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$E2,M1$ MULTIPOLE MIXING RATIOS IN EVEN-EVEN NUCLEI, $A \geq 152$*

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A survey is presented of $E2,M1$ mixing ratios of gamma-ray transitions in even-even nuclei with mass numbers $A \geq 152$. Angular distribution and correlation data from the literature are analyzed in terms of a consistent choice of the phase relationship between the $E2$ and $M1$ matrix elements. The cutoff date for the literature was June 1975. Based on an average of the experimental results from the literature, a recommended value of the $E2,M1$ mixing ratio for each transition is included.

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INTRODUCTION

A nuclear gamma ray which connects a level of spin J_1 with one of spin J_2 may carry any angular momentum L between $J_1 + J_2$ and $|J_1 - J_2|$. Consideration of the emission probabilities for electromagnetic radiation leads one to expect a reduction of 1–3 orders of magnitude in the ratio of the emission probability of the $L + 1$ multipole relative to the L multipole.[1] However, in practice this expectation is modified by the nuclear matrix elements, whose influence may be sufficient to cause the $L + 1$ multipole to be favored strongly over the L multipole. The ratio of the transition probabilities of these multipoles then can provide a means for investigating nuclear states and for testing predictions of various nuclear models. The most frequently observed multipole mixture is the $E2 + M1$, which is the subject of the present study. Experimental results for even-even nuclei in the mass region $A \geq 152$ are surveyed; other mass regions will be considered in succeeding publications.

In the past, various compilations of angular correlation data have appeared; these have been primarily concerned with examining specific levels in a certain mass region (such as phonon levels in spherical nuclei) or with comparison between experiment and a certain specific theory. The most recent and comprehensive survey of the present type was done by Hamilton,[2] who examined even-even deformed and transitional nuclei. Comparison of data with theory in the nuclei presently under study has been made previously by, for example, Potnis and Rao,[3] Tamura and Yoshida,[4] Grechukhin,[5] Kumar,[6] Bodenstedt,[7] Reddingius et al.,[8] and Krane.[9] In order to update previous compilations and to provide a more comprehensive collection of experimental data analyzed in a consistent manner, the present survey was undertaken and includes published data available up to June 1975.

PHASE CONVENTION

The comparison between the transition strengths of the $L + 1$ and L multipole transitions is usually expressed in terms of the multipole mixing ratio δ, defined as the ratio of the $L + 1$ and L matrix elements:

$$\delta = \frac{\langle \| L + 1 \| \rangle}{\langle \| L \| \rangle}. \tag{1}$$

(The ratio of the intensities is then proportional to δ^2.)

Since δ is expressed as a ratio of matrix elements, the phase of δ becomes a meaningful observable which can be determined experimentally and can be predicted from theoretical calculations. It is therefore of the utmost importance that this phase be carefully defined, so that it can be extracted unambiguously from the experimental data and so that the appropriate electromagnetic multipole operators may be used for the theoretical calculations. The relationship between the experimentally determined multipole mixing ratios and the multipole operators used for theoretical calculations will not be considered in the present work. We state only that the mixing ratios as defined in the present work are related to the matrix elements of the electromagnetic multipole operators $\mathfrak{M}(E2)$ and $\mathfrak{M}(M1)$ (see, for example, Bohr and Mottelson[10] for discussion of these operators), as

$$\delta = \frac{\sqrt{3}}{10} k \frac{\langle J_f \| \mathfrak{M}(E2) \| J_i \rangle}{\langle J_f \| \mathfrak{M}(M1) \| J_i \rangle}$$

$$\delta = 0.835\ E_\gamma(\mathrm{MeV}) \frac{\langle J_f \| \mathfrak{M}(E2) \| J_i \rangle}{\langle J_f \| \mathfrak{M}(M1) \| J_i \rangle} \tag{2}$$

where k is the photon momentum and E_γ is its energy in MeV. A more comprehensive discussion of electromagnetic multipole operators and the transformation properties of their matrix elements is given in the work of Alder and Steffen.[11]

The types of experimental determination of δ which we consider are those involving angular distributions and correlations; since each radiation multipole has a characteristic angular distribution pattern, a study of the composite radiation pattern for a given gamma-ray transition gives information on the multipolarities present. The experimental data are then expressed in terms of an angular distribution function, usually as a series of Legendre polynomials

$$W(\theta) = a_0 + a_2 P_2(\cos\theta) + a_4 P_4(\cos\theta) \tag{3}$$

where θ gives the emission direction of the gamma ray relative to a suitably chosen axis. The coefficients a_k contain the information on the nuclear spins and gamma-ray matrix elements. These coefficients are given in terms of the multipole mixing ratio by an expression of the form

$$a_k \sim A + B\delta + C\delta^2. \tag{4}$$

The constants A, B, and C are basically combinations of angular momentum coupling coefficients. The question of the phase of δ then relates directly to the choice of the coefficient B, which in turn depends on the details of the experiment. Since a meaningful comparison of results from different experiments (possibly employing different techniques) depends on the choice of the sign of the coefficient B, we present below a brief comparison of the different techniques which can be used to analyze angular correlation and distribution data. We will consider three basic types of experiment: angular distributions of gamma rays from oriented states, angular correlations of gamma rays from unoriented states, and angular correlations of gamma rays from oriented states. These experiments will be referred to as $\mathbf{J}\gamma(\theta)$, $\gamma\gamma(\theta)$, and $\mathbf{J}\gamma\gamma(\theta)$, respectively.

In the following sections, we present a summary of the formulism of the various phase conventions, as applied to $\gamma\gamma(\theta)$ experiments. The extension to experiments of the $\mathbf{J}\gamma(\theta)$ type is straightforward and is accomplished by replacing the coefficients describing the first gamma ray by appropriate coefficients describing the degree of orientation of the emitting state. (These orientation parameters have been previously tabulated, for example, for cases in which the orientation is achieved by means of a nuclear reaction[12] or by means of static electromagnetic fields at low temperatures.[13])

Biedenharn-Rose Convention

The majority of the early angular correlation data has been analyzed using the phase convention of Biedenharn and Rose.[14] In this convention, the angular distribution coefficients describing the various radiations are written in a symmetric manner. However, in the case of a $\gamma\gamma(\theta)$ measurement, this results in the mixing ratio of the first radiation being defined in terms of absorption matrix elements, while that of the second radiation is defined in terms of emission matrix elements. That is,

$$a_k = A_k(\gamma_1)A_k(\gamma_2), \tag{5}$$

where

$$A_k(\gamma_i) = \frac{F_k(L_iL_iJ_iJ) + 2\delta_i F_k(L_iL_i'J_iJ) + \delta_i^2 F_k(L_i'L_i'J_iJ)}{1+\delta_i^2}, \tag{6}$$

with $i = 1{,}2$. Here the cascade is assumed to be $J_1 \xrightarrow{\gamma_1} J \xrightarrow{\gamma_2} J_2$ and the mixing ratios are given by

$$\delta_1 = \frac{\langle J_1\|L_1'\|J\rangle}{\langle J_1\|L_1\|J\rangle}, \qquad \delta_2 = \frac{\langle J_2\|L_2'\|J\rangle}{\langle J_2\|L_2\|J\rangle}. \tag{7}$$

The coefficients $F_k(LL'J_iJ)$ are combinations of angular momentum coupling coefficients and have been tabulated previously.[15] As will be shown below, this choice of phase eliminates the necessity for the retention of an extraneous phase factor in the expression for the angular distribution coefficients A_k and allows the formulism to be applied more directly to the case of the angular distribution of radiation which follows a nuclear reaction. In the latter case, the first radiation can truly be considered in terms of an absorption process. However, as was pointed out by Ofer,[16] this choice leads to possible confusion in the case of a cascade of three radiations γ_1, γ_2, and γ_3. Here if one measures $\gamma_1\gamma_2(\theta)$ and $\gamma_2\gamma_3(\theta)$ the deduced δ_2 changes sign between the two experiments, and the selection of an unambiguous value for theoretical comparison must be modified with reference to the type of experiment employed in the measurement.

Rose-Brink Convention

The choice of phase of Rose and Brink[17] eliminates the ambiguity discussed above, although the symmetry of the expression is correspondingly lost. Here we take

$$a_k = B_k(\gamma_1)A_k(\gamma_2) \tag{8}$$

where (for a cascade $J_1 \xrightarrow{\gamma_1} J_2 \xrightarrow{\gamma_2} J_3$)

$$B_k(\gamma_1) = \frac{R_k(L_1L_1J_2J_1) + (-)^{L_1-L_1'}2\delta_1 R_k(L_1L_1'J_2J_1) + \delta_1^2 R_k(L_1'L_1'J_2J_1)}{1+\delta_1^2} \tag{9}$$

$$A_k(\gamma_2) = \frac{R_k(L_2L_2J_2J_3) + 2\delta_2 R_k(L_2L_2'J_2J_3) + \delta_2^2 R_k(L_2'L_2'J_2J_3)}{1+\delta_2^2} \tag{10}$$

with

$$R_k(LL'J_1J_2) = (-)^{L-L'+k}F_k(LL'J_2J_1). \quad (11)$$

The mixing ratios are defined in terms of absorption matrix elements for both transitions:

$$\delta_1 = \frac{\langle J_1\|L_1'\|J_2\rangle}{\langle J_1\|L_1\|J_2\rangle}, \qquad \delta_2 = \frac{\langle J_2\|L_2'\|J_3\rangle}{\langle J_2\|L_2\|J_3\rangle}. \quad (12)$$

The phase factor $(-)^{L_1-L_1'}$ which appears in Eq. (9) permits δ_1 and δ_2 to be expressed in terms of the same type (that is, absorption) of matrix element.

