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The NUBASE2020 evaluation of nuclear physics properties^{*}

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The NUBASE2020 evaluation of nuclear physics properties**

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Abstract: The NUBASE2020 evaluation contains the recommended values of the main nuclear physics properties for all nuclei in their ground and excited, isomeric ($T_{1/2} \geq 100$ ns) states. It encompasses all experimental data published in primary (journal articles) and secondary (mainly laboratory reports and conference proceedings) references, together with the corresponding bibliographical information. In cases where no experimental data were available for a particular nuclide, trends in the behavior of specific properties in neighboring nuclei were examined and estimated values are proposed. Evaluation procedures and policies that were used during the development of this evaluated nuclear data library are presented, together with a detailed table of recommended values and their uncertainties.

Keywords: NUBASE2020 evaluation, nuclear properties, atomic masses, isomers, excitation energy of isomers, spin and parity, half-life, year of discovery, decay modes

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1 Introduction

NUBASE2020 is an evaluated nuclear data library that contains the recommended values of the main nuclear physics properties: masses, excitation energies (for excited isomers), half-lives, spins and parities and decay modes, and their intensities, for all known nuclei in their ground and excited, isomeric ($T_{1/2} \geq 100$ ns) states. It also includes information for yet unobserved nuclides that is based on systematic trends of nuclear properties in neighboring nuclei. The present publication includes updated results for these properties, which were reported in previous versions of this library [1–4]. The recommended data are presented in Table I.

The information included in NUBASE2020 represents the fundamental building blocks of the modern nuclear physics, and specifically of the nuclear structure and nuclear astrophysics research. One of the main applications of NUBASE2020 is the “Atomic Mass Evaluation” (AME2020 - the second and third articles included in this issue) where it is imperative to have an unambiguous identification of all states involved in a particular decay, reaction or mass-spectrometry measurement. This is the main reason for coupling the two evaluations together in the present issue. Furthermore, with

the advances of modern mass-spectrometry techniques and the availability of intense stable and rare-isotope beams, a large number of short-lived nuclei can be produced in a single experiment and their masses can be measured with a high precision. Thus, NUBASE2020 can be a trusted source of information in future mass measurements, where an unambiguous identification of specific nuclides in complex mass-spectrometry data would be required.

NUBASE2020 also serves nuclear structure research, astrophysics network calculations, and theoretical studies of nuclear properties, where complete, up-to-date and reliable data for all known nuclei are needed. It can be particularly useful in present and future studies of nuclei and their properties at the major nuclear physics facilities around the world, such as FAIR, ISOLDE and SPIRAL2 (Europe), ATLAS and FRIB (USA), HIAF (China), RIBF at RIKEN (Japan), ISAC and ARIEL (Canada), and elsewhere.

Furthermore, the evaluated data included in NUBASE2020 are a valuable source of information for specialists in a number of applied nuclear fields, such as safeguards, nuclear forensics, reactor engineering, waste management, material analysis, medical diagnostics and radiotherapy, and elsewhere, where one needs to access reliable

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nuclear physics information for any nuclide.

The recommended data included in NUBASE2020 fulfill several user-demanded requirements, namely that they are: a) *complete* – include all measured quantities and their uncertainties, b) *up-to-date* – include results from all recent publications, c) *credible and reliable* – identify and resolve contradictory results that exist in the scientific literature, as well as in other nuclear physics databases, d) *properly referenced* – provide comprehensive bibliographical information for all included properties.

In general, NUBASE2020 was updated via three different routes: a) directly from the literature by compiling and evaluating data that were published in *primary* (nuclear physics journals) and *secondary* (abstracts, conference proceedings, private communications, theses, arXiv publications and laboratory reports) references; b) by consulting, and when merited by adopting, recommendations made in topical evaluations that include nuclear properties covered by NUBASE (see the text for details); c) by consulting, and when merited by adopting, recommended values from the “Evaluated Nuclear Structure Data File” (ENSDF) database [5].

It is important to note that data presented in ENSDF and in other topical evaluations were carefully examined, and only results that were found to be *valid* and *up-to-date* were considered. In general, the content of ENSDF is very large, since it encompasses the complex nuclear structure and decay properties for all nuclei and all excited nuclear states. Maintenance of this library requires an enormous effort and it is not surprising that occasionally some older data are missing or misrepresented, and that some recent data are not included. When such cases were identified, the data were re-evaluated and the corresponding conclusions were added as comments in Table I.

The content of NUBASE2020, together with the adopted policies that were used during the development of this nuclear physics data library, is described below. All experimental data available to the authors by October 30, 2020 were considered.

2 Content of NUBASE2020

The NUBASE2020 evaluation contains recommended properties for the ground state of 3340 nuclides and for 1938 excited isomeric ($T_{1/2} \geq 100$ ns) states, derived from all available experimental data. It also includes information for yet unobserved nuclei (218 in their ground state and 45 excited isomers) whose properties were estimated by following the systematic trends in neighboring nuclei (TNN, see section 3.1).

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

for all experimental values of the above items.

2.1 Mass excess

In general, the knowledge of atomic masses can provide valuable information on the lifetimes of nuclear states and their decay modes, and in particular on the β -delayed particle decay probabilities for nuclei far from the line of stability.

The mass-excess values and their uncertainties that are presented in Table I were adopted from the latest edition of the Atomic Mass Evaluation, AME2020, as described in the second and third articles of the present issue. Figure 1 displays the uncertainties of the mass-excess values as a function of N and Z .

2.2 Isomers

Nuclear isomers are excited, intrinsic (single-particle in nature) states with lifetimes ranging from nanoseconds (or even shorter) to years. There are several recent compilations and review articles, where the physics of nuclear isomers was discussed in detail and the reader is referred to Refs. [6, 7] and references therein.

Following the NUBASE2003 publication [2], the present evaluation includes isomeric states with half-lives longer than 100 ns. Although this limit is somewhat arbitrary, the main reason for this choice was to include all short-lived isomers that can be directly produced at the present and future accelerator beam facilities and that can survive the time-of-flight path of the employed recoil mass separator, and as a consequence, their decay properties and/or masses can be directly measured.

Figure 2 shows a compilation of all such known isomers as a function of N and Z .

Isomers are listed in Table I in the order of increasing excitation energy and they are identified by the letters ‘ m ’, ‘ n ’, ‘ p ’, ‘ q ’, or ‘ r ’ which are appended to the nuclide name, e.g. ^{90}Nb for the ground state, $^{90}\text{Nb}^m$ for the first excited isomer, $^{90}\text{Nb}^n$, $^{90}\text{Nb}^p$, $^{90}\text{Nb}^q$, and $^{90}\text{Nb}^r$ for the second, third, fourth and fifth ones, respectively. In four cases, namely ^{98}Y , ^{174}Lu , ^{179}Ta and ^{214}Ra , a sixth isomer is presented and they were labeled with the letter ‘ x ’ (see the Explanation of Table I for details).

The excitation energy of an isomeric states is determined by different experimental methods, which are generally attributed to the category of either *internal* or *external* relations. A typical *internal* relation involves the γ -ray energy, or the energies of a cascade of γ rays, associated with the isomer decay. The most-accurate values for the excitation energies of isomers that are deduced by this approach can be determined by a least-squares fit to the energies of all γ rays observed along the decay path of a particular isomer. In cases where *internal* relations cannot be established, connections to other nuclides (*external* relations) can be used to deduce the mass difference (excitation energy) between the ground state and isomers, and the excitation energies are taken from AME2020.

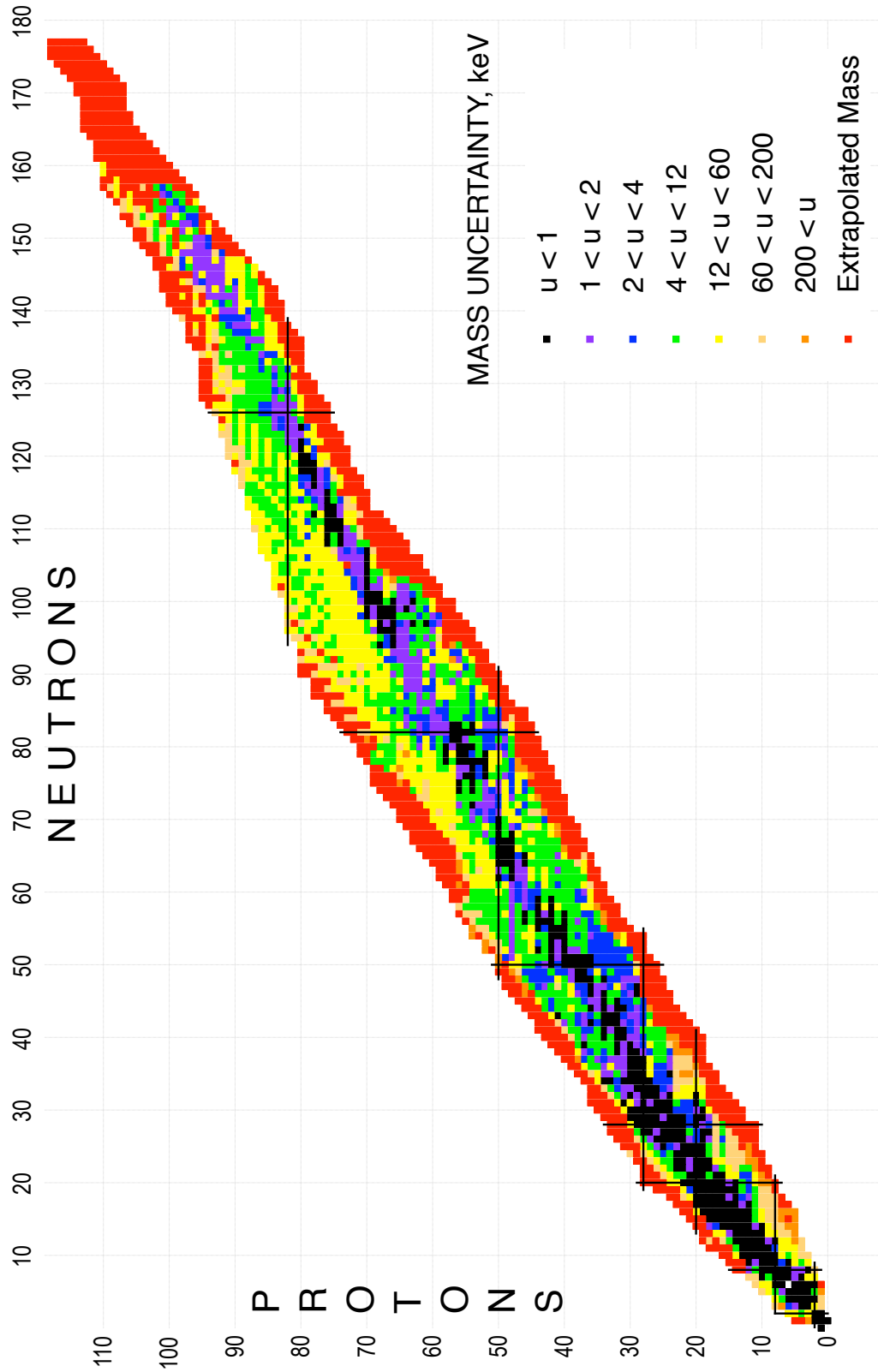


Fig. 1. Nuclear chart displaying the mass-excess uncertainties for all nuclei in their ground state.

