The NUBASE2016 evaluation of nuclear properties*

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Abstract: This paper presents the NUBASE2016 evaluation that contains the recommended values for nuclear and decay properties of 3437 nuclides in their ground and excited isomeric ($T_{1/2}\geq$100 ns) states. All nuclides for which any experimental information is known were considered. NUBASE2016 covers all data published by October 2016 in primary (journal articles) and secondary (mainly laboratory reports and conference proceedings) references, together with the corresponding bibliographical information. During the development of NUBASE2016, the data available in the "Evaluated Nuclear Structure Data File" (ENSDF) database were consulted and critically assessed for their validity and completeness. Furthermore, a large amount of new data and some older experimental results that were missing from ENSDF were compiled, evaluated and included in NUBASE2016. The atomic mass values were taken from the "Atomic Mass Evaluation" (AME2016, second and third parts of the present issue). In cases where no experimental data were available for a particular nuclide, trends in the behavior of specific properties in neighboring nuclides (TNN) were examined. This approach allowed to estimate values for a range of properties that are labeled in NUBASE2016 as "non-experimental" (flagged "#"). Evaluation procedures and policies used during the development of this database are presented, together with a detailed table of recommended values and their uncertainties.

AMDC: http://amdc.impcas.ac.cn/

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1 Introduction

NUBASE is a database containing values of the main nuclear properties, such as masses, excitation energies of isomers, half-lives, spins and parities, and decay modes and their intensities, for all known nuclides in their ground and excited isomeric states. The information presented in NUBASE represents the fundamental building blocks of modern nuclear physics, and specifically, of nuclear structure and nuclear astrophysics research. The first version of NUBASE was published in 1997 [1] and since then it has been widely used in many fields from fundamental physics to applied nuclear sciences. The present publication includes updated information of all nuclear properties given in the previous publications of NUBASE [1–3].

One of the main applications of NUBASE2016 is the "Atomic Mass Evaluation" (AME2016, second and third parts of this issue) where it is imperative to have an unambiguous identification of all states involved in a particular decay, reaction or mass-spectrometric measurement. This is the primary reason for which the two evaluations are published jointly in the present issue, for the third time since the publication of the NUBASE2003 [2].

Furthermore, with the advances of modern mass-spectrometry techniques (see for example the special issue of "one hundred years of mass spectrometry" for relevant topics [4]) and the availability of intense stable and rare-isotope beams, a large number of unstable nuclei can be produced in a single experiment in their ground and/or isomeric states, and their masses can be measured with high precision. Thus, NUBASE2016 can be particularly useful in future mass measurements, where an unambiguous identification of complex mass-spectrometric data would be required.

Applications of this database in astrophysics network calculations and in theoretical studies of nuclear properties, where complete and reliable data for all known nuclei are needed, are also envisioned.

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Last, but not least, the evaluated data presented in NUBASE2016 are also useful for specialists in applied nuclear fields, such as reactor engineering and design, fuel manufacture and transport, waste management, material analysis, medical diagnostics and radiotherapy, and others, where one needs to access basic information for a given nuclide.

The information presented in NUBASE2016 fulfills several user-demanded requirements, namely that it is: a) *complete* – includes all measured quantities and their uncertainties, b) *up-to-date* – results from the most recent publications are included, c) *credible and reliable* – identifies and resolves contradictory results that exist in the scientific literature, as well as in other nuclear physics databases, d) *properly referenced* – provides comprehensive information for the traceability of all included data.

Most of the data included in NUBASE2016 are in principle available in two other evaluated databases: the "Evaluated Nuclear Structure Data File" (ENSDF) [5] and the "Atomic Mass Evaluation" (AME2016). Therefore, the demand for NUBASE could be partially fulfilled by combining these two databases into a single, 'horizontal' structure, which exists in AME, but not in ENSDF. Therefore, NUBASE2016 can be considered at a first level as a critical combination of those two evaluations.

During the development of the present version of NUBASE, it was imperative to examine all available literature for several nuclides in order to revise results adopted in ENSDF, and to ensure that the recommended data are presented in a consistent way (*credibility and reliability* requirements). It was also necessary to include all the available experimental data, i.e. not only results that were published recently (*up-to-date* requirement), but also older data that were missing in ENSDF (*completeness* requirement). This implied that some extra evaluation work was necessary. The corresponding conclusions are added as remarks in the NUBASE2016 table, and in the discussions below. Complete bibliographical references are given for all added experimental data in Table I (see Section 2.8).

There is no strict literature cut-off date for the results presented in the NUBASE2016 evaluation: all data available to the authors until October 2016 have been included. Results that were not incorporated for special reasons, e.g. the need for a heavy revision of the evaluation at too late a stage of development, are added, whenever possible, in remarks to the relevant data.

During the preparation of NUBASE2016, we noticed that Ref. [6] reports important decay data for proton-rich nuclides ^{67}Kr, ^{63}Se and ^{59}Ge, where a two-proton emission from ^{67}Kr was observed. We found that it was too heavy an effort at this stage to include these results into NUBASE2016, especially to establish the atomic mass surface in this region. They are not included in the currect evaluation, but the original paper is just mentioned here.

The contents of NUBASE2016 are described below, together with the adopted policies that were used during the development of this database. Section 3 presents the updating procedures, while the electronic distribution and interactive display of NUBASE2016 contents by means of a stand-alone PC-program are described in Section 4.

2 Contents of NUBASE2016

The NUBASE2016 evaluation contains recommended values for the basic nuclear ground-state properties, for 3437 nuclides, derived from all available experimental results, together with some values estimated by extrapolating neighboring ones. It also contain data for 1318 nuclides which have one or more excited isomeric states with half-lives longer than 100 ns.

Similar to the previous editions, NUBASE2016 also contains data on 186 isobaric analog states (IAS), which have their excitation energies determined either through an "internal relation" and taken from ENSDF, or through an "external relation" and then determined by the AME2016 evaluation.

For each nuclide (A,Z), and for each state (ground or excited isomer), the following properties were compiled and, when necessary, evaluated: mass excess, excitation energy of excited isomeric states, half-life, spin and parity, decay modes and their intensities, isotopic abundance (for a stable nuclide), year of discovery and the corresponding bibliographical information for all experimental data.

References to published articles in the description sections below are given by means of the keynumber style used in the "Nuclear Science Reference" (NSR) bibliographical database [7]. However, references quoted in the NUBASE2016 tables are abbreviated with the first two digits of the year of publication being omitted from the NSR keynumbers. The complete reference list is given at the end of this issue, together with the references used in AME (see AME2016, Part II).

At the time the work on NUBASE2016 was completed, superheavy elements (SHE) up to Z = 118 were officially named by The Commission on Nomenclature of Inorganic Chemistry of the International Union of Pure and Applied Chemistry (IUPAC) [8]:

113 Nihonium (Nh),
115 Moscovium (Mc),
117 Tennessine (Ts),
118 Oganesson (Og).

We were not able to include the new names in AME2016 and NUBASE2016, but instead we used the provisional symbols Ed, Ef, Eh, and Ei for elements 113, 115, 117, and 118, respectively.

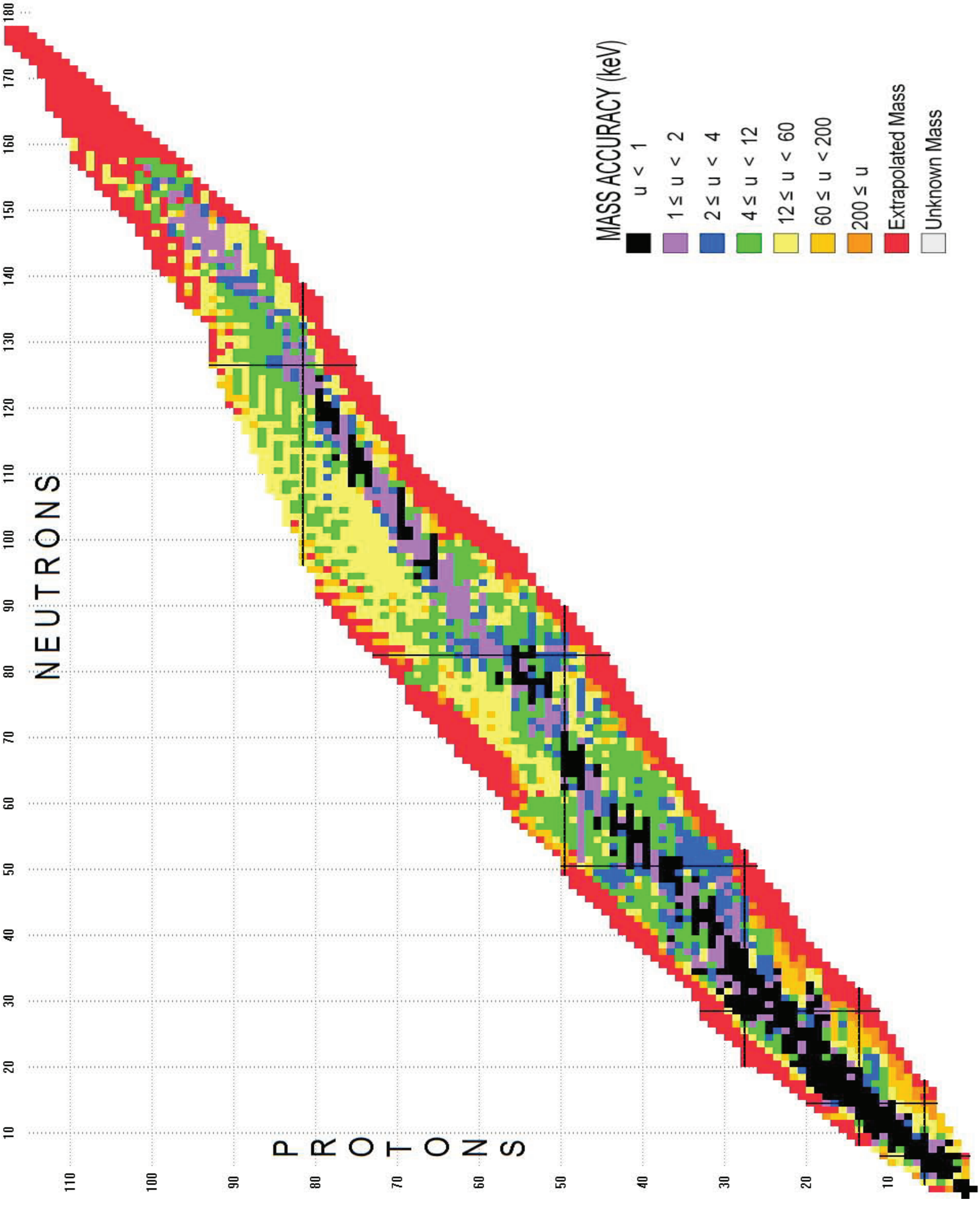

Figure 1. Chart of the nuclides displaying the accuracy 'u' of masses (created by NUCLEUS-AMDC).

NUBASE2016 contains numerical and bibliographical data for all known nuclides for which at least one property is known experimentally in their ground state, excited isomeric states with $T_{1/2} \geq 100$ ns, and/or IAS. It also includes information on yet unobserved nuclides, estimated from the observed experimental trends of neighboring nuclides (TNN). This ensures continuity in the set of considered nuclides simultaneously in N, in Z, in A and in $N-Z$. The chart of nuclides defined in this way has a smooth contour.

For experimentally unknown properties, values were also estimated from TNN. Similarly to AME2016, the estimated values are flagged with the symbol '#' to indicate non-experimental information.

As a rule, one standard deviations (1σ) are used in NUBASE2016 to represent the uncertainties associated with the quoted experimental values. Unfortunately, authors of research articles do not always define the meaning of their reported uncertainties and those values were assumed to be one standard deviations . In many cases, uncertainties are not even given at all and were estimated by us, considering the limitations of the experimental method.

Values and corresponding uncertainties for properties given in NUBASE2016 are rounded , even if unrounded values were given in the literature or in ENSDF. In cases where the two furthest left significant digits in the uncertainty were larger than a given limit (set to *30* for masses and energies to be consistent with AME2016, and set to *25* for all other quantities, as used in ENSDF), values and uncertainties were rounded accordingly (see examples in the 'Explanation of table'). In a few cases that were deemed essential for traceability purposes (e.g. isotopic abundances) the original (unrounded) value is also provided in an associated comment.

2.1 Mass excess

In NUBASE2016 the mass excess values (in keV), defined as being differences between the atomic mass (in mass units) and the mass number, together with their one-standard-deviation uncertainty, are taken from the mass tables of the AME2016 evaluation.

In general, knowledge of masses can provide valuable information on decay modes, in particular for a particle-decay instability, or β-delayed particle-decay, for nuclei far from the line of stability. Such information is used in NUBASE2012, for example for ^{10}He, ^{39}Sc, ^{62}As, or ^{63}As. In some cases, the claimed observations of decay modes were rejected when it was found that they were not allowed through simple energetics.

Figure 1 displays the mass accuracy from the main table, as a function of N and Z.

2.2 Isomers

In the first version of NUBASE [1], a definition for excited isomers was adopted: excited states with a half-life longer than one millisecond. Within this definition, all β-decaying states were included in this category, since they have a lower half-life limit of one millisecond. However, already at that time, it was noticed that such a definition had several drawbacks, particularly for neutron-deficient alpha- and proton-decaying nuclides, where much shorter-lived states were known to exist. Moreover, several cases are known where isomers with half-lives far below one millisecond survive longer than the ground state itself, e.g. ^{216}Fr.

With the publication of NUBASE2003 [2], the definition of isomers was extended to half-lives longer than 100 ns, and such states are now included in NUBASE2016. The main reasons for this change were to include:

a) all proton- and alpha-decaying states observed in many neutron-deficient nuclei,

b) isomers that may be detected in mass-spectrometric experiments performed at accelerator facilities following the immediate detection of the produced nuclei, and

c) all possible isomers that may be detected in such experiments in the future.

In NUBASE2016, isomers are tabulated in order of increasing excitation energy and identified by appending the letters 'm', 'n', 'p', 'q', or 'r' to the nuclide name, e.g. ^{90}Nb for the ground state, ^{90}Nb^m for the first excited isomer, ^{90}Nb^n for the second one, and ^{90}Nb^p, ^{90}Nb^q, and ^{90}Nb^r for the third, fourth and fifth ones, respectively. In the cases of ^{179}Ta and ^{214}Ra a sixth isomer had to be included, and they were labeled provisionally with the letter 'x'.

Suffix 'x' also applies to mixtures of levels which are used in the atomic mass evaluation. These mixtures occur in spallation reactions or in fission and they appear in mass measurements performed using mass spectrometers. For each mixture, the excitation energy and the relative production rate of isomeric state with respect to ground state are given.

The excitation energy of a given isomer can be determined using different experimental methods, which, in general, belong to the category of either internal or external relations. A typical internal relation is via the γ-ray decay energy, or a combination of such γ-ray energies. The most accurate values for the excitation energies of isomers deduced by this approach can be found in ENSDF, where a least-squares fitting procedure is applied to all γ rays along the decay path of a particular isomer. However, when no such internal relations can be established, then the relation to other nuclides (external relations) can be used to deduce the mass (or energy) difference between excited and ground-state isomers. In all such cases, the most accurate values can only be derived using the AME evaluation procedure and the values are therefore taken from AME2016. The origin (the method used to establish the external relation) of each isomer data element is then indicated by a two-letter code, next to the isomer excitation energy, in the NUBASE2016 table. For internal relations, the origin field is left blank and the numerical values are taken either from ENSDF or from literature updates. In the latter case, a least-squares fit to the measured γ-ray decay energies from complex level schemes was applied, in accordance with the current ENSDF policies.

It also happens that connections between excited and ground state isomers can be obtained by both internal relations and one, or more, external relations with comparable accuracies. All relations are then combined within the AME2016 data by adding an equation that relates the excitation energy obtained from ENSDF (or from literature), so that AME2016 derives the best combination of all data. For example, the AME2016 derives the mass of ^{178}Lu^m at 66% from E_x(IT)=120(3) keV [1993Bu02] and at 34% from ^{176}Lu(t,p)^{178}Lu^m=4482(5) keV [1981Gi01]. The adjusted excitation energy is thus 123.8(2.6) keV.

In some cases, excitation energies known from internal relations are essential in order to determine the mass of the ground state. Those values are labeled in the NUBASE table with 'IT' in the origin field. They are entered as an equation in AME2016 so that the ground state mass can be derived. For example, the mass of ^{62}Mn was listed as unknown in AME2012, since it was the excited isomer that was measured in a Penning trap experiment [2012Na15]. However, the excitation energy of ^{62}Mn^m was determined recently via γ-ray spectroscopy [2015Ga38], so the mass of the ground state is established experimentally. An interesting case is the mass and excitation energy of ^{186}Tl^n, where its mass is experimentally known from a Penning trap (ISOLTRAP) measurement [2014Bo26]. The well known transition from ^{186}Tl^n to ^{186}Tl^m allows to determine not only the mass of the latter, but also the excitation energy of the α-decaying isomers in the parent nuclides ^{190}Bi^m, ^{194}At^m and ^{198}Fr^m.

When the existence of an isomer is ambiguous, it is flagged with 'EU' ("existence uncertain") in the origin field (e.g. ^{73}Zn^n). A comment is generally added to indicate why this existence is questioned, or where this matter is discussed in more detail. Five isomers, namely ^{73}Zn^n, ^{138}Pm^n, ^{141}Tb^m, ^{185}Bi^n, ^{273}Ds^m are treated in this way in the present evaluation and the mass excess and excitation energy values are given for them all except ^{138}Pm^n, for which the existence is strongly doubted.

When a particular isomer was initially reported as "discovered", but later it was proved to be an error, it is flagged with 'RN' in the origin field, indicating "reported, non existent". Three isomers, namely ^{117}La^m, ^{156}Tm^n and ^{181}Pb^m are treated in this way. In these cases, no mass-excess or excitation energy values are given, and, similarly to the 'EU' choice above, a "non existent" label is added.

Note: the use of the two flags, 'EU' and 'RN', was extended to cases where the discovery of a nuclide is questioned (e.g. ^{260}Fm or ^{289}Lv). However, an estimate for the ground state mass, derived from trends in the mass surface (TMS), is always given in AME2016 and NUBASE2016.

In several instances, lower and higher limits for the excitation energy of a particular isomer are presented in ENSDF. The policy of NUBASE2016 is that a uniform distribution of probabilities is assumed, which yields a mid-range value and a 1σ uncertainty corresponding to 29% of the range (see Appendix B of the AME2016, Part I in this issue for a complete description of this procedure). For example, the excitation energy of the ^{162}Tm^m isomer is known from ENSDF to be above the 66.90 keV level. On the other hand, there is also solid experimental evidence that it is below the 192 keV level, and so this information is presented as $E_x = 130(40)$ keV in NUBASE2016. However, if such a value is based on theoretical considerations, or from TNN, the resulting E_x is considered as a non-experimental quantity and the value is consequently flagged with the '#' symbol.

In cases where the uncertainty of the excitation energy, σ, is relatively large as compared to the E_x value, the assignment of the level as a ground or isomeric state is uncertain. If $\sigma > E_x/2$, a '$*$' flag is added in the NUBASE2016 table.

The ordering of several ground and excited isomeric states were reversed as compared to the recommendations in ENSDF. These cases are flagged with the '&' symbol in the NUBASE2016 table. In several other instances, evidence was found for states located below the adopted ground state in ENSDF. There are also cases where the trends in neighboring nuclides, with the same parities in N and Z, strongly suggest that such a lower state should exist. Such results were added in the NUBASE tables and can be easily located, as they are flagged with the '&' symbol. In a growing number of cases, new experimental information on masses led to a reversal of the ordering between previously assigned ground and excited isomeric states. Thanks to the coupling of the NUBASE2016 and AME2016 evaluations, all changes in the ordering of nuclear levels have been carefully synchronized.

Finally, there are cases where data exist on the ordering in energy of the isomers, e.g. if one of them is known to decay into the other one, or if the Gallagher-Moszkowski rule [9] points strongly to one of the two as being the ground-state. Detailed discussions can be found in Ref. [10].

2.2.1 Isobaric analog states (IAS)

In the previous version of NUBASE [3] we have included the $T = 3/2$ to $T = 3$ experimentally observed (IAS). These states are also included in NUBASE2016 and generally labelled with i or j superscripts, for members of successively higher multiplets. The experimental information about IAS has been evaluated in more detail recently in Ref. [11]. Some nuclides belong simultaneously to several categories, for example, they may be in their ground state but they may also be IAS of some other ground state nucleus, as is the general case for ground state mirror nuclei. Here, the IAS label is not present, since these nuclides are already naturally included in the database. Another exception is the set of $N = Z$, $T = 1$ odd-odd ground state nuclides which are also already part of the original dataset of ground state masses. They are: ^{34}Cl$_{17}$, ^{42}Sc$_{21}$, ^{46}V$_{23}$, ^{50}Mn$_{25}$, ^{54}Co$_{27}$, ^{62}Ga$_{31}$ and ^{70}Br$_{35}$. The reader may note that the $Z = 29$ and $Z = 33$ nuclides are not included in this series, since their ground states are $T = 0$, as expected from theory. Finally, there are eight excited isomers, $^{16}N^m$, $^{26}Al^m$, $^{34}Cl^m$, $^{38}K^m$, $^{46}V^m$, $^{50}Mn^m$, $^{54}Co^m$ and $^{72}Ga^m$, which are also IAS. In such cases, the isomer labels ('m', 'n',...) are used preferentially over the IAS labels. Here we note with interest that five of them have experimentally determined excitation energies, at least partly, by the JYFLTRAP-Jyväskylä Penning trap.

In NUBASE2016 there are roughly 181 unique IAS masses, of which 113 are evaluated in the AME via external relations, and 68 cases evaluated through internal relations and published in ENSDF. There are five cases where no clear experimental data is available, and although some Isobaric Multiplet Mass Equation (IMME) [12] and Coulomb Displacement Energy (CDE) [13] calculations point to a likely IAS state, their existence cannot yet be certified experimentally (for example $^{15}O^i$).

The isospin multiplet assignment given in the table is the logical IAS multiplet value, and has not necessarily been deduced experimentally.

2.3 Half-life

Fig. 2 displays the half-lives of nuclides in NUBASE2016. In the light mass region, nuclides beyond the particle driplines can be studied with modern radioactive ion facilities. Most of these unbound nuclides exist for a very short time before they directly decay via particle emission. For some of them, such as ^{19}Mg and ^{26}O, the half-lives can be determined experimentally with novel experimental methods. For most unbound nuclei, only the total level width ($\Gamma_{\rm cm}$) can be measured and therefore the half-life ($T_{1/2}$) can be deduced using the equation $\Gamma_{\rm cm}\, T_{1/2} \simeq \hbar \times \ln 2$ so that

$$T_{1/2}\,({\rm s}) \simeq 4.562\,10^{-22}/\Gamma_{\rm cm}\,({\rm MeV}).$$

The following units are used for convenient display in NUBASE2016: seconds (s) and its sub-units, minutes (m), hours (h), days (d) and years (y) and its sub-units. Conversion between years and seconds or days could follow various definitions: Julian year, Gregorian year, tropical year 1900, epoch 2000, etc., differing only slightly from each other. A fixed value of:

1 y = 31 556 926 s or

1 y = 365.2422 d

was adopted in NUBASE2016.

Asymmetric uncertainties for half-lives, $T_{1/2}{}^{+a}_{-b}$, are often presented in the literature. However, for these values to be used in practical applications, they need to be symmetrized. A rough symmetrization procedure was used earlier (see AME1995) where the central value was taken as the mid-value between the upper and lower 1σ-equivalent limits, $T_{1/2}+(a-b)/2$, and the uncertainty was defined to be the average of the two uncertainties, $(a+b)/2$. A strict statistical derivation (see Appendix A) shows that a better approximation for the central value can be obtained by using

$$T_{1/2}+0.64\times(a-b).$$

The exact expression for asymmetric uncertainties, adopted in NUBASE2016, is presented in Appendix A.

When two or more independent measurements were reported in the literature, the corresponding values were weighted by their reported precisions and then averaged. While doing this, the NORMALIZED CHI, χ_n (or 'consistency factor' or 'Birge ratio'), as defined in AME2016, is considered. When χ_n is larger than 2.5, departure from the statistical result is allowed and the external uncertainty for the average result is adopted. This follows the same policy that is discussed and adopted in AME2016. Very rarely, when χ_n is so large that all individual uncertainties can be considered as irrelevant, the arithmetic (unweighted) average is adopted and the corresponding uncertainty is based on the dispersion of the values. In such cases, the list of values that were averaged, together with the χ_n value (when relevant) and the reason for this choice, are given in the NUBASE2016 table. When contradictory (conflicting) results were identified in the literature, attention was focused on establishing the reason for such discrepancies, and consequently, any bad data were rejected. The justification for such decisions are given as comments in the NUBASE2016 table.

In experiments where extremely rare events are detected and where the results are very asymmetric (e.g. studies of super-heavy nuclei), the half-life values reported in different publications were not directly averaged. Instead, when the information presented in the literature was sufficient (e.g. ^{264}Hs), the decay times associated with the individual events were combined, as prescribed by Schmidt *et. al.* [1984Sc13].

Some experimental results are reported in the literature as a range of values with a most probable lower and upper limit. These are treated, as in the case of isomer excitation energies (see preceding page), as a uniform distribution of probabilities.

In the NUBASE2016 table, an upper or lower limit on the half-life value is given for nuclides identified using a time-of-flight technique. The following policies were considered:
i) For *observed* nuclides, the lower limit for the half-life is given in place of the uncertainty (e.g. ^{44}Si). However, such limits should be used with caution, since they may be far below the actual half-life. In order to avoid confusion, a somewhat more realistic estimate (flagged with #), derived using TNN is also given. ii) For nuclides that were sought, but *not observed*, the upper limit is given in place of the actual half-life uncertainty. Upper limits for a dozen undetected nuclides were evaluated by F. Pougheon [1993Po.A], based on the time-of-flight of the experimental setup and the production yields expected from TNN (e.g. ^{21}Al).

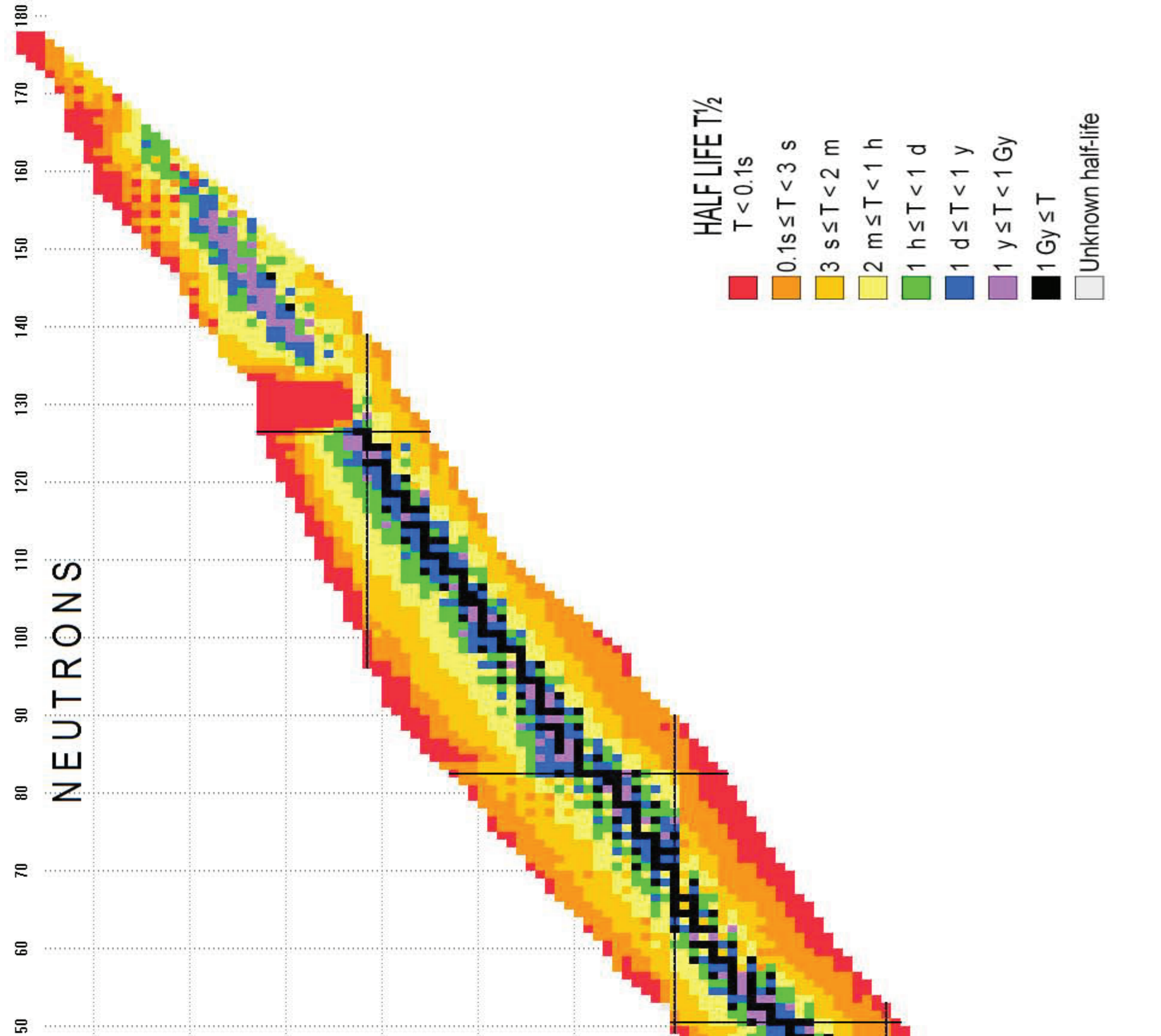

Figure 2. Chart of the nuclides displaying half-lives (created by NUCLEUS-AMDC).

When ground-state half-lives for nuclides with the same parities in Z and N are found to vary smoothly, interpolation or extrapolation (TNN) is used to obtain reasonable estimates for unknown cases.

The super-allowed $0^+ \to 0^+$ nuclear β decays between isospin analog states with isospin T=1 and spin-parity J^π=0^+ are of particular interest due to their pivotal role in the precise determination of V_{ud} to test the unitarity of the Cabibbo–Kobayashi–Maskawa (CKM) Matrix. The evaluation of super-allowed decays, including their half-lives, is a long-standing work carried out by J.C Hardy and I.S. Towner. In the most recent survey [14], experimental data of 20 super-allowed transitions have been compiled and carefully evaluated. Half-lives of these nuclides are compared in Fig. 3. It can be seen clearly that the values listed in NUBASE2016 agree well with the values from Ref. [14]. The only significant differences occur for ^{18}Ne and ^{42}Ti, for which new experimental results were published after the publication of Ref. [14].

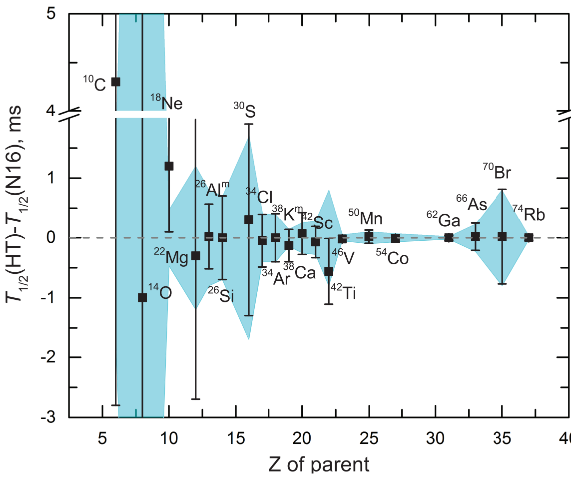

Figure 3. Comparison of $T_{1/2}$ for 20 super-allowed β emitters from NUBASE2016 (N16) and Ref. [14] (HT). The error bars at the points display the uncertainties from Ref.[14], and the shaded area displays the uncertainties in NUBASE2016.

2.4 Spin and parity

As for ENSDF, spin and parity values are presented with and without parentheses, based on strong and weak assignment arguments, respectively (see the introductory pages of Ref. [15]). Unfortunately, parentheses in ENSDF are also applied to estimates from theory or from TNN. In NUBASE2016, following our policy of making a clear distinction between experimental and non-experimental information, parentheses are used if the so-called "weak" argument is based on experimental observations, while the symbol '#' is used for the other cases. It should also be noted that despite the well-defined evaluation policies [15], there are a number of inconsistencies in ENSDF regarding the spins and parities for nuclear states. Often, the proposed assignments reflect the interpretation of a particular ENSDF evaluator, rather than that of firm policy rules. As a result, assignments to similar states in neighboring nuclides are put in parenthesis by one evaluator, but not by another, although similar experimental information is available.

We have tried to use a consistent approach in assigning spins and parities to nuclear states, but the survey is still far from complete and the reader may still find inconsistencies. The authors would gratefully appreciate feedback from users for such cases, to improve future versions of NUBASE.

If spins and parities are not determined experimentally, they can be estimated from TNN with the same parities in N and Z. Although, this is frequently the case for odd-A nuclides, such trends are also sometimes valid for odd–odd nuclides, especially in the neighborhood of magic numbers. In all cases, the estimated values are flagged with the '#' symbol.

The review of nuclear radii, moments and spins by Otten [1989Ot.A], as well as the recent compilation by MacDonald [16], were used to check and complete the spin values in NUBASE2016.

The spins and parities of odd-even, even-odd, odd-odd nuclides in their ground states are displayed in Fig. 4, Fig. 5 and Fig. 6, respectively.

2.5 Decay modes and their intensities

Fig. 7 displays the main decay modes of all known nuclides. The most important policy in assembling the information for the decay modes was to establish a clear distinction between a decay mode that is energetically allowed, but not yet experimentally observed (represented by a question mark alone, which refers to the decay mode itself), and a decay mode which is actually observed, but for which the intensity could not be determined (represented by '=?', the question mark referring here to the quantity after the equal sign).

As in ENSDF, no corrections were made to normalize the primary intensities to 100%.

In addition to applying direct updates from the literature, partial evaluations completed by other authors were also considered and properly referenced. Those cases are mentioned below when discussing some particular decay modes.

β^+ decay

In the NUBASE evaluations some definitions and notations for β^+ decay were refined to provide a clearer presentation of the available information. Specifically, β^+ denotes the decay process that includes both electron capture, labeled ε, and decay by positron emission, labeled e^+. One can then symbolically write: $\beta^+ = \varepsilon + e^+$. It is well known that for an available energy below 1022 keV, only electron capture, ε, is allowed, while above that value the two processes are in competition.

Remark: this notation is **not** the same as the one used implicitly in ENSDF, where the combination of both modes is denoted "$\varepsilon + \beta^+$".

When the two modes compete, the separated intensities are not always experimentally available and frequently they are deduced from model calculations, as is the policy in ENSDF. In continuation of one of the general NUBASE policies, in which only experimental information is used whenever possible, it was decided not to retain the separated values calculated in ENSDF (which are scarce and not always updated). Only in a few very specific cases, where the distinction is of importance, such as rare processes (^{91}Nb, ^{54}Mn, ^{119}Te^{m}), separate values are given.

By the same token, both electron-capture-delayed fission (εSF) and positron-delayed fission (e^+SF) are given with the same symbol β^+SF.

Double-β decay

In the course of this work it was found that half-lives for double-β-decaying nuclides were not always consistently given in ENSDF. Since the two-neutrino gs-gs transition is the dominant decay process (one exception may be ^{98}Mo, for which the neutrinoless decay is predicted to be faster, see [2002Tr04]), only those half-life values or their upper-limits were presented in the NUBASE2016 table. No attempt was made to convert the upper limit results given by different authors to the same statistical confidence level (CL).

The excellent compilation of Tretyak and Zdesenko [2002Tr04] was of great help in evaluating such decays.

β-delayed particle decays

For delayed particle decays, intensity relations must be carefully considered. By definition, the intensity of a decay mode is the percentage of decaying parent nuclei in that mode. But traditionally, the intensities of the pure β decay are summed with those of the delayed particles in order to give an intensity that is assigned to the pure β decay. For example, if the (*A*, *Z*) nuclide has a decay described traditionally by 'β^-=100; β^-n=20', this means that for 100 decays of the parent, 80 (*A*, *Z*+1) and 20 (*A*–1, *Z*+1) daughter nuclei are produced and that 100 electrons and 20 delayed neutrons are emitted. A strict notation in this case, using the definition above, would be 'β^-=80; β^-n=20'. However, in the present work, it has been decided to follow the above traditional notation.

This also holds for more complex delayed emissions. For example, a decay described by: 'β^-=100; β^-n=30; β^-2n=20; $\beta^-\alpha$=10' corresponds to the emission of 100 electrons, (30+2×20=70) delayed-neutrons and 10 delayed-α particles; and in terms of residual nuclides, to 40 (*A*, *Z*+1), 30 (*A*–1, *Z*+1), 20 (*A*–2, *Z*+1) and 10 (*A*–4, *Z*–1). More generally, the number of emitted neutrons per 100 decays, P_n, can be written as:

$$P_\text{n} = \sum_i i \times \beta^-_{i\text{n}};$$

and similar expressions can be written for α and proton emission. The number of residual daughter nuclides (*A*, *Z*+1) populated via β^- decay is then:

$$\beta^- - \sum_i \beta^-_{i\text{n}} - \sum_j \beta^-_{j\alpha} - \dots$$

Another special remark concerns the intensity of a particular β-delayed mode. In general, the primary (parent) β decay populates several excited states in the daughter nuclide, which can further decay by particle emission. However, in a case where the ground state of the daughter nuclide decays also by the same particle emission, some authors included its decay in the value for the corresponding β-delayed intensity. It has been decided to not use such an approach in NUBASE2016 for two main reasons. Firstly, the energies of delayed particles emitted from excited states are generally much higher than those emitted from the ground state, implying different subsequent processes. Secondly, the characteristic decay times from excited states are related to the parent, whereas decays from the daughter's ground state are connected to the daughter nuclide itself. For example, ^{9}C decays via β^+ with an intensity of 100% of which 12% and 11% populate two excited proton-emitting states in ^{9}B, and 17% goes to an α-emitting state. Thus, β^+p=23% and $\beta^+\alpha$=17%, from which the user of the NUBASE2016 table can derive a 60% direct feeding of the ground state of ^{9}B. In a slightly different example, ^{8}B decays to only two excited states in ^{8}Be, which in turn decay by α- and γ-ray emissions, but not to the ^{8}Be ground state. Thus, one may write β^+=100% and $\beta^+\alpha$=100%, the difference of which leaves 0% for the feeding of the daughter's ground state.

Finally, the users should be aware that the percentages given in the NUBASE2016 table are related to 100 parent decaying nuclei, rather than to the primary beta-decay fraction. An illustrative example is given by the decay of ^{228}Np, for which the delayed-fission probability is given in the original paper as 0.020(9)% [1994Kr13], but this value is relative to the ε process, which has an intensity of 60(7)%. Thus, the renormalized delayed-fission intensity is 0.020(9)% × 0.60(7) = 0.012(6)% of the total decay intensity.

In compiling the data for β^+-delayed proton and α activities, the remarkable work of Hardy and Hagberg [1989Ha.A], in which the corresponding physics was reviewed and discussed in detail, was consulted. The review of Honkanen, Äystö and Eskola [17] on delayed proton decays has also been consulted.

Similarly, the review of delayed neutron emission by Hansen and Jonson [18] was carefully examined and used in the NUBASE tables, together with the evaluation of Rudstam, Aleklett and Sihver [1993Ru01].

2.6 Isotopic abundances

Isotopic abundances are taken from the compilation of M. Berglund and M.E. Wieser [2011Be53] and the values are listed in the decay field with the symbol *IS*. These data

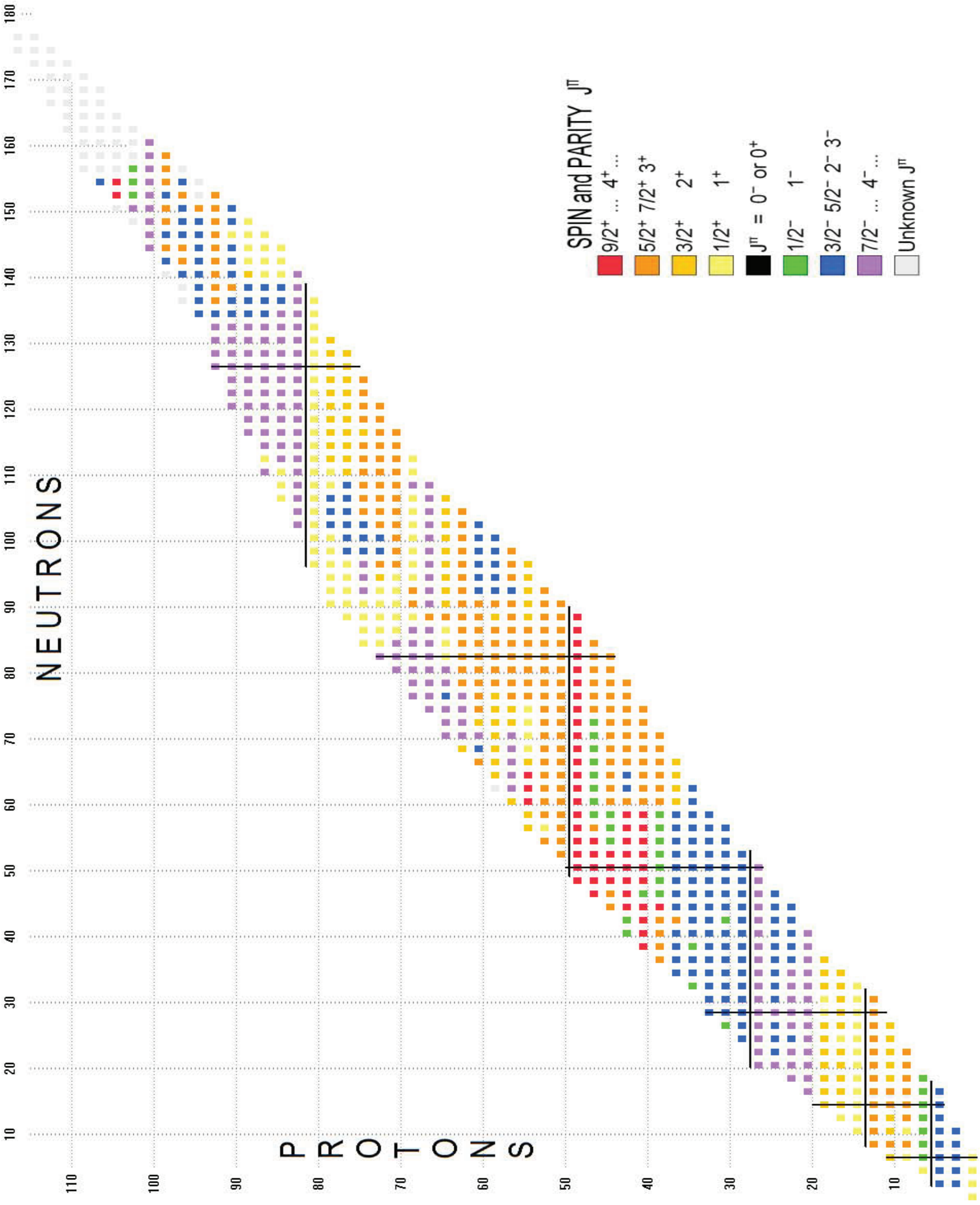

Figure 4. Chart of the nuclides displaying spins and parities. Only the odd-Z even-N nuclides are shown (created by NUCLEUS-AMDC).

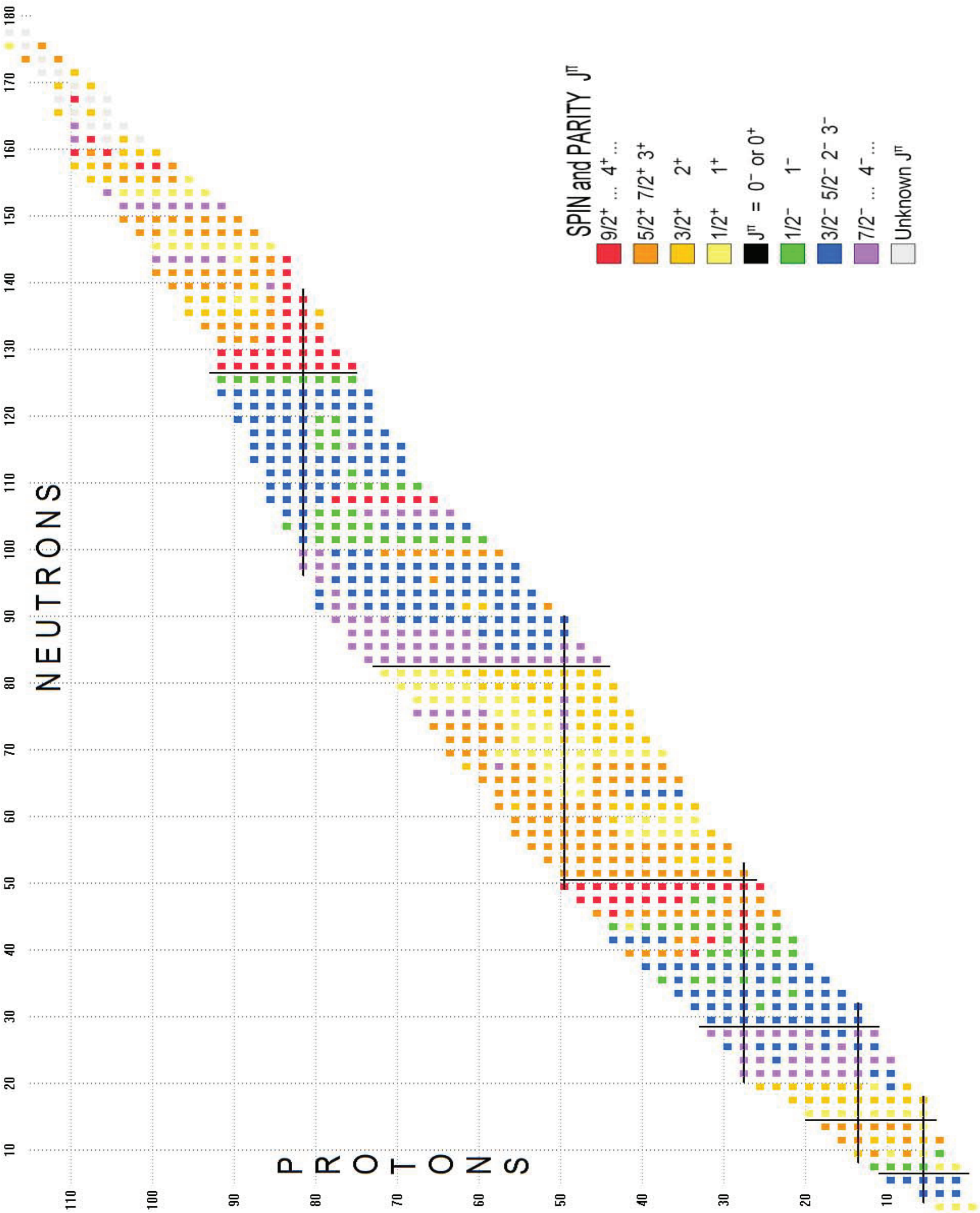

Figure 5. Chart of the nuclides displaying spins and parities. Only the even-Z odd-N nuclides are shown (created by NUCLEUS-AMDC).

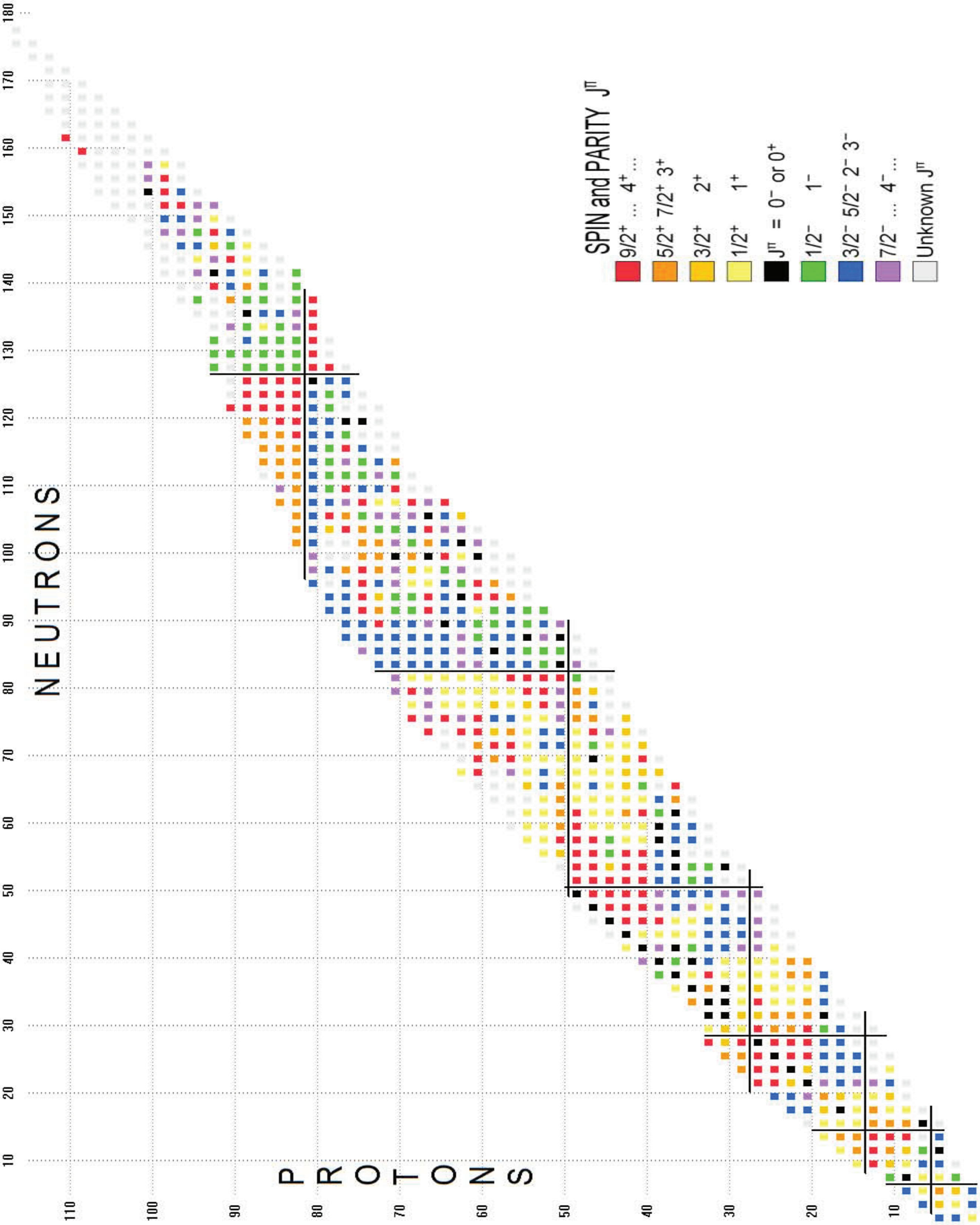

Figure 6. Chart of the nuclides displaying spins and parities. Only the odd-Z odd-N nuclides are shown (created by Nucleus-AMDC).

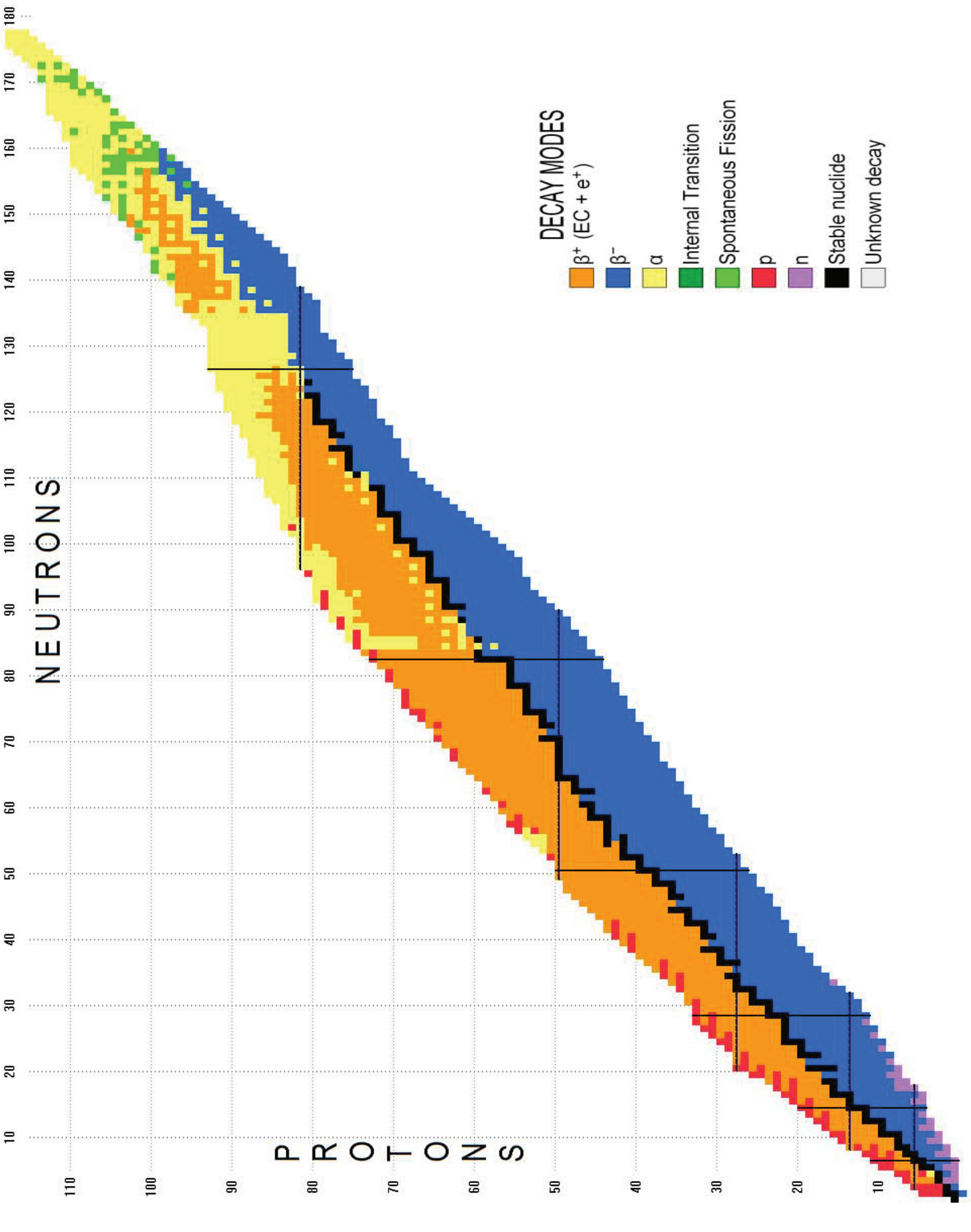

Figure 7. Chart of the nuclides displaying decay modes (created by NUCLEUS-AMDC).

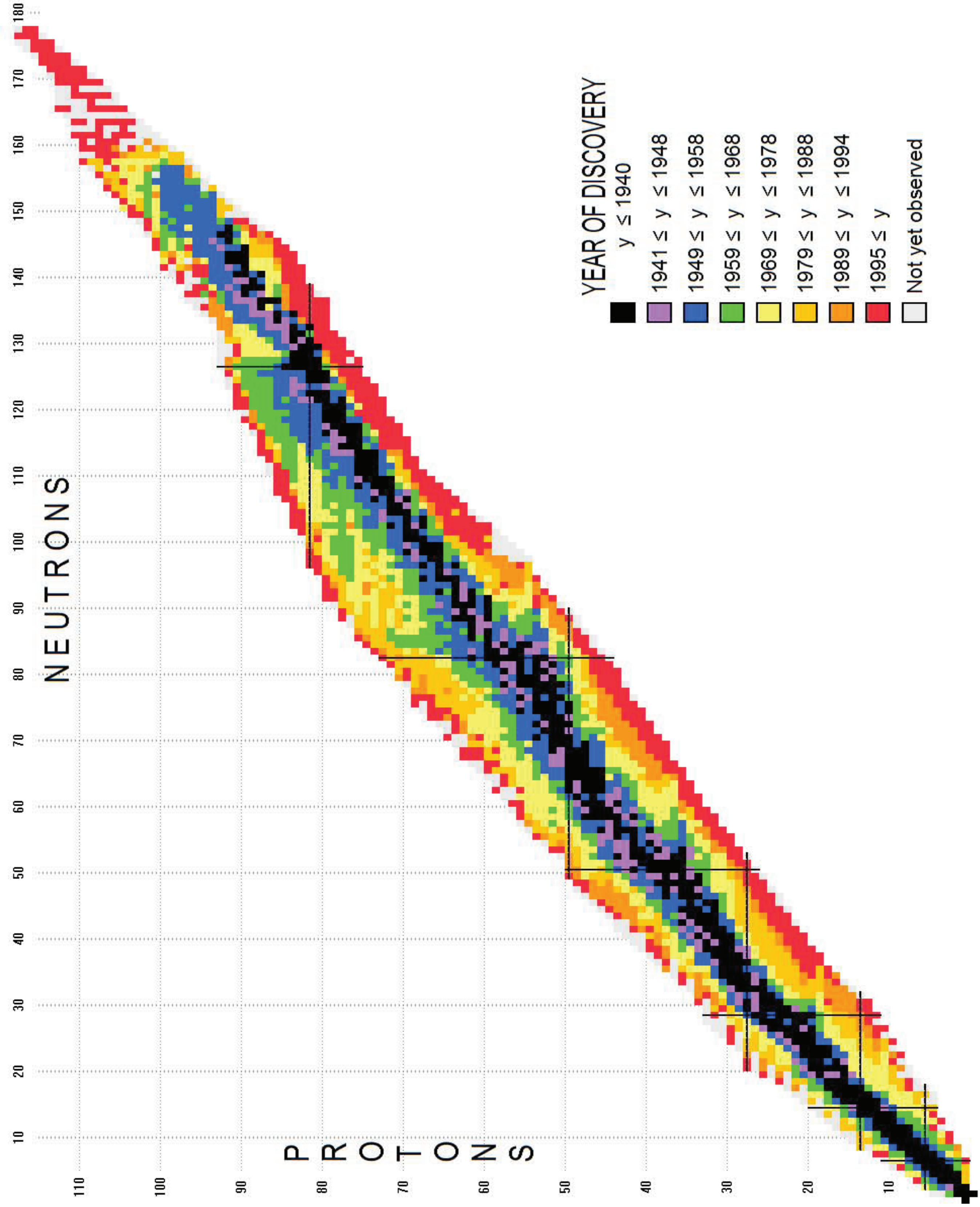

Figure 8. Chart of the nuclides displaying the years of discovery (created by NUCLEUS-AMDC).

are given in the NUBASE tables as presented originally in [2011Be53], and so in this case the rounding policy was not applied.

2.7 Year of discovery

As in NUBASE2012, the present tables include information of the year of discovery for each nuclide in its ground or isomeric state. For the former, recent evaluations performed by a group at Michigan State University [19] were adopted. Similar criteria was used when assigning the year of discovery for isomeric states. The information about the year of discovery is illustrated in Fig. 8.

2.8 References

The year of the archival file for the nuclides evaluated in ENSDF is indicated, otherwise this entry is left blank.

References for all of the experimental updates are given by the NSR keynumber style [7], and are listed at the end of this issue. They are followed by one, two or three one-letter codes which specify the added or modified physical quantities. In cases where more than one reference is needed to describe a particular update, they are given as a remark. No reference is given for estimated values. The initials of the former and present evaluators, AHW, FGK, GAU, HWJ, JBL, MMC, WGM, XUX, are used as reference keys in cases where it may not be precisely clear that the re-interpretation of data were made by the authors.

3 Updating procedure

In general, NUBASE was updated via two routes: from ENSDF after each new A-chain evaluation is published (or from the bi-annual releases), and directly from the literature. Data available in the "eXperimental Unevaluated Nuclear Data List " (XUNDL)[20] database were also regularly consulted.

ENSDF files are retrieved from NNDC using the on-line service [5]. Computer programs, originally developed by O. Bersillon and J. Blachot [21], were used to successively:

- check that each Z in the A-chain has an 'adopted levels' data set; if not, a corresponding data set is generated from the 'decay' or 'reaction' data set,
- extract the 'adopted levels' data sets from ENSDF,
- extract the required physical quantities from these data sets, and convert them into the NUBASE format.

The processed data were used to manually update the previous version of NUBASE.

ENSDF is updated generally by A-chains and more recently also by individual nuclides. Its contents are extensive, since it encompasses all of the complex nuclear structure and decay properties. This is a huge effort, and it is not surprising that occasionally some older data (in particular annual reports, conference proceedings, and theses) are missing and that some recent data have not yet been included. When such cases were revealed, they were analyzed and evaluated, as described above, and the NUBASE2016 database was updated accordingly. In principle, these new data will be included in future ENSDF evaluations and the corresponding references can then be removed from future NUBASE distributions. Unfortunately, it has been observed in the past that such a procedure was not always adhered to. In fact, in some newer ENSDF files, quotations to earlier NUBASE publications were found, which leads to an undesirable loop resulting in non-traceable information. For this reason, in such cases the original references are repeated here again.

4 Distribution and displays of NUBASE2016

The full contents of the present evaluation is available on-line at the Atomic Mass Data Center (AMDC) website [22], as well as at a mirror website maintained by the International Atomic Energy Agency (IAEA) [23]. An electronic ASCII file for the NUBASE2016 table is also distributed at the AMDC website. Any work that uses those files should make reference to the present publication and not to the electronic files.

The contents of NUBASE2016 can be displayed by the stand-alone PC-program called "NUCLEUS". The charts of nuclides shown in this paper were created by using this program. The program "NUCLEUS" has been updated according to the present NUBASE2016 evaluation and can be downloaded from the AMDC website [22] and the IAEA [23].

5 Conclusions

The 'horizontal' evaluated database, NUBASE2016, which contains the recommended values for the main properties of all known nuclides in their ground and excited isomeric states, has been updated. These data originate from the intersection of two evaluated databases: ENSDF, followed by a critical assessment of the validity and completeness of those data, including new updates from the literature, and AME2016. The main requirement in developing NUBASE2016 was to cover as completely as possible all available experimental data and to provide proper references to them, especially for cases that are not already included in ENSDF. This traceability allows any user to check the recommended data and, if necessary, to undertake a re-evaluation.

As a result of this 'horizontal' work, better homogeneity in handling and presentation of all data was obtained for all known nuclides. Furthermore, isomeric assignments were examined more critically and the data of their excitation energies were improved.

6 Acknowledgments

We wish to thank many colleagues who answered our questions about their experiments and those who sent us preprints of their papers. We appreciate the help provided by

J.K. Tuli and B. Singh in solving some of the puzzles we encountered in ENSDF. Continuous interest, discussions, suggestions and encouragements from D. Lunney, Zhang Yuhu and Furong Xu were highly appreciated.

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Appendix A Symmetrization of asymmetric uncertainties

Experimental data are sometimes given with asymmetric uncertainties, X^{+a}_{-b}. If these data are to be used in some practical applications, their uncertainties may need to be symmetrized. A simple method (Method 1) that was developed earlier, uses the central value to be in the middle between the upper and lower 1 σ-equivalent limits

$X+(a-b)/2$, with the uncertainty defined to be the average of the two uncertainties

$(a+b)/2$.

An alternative method (Method 2) considers the random variable x associated with the measured quantity. For this random variable, one assumes that the probability density function is an asymmetric normal distribution having a modal (most probable) value of $x = X$, a standard deviation b for $x < X$, and a standard deviation a for $x > X$ (Fig. 9). Then the average value of this distribution is

$$\langle x \rangle = X + \sqrt{2/\pi}\,(a-b),$$

with variance

$$\sigma^2 = (1-2/\pi)\,(a-b)^2 + ab. \quad (1)$$

The median value m which divides the distribution into two equal areas is given, for $a > b$, by

$$\mathrm{erf}\left(\frac{m-X}{\sqrt{2}a}\right) = \frac{a-b}{2a}, \quad (2)$$

and by a similar expression for $b > a$.

One can then define the equivalent symmetric normal distribution that have a mean value equal to the median value m of the previous distribution with same variance σ.

If the shift $m-X$ of the central value is small compared to a or b, expression (2) can be written [24]:

$$m - X \simeq \sqrt{\pi/8}\,(a-b)$$

$$m - X \simeq 0.6267\,(a-b).$$

In order to allow for a small non-linearity that appears for higher values of $m-X$, the relation

$$m - X = 0.64\,(a-b).$$

was adopted for Method 2. In NUBASE2016, Method 2 is used for the symmetrization of asymmetric half-lives and decay intensities. Table A illustrates the results from both methods.

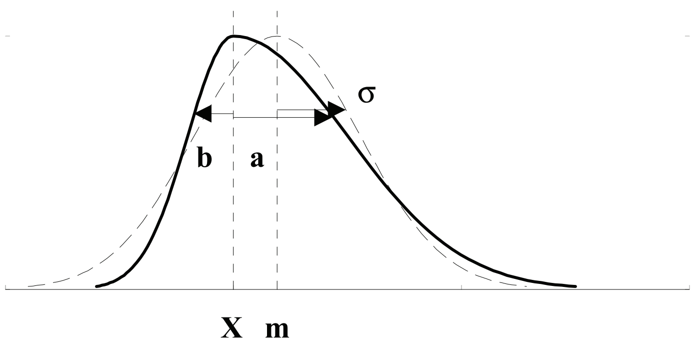

Figure 9. Simulated asymmetric probability density function (heavy solid line) and the equivalent symmetric one (dashed line).

Table A. Examples of two different treatments of asymmetric half-life uncertainties.
Method 1 is the classical method, used previously, as in the AME1995.
Method 2 is the one developed in NUBASE2003, described in this Appendix.

Nuclide	Original $T_{1/2}$		Method 1	Method 2
^{83}Mo	6+30–3	ms	20 ± 17	23 ± 19
^{100}Kr	7+11–3	ms	11 ± 7	12 ± 8
^{264}Hs	327+448–120	μs	490 ± 280	540 ± 300
^{266}Mt	1.01+0.47–0.24	ms	1.1 ± 0.4	1.2 ± 0.4

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References in the text such as [1993Po.A] or [2015Ga38] are listed under " References used in the AME2016 and the NUBASE2016 evaluations", p. 030003-261.

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Table I. The NUBASE2016 table of nuclear and decay properties

EXPLANATION OF TABLE

Data are presented in groups ordered according to increasing mass number A.

Nuclide — Nuclidic name: mass number $A = N + Z$ and element symbol (for $Z > 109$ see Section 2). Elements with upper suffix 'm', 'n', 'p', 'q', 'r' or 'x' indicate assignments to excited isomeric states (defined as higher states with half-lives greater than 100 ns). Suffixes 'p' and 'q' also indicate non-isomeric levels, but used in the AME2016. Suffix 'r' also indicates a state from a proton resonance occurring in (p,γ) reactions (e.g. ^{28}Si^r). Suffix 'x' also applies to mixtures of levels (with relative ratio R, given in the 'Half-life'column), e.g. occurring in spallation reactions (indicated 'spmix' in the 'J^π' column) or fission ('fsmix').

Mass excess — Mass excess [M(in u)$-A$], in keV, and its one standard deviation uncertainty as given in the 'Atomic Mass Evaluation' (AME2016, in the second part of this volume).
Rounding-off policy: in cases where the furthest-left significant digit in the error is larger than 3, values and errors are rounded-off, but not to more than tens of keV. (Examples: $2345.67 \pm 2.78 \to 2345.7 \pm 2.8, 2345.67 \pm 4.68 \to 2346 \pm 5$, but $2346.7 \pm 468.2 \to 2350 \pm 470$).

- \# instead of a decimal point: value and uncertainty are not derived only from experimental data, but at least partly with estimates from TMS (see AME2016).

Excitation energy — For excited isomers only: energy difference, in keV, between levels adopted as higher level isomer and ground state isomer, and its one standard deviation uncertainty, as given in AME2016 when derived from the AME, otherwise as given by ENSDF.
The rounding-off policy is the same as for the mass excesses (see above).

- \# instead of a decimal point: value and uncertainty derived from trends in neighboring nuclides.

The excitation energy is followed by its origin code when derived from a method other than γ-ray spectrometry:

- MD mass doublet
- RQ reaction Q-value
- AD α energy difference
- BD β energy difference
- p, 2p one-, two-proton decay
- IT combination of AME and γ-ray data
- Nm estimated value derived using the Nilsson model

When the existence of an isomer is questionable the following codes are used:

- EU existence of isomer is under discussion (e.g. ^{73}Zn^n).
  If existence is strongly doubted, no excitation energy and no mass are given. They are replaced by the mention "non existent" (e.g. ^{138}Pm^n).
- RN isomer has been proven not to exist (e.g. ^{181}Pb^m). Excitation energy and mass are replaced by the mention "non existent".

Remark: codes EU and RN are also used when the discovery of a nuclide (e.g. ^{260}Fm or ^{289}Lv) is questioned. In this case an estimate derived from trends in the mass surface is always given for the ground state mass.

Isomeric assignment:

- $*$ if the uncertainty σ on the excitation energy E is greater than half the excitation energy ($\sigma > E/2$), these quantities are followed by an asterisk (e.g. ^{130}In and ^{130}In^m).
- & when the ordering of the ground state isomer and the excited isomer are reversed as compared to ENSDF, an ampersand sign is added (e.g. ^{102}Y and ^{102}Y^m).

Half-life	s = seconds; m = minutes; h = hours; d = days; y = years; 1 y = 31 556 926 s or 365.2422 d adopted values for NUBASE (see text) STABLE = stable nuclide, or nuclide for which no finite half-life value has been found. # value estimated from trends in neighboring nuclides with the same Z and N parities. subunits:

ms	:	10^{-3}	s	millisecond	ky	:	10^{3}	y	kiloyear
μs	:	10^{-6}	s	microsecond	My	:	10^{6}	y	megayear
ns	:	10^{-9}	s	nanosecond	Gy	:	10^{9}	y	gigayear
ps	:	10^{-12}	s	picosecond	Ty	:	10^{12}	y	terayear
fs	:	10^{-15}	s	femtosecond	Py	:	10^{15}	y	petayear
as	:	10^{-18}	s	attosecond	Ey	:	10^{18}	y	exayear
zs	:	10^{-21}	s	zeptosecond	Zy	:	10^{21}	y	zettayear
ys	:	10^{-24}	s	yoctosecond	Yy	:	10^{24}	y	yottayear

R: For isomeric mixtures only, it is the production ratio of the excited isomer state to the ground state isomer.

J^{π}

Spin and parity:

()	uncertain spin and/or parity.
#	values estimated from trends in neighboring nuclides with the same Z and N parities.
high	high spin.
low	low spin.
am	same J^{π} as α-decay parent
T	Isopin multiplet for isobaric analog states (IAS).

For isomeric mixtures only: mix (spmix and fsmix if observed in spallation and fission, respectively).

Ens

Year of the ENSDF file archive
(in order to reduce the width of the Table, the two century digits are omitted).

Reference

Reference keys:
(in order to reduce the width of the Table, the two century digits are omitted. However, at the end of this volume the full reference key-number is given, ie. 2010Cr02 as opposed to 10Cr02)

10Cr02	updates to ENSDF derived from a regular journal. These keys are taken from Nuclear Data Sheets. Where not yet available, the style 12Ma.1 is provisionally adopted.
12Dr.A	updates to ENSDF derived from an abstract, preprint, private communication, conference, thesis or annual report.
AHW	(or FGK, GAU, HWJ, JBL, MMC, WGM), re-interpretation by one of the evaluators of NUBASE.
Mirror	deduced from mirror nuclide properties.
Imme	deduced from Isobaric Multiplet Mass Equation.

The reference key-numbers are followed by one, two or three letter codes which specifies the added or modified physical quantities:

E	for the isomer excitation energy
T	for half-life
J	for spin and/or parity
D	for decay mode and/or intensity
I	for identification

Year of discovery

for ground states [15] and for excited isomers (see text).

Decay modes and intensities	Decay modes followed by their intensities (in %), and their one standard deviation uncertainties. The special notation 1.8e–12 stands for 1.8×10^{-12}. The uncertainties are given - only in this field - in the ENSDF-style: α=25.9 23 stands for α=25.9 ± 2.3 % The ordering is according to decreasing intensities. α ? means α decay is energetically allowed. α=? means α decay has been observed but not yet quantified.

α	α emission	
p 2p	proton emission	2-proton emission
n 2n	neutron emission	2-neutron emission
ε	electron capture	
e^+	positron emission	
β^+	β^+ decay ($\beta^+ = \varepsilon + e^+$)	
β^-	β^- decay	
$2\beta^-$	double β^- decay	
$2\beta^+$	double β^+ decay	
β^-n	β^- delayed neutron emission	
β^-2n	β^- delayed 2-neutron emission	
β^+p	β^+ delayed proton emission	
β^+2p	β^+ delayed 2-proton emission	
$\beta^-\alpha$	β^- delayed α emission	
$\beta^+\alpha$	β^+ delayed α emission	
β^-d	β^- delayed deuteron emission	
IT	internal transition	
SF	spontaneous fission	
β^+SF	β^+ delayed fission	
β^-SF	β^- delayed fission	
^{24}Ne	heavy cluster emission	
...	list is continued in a remark, at the end of the *A*-group	

For long-lived nuclides:

IS	Isotopic abundance (from [2011Be53])

*	A remark on the corresponding nuclide is given below the block of data corresponding to the same *A*.

Remarks. For nuclides marked with an asterisk at the end of the line, extra comments have been added. They are collected in groups at the end of each block of data corresponding to the same *A*. They start with a letter code, similar the ones following the reference key-number, as given above, indicating to which quantity the remark applies. They give:

i) Continuation for the list of decays. In this case, the remark starts with three dots.
ii) Information explaining how a value has been derived.
iii) Reasons for changing a value or its uncertainty as given by the authors, or for rejecting it.
iv) Complementary references to updated data.
v) Separate values used in the adopted average.

TNN : Trends from neighboring nuclides.
τ : meanlife (or lifetime) $T = \tau \times ln2$

Table I. The NUBASE2016 table (Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{1}n	8071.3171	0.0005				613.9	s	0.6	$1/2^+$	06			1932	β^-=100	*
^{1}H	7288.9706	0.0001				STABLE			$1/2^+$	06	11Be53	D	1920	IS=99.9885 70	
*^{1}n	T : also 15Ar07=610.1(0.8) τ=880.2(1.2), 13Yu07=615.3(1.5) τ=887.7(2.2),														**
*^{1}n	T : 12Ar05=611.1(1.5) τ=881.6(2.1)														**
^{2}H	13135.7217	0.0001				STABLE			1^+	03			1932	IS=0.0115 70	
^{3}H	14949.8099	0.0002				12.32	y	0.02	$1/2^+$	00			1934	β^-=100	
^{3}He	14931.2179	0.0002				STABLE			$1/2^+$	98			1934	IS=0.000134 3	
^{3}Li	28670#	2000#				p-unstable				98			1969	p ?	*
*^{3}Li	I : identification in 69Wi13 not accepted, see ENSDF'98														**
^{4}H	24620	100				139	ys	10	2^-	98	03Me11	T	1981	n=100	*
^{4}He	2424.9156	0.0001				STABLE			0^+	98			1908	IS=99.999866 3	
^{4}Li	25320	210				91	ys	9	2^-	98	65Ce02	T	1965	p=100	
*^{4}H	T : width=3.28(0.23) MeV; also 91Go19=4.7(1.0) outweighed, not used														**
^{5}H	32890	90				> 910	ys		$(1/2^+)$	02	03Go11	T	1987	2n=100	*
^{5}He	11231	20				700	ys	30	$3/2^-$	02			1937	n=100	
^{5}Li	11680	50				370	ys	30	$3/2^-$	02			1941	p=100	
^{5}Be	37140#	2000#							$1/2^+$#	02				p ?	
*^{5}H	T : from width < 0.5 MeV; conflicting with 01Ko52=280(50) ys, width=1.9(0.4)														**
*^{5}H	T : (same authors) but with instrumental resolution=1.3 MeV														**
*^{5}H	T : others 91Go19=66(25) ys 95Al31=110 ys probably for higher state														**
*^{5}H	J : from angular distribution consistent with $l=0$														**
^{6}H	41880	250				290	ys	70	2^-#	02			1984	n ?; 3n ?	
^{6}He	17592.10	0.05				806.92	ms	0.24	0^+	02	15Pf01	D	1936	β^-=100; β^-d=0.000278 18	*
^{6}Li	14086.8789	0.0014				STABLE			1^+	02			1921	IS=7.59 4	
^{6}Li^{i}	17649.76	0.10	3562.88	0.10		56	as	14	0^+T=1	02	81Ro02	E	1981	IT=100	
^{6}Be	18375	5				5.0	zs	0.3	0^+	02			1958	2p=100	
^{6}B	47320#	2000#				p-unstable#			2^-#					2p ?	
*^{6}He	D : other β^-d from 09Ra33=1.65(0.10)e–6 but with 525 keV threshold														**
*^{6}He	T : symmetrized from 12Kn01=806.89(0.11)(+0.23–0.19)														**
^{7}H	49140#	1000#				500#	ys		$1/2^+$#				2003	2n ?	
^{7}He	26073	8				2.51	zs	0.07	$(3/2)^-$	03	12Ca05	T	1967	n=100	*
^{7}Li	14907.105	0.004				STABLE			$3/2^-$	03			1921	IS=92.41 4	
^{7}Li^{i}	26150	30	11250	30	RQ				$3/2^-$T=3/2	03					
^{7}Be	15769.00	0.07				53.22	d	0.06	$3/2^-$	03			1938	ε=100	
^{7}Be^{i}	26750	30	10980	30	RQ				$3/2^-$T=3/2	03				p ?; 3He ?; α ?	
^{7}B	27677	25				570	ys	14	$(3/2^-)$	14	11Ch32	T	1967	p=100	*
*^{7}He	T : from 12Ca05=182(5) keV														**
*^{7}He	T : others 09Ak03=190(30) 08De29=125(+40–15) 02Me07=150(80) 69St02=160(30)														**
*^{7}B	T : from width 11Ch32=801(20) keV 570(14) ys														**
^{8}He	31609.68	0.09				119.1	ms	1.2	0^+	05			1965	β^-=100; β^-n=16 1; β^-t=0.9 1	
^{8}Li	20945.80	0.05				839.40	ms	0.36	2^+	05	10Fl01	T	1935	β^-=100; $\beta^-\alpha$=100	*
^{8}Li^{i}	31768	5	10822	5	RQ				0^+T=2	05					
^{8}Be	4941.67	0.04				81.9	as	3.7	0^+	05			1932	α=100	
^{8}Be^{i}	21568	3	16626	3					2^+frg.T=1		04Ti06	E	2004	$\alpha\approx$100	*
^{8}Be^{j}	32436.0	2.0	27494.3	2.0	RQ				0^+T=2	05				n=39.4; d=27.0; 3H=11.7; α=7.9; …	*
^{8}B	22921.6	1.0				770	ms	3	2^+	05			1950	β^+=100; $\beta^+\alpha$=100	*
^{8}Bx^{i}	33546	8	10624	8	RQ				0^+T=2	05			1975		
^{8}C	35064	18				3.5	zs	1.4	0^+	05	11Ch32	T	1974	2p=100	*
*^{8}Li	D : β^- decay to first 2^+ state in ^{8}Be, which decays 100% in 2 α														**
*^{8}Be^{i}	E : strongest frg; other: 296(3) higher I(16626)/I(16922)=1.22 in ^{6}Li(^{6}Li,α)														**
*^{8}Be^{i}	E : and 1.15 in ^{10}B(d,α); see 04Ti06 p.213														**
*^{8}Be^{j}	D : …; p=6.9; 3He=6.6; IT=0.60														**
*^{8}B	D : β^+ to 2 excited states in ^{8}Be, then α and γ, but not to ^{8}Be ground-state														**
*^{8}C	T : from width 130(50) keV 3.51(1.35) zs														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{9}He	40940	50				2.5	zs	2.3	$1/2^{(+)}$	06	16Ub01	J	1987	n=100	*
^{9}Li	24954.90	0.19				178.3	ms	0.4	$3/2^-$	06	95Re.A	D	1951	β^-=100; β^-n=50.8 2	
^{9}Be	11348.45	0.08				STABLE			$3/2^-$	06			1921	IS=100.	
^{9}Be^i	25738.8	1.7	14390.3	1.7	RQ	1.25	as	0.10	$3/2^-$T=3/2	06			1976		
^{9}B	12416.5	0.9				800	zs	300	$3/2^-$	06			1940	p=100	
^{9}Bx^i	27071.0	2.3	14654.5	2.5	RQ				$3/2^-$T=3/2	06					
^{9}C	28911.0	2.1				126.5	ms	0.9	$(3/2^-)$	06			1964	β^+=100; β^+p=61.6; $\beta^+\alpha$=38.4	

*^{9}He T : derived from width 13Al14=180(100); other width 99Bo26=100(60) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{10}He	49200	90				3.1	zs	2.0	0^+	07			1994	2n=100	*
^{10}Li	33053	13				2.0	zs	0.5	$(1^-,2^-)$	07	94Yo01	TJ	1975	n=100	
^{10}Li^m	33250	40	200	40	RQ	3.7	zs	1.5	1^+	07	97Zi04	T	1994	IT=100	*
^{10}Li^n	33530	40	480	40	RQ	1.35	zs	0.24	(2^+)	07	94Yo01	T	1993	IT=100	*
^{10}Be	12607.49	0.08				1.51	My	0.04	0^+	07			1935	β^-=100	
^{10}Be^i	33787	21	21179	21	RQ				(2^-)T=2	07				n ?; p ?; 3H ?	
^{10}B	12050.609	0.015				STABLE			3^+	07			1920	IS=19.9 7	
^{10}B^i	13790.66	0.04	1740.05	0.04					0^+T=1	07				IT=100	
^{10}C	15698.67	0.07				19.3009	s	0.0017	0^+	07	16Du10	T	1949	β^+=100	*
^{10}N	38800	400				200	ys	140	(2^-)	07	02Le16	TJ	2002	p ?	

*^{10}He D : most probably 2 neutron emitter from S_{2n}=–1440(90) keV **
*^{10}Li^m T : average 97Zi04=120(+100–50) 94Yo01=100(70) keV **
*^{10}Li^n T : average 94Yo01=358(23) 93Bo03=150(70) keV, Birge ratio B=2.8 **
*^{10}C T : also 16Du10(2)=19.2969(0.0074) 09Ba04=19.282(0.011) 08Ia01=19.310(0.004) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{11}Li	40728.3	0.6				8.75	ms	0.14	$3/2^-$	12	12Ke01	D	1966	β^-=100; β^-n=86.3 9; β^-2n=4.1 4; ...	*
^{11}Be	20177.17	0.24				13.76	s	0.07	$1/2^+$	12	81Al03	D	1958	β^-=100; $\beta^-\alpha$=2.9 4; ...	*
^{11}Be^i	41336	20	21158	20	RQ	0.93	zs	0.13	$3/2^-$T=5/2		MMC162	J	1997	IT ?	*
^{11}B	8667.707	0.012				STABLE			$3/2^-$	12			1920	IS=80.1 7	
^{11}B^i	21228	9	12560	9	RQ			T=3/2	$1/2^+,(3/2^+)$	12			1963		
^{11}B^j	42230	80	33570	80	2p				$3/2^-$T=5/2		MMC146	J			
^{11}C	10649.40	0.06				20.364	m	0.014	$3/2^-$	12			1934	β^+=100	
^{11}C^i	22810	40	12160	40	RQ				$1/2^+$T=3/2	12	71Wa21	D	1971	p=?	
^{11}N	24300	50				550	ys	20	$1/2^+$	12			1974	p=100	*
^{11}N^m	25040	80	740	60		690	ys	80	$1/2^-$	12	96Ax01	ETJ	1974	p=100	

*^{11}Li D : ...; β^-3n=1.9 2; $\beta^-\alpha$=1.7 3; β^-d=0.0130 13; β^-t=0.0093 8 **
*^{11}Li D : total β^- delayed neutron emission Pn=100.3(1.4)% **
*^{11}Be D : ...; β^-p=0.00083 9; β^-n ? **
*^{11}Be^i T : from width 97Te07=490(70) keV **
*^{11}N T : from ENSDF2012 : width=830(30) keV **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{12}Li	49010	30				$<$ 10	ns			00	74Bo05	I	2008	n ?	
^{12}Be	25077.8	1.9				21.50	ms	0.04	0^+	00	01Be53	T	1966	β^-=100; β^-n=0.50 3	*
^{12}Be^m	27328.8	2.1	2251	1		229	ns	8	0^+		07Sh34	EJT	2007	IT=100	
^{12}B	13369.4	1.3				20.20	ms	0.02	1^+	00	66Sc23	D	1935	β^-=100; $\beta^-\alpha$=1.6 3	
^{12}B^i	26088	19	12719	19	RQ				0^+T=2	00	08Ch28	J			*
^{12}C	0.0	0.0				STABLE			0^+	00			1919	IS=98.93 8	
^{12}C^i	15108	3	15108	3	RQ				1^+T=1	00				IT=?; α ?	
^{12}C^j	27595.0	2.4	27595.0	2.4	RQ				0^+T=2	00					
^{12}N	17338.1	1.0				11.000	ms	0.016	1^+	00	66Sc23	D	1949	β^+=100; $\beta^+\alpha$=3.5 5	
^{12}N^i	29534	29	12195	29	2p				(0^+)T=2		MMC142	J			
^{12}O	31915	24				$>$ 6.3	zs		0^+	00	12Ja11	T	1978	2p=60 30	*

*^{12}Be D : from 99Be53; also 95Re.A=0.52(0.09)% outweighed, not used **
*^{12}B^i J : 08Ch28 "suggests that the 12.75-MeV, ...was a T=1 state, not the IAS" **
*^{12}O T : from width 12Ja11<72 keV; others 09Su14=600(500)keV 95Kr03t=578(205)keV **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{13}Li	56980	70				3.3	zs	1.2	$3/2^-$#		08Ak03	D	2008	2n=100	*
^{13}Be	33659	10				1.0	zs	0.7	$(1/2^-)$		10Ko17	TJ	1983	n ?	*
^{13}Be^p	35160	50	1500	50	RQ				$(5/2^+)$				1992		
^{13}B	16561.9	1.0				17.33	ms	0.17	$3/2^-$	00			1956	β^-=100; β^-n=0.28 4	
^{13}C	3125.0088	0.0002				STABLE			$1/2^-$	01			1929	IS=1.07 8	
^{13}C^i	18233.8	1.1	15108.8	1.1	RQ				$3/2^-$T=3/2	00				IT=0.82 7; N ?; α ?	

... A-group is continued on next page ...

Table I. The NUBASE2016 **table (continued, Explanation of Table on page 18)**

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{13}N	5345.48	0.27				9.965	m	0.004	$1/2^-$	00			1934	β^+=100	
^{13}N^{i}	20410.59	0.18	15065.1	0.3	RQ				$3/2^-$T=3/2	00				IT=4.9 3; P ?; α ?	
^{13}O	23115	10				8.58	ms	0.05	$(3/2^-)$	00	70Es03	D	1963	β^+=100; β^+p=10.9 20	
$*^{13}$Li	T : from width 13Ko03=125(60-40) keV														**
$*^{13}$Be	T : from width 10Ko17=450(30) keV; other 95Pe12=300(200) keV														**
$*^{13}$Be	J : 1/2$^+$ assigned to ground state in 01Th01 and 08Ch07, questioned in 10Ko17														**
$*^{13}$Be	J : see discussion in AME2012, Part I, Section 6.3, p.1313														**
$*^{13}$Be	J : and 14Ra07=1/2$^+$														**
^{14}Be	39950	130				4.35	ms	0.17	0^+	01	02Je11	D	1973	β^-=100; β^-n=98 2; β^-2n=0.8 08; …	*
^{14}Be^{p}	41470	60	1520	150	RQ				(2^+)		95Bo10	I	1995		
^{14}B	23664	21				12.5	ms	0.5	2^-	01	95Re.A	D	1966	β^-=100; β^-n=6.04 23; β^-2n ?	
^{14}B^{i}	40728	20	17065	29	RQ	4.15	zs	1.9	0^+T=3		MMC162	J	2001	IT ?	*
^{14}C	3019.893	0.004				5.70	ky	0.03	0^+	01			1936	β^-=100	
^{14}C^{i}	25120	100	22100	100					(2^-)T=2	01			1989	IT=100	
^{14}N	2863.4167	0.0001				STABLE			1^+	01			1920	IS=99.636 20	
^{14}N^{i}	5176.007	0.010	2312.590	0.010					0^+T=1	01	01Ba06	E	1963	IT=100	
^{14}O	8007.781	0.025				70.620	s	0.013	0^+	01	13La23	T	1949	β^+=100	*
^{14}F	31960	40				500	ys	60	2^-	14	10Go16	TJ	2010	p ?	*
$*^{14}$Be	D : …; β^-3n=0.2 2; β^-t=0.02 1; $\beta^-\alpha$<0.004														**
$*^{14}$Be	D : supersedes 99Be53, same group														**
$*^{14}$B^{i}	T : from width 01Ta23=110(50) keV														**
$*^{14}$O	T : average 13La23(beta)=70.610(0.030), 04Ba78=70.641(0.020),														**
$*^{14}$O	T : 78Wi04=70.613(0.025) and 73Cl12=70.590(0.030);														**
$*^{14}$O	T : others outweighed : 13La23(γ)=70.632(0.094), 06Bu12=70.696(0.052)														**
$*^{14}$O	T : and 01Ga59=70.560(0.049)														**
$*^{14}$F	T : from width 10Go16=910(100) keV														**
^{15}Be	49830	170				790	ys	270	$(5/2^+)$	15	13Sn02	TD	2013	n=100	*
^{15}B	28958	21				9.93	ms	0.07	$3/2^-$	02	95Re.A	D	1966	β^-=100; β^-n=93.6 12; β^-2n=0.4 2	*
^{15}C	9873.1	0.8				2.449	s	0.005	$1/2^+$	02			1950	β^-=100	
^{15}N	101.4387	0.0006				STABLE			$1/2^-$	02			1929	IS=0.364 20	
^{15}N^{i}	11717	4	11615	4	RQ				$1/2^+$T=3/2	02				n ?; p ?; IT=0.00523 19	
^{15}O	2855.6	0.5				122.24	s	0.16	$1/2^-$	02			1934	β^+=100	
^{15}O^{i}	14020#	40#	11165#	35#					$(1/2^+)$T=3/2	02	Imme	E		p=100	
^{15}F	16567	14				1.1	zs	0.3	$1/2^+$	02	04Go15	J	1978	p=100	*
^{15}Ne	40220	70			2p	770	ys	300	$(3/2^-)$	14	14Wa09	JD	2014	2p=100	*
$*^{15}$Be	T : from width 13Sn02=575(200) keV														**
$*^{15}$B	D : β^-2n intensity is from 89Re.A J : given in 91Aj01														**
$*^{15}$B	T : also 03Ye02=9.86(+0.15–0.19)														**
$*^{15}$F	T : from 16De15=370(70)(+200–0) keV														**
$*^{15}$Ne	T : from width 590(230) keV														**
^{16}Be	57450	170				650	ys	130	0^+	15	12Sp02	TD	2012	2n=100	*
^{16}B	37113	25				> 4.6	zs		0^-#	16			2000	n ?	
^{16}C	13694	4				747	ms	8	0^+	99	89Re.A	D	1961	β^-=100; β^-n=97.9 23	
^{16}N	5683.9	2.3				7.13	s	0.02	2^-	99	16Re01	D	1933	β^-=100; $\beta^-\alpha$=0.00145 8	*
^{16}N^{m}	5804.3	2.3	120.42	0.12		5.25	μs	0.06	0^-T=1	99	14Si.A	D	1957	IT≈100; β^-=0.00040 4	*
^{16}N^{i}	15613	7	9929	7	RQ				0^+T=2	99					
^{16}O	−4737.0013	0.0001				STABLE			0^+	99			1919	IS=99.757 16	
^{16}O^{i}	8059	4	12796	4	RQ				0^-T=1	99				IT=100	
^{16}O^{j}	17984	4	22721	4	RQ				0^+T=2	99					
^{16}F	10680	8				11	zs	6	0^-	99			1964	p=100	
^{16}Ne	23987	20				> 5.7	zs		0^+	99	14Br19	T	1977	2p=100	*
$*^{16}$Be	T : from decay width 0.8(+0.1–0.2) MeV														**
$*^{16}$N	D : symmetrized from 16Re01=0.00149(5stat)(+0–10sys); other 74Ne10=0.00100 7														**
$*^{16}$N^{m}	D : from B.Singh, average 3 results 83Mi20 83Ga18 (also 82Ga05) 75Pa01														**
$*^{16}$Ne	T : 14Br19 L<80 keV (3 σ upper limit)														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{17}B	43720	200				5.08	ms	0.05	(3/2$^-$)	99	88Du09	D	1973	β^-=100; β^-n=63 1; β^-2n=11 7; …	*
^{17}C	21032	17				193	ms	5	(3/2$^+$)	99	01Ma08	J	1968	β^-=100; β^-n=28.4 13; β^-2n ?	*
^{17}N	7870	15				4.173	s	0.004	1/2$^-$	99	94Do08	D	1949	β^-=100; β^-n=95 1; $\beta^-\alpha$=0.0025 4	
^{17}O	−808.7635	0.0007				STABLE			5/2$^+$	99			1925	IS=0.038 1	
^{17}O^i	10270.02	0.17	11078.78	0.17	RQ				1/2$^-$T=3/2	99				β^- ?; N ?; IT=0.42 14	
^{17}F	1951.70	0.25				64.370	s	0.027	5/2$^+$	99	16Br01	T	1934	β^+=100	*
^{17}F^i	13144.7	1.9	11193.0	1.9	RQ				1/2$^-$T=3/2	99					
^{17}Ne	16500.4	0.4				109.2	ms	0.6	1/2$^-$	99	88Bo39	D	1963	β^+=100; β^+p=96.0 9; $\beta^+\alpha$=2.7 9	
^{17}Na	35170	1000							3/2$^+$#					p ?	
*^{17}B	D : …; β^-3n=3.5 7; β^-4n=0.4 3														**
*^{17}C	T : average 95Sc03=193(6) 95Re.A=188(10) 86Cu01=202(17)														**
*^{17}C	D : β^-n intensity is from 95Re.A														**
*^{17}F	T : average 16Br01=64.402(0.042) 15Gr14=64.347(0.035)														**
^{18}B	51790	200				< 26	ns		(2$^-$)	16			2010	n ?	
^{18}C	24920	30				92	ms	2	0$^+$	96			1969	β^-=100; β^-n=31.5 15; β^-2n ?	
^{18}N	13113	19				619.2	ms	1.9	1$^-$	96	05Li60	TD	1964	β^-=100; β^-n=7.0 15; $\beta^-\alpha$=12.2 6; β^-2n ?	*
^{18}O	−782.8156	0.0007				STABLE			0$^+$	96			1929	IS=0.205 14	
^{18}O^i	15495	20	16278	20					1$^-$T=2		AHW	E			*
^{18}F	873.1	0.5				109.739	m	0.009	1$^+$	96	14Un01	T	1937	β^+=100	*
^{18}F^m	1994.5	0.5	1121.36	0.15		162	ns	7	5$^+$	96				IT=100	
^{18}F^i	1914.7	0.5	1041.55	0.08					0$^+$T=1	96				IT=100	
^{18}Ne	5317.6	0.4				1664.20	ms	0.47	0$^+$	96	15La19	T	1954	β^+=100	*
^{18}Na	25040	90				1.3	zs	0.4	1$^-$#	15	04Ze05	TD	2004	p=?	
*^{18}N	D : $\beta^-\alpha$ intensity from 89Zh04														**
*^{18}N	D : other β^-n 94Sc01=2.2(0.4)% 95Re.A=10.9(0.9) 91Re02=14.3(2.0)(same group)														**
*^{18}N	T : average 05Li60=619(2) 99Og03=620(14) 82Ol01=624(12) 64Ch19=630(30)														**
*^{18}O^i	E : assuming 16399(5), 17025(10) levels to be IAS's of 114.90(0.18), 747(10)														**
*^{18}O^i	E : levels in ^{18}N (see 95Ti07)														**
*^{18}F	T : average 14Un01=109.770(0.018) 10Ga04=109.722(0.012) 04Sc04=109.748(0.021)														**
*^{18}Ne	T : average 15La19=1664.00(+0.57–0.48) 13Gr03=1664.8(1.1)														**
*^{18}Ne	T : 13Gr03 supersedes 07Gr18=1665.6(1.9) of same group														**
^{19}B	59770	530				2.92	ms	0.13	3/2$^-$#	96	03Yo02	TD	1984	β^-=100; β^-n=71 9; β^-2n=17 5; β^-3n<9.1	*
^{19}C	32410	100				46.2	ms	2.3	(1/2$^+$)	96	88Du09	TD	1974	β^-=100; β^-n=47 3; β^-2n=7 3	*
^{19}N	15856	16				336	ms	3	1/2$^-$	96	06Su12	TJD	1968	β^-=100; β^-n=41.8 9	
^{19}O	3332.9	2.6				26.470	s	0.006	5/2$^+$	96	13Uj01	T	1936	β^-=100	*
^{19}F	−1487.4442	0.0009				STABLE			1/2$^+$	96			1920	IS=100.	
^{19}F^i	6052.2	0.9	7539.6	0.9					5/2$^+$T=3/2	96				IT=100	
^{19}Ne	1752.05	0.16				17.274	s	0.010	1/2$^+$	96	14Br06	T	1939	β^+=100	*
^{19}Ne^i	9253	9	7501	9	RQ				(5/2)$^+$T=3/2	96	MMC127	J			*
^{19}Na	12929	11				> 1	as		(5/2$^+$)	15	10Mu12	T	1969	p=100	*
^{19}Mg	31830	50				5	ps	3	1/2$^-$#	14	09Mu17	TD	2007	2p=100	*
*^{19}B	D : symmetrized from 71.8(+8.3–9.1)% 16.0(+5.6–4.8)%														**
*^{19}C	T : average 88Du09=49(4) 95Re.A=44(4) 95Oz02=45.5(4.0)														**
*^{19}C	J : from 01Ma08, 99Na27 and 95Ba28														**
*^{19}O	T : average 13Uj01=26.476(0.009) 94It.A=26.464(0.009)														**
*^{19}Ne	T : unweighed average of 14Br06=17.283(0.008), 13Uj01=17.254(0.005),														**
*^{19}Ne	T : 12Tr06=17.262(0.007) and 94Ko.A=17.296(0.005)														**
*^{19}Ne	T : 92Ge08=18.5(0.6) for q=10$^+$ (bare ion)														**
*^{19}Ne^i	J : if this is the IAS of ^{19}O ground-state 5/2$^+$; not yet confirmed														**
*^{19}Na	T : from upper limit of 40 keV, dominated by resolution: <1 eV suggested														**
*^{19}Mg	T : symmetrized from 6(+2–4); supersedes 07Mu15=4.0(1.5) ps														**
^{20}B	68450#	800#												n ?; β^-n ?; β^-2n ?	
^{20}C	37500	230				16	ms	3	0$^+$	98	90Mu06	TD	1981	β^-=100; β^-n=70 11; β^-2n<18.6	*
^{20}N	21770	80				136	ms	3		98	06Su12	TD	1969	β^-=100; β^-n=42.9 14; β^-2n ?	
^{20}O	3796.2	0.9				13.51	s	0.05	0$^+$	98			1959	β^-=100	
^{20}F	−17.463	0.030				11.163	s	0.008	2$^+$	98	98Ti06	T	1935	β^-=100	
^{20}F^i	6503	3	6521	3	RQ				0$^+$T=2	98					
^{20}Ne	−7041.9305	0.0016				STABLE			0$^+$	98			1913	IS=90.48 3	
^{20}Ne^i	3230.5	2.0	10272.5	2.0	RQ				2$^+$T=1	98				IT=100	
^{20}Ne^j	9690.9	2.8	16732.8	2.8	RQ				0$^+$T=2	98				IT=100	
^{20}Na	6850.6	1.1				447.9	ms	2.3	2$^+$	98	89Cl02	D	1950	β^+=100; $\beta^+\alpha$=25.0 4	
^{20}Na^i	13349.0	1.2	6498.4	0.5	p				0$^+$T=2	98			1979	p=100	
^{20}Mg	17477.7	1.9				93	ms	5	0$^+$	16			1974	β^+=100; β^+p=30.3 12	
*^{20}C	D : average β^-n 03Yo02=65(+19–18)% 90Mu06=72(14)%														**
*^{20}C	T : average 90Mu06=14(+6–5) 95Re.A 16.7(3.5); also 03Yo02=21.8(+15.0–7.4)														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{21}B	77330#	900#				<260 ns	$3/2^-$#	04	03Oz01 I		n ?	
^{21}C	45640#	600#				<30 ns	$1/2^+$#	04	93Po.A I		n ?	
^{21}N	25230	130				84 ms 7	$(1/2^-)$	15		1970	β^-=100; β^-n=90.5 42; β^-2n ?	
^{21}O	8062	12				3.42 s 0.10	$(5/2^+)$	04		1968	β^-=100; β^-n=0#	
^{21}F	−47.6	1.8				4.158 s 0.020	$5/2^+$	04		1955	β^-=100	
^{21}Ne	−5731.78	0.04				STABLE	$3/2^+$	04		1928	IS=0.27 1	
^{21}Ne^i	3127.4	1.4	8859.2	1.4		T=3/2	$(3/2,5/2)^+$	04				
^{21}Na	−2184.63	0.10				22.422 s 0.010	$3/2^+$	04	15Gr05 T	1940	β^+=100	
^{21}Na^i	6790	4	8975	4	p		$5/2^+$T=3/2	04				
^{21}Mg	10903.8	0.8				118.6 ms 0.5	$5/2^+$	04	15Lu13 D	1963	β^+=100; β^+p=32.6 10; $\beta^+\alpha$=?; β^+pα=0.016 3	
^{21}Al	26990#	600#				<35 ns	$5/2^+$#	04	93Po.A I		p ?	

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{22}C	53610	230				6.2 ms 1.3	0^+	15		1986	β^-=100; β^-n=61 14; β^-2n<37	*
^{22}N	31760	210				23 ms 3	0^-#	15		1979	β^-=100; β^-n=34 3; β^-2n=12 3	
^{22}O	9280	60				2.25 s 0.09	0^+	15		1969	β^-=100; β^-n<22	
^{22}F	2793	12				4.23 s 0.04	(4^+)	15		1965	β^-=100; β^-n<11	
^{22}Ne	−8024.719	0.018				STABLE	0^+	15		1913	IS=9.25 3	
^{22}Ne^i	5855	10	13880	10			4^+T=2	15	87Wi03 E			*
^{22}Na	−5181.51	0.17				2.6018 y 0.0022	3^+	15		1935	β^+=100	
^{22}Na^m	−4598.46	0.20	583.05	0.10		243 ns 2	1^+	15			IT=100	
^{22}Na^i	−4524.51	0.22	657.00	0.14		19.6 ps 0.7	0^+T=1	15			IT=100	
^{22}Mg	−399.9	0.3				3.8755 s 0.0012	0^+	15		1961	β^+=100	
^{22}Mg^i	13645	6	14044	6	p		$(4)^+$T=2	15	MMC12 J		α=?; p=?	*
^{22}Al	18200#	400#				91.1 ms 0.5	$(4)^+$	15		1982	β^+=100; β^+p=55 3; β^+2p=1.10 11; …	*
^{22}Si	33340#	500#				29 ms 2	0^+	15		1987	β^+=100; β^+p=32 4	

*^{22}C T : symmetrized from 6.1(+1.4–1.2) D : symmetrized from β^-n=61(+14–13)% **
*^{22}Ne^i E : 16Ma.A=13880(10) is preferred as IAS but not proven; 90En08=14060(20) **
*^{22}Mg^i J : IAS of ^{22}Al and ^{22}F ground-state **
*^{22}Al D : …; $\beta^+\alpha$=0.038 17 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{23}C	64170#	1000#					$3/2^+$#				n ?	
^{23}N	36720	420				13.9 ms 1.4	$1/2^-$#	07	03Yo02 TD	1985	β^-=100; β^-n=42 6; β^-2n=8 4; β^-3n<3.4	*
^{23}O	14620	120				97 ms 8	$1/2^+$	07	07Su05 TD	1970	β^-=100; β^-n=7 2	
^{23}F	3290	30				2.23 s 0.14	$5/2^+$	07	95Re.A D	1970	β^-=100; β^-n<14	
^{23}Ne	−5154.05	0.10				37.140 s 0.028	$5/2^+$	07	15La19 T	1936	β^-=100	*
^{23}Na	−9529.8525	0.0018				STABLE	$3/2^+$	07		1921	IS=100.	
^{23}Na^i	−1638.66	0.15	7891.19	0.15			$5/2^+$T=3/2	07			IT=100	
^{23}Na^j	10060.6	2.0	19590.4	2.0		240 zs 120	T=5/2		85Ev01 T			*
^{23}Mg	−5473.51	0.16				11.317 s 0.011	$3/2^+$	07		1939	β^+=100	
^{23}Mg^i	2328.7	1.4	7802.2	1.4			$5/2^+$T=3/2	07	00Pe28 D	1981	IT≈100; p=0.17 8	
^{23}Al	6748.1	0.3				470 ms 30	$5/2^+$	07		1969	β^+=100; β^+p=0.46 23	
^{23}Al^i	18530	60	11780	60	p		$(5/2)^+$T=5/2	07		1997	p=0.10 5; 2p=3.6 4	
^{23}Si	23700#	500#				42.3 ms 0.4	$3/2^+$#	07	97Bl04 TD	1986	β^+=100; β^+p≈88; β^+2p=3.6 3	

*^{23}N T : symmetrized from 14.1(+1.2–1.5) **
*^{23}N D : symmetrized from 42.2(+6.3–6.5)% 8.0(+3.8–3.4)% **
*^{23}Ne T : average 15La19=37.148(0.032) 07Gr18=37.11(0.06); other 74Al03=37.24(0.12) **
*^{23}Na^j T : from width=1.9(0.8) keV **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{24}N	46940#	400#				<52 ns		07	93Po.A I		n ?	
^{24}O	18500	160				77.4 ms 4.5	0^+	07	15Ca09 TD	1970	β^-=100; β^-n=43 4	*
^{24}F	7540	100				384 ms 16	3^+	07	07Su05 T	1970	β^-=100; β^-n<5.9	*
^{24}Ne	−5951.6	0.5				3.38 m 0.02	0^+	07		1956	β^-=100	
^{24}Na	−8417.901	0.017				14.957 h 0.004	4^+	07	14Un01 T	1934	β^-=100	*
^{24}Na^m	−7945.694	0.017	472.2074	0.0008		20.18 ms 0.10	1^+	07		1961	IT≈100; β^-=0.05	
^{24}Na^i	−2450.53	0.13	5967.37	0.13			0^+T=2	07				
^{24}Mg	−13933.569	0.013				STABLE	0^+	07		1920	IS=78.99 4	
^{24}Mg^i	−4417.29	0.04	9516.28	0.04			(4^+)T=1	07				
^{24}Mg^j	1502.8	0.6	15436.4	0.6			0^+T=2	07				
^{24}Al	−48.86	0.23				2.053 s 0.004	4^+	07		1953	β^+=100; $\beta^+\alpha$=0.035 6; β^+p=0.0016 3	
^{24}Al^m	376.94	0.25	425.8	0.1		130 ms 3	1^+	07		1968	IT=82.5 30; β^+=17.5 30; $\beta^+\alpha$=0.028 6	
^{24}Al^i	5900	3	5949	3	p		0^+T=2	07				
^{24}Si	10745	19				140 ms 8	0^+	07	98Cz01 D	1979	β^+=100; β^+p=37.6 25	
^{24}P	33320#	500#					1^+#				p ?; β^+ ?; β^+p ?	

