 .473	72	ABUL-KHAIL	+
12-MG- 25 (10%, I=5/2)		4.6 (.4)	2.7 (.5)	M	ZP/A 292.96	79	KOESTER	+
	3.62 (.14)			BO	ACR/A 29.473	72	ABUL-KHAIL	+
12-MG- 26 (11.0%, I=0)	4.92 (.15)			BO	ACR/A 28.473	72	ABUL-KHAIL	+
13-AL- 27 (100%, I=5/2)		3.20 (.08)	3.80 (.12)	M	ZP/A 292.95	79	KOESTER	+
	3.449 (.005)			IN	NIM 157.495	78	BRUSPIESS	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
13-AL- 27 (CONT.)		B+ - B- =	0.52 (.02)	NP	JPR 40.829	79	GLRETTLI	+ 19
14-SI	4.149 (.001)			DO	PRL 29.871	72	SHULL	+
14-SI- 28 (92.2%, I=0)	4.106 (.006)			CF	ZP/A 289.389	79	KOESTER	+
14-SI- 29 (4.7%, I=1/2)	4.7 (.1)	4.09 (.15)	5.6 (.4)	CF	ZP/A289.389	79	KOESTER	+ 14
14-SI- 30 (3.1%, I=0)	4.58 (.08)			CF	ZP/A 289.389	79	KOESTER	+
15-P - 31 (100%, I=1/2)	5.13 (.01)			CF	ZP/A 277.77	78	KOESTER	+
		B+ - B- =	0.7	NP	UNPUBL-BRC	81	GLRETTLI	+ 18
16-S	2.847 (.001)			SR	ZN/A26.400	71	TRUESTEDT	+
16-S - 32 (95%, I=0)	2.804 (.002)			CF	ZP/A289.389	79	KOESTER	+
16-S - 33 (0.74%, I=3/2)	4.74 (.19)			CF	ZP/A289.389	79	KOESTER	+
		B+ - B- =	3. (3.)	CF	78HARWELL	78	KOESTER	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
16-S - 34 (4.2%, I=0)	3.48 (.03)			CF	ZP/A289.399	79	KOESTER	+
16-S - 36 (0.013% ,I=0)								
17-CL	9.5792(.0008)			GR	ZP/A272.189	75	KOESTER	+
17-CL- 35 (75.77% I=3/2)	11.70 (.09)	16.3 (.2)	4.0 (.3)	CF	ZP/A282.371	77	KOESTER	+
		B+ - B- = 13.0	(1.0)	NP	UNPUBL-BAC	81	GLAETTLI	+
17-CL- 37 (24.23% I=3/2)	3.08 (.06)	3.10 (.07)	3.05 (.07)	CF	ZP/A282.371	77	KOESTER	+
		B+ - B- = 0.4		NP	UNPUBL-BAC	81	GLAETTLI	+ 17
18-AR	1.884 (.006)			TR	PR140.1303	66	KROHN	+
18-AR- 36 (0.34%, I=0)	24.21 (.07)			TR	PR140.1303	66	KROHN	+
18-AR- 38 (0.07%, I=0)								
18-AR- 40 (99.59% I=0)	1.83 (.05)				BAL325.111.ED.	73	TUSHNBSHNB	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	- METHOD -	- REFERENCE -	- YEAR -	-AUTHOR'S NAME -	C.
19-K	3.67 (.02)			BO	RCR/R19.514	73	COOPER	+
19-K - 39 (93.3%, I=3/2)	3.79 (.02)	5.06 (.03)	2.43 (.03)	CF	UNPUBL.MUN	79	KOESTER	+
		B+ - B- = +3.0		NP	JPR40.829	79	BLRETTLI	+
19-K - 40 (0.012%, I=4)								
19-K - 41 (6.7%, I=3/2)	2.58 (.06)	2.38 (.08)	2.84 (.07)	CF	UNPUBL.MUN	79	KOESTER	+
20-CA	4.90 (.03)			CF	EENBO.1	77	KOESTER	
20-CA- 40 (96.94%, I=0)	4.9 (.2)			BO	PRB1.527	61	SHULL	+
20-CA- 42 (0.64%, I=0)								
20-CA- 43 (0.13%, I=7/2)								
20-CA- 44 (2.13%, I=0)	1.8 (.1)			BO	PRB1.527	61	SHULL	+
20-CA- 46 (0.003%, I=0)								
20-CA- 48 (0.18%, I=0)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
21-SC- 45 (100%, I=7/2)	12.29 (.11)	7.0 (.4)	19.1 (.5)	CF	UNPUBL.MUN	75	KOESTER	+
		B+ - B- = -12.3		NP	BAP22.993	77	MARSHAK	
22-TI	-3.438 (.002)			IN	NIM157.496	78	BRUSPIESS	+
22-TI- 46 (8.0%, I=0)	4.73 (.06)			CF	UNPUBL.MUN	80	KOESTER	+
22-TI- 47 (7.5%, I=5/2)	3.49 (.12)	0.6 (.3)	7.6 (.4)	CF	UNPUBL.MUN	80	KOESTER	+
22-TI- 48 (73.7%, I=0)	-5.84 (.02)			CF	UNPUBL.MUN	80	KOESTER	+
22-TI- 49 (5.5%, I=7/2)	1.00 (.05)	5.5 (.3)	-4.8 (.3)	CF	UNPUBL.MUN	80	KOESTER	+ 22
22-TI- 50 (5.3%, I=0)	5.93 (.08)			CF	UNPUBL.MUN	80	KOESTER	+
23-V	-0.3824(.0012)			IN	NIM157.498	78	BRUSPIESS	+ 23
23-V - 50 (0.25%, I=6)								
23-V - 51 (99.75% I=7/2)	-0.414	5.11 (.28)	-7.52 (.22)	NP	BAP22.1246	77	MARSHAK	23
		B+ - B- = +12.94		NP	JPR40.529	79	GLAETTLI	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
24-CR	3.635 (.007)			CF	ZP/A287.61	70	KOESTER	*
24-CR- 50 (4.35%, I=0)	-4.50 (.05)			CF	ZP/A287.61	70	KOESTER	*
24-CR- 52 (83.8%, I=0)	4.914 (.015)			CF	ZP/A287.61	70	KOESTER	*
24-CR- 53 (9.59%, I=3/2)	-4.20 (.03)	1.16 (.10)	-13.0 (.2)	CF	ZP/A287.61	70	KOESTER	*
24-CR- 54 (2.36%, I=0)	4.55 (.10)			CF	ZP/A287.61	70	KOESTER	*
25-MN- 55 (100%, I=5/2)	-3.73 (.02)	-2.21 (.05)	-5.84 (.07)	CF	EENBO.1	77	KOESTER	
26-FE	9.34 (.06)			PR	PR/B3.830	71	SCHNEIDER	*
26-FE- 54 (5.8%, I=0)	4.2 (.1)			BO	PRB1.527	51	SHULL	*
26-FE- 56 (91.7%, I=0)	10.1 (.2)			BO	PRB1.527	51	SHULL	*
26-FE- 57 (2.19%, I=1/2)	2.3 (.1)			BO	PRB1.527	51	SHULL	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
26-FE- 58 (0.31%, I=0)	15. (7.)			TR	FRM-124	77	WEBER	*
27-CO- 59 (100%, I=7/2)	2.50 (.03)			BO	PR/A136.195	64	MOON	
		B+ - B- = -12.5 (.4)		NP	JPR40.629	78	GLAETTLI	*
28-NI	10.3 (.1)			BO	PR81.527	51	SHULL	*
28-NI- 58 (67.88 %, I=0)	14.4 (.1)				BAL525111.ED.	73	MUGHABGHAB	*
28-NI- 60 (26.23% I=0)	2.8 (.1)			BO	PR81.527	51	SHULL	*
28-NI- 61 (1.19%, I=3/2)	7.60 (.06)			BO	PR158.1225	67	SIDHU	*
28-NI- 62 (3.66%, I=0)	-8.7 (.2)			BO	ARN611.303	61	WILKINSON	*
28-NI- 64 (1.08%, I=0)	-0.38 (.07)			BO	PR158.1225	67	SIDHU	*
29-CU	7.710 (.004)			IN	NIR157.495	78	BRUSPIESS	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
29-CU- 63 (69.1%, I=3/2)	6.72 (.15)			TR	PR111.261	58	KEATING	+
		B+ - B- =	0.45 (.05)	NP	JPR40.629	79	GLAETTLI	+
29-CU- 65 (30.9%, I=3/2)	11.09 (.19)			TR	PR111.261	58	KEATING	+
		B+ - B- =	3.7 (.2)	NP	JPR40.629	79	GLAETTLI	+
30-ZN	5.680 (.005)			IN	NIM157.495	78	BRUSPIESS	+
30-ZN- 64 (48.9%, I=0)	5.6 (.2)			BO	UNPUBL.MIT	67	SHULL	
30-ZN- 66 (27.8%, I=0)	6.3 (.2)			BO	UNPUBL.MIT	67	SHULL	
30-ZN- 67 (4.1%, I=5/2)								
30-ZN- 68 (18.6%, I=0)	8.7 (.2)			BO	UNPUBL.MIT	67	SHULL	
30-ZN- 70 (0.62%, I=0)								
31-GA	7.2 (.1)			BO	PR131.2098	63	ARNOLD	+
31-GA- 69 (60%, I=3/2)								