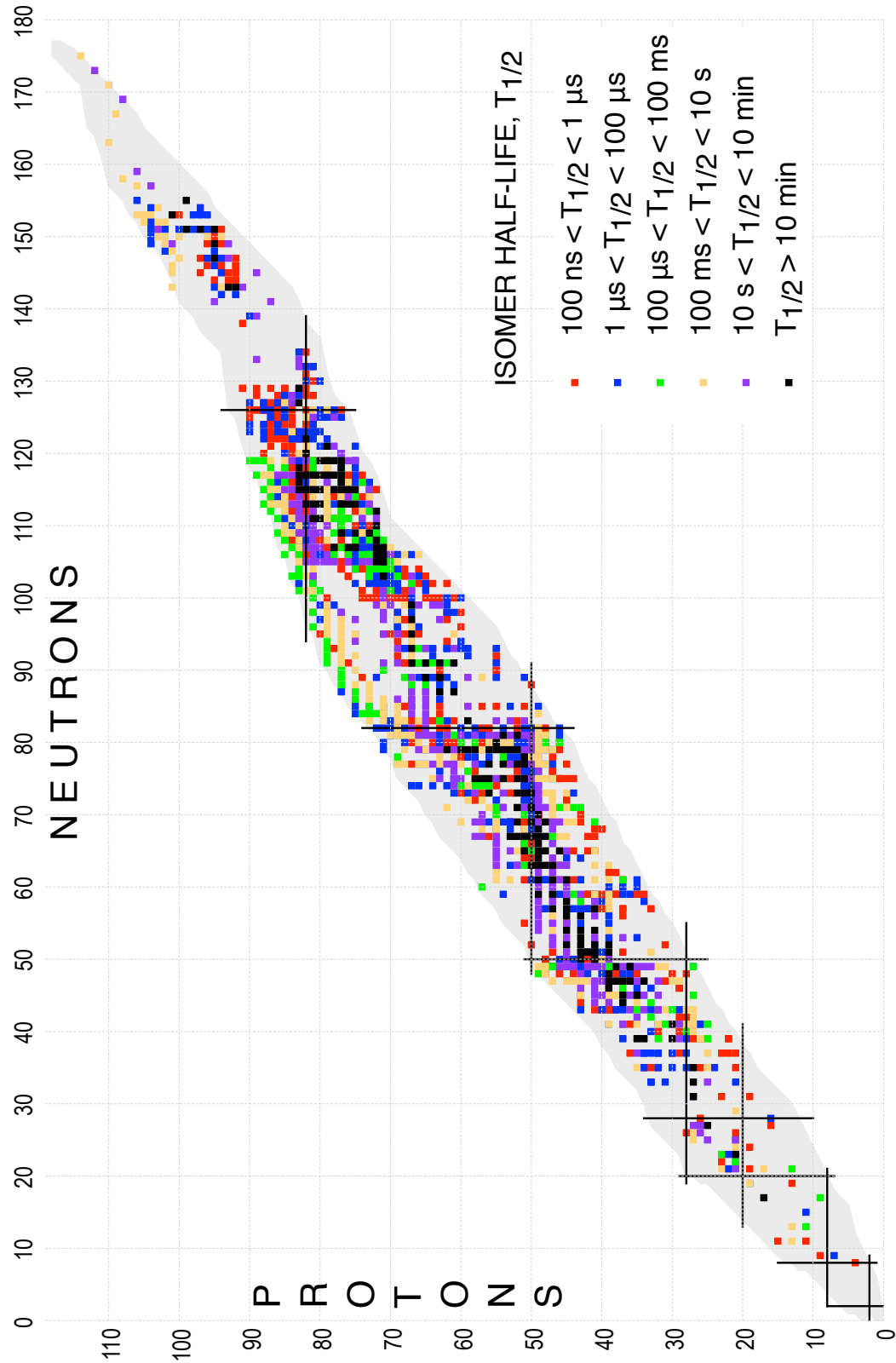


Fig. 2. Nuclear chart displaying isomeric states with $T_{1/2} \geq 100$ ns. For a given isotope where multiple isomers exist, only the longest-lived state is plotted.

The method used to establish the *external* relation for a particular isomer (the origin) is indicated by a two-letter code in Table I, next to the isomer excitation energy (see the Explanation of Table I for details). For *internal* relations, the origin field is left blank and the numerical values are taken either from ENSDF or from literature updates, where a least-squares fit to the measured γ -ray energies was performed, whenever possible.

There are also cases where the energy difference between the isomer and the ground state can be obtained by both the *internal* and one, or more, *external* relations with comparable accuracies. In such cases, the excitation energy of the isomer is taken from AME2020. For example, the mass of $^{178}\text{Lu}^m$ is determined in AME2020 at 66% from $E_x(\text{IT})=120(3)$ keV [1993Bu02] and at 34% from $^{176}\text{Lu}(\text{t,p})^{178}\text{Lu}^m=4482(5)$ keV [1981Gi01], resulting in an adjusted excitation energy of 123.8(2.6) keV for the isomer.

In contrast to ENSDF, where the isomer excitation energies may not be quantified and are often given as floating levels with ‘+X’, ‘+Y’, etc., estimated values are always provided in NUBASE2020, based on theoretical considerations or TNN. In such cases, the reported excitation energies are considered as a non-experimental quantity and the values are flagged with the symbol ‘#’.

When the existence of an isomer is uncertain and it is still under discussion, it is flagged with ‘EU’ (“Existence Uncertain”) in the origin field. A comment is usually added to indicate why the existence of this state is questioned or where this issue is discussed in more detail. Eleven isomers, namely $^{138}\text{Pm}^m$, $^{142}\text{Nd}^m$, $^{144}\text{Cs}^n$, $^{152}\text{Pm}^n$, $^{156}\text{Tm}^m$, $^{162}\text{Lu}^n$, $^{174}\text{W}^m$, $^{174}\text{W}^n$, $^{185}\text{Bi}^n$, $^{190}\text{Tl}^n$, and $^{273}\text{Ds}^m$ are treated in this way in the present evaluation. Nevertheless, the mass excess and excitation energy values are given for all of them, except for $^{138}\text{Pm}^m$, $^{142}\text{Nd}^m$, $^{144}\text{Cs}^n$, $^{152}\text{Pm}^n$, $^{174}\text{W}^m$, $^{174}\text{W}^n$, and $^{190}\text{Tl}^n$, where the existence is strongly doubted.

When an isomer was initially reported as “discovered”, but later this was proven to be an error, such a case is flagged with ‘RN’ (“Reported Non-existent”) in the origin field. Nine isomers, namely $^{76}\text{Cu}^m$, $^{84}\text{Ga}^m$, $^{84}\text{As}^m$, $^{85}\text{Nb}^n$, $^{86}\text{Nb}^n$, $^{117}\text{La}^m$, $^{181}\text{Pb}^m$, $^{196}\text{Pb}^m$, and $^{197}\text{Bi}^n$ are treated in this way and no mass excess or excitation energy values are given. Similarly to the ‘EU’ cases, a “non-exist” label is also added. 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 or ^{293}Og). However, an estimate for the ground state mass, derived from Trends from the Mass Surface (TMS), is always given in AME2020 and NUBASE2020.

Sometimes, upper and lower limits are known for the excitation energy of the isomeric state. Such cases are treated with uniform probability distribution, as explained in section 3.2. For example, there is solid experimental evidence [1974De47] that the excitation energy of the $^{162}\text{Tm}^m$ isomer is between the 66.9 keV and 192.0 keV levels and this information is presented (after rounding) in Table I as $E_x =$

130(40) keV.

When it is not clear which state is the ground state and which one is the isomer, the flag ‘*’ is added in Table I. Similarly, when the uncertainty of the isomer excitation energy, ΔE_x , is relatively large compared to E_x , e.g. $\Delta E_x > E_x/2$, the assignment of the level as a ground or isomeric state is also considered to be uncertain and it is flagged with the symbol ‘*’, as well.

Based on new experimental mass information, the ordering of several ground and excited isomeric states was reversed in the present work, when compared to the recommendations in ENSDF, and such cases are flagged with the symbol ‘&’ in Table I. In a few other instances, evidence was found for a state that is located below the adopted in ENSDF ground state and such results were also flagged with the symbol ‘&’ in Table I. It is worth noting that because of the coupling between NUBASE2020 and AME2020 all changes in the ordering of nuclear levels are firmly established and synchronized.

2.2.1 Isobaric analog states

NUBASE2020 contains information for 205 Isobaric Analog States (IAS), which are labeled in Table I with the isospin multiplet value, T . Their excitation energies were determined via either the “*internal*” or “*external*” relation. The IAS nuclides are generally marked with the i or j superscripts, except for eight excited isomers, $^{16}\text{N}^m$, $^{26}\text{Al}^m$, $^{34}\text{Cl}^m$, $^{38}\text{K}^m$, $^{46}\text{V}^m$, $^{50}\text{Mn}^m$, $^{54}\text{Co}^m$, and $^{70}\text{Br}^m$. The isospin value is not given for most nuclei in their ground state, since they have $T = |T_z| = \frac{1}{2} |N - Z|$. However, it is included for the ground state of the $N = Z$, odd-odd ^{34}Cl , ^{42}Sc , ^{46}V , ^{50}Mn , ^{54}Co , ^{62}Ga , ^{66}As , ^{70}Br , and ^{74}Rb ($T = 1$) and ^{30}P , ^{38}K , and ^{58}Cu ($T = 0$) nuclides.