*^{24}O T : average 15Ca09=80(5) 01Pe14=67(10) **
*^{24}F J : 15Ca09=3^+ **
*^{24}Na T : average 14Un01=14.955(0.007) 83Wa26=14.958(0.005) and **
*^{24}Na T : 80Ho17=14.9590(0.0150); all values are from standard labs **
*^{24}Na T : original unc of 80Ho17=0.0012 increased to 0.1% by evaluator **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{25}N	55980#	500#				<260	ns		$1/2^-$#	09	99Sa06	ID		n ?; 2n ?; β^- ?	*
^{25}O	27330	170				5.18	zs	0.35	$3/2^+$#	09	16Ko11	T	2008	n=100	*
^{25}F	11330	100				80	ms	9	$(5/2^+)$	09			1970	β^-=100; β^-n=23.1 45; β^-2n=0#	
^{25}Ne	−2036	29				602	ms	8	$1/2^+$	09			1970	β^-=100	
^{25}Na	−9357.8	1.2				59.1	s	0.6	$5/2^+$	09			1943	β^-=100	
^{25}Mg	−13192.78	0.05				STABLE			$5/2^+$	09			1920	IS=10.00 1	
^{25}Mg^i	−5405.8	0.3	7787.0	0.3					$5/2^+$T=3/2	09					
^{25}Al	−8915.97	0.06				7.183	s	0.012	$5/2^+$	09			1953	β^+=100	
^{25}Al^i	−1014.9	1.8	7901.1	1.8	RQ				$5/2^+$T=3/2	09					
^{25}Si	3827	10				220	ms	3	$5/2^+$	09			1963	β^+=100; β^+p=35 2	
^{25}P	19740#	400#				<30	ns		$1/2^+$#	09	93Po.A	I		p ?	
*^{25}N	D : in 99Sa06 experiment, 240 ^{25}N events expected, none observed														**
*^{25}O	T : from decay width 16Ko11=88(6) keV; other 13Ca18=20(+60–20) keV														**
^{26}O	34660	160				4.2	ps	3.3	0^+	16	13Ko10	T	2012	2n=100	*
^{26}F	18650	110				8.2	ms	0.9	1^+	16			1979	β^-=100; β^-n=13.5 40; β^-2n=0.4#	
^{26}F^m	19290	110	643.4	0.1		2.2	ms	0.1	(4^+)	16			2013	IT=82 11; β^-=?; β^-n=12 8	
^{26}Ne	481	18				197	ms	2	0^+	16			1970	β^-=100; β^-n=0.13 3	
^{26}Na	−6861	4				1071.28	ms	0.25	3^+	16			1958	β^-=100	
^{26}Na^m	−6779	4	82.5	0.6		9	μs	2	1^+	16			1987	IT=100	
^{26}Mg	−16214.542	0.030				STABLE			0^+	16			1920	IS=11.01 3	
^{26}Al	−12210.15	0.07				717	ky	24	5^+	16			1934	β^+=100	
^{26}Al^m	−11981.85	0.07	228.306	0.013	MD	6346.0	ms	0.8	0^+T=1	16			1934	β^+=100	
^{26}Si	−7141.02	0.11				2.2453	s	0.0007	0^+	16			1960	β^+=100	
^{26}Si^i	5926	11	13068	11	p				(3^+)T=2	16					
^{26}P	10970#	200#				43.7	ms	0.6	$(3)^+$	16			1983	β^+=100; β^+p=36.8 20; …	*
^{26}P^m	11130#	200#	164.4	0.1		120	ns	9		16			2014	IT=100	
^{26}S	27080#	600#				<79	ns		0^+	16				2p ?	
*^{26}O	T : symmetrized from 13Ko10=4.5(+1.1–1.5 stat)(3 systematics)														**
*^{26}P	D : …; β^+2p=2.16 24 D : β^+p + β^+2p=39(2)														**
^{27}O	44670#	500#				<260	ns		$3/2^+$#		99Sa06	I		n ?; 2n ?	
^{27}F	25450	390				4.9	ms	0.2	$5/2^+$#	11	98No.A	T	1981	β^-=100; β^-n=77 21; β^-2n=5#	*
^{27}Ne	7050	90				31.5	ms	1.3	$(3/2^+)$	11			1977	β^-=100; β^-n=2.0 5; β^-2n=0#	
^{27}Na	−5518	4				301	ms	6	$5/2^+$	11			1968	β^-=100; β^-n=0.13 4	
^{27}Mg	−14586.61	0.05				9.435	m	0.027	$1/2^+$	11	15ZaZY	T	1934	β^-=100	*
^{27}Al	−17196.86	0.05				STABLE			$5/2^+$	11			1922	IS=100.	
^{27}Al^i	−10383.1	0.7	6813.8	0.7					$1/2^+$T=3/2	11				IT=100	
^{27}Si	−12384.50	0.11				4.15	s	0.04	$5/2^+$	11			1939	β^+=100	
^{27}Si^i	−5759.5	2.3	6625.0	2.3	RQ				$1/2^+$T=3/2	11			1977	IT ?	
^{27}P	−722	26				260	ms	80	$1/2^+$	11			1977	β^+=100; β^+p=0.07	
^{27}P^i	12010	30	12730	40	p				$5/2^+$T=5/2	11			1991	IT ?	
^{27}S	17030#	400#				15.5	ms	1.5	$(5/2^+)$	11			1986	β^+=100; β^+p=2.3 9; β^+2p=1.1 5	
*^{27}F	T : others not used: 99Re16=6.5(1.1) 97Ta22=5.3(0.9) outweighed; and														**
*^{27}F	T : 99Dl01=5.2(0.3) same data as in 99Re16														**
*^{27}Mg	T : average 15ZaZY=9.408 (0.012) 70Re13=9.462 (0.012); Birge ratio=3.18														**
^{28}O	52080#	700#				<100	ns		0^+	13	98Po.A	I		n ?; 2n ?; β^-=0	*
^{28}F	33740	390				46	zs			13				n ?	
^{28}Ne	11300	130				20	ms	1	0^+	13			1979	β^-=100; β^-n=12 1; β^-2n=3.7 5	
^{28}Na	−988	10				30.5	ms	0.4	1^+	13			1969	β^-=100; β^-n=0.58 12	
^{28}Mg	−15018.8	2.0				20.915	h	0.009	0^+	13			1953	β^-=100	
^{28}Al	−16850.64	0.08				2.245	m	0.005	3^+	13			1934	β^-=100	
^{28}Al^i	−10858.06	0.13	5992.58	0.10					0^+T=2	13					
^{28}Si	−21492.7943	0.0005				STABLE			0^+	13			1920	IS=92.223 19	
^{28}Si^r	−8951.75	0.05	12541.04	0.05	RQ				(3^+)	13					
^{28}Si^i	−12176.87	0.10	9315.92	0.10		1.5	fs	0.6	3^+T=1	13					
^{28}Si^j	−6265.8	1.0	15227	1					(0^+)T=2	13	68Mc12	D	1968	α=90 11; p=10 11	
^{28}P	−7147.7	1.2				270.3	ms	0.5	3^+	13	79Ho27	D	1953	β^+=100; β^+p=0.0013 4; $\beta^+\alpha$=0.00086 25	
^{28}P^i	−1261	20	5887	20	p				0^+T=2	13					
^{28}S	4070	160				125	ms	10	0^+	13			1982	β^+=100; β^+p=20.7 19	
^{28}Cl	27520#	600#							1^+#					p ?	
*^{28}O	D : in 97Ta22 and 99Sa06, 11 and 37 ^{28}O events expected, none observed														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{29}F	40150	530				2.5	ms	0.3	$5/2^+$#	12	99Dl01	D	1989	β^-=100; β^-n=60 40; β^-2n=5#	*
^{29}Ne	18400	150				14.7	ms	0.4	$(3/2^-)$	12	05Tr13	T	1985	β^-=100; β^-n=28 5; β^-2n=4 1	*
^{29}Na	2680	7				44.1	ms	0.9	$3/2^{(+\#)}$	12	95Re.A	D	1969	β^-=100; β^-n=25.9 23; β^-2n=0#	*
^{29}Mg	−10603	11				1.30	s	0.12	$3/2^+$	12			1971	β^-=100	
^{29}Al	−18207.8	0.3				6.56	m	0.06	$5/2^+$	12			1939	β^-=100	
^{29}Si	−21895.0784	0.0006				STABLE			$1/2^+$	12			1920	IS=4.685 8	
^{29}Si^i	−13605	5	8290	5					$5/2^+$T=3/2	12				IT=100	
^{29}P	−16952.8	0.4				4.142	s	0.015	$1/2^+$	12			1941	β^+=100	
^{29}P^i	−8571.0	2.5	8381.8	2.4	RQ				$5/2^+$T=3/2	12			1969	IT=100	
^{29}S	−3160	50				188	ms	4	$5/2^+$#	12	79Vi01	D	1964	β^+=100; β^+p=46.4 10	
^{29}Cl	13160	190						<10ps	$(1/2^+)$	16	15Mu13	I		p=100	

*^{29}F D : β^-n from 99Dl01=100(80)% **
*^{29}Ne T : average 05Tr13=13.8(0.5) 97No.A=15.6(0.5); others outweighed, not used: **
*^{29}Ne T : 06Tr02=15.1(2.6) 16.4(1.3) 99Dl01=15(4) 99Re16=19(9) 97Ta22=15(3) **
*^{29}Ne J : 16Ko05=$(3/2^-)$ **
*^{29}Na D : β^-n: average 95Re.A=27.1(1.6)% 84La03=21.5(3.0)% **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{30}F	48110#	600#						<260 ns		10	99Sa06	I		n ?	
^{30}Ne	23280	250				7.22	ms	0.18	0^+	10	15St14	T	1985	β^-=100; β^-n=13 4; β^-2n=8.9 23	*
^{30}Na	8475	5				48.4	ms	1.7	2^+	10	99Dl01	T	1969	β^-=100; β^-n=30 4; …	*
^{30}Mg	−8884	3				313	ms	4	0^+	10	84La03	D	1971	β^-=100; β^-n<0.06	*
^{30}Al	−15864.8	2.9				3.62	s	0.06	3^+	10			1961	β^-=100	
^{30}Si	−24432.960	0.022				STABLE			0^+	10			1924	IS=3.092 11	
^{30}P	−20200.85	0.07				2.498	m	0.004	1^+T=0	10			1934	β^+=100	*
^{30}P^i	−19523.84	0.08	677.01	0.03					0^+T=1	10					
^{30}S	−14059.25	0.21				1.1759	s	0.0017	0^+	10	11So11	T	1961	β^+=100	
^{30}Cl	4440#	200#						<30 ns	3^+#	10	93Po.A	I		p ?	
^{30}Ar	20930	210						<10ps	0^+	16			2015	2p=100	

*^{30}Ne T : average 15St14=7.18(0.22) 07Tr08=7.3(0.3) **
*^{30}Na D : …; β^-2n=1.15 25; $\beta^-\alpha$=5.5e–5 2 **
*^{30}Na T : average 99Dl01=50(4) 97Ta22=48(5) 84La02=48(2) **
*^{30}Mg T : average 08Hi05=314(5) and 312(7) **
*^{30}P D : first observed radionuclide, in 1934 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{31}F	56140#	550#				1#	ms	(>260 ns)	$5/2^+$#	13			1999	β^- ?; β^-n=10#; β^-2n=0#	
^{31}Ne	31180	270				3.4	ms	0.8	$(3/2^-)$	13			1996	β^-=100; β^-n=10#; β^-2n=4#	
^{31}Na	12246	14				17.35	ms	0.40	$3/2^{(+\#)}$	13	93Kl02	J	1969	β^-=100; β^-n=37.3 54; …	*
^{31}Mg	−3122	3				236	ms	20	$1/2^{(+)}$	13			1977	β^-=100; β^-n=6.2 19	*
^{31}Al	−14950.7	2.2				644	ms	25	$5/2^{(+)}$	13			1971	β^-=100; β^-n<1.6	
^{31}Si	−22949.04	0.04				157.36	m	0.26	$3/2^+$	13			1934	β^-=100	
^{31}P	−24440.5410	0.0007				STABLE			$1/2^+$	13			1920	IS=100.	
^{31}P^i	−18059.7	2.0	6380.8	2.0					$3/2^+$T=3/2	13				IT=100	
^{31}S	−19042.52	0.23				2.5534	s	0.0018	$1/2^+$	13			1940	β^+=100	
^{31}S^i	−12761.9	0.6	6280.60	0.60					$3/2^+$T=3/2	13					
^{31}Cl	−7035	3				190	ms	1	$3/2^+$	13			1977	β^+=100; β^+p=2.4 2	
^{31}Cl^i	5256	3	12291	5	RQ				$3/2^+$T=5/2						
^{31}Ar	11330#	200#				15.1	ms	0.3	$5/2^+$	13	14Ko17	T	1986	β^+=100; β^+p=68.3 3; β^+2p=9.0 2; …	*

*^{31}Na D : …; β^-2n=0.87 24; β^-3n<0.05 **
*^{31}Mg D : strongly conflicting with earlier 84La03=1.7(0.3)% **
*^{31}Ar D : …; β^+pα<0.38; β^+3p=0.07 2; $\beta^+\alpha$<0.03; 2p<0.0006 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{32}Ne	37000#	500#				3.5	ms	0.9	0^+	11			1990	β^-=100; β^-n=30#; β^-2n=7#	
^{32}Na	18640	40				12.9	ms	0.3	(3^-)	11	08Tr04	TJ	1972	β^-=100; β^-n=24 7; β^-2n=8 2	*
^{32}Mg	−829	3				86	ms	5	0^+	11			1977	β^-=100; β^-n=5.5 5	
^{32}Al	−11099	7				33.0	ms	0.2	1^+	11			1971	β^-=100; β^-n=0.7 5	
^{32}Al^m	−10142	7	956.6	0.5		200	ns	20	(4^+)	11			1996	IT=100	
^{32}Si	−24077.69	0.30				153	y	19	0^+	11			1953	β^-=100	
^{32}P	−24304.87	0.04				14.268	d	0.005	1^+	11			1934	β^-=100	*
^{32}P^i	−19232.43	0.07	5072.44	0.06					0^+T=2	11				IT=100	
^{32}S	−26015.5336	0.0013				STABLE			0^+	11			1920	IS=94.99 26	
^{32}S^i	−19014.1	0.4	7001.4	0.4					1^+T=1	11				IT=100	
^{32}S^j	−13967.57	0.28	12047.96	0.28					0^+T=2	11				IT=100	
^{32}Cl	−13334.7	0.6				298	ms	1	1^+	11			1953	β^+=100; $\beta^+\alpha$=0.054 8; β^+p=0.026 5	
^{32}Cl^i	−8288.4	0.7	5046.3	0.3					0^+T=2	11				IT=100	
^{32}Ar	−2200.4	1.8				98	ms	2	0^+	11			1977	β^+=100; β^+p=35.58 0.22	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …														
^{32}K	21100#	400#						1^+#					p ?	
^{32}K^m	22050#	410#	950#	100#				4^+#		Mirror	I		p ?	
*^{32}Na	T : average 08Tr04=13.1(0.5) and 11.5(1.2) 98No.A=11.5(0.8) 84La03=13.2(0.4)													**
*^{32}P	T : also 14Un01=14.263(0.035)													**
^{33}Ne	46000#	600#				<260 ns		$7/2^-$#	11	02No11	I		n ?	*
^{33}Na	23780	450				8.2 ms	0.4	$(3/2^+)$	11			1972	β^-=100; β^-n=47 6; β^-2n=13 3	
^{33}Mg	4962.3	2.9				90.5 ms	1.6	$3/2^-$	11			1979	β^-=100; β^-n=14 2; β^-2n=3#	
^{33}Al	−8497	7				41.7 ms	0.2	$5/2^+$	11	06Hi18	J	1971	β^-=100; β^-n=8.5 7	
^{33}Si	−20514.3	0.7				6.18 s	0.18	$3/2^+$	11			1971	β^-=100	
^{33}P	−26337.3	1.1				25.35 d	0.11	$1/2^+$	11			1951	β^-=100	
^{33}S	−26585.8543	0.0014				STABLE		$3/2^+$	11			1926	IS=0.75 2	
^{33}S^i	−21106.06	0.13	5479.79	0.13				$1/2^+$T=3/2	11				IT=100	
^{33}Cl	−21003.3	0.4				2.5038 s	0.0022	$3/2^+$	11	15Gr14	T	1940	β^+=100	
^{33}Cl^i	−15454.9	0.5	5548.4	0.4	RQ			$1/2^+$T=3/2	11				IT=100	
^{33}Ar	−9384.3	0.4				173.0 ms	2.0	$1/2^+$	11			1964	β^+=100; β^+p=38.7 10	
^{33}K	7040#	200#				<25 ns		$3/2^+$#	11	93Po.A	I		p ?	
*^{33}Ne	T : estimated half-life 1# ms for β^- decay					I : also 02Le.A < 1.5 μs								**
^{34}Ne	52840#	510#				1# ms (>1.5 μs)		0^+	12	02Le.A	I	2002	β^- ?; β^-2n=40#; β^-n=1#	
^{34}Na	31680	600				5.5 ms	1.0	1^+	12	GAu03	D	1983	β^-=100; β^-2n≈50; β^-n≈15	*
^{34}Mg	8323	29				20 ms	10	0^+	12			1979	β^-=100; β^-n=30#; β^-2n=0.4#	
^{34}Al	−3000	3				56.3 ms	0.5	(4^-)	12			1977	β^-=100; β^-n=26 4; β^-2n=0.4#	
^{34}Al^m	−2450#	100#	550#	100#		26 ms	1	(1^+)		12Ro25	TJ	2012	β^-≈100; β^-n=30#; β^-2n=0.4#	
^{34}Si	−19957	14				2.77 s	0.20	0^+	12			1971	β^-=100	
^{34}Si^m	−15701	14	4256.1	0.4		< 210 ns		(3^-)	12			1989	IT=100	
^{34}P	−24548.7	0.8				12.43 s	0.10	1^+	12			1945	β^-=100	
^{34}S	−29931.69	0.04				STABLE		0^+	12			1926	IS=4.25 24	
^{34}Cl	−24440.08	0.05				1.5266 s	0.0004	0^+T=1	12			1934	β^+=100	
^{34}Cl^m	−24293.72	0.05	146.360	0.027	MD	31.99 m	0.03	3^+T=0	12			1965	β^+=55.4 6; IT=44.6 6	
^{34}Ar	−18378.29	0.08				843.8 ms	0.4	0^+	12			1966	β^+=100	
^{34}Ar^i	−10444	5	7934	5	RQ			1^+#T=2	12			1969	β^+ ?; IT ?	
^{34}K	−1220#	200#				<40 ns		1^+#	12	93Po.A	I		p ?	
^{34}Ca	13850#	300#				<35 ns		0^+	12	93Po.A	I		2p ?	
*^{34}Na	D : β^-n≈15%, β^-2n≈50% estimated from $P_n = \beta^-$n + 2×β^-2n=115(20)% in 84La03													**
*^{34}Na	D : assuming β^-n/β^-2n=0.3 from trends in the ^{30}Na-^{33}Na series: 26 41 3 4													**
^{35}Na	38230#	670#				1.5 ms	0.5	$3/2^+$#	11			1983	β^-=100; β^-n=60#; β^-2n=10#	*
^{35}Mg	15640	270				70 ms	40	$7/2^-$#	11			1989	β^-=100; β^-n=52 46; β^-2n=20#	
^{35}Al	−224	7				37.2 ms	0.8	$5/2^+$#	11			1979	β^-=100; β^-n=38 2; β^-2n=0.2#	
^{35}Si	−14390	40				780 ms	120	$7/2^-$#	15	95Re.A	D	1971	β^-=100; β^-n<5	
^{35}P	−24857.8	1.9				47.3 s	0.8	$1/2^+$	11			1971	β^-=100	
^{35}S	−28846.21	0.04				87.37 d	0.04	$3/2^+$	11			1936	β^-=100	
^{35}S^i	−19691	10	9155	10	RQ		T=5/2	$(1/2:9/2)^+$	11			1975		
^{35}Cl	−29013.53	0.04				STABLE		$3/2^+$	11			1919	IS=75.76 10	
^{35}Cl^i	−23359.05	0.22	5654.48	0.22				$3/2^+$T=3/2	11				IT=100	
^{35}Ar	−23047.3	0.7				1.7756 s	0.0010	$3/2^+$	11			1940	β^+=100	
^{35}Ar^i	−17474.6	0.7	5572.66	0.15				$3/2^+$T=3/2	11				IT=100	
^{35}K	−11172.9	0.5				178 ms	8	$3/2^+$	11	06Me04	J	1976	β^+=100; β^+p=0.37 15	
^{35}K^i	−2110	40	9060	40	2p			$3/2^+$T=5/2						
^{35}Ca	4790#	200#				25.7 ms	0.2	$1/2^+$#	11			1985	β^+=100; β^+p=95.9 14; β^+2p=4.1 6	
*^{35}Na	D : β^-n has been observed by 83La12 but not quantified													**
^{36}Na	46300#	680#				<180 ns			12				n ?	
^{36}Mg	20380	690				3.9 ms	1.3	0^+	12			1989	β^-=100; β^-n=30#; β^-2n=3#	
^{36}Al	5950	150				90 ms	40		12			1979	β^-=100; β^-n<30; β^-2n=7#	
^{36}Si	−12440	70				450 ms	60	0^+	12	95Re.A	D	1971	β^-=100; β^-n=12 5	
^{36}P	−20251	13				5.6 s	0.3	4^-	12	15Ch56	J	1971	β^-=100; β^-n=0#	
^{36}S	−30664.13	0.19				STABLE		0^+	12			1938	IS=0.01 1	
^{36}Cl	−29522.01	0.04				301.3 ky	1.5	2^+	12			1941	β^-=98.1 1; β^+=1.9 1	
^{36}Cl^i	−25222.34	0.04	4299.667	0.014				$(0)^+$T=2	12				IT=100	
^{36}Ar	−30231.540	0.027				STABLE		0^+	12			1920	IS=0.3336 21; 2β^+ ?	
^{36}Ar^i	−23620.5	0.3	6611.0	0.3				2^+T=1	12				IT=100	
^{36}Ar^j	−19379.4	1.2	10852.2	1.2	RQ			0^+T=2	12				IT=100	
^{36}K	−17417.1	0.3				341 ms	3	2^+	12			1967	β^+=100; β^+p=0.048 14; $\beta^+\alpha$=0.0034 13	
^{36}K^i	−13134.5	2.4	4282.6	2.4	p			0^+T=2	12				p=100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …															
^{36}Ca	−6450	40				101.2	ms	1.5	0^+	12	07Do17	T	1977	β^+=100; β^+p=51.2 10	*
^{36}Sc	15350#	300#												p ?	
*^{36}K^i	E : ENSDF2012 finds 4281.9(0.8) as IAS of ^{36}Ca ground-state														**
*^{36}Ca	T : average 07Do17=100.1(2.3) 95Tr02=102(2)														**
^{37}Na	53530#	690#				1#	ms	(>1.5 μs)	$3/2^+$#	12	02Le.A	I	2002	β^- ?; β^-n=100#; β^-2n=50#	
^{37}Mg	28210	700				8	ms	4	$(3/2^-)$	12	14Ko14	J	1996	β^- ?; β^-n=80#; β^-2n=20#	
^{37}Al	9810	180				11.5	ms	0.4	$5/2^+$#	12	15St14	TD	1979	β^-=100; β^-n>29 3; β^-2n>1 1	
^{37}Si	−6570	110				90	ms	60	$7/2^-$#	15			1979	β^-=100; β^-n=17 13; β^-2n=0.2#	
^{37}P	−19000	40				2.31	s	0.13	$(1/2^+)$	12	15Ch56	J	1971	β^-=100; β^-n=0.02#	
^{37}S	−26896.42	0.20				5.05	m	0.02	$7/2^-$	12			1945	β^-=100	
^{37}Cl	−31761.54	0.05				STABLE			$3/2^+$	12			1919	IS=24.24 10	
^{37}Cl^i	−21539.7	0.3	10221.8	0.3	RQ				$7/2^-$T=5/2	12			1984	IT=100	
^{37}Ar	−30947.66	0.21				35.011	d	0.019	$3/2^+$	12			1941	ε=100	
^{37}Ar^i	−25956	6	4992	6	RQ				$3/2^+$T=3/2	12	14Kr04	J	1973		
^{37}K	−24800.20	0.09				1.2365	s	0.0009	$3/2^+$	12	14Sh25	T	1958	β^+=100	*
^{37}K^i	−19749.9	0.8	5050.3	0.8	RQ				$3/2^+$T=3/2	12			1973	IT=100	
^{37}Ca	−13136.1	0.6				181.1	ms	1.0	$3/2^+$#	12			1964	β^+=100; β^+p=82.1 7	*
^{37}Sc	3520#	300#							$7/2^-$#					p ?	
*^{37}K	T : more precisely 14Sh25=1.23651(0.00094)														**
*^{37}Ca	TD : also 07Do17=181.7(3.6) ms; 72.2(4.3)%; also β^+p=74.5(0.7)% from 95Tr03														**
^{38}Mg	34070#	500#				1#	ms	(>260 ns)	0^+	13			2002	β^-=100#; β^-n=80#; β^-2n=7#	
^{38}Al	16210	370				9.0	ms	0.7		08	15St14	T	1989	β^-=100; β^-n=0#; β^-2n=10#	*
^{38}Si	−4170	100				90#	ms	(>1 μs)	0^+	08			1979	β^-=100#; β^-n=30#	
^{38}P	−14620	70				640	ms	140	(2^-)	08	15Ch56	J	1971	β^-=100; β^-n=12 5	
^{38}S	−26861	7				170.3	m	0.7	0^+	08			1958	β^-=100	
^{38}Cl	−29798.10	0.10				37.24	m	0.05	2^-	08			1940	β^-=100	
^{38}Cl^m	−29126.73	0.10	671.365	0.008		715	ms	3	5^-	08			1954	IT=100	
^{38}Cl^i	−21590	24	8208	24	RQ				0^+T=3	08					
^{38}Ar	−34714.82	0.19				STABLE			0^+	08			1934	IS=0.0629 7	
^{38}Ar^i	−24083.9	0.9	10630.9	0.9					(2^-)T=2	08					
^{38}Ar^j	−15940	30	18780	30	RQ				0^+T=3	08					
^{38}K	−28800.75	0.20				7.636	m	0.018	3^+T=0	08	14Kr04	J	1937	β^+=100	
^{38}K^m	−28670.61	0.20	130.15	0.04	MD	924.46	ms	0.14	0^+T=1	08	10Ba43	T	1953	β^+=100	
^{38}K^n	−25342.61	0.26	3458.14	0.17		21.95	μs	0.11	$(7)^+$	08			1971	IT=100	
^{38}Ca	−22058.50	0.19				443.70	ms	0.25	0^+	08	15Bl02	T	1966	β^+=100	*
^{38}Sc	−4250#	200#				<300 ns			2^-#	08	94Bl10	I		p ?	
^{38}Sc^m	−3580#	220#	670#	100#					5^-#		Mirror	I		IT ?; p ?	
^{38}Ti	10870#	300#				<120 ns			0^+	08	96Bl21	I		2p ?	
*^{38}Al	T : other 04Gr20=7.6(0.6) without γ-correlation I : 89Gu03>200ns														**
*^{38}Ca	T : average 15Bl02=443.63(0.35) 11Pa38=443.77(0.36)														**
^{39}Mg	42280#	510#				<180 ns			$7/2^-$#	07				n ?	*
^{39}Al	20650#	400#				7.6	ms	1.6	$5/2^+$#	11			1989	β^-=100; β^-n=90#; β^-2n=1#	
^{39}Si	2320	140				47.5	ms	2.0	$5/2^-$#	15			1979	β^-=100; β^-n=25#; β^-2n=2#	
^{39}P	−12770	110				282	ms	24	$1/2^+$#	06	04Gr20	T	1977	β^-=100; β^-n=26 8	*
^{39}S	−23160	50				11.5	s	0.5	$(7/2)^-$	06			1971	β^-=100	
^{39}Cl	−29800.2	1.7				56.2	m	0.6	$3/2^+$	06			1949	β^-=100	
^{39}Ar	−33242	5				269	y	3	$7/2^-$	06			1950	β^-=100	
^{39}Ar^i	−24161	7	9081	9	RQ			T=5/2	$3/2^+$	06	MMC149	J			*
^{39}K	−33807.190	0.005				STABLE			$3/2^+$	06	14Kr04	J	1921	IS=93.2581 44	
^{39}K^i	−27261.2	2.0	6546	2					$7/2^-$T=3/2	06				IT=100	
^{39}Ca	−27282.7	0.6				860.3	ms	0.8	$3/2^+$	06	10Bl09	T	1943	β^+=100	*
^{39}Ca^i	−20917#	9#	6366#	9#					$3/2^+$T=3/2		Imme	E			
^{39}Sc	−14173	24				< 300	ns		$7/2^-$#	06	GAu128	D	1988	p=100	*
^{39}Sc^i	−5050	40	9120	50	2p				$(3/2^+)$T=5/2	06					
^{39}Ti	2200#	200#				28.5	ms	0.9	$3/2^+$#	06	07Do17	TD	1990	β^+=100; β^+p=93.7 28; …	*
*^{39}Mg	T : estimated half-life 1# ms for β^- decay														**
*^{39}P	T : average 04Gr20=250(80) 98Wi.A=320(30) 95Re.A=190(50)														**
*^{39}Ar^i	J : due to IAS appartenance; was $(3/2,5/2)^+$ in ENSDF2006														**
*^{39}Ca	T : average 10Bl09=860.7(1.0) 77Az01=859.4(1.6) 73Al11=860.4(3.0)														**
*^{39}Sc	D : most probably proton emitter from S_p=−597(24) keV														**
*^{39}Ti	D : …; β^+2p=15# D : β^+2p decay observed in 92Mo15														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{40}Mg	48350#	500#				1# ms (>170 ns)	0^+	07	14Cr02 I	2007	β^- ?; β^-n=100#; β^-2n=50#	*
^{40}Al	27590#	400#				10# ms (>260 ns)		04		2002	β^- ?; β^-n=0#; β^-2n=90#	
^{40}Si	5430	350				33.0 ms 1.0	0^+	06	04Gr20 TD	1989	β^-=100; β^-n=40#; β^-2n=60#	
^{40}P	−8110	150				150 ms 8	$(2^-,3^-)$	04		1979	β^-=100; ; β^-n=15.8 21; β^-2n=2#	
^{40}S	−22838	4				8.8 s 2.2	0^+	04		1971	β^-=100	
^{40}Cl	−27560	30				1.35 m 0.02	2^-	04		1956	β^-=100	
^{40}Ar	−35039.8946	0.0022				STABLE	0^+	04		1920	IS=99.6035 25	
^{40}K	−33535.49	0.06				1.248 Gy 0.003	4^-	04	14Kr04 J	1935	IS=0.0117 1; β^-=89.28 13; β^+=10.72 13	
^{40}K^m	−31891.85	0.06	1643.639	0.011		336 ns 12	0^+	04		1968	IT=100	
^{40}K^i	−29151.5	0.3	4384.0	0.3			0^+T=2	04			IT=100	
^{40}Ca	−34846.384	0.021				STABLE (>5.9 Zy)	0^+	04	99Be64 T	1922	IS=96.94 16; 2β^+ ?	
^{40}Ca^i	−27188.20	0.05	7658.18	0.05			4^-T=1	04	AHW E		IT=100	*
^{40}Ca^j	−22858.4	1.0	11988	1			0^+T=2	04			IT=100	
^{40}Sc	−20523.3	2.8				182.3 ms 0.7	4^-	04		1955	β^+=100; β^+p=0.44 7; $\beta^+\alpha$=0.017 5	
^{40}Sc^i	−16164	6	4359	6	RQ		0^+T=2	04			IT=100	
^{40}Ti	−8850	160				52.4 ms 0.3	0^+	04	07Do17 TD	1982	β^+=100; β^+p=95.8 13	
^{40}V	12170#	300#					2^-#				p ?	
*^{40}Mg	I : 14Cr02 5 events observed in direct two-proton removal from 42Si											**
*^{40}Ca^i	E : Original 7658.23(0.05) recalibrated -0.05 keV for ^{27}Al+p resonances											**
^{41}Al	33420#	500#				2# ms (>260 ns)	$5/2^+$#	16		2002	β^- ?; β^-n=50#; β^-2n=10#	
^{41}Si	12120	550				20.0 ms 2.5	$7/2^-$#	16		1989	β^-=100; β^-n=45#; β^-2n=10#	
^{41}P	−4980	120				101 ms 5	$1/2^+$#	16		1979	β^-=100; β^-n=30 10; β^-2n=0.2#	
^{41}S	−19009	4				1.99 s 0.05	$7/2^-$#	16		1979	β^-=100; β^-n=0.1#	
^{41}Cl	−27310	70				38.4 s 0.8	$(1/2^+)$	16		1971	β^-=100	
^{41}Ar	−33067.5	0.3				109.61 m 0.04	$7/2^-$	16		1936	β^-=100	
^{41}K	−35559.543	0.004				STABLE	$3/2^+$	16	14Kr04 J	1921	IS=6.7302 44	
^{41}K^i	−27210	15	8349	15	RQ		$7/2^-$T=5/2	16	75Me10 J	1975		*
^{41}Ca	−35137.89	0.14				99.4 ky 1.5	$7/2^-$	16		1939	ε=100	
^{41}Ca^i	−29320.8	0.5	5817.1	0.5		< 28 fs	$3/2^+$T=3/2	16			IT=100	
^{41}Sc	−28642.41	0.08				596.3 ms 1.7	$7/2^-$	16		1941	β^+=100	
^{41}Sc^r	−25760.09	0.09	2882.32	0.05	RQ		$7/2^+$	16			P=59 2; IT=41 2	
^{41}Sc^i	−22704	3	5939	3	RQ		$3/2^+$T=3/2	16			p=100	
^{41}Ti	−15698	28				81.9 ms 0.5	$3/2^+$	16	07Do17 D	1964	β^+=100; β^+p=91.1 6	
^{41}V	320#	200#					$7/2^-$#				p ?	
*^{41}K^i	I : ENSDF=$5/2^-$,$7/2^-$ and T=3/2 ; NUBASE adopts this level as IAS of ^{41}Ar ground-state											**
^{42}Al	40100#	600#				1# ms (>170 ns)		16		2007	β^- ?; β^-n=30#; β^-2n=40#	
^{42}Si	16470#	500#				12.5 ms 3.5	0^+	16		1990	β^-=100; β^-n=40#; β^-2n=60#	
^{42}P	1010	310				48.5 ms 1.5		16		1979	β^-=100; β^-n=50 20; β^-2n=20#	
^{42}S	−17637.7	2.8				1.016 s 0.015	0^+	16		1979	β^-=100; β^-n<4	
^{42}Cl	−24830	60				6.8 s 0.3	(2^-)	16		1971	β^-=100; β^-n=0#	
^{42}Ar	−34423	6				32.9 y 1.1	0^+	16		1952	β^-=100	
^{42}K	−35022.03	0.11				12.355 h 0.007	2^-	16	14Kr04 J	1935	β^-=100	
^{42}K^i	−28570	100	6450	100			(0^+)T=3	16				
^{42}Ca	−38547.24	0.15				STABLE	0^+	16		1934	IS=0.647 23	
^{42}Ca^i	−28797	10	9750	10			(2^-)T=2	16				
^{42}Sc	−32121.15	0.17				680.79 ms 0.28	0^+T=1	16		1955	β^+=100	
^{42}Sc^m	−31504.83	0.18	616.32	0.06	MD	61.7 s 0.4	7^+	16		1963	β^+=100	*
^{42}Sc^r	−26044.89	0.17	6076.26	0.07	RQ		$(2^+,3^+,4^+)$	16			IT=100	
^{42}Ti	−25104.67	0.28				208.65 ms 0.80	0^+	16		1964	β^+=100	
^{42}V	−7620#	200#				<55 ns	2^-#	16	92Bo37 I		p ?	
^{42}Cr	6730#	400#				13.3 ms 1.0	0^+	16		1996	$\beta^+\approx$100; β^+p=94.4 50; 2p ?	
*^{42}Sc^m	J : 5^+,6^+,7^+ from β^+ decay to 6^+ level; 7^+ is most likely from shell model											**
^{43}Al	47020#	800#				1# ms (>170 ns)	$5/2^+$#	15		2007	β^- ?; β^-n=100#; β^-2n=50#	
^{43}Si	23100#	600#				15# ms (>260 ns)	$3/2^-$#	15	02No11 I	2002	β^- ?; β^-n=40#; β^-2n=30#	
^{43}P	4680	550				35.8 ms 1.3	$(1/2^+)$	15	04Gr20 T	1989	β^-=100; β^-n=100; β^-2n=10#	*
^{43}S	−12195	5				265 ms 13	$3/2^-$#	15		1979	β^-=100; β^-n=40 10	
^{43}S^m	−11874	5	320.7	0.5		415.0 ns 2.6	$(7/2^-)$	15	09Ga05 J	2000	IT=100	*
^{43}Cl	−24160	60				3.13 s 0.09	$(3/2^+)$	15	06Wi10 J	1976	β^-=100; β^-n=2#	
^{43}Ar	−32010	5				5.37 m 0.06	$5/2^{(-)}$	15		1969	β^-=100	
^{43}K	−36575.4	0.4				22.3 h 0.1	$3/2^+$	01	14Kr04 J	1949	β^-=100	
^{43}K^m	−35837.1	0.4	738.30	0.06		200 ns 5	$7/2^-$	15		1978	IT=100	
^{43}Ca	−38408.82	0.23				STABLE	$7/2^-$	15		1934	IS=0.135 10	
^{43}Ca^i	−30414	14	7995	14	RQ		$(3/2)^+$T=5/2	15				
^{43}Sc	−36188.1	1.9				3.891 h 0.012	$7/2^-$	15		1935	β^+=100	
^{43}Sc^m	−36036.3	1.9	151.79	0.08		438 μs 5	$3/2^+$	15	77Mi10 T	1964	IT=100	*
^{43}Sc^n	−33064.4	1.9	3123.73	0.15		472 ns 3	$19/2^-$	15	08Fe02 T	1978	IT=100	*
^{43}Sc^i	−31956	3	4232	4	RQ		$7/2^-$T=3/2	15				

... A-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …												
^{43}Ti	−29321	7				509 ms 5	7/2−	15		1948	β^+=100; β^+p ?	
^{43}Ti^m	−29008	7	313.0	1.0		11.9 μs 0.3	(3/2+)	15		1978	IT=100	
^{43}Ti^n	−26255	7	3066.4	1.0		556 ns 6	(19/2−)	15		1978	IT=100	
^{43}Ti^i	−24610#	50#	4710#	50#			7/2−#T=3/2					
^{43}V	−17920	40				79.3 ms 2.4	7/2−#	15	07Do17 D	1987	β^+=100; β^+p<2.5	
^{43}V^i	−9705	15	8210	50	RQ		3/2+T=5/2					
^{43}Cr	−1970#	400#				21.1 ms 0.3	(3/2+)	15	11Po01 T	1992	β^+=100; β^+p=79.3 30; β^+2p=11.6 10; …	*

*^{43}P T : average 04Gr20=36.5(1.5) 95So03=33(3) **
*^{43}S^m T : average 12Ch16=415(3) 09Ga05=415(5) **
*^{43}Sc^m T : average 77Mi10=438(7) 65De15=470(20) 64Ho14=435(7) **
*^{43}Sc^n T : average 08Fe02=481(9) 81Da06=469(4) 78Ha07=473(5) **
*^{43}Cr D : …; β^+3p=0.13 +18-8; $\beta^+\alpha$? **
*^{43}Cr T : average 11Po01=20.6(0.9) 07Do17=21.1(0.4) 01Gi01=21.6(0.7) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{44}Si	28510#	600#				10# ms (>360 ns)	0+	11		2007	β^- ?; β^-n=100#; β^-2n=50#	
^{44}P	10450#	500#				18.5 ms 2.5		11		1989	β^-=100; β^-n=20#; β^-2n=70#	
^{44}S	−9204	5				100 ms 1	0+	11		1979	β^-=100; β^-n=18 3	
^{44}S^m	−7839	5	1365.0	0.8		2.619 μs 0.026	0+	11		2005	IT=100	
^{44}Cl	−20380	140				560 ms 110	(2−)	11		1979	β^-=100; β^-n<8	
^{44}Ar	−32673.3	1.6				11.87 m 0.05	0+	11		1969	β^-=100	
^{44}K	−35781.5	0.4				22.13 m 0.19	2−	11	14Kr04 J	1954	β^-=100	
^{44}Ca	−41468.7	0.3				STABLE	0+	11		1922	IS=2.09 11	
^{44}Ca^i	−29619	10	11850	10			2−T=3	11				*
^{44}Sc	−37816.0	1.8				4.0420 h 0.0025	2+	11	16Ga24 T	1937	β^+=100	*
^{44}Sc^m	−37748.1	1.8	67.8679	0.0014		154.8 ns 0.8	1−	11		1967	IT=100	
^{44}Sc^n	−37669.8	1.8	146.1914	0.0020		51.0 μs 0.3	0−	11		1963	IT=100	
^{44}Sc^p	−37544.8	1.8	271.240	0.010		58.61 h 0.10	6+	11		1940	IT=98.80 7; β^+=1.20 7	
^{44}Sc^i	−35038.2	2.5	2778	3	RQ		0+T=2	11				
^{44}Ti	−37548.6	0.7				59.1 y 0.3	0+	11		1954	ε=100	
^{44}Ti^i	−30942.2	0.9	6606.4	0.5			2+T=1	11			IT=100	
^{44}Ti^j	−28210.6	2.1	9338	2			0+frg.T=2	11			IT=100	*
^{44}V	−24120	180			*	111 ms 7	(2)+	11		1971	β^+=100; $\beta^+\alpha$=?; β^+p ?	
^{44}V^m	−23850#	210#	270#	100#	*	150 ms 3	(6)+	11		1997	β^+=100	
^{44}V^n	−23970#	210#	150#	100#			0−#		Mirror I			
^{44}V^i	−21124	13	2990	180	p		0+#T=2		92Bo37 D	1992	p=100	
^{44}Cr	−13360#	300#				42.8 ms 0.6	0+	11	07Do17 D	1987	β^+=100; β^+p=14.0 9	
^{44}Mn	7030#	500#				<105 ns	2−#	11			p ?	

*^{44}Ca^i J : ENSDF no J^π; data from (e,e') scattering 84Ra04; IAS candidate **
*^{44}Sc T : 16Ga24=242.52(0.15) min, but the authors quote in error 4.042(0.025) h **
*^{44}Ti^j E : strongest fragment 9338(2); other 40(2) lower **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{45}Si	37490#	700#				1# ms	3/2−#				β^- ?; β^-n=100#; β^-2n=50#	
^{45}P	15600#	500#				8# ms (>200 ns)	1/2+#	08		1990	β^- ?; β^-n=30#; β^-2n=30#	
^{45}S	−3990	1040				68 ms 2	3/2−#	08		1989	β^-=100; β^-n=54; β^-2n=4#	
^{45}Cl	−18260	140				413 ms 25	(3/2+)	08	12Ri08 J	1979	β^-=100; β^-n=24 4	
^{45}Ar	−29770.8	0.5				21.48 s 0.15	(5/2−,7/2−)	08		1974	β^-=100	
^{45}K	−36615.6	0.5				17.8 m 0.6	3/2+	08	14Kr04 J	1964	β^-=100	
^{45}Ca	−40812.2	0.4				162.61 d 0.09	7/2−	08		1940	β^-=100	
^{45}Sc	−41071.9	0.7				STABLE	7/2−	08		1923	IS=100.	
^{45}Sc^m	−41059.5	0.7	12.40	0.05		318 ms 7	3/2+	08		1964	IT=100	
^{45}Sc^i	−34373	15	6699	15			7/2−T=5/2	08				
^{45}Ti	−39009.8	0.8				184.8 m 0.5	7/2−	08		1941	β^+=100	
^{45}Ti^m	−38973.3	0.8	36.53	0.15		3.0 μs 0.2	3/2−	08		2006	IT=100	
^{45}Ti^i	−34291	3	4719	3	RQ		7/2−T=3/2	08				
^{45}V	−31886.0	0.9				547 ms 6	7/2−	08		1975	β^+=100	
^{45}V^m	−31829.2	1.1	56.8	0.6		512 ns 13	(3/2−)	08	11Ho02 T	1980	IT=100	*
^{45}V^i	−27090	9	4796	9	RQ		7/2−T=3/2	08			p=100	
^{45}Cr	−19510	40			*	60.9 ms 0.4	7/2−#	08		1974	β^+=100; β^+p=34.4 8	
^{45}Cr^m	−19400	40	107	1	*	> 80 μs	(3/2)	11	11Ho02 ETJ	2011	IT=100	
^{45}Mn	−5250#	400#				<70 ns	7/2−#	08	92Bo37 I		p ?	
^{45}Fe	13760#	400#				2.2 ms 0.3	3/2+#	08	05Do20 T	1996	2p=57 10; β^+<43; β^+p<43; β^+p=25 5	*

*^{45}V^m T : average 11Ho02=468(23) 87Ha.B=430(80) 82Ho11=539(18) 82Al.C=610(80) and **
*^{45}V^m T : 80Gr.A=510(50) **
*^{45}Fe T : average 05Do20=1.6(+0.5–0.3) 02Gi09=4.7(+3.4–1.4) 02Pf02=3.2(+2.6–1.0) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{46}P	22970#	700#				4#	ms	(>200 ns)		00	90Le03	I	1990	β^- ?; β^-n=0#; β^-2n=90#	
^{46}S	340#	500#				50	ms	8	0^+	10			1989	β^-=100; β^-n=70#; β^-2n=3#	
^{46}Cl	−13860	210				232	ms	2	2^-#	12			1989	β^-=100; β^-n=60 9; β^-2n=0.3#	
^{46}Ar	−29772.9	1.1				8.4	s	0.6	0^+	00			1974	β^-=100	
^{46}K	−35413.9	0.7				105	s	10	2^-	00	14Pa45	J	1965	β^-=100	
^{46}Ca	−43139.4	2.2				STABLE			0^+	00			1938	IS=0.004 3; 2β^- ?	*
^{46}Sc	−41761.2	0.7				83.80	d	0.03	4^+	00	14Un01	T	1936	β^-=100	*
^{46}Sc^m	−41709.2	0.7	52.011	0.001		9.4	μs	0.8	6^+	00			1966	IT=100	
^{46}Sc^n	−41618.7	0.7	142.528	0.007		18.75	s	0.04	1^-	00			1948	IT=100	
^{46}Sc^i	−36748	4	5013	4	RQ				0^+T=3	00					
^{46}Ti	−44127.80	0.16				STABLE			0^+	00			1934	IS=8.25 3	
^{46}Ti^i	−34962	7	9166	7	RQ				4^+T=2	00					
^{46}Ti^j	−29977	6	14151	6	RQ				0^+T=3	00					
^{46}V	−37075.35	0.20				422.64	ms	0.05	0^+T=1	00	12Pa07	T	1952	β^+=100	*
^{46}V^m	−36273.89	0.22	801.46	0.10		1.02	ms	0.07	3^+T=0	00			1962	IT=100	
^{46}Cr	−29472	11				224.3	ms	1.3	0^+	10	15Mo01	T	1972	β^+=100	
^{46}Cr^i	−20328	13	9144	17	RQ				(4^+)T=2	10				p=?	
^{46}Mn	−12570#	400#			*	36.2	ms	0.4	(4^+)	10			1987	β^+=100; β^+p=57.0 8; β^+2p≈18; $\beta^+\alpha$?	*
^{46}Mn^m	−12420#	410#	150#	100#	*	1#	ms		1^-#					β^+ ?	
^{46}Mn^i	−7390	50	5180#	400#	p				T=3						
^{46}Fe	910#	500#				13.0	ms	2.0	0^+	10	07Do17	TD	1992	β^+=100; β^+p=78.7 38; β^+2p=?	*

*^{46}Ca T : 99Be64 : 0ν-$\beta\beta$>100 Ey **
*^{46}Sc T : average 14Un01=83.84(0.08) 83Wa26=83.73(0.11) 80Ho17=83.819(0.080); **
*^{46}Sc T : all values are from standard labs **
*^{46}Sc T : original unc of 80Ho17=0.006 increased to 0.1% by evaluator **
*^{46}V T : average 12Pa07=422.66(0.06) 97Ko65=422.57(0.13) **
*^{46}Mn T : others 92Bo37=41(+7–6) 01Gi01=34.0(+4.5–3.5) **
*^{46}Mn D : β^+2p≈18% estimated from $P_p = \beta^+$p + 2×β^+2p=57(1)% **
*^{46}Fe T : average 14Po05=16.4(+4.2–2.8) 07Do17=13.0(2.0) 01Gi01=9.7(+3.5–4.3) **
*^{46}Fe D : other β^+p 14Po05=66(4)% 01Gi01=36(20)%; β^+2p, 1 event in 14Po05 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{47}P	29710#	800#				2#	ms		$1/2^+$#					β^- ?; β^-n=0.4#; β^-2n=0.03#	
^{47}S	7370#	500#				20#	ms	(>200 ns)	$3/2^-$#	07	89Gu03	I	1989	β^- ?; β^-n=10#; β^-2n=10#	
^{47}Cl	−9780#	400#				101	ms	5	$3/2^+$#	07			1989	β^-=100; β^-n<3; β^-2n=0.3#	
^{47}Ar	−25366.3	1.1				1.23	s	0.03	$(3/2)^-$	07			1985	β^-=100; β^-n<0.2	
^{47}K	−35712.0	1.4				17.50	s	0.24	$1/2^+$	07	14Kr04	J	1964	β^-=100	
^{47}Ca	−42344.4	2.2				4.536	d	0.003	$7/2^-$	07			1951	β^-=100	
^{47}Sc	−44336.6	1.9				3.3492	d	0.0006	$7/2^-$	07			1945	β^-=100	
^{47}Sc^m	−43569.8	1.9	766.83	0.09		272	ns	8	$(3/2)^+$	07			1968	IT=100	
^{47}Ti	−44937.36	0.12				STABLE			$5/2^-$	07			1934	IS=7.44 2	
^{47}Ti^i	−37588.4	0.7	7349.0	0.7					$7/2^-$T=5/2	07					
^{47}V	−42006.62	0.17				32.6	m	0.3	$3/2^-$	07			1942	β^+=100	
^{47}V^i	−37856.27	0.20	4150.35	0.11					$5/2^{(-)}$T=3/2	07				IT=100	
^{47}Cr	−34563	6				500	ms	15	$3/2^-$	07			1972	β^+=100	
^{47}Cr^j	−29803#	21#	4760#	20#					$5/2^-$#T=5/2						
^{47}Mn	−22570	30				88.0	ms	1.3	$5/2^-$#	07	07Do17	TD	1987	β^+=100; β^+p<1.7	
^{47}Mn^i	−15191	17	7380	40	RQ				$7/2^-$#T=5/2	07			2001	p=100	
^{47}Fe	−6870#	500#				21.9	ms	0.2	$7/2^-$#	07	07Do17	TD	1992	β^+=100; β^+p=88.4 9	
^{47}Fe^m	−6100#	510#	770#	100#					$3/2^+$#		Mirror	I		IT ?	
^{47}Co	10370#	600#							$7/2^-$#	07	Mirror	I		p ?	

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{48}S	12760#	600#				10#	ms	(>200 ns)	0^+	06			1990	β^- ?; β^-n=80#; β^-2n=10#	
^{48}Cl	−4280#	500#				100#	ms	(>200 ns)		06	89Gu03	I	1989	β^- ?; β^-n=60#; β^-2n=40#	
^{48}Ar	−22280	310				415	ms	15	0^+	10	12We08	TD	2004	β^-=100; β^-n=38 6	*
^{48}K	−32284.5	0.8				6.8	s	0.2	1^-	06	14Pa45	J	1972	β^-=100; β^-n=1.14 15	
^{48}Ca	−44224.63	0.10				45	Ey	6	0^+	06	15Ba11	T	1938	IS=0.187 21; 2β^-=75 +25-38; β^- ?	*
^{48}Sc	−44504	5				43.67	h	0.09	6^+	06			1937	β^-=100	
^{48}Ti	−48492.71	0.11				STABLE			0^+	06			1923	IS=73.72 3	
^{48}Ti^i	−37767	6	10726	6					(6^+)T=3	06					
^{48}V	−44477.7	1.0				15.9735	d	0.0025	4^+	06			1937	β^+=100	
^{48}V^i	−41458.84	0.24	3018.9	0.9	RQ				$(0)^+$T=2	06				IT=100	
^{48}Cr	−42822	7				21.56	h	0.03	0^+	06			1952	β^+=100	
^{48}Cr^i	−37029	7	5792.77	0.24					4^+T=1	06			1987	IT=100	
^{48}Cr^j	−34062	15	8760	17	RQ				0^+frg.T=2	06					*
^{48}Mn	−29296	7				158.1	ms	2.2	4^+	06			1987	β^+=100; β^+p=0.28 4; $\beta^+\alpha$=6e–4	
^{48}Mn^i	−26260	7	3036.7	0.9					0^+T=2	06	MMC12	J		p=100	
^{48}Fe	−18000#	400#				45.3	ms	0.6	0^+	06	07Do17	TD	1987	β^+=100; β^+p=15.3 5	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{48}Co	1500#	500#							6^+#	06				p ?	
^{48}Ni	16790#	500#				2.8	ms	0.8	0^+	06	11Po09	TD	2000	2p=70 20; β^+=30 20; β^+p ?	*
*^{48}Ar	T : average 12We08=381(35) 412(19) 04Gr20=475(40)														**
*^{48}Ca	T : symmetrized from 15Ba11=44(+6–5)														**
*^{48}Cr^j	E : strongest frg; other: 10(15)keV lower														**
*^{48}Fe	D : average 07Do17=15.9(6)% 16Or03=14.4(7)%; other 96Fa09>3.6(1.1)%														**
*^{48}Fe	T : other 16Or03=51(3) 96Fa09=44(7)														**
*^{48}Ni	T : average 05Do20=2.1(+2.1–0.7) 14Po05=11Po09=2.1(+1.4–0.4)														**
^{49}S	21090#	670#						<200 ns	$3/2^-$#	08	90Le03	I		n ?; β^- ?; β^-n=4#; β^-2n=30#	*
^{49}Cl	940#	600#				50#	ms	(>200 ns)	$3/2^+$#	08	89Gu03	I	1989	β^- ?; β^-n=70#; β^-2n=20#	
^{49}Ar	−17190#	400#				236	ms	8	$3/2^-$#	08	12We08	TD	1989	β^-=100; β^-n=29 6; β^-2n=0.3#	
^{49}K	−29611.5	0.8				1.26	s	0.05	$1/2^+$	11	14Pa45	J	1972	β^-=100; β^-n=86 9	
^{49}Ca	−41299.77	0.20				8.718	m	0.006	$3/2^-$	08			1950	β^-=100	
^{49}Sc	−46561.3	2.7				57.18	m	0.13	$7/2^-$	08			1940	β^-=100	
^{49}Ti	−48563.79	0.11				STABLE			$7/2^-$	08			1934	IS=5.41 2	
^{49}V	−47961.9	0.8				330	d	15	$7/2^-$	08			1940	ε=100	
^{49}V^i	−41530	4	6432	4	RQ				$7/2^-$T=5/2						
^{49}Cr	−45333.1	2.2				42.3	m	0.1	$5/2^-$	08			1942	β^+=100	
^{49}Cr^i	−40569	5	4764	5					$(7/2)^-$T=3/2	08	85Fu03	E	1969	IT=100	*
^{49}Mn	−37620.6	2.3				382	ms	7	$5/2^-$	08			1970	β^+=100	
^{49}Mn^i	−32804	18	4817	18	p				$(7/2^-)$T=3/2	08				p=100	
^{49}Fe	−24751	24				64.7	ms	0.3	$(7/2^-)$	08	96Fa09	J	1970	β^+=100; β^+p=56.7 4	
^{49}Co	−9880#	500#						<35 ns	$7/2^-$#	08	94Bl10	I		p ?	
^{49}Ni	8200#	600#				7.5	ms	1.0	$7/2^-$#	08			1996	β^+=100; β^+p=83 13	
*^{49}S	I : statistics precludes any conclusion, say authors														**
*^{49}Cr^i	E : strongest component surrounded by several weak l=3 lines														**
*^{49}Cr^i	E : 85Fu03 cannot confirm IAS identity and frgs														**
^{50}Cl	7740#	600#				20#	ms	(>620 ns)		10	09Ta24	I	2009	β^- ?; β^-n=70#; β^-2n=30#	
^{50}Ar	−13330#	500#				106	ms	6	0^+	15			1989	β^-=100; β^-n=37 7; β^-2n=0.1#	
^{50}K	−25728	8				472	ms	4	0^-	10	14Pa45	J	1972	β^-=100; β^-n=29 3; β^-2n=10#	
^{50}K^m	−25557	8	171.4	0.4		125	ns	40	(2^-)	10	FGK127	J	1999	IT=100	*
^{50}Ca	−39589.2	1.6				13.9	s	0.6	0^+	10			1964	β^-=100	
^{50}Sc	−44547	15				102.5	s	0.5	5^+	10			1959	β^-=100	
^{50}Sc^m	−44290	15	256.895	0.010		350	ms	40	$(2^+,3^+)$	10			1963	IT>97.5; β^-<2.5	
^{50}Ti	−51431.66	0.12				STABLE			0^+	10			1934	IS=5.18 2	
^{50}V	−49224.0	0.4				150	Py	40	6^+	10			1949	IS=0.250 4; β^+=83 11; β^-=17 11	*
^{50}V^i	−44410.42	0.29	4813.6	0.5	RQ				0^+T=3	10					
^{50}Cr	−50262.1	0.4				STABLE		(>1.3 Ey)	0^+	10			1930	IS=4.345 13; 2β^+ ?	*
^{50}Cr^i	−41836	7	8426	7	RQ				6^+T=2	10					
^{50}Cr^j	−37039	6	13223	6	RQ				0^+T=3	10					
^{50}Mn	−42627.6	0.4				283.19	ms	0.10	0^+T=1	10			1952	β^+=100	*
^{50}Mn^m	−42402.3	0.4	225.31	0.07	MD	1.75	m	0.03	5^+T=0	10			1962	β^+=100	
^{50}Fe	−34476	8				152.1	ms	0.6	0^+	10	15Mo01	T	1977	β^+=100; β^+p≈0	
^{50}Fe^i	−26000	10	8477	13	RQ				(6^+)T=2	10					
^{50}Co	−17630#	400#				38.8	ms	0.2	(6^+)	10	96Fa09	J	1987	β^+=100; β^+p=70.5 7; β^+2p ?	
^{50}Co^i	−12746	15	4880#	400#	2p				$(0)^+$T=3	10	07Do17	D		p=100	
^{50}Ni	−4120#	500#				18.5	ms	1.2	0^+	10	07Do17	TD	1994	β^+=100; β^+p=86.7 39; β^+2p ?	*
*^{50}K^m	E : also 12Ka36=172.4(0.5) J : E2 to ground-state														**
*^{50}K^m	T : others recent 12Ka36=138(+50–41) 09Cr03<500 ns; discovered in 99Le68														**
*^{50}V	T : symmetrized from 140(+40–30)														**
*^{50}Cr	T : 03Bi05>1.3Ey 85No03>0.18Ey														**
*^{50}Mn	T : also 13Su07=288(7)														**
*^{50}Ni	T : other 03Ma34=12(+3–2) D : other 03Ma34=70(20)%														**
^{51}Cl	14290#	700#				2#	ms	(>200 ns)	$3/2^+$#	06			1990	β^- ?; β^-n=40#; β^-2n=20#	
^{51}Ar	−6690#	600#				60#	ms	(>200 ns)	$3/2^-$#	06	89Gu03	I	1989	β^- ?; β^-n=40#; β^-2n=10#	
^{51}K	−22516	13				365	ms	5	$3/2^+$	06	14Pa45	J	1983	β^-=100; β^-n=65 6; β^-2n=4#	*
^{51}Ca	−36332.3	0.5				10.0	s	0.8	$(3/2^-)$	06	06Pe16	J	1980	β^-=100; β^-n=3#	
^{51}Sc	−43229	20				12.4	s	0.1	$(7/2)^-$	06			1966	β^-=100; β^-n=0#	
^{51}Ti	−49732.8	0.5				5.76	m	0.01	$3/2^-$	06			1947	β^-=100	
^{51}V	−52203.8	0.4				STABLE			$7/2^-$	06			1924	IS=99.750 4	
^{51}Cr	−51451.4	0.4				27.7010	d	0.0011	$7/2^-$	06			1940	ε=100	
^{51}Cr^i	−44838	5	6613	5	RQ				$7/2^-$T=5/2	06					
… *A*-group is continued on next page …															

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{51}Mn	−48243.9	0.5				46.2	m	0.1	5/2−	06	15Ba49	J	1938	β^+=100	
^{51}Mn^i	−43793.3	1.6	4450.6	1.5	RQ				7/2−T=3/2	06				IT=100	*
^{51}Fe	−40203	9				305.4	ms	2.3	5/2−	06	15Sh16	T	1972	β^+=100	*
^{51}Co	−27340	50				68.8	ms	1.9	7/2−#	06	07Do17	TD	1987	β^+=100; β^+p<3.8	
^{51}Co^i	−20674	18	6670	50	p				7/2−#T=5/2		07Do17	D		p=100	
^{51}Ni	−11900#	500#				23.8	ms	0.2	7/2−#	06	07Do17	TD	1987	β^+=100; β^+p=87.2 8; β^+2p=0.5 2	*

*^{51}K D : average 06Pe16=63(8)% 83La23=68(10)%; other 82Ca04=47(5)% **
*^{51}Mn^i E : NDS916 gives 4450.0(0.6) may be based on mis-interpretation of 86Di01 **
*^{51}Fe T : average 15Sh16=308(5) 13Su07=301(4) 87Ha.B=305(5) 84Ay01=310(5) **
*^{51}Ni D : β^+2p from 12Au08 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{52}Ar	−1280#	600#				10#	ms	(>620 ns)	0+	15			2009	β^- ?; β^-n=30#; β^-2n=7#	
^{52}K	−17140	30				110	ms	4	2−#	15	06Pe16	T	1983	β^-=100; β^-n=74 9; β^-2n=2.3 3	*
^{52}Ca	−34266.3	0.7				4.6	s	0.3	0+	15	83La23	D	1985	β^-=100; β^-n<2	
^{52}Sc	−40440	80				8.2	s	0.2	3(+)	15			1980	β^-=100; β^-n=4#	
^{52}Ti	−49470	7				1.7	m	0.1	0+	15			1966	β^-=100	
^{52}V	−51443.8	0.4				3.743	m	0.005	3+	15			1934	β^-=100	
^{52}Cr	−55419.2	0.3				STABLE			0+	15			1923	IS=83.789 18	
^{52}Cr^i	−44154.3	0.5	11264.9	0.4					3+T=3	15				IT=100	
^{52}Mn	−50707.3	1.8				5.591	d	0.003	6+	15			1938	β^+=100	
^{52}Mn^m	−50329.6	1.8	377.749	0.005		21.1	m	0.2	2+	15			1937	β^+=98.22 5; IT=1.78 5	*
^{52}Mn^i	−47785	5	2922	5	RQ				0+T=2	15				IT=100	
^{52}Fe	−48330	5				8.275	h	0.008	0+	15			1948	β^+=100	*
^{52}Fe^m	−41372	5	6958.0	0.4		45.9	s	0.6	12+	15			1979	β^+≈100; IT=0.021 5	
^{52}Fe^i	−42676	5	5654.5	0.4					6+T=1	15				IT=100	
^{52}Fe^j	−39776	6	8555	8	RQ				0+ frg.T=2	15					*
^{52}Co	−34361	8				111.1	ms	2.3	(6+)	15	16Or08	T	1987	β^+=100; β^+p ?	*
^{52}Co^m	−33974	10	387	13	MD	102	ms	6	2+#		16Or08	T	2016	β^+=100; IT ?; β^+p ?	
^{52}Co^i	−31426	10	2935	13					0+T=2		16Or03	D	2016	IT=75 23; p=?	
^{52}Ni	−22330#	400#				41.8	ms	1.0	0+	15	16Or03	TD	1987	β^+=100; β^+p=31.1 5	*
^{52}Cu	−2280#	600#							3+#		Mirror	I		p ?	

*^{52}K T : average 06Pe16=118(6) 85Hu03=110(30) 83La23=105(5) **
*^{52}Mn^m T : other: 95Ir01=22.7(3.0) for q=25+ (bare ion) **
*^{52}Fe T : other: 95Ir01=12.5(+1.5–1.2) for q=26+ (bare ion) **
*^{52}Fe^j E : probably fragmented, unresolved doublet separated by ≈4 keV **
*^{52}Co T : average 16Or08=112(3) 15Sh16=112(4) 13Su07=103(7) other: 97Ha04=104(11) **
*^{52}Ni T : average 16Or03=42.8(3) 07Do17=40.8(2); other 94Fa06=38(5) **
*^{52}Ni D : other 07Do17=31.4(15) 94Fa06=17.0(14) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{53}Ar	6790#	700#				3#	ms	(>620 ns)	5/2−#	11	09Ta24	I	2009	β^- ?; β^-n=20#; β^-2n=30#	
^{53}K	−12300	110				30	ms	5	(3/2+)	09	06Pe16	JD	1983	β^-=100; β^-n=64 11; β^-2n≈10 5	
^{53}Ca	−29390	40				461	ms	90	3/2−#	14			1983	β^-=100; β^-n=40 10	
^{53}Sc	−38910	90				2.4	s	0.6	(7/2−)	14	10Cr02	TJ	1980	β^-=100; β^-n=0.2#	
^{53}Ti	−46830	100				32.7	s	0.9	(3/2)−	09			1977	β^-=100	
^{53}V	−51851	3				1.543	m	0.014	7/2−	09			1960	β^-=100	
^{53}Cr	−55287.0	0.3				STABLE			3/2−	09			1930	IS=9.501 17	
^{53}Mn	−54690.1	0.5				3.7	My	0.4	7/2−	09	15Ba49	J	1955	ε=100	*
^{53}Mn^i	−47717	4	6974	4	RQ				3/2−T=5/2	09			1976		
^{53}Fe	−50947.5	1.7				8.51	m	0.02	7/2−	09			1938	β^+=100	*
^{53}Fe^m	−47907.1	1.7	3040.4	0.3		2.54	m	0.02	19/2−	09			1967	IT=100	
^{53}Fe^i	−46698	3	4250	3					7/2−T=3/2	09					
^{53}Co	−42659.4	1.7				242	ms	8	7/2−#	09	02Lo13	T	1970	β^+=100	*
^{53}Co^m	−39485.2	1.9	3174.2	0.9	MD	247	ms	12	(19/2−)	09			1970	β^+≈98.5; p≈1.5	*
^{53}Co^i	−38334.4	2.6	4325.0	2.0					(7/2−)T=3/2	09	16Su10	ED	1976	IT≈100; p<0.9 3	
^{53}Ni	−29631	25				55.2	ms	0.7	(7/2−)T=3/2	13	16Su10	D	1976	β^+=100; β^+p=22.7 7	*
^{53}Cu	−13270#	500#				<130 ns			3/2−#	13				p ?	

*^{53}Mn T : 3.74(0.04) My as given in ENSDF2009 is typo **
*^{53}Fe T : other: 95Ir01=8.5(0.3) for q=26+ (bare ion) **
*^{53}Co T : average 02Lo13=240(9) 89Ho13=240(20) 73Ko10=262(25) **
*^{53}Co T : 13Su07=230(17) for which state ? **
*^{53}Co^m D : p≈1.5 from ENSDF'90 **
*^{53}Ni D : average 16Su10=22(1) 07Do17=23.4(1.0); other: 76Vi02≈45 **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{54}K	−5000#	600#				10	ms	5	2^-#	14			1983	β^-=100; β^-n=1#; β^-2n=30#	
^{54}Ca	−25160	50				90	ms	6	0^+	14	08Ma01	TD	1997	β^-=100; β^-n=7#; β^-2n=0#	*
^{54}Sc	−33890	270				526	ms	15	$(3)^+$	14			1990	β^-=100; β^-n=16 9	
^{54}Sc^m	−33780	270	110.5	0.3		2.77	μs	0.02	$(5^+,4^+)$	14	10Cr02	J	1998	IT=100	
^{54}Ti	−45620	80				2.1	s	1.0	0^+	14			1980	β^-=100	
^{54}V	−49893	15				49.8	s	0.5	3^+	14			1970	β^-=100	
^{54}V^m	−49785	15	108.0	1.0		900	ns	500	$(5)^+$	14			1998	IT=100	
^{54}Cr	−56934.8	0.4				STABLE			0^+	14			1930	IS=2.365 7	
^{54}Mn	−55557.6	1.1				312.20	d	0.20	3^+	14			1938	ε=100; β^-=0.93e–4; e$^+$=1.28e–7 25	*
^{54}Mn^i	−49411.5	2.8	6146.2	3.0	RQ				0^+T=3						
^{54}Fe	−56254.5	0.4				STABLE			0^+	14			1923	IS=5.845 35; 2β^+ ?	
^{54}Fe^m	−49727.4	1.2	6527.1	1.1		364	ns	7	10^+	14			1983	IT=100	
^{54}Fe^j	−41386	20	14868	20	RQ				0^+T=3	14					
^{54}Co	−48010.0	0.4				193.28	ms	0.07	0^+T=1	14			1952	β^+=100	
^{54}Co^m	−47812.4	0.4	197.57	0.10	MD	1.48	m	0.02	7^+T=0	14			1962	β^+=100	
^{54}Ni	−39278	5				114.2	ms	0.3	0^+	14			1977	β^+=100; β^+p ?	
^{54}Ni^m	−32821	5	6457.4	0.9		152	ns	4	10^+	14	08Ru09	JD	2008	IT=64 2; p=36 2	
^{54}Cu	−21410#	400#					<75 ns		3^+#	14				p ?	
^{54}Zn	−6270#	400#				1.8	ms	0.5	0^+	14	11As08	TD	2005	2p=87 7	*

*^{54}Ca T : average 10Cr02=107(14) 08Ma01=86(7) **
*^{54}Mn D : e$^+$ average 98Wu01=1.20(0.26)e–7% 97Za07=2.2(0.9)e–7% **
*^{54}Zn T : symmetrized from 11As08=1.59(+0.60–0.35); other 05Bl15=3.2(+1.8–0.8) **
*^{54}Zn D : averaged from 11As08=92(+6–13)% 05Bl15=87(+10–17)% **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{55}K	710#	700#				3#	ms	(>620 ns)	$3/2^+$#	09	09Ta24	I	2009	β^- ?; β^-n=40#; β^-2n=1#	
^{55}Ca	−18350#	300#				22	ms	2	$5/2^-$#	09			1997	β^-=100; β^-n=1#; β^-2n=0.4#	
^{55}Sc	−30160	450				96	ms	2	$(7/2)^-$	08	10Cr02	TJD	1990	β^-=100; β^-n=17 7; β^-2n=0#	*
^{55}Ti	−41670	160				1.3	s	0.1	$(1/2)^-$	10			1980	β^-=100; β^-n=0#	
^{55}V	−49140	100				6.54	s	0.15	$7/2^-$#	08			1977	β^-=100	
^{55}Cr	−55109.7	0.4				3.497	m	0.003	$3/2^-$	08			1952	β^-=100	
^{55}Mn	−57712.4	0.3				STABLE			$5/2^-$	08	15Ba49	J	1923	IS=100.	
^{55}Fe	−57481.3	0.3				2.744	y	0.009	$3/2^-$	09			1939	ε=100	
^{55}Fe^i	−49848	6	7633	6	RQ				$5/2^-$T=5/2	09					
^{55}Co	−54029.9	0.4				17.53	h	0.03	$7/2^-$	09			1938	β^+=100	
^{55}Co^i	−49308.5	0.4	4721.44	0.10					$3/2^-$frg.T=3/2	09			1981	IT=100	*
^{55}Ni	−45335.8	0.7				204.7	ms	1.7	$7/2^-$	08	02Lo13	T	1972	β^+=100	*
^{55}Ni^i	−40736.8	1.2	4599	1					$7/2^-$frg.T=3/2		13Tr09	E			*
^{55}Cu	−31640	160				57	ms	3	$3/2^-$#	08	13Tr09	T	1987	β^+=100; β^+p=15.0 43	*
^{55}Zn	−14570#	400#				19.8	ms	1.3	$5/2^-$#	08	07Do17	TD	2001	β^+=100; β^+p=91.0 51	

*^{55}Sc T : others 04Li75=115(15) 02Sh43=103(7) 98So03=120(40) **
*^{55}Co^i E : strongest frg (spectr. factor 0.45); other 26.69(0.15) higher (sf=0.37) **
*^{55}Ni T : average 02Lo13=196(5) 99Re06=204(3) 87Ha.A=212.1(3.8) 84Ay01=208(5) **
*^{55}Ni T : and 77Ho25=189(5) 76Ed.A=219(6); 97Wo06=204(3) superseded by 99Re06 **
*^{55}Ni J : spectroscopy factor information in 14Sa46 **
*^{55}Ni^i E : strongest frg (total strength 2.0); other 20keV lower (tot.str 0.8) **
*^{55}Cu T : 07Do17 27(8)ms poor statistics D : from 07Do17 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{56}K	7930#	800#				1#	ms	(>620 ns)	2^-#	11	09Ta24	I	2009	β^- ?; β^-n=50#; β^-2n=40#	
^{56}Ca	−13900#	400#				11	ms	2	0^+	11			1997	β^-=100; β^-n=5#; β^-2n=0.2#	
^{56}Sc	−24850	590			*	26	ms	6	(1^+)	11	10Cr02	J	1997	β^-=100; β^-n=10#; β^-2n=0.5#	
^{56}Sc^m	−24850#	600#	0#	100#	*	75	ms	6	$(6^+,5^+)$	11	10Cr02	J	2004	β^-=100; β^-n>14 2; β^-2n=0.5#	
^{56}Sc^n	−24080	590	774.9	0.3		290	ns	30	(4^+)	11			2004	IT=100	*
^{56}Ti	−39320	120				200	ms	5	0^+	11	98Am04	D	1980	β^-=100; β^-n=0.1#	
^{56}V	−46150	180				216	ms	4	(1^+)	11	98Am04	D	1980	β^-=100; β^-n=0#	
^{56}Cr	−55285.0	0.6				5.94	m	0.10	0^+	11	60Dr03	D	1960	β^-=100	
^{56}Mn	−56911.5	0.3				2.5789	h	0.0001	3^+	11			1934	β^-=100	
^{56}Fe	−60607.1	0.3				STABLE			0^+	11			1923	IS=91.754 36	
^{56}Fe^i	−49103.4	0.4	11503.7	0.3					3^+T=3	11					
^{56}Co	−56040.4	0.5				77.236	d	0.026	4^+	11			1941	β^+=100	
^{56}Co^i	−52448	9	3593	9	RQ				(0^+)frg.T=2	11					*
^{56}Ni	−53907.5	0.4				6.075	d	0.010	0^+	11			1952	β^+=100	
^{56}Ni^i	−47475.6	0.8	6431.9	0.7					4^+T=1	11					
^{56}Ni^j	−43964	4	9944	4	RQ				0^+frg.T=2						*
^{56}Cu	−38643	15				93	ms	3	(4^+)	11	01Bo54	TJD	1987	β^+=100; β^+p=0.40 12	
^{56}Cu^i	−35099	10	3544	18	p				T=2		16Or03	D	2007	IT=56 6; p=46 6	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{56}Zn	−25390#	400#				32.9	ms	0.8	0^+	11	14Or04	TD	2001	β^+=100; β^+p=88.0 23	*
^{56}Zn^{i}	−21530#	650#	3860#	510#					3^+#T=3					p ?	
^{56}Ga	−3390#	500#							3^+#					p ?	
*^{56}Sc^{n}	T : other 12Ka36=350(+260–120)														**
*^{56}Co^{i}	E : strongest frg (cross section 115); other 70(9) keV lower (xs=55)														**
*^{56}Ni^{j}	E : strongest frg; others 68(6) and 98(6) keV higher														**
*^{56}Zn	T : other 07Do17=30.0(1.7)														**
*^{56}Zn	D : average 14Or04=88.5(26) 07Do17=86.0(49)														**
^{57}Ca	−6870#	400#				5#	ms	(>620 ns)	$5/2^-$#	10	09Ta24	I	2009	β^- ?; β^-n=20#; β^-2n=2#	
^{57}Sc	−21000	1300				22	ms	2	$7/2^-$#	10	10Cr02	T	1997	β^-=100; β^-n=30#; β^-2n=1#	*
^{57}Ti	−33920	260				95	ms	8	$5/2^-$#	10	99So20	T	1985	β^-=100; β^-n=0.04#	*
^{57}V	−44410	80				350	ms	10	$(7/2^-)$	10	03Ma02	T	1980	β^-=100; β^-n=0.4#	*
^{57}Cr	−52524.7	1.1				21.1	s	1.0	$(3/2)^-$	10			1978	β^-=100	
^{57}Mn	−57486.3	1.5				85.4	s	1.8	$5/2^-$	98	15Ba49	J	1954	β^-=100	
^{57}Fe	−60181.8	0.3				STABLE			$1/2^-$	98			1935	IS=2.119 10	
^{57}Co	−59345.6	0.5				271.70	d	0.10	$7/2^-$	98	14Un01	T	1941	ε=100	*
^{57}Co^{i}	−52092.3	0.4	7253.3	0.6	RQ				$1/2^-$T=5/2		MMC120	J			
^{57}Ni	−56083.8	0.6				35.60	h	0.06	$3/2^-$	98			1938	β^+=100	
^{57}Ni^{i}	−50845.0	0.9	5238.8	0.7					$7/2^-$frg.T=3/2	98					*
^{57}Cu	−47308.9	0.5				196.3	ms	0.7	$3/2^-$	98			1976	β^+=100	
^{57}Cu^{i}	−42010	25	5299	25	p				$7/2^-$T=3/2						
^{57}Zn	−32550#	200#				38	ms	4	$7/2^-$#	98	02Lo13	T	1976	β^+=100; β^+p≈65	*
^{57}Ga	−15010#	400#							$1/2^-$#					p ?	
*^{57}Sc	T : other 03So21=13(4)														**
*^{57}Ti	T : average 05Li53=98(5) 99So20=67(25) 96Do23=56(20)														**
*^{57}Ti	T : 98Am04=180(30) conflicting, not used														**
*^{57}V	J : 98So03 proposed $3/2^-$, supported in 03Ma02; same group 05Li53 favors $7/2^-$														**
*^{57}Co	T : average 14Un01=271.87(0.44) (supersedes 92Un01=272.11(0.26)),														**
*^{57}Co	T : 12Da06=271.82(0.17) 97Ma75=271.68(0.27) 83Wa26=271.84(0.27)														**
*^{57}Co	T : 81Va11=270.90(0.27) 80Ho17=271.77(0.27) 72La14=271.23(0.21)														**
*^{57}Co	T : 65An07=271.65(0.13); original unc of 97Ma75=0.09 83Wa26=0.04														**
*^{57}Co	T : 81Va11=0.09 80Ho17=0.05 increased to 0.1% by evaluator														**
*^{57}Ni^{i}	E : strongest frg; 79Ik04 others 98(7)keV lower(5.5%) 128(7)keV higher(10.0%)														**
*^{57}Ni^{i}	E : strongest frg; 78Na11 others 104(5)keV lower, 129(5)keV higher														**
*^{57}Zn	T : average 02Lo13=37(5) 76Vi02=40(10)														**
^{58}Ca	−1920#	500#				3#	ms	(>620 ns)	0^+	10			2009	β^- ?; β^-n=2#; β^-2n=4#	
^{58}Sc	−14880#	400#				12	ms	5	3^+#	10			1997	β^-=100; β^-n=20#; β^-2n=1#	
^{58}Ti	−31110#	200#				55	ms	6	0^+	14	11Da08	T	1992	β^-=100; β^-n=1#	*
^{58}V	−40400	90				191	ms	10	(1^+)	10			1980	β^-=100; β^-n=0.8#	
^{58}Cr	−51991.8	1.5				7.0	s	0.3	0^+	10			1980	β^-=100	
^{58}Mn	−55827.6	2.7				3.0	s	0.1	1^+	10			1961	β^-=100	
^{58}Mn^{m}	−55755.8	2.7	71.77	0.05		65.4	s	0.5	4^+	10			1961	β^-=?; IT=20#	
^{58}Fe	−62155.1	0.3				STABLE			0^+	10			1935	IS=0.282 4	
^{58}Co	−59847.2	1.2				70.86	d	0.06	2^+	10			1941	β^+=100	
^{58}Co^{m}	−59822.3	1.2	24.95	0.06		9.10	h	0.09	5^+	10			1950	IT=100	
^{58}Co^{n}	−59794.1	1.2	53.15	0.07		10.5	μs	0.3	4^+	10			1964	IT=100	
^{58}Co^{i}	−54095	8	5752	8	RQ				0^+frg.T=3	10					*
^{58}Ni	−60228.7	0.4				STABLE		(>700 Ey)	0^+	10			1921	IS=68.077 19; 2β^+ ?	*
^{58}Ni^{i}	−51400	40	8830	40	RQ				2^+T=2	10					
^{58}Ni^{j}	−45690	7	14539	7	RQ				0^+T=3	10	MMC12	J			
^{58}Cu	−51667.7	0.6				3.204	s	0.007	1^+T=0	10			1952	β^+=100	
^{58}Cu^{i}	−51464.7	0.6	202.99	0.24					0^+T=1	10					
^{58}Zn	−42300	50				86.7	ms	2.4	0^+	14			1986	β^+=100; β^+p<3	
^{58}Ga	−23540#	300#			*				2^+#		Mirror	I		p ?	
^{58}Ga^{m}	−23510#	320#	30#	100#	*				5^+#		Mirror	I		p ?	
^{58}Ge	−7080#	500#							0^+		Mirror	I		2p ?	
*^{58}Ti	T : average 11Da08=57(10) 03So21=59(9) 99So20=47(10)														**
*^{58}Co^{i}	E : strongest fragment (cross section 98); other 20(8) keV lower (xs=90)														**
*^{58}Ni	T : >400 Ey to 2^+ level of ^{58}Fe, >700 Ey to ground-state														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{59}Sc	−10300#	400#				10#	ms	(>620 ns)	7/2−#	09	09Ta24	I	2009	β^- ?; β^-n=50#; β^-2n=1#	
^{59}Ti	−25510#	200#				28.5	ms	1.9	5/2−#	02	11Da08	T	1997	β^-=100; β^-n=0.3#; β^-2n=0.01#	*
^{59}Ti^m	−25400#	200#	109.0	0.5		590	ns	50	(1/2−)		12Ka36	ETJ	2012	IT=100	*
^{59}V	−37830	160				95	ms	6	(5/2−)	02	05Li53	TJ	1985	β^-=100; β^-n=6#	*
^{59}Cr	−48090	220				1050	ms	90	(1/2−)	02	05Li53	TJ	1980	β^-=100	*
^{59}Cr^m	−47590	220	503.0	1.7		96	μs	20	(9/2+)	02			1998	IT=100	
^{59}Mn	−55525.3	2.3				4.59	s	0.05	5/2−	02	15Ba49	J	1976	β^-=100	
^{59}Fe	−60664.8	0.4				44.495	d	0.009	3/2−	02			1938	β^-=100	
^{59}Co	−62229.7	0.4				STABLE			7/2−	02			1923	IS=100.	
^{59}Ni	−61156.7	0.4				81	ky	5	3/2−	02	94Ru19	T	1951	β^+=100	*
^{59}Ni^i	−53814.8	2.1	7341.9	2.1	RQ				7/2− frg.T=5/2						*
^{59}Cu	−56358.3	0.5				81.5	s	0.5	3/2−	02			1947	β^+=100	
^{59}Cu^i	−52472.8	2.2	3885.5	2.1					3/2− frg.T=3/2	02				IT=100	*
^{59}Zn	−47215.6	0.8				182.0	ms	1.8	3/2−	15			1981	β^+=100; β^+p=0.10 3	
^{59}Ga	−33760#	170#						<43 ns	3/2−#	15				p ?	
^{59}Ge	−15870#	400#				8#	ms	(>620 ns)	7/2−#	15	15Ci06	IT	2015	β^+ ?	

*^{59}Ti T : average 11Da08=27.5(2.5) 03So21=30(3); other 99So20=58(17) **
*^{59}Ti^m T : symmetrized from 587(+57–51) **
*^{59}V T : average 05Li53=97(2) 99So20=75(7) (supersedes 98So03=70(40)) **
*^{59}V T : 98Am04=130(20) conflicting, not used **
*^{59}Cr T : others 96Do23=460(50), 88Bo06=600(300), 85Bo49=1000(400) **
*^{59}Ni T : average 94Ru19=108(13) 94Ru19(meteorite)=120(22) 81Ni08=76(5) **
*^{59}Ni^i E : strongest frg(100%); 3 others 40.1(0.3)keV higher (0.140%), 17.7(0.3)keV **
*^{59}Ni^i E : higher (0.122%) and 36.3(0.2)keV lower (0.110%) **
*^{59}Cu^i E : 76Ga19 strongest fragment (sp.factor 0.6); other 21(6) (sf 0.4) higher **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{60}Sc	−4050#	500#				3#	ms	(>620 ns)	3+#		09Ta24	I	2009	β^- ?; β^-n=0.4#; β^-2n=50#	
^{60}Ti	−22330#	300#				22.2	ms	1.6	0+	14	11Da08	T	1997	β^-=100; β^-n=2#; β^-2n=0#	*
^{60}V	−33240	220			*	122	ms	18	3+#	13			1985	β^-=100; β^-n=5#; β^-2n=0.03#	
^{60}V^m	−33240#	270#	0#	150#	*	40	ms	15	1+#	13			1999	β^-=?; IT ?; β^-n=5#; β^-2n=0.03#	
^{60}V^n	−33040	220	203.7	0.7		230	ns	24	(4+)	13	12Ka36	ET	1999	IT=100	*
^{60}Cr	−46670	190				490	ms	10	0+	13			1980	β^-=100; β^-n=0#	
^{60}Mn	−52967.9	2.3				280	ms	20	1+	13			1978	β^-=100	
^{60}Mn^m	−52696.0	2.3	271.90	0.10		1.77	s	0.02	4+	13			1978	β^-=88.5 8; IT=11.5 8	*
^{60}Fe	−61413	3				2.62	My	0.04	0+	13			1957	β^-=100	*
^{60}Co	−61650.3	0.4				5.2712	y	0.0004	5+	13			1941	β^-=100	
^{60}Co^m	−61591.7	0.4	58.59	0.01		10.467	m	0.006	2+	13			1963	IT≈100; β^-=0.25 3	
^{60}Ni	−64473.1	0.4				STABLE			0+	13			1921	IS=26.223 15	
^{60}Ni^i	−53347	4	11126	4	RQ				5+ T=3						
^{60}Cu	−58345.1	1.6				23.7	m	0.4	2+	13			1947	β^+=100	
^{60}Cu^i	−55804	5	2541	5	RQ				(0+) T=2	13				IT=100	
^{60}Zn	−54174.3	0.6				2.38	m	0.05	0+	13			1955	β^+=100	
^{60}Zn^i	−49322.1	0.9	4852.2	0.7					(2+) T=1	13				IT=100	
^{60}Zn^j	−46807	24	7367	24	RQ				0+ T=2	13					
^{60}Ga	−39590#	200#				70	ms	10	(2+)	13	01Ma96	TJ	1995	β^+=100; β^+p=1.6 7; $\beta^+\alpha$<0.023 20	*
^{60}Ga^i	−37050#	210#	2540#	50#											
^{60}Ge	−27090#	300#				30#	ms	(>110 ns)	0+	13			2005	β^+ ?; β^+p ?	
^{60}As	−5470#	400#							5+#		Mirror	I		p ?	
^{60}As^m	−5410#	400#	60#	20#					2+#		Mirror	I		p ?	

*^{60}Ti T : average 11Da08=22.4(2.5) 03So21=22(2) **
*^{60}V^n E : 12Ka36=99.7(0.5) and 104.0(0.5) γ rays in cascade to ground-state **
*^{60}V^n T : symmetrized from 12Ka36=229(+25–23); others 10Da06=320(90) 99Da.A=320(90) **
*^{60}Mn^m I : also an isomer T=1.0(+0.3–0.2) μs decay by 114 keV γ-rays to ground-state or ^{60}Mn^m **
*^{60}Fe T : 15Wa06=2.50(0.12) confirms 09Ru08=2.62(0.04), rules out 84Ku28=1.49(27) **
*^{60}Fe T : and 57Ro54=0.3 **
*^{60}Ga T : average 02Lo13=70(13) 01Ma96=70(15) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{61}Sc	930#	600#				2#	ms	(>620 ns)	7/2−#	15			2009	β^- ?; β^-n=60#; β^-2n=1#	
^{61}Ti	−16350#	400#				15	ms	4	1/2−#	15			1997	β^-=100; β^-n=1#; β^-2n=1#	
^{61}V	−30510	890				48.2	ms	0.8	(3/2−,5/2−)	15			1992	β^-=100; β^-n>10; β^-2n=0.01#	
^{61}Cr	−42480	100				243	ms	9	(5/2−)	15	09Cr02	T	1985	β^-=100; β^-n=0.6#	
^{61}Mn	−51742.1	2.3				709	ms	8	5/2−	15	15Ba49	J	1980	β^-=100; β^-n=0.6#	*
^{61}Fe	−58920.5	2.6				5.98	m	0.06	(3/2−)	15			1957	β^-=100	
^{61}Fe^m	−58058.8	2.6	861.67	0.11		238	ns	5	9/2+	15			1998	IT=100	
^{61}Co	−62898.1	0.8				1.649	h	0.005	7/2−	15			1947	β^-=100	
^{61}Ni	−64221.9	0.4				STABLE			3/2−	15			1934	IS=1.1399 13	
^{61}Cu	−61984.1	1.0				3.339	h	0.008	3/2−	15	10Vi07	J	1937	β^+=100	*
^{61}Cu^i	−55610	7	6374	7	RQ				3/2− frg.T=5/2						*
^{61}Zn	−56349	16				89.1	s	0.2	3/2−	15			1955	β^+=100	
^{61}Zn^i	−53190#	100#	3160#	100#					3/2−# T=3/2						
^{61}Zn^j	−46360	70	9990	70					3/2− T=5/2	15					

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{61}Ga	−47130	40					167	ms	3	3/2−	15			1987	β^+=100; β^+p<0.25	
^{61}Ga^m	−47040#	110#	90#	100#						1/2−#		Mirror	I			
^{61}Ga^i	−43780	30	3360	50	p					(3/2−)T=3/2	15			1987	p=100	
^{61}Ge	−33360#	300#					44	ms	6	3/2−#	15			1987	β^+=100; β^+p>62	
^{61}As	−16900#	300#								3/2−#		Mirror	I		p ?	
*^{61}Mn	D : β^-n has been observed by 99Ha05; 13Ra17 quotes β^-n=0.6(0.1)% unpubl.															**
*^{61}Cu	J : directly measured in 10Vi07															**
*^{61}Cu^i	E : strongest frg (xs=55); other 18(7) keV higher (xs=35)															**
^{62}Ti	−12500#	400#					10#	ms	(>620 ns)	0+	12			2009	β^- ?; β^-n=4#; β^-2n=0.1#	
^{62}V	−25480#	300#					33.6	ms	2.3	3+#	12			1997	β^-=100; β^-n=20#; β^-2n=0.5#	
^{62}Cr	−40890	150					206	ms	12	0+	12			1985	β^-=100; β^-n=1#	
^{62}Mn	−48524	7				*	92	ms	13	1+	12	15He28	J	1983	β^-=100; β^-n=0.03#	*
^{62}Mn^m	−48181.0	2.6	343	6		*	671	ms	5	4+	12	15He28	J	1983	β^-=100; β^-n=0.03#; IT ?	
^{62}Fe	−58878.0	2.8					68	s	2	0+	12			1975	β^-=100	
^{62}Co	−61424	19					1.54	m	0.10	(2)+	12			1949	β^-=100	
^{62}Co^m	−61402	20	22	5			13.86	m	0.09	(5)+	12			1957	β^->99; IT<1	
^{62}Ni	−66746.3	0.4					STABLE			0+	12			1934	IS=3.6346 40	
^{62}Cu	−62787.4	0.6					9.67	m	0.03	1+	12	10Vi07	J	1936	β^+=100	*
^{62}Cu^i	−58174	6	4614	6	RQ					(0)+T=3	12					*
^{62}Zn	−61168.0	0.6					9.193	h	0.015	0+	12			1948	β^+=100	
^{62}Ga	−51986.9	0.6					116.121	ms	0.021	0+T=1	12			1978	β^+=100	*
^{62}Ga^j	−51415.7	0.6	571.2	0.1						1(+)T=2	12	98Vi06	EJ	1998	IT=100	
^{62}Ge	−41740#	140#					129	ms	35	0+	12			1991	β^+=100; β^+p ?	
^{62}As	−24320#	300#								1+#					p=100#	*
*^{62}Mn	D : β^-n 99So20≈0 99Ha05>0															**
*^{62}Cu	J : directly measured in 10Vi07															**
*^{62}Cu^i	E : ENSDF=4628(10)															**
*^{62}Ga	T : also 13Da16=116.15(0.13) no weight															**
*^{62}As	D : most probably p-unstable from estimated S_p=–1860#(420#) keV															**
^{63}Ti	−5750#	500#					3#	ms	(>620 ns)	1/2−#	09	09Ta24	I	2009	β^- ?; β^-n=7#; β^-2n=4#	
^{63}V	−21890#	400#					19.6	ms	0.9	(3/2−,5/2−)	09	14Su07	TJ	1997	β^-=100; β^-n>35; β^-2n=0.2#	*
^{63}Cr	−36010	360					129	ms	2	1/2−#	09			1992	β^-=100; β^-n=1#	*
^{63}Mn	−46887	4					275	ms	4	5/2−	09	15Ba49	J	1985	β^-=100; β^-n=0.2#	*
^{63}Fe	−55636	4					6.1	s	0.6	(5/2−)	09			1980	β^-=100	
^{63}Co	−61851	19					26.9	s	0.4	7/2−	09	94It.A	T	1960	β^-=100	*
^{63}Ni	−65512.8	0.4					101.2	y	1.5	1/2−	09			1951	β^-=100	
^{63}Ni^m	−65425.7	0.4	87.15	0.11			1.67	μs	0.03	5/2−	09			1978	IT=100	
^{63}Cu	−65579.8	0.4					STABLE			3/2−	09	10Vi07	J	1923	IS=69.15 15	*
^{63}Zn	−62213.4	1.6					38.47	m	0.05	3/2−	09			1937	β^+=100	
^{63}Zn^i	−56723	6	5490	6	RQ					3/2−T=5/2	09					
^{63}Ga	−56547.1	1.3					32.4	s	0.5	3/2(−)	09	12Pr11	J	1965	β^+=100	
^{63}Ge	−46920	40					142	ms	8	3/2−#	09	02Lo13	TD	1991	β^+=100; β^+p ?	*
^{63}As	−33500#	200#							<43 ns	3/2−#	09				p=100#	*
*^{63}V	T : average 14Su07=20(1) 11Da08=19.2(2.4) 03So02=17(3)															**
*^{63}Cr	T : other 11Da08=128(8)															**
*^{63}Mn	D : β^-n has been observed by 99Ha05 but not quantified															**
*^{63}Co	T : average 94It.A=26.41(0.27) 72Jo08=27.5(0.3) 69Wa15=26(1)															**
*^{63}Cu	J : directly measured in 10Vi07															**
*^{63}Ge	T : average 02Lo13=150(9) 93Wi03=95(+23–20)															**
*^{63}As	D : most probably p-unstable from estimated S_p=–980#(240#) keV															**
^{64}Ti	−1030#	600#					4#	ms	(>620 ns)	0+	13			2013	β^- ?; β^-n=90#; β^-2n=2#	
^{64}V	−16320#	400#					15	ms	2	(1,2)	14			1997	β^-=100; β^-n=30#; β^-2n=4#	
^{64}V^m	−16240#	400#	81.0	0.7			< 1	μs			14			2014	IT≈100	
^{64}Cr	−33480	440					43	ms	1	0+	14			1992	β^-=100; β^-n=2#	
^{64}Mn	−42989	4					88.8	ms	2.4	1+	07	11Da08	T	1985	β^-=100; β^-n=33 2	*
^{64}Mn^m	−42815	4	174.1	0.5			439	μs	31	(4+)	07	10Da06	E	1998	IT=100	*
^{64}Fe	−54970	5					2.0	s	0.2	0+	07			1980	β^-=100	
^{64}Co	−59792	20					300	ms	30	1+	07			1969	β^-=100	
^{64}Co^m	−59686	4	107	20	MD		300#	ms		5+#		08Bl05	E	2008	β^- ?; IT ?	
^{64}Ni	−67098.9	0.5					STABLE			0+	07			1935	IS=0.9255 19	
^{64}Cu	−65424.5	0.4					12.7004	h	0.0020	1+	07	12Be04	TD	1936	β^+=61.52 26; β^-=38.48 26	*
^{64}Cu^i	−58599	6	6826	6						0+frg.T=4	07	71Be29	E			*
^{64}Zn	−66004.0	0.6					STABLE		(>8.9 Ey)	0+	07			1922	IS=49.17 75; 2β^+ ?	
… *A*-group is continued on next page …																

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...															
^{64}Ga	−58832.8	1.4				2.627	m	0.012	$0^{(+\#)}$	07			1953	β^+=100	
^{64}Ga^m	−58790.0	1.4	42.85	0.08		21.9	μs	0.7	(2^+)	07			1999	IT=100	
^{64}Ga^i	−56925.8	2.5	1907.0	2.2	RQ				(0^+)T=2	07					
^{64}Ge	−54315	4				63.7	s	2.5	0^+	07			1972	β^+=100	
^{64}As	−39530#	200#				40	ms	30	0^+#	07			1995	β^+=100; β^+p ?	*
^{64}Se	−26700#	500#				30#	ms	(>180 ns)	0^+	07			2005	β^+ ?; β^+p ?	

*^{64}Mn T : average 11Da08=90(9) 02So.A=91(4) 99So20=85(5) 99Ha05=89(4) **
*^{64}Mn J : 15He28=1^+ **
*^{64}Mn^m T : average 11Li50=400(40) 05Ga.B=500(50) **
*^{64}Cu J : directly measured in 10Vi07 **
*^{64}Cu^i E : strongest fragment (xs=100); other 16 keV lower (xs=37) **
*^{64}As T : symmetrized from 18(+43–7) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{65}V	−11780#	500#				10#	ms	(>620 ns)	$5/2^-$#	10	09Ta24	I	2009	β^- ?; β^-n=40#; β^-2n=1#	
^{65}Cr	−28220#	300#				27.5	ms	2.1	$1/2^-$#	10	11Da08	T	1997	β^-=100; β^-n=5#; β^-2n=0.3#	*
^{65}Mn	−40967	4				91.9	ms	0.7	$(5/2^-)$	10	13Ol06	TJ	1985	β^-=100; β^-n=7#	*
^{65}Fe	−51218	5				810	ms	50	$(1/2^-)$	10	13Ol06	D	1980	β^-=100; β^-n=7.9 12	*
^{65}Fe^m	−50824	5	393.7	0.2		1.12	s	0.15	$(9/2^+)$	10	13Ol06	E	2008	β^- ?	
^{65}Fe^n	−50820	5	397.6	0.2		420	ns	13	$(5/2^+)$	10	13Ol06	EJ	1998	IT=100	*
^{65}Co	−59185.2	2.1				1.16	s	0.03	$(7/2)^-$	10			1978	β^-=100	
^{65}Ni	−65125.7	0.5				2.5175	h	0.0005	$5/2^-$	10			1946	β^-=100	
^{65}Ni^m	−65062.3	0.5	63.37	0.05		69	μs	3	$1/2^-$	10			1978	IT=100	
^{65}Cu	−67263.7	0.6				STABLE			$3/2^-$	10	10Vi07	J	1923	IS=30.85 15	*
^{65}Zn	−65912.0	0.6				243.93	d	0.09	$5/2^-$	10			1939	β^+=100	
^{65}Zn^m	−65858.1	0.6	53.928	0.010		1.6	μs	0.6	$1/2^-$	10	FGK149	J		IT=100	*
^{65}Ga	−62657.5	0.8				15.2	m	0.2	$3/2^-$	10			1938	β^+=100	
^{65}Ge	−56478.2	2.2				30.9	s	0.5	$3/2^-$	10			1972	β^+=100; β^+p=0.011 3	
^{65}As	−46940	80				170	ms	30	$3/2^-$#	10	02Lo13	T	1991	β^+=100; β^+p ?	*
^{65}As^i	−43451	17	3490	90	p				$(3/2^-)$T=3/2	10	11Ro47	J	1993	p=100	*
^{65}Se	−33020#	300#				33	ms	4	$3/2^-$#	10	11Ro47	T	1993	β^+=100; β^+p=?	

*^{65}Cr T : average 11Da08=28(3) 03So21=27(3) **
*^{65}Mn T : average 13Ol06=91.9(0.9) 03So21=92(1) **
*^{65}Mn T : other recent 11Da08=84(8), outweighed, not used **
*^{65}Mn D : β^-n has been observed by 99Ha05 but not quantified **
*^{65}Fe J : 09Pa16=$(1/2^-)$ **
*^{65}Fe^n E : also 10Da06=396.8 uncertainty not given T : 10Da06=420(13) **
*^{65}Cu J : directly measured in 10Vi07 **
*^{65}Zn^m J : E2 to ground-state $(5/2^-)$ and M1 from $3/2^-$ **
*^{65}As T : average 02Lo13=126(16) 95Mo26=190(11) with Birge ratio *B*=3.3 **
*^{65}As^i J : IAS studied in 93Ba12 and 11Ro47 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{66}V	−5610#	500#				5#	ms	(>620 ns)		10	09Ta24	I	2009	β^- ?; β^-n=20#; β^-2n=40#	
^{66}Cr	−24720#	400#				23.8	ms	1.8	0^+	15	11Li50	T	1997	β^-=100; β^-n=7#; β^-2n=0#	*
^{66}Mn	−36750	11				64.2	ms	0.8	(1^+)	10	11Pa.A	TD	1992	β^-=100; β^-n=8.4 9; β^-2n=0.2#	*
^{66}Mn^m	−36286	11	464.5	0.4		780	μs	40	(5^-)		11Li50	ETJ	2005	IT≈100; β^- ?	*
^{66}Fe	−50068	4				351	ms	6	0^+	10	12Li02	T	1985	β^-=100; β^-n=0#	
^{66}Co	−56409	14				194	ms	17	(1^+)	10	12Li02	J	1985	β^-=100; β^-n=0#	
^{66}Co^m	−56234	14	175.1	0.3		1.21	μs	0.01	(3^+)	10	12Li02	EJ	1998	IT=100	
^{66}Co^n	−55767	15	642	5		> 100	μs		(8^-)	10	98Gr14	E	1998	IT=100	
^{66}Ni	−66006.3	1.4				54.6	h	0.3	0^+	10			1948	β^-=100	
^{66}Cu	−66258.3	0.7				5.120	m	0.014	1^+	10	10Vi07	J	1937	β^-=100	*
^{66}Cu^m	−65104.1	1.6	1154.2	1.4		600	ns	17	$(6)^-$	10	11Lo01	T	1972	IT=100	*
^{66}Zn	−68899.2	0.7				STABLE			0^+	10			1922	IS=27.73 98	
^{66}Ga	−63723.7	1.1				9.304	h	0.008	0^+	10	10Se16	T	1937	β^+=100	*
^{66}Ga^i	−59874	6	3850	6	RQ				0^+T=3						
^{66}Ge	−61607.0	2.4				2.26	h	0.05	0^+	10			1950	β^+=100	
^{66}As	−52025	6				95.77	ms	0.23	0^+T=1	10	MMC156	J	1978	β^+=100	*
^{66}As^m	−50668	6	1356.63	0.17		1.14	μs	0.04	5^+	10	13Ru10	TJ	1995	IT=100	*
^{66}As^n	−49001	6	3023.8	0.3		7.98	μs	0.26	9^+	10	13Ru10	TJ	1998	IT=100	*
^{66}Se	−41660#	200#				33	ms	12	0^+	10	02Lo13	TD	1993	β^+=100; β^+p ?	

*^{66}Cr T : average 11Li50=24(2) 11Da08=23(4); other 05Ga01=10(6) outweighed **
*^{66}Mn J : 11Li50=(1^+) due to large ground-state feeding from ^{66}Cr **
*^{66}Mn^m E : other 05Ga.B=294 + 170 keV T : other 05Ga.B=750(250) **
*^{66}Cu J : directly measured in 10Vi07 **
*^{66}Cu^m T : average 11Lo01=601(30) 72Bl16=600(20) **
*^{66}Ga T : other 12Gy01=9.312(0.032) not used; ENSDF=9.49(0.03) **
*^{66}As J : 0^+ since super-allowed β^-decay; see also 98Gr12 **
*^{66}As^m T : average 13Ru10=1.15(0.04) 01Gr07=1.1(0.1) **
*^{66}As^n T : average 13Ru10=7.9(0.3) 01Gr07=8.2(0.5) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{67}V	−650#	600#				2#	ms	(>620 ns)	$5/2^-$#	13			2013	β^- ?; β^-n=60#; β^-2n=3#	
^{67}Cr	−18680#	400#				10#	ms	(>300 ns)	$1/2^-$#	05	97Be70	I	1997	β^- ?; β^-n=10#; β^-2n=1#	
^{67}Mn	−33460#	300#				46.7	ms	2.3	$5/2^-$#	05	11Da08	TD	1997	β^-=100; β^-n=10 5; β^-2n=0.01#	*
^{67}Fe	−45610	270				394	ms	9	$(1/2^-)$	05	02So.A	TD	1985	β^-=100; β^-n=1#	*
^{67}Fe^m	−45210	270	402	9		64	μs	17	$(5/2^+,7/2^+)$	05	11Da08	EJ	1998	IT=100	*
^{67}Fe^n	−45160#	290#	450#	100#		75	μs	21	$(9/2^+)$		08Bl05	TJ	2008	IT=100	
^{67}Co	−55322	6				329	ms	28	$(7/2^-)$	05	08Pa33	TJ	1985	β^-=100; β^-n=0.04#	
^{67}Co^m	−54830	6	491.6	1.0		496	ms	33	$(1/2^-)$		09Pa16	E	2008	IT>80; β^- ?	*
^{67}Ni	−63742.7	2.9				21	s	1	$1/2^-$	05	00Ri14	J	1978	β^-=100	
^{67}Ni^m	−62736.1	2.9	1006.6	0.2		13.34	μs	0.19	$9/2^+$	05	14Di08	ETJ	1998	IT=100	*
^{67}Cu	−67319.5	0.9				61.83	h	0.12	$3/2^-$	05			1948	β^-=100	
^{67}Zn	−67880.3	0.8				STABLE			$5/2^-$	05			1928	IS=4.04 16	
^{67}Zn^m	−67787.0	0.8	93.312	0.005		9.19	μs	0.06	$1/2^-$	05	15Ch57	T	1972	IT=100	*
^{67}Zn^n	−67275.8	0.8	604.48	0.05		333	ns	14	$9/2^+$	05			1973	IT=100	
^{67}Ga	−66879.0	1.2				3.2617	d	0.0005	$3/2^-$	05			1938	ε=100	
^{67}Ge	−62658	5				18.9	m	0.3	$1/2^-$	05			1950	β^+=100	
^{67}Ge^m	−62640	5	18.20	0.05		13.7	μs	0.9	$5/2^-$	05			1978	IT=100	
^{67}Ge^n	−61906	5	751.70	0.06		109.1	ns	3.8	$9/2^+$	05	00Ch07	T	1973	IT=100	*
^{67}As	−56587.2	0.4				42.5	s	1.2	$(5/2^-)$	05			1980	β^+=100	
^{67}Se	−46580	70				133	ms	11	$5/2^-$#	05	95Bl23	T	1991	β^+=100; β^+p=0.5 1	*
^{67}Br	−32790#	400#							$1/2^-$#					p ?	

*^{67}Mn T : average 11Da08=51(4) 03So21=47(4) 99Ha05=42(4) **
*^{67}Fe T : others recent 11Da08=304(81) 08Pa33=416(29), outweighed, not used **
*^{67}Fe^m T : average 03Sa02=75(21) 98Gr14=43(30), same authors, different experiment **
*^{67}Fe^m E : less than 30 keV above 387.7 level **
*^{67}Co^m E : 09Pa16=491.55(0.11) γ ray; 08Pa33=491.6(1.0) D : from 08Pa33 **
*^{67}Ni^m T : average 14Di08=13.7(0.6) 98Gr14=13.3(0.2); other 02Ge16=13(1) **
*^{67}Zn^m T : unweighed average 15Ch57=9.37(0.04) 98At04=9.34(0.20) 96Hw03=9.01(0.03) **
*^{67}Zn^m T : 75Ro25=9.1(0.4) 73Le18=9.20(0.07) 72Le37=9.15(0.05) **
*^{67}Ge^n T : average 00Ch07=101(3) 79Al04=110.9(1.4); Birge ratio B=2.99 **
*^{67}Se T : average 02Lo13=136(12) 94Ba50=107(35) **
*^{67}Se T : values from 95Bl23 for ^{67}Se=60(+17−11) and ^{71}Kr questioned in 97Oi01 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{68}Cr	−14800#	500#				5#	ms	(>620 ns)	0^+	12	09Ta24	I	2009	β^- ?; β^-n=10#; β^-2n=0.1#	
^{68}Mn	−28380#	400#				33.7	ms	1.5	> 3	12	15Be32	T	1995	β^-=100; β^-n=10#; β^-2n=2#	*
^{68}Fe	−43490	370				188	ms	4	0^+	12			1985	β^-=100; β^-n>0	
^{68}Co	−51930	190			*	200	ms	20	(7^-)	12			1985	β^-=100; β^-n=1#	
^{68}Co^m	−51780#	240#	150#	150#	*	1.6	s	0.3	(1^+)	12			1998	β^-=100	
^{68}Co^n	−51740#	240#	195#	150#	*	101	ns	10	$(0,1)$	12	10Da06	T	2010	IT=100	*
^{68}Ni	−63463.8	3.0				29	s	2	0^+	12			1977	β^-=100	
^{68}Ni^m	−61860	3	1603.52	0.27		270	ns	5	0^+	12	15Fl01	E		4.IT=100	*
^{68}Ni^n	−60615	3	2849.1	0.3		850	μs	30	5^-	12	15Wi02	T	1995	IT=100	*
^{68}Cu	−65567.0	1.6				30.9	s	0.6	1^+	12	10Vi07	J	1953	β^-=100	*
^{68}Cu^m	−64845.7	1.6	721.26	0.08		3.75	m	0.05	6^-	12	10Vi07	J	1969	IT=86 2; β^-=14 2	*
^{68}Zn	−70007.1	0.8				STABLE			0^+	12			1922	IS=18.45 63	
^{68}Ga	−67086.0	1.4				67.845	m	0.018	1^+	12	14Ga09	T	1937	β^+=100	*
^{68}Ge	−66978.8	1.9				270.93	d	0.13	0^+	12			1948	ε=100	
^{68}As	−58894.5	1.8				151.6	s	0.8	3^+	12			1971	β^+=100	
^{68}As^m	−58469.4	1.8	425.1	0.2		111	ns	20	1^+	12			1994	IT=100	*
^{68}Se	−54189.4	0.5				35.5	s	0.7	0^+	12			1990	β^+=100	
^{68}Br	−38790#	260#				<1.5 μs			3^+#	12	95Bl06	I		p ?	

*^{68}Mn T : average 15Be32=38.3(3.6) 35.2(2.0) 11Da08=29(4) 03So21=28(8) 99Ha05=28(4) **
*^{68}Mn D : β^-n has been observed by 99Ha05 but not quantified **
*^{68}Co^n J : 12Li02 strong feeding in β^- of ^{68}Fe (0^+) **
*^{68}Ni^m E : average 15Fl01=1603.6(0.6) 13Re18=1603.5(0.3) **
*^{68}Ni^n T : average 15Wi02=840(40) 95Br10=860(50) **
*^{68}Cu J : directly measured in 10Vi07 **
*^{68}Cu^m J : directly measured in 10Vi07 **
*^{68}Ga T : also 12Lu14=67.87(0.10); discrepant 83Iw02=67.629(0.24) **
*^{68}As^m T : symmetrized from 94Ba50=107(+23−16) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{69}Cr	−8580#	500#					2#	ms	(>620 ns)	7/2$^+$#	14			2013	β^- ?; β^-n=20#; β^-2n=6#	
^{69}Mn	−24770#	400#					22.1	ms	1.6	5/2$^-$#	14	15Be32	TD	1995	β^-=100; β^-n=50 20; β^-2n=0.4#	*
^{69}Fe	−39030#	400#					108.2	ms	4.5	1/2$^-$#	14	13Ma87	T	1992	β^-=100; β^-n=7#; β^-2n=0#	*
^{69}Co	−50280	140					180	ms	20	7/2$^-$#	14	15Li33	T	1985	β^-=100; β^-n=1#	
^{69}Co^m	−49780#	240#	500#	200#			750	ms	250	1/2$^-$#		15Li33	TD	2015	β^-=100	
^{69}Ni	−59979	4					11.4	s	0.3	(9/2$^+$)	14			1984	β^-=100	
^{69}Ni^m	−59658	4	321	2			3.5	s	0.4	(1/2$^-$)	14			1998	$\beta^-\approx$100; IT<0.01	*
^{69}Ni^n	−57279	4	2700.0	1.0			439	ns	3	(17/2$^-$)	14			1998	IT=100	
^{69}Cu	−65736.2	1.4					2.85	m	0.15	3/2$^-$	14	10Vi07	J	1966	β^-=100	*
^{69}Cu^m	−62994.2	1.6	2742.0	0.7			357	ns	2	(13/2$^+$)	14			1997	IT=100	
^{69}Zn	−68417.8	0.8					56.4	m	0.9	1/2$^-$	14			1937	β^-=100	
^{69}Zn^m	−67979.2	0.8	438.636	0.018			13.756	h	0.018	9/2$^+$	14			1970	IT$\approx$100; β^-=0.033 3	
^{69}Ga	−69327.8	1.2					STABLE			3/2$^-$	14			1923	IS=60.108 9	
^{69}Ge	−67100.7	1.3					39.05	h	0.10	5/2$^-$	14			1938	β^+=100	
^{69}Ge^m	−67013.9	1.3	86.76	0.02			5.1	μs	0.2	1/2$^-$	14			1978	IT=100	
^{69}Ge^n	−66702.8	1.3	397.94	0.02			2.81	μs	0.05	9/2$^+$	14			1978	IT=100	
^{69}As	−63110	30					15.2	m	0.2	5/2$^-$	14			1955	β^+=100	
^{69}Se	−56434.7	1.5					27.4	s	0.2	1/2$^-$	14			1974	β^+=100; β^+p=0.045 10	
^{69}Se^m	−56395.9	1.5	38.85	0.22			2.0	μs	0.2	5/2$^-$	14			1988	IT=100	
^{69}Se^n	−55860.7	1.6	574.0	0.4			955	ns	16	9/2$^+$	14	00Ch07	T	1988	IT=100	*
^{69}Br	−46260	40				*	< 24	ns		(5/2$^-$)	15			1988	p=100	
^{69}Br^m	−46220#	110#	40#	100#		*				5/2$^-$#		Mirror	I			
^{69}Br^n	−45690#	110#	570#	100#						9/2$^+$#		Mirror	I			
^{69}Br^i	−42771	19	3490	50	p					(5/2$^-$)T=3/2	14	11Ro47	I	2011	p=100	
^{69}Kr	−32440#	400#					28	ms	1	(5/2$^-$)	15	14De41	D	1995	β^+=100; β^+p=55 7	*
*^{69}Mn	T : average 15Be32=24.1(2.6) 25.8(2.8) 11Da08=18(4) 99Ha05=14(4)															**
*^{69}Fe	T : average 13Ma87=102(10) 11Da08=110(6) 03So21=109(9)															**
*^{69}Ni^m	E : 9/2$^+$ level in isotones: ^{73}Ge=–66 ^{71}Zn=157(1) ^{69}Ni=–321(2) exhibits															**
*^{69}Ni^m	E : unusually strong variations															**
*^{69}Cu	J : directly measured in 10Vi07															**
*^{69}Se^n	T : average 00Ch07=950(21) 95Po01=960(23)															**
*^{69}Kr	T : 14De41=28(1) 11Ro47=27(3) 97Xu01=32(10) D : β^+p=52.5(6.5) + 2.4(0.5)															**
^{70}Cr	−4480#	600#					1#	ms	(>620 ns)	0$^+$	13			2013	β^- ?; β^-n=40#; β^-2n=2#	
^{70}Mn	−19500#	500#					19.9	ms	1.7		09	15Be32	TD	2009	β^-=100; β^-n=20#; β^-2n=7#	
^{70}Fe	−36510#	400#					63.0	ms	4.5	0$^+$	04	13Ma87	T	1997	β^-=100; β^-n=10#	*
^{70}Co	−46630#	300#				*	112	ms	7	(6$^-$,7$^-$)	16			1985	β^-=100; β^-n=3#; β^-2n=0#	
^{70}Co^m	−46430#	360#	200#	200#		*	470	ms	50	3$^+$#	16			1998	$\beta^-\approx$100; IT ?; β^-n=3#; β^-2n=0#	
^{70}Ni	−59213.9	2.1					6.0	s	0.3	0$^+$	04			1987	β^-=100	
^{70}Ni^m	−56353.9	2.9	2860	2			232	ns	1	(8$^+$)	04			1997	IT=100	
^{70}Cu	−62976.4	1.1					44.5	s	0.2	6$^-$	04	10Vi07	J	1971	β^-=100	*
^{70}Cu^m	−62875.3	1.1	101.1	0.3			33	s	2	3$^-$	04	10Vi07	J	2002	β^-=52 9; IT=48 9	*
^{70}Cu^n	−62733.8	1.2	242.6	0.5			6.6	s	0.2	1$^+$	04	10Vi07	J	1971	β^-=93.2 9; IT=6.8 9	*
^{70}Zn	−69564.7	1.9					STABLE			0$^+$	04			1922	IS=0.61 10; 2β^- ?	*
^{70}Ga	−68910.1	1.2					21.14	m	0.03	1$^+$	04			1937	$\beta^-\approx$100; ε=0.41 6	
^{70}Ge	−70561.9	0.8					STABLE			0$^+$	04			1923	IS=20.57 27	
^{70}As	−64340	50					52.6	m	0.3	4$^+$	04			1950	β^+=100	
^{70}As^m	−64310	50	32.008	0.002			96	μs	3	2$^+$	04			1979	IT=100	
^{70}Se	−61929.9	1.6					41.1	m	0.3	0$^+$	04			1950	β^+=100	
^{70}Br	−51426	15					79.1	ms	0.8	0$^+$T=1	04			1978	β^+=100; β^+p ?	
^{70}Br^m	−49134	15	2292.3	0.8			2.2	s	0.2	9$^+$	04			1981	β^+=?; IT ?; β^+p ?	
^{70}Kr	−41100#	200#					52	ms	17	0$^+$	04			1995	β^+=100; β^+p<1.3	
*^{70}Fe	T : average 13Ma87=61(5) 11Da08=71(10); other 03So21=94(17) not used															**
*^{70}Cu	J : directly measured in 10Vi07															**
*^{70}Cu^m	J : directly measured in 10Vi07															**
*^{70}Cu^n	J : directly measured in 10Vi07															**
*^{70}Zn	T : 03Ki08 : 0ν-$\beta\beta$>13 Py															**
^{71}Mn	−15570#	500#					5#	ms	(>400 ns)	5/2$^-$#	10	10Oh02	I	2010	β^- ?; β^-n=30#; β^-2n=3#	
^{71}Fe	−31430#	400#					33.7	ms	3.8	7/2$^+$#	10	13Ma87	T	1997	β^-=100; β^-n=10#; β^-2n=0.3#	*
^{71}Co	−44370	470					80	ms	3	(7/2$^-$)	10	12Ra10	TJD	1992	β^-=100; β^-n=3 1	*
^{71}Ni	−55406.2	2.2					2.56	s	0.03	(9/2$^+$)	10			1987	β^-=100	
^{71}Ni^m	−55406.0	2.3	499	5			2.3	s	0.3	(1/2$^-$)	10			2009	β^-=100	
^{71}Cu	−62711.1	1.5					19.4	s	1.4	3/2$^-$	10	10Vi07	J	1983	β^-=100	*
^{71}Cu^m	−59955.4	1.6	2755.7	0.6			271	ns	13	(19/2$^-$)	10	98Gr14	TJ	1998	IT=100	*
^{71}Zn	−67328.8	2.7					2.45	m	0.10	1/2$^-$	10			1955	β^-=100	
^{71}Zn^m	−67171.1	2.4	157.7	1.3	MD		4.125	h	0.007	9/2$^+$	10	12Re05	T	1958	$\beta^-\approx$100; IT$\leq$0.05	
^{71}Ga	−70139.1	0.8					STABLE			3/2$^-$	10			1923	IS=39.892 9	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{71}Ge	−69906.5	0.8					11.43	d	0.03	$1/2^-$	10			1941	ε=100	
^{71}Ge^m	−69708.1	0.8	198.354	0.014			20.41	ms	0.18	$9/2^+$	10			1959	IT=100	
^{71}As	−67893	4					65.30	h	0.07	$5/2^-$	10			1939	β^+=100	
^{71}Se	−63146.5	2.8					4.74	m	0.05	$(5/2^-)$	10			1957	β^+=100	
^{71}Se^m	−63097.7	2.8	48.79	0.05			5.6	μs	0.7	$(1/2^-)$	10			1982	IT=100	
^{71}Se^n	−62886.0	2.8	260.48	0.10			19.0	μs	0.5	$(9/2^+)$	10			1982	IT=100	
^{71}Br	−56502	5					21.4	s	0.6	$(5/2)^-$	10			1981	β^+=100	
^{71}Kr	−46330	130					100	ms	3	$(5/2)^-$	10			1981	β^+=100; β^+p=2.1 7	
^{71}Rb	−32060#	400#				*				$5/2^-$#					p ?	
^{71}Rb^m	−32010#	410#	50#	100#		*				$1/2^-$#		Mirror	I			
^{71}Rb^n	−31800#	410#	260#	100#						$9/2^+$#		Mirror	I			
*^{71}Fe	T : average 13Ma87=42(6) 11Da08=28(5)															**
*^{71}Co	D : taking into account 12Ra10<2.7(0.9)% and 05Ma95>3(1)% of same group															**
*^{71}Cu	T : average 99Pr10=19(3) 83Ru06=19.5(1.6)															**
*^{71}Cu	J : directly measured in 10Vi07															**
*^{71}Cu^m	T : average 98Is11=250(30) 98Gr14=275(14)															**
^{72}Mn	−9900#	600#					2#	ms	(>620 ns)		13			2013	β^- ?; β^-n=50#; β^-2n=10#	
^{72}Fe	−28430#	500#					19	ms	4	0^+	10	13Ma87	TD	1997	β^-=?; β^-n=10#; β^-2n=0#	
^{72}Co	−40200#	400#					52.5	ms	0.3	$(6^-,7^-)$	10	16Mo07	T	1992	β^-=100; β^-n>6 2; β^-2n=0.2#	*
^{72}Co^m	−40000#	450#	200#	200#		*	47.8	ms	0.5	$(0^+,1^+)$		16Mo07	TJ	2016	β^-=100	
^{72}Ni	−54226.1	2.2					1.57	s	0.05	0^+	10			1987	β^-=100; β^-n=0#	
^{72}Cu	−59783.0	1.4					6.63	s	0.03	2^-	10	10Vi07	J	1983	β^-=100	*
^{72}Cu^m	−59512.7	1.7	270.3	1.0			1.76	μs	0.03	(6^-)	10			1998	IT=100	*
^{72}Zn	−68145.5	2.1					46.5	h	0.1	0^+	10			1951	β^-=100	
^{72}Ga	−68588.3	0.8					14.025	h	0.010	3^-	10	12Kr07	T	1939	β^-=100	
^{72}Ga^m	−68468.6	0.8	119.66	0.05			39.68	ms	0.13	(0^+)T=1	10			1968	IT=100	
^{72}Ge	−72585.90	0.08					STABLE			0^+	10			1923	IS=27.45 32	
^{72}Ge^m	−71894.47	0.09	691.43	0.04			444.2	ns	0.8	0^+	10			1984	IT=100	
^{72}As	−68230	4					26.0	h	0.1	2^-	10			1939	β^+=100	
^{72}Se	−67868.2	2.0					8.40	d	0.08	0^+	10			1948	ε=100	
^{72}Br	−59061.7	1.0					78.6	s	2.4	1^+	10			1970	β^+=100	
^{72}Br^m	−58960.9	1.0	100.76	0.15			10.6	s	0.3	(3^-)	10			1980	IT≈100; β^+=?	
^{72}Kr	−53941	8					17.16	s	0.18	0^+	10	03Pi03	T	1973	β^+=100	*
^{72}Rb	−38330#	500#				*			<1.5 μs	1^+#		95Bl06	I		p ?	
^{72}Rb^m	−38230#	510#	100#	100#		*				3^-#					p ?	
*^{72}Co	T : others 14Xu07=52.8(1.6) 14Ra20=55(4) 05Ma59=59(2) 03Sa40=62(3)															**
*^{72}Co	J : feeding of the 6^+ level in ^{72}Ni and shell model D : 05Ma95 β^-n>6 2															**
*^{72}Cu	J : directly measured in 10Vi07															**
*^{72}Cu^m	D : no β^-decay observed in 05Th.A															**
*^{72}Kr	T : average 03Pi03=17.1(0.2) 73Da22=17.4(0.4)															**
^{73}Fe	−22900#	500#					12.9	ms	1.6	$7/2^+$#	16			2010	β^- ?; β^-n=20#; β^-2n=4#	
^{73}Co	−37420#	400#					40.7	ms	1.3	$7/2^-$#	16	12Ra10	D	1995	β^-=100; β^-n=9 4; β^-2n=0.01#	*
^{73}Ni	−50108.2	2.4					840	ms	30	$(9/2^+)$	16			1987	β^-=100; β^-n=0.3#	
^{73}Cu	−58987.4	1.9					4.2	s	0.3	$3/2^-$	04	10Vi07	J	1983	β^-=100; β^-n=0#	*
^{73}Zn	−65593.4	1.9					23.5	s	1.0	$(1/2)^-$	04			1972	β^-=100	
^{73}Zn^m	−65397.9	1.9	195.5	0.2			13.0	ms	0.2	$(5/2^+)$	04			1985	IT=100	
^{73}Zn^n	−65355.8	2.8	237.6	2.0	EU		5.8	s	0.8	$(9/2^+)$	04			1998	IT=?; β^-=?	*
^{73}Ga	−69699.3	1.7					4.86	h	0.03	$1/2^-$	04	11Ch16	J	1949	β^-=100	
^{73}Ge	−71297.52	0.06					STABLE			$9/2^+$	04			1933	IS=7.75 12	
^{73}Ge^m	−71284.24	0.06	13.2845	0.0015			2.92	μs	0.03	$5/2^+$	04			1975	IT=100	
^{73}Ge^n	−71230.79	0.06	66.726	0.009			499	ms	11	$1/2^-$	04			1957	IT=100	
^{73}As	−70953	4					80.30	d	0.06	$3/2^-$	04			1948	ε=100	
^{73}As^m	−70525	4	427.906	0.021			5.7	μs	0.2	$9/2^+$	04			1956	IT=100	
^{73}Se	−68227	7					7.15	h	0.08	$9/2^+$	04			1948	β^+=100	
^{73}Se^m	−68201	7	25.71	0.04			39.8	m	1.3	$3/2^-$	04			1960	IT=72.6 3; β^+=27.4 3	
^{73}Br	−63647	7					3.4	m	0.2	$1/2^-$	04			1970	β^+=100	
^{73}Kr	−56552	7					27.3	s	1.0	$3/2^-$	04			1972	β^+=100; β^+p=0.25 3	
^{73}Kr^m	−56118	7	433.66	0.12			107	ns	10	$(9/2^+)$	04			1993	IT=100	
^{73}Rb	−46080#	200#							<30 ns	$3/2^-$#	04	96Pf01	I		p ?	
^{73}Rb^m	−45650#	220#	430#	100#						$9/2^+$#		Mirror	I			
^{73}Rb^i	−42850	40	3230#	200#	p					$1/2^-$T=3/2		93Ba61	JD	1993	p=100	
^{73}Sr	−31950#	400#					> 25	ms		$1/2^-$#	04			1993	β^+=100; β^+p=?	
*^{73}Co	D : taking into account 12Ra10<22(8)% 10Ho12<7.9% 05Ma95>9(4)%															**
*^{73}Cu	J : directly measured in 10Vi07															**
*^{73}Zn^n	E : if 42.1 keV γ feeds ^{73}Zn^m, EU: see discussion in ENSDF'04															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{74}Fe	−19590#	600#				2#	ms	(>400 ns)	0^+	10	10Oh02	I	2010	β^- ?; β^-n=30#; β^-2n=2#	
^{74}Co	−32820#	500#				31.3	ms	1.3		06	05Ma95	TD	1995	β^-=100; β^-n>26 9; β^-2n=1#	*
^{74}Ni	−48460#	200#				507.7	ms	4.6	0^+	06	14Xu07	T	1987	β^-=100; β^-n=5#	
^{74}Cu	−56006	6				1.63	s	0.05	2^-	06	10Vi07	J	1987	β^-=100; β^-n=40#	*
^{74}Zn	−65756.7	2.5				95.6	s	1.2	0^+	06			1972	β^-=100	
^{74}Ga	−68049.6	3.0				8.12	m	0.12	(3^-)	06	13Ma15	J	1956	β^-=100	
^{74}Ga^m	−67990	3	59.571	0.014		9.5	s	1.0	$(0)^{(+\#)}$	06			1974	IT=75 25; β^- ?	
^{74}Ge	−73422.442	0.013				STABLE			0^+	06			1923	IS=36.50 20	
^{74}As	−70860.1	1.7				17.77	d	0.02	2^-	06			1938	β^+=66 2; β^-=34 2	
^{74}Se	−72213.201	0.015				STABLE		(>15 Ey)	0^+	06	15Je02	T	1922	IS=0.89 4; 2β^+ ?	
^{74}Br	−65288	6				25.4	m	0.3	(0^-)	06			1952	β^+=100	
^{74}Br^m	−65274	6	13.58	0.21		46	m	2	$4^{(+\#)}$	06			1953	β^+=100	
^{74}Kr	−62331.8	2.0				11.50	m	0.11	0^+	06			1960	β^+=100	
^{74}Kr^i	−61790	30	540	30							98Gr.A	E	1998	IT=100	*
^{74}Rb	−51916	3				64.776	ms	0.030	0^+T=1	06			1977	β^+=100; β^+p ?	
^{74}Sr	−40830#	100#				27	ms	8	0^+	15			1995	β^+=100; β^+p ?	

*^{74}Co T : average 14Xu07=31.6(1.5) 05Ma95=30(3) **
*^{74}Co T : others recent 11Da08=19(7) 10Ho12=34(+6–9) D : β^-n=18(15)% in 10Ho12 **
*^{74}Cu D : β^-n has been observed by 91Kr15 but not quantified **
*^{74}Kr^i E : E(g)<85 to 2^+ level at 455.61(0.10) keV **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{75}Fe	−13640#	600#				2#	ms	(>620 ns)	$9/2^+$#	13			2013	β^- ?; β^-n=80#; β^-2n=20#	
^{75}Co	−29650#	500#				26.5	ms	1.2	$7/2^-$#	13	14Xu07	T	1995	β^-=100; β^-n<16; β^-2n=0.5#	
^{75}Ni	−44030#	300#				331.6	ms	3.2	$7/2^+$#	13	14Xu07	T	1992	β^-=100; β^-n=10.0 28	
^{75}Cu	−54471.3	2.3				1.224	s	0.003	$5/2^-$	13	10Vi07	J	1985	β^-=100; β^-n=3.5 6	
^{75}Cu^m	−54409.6	2.3	61.7	0.4		310	ns	8	$(1/2^-,3/2^-)$	13			2010	IT=100	
^{75}Cu^n	−54405.1	2.3	66.2	0.4		149	ns	5	$(3/2^-,1/2^-)$	13	16Pe14	EJT	2010	IT=100	
^{75}Zn	−62558.9	2.0				10.2	s	0.2	$(7/2^+)$	13			1974	β^-=100	
^{75}Zn^m	−62432.0	2.0	126.94	0.09		5#	s		$(1/2^-)$	13			2011	β^- ?; IT ?	
^{75}Ga	−68464.6	2.4				126	s	2	$3/2^-$	13			1960	β^-=100	
^{75}Ge	−71856.96	0.05				82.78	m	0.04	$1/2^-$	13			1939	β^-=100	
^{75}Ge^m	−71717.27	0.06	139.69	0.03		47.7	s	0.5	$7/2^+$	13			1952	IT≈100; β^-=0.030 6	
^{75}Ge^n	−71664.77	0.08	192.19	0.06		216	ns	5	$5/2^+$	13			1982	IT=100	
^{75}As	−73034.2	0.9				STABLE			$3/2^-$	13			1920	IS=100.	
^{75}As^m	−72730.3	0.9	303.9243	0.0008		17.62	ms	0.23	$9/2^+$	13			1957	IT=100	
^{75}Se	−72169.48	0.07				119.78	d	0.05	$5/2^+$	13			1947	ε=100	
^{75}Br	−69107	4				96.7	m	1.3	$3/2^-$	13			1948	β^+=100	
^{75}Kr	−64324	8				4.60	m	0.07	$5/2^+$	13			1960	β^+=100	
^{75}Rb	−57218.7	1.2				19.0	s	1.2	$3/2^{(-)}$	13			1975	β^+=100	
^{75}Sr	−46620	220				88	ms	3	$(3/2^-)$	13			1991	β^+=100; β^+p=5.2 9	
^{75}Y	−31820#	300#				100#	μs		$5/2^+$#					β^+ ?; β^+p ?; p ?	