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD -	REFERENCE -	YEAR	-AUTHOR'S NAME -	C.
31-GA- 71 (40%, I=3/2)								
32-GE	8.19291 .00171			PR	ACK/A32.375	78	SCHNEIDER	
32-GE- 70 (20.7%, I=0)	8.4 (.4)			TM	70 HELSINKI1.651	70	VERTEBNY	+ 32
32-GE- 72 (27.5%, I=0)	7.8 (.4)			TM	70 HELSINKI1.651	70	VERTEBNY	+ 32
32-GE- 73 (7.7% I =9/2)	2.8 (1.3)			TM	70 HELSINKI1.661	70	VERTEBNY	+ 32
32-GE- 74 (36.4%, I=0)	7.0 (.2)			TM	70 HELSINKI1.661	70	VERTEBNY	+ 32
32-GE- 76 (7.7%, I=0)								
33-AS- 75 (100%, I=3/2)	6.58 (.01)	6.04 (.05)	7.47 (.08)	CF	ZP/A296.45	80	KOESTER	+
		B+ - B- =	-1.43 (.12)	NP	JPA40.529	79	GLAETTLI	+
34-SE	7.970 (.009)			CF	ZP/A296.43	80	KOESTER	+
34-SE- 74 (0.9%, I=0)	0.8 (3.0)			CF	ZP/A296.43	80	KOESTER	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
34-SE- 76 (9%,I=0)	12.2 (.1)			CF	ZP/R296.43	80	KOESTER	*
34-SE- 77 (7.5%,I =1/2)	8.25 (.08)			CF	ZP/R296.43	80	KOESTER	*
34-SE- 78 (23.5%, I=0)	8.24 (.09)			CF	ZP/R296.43	80	KOESTER	*
34-SE- 80 (50%, I=0)	7.48 (.03)			CF	ZP/R296.43	80	KOESTER	*
34-SE- 82 (8.84%, I=0)	6.34 (.08)			CF	ZP/R296.43	80	KOESTER	*
35-BR	6.79 (.02)			GR	ZP/RZ72.189	75	KOESTER	*
35-BR- 79 (50.49 %, I=3/2)	6.79 (.07)			CF	ZP/R301.215	81	KOESTER	*
		B+ - B- = -2.3		NP	UNPUBL-SAC	81	GLRETTLI	*
35-BR- 81 (49.31 %, I=3/2)	6.78 (.07)			CF	ZP/R301.215	81	KOESTER	*
		B+ - B- = 1.2		NP	UNPUBL-SAC	81	GLRETTLI	*
36-KR	7.85 (.02)			TM	PR/D8.1305	73	KROHN	*
36-KR- 78 (0.35%, I=0)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
36-KR- 80								
36-KR- 82 (11.6%, I=0)								
36-KR- 83 (11.5%, I=9/2)								
36-KR- 84 (57.0%, I=0)								
36-KR- 86 (17.3%, I=0)								
37-RB	7.08 (.02)			CF	ZN/A27.901	72	KOESTER	*
37-RB- 85 (72.17 %, I=5/2)	7.07 (.10)			CF	ZP/A301.215	81	KOESTER	*
37-RB- 87 (27.83 %, I=3/2)	7.27 (.12)			CF	ZP/A301.215	81	KOESTER	*
38-SR	7.02 (.02)			CF	ZP/A301.215	81	KOESTER	*
38-SR- 84 (0.56%, I=0)								
38-SR- 86 (9.9%, I=0)	5.68 (.05)			CF	ZP/A301.215	81	KOESTER	*
38-SR- 87 (7%, I=9/2)	7.41 (.07)			CF	ZP/A301.215	81	KOESTER	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
38-SR- 88 (82.6%, I=0)	7.15 (.06)			CF	ZP/A301.215	81	KOESTER	+
39-Y - 89 (100%, I=1/2)	7.75 (.02)	8.4 (.2)	5.8 (.5)	CF	ZP/A301.215	81	KOESTER	+
	7.75 (.02)			CF	EEN80.1	77	KOESTER	
		B+ - B- = +2.6 (.7)		NP	JP840.829	79	BLRETTLI	+
40-ZR	7.15 (.03)			CF	ZP/A301.215	81	KOESTER	+
40-ZR- 90 (51.48 %, I=0)	8.5 (.1)			CF	ZP/A301.215	81	KOESTER	+
40-ZR- 91 (11.23 %, I=5/2)	8.8 (.1)	7.9 (.2)	10.1 (.2)	CF	ZP/A301.215	81	KOESTER	+
		B+ - B- = -2.2 (.3)		NP	JP840.829	79	BLRETTLI	+
40-ZR- 92 (17.11 %, I=0)	7.5 (.2)			CF	ZP/A301.215	81	KOESTER	+
40-ZR- 93	5.5 (.1)			CF	ZP/A301.215	81	KOESTER	+
40-ZR- 94 (17.4%, I=0)	8.3 (.2)			CF	ZP/A301.215	81	KOESTER	+
40-ZR- 96 (2.8%, I=0)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
41-NB- 93 (100%, I=9/2)	7.054 (.003)			IN	NIM157.496	78	BAUSPIESS	*
	7.14 (.03)	7.06 (.04)	7.35 (.04)	TM	ZN/RZ9.1750	74	DILG	
		B+ - B- =	-0.28 (.02)	MP	JPR40.629	79	GLRETTLI	*
42-MO	6.95 (.07)			CF	EENBO.1	77	KOESTER	
42-MO- 92 (15.48 %, I=0)								
42-MO- 94 (9.1%, I=0)								
42-MO- 95 (15.72% I=5/2)								
42-MO- 96 (16.53% I=0)								
42-MO- 97 (9.5%, I=5/2)								
42-MO- 98 (23.78% I=0)								
42-MO-100 (9.6%, I=0)								
43-TC- 99 (T1/2= 2.1E5Y, I=9/2)	6.8 (.3)			BD	ANL-5794.393	63	MUELLER	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
44-RU	7.21 (.07)			CF	EENDO.1	77	KOESTER	
44-RU- 96 (5.5%, I=0)								
44-RU- 98 (1.9%, I=0)								
44-RU- 99 (12.7%, I=5/2)								
44-RU-100 (12.6%, I=0)								
44-RU-101 (17.07% I=5/2)								
44-RU-102 (31.61% I=0)								
44-RU-104 (18.58% I=0)								
45-RH-103 (100%, I=1/2)	5.88 (.04)			CF	EENDO.1	77	KOESTER	
46-PD	5.91 (.06)			BO	PR140.A2003	68	CABLE	*
46-PD-102 (1%, I=0)								
46-PD-104 (11%, I=0)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
45-PD-105 (22.53 %. I=5/2)								
46-PD-106 (27.33 %. I=0)								
46-PD-108 (26.71 %. I=0)								
46-PD-110 (11.8%. I=0)								
47-AG	5.923 (.006)			IN	NIM 157.495	78	BRUMPIESS	+
47-AG-107 (51.8%. I=1/2)		B+ - B- =	2.3 (.3)	NP	JPR 40.629	79	GLRETTLI	+
47-AG-109 (48.2%. I=1/2)	4.19 (.03)	3.27 (.08)	7.0 (.2)	CF	ZP/A297.85	80	KOESTER	+
	-1 0.025							
		B+ - B- =	-3.7 (.3)	NP	JPR 40.629	79	GLRETTLI	+
48-CD	5.1 (.3)			BO	PR126.2262	62	ARNOLD	+ 48
	4.9 (.2)			TR	RS133.816	62	BALLY	+ 48
48-CD-106 (1.2%. I=0)								
48-CD-108 (0.9%. I=0)								

