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in Even-Even Atomic Nuclei

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THE 0^+ STATES AND ELECTRIC MONOPOLE TRANSITIONS
IN EVEN-EVEN ATOMIC NUCLEI

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ABSTRACT

Experimental data on energies of the 0^+ excited states in even-even nuclei over the whole periodic table have been collected and systematized. Experimental values of the probabilities of the E0 transitions between levels with both 0^+ and non-zero spins are presented. Measurements of the dimensionless ratio

$$X \left(\frac{B(E0, I_i \rightarrow I_f)}{B(E2, I_i \rightarrow I_f)} \right)$$

are given. The penetration parameters for competitive M1 transitions (in the case of transitions between the levels with non-zero spins) are provided. Experimental data on the probabilities of the Coulomb excitation of the levels considered are reported. The properties of the 0^+ excited state are discussed.

INTRODUCTION

Many experimental and theoretical studies have been carried out on states of the 0^+ type in atomic nuclei. The position of excited 0^+ states and the methods for their de-excitation, as shown in several studies [1-7], are of

critical importance in determining the applicability of the different nuclear models. There is now undoubtedly a growing interest in the study of the nature of these levels. The 0^+ excitations in the reactions of single-nucleon and two-nucleon transfers are the subject of particularly intensive study, and reactions of the type (p,t) , (t,p) , (α,t) , (p,d) etc. provide valuable data for studies on the nature of levels. 0^+ excitations have been discovered in most known even-even atomic nuclei; in several deformed and transition nuclei two, and sometimes even five, 0^+ states have been found below the energy gap 2Δ . Data on the energies of electric monopole excitations have become much more complete in recent years. At present, there is no unified theoretical description of the various 0^+ excitations in nuclei. In particular, many difficulties arise in describing the 0^+ excitations near and above the energy gap.

A considerable number of studies have been devoted to the characteristics of electric monopole transitions. This is understandable since work of this kind provides substantial information about the shape of the nucleus and the details of its structure. It is known that EO transitions are purely a penetration effect. They are different from zero only where the transition is accompanied by changes in the surface of the nucleus, i.e. in calculating the probability of such transitions an adiabatic approximation cannot be used. In nuclear models where the form of the nucleus is determined, EO transitions are strictly forbidden. Such transitions may occur between nuclear states having identical spin and parity. If $I \neq 0$, the EO component is usually mixed with the M1 and M2 components. In investigating transitions of the type $I \rightarrow I$ for $I \neq 0$ it is not the absolute value of the monopole component which is important but the data on the structure of nuclear levels which can be obtained from a study of the matrix elements of monopole transition. However, the experimental data on the probabilities of electric monopole transitions have long ceased to be sufficient.

The experimental and theoretical data on the energies of excited 0^+ levels and on the characteristics of electric monopole transitions were systematized in Refs [8-10]. References [8-9] contain data on nuclei of the deformed region, while only the probabilities of EO transitions were considered in Ref. [10]. The experimental data on all even-even nuclei have not yet been fully systematized. In the present study an attempt has been made to collect (as fully as possible) and systematize the experimental data on monopole excitations ($I^\pi = 0^+$) and the characteristics of electric monopole transitions (EO) for all even-even atomic nuclei (from studies published up to 1 January 1976; the data given in Refs [8-10] are included in the present survey).

1. SYSTEMATIZATION OF THE EXPERIMENTAL DATA

The characteristics of the 0^+ excitations of even-even nuclei are given in Table 1, which shows the energies of the 0^+ states and the probabilities of Coulomb excitation of the levels from which E0 transitions were observed. For the energy of the 0^+ levels, the studies in which the level was first discovered are usually cited, together with the most reliable recent data. In the case of the probability of E2 transitions, only the latest results are given; these data are given more fully in Refs [11-12]. The table also gives the values of $q^2 = W_e(E0)/W_e(E2)$, the ratio between the probabilities of E0 and E2 conversion transitions. If the ratio of E0 of K conversion electrons and the E2 component of the gamma transition has been measured, the table gives the value of $\mu_k = W_k(E0)/W_\gamma(E2)$ denoted by $IK(E0)/IG(E2)$. It should be mentioned that the value of q^2 is generally obtained from measurements of the conversion coefficients, while from measurements of the angular correlation of conversion electrons we can obtain the value of q which determines the ratio of the amplitudes of the E0 and E2 components of conversion electrons. Since measurements of the e_γ -angular correlation enable us to determine not only the value but also the sign of q , the table also gives the values of q with the sign in cases where they have been determined. From the experimental value of q we can calculate the value of the nuclear matrix element of E0 transition:

$$\rho(E0) = q \sqrt{\frac{\alpha(E2) W_\gamma(E2)}{\Omega(Z, k)}} \quad (1)$$

In a mixed E0 + M1 + E2 transition the M1 process of conversion may depend on the penetration effect. The table gives the values of the parameter λ which characterize the penetration effect in the M1 component. Lastly, the table contains the values of the dimensionless parameter X introduced by Rasmussen [13]:

$$X_0 = \frac{B(E0, 0_k^+ \rightarrow 0_1^+)}{B(E2, 0_k^+ \rightarrow 2_1^+)} = 2.54 \cdot 10^9 A^{4/3} \cdot \frac{E_\gamma^5}{\Omega(Z, k)} \cdot q^2 \cdot \alpha(E2) \quad , \quad (2)$$

$B(E0, 0_k^+ \rightarrow 0_1^+) = e^2 Q^2 R_o^4$, R_o is the radius of the nucleus, 0_k^+ is a level of type 0^+ with number K , 0_1^+ is the ground state of the nucleus and 2_1^+ the first excited state with spin 2^+ .

For transitions between levels of non-zero spin, the table gives the ratios

$$X_2 = \frac{B(E0, I_k^+ \rightarrow I_1^+)}{B(E2, I_k^+ \rightarrow I_1^+)} , \quad (3)$$

Here the spins of the K-th and 1st levels are equal. Both these ratios are denoted by X in the table. If the investigators have determined the ratios of the probabilities of other E0 and E2 transitions, these cases are mentioned specially in the table. For example, if the ratio $B(E0)/B(E2, 22 \rightarrow 01)$ is given, this means the ratio between the probability of E0 transition from the 2^+ level under consideration to the level of the main rotational band 2^+ and the value of $B(E2)$ from the second excited state of type 2^+ to the ground state of the nucleus under study. In some studies the ratio of $B(E0)$ to the sum of the normalized probabilities of E2 transitions from the level under consideration to the levels of the main rotational band is determined. Such ratios are indicated in the table as $B(E0)/SB(E2)$. Lastly, the ratios of the normalized probabilities of E0 and E2 transitions are sometimes multiplied by the ratios of the corresponding Clebsch-Gordon coefficients. The values of X thus corrected for transitions between the different terms of the rotational band are equal to each other. Such values are noted in the remarks on the table.

The table contains 11 columns denoting the following:

1. Atomic number of the nucleus Z;
2. Symbol of the isotope under study;
3. Mass number of the isotope A;
4. Level energy, in MeV;
5. Quantum characteristics of the level I^π ;
6. Energy of the particular transition, in MeV;
7. Multipolarity of transition;
8. Quantity to be determined:

$B(E2)$ or $B(E2)^\lambda$, denoted by BE2U

$I_K(E0)/I_G(E2) = \mu_k$

QSQ, which means q^2

$Q = q$

RHO, which means $\rho(E_0)$

LAMBDA- λ -parameter of penetration of the M1 component

E - a quantity equal to \sqrt{X} and coinciding in sign with ρ

X - or any ratio referred to above;

9. Values of the quantity in column 7, here $B(E2)$ are given in $e^2 \text{barn}^2$, the figures in brackets denoting the order of magnitude. For example, $1.78(-2)$ means 1.78×10^{-2} . Sometimes we give the limits of the quantity measured, i.e. GT, LT or GE, LE (which denote $>$, $<$ or \geq , \leq);
10. Error of the quantity determined; if the + error and the - error are different, both values are given;
11. Study in which the particular quantity was measured.

2. DISCUSSION OF EXPERIMENTAL DATA

2.1. Energy characteristics of the 0^+ levels

It will be seen from the table that a large part of the experimental material relates to the energy characteristics of the excited 0^+ states. The probabilities of de-excitation of the 0^+ levels have been investigated much less thoroughly. Figure 1 gives the energy values known so far of the first excited 0^+ levels in even-even nuclei; the $E(0_1^+)$ values corresponding to isotopes with $Z = \text{const}$ are connected by lines. The same figure also shows the deformation parameter β_0 as a function of A for nuclei with $150 < A < 190$ and $A > 228$ [14]. Figure 2 shows the ratio of the energies of the first two excited 0^+ states. For most isotopes the value of $E(0_2^+)/E(0_1^+)$ lies within 1.1-1.6, i.e. at least for these nuclei, the second 0^+ level is not a two-phonon state of β - and γ -vibrations. In many nuclei (^{150}Sm , ^{154}Sm , ^{156}Gd , ^{160}Gd , ^{168}Yb , ^{170}Yb , ^{174}Yb , ^{176}Hf , ^{178}Hf , ^{202}Hg and ^{246}Cm) the energies of the first two excited 0^+ states differ altogether by ≈ 100 keV, i.e. the ratio $E(0_2^+)/E(0_1^+) \approx 1.03-1.15$ although, as will be shown later, the properties of these close 0^+ levels are quite different. In the case of nuclei with $A > 50$, Fig. 1 illustrates the correlation between $E(0_1^+)$ and A (see, for example, the Se, Kr, Sr, Ru, Cd or Nd, Sm and Gd isotopes); for deformed nuclei it also illustrates the correlation between the deformation parameter β_0 and the position of the first 0^+ level. The correlation with β_0 is demonstrated more graphically

in Fig. 3, which gives the experimental values of the energies of the 0^+ excitations ($E(0^+) < 2$ MeV) for the region of transition nuclei and deformed nuclei with $140 < A < 190$. It also indicates the theoretical values of the energy of the gap $2\Delta_N$ and $2\Delta_Z$ (for neutrons and protons, respectively [15]). In most cases, the two excited 0^+ levels undoubtedly lie below the gap, and in many nuclei the third level also has the energy 2Δ . In several nuclei (for example, ^{170}Yb , ^{172}Yb , ^{174}Yb , ^{178}Hf , ^{184}W , ^{186}Os and ^{188}Os) even a fourth, and sometimes a fifth, excited 0^+ state with energy below 2 MeV have been discovered. It cannot be affirmed with confidence that these levels, too, are below the gap energy because of the uncertainty of the theoretical values of Δ . It is however clear that their energy $< 2\Delta$.

2.2. Probabilities of electric monopole transitions

Experimental data on the nuclear matrix elements of E0 transitions are given in Fig. 4. It will be seen that measurements of $q(E0)$ are few and, in many cases, the errors are large. Most experiments give absolute values of $q(E0)$ and its sign is determined only in experiments on angular correlations of conversion electrons but such studies are extremely few (see, for example, the $2^+ \rightarrow 2^+$ transitions of ^{160}Dy , ^{190}Os , ^{192}Pt or ^{194}Pt). All the experimental values of $q(E0)$ are lower than the single-particle estimate of $q(E0) = 1$ [16]. For the lightest nuclei with $A < 30$, the values of $q(E0)$ vary within 0.6–0.3. In the region of nuclei of $A = 30$ –150, $q(E0)$ is almost constant and equals ≈ 0.1 (the only exceptions being ^{72}Se and some transitions in ^{114}Cd). The highest values of $q(E0) \approx 0.2$ –0.3 were obtained for the first excited 0^+ states, which are similar in their properties to the β -vibrational states.

In the case of the isotopes ^{152}Sm , ^{154}Gd , ^{174}Hf , ^{176}Hf etc., the values of $q(E0)$ have been determined for transitions between all terms of the β vibrational and main rotational bands with spins of up to $I^\pi = 6^+, 8^+$. It should be mentioned that in determining $q(E0, 4_\beta \rightarrow 4_g)$, $q(E0, 6_\beta \rightarrow 6_g)$ in the isotopes ^{152}Sm and ^{154}Gd no account was taken of the effect of band mixing. It has been shown in studies that, within experimental error, the value of $q(E0)$ does not depend on spin. If $q(E0)$ depended on spin, the dependence could be written in the following form

$$\rho(E0, I_\beta \rightarrow I_g) = \rho_0 + \Delta\rho(I + 1). \quad (4)$$

Substituting into this expression the values of $q(E0)$ for transitions with $I \geq 2$, the values obtained for ^{154}Gd were $q_0 = 0.29 \pm 0.03$ and $\Delta q = -0.001 \pm 0.003$ and for ^{152}Sm $q_0 = 0.255 \pm 0.025$ and $\Delta q = 0.0005 \pm 0.0022$; the value of q_0 is in excellent agreement with $q(E0)$. No appreciable variation of q from I_β^π was observed for the isotopes ^{174}Hf and ^{176}Hf (see Table 1).

$E0$ transitions between the levels of the γ -vibrational and main rotational bands are forbidden by the selection rules for K . These transitions can occur only as a result of mixing of the wave functions of the levels, and the degree of the purity of the states can be judged from the value of $q(E0)$. In practically all experimentally observed cases, the values of $q(E0, 2_\gamma^+ \rightarrow 2_g^+)$ are lower than those of $q(E0, 2_\beta^+ \rightarrow 2_1^+)$ by a factor of 5-10 (see Table 1, for example, ^{154}Gd , ^{160}Dy , ^{170}Yb , ^{182}W , etc.).

Lifetimes have not been measured for most of the known excited 0^+ levels and the value of the nuclear matrix element of the $E0$ transition cannot be determined. It is however possible to determine the experimental value of

$$X = \frac{e^2 \rho^2 R^4}{B(E2)} \quad (5)$$

the ratio of the normalized probabilities of $E0$ and $E2$ transitions which de-excite the states under study to the levels of the main rotational band. Apart from the values

$$X_0 = \frac{B(E0, 0_i^+ \rightarrow 0_1^+)}{B(E2, 0_i^+ \rightarrow 2_1^+)} , \quad (6)$$

similar ratios for the rotational levels are determined experimentally, namely

$$X_k = \frac{B(E0, I_i^+ \rightarrow I_1^+)}{B(E2, I_i^+ \rightarrow I_1^+)} , \quad (7)$$

where $I_i^+ = I_1^+ = 2^+, 4^+$ etc. and $k = 2, 4$, etc. If, for example, the value of $B(E2, 2_i^+ \rightarrow 2_1^+)$ is not known, the following value is determined

$$X_2 = \frac{B(E0, 2_i^+ \rightarrow 2_1^+)}{B(E2, 2_i^+ \rightarrow 0_1^+)} . \quad (8)$$

The values of X_k , multiplied by the appropriate ratios of the Clebsch-Gordon coefficients if the internal structure of the levels of one rotational band

are identical, will be equal to each other. In particular, for transitions from the band $K^{\pi} = 0^+$ to the main rotational band the ratios $S = X_2/3.5 X_0$ and $S' = X_2/5X_0$ should, in this case, be equal to one.

The values of the dimensionless ratio X have been measured for a very large number of levels. In the region of $A < 150$ the value of X has been determined only in eight nuclei, while all the other measurements relate to the region of transition and strongly-deformed nuclei with $A > 150$. The experimental values of X vary within very wide limits from $\approx 10^{-5}$ (for example, ^{192}Pt) to $\approx 10^{+2}$ (^{130}Xe). In most nuclei the value of X has been determined for levels 0^+ , 2^+ or only for $I^{\pi} = 0^+$. In ^{152}Sm , ^{152}Gd , ^{158}Dy , ^{172}Hf , ^{178}Hf and ^{182}W nuclei the ratios of the normalized probabilities of E0 and E2 transitions have been determined for transitions from levels up to a value of $I^{\pi} = 4^+$, in ^{156}Dy and ^{174}Hf nuclei up to 6^+ and in ^{154}Gd and ^{176}Hf nuclei up to 10^+ .

For transitions in ^{174}Hf (Ref. 73G00353) the values given for X_k have been multiplied by the appropriate ratios of the Clebsch-Gordon coefficients:

$$X_k = \frac{B(E0, I_i \rightarrow I_f)}{B(E2, I_i \rightarrow I_{i+2})} \cdot \frac{\langle I_i 2K_i K_f - K_i / I_f + 2, K_f \rangle^2}{\langle I_i 0K_i K_f - K_i / I_f, K_f \rangle^2}. \quad (9)$$

The values of X_k for transitions from levels $1198.0(0^+)$, $1276.5(2^+)$ and $1451.4(4^+)$ are equal to each other within experimental error (see Table 1), the average weighted value being $\bar{X} = 0.22 \pm 0.05$. Similarly, for transitions from levels $1433.9(0^+)$, $1496.5(2^+)$ and $1635.8(4^+)$ the average weighted value is $\bar{X} = 0.15 \pm 0.06$. Quite obviously, each group of three levels forms a rotational band.

The ratios X for close-lying 0^+ levels with an energy difference of 100–200 keV (see, for example, the isotopes ^{156}Gd , ^{168}Yb , ^{170}Yb , ^{176}Hf and ^{178}Hf) differ by a factor of 3–40. As a rule, such closely situated 0^+ levels are not excited in the same reaction, i.e. these levels are different in nature and there is little interaction between them.