Detailed experimental information about IAS was recently compiled in Refs. [8, 9].

2.3 Half-life

The lifetime is a fundamental property of a nuclear level. It is related to the total decay width, Γ , a linear sum of all partial decay widths (γ ray, conversion electrons, α decay, β decay, fission, etc.), through the uncertainty relationship:

$$\Gamma = \frac{\hbar}{\tau} \quad (1)$$

where $\tau = T_{1/2}/\ln(2)$ is the level mean life and $T_{1/2}$ is the half-life.

Figures 3 displays the ground-state half-life as a function of N and Z for all nuclei included in Table I.

Some light nuclei ($A < 30$) that are located beyond the particle drip-lines are known to exist for a very short time before disintegrating by particle emissions. In such cases only the total level width can be measured and the half-life is deduced by means of equation 1 (in convenient units):

$$T_{1/2} [\text{s}] \simeq 4.562 \times 10^{-22} / \Gamma [\text{MeV}] \quad (2)$$

where Γ is the total width in the center of mass frame. The

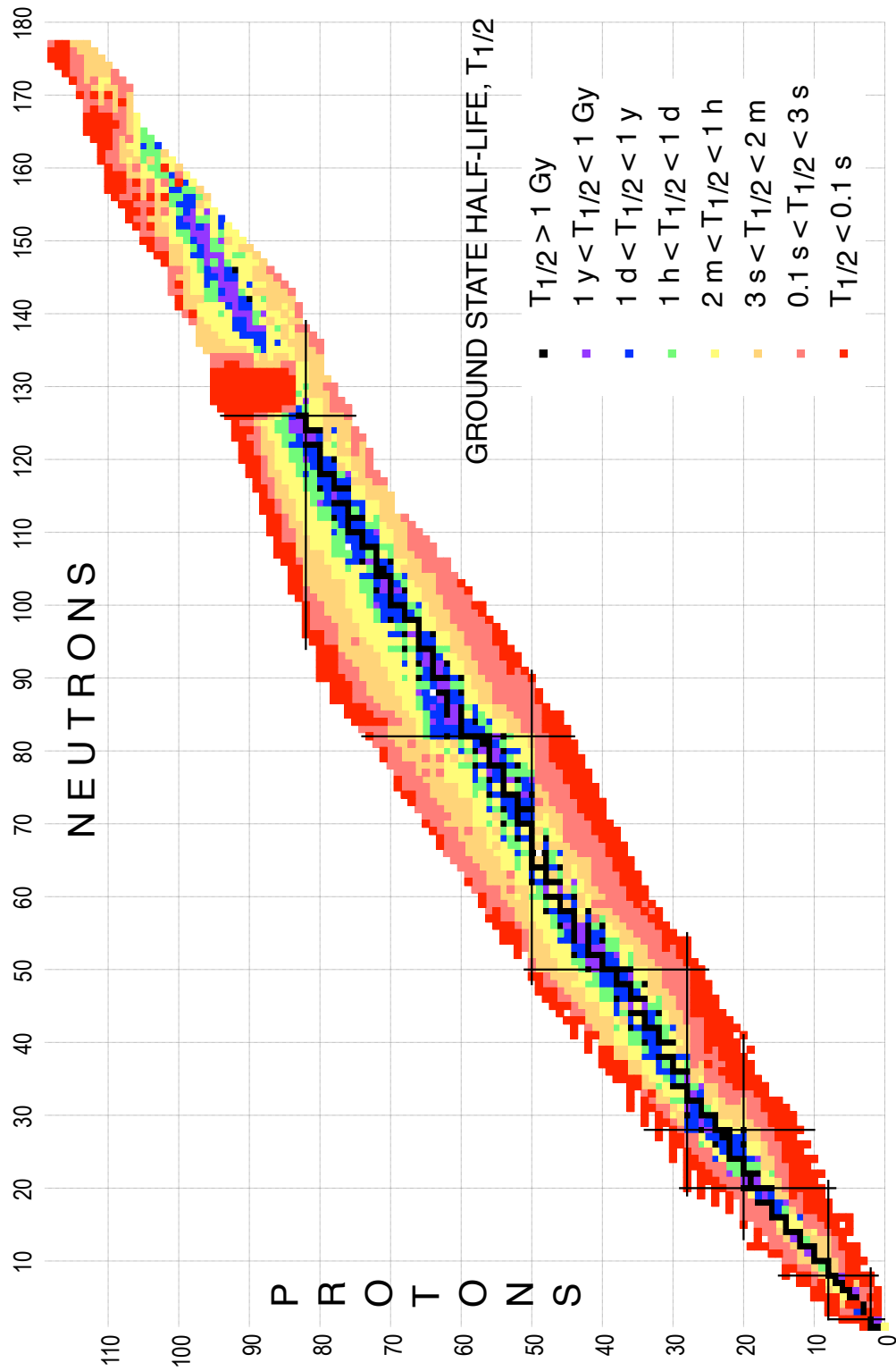


Fig. 3. Nuclear chart displaying the ground-state half-lives for all nuclei.

heaviest nuclide whose half-life is determined by this approach is ^{29}Cl .

The following units are used in NUBASE2020 for a convenient display of half-lives: seconds (s) and its sub-units, minutes (m), hours (h), days (d) and years (y), and its sub-units (see Explanation of Table I for details). While several definitions can be used to convert values between years and days or seconds, such as Julian year, Gregorian year, Sidereal year, Tropical year and others, the conversion via Tropical year is adopted in NUBASE2020:

$$1\text{ y} = 365.2422\text{ d} = 31556926\text{ s}$$

When more than one value is known for the half-life of a particular level, a statistical analysis was performed in accordance with the policies outlined in section 3.2. Experimental half-lives are sometimes given in the literature with most probable lower and upper limits. Such cases are treated with uniform probability distribution, as explained in section 3.2. For example, the half-life of $^{97}\text{In}^m$ is given as $1.2\text{ }\mu\text{s} \leq T_{1/2} \leq 230\text{ }\mu\text{s}$ in Ref. [2018Pa20] and the recommended value in NUBASE2020 is $T_{1/2} = 120(70)\text{ }\mu\text{s}$. Half-lives with asymmetric uncertainties are also frequently reported in the literature. Since it is envisioned that NUBASE2020 will be used by specialists in various application fields, such values are symmetrized prior to performing any statistical analyses, as described in section 3.3.

In experiments where rare events were detected, for example in studies of super-heavy nuclei, the half-lives reported in different publications were not directly averaged. Instead, when the information presented in the literature was sufficient, the time information associated with the individual events was combined and analyzed, as prescribed by Schmidt *et al.* [1984Sc13]. In recent review articles that deal with properties of super-heavy nuclei [2014Kh04, 2016Fo10, 2016Ho09, 2017Og01] events from several experiments were combined together in order to determine the best values. We have adopted these half-life values, rather than averaging the individual results.

In cases of long-lived nuclides that are of importance to metrology and other applications, all available experimental data were carefully examined, including values published by various metrology laboratories over many years. As a policy, we adopted the latest reported value by a particular laboratory, including the latest results published by Unterwiesing and Fitzgerald [10], which superseded the earlier assessment made by the same authors [11].

An upper or a lower limit for the half-life value is given in Table I for nuclides identified using a time-of-flight technique. The following policies were implemented: a) for *observed* nuclides, the lower limit for the half-life is given in the place of the uncertainty field. However, such a value should be used with caution, since it may be far shorter than the actual level half-life. In order to avoid confusion, a somewhat more realistic estimate, derived from TNN and flagged with

#, is also given (see for example the data entry for ^{44}Si). The same notation is also used for half-life limits of very long-lived (stable) nuclei (see for example the data entry for ^{188}Os); b) for nuclides that were looked for, but *not observed*, the upper limit is given in the place of the uncertainty field. For example, upper limits were estimated for a number of unobserved nuclides by F. Pougheon [1993Po.A], based on the time-of-flight information and the production yields expected from TNN (see for example the data entry for ^{21}Al).

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 ground-state-to-ground-state transition is the dominant decay mode, only those experimental half-life values, or their upper-limits, are included in NUBASE2020. In a few cases, other partial lifetime data are also compiled and these are given as comments in Table I. No attempt was made to convert the half-life values given by different authors to the same statistical confidence level (CL). The compilations by Barabash [2020Ba.A, 2011Ba28] were consulted in covering such decays.

For nuclei in their ground or excited isomeric state whose half-lives were not directly measured, values from TNN were estimates and included in Table I, whenever possible. Such cases are flagged with the symbol ‘#’.

2.4 Spin and parity

Spin and parity values are presented with or without parentheses, based on “weak” or “strong” arguments, respectively, as adopted in ENSDF [12], but with one important exception. Since, it is a policy of NUBASE2020 to make a clear distinction between experimental and non-experimental information, parentheses are used only when the so-called “weak” arguments are based on experimental observations. In cases where the assignments are based on theoretical predictions or TNN, the values are presented without parentheses and they are flagged with the symbol ‘#’. This is in contrast to ENSDF, where values determined from theory or systematics are given in parentheses, and as a consequence, it is not possible to distinguish these tentative values from ones determined from experimental data. It should also be noted, that despite well-defined evaluation policies [12], there are a number of inconsistencies in ENSDF regarding the spin and parity assignments. Often, the proposed spins and parities reflect the interpretation of a particular ENSDF evaluator, rather than that of firm policy rules. As a result, assignments to similar states in neighboring nuclei are put in parenthesis by one evaluator, but not by another, although similar experimental information is available.