Ferguson Convention

Although the convention of Ferguson[18] has not been widely used for the analysis of $\gamma\gamma(\theta)$ experiments, the extensive discussion of the $\mathbf{J}\gamma\gamma(\theta)$ formulism presented therein has resulted in its frequent use for the analysis of experiments of the $\mathbf{J}\gamma\gamma(\theta)$ type. In this convention, emission matrix elements are used to describe both radiations, and the angular distribution coefficients are expressed in terms of $\bar{Z}_1$ coefficients, which are related to the F-coefficients by

$$\bar{Z}_1(LJ_1L'J_1;J_2k) = (-)^{J_2-J_1+L-L'+k}\sqrt{2J_1+1}\,F_k(LL'J_2J_1). \quad (13)$$

The $\gamma\gamma(\theta)$ correlation coefficients are given by

$$a_k = B_k(\gamma_1)A_k(\gamma_2) \quad (14)$$

where

$$B_k(\gamma_1) = \bar{Z}_1(L_1J_2L_1J_2;J_1k) + (-)^{L_1+L_1'}2\delta_1\bar{Z}_1(L_1J_2L_1'J_2;J_1k) + \delta_1^2\bar{Z}_1(L_1'J_2L_1'J_2;J_1k), \quad (15)$$

$$A_k(\gamma_2) = \bar{Z}_1(L_2J_2L_2J_2;J_3k) + 2\delta_2\bar{Z}_1(L_2J_2L_2'J_2;J_3k) + \delta_2^2\bar{Z}_1(L_2'J_2L_2'J_2;J_3k) \quad (16)$$

where the mixing ratios are given in terms of emission matrix elements

$$\delta_1 = \frac{\langle J_2\|L_1'\|J_1\rangle}{\langle J_2\|L_1\|J_1\rangle}, \qquad \delta_2 = \frac{\langle J_3\|L_2'\|J_2\rangle}{\langle J_3\|L_2\|J_2\rangle}. \quad (17)$$

It should be noted that the coefficients B_k and A_k defined in this manner are not normalized (that is, $a_0 \neq 1$).

The formulism of Ferguson for $\mathbf{J}\gamma\gamma(\theta)$ measurements preserves the sense of the phases given above. Here the radiation γ_1 is described by an expression containing coefficients G_γ; these coefficients are related to the generalized F-coefficients[19] through a phase $(-)^{L_1-L_1'}$.

Krane-Steffen Convention

In this convention,[20] the original formulation of Biedenharn and Rose is used for the radiation γ_2, which is always expressed in terms of emission matrix elements. The difference lies in always expressing γ_1 in terms of emission matrix elements as well. In this convention,

$$a_k = B_k(\gamma_1)A_k(\gamma_2) \quad (18)$$

with

$$B_k(\gamma_1) = \frac{F_k(L_1L_1J_1J_2) + (-)^{L_1+L_1'}2\delta_1F_k(L_1L_1'J_1J_2) + \delta_1^2F_k(L_1'L_1'J_1J_2)}{1+\delta_1^2}, \quad (19)$$

$$A_k(\gamma_2) = \frac{F_k(L_2L_2J_3J_2) + 2\delta_2F_k(L_2L_2'J_3J_2) + \delta_2^2F_k(L_2'L_2'J_3J_2)}{1+\delta_2^2}, \quad (20)$$

$$\delta_1 = \frac{\langle J_2\|L_1'\|J_1\rangle}{\langle J_2\|L_1\|J_1\rangle}, \qquad \delta_2 = \frac{\langle J_3\|L_2'\|J_2\rangle}{\langle J_3\|L_2\|J_2\rangle}. \quad (21)$$

A complete formulism for analyzing $\mathbf{J}\gamma\gamma(\theta)$ experiments using this phase convention recently has been published.[19]

Relationships of Phase Conventions

The relationships of the various phase conventions discussed above will be summarized briefly. More detailed examinations of these relationships have been given by Ferguson[18] and by Rose and Brink.[17] The multipole operators, which have been represented here only symbolically by $\langle J\|L\|J'\rangle$, are discussed extensively by Rose and Brink[17] and by Alder and Steffen.[11]

The $\gamma\gamma(\theta)$ data summarized in the present compilation have been analyzed using the Krane-Steffen convention, and the mixing ratios are related to those ratios obtained using the other conventions as

$$\delta_{KS} = -\delta_{RB} = -\delta_F; \qquad \delta_{1_{KS}} = -\delta_{1_{BR}}; \qquad \delta_{2_{KS}} = \delta_{2_{BR}}. \quad (22)$$

In the case of $J\gamma(\theta)$ experiments, the gamma ray is represented by the appropriate equation given above for $A_k(\gamma_2)$ [Eqs. (6), (10), (16), or (20)] and the parameter $B_k(\gamma_1)$ is replaced by parameters which describe the degree of orientation of the emitting level.[12,13] The $\gamma\gamma(\theta)$ and $J\gamma\gamma(\theta)$ experiments are analyzed as discussed above.

COMPILATION AND POLICIES

In Table I are presented the results of a survey to June 1975 of the angular distribution and correlation literature for even-even nuclei, $A \geq 152$. The angular correlation coefficients are given in terms of the Legendre polynomial expansion as

$$W(\theta) = a_0 + a_2P_2(\cos\theta) + a_4P_4(\cos\theta). \quad (23)$$

In some of the older literature, the angular distribution is expressed as

$$W(\theta) = b_0 + b_2\cos 2\theta + b_4\cos 4\theta \quad (24)$$

or as

$$W(\theta) = c_0 + c_2\cos^2\theta + c_4\cos^4\theta. \quad (25)$$

These coefficients are related by

$$a_0 = b_0 - \frac{b_2}{3} - \frac{b_4}{15} = c_0 + \frac{c_2}{3} + \frac{c_4}{5}, \quad (26)$$

$$a_2 = \frac{4}{3}b_2 - \frac{16}{21}b_4 = \frac{2}{3}c_2 + \frac{4}{7}c_4, \quad (27)$$

$$a_4 = \frac{64}{35}b_4 = \frac{8}{35}c_4. \quad (28)$$

The angular correlation coefficients are normalized such that $a_0 = 1$.

In general, we have taken the distribution or correlation coefficients directly from the reference cited. Where necessary, we have applied the appropriate corrections for solid angle, attenuation due to external perturbations, and competing cascades, as given by the authors of the work.

Using the Krane-Steffen phase convention, we extracted the $E2,M1$ mixing ratios δ directly from the tabulated coefficients. [The relationships between the angular correlation coefficients (a_2 and a_4) for $\gamma\gamma(\theta)$ experiments and the mixing ratio δ have been tabulated by Taylor, Singh, Prato, and McPherson.[21] For $J\gamma(\theta)$ experiments, the dependence of a_2 and a_4 on δ has been tabulated by der Mateosian and Sunyar.[22]] In actuality, we have used the a_2 coefficient to calculate the two allowed values of δ and then have selected that value of δ which gives the best agreement with a_4 (or with, for example, internal conversion coefficients). The uncertainties quoted for δ correspond directly to the uncertainties of a_2. [A more direct and less ambiguous means of extracting δ would be to analyze the measured angular distribution $W(\theta)$ directly using δ as a parameter, rather than extracting a_2 and a_4 values. This is frequently done, in the case of $J\gamma\gamma(\theta)$ experiments, for example, by means of a χ^2 plot. Such analyses would in fact be preferable also for the $\gamma\gamma(\theta)$ experiments; ambiguities and uncertainties which may arise resulting from the interpretation of the a_2 and a_4 values can often be eliminated by this type of analysis.] We have assumed, unless it was otherwise stated, that the authors' given uncertainties on a_2 and a_4 correspond to one standard deviation (that is, a 67% confidence limit).

In cases in which the coefficients a_2 and a_4 were not given, the corresponding entries have been left blank.

In several cases, when δ is large, only a lower limit on the magnitude of δ may be determined. These results are indicated, for example, as $|\delta| > 10$ (see Explanation of Table). In other cases, the sign may be determined, but the magnitude may be uncertain (again this occurs when δ is large). An example of this type would be $\delta = +10^{+\infty}_{-5}$; this indicates that the a_2 and a_4 values suggest $\delta = +10$, but that the uncertainties permit δ to take any positive value $\geq +5$.

In Table II are presented the recommended values of the $E2,M1$ mixing ratios, derived from the data given in Table I. Wherever appropriate, in computing the value of δ presented in Table II, we have taken a weighted average of the angular distribution or correlation coefficients. In most cases the data from various references for a given transition were sufficiently consistent internally to permit the calculation of a weighted average. For the cases of transitions for which the various results were inconsistent with one another, preference was given to more recent data obtained with Ge(Li) detectors. For those few remaining cases in which, in the opinion of the compiler, reasonably strong support exists for either of two conflicting values, the value shown is that for which some preference, however slight, exists; these cases are designated by an asterisk (*).

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EXPLANATION OF TABLE I

INITIAL LEVEL E(KEV) J	The energy in keV and spin-parity assignment of the initial state of the gamma-ray transition
FINAL LEVEL E(KEV) J	Same as above for final state
GAMMA-RAY E(KEV)	The energy in keV of the gamma-ray transition $E_{\text{gamma}} = E_{\text{initial}} - E_{\text{final}}$
ALIGNMENT	The means of obtaining the alignment of the initial level or of detecting the alignment of the final level
122, etc.	In this case the energy in keV of the coincident radiation is listed (angular correlation)
HT	By application of a magnetic field **H** at low temperatures (cryogenic orientation)
QT	By electric quadrupole interactions at low temperatures (cryogenic orientation)
(A,A), (O,O) (P,N), etc.	Incoming, outgoing particles (nuclear reactions) A alpha (^{4}He) P proton N neutron O ^{16}O