-NUCLIDE-	- B(FM)	- - B+(FM)	- - B-(FM)	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME -	C.
48-CD-110 (12.39 %. I=0)								
48-CD-111 (12.75 %. I=1/2)								
48-CD-112 (24.07 %. I=0)	7.4 (.2)			TM	RE27.1117	89	VERTEBNYI	*
48-CD-113 (12.36 %. I=1/2)	-8.0 -1 7.5			BD	JPR25.815	84	SMITH	
48-CD-114 (28.86 %. I=0)	6.4 (.2)			TM	RE27.1117	89	VERTEBNYI	*
48-CD-116 (7.58%. I=0)	7.1 (.2)			TM	RE27.1117	89	VERTEBENYI	*
49-IN	4.065 (.020) -1 0.054			CF	ZP/A297.86	80	KOESTER	*
49-IN-113 (4.28%. I=9/2)	5.39 (.06)			CF	ZP/A297.86	80	KOESTER	*
49-IN-115 (95.72 %. I=9/2)	4.00 (.03) -1 0.058	2.1 (.1)	6.4 (.4)	CF	ZP/A297.86	80	KOESTER	*
50-SN	6.228 (.004)			IN	NIM157.495	78	BRUGPIESS	*
	6.220 (.002)			IN	78GRTLINBURG2.1094	78	BRUGPIESS	*