There is a large amount of recent experimental data on directly measured spins for nuclei far from the line of stability, where the “in-source” (e.g. RILIS at ISOLDE (CERN) and TRILIS at ISAC (TRIUMF)) and “collinear” (e.g. CRIS at ISOLDE (CERN)) laser spectroscopy techniques were de-

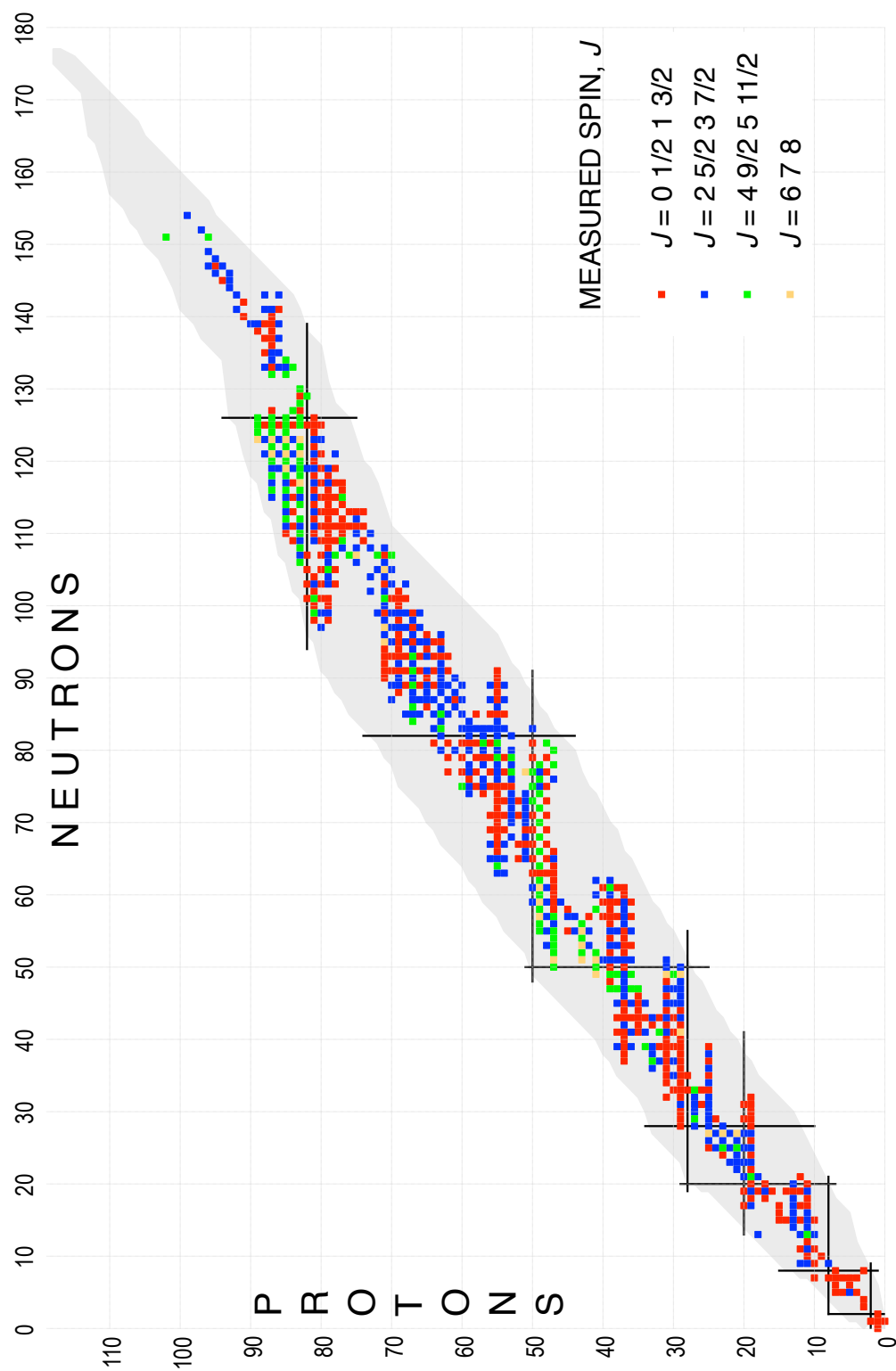


Fig. 4. Nuclear chart displaying the measured ground-state spins.

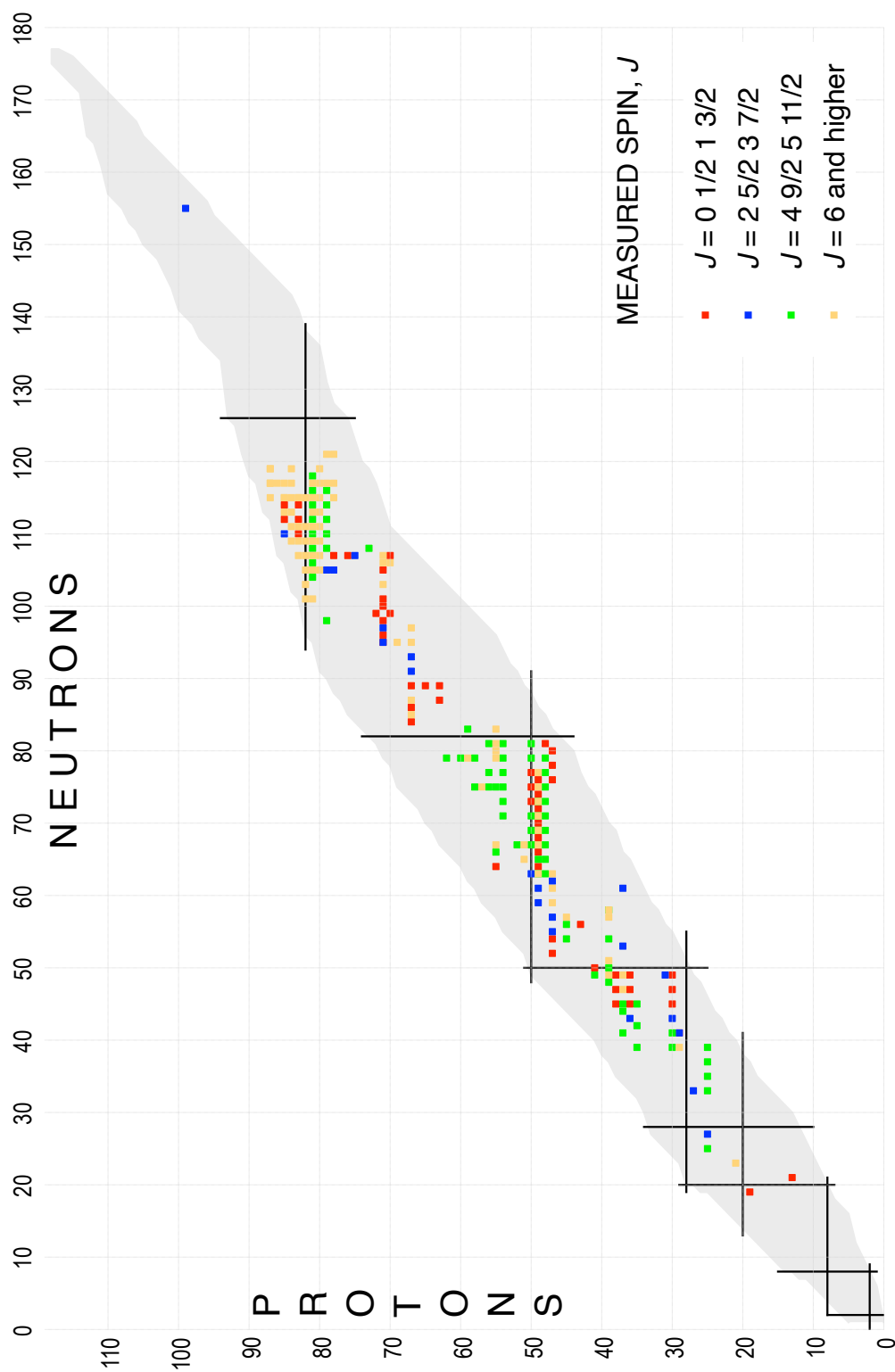


Fig. 5. Nuclear chart displaying the measured isomeric-state spins.

ployed. In the present work, we compiled the experimentally measured spins for 1062 states (827 ground states and 235 isomers) and the corresponding values are flagged in Table I with the symbol ‘*’. We have consulted previous compilations by Fuller [13], Otten [1989Ot.A] and McDonald [14], as well as recently measured values in the literature. Figures 4 and 5 show plots of the directly measured spins for the ground and isomeric states, respectively, as a function of N and Z .

The experimental methods that are used for spin determination do not provide direct information about the parity of a given state. However, we have used additional spectroscopy data, such as l value in transfer reactions, hindrance factors in α decay, measured magnetic moments, as well as other spectroscopic information, in order to make such assignments in Table I.

2.5 Decay modes and their intensities

Figure 6 displays the main ground-state decay modes for all nuclei included in Table I.

The most important policy in assembling the information about the decay modes and their intensities was to unambiguously establish whether a particular decay is energetically allowed, but not experimentally observed (represented by a question mark alone ‘?’, e.g. ‘IT ?’ or ‘ α ?’, the question mark refers to the decay mode), and whether the decay is actually observed, but its intensity is not determined (represented by ‘=?’, e.g. ‘IT=?’ or ‘ α =?’), the question mark refers to the branching intensity).

In cases of multiple decay modes, normalization of primary intensities to 100% was made only when the competing decays were experimentally observed. Otherwise, no such corrections were made.

Similarly to previous versions of NUBASE [1–4], β^+ denotes a decay process that includes both electron capture, ε , and positron emission, e^+ , decays, so that one can symbolically write $\beta^+ = \varepsilon + e^+$. It should be made clear that this notation is *not* the same as that used in ENSDF, where the combination of both modes is labeled as $\varepsilon + \beta^+$. When the available decay energy is below $2m_e \simeq 1022$ keV, only electron capture decay mode is allowed, while above that value the two processes are in competition. In the latter case, the separated intensities are not always experimentally available and they are frequently deduced from model calculations. Following one of the general policies of NUBASE that experimental information is exclusively used whenever possible, only measured values for β^+ , ε and e^+ are included in Table I. By the same token, both electron capture-delayed fission (e SF) and positron-delayed fission (e^+ SF) are given with the same symbol β^+ SF.