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{76}Co	−24510#	600#			&	23	ms	6	(8^-)	14	14Xu07	TD	2010	β^-=100; β^-n=4#; β^-2n=6#	*
^{76}Co^m	−24410#	610#	100#	100#	&	16	ms	4	(1^-)		15So23	TJD	2015	β^-=100	
^{76}Co^n	−23770#	610#	740#	100#		2.99	μs	0.27	(3^+)		15So23	TJD	2015	IT=100	*
^{76}Ni	−41630#	400#				234.6	ms	2.7	0^+	07	14Xu07	T	1995	β^-=100; β^-n=14 3.6	
^{76}Ni^m	−39210#	400#	2418.7	1.0		547.8	ns	3.3	(8^+)	07	15So23	T	2005	IT=100	*
^{76}Cu	−50976	7			*	637.7	ms	5.5	$(3,4)$	95	09Wi03	D	1987	β^-=100; β^-n=7.2 5	*
^{76}Cu^m	−50980#	200#	0#	200#	*	1.27	s	0.30	$(1,3)$	95	90Wi12	J	1990	β^-=100	
^{76}Zn	−62303.0	1.5				5.7	s	0.3	0^+	95			1974	β^-=100	
^{76}Ga	−66296.6	2.0				32.6	s	0.6	2^-	95	11Ma45	J	1961	β^-=100	
^{76}Ge	−73212.889	0.018				1.66	Zy	0.13	0^+	95	15Ba11	T	1933	IS=7.73 12; 2β^-=100	*
^{76}As	−72291.4	0.9				1.0778	d	0.0020	2^-	95			1934	β^-≈100; ε<0.02	
^{76}As^m	−72247.0	0.9	44.425	0.001		1.84	μs	0.06	$(1)^+$	95			1966	IT=100	
^{76}Se	−75251.950	0.016				STABLE			0^+	95			1922	IS=9.37 29	
^{76}Br	−70289	9				16.2	h	0.2	1^-	95			1952	β^+=100	
^{76}Br^m	−70186	9	102.58	0.03		1.31	s	0.02	$(4)^+$	95			1979	IT>99.4; β^+<0.6	
^{76}Kr	−69014	4				14.8	h	0.1	0^+	95			1954	β^+=100	
^{76}Rb	−60479.1	0.9				36.5	s	0.6	$1^{(-)}$	95			1969	β^+=100; $\beta^+\alpha$=3.8e–7 10	
^{76}Rb^m	−60162.2	0.9	316.93	0.08		3.050	μs	0.007	(4^+)	95	00Ch07	T	1986	IT=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... A-group continued ...														
^{76}Sr	−54250	30			7.89	s	0.07	0^+	11			1990	β^+=100; β^+p=3.4e–5 8	
^{76}Y	−38480#	300#			120#	μs	(>200 ns)	1^-#	07	01Ki13	I	2001	β^+ ?; p ?; β^+p ?	*
*^{76}Co	T : symmetrized from 14Xu07=21.7(+6.5–4.9) J : 15So23=(8^-)													**
*^{76}Co^n	E : 15So23=638.4(0.8) above (1^-) 76Com													**
*^{76}Co^n	T : symmetrized from 15So23=2.96(+0.29–0.25)													**
*^{76}Ni^m	E : 12Ka36=142.7(0.5), 355.5(0.5), 929.9(0.5) and 990.6(0.5) γ rays in													**
*^{76}Ni^m	E : cascade to ground-state =2418.7(1.0); other 05Ma59=2420(4)													**
*^{76}Ni^m	T : others 14Ra20=636(90) 12Ka36=409(+58–50)) 05Ma59=590(+180–110)													**
*^{76}Cu	T : average 10Ho12=599(18) 05Va19=653(24) 91Kr15=641(6)													**
*^{76}Cu	J : from 05Va19 and 90Wi12													**
*^{76}Ge	T : symmetrized from 15Ba11=1.65(+0.14–0.12)													**
*^{76}Ge	T : 13Ag11 : 0ν-$\beta\beta$ >30Yy (90%C.L.) combined GERDA+HDM+IGEX results;													**
*^{76}Ge	T : claim for 0ν-$\beta\beta$ 01Kl13=15 Yy 04Kl03=11.2 Yy not trusted. See also													**
*^{76}Ge	T : 02Aa.A and 02Zd02													**
*^{76}Y	I : also 00We.A>170 ns same group													**
^{77}Co	−21020#	600#			15	ms	6	$7/2^-$#	14			2014	β^-=100; β^-n=90#; β^-2n=5#	*
^{77}Ni	−36800#	500#			158.9	ms	4.2	$9/2^+$#	12	14Xu07	T	1995	β^-=100; β^-n=30 24; β^-2n=0#	*
^{77}Cu	−48620#	150#			467.9	ms	2.1	$5/2^-$	12			1987	β^-=100; β^-n=30.3 20	
^{77}Zn	−58789.2	2.0			2.08	s	0.05	$(7/2^+)$	12			1977	β^-=100	
^{77}Zn^m	−58016.8	2.0	772.440	0.015	1.05	s	0.10	$(1/2^-)$	12	09Pa35	J	1986	β^-=66 7; IT=34 7	
^{77}Ga	−65992.3	2.4			13.2	s	0.2	$3/2^{(-)}$	12			1968	β^-=100	
^{77}Ge	−71212.86	0.05			11.211	h	0.003	$7/2^+$	12			1939	β^-=100	
^{77}Ge^m	−71053.15	0.08	159.71	0.06	53.7	s	0.6	$1/2^-$	12			1947	β^-=81 2; IT=19 2	
^{77}As	−73916.3	1.7			38.79	h	0.05	$3/2^-$	12			1951	β^-=100	
^{77}As^m	−73440.8	1.7	475.48	0.04	114.0	μs	2.5	$9/2^+$	12			1957	IT=100	
^{77}Se	−74599.49	0.06			STABLE			$1/2^-$	12			1922	IS=7.63 16	
^{77}Se^m	−74437.57	0.06	161.9223	0.0010	17.36	s	0.05	$7/2^+$	12			1947	IT=100	
^{77}Br	−73234.8	2.8			57.04	h	0.12	$3/2^-$	12			1948	β^+=100	
^{77}Br^m	−73128.9	2.8	105.86	0.08	4.28	m	0.10	$9/2^+$	12			1961	IT=100	
^{77}Kr	−70169.4	2.0			74.4	m	0.6	$5/2^+$	12			1948	β^+=100	
^{77}Kr^m	−70102.9	2.0	66.50	0.05	118	ns	12	$3/2^-$	12			1975	IT=100	
^{77}Rb	−64830.5	1.3			3.78	m	0.04	$3/2^-$	12			1972	β^+=100	
^{77}Sr	−57803	8			9.0	s	0.2	$5/2^+$	12	13Ma15	J	1976	β^+=100; β^+p=0.08 3	
^{77}Y	−46440#	200#			63	ms	17	$5/2^+$#	12	00We.A	D	1999	β^+=?; β^+p ?; p<10	*
^{77}Zr	−32040#	400#			100#	μs		$3/2^-$#					β^+ ?; β^+p ?; p ?	
*^{77}Co	T : symmetrized from 14Xu07=13.0(+7.2–4.3)													**
*^{77}Ni	D : from 10Ho12													**
*^{77}Y	D : limit for p is from 00We.A T : symmetrized from 01Ki13=57(+22–12)													**
^{78}Ni	−33890#	600#			122.2	ms	5.1	0^+	09	14Xu07	T	1995	β^-=100; β^-n=50#; β^-2n=0#	
^{78}Cu	−44500	500			330.7	ms	2.0	(5^-)	09	14Xu07	T	1991	β^-=100; β^-n=50.6 45; β^-2n=0.2#	*
^{78}Zn	−57483.2	1.9			1.47	s	0.15	0^+	09			1977	β^-=100; β^-n=0#	
^{78}Zn^m	−54807.9	2.1	2675.3	1.0	320	ns	6	(8^+)	09	12Ka36	ET	1998	IT=100	*
^{78}Ga	−63706.0	1.9			5.09	s	0.05	2^-	09	11Ma45	J	1972	β^-=100	
^{78}Ga^m	−63207.1	2.0	498.9	0.5	110	ns	3		09	10Da06	ET	2010	IT=100	*
^{78}Ge	−71862	4			88.0	m	1.0	0^+	09			1953	β^-=100	
^{78}As	−72817	10			90.7	m	0.2	2^-	09			1937	β^-=100	
^{78}Se	−77025.94	0.18			STABLE			0^+	09			1922	IS=23.77 28	
^{78}Br	−73452	4			6.45	m	0.04	1^+	09			1937	$\beta^+\approx$100; β^-<0.01	
^{78}Br^m	−73271	4	180.89	0.13	119.4	μs	1.0	(4^+)	09			1958	IT=100	
^{78}Kr	−74178.3	0.3			STABLE		(>110 Ey)	0^+	09	94Sa31	T	1920	IS=0.355 3; 2β^+ ?	*
^{78}Rb	−66935	3			17.66	m	0.03	$0^{(+)}$	09			1968	β^+=100	
^{78}Rb^m	−66888	3	46.84	0.14	910	ns	40	(1^-)	09			1996	IT=100	
^{78}Rb^n	−66824	3	111.19	0.22	5.74	m	0.03	$4^{(-)}$	09			1968	β^+=91 2; IT=9 2	
^{78}Rb^x	−66861	12	74	12	$R = 2.0$ 0.5			spmix						
^{78}Sr	−63174	7			156.1	s	2.7	0^+	09	11Pe29	T	1982	β^+=100	*
... A-group is continued on next page ...														

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{78}Y	−52170#	300#			*	54	ms	5	(0$^+$)	09	01Ga24	TJ	1992	β^+=100; β^+p ?	*
^{78}Y^m	−52170#	580#	0#	500#	*	5.8	s	0.6	(5$^+$)	09			1998	β^+=100; β^+p ?	
^{78}Zr	−40850#	400#				50#	ms	(>200 ns)	0$^+$	09	01Ki13	I	2001	β^+ ?; β^+p ?	*
*^{78}Cu	D : β^-n average 10Ho12=44.0(5.4)% 09Wi03=65(8)%														**
*^{78}Cu	J : from 12Ko29 ; other 11Ko36 (6$^-$)														**
*^{78}Zn^m	E : 12Ka36=145.7(0.5), 730.0(0.5), 890.5(0.5) and 909.1(0.5) γ rays in														**
*^{78}Zn^m	E : cascade to ground-state =2675.3(1.0)														**
*^{78}Zn^m	T : average 12Ka36=320(+9–8) 00Da07=319(9)														**
*^{78}Ga^m	E : this is level 559.6(0.7) <500 ns in ENSDF'09														**
*^{78}Kr	T : limit given here is for the K-e$^+$ decay (theoretically faster)														**
*^{78}Sr	T : average 11Pe29=155(3) 97Mu02=168(12) 92Gr09=159(8)														**
*^{78}Y	T : average 01Ga24=50(8) 01Ki13=55(+9–6)														**
*^{78}Zr	I : also 00We.A>170 ns same group														**
^{79}Ni	−27570#	600#				44	ms	8	5/2$^+$#	16			2010	β^-=100; β^-n=60#; β^-2n=40#	
^{79}Cu	−41740#	300#				241.0	ms	3.2	5/2$^-$#	16			1991	β^-=100; β^-n=66 12; β^-2n=0#	
^{79}Zn	−53432.3	2.2				746	ms	42	9/2$^+$	16			1981	β^-=100; β^-n=1.7 5	
^{79}Zn^m	−52330	150	1100	150		> 200	ms		1/2$^+$	16			2015	IT=?; β^- ?	
^{79}Ga	−62547.7	1.9				2.848	s	0.003	3/2$^{(-)}$	16			1974	β^-=100; β^-n=0.089 19	
^{79}Ge	−69530	40				18.98	s	0.03	(1/2)$^-$	16			1970	β^-=100	
^{79}Ge^m	−69340	40	185.95	0.04		39.0	s	1.0	7/2$^+$#	16			1970	β^-=96 1; IT=4 1	
^{79}As	−73636	5				9.01	m	0.15	3/2$^-$	16			1950	β^-=100	
^{79}As^m	−72863	5	772.81	0.06		1.21	μs	0.01	(9/2)$^+$	16	98Gr14	T	1998	IT=100	
^{79}Se	−75917.46	0.22				327	ky	28	7/2$^+$	16			1950	β^-=100	
^{79}Se^m	−75821.69	0.22	95.77	0.03		3.92	m	0.01	1/2$^-$	16			1950	IT≈100; β^-=0.056 11	
^{79}Br	−76068.0	1.0				STABLE			3/2$^-$	16			1920	IS=50.69 7	
^{79}Br^m	−75860.4	1.0	207.61	0.09		4.85	s	0.04	9/2$^+$	16			1954	IT=100	
^{79}Kr	−74442	3				35.04	h	0.10	1/2$^-$	16			1948	β^+=100	
^{79}Kr^m	−74312	3	129.77	0.05		50	s	3	7/2$^+$	16			1940	IT=100	
^{79}Rb	−70803.0	2.1				22.9	m	0.5	5/2$^+$	16			1957	β^+=100	
^{79}Sr	−65477	8				2.25	m	0.10	3/2$^{(-)}$	16			1972	β^+=100	
^{79}Y	−57820	80				14.8	s	0.6	5/2$^+$#	16			1992	β^+=100	
^{79}Zr	−46770#	300#				56	ms	30	5/2$^+$#	16			1999	β^+=100; β^+p ?	
^{79}Nb	−31650#	500#							9/2$^+$#					p ?; β^+ ?; β^+p ?	
^{80}Ni	−22630#	700#				30	ms	22	0$^+$	14			2014	β^-=100; β^-n=60#; β^-2n=40#	*
^{80}Cu	−36200#	400#				113.3	ms	6.4		14	14Xu07	T	1995	β^- ?; β^-n=40#; β^-2n=20#	
^{80}Zn	−51648.6	2.6				562.2	ms	3.0	0$^+$	14	14Xu07	T	1981	β^-=100; β^-n=1.0 5	
^{80}Ga	−59223.7	2.9			*	1.9	s	0.1	6$^{(-)}$	14	13Ve03	TJ	1974	β^-=100; β^-n=0.86 7	
^{80}Ga^m	−59201.3	2.9	22.45	0.10	*	1.3	s	0.2	3$^{(-)}$	14	13Ve03	TJ	2011	β^- ?; β^-n=1#; IT ?	
^{80}Ge	−69535.3	2.1				29.5	s	0.4	0$^+$	05			1972	β^-=100	
^{80}As	−72214	3				15.2	s	0.2	1$^+$	05			1954	β^-=100	
^{80}Se	−77759.5	1.0				STABLE			0$^+$	05			1922	IS=49.61 41; 2β^- ?	
^{80}Br	−75889.0	1.0				17.68	m	0.02	1$^+$	05			1937	β^-=91.7 2; β^+=8.3 2	
^{80}Br^m	−75803.2	1.0	85.843	0.004		4.4205	h	0.0008	5$^-$	05			1937	IT=100	
^{80}Kr	−77893.3	0.7				STABLE			0$^+$	05			1920	IS=2.286 10	
^{80}Rb	−72175.5	1.9				33.4	s	0.7	1$^+$	05	93Al03	T	1961	β^+=100	
^{80}Rb^m	−71681.6	2.0	493.9	0.5		1.63	μs	0.04	(6$^+$)	05	92Do10	E	1980	IT=100	
^{80}Sr	−70311	3				106.3	m	1.5	0$^+$	05			1961	β^+=100	
^{80}Y	−61148	6				30.1	s	0.5	4$^-$	05			1981	β^+=100	
^{80}Y^m	−60920	6	228.5	0.1		4.8	s	0.3	1$^-$	05	01No07	J	1998	IT=81 2; β^+=19 2	*
^{80}Y^n	−60835	6	312.6	0.9		4.7	μs	0.3	(2$^+$)	05			1997	IT=100	
^{80}Zr	−54360#	300#				4.6	s	0.6	0$^+$	05	01Ki13	T	1987	β^+=100	*
^{80}Nb	−38420#	400#							4$^-$#					p ?; β^+ ?; β^+p ?	
*^{80}Ni	T : symmetrized from 14Xu07=23.9(+26.0–17.2)														**
*^{80}Y^m	J : 228.5 M3 γ ray to 4$^-$ level														**
*^{80}Zr	T : average 01Ki13=5.3(+1.1–0.9) 00Re03=4.1(+0.8–0.6)														**
^{81}Cu	−31420#	500#				73.2	ms	6.8	5/2$^-$#	10	14Xu07	TD	2010	β^-=100; β^-n=70#; β^-2n=30#	
^{81}Zn	−46200	5				303.2	ms	2.6	(5/2$^+$)	08	14Xu07	T	1991	β^-=100; β^-n=9.1 24; β^-2n=0#	*
^{81}Ga	−57628	3				1.217	s	0.005	5/2$^-$	08	11Ch16	J	1976	β^-=100; β^-n=11.9 7	
^{81}Ge	−66291.7	2.1				8	s	2	9/2$^+$#	08			1972	β^-=100	*
^{81}Ge^m	−65612.6	2.1	679.14	0.04		8	s	2	(1/2$^+$)	08			1981	β^-≈100; IT<1	
^{81}As	−72533.3	2.6				33.3	s	0.8	3/2$^-$	08			1960	β^-=100	
^{81}Se	−76389.0	1.0				18.45	m	0.12	1/2$^-$	08			1948	β^-=100	
^{81}Se^m	−76286.0	1.0	103.00	0.06		57.28	m	0.02	7/2$^+$	08			1971	IT≈100; β^-=0.051 14	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …														
^{81}Br	−77977.0	1.0			STABLE			3/2$^-$	08			1920	IS=49.31 7	
^{81}Br^m	−77440.8	1.0	536.20	0.09	34.6	μs	2.8	9/2$^+$	08			1967	IT=100	
^{81}Kr	−77696.2	1.1			229	ky	11	7/2$^+$	08			1950	ε=100	
^{81}Kr^m	−77505.6	1.1	190.64	0.04	13.10	s	0.03	1/2$^-$	08			1940	IT≈100; ε=0.0025 4	
^{81}Rb	−75457	5			4.572	h	0.004	3/2$^-$	08			1949	β^+=100	
^{81}Rb^m	−75371	5	86.31	0.07	30.5	m	0.3	9/2$^+$	08			1956	IT=97.6 6; β^+=2.4 6	
^{81}Sr	−71528	3			22.3	m	0.4	1/2$^-$	08			1952	β^+=100	
^{81}Sr^m	−71449	3	79.23	0.04	390	ns	50	(5/2)$^-$	08			1983	IT=100	
^{81}Sr^n	−71439	3	89.05	0.07	6.4	μs	0.5	(7/2$^+$)	08			1989	IT ?	
^{81}Y	−65713	5			70.4	s	1.0	(5/2$^+$)	08			1981	β^+=100	
^{81}Zr	−57460	90			5.5	s	0.4	(3/2$^-$)	08			1997	β^+=100; β^+p=0.12 2	
^{81}Nb	−46360#	400#			< 44	ns		9/2$^+$#	08	00We.A	I		p ?; β^+ ?; β^+p ?	*
^{81}Mo	−31750#	500#			1#	ms	(>400 ns)	5/2$^+$#	15	13Su23	I	2013	β^+ ?; β^+p ?	

*^{81}Zn D : β^-n average 12Ma37=12(4) 91Kr15=7.5(3.0)%; other 10Ho12=30(13)% not used **
*^{81}Ge T : derived from 7.6(0.6), for mixture of ground-state and isomer with almost same half-life **
*^{81}Nb I : also 99Ja02<80 01Ki13<200 ns T : estimated half-life for β^+: 100# ms **

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{82}Cu	−25320#	600#			50#	ms	(>400 ns)		10	10Oh02	I	2010	β^- ?; β^-n=30#; β^-2n=60#	
^{82}Zn	−42314	3			177.9	ms	2.5	0$^+$	12	16Al10	D	1997	β^-=100; β^-n=69 7; β^-2n=0#	*
^{82}Ga	−52930.7	2.4			599	ms	2	(2)	03	12Ch51	J	1976	β^-=100; β^-n=21.3 13; β^-2n=0#	*
^{82}Ga^m	−52789.7	2.5	141.0	0.5	93.5	ns	6.7	(4$^-$)		16Al10	TJ	2009	IT=100	*
^{82}Ge	−65415.1	2.2			4.56	s	0.26	0$^+$	11			1972	β^-=100	
^{82}As	−70105	4			19.1	s	0.5	(2$^-$)	03	04Ga44	J	1968	β^-=100	
^{82}As^m	−69973	4	132.1	0.2	13.6	s	0.4	(5$^-$)	03	14Mi16	E	1970	β^-=100	*
^{82}Se	−77593.9	0.5			92	Ey	7	0$^+$	03	15Ba11	T	1922	IS=8.73 22; 2β^-=100	
^{82}Br	−77498.7	1.0			35.282	h	0.007	5$^-$	03			1937	β^-=100	
^{82}Br^m	−77452.8	1.0	45.9492	0.0010	6.13	m	0.05	2$^-$	03			1965	IT=97.6 3; β^-=2.4 3	
^{82}Kr	−80591.785	0.005			STABLE			0$^+$	03			1920	IS=11.593 31	
^{82}Rb	−76188	3			1.273	m	0.002	1$^+$	03			1949	β^+=100	
^{82}Rb^m	−76118.8	2.6	69.0	1.5	6.472	h	0.006	5$^-$	03			1957	β^+≈100; IT<0.33	
^{82}Sr	−76010	6			25.36	d	0.03	0$^+$	03	87Ho06	T	1952	ε=100	*
^{82}Y	−68064	5			8.30	s	0.20	1$^+$	03			1980	β^+=100	
^{82}Y^m	−67661	5	402.63	0.14	258	ns	22	4$^-$	03	94Mu02	T	1994	IT=100	*
^{82}Y^n	−67557	5	507.50	0.13	147	ns	7	6$^+$	03			1994	IT=100	
^{82}Zr	−63631	11			32	s	5	0$^+$	03			1982	β^+=100	
^{82}Nb	−52090#	300#			50	ms	5	(0$^+$)	08			1992	β^+=100; β^+p ?	
^{82}Nb^m	−50910#	300#	1180	1	92	ns	17	(5$^+$)	08	08Ga04	ETJ	2008	IT=100	
^{82}Mo	−40370#	400#			30#	ms	(>400 ns)	0$^+$	15	13Su23	I	2013	β^+ ?; β^+p ?	

*^{82}Zn T : 14Xu07=177.9(2.5); others 16Al10=155(26) 12Ma37=228(10) **
*^{82}Ga D : average 93Ru01=31.1(4.4)% 86Wa17=19.8(1.7)% 80Lu04=21.4(2.2)% **
*^{82}Ga^m T : average 16Al10=89(9) 12Ka36=98(+10–9); other 09Fo05<500 ns **
*^{82}As^m E : 15Et01=131.6(1.5) 14Mi16=132.1(0.2) **
*^{82}Sr T : average 87Ho06=25.36(0.03) 87Ju02=25.342(0.053) **
*^{82}Y^m T : average 94Mu02=220(50) 93Wo04=268(25) **

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{83}Zn	−36290#	300#			119	ms	16	3/2$^+$#	15	16Al10	T	1997	β^-=100; β^-n=10#; β^-2n=3#	*
^{83}Ga	−49257.1	2.6			308.1	ms	1.0	5/2$^-$#	15			1976	β^-=100; β^-n=62.8 25; β^-2n=0#	
^{83}Ga^m	−49059.8	2.6	197.3	0.5	120	ns	5			16Al10	ETD	2016	IT=100	
^{83}Ge	−60976.4	2.4			1.85	s	0.06	(5/2$^+$)	15			1972	β^-=100; β^-n=0.1#	
^{83}As	−69669.3	2.8			13.4	s	0.4	5/2$^-$#	15			1968	β^-=100	
^{83}Se	−75341	3			22.25	m	0.04	9/2$^+$	15	15Kr02	T	1937	β^-=100	
^{83}Se^m	−75112	3	228.92	0.07	70.1	s	0.4	1/2$^-$	15			1969	β^-=100	
^{83}Br	−79014	4			2.374	h	0.004	3/2$^-$	15			1937	β^-=100	
^{83}Br^m	−75945	4	3069.2	0.4	729	ns	77	(19/2$^-$)	15	11Ru.A	T	1989	IT=100	*
^{83}Kr	−79990.633	0.009			STABLE			9/2$^+$	15			1920	IS=11.500 19	
^{83}Kr^m	−79981.228	0.009	9.4053	0.0008	156.8	ns	0.5	7/2$^+$	15			1963	IT=100	
^{83}Kr^n	−79949.076	0.009	41.5575	0.0007	1.830	h	0.013	1/2$^-$	15	10Li13	T	1971	IT=100	*
^{83}Rb	−79070.6	2.3			86.2	d	0.1	5/2$^-$	15			1950	ε=100	
^{83}Rb^m	−79028.5	2.3	42.0780	0.0020	7.8	ms	0.7	9/2$^+$	15	68Et01	T	1968	IT=100	
^{83}Sr	−76798	7			32.41	h	0.03	7/2$^+$	15			1952	β^+=100	
^{83}Sr^m	−76539	7	259.15	0.09	4.95	s	0.12	1/2$^-$	15			1972	IT=100	
^{83}Y	−72206	19			7.08	m	0.08	(9/2$^+$)	15	92Bu10	J	1962	β^+=100	
^{83}Y^m	−72144	19	62.04	0.10	2.85	m	0.02	(3/2$^-$)	15			1972	β^+=60 5; IT=40 5	
^{83}Zr	−65912	6			42	s	2	1/2$^-$#	15			1974	β^+=100; β^+p=?	
^{83}Zr^m	−65859	6	52.72	0.05	530	ns	120	(5/2$^-$)	15			1988	IT=100	
^{83}Zr^n	−65835	6	77.04	0.07	1.8	μs	0.1	(7/2$^+$)	15			1988	IT=100	
^{83}Nb	−57560	150			3.9	s	0.2	(9/2$^+$)	15	GAu15b	J	1988	β^+=100	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{83}Mo	−46340#	400#					23	ms	19	3/2⁻#	15	01Ki13	TD	1999	β^+=100; β^+p ?	*
^{83}Tc	−31320#	500#								1/2⁻#					p ?; β^+ ?; β^+p ?	

*^{83}Zn T : average 16Al10=122(28) 12Ma37=117(20) **
*^{83}Br^m T : average 11Ru.A=862(148) 97Is13=700(100) 89Wi01=600(200) **
*^{83}Kr^n T : average 10Li13=1.82(0.02) 09Ka30=1.85(0.03) 71Ru17=1.83(0.02) **
*^{83}Nb J : ENSDF=(5/2⁺,7/2⁺,9/2⁺); TNN trends in N=41 isotopes suggests (9/2⁺) **
*^{83}Mo T : symmetrized from 01Ki13=6(+30–3) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{84}Zn	−31930#	400#					50#	ms	(>400 ns)	0⁺	10	10Oh02	I	2010	β^- ?; β^-n=40#; β^-2n=4#	
^{84}Ga	−44090#	200#					85	ms	10	0⁻#	09	16Ma50	D	1991	β^-=100; β^-n=40 7; β^-2n=2#	*
^{84}Ge	−58148	3					951	ms	9	0⁺	09	13Ma22	T	1972	β^-=100; β^-n=10.7 6	*
^{84}As	−65854	3				*	4.02	s	0.03	(3⁻)	09	93Ru01	TD	1968	β^-=100; β^-n=0.28 4	*
^{84}As^m	−65850#	100#	0#	100#		*	650	ms	150		09			1974	β^-=100	*
^{84}Se	−75947.7	2.0					3.26	m	0.10	0⁺	09			1960	β^-=100	
^{84}Br	−77783	26					31.76	m	0.08	2⁻	09			1943	β^-=100	
^{84}Br^m	−77470	100	310	100	BD		6.0	m	0.2	(6)⁻	09			1957	β^-=100	
^{84}Br^n	−77375	26	408.2	0.4			< 140	ns		1⁺	09			1970	IT=100	
^{84}Kr	−82439.335	0.004					STABLE			0⁺	09			1920	IS=56.987 15	
^{84}Kr^m	−79203.27	0.18	3236.07	0.18			1.83	μs	0.04	8⁺	09			1982	IT=100	
^{84}Rb	−79759.0	2.2					32.82	d	0.07	2⁻	09			1947	β^+=96.1 20; β^-=3.9 20	
^{84}Rb^m	−79295.4	2.2	463.59	0.08			20.26	m	0.04	6⁻	09			1940	IT≈100; β^+<0.0012	
^{84}Sr	−80649.6	1.2					STABLE			0⁺	09			1936	IS=0.56 1; 2β^+ ?	
^{84}Y	−73894	4					39.5	m	0.8	(6⁺)	09			1962	β^+=100	
^{84}Y^m	−73827	4	67.0	0.2			4.6	s	0.2	1⁺	09			1976	β^+=100	
^{84}Y^n	−73684	4	210.42	0.16			292	ns	10	(4⁻)	09			2005	IT=100	
^{84}Zr	−71422	5					25.8	m	0.5	0⁺	09			1977	β^+=100	
^{84}Nb	−61219	13					9.8	s	0.9	(1⁺)	09	09St04	J	1977	β^+=100	
^{84}Nb^m	−61171	13	48	1			176	ns	46	(3⁺)		09Ga40	ETJ	2009	IT=100	
^{84}Nb^n	−60881	13	337.7	0.4			92	ns	5	(5⁻)	09	09Ga40	T	2000	IT=100	
^{84}Mo	−54170#	300#					2.3	s	0.3	0⁺	09			1991	β^+=100; β^+p ?	
^{84}Tc	−37700#	400#								1⁺#					p ?; β^+ ?; β^+p ?	

*^{84}Ga D : β^-n others 10Wi03=74(14)% 91Kr15=70(15)% **
*^{84}Ga I : a β^-decaying isomer was identified in 09Le26 and adopted in ENSDF'2009, **
*^{84}Ga I : questioned in 10Wi03 **
*^{84}Ge T : average 13Ma22=942(17) 93Ru01=947(11) 91Kr15=984(23) **
*^{84}Ge D : average 93Ru01=10.8(0.6)% 91Kr15=9.5(2.0)% **
*^{84}As J : 16Ko24 proposed (2⁻) **
*^{84}As^m I : identification discussed in ENSDF2009 **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{85}Zn	−25230#	500#					50#	ms	(>400 ns)	5/2⁺#	14	10Oh02	I	2010	β^- ?; β^-n=30#; β^-2n=7#	
^{85}Ga	−39850#	300#					92.2	ms	3.5	(5/2⁻)	14	13Mi19	T	1997	β^-=100; β^-n>35; β^-2n=6#	*
^{85}Ge	−53123	4					494	ms	8	(3/2⁺,5/2⁺)	14	13Ma22	T	1991	β^-=100; β^-n=16.5 23; β^-2n=0#	*
^{85}As	−63189	3					2.021	s	0.012	(5/2⁻)	14	12Ku06	J	1967	β^-=100; β^-n=62.9 20	
^{85}Se	−72413.6	2.6					32.9	s	0.3	(5/2)⁺	14			1960	β^-=100	
^{85}Br	−78575	3					2.90	m	0.06	3/2⁻	14			1943	β^-=100	
^{85}Kr	−81480.3	2.0					10.739	y	0.014	9/2⁺	14			1940	β^-=100	
^{85}Kr^m	−81175.4	2.0	304.871	0.020			4.480	h	0.008	1/2⁻	14			1937	β^-=78.8 5; IT=21.2 5	
^{85}Kr^n	−79488.5	2.0	1991.8	0.2			1.82	μs	0.05	(17/2⁺)	14	11Ru.A	T	1989	IT=100	
^{85}Rb	−82167.331	0.005					STABLE			5/2⁻	14			1921	IS=72.17 2	
^{85}Rb^m	−81653.325	0.005	514.0065	0.0022			1.015	μs	0.001	9/2⁺	14			1964	IT=100	
^{85}Sr	−81103.3	2.8					64.849	d	0.007	9/2⁺	14			1940	ε=100	
^{85}Sr^m	−80864.5	2.8	238.79	0.05			67.63	m	0.04	1/2⁻	14			1940	IT=86.6 4; β^+=13.4 4	
^{85}Y	−77842	19					2.68	h	0.05	(1/2)⁻	14			1952	β^+=100	
^{85}Y^m	−77822	19	19.68	0.17			4.86	h	0.20	(9/2)⁺	14			1952	β^+≈100; IT<0.002	
^{85}Y^n	−77576	19	266.18	0.10			178	ns	7	(5/2)⁻	14			1977	IT=100	
^{85}Zr	−73175	6					7.86	m	0.04	(7/2⁺)	14			1963	β^+=100	
^{85}Zr^m	−72883	6	292.2	0.3			10.9	s	0.3	1/2⁻#	14			1976	IT<100; β^+>0	
^{85}Nb	−66280	4					20.5	s	0.7	9/2⁺#	14			1988	β^+=100	*
^{85}Nb^m	−66130#	80#	150#	80#			3.3	s	0.9	(1/2⁻)	14	05Ka39	J	1988	IT=?; β^+ ?	*
^{85}Mo	−57510	16					3.2	s	0.2	(1/2⁺)	14	05Xu04	J	1992	β^+=100; β^+p=0.14 2	
^{85}Tc	−45850#	400#							<110 ns	1/2⁻#	14	00We.A	I		p ?	*
^{85}Ru	−30950#	500#					1#	ms	(>400 ns)	3/2⁻#	15	13Su23	I	2013	β^+ ?; β^+p ?; p ?	

*^{85}Ga T : average 13Mi19=92(4) 12Ma37=93(7) **
*^{85}Ge J : (3/2⁺,5/2⁺) from 13Ko31 **
*^{85}Nb T : average 05Ka39=17(2) 88Ku14=20.9(0.7) **
*^{85}Nb^m E : 05Ka39 > 69 keV **
*^{85}Tc I : also 99Ja02<100 ns T : estimated half-life for β^+ decay: 100# ms **

Table I. The NUBASE2016 **table (continued, Explanation of Table on page 18)**

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{86}Ga	−34080#	400#					47	ms	18		15	13Mi19	TD	1997	β^-=100; β^-n=60 10; β^-2n=20 10	*
^{86}Ge	−49400	440					226	ms	21	0^+	15			1994	β^-=100; β^-n=45 15	
^{86}As	−58962	3					945	ms	8	$(1^-,2^-)$	15	15Ma61	J	1973	β^-=100; β^-n=35.5 6; β^-2n=0.02#	
^{86}Se	−70503.2	2.5					14.3	s	0.3	0^+	15			1973	β^-=100; β^-n=0#	
^{86}Se^m	−68131.2	2.7	2372.0	1.0			620	ms	240			15Ma61	ET	2015	IT≈100	*
^{86}Br	−75632	3					55.1	s	0.4	(1^-)	15			1962	β^-=100	
^{86}Kr	−83265.666	0.004					STABLE			0^+	15			1920	IS=17.279 41; $2\beta^-$?	
^{86}Rb	−82746.99	0.20					18.642	d	0.018	2^-	15			1941	β^-≈100; ε=0.0052 5	
^{86}Rb^m	−82190.94	0.27	556.05	0.18			1.017	m	0.003	6^-	15			1951	IT≈100; β^-<0.3	
^{86}Sr	−84523.089	0.005					STABLE			0^+	15			1931	IS=9.86 1	
^{86}Sr^m	−81567.00	0.12	2956.09	0.12			455	ns	7	8^+	15			1971	IT=100	
^{86}Y	−79283	14					14.74	h	0.02	4^-	15			1951	β^+=100	
^{86}Y^m	−79065	14	218.21	0.09			47.4	m	0.4	(8^+)	15			1962	IT=99.31 4; β^+=0.69 4	
^{86}Y^n	−78981	14	302.18	0.09			125.3	ns	5.5	6^+	15	10Ru07	J	2000	IT=100	*
^{86}Zr	−77969	4					16.5	h	0.1	0^+	15			1951	β^+=100	
^{86}Nb	−69134	5				*	88	s	1	(6^+)	15			1974	β^+=100	
^{86}Nb^m	−68880#	160#	250#	160#		*	56.3	s	8.3	high	15	94Sh07	TJD	1994	β^+=100	*
^{86}Mo	−64110	4					19.1	s	0.3	0^+	15			1991	β^+=100	
^{86}Tc	−51570#	300#					55	ms	7	(0^+)	15			1992	β^+=100; β^+p ?	
^{86}Tc^m	−50050#	300#	1524	10			1.10	μs	0.12	(6^+)	15	08Ga04	T	2000	IT=100	*
^{86}Ru	−39770#	400#					50#	ms	(>400 ns)	0^+	15	13Su23	I	2013	β^+ ?; β^+p ?	

*^{86}Ga T : symmetrized from 13Mi19=43(+21–15) **
*^{86}Se^m E : error estimated by evaluator **
*^{86}Y^n T : average 10Ru07=127(14) 00Io02=125(6) **
*^{86}Nb^m I : existence considered as uncertain in ENSDF'15; needs confirmation **
*^{86}Tc^m T : average 08Ga04=1.10(0.14) 00Ch07=1.11(0.21) E : unc. estimated by GAu **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{87}Ga	−29250#	500#					10#	ms	(>400 ns)	$5/2^-$#	15	10Oh02	I	2010	β^- ?; β^-n=90#; β^-2n=7#	
^{87}Ge	−44080#	300#					150#	ms	(>300 ns)	$5/2^+$#	15	97Be70	I	1997	β^- ?; β^-n=3#; β^-2n=1#	
^{87}As	−55617.9	3.0					492	ms	25	$(5/2^-,3/2^-)$	15	15Ko19	TJ	1970	β^-=100; β^-n=15.4 22; β^-2n=0#	*
^{87}Se	−66426.1	2.2					5.50	s	0.14	$(3/2^+)$	15	15Ko19	J	1968	β^-=100; β^-n=0.36 8	
^{87}Br	−73892	3					55.65	s	0.12	$(5/2^-)$	15			1943	β^-=100; β^-n=2.60 4	
^{87}Kr	−80709.52	0.25					76.3	m	0.5	$5/2^+$	15			1940	β^-=100	
^{87}Rb	−84597.791	0.006					49.7	Gy	0.3	$3/2^-$	15			1921	IS=27.83 2; β^-=100	
^{87}Sr	−84880.066	0.005					STABLE			$9/2^+$	15			1931	IS=7.00 1	
^{87}Sr^m	−84491.537	0.006	388.5287	0.0023			2.815	h	0.012	$1/2^-$	15			1940	IT≈100; ε=0.30 8	
^{87}Y	−83018.4	1.1					79.8	h	0.3	$1/2^-$	15			1940	β^+=100	
^{87}Y^m	−82637.6	1.1	380.82	0.07			13.37	h	0.03	$9/2^+$	15			1940	IT=98.43 11; β^+=1.57 11	
^{87}Zr	−79347	4					1.68	h	0.01	$9/2^+$	15			1948	β^+=100	
^{87}Zr^m	−79011	4	335.84	0.19			14.0	s	0.2	$1/2^-$	15			1972	IT=100	
^{87}Nb	−73874	7					3.7	m	0.1	$(1/2)^-$	15			1971	β^+=100	
^{87}Nb^m	−73870	7	3.9	0.1			2.6	m	0.1	$(9/2)^+$	15			1972	β^+=100	
^{87}Mo	−66884.8	2.9					14.1	s	0.3	$7/2^+$#	15			1977	β^+=100; β^+p=15 5	
^{87}Tc	−57690	4				*	2.2	s	0.2	$9/2^+$#	15			1991	β^+=100; β^+p ?	
^{87}Tc^m	−57683	4	7	1		*	2#	s		$1/2^-$#		09Ga40	E		β^+ ?; IT ?	*
^{87}Tc^n	−57619	4	71	1			647	ns	24	$7/2^+$#	15			2009	IT=100	
^{87}Ru	−45520#	400#					50#	ms	(>1.5 μs)	$1/2^-$#	15	95Ry03	I	1995	β^+ ?; β^+p ?	

*^{87}As T : average 15Ko19=560(80) 13Ma22=484(35) 93Ru01=485(40) **
*^{87}As T : others 12Qu01=1450(550)(+3900–1100) 78Cr03=730(60) **
*^{87}Tc^m E : observed 64 keV γ ray in parallel to 71 keV one depopulating ^{87}Tc^n **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{88}Ge	−40140#	400#					100#	ms	(>300 ns)	0^+	14			1997	β^- ?; β^-n=6#; β^-2n=0.1#	
^{88}As	−50720#	200#					270	ms	150		14	12Qu01	T	1994	β^-=100; β^-n=30#	*
^{88}Se	−63884	3					1.53	s	0.06	0^+	14			1970	β^-=100; β^-n=0.99 10	
^{88}Br	−70716	3					16.34	s	0.08	(1^-)	14	15Cz01	J	1948	β^-=100; β^-n=6.58 18	
^{88}Br^m	−70446	3	270.1	0.5			5.51	μs	0.04	(4^-)	14	11Ru.A	T	1970	IT=100	*
^{88}Kr	−79691.3	2.6					2.825	h	0.019	0^+	14			1939	β^-=100	
^{88}Rb	−82608.99	0.16					17.773	m	0.018	2^-	14			1939	β^-=100	
^{88}Rb^m	−81235.2	0.3	1373.8	0.3			123	ns	13	(7^+)	14			2000	IT=100	
^{88}Sr	−87921.618	0.006					STABLE			0^+	14			1923	IS=82.58 1	
^{88}Y	−84299.0	1.5					106.626	d	0.021	4^-	14			1948	β^+=100	
^{88}Y^m	−83906.1	1.5	392.86	0.09			301	μs	3	1^+	14			1955	IT=100	
^{88}Y^n	−83624.5	1.5	674.55	0.04			13.98	ms	0.17	8^+	14			1962	IT=100	
^{88}Zr	−83629	5					83.4	d	0.3	0^+	14			1951	ε=100	
^{88}Zr^m	−80741	5	2887.79	0.06			1.320	μs	0.025	8^+	14			1978	IT=100	
^{88}Nb	−76170	60				*	14.50	m	0.11	(8^+)	14			1964	β^+=100	
^{88}Nb^m	−76040	100	130	120	BD	*	7.7	m	0.1	(4^-)	14			1971	β^+=100	
^{88}Mo	−72687	4					8.0	m	0.2	0^+	14			1971	β^+=100	

. . . *A*-group is continued on next page . . .

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...																
^{88}Tc	−61680	150				*	6.4	s	0.8	$(5^+,6^+,7^+)$	14			1991	β^+=100; β^+p ?	
^{88}Tc^m	−61680#	340#	0#	300#		*	5.8	s	0.2	(2^+)	14	09Ga40	J	1993	β^+=100; β^+p ?	*
^{88}Tc^n	−61580#	160#	100#	50#			146	ns	12	(4^+)	14	09Ga40	TJ	2009	IT=100	
^{88}Ru	−54340#	300#					1.3	s	0.3	0^+	14			1994	β^+=100; β^+p ?	*
^{88}Rh	−36860#	400#					1#	ms							β^+ ?	

*^{88}As T : symmetrized from 12Qu01=200(5)(+200–90) **
*^{88}Br^m J : 15Cz01=(4^-) **
*^{88}Tc^m J : 09Ga40 suggest this state to be 2^+, plus existence of an isomer 95 keV **
*^{88}Tc^m J : above this 2^+, that decays by E2, with half-life=146(12) ns **
*^{88}Ru T : symmetrized from 01Ki13=1.2(+0.3–0.2) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{89}Ge	−33730#	400#					50#	ms	(>300 ns)	$3/2^+$#	13			1997	β^- ?; β^-n=20#; β^-2n=2#	
^{89}As	−46800#	300#					200#	ms	(>150 ns)	$5/2^-$#	13	94Be24	I	1994	β^- ?; β^-n=100#; β^-2n=0.3#	
^{89}Se	−58992	4					430	ms	50	$5/2^+$#	13			1971	β^-=100; β^-n=7.8 25	
^{89}Br	−68274	3					4.357	s	0.022	$(3/2^-,5/2^-)$	13			1959	β^-=100; β^-n=13.8 4	
^{89}Kr	−76535.8	2.1					3.15	m	0.04	$3/2^{(+)}$	13	95Ke04	J	1940	β^-=100	*
^{89}Rb	−81712	5					15.32	m	0.10	$3/2^-$	13			1940	β^-=100	
^{89}Sr	−86209.02	0.09					50.563	d	0.025	$5/2^+$	13			1937	β^-=100	
^{89}Y	−87708.4	1.6					STABLE			$1/2^-$	13			1923	IS=100.	
^{89}Y^m	−86799.4	1.6	908.97	0.03			15.663	s	0.005	$9/2^+$	13	94It.A	T	1951	IT=100	
^{89}Zr	−84876	3					78.41	h	0.12	$9/2^+$	13			1948	β^+=100	
^{89}Zr^m	−84288	3	587.82	0.10			4.161	m	0.010	$1/2^-$	13			1953	IT=93.77 12; β^+=6.23 12	
^{89}Nb	−80625	24				*	2.03	h	0.07	$(9/2^+)$	13			1954	β^+=100	
^{89}Nb^m	−80630#	40#	0#	30#		*	1.10	h	0.03	$(1/2)^-$	13			1954	β^+=100	
^{89}Mo	−75015	4					2.11	m	0.10	$(9/2^+)$	13			1980	β^+=100	
^{89}Mo^m	−74628	4	387.5	0.2			190	ms	15	$(1/2^-)$	13			1980	IT=100	
^{89}Tc	−67395	4					12.8	s	0.9	$(9/2^+)$	13			1991	β^+=100	
^{89}Tc^m	−67332	4	62.6	0.5			12.9	s	0.8	$(1/2^-)$	13			1991	$\beta^+\approx$100; IT<0.01	
^{89}Ru	−58260#	300#					1.5	s	0.2	$(9/2^+)$	13	12Lo08	D	1992	β^+=100; β^+p=3.1 18	*
^{89}Rh	−45860#	360#					10#	ms	(>1.5 μs)	$7/2^+$#	13			1995	β^+ ?; β^+p ?; p ?	*

*^{89}Kr J : positive parity, since no β^- transition to ^{89}Rb ground-state **
*^{89}Ru D : β^+p symmetrized from 3.0(+1.9–1.7)% T : other recent 12Lo08=2.2(1.2) **
*^{89}Rh T : post-deadline 16Ce02<120 ns **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{90}Ge	−29220#	500#					50#	ms	(>400 ns)	0^+	10	10Oh02	I	2010	β^- ?; β^-n=50#; β^-2n=2#	
^{90}As	−41330#	400#					80#	ms	(>300 ns)		09	97Be70	I	1997	β^- ?; β^-n=30#; β^-2n=3#	
^{90}As^m	−41210#	400#	124.5	0.5			220	ns	100			12Ka36	ET	2012	IT=100	*
^{90}Se	−55800	330					210	ms	80	0^+	12	12Qu01	T	1994	β^-=100; β^-n=1#	*
^{90}Br	−64000	3					1.910	s	0.010		98	93Ru01	T	1959	β^-=100; β^-n=25.2 9	*
^{90}Kr	−74959.2	1.9					32.32	s	0.09	0^+	98			1951	β^-=100	
^{90}Rb	−79364	6					158	s	5	0^-	98			1951	β^-=100	
^{90}Rb^m	−79257	6	106.90	0.03			258	s	4	3^-	98			1967	β^-=97.4 4; IT=2.6 4	
^{90}Rb^x	−79293	14	71	12			$R=2$ 1			fsmix						
^{90}Sr	−85948.1	2.1					28.79	y	0.06	0^+	98			1948	β^-=100	
^{90}Y	−86494.1	1.6					64.00	h	0.21	2^-	98			1937	β^-=100	
^{90}Y^m	−85812.4	1.6	681.67	0.10			3.19	h	0.06	7^+	98			1961	IT$\approx$100; β^-=0.0018 2	
^{90}Zr	−88772.54	0.12					STABLE			0^+	98			1924	IS=51.45 40	
^{90}Zr^m	−86453.54	0.12	2319.000	0.010			809.2	ms	2.0	5^-	98			1972	IT=100	
^{90}Zr^n	−85183.12	0.12	3589.419	0.016			131	ns	4	8^+	98			1977	IT=100	
^{90}Nb	−82662	3					14.60	h	0.05	8^+	98			1951	β^+=100	
^{90}Nb^m	−82540	3	122.370	0.022			63	μs	2	6^+	98			1967	IT=100	
^{90}Nb^n	−82537	3	124.67	0.25			18.81	s	0.06	4^-	98			1969	IT=100	
^{90}Nb^p	−82491	3	171.10	0.10			< 1	μs		7^+	98			1981	IT=100	
^{90}Nb^q	−82280	3	382.01	0.25			6.19	ms	0.08	1^+	98			1967	IT=100	
^{90}Nb^r	−80782	3	1880.21	0.20			472	ns	13	(11^-)	98	05Ch65	TJ	1978	IT=100	*
^{90}Mo	−80173	3					5.56	h	0.09	0^+	98			1953	β^+=100	
^{90}Mo^m	−77298	3	2874.73	0.15			1.12	μs	0.05	8^+#	98			1971	IT=100	
^{90}Tc	−70724.7	1.0					49.2	s	0.4	(8^+)	98	93Ru03	J	1974	β^+=100	
^{90}Tc^m	−70580.7	1.3	144.0	1.7	MD		8.7	s	0.2	1^+	98			1974	β^+=100	
^{90}Ru	−64884	4					11	s	3	0^+	98			1991	β^+=100	
^{90}Rh	−51700#	300#				*	15	ms	7	0^+#	98	01Ki13	TD	1994	β^+=100; β^+p ?	*
^{90}Rh^m	−51700#	580#	0#	500#		*	1.1	s	0.3	9^+#		01Ki13	TD	2001	β^+=100; β^+p ?	*
^{90}Pd	−39710#	400#					10#	ms	(>400 ns)	0^+		16Ce02	I	2016	β^+ ?	

*^{90}As^m T : symmetrized from 200(+120–90) **
*^{90}Se T : symmetrized from 12Qu01=195(7)(+95–65) **
*^{90}Br T : supersedes 80Al15=1.92(0.02) same grp; other 12Qu01=1850(110)(+190–170) **
*^{90}Nb^r T : average 05Ch65=470(10) 81Fi02=440(20) 78Ha52=477(8) **
*^{90}Rh T : symmetrized from 12(+9–4) **
*^{90}Rh^m T : symmetrized from 1.0(+0.3–0.2) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{91}As	−36900#	400#					50#	ms	(>300 ns)	5/2−#	13	97Be70	I	1997	β^- ?; β^-n=90#; β^-2n=3#	
^{91}Se	−50580	430					270	ms	50	1/2+#	13			1975	β^-=100; β^-n=21 10; β^-2n=0.03#	
^{91}Br	−61107	4					543	ms	4	5/2−#	13			1974	β^-=100; β^-n=19.5 26	
^{91}Kr	−70974.0	2.2					8.57	s	0.04	5/2(+)	13			1951	β^-=100; β^-n=0#	
^{91}Rb	−77745	8					58.2	s	0.3	3/2(−)	13			1951	β^-=100; β^-n=0#	
^{91}Sr	−83652	5					9.65	h	0.06	5/2+	13			1943	β^-=100	
^{91}Y	−86351.3	1.8					58.51	d	0.06	1/2−	13			1943	β^-=100	
^{91}Y^m	−85795.7	1.8	555.58	0.05			49.71	m	0.04	9/2+	13			1953	IT>98.5; β^-<1.5	
^{91}Zr	−87895.57	0.10					STABLE			5/2+	13			1934	IS=11.22 5	
^{91}Zr^m	−84728.3	0.4	3167.3	0.4			4.35	μs	0.14	(21/2+)	13			1985	IT=100	
^{91}Nb	−86638.0	2.9					680	y	130	9/2+	13	91Hi.A	D	1951	ε≈100; e$^+$=0.0138 25	
^{91}Nb^m	−86533.4	2.9	104.60	0.05			60.86	d	0.22	1/2−	13	91Hi.A	D	1950	IT=96.6 5; ε=3.4 5; ; e$^+$=0.0028 2	
^{91}Nb^n	−84603.6	2.9	2034.42	0.20			3.76	μs	0.12	(17/2−)	13			1974	IT=100	
^{91}Mo	−82209	6					15.49	m	0.01	9/2+	13			1948	β^+=100	
^{91}Mo^m	−81556	6	653.01	0.09			64.6	s	0.6	1/2−	13			1953	IT=50.0 16; β^+=50.0 16	
^{91}Tc	−75986.6	2.4					3.14	m	0.02	(9/2)+	13			1974	β^+=100	
^{91}Tc^m	−75847.3	2.4	139.3	0.3			3.3	m	0.1	(1/2)−	13			1975	β^+>99; IT<1	
^{91}Ru	−68239.8	2.2				*	8.0	s	0.4	(9/2+)	13			1983	β^+=100; β^+p ?	
^{91}Ru^m	−68580	500	−340	500	BD	*	7.6	s	0.8	(1/2−)	13			1983	β^+≈100; β^+p=?; IT ?	
^{91}Rh	−58570#	300#					1.60	s	0.15	7/2+#	13			1994	β^+=100; β^+p=1.3 5	*
^{91}Rh^m	−58400#	300#	172.9	0.4			1.46	s	0.11	1/2−#	13			2004	β^+=100; IT ?	
^{91}Pd	−45930#	400#					10#	ms	(>1.5 μs)	7/2+#	13	95Ry03	I	1995	β^+ ?; β^+p ?	

*^{91}Rh T : average 04De40=1.7(0.2) 01Ki13=1.47(0.22); 00We.A(same group)=1.74(0.14) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{92}As	−30980#	500#					30#	ms	(>300 ns)		12	97Be70	I	1997	β^- ?; β^-n=60#; β^-2n=40#	
^{92}Se	−46720#	400#					100#	ms	(>300 ns)	0+	12	97Be70	I	1997	β^- ?; β^-n=2#; β^-2n=0#	
^{92}Se^m	−44780#	400#	1940	50			12	μs	4			12Ka36	ET	2012	IT=100	*
^{92}Br	−56233	7					0.314s	0.	016	(2−)	12			1974	β^-=100; β^-n=33.1 25; β^-2n=0.01#	*
^{92}Br^m	−55571	7	662	1			88	ns	8			12Ka36	ET	2012	IT=100	*
^{92}Br^n	−55095	7	1138	1			85	ns	10			12Ka36	ET	2012	IT=100	*
^{92}Kr	−68769.3	2.7					1.840	s	0.008	0+	12			1951	β^-=100; β^-n=0.0332 25	
^{92}Rb	−74772	6					4.48	s	0.03	0−	12			1960	β^-=100; β^-n=0.0107 5	
^{92}Sr	−82867	3					2.611	h	0.017	0+	12			1956	β^-=100	
^{92}Y	−84816	9					3.54	h	0.01	2−	12			1940	β^-=100	
^{92}Y^m	−84010	50	807	50			3.7	μs	0.5	7+#	12	11Ru.A	ET	2009	IT=100	*
^{92}Zr	−88459.03	0.10					STABLE			0+	12			1924	IS=17.15 8	
^{92}Nb	−86453.3	1.8					34.7	My	2.4	7+	12			1938	β^+=100	
^{92}Nb^m	−86317.8	1.8	135.5	0.4			10.15	d	0.02	(2)+	12			1959	β^+=100	
^{92}Nb^n	−86227.5	1.8	225.8	0.4			5.9	μs	0.2	(2)−	12			1958	IT=100	
^{92}Nb^p	−84250.0	1.8	2203.3	0.4			167	ns	4	(11−)	12			1989	IT=100	
^{92}Mo	−86808.58	0.16					STABLE		(>190 Ey)	0+	12	97Ba35	T	1930	IS=14.53 30; 2β^+ ?	*
^{92}Mo^m	−84048.06	0.21	2760.52	0.14			190	ns	3	8+	12			1964	IT=100	
^{92}Tc	−78926	3					4.25	m	0.15	(8)+	12			1964	β^+=100	
^{92}Tc^m	−78656	3	270.09	0.08			1.03	μs	0.07	(4+)	12			1976	IT=100	
^{92}Tc^n	−78397	3	529.42	0.13			< 0.1	μs		(3+)	12			1976	IT=100	
^{92}Tc^p	−78215	3	711.33	0.15			< 0.1	μs		1+	12			1976	IT=100	
^{92}Ru	−74301.2	2.7					3.65	m	0.05	0+	12			1971	β^+=100	
^{92}Rh	−62999	4					4.66	s	0.25	(6+)	12	04De40	J	1994	β^+=100; β^+p=1.9 1	*
^{92}Rh^m	−62950#	100#	50#	100#			0.53	s	0.37	(2+)	12	04De40	TJD	2004	β^+=100; β^+p=?	*
^{92}Pd	−54580#	300#					1.1	s	0.3	0+	12	01Ki13	TD	1994	β^+=100; β^+p ?	*
^{92}Ag	−37130#	500#					1#	ms	(>400 ns)			16Ce02	I	2016	β^+ ?	

*^{92}Se^m E : 12Ka36=503.4(0.5), 538.8(0.5) and 897.8(0.5) γ rays in cascade to **
*^{92}Se^m E : ground-state =1940(1); error increased for possible missing γ **
*^{92}Se^m T : symmetrized from 10.3(+5.5–2.8) **
*^{92}Br I : also an isomer with T<500 ns decaying by γ-rays 1039, 780, 301… keV **
*^{92}Br^m T : symmetrized from 89(+7–8) **
*^{92}Br^n T : symmetrized from 84(+10–9); other 09Fo05<500 ns assuming single isomer **
*^{92}Y^m T : average 11Ru.A=3.3(0.6) 09Fo05=4.2(+0.8–0.6) **
*^{92}Y^m E : observed 315 and 419 γ rays; low energy transition may directly **
*^{92}Y^m E : depopulate the isomer **
*^{92}Mo T : T>190 Ey (2σ) **
*^{92}Rh D : from 12Lo08 **
*^{92}Rh^m I : this state is not observed in 12Lo08 **
*^{92}Pd T : symmetrized from 1.0(+0.3–0.2) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{93}Se	−40720#	400#				50#	ms	(>300 ns)	$1/2^+$#	11	97Be70	I	1997	β^- ?; β^-n=30#; β^-2n=2#	
^{93}Se^m	−40040#	400#	678.2	0.7		420	ns	100			12Ka36	ET	2012	IT=100	*
^{93}Br	−52890	430				152	ms	8	$5/2^-$#	11	13Mi13	TD	1981	β^-=100; β^-n=55 10; β^-2n=0.01#	*
^{93}Kr	−64136.0	2.5				1.286	s	0.010	$1/2^+$	11			1951	β^-=100; β^-n=1.95 11	*
^{93}Rb	−72620	8				5.84	s	0.02	$5/2^-$	11			1960	β^-=100; β^-n=1.39 7	
^{93}Rb^m	−68197	8	4423.1	1.5		111	ns	11	$(27/2^-)$	11			2010	IT=100	
^{93}Rb^x	−72367	8	253.39	0.03		< 0.5	ns		$3/2^-$	11	86Si20	T	1970	IT=100	*
^{93}Sr	−80086	8				7.43	m	0.03	$5/2^+$	11			1959	β^-=100	
^{93}Y	−84227	10				10.18	h	0.08	$1/2^-$	11			1948	β^-=100	
^{93}Y^m	−83468	10	758.719	0.021		820	ms	40	$9/2^+$	11	07Ch07	J	1974	IT=100	
^{93}Zr	−87122.0	0.5				1.61	My	0.05	$5/2^+$	11			1950	β^-=100	
^{93}Nb	−87212.8	1.5				STABLE			$9/2^+$	11			1932	IS=100.	
^{93}Nb^m	−87182.0	1.5	30.77	0.02		16.12	y	0.12	$1/2^-$	11			1965	IT=100	
^{93}Nb^n	−79753	17	7460	17		1.5	μs	0.5		11			2007	IT ?	*
^{93}Mo	−86807.07	0.18				4.0	ky	0.8	$5/2^+$	11			1946	ε=100	
^{93}Mo^m	−84382.12	0.18	2424.95	0.04		6.85	h	0.07	$21/2^+$	11			1950	IT≈100; β^+=0.12 1	
^{93}Mo^n	−77112	17	9695	17		1.8	μs	1.0	$(39/2^-)$	11			2005	IT ?	*
^{93}Tc	−83606.1	1.0				2.75	h	0.05	$9/2^+$	11			1948	β^+=100	
^{93}Tc^m	−83214.3	1.0	391.84	0.08		43.5	m	1.0	$1/2^-$	11			1939	IT=77.4 6; β^+=22.6 6	
^{93}Tc^n	−81420.9	1.0	2185.16	0.15		10.2	μs	0.3	$(17/2)^-$	11			1973	IT=100	
^{93}Ru	−77216.7	2.1				59.7	s	0.6	$(9/2)^+$	11			1972	β^+=100	
^{93}Ru^m	−76482.3	2.1	734.40	0.10		10.8	s	0.3	$(1/2)^-$	11			1983	β^+=78.0 23; IT=22.0 23; β^+p=0.027 5	
^{93}Ru^n	−75134.2	2.3	2082.5	0.9		2.49	μs	0.15	$(21/2)^+$	11			1983	IT=100	
^{93}Rh	−69011.8	2.6				13.9	s	1.6	$9/2^+$#	11			1994	β^+=100	
^{93}Pd	−59000#	300#				1.15	s	0.05	$(9/2^+)$	11	12Lo08	TD	1994	β^+=100; β^+p=7.5 5	
^{93}Ag	−46270#	400#				20#	ms	(>1.5 μs)	$9/2^+$#	11	95Ry03	I	1994	β^+ ?; p ?; β^+p ?	*

*^{93}Se^m E : 12Ka36=208.3(0.5) and 469.9(0.5) γ rays in cascade to ground-state **
*^{93}Se^m T : symmetrized from 390(+120–80) **
*^{93}Br D : symmetrized from 13Mi13 β^-n=53(+11–8)% **
*^{93}Kr T : also 13Mi13=1.298(0.054) outweighed D : also 13Mi13=1.9(+0.6–0.2) **
*^{93}Rb^x T : 70Gr38=57(15) μs not confirmed in 14Mi12; most likely ^{95}Y^m **
*^{93}Rb^x J : 253.4 keV M1 (and E2) γ ray to $5/2^-$; β^- feeding from $1/2^+$ ^{93}Kr **
*^{93}Nb^n E : ENSDF2011 : x keV above 7435.3(2.1) $37/2^-$ level; NUBASE assumes x<50 **
*^{93}Mo^n E : ENSDF2011 : x keV above 9670.0(2.3) (35/2,37/2) level; NUBASE assumes x<50 **
*^{93}Mo^n T : symmetrized from 1.1(+1.5–0.4) **
*^{93}Ag I : the few events reported in 94He28 are not trusted by NUBASE **
*^{93}Ag I : 10St.A>0.2 μs **
*^{93}Ag T : estimated half-life is for β^+ decay; p-decay would be much shorter **
*^{93}Ag T : post-deadline 16Ce02=228#(16#) ns **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{94}Se	−36800#	500#				20#	ms	(>300 ns)	0^+	06	97Be70	I	1997	β^- ?; β^-n=20#; β^-2n=0.2#	
^{94}Br	−47400#	300#				70	ms	20	2^-#	06			1981	β^-=100; β^-n=68 16; β^-2n=3#	
^{94}Br^m	−47110#	300#	294.6	0.5		530	ns	15			12Ka36	ET	2012	IT=100	
^{94}Kr	−61348	12				212	ms	5	0^+	11			1972	β^-=100; β^-n=1.11 7	
^{94}Rb	−68562.8	2.0				2.702	s	0.005	$3^{(-)}$	11			1961	β^-=100; β^-n=10.5 4	
^{94}Rb^m	−66487.9	2.4	2074.9	1.4		107	ns	16	(10^-)	11			2008	IT=100	
^{94}Sr	−78845.7	1.7				75.3	s	0.2	0^+	11			1959	β^-=100	
^{94}Y	−82351	6				18.7	m	0.1	2^-	06			1948	β^-=100	
^{94}Y^m	−81149	6	1202.3	1.0		1.295	μs	0.005	(5^+)	06	11Ru.A	T	1999	IT=100	
^{94}Zr	−87269.32	0.16				STABLE		(>110 Py)	0^+	06	99Ar25	T	1924	IS=17.38 28; $2\beta^-$?	
^{94}Nb	−86369.1	1.5				20.4	ky	0.4	6^+	06	12He11	T	1938	β^-=100	
^{94}Nb^m	−86328.2	1.5	40.892	0.012		6.263	m	0.004	3^+	06			1962	IT=99.50 6; β^-=0.50 6	
^{94}Mo	−88414.06	0.14				STABLE			0^+	06			1930	IS=9.15 9	
^{94}Tc	−84158	4				293	m	1	7^+	06			1948	β^+=100	
^{94}Tc^m	−84082	5	76	3		52.0	m	1.0	$(2)^+$	06			1948	β^+≈100; IT<0.1	
^{94}Ru	−82584	3				51.8	m	0.6	0^+	06			1952	β^+=100	
^{94}Ru^m	−79940	3	2644.1	0.4		71	μs	4	8^+	06			1971	IT=100	
^{94}Rh	−72908	3			*	70.6	s	0.6	(4^+)	06	06Ba55	J	1979	β^+=100; β^+p=1.8 5	
^{94}Rh^m	−72853	3	54.60	0.20		480	ns	30	(2^+)	06			2004	IT=100	
^{94}Rh^n	−72610#	200#	300#	200#	*	25.8	s	0.2	(8^+)	06			1973	β^+=100	
^{94}Pd	−66102	4				9.0	s	0.5	0^+	06			1982	β^+=100	
^{94}Pd^m	−61219	4	4883.1	0.4		511.0	ns	7.3	(14^+)	06	11Br01	T	1995	IT=100	*
^{94}Pd^n	−58893	4	7209.1	1.8		197	ns	22	(19^-)		11Br01	TJ	2011	IT=100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{94}Ag	−52410#	400#				37	ms	18	0^+#	06			1994	β^+=100; β^+p ?	*
^{94}Ag^m	−51060#	570#	1350#	400#		550	ms	60	(7^+)	06			1994	β^+=100; β^+p=20	
^{94}Ag^n	−45920#	300#	6490#	500#		400	ms	40	(21^+)	06			2002	β^+=95.4 7; β^+p=27; p=4.1 6; 2p=0.5 3	*
^{94}Cd	−40140#	500#				80#	ms	(>400 ns)	0^+		16Ce02	I	2016	β^+ ?	
*^{94}Pd^m	T : average 11Br01=499(13) 09Ga40=468(19) 02La18=530(10)														**
*^{94}Pd^n	E : from 4883.1(0.4) for the 14^+ state and 1651(1), 267(1) and 408(1) keV														**
*^{94}Pd^n	E : γ rays in a cascade from (19^-); uncertainties added in quadrature														**
*^{94}Ag	T : symmetrized from 26(+26–9)														**
*^{94}Ag^n	D : p=1.9(5) + 2.2(4) from 05Mu15, 2p from 06Mu03														**
^{95}Se	−30460#	500#				10#	ms	(>400 ns)	$3/2^+$#	12	10Oh02	I	2010	β^- ?; β^-n=10#; β^-2n=3#	
^{95}Br	−43770#	300#				50#	ms	(>300 ns)	$5/2^-$#	10	97Be70	I	1997	β^- ?; β^-n=70#; β^-2n=0.2#	
^{95}Br^m	−43230#	300#	537.9	0.5		6.8	μs	1.0			12Ka36	ET	2012	IT=100	*
^{95}Kr	−56159	19				114	ms	3	$1/2^{(+)}$	10			1994	β^-=100; β^-n=2.87 18; β^-2n=0#	
^{95}Kr^m	−55964	19	195.5	0.3		1.582	μs	0.022	$(7/2^+)$	10	12Ka36	T	2006	IT=100	*
^{95}Rb	−65891	20				377.7	ms	0.8	$5/2^-$	10			1967	β^-=100; β^-n=8.7 3	
^{95}Rb^m	−65056	20	835.0	0.6		< 500	ns		$9/2^+$#	10			2009	IT=100	
^{95}Sr	−75120	6				23.90	s	0.14	$1/2^+$	10			1961	β^-=100	
^{95}Y	−81209	7				10.3	m	0.1	$1/2^-$	10			1959	β^-=100	
^{95}Y^m	−80121	7	1087.6	0.6		48.6	μs	0.5	$9/2^+$	10	11Ru.A	T	1981	IT=100	
^{95}Zr	−85659.9	0.9				64.032	d	0.006	$5/2^+$	10			1946	β^-=100	
^{95}Nb	−86786.3	0.5				34.991	d	0.006	$9/2^+$	10			1951	β^-=100	
^{95}Nb^m	−86550.6	0.5	235.69	0.02		3.61	d	0.03	$1/2^-$	10			1969	IT=94.4 6; β^-=5.6 6	
^{95}Mo	−87711.86	0.12				STABLE			$5/2^+$	10			1930	IS=15.84 11	
^{95}Tc	−86021	5				20.0	h	0.1	$9/2^+$	10			1947	β^+=100	
^{95}Tc^m	−85982	5	38.91	0.04		61	d	2	$1/2^-$	10			1959	β^+=96.12 32; IT=3.88 32	
^{95}Ru	−83458	10				1.643	h	0.013	$5/2^+$	10			1948	β^+=100	
^{95}Rh	−78341	4				5.02	m	0.10	$(9/2)^+$	10			1967	β^+=100	
^{95}Rh^m	−77798	4	543.3	0.3		1.96	m	0.04	$(1/2)^-$	10			1974	IT=88 5; β^+=12 5	
^{95}Pd	−69966	3				7.5	s	0.5	$9/2^+$#	10	12Lo08	T	1980	β^+=100; β^+p ?	
^{95}Pd^m	−68091	3	1875.13	0.14		13.3	s	0.3	$(21/2^+)$	10			1982	β^+=?; IT=11 3; β^+p=0.93 15	
^{95}Ag	−59600#	300#				1.76	s	0.09	$(9/2^+)$	10	12Lo08	TD	1994	β^+=100; β^+p=2.5 3	*
^{95}Ag^m	−59260#	300#	344.2	0.3		< 500	ms		$(1/2^-)$	10			2003	IT=100	
^{95}Ag^n	−57070#	300#	2531.3	1.5		< 16	ms		$(23/2^+)$	10			2003	IT=100	
^{95}Ag^p	−54740#	300#	4860.0	1.5		< 40	ms		$(37/2^+)$	10			2003	IT=100	
^{95}Cd	−46630#	400#				90	ms	40	$9/2^+$#		10St.A	T	2011	β^+ ?; β^+p ?	*
*^{95}Br^m	T : symmetrized from 6.7(+1.1–0.9)														**
*^{95}Kr^m	E : also 12Ka36=82.6(0.5) and 114.3(0.5) γ rays in cascade to ground-state														**
*^{95}Kr^m	T : other 11Ru.A=1.28(0.05) 06Ge05=1.4(0.2)														**
*^{95}Ag	T : average 12Lo08=1.85(0.08) 05Ha45=1.76(0.13) 03Do09=1.85(0.34) and														**
*^{95}Cd	T : symmetrized from 73(+53–28)														**
^{96}Br	−38160#	300#				20#	ms	(>300 ns)		08	97Be70	I	1997	β^- ?; β^-n=50#; β^-2n=6#	
^{96}Br^m	−37850#	300#	311.5	0.5		3.0	μs	0.9			12Ka36	ET	2012	IT=100	*
^{96}Kr	−53080	20				80	ms	8	0^+	12			1994	β^-=100; β^-n=3.7 4	
^{96}Rb	−61354	3			*	201	ms	1	2^-	08	93Ru01	T	1967	β^-=100; β^-n=13.3 7; β^-2n=0.02#	*
^{96}Rb^m	−61350#	200#	0#	200#	*	200#	ms	(>1 ms)	$1^{(+\#)}$		81Bo30	JI	1981	β^- ?; IT ?; β^-n=10#; β^-2n=0.02#	*
^{96}Rb^n	−60219	3	1134.6	1.1		1.80	μs	0.04	(10^-)	08			1999	IT=100	*
^{96}Sr	−72924	8				1.07	s	0.01	0^+	08			1971	β^-=100; β^-n=0#	
^{96}Y	−78336	6				5.34	s	0.05	0^-	08			1975	β^-=100	
^{96}Y^m	−76796	6	1540	9	MD	9.6	s	0.2	8^+	08	07Ch07	J	1974	β^-=100	
^{96}Zr	−85438.85	0.11				23	Ey	2	0^+	08	15Ba11	T	1934	IS=2.80 9; 2β^-=100	
^{96}Nb	−85602.82	0.15				23.35	h	0.05	6^+	08			1949	β^-=100	
^{96}Mo	−88794.88	0.12				STABLE			0^+	08			1930	IS=16.67 15	
^{96}Tc	−85822	5				4.28	d	0.07	7^+	08			1947	β^+=100	
^{96}Tc^m	−85788	5	34.23	0.04		51.5	m	1.0	4^+	08			1950	IT=98.0 5; β^+=2.0 5	
^{96}Ru	−86080.37	0.17				STABLE		(>80 Ey)	0^+	08	13Be09	T	1931	IS=5.54 14; 2β^+ ?	*
^{96}Rh	−79688	10				9.90	m	0.10	6^+	08			1967	β^+=100	
^{96}Rh^m	−79636	10	51.98	0.09		1.51	m	0.02	3^+	08			1966	IT=60 5; β^+=40 5	
^{96}Pd	−76183	4				122	s	2	0^+	08			1980	β^+=100	
^{96}Pd^m	−73652	4	2530.57	0.23		1.81	μs	0.01	8^+#	08	98Gr.B	TD	1983	IT=100	*
^{96}Ag	−64510	90			*	4.44	s	0.04	$(8)^+$	08	12Lo08	TD	1982	β^+=100; β^+p=6.9 7	*
^{96}Ag^m	−64510#	100#	0#	50#	*	6.9	s	0.5	(2^+)	08	12Lo08	TD	2003	β^+=100; β^+p=15.1 26	*
^{96}Ag^n	−62050	90	2461.4	0.3		100	μs	10	(13^-)		11Bo23	TJD	2011	IT=100	*
^{96}Ag^p	−61830	90	2680	7		1.543	μs	0.028	(15^+)	08	11Bo23	ETJ	2011	IT=100	*
^{96}Ag^q	−57570	90	6945	7		160	ns	30	(19^+)		11Bo23	ETJ	2011	IT=100	*
… *A*-group is continued on next page …															

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

… *A*-group continued …

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{96}Cd	−55570#	400#				880	ms	90	0^+	10	12Lo08	D	2008	β^+=100; β^+p=5.5 40	*
^{96}Cd^m	−50270#	400#	5300#	2000#		300	ms	110	16^+	10	11Na34	TJD	2011	β^+=100; β^+p ?	*
^{96}In	−37890#	500#				1#	ms	(>400 ns)			16Ce02	I	2016	β^+ ?	

*^{96}Br^m T : symmetrized from 2.7(+1.1–0.7) **
*^{96}Rb J : measured magnetic moment consistent with 2^- **
*^{96}Rb^m I : non-observation in 81Th04 is not in contradiction with 81Bo30 experiment **
*^{96}Rb^n T : average 12Ka36=1.72(+0.16–0.14) 11Ru.A=1.77(0.05) 05Pi13=2.0(0.1) **
*^{96}Rb^n T : 99Ge01=1.65(0.15) **
*^{96}Ru T : 13Be09 : 2ν-$\beta^+\varepsilon$>80Ey (theor. most probable); 2nu$\beta^+\beta^+$>140Ey 0nu2K>1Zy **
*^{96}Pd^m T : supersedes 97Gr02=1.7(0.1); others 09Ga40=1.76(0.05) 07My02=2.10(0.21) **
*^{96}Pd^m T : 83Gr01=2.2(0.3) J : from 03Ba39 **
*^{96}Ag T : average 12Lo08=4.40(0.09) 03Ba39=4.40(0.06) 97Sc30=4.50(0.06) **
*^{96}Ag D : β^+p average 12Lo08=6.5(0.8) 03Ba39=8.5(1.5) **
*^{96}Ag^m T : average 12Lo08=6.8(1.0) 03Ba39=6.9(0.6) D : average 12Lo08=14(3) 03Ba39=18(5) **
*^{96}Ag^n E : from least-squares fit to γ-ray energies using 11Bo23 level scheme **
*^{96}Ag^n T : other 11Be34=8.6(6.3) μs using a collection time of 12 μs **
*^{96}Ag^p E : 25-50 keV above the 2643 13^+ level **
*^{96}Ag^p T : average 11Bo23=1.56(0.03) 11Be34=1.45(0.07) **
*^{96}Ag^q E : 4265 above the ^{96}Ag^p **
*^{96}Cd T : average 11Na34=670(150) 10St.A=990(130) 08Ba53=1030(+240–210) **
*^{96}Cd^m T : symmetrized from 11Na34=290(+110–100) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{97}Br	−34060#	400#				10#	ms	(>300 ns)	$5/2^-$#	10			1997	β^- ?; β^-n=90#; β^-2n=5#	
^{97}Kr	−47420	130				62.2	ms	3.2	$3/2^+$#	10	11Ni01	T	1997	β^-=100; β^-n=6.7 6; β^-2n=0.1#	*
^{97}Rb	−58519.1	1.9				169.1	ms	0.6	$3/2^+$	15			1969	β^-=100; β^-n=25.5 9; β^-2n=0#	
^{97}Rb^m	−58442.5	1.9	76.6	0.2		5.7	μs	0.6	$(1/2,3/2)^-$	15			2012	IT=100	
^{97}Sr	−68581	3				429	ms	5	$1/2^+$	10			1978	β^-=100; β^-n<0.05	
^{97}Sr^m	−68273	3	308.13	0.11		165	ns	4	$7/2^+$	10	15Cz01	T	1990	IT=100	*
^{97}Sr^n	−67750	3	830.83	0.23		515	ns	10	$(9/2^+)$	10	13Ru07	TJ	1974	IT=100	
^{97}Y	−76121	7				3.75	s	0.03	$1/2^-$	10	07Ch07	J	1970	β^-=100; β^-n=0.055 4	
^{97}Y^m	−75453	7	667.52	0.23		1.17	s	0.03	$9/2^+$	10	07Ch07	J	1970	β^->99.3; IT<0.7; β^-n<0.08	
^{97}Y^n	−72598	7	3522.6	0.4		142	ms	8	$(27/2^-)$	10			1986	IT=94.8 9; β^-=5.2 9	
^{97}Zr	−82942.7	0.4				16.749	h	0.008	$1/2^+$	10			1951	β^-=100	
^{97}Zr^m	−81678.3	0.4	1264.35	0.16		104.8	ns	1.7	$7/2^+$	10	11Ru.A	T	1976	IT=100	*
^{97}Nb	−85606	4				72.1	m	0.7	$9/2^+$	10			1951	β^-=100	
^{97}Nb^m	−84863	4	743.35	0.03		58.7	s	1.8	$1/2^-$	10			1950	IT=100	
^{97}Mo	−87544.69	0.16				STABLE			$5/2^+$	10			1930	IS=9.60 14	
^{97}Tc	−87224	4				4.21	My	0.16	$9/2^+$	10			1946	ε=100	
^{97}Tc^m	−87127	4	96.57	0.06		91.0	d	0.6	$1/2^-$	10			1954	IT=96.06 18; ε=3.94 18	
^{97}Ru	−86120.6	2.8				2.8370	d	0.0014	$5/2^+$	10	09Go29	T	1946	β^+=100	
^{97}Rh	−82600	40				30.7	m	0.6	$9/2^+$	10			1955	β^+=100	
^{97}Rh^m	−82340	40	258.76	0.18		46.2	m	1.6	$1/2^-$	10			1971	β^+=94.4 6; IT=5.6 6	
^{97}Pd	−77806	5				3.10	m	0.09	$5/2^+$#	10			1969	β^+=100	
^{97}Ag	−70830	110				25.5	s	0.3	$(9/2)^+$	10	14Fe01	J	1978	β^+=100	
^{97}Ag^m	−70430#	230#	400#	200#		100#	ms		$1/2^-$#					IT ?	
^{97}Cd	−60450#	300#				1.10	s	0.08	$(9/2^+)$	10	11Lo09	TJD	1978	β^+=100; β^+p=11.8 20	
^{97}Cd^m	−58950#	580#	1500#	500#		3.8	s	0.2	$(25/2^+)$	10	11Lo09	TJD	1982	β^+=100; β^+p=25 4	
^{97}In	−47190#	400#				50	ms	30	$9/2^+$#		10St.A	TD	2011	β^+=100; p ?; β^+p ?	*

*^{97}Kr T : average 11Ni01=60(+6–5) 03Be05=63(4) **
*^{97}Sr^m E : also 12Ka36=141.3(0.5) and 167.6(0.5) γ rays in cascade to ground-state **
*^{97}Sr^m T : others 11Ru.A=180.9(2.8) 06Hw01=165(25) 83Kr11=170(10) **
*^{97}Zr^m T : average 11Ru.A=106.1(2.1) 85Be20=102(3); others outweighed 06Hw01=97(16) **
*^{97}Zr^m T : 96Lh03=106(7) **
*^{97}In T : symmetrized from 26(+47–10) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{98}Br	−28250#	400#				5#	ms	(>400 ns)		10	10Oh02	I	2010	β^- ?; β^-n=70#; β^-2n=20#	
^{98}Kr	−44310#	300#				42.8	ms	3.6	0^+	03	11Ni01	T	1997	β^-=100; β^-n=7.0 10; β^-2n=0#	*
^{98}Rb	−54369	16				114	ms	5	$0^{(-\#)}$	03	81Th04	J	1971	β^-=100; β^-n=13.8 6; β^-2n=0.051 7	*
^{98}Rb^m	−54296	20	73	26	BD	96	ms	3	$(3,4)^{(+\#)}$	03			1980	β^-=100; β^-n=10#; β^-2n=0.05#	*
^{98}Rb^n	−54191	16	178.3	0.4		358	ns	7		09	12Ka36	ET	2009	IT=100	*
^{98}Sr	−66423	3				653	ms	2	0^+	03			1971	β^-=100; β^-n=0.25 5	
^{98}Y	−72295	8				548	ms	2	$(0)^-$	03			1970	β^-=100; β^-n=0.331 24	
^{98}Y^m	−72054	28	241	29	BD	2.0	s	0.2	$(5^+,4^-)$	03			1977	β^-=?; IT=10#; β^-n=3.4 10	*
^{98}Y^n	−72124	8	170.74	0.06		610	ns	9	$(2)^-$	03	11Ru.A	T	1972	IT=100	
^{98}Y^p	−71799	8	496.19	0.15		6.87	μs	0.05	(4^-)	03	11Ru.A	T	1970	IT=100	*
^{98}Y^q	−71114	8	1181.1	0.4		806	ns	21	(10^-)	03	11Ru.A	T	1972	IT=100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{98}Zr	−81287	8				30.7	s	0.4	0^+	03			1967	β^-=100	
^{98}Zr^m	−74683	8	6603.7	0.3		1.9	μs	0.2	(17^-)		06Si36	EJT	2005	IT=100	
^{98}Nb	−83525	5				2.86	s	0.06	1^+	03			1960	β^-=100	
^{98}Nb^m	−83441	6	84	4		51.3	m	0.4	(5^+)	03			1948	$\beta^-\approx$100; IT=0.1#	
^{98}Mo	−88115.97	0.17				STABLE		(>100 Ty)	0^+	03	52Fr23	T	1930	IS=24.39 37; 2β^- ?	*
^{98}Tc	−86432	3				4.2	My	0.3	$(6)^+$	03			1955	β^-=100; β^+=0	
^{98}Tc^m	−86341	3	90.76	0.16		14.7	μs	0.3	$(2)^-$	03			1976	IT=100	
^{98}Ru	−88225	6				STABLE			0^+	03			1944	IS=1.87 3	
^{98}Rh	−83175	12			*	8.72	m	0.12	$(2)^+$	03			1955	β^+=100	
^{98}Rh^m	−83120#	50#	60#	50#	*	3.6	m	0.2	(5^+)	03			1966	IT=89 5; β^+=11 5	
^{98}Pd	−81321	5				17.7	m	0.3	0^+	03			1955	β^+=100	
^{98}Ag	−73070	30				47.5	s	0.3	$(5,6)^+$	03	14Fe01	J	1978	β^+=100; β^+p=0.0012 5	*
^{98}Ag^m	−72900	30	167.83	0.15		220	ns	20	(3^+)	03	98Gr.B	ETD	1998	IT=100	
^{98}Cd	−67640	50				9.2	s	0.3	0^+	03			1978	β^+=100; β^+p<0.025	
^{98}Cd^m	−65210	50	2427.5	0.6		189	ns	19	(8^+)	03	04Bl10	TJ	1996	IT=100	*
^{98}Cd^n	−61010	50	6635	2		240	ns	40	(12^+)		04Bl10	ETJ	2004	IT=100	*
^{98}In	−53900#	300#			*	37	ms	5	0^+#	03	12Lo08	TD	1994	β^+=100; β^+p=5.6 3	*
^{98}In^m	−53900#	580#	0#	500#	*	1.01	s	0.13		03	12Lo08	TD	2001	β^+=100; β^+p=19 2	*

*^{98}Kr T : average 11Ni01=42(4) 03Be05=46(8) **
*^{98}Rb T : also 11Ni01=102(4), maybe mixture **
*^{98}Rb^m I : also an isomer with T=700(+60–50) ns decaying by γ-rays of 178, 124 keV **
*^{98}Rb^n E : average 12Ka36=178.4(0.5) 09Fo05=178.0(0.7) T : other 09Fo05=700(+60–50) **
*^{98}Y^m J : 04Br14=(5^+) 95Ha.B=(4^-) 94St31=(5^+) **
*^{98}Y^p J : from 04Br14; ENSDF=(2^-) and (p1/2[303]+n9/2[404]) config (in error) **
*^{98}Y^q J : from 04Br14; ENSDF=(8^-) from (2^-) for 496 keV isomer **
*^{98}Mo T : 52Fr23 : 0ν-$\beta\beta$>100 Ty (theoretically faster, see text) **
*^{98}Ag D : symmetrized from β^+p=0.0011(+5–4)% **
*^{98}Cd^m T : average 04Bl10=170(+60–40) 98Gr.B=190(20), the latter supersedes **
*^{98}Cd^m T : 97Gr02=200(+300–170); other 97Go18=480(160) outweighed **
*^{98}Cd^n T : symmetrized from 230(+40–30) E : unc. estimated by evaluator **
*^{98}In T : average 12Lo08=47(13) 10St.A=32(6) 08Ba53=44(+13–12) 01Ki13=32(+32–11) **
*^{98}In D : β^+p symmetrized from 12Lo08=5.5(+0.3–0.2) **
*^{98}In^m T : average 12Lo08=1.27(0.30) 10St.A=0.86(0.21) 08Ba53=0.92(+0.27–0.17) and **
*^{98}In^m T : 01Ki13=1.2(+1.2–0.4) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{99}Kr	−38760#	400#				40	ms	11	$5/2^-$#	11	03Be05	TD	1997	β^-=100; β^-n=11 7; β^-2n=2#	*
^{99}Rb	−51121	4				56.4	ms	1.2	$(3/2^+)$	15			1971	β^-=100; β^-n=15.8 24; β^-2n=0.01#	
^{99}Sr	−62521	5				269	ms	1	$3/2^+$	11			1975	β^-=100; β^-n=0.100 19	
^{99}Y	−70650	7				1.484	s	0.007	$5/2^+$	11	07Ch07	J	1975	β^-=100; β^-n=1.7 4	
^{99}Y^m	−68508	7	2141.65	0.19		8.6	μs	0.8	$(17/2^+)$	11			1985	IT=100	
^{99}Zr	−77621	11				2.1	s	0.1	$1/2^+$	11	02Ca37	J	1970	β^-=100	
^{99}Zr^m	−77369	11	251.96	0.09		293	ns	10	$7/2^+$	11	FGK126	J	1970	IT=100	*
^{99}Nb	−82335	12				15.0	s	0.2	$9/2^+$	11			1950	β^-=100	
^{99}Nb^m	−81970	12	365.27	0.08		2.5	m	0.2	$1/2^-$	11			1960	β^-=?; IT<3.8	
^{99}Mo	−85970.10	0.23				65.976	h	0.024	$1/2^+$	11			1948	β^-=100	
^{99}Mo^m	−85872.32	0.23	97.785	0.003		15.5	μs	0.2	$5/2^+$	11			1958	IT=100	
^{99}Mo^n	−85286.00	0.30	684.10	0.19		760	ns	60	$11/2^-$	11			1975	IT=100	
^{99}Tc	−87327.9	0.9				211.1	ky	1.2	$9/2^+$	11			1938	β^-=100	
^{99}Tc^m	−87185.2	0.9	142.6832	0.0011		6.0067	h	0.0005	$1/2^-$	11			1958	IT$\approx$100; β^-=0.0037 6	
^{99}Ru	−87625.4	0.3				STABLE			$5/2^+$	11			1931	IS=12.76 14	
^{99}Rh	−85581	7				16.1	d	0.2	$(1/2^-)$	11			1952	β^+=100	
^{99}Rh^m	−85516	7	64.6	0.5		4.7	h	0.1	$9/2^+$	11			1952	$\beta^+\approx$100; IT<0.16	
^{99}Pd	−82183	5				21.4	m	0.2	$(5/2)^+$	11			1955	β^+=100	
^{99}Ag	−76712	6				2.07	m	0.05	$(9/2)^+$	11	14Fe01	J	1967	β^+=100	
^{99}Ag^m	−76206	6	506.1	0.4		10.5	s	0.5	$(1/2)^-$	11	14Fe01	J	1978	IT=100	
^{99}Cd	−69931.1	1.6				16	s	3	$5/2^+$#	11			1978	β^+=100; β^+p=0.21 8; $\beta^+\alpha$<1e–4	*
^{99}In	−61380#	300#				3.1	s	0.2	$9/2^+$#	11	12Lo08	TD	1994	β^+=100; β^+p=0.9 4	*
^{99}In^m	−60980#	340#	400#	150#		1#	s		$1/2^-$#					β^+ ?; IT ?	
^{99}Sn	−47940#	500#				5#	ms	(>0.2 μs)	$9/2^+$#		10St.A	I	2011	β^+ ?; β^+p ?	*
^{99}Sn^m	−47540#	510#	400#	100#					$1/2^-$#		Mirror	I			

*^{99}Kr T : also 11Ni01=13(+34–6) **
*^{99}Zr^m J : 130.2 γ ray, E2 to $3/2^+$ and 121.7 keV, γ ray, M1 to $1/2^+$ **
*^{99}Cd D : symmetrized from β^+p=0.17(+11–5)% **
*^{99}In T : recent not used 01Ki13=3.0(+0.8–0.7) **
*^{99}Sn I : the 3 events reported in 95Ry03 are not trusted by NUBASE **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{100}Kr	−35050#	400#				12	ms	8	0^+	11	11Ni01	TD	1997	β^-=100; β^-n=10#; β^-2n=0.4#	*
^{100}Rb	−46247	20				48	ms	3	$(3^+),4^-$#	08	11Ni01	T	1978	β^-=100; β^-n=6 3; β^-2n=0.16 8	
^{100}Sr	−59821	7				202	ms	3	0^+	08			1978	β^-=100; β^-n=0.78 13	
^{100}Sr^m	−58202	7	1618.72	0.20		122	ns	9	(4^-)		12Ka36	T	1995	IT=100	*
^{100}Y	−67327	11				735	ms	7	(1^-)	08	83Wo10	J	1977	β^-=100; β^-n=0.92 8	*
^{100}Y^m	−67183	11	144	16	MD	940	ms	30	$4^{(+)}$	08	13Ma15	J	1977	β^-=100; β^-n=1#	
^{100}Zr	−76377	8				7.1	s	0.4	0^+	08			1970	β^-=100	
^{100}Nb	−79797	8				1.5	s	0.2	1^+	08			1967	β^-=100	
^{100}Nb^m	−79484.7	2.0	313	8	MD	2.99	s	0.11	(5^+)	08			1967	β^-=100	
^{100}Nb^n	−79450	11	347	8		460	ns	60	$(4^-,5^-,6^-)$	08			1986	IT=100	*
^{100}Nb^p	−79063	11	734	8		12.43	μs	0.26	(8^-)	08	11Ru.A	T	1980	IT=100	*
^{100}Mo	−86193.0	0.3				7.1	Ey	0.4	0^+	08	15Ba11	T	1930	IS=9.82 31; 2β^-=100	*
^{100}Tc	−86020.9	1.4				15.46	s	0.19	1^+	08			1952	β^-≈100; ε=0.0018 9	
^{100}Tc^m	−85820.2	1.4	200.67	0.04		8.32	μs	0.14	$(4)^+$	08			1958	IT=100	
^{100}Tc^n	−85777.0	1.4	243.95	0.04		3.2	μs	0.2	$(6)^+$	08			1967	IT=100	
^{100}Ru	−89227.4	0.3				STABLE			0^+	08			1931	IS=12.60 7	
^{100}Rh	−85591	18				20.8	h	0.1	1^-	08			1948	ε=95.1 5; e$^+$=4.9 5	
^{100}Rh^m	−85516	18	74.782	0.014		214.0	ns	2.0	$(2)^+$	08			1965	IT=100	
^{100}Rh^n	−85483	18	107.6	0.2		4.6	m	0.2	(5^+)	08			1973	IT≈98.3; β^+≈1.7	
^{100}Rh^p	−85371	18	219.61	0.22		130	ns	10	(7^+)	08			1984	IT=100	
^{100}Pd	−85213	18				3.63	d	0.09	0^+	08			1948	ε=100	
^{100}Ag	−78138	5				2.01	m	0.09	$(5)^+$	08	14Fe01	J	1970	β^+=100	
^{100}Ag^m	−78122	5	15.52	0.16		2.24	m	0.13	$(2)^+$	08			1980	β^+=?; IT ?	
^{100}Cd	−74194.6	1.7				49.1	s	0.5	0^+	10			1970	β^+=100	
^{100}In	−64310	180				5.83	s	0.17	6^+#	14	12Lo08	TD	1982	β^+=100; β^+p=1.64 24	*
^{100}Sn	−57280	300				1.16	s	0.16	0^+	14	12Hi07	T	1994	β^+=100; β^+p<17	*
^{100}Sn^m	−52780#	360#	4500#	200#		100#	ns		6^+#					p ?	

*^{100}Kr T : symmetrized from 11Ni01=7(+11–3) **
*^{100}Sr^m E : also 12Ka36=129.6(0.5), 288.1(0.5) and 1201.8(0.5) γ rays in cascade **
*^{100}Sr^m E : to ground-state =1619.5(0.9) keV **
*^{100}Sr^m T : other 95Pf04=85(7) **
*^{100}Y J : ENSDF=1^-,2^-; but 1^- is favored from (p5/2[303]+n3/2[411]), see 83Wo10 **
*^{100}Nb^n E : 34.3 keV above 5^+ isomer **
*^{100}Nb^p E : 420.7 keV above 5^+ isomer **
*^{100}Nb^p J : 28 keV, (E2) γ to (6^-). Mult. from intensity balances **
*^{100}Mo T : also 14Ca46=7.15(0.37stat)(0.66syst) **
*^{100}Mo T : and 15Ba11=670(+50–40) 14Ar08=750(60stat)(60syst) to first exc. 0^+ state **
*^{100}In T : average 12Lo08=5.7(0.3) 02Pl03=5.9(0.2) **
*^{100}In D : β^+p average 12Lo08=1.7(0.4) 02Pl03=1.6(0.3) **
*^{100}Sn T : average 12Hi07=1.16(0.20) 08Ba53=0.55(+0.70–0.31) 96Ki23=0.94(+0.54–0.26) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{101}Kr	−29130#	500#				5#	ms	(>400 ns)	$5/2^+$#	10	10Oh02	I	2010	β^- ?; β^-n=20#; β^-2n=2#	
^{101}Rb	−42850#	200#				31.8	ms	3.3	$3/2^+$#	06	11Ni01	T	1992	β^-=100; β^-n=28 4; β^-2n=0.3# ?	*
^{101}Sr	−55325	8				113.8	ms	1.7	$(5/2^-)$	06	11Ni01	T	1983	β^-=100; β^-n=2.37 14	*
^{101}Y	−65061	7				426	ms	20	$5/2^+$	06	07Ch07	J	1983	β^-=100; β^-n=1.94 18	*
^{101}Y^m	−64730	7	331.5	0.7		190	ns	40			12Ka36	ETD	2012	IT=100	*
^{101}Y^n	−63854	7	1207.0	1.6		870	ns	90			09Fo05	ETD	2009	IT=100	*
^{101}Zr	−73166	8				2.3	s	0.1	$3/2^+$	06	02Ca37	J	1972	β^-=100	
^{101}Nb	−78891	4				7.1	s	0.3	$(5/2\#)^+$	06			1970	β^-=100	*
^{101}Mo	−83519.9	0.3				14.61	m	0.03	$1/2^+$	06			1941	β^-=100	
^{101}Mo^m	−83506.4	0.3	13.497	0.009		226	ns	7	$3/2^+$	06			1977	IT=100	
^{101}Mo^n	−83462.9	0.3	57.015	0.011		133	ns	70	$5/2^+$	06			1977	IT=100	
^{101}Tc	−86345	24				14.22	m	0.01	$9/2^+$	06			1941	β^-=100	
^{101}Tc^m	−86137	24	207.526	0.020		636	μs	8	$1/2^-$	06			1964	IT=100	
^{101}Ru	−87958.1	0.4				STABLE			$5/2^+$	06			1931	IS=17.06 2	
^{101}Ru^m	−87430.5	0.4	527.56	0.10		17.5	μs	0.4	$11/2^-$	06			1974	IT=100	
^{101}Rh	−87412	6				3.3	y	0.3	$1/2^-$	06			1948	ε=100	
^{101}Rh^m	−87255	6	157.32	0.03		4.34	d	0.01	$9/2^+$	06			1944	ε=92.80 25; IT=7.20 25	
^{101}Pd	−85432	5				8.47	h	0.06	$5/2^+$	06			1948	β^+=100	
^{101}Ag	−81334	5				11.1	m	0.3	$9/2^+$	06	14Fe01	J	1966	β^+=100	
^{101}Ag^m	−81060	5	274.1	0.3		3.10	s	0.10	$(1/2)^-$	06	14Fe01	J	1975	IT=100	*
^{101}Cd	−75836.5	1.5				1.36	m	0.05	$5/2^+$#	06			1969	β^+=100	

... *A*-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{101}In	−68610#	200#					15.1	s	1.1	$9/2^+$#	06	97Sz04	T	1988	β^+=100; β^+p=?	*
^{101}In^m	−68060#	220#	550#	100#			10#	s		$1/2^-$#					β^+=95#; IT=5#	
^{101}Sn	−60310	300					1.97	s	0.16	$(7/2^+)$	07	12Lo08	TD	1994	β^+=100; β^+p=21.0 7	*
*^{101}Rb	T : average 11Ni01=31(+5–4) 95Lh04=32(5)															**
*^{101}Sr	T : average 11Ni01=113(2) 86Wa17=114(4) 83Wo10=121(6)															**
*^{101}Y	T : average 96Me09=400(20) 86Wa17=440(20) 83Wo10=500(50)															**
*^{101}Y	T : 93Ru01=279(9) conflicting, not used															**
*^{101}Y^m	E : 12Ka36=128.0(0.5) and 203.5(0.5) γ rays in cascade to ground-state															**
*^{101}Y^m	T : symmetrized from 187(+49–38)															**
*^{101}Y^n	T : symmetrized from 860(+90–80)															**
*^{101}Y^n	E : from a least-squares fit to Eg using 09Fo05 level scheme															**
*^{101}Nb	J : positive parity due to M1 + E2 γ from a + exc. level															**
*^{101}Ag^m	J : from ENSDF : E3 γ to $(7/2)^+$ level															**
*^{101}In	T : average 97Sz04=14.9(1.2) 88Hu07=16(3)															**
*^{101}Sn	T : average 12Lo08=2.1(0.2) 07Se04=1.3(0.5) 07Ka15=1.9(0.3)															**
*^{101}Sn	D : β^+p average 12Lo08=22(1) 10St.A=20(1) J : from 10Da17															**
^{102}Rb	−37710#	300#					37	ms	3	(4^+)	09	16Wa16	JD	1995	β^-=100; β^-n=65 22; β^-2n=2#	*
^{102}Sr	−52160	70					69	ms	6	0^+	09			1986	β^-=100; β^-n=5.5 15	*
^{102}Y	−61173	4				* &	298	ms	9	(2^-)	09	11Ha48	J	1983	β^-=100; β^-n=4.9 12	*
^{102}Y^m	−60970#	200#	200#	200#		* &	360	ms	40	(>5)	09	11Ha48	J	1980	β^-=100; β^-n=4.9 12	
^{102}Zr	−71588	9					2.9	s	0.2	0^+	09			1970	β^-=100	
^{102}Nb	−76304.5	2.5					4.3	s	0.4	(4^+)	09			1972	β^-=100	
^{102}Nb^m	−76210	8	94	7	MD		1.3	s	0.2	1^+	09			1976	β^-=100	
^{102}Mo	−83566	8					11.3	m	0.2	0^+	09			1954	β^-=100	
^{102}Tc	−84573	9				*	5.28	s	0.15	1^+	09			1954	β^-=100	
^{102}Tc^m	−84553	13	20	10		*	4.35	m	0.07	$(4,5)$	09			1954	β^-=98 2; IT=2 2	
^{102}Ru	−89106.4	0.4					STABLE			0^+	09			1931	IS=31.55 14	
^{102}Rh	−86783	6					207.0	d	1.5	$(1^-,2^-)$	09	98Sh21	T	1941	β^+=78 5; β^-=22 5	*
^{102}Rh^m	−86642	6	140.73	0.09			3.742	y	0.010	6^+	09	99Gi14	J	1962	$\beta^+\approx$100; IT=0.233 24	
^{102}Pd	−87903.2	0.6					STABLE			0^+	09			1935	IS=1.02 1; $2\beta^+$?	
^{102}Ag	−82247	8					12.9	m	0.3	$5^{(+)}$	09			1960	β^+=100	
^{102}Ag^m	−82238	8	9.40	0.07			7.7	m	0.5	2^+	09			1967	β^+=51 5; IT=49 5	
^{102}Cd	−79659.7	1.7					5.5	m	0.5	0^+	09			1969	β^+=100	
^{102}In	−70695	5					23.3	s	0.1	(6^+)	09	95Sz01	J	1981	β^+=100; β^+p=0.0093 13	
^{102}Sn	−64930	100					3.8	s	0.2	0^+	09			1994	β^+=100	*
^{102}Sn^m	−62910	100	2017	2			367	ns	8	(6^+)	09	98Li50	E	1996	IT=100	*
*^{102}Rb	T : also 15Lo04=37(10) 11Ni01=35(+15–8) D : β^-n=18(8)% in 85Pf.A															**
*^{102}Sr	T : also 11Ni01=85(15)															**
*^{102}Y	J : in 11Ha48, combining 07Ch07=(2,3) with spectrocopy data from 91Hill															**
*^{102}Rh	T : average 98Sh21=207.3(1.7) 61Hi06=206(3)															**
*^{102}Sn	T : 95Fa.A=4.6(1.4) supersedes 95Sc28=4.5(0.7), preliminary from same group															**
*^{102}Sn^m	T : from 11Hi.A															**
^{103}Rb	−33610#	400#					26	ms	11	$3/2^+$#	15	15Lo04	TD	2010	β^-=100; β^-n=50#; β^-2n=2#	*
^{103}Sr	−47420#	200#					53	ms	10	$5/2^+$#	15			1997	β^-=100; β^-n=2#; β^-2n=0.01#	
^{103}Y	−58458	11					239	ms	12	$5/2^+$#	09	11Ni01	T	1994	β^-=100; β^-n=8.0 17	*
^{103}Zr	−67815	9					1.38	s	0.07	$5/2^-$#	09	09Pe06	TD	1987	β^-=100; β^-n<1	
^{103}Nb	−75029	4					1.5	s	0.2	$5/2^+$#	09			1971	β^-=100; β^-n=0#	
^{103}Mo	−80961	9					67.5	s	1.5	$3/2^+$	09	09Ch09	J	1963	β^-=100	
^{103}Tc	−84604	10					54.2	s	0.8	$5/2^+$	09			1957	β^-=100	
^{103}Ru	−87267.2	0.4					39.247	d	0.013	$3/2^+$	09			1945	β^-=100	*
^{103}Ru^m	−87029.0	0.8	238.2	0.7			1.69	ms	0.07	$11/2^-$	09			1964	IT=100	
^{103}Rh	−88031.7	2.3					STABLE			$1/2^-$	09			1934	IS=100.	
^{103}Rh^m	−87991.9	2.3	39.753	0.006			56.114	m	0.009	$7/2^+$	09			1943	IT=100	
^{103}Pd	−87457.2	0.9					16.991	d	0.019	$5/2^+$	09			1950	ε=100	
^{103}Ag	−84803	4					65.7	m	0.7	$7/2^+$	09			1954	β^+=100	
^{103}Ag^m	−84669	4	134.45	0.04			5.7	s	0.3	$1/2^-$	09			1962	IT=100	
^{103}Cd	−80651.6	1.8					7.3	m	0.1	$5/2^+$#	09			1960	β^+=100	
^{103}In	−74633	10					60	s	1	$9/2^+$#	09	97Sz04	T	1978	β^+=100	
^{103}In^m	−74001	10	631.7	0.1			34	s	2	$1/2^-$#	09			1988	β^+=67; IT=33	
^{103}Sn	−66970	70					7.0	s	0.2	$5/2^+$#	09			1981	β^+=100; β^+p=1.2 1	
^{103}Sb	−56180#	300#					<49	ns		$5/2^+$#	15				p ?	
*^{103}Rb	T : symmetrized from 15Lo04=23(+13–9)															**
*^{103}Y	T : average 11Ni01=234(+18–15) 09Pe06=260(+40–20) 96Me09=230(20) and															**
*^{103}Y	T : 96Lh04=190(50) D : average 09Pe06=8(2)% 96Me09=8(3)%															**
*^{103}Ru	T : other recent 09Go29=39.210(0.038)															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{104}Sr	−44110#	300#					50.6	ms	4.2	0^+	15	15Lo04	T	1997	β^-=100; β^-n=9#; β^-2n=0#	*
^{104}Y	−54060#	400#					197	ms	4		15			1994	β^-=100; β^-n=34 10; β^-2n=0#	
^{104}Zr	−65724	9					920	ms	28	0^+	07	09Pe06	TD	1990	β^-=100; β^-n<1	
^{104}Nb	−71819.0	2.7				*	4.9	s	0.3	(1^+)	07			1971	β^-=100; β^-n=0.06 3	*
^{104}Nb^m	−71600	120	210	120	BD	*	940	ms	40	high	07			1976	β^-=100; β^-n=0.05 3	
^{104}Mo	−80350	9					60	s	2	0^+	07			1962	β^-=100	
^{104}Tc	−82503	25					18.3	m	0.3	(3^+)	07			1956	β^-=100	
^{104}Tc^m	−82433	25	69.7	0.2			3.5	μs	0.3	(5^+)	07			1981	IT=100	*
^{104}Tc^n	−82397	25	106.1	0.3			400	ns	20	$^{(+)}$	07			1999	IT=100	
^{104}Ru	−88095.7	2.5					STABLE			0^+	07			1931	IS=18.62 27; 2β^- ?	*
^{104}Rh	−86959.3	2.3					42.3	s	0.4	1^+	07			1939	$\beta^-\approx$100; β^+=0.45 10	
^{104}Rh^m	−86830.3	2.3	128.9679	0.0005			4.34	m	0.03	5^+	07			1939	IT≈100; β^-=0.13 1	
^{104}Pd	−89395.1	1.3					STABLE			0^+	07			1935	IS=11.14 8	
^{104}Ag	−85116	4					69.2	m	1.0	5^+	07			1955	β^+=100	
^{104}Ag^m	−85109	4	6.90	0.22			33.5	m	2.0	2^+	07			1959	$\beta^+\approx$100; IT<0.07	
^{104}Cd	−83968.4	1.7					57.7	m	1.0	0^+	07			1955	β^+=100	
^{104}In	−76183	6					1.80	m	0.03	(5^+)	07	13Ma15	J	1977	β^+=100	
^{104}In^m	−76090	6	93.48	0.10			15.7	s	0.5	(3^+)	07			1988	IT=80; β^+=20	
^{104}Sn	−71627	6					20.8	s	0.5	0^+	07			1985	β^+=100	
^{104}Sb	−59170	120					470	ms	130		07	95Fa.A	D	1995	β^+=?; β^+p<7; p<7; α ?	*
*^{104}Sr	T : average 15Lo04=53(5) 11Ni01=43(+9–7)															**
*^{104}Nb	D : β^-n=0.71% of 83En03, conflicting, not used															**
*^{104}Tc^m	J : E2 γ to (3^+) level (from ENSDF)															**
*^{104}Ru	T : 0ν-$\beta\beta$ to 1st exc. state : 13Be09>650Ey 12An08>190Ey															**
*^{104}Sb	T : symmetrized from 440(+150–110) D : 95Fa.A supersedes 95Sc28 p<1%															**
^{105}Sr	−38610#	500#					39	ms	5	$5/2^+$#	15			1997	β^-=100; β^-n=10#; β^-2n=1#	
^{105}Y	−51270	1340					95	ms	9	$5/2^+$#	15			1994	β^-=100; β^-n<82; β^-2n=0#	
^{105}Zr	−61465	12					670	ms	28	$(5/2^+)$	15			1992	β^-=100; β^-n<2	
^{105}Nb	−69916	4					2.95	s	0.06	$5/2^+$#	05			1984	β^-=100; β^-n=1.7 9	
^{105}Mo	−77337	9					35.6	s	1.6	$(5/2^-)$	05			1962	β^-=100	
^{105}Tc	−82290	40					7.6	m	0.1	$(3/2^-)$	05			1955	β^-=100	
^{105}Ru	−85934.5	2.5					4.44	h	0.02	$3/2^+$	05			1945	β^-=100	
^{105}Ru^m	−85913.9	2.5	20.610	0.013			340	ns	15	$(5/2)^+$	05			1974	IT=100	
^{105}Rh	−87851.2	2.5					35.357	h	0.037	$7/2^+$	05	09Go29	T	1945	β^-=100	
^{105}Rh^m	−87721.4	2.5	129.782	0.004			42.9	s	0.3	$1/2^-$	05			1950	IT=100	
^{105}Pd	−88417.9	1.1					STABLE			$5/2^+$	05			1935	IS=22.33 8	
^{105}Pd^m	−87928.8	1.1	489.14	0.04			36.1	μs	0.4	$11/2^-$	05			1970	IT=100	
^{105}Ag	−87071	5					41.29	d	0.07	$1/2^-$	05			1939	β^+=100	
^{105}Ag^m	−87046	5	25.479	0.016			7.23	m	0.16	$7/2^+$	05			1969	IT≈100; β^+=0.34 7	
^{105}Cd	−84333.8	1.4					55.5	m	0.4	$5/2^+$	05			1950	β^+=100	
^{105}In	−79641	10					5.07	m	0.07	$9/2^+$	05			1975	β^+=100	
^{105}In^m	−78967	10	674.08	0.25			48	s	6	$(1/2)^-$	05			1975	IT=?; β^+=25#	
^{105}Sn	−73338	4					34	s	1	$(5/2^+)$	05	85De08	J	1981	β^+=100; β^+p=?	
^{105}Sb	−64015	22					1.12	s	0.16	$(5/2^+)$	05	95Fa.A	T	1994	β^+ ?; p<0.1; β^+p ?	*
^{105}Te	−52810	300					633	ns	66	$(7/2^+)$	06	06Se08	T	2006	$\alpha\approx$100	*
*^{105}Sb	T : 95Fa.A supersedes 95Sc28=1.30(0.15), preliminary from same group															**
*^{105}Sb	D : p 05Li47<0.1% above 430 keV disagrees with 94Ti03≈1%															**
*^{105}Te	T : average 06Li41=620(70) 06Se08=700(+250–170)															**
*^{105}Te	J : same spin as 171.7 state in ^{101}Sn															**
^{106}Sr	−34790#	600#					21	ms	8	0^+	15	15Lo04	T	2010	β^-=100; β^-n=10#; β^-2n=0.03#	*
^{106}Y	−46050#	500#					74	ms	6	2^+#	15	15Lo04	T	1997	β^-=100; β^-n=20#; β^-2n=0.5#	*
^{106}Zr	−58550	430					178.6	ms	5.8	0^+	15	15Lo04	T	1994	β^-=100; β^-n<7	*
^{106}Nb	−66203	4					1050	ms	100	(1^-)	15	14Lu07	J	1976	β^-=100; β^-n=4.5 3	*
^{106}Nb^m	−65998	4	204.8	0.1			800	ns	50	(3^+)	15			1999	IT=100	
^{106}Nb^n	−65998	4	204.8	0.5			849	ns	45	(3^+)		14Lu07	EJ	1999	IT=100	*
^{106}Mo	−76135	9					8.73	s	0.12	0^+	08			1969	β^-=100	
^{106}Tc	−79776	12					35.6	s	0.6	$(1,2)^{(+\#)}$	08			1965	β^-=100	
^{106}Ru	−86323	5					371.8	d	0.18	0^+	08			1948	β^-=100	
^{106}Rh	−86363	5					30.07	s	0.35	1^+	08			1947	β^-=100	
^{106}Rh^m	−86231	10	132	11	BD		131	m	2	$(6)^+$	08			1955	β^-=100	
^{106}Pd	−89907.5	1.1					STABLE			0^+	08			1935	IS=27.33 3	
^{106}Ag	−86942	3					23.96	m	0.04	1^+	08			1937	β^+=?; $\beta^-\approx$0.5	
^{106}Ag^m	−86852	3	89.66	0.07			8.28	d	0.02	6^+	08			1938	β^+=100; IT≤4.2e–6	
^{106}Cd	−87132.1	1.1					STABLE		(>1.1 Zy)	0^+	08	16Be11	T	1935	IS=1.25 6; 2β^+ ?	*
^{106}In	−80608	12					6.2	m	0.1	7^+	08			1962	β^+=100	
^{106}In^m	−80579	12	28.6	0.3			5.2	m	0.1	$(2)^+$	08			1966	β^+=100	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{106}Sn	−77354	5				1.92	m	0.08	0^+	08			1975	β^+=100	
^{106}Sb	−66473	7				600	ms	200	(2^+)	08			1981	β^+=100	
^{106}Sb^m	−66370	7	103.5	0.3		226	ns	14	(4^+)	08	99So08	T	1998	IT=100	*
^{106}Te	−58220	100				78	μs	11	0^+	08	16Ca33	T	1981	α=100	*
*^{106}Sr	T : symmetrized from 15Lo04=20(+8–7)														**
*^{106}Y	T : average 15Lo04=82(+10–5) 15NiZZ=62(9) 11Ni01=62(+25–14)														**
*^{106}Zr	T : average 15Lo04=175(7) 11Ni01=186(+11–10)														**
*^{106}Nb	T : unweighed average 09Pe06=1240(20) 96Me09=900(20) 83Sh06=1020(50)														**
*^{106}Nb^n	T : average 12Ka36=660(+110–100) 99Ge01=890(50)														**
*^{106}Cd	T : for $\varepsilon\beta^+$, theoretically faster channel; others 12Be14>210Ey 02Tr04>410Ey														**
*^{106}Sb^m	T : average 99So08=232(21) 98Li50=220(20)														**
*^{106}Te	T : average 16Ca33=70(+20–15) 05Ja03=85(+25–15) 94Pa11=60(+40–20) and														**
*^{106}Te	T : 81Sc17=60(+30–10)														**
^{107}Sr	−28900#	700#				10#	ms	(>400 ns)	$1/2^+$#	10	10Oh02	I	2010	β^- ?; β^-n=30#; β^-2n=3#	
^{107}Y	−42360#	500#				33.5	ms	0.3	$5/2^+$#	15	15Lo04	T	1997	β^-=100; β^-n=30#; β^-2n=0.1#	
^{107}Zr	−54380	1120				145.7	ms	2.4	$5/2^+$#	15	15Lo04	T	1994	β^-=100; β^-n<23	*
^{107}Nb	−63724	8				289	ms	9	$5/2^+$#	08	15Lo04	T	1992	β^-=100; β^-n=7.4 8	*
^{107}Mo	−72552	9				3.5	s	0.5	$(5/2^+)$	08			1972	β^-=100	
^{107}Mo^m	−72487	9	65.4	0.2		420	ns	30	$(1/2^+)$	08			1976	IT=100	
^{107}Tc	−78750	9				21.2	s	0.2	$(3/2^-)$	08	09Gu11	J	1965	β^-=100	
^{107}Tc^m	−78720	9	30.1	0.1		3.85	μs	0.05	$(1/2^+)$	08			2007	IT=100	
^{107}Tc^n	−78684	9	65.72	0.14		184	ns	3	$(5/2^+)$	08			1974	IT=100	
^{107}Ru	−83863	9				3.75	m	0.05	$(5/2)^+$	08			1951	β^-=100	
^{107}Rh	−86864	12				21.7	m	0.4	$7/2^+$	08			1951	β^-=100	
^{107}Rh^m	−86596	12	268.36	0.04		> 10	μs		$1/2^-$	08			1986	IT=100	
^{107}Pd	−88372.6	1.2				6.5	My	0.3	$5/2^+$	08			1958	β^-=100	
^{107}Pd^m	−88256.9	1.2	115.74	0.12		850	ns	100	$1/2^+$	08			1969	IT=100	
^{107}Pd^n	−88158.0	1.2	214.6	0.3		21.3	s	0.5	$11/2^-$	08			1952	IT=100	
^{107}Ag	−88406.7	2.4				STABLE			$1/2^-$	08	14Fe01	J	1924	IS=51.839 8	
^{107}Ag^m	−88313.6	2.4	93.125	0.019		44.3	s	0.2	$7/2^+$	08			1940	IT=100	
^{107}Cd	−86990.3	1.7				6.50	h	0.02	$5/2^+$	08			1946	β^+=100	
^{107}In	−83564	11				32.4	m	0.3	$9/2^+$	08			1949	β^+=100	
^{107}In^m	−82886	11	678.5	0.3		50.4	s	0.6	$1/2^-$	08			1973	IT=100	
^{107}Sn	−78512	5				2.90	m	0.05	$(5/2^+)$	08			1976	β^+=100	
^{107}Sb	−70653	4				4.0	s	0.2	$5/2^+$#	08			1994	β^+=100	
^{107}Te	−60540	70				3.1	ms	0.1	$5/2^+$#	08			1979	α=70 30; β^+ ?; β^+p ?	
^{107}I	−49430#	300#				20#	μs		$5/2^+$#					α ?	
*^{107}Zr	T : average 15Lo04=150(3) 11Ni01=138(4); not used 09Pe06=150(+40–30)														**
*^{107}Nb	T : average 15Lo04=280(20) 09Pe06=290(11) 96Me09=300(30)														**
*^{107}Nb	D : average 09Pe06=8(1)% 96Me09=6.0(1.5)%														**
^{108}Y	−37300#	600#				30	ms	5		15			2010	β^-=100; β^-n=30#; β^-2n=2#	
^{108}Zr	−51350#	400#				78.5	ms	2.0	0^+	15			1997	β^-=100; β^-n=2#	
^{108}Zr^m	−49280#	400#	2074.5	0.8		540	ns	30	(6^+)	15	12Ka36	T	2011	IT≈100	*
^{108}Nb	−59546	8				198	ms	6	(2^+)	15			1994	β^-=100; β^-n=6.3 5; β^-2n=0#	
^{108}Nb^m	−59379	8	166.6	0.5		109	ns	2	$(4^-,5)$	15	12Ka36	J	2012	IT=100	
^{108}Mo	−70756	9				1.105	s	0.010	0^+	08	09Pe06	TD	1972	β^-=100; β^-n<0.5	*
^{108}Tc	−75923	9				5.17	s	0.07	$(2)^+$	08			1970	β^-=100	
^{108}Ru	−83661	9				4.55	m	0.05	0^+	08			1955	β^-=100	
^{108}Rh	−85032	14				16.8	s	0.5	1^+	08			1955	β^-=100	
^{108}Rh^m	−84917	12	115	18	MD	6.0	m	0.3	$(5)^{(+\#)}$	08			1969	β^-=100	
^{108}Pd	−89524.2	1.1				STABLE			0^+	08			1935	IS=26.46 9	
^{108}Ag	−87606.8	2.4				2.382	m	0.011	1^+	08			1937	β^-=97.15 20; β^+=2.85 20	
^{108}Ag^m	−87497.3	2.4	109.466	0.007		438	y	9	6^+	08			1969	β^+=91.3 9; IT=8.7 9	
^{108}Cd	−89252.4	1.1				STABLE		(>410 Py)	0^+	08	95Ge14	T	1935	IS=0.89 3; 2β^+ ?	
^{108}In	−84120	9				58.0	m	1.2	7^+	08			1949	β^+=100	
^{108}In^m	−84090	9	29.75	0.05		39.6	m	0.7	2^+	08			1955	β^+=100	
^{108}Sn	−82070	5				10.30	m	0.08	0^+	08			1968	β^+=100	
^{108}Sb	−72445	5				7.4	s	0.3	(4^+)	08			1976	β^+=100	
^{108}Te	−65782	5				2.1	s	0.1	0^+	08	85Ti02	D	1974	β^+=51 4; α=49 4; β^+p=2.4 10; $\beta^+\alpha$<0.065	
^{108}I	−52650	130				36	ms	6	1^+#	08	94Pa12	D	1991	α=?; β^+=9#; p<1; β^+p ?	*
*^{108}Zr^m	T : symmetrized from 12Ka36=536(+26–25); other 11Su11=620(150)														**
*^{108}Mo	T : average 09Pe06=1.110(0.011) 95Jo02=1.090(0.020) D : β^-n not allowed														**
*^{108}I	D : β^+=9%# estimated in 94Pa12 using theoretical β^+ half-life ≈400 ms														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{109}Y	−33200#	700#				25	ms	5	$5/2^+$#	15			2010	β^-=100; β^-n=60#; β^-2n=1.5#	
^{109}Zr	−46190#	500#				56	ms	3	$1/2^+$#	15			1997	β^-=100; β^-n=5#; β^-2n=0#	
^{109}Nb	−56690	260				106.9	ms	4.9	$5/2^+$#	06	15Lo04	T	1994	β^-=100; β^-n=31 5	*
^{109}Nb^m	−56380	260	312.2	0.5		115	ns	8			12Ka36	ET	2011	IT=100	*
^{109}Mo	−66666	11				700	ms	14	$5/2^+$#	06	09Pe06	TD	1992	β^-=100; β^-n=1.3 6	*
^{109}Mo^m	−66596	11	69.7	0.5		210	ns	60	$(1/2^+)$		12Ka36	ET	2012	IT=100	*
^{109}Tc	−74283	10				1.14	s	0.03	$5/2^+$	06	09Pe06	T	1976	β^-=100; β^-n=0.08 2	*
^{109}Ru	−80738	9				34.5	s	1.0	$5/2^+$#	06			1967	β^-=100	
^{109}Ru^m	−80642	9	96.2	0.3		680	ns	30	$(5/2^-)$	06			1976	IT=100	
^{109}Rh	−84999	4				80	s	2	$7/2^+$	06			1972	β^-=100	
^{109}Rh^m	−84773	4	225.974	0.021		1.66	μs	0.04	$3/2^+$	06	FGK127	J	1987	IT=100	*
^{109}Pd	−87606.5	1.1				13.7012	h	0.0024	$5/2^+$	06			1937	β^-=100	
^{109}Pd^m	−87493.1	1.1	113.400	0.010		380	ns	50.	$1/2^+$	06			1978	IT=100	
^{109}Pd^n	−87417.5	1.1	188.990	0.010		4.696	m	0.003	$11/2^-$	06			1957	IT=100	
^{109}Ag	−88719.4	1.3				STABLE			$1/2^-$	06			1924	IS=48.161 8	
^{109}Ag^m	−88631.4	1.3	88.0341	0.0011		39.6	s	0.2	$7/2^+$	06			1967	IT=100	
^{109}Cd	−88504.3	1.5				461.6	d	0.4	$5/2^+$	06	16Fe04	T	1950	ε=100	*
^{109}Cd^m	−88444.8	1.5	59.49	0.11		12	μs	2	$1/2^+$	06			1956	IT=100	
^{109}Cd^n	−88040.8	1.5	463.5	0.3		10.9	μs	0.5	$11/2^-$	06			1964	IT=100	
^{109}In	−86490	4				4.167	h	0.018	$9/2^+$	06			1948	β^+=100	
^{109}In^m	−85840	4	650.1	0.3		1.34	m	0.07	$1/2^-$	06			1966	IT=100	
^{109}In^n	−84388	4	2101.8	0.2		209	ms	6	$(19/2^+)$	06			1963	IT=100	
^{109}Sn	−82630	8				18.0	m	0.2	$(5/2^+,7/2^+)$	06	13Ma15	J	1966	β^+=100	
^{109}Sb	−76251	5				17.0	s	0.7	$5/2^+$#	06			1976	β^+=100	
^{109}Te	−67715	4				4.6	s	0.3	$(5/2^+)$	06			1967	β^+=96.1 13; α=3.9 13; …	*
^{109}I	−57672	7				103	μs	5	$1/2^+$	06	07Ma35	D	1984	p=100; α=0.014 4	
^{109}Xe	−46170	300				13	ms	2	$7/2^+$#		06Li41	TDJ	2006	$\alpha\approx$100; β^+ ?; β^+p ?	*

*^{109}Nb T : average 15Lo04=110(6) 11Ni01=100(+9–8); other 09Pe06=130(20) **
*^{109}Nb D : 09Pe06 β^-n<15% conflicting **
*^{109}Nb^m E : other 11Wa03=313.1(0.5) keV **
*^{109}Nb^m T : symmetrized from 12Ka36=114(+8–7); other 11Wa03=150(30) **
*^{109}Mo T : also 15Lo04=700(+40–60) **
*^{109}Mo^m T : symmetrized from 12Ka36=194(+76–49) **
*^{109}Tc J : 12Ku28=$5/2^+$ **
*^{109}Rh^m J : 225.9 keV E2 γ ray to $7/2^+$ **
*^{109}Cd T : unweighed average 16Fe04=462.1(0.3) 14Un01=462.3(0.8) **
*^{109}Cd T : 11Va02=462.29(0.30) 04Sc04=459.6(1.7) 97Ma75=460.15(0.16) **
*^{109}Cd T : 82La25=463.1(0.8) 81Va11=461.9(0.3) **
*^{109}Te D : …; β^+p=9.4 31; $\beta^+\alpha$<0.005 **
*^{109}Xe J : same as 150 level in ^{105}Te **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{110}Zr	−42890#	600#				37.5	ms	2.0	0^+	12	15Lo04	T	1997	β^-=100; β^-n=7#; β^-2n=0#	
^{110}Nb	−52310	840				82	ms	2	$(5)^{(+\#)}$	12	15Lo04	T	1994	β^-=100; β^-n=40 8; β^-2n=0.09#	
^{110}Mo	−64543	24				292	ms	7	0^+	12	15Lo04	T	1992	β^-=100; β^-n=2.0 7	
^{110}Tc	−71035	9				900	ms	13	$(2^+,3^+)$	12			1976	β^-=100; β^-n=0.04 2	
^{110}Ru	−80073	9				12.04	s	0.17	0^+	12			1970	β^-=100	
^{110}Rh	−82829	18			*	3.35	s	0.12	(1^+)	12			1963	β^-=100	
^{110}Rh^m	−82610#	150#	220#	150#	*	28.5	s	1.3	(6^+)	12			1969	β^-=100	
^{110}Pd	−88330.9	0.6				STABLE		(>200 Ey)	0^+	12	13Le10	T	1935	IS=11.72 9; 2β^- ?	*
^{110}Ag	−87457.3	1.3				24.56	s	0.11	1^+	12			1937	$\beta^-\approx$100; ε=0.30 6	
^{110}Ag^m	−87456.2	1.3	1.112	0.016		660	ns	40	2^-	12			1975	IT=100	
^{110}Ag^n	−87339.7	1.3	117.59	0.05		249.83	d	0.04	6^+	12			1938	β^-=98.67 8; IT=1.33 8	
^{110}Cd	−90348.0	0.4				STABLE			0^+	12			1925	IS=12.49 18	
^{110}In	−86470	12				4.92	h	0.08	7^+	12			1939	β^+=100	
^{110}In^m	−86408	12	62.08	0.04		69.1	m	0.5	2^+	12			1962	β^+=100	
^{110}Sn	−85842	14				4.154	h	0.004	0^+	12			1965	ε=100	
^{110}Sb	−77450	6				23.6	s	0.3	(3^+)	12			1972	β^+=100	
^{110}Te	−72230	7				18.6	s	0.8	0^+	12			1977	$\beta^+\approx$100; α=0.003#	
^{110}I	−60460	50				664	ms	24	(1^+)	12			1977	β^+=83 4; α=17 4; β^+p=11 3; $\beta^+\alpha$=1.1 3	
^{110}Xe	−51920	100				93	ms	3	0^+	12			1981	α=64 35; β^+ ?; β^+p ?	