A2, A4	The coefficients a_2, a_4 with the uncertainties in the last digit or digits indicated in parentheses
DELTA	The *E2,M1* mixing ratio δ, with the uncertainty limits indicated in parentheses, using the following notation (00 is the symbol for ∞)
+ 10 (1)	$\delta = +10 \pm 1$
+ 10 (+ 2, − 1)	$\delta = +10^{+2}_{-1}$
− 10 (+ 2, − 1)	$\delta = -(10^{+2}_{-1})$
+ 1.0 (+ 10, − 5)	$\delta = +1.0^{+1.0}_{-0.5}$
+ 10 (+ 00, − 5)	$\delta = +10^{+\infty}_{-5}$
10 (00)	$\lvert\delta\rvert \geq 10$
	Note that a positive sign indicates that the phase of δ has been explicitly determined; no sign indicates no phase determination
METHOD	Method used
J	Nuclear orientation by technique not using coincident emitted radiation; for example, nuclear reaction or low-temperature techniques
G	Gamma ray detected using solid-state Ge(Li) detectors
N	Gamma ray detected using NaI or equivalent scintillation detector
P	Gamma-ray polarization measurement
E	Conversion electron detected
	For example:
	GG = $\gamma\gamma(\theta)$ with 2 Ge(Li) detectors
	NG = $\gamma\gamma(\theta)$ with γ_1 detected in a NaI detector and γ_2 in a Ge(Li) detector
	JG = J$\gamma(\theta)$ with Ge(Li)
	NNN = 3 gamma rays measured in cascade using NaI detectors
SAMPLE ENTRIES	Line 1 of page 1 of Table
	69Aq01 measured the angular correlation between the 689- and 122-keV gamma rays in ^{152}Sm using a Ge(Li)-NaI combination. They reported $a_2 = -0.082 \pm 0.015$ and $a_4 = 0.370 \pm 0.100$, from which is deduced $\lvert\delta\rvert > 36$ for the 689-keV transition
	Line 2 of page 1 of Table
	69Fr01 measured the angular distribution of the 689-keV transition following Coulomb excitation by ^{16}O. They used a Ge(Li) detector and reported $a_2 = -0.131 \pm 0.090$ and $a_4 = -0.500 \pm 0.150$, from which is deduced $\delta = +67^{+\infty}_{-54}$ for the 689-keV transition

TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
SM 152	811	2+	122	2+	689	122	-.082 (15)	.370 (100)	36 (00)	GN	69AQ01
						0,0	-.131 (90)	-.500 (150)	+67 (+00,-54)	JG	69FR10
						122	-.075 (30)	.377 (70)	25 (00)	GG	70BA32
						122	-.071 (20)	.390 (40)	29 (00)	GN	70HE29
						122	-.118 (10)	.325 (24)	+17 (+5 ,-3)	EG	70RAZF
						122	-.125 (55)	.330 (90)	+15 (+00,-8)	GN	71RU05
						A,A			+13 (+28,-5)	JG	72MC30
						122	-.160 (40)	.360 (70)	+8 (+9 ,-3)	GN	73KA05
						0,0	.020 (70)	-.400 (100)	+8 (+6 ,-3)	JG	74D004
SM 152	1026	4+	367	4+	656	0,0	.014 (130)	-.590 (230)	+2.9 (+19,-9)	JG	69FR10
						245	-.196 (29)	.181 (53)	+3.1 (+15,-14)	GG	70RAZF
						245	-.150 (44)	.154 (70)	+8 (+00,-7)	GG	71BA54
						0,0	.120 (100)	-.390 (140)	+2.1 (3)	JG	74D004
SM 152	1087	2+	122	2+	965	122	-.020 (20)	.220 (50)	-13.3 (+72,-34)	NN	57OF06
						122	.023 (35)	.375 (50)	-7.7 (+40,-20)	NN	59LI48
						122	.049 (30)	.312 (80)	-6.1 (+19,-12)	NN	60DE16
						122	-.035 (23)	.310 (60)	-18 (+22,-6)	GN	69AQ01
						0,0	-.207 (36)	-.550 (70)	-27 (+55,-11)	JG	69FR10
						122	.017 (5)	.320 (22)	-8.1 (+5 ,-4)	GG	70BA32
						122	-.029 (8)	.280 (20)	-16 (3)	GN	70HE29
						122	.006 (2)	.322 (5)	-9.2 (2)	EG	70RAZF
						122	-.014 (10)	.306 (10)	-12 (2)	GN	70RU09
						122	-.008 (5)	.327 (12)	-11 (1)	GG	71LA11
						A,A			-3.8 (18)	JG	72MC30
						122	-.010 (5)	.323 (8)	-11.3 (+8 ,-7)	GN	73KA05
						0,0	-.221 (52)	-.369 (71)	-23 (+00,-15)	JG	74D004
SM 152	1235	3+	367	4+	869	245	.141 (34)	-.235 (46)	-6.6 (+28,-16)	NN	59LI48
						245	.187 (26)	.167 (64)	-9.1 (+18,-13)	NE	60NA09
						245	.258 (24)	.150 (30)	-6.2 (+8 ,-7)	NE	63BI13
						122	.133 (16)	-.173 (33)	-7.1 (+13,-9)	GG	70BA32
						245	.160 (9)	-.190 (20)	-5.6 (4)	GN	70HE29
						245			-5.0 (7)	GG	70LAZL
						245	.151 (6)	-.167 (13)	-6.1 (3)	EG	70RAZF
						245	.126 (13)	-.189 (21)	-7.6 (+11,-8)	GN	70RU09
						245	.144 (8)	-.185 (13)	-6.4 (+6 ,-4)	GG	71BA54
						122	.088 (8)	-.186 (12)	-12.2 (+16,-12)	GN	73KA05
SM 152	1235	3+	122	2+	1113	122	-.140 (40)	-.080 (20)	+12 (+20,-4)	NN	57OF06
						122	-.169 (24)	-.064 (22)	+23 (+50,-10)	NN	59LI48
						122	-.250 (60)	-.043 (23)	-17 (+00,-10)	NN	60DE16
						122	-.242 (7)	-.080 (10)	-20 (+5 ,-3)	GN	69AQ01
						122	-.260 (10)	-.082 (14)	-13.8 (+30,-21)	GG	70BA32
						122	-.254 (7)	-.090 (10)	-15 (+3 ,-2)	GN	70HE29
						122	-.250 (8)	-.091 (5)	-16.8 (+36,-25)	EG	70RAZF
						122	-.290 (8)	-.086 (15)	-8.8 (+10,-9)	GN	70RU09
						122	-.292 (8)	-.093 (15)	-8.6 (+9 ,-7)	GG	71LA11
						122	-.232 (5)	-.098 (9)	-28 (+6 ,-5)	GN	73KA05
SM 152	1372	4+	367	4+	1005	0,0	-.360 (60)	-.510 (100)	-13 (+00,-8)	JG	69FR10
						122	.005 (53)	.067 (91)	-3.0 (+20,-9)	GG	70BA32
						122	-.040 (30)	.130 (60)	-4.5 (+25,-12)	GN	70HE29
						245			-6 (+19,-3)	GG	70LAZL
						245	.011 (12)	.100 (30)	-2.8 (+3 ,-2)	EG	70RAZF
						245	-.008 (16)	.102 (24)	-3.3 (+5 ,-4)	GG	71BA54
						122	.010 (60)	.100 (100)	-2.8 (+22,-9)	GN	73KA05
						0,0	-.251 (99)	-.524 (146)	10 (00)	JG	74D004
SM 152	1530	2-	1041	3-	489	122	-.105 (15)	-.324 (37)	-5.7 (6)	GG	70BA32
GD 152	931	2+	344	2+	586	344	.282 (61)	.202 (104)	-2.0 (+5 ,-4)	GG	70BA32
						344	.172 (11)	.275 (19)	-3.05 (14)	GN	72KA45
GD 152	1109	2+	344	2+	765	344	-.222 (17)	.321 (39)	+4.3 (+7 ,-6)	GN	72KA45
GD 152	1318	2+	344	2+	974	344	-.149 (34)	.114 (57)	+0.58 (7)	GN	72KA45
GD 152	1434	3+	755	4+	679	411	.014 (30)	-.186 (37)	24 (00)	NN	65SC06
						344	.003 (74)	-.232 (128)	9 (00)	GG	70BA32
GD 152	1434	3+	344	2+	1090	344	-.288 (45)	.058 (47)	-0.29 (5)	NN	60DE16
						344	-.168 (13)	-.068 (43)	-0.12 (+3 ,-2)	NN	61GR28
						344	-.201 (16)	-.018 (23)	-0.17 (2)	NN	65SC06
						344	-.243 (19)	.015 (33)	-0.22 (3)	GG	70BA32
GD 152	1941	2+	1318	2+	623	344	-1.000 (400)		+0.7 (+8 ,-5)	JG	72KA45