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	- METHOD -	REFERENCE	- YEAR	-AUTHOR'S NAME -	C.
50-SN-112 (1.0%, I=0)								
50-SN-114 (0.66%, I=0)								
50-SN-115 (0.35%, I=1/2)								
50-SN-116 (14.3%, I=0)	5.8 (.1)			BO	ACR23.868	67	KAY	+
50-SN-117 (7.61%, I=1/2)	6.40 (.25)			BO	ACR23.868	67	KAY	
50-SN-118 (24.03 %, I=0)	5.8 (.1)			BO	ACR23.868	67	KAY	+
50-SN-119 (8.58%, I=1/2)	6.00 (.25)			BO	ACR23.868	67	KAY	+
50-SN-120 (32.86 %, I=0)	6.4 (.1)			BO	ACR23.868	67	KAY	+
50-SN-122 (4.72%, I=0)	5.5 (.3)			BO	ACR23.868	67	KAY	+
50-SN-124 (5.94%, I=0)	5.9 (.2)			BO	ACR23.868	67	KAY	+
51-SB	5.641 (.012)			CF	ZN/R26.391	71	KOESTER	+
51-SB-121 (57.25 %, I=5/2)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
51-SB-123 (42.75 %. I=7/2)								
52-TE	5.43 (.04)			CF	ZN/A26.391	71	KOESTER	+
52-TE-120 (0.09%. I=0)	5.3 (.5)			TR	RS127.620	56	HEINDL	+
52-TE-122 (2.4%. I=0)								
52-TE-123 (0.87%. I=1/2)	5.8 (.3)			TR	RS127.620	56	HEINDL	+
52-TE-124 (4.61%. I=0)	5.6 (.3)			BD	ARN11.303	61	WILKINSON	+
52-TE-125 (6.99%. I=1/2)	5.6 (.3)			BD	ARN11.303	61	WILKINSON	+
52-TE-126 (18.71 %. I=0)								
52-TE-128 (31.79 %. I=0)								
52-TE-130 (34.48 %. I=0)	5.7 (.3)			TR	RS127.620	56	HEINDL	+
53-J -127 (100%. I=5/2)	5.28 (.02)			CF	ZN/A27.901	72	KOESTER	+

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	- METHOD -	- REFERENCE -	- YEAR -	-AUTHOR'S NAME -	C.
54-XE	4.89 (.03)			BO	PR/D8.1305	73	KROHN	*
54-XE-124 (0.1%, I=0)								
54-XE-126 (0.09%, I=0)								
54-XE-128 (1.9%, I=0)								
54-XE-129 (26.14 %, I=1/2)								
54-XE-130 (3.9%, I=0)								
54-XE-131 (21.18 %, I=3/2)								
54-XE-132 (26.89 %, I=0)								
54-XE-134 (10.4%, I=0)								
54-XE-136 (8.9%, I=0)								
55-CS-133 (100%, I=7/2)	5.42 (.02)			CF	ZN/A27.901	72	KOESTER	*
		B+ - B- =	+2.6 (.3)	NP	JPR40.629	79	GLAETTLI	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
56-BA	5.25 (.04)			BO	ZK136.316	72	COOPER	*
56-BA-130 (0.1%, I=0)								
56-BA-132 (0.09%, I=0)								
56-BA-134 (2.4%, I=0)								
56-BA-135 (6.59%, I=3/2)								
56-BA-136 (7.81%, I=0)								
56-BA-137 (11.32 %, I=3/2)								
56-BA-138 (71.66 %, I=0)								
57-LA	8.27 (.05)			CF	EENBO.1	77	KOESTER	
57-LA-138 (0.09%, I=5)								
57-LA-139 (99.91 %, I=7/2)		B+ - B- =	6.1 (.4)	NP	JPR40.629	79	GLRETTLI	*
58-CE	4.84 (.06)			BO	JCP35.1950	61	ATOJI	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
58-CE-136 (0.19%, I=0)								
58-CE-138 (0.26%, I=0)								
58-CE-140 (88.48 %, I=0)	4.7 (.1)			BO	PR91.597	53	KOEHLER	*
58-CE-142 (11.07 %, I=0)	4.5 (.2)			BO	PR91.597	53	KOEHLER	*
59-PR-141 (100%, I=5/2)	4.45 (.05)			CF	EENBO.1	77	KOESTER	
60-ND	7.69 (.05)			BO	ACR/B31.2745	75	BUECHERLE	*
60-ND-142 (27.11 %, I=0)	7.7 (.3)			BO	PR91.597	53	KOEHLER	*
60-ND-143 (12.17 %, I=7/2)								
60-ND-144 (23.85 %, I=0)	2.4 (.1)				BNL325	73	MUGHABGHAB	*
60-ND-145 (8.5%, I=7/2)								
60-ND-146 (17.22 %, I=0)	8.7 (.2)			BO	PR91.597	53	KOEHLER	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
60-ND-148 (5.7%, I=0)								
60-ND-150 (5.6%, I=0)								
61-PM-147 (T1/2= 2.62Y)	12.6 (.4)			CF	UNPUBL.DRWL	72	KOEHLER	
62-SM								
62-SM-144 (3.1%, I=0)								
62-SM-147 (15%, I=7/2)								
62-SM-148 (11.2%, I=0)								
62-SM-149 (13.8%, I=7/2)								
62-SM-150 (7.4%, I=0)								
62-SM-152 (26.7%, I=0)	-5.0 (.6)			BO	PR91.597	53	KOEHLER	*
62-SM-154 (22.8%, I=0)	8. (1.)			BO	PR91.597	53	KOEHLER	*
63-EU	6.0 (.4)			BO	PR126.2262	62	ARNOLD	*