*^{110}Pd T : >198Ey, >172Ey(95% CL) for first excited 0^+ and 2^+ ; 52Wi26>0.6Ey **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{111}Zr	−37560#	700#				24.0	ms	0.5	$3/2^+$#	15	15Lo04	T	2010	β^-=100; β^-n=10#; β^-2n=1#	
^{111}Nb	−48880#	300#				54	ms	2	$5/2^+$#	15			1997	β^-=100; β^-n=90#; β^-2n=0#	
^{111}Mo	−59940	13				193.6	ms	4.4	$1/2^+$#	15	15Lo04	T	1994	β^-=100; β^-n<12	*
^{111}Mo^m	−59840#	50#	100#	50#		200	ms		$7/2^-$#	15			2011	β^-=100; β^-n=0.02#	
^{111}Tc	−69025	11				350	ms	11	$5/2^+$#	09	09Pe06	T	1988	β^-=100; β^-n=0.85 20	
^{111}Ru	−76785	10				2.12	s	0.07	$5/2^+$	09			1971	β^-=100	
^{111}Rh	−82304	7				11	s	1	$(7/2^+)$	09			1975	β^-=100	
^{111}Pd	−85985.9	0.7				23.4	m	0.2	$5/2^+$	09			1937	β^-=100	
^{111}Pd^m	−85813.7	0.7	172.18	0.08		5.5	h	0.1	$11/2^-$	09			1952	IT=73 3; β^-=27 3	
^{111}Ag	−88215.4	1.5				7.433	d	0.010	$1/2^-$	09	16Co01	T	1937	β^-=100	*
^{111}Ag^m	−88155.6	1.5	59.82	0.04		64.8	s	0.8	$7/2^+$	09			1957	IT=99.3 2; β^-=0.7 2	
^{111}Cd	−89252.2	0.4				STABLE			$1/2^+$	09			1925	IS=12.80 12	
^{111}Cd^m	−88856.0	0.4	396.214	0.021		48.50	m	0.09	$11/2^-$	09			1945	IT=100	
^{111}In	−88392	3				2.8063	d	0.0007	$9/2^+$	09	16Dz01	T	1947	ε=100	
^{111}In^m	−87855	3	536.99	0.07		7.7	m	0.2	$1/2^-$	09			1966	IT=100	
^{111}Sn	−85939	5				35.3	m	0.6	$7/2^+$	09			1949	β^+=100	
^{111}Sn^m	−85684	5	254.71	0.04		12.5	μs	1.0	$1/2^+$	09			1972	IT=100	
^{111}Sb	−80837	9				75	s	1	$(5/2^+)$	09			1972	β^+=100	
^{111}Te	−73587	6				26.2	s	0.6	$(5/2)^+$	09	05Sh24	T	1967	β^+=100; β^+p=?	*
^{111}I	−64954	5				2.5	s	0.2	$5/2^+$#	09			1977	$\beta^+\approx$100; $\alpha\approx$0.1; β^+p ?	
^{111}Xe	−54400	90				740	ms	200	$5/2^+$#	09	12Ca03	D	1979	β^+ ?; α=10.4 1.9; β^+p ?	
^{111}Cs	−42820#	200#				1#	μs		$3/2^+$#					p ?	

*^{111}Mo T : average 15Lo04=196(5) 11Ku16=186(9); other 09Pe06=200(+41–36) **
*^{111}Ag T : average 16Co01=7.423(0.013) 74Ro18=7.450(0.017) **
*^{111}In T : average 16Dz01=2.8067(0.0034) 14Un01=2.805(0.004) 04Sc04=2.8063(0.0007) **
*^{111}Te T : others 67Ka01=19.0(7) 67Bo41=19.5(5) conflicting, not used **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{112}Zr	−33810#	700#				43	ms	21	0^+	15	15Lo04	T	2010	β^-=100; β^-n=30#; β^-2n=0.3#	*
^{112}Nb	−44270#	300#				38	ms	2	2^+#	15	15Lo04	T	1997	β^-=100; β^-n=70#; β^-2n=1#	
^{112}Mo	−57460#	200#				125	ms	5	0^+	15	15Lo04	T	1994	β^-=100; β^-n=0.3#	
^{112}Tc	−65259	6				323	ms	6	(2^+)	15	15Lo04	T	1990	β^-=100; β^-n=1.5 2	
^{112}Tc^m	−64907	6	352.3	0.7		150	ns	17		15	FGK127	E	2010	IT=100	*
^{112}Ru	−75631	10				1.75	s	0.07	0^+	15			1970	β^-=100	
^{112}Rh	−79730	40				3.4	s	0.4	(1^+)	15	99Lh01	T	1972	β^-=100	*
^{112}Rh^m	−79390	60	340	70	BD	6.73	s	0.15	(6^+)	15	99Lh01	T	1987	β^-=100	*
^{112}Pd	−86322	7				21.04	h	0.17	0^+	15			1951	β^-=100	
^{112}Ag	−86583.7	2.4				3.130	h	0.008	$2^{(-)}$	15			1938	β^-=100	
^{112}Cd	−90574.86	0.25				STABLE			0^+	15			1925	IS=24.13 21	
^{112}In	−87990	4				14.88	m	0.15	1^+	15			1947	β^+=57.4 48; β^-=42.6 48	
^{112}In^m	−87833	4	156.592	0.025		20.67	m	0.08	4^+	15			1953	IT=100	
^{112}In^n	−87639	4	350.80	0.05		690	ns	50	$(7)^+$	15			1976	IT=100	
^{112}In^p	−87376	4	613.82	0.06		2.81	μs	0.03	8^-	15	87Eb02	J	1976	IT=100	
^{112}Sn	−88655.06	0.29				STABLE			0^+	15			1927	IS=0.97 1; 2β^+ ?	*
^{112}Sb	−81599	18				53.5	s	0.6	(3^+)	15			1959	β^+=100	
^{112}Sb^m	−80773	18	825.9	0.4		536	ns	22	(8^-)	15			1976	IT=100	
^{112}Te	−77568	8				2.0	m	0.2	0^+	15			1976	β^+=100	
^{112}I	−67063	10				3.34	s	0.08	1^+#	15	78Ro19	D	1977	$\beta^+\approx$100; α=0.0012; β^+p=0.88 10; …	*
^{112}Xe	−60026	8				2.7	s	0.8	0^+	15			1978	$\beta^+\approx$100; α=1.2 8; β^+p ?	
^{112}Cs	−46290	90				490	μs	30	1^+#	15			1994	p$\approx$100; α<0.26	

*^{112}Zr T : symmetrized from 15Lo04=30(+30–10) **
*^{112}Tc^m E : 12Ka36=93.1(0.5) keV and 259.2(0.5) keV γ rays in cascade to 2^+# ground-state **
*^{112}Rh T : 99Lh01=3.45(0.37) supersedes 91Jo11=2.1(0.3), 88Ay02=3.8(0.6) same group **
*^{112}Rh^m T : supersedes 88Ay02=6.8(0.2) of same group **
*^{112}Sn T : >1.3 Zy for 0ν-$\varepsilon\varepsilon$ transition to 0^+_3 state in ^{112}Cd **
*^{112}I D : …; $\beta^+\alpha$=0.104 12 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{113}Nb	−40510#	400#				32	ms	4	$5/2^+$#	15			1997	β^-=100; β^-n=90#; β^-2n=2#	
^{113}Mo	−52490#	300#				80	ms	2	$3/2^+$#	15			1994	β^-=100; β^-n=3#	
^{113}Tc	−62812	3				152	ms	8	$5/2^+$#	15			1992	β^-=100; β^-n=2.1 3	*
^{113}Tc^m	−62698	3	114.4	0.5		527	ns	16	$(5/2^-)$	15	12Ka36	T	2010	IT=100	*
^{113}Ru	−71870	40				800	ms	50	$(1/2^+)$	10			1988	β^-=100	
^{113}Ru^m	−71740	40	130	18		510	ms	30	$(7/2^-)$	10	98Ku17	E	1998	IT=?; β^-=?	*
^{113}Rh	−78768	7				2.80	s	0.12	$(7/2^+)$	10	93Pe11	J	1971	β^-=100	
^{113}Pd	−83591	7				93	s	5	$(5/2^+)$	10			1954	β^-=100	
^{113}Pd^m	−83510	7	81.1	0.3		300	ms	100	$(9/2^-)$	10			1993	IT=100	
^{113}Ag	−87027	17				5.37	h	0.05	$1/2^-$	10			1949	β^-=100	
^{113}Ag^m	−86984	17	43.50	0.10		68.7	s	1.6	$7/2^+$	10			1958	IT=64 7; β^-=36 7	
^{113}Cd	−89043.28	0.24				8.04	Py	0.05	$1/2^+$	10			1925	IS=12.22 12; β^-=100	*
^{113}Cd^m	−88779.74	0.24	263.54	0.03		13.89	y	0.11	$11/2^-$	10	11Ko01	TD	1965	β^-=99.9036 19; IT=0.0964 19	*
^{113}In	−89367.12	0.19				STABLE			$9/2^+$	10			1934	IS=4.29 5	
^{113}In^m	−88975.42	0.19	391.699	0.003		1.6579	h	0.0004	$1/2^-$	10			1939	IT=100	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …															
^{113}Sn	−88328.1	1.6				115.09	d	0.03	$1/2^+$	10			1939	β^+=100	
^{113}Sn^m	−88250.7	1.6	77.389	0.019		21.4	m	0.4	$7/2^+$	10			1961	IT=91.1 23; β^+=8.9 23	
^{113}Sb	−84417	17				6.67	m	0.07	$5/2^+$	10			1958	β^+=100	
^{113}Te	−78347	28				1.7	m	0.2	$(7/2^+)$	10			1974	β^+=100	
^{113}I	−71120	8				6.6	s	0.2	$5/2^+$#	10			1977	β^+=100; α=3.310e−7; $\beta^+\alpha$?	
^{113}Xe	−62204	7				2.74	s	0.08	$5/2^+$#	10			1973	$\beta^+\approx$100; $\alpha\approx$0.011; β^+p=7 4; $\beta^+\alpha\approx$0.007 4	*
^{113}Xe^m	−61800	7	403.6	1.4		6.9	μs	0.3	$(11/2^-)$		13Pr01	ETJ	2013	IT=100	
^{113}Cs	−51765	9				17.7	μs	0.4	$(3/2^+)$	15			1984	p=100	
^{113}Ba	−39780#	300#				100#	ms		$5/2^+$#					p ?; α ?	

*^{113}Tc J : 07Ku23 > 5/2 **
*^{113}Tc^m T : symmetrized from 12Ka36=526(+16–15) ms **
*^{113}Ru^m E : above the 99 keV level and below 160 keV **
*^{113}Cd T : from 07Be61=8.037(0.005)(0.05 systematics); **
*^{113}Cd T : other 09Da03=8.00(0.11)(syt 0.24) outweighed **
*^{113}Cd^m T : average 11Ko01=13.97(0.13) 72Wa11=14.6(0.5) 65Fl02=13.6(0.2) **
*^{113}In^m T : 99.476 m 23 **
*^{113}Xe D : α=0.0024-0.0204% from estimated limit for the reduced width, see 85Ti02 **
*^{113}Xe D : β^+p and $\beta^+\alpha$ derived from β^+p/α=605(35) and β^+p/$\beta^+\alpha$=500-1500 in 85Ti02 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{114}Nb	−35390#	500#				17	ms	5		15			2010	β^-=100; β^-n=50#; β^-2n=6#	
^{114}Mo	−49810#	300#				58	ms	2	0^+	15			1997	β^-=100; β^-n=3#	
^{114}Tc	−58600	430			&	90	ms	20	(1^+)	12	11Ri01	TJ	1994	β^-=100; β^-n=6#	*
^{114}Tc^m	−58437	13	160	430	&	100	ms	20	$(4,5)$	12	11Ri01	TJ	2011	β^- ?; β^-n=6#	
^{114}Ru	−70222	4				540	ms	30	0^+	12	06Mo07	T	1991	β^-=100; β^-n=0#; β^-2n=0#	*
^{114}Rh	−75710	70			*	1.85	s	0.05	1^+	12			1988	β^-=100	
^{114}Rh^m	−75510#	170#	200#	150#	*	1.85	s	0.05	(7^-)	12			1987	β^-=100	
^{114}Pd	−83491	7				2.42	m	0.06	0^+	12			1958	β^-=100	
^{114}Ag	−84931	5				4.6	s	0.1	1^+	12			1958	β^-=100	
^{114}Ag^m	−84732	7	199	5		1.50	ms	0.05	$(<6^+)$	12			1990	IT=100	
^{114}Cd	−90014.93	0.28				STABLE		(>92 Py)	0^+	12	95Ge14	T	1925	IS=28.73 42; 2β^- ?	
^{114}In	−88569.8	0.3				71.9	s	0.1	1^+	12			1937	β^-=99.50 15; β^+=0.50 15	
^{114}In^m	−88379.5	0.3	190.2682	0.0008		49.51	d	0.01	5^+	12			1939	IT=96.75 24; β^+=3.25 24	
^{114}In^n	−88067.9	0.3	501.948	0.003		43.1	ms	0.6	8^-	12			1958	IT=100	
^{114}In^p	−87928.1	0.3	641.745	0.003		4.3	ns	0.4	7^+	12			1975	IT=100	*
^{114}Sn	−90559.723	0.029				STABLE			0^+	12			1927	IS=0.66 1	
^{114}Sn^m	−87472.35	0.08	3087.37	0.07		733	ns	14	7^-	12			1980	IT=100	
^{114}Sb	−84497	22				3.49	m	0.03	3^+	12			1959	β^+=100	
^{114}Sb^m	−84002	22	495.5	0.7		219	μs	12	(8^-)	12			1973	IT=100	
^{114}Te	−81889	28				15.2	m	0.7	0^+	12			1968	β^+=100	
^{114}I	−72800#	150#				2.1	s	0.2	1^+	12			1977	β^+=100; β^+p ?	
^{114}I^m	−72530#	150#	265.9	0.5		6.2	s	0.5	(7)	12	JBl96	D	1995	β^+=91 2; IT=9 2	*
^{114}Xe	−67086	11				10.0	s	0.4	0^+	12			1977	β^+=100	
^{114}Cs	−54680	70				570	ms	20	(1^+)	12			1978	$\beta^+\approx$100; α=0.018 6; β^+p=8.7 13; $\beta^+\alpha$=0.19 3	
^{114}Ba	−45910	100				460	ms	125	0^+	12	16Ca33	T	1995	$\beta^+\approx$100; β^+p=20 10; α=0.9 3; 12C<0.0034	*

*^{114}Tc T : others, might be mixture of ground-state and m : 15Lo04=120(10) 06Mo07=91(+62–35) **
*^{114}Tc T : 99Wa09=150(30) **
*^{114}Ru T : average 06Mo07=510(+69–65) 92Jo05=530(60) 91Le09=570(50) **
*^{114}In^p T : typo in NUBASE2012 : 4.3 μs, should be 4.3 ns cf. 75Ra07 and ENSDF2012 **
*^{114}I^m D : evaluated for NUBASE by J. Blachot, based on ^{114}I IT decay **
*^{114}Ba T : average 16Ca33=380(+190–110) 97Ja12=430(+300–150) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{115}Nb	−31350#	500#				23	ms	8	$5/2^+$#	15			2010	β^-=100; β^-n=60#; β^-2n=1#	
^{115}Mo	−44750#	400#				45.5	ms	2.0	$3/2^+$#	15			2010	β^-=100; β^-n=3#; β^-2n=0.01#	
^{115}Tc	−56320	790				78	ms	2	$5/2^+$#	15			1994	β^-=100; β^-n=20#	
^{115}Ru	−66190	90				318	ms	19	$(3/2^+)$	12	11Ri07	J	1992	β^-=100; β^-n=0.02#	*
^{115}Ru^m	−65940#	140#	250#	100#		76	ms	6	$(9/2^-)$	12			2010	IT=100	*
^{115}Rh	−74230	7				990	ms	50	$(7/2^+)$	12	11Ri07	J	1988	β^-=100; β^-n=0.05#	
^{115}Pd	−80426	14				25	s	2	$(1/2)^+$	12			1958	β^-=100	
^{115}Pd^m	−80337	14	89.21	0.16		50	s	3	$(7/2^-)$	12			1987	β^-=92.0 20; IT=8.0 20	
^{115}Ag	−84983	18				20.0	m	0.5	$1/2^-$	12			1949	β^-=100	
^{115}Ag^m	−84942	18	41.16	0.10		18.0	s	0.7	$7/2^+$	12			1958	β^-=79.0 3; IT=21.0 3	
^{115}Cd	−88084.5	0.7				53.46	h	0.05	$1/2^+$	12			1939	β^-=100	
^{115}Cd^m	−87903.5	0.9	181.0	0.5		44.56	d	0.24	$11/2^-$	12	FGK127	J	1959	$\beta^-\approx$100; IT<0.003	*
^{115}In	−89536.346	0.012				441	Ty	25	$9/2^+$	12			1924	IS=95.71 5; β^-=100	
^{115}In^m	−89200.102	0.021	336.244	0.017		4.486	h	0.004	$1/2^-$	12			1961	IT=95.0 7; β^-=5.0 7	
^{115}Sn	−90033.835	0.015				STABLE			$1/2^+$	12			1927	IS=0.34 1	
^{115}Sn^m	−89421.03	0.04	612.81	0.04		3.26	μs	0.08	$7/2^+$	12			1967	IT=100	
^{115}Sn^n	−89320.20	0.12	713.64	0.12		159	μs	1	$11/2^-$	12			1958	IT=100	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{115}Sb	−87003	16					32.1	m	0.3	$5/2^+$	12			1958	β^+=100	
^{115}Sb^m	−84207	16	2796.26	0.09			159	ns	3	$(19/2)^-$	12			1977	IT=100	
^{115}Te	−82063	28				*	5.8	m	0.2	$7/2^+$	12			1961	β^+=100	
^{115}Te^m	−82053	29	10	7		*	6.7	m	0.4	$(1/2)^+$	12	GAu	E	1974	$\beta^+\approx$100; IT<0.06	*
^{115}Te^n	−81783	28	280.05	0.20			7.5	μs	0.2	$11/2^-$	12			1972	IT=100	
^{115}I	−76338	29					1.3	m	0.2	$5/2^+$#	12			1969	β^+=100	
^{115}Xe	−68657	12					18	s	4	$(5/2^+)$	12			1969	β^+=100; β^+p=0.34 6; α=0.0003 1	
^{115}Cs	−59700#	100#					1.4	s	0.8	$9/2^+$#	12			1978	β^+=100; β^+p$\approx$0.07	
^{115}Ba	−49020#	200#					450	ms	50	$5/2^+$#	12			1997	β^+=100; β^+p>15	

*^{115}Ru J : suggested in 11Ri07 from β^- decay study **
*^{115}Ru^m E : ENSDF2012 > 61.7 keV **
*^{115}Cd^m J : measured magnetic moment and L(d,p)=5 **
*^{115}Te^m E : less than 20 keV, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{116}Mo	−41500#	500#					32	ms	4	0^+	15			2010	β^-=100; β^-n=10#; β^-2n=0#	
^{116}Tc	−51460#	300#					57	ms	3	2^+#	15			1997	β^-=100; β^-n=20#; β^-2n=0.05#	
^{116}Ru	−64069	4					204	ms	6	0^+	15			1994	β^-=100; β^-n=0.1#	
^{116}Rh	−70740	70				*	685	ms	39	1^+	10	06Mo07	TD	1970	β^-=100; β^-n<2.1	*
^{116}Rh^m	−70540#	170#	200#	150#		*	570	ms	50	(6^-)	10			1987	β^-=100	
^{116}Pd	−79832	7					11.8	s	0.4	0^+	10			1970	β^-=100	
^{116}Ag	−82543	3					3.83	m	0.08	(0^-)	10			1958	β^-=100	*
^{116}Ag^m	−82495	3	47.90	0.10			20	s	1	(3^+)	10			2005	β^-=93.0; IT=7.0	
^{116}Ag^n	−82413	3	129.80	0.22			9.3	s	0.3	(6^-)	10			1970	β^-=92.0; IT=8.0	
^{116}Cd	−88712.48	0.16					28.7	Ey	1.3	0^+	10	15Ba11	T	1925	IS=7.49 18; $2\beta^-$=100	*
^{116}In	−88249.75	0.22					14.10	s	0.03	1^+	10	13Wr01	D	1937	$\beta^-\approx$100; ε=0.0237 43	*
^{116}In^m	−88122.48	0.22	127.267	0.006			54.29	m	0.17	5^+	10			1945	β^-=100	
^{116}In^n	−87960.09	0.22	289.660	0.006			2.18	s	0.04	8^-	10			1950	IT=100	
^{116}Sn	−91525.97	0.10					STABLE			0^+	10			1922	IS=14.54 9	
^{116}Sn^m	−89160.00	0.10	2365.975	0.021			348	ns	19	5^-	10			1964	IT=100	
^{116}Sn^n	−87978.81	0.20	3547.16	0.17			833	ns	30	10^+	10			1978	IT=100	
^{116}Sb	−86822	5					15.8	m	0.8	3^+	10			1949	β^+=100	
^{116}Sb^m	−86728	5	93.99	0.05			194	ns	4	1^+	10			1976	IT=100	
^{116}Sb^n	−86440	40	390	40	BD		60.3	m	0.6	8^-	10			1949	β^+=100	
^{116}Te	−85269	28					2.49	h	0.04	0^+	10			1958	β^+=100	
^{116}I	−77490	100					2.91	s	0.15	1^+	10			1976	β^+=100	
^{116}I^m	−77060	100	430.4	0.5			3.27	μs	0.16	(7^-)	10			1990	IT=100	
^{116}Xe	−73047	13					59	s	2	0^+	10			1969	β^+=100	
^{116}Cs	−62040#	100#				*	700	ms	40	(1^+)	10	77Bo28	D	1975	β^+=100; β^+p=0.28 7; $\beta^+\alpha$=0.049 25	*
^{116}Cs^m	−61940#	120#	100#	60#		*	3.85	s	0.13	4^+,5,6	10			1975	β^+=100; β^+p=0.51 15; $\beta^+\alpha$=0.008 2	
^{116}Ba	−54580#	200#					1.3	s	0.2	0^+	10			1997	β^+=100; β^+p=3 1	
^{116}La	−40650#	310#					10#	ms			10				β^+ ?; β^+p ?; p ?	*

*^{116}Rh T : average 06Mo07=688(+52–50) 88Ay02=680(60) D : β^-n limit from 06Mo07 **
*^{116}Ag T : 230(5) s **
*^{116}Cd T : also 0ν-$\beta\beta$ 96Ar36>5000Ey and Majoron 96Ar36>1200Ey 98Da23>1200Ey **
*^{116}In D : average 13Wr01=0.0246(44stat)(39syst) 98Bh04=0.0227 63 **
*^{116}In T : also 13Wr01=14.9(0.8) **
*^{116}Cs D : from 77Bo28; ENSDF2010 erroneously gives β^+p=2.8 7 **
*^{116}La T : half-life estimate is for β^+ decay; no p-decay within 20 μs-20ms **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{117}Mo	−36170#	500#					22	ms	5	$3/2^+$#	15			2010	β^-=100; β^-n=10#; β^-2n=0.2#	
^{117}Tc	−48380#	400#					44.5	ms	3.0	$5/2^+$#	15			1997	β^-=100; β^-n=30#; β^-2n=0#	
^{117}Ru	−59490	430					151	ms	3	$3/2^+$#	15			1994	β^-=100; β^-n=0.5#	
^{117}Ru^m	−59310	430	185.0	0.4			2.49	μs	0.6		15			2012	IT=100	*
^{117}Rh	−68897	9					421	ms	30	$7/2^+$#	11	06Mo07	TD	1991	β^-=100; β^-n<7.6	*
^{117}Pd	−76424	7					4.3	s	0.3	$(3/2^+)$	11	04Ur04	J	1968	β^-=100	
^{117}Pd^m	−76221	7	203.3	0.3			19.1	ms	0.7	$(9/2^-)$	11	04Ur04	J	1990	IT=100	
^{117}Ag	−82182	14					73.6	s	1.4	$1/2^-$#	11			1958	β^-=100	*
^{117}Ag^m	−82153	14	28.6	0.2			5.34	s	0.05	$7/2^+$#	11			1990	β^-=94.0 15; IT=6.0 15	*
^{117}Cd	−86418.4	1.0					2.49	h	0.04	$1/2^+$	11			1939	β^-=100	
^{117}Cd^m	−86282.0	1.0	136.4	0.2			3.36	h	0.05	$11/2^-$	11	13Yo02	J	1966	$\beta^-\approx$100; IT$\approx$0	
^{117}In	−88943	5					43.2	m	0.3	$9/2^+$	11			1937	β^-=100	
^{117}In^m	−88628	5	315.303	0.011			116.2	m	0.3	$1/2^-$	11			1940	β^-=52.9 15; IT=47.1 15	
^{117}Sn	−90397.8	0.5					STABLE			$1/2^+$	11			1923	IS=7.68 7	
^{117}Sn^m	−90083.2	0.5	314.58	0.04			14.00	d	0.05	$11/2^-$	12			1950	IT=100	
^{117}Sn^n	−87991.4	0.6	2406.4	0.4			1.75	μs	0.07	$(19/2^+)$	11			1979	IT=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{117}Sb	−88640	8					2.80	h	0.01	$5/2^+$	11			1947	β^+=100	
^{117}Sb^m	−85509	8	3130.76	0.19			355	μs	17	$(25/2)^+$	11			1970	IT=100	
^{117}Sb^n	−85409	8	3230.7	0.2			290	ns	5	$(23/2^-)$	11			1987	IT=100	
^{117}Te	−85095	13					62	m	2	$1/2^+$	11			1958	ε=75 1; e$^+$=25 1	
^{117}Te^m	−84799	13	296.1	0.5			103	ms	3	$(11/2^-)$	11	99Mo30	J	1963	IT ?	
^{117}I	−80436	26					2.22	m	0.04	$(5/2)^+$	11			1969	β^+=100; e$^+$≈77	
^{117}Xe	−74185	10					61	s	2	$5/2^{(+)}$	11			1969	β^+=100; β^+p=0.0029 6	
^{117}Cs	−66490	60				*	8.4	s	0.6	$9/2^+$#	11			1972	β^+=100	
^{117}Cs^m	−66340#	100#	150#	80#		*	6.5	s	0.4	$3/2^+$#	11			1978	β^+=100	
^{117}Cs^x	−66440	80	50	50			$R=?$			spmix						
^{117}Ba	−57460	250					1.75	s	0.07	$(3/2)^{(+\#)}$	11	97Ja12	D	1977	β^+=100; β^+p=13 3; $\beta^+\alpha$=0.024 8	*
^{117}La	−46470#	200#					21.7	ms	1.8	$(3/2^+)$	11	11Li28	TJ	2001	p=?; β^+=6.1#; β^+p ?	*
^{117}La^m			non existent		RN		10	ms	5	$(9/2^+)$	11	01So02	I			*
*^{117}Ru^m	T : symmetrized from 12Ka36=2.487(+0.058–0.055)															**
*^{117}Rh	T : average 06Mo07=394(+47–43) 91Pe10=440(40)															**
*^{117}Ag	T : symmetrized from 72.8(+2.0–0.7)															**
*^{117}Ag^m	J : E3 to ground-state $1/2^-$#															**
*^{117}Ba	D : β^+p from 97Ja12. β^+p/$\beta^+\alpha$=350-1200 from 85Ti02 yields $\beta^+\alpha$=0.011%-0.037%															**
*^{117}La	T : average 11Li28=20.1(2.5) 01Ma69=24(3) 01So02=22(5)															**
*^{117}La^m	I : reported in 01So02 with E=121(10) keV. Not observed in 11Li28															**
^{118}Mo	−32630#	500#					21	ms	6	0^+	15	15Lo04	TD	2015	β^-=100; β^-n=10#; β^-2n=0.08#	*
^{118}Tc	−43790#	400#					30	ms	4	2^+#	15			2010	β^-=100; β^-n=30#; β^-2n=0.6#	
^{118}Ru	−57260#	200#					99	ms	3	0^+	15			1994	β^-=100; β^-n=1#	
^{118}Rh	−64887	24					284	ms	9	$(4^-10)^{(+\#)}$	06	15Lo04	T	1994	β^-=100; β^-n=3.1 14	*
^{118}Pd	−75388.7	2.5					1.9	s	0.1	0^+	06			1969	β^-=100	
^{118}Ag	−79553.8	2.5					3.76	s	0.15	1^-	95	93Ja03	J	1967	β^-=100	
^{118}Ag^m	−79508.0	2.5	45.79	0.09			0.1	μs		$0^{(-)}$to$2^{(-)}$	95			1989	IT=100	
^{118}Ag^n	−79426.2	2.5	127.63	0.10			2.0	s	0.2	$4^{(+)}$	95			1971	β^-=59; IT=41	
^{118}Ag^p	−79274.4	2.5	279.37	0.20			0.1	μs		$(2^+,3^+)$	95			1989	IT=100	
^{118}Cd	−86702	20					50.3	m	0.2	0^+	95			1961	β^-=100	
^{118}In	−87228	8				*	5.0	s	0.5	1^+	95			1949	β^-=100	
^{118}In^m	−87130#	50#	100#	50#		*	4.364	m	0.007	5^+	95	94It.A	T	1964	β^-=100	
^{118}In^n	−86990#	50#	240#	50#			8.5	s	0.3	8^-	95			1969	IT=98.6 3; β^-=1.4 3	*
^{118}Sn	−91652.9	0.5					STABLE			0^+	95			1924	IS=24.22 9	
^{118}Sn^m	−89078.0	0.5	2574.91	0.04			230	ns	10	7^-	95			1961	IT=100	
^{118}Sn^n	−88544.8	0.5	3108.06	0.22			2.52	μs	0.06	(10^+)	95	11Fo15	J	1973	IT=100	
^{118}Sb	−87996	3					3.6	m	0.1	1^+	95			1947	β^+=100	
^{118}Sb^m	−87945	3	50.814	0.021			20.6	μs	0.6	$(3)^+$	95			1975	IT=100	
^{118}Sb^n	−87746	5	250	6	BD		5.00	h	0.02	8^-	95			1947	β^+=100	
^{118}Te	−87697	18					6.00	d	0.02	0^+	95			1948	ε=100	
^{118}I	−80971	20					13.7	m	0.5	2^-	95			1957	β^+=100	
^{118}I^m	−80782	20	188.8	0.7			8.5	m	0.5	(7^-)	95	03Mo36	E	1968	β^+≈100; IT=?	*
^{118}Xe	−78079	10					3.8	m	0.9	0^+	95			1965	β^+=100	
^{118}Cs	−68409	13				*	14	s	2	2	95			1969	β^+=100; β^+p=0.021 14; $\beta^+\alpha$=0.0012 5	*
^{118}Cs^m	−68310#	60#	100#	60#		*	17	s	3	(7^-)	95	93Be46	J	1972	β^+=100; β^+p=0.021 14; $\beta^+\alpha$=0.0012 5	
^{118}Cs^x	−68404	12	5	4			$R<0.1$			spmix						
^{118}Ba	−62350#	200#					5.2	s	0.2	0^+	06	97Ja12	T	1997	β^+=100	
^{118}La	−49560#	300#					200#	ms							β^+ ?; β^+p ?	
*^{118}Mo	T : symmetrized from 15Lo04=19(+7–4)															**
*^{118}Rh	T : average 15Lo04=285(10) 06Mo07=266(+22–21) 00Jo18=310(30)															**
*^{118}Rh	J : from 00Jo18															**
*^{118}In^n	E : 138.2(0.5) keV above ^{118}In^m, from ENSDF															**
*^{118}I^m	E : from a least-squares fit to level scheme of 03Mo36															**
*^{118}Cs	D : derived from β^+p=0.042(6)%, $\beta^+\alpha$=0.0024(4)% for mixture of ground-state and isomer.															**
*^{118}Cs	D : Replaced by uniform distributions from zero to values for each isomer															**
^{119}Tc	−40370#	500#					22	ms	3	$5/2^+$#	15			2010	β^-=100; β^-n=30#; β^-2n=0.1#	
^{119}Ru	−52560#	300#					69.5	ms	2.0	$3/2^+$#	15			1997	β^-=100; β^-n=3#; β^-2n=0#	
^{119}Ru^m	−52330#	300#	227.1	0.7			384	ns	22		15			2012	IT=100	*
^{119}Rh	−62823	9					190	ms	6	$7/2^+$#	09	15Lo04	T	1994	β^-=100; β^-n=6.4 16	
^{119}Pd	−71408	8					920	ms	80	$3/2^+$#	09	06Mo07	TD	1991	β^-=100; β^-n=0#	*
^{119}Pd^m	−71110#	150#	300#	150#			3#	ms		$11/2^-$#					IT ?; β^- ?	
^{119}Ag	−78646	15				* &	6.0	s	0.5	$1/2^-$#	09			1975	β^-=100	
^{119}Ag^m	−78626#	25#	20#	20#		* &	2.1	s	0.1	$7/2^+$#	09			1975	β^-=100	*
^{119}Cd	−83980	40					2.69	m	0.02	$1/2^+$	09	13Yo02	J	1961	β^-=100	
^{119}Cd^m	−83830	40	146.54	0.11			2.20	m	0.02	$11/2^-$	09	13Yo02	J	1974	β^-=100	
… *A*-group is continued on next page …																

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... A-group continued ...															
^{119}In	−87699	7				2.4	m	0.1	$9/2^+$	09			1949	β^-=100	
^{119}In^m	−87388	7	311.37	0.03		18.0	m	0.3	$1/2^-$	09			1973	β^-=95.6; IT=4.4	
^{119}In^n	−87045	7	654.27	0.07		130	ns	15	$(3/2)^+$	09			1974	IT=100	
^{119}In^p	−85042	7	2656.9	1.8		240	ns	25	$(25/2^+)$	09			2002	IT=100	
^{119}Sn	−90065.0	0.7				STABLE			$1/2^+$	09			1925	IS=8.59 4	
^{119}Sn^m	−89975.5	0.7	89.531	0.013		293.1	d	0.7	$11/2^-$	09			1950	IT=100	
^{119}Sn^n	−87938.0	1.2	2127.0	1.0		9.6	μs	1.2	$(19/2^+)$	09			1992	IT=100	
^{119}Sn^p	−87696.0	0.8	2369.0	0.3		96	ns	9	$23/2^+$		16Is03	ETJ	2016	IT=100	
^{119}Sb	−89474	8				38.19	h	0.22	$5/2^+$	09			1947	ε=100	
^{119}Sb^m	−86920	8	2553.6	0.3		130	ns	3	$19/2^-$	09	91Io02	J	1991	IT=100	
^{119}Sb^n	−86622	11	2852	7		850	ms	90	$27/2^+$#	09			1979	IT=100	*
^{119}Te	−87181	8				16.05	h	0.05	$1/2^+$	09			1948	ε=97.94 5; e$^+$=2.06 5	
^{119}Te^m	−86920	8	260.96	0.05		4.70	d	0.04	$11/2^-$	09			1960	ε=99.59 4; e$^+$=0.41 4; IT<0.008	
^{119}I	−83766	28				19.1	m	0.4	$5/2^+$	09			1954	e$^+$=51 4; ε=49 4	
^{119}Xe	−78794	10				5.8	m	0.3	$5/2^{(+)}$	09	90Ne.A	J	1965	e$^+$=79 5; ε=21 5	
^{119}Cs	−72305	14			*	43.0	s	0.2	$9/2^+$	09	75Ho09	D	1969	β^+=100; $\beta^+\alpha$<2e–6	
^{119}Cs^m	−72260#	30#	50#	30#	*	30.4	s	0.1	$3/2^{(+)}$	09			1978	β^+=100	
^{119}Cs^x	−72289	9	16	11		$R=.5$ .25			spmix						
^{119}Ba	−64590	200				5.4	s	0.3	$(5/2^+)$	09			1974	β^+=100; β^+p=25 2	
^{119}La	−54790#	300#				1#	s		$11/2^-$#					β^+ ?	
^{119}Ce	−43940#	500#				200#	ms		$5/2^+$#					β^+ ?; β^+p ?	

*^{119}Ru^m T : symmetrized from 12Ka36=383(+22–21) **
*^{119}Pd T : average 06Mo07=918(111) 91Pe04=920(130) **
*^{119}Ag^m E : estimated from $7/2^+$ level in isotopes ^{113}Ag=43 ^{115}Ag=41 ^{117}Ag=28 **
*^{119}Sb^n E : estimated less than 20 keV above 2841.7 level **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{120}Tc	−35520#	500#				21	ms	5		15			2010	β^-=100; β^-n=30#; β^-2n=2#	
^{120}Ru	−50010#	400#				45	ms	2	0^+	15			2010	β^-=100; β^-n=4#	
^{120}Rh	−58820#	200#				129.6	ms	4.2		13	15Lo04	T	1994	β^-=100; β^-n<5.4; β^-2n=0#	*
^{120}Rh^m	−58660#	200#	157.2	0.7		295	ns	16		13	12Ka36	ETD	2012	IT=100	*
^{120}Pd	−70280.1	2.3				492	ms	33	0^+	14	06Mo07	TD	1993	β^-=100; β^-n<0.7	*
^{120}Ag	−75652	4				1.52	s	0.07	$4^{(+)}$	02	12Ba58	TJ	1971	β^-=100; β^-n<0.003	*
^{120}Ag^m	−75650#	50#	0#	50#		940	ms	100	$(0^-,1^-)$		12Ba58	TJD	2012	β^-=?; IT ?	
^{120}Ag^n	−75449	4	203.0	0.2		384	ms	22	$7^{(-)}$	02	12Ba58	EJD	1971	IT=68 10; β^-=32 5	*
^{120}Cd	−83957	4				50.80	s	0.21	0^+	02			1973	β^-=100	
^{120}In	−85730	40			*	3.08	s	0.08	1^+	02			1958	β^-=100	
^{120}In^m	−85680#	50#	50#	60#	* &	46.2	s	0.8	$(5)^+$	02	13Ma15	J	1960	β^-=100	
^{120}In^n	−85430#	200#	300#	200#	* &	47.3	s	0.5	$8^{(-)}$	02	79Fo10	J	1960	β^-=100	
^{120}Sn	−91098.4	0.9				STABLE			0^+	02			1926	IS=32.58 9	
^{120}Sn^m	−88616.8	0.9	2481.63	0.06		11.8	μs	0.5	7^-	02			1960	IT=100	
^{120}Sn^n	−88196.2	0.9	2902.22	0.22		6.26	μs	0.11	10^+	02	FGK128	J	1987	IT=100	*
^{120}Sb	−88418	7			*	15.89	m	0.04	1^+	02			1937	β^+=100	
^{120}Sb^m	−88420#	100#	0#	100#	*	5.76	d	0.02	8^-	02			1958	β^+=100	
^{120}Sb^n	−88340	7	78.16	0.05		246	ns	2	(3^+)	02			1976	IT=100	
^{120}Sb^p	−86090	7	2328.3	0.6		400	ns	8		02			1983	IT=100	
^{120}Te	−89368	3				STABLE			0^+	02			1936	IS=0.09 1; 2β^+ ?	
^{120}I	−83753	15				81.67	m	0.18	2^-	02	06Ph01	T	1957	β^+=100	*
^{120}I^m	−83680	15	72.61	0.09		242	ns	5	3^+	02	11Mo27	TJ	1974	IT=100	*
^{120}I^n	−83433	21	320	15		53	m	4	(7^-)	02			1967	β^+=100	
^{120}Xe	−82172	12				46.0	m	0.6	0^+	02	06Ph01	T	1965	β^+=100	
^{120}Cs	−73889	10			*	60.4	s	0.6	$2^{(+)}$	02	06Ph01	T	1969	β^+=100; $\beta^+\alpha$<2.0e–5 4; β^+p<7e–6 3	*
^{120}Cs^m	−73790#	60#	100#	60#	*	57	s	6	(7^-)	02	75Ho09	D	1977	β^+=100; $\beta^+\alpha$<2.0e–5 4; β^+p<7e–6 3	
^{120}Cs^x	−73884	9	5	4		$R<0.1$			spmix						
^{120}Ba	−68890	300				24	s	2	0^+	02	92Xu04	T	1974	β^+=100	
^{120}La	−57570#	300#				2.8	s	0.2		02			1984	β^+=100; β^+p=?	
^{120}Ce	−49600#	500#				250#	ms		0^+					β^+ ?; β^+p ?	

*^{120}Rh T : average 15Lo04=131(5) 06Mo07=136(+14–13)) 04Wa26=120(10) **
*^{120}Rh^m E : 12Ka36=59.1(0.5) and 98.1(0.5) γ rays in cascade to ground-state **
*^{120}Rh^m T : symmetrized from 12Ka36=294(+16–15) **
*^{120}Pd D : 2ν-$\beta\beta$ decay estimated 150(60) Ey **
*^{120}Ag T : not used 83Re05=1.25(0.03) 71Fo22=1.17(0.05) D : from 93Ru01 **
*^{120}Ag^n T : average 12Ba58=440(50) 03Wa13=400(30) 71Fo22=320(40) **
*^{120}Sn^n J : E2 (from intensity balance) to 8^+ I(354.9)/I(65.7)=8.7(1.0) **
*^{120}I T : average 06Ph01=82.1(0.6) 00Ho19=81.7(0.2) 65An05=81.0(0.6) **
*^{120}I^m T : average 11Mo27=244(5) 74Mu10=228(15) **
*^{120}Cs T : average 06Ph01=60.0(7) 93Al03=60(2) 77Ge03=64(3) 69Ch18=61.3(1.4) **
*^{120}Cs D : isomers not distinguished by 75Ho09 in $\beta^+\alpha$ and β^+p. Values replaced **
*^{120}Cs D : by upper limits for both (see ENSDF evaluation of ^{118}Cs) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{121}Tc	−31780#	500#					22	ms	6	5/2+#	15			2015	β^-=100; β^-n=50#; β^-2n=0.7#	
^{121}Ru	−45050#	400#					29	ms	2	3/2+#	15			2010	β^-=100; β^-n=6#; β^-2n=0#	
^{121}Rh	−56250	620					76	ms	5	7/2+#	10	15Lo04	T	1994	β^-=100; β^-n=7#	
^{121}Pd	−66182	3					290	ms	1	3/2+#	10	15Lo04	T	1994	β^-=100; β^-n<0.8	
^{121}Pd^m	−66047	3	135.5	0.5			460	ns	90	11/2−#	10	12Ka36	ETD	2007	IT=100; β^- ?; β^-n=0#	*
^{121}Pd^n	−66022	15	160	15			460	ns	90			12Ka36	ETD	2007	IT=100; β^- ?; β^-n=0#	*
^{121}Ag	−74403	12				*	780	ms	20	7/2+#	10			1982	β^-=100; β^-n=0.080 13	
^{121}Ag^m	−74383#	23#	20#	20#		*	200#	ms		1/2−#					β^- ?; IT ?	
^{121}Cd	−81073.8	1.9					13.5	s	0.3	3/2+	10	13Yo02	J	1965	β^-=100	
^{121}Cd^m	−80858.9	1.9	214.86	0.15			8.3	s	0.8	11/2−	10	13Yo02	J	1982	β^-=100	
^{121}In	−85836	27					23.1	s	0.6	9/2+	10			1960	β^-=100	
^{121}In^m	−85522	27	313.68	0.07			3.88	m	0.10	1/2−	10			1974	β^-=98.8 2; IT=1.2 2	
^{121}In^n	−83388	27	2448	1			17	μs	2	(21/2−)		10Re01	ETJ	2010	IT=100	*
^{121}Sn	−89197.3	1.0					27.03	h	0.04	3/2+	10			1948	β^-=100	
^{121}Sn^m	−89191.0	1.0	6.31	0.06			43.9	y	0.5	11/2−	10			1962	IT=77.6 20; β^-=22.4 20	
^{121}Sn^n	−87198.5	1.3	1998.8	0.9			5.3	μs	0.5	(19/2+)	10			1995	IT=100	*
^{121}Sn^p	−86976.2	1.1	2221.1	0.4			520	ns	50	(23/2+)		16Is03	EJT	2012	IT=100	
^{121}Sn^q	−86362.7	2.1	2834.6	1.8			167	ns	25	(27/2−)	10			1995	IT=100	
^{121}Sb	−89600.3	2.6					STABLE			5/2+	10			1922	IS=57.21 5	
^{121}Sb^m	−86859	12	2741	12			179	μs	6	(25/2+)	10	09Wa02	EJ	2008	IT=100	*
^{121}Te	−88546	26					19.17	d	0.04	1/2+	10			1939	β^+=100	
^{121}Te^m	−88252	26	293.974	0.022			164.2	d	0.8	11/2−	10			1940	IT=88.6 11; β^+=11.4 11	
^{121}I	−86251	5					2.12	h	0.01	5/2+	10			1950	β^+=100	
^{121}I^m	−83874	5	2376.9	0.4			9.0	μs	1.4		10			1982	IT=100	
^{121}Xe	−82481	10					40.1	m	2.0	5/2(+)	10			1952	β^+=100	
^{121}Cs	−77102	14					155	s	4	3/2(+)	10			1969	β^+=100	
^{121}Cs^m	−77034	14	68.5	0.3			122	s	3	9/2(+)	10			1981	β^+=83; IT=17	
^{121}Cs^x	−77056	16	46	8			$R=21$			spmix						
^{121}Ba	−70740	140					29.7	s	1.5	5/2(+)	10	75Bo11	D	1975	β^+=100; β^+p=0.02 1	
^{121}La	−62190#	300#					5.3	s	0.2	11/2−#	10			1988	β^+=100; β^+p ?	
^{121}Ce	−52690#	400#					1.1	s	0.1	(5/2)(+#)	10			1997	β^+=100; β^+p≈1	
^{121}Pr	−41420#	500#					12	ms	5	(3/2)	10			2005	p≈100	*

*^{121}Pd^m T : symmetrized from 12Ka36=460(+85–92) E : other 07To23=135(3) keV **
*^{121}Pd^n T : symmetrized from 12Ka36=463(+83–94) and assuming two cascading isomers **
*^{121}Pd^n E : x keV above 121Pdm, x below energy threshold 50 keV **
*^{121}In^n T : other 02Lu15=350(50) ns, assigned J=(25/2+); further studies are needed **
*^{121}Sn^n E : ^{121}Sn^n=1998.8(0.9) and ^{121}Sn^p=2834.6(1.8) are from ENSDF2000,not in 2010 **
*^{121}Sb^m E : above 2720.9 level and <2761; other 08Jo03=2721.1 + x with x<60 or x<80 **
*^{121}Pr T : symmetrized from 10(+6–3) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{122}Ru	−42150#	500#					25	ms	1	0+	15			2010	β^-=100; β^-n=7#; β^-2n=0#	
^{122}Rh	−52080#	300#					51	ms	6		13	15Lo04	TD	1997	β^-=100; β^-n=10#; β^-2n=0.01#	
^{122}Rh^m	−51810#	300#	271.0	0.7			830	ns	120		13	12Ka36	ETD	2012	IT=100	*
^{122}Pd	−64616	20					195	ms	5	0+	14	15Lo04	T	1994	β^-=100; β^-n<2.5	
^{122}Ag	−71110	40				*	529	ms	13	(3+)	07			1978	β^-=100; β^-n=0.186 10	
^{122}Ag^m	−71030#	60#	80#	50#		*	550	ms	50	(1−)	07			2000	β^-=100; IT ?; β^-n=0.2#	*
^{122}Ag^n	−71030#	60#	80#	50#		*	200	ms	50	(9−)	07			2000	β^-=100; IT ?; β^-n=0.2#	*
^{122}Ag^p	−71030#	60#	80#	50#		*	6.3	μs	1.0			13La11	T	2013	IT=100	
^{122}Cd	−80612.4	2.3					5.24	s	0.03	0+	07			1973	β^-=100	
^{122}In	−83570	50				*	1.5	s	0.3	1+	07			1963	β^-=100	
^{122}In^m	−83530#	80#	40#	60#		*	10.3	s	0.6	5+	07			1979	β^-=100	
^{122}In^n	−83290	130	290	140	BD		10.8	s	0.4	(8−)	07			1979	β^-=100	
^{122}Sn	−89941.3	2.4					STABLE			0+	07			1928	IS=4.63 3; 2β^- ?	
^{122}Sn^m	−87532.3	2.4	2409.03	0.04			7.5	μs	0.9	7−	07			1979	IT=100	
^{122}Sn^n	−87175.7	2.6	2765.6	1.0			62	μs	3	(10+)	07			1992	IT=100	
^{122}Sn^p	−85221.1	2.5	4720.2	0.5			146	ns	15	(15−)		12As05	EJT	2012	IT=100	
^{122}Sb	−88335.4	2.6					2.7238	d	0.0002	2−	07			1939	β^-=97.59 12; β^+=2.41 12	
^{122}Sb^m	−88274.0	2.6	61.4131	0.0005			1.86	μs	0.08	3+	07			1962	IT=100	
^{122}Sb^n	−88197.9	2.6	137.4726	0.0008			530	μs	30	(5)+	07			1963	IT=100	
^{122}Sb^p	−88171.8	2.6	163.5591	0.0017			4.191	m	0.003	(8)−	07			1947	IT=100	
^{122}Te	−90314.5	1.5					STABLE			0+	07			1932	IS=2.55 12	
^{122}I	−86080	5					3.63	m	0.06	1+	07	12At01	D	1950	e+=78 2; ε=22 2	
^{122}I^m	−85765	5	314.9	0.4			190	ns	10	(7−)	07	12Mo.A	T	2004	IT=100	
^{122}I^n	−85701	5	379.4	0.5			81	μs	3	(7−)	07	12Mo.A	T	2004	IT=100	
^{122}I^p	−85686	5	394.1	0.5			81	μs	3	(8+)	07	12Mo.A	T	2004	IT=100	
^{122}I^q	−85636	5	444.1	0.5			148	ns	5	(8−)	07	12Mo.A	T	2004	IT=100	
^{122}Xe	−85355	11					20.1	h	0.1	0+	07			1952	ε=100	
^{122}Cs	−78140	30					21.18	s	0.19	1+	07	75Ho09	D	1969	β^+=100; $\beta^+\alpha$<2e–7	*
^{122}Cs^m	−78090	30	45.87	0.12			> 1	μs		(3)+	07			1987	IT=100	
^{122}Cs^n	−78005	9	140	30	MD		3.70	m	0.11	8(−)	07			1969	β^+=100	
^{122}Cs^p	−78010	30	127.07	0.16			360	ms	20	(5)−	07			1969	IT=100	
^{122}Cs^x	−78130	30	14	7			$R=0.1.05$			spmix						

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...																
^{122}Ba	−74609	28					1.95	m	0.15	0^+	07			1974	β^+=100	
^{122}La	−64540#	300#					8.6	s	0.5		07			1984	β^+=100; β^+p=?	
^{122}Ce	−57870#	400#					2#	s		0^+	07			2005	β^+ ?; β^+p ?	
^{122}Pr	−44780#	500#					500#	ms							β^+ ?; β^+p ?	

∗^{122}Rh^m E : 12Ka36=63.9(0.5) and 207.1(0.5) γ rays in cascade to ground-state ∗∗
∗^{122}Rh^m T : symmetrized from 12Ka36=820(+130−110) ∗∗
∗^{122}Ag^m D : β^-n has been observed by 00Kr18 but not quantified ∗∗
∗^{122}Ag^n D : β^-n has been observed by 00Kr18 but not quantified ∗∗
∗^{122}Cs D : $\beta^+\alpha$ intensity upper limit is from 75Ho09 ∗∗

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{123}Ru	−37080#	500#					19	ms	2	$3/2^+$#	15			2010	β^-=100; β^-n=20#; β^-2n=0.2#	
^{123}Rh	−49360#	400#					42	ms	4	$7/2^+$#	15			2010	β^-=100; β^-n=20#; β^-2n=0#	
^{123}Pd	−60430	790					108	ms	2	$3/2^+$#	15			1994	β^-=100; β^-n=0.4#	
^{123}Ag	−69550	30				∗	300	ms	5	$7/2^+$#	04	06Mo07	D	1976	β^-=100; β^-n=1.0 5	
^{123}Ag^m	−69530#	40#	20#	20#		∗	100#	ms		$1/2^-$#					β^- ?; IT ?	
^{123}Ag^n	−68150#	60#	1400#	50#			202	ns	20			13La11	ETD	2013	IT=100	∗
^{123}Ag^p	−68080	30	1473	2			393	ns	15	$(17/2^-)$		13La11	ET	2009	IT=100	∗
^{123}Cd	−77414.2	2.7					2.10	s	0.02	$3/2^+$	04	13Yo02	J	1983	β^-=100	
^{123}Cd^m	−77271	3	143	4	MD		1.82	s	0.03	$11/2^-$	04	13Yo02	J	1986	β^-=?; IT ?	
^{123}In	−83430	20					6.17	s	0.05	$(9/2)^+$	04			1960	β^-=100	
^{123}In^m	−83103	20	327.21	0.04			47.4	s	0.4	$(1/2)^-$	04			1960	β^-=100	
^{123}In^n	−81352	20	2078.1	0.6			1.4	μs	0.2	$(17/2^-)$		04Sc42	ETJ	2004	IT=100	∗
^{123}In^p	−81300	50	2128.1	50.0			>100	μs		$(21/2^-)$	10	10Re01	EJT	2010	IT=100	∗
^{123}Sn	−87816.2	2.4					129.2	d	0.4	$11/2^-$	04			1948	β^-=100	
^{123}Sn^m	−87791.6	2.4	24.6	0.4			40.06	m	0.01	$3/2^+$	04			1948	β^-=100	
^{123}Sn^n	−85871.2	2.6	1945.0	1.0			7.4	μs	2.6	$(19/2^+)$	04			1992	IT=100	
^{123}Sn^p	−85663.2	2.7	2153.0	1.2			6	μs		$(23/2^+)$	04			1994	IT=100	
^{123}Sn^q	−85103.2	2.8	2713.0	1.4			34	μs		$(27/2^-)$	04			1994	IT=100	
^{123}Sb	−89224.1	1.5					STABLE			$7/2^+$	04			1922	IS=42.79 5	
^{123}Sb^m	−86986.3	1.5	2237.8	0.3			214	ns	3	$19/2^-$		09Wa02	ETJ	2005	IT=100	∗
^{123}Sb^n	−86610.7	1.6	2613.4	0.4			65	μs	1	$23/2^+$		09Wa02	ETJ	2007	IT=100	∗
^{123}Te	−89172.2	1.5					STABLE		(>2 Py)	$1/2^+$	04	03Al02	T	1932	IS=0.89 3; ε=100	
^{123}Te^m	−88924.7	1.5	247.47	0.04			119.2	d	0.1	$11/2^-$	04			1951	IT=100	
^{123}I	−87944	4					13.2235	h	0.0019	$5/2^+$	04			1949	β^+=100	
^{123}Xe	−85249	10					2.08	h	0.02	$1/2^+$	04	90Ne.A	J	1952	β^+=100	
^{123}Xe^m	−85064	10	185.18	0.11			5.49	μs	0.26	$7/2^{(-)}$	04			1981	IT=100	
^{123}Cs	−81044	12					5.88	m	0.03	$1/2^+$	04			1954	β^+=100	
^{123}Cs^m	−80888	12	156.27	0.05			1.64	s	0.12	$(11/2)^-$	04			1972	IT=100	
^{123}Cs^n	−80792	23	252	20			114	ns	5	$(9/2^+)$	04	GAu127	E	2000	IT=100	∗
^{123}Cs^x	−81037	13	7	4			$R<0.1$			spmix						
^{123}Ba	−75655	12					2.7	m	0.4	$5/2^{(+)}$	04			1962	β^+=100	
^{123}Ba^m	−75534	12	120.95	0.08			830	ns	60	$1/2^+$#	04			1991	IT=100	
^{123}La	−68650#	200#					17	s	3	$11/2^-$#	04			1978	β^+=100	
^{123}Ce	−60290#	300#					3.8	s	0.2	$(5/2)^{(+\#)}$	04			1984	β^+=100; β^+p=?	
^{123}Pr	−50230#	400#					800#	ms		$3/2^+$#					β^+ ?; β^+p ?	

∗^{123}Ag^n E : 13La11=1365keV above ^{123}Ag^m ∗∗
∗^{123}Ag^p T : average 13La11=393(16) 09St28=396(37) J : 09St28=(17/2$^-$) ∗∗
∗^{123}In^n E : derived by NUBASE from least-squares fit to γ-ray energies ∗∗
∗^{123}In^p E : no direct depopulating γ seen, assumed less than 50 keV ∗∗
∗^{123}Sb^m E : derived from least-squares fit to γ-ray energies ∗∗
∗^{123}Sb^m ETJ : also 07Ju06 2239.1(1.0) keV, 190(30) ns, 19/2$^-$; and ∗∗
∗^{123}Sb^m ETJ : 05Po03 2247.1(0.4) keV, 110(10) ns (conflicting), (19/2$^-$) ∗∗
∗^{123}Sb^n E : derived from least-squares fit to γ-ray energies ∗∗
∗^{123}Sb^n ETJ : also 07Ju06 2614.1(1.0) keV, 66(4) μs, 23/2$^+$; and ∗∗
∗^{123}Sb^n ETJ : 08Jo03 2614.2(0.6) keV, 52(3) μs (conflicting), 23/2$^+$ ∗∗
∗^{123}Cs^n E : 231.63 + x; x estimared 20#20 ∗∗

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{124}Ru	−33960#	600#					15	ms	3	0^+	15			2010	β^-=100; β^-n=10#; β^-2n=0#	
^{124}Rh	−44890#	400#					30	ms	2		15			2010	β^-=100; β^-n=20#; β^-2n=0.3#	
^{124}Pd	−58390#	300#					88	ms	15	0^+	14	15Lo04	T	1997	β^-=100; β^-n=0.03#	
^{124}Pd^m	−58330#	300#	62.2	1.6			>20	μs			14	12Ka36	ET	2012	IT=100; β^- ?	
^{124}Ag	−66200	250				∗	177.9	ms	2.6	(2^-)	15	14Ba18	J	1984	β^-=100; β^-n=1.3 9	∗
^{124}Ag^m	−66200#	270#	0#	100#		∗	144	ms	20	(8^-)	15	14Ba18	TJ	1995	β^-=100; β^-n=1#	
^{124}Ag^n	−65970	250	231.1	0.7			1.7	μs	0.3		15	12Ka36	E	2012	IT=100	∗
^{124}Cd	−76701.7	3.0					1.25	s	0.02	0^+	08			1974	β^-=100	
^{124}In	−80870	30				∗	3.12	s	0.09	3^+	08	13Ma15	J	1964	β^-=100	
^{124}In^m	−80890	50	−20	60	BD	∗	3.7	s	0.2	$(8)^{(-\#)}$	08			1974	$\beta^-\approx$100; IT ?	

... *A*-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

. . . A-group continued . . .

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{124}Sn	−88234.2	1.0					STABLE		(>100 Py)	0^+	08	52Ka41	T	1922	IS=5.79 5; 2β^- ?	
^{124}Sn^m	−86029.6	1.0	2204.620	0.023			270	ns	60	5^-	08	FGK127	J	1979	IT=100	*
^{124}Sn^n	−85909.2	1.0	2325.01	0.04			3.1	μs	0.5	7^-	08	FGK127	J	1979	IT=100	
^{124}Sn^p	−85577.6	1.1	2656.6	0.5			45	μs	5	10^+	08	FGK127	J	1992	IT=100	
^{124}Sn^q	−83682.8	1.2	4551.4	0.7			260	ns	25	15^-		12As05	EJT	2012	IT=100	
^{124}Sb	−87620.2	1.5					60.20	d	0.03	3^-	08			1939	β^-=100	
^{124}Sb^m	−87609.3	1.5	10.8627	0.0008			93	s	5	5^+	08			1947	IT=75 5; β^-=25 5	
^{124}Sb^n	−87583.4	1.5	36.8440	0.0014			20.2	m	0.2	$(8)^-$	08			1947	IT=100	
^{124}Sb^p	−87579.4	1.5	40.8038	0.0007			3.2	μs	0.3	$(3^+,4^+)$	08			1989	IT=100	
^{124}Te	−90525.3	1.5					STABLE			0^+	08			1932	IS=4.74 14	
^{124}I	−87365.7	2.4					4.1760	d	0.0003	2^-	08			1938	β^+=100	
^{124}Xe	−87661.4	1.8					STABLE		(>200 Ty)	0^+	08			1922	IS=0.0952 3; 2β^+ ?	*
^{124}Cs	−81731	8					30.9	s	0.4	1^+	08			1969	β^+=100	
^{124}Cs^m	−81268	8	462.63	0.14			6.3	s	0.2	$(7)^+$	08			1983	IT=100	
^{124}Cs^x	−81701	22	30	20			$R=?$			spmix						
^{124}Ba	−79090	12					11.0	m	0.5	0^+	08			1967	β^+=100	
^{124}La	−70260	60				* &	29.21	s	0.17	$(7^-,8^-)$	08	92Id01	J	1978	β^+=100	
^{124}La^m	−70160#	120#	100#	100#		* &	21	s	4	low$^{(+\#)}$	08	92Id01	J	1992	β^+=100	
^{124}Ce	−64920#	300#					9.1	s	1.2	0^+	08	97As05	T	1978	β^+=100	*
^{124}Pr	−53150#	400#					1.2	s	0.2		08			1986	β^+=100; β^+p=?	
^{124}Nd	−44530#	500#					500#	ms		0^+					β^+ ?; β^+p ?	

*^{124}Ag T : average 15Lo04=180(3) 95Fe12=172(5); other 14Ba18=191(28) **
*^{124}Ag^n E : 12Ka36=75.5(0.5) and 155.6(0.5) γ rays in cascade to ground-state **
*^{124}Sn^m J : E1 to 4^+; L(p,p)=5 for ^{124}Sn^m; E2 to 5^- for ^{124}Sn^n; E2 to 8^+ for ^{124}Sn^p **
*^{124}Xe T : 2ν-$\varepsilon\varepsilon$: 16Ab03>4.7 Zy (at 90% C.L.) **
*^{124}Ce T : average 97As05=10.8(1.5) 78Bo32=6(2) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{125}Rh	−42000#	500#					26.5	ms	2.0	$7/2^+$#	15			2010	β^-=100; β^-n=20#; β^-2n=0.03#	
^{125}Pd	−54120#	400#					57	ms	10	$3/2^+$#	15			2008	β^-=100 ?; β^-n=6#	
^{125}Ag	−64520	430				*	159	ms	8	$7/2^+$#	15			1994	β^-=100; β^-n=5#	
^{125}Ag^m	−64500#	430#	20#	20#		*	50#	ms		$1/2^-$#					β^- ?; IT ?	
^{125}Ag^n	−63640#	430#	880#	20#			80	ns	17		15	13La11	ET	2013	IT=100	*
^{125}Ag^p	−63020	430	1501.2	0.6			491	ns	20	$(17/2^-)$	15			2009	IT=100	
^{125}Cd	−73348.1	2.9					680	ms	40	$3/2^+$	11	13Yo02	J	1986	β^-=100	
^{125}Cd^m	−73162	3	186	4	MD		480	ms	30	$11/2^-$	11	13Yo02	J	1986	β^-=100	
^{125}Cd^n	−71840	70	1512	70			19	μs	3	$(19/2^+)$		11Si32	EJT	2011	IT=100	*
^{125}In	−80477	27					2.36	s	0.04	$9/2^+$	11			1967	β^-=100	
^{125}In^m	−80117	27	360.12	0.09			12.2	s	0.2	$1/2^{(-)}$	11			1974	β^-=100	
^{125}In^n	−78468	27	2009.4	0.7			9.4	μs	0.6	$(19/2^+)$	11			1998	IT=100	
^{125}In^p	−78316	27	2161.2	0.9			5.0	ms	1.5	$(23/2^-)$	11			1998	IT=100	
^{125}Sn	−85896.4	1.0					9.64	d	0.03	$11/2^-$	11			1939	β^-=100	
^{125}Sn^m	−85868.9	1.0	27.50	0.14			9.52	m	0.05	$3/2^+$	11			1939	β^-=100	
^{125}Sn^n	−84003.6	1.0	1892.8	0.3			6.2	μs	0.2	$19/2^+$	11	08Lo07	J	2000	IT=100	
^{125}Sn^p	−83836.9	1.1	2059.5	0.4			650	ns	60	$23/2^+$	11	16Is03	T	2008	IT=100	*
^{125}Sn^q	−83272.9	1.1	2623.5	0.5			230	ns	17	$(27/2^-)$	11	08Lo07	T	2000	IT=100	
^{125}Sb	−88256.3	2.6					2.7586	y	0.0003	$7/2^+$	11			1951	β^-=100	*
^{125}Sb^m	−86285.1	2.6	1971.25	0.20			4.1	μs	0.2	$15/2^-$	11			2007	IT=100	
^{125}Sb^n	−86144.2	2.6	2112.1	0.3			28.0	μs	0.7	$19/2^-$	11	FGK128	J	2007	IT=100	*
^{125}Sb^q	−85785.3	2.6	2471.0	0.4			272	ns	16	$(23/2)^+$	11			2007	IT=100	
^{125}Te	−89023.0	1.5					STABLE			$1/2^+$	11			1931	IS=7.07 15	
^{125}Te^m	−88878.2	1.5	144.775	0.008			57.40	d	0.15	$11/2^-$	11			1949	IT=100	
^{125}I	−88837.2	1.5					59.407	d	0.010	$5/2^+$	11			1947	ε=100	
^{125}Xe	−87193.4	1.8					16.9	h	0.2	$1/2^{(+)}$	11			1950	β^+=100	
^{125}Xe^m	−86940.8	1.8	252.61	0.14			56.9	s	0.9	$9/2^{(-)}$	11			1954	IT=100	
^{125}Xe^n	−86897.5	1.8	295.89	0.15			140	ns	30	$7/2^{(+)}$	11			1979	IT=100	
^{125}Cs	−84088	8					46.7	m	0.1	$1/2^{(+)}$	11			1954	β^+=100	
^{125}Cs^m	−83822	8	266.1	1.1			900	μs	30	$(11/2^-)$	11	98Su16	J	1998	IT=100	
^{125}Ba	−79669	11					3.3	m	0.3	$1/2^{(+\#)}$	11			1968	β^+=100	
^{125}Ba^m	−79559	23	110	20			2.76	μs	0.14	$(7/2^-)$	11	FGK128	J	1989	IT=100	*
^{125}La	−73759	26					64.8	s	1.2	$11/2^-$#	11			1973	β^+=100	
^{125}La^m	−73652	26	107.00	0.10			390	ms	40	$(3/2^+)$	11	99Ca21	J	1998	IT=100	*
^{125}Ce	−66660#	200#					9.7	s	0.3	$(7/2^-)$	11	02Pe15	J	1978	β^+=100; β^+p=?	
^{125}Ce^m	−66570#	200#	93.6	0.4			13	s	10	$(1/2^+)$	11	07Su07	ETJ	2007	IT=100	*

. . . A-group is continued on next page . . .

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{125}Pr	−57940#	300#					3.3	s	0.7	$3/2^+$#	11			2002	β^+=100; β^+p ?	
^{125}Nd	−47600#	400#					650	ms	150	$(5/2)^{(+\#)}$	11			1999	β^+=100; β^+p>0	
*^{125}Ag^n	E : 13La11: 859.9keV above ^{125}Ag^m															**
*^{125}Cd^n	E : 11Si32=1461.8(0.5) keV above the $11/2^-$ isomer															**
*^{125}Sn^p	J : E2 to $19/2^+$ for ^{125}Sn^p; E2 to $23/2^-$ for ^{125}Sn^q															**
*^{125}Sb	T : rounded from ENSDF2011=2.75856(0.00025); other 16Li01=2.75817(0.00082)															**
*^{125}Sb^n	J : E2 to $15/2^-$ T : others recent 10Re01=25(4) 07Ju06=25(4)															**
*^{125}Ba^m	E : 67.7(0.4) above $5/2^+$# level at estimated 30#20 J : E1 to $5/2^+$															**
*^{125}La^m	J : $3/2^+$# from trends in La isotopes; low spin and even-parity from 99Ca21															**
*^{125}Ce^m	T : symmetrized from 134(+641–61) s for fully ionized ion; icc=38.1 for a															**
*^{125}Ce^m	T : 93.6(0.4) keV, E3 transition; ENSDF quotes 3.4(2.7) s															**
^{126}Rh	−37300#	500#					19	ms	3		15			2010	β^-=100; β^-n=30#; β^-2n=0.2#	
^{126}Pd	−51860#	400#					48.6	ms	1.2	0^+	15			2008	β^-=100; β^-n=0.4#	
^{126}Pd^m	−49840#	400#	2023.5	0.7			330	ns	40	(5^-)	15			2013	IT=100	
^{126}Pd^n	−49750#	400#	2109.7	0.9			440	ns	30	(7^-)	15			2013	IT=100	
^{126}Pd^p	−49450#	400#	2406.0	1.0			23.0	ns	0.9	(10^+)	15			2014	IT=?; B ?	
^{126}Ag	−60680#	200#					99.3	ms	4.6	2^+#	15	15Lo04	T	1994	β^-=100; β^-n=6#	*
^{126}Ag^m	−60580#	220#	100#	100#			92	ms	9	8^-#	15			1995	β^-=100; IT ?; β^-n=6#	
^{126}Ag^n	−60430#	200#	254.8	0.5			27	μs	6	1^-#	15			2012	IT=100	
^{126}Cd	−72256.8	2.5					513	ms	6	0^+	03	15Lo04	T	1978	β^-=100	
^{126}In	−77773	27				*	1.53	s	0.01	$3^{(+\#)}$	03			1974	β^-=100	
^{126}In^m	−77710	50	70	60	BD	*	1.64	s	0.05	$8^{(-\#)}$	03	79Fo10	J	1970	β^-=100	
^{126}In^n	−77530	27	243.3	0.2			22	μs	2	$1^{(-)}$		04Sc42	ETJ	2003	IT=100	
^{126}Sn	−86015	10					230	ky	14	0^+	03			1962	β^-=100	
^{126}Sn^m	−83796	10	2218.99	0.08			5.8	μs	0.7	7^-	03	12As05	T	1979	IT=100	*
^{126}Sn^n	−83451	10	2564.5	0.5			7.6	μs	0.3	10^+	03	12As05	TJ	2000	IT=100	*
^{126}Sn^p	−81669	10	4345.7	0.8			160	ns	20	15^-		12As05	EJT	2012	IT=100	
^{126}Sb	−86390	30					12.35	d	0.06	(8^-)	03			1956	β^-=100	
^{126}Sb^m	−86370	30	17.7	0.3			19.15	m	0.08	(5^+)	03			1956	β^-=86 4; IT=14 4	
^{126}Sb^n	−86350	30	40.4	0.3			11	s		(3^-)	03			1976	IT=100	
^{126}Sb^p	−86290	30	104.6	0.3			553	ns	5	(3^+)	03			1976	IT=100	
^{126}Te	−90065.3	1.5					STABLE			0^+	03			1924	IS=18.84 25	
^{126}I	−87911	4					12.93	d	0.05	2^-	03			1938	β^+=52.7 5; β^-=47.3 5	
^{126}I^m	−87800	4	111.00	0.23			128	ns		3^+		12Mo.A	EJT	2012	IT=100	
^{126}Xe	−89147	3					STABLE			0^+	03			1922	IS=0.0890 2; 2β^+ ?	
^{126}Cs	−84351	10					1.64	m	0.02	1^+	03			1954	β^+=100	
^{126}Cs^m	−84078	10	273.0	0.7			> 1	μs			03			1993	IT=100	
^{126}Cs^n	−83755	10	596.1	1.1			171	μs	14		03			1993	IT=100	
^{126}Ba	−82670	12					100	m	2	0^+	03			1954	β^+=100	
^{126}La	−74970	90				*	54	s	2	$(5)^{(+\#)}$	03			1961	β^+=100	
^{126}La^m	−74760	400	210	410	BD	*	20	s	20	$(0^-,1^-,2^-)$	03			1997	β^+=100	*
^{126}Ce	−70821	28					51.0	s	0.3	0^+	03			1978	β^+=100	
^{126}Pr	−60320#	200#					3.12	s	0.18	$(4,5,6)$	03	88Ba42	T	1983	β^+=100; β^+p=?	*
^{126}Nd	−52990#	300#					1#	s	(>200 ns)	0^+	03	00So11	I	2000	β^+ ?; β^+p ?	
^{126}Pm	−39350#	500#					500#	ms							β^+ ?; β^+p ?	
*^{126}Ag	T : average 15Lo04=98(5) 95Fe12=107(12); other 14Ba18=52(10) at variance															**
*^{126}Sn^m	T : average 12As05=6.6(1.4) 10Tl01=5.6(0.8)															**
*^{126}Sn^n	T : average 12As05=7.7(0.5) 10Tl01=7.5(0.3)															**
*^{126}La^m	T : 97As05: "by far shorter than 50 s"															**
*^{126}Pr	T : average 95Os03=3.14(0.22) 88Ba42=3.0(0.4) 83Ni05=3.2(0.6)															**
^{127}Rh	−34030#	600#					28	ms	14	$7/2^+$#	15	15Lo04	TD	2015	β^-=100; β^-n=30#; β^-2n=0.2#	*
^{127}Pd	−47180#	500#					38	ms	2	$3/2^+$#	15			2010	β^-=100; β^-n=10#; β^-2n=0#	
^{127}Ag	−58440#	200#					89	ms	2	$7/2^+$#	11	15Lo04	T	1995	β^-=100; β^-n=7#	*
^{127}Ag^m	−58420#	200#	20#	20#		*	20#	ms		$1/2^-$#					β^- ?; IT ?	
^{127}Cd	−68747	12					330	ms	20	$3/2^+$	11	13Yo02	J	1986	β^-=100; β^-n=0.03#	*
^{127}Cd^m	−68472	8	276	15	MD		200#	ms		$11/2^-$		13Yo02	J		β^- ?; IT ?	
^{127}Cd^n	−66930	30	1813	32			17.5	μs	0.3	$(19/2^+)$		10Na17	ETJ	2010	IT=100	*
^{127}In	−76896	21					1.09	s	0.01	$(9/2^+)$	11			1975	β^-=100; β^-n<0.03	
^{127}In^m	−76487	21	408.9	0.3			3.67	s	0.04	$1/2^-$#	11			1974	β^-=100; β^-n=0.69 4	
^{127}In^n	−75030	60	1870	60	BD		1.04	s	0.10	$(21/2^-)$	11			2004	β^-=100; β^-n=1#	
^{127}In^p	−74531	21	2364.7	0.9			9	μs	2	$(29/2^+)$	11	04Sc42	ETJ	2004	IT=100	*

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Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{127}Sn	−83471	10					2.10	h	0.04	$11/2^-$	11			1951	β^-=100	
^{127}Sn^m	−83466	10	5.07	0.06			4.13	m	0.03	$3/2^+$	11			1962	β^-=100	
^{127}Sn^n	−81644	10	1826.67	0.16			4.52	μs	0.15	$19/2^+$	11	08Lo07	J	2000	IT=100	
^{127}Sn^p	−81540	10	1930.97	0.17			1.26	μs	0.15	$(23/2^+)$	11			2004	IT=100	
^{127}Sn^q	−80919	10	2552.4	1.0			250	ns	30	$(27/2^-)$	11	08Lo07	J	2008	IT=100	
^{127}Sb	−86699	5					3.85	d	0.05	$7/2^+$	11			1939	β^-=100	
^{127}Sb^m	−84779	5	1920.19	0.21			11	μs	1	$15/2^-$	11	09Wa24	J	1974	IT=100	
^{127}Sb^n	−84374	5	2324.7	0.4			234	ns	12	$23/2^+$	11	09Wa24	TJ	2005	IT=100	*
^{127}Te	−88281.7	1.5					9.35	h	0.07	$3/2^+$	11			1938	β^-=100	
^{127}Te^m	−88193.5	1.5	88.23	0.07			106.1	d	0.7	$11/2^-$	11			1940	IT=97.6 2; β^-=2.4 2	
^{127}I	−88984	4					STABLE			$5/2^+$	11			1920	IS=100.	
^{127}Xe	−88322	4					36.346	d	0.003	$1/2^+$	11			1950	ε=100	
^{127}Xe^m	−88025	4	297.10	0.08			69.2	s	0.9	$9/2^-$	11			1940	IT=100	
^{127}Cs	−86240	6					6.25	h	0.10	$1/2^+$	11			1950	β^+=100	
^{127}Cs^m	−85788	6	452.23	0.21			55	μs	3	$(11/2)^-$	11			1980	IT=100	
^{127}Ba	−82818	11					12.7	m	0.4	$1/2^+$	11			1952	β^+=100	
^{127}Ba^m	−82738	11	80.32	0.11			1.93	s	0.07	$7/2^-$	11			1992	IT=100	
^{127}La	−77896	26					5.1	m	0.1	$(11/2^-)$	11			1963	β^+=100	
^{127}La^m	−77882	26	14.2	0.4			3.7	m	0.4	$(3/2^+)$	11			1963	$\beta^+\approx$100	
^{127}Ce	−71979	29					34	s	2	$(1/2^+)$	11			1978	β^+=100	
^{127}Ce^m	−71972	29	7.3	1.1			28.6	s	0.7	$5/2^+$#	11			1978	β^+=100	
^{127}Ce^n	−71942	29	36.8	1.2			> 10	μs		$(7/2^-)$	11			1995	IT=100	
^{127}Pr	−64540#	200#					4.2	s	0.3	$3/2^+$#	11			1995	β^+=100	
^{127}Pr^m	−63940#	280#	600#	200#			50#	ms		$11/2^-$	11	98Mo30	J	1998	β^+ ?; IT ?	
^{127}Nd	−55540#	300#					1.8	s	0.4	$5/2^+$#	11			1983	β^+=100; β^+p=?	
^{127}Pm	−44790#	400#					1#	s		$5/2^+$#					β^+ ?; p ?	

*^{127}Rh T : symmetrized from 15Lo04=20(+20–7) **
*^{127}Ag T : other 96Wo.A=79(3) supersedes 95Fe12=109(25) from same group **
*^{127}Cd T : from 15Lo04=330(20) **
*^{127}Cd^n E : 1560.1(0.5) keV above ^{127}Cd^m T : other 12Ka36=11.0(+9.2–3.5) **
*^{127}In^p E : derived by NUBASE from least-squares fit to γ-ray energies **
*^{127}Sb^n T : also 05Po03=165(20) conflicting, not used **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{128}Pd	−44490#	500#					35	ms	3	0^+	16			2010	β^-=100; β^-n=20#	
^{128}Pd^m	−42340#	500#	2151.0	1.0			5.8	μs	0.8	(8^+)	16			2013	IT=100	
^{128}Ag	−54620#	300#					59	ms	5		15	15Lo04	T	2000	β^-=100; β^-n=8#; β^-2n=0.01#	
^{128}Cd	−67242	7					246	ms	2	0^+	15	16Du13	T	1986	β^-=100; β^-n=0.7#	*
^{128}Cd^m	−65372	7	1870.5	0.3			270	ns	7	(5^-)	15			2009	IT=100	
^{128}Cd^n	−64527	7	2714.6	0.4			3.56	μs	0.06	(10^+)	15			2009	IT=100	
^{128}Cd^p	−62955	7	4286.6	1.5			6.3	ms	0.8	(15^-)		16Ju.A	ETJ	2016	IT=100	
^{128}In	−74150	150					816	ms	27	$(3)^+$	15	93Ru01	D	1975	β^-=100; β^-n=0.038 3	*
^{128}In^m	−74060	30	80	160	BD		720	ms	100	(8^-)	15			1986	β^-=100	
^{128}In^n	−73900	150	247.87	0.10			23	μs	2	$(1)^-$	15	04Sc42	J	1988	IT=100	
^{128}Sn	−83362	18					59.07	m	0.14	0^+	15			1956	β^-=100	
^{128}Sn^m	−81271	18	2091.50	0.11			6.5	s	0.5	(7^-)	15			1979	IT=100	
^{128}Sn^n	−80870	18	2491.91	0.17			2.91	μs	0.14	(10^+)	15			1981	IT=100	
^{128}Sn^p	−79263	18	4099.5	0.4			220	ns	30	(15^-)	15			2011	IT=100	
^{128}Sb	−84630	19				*	9.05	h	0.04	8^-	15			1956	β^-=100	
^{128}Sb^m	−84620	18	10	7		*	10.41	m	0.18	5^+	15			1955	β^-=96.4 10; IT=3.6 10	*
^{128}Te	−88993.7	0.9					2.0	Yy	0.3	0^+	15	15Ba11	T	1924	IS=31.74 8; 2β^-=100	
^{128}Te^m	−86202.9	0.9	2790.8	0.3			363	ns	27	(10^+)	15	04Va03	T	1998	IT=100	*
^{128}I	−87739	4					24.99	m	0.02	1^+	15			1934	β^-=93.1 8; β^+=6.9 8	
^{128}I^m	−87601	4	137.851	0.003			845	ns	20	4^-	15			1982	IT=100	
^{128}I^n	−87572	4	167.368	0.004			175	ns	15	$(6)^-$	15			1991	IT=100	
^{128}Xe	−89860.3	1.1					STABLE			0^+	15			1922	IS=1.9102 8	
^{128}Xe^m	−87073.1	1.1	2787.2	0.3			83	ns	2	8^-	15			1981	IT=100	
^{128}Cs	−85932	5					3.640	m	0.014	1^+	15	93Al03	T	1951	β^+=100	*
^{128}Ba	−85378	5					2.43	d	0.05	0^+	15			1950	ε=100	
^{128}La	−78630	50				*	5.18	m	0.14	(5^+)	15	97Ha30	T	1961	β^+=100	*
^{128}La^m	−78530#	110#	100#	100#		*	< 1.4	m		$(1^+,2^-)$	15			1995	β^+=100	
^{128}Ce	−75534	28					3.93	m	0.02	0^+	15	00Li08	T	1968	β^+=100	*
^{128}Pr	−66331	30					2.85	s	0.09	(3^+)	15	99Xi03	J	1985	β^+=100; β^+p=?	*
^{128}Nd	−60310#	200#					5#	s		0^+	15			1985	β^+ ?	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

… *A*-group continued …

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{128}Pm	−47790#	300#					1.0	s	0.3	$(5,6,7)^{(+\#)}$	15	93Li40	D	1999	$\beta^+\approx$100; β^+p ?; p=0	*
^{128}Sm	−38670#	500#					500#	ms		0^+					β^+ ?; β^+p ?	

*^{128}Cd T : average 16Du13=246.2(2.1) 15Lo04t=245(5) **
*^{128}In T : average 15Lo04=810(30) 86Go10=840(60) **
*^{128}Sb^m E : less than 20 keV above ground state, see ENSDF **
*^{128}Te^m T : average 04Va03=337(59) 98Zh09=370(30) **
*^{128}Cs T : average 93Al03=3.66(0.02) 76He04=3.62(0.02) **
*^{128}La T : average 97Ha30=5.4(0.2) 77Zo02=5.2(0.4) 66Pa06=4.9(0.4) 66Li04=4.9(0.4) **
*^{128}Ce T : average 00Li08=4.0(0.1) 97Ha30=4.1(0.3) 97As05=3.925(0.021) **
*^{128}Pr T : average 99Xi03=2.8(0.1) 88Ba42=3.1(0.3) 85Wi07=3.2(+0.5–0.4) **
*^{128}Pr D : from 85Wi07 **
*^{128}Nd T : 83Ni05 gave 4(2) s. Proved, in 85Wi07, to be due to ^{128}Pr, not to ^{128}Nd **
*^{128}Pm D : p=0% from 93Li40 J : from 02Xu11 and calculated 6^+ **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{129}Pd	−37610#	600#					31	ms	7	$7/2^-$#	15			2015	β^-=100; β^-n=90#; β^-2n=2#	
^{129}Ag	−51980#	400#				*	49.9	ms	3.5	$7/2^+$#	14	15Lo04	T	2000	β^-=100; β^-n=10#	*
^{129}Ag^m	−51960#	400#	20#	20#		*	10#	ms		$1/2^-$#	14				β^- ?; β^-n=10#	*
^{129}Cd	−63058	17				* &	151.5	ms	5.7	$3/2^+$	14	16Du13	T	1986	β^-=100; β^-n=0.1#	*
^{129}Cd^m	−62910#	150#	150#	150#		* &	147	ms	3	$11/2^-$	14	16Du13	T	2003	β^-=100; β^-n=0.1#	*
^{129}Cd^n	−60970#	150#	2090#	150#			3.6	ms	0.2	$(21/2^+)$	14	14Ta29	TJ	2014	IT=100	*
^{129}In	−72837.7	2.7					570	ms	10	$(9/2^+)$	14	15Lo04	T	1975	β^-=100; β^-n=0.23 7	*
^{129}In^m	−72380	3	458	4	MD		1.23	s	0.03	$(1/2^-)$	14	04Ga24	J	1976	$\beta^-\approx$100; IT<0.3; β^-n=3.6 4	
^{129}In^n	−71149.7	2.7	1687.97	0.25			11.2	μs	0.2	$(17/2^-)$	14	14Ta.A	T	2003	IT=100	
^{129}In^p	−71180	50	1660	50	BD		670	ms	100	$(23/2^-)$	14	04Ga24	ETJ	2004	$\beta^-\approx$100; IT ?	
^{129}In^q	−70920	50	1921	50			110	ms	15	$(29/2^+)$	14			2004	IT$\approx$100; β^- ?	*
^{129}Sn	−80591	17					2.23	m	0.04	$3/2^+$	14			1962	β^-=100	
^{129}Sn^m	−80556	17	35.15	0.05			6.9	m	0.1	$11/2^-$	14			1962	$\beta^-\approx$100; IT<0.002	
^{129}Sn^n	−78829	17	1761.6	1.0			3.49	μs	0.11	$(19/2^+)$	14	08Lo07	T	2000	IT=100	*
^{129}Sn^p	−78788	17	1802.6	1.0			2.22	μs	0.13	$23/2^+$	14	08Lo07	TJ	2000	IT=100	*
^{129}Sn^q	−78038	17	2552.9	1.1			221	ns	18	$(27/2^-)$	14	08Lo07	J	2008	IT=100	
^{129}Sb	−84629	21					4.366	h	0.026	$7/2^+$	14			1939	β^-=100	
^{129}Sb^m	−82778	21	1851.31	0.06			17.7	m	0.1	$(19/2^-)$	14			1982	β^-=85; IT=15	
^{129}Sb^n	−82768	21	1861.06	0.05			2.2	μs	0.2	$(15/2^-)$	14			1987	IT=100	
^{129}Sb^p	−82490	21	2139.4	0.3			1.1	μs	0.1	$(23/2^+)$	14			2003	IT=100	
^{129}Te	−87004.8	0.9					69.6	m	0.3	$3/2^+$	14			1939	β^-=100	
^{129}Te^m	−86899.3	0.9	105.51	0.03			33.6	d	0.1	$11/2^-$	14			1940	IT=64 7; β^-=36 7	
^{129}I	−88507	3					15.7	My	0.4	$7/2^+$	14			1951	β^-=100	
^{129}Xe	−88696.059	0.005					STABLE			$1/2^+$	14			1920	IS=26.4006 82	
^{129}Xe^m	−88459.92	0.03	236.14	0.03			8.88	d	0.02	$11/2^-$	14			1951	IT=100	
^{129}Cs	−87499	5					32.06	h	0.06	$1/2^+$	14			1950	β^+=100	
^{129}Cs^m	−86924	5	575.40	0.14			718	ns	21	$(11/2^-)$	14			1977	IT=100	
^{129}Ba	−85063	11					2.23	h	0.11	$1/2^+$	14			1950	β^+=100	
^{129}Ba^m	−85055	11	8.42	0.06			2.135	h	0.010	$7/2^+$	14			1950	$\beta^+\approx$100; IT=?	
^{129}La	−81325	21					11.6	m	0.2	$(3/2^+)$	14			1963	β^+=100	
^{129}La^m	−81153	21	172.33	0.20			560	ms	50	$(11/2^-)$	14			1969	IT=100	
^{129}Ce	−76287	28					3.5	m	0.3	$(5/2^+)$	14			1977	β^+=100	
^{129}Pr	−69774	30					30	s	4	$(3/2^+)$	14	96Gi08	J	1977	β^+=100	
^{129}Pr^m	−69390	30	382.57	0.24			1#	ms		$(11/2^-)$	14			1997	IT=100	
^{129}Nd	−62320#	200#					6.8	s	0.6	$5/2^+$#	14	10Xu12	T	1977	β^+=100; β^+p=?	*
^{129}Nd^m	−62270#	220#	50#	100#			2.6	s	0.4	$1/2^+$#	14			2010	β^+=100; β^+p=?	
^{129}Pm	−52880#	300#					2.4	s	0.9	$(5/2^-)$	14			2004	β^+=100; β^+p ?; p ?	
^{129}Sm	−42000#	500#					550	ms	100	$(3/2^+,1/2^+)$	14			1999	β^+=100; β^+p=?	

*^{129}Ag T : average 15Lo04=52(4) 00Kr18=46(+5–9) **
*^{129}Ag D : β^-n has been observed by 00Kr18 but not quantified **
*^{129}Ag^m T : 00Kr18≈160 ms is not convincing **
*^{129}Cd D : β^-n has been observed by 05Kr20 but not quantified **
*^{129}Cd T : average 16Du13=157(8) 15Ta13=146(8) **
*^{129}Cd T : other 15Lo04=154.5(2.0) for mixture of two states **
*^{129}Cd^m T : other 15Ta13=151(15) ms **
*^{129}Cd^m D : β^-n has been observed by 05Kr20 but not quantified **
*^{129}Cd^n E : 1940 keV above the $11/2^-$ isomer **
*^{129}In J : from 04Ga24 **
*^{129}In^q E : 281.0 (0.2) keV γ above the $23/2^-$ isomer **
*^{129}Sn^n T : average 08Lo07=3.4(0.4) 04Ga24=3.2(0.2) 00Pi03=3.7(0.2) 00Ge07=3.6(0.2) **
*^{129}Sn^p T : average 08Lo07=2.4(4) 04Ga24=2.0(2) 00Ge07=2.4(2) **
*^{129}Nd T : average 10Xu12=6.7(0.7) 97Gi07=7(1); 85Wi07=4.9(0.2) is for gs+m mixture **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{130}Ag	−45700#	500#					40.6	ms	4.5		15	15Lo04	T	2000	β^-=100; β^-n=90#; β^-2n=2#	*
^{130}Cd	−61118	22					126.8	ms	1.8	0^+	08	16Du13	T	1986	β^-=100; β^-n=3.5 10	*
^{130}Cd^m	−58988	22	2129.6	1.0			240	ns	16	(8^+)	08	12Ka36	ET	2007	IT=100	*
^{130}In	−69880	40				*	284	ms	10	$1^{(-)}$	08	15Lo04	T	1973	β^-=100; β^-n=0.93 13	
^{130}In^m	−69830	40	50	50	BD	*	540	ms	10	8^-#	08			1973	β^-=100; β^-n=1.65 15	
^{130}In^n	−69480	50	400	60	BD		540	ms	10	(5^+)	08			1986	β^-=100; β^-n=1.65 15	
^{130}In^p	−69490	40	388.3	0.2			5.3	μs	0.4	(3^+)	08	12Ka36	T	2003	IT=100	*
^{130}Sn	−80132.2	1.9					3.72	m	0.07	0^+	01			1972	β^-=100	
^{130}Sn^m	−78185.3	1.9	1946.88	0.10			1.7	m	0.1	7^-	01	05Le34	J	1974	β^-=100	
^{130}Sn^n	−77697.4	1.9	2434.79	0.12			1.501	μs	0.017	(10^+)	01	11Pi05	T	1981	IT=100	
^{130}Sb	−82286	14					39.5	m	0.8	(8^-)	01	02Ge07	J	1962	β^-=100	
^{130}Sb^m	−82281	14	4.80	0.20			6.3	m	0.2	$(4,5)^+$	01			1962	β^-=100	
^{130}Sb^n	−82201	14	84.67	0.04			800	ns	100	6^-	01	02Ge07	TJ	2002	IT=100	
^{130}Sb^p	−80741	14	1544.7	0.5			1.8	μs	0.2	(13^+)		02Ge07	ETJ	2002	IT=100	
^{130}Te	−87352.949	0.011					690	Ey	130	0^+	01	15Ba11	T	1924	IS=34.08 62; 2β^-=100	*
^{130}Te^m	−85206.54	0.04	2146.41	0.04			186	ns	11	7^-	01	04Va03	T	1972	IT=100	*
^{130}Te^n	−84685.7	0.8	2667.2	0.8			1.90	μs	0.08	(10^+)	01	04Br19	E	1998	IT=100	*
^{130}Te^p	−82977.5	1.8	4375.4	1.8			261	ns	33		01			1998	IT=100	
^{130}I	−86936	3					12.36	h	0.01	5^+	01			1938	β^-=100	
^{130}I^m	−86896	3	39.9525	0.0013			8.84	m	0.06	2^+	01			1966	IT=84 2; β^-=16 2	
^{130}I^n	−86866	3	69.5865	0.0007			133	ns	7	$(6)^-$	01			1989	IT=100	
^{130}I^p	−86854	3	82.3960	0.0019			315	ns	15	$(8)^-$	01			1989	IT=100	
^{130}I^q	−86851	3	85.1099	0.0010			254	ns	4	$(6)^-$	01			1975	IT=100	
^{130}Xe	−89880.463	0.009					STABLE			0^+	01			1922	IS=4.0710 13	
^{130}Cs	−86900	8					29.21	m	0.04	1^+	01			1952	β^+=98.4; β^-=1.6	
^{130}Cs^m	−86737	8	163.25	0.11			3.46	m	0.06	5^-	01			1977	IT≈100; β^+=0.16 2	
^{130}Cs^x	−86873	17	27	15			$R=.2$		.1	fsmix						
^{130}Ba	−87261.5	2.6					STABLE		1 Zy	0^+	01	15Ba11	T	1936	IS=0.106 1; 2β^+ ?	
^{130}Ba^m	−84786.4	2.6	2475.12	0.18			9.54	ms	0.14	8^-	01	02Mo31	T	1969	IT=100	*
^{130}La	−81627	26					8.7	m	0.1	$3^{(+)}$	01			1961	β^+=100	
^{130}La^m	−81413	26	214.0	0.5			760	ns	90	(5^+)		14Io01	ETJ	2012	IT=100	
^{130}La^n	−81308	26	319.1	0.5			33	ns	1	(6^+)		14Io01	ETJ	2014	IT=100	
^{130}Ce	−79423	28					22.9	m	0.5	0^+	01			1965	β^+=100	
^{130}Ce^m	−76969	28	2453.6	0.3			100	ns	8	(7^-)	01			1999	IT=100	
^{130}Pr	−71180	60					40.0	s	0.4	$(6,7)^{(+\#)}$	01	88Ba42	J	1977	β^+=100	
^{130}Pr^m	−71080#	120#	100#	100#			10#	s		2^+#	01	88Ba42	J	1988	β^+ ?	*
^{130}Nd	−66596	28					21	s	3	0^+	01	01Gi17	T	1977	β^+=100	*
^{130}Pm	−55400#	200#					2.6	s	0.2	$(5^+,6^+,4^+)$	01	99Xi03	J	1985	β^+=100; β^+p=?	
^{130}Sm	−47510#	400#					1#	s		0^+	01			1999	β^+ ?	
^{130}Eu	−33680#	500#					1.0	ms	0.4	(1^+)	08			2004	p≈100; β^+=1#; β^+p ?	*

*^{130}Ag T : average 15Lo04=42(5) 05Kr20=35(10) **
*^{130}Cd T : average 16Du13=126(4) 15Lo04=127(2) **
*^{130}Cd^m T : average 12Ka36=248(+21−19) 07Ju05=220(30) **
*^{130}Cd^m E : 12Ka36=128.0(0.5), 138.0(0.5), 538.2(0.5) and 1325.4(0.5) γ rays in cascade to ground-state **
*^{130}In^p E : other 12Ka36=388.5(0.5) **
*^{130}In^p T : symmetrized from 12Ka36=5.25(+0.40−0.35); other 04Sc42=3.1(0.3) **
*^{130}Te T : 15Al20 : 0ν-$\beta\beta$>2700 Zy **
*^{130}Te^m T : other conflicting data: 72Ke28=115(11) J : E1 to 6^+, E2 to 4^+ **
*^{130}Te^n E : other: less than 25 keV above 2648.57(0.22) (8^+) level, see ENSDF'01 **
*^{130}Te^n T : other conflicting data, not used: 98Zh09=4.2(0.9) μs **
*^{130}Ba^m T : others 66Br14=8.8(0.2) 69Wa.A=13.5(1.0) not used **
*^{130}Pr^m J : 88Ba42: there is also a low-spin component in ^{130}Pr activity **
*^{130}Pr^m J : see also the discussion in 01Gi17 on three isomeric states in ^{130}Pr **
*^{130}Nd T : other 00Xu08=13(3) 77Bo02=28(3) conflicting, not used **
*^{130}Eu T : symmetrized from 0.90(+0.49−0.29) D : estim from β^+ half-live=49# ms **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{131}Ag	−40380#	500#					35	ms	8	$7/2^+$#	15			2013	β^-=100; β^-n=90#; β^-2n=10	
^{131}Cd	−55220	100					98	ms	2	$7/2^-$#	06	15Lo04	T	2000	β^-=100; β^-n=3.5 10; β^-2n=0#	
^{131}In	−68025.0	2.7					261	ms	3	$(9/2^+)$	06	15Lo04	T	1976	β^-=100; β^-n=2.2 3	*
^{131}In^m	−67660	7	365	8	MD		350	ms	50	$(1/2^-)$	06			1984	β^-≈100; β^-n<2.0 3; IT<0.018	
^{131}In^n	−64280	90	3750	90	BD		320	ms	60	$(21/2^+)$	06			1984	β^->99; β^-n=0.028 5; IT<1	
^{131}In^p	−64241.4	2.7	3783.6	0.5			669	ns	34	$(17/2^+)$		09Go40	TJ	2009	IT=100	*
^{131}Sn	−77265	4					56.0	s	0.5	$3/2^+$	06	05Le34	J	1963	β^-=100	
^{131}Sn^m	−77200	4	65.1	0.3			58.4	s	0.5	$11/2^-$	06	04Fo06	E	1977	β^-=100; IT<0.0004#	*
^{131}Sn^n	−72595	4	4670.0	0.3			304	ns	15	$(23/2^-)$	06	12Ka36	T	2001	IT=100	*
^{131}Sb	−81981.4	2.1					23.03	m	0.04	$(7/2^+)$	06			1956	β^-=100	
^{131}Sb^m	−80305.3	2.1	1676.06	0.06			91	μs	4	$15/2^-$#	06			1969	IT=100	
^{131}Sb^n	−80294.2	2.3	1687.2	0.9			4.3	μs	0.8	$(19/2^-)$	06			2000	IT=100	
^{131}Sb^p	−79815.8	2.6	2165.6	1.5			1.1	μs	0.2	$(23/2^+)$	06			2000	IT=100	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{131}Te	−85211.01	0.06					25.0	m	0.1	$3/2^+$	06			1939	β^-=100	
^{131}Te^m	−85028.75	0.06	182.258	0.018			32.48	h	0.11	$11/2^-$	06	08Ea01	T	1940	β^-=74.1 5; IT=25.9 5	
^{131}Te^n	−83271.0	0.4	1940.0	0.4			93	ms	12	$(23/2^+)$	06			1998	IT=100	
^{131}I	−87442.7	0.6					8.0252	d	0.0006	$7/2^+$	06			1939	β^-=100	
^{131}I^m	−85524.3	0.7	1918.4	0.42			24	μs	1	$19/2^-$		09Wa11	EJT	2009	IT=100	*
^{131}Xe	−88413.558	0.009					STABLE			$3/2^+$	06			1920	IS=21.2324 30	
^{131}Xe^m	−88249.628	0.012	163.930	0.008			11.84	d	0.04	$11/2^-$	06			1966	IT=100	
^{131}Cs	−88059	5					9.689	d	0.016	$5/2^+$	06			1947	ε=100	
^{131}Ba	−86683.7	2.6					11.52	d	0.01	$1/2^+$	06	12Da04	T	1947	β^+=100	
^{131}Ba^m	−86495.7	2.6	187.995	0.009			14.26	m	0.09	$9/2^-$	06	12Da04	T	1963	IT=100	
^{131}La	−83769	28					59	m	2	$3/2^+$	06			1951	β^+=100	
^{131}La^m	−83464	28	304.60	0.24			170	μs	7	$11/2^-$	06			1966	IT=100	
^{131}Ce	−79710	30					10.3	m	0.3	$7/2^+$	06			1966	β^+=100	
^{131}Ce^m	−79650	30	63.09	0.09			5.4	m	0.4	$(1/2^+)$	06	96Gi08	E	1966	β^+=100	
^{131}Pr	−74300	50					1.50	m	0.03	$3/2^+$#	06	96Gi08	T	1977	β^+=100	*
^{131}Pr^m	−74150	50	152.4	0.3			5.73	s	0.20	$(11/2^-)$	06			1996	IT=96.4 12; β^+=3.6 12	
^{131}Nd	−67768	28					25.4	s	0.9	$(5/2)^{(+\#)}$	06			1977	β^+=100; β^+p=?	
^{131}Pm	−59660#	200#					6.3	s	0.8	$(11/2^-)$	06	99Ga41	T	1998	β^+=100	
^{131}Sm	−50130#	400#					1.2	s	0.2	$5/2^+$#	06			1986	β^+=100; β^+p=?	
^{131}Eu	−39270#	400#					17.8	ms	1.9	$3/2^+$	06			1998	p=89 9; β^+ ?; β^+p ?	