The values of X have been measured for some, at least two, 2^+ levels in ^{152}Gd , ^{162}Er , ^{170}Yb , ^{176}Hf , ^{178}Hf , ^{182}W , ^{188}Pt , ^{190}Pt , ^{192}Pt and ^{194}Pt nuclei. For deformed nuclei, one of these states can be the first excited

level of the β -band and the other the level of γ -vibrations, and the values of X in this case should be substantially different. For the isotopes ^{152}Gd , ^{176}Hf and ^{178}Hf , however, even if they differ, they do so by a factor of not more than 2, which is an indication of strong mixing of the states. We should note that in determining the values of X for $2^+ \rightarrow 2^+$ transitions with $\Delta K = 2$ it is necessary to take into account the contribution of the M1-component which, in spite of forbiddenness of the quantum number K , is considerable (for example, ^{178}Hf). For W and Pt isotopes, the values of $X(E0/E2)$ for transitions from different 2^+ levels differ by a factor of 10-1000, i.e. mixing of states is slight in these isotopes.

3. THE NATURE OF MONOPOLE EXCITATIONS

Low-lying monopole excitations have been investigated in many theoretical studies. In phenomenological models, the first excited 0^+ levels of deformed nuclei are interpreted as collective 0^+ levels of β -vibrations. In the vibrational model, one such state is possible, and is associated with the main rotational band through strong E0 and E2 transitions; the values of X are determined by the equilibrium-deformation parameter β_0 , $X = 4\beta_0^2$ [17] and the typical values of $X \approx 0.3-0.4$. The nuclear matrix element of ${}^0\text{E}0$ transition $\varrho(E0) \approx 0.5$. In the model of non-axial nuclei [18] two states of collective vibrations with $K^\pi = 0^+$ are possible - levels 0_β^+ and 0_γ^+ . For the level of β -vibrations the values of $X \approx 0.3-0.4$ and for the level of γ -vibrations $X(E0/E2)$ is higher by a factor of 10-100.

In microscopic models, 0^+ excitations are regarded as internal excitations of the system of nucleons, which interact with each other through the effect of residual forces. With models of this kind it is possible in theory to give a uniform description of both collective and single-particle excitations in nuclei. In the well-known "pairing + quadrupole - quadrupole" interaction model [19] the β vibrational states of deformed nuclei were studied [20-24]. However, such a model gives only one 0^+ state with an energy lower than 2Δ so that other 0^+ levels lying below the gap are "superfluous" from the standpoint of this model. To describe such "superfluous zeros", components of residual interaction other than quadrupole-quadrupole interaction have been introduced in a number of studies. Pyatov and associates [5, 25-27] have introduced the

spin-quadrupole interaction. In Ref. [6] account was taken of the quadrupole-quadrupole interaction in the particle-hole channel and of the pairing interaction in the particle-particle channel modified on the basis of the condition of the gradient invariance of the theory [28, 29]. In addition to the quadrupole-quadrupole interaction, Ref. [7] also takes into consideration the monopole-monopole interaction. Introduction of one further interaction results in the appearance of only one other 0^+ excitation below the gap energy. Other types of 0^+ excitation within the framework of microscopic models should have an energy $> 2\Delta$.

Let us now consider the properties of the 0^+ excitations discussed in the microscopic model.

1. Pairing vibrations. They are due to pairing interactions and represent the superposition of two-quasi-particle states, other than neutron and proton states, both quasi-particles of one pair being at one level. The contributions of the different states to the sums, the squares of which determine the normalized probabilities of transitions, are incoherent and the values of $B(E0)$ and $B(E2)$ are generally small. Since the matrix elements of $E0$ transitions from the levels of pairing vibrations are much greater than those of the parallel $E2$ transitions, the quantity X can in general assume high values, $X >> 1$. Pairing vibrations should generally be observed above the energy gap.
2. Unlike the T -even states, the coherent fluctuations of pairing, which were studied by Belyaev [28-29], have contributions of the same sign from the particle and hole excitations to the T -odd phonon. These states can also be below the gap and in their case, the quantity X can have very high values, $X >> 1$.
3. The β vibrations due to quadrupole interactions lie below the energy gap and have high values of $B(E2)$. Owing to the coherence of the contributions of the individual two-quasi-particle components (the quasi-particles of one pair at different levels) to the sums determining $B(E2)$ and the incoherence of the contributions to the sums for $B(E0)$, we can expect $X < 1$. However, because of interference of the phonons of β vibrations and pairing vibrations for states close to the energy gap, X may increase noticeably.

4. Spin-quadrupole interactions lead to the appearance of 0^+ levels below 2Δ . The main contribution to $B(E0)$ comes from the two-quasi-particle states (the quasi-particles of one pair always at different orbitals) in which the quasi-particles are at levels with $\Delta N = \pm 2$. For states with quasi-particles at different levels of one shell ($\Delta N = 0$) $B(E0) = 0$. All states contribute to $B(E2)$ and therefore $X < < 1$ for 0^+ levels of this type. Coupling of β vibrations with spin-quadrupole interaction results in a decrease in the value of X .

Most of the first excited states of deformed nuclei (for example, ^{152}Sm , ^{154}Sm , ^{156}Sm , ^{154}Gd , ^{156}Gd , ^{158}Gd , ^{156}Dy , ^{158}Dy , ^{160}Dy , ^{162}Er , ^{164}Er , ^{168}Yb , ^{174}Hf , ^{176}Hf , ^{178}Hf , etc.) can be related to states similar in their properties to the β vibrational state. They appear during Coulomb excitation of nuclei or in the reactions of inelastic scattering of charged particles of type (d,d') , (α,α') etc. The experimental values of $Q(E0)$ and $X(E0/E2)$ for these levels are generally lower by several factors than those estimated by the phenomenological models. Agreement with a phenomenological model is observed only in nuclei of the transuranic region. Agreement with the microscopic models is better although the energy values and also the values of $Q(E0)$ and $X(E0/E2)$ indicate a strong mixing of β vibrations with rotational motion. As the energy of β vibrations increases, their coupling with pairing vibrations is enhanced. The mixing effects lead to pronounced changes in the values of X [5].

Most experimental values of $X < 1$ or $X < < 1$ (see Table 1). In a number of nuclei, however, there were 0^+ states whose de-excitation to the levels of the main rotational band occurred through $E0$ transitions with large $B(E0)$ and $E2$ transitions with much smaller $B(E2)$. The ratios between the normalized probabilities of $E0$ and $E2$ transitions for such 0^+ levels are high, $X(E0/E2) > 10$:

52	± 15 (2.001 MeV, ^{106}Pd);	
6	± 3 and 100 ± 50 (1.794 and 2.016 MeV, ^{130}Xe);	
5.56	± 1.84 (2.185 MeV, ^{164}Er);	
19	± 4 and 6.0 ± 0.7 (1.296 and 1.336 MeV, ^{172}Hf);	
8.3	± 1.0 (1.293 MeV, ^{176}Hf); and	
5.6	± 0.3 (2.086 MeV, ^{194}Pt).	(10)

It will be seen that in all cases the energy localization of the 0^+ states is in the gap region. On the basis of their characteristics, these levels can be interpreted as a special case of pairing vibrations which are odd in relation to the time operator, i.e. the levels of coherent fluctuations of pairing [28, 29]; it is also not impossible that they may be due to the interaction of pairing vibrations with β vibrations.

The levels lying in the gap region and having values of $X \approx 1$ can be identified in a number of cases with those of pairing vibrations. Such levels should be strongly populated in the reaction of two-nucleon transfers and not appear during Coulomb excitation and in inelastic scattering of particles. The most likely states for the levels of pairing neutron or proton vibrations are the 0^+ states:

$$\begin{aligned} {}^{160}\text{Dy} &- 1.953 \text{ MeV } (X = 0.65); \\ {}^{164}\text{Er} &- 1.766 \text{ and } 2.170 \text{ MeV } (0.78 \pm 0.11 \text{ and } 1.76 \pm 0.25); \\ {}^{168}\text{Yb} &- 1.543 \text{ MeV } (0.76 - 3.1); \\ {}^{170}\text{Yb} &- 1.480 \text{ and } 1.566 \text{ MeV } (0.95 \pm 0.06 \text{ and } 0.66 \pm 0.05); \\ {}^{178}\text{Hf} &- 1.444 \text{ and } 1.772 \text{ MeV } (0.50 \pm 0.02 \text{ and } 0.57 \pm 0.16). \end{aligned} \quad (11)$$

In all nuclei except ${}^{160}\text{Dy}$, two other 0^+ levels below these states were observed experimentally. It should be mentioned that rotational bands were observed at the levels of pairing vibrations only in ${}^{170}\text{Yb}$.

CONCLUSION

There is no doubt that the electric monopole excitations observed experimentally are in practically all cases strongly mixed. Even the "classical" β vibrations at the beginning of the deformation region (Sm and Gd isotopes) are strongly mixed with other types of excitation. Only the monopole interactions in even-even nuclei can be explained by means of the existing theoretical treatments. Increasingly large volumes of experimental data give rise to ever-increasing numbers of "superfluous" zeros. It is obvious that understanding the nature of 0^+ excitations requires fuller and more reliable data on the de-excitation of the 0^+ levels. Detailed studies on the different types of reaction and determinations of excitation cross-sections are essential.

All collected and systematized experimental data on the O^+ excitations of the rotational states and on the de-excitation mechanisms of these states have been recorded on magnetic tape and stored in computers at the Nuclear Data Centre of the Leningrad Institute of Nuclear Physics.

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*/ Translator's note. The meaning of this abbreviation is not known. It might be "Ehlementarnye Chastitsy i Atomnye Yadra" (Elementary particles and the atomic nucleus).

FIGURES

Fig. 1. The first excited 0^+ states in even-even atomic nuclei.

Fig. 2. The ratios of energies of the first two excited 0^+ states for even-even nuclei.

Fig. 3(a). Experimental values of the energies of 0^+ excitations in Sm and Gd isotopes. Below: the static deformation parameter β_0 as a function of A . Above: the calculated values of the energy gap for neutrons $2\Delta_n$ and for protons Δ_z [15].

Fig. 3(b) The same for Dy and Er isotopes.

Fig. 3(c) The same for Yb, Hf, W and Os isotopes.

Fig. 4. Experimental values of the normalized nuclear matrix element of E0 transitions in even-even nuclei.

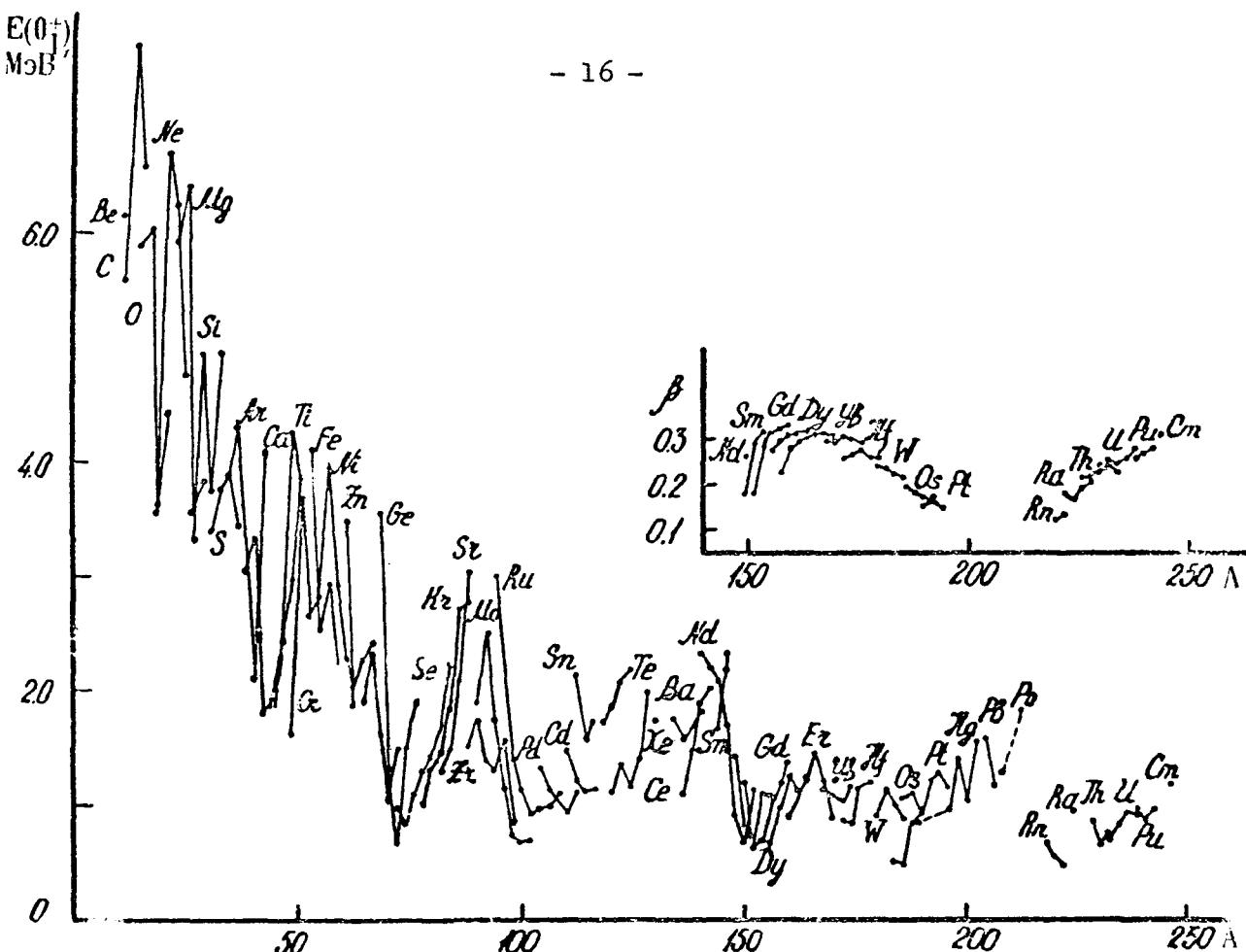


Рис. 1. Первые возбужденные 0^+ – состояния в четно – четных атомных ядрах.

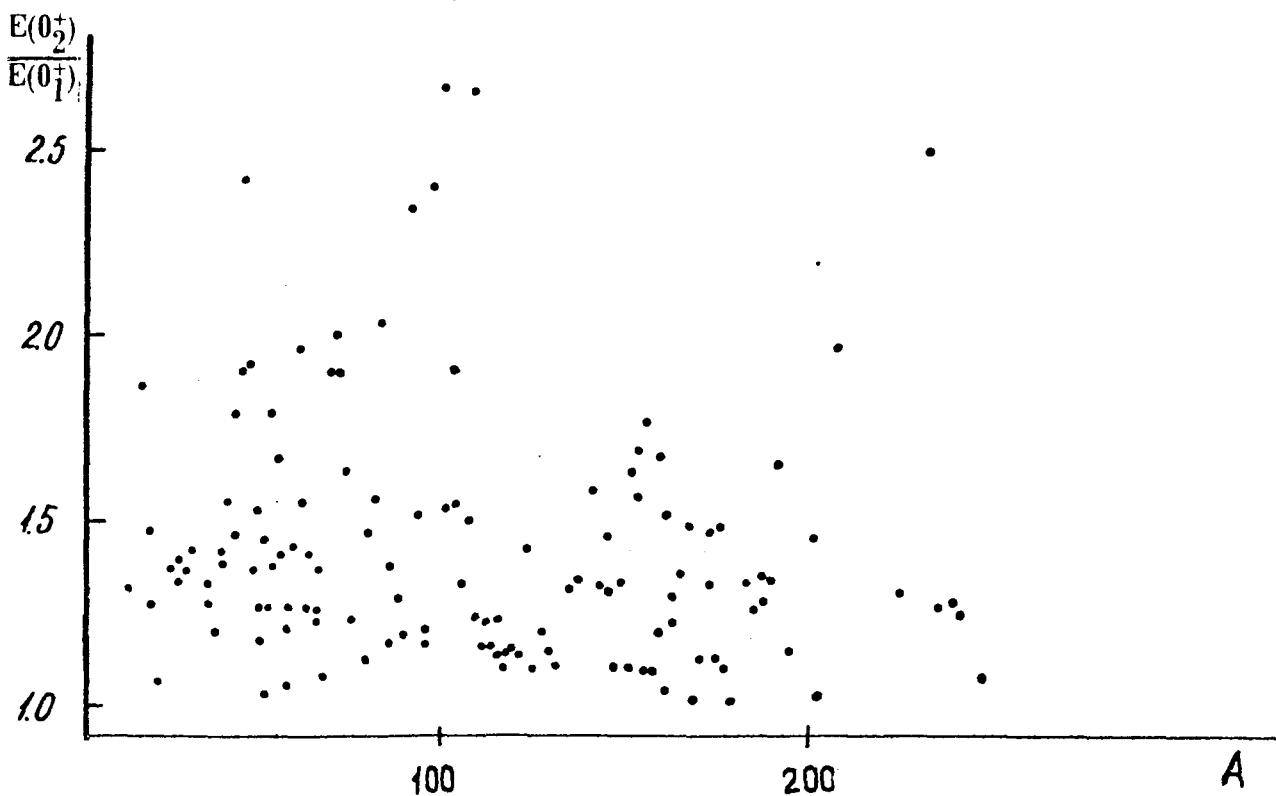


Рис. 2. Отношения энергий первых двух возбужденных 0^+ – состояний для четно – четных ядер.