See page 388 for Explanation of Table I

TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
GD 154	816	2+	123	2+	692	123	-.134 (26)	.235 (41)	+12 (+10,-4)	GN	67HA35
						123	-.150 (40)	.369 (66)	+9 (+11,-3)	GN	69HA01
						123	-.040 (100)		+1.75 (+30,-10)	EN	71MA65
						123	-.145 (35)	.305 (65)	+10 (+11,-4)	GN	71RU05
						123	-.144 (22)	.311 (40)	+10 (+5 ,-3)	GN	71WH01
GD 154	996	2+	123	2+	873	722	-.133 (24)	-.039 (37)	-4.2 (+26,-14)	NN	58HI73
						722	-.083 (15)	-.007 (20)	-30 (+00,-17)	NN	60DE16
						123	.040 (55)	.278 (94)	-6.6 (+74,-19)	NN	60DE16
						123	-.012 (14)	.324 (1)	-11.8 (+30,-21)	GN	67HA35
						123	.018 (20)	.302 (40)	-8.1 (+21,-14)	GN	69HA01
						722	-.126 (16)	.006 (2)	-5.0 (+16,-11)	NN	69VA09
						123	-.002 (16)	.303 (42)	-10.2 (+27,-18)	NN	69VA09
						123	.020 (12)	.322 (21)	-8 (1)	GN	70RU09
						722	-.097 (4)	.004 (4)	-9.7 (+16,-12)	NN	71LA11
						123	-.007 (13)	.330 (23)	-10.9 (+30,-20)	GG	71LA11
						123	.002 (12)	.323 (1)	-9.7 (+18,-13)	GN	71WH01
						722	-.103 (15)		-13 (+8 ,-3)	GG	72G035
						123	-.006 (11)	.315 (12)	-10.9 (+18,-15)	GG	72G035
						723			-10 (+4 ,-2)	GN	730801
GD 154	1048	4+	371	4+	677	248	-.168 (20)	.178 (29)	+4.4 (+46,-17)	GN	71WH01
						248	-.200 (23)	.153 (39)	+2.6 (5)	GN	73C037
GD 154	1131	3+	371	4+	757	248	.179 (13)	-.154 (21)	-4.9 (4)	NN	69VA09
						248	.156 (15)	-.180 (37)	-5.9 (7)	GN	70RU09
						248	.161 (4)	-.174 (5)	-5.6 (2)	GN	71WH01
						248	.185 (21)	-.157 (25)	-4.7 (6)	GG	72G035
GD 154	1131	3+	123	2+	1008	591	-.008 (23)	.011 (32)	-18 (+10,-6)	NN	58HI73
						123	-.181 (72)	-.011 (87)	11 (00)	NN	60DE16
						123	-.161 (11)	-.090 (20)	+8.0 (+14,-9)	GN	67HA35
						123	-.205 (25)	-.026 (50)	30 (00)	NN	69VA09
						123	-.294 (10)	-.076 (15)	-8.4 (+11,-3)	GN	70RU09
						123	-.316 (10)	-.082 (10)	-6.7 (7)	GG	71LA11
						123	-.239 (18)	-.073 (26)	-22 (+24,-7)	GN	71WH01
						123	-.248 (16)	-.088 (36)	-18 (+10,-5)	GG	72G035
						591			-9.5 (+70,-40)	GN	730801
GD 154	1265	4+	371	4+	893	248	.003 (28)	.098 (98)	-3.0 (+8 ,-5)	NN	69VA09
						248	-.037 (10)	.160 (13)	-4.4 (5)	GN	71WH01
						248	-.035 (15)	.114 (19)	-4.2 (+10,-6)	GN	73C037
GD 156	1154	2+	89	2+	1065	812	-.011 (10)		+7.4 (+22,-14)	NN	61CL02
						812	-.030 (20)	.000 (20)	+5.6 (+22,-12)	NN	62BA38
						89	.060 (20)	.310 (20)	-5.6 (+10,-7)	NN	62BA38
						356	-.029 (55)	-.049 (97)	2 (00)	GN	67KE15
						89	-.120 (78)	.216 (191)	5 (00)	NG	67KE15
						812	.063 (10)	.007 (10)	-18 (+21,-6)	GN	70RU09
						89	-.035 (6)	.337 (12)	-18 (3)	GN	72HA17
						HT	.110 (40)	.017 (40)	-6.5 (+79,-26)	JG	75UL01
GD 156	1129	2+	89	2+	1040	89	.054 (43)	.250 (90)	-5.9 (+28,-14)	GN	72HA17
GD 156	1249	3+	288	4+	960	262	.257 (93)	.138 (151)	+5 (+20,-3)	GN	67KE15
						HT	.075 (30)	.001 (30)	-11.7 (+53,-27)	JG	75UL01
GD 156	1249	3+	89	2+	1159	89	-.235 (131)	-.112 (162)	6 (00)	NG	67KE15
						262	.033 (60)	.020 (90)	-10 (+00,-5)	GN	67KE15
						HT	.028 (9)	-.015 (9)	-11.8 (+7 ,-6)	JG	75UL01
GD 156	1355	4+	289	4+	1066	199	-.084 (79)	.180 (105)	3 (00)	NG	67KE15
						199	-.030 (27)	.134 (64)	-4.0 (+16,-9)	GN	75UL01
GD 156	1511	4+	1249	3+	262	535	.059 (112)	.002 (198)	5 (00)	NG	67KE15
						HT	-.161 (8)	.030 (9)	+9.2 (+7 ,-6)	JG	75UL01
GD 156	1511	4+	289	4+	1223	199	.040 (10)	.110 (20)	-2.3 (3)	NN	59OF11
						535	-.110 (20)	.000 (10)	-2.5 (+25,-9)	NN	59OF11
						QT	.134 (5)		-1.15 (10)	JN	62L001
						199	.057 (29)	.108 (31)	-2.1 (4)	NG	67KE15
						535	-.142 (6)	.001 (1)	-1.68 (17)	NN	68WE17
						199	.080 (5)	.121 (6)	-1.83 (6)	NN	68WE17
						199	.053 (13)	.126 (35)	-2.07 (+14,-13)	GN	75UL01
						HT	.268 (4)	-.010 (5)	-2.5 (+8 ,-5)	JG	75UL01
GD 156	1622	5+	1511	4+	112	356	.026 (56)	.235 (185)	+0.15 (+10,-9)	GN	75UL01
GD 156	1622	5+	585	6+	1038	199	.092 (76)	.152 (176)	-7 (+21,-3)	GN	75UL01
GD 156	1622	5+	288	4+	1333	199	-.302 (67)	-.126 (104)	-3.5 (+26,-14)	NG	67KE15
						HT	.348 (12)	.082 (12)	-3.8 (2)	JG	75UL01
GD 156	1966	1+	1154	2+	812	1154	-.145 (23)		-0.092 (19)	NN	61CL02
						1154	-.180 (20)	-.010 (20)	-0.062 (18)	NN	62BA38
						1154	-.195 (10)	-.002 (10)	-0.048 (8)	NG	70RU09
						89	.045 (7)	-.012 (13)	-0.035 (30)	GN	72HA17
GD 156	1966	1+	89	2+	1877	89	-.580 (28)	-.126 (34)	+0.41 (+8 ,-6)	GN	72HA17
GD 156	2027	1+	89	2+	1938	89	.321 (21)	-.198 (27)	-0.55 (3)	GN	72HA17
GD 156	2187	1+	89	2+	2098	89	.270 (20)	-.150 (20)	-0.48 (3)	NN	62BA38
						89	.581 (22)	-.410 (20)	-1.2 (2)	GN	72HA17

See page 388 for Explanation of Table I

TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
ER 168	821	2+	80	2+	741	720	.028 (17)	-.011 (29)	6 (00)	NN	64RE05
						720	.013 (1)	.001 (2)	+65 (+00,-26)	NN	71LA11
						0,0	-.181 (47)	-.423 (73)	19 (00)	JG	72D001
						A,A			70 (00)	JG	72MC30
						720	.036 (13)	-.010 (20)	8 (00)	GG	73QU01
						80	-.050 (12)	.326 (24)	-28 (+22,-8)	GG	73QU01
ER 168	896	3+	264	4+	632	184	-.004 (7)	.170 (20)	+37 (+11,-7)	EN	71HA50
						184	.180 (8)	-.177 (20)	-4.8 (3)	GG	73QU01
ER 168	896	3+	80	2+	816	198	-.019 (21)	.000 (25)	7 (00)	NN	64RE05
						198	.022 (4)		-60 (+00,-30)	EN	71HA50
						80	-.157 (8)	-.091 (16)	+16.8 (+32,-25)	GG	73QU01
ER 168	995	4+	264	4+	731	184	-.180 (20)	-.090 (20)	-18 (+29,-7)	EN	71HA50
						0,0	-.413 (64)	-.557 (96)	-5 (+10,-3)	JG	72D001
						184	-.130 (12)	.160 (20)	+25 (+00,-13)	GG	73QU01
						99	-.120 (12)	.002 (15)	+50 (+00,-33)	GG	73QU01
ER 168	1541	3-	1094	4-	447	198	.007 (4)		-0.15 (1)	NN	73KI09
ER 170	932	2+	79	2+	853	0,0	-.179 (42)	-.509 (70)	-57 (+00,-36)	JG	72D001
						A,A			10 (00)	JG	72MC30
ER 170	1101	4+	261	4+	840	0,0	-.306 (73)	-.623 (113)	9 (00)	JG	72D001
ER 170	1124	4+	261	4+	863	0,0	-.416 (121)	-.661 (205)	-5 (+00,-3)	JG	72D001
YB 172	1172	3+	260	4+	912	181	.390 (60)	-.160 (40)	-1.2 (+7 ,-4)	NN	65GU01
						181	.465 (9)		-1.7 (2)	NE	69VU01
YB 172	1172	3+	79	2+	1094	79	-.240 (32)	-.006 (24)	-0.22 (4)	NN	63ST09
						79	-.281 (16)	-.049 (9)	-10 (+3 ,-2)	NN	65GU01
						91	.348 (36)	.077 (31)	-3.7 (3)	NN	65GU01
						203	-.083 (16)	.019 (26)	-3.6 (+6 ,-5)	NN	65GU01
						79	-.410 (10)	-.042 (12)	-3.3 (2)	GN	67BL01
						91	.420 (20)	.012 (25)	-3.14 (+16,-14)	GN	67BL01
						203	-.072 (17)	.004 (24)	-4.0 (+9 ,-6)	GN	67BL01
						79	-.136 (14)		-2.8 (+27,-7)	NE	67KL01
						79	-.045 (8)	.005 (3)	-2.3 (+4 ,-3)	PN	67WE08
						79	-.123 (4)		-3.3 (4)	NE	69VU01
						79	-.386 (16)	-.081 (16)	-3.8 (+5 ,-3)	NN	71WA03
						91	.354 (15)	.062 (28)	-3.64 (+15,-14)	NN	71WA03
YB 172	1263	4+	260	4+	1003	181	-.100 (20)	.130 (20)	-17 (+00,-9)	NN	65GU01
						181	.250 (40)		13 (30)	NE	69VU01
YB 172	1376	5+	260	4+	1115	181	.430 (260)		3.3 (00)	NE	69VU01
YB 172	1466	2+	79	2+	1387	79			-9.3 (+50,-25)	GG	70LAZL
YB 172	1477	2+	79	2+	1398	79			+1.0 (+00,-6)	GG	70LAZL
YB 172	1550	3+	79	2+	1471	79			-5.6 (+30,-20)	GG	70LAZL
YB 172	1609	2+	79	2+	1530	79			+8.0 (+20,-15)	GG	70LAZL
YB 172	1663	3+	79	2+	1584	79	-.134 (15)	.002 (32)	-0.074 (20)	NN	63ST09
YB 172	2073	4+	1263	4+	810	1094	-.146 (8)	-.009 (11)	-0.25 (+50,-13)	NN	65GU01
						181	-.350 (100)		+0.12 (13)	NE	69VU01
						91	-.380 (84)	.036 (50)	0.00 (+13,-17)	NN	71WA03
YB 172	2073	4+	1172	3+	901	1094	.031 (22)	-.020 (44)	+0.049 (38)	NN	63ST09
						79	.083 (14)	-.030 (28)	-0.30 (8)	NN	63ST09
						1094	.021 (6)	.018 (13)	+0.066 (11)	NN	65GU01
YB 174	1518	6+	526	6+	992	272	.028 (10)	.076 (10)	-1.84 (+13,-12)	NN	71GI06
						272	.047 (15)	.078 (22)	-1.63 (+17,-14)	NG	74SC15
HF 174	901	2+	91	2+	809	A,N	-.067 (40)	-.044 (53)	-11 (+00,-7)	JG	71EJ01
HF 174	1063	4+	298	4+	765	A,N	-.290 (30)	-.085 (40)	-2.5 (+13,-7)	JG	71EJ01
HF 174	1308	6+	609	6+	699	A,N	-.090 (60)	-.075 (50)	-0.9 (2)	JG	71EJ01