*^{131}In D : from 93Ru01 **
*^{131}In^p E : other 12Ka36=3783.6(0.5) **
*^{131}In^p T : average 12Ka36=685(+42–39) 09Go40=630(60) J : from 09Go40 **
*^{131}Sn^m J : from 05Le34 **
*^{131}Sn^n E : 4605.02(0.21) above the 58.4 s 11/2$^-$ level **
*^{131}Sn^n T : average 12Ka36=309(+24–23) 84Fo19=300(20) **
*^{131}I^m E : derived from least-squares fit to γ-ray energies **
*^{131}Pr T : average 96Gi08=1.57(0.07) 93Al03=1.48(0.02) 83Ga.A=1.58(0.05) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{132}Ag	−33790#	500#					30	ms	14		15	15Lo04	TD	2015	β^-=100; β^-n=0#; β^-2n=90#	*
^{132}Cd	−50260#	200#					82	ms	4	0^+	05	15Lo04	T	2000	β^-=100; β^-n=60 15; β^-2n=0.2#	
^{132}In	−62410	60					198	ms	2	(7^-)	05	15Lo04	T	1973	β^-=100; β^-n=6.3 9; β^-2n=0#	
^{132}Sn	−76546.5	2.0					39.7	s	0.8	0^+	05			1963	β^-=100	
^{132}Sn^m	−71698.0	2.0	4848.52	0.20			2.079	μs	0.016	(8^+)	05	12Ka36	T	1986	IT=100	*
^{132}Sb	−79635.3	2.5					2.79	m	0.07	$(4)^+$	05			1956	β^-=100	
^{132}Sb^m	−79440	30	200	30			4.10	m	0.05	(8^-)	05	89St06	E	1956	β^-=100	
^{132}Sb^n	−79380.8	2.5	254.5	0.3			102	ns	4	(6^-)	05			1974	IT=100	
^{132}Te	−85188	3					3.204	d	0.013	0^+	05			1948	β^-=100	
^{132}Te^m	−83413	3	1774.80	0.09			145	ns	8	6^+	05			1973	IT=100	
^{132}Te^n	−83263	3	1925.47	0.09			28.1	μs	1.5	7^-	05	FGK128	J	1979	IT=100	*
^{132}Te^p	−82465	3	2723.3	0.8			3.70	μs	0.09	(10^+)	05			1979	IT=100	
^{132}I	−85703	4					2.295	h	0.013	4^+	05			1948	β^-=100	
^{132}I^m	−85594	10	110	11	BD		1.387	h	0.015	(8^-)	05			1973	IT=86 2; β^-=14 2	
^{132}Xe	−89278.962	0.005					STABLE			0^+	05			1920	IS=26.9086 33	
^{132}Xe^m	−86526.75	0.17	2752.21	0.17			8.39	ms	0.11	(10^+)	05			1976	IT=100	
^{132}Cs	−87152.7	1.0					6.480	d	0.006	2^+	05			1953	β^+=98.13 9; β^-=1.87 9	
^{132}Ba	−88435.0	1.1					STABLE		(>300 Ey)	0^+	05	96Ba24	T	1936	IS=0.101 1; 2β^+ ?	
^{132}La	−83720	40					4.8	h	0.2	2^-	05			1951	β^+=100	
^{132}La^m	−83530	40	188.20	0.11			24.3	m	0.5	6^-	05			1969	IT=76; β^+=24	
^{132}Ce	−82471	20					3.51	h	0.11	0^+	05			1960	β^+=100	
^{132}Ce^m	−80130	20	2341.15	0.21			9.4	ms	0.3	8^-	05	09Pe31	J	1969	IT=100	
^{132}Pr	−75227	29				*	1.49	m	0.11	(2^+)	05	94Bu18	TJ	1974	β^+=100	*
^{132}Pr^m	−75200#	40#	30#	30#		*	1#	s		(5^+)	05	90Ko25	J	1990	β^+ ?	
^{132}Pr^n	−74980#	40#	250#	30#			2.46	μs	0.04	(8^+)		12Ta18	TJD	2012	IT=100	*
^{132}Pr^p	−74960#	100#	270#	100#			486	ns	70	(8^-)		12Ta18	TJD	2012	IT=100	*
^{132}Nd	−71426	24					1.56	m	0.10	0^+	05	95Bu11	T	1977	β^+=100	*
^{132}Pm	−61630#	150#					6.2	s	0.6	(3^+)	05			1977	β^+=100; β^+p≈5e–5	
^{132}Sm	−55080#	300#					4.0	s	0.3	0^+	05			1989	β^+=100; β^+p ?	
^{132}Eu	−42200#	400#					100#	ms			05	93Li40	D		β^+ ?; β^+p ?; p=0	

*^{132}Ag T : symmetrized from 15Lo04=28(+15–12) **
*^{132}Sn^m T : average 12Ka36=2.088(0.017) 94Fo14=2.03(4); other 82Ka25=1.7(2) **
*^{132}Te^n J : E1 to 6$^+$ **
*^{132}Pr T : average 94Bu18=1.47(0.12) 74Ar27=1.6(0.3) **
*^{132}Pr^n E : 12Ta18=219.9(0.14) keV above (5$^+$) isomer **
*^{132}Pr^p E : 12Ta18=273.0(0.14) keV above (5$^+$) isomer **
*^{132}Nd T : average 95Bu11=1.47(0.12) 77Bo02=1.75(0.17) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{133}Cd	−43920#	300#				61	ms	6	$7/2^-$#	11	15Lo04	T	2010	β^-=100; β^-n=0.5#; β^-2n=90#	*
^{133}In	−57460#	200#				165	ms	3	$(9/2^+)$	11	96Ho16	J	1996	β^-=100; β^-n=85 10; β^-2n=0.4#	*
^{133}In^m	−57130#	200#	330#	40#		180#	ms		$(1/2^-)$	11	96Ho16	J	1996	IT ?; β^- ?	
^{133}Sn	−70873.9	1.9				1.46	s	0.03	$(7/2^-)$	11			1973	β^-=100; β^-n=0.0294 24	
^{133}Sb	−78924	3				2.34	m	0.05	$7/2^+$#	11			1966	β^-=100	
^{133}Sb^m	−74360	100	4560	100		16.54	μs	0.19	$(21/2^+)$	11			1978	IT=100	
^{133}Te	−82937.1	2.1				12.5	m	0.3	$3/2^+$#	11			1940	β^-=100	
^{133}Te^m	−82602.8	2.1	334.26	0.04		55.4	m	0.4	$(11/2^-)$	11			1957	β^-=83.5 20; IT=16.5 20	
^{133}Te^n	−81326.7	2.2	1610.4	0.5		100	ns	5	$(19/2^-)$	11			2001	IT=100	
^{133}I	−85858	6				20.83	h	0.08	$7/2^+$	11			1940	β^-=100	
^{133}I^m	−84224	6	1634.148	0.010		9	s	2	$(19/2^-)$	11			1970	IT=100	
^{133}I^n	−84129	6	1729.137	0.010		170	ns		$(15/2^-)$	11			1984	IT=100	
^{133}I^p	−83423	6	2435.00	0.23		780	ns	1606	$(19/2^+)$	11			2004	IT=100	
^{133}I^q	−83364	6	2493.7	0.4		469	ns	15	$(23/2^+)$	11			2009	IT=100	
^{133}Xe	−87643.6	2.4				5.2475	d	0.0005	$3/2^+$	11	02Un02	T	1940	β^-=100	
^{133}Xe^m	−87410.4	2.4	233.221	0.015		2.198	d	0.013	$11/2^-$	11			1951	IT=100	
^{133}Cs	−88070.931	0.008				STABLE			$7/2^+$	11			1921	IS=100.	
^{133}Ba	−87553.6	1.0				10.551	y	0.011	$1/2^+$	11			1941	ε=100	
^{133}Ba^m	−87265.3	1.0	288.252	0.009		38.90	h	0.06	$11/2^-$	11	12Da04	T	1941	IT≈100; ε=0.0104 5	*
^{133}La	−85494	28				3.912	h	0.008	$5/2^+$	11			1950	β^+=100	
^{133}Ce	−82418	16				97	m	4	$1/2^+$	11			1951	β^+=100	
^{133}Ce^m	−82381	16	37.2	0.7		5.1	h	0.3	$9/2^-$	11			1951	β^+=100	
^{133}Pr	−77938	12				6.5	m	0.3	$(3/2^+)$	11			1970	β^+=100	
^{133}Pr^m	−77746	12	192.12	0.14		1.1	s	0.2	$(11/2^-)$	11			1995	IT=100	
^{133}Nd	−72330	50				70	s	10	$(7/2^+)$	11			1977	β^+=100	
^{133}Nd^m	−72200	50	127.97	0.12		70	s		$(1/2)^+$	11	95Br24	D	1993	β^+≈100; IT=?	
^{133}Nd^n	−72150	50	176.10	0.10		301	ns	18	$(9/2^-)$	11			1993	IT=100	
^{133}Pm	−65410	50				13.5	s	2.1	$(3/2^+)$	11			1977	β^+=100	
^{133}Pm^m	−65280	50	129.7	0.7		8#	s		$(11/2^-)$	11			1996	β^+ ?; IT ?	
^{133}Sm	−57230#	300#				2.89	s	0.16	$(5/2^+)$	11			1977	β^+=100; β^+p=?	
^{133}Sm^m	−57110#	310#	120#	60#		3.5	s	0.4	$(1/2^-)$	11			1993	β^+ ?; IT ?; β^+p ?	
^{133}Eu	−47240#	300#				200#	ms		$11/2^-$#					β^+ ?; β^+p ?	
^{133}Gd	−35860#	500#				10#	ms		$5/2^+$#					β^+ ?; β^+p ?	
*^{133}Cd	T : average 15Lo04=64(8) 05Kr20=57(10)														**
*^{133}Cd	D : delayed neutrons were observed in 05Kr20														**
*^{133}In	T : average 15Lo04=163(7) 02Di12=165(3)														**
*^{133}Ba^m	T : average 12Da04=38.88(0.08) 11Gr01=38.92(0.09)														**
^{134}Cd	−38920#	400#				65	ms	15	0^+	15			2015	β^-=100; β^-n=0.2#; β^-2n=90#	
^{134}In	−51660#	300#				140	ms	4	high	04	95Jo.A	D	1996	β^-=100; β^-n=65; β^-2n<4	*
^{134}Sn	−66434	3				890	ms	20	0^+	04	15Lo04	T	1974	β^-=100; β^-n=17 13	
^{134}Sn^m	−65187	3	1247.4	0.5		87	ns	8	6^+	04	12Ka36	T	2000	IT=100	*
^{134}Sb	−74020.5	1.7				780	ms	60	(0^-)	11			1967	β^-=100; β^-n=5#	
^{134}Sb^m	−73741.5	2.0	279	1		10.07	s	0.05	(7^-)	11			1968	β^-=100; β^-n=0.088 4	
^{134}Te	−82533.7	2.7				41.8	m	0.8	0^+	04			1948	β^-=100	
^{134}Te^m	−80842.4	2.7	1691.34	0.16		164.1	ns	0.9	6^+	04			1970	IT=100	
^{134}I	−84043	5				52.5	m	0.2	$(4)^+$	04			1948	β^-=100	
^{134}I^m	−83727	5	316.49	0.22		3.52	m	0.04	$(8)^-$	04			1970	IT=97.7 10; β^-=2.3 10	
^{134}Xe	−88125.822	0.009				STABLE		(>11 Py)	0^+	04	89Ba22	T	1920	IS=10.4357 21; 2β^- ?	*
^{134}Xe^m	−86160.3	0.5	1965.5	0.5		290	ms	17	(7^-)	04			1968	IT=100	
^{134}Xe^n	−85100.6	1.5	3025.2	1.5		5	μs	1	(10^+)	04			2001	IT=100	
^{134}Cs	−86891.154	0.016				2.0652	y	0.0004	4^+	04			1940	β^-=100; ε=0.0003 1	
^{134}Cs^m	−86752.410	0.016	138.7441	0.0026		2.912	h	0.002	8^-	04			1975	IT=100	
^{134}Ba	−88949.9	0.3				STABLE			0^+	04			1936	IS=2.417 18	
^{134}Ba^m	−85992.7	0.6	2957.2	0.5		2.63	μs	0.14	(10^+)	04			1982	IT=100	
^{134}La	−85219	20				6.45	m	0.16	1^+	04			1951	β^+=100	
^{134}La^m	−84780#	100#	440#	100#		29	μs	4		04			1985	IT=100	*
^{134}Ce	−84833	20				3.16	d	0.04	0^+	04			1951	ε=100	
^{134}Ce^m	−81624	20	3208.6	0.4		308	ns	5	10^+	04			1980	IT=100	
^{134}Pr	−78528	20				17	m	2	2^-	04			1967	β^+=100	
^{134}Pr^m	−78460	20	68	1		11	m		(6^-)	04	11Ti10	E	1973	β^+=100; IT≈0	
^{134}Nd	−75646	12				8.5	m	1.5	0^+	04			1970	β^+=100	
^{134}Nd^m	−73353	12	2293.0	0.4		410	μs	30	$(8)^-$	04			1969	IT=100	
^{134}Pm	−66740	60			* &	22	s	1	(5^+)	04			1977	β^+=100	
^{134}Pm^m	−66740#	120#	0#	100#	* &	5	s		(2^+)	04			1988	β^+=100	
^{134}Pm^n	−66620#	80#	120#	50#		20	μs	1	(7^-)		09Cu02	TJ	2009	IT=100	*
^{134}Sm	−61380#	200#				9.5	s	0.8	0^+	04			1977	β^+=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

… *A*-group continued …

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{134}Eu	−49930#	300#					500	ms	200		04			1989	β^+=100; β^+p=?	
^{134}Gd	−41300#	400#					400#	ms		0^+	04				β^+ ?; β^+p ?	
*^{134}In	T : other 15Lo04=126(7)															**
*^{134}In	D : β^-2n intensity limits is from 95Jo.A															**
*^{134}Sn^m	T : symmetrized from 12Ka36=86(+8–7); other 00Ko15=80(15)															**
*^{134}Xe	D : and 89Ba22 : 0ν-$\beta\beta$>58Zy and >26Zy for $0^+\to0^+$ and $0^+\to2^+$ respectively															**
*^{134}La^m	E : 100#100 keV above 336.44(17) level															**
*^{134}Pm^m	E : 70.7(0.2) keV above a 6^+ state that decays via a low-energy γ to 5^+															**
^{135}In	−46530#	400#					101	ms	4	$9/2^+$#	08	15Lo04	T	2002	β^- ?; β^-n=90#; β^-2n=8#	*
^{135}Sn	−60632	3					515	ms	5	$7/2^-$#	08	15Lo04	T	1994	β^-=100; β^-n=21 3; β^-2n=6#	
^{135}Sb	−69690.3	2.6					1.679	s	0.015	$(7/2^+)$	08			1964	β^-=100; β^-n=22 3	
^{135}Te	−77728.8	1.7					19.0	s	0.2	$(7/2^-)$	08			1969	β^-=100	
^{135}Te^m	−76173.9	1.7	1554.89	0.16			511	ns	20	$(19/2^-)$	08			1980	IT=100	
^{135}I	−83779.1	2.1					6.58	h	0.03	$7/2^+$	08			1940	β^-=100	
^{135}Xe	−86413	4					9.14	h	0.02	$3/2^+$	08			1940	β^-=100	
^{135}Xe^m	−85886	4	526.551	0.013			15.29	m	0.05	$11/2^-$	08			1960	IT≈100; β^-=0.30 17	*
^{135}Cs	−87581.6	1.0					1.33	My	0.19	$7/2^+$	08	16Ma05	T	1949	β^-=100	*
^{135}Cs^m	−85948.7	1.8	1632.9	1.5			53	m	2	$19/2^-$	08			1962	IT=100	
^{135}Ba	−87850.5	0.3					STABLE			$3/2^+$	08			1932	IS=6.592 12	
^{135}Ba^m	−87582.3	0.3	268.218	0.020			28.11	h	0.02	$11/2^-$	08	12Da04	T	1948	IT=100	
^{135}La	−86643	9					19.5	h	0.2	$5/2^+$	08			1948	β^+=100	
^{135}Ce	−84616	10					17.7	h	0.3	$1/2^{(+)}$	08			1948	β^+=100	
^{135}Ce^m	−84170	10	445.81	0.21			20	s	1	$(11/2^-)$	08			1963	IT=100	
^{135}Pr	−80936	12					24	m	1	$3/2^{(+)}$	08			1954	β^+=100	
^{135}Pr^m	−80578	12	358.06	0.06			105	μs	10	$(11/2^-)$	08			1973	IT=100	
^{135}Nd	−76214	19					12.4	m	0.6	$9/2^{(-)}$	08			1970	β^+=100	
^{135}Nd^m	−76149	19	64.95	0.24			5.5	m	0.5	$(1/2^+)$	08			1970	β^+>99.97; IT<0.03	
^{135}Pm	−70050	80					49	s	3	$(5/2^+,3/2^+)$	08			1975	β^+=100	
^{135}Pm^m	−69830#	50#	220#	90#			40	s	3	$(11/2^-)$	08	89Ko07	TJ	1989	β^+=100	*
^{135}Sm	−62860	150				*	10.3	s	0.5	$(7/2^+)$	08	77Bo02	J	1977	β^+=100; β^+p=0.02 1	
^{135}Sm^m	−62860#	340#	0#	300#		*	2.4	s	0.9	$(3/2^+,5/2^+)$	08	89Vi04	TJD	1989	β^+=100	*
^{135}Eu	−54150#	200#					1.5	s	0.2	$11/2^-$#	08			1989	β^+=100; β^+p ?	
^{135}Gd	−44390#	400#					1.1	s	0.2	$(5/2^+)$	08			1996	β^+=100; β^+p=18	
^{135}Tb	−32830#	400#					1.01	ms	0.28	$(7/2^-)$	08			2004	p≈100; β^+ ?	*
*^{135}In	T : average 15Lo04=103(5) 02Di12=92(10)															**
*^{135}In	D : delayed neutrons were observed in 02Di12															**
*^{135}Xe^m	D : β^- ranging from 0.004% to 0.6%															**
*^{135}Cs	T : average 16Ma05=1.6(0.6) by AMS and 1.3(0.2) ICPMS															**
*^{135}Pm^m	E : Trends of 11/2$^-$ level in Pm isotopes: ^{133}Pm: 129.7(0.7) ^{135}Pm: 150#50															**
*^{135}Pm^m	E : ^{137}Pm: 150(50) ^{139}Pm: 188.7(0.3) ^{141}Pm: 628.40(0.10) ^{143}Pm: 959.7(0.1)															**
*^{135}Pm^m	E : (N>82) ^{145}Pm: 794.6(0.4) ^{147}Pm: 649.3(0.4) ^{149}Pm: 240.215(0.007)															**
*^{135}Pm^m	E : ENSDF2008 : 68.7 + y															**
*^{135}Sm^m	I : existence of ^{135}Sm^m and spins of both states are discussed in ENSDF															**
*^{135}Tb	T : symmetrized from 940(+330–220) μs															**
^{136}In	−40510#	400#					86	ms	9		15	15Lo04	TD	2015	β^-=100; β^-n=0#; β^-2n=90#	*
^{136}Sn	−55900#	300#					350	ms	5	0^+	14	15Lo04	T	1994	β^-=100; β^-n=28 3; β^-2n=2#	*
^{136}Sb	−64507	6					923	ms	14	(1^-)	02	15Lo08	J	1976	β^-=100; β^-n=16.3 32; β^-2n=10#	
^{136}Sb^m	−64230	6	277.0	0.7			570	ns	5	(6^-)	02	12Ka36	ET	2001	IT=100	*
^{136}Te	−74425.3	2.3					17.63	s	0.08	0^+	02			1974	β^-=100; β^-n=1.31 5	
^{136}I	−79545	14					83.4	s	1.0	(1^-)	02			1949	β^-=100	
^{136}I^m	−79339	5	206	15	BD		46.9	s	1.0	(6^-)	02			1959	β^-=100; IT=0	
^{136}Xe	−86429.159	0.007					2.19	Zy	0.06	0^+	02	15Ba11	T	1920	IS=8.8573 44; 2β^-=100	*
^{136}Xe^m	−84537.456	0.016	1891.703	0.014			2.95	μs	0.09	6^+	02			1969	IT=100	
^{136}Cs	−86338.7	1.9					13.16	d	0.03	5^+	02			1951	β^-=100	
^{136}Cs^m	−85820.8	1.9	517.9	0.1			17.5	s	0.2	8^-	02	11Wi09	ET	1981	IT=?; β^- ?	*
^{136}Ba	−88886.9	0.3					STABLE			0^+	02			1932	IS=7.854 24	
^{136}Ba^m	−86856.4	0.3	2030.466	0.018			308.4	ms	1.9	7^-	02			1965	IT=100	
^{136}Ba^n	−85529.5	0.5	3357.4	0.4			91	ns	2	(10^+)		04Va03	TD	2004	IT=100	*
^{136}La	−86040	50					9.87	m	0.03	1^+	02			1950	β^+=100	
^{136}La^m	−85780	50	259.3	0.4			114	ms	3	$(7)^{(-\#)}$	02	05Bh06	EJ	1966	IT=100	
^{136}Ce	−86508.4	0.4					STABLE		(>38 Py)	0^+	02	01Da22	T	1936	IS=0.185 2; 2β^+ ?	*
^{136}Ce^m	−83412.9	0.6	3095.5	0.4			1.96	μs	0.09	10^+	02	13Va10	T	1991	IT=100	*
^{136}Pr	−81340	11					13.1	m	0.1	2^+	02			1968	β^+=100	
^{136}Nd	−79199	12					50.7	m	0.3	0^+	02			1968	β^+=100	
^{136}Pm	−71170	70				* &	107	s	6	$(5)^{(+\#)}$	02	FGK12a	J	1982	β^+=100	*
^{136}Pm^m	−71070	90	100	120	MD	* &	300	s	50	$(2)^{(+\#)}$	02	88Ke03	T	1988	β^+=100	*
^{136}Pm^n	−71100	70	68	25			1.5	μs	0.1	8^+#	02	08Ri05	ET	1987	IT=100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{136}Sm	−66811	12					47	s	2	0^+	02			1982	β^+=100	
^{136}Sm^m	−64546	12	2264.7	1.1			15	μs	1	(8^-)	02			1994	IT=100	
^{136}Eu	−56240#	200#				*	3.3	s	0.3	(7^+)	02	89Vi04	D	1987	β^+=100; β^+p=0.09 3	
^{136}Eu^m	−56240#	540#	0#	500#		*	3.8	s	0.3	(3^+)	02	89Vi04	D	1987	β^+=100; β^+p=0.09 3	
^{136}Gd	−49090#	300#					1#	s	(>200 ns)	0^+	02	00So11	I	2000	β^+ ?; β^+p ?	
^{136}Tb	−36130#	500#					200#	ms			02				β^+ ?; β^+p ?	
*^{136}In	T : symmetrized from 15Lo04=85(+10–8)															**
*^{136}Sn	D : β^-n average 11Ar18=27(4)% 02Sh08=30(5)%															**
*^{136}Sb^m	E : 12Ka36=53.9(0.5) and 173.1(0.5) γ in cascade to ground-state; 15Lo08=269.3															**
*^{136}Sb^m	T : others 15Lo08=489(40) 07Si27=480(100) 01Mi22=570(50)															**
*^{136}Xe	T : others 14Al03=2.165(0.061)Zy 12Ga17=2.38(0.14)Zy 02Be74>10Zy															**
*^{136}Xe	T : 0ν-$\beta\beta$: 16As01>2500 Zy 13Ga07>19000 Zy 12Au03>16000 Zy (all at 90% C.L.)															**
*^{136}Cs^m	E : also 83We07=518(5)															**
*^{136}Ba^n	T : other 04Sh15=94(10) outweighed															**
*^{136}Ce	T : also 11Be02>18Py; both for 2ν-$\beta\beta$ and 1 σ															**
*^{136}Ce^m	T : average 13Va10=1.9(0.1) 75Yo01=2.2(0.2)															**
*^{136}Pm	J : expected 5^+ n9/2[514]+p1/2[550]; supported by observed direct feeding															**
*^{136}Pm	J : to I=4,5,6 levels following ^{136}Pm β^+ decay															**
*^{136}Pm^m	J : expected 2^+ n9/2[514]+p1/2[550]; supported by observed direct feeding															**
*^{136}Pm^m	J : to I=2^+ and 3^+ levels following β^+ decay															**
*^{136}Pm^n	E : 08Ri05=42.7(0.2) keV above a long lived state that could be either the															**
*^{136}Pm^n	E : ground-state or an excited level located <50 keV above the ground-state owing to non-															**
*^{136}Pm^n	E : observation of any decay radiation															**
^{137}In	−35040#	500#					70	ms	40	$9/2^+$#	15	15Lo04	TD	2015	β^-=100; β^-n=0#; β^-2n=90#	*
^{137}Sn	−49790#	400#					273	ms	7	$5/2^-$#	07	11Ar18	TD	1994	β^-=100; β^-n=50 8; β^-2n=40#	
^{137}Sb	−60060	50					484	ms	22	$7/2^+$#	07	11Ar18	TD	1994	β^-=100; β^-n=49 6; β^-2n=0.3#	*
^{137}Te	−69303.8	2.1					2.49	s	0.05	$3/2^-$#	07			1975	β^-=100; β^-n=2.99 16	*
^{137}I	−76356	8					24.13	s	0.12	$7/2^+$#	07	16Ag03	D	1943	β^-=100; β^-n=7.76 14	*
^{137}Xe	−82383.40	0.10					3.818	m	0.013	$7/2^-$	07			1943	β^-=100	
^{137}Cs	−86545.6	0.4					30.08	y	0.09	$7/2^+$	07			1951	β^-=100	
^{137}Ba	−87721.2	0.3					STABLE			$3/2^+$	07			1932	IS=11.232 24	
^{137}Ba^m	−87059.5	0.3	661.659	0.003			2.552	m	0.001	$11/2^-$	07			1965	IT=100	
^{137}Ba^n	−85372.1	0.6	2349.1	0.5			590	ns	100	$(17/2^-)$	07			1973	IT=100	
^{137}La	−87140.7	1.7					60	ky	20	$7/2^+$	07			1948	ε=100	
^{137}La^m	−85271.2	1.7	1869.50	0.21			342	ns	25	$19/2^-$	07			1982	IT=100	
^{137}Ce	−85918.6	0.4					9.0	h	0.3	$3/2^+$	07			1948	β^+=100	
^{137}Ce^m	−85664.3	0.4	254.29	0.05			34.4	h	0.3	$11/2^-$	07			1958	IT=99.21 4; β^+=0.79 4	
^{137}Pr	−83202	8					1.28	h	0.03	$5/2^+$	07			1958	β^+=100	
^{137}Pr^m	−82641	8	561.22	0.23			2.66	μs	0.07	$11/2^-$	07			1987	IT=100	
^{137}Nd	−79585	12					38.5	m	1.5	$1/2^+$	07			1970	β^+=100	
^{137}Nd^m	−79066	12	519.43	0.20			1.60	s	0.15	$11/2^-$	07			1970	IT=100	
^{137}Pm	−74073	13				&	2#	m		$5/2^+$#				1975	β^+ ?	
^{137}Pm^m	−73930	50	150	50	BD	&	2.4	m	0.1	$11/2^-$	07			1973	β^+=100	
^{137}Sm	−68030	40					45	s	1	$(9/2^-)$	07			1986	β^+=100	
^{137}Sm^m	−67850#	60#	180#	50#			20#	s		$1/2^+$#					β^+ ?	
^{137}Eu	−60146	4					8.4	s	0.5	$11/2^-$#	07	88Be.A	T	1982	β^+=100	
^{137}Gd	−51210#	300#					2.2	s	0.2	$(7/2)^{(+\#)}$	07			1999	β^+=100; β^+p=?	
^{137}Tb	−40970#	400#					600#	ms		$11/2^-$#					p ?; β^+ ?	
*^{137}In	T : symmetrized from 15Lo04=65(+40–30)															**
*^{137}Sb	T : average 11Ar18=492(25) 02Sh08=450(50)															**
*^{137}Sb	D : β^-n average 11Ar18=49(8)% 02Sh08=49(10)%															**
*^{137}Te	J : TNN of N=85 isotones. ENSDF'07 gives $(7/2^-)$ from shell-model prediction															**
*^{137}Te	D : from 93Ru01 evaluation															**
*^{137}I	T : 93Ru01=24.13(0.12) supersedes 74Ru08=24.5(0.2) from same group															**
^{138}Sn	−44860#	500#					150	ms	30	0^+	16			2010	β^-=100; β^-n≈36; β^-2n=5#	*
^{138}Sn^m	−43520#	500#	1344	2			210	ns	45	(6^+)	16			2014	IT=100	
^{138}Sb	−54220	1060					348	ms	15	(0^-)	16	FGK16a	J	1994	β^-=100; β^-n=72 8; β^-2n=2#	*
^{138}Te	−65696	4					1.4	s	0.4	0^+	03			1975	β^-=100; β^-n=6.3 21	
^{138}I	−71980	6					6.23	s	0.03	(1^-)	16	93Ru01	D	1949	β^-=100; β^-n=5.46 18	
^{138}I^m	−71912	6	67.9	0.5			1.26	μs	0.16	(3^-)	16			2007	IT=100	*
^{138}Xe	−79972.2	2.8					14.14	m	0.05	0^+	03	12Wa21	T	1943	β^-=100	*
^{138}Cs	−82887	9					33.41	m	0.18	3^-	03			1943	β^-=100	
^{138}Cs^m	−82807	9	79.9	0.3			2.91	m	0.08	6^-	03			1971	IT=81 2; β^-=19 2	
^{138}Cs^x	−82847	25	40	23			R =?			fsmix						
^{138}Ba	−88261.6	0.3					STABLE			0^+	03			1925	IS=71.698 42	
^{138}Ba^m	−86171.1	0.3	2090.54	0.06			800	ns	100	6^+	03			1971	IT=100	
… *A*-group is continued on next page …																

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

… A-group continued …

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{138}La	−86519	3					102	Gy	1	5^+	03			1947	IS=0.08881 71; β^+=65.6 5; β^-=34.4 5	
^{138}La^m	−86446	3	72.57	0.03			116	ns	5	$(3)^+$	03			1975	IT=100	
^{138}La^n	−85780	3	739.2	0.5			2.0	μs	0.3	7^-		14As02	ETJ	2014	IT=100	
^{138}Ce	−87571	5					STABLE		(>57 Py)	0^+	03	11Be02	T	1936	IS=0.251 2; 2β^+ ?	*
^{138}Ce^m	−85442	5	2129.17	0.12			8.65	ms	0.20	7^-	03			1960	IT=100	
^{138}Pr	−83134	11					1.45	m	0.05	1^+	03			1951	β^+=100	
^{138}Pr^m	−82782	17	352	19	BD		2.12	h	0.04	7^-	03			1958	β^+=100	
^{138}Nd	−82018	12					5.04	h	0.09	0^+	03			1965	β^+=100	
^{138}Nd^m	−78843	12	3174.9	0.4			370	ns	5	10^+	03	13Va10	T	1975	IT=100	
^{138}Pm	−74940	28				*	10	s	2	1^+#	03			1981	β^+=100	
^{138}Pm^m	−74911	13	30	30	BD	*	3.24	m	0.05	5^-#	03			1973	β^+=100	
^{138}Pm^n			non existent		EU		3.24	m	0.05	(3^+)		81De38	I		β^+=100	*
^{138}Sm	−71498	12					3.1	m	0.2	0^+	03			1982	β^+=100	
^{138}Eu	−61750	28					12.1	s	0.6	(6^-)	03			1982	β^+=100	
^{138}Gd	−55800#	200#					4.7	s	0.9	0^+	03			1985	β^+=100	
^{138}Gd^m	−53570#	200#	2233.1	0.5			6.2	μs	0.2	(8^-)	03	11Pr02	T	1997	IT=100	*
^{138}Tb	−43670#	300#					800#	ms	(>200 ns)		03	00So11	I	1993	β^+ ?; β^+p ?; p=0	*
^{138}Dy	−34930#	500#					200#	ms		0^+					β^+ ?; β^+p ?	
*^{138}Sn	T : symmetrized from 15Lo04=140(+30–20)															**
*^{138}Sb	J : expected pg7/2 nf7/2 config and strong repulsive residual interaction															**
*^{138}I^m	J : 67.9 E2 γ ray (delayed) to (1^-)															**
*^{138}Xe	T : average of 12Wa21=14.18(0.10) 72Mo33=14.08(0.08) 69Ca03=14.17(0.07)															**
*^{138}Ce	T : also 01Da22>150Ty; both for 2ν-$\beta\beta$ and 1 σ															**
*^{138}Pm^n	D : arguments for a second isomer of intermediate spin are not convincing															**
*^{138}Gd^m	E : for least-squares fit to γ-ray energies in 11Pr02															**
*^{138}Tb	D : from 93Li40															**

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{139}Sn	−38440#	500#					130	ms	60	$5/2^-$#	15			2015	β^-=100; β^-n=80#; β^-2n=20#	
^{139}Sb	−49790#	400#					93	ms	13	$7/2^+$#	01	11Ar18	TD	1994	β^-=100; β^-n=90 10; β^-2n=3#	
^{139}Te	−60205	4					500#	ms	(>150 ns)	$5/2^-$#	01	94Be24	I	1994	β^- ?; β^-n=2#	
^{139}I	−68471	4					2.282	s	0.010	$7/2^+$#	01	93Ru01	T	1949	β^-=100; β^-n=10.0 3	*
^{139}Xe	−75644.6	2.1					39.68	s	0.14	$3/2^-$	01			1951	β^-=100	
^{139}Cs	−80701	3					9.27	m	0.05	$7/2^+$	01			1939	β^-=100	
^{139}Ba	−84913.8	0.3					83.13	m	0.06	$(7/2^-)$	01	12Da17	T	1937	β^-=100	*
^{139}La	−87226.2	2.0					STABLE			$7/2^+$	01			1924	IS=99.91119 71	
^{139}La^m	−85426.3	2.1	1799.9	0.5			315	ns	35	$(17/2^+)$		12As06	ETJ	2012	IT=100	
^{139}Ce	−86948	7					137.641	d	0.020	$3/2^+$	01			1948	ε=100	
^{139}Ce^m	−86194	7	754.24	0.08			56.54	s	0.13	$11/2^-$	01	94It.A	T	1967	IT=100	
^{139}Pr	−84819	8					4.41	h	0.04	$5/2^+$	01			1951	β^+=100	
^{139}Nd	−82014	28					29.7	m	0.5	$3/2^+$	01			1951	β^+=100	
^{139}Nd^m	−81783	28	231.15	0.05			5.50	h	0.20	$11/2^-$	01			1951	β^+=88.2 4; IT=11.8 4	
^{139}Nd^n	−79398	28	2616	2			276.8	ns	1.8	$23/2^+$	01	13Va10	ETJ	1980	IT ?	*
^{139}Pm	−77500	14					4.15	m	0.05	$(5/2)^+$	01			1967	β^+=100	
^{139}Pm^m	−77311	14	188.7	0.3			180	ms	20	$(11/2)^-$	01			1975	IT≈100; β^+=0.16#	
^{139}Sm	−72380	11					2.57	m	0.10	$1/2^+$	01			1971	β^+=100	
^{139}Sm^m	−71923	11	457.40	0.22			10.7	s	0.6	$11/2^-$	01			1973	IT=93.7 5; β^+=6.3 5	
^{139}Eu	−65398	13					17.9	s	0.6	$(11/2)^-$	01			1975	β^+=100	
^{139}Eu^m	−65250	13	148.2	0.2			10	μs	2	$(7/2^+)$		11Cu01	ETJ	2011	IT=100	
^{139}Gd	−57630#	200#				*	5.7	s	0.3	$9/2^-$#	01	99Xi04	T	1983	β^+=100; β^+p=?	*
^{139}Gd^m	−57380#	250#	250#	150#		*	4.8	s	0.9	$1/2^+$#	01			1983	β^+=100; β^+p=?	*
^{139}Tb	−48130#	300#					1.6	s	0.2	$11/2^-$#	01			1999	β^+=100; β^+p ?	
^{139}Dy	−37640#	500#					600	ms	200	$(7/2^+)$	01			1999	β^+=100; β^+p ?	
*^{139}I	T : average 93Ru01=2.280(0.011) 80Al15=2.29(0.02)															**
*^{139}Ba	T : average 12Da17=83.01(0.14) 12Da04=83.25(0.08) 72Em01=82.71(0.18)															**
*^{139}Nd^n	T : average 13Va10=278(2) 08Fe02=272(4)															**
*^{139}Nd^n	T : 80Mu10 > 141 ns															**
*^{139}Gd	T : average 99Xi04=5.8(0.9) 88Be.A=5.8(0.4); other 83Ni05=4.9(1.0) not used															**
*^{139}Gd	T : since it corresponds to a mixture of ground-state and isomer															**
*^{139}Gd^m	D : assuming that the delayed protons reported in 83Ni05 are from both states															**

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{140}Sb	−43940#	600#					100#	ms	(>400 ns)	$(4^-,3^-)$	16			2010	β^- ?; β^-n=40#; β^-2n=20#	
^{140}Sb^m	−43610#	600#	330	10			41	μs	8	$(6^-,7^-)$	16			2016	IT=100	*
^{140}Te	−56580	60					300#	ms	(>300 ns)	0^+	07			1994	β^- ?; β^-n=3#	
^{140}I	−63606	12					860	ms	40	(4^-)	07			1972	β^-=100; β^-n=9.3 10; β^-2n=0#	
^{140}Xe	−72986.5	2.3					13.60	s	0.10	0^+	07			1951	β^-=100	
^{140}Cs	−77050	8					63.7	s	0.3	1^-	07			1950	β^-=100	
^{140}Cs^m	−77036	8	13.931	0.021			471	ns	51	$(2)^-$	07			1974	IT=100	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{140}Ba	−83269	8					12.7527	d	0.0023	0^+	07			1939	β^-=100	
^{140}La	−84315.9	2.0					40.285	h	0.003	3^-	07			1935	β^-=100	
^{140}Ce	−88076.1	1.6					STABLE			0^+	07			1925	IS=88.450 51	
^{140}Ce^m	−85968.2	1.6	2107.86	0.03			7.3	μs	1.5	6^+	07			1966	IT=100	
^{140}Pr	−84688	6					3.39	m	0.01	1^+	07			1938	e$^+$=51.3 18; ε=48.7 18	*
^{140}Pr^m	−84560	6	127.8	0.3			350	ns	20	5^+	07			1964	IT=100	
^{140}Pr^n	−83924	6	763.7	0.5			3.05	μs	0.20	$(7)^-$	07			1964	IT=100	
^{140}Nd	−84259	3					3.37	d	0.02	0^+	07			1949	ε=100	
^{140}Nd^m	−82038	3	2221.4	0.1			600	μs	50	7^-	07			1962	IT=100	
^{140}Nd^n	−76829	3	7429.6	0.7			1.22	μs	0.06	20^+		08Fe02	ETJ	2008	IT=100	*
^{140}Pm	−78214	24					9.2	s	0.2	1^+	07			1966	β^+=100	
^{140}Pm^m	−77783	13	431	28	BD		5.95	m	0.05	8^-	07			1966	β^+=100	
^{140}Sm	−75456	12					14.82	m	0.12	0^+	07			1967	β^+=100	
^{140}Eu	−66990	50					1.51	s	0.02	1^+	07			1982	β^+=100	
^{140}Eu^m	−66780	50	210	15			125	ms	2	(5^-)	07			1988	IT≈100; β^+<1	*
^{140}Eu^n	−66320	50	669	15			299.8	ns	2.1	(8^+)	07			2002	IT=100	*
^{140}Gd	−61782	28					15.8	s	0.4	0^+	07			1985	β^+=100	
^{140}Tb	−50480	800					2.32	s	0.16	(7^+)	07	06Xu03	T	1986	β^+=100; β^+p=0.26 13	*
^{140}Dy	−42830#	400#					700#	ms		0^+	07			2002	β^+ ?; β^+p ?	
^{140}Dy^m	−40660#	400#	2166.1	0.5			7.0	μs	0.5	(8^-)	07			2002	IT=100	
^{140}Ho	−29260#	500#					6	ms	3	8^+#	07			1999	p=?; β^+=1#; β^+p ?	*

*^{140}Sb^m E : 16Lo01=298.2 + x, x estimated by authors x=30# **
*^{140}Pr T : other: 07Li71=7.3(0.4) for q=59$^+$ (bare ion) 3.04(0.10) for q=58$^+$ **
*^{140}Pr T : (H-like ion) and 3.84(0.15) for q=57$^+$ (He–like ion) **
*^{140}Pr D : e$^+$=42.4(2.3)%; ε=57.6(2.3)% for q=58$^+$ (H-like ion) and **
*^{140}Pr D : e$^+$=51.2(3.1)%; ε=48.8(3.1)% for q=57$^+$ (He–like ion) **
*^{140}Nd^n E : uncertainty not given, estimated by evaluator **
*^{140}Nd^n T : average 13Va10=1.2(0.1) 08Fe02=1.23(0.07) **
*^{140}Eu^m E : less than 50 keV above 185.3 level, from ENSDF, thus 185.3 + 25(15) **
*^{140}Eu^n E : 459.5(0.3) keV above ^{140}Eu^m **
*^{140}Tb T : average 06Xu03=2.0(0.5) 00Xu08=2.1(0.4) 91Fi03=2.4(0.2) 86Wi15=2.4(0.4) **
*^{140}Ho D : from estimated β^+ half-life 400# ms; p observed in 99Ry04 **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{141}Sb	−39110#	500#					100#	ms		$7/2^+$#					β^- ?; β^-n=90#; β^-2n=3#	
^{141}Te	−50490#	400#					150#	ms	(>150 ns)	$5/2^-$#	14	94Be24	I	1994	β^- ?; β^-n=8#; β^-2n=0.4#	
^{141}I	−59927	16					430	ms	20	$7/2^+$#	14			1974	β^-=100; β^-n=21 3	*
^{141}Xe	−68197.3	2.9					1.73	s	0.01	$5/2^{(-\#)}$	14			1951	β^-=100; β^-n=0.044 5	
^{141}Cs	−74478	9					24.84	s	0.16	$7/2^+$	14			1962	β^-=100; β^-n=0.035 3	
^{141}Ba	−79733	5					18.27	m	0.07	$3/2^-$	14			1945	β^-=100	
^{141}La	−82932	4					3.92	h	0.03	$(7/2^+)$	14			1951	β^-=100	
^{141}Ce	−85432.9	1.6					32.511	d	0.013	$7/2^-$	14			1948	β^-=100	
^{141}Pr	−86015.6	1.7					STABLE			$5/2^+$	14			1924	IS=100.	
^{141}Nd	−84193	3					2.49	h	0.03	$3/2^+$	14			1949	β^+=100	
^{141}Nd^m	−83436	3	756.51	0.05			62.0	s	0.8	$11/2^-$	14	70Ab05	D	1960	IT≈100; β^+=0.032 8	
^{141}Pm	−80523	14					20.90	m	0.05	$5/2^+$	14			1952	β^+=100	
^{141}Pm^m	−79894	14	628.62	0.07			630	ns	20	$11/2^-$	14			1970	IT=100	
^{141}Pm^n	−77992	14	2530.75	0.17			> 2	μs			14			1985	IT=100	
^{141}Sm	−75934	9					10.2	m	0.2	$1/2^+$	14			1967	β^+=100	
^{141}Sm^m	−75758	9	175.9	0.3			22.6	m	0.2	$11/2^-$	14			1967	β^+≈100; IT=0.31 3	
^{141}Eu	−69926	13					40.7	s	0.7	$5/2^+$	14			1977	β^+=100	
^{141}Eu^m	−69830	13	96.45	0.07			2.7	s	0.3	$11/2^-$	14			1973	IT=86 3; β^+=14 3	*
^{141}Gd	−63224	20					14	s	4	$(1/2^+)$	14			1986	β^+=100; β^+p=0.03 1	*
^{141}Gd^m	−62846	20	377.76	0.09			24.5	s	0.5	$(11/2^-)$	14			1986	β^+=89 2; IT=11 2	
^{141}Tb	−54540	110				*	3.5	s	0.2	$(5/2^-)$	14			1986	β^+=100	
^{141}Tb^m	−54540#	230#	0#	200#	EU	*	7.9	s	0.6	$11/2^-$#	14	88Be.A	I	1988	β^+=100	*
^{141}Dy	−45380#	300#					900	ms	140	$(9/2^-)$	14			1984	β^+=100; β^+p=?	
^{141}Ho	−34360#	400#					4.1	ms	0.1	$(7/2^-)$	14			1998	p=?; β^+=1#; β^+p ?	*
^{141}Ho^m	−34290#	400#	66	2			7.3	μs	0.3	$(1/2^+)$	14			1998	p=100	

*^{141}I D : rounded from 21.2(3.0); 80Al15=21.2(3.0) included in 93Ru01=22(3) **
*^{141}Eu^m D : symmetrized from IT=87(+2–4)% and β^+=13(+4–2)% **
*^{141}Gd J : weak arguments in ENSDF'2001 for J^π assignment; same for ^{141}Gd^m **
*^{141}Tb^m I : existence discussed in 88Be.A. Provisionally accepted **
*^{141}Ho D : from estimated β^+ half-life 200# ms **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{142}Te	−46370#	500#				100#	ms	(>150 ns)	0^+	11	94Be24	I	1994	β^- ?; β^-n=10#; β^-2n=0#	
^{142}I	−54770	370				222	ms	12	2^-#	11			1975	β^-=100; β^-n=20#; β^-2n=1#	
^{142}Xe	−65229.6	2.7				1.23	s	0.02	0^+	11			1960	β^-=100; β^-n=0.21 6	*
^{142}Cs	−70515	7				1.684	s	0.014	0^-	11			1962	β^-=100; β^-n=0.090 4	
^{142}Ba	−77842	6				10.6	m	0.2	0^+	11			1959	β^-=100	*
^{142}La	−80024	6				91.1	m	0.5	2^-	11			1953	β^-=100	
^{142}La^m	−79878	6	145.82	0.08		870	ns	170	$(4)^-$	11			1983	IT=100	
^{142}Ce	−84533.2	2.5				STABLE		(>50 Py)	0^+	11			1925	IS=11.114 51; α ?; 2β^- ?	*
^{142}Pr	−83787.5	1.7				19.12	h	0.04	2^-	11			1935	$\beta^-\approx$100; ε=0.0164 8	
^{142}Pr^m	−83783.8	1.7	3.694	0.003		14.6	m	0.5	5^-	11			1967	IT=100	
^{142}Nd	−85950.0	1.4				STABLE			0^+	11			1924	IS=27.152 40	
^{142}Nd^m	−83740.7	1.4	2209.303	0.021		16.5	μs		6^+	14			1964	IT=100	
^{142}Pm	−81142	24				40.5	s	0.5	1^+	11			1959	e$^+$=77.1 27; ε=22.9 27	*
^{142}Pm^m	−80259	24	883.17	0.16		2.0	ms	0.2	$(8)^-$	11			1971	IT=100	
^{142}Pm^n	−78313	24	2828.7	0.6		67	μs	5	(13^-)	11			1974	IT=100	
^{142}Sm	−78986	3				72.49	m	0.05	0^+	11			1959	β^+=100	
^{142}Sm^m	−76614	3	2372.1	0.4		170	ns	2	7^-	11			1975	IT=100	
^{142}Sm^n	−75324	3	3662.2	0.7		480	ns	60	10^+	11			1979	IT=100	
^{142}Eu	−71310	30				2.36	s	0.10	1^+	11	91Fi03	T	1966	β^+=100	*
^{142}Eu^m	−70856	12	460	30	BD	1.223	m	0.008	8^-	11			1966	β^+=100	
^{142}Gd	−66960	28				70.2	s	0.6	0^+	11			1986	ε=52 5,e$^+$=48 5	
^{142}Tb	−56560	700				597	ms	17	1^+	11			1991	β^+=100; β^+p=0.0022 11	
^{142}Tb^m	−56280	700	279.7	0.4		303	ms	17	5^-	11			1986	IT=100	
^{142}Tb^n	−55910	700	652.1	0.6		26	μs	1	8^+	11			1989	IT=100	
^{142}Dy	−50120#	730#				2.3	s	0.3	0^+	11			1986	β^+=100; β^+p=0.06 3	
^{142}Ho	−37250#	400#				400	ms	100	$(7^-,8^+)$	11			2001	$\beta^+\approx$100; β^+p=?; p$\approx$0	*
^{142}Er	−28030#	500#				10#	μs		0^+					p ?	

*^{142}Xe D : 03Be05=0.21(6) 75As04=0.406(0.034) T : 03Be05=1.250(0.025) **
*^{142}Ba D : β^-n=0.091(0.003)% in ENSDF'00 contradicts $Q(\beta^-$n)=–2979(7) keV **
*^{142}Ce T : lower limit is for α decay; for $\beta\beta$ decay 11Be02>300Py 01Da22>260 Py **
*^{142}Pm T : other: 09Wi09=56(3) for q=61$^+$ (bare ion) 39.2(0.7) for q=60$^+$ **
*^{142}Pm T : (H-like ion) and 39.6(1.4) for q=59$^+$ (He–like ion) **
*^{142}Pm D : e$^+$=71.0(1.3)%; ε=29.0(1.3)% for q=60$^+$ (H-like ion) and **
*^{142}Pm D : e$^+$=79.8(1.0)%; ε=20.2(1.0)% for q=59$^+$ (He–like ion) **
*^{142}Eu T : average 91Fi03=2.34(0.12) 75Ke08=2.4(0.2) **
*^{142}Ho D : p=0 from 93Li40 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{143}Te	−40280#	500#				100#	ms	(>400 ns)	$7/2^+$#	12			2010	β^- ?; β^-n=20#; β^-2n=2#	
^{143}I	−50630#	200#				130	ms	45	$7/2^+$#	12			1994	β^- ?; β^-n=70#; β^-2n=0.02#	
^{143}Xe	−60203	5				511	ms	6	$5/2^-$	12	03Be05	D	1951	β^-=100; β^-n=1.00 15	
^{143}Cs	−67676	8				1.791	s	0.007	$3/2^+$	12			1962	β^-=100; β^-n=1.64 7	
^{143}Ba	−73937	7				14.5	s	0.3	$5/2^-$	12			1962	β^-=100	
^{143}La	−78172	7				14.2	m	0.1	$(7/2)^+$	12			1951	β^-=100	
^{143}Ce	−81606.7	2.5				33.039	h	0.006	$3/2^-$	12			1948	β^-=100	
^{143}Pr	−83068.2	1.9				13.57	d	0.02	$7/2^+$	12			1948	β^-=100	
^{143}Nd	−84002.2	1.4				STABLE			$7/2^-$	12			1933	IS=12.174 26	
^{143}Pm	−82960.7	3.0				265	d	7	$5/2^+$	12			1952	ε=100; e$^+$<5.7e–6	
^{143}Sm	−79517.2	2.8				8.75	m	0.06	$3/2^+$	12			1956	β^+=100	
^{143}Sm^m	−78763.2	2.8	753.99	0.16		66	s	2	$11/2^-$	12			1960	IT$\approx$100; β^+=0.24 5	
^{143}Sm^n	−76723	3	2793.8	1.3		30	ms	3	$23/2^-$	12	FGK128	J	1969	IT=100	*
^{143}Eu	−74241	11				2.59	m	0.02	$5/2^+$	12			1965	β^+=100	
^{143}Eu^m	−73851	11	389.51	0.04		50.0	μs	0.5	$11/2^-$	12			1978	IT=100	
^{143}Gd	−68230	200				39	s	2	$(1/2)^+$	12	78Fi02	D	1975	β^+=100; β^+p=?; $\beta^+\alpha$=?	*
^{143}Gd^m	−68080	200	152.6	0.5		110.0	s	1.4	$11/2^-$	12	78Fi02	D	1973	β^+=100; β^+p=?; $\beta^+\alpha$=?	*
^{143}Tb	−60420	50			*	12	s	1	$(11/2^-)$	12			1985	β^+=100	
^{143}Tb^m	−60420#	110#	0#	100#	*		s	<21s	$5/2^+$#	12			1986	β^+ ?	
^{143}Dy	−52169	13				5.6	s	1.0	$(1/2^+)$	12	03Xu04	J	1983	β^+=100; β^+p=?	*
^{143}Dy^m	−51858	13	310.7	0.6		3.0	s	0.3	$(11/2^-)$	12	03Xu04	EJD	2003	β^+=100; β^+p=?	
^{143}Dy^n	−51763	13	406.3	0.8		1.2	μs	0.3		12	05Ri17	E	2005	IT=100	*
^{143}Ho	−42050#	300#				300#	ms	(>200 ns)	$11/2^-$#	12	00So11	I	2000	β^+ ?; β^+p ?	
^{143}Er	−31260#	400#				200#	ms		$9/2^-$#	12				β^+ ?; β^+p ?	

*^{143}Sm^n J : E3 to 17/2$^+$ **
*^{143}Gd D : 78Fi02: β^+p and/or $\beta^+\alpha$ for ^{143}Gd+^{143}Gd^m=0.001%, 39 particles detected **
*^{143}Gd^m J : from 05Ba64 **
*^{143}Dy T : 03Xu04=5.6(1.0); 84Ni03=3.2(0.6) 83Ni05=4.1(0.3) in diff. experiments **
*^{143}Dy^n E : 95.6(0.5) above 11/2$^-$ isomer **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{144}I	−45280#	400#				100#	ms	(>150 ns)	1^-#	01	94Be24	I	1994	β^- ?; β^-n=40#; β^-2n=1#	
^{144}Xe	−56872	5				388	ms	7	0^+	01	03Be05	TD	2003	β^-=100; β^-n=3.0 3	
^{144}Cs	−63271	20			*	994	ms	6	$1^{(-)}$	10			1967	β^-=100; β^-n=3.03 13	
^{144}Cs^m	−63179	20	92.2	0.5		1.1	μs	0.1	(4^-)	10			2009	IT=100	
^{144}Cs^n	−62970#	200#	300#	200#	*	< 1	s		(> 3)	10			1978	β^-=?; IT ?	
^{144}Ba	−71767	7				11.5	s	0.2	0^+	01			1967	β^-=100	*
^{144}La	−74850	13				40.8	s	0.4	(3^-)	01			1967	β^-=100	
^{144}Ce	−80431.9	2.9				284.91	d	0.05	0^+	01			1945	β^-=100	
^{144}Pr	−80750.5	2.8				17.28	m	0.05	0^-	01			1951	β^-=100	
^{144}Pr^m	−80691.5	2.8	59.03	0.03		7.2	m	0.3	3^-	01			1970	IT≈100; β^-=0.07	
^{144}Nd	−83748.0	1.4				2.29	Py	0.16	0^+	01			1924	IS=23.798 19; α=100	
^{144}Pm	−81416.1	3.0				363	d	14	5^-	01	94Hi05	D	1952	ε=100; e$^+$<8e–5	
^{144}Pm^m	−80575	3	840.90	0.05		780	ns	200	$(9)^+$	01			1993	IT=100	
^{144}Pm^n	−72820	4	8595.8	2.2		2.7	μs		(27^+)	01			1994	IT=100	
^{144}Sm	−81965.5	1.6				STABLE			0^+	01			1933	IS=3.07 7; 2β^+ ?	
^{144}Sm^m	−79641.9	1.6	2323.60	0.08		880	ns	25	6^+	01			1972	IT=100	
^{144}Eu	−75619	11				10.2	s	0.1	1^+	01			1965	β^+=100	
^{144}Eu^m	−74491	11	1127.6	0.6		1.0	μs	0.1	8^-	01	FGK127	J	1976	IT=100	*
^{144}Gd	−71760	28				4.47	m	0.06	0^+	01			1968	β^+=100	
^{144}Gd^m	−68327	28	3433.1	0.5		145	ns	30	(10^+)	01			1978	IT=100	
^{144}Tb	−62368	28				1	s		1^+	01			1982	β^+=100	
^{144}Tb^m	−61971	28	396.9	0.5		4.25	s	0.15	(6^-)	01			1982	IT=66; β^+=34	*
^{144}Tb^n	−61892	28	476.2	0.5		2.8	μs	0.3	(8^-)	01			1996	IT=100	
^{144}Tb^p	−61851	28	517.1	0.5		670	ns	60	(9^+)	01			1996	IT=100	
^{144}Tb^q	−61824	28	544.5	0.6		< 300	ns		(10^+)	01			1996	IT=100	
^{144}Dy	−56570	7				9.1	s	0.4	0^+	01			1986	β^+=100; β^+p=?	
^{144}Ho	−44610	8				700	ms	100	(5^-)	08			1986	β^+=100; β^+p=?	
^{144}Ho^m	−44345	8	265.3	0.3		519	ns	5	(8^+)	08	10Ma08	T	2001	IT=100	
^{144}Er	−36610#	200#				400#	ms	(>200 ns)	0^+	06			2003	β^+ ?	
^{144}Tm	−22260#	400#				2.3	μs	0.9	(10^+)	08			2005	p=?; β^+=0#	*

*^{144}Ba D : β^-n=3.6(0.7)% in ENSDF'01 belongs in fact to ^{144}Cs; β^-n not allowed **
*^{144}Eu^m J : E2 to 6^- **
*^{144}Tb^m T : other 03Li42=12(2) s for q=65$^+$ (bare ion) **
*^{144}Tm T : symmetrized from 1.9(+1.2–0.5) μs **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{145}I	−40940#	500#				100#	ms	(>400 ns)	$7/2^+$#	10	10Oh02	I	2010	β^- ?; β^-n=40#; β^-2n=0.3#	
^{145}Xe	−51493	11				188	ms	4	$3/2^-$#	09			2003	β^-=100; β^-n=5.0 6; β^-2n=0#	
^{145}Cs	−60054	9				582	ms	6	$3/2^+$	09	93Ru01	T	1971	β^-=100; β^-n=14.7 9	*
^{145}Cs^m	−59291	9	762.9	0.4		500	ns	100	$19/2^-$#		15YaZW	TD	2015	IT=100	*
^{145}Ba	−67516	8				4.31	s	0.16	$5/2^-$	09			1974	β^-=100	
^{145}La	−72835	12				24.8	s	2.0	$(5/2^+)$	09			1974	β^-=100	
^{145}Ce	−77070	30				3.01	m	0.06	$5/2^-$#	09			1954	β^-=100	
^{145}Pr	−79626	7				5.984	h	0.010	$7/2^+$	09			1954	β^-=100	
^{145}Nd	−81432.0	1.4				STABLE			$7/2^-$	09			1933	IS=8.293 12	
^{145}Pm	−81267.5	2.9				17.7	y	0.4	$5/2^+$	09			1951	ε=100; α=2.8e–7	
^{145}Sm	−80651.3	1.6				340	d	3	$7/2^-$	09			1947	ε=100	
^{145}Sm^m	−71865.1	1.7	8786.2	0.7		990	ns	170	$(49/2^+)$	09			1993	IT=100	*
^{145}Eu	−77992	3				5.93	d	0.04	$5/2^+$	09			1951	β^+=100	
^{145}Eu^m	−77276	3	716.0	0.3		490	ns	30	$11/2^-$	09			1975	IT=100	
^{145}Gd	−72926	20				23.0	m	0.4	$1/2^+$	09			1959	β^+=100	
^{145}Gd^m	−72177	20	749.1	0.2		85	s	3	$11/2^-$	09			1969	IT=94.3 5; β^+=5.7 5	
^{145}Tb	−66390	110			* &	30.9	s	0.6	$(11/2^-)$	09			1981	β^+=100	
^{145}Tb^m	−65540	200	850	230	BD * &				$(3/2^+)$	09			1993	β^+ ?	
^{145}Dy	−58243	7				9.5	s	1.0	$(1/2^+)$	09	93Al03	T	1982	β^+=100; β^+p=?	*
^{145}Dy^m	−58125	7	118.2	0.2		14.1	s	0.7	$(11/2^-)$	09			1982	β^+=100; β^+p≈50	
^{145}Ho	−49120	7			*	2.4	s	0.1	$11/2^-$#	09			1987	β^+=100	
^{145}Ho^m	−49020#	100#	100#	100#	*	100#	ms		$5/2^+$#					β^+ ?; IT ?	
^{145}Er	−39240#	200#				900	ms	300	$1/2^+$#	09			1989	β^+=100; β^+p=?	*
^{145}Er^m	−39040#	200#	205	4	p	1.0	s	0.3	$11/2^-$#		10Ma20	T	2010	β^+ ?	
^{145}Tm	−27580#	200#				3.17	μs	0.20	$(11/2^-)$	09			1998	p=100	

*^{145}Cs T : average 93Ru01=579(6) 82Ra13=594(13); other 16Wu.At=613(+32–24) **
*^{145}Cs^m E : 16Ya.A=762.9(0.4) **
*^{145}Sm^m T : symmetrized from 960(+190–150) **
*^{145}Dy T : average 93Al03=10.5(1.5) 93To04=6(2) 84Sc.C=10(1) **
*^{145}Er T : 89Vi02=900(300) for mixture gs+isomer; similarly 900(200) from 10Ma20 **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{146}Xe	−47955	24					146	ms	6	0^+	97	03Be05	TD	1989	β^-=100; β^-n=6.9 15	
^{146}Cs	−55310.4	2.9					323	ms	6	1^-	97	93Ru01	T	1971	β^-=100; β^-n=14.2 5; β^-2n=0#	*
^{146}Cs^m	−55263.7	2.9	46.7	0.1			1.25	μs	0.05	4^-#		15YaZW	TD	2015	IT=100	*
^{146}Ba	−64947	21					2.22	s	0.07	0^+	97	93Ru01	D	1970	β^-=100	*
^{146}La	−69050	30				*	6.27	s	0.10	2^-	97	93Ru01	D	1970	β^-=100	*
^{146}La^m	−68920	130	130	130		*	10.0	s	0.1	(6^-)	97	79Ke02	E	1969	β^-=100	*
^{146}Ce	−75635	16					13.52	m	0.13	0^+	97			1953	β^-=100	
^{146}Pr	−76680	30					24.15	m	0.18	$(2)^-$	97			1953	β^-=100	
^{146}Nd	−80925.9	1.4					STABLE			0^+	97			1924	IS=17.189 32; 2β^- ?; α ?	
^{146}Pm	−79454	4					5.53	y	0.05	3^-	99			1960	ε=66.0 13; β^-=34.0 13	
^{146}Sm	−80996	3					68	My	7	0^+	97	12Ki16	T	1953	α=100	
^{146}Eu	−77118	6					4.61	d	0.03	4^-	97			1957	β^+=100	
^{146}Eu^m	−76452	6	666.37	0.16			235	μs	3	9^+	97			1962	IT=100	
^{146}Gd	−76086	4					48.27	d	0.10	0^+	01			1957	ε=100	
^{146}Tb	−67760	40				*	8	s	4	1^+	97			1974	β^+=100	
^{146}Tb^m	−67610#	110#	150#	100#		*	24.1	s	0.5	5^-	97	93Al03	T	1974	β^+=100	
^{146}Tb^n	−66830#	110#	930#	100#			1.18	ms	0.02	(10^+)	97			1989	IT=100	*
^{146}Dy	−62555	7					33.2	s	0.7	0^+	97	93Al03	T	1981	β^+=100	
^{146}Dy^m	−59619	7	2935.7	0.6			150	ms	20	(10^+)	97	FGK128	J	1982	IT=100	*
^{146}Ho	−51238	7					2.8	s	0.5	(6^-)	97	10Ma37	TJ	1982	β^+=100; β^+p=?	*
^{146}Er	−44322	7					1.7	s	0.6	0^+	97	93To05	D	1993	β^+=100; β^+p=?	
^{146}Tm	−31060#	200#					155	ms	20	(1^+)		05Ro40	TJD	1993	p≈100; β^+ ?; β^+p ?	*
^{146}Tm^m	−30750#	200#	304	6	p		75	ms	7	(5^-)	02	06Ta08	TJ	1993	p≈100; β^+ ?; β^+p ?	*
^{146}Tm^n	−30620#	200#	437	7	p		200	ms	3	(10^+)	02	06Ta08	TJ	1993	p=?; β^+=16#; β^+p ?	*

*^{146}Cs T : average 93Ru01=321(2) 76Lu02=343(7); other 16Wu.A=288(13) **
*^{146}Cs^m E : 16Ya.A=46.7(0.1) **
*^{146}Ba D : 93Ru01 β^-n<0.02% is not relevant since $Q(\beta^-$n)=–176(24) is negative **
*^{146}La D : 93Ru01 β^-n<0.007% is not relevant since $Q(\beta^-$n)=–50(50) is negative **
*^{146}La^m E : derived from Q(^{146}La^m)=6660(120) in 79Ke02 **
*^{146}Tb^n E : 779.6 keV above ^{146}Tb^m, from ENSDF **
*^{146}Dy^m J : E3 to (7^-) **
*^{146}Ho J : from β^+p branching in 10Ma37; supported by β^+p spectrum from 85Wi15 **
*^{146}Tm T : also 05Bb02=190(80) ms **
*^{146}Tm^m T : unweighed average 06Ta08=68(3) 05Ro40=82(4); 05Bb02=75(3)superseded in 06Ta08 **
*^{146}Tm^n T : average 07DaZU=213(9) 06Ta08=198(3) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{147}Xe	−42360#	200#					130	ms	80	$3/2^-$#	09			1994	β^-=100; β^-n=4.0 23; β^-2n=0.01#	*
^{147}Cs	−51920	8					230	ms	1	$(3/2^+)$	09			1978	β^-=100; β^-n=28.5 17	
^{147}Cs^m	−51219	8	701.4	0.4			190	ns	20	$19/2^-$#		15YaZW	TD	2015	IT=100	*
^{147}Ba	−60264	20					894	ms	10	$5/2^-$	09	13Rz01	J	1978	β^-=100; β^-n=0.06 3	
^{147}La	−66678	11					4.06	s	0.04	$(5/2^+)$	09	96Ur02	J	1979	β^-=100; β^-n=0.041 4	
^{147}Ce	−72014	9					56.4	s	1.0	$(5/2^-)$	09			1964	β^-=100	
^{147}Pr	−75444	16					13.4	m	0.3	$3/2^+$	09	15Wa28	J	1964	β^-=100	
^{147}Nd	−78146.7	1.4					10.98	d	0.01	$5/2^-$	09			1947	β^-=100	
^{147}Pm	−79042.3	1.4					2.6234	y	0.0002	$7/2^+$	09			1947	β^-=100	
^{147}Sm	−79266.4	1.4					106.6	Gy	0.7	$7/2^-$	09	09Ko15	T	1933	IS=14.99 18; α=100	
^{147}Eu	−77544.8	2.6					24.1	d	0.6	$5/2^+$	09			1951	β^+≈100; α=0.0022 6	
^{147}Eu^m	−76919.5	2.6	625.27	0.05			765	ns	15	$11/2^-$	09			1970	IT=100	
^{147}Gd	−75356.9	2.0					38.06	h	0.12	$7/2^-$	09			1957	β^+=100	
^{147}Gd^m	−66769.1	2.1	8587.8	0.5			510	ns	20	$(49/2^+)$	09			1982	IT=100	
^{147}Tb	−70743	8					1.64	h	0.03	$(1/2^+)$	09			1969	β^+=100	
^{147}Tb^m	−70692	8	50.6	0.9			1.87	m	0.05	$11/2^-$#	09	93Al03	T	1987	β^+=100	*
^{147}Dy	−64196	9					67	s	7	$(1/2^+)$	09			1975	β^+=100; β^+p≈0.05	
^{147}Dy^m	−63446	9	750.5	0.4			55.2	s	0.5	$(11/2^-)$	09			1976	β^+=68.9 23; IT=31.1 23	
^{147}Dy^n	−60789	9	3407.2	0.8			400	ns	10	$(27/2^-)$	09			1985	IT=100	
^{147}Ho	−55757	5					5.8	s	0.4	$(11/2^-)$	09			1982	β^+=100	
^{147}Ho^m	−53070	5	2687.1	0.4			315	ns	30	$(27/2^-)$	09			1982	IT=100	
^{147}Er	−46610	40				*	3.2	s	1.2	$(1/2^+)$	09	10Ma27	T	1992	β^+=100; β^+p=?	
^{147}Er^m	−46510#	60#	100#	50#		*	1.6	s	0.2	$(11/2^-)$	09	10Ma27	T	1982	β^+=100; β^+p=?	*
^{147}Tm	−35974	7					580	ms	30	$11/2^-$	09			1982	β^+=85 5; p=15 5	
^{147}Tm^m	−35913	7	62	5	p		360	μs	40	$3/2^+$	09			1984	p=100	

*^{147}Xe T : symmetrized from 100(+100–50) D : from β^-n<8% **
*^{147}Cs^m E : 16Ya.A=701.4(0.4) **
*^{147}Tb^m T : average 93Al03=1.92(0.07) 73Bo13=1.83(0.06) **
*^{147}Er^m E : estimated from $11/2^-$ level in isotones ^{141}Sm=175 ^{143}Gd=152 ^{145}Dy=118 **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{148}Xe	−38600#	300#			100#	ms	(>400 ns)	0^+	14	10Oh02	I	2010	β^- ?; β^-n=10#; β^-2n=0#	
^{148}Cs	−46911	13			145	ms	4		14	16Wu.A	T	1978	β^-=100; β^-n=25.1 25; β^-2n=0#	*
^{148}Cs^m	−46866	13	45.2	0.1	4.8	μs	0.2	4^-#		15YaZW	TD	2015	IT=100	*
^{148}Ba	−57590	60			620	ms	5	0^+	14	16Wu.A	T	1979	β^-=100; β^-n=0.4 3	*
^{148}La	−62709	19			1.35	s	0.04	(2^-)	14	16Wu.A	T	1969	β^-=100; β^-n=0.15 3	*
^{148}Ce	−70398	11			56.8	s	0.3	0^+	14			1964	β^-=100	
^{148}Pr	−72535	15			2.29	m	0.02	1^-	14			1964	β^-=100	
^{148}Pr^m	−72458	15	76.80	0.20	2.01	m	0.07	(4)	14			1964	β^-=64 10; IT=36 10	
^{148}Nd	−77408.0	2.1			STABLE		(>3.0 Ey)	0^+	14	82Be20	T	1937	IS=5.756 21; 2β^- ?; α ?	*
^{148}Pm	−76866	6			5.368	d	0.007	1^-	14			1947	β^-=100	
^{148}Pm^m	−76728	6	137.9	0.3	41.29	d	0.11	$5^-,6^-$	14			1951	β^-=95.8 6; IT=4.2 6	
^{148}Sm	−79336.3	1.4			6.3	Py	1.3	0^+	14	16Ca.1	T	1933	IS=11.24 10; α=100	*
^{148}Eu	−76299	10			54.5	d	0.5	5^-	14			1951	β^+=100; α=9.4e–7 28	
^{148}Eu^m	−75579	10	720.4	0.3	162	ns	8	9^+	14			1980	IT=100	
^{148}Gd	−76269.3	1.6			70.9	y	1.0	0^+	14	03Fu10	T	1953	α=100; 2β^+ ?	*
^{148}Tb	−70537	12			60	m	1	2^-	14			1960	β^+=100	
^{148}Tb^m	−70447	12	90.1	0.3	2.20	m	0.05	$(9)^+$	14			1973	β^+=100	
^{148}Tb^n	−61918	12	8618.6	1.0	1.310	μs	0.007	(27^+)	14			1980	IT=100	
^{148}Dy	−67860	9			3.3	m	0.2	0^+	14			1974	β^+=100	
^{148}Dy^m	−64941	9	2919.1	1.0	471	ns	20	10^+	14			1978	IT=100	
^{148}Ho	−57990	80			2.2	s	1.1	(1^+)	14			1979	β^+=100	
^{148}Ho^m	−57740#	130#	250#	100#	9.49	s	0.12	$5\#^{(-)}$	14	93Al03	T	1979	β^+=100; β^+p=0.08 1	*
^{148}Ho^n	−57050#	130#	940#	100#	2.36	ms	0.06	$(10)^+$	14			1984	IT=100	*
^{148}Er	−51479	10			4.6	s	0.2	0^+	14			1982	β^+=100; β^+p≈0.15	
^{148}Er^m	−48566	10	2913.2	0.4	13	μs	3	(10^+)	14			1982	IT=100	
^{148}Tm	−38765	10			700	ms	200	(10^+)	14			1982	β^+=100; β^+p ?	
^{148}Yb	−30330#	400#			250#	ms		0^+					β^+ ?; β^+p ?	

*^{148}Cs T : average 16Wu.A=144(5) 93Ru01=140(12) 86Hi08=158(7) 86Wa17=130(10) and **
*^{148}Cs T : 78Ko29=130(40) **
*^{148}Cs^m E : 16Ya.A=45.2(0.1) **
*^{148}Ba T : average 16Wu.A=621(11) 86Wa17=620(5) 84Ch02=607(25) 82Ga24=630(50) **
*^{148}La T : unweighed average 16Wu.A=1.27(+0.10–0.09) 86Wa17=1.40(0.02) **
*^{148}La T : 93Ru01=1.428(0.012) and 69Wi.A=1.29(0.08) **
*^{148}Nd T : lower limit is for 2β^- decay **
*^{148}Sm T : symmetrized from 16Ca.1=6.4(+1.2–1.3) Py **
*^{148}Gd T : 81Pr06=74.6(3.0) unweighed not used **
*^{148}Ho^m T : average 93Al03=9.30(0.20) 89Ta11=9.59(0.15) **
*^{148}Ho^n E : 694.4 keV above ^{148}Ho^m, from ENSDF **

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{149}Cs	−43250#	400#			113	ms	8	$3/2^+$#	04	16Wu.A	TD	1979	β^-=100; β^-n=60#; β^-2n=0#	
^{149}Ba	−53120	440			348	ms	4	$3/2^-$#	04	16Wu.A	T	1993	β^-=100; β^-n=0.43 12	*
^{149}La	−60220	200			1.07	s	0.02	$(3/2^-)$	07	16Wu.A	T	1979	β^-=100; β^-n=1.43 28	*
^{149}Ce	−66670	10			4.94	s	0.04	$3/2^-$#	04	96Ya.A	T	1974	β^-=100	
^{149}Pr	−71039	10			2.26	m	0.07	$(5/2^+)$	04			1964	β^-=100	
^{149}Nd	−74375.5	2.1			1.728	h	0.001	$5/2^-$	04			1938	β^-=100	
^{149}Pm	−76064.3	2.3			53.08	h	0.05	$7/2^+$	04			1947	β^-=100	
^{149}Pm^m	−75824.1	2.3	240.214	0.007	35	μs	3	$11/2^-$	04			1966	IT=100	
^{149}Sm	−77135.7	1.3			STABLE		(>2 Py)	$7/2^-$	04			1933	IS=13.82 7; α ?	
^{149}Eu	−76441	4			93.1	d	0.4	$5/2^+$	04			1959	ε=100	
^{149}Eu^m	−75945	4	496.386	0.002	2.45	μs	0.05	$11/2^-$	04			1961	IT=100	
^{149}Gd	−75127	3			9.28	d	0.10	$7/2^-$	04			1951	β^+=100; α=4.3e–4 10	
^{149}Tb	−71489	4			4.118	h	0.025	$1/2^+$	04			1950	β^+=83.3 17; α=16.7 17	
^{149}Tb^m	−71453	4	35.78	0.13	4.16	m	0.04	$11/2^-$	04			1962	β^+≈100; α=0.022 3	
^{149}Dy	−67696	9			4.20	m	0.14	$7/2^{(-)}$	04	88Ah02	J	1958	β^+=100	
^{149}Dy^m	−65035	9	2661.1	0.4	490	ms	15	$(27/2^-)$	04			1976	IT=99.3 3; β^+=0.7 3	*
^{149}Ho	−61647	12			21.1	s	0.2	$(11/2^-)$	04			1979	β^+=100	
^{149}Ho^m	−61598	12	48.80	0.20	56	s	3	$(1/2^+)$	04			1988	β^+=100	
^{149}Er	−53742	28			4	s	2	$(1/2^+)$	04			1984	β^+=100; β^+p=7 2	
^{149}Er^m	−53000	28	741.8	0.2	8.9	s	0.2	$(11/2^-)$	04			1984	β^+=96.5 7; IT=3.5 7; β^+p=0.18 7	
^{149}Er^n	−51131	28	2611.1	0.3	610	ns	80	$(19/2^+)$	04			1987	IT=100	
^{149}Er^p	−50470	30	3272	20	4.8	μs	0.1	$(27/2^-)$	04			1987	IT=100	*
^{149}Tm	−43880#	200#			900	ms	200	$(11/2^-)$	04			1987	β^+=100; β^+p=0.26 15	*
^{149}Yb	−33200#	300#			700	ms	200	$(1/2^+)$	04	05Xu04	J	2001	β^+=100; β^+p≈100	*

*^{149}Ba T : average 16Wu.A=352(6) 93Ru01=324(18) 86Wa17=346(6) **
*^{149}La T : average 16Wu.A=1.11(0.04) 93Ru01=1.066(0.034) 86Wa17=1.04(0.04) **
*^{149}Dy^m T : other 03Li42=11(1) s for q=66$^+$ (bare ion) **
*^{149}Er^p E : 3242.7 + 30(20) keV **
*^{149}Tm D : symmetrized from β^+p=0.2(+0.2–0.1)% **
*^{149}Yb J : ($1/2^+$,$3/2^+$) in ENSDF2004 and 1/2 in 05Xu04; 06Xu07=($1/2^-$) however, **
*^{149}Yb J : no $1/2^-$ ground-state or isomer for e–o in this region **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{150}Cs	−38170#	400#					84.4	ms	8.2		13	16Wu.A	TD	1979	β^-=100; β^-n=80#; β^-2n=2#	
^{150}Ba	−49900#	300#					259	ms	5	0^+	13	16Wu.A	T	1994	β^-=100; β^-n=1#	
^{150}La	−56130	440					504	ms	15	(3^+)	13	16Wu.A	T	1993	β^-=100; β^-n=2.7 3	*
^{150}Ce	−64847	12					6.05	s	0.07	0^+	13	15Ko23	T	1970	β^-=100	
^{150}Pr	−68300	9					6.19	s	0.16	1^-	13	15Ko23	J	1970	β^-=100	*
^{150}Nd	−73679.8	1.3					8.2	Ey	0.9	0^+	13	15Ba11	T	1937	IS=5.638 28; 2β^-=100	*
^{150}Pm	−73597	20					2.698	h	0.015	(1^-)	13			1952	β^-=100	
^{150}Sm	−77051.1	1.3					STABLE			0^+	13			1934	IS=7.38 1	
^{150}Eu	−74792	6					36.9	y	0.9	$5^{(-\#)}$	13			1950	β^+=100	
^{150}Eu^m	−74750	6	41.7	1.0			12.8	h	0.1	0^-	13			1953	β^-=89 2; β^+=11 2; IT≤5e–8	
^{150}Gd	−75764	6					1.79	My	0.08	0^+	13			1953	α=100; 2β^+ ?	
^{150}Tb	−71106	7					3.48	h	0.16	$(2)^-$	13			1959	β^+≈100; α<0.05	
^{150}Tb^m	−70645	26	461	27	MD		5.8	m	0.2	9^+	13			1993	β^+≈100; IT ?	
^{150}Dy	−69310	4					7.17	m	0.05	0^+	13			1959	β^+=64 5; α=36 5	
^{150}Ho	−61946	14				*	76.8	s	1.8	$(2)^-$	13	93Al03	T	1963	β^+=100	*
^{150}Ho^m	−61950	50	−0	50	BD	*	23.3	s	0.3	$(9)^+$	13			1980	β^+=100	
^{150}Ho^n	−54050	50	7900	50			787	ns	36	(28^-)	13			2006	IT=100	*
^{150}Er	−57831	17					18.5	s	0.7	0^+	13			1982	β^+=100	
^{150}Er^m	−55035	17	2796.5	0.5			2.55	μs	0.10	10^+#	13			1984	IT=100	
^{150}Tm	−46490#	200#				* &	3#	s		(1^+)		88Ni02	J	1982	β^+=100	
^{150}Tm^m	−46350#	240#	140#	140#		* &	2.20	s	0.06	(6^-)	13			1981	β^+=100; β^+p=1.2 3	
^{150}Tm^n	−45680#	240#	810#	140#			5.2	ms	0.3	10^+#	13			1984	IT=100	*
^{150}Yb	−38640#	300#					700#	ms	(>200 ns)	0^+	13			2000	β^+ ?	
^{150}Lu	−24640#	300#					45	ms	3	$(5^-,6^-)$	13	00Gi01	J	1993	p=?; β^+=29#	
^{150}Lu^m	−24620#	300#	22	5	p		40	μs	7	$(1^+,2^+)$	13	00Gi01	J	1998	p=100	*

*^{150}La T : average 16Wu.At=510(+10–22) 95Ok02=510(30) **
*^{150}Pr T : also 15Ko23=8.2 s (no unc.) is "apparent" value direct+growth from 150Ce **
*^{150}Nd T : and 15Ba11=120(+30–20) to first exc. 0^+ state **
*^{150}Ho T : average 93Al03=78(2) 82No08=72(4) **
*^{150}Ho^n E : 7912.1(2.3) keV above the $(9)^+$ isomer **
*^{150}Tm^n E : 671.3(1.0) keV above ^{150}Tm^m, from ENSDF **
*^{150}Lu^m T : symmetrized from 03Gi10=39(+8–6) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{151}Cs	−34230#	500#					69	ms	26	$3/2^+$#	09	16Wu.A	TD	1979	β^-=100; β^-n=90#; β^-2n=0.4#	
^{151}Ba	−44940#	400#					167	ms	5	$3/2^-$#	09	16Wu.A	TD	1994	β^-=100; β^-n=7#	
^{151}La	−53310	440					465	ms	24	$5/2^+$#	09	16Wu.A	TD	1994	β^-=100; β^-n=6#	*
^{151}Ce	−61225	18					1.76	s	0.06	$(3/2^-)$	09	10Si03	J	1997	β^-=100	*
^{151}Pr	−66780	12					18.90	s	0.07	$(3/2^-)$	09			1990	β^-=100	
^{151}Pr^m	−66745	12	35.10	0.10			50	μs	8	$(7/2^+)$	09	12Ma03	T	2006	IT=100	
^{151}Nd	−70943.0	1.3					12.44	m	0.07	$3/2^+$	09			1938	β^-=100	
^{151}Pm	−73386	5					28.40	h	0.04	$5/2^+$	09			1952	β^-=100	
^{151}Sm	−74576.3	1.3					90	y	8	$5/2^-$	09			1947	β^-=100	
^{151}Sm^m	−74315.2	1.3	261.13	0.04			1.4	μs	0.1	$(11/2)^-$	09			1973	IT=100	
^{151}Eu	−74652.9	1.3					4.6	Ey	1.2	$5/2^+$	09	14Ca13	T	1933	IS=47.81 6; α=100	
^{151}Eu^m	−74456.7	1.3	196.245	0.010			58.9	μs	0.5	$11/2^-$	09			1958	IT=100	
^{151}Gd	−74189	3					123.9	d	1.0	$7/2^-$	09			1950	ε=100; α=1.0e–6 6	*
^{151}Tb	−71624	4					17.609	h	0.001	$1/2^{(+)}$	09			1953	β^+≈100; α=0.0095 15	
^{151}Tb^m	−71524	4	99.53	0.05			25	s	3	$(11/2^-)$	09			1978	IT=93.4 20; β^+=6.6 20	
^{151}Dy	−68752	3					17.9	m	0.3	$7/2^{(-)}$	09			1959	β^+=?; α=5.6 4	
^{151}Ho	−63623	8					35.2	s	0.1	$11/2^{(-)}$	09	87Ne.A	J	1963	β^+=?; α=22 3	
^{151}Ho^m	−63582	8	41.0	0.2			47.2	s	1.3	$1/2^{(+)}$	09	87Ne.A	J	1963	α=77 18; β^+ ?	*
^{151}Er	−58266	16					23.5	s	2.0	$(7/2^-)$	09			1970	β^+=100	
^{151}Er^m	−55680	16	2586.0	0.5			580	ms	20	$(27/2^-)$	09			1980	IT=95.3 3; β^+=4.7 3	*
^{151}Er^n	−47979	16	10286.6	1.0			420	ns	50	$(65/2^-,61/2^+)$	09	09Fu05	J	1990	IT=100	
^{151}Tm	−50773	19					4.17	s	0.11	$(11/2^-)$	09			1982	β^+=100	
^{151}Tm^m	−50679	20	94	6	AD		6.6	s	2.0	$(1/2^+)$	09			1987	β^+=100	
^{151}Tm^n	−48117	19	2655.67	0.22			451	ns	34	$(27/2^-)$	09			1982	IT=100	
^{151}Yb	−41540	300					1.6	s	0.5	$(1/2^+)$	09	86To12	T	1985	β^+=100; β^+p=?	*
^{151}Yb^m	−40790#	320#	750#	100#			1.6	s	0.5	$(11/2^-)$	09	86To12	T	1986	β^+≈100; β^+p=?; IT=0.4#	*
^{151}Yb^n	−39000#	580#	2540#	500#			2.6	μs	0.7	$19/2^-$#	09			1993	IT=100	*
^{151}Yb^p	−39090#	580#	2450#	500#			20	μs	1	$27/2^-$#	09			1987	IT=100	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{151}Lu	−30110#	300#					78.4	ms	0.9	(11/2$^-$)	09	15Ta12	TJ	1982	p=?; β^+=37#	*
^{151}Lu^m	−30060#	300#	53	4	p		16.5	μs	0.7	(3/2$^+$)	09	15Ta12	TJ	1998	p=100	*

*^{151}La T : symmetrized from 457(+30–18) **
*^{151}Ce T : average 16Wu.A=1.71(0.09) 06Ko25=1.76 (0.06) **
*^{151}Ce I : isomer with T=1.02(0.06) suggested in ENSDF2009 not trusted by NUBASE **
*^{151}Gd D : symmetrized from α=0.8(+0.8–0.4)e–6% **
*^{151}Ho^m D : symmetrized from α=80(+15–20)% **
*^{151}Er^m T : other 03Li42=19(3) s for q=68$^+$ (bare ion) **
*^{151}Yb T : derived from 1.6(0.1), for mixture of ground-state and isomer with almost same half-life **
*^{151}Yb^m E : 740# estimated in 90Ak01 (see ENSDF'09) **
*^{151}Yb^n E : above the 1791.2 keV level above ^{151}Yb^m (see ENSDF'09) **
*^{151}Yb^p E : 2448 keV above ^{151}Yb^m (see ENSDF'97) **
*^{151}Lu D : p=63.4(0.9)% in ENSDF'09, based on predicted β^+ decay half-life≈220 ms **
*^{151}Lu T : average 15Ta12=78(1) 99Bi14=80(2) **
*^{151}Lu^m T : average 15Ta12=17(1) 99Bi14=16(1) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{152}Cs	−28930#	500#					30#	ms							β^- ?; β^-n ?	
^{152}Ba	−41710#	400#					139	ms	8	0$^+$	13	16Wu.A	TD	2010	β^-=100; β^-n=5#	
^{152}La	−49290#	300#					287	ms	16		13	16Wu.A	TD	1994	β^-=100; β^-n=50#	*
^{152}Ce	−58980#	200#					1.42	s	0.02	0$^+$	13	16Wu.A	T	1990	β^-=100	
^{152}Pr	−63758	19					3.57	s	0.11	4$^+$	13	99To04	J	1983	β^-=100	*
^{152}Pr^m	−63643	19	114.8	0.2			4.1	μs	0.1	(3$^+$)	13			1990	IT=100	
^{152}Nd	−70149	24					11.4	m	0.2	0$^+$	13			1969	β^-=100	
^{152}Pm	−71254	26				*	4.12	m	0.08	1$^+$	13			1958	β^-=100	
^{152}Pm^m	−71110	80	140	90	BD	*	7.52	m	0.08	4$^-$	13			1971	β^-=100	
^{152}Pm^n	−71000#	150#	250#	150#		*	13.8	m	0.2	(8)	13			1971	β^-≈100; IT=?	*
^{152}Sm	−74762.6	1.2					STABLE			0$^+$	13			1933	IS=26.75 16	
^{152}Eu	−72888.3	1.3					13.517	y	0.009	3$^-$	13			1938	β^+=72.08 13; β^-=27.92 13	
^{152}Eu^m	−72842.7	1.3	45.5998	0.0004			9.3116	h	0.0013	0$^-$	13			1958	β^-=73 3; β^+=27 3	
^{152}Eu^n	−72823.0	1.3	65.2969	0.0004			940	ns	80	1$^-$	13			1978	IT=100	
^{152}Eu^p	−72810.1	1.3	78.2331	0.0004			165	ns	10	1$^+$	13			1978	IT=100	
^{152}Eu^q	−72798.5	1.3	89.8496	0.0004			384	ns	10	4$^+$	13			1970	IT=100	
^{152}Eu^r	−72740.4	1.3	147.86	0.10			95.8	m	0.4	8$^-$	13	15Hu02	T	1963	IT=100	
^{152}Gd	−74706.9	1.2					108	Ty	8	0$^+$	13			1938	IS=0.20 1; α=100; 2β^+ ?	
^{152}Tb	−70720	40					17.5	h	0.1	2$^-$	13			1959	β^+=100; α<7e–7	
^{152}Tb^m	−70380	40	342.15	0.16			960	ns	10	5$^-$	13			1972	IT=100	
^{152}Tb^n	−70220	40	501.74	0.19			4.2	m	0.1	8$^+$	13			1971	IT=78.9 6; β^+=21.1 6	
^{152}Dy	−70118	5					2.38	h	0.02	0$^+$	13			1958	ε≈100; α=0.100 7	
^{152}Ho	−63605	13					161.8	s	0.3	2$^-$	13			1963	β^+=88 3; α=12 3	
^{152}Ho^m	−63445	13	160	1			49.8	s	0.2	9$^+$	13			1963	β^+=89.2 17; α=10.8 17	
^{152}Ho^n	−60585	13	3019.59	0.19			8.4	μs	0.3	19$^-$	13			1997	IT=100	
^{152}Er	−60500	9					10.3	s	0.1	0$^+$	13			1963	α=90 4; β^+=10 4	
^{152}Tm	−51720	50				*	8.0	s	1.0	(2#)$^-$	13			1980	β^+=100	
^{152}Tm^m	−51820	240	−100	250		*	5.2	s	0.6	(9)$^+$	13			1980	β^+=100	
^{152}Tm^n	−49060#	140#	2665#	130#			294	ns	12	(17$^+$)	13			1986	IT=100	*
^{152}Yb	−46270	150					3.03	s	0.06	0$^+$	13			1982	β^+=100	
^{152}Yb^m	−43530	150	2744.5	1.0			30	μs	1	(10$^+$)	13			1995	IT=100	
^{152}Lu	−33420#	200#					650	ms	70	(4$^-$,5$^-$,6$^-$)	13	88Ni02	T	1987	β^+=100; β^+p=15 7	*

*^{152}La T : symmetrized from 298(+6–23) **
*^{152}Pr T : average 90An31=3.7(0.2) 85Br08=3.8(0.2) 83Hi05=3.24(0.19) **
*^{152}Pm^n E : ENSDF: "Probably feeds 7.52 m level" at 140 keV **
*^{152}Tm^n E : 2555.05(0.19) above ^{152}Tm^m **
*^{152}Lu T : average 88Ni02=600(100) 87To02=700(100) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{153}Ba	−36470#	400#					116	ms	52	5/2$^-$#		16Wu.A	TD	2016	β^-=100; β^-n=3#; β^-2n=0#	
^{153}La	−46060#	300#					245	ms	18	5/2$^+$#	06	16Wu.A	TD	1994	β^-=100; β^-n=50#	
^{153}Ce	−54910#	200#					865	ms	25	3/2$^-$#	06	16Wu.A	TD	1994	β^-=100; β^-n=0.01#	
^{153}Pr	−61568	12					4.28	s	0.11	5/2$^-$#	06			1987	β^-=100; β^-n=0.02#	
^{153}Nd	−67330.3	2.7					31.6	s	1.0	(3/2)$^-$	06			1987	β^-=100	
^{153}Nd^m	−67138.6	2.9	191.7	1.0			1.10	μs	0.04	(5/2$^+$)	06	10Si03	TJ	1996	IT=100	*
^{153}Pm	−70648	9					5.25	m	0.02	5/2$^-$	06			1962	β^-=100	
^{153}Sm	−72559.7	1.2					46.284	h	0.004	3/2$^+$	06			1938	β^-=100	
^{153}Sm^m	−72461.3	1.2	98.37	0.10			10.6	ms	0.3	11/2$^-$	06			1971	IT=100	
^{153}Eu	−73367.2	1.3					STABLE		(>550 Py)	5/2$^+$	06	12Da16	T	1933	IS=52.19 6	
^{153}Eu^m	−71596.2	1.4	1771.0	0.4			475	ns	10	19/2$^-$	06			2000	IT=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...																
^{153}Gd	−72882.6	1.2					240.4	d	1.0	$3/2^-$	06			1947	ε=100	
^{153}Gd^m	−72787.4	1.2	95.1736	0.0008			3.5	μs	0.4	$9/2^+$	06			1979	IT=100	
^{153}Gd^n	−72711.4	1.2	171.188	0.004			76.0	μs	1.4	$(11/2^-)$	06			1967	IT=100	
^{153}Tb	−71313	4					2.34	d	0.01	$5/2^+$	06			1957	β^+=100	
^{153}Tb^m	−71150	4	163.175	0.005			186	μs	4	$11/2^-$	06			1965	IT=100	
^{153}Dy	−69143	4					6.4	h	0.1	$7/2^{(-)}$	06			1958	$\beta^+\approx$100; α=0.0094 14	
^{153}Ho	−65012	5					2.01	m	0.03	$11/2^-$	06			1963	$\beta^+\approx$100; α=0.051 25	
^{153}Ho^m	−64943	5	68.7	0.3			9.3	m	0.5	$1/2^+$	06			1963	$\beta^+\approx$100; α=0.18 8	
^{153}Ho^n	−62240	11	2772	10			229	ns	2	$(31/2^+)$	06			1980	IT=100	
^{153}Er	−60469	9					37.1	s	0.2	$7/2^{(-)}$	06	85Ah.A	J	1963	α=53 3; β^+=47 3	*
^{153}Er^m	−57671	9	2798.2	1.0			373	ns	9	$(27/2^-)$	06			1979	IT=100	
^{153}Er^n	−55221	9	5248.1	1.0			248	ns	32	$(41/2^-)$	06			1979	IT=100	
^{153}Tm	−53973	12					1.48	s	0.01	$(11/2^-)$	06			1964	α=91 3; β^+=9 3	
^{153}Tm^m	−53930	12	43.2	0.2			2.5	s	0.2	$(1/2^+)$	06			1988	α=92 3; β^+=?	
^{153}Yb	−47210#	200#					4.2	s	0.2	$7/2^-$#	06	88Wi05	D	1977	β^+=?; α=50#; β^+p=0.008 2	
^{153}Yb^m	−44510#	220#	2700	100			15	μs	1	$27/2^-$	06			1989	IT=100	*
^{153}Lu	−38370	150					900	ms	200	$11/2^-$	06	97Ir01	D	1989	β^+ ?; α=?; p=0	*
^{153}Lu^m	−38290	150	80	5			1#	s		$1/2^+$	06	97Ir01	ED	1997	β^+ ?; α=?; IT=?; p=0	
^{153}Lu^n	−35870	150	2502.5	0.4			> 100	ns		$23/2^-$	06			1993	IT=100	
^{153}Lu^p	−35740	150	2632.9	0.5			15	μs	3	$27/2^-$	06			1993	IT=100	
^{153}Hf	−27300#	300#					400#	ms	(>200 ns)	$1/2^+$#	06	00So11	I	2000	β^+ ?	
^{153}Hf^m	−26550#	320#	750#	100#			500#	ms		$11/2^-$#					β^+ ?; IT ?	
*^{153}Nd^m	T : average 10Si03=1.17(0.07) 96Ya12=1.06(0.05)															**
*^{153}Er	J : and 89Ot.A															**
*^{153}Yb^m	E : in ENSDF 2578.2 + x															**
*^{153}Lu	D : p=0% decay is from 97Ir01															**
^{154}Ba	−32820#	500#					53	ms	48	0^+		16Wu.A	TD	2016	β^-=100	
^{154}La	−41530#	300#					161	ms	15			16Wu.A	TD	2016	β^-=100; β^-n=20#; β^-2n=0.1#	
^{154}Ce	−52220#	200#					722	ms	14	0^+	09	16Wu.A	TD	1994	β^-=100; β^-n=0.1#	
^{154}Pr	−58100	110					2.3	s	0.1	(3^+)	09			1988	β^-=100; β^-n=0.2#	
^{154}Nd	−65820	50					25.9	s	0.2	0^+	09			1970	β^-=100	
^{154}Nd^m	−64520	50	1297.9	0.4			3.2	μs	0.3	(4^-)	09	09Si21	ETJ	1970	IT=100	*
^{154}Pm	−68510	50				*	2.68	m	0.07	(4^+)	09	12So10	J	1958	β^-=100	
^{154}Pm^m	−68490	40	20	12		*	1.73	m	0.10	(1^-)	09	12So10	J	1958	β^-=100	
^{154}Sm	−72455.2	1.5					STABLE		(>2.3 Ey)	0^+	09			1933	IS=22.75 29; 2β^- ?	
^{154}Eu	−71738.1	1.3					8.601	y	0.010	3^-	09			1947	$\beta^-\approx$100; ε=0.018 12	
^{154}Eu^m	−71669.9	1.3	68.1702	0.0004			2.2	μs	0.1	2^+	09			1964	IT=100	
^{154}Eu^n	−71592.8	1.3	145.3	0.3			46.3	m	0.4	(8^-)	09			1975	IT=100	
^{154}Gd	−73706.0	1.2					STABLE			0^+	09			1938	IS=2.18 3	
^{154}Tb	−70160	50				*	21.5	h	0.4	$0^{(+\#)}$	09			1950	$\beta^+\approx$100; β^-<0.1	
^{154}Tb^m	−70150	50	12	7		*	9.994	h	0.039	3^-	09	09Gy01	T	1972	β^+=78.2 7; IT=21.8 7; β^-<0.1	*
^{154}Tb^n	−69960#	160#	200#	150#		*	22.7	h	0.5	7^-	09			1972	β^+=98.2 6; IT=1.8 6	
^{154}Tb^p	−62160#	900#	8000#	900#			513	ns	42		09			1982	IT ?	
^{154}Dy	−70394	7					3.0	My	1.5	0^+	09			1961	α=100; 2β^+ ?	
^{154}Ho	−64639	8					11.76	m	0.19	2^-	09			1966	$\beta^+\approx$100; α=0.019 5	
^{154}Ho^m	−64397	27	243	28	AD		3.10	m	0.14	8^+	09			1968	β^+=100; α<0.001; IT$\approx$0	
^{154}Er	−62605	5					3.73	m	0.09	0^+	09			1963	$\beta^+\approx$100; α=0.47 13	
^{154}Tm	−54427	14				*	8.1	s	0.3	(2^-)	09			1964	α=54 5; β^+=46 5	
^{154}Tm^m	−54350	50	70	50	BD	*	3.30	s	0.07	(9^+)	09			1964	α=58 5; β^+=42 5; IT ?	*
^{154}Yb	−49932	17					409	ms	2	0^+	09			1964	α=92.6 12; β^+=7.4 12	
^{154}Lu	−39720#	200#					1#	s		(2^-)	09			1981	β^+ ?	
^{154}Lu^m	−39660#	200#	60	12	AD		1.12	s	0.08	(9^+)	09	88Vi02	D	1981	$\beta^+\approx$100; β^+p=?; $\beta^+\alpha$=?; α=0.002#	*
^{154}Lu^n	−37000#	220#	2720#	100#			35	μs	3	(17^+)	09			1990	IT=100	*
^{154}Hf	−32670#	300#					2	s	1	0^+	09			1981	$\beta^+\approx$100; $\alpha\approx$0	
^{154}Hf^m	−29960#	300#	2710#	30#			9	μs	4	(10^+)	09			1989	IT=100	*
*^{154}Nd^m	E : from a least-squares fit to γ-ray energies in 09Si21															**
*^{154}Tb^m	E : estimated by NUBASE from 73Ba20<25 keV															**
*^{154}Tm^m	D : IT decay has not been observed															**
*^{154}Lu^m	D : β^+p and $\beta^+\alpha$ modes observed in 88Vi02; β^+p confirmed in 90Sh.A															**
*^{154}Lu^n	E : 2431.3 + 130.4 + z, above ^{154}Lu^m ; z estimated 100#100															**
*^{154}Hf^m	E : 42#28 above 2671 level, see ENSDF'09															**
^{155}La	−37930#	400#					101	ms	28	$5/2^+$#		16Wu.A	TD	2016	β^-=100; β^-n=60#; β^-2n=0#	
^{155}Ce	−47780#	300#					313	ms	7	$5/2^-$#	05	16Wu.A	TD	1994	β^-=100; β^-n=0.2#	
^{155}Pr	−55415	17					1.47	s	0.3	$5/2^-$#	05	16Wu.A	TD	1992	β^-=100; β^-n=0.3#	
^{155}Nd	−62284	9					8.9	s	0.2	$3/2^-$#	05			1986	β^-=100	
^{155}Pm	−66940	5					41.5	s	0.2	$(5/2^-)$	05			1982	β^-=100	

... *A*-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{155}Sm	−70190.8	1.5					22.3	m	0.2	$3/2^-$	05			1951	β^-=100	
^{155}Sm^m	−70174.3	1.6	16.5	0.5			2.8	μs	0.5	$5/2^+$		10Si03	ETJ	2010	IT=100	
^{155}Sm^n	−69652.2	1.7	538.6	0.7			1.00	μs	0.08	$11/2^-$		10Si03	ETJ	2010	IT=100	
^{155}Eu	−71818.1	1.4					4.741	y	0.009	$5/2^+$	05	14Un01	T	1947	β^-=100	*
^{155}Gd	−72069.9	1.2					STABLE			$3/2^-$	05			1933	IS=14.80 12	
^{155}Gd^m	−71948.8	1.2	121.05	0.19			31.97	ms	0.27	$11/2^-$	05			1967	IT=100	
^{155}Tb	−71250	10					5.32	d	0.06	$3/2^+$	05			1957	ε=100	
^{155}Dy	−69156	10					9.9	h	0.2	$3/2^-$	05			1958	β^+=100	
^{155}Dy^m	−68922	10	234.33	0.03			6	μs	1	$(11/2^-)$	05			1970	IT=100	
^{155}Ho	−66040	17					48	m	1	$5/2^+$	05			1959	β^+=100	
^{155}Ho^m	−65898	17	141.97	0.11			880	μs	80	$(11/2^-)$	05			1984	IT=100	
^{155}Er	−62209	6					5.3	m	0.3	$(7/2^-)$	05			1969	$\beta^+\approx$100; α=0.022 7	
^{155}Tm	−56626	10					21.6	s	0.2	$(11/2^-)$	05			1971	β^+=99.11 24; α=0.89 24	
^{155}Tm^m	−56585	12	41	6			45	s	3	$1/2^+$	05	FGK12a	J	1990	β^+>92; α<8	*
^{155}Yb	−50503	17					1.793	s	0.019	$(7/2^-)$	05			1964	α=89 4; β^+=11 4	
^{155}Lu	−42545	19					68.6	ms	1.6	$(11/2^-)$	05			1965	α=90 2; β^+ ?	
^{155}Lu^m	−42524	20	21	4	AD		138	ms	8	$(1/2^+)$	05			1967	α=76 16; β^+ ?	
^{155}Lu^n	−40764	19	1781.0	2.0	AD		2.69	ms	0.03	$25/2^-$#	05			1981	$\alpha\approx$100; IT ?	
^{155}Hf	−34170#	300#					840	ms	30	$7/2^-$#	05	11Sa59	T	1981	$\beta^+\approx$100; α ?	
^{155}Ta	−23930#	300#					3.2	ms	1.3	$(11/2^-)$	07			2007	p=100	*

*^{155}Eu T : average (values in days) 14Un01=1730.1(3.5) 98Si12=1739(8) **
*^{155}Tm^m J : favored α decay from ^{159}Lu $1/2^+$ **
*^{155}Ta T : symmetrized from 2.9(+1.5–1.1) I : NUBASE expects $1/2^+$ 30#20 below **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{156}La	−33050#	400#					84	ms	78			16Wu.A	TD	2016	β^-=100; β^-n ?	
^{156}Ce	−44820#	300#					233	ms	9	0^+		16Wu.A	TD	2016	β^-=100; β^-n=1#	
^{156}Pr	−51570#	200#					444	ms	6			16Wu.A	TD	1992	β^-=100; β^-n=0.7#	
^{156}Nd	−60470	200					5.06	s	0.13	0^+	12	07Sh05	T	1987	β^-=100	*
^{156}Nd^m	−59040	200	1431.3	0.4			365	ns	145	(5^-)	12	09Si21	ET	1998	IT=100	
^{156}Pm	−64164	4					27.2	s	0.50	4^+	12	16Ko.A	TJ	1986	β^-=100	*
^{156}Pm^m	−64014	4	150.3	0.1			5.6	s	0.6	1^+	12	16Ko.A	TJD	2007	IT$\approx$98; β^-=2#	
^{156}Sm	−69360	9					9.4	h	0.2	0^+	12			1951	β^-=100	
^{156}Sm^m	−67962	9	1397.55	0.09			185	ns	7	5^-	12			1974	IT=100	
^{156}Eu	−70083	4					15.19	d	0.08	0^+	12			1947	β^-=100	
^{156}Gd	−72534.9	1.2					STABLE			0^+	12			1933	IS=20.47 9	
^{156}Gd^m	−70397.3	1.2	2137.60	0.05			1.3	μs	0.1	7^-	12			1969	IT=100	
^{156}Tb	−70091	4					5.35	d	0.10	3^-	12			1950	$\beta^+\approx$100; β^- ?	
^{156}Tb^m	−70037	5	54	3			24.4	h	1.0	(7^-)	12			1970	IT=100	*
^{156}Tb^n	−70003	4	88.4	0.2			5.3	h	0.2	(0^+)	12			1950	IT=?; β^+=?	
^{156}Dy	−70529.0	1.2					STABLE		(>1 Ey)	0^+	12	58Ri23	T	1948	IS=0.056 3; α ?; 2β^+ ?	*
^{156}Ho	−65480	60					56	m	1	4^-	12			1957	β^+=100	
^{156}Ho^m	−65430	60	52.37	0.30			9.5	s	1.5	1^-	12			1995	IT$\approx$100; β^+ ?	*
^{156}Ho^n	−65304	28	170	70	MD		7.6	m	0.3	(9^+)	12			1975	β^+=75; IT ?	
^{156}Er	−64212	25					19.5	m	1.0	0^+	12			1967	β^+=100; α=17e–6 4	
^{156}Tm	−56835	14					83.8	s	1.8	2^-	12			1971	$\beta^+\approx$100; α=0.064 10	
^{156}Tm^m	−56440#	200#	400#	200#			400	ns		(11^-)	12			1985	IT=100	*
^{156}Tm^n			non existent		RN		19	s	3	9^+		91To08	I			*
^{156}Yb	−53266	9					26.1	s	0.7	0^+	12			1970	β^+=90 2; α=10 2	
^{156}Lu	−43700	50				*	494	ms	12	$(2)^-$	12			1965	α=?; β^+=5#	
^{156}Lu^m	−43680	240	20	250		*	198	ms	2	$(9)^+$	12	96Pa01	D	1979	α=94 6; β^+ ?	*
^{156}Hf	−37820	150					23	ms	1	0^+	12	96Pa01	D	1979	α=97 3; β^+ ?	*
^{156}Hf^m	−35860	150	1959.0	1.0	AD		480	μs	40	8^+	12	96Pa01	T	1979	α=100	*
^{156}Ta	−25860#	300#					106	ms	4	(2^-)	12			1992	p=71 3; β^+=29 3	
^{156}Ta^m	−25770#	300#	94	8	AD		360	ms	40	(9^+)	12			1993	β^+=95.8 9; p=4.2 9	

*^{156}Nd T : others 89Ok.A=5.51(0.10) 87Gr12=5.47(0.11), see discussion in 07Sh05 **
*^{156}Pm T : unweighed average 16Ko.A=27.78(0.07) 87Gr12=26.70(0.10) **
*^{156}Tb^m E : derived from E3 24h to 4^+ 49.630 level and E(IT)< B(L)=9 keV **
*^{156}Dy T : lower limit is for α decay **
*^{156}Ho^m E : Error not given, estimated by NUBASE **
*^{156}Tm^m E : 203.6 keV above unknown level **
*^{156}Tm^n I : see also the discussion in ENSDF'03 **
*^{156}Lu^m D : derived from original α=98(9)% **
*^{156}Hf D : derived from original α=100(6)% **
*^{156}Hf^m T : average 96Pa01=520(10) 81Ho.A=444(17) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{157}Ce	−39930#	400#					175	ms	41	$7/2^+$#		16Wu.A	TD	2016	β^-=100; β^-n=2#	
^{157}Pr	−48540#	300#					307	ms	21	$5/2^-$#		16Wu.A	TD	2016	β^-=100; β^-n=6#	*
^{157}Nd	−56462	25					1.15	s	0.03	$5/2^-$#	16	16Wu.A	TD	1992	β^-=100	
^{157}Pm	−62297	7					10.56	s	0.10	$(5/2^-)$	16			1987	β^-=100	
^{157}Sm	−66678	4					8.03	m	0.07	$3/2^-$#	16			1973	β^-=100	
^{157}Eu	−69459	4					15.18	h	0.03	$5/2^+$	16			1951	β^-=100	
^{157}Gd	−70823.5	1.2					STABLE			$3/2^-$	16			1933	IS=15.65 2	
^{157}Gd^m	−70759.6	1.2	63.916	0.005			460	ns	40	$5/2^+$	16			1964	IT=100	
^{157}Gd^n	−70397.0	1.2	426.539	0.023			18.5	μs	2.3	$11/2^-$	16			1961	IT=100	
^{157}Tb	−70763.4	1.2					71	y	7	$3/2^+$	16			1960	ε=100	
^{157}Dy	−69425	5					8.14	h	0.04	$3/2^-$	16			1953	β^+=100	
^{157}Dy^m	−69263	5	161.99	0.03			1.3	μs	0.2	$9/2^+$	16			1974	IT=100	
^{157}Dy^n	−69226	5	199.38	0.07			21.6	ms	1.6	$11/2^-$	16			1970	IT=100	
^{157}Ho	−66833	23					12.6	m	0.2	$7/2^-$	16			1966	β^+=100	
^{157}Er	−63414	27					18.65	m	0.10	$3/2^-$	16			1966	β^+=100	
^{157}Er^m	−63259	27	155.4	0.3			76	ms	6	$9/2^+$	16			1971	IT=100	
^{157}Tm	−58709	28					3.63	m	0.09	$1/2^+$	16			1974	β^+=100	
^{157}Yb	−53422	11					38.6	s	1.0	$7/2^-$	16			1970	β^+=99.5; α=0.5	
^{157}Lu	−46441	12					6.8	s	1.8	$(1/2^+,3/2^+)$	16			1977	β^+ ?; α=?	*
^{157}Lu^m	−46420	12	20.9	2.0	AD		4.79	s	0.12	$(11/2^-)$	16			1972	β^+=?; α=6 2	
^{157}Hf	−38900#	200#					115	ms	1	$(7/2^-)$	16			1965	α=94 4; β^+=14 9	
^{157}Ta	−29590	150					10.1	ms	0.4	$1/2^+$	16			1979	α=?; p=3.4 12; β^+=1#	
^{157}Ta^m	−29570	150	22	5	AD		4.3	ms	0.1	$11/2^-$	16			1996	α=?; β^+=1#; p=0	
^{157}Ta^n	−28000	150	1593	9	AD		1.7	ms	0.1	$25/2^-$#	16			1996	α=100	
^{157}W	−19470#	400#					275	ms	40	$(7/2^-)$	16	10Bi03	D	2010	β^+=100; α=0	
^{157}W^p	−19150#	400#	320	30	AD					$(9/2^-)$	16			2010	IT ?	

*^{157}Pr T : symmetrized from 295(+29−11) **
*^{157}Lu T : ENSDF'16 average of conflicting 91To09=5.7(0.5) 91Le15=92Po14=9.6(0.8) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{158}Ce	−36660#	400#					99	ms	93	0^+		16Wu.A	TD	2016	β^-=100; β^-n ?	
^{158}Pr	−44330#	300#					181	ms	14			16Wu.A	TD	2016	β^-=100; β^-n=10#	
^{158}Nd	−54060#	200#					810	ms	30	0^+	13	16Wu.A	TD	1992	β^-=100	*
^{158}Pm	−59089	13					4.8	s	0.5		04			1987	β^-=100	
^{158}Pm^m	−58940#	50#	150#	50#			> 16	μs				15YoZX	TD	2015	IT=100	
^{158}Sm	−65250	5					5.30	m	0.03	0^+	04			1970	β^-=100	
^{158}Sm^m	−63971	5	1279.1	1.8			115	ns	18	(5^-)	04			1973	IT=100	
^{158}Eu	−67255	10					45.9	m	0.2	(1^-)	04			1951	β^-=100	
^{158}Gd	−70689.5	1.2					STABLE			0^+	04			1933	IS=24.84 7	
^{158}Tb	−69470.7	1.4					180	y	11	3^-	04			1957	β^+=83.4 7; β^-=16.6 7	
^{158}Tb^m	−69360.4	1.8	110.3	1.2			10.70	s	0.17	0^-	04			1957	IT≈100; β^-<0.6; β^+<0.01	
^{158}Tb^n	−69082.3	2.3	388.4	1.8			400	μs	40	(7^-)	04			1961	IT=100	
^{158}Dy	−70407.3	2.4					STABLE			0^+	04			1938	IS=0.095 3; α ?; 2β^+ ?	
^{158}Ho	−66188	27					11.3	m	0.4	5^+	04			1961	β^+≈100; α ?	
^{158}Ho^m	−66121	27	67.199	0.010			28	m	2	2^-	04			1960	IT>81; β^+<19	
^{158}Ho^n	−66010#	80#	180#	70#			21.3	m	2.3	(9^+)	04			1970	β^+>93; IT<7#	
^{158}Er	−65304	25					2.29	h	0.06	0^+	07			1961	ε=100	
^{158}Tm	−58703	25				*	3.98	m	0.06	2^-	04			1970	β^+=100	
^{158}Tm^m	−58650#	100#	50#	100#		*	20	ns		(5^+)	04	81Dr07	T	1981	IT ?	*
^{158}Yb	−56010	8					1.49	m	0.13	0^+	04			1967	β^+≈100; α≈0.0021 12	
^{158}Lu	−47212	15					10.6	s	0.3	2^-	04	95Ga.A	J	1979	β^+=99.09 20; α=0.91 20	
^{158}Hf	−42102	17					0.99	s	0.03	0^+	04	15Li24	T	1965	β^+=55.7 19; α=44.3 19	
^{158}Ta	−31170#	200#					49	ms	8	(2^-)	04	97Da07	TD	1979	α=96 4; β^+ ?	*
^{158}Ta^m	−31030#	200#	141	11	AD		36.0	ms	0.8	(9^+)	04	97Da07	ETJ	1979	α=95 5; β^+ ?; IT ?	*
^{158}Ta^n	−28360#	200#	2805	16	AD		6.1	μs	0.1	(19^-)		14Ca03	TJD	2014	IT=98.6 2; α=1.4 2	*
^{158}W	−23630#	300#					1.25	ms	0.21	0^+	06			1981	α=100	
^{158}W^m	−21740#	300#	1889	8	AD		143	μs	19	(8^+)	06			1995	α=100	

*^{158}Nd T : symmetrized from 820(+15−36) **
*^{158}Tm^m I : T≈20 s in 81Dr07 was a typo. Value in Fig. 2 was correct. See 96Dr.A **
*^{158}Ta T : average 97Da07=72(12) 96Pa01=46(4) with Birge ratio B=2 **
*^{158}Ta D : derived from original α≈100(8)% **
*^{158}Ta^m T : average 97Da07=37.7(1.5) 96Pa01=35(1) 79Ho10=36.8(1.6) **
*^{158}Ta^n E : 14Ca03=2668 above 9^+ isomer **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{159}Pr	−41090#	400#				134	ms	43	5/2−#		16Wu.A	TD	2016	β^-=100; β^-n=30#	
^{159}Nd	−49810#	300#				500	ms	30	7/2+#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.02#	*
^{159}Pm	−56554	10				1.49	s	0.13	5/2−#	12	16Wu.A	T	1998	β^-=100	*
^{159}Pm^m	−55089	10	1465.0	0.5		4.42	μs	0.17			15YoZX	ETD	2015	IT=100	
^{159}Sm	−62208	6				11.37	s	0.15	5/2−	12			1986	β^-=100	
^{159}Sm^m	−60931	6	1276.8	0.5		116	ns	8	(11/2−)	12	09Ur04	ET	2009	IT=100	
^{159}Eu	−66043	4				18.1	m	0.1	5/2+	12			1961	β^-=100	
^{159}Gd	−68561.4	1.2				18.479	h	0.004	3/2−	12			1949	β^-=100	
^{159}Tb	−69532.4	1.3				STABLE			3/2+	12	12Vi10	J	1933	IS=100.	*
^{159}Dy	−69167.1	1.5				144.4	d	0.2	3/2−	12			1951	ε=100	
^{159}Dy^m	−68814.3	1.5	352.77	0.14		122	μs	3	11/2−	12			1965	IT=100	
^{159}Ho	−67330	3				33.05	m	0.11	7/2−	12			1958	β^+=100	
^{159}Ho^m	−67124	3	205.91	0.05		8.30	s	0.08	1/2+	12			1966	IT=100	
^{159}Er	−64561	4				36	m	1	3/2−	12			1962	β^+=100	
^{159}Er^m	−64378	4	182.602	0.024		337	ns	14	9/2+	12			1971	IT=100	
^{159}Er^n	−64132	4	429.05	0.03		590	ns	60	11/2−	12			1971	IT=100	
^{159}Tm	−60570	28				9.13	m	0.16	5/2+	12			1971	β^+=100	
^{159}Yb	−55839	18				1.67	m	0.09	5/2(−)	12			1975	β^+=100	
^{159}Lu	−49710	40			*	12.1	s	1.0	1/2+	12	FGK12a	J	1980	$\beta^+\approx$100; α=0.1#	*
^{159}Lu^m	−49610#	90#	100#	80#	*	10#	s		11/2−#					β^+ ?; IT ?; α ?	
^{159}Hf	−42853	17				5.20	s	0.10	7/2−	12	96Pa01	T	1973	β^+=65 7; α=35 7	
^{159}Ta	−34439	20				1.04	s	0.09	1/2+	12	97Da07	T	1979	β^+ ?; α=34 5	*
^{159}Ta^m	−34375	19	64	5	AD	560	ms	60	11/2−	12			1994	α=55 1; β^+ ?	
^{159}W	−25300#	300#				8.2	ms	0.7	7/2−#	12	96Pa01	TD	1981	α=82 16; β^+ ?	*
^{159}Re	−14750#	310#				40#	μs		1/2+#				2006	p ?; α ?	
^{159}Re^m	−14540#	300#	210#	50#		21.6	μs	3.3	11/2−	12	07Pa27	T	2006	p=?; α=7.5 35	*

*^{159}Nd T : symmetrized from 485(+39–20) **
*^{159}Pm T : average 16Wu.A=1.48(0.18) 05Ic02=1.5(0.2) **
*^{159}Tb J : 3/2 confirmed by a novel technique in 12Vi10 (see text) **
*^{159}Lu J : favored α decay from ^{163}Ta 1/2+ **
*^{159}Ta T : average 97Da07=0.83(0.18) 96Pa01=1.10(0.10) **
*^{159}W D : derived from original α=92(23)% **
*^{159}Re^m T : average 07Pa27=23(6) 06Jo10=21(4) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{160}Pr	−36520#	400#				170	ms	140			16Wu.A	TD	2016	β^-=100	
^{160}Nd	−47130#	300#				439	ms	37	0+	13	16Wu.A	TD	1985	β^-=100; β^-n=0.08#	*
^{160}Pm	−53000#	200#				725	ms	57	0−#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.03#	
^{160}Sm	−60235	6				9.6	s	0.3	0+	05			1986	β^-=100	
^{160}Sm^m	−58874	6	1361.3	0.4		120	ns	46	(5−)		09Si21	ETJ	2009	IT=100	
^{160}Sm^n	−57478	6	2757.3	0.4		1.8	μs	0.4	(11+)		16Pa01	ETJ	2016	IT=100	
^{160}Eu	−63480	10				42.4	s	0.2	(5−)	05	16Ha.A	TJ	1973	β^-=100	
^{160}Eu^m	−63400	12	80	7		29.9	s	0.3	(1−)	05	16Ha.A	ETJ	2016	β^-=100	
^{160}Gd	−67941.7	1.3				STABLE		(>31 Ey)	0+	05	01Da22	T	1933	IS=21.86 19; 2β^- ?	
^{160}Tb	−67836.3	1.3				72.3	d	0.2	3−	05			1943	β^-=100	
^{160}Dy	−69672.7	0.8				STABLE			0+	05			1938	IS=2.329 18	
^{160}Ho	−66383	15				25.6	m	0.3	5+	05			1950	β^+=100	
^{160}Ho^m	−66323	15	59.98	0.03		5.02	h	0.05	2−	05			1955	IT=73 3; β^+=27 3	
^{160}Ho^n	−66186	22	197	16		3	s		(9+)	05	GAu	E	1988	IT=100	*
^{160}Er	−66064	24				28.58	h	0.09	0+	05			1954	ε=100	
^{160}Tm	−60300	30				9.4	m	0.3	1−	05			1970	β^+=100	
^{160}Tm^m	−60230	40	70	20		74.5	s	1.5	(5+)	05			1983	IT=85 5; β^+=15 5	
^{160}Tm^n	−60200#	60#	100#	50#		200	ns		(8)	05			1986	IT=100	*
^{160}Yb	−58163	7				4.8	m	0.2	0+	05			1967	β^+=100	
^{160}Lu	−50270	60			*	36.1	s	0.3	2−#	05			1979	β^+=100; α<1e–4	
^{160}Lu^m	−50270#	120#	0#	100#	*	40	s	1		05			1980	$\beta^+\approx$100; α ?	
^{160}Hf	−45939	10				13.6	s	0.2	0+	05			1973	β^+=99.3 2; α=0.7 2	
^{160}Ta	−35820	50			&	1.70	s	0.20	(2−)	05	96Pa01	JD	1979	β^+ ?; α=?	*
^{160}Ta^m	−35710	240	110	250	&	1.55	s	0.04	(9)+	05	96Pa01	TJ	1979	β^+=66#; α=?	*
^{160}W	−29330	150				90	ms	5	0+	05	96Pa01	TD	1979	α=87 8; β^+ ?	*
^{160}Re	−16740#	300#				611	μs	7	(4−)	05	11Da12	TJD	1992	p=89 1; α=11 1	*
^{160}Re^m	−16560#	300#	182	16		2.8	μs	0.1	(9+)		11Da01	JT	2011	IT=100	

*^{160}Nd I : first seen in 85Si25 in the thermal fission of ^{252}Cf; 12Ku26>300ns **
*^{160}Ho^n E : less than 55 keV above 169.61 level, from ENSDF **
*^{160}Tm^n E : 98.2 + x, x estimated 0#50 **
*^{160}Ta J : from α correlation with ^{156}Lu line **
*^{160}Ta^m J : from α correlation with ^{156}Lu^m line **
*^{160}W T : average 96Pa01=91(5) 81Ho10=81(15) **
*^{160}Re J : protons from $d_{3/2}$ orbital; 92Pa05=(2−) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{161}Nd	−42590#	400#					215	ms	76	$1/2^-$#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.6#	
^{161}Pm	−50240#	300#					1.05	s	0.15	$5/2^-$#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.4#	
^{161}Pm^m	−49270#	300#	966.0	0.5			0.89	μs	0.09	$(13/2^+)$		15YoZX	ETJ	2015	IT=100	
^{161}Sm	−56672	7					4.8	s	0.4	$7/2^+$#	11			1998	β^-=100	
^{161}Eu	−61792	10					26.2	s	2.3	$5/2^+$#	11	16Wu.A	T	1986	β^-=100	*
^{161}Gd	−65505.8	1.6					3.646	m	0.003	$5/2^-$	11	94It.A	T	1949	β^-=100	
^{161}Tb	−67461.6	1.4					6.89	d	0.02	$3/2^+$	11			1949	β^-=100	
^{161}Dy	−68055.8	0.8					STABLE			$5/2^+$	11			1934	IS=18.889 42	
^{161}Dy^m	−67570.2	0.8	485.56	0.16			760	ns	170	$11/2^-$	11	12Sw01	T	2012	IT=100	
^{161}Ho	−67197.3	2.2					2.48	h	0.05	$7/2^-$	11			1954	ε=100	
^{161}Ho^m	−66986.2	2.2	211.15	0.03			6.76	s	0.07	$1/2^+$	11			1965	IT=100	
^{161}Er	−65202	9					3.21	h	0.03	$3/2^-$	11			1954	β^+=100	
^{161}Er^m	−64806	9	396.44	0.04			7.5	μs	0.7	$11/2^-$	11			1969	IT=100	
^{161}Tm	−61899	28					30.2	m	0.8	$7/2^+$	11			1959	β^+=100	
^{161}Tm^m	−61891	28	7.51	0.24			5#	m		$(1/2^+)$	11			1981	β^+ ?; IT ?	
^{161}Tm^n	−61821	28	78.20	0.03			110	ns	3	$7/2^-$	11			1981	IT=100	
^{161}Yb	−57839	15					4.2	m	0.2	$3/2^-$	11			1974	β^+=100	
^{161}Lu	−52562	28					77	s	2	$1/2^+$	11			1973	β^+=100	
^{161}Lu^m	−52388	28	174	4			7.3	ms	0.4	$(9/2^-)$	11			1973	IT=100	*
^{161}Hf	−46315	23					18.4	s	0.4	$(7/2^-)$	15			1973	$\beta^+\approx$100; α<0.13	
^{161}Hf^m	−45986	23	329.0	0.5			4.8	μs	0.2	$(13/2^+)$	15			2014	IT=100	
^{161}Ta	−38779	24				*	3#	s		$(1/2^+)$	11			1979	β^+ ?; α ?	
^{161}Ta^m	−38718	12	61	23	AD	*	3.08	s	0.11	$(11/2^-)$	11	12Th13	D	1979	β^+ ?; α=7(3)	
^{161}W	−30560#	200#					409	ms	16	$7/2^-$#	11	96Pa01	T	1973	α=73 3; β^+=27 3	*
^{161}Re	−20840	150					440	μs	1	$1/2^+$	11	06La16	T	1979	p$\approx$100; α<1.4	
^{161}Re^m	−20720	150	123.7	1.3			14.7	ms	0.3	$11/2^-$	11			1979	α=93.0 3; p=7.0 3	
^{161}Os	−9980#	400#					640	μs	60	$(7/2^-)$	11			2010	$\alpha\approx$100	

*^{161}Eu T : average 16Wu.A=30.1(9.0) 90An31=24(4) 86Ma12=27(3) **
*^{161}Lu^m E : 166.5(0.8) keV above $(3/2^+)$ level at x<15 keV **
*^{161}W T : average 96Pa01=409(18) 79Ho10=410(40) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{162}Nd	−39550#	400#					310	ms	200	0^+		16Wu.A	TD	2012	β^-=100	
^{162}Pm	−46370#	300#					630	ms	180	6^-#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.8#	
^{162}Sm	−54530#	200#					2.7	s	0.3	0^+	07	16Wu.A	T	2005	β^-=100	
^{162}Eu	−58700	40					11	s		(1^+)	07	16Wu.A	T	1987	β^-=100	
^{162}Eu^m	−58540	40	157	5			7.5	s	0.6	(6^+)	07	16Ko.A	ETJ	2016	β^-=100	
^{162}Gd	−64280	4					8.4	m	0.2	0^+	07			1967	β^-=100	
^{162}Tb	−65680	40					7.60	m	0.15	(1^-)	16			1965	β^-=100	
^{162}Dy	−68181.5	0.8					STABLE			0^+	07			1934	IS=25.475 36	
^{162}Dy^m	−65993.4	0.9	2188.1	0.3			8.3	μs	0.3	8^+		11Sw02	ETD	2011	IT=100	
^{162}Ho	−66042	3					15.0	m	1.0	1^+	07			1957	β^+=100	
^{162}Ho^m	−65936	3	105.87	0.06			67.0	m	0.7	6^-	07			1961	IT=62; β^+=38	
^{162}Er	−66334.5	0.8					STABLE		(>140 Ty)	0^+	07	56Po16	T	1938	IS=0.139 5; α ?; 2β^+ ?	*
^{162}Er^m	−64308.5	0.8	2026.01	0.13			88	ns	16	$7^{(-)}$	07	12Sw01	TJ	1974	IT=100	
^{162}Tm	−61478	26					21.70	m	0.19	1^-	07			1963	β^+=100	
^{162}Tm^m	−61350	50	130	40			24.3	s	1.7	5^+	07	GAu	E	1974	IT ?; β^+=19 4	*
^{162}Yb	−59826	15					18.87	m	0.19	0^+	07			1963	β^+=100	
^{162}Lu	−52830	80				*	1.37	m	0.02	$1^{(-)}$	07			1978	β^+=100	
^{162}Lu^m	−52710#	220#	120#	200#		*	1.5	m		4^-#	07			1980	$\beta^+\approx$100; IT ?	
^{162}Lu^n	−52530#	220#	300#	200#		*	1.9	m			07			1980	$\beta^+\approx$100; IT ?	
^{162}Hf	−49169	9					39.4	s	0.9	0^+	07			1982	$\beta^+\approx$100; α=0.008 1	
^{162}Ta	−39780	50					3.57	s	0.12	7^+#	16			1985	$\beta^+\approx$100; α=0.074 10; β^+p ?	
^{162}W	−33999	18					1.19	s	0.12	0^+	16			1973	β^+ ?; α=45.2 16	
^{162}Re	−22500#	200#					107	ms	13	(2^-)	07			1979	α=94 6; β^+ ?	
^{162}Re^m	−22330#	200#	175	9	AD		77	ms	9	(9^+)	07			1979	α=91 5; β^+ ?	
^{162}Os	−14440#	300#					2.1	ms	0.1	0^+	07			1989	α=100	

*^{162}Eu T : 16Wu.A=11.8(1.4) 87Gr12=10.6(1.0) but values include both ground-state and isomer **
*^{162}Eu J : from 16Ko.A, conf p5/2[413]n7/2[633],Kp=1^+ **
*^{162}Er T : lower limit is for α decay **
*^{162}Tm^m E : above 66.90 level and less than 192 keV, from ENSDF **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{163}Pm	−43250#	400#					430	ms	350	5/2−#	13	16Wu.A	TD	2012	β^-=100; β^-n=1#	
^{163}Sm	−50720#	300#					1.3	s	0.5	1/2−#	13	16Wu.A	TD	2012	β^-=100	
^{163}Eu	−56480	70					7.7	s	0.4	5/2+#	10	08Os02	T	2007	β^-=100	
^{163}Gd	−61314	8					68	s	3	7/2+#	10			1982	β^-=100	
^{163}Gd^m	−61176	8	137.8	1.0			23.5	s	1.0	1/2−#		14Ha38	ETD	2014	β^-=100	
^{163}Tb	−64596	4					19.5	m	0.3	3/2+	10			1966	β^-=100	
^{163}Dy	−66381.2	0.8					STABLE			5/2−	10			1934	IS=24.896 42	
^{163}Ho	−66378.3	0.8					4.570	ky	0.025	7/2−	10			1957	ε=100	*
^{163}Ho^m	−66080.4	0.8	297.88	0.07			1.09	s	0.03	1/2+	10			1957	IT=100	
^{163}Ho^n	−64268.9	0.9	2109.4	0.4			800	ns	150	(23/2+)		12Sw01	ETJ	2012	IT=100	
^{163}Er	−65168	5					75.0	m	0.4	5/2−	10			1953	β^+=100	
^{163}Er^m	−64723	5	445.5	0.6			580	ns	100	(11/2−)	10			1974	IT=100	
^{163}Tm	−62729	6					1.810	h	0.005	1/2+	10			1959	β^+=100	
^{163}Tm^m	−62642	6	86.92	0.05			380	ns	30	(7/2)−	10			1975	IT=100	
^{163}Yb	−59299	15					11.05	m	0.35	3/2−	10			1967	β^+=100	
^{163}Lu	−54791	28					3.97	m	0.13	1/2(+)	10			1979	β^+=100	
^{163}Hf	−49264	25					40.0	s	0.6	(5/2−)	15			1982	β^+=100; α<0.0001	
^{163}Ta	−42530	40					10.6	s	1.8	1/2+	10	FGK12a	J	1985	$\beta^+\approx$100; $\alpha\approx$0.2	*
^{163}Ta^m	−42390#	40#	140#	18#	AD		10#	s		(9/2−)		FGK12a	J		β^+ ?; α ?; IT ?	*
^{163}W	−34910	50					2.63	s	0.09	7/2−	10			1973	β^+ ?; α=14 2	
^{163}W^m	−34430	50	480.3	0.7			154	ns	3	13/2+	10			2010	IT=100	
^{163}Re	−26002	19					390	ms	70	1/2+	10			1979	β^+ ?; α=32 3	
^{163}Re^m	−25882	19	120	5	AD		214	ms	5	11/2−	10			1979	α=66 4; β^+ ?	
^{163}Os	−16190#	300#					5.5	ms	0.6	7/2−	10	13Dr06	J	1981	$\alpha\approx$100; β^+ ?	
*^{163}Sm	T : symmetrized from 16Wu.A=1.23(+0.51–0.47)															**
*^{163}Ho	T : other: 92Ju01=47(+5–4) d for q=66+ (bare ion)															**
*^{163}Ta	J : favored a-decay from 1/2+ isomer in ^{167}Re															**
*^{163}Ta^m	J : favored a-decay from (9/2−) ground-state in ^{167}Re															**
^{164}Pm	−38870#	400#					200#	ms							β^- ?; β^-n ?	
^{164}Sm	−48100#	300#					1.43	s	0.24	0+	15	16Wu.A	TD	2012	β^-=100; β^-n=0#	
^{164}Sm^m	−46620#	300#	1485.5	1.2			600	ns	140	(6−)	15			2014	IT=100	
^{164}Eu	−53380#	110#					4.15	s	0.19	0−#	08	16Wu.A	T	2007	β^-=100	
^{164}Gd	−59770#	100#					45	s	3	0+	06			1988	β^-=100	
^{164}Tb	−62080	100					3.0	m	0.1	(5+)	01			1968	β^-=100	
^{164}Dy	−65968.0	0.8					STABLE			0+	01			1934	IS=28.260 54	
^{164}Ho	−64981.5	1.5					29	m	1	1+	01			1938	ε=60 5; β^-=40 5	
^{164}Ho^m	−64841.7	1.5	139.77	0.08			36.4	m	0.3	6−	01	08Ha21	T	1966	IT=100	*
^{164}Er	−65942.9	0.8					STABLE			0+	01			1938	IS=1.601 3; α ?; 2β^+ ?	
^{164}Er^m	−62566.8	1.4	3376.1	1.1			68	ns	2	(12+)	01	12Sw02	T	1980	IT=100	*
^{164}Tm	−61904	24				*	2.0	m	0.1	1+	01			1960	ε=61 1; e+=39 1	
^{164}Tm^m	−61894	25	10	6		*	5.1	m	0.1	6−	01	GAu	E	1971	IT$\approx$80; $\beta^+\approx$20	*
^{164}Yb	−61017	15					75.8	m	1.7	0+	01			1960	ε=100	
^{164}Lu	−54642	28					3.14	m	0.03	1(−)	07			1977	β^+=100	
^{164}Hf	−51819	16					111	s	8	0+	01			1981	β^+=100	
^{164}Ta	−43283	28					14.2	s	0.3	(3+)	08			1982	β^+=100	
^{164}W	−38236	10					6.3	s	0.2	0+	01			1973	β^+=96.2 12; α=3.8 12	
^{164}Re	−27470	50				*	719	ms	161	(2−)	01	09Ha42	TD	1979	α=?; β^+=42#	*
^{164}Re^m	−27520	240	−50	250		*	890	ms	130	(9+)		09Ha42	TD	2009	β^+ ?; α=3 1	*
^{164}Os	−20420	150					21	ms	1	0+	01			1981	α=?; β^+=2#	
^{164}Ir	−7340#	310#					1#	ms		2−#	06				p ?; α ?; β^+ ?	
^{164}Ir^m	−7080#	300#	260#	100#			70	μs	10	(9+)	06	14Dr02	TD	2001	p=?; α=4 2; β^+ ?	
*^{164}Eu	T : average 16Wu.A=3.80(0.56) 08Os02=4.2(0.2)															**
*^{164}Ho^m	T : other 66Jo07=37.5(+1.5–0.5)															**
*^{164}Er^m	T : ENSDF'2001 >170 ns															**
*^{164}Tm^m	E : less than 20 keV, from ENSDF															**
*^{164}Re	T : average 09Ha42=848(+140–105) 96Pa01=380(160) 81Ho10=880(240)															**
*^{164}Re^m	T : symmetrized from 864(+150–110)															**
^{165}Sm	−43810#	400#					980	ms	210	5/2−#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.02#	
^{165}Eu	−50720#	140#					2.53	s	0.25	5/2+#	08	16Wu.A	T	2007	β^-=100; β^-n=0.2#	*
^{165}Gd	−56450#	120#					11.0	s	0.9	1/2−#	06	16Wu.A	T	1998	β^-=100	*
^{165}Tb	−60570#	100#					2.11	m	0.10	3/2+#	06			1983	β^-=100	
^{165}Dy	−63612.6	0.8					2.334	h	0.001	7/2+	06			1935	β^-=100	
^{165}Dy^m	−63504.4	0.8	108.1552	0.0013			1.257	m	0.006	1/2−	06			1963	IT=97.76 11; β^-=2.24 11	
^{165}Ho	−64899.0	1.0					STABLE			7/2−	06			1934	IS=100.	
^{165}Ho^m	−64537.3	1.0	361.675	0.011			1.512	μs	0.004	3/2+	06			1958	IT=100	
^{165}Ho^n	−64183.7	1.0	715.33	0.02			< 100	ns		7/2+	06			1958	IT=100	
^{165}Er	−64521.6	1.0					10.36	h	0.04	5/2−	06			1950	ε=100	
^{165}Er^m	−63970.3	1.2	551.3	0.6			250	ns	30	11/2−	06			1970	IT=100	
^{165}Er^n	−62698.6	1.2	1823.0	0.6			370	ns	40	(19/2)		12Sw01	EJT	2012	IT=100	

. . . A-group is continued on next page . . .