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
63-EU-151 (47.8%, I=5/2)								
63-EU-153 (52.8%, I=5/2)	8.22 (.14)			IN	UNPUBL.-ILL.	81	KISCHKO	+
64-GD	9.5 (.4)			BO	KKHB.302	75	WRTANABE	+
64-GD-152 (0.2%, I=0)								
64-GD-154 (2.2%, I=0)								
64-GD-155 (14.9%, I=3/2)								
64-GD-156 (20.5%, I=0)								
64-GD-157 (15.7%, I=3/2)								
64-GD-158 (24.7%, I=0)								
64-GD-160 (21.7%, I=0)	9.15 (.05)			BO	PR /85.997	72	MOON	
65-TB-159 (100%, I=3/2)	7.38 (.03)			CF	EEM80.1	77	KOESTER	
		B+ - B- =	3.5 (1.4)	NP	JET42.397	75	MKOPYAN	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
66-DY	16.9 (.4)			BD	PR174.1553	68	CHILD	*
66-DY-156 (0.06%, I=0)								
66-DY-158 (0.1%, I=0)								
66-DY-160 (2.3%, I=0)	6.7 (.4)			BD	PR174.1553	68	CHILD	*
66-DY-161 (18.9%, I=5/2)	10.3 (.4)			BD	PR174.1553	68	CHILD	*
66-DY-162 (25.5%, I=0)	-1.4 (.5)			BD	PR174.1553	68	CHILD	*
66-DY-163 (24.9%, I=5/2)	5.0 (.4)			BD	PR174.1553	68	CHILD	*
66-DY-164 (28.2%, I=0)	49.4 (.5)			BD	PR174.1553	68	CHILD	*
67-HO-165 (100%, I=7/2)	8.08 (.05)			BD	ACR/A35.818	79	BOUCHERLE	*
		7.0 (.4)	10.4 (.4)	NP	RIP18.411	74	LITTLE	*
		B+ - B- =	-3.5 (.4)	NP	JPR40.629	79	GLRETTLI	*
68-ER	8.03 (.03)			CF	EEN80.1	77	KDESTER	

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
68-ER-162 (0.14%. I=0)								
68-ER-164 (1.6%. I=0)	9.8 (.7)			TM	70HELSINKI 1.661	70	VERTEBNY	+
68-ER-166 (33.4%. I=0)	12.3 (.6)			TM	70HELSINKI 1.661	70	VERTEBNY	+
68-ER-167 (22.9%. I=7/2)								
68-ER-168 (27.0%. I=0)	10.2 (.5)			TM	70HELSINKI1.661	70	VERTEBNI	+
68-ER-170 (15%. I=0)	10.9 (.5)			TM	70HELSINKI 1.661	70	VERTEBNY	+
69-TM-169 (100%. I=1/2)	7.05 (.05)			CF	EEN80.1	77	KOESTER	
70-YB	12.90 (.07)			BO	JCP52.6430	70	AYOJI	
	12.62 (.12)			BO	PR121.610	61	AYOJI	+
70-YB-168 (0.14%. I=0)								
70-YB-170 (3.0%. I=0)								
70-YB-171 (14.3%. I=1/2)								

NUCLIDE	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
70-YB-172 (21.9%, I=0)								
70-YB-173 (16.3%, I=5/2)								
70-YB-174 (31.8%, I=0)								
70-YB-176 (12.7%, I=0)								
71-LU	7.3 (.2)			80	PR121.610	61	ATOJI	
71-LU-175 (97.4%, I=7/2)								
71-LU-176 (2.6%, I=7)								
72-HF	7.77 (.14)			80	PR121.610	61	ATOJI	
72-HF-174 (0.18%, I=0)								
72-HF-176 (5.2%, I=0)								
72-HF-177 (18.5%, I=0)								
72-HF-178 (27.2%, I=0)								