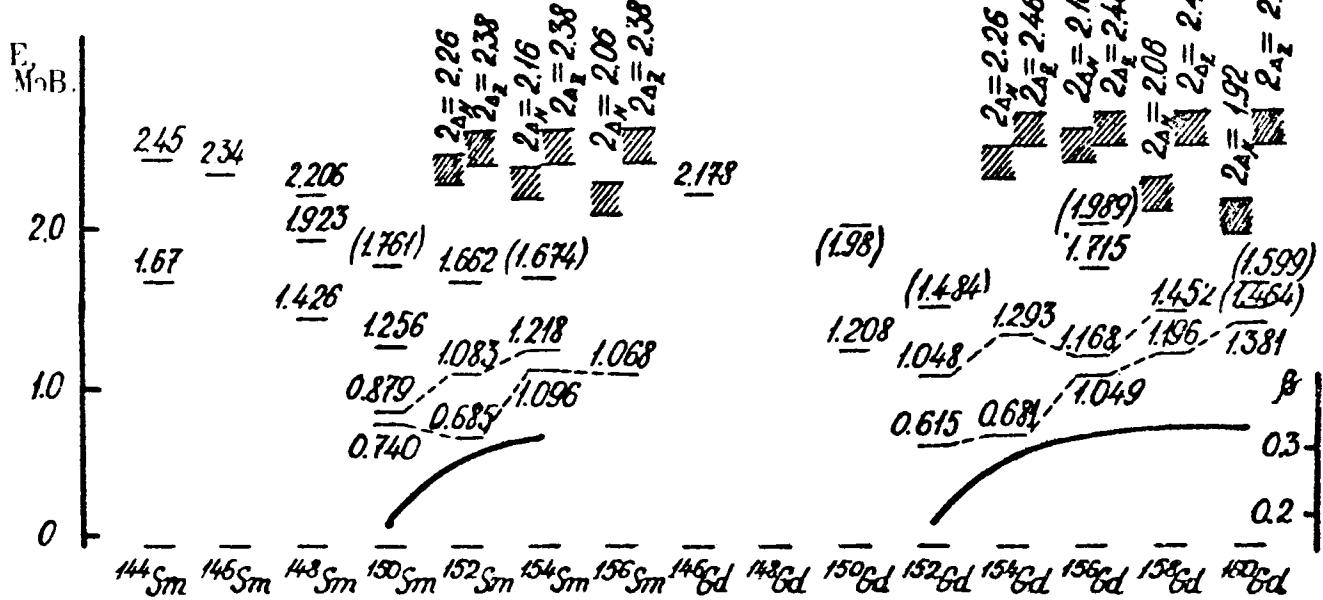


Рис. 3. а) Экспериментальные значения энергий 0^+ – возбуждений в изотопах Sm и Gd. Внизу дана зависимость параметра статической деформации β от A. Вверху приведены вычисленные значения энергетической щели для нейтронов – $2\Delta_n$ и протонов – $2\Delta_z$ [15].

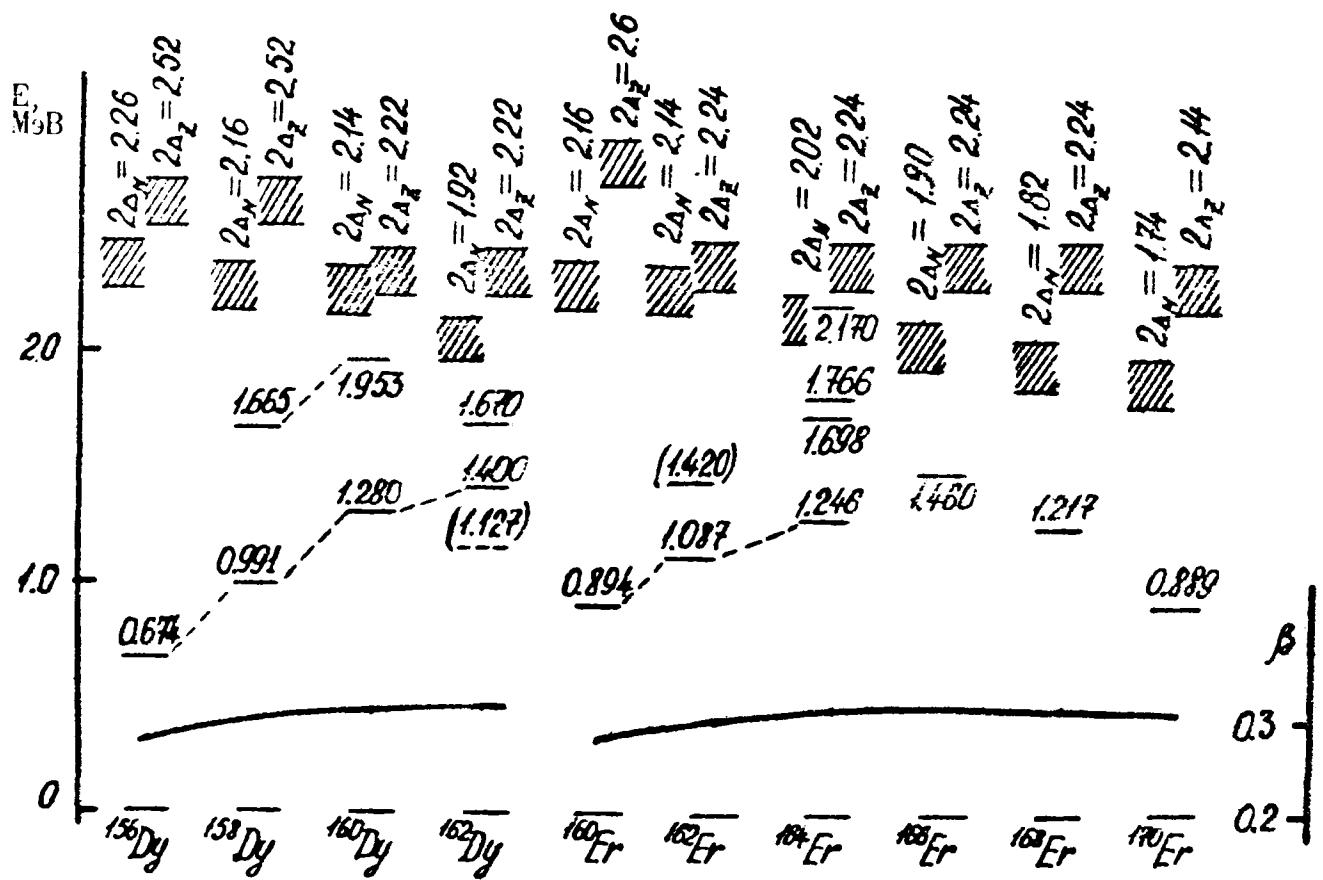


Рис. 3. б) То же для изотопов Dy и Er.

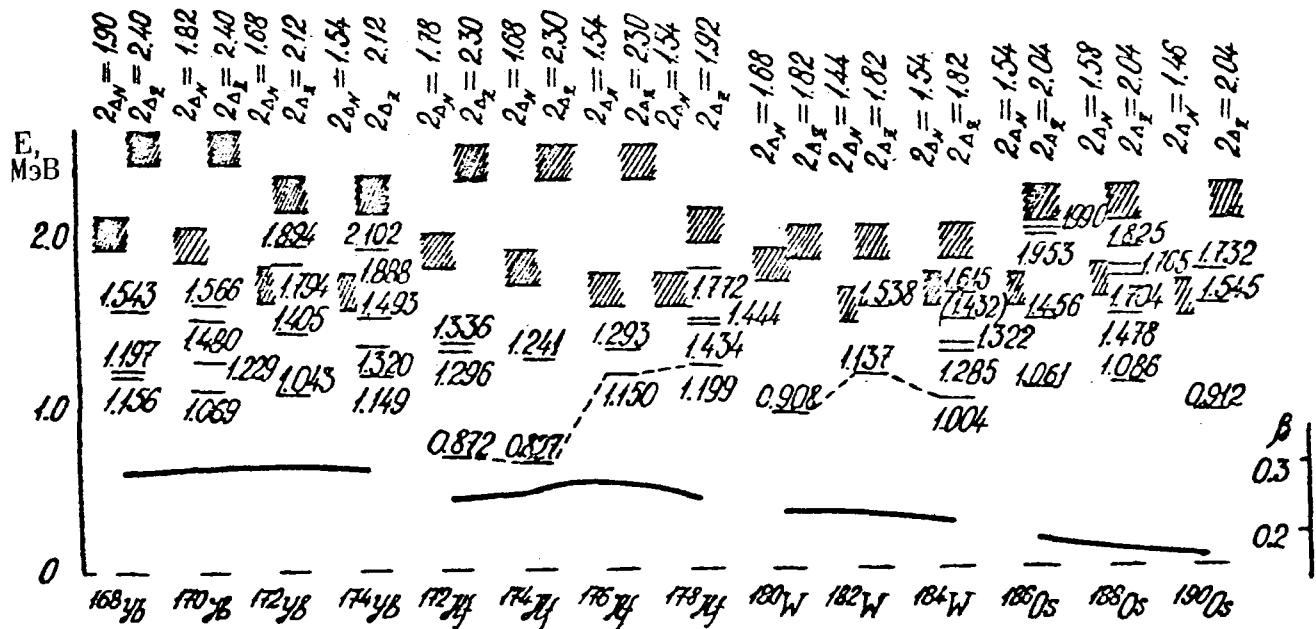


Рис. 3. в) То же для изотопов Yb, Hf, W, Os.

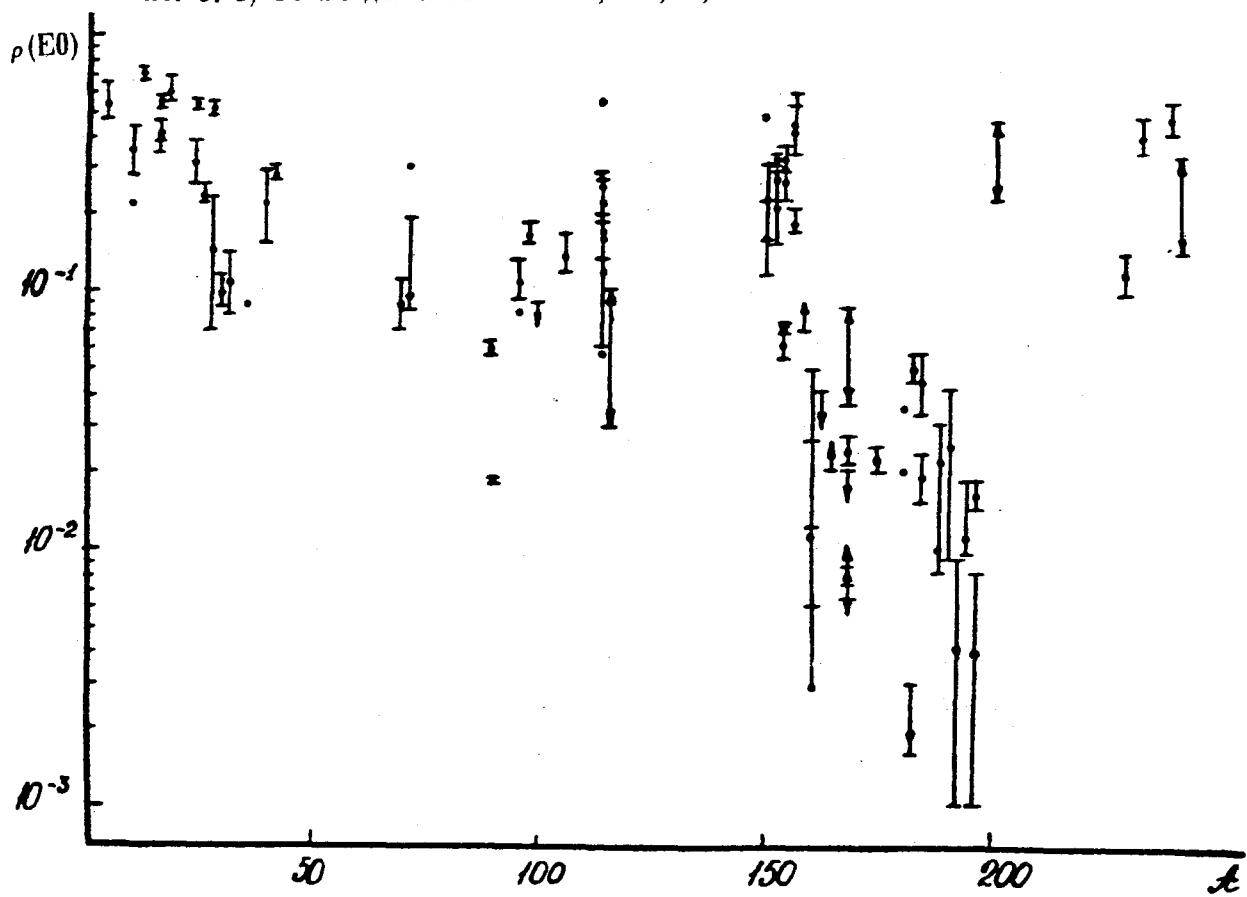


Рис. 4. Экспериментальные значения приведенного ядерного матричного элемента $E0$ – переходов в четно – четных ядрах.

Таблица

2	HF	6	25.26	0+	20.26	E0	RHO	5.5(-1)	9	68FR0657
6	EE	10	6.18	0+						75UA1659
6	HF	10	6.18	0+	5.18	E0				6VAL1262
6	HF	10	6.18	0+	6.18	EU	RHO	2.2(-1)		69AL1262
8	C	12	5.60	0+						72SA0511
8	C	12	7.456	0+						61WA0133
8	C	12	7.45	0+						76PL0878
8	C	12	7.4562	0+						74CM0069
6	C	12	7.455	0+						75MA0031
6	C	12	7.455	0+	7.455	E0				75MA0031
6	C	12	7.455	0+	7.455	EU				75DA2063
8	C	12	7.45	0+	7.45	E0	RHO	6.7(-1)	17	56FR0225
6	C	12	7.45	0+	7.45	E0	RHO	7.1(-1)	3	68ST0616
6	C	12	7.45	0+	7.45	E0	RHO	7.6(-1)		69AL1262
6	C	12	7.46	0+	7.46	E0	RHO	7.3(-1)	5	64CR1580
6	C	12	7.46	0+	7.46	E0	RHO	7.6(-1)	7	65GU0111
6	C	12	7.46	0+	7.46	E0	RHO	7.1(-1)	6	67CR0152
6	C	12	7.46	0+	7.46	E0	RHO	5(-1)		55SC1281
6	C	12	10.1	(0+)						61WA0133
6	C	12	17.76	0+						74PA0876
8	C	12	17.8	0+						73JA0247
6	C	12	17.8	0+						73JA0247
6	C	12	27.611	0+						74G01525
6	C	14	6.5892	0+						70A0001
6	C	14	7.01	0+						66M10063
8	O	16	14.00	0+	14.00	E0	RHO	3.8(-1)	8	68ST0306
8	O	16	5.91	(0+)						68T00500
8	O	16	5.91	0+						70AD0697
8	O	16	5.91	(0+)						73PR1382
8	O	16	5.930	0+						72GR1756
8	O	16	6.05	0+						66L01069
8	O	16	6.052	0+						70BE0152
8	O	16	6.052	0+						72AD0883
8	O	16	6.05	0+						73A10271
8	O	16	6.05	0+						76FL1650
8	C	16	6.051	0+	6.051	E0				62NE0639
8	C	16	6.050	0+	6.050	E0	RHO	6.2(-1)		56DE0136
8	O	16	6.05	0+	6.05	E0	RHO	6.0(-1)	6	68ST0357
8	O	16	6.05	0+	6.05	E0	RHO	6.2(-1)		69AL1262
8	O	16	11.2610	0+						72AD0883
8	O	16	12.03	0+	12.03	E0	RHO	5.6(-1)	3	70K10083
8	O	16	12.050	0+	12.050	E0	RHO	6.8(-1)	5	68ST0376
8	O	16	12.05	0+	12.05	E0	RHO	6.8(-1)	5	68ST0357
8	O	16	12.05	0+	12.05	E0	RHO	6.5(-1)	1	70MA0000
8	O	16	12.05	0+	12.05	E0	RHO	6.6(-1)	10	73BE0252
8	O	16	14.00	0+	14.0	E0	RHO	6.1(-1)	3	70MA0000
8	O	16	14.017	0+						71OP0609
8	O	16	14.035	0+						73MA0257
8	O	16	16.3	(0+)						75VA0734
8	O	16	22.9	0+						64CE0236
8	O	18	3.627	0+						73BE2007
8	O	18	3.63	0+						66MI0063
8	O	18	3.63	0+						66WI0975
8	O	18	3.632	0+						73WA0618
8	C	18	3.63	0+						76EC1645
8	O	18	3.63	0+						76KA0470
8	O	18	3.63	0+	3.63	E0	RHO	3.8(-1)		69AL1262
8	O	18	3.63	0+	3.63	E0	RHO	6.1(-1)	7	75SD1899
8	O	18	5.329	0+						72BE2007
8	O	18	5.33	0+						66MI0063
8	O	18	5.33	0+						66WI0975
8	O	18	5.33	0+						66L00127
8	O	18	5.33	0+						71BE0401
8	O	18	5.33	0+	5.33	E0	RHO	<= 4.5(-1)		75SD1899
8	O	20	6.446	0+						62H10081
8	O	20	6.446	0+						72SA0511
8	O	20	6.45	0+						64MI0063
10	NE	18	3.576	0+						70LE0116
10	NE	18	3.46	(0+)						70AD0497
10	NE	18	3.58	0+						75OL1557
10	NE	18	3.614	(0+)						72PA0489
10	NE	18	3.614	(0+)						72PA0485
10	NE	18	4.59	0+						75NE1686
10	NE	20	6.71	0+						64PE0489
10	NE	20	6.72	0+						66AB0071
10	NE	20	6.722	0+						71MI1750
10	NE	20	6.722	0+						73OB1682
10	NE	20	6.722	0+						75BE0019