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...																
^{165}Tm	−62929.6	1.7					30.06	h	0.03	$1/2^+$	06			1953	β^+=100	
^{165}Tm^m	−62849.2	1.7	80.37	0.06			80	μs	3	$7/2^+$	06			1967	IT=100	
^{165}Tm^n	−62769.1	1.7	160.47	0.06			9.0	μs	0.5	$7/2^-$	06			1968	IT=100	
^{165}Yb	−60295	27					9.9	m	0.3	$5/2^-$	06			1964	β^+=100	
^{165}Yb^m	−60168	27	126.80	0.09			300	ns	30	$9/2^+$	06			1980	IT=100	
^{165}Lu	−56442	27					10.74	m	0.10	$1/2^+$	06			1973	β^+=100	
^{165}Hf	−51636	28					76	s	4	$(5/2^-)$	06			1981	β^+=100	
^{165}Ta	−45848	14					31.0	s	1.5	$(1/2^+,3/2^+)$	06	FGK12a	J	1982	β^+=100	*
^{165}Ta^m	−45823	17	24	18	AD		30#	s		$(9/2^-)$		FGK12a	J		β^+ ?; α ?	*
^{165}W	−38861	25					5.1	s	0.5	$(5/2^-)$	06			1975	$\beta^+\approx$100; α<0.2	
^{165}Re	−30660	24				*	2.62	s	0.14	$(1/2^+)$	15	05Sc22	T	1981	β^+ ?; α=14 8	*
^{165}Re^m	−30632	12	27	22	AD	*	1.74	s	0.06	$(11/2^-)$	15			1978	β^+ ?; α=13 1	
^{165}Os	−21800#	200#					71	ms	3	$(7/2^-)$	14			1978	α=90 2; β^+ ?	
^{165}Ir	−11590#	160#					50#	ns	<1 μs	$1/2^+$#	06	97Da07	I		p ?; α ?	
^{165}Ir^m	−11410	150	180#	50#			325	μs	33	$(11/2^-)$	06	14Dr02	TD	1996	p=87 4; α=12 2	*

*^{165}Eu T : average 16Wu.A=2.14(0.45) 08Os02=2.7(0.3) **
*^{165}Gd T : unweighed average 16Wu.A=12.5(1.3) 98Ic02=9.3(2.3) and 11.2(0.3) **
*^{165}Ta J : favored α decay from ^{169}Re^m (J=($1/2^+$,$3/2^+$)) **
*^{165}Ta^m J : favored α decay from ^{169}Re (J=($9/2^-$)) **
*^{165}Re T : symmetrized from 05Sc22=2.614(+0.142–0.128); also 12Th13=1.6(0.6) **
*^{165}Ir^m T : average 14Dr02=340(40) 97Da07=290(60) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{166}Sm	−40730#	400#					800	ms	630	0^+		16Wu.A	TD	2016	β^-=100	
^{166}Eu	−47210#	360#					1.24	s	0.12	6^-#	14	16Wu.A	T	2007	β^-=100; β^-n=0.6#	*
^{166}Gd	−54530#	200#					5.1	s	0.8	0^+	15	16Wu.A	T	2005	β^-=100	*
^{166}Gd^m	−52930#	200#	1601.5	1.1			950	ns	60	(6^-)	15			2014	IT=100	
^{166}Tb	−57880	70					27.1	s	1.5	(2^-)	08	16Wu.A	T	1996	β^-=100	*
^{166}Dy	−62584.8	0.9					81.6	h	0.1	0^+	08			1949	β^-=100	
^{166}Ho	−63071.3	1.0					26.824	h	0.012	0^-	08			1936	β^-=100	
^{166}Ho^m	−63065.3	1.0	5.969	0.012			1.133	ky	0.05	7^-	08	12Ne05	T	1952	β^-=100	
^{166}Ho^n	−62880.4	1.0	190.9021	0.0020			185	μs	15	3^+	08			1960	IT=100	
^{166}Er	−64926.0	1.2					STABLE			0^+	08			1934	IS=33.503 36	
^{166}Tm	−61888	12					7.70	h	0.03	2^+	08			1948	β^+=100	
^{166}Tm^m	−61771	13	117	5			348	ms	21	(6^-)	08	96Dr07	T	1996	IT=100	*
^{166}Tm^n	−61649	13	239	5			2	μs	1	(6^-)	08	96Dr07	EDT	1995	IT=100	*
^{166}Yb	−61596	7					56.7	h	0.1	0^+	08			1954	ε=100	
^{166}Lu	−56021	30					2.65	m	0.10	6^-	08			1969	β^+=100	
^{166}Lu^m	−55990	30	34.37	0.22			1.41	m	0.10	$3^{(-)}$	08			1974	β^+=58 5; IT=42 5	
^{166}Lu^n	−55980	30	43.0	0.4			2.12	m	0.10	0^-	08			1974	β^+>80; IT<20	
^{166}Hf	−53859	28					6.77	m	0.30	0^+	08			1965	β^+=100	
^{166}Ta	−46098	28					34.4	s	0.5	$(2)^+$	08			1977	β^+=100	
^{166}W	−41888	9					19.2	s	0.6	0^+	08			1975	$\beta^+\approx$100; α=0.035 12	
^{166}Re	−31890	70					2.25	s	0.21	(7^+)	08	92Me10	J	1978	β^+=?; α=5 2	*
^{166}Re^p	−31740#	90#	150#	50#						3^-#	08					
^{166}Os	−25432	18					213	ms	5	0^+	16			1977	α=72 13; β^+=28 13	
^{166}Ir	−13350#	200#					10.5	ms	2.2	(2^-)	08			1981	α=93 3; p=7 3	
^{166}Ir^m	−13180#	200#	171	6	p		15.1	ms	0.9	(9^+)	08			1996	α=98.2 6; p=1.8 6	
^{166}Pt	−4730#	300#					300	μs	100	0^+	08			1996	α=100	

*^{166}Eu T : symmetrized from 16Wu.A=1.27(+0.09–0.14) **
*^{166}Gd T : average 16Wu.A=5.4(1.2) 05Ic02=00As.A=4.8(1.0) **
*^{166}Tb T : average 16Wu.A=28.3(2.0) 05Ic02=00As.A=25.6(2.2) **
*^{166}Tm^m E : less than 16 keV above 109.338 level **
*^{166}Tm^m T : average 340(25) (34.4 keV γ-time) 370(40) (74.9 keV γ-time) **
*^{166}Tm^n E : 121.710 keV above the 340 ms isomer **
*^{166}Tm^n T : other 02Ca46=36(2) ns adopted in ENSDF'08 **
*^{166}Re D : from 2% < α < 8% as discussed in ENSDF J : 92Me10 β^+ to 6^+ state **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{167}Eu	−44010#	400#					1.33	s	0.51	$5/2^+$#	13	16Wu.A	TD	2012	β^-=100; β^-n=3#	
^{167}Gd	−50810#	300#					4.2	s	0.3	$5/2^-$#	13	16Wu.A	TD	2012	β^-=100	*
^{167}Tb	−55930#	200#					18.9	s	1.6	$3/2^+$#	00	16Wu.A	T	1999	β^-=100	*
^{167}Dy	−59930	60					6.20	m	0.08	$(1/2^-)$	00			1960	β^-=100	
^{167}Ho	−62281	5					3.1	h	0.1	$7/2^-$	00			1955	β^-=100	
^{167}Ho^m	−62022	5	259.34	0.11			6.0	μs	1.0	$3/2^+$	00			1977	IT=100	
^{167}Er	−63291.2	1.2					STABLE			$7/2^+$	00			1934	IS=22.869 9	
^{167}Er^m	−63083.4	1.2	207.801	0.005			2.269	s	0.006	$1/2^-$	00			1986	IT=100	
^{167}Tm	−62543.6	1.3					9.25	d	0.02	$1/2^+$	00			1948	ε=100	
^{167}Tm^m	−62364.1	1.3	179.480	0.019			1.16	μs	0.06	$(7/2)^+$	00			1964	IT=100	
^{167}Tm^n	−62250.8	1.3	292.820	0.020			0.9	μs	0.1	$7/2^-$	00			1965	IT=100	

... *A*-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{167}Yb	−60591	4				17.5	m	0.2	5/2$^-$	00			1954	β^+=100	
^{167}Yb^m	−60019	4	571.548	0.022		180	ns		(11/2)$^-$	00			1976	IT=100	
^{167}Lu	−57500	30			*	51.5	m	1.0	7/2$^+$	06			1958	β^+=100	
^{167}Lu^m	−57500#	40#	0#	30#	*	> 1	m		1/2$^{(-\#)}$	06			1998	IT ?; β^+ ?	
^{167}Hf	−53468	28				2.05	m	0.05	(5/2)$^-$	00			1969	β^+=100	
^{167}Ta	−48351	28				1.33	m	0.07	(3/2$^+$)	00			1982	β^+=100	
^{167}W	−42098	18				19.9	s	0.5	3/2$^-$#	00			1985	β^+=99.96 1; α=0.04 1	*
^{167}Re	−34830#	40#			&	3.4	s	0.4	(9/2$^-$)	00	10An01	J	1992	$\alpha\approx$100; β^+ ?	
^{167}Re^m	−34700	40	128#	13#	&	5.9	s	0.3	1/2$^+$	00	11Ko.B	EJ	1984	$\beta^+\approx$99; $\alpha\approx$1	
^{167}Os	−26500	70				839	ms	5	7/2$^-$	09	10Sc02	TJD	1977	α=51 4; β^+ ?	*
^{167}Os^m	−26060	70	435.1	1.0		672	ns	7	(13/2$^+$)	09	10Sc02	E	2009	IT=100	*
^{167}Ir	−17072	18				29.3	ms	0.6	1/2$^+$	02	05Sc22	TD	1981	α=43 2; p=39.3 13; β^+ ?	*
^{167}Ir^m	−16897	18	175.5	2.1	p	25.7	ms	0.8	11/2$^-$	02	04Ke06	T	1995	α=90 3; β^+ ?; p=0.42 8	*
^{167}Pt	−6610#	300#				800	μs	160	7/2$^-$#	00	04Ke06	T	1996	α=100	*

*^{167}Gd T : symmetrized from 4.26(+0.18–0.32) **
*^{167}Tb T : average 16Wu.A=18.6(2.0) 99As03=19.4(2.7) **
*^{167}W J : lowest observed state in 92Th06 is 13/2$^+$ **
*^{167}Os D : average 10Sc02=51(5)% 96Pa01=49(7)% 81Ho10=58(12)% **
*^{167}Os^m E : also 10Sc02=434.3(1.1), unc. estimated by evaluator, based on Table II **
*^{167}Ir T : from p-decay; α-decay 05Sc22=30.9(1.3) 97Da07=35.2(2.0) not used **
*^{167}Ir^m T : other not used 05Sc22=28.7(3.3) from α-decay and 28.8(1.3) from p-decay **
*^{167}Ir^m T : 97Da07=30.0(0.6) conflicting, not used D : p from 05Sc22 **
*^{167}Pt T : average 04Ke06=900(+300–200) 96Bi07=700(200) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{168}Eu	−39740#	500#				200	ms	100	2$^+$#	13	16Wu.A	TD	2012	β^-=100; β^-n=10#	
^{168}Gd	−48360#	400#				3.03	s	0.16	0$^+$	13	16Wu.A	TD	1985	β^-=100	*
^{168}Tb	−52720#	300#				9.4	s	0.4	(4$^-$)	10	16Wu.A	T	1999	β^-=100	
^{168}Tb^m	−52510#	300#	211	2		0.71	μs	0.03	(6$^+$)		16Gu.A	ETJ	2016	IT=100	
^{168}Dy	−58560	140				8.7	m	0.3	0$^+$	10			1982	β^-=100	
^{168}Ho	−60060	30				2.99	m	0.07	3$^+$	10			1960	β^-=100	
^{168}Ho^m	−60000	30	59	1		132	s	4	(6$^+$)	10	90Ch37	E	1990	IT$\approx$100; β^-<0.5	
^{168}Ho^n	−59920	30	143.43	0.17		> 4	μs		(1)$^-$	10			1990	IT=100	
^{168}Ho^p	−59870	30	192.57	0.20		108	ns	11	1$^+$	10			1990	IT=100	
^{168}Er	−62991.2	1.2				STABLE			0$^+$	10			1934	IS=26.978 18	
^{168}Er^m	−61897.2	1.2	1094.0383	0.0016		109.0	ns	0.7	4$^-$	10			1974	IT=100	
^{168}Tm	−61312.9	1.7				93.1	d	0.2	3$^+$	10			1949	$\beta^+\approx$100; β^-=0.010 7	
^{168}Yb	−61581.9	1.2				STABLE		(>130 Ty)	0$^+$	10	56Po16	T	1938	IS=0.123 3; α ?; 2β^+ ?	*
^{168}Lu	−57070	40				5.5	m	0.1	6$^{(-)}$	10			1960	β^+=100	
^{168}Lu^m	−56870	40	202.81	0.12		6.7	m	0.4	3$^+$	10			1960	β^+>99.6 4; IT<0.8	
^{168}Hf	−55361	28				25.95	m	0.20	0$^+$	10			1961	$\varepsilon\approx$98; e$^+\approx$2	
^{168}Ta	−48394	28				2.0	m	0.1	(2$^-$,3$^+$)	10			1969	β^+=100	*
^{168}W	−44893	13				50.9	s	1.9	0$^+$	10			1971	$\beta^+\approx$100; α=0.0032 10	
^{168}Re	−35790	30				4.4	s	0.1	(7$^+$)	10			1992	$\beta^+\approx$100; $\alpha\approx$0.005	
^{168}Os	−29995	10				2.1	s	0.1	0$^+$	10			1977	β^+=57 4; α=43 4	
^{168}Ir	−18670	60				230	ms	50	(2$^-$)	10			1978	$\alpha\approx$100; β^+ ?; β^+p ?	*
^{168}Ir^m	−18620	240	50	250		163	ms	16	(9$^+$)	10	09Ha42	TD	1996	α=77 9; β^+ ?; β^+p ?	*
^{168}Pt	−11010	150				2.02	ms	0.10	0$^+$	10			1981	$\alpha\approx$100; β^+=0.2#	

*^{168}Gd I : first seen in 85Si25 via thermal fission of ^{252}Cf **
*^{168}Tb T : average 16Wu.A=9.49(0.39) 99As03=8.2(1.3) J : 16Gu.A=(4$^-$) **
*^{168}Yb T : lower limit is for α decay **
*^{168}Ta T : other: 02At01=5.2(0.7) for q=73$^+$ (bare ion) **
*^{168}Ir T : symmetrized from 09Ha42=222(+60–40) **
*^{168}Ir J : from correlations between α's depopulating (2$^-$) isomers down to ^{152}Tm **
*^{168}Ir^m T : average 09Ha42=160(+30–20) 09Ha42=153(+40–30)(indept) 96Pa01=161(21) **
*^{168}Ir^m J : from correlations between α's depopulating (9$^+$) isomers down to ^{152}Tm **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{169}Gd	−44150#	500#				750	ms	210	7/2$^-$#	13	16Wu.A	TD	2012	β^-=100; β^-n=0#	
^{169}Tb	−50330#	300#				5.13	s	0.32	3/2$^+$#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.01#	
^{169}Dy	−55600	300				39	s	8	(5/2)$^-$	08			1990	β^-=100	
^{169}Ho	−58797	20				4.72	m	0.10	7/2$^-$	08			1963	β^-=100	
^{169}Ho^m	−57411	20	1386.2	0.4		118	μs	6	(19/2$^+$)		10Dr05	ETJ	2010	IT=100	
^{169}Er	−60923.1	1.2				9.392	d	0.018	1/2$^-$	08			1956	β^-=100	
^{169}Er^m	−60831.1	1.2	92.05	0.10		285	ns	20	(5/2)$^-$	08			1969	IT=100	
^{169}Er^n	−60679.4	1.2	243.69	0.17		200	ns	10	7/2$^+$	08			1969	IT=100	
^{169}Tm	−61275.2	0.8				STABLE			1/2$^+$	08			1934	IS=100.	
^{169}Tm^m	−60959.1	0.8	316.1463	0.0001		659.9	ns	2.3	7/2$^+$	08			1950	IT=100	*
^{169}Yb	−60377.6	1.2				32.018	d	0.005	7/2$^+$	08			1946	ε=100	
^{169}Yb^m	−60353.4	1.2	24.1999	0.0016		46	s	2	1/2$^-$	08			1949	IT=100	
^{169}Lu	−58085	3				34.06	h	0.05	7/2$^+$	08			1955	β^+=100	
^{169}Lu^m	−58056	3	29.0	0.5		160	s	10	(1/2$^-$)	08			1965	IT=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

… *A*-group continued …

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{169}Hf	−54717	28					3.24	m	0.04	$(5/2^-)$	08			1969	β^+=100	
^{169}Ta	−50290	28					4.9	m	0.4	$(5/2^+)$	08	98Zh03	J	1969	β^+=100	
^{169}W	−44918	15					74	s	6	$5/2^-$#	08			1985	β^+=100	
^{169}Re	−38409	11					8.1	s	0.5	$(9/2^-)$	15	92Me10	D	1978	β^+=?; α=0.005 3	*
^{169}Re^m	−38234	14	175	13	AD		15.1	s	1.5	$(1/2^+,3/2^+)$	15			1984	β^+ ?; $\alpha\approx$0.2; IT ?	
^{169}Os	−30723	25					3.46	s	0.11	$(5/2^-)$	08	96Pa01	T	1972	β^+=86.3 8; α=13.7 8	*
^{169}Ir	−22094	23					353	ms	4	$(1/2^+)$	08	12Th13	D	1978	α=53 7; β^+ ?	*
^{169}Ir^m	−21941	12	153	22	AD		280	ms	1	$(11/2^-)$	08	12Th13	TD	1984	α=79 5; β^+ ?; p ?	*
^{169}Pt	−12510#	200#					6.99	ms	0.09	$(7/2^-)$	08	09Go16	T	1981	α=?; β^+=1#	*
^{169}Au	−1790#	300#					150#	μs		$1/2^+$#					p ?; α ?; β^+ ?	

*^{169}Tm^m	E : ENSDF2008=316.14633 (0.00011)	**
*^{169}Re	D : α=0.005(3)% derived from original α=0.001% - 0.01%	**
*^{169}Re	J : favored α decay from $(11/2^-)$ 173Ir to $(11/2^-)$ level at 136.2 keV	**
*^{169}Os	T : average 96Pa01=3.6(0.2) 95Hi02=3.2(0.3) 84Sc06=3.5(0.2) 82En03=3.4(0.2)	**
*^{169}Ir	T : also 12Th13=570(30)	**
*^{169}Ir	D : average of 12Th13=57(9)% 05Sc22=42(15)% 99Po09=50(18)%	**
*^{169}Ir^m	D : average 12Th13=78(6)% 99Po09=84(8)% 96Pa01=72(13)%; 05Sc22=59(4)% at	**
*^{169}Ir^m	D : variance, not used	**
*^{169}Pt	T : average 09Go16=6.99(0.10) 04Ke06=7.0(0.2)	**

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{170}Gd	−41380#	600#					420	ms	130	0^+	13	16Wu.A	TD	2012	β^-=100; β^-n=0#	
^{170}Tb	−46720#	400#					960	ms	68	2^-#	13	16Wu.A	TD	2012	β^-=100; β^-n=0.01#	
^{170}Dy	−53660#	200#					54.9	s	8.0	0^+	10	16Wu.A	TD	2010	β^-=100	
^{170}Dy^m	−52020#	200#	1643.92	0.22			0.94	μs	0.16	(6^+)		16So.A	ETJ	2016	IT=100	*
^{170}Ho	−56240	50				*	2.76	m	0.05	6^+#	02			1960	β^-=100	
^{170}Ho^m	−56140	60	100	80	BD	*	43	s	2	(1^+)	02			1960	β^-=100	
^{170}Er	−60108.7	1.5					STABLE		(>320 Py)	0^+	02	96De60	T	1934	IS=14.910 36; $2\beta^-$?; α ?	
^{170}Tm	−59795.9	0.8					128.6	d	0.3	1^-	02			1936	$\beta^-\approx$100; ε=0.131 10	
^{170}Tm^m	−59612.7	0.8	183.197	0.004			4.12	μs	0.13	$(3)^+$	02			1967	IT=100	
^{170}Yb	−60763.919	0.010					STABLE			0^+	02			1938	IS=2.982 39	
^{170}Yb^m	−59505.46	0.14	1258.46	0.14			370	ns	15	4^-	02			1981	IT=100	
^{170}Lu	−57306	17					2.012	d	0.020	0^+	02			1951	β^+=100	
^{170}Lu^m	−57213	17	92.91	0.09			670	ms	100	$(4)^-$	02			1965	IT=100	
^{170}Hf	−56254	28					16.01	h	0.13	0^+	06			1961	ε=100	
^{170}Ta	−50138	28					6.76	m	0.06	$(3)^{(+\#)}$	02			1969	β^+=100	
^{170}W	−47291	13					2.42	m	0.04	0^+	02			1971	$\beta^+\approx$100; α<1#	
^{170}Re	−38913	23					9.2	s	0.2	(5^+)	02			1974	$\beta^+\approx$100; α<0.01#	
^{170}Os	−33926	10					7.37	s	0.18	0^+	08			1972	β^+=?; α=9.5 10	
^{170}Ir	−23360#	90#					910	ms	150	(3^-)	08			1977	β^+ ?; α=5.2 17	*
^{170}Ir^m	−23200	70	160#	50#			811	ms	18	(8^+)	08			1977	α=36 10; β^+ ?; IT ?	
^{170}Pt	−16299	18					13.93	ms	0.16	0^+	02	04Ke06	T	1981	α=?; β^+=2#	*
^{170}Au	−3750#	200#					290	μs	50	(2^-)	02	04Ke06	TD	2002	p=89 10; α=11 10	*
^{170}Au^m	−3470#	200#	280	13	p		620	μs	50	(9^+)	02	04Ke06	TD	2002	p=58 5; α=42 5	*

*^{170}Dy^m	T : symmetrized from 16So.A=0.91(+0.18–0.13)	**
*^{170}Ir	T : symmetrized from 870(+180–120)	**
*^{170}Pt	T : average 04Ke06=14.0(0.2) 98Ki20=13.5(0.3) 96Bi07=14.7(0.5)	**
*^{170}Au	T : symmetrized from 286(+50–40)	**
*^{170}Au^m	T : 04Ke06=617(+50–40); other 02Ma61=570(+310–150) D : and 02Ma61=75(15)%	**

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{171}Tb	−44030#	500#					1.23	s	0.10	$3/2^+$#	13	16Wu.A	TD	2012	β^-=100; β^-n=1#	*
^{171}Dy	−50190#	300#					4.07	s	0.40	$7/2^-$#	13	16Wu.A	TD	2012	β^-=100	
^{171}Ho	−54520	600					53	s	2	$7/2^-$#	02			1989	β^-=100	
^{171}Er	−57719.0	1.6					7.516	h	0.002	$5/2^-$	02			1938	β^-=100	
^{171}Er^m	−57520.4	1.6	198.6	0.1			210	ns	10	$1/2^-$	02			1969	IT=100	
^{171}Tm	−59210.3	1.0					1.92	y	0.01	$1/2^+$	02			1948	β^-=100	
^{171}Tm^m	−58785.3	1.0	424.9560	0.0015			2.60	μs	0.02	$7/2^-$	02			1948	IT=100	
^{171}Tm^n	−57535.8	1.0	1674.5	0.3			1.7	μs	0.2	$19/2^+$		09Wa06	ETJ	2009	IT=100	
^{171}Yb	−59306.810	0.013					STABLE			$1/2^-$	02			1934	IS=14.09 14	
^{171}Yb^m	−59211.528	0.013	95.282	0.002			5.25	ms	0.24	$7/2^+$	02			1968	IT=100	
^{171}Yb^n	−59184.394	0.013	122.416	0.002			265	ns	20	$5/2^-$	02			1968	IT=100	
^{171}Lu	−57828.4	1.9					8.24	d	0.03	$7/2^+$	02			1951	β^+=100	
^{171}Lu^m	−57757.3	1.9	71.13	0.08			79	s	2	$1/2^-$	02			1965	IT=100	
^{171}Hf	−55431	29					12.1	h	0.4	$7/2^+$	02	00Ye02	J	1951	β^+=100	
^{171}Hf^m	−55409	29	21.93	0.09			29.5	s	0.9	$1/2^-$	02	00Ye02	J	1997	IT$\approx$100; β^+ ?	
^{171}Ta	−51720	28					23.3	m	0.3	$(5/2^-)$	02			1969	β^+=100	
^{171}W	−47086	28					2.38	m	0.04	$(5/2^-)$	02			1983	β^+=100	
^{171}Re	−41250	28					15.2	s	0.4	$(9/2^-)$	02			1987	β^+=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …															
^{171}Os	−34302	18				8.3	s	0.2	(5/2$^-$)	02			1972	β^+ ?; α=1.80 21	
^{171}Ir	−26410	40				3.1	s	0.3	1/2$^+$	02	11Ko.B	TJ	1967	β^+ ?; α=15 2	*
^{171}Ir^m	−26250#	40#	167#	12#		1.47	s	0.06	(11/2$^-$)	02	11Ko.B	T	1967	α=54 5; β^+ ?; p ?	*
^{171}Pt	−17470	70				45.5	ms	2.5	7/2$^-$	10	10Sc02	J	1981	α=90 7; β^+ ?	
^{171}Pt^m	−17060	70	412.6	1.0		901	ns	9	13/2$^+$	10	FGK128	J	2010	IT=100	*
^{171}Au	−7562	21				22.3	μs	2.4	(1/2$^+$)	02	04Ke06	T	1997	p≈100; α ?	*
^{171}Au^m	−7308	18	255	10	p	1.036	ms	0.016	11/2$^-$	02	04Ke06	TD	1996	α=60.0 28; p=40.0 28	*
^{171}Hg	3480#	300#				70	μs	30	3/2$^-$#	04			2004	α≈100; β^+=0.01#	*
*^{171}Tb	T : symmetrized from 1.24(+0.09–0.10)														**
*^{171}Ir	T : other 02Ro17=3.2(+1.3–0.7) D : 13An10=15(2)														**
*^{171}Ir^m	D : average 10An01=53(5)% 96Pa01=58(11)%														**
*^{171}Ir^m	T : average 11Ko.B=1.50(0.07) 10An01=1.40(0.10)														**
*^{171}Pt^m	J : M2 to 9/2$^-$														**
*^{171}Au	T : average 04Ke06=22(+3–2) 99Po09=17(+9–5)														**
*^{171}Au	T : other 03Ba20=37(+7–5) conflicting, not used														**
*^{171}Au^m	T : average 04Ke06=1.09(0.03) 03Ba20=1.014(0.019)														**
*^{171}Au^m	D : average 04Ke06=34(4)% 97Da07=46(4)%; Birge ratio B=2.1														**
*^{171}Hg	T : symmetrized from 59(+36–16)														**
^{172}Tb	−39850#	500#				760	ms	190	6$^+$#	13	16Wu.A	TD	2012	β^-=100; β^-n=1#	
^{172}Dy	−48010#	300#				3.4	s	0.2	0$^+$	13	16Wa19	TD	2012	β^-=100	
^{172}Dy^m	−46730#	300#	1278	1		710	ms	50	(8$^-$)		16Wa19	ETJ	2016	β^-=19 3; IT=81 3	
^{172}Ho	−51480#	200#				25	s	3	0$^+$#	15			1991	β^-=100	
^{172}Er	−56484	4				49.3	h	0.5	0$^+$	15			1956	β^-=100	
^{172}Er^m	−54983	4	1500.9	0.3		579	ns	62	(6$^+$)	15	10Dr02	ETJ	2006	IT=100	
^{172}Tm	−57374	6				63.6	h	0.3	2$^-$	15			1956	β^-=100	
^{172}Tm^m	−56898	6	476.2	0.2		132	μs	7	(6$^+$)	15			2008	IT=100	
^{172}Yb	−59255.446	0.014				STABLE			0$^+$	95			1934	IS=21.68 13	
^{172}Yb^m	−57705.02	0.06	1550.43	0.06		3.6	μs	0.1	6$^-$	95			1969	IT=100	
^{172}Lu	−56736.0	2.3				6.70	d	0.03	4$^-$	95			1951	β^+=100	
^{172}Lu^m	−56694.1	2.3	41.86	0.04		3.7	m	0.5	1$^-$	95			1962	IT=100; β^+<0.18	
^{172}Lu^n	−56670.2	2.3	65.79	0.04		332	ns	20	(1)$^+$	95			1965	IT=100	
^{172}Lu^p	−56626.6	2.3	109.41	0.10		440	μs	12	(1)$^+$	95			1965	IT=100	
^{172}Lu^q	−56522.4	2.3	213.57	0.17		150	ns		(6$^-$)	95			1974	IT=100	
^{172}Hf	−56402	24				1.87	y	0.03	0$^+$	95			1951	ε=100	
^{172}Hf^m	−54396	24	2005.84	0.11		163	ns	3	(8$^-$)	95			1976	IT=100	
^{172}Ta	−51330	28				36.8	m	0.3	(3$^+$)	15			1964	β^+=100	
^{172}W	−49097	28				6.6	m	0.9	0$^+$	95			1964	β^+=100	
^{172}Re	−41540	40			*	15	s	3	(5$^+$)	16			1972	β^+=100	
^{172}Re^m	−41540#	110#	0#	100#	*	55	s	5	(2)	16			1977	β^+=100	
^{172}Os	−37244	13				19.2	s	0.9	0$^+$	95	95Hi02	D	1971	β^+=?; α=1.1 2	
^{172}Ir	−27380	30				4.4	s	0.3	(3$^-$,4$^-$)	16			1967	β^+ ?; α=2	
^{172}Ir^m	−27240	30	139	10	AD	2.19	s	0.07	(7$^+$)	16			1967	β^+ ?; α=9.5 11	
^{172}Pt	−21107	10				97.6	ms	1.3	0$^+$	10	10An02	D	1981	α=97 3; β^+ ?	
^{172}Au	−9320	60				28	ms	4	(2$^-$)	10			1993	α=?; p<2; β^+ ?	*
^{172}Au^m	−9160	240	160	250		11.0	ms	1.0	(9$^+$)	10	09Ha42	T	1993	α=?; p<2	*
^{172}Hg	−1060	150				231	μs	9	0$^+$	10			1999	α≈100; β^+=0.1#	
*^{172}Au	T : symmetrized from 09Ha42=22(+6–4)														**
*^{172}Au	J : from correlations between α's depopulating (2$^-$) isomers down to ^{152}Tm														**
*^{172}Au^m	T : average 09Ha42=9(+2–1) 09Ha42=8(+5–2) (independent measurements)														**
*^{172}Au^m	T : others 96Pa01=6.3(1.5) 93Se09=4(1)														**
^{173}Dy	−43940#	400#				1.43	s	0.20	9/2$^+$#	13	16Wu.A	TD	2012	β^-=100	
^{173}Ho	−49350#	300#				6.90	s	0.48	7/2$^-$#	13	16Wu.A	TD	2012	β^-=100	
^{173}Er	−53650#	200#				1.434	m	0.017	(7/2$^-$)	95	94It.A	T	1972	β^-=100	
^{173}Tm	−56256	4				8.24	h	0.08	(1/2$^+$)	95			1961	β^-=100	
^{173}Tm^m	−55938	4	317.73	0.20		10.7	μs	1.7	7/2$^-$	95	12Hu10	TJ	1972	IT=100	*
^{173}Tm^n	−54350	4	1905.7	0.4		250	ns	69	19/2$^-$	95	12Hu10	ETJ	2012	IT=100	
^{173}Tm^p	−52208	4	4047.9	0.5		121	ns	28	35/2$^-$	95	12Hu10	ETJ	2012	IT=100	
^{173}Yb	−57551.225	0.011				STABLE			5/2$^-$	95			1934	IS=16.103 63	
^{173}Yb^m	−57152.3	0.5	398.9	0.5		2.9	μs	0.1	1/2$^-$	95			1963	IT=100	
^{173}Lu	−56880.9	1.6				1.37	y	0.01	7/2$^+$	95			1951	ε=100	
^{173}Lu^m	−56757.2	1.6	123.672	0.013		74.2	μs	1.0	5/2$^-$	95			1962	IT=100	
^{173}Hf	−55412	28				23.6	h	0.1	1/2$^-$	06			1951	β^+=100	
^{173}Hf^m	−55305	28	107.16	0.05		180	ns	8	5/2$^-$	06			1973	IT=100	
^{173}Hf^n	−55215	28	197.47	0.10		160	ns	40	7/2$^+$	06			1973	IT=100	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{173}Ta	−52397	28				3.14	h	0.13	$5/2^-$	95			1960	β^+=100	
^{173}Ta^m	−52224	28	173.10	0.21		225	ns	15	$9/2^-$	95	95Ca27	E	1977	IT=100	*
^{173}Ta^n	−50678	28	1719.4	1.0		132	ns	3	$21/2^-$		06Th07	ETJ	2006	IT=100	
^{173}W	−48727	28				7.6	m	0.2	$5/2^-$	95			1963	β^+=100	
^{173}Re	−43554	28				2.0	m	0.3	$(5/2^-)$	95			1986	β^+=100	
^{173}Os	−37438	15				22.4	s	0.9	$5/2^-$	15			1971	$\beta^+\approx$100; α=0.4 2	
^{173}Ir	−30268	11				9.0	s	0.8	$(1/2^+,3/2^+)$	15	01Ko44	J	1967	β^+>93; α<7	*
^{173}Ir^m	−30042	11	226	9	AD	2.20	s	0.05	$(11/2^-)$	15	01Ko44	J	1967	β^+=88 1; α=12 1	*
^{173}Pt	−21940	60				382	ms	2	$(5/2^-)$	15			1966	α=86 4; β^+ ?	
^{173}Au	−12832	23				25.5	ms	0.8	$(1/2^+)$	15	12Th13	T	1983	α=86 13; β^+=6#	*
^{173}Au^m	−12619	12	214	21	AD	12.2	ms	0.1	$(11/2^-)$	15	99Po09	D	1984	α=89 11; β^+=4#	
^{173}Hg	−2710#	200#				800	μs	80	$3/2^-$#	15			1999	α=100	*

*^{173}Tm^m T : average 12Hu10=11.1(2.8) 72Pu02=10.4(2.1) **
*^{173}Ta^m T : other recent 06Th07=163(2), conflicting, not used **
*^{173}Ir J : favored α decay from (1/2$^+$,3/2$^+$) ^{177}Au ground-state **
*^{173}Ir^m J : favored α decay from (11/2$^-$) ^{177}Au isomer **
*^{173}Au T : average 12Th13=26.3(1.2) 99Po09=25(1) **
*^{173}Au D : from 99Po09=94(+6–19)%; and for isomer ^{173}Au^m 92(+8–13)% **
*^{173}Hg J : 12Od01=(7/2$^-$) based on α chain, not trusted **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{174}Dy	−41370#	500#				1#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?; β^-n=0#	
^{174}Ho	−45690#	300#				3.2	s	1.1	8^-#	13	16Wu.A	TD	2012	β^-=100	
^{174}Er	−51950#	300#				3.2	m	0.2	0^+	99			1989	β^-=100	
^{174}Er^m	−50840#	300#	1111.6	1.1		3.9	s	0.3	8^-		16Wu.A	T	2006	IT=100	*
^{174}Tm	−53860	40				5.4	m	0.1	$(4)^-$	99			1960	β^-=100	
^{174}Tm^m	−53610	40	252.4	0.5		2.29	s	0.01	(0^+)		06Ch10	TJD	2006	IT>98.5; β^-<1.5	*
^{174}Yb	−56944.512	0.011				STABLE			0^+	99			1934	IS=32.026 80	
^{174}Yb^m	−55426.364	0.017	1518.148	0.013		830	μs	40	6^+	99			1964	IT=100	
^{174}Yb^n	−55179.3	0.5	1765.2	0.5		256	ns	11	7^-		05Dr05	EJT	2005	IT=100	
^{174}Lu	−55570.2	1.6				3.31	y	0.05	1^-	99	98Ge13	J	1951	β^+=100	
^{174}Lu^m	−55399.4	1.6	170.83	0.05		142	d	2	6^-	99	98Ge13	J	1960	IT=99.38 2; ε=0.62 2	
^{174}Lu^n	−55329.4	1.6	240.818	0.004		395	ns	15	(3^+)	99			1980	IT=100	
^{174}Lu^p	−55205.0	1.6	365.183	0.006		145	ns	3	(4^-)	99			1980	IT=100	
^{174}Lu^q	−53714.5	1.7	1855.7	0.5		194	ns	24	13^+		09Ko19	ETJ	2009	IT=100	
^{174}Lu^r	−49720.6	1.8	5849.6	0.9		242	ns	19	(26^-)		09Ko19	ETJ	2009	IT=100	
^{174}Hf	−55844.5	2.3				2.0	Py	0.4	0^+	04			1939	IS=0.16 1; α=100; 2β^+ ?	
^{174}Hf^m	−54295.2	2.9	1549.3	1.8		138	ns	4	6^+	04	FGK129	J	1976	IT=100	*
^{174}Hf^n	−54047.0	2.9	1797.5	1.8		2.39	μs	0.04	8^-	04	FGK129	J	1974	IT=100	
^{174}Hf^p	−52532.8	2.9	3311.7	1.8		3.7	μs	0.2	14^+	04	FGK129	J	1974	IT=100	
^{174}Ta	−51741	28				1.14	h	0.08	3^+	99			1960	β^+=100	
^{174}W	−50227	28				33.2	m	2.1	0^+	99			1964	β^+=100	
^{174}W^m	−48555	28	1672.0	0.5		> 187	ns			99			1976	IT=100	
^{174}W^n	−48307	28	1919.7	0.5		187	ns	25		99			1976	IT=100	
^{174}W^p	−47959	28	2267.8	0.4		158	ns	3	8^-		06Ta13	ETJ	2006	IT=100	*
^{174}W^q	−46711	28	3515.6	0.4		128	ns	8	12^+		06Ta13	ETJ	2006	IT=100	*
^{174}Re	−43673	28				2.40	m	0.04	3^+#	99			1972	β^+=100	
^{174}Re^m	−43570#	60#	100#	50#		1#	m	(>1 μs)	7^+#		12Gu14	T	2012	IT ?; β^+ ?	
^{174}Os	−39995	10				44	s	4	0^+	99			1971	$\beta^+\approx$100; α=0.024 7	*
^{174}Ir	−30863	24				7.9	s	0.6	(3^+)	99			1967	β^+=99.5 3; α=0.5 3	
^{174}Ir^m	−30671	23	192	11	AD	4.9	s	0.3	(7^+)	99			1992	β^+=97.5 3; α=2.5 3	
^{174}Pt	−25318	10				889	ms	17	0^+	99			1966	α=76 8; β^+ ?	
^{174}Au	−14240#	90#				139	ms	3	low	99	02Ro17	TD	1983	α=90 6; β^+ ?	*
^{174}Au^m	−13990	70	250#	50#		171	ms	29	high		96Pa01	TJ	1995	α=?; β^+ ?	
^{174}Hg	−6641	19				2.0	ms	0.4	0^+	99	99Se14	T	1997	$\alpha\approx$100; β^+=0.4#	*

*^{174}Er^m T : average 16Wu.A=3.37(0.73) 09Dr06=4.02(0.35) **
*^{174}Er^m E : uncertainty estimated by NUBASE **
*^{174}Tm^m E : uncertainty estimated by NUBASE **
*^{174}Hf^m J : multiple decay branches, transition mult., magnetic moment; also n and p **
*^{174}W^p E : derived from least-squares fit to γ-ray energies **
*^{174}W^q E : derived from least-squares fit to γ-ray energies **
*^{174}Os D : symmetrized from 71Bo06 α=0.020(+10–4)% **
*^{174}Au T : others 96Pa01=171(29) 83Sc24=120(20) **
*^{174}Hg T : symmetrized from 1.9(+0.4–0.3) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{175}Ho	−43200#	400#					1.88	s	0.55	7/2$^-$#	13	16Wu.A	TD	2012	β^-=100; β^-n=0#	
^{175}Er	−48650#	400#					1.2	m	0.3	9/2$^+$#	04			1996	β^-=100	
^{175}Tm	−52310	50					15.2	m	0.5	1/2$^+$#	04			1961	β^-=100	
^{175}Tm^m	−51870	50	440.0	1.1			319	ns	35	7/2$^-$	04	12Hu10	ETJ	2012	IT=100	
^{175}Tm^n	−50790	50	1517.7	1.2			21	μs	14	23/2$^+$	04	12Hu10	ETJ	2012	IT=100	
^{175}Yb	−54695.55	0.07					4.185	d	0.001	7/2$^-$	04	12Fl05	J	1945	β^-=100	
^{175}Yb^m	−54180.68	0.07	514.866	0.004			68.2	ms	0.3	1/2$^-$	04			1972	IT=100	
^{175}Lu	−55165.6	1.2					STABLE			7/2$^+$	04			1934	IS=97.401 13	
^{175}Lu^m	−54812.1	1.2	353.48	0.13			1.49	μs	0.07	5/2$^-$	04			1965	IT=100	
^{175}Lu^n	−53773.4	1.3	1392.2	0.6			984	μs	30	19/2$^+$	04	98Wh02	J	1998	IT=100	
^{175}Hf	−54481.7	2.3					70.65	d	0.19	5/2$^{(-)}$	04	12Fa07	T	1949	ε=100	
^{175}Hf^m	−54355.8	2.3	125.89	0.12			53.7	μs	1.5	1/2$^-$	04			1964	IT=100	
^{175}Hf^n	−53048.3	2.3	1433.41	0.12			1.10	μs	0.08	19/2$^+$	04	95Gj01	J	1990	IT=100	
^{175}Hf^p	−51466.1	2.3	3015.6	0.4			1.21	μs	0.15	35/2$^-$	04	95Gj01	J	1980	IT=100	
^{175}Hf^q	−49845.5	2.6	4636.2	1.2			1.9	μs	0.1	45/2$^+$	04	04Ko.A	JT	1990	IT=100	
^{175}Ta	−52409	28					10.5	h	0.2	7/2$^+$	04			1960	β^+=100	
^{175}Ta^m	−52278	28	131.41	0.17			222	ns	8	9/2$^-$	04	96Ko17	JT	1972	IT=100	
^{175}Ta^n	−52070	28	339.2	1.3			170	ns	20	(1/2$^+$)	04			1969	IT=100	
^{175}Ta^p	−50841	28	1567.6	0.3			1.95	μs	0.15	21/2$^-$	04	96Ko17	JT	1996	IT=100	
^{175}W	−49633	28					35.2	m	0.6	(1/2$^-$)	04			1963	β^+=100	
^{175}W^m	−49398	28	234.96	0.15			216	ns	6	(7/2$^+$)	04			1978	IT=100	
^{175}Re	−45288	28					5.89	m	0.05	5/2$^-$#	04			1967	β^+=100	
^{175}Os	−40105	12					1.4	m	0.1	(5/2$^-$)	04			1972	β^+=100	
^{175}Ir	−33395	12					9	s	2	5/2$^-$#	04			1967	β^+=99.15 28; α=0.85 28	
^{175}Pt	−25713	18					2.43	s	0.04	(7/2$^-$)	04	14Pe02	T	1966	α=64 5; β^+ ?	
^{175}Au	−17400	40					202	ms	6	1/2$^+$	04	13An10	TJD	1975	α=88 3; β^+ ?	*
^{175}Au^m	−17240#	40#	167#	11#	AD		134	ms	4	(11/2$^-$)	04	11Ko.B	TD	1975	α=75 4; β^+ ?	*
^{175}Hg	−7970	70					10.6	ms	0.4	(7/2$^-$)	09			1983	α=?; β^+=1#	
^{175}Hg^m	−7480	70	494	2			340	ns	30	(13/2$^+$)	09			2009	IT=100	

*^{175}Au T : average 13An10=207(7) 11Ko.B=188(12) **
*^{175}Au J : favored α decay to 1/2$^+$ states in ^{171}Ir and ^{167}Re and from 1/2$^+$ in ^{179}Tl **
*^{175}Au D : average 13An10=90(7) 11Ko.B=87(4) **
*^{175}Au D : α=87(4) from 11Ko.B, after correction for α=64(5) of ^{175}Pt daughter **
*^{175}Au^m T : average 11Ko.B=124(8) 10An01=138(5); the former supersedes 01Ko44=143(8) **
*^{175}Au^m T : others 02Ro17=158(3) 96Pa01=185(30) 83Sc24=200(22) for mixture ground-state and m **
*^{175}Au^m J : favored α decay to (11/2$^-$) excited isomer ^{171}Ir^m **
*^{175}Au^m D : α=75(4)% from 11Ko.B, after correction for α=64(5)% of ^{175}Pt daughter **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{176}Ho	−39290#	500#					2#	s	(>300 ns)		13	12Ku26	I	2012	β^- ?; β^-n=0.1#	
^{176}Er	−46630#	400#					20#	s	(>300 ns)	0$^+$	13	12Ku26	I	2012	β^- ?	
^{176}Tm	−49370	100					1.85	m	0.03	(4$^+$)	06	94It.A	T	1961	β^-=100	
^{176}Yb	−53491.314	0.015					STABLE		(>160 Py)	0$^+$	06	96De60	T	1934	IS=12.996 83; 2β^- ?; α ?	
^{176}Yb^m	−52441.5	0.6	1049.8	0.6			11.4	s	0.3	8$^-$	06			1967	IT=?; β^-<10#	
^{176}Lu	−53382.2	1.2					36.84	Gy	0.18	7$^-$	06	14Hu07	T	1935	IS=2.599 13; β^-=100	*
^{176}Lu^m	−53259.4	1.2	122.845	0.004			3.664	h	0.019	1$^-$	06			1935	$\beta^-\approx$100; ε=0.095 16	
^{176}Lu^n	−51867.7	1.3	1514.5	0.5			312	ns	69	12$^+$	06			2000	IT=100	
^{176}Lu^p	−51794.7	1.6	1587.5	1.1			40	μs	3	14$^+$	06	FGK128	J	2000	IT=100	*
^{176}Hf	−54576.3	1.5					STABLE			0$^+$	06			1934	IS=5.26 7	
^{176}Hf^m	−53243.2	1.5	1333.07	0.07			9.6	μs	0.3	6$^+$	06			1964	IT=100	
^{176}Hf^n	−53017.0	1.5	1559.31	0.09			9.9	μs	0.2	8$^-$	06			1967	IT=100	
^{176}Hf^p	−51710.5	1.7	2865.8	0.7			401	μs	6	14$^-$	06			1975	IT=100	
^{176}Hf^q	−49712.8	2.2	4863.5	1.6			43	μs	4	22$^-$	06	10Mu13	JT	1976	IT=100	
^{176}Ta	−51370	30					8.09	h	0.05	(1)$^-$	06			1948	β^+=100	
^{176}Ta^m	−51270	30	103.0	1.0			1.08	ms	0.07	(7$^+$)	06	78Du06	ET	1971	IT=100	*
^{176}Ta^n	−49900	30	1474.0	1.4			3.8	μs	0.4	14$^-$	06			1978	IT=100	*
^{176}Ta^p	−48500	30	2874.0	1.4			970	μs	70	20$^-$	06			1994	IT=100	*
^{176}W	−50642	28					2.5	h	0.1	0$^+$	06			1950	ε=100	
^{176}Re	−45063	28					5.3	m	0.3	(3$^+$)	06			1967	β^+=100	
^{176}Os	−42098	28					3.6	m	0.5	0$^+$	06			1970	β^+=100	
^{176}Ir	−33878	17					8.7	s	0.5		06			1967	β^+=96.9 6; α=3.1 6	
^{176}Pt	−28934	13					6.33	s	0.15	0$^+$	06			1966	β^+ ?; α=40 2	
^{176}Au	−18520	30				*	1.05	s	0.01	(3$^-$,4$^-$)	06	14An10	J	1975	α=75 8; β^+ ?	*
^{176}Au^m	−18380	30	139	13	AD	*	860	ms	160	(7$^+$)	06	02Ro17	T	2002	α=?; β^+ ?	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{176}Hg	−11785	11				20.3	ms	1.4	0^+	06			1983	α=90 9; β^+ ?	*
^{176}Tl	580	80				6.2	ms	2.3	$(3^-,4^-,5^-)$	09			2004	p≈100; α ?; β^+ ?	*
*^{176}Lu	T : average 14Hu07=37.22(0.29) 13Ko20=36.40(0.35) 06Lu03=35.6(0.7)														**
*^{176}Lu	T : 03Ni11=36.77(0.75) 92Da03=37.3(0.5) 65Br25=36.8(6)														**
*^{176}Lu^p	J : 73.0 γ (E2) to 12^+ state														**
*^{176}Ta^m	T : average 78Du06=1.05(0.10) 71Go21=1.1(0.1) J : from 98Ko09														**
*^{176}Ta^n	E : 1371(1) keV above ^{176}Ta^m														**
*^{176}Ta^p	E : 2771(1) keV above ^{176}Ta^m														**
*^{176}Au	D : α=75 8 as quoted in 14An10														**
*^{176}Au^m	T : symmetrized from 840(+170−140) J : from α decay to ^{172}Ir^m														**
*^{176}Hg	D : α symmetrized from 99Po09=94(+6−12)%														**
*^{176}Tl	T : symmetrized from 5.2(+3.0−1.4)														**
^{177}Er	−42860#	500#				3#	s	(>300 ns)	$1/2^-$#	13	12Ku26	I	2012	β^- ?	
^{177}Tm	−47470#	300#				90	s	6	$(7/2^-)$	03			1989	β^-=100	
^{177}Yb	−50986.40	0.22				1.911	h	0.003	$9/2^+$	03	12Fl05	J	1945	β^-=100	
^{177}Yb^m	−50654.9	0.4	331.5	0.3		6.41	s	0.02	$1/2^-$	03	12Fl05	J	1962	IT=100	
^{177}Lu	−52383.8	1.2				6.6457	d	0.0026	$7/2^+$	03	12Ko24	T	1945	β^-=100	*
^{177}Lu^m	−52233.4	1.2	150.3967	0.0010		130	ns	3	$9/2^-$	03			1949	IT=100	
^{177}Lu^n	−51814.1	1.2	569.7068	0.0016		155	μs	7	$1/2^+$	03			1965	IT=100	
^{177}Lu^p	−51413.6	1.2	970.1750	0.0024		160.44	d	0.06	$23/2^-$	03			1962	β^-=78.6 8; IT=21.4 8	
^{177}Lu^q	−49612.2	1.4	2771.6	0.7		625	ns	62	$33/2^+$		04Dr06	ETJ	2004	IT=100	
^{177}Lu^r	−48853.5	1.4	3530.3	0.7		6	μs	2	$39/2^-$	03	11Ko.A	T	2003	IT=100	*
^{177}Hf	−52880.6	1.4				STABLE			$7/2^-$	03			1934	IS=18.60 9	
^{177}Hf^m	−51565.1	1.4	1315.4504	0.0008		1.09	s	0.05	$23/2^+$	03			1966	IT=100	
^{177}Hf^n	−51538.2	1.4	1342.38	0.20		55.9	μs	1.2	$(19/2^-)$	03			1976	IT=100	
^{177}Hf^p	−50140.6	1.4	2740.02	0.15		51.4	m	0.5	$37/2^-$	03			1971	IT=100	*
^{177}Ta	−51715	3				56.56	h	0.06	$7/2^+$	03			1948	β^+=100	
^{177}Ta^m	−51642	3	73.36	0.15		410	ns	7	$9/2^-$	03			1973	IT=100	
^{177}Ta^n	−51529	3	186.15	0.06		3.62	μs	0.10	$5/2^-$	03			1971	IT=100	
^{177}Ta^p	−50360	3	1355.01	0.19		5.31	μs	0.25	$21/2^-$	03			1971	IT=100	
^{177}Ta^q	−47059	3	4656.3	0.5		133	μs	4	$49/2^-$	03			1994	IT=100	
^{177}W	−49702	28				132	m	2	$1/2^-$	03			1950	β^+=100	
^{177}Re	−46269	28				14	m	1	$5/2^-$	03			1957	β^+=100	
^{177}Re^m	−46184	28	84.71	0.10		50	μs	10	$5/2^+$	03			1972	IT=100	
^{177}Os	−41956	15				3.0	m	0.2	$1/2^-$	03			1970	β^+=100	
^{177}Ir	−36047	20				30	s	2	$5/2^-$	03			1967	β^+≈100; α=0.06 1	
^{177}Pt	−29370	15				10.6	s	0.4	$5/2^-$	03			1966	β^+=94.3 5; α=5.7 5	
^{177}Pt^m	−29223	15	147.4	0.4		2.2	μs	0.3	$1/2^-$	03			1979	IT=100	
^{177}Au	−21545	10				1.46	s	0.03	$(1/2^+,3/2^+)$	03	01Ko44	TJ	1968	α=40 6; β^+ ?	*
^{177}Au^m	−21356	10	189	8	AD	1.180	s	0.012	$11/2^-$	03	01Ko44	ETJ	1975	α=66 10; β^+ ?	*
^{177}Hg	−12780	80				127.3	ms	1.8	$(7/2^-)$	03	05Ca43	J	1975	α=85; β^+=15	*
^{177}Hg^m	−12460	80	323	1		1.50	μs	0.15	$(13/2^+)$		03Me20	ETJ	2003	IT=100	
^{177}Tl	−3341	22				18	ms	5	$(1/2^+)$	03			1999	α=73 13; p=27 13	
^{177}Tl^m	−2534	12	807	18	p	180	μs	60	$(11/2^-)$	03	04Ke06	TD	1997	p=51 8; α=49 8	*
*^{177}Lu	T : average 12Ko24=6.639(0.009) 11Po07=6.6465(0.0032) 01Sc23=6.646(0.005)														**
*^{177}Lu^r	E : derived by NUBASE from least-squares fit to γ-ray energies														**
*^{177}Lu^r	T : 04Al04=7(2) m, not trusted														**
*^{177}Hf^p	T : other 04Al04=76(+16−9) from decay growth														**
*^{177}Au	T : average 09An14=1.53(0.07) 01Ko44=1.46(0.03) D : from 09An14														**
*^{177}Au^m	D : from 09An14														**
*^{177}Hg	J : also 09An20														**
*^{177}Tl^m	T : 04Ke06=160(+70−40) D : also 04Ke06=55(20)%														**
^{178}Er	−40260#	600#				1#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?; β^-n=0#	
^{178}Tm	−44120#	400#				30#	s	(>300 ns)		11	09St16	I	2008	β^- ?	
^{178}Yb	−49695	10				74	m	3	0^+	09			1973	β^-=100	
^{178}Lu	−50337.8	2.3				28.4	m	0.2	$1^{(+)}$	09			1957	β^-=100	
^{178}Lu^m	−50214	3	123.8	2.6	RQ	23.1	m	0.3	$9^{(-)}$	09	98Ge13	J	1951	β^-=100	
^{178}Hf	−52435.2	1.4				STABLE			0^+	09			1934	IS=27.28 7	
^{178}Hf^m	−51287.8	1.4	1147.416	0.006		4.0	s	0.2	8^-	09			1960	IT=100	
^{178}Hf^n	−49989.1	1.4	2446.09	0.08		31	y	1	16^+	09			1968	IT=100	
^{178}Hf^p	−49862.8	1.4	2572.4	0.3		68	μs	2	14^-	09			1977	IT=100	
^{178}Ta	−50600#	50#			*	2.36	h	0.08	7^-#	09			1950	β^+=100	
^{178}Ta^m	−50498	15	100#	50#	*	9.31	m	0.03	1^+#	09	96Ko13	E	1950	β^+=100	*
^{178}Ta^n	−49130#	50#	1467.82	0.16		59	ms	3	15^-	09	96Ko13	ETJ	1979	IT=100	*
^{178}Ta^p	−47700#	50#	2901.9	0.7		290	ms	12	21^-	09	96Ko13	ETJ	1996	IT=100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{178}W	−50407	15				21.6	d	0.3	0^+	09			1950	ε=100	
^{178}W^m	−43834	15	6572.7	0.3		220	ns	10	25^+	09			1998	IT=100	
^{178}Re	−45653	28				13.2	m	0.2	(3^+)	09			1957	β^+=100	
^{178}Os	−43544	14				5.0	m	0.4	0^+	09			1967	β^+=100	
^{178}Ir	−36252	20				12	s	2		09			1972	β^+=100	
^{178}Pt	−31998	10				20.7	s	0.7	0^+	09			1966	β^+=92.3 3; α=7.7 3	
^{178}Au	−22304	10				2.6	s	0.5		09			1968	β^+<60; α>40	
^{178}Au^m	−22115	10	189	14		> 1	s				15Ma.A	ET	2015	β^+ ?; α ?	
^{178}Au^p	−21939	24	365	21	AD										
^{178}Hg	−16316	11				266.5	ms	2.4	0^+	09	12Ve04	D	1971	α=89 4; β^+ ?	
^{178}Tl	−4790#	90#				255	ms	9	$(4^-,5^-)$	09	13Li49	TJD	1997	α=62 2; β^+=38 2; β^+SF=0.15 6	*
^{178}Pb	3574	24				230	μs	150	0^+	09	01Ro.B	T	2001	$\alpha\approx$100; β^+ ?	*

*^{178}Ta^m E : 1^+ state (p9/2$^-$[514]+n7/2$^-$[514]) is expected 104 keV above the 7^- ground-state, **
*^{178}Ta^m E : based on E=220 keV for 8^+ (p9/2$^-$[514]+n7/2$^-$[514]) and residual energy **
*^{178}Ta^m E : shift of 50 keV from known Gallagher-Moszkowski splitting energy **
*^{178}Ta^n E : from least-squares fit to γ-rays in 96Ko13 **
*^{178}Ta^n T : average 96Ko13=58(4) 79Du02=60(5) **
*^{178}Ta^p E : from least-squares fit to γ-rays in 96Ko13 **
*^{178}Tl T : average 13Li49=252(20) 02Ro17=254(+11–9) **
*^{178}Pb T : two events at 202 and 147 μs, see 84Sc13 **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{179}Tm	−41600#	500#				20#	s	(>300 ns)	$1/2^+$#	13	12Ku26	I	2012	β^- ?; β^-n=0#	
^{179}Yb	−46540#	200#				8.0	m	0.4	$(1/2^-)$	09			1982	β^-=100	
^{179}Lu	−49059	5				4.59	h	0.06	$7/2^+$	09			1961	β^-=100	
^{179}Lu^m	−48467	5	592.4	0.4		3.1	ms	0.9	$1/2^+$	09			1982	IT=100	
^{179}Hf	−50462.9	1.4				STABLE			$9/2^+$	09			1934	IS=13.62 2	
^{179}Hf^m	−50087.9	1.4	375.0352	0.0025		18.67	s	0.04	$1/2^-$	09			1962	IT=100	
^{179}Hf^n	−49357.2	1.4	1105.74	0.16		25.05	d	0.25	$25/2^-$	09			1970	IT=100	
^{179}Hf^p	−46687.7	2.5	3775.2	2.1		15	μs	5	$(43/2^+)$	09			2000	IT=100	
^{179}Ta	−50357.3	1.5				1.82	y	0.03	$7/2^+$	09			1950	ε=100	
^{179}Ta^m	−50326.6	1.5	30.7	0.1		1.42	μs	0.08	$9/2^-$	09			1964	IT=100	
^{179}Ta^n	−49837.1	1.5	520.23	0.18		280	ns	80	$1/2^+$	09	FGK128	J	1974	IT=100	
^{179}Ta^p	−49104.7	1.5	1252.60	0.23		322	ns	16	$21/2^-$	09	97Ko13	J	1982	IT=100	
^{179}Ta^q	−49040.1	1.6	1317.2	0.4		9.0	ms	0.2	$25/2^+$	09	97Ko13	J	1982	IT=100	
^{179}Ta^r	−49029.3	1.6	1328.0	0.4		1.6	μs	0.4	$23/2^-$	09	97Ko13	J	1982	IT=100	
^{179}Ta^x	−47718.0	1.6	2639.3	0.5		54.1	ms	1.7	$37/2^+$	09	97Ko13	J	1982	IT=100	
^{179}W	−49295	15				37.05	m	0.16	$7/2^-$	09			1950	β^+=100	
^{179}W^m	−49073	15	221.91	0.03		6.40	m	0.07	$1/2^-$	09			1950	IT$\approx$100; β^+=0.29 4	
^{179}W^n	−47663	15	1631.90	0.08		390	ns	30	$21/2^+$	09	94Wa05	J	1978	IT=100	
^{179}W^p	−45947	15	3348.41	0.14		750	ns	80	$35/2^-$	09	94Wa05	J	1978	IT=100	
^{179}Re	−46584	25				19.5	m	0.1	$5/2^+$	09			1960	β^+=100	
^{179}Re^m	−46519	25	65.35	0.09		95	μs	25	$(5/2^-)$	09			1972	IT=100	
^{179}Re^n	−44760	60	1822	50		408	ns	12	$(23/2^+)$	09			1972	IT=100	*
^{179}Re^p	−41176	25	5408.0	0.5		466	μs	15	$(47/2^+,49/2^+)$	09			1989	IT=100	
^{179}Os	−43019	17				6.5	m	0.3	$1/2^-$	09			1968	β^+=100	
^{179}Os^m	−42874	17	145.41	0.12		500	ns		$(7/2)^-$	09			1983	IT=100	
^{179}Os^n	−42776	17	243.0	0.8		783	ns	14	$(9/2)^+$	09			1983	IT=100	
^{179}Ir	−38082	10				79	s	1	$(5/2)^-$	09			1992	β^+=100	
^{179}Pt	−32268	8				21.2	s	0.4	$1/2^-$	09			1966	$\beta^+\approx$100; α=0.24 3	
^{179}Au	−24989	12				7.1	s	0.3	$(1/2^+,3/2^+)$	09			1968	β^+=78.0 9; α=22.0 9	
^{179}Au^m	−24900	12	89.5	0.5		328	ns	2	$(3/2^-)$		11Ve01	ETD	2011	IT=100	*
^{179}Hg	−16928	27				1.05	s	0.03	$7/2^-$	09	12Ve04	D	1970	α=75 4; β^+ ?; β^+p$\approx$0.15	
^{179}Hg^m	−16757	27	171.4	0.4		6.4	μs	0.9	$13/2^+$	09	02Je09	J	2002	IT=100	
^{179}Tl	−8270	40				265	ms	10	$1/2^+$	09	13An10	TJD	1983	α=60 2; β^+ ?	*
^{179}Tl^m	−7440#	40#	825#	10#		1.41	ms	0.03	$(11/2^-)$	09	11Ko.B	TJ	1983	$\alpha\approx$100; IT ?; β^+ ?	*
^{179}Pb	2050	80				3.9	ms	1.1	$(9/2^-)$	10	10An01	TDJ	2010	α=100	*

*^{179}Re^n E : x keV above 1772.20(0.22) level; x estimated 50(50) by NUBASE **
*^{179}Au^m E : uncertainty estimated by NUBASE **
*^{179}Au^p E : 44(15) above 89.5 keV level **
*^{179}Tl T : others 11Ko.B=489(21) 02Ro17=415(55) **
*^{179}Tl J : α decay to $1/2^+$ in ^{175}Au **
*^{179}Tl^m J : from α decay to ^{175}Au^m E : estimated from TNN in ^{177,181,183}Tl **
*^{179}Tl^m T : average 11Ko.B=1.36(0.04) 10An01=1.46(0.04) **
*^{179}Pb T : symmetrized from 3.5(+1.4–0.8) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{180}Tm	−37920#	500#				5#	s	(>300 ns)		15			2012	β^- ?; β^-n=0#	
^{180}Yb	−44600#	300#				2.4	m	0.5	0^+	15			1987	β^-=100	
^{180}Lu	−46680	70				5.7	m	0.1	5^+	15			1971	β^-=100	
^{180}Lu^m	−46670	70	13.9	0.3		1	s		3^-	15	95Me03	JT	1995	β^- ?; IT ?	
^{180}Lu^n	−46060	70	624.0	0.5		> 1	ms		(9^-)	15			2001	IT=100	
^{180}Hf	−49779.3	1.4				STABLE			0^+	15			1934	IS=35.08 16	
^{180}Hf^m	−48637.7	1.4	1141.552	0.015		5.53	h	0.02	8^-	15			1951	IT≈100; β^-=0.31 8	
^{180}Hf^n	−48404.9	1.4	1374.36	0.04		570	μs	20	(4^-)	15			1990	IT=100	*
^{180}Hf^p	−47293.8	1.5	2485.5	0.5		940	ns	110	12^+	15			2000	IT=100	
^{180}Hf^q	−46181.8	1.7	3597.5	1.0		90	μs	10	(18^-)	15			1999	IT=100	
^{180}Ta	−48932.9	1.9				8.154	h	0.006	1^+	15			1938	ε=85 3; β^-=15 3	
^{180}Ta^m	−48857.5	1.4	75.3	1.4	RQ	STABLE		(>7.1 Py)	9^-	15			1940	IS=0.01201 32; β^- ?	
^{180}Ta^n	−47480.5	1.9	1452.39	0.22		31.2	μs	1.4	15^-	15			1996	IT=100	
^{180}Ta^p	−45254.0	2.1	3678.9	1.0		2.0	μs	0.5	(22^-)	15			2000	IT=100	
^{180}Ta^q	−44760.7	2.5	4172.2	1.6		17	μs	5	(24^+)	15	00Wh04	EJ	2000	IT=100	
^{180}W	−49636.1	1.4				1.8	Ey	0.2	0^+	15			1937	IS=0.12 1; α≈100; 2β^+ ?	*
^{180}W^m	−48107.0	1.4	1529.05	0.04		5.47	ms	0.09	8^-	15			1978	IT=100	
^{180}W^n	−46371.2	1.4	3264.9	0.3		2.3	μs	0.2	14^-	15			1966	IT=100	
^{180}Re	−45837	21				2.46	m	0.03	$(1)^-$	15			1955	β^+=100	
^{180}Re^m	−45750#	40#	90#	30#		> 1	μs		$(4^+,5^+)$		05El10	J	2005	IT≈100; β^+ ?	
^{180}Re^n	−42280#	40#	3561#	30#		9.0	μs	0.7	(21^-)	15	05El10	TJD	2005	IT=100	*
^{180}Os	−44358	16				21.5	m	0.4	0^+	15			1967	β^+=100	
^{180}Ir	−37978	22				1.5	m	0.1	(5^+)	15			1972	β^+=100	
^{180}Pt	−34436	11				56	s	3	0^+	15			1966	β^+≈100; α≈0.3	
^{180}Au	−25626	5				8.4	s	0.6		15			1977	β^+<98.2; α>1.8	
^{180}Hg	−20250	13				2.59	s	0.01	0^+	15			1970	β^+=52 2; α=48 2	
^{180}Tl	−9390	60				1.09	s	0.01	$4^{(-)}$	15	12Bi.A	J	1987	β^+=94 4; α=6 4; β^+SF=0.0032 2	
^{180}Pb	−1941	12				4.1	ms	0.3	0^+	15			1996	α=100	

*^{180}Hf^n I : isomer at 2425.8(1.0) 15(5) μs (10^+) reported then retracted by authors **
*^{180}W T : 03Da09>80 Py for 2β^- decay **
*^{180}Re^n E : 3471.8(0.6) above (5^+) level, most likely isomer, estimated to be 90#30 keV **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{181}Tm	−35170#	600#				5#	s	(>300 ns)	1/2$^+$#	13	12Ku26	I	2012	β^- ?; β^-n=0.4#	
^{181}Yb	−41090#	300#				1#	m	(>300 ns)	3/2$^-$#	13	09St16	I	2000	β^- ?	
^{181}Lu	−44800	130				3.5	m	0.3	7/2$^+$#	06			1982	β^-=100	
^{181}Hf	−47402.8	1.4				42.39	d	0.06	1/2$^-$	06			1935	β^-=100	
^{181}Hf^m	−46807.5	1.4	595.27	0.04		80	μs	5	9/2$^+$	06	01Sh36	T	2001	IT=100	
^{181}Hf^n	−46359.3	1.6	1043.5	0.8		100	μs		(17/2$^+$)	06			2001	IT=100	
^{181}Hf^p	−45660.9	1.9	1741.9	1.3		1.5	ms	0.5	(25/2$^-$)	06			2001	IT=100	
^{181}Ta	−48438.3	1.4				STABLE			7/2$^+$	06			1932	IS=99.98799 32	
^{181}Ta^m	−48432.1	1.4	6.237	0.020		6.05	μs	0.12	9/2$^-$	06			1979	IT=100	
^{181}Ta^n	−47823.1	1.4	615.19	0.03		18	μs	1	1/2$^+$	06			1948	IT=100	
^{181}Ta^p	−47010	14	1428	14		140	ns	36	(19/2$^+$)	06			1998	IT=100	*
^{181}Ta^q	−46954.9	1.4	1483.43	0.21		25.2	μs	1.8	21/2$^-$	06	98Wh02	T	1998	IT=100	*
^{181}Ta^r	−46210.4	1.7	2227.9	0.9		210	μs	20	29/2$^-$	06	98Wh02	J	1998	IT=100	
^{181}W	−48233.8	1.4				121.2	d	0.2	9/2$^+$	06			1947	ε=100	
^{181}W^m	−47868.3	1.4	365.55	0.13		14.59	μs	0.15	5/2$^-$	06			1968	IT=100	
^{181}W^n	−46580.7	1.5	1653.1	0.6		140	ns	20	21/2$^+$	06			1973	IT=100	
^{181}Re	−46517	13				19.9	h	0.7	5/2$^+$	06			1957	β^+=100	
^{181}Re^m	−46254	13	262.91	0.11		156.7	ns	1.9	9/2$^-$	06			1967	IT=100	
^{181}Re^n	−44861	13	1656.37	0.14		250	ns	10	21/2$^-$	06			1974	IT=100	
^{181}Re^p	−44636	13	1880.57	0.16		11.5	μs	0.9	25/2$^+$	06			2000	IT=100	
^{181}Re^q	−42648	13	3869.40	0.18		1.2	μs	0.2	(35/2$^-$)	06			2000	IT=100	
^{181}Os	−43550	25				105	m	3	1/2$^-$	06			1966	β^+=100	
^{181}Os^m	−43501	25	49.20	0.14		2.7	m	0.1	7/2$^-$	06			1966	β^+=100	
^{181}Os^n	−43393	25	156.91	0.15		262	ns	6	9/2$^+$	06			1974	IT=100	
^{181}Ir	−39463	5				4.90	m	0.15	5/2$^-$	06			1972	β^+=100	
^{181}Ir^m	−39174	5	289.33	0.13		298	ns		5/2$^+$	06			1992	IT=100	
^{181}Ir^n	−39097	5	366.30	0.22		126	ns	6	9/2$^-$	06			1992	IT=100	
^{181}Pt	−34382	14				52.0	s	2.2	1/2$^-$	06	95Bi01	D	1966	β^+≈100; α=0.074 10	
^{181}Pt^m	−34265	14	116.65	0.08		> 300	ns		(7/2)$^-$	06			1992	IT=100	
^{181}Au	−27871	20				13.7	s	1.4	(3/2$^-$)	06			1968	β^+=?; α=2.7 5	
^{181}Hg	−20661	15				3.6	s	0.1	1/2$^{(-\#)}$	06			1969	β^+=73 2; α=27 2; β^+p=0.013 3; β^+α=9e–6 6	
^{181}Hg^m	−20450	50	210	50		480	μs	20	13/2$^+$	06	09An17	T	2009	IT ?	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{181}Tl	−12799	9					3.2	s	0.3	$1/2^+$	09	09An14	J	1996	β^+ ?; α<10	*
^{181}Tl^m	−11963	9	835.9	0.4			1.40	ms	0.03	$(9/2^-)$	09	09An14	J	1984	IT=99.60 4; α=0.40 6; β^+ ?	
^{181}Pb	−3120	80					39.0	ms	0.8	$(9/2^-)$	06	09An20	TJ	1989	α=?; β^+=2#	*
^{181}Pb^m			non existent		RN					$13/2^+$#		96To01	I			
*^{181}Ta^p	E : x keV above 1403.2(0.6) level; x<50															**
*^{181}Ta^q	T : average 98Wh02=25(2) 98Dr09=23(+6–2)															**
*^{181}Tl	T : average 98To14=3.2(0.3) 92Bo.D=3.4(0.6)															**
*^{181}Pb	T : average 09An20=36(2) 05Ca.A=39.6(0.9)															**
^{182}Yb	−38820#	400#					10#	s	(>300 ns)	0^+	15	12Ku26	I	2012	β^- ?	
^{182}Lu	−41880#	200#					2.0	m	0.2	1^-#	15			1982	β^-=100	
^{182}Hf	−46050	6					8.90	My	0.09	0^+	15			1961	β^-=100	
^{182}Hf^m	−44877	6	1172.87	0.18			61.5	m	1.5	$(8)^-$	15	FGK128	J	1971	β^-=54 2; IT=46 2	*
^{182}Hf^n	−43479	6	2571.3	1.2			40	μs	10	(13^+)	15			1999	IT=100	
^{182}Ta	−46429.9	1.4					114.74	d	0.12	3^-	15			1938	β^-=100	
^{182}Ta^m	−46413.6	1.4	16.273	0.004			283	ms	3	5^+	15			1968	IT=100	
^{182}Ta^n	−45910.3	1.4	519.577	0.016			15.84	m	0.10	10^-	15			1947	IT=100	
^{182}W	−48246.1	0.7					STABLE		(>7.7 Zy)	0^+	15			1930	IS=26.50 16; α ?	
^{182}W^m	−46015.5	0.7	2230.65	0.14			1.3	μs	0.1	(10^+)	15			1969	IT=100	
^{182}Re	−45450	100				*	64.2	h	0.5	7^+	15			1950	β^+=100	
^{182}Re^m	−45386	20	60	100	BD	*	14.14	h	0.45	2^+	15			1950	β^+=100	
^{182}Re^n	−45150	140	300	100			585	ns	30	$(2)^-$	15			1969	IT=100	*
^{182}Re^p	−44930	140	520	100			780	ns	90	(4^-)	15			1984	IT=100	*
^{182}Os	−44609	22					21.84	h	0.20	0^+	15			1950	ε=100	
^{182}Os^m	−42778	22	1831.4	0.3			780	μs	70	$(8)^-$	15			1966	IT=100	
^{182}Os^n	−37560	22	7049.5	0.4			150	ns	10	(25^+)	15			1988	IT=100	
^{182}Ir	−39052	21					15.0	m	1.0	3^+	15			1961	β^+=100	
^{182}Ir^m	−38981	21	71.02	0.17			170	ns	40	(5^+)	15			1990	IT=100	
^{182}Ir^n	−38876	21	176.4	0.3			130	ns	50	(6^-)	15			1990	IT=100	
^{182}Pt	−36168	13					2.67	m	0.12	0^+	15			1963	$\beta^+\approx$100; α=0.038 2	
^{182}Au	−28301	20					15.5	s	0.4	(2^+)	15			1970	$\beta^+\approx$100; α=0.13 5	
^{182}Au^p	−28180	30	120	40						high						
^{182}Hg	−23577	10					10.83	s	0.06	0^+	15	71Ho07	D	1968	β^+=86.2 9; α=13.8 9; β^+p<1e–5	
^{182}Tl	−13328	12				*	1.9	s	0.1	(2^-)	10	16Va01	TJD	1991	$\beta^+\approx$100; α<0.49; β^+SF<3.4e–6	
^{182}Tl^m	−13280#	50#	50#	50#		*	3#	s		(7^+)		91Bo22	J			
^{182}Tl^p	−12830#	100#	500#	100#						(10^-)						
^{182}Pb	−6825	12					55	ms	5	0^+	15			1986	α=?; β^+=2#	
*^{182}Hf^m	J : E1 to 8^+															**
*^{182}Re^n	E : 235.732(0.022) above ^{182}Re^m															**
*^{182}Re^p	E : 461.3(0.1) above ^{182}Re^m															**
^{183}Yb	−35100#	400#					3#	s	(>300 ns)	$3/2^-$#	16	12Ku26	I	2012	β^- ?	
^{183}Lu	−39720	80					58	s	4	$(7/2^+)$	16			1983	β^-=100	
^{183}Hf	−43280	30					1.018	h	0.002	$(3/2^-)$	16			1956	β^-=100	
^{183}Hf^m	−41820	70	1464	64			40	s	30	$27/2^-$#	16	10Re07	ETJ	2010	IT<100; β^- ?	*
^{183}Ta	−45292.8	1.4					5.1	d	0.1	$7/2^+$	16			1950	β^-=100	
^{183}Ta^m	−45219.6	1.4	73.164	0.014			106	ns	10	$(9/2)^-$	16			1967	IT=100	
^{183}Ta^n	−43957	15	1336	15			900	ns	300	$(19/2^+)$	16	09Sh17	ETJ	2009	IT=100	*
^{183}W	−46365.6	0.7					STABLE		(>670 Ey)	$1/2^-$	16			1930	IS=14.31 4; α ?	
^{183}W^m	−46056.1	0.7	309.492	0.004			5.30	s	0.08	$11/2^+$	16			1961	IT=100	
^{183}Re	−45810	8					70.0	d	1.4	$5/2^+$	16			1950	ε=100	
^{183}Re^m	−43903	8	1907.21	0.15			1.04	ms	0.04	$(25/2^+)$	16			1966	IT=100	
^{183}Os	−43660	50					13.0	h	0.5	$9/2^+$	16			1950	β^+=100	
^{183}Os^m	−43490	50	170.73	0.07			9.9	h	0.3	$1/2^-$	16				β^+=85 2; IT=15 2	
^{183}Ir	−40203	24					58	m	5	$5/2^-$	16	61Di04	T	1961	$\beta^+\approx$100; α=0.05#	*
^{183}Pt	−35772	16					6.5	m	1.0	$1/2^-$	16			1963	$\beta^+\approx$100; α=0.0096 5	
^{183}Pt^m	−35737	16	34.74	0.07			43	s	5	$7/2^-$	16			1979	$\beta^+\approx$100; IT=3.1 8; α<3e–4	
^{183}Pt^n	−35576	16	195.90	0.10			> 150	ns		$(9/2)^+$	16			1990	IT=100	
^{183}Au	−30191	9					42.8	s	1.0	$5/2^-$	16	94Pa37	J	1968	$\beta^+\approx$100; α=0.55 25	
^{183}Au^m	−30118	9	73.3	0.4			> 1	μs		$(1/2)^+$	16			1984	IT=100	
^{183}Au^p	−29960	9	230.6	0.6			< 1	μs		$(11/2)^-$	16			1984	IT=100	
^{183}Hg	−23805	7					9.4	s	0.7	$1/2^-$	16			1969	β^+=88.3 20; α=11.7 20; β^+p=2.6e–4 8	
^{183}Hg^m	−23601	13	204	14	AD		> 8#	μs		$13/2^+$#		81Mi12	I		β^+ ?	*
^{183}Tl	−16587	9					6.9	s	0.7	$1/2^{(+)}$	16	13Ba41	J	1980	β^+=?; α=2#	
^{183}Tl^m	−15959	9	628.7	0.5			53.3	ms	0.3	$(9/2^-)$	16			1980	IT=?; α=1.5 3; β^+ ?	*
^{183}Tl^n	−15612	9	975.01	0.23			1.48	μs	0.10	$(13/2^+)$	16			2001	IT=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{183}Pb	−7575	28					535	ms	30	$3/2^-$	16	09Se13	J	1980	α=?; β^+=10#	
^{183}Pb^m	−7481	28	94	8	AD		415	ms	20	$13/2^+$	16	09Se13	J	1980	$\alpha\approx$100; β^+ ?; IT ?	
*^{183}Hf^m	T : for q=71$^+$ (H+ like ion); symmetrized from 10(+48–5)															**
*^{183}Ta^n	E : less than 50 keV above 1310.16 level															**
*^{183}Ir	T : average 61Di04=55(7) 61La05=60(6)															**
*^{183}Hg^m	I : lack of E(a)=6073-γ coinc. in ^{187}Pb^m decay; no isomer seen in 01Sc41															**
*^{183}Tl^m	E : uncertainty estimated by NUBASE						D : IT from 11Ve.A									**
^{184}Yb	−32540#	500#					1#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?	
^{184}Lu	−36410#	300#					20	s	3	(3^+)	10	95Kr04	TJ	1989	β^-=100	
^{184}Hf	−41500	40					4.12	h	0.05	0^+	10			1973	β^-=100	
^{184}Hf^m	−40230	40	1272.2	0.4			48	s	10	(8^-)	10	12Re.A	D	1995	IT=?; β^-=?	*
^{184}Hf^n	−39020	40	2477	10			16	m	7	15^+#	10	10Re07	ET	2010	β^- ?; IT ?	*
^{184}Ta	−42839	26					8.7	h	0.1	(5^-)	10			1955	β^-=100	
^{184}W	−45705.4	0.7					STABLE		(>8.9 Zy)	0^+	10	04Co26	T	1930	IS=30.64 2; α ?	
^{184}W^m	−44420.4	0.7	1284.997	0.008			8.33	μs	0.18	5^-	10			1969	IT=100	
^{184}W^n	−41842.2	2.6	3863.2	2.5			188	ns	38	$(14^-,15,17^-)$	10			2004	IT=100	
^{184}Re	−44220	4					35.4	d	0.7	$3^{(-)}$	10			1940	β^+=100	
^{184}Re^m	−44032	4	188.0463	0.0017			169	d	8	$8^{(+)}$	10			1964	IT=74.5 8; ε=25.5 8	
^{184}Os	−44252.5	0.8					STABLE		(>56 Ty)	0^+	10			1937	IS=0.02 1; α ?; 2β^+ ?	*
^{184}Ir	−39611	28					3.09	h	0.03	5^-	10			1960	β^+=100	
^{184}Ir^m	−39385	28	225.65	0.11			470	μs	30	3^+	10			1988	IT=100	
^{184}Ir^n	−39283	28	328.40	0.24			350	ns	90	$(7)^+$	10			1988	IT=100	
^{184}Pt	−37334	16					17.3	m	0.2	0^+	10	95Bi01	D	1963	$\beta^+\approx$100; α=0.0017 7	
^{184}Pt^m	−35494	16	1840.3	0.8			1.01	ms	0.05	8^-	10			1966	IT=100	
^{184}Au	−30319	22					20.6	s	0.9	5^+	10			1969	$\beta^+\approx$100; α<0.016	
^{184}Au^m	−30251	22	68.46	0.04			47.6	s	1.4	2^+	10			1969	β^+=?; IT=30 10; α<0.016	
^{184}Hg	−26349	10					30.87	s	0.26	0^+	10			1969	β^+=98.89 6; α=1.11 6	
^{184}Tl	−16883	10				*	9.5	s	0.2	(2^-)	10	16Va01	TJD	1976	β^+=98.78 30; α=1.22 30	
^{184}Tl^m	−16930	30	−50	30	AD	*	10#	s		(7^+)		16Va01	JD	2016	β^+ ?; IT ?; α=0.047 6	
^{184}Tl^n	−16430	30	450	30	AD		47.1	ms	0.7	(10^-)	10	15Va10	TD	1984	IT$\approx$100; α=0.089 19	*
^{184}Pb	−11052	13					490	ms	25	0^+	10	04An07	D	1980	α=80 11; β^+ ?	*
^{184}Bi	1060	80				* &	6.6	ms	1.5	3^+#	10			2003	α= ?	
^{184}Bi^m	1210#	130#	150#	100#		* &	13	ms	2	10^-#	10			2002	α= ?	
*^{184}Hf^m	E : 10Re07=1264(10)						T : 12Re19=113(+60–47) for q=72$^+$ (bare ion)									**
*^{184}Hf^n	T : symmetrized from 12Re19=12(+8–6) for q=72$^+$; supersedes 10Re07=12(+10–4)															**
*^{184}Os	T : lower limit is for α decay; 13Be07: 2β^+>25Py															**
*^{184}Tl^n	E : 506.1(0.1) keV above ^{184}Tl^m															**
*^{184}Pb	D : average 04An07=80(15)% 03Va16=80(15)%															**
^{185}Yb	−28500#	500#					300#	ms	(>300 ns)	$3/2^-$#	13	12Ku26	I	2012	β^- ?	
^{185}Lu	−33890#	300#					6#	s	(>300 ns)	$7/2^+$#	13	09St16	I	2009	β^- ?	
^{185}Hf	−38320	60					3.5	m	0.6	$3/2^-$#	06			1993	β^-=100	
^{185}Ta	−41394	14					49.4	m	1.5	$7/2^+$#	06			1950	β^-=100	
^{185}Ta^m	−40988	14	406	1			900	ns	300	$(3/2^+)$	06	07Sh42	ETJ	2007	IT=100	
^{185}Ta^n	−40121	14	1273.4	0.4			11.8	ms	1.4	$21/2^-$	06	09La17	EJT	1999	IT=100	
^{185}W	−43387.8	0.7					75.1	d	0.3	$3/2^-$	06			1940	β^-=100	
^{185}W^m	−43190.4	0.7	197.383	0.023			1.597	m	0.004	$11/2^+$	06	94It.A	T	1950	IT=100	
^{185}Re	−43819.0	0.8					STABLE			$5/2^+$	06			1931	IS=37.40 2	
^{185}Re^m	−41695.2	1.4	2123.8	1.1			121	ns	13	(21/2)	06			1997	IT=100	
^{185}Os	−42805.9	0.8					92.95	d	0.09	$1/2^-$	06	12Kr05	T	1947	ε=100	
^{185}Os^m	−42703.5	0.8	102.37	0.11			3.0	μs	0.4	$7/2^-$	06	FGK128	J	1970	IT=100	*
^{185}Os^n	−42530.4	0.8	275.53	0.12			780	ns	50	$11/2^+$	06			1970	IT=100	
^{185}Ir	−40336	28					14.4	h	0.1	$5/2^-$	06			1958	β^+=100	
^{185}Ir^m	−38140	40	2197	23			120	ns	20		06			1979	IT=100	*
^{185}Pt	−36688	26					70.9	m	2.4	$(9/2^+)$	06			1960	$\beta^+\approx$100; α=0.0050 20	*
^{185}Pt^m	−36585	26	103.41	0.05			33.0	m	0.8	$(1/2^-)$	06			1970	β^+=?; IT<2	
^{185}Pt^n	−36487	26	200.89	0.04			728	ns	20	$5/2^-$	06			1996	IT=100	
^{185}Au	−31858.1	2.6				*	4.25	m	0.06	$5/2^-$	06			1960	$\beta^+\approx$100; α=0.26 6	
^{185}Au^m	−31760#	100#	100#	100#		*	6.8	m	0.3	$1/2^+$#	06			1960	β^+<100; IT ?	
^{185}Hg	−26184	14					49.1	s	1.0	$1/2^-$	06			1960	β^+=94 1; α=6 1	
^{185}Hg^m	−26080	14	103.7	0.4			21.6	s	1.5	$13/2^+$	06	13Sa43	E	1970	IT=54 10; β^+=46 10; $\alpha\approx$0.03	
^{185}Tl	−19758	21					19.5	s	0.5	$1/2^{(+\#)}$	06	13Ba41	J	1976	β^+=?; α ?	
^{185}Tl^m	−19303	21	454.8	1.5			1.93	s	0.08	$9/2^{(-\#)}$	06	13Ba41	J	1976	IT$\approx$100; α=?; β^+ ?	
^{185}Pb	−11541	16				*	6.3	s	0.4	$3/2^-$	06			1975	α=34 25; β^+ ?	
^{185}Pb^m	−11470	50	70	50	AD	*	4.07	s	0.15	$13/2^+$	06	02An15	T	1975	α=50 25; β^+ ?	*
… *A*-group is continued on next page …																

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{185}Bi	−2240#	80#				* &	2#	ms		9/2$^-$#		96Da06	J	1996	p ?; α ?	*
^{185}Bi^m	−2156	13	80#	80#		* &	58	μs	4	1/2$^+$	06			1996	p=90 2; α=10 2	
^{185}Bi^n	−2060#	100#	180#	60#	EU		50	μs	10	13/2$^+$#		04An07	ITD	2004	p=?; α=?	*
*^{185}Os^m	J : E1 from 9/2$^+$															**
*^{185}Ir^m	E : x<80 keV above 2157.3(0.5) level															**
*^{185}Pt	D : if the 4444(10) keV α line is from ground-state; otherwise α=0.0010(4)% from isomer															**
*^{185}Pb^m	T : average 02An15=4.3(0.2) 80Sc09=3.73(0.24) (excluding the 6.1 s activity)															**
*^{185}Bi	T : estimated from 9/2$^-$ isomers in odd Bi and Tl isotopes															**
*^{185}Bi^n	E : 100 keV above ^{185}Bi^m T : similar to ^{185}Bi^m															**
^{186}Lu	−30210#	400#					2#	s	(>300 ns)		13	12Ku26	I	2012	β$^-$?	
^{186}Hf	−36420	50					2.6	m	1.2	0$^+$	03			1998	β$^-$=100	
^{186}Hf^m	−33450	70	2968	43			> 20	s		17$^+$#		10Re07	ET	2010	β$^-$?; IT ?	*
^{186}Ta	−38610	60					10.5	m	0.3	(2$^-$,3$^-$)	03			1955	β$^-$=100	
^{186}Ta^m	−38270	60	336	20			1.54	m	0.05	9$^+$#		04Xu08	T	2010	β$^-$?; IT ?	*
^{186}W	−42508.5	1.2					STABLE		(>4.1 Ey)	0$^+$	03	03Da09	T	1930	IS=28.43 19; 2β$^-$?; α ?	*
^{186}W^m	−40991.3	1.3	1517.2	0.6			18	μs	1	7$^-$	03	12La.A	J	1998	IT=100	
^{186}W^n	−38965.7	2.4	3542.8	2.1			2.0	s	0.2	16$^+$	03	12La.A	TJ	1998	IT=100	
^{186}Re	−41927.1	0.8					3.7183	d	0.0011	1$^-$	03			1939	β$^-$=92.53 10; ε=7.47 10	
^{186}Re^m	−41778.9	0.9	148.2	0.5			200	ky		(8$^+$)	03	15Ma60	E	1972	IT=?; β$^-$<10	
^{186}Os	−42999.9	0.8					2.0	Py	1.1	0$^+$	03			1931	IS=1.59 3; α=100	
^{186}Ir	−39172	17					16.64	h	0.03	5$^+$	03			1958	β$^+$=100	
^{186}Ir^m	−39171	17	0.8	0.4			1.92	h	0.05	2$^-$	03	91Be25	ET	1962	β$^+$≈75; IT≈25	*
^{186}Pt	−37864	22					2.08	h	0.05	0$^+$	03			1961	β$^+$=100; α≈1.4e–4	
^{186}Au	−31715	21					10.7	m	0.5	3$^-$	03			1960	β$^+$=100; α=0.0008 2	
^{186}Au^m	−31487	21	227.77	0.07			110	ns	10	2$^+$	03			1983	IT=100	
^{186}Hg	−28539	12					1.38	m	0.06	0$^+$	03			1960	β$^+$≈100; α=0.016 5	
^{186}Hg^m	−26322	12	2217.3	0.4			82	μs	5	(8$^-$)	03			1984	IT=100	
^{186}Tl	−19887	22				* &	40#	s		(2$^-$)	03	91Va04	I	1975	β$^+$?	*
^{186}Tl^m	−19860	30	20	40		* &	27.5	s	1.0	7$^{(+)}$	03	13Ba41	J	1975	β$^+$≈100; α≈0.006	
^{186}Tl^n	−19490	30	400	40	MD		2.9	s	0.2	10$^{(-)}$	03	13Ba41	J	1977	IT=100	*
^{186}Pb	−14682	11					4.82	s	0.03	0$^+$	03			1972	β$^+$?; α=40 8	
^{186}Bi	−3146	17				*	14.8	ms	0.7	(3$^+$)	03	13La02	D	1997	α≈100; β$^+$=0.6#; β$^+$SF=0.011	*
^{186}Bi^m	−2980#	100#	170#	100#		*	9.8	ms	0.4	(10$^-$)	03	13La02	D	1984	α≈100; β$^+$=0.6#; β$^+$SF=0.011	*
^{186}Po	4101	18					34	μs	12	0$^+$	13	13An13	T	2005	α≈100; p ?	*
*^{186}Hf^m	T : for q=72$^+$ (bare ion) in 10Re07															**
*^{186}Ta^m	T : 12Re19=3.0(+1.5–0.8) q=72$^+$(H+ like ion); supersedes 10Re07=3.4(+2.4–1.4)															**
*^{186}W	T : given limit is for 2β$^-$ decay															**
*^{186}W	T : for α decay 04Co26>8.2 Zy, 03Da05>170 Ey, 03Ce01>27 Ey, 97Ge15>6.5 Ey															**
*^{186}Ir^m	T : average 91Be25=1.90(0.05) 70Fi.A=2.0(0.1)															**
*^{186}Ir^m	E : E is positive and below 1.5 keV															**
*^{186}Tl	I : identified as decay level from ^{190}Bi in 91Va04															**
*^{186}Tl^n	E : 374.0(0.2) keV above ^{186}Tl^m J : also 12Bi.A															**
*^{186}Bi	T : average 03An27=14.8(0.8) 97Ba21=15.0(1.7)															**
*^{186}Bi	D : 13La02=0.022 13 for both isomers															**
*^{186}Bi^m	T : from 03An27															**
*^{186}Po	T : symmetrized from 13An13=28(+16–6)															**
^{187}Lu	−27580#	400#					1#	s	(>300 ns)	7/2$^+$#	13	12Ku26	I	2012	β$^-$?	
^{187}Hf	−32820#	300#					30#	s	(>300 ns)	3/2$^-$#	09	99Be63	I	1999	β$^-$?	
^{187}Hf^m	−32320#	420#	500#	300#		*	270	ns	80	9/2$^-$#		09Al30	TD	2009	IT=100	
^{187}Ta	−36900	60					2.3	m	6	7/2$^+$#	09	10Re07	T	1999	β$^-$?	
^{187}Ta^m	−35110	60	1789	13			22	s	9	27/2$^-$#		10Re07	ET	2010	β$^-$?; IT ?	*
^{187}Ta^n	−33970	60	2935	14			> 5	m		41/2$^+$#		10Re07	ET	2010	β$^-$?; IT ?	*
^{187}W	−39904.0	1.2					24.000	h	0.004	3/2$^-$	09			1940	β$^-$=100	
^{187}W^m	−39493.9	1.2	410.06	0.04			1.38	μs	0.07	(11/2$^+$)	09			2008	IT=100	
^{187}Re	−41216.5	0.7					43.3	Gy	0.07	5/2$^+$	09			1931	IS=62.60 2; β$^-$=100; α<0.0001	*
^{187}Re^m	−41010.3	0.7	206.2473	0.0010			555.3	ns	1.7	9/2$^-$	09			1949	IT=100	
^{187}Re^n	−39534.5	0.9	1682.0	0.6			354	ns	62	21/2$^+$	09	16Re02	ETJ	2003	IT=100	
^{187}Os	−41218.9	0.7					STABLE			1/2$^-$	09			1931	IS=1.96 2	
^{187}Os^m	−41118.5	0.7	100.45	0.04			112	ns	6	7/2$^-$	09			1964	IT=100	
^{187}Os^n	−40961.8	0.7	257.10	0.07			231	μs	2	11/2$^+$	09			1964	IT=100	
^{187}Ir	−39549	28					10.5	h	0.3	3/2$^+$	09			1958	β$^+$=100	
^{187}Ir^m	−39363	28	186.16	0.04			30.3	ms	0.6	9/2$^-$	09			1963	IT=100	
^{187}Ir^n	−39115	28	433.75	0.06			152	ns	12	11/2$^-$	09			1969	IT=100	
^{187}Ir^p	−37061	28	2487.7	0.4			1.8	μs	0.5	29/2$^-$		10Mo09	ETJ	2010	IT=100	
^{187}Pt	−36685	24					2.35	h	0.03	3/2$^-$	09			1961	β$^+$=100	
^{187}Pt^m	−36511	24	174.38	0.22			311	μs	15	(11/2$^+$)	09			1976	IT=100	
… *A*-group is continued on next page …																

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{187}Au	−33028	22					8.3	m	0.2	$1/2^{(+)}$	09			1955	$\beta^+\approx$100; α=0.003#	
^{187}Au^m	−32908	22	120.33	0.14			2.3	s	0.1	$9/2^{(-)}$	09			1983	IT=100	
^{187}Hg	−28118	14					1.9	m	0.3	$3/2^{(-)}$	09	70Ha18	TD	1960	β^+=100; α>1.2e–4	*
^{187}Hg^m	−28059	19	59	16	MD		2.4	m	0.3	$13/2^+$	09	70Ha18	D	1970	β^+=100; α>2.5e–4	*
^{187}Tl	−22445	8					51	s		$(1/2^+)$	09			1976	β^+<100; α=0.03#	
^{187}Tl^m	−22111	8	334	3	AD		15.60	s	0.12	$9/2^{(-)}$	09	13Ba41	J	1976	IT=?; β^+ ?; α=0.15 5	
^{187}Tl^n	−20970	50	1480	50			1.11	μs			09			2000	IT=100	*
^{187}Tl^p	−19863	8	2582.5	0.3			690	ns	40	$(25/2^-,27/2,.)$	09			2000	IT=100	
^{187}Pb	−14987	5				*	15.2	s	0.3	$3/2^-$	09	09Se13	J	1972	β^+ ?; α=9.5 20	
^{187}Pb^m	−14968	11	19	10	MD	*	18.3	s	0.3	$13/2^+$	09	09Se13	J	1972	β^+ ?; α=12 2	
^{187}Bi	−6383	10					37	ms	2	$9/2^-$#	09			1999	α=100	
^{187}Bi^m	−6275	12	108	8	AD		370	μs	20	$1/2^+$#	09			1984	α=100	
^{187}Bi^n	−6131	21	252	18			7	μs	5	$(13/2^+)$	09	02Hu14	ETJ	2002	IT=100	*
^{187}Po	2830	30				*	1.40	ms	0.25	$(1/2^-,5/2^-)$	09			2005	$\alpha\approx$100; β^+ ?	
^{187}Po^m	2830	30	4	27	AD	*	0.5	ms		$13/2^+$#		06An11	ETD	2006	α=?; β^+ ?	

*^{187}Ta^m T : for q=73$^+$ (bare ion) in 10Re07 **
*^{187}Ta^n T : for q=73$^+$ (bare ion) in 10Re07 **
*^{187}Re T : other: 96Bo37=32.9(2.0) y for q=75$^+$ (bare ion) **
*^{187}Hg T : from 70Ha18; 98Ru04=2.4 m, not documented, no uncertainty given **
*^{187}Hg^m T : from 70Ha18; 98Ru04=2.2 m, not documented, no uncertainty given **
*^{187}Tl^n E : x above 1433.23(0.19) level; x=50(50) keV estimated by NUBASE **
*^{187}Bi^n T : symmetrized from 3.2(+7.6–2.0) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{188}Lu	−23790#	500#					300#	ms	(>300 ns)		13	12Ku26	I	2012	β^- ?	
^{188}Hf	−30880#	300#					20#	s	(>300 ns)	0^+	02	99Be63	I	1999	β^- ?	
^{188}Ta	−33610	50					19.6	s	2.0		02	09Al30	TD	1999	β^-=100	
^{188}Ta^m	−33320	50	292.4	0.2			3.6	μs	0.4			05Ca02	ET	2005	IT=100	*
^{188}W	−38668	3					69.78	d	0.05	0^+	02			1951	β^-=100	
^{188}W^m	−36739	3	1929.3	1.6			109.5	ns	3.5	8^-		10La16	ETJ	2010	IT=100	
^{188}Re	−39016.8	0.7					17.0040	h	0.0022	1^-	02			1939	β^-=100	
^{188}Re^m	−38844.7	0.7	172.069	0.009			18.59	m	0.04	$(6)^-$	02			1953	IT=100	
^{188}Os	−41137.2	0.7					STABLE			0^+	02			1931	IS=13.24 8	
^{188}Ir	−38345	9					41.5	h	0.5	1^-	02			1950	β^+=100	
^{188}Ir^m	−37380	30	970	30			4.2	ms	0.2	11^-#	02	GAu	E	1971	IT$\approx$100; β^+ ?	*
^{188}Pt	−37821	5					10.2	d	0.3	0^+	02			1954	ε=100; α=2.6e–5 3	
^{188}Au	−32371.3	2.7					8.84	m	0.06	$1^{(-)}$	02			1955	β^+=100	
^{188}Hg	−30202	12					3.25	m	0.15	0^+	02			1960	β^+=100; α=3.7e–5 8	
^{188}Hg^m	−27478	12	2724.3	0.4			134	ns	15	(12^+)	02			1983	IT=100	*
^{188}Tl	−22336	30				*	71	s	2	(2^-)	02			1970	β^+=100	
^{188}Tl^m	−22308	9	30	30	MD	*	71	s	1	$7^{(+)}$	02	13Ba41	J	1970	β^+=100	
^{188}Tl^n	−22030	40	310	30			41	ms	4	(9^-)	02			1981	IT$\approx$100; β^+ ?	*
^{188}Pb	−17815	11					25.1	s	0.1	0^+	02	03Va16	D	1972	β^+=?; α=9.3 8	*
^{188}Pb^m	−15237	11	2578.2	0.7			1.15	μs	0.03	(8^-)	02	04Dr04	T	1999	IT=100	
^{188}Pb^n	−15105	11	2709.7	0.3			94	ns	12	(12^+)	02	04Dr04	EJ	2004	IT=100	*
^{188}Pb^p	−13032	11	4783.2	0.3			437	ns	55	(19^-)	02	04Dr04	ETJ	2000	IT=100	*
^{188}Bi	−7195	11				&	60	ms	3	3^+#	02	13La02	TD	1980	α=?; β^+=1.1#; β^+SF=0.0016	*
^{188}Bi^m	−7130	30	66	30	AD		> 5	μs		7^+#		06An04	ET	1984	IT ?	
^{188}Bi^n	−7040	30	153	30	AD	&	265	ms	10	(10^-)	02	13La02	TD	1984	α=?; β^+=4.9#; β^+SF=0.0016	*
^{188}Po	−544	20					275	μs	30	0^+	02	03Va16	T	1999	α=?; β^+ ?	

*^{188}Ta^m T : average 11St21=3.5(0.4) 09Al30=4.4(1.0); other 05Ca02=5(2) **
*^{188}Ir^m E : less than 100 keV above 923.5 level, from ENSDF **
*^{188}Hg^m T : other 04Gl04=270(51) **
*^{188}Tl^n E : 268.8(0.2) keV above ^{188}Tl^m, from 91Va04 **
*^{188}Pb D : also 03Va16=8.0(0.6)% **
*^{188}Pb^n T : lifetime 99Dr10=136(18) ns **
*^{188}Pb^p T : lifetime τ=630(80) ns **
*^{188}Bi T : 13La02 supersedes 06An04=66(6) 03An26=60(3) **
*^{188}Bi D : 13La02=0.0032 16 for both beta-delayed fission isomers **
*^{188}Bi^n T : 13La02 supersedes 06An04=280(20) 03An26=265(15) of same group **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{189}Hf	−27160#	300#					2#	s	(>300 ns)	$3/2^-$#	12	09Al30	I	2009	β^- ?	
^{189}Ta	−31830#	200#					3#	s	(>300 ns)	$7/2^+$#	03	99Be63	I	1999	β^- ?	
^{189}Ta^m	−30230#	450#	1600#	400#			1.6	μs	0.2			09Al30	TD	2009	IT=100	*
^{189}W	−35620	40					10.7	m	0.5	$3/2^-$#	03			1963	β^-=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

. . . *A*-group continued . . .

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{189}Re	−37979	8					24.3	h	0.4	$5/2^+$	03			1963	β^-=100	
^{189}Re^m	−36208	8	1770.9	0.6			223	μs	14	$29/2^+$	03	16Re02	ETJ	2016	IT=100	
^{189}Os	−38986.7	0.7					STABLE			$3/2^-$	03			1931	IS=16.15 5	
^{189}Os^m	−38955.9	0.7	30.812	0.015			5.81	h	0.06	$9/2^-$	03			1960	IT=100	
^{189}Ir	−38450	13					13.2	d	0.1	$3/2^+$	03			1955	ε=100	
^{189}Ir^m	−38078	13	372.17	0.04			13.3	ms	0.3	$11/2^-$	03			1960	IT=100	
^{189}Ir^n	−36117	13	2333.2	0.5			3.7	ms	0.2	$(25/2)^+$	03			1975	IT=100	
^{189}Pt	−36469	10					10.87	h	0.12	$3/2^-$	03			1955	β^+=100	
^{189}Pt^m	−36296	10	172.80	0.06			464	ns	25	$9/2^-$	03			1970	IT=100	
^{189}Pt^n	−36278	10	191.5	0.7			143	μs	5	$(13/2^+)$	03			1976	IT=100	
^{189}Au	−33582	20					28.7	m	0.3	$1/2^+$	03			1955	β^+=100; α<3e–5	
^{189}Au^m	−33335	20	247.23	0.16			4.59	m	0.11	$11/2^-$	03			1966	$\beta^+\approx$100; IT=?	
^{189}Au^n	−33257	20	325.11	0.16			190	ns	15	$9/2^-$	03			1975	IT=100	
^{189}Au^p	−31027	20	2554.7	1.2			242	ns	10	$31/2^+$	03			1975	IT=100	
^{189}Hg	−29630	30					7.6	m	0.1	$3/2^-$	03			1955	β^+=100; α<3e–5	
^{189}Hg^m	−29548	18	80	30	MD		8.6	m	0.1	$13/2^+$	03			1966	β^+=100; α<3e–5	
^{189}Tl	−24616	8					2.3	m	0.2	$(1/2^+)$	11			1972	β^+=100	
^{189}Tl^m	−24331	8	285	6	AD		1.4	m	0.1	$9/2^{(-)}$	11	85Bo46	J	1972	$\beta^+\approx$100; IT<4	*
^{189}Pb	−17844	14				*	39	s	8	$3/2^-$	11	09Sa09	T	1972	$\beta^+\approx$100; $\alpha\approx$0.4	*
^{189}Pb^m	−17804	14	40	4	AD	*	50.5	s	2.1	$13/2^+$	11	09Sa09	T	2009	$\beta^+\approx$100; α<1; IT ?	*
^{189}Pb^n	−15370#	30#	2475#	30#			26	μs	5	$(31/2^-)$	11			2005	IT=100	*
^{189}Bi	−10065	21					658	ms	47	$(9/2^-)$	11			1973	$\alpha\approx$100	
^{189}Bi^m	−9881	21	184	5	AD		4.9	ms	0.3	$(1/2^+)$	11	03An26	T	1984	α>50; β^+<50	*
^{189}Bi^n	−9707	21	357.6	0.5			880	ns	50	$(13/2^+)$	11			2001	IT$\approx$100	
^{189}Po	−1422	22					3.8	ms	0.4	$(5/2^-)$	07	05Va04	T	1999	$\alpha\approx$100; β^+ ?	*

*^{189}Ta^m T : other 11St21=0.58(0.22), possibly a different isomer **
*^{189}Tl^m J : also 13Ba41=9/2 **
*^{189}Pb J : 09Se13: α to ^{185}Hg 26.1 level **
*^{189}Pb^m T : average 09Sa09=50(3) 72Ga27=51(3) **
*^{189}Pb^m J : 09Se13: from α decay from ^{193}Po^m **
*^{189}Pb^n E : 2434.50(0.18) keV above ^{189}Pb^m $(13/2^+)$ **
*^{189}Pb^n T : from lifetime 05Ba51 τ=32(+10–2) μs, or T=22.2(+6.9–1.4) **
*^{189}Bi^m T : average 03An26=4.9(0.5) 03Ke08=4.6(+0.8–0.6) 97An09=4.8(0.5) **
*^{189}Bi^m T : and 97Wa05=5.2(0.6); 95Ba75=7.0(0.2), conflicting not used **
*^{189}Po T : average 05Va04=3.5(0.5) 99An52=5(1) J : favored decay to $(5/2^-)$ level **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{190}Hf	−25030#	400#					2#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?	
^{190}Ta	−28510#	200#				*	5.3	s	0.7	(3)	10	09Al30	TJD	2009	β^-=100	
^{190}Ta^m	−28310#	250#	200#	150#		*	42	ns	7		10	09Al30	TD	2009	IT=100	
^{190}W	−34380	40					30.0	m	1.5	0^+	03			1976	β^-=100	
^{190}W^m	−32640	40	1742.0	2.0			111	ns	17	8^+		10La16	ETJ	2010	IT=100	
^{190}W^n	−32540	40	1839.0	2.2			166	μs	6	10^-	03	10La16	ETJ	2000	IT=100	*
^{190}Re	−35640	70					3.1	m	0.3	$(2)^-$	03			1955	β^-=100	
^{190}Re^m	−35440	70	204	10			3.2	h	0.2	(6^-)	03	12Re19	E	1962	β^-=54.4 20; IT ?	
^{190}Os	−38707.8	0.6					STABLE			0^+	03			1931	IS=26.26 2	
^{190}Os^m	−37002.4	0.6	1705.4	0.2			9.86	m	0.03	10^-	03	12Kr05	T	1950	IT=100	*
^{190}Ir	−36753.5	1.4					11.78	d	0.10	4^-	03			1947	β^+=100; e$^+$<0.002	
^{190}Ir^m	−36727.4	1.4	26.1	0.1			1.120	h	0.003	(1^-)	03			1964	IT=100	
^{190}Ir^n	−36717.3	1.4	36.154	0.025			> 2	μs		$(4)^+$	03			1996	IT=100	
^{190}Ir^p	−36377.1	1.4	376.4	0.1			3.087	h	0.012	$(11)^-$	03			1950	β^+=91.4 2; IT=8.6 2	
^{190}Pt	−37306.5	0.7					650	Gy	30	0^+	03			1949	IS=0.012 2; α=100; 2β^+ ?	
^{190}Au	−32834	3				*	42.8	m	1.0	1^-	03			1959	β^+=100; α<1e–6	
^{190}Au^m	−32630#	150#	200#	150#		*	125	ms	20	11^-#	03			1982	IT$\approx$100; β^+ ?	
^{190}Hg	−31371	16					20.0	m	0.5	0^+	03			1959	$\varepsilon\approx$100; e$^+$<1; α<3.4e–7	
^{190}Tl	−24372	8				*	2.6	m	0.3	$2^{(-)}$	03			1970	β^+=100	
^{190}Tl^m	−24289	6	83	10	MD	*	3.7	m	0.3	$7^{(+\#)}$	03			1970	β^+=100	
^{190}Tl^n	−24080#	70#	290#	70#			750	μs	40	(8^-)	03			1981	IT=100	*
^{190}Tl^p	−23960#	70#	410#	70#			> 1	μs		9^-	03	91Va04	ET	1991	IT ?	*
^{190}Pb	−20417	13					71	s	1	0^+	03			1972	β^+ ?; α=0.40 4	
^{190}Pb^m	−17802	13	2614.8	0.8			150	ns	14	10^+	03	01Dr05	J	1998	IT=100	*
^{190}Pb^n	−17799	24	2618	20			24.3	μs	2.1	(12^+)	03			1998	IT ?	*
^{190}Pb^p	−17759	13	2658.2	0.8			7.7	μs	0.3	11^-	03	01Dr05	JT	1985	IT=100	*

. . . *A*-group is continued on next page . . .