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
72-HF-179 (13.8% I=9/2)								
72-HF-180 (35.1% I=0)								
73-TA	6.91 (.07)			CF	ZN/A26.381	71	KOESTER	*
73-TA-180 (.0012% I=0)								
73-TA-181 (99.98% I=7/2)		B+ - B- =	-0.59 (.06)	NP	PRL33.102	74	ROUGERU	* 73
74-W	4.77 (.05)			CF	ZP219.300	68	KOESTER	*
74-W -180 (0.13% I=0)								
74-W -182 (26.3% I=0)	8.33 (.14)			BO	YF10.328	69	ALEKSANDROV	*
74-W -183 (14.3% I=1/2)	4.3 (.5)			BO	YF10.328	69	ALEKSANDROV	*
74-W -184 (30.7% I=0)	7.59 (.09)			BO	YF10.328	69	ALEKSANDROV	*
74-W -186 (28.6% I=0)	-1.19 (.05)			BO	YF10.328	69	ALEKSANDROV	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
75-RE	9.2 (.2)			BO	ARN11.303	61	WILKINSON	*
75-RE-185 (37.5%, I=5/2)								
75-RE-187 (62.5%, I=5/2)								
76-OS	10.7 (.2)			BO	ANL-6797.303	63	MUELLER	*
76-OS-184 (0.02%, I=0)								
76-OS-186 (1.6%, I=0)								
76-OS-187 (1.6%, I=1/2)								
76-OS-188 (13.3%, I=0)	7.8 (.3)			BO	ANL-6797.303	63	MUELLER	*
76-OS-189 (16.1%, I=3/2)	11.0 (.3)			BO	ANL-6797.303	63	MUELLER	*
76-OS-190 (26.4%, I=0)	11.4 (.3)			BO	ANL-6797.303	63	MUELLER	*
76-OS-192 (41%, I=0)	11.9 (.4)			BO	ANL-6797.303	63	MUELLER	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
77-IR	10.6 (.3)			BD	ANL6797.393	63	MUELLER	*
77-IR-191 (37.4%, I=3/2)								
77-IR-193 (62.6%, I=3/2)								
78-PT	9.5 (.3)			BD	PR81.527		SMULL	*
78-PT-190 (0.01%, I=0)	9.			TM	SNP22.348	75	VERTEBNYI	*
78-PT-192 (1.78%, I=0)	9.9 (.5)			TM	SNP22.348	75	VERTEBNYI	*
78-PT-194 (32.9%, I=0)	10.55 (.08)			TM	SNP22.348	75	VERTEBNYI	*
78-PT-195 (33.8%, I=1/2)		B+ - B- =	-2.3 (.4)	NP	JPR40.829	79	GLAETTLI	*
78-PT-196 (25.3%, I=0)	8.89 (.08)			TM	SNP22.348	75	VERTEBNYI	*
78-PT-198 (7.2%, I=0)	7.8 (.1)			TM	SNP22.348	75	VERTEBNYI	*
79-AU-197 (100%, I=3/2)	7.63 (.06)			CF	EEN80.1	77	KOESTER	
		B+ - B- =	-3.5 (.3)	NP	JPR40.629	79	GLAETTLI	*

-NUCLIDE-	- B(FM) -	- B+(FM) -	- B-(FM) -	- METHOD -	REFERENCE -	YEAR	-AUTHOR'S NAME -	C.
80-HG	12.66 (.02)			GR	EEN80.1	77	KOESTER	
80-HG-196 (0.15%, I=0)								
80-HG-198 (10.1%, I=0)								
80-HG-199 (16.9%, I=1/2)								
80-HG-200 (23.1%, I=0)								
80-HG-201 (13.2%, I=3/2)								
80-HG-202 (29.7%, I=0)								
80-HG-204 (6.8%, I=0)								
81-TL	8.89 (.02)			CF	EEN80.1	77	KOESTER	
81-TL-203 (29.5%, I=1/2)								
81-TL-205 (70.5%, I=1/2)								
82-PB	9.4003(.0014)			GR	PRL36.1021	76	KOESTER	*

NUCLIDE	B(FM)		B+(FM)		B-(FM)		METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
82-PB-204 (1.4%, I=0)											
82-PB-206 (24.1%, I=0)											
82-PB-207 (22.1%, I=1/2)			B+ - B- =		0.2	.4	NP	JPR40.629	79	GLAETTLI	
82-PB-208 (52.4%, I=0)											
83-BI-209 (100%, I=9/2)	8.5256	.0014					TR	PRL36.1021	76	KOESTER	*
85-AT											
86-RN											
87-FR											
88-RA-226 (T1/2= 1.62E3Y I=0)	10.0	1.0					TM	SNP14.1	72	KALABIN	*
90-TH-232 (100%, I=0)	9.84	.03					TM	NP61.381	65	RAYBURN	*

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	AUTHOR'S NAME	C.
91-PA-231 (T1/2= 3.25E4 Y. I=3/2)	9.1 (.3)			BD	UNPUBL.HARWELL	73	WEDGEWOOD	+
92-U	8.42 (.02)			BD	AERE-R9079	79	COOPER	+
92-U -234 (0.005% I=0)								
92-U -235 (0.72% I=7/2)	9.8 (.8)			BD	ACR20.587	66	ATOJI	
92-U -238 (99.27% I=0)	8.55 (.05)			BD	ACR20.587	66	ATOJI	
93-NP-237 (T1/2= 2.14E6Y I=5/2)	10.55 (.10)			BD	ACR/A30.667	74	HEATON	+
94-PU-239 (T1/2= 2.44E4 Y. I=1/2)	7.7 (.1)			BD	JNM34.201	70	GREEN	
94-PU-240 (T1/2= 6.54E3 Y. I=0)	9.5 (.1)			BD	ACR/B27.2284	71	LANDER	+
94-PU-242 (T1/2= 3.87E5 Y. I=0)	8.1 (.1)			BD	ACR/B27.2254	71	LANDER	+

-NUCLIDE-	B(FM)	B+(FM)	B-(FM)	METHOD	REFERENCE	YEAR	-AUTHOR'S NAME	C.
95-AM-243 (T1/2= 7.37E3 Y, I=5/2)	8.3 ! .2 !			BD	JPRL40.335	78	BOEUF	+
96-CM-244 (T1/2= 17.9Y, I=7/2)	9.5 ! .3 !			BD	PHY/BC86.31	77	FOURNIER	+

ABBREVIATIONS USED IN COLUMN "METHOD"

BD	BRAGG - DIFFRACTION
CF	CHRISTIANSEN - FILTER
DD	DYNAMIC DIFFRACTION
GR	GRAVITY - REFRACTION
HE	HIGH ENERGY
IN	INTERFEROMETER
M	MANY METHODS
NP	NUCLEAR - POLARIZATION
PR	PRIM - REFRACTION
SA	SMALL - ANGLE - SCATTERING
TM	TRANSMISSION
TR	TOTAL REFLECTION