For β -delayed particle decays, intensity relations were carefully considered. By definition, the intensity of a specific β -delayed particle decay is taken as a percentage of the main β -decay mode. For example, if the decay of the (A, Z)

nuclide is described as ‘ $\beta^- = 100$; $\beta^- n = 20$ ’, 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.

This notation also holds for more complex β -delayed particle emissions. For example, a decay described by ‘ $\beta^- = 100$; $\beta^- n = 30$; $\beta^- 2n = 20$; $\beta^- \alpha = 10$ ’ corresponds to the emission of 100 electrons, 70 $(30+2 \times 20)$ 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 $(A-4, Z-1)$, respectively.

In general, the number of neutrons emitted per 100 β^- decays, P_n , can be written as:

$$P_n = \sum_i i \times \beta_{in}^-;$$

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

$$\beta^- - \sum_i \beta_{in}^- - \sum_j \beta_{ja}^- - \dots$$

Sometimes, the primary (parent) β decay can populate 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 particle intensity. It is a policy of NUBASE2020 to not use such an approach for two main reasons: a) the energies of delayed particles emitted from excited states are generally much higher compared to those emitted from the ground state, thus implying different subsequent processes; b) 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, ^9C decays via β^+ emission to the ground state of the proton-unbound ^9B nuclide (feeding intensity of 54.1(1.5)% [2001Be51]) and to several excited states that are proton and/or α unbound. If one takes the β^+ intensities to the excited states in ^9B from Ref. [2000Ge09] and renormalizes them to per 100 decays of the parent, then $\beta^+ p = 7.5(0.6)\%$ and $\beta^+ \alpha = 38.4(1.6)\%$ can be determined for ^9C . In a slightly different example, ^8B decays via β^+ emission only to two excited, α -unbound states in ^8Be , but not to the ^8Be ground state. Thus, one may write $\beta^+ = 100\%$ and $\beta^+ \alpha = 100\%$, and therefore, no net population of the ^8Be ground state.

It should be pointed out that the percentages given in the Table I are related to 100 decays of the parent nuclei, rather than to the primary decay mode fraction. For example, the delayed-fission probability in the decay of ^{228}Np is given in the original article 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)% $\times$ 0.60(7) = 0.012(6)% of the total decay intensity.

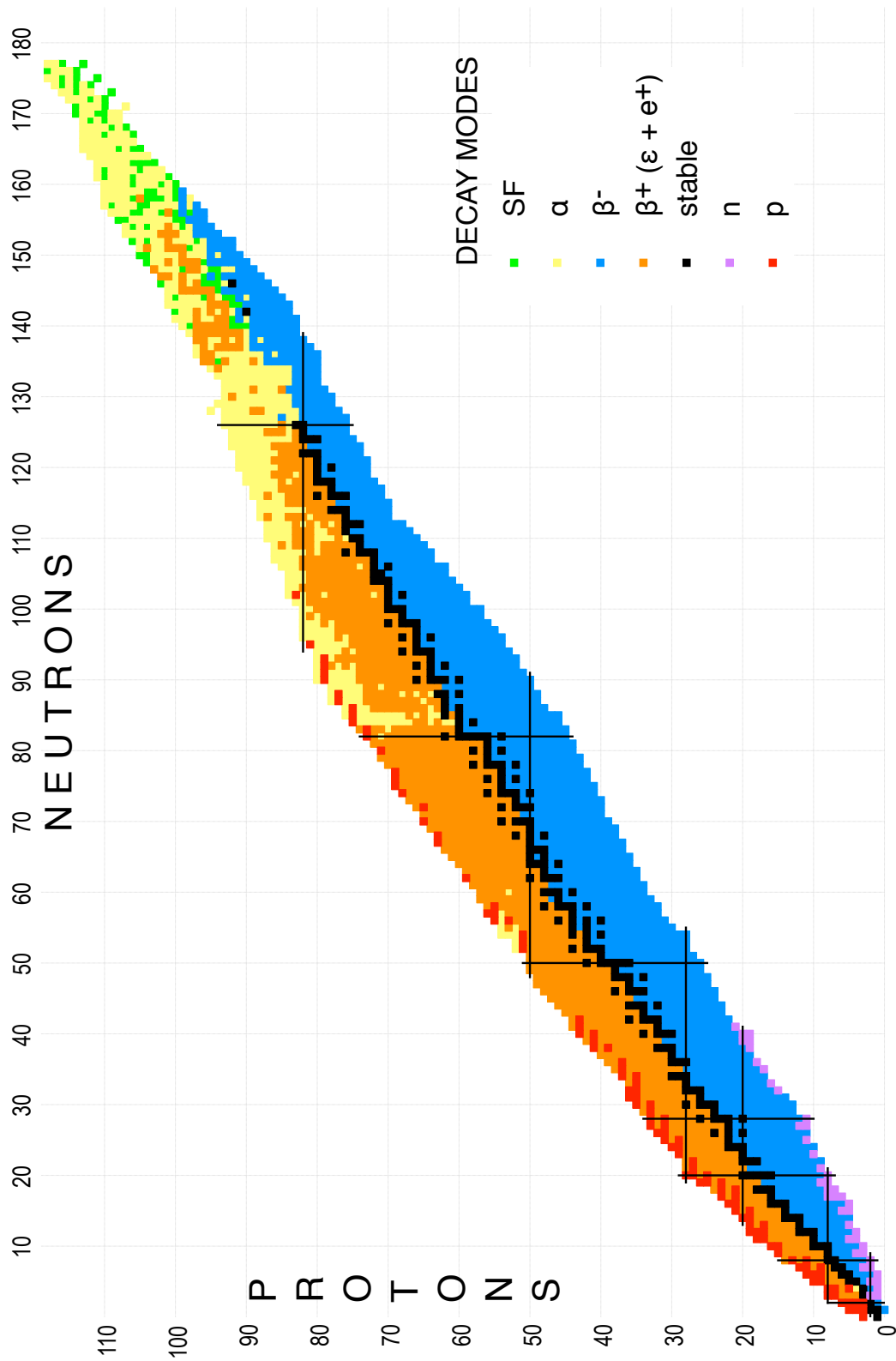


Fig. 6. Nuclear chart displaying the main decay mode for nuclei in their ground state.

In addition to applying direct updates from the literature, partial evaluations completed by other authors were also considered in the evaluation of delayed particle data. For example, in compiling data for delayed proton- and α -branching intensities, the work of Hardy and Hagberg [1989Ha.A], Jonsson and Riisager [15], Blank and Borge [16] and Pfützner *et al.* [17], where the corresponding physics was reviewed, as well as the recent compilation of Batchelder [18], were consulted. Similarly, data on β -delayed neutron emission probabilities that were recommended by a recent IAEA Coordinated Research Project [19] were also consulted.

2.6 Isotopic abundances

Isotopic abundances are given in the decay field of Table I with the symbol *IS* and the values were taken from the most-recent publication of Meija *et al.* [20]. In several cases the *IS* values are listed in Ref. [20] as an interval $[a, b]$, but in Table I they are given as $IS = (a + b)/2$ with a variance $\sigma^2 = (b - a)^2/12$ (see section 3.2).

2.7 Year of discovery

Similarly to the previous version of NUBASE [3, 4], Table I includes information about the year of discovery for each nuclide in its ground or isomeric state. For the former, recommendations by Thoennessen [21] were adopted. Similar criteria were used when assigning the year of discovery for isomeric states.

2.8 References and Dissemination

The year of the ENSDF archival file that was consulted during the development of NUBASE2020 is given in Table I. The entry is left blank when information for a particular nuclide was not available in ENSDF.

The bibliographical information used in NUBASE2020 is referenced by means of the “Nuclear Science Reference” (NSR) database [22] keynumber style. However, references quoted in Table I are abbreviated with the first two digits of the year of publication being omitted from the NSR-style keynumbers. They are followed by up to three one-letter codes which specify the added or modified physics quantities (see the Explanation of Table I).

In cases where more than one reference was needed to describe a particular update, they were included as comments in Table I. No references were given for estimated values.

The initials of the former and present evaluators, e.g. GAU (G. AUDI), HWJ (W. HUANG), FGK (F. KONDEV), MMC (M. MACCORMICK), SAR (S. NAIMI) WGM (M. WANG), AHW (A. WAPSTRA), were used as reference keys where it may not be clear that the re-interpretation of data was made by the NUBASE evaluators.

In cases of directly measured spins, references are provided only to papers that were not included in the most-recent compilation of McDonald *et al.* [14].

The complete reference list is given at the end of this issue

(see AME2020, Part II), together with the references used in AME2020.

The recommended data for the basic nuclear physics properties are also made available as an ASCII-formatted file (**nubase.mas20**) at the dissemination websites of the collaboration [23].

3 Policies of NUBASE2020

3.1 Trends in neighboring nuclei (TNN)

In general, NUBASE2020 contains numerical and bibliographical information for all known nuclei for which at least one property is experimentally known. However, it also includes results on yet unobserved nuclides, as well as data on properties (mostly excitation energy for isomers, half-lives and spins and/or parities) that are not yet measured. Such values are estimated from the systematics trends of a particular property in neighboring nuclei by ensuring a continuity in *N*, in *Z*, *A*, and in *N* − *Z*. This approach allowed to follow the behavior of a particular property as a function of *N* and *Z* in a consistent way and it proved beneficial in deducing values for other relevant properties. Similarly to AME2020, where masses estimated from Trends from the Mass Surface (TMS) are flagged with ‘#’, the same symbol is used in NUBASE2020 to indicate non-experimental information inferred from TNN. It should be pointed out, however, that deviations from TNN are expected when nuclear structure effects, such as deformation and/or shape changes, occur. Such data were taken into account to the best knowledge of the present authors.

3.2 Averaging procedure and uncertainties

It is a policy of NUBASE2020 to use one standard deviation as a representation of uncertainties associated with the recommended values. Unfortunately, authors of research articles do not always clarify the meaning of their reported uncertainties and, under such circumstances, these values are assumed to be one standard deviation. In several instances, uncertainties are not given at all and in such cases they were estimated by the evaluators, considering the limitations of the employed experimental method. When both the statistical and systematic uncertainties were reported in the literature, they were combined in a quadrature by the NUBASE2020 evaluators.