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …																
^{190}Bi	−10600	23					6.3	s	0.1	(3$^+$)	03	91Va04	J	1972	α=77 21; β^+=?	*
^{190}Bi^m	−10470	30	130	40	AD		6.2	s	0.1	(10$^-$)	03	91Va04	J	1988	α=70 9; β^+ ?; β^+p ?	*
^{190}Bi^n	−10479	27	121	15			175	ns	8	(5$^-$)		09An11	ET	2009	IT=100	*
^{190}Bi^p	−10200	50	404	40			1.3	μs	0.8	(8$^-$)	03	09An11	EJT	2001	IT=100	*
^{190}Po	−4564	13					2.46	ms	0.05	0$^+$	03			1996	$\alpha\approx$100; β^+=0.1#	
*^{190}W^n	T : others 11St21=108(9) 09Al30=106(18) μs 05Ca02=60(+1500–30) μs 00Po26<3.1ms															**
*^{190}W^n	E : other 00Po26=2381															**
*^{190}Os^m	J : M2 + E3 to 8$^+$ member of the ground-state band															**
*^{190}Tl^n	E : 161.9 keV above ^{190}Tl^m															**
*^{190}Tl^p	E : 236.2 keV above ^{190}Tl^m															**
*^{190}Pb^m	T : uncertainty from 12Dr.A															**
*^{190}Pb^n	E : above ^{190}Pb^m, see 01Dr05 T : uncertainty from 12Dr.A															**
*^{190}Pb^p	T : average 01Dr05=7.2(0.6) 85St16=7.9(0.4)															**
*^{190}Bi	D : symmetrized from α=90(+10–30)% T : also 13Ny01=7.7(+1.0–0.8) not used															**
*^{190}Bi^m	T : also 13Ny01=5.9(+1.0–0.8) not used															**
*^{190}Bi^n	J : E1 and M1(+E2) γs in cascade to (3$^+$), absence of direct γ to (3$^+$)															**
*^{190}Bi^p	E : 274(1) keV above the (10$^-$) isomer J : E2 to (10$^-$)															**
*^{190}Bi^p	T : symmetrized from 09An11=1.0(+1.0–0.5)															**
^{191}Ta	−26490#	300#					3#	s	(>300 ns)	7/2$^+$#	11	09St16	I	2009	β^- ?	
^{191}W	−31180	40				*	45#	s	(>300 ns)	3/2$^-$#	07	99Be63	I	1999	β^- ?	
^{191}W^m	−30950	60	235	50		*	340	ns	14			11St21	ETD	2009	IT=100	*
^{191}Re	−34350	10					9.8	m	0.5	(3/2$^+$, 1/2$^+$)	07			1963	β^-=100	*
^{191}Re^m	−32749	10	1601.5	0.4			51	μs	3	25/2$^-$		16Re02	EJT	2011	IT=100	
^{191}Os	−36395.2	0.7					14.99	d	0.02	9/2$^-$	07	12Kr05	T	1940	β^-=100	
^{191}Os^m	−36320.8	0.7	74.382	0.003			13.10	h	0.05	3/2$^-$	07	12Kr05	T	1952	IT=100	*
^{191}Ir	−36708.8	1.3					STABLE			3/2$^+$	07			1935	IS=37.3 2	
^{191}Ir^m	−36537.5	1.3	171.29	0.04			4.899	s	0.023	(11/2$^-$)	07			1955	IT=100	
^{191}Ir^n	−34607.8	1.6	2101.0	0.9			5.7	s	0.4	31/2$^{(+)}$	07	12Dr02	ETJ	1979	IT=100	*
^{191}Pt	−35698	4					2.83	d	0.02	3/2$^-$	07			1948	ε=100	
^{191}Pt^m	−35597	4	100.663	0.020			> 1	μs		(9/2)$^-$	07			1976	IT=100	
^{191}Pt^n	−35549	4	149.035	0.022			95	μs	5	(13/2)$^+$	07			1967	IT=100	
^{191}Au	−33798	5					3.18	h	0.08	3/2$^+$	07			1954	β^+=100	
^{191}Au^m	−33532	5	266.2	0.7			920	ms	110	(11/2$^-$)	07			1971	IT=100	
^{191}Au^n	−31308	5	2489.6	0.9			402	ns	20	(31/2$^+$)	07			1985	IT=100	
^{191}Hg	−30592	22					49	m	10	3/2$^{(-)}$	07	86Ul02	J	1954	β^+=100; α<5e–6	
^{191}Hg^m	−30460	30	128	22			50.8	m	1.5	13/2$^{(+)}$	07	01Sc41	E	1954	β^+=100; α<5e–6	*
^{191}Tl	−26283	7					20#	m		1/2$^{(+)}$	07	13Ba41	J	1974	β^+ ?	
^{191}Tl^m	−25986	7	297	7	BD		5.22	m	0.16	9/2$^{(-)}$	07			1970	β^+=100	
^{191}Pb	−20230	40				*	1.33	m	0.08	(3/2$^-$)	07	10Co13	JD	1974	$\beta^+\approx$100; α=0.51 5	
^{191}Pb^m	−20231	28	0	50	MD	*	2.18	m	0.08	13/2$^{(+)}$	07	88Me.A	J	1975	$\beta^+\approx$100; $\alpha\approx$0.02	
^{191}Pb^n	−17610	60	2620	50			180	ns	80	(33/2$^+$)	07			1999	IT=100	*
^{191}Bi	−13239	7					11.7	s	0.4	(9/2$^-$)	16	13Ny01	T	1972	α=51 10; β^+ ?	
^{191}Bi^m	−12997	9	242	4	AD		114	ms	6	(1/2$^+$)	16	13Ny01	T	1981	α=68 5; IT=32 5; B ?	
^{191}Bi^n	−12809	7	429.7	0.5			562	ns	10	13/2$^+$#	16			2001	IT=100	
^{191}Bi^p	−11364	26	1875	25			400	ns	40		16			2016	IT=100	*
^{191}Po	−5069	7					22	ms	1	(3/2$^-$)	07			1993	α=?; β^+=1#	
^{191}Po^m	−5008	12	61	11	AD		93	ms	3	(13/2$^+$)	07			1999	α=?; β^+=4#	
^{191}At	3864	16					2.1	ms	0.8	(1/2$^+$)	07			2003	$\alpha\approx$100; β^+ ?	*
^{191}At^m	3922	18	58	20	AD		2.2	ms	0.4	(7/2$^-$)	07			2003	$\alpha\approx$100; β^+ ?	*
*^{191}W^m	T : average 11St21=360(20) 09Al30=320(20) ns E : 68 + 167 keV γ-rays															**
*^{191}Re	I : also an isomer with T=77(33) μs decaying by g of 444, 419, 225, 139 keV															**
*^{191}Os^m	T : other 12Kr05=13.6(0.2) from the decay growth J : M3 + E4 to 9/2$^-$															**
*^{191}Ir^n	T : average 12Dr02=5.8(0.6) 79Lu01=5.5(0.7)															**
*^{191}Ir^n	E : from least-squares fit to γ-ray energies using 12Dr02 level scheme															**
*^{191}Hg^m	E : original uncertainty (8 keV) increased by 20 for gs+m lines in trap															**
*^{191}Pb^n	E : 2602.31(0.24) above ^{191}Pb^m T : symmetrized from 150(+100–50)															**
*^{191}Bi^p	E : x keV above 1825.1 level; x=50#															**
*^{191}At	T : symmetrized from 1.7(+1.1–0.5)															**
*^{191}At^m	T : symmetrized from 2.1(+0.4–0.3)															**
^{192}Ta	−23060#	400#					2.2	s	0.7	(2)	12			2009	β^-=100	
^{192}W	−29650#	200#					1#	m	(>300 ns)	0$^+$	12			1999	β^- ?	
^{192}Re	−31590	70					16.0	s	0.9		12	12Al05	T	1965	β^-=100	*
^{192}Re^m	−31430	70	159	1			88	μs	8		12	11St21	ETD	2005	IT=100	*
^{192}Re^n	−31320	70	267	10			70	s	30		12	12Re19	ET	2012	β^-=?; IT=?	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{192}Os	−35882.2	2.3					STABLE		(>53 Ey)	0^+	12	13Be07	T	1931	IS=40.78 19; 2β^- ?; α ?	∗
^{192}Os^m	−33866.8	2.3	2015.40	0.11			5.9	s	0.1	10^-	12	13Dr05	J	1965	IT>87; β^-<13	∗
^{192}Os^n	−31301.9	2.5	4580.3	1.0			204	ns	7	(20^+)	12	13Dr05	ETJ	2004	IT=100	
^{192}Ir	−34835.6	1.3					73.830	d	0.015	4^+	12	14Un01	T	1937	β^-=95.24 4; ε=4.76 4	
^{192}Ir^m	−34778.9	1.3	56.720	0.005			1.45	m	0.05	1^-	12			1937	IT≈100; β^-=0.0175	
^{192}Ir^n	−34667.5	1.3	168.14	0.12			241	y	9	(11^-)	12			1959	IT=100	
^{192}Pt	−36288.5	2.6					STABLE			0^+	12			1935	IS=0.782 24	
^{192}Pt^m	−34116.1	2.6	2172.37	0.13			272	ns	23	$(10)^-$	12			1976	IT=100	
^{192}Au	−32772	16					4.94	h	0.09	1^-	12			1948	β^+=100	
^{192}Au^m	−32637	16	135.41	0.25			29	ms		$5\#^+$	12			1976	IT=100	
^{192}Au^n	−32340	16	431.6	0.5			160	ms	20	(11^-)	12			1976	IT=100	
^{192}Hg	−32012	16					4.85	h	0.20	0^+	12			1952	ε=100; α<4e–6	
^{192}Tl	−25870	30					9.6	m	0.4	$2^{(-)}$	12	13Ba41	J	1961	β^+=100	
^{192}Tl^m	−25730	50	138	45			10.8	m	0.2	$7^{(+)}$	12	13Ba41	J	1961	β^+=100	
^{192}Tl^n	−25480	50	388	45			296	ns	5	(8^-)	12			1980	IT=100	
^{192}Tl^p	−25695	25	180	40	AD					(3^+)	12	91Va04	E	1991	α=100	
^{192}Pb	−22556	13					3.5	m	0.1	0^+	12			1974	β^+≈100; α=0.0059 7	
^{192}Pb^m	−19975	13	2581.1	0.4			166	ns	6	10^+	12	07Io03	J	1985	IT=100	
^{192}Pb^n	−19931	13	2625.1	1.1			1.09	μs	0.04	12^+	12	07Io03	J	1979	IT=100	
^{192}Pb^p	−19813	13	2743.5	0.4			756	ns	14	11^-	12	07Io03	J	1991	IT=100	
^{192}Bi	−13530	30					34.6	s	0.9	(3^+)	12			1971	β^+=88 5; α=12 5	
^{192}Bi^m	−13398	9	140	30	MD		39.6	s	0.4	(10^-)	12			1966	β^+=90 3; α=10 3	
^{192}Po	−8071	11					32.2	ms	0.3	0^+	12			1977	α=?; β^+=0.5#	
^{192}Po^m	−5776	11	2294.6	1.0			580	ns	100	(11^-)	12			1999	IT=100	
^{192}At	2926	28				∗ &	11.5	ms	0.6	$3^+\#$	12	13An03	D	2006	α=100; β^+=0.6#; β^+SF=0.21	∗
^{192}At^m	2926	28	0	40	AD	∗ &	88	ms	6	$(9^-,10^-)$	12	13An03	D	2006	α=100; β^+=4.6#; β^+SF=0.21	

∗^{192}Re T : average 12Al05=16(2) 79Ka.B=16(1) ∗∗
∗^{192}Re^m T : average 11St21=85(10) 09Al30=93(15); also 05Ca02=120(+210–50) μs ∗∗
∗^{192}Re^m E : 159.3 keV γ and X rays seen only in 11St21 ∗∗
∗^{192}Re^n T : symmetrized from 12Re19=61(+40–20) s for q=75$^+$ ∗∗
∗^{192}Os T : lower limit is for $\beta\beta$ decay ∗∗
∗^{192}Os^m T : 15Ak02 H-like τ=15.1(+1.5–1.3) s, T=10.5(+1.0–0.9) s ∗∗
∗^{192}Ir T : average 14Un01=73.831(0.074) 92Wo06=73.84(0.05) and 73.814(0.017) ∗∗
∗^{192}Ir T : 80Ho17=73.831(0.074) 72La14=74.02(0.06) ∗∗
∗^{192}Ir T : original unc of 80Ho17=0.008 increased to 0.1% by evaluator ∗∗
∗^{192}At D : 13An03=0.42 9 for both isomers ∗∗

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{193}Ta	−20870#	400#					500#	ms	(>300 ns)	$7/2^+\#$	13	12Ku26	I	2012	β^- ?; β^-n=0.7#	
^{193}W	−26290#	200#					3#	s	(>300 ns)	$3/2^-\#$	11	09St16	I	2009	β^- ?	
^{193}Re	−30230	40					20#	s	(>300 ns)	$5/2^+\#$	06	99Be63	I	1999	β^- ?	
^{193}Re^m	−30080	40	146.0	0.2			69	μs	6	$(9/2^-)$	06	11St21	ETJ	2005	IT=100	∗
^{193}Os	−33394.3	2.3					29.830	h	0.018	$3/2^-$	06	12Kr05	T	1940	β^-=100	∗
^{193}Os^m	−33152.3	2.4	242.0	0.5			132	ns	29			11St21	ETD	2011	IT=100	
^{193}Ir	−34536.2	1.3					STABLE			$3/2^+$	06			1935	IS=62.7 2	
^{193}Ir^m	−34456.0	1.3	80.239	0.006			10.53	d	0.04	$11/2^-$	06			1957	IT=100	
^{193}Ir^n	−32258.7	1.6	2277.5	1.0			124.8	μs	2.1	$31/2^+$		12Dr02	ETJ	2012	IT=100	
^{193}Pt	−34479.6	1.4					50	y	6	$1/2^-$	06			1948	ε=100	
^{193}Pt^m	−34329.8	1.4	149.78	0.04			4.33	d	0.03	$13/2^+$	06			1949	IT=100	
^{193}Au	−33405	9					17.65	h	0.15	$3/2^+$	06			1948	β^+=100; α<1e–5	
^{193}Au^m	−33115	9	290.19	0.03			3.9	s	0.3	$11/2^-$	06			1955	IT≈100; β^+≈0.03	
^{193}Au^n	−30919	9	2486.5	0.6			150	ns	50	$31/2^+$	06	07Ok05	J	1985	IT=100	
^{193}Hg	−31062	16					3.80	h	0.15	$3/2^{(-)}$	06			1952	β^+=100	
^{193}Hg^m	−30921	16	140.76	0.05			11.8	h	0.2	$13/2^{(+)}$	06			1973	β^+=92.8 5; IT=7.2 5	
^{193}Tl	−27477	7					21.6	m	0.8	$1/2^{(+\#)}$	06			1960	β^+=100	
^{193}Tl^m	−27105	8	372	4			2.11	m	0.15	$9/2^{(-)}$	06	13Ba41	J	1963	IT=75; β^+=25	∗
^{193}Pb	−22190	50				∗	5#	m		$(3/2^-)$	06	GAu	J	1974	β^+ ?	∗
^{193}Pb^m	−22060#	90#	130#	80#		∗	5.8	m	0.2	$13/2^+$	06	91Du07	J	1974	β^+=100	
^{193}Pb^n	−19450#	90#	2742#	80#			180	ns	15	$33/2^+$	06	04Io01	J	1991	IT=100	∗
^{193}Bi	−15885	8					63.6	s	3.0	$(9/2^-)$	06			1971	β^+ ?; α=3.5 15	∗
^{193}Bi^m	−15580	9	305	6	AD		3.07	s	0.13	$(1/2^+)$	06	15He27	T	1970	α=84 16; β^+ ?	
^{193}Bi^n	−15280	8	605.5	0.5			153	ns	10	$(13/2^+)$	06			2004	IT=100	
^{193}Bi^p	−13535	9	2350	5			85	μs	3	$(29/2^+)$	06	15He27	EJT	2004	IT=100	
^{193}Bi^q	−13480	9	2405	5			3.02	μs	0.08	$(29/2^-)$	06	15He27	ET	2004	IT=100	
^{193}Po	−8325	15					388	ms	40	$(3/2^-)$	15	13Se03	J	1967	α=?; β^+=5#	
^{193}Po^m	−8225	15	100	6	AD		245	ms	11	$(13/2^+)$	15	13Se03	J	1981	α=?; β^+=3#	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

. . . A-group continued . . .

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{193}At	−67	22				*	29	ms	5	1/2+#	06			2003	α≈100	*
^{193}At^m	−59	21	8	9	AD	*	21	ms	5	7/2−#	06			1995	α≈100	
^{193}At^n	−25	21	42	9	AD		28	ms	4	13/2+#	06			2003	α=24 10; IT=76 10	*
^{193}Rn	9043	25					1.15	ms	0.27	3/2−#	07	06An36	TD	2006	α≈100	

*^{193}Re^m E : a γ of 11St21=145.2(0.5) 09Al30=146.1(0.2) keV is observed in decay **
*^{193}Re^m T : average 11St21=65(9) 09Al30=72(8); also 05Ca02=75(+450–40) μs **
*^{193}Os T : other 92An13=30.11(0.01); large syst. unc due to large dead-time effect **
*^{193}Os I : also an isomer with T=132(29) decaying via a 242 keV γ-ray **
*^{193}Tl^m E : less than 13 keV above 365.2 level, from ENSDF **
*^{193}Pb J : from α decay from ^{197}Po **
*^{193}Pb T : T=4.0 m reported in Karlsruhe charts 1981 and 1995. Not traceable **
*^{193}Pb^n E : 2612.5(0.5) above ^{193}Pb^m **
*^{193}Bi D : α=3.5 15 is from ENSDF'98, wrongly attributed in ENSDF'2006 to NUBASE **
*^{193}At T : symmetrized from 28(+5–4) **
*^{193}At^n T : symmetrized from 27(+4–3) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{194}Ta	−17300#	500#					300#	ms	(>300 ns)		13	12Ku26	I	2012	β− ?; β−n=0.02#	
^{194}W	−24530#	300#					5#	s	(>300 ns)	0+	11			2008	β− ?	
^{194}Re	−27240#	200#					5	s	1	(0+,1)	14	12Al05	T	1999	β−=100	*
^{194}Re^m	−26960#	200#	285	40			25	s	8	(11−)	14	12Re19	E	2012	β−=100	*
^{194}Re^n	−26410#	200#	833	33			100	s	10		14	12Re19	E	2012	β−=100	
^{194}Re^p	−26140#	200#	1100#	1000#			45	μs	18		14	11St21	TD	2011	IT=100	*
^{194}Re^q	−25240#	200#	2000#	1000#			38	μs	37		14			2005	IT=100	*
^{194}Os	−32435.1	2.4					6.0	y	0.2	0+	06			1951	β−=100	
^{194}Ir	−32531.7	1.3					19.28	h	0.13	1−	06			1937	β−=100	
^{194}Ir^m	−32384.6	1.3	147.072	0.002			31.85	ms	0.24	4+	06			1959	IT=100	
^{194}Ir^n	−32160	70	370	70	BD		171	d	11	(10,11)$^{(-\#)}$	06			1968	β−=100	
^{194}Pt	−34760.1	0.5					STABLE			0+	06			1935	IS=32.86 40	
^{194}Au	−32211.9	2.1					38.02	h	0.10	1−	06			1948	β+=100	
^{194}Au^m	−32104.5	2.2	107.4	0.5			600	ms	8	(5+)	06			1975	IT=100	
^{194}Au^n	−31736.1	2.2	475.8	0.6			420	ms	10	(11−)	06			1953	IT=100	
^{194}Hg	−32183.9	2.9					447	y	28	0+	06	15Do01	T	1962	ε=100	*
^{194}Tl	−26937	14					33.0	m	0.5	2−	06			1960	β+=100; α<1e–7	
^{194}Tl^m	−26677	4	260	14	MD		32.8	m	0.2	7$^{(+)}$	06	13Ba41	J	1960	β+=100	
^{194}Pb	−24208	17					10.7	m	0.6	0+	06			1960	β+=100; α=7.3e–6 29	
^{194}Pb^m	−21580	17	2628.1	0.4			370	ns	13	12+	06	FGK128	J	1972	IT=100	*
^{194}Pb^n	−21275	17	2933.0	0.4			133	ns	7	11−	06			1986	IT=100	*
^{194}Bi	−16029	6				*	95	s	3	(3+)	06			1971	β+≈100; α=0.46 25	
^{194}Bi^m	−15880	50	150	50	MD	*	125	s	2	(6+,7+)	06			1976	β+≈100; α ?	
^{194}Bi^n	−15849	8	180	10	AD		115	s	4	(10−)	06			1988	β+≈100; α=0.20 7	
^{194}Po	−11005	13					392	ms	4	0+	06			1967	α≈100; β+ ?	
^{194}Po^m	−8480	13	2525.2	0.8			15	μs	2	(11−)	06			1999	IT=100	
^{194}At	−720	25					286	ms	7	(4−,5−)	06	13An03	TD	2009	α≈100; β+=8.3#; β+SF=0.032	*
^{194}At^m	−740	30	−20	40	AD		323	ms	7	(9−,10−)	06	13An03	T	1984	α≈100; β+=8.3#; β+SF=0.032	*
^{194}Rn	5723	17					780	μs	160	0+	07			2006	α≈100; β+ ?	

*^{194}Re T : other 09Ku28=1.0(0.5) withdrawn by authors in 14Ku23 **
*^{194}Re^m T : from 12Al05 two exc. isomers with 25(8) s 100(10) s; could be exchanged **
*^{194}Re^p D : only 86.3 keV γ is seen, but not those seen in ^{194}Re^q **
*^{194}Re^q I : decaying by delayed γ-rays of 464, 148, 128 **
*^{194}Hg T : average 81Ho18=477(32) 79Pr15=358(55), values corrected in 15Do01 for **
*^{194}Hg T : the new branching intensity of the 328.5 g ray. **
*^{194}Pb^m J : E2 to 10+; magnetic moment **
*^{194}Pb^n J : E2 to 9−; magnetic moment **
*^{194}At T : 13An03 supersedes 09An11=253(10) D : 13An03=0.065 8 for both isomers **
*^{194}At J : favored α-decay to (5−) isomer in ^{190}Bi **
*^{194}At^m T : 13An03=323(7) supersedes 09An11=310(8); other 13Ny01=300(+50–40) **
*^{194}At^m J : favored α-decay to (10−) isomer in ^{190}Bi **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{195}W	−21010#	300#					3#	s	(>300 ns)	5/2−#		12Ku26	I	2012	β− ?	
^{195}Re	−25580#	300#					6	s	1	5/2+#	14			2008	β−=100	
^{195}Os	−29510	60					6.5	m	1.1	3/2−#	14			2004	β− ?	
^{195}Os^m	−29060	60	454	10			2.0	h	1.7	13/2+#	14	12Re19	ED	2012	β−=?; IT=?	*
^{195}Ir	−31692.3	1.3					2.29	h	0.17	3/2+	14			1952	β−=100	
^{195}Ir^m	−31592	5	100	5			3.67	h	0.08	11/2−	14			1968	β−=95 5; IT=5 5	
^{195}Ir^n	−29338	6	2354	6			4.4	μs	0.6	(27/2+)		11St21	ETJ	2011	IT=100	*
^{195}Pt	−32793.8	0.5					STABLE			1/2−	14			1935	IS=33.78 24	
^{195}Pt^m	−32534.7	0.5	259.077	0.023			4.010	d	0.005	13/2+	14			1960	IT=100	

. . . A-group is continued on next page . . .

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... A-group continued ...																
^{195}Au	−32567.0	1.1					186.01	d	0.06	$3/2^+$	14			1948	ε=100	
^{195}Au^m	−32248.4	1.1	318.58	0.04			30.5	s	0.2	$11/2^-$	14			1952	IT=100	
^{195}Au^n	−30067	20	2500	20			12.89	μs	0.21	$31/2^{(-)}$	14	13Dr01	ET	2013	IT=100	*
^{195}Hg	−31013	23					10.69	h	0.16	$1/2^-$	14	15Do01	T	1952	β^+=100	*
^{195}Hg^m	−30837	23	176.07	0.04			41.60	h	0.19	$13/2^+$	14	15Do01	T	1951	IT=54.2 20; β^+=45.8 20	*
^{195}Tl	−28155	11					1.16	h	0.05	$1/2^+$	14			1955	β^+=100	
^{195}Tl^m	−27672	11	482.63	0.17			3.6	s	0.4	$9/2^-$	14			1957	IT=100	
^{195}Pb	−23708	18					15	m		$3/2^-$	14			1957	β^+=100	
^{195}Pb^m	−23505	18	202.9	0.7			15.0	m	1.2	$13/2^{(+)}$	14	91Gr12	E	1957	β^+=100	*
^{195}Pb^n	−21949	18	1759.0	0.7			10.0	μs	0.7	$(21/2^-)$	14			1976	IT=100	
^{195}Bi	−18026	5					183	s	4	$9/2^{(-)}$	14	GAu14b	J	1971	$\beta^+\approx$100; α=0.03 2	
^{195}Bi^m	−17626	8	399	6	AD		87	s	1	$(1/2^+)$	14	GAu14b	J	1974	β^+=67 17; α=33 17	*
^{195}Bi^n	−15631	5	2395.5	0.5			750	ns	50	$(29/2^-)$	14	15Ro20	J	2003	IT=100	
^{195}Bi^p	−14690	5	3336	2			1.6	μs	0.1	$(31/2^-)$	15	15Ro20	ETJ	2015	IT=100	*
^{195}Po	−11060	40					4.64	s	0.09	$(3/2^-)$	15	13Se03	J	1967	α=94 4; β^+ ?	
^{195}Po^m	−10965	28	90	50	AD		1.92	s	0.02	$(13/2^+)$	15	13Se03	J	1967	$\alpha\approx$90; $\beta^+\approx$10; IT<0.01	
^{195}At	−3470	10					290	ms	20	$1/2^+$	14			1999	$\alpha\approx$100; β^+ ?	
^{195}At^m	−3441	8	29	7	AD		143	ms	3	$(7/2^-)$	14			1995	α=?; IT=12 4; β^+ ?	*
^{195}At^p	−3370#	40#	100#	40#						$(13/2^+)$		13Uu01	J		IT ?	*
^{195}Rn	5050	50				*	7	ms	3	$3/2^-$	14			2001	$\alpha\approx$100	*
^{195}Rn^m	5131	17	80	50	AD	*	6	ms	3	$13/2^+$	14			2001	$\alpha\approx$100	*

*^{195}Os^m T : symmetrized from 32(+154–16) m for q=76$^+$ (bare ion) **
*^{195}Ir^n E : 268.4, 404.4, 476.4, 537.8, 566.7 γs in cascade to ^{195}Ir^m **
*^{195}Au^n E : 13Dr01=2460.9 + x, x=40#(20#) estimated by NUBASE T : τ=18.6(0.3) **
*^{195}Hg T : average 15Do01=10.84(0.03) 01Li17=10.53(0.03), Birge ratio B=7.3 **
*^{195}Hg^m T : average 15Do01=41.6(0.2) 73Vi09=41.6(0.8) **
*^{195}Pb^m J : same as ^{199}Po^m and ^{203}Rn^m, from α decay **
*^{195}Bi^m J : spins of ground-state and of isomer derived from α decay to daughter **
*^{195}Bi^p E : uncertainty estimated by NUBASE **
*^{195}At^m E : ENSDF14=33.0(1.0) is erroneous **
*^{195}At^p E : estimated 70#(40#) above ^{195}Atm; 13Ny01 estimated upper limit is 130 keV **
*^{195}Rn T : symmetrized from 01Uu01=6(+3–2) **
*^{195}Rn^m T : symmetrized from 01Uu01=5(+3–2) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{196}W	−18880#	400#					3#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?	
^{196}Re	−22540#	300#					2.4	s	1.5		13			2008	β^- ?	*
^{196}Re^m	−22420#	300#	120#	40#			3.6	μs	0.6			11St21	T	2009	IT=100	*
^{196}Os	−28280	40					34.9	m	0.2	0^+	07			1977	β^-=100	
^{196}Ir	−29440	40					52	s	1	(0^-)	07			1966	β^-=100	
^{196}Ir^m	−29227	20	210	40	BD		1.40	h	0.02	$(10,11^-)$	07			1959	$\beta^-\approx$100; IT<0.3	
^{196}Pt	−32644.5	0.5					STABLE			0^+	07			1935	IS=25.21 34	
^{196}Au	−31138.7	3.0					6.1669	d	0.0006	2^-	07			1937	β^+=92.8 8; β^-=7.2 8	
^{196}Au^m	−31054	3	84.656	0.020			8.1	s	0.2	(5^+)	07			1971	IT=100	
^{196}Au^n	−30543	3	595.66	0.04			9.6	h	0.1	12^-	07			1960	IT=100	
^{196}Hg	−31825.9	2.9					STABLE		(>2.5 Ey)	0^+	07	90Bu28	T	1930	IS=0.15 1; 2β^+ ?	
^{196}Tl	−27497	12					1.84	h	0.03	2^-	07			1955	β^+=100	
^{196}Tl^m	−27103	12	394.2	0.5			1.41	h	0.02	$7^{(+)}$	07	13Ba41	J	1960	β^+=96.2 4; IT=3.8 4	
^{196}Pb	−25348	8					37	m	3	0^+	07			1957	β^+=100; α<3e–5	
^{196}Pb^m	−23610	8	1738.27	0.12			< 1	μs		4^+	07			1973	IT=100	
^{196}Pb^n	−23550	8	1797.51	0.14			140	ns	14	5^-	07			1973	IT=100	
^{196}Pb^p	−22653	8	2694.6	0.3			270	ns	4	12^+	07			1973	IT=100	
^{196}Bi	−18009	24					5.1	m	0.2	(3^+)	07			1976	$\beta^+\approx$100; α=0.00115 34	
^{196}Bi^m	−17843	25	166.4	2.9	AD		0.6	s	0.5	(7^+)	07			1987	IT=?; β^+ ?	
^{196}Bi^n	−17737	25	272	3	AD		4.00	m	0.05	(10^-)	07			1987	β^+=74.2 25; IT=25.8 25; α=0.00038 10	
^{196}Po	−13473	14					5.56	s	0.09	0^+	07	05Uu02	T	1967	$\alpha\approx$98; $\beta^+\approx$2	*
^{196}Po^m	−10979	14	2493.9	0.4			856	ns	17	11^-	07			1995	IT=100	
^{196}At	−3910	30				*	388	ms	7	(3^+)	07	93An11	D	1967	α=?; β^+=5#; β^+SF=0.088	*
^{196}At^m	−3950	18	−40	40	AD	*	20#	ms		(10^-)		96En01	D	1996	$\alpha\approx$100	*
^{196}At^n	−3750	30	157.9	0.1			11	μs	2	(5^+)	07			2000	IT=100	
^{196}Rn	1971	14					4.7	ms	1.1	0^+	07			1995	$\alpha\approx$100; β^+=0.06#	*

*^{196}Re T : symmetrized from 14Ku23=3(+1–2) **
*^{196}Re^m D : only Kx-rays observed; E>72 keV (K-shell binding energy) **
*^{196}Po T : average 05Uu02=5.1(+3.1–1.4) 97Pu01=5.5(0.1) 93Wa04=5.8(0.2) **
*^{196}Po T : other not used : 10He25=4.1(+5.6–1.5) ms **
*^{196}At J : same as ^{192}Bi, from α decay T : also 14Ka23=350(90) **
*^{196}At^m I : level not accepted in ENSDF **
*^{196}Rn T : symmetrized from 4.4(+1.3–0.9) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{197}W	−15140#	400#					1#	s	(>300 ns)	5/2−#	13	12Ku26	I	2012	β^- ?	
^{197}Re	−20500#	300#					300#	ms	(>300 ns)	5/2+#	13			2009	β^- ?	
^{197}Os	−25310#	200#					2.8	m	0.6	5/2−#	09			2003	β^-=100	
^{197}Ir	−28264	20					5.8	m	0.5	(3/2+)	05			1952	β^-=100	
^{197}Ir^m	−28149	21	115	5			8.9	m	0.3	(11/2−)	05			1976	$\beta^-\approx$100; IT=0.25 10	
^{197}Ir^n	−27860#	200#	400#	200#			30	μs	8			05Ca02	T	2005	IT=100	
^{197}Pt	−30419.7	0.5					19.8915	h	0.0019	1/2−	05			1936	β^-=100	
^{197}Pt^m	−30020.1	0.5	399.59	0.20			95.41	m	0.18	13/2+	05			1941	IT=96.7 4; β^-=3.3 4	
^{197}Au	−31139.7	0.5					STABLE			3/2+	05			1935	IS=100.	
^{197}Au^m	−30730.6	0.5	409.15	0.08			7.73	s	0.06	11/2−	05			1945	IT=100	
^{197}Au^n	−28607.2	1.1	2532.5	1.0			150	ns	5	27/2+#		06Wh02	ETJ	2006	IT=100	
^{197}Hg	−30540	3					64.94	h	0.07	1/2−	05	01Li17	T	1941	ε=100	*
^{197}Hg^m	−30241	3	298.93	0.08			23.8	h	0.1	13/2+	05			1943	IT=91.4 7; ε=8.6 7	
^{197}Tl	−28342	16					2.84	h	0.04	1/2+	05			1955	β^+=100	
^{197}Tl^m	−27734	16	608.22	0.08			540	ms	10	9/2−	05	13Ba41	J	1953	IT=100	
^{197}Pb	−24745	5					8.1	m	1.7	3/2−	05			1955	β^+=100	
^{197}Pb^m	−24426	5	319.31	0.11			42.9	m	0.9	13/2+	05			1957	β^+=81 2; IT=19 2	
^{197}Pb^n	−22831	5	1914.10	0.25			1.15	μs	0.20	21/2−	05			1978	IT=100	
^{197}Bi	−19687	8					9.33	m	0.50	(9/2−)	05			1971	β^+=100; α=1e–4#	*
^{197}Bi^m	−19155	8	533	12	AD		5.04	m	0.16	(1/2+)	05			1966	α=55 40; β^+=45 40; IT<0.3	*
^{197}Bi^n	−17284	14	2403	12			263	ns	13	(29/2−)	05	86Ch01	TJD	1986	IT=100	*
^{197}Bi^p	−16758	8	2929.5	0.5			209	ns	30	(31/2−)	05	86Ch01	TJD	1986	IT=100	
^{197}Po	−13360	50					53.6	s	0.9	(3/2−)	05	93Wa04	T	1965	β^+ ?; α=44 7	*
^{197}Po^m	−13130#	90#	230#	80#			25.8	s	0.1	(13/2+)	05	93Wa04	T	1967	α=84 9; β^+ ?; IT=0.01#	*
^{197}At	−6355	8				*	388.2	ms	5.6	(9/2−)	05	05De01	T	1967	α=96.1 12; β^+=3.9 12	*
^{197}At^m	−6311	9	45	8	AD	*	2.0	s	0.2	(1/2+)	05			1985	$\alpha\approx$100; β^+ ?; IT<0.004; β^+ ?	*
^{197}At^n	−6044	8	310.7	0.2			1.3	μs	0.2	(13/2+)		08An11	ETJ	1999	IT=100	*
^{197}Rn	1510	16					54	ms	6	(3/2−)	05	08An05	T	1995	$\alpha\approx$100; β^+ ?	*
^{197}Rn^m	1709	16	199	11			25.6	ms	2.5	(13/2+)	05	08An05	T	1996	$\alpha\approx$100; β^+ ?	*
^{197}Fr	10250	50					2.33	ms	1.88	7/2−#	14	13Ka16	T	2013	$\alpha\approx$100	*

*^{197}Hg T : 66El09=64.14(0.05) strongly conflicting: Birge ratio would be B=9.3 **
*^{197}Tl^m J : also in 12Bi.A **
*^{197}Bi I : ENSDF'05 reported an isomer at 2129.3(0.4) keV, 204(18) ns, (23/2−), **
*^{197}Bi I : not trusted by NUBASE, see fig.3 in 86Ch01 **
*^{197}Bi^m J : α decay to ^{193}Tl ground-state **
*^{197}Bi^n T : more recent 95Zh36=252.6(38.7) outweighed, not used **
*^{197}Bi^n E : 95Zh36=2383.1 + x, with x<40 keV; 86Ch01=2360.4 + x is the same level **
*^{197}Bi^n E : but authors mis-assigned the 97 keV γ-ray, see Fig.1 of 95Zh36 **
*^{197}Po T : average 93Wa04=53(1) 71Ho01=60(6) 67Le21=58(3) 67Si09=52(4); other not **
*^{197}Po T : used 96Ta18=84(16) **
*^{197}Po^m T : others not used 71Ho01=27(3) 67Le21=29(9) 67Si09=26(2); **
*^{197}Po^m T : also 10He25=14.45(+14.45–4.9) ms for 3 events, strongly conflicting **
*^{197}At T : average 05De01=390(16) 99Sm07=388(6); also 14Ka23=354(+17–15) **
*^{197}At^m T : also 14Ka23=2.8(+3.8–1.0) **
*^{197}At^n T : other 99Sm07=5.5(1.4) **
*^{197}Rn T : symmetrized from 08An05=53(+7–5) J : from α decay to ^{193}Po **
*^{197}Rn^m T : symmetrized from 08An05=25(+3–2) J : from α decay to ^{193}Po^m **
*^{197}Rn^m T : others 05Uu02=30(+150–15) 96En02=19(+8–4) 95Mo14=18(+9–5) **
*^{197}Fr T : symmetrized from 13Ka16=0.6(+30–3) **

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{198}Re	−17140#	400#			300#	ms	(>300 ns)		16	09St16	I	2009	β^- ?; β^-n=0#	*
^{198}Os	−23840#	200#			1#	m	(>300 ns)	0+	16	09Po02	I	2008	β^- ?	
^{198}Ir	−25820#	200#			8	s	1		16			1973	β^-=100	
^{198}Pt	−29904.0	2.1			STABLE			0+	16			1935	IS=7.36 13; 2β^- ?; α ?	*
^{198}Au	−29580.8	0.5			2.6941	d	0.0002	2−	16			1937	β^-=100	
^{198}Au^m	−29268.6	0.5	312.2227	0.0020	124	ns	4	5+	16			1968	IT=100	
^{198}Au^n	−28768.9	1.6	811.9	1.5	2.272	d	0.016	12−	16	FGK128	J	1972	IT=100	*
^{198}Hg	−30954.3	0.5			STABLE			0+	16			1925	IS=9.97 20	
^{198}Tl	−27529	8			5.3	h	0.5	2−	16			1949	β^+=100	
^{198}Tl^m	−26985	8	543.6	0.4	1.87	h	0.03	7+	16			1949	β^+=55.9 23; IT=44.1 23	
^{198}Tl^n	−26842	8	686.8	0.5	150	ns	40	(5,7,9)+	16			1977	IT=100	
^{198}Tl^p	−26787	8	742.4	0.4	32.1	ms	1.0	10−	16	FGK128	J	1975	IT=100	*
^{198}Pb	−26067	9			2.4	h	0.1	0+	16			1955	β^+=100	
^{198}Pb^m	−23926	9	2141.4	0.4	4.19	μs	0.10	7−	16	FGK128	J	1972	IT=100	*
^{198}Pb^n	−23836	9	2231.4	0.5	137	ns	10	9−	16	FGK128	J	1989	IT=100	*
^{198}Pb^p	−23245	9	2821.7	0.6	212	ns	4	12+	16	FGK128	J	1973	IT=100	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{198}Bi	−19369	28				10.3	m	0.3	$3^{(+)}$	16	16Ly01	J	1950	β^+=100	
^{198}Bi^m	−19085	28	280	40	MD	11.6	m	0.3	$7^{(+)}$	16	16Ly01	J	1992	β^+=100	
^{198}Bi^n	−18837	28	530	40	MD	7.7	s	0.5	$10^{(-)}$	16	16Ly01	J	1972	IT=100	*
^{198}Po	−15473	17				1.760	m	0.024	0^+	16			1965	α=57 2; β^+=43 2	
^{198}Po^m	−12907	17	2565.92	0.20		200	ns	20	11^-	16			1990	IT=100	
^{198}Po^n	−12730	50	2740	50		750	ns	50	12^+	16			1990	IT ?	
^{198}At	−6715	6				3.0	s	0.1	(3^+)	16	14Ka23	T	1967	α>94; β^+ ?	
^{198}At^m	−6430	8	284	10	AD	1.21	s	0.06	(10^-)	16			1967	α=84 16; β^+ ?	
^{198}Rn	−1230	13				65	ms	3	0^+	16			1984	α=?; β^+=1#	
^{198}Fr	9570	30				15	ms	3	low	16			2013	$\alpha\approx$100	
^{198}Fr^m	9580	40	0	50		1.1	ms	0.7	high	16			2013	$\alpha\approx$100	
*^{198}Re	I : other 12Ku26>300 ns														**
*^{198}Pt	T : 52Fr23 : 0ν-$\beta\beta$>320 Ty														**
*^{198}Au^n	J : M4 to 8^+; magnetic moment														**
*^{198}Tl^p	J : E3 to 7^+														**
*^{198}Pb^m	J : E2 to 5^-; magnetic moment														**
*^{198}Pb^n	J : E2 to 7^-														**
*^{198}Pb^p	J : E2 to 10^+; magnetic moment														**
*^{198}Bi^n	E : 248.5(0.5) keV above ^{198}Bi^m, from 92Hu04					J : E3 to (7^+)									**
^{199}Re	−14860#	400#				100#	ms	(>300 ns)	$5/2^+$#	13	12Ku26	I	2012	β^- ?	
^{199}Os	−20480#	200#				6	s	3	$5/2^-$#	07	14Ku23	T	2008	β^-=100	*
^{199}Ir	−24400	40				7	s	5	$3/2^+$#	07	14Ku23	T	1993	β^- ?	*
^{199}Ir^m	−24270#	60#	130#	40#		235	ns	90	$11/2^-$#	07			2005	IT=100	*
^{199}Pt	−27388.7	2.2				30.80	m	0.21	$5/2^-$	07			1937	β^-=100	
^{199}Pt^m	−26964.7	3.0	424	2		13.6	s	0.4	$(13/2)^+$	07			1959	IT=100	
^{199}Au	−29093.7	0.5				3.139	d	0.007	$3/2^+$	07			1937	β^-=100	
^{199}Au^m	−28544.8	0.5	548.9405	0.0021		440	μs	30	$(11/2)^-$	07			1968	IT=100	
^{199}Hg	−29546.1	0.5				STABLE			$1/2^-$	07			1925	IS=16.87 22	
^{199}Hg^m	−29013.6	0.5	532.48	0.10		42.67	m	0.09	$13/2^+$	07			1948	IT=100	
^{199}Tl	−28059	28				7.42	h	0.08	$1/2^+$	07			1949	β^+=100	
^{199}Tl^m	−27310	28	748.87	0.06		28.4	ms	0.2	$9/2^-$	07			1963	IT=100	
^{199}Pb	−25232	10				90	m	10	$3/2^-$	07			1950	β^+=100	
^{199}Pb^m	−24803	10	429.5	2.7		12.2	m	0.3	$(13/2^+)$	07			1955	IT=93; β^+=7	*
^{199}Pb^n	−22668	10	2563.8	2.7		10.1	μs	0.2	$(29/2^-)$	07			1981	IT=100	*
^{199}Bi	−20798	11				27	m	1	$9/2^-$	07			1950	β^+=100	
^{199}Bi^m	−20131	11	667	3		24.70	m	0.15	$(1/2^+)$	07			1950	β^+=?; IT<2; $\alpha\approx$0.01	
^{199}Bi^n	−18851	18	1947	14		100	ns	30	$25/2^+$#	07			1974	IT=100	*
^{199}Bi^p	−18250	18	2548	14		168	ns	13	$29/2^-$#	07			1985	IT=100	*
^{199}Po	−15208	18				5.47	m	0.15	$(3/2^-)$	07	13Se03	J	1965	β^+=92.5 3; α=7.5 3	
^{199}Po^m	−14897	18	311.9	2.7	AD	4.17	m	0.05	$13/2^{(+)}$	07			1964	β^+=73.5 10; α=24 1; IT=2.5 10	*
^{199}At	−8823	5				7.02	s	0.12	$9/2^{(-)}$	07	05De01	T	1967	α=89 6; β^+ ?	*
^{199}At^m	−8579	5	244.0	1.0		273	ms	9	$(1/2^+)$		14Au03	TJD	2013	IT$\approx$100; α=1#	*
^{199}At^n	−8250	5	572.9	0.1		70	ns	20	$(13/2^+)$	07	10Ja05	ETJ	2000	IT=100	
^{199}At^p	−6530	5	2293.4	0.5		800	ns	50	$(29/2^+)$		10Ja05	ETJ	2010	IT=100	
^{199}Rn	−1500	40				590	ms	30	$(3/2^-)$	07	05Uu02	J	1980	α=?; β^+=6#	*
^{199}Rn^m	−1337	29	160	50	AD	310	ms	20	$(13/2^+)$	07	05Uu02	J	1981	α=?; β^+=3#	
^{199}Fr	6771	14				6.6	ms	2.2	$1/2^+$#	07	13Ka16	T	1999	$\alpha\approx$100; β^+ ?	*
^{199}Fr^m	6817	10	45	13	AD	6.5	ms	0.9	$7/2^-$#		13Ka16	T	2013	$\alpha\approx$100; β^+ ?	*
^{199}Fr^n	7020#	50#	250#	50#		2.2	ms	1.2			13Uu01	TD	2013	α=?; β^+ ?	*
*^{199}Os	T : symmetrized from 14Ku23=14Mo15=5(+4–2)														**
*^{199}Ir	T : symmetrized from 14Ku23=14Mo15=6(+5–4)														**
*^{199}Ir^m	T : range 80-390 ns														**
*^{199}Pb^m	E : 424.8(0.2) + x; x < 9.3 keV			D : from 78Le.A											**
*^{199}Pb^n	E : 2559.1(0.4) + x; x < 9.3 keV														**
*^{199}Bi^n	E : 1922.3 + x ; x<50 in ENSDF'07														**
*^{199}Bi^p	E : 2523.2 + x ; x<50 in ENSDF'07														**
*^{199}Po^m	J : same as ^{203}Rn^m, from α decay; also 13Se03=$(13/2^+)$														**
*^{199}At	T : average 12Fo09=6.7(0.5) 05De01=6.92(0.13) 05Uu02=7.8(0.4) 67Tr06=7.2(0.5)														**
*^{199}At	J : spins of ground-state derived from α decay to daughter														**
*^{199}At	D : symmetrized from α=92(+3–8)%														**
*^{199}At^m	T : 14Au03=273(9) 13Ja06=310(80)														**
*^{199}Rn	T : others 14Ka23=340(+280–110)														**
*^{199}Fr	T : average 13Ka16=4.5(+3.1–1.3) 99Ta20=12(+10–4)					J : same as ^{195}At									**
*^{199}Fr^m	T : average 13Ka16=6.2(+1.1–0.8) 13Uu01=7(+3–2)					J : same as ^{195}Atm									**
*^{199}Fr^n	T : symmetrized from 13Uu01=1.6(+1.6–.6)														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{200}Os	−18780#	300#					7	s	4	0^+	08	14Ku23	T	2005	β^-=100	*
^{200}Ir	−21610#	200#					43	s	6	$(2^-,3^-)$	11	14Mo15	T	2008	β^-=100	*
^{200}Pt	−26599	20					12.6	h	0.3	0^+	07			1957	β^-=100	
^{200}Au	−27240	27					48.4	m	0.3	$1^{(-)}$	07			1951	β^-=100	
^{200}Au^m	−26233	26	1010	40	BD		18.7	h	0.5	12^-	07			1968	β^-=82 2; IT=18 2	
^{200}Hg	−29503.3	0.5					STABLE			0^+	07			1925	IS=23.10 19	
^{200}Tl	−27047	6					26.1	h	0.1	2^-	07			1949	β^+=100	
^{200}Tl^m	−26293	6	753.6	0.24			34.0	ms	0.9	7^+	07			1963	IT=100	
^{200}Tl^n	−26285	6	762.00	0.24			330	ns	50	5^+	07			1972	IT=100	
^{200}Pb	−26251	11					21.5	h	0.4	0^+	07			1950	ε=100	
^{200}Pb^m	−24068	11	2183.3	1.1			448	ns	12	(9^-)	07			1972	IT=100	
^{200}Pb^n	−23245	11	3005.8	1.2			199	ns	3	(12^+)	07			1975	IT=100	
^{200}Bi	−20371	22				*	36.4	m	0.5	7^+	07			1950	β^+=100	
^{200}Bi^m	−20270#	70#	100#	70#		*	31	m	2	(2^+)	07			1978	β^+<100; IT ?	
^{200}Bi^n	−19943	22	428.20	0.10			400	ms	50	(10^-)	07			1972	IT=100	
^{200}Po	−16942	8					11.51	m	0.08	0^+	07			1951	β^+=88.9 3; α=11.1 3	
^{200}Po^m	−14346	8	2596.1	0.3			100	ns	10	11^-	07			1985	IT=100	
^{200}Po^n	−14125	11	2817	8			268	ns	3	12^+	07			1985	IT=100	*
^{200}At	−8988	24					43.2	s	0.9	(3^+)	07	96Ta18	T	1963	α=52 3; β^+=48 3	*
^{200}At^m	−8875	25	112.9	2.9	AD		47	s	1	(7^+)	07			1967	α=43 7; β^+=?; IT ?	
^{200}At^n	−8644	25	343.8	3.0	AD		8.0	s	2.1	(10^-)	07			1967	IT<89.5 3; $\alpha\approx$10.5 3; β^+ ?	*
^{200}Rn	−4005	14					1.09	s	0.16	0^+	07			1971	α=92 8; β^+ ?	*
^{200}Rn^m	−1685	24	2320	20			28	μs	9		07			2002	IT=100	*
^{200}Fr	6130	30				*	47.5	ms	2.8	(3^+)	07	14Ka23	TD	1995	α=100; β^-=2.5#; β^-SF>1.4	*
^{200}Fr^m	6180	50	50	60	AD	*	190	ms	120	10^-#		96En01	TD	1996	$\alpha\approx$100; IT ?	*
^{200}Fr^n	6280#	60#	150#	50#			790	ns	360			14Ka23	T	2014	IT ?	*

*^{200}Os T : symmetrized from 14Ku23=14Mo15=6(+4–3); other 05Ku.A=4.6(1.3) same group **
*^{200}Ir J : from 13Mo20=(2-,3-) **
*^{200}Po^n E : Ex<25 keV above 2804.5(0.6) level **
*^{200}At T : average 96Ta18=44(2) 92Hu04=43(1) **
*^{200}At^n E : 230.9(0.2) keV above ^{200}At^m, from ENSDF **
*^{200}At^n T : symmetrized from 7.3(+2.6–1.5) **
*^{200}Rn T : symmetrized from 1.03(+0.20–0.11) D : symmetrized from 86(+14–4)% **
*^{200}Rn^m E : Estimated 20#(20#) keV above 2300.5(0.5) level **
*^{200}Rn^m T : symmetrized from 25(+11–6) **
*^{200}Fr T : average 14Ka23=46(4) 05De01=49(4) **
*^{200}Fr^m I : two events with 100 ms and E(a)=7550 correlated with E(a)=6880 **
*^{200}Fr^m I : assigned by evaluators to ^{200}Fr^m and ^{196}At^m **
*^{200}Fr^m I : existence under discussion, level not accepted in ENSDF **
*^{200}Fr^m T : symmetrized from 100(+180–40) (2 evts with half-life=100ms), see 84Sc13 **
*^{200}Fr^n E : 14Ka23 >101.13 keV T : symmetrized from 14Ka23=600(+500–200) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{201}Os	−15240#	300#					1#	s	(>300 ns)	$1/2^-$#	13			2009	β^- ?	
^{201}Ir	−19900#	200#					21	s	5	$(3/2^+)$	11	14Mo15	T	2008	β^-=100	*
^{201}Pt	−23740	50					2.5	m	0.1	$(5/2^-)$	07			1962	β^-=100	
^{201}Au	−26401	3					26.0	m	0.8	$3/2^+$	07			1952	β^-=100	
^{201}Au^m	−25807	6	594	5			730	μs	630	$(11/2^-)$	07	11St21	ETJ	1981	IT=100	*
^{201}Au^n	−24791	6	1610	5			5.6	μs	2.4			11St21	ETD	2011	IT=100	*
^{201}Hg	−27662.5	0.7					STABLE			$3/2^-$	07			1925	IS=13.18 9	
^{201}Hg^m	−26896.3	0.7	766.22	0.15			94.0	μs	2.0	$13/2^+$	07			1961	IT=100	
^{201}Tl	−27181	14					3.0442	d	0.0019	$1/2^+$	07	14Un01	T	1950	ε=100	*
^{201}Tl^m	−26262	14	919.16	0.21			2.01	ms	0.07	$(9/2^-)$	07			1962	IT=100	
^{201}Pb	−25271	14					9.33	h	0.03	$5/2^-$	07			1950	β^+=100	
^{201}Pb^m	−24642	14	629.1	0.3			60.8	s	1.8	$13/2^+$	07			1952	IT$\approx$100; β^+ ?	
^{201}Pb^n	−22333	24	2938	20			508	ns	3	$(29/2^-)$	07			1981	IT=100	*
^{201}Bi	−21416	15					103	m	3	$9/2^-$	07			1950	β^+=100	
^{201}Bi^m	−20570	15	846.35	0.18			57.5	m	2.1	$1/2^+$	07			1950	β^+>91.1#; IT<8.6; α=?	*
^{201}Bi^n	−19443	27	1973	23			118	ns	28	$25/2^+$#	07			1982	IT=100	*
^{201}Bi^p	−19404	27	2012	23			105	ns	75	$27/2^+$#	07			1985	IT=100	*
^{201}Bi^q	−18635	27	2781	23			124	ns	4	$29/2^-$#	07			1982	IT=100	*
^{201}Po	−16521	5					15.6	m	0.1	$3/2^-$	07	13Se03	J	1951	β^+=98.87 3; α=1.13 3	
^{201}Po^m	−16097	5	423.8	2.4	AD		8.96	m	0.12	$13/2^+$	07	13Se03	J	1962	IT=56.2 12; β^+=41.4 7; α=2.4 5	
^{201}At	−10789	8					85.2	s	1.6	$(9/2^-)$	07			1963	α=71 7; β^+=29 7	
^{201}At^m	−10330	8	459	1			45	ms	3	$1/2^+$		14Au03	ETJ	2015	IT=100	
^{201}At^n	−8470	8	2319	1			3.39	μs	0.09	$29/2^+$		15Au01	ETJ	2015	IT=100	*

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… A-group continued …															
^{201}Rn	−4070	50				7.0	s	0.4	$(3/2^-)$	07			1967	α=?; β^+=49#	
^{201}Rn^m	−3790#	90#	280#	80#		3.8	s	0.1	$(13/2^+)$	07			1967	β^+=66#; α=?	*
^{201}Fr	3589	9				62.8	ms	1.9	$(9/2^-)$	07	14Ka23	T	1980	α=100	*
^{201}Fr^m	3715	11	127	11	AD	17	ms	7	$(1/2^+)$	07	14Ka23	T	2005	α=100	*
^{201}Fr^n	3790	60	200	60		890	ns	360	$(13/2^+)$		14Ka23	ETJ	2014	IT=100	*
^{201}Ra	11937	20				20	ms	30	$(3/2^-)$		14Ka23	TJ	2005	α=100	*
^{201}Ra^m	12200	26	263	26		6	ms	5	$(13/2^+)$	07			2005	α=100	*

*^{201}Ir J : from 13Mo20=($1/2^+$,$3/2^+$,$5/2^+$), $3/2^+$ agrees with systematics of odd-A Z=77 **
*^{201}Au^m T : symmetrized from 340(+900–290) μs **
*^{201}Au^n E : 378.2, 638 γs above ^{201}Au^m **
*^{201}Tl T : average 14Un01=3.046(0.006) 04Sc04=3.0486(0.0030) 94Si26=3.0400(0.0028) **
*^{201}Pb^n E : estimated 20#(20#) keV above 2917.6(0.9) level **
*^{201}Bi^m D : α decay is observed. Its branching ratio is estimated 0.3%# in ENSDF **
*^{201}Bi^n E : 1933.3(0.4) + x ; x<80 **
*^{201}Bi^p E : 1972.3(0.4) + x ; x<80 **
*^{201}Bi^q E : 2741.0(0.3) + x ; x<80 **
*^{201}At^n E : error estimated by evaluator **
*^{201}Rn^m T : other 10He25=3.24(+3.24–1.08) ms **
*^{201}Fr T : average 14Ka23=64(3) 05Uu02=53(4) 05De01=67(3) **
*^{201}Fr^m T : average 14Ka23=8(+12–3) 05Uu02=19(+19–6) **
*^{201}Fr^n E : derived from range in 14Ka23 101 to 300 keV **
*^{201}Fr^n T : symmetrized from 14Ka23=700(+500–200) **
*^{201}Ra T : symmetrized from 14Ka23=8(+40–4) **
*^{201}Ra^m T : symmetrized from 1.6(+7.7–0.7) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{202}Os	−13090#	400#				200#	ms	(>300 ns)	0^+	13			2009	β^- ?	
^{202}Ir	−16780#	300#				11	s	3	(2^-)	08	14Ku23	T	2008	β^-=100	*
^{202}Ir^m	−14780#	300#	2000#	1000#		3.4	μs	0.6			11St21	TD	2011	IT=100	*
^{202}Pt	−22692	25				44	h	15	0^+	08			1992	β^-=100	
^{202}Pt^m	−20904	25	1788.5	0.4		141	μs	7	(7^-)	08	11St21	T	2005	IT≈100	
^{202}Au	−24353	23				28.4	s	1.2	(1^-)	08			1967	β^-=100	
^{202}Hg	−27345.3	0.7				STABLE			0^+	08			1920	IS=29.86 26	*
^{202}Tl	−25980.2	1.6				12.31	d	0.08	2^-	08			1940	ε=100	
^{202}Tl^m	−25030.0	1.6	950.19	0.10		591	μs	3	7^+	08			1958	IT=100	
^{202}Pb	−25941	4				52.5	ky	2.8	0^+	08			1954	ε=100	
^{202}Pb^m	−23771	4	2169.85	0.08		3.54	h	0.02	9^-	08			1954	IT=90.5 5; β^+=9.5 5	
^{202}Pb^n	−21800	50	4140	50		110	ns	5	16^+#	08			1986	IT=100	*
^{202}Pb^p	−20640	50	5300	50		107	ns	3	19^-#	08			1987	IT=100	*
^{202}Bi	−20741	15				1.72	h	0.05	$5^{(+\#)}$	08			1951	β^+=100; α<1e–5	*
^{202}Bi^m	−20116	19	625	12		3.04	μs	0.06	10^-#	08			1981	IT=100	*
^{202}Bi^n	−18124	19	2617	12		310	ns	50	(17^+)	08			1981	IT=100	*
^{202}Po	−17942	9				44.6	m	0.4	0^+	08			1951	β^+=?; α=1.92 7	
^{202}Po^m	−16230	15	1712	12		110	ns	15	8^+	08			1971	IT=100	*
^{202}At	−10591	28				184	s	1	$3^{(+)}$	08	16Ly01	JD	1961	β^+=?; α=12 7	
^{202}At^m	−10401	28	190	40	MD	182	s	2	$7^{(+)}$	08	16Ly01	J	1992	IT ?; β^+ ?; α=8.7 15	
^{202}At^n	−10010	28	580	40	MD	460	ms	50	$10^{(-)}$	08	16Ly01	J	1992	IT≈100; α=0.096 11; β^+=0.033#	*
^{202}Rn	−6275	18				9.7	s	0.1	0^+	08			1967	α=78 8; β^+ ?	
^{202}Rn^m	−3970#	50#	2310#	50#		2.22	μs	0.07	11^-#		02Do19	T	2002	IT=100	
^{202}Fr	3096	7				372	ms	12	3^+	08	14Ka23	T	1980	α=?; β^+=14#	*
^{202}Fr^m	3370	9	274	12	AD	286	ms	13	10^-	08	14Ka23	T	1980	α=?; β^+=14#	*
^{202}Ra	9075	15				4.1	ms	1.1	0^+	08	14Ka23	T	2005	α=100	*

*^{202}Ir T : 14Ku23=11(3) supersedes 14Mo15=15(3) J : from 13Mo20=(2^-) **
*^{202}Ir^m D : 311.5, 655.9, 737.2, 889.2, 967.6 γ rays seen in decay **
*^{202}Hg D : lower half-life limit for ^{24}Ne decay T>3.7 Zy, from 90Bu28 **
*^{202}Pb^n E : 4091.0(0.7) + x; x estimated 50(50) **
*^{202}Pb^p E : 5251.0(0.5) + u; u estimated 50(50) **
*^{202}Bi J : re-evaluation to a possible 6^+ is discussed in 96Ca02 **
*^{202}Bi^m E : 605 + x with x<40 keV **
*^{202}Bi^n E : 2597.07(0.25) + x, with x<40 keV **
*^{202}Po^m E : 1691.5(0.4) + x, with x<40 keV **
*^{202}At^n E : 391.7(0.5) keV above ^{202}At^m **
*^{202}Fr J : from 13Fl09=3^+ (see their Fig.2) **
*^{202}Fr^m J : from 13Fl09=10- (see their Fig.2) **
*^{202}Ra T : symmetrized from 14Ka23=3.8(+1.3–0.8) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{203}Os	−7640#	400#				100#	ms	(>300 ns)	9/2+#	13	12Ku26	I	2012	β^- ?; β^-n=7#	
^{203}Ir	−14690#	400#				6#	s	(>300 ns)	3/2+#	13	09St16	I	2009	β^- ?	
^{203}Ir^m	−12550#	400#	2140#	50#		798	ns	350	(23/2+)		11St21	TJD	2011	IT=100	*
^{203}Pt	−19630#	200#				22	s	4	(1/2−)	06	14Mo15	T	2008	β^-=100	*
^{203}Pt^m	−16530#	200#	3100#	1000#		641	ns	55	33/2+#		11St21	TJD	2011	IT=100	
^{203}Au	−23143	3				60	s	6	3/2+	05			1952	β^-=100	
^{203}Au^m	−22502	4	641	3		140	μs	44	11/2−#	05	11St21	TJ	2005	IT=100	
^{203}Hg	−25269.3	1.6				46.613	d	0.018	5/2−	05	14Un01	T	1943	β^-=100	*
^{203}Hg^m	−24336.2	1.6	933.14	0.23		21.9	μs	1.0	(13/2+)	05	11St21	T	1964	IT=100	
^{203}Hg^n	−16988.3	1.7	8281.0	0.5		146	ns	30	(53/2+)		11Sz01	EJT	2011	IT=100	
^{203}Tl	−25761.4	1.2				STABLE			1/2+	05			1931	IS=29.52 1	
^{203}Tl^m	−22200	50	3565	50		7.7	μs	0.5	(25/2+)	05			1998	IT=100	*
^{203}Pb	−24787	7				51.916	h	0.015	5/2−	05	14Un01	T	1942	ε=100	*
^{203}Pb^m	−23962	7	825.2	0.3		6.21	s	0.11	13/2+	05			1955	IT=100	
^{203}Pb^n	−21838	7	2949.2	0.4		480	ms	7	29/2−	05			1977	IT=100	
^{203}Pb^p	−21820	50	2970	50		122	ns	4	25/2−#	05			1988	IT=100	*
^{203}Bi	−21525	13				11.76	h	0.05	9/2−	05			1950	β^+=100	
^{203}Bi^m	−20427	13	1098.12	0.12		305	ms	5	1/2+	05			1984	IT=100	
^{203}Bi^n	−19484	13	2041.5	0.6		194	ns	30	25/2+	05			1978	IT=100	
^{203}Po	−17311	9				36.7	m	0.5	5/2−	05	13Se03	J	1951	β^+≈100; α=0.11 2	
^{203}Po^m	−16669	9	641.68	0.17		45	s	2	13/2+	05	13Se03	J	1969	IT≈100; α=0.04#	
^{203}Po^n	−15153	9	2158.5	0.6		> 200	ns			05			1986	IT=100	
^{203}At	−12163	11				7.4	m	0.2	9/2−	05			1951	β^+=69 3; α=31 3	
^{203}Rn	−6154	18				44	s	2	3/2−#	05			1967	α=66 9; β^+ ?	*
^{203}Rn^m	−5791	18	363	4	AD	26.9	s	0.5	13/2(+)	05	87Bo29	J	1967	α=75 10; β^+ ?	
^{203}Fr	876	6				550	ms	10	9/2−	05	13Fl09	J	1967	α≈100; β^+=5#	
^{203}Fr^m	1237	7	361	6		43	ms	4	(1/2+)		13Ja06	TJD	2013	IT=?; α=20 4	
^{203}Fr^n	1300	100	426	100		370	ns	50	(13/2+)		13Ja06	TJD	2013	IT≈100	
^{203}Ra	8660	40				36	ms	13	(3/2−)	05	96Le09	J	1996	α≈100; β^+ ?	*
^{203}Ra^m	8851	29	190	50	AD	25	ms	5	(13/2+)	05	96Le09	J	1996	α≈100; β^+ ?	*

*^{203}Ir^m E : 207.0, 841.3, 894.7 γs in cascade to 11/2− estimated at 200(50) keV **
*^{203}Pt J : from 13Mo20=(1/2−) **
*^{203}Hg T : average 14Un01=46.62(0.06) 83Wa26=46.612(0.019) **
*^{203}Tl^m E : 3514.6 + x and x estimated 50(50) keV **
*^{203}Pb T : average 14Un01=51.923(0.036) 01Li17=51.99(0.03) 80Ho17=51.88(0.02) **
*^{203}Pb^p E : 2923.4(0.7) + x ; x estimated 50(50) **
*^{203}Rn J : not yet known, will be same as ^{195}Pb and ^{199}Po, from α decay **
*^{203}Ra T : symmetrized from 05Uu02=31(+17–9); other 14Ka23=50(+40–15) **
*^{203}Ra^m T : symmetrized from 05Uu02=24(+6–4); other 14Ka23=37(+37–12) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{204}Ir	−9690#	400#				1#	s	(>300 ns)		13	12Ku26	I		β^- ?; β^-n=0.01#	
^{204}Pt	−17920#	200#				10.3	s	1.4	0+	10			2008	β^-=100	*
^{204}Pt^m	−15930#	200#	1995.1	0.7		5.5	μs	0.7	(5−)	10	11St21	E	2009	IT=100	*
^{204}Pt^n	−15890#	200#	2035	23		55	μs	3	(7−)	10			2009	IT ?	*
^{204}Pt^p	−14730#	200#	3193	23		146	ns	14	(10+)	10			2009	IT=100	*
^{204}Au	−20650#	200#				38.3	s	1.3	(2−)	10	14Mo15	T	1972	β^-=100	*
^{204}Au^m	−16830#	200#	3816#	1000#		2.1	μs	0.3	16+#	10	11St21	JD	2008	IT=100	*
^{204}Hg	−24690.1	0.5				STABLE			0+	10			1920	IS=6.87 15; 2β^- ?	
^{204}Hg^m	−20301.4	0.7	4388.7	0.5		29	ns	2 1	4+		15Wr02	ETJ	2015	IT=100	
^{204}Hg^n	−17464.0	0.7	7226.1	0.5		> 480	ns	2	2+		15Wr02	ETJ	2015	IT=100	
^{204}Tl	−24346.1	1.2				3.783	y	0.012	2−	10			1953	β^-=97.08 7; ε+β^+=2.92 7	
^{204}Tl^m	−23242.0	1.2	1104.1	0.2		61.7	μs	1.0	7+	10	11Br12	EJ	1972	IT=100	
^{204}Tl^n	−22027.1	1.2	2319.0	0.3		2.6	μs	0.2	12−	10	11Br12	EJ	1998	IT=100	
^{204}Tl^p	−19954.5	1.3	4391.6	0.5		420	ns	30	18+	10	11Br12	ETJ	1998	IT=100	
^{204}Tl^q	−18106.7	1.3	6239.4	0.5		90	ns	3	22−	10	11Br12	ETJ	2011	IT=100	
^{204}Pb	−25109.9	1.1				STABLE		(>140 Py)	0+	10			1932	IS=1.4 1; α ?	*
^{204}Pb^m	−23835.8	1.1	1274.13	0.05		265	ns	6	4+	10			1963	IT=100	
^{204}Pb^n	−22924.0	1.1	2185.88	0.08		66.93	m	0.10	9−	10			1956	IT=100	
^{204}Pb^p	−22845.5	1.1	2264.42	0.06		490	ns	70	7−	10			1978	IT=100	*
^{204}Bi	−20646	9				11.22	h	0.10	6+	10			1947	β^+=100	
^{204}Bi^m	−19841	9	805.5	0.3		13.0	ms	0.1	10−	10			1974	IT=100	
^{204}Bi^n	−17813	9	2833.4	1.1		1.07	ms	0.03	17+	10			1974	IT=100	
^{204}Po	−18341	11				3.519	h	0.012	0+	10			1951	β^+=99.33 3; α=0.67 3	
^{204}Po^m	−16702	11	1639.03	0.06		158.6	ns	1.8	8+	10	10Ka29	T	1970	IT=100	*
^{204}At	−11875	22				9.12	m	0.11	7+	10			1961	β^+=96.2 2; α=3.8 2	*
^{204}At^m	−11288	22	587.30	0.20		108	ms	10	10−	10			1969	IT=100	
^{204}Rn	−7970	7				1.242	m	0.023	0+	10			1967	α=72.4 9; β^+ ?	

... A-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
. . . *A*-group continued . . .															
^{204}Fr	607	25				1.75	s	0.26	3^+	10	95Bi.A	D	1964	α=96 2; β^+ ?	*
^{204}Fr^m	658	25	50	4	AD	2.41	s	0.19	$7^{(+)}$	10	95Bi.A	D	1967	α=90 2; β^+ ?	*
^{204}Fr^n	934	25	326	4	AD	1.65	s	0.15	$10^{(-)}$	10	13Ja06	T	1992	α=53 10; IT=47 10	*
^{204}Ra	6057	15				60	ms	9	0^+	10	05Uu02	T	1995	$\alpha\approx$100; β^+=0.3#	*

*^{204}Pt T : other 14Mo15=16(+6–5) **
*^{204}Pt^m E : 872.4(0.5),1122.7(0.5) γs to 0^+ **
*^{204}Pt^n E : 1995.1(0.7) + x ; x < 80 keV **
*^{204}Pt^p E : 1157.5(0.5) γ to ^{204}Pt^n **
*^{204}Au T : average 14Mo15=37.2(0.8) 84Cr01=39.8(0.9); other 72Pa06=40(3) **
*^{204}Au^m E : 839.0, 976.6 γs in cascade to 12^-# estimated at 2000#(1000#) keV **
*^{204}Pb T : also 13Be16>140Ey **
*^{204}Pb^p T : symmetrized from 450(+100–30) **
*^{204}Po^m T : average 10Ka29=161(4) 87Ra04=158(2); others 90Fa03=150(10) 83He08=150(10) **
*^{204}Po^m T : 71Ha01=140(5) 70Ya03=190(20) 70Br.A=143(5) **
*^{204}At T : other 10Ka29=9.6(2) **
*^{204}Fr T : average 05Uu02=1.9(0.5) 92Hu04=1.7(0.3) J : 14Ly01=3 13Vo10=3 **
*^{204}Fr^m T : average 13Ja06=2.6(0.3) 05Uu02=1.6(+0.5–0.3) 92Hu04=2.6(0.3) **
*^{204}Fr^m J : 15Vo05=7 **
*^{204}Fr^n E : 276.1 keV above ^{204}Fr^m, from 95Bi.A D : from 14Ly01 **
*^{204}Fr^n T : 13Ja06=1.65(0.15) supersedes 05Uu02=0.8(0.2) same group J : 15Vo05=10 **
*^{204}Ra T : average 05Uu02=54(+19–11) 96Le09=59(+12–9); other 10He25=44(+44–15) **
*^{204}Ra T : 95Le04=45(+55–21) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{205}Ir	−5960#	500#				300#	ms	(>300 ns)	3/2+#	13	12Ku26	I	2012	β^- ?; β^-n=10#	
^{205}Pt	−12970#	300#				5#	s	(>300 ns)	9/2+#	11	10Al24	I	2009	β^- ?	
^{205}Au	−18770#	200#				32.5	s	1.4	3/2+#	04	09Po01	T	1994	β^-=100	*
^{205}Au^m	−17860#	200#	907	5		6	s	2	11/2−#		09Po01	ETJ	2009	IT=?; β^-=?	
^{205}Au^n	−15920#	200#	2850	5		163	ns	5	19/2+#		11St21	ET	2011	IT=100	
^{205}Hg	−22288	4				5.14	m	0.09	1/2−	04			1940	β^-=100	*
^{205}Hg^m	−20732	4	1556.40	0.17		1.09	ms	0.04	13/2+	04			1985	IT=100	
^{205}Hg^n	−18972	4	3315.8	0.9		5.89	μs	0.18	(23/2−)		11St21	ETJ	2011	IT=100	*
^{205}Tl	−23820.9	1.2				STABLE			1/2+	04			1931	IS=70.48 1	
^{205}Tl^m	−20530.3	1.2	3290.60	0.17		2.6	μs	0.2	25/2+	04			1976	IT=100	
^{205}Tl^n	−18985.3	1.9	4835.6	1.5		235	ns	10	(35/2−)	04			2004	IT=100	
^{205}Pb	−23770.2	1.1				17.3	My	0.7	5/2−	04			1954	ε=100	
^{205}Pb^m	−23767.9	1.1	2.329	0.007		24.2	μs	0.4	1/2−	04			1994	IT=100	
^{205}Pb^n	−22756.4	1.1	1013.85	0.03		5.55	ms	0.02	13/2+	04			1960	IT=100	
^{205}Pb^p	−20574.5	1.2	3195.7	0.5		217	ns	5	25/2−	04			1973	IT=100	
^{205}Bi	−21065	5				15.31	d	0.04	9/2−	04			1951	β^+=100	
^{205}Bi^m	−19568	5	1497.17	0.09		7.9	μs	0.7	1/2+	04			1972	IT=100	
^{205}Bi^n	−18926	5	2139.0	0.7		220	ns	25	25/2+	04			1978	IT=100	
^{205}Po	−17521	10				1.74	h	0.08	5/2−	04			1951	$\beta^+\approx$100; α=0.04 1	
^{205}Po^m	−17378	10	143.166	0.017		310	ns	60	1/2−	04			1960	IT=100	
^{205}Po^n	−16641	10	880.31	0.07		645	μs	20	13/2+	04			1962	IT=100	
^{205}Po^p	−16060	10	1461.21	0.21		57.4	ms	0.9	19/2−	04			1973	IT=100	
^{205}Po^q	−14434	10	3087.2	0.4		115	ns	10	29/2−	04			1985	IT=100	
^{205}At	−12972	15				33.8	m	0.2	9/2−	04	10Ka29	T	1951	β^+ ?; α=10 2	
^{205}At^m	−10632	15	2339.65	0.23		7.76	μs	0.14	29/2+	04			1982	IT=100	
^{205}Rn	−7710	5				2.83	m	0.07	5/2−	04			1967	β^+ ?; α=24.6 9	
^{205}Rn^m	−7053	5	657.1	0.5		> 10	s		13/2+#	04	10De04	ED	2010	IT$\approx$100; α ?; β^+ ?	
^{205}Fr	−1310	8				3.82	s	0.06	9/2−	04	10De04	T	1964	$\alpha\approx$100; β^+<1	*
^{205}Fr^m	−766	8	544.0	1.0		80	ns	20	(13/2+)		12Ja01	EJT	2012	IT=100	
^{205}Fr^n	−701	9	609	5		1.15	ms	0.04	(1/2+)		12Ja01	ETJ	2012	IT=100	
^{205}Ra	5840	70				220	ms	50	(3/2−)	04			1987	α=?; β^+ ?	*
^{205}Ra^m	6140#	100#	300#	100#		180	ms	50	(13/2+)	04			1995	α=?; IT ?; β^+ ?	*
^{205}Ac	14110	50				80	ms	60	9/2−#	14	14Zh03	T	2014	$\alpha\approx$100; β^+=0.2#	*

*^{205}Au T : average 09Po01=34(2) 94We02=31(2); other 16Ca25=35(17) **
*^{205}Hg T : other 10Ku02=5.61(0.38) for q=80$^+$ (bare ion) **
*^{205}Hg^n E : least-squares fit to γ-ray energies 227.6(0.5), 722.6(0.5), 810.0(0.5) 1014.7(0.5) **
*^{205}Fr T : unweighed average 10De04=4.03(0.08) 05De01=3.80(0.03) 81Ri04=3.96(0.04) **
*^{205}Fr T : 74Ho27=3.7(0.1) 67Va20=3.7(0.2) 64Gr04=3.7(0.4) **
*^{205}Fr J : from 14Ly01=9/2 13Vo10=9/2 13Fl09=9/2; parity from mag. moment **
*^{205}Ra T : symmetrized from 210(+60–40) **
*^{205}Ra^m T : symmetrized from 170(+60–40); other 10He25=68(+68–23) ms **
*^{205}Ac T : symmetrized from 14Zh03=20(+97–9) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{206}Pt	−9630#	300#				5#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?; β^-n=0#	
^{206}Au	−14220#	300#				47	s	11	$(5^+,6^+)$	16	16Ca25	TJ	2009	β^-=100	*
^{206}Hg	−20946	20				8.32	m	0.07	0^+	08			1961	β^-=100	
^{206}Hg^m	−18844	20	2102.4	0.3		2.09	μs	0.02	5^-	08	11St21	T	1982	IT=100	*
^{206}Hg^n	−17224	20	3722.3	1.0		106	ns	6	(10^+)	08	11St21	ETJ	2001	IT=100	*
^{206}Tl	−22253.4	1.3				4.202	m	0.011	0^-	08			1935	β^-=100	
^{206}Tl^m	−19610.3	1.3	2643.10	0.18		3.74	m	0.03	(12^-)	08			1976	IT=100	
^{206}Pb	−23785.6	1.1				STABLE		(>2.5 Zy)	0^+	08	13Be16	T	1927	IS=24.1 1; α ?	
^{206}Pb^m	−21585.4	1.1	2200.16	0.04		125	μs	2	7^-	08			1953	IT=100	
^{206}Pb^n	−19758.3	1.3	4027.3	0.7		202	ns	3	12^+	08			1971	IT=100	
^{206}Bi	−20028	8				6.243	d	0.003	$6^{(+)}$	08			1947	β^+=100	
^{206}Bi^m	−19968	8	59.897	0.017		7.7	μs	0.2	(4^+)	08			1957	IT=100	
^{206}Bi^n	−18983	8	1044.8	0.7		890	μs	10	(10^-)	08			1974	IT=100	
^{206}Po	−18189	4				8.8	d	0.1	0^+	08			1947	β^+=94.55 5; α=5.45 5	
^{206}Po^m	−16603	4	1585.90	0.11		232	ns	4	8^+	08	FGK145	J	1970	IT=100	*
^{206}Po^n	−15927	4	2262.09	0.12		1.05	μs	0.06	9^-	08	FGK145	J	1970	IT=100	*
^{206}At	−12430	15				30.6	m	0.8	$(5)^+$	08			1961	β^+=99.10 8; α=0.90 8	
^{206}At^m	−11620	15	810	3		813	ns	21	$(10)^-$	08	09Dr08	T	1999	IT=100	*
^{206}Rn	−9133	9				5.67	m	0.17	0^+	08			1954	α=62 3; β^+=38 3	
^{206}Fr	−1242	28				16	s		3^+	08	16Ly01	D	1964	β^+=?; α=88.4 33	*
^{206}Fr^m	−1048	28	190	40		16	s		$7^{(+)}$	08	16Ly01	D	1964	α=84.7 15; β^+ ?; IT ?	*
^{206}Fr^n	−517	28	730	40	MD	700	ms	100	$10^{(-)}$	08	16Ly01	D	1983	IT=?; α=13 2	*
^{206}Fr^x	−1140	100	100	100	MD	R =?			spmix						
^{206}Ra	3566	18				240	ms	20	0^+	08			1967	α=?; β^+=2.5#	
^{206}Ac	13480	50				25	ms	7	(3^+)	08			1998	$\alpha\approx$100; β^+=0.2#	*
^{206}Ac^m	13700	30	220	60	AD	41	ms	16	(10^-)	08			1996	$\alpha\approx$100; β^+ ?	*

*^{206}Au T : average 16Ca25=56(17) 15Mo20=40(15) **
*^{206}Hg^m T : average 11St21(=09Si35)=2.09(0.02) 82Be38=2.15(0.21) **
*^{206}Hg^n T : average 11St21(=09Si35)=112(4) 09Al29=96(15) 01Fo08=92(8) 01La09=90(10) **
*^{206}Po^m J : measured magnetic moment and non-observation of γs to 3^+ and 4^+ levels **
*^{206}Po^n J : E1 γs to 8^+ levels **
*^{206}At^m T : others 10Ka29=377(44) 99Fe10=410(80) **
*^{206}At^m E : from ENSDF'08 806.7(1.4) + x; x<6 estimated by NUBASE **
*^{206}Fr J : 14Ly01=3 13Vo10=3 **
*^{206}Fr^m T : 92Hu04=15.9(0.3) J : 15Vo05=7 **
*^{206}Fr^n E : 81Ri04=531(2) keV above ^{206}Fr^m J : 15Vo05=10 **
*^{206}Ac T : symmetrized from 98Es02=22(+9–5); also 14Zh03=41(+56–15) **
*^{206}Ac^m T : symmetrized from 98Es02=33(+22–9) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{207}Pt	−4540#	400#				1#	s	(>300 ns)	$9/2^+$#	13	12Ku26	I	2012	β^- ?; β^-n=2#	
^{207}Au	−10810#	300#				10#	s	(>300 ns)	$3/2^+$#	11			2010	β^- ?; β^-n=0.4#	
^{207}Hg	−16487	30				2.9	m	0.2	$9/2^+$#	11			1982	β^-=100	
^{207}Tl	−21034	5				4.77	m	0.02	$1/2^+$	11			1908	β^-=100	*
^{207}Tl^m	−19686	5	1348.18	0.16		1.33	s	0.11	$11/2^-$	11			1965	IT$\approx$100; β^-<0.1#	
^{207}Pb	−22452.0	1.1				STABLE		(>1.9 Zy)	$1/2^-$	11	13Be16	T	1927	IS=22.1 1; α ?	
^{207}Pb^m	−20818.6	1.1	1633.356	0.004		806	ms	5	$13/2^+$	11			1951	IT=100	
^{207}Bi	−20054.6	2.4				31.20	y	0.03	$9/2^-$	11	14Un01	T	1950	β^+=100	
^{207}Bi^m	−17953.0	2.4	2101.61	0.16		182	μs	6	$21/2^+$	11			1967	IT=100	
^{207}Po	−17146	7				5.80	h	0.02	$5/2^-$	11			1947	$\beta^+\approx$100; α=0.021 2	
^{207}Po^m	−17077	7	68.557	0.014		205	ns	10	$1/2^-$	11			1963	IT=100	
^{207}Po^n	−16031	7	1115.076	0.017		49	μs	4	$13/2^+$	11			1962	IT=100	
^{207}Po^p	−15763	7	1383.16	0.07		2.79	s	0.08	$19/2^-$	11			1961	IT=100	
^{207}At	−13227	12				1.81	h	0.03	$9/2^-$	11			1951	β^+ ?; $\alpha\approx$10	
^{207}At^m	−11110	12	2117.3	0.6		108	ns	2	$25/2^+$	11			1981	IT=100	
^{207}Rn	−8635	8				9.25	m	0.17	$5/2^-$	11			1954	β^+=79 3; α=21 3	
^{207}Rn^m	−7736	8	899.1	1.0		184.5	μs	0.9	$13/2^+$	11			1974	IT=100	
^{207}Fr	−2844	18				14.8	s	0.1	$9/2^-$	11	85Co24	J	1964	α=95 2; β^+ ?	
^{207}Ra	3540	50				1.38	s	0.18	$5/2^-$#	11			1967	$\alpha\approx$86; β^+ ?	*
^{207}Ra^m	4102	20	560	50	AD	57	ms	8	$13/2^+$#	11	96Le09	T	1987	IT=85#; α=?; β^+=0.55#	*
^{207}Ac	11150	50				31	ms	8	$9/2^-$#	11	98Es02	T	1994	$\alpha\approx$100	*

*^{207}Tl T : other 05Oh08=4.25(0.14) 10Ku02=4.70(0.19) for q=81$^+$ (bare ion) **
*^{207}Ra T : average 95Uu01=1.1(+0.9–0.3) 68Lo15=1.8(0.5) 67Va22=1.3(0.2) **
*^{207}Ra^m T : average 96Le09=63(16) 87He10=55(10) **
*^{207}Ac T : average 98Es02=27(+11–6) 94Le05=22(+40–9) **
*^{207}Ac J : unhindered α decay to ^{203}Fr 9/2$^-$# **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{208}Pt	−990#	400#				1#	s	(>300 ns)	0^+	13	12Ku26	I	2012	β^- ?; β^-n=90#	
^{208}Au	−6100#	300#				10#	s	(>300 ns)		11	10Al24	I	2010	β^- ?; β^-n=5#	
^{208}Hg	−13270	30				42	m	5	0^+	10			1994	β^-=100	*
^{208}Hg^m	−11930	40	1338	24		99	ns	14	(8^+)	10			2009	IT=100	*
^{208}Tl	−16750.1	1.9				3.053	m	0.004	5^+	07			1909	β^-=100	
^{208}Pb	−21748.6	1.1				STABLE		(>2.6 Zy)	0^+	07	13Be16	T	1927	IS=52.4 1; α ?	
^{208}Pb^m	−16853.4	1.1	4895.23	0.05		500	ns	10	10^+	07	98Pf02	T	1998	IT=100	
^{208}Bi	−18870.2	2.3				368	ky	4	5^+	07			1953	β^+=100	
^{208}Bi^m	−17299.1	2.3	1571.1	0.4		2.58	ms	0.04	10^-	07			1961	IT=100	
^{208}Po	−17469.6	1.7				2.898	y	0.002	0^+	07			1947	$\alpha\approx$100; β^+=0.0040 4	
^{208}Po^m	−15941.4	1.7	1528.22	0.04		350	ns	20	8^+	07			1968	IT=100	
^{208}At	−12470	9				1.63	h	0.03	6^+	07			1950	β^+=99.45 6; α=0.55 6	
^{208}At^m	−10194	9	2276.4	1.8		1.5	μs	0.2	16^-	07			1991	IT=100	
^{208}Rn	−9656	11				24.35	m	0.14	0^+	07			1955	α=62 7; β^+=38 7	
^{208}Rn^m	−7828	11	1828.3	0.4		487	ns	12	8^+	07			1979	IT=100	*
^{208}Fr	−2666	12				59.1	s	0.3	7^+	07	78Ek02	J	1964	α=89 3; β^+=11 3	
^{208}Fr^m	−1839	22	827	18		432	ns	11	(10^-)	07	09Dr08	T	2009	IT=100	*
^{208}Ra	1728	9				1.110	s	0.045	0^+	07	10He25	TD	1967	α=87 3; β^+ ?	*
^{208}Ra^m	3875	9	2147.4	0.4		263	ns	17	(8^+)	07	05Re02	T	1998	IT=100	*
^{208}Ac	10750	60				97	ms	15	(3^+)	07	14Ya19	T	1994	α=?; β^+=1#	*
^{208}Ac^m	11258	28	500	50	AD	28	ms	7	(10^-)	07	96Ik01	T	1994	α=?; IT<10#; β^+=1#	*
^{208}Th	16680	30				2.4	ms	1.2	0^+	11			2010	$\alpha\approx$100	*
*^{208}Hg	T : symmetrized from 98Zh22=41(+5–4); other 16Ca25=132(50) s														**
*^{208}Hg^m	E : 1296.9(0.9) + x and x<83 keV														**
*^{208}Rn^m	T : other 10Ka29=590(144) ns														**
*^{208}Fr^m	T : from lifetime 09Dr08=623(16); other 10Ka29=233(18), not trusted														**
*^{208}Fr^m	T : also 06Me03=446(14) originally assigned to ^{209}Fr, see 09Dr04														**
*^{208}Ra	T : other 68Lo15=1.8(0.5) 67Va22=1.2(0.2)														**
*^{208}Ra^m	T : average 05Re02=250(30) 99Co13=270(21)														**
*^{208}Ac	T : average 14Ya19=93(+40–22) 96Ik01=83(+34–19) 94Le05=95(+24–16)														**
*^{208}Ac^m	E : if α decay goes to (7^+) ^{204}Fr^m, instead of (10^-) as assumed in AME, then														**
*^{208}Ac^m	E : E will become 234(22) keV														**
*^{208}Ac^m	T : average 96Ik01=21(+28–8) 94Le05=25(+9–5)														**
*^{208}Th	T : symmetrized from 10He25=1.7(+1.7–0.6)														**
^{209}Au	−2540#	400#				1#	s	(>300 ns)	$3/2^+$#	15	10Al24	I	2010	β^- ?; β^-n=90#	
^{209}Hg	−8640#	150#				38	s	6	$9/2^+$#	15			1998	β^-=100; β^-n=0#	*
^{209}Tl	−13645	6				2.162	m	0.007	$1/2^+$	15			1950	β^-=100; β^-n=0#	
^{209}Pb	−17614.6	1.7				3.234	h	0.007	$9/2^+$	15			1940	β^-=100	
^{209}Bi	−18258.7	1.4				20.1	Ey	0.8	$9/2^-$	15			1924	IS=100.; α=100	
^{209}Po	−16366.1	1.8				124	y	3	$1/2^-$	15	13Se03	J	1949	$\alpha\approx$100; β^+=0.454 7	
^{209}Po^m	−12100.7	1.8	4265.4	0.3		119	ns	4	$31/2^-$	15			1974	IT=100	
^{209}At	−12883	5				5.42	h	0.05	$9/2^-$	15			1951	β^+=95.9 5; α=4.1 5	
^{209}At^m	−10454	5	2429.32	0.22		916	ns	10	$29/2^+$	15			1975	IT=100	
^{209}Rn	−8941	10				28.8	m	1.0	$5/2^-$	15			1952	β^+=83 2; α=17 2	
^{209}Rn^m	−7767	10	1174.01	0.13		13.4	μs	1.3	$13/2^+$	15			1985	IT=100	
^{209}Rn^n	−5304	10	3636.81	0.23		3.0	μs	0.3	$35/2^+$	15			1985	IT=100	
^{209}Fr	−3770	15				50.5	s	0.7	$9/2^-$	15	78Ek02	J	1964	α=89 3; β^+=11 3	
^{209}Fr^m	890	15	4659.8	0.7		420	ns	18	$45/2^-$	15			2006	IT=100	*
^{209}Ra	1858	6				4.71	s	0.08	$5/2^-$	15	08Ha12	T	1967	$\alpha\approx$100; β^+ ?	
^{209}Ra^m	2740	6	882.4	0.7		117	μs	5	$13/2^+$	15	08Ha12	D	2008	$\alpha\approx$90; $\beta^+\approx$10	
^{209}Ac	8840	50				94	ms	10	$(9/2^-)$	15	14Ya19	T	1968	α=?; β^+=1#	*
^{209}Th	16370#	140#				60#	ms		$5/2^-$#					α ?; β^+ ?	
^{209}Th^m	16840#	100#	470#	100#		3.1	ms	1.2	$(13/2^+)$	15			1996	$\alpha\approx$100; β^+ ?	*
*^{209}Hg	T : symmetrized from ENSDF2015=36(+7–4); other 16Ca25=6(1)														**
*^{209}Fr^m	T : from lifetime 09Dr04=606(26);														**
*^{209}Ac	T : average 14Ya19=98(22) 00He17=98(+59–27) 96Ik01=82(+18–13)														**
*^{209}Ac	T : 94Le05=91(+21–14) and 68Va04=100(50)														**
*^{209}Th^m	T : symmetrized from ENSDF2015=2.5(+1.7–0.7)														**
^{210}Au	2330#	400#				1#	s	(>300 ns)		14	10Al24	I	2010	β^- ?; β^-n=10#	
^{210}Hg	−5370#	200#				64	s	10	0^+	14	16Ca25	TD	1998	β^-=100; β^-n=2.2 22	
^{210}Hg^m	−4710#	200#	663	2		2.1	μs	0.7	(3^-)	14			2013	IT=100	
^{210}Hg^n	−3960#	200#	1406	23		2	μs	1	8^+#	14	13Go10	E	2013	IT=100	*
^{210}Tl	−9247	12				1.30	m	0.03	5^+#	14			1909	β^-=100; β^-n=0.009 6	*
^{210}Pb	−14728.5	1.4				22.20	y	0.22	0^+	14			1900	β^-=100; α=1.9e–6 4	
^{210}Pb^m	−13451	5	1278	5		201	ns	17	8^+	14			1980	IT=100	
^{210}Bi	−14792.0	1.4				5.012	d	0.005	1^-	14			1905	β^-=100; α=13.2e–5 10	
^{210}Bi^m	−14520.7	1.4	271.31	0.11		3.04	My	0.06	9^-	14			1953	α=100	

... A-group is continued on next page ...

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{210}Po	−15953.1	1.1				138.376	d	0.002	0^+	14			1898	α=100	
^{210}Po^m	−14396.1	1.1	1556.97	0.03		98.9	ns	2.5	8^+	14			1968	IT=100	
^{210}Po^n	−10895.5	1.1	5057.65	0.05		263	ns	5	16^+	14			1985	IT=100	
^{210}At	−11972	8				8.1	h	0.4	$(5)^+$	14			1949	$\beta^+\approx$100; α=0.175 20	
^{210}At^m	−9422	8	2549.6	0.2		482	ns	6	$(15)^-$	14			1970	IT=100	
^{210}At^n	−7944	8	4027.7	0.2		5.66	μs	0.07	$(19)^+$	14			1975	IT=100	
^{210}Rn	−9605	5				2.4	h	0.1	0^+	14			1952	α=96 1; β^+ ?	
^{210}Rn^m	−7900	30	1710	30	AD	644	ns	40	8^+#	14			1979	IT ?	
^{210}Rn^n	−5750	30	3857	30		1.06	μs	0.05	$(17)^-$	14			1979	IT=100	*
^{210}Rn^p	−3090	30	6514	30		1.04	μs	0.07	$(23)^+$	14			1986	IT=100	*
^{210}Fr	−3333	15				3.18	m	0.06	6^+	14	05Ku06	D	1964	α=71 4; β^+ ?	
^{210}Ra	443	9				4.0	s	0.1	0^+	14	08Ha12	T	1967	α=?; β^+=4#	*
^{210}Ra^m	2494	9	2050.9	0.7		2.29	μs	0.03	8^+	14	04Re04	TJ	1998	IT=100	*
^{210}Ac	8790	60				350	ms	40	7^+#	14	00He17	T	1968	α=?; β^+=9#	*
^{210}Th	14059	19				16.0	ms	3.6	0^+	14			1995	α=?; β^+=1#	
*^{210}Hg^n	E : from 13Go10; stated to be less than 80 keV above 1366 level														**
*^{210}Tl	D : symmetrized from β^-n=0.007(+7–4)%														**
*^{210}Rn^n	E : ENSDF2014: 2147.4(0.2) keV above the 8^+ level, quoted 3812.40(0.16) + x														**
*^{210}Rn^p	E : ENSDF2014: 4803.7(0.4) keV above the 8^+ level, quoted 6469.02(0.21) + x														**
*^{210}Ra	T : also 07Le14=2.5(+1.4–0.7) and 3.5(+4.8–1.3)														**
*^{210}Ra^m	T : average 13Ba29=2.1(0.1) 06Ha17=2.28(0.08) 04Re04=2.1(0.1) 04He25=2.36(0.04)														**
*^{210}Ac	T : average 00He17=335(+64–46) 68Va04=350(50)														**
^{211}Hg	−620#	200#				26	s	8	$9/2^+$#	13	16Ca25	TD	2010	β^-=100; β^-n=6.3 63	
^{211}Tl	−6080	40				80	s	16	$1/2^+$	13	14Mo02	J	1998	β^-=100; β^-n=2.2 22	*
^{211}Pb	−10492.9	2.3				36.164	m	0.012	$9/2^+$	13	16Ai01	T	1904	β^-=100	
^{211}Pb^m	−8789	15	1704	15		159	ns	28	$(27/2^+)$	13	05La01	ET	2005	IT=100	*
^{211}Bi	−11859	5				2.14	m	0.02	$9/2^-$	13			1905	$\alpha\approx$100; β^-=0.276 4	
^{211}Bi^m	−10602	11	1257	10		1.4	μs	0.3	$(25/2^-)$	13			1998	IT=100	
^{211}Po	−12432.6	1.3				516	ms	3	$9/2^+$	15	13Se03	J	1913	α=100	
^{211}Po^m	−10970	5	1462	5	AD	25.2	s	0.6	$(25/2^+)$	15			1954	$\alpha\approx$100; IT=0.016 4	
^{211}Po^n	−10298	5	2135	5		243	ns	21	$(31/2^-)$	15			1998	IT$\approx$100; α ?	
^{211}Po^p	−7561	6	4872	6		2.8	μs	0.7	$(43/2^+)$	15			1998	IT$\approx$100; α ?	
^{211}At	−11647.3	2.7				7.214	h	0.007	$9/2^-$	13			1940	ε=58.20 8; α=41.80 8	
^{211}At^m	−6832.8	2.7	4814.5	0.5		4.23	μs	0.07	$(39/2^-)$	13			1971	IT=100	
^{211}Rn	−8755	7				14.6	h	0.2	$1/2^-$	13			1952	β^+=72.6 17; α=27.4 17	
^{211}Rn^m	−7152	16	1603	14		596	ns	28	$(17/2^-)$	13			1981	IT=100	*
^{211}Rn^n	125	16	8880	14		201	ns	4	$(63/2^-)$	13			1981	IT=100	*
^{211}Fr	−4140	12				3.10	m	0.02	$9/2^-$	13	05Ku06	D	1964	α=87 3; β^+ ?	
^{211}Fr^m	−1717	12	2423.16	0.24		146	ns	14	$(29/2^+)$	13			1986	IT=100	
^{211}Fr^n	517	12	4657.3	0.4		123	ns	14	$(45/2^-)$	13			1986	IT=100	
^{211}Ra	832	8				13.2	s	1.4	$5/2^{(-)}$	13	07Le14	T	1967	α>93; β^+<7	*
^{211}Ra^m	2030	8	1198.1	0.8		9.5	μs	0.3	$13/2^+$	13	13Ba29	T	2004	IT=100	*
^{211}Ac	7200	50				213	ms	25	$9/2^-$	13	00He17	T	1968	$\alpha\approx$100; β^+<0.2	*
^{211}Th	13910	70				48	ms	20	$5/2^-$#	13			1995	α=?; β^+=0.5#	*
^{211}Pa	22080#	100#				3#	ms	(>300 ns)	$9/2^-$#	13			2006	α ?; β^+ ?; p ?	
*^{211}Tl	T : average 16Ca25=76(18) 12Be28=88(+46–29) D : β^-n 16Ca25=2.2 22														**
*^{211}Pb	T : average 16Ai01=36.164(0.013) 15Ko09=36.165(0.037)														**
*^{211}Pb^m	E : E=1679.1 + x in 05La01, where x<50 keV														**
*^{211}Rn^m	E : 1577.8 + x ; x<50														**
*^{211}Rn^n	E : 8854.5(0.4) + y ; y<50														**
*^{211}Ra	T : average 07Le14=9(5) 68Lo15=12(2) 67Va22=15(2)														**
*^{211}Ra^m	T : average 13Ba29=9.4(0.4) 06Ha17=9.7(0.6); other 04He25=4.0(0.5)														**
*^{211}Ac	T : average 00He17=200(29) 68Va04=250(50)														**
*^{211}Th	T : symmetrized from 95Uu01=37(+28–11); other 15Ya13=20.8(+37.9–8.2)(2 evts)														**
^{212}Hg	2760#	300#				1#	m	(>300 ns)	0^+	11	10Al24	I	2010	β^- ?; β^-n=8#	
^{212}Tl	−1550#	200#				31	s	8	(5^+)	12	16Ca25	TD	1998	β^-=100; β^-n=1.8 18	
^{212}Pb	−7548.8	1.8				10.64	h	0.01	0^+	05			1905	β^-=100	
^{212}Pb^m	−6213.8	2.7	1335	2		6.0	μs	0.8	8^+#	05	12Re.B	E	1998	IT=100	*
^{212}Bi	−8118.0	1.9				60.55	m	0.06	$1^{(-)}$	05	89Ha.A	D	1905	β^-=64.06 6; α=35.94 6; $\beta^-\alpha$=0.014	
^{212}Bi^m	−7870	30	250	30	AD	25.0	m	0.2	$(8^-,9^-)$	05			1978	α=67 1; β^-=33 1; $\beta^-\alpha$=30 1	
^{212}Bi^n	−6639	30	1479	30	MD	7.0	m	0.3	> 16	05	13Ch12	D	1978	β^-=?; IT>75	*
^{212}Po	−10369.5	1.2				294.7	ns	1.0	0^+	05	13Be31	T	1906	α=100	
^{212}Po^m	−7446	5	2923	4	AD	45.1	s	0.6	(18^+)	05			1962	$\alpha\approx$100; IT=0.07 2	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
... *A*-group continued ...															
^{212}At	−8628.2	2.4				314	ms	2	(1^-)	05			1954	$\alpha\approx100$; $\beta^+<0.03$; $\beta^-<2e{-}6$	
^{212}At^m	−8405.3	2.4	222.9	0.9	AD	119	ms	3	9^-#	05			1970	$\alpha>99$; IT<1	
^{212}At^n	−3856.6	2.6	4771.6	1.1		152	μs	5	(25^-)	05			1998	IT=100	
^{212}Rn	−8660	3				23.9	m	1.2	0^+	05			1950	α=100; $2\beta^+$?	
^{212}Rn^m	−7020	3	1639.8	0.3		118	ns	14	6^+	05	FGK128	J	1971	IT=100	*
^{212}Rn^n	−6966	3	1694.0	0.4		910	ns	30	8^+	05	FGK128	J	1971	IT=100	
^{212}Rn^p	−2486	3	6174.0	0.4		104.0	ns	2.8	22^+	05	09Dr12	ETJ	1977	IT=100	
^{212}Rn^q	−81	3	8579.0	0.5		154	ns	14	30^+	05	09Dr12	EJ	1977	IT=100	
^{212}Fr	−3516	9				20.0	m	0.6	5^+	05	78Ek02	J	1950	β^+=57 2; α=43 2	
^{212}Fr^m	−1965	9	1551.4	0.3		31.9	μs	0.7	(11^+)	05			1977	IT=100	
^{212}Fr^n	−1024	9	2492.2	0.4		604	ns	28	(15^-)	05			1977	IT=100	
^{212}Fr^p	2339	9	5854.7	0.6		312	ns	21	(27^-)	05			1986	IT=100	
^{212}Fr^q	5017	9	8533.4	1.1		23.6	μs	2.1	34^+#	05			1990	IT=100	
^{212}Ra	−199	11				13.0	s	0.2	0^+	05			1967	α=?; β^+=15#	
^{212}Ra^m	1759	11	1958.4	0.5		8.1	μs	0.7	8^+	05	13Ba29	T	1986	IT=100	*
^{212}Ra^n	2414	11	2613.4	0.5		512	ns	104	11^-	05	13Ba29	T	1986	IT=100	*
^{212}Ac	7280	50				895	ms	28	6^+#	05	14Ya19	T	1968	α=?; β^+=3#	*
^{212}Th	12111	10				31.7	ms	1.3	0^+	15			1980	$\alpha\approx100$; β^+=0.3#	
^{212}Pa	21590	70				7.5	ms	2.8	7^+#	05	14Ya19	T	1997	α=100	*

*^{212}Pb^m T : 12Go19=6.0(0.8) supersedes 12Re.B=5.0(0.3); other 98Pf02=5(1) **
*^{212}Bi^n D : IT not observed, deduced from half-life>30 m for highly charged ions **
*^{212}Rn^m J : E2 to 4^+ for ^{212}Rn^m; E2 to 6^+ for ^{212}Rn^n; magnetic moment measurement **
*^{212}Ra^m T : average 13Ba29=7.1(0.2) 06Ha17=9.7(0.6) 04He25=8.31(0.25) 86Ko01=10.9(0.4) **
*^{212}Ra^m J : 63.3 keV γ to 6^+; no γ to 2^+ and 4^+; measured magnetic moment **
*^{212}Ra^n T : average 13Ba29=480(40) 86Ko01=850(130) **
*^{212}Ra^n J : 655 keV γ E3 to 8^+; measured magnetic moment **
*^{212}Ac T : average 14Ya19=880(35) 00He17=880(110) 68Va04=930(50) **
*^{212}Ac J : ENSDF proposes to assign 7^+, if the observed α feeds the ^{208}Fr 7^+ ground-state **
*^{212}Pa T : average 14Ya10=5.1(+5.1–1.7) 97Mi03=5.1(+6.1–1.9) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{213}Hg	7670#	300#				1#	s	(>300 ns)	$5/2^+$#	11	10Al24	I	2010	β^- ?; β^-n=30#	
^{213}Tl	1784	27				24	s	4	$1/2^+$	12	16Ca25	TD	2010	β^-=100; β^-n=7.6 34	
^{213}Pb	−3204	7				10.2	m	0.3	$(9/2^+)$	07			1964	β^-=100	
^{213}Bi	−5232	5				45.61	m	0.04	$9/2^-$	07	13Ma13	T	1947	β^-=97.91 3; α=2.09 3	*
^{213}Bi^m	−3930#	200#	1300#	200#		> 168	s		$25/2^-$#		08Ch.A	T	2008		
^{213}Po	−6654	3				3.708	μs	0.008	$9/2^+$	07	13Su13	T	1947	α=100	
^{213}At	−6580	5				125	ns	6	$9/2^-$	07			1968	α=100	
^{213}At^m	−5210	50	1370	50		110	ns	17		07			1980	IT=100	*
^{213}At^n	−3600	50	2980	50		45	μs	4	$(49/2^+)$	07			2003	IT=100	*
^{213}Rn	−5696	3				19.5	ms	0.1	$9/2^+$#	07			1967	α=100	
^{213}Rn^m	−3990	50	1710	50		1.00	μs	0.21	$(25/2^+)$	07			1988	IT=100	*
^{213}Rn^n	−3460	50	2240	50		1.36	μs	0.07	$(31/2^-)$	07			1988	IT=100	*
^{213}Rn^p	280	50	5980	50		164	ns	11	$(55/2^+)$	07			1988	IT=100	*
^{213}Fr	−3553	5				34.14	s	0.06	$9/2^-$	07	13Fi08	T	1964	α=99.44 5; β^+=0.56 5	*
^{213}Fr^m	−1963	5	1590.41	0.18		505	ns	14	$21/2^-$	07			1971	IT=100	
^{213}Fr^n	−1015	5	2537.62	0.23		238	ns	6	$29/2^+$	07			1971	IT=100	
^{213}Fr^p	4542	5	8094.8	0.7		3.1	μs	0.2	$(65/2^-)$	07			1989	IT=100	
^{213}Ra	346	10				2.73	m	0.05	$1/2^-$	07			1955	α=80 5; β^+ ?	
^{213}Ra^m	2114	11	1768	4	AD	2.20	ms	0.05	$(17/2^-)$	07	06Ku26	TD	1976	IT$\approx$99; α=0.6 4	*
^{213}Ac	6155	15				738	ms	16	$9/2^-$#	07			1968	α=?; β^+ ?	
^{213}Th	12120	9				144	ms	21	$5/2^-$#	07			1968	α=?; β^+=1.4#	
^{213}Th^m	13300	9	1180	3		1.4	μs	0.4	$13/2^+$#		07Kh22	TD	2007	IT=100	*
^{213}Th^p	12380#	50#	260#	50#											
^{213}Pa	19660	70				7	ms	3	$9/2^-$#	07	95Ni05	TD	1995	α=100	*

*^{213}Bi T : average 13Ma13=45.62(0.06) 73Po16=45.59(0.06) **
*^{213}At^m E : 1318.1(0.6) + x ; x estimated 50(50) by NUBASE **
*^{213}At^n E : 2926 + y ; y estimated 50(50) by NUBASE **
*^{213}Rn^m E : 1664.0(1.0) + x ; x=50(50) estimated by NUBASE **
*^{213}Rn^n E : 2186.7 + x ; x=50(50) estimated by NUBASE **
*^{213}Rn^p E : 5929 + y ; y=50(50) estimated by NUBASE **
*^{213}Fr T : see discussion of previous results in 13Fi08 **
*^{213}Ra^m E : derived from difference in α decay energy in the AME evaluation. **
*^{213}Ra^m E : 76Ra37 less than 10 keV above 1769.7 level, thus 1775(3) keV **
*^{213}Ra^m J : $17/2^-$ or $13/2^+$ as proposed in 76Ra37 **
*^{213}Th^m E : uncertainty estimated by NUBASE **
*^{213}Pa T : symmetrized from 5.3(+4.0–1.6) **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{214}Hg	11180#	400#				1#	s	(>300 ns)	0^+	11	10Al24	I	2010	β^- ?; β^-n=10#	
^{214}Tl	6470#	200#				11	s	2	5^+#	11	16Ca25	TD	2010	β^-=100; β^-n=34 12	
^{214}Pb	−182.8	2.0				27.06	m	0.07	0^+	15			1904	β^-=100	
^{214}Pb^m	1237	20	1420	20		6.2	μs	0.3	8^+#	15			2012	IT=100	*
^{214}Bi	−1201	11				19.9	m	0.4	1^-	09	89Ha.A	D	1904	$\beta^-\approx$100; α=0.021 1; $\beta^-\alpha$=0.003	
^{214}Bi^m	−1000#	100#	200#	100#		> 93	s		8^-#		08Ch.A	T	2008		
^{214}Po	−4470.0	1.4				163.72	μs	0.27	0^+	09	13Be31	T	1912	α=100	*
^{214}At	−3380	4				558	ns	10	1^-	09			1949	α=100	
^{214}At^m	−3321	8	59	9	AD	265	ns	30		09			1982	α<100	
^{214}At^n	−3146	5	234	6	AD	760	ns	15	9^-	09			1982	α<100	
^{214}Rn	−4320	9				270	ns	20	0^+	09			1970	α=100	
^{214}Rn^m	275	9	4595.4	1.8		245	ns	30	(22^+)	09			1983	IT=100	
^{214}Fr	−959	9				5.18	ms	0.16	(1^-)	09	15Kh09	T	1967	α=100	*
^{214}Fr^m	−837	8	122	5	AD	3.35	ms	0.05	(8^-)	09			1962	α=100	
^{214}Fr^n	−321	10	638	5		103	ns	4	(11^+)	09			1993	IT=100	
^{214}Fr^p	5620	100	6580	100		108	ns	7	(33^+)	09			1994	IT ?	*
^{214}Ra	93	5				2.437	s	0.016	0^+	09	15Kh09	T	1967	$\alpha\approx$100; β^+=0.059 4	*
^{214}Ra^m	1913	5	1819.7	1.8		118	ns	7	6^+	09			2004	IT=100	
^{214}Ra^n	1958	5	1865.2	1.8		67.3	μs	1.5	8^+	09			1971	IT$\approx$100; α=0.09 7	
^{214}Ra^p	2776	5	2683.2	1.8		295	ns	7	11^-	09			1979	IT=100	
^{214}Ra^q	3571	5	3478.4	1.8		279	ns	4	14^+	09			1979	IT=100	
^{214}Ra^r	4240	5	4146.8	1.8		225	ns	4	17^-	09			1979	IT=100	
^{214}Ra^x	6670	5	6577.0	1.8		128	ns	4	(25^-)	09			1992	IT=100	
^{214}Ac	6444	15				8.2	s	0.2	5^+#	09			1968	α>89 3; β^+<11 3	
^{214}Th	10695	11				87	ms	10	0^+	09			1968	$\alpha\approx$100; β^+=0.1#	
^{214}Th^m	12876	11	2181.0	2.7		1.24	μs	0.12	8^+#	09			2007	IT=100	
^{214}Pa	19490	80				17	ms	3		09	95Ni05	D	1995	$\alpha\approx$100	

*^{214}Pb^m E : 1365 + x ; x=20-90 keV **
*^{214}Po T : average 13Be31=163.6(0.3) 12Su11=164.2(0.6) **
*^{214}Fr T : average 15Kh09=5.9(0.4) 05Li17=4.6(0.7) 68To10=5.0(0.2) 68Va18=5.5(0.5) **
*^{214}Fr^p E : 6477 + y ; y=100(100) estimated by NUBASE **
*^{214}Ra T : average 15Kh09=2.36(0.06) 12No08=2.435(0.020) 73Be33=2.46(0.03) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{215}Hg	16210#	400#				1#	s	(>300 ns)	$3/2^+$#	13	10Al24	I	2010	β^- ?; β^-n=4#	
^{215}Tl	9910#	300#				10	s	4	$1/2^+$#	13	16Ca25	TD	2010	β^-=100; β^-n=4.6 46	
^{215}Pb	4340	50				2.34	m	0.19	$9/2^+$#	13	16Ca25	T	1998	β^-=100	*
^{215}Bi	1629	6				7.6	m	0.2	$(9/2^-)$	13			1953	β^-=100	
^{215}Bi^m	2996	21	1367	20		36.9	s	0.6	$(25/2^-)$	13			2001	IT=76.9 5; β^-=23.1 5	*
^{215}Po	−541.7	2.1				1.781	ms	0.005	$9/2^+$	13			1911	α=100; β^-=2.3e–4 2	
^{215}At	−1256	7				100	μs	20	$9/2^-$	13			1944	α=100	
^{215}Rn	−1169	8				2.30	μs	0.10	$9/2^+$	13			1952	α=100	
^{215}Fr	318	7				86	ns	5	$9/2^-$	13			1970	α=100	
^{215}Ra	2534	8				1.67	ms	0.01	$9/2^+$#	13			1967	α=100	
^{215}Ra^m	4412	8	1877.8	0.3		7.31	μs	0.13	$(25/2^+)$	13	04He25	T	1983	IT=100	*
^{215}Ra^n	4781	8	2246.9	0.4		1.39	μs	0.07	$(29/2^-)$	13			1998	IT=100	
^{215}Ra^p	6340	50	3810	50		555	ns	10	$(43/2^-)$	13			1987	IT=100	*
^{215}Ac	6031	12				170	ms	10	$9/2^-$	13			1968	$\alpha\approx$100; β^+=0.09 2	
^{215}Ac^m	7827	12	1796.0	0.9		185	ns	30	$(21/2^-)$	13			1983	IT=100	
^{215}Ac^n	8520	50	2490	50		335	ns	10	$(29/2^+)$	13			1983	IT=100	*
^{215}Th	10922	9				1.2	s	0.2	$(1/2^-)$	13			1968	α=100	*
^{215}Th^m	12390	50	1470	50		770	ns	60	$9/2^+$#	13			2005	IT=100	*
^{215}Pa	17860	70				14	ms	2	$9/2^-$#	13			1979	α=100	
^{215}U	24920	90				1.4	ms	0.9	$5/2^-$#	15	15Ya13	T	2015	α>0; β^+ ?	*

*^{215}Pb T : average 16Ca25=98(30)s 13De20=147(12)s; others 14Mo02=160(40) 96Ry.B=36(1) **
*^{215}Bi^m E : 1347.5(0.2) + x ; x=20(20) estimated by NUBASE **
*^{215}Ra^m T : average 04He25=7.6(0.2) 98St24=6.9(0.3) 88Fu10=7.2(0.2) **
*^{215}Ra^p E : 3756.6(0.4) + x ; x=50(50) estimated by NUBASE **
*^{215}Ac^n E : 2438 + x ; x=50(50) from ENSDF'2001 **
*^{215}Th T : also 07Le14=0.63(+1.26–0.21) **
*^{215}Th^m E : 1421.3(0.3) + x ; x=50(50) estimated by NUBASE **
*^{215}U T : symmetrized from 15Ya13=0.73(+1.33–0.29) ms **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{216}Hg	19860#	400#					100#	ms	(>300 ns)	0^+	11	10Al24	I	2010	β^- ?; β^-n=6#	
^{216}Tl	14720#	300#					6	s	3	5^+#	11	16Ca25	TD	2010	β^-=100; β^-n<11.5	
^{216}Pb	7480#	200#					1.65	m	0.2	0^+	15	16Ca25	TD	2010	β^-=100	
^{216}Pb^m	8990#	200#	1514	20			400	ns	40	8^+#	15			2012	IT=100	*
^{216}Bi	5874	11				*	2.25	m	0.05	$(6^-,7^-)$	07			1989	$\beta^-\approx$100	
^{216}Bi^m	5898	15	24	19	MD	*	6.6	m	2.1	$(3)^{(-\#)}$	07			1989	$\beta^-\approx$100	
^{216}Po	1782.4	1.8					145	ms	2	0^+	07			1910	α=100; 2β^- ?	
^{216}At	2257	4					300	μs	30	$1^{(-)}$	07			1948	$\alpha\approx$100; β^-<0.006; ε<3e–7	
^{216}At^m	2417	10	161	11	AD		100#	μs		9^-#	07			1971	α=100	
^{216}Rn	253	6					45	μs	5	0^+	07			1949	α=100	
^{216}Fr	2971	4					700	ns	20	(1^-)	07			1970	α=100; β^+<2e–7#	
^{216}Fr^m	3190	6	219	6	AD		850	ns	30	(9^-)		07Ku30	TJD	2007	α=?; β^+ ?	
^{216}Ra	3291	9					182	ns	10	0^+	07			1972	α=100; ε<1e–8	
^{216}Ac	8144	11					440	μs	16	(1^-)	07			1967	α=100; β^+=7e–5#	
^{216}Ac^m	8188	10	44	8	AD		441	μs	7	(9^-)	07			1966	α=100; β^+=7e–5#	
^{216}Ac^n	8560#	100#	420#	100#			300	ns			07			2006	IT=100	*
^{216}Th	10298	12					26.0	ms	0.2	0^+	07			1968	$\alpha\approx$100; β^+=0.01#	
^{216}Th^m	12342	14	2043	9	AD		134	μs	4	(8^+)	07			1983	IT ?; α=2.8 9	
^{216}Th^n	12945	12	2646.8	0.1			580	ns	30	(11^-)	07	01Ha46	J	1983	IT=100	
^{216}Th^p	13979	12	3681.4	0.7			740	ns	70	(14^+)	07			2001	IT=100	
^{216}Pa	17800	50					105	ms	12		07	96An21	T	1972	α=?; β^+=2#	*
^{216}U	23066	28					6.9	ms	2.9	0^+	15	15Ma37	T	2015	α=100	*
^{216}U^m	25320	30	2250	40			1.4	ms	0.9	8^+#	15	15Ma37	T	2015	α=100	*

*^{216}Pb^m E : 1459 + x ; x=20-90 keV **
*^{216}Ac^n E : 322 + x, x=100#100 **
*^{216}Pa T : others 98Ik01=150(70-40), 140(50-30) 79Sc09=170(100-40) 71Su14=200(40) **
*^{216}U T : average 15Ma37=4.72(+4.72–1.57) 15De22=3.8(+8.8–3.2) **
*^{216}U^m T : symmetrized from 15Ma37=0.74(+1.34–0.29) **

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{217}Tl	18310#	400#					1#	s	(>300 ns)	$1/2^+$#	11	10Al24	I	2010	β^- ?; β^-n=100#	
^{217}Pb	12240#	300#					20	s	5	$9/2^+$#	11	16Ca25	TD	2010	β^-=100	
^{217}Bi	8730	18					98.5	s	1.3	$9/2^-$#	14			1998	β^-=100	
^{217}Bi^m	10210	40	1480	40			2.70	μs	0.06	$25/2^-$#	14	14Mo02	T	2012	IT=100	*
^{217}Po	5884	7					1.514	s	0.026	$(9/2^+)$	03	04Li28	TJ	1956	α>95; β^-<5	*
^{217}At	4395	5					32.62	ms	0.24	$9/2^-$	03	13Su13	T	1947	$\alpha\approx$100; β^-=0.008 2	*
^{217}Rn	3659	4					540	μs	50	$9/2^+$	03			1949	α=100	
^{217}Fr	4315	7					16.8	μs	1.9	$9/2^-$	03	90An19	T	1968	α=100	*
^{217}Ra	5890	7					1.63	μs	0.17	$(9/2^+)$	03	90An19	T	1970	α=100	*
^{217}Ac	8704	11					69	ns	4	$9/2^-$	03			1972	α=100; β^+=6.9e–9	
^{217}Ac^m	10716	18	2012	20	AD		740	ns	40	$(29/2)^+$	03			1973	IT=95.7 10; α=4.3 10	
^{217}Th	12206	11					247	μs	4	$9/2^+$#	03	05Ku31	T	1968	α=100	*
^{217}Th^m	12880	11	673.8	1.8			141	ns	50	$(15/2^-)$	03			1989	IT=100	*
^{217}Th^n	14510#	60#	2307#	55#			71	μs	14	$(25/2^+)$		05Ku31	ETJ	2002	IT=100	*
^{217}Pa	17068	16					3.48	ms	0.09	$9/2^-$#	03	02He29	T	1968	α=100; B=0.0024#	*
^{217}Pa^m	18929	16	1860	7	AD		1.08	ms	0.03	$(23/2^-)$	03	02He29	TD	1979	α=73 4; IT ?	*
^{217}U	22970#	70#					800	μs	700	$1/2^-$#	03	05Le42	T	2000	$\alpha\approx$100; β^-=0.05#	*

*^{217}Bi^m E : 1436 + y ; y=40(40) estimated by NUBASE **
*^{217}Po T : average 03Ku25=1.53(0.03) 96Ry.B=1.47(0.05); other 04Li28=1.6(0.2) **
*^{217}At T : average 13Su13=32.8(0.3) 63Di05=32.3(0.4) **
*^{217}At D : average β^- 97Ch53=0.0067(24)% 69Le.A=0.012(4)% **
*^{217}Fr T : average 90An19=16(2) 70Bo13=22(5) **
*^{217}Ra T : average 90An19=1.7(0.3) 70Bo13=1.6(0.2) **
*^{217}Th T : unweighed average 05Ku31=257(2) 02He29=237(2) 00He17=247(3) 73Ha32=252(7) **
*^{217}Th T : others 15Kh09=259(12) 05Li17=310(70) **
*^{217}Th^m E : uncertainty estimated by NUBASE **
*^{217}Th^n T : symmetrized from 05Ku31=67(+17–11); other 02Mu.A=20(5) **
*^{217}Th^n E : weak Kx rays placed it less than 110 keV above $21/2^+$ at 2252 keV **
*^{217}Pa T : average 02He29=3.8(0.2) 00He17=3.4(0.1) **
*^{217}Pa^m J : from 13As01 **
*^{217}U T : symmetrized from 0.19(+1.13–0.10) ms; other 00Ma65=15.6(+21.3–5.7) ms **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{218}Tl	23180#	400#				200#	ms		5^+#					β^- ?; β^-n=70#	
^{218}Pb	15450#	300#				15	s	7	0^+	11	16Ca25	TD	2009	β^-=100	
^{218}Bi	13216	27				33	s	1	$(6^-,7^-,8^-)$	06	04De16	J	1998	β^-=100	
^{218}Po	8356.9	2.0				3.098	m	0.012	0^+	06			1904	α≈100; β^-=0.02#	
^{218}At	8098	12				1.5	s	0.3	1^-#	06			1943	α≈100; β^-=0.1#	
^{218}Rn	5217.3	2.3				33.75	ms	0.15	0^+	06	12Su11	T	1948	α=100	
^{218}Fr	7059	5				1.0	ms	0.6	1^-	06			1949	α=100	
^{218}Fr^m	7146	6	86	4	AD	22.0	ms	0.5	(8^-)	06	99Sh03	J	1982	α≈100; IT ?	
^{218}Fr^p	7260#	150#	200#	150#					high						
^{218}Ra	6651	11				25.2	μs	0.3	0^+	06			1970	α=100; 2β^+ ?	
^{218}Ac	10840	50				1.00	μs	0.04	1^-#	06	15Kh09	T	1970	α=100	*
^{218}Ac^m	10990#	70#	150#	50#		32	ns	9	(9^-)		94De04	ET	1994		*
^{218}Ac^n	11370#	70#	530#	50#		103	ns	11	(11^+)	06			1994	IT=100	*
^{218}Th	12367	11				117	ns	9	0^+	06			1973	α=100	*
^{218}Pa	18684	18				113	μs	10		06			1979	α=100	
^{218}U	21895	14				550	μs	140	0^+	06			1992	α=100	*
^{218}U^m	24004	18	2109	17	AD	660	μs	200	(8^+)	06	15Ma37	T	2005	α=100	*

*^{218}Ac T : average 15Kh09=0.96(0.05) 89Mi17=1.06(0.09) 83Sc23=1.12(0.11) **
*^{218}Ac^m E : at least 122.5 in 94De04 **
*^{218}Ac^n E : 384.49(0.13) keV above ^{218}Ac^m, from ENSDF **
*^{218}Th T : also 15Kh09=160(40) **
*^{218}U T : symmetrized from 510(+170–100) **
*^{218}U^m T : average 15Ma37=280(+1300–120) 05Le42=560(+260–140) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{219}Pb	20280#	400#				10#	s	(>300 ns)	$9/2^+$#	11	10Al24	I	2009	β^- ?	
^{219}Bi	16280#	200#				8.7	s	2.9	$9/2^-$#	12	16Ca25	T	2009	β^-=100	*
^{219}Po	12681	16				10.3	m	1.0	$9/2^+$#	15	15Fi07	T	1998	β^- ?; α=28.2 20	*
^{219}At	10396	3				56	s	3	$(9/2^-)$	16			1953	α=93.6 10; β^-=?	
^{219}Rn	8829.4	2.1				3.96	s	0.01	$5/2^+$	01			1903	α=100	
^{219}Fr	8618	7				20	ms	2	$9/2^-$	01			1948	α=100	
^{219}Ra	9394	8				10	ms	3	$(7/2)^+$	01			1952	α=100	
^{219}Ac	11570	50				11.8	μs	1.5	$9/2^-$	01			1970	α=100; β^+=1e–6#	
^{219}Th	14470	50				1.021	μs	0.024	$9/2^+$#	12	15Kh09	T	1973	α=100; β^+=1e–7#	*
^{219}Pa	18540	50				53	ns	10	$9/2^-$	01			2005	α=100; β^+=5e–9#	
^{219}U	23290	50				55	μs	25	$9/2^+$#	01			1993	α=100; β^+=1.4e–5#	*
^{219}Np	29460	90				< 5	μs		$9/2^-$#	16	15De22	D		α=100	

*^{219}Bi T : other 12Be28t=22(7) **
*^{219}Po T : from 15Fi07=620(59) s **
*^{219}Th T : 15Kh09=0.97(0.04) 73Ha32=1.05(0.03) **
*^{219}U T : symmetrized from 42(+34–13); also 05Le42=80(+100–30) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{220}Pb	23670#	400#				30#	s	(>300 ns)	0^+	11	10Al24	I	2010	β^- ?	
^{220}Bi	20820#	300#				9.5	s	5.7	1^-#	11	16Ca25	TD	2010	β^-=100; β^-n=0.04#	
^{220}Po	15263	18				40#	s	(>300 ns)	0^+	11	98Pf02	I	1998	β^- ?	
^{220}At	14376	14				3.71	m	0.04	$3^{(-\#)}$	11			1989	β^-=92 2; α=8 2	
^{220}Rn	10612.1	1.8				55.6	s	0.1	0^+	11			1900	α=100; 2β^- ?	
^{220}Fr	11482	4				27.4	s	0.3	1^+	11	78Ek02	J	1948	α≈100; β^-=0.35 5	
^{220}Ra	10270	8				17.9	ms	1.4	0^+	11	00He17	T	1949	α=100	*
^{220}Ac	13744	6				26.36	ms	0.19	(3^-)	11	90An19	T	1970	α=100; β^+=5e–4#	*
^{220}Th	14669	22				9.7	μs	0.6	0^+	11			1973	α=100; ε=2e–7#	
^{220}Pa	20220#	50#				780	ns	160	1^-#	11			2005	α=100; β^+=3e–7#	
^{220}U	22930#	100#				60#	ns		0^+					α ?; β^+ ?	
^{220}Np	30310#	200#				30#	ns		1^-#					α ?	