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TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
GD 158	1188	2+	80	2+	1108	80	-.044 (56)	.260 (66)	9 (00)	NN	68SC04
DY 160	966	2+	87	2+	879	299	-.045 (10)	-.020 (20)	75 (00)	NN	58OF01
						299	-.126 (26)	.015 (20)	-7 (+6 ,-3)	NN	59AR59
						HT	.310 (45)		-6.1 (+23,-14)	JN	60J012
						299	-.116 (37)		-6 (+10,-3)	NN	60KL01
						392	-.062 (16)	.011 (19)	-23 (+00,-11)	NN	62SI06
						299	-.120 (23)	.009 (14)	-7 (+4 ,-3)	NN	63MI07
						392	-.081 (6)	.002 (9)	-14.9 (+39,-25)	NN	65GU02
						87	-.043 (6)	.327 (6)	-22 (+5 ,-3)	NN	65GU02
						299	-.124 (22)	.014 (22)	-6 (+7 ,-2)	NN	65GU05
						299	-.079 (3)	-.004 (3)	-15.0 (+18,-14)	NN	65GU02
						87	-.092 (10)	.300 (10)	30 (00)	NN	65RE04
						299	-.126 (20)	-.008 (11)	-6.4 (+27,-16)	NN	65RE04
						87	-.020 (13)	.325 (3)	-13 (+4 ,-2)	NG	67JA04
						299	-.088 (15)	-.020 (22)	-17 (+16,-6)	GN	67JA04
						299	-.089 (11)	-.015 (17)	-13.4 (+63,-33)	GG	71KR02
						87	.012 (17)	.324 (25)	-9.7 (+25,-17)	GG	71KR02
						299,87	-.217 (42)	.076 (46)	-7.0 (+30,-14)	NNN	71PA25
						87	-.030 (4)	.322 (17)	-16.1 (+15,-13)	GG	73GA10
						299	-.088 (5)	-.004 (6)	-16.9 (+33,-24)	GG	73GA10
						HT	.065 (5)	.010 (4)	-18 (+8 ,-4)	JG	74F027
DY 160	1049	3+	284	4+	765	215			-4.7 (+50,-17)	GG	70LAZL
						87	.140 (100)	.110 (130)	-7 (+35,-4)	GG	71KR02
						HT	.049 (6)	-.014 (4)	-7.7 (+7 ,-6)	JG	74F027
DY 160	1049	3+	87	2+	962	HT	.301 (157)		-4.5 (+27,-13)	JN	60J012
						215	.079 (16)	-.016 (21)	-5.5 (+10,-9)	NN	63MI07
						215	-.010 (20)		-20 (+30,-8)	NN	65GU05
						87	-.070 (30)	.001 (10)	+5.9 (+16,-12)	NN	65RE04
						215	-.005 (20)	.008 (34)	-18 (+20,-6)	GN	67JA04
						87	-.109 (42)	-.113 (106)	+8.3 (+65,-26)	NG	67JA04
						215			-9.0 (+28,-17)	GG	70LAZL
						215	.000 (50)	.000 (50)	-16 (+00,-9)	GG	71KR02
						87	-.247 (44)	-.057 (33)	-18 (+00,-9)	GG	71KR02
						HT	.080 (52)	-.055 (32)	-6 (+4 ,-2)	JG	74F027
DY 162	888	2+	81	2+	808	A,A			-7 (+00,-6)	JG	70ENZX
						0,0	-.135 (62)	-.557 (95)	20 (00)	JG	720001
DY 162	1061	4+	266	4+	795	0,0	-.564 (92)	-.379 (132)	-2.4 (+47,-10)	JG	720001
DY 164	762	2+	73	2+	689	A,A			-8 (+00,-6)	JG	70ENZX
ER 166	786	2+	81	2+	705	0,0	-.242 (42)	-.464 (68)	-27 (+33,-12)	JG	720001
						A,A			21 (00)	JG	72MC30
ER 166	859	3+	81	2+	779	81			10 (00)	NN	61B020
ER 166	956	4+	265	4+	691	0,0	-.465 (63)	-.546 (93)	-3.3 (+30,-12)	JG	720001
ER 166	1074	5+	545	6+	530	280	-.003 (9)	-.101 (16)	-85 (+00,-43)	NN	65RE02
ER 166	1074	5+	265	4+	810	184	-.190 (60)	.010 (60)	-11 (+00,-6)	NN	58GR43
						HT	.071 (18)	.468 (22)	-26 (+11,-5)	JN	59P062
						184	-.084 (19)	-.046 (10)	+16 (+12,-5)	NN	63GE09
						712	.013 (3)	.004 (5)	-11 (+20,-5)	NN	63GE09
						184	-.146 (4)	-.042 (6)	-36 (+12,-6)	NN	65RE02
						712	.013 (4)	.007 (5)	-19 (+15,-6)	NN	65RE02
						184	-.116 (5)	-.030 (5)	+60 (+40,-20)	NN	72CA42
						184	-.169 (7)	-.059 (2)	-16.4 (+31,-26)	GN	72MI21
ER 166	1376	7+	545	6+	831	280	-.206 (18)	-.043 (24)	-5.9 (+14,-9)	NN	63GE09
						280	-.111 (7)	-.047 (11)	-70 (+00,-30)	NN	65RE02
						280	-.117 (7)	-.051 (3)	-42 (+25,-13)	GN	72MI21

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TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
HF 176	1227	2+	89	2+	1138	A,N	-.380 (130)	.080 (140)	4 (00)	JG	73HA07
HF 176	1391	4+	290	4+	1101	A,N	-.200 (130)	-.360 (120)	0.7 (50)	JG	73HA07
HF 178	1175	2+	93	2+	1082	A,A			11 (00)	JG	71VA06
						93	-.110 (200)	.750 (280)	2 (00)	GN	72LI03
HF 178	1276	2+	93	2+	1183	93	-.056 (51)	-.025 (57)	+0.41 (+9 ,-7)	NN	68NI03
						93	-.064 (29)	.063 (43)	+0.43 (+4 ,-5)	GN	70HA43
						93	-.054 (23)	.041 (33)	+0.410 (36)	GN	72LI03
HF 178	1496	2+	93	2+	1403	93	.451 (35)	.122 (40)	-1.0 (+2 ,-3)	NN	68NI03
						93	.494 (15)	.143 (20)	-0.8 (1)	GN	70HA43
						93	.505 (14)	.118 (16)	-0.73 (5)	GN	72LI03
HF 180	1201	2+	93	2+	1107	A,A			+10 (+22,-6)	JG	74VA09
W 182	1221	2+	100	2+	1121	152	-.010 (14)	.013 (19)	+4 (+16,-2)	NN	60HI02
						68	.039 (8)	.000 (10)	+5.0 (+6 ,-4)	NN	63EL02
						130	-.138 (15)	.310 (22)	+12 (3)	NN	63EL02
						68	-.147 (51)	-.002 (1)	-5 (+7 ,-3)	NN	65RE12
						100	-.081 (5)	.302 (1)	+200 (+00,-99)	NN	65RE12
						152	-.021 (16)	.010 (11)	+2 (+4 ,-1)	NN	65RE12
						P,P	-.029 (25)		+16 (+16,-6)	JG	71MI08
						130	-.107 (14)	.326 (16)	+23 (+21,-7)	GG	72HE10
						HT	.022 (8)	.007 (11)	+21 (+19,-6)	JG	72KR05
						68	-.006 (6)	.040 (40)	+12 (+2 ,-1)	GG	75CU01
W 182	1257	2+	100	2+	1157	P,P	-.154 (30)		-0.59 (6)	JG	71MI08
						130	.441 (99)	.234 (136)	-1.0 (+6 ,-4)	GG	72HE10
						HT	-.011 (40)	.049 (47)	-0.62 (+35,-20)	JG	72KR05
W 182	1331	3+	329	4+	1002	229	.111 (12)	.172 (1)	-8.9 (+16,-10)	NN	65RE12
						HT	.078 (22)	.031 (25)	-8.9 (+30,-18)	JG	72KR05
W 182	1331	3+	100	2+	1231	100	.037 (12)	-.002 (18)	+3.1 (2)	NN	60HI02
						222	-.012 (14)	-.001 (20)	14 (00)	NN	60HI02
						100	-.041 (12)	-.001 (1)	+4.8 (4)	NN	65RE12
						222	-.017 (11)	.008 (13)	24 (00)	NN	67MA31
						HT	.050 (9)	.027 (14)	-60 (+99,-20)	JG	72KR05
						130	-.228 (20)	-.079 (20)	-32 (+00,-15)	GG	75QU01
W 182	1374	3-	1289	2-	85	HT	-.125 (17)	-.025 (21)	+0.30 (2)	JG	72KR05
						68	.106 (18)	.004 (12)	+0.31 (5)	GG	75QU01
W 182	1487	4-	1374	3-	114	HT	-.162 (15)	.018 (17)	+0.31 (2)	JG	72KR05
						152	-.160 (90)	.090 (120)	+0.9 (+17,-6)	GN	73SE14
						152	-.080 (15)	.005 (15)	+0.31 (5)	GG	75QU01
W 182	1553	4-	1487	4-	66	114	.081 (10)	.030 (30)	+0.15 (15)	GG	75QU01
W 182	1553	4-	1374	3-	179	152	-.150 (10)	-.035 (25)	+0.56 (+8 ,-5)	NN	63EL02
						HT	-.504 (16)	.006 (7)	+1.92 (+13,-7)	JG	72KR05
						152	-.165 (12)	.018 (22)	+0.68 (+22,-10)	GN	73SE14
						152	-.153 (9)	-.005 (12)	+0.96 (40)	GG	75QU01
W 184	903	2+	111	2+	792	111	-.065 (8)	.327 (9)	-60 (+00,-22)	NN	60BO07
						111	-.027 (3)	.307 (15)	-15.0 (+10,-8)	NN	64KO13
						111	-.038 (11)		-20 (+7 ,-5)	NE	69ZU01
						111	-.036 (8)		-18.7 (+46,-31)	NG	70DO08
						P,P	-.114 (14)		-19 (+11,-5)	JG	71MI08
						HT			-16.65 (85)	JG	72BU35
						111	-.043 (7)		-22.0 (+60,-35)	GG	73CA08
						HT			-18.2 (12)	JG	73HU06
						HT	.150 (3)	-.019 (3)	-16.1 (9)	JG	73KR01
W 184	1006	3+	364	4+	642	253	.116 (19)	-.185 (29)	-8.5 (+21,-14)	GG	73CA08
						HT			-6.7 (18)	JG	73HU06
						HT	.095 (8)	.007 (11)	-8.5 (7)	JG	73KR01
W 184	1006	3+	111	2+	895	111	-.322 (29)	-.064 (36)	-6.3 (+22,-14)	NN	60BO07
						111	-.197 (57)	-.057 (48)	12 (00)	NG	70DO08
						111	-.263 (13)	-.063 (20)	-13.1 (+37,-21)	GG	73CA08
						HT			-17.5 (12)	JG	73HU06
						HT	.015 (7)	.017 (10)	-13.2 (9)	JG	73KR01
W 184	1122	2+	111	2+	1011	HT	-.408 (57)	-.265 (88)	+2.3 (+7 ,-5)	JG	73KR01
W 184	1135	4+	364	4+	771	HT			14 (00)	JG	73HU06
						HT	.279 (16)	-.010 (26)	-6.3 (+32,-20)	JG	73KR01
W 184	1386	2+	111	2+	1275	P,P	.050 (60)		+6 (+6 ,-2)	JG	71MI08
						HT	.091 (41)	.075 (62)	18 (30)	JG	73KR01