ABBREVIATIONS USED IN COLUMN "REFERENCE"

(/A, /B, /C MEANS SERIES A, B, C OF THE JOURNAL)

ACR	ACTA CRYSTALLOGRAPHICA
ACS	JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
ACSA	ACTA CHEMICA SCANDINAVICA
AE	AKTIEBOLAGET ATOMENERGIE, STOCKHOLM / STUDSVIK
AECU	USAEC REPORTS, DIV. TECH. INF., EXTINCT
AERE	AERE - HAREWELL REPORTS
AIP	ADVANCES IN PHYSICS
AKE	ATOMKERNENERGIE
ANL-	ARGONNE NATIONAL LABORATORY REPORTS
ARN	ANNUAL REVIEW OF NUCLEAR SCIENCE
BAP	BULLETIN OF THE AMERICAN PHYSICAL SOCIETY
BNL	BROOKHAVEN NATIONAL LABORATORY REPORTS
BMC	BULLETIN DE LA SOCIETE FRANCAISE DE MINERALOGIE ET DE CRISTALLOGRAPHIE
CJB	CANADIAN JOURNAL OF PHYSICS
CR	COMPTES RENDUS
EANDC	EUROPEAN - AMERICAN NUCLEAR DATA COMMITTEE
EEN	ERGEBNISSE DER EXAKTEN NATURWISSENSCHAFTEN
FRM	FORSCHUNGSREAKTOR MUENCHEN, REPORTS
76GATLINBURG	CONFERENCE ON NEUTRON SCATTERING, CONF-760601, ORNL
55GENEVA	FIRST INTERNATIONAL CONFERENCE ON PEACEFUL USES OF ATOMIC ENERGY, IAEA
78HARWELL	INTERNATIONAL CONFERENCE ON NEUTRON PHYSICS AND NUCLEAR DATA FOR REACTORS AND OTHER APPLIED PURPOSES
70HELSINKI	CONFERENCE ON NUCLEAR DATA REACTORS, IAEA
IAEA	INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA
ICP	APPLIED CHEMISTRY CORPORATION, IDAHO
ILL	INSTITUT LAUE-LANGEVIN, GRENOBLE
JAP	JOURNAL OF APPLIED PHYSICS
JCP	JOURNAL OF CHEMICAL PHYSICS
JET	SOVIET PHYSICS - JETP
JINR	JOINT INSTITUTE OF NUCLEAR RESEARCH, DUBNA
JNM	JOURNAL OF NUCLEAR MATERIALS
JP	JOURNAL OF PHYSICS
JPC	JOURNAL DE CHIMIE, PHYSIQUE ET DE PHYSICOCHIMIE
JPJ	JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN
JPR	JOURNAL DE PHYSIQUE
JPRL	JOURNAL DE PHYSIQUE LETTRES
JPRS	JOURNAL DE PHYSIQUE SUPPLEMENT
KKH	KAKURIKEN KENKYU HOKOKU (JAPAN)
KRI	KRISTALLOGRAFIYA
KIEV-ITP	ACADEMY OF SCIENCE UKRAINIAN SSR, INSTITUTE FOR THEORETICAL PHYSICS
72LOS ANGELES	INTERNATIONAL CONFERENCE ON FEW-PARTICLES, PROCEEDINGS BY NORTH-HOLLAND AMET.
78LOWELL	INTERNATIONAL CONFERENCE ON INTERACTION NEUTRON NUCLEI, CONF-760715
MIT	MASS. INST. TECHN.
MUN	MUNICH

ABBREVIATIONS USED IN COLUMN "REFERENCE" (CONT.)

NEANDC	NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMISION
NB.GS.COMP.	NOBLE GAS COMPOUNDS
NDR	NUCLEAR DATA FOR REACTORS - IAEA
NIM	NUCLEAR INSTRUMENTS AND METHODS
NP	NUCLEAR PHYSICS
NYD-GEN	COLUMBIA UNIVERSITY, NEW YORK
ORNL	OAK RIDGE NATIONAL LABORATORY
PA	PHYSICS ABSTRACTS
PCS	PHYSICS AND CHEMISTRY OF SOLIDS
75PETTEN	NEUTRON DIFFRACTION CONFERENCE RCN-REPORT
PHY	PHYSICA
PL	PHYSICS LETTERS
PR	PHYSICAL REVIEW
PRL	PHYSICAL REVIEW LETTERS
PRS	PROCEEDINGS ROYAL SOCIETY OF LONDON
RCN	REACTOR CENTRUM NEDERLAND
RSI	REVIEW OF SCIENTIFIC INSTRUMENTS
RMP	REVIEW OF MODERN PHYSICS
72ROME	SYMPOSIUM ON PRESENT STATUS AND NOVEL DEVELOPEMENTS IN THE MANY BODY PROBLEM. ROME 1972
SAC	CEN SACLEY
SJPN	SOVIET JOURNAL OF PARTICLE AND NUCLEI
SNP	SOVIET JOURNAL OF NUCLEAR PHYSICS
SPC	SOVIET PHYSICS - CRYSTALLOGRAPHY
SSC	SOLID STATE COMMISSION
USNDC	REPORTS TO NUCLEAR DATA COMMISION
VIE	VIENNA
YF	YADERNAYA FISIKA
ZAAC	ZEITSCHRIFT FUER ANORGANISCHE ALLGEMEINE CHEMIE
ZK	ZEITSCHRIFT FUER KRISTALLOGRAPHIE
ZMP	ZEITSCHRIFT FUER ANGEWANDTE MATHEMATISCHE PHYSIK
ZN	ZEITSCHRIFT FUER NATURFORSCHUNG
ZP	ZEITSCHRIFT FUER PHYSIK
77ZUERICH	INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS AND NUCLEAR STRUCTURE. BIRKHAUSER-VERLAG. BASEL-STUTTGART