Sometimes lower (*l*) and upper (*u*) limits of a particular quantity, *q*, are reported in the literature, e.g. $q \in [l, u]$. A policy of NUBASE2020 is that uniform probability distribution is assumed in such cases, which yields a mean value of $m = (l + u)/2$ and a standard deviation of $\sigma = (u - l)/\sqrt{12} \simeq 0.29 \times (u - l)$.

When results from two or more independent measurements were reported in the literature, the corresponding values were weighted by their reported uncertainties and averaged. The weighted average value and its uncertainty are cal-

culated as:

$$\bar{x} \pm \Delta\bar{x} = \sum_{i=1}^N w_i x_i / \sum_{i=1}^N w_i \pm \sqrt{1 / \sum_{i=1}^N w_i} \quad (3)$$

where $w_i = 1/\Delta x_i^2$ and x_i and Δx_i are the value and its uncertainty reported in the i^{th} experiment, and the summation is over all N experiments. For each average value the NORMALIZED CHI, χ_n (or ‘consistency factor’ or ‘Birge ratio’), defined as:

$$\chi_n = \sqrt{\frac{1}{N-1} \sum_{i=1}^N w_i (x_i - \bar{x})^2} \quad (4)$$

is also calculated.

It is a policy of NUBASE2020 to use the weighted average result (equation 3) when χ_n is smaller or equal to 2.5. In cases where χ_n is larger than 2.5, but less or equal to 4, departure from the statistical result (equation 3) is allowed and the external uncertainty for the average value is adopted:

$$\bar{x} \pm \Delta\bar{x} = \sum_{i=1}^N w_i x_i / \sum_{i=1}^N w_i \pm \chi_n \times \sqrt{1 / \sum_{i=1}^N w_i} \quad (5)$$

In rare cases when χ_n is larger than 4, all individual uncertainties are considered to be irrelevant and the arithmetic (unweighted) average is adopted:

$$\bar{x} \pm \Delta\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i \pm \sqrt{\frac{1}{N(N-1)} \sum_{i=1}^N (x_i - \bar{x})^2} \quad (6)$$

The values used in the statistical analysis of a particular quantity are given as comments in Table I. When contradictory (discrepant) results were identified in the literature, a great deal of attention was focused on establishing the reason for such discrepancies, and consequently, on rejecting (or correcting) the corresponding unreliable data prior to performing the statistical analysis. The reasons for such decisions are given as comments in Table I.

3.3 Symmetrization of asymmetric uncertainties

Experimental results are sometimes reported in the literature with asymmetric uncertainties, e.g. X_{-b}^{+a} , and it is a policy of NUBASE to symmetrize these uncertainties.

Similarly to the previous version of NUBASE [1–4], the asymmetric uncertainty is associated with a two-piece normal distribution (sometimes called “split-normal distribution” or “Fechner distribution”), $TN(X, a, b)$, and the symmetrization is achieved by mapping this distribution into a normal (symmetric) distribution, $N(\mu, \sigma)$, where μ is the mean value and σ is the standard deviation.

The probability density function of a two-piece normal distribution is given as:

$$f(x) = \begin{cases} A \times \exp[-(x-X)^2/2a^2] & \text{if } x > X, \\ A \times \exp[-(x-X)^2/2b^2] & \text{if } x < X \end{cases} \quad (7)$$

It has a modal (most probable) value of $x = X$, a standard deviation b for $x < X$ and a standard deviation a for $x > X$ (see Figure 7), with $A = (\sqrt{\pi/2} \times (a+b))^{-1}$. This distribution is formed by taking the left half of a normal distribution $N(X, b)$ and the right half of a normal distribution $N(X, a)$ and scaling them to give a common value of $f(x) = A$ at the mode X (see Figure 7). The mean value and the variance of this distribution can be determined as [24]:

$$\mu = X + \sqrt{2/\pi} \times (a-b) \quad (8)$$

$$\sigma^2 = (1-2/\pi) \times (a-b)^2 + a \times b \quad (9)$$

The median value m , which divides the distribution into two equal areas is then:

$$m = \begin{cases} X + a\sqrt{2} \times \text{erf}^{-1}\left(\frac{a-b}{2a}\right) & \text{if } a > b, \\ X + b\sqrt{2} \times \text{erf}^{-1}\left(\frac{a-b}{2b}\right) & \text{if } b > a. \end{cases} \quad (10)$$

If one takes $\text{erf}^{-1}(z) \simeq \sqrt{\pi}z/2$ then

$$m - X \simeq \sqrt{\pi/8} \times (a-b) \simeq 0.6267 \times (a-b) \quad (11)$$

In order to allow for a small non-linearity that appears for high values of $m - X$, equation 11 is modified to:

$$m \simeq X + 0.64 \times (a-b) \quad (12)$$

Following the above approach, the two-piece normal distribution $TN(X, a, b)$ is mapped into an equivalent normal (symmetric) distribution $N(m, \sigma)$ (see Figure 7) that have a mean value equal to the median value m (equation 12) and variance σ (equation 9). As a consequence, X_{-b}^{+a} is symmetrized to $m \pm \sigma$ and the latter is adopted in NUBASE2020.

3.4 Rounding policy

In general, values for properties presented in NUBASE2020 and their uncertainties are rounded off, even if unrounded ones were given in the literature or in ENSDF. However, for some very precise data, as well as for data that were deemed essential for traceability purposes (e.g. isotopic abundances), the precisions quoted in the original publications were retained.

In cases where the two furthest-left significant digits in the uncertainty were larger than a given limit (set to 30 for the mass excess and excitation energy of isomers in order to be consistent with AME, and set to 25 for half-lives and branching ratios, as generally used in ENSDF), the adopted values and corresponding uncertainties were rounded off accordingly.

4 Conclusions and outlook

The NUBASE2020 evaluated nuclear data library contains the recommended values for the basic nuclear physics properties for all known nuclei, such as mass excess, excitation

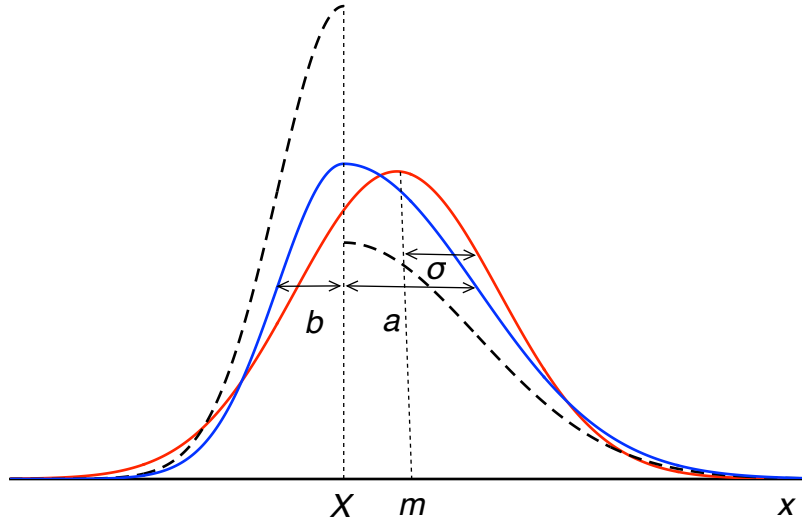


Fig. 7. (dashed black) original Normal distributions, $N(X, b)$ (left on X) and $N(X, a)$ (right on X), associated with the measured quantity X_{-b}^{+a} ; (solid blue) a two-piece normal distribution $TN(X, a, b)$; (solid red) the equivalent Normal (symmetric) distribution, $N(m, \sigma)$; see section 3.3 for details.

energy of the excited isomeric state, half-life, spin and parity, decay modes and their intensities, isotopic abundance (for stable nuclides), year of discovery, as well as the corresponding bibliographical information. It also contains information for yet unobserved nuclei whose properties were estimated by following the systematic trends in neighboring nuclei.

One of the main requirements in the development of NUBASE2020 was to cover the available experimental data as completely as possible and to provide proper references to all experimental results, especially for cases that are not included in ENSDF or in other topical evaluations. Such a traceability would allow any user to promptly review the recommended data and, if necessary, to undertake a re-evaluation.

NUBASE2020 is an integral part of AME2020 and the synchronization of these two libraries allows better homogeneity of all experimental data to be achieved. Furthermore, assignments of isomeric states and determination of their excitation energies were put on a firm basis and the data were improved.

In the future development of NUBASE, it is envisioned to include additional nuclear properties, such as magnetic and quadrupole moments, charge-radii and isotope shifts, cross sections of importance to nuclear astrophysics applications, as well as additional decay properties of relevance to energy and non-energy applications, in order to better serve the broader nuclear physics community.

5 Acknowledgments

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Table I. The NUBASE2020 table of nuclear and decay properties**EXPLANATION OF TABLE I**

Data are presented in groups ordered by increasing mass number, A .