20 CA 44 7.457	2+	2.657	E2	BE2	>= 2.4(-3)	73MC1406
20 CA 44 2.657	2+	1.500	E2+M1	BE2	>= 6.0(-3)	73MC1406
20 CA 44 3.044	2+	0.761	E2+M1	BE2	1.5(-5)	73MC1406
20 CA 44 3.303	2+	3.303	E2	BE2	1.5(-3)	73MC1406
20 CA 44 3.392	(0+)				+60-10	67RJ0033
20 CA 44 5.864	0+				+15-5	67RJ0033
20 LA 44 2.427	0+					67RJ0033
20 CA 45 2.425	0+					67WI1419
20 CA 46 2.42	0+					73DU0637
20 CA 46 2.423	0+					73TR0576
20 CA 46 2.423	0-					74BE0099
20 CA 46 6.75E	0-					73CR0574
20 CA 46 5.316	0-					67RJ0033
20 CA 46 5.316	(0+)					73CR0574
20 CA 46 5.328	0+					67WI1419
20 CA 46 5.596	0+					67RJ0033
20 CA 46 5.617	0+					67WI1419
20 CA 46 5.628	0+					67RJ0033
20 CA 46 6.067	(0+)					67RJ0033
20 CA 46 6.568	0+					67WI1419
20 CA 46 7.252	0+					67WI1419
20 CA 45 7.83	0+					74DU0637
20 CA 45 4.281	0+					69J00209
20 CA 45 4.281	0-					66HI0328
20 CA 48 4.284	0+					67RJ0033
20 CA 48 4.284	0-					70BE1037
20 CA 48 4.284	0-					70RE1037
20 CA 48 5.459	0+					66HI0328
20 CA 48 5.459	0-					67RJ0033
20 CA 48 5.659	0+					67J00209
20 CA 48 6.280	(0+)					7CPA0485
20 CA 50 3.519	0+					66HI0328
20 CA 50 4.470	0+					66HI0328
20 CA 50 4.470	(0+)					67BJ0033
22 TI 42 1.83	(0+)					68HA0432
22 TI 42 1.83	(0+)					76AL1013
22 TI 42 1.89	(0+)					68SH0001
22 TI 42 2.68	(0+)					76AL1013
22 TI 42 5.55	0+					76AL1013
22 TI 42 6.37	(0+)					76AL1013
22 TI 44 1.905	0+					71SI0463
22 TI 44 1.903	0+					72RA0453
22 TI 44 1.9042	0+					73D10579
22 TI 44 1.905	(0+)					73SI0946
22 TI 44 1.90	0+					74ST0965
22 TI 44 4.605	0+					72PA0453
22 TI 44 4.61	0+					72K00368
22 TI 44 4.84	0+					74ST0965
22 TI 44 8.54	(0+)					76BT0965
22 TI 44 9.330	0+					72RA0453
22 TI 44 9.35	0+					66GA0726
22 TI 44 9.38	0+					72K00568
22 TI 46 2.56	0+					66HO0606
22 TI 46 2.603	0+					68LE0273
22 TI 46 2.61	0+					69W00686
22 TI 46 2.61	0+					67CH0894
22 TI 46 2.611	0+					70RA0528
22 TI 46 2.61	0+					72K00568
22 TI 46 2.611	0+					72AS0131
22 TI 46 2.610	0+					73RA0371
22 TI 46 2.61	0+					76MO0506
22 TI 46 3.370	(0+)					73RA0371
22 TI 48 2.998	0+					73JA1796
22 TI 48 2.998	0-					73RA0190
22 TI 48 3.00	0+					67WI0422
22 TI 48 3.00	0+					67CH0894
22 TI 48 3.00	0-					72K00368
22 TI 48 3.00	1+					74MO0506
22 TI 48 4.391	1+					67WI0422
22 TI 48 6.974	1+					67WI0422
22 TI 50 3.879	0+					67WI0422
22 SI 50 3.87	0+					74PR1345
22 TI 50 5.633	0+					67WI0422
22 TI 50 6.046	0+					67WI0422
22 TI 50 7.808	0+					67WI0422
26 CR 48 1.63	(0+)					69MA0602
26 CR 48 1.92	0+					71BR0058
26 CR 48 3.42	(0+)					72SH0017

26 CR 48	6.26	0+	72SH0017
26 CR 48	6.280	(0+)	71D00173
26 CR 48	6.36	0+	71RA0058
26 CR 48	5.67	(0+)	72SH0017
26 CR 48	5.960	(0+)	71D00173
26 CR 48	6.855	0+	71D00173
26 CR 48	8.75	(0+)	71RA0058
26 CR 48	8.86	0+	72PA0138
26 CR 50	3.6976	(0+)	71RA0575
26 CR 50	3.86	0+	72RA0138
26 CR 50	3.8952	(0+)	74PE0109
26 CR 50	3.8952	0+	71BA0575
26 CR 50	6.05	0+	71BA0575
26 CR 50	6.35	0+	71FA0575
26 CR 50	6.75	0+	61VA0067
26 CR 52	2.668	(0)	65RA0561
26 CR 52	2.668	0+	70RA0689
26 CR 52	2.667	0+	67KA0931
26 CR 52	2.650	0+	70RA0689
26 CR 52	4.742	0+	70RA0689
26 CR 52	5.585	0+	70RA0689
26 CR 52	5.737	0+	70VE6165
26 CR 56	2.8294	0+	70VE6165
26 CR 56	3.986	0+	70VE6165
26 CR 56	4.573	0+	70RA0643
26 CR 56	3.897	0+	72EV0268
26 FE 52	4.13	0+	70SU0468
26 FE 52	4.14	0+	72EV0268
26 FE 52	5.72	0+	72EV0268
26 FE 52	8.05	0+	72EV0268
26 FE 52	8.52	0+	72EV0268
26 FE 52	8.53	0+	72EV0268
26 FE 52	10.30	0+	70SU0468
26 FE 54	2.56	0+	67CH0894
26 FE 54	2.56	0-	70VE6165
26 FE 54	2.566	0-	72M00012
26 FE 54	2.566	0-	74SU0461
26 FE 54	2.56	0-	72EV0268
26 FE 54	4.29	0+	72EV0268
26 FE 54	6.50	0+	72EV0268
26 FE 56	7.58	(0+)	64GA0726
26 FE 56	8.48	0+	72EV0268
26 FE 56	8.52	(0+)	72EV0268
26 FE 56	10.25	(0+)	72EV0268
26 FE 56	10.70	0+	72EV0268
26 FE 56	2.939	0+	67MA0593
26 FE 56	2.939	0+	73KE0525
26 FE 56	2.942	0+	66C00748
26 FE 56	2.9411	0+	69AR0261
26 FE 56	2.9417	0+	76LA0333
26 FE 56	2.960	0+	74DE0205
26 FE 56	3.120	0+	76PE0205
26 FE 56	3.401	0-	66C00748
26 FE 56	3.6052	0+	69AR0261
26 FE 56	3.600	0+	73KE0525
26 FE 56	3.6070	0+	76LA0333
26 FE 56	3.600	0+	74DE0205
26 FE 56	4.296	0+	66C00748
26 FE 56	4.3020	(0+)	76LA0333
26 FE 56	4.7299	(0+)	76LA0333
26 FE 56	4.73	0+	72EV0268
26 FE 56	5.41	0+	72EV0268
26 FE 56	6.50	0+	72EV0268
26 FE 56	8.11	(0+)	72EV0268
26 FE 56	9.20	(0+)	69EA0641
26 FE 58	2.2568	0+	69SC0122
26 FE 58	2.2568	0+	67C01033
26 FE 58	2.26	0+	67C01033
26 FE 58	3.24	0+	69FA0641
26 FE 58	3.2640	0+	69SC0122
26 FE 58	3.244	0+	67C01033
26 FE 58	4.17	0+	67C01033
26 FE 58	6.35	0+	67C01033
26 FE 58	6.65	(0+)	67PD1033
26 FE 58	5.15	0+	67C01033
26 FE 58	5.41	0+	67C01033
26 FE 58	5.52	0+	67C01033
26 FE 58	5.522	0+	69FA0641

26 FE 58	5.60	0+	67C01033
26 FE 58	5.83	0+	67C01033
26 FE 58	6.18	(0+)	67FD1033
26 FE 58	6.46	0+	67C01033
26 FE 58	6.65	0+	67C01033
26 FE 58	6.76	0+	67C01033
26 FE 58	6.86	(0+)	67C01033
26 FE 58	7.12	0+	67C01033
28 NI 56	3.95	0+	72U0481
28 NI 56	3.95	0+	74FU0447
28 NI 56	3.9521	0+	76NA1880
28 NI 56	3.952	0+	74BE0429
28 NI 56	3.956	0+	75SC0113
28 NI 56	3.96	0+	72EV0268
28 NI 56	4.95	0+	65DA0363
28 NI 56	4.99	0+	70SU0468
28 NI 56	5.000	0+	70BR2200
28 NI 56	5.00	(0+)	72EV0268
28 NI 56	5.002	0+	74NA1880
28 NI 56	5.007	0+	76BE0429
28 NI 56	5.003	0+	75SC0113
28 NI 56	5.01	0+	76FU0447
28 NI 56	6.00	0+	74FU0447
28 NI 56	6.50	0+	72U0481
28 NI 56	6.58	0+	68DA0363
28 NI 56	6.58	0+	72EV0268
28 NI 56	6.62	0+	76FU0447
28 NI 56	6.64	0+	70BR2200
28 NI 56	6.654	0+	75SC0113
28 NI 56	6.662	0+	76KA1880
28 NI 56	7.289	0+	70BR2200
28 NI 56	7.69	0+	76FU0447
28 NI 56	7.903	0+	75SC0113
28 NI 56	7.912	0+	70BR2200
28 NI 56	7.91	0+	76FU0447
28 NI 56	7.913	0+	74NA1880
28 NI 56	7.92	0+	65DA0363
28 NI 56	7.92	0+	72EV0268
28 NI 56	7.95	0+	72U0481
28 NI 56	9.75	0+	76FU0447
28 NI 56	9.917	0+	76NA1880
28 NI 56	9.94	0+	76FU0447
28 NI 56	9.96	0+	72EV0268
28 NI 56	9.994	0+	74NA1880
28 NI 56	10.021	0+	74NA1880
28 NI 56	10.1	0+	72U0481
28 NI 56	10.25	0+	76FU0447
28 NI 58	2.94	0+	70SU0468
28 NI 58	2.9425	0+	70RA0065
28 NI 58	2.940	0+	76K00065
28 NI 58	3.50	0+	76K00065
28 NI 58	3.55	0+	72EV0268
28 NI 58	5.96	0+	76K00065
28 NI 58	10.39	0+	72EV0268
28 NI 58	14.47	0+	76K00065
28 NI 60	2.286	(0+)	60VA0076
28 NI 60	2.2868	0+	72VA0253
28 NI 60	2.284	0+	73RD0577
28 NI 60	2.284	0+	73RD0577
28 NI 60	2.283	0+	76K00065
28 NI 60	2.293	0+	71DA0259
28 NI 60	3.93	0+	72EV0268
28 NI 60	3.738	0+	71DA0253
28 NI 60	4.340	0+	74KD0045
28 NI 60	5.531	(0+)	71DA0253
28 NI 62	2.04	0+	69BE0594
28 NI 62	2.0484	0+	69FA0026
28 NI 62	2.0474	0+	70VA0427
28 NI 62	2.0484	0+	70FA0569
28 NI 62	2.049	0+	76M00086
28 NI 62	2.047	0+	75K01681
28 NI 62	2.055	0+	71DA0253
28 NI 62	2.06	(0+)	70ES0201
28 NI 62	2.85	0+	69DA0858
28 NI 62	2.877	0+	71RA0253
28 NI 62	2.889	0+	75K01681
28 NI 62	3.46	0+	69DA0858
28 NI 62	3.464	0+	71DA0253

28 NI 62	3.857	(0+)	71DA0253
28 NI 62	4.226	0+	75K01681
28 NI 62	4.623	0+	75K01681
28 NI 62	4.631	0+	71DA0253
28 NI 62	5.647	0+	75K01681
28 NI 62	5.673	0+	71DA0253
28 NI 64	2.27	0+	698E0594
28 NI 64	2.270	0+	71DA0253
28 NI 64	2.860	0+	71DA0253
28 NI 64	3.020	(0+)	71DA0253
28 NI 64	4.211	(0+)	71DA0253
28 NI 66	2.437	0+	71DA0253
28 NI 66	2.664	0+	71DA0253
28 NI 66	2.965	0+	71DA0253
30 ZN 60	3.904	0+	74KA0620
30 ZN 60	3.51	0+	72GR1T56
30 ZN 60	6.88	0+	72W10481
30 ZN 60	7.47	0+	72W10481
30 ZN 62	1.88	0+	73H10177
30 ZN 62	2.33	0+	74H11381
30 ZN 62	2.38	0+	70JA0107
30 ZN 62	2.38	0+	73KA0865
30 ZN 62	3.93	0+	73KA0865
30 ZN 62	3.96	0+	75H10177
30 ZN 62	3.98	0+	72FA0545
30 ZN 62	3.98	0+	72FA0545
30 ZN 62	4.00	(0+)	73KA0865
30 ZN 62	4.00	0+	74H11381
30 ZN 62	4.37	0+	72FA0545
30 ZN 62	4.57	0+	72FA0545
30 ZN 62	4.62	(0+)	74H11381
30 ZN 62	5.17	0+	73H10177
30 ZN 62	5.24	(0+)	74H11381
30 ZN 64	1.90	0+	67F00128
30 ZN 64	1.9115	0+	67CA0201
30 ZN 64	1.910	0-	75AN2139
30 ZN 64	1.94	0+	74H11381
30 ZN 64	1.96	0+	69L10613
30 ZN 64	2.600	0+	76H11381
30 ZN 64	2.607	0+	75AN2139
30 ZN 64	2.61	0+	67F00128
30 ZN 64	2.618	0+	67CA0201
30 ZN 64	3.24	0+	74H11381
30 ZN 64	4.01	(0+)	76H11381
30 ZN 64	4.48	(0+)	76H11381
30 ZN 66	2.360	0+	67CA0201
30 ZN 66	2.3723	0+	66FR0899
30 ZN 66	2.3723	(0+)	66FR0899
30 ZN 66	2.371	0+	67KA0931
30 ZN 66	2.3717	0+	68CA1743
30 ZN 66	2.373	0+	68SH0196
30 ZN 66	2.3722	0+	70PH0647
30 ZN 66	2.3728	0+	71CA0269
30 ZN 66	2.379	0+	72HU0264
30 ZN 66	2.372	0+	73AN2139
30 ZN 66	2.38	0+	67F00525
30 ZN 66	2.39	0+	67F00128
30 ZN 66	2.9381	0+	73SZ0217
30 ZN 66	3.106	0+	68SH0114
30 ZN 66	3.106	0+	68SH0114
30 ZN 66	3.1051	0+	70PH0647
30 ZN 66	3.120	0+	72HU0264
30 ZN 66	3.2126	0+	73SZ0217
30 ZN 66	3.328	0+	68SH0114
30 ZN 66	3.528	0+	68SH0114
30 ZN 66	3.529	0+	72HU0264
30 ZN 66	3.824	0+	68SH0114
30 ZN 66	3.826	0+	68SH0114
30 ZN 66	4.917	0+	72HU0264
30 ZN 68	1.63	(0+)	65L10613
30 ZN 68	1.650	0+	67CA0201
30 ZN 68	1.647	0+	68HU0086
30 ZN 68	1.65	0+	68IN1013
30 ZN 68	1.656	0+	68CA1529
30 ZN 68	1.6559	0+	71DT0069
30 ZN 68	1.656	0+	72HU0264
30 ZN 68	1.6559	0+	72SL0026
30 ZN 68	3.100	0+	72HU0264
			1.4599 EO