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TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
PT 184	649	2+	163	2+	486	163			+18 (+00,-13)	GG	74CA13
PT 184	940	3+	163	2+	486	163			+9 (+00,-5)	GG	74CA13
W 186	737	2+	122	2+	615	A,A	-.140 (15)		-11.1 (+35,-24)	JG	71MI08
W 186	1286	2+	122	2+	1164	A,A	-.018 (50)		+13 (+79,-6)	JG	71MI08
OS 186	767	2+	137	2+	630	137	-.020 (10)	.180 (30)	-13 (+3 ,-2)	NN	57LI35
						137	-.081 (7)	.320 (20)	60 (00)	NN	59KI44
						137	-.073 (10)	.310 (14)	50 (00)	NN	61BO08
						137	-.060 (10)	.280 (30)	-45 (+55,-17)	NN	61LE06
						137	-.070 (24)	.305 (38)	24 (00)	NN	63VE11
						0,0	-.165 (40)	-.492 (70)	25 (00)	JG	69CA19
						137	-.129 (17)	.332 (12)	+13.5 (+65,-35)	NN	69SC11
						137	-.001 (52)	.302 (49)	-10 (+22,-4)	GG	71KR01
						137	-.041 (5)	.184 (5)	-21 (3)	NN	72NA32
						137	-.034 (48)	.202 (55)	-18 (+00,-10)	GG	72RAYO
OS 186	910	3+	137	2+	773	137	-.269 (38)	-.016 (51)	-12 (+17,-5)	GG	71KR01
OS 188	633	2+	155	2+	478	155	-.038 (64)	.353 (18)	-19 (+00,-11)	NN	56PO13
						155	-.055 (11)	.289 (27)	-34 (+36,-11)	NN	59KI44
						155	-.079 (54)	.402 (83)	25 (00)	NN	60AR01
						155	-.033 (10)	.317 (20)	-17 (+5 ,-3)	NN	63YA01
						0,0	-.157 (40)	-.437 (60)	30 (00)	JG	69CA19
						155	-.015 (14)	.288 (21)	-12 (+3 ,-2)	GG	71KR01
						P,P	-.057 (24)		17 (00)	JG	71MI08
OS 188	790	3+	155	2+	635	155	-.430 (175)	.048 (210)	-8 (+12,-3)	NN	63YA01
						155	-.312 (30)	-.003 (19)	-7 (+3 ,-2)	GG	71KR01
OS 188	1843	1+	633	2+	1210	633	-.209 (13)	.050 (14)	-0.036 (11)	NN	69YA02
PT 188	506	2+	266	2+	340	P,N			-54 (+39,-17)	JG	72YO04
OS 190	557	2+	187	2+	371	187	.028 (12)	.156 (16)	-14 (+11,-4)	NN	63YA01
						0,0	-.275 (50)	-.469 (70)	-10.8 (+67,-33)	JG	69CA19
						P,P			-11 (3)	JN	69RO03
						187	-.075 (43)		-6.3 (+17,-11)	NE	69SA18
						187	.013 (10)	.296 (15)	-8.5 (+11,-9)	GG	71KR01
						P,P	-.156 (18)		-8.6 (+28,-17)	JG	71MI08
						187	-.010 (20)	.280 (30)	-11.4 (+46,-26)	GG	74HE08
						615	-.043 (9)	-.004 (13)	-9 (+8 ,-3)	GG	74HE08
OS 190	755	3+	557	2+	198	557	-.320 (30)	-.020 (40)	-6.4 (+24,-14)	GG	74HE08
OS 190	755	3+	548	4+	208	361	.070 (20)	-.170 (40)	-17 (+11,-5)	GG	74HE08
OS 190	755	3+	187	2+	569	187	-.208 (51)	-.064 (64)	+14 (+00,-7)	EN	65YA01
						187	-.288 (18)	.008 (23)	-9.0 (+26,-16)	GG	71KR01
						187	-.282 (15)	-.050 (20)	-9.8 (+24,-17)	GG	74HE08
OS 190	955	4+	548	4+	407	361	-.010 (20)	.130 (40)	-3.3 (+7 ,-5)	GG	74HE08
OS 190	1163	4+	756	3+	407	569	.049 (11)	.096 (17)	-5 (+27,-3)	GG	74HE08
OS 190	1204	5+	548	4+	656	361	-.200 (30)	-.050 (40)	-9 (+7 ,-3)	GG	74HE08
OS 190	1584	4-	1387	3-	197	829	-.110 (30)	-.090 (50)	-2.0 (+6 ,-5)	GG	74HE08
PT 190	598	2+	296	2+	302	P,N			+6.8 (+30,-12)	JG	72YO04

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TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
OS 192	489	2+	206	2+	283	0,0	-.390 (50)	-.451 (50)	-5.2 (+16,-11)	JG	69CA19
						P,P			-4.7 (+6 ,-7)	JN	69R003
						P,P	-.261 (30)		-3.0 (+9 ,-7)	JG	71MI08
						201206	.180 (30)	.130 (30)	-3.8 (7)	GN	75BE19
OS 192	690	3+	206	2+	484	206	-.274 (11)	-.073 (15)	-10.9 (+21,-15)	NG	69GR19
						206	-.280 (30)	-.070 (60)	-10 (+7 ,-3)	NG	69KH04
						206	-.304 (21)	-.060 (50)	-7.6 (+20,-13)	NG	70BE08
						HT			-5.8 (8)	JG	70HI12
						206	-.308 (15)	-.070 (20)	-7.2 (+13,-10)	GG	74HE08
						206	-.280 (7)	-.082 (8)	-10 (1)	NG	75BE19
OS 192	690	3+	489	2+	201	HT			1.9 (00)	JG	70HI12
						283	.24 (50)	.020 (60)	-3.7 (+33,-15)	GG	74HE08
						489	-.360 (30)	-.030 (30)	-4.6 (10)	GN	75BE19
PT 192	612	2+	316	2+	296	316	-.051 (2)	.091 (1)	+6.7 (5)	NN	67K013
						316	-.148 (13)	.292 (20)	+9.6 (+24,-15)	GN	68HA46
						316	-.152 (16)	.302 (20)	+9.1 (+27,-17)	GG	69GR19
						598	.000 (30)	.000 (60)	+10 (+00,-6)	NG	69KH04
						HT			+15 (+10,-5)	JG	69RE06
						316	-.177 (18)	-.092 (38)	+5.5 (+17,-10)	NE	70HI02
						HT			+6 (+3 ,-1)	JG	70HI12
						316	-.154 (4)	.313 (8)	+8.8 (+6 ,-5)	GG	73HO20
						316	-.150 (3)	.312 (4)	+9.4 (4)	GG	74HE08
PT 192	921	3+	612	2+	308	612	-.094 (15)	-.023 (20)	+7.1 (+12,-8)	GN	68HA46
						296	.000 (10)	-.012 (15)	+3.7 (+12,-7)	GG	69GR19
						612	-.124 (8)	-.080 (13)	+9.9 (10)	GN	69GR19
						612	-.120 (20)	-.027 (20)	+9.4 (+30,-19)	GN	69KE11
						612	-.100 (20)	-.070 (40)	+7.6 (+18,-13)	NG	69KH04
						HT			+7.3 (2)	JG	69RE06
						612	-.084 (10)	-.075 (12)	+6.5 (+6 ,-5)	NG	70BE08
						612	-.172 (51)	.193 (97)	+11 (+00,-6)	NE	70HI02
						HT			+7.1 (6)	JG	70HI12
						296316	.090 (12)	.062 (15)	+4.4 (+13,-7)	NNN	72SI39
						296	-.003 (5)	-.031 (9)	2.5 (00)	GG	73HO20
						316	.010 (4)	-.024 (8)	+5 (+00,-3)	GG	73HO20
						316	.025 (4)	-.030 (6)	+9.6 (+28,-19)	GG	74HE08
PT 192	921	3+	316	2+	605	316	-.480 (16)		-2.1 (+3 ,-2)	NG	68HA46
						316	-.492 (15)	-.051 (20)	-2.0 (2)	GN	69GR19
						316	-.410 (15)	-.070 (22)	-3.3 (3)	NG	69KE11
						316	-.490 (30)	-.050 (50)	-2.0 (4)	GN	69KH04
						HT			-1.5 (1)	JG	69RE06
						316	-.450 (10)	-.065 (13)	-2.6 (2)	NG	70BE08
						316	-.626 (50)	.108 (107)	-3.3 (+7 ,-4)	NE	70HI02
						HT			-1.5 (1)	JG	70HI12
						316			-3.0 (+12,-9)	NE	70SE09
						316	-.587 (13)	-.045 (19)	-1.8 (2)	GG	74HE08
PT 192	1201	4+	785	4+	417	468	-.12 (26)	-.027 (20)	8 (00)	GN	69KE11
						468	-.120 (30)	.110 (60)	8 (00)	GN	69KH04
						HT			-4 (+7 ,-3)	JG	70HI12
						316	-.210 (40)	.240 (60)	+2.5 (+16,-8)	GG	74HE08
						468	-.150 (40)	.160 (60)	+8 (+00,-7)	GG	74HE08
PT 194	622	2+	329	2+	293	329	-.045 (53)	.301 (16)	9 (00)	NN	55MA34
						329	-.071 (42)	.311 (70)	16 (00)	NN	62BU03
						645	-.107 (56)	.315 (72)	10 (00)	NN	62BU03
						645	-.050 (10)	.225 (11)	+10 (+4 ,-2)	NN	65KE11
						645	.083 (10)	.327 (15)	+3.0 (3)	NN	66AG02
						329	-.131 (17)	.003 (18)	+7.0 (+30,-17)	NE	67AL09
						329	-.101 (14)	.323 (22)	+30 (+39,-11)	GN	69HA43
						329	-.127 (8)	.325 (10)	+14.0 (+28,-19)	GG	71KR01
PT 194	924	3+	329	2+	594	329	-.230 (30)	-.160 (60)	-30 (+00,-16)	GN	73SI22
PT 194	1513	2+	329	2+	1184	329	-.420 (140)	-.090 (210)	+1.6 (+10,-6)	NN	65MA10
						329	-.250 (20)	.180 (50)	+0.86 (+9 ,-7)	GN	73SI22
PT 194	1623	2+	329	2+	1294	329	.370 (70)	.300 (130)	-1.5 (4)	GN	73SI22
PT 194	1672	2+	329	2+	1343	329	.410 (60)	.140 (120)	-0.7 (+9 ,-6)	GN	73SI22
PT 194	2114	2+	329	2+	1786	329	-.133 (114)	.214 (139)	+0.55 (+29,-19)	NN	65MA10