Nuclide	Nuclide name: mass number $A = N + Z$ and element symbol. The superscript suffixes ‘ m ’, ‘ n ’, ‘ p ’, ‘ q ’, ‘ r ’ and ‘ x ’ indicate assignments to excited isomeric states with a half-life greater than 100 ns. Suffixes ‘ p ’ and ‘ q ’ can also indicate non-isomeric levels, which are used in AME2020. Suffix ‘ r ’ can also indicate a state from a proton resonance occurring in (p, γ) reactions (e.g. $^{28}\text{Si}^r$). Suffix ‘ x ’ can also indicate a mixture of levels with a relative ratio, R , given in the ‘Half-life’ column. They occur in spallation reactions or fission and are labeled as ‘spmix’ or ‘fsmix’ in the ‘ J^π ’ column, respectively. Suffixes ‘ i ’ and ‘ j ’ indicate Isobaric Analog States.
Mass excess	Mass excess [$M(\text{in u}) - A$] and its uncertainty (one standard deviation) in keV, as recommended in AME2020. Rounding policy: in cases where the furthest-left significant digit in the uncertainty is larger than 3, values are rounded-off, but not to more than tens of keV. (Examples: $2345.67 \pm 2.78 \rightarrow 2345.7 \pm 2.8$, $2345.67 \pm 4.68 \rightarrow 2346 \pm 5$, but $2346.7 \pm 468.2 \rightarrow 2350 \pm 470$). # indicates that the Mass excess value and its uncertainty are not derived from experimental data, but at least partly from the Trends from the Mass Surface (see the AME2020 publication for details).
Excitation energy	The energy difference between the excited isomer and the ground state, and its uncertainty (one standard deviation) in keV. The rounding policy is the same as for the mass excess (see above), with the exception of the very precise values for the $^{229}\text{Th}^m$ and $^{235}\text{U}^m$ isomers, which are given in the comments. # indicates that the excitation energy and its uncertainty are not derived from experimental data, but from the Trends in Neighboring Nuclei (TNN) (see section 3.1) When the excitation energy is determined by an <i>external</i> relation, it is followed by one or two-letters code (the origin code) that indicates the method used to establish such a relation. The field is left blank when the value is derived from γ-ray spectroscopy data (<i>internal</i> relation): MD mass doublet RQ reaction Q-value AD α energy difference BD β-decay end-point energy data p, 2p one-, two-proton decay IT combination of AME and γ-ray spectroscopy data Nm estimated value derived using the Nilsson model When the existence of a nuclide or an isomer is questionable the following codes are used: EU the existence is under discussion (e.g. $^{185}\text{Bi}^n$). If the existence is strongly doubted, no excitation energy and mass excess values are given, and they are replaced by the keyword “non-exist” (e.g. $^{138}\text{Pm}^m$). RN the isomer has been proven not to exist (e.g. $^{181}\text{Pb}^m$). Excitation energy and mass excess values are replaced by the keyword “non-exist”. <i>Remark:</i> codes EU and RN are also used when the discovery of a nuclide is questioned (e.g. ^{260}Fm and ^{289}Lv). In this case, a mass excess value derived from the Trends from the Mass Surface (see the AME2020 publication for details) is always given for the ground state.

Isomer assignment:

- * when the available experimental information is insufficient to unambiguously determine which state is the ground state and which one is the excited isomer, as well as in cases where the uncertainty (ΔE_x) of the excitation energy (E_x) is greater than half the excitation energy value ($\Delta E_x > E_x/2$), these quantities are followed by an asterisk (see for example ^{102}Y and $^{102}\text{Y}^m$).
- & when the ordering of the ground state and the excited isomer is reversed in comparison to the assignment made in ENSDF, the ampersand sign is added in the table (see for example ^{100}Y and $^{100}\text{Y}^m$).

Half-life

Half-life value (see section 2.3).

s = seconds; m = minutes; h = hours; d = days; y = years; 1 y = 365.2422 d = 31 556 926 s.

STABLE = stable nuclide or nuclide for which no finite half-life value was established.

indicate non-experimental value estimated from Trends in Neighboring Nuclei (TNN) (see section 3.1).

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

 J^π

Spin and parity (see section 2.4):

- () uncertain spin and/or parity based on *weak* experimental arguments.
- * directly measured spin (see section 2.4).
- # non-experimental value estimated from Trends in Neighboring Nuclei (TNN) (see section 3.1) or from theoretical predictions.
- high high spin.
- low low spin.
- am same J^π as the α -decay parent nuclide.
- T isospin multiplet value for Isobaric Analog States (see section 2.2.1).

Ens

Year of the ENSDF file archive. In order to reduce the width of the table, the two century digits are omitted.

Reference

Reference key-numbers (see section 2.8). In order to reduce the width of the table, the two century digits are omitted from the NSR reference key. The complete references list and associated NSR reference key-numbers are given in the second AME publication in the present volume.

10Cr02	updates derived from a <i>primary</i> (journal article) reference with the keynumber taken from the “Nuclear Science Reference” (NSR) database [22] (see section 2.8). When the keynumber was not available, the style 12Ma.1 was provisionally adopted.
12Dr.A	updates derived from a <i>secondary</i> (abstract, preprint, private communication, not-refereed conference proceeding, thesis or laboratory report) reference.
AHW	(or GAU, HWJ, FGK, MMC, SAR, WGM), re-interpretation by one of the NUBASE evaluators.
Mirror	deduced from mirror nuclide properties.
Imme	deduced from Isobaric Multiplet Mass Equation.

The reference key-numbers are followed by codes having up to three letters that indicates which physics quantity was added or modified:

M	mass excess
E	isomer excitation energy
T	half-life
J	spin and/or parity
D	decay mode and/or its intensity
I	identification

Year of
discovery

Year of discovery assigned for the ground and excited isomeric states (see section 2.7).

Decay modes
and intensities

Decay modes followed by their intensities and associated uncertainties, both in % (see section 2.5). The ordering is according to decreasing intensities. The uncertainties are given by the ENSDF-style format, e.g. $\alpha=25.9 \pm 2.3$ stands for $\alpha=25.9 \% \pm 2.3 \%$. The notation $1.8e-12$ stands for 1.8×10^{-12} .

$\alpha ?$ means that the α -decay mode is energetically allowed, but not experimentally observed

$\alpha=?$ means that the α -decay is observed, but its intensity is not experimentally known

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 ($\beta^+ = \epsilon + e^+$)
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^-3n	β^- -delayed 3-neutron emission
β^+p	β^+ -delayed proton emission
β^+2p	β^+ -delayed 2-proton emission
β^+3p	β^+ -delayed 3-proton emission
$\beta^-\alpha$	β^- -delayed α emission
$\beta^+\alpha$	β^+ -delayed α emission
β^-d	β^- -delayed deuteron emission
β^-t	β^- -delayed triton emission
IT	internal transition

SF	spontaneous fission
β^+ SF	β^+ -delayed fission
β^- SF	β^- -delayed fission
^{24}Ne	heavy cluster emission

For stable or long-lived nuclides:

IS	Isotopic abundance taken from Ref. [20] (see section 2.6).
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- * Indicates a comment to a nuclide, which is given below the block of data corresponding to the same A. The asterisk symbol is also included at the end of the data line. The comment starts with a letter code, similar to the one that follows the reference key-number (see above), indicating to which physics quantity the remark is applied. It contains: *(i)* information explaining how a specific value was derived; *(ii)* reasons for changing a value or its uncertainty that were reported by the original authors, or for rejecting it; *(iii)* complementary references to updated data; *(iv)* individual values used in the statistical analysis of data.