30 ZN 68	3.157	0+					72HU0266
30 ZN 68	3.712	0+					72HU0266
30 ZN 68	4.145	0+					72HU0266
30 ZN 70	1.069	0+					72HU0266
30 ZN 70	2.134	0-					72HU0266
30 ZN 70	3.325	(u+)					72HU0266
30 ZN 70	3.677	0+					72HU0266
30 ZN 72	1.505	0+					72HU0266
30 ZN 72	2.476	0+					72HU0266
32 GE 68	3.55	0+					72SM0017
32 GE 70	1.216	0+					67PA0159
32 GE 70	1.216	0-					69VA1427
32 GF 70	1.2153	0+					68DE0473
32 GF 70	1.213	0-					76RA0334
32 GF 70	1.216	0+					76RA0644
32 GF 70	1.215	0+	1.215	E0			75BU0083
32 GF 70	1.215	0+	1.215	E0	RHO	9(-2)	2
32 GE 70	1.21	0+	0.176	E2	RE2U	< 6(-3)	
32 GE 70	1.216	0+	0.176	E2	RE2U	1.50(-2)	17
32 GF 70	1.216	0+	0.1795	E2	RE2U	1.58(-2)	26
32 GF 70	2.307	0+					69VA1427
32 GF 70	2.3071	0+					69HI0250
32 GE 70	2.301	0-					76BA0334
32 GF 70	2.3687	0-					69VA1427
32 GE 70	2.3871	0+					69HI0250
32 GE 70	3.107	(0)					68VA1427
32 GF 70	3.1072	0+					69HI0250
32 GE 72	0.6896	0+	0.6896	E0	RHO	9.5(-2)	5
32 GE 72	0.690	0-					76DR0948
32 GE 72	0.690	0+					76BA0334
32 GF 72	0.690	0+	0.690	E0			62NE0639
32 GF 72	0.6912	0-	0.6912	E0			71RE0461
32 GF 72	0.690	0+	0.690	E0			74NI0083
32 GE 72	0.690	0+	0.690	E0	RHO	1.1(-1)	2
32 GE 72	0.690	0-	0.690	E0	RHO	1.0(-1)	
32 GF 72	0.690	0-	0.690	E0	RHO	9.6(-2)	13
32 GE 72	0.693	0+	0.145	E2	RE2U	5.1(-3)	5
32 GF 72	1.464	2+	0.630	E0+M1+E2	IK(E0)/IG(E2)	<< 2(-2)	
32 GF 72	1.464	2+	0.630	E0+M1+E2	OSD	0.5(0)	1
32 GE 74	1.486	0-					72HA0369
32 GE 74	1.4826	0-					64DA0456
32 GE 74	1.4829	0+					71CA0163
32 GE 74	1.4824	0-					72VA0168
32 GE 74	1.4824	0+					75TA0107
32 GE 74	1.4824	0-					75CA0183
32 GE 74	1.9111	0+					71CA0401
34 SE 72	0.922	0+	0.922	E0			73WY0796
34 SE 72	0.937	0-					73RA0721
34 SF 72	0.9348	0+					76CO0167
34 SE 72	0.9368	0+	0.9368	(E0)			72CO1457
34 SE 72	0.937	0+	0.937	E0	RHO	1.76(-1)	48-70
34 SE 72	0.9360	0+	0.9360	E0	RHO	3.04(-1)	3
34 SE 72	0.937	0+	0.075	E2	BF2	3.2(-1)	6
34 SE 74	0.8536	0+					70GO0241
34 SE 74	0.854	0+					74RA1123
34 SE 74	0.8541	0-	0.2193	E2	SE2	1.51(-1)	10
34 SE 74	1.060	(u+)					74BA0156
34 SE 74	1.2693	2+	1.2692	E2	BF2	1.6(-3)	1
34 SE 74	1.11	(0+)					65LI0613
34 SE 74	1.123	0+					71HI0604
34 SE 74	1.123	0+					71II0901
34 SE 74	1.1220	0+					72AR0545
34 SE 76	1.216	2+	1.2161	E2	BF2	2.6(-3)	1
34 SE 76	1.2162	2+	0.6572	E2+M1	SE2	8.2(-2)	2
34 SE 76	1.7874	2+	1.2288	E2	SE2	2(-3)	1
34 SE 78	1.3086	2+	1.3088	E2	BF2	2.1(-3)	1
34 SE 78	1.3088	2+	0.6945	E2+M1	BF2	6.6(-2)	5
34 SE 78	1.4983	0+					71RA0658
34 SE 78	1.4985	0+	0.6868	E2	BF2	5.8(-2)	10
34 SE 78	1.5021	(0+)					76BA0156
34 SE 78	1.51	0+					70MC0529
34 SE 78	1.4930	(0+)					65LI0360
34 SE 78	1.9975	2+	1.9975	E2	SE2	1.7(-6)	7
34 SE 78	2.3269	(0+)					70MC0529
34 SE 78	2.334	0-					71RA0658
34 SE 78	2.4526	(0+)					70MC0529
34 SE 80	1.6645	2+	1.6695	E2	BF2	2.68(-3)	8
34 SE 80	1.6645	2+	1.6695	E2	BF2	2.84(-3)	10
34 SE 80	1.6645	2+	1.6695	E2	BF2		76BA0154

48 CD 112 1.468	2+	0.851	E2+E1	BE2		3(-4)	> 5-3	73GR0633
48 CD 112 1.7836	2+	0.8514	E2	BE2	2.2(-2)	5	694I0687	
48 CD 112 1.86	0+						60C01582	
48 CD 112 1.8697	0+						70MA0321	
48 CD 112 1.876	0+						67RA1319	
48 CD 112 1.871	0+						69LI1127	
48 CD 112 1.8702	0+						72KA0204	
48 CD 112 1.8708	0+						72WA0417	
48 CD 112 1.870	0+						74GE0129	
48 CD 112 1.88	(0)						70ES0201	
48 CD 112 2.28	0+						60C01582	
48 CD 112 2.302	0+						678A1319	
48 CD 112 2.83	0+						60C01582	
48 CD 114 1.1342	0+						70BA1069	
48 CD 114 1.1342	0+						71F00334	
48 CD 114 1.134	0+						74GI0397	
48 CD 114 1.134	0+	1.134	E0	RHO	1.6(-1)	3	668A0154	
48 CD 114 1.134	0+	0.976	E2	BE2	9.8(-2)	22	65G00097	
48 CD 114 1.15	0+						60C01582	
48 CD 114 1.209	2+	1.209	E2	BE2	4.0(-4)	8	57ST0267	
48 CD 114 1.209	2+	1.209	E2	BE2	1.8(-3)	6	61ST0209	
48 CD 114 1.209	2+	1.209	E2	BE2	1.75(-3)	26	65G00097	
48 CD 114 1.209	2+	0.651	E0+E2	BE2	1.6(-1)	3	57ST0209	
48 CD 114 1.209	2+	0.651	E0+E2	BE2	1.6(-1)	5	61ST0209	
48 CD 114 1.209	2+	0.651	E0+E2	BE2	1.39(-1)	31	65G00154	
48 CD 114 1.2093	2+	0.6502	E2	BE2	8.12(-2)	227	69MI0687	
48 CD 114 1.208	2+	0.650	E2+E1	BE2	7.9(-2)	23	73GR0633	
48 CD 114 1.209	2+	0.651	E0+E2	RHO	< 1.1(-1)		668A0154	
48 CD 114 1.3034	0+						71F00334	
48 CD 114 1.306	0+						74GI0397	
48 CD 114 1.305	0+	1.305	E0	RHO	5.4(-1)		668A0154	
48 CD 114 1.305	0+	0.171	E0	RHO	2.5(-1)		65BA0154	
48 CD 114 1.31	0+						60C01582	
48 CD 114 1.364	2+	1.364	E2	BE2	1.6(-3)	6	61ST0209	
48 CD 114 1.364	2+	1.364	E2	BE2	1.28(-3)	26	65G00097	
48 CD 114 1.364	2+	0.806	E0+E2	BE2	< 2.6(-2)	6	61ST0209	
48 CD 114 1.364	2+	0.806	E0+E2	BE2	< 1.9(-2)	6	65G00097	
48 CD 114 1.3660	2+	0.8068	E2	BE2	1.28(-2)	39	69MI0687	
48 CD 114 1.363	2+	0.805	E2+E1	BE2	3(+5)	+63=5	73GR0633	
48 CD 114 1.364	2+	0.806	E0+E2	RHO	2:2(-1)	6	668A0154	
48 CD 114 1.364	2+	0.154	E0+E2	RHO	1.7(-1)	11	668A0154	
48 CD 114 1.608	(0+)						61SM0183	
48 CD 114 1.731	6+	0.668	E0+E2	RHO	3.7(-2)		668A0154	
48 CD 114 1.861	2+	0.631	E0+E2	RHO	1.2(-1)		668A0154	
48 CD 114 1.86	0+						60C01582	
48 CD 114 1.861	(0)						74GI0397	
48 CD 114 2.068	(0+)						61SM0183	
48 CD 114 2.53	0+						60C01582	
48 CD 114 2.62	0-						60C01582	
48 CD 114 2.90	0+						60C01582	
48 CD 114 3.23	0+						60C01582	
48 CD 114 3.66	0+						60C01582	
48 CD 114 1.1540	(0+)						70BA1069	
48 CD 114 1.2136	2+	0.690	E2	BE2	7.3(-2)	20	69MI0687	
48 CD 114 1.283	0+						74GI0397	
48 CD 114 1.377	0+						70DE0064	
48 CD 114 1.377	(0+)						72DE0449	
48 CD 114 1.377	0+						73DE0307	
48 CD 114 1.381	0+						74GI0397	
48 CD 114 1.917	(0)						74GI0397	
48 CD 114 1.953	(0)						74GI0397	
50 SN 112 2.153	0+						72SI0449	
50 SN 114 1.58	0+						67SC1316	
50 SN 114 1.95	0+						67SC1316	
50 SN 114 1.954	0+						69BJ0481	
50 SN 114 1.970	0+						72SI0449	
50 SN 114 2.155	(0+)						69BJ0481	
50 SN T16 1.73	0+						66B01557	
50 SN 116 1.75	0+						67FE0665	
50 SN 116 1.759	0+						68BJ0001	
50 SN 116 1.7569	0+						73FE0195	
50 SN 116 1.756	0+						76AC0078	
50 SN 116 1.7570	0+	1.7570	E0	RHO	> 3(-2)	< 1(-1)	72PL0443	
50 SN 116 1.7576	0+	1.7576	E0	X	2.3(-2)	7	71SA0065	
50 SN 116 1.762	0+						65AL0481	
50 SN 116 1.76	0+						67SE1316	
50 SN 116 2.026	0+						76AC0078	
50 SN 116 2.03	0+						67SC1316	

50 SN 116 2.5457	(+)						73FE0195
50 SN 116 2.62	0+						67SC1316
50 SN 118 1.75	0+						60C01582
50 SN 118 1.75	0+						67SC1316
50 SN 118 1.7575	0+						70HA0203
50 SN 118 1.758	0+						76AC0078
50 SN 118 2.03	0+						60C01582
50 SN 118 2.043	0+						65AL0481
50 SN 118 2.05	0+						67SC1316
50 SN 118 2.0564	0+						70HA0203
50 SN 118 2.057	0+						76AC0078
50 SN 118 2.064	0+						68BJ0001
50 SN 118 2.48	0+						60C01582
50 SN 118 2.487	0+						65AL0481
50 SN 118 2.49	0+						67SC1316
50 SN 118 2.4965	0+						70HA0203
50 SN 118 3.136	0+						68BJ0001
50 SN 118 3.1371	0+						70HA0203
50 SN 120 1.872	0+						65AL0481
50 SN 120 1.8756	0+						71LI0150
50 SN 120 1.8756	0+						71LI0150
50 SN 120 1.875	0+						76AE0078
50 SN 120 1.874	0+						76K10001
50 SN 120 1.88	0+						67SC1316
50 SN 120 1.881	0+						68BJ0001
50 SN 120 1.89	0+						60C01582
50 SN 120 2.150	0+						68BJ0001
50 SN 120 2.159	0+						76K10001
50 SN 120 2.16	0+						60C01582
50 SN 120 2.1607	0+						71LI0150
50 SN 120 2.1607	0+						71LI0150
50 SN 120 2.17	0+						67SC1316
50 SN 120 2.31	0-						67SC1316
50 SN 120 2.518	0+						76K10001
50 SN 120 2.60	0+						67SC1316
50 SN 120 2.62	0+						60C01582
50 SN 120 2.632	0-						65AL0481
50 SN 122 2.089	0+						76AC0078
50 SN 124 2.193	0+						76AC0078
52 TE 120 1.103	0+						69SP1270
52 TE 120 1.103	0+	1.103	E0				70GA2048
52 TE 122 1.3575	0+						68LA1447
52 TE 122 1.357	0+						69SP1270
52 TE 122 1.357	0+						70GA2048
52 TE 122 1.353	0+						72AU0353
52 TE 122 1.9407	(+)						68LA1447
52 TE 122 1.940	(+)						70GA2048
52 TE 124 1.156	0+	1.156	E0	X		1.83(-1)	71ZH0043
52 TE 124 1.290	0+						7DCH0302
52 TE 124 1.656	0+						69RA1113
52 TE 124 1.657	0+						69RA1721
52 TE 124 1.658	0+	1.658	E0	X		6.7(-2)	71ZH0043
52 TE 124 1.658	0+	0.502	E0				71ZH0043
52 TE 124 1.88	0+						72AU0353
52 TE 124 2.020	0+	0.865	E0				71ZH0043
52 TE 124 1.396	0+						76GR0691
52 TE 124 1.396	0+	1.596	E0	X		2.59(+1)	71ZH0043
52 TE 124 1.685	0+	1.685	E0				71ZH0043
52 TE 124 1.875	0+						71ZE0644
52 TE 126 1.878	0+						716R0697
52 TE 126 2.061	0+	2.061	E0				70GA2048
52 TE 126 2.061	0+	2.061	E0				71ZH0043
52 TE 126 2.061	0+	0.664	E0				71ZH0043
52 TE 126 2.582	0+						71GR0697
52 TE 128 1.979	0+						71ZE0644
52 TE 128 2.305	0+						71SE0644
54 XE 130 1.7395	(+)						73RA0233
54 XE 130 1.7939	(+)						73W00765
54 XE 130 1.7921	(+)						76GE2363
54 XE 130 1.794	0+	1.794	E0	X		6(0)	3
54 XE 130 2.0170	(+)						73BA0087
54 XE 130 2.0170	(+)						73H00745
54 XE 130 2.0161	0+	2.0161	E0	X		1.00(+2)	50
54 XE 130 2.016	0+	2.016	E0	X		1.00(+2)	50
54 XE 130 2.016	2+	0.563	E0+M1+E2	I _K (E0)/I _G (E2)		< 6.5(-2)	736A2080
56 BA 134 1.768	0+	1.760	E0				71AB0736
56 BA 134 1.7697	0+	1.7599	E0				73AL1035
56 BA 134 2.3367	0+	2.335	E0				73AL1035