*^{220}Ra T : average 00He17=18(2) 90An19=17(2) 61Ru06=23(5) **
*^{220}Ac T : average 90An19=26.4(0.2) 70Bo13=26.1(0.5) **

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{221}Bi	24100#	300#				5#	s	(>300 ns)	$9/2^-$#	11	10Al24	I	2009	β^- ?; β^-n=2#	
^{221}Po	19774	20				2.2	m	0.7	$9/2^+$#	13			2010	β^- ?	*
^{221}At	16783	14				2.3	m	0.2	$3/2^-$#	07			1989	β^-=100	
^{221}Rn	14471	6				25.7	m	0.5	$7/2^+$	07	97Li23	T	1956	β^-=78 1; α=22 1	
^{221}Fr	13277	5				4.801	m	0.005	$5/2^-$	07	13Su13	T	1947	α≈100; β^-=0.0048 15; 14C=8.8e–11 11	*
^{221}Ra	12964	5				28	s	2	$5/2^+$	07	94Bo28	D	1949	α=100; 14C=1.2e–10 9	
^{221}Ac	14520	50				52	ms	2	$9/2^-$#	07			1968	α=100	
^{221}Th	16940	8				1.78	ms	0.03	$7/2^+$#	07	14Lo10	T	1970	α=100	
^{221}Pa	20380	50				5.9	μs	1.7	$9/2^-$	07			1983	α=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{221}U	24520	50				660	ns	140	(9/2$^+$)	15			2015	α≈100; β$^+$?	
^{221}Np	29850#	200#				30#	ns		9/2$^-$#					α ?	
*^{221}Po	T : symmetrized from 10Ch19=112(+58–28) s														**
*^{221}Fr	D : β$^-$ intensity is from 97Ch53; ^{14}C intensity is from 94Bo28														**
*^{221}Fr	T : average 13Su13=4.806(0.006) 10Wa42=4.768(0.017) 07Je07=4.79(0.02)														**
^{222}Bi	28730#	300#				2#	s	(>300 ns)	1$^-$#		10Al24	I	2009	β$^-$?; β$^-$n=1#	
^{222}Po	22490	40				9.1	m	7.2	0$^+$	11			2010	β$^-$?	*
^{222}At	20953	16				54	s	10		11			1989	β$^-$=100	
^{222}Rn	16372.2	1.9				3.8215	d	0.0002	0$^+$	11	15Be07	T	1899	α=100	*
^{222}Fr	16378	7				14.2	m	0.3	2$^-$	11	78Ek02	J	1975	β$^-$=100	
^{222}Ra	14320	4				33.6	s	0.4	0$^+$	11	12Po13	T	1948	α=100; 14C=3.0e–8 10	*
^{222}Ac	16621	5			*	5.0	s	0.5	1$^-$	11			1949	α=99 1; β$^+$=1 1	
^{222}Ac^m	16820#	150#	200#	150#	*	1.05	m	0.05	high	11			1972	α=?; IT<10; β$^+$=1.4 4	*
^{222}Th	17203	12				2.24	ms	0.03	0$^+$	11			1970	α=100; ε<1.3e–8#	
^{222}Pa	22160#	70#				3.2	ms	0.3		11	95Ni.A	T	1970	α=100	*
^{222}U	24270	50				4.7	μs	0.7	0$^+$	15			1983	α=100; β$^+$<1e–6#	
^{222}Np	31020#	200#				700#	ns		1$^-$#					α ?	
*^{222}Po	T : symmetrized from 10Ch19=145(+694–66) s														**
*^{222}Rn	T : rounded from 15Be07=3.82146(16stat,4syst)														**
*^{222}Ra	T : others not used 95Ko54=36.17(0.10) 82Bo04=43(4)														**
*^{222}Ac^m	D : derived from 0.7% < β$^+$ < 2%, in ENSDF														**
*^{222}Pa	T : average 95Ni.A=3.3(0.3) 79Sc09=2.9(+0.6–0.4)														**
*^{222}Pa	T : 70Bo13=5.7(0.5) conflicting, not used														**
^{223}Bi	32140#	400#				1#	s	(>300 ns)	9/2$^-$#	11	10Al24	I	2009	β$^-$?; β$^-$n=5#	
^{223}Po	27080#	200#				1#	m	(>300 ns)	9/2$^+$#	11	10Al24	I	2010	β$^-$?	
^{223}At	23428	14				50	s	7	3/2$^-$#	01			1989	β$^-$≈100; α=0.008#	
^{223}Rn	20390	8				24.3	m	0.4	7/2$^{(+\#)}$	01			1964	β$^-$=100; α=0.0004#	
^{223}Fr	18382.4	1.9				22.00	m	0.07	3/2$^-$	01	85Co24	J	1939	β$^-$≈100; α=0.006	
^{223}Ra	17233.3	2.1				11.4377	d	0.0022	3/2$^+$	01	15Ko06	T	1905	α=100; 14C=8.9e–8 4	*
^{223}Ac	17826	7				2.10	m	0.05	(5/2$^-$)	01			1948	α=99; ε=1	
^{223}Th	19386	9				600	ms	20	(5/2)$^+$	01			1952	α=100	
^{223}Pa	22320	70				5.1	ms	0.3	9/2$^-$#	01	99Ho28	T	1970	α=100; β$^+$<0.001#	*
^{223}U	25840	70				21	μs	8	7/2$^+$#	01			1991	α≈100; β$^+$=0.2#	*
^{223}Np	30600#	200#				1#	μs		9/2$^-$#					α ?	
*^{223}Ra	T : average 15Ko06=11.4362(0.0050) 15Be13=11.447(0.007) 15Be13=11.445(0.013)														**
*^{223}Ra	T : 15Co02=11.4358(0.0028)														**
*^{223}Pa	T : average 99Ho28=4.9(0.4) 95Ni.A=5.0(1.0) 70Bo13=6.5(1.0)														**
*^{223}U	T : symmetrized from 18(+10–5)														**
^{224}Bi	36830#	400#				300#	ms	(>300 ns)	1$^-$#	15	10Al24	I	2010	β$^-$?; β$^-$n=10#	
^{224}Po	29910#	200#				1#	m	(>300 ns)	0$^+$	15	10Al24	I	2010	β$^-$?	
^{224}At	27711	22				2.5	m	1.5		15			2010	β$^-$?	*
^{224}Rn	22445	10				107	m	3	0$^+$	15			1964	β$^-$=100	
^{224}Fr	21749	11				3.33	m	0.10	1$^-$	15	85Co24	J	1969	β$^-$=100	
^{224}Fr^x	21850#	100#	100#	100#	MD	*contamnt*	n								
^{224}Ra	18825.9	1.8				3.6319	d	0.0023	0$^+$	15			1902	α=100; 14C=4.0e–9 12	
^{224}Ac	20234	4				2.78	h	0.16	(0$^-$)	15			1948	β$^+$=90.6 17; α=9.4 17; β$^-$<1.6#	*
^{224}Th	19994	10				1.04	s	0.02	0$^+$	15			1949	α=100; 2β$^+$?	
^{224}Pa	23862	8				846	ms	20	5$^-$#	15			1958	α≈100; β$^+$=0.1#	
^{224}U	25722	23				396	μs	17	0$^+$	15	14Lo10	T	1991	α=100; β$^+$<1.2e–4#	
^{224}Np	31880#	200#				100#	μs		1$^-$#					α ?	
*^{224}At	T : symmetrized from 10Ch19=76(+138–23) s														**
*^{224}Ac	D : symmetrized from 51Me10 β$^+$=90.9(+1.4–2.0)%; α=9.1(+2.0–1.4)%														**
^{225}Po	34530#	300#				20#	s	(>300 ns)	9/2$^+$#	11	10Al24	I	2010	β$^-$?	
^{225}At	30400#	300#				2#	m	(>300 ns)	1/2$^+$#	11	10Al24	I	2010	β$^-$?	
^{225}Rn	26534	11				4.66	m	0.04	7/2$^-$	09			1969	β$^-$=100	
^{225}Fr	23821	12				3.95	m	0.14	3/2$^-$	09	85Co24	J	1969	β$^-$=100	
^{225}Ra	21993.1	2.6				14.9	d	0.2	1/2$^+$	09			1947	β$^-$=100	
^{225}Ac	21637	5				9.920	d	0.003	3/2$^-$#	09	12Po14	T	1947	α=100; 14C=4.5e–12 14	
^{225}Th	22310	5				8.75	m	0.04	(3/2$^+$)	09			1949	α≈90; ε≈10	
^{225}Pa	24340	70				1.7	s	0.2	5/2$^-$#	09			1958	α=100	

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …														
^{225}U	27380	11			61	ms	4	$5/2^+$#	09	00He17	T	1989	α=100	*
^{225}Np	31590	70			6	ms	5	$9/2^-$#	09	15De22	T	1994	α=100; β^+ ?	*
*^{225}U	T : symmetrized from 00He17=59(+5–2); others not used 03Ni10=135(+93–39)													**
*^{225}U	T : 01Ku07=84(4) 94An02=68(+45–20) 92To02=95(15) and 89He13=80(+40–10)													**
*^{225}Np	T : symmetrized from 15De22=3.3(+7.6–2.7); also 15De22=3.8(+7.6–2.7)													**
^{226}Po	37550#	400#			20#	s	(>300 ns)	0^+	11	10Al24	I	2010	β^- ?	
^{226}At	34610#	300#			20#	s	(>300 ns)		11	10Al24	I	2010	β^- ?; β^-n=0#	
^{226}Rn	28747	10			7.4	m	0.1	0^+	96			1969	β^-=100	
^{226}Fr	27521	6			49	s	1	1^-	96	85Co24	J	1969	β^-=100	
^{226}Ra	23667.8	1.9			1.600	ky	0.007	0^+	96	90We01	D	1898	α=100; 14C=2.6e–9 6; 2β^- ?	*
^{226}Ac	24309	3			29.37	h	0.12	$(1)^{(-\#)}$	96			1950	β^-=83 3; ε=17 3; α=0.006 2	
^{226}Th	23198	4			30.70	m	0.03	0^+	96	01Bo11	D	1948	α=100; ^{18}O<3.2e–12	*
^{226}Pa	26033	11			1.8	m	0.2		96			1949	α=74 5; β^+=26 5	
^{226}U	27329	13			269	ms	6	0^+	14	01Ca.B	T	1973	α=100	*
^{226}Np	32780#	90#			35	ms	10		96			1990	α=100; β^+=0.003#	
*^{226}Ra	D : ^{14}C : average 90We01=2.3(0.8)e–9% 86Ba26=2.9(1.0)e–9% 85Ho21=3.2(1.6)e–9%													**
*^{226}Th	T : from 12Po13; other 87Mi10=30.57(0.10)													**
*^{226}U	T : average 01Ca.B=258(13) 00He17=281(9) 99Gr28=260(10)													**
^{227}Po	42280#	400#			5#	s	(>300 ns)	$9/2^+$#	16			2010	β^- ?	
^{227}At	37480#	300#			20#	s	(>300 ns)	$1/2^+$#	16			2010	β^- ?; β^-n=0.2#	
^{227}Rn	32886	14			20.2	s	0.4	$(5/2)^{(+\#)}$	16			1986	β^-=100	
^{227}Fr	29682	6			2.47	m	0.03	$1/2^+$	16	85Co24	J	1972	β^-=100	
^{227}Ra	27177.7	2.0			42.2	m	0.5	$3/2^+$	16			1953	β^-=100	
^{227}Ac	25849.6	1.9			21.772	y	0.003	$3/2^-$	16			1902	β^-=98.62 36; α=1.38 36	
^{227}Th	25804.8	2.1			18.697	d	0.007	$(1/2^+)$	16			1906	α=100	
^{227}Pa	26831	7			38.3	m	0.3	$(5/2^-)$	16			1948	α=85 2; ε=15 2	
^{227}U	29045	10			1.1	m	0.1	$(3/2^+)$	16			1952	α=100; β^+<0.001#	
^{227}Np	32560	70			510	ms	60	$5/2^-$#	16			1990	$\alpha\approx$100; β^+=0.05#	
^{227}Pu	36770#	100#			20#	ms		$5/2^+$#					α ?	
^{228}At	41680#	400#			5#	s	(>300 ns)		14	10Al24	I	2010	β^- ?; β^-n=0.6#	
^{228}Rn	35243	18			65	s	2	0^+	14			1989	β^-=100	
^{228}Fr	33384	7			38	s	1	2^-	14	85Co24	J	1972	β^-=100	*
^{228}Ra	28940.3	2.0			5.75	y	0.03	0^+	14			1907	β^-=100	
^{228}Ac	28894.7	2.1			6.15	h	0.02	3^+	14			1908	β^-=100	*
^{228}Th	26771.0	1.8			1.9124	y	0.0008	0^+	14	93Bo20	D	1905	α=100; ^{20}O=1.13e–11 22	*
^{228}Pa	28924	4			22	h	1	3^+	14			1948	β^+=98.15 17; α=1.85 17	
^{228}U	29222	14			9.1	m	0.2	0^+	14			1949	α>95; ε<5	
^{228}Np	33600	50			61.4	s	1.4		14	94Kr13	D	1994	ε=60 7; α=40 7; β^+SF=0.012 6	*
^{228}Pu	36087	29			2.1	s	1.3	0^+	14	03Ni10	T	1994	$\alpha\approx$100; β^+<7#	*
*^{228}Fr	I : 08Ch.A reports an excited isomer with half-life=94(+170–29) s													**
*^{228}Ac	I : 08Ch.A reports an excited isomer with half-life=149(+95–42) s													**
*^{228}Th	T : average 14Un01=698.3(0.6) 71Jo14=698.77(0.32) 56Ki16=697.6(0.7)													**
*^{228}Np	D : β^+SF=0.020(9)% defined in 94Kr13 relative to ε, thus 0.012(6)% of total													**
*^{228}Pu	T : symmetrized from 03Ni10=1.1(+2.0–0.5)													**
^{229}At	44820#	400#			5#	s	(>300 ns)	$1/2^+$#	11	10Al24	I	2010	β^- ?; β^-n=4#	
^{229}Rn	39362	13			11.9	s	1.3	$5/2^+$#	09			2009	β^- ?	*
^{229}Fr	35668	5			50.2	s	0.4	$(1/2^+)$	08	14Bu06	J	1975	β^-=100	*
^{229}Ra	32562	15			4.0	m	0.2	$5/2^+$	08			1975	β^-=100	
^{229}Ac	30690	12			62.7	m	0.5	$(3/2^+)$	08			1952	β^-=100	
^{229}Th	29585.6	2.4			7.920	ky	0.017	$5/2^+$	08	14Va04	T	1947	α=100	*
^{229}Th^m	29585.6	2.4	0.0076	0.0005	< 1	s		$(3/2^+)$	08	16We07	ETD	1994	IT=100; α ?	*
^{229}Pa	29897	3			1.50	d	0.05	$(5/2^+)$	08			1949	$\varepsilon\approx$100; α=0.48 5	
^{229}Pa^m	29909	3	12.20	0.04	420	ns	30	$3/2^-$	08	15Ah04	EJD	1982	ε ?; IT ?	*
^{229}U	31211	6			57.8	m	0.5	$(3/2^+)$	08	15Ah04	T	1949	$\beta^+\approx$80; $\alpha\approx$20	
^{229}Np	33780	90			4.00	m	0.18	$5/2^+$#	08	04Sa05	TD	1968	α=68 11; β^+ ?	*
^{229}Np^p	33940#	100#	160#	50#				$5/2^-$#						
^{229}Pu	37400	50			91	s	26	$3/2^+$#	08	10Kh06	TD	1994	α=50 20; β^+=50 20; SF<7	*
… *A*-group is continued on next page …														

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …														
^{229}Am	42150	90			1.8	s	1.5	$5/2^-$#	15			2015	α≈91; β^+ ?	*
^{229}Am^p	42530#	220#	380#	200#									IT ?	
*^{229}Rn	T : symmetrized from 09Ne03=12.0(+1.2–1.3)													**
*^{229}Fr	T : 92Bo05=50.2(0.4); ENSDF2008 50.2 S 20 is misprint													**
*^{229}Th	T : as evaluated by 14Va04													**
*^{229}Th^m	T : >60 s for 2^+ charge state from 16We07; others 09In01(1m<T<3m); 09Ki14<2h													**
*^{229}Th^m	E : 0.0063<Ex<0.0183 from 16We07; other 94He08=0.0035(0.0010)													**
*^{229}Pa^m	D : 98Le15 IT=100 rejected by 15Ah04													**
*^{229}Np	T : average 04Sa05=4.0(0.4) 68Ha14=4.0(0.2)													**
*^{229}Pu	T : average 10Kh06=67(+41–19) 01Ca.B=90(+71–27)													**
*^{229}Pu	D : from ENSDF'97													**
*^{229}Am	T : symmetrized from 15De22=0.9(+2.1–0.7); also 15De22=6.4(+14.9–5.4)													**
^{230}Rn	42050#	200#			10#	s	(>300 ns)	0^+	12	10Al24	I	2010	β^- ?	
^{230}Fr	39487	7			19.1	s	0.5		12			1987	β^-=100	
^{230}Ra	34516	10			93	m	2	0^+	12			1978	β^-=100	
^{230}Ac	33838	16			122	s	3	(1^+)	12			1973	β^-=100; β^-SF=1.2e–6 4	
^{230}Th	30862.6	1.2			75.4	ky	0.3	0^+	12			1907	α=100; SF<4e–12; ^{24}Ne=5.8e–11 13	
^{230}Pa	32174	3			17.4	d	0.5	2^-	14			1948	β^+=92.2 7; β^-=7.8 7; α=0.0032 1	
^{230}U	31615	5			20.23	d	0.02	0^+	12	12Po12	T	1948	α=100; 22Ne=4.8e–12 20; SF<1.4e–10#; …	*
^{230}Np	35240	50			4.6	m	0.3		12			1968	β^+<97; α>3	
^{230}Pu	36934	15			1.70	m	0.17	0^+	12	01Ca.B	T	1990	α≈100; β^+ ?	
^{230}Am	42930#	130#			40	s	16		12	16Ka13	TD	2003	β^+≈100; β^+SF=?; SF=?	*
*^{230}U	D : …; $2\beta^+$?													**
*^{230}Am	T : symmetrized from 16Ka13=32(+22–9) s													**
^{231}Rn	46450#	300#			300#	ms	(>300 ns)	$1/2^+$#	13	10Al24	I	2010	β^- ?	
^{231}Fr	42081	8			17.6	s	0.6	$(1/2^+)$	13	14Bu06	J	1985	β^-=100	
^{231}Ra	38216	11			104	s	1	$(5/2^+)$	13	06Bo33	T	1983	β^-=100	
^{231}Ra^m	38282	11	66.21	0.09	53	μs		$(1/2^+)$	13			2001	IT=100	
^{231}Ac	35763	13			7.5	m	0.1	$1/2^+$	13			1973	β^-=100	
^{231}Th	33815.9	1.2			25.52	h	0.01	$5/2^+$	13			1911	β^-=100; α=4e–11#	
^{231}Pa	33424.4	1.8			32.76	ky	0.11	$3/2^-$	13			1918	α=100; SF≤3e–10; ^{24}Ne=13.4e–10 17; …	*
^{231}U	33806.0	2.7			4.2	d	0.1	$(5/2)^{(+\#)}$	13			1949	ε≈100; α=0.004 1	
^{231}Np	35620	50			48.8	m	0.2	$(5/2)^{(+\#)}$	13			1950	β^+=98 1; α=2 1	
^{231}Pu	38309	23			8.6	m	0.5	$(3/2^+)$	13			1999	β^+=87 5; α=13 5	*
^{231}Am	42410#	300#			1#	m		$5/2^-$#					β^+ ?; α ?	
^{231}Cm	47270#	300#			20#	s		$3/2^+$#					β^+ ?; α ?	
*^{231}Pa	D : …; ^{23}F=9.9e–13													**
*^{231}Pu	D : symmetrized from 99La14=90(+3–7)% and 10(+7–3)%													**
^{232}Fr	46073	14			5.5	s	0.6	(5)	06			1990	β^-=100; β^-SF<2e–4	
^{232}Ra	40497	9			4.0	m	0.3	0^+	06	08Ch.A	T	1983	β^-=100	*
^{232}Ac	39154	13			1.98	m	0.08	(1^+)	06			1986	β^-=100	
^{232}Th	35446.8	1.4			14.0	Gy	0.1	0^+	06			1898	IS=100.; α=100; SF=1.1e–9 4; …	*
^{232}Pa	35947	8			1.32	d	0.02	(2^-)	06			1949	β^-≈100; ε=0.003 1	
^{232}U	34609.5	1.8			68.9	y	0.4	0^+	06			1949	α=100; ^{24}Ne=8.9e–10 7; SF=2.7e–12 6; …	*
^{232}Np	37360#	100#			14.7	m	0.3	(4^+)	06			1950	β^+≈100; α≈0.0002#	
^{232}Pu	38363	18			33.7	m	0.5	0^+	06			1973	ε=90#; α=11 6	*
^{232}Am	43340#	300#			1.31	m	0.04	1^-#	06			1967	β^+=?; α=3#; β^+SF=0.069 10	
^{232}Cm	46310#	200#			10#	s		0^+					β^+ ?; α ?	
*^{232}Ra	T : average 08Ch.A=4.00(0.33) 86Gi08=4.2(0.8)													**
*^{232}Th	D : …; ^{24}Ne+^{26}Ne<2.78e–10; $2\beta^-$?													**
*^{232}U	D : …; ^{28}Mg<5e–12													**
*^{232}Pu	T : average 00La25=33.1(0.8) 73Ja06=34.1(0.7) D : 52Or.A α>1.6% 73Ja06<20%													**
^{233}Fr	48920	20			900	ms	100	$1/2^+$#	14			2010	β^-=100; β^-n=0#	
^{233}Ra	44334	9			30	s	5	$1/2^+$#	05			1990	β^-=100	
^{233}Ac	41308	13			145	s	10	$(1/2^+)$	05			1983	β^-=100	
^{233}Th	38731.7	1.4			21.83	m	0.04	$(1/2)^+$	05			1935	β^-=100	
^{233}Pa	37489.5	1.3			26.975	d	0.013	$3/2^-$	05			1938	β^-=100	
^{233}U	36919.2	2.3			159.2	ky	0.2	$5/2^+$	05			1947	α=100; SF<6e–11; ^{24}Ne=7.2e–11 9; …	*
^{233}Np	37950	50			36.2	m	0.1	$5/2^+$#	05	50Ma14	D	1950	β^+≈100; α=0.0007	*
^{233}Np^p	38000#	60#	50#	30#				$(5/2^-)$	05					
… *A*-group is continued on next page …														

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{233}Pu	40050	50				20.9	m	0.4	$5/2^+$#	05			1957	$\beta^+\approx$100; α=0.12 5	
^{233}Am	43260#	100#				3.2	m	0.8	$5/2^-$#	05	00Sa52	TD	2000	β^+ ?; α=4.5 9	*
^{233}Cm	47290	70				27	s	10	$3/2^+$#	05	10Kh06	TD	2001	α=20 10; β^+=80 10	*
^{233}Bk	52860#	220#				40	s	30		15	15De22	TD	2015	$\alpha\approx$82; β^+ ?	*
*^{233}U	D : …; ^{28}Mg<1.3e–13														**
*^{233}Np	D : α observed in 50Ma14 with β^+/α=1.5e5														**
*^{233}Am	D : combining 10Kh06 α<6 and 00Sa52 α>3														**
*^{233}Cm	T : symmetrized from 23(+13–6)														**
*^{233}Bk	T : symmetrized from 15De22=21(+48–17)														**
^{234}Ra	46931	8				30	s	10	0^+	07			1990	β^-=100; β^-SF<1e–4	
^{234}Ac	44841	14				45	s	2	1^+#	07	08Ch.A	T	1986	β^-=100	*
^{234}Th	40613.0	2.6				24.10	d	0.03	0^+	07			1900	β^-=100; α<1e–4	
^{234}Pa	40339	4				6.70	h	0.05	4^+	07	78Ga07	D	1913	β^-=100; SF<3e–10	
^{234}Pa^m	40417.9	2.8	79	3		1.159	m	0.011	(0^-)	07	78Ga07	D	1951	$\beta^-\approx$100; IT=0.16 4; SF<1e–10	*
^{234}U	38145.0	1.1				245.5	ky	0.6	0^+	07			1912	IS=0.0054 5; α=100; SF=1.64e–9 22; …	*
^{234}U^m	39566.3	1.1	1421.257	0.017		33.5	μs	2.0	6^-	07			1963	IT=100	
^{234}Np	39955	8				4.4	d	0.1	(0^+)	07			1949	β^+=100	
^{234}Pu	40350	7				8.8	h	0.1	0^+	07			1949	$\varepsilon\approx$94; $\alpha\approx$6	
^{234}Am	44460#	160#				2.32	m	0.08		07	90Ha02	D	1967	$\beta^+\approx$100; α=0.039 12; β^+SF=0.0066 18	*
^{234}Cm	46725	17				52	s	9	0^+	07	10Kh06	D	2001	$\beta^+\approx$71; $\alpha\approx$27; SF$\approx$2	*
^{234}Bk	53460#	140#				20	s	5		07	16Ka13	T	2003	α>80; β^+<20	*
*^{234}Ac	I : 08Ch.A reports two excited isomers with T>93 s and T=149(+95–42) s														**
*^{234}Pa^m	E : less than 10 keV above (3^+) level at 73.92(0.02), see ENSDF2007														**
*^{234}U	D : …; ^{28}Mg=1.4e–11 3; ^{24}Ne+^{26}Ne=9e–12 7														**
*^{234}Am	T : also 04Sa05=3.5(1.3) not used														**
*^{234}Cm	T : average 16Ka13=49(+15–9) 01Ca.B=51(12)														**
*^{234}Bk	T : symmetrized from 16Ka13=19(+6–4) s														**
^{235}Ra	51130#	300#				3#	s		$5/2^+$#					β^- ?	
^{235}Ac	47357	14				62	s	4	$1/2^+$#	14	08Ch.A	T	2006	β^- ?	
^{235}Th	44018	13				7.2	m	0.1	$1/2^+$#	14			1969	β^-=100	
^{235}Pa	42289	14				24.4	m	0.2	$(3/2^-)$	14			1950	β^-=100	
^{235}U	40918.8	1.1				704	My	1	$7/2^-$	14			1935	IS=0.7204 6; α=100; …	*
^{235}U^m	40918.9	1.1	0.0760	0.0004		25.7	m	0.1	$1/2^+$	14	16Ch11	T	1966	IT=100	
^{235}U^n	43420	300	2500	300		3.6	ms	1.8		14			2007	SF ?	
^{235}Np	41043.1	1.4				396.1	d	1.2	$5/2^+$	14			1949	$\varepsilon\approx$100; α=0.00260 13	
^{235}Pu	42182	21				25.3	m	0.5	$(5/2^+)$	14			1957	$\beta^+\approx$100; α=0.0028 7	
^{235}Am	44630	50				10.3	m	0.6	$5/2^-$#	14			1996	$\beta^+\approx$100; α=0.40 5	
^{235}Cm	48030#	200#				5#	m		$5/2^+$#	14				β^+ ?; α ?	
^{235}Cm^p	48080#	210#	50#	50#					*am*						
^{235}Bk	52700#	400#				1#	m							β^+ ?; α ?	
*^{235}U	D : …; SF=7e–9 2; ^{20}Ne=8e–10 4; ^{25}Ne$\approx$8e–10; ^{28}Mg=8e–10														**
^{236}Ac	51220	40				4.5	m	3.6		15	10Ch19	T	2010	β^- ?	*
^{236}Th	46255	14				37.3	m	1.5	0^+	15			1973	β^-=100	
^{236}Pa	45334	14				9.1	m	0.1	$1^{(-)}$	06			1963	β^-=100; β^-SF=6e–8 4	*
^{236}U	42444.6	1.1				23.42	My	0.03	0^+	06			1951	α=100; SF=9.4e–8 4	*
^{236}U^m	45195	3	2750	3		120	ns	2	(0^+)	06			1969	IT=87 6; SF=13 6; α<10	
^{236}Np	43380	50			*	153	ky	5	(6^-)	06			1949	ε=86.3 8; β^-=13.5 8; α=0.16 4	
^{236}Np^m	43438	7	60	50	*	22.5	h	0.4	1	06			1949	ε=50 3; β^-=50 3	
^{236}Np^p	43616	14	240	50	AD				(3^-)	06					
^{236}Pu	42901.6	1.8				2.858	y	0.008	0^+	06	90Og01	D	1949	α=100; SF=1.9e–7 4; 28Mg=2e–12; 2β^+ ?	
^{236}Pu^m	44087.0	1.8	1185.45	0.15		1.2	μs	0.3	5^-	06			2005	IT=100	
^{236}Am	46040#	110#				3.6	m	0.1	(5^-)	06	04Sa05	D	1998	β^+=?; α=4.0e–3 1	
^{236}Am^m	46090#	120#	50#	50#		2.9	m	0.2	(1^-)	06			2004	β^+=?; α=?	
^{236}Cm	47855	18				6.8	m	0.8	0^+	06	10Kh06	TD	2010	β^+=82 2; α=18 2; SF<0.1	
^{236}Bk	53540#	400#				2#	m			06				β^+ ?; α ?	
*^{236}Ac	T : symmetrized from 10Ch19=72(+345–33) s														**
*^{236}Pa	D : β^-SF decay questioned in 90Ha02														**
*^{236}U	D : and Ne+Mg < 4e–10%, from 89Mi.A														**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{237}Ac	54020#	400#					4#	m		$1/2^+$#					β^- ?	
^{237}Th	49955	16					4.8	m	0.5	$5/2^+$#	06			1993	β^-=100	
^{237}Pa	47528	13					8.7	m	0.2	$(1/2^+)$	06			1954	β^-=100	
^{237}U	45390.2	1.2					6.752	d	0.002	$1/2^+$	06			1940	β^-=100	
^{237}U^m	45664.2	1.6	274.0	1.0			155	ns	6	$(7/2)^-$	06			1968	IT=100	
^{237}Np	44871.7	1.1					2.144	My	0.007	$5/2^+$	06	89Pr.A	D	1948	α=100; SF<2e–10; ^{30}Mg<4e–12	*
^{237}Np^m	45816.9	1.1	945.20	0.10			710	ns	40	(11/2,13/2)	06			1990	IT=100	
^{237}Pu	45091.7	1.7					45.64	d	0.04	$7/2^-$	06			1949	$\varepsilon\approx$100; α=0.0042 4	
^{237}Pu^m	45237.2	1.7	145.543	0.008			180	ms	20	$1/2^+$	06			1972	IT=100	
^{237}Pu^n	47990	250	2900	250			1.1	μs	0.1		06			1970	SF=?	
^{237}Am	46570#	60#					73.6	m	0.8	$5/2^{(-)}$	06			1970	$\beta^+\approx$100; α=0.025 3	
^{237}Cm	49250	70					20#	m		$5/2^+$#	06	02As08	D	2002	β^+ ?; α=1.8	*
^{237}Cm^p	49450#	170#	200#	150#						$7/2^-$						
^{237}Bk	53190#	220#					2#	m		$(3/2^-)$					β^+ ?; α ?	
^{237}Cf	57940	90					0.8	s	0.2	$5/2^+$#	06	10Kh06	TD	1995	α=70 10; SF=30 10; β^+ ?	*
*^{237}Np	D : and cluster (Z=10-14) < 1.8e–12%, from 92Mo03															**
*^{237}Cm	D : partial α T=6.6e4 s or 1100 m															**
*^{237}Cf	T : others not used 95La09=2.1(0.3)															**
^{238}Th	52530#	280#					9.4	m	2.0	0^+	15			1999	β^-=100	
^{238}Pa	50894	16					2.28	m	0.09	3^-#	15	85Ba57	D	1968	β^-=100; β^-SF<2.6e–6	
^{238}U	47307.8	1.5					4.468	Gy	0.006	0^+	15	91Tu02	D	1896	IS=99.2742 10; α=100; …	*
^{238}U^m	49865.7	1.6	2557.9	0.5			280	ns	6	0^+	15			1979	IT=?; SF=2.6 4; α<0.5	
^{238}Np	47454.7	1.1					2.099	d	0.002	2^+	15			1949	β^-=100	
^{238}Np^m	49760#	200#	2300#	200#			112	ns	39		15			1970	SF$\approx$100; IT ?	
^{238}Pu	46163.2	1.1					87.7	y	0.1	0^+	15	89Wa10	D	1949	α=100; SF=1.9e–7 1; …	*
^{238}Am	48420	50					98	m	2	1^+	15			1950	β^+=100; α=1.0e–4 4	
^{238}Am^m	50920#	210#	2500#	200#			35	μs	18		15			1967	SF$\approx$100; IT ?	
^{238}Cm	49445	12					2.2	h	0.4	0^+	15			1994	ε ?; α=3.84 18; SF=0.048 2	
^{238}Bk	54220#	260#					2.40	m	0.08		15			1994	$\beta^+\approx$100; α ?; β^+SF=0.048 2	
^{238}Cf	57280#	300#					21.1	ms	1.3	0^+	15	01Og08	D	1995	SF$\approx$100; $\alpha\approx$0.2; β^+ ?	
*^{238}U	D : …; SF=5.45e–5 7; 2β^-=2.2e–10 7															**
*^{238}U	D : 2β^-=2.2(7)e–10% derived from 2β^- half-life T=2.0(0.6) Zy, in 91Tu02															**
*^{238}Pu	D : …; ^{32}Si$\approx$1.4e–14; ^{28}Mg+^{30}Mg$\approx$6e–15															**
^{239}Th	56450#	400#					2#	m		$7/2^+$#					β^- ?	
^{239}Pa	53340#	200#					1.8	h	0.5	$(3/2)^{(-\#)}$	14			1995	β^-=100	
^{239}U	50572.7	1.5					23.45	m	0.02	$5/2^+$	14			1937	β^-=100	
^{239}U^m	50593#	20#	20#	20#			> 250	ns		$(5/2^+)$	14			1994	β^-=100	
^{239}U^n	50706.5	1.5	133.7991	0.0010			780	ns	40	$1/2^+$	14			1975	IT=100	
^{239}Np	49311.1	1.3					2.356	d	0.003	$5/2^+$	14			1940	β^-=100; α=5e–10#	
^{239}Pu	48588.3	1.1					24.11	ky	0.03	$1/2^+$	14			1946	α=100; SF=3.1e–10 6	
^{239}Pu^m	48979.9	1.1	391.584	0.003			193	ns	4	$7/2^-$	14			1955	IT=100	
^{239}Pu^n	51690	200	3100	200			7.5	μs	1.0	$(5/2^+)$	14			1970	SF$\approx$100; IT ?	
^{239}Am	49390.4	2.0					11.9	h	0.1	$(5/2)^-$	14			1949	$\varepsilon\approx$100; α=0.010 1	
^{239}Am^m	51890	200	2500	200			163	ns	12	$(7/2^+)$	14			1969	SF$\approx$100; IT ?	
^{239}Cm	51150	50					2.5	h	0.4	$(7/2^-)$	14	02Sh.C	TD	1952	$\beta^+\approx$100; α=6.2e–3 14	
^{239}Cm^p	51390#	110#	240#	100#						$1/2^+$						
^{239}Bk	54250#	210#					4#	m		$(7/2^+)$	14	89Ha27	J		β^+>99#; α<1; SF<1	
^{239}Bk^p	54290#	210#	41	11	AD					$(3/2^-)$		89Ha27	J			
^{239}Cf	58270#	210#					60	s	30	$5/2^+$#	14			1981	α=?; β^+ ?	*
^{239}Es	63560#	300#					1#	s							α ?; β^+ ?; SF ?	
*^{239}Cf	T : symmetrized from 81Mu12=39(+37–12)															**
^{240}Pa	56910#	200#					2#	m							β^- ?	
^{240}U	52715.5	2.6					14.1	h	0.1	0^+	08			1953	β^-=100; α<1e–10#	
^{240}Np	52316	17				*	61.9	m	0.2	(5^+)	08			1953	β^-=100	
^{240}Np^m	52334	13	18	14		*	7.22	m	0.02	(1^+)	08	81Hs02	E		$\beta^-\approx$100; IT=0.12 1	
^{240}Pu	50125.4	1.1					6.561	ky	0.007	0^+	08	13Sa65	D	1949	α=100; SF=5.63e–6 6; 34Si<1.3e–11	*
^{240}Pu^m	51434.1	1.1	1308.74	0.05			165	ns	10	(5^-)	08			1967	IT=100	
^{240}Am	51510	14					50.8	h	0.3	(3^-)	08			1949	β^+=100; $\alpha\approx$1.9e–4 7	
^{240}Am^m	54510	200	3000	200			940	μs	40		08			1967	SF$\approx$100; IT ?	
^{240}Cm	51724.3	1.9					27	d	1	0^+	08			1949	$\alpha\approx$100; ε<0.5; SF=3.9e–6 8	

… A-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																
^{240}Bk	55660#	150#					4.8	m	0.8		08			1980	β^+ ?; α=10#; β^+SF=0.0020 13	*
^{240}Bk^p	55900#	180#	240#	100#						*am*						
^{240}Cf	57991	19					40.3	s	0.9	0^+	08	10As.A	T	1970	α=98.5 2; SF=1.5 2; β^+?	*
^{240}Es	64200#	400#					1#	s							α ?; β^+ ?	
*^{240}Pu	D : SF=5.632(0.062)e–6 from SF half-life 13Sa65=116.5(1.3) Gy															**
*^{240}Bk	D : symmetrized from β^+SF=0.0013(+18–7)%															**
*^{240}Cf	D : from 10Kh06; also 95La09 $\alpha\approx$98; SF$\approx$2															**
^{241}Pa	59640#	300#					2#	m		$3/2^-$#					β^- ?	
^{241}U	56200#	200#					5#	m		$7/2^+$#	15				β^- ?	
^{241}Np	54260	70					13.9	m	0.2	$(5/2^+)$	15			1959	β^-=100; α<10e–6	
^{241}Pu	52955.2	1.1					14.329	y	0.029	$5/2^+$	15			1949	$\beta^-\approx$100; α=0.00247; SF<2.4e–14	
^{241}Pu^m	53116.9	1.1	161.6853	0.0009			880	ns	50	$1/2^+$	15			1975	IT=100	
^{241}Pu^n	55160	200	2200	200			20.5	μs	2.2		15			1970	SF=100	
^{241}Am	52934.4	1.1					432.6	y	0.6	$5/2^-$	15			1949	α=100; SF=3.6e–10 9; 34Si<7.4e–14	
^{241}Am^m	55130	100	2200	100			1.2	μs	0.3		15			1969	SF=100	
^{241}Cm	53701.8	1.6					32.8	d	0.2	$1/2^+$	15			1952	ε=99.0 1; α=1.0 1	
^{241}Bk	56030#	200#					4.6	m	0.4	$(7/2^+)$	15			2003	α ?; β^+ ?	
^{241}Bk^p	56080#	200#	51	3	AD					$(3/2^-)$	15					
^{241}Cf	59330#	170#					2.35	m	0.18	$7/2^-$#	15	10As.A	T	1970	β^+ ?; $\alpha\approx$25	*
^{241}Cf^p	59480#	190#	150#	100#	Nm					$(1/2^+)$	15					
^{241}Es	63860#	230#					10	s	5	$(3/2^-)$	15	96Ni09	TJD	1996	α=?; β^+ ?	*
^{241}Es^p	64020#	300#	160#	200#						*am*						
^{241}Fm	69130#	300#					730	μs	60	$5/2^+$#	15			2008	SF=?; α<14; β^+<12	
*^{241}Cf	T : from 10As.A=141(11) s; other 70Si19=3.78(0.70) m															**
*^{241}Es	T : symmetrized from 96Ni09=8(+6–4)															**
^{242}U	58620#	200#					16.8	m	0.5	0^+	02			1979	β^-=100	
^{242}Np	57420	200				*	2.2	m	0.2	(1^+)	02			1979	β^-=100	
^{242}Np^m	57420#	210#	0#	50#		*	5.5	m	0.1	6^+#	02			1981	β^-=100	
^{242}Pu	54716.9	1.2					375	ky	2	0^+	02	13Sa65	D	1950	α=100; SF=5.56e–4 7	*
^{242}Am	55468.1	1.1					16.02	h	0.02	1^-	02			1949	β^-=82.7 3; ε=17.3 3	
^{242}Am^m	55516.7	1.1	48.60	0.05			141	y	2	5^-	02			1950	IT$\approx$100; α=0.45 2; SF<4.7e–9	
^{242}Am^n	57670	80	2200	80			14.0	ms	1.0	$(2^+,3^-)$	02			1962	SF$\approx$100; IT=?; α ?	
^{242}Cm	54803.8	1.1					162.8	d	0.2	0^+	02			1949	α=100; SF=6.2e–6 3; 34Si=1.1e–14 4; …	*
^{242}Cm^m	57600	100	2800	100			180	ns	70		02			1971	SF ?; IT ?	
^{242}Bk	57730#	200#					7.0	m	1.3	2^-#	02	80Ga07	D	1972	$\beta^+\approx$100; β^+SF<3e–5; α ?	
^{242}Bk^m	57930#	280#	200#	200#			600	ns	100		02			1972	SF$\approx$100; IT ?	
^{242}Bk^p	57980#	220#	250#	100#						4^-						
^{242}Cf	59387	13					3.49	m	0.15	0^+	02	70Si19	T	1967	α=80 20; β^+ ?; SF<0.014	*
^{242}Es	64800#	260#					17.8	s	1.6		02	10An08	TD	1994	α=57 3; β^+=43 3; β^+SF=0.6 2	*
^{242}Fm	68400#	400#					800	μs	200	0^+	02			1975	SF=?; α ?	*
*^{242}Pu	D : SF=5.564(0.072)e–4 from SF half-life 13Sa65=67.4(0.9) Gy															**
*^{242}Cm	D : …; 2β^+ ? D : symmetrized from ^{34}Si=1.0(+4–3)e–14															**
*^{242}Cf	T : average 70Si19=3.68(0.44) 67Si07=3.4(0.2) 67Fi04=3.2(0.5) 67Il01=3.7(0.3)															**
*^{242}Es	T : others 00Sh10=11(3) 96Ni09=16(+6–4)															**
*^{242}Es	D : β^+SF from 00Sh10; other 10An08=1.3(+1.2–0.7)%															**
*^{242}Fm	T : conflicting 08Kh10 excludes 4 μs-1s															**
^{243}U	62360#	300#					10#	m		$9/2^-$#					β^- ?	
^{243}Np	59880#	30#					1.85	m	0.15	$5/2^+$#	14			1979	β^-=100	
^{243}Np^p	59926	10	50#	30#	Nm					$(5/2^-)$						
^{243}Pu	57754.6	2.5					4.956	h	0.003	$7/2^+$	14			1951	β^-=100	
^{243}Pu^m	58138.2	2.5	383.64	0.25			330	ns	30	$(1/2^+)$	14			1975	IT=100	
^{243}Am	57175.0	1.4					7.364	ky	0.022	$5/2^-$	14			1950	α=100; SF=3.7e–9 9	
^{243}Am^m	59480	200	2300	200			5.5	μs	0.5		14			1970	SF$\approx$100; IT ?	
^{243}Cm	57182.0	1.5					29.1	y	0.1	$5/2^+$	14			1950	$\alpha\approx$100; ε=0.29 3; SF=5.3e–9 9	
^{243}Cm^m	57269.4	1.5	87.4	0.1			1.08	μs	0.03	$1/2^+$	14			1971	IT=100	
^{243}Cm^p	57279	16	97	16	AD					$(7/2^+)$	14			1984	IT ?	
^{243}Bk	58690	5					4.6	h	0.2	$3/2^-$#	14			1950	$\beta^+\approx$100; $\alpha\approx$0.15	
^{243}Bk^p	58710	19	20	20	AD					$(7/2^-)$						
^{243}Cf	60990#	110#					10.7	m	0.5	$(1/2^+)$	14			1967	$\beta^+\approx$86; $\alpha\approx$14	
^{243}Es	64750#	210#					21.6	s	1.6	$(7/2^+)$	14			1973	α=61 6; β^+=39 6; SF<1	
^{243}Fm	69390#	220#					231	ms	9	$7/2^-$#	14			1981	α=91 3; SF=9 1; β^+ ?	*
*^{243}Fm	D : 08Kh10 β^+<10															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{244}Np	63200#	300#					2.29	m	0.16	(7$^-$)	03			1987	β^-=100	
^{244}Pu	59806.0	2.3					80.0	My	0.9	0$^+$	03	92Mo25	D	1954	$\alpha\approx$100; SF=0.121 4; 2β^-<7.3e–9	*
^{244}Pu^m	61022	3	1216	2			1.75	s	0.12	(8$^-$)		16Ho13	ETJ	2016	IT=100	
^{244}Am	59879.2	1.5					10.1	h	0.1	6$^-$#	03			1950	β^-=100	
^{244}Am^m	59968.5	1.4	89.3	1.6	RQ		26	m	1	1$^+$	03			1950	$\beta^-\approx$100; ε=0.0361 13	
^{244}Am^n	60080#	200#	200#	200#			900	μs	150		03			1967	SF$\approx$100; IT ?	
^{244}Am^p	60080#	200#	200#	200#			6.5	μs			03			1969	SF$\approx$100; IT ?	
^{244}Cm	58451.9	1.1					18.10	y	0.02	0$^+$	03			1950	α=100; SF=1.37e–4 3	
^{244}Cm^m	59492.1	1.1	1040.188	0.012			34	ms	2	6$^+$	03			1963	IT=100	
^{244}Cm^n	59550#	900#	1100#	900#			> 500	ns			03			1969	SF$\approx$100; IT ?	
^{244}Bk	60714	14					5.02	h	0.03	(4$^-$)	03	14So17	T	1972	β^+ ?; α=0.006 3	
^{244}Bk^m	61210#	300#	500#	300#			820	ns	60		03			1972	SF$\approx$100; IT ?	
^{244}Bk^p	60850#	50#	140#	50#						*am*						
^{244}Cf	61478.2	2.6					19.4	m	0.6	0$^+$	03			1956	$\alpha\approx$100; ε ?	
^{244}Es	66030#	180#					37	s	4		03			1973	β^+=?; α=5 3; β^+SF=0.01	*
^{244}Es^p	66230#	240#	200#	150#						*am*						
^{244}Fm	68970#	200#					3.12	ms	0.08	0$^+$	03	08Kh10	TD	1967	SF$\approx$100; β^+<2; α=0.4#	*
*^{244}Pu	T : and $T(2\beta^-) > 1.1$ Ey, from 92Mo25; thus 2β^- < 7.3 e–9%															**
*^{244}Es	D : symmetrized from α=4(+3–2)%															**
*^{244}Fm	T : other 12Sv02=3.47(0.26)															**
^{245}Np	65890#	300#					2#	m		5/2$^+$#					β^- ?	
^{245}Pu	63178	14					10.5	h	0.1	(9/2$^-$)	11			1955	β^-=100	
^{245}Pu^m	63443	14	264.5	0.3			330	ns	20	(5/2$^+$)	11			2007	IT=100	
^{245}Am	61900.5	1.9					2.05	h	0.01	(5/2)$^+$	11			1955	β^-=100	
^{245}Am^m	64300#	400#	2400#	400#			640	ns	60		11			1972	SF$\approx$100; IT ?	
^{245}Cm	61004.6	1.1					8.25	ky	0.07	7/2$^+$	11	12Ch30	T	1954	α=100; SF=6.1e–7 9	
^{245}Cm^m	61360.5	1.1	355.92	0.10			290	ns	20	1/2$^+$	11			1975	IT=100	
^{245}Bk	61813.8	1.8					4.95	d	0.03	3/2$^-$	11			1951	$\varepsilon\approx$100; α=0.12 1	
^{245}Bk^p	61860#	30#	50#	30#						(7/2$^-$)						
^{245}Cf	63385.2	2.4					45.0	m	1.5	1/2$^+$	11			1956	β^+ ?; α=36 3	
^{245}Es	66370#	200#					1.1	m	0.1	(3/2$^-$)	11			1967	β^+ ?; α=40 10	
^{245}Es^p	66650#	200#	283	15						(7/2$^-$)	11			2005	IT=100	*
^{245}Es^q	66700#	230#	330#	100#						(1/2$^-$)						
^{245}Fm	70190#	200#					4.2	s	1.3	1/2$^+$#	11			1967	α=?; β^+=4.2#; SF=0.13#	
^{245}Md	75270#	310#				* &	400	ms	200	(7/2$^-$)	11	96Ni09	TJD	1996	α=?; β^+ ?	*
^{245}Md^m	75370#	330#	100#	100#		* &	900	μs	250	1/2$^-$#	11			1996	SF=?; α ?	
*^{245}Es^p	E : 253.2 keV above the 7/2$^+$ [633] level at 30(15) keV															**
*^{245}Md	T : symmetrized from 96Ni09=350(+230–160)															**
^{246}Pu	65395	15					10.84	d	0.02	0$^+$	11			1955	β^-=100	
^{246}Am	64994#	18#					39	m	3	(7$^-$)	11			1955	β^-=100	
^{246}Am^m	65024	15	30#	10#			25.0	m	0.2	2$^{(-)}$	11			1955	$\beta^-\approx$100; IT<0.02	
^{246}Am^n	66990#	800#	2000#	800#			73	μs	10		11			1972	SF$\approx$100; IT ?	
^{246}Cm	62617.0	1.5					4.706	ky	0.040	0$^+$	11			1954	$\alpha\approx$100; SF=0.02615 7	
^{246}Cm^m	63796.7	1.5	1179.66	0.13			1.12	s	0.24	8$^-$	11	12Ta.A	ETJ	2012	IT=100	
^{246}Bk	63970	60					1.80	d	0.02	2$^{(-)}$	11			1954	$\beta^+\approx$100; α=0.1#	
^{246}Cf	64090.3	1.5					35.7	h	0.5	0$^+$	11			1951	α=100; SF=2.4e–4 4; ε<4e–3	
^{246}Es	67900#	220#					7.5	m	0.5	4$^-$#	11			1954	β^+=90.1 18; α=9.9 18; β^+SF$\approx$0.003	
^{246}Es^p	68250#	300#	350#	200#						*am*						*
^{246}Fm	70189	15					1.54	s	0.04	0$^+$	11	10An08	T	1966	α=?; SF=6.8 6; ε<1.3; β^+SF=10 5	*
^{246}Md	76120#	260#					0.92	s	0.18		11	10An08	TD	1996	α=100	*
^{246}Md^m	76170#	260#	60	60	AD		4.4	s	0.8		11			2010	β^+>77; β^+SF>10; α<23	
*^{246}Es^p	E : above level decaying by 152.3(0.5) keV γ															**
*^{246}Fm	D : from 96Ni09															**
*^{246}Md	T : average 10An08=0.9(0.2) 96Ni09=1.0(0.4)															**
^{247}Pu	69110#	200#					2.27	d	0.23	1/2$^+$#	15			1983	β^-=100	
^{247}Am	67150#	100#					23.0	m	1.3	5/2#	15			1967	β^-=100	
^{247}Cm	65533	4					15.6	My	0.5	9/2$^-$	15			1954	α=100	
^{247}Cm^m	65760	4	227.38	0.19			26.3	μs	0.3	5/2$^+$	15			1968	IT=100	
^{247}Cm^n	65938	4	404.90	0.03			100.6	ns	0.6	1/2$^+$	15			2003	IT=100	
^{247}Bk	65490	5					1.38	ky	0.25	3/2$^-$	15			1965	$\alpha\approx$100; SF ?	
^{247}Cf	66104	15					3.11	h	0.03	7/2$^+$#	15			1954	$\varepsilon\approx$100; α=0.035 5	
^{247}Es	68578	19					4.55	m	0.26	(7/2$^+$)	15	89Ha27	J	1967	$\beta^+\approx$93; $\alpha\approx$7; SF$\approx$9e–5#	
^{247}Fm	71670#	120#					31	s	1	(7/2$^+$)	15			1967	α=64; β^+ ?	
^{247}Fm^m	71720#	110#	49	8	AD		5.1	s	0.2	(1/2$^+$)	15			1967	α=88 2; β^+ ?; IT ?	
^{247}Md	75940#	210#					1.2	s	0.1	(7/2$^-$)	15			1981	$\alpha\approx$100; SF<0.1	
^{247}Md^m	76200#	210#	260	40	AD		250	ms	40	(1/2$^-$)	15	10An08	D	1993	α=79 5; SF=21 5	

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{248}Am	70560#	200#					3#	m			14				β^- ?	
^{248}Cm	67392.8	2.4					348	ky	6	0^+	14			1956	α=91.61 16; SF=8.39 16; 2β^- ?	
^{248}Cm^m	68850.9	2.6	1458.1	1.0			146	μs	18	(8^-)	14	12Ta.A	ETJ	2012	IT=100	
^{248}Bk	68080#	70#				*	> 9	y		6^+#	14			1956	α ?	
^{248}Bk^m	68108	21	30#	70#		*	23.7	h	0.2	$1^{(-)}$	14			1956	β^-=70 5; ε=30 5; α=0.001#	
^{248}Bk^p	68130	50	50#	50#						(5^-)						
^{248}Cf	67238	5					333.5	d	2.8	0^+	14			1954	$\alpha\approx$100; SF=0.0029 3	
^{248}Es	70300#	50#					24	m	3	2^-#	14			1956	$\beta^+\approx$100; $\alpha\approx$0.25; β^+SF=3e–5	
^{248}Fm	71898	8					34.5	s	1.2	0^+	14			1958	α=95 5; β^+=5 5; SF=0.10 5	
^{248}Fm^m	73100#	100#	1200#	100#			10.1	ms	0.6		14			2010	α ?; B ?	
^{248}Md	77150#	240#					7	s	3		14			1973	β^+=80 10; α=20 10; β^+SF<0.05	
^{248}No	80620#	220#					<2 μs			0^+	14	03Be18	I		SF ?	
^{249}Am	73100#	300#					1#	m							β^- ?	
^{249}Cm	70750.7	2.4					64.15	m	0.03	$(1/2^+)$	11			1956	β^-=100	
^{249}Cm^m	70799.5	2.4	48.76	0.04			23	μs		$(7/2^+)$	11			1966	α=100	
^{249}Bk	69846.4	1.2					327.2	d	0.3	$7/2^+$	11	14Ch47	T	1954	$\beta^-\approx$100; α=0.00145 8; SF=47e–9 2	
^{249}Bk^m	69855.2	1.2	8.777	0.014			300	μs		$(3/2^-)$	11			1975	IT=100	
^{249}Cf	69722.8	1.2					351	y	2	$9/2^-$	11			1954	α=100; SF=5.0e–7 4	
^{249}Cf^m	69867.8	1.2	144.98	0.05			45	μs	5	$5/2^+$	11			1967	IT=100	
^{249}Es	71180#	30#					102.2	m	0.6	$7/2^+$	11			1956	$\beta^+\approx$100; α=0.57 8	
^{249}Fm	73519	6					1.6	m	0.1	$(7/2^+)$	11	11Lo06	J	1960	β^+ ?; α=33 9	*
^{249}Md	77230#	200#					23.4	s	2.4	$(7/2^-)$	11	01He35	J	1973	α>60; β^+ ?	*
^{249}Md^m	77330#	220#	100#	100#			1.9	s	0.9	$(1/2^-)$	11	01He35	TJD	2001	α=100	*
^{249}No	81780#	280#					57	μs	12	$5/2^+$#	11	03Be18	T	2003	β^+ ?; α ?	*
*^{249}Fm	T : from 04He28; others 66Ak01=2.6(0.7) 59Pe27=2.5(1.0)															**
*^{249}Md	T : average 09He20=23(3) 73Es01=24(4)															**
*^{249}Md^m	T : symmetrized from 1.5(+1.2–0.5)															**
*^{249}No	T : symmetrized from 54.0(+13.9–9.2)															**
^{250}Cm	72990	10					8300#	y		0^+	01			1966	SF$\approx$74; $\alpha\approx$18; $\beta^-\approx$8	
^{250}Bk	72950	4					3.212	h	0.005	2^-	01			1954	β^-=100	
^{250}Bk^m	72986	4	35.59	0.10			29	μs	1	4^+	01	08Ah02	EJ	1966	IT=100	
^{250}Bk^n	73034	4	84.1	2.1	AD		213	μs	8	7^+	01	08Ah02	EJ	1972	IT ?	
^{250}Cf	71170.4	1.5					13.08	y	0.09	0^+	01			1954	$\alpha\approx$100; SF=0.077 3	
^{250}Es	73230#	100#				*	8.6	h	0.1	(6^+)	01			1956	β^+>97; α ?	
^{250}Es^m	73430#	180#	200#	150#		*	2.22	h	0.05	$1^{(-)}$	01			1970	$\beta^+\approx$100; α ?	
^{250}Fm	74072	8					30.4	m	1.5	0^+	01	06Ba09	T	1954	α>90; ε<10; SF=0.0069 10	*
^{250}Fm^m	75271	8	1199.2	1.0			1.92	s	0.05	(8^-)	01	08Gr17	ETJ	1973	IT>80; α<20; β^+ ?; SF<8.2E-5	
^{250}Md	78630#	300#					52	s	5		01	08An16	TD	1973	β^+=93 1; α=7 1; β^+SF=0.02	*
^{250}No	81560#	200#					5.0	μs	0.6	0^+	06	06Pe17	TD	2003	SF$\approx$100; α<2.1; β^+=0.00025#	*
^{250}No^m	82610#	280#	1050#	200#			51	μs	18	(6^+)	06	06Pe17	T	2001	SF$\approx$100; IT ?; α ?	*
*^{250}Fm	T : others not used 06Fo02=18(+13–6) 66Ak01=30(3)															**
*^{250}Md	T : average 08An16=50(+10–7) 73Es01=52(6)															**
*^{250}Md	D : other recent 06Fo02 β^+=91(+7–19)%; α=9(+19–7)%															**
*^{250}No	T : average 06Pe17=3.7(+1.1–0.8) 03Be18=5.6(+0.9–0.7)															**
*^{250}No^m	T : average 06Pe17=43(+22–15) 03Be18=46(+22–14) 01Og08=36(+11–6)															**
^{251}Cm	76648	23					16.8	m	0.2	$(1/2^+)$	13			1978	β^-=100	
^{251}Bk	75228	11					55.6	m	1.1	$(3/2^-)$	13			1967	β^-=100	
^{251}Bk^m	75264	11	35.5	1.3			58	μs	4	$7/2^+$#	13			1966	IT=100	
^{251}Cf	74135	4					900	y	40	$1/2^+$	13			1954	$\alpha\approx$100; SF ?	
^{251}Cf^m	74505	4	370.47	0.03			1.3	μs	0.1	$11/2^-$	13			1971	IT=100	
^{251}Es	74512	6					33	h	1	$3/2^-$	13			1956	ε ?; α=0.5 2	
^{251}Fm	75954	15					5.30	h	0.08	$(9/2^-)$	13			1957	β^+=98.20 13; α=1.80 13	
^{251}Fm^m	76154	15	200.00	0.10			21.1	μs	1.9	$5/2^+$	13			1970	IT=100	*
^{251}Md	78967	19					4.21	m	0.23	$(7/2^-)$	13	06Ch52	TD	1973	β^+ ?; α=10 1	*
^{251}Md^p	79020	18	53	8	AD					$(1/2^-)$	13			2006	IT ?	
^{251}No	82850#	110#					800	ms	10	$(7/2^+)$	13	06He27	J	1967	α=83 16; β^+ ?; SF<0.3	*
^{251}No^m	82960#	110#	106	6			1.02	s	0.03	$(1/2^+)$	13			1997	α=100	
^{251}No^n	84600#	120#	1750	50			2	μs			13			2006	IT ?	*
^{251}Lr	87730#	300#					150#	μs							β^+ ?; α ?	
*^{251}Fm^m	T : 11As03=21.1(1.9) 06He20=21(3) 71Di03=15.2(2.3)															**
*^{251}Fm^m	E : 11As03=200.09(0.11) 06He20=199.9(0.3)															**
*^{251}Md	T : average 06Ch52=4.27(0.26) 73Es01=4.0(0.5)															**
*^{251}No	D : symmetrized from 01He35 α=91(+9–22)%															**
*^{251}No^n	E : 1699.7(0.8) + x ; x estimated 50(50)															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{252}Cm	79060#	300#					1#	m	<2d	0^+	06	66Rg01	I		β^- ?	
^{252}Bk	78540#	200#					1.8	m	0.5		06	92Kr.A	TD	1992	β^-=?; α ?	
^{252}Cf	76034.6	2.4					2.645	y	0.008	0^+	06			1954	α=96.908 8; SF=3.092 8	
^{252}Es	77290	50					471.7	d	1.9	(4^+)	06	FGK12a	J	1956	α=78 2; ε=22 2	∗
^{252}Fm	76816	5					25.39	h	0.04	0^+	06			1956	$\alpha\approx$100; SF=0.0023 2; 2β^+ ?	
^{252}Md	80510#	130#					2.3	m	0.8		06			1973	β^+>50; α ?	
^{252}Md^p	80550	80	40#	100#						*am*						
^{252}No	82871	9					2.45	s	0.02	0^+	06	11Ga19	T	1967	α>66.7 6; SF=32.2 5; β^+<1.1 4	∗
^{252}No^m	84126	9	1254.5	0.7			109	ms	4	(8^-)		11Lo06	T	2007	IT=100	∗
^{252}Lr	88740#	240#					369	ms	75		06	08Ne01	TD	2001	β^+=71#; α=?; SF<1	∗
^{252}Lr^p	88910#	240#	170	30	AD											

∗^{252}Es J : strong direct ε feeding to 3^+; known structures in TNN ∗∗
∗^{252}No T : average 11Ga19=2.47(0.02) 01Og08=2.44(0.04) ∗∗
∗^{252}No T : others 12Sv02=2.3(0.1) 04He28=2.52(0.22) 03Be18=2.38(+0.26–0.22) ∗∗
∗^{252}No D : SF 01Og08=32.2(0.5)%; other 11Ga19=29.3(0.5)% ∗∗
∗^{252}No^m E : average 08Ro21=1255(1) 07Su19=1254(1) ∗∗
∗^{252}No^m T : average 11Lo06=110(8) 08Ro21=109(6) 07Su19=110(10) ∗∗
∗^{252}No^m J : from 08Ro21 based on comparison with theory; other 07Su19=(8^+) ∗∗
∗^{252}Lr T : average 08Ne01=270(+180–80) 01He35=360(+110–70) ∗∗

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{253}Bk	80930#	360#					10#	m			13	91Kr.A	I	1991	β^- ?	∗
^{253}Cf	79302	4					17.81	d	0.08	$(7/2^+)$	13			1954	$\beta^-\approx$100; α=0.31 4	
^{253}Es	79010.5	1.2					20.47	d	0.03	$7/2^+$	13	05Ah03	D	1954	α=100; SF=10e–6 1	∗
^{253}Fm	79345.7	2.9					3.00	d	0.12	$(1/2)^+$	13			1957	ε=88 1; α=12 1	
^{253}Fm^m	79697	7	351	6			560	ns	60	$(11/2^-)$	13	11An13	ETJ	2011	IT=100	∗
^{253}Md	81170#	30#					12	m	8	$(7/2^-)$	13			1992	$\beta^+\approx$100; α=0.6#	∗
^{253}Md^p	81230#	40#	60	30						$1/2^-$#	13			1971	IT ?	
^{253}No	84359	7					1.56	m	0.02	$(9/2^-)$	13			1967	α=55 3; β^+ ?; SF=0.001#	∗
^{253}No^m	84526	7	167.34	0.45			30.3	μs	1.6	$(5/2^+)$	13	09He23	T	1973	α=?	∗
^{253}No^n	85560	110	1200	110			706	μs	24	$(25/2^+)$		11Lo06	TJ	2011	IT ?	∗
^{253}No^p	85800	200	1440	200			627	μs	5		13					∗
^{253}Lr	88580#	200#				∗	632	ms	46	$(7/2^-)$	13	01He35	TJD	1985	α=90 10; SF=2.6 21; β^+=1#	∗
^{253}Lr^m	88610#	230#	30#	100#		∗	1.32	s	0.14	$(1/2^-)$	13	09He20	TJD	1985	α=90 10; SF=8 5; β^+=1#	∗
^{253}Rf	93560#	410#				∗	13	ms	5	$(7/2)^{(+\#)}$	06	95Ho.B	TJ	1997	SF=?; α ?	∗
^{253}Rf^m	93760#	440#	200#	150#		∗	52	μs	14	$(1/2)^{(-\#)}$	06	97He29	J	1995	SF=?; α=5#	∗

∗^{253}Bk I : possible identification in 91Kr.A; needs confirmation ∗∗
∗^{253}Es D : SF=8.7(0.3)e–6% from ENSDF'99 : from α/SF=1.15(0.03)e7 (1965Me02) ∗∗
∗^{253}Fm^m E : 211 keV above $(7/2^+)$ level at 130-150 keV ∗∗
∗^{253}Md T : symmetrized from 6.4(+11.6–3.6) ∗∗
∗^{253}No T : average 09He23=1.56(0.02) m 09Qi04=1.57(+0.18–0.15) m 67Mi03=95(10) s ∗∗
∗^{253}No T : and 67Gh01=105(20) s ∗∗
∗^{253}No J : from 11Lo06 and 10St14 ∗∗
∗^{253}No D : ε/e$^+$=0.45(0.03) ∗∗
∗^{253}No^m E : average 11An13=167.5(0.5) 10St14=166.7(1.0) ∗∗
∗^{253}No^m T : average 09He23=28(3) 07Lo11=31.1(2.1) 73Be33=31.3(4.1); ∗∗
∗^{253}No^m T : others 11An13=22.7(0.5) and 10St14=24(2) disagree ∗∗
∗^{253}No^n E : greater than 1011 and less than 1380 keV ∗∗
∗^{253}No^n T : 11Lo06=706(24) 11An13=627(5) 07Lo11=970(210) ∗∗
∗^{253}No^n T : possibly two isomers with 792(43) μs and 641(23) μs in 11Lo06 ∗∗
∗^{253}No^n T : possibly two isomers with 650(15) μs and 552(15) μs in 11An13 ∗∗
∗^{253}No^p E : ENSDF=1440 + x, x unknown ∗∗
∗^{253}Lr T : average 09He20=670(60) 01He35=570(+70–60) ∗∗
∗^{253}Lr D : symmetrized from SF=1.3(+3.0–1.0)% ∗∗
∗^{253}Lr^m T : supersedes 01He35=1.49(+0.30–0.21); other 10He11=1.2(+0.7–0.4) ∗∗
∗^{253}Rf I : the state with ≈1.8 s reported in earlier ENSDF is not confirmed ∗∗
∗^{253}Rf T : symmetrized from 11(+6–3) I : ENSDF06 reported 253Rf ground-state and m ∗∗
∗^{253}Rf^m T : symmetrized from 48(+17–10) ∗∗

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{254}Bk	84390#	300#						1#	m			05				β^- ?	
^{254}Cf	81341	11						60.5	d	0.2	0^+	05			1955	SF≈100; α=0.31 2; 2β^- ?	
^{254}Es	81991	4						275.7	d	0.5	(7^+)	05			1954	α≈100; ε=0.03#; β^-=1.74e–4 8; SF<3e–6	
^{254}Es^m	82075	3	84.2	2.5	AD			39.3	h	0.2	2^+	05			1954	β^-=98 2; IT<3; α=0.32 1; ε=0.076 7; …	*
^{254}Fm	80902.8	2.4						3.240	h	0.002	0^+	05			1954	α≈100; SF=0.0592 3	
^{254}Md	83450#	100#				*		10	m	3	0^-#	05			1970	β^+≈100; α ?	
^{254}Md^m	83500#	140#	50#	100#		*		28	m	8	3^-#	05			1970	β^+≈100; α ?	
^{254}No	84723	10						51.2	s	0.4	0^+	05	06He19	T	1966	α=90 1; β^+=10 1; SF=0.23 1	*
^{254}No^m	86018	10	1295	2				264.9	ms	1.4	(8^-)	05	11Lo06	T	1973	IT>80; SF=0.020 12; α=0.01	*
^{254}No^n	87940#	300#	3220#	300#				183.8	μs	1.6	(16^+)		10He10	ETD	2006	IT=100; SF<0.012	*
^{254}Lr	89870#	300#						17.1	s	1.8		05	08An16	TD	1981	α=72 2; β^+=28 2; SF ?	*
^{254}Lr^p	89940#	310#	60	50	AD												
^{254}Lr^q	90090#	330#	220#	120#													
^{254}Rf	93200#	280#						23.2	μs	1.0	0^+	05	15Da12	T	1997	SF=?; α<1.5	*
^{254}Rf^m	94500#	340#	1300#	200#				4.7	μs	1.1	(8^-)		15Da12	JT	2015	IT=100; SF ?	
^{254}Rf^n	95200#	570#	2000#	500#				247	μs	73	(16^+)		15Da12	JT	2015	IT=100	

*^{254}Es^m D : …; SF<0.045 **
*^{254}No D : from 10He10 **
*^{254}No^m T : average 11Lo06=259(17) 10Cl01=263(2) 10He10=275(7) 06He19=266(2) **
*^{254}No^m T : 06Ta19=266(10); other 73Gh03=280(40) **
*^{254}No^n T : average 06He19=184(3) 10He10=198(13) 10Cl01=184(2) 06Ta19=171(9) **
*^{254}No^n E : 2917(3) + x ; x estimated 300#300; 10Cl01=2930(2) but their level **
*^{254}No^n E : scheme is disputed J : from 06He19 **
*^{254}Lr T : average 08An16=18(2) 01Ga20=13.4(4.2); 85He22=13(+3–2) same group; other **
*^{254}Lr T : 06Fo02=22(+9–6) D : not used 06Fo02 α=60(+11–15)%; β^+=40(+15–11)% **
*^{254}Rf T : average 15Da12=23.2(1.1) 97He29=23(3); other 08Dr05=29.6(+0.7–0.6) **

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{255}Cf	84810#	200#						85	m	18	$(7/2^+)$	13			1981	β^-=100; SF<0.001#; α=2e–7#	
^{255}Es	84089	11						39.8	d	1.2	$(7/2^+)$	13			1954	β^-=92.0 4; α=8.0 4; SF=0.0041 2	
^{255}Fm	83800	4						20.07	h	0.07	$7/2^+$	13			1954	α=100; SF=2.4e–5 10	
^{255}Md	84843	7						27	m	2	$(7/2^-)$	13			1958	β^+=93 1; α=7 1; SF<0.15	
^{255}Md^p	84850#	70#	10#	70#							$1/2^-$#	13					
^{255}No	86807	15						3.52	m	0.18	$(1/2^+)$	13	11As03	TJ	1967	β^+=70 5; α=30 5	
^{255}No^m	87020#	100#	210#	100#				1#	s		$11/2^-$#						
^{255}No^p	86910#	70#	100#	70#	Nm						$(7/2^+)$						
^{255}Lr	89947	18						31.1	s	1.1	$(1/2^-)$	13	06Ch52	TJ	1971	α=99.7 1; β^+=0.3 1; SF<0.1	
^{255}Lr^m	89988	19	41	8	AD			2.54	s	0.05	$(7/2^-)$	13	06Ch52	J	2006	IT≈60; α≈40	
^{255}Lr^n	90741	22	794	12				< 1	μs		$(15/2^+)$	13			2009	IT=100	*
^{255}Lr^p	91410	22	1463	12				1.70	ms	0.03	$(25/2^+)$	13			2008	IT=100; α<0.15	*
^{255}Rf	94330#	120#						1.66	s	0.07	$(9/2^-)$	13	15An05	D	1975	SF=45 3; α=48 3; β^+<1	*
^{255}Rf^m	94480#	120#	150	22	AD			50	μs	17	$(5/2^+)$		15An05	ETJ	2015	IT=100	
^{255}Db	99590#	360#						1.7	s	0.5		13			1977	α ?; SF≈20	*

*^{255}Lr^n E : 740.0 keV above $9/2^+$, which is <30 above 255Lrm **
*^{255}Lr^p E : 1408.6 keV above $9/2^+$, which is <30 above 255Lrm **
*^{255}Rf T : average 06He27=1.68(0.09) 01He35=1.64(0.11) D : 15An05 SF=45 3; α=48 3 **
*^{255}Db T : symmetrized from 1.6(+0.6–0.4) **

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{256}Cf	87040#	310#						12.3	m	1.2	0^+	99			1980	SF=100; α=6.2e–7#; 2β^- ?	
^{256}Es	87190#	100#				*		25.4	m	2.4	$(1^+,0^-)$	99			1981	β^-=100	
^{256}Es^m	87190#	140#	0#	100#		*		7.6	h		(8^+)	99			1976	β^-≈100; β^-SF=0.002	
^{256}Fm	85487	6						157.6	m	1.3	0^+	99			1955	SF=91.9 3; α=8.1 3	
^{256}Md	87460#	120#				*	&	30#	m		7^-#					β^+ ?; α ?; SF ?	
^{256}Md^m	87620	70	160#	100#		*	&	77	m	2	(1^-)	99	FGK12b	I	1955	β^+=?; α=9.2 7; SF<3	*
^{256}Md^p	87700#	120#	240#	140#							*am*						
^{256}No	87822	8						2.91	s	0.05	0^+	99			1963	α≈100; SF=0.53 6; ε<0.01#	
^{256}Lr	91750	80						27	s	3		99			1965	α=85 10; β^+=15 10; SF<0.03	
^{256}Lr^p	91980#	90#	230#	40#													
^{256}Rf	94222	18						6.67	ms	0.10	0^+	14			1975	SF=?; α=0.32 17	*
^{256}Rf^m	95340#	100#	1120#	100#				25	μs	2	(5^-)	14			2009	IT=100; SF ?	
^{256}Rf^n	95620#	100#	1400#	100#				17	μs	2	(8^-)	14			2009	IT=100; SF ?	
^{256}Rf^p	96620#	200#	2400#	200#				27	μs	5		14			2009	IT=100; SF ?	
^{256}Db	100500#	240#						1.7	s	0.4		16	01He35	TD	2001	α=70 11; β^+=36 12; SF=?	*

*^{256}Md^m I : Following the Gallagher-Moskowsky rule, this should be the ground-state **
*^{256}Rf D : other 10St14 SF=97(+2–6)% **
*^{256}Db T : symmetrized from 01He35=1.6(+0.5–0.3); other 83Og.A=2.6(+1.4–0.8) **
*^{256}Db D : 01He35 β^+=36(12)% 08Ne01 α=70(11)% **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{257}Es	89400#	410#					7.7	d	0.2	7/2$^+$#	13			1987	β^-=100; α=4e–4#	
^{257}Fm	88590	4					100.5	d	0.2	(9/2$^+$)	13			1964	$\alpha\approx$100; SF=0.210 4	
^{257}Md	88993.1	1.6					5.52	h	0.05	(7/2$^-$)	13			1965	ε=85 3; α=15 3; SF<1	
^{257}No	90247	7					24.5	s	0.5	(3/2$^+$)	13	02Ho11	D	1967	α=?; β^+=15 8	
^{257}No^p	90550#	110#	300#	110#						9/2$^+$#*am*						
^{257}Lr	92670#	40#					6.0	s	0.4	(1/2$^-$)	13	10St14	T	1971	$\alpha\approx$100; β^+=0.01#; SF=0.001#	*
^{257}Lr^p	92820#	110#	150#	100#						*am*	13					
^{257}Rf	95866	11					4.82	s	0.13	(1/2$^+$)	13	FGK10a	J	1969	α=?; β^+=19.4 14; SF=1.3 3	*
^{257}Rf^m	95940	10	73	11	AD		4.3	s	0.2	(11/2$^-$)	13	10Be16	T	1997	α=88 2; β^+=11 2; SF<1.4	*
^{257}Rf^n	97022	10	1155	11	AD		106	μs	6	(21/2$^+$)	13	13Ri07	TJ	2009	IT=100	*
^{257}Db	100210#	200#				*	2.3	s	0.2	(9/2$^+$)	13			1985	α>94; SF<6; β^+=1#	
^{257}Db^m	100350#	230#	140#	110#		*	670	ms	60	(1/2$^-$)	99	01He35	J	1985	α>87; SF<13; β^+=1#	
*^{257}Lr	T : average 10St14=6.3(+0.9–0.7)) and 5.8 (0.5)															**
*^{257}Lr	T : others not used 97He29=3.3(+0.5–0.4) 97He29=4.3(+1.3–0.8)															**
*^{257}Lr	T : 76Be.A=0.646(0.025) 71Es01=0.6(0.1)															**
*^{257}Lr	J : feeding in ε decay of 1/2$^+$ ^{257}Rf; and TNN trends for e–o neighbors															**
*^{257}Rf	J : favorite α to the 1/2$^+$ state at 670 keV D : also 09Qi04 SF=2(1)%															**
*^{257}Rf	T : average 10St14=5.5(0.4) 10Be16=4.8(0.2) 09Qi04=4.7(0.3)															**
*^{257}Rf	T : 85So03=3.8(0.8) 74Be.A=4.8(0.3) 71Gh03=4.8(0.5)															**
*^{257}Rf^m	E : 97He29=118(4) keV from direct comparison of two α lines															**
*^{257}Rf^m	T : average 10Be16=4.6(0.3) 08Dr05=4.1(+0.7–0.6) 97He29=3.9(0.4)															**
*^{257}Rf^m	T : 09Qi04=4.1(+2.4–1.3) maybe to a 11/2$^-$ level in ^{257}Lr															**
*^{257}Rf^n	E : 1082(4) keV above ^{257}Rf^m															**
*^{257}Rf^n	T : 10Be16=134.9 (7.7), reanalyzed in 13Ri07 to 10Be16=110(5)															**
^{258}Es	92700#	400#					3#	m							β^- ?; α ?	
^{258}Fm	90430#	200#					370	μs	14	0$^+$	01	86Hu05	T	1971	SF$\approx$100; α ?	*
^{258}Md	91687	4				*	51.5	d	0.3	8$^-$#	01	93Mo18	D	1970	$\alpha\approx$100; β^+<0.0015; β^-<0.0015	*
^{258}Md^m	91690#	200#	0#	200#		*	57.0	m	0.9	1$^-$#	01	93Mo18	D	1980	ε=?; SF<20; β^-<10#; α<1.2	*
^{258}No	91480#	100#					1.2	ms	0.2	0$^+$	01			1989	SF$\approx$100; α=0.001#; 2β^+ ?	
^{258}Lr	94780#	100#					3.6	s	0.4		01	14Ha04	TD	1971	α=?; β^+=2.6 18	*
^{258}Lr^p	95020#	140#	240#	100#						*am*						
^{258}Rf	96340	30					13.8	ms	0.9	0$^+$	01	08Ga08	T	1969	SF=87 2; α=13 2	*
^{258}Db	101800#	310#				*	4.5	s	0.4		01	09He20	T	1981	α=63 6; β^+=37 6; SF<1#	*
^{258}Db^m	101860#	320#	60#	100#		*	1.9	s	0.5		01	09He20	T	1985	$\beta^+\approx$100; IT ?	
^{258}Sg	105240#	410#					2.7	ms	0.5	0$^+$	01	09Fo02	T	1997	SF=?; α<20	*
*^{258}Fm	T : average 86Hu05=360(20) 71Hu03=380(20) (all 1σ) ENSDF gives 3σ															**
*^{258}Md	D : derived from: "the sum of SF, ε and β^- decay branches < 0.003%" in															**
*^{258}Md	D : 93Mo18 and T(SF)>150000 y, from 86Lo16, thus SF<1e–4%#															**
*^{258}Md^m	D : SF<20% derived from 93Mo18 "the sum of SF and β^- decay branches < 30%"															**
*^{258}Lr	T : symmetrized from 14Ha04=3.54(+0.46–0.36)															**
*^{258}Rf	T : average 08Ga08=14.7(+1.2–1.0) 85So03=13(3) 69Gh01=11(2)															**
*^{258}Db	T : average 09He20=4.3(0.5) 06Fo02=4.8(+1.0–0.8) 01Ga20=4.3(1.1) and															**
*^{258}Db	T : 85He22=4.4(+0.9–0.6)															**
*^{258}Db	D : average β^+ 06Fo02=39(+11–9)% 85He22=33(+9–5)%															**
*^{258}Sg	T : symmetrized from 09Fo02=2.6(+0.6–0.4); combining with earlier work															**
^{259}Fm	93700#	280#					1.5	s	0.2	3/2$^+$#	13			1980	SF=100	
^{259}Md	93620#	200#					1.60	h	0.06	7/2$^-$#	13			1982	SF=?; α<1.3	
^{259}No	94079	7					58	m	5	(9/2$^+$)	13	13As02	J	1973	α=75 4; ε=25 4; SF<10	
^{259}No^p	94310#	150#	230#	150#												
^{259}Lr	95850#	70#					6.2	s	0.3	1/2$^-$#	13			1971	α=78 2; SF=22 2; β^+=0.6#	
^{259}Lr^p	96200#	170#	350#	150#												
^{259}Rf	98360#	70#					2.63	s	0.26	7/2$^+$#	13	08Ga08	T	1969	α=92 2; SF=8 2; β^+=0.3#	*
^{259}Rf^p	98430#	100#	60	70	Nm					(3/2$^+$)						
^{259}Rf^q	98570#	110#	210	90	Nm					(9/2$^+$)						
^{259}Db	101990	50					510	ms	160	9/2$^+$#	13	01Ga20	D	2001	α=100	
^{259}Sg	106520#	120#					402	ms	56	(11/2$^-$)	13	15An05	TJD	1985	α=97 1; SF<3; ε<1	*
^{259}Sg^m	106610#	120#	87	22	AD		226	ms	27	(1/2$^+$)		15An05	TJD		α=97 1; SF>3; ε<1	*
*^{259}Rf	T : average 08Ga08=2.5(+0.4–0.3) 94Gr08=1.7(+0.8–0.5)															**
*^{259}Sg	D : SF=3(1)% assumed from shorter-lived isomeric state															**
*^{259}Sg^m	D : SF=3(1)% assumed from this state															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{260}Fm	95770#	440#			EU			1#	m		0^+					SF ?	*
^{260}Md	96550#	320#						27.8	d	0.8		99	92Lo.B	TD	1989	SF=?; α<5; ε<5; β^-<3.5	*
^{260}No	95610#	200#						106	ms	8	0^+	99			1985	SF=100	
^{260}Lr	98280#	120#						3.0	m	0.5		99			1971	α=80 20; β^+=20 20	
^{260}Rf	99150#	200#						21	ms	1	0^+	99			1985	SF=?; α=2#; ε=0.01#	*
^{260}Db	103670#	90#						1.52	s	0.13		99			1970	α>90.4 6; SF<9.6 6; β^+<2.5	*
^{260}Db^p	103870#	180#	200#	150#													
^{260}Sg	106548	21						4.95	ms	0.33	0^+	99	09He20	T	1984	SF=60 30; α=40 30	*
^{260}Bh	113320#	250#						41	ms	14		16	08Ne01	TD	2008	$\alpha\approx$100; β^+ ?; SF ?	*

*^{260}Fm I : half-life ≈4 ms and SF=100 mode were reported in the 92Lo.B internal **
*^{260}Fm I : report. Not confirmed in subsequent experiment by same group (97Lo.A) **
*^{260}Fm I : Discovery of this nuclide is considered unproven **
*^{260}Md T : supersedes 86Hu01=31.8(0.5) of same group **
*^{260}Rf T : also 08Ga08=22.2(+3.0–2.4) 08Go.A=21(+7.3,–4.3) **
*^{260}Db T : also 04Mo26=1.5(+0.8–0.4) 04Ga29=0.89(+0.79–0.35) **
*^{260}Sg T : supersedes 85Mu11=3.6(+0.9–0.6) **
*^{260}Sg D : symmetrized from SF=50(+30–20)% and α=50(+20–30)% **
*^{260}Bh T : symmetrized from 08Ne01=35(+19–9) **

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{261}Md	98580#	510#						40#	m		$7/2^-$#					α ?	
^{261}No	98460#	200#						3#	h		$3/2^+$#					α ?	
^{261}Lr	99560#	200#						39	m	12		99			1987	SF=?; α ?	
^{261}Rf	101320	50				*	&	2.2	s	0.3	$3/2^+$#	15	11Ha13	TD	1970	SF=73 6; α=27 6	*
^{261}Rf^m	101390#	110#	70#	100#		*	&	20	s	4	$9/2^+$#	15	13Mu08	T	1970	α=?; β^+<15; SF<10	*
^{261}Rf^p	101620#	110#	300#	100#													
^{261}Db	104310#	110#						4.7	s	1.0		99	13Su04	TD	1970	SF=73 11; α=?	*
^{261}Db^p	104610#	230#	300#	200#													
^{261}Sg	108005	18						183	ms	5	$(3/2^+)$	99	10St14	TJD	1984	α=98.1 4; β^+=1.3 3; SF=0.6 2	*
^{261}Sg^m	108110#	50#	100#	50#				9.3	μs	1.8	$(11/2^-)$	99	10Be16	TJ	2010	IT=100	*
^{261}Bh	113130#	210#						12.8	ms	3.2	$(5/2^-)$	99	10He11	TJD	1989	α=95 5; SF<5	*

*^{261}Rf T : average 12Ha05=2.6(+0.7–0.5) 11Ha13=1.9(0.4) 08Go.A=2.2(+0.9–0.5) **
*^{261}Rf T : others 08Dv02=3(1) 08Mo09 2 events at 2.97 and 8.3s 02Ho11=4.2(+3.4–1.3) **
*^{261}Rf T : 13Mu08=3.9(3.0) using SF events **
*^{261}Rf D : SF others 12Ha05=82(9)%, 11Ha13=73(6)%, 08Dv02=91% for 11 events **
*^{261}Rf^m T : symmetrized from 19(+5–3); others 08Dv02=20(+110–10) 02Ho11=78(+11–6) **
*^{261}Db T : average 13Su04=4.7(+3.6–1.4) 10St14=4.1(+1.4–0.8) **
*^{261}Db D : observed 11 SF and 4 α decays; uncertainty evaluated by NUBASE **
*^{261}Sg T : average 10St14=184(5) 10Be16=178(14) **
*^{261}Sg^m T : symmetrized from 9.0(+2.0–1.5) **
*^{261}Bh T : symmetrized from 10He11=11.8(+3.9–2.4); others not used 06Fo02=10(+14–5) **
*^{261}Bh T : and 08Ne08=6.7(+3.8–1.8) **

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{262}Md	101630#	500#						3#	m							SF ?; α ?	
^{262}No	100100#	360#						5	ms		0^+	01			1989	SF≈100; α ?	
^{262}Lr	102100#	200#						4	h			01			1987	β^+=?; SF<10; α ?	
^{262}Rf	102390#	220#				*		250	ms	100	0^+	01	08Go.A	TD	1985	SF≈100	*
^{262}Rf^m	103390#	460#	1000#	400#		*		47	ms	5	high		96La11	I	1978	SF=100	*
^{262}Db	106250#	140#						34	s	4		01	14Ha04	TD	1971	SF=52 4; α=?; β^+=3#	*
^{262}Db^p	106300#	160#	50#	70#												α ?	
^{262}Sg	108370	40						10.9	ms	2.3	0^+	01	06Gr24	TD	2001	SF≈100; α ?	*
^{262}Sg^p	109220	90	860	90	AD												
^{262}Bh	114540#	310#						84	ms	11		01	09He20	T	1981	α=?; SF<20	*
^{262}Bh^m	114760#	310#	210	50	AD			9.5	ms	1.6		01	06Fo02	T	1981	α=?; SF<10	*

*^{262}Rf T : symmetrized from 08Go.A=210(+128–58) ms; 7 SF events **
*^{262}Rf T : conflicting 96La11=2.1(0.2) 94La22=1.2(+1.0–0.5) **
*^{262}Rf T : 11Ha13 and 08Go.A suggest these activities belong to ^{261}Rf **
*^{262}Rf D : this suggestion contradicts 96La11 α<0.8; not adopted by NUBASE **
*^{262}Rf^m I : assigned in 96La11 to K-isomeric state T : 85So03=47(5) **
*^{262}Db T : symmetrized from 14Ha04=33.8(+4.4–3.5) **
*^{262}Sg T : 06Gr24=15(+5–3) 01Ho06=6.9(+3.8–1.8) D : no α observed α<16% **
*^{262}Bh T : average 09He20=83(14) 06Fo02=84(+21–16) **
*^{262}Bh T : other 08Ne08(10 events)=120(+55–29) not used **
*^{262}Bh^m T : 06Fo02=9.6(+3.6–2.4) 97Ho14(11 events)=12.2(+5.5–2.8) 89Mu09=8.0(2.1) **
*^{262}Bh^m T : also 09He20=22(4) 08Ne08(4 events)=16(+14–5) not used **

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{263}No	103130#	490#					20#	m							α ?; SF ?	
^{263}Lr	103730#	280#					5#	h							α ?	
^{263}Rf	104760#	150#					11	m	3	$3/2^+$#	99	93Gr.C	TD	2003	SF=?; α=30	*
^{263}Rf^p	105060#	250#	300#	200#												
^{263}Db	107110#	170#					29	s	9		99	92Kr01	D	1992	SF=56 14; α=?; β^+=6.9 16	*
^{263}Db^p	107370#	260#	260#	200#												
^{263}Sg	110190#	100#				*	940	ms	140	$7/2^+$#	99	06Gr24	TD	1974	α=87 8; SF=13 8	*
^{263}Sg^m	110240#	100#	51	19	Nm	*	420	ms	100	$3/2^+$#	99	04Fo08	T	1995	α=?; IT ?	*
^{263}Sg^p	110290#	100#	100	30	AD											
^{263}Bh	114500#	310#					200#	ms			99				α ?	
^{263}Hs	119680#	130#					760	μs	40	$3/2^+$#	99	09Dr02	TD	2009	α=?; SF<8.4	*
^{263}Hs^m	120000#	130#	320	70	AD		760	μs	40	$11/2^-$#		09Dr02	TD	2009	α=?; SF ?	
*^{263}Rf	T : average 03Kr20=24(+19–7) m 93Gr.C=500(+300–200) s 92Cz.A=600(+300–200) s															**
*^{263}Rf	T : also one SF event 08Dv02=8(+40–4) s															**
*^{263}Db	D : SF from 92Kr01=57(+13–15)%; β^+ average 03Kr20=3(+4–1)% 93Gr.C=8(2)%															**
*^{263}Db	T : Possibly a candidate for the 54(+98–21) s SF decay observed in 98Ik02															**
*^{263}Db	T : symmetrized from 27(+10–7)															**
*^{263}Sg	T : average 06Gr24=820(+370–190) 94Gr08=553(+336–152) 74Gh04=900(200); all															**
*^{263}Sg	T : produced via direct production mechanisms															**
*^{263}Sg^m	T : average 04Fo08=290(+170–90) 04Mo40=549(+300–143) ms 03Gi05=222(+404–87)															**
*^{263}Sg^m	T : and 98Ho13=310(+160–80) ms; all produced via α decay of parent															**
*^{263}Sg^m	T : also 10Ni14 at τ=702ms via α-decay of parent, but with low energy															**
*^{263}Hs	T : symmetrized from 740(+48–21) 6 events for both states (low statistics)															**
*^{263}Hs	D : 09Dr02 no SF observed															**
^{264}No	105010#	590#					1#	m		0^+					α ?; SF ?	
^{264}Lr	106380#	440#					10#	h							α ?; SF ?	
^{264}Rf	106080#	360#					1#	h		0^+					α ?	
^{264}Db	109360#	240#					3#	m							α ?	
^{264}Sg	110780#	280#					47	ms	20	0^+	06			2006	SF≈100; α ?	*
^{264}Bh	116060#	180#					1.07	s	0.21		99	04Mo26	TD	1995	α=86; SF=14; β^+ ?	*
^{264}Bh^p	116290#	230#	230#	150#						*am*						
^{264}Hs	119563	29					540	μs	300	0^+	99	95Ho.B	T	1986	α≈50; SF≈50	*
*^{264}Sg	T : symmetrized from 37(+27–11); also 10Ni14(1 event)=86.4 ms															**
*^{264}Sg	D : no α observed α<36%															**
*^{264}Bh	T : average 04Mo26=0.9(+0.3–0.2) 04Ga29=1.17(+0.88–0.44) and															**
*^{264}Bh	T : 02Ho11=1.02(+0.69–0.29)															**
*^{264}Hs	T : 95Ho.B (2 events 76 μs and 825 μs) 87Mu15 (1 event 80 μs); average of the															**
*^{264}Hs	T : 3 events: 327(+448–120) μs, see 84Sc13															**
^{265}Lr	108230#	550#					10#	h							α ?; SF ?	
^{265}Rf	108690#	360#					1.6	m	0.8	$3/2^+$#	15	15Ut02	T	2010	SF≈100; α ?	*
^{265}Db	110480#	220#					15#	m							α ?	
^{265}Sg	112790#	120#				&	9.2	s	1.6	$9/2^+$#	15	12Ha05	T	1994	α>50; SF ?	*
^{265}Sg^m	112860#	120#	60#	160#		&	16.4	s	2.4	$3/2^+$#	15	13Su04	T	1994	α>65 16; SF ?	*
^{265}Bh	116420#	230#					1.19	s	0.52		99	04Ga29	TD	2004	α=?	*
^{265}Hs	120900	24					1.96	ms	0.16	$3/2^+$#	99	09He20	T	1984	α≈100; SF<1	*
^{265}Hs^m	121130	24	229	22	AD		360	μs	150	$9/2^+$#	99	09He20	T	1995	α≈100; IT ?	*
^{265}Mt	126680#	450#					2#	ms							α ?	
*^{265}Rf	T : symmetrized from 15Ut02=1.0(+1.2–0.3)															**
*^{265}Sg	T : average 12Ha05=8.5(+2.6,–1.6) 08Du09=8.9(+2.7–1.9)															**
*^{265}Sg^m	T : average 13Su04=20(+15–6) 12Ha05=14.4(+3.7,–2.5) 08Du09=16.2(+4.7–3.5)															**
*^{265}Bh	T : symmetrized from 0.94(+0.70–0.31)															**
*^{265}Hs	T : average 09He20=1.9(0.2) 99He11=2.0(+0.3–0.2)															**
*^{265}Hs^m	T : symmetrized from 300(+200–100); other 99He11=750(+170–120)															**
^{266}Lr	111620#	580#					21	h	14		14			2014	SF=100	*
^{266}Rf	110080#	470#					4#	h		0^+					α ?; SF ?	
^{266}Db	112740#	280#					80	m	70		07	07Og02	T	2007	α ?; SF ?; β^+ ?	*
^{266}Sg	113620#	250#					390	ms	110	0^+	05	13Og03	TD	2006	SF=100	*
^{266}Bh	118100#	160#					2.5	s	1.6		05	08Mo09	T	2000	α≈100; β^+ ?; SF ?	*
^{266}Hs	121140	40					3.02	ms	0.54	0^+	05	11Ac.A	T	2001	α=?; SF≈1.4#	*
^{266}Hs^m	122240	80	1100	70	AD		280	ms	220	9^-#		11Ac.A	T	2011	α=?	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …															
^{266}Mt	127960#	310#				1.2	ms	0.4		05	97Ho14	T	1982	α=?; SF<5.5	*
^{266}Mt^m	129100#	310#	1140	80	AD	6	ms	3			97Ho14	TD	1984	α=100	*
*^{266}Lr	T : symmetrized from 14Kh04=11(+21–5)														**
*^{266}Db	T : one event at 31.74 m, yields 22(+105–10), see 84Sc13														**
*^{266}Sg	T : average 13Og03=280(+190–80) ms 08Dv02=360(+250–100) ms														**
*^{266}Sg	T : 08Dv02 supersedes 06Dv01=444(+444–148)														**
*^{266}Sg	I : 98Tu01=21(+20–12) s 94La22=10-30 s with 18%<α<50% 50%<SF<82% re-assigned														**
*^{266}Sg	I : to ^{265}Sg, see 08Dv02; 10Gr04 one SF event after 23 ms, not trusted														**
*^{266}Bh	T : 2 events at 2.469 and 1.31 s; other 06Qi03=0.66(+0.59–0.26)														**
*^{266}Hs	T : average 11Ac.A=2.97(+0.78–0.51) 01Ho06=2.3(+1.3–0.6)														**
*^{266}Hs^m	T : symmetrized from 11Ac.A=74(+354–34); the possibility in 01Ho06 that														**
*^{266}Hs^m	T : 01Ho06=6.3(+8.6–2.3) is ruled out by the 11Ac.A result														**
*^{266}Mt	T : 10 events yielding 1.01(+0.47–0.24), see 84Sc13														**
*^{266}Mt^m	T : 3 events at 7.8, 2.0 and 5.0 yield 3.4(+4.7–1.3), see 84Sc13														**
^{267}Rf	113440#	580#				2.5	h	1.5		05	06Og05	TD	2004	SF=100	*
^{267}Rf^p	113660#	580#	220#	100#											
^{267}Db	114070#	410#				100	m	60		05	13Ru11	T	2004	SF=100	*
^{267}Sg	115810#	260#				1.8	m	0.7			08Dv02	TD	2008	SF=83; α=17	*
^{267}Sg^p	115880#	280#	70#	100#											
^{267}Bh	118770#	260#				22	s	10		05			2000	α=100	*
^{267}Hs	122650#	100#				55	ms	11	5/2$^+$#	05			1995	α>80; SF ?	*
^{267}Hs^m	122690#	100#	39	24	AD	990	μs	90		05	04Fo08	TD	2004	α=?; IT ?	*
^{267}Mt	127790#	500#				10#	ms							α ?	
^{267}Ds	133880#	140#				10	μs	8	3/2$^+$#	05	95Gh04	T	1995	α=100	*
*^{267}Rf	T : symmetrized from 1.3(+2.3–0.5); supersedes 04Og12 one event at 2.3 h														**
*^{267}Db	T : 13Ru11 one event at 30.6 m and 04Og03 one event at 73														**
*^{267}Sg	T : symmetrized from 80(+60–20) s ; other 99Og.B=19 ms not trusted														**
*^{267}Bh	T : symmetrized from 00Wi15=17(+14–6)														**
*^{267}Hs	T : symmetrized from 52(+13–8)														**
*^{267}Hs^m	T : 04Fo08(2 events)=940(+120–45); other not trusted 04Mo40 (1 event)=803 ms														**
*^{267}Ds	T : one single event, τ=4 μs, thus *T*=2.8(+13.0–1.3), see 84Sc13														**
^{268}Rf	115480#	660#				1#	h		0$^+$					α ?; SF ?	
^{268}Db	117060#	530#				29	h	4		05	13Ru11	T	2004	SF≈100; β^+ ?	*
^{268}Db^p	117210#	530#	150	70											
^{268}Sg	116800#	470#				2#	m		0$^+$					α ?; SF ?	
^{268}Bh	120810#	380#				25#	s							α ?; SF ?	
^{268}Hs	122830#	280#				1.42	s	1.13	0$^+$		10Ni14	TD	2010	α≈100	*
^{268}Mt	129150#	230#				27	ms	6	5$^+$#,6$^+$#	05	04Mo26	T	1995	α=100	*
^{268}Ds	133650#	300#				100#	μs		0$^+$					α ?	
*^{268}Db	T : average 13Ru11=26(+7–5) 13Og01=25.9(+6.2–4.2) 07St18=28(+11–4)														**
*^{268}Db	T : 13Og01 supersedes 12Og02=27.9(+7.8–5.0) 05Og02=29(+9–6) 04Og03=16(+19–6)														**
*^{268}Hs	T : symmetrized from 0.38(+1.8–0.17)														**
*^{268}Mt	T : mean lifetime of 14 events in 04Mo26=30 ms and 6 events in 02Ho11=60 ms														**
^{269}Db	119150#	620#				3#	h							α ?; SF ?	
^{269}Sg	119760#	360#				5	m	3		15	15Ut02	T	2010	α≈100; SF ?	*
^{269}Bh	121480#	370#				1#	m							α ?	
^{269}Hs	124560#	120#				16	s	6	9/2$^+$#	05	13Su04	T	1996	α=100	*
^{269}Mt	129370#	460#				100#	ms							α ?	
^{269}Ds	134830	30				230	μs	110	9/2$^+$#	05	95Ho03	T	1995	α=100	*
*^{269}Sg	T : symmetrized from 15Ut02=3.1(+3.7–1.1)														**
*^{269}Hs	T : average 13Su04=12(+9–4) and 02Ho11 2 events at 19.7s 22.0s, see 84Sc13														**
*^{269}Ds	T : symmetrized from 170(+160–60)														**
^{270}Db	122310#	620#				2.0	h	1.3		10	14Kh04	TD	2010	SF=100	*
^{270}Sg	121490#	560#				3#	m		0$^+$					α ?; SF ?	
^{270}Bh	124230#	290#				3.8	m	3.0		07	07Og02	TD	2007	α=100	*
^{270}Bh^p	124920#	350#	690#	200#											
^{270}Hs	125110#	250#				9	s	4	0$^+$	05	13Og03	T	2003	α=100; SF ?	*
^{270}Mt	130710#	170#				6.3	ms	1.5		05			2004	α≈100	*

… *A*-group is continued on next page …

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)					Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
… *A*-group continued …																	
^{270}Ds	134680	50						205	μs	48	0^+	05	11Ac.A	T	2001	$\alpha\approx$100; SF<0.2	*
^{270}Ds^m	136070	60	1390	60	AD			10	ms	6	$(10)^{(-\#)}$	05			2001	α=?; IT ?	*
*^{270}Db	T : symmetrized from 14Kh04=1.0(+1.9–0.4); other not used 13Og04=17(+15–6)																**
*^{270}Bh	T : symmetrized from 61(+292–28) s																**
*^{270}Hs	T : symmetrized from 13Og03=7.6(+4.9–2.2); other estimated 03Tu05=3.6(+0.8–1.4)																**
*^{270}Mt	T : symmetrized from 5.0(+2.4–0.3)																**
*^{270}Ds	T : average 11Ac.A=200(+70–40) 01Ho06=100(+140–40)																**
*^{270}Ds^m	T : symmetrized from 6.0(+8.2–2.2)																**
^{271}Sg	124760#	590#						3.1	m	1.6		06	06Og05	TD	2004	α=70; SF=30	*
^{271}Bh	125920#	420#						10	m	8		05	13Ru11	TD		α=100	*
^{271}Hs	127740#	280#						10#	s						2008	α ?; SF ?	
^{271}Mt	131100#	330#						400#	ms							α ?	
^{271}Ds	135950#	100#				*	&	90	ms	40	$13/2^-$#	05			1998	α=100	*
^{271}Ds^m	136020#	100#	68	27	AD	*	&	1.7	ms	0.4	$9/2^+$#	05			1995	α=100	*
*^{271}Sg	T : symmetrized from 1.9(+2.4–0.6); supersedes 04Og12=2.4(4.3-1.0) α=50; SF=50																**
*^{271}Bh	T : 13Ru11 one event at 2.6 m																**
*^{271}Ds	T : symmetrized from 69(+56–21)																**
*^{271}Ds^m	T : symmetrized from 1.63(+0.44–0.29)																**
^{272}Sg	126580#	730#						4#	m		0^+					α ?; SF ?	
^{272}Bh	128790#	530#						11.3	s	1.8		05	13Ru11	T	2004	$\alpha\approx$100	*
^{272}Hs	129010#	510#						10#	s		0^+					α ?; SF ?	
^{272}Mt	133580#	490#						400#	ms							α ?; SF ?	
^{272}Ds	136020#	410#						200#	ms		0^+					SF ?	
^{272}Rg	142770#	230#						4.5	ms	1.0	5^+#,6^+#	05	04Mo26	T	1995	α=100	*
*^{272}Bh	T : average 13Ru11=9.2(+3.1–1.8) 13Og01=12.0(+3.1–2.1)																**
*^{272}Bh	T : 13Og01 supersedes 12Og02=8.2(+2.5–1.6)s 04Og03=9.8(+11.7–3.5)s																**
*^{272}Rg	T : mean lifetime of 14 events in 04Mo26=5.5 ms and 6 events in 02Ho11=2.3																**
^{273}Sg	130020#	500#						5#	m							SF ?	
^{273}Bh	130630#	690#						1#	m							α ?; SF ?	
^{273}Hs	131890#	370#						1060	ms	500	$3/2^+$#	15	15Ut02	T	2010	$\alpha\approx$100	*
^{273}Hs^p	132000#	380#	110#	100#												α ?; SF ?	
^{273}Mt	134710#	420#						800#	ms							α ?; SF ?	
^{273}Ds	138360#	130#						240	μs	80	$13/2^-$#	05	13Su04	T	1996	α=100	*
^{273}Ds^m	138560#	130#	198	20	EU			120	ms		$3/2^+$#	05			1996	α=100	
^{273}Rg	142700#	530#						2#	ms							α ?	
*^{273}Hs	T : symmetrized from 15Ut02=760(+710–240)																**
*^{273}Ds	T : average 13Su04=190(+140–60) ENSDF=170(+170–60) for 4 events :																**
*^{273}Ds	T : 08Mo09 2 events at 520 and 40 μs; 02Ho11 at 310; 96Ho13 at 110 μs																**
^{274}Bh	133680#	620#						60	s	30		10	14Kh04	TD	2010	α=100	*
^{274}Hs	133490#	590#						500#	ms		0^+					α ?; SF ?	
^{274}Mt	137250#	350#						850	ms	540		07	07Og02	TD	2007	α=100	*
^{274}Ds	139200#	390#						10#	ms		0^+					α ?; SF ?	
^{274}Rg	144610#	180#						29	ms	18		05	08Mo09	TD	2004	$\alpha\approx$100	*
*^{274}Bh	T : average 14Kh04=30(+54–12) 13Og04=54(+65–19)s																**
*^{274}Mt	T : symmetrized from 440(+810–170)ms																**
*^{274}Rg	T : 2 events at 9.26 and 34.3 ms																**
^{275}Bh	135690#	600#						5#	m							SF ?	
^{275}Hs	136620#	590#						290	ms	150		05	06Og05	TD	2004	α=100	*
^{275}Hs^p	136860#	600#	240#	100#													
^{275}Mt	138830#	420#						117	ms	74		05	13Ru11	T	2004	α=100	*
^{275}Ds	141570#	410#						10#	ms							α ?; SF ?	
^{275}Rg	145300#	520#						5#	ms							α ?	
*^{275}Hs	T : symmetrized from 190(+220–70) ms; supersedes 04Og12=150(+270–60)																**
*^{275}Mt	T : 13Ru11 one event at 51.3 ms and 04Og03 one event at 9.7																**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{276}Hs	138290#	750#					100#	ms		0^+					α ?; SF ?	
^{276}Mt	141320#	530#				*	630	ms	100		05	13Ru11	T	2004	α=100	*
^{276}Mt^m	141570#	540#	250	80	AD	*	10	s	5			13Og01	TD	2012	α=100	*
^{276}Ds	142540#	550#					100#	ms		0^+					α ?; SF ?	
^{276}Rg	147490#	630#					10#	ms							α ?; SF ?	
^{276}Cn	150350#	600#					100#	μs		0^+					α ?; SF ?	
*^{276}Mt	T : average 13Ru11=750(+250–150) 13Og01=540(+140–90)															**
*^{276}Mt	T : 13Og01 supersedes 12Og02=680(+200–120)ms 04Og03=720(+870–250)ms															**
*^{276}Mt^m	T : symmetrized from 6(+8–2) supersedes 12Og02															**
^{277}Hs	141490#	540#					11	ms	9	3/2$^+$#	14	10Du06	TD	2010	SF=100	*
^{277}Hs^m	141590#	550#	100#	100#			110	s	70		14	12Ho12	TD	2012	SF=100	*
^{277}Hs^p	142150#	580#	660#	200#												
^{277}Mt	142970#	700#					9	s	6		14	13Og04	TD	2013	SF=100; α ?	*
^{277}Ds	145140#	380#					6	ms	3	11/2$^+$#	15	15Ut02	T	2010	$\alpha\approx$100; SF ?	*
^{277}Rg	148340#	520#					10#	ms							α ?; SF ?	
^{277}Cn	152400#	140#					850	μs	280	3/2$^+$#	05	13Su04	T	1996	α=100	*
*^{277}Hs	T : symmetrized from 3.0(+14.4–1.4); 99Og10 one SF event at 16.5m, not trusted															**
*^{277}Hs^m	T : (SF 1 event) symmetrized from τ=34(+164–16) s															**
*^{277}Mt	T : symmetrized from 13Og04=5(+9–2) s															**
*^{277}Ds	T : symmetrized from 15Ut02=4.1(+3.7–1.3)															**
*^{277}Cn	T : average 13Su04=610(+460–180) and 4 events : 08Mo09 at 1100 and 1220 μs,															**
*^{277}Cn	T : 02Ho11 at 1406 μs and 96Ho13 at 280 μs															**
^{278}Mt	145740#	620#					7	s	3		10	14Kh04	T	2010	α=100	*
^{278}Mt^p	146210#	650#	470#	200#												
^{278}Ds	146380#	630#					270#	ms		0^+					α ?; SF ?	
^{278}Rg	150520#	360#					8	ms	5		07	07Og02	TD	2007	α=100	*
^{278}Cn	152930#	440#					2#	ms		0^+					α ?; SF ?	
^{278}Ed	158890#	180#					2.3	ms	1.3		05	12Mo25	TD	2004	$\alpha\approx$100	*
*^{278}Mt	T : average 14Kh04=3.6(+6.5–1.4) 13Og04=5.2(+6.2–1.8)s															**
*^{278}Rg	T : symmetrized from 4.2(+7.5–1.7)															**
*^{278}Ed	T : 3 events at 0.344, 4.930 and 0.667 ms; supersedes 08Mo09															**
^{279}Mt	147500#	670#					30#	s							α ?; SF ?	
^{279}Ds	149130#	600#					210	ms	50		05	06Og05	TD	2004	SF=90; α=10	*
^{279}Ds^p	149410#	610#	280#	100#												
^{279}Rg	151780#	420#					180	ms	110		05	13Ru11	T	2004	α=100	*
^{279}Rg^p	151910#	430#	130#	100#												
^{279}Cn	155030#	460#					5#	ms							α ?; SF ?	
^{279}Ed	159240#	700#					1#	ms							α ?; SF ?	
*^{279}Ds	T : symmetrized from 200(+50–40); supersedes 04Og12=180(+50–30) and															**
*^{279}Ds	T : 04Og07=290(+350–100);															**
*^{279}Ds	T : others : 09St21 one SF event at 185 ms, 07Ei02 one SF event at 536 ms															**
*^{279}Rg	T : 13Ru11 one event at 16.1 ms and 04Og03 one event at 170															**
^{280}Ds	150520#	780#					11	s	6	0^+	05	01Og01	TD	1999	SF=100	*
^{280}Rg	153890#	530#					4.3	s	0.7		05	13Ru11	T	2004	α=100	*
^{280}Cn	155700#	580#					5#	ms		0^+					α ?; SF ?	
^{280}Ed	161140#	400#					10#	ms							α ?; SF ?	
*^{280}Ds	T : 3 events at 6.93, 14.3 and 7.4 yield 6.6(+9–2.4), see 84Sc13															**
*^{280}Rg	T : average 13Ru11=6.4(+2.1–1.3) 13Og01=3.61(+0.90–0.60);															**
*^{280}Rg	T : 13Og01 supersedes 12Og02=3.53(+0.99–0.63)ms 04Og03=3.6(+4.3–1.3)ms															**
^{281}Ds	153430#	580#					14	s	4	3/2$^+$#	05	10Du06	TD	2004	SF=85 12; α=15 12	*
^{281}Ds^m	153470#	550#	40#	240#			0.9	s	0.7			12Ho12	TD	2012	α=100	*
^{281}Rg	155300#	810#					24	s	8		10	16Fo16	T	2010	SF=100	*
^{281}Cn	158020#	390#					180	ms	80	3/2$^+$#	15	15Ut02	T	2010	$\alpha\approx$100; SF ?	*
^{281}Ed	161810#	300#					100#	ms							α ?; SF ?	
*^{281}Ds	T : average 10Du06=20(+20–7) 07Og01=11.1(+5.0–2.7); supersedes															**
*^{281}Ds	T : 04Og07=9.6(+5.0–2.5); 99Og10 one α event at 1.6 m, not trusted															**
*^{281}Ds	D : symmetrized from SF=91(+7–16)%; α=9(+16–7)%															**
*^{281}Ds^m	T : symmetrized from 0.25(+1.18–0.11) s															**
*^{281}Rg	T : symmetrized from 16Fo16=21(+10–5), reanalyzed data of 13Og04=17(+6–3),															**
*^{281}Rg	T : 12Og06=26(+25–8), 10Og01=26(+25–8)															**
*^{281}Cn	T : symmetrized from 15Ut02=130(+120–40)															**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{282}Rg	157800#	650#			1.6	m	0.7		05	14Kh04	TD	2010	α=100	*
^{282}Cn	158980#	660#			900	μs	240	0^+	05	06Og05	TD	2004	SF=100	*
^{282}Ed	163730#	360#			140	ms	90		07	07Og02	TD	2007	α=100	*
*^{282}Rg	T : average 14Kh04=3.1(+5.7–1.2)m 13Og04=59(+55–19)s													**
*^{282}Cn	T : symmetrized from SF=820(+300–180); supersedes 04Og12=500(+330–140)													**
*^{282}Cn	T : also 10El06 one SF event at 522 μs; 09St21 one SF at 3600 μs													**
*^{282}Ed	T : symmetrized from 73(+134–29)													**
^{283}Rg	159280#	700#			30#	s							α ?; SF ?	
^{283}Cn	161490#	610#			4.1	s	1.0		06	06Og05	TD	2004	α=?; SF<10	*
^{283}Ed	164710#	440#			160	ms	100		05	13Ru11	T	2004	α=100	*
*^{283}Cn	T : symmetrized from 3.8(+1.2–0.7); supersedes 04Og12=4.0(+1.3–0.7) and													**
*^{283}Cn	T : 04Og07=6.1(+7.2–2.2); other 07Ho18=6.9(+6.9–2.3), SF=50													**
*^{283}Cn	T : 09St21 one α event at 1.92 s													**
*^{283}Cn	T : Four SF events at 99Og07=9.3 m, 3.8 m, 99Og05=3.0 m, 0.9 m, not trusted													**
*^{283}Ed	T : 13Ru11 one event at 68.4 ms and 04Og03 one event at 100													**
^{284}Cn	162550#	810#			104	ms	20	0^+	05	10Du06	TD	2004	SF=100	*
^{284}Ed	166590#	530#			930	ms	140		05	13Ru11	T	2004	α=100	*
^{284}Fl	168920#	660#			3.3	ms	1.4	0^+	15	15Ut02	TD	2015	SF≈100; α ?	*
*^{284}Cn	T : average 10Du06=101(+50–25) 07Og01=97(+31–19); supersedes													**
*^{284}Cn	T : 04Og12=101(+41–22) and 04Og07=98(+41–23)													**
*^{284}Cn	TD : 01Og01 3 α's at 53.9 s, 10.3 s, 18.0 s, not trusted													**
*^{284}Ed	T : average 13Ru11=810(+230–150) 13Og01=970(+250–170);													**
*^{284}Ed	T : 13Og01 supersedes 12Og02=940(+290–180)ms 04Og03=480(+580–170)ms													**
*^{284}Fl	T : 5 events at 0.555, 8.588, 0.857, 7.246 and 0.529 ms													**
^{285}Cn	165170#	580#			32	s	9	5/2$^+$#	05	10Du06	TD	2004	α=100	*
^{285}Cn^m	165740#	560#	570#	250#	15	s	12			12Ho12	TD	2012	α=100	*
^{285}Ed	167730#	810#			3.3	s	1.1		10	16Fo16	T	2010	α=100	*
^{285}Fl	171000#	390#			210	ms	100		15	15Ut02	T	2010	α≈100; SF ?	*
*^{285}Cn	T : average 10Du06=30(+30–10) 07Og01=29(+13–7); supersedes													**
*^{285}Cn	T : 04Og07=34(+17–9); 99Og10 one event at 15.4 m, not trusted													**
*^{285}Cn^m	T : symmetrized from 4.0(+19.1–1.8) s													**
*^{285}Ed	T : symmetrized from 16Fo16=2.9(+1.4–0.7), reanalyzed data of													**
*^{285}Ed	T : 13Og04=4.2(+1.4–0.8), 12Og06=4.9(+6.7–1.8), 10Og01=5.5(+5.0–1.8)													**
*^{285}Fl	T : symmetrized from 15Ut02=150(+140–50)													**
^{286}Ed	170010#	660#			7	s	3		10	14Kh04	T	2010	α=100	*
^{286}Fl	171770#	660#			140	ms	30	0^+	05	06Og05	TD	2004	SF≈60; α≈40	*
*^{286}Ed	T : average 14Kh04=2.9(+5.3–1.1) 13Og04=13(+12–4)													**
*^{286}Fl	T : symmetrized from 130(+40–20); supersedes 04Og12=160(+70–30) and													**
*^{286}Fl	T : 04Og07=290(+540–110); also one α each 10El06=76 ms, 09St21=301 ms													**
^{287}Ed	171250#	730#			2#	m							α ?; SF ?	
^{287}Fl	174070#	610#			520	ms	130		05	06Og05	TD	2004	α=100	*
^{287}Ef	177900#	440#			95	ms	60		05	13Ru11	T	2004	α=100	*
*^{287}Fl	T : symmetrized from 480(+160–90); supersedes 04Og12=510(+180–100)													**
*^{287}Fl	T : supersedes 04Og07=1.1(+1.3–0.4); 99Og07 2 evts 1.32, 14.4 s not trusted													**
*^{287}Fl	T : also 09St21 one α event at 815 ms													**
*^{287}Ef	T : 13Ru11 one event at 67.6 ms and 04Og03 one event at 32 ms													**
^{288}Fl	175040#	810#			750	ms	140	0^+	05	11Ga19	TD	2004	α=100	*
^{288}Ef	179770#	540#			170	ms	25		05	13Ru11	T	2004	α=100	*
*^{288}Fl	T : average 11Ga19=520(+220–130) 07Og01=800(+270–160); supersedes													**
*^{288}Fl	T : 10Du06=470(+240–120); 04Og12=800(+320–180) and 04Og07=630(+270–140)													**
*^{288}Fl	T : 01Og01=1800(+2100–600) re-assigned to ^{289}Fl													**
*^{288}Ef	T : average 13Ru11=150(+43–28) 13Og01=171(+42–28);													**
*^{288}Ef	T : 13Og01 supersedes 12Og02=173(+52–32) ms and 04Og03=87(+105–30) ms													**

Table I. The NUBASE2016 table (continued, Explanation of Table on page 18)

Nuclide	Mass excess (keV)		Excitation energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{289}Fl	177560#	580#				2.4	s	0.6	5/2$^+$#	05	10Du06	TD	2004	α=100	*
^{289}Fl^m	178330#	560#	770#	260#		1.1	s	0.8			12Ho12	TD	2012	α=100	*
^{289}Ef	180670#	810#				310	ms	90		10	16Fo16	T	2010	α=100	*
^{289}Lv	184530#	490#			RN	2#	ms		5/2$^+$#	00	02Ni10	I		α ?	*
*^{289}Fl	T : average 10Du06=0.97(+0.97–0.32) 07Og01=2.6(+1.2–0.7);														**
*^{289}Fl	T : supersedes 04Og07=2.7(+1.4–0.7);														**
*^{289}Fl	T : 99Og10 one event at 30.4 s, not trusted														**
*^{289}Fl^m	T : symmetrized from 0.28(+1.35–0.13) s														**
*^{289}Ef	T : symmetrized from 16Fo16=270(+120–60), reanalyzed data of														**
*^{289}Ef	T : 13Og04=330(+120–80), 12Og06=430(+590–160), 10Og01=220(+260–80)														**
*^{289}Lv	T : 99Ni03=600(+860–300) α decay retracted by authors in 02Ni10														**
^{290}Ef	182890#	660#				410	ms	190		10	13Og04	T	2010	α=100	*
^{290}Lv	185200#	660#				8	ms	3	0$^+$	05	06Og05	TD	2004	α=100	*
*^{290}Ef	T : symmetrized from 13Og04=240(+280–90); other 14Kh04=1300(+2300–500)														**
*^{290}Lv	T : symmetrized from 7.1(+3.2–1.7); supersedes 04Og07=15(+26–6)														**
^{291}Ef	183990#	780#				1#	s							α ?; SF ?	
^{291}Lv	187390#	610#				28	ms	15		05	06Og05	TD	2004	α=100	*
^{291}Eh	191800#	590#				2#	ms							α ?; SF ?	
*^{291}Lv	T : symmetrized from 18(+22–6); supersedes 04Og07=6.3(+11.6–2.5)														**
^{292}Lv	188240#	810#				24	ms	12	0$^+$	05	04Og12	TD	2004	α=100	*
^{292}Eh	193580#	670#				10#	ms							α ?; SF ?	
*^{292}Lv	T : symmetrized from 18(+16–6)														**
*^{292}Lv	T : 01Og01 reported one event at 46.9 ms, re-assigned to next isotope														**
^{293}Lv	190670#	590#				80	ms	40		05	07Og01	TD	2004	α=100	*
^{293}Lv^m	191410#	560#	740#	270#		80	ms	60			12Ho12	TD	2012	α=100	*
^{293}Eh	194390#	810#				21	ms	6		10	16Fo16	T	2010	α=100	*
^{293}Ei	198870#	700#			RN	1#	ms		1/2$^+$#	00	02Ni10	I		α ?	*
*^{293}Lv	T : symmetrized from 61(+57–20); supersedes 04Og07=53(+62–19)														**
*^{293}Lv^m	T : symmetrized from 20(+96–9) ms														**
*^{293}Eh	T : symmetrized from 16Fo16=18(+8–4), reanalyzed data of														**
*^{293}Eh	T : 13Og04=22(+8–4), 12Og06=27(+12–6), 10Og01=14(+11–4)														**
*^{293}Ei	T : 99Ni03=120(+180–60) α decay retracted by authors in 02Ni10														**
^{294}Eh	196520#	660#				70	ms	30		10	14Kh04	T	2010	α=100	*
^{294}Ei	199460#	660#				1.15	ms	0.47	0$^+$	05	12Og06	T	2006	α=100	*
*^{294}Eh	T : average 14Kh04=51(+94–20) 13Og04=50(+60–18)														**
*^{294}Ei	T : 12Og06=0.135 ms (1 event) 06Og05=0.89 (4 events) 04Og12=1.8 ms (1 event)														**
^{295}Ei	201510#	640#				10#	ms				04Og05	TD		α ?	*
*^{295}Ei	T : 04Og05 reports one α event at 2.55 ms ; re-assigned to ^{294}Ei														**