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TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
PT 196	688	2+	355	2+	333	355	.080 (60)	.327 (42)	-4.9 (+30,-14)	NN	53ST05
						355	.068 (25)	.287 (3)	-9.0 (+43,-21)	NN	56P047
						355	.070 (3)	.290 (7)	-5.0 (5)	NN	63IK01
						355	.114 (7)	-.061 (7)	-4.9 (2)	NE	65PE06
						355	.113 (5)	.315 (10)	-4.03 (12)	GN	69HA43
						355	.058 (7)	.305 (10)	-5.7 (3)	GG	71KR01
HG 198	1088	2+	412	2+	676	412	-.261 (23)	.137 (12)	+1.90 (+14,-9)	NN	53SC19
						412	-.320 (30)	.237 (22)	+1.6 (+4 ,-2)	NN	53SC23
						412	-.258 (64)	.180 (70)	+0.9 (+9 ,-2)	NN	64JE04
						412	-.260 (19)	.150 (26)	+0.90 (+10,-8)	NN	64KE02
						412	-.332 (9)	.232 (13)	+1.6 (2)	NN	64SA11
						412	-.270 (20)	.190 (20)	+0.95 (+14,-9)	NN	65PE05
						412	-.310 (6)	.200 (10)	+1.26 (9)	NN	66UH01
						412	-.315 (13)	.239 (9)	+1.4 (2)	NN	67KO13
						412	-.253 (5)	.107 (7)	+0.87 (2)	NN	69ZA02
						412	-.287 (10)	.194 (17)	+1.07 (8)	GN	71BE09
						412	-.290 (16)	.194 (23)	+1.09 (+13,-12)	GN	71PA06
						412	-.272 (10)	.143 (6)	+0.96 (+7 ,-5)	NN	72VE03
						412	-.299 (3)	.193 (11)	+1.17 (2)	NN	74KA18
HG 198	1419	3+	412	2+	1008	412	.220 (40)	-.070 (60)	+1.3 (+3 ,-4)	GN	71BE09
						412	.220 (40)	-.120 (80)	+1.3 (+3 ,-4)	GN	71PA06
HG 198	1613	2+	412	2+	1201	412	.421 (17)	.017 (23)	-0.29 (+5 ,-4)	GN	71BE09
						412	.350 (30)	.030 (40)	-0.15 (5)	GN	71PA06
HG 198	1833	2+	412	2+	1421	412	.363 (17)	.021 (24)	-0.17 (3)	GN	71BE09
						412	.370 (30)	.050 (40)	-0.19 (+5 ,-6)	GN	71PA06
HG 198	1847	3+	1049	4+	798	637	.270 (60)	-.250 (90)	-2.8 (+12,-9)	GN	71BE09
HG 198	1847	3+	412	2+	1436	412	.054 (36)	-.006 (50)	+0.17 (5)	GN	71BE09
						412	.020 (50)	.090 (80)	+0.12 (7)	GN	71PA06
HG 198	1859	2+	412	2+	1447	412	.387 (31)	.056 (43)	-0.22 (6)	GN	71BE09
						412	.420 (50)	.110 (80)	-0.29 (+17,-10)	GN	71PA06
HG 198	1901	2+	412	2+	1490	412	.400 (40)	.015 (56)	-0.24 (+10,-7)	GN	71BE09
HG 198	2361	3+	1048	4+	1312	412	-.066 (24)	-.030 (30)	-0.088(+28,-29)	GN	71BE09
						637	-.066 (22)	.026 (34)	-0.088 (26)	GN	71BE09
HG 198	2453	1+	412	2+	2041	412	-.215 (24)	-.031 (32)	-0.031 (21)	GN	71BE09
HG 200	1254	2+	368	2+	886	368	.200 (90)	.320 (170)	-2.7 (+14,-8)	GN	71HA09
						368			-2.0 (+10,-5)		74BR02
HG 200	1574	2+	368	2+	1206	368	.063 (4)	.029 (8)	+0.244 (6)	NN	57LI39
						368	.065 (3)	.020 (7)	+0.241 (4)	NN	60GR06
						368	.078 (6)	.029 (9)	+0.224 (8)	NN	65SA02
						368	.100 (40)	-.030 (60)	+0.20 (5)	GN	69BE66
						368	.040 (21)	.062 (35)	+0.275 (29)	GN	71HA09
HG 200	1593	2+	368	2+	1225	368	.260 (40)	.250 (70)	-2.2 (3)	GN	71HA09
HG 200	1642	2+	368	2+	1273	368	.240 (30)	-.010 (40)	+0.014 (40)	GN	71HA09
HG 200	1731	2+	368	2+	1363	368	.490 (80)	.190 (130)	-0.7 (+6 ,-4)	GN	71HA09
HG 200	1776	3+	948	4+	828	580	-.123 (7)	.070 (15)	-0.020 (8)	NN	57LI39
						580	-.076 (6)	-.012 (7)	-0.076 (7)	NN	65SA02
						368	-.080 (40)	.030 (60)	-0.071 (47)	GN	69BE66
						368	-.057 (10)	-.015 (15)	-0.098 (12)	GN	71HA09
HG 200	1776	3+	368	2+	1407	368	-.380 (20)	.010 (30)	-0.44 (4)	GN	71HA09
HG 200	1883	2+	368	2+	1515	368	.101 (5)	.007 (12)	+0.19 (1)	NN	60GR06
						368	.104 (14)	-.017 (20)	+0.19 (2)	NN	65SA02
						368	.140 (30)	.110 (50)	+0.14 (4)	GN	71HA09