A2	SM 150	1.046	2+	0.712	E0+E2	BE2		3.9(-1)	12	66SE0925
A2	SM 150	1.046	2+	0.712	E0+E2	RHO	2(+1)		66LU0074	
A2	SM 150	1.046	2+	0.712	E0+E2	RHO	2.2(-1)	7	70GR2074	
A2	SM 150	1.046	2+	0.712	E0+E2	X	5(-2)		63LU0042	
A2	SM 150	1.047	2+	0.712	E0+E2	X	5(-2)		63GR0216	
A2	SM 150	1.047	2+	0.712	E0+E2	S(E0)/SB(E2)	2.1(-2)	5	70GR2074	
A2	SM 150	1.194	2+	1.194	E2	BE2U	8.9(-2)	66	66SE0925	
A2	SM 150	1.194	2+	0.859	E0+E2	BE2	4.2(-2)	21	66RE0925	
A2	SM 150	1.194	2+	0.859	E0+E2	RHO	4.7(-2)		68LU0074	
A2	SM 150	1.255	0+						72DE0385	
A2	SM 150	1.256	0+	1.256	E0				68LU0074	
A2	SM 150	1.256	0+	1.256	E0	X	>= 1.1(-1)		63GR0216	
A2	SM 150	1.256	0+	1.256	E0	R(E0,04-02)/R(E0,04-01)	>= 1.6(+1)		63GR0216	
A2	SM 150	1.261	0+						70LA0615	
A2	SM 150	1.28	0+						66RA0000	
A2	SM 150	1.761	(0+)						70LA0615	
A2	SM 152	0.685	0+						66RJ0145	
A2	SM 152	0.688	0+						72DE0385	
A2	SM 152	0.688	0+						74OE0237	
A2	SM 152	0.585	0+						754I0291	
A2	SM 152	0.684	0+	0.685	E0	RHO	1.9(-1)	6	67YD0189	
A2	SM 152	0.685	0+	0.685	E0	RHO	2.0(-1)	6	67EW0191	
A2	SM 152	0.685	0+	0.685	E0	RHO	2.55(-1)	10	71RU0401	
A2	SM 152	0.685	0+	0.685	E0	RHO	2.60(-1)	20	72DU0545	
A2	SM 152	0.685	0+	0.685	E0	X	7(12)	1	64RJ1214	
A2	SM 152	0.685	0+	0.563	E2	BE2	1.8(-1)	2	64FR1047	
A2	SM 152	0.685	0+	0.563	E2	BE2	1.57(-1)	23	71RU0401	
A2	SM 152	0.685	0+	0.563	E2	BE2	1.59(-1)	10	72PU0545	
A2	SM 152	0.694	0+						70LA0615	
A2	SM 152	0.81	2+	0.81	E2	BE2U	6.1(-2)	16	65YD00273	
A2	SM 152	0.811	2+	0.811	E2	BE2U	7.0(-2)	16	66RE0925	
A2	SM 152	0.811	2+	0.811	E2	BE2U	6.3(-2)	25	66RA0794	
A2	SM 152	0.811	2+	0.811	E2	BE2U	2.3(-2)	9	68VE0489	
A2	SM 152	0.811	2+	0.811	E2	BE2U	2.28(-2)	16	69FR1047	
A2	SM 152	0.811	2+	0.688	E0+M1+E2	BE2	2.58(-2)	26	64FR1047	
A2	SM 152	0.810	2+	0.688	E0+M1+E2	BE2	2.6(-2)	2	71DU0401	
A2	SM 152	0.810	2+	0.688	E0+E2	QSO	6.7(0)	7	64RJ1214	
A2	SM 152	0.810	2+	0.68	E0+E2	QSO	6.4(0)	8	69HU0592	
A2	SM 152	0.811	2+	0.689	E0+41+E2	Q	2.5(0)	3	72ST0315	
A2	SM 152	0.811	2+	0.69	E0+M1+E2	Q	>= 2.16(0) <= 2.78(0)		73KA0247	
A2	SM 152	0.811	2+	0.689	E0+M1+E2	LAMBDA	0(+3)	3	72ST0315	
A2	SM 152	0.811	2+	0.689	E0+M1+E2	LAMBDA	>= -3.65(+2) <= 2.90(+2)		73KA0247	
A2	SM 152	0.810	2+	0.688	E0+E2	RHO	3.6(-1)	5	54SH0518	
A2	SM 152	0.810	2+	0.688	E0+E2	RHO	>= 2.6(-2)		66L00624	
A2	SM 152	0.810	2+	0.68	E0+E2	RHO	2.6(-1)	8	67YD0189	
A2	SM 152	0.810	2+	0.688	E0+M1+E2	RHO	2.3(-1)	5	67EW0191	
A2	SM 152	0.810	2+	0.688	E0+E2	RHO	2.8(-1)	2	64RJ1214	
A2	SM 152	0.810	2+	0.688	E0+M1+E2	RHO	2.55(-1)	12	72RU0545	
A2	SM 152	0.811	2+	0.689	E0+M1+E2	E	+6.6(+1)	8	72RU0315	
A2	SM 152	0.810	2+	0.688	E0+E2	X	> 7(-1)		63LU0042	
A2	SM 152	0.810	2+	0.688	E0+E2	X	4.3(+1)	5	69RJ1214	
A2	SM 152	0.811	2+	0.689	E0+M1+E2	X	4.1(+1)	5	72ST0315	
A2	SM 152	1.023	4+	0.657	E0+M1+E2	BE2	3.7(-2)		69FR1047	
A2	SM 152	1.023	4+	0.657	E0+M1+E2	BE2	2.5(-2)	6	71DU0401	
A2	SM 152	1.023	4+	0.657	E0+E2	QSO	7.1(0)	27	69HU0592	
A2	SM 152	1.023	4+	0.657	E0+E2	RHO	1.9(-1)	7	66L00624	
A2	SM 152	1.023	4+	0.657	E0+E2	RHO	1.9(-1)	8	67YD0189	
A2	SM 152	1.023	4+	0.657	E0+E2	RHO	3.1(-1)	12	64RJ1214	
A2	SM 152	1.023	4+	0.657	E0+M1+E2	RHO	2.61(-1)	36	72RU0545	
A2	SM 152	1.023	4+	0.657	E0+E2	X	6.6(-1)	21	69RJ1214	
A2	SM 152	1.0828	(0+)						71BA2462	
A2	SM 152	1.0828	0+						73GA0239	
A2	SM 152	1.0828	0-						74GU0541	
A2	SM 152	1.0830	(0+)						75WI0291	
A2	SM 152	1.087	2+	1.087	E2	BE2U			66SE0925	
A2	SM 152	1.087	2+	1.087	E2	BE2U	8.13(-2)	57	66GU0895	
A2	SM 152	1.087	2+	0.96	E0+E2	BE2	2.8(-2)	10	65YD00273	
A2	SM 152	1.087	2+	0.964	E0+E2	BPZ	4.17(-2)	62	69FR1047	
A2	SM 152	1.086	2+	0.964	E0+E2	QSO	6.0(-2)	8	69HU0592	
A2	SM 152	1.086	2+	0.964	E0+M1+E2	Q	>= -2.15(-1) <= +3.17(-1)		73KA0247	
A2	SM 152	1.086	2+	0.964	E0+M1+E2	LAMBDA	>= -1.34(+2) <= +1.65(+2)		73KA0247	
A2	SM 152	1.091	0+						66RJ0145	
A2	SM 152	1.09	2+	1.09	E2	BE2U	6.8(-2)	12	65YD00273	
A2	SM 152	1.372	4+	1.006	E0+E2	BE2	3.70(-2)	13	69FR1047	
A2	SM 152	1.372	4+	1.006	E0+F?	QSO	5.0(-1)	17	69HU0592	
A2	SM 152	1.662	0+						72DE0385	
A2	SM 152	1.666	8-	0.561	E0+E2	RHO	2.05(-1)	60	66L00624	
A2	SM 152	2.103	10+	0.495	E0+E2	RHO	2.8(-1)	10	66L00624	

62	SM	154	1.096	0+						68VE0489
62	SM	154	1.0998	0+						71AA0172
62	SM	154	1.099	0+						73EL0493
62	SM	154	1.100	0+						69Y00273
62	SM	154	1.117	0+						66BJ0145
62	SM	154	1.178	2+	1.178	E2	REZU	2.0(-2)	5	68VE0489
62	SM	154	1.18	2-	1.18	E2	BEZU	3.0(-2)	7	65Y00273
62	SM	154	1.202	(0+)						73FL0493
62	SM	154	1.218	0+						66BJ0145
62	SM	154	1.474	(0)						73EL0493
62	SM	154	1.068	0+						66BJ0145
64	GD	146	2.178	0-						69SP0033
64	GD	146	2.179	0+						71SP0063
64	GD	150	1.208	0+						74GR0113
64	GD	150	1.209	0+						73FL0806
64	GR	150	1.2075	0+	1.2075	E0				73VY0043
64	GD	150	1.210	0+						71FL1235
64	GD	150	(1.98)	(0+)						73FL0806
64	GD	152	0.615	0+						73FL0806
64	GD	152	0.615	0+	0.615	E0	IK(E0)/IG(E2)	1.31(-1)	10	71Z00513
64	GD	152	0.615	0+	0.615	E0	X	5.8(-3)		60T00389
64	GD	152	0.615	0+	0.615	E0	X	1.05(-2)		61HA1758
64	GR	152	0.615	0+	0.615	E0	X	1.04(-2)		67GR0585
64	GD	152	0.6157	0+	0.6157	E0	X	6.2(-3)	6	70G00255
64	GD	152	0.615	0+	0.615	E0	X	1.3(-2)	1	71Z00513
64	GD	152	0.9311	2-	0.5867	E0+E1+E2	IK(E0)/IG(E2)	>= 1.1(-2) <= 1.2(-2)		70G00255
64	GD	152	0.931	2+	0.586	E0+E2	IK(E0)/IG(E2)	1.2(-2)	1	71Z00513
64	GD	152	0.931	2+	0.586	E0+E2	QSO	4.2(0)	10	69MU0592
64	GD	152	0.931	2+	0.586	E0+E1+E2	Q	>= 3.55(-1) <= 1.195(0)		72KA0615
64	GD	152	0.931	2+	0.586	E0+E1+E2	LAMBDA	>= -1.38(+2) <= +2.5(+1)		72KA0615
64	GD	152	0.931	2+	0.586	E0+E2	X	3.4(-2)		60T00389
64	GD	152	0.931	2+	0.586	E0+E2	X	1(-1)		63LU0042
64	GD	152	0.931	2+	0.586	E0+E2	X	5(-2)		67GR0585
64	GD	152	0.9311	2+	0.5867	E0+E1+E2	X	>= 3.4(-2) <= 3.8(-2)		70G00255
64	GD	152	0.931	2+	0.586	E0+E2	X	6.0(-2)	6	71Z00513
64	GD	152	0.931	2+	0.586	E0+E2	B(E0)/B(E2,22=02)	5.5(-3)		60T00389
64	GD	152	0.931	2+	0.586	E0+E2	B(E0)/B(E2,22=01)	2.8(0)		67GR0585
64	GD	152	0.931	2+	0.586	E0+E2	B(E0)/B(E2,22=02)	1.5(-2)		67GR0585
64	GD	152	1.046	0+						71FL1235
64	GD	152	1.048	0+						73FL0806
64	GD	152	1.048	0+	1.048	E0				69AD0109
64	GD	152	1.048	0+	1.048	E0	IK(E0)/IG(E2)	1.2(-2)	2	71Z00513
64	GD	152	1.048	0+	1.048	E0	X	>= 5(-2)		60T00389
64	GD	152	1.048	0+	1.048	E0	X	6.7(-2)		61HA1758
64	GD	152	1.048	0+	1.048	E0	X	> 6.2(-2)		67GR0585
64	GD	152	1.048	0+	1.048	E0	X	8.7(-2)	13	71Z00513
64	GD	152	1.048	0+	1.048	E0	B(E0,03=02)/B(E0,03=01)	6.3(+1)		61HA1758
64	GD	152	1.048	0+	1.048	E0	B(E0,03=02)/B(E0,03=01)	5.9(+1)		67GR0585
64	GD	152	1.048	0+	1.048	E0	B(E0,03=02)/B(E2,03=02)	1.5(-2)		67GD0585
64	GD	152	1.048	0+	1.048	E	B(E0)/B(E2,03=22)	1.25(-6)		67GR0585
64	GD	152	1.048	0+	0.4325	E0	IK(E0)/IG(E2)	8.8(0)	24	71Z00513
64	GD	152	1.048	0+	0.432	E0	B(E0,03=02)/B(E2,03=21)	>= 2(0)		60T00389
64	GD	152	1.048	0+	0.4325	E0	B(E0)/B(E2,03=22)	1.7(-2)	5	71Z00513
64	GD	152	1.053	0+						72EL0473
64	GD	152	1.109	2+	0.766	E0+E2	QSO	2.5(0)	11	69MU0592
64	GD	152	1.282	2+	0.5269	E0+E2	IK(E0)/IG(E2)	7.3(-2)	7	71Z00513
64	GD	152	1.282	2+	0.5269	E0+E2	X	2.34(+1)	23	71Z00513
64	GD	152	1.3184	2+	0.9761	E0+E2	IK(E0)/IG(E2)	2.4(-3)	3	71Z00513
64	GD	152	1.3184	2+	0.9761	E0+E2	X	8.8(-2)	11	71Z00513
64	GD	152	1.3184	2+	0.3878	E0+E2	IK(E0)/IG(E2)	3.6(+1)	10	71Z00513
64	GD	152	1.3184	2+	0.3878	E0+E2	X	3.1(-1)	8	71Z00513
64	GD	152	1.484	(0+)						69AD0109
64	GD	152	1.484	(0+)	1.484	E0				67GR0585
64	GD	152	1.862	2+	0.5637	E0+E2	IK(E0)/IG(E2)	2.6(+1)	5	71Z00513
64	GD	152	1.862	2+	0.5637	E0+E2	X	9.3(-1)	18	71Z00513
64	GD	152	2.721	(0+)	2.721	E0				67GR0585
64	GD	154	0.681	0+						71FL1235
64	GD	154	0.681	0+						72FL0473
64	GD	154	0.6807	0+						75S00365
64	GD	154	0.681	0+	0.61	E0	RHO	6.1(-1)	9	67Y00189
64	GD	154	0.681	0+	0.681	E0	RHO	2.86(-1)	26	71RU0401
64	GD	154	0.681	0+	0.681	EQ	RHO	3.13(-1)	36	72RU0545
64	GD	154	0.681	0+	0.681	E0	X	1.7(-1)	3	69RI1214
64	GD	154	0.681	0+	0.558	E2	B&2	2.1(-1)	3	71RU0401
64	GD	154	0.681	0+	0.558	E2	B&2	2.58(-1)	35	72RU0545
64	GD	154	0.81	2+	0.81	E2	BEZU	1.2(-1)	8	69Y00273
64	GD	154	0.816	2+	0.693	E0+E1+E2	B&2	4.0(-2)	2	71RU0601
64	GD	154	0.816	2+	0.693	QSO		9(0)	2	66HA0297

64	GD	154	0.816	2+	0.693	E0+E2	RHO		3.2(-1)	16	66LD0624
64	GD	154	0.816	2+	0.693	E0+E2	RHO		5.0(-1)	9	67Y00189
64	GD	154	0.816	2+	0.693	E0+E2	RHO		6.4(-1)		69R31214
64	GD	154	0.816	2+	0.693	E0+E2	RHO		2.86(-1)	36	72RU0565
64	GD	154	0.816	2+	0.693	E0+E2	X		> 3(-1)		63LU0062
64	GD	154	0.816	2+	0.693	E0+E2	X		4.5(-1)	6	69R11214
64	GD	154	0.998	2+	0.998	E2	BE2U		1.16(-1)		67BL0576
64	GD	154	0.998	2+	0.998	E2	OSO		0(-2)	6	72HA0349
64	GD	154	0.998	2+	0.973	E0+E2	RHO		6.2(-2)	9	71RU0601
64	GD	154	1.00	2+	1.00	E2	BE2U		1.3(-1)	5	65Y00273
64	GD	154	1.00	2+	0.87	E0+F2	RFZ		5.5(-2)	30	65Y00273
64	GD	154	1.048	4+	0.676	E0+M1+E2	BE2		3.8(-2)	6	71RU0401
64	GD	154	1.048	4+	0.676	E0+E2	OSO		> 2(0)		66HA0297
64	GD	154	1.048	4+	0.676	E0+E2	OSO		1.23(+1)	36	72HA0349
64	GD	154	1.048	4+	0.676	E0+E2	RHO		1.4(-1)	6	66LD0624
64	GD	154	1.048	4+	0.676	E0+E2	RHO		1.6(-1)	6	66LD0624
64	GD	154	1.048	4+	0.676	E0+E2	RHO		3.3(-1)	18	67Y00189
64	GD	154	1.048	4+	0.676	E0+M1+E2	RHO		2.78(+1)	36	72RU0565
64	GD	154	1.048	4+	0.676	E0+E2	X		5.8(-1)	18	69R11214
64	GD	154	1.0474	4+	0.6766	E0+M1+E2	X		3.4(-1)	7	74E02460
64	GD	154	1.2146	0+							68HA0686
64	GD	154	1.265	4+	0.896	E0+E2	RHO		7(-2)	+3-4	71RU0601
64	GD	154	1.293	(0+)							68ME1089
64	GD	154	1.293	0+							73FL0806
64	GD	154	1.2954	0+							75S00365
64	GD	154	1.368	6+	0.650	E0+M1+E2	BE2		3.3(-2)	10	71RU0401
64	GD	154	1.368	6+	0.650	E0+E2	RHO		2.7(-1)	8	66LD0624
64	GD	154	1.368	6+	0.650	E0+E2	RHO		2.2(-1)	13	66LD0624
64	GD	154	1.368	6+	0.650	E0+M1+E2	RHO		2.56(-1)	64	72RU0545
64	GD	154	1.3656	6+	0.6686	E0+M1+E2	X		3.6(-1)	8	74E02460
64	GD	154	1.7562	8+	0.6119	E0+M1+E2	X		4.8(-1)	+18+11	74E02460
64	GD	154	1.760	8+	0.614	E0+E2	RHO		> 2.0(-1)		66LD0624
64	GD	154	2.1936	10+	0.5573	E0+M1+E2	X		2.7(-1)	+16=12	74G02460
64	GD	154	1.049	0+							65Y00273
64	GD	154	1.049	0+							73FL0806
64	GD	154	1.0495	0+							74KL1451
64	GD	154	1.049	0+							74GU0943
64	GD	154	1.049	0+	0.960	E2	BE2		2.9(-2)	6	71RU0401
64	GD	154	1.050	0+							74EL0473
64	GD	154	1.050	0+	1.050	E0	RHO		4.1(-1)	9	67EW0191
64	GD	154	1.050	0+	1.050	E0	RHO		4.1(-1)	5	69BA0147
64	GD	154	1.050	0+	1.050	E0	RHO		1.79(-1)	17	71RU0401
64	GD	154	1.050	0+	1.050	E0	X		< (-1)		69BA0147
64	GD	154	1.130	2+	1.130	E2	BE2U		7(-2)	3	65Y00273
64	GD	154	1.130	2+	1.040	E0+M1+E2	BE2		1.03(-2)	13	71RU0401
64	GD	154	1.130	2+	1.040	E0+M1+E2	OSO		5.9(0)	3	72HA0349
64	GD	154	1.130	2+	1.060	E0+M1+E2	RHO		4.4(-1)	12	67EW0191
64	GD	154	1.130	2+	1.060	E0+E2	X		> 4(-1)		63LU0062
64	GD	154	1.15	2+	1.15	E2	BE2U		6(-2)	2	65Y00273
64	GD	154	1.155	2+	1.155	E2	BE2U		9.8(-2)		67BL0576
64	GD	154	1.15	2+	1.06	E2	BE2		2.0(-2)	9	65Y00273
64	GD	154	1.154	2+	1.065	OSO			1.0(-1)	6	72HA0349
64	GD	154	1.168	0+							73FL1235
64	GD	154	1.168	0+							73FL0806
64	GD	154	1.1681	0+							74KL1451
64	GD	154	1.168	0+	1.168	E0			< 1.8(-2)		69R10169
64	GD	154	1.168	0+	1.168	E0	X				69BA0147
64	GD	154	1.172	0+							74GU0943
64	GD	154	1.298	4+	1.009		OSO		6.0(0)	20	72HA0349
64	GD	154	1.715	0+							74GU0943
64	GD	154	1.74	(0+)							73FL0806
64	GD	154	1.989	(0+)							74GU0943
64	GD	158	1.196	0+							73FL0806
64	GD	158	1.1960	0+							73WH0410
64	GD	158	1.1960	0+							73KL1966
64	GD	158	1.1956	0+							73RL0185
64	GD	158	1.449	0+							67BL0576
64	GD	158	1.452	0+							70BE0116
64	GD	158	1.452	0+							71FL1235
64	GD	158	1.454	0+							72EL0473
64	GD	158	1.4524	0+							73WH0410
64	GD	158	1.4516	0+							75KL1966
64	GD	160	1.381	0+							76EL1864
64	GD	160	1.466	(0+)							76EL1864
64	DY	160	1.599	(0+)							68GR0385
64	DY	156	0.676	0+	0.676	E0	X		> 6(-2)		68AB0032
64	DY	156	0.829	2+	0.691	E0+E2	X		1.5(-1)	7	68AB0032