MEANING OF NUMBERS IN COLUMN "C." (COMMENT)

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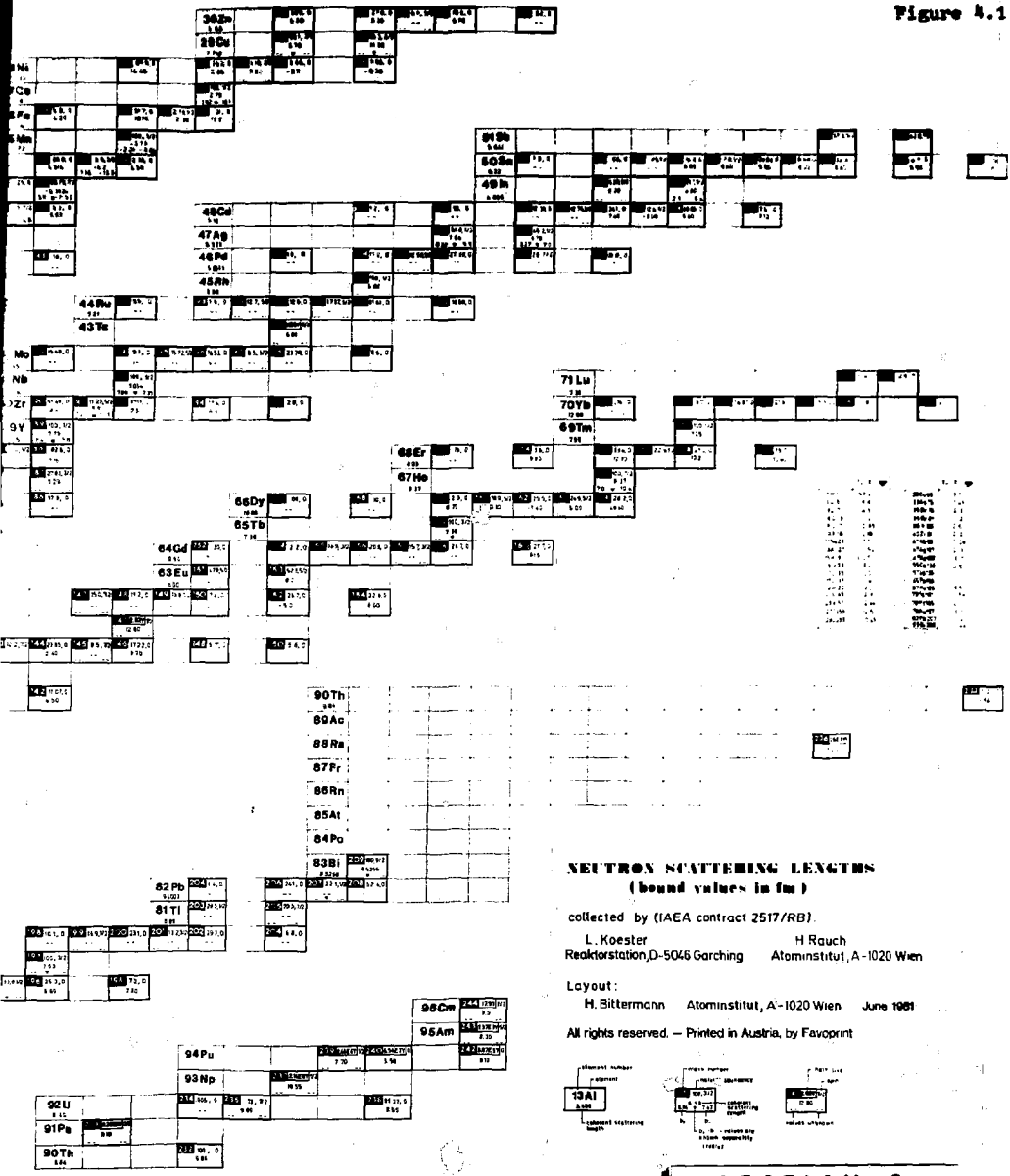
1 : CORRECTED FOR NEW B-VALUE OF 1-H - 2
1A: OBTAINED FROM SIGMA SCATT. AND THEORY
1B: OBTAINED BY A COMBINATION WITH PL/891.200 (1980)
2 : USE VALUE FOR 2-HE
5 : FOR B+(FM) AND B-(FM) THE VALUES 3.9 AND -5.2 ARE POSSIBLE TOO
13 : THE OTHER SIGN OF THE VALUE IS POSSIBLE TOO
14 : FOR B+(FM) AND B-(FM) THE VALUES 5.39 (.15) AND 2.8 (.4) ARE POSSIBLE TOO
15 : SMALLER THAN 0.7 FM
17 : SMALLER THAN 0.4 FM
21 : SIGN CHANGED
22 : FOR B+(FM) AND B-(FM) THE VALUES -3.5 (.2) AND 6.8 (.3) ARE POSSIBLE TOO
23 : USE VALUE FOR 23-V . WITHOUT CORRECTION FOR 23-V - 50
32 : CALCULATED FROM CROSS SECTION DATA
36 : CALCULATED FROM CROSS SECTION DATA
48 : VALUE DEPENDS ON LAMDA
63 : NON RESONANT CONTRIBUTION FOR LAMDA = 1.067 A
73 : WITHOUT CORRECTION FOR 73-TA-180.
74 : CALCULATED FROM A 90.7% ENRICHED W -186 SAMPLE

SECTION 1

Figure 4.1



NEUTRON SCATTERING LENGTHS
(bound values in fm)

collected by (IAEA contract 2517/RB).

L. Koester
Reaktorstation, D-5046 Garching

H Rauch
Atominstitut, A-1020 Wien

Layout:
H. Bittermann Atominstitut, A-1020 Wien June 1981

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SECTION 2