See page 388 for Explanation of Table I

TABLE I. Experimental Data on Angular Distributions and Mixing Ratios

NUCLIDE	INITIAL LEVEL E(KEV)	J	FINAL LEVEL E(KEV)	J	GAMMA-RAY E(KEV)	ALIGN-MENT	A2	A4	DELTA	METHOD	REFERENCE
PB 206	1341	3+	803	2+	538	HT	.240 (4)	.015 (15)	-0.033 (5)	JG	73KA35
PB 206	1684	4+	1341	3+	343	HT	.237 (4)	-.007 (20)	-0.027 (3)	JG	73KA35
PB 206	2384	6-	2200	7-	184	398	.030 (5)	-.007 (7)	-0.040 (13)	NN	70ZA03
PB 206	2782	5-	2384	6-	398	HT	.200 (3)	.013 (15)	+0.038 (3)	JG	73KA35
PB 206	3279	5-	2782	5-	497	HT	-.352 (4)		-0.09 (2)	JG	73KA35
PB 206	3279	5-	2384	6-	895	HT	.167 (3)	.040 (20)	-0.030 (3)	JG	73KA35
PB 206	3403	5-	2384	6-	1019	HT	.127 (4)	-.003 (20)	-0.018 (3)	JG	73KA35
PB 208	3475	4-	3198	5-	277	2615	-.285 (17)	.074 (22)	+0.050 (24)	GN	72JA25
PB 208	3475	4-	2615	3-	860	2615	-.096 (9)	.020 (20)	+0.023 (7)	NN	61SI11
						2615	-.109 (13)	.017 (21)	+0.013 (10)	NN	62W005
						2615	-.105 (14)	-.009 (18)	+0.016 (11)	GN	72JA25
PB 208	3709	5-	3198	5-	511	583	.168 (8)	-.010 (15)	+0.072 (29)	NN	61SI11
						2615	.311 (10)	-.008 (17)	+0.034 (24)	NN	61SI11
						583	.129 (14)	.014 (14)	+0.20 (4)	NN	62W005
						583	.159 (17)	.009 (16)	+0.10 (6)	NN	64SP06
						2615	.242 (13)	.023 (18)	+0.172 (25)	NN	64SP06
						583	.123 (19)	.064 (22)	+0.22 (12)	NN	67J017
						583	.162 (10)	.020 (20)	+0.093 (36)	NN	69B001
						2615	.318 (10)	-.016 (11)	+0.017 (24)	GN	72JA25
PB 208	3961	4-	3198	5-	763	2615	.279 (49)	.005 (46)	-0.39 (5)	NN	61SI11
PO 212	1513	2+	727	2+	785	727			+0.10 (+2 ,-3)	NN	60GA15
						727	.200 (18)		+0.066 (24)	NN	61GI05
PO 212	1806	2+	727	2+	1079	727			-3 (1)	NN	60GA15
						727	.182 (60)		+0.09 (8)	NN	61GI05
PO 214	1378	2+	609	2+	769	609	-.220 (65)	.378 (125)	+4.4 (+43,-19)	NN	61TA07
PO 214	1544	3+	609	2+	935	609	-.070 (30)		0.00 (40)	NN	58BI87
PO 214	1730	2+	609	2+	1120	609	.210 (40)	-.002 (46)	+0.05 (5)	NN	58BI87
PO 214	1848	2+	609	2+	1238	609	.165 (31)	.024 (37)	+0.11 (4)	NN	58BI87
PO 214	2017	2+	609	2+	1408	609	-.003 (10)	.325 (20)	-10.3 (+16,-12)	NN	58BI87
PO 214	2119	1+	609	2+	1509	609	-.102 (23)	.004 (15)	-0.13 (2)	NN	58BI87
TH 232	774	2+	50	2+	724	A,A			-1.5 (+28,-7)	JG	72MC30
TH 232	785	2+	50	2+	735	A,A			+23 (10)	JG	72MC30
CM 244	1042	6+	296	6+	746	154	-.050 (12)	.059 (15)	+0.92 (8)	NN	63HA29

See page 388 for Explanation of Table I

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TABLE II. Recommended Values of $E2,M1$ Mixing Ratios

$\delta = +10\ (1)$ indicates $\delta = +10 \pm 1$

$\delta = -10^{+2}_{-1}$ indicates $-12 \leq \delta \leq -9$

$\delta = +1.0^{+10}_{-5}$ indicates $+0.5 \leq \delta \leq +2.0$

NUCLIDE	E_γ(keV)	δ
^{152}Sm	489	-5.7 (6)
	656	$+2.1$ (3)
	689	$+12^{+4}_{-2}$
	869	-5.9 (2)
	965	-9.5 (2)
	1005	-2.9 (2)
	1113	-16 (2)*
^{152}Gd	586	-3.05 (14)
	623	$+0.7^{+8}_{-5}$
	679	$> +9,\ < -14$
	765	$+4.3$ (7)
	974	$+0.58$ (7)
	1090	-0.20 (2)
^{154}Gd	677	$+2.6$ (5)
	692	$+10^{+4}_{-2}$
	757	-5.4 (2)
	873	-9.1 (7)
	893	-4.0 (4)
	1008	-20 (5)*
^{156}Gd	112	$+0.15$ (10)
	262	$+9.2$ (6)
	812	-0.56 (7)
	960	-12^{+5}_{-3}
	1038	-7^{+21}_{-3}
	1040	-5.9^{+28}_{-14}
	1065	-18 (3)
	1066	-4.0^{+16}_{-9}
	1159	-11.8 (6)
	1223	-1.9 (1)
	1333	-3.8 (2)
	1877	$+0.41^{+8}_{-6}$
	1938	-0.55 (3)
	2098	-1.2 (2)
^{158}Gd	1108	$> +30,\ < -9$
^{160}Dy	765	-7.7 (6)
	879	-15 (1)
	962	-7.9^{+24}_{-13}
^{162}Dy	795	-2.4^{+47}_{-10}
	808	$> +26,\ < -26$
^{164}Dy	689	-8^{+20}_{-6}
^{166}Er	530	$-85^{+\infty}_{-43}$
	691	-3.3^{+30}_{-12}
	705	-27^{+33}_{-12}
	770	$> +10,\ < -10$
	810	-17 (3)
	831	-35^{+13}_{-7}
^{168}Er	447	-0.15 (1)
	632	-4.8 (3)
	731	$-100^{+\infty}_{-60}$
	741	-28^{+22}_{-8}
	816	$+16.8^{+32}_{-25}$
^{170}Er	840	$> +12,\ < -9$
	853	$-57^{+\infty}_{-36}$
	863	$-5^{+\infty}_{-3}$
^{172}Yb	810	$+0.05$ (9)
	901	$+0.06$ (1)
	912	-1.6 (2)
	1003	$-17^{+\infty}_{-9}$
	1094	-3.3 (2)
	1115	$> +3,\ < -3$
	1387	-9.3^{+50}_{-25}
	1398	$+1.0^{+\infty}_{-6}$
	1471	-5.6^{+30}_{-20}
	1530	$+8.0^{+20}_{-15}$
	1584	-0.074 (20)
^{174}Yb	992	-1.75 (10)
^{174}Hf	699	-0.9 (2)
	765	-2.5^{+13}_{-7}
	809	$-11^{+\infty}_{-7}$
^{176}Hf	1101	$> +8,\ < -3$
	1138	$> +5,\ < -0.7$
^{178}Hf	1082	$> +32,\ < -11$
	1183	$+0.410$ (36)
	1403	-0.73 (5)
^{180}Hf	1107	$+10^{+22}_{-6}$
^{182}W	66	$+0.15$ (15)
	85	$+0.30$ (2)
	114	$+0.31$ (2)
	179	$+0.84^{+11}_{-6}$
	1002	-8.9^{+14}_{-8}
	1121	$+14$ (2)
	1157	-0.59 (6)
	1231	-50^{+80}_{-10}
^{184}W	642	-8.3 (6)
	771	-10^{+6}_{-3}
	792	-17.0 (6)
	895	-14.7 (7)
	1011	$+2.3^{+7}_{-5}$
	1275	$+20^{+30}_{-8}$

*The literature for this transition suggests two or more values for δ which are not in mutual agreement. The selection of this particular value over the others is made on the basis of a very weak preference

TABLE II. Recommended Values of $E2,M1$ Mixing Ratios

$\delta = +10\ (1)$ indicates $\delta = +10 \pm 1$
$\delta = -10^{+2}_{-1}$ indicates $-12 \leq \delta \leq -9$
$\delta = +1.0^{+10}_{-5}$ indicates $+0.5 \leq \delta \leq +2.0$

NUCLIDE	E_γ(keV)	δ
^{184}Pt	486	$+18^{+\infty}_{-5}$
	777	$+9^{+\infty}_{-5}$
^{186}W	615	-11.1^{+35}_{-24}
	1164	$+13^{+70}_{-6}$
^{186}Os	630	-28 (5)
	773	-12^{+17}_{-5}
^{188}Os	478	-15 (2)
	635	-7^{+3}_{-2}
	1210	-0.036 (11)
^{188}Pt	340	-54^{+39}_{-17}
^{190}Os	197	-2.0 (6)
	198	-6.4^{+24}_{-14}
	208	-17^{+11}_{-5}
	371	-8.6 (5)
	407[a]	-3.3^{+7}_{-5}
	407[b]	-5^{+27}_{-3}
	569	-9.4^{+18}_{-12}
	656	-9^{+7}_{-3}
^{190}Pt	302	$+6.8^{+30}_{-12}$
^{192}Os	201	-4.5 (9)
	283	-4.1 (5)
	484	-8.2 (5)
^{192}Pt	296	$+9.1$ (3)
	308	$+7.2$ (2)
	417	-4^{+7}_{-3} *
	605	-1.5 (1)*
^{194}Pt	293	$+16^{+3}_{-2}$
	594	$-30^{+\infty}_{-16}$
	1184	$+0.86^{+9}_{-7}$
	1294	-1.5 (4)
	1343	-0.7^{+9}_{-6}
	1786	$+0.55^{+29}_{-19}$
^{196}Pt	333	-5.0 (3)*
^{198}Hg	676	$+1.17$ (2)*
	798	-2.8^{+12}_{-9}
	1008	$+1.3$ (3)
	1201	-0.22 (4)
	1312	-0.088 (19)
	1421	-0.17 (3)
	1436	$+0.15$ (4)
	1447	-0.23 (6)
	1490	-0.24^{+10}_{-7}
	2041	-0.031 (21)
^{200}Hg	828	-0.081 (6)
	886	-2.3^{+8}_{-4}
	1206	$+0.238$ (3)
	1225	-2.2 (3)
	1273	$+0.014$ (40)
	1363	-0.7^{+6}_{-4}
	1407	-0.44 (4)
	1515	$+0.19$ (1)
^{206}Pb	184	-0.040 (13)
	343	-0.027 (3)
	398	$+0.038$ (3)
	497	-0.09 (2)
	538	-0.033 (5)
	895	-0.030 (3)
	1019	-0.018 (3)
^{208}Pb	277	$+0.050$ (24)
	511	$+0.07$ (3)
	763	-0.39 (5)
	860	$+0.018$ (5)
^{212}Po	785	$+0.083$ (17)
	1079	$+0.09$ (8)
^{214}Po	769	$+4.4^{+43}_{-19}$
	935	0.00 (40)
	1120	$+0.05$ (5)
	1238	$+0.11$ (4)
	1408	-10.3^{+16}_{-12}
	1509	-0.13 (2)
^{232}Th	724	-1.5^{+28}_{-7}
	734	$+23$ (10)
^{244}Cm	746	$+0.92$ (8)

[a] 955–548 keV (4 + – 4+) transition
[b] 1163–756 keV (4 +–3 +) transition

*The literature for this transition suggests two or more values for δ which are not in mutual agreement. The selection of this particular value over the others is made on the basis of a very weak preference