66	DY	156	1.088	6+	0.682	E0+E2	X		2.0(-1)	7	68AB0032
66	DY	156	1.437	6+	0.666	E0+E2	X		1.2(-1)	6	68AB0032
66	DY	156	0.986	0+	0.984	E0					68AB0749
66	DY	156	0.991	0+							72MA0358
66	DY	156	0.9911	0+							75RU0974
66	DY	156	0.691	0+	0.991	E0	RHO		> 6.3(-2)		66GR0001
66	DY	156	0.691	0+	0.991	E0	RHO		> 7.7(-2)		66GR0001
66	DY	156	0.991	0+	0.991	E0	X		1.0(-1)		66GR0001
66	DY	156	0.991	0+	0.991	E0	X		1.5(-1)		66GR0001
66	DY	156	0.690	0+	0.990	E0	X		8(-2)	3	73BU0084
66	DY	156	0.9904	0+	0.9904	E0	X		8(-2)	4	75AL0458
66	DY	156	1.0854	2+	0.8960	E0+E2	X		> 5(-2)		75AL0458
66	DY	156	1.2803	6+	0.5629	E0+E2	X		7(-2)	3	75AL0458
66	DY	160	1.665	0+	1.053	(E0)					68AB0749
66	DY	160	0.966	2+	0.966	E2	BE2U		6.9(-2)	20	65Y00273
66	DY	160	0.9661	2+	0.9661	E2	BE2U		1.05(-1)	8	740E0543
66	DY	160	0.966	2+	0.879	E0+E1+E2	BE2		2.6(-2)	13	65Y00273
66	DY	160	0.966	2+	0.879	E0+E1+E2	I(E0)/IG(E2)		< 1.0(-2)		73GA2080
66	DY	160	0.966	2+	0.879	E0+E1+E2	0		< 3(-2)	10	72ZU0237
66	DY	160	0.966	2+	0.879	E0+E1+E2	0		< 3(-2)	9	73ZA0581
66	DY	160	0.966	2+	0.879	E0+E1+E2	LAMBDA		0		72ZU0237
66	DY	160	0.966	2+	0.879	E0+E1+E2	LAMBDA		0		73ZA0581
66	DY	160	0.966	2+	0.879	E0+E1+E2	RHO		> 1.1(-2)	37	72ZU0237
66	DY	160	0.966	2+	0.879	E0+E1+E2	RHO		< 3(-3)	9	73ZA0581
66	DY	160	0.966	2+	0.879	E0+E1+E2	X		8.3(-4)	500	72ZU0237
66	DY	160	1.263	0+	1.263	E0	X		> 3(-1)		69GR0635
66	DY	160	1.275	0+							72MA0358
66	DY	160	1.280	0+	1.280	E0	X		2.7(-1)	8	76AL0066
66	DY	160	1.2800	0+	1.2800	E0	X		2.6(-1)	8	76AL2103
66	DY	160	1.3490	2+	1.263	E0+E2	B(E0)/SB(E2)		2.2(-1)	7	76AL2103
66	DY	160	1.3490	2+	1.2627	E0+E2	B(E0)/SR(E2)		2.3(-1)	7	76AL0066
66	DY	160	1.9532	0+	1.9532	E0					76AL2103
66	DY	160	1.953	0+	1.953	E0	X		6.5(-1)		69GR0635
66	DY	162	0.8882	2+	0.8882	E2	BE2U		1.05(-1)	8	740E0543
66	DY	162	1.127	0+							67BA0117
66	DY	162	1.4003	0+							73BA0059
66	DY	162	1.600	0+	1.600	F0	RHO		< 4(-2)		75ED0886
66	DY	162	1.600	0+	1.40	E0	RHO		< 4(-2)		75ED0103
66	DY	162	1.400	0+	1.400	E0	X		4.8(-2)	6	75ED0886
66	DY	162	1.400	0+	1.400	E0	X		4.8(-2)	6	75ED0103
66	DY	162	1.670	0+							72MA0358
66	DY	164	0.7618	2+	0.7618	E2	BE2U		1.01	9	740E0543
68	ER	158	0.8064	0+	0.8064	E0	X		3.6(-2)	7	75AG0239
68	ER	158	0.9890	2+	0.7968	E0+E1+E2	B(E0)/B(E2,22+61)		7.8(-2)	15	75AG0239
68	ER	158	0.9890	2+	0.7968	E0+E1+E2	B(E0)/B(E2,22+01)		6.4(-2)	10	75AG0239
68	ER	158	1.257	6+	0.7298	E0+E1+E2	B(F0)/B(E2,42+21)		5.0(-2)	30	75AG0239
68	ER	158	1.257	6+	0.7298	E0+E1+E2	B(E0)/B(E2,42+61)		1.30(-1)	70	75AG0239
68	ER	158	1.3869	(0+)							75AG0239
68	ER	160	0.894	0+							75AG0086
68	ER	162	1.067	0+							73BA0090
68	ER	162	1.077	0+							70AB0117
68	ER	162	1.081	0+							68TJ0585
68	ER	162	1.0871	0+	1.0871	E0	X		3.0(-1)	9	74DE0349
68	ER	162	1.1710	2+	1.0690	E0+E1+E2	B(E0)/B(E2,22+61)		4.1(-1)	7	74DE0349
68	ER	162	1.4204	(0+)	1.4204	E0	X		8.1(-2)	74	74DE0349
68	ER	162	1.4299	2+	1.3281	E0+E1+E2	B(E0)/B(E2,23+61)		6.7(-2)	88	74DE0349
68	ER	162	1.5004	2+	1.3982	E0+E1+E2	B(E0)/B(E2,24+61)		1.46(-1)	88	74DE0349
68	ER	162	2.1142	(0+)							74DE0146
68	ER	164	1.238	0+	1.238	F0	RHO		> 9(-3)		66GR0001
68	ER	164	1.238	0+	1.238	E0	RHO		> 2(-2)		66GR0001
68	ER	164	1.238	0+	1.238	F0	X		4.7(-2)		66GR0001
68	ER	164	1.238	0+	1.238	E0	X		> 1f(-2)		66GR0001
68	ER	164	1.248	0+							72MA0358
68	ER	164	1.2460	0+	1.2460	E0					71DE0577
68	ER	164	1.246	0+	1.246	E0	X		1.5(-1)	3	67VR0604
68	ER	164	1.2460	0+	1.246	E0	X		1.4(-1)	2	74DE0144
68	ER	164	1.3146	2+	1.323	E0+E1+E2	X		2.4(-1)	4	74DE0144
68	ER	164	1.498	0+	1.698	E0	X		3.9(-1)	6	67VR0604
68	ER	164	1.7659	0+	1.7659	E0					71DE0577
68	ER	164	1.766	0+	1.766	E0	X		7.8(-1)	11	67VR0604
68	ER	164	1.7659	0+	1.765	E0	X		6.3(-1)	10	74DE0144
68	ER	164	1.7885	2+	1.697	E0+E1+E2	X		3.0(-1)	3	74DE0144
68	ER	164	1.8334	2+	1.762	E0+E1+E2	X		1.1(-1)	2	74DE0144
68	ER	164	1.9114	2+	1.820	E0+E1+E2	X		8.9(-1)		74DE0144
68	ER	164	1.9565	2+	1.868	E0+E1+E2	X		1.3(-1)	6	74DE0144
68	ER	164	2.1725	0+	2.1725	E0					71DE0577
68	ER	164	2.170	0+	2.170	E0	X		1.76(0)	25	67VR0604
68	ER	164	2.1725	0+	2.172	E0	X		8.8(-1)	18	74DE0144

72 HF 178 1.1492	0+	1.1992	E0	x		1.60(-1)	9	76HA2540
72 HF 178 1.237	0+							65SM1691
72 HF 178 1.276	2+	1.183	E0+M1+E2					72LI0252
72 HF 178 1.276	2+	1.183	E0+M1+E2	x		1.6(-1)	6	67NI0385
72 HF 178 1.2766	2+	1.1834	E0+M1+E2	x		1.56(0)	15	76HA2540
72 HF 178 1.276	2+	1.183	E0+M1+E2	B(E0)/B(E2,23-61)		2.6(-1)	6	71F00353
72 HF 178 1.276	2+	1.183	E0+M1+E2	B(E0)/B(E2,23-01)		1.35(0)	12	72GI0321
72 HF 178 1.434	0+							65SM1691
72 HF 178 1.434	0+							68HU0106
72 HF 178 1.434	0+							71GU0270
72 HF 178 1.434	0+	1.634	E0					72LI0252
72 HF 178 1.434	0+	1.634	E0	x		1.0(-1)	2	67NI0385
72 HF 178 1.434	0+	1.634	E0	x		1.1(-1)	3	71F00353
72 HF 178 1.434	0+	1.634	E0	x		1.15(-1)	7	72GI0321
72 HF 178 1.4340	0+	1.6340	E0	x		6.6(-2)	7	74HA2540
72 HF 178 1.440	0+							61GA1590
72 HF 178 1.444	0+							68HU0106
72 HF 178 1.443	0+							71GU0270
72 HF 178 1.444	0+	1.644	E0					71F00353
72 HF 178 1.444	0+	1.644	E0					72LI0252
72 HF 178 1.444	0+	1.644	E0	x		5.3(-1)	16	61GA1590
72 HF 178 1.444	0+	1.644	E0	x		3.8(-1)	8	67NI0385
72 HF 178 1.444	0+	1.644	E0	x		5.2(-1)	3	72GI0321
72 HF 178 1.4437	0+	1.6437	E0	x		5.0(-1)	2	76HA2540
72 HF 178 1.651	6+	1.145	E0+M1+E2	B(E0)/B(E2,43-61)		1.5(-1)	7	71F00353
72 HF 178 1.498	2+	1.403	E0+M1+E2	QSO		2.0(0)	6	73HA0349
72 HF 178 1.498	2+	1.403	E0+M1+E2	x		1.2(-1)	5	67NI0385
72 HF 178 1.4985	2+	1.4029	E0+M1+E2	x		7.6(-1)	6	76HA2540
72 HF 178 1.498	2+	1.403	E0+M1+E2	B(E0)/B(E2,24-61)		2.1(-1)	9	71F00353
72 HF 178 1.498	2+	1.403	E0+M1+E2	B(E0)/B(E2,23-01)		6.7(-1)	7	72GI0321
72 HF 178 1.636	6+	1.329	E0+M1+E2	B(E0)/B(E2,44-61)		< 2.0(-1)		71F00353
72 HF 178 1.772	0+							72LI0252
72 HF 178 1.772	0+	1.772	E0	x		5.7(-1)	16	76HA2540
72 HF 180 1.2005	2+	1.2005	E2	BE2		1.10(-1)	11	74VA0442
74 W 180 0.908	0+	0.908	E0	RHO		2(-2)		66GR0005
74 W 180 0.908	0+	0.908	E0	RHO		3.5(-2)		66GR0004
74 W 180 0.908	0+	0.908	E0	x		2(-1)		66GR0004
74 W 180 0.908	0+	0.908	E0	x		6.1(-2)		66GR0004
74 W 182 1.138	0+							71GU0273
74 W 182 1.137	0+							72MA1380
74 W 182 1.137	0+							75KL0093
74 W 182 1.1367	0+							75DE0125
74 W 182 1.222	2+	1.222	E2	BE2		5.1(-2)		58AL1325
74 W 182 1.222	2+	1.222	E2	BE2		2.48(-2)	12	69MI1204
74 W 182 1.222	2+	1.222	E0+E2	BE2		4.3(-2)		58AL1325
74 W 182 1.222	2+	1.222	E0+E2	BE2		4.7(-2)	3	69MI1204
74 W 182 1.221	2+	1.221	E2+M1	BE2		4.7(-2)	3	71MI0001
74 W 182 1.222	2+	1.221	E0+M1+E2	0		1.6(-1)	9	75WE0887
74 W 182 1.222	2+	1.221	E0+M1+E2	RHO		1.9(-3)	11	75LE0R87
74 W 182 1.222	2+	1.222	E0+E2	x		3.2(-2)		64DA0529
74 W 182 1.222	2+	1.221	E0+M1+E2	x		1.6(-3)	11	75WE0887
74 W 182 1.257	2+	1.257	E2	BE2U		2.3(-2)	2	69MI1204
74 W 182 1.257	2+	1.157	E0+E2	BF2		4.4(-3)	7	69MI1204
74 W 182 1.257	2+	1.157	E2+M1	BE2		3.7(-3)	6	71MI0001
74 W 182 1.257	2+	1.157	E0+E2	QSO		1.1(0)	7	68V00221
74 W 182 1.2575	2+	1.1573	E0+E2	QSO		1.1(0)	7	75FE0147
74 W 182 1.257	2+	1.157	E0+M1+E2	0		1.13(0)	13	75WE0887
74 W 182 1.257	2+	1.157	E0+M1+E2	RHO		4.9(-2)	6	75WE0887
74 W 182 1.2575	2+	1.1573	E0+E2	x		7(-2)	6	75FE0147
74 W 182 1.257	2+	1.157	E0+M1+E2	x		9.0(-2)	24	75WE0887
74 W 182 1.257	2+	1.157	E0+E2	B(E0)/SB(E2)		3.7(-3)	4	64GA0671
74 W 182 1.4429	6+	1.1136	E0+E2	QSO		< 4.5(-1)		75FE0147
74 W 182 1.442	6+	1.113	E0+M1+E2	0		4.1(-1)	9	75WE0887
74 W 182 1.442	6+	1.113	E0+M1+E2	x		1.1(-2)	5	75WE0887
74 W 182 1.538	0+	1.638	E0+E2	B(E0)/SB(E2)		> 1(0)		69GA0673
74 W 182 1.7568	6+	1.0765	E0+E2	QSO		> 2.3(-1)	< 3.7(-1)	75FE0147
74 W 182 2.2395	0+							75DE0125
74 W 182 2.240	0+							73KL0093
74 W 182 2.240	0+							74DE0146
74 W 182 2.284	0+							73KL0093
74 W 184 0.904	2+	0.904	E2	BF2		3.8(-2)		58AL1325
74 W 184 0.904	2+	0.904	E2	BE2		3.6(-8)	10	61GD1276
74 W 184 0.904	2+	0.904	E2	BF2		2.46(-2)	12	69MI1204
74 W 184 0.904	2+	0.793	E0+M1+E2	BE2		5.5(-2)	14	58AL1325
74 W 184 0.904	2+	0.793	E0+M1+E2	BF2		6.5(-2)	23	61GD1276
74 W 184 0.904	2+	0.793	E0+M1+E2	BE2		4.5(-2)	14	69MI1204
74 W 184 0.903	2+	0.793	E2+M1	BF2		6.5(-2)	3	71MI0001
74 W 184 0.904	2+	0.793	E0+M1+E2	0		< 3.7(-1)		69ZU0313

74 W 184 0.904	2+	0.793	E0+M1+E2	0	+3.0(+1)	+8-30	70000353
74 W 184 0.904	2+	0.793	E0+M1+E2	0	+1.6(-1)	+6n-12	70000353
74 W 184 0.904	2+	0.792	E0+M1+E2	0	<= 2.3(-1)		704G2121
74 W 184 0.904	2+	0.792	E0+M1+E2	0	<= 2.4(-1)		704G2121
74 W 184 0.904	2+	0.793	E0+M1+E2	LAMBDA	>= -3.2(+1)	<= +9.56(+2)	792U0313
74 W 184 0.904	2+	0.793	E0+M1+E2	LAMBDA	+1.3(+1)	+6n-80	70100353
74 W 184 0.904	2+	0.793	E0+M1+E2	RHO	+7.7(+1)	+6n-36	70000353
74 W 184 0.904	2+	0.793	E0+M1+E2	RHO	<= 3.5(-2)		687U0313
74 W 184 0.904	2+	0.792	E0+M1+E2	RHO	<= 2.1(-2)		704G2121
74 W 184 0.904	2+	0.792	E0+M1+E2	RHO	<= 2.3(-2)		704G2121
74 W 184 0.904	2+	0.793	E0+M1+E2	X	1.5(-2)		640A0529
74 W 184 0.904	2+	0.793	E0+M1+E2	X	<= 4.5(-3)		692U0313
74 W 184 0.904	2+	0.792	E0+M1+E2	X	<= 1.7(-3)		704G2121
74 W 184 0.904	2+	0.792	E0+M1+E2	X	<= 1.9(-3)		704G2121
74 W 184 1.004	0+						68FA1495
74 W 184 1.003	0+						695A05X1
74 W 184 1.003	0+						796U0273
74 W 184 1.009	0+						72MA1380
74 W 184 1.0023	0+						73CA0419
74 W 184 1.002	0+						73FA0489
74 L 184 1.002	0+						73CA0037
74 L 184 1.0025	0+						74GR0066
74 L 184 1.0028	0+						75BU1401
74 L 184 1.0041	0+	1.0041	F0				75KL0144
74 L 184 1.0041	0+	1.0041	F0	RHO	1.9(-2)	4	75FE0230
74 L 184 1.0041	0+	1.0041	EU	X	6(-3)	3	75FE0230
74 W 184 1.1213	2+	1.0102	F0+M1+E2	DSP	1.0		75FE0230
74 W 184 1.1213	2+	1.0102	E0+M1+E2	RHO	4.4(-2)	12	75FE0230
74 W 184 1.1213	2+	1.0102	E0+M1+E2	X	9.5(-2)	19	75FE0230
74 W 184 1.285	0+						71GU0273
74 W 184 1.3221	0+						74GR0066
74 W 184 1.38A	2+	1.275	E2+M1	BE2	7.4(-3)	15	71MI0001
74 W 184 1.432	(0+)						71GU0273
74 W 184 1.6150	0+						74GR0066
74 W 184 2.182	(0+)						73CA0489
74 L 184 2.182	0+						73CA0037
74 W 184 2.2947	(0+)						74GR0066
74 L 184 2.415	(0+)						73CA0489
74 W 184 2.415	0+						73CA0037
74 W 186 0.737	2+	0.615	E2+M1	BE2	6.9(-3)	6	71MI0001
74 W 186 0.883	(0+)						71GU0273
74 W 186 0.8817	0+						73GU0241
74 W 186 0.8817	(0+)						74GU0241
74 W 186 1.150	(0+)						71GU0273
74 W 186 1.286	2+	1.163	E2+M1	BE2	3.4(-3)	4	71MI0001
74 W 186 0.768	2+	0.631	E2+M1	BE2	8.2(-2)	12	71MI0001
74 OS 184 1.061	0+						75TH0001
74 OS 184 1.456	0+						75TH0001
74 OS 184 1.453	0+						75TH0001
74 OS 184 1.990	0+						75TH0001
74 OS 188 0.633	2+	0.633	F2	BE2	4.0(-2)	15	616G1274
74 OS 188 0.633	2+	0.633	E2	BE2	5.00(-2)	64	69CA1532
74 OS 188 0.633	2+	0.478	E0+M1+F2	BE2	1.1(-2)	3	616G1274
74 OS 188 0.633	2+	0.478	E0+M1+F2	BE2	1.46(-2)	13	69CA1532
74 OS 188 0.633	2+	0.475	F2+M1	BE2	1.56(-1)	11	71MI0001
74 OS 188 0.633	2+	0.478	F0+M1+E2	0	3.2(-1)	*12-20	67IK0167
74 OS 188 0.633	2+	0.475	E0+M1+E2	RHO	2.2(-2)	*6-14	67IK0167
74 OS 188 1.086	0+						54K10755
74 OS 188 1.086	0+						61KA0385
74 OS 188 1.086	0+						66RA0577
74 OS 188 1.085	0+						69YA0456
74 OS 188 1.0863	0-						73SH0700
74 OS 188 1.0863	0+						73SH1517
74 OS 188 1.0865	0+						75TH0001
74 OS 188 1.0865	0+						75TH0444
74 OS 188 1.086	0+	1.0	0	EU	<= 2.2(-2)		75SV0213
74 OS 188 1.0862	0+	1.0862	F0	RHO	>= 2.2(-2)		75MA0435
74 OS 188 1.086	0+	1.086	EU	RHO	<= 2.2(-2)		74EE0152
74 OS 188 1.0862	0+	1.0862	EU	RHO	>= 2.2(-2)		74BE2505
74 OS 188 1.086	0+	1.086	X		<= 3.5(-3)		74BE0152
74 OS 188 1.0862	0+	1.0862	X		>= 3.5(-3)		74BE2505
74 OS 188 1.086	0+	0.931	E2	BE2U	6.12(-3)	150	69CA1532
74 OS 188 1.477	0+						75TH0001
74 OS 188 1.4780	0+						75TH0444
74 OS 188 1.4781	0+						75SV0213
74 OS 188 1.4780	0+						75MA0435
74 OS 188 1.4780	0+						73SH0700
74 OS 188 1.4780	0+						73SH1517

78 PT 192 0.612	2+	0.296	E0+M1+E2	RHO	+1(-3)	+20-17	64MA0601
78 PT 192 0.612	2+	0.296	E0+M1+E2	RHO	+3(-3)	+10-13	73AL1652
78 PT 192 0.612	2+	0.296	E0+M1+E2	RHO	+6(-3)	5	76V00123
78 PT 192 0.612	2+	0.296	E0+M1+E2	E	+6(-3)	8	70HI0220
78 PT 192 0.612	2+	0.296	E0+M1+F2	E	+1(-3)	+5-6	73AL1652
78 PT 192 0.612	2+	0.296	E0+M1+E2	F	+3.6(-3)	+16-53	76V00123
78 PT 192 0.612	2+	0.296	E0+M1+E2	X	3.6(-5)	48	70HI0220
78 PT 192 0.612	2+	0.296	E0+M1+E2	X	FROM2, (-6)	T04.3(-5)	73AL1652
78 PT 192 0.612	2+	0.296	E0+M1+E2	X	1.3(-5)	+14-10	76V00123
78 PT 192 1.195	0+	1.195	E0	X	2.2(-2)	7	70FR1635
78 PT 192 1.1951	0+	1.1950	F0	X	2.2(-2)	3	72FI0369
78 PT 192 1.4342	2+	1.4227	E0+(M1)+E2	X	>= 2.5(-1)	5	72FI0369
78 PT 192 1.576	2+	1.260	E0+E2	X	2.5(-1)	5	70ER1635
78 PT 194 0.622	2+	0.622	E2	BE2	1.7(-3)	6	61G01274
78 PT 194 0.622	2+	0.622	E2	BE2	2.2(-3)	6	70R0495
78 PT 194 0.622	2+	0.293	E0+M1+E2	BE2	2.3(-1)	5	61G01274
78 PT 194 0.622	2+	0.293	E0+M1+E2	Q	+2.5(-1)	13	67AL0177
78 PT 194 0.622	2+	0.293	E0+M1+E2	Q	>= -2.0(-1) <= +2.5(-1)	67JK0167	
78 PT 194 0.622	2+	0.293	E0+M1+F2	Q	>= -1.7(-1) <= +2.4(-1)	71D00418	
78 PT 194 0.622	2+	0.293	E0+M1+E2	LAMBDA	>= -5.0(+1) <= +3.5(+1)	67AL0177	
78 PT 194 0.622	2+	0.293	E0+M1+E2	LAMBDA	>= -5.0(+1) <= +1.50(+2)	67JK0167	
78 PT 194 0.622	2+	0.293	E0+M1+E2	LAMBDA	>= -1.70(+2) <= +2.70(+2)	71D00418	
78 PT 194 0.622	2+	0.293	E0+M1+E2	RHO	1.09(-2)	66	67AL0177
78 PT 194 1.267	0+						59J01205
78 PT 194 1.267	0+	1.267	E0				64BE0529
78 PT 194 1.267	0+	1.267	E0				70BE0311
78 PT 194 1.2673	0+	1.2674	E0	OSQ	3.4(-1)	6	75FE0286
78 PT 194 1.267	0+	1.267	E0	X	6.7(-3)	13	70ER1635
78 PT 194 1.2673	0+	1.2674	E0	X	8(-3)	2	75FE0286
78 PT 194 1.4793	0+	1.4793	F0	OSQ	1.16(+1)	13	75FE0286
78 PT 194 1.4793	0+	1.4793	E0	X	6.4(-1)	6	75FE0286
78 PT 194 1.480	0+	1.480	E0				66RE0529
78 PT 194 1.480	0+	1.480	E0				70BE0311
78 PT 194 1.5119	2+	1.1834	E0+E2	OSQ	4.1(-1)	16	75FE0286
78 PT 194 1.5119	2+	1.1834	E0+E2	X	2.2(-2)	9	75FE0286
78 PT 194 1.5119	2+	0.8897	E0+E2	OSQ	8.0(+1)	52	75FE0286
78 PT 194 1.5119	2+	0.8897	E0+E2	X	2.2(-2)	15	75FE0286
78 PT 194 1.567	0+	1.567	E0				64BE0529
78 PT 194 1.567	0+	1.567	E0				70BE0311
78 PT 194 1.5673	0+	1.5673	E0	OSQ	4.8(-1)	6	75FE0286
78 PT 194 1.5673	0+	1.5673	E0	X	2.0(-2)	4	75FE0286
78 PT 194 1.551	0+						72MA1380
78 PT 194 1.623	2+	1.295	E0+M1+E2				64BE0529
78 PT 194 1.623	2+	1.295	E0+M1+E2				70BE0311
78 PT 194 1.6223	2+	1.2957	E0+E2	OSQ	3.7(0)	15	75FE0286
78 PT 194 1.623	2+	1.295	E0+E2	X	>= 7(-2)		70ER1635
78 PT 194 1.6223	2+	1.295	E0+E2	X	2.4(-1)	9	75FE0286
78 PT 194 1.6223	2+	1.2937	E0+E2	X	6.2(+1)	34	75FE0286
78 PT 194 1.6223	2+	1.0002	E0+E2	OSQ	2.4(-2)	12	75FE0286
78 PT 194 2.085	0+	2.085	E0				64RE0529
78 PT 194 2.085	0+	2.085	E0				70BE0311
78 PT 194 2.0857	0+	2.0858	E0	OSQ	6.21(+1)	7	75FE0286
78 PT 194 2.0857	0+	2.0858	E0	X	5.6(0)	3	75FE0286
78 PT 194 2.163	0+	2.163	E0				64BE0529
78 PT 194 2.164	0+	2.164	E0				70BE0311
78 PT 194 2.1637	0+	2.1661	E0	OSQ	1.59(+1)	13	75FE0286
78 PT 194 2.1637	0+	1.1661	E0	X	1.5(0)	3	75FE0286
78 PT 194 2.3117	2+	1.9833	E0+E2	OSQ	1.3(+1)	6	75FE0286
78 PT 194 2.3117	2+	1.9833	E0+E2	X	2.1(0)	7	75FE0286
78 PT 194 2.356	0+	2.356	E0				64BE0529
78 PT 194 2.357	0+	2.357	E0				70BE0311
78 PT 194 2.3566	0+	2.3570	E0	OSQ	> 7(0)		75FE0286
78 PT 194 2.3566	0+	2.3570	E0	X	> 1.2(0)		75FE0286
78 PT 194 0.689	2+	0.689	E2	BE2	< 2.6(-4)		61GE01274
78 PT 194 0.689	2+	0.333	E0+M1+E2	Q	5.6(+1)	10	58GE1119
78 PT 194 0.689	2+	0.333	E0+M1+E2	Q	+6.3(-1)	5	62GE0241
78 PT 194 0.689	2+	0.333	E0+M1+F2	Q	+1.10(-1)	+145=110	62GE0241
78 PT 194 0.689	2+	0.333	E0+M1+E2	Q	+3.9(-1)	5	65PE0466
78 PT 194 0.689	2+	0.333	E0+M1+F2	Q	+2.2(+1)	7	65PE0466
78 PT 194 0.689	2+	0.333	E0+M1+E2	Q	+6.4(+1)	+9=10	71D00418
78 PT 194 0.689	2+	0.333	E0+M1+E2	Q	+2.3(-1)	+16=20	71D00418
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	0(0)		58GE1119
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	2.7(+1)	13	62GE0241
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	9.15(+1)	50	62GE0241
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	+6.8(+1)	12	65PE0466
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	+2(0)	6	65PE0466
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	>= 5.6(+1)	<= 7.7(+1)	71D00418
78 PT 194 0.689	2+	0.333	E0+M1+E2	LAMBDA	>= -3(0)	<= +1.5(+1)	71D00418

78	PT	196	0.689	2+	0.333	E0+E1+E2	RHO	3.9(-2)	7	58GE1119
78	PT	196	0.589	2+	0.333	E0+E1+E2	RHO	4.6(-2)	2	62GE0261
78	PT	196	0.689	2+	0.333	E0+E1+E2	RHO	4.6(-3)	4	62GE0261
78	PT	196	1.137	0+						67M00330
78	PT	196	1.135	0+						68YA0321
78	PT	196	1.137	0+						68YA0065
78	PT	196	1.135	0+						70ER1635
78	PT	196	1.143	0+						68GR0937
80	HG	198	0.522	0+						75RA1156
80	HG	188	0.8245	0+	0.8265	E0				75HA0000
80	HG	188	0.8245	0+	0.8265	E0				75HA0830
80	HG	188	0.8245	0+	0.8265	E0				75HA0562
80	HG	174	0.956	0-	0.956	E0	B(E0)/B(E2,21-01)	1.1(-4)		70GD1781
80	HG	196	0.950	0-	0.960	E0				69G00056
80	HG	198	1.088	2+	0.676	E0+E1+E2	LAMBDA	>= 5(0)	<= 2.6(+1)	66SA0529
80	HG	198	1.088	2+	0.676	E0+E1+E2	LAMBDA	>= 3.1(+1)	<= 5.2(+1)	66SA0529
80	HG	198	1.088	2+	0.676	E0+E1+E2	RHO	>= 2.1(-1)	<= 4.2(-1)	66SA0529
80	HG	198	1.088	2+	0.676	E0+E1+E2	RHO	>= -4.2(-1)	<= -2.9(-1)	66SA0529
80	HG	198	1.088	2+	0.676	E0+E1+E2	X	FROM 4.6(-1)	T01.85(0)	66SA0529
80	HG	198	1.088	2+	0.676	E0+E1+E2	X	FROM 8.7(-1)	T01.85(0)	66SA0529
80	HG	198	1.4015	0-						71PA0193
80	HG	200	1.029	0-						65MA0478
80	HG	200	1.0295	0-						67SC1548
80	HG	200	1.0291	(0+)						70SA0542
80	HG	200	1.0294	0+						71MA0405
80	HG	200	1.0293	0+						76BR0366
80	HG	200	1.0293	0+						76BR0366
80	HG	200	1.5151	0+						71K00513
80	HG	200	1.5152	0+						76BR0366
80	HG	200	1.5152	0+						76BR0366
80	HG	200	1.8568	0+						76BR0366
80	HG	200	1.8570	0+	1.857	E0				71MA0405
80	HG	200	1.8568	0+	1.8576	E0				76BR0366
80	HG	200	2.6971	0+	1.6678	(E0)				76BR0366
80	HG	200	2.6971	0+	1.1819	(E0)				76BR0366
80	HG	202	1.5647	0+						76BR0091
80	HG	202	1.5647	0+						75BR0566
80	HG	202	1.643	0+						76BR0091
80	HG	202	1.643	0+						75BR0546
82	PB	204	1.585	0+	1.385	E0	B(E0)/B(E2,21-01)	9.1(-4)		70G01781
82	PB	204	1.585	0+	1.388	E0	B(E0)/B(E2,02-21)	4.0(-3)		70G01781
82	PB	204	1.590	0+	1.590	E0				69G00056
82	PB	206	1.167	0+						74LA0646
82	PB	206	1.166	0+						74FL0509
82	PB	206	1.17	0+						67H00886
82	PB	206	2.315	0+						76LA0646
82	PB	206	2.32	0+						67H00886
82	PB	206	5.637	0+						74FL0509
82	PB	208	11.475	0+						73B00293
84	PO	208	1.270	0+	1.270	E0				69B00056
84	PO	208	1.273	0+	1.273	E0	B(E0)/B(E2,21-01)	2.83(-3)	9	70G01781
84	PO	208	1.273	0+	1.273	E0	B(E0)/B(E2,02-21)	7.8(-3)	10	70G01781
84	PO	212	1.8012	0+	1.800	E0				72PA0165
86	RN	218	0.650	0+						72MA1380
86	RN	220	0.534	0+						72MA1380
86	RN	222	0.449	0+						72MA1380
88	RA	224	0.918	0+						76FR0760
88	RA	224	1.223	0+						74FR0760
90	TH	228	0.830	0+	0.830	E0	X	8.3(-1)		72MA1380
90	TH	228	1.1536	2+	0.1865	E0+E1+E2	RHO	1.1(-1)	2	74DE2297
90	TH	230	0.635	0+						76MC1166
90	TH	230	0.632	0+						75TH1227
90	TH	230	0.636	0+	0.636	E0	X	2.2(-1)	10	72MA1380
90	TH	230	0.677	2+	0.677	E2	BE2U	4.6(-2)	6	76MC1166
90	TH	230	1.590	0+						76MA1380
90	TH	232	0.730	0+						60DU0202
90	TH	232	0.731	0+						72EL0545
90	TH	232	0.730	0+						76MC1166
90	TH	232	0.730	0+	0.730	E0	X	1.2(-1)	1	72MA1380
90	TH	232	0.775	2+	0.775	E2	BE2U	1.22(-1)	24	60601803
90	TH	232	0.776	2+	0.776	E2	BE2U	1.0(-1)	4	76MC1166
90	TH	232	0.775	2+	0.725	E0+E2	RHO	8(-2)		548E0009
90	TH	232	0.775	2+	0.725	E0+E2	RHO	FROM 1.7(-1)	T02.5(-1)	6060U0202
90	TH	232	0.776	2+	0.725	E0+E2	RHO	3.7(-1)	6	76MC1166
90	TH	232	0.785	2+	0.785	E2	BE2U	1.22(-1)	8	76MC1166
92	U	232	0.695	0+	0.695	/E0	X	1.7(-1)	6	72MA1380
92	U	234	0.810	0+						68E..0261
92	U	234	0.810	0+						70SC0528

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