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^1_0n	8071.3181	0.0004			609.8 s 0.6	$1/2^+*$	06	19Ma40 T	1932	β^- =100	*
^1_1H	7288.9710	0.0001			STABLE	$1/2^+*$	06	11Be53 D	1920	IS=99.9855 78	*
* ^1_0n	T : from the world average in 19Ma40=609.8(0.6) (τ =879.7(0.8) s)										**
* ^1_1H	M : rounded from 7288.971064(0.000013) keV										**
^2_0H	13135.7229	0.0001			STABLE	1^+*	03		1932	IS=0.0145 78	*
* ^2_0H	M : rounded from 13135.722895(0.000015) keV										**
^3_0H	14949.8109	0.0001			12.32 y 0.02	$1/2^+*$	00		1934	β^- =100	*
^3_1He	14931.2188	0.0001			STABLE	$1/2^+*$	98		1934	IS=0.0002 2	*
^3_2Li	28670#	2000#			p-unstable	$3/2^-$ #	98			p ?	*
* ^3_0H	M : rounded from 14949.81090(0.00008) keV										**
* ^3_1He	M : rounded from 14931.21888(0.00006) keV										**
* ^3_2Li	I : identification in 69Wi13 not accepted										**
^4_0H	24620	100			139 ys 10	2^-	98	03Me11 T	1981	n=100	*
^4_1He	2424.9158	0.0001			STABLE	0^+	98		1908	IS=99.9998 2	*
^4_2Li	25320	210			91 ys 9	2^-	98	65Ce02 T	1965	p=100	*
* ^4_0H	T : width=3.28(0.23) MeV; other 91Go19=4.7(1.0) outweighed, not used										**
* ^4_1He	M : rounded from 2424.91587(0.00015) keV										**
^5_0H	32890	90			86 ys 6	$(1/2^+)$	19	17Wu03 T	1987	2n=100	*
^5_1He	11231	20			602 ys 22	$3/2^-$	02		1937	n=100	*
^5_2Li	11680	50			370 ys 30	$3/2^-$	02		1941	p=100	*
^5_3Be	37140#	2000#			p-unstable	$1/2^+$ #	18			p ?	*
* ^5_0H	T : from width=5.3(0.4) MeV in 17Wu03										**
* ^5_1He	J : from angular distribution data consistent with $l = 0$ in 01Ko52										**
* ^5_2He	T : from width=758(28) keV, average 12Lu01=767(10) keV										**
* ^5_3He	T : 09Ak03=670 (12, stat) (30, syst) keV; Birge ratio=2.9										**
^6_0H	41880	250			294 ys 67	2^- #	19		1984	n ?; 3n ?	*
^6_1He	17592.10	0.05			806.92 ms 0.24	0^+	02	15Pf01 D	1936	β^- =100; β^- -d=0.000278 18	*
^6_2Li	14086.8804	0.0014			STABLE	1^+*	02		1921	IS=4.85 171	*
$^6_2\text{Li}^i$	17649.76	0.10	3562.88	0.10	56 as 14	0^+ T=1	02	81Ro02 E	1981	IT=100	*
^6_3Be	18375	5			5.0 zs 0.3	0^+	02		1958	2p=100	*
^6_4B	47320#	2000#			p-unstable	2^- #				2p ?	*
* ^6_0H	T : from width=1.55(0.35) MeV, average 84Al08=1.8(5) MeV 86Be35=1.3(5) MeV										**
* ^6_1He	D : other β^- -d 09Ra33=1.65(0.10)e-6, but with 525-keV threshold										**
* ^6_2He	T : symmetrized from 12Kn01=806.89(0.11, stat)(+0.23-0.19, syst)										**
^7_0H	49140#	1000#			652 ys 558	$1/2^+$ #	17	08Ca22 T	2003	2n ?	*
^7_1He	26073	8			2.51 zs 0.07	$(3/2)^-$	03	12Ca05 T	1967	n=100	*
^7_2Li	14907.105	0.004			STABLE	$3/2^-*$	03		1921	IS=95.15 171	*
$^7_2\text{Li}^i$	26150	30	11250	30	RQ	$3/2^-$ T=3/2	03				*
^7_3Be	15769.00	0.07			53.22 d 0.06	$3/2^-$	03		1938	ε =100	*
$^7_3\text{Be}^i$	26750	30	10980	30	RQ	$3/2^-$ T=3/2	03			p ?; ^3He ?; α ?	*
^7_4B	27677	25			570 ys 14	$(3/2^-)$	14	11Ch32 T	1967	p=100	*
* ^7_0H	T : symmetrized from 08Ca22=0.09(+94-6) MeV										**
* ^7_1He	T : from width=182(5) keV in 12Ca05; others 09Ak03=190(30)										**
* ^7_2He	T : 08De29=125(+40-15) 02Me07=150(80) 69St02=160(30) (outweighed)										**
* ^7_3B	T : from width=801(20) keV in 11Ch32										**
^8_0H	31609.68	0.09			119.5 ms 1.5	0^+	05	15Bi05 TD	1965	β^- =100; β^- -n=16 1;	*
^8_1Li	20945.80	0.05			838.7 ms 0.3	2^+	05	10Fl01 T	1935	β^- -t=0.9 1	*
$^8_2\text{Li}^i$	31768	5	10822	5	RQ	0^+ T=2	05			β^- =100; β^- - α =100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^8Be	4941.67	0.04				81.9 as 3.7	0^+	05		1932	$\alpha=100$	
$^8\text{Be}^i$	21568	3	16626	3			2^+ frg. T=1	04Ti06	E	2004	$\alpha\approx 100$	
$^8\text{Be}^j$	32436.0	2.0	27494.3	2.0	RQ		0^+ T=2	05			$n=39.4; d=27.0; ^3\text{H}=11.7;$ $\alpha=7.9; p=6.9; ^3\text{He}=6.6;$ IT=0.60	*
^8B	22921.6	1.0				771.9 ms 0.9	2^+	05 20Vi03	T	1950	$\beta^+=100; \beta^+ \alpha=100$	*
$^8\text{B}^i$	33546	8	10624	8	RQ		0^+ T=2	05		1975		
^8C	35064	18				3.5 zs 1.4	0^+	18		1974	2p=100	*
^8He	D : $\% \beta^-$ intensity from $^8\text{Be} \alpha 1$											**
^8Li	D : β^- decay to first 2^+ state in ^8Be , which decays 100% by 2α											**
^8Li	T : average 10Fl01=838.40(0.36) 03Wi17=839.60(1.06) 90Sa16=840.3(0.9)											**
^8B	T : average 20Vi03=771.9(1.7), 773.9(1.8), 770.9(1.7), uncertainty in the											**
^8B	T : last value from priv. comm. with the authors (from 2.7 to 1.7),											**
^8B	T : $^{73}\text{McZ}W=772(4)$ $^{71}\text{Wi}05=762(5)$ $^{64}\text{Ma}35=774(4)$											**
^8C	T : from width=130(50) keV in $^{11}\text{Ch}32$											**
^9He	40940	50				2.5 zs 2.3	$1/2^+$	06 16Ub01	J	1987	$n=100$	*
^9Li	24954.91	0.19				178.2 ms 0.4	$3/2^-$	06 15Bi05	TD	1951	$\beta^-=100; \beta^- n=50.5$ 10	
^9Be	11348.45	0.08				STABLE	$3/2^-*$	06		1921	IS=100	
$^9\text{Be}^i$	25738.8	1.7	14390.3	1.7	RQ	1.25 as 0.10	$3/2^-$ T=3/2	06		1976		
^9B	12416.5	0.9				800 zs 300	$3/2^-$	06		1940	p=100	
$^9\text{B}^i$	27071.0	2.3	14654.5	2.5	RQ		$3/2^-$ T=3/2	06				
^9C	28911.0	2.1				126.5 ms 0.9	$3/2^-$	06 01Be51	D	1964	$\beta^+=100; \beta^+ p=7.5$ 6; $\beta^+ \alpha=38.4$ 16	*
^9He	T : from width=180(100) keV in $^{13}\text{Al}14$; other width=100(60) keV in $^{99}\text{Bo}26$											**
^9C	D : $\% \beta^+ p$ from $\% \beta^+$ (to ^9B gs)=54.1(1.5) from 01Be51 and $\% \beta^+$ (to ^9B exc)											**
^9C	D : from 00Ge09, but renormalized in order to have $\% \beta^+ (^9\text{C})=100$, and											**
^9C	D : $\% p/\% \alpha$ from 00Ge09; $\% \beta^+ \alpha=100 - \% \beta^+$ (to ^9B gs) - $\% \beta^+$											**
^9C	J : from 04Ti06											**
^{10}He	49200	90				260 ys 40	0^+	07		1994	2n=100	*
^{10}Li	33053	13				2.0 zs 0.5	$(1^-, 2^-)$	07 94Yo01	TJ	1975	$n=100$	
$^{10}\text{Li}^m$	33250	40	200	40	RQ	3.7 zs 1.5	1^+	07 97Zi04	T	1994	IT=100	*
$^{10}\text{Li}^n$	33530	40	480	40	RQ	1.35 zs 0.24	(2^+)	07 94Yo01	T	1993	IT=100	*
^{10}Be	12607.49	0.08				1.387 My 0.012	0^+	07 10Ch18	T	1935	$\beta^-=100$	*
$^{10}\text{Be}^i$	33787	21	21179	21	RQ		(2^-) T=2	07			$n ?; p ?; ^3\text{H} ?$	
^{10}B	12050.611	0.015				STABLE	3^+*	07		1920	IS=19.65 44	
$^{10}\text{B}^i$	13790.66	0.04	1740.05	0.04			0^+ T=1	07			IT=100	
^{10}C	15698.67	0.07				19.3011 s 0.0015	0^+	07 16Du10	T	1949	$\beta^+=100$	*
^{10}N	38800	400				143 ys 36	$1^-, 2^-$	17 17Ho10	TJ	2002	p ?	*
^{10}He	D : most probably 2 neutron emitter from $S_{2n}=-1440(90)$ keV											**
^{10}He	T : from width=1.76(0.27) MeV, average 10Ko43=1.8(4) and 10Jo06=1.73(0.36),											**
^{10}He	T : the latter average of 1.11(0.76), assuming a single narrow resonance,											**
^{10}He	T : and 1.91(0.41), assuming two overlapping resonances; others:											**
^{10}He	T : width=2 MeV in $^{12}\text{Si}07$, 100-500 keV in $^{94}\text{Os}04$, <1.2 MeV in $^{94}\text{Ko}16$											**
$^{10}\text{Li}^m$	T : from average width=120(+100-50) keV in $^{97}\text{Zi}04$ and 100(70) keV in $^{94}\text{Yo}01$											**
$^{10}\text{Li}^n$	T : from average width=358(23) keV in $^{94}\text{Yo}01$, 150(70) keV in $^{93}\text{Bo}03$;											**
$^{10}\text{Li}^n$	T : Birge ratio=2.8											**
^{10}Be	T : average 10Ch18=1.386(0.016) 10Ko19=1.388(0.018)											**
^{10}C	T : average 16Du10=19.2969(0.0074), 19.3009(0.0017) 09Ba06=19.282(0.011)											**
^{10}C	T : 08Ia01=19.310(0.004) 90Ba02=19.295(0.015) 74Az01=19.280(0.020)											**
^{10}C	T : $^{74}\text{Ro}21=19.150(0.030)$											**
^{10}N	T : from width=3.1(+0.9-0.7) MeV for $J=2^-$ in $^{17}\text{Ho}10$; other:											**
^{10}N	T : width=2.5(+2.0-1.5) MeV for $J=1^-$ in $^{17}\text{Ho}10$.											**
^{11}Li	40728.3	0.6				8.75 ms 0.06	$3/2^-*$	12 12Ke01	D	1966	$\beta^-=100; \beta^- n=86.3$ 9; $\beta^- 2n=4.1$ 4; $\beta^- 3n=1.9$ 2; $\beta^- \alpha=1.7$ 3; $\beta^- d=0.0130$ 13; $\beta^- t=0.0093$ 8	*
^{11}Be	20177.17	0.24				13.76 s 0.07	$1/2^+*$	12 19Re03	D	1958	$\beta^-=100; \beta^- \alpha=3.3$ 1;	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{11}\text{Be}^i$	41336	20	21158	20	RQ	0.93 zs 0.13	$3/2^-$ T=5/2		MMC162J	1997	β^- p=0.0013 3; β^- n ?	
^{11}B	8667.708	0.012				STABLE	$3/2^-*$	12		1920	IT ?	
$^{11}\text{B}^i$	21228	9	12560	9	RQ		$1/2^+, (3/2^+)$	12		1963	IS=80.35 44	
$^{11}\text{B}^j$	42230	80	33570	80	2p		$3/2^-$ T=5/2		MMC146J			
^{11}C	10649.40	0.06				20.3402 m 0.0053	$3/2^-*$	12	18Va04 T	1934	β^+ =100	
$^{11}\text{C}^i$	22810	40	12160	40	RQ		$1/2^+$ T=3/2	12	71Wa21 D	1971	p=?	
^{11}N	24366	5				585 ys 7	$1/2^+$	12	19We11 T	1974	p=100	
$^{11}\text{N}^m$	25110	60	740	60		690 ys 80	$1/2^-$	12	96Ax01 ETJ	1974	p=100	
^{11}O	47740	60				198 ys 12	$(3/2^-)$	20	20We08 TJ	2019	2p=100	
* ^{11}Li	T : average 97Mo35=8.99(0.10) 96Mu19=8.2(0.2) 95Re.A=8.4(0.2)											
* ^{11}Li	T : 81Bj01=8.83(0.12) and 74Ro31=8.5(0.2)											
* ^{11}Be	D : % β^- - α from 19Re03=3.30(0.10); other 81A103=2.9(4)											
* ^{11}Be	D : % β^- -p from 19Ay03=0.0013(0.0003); others (indirect) 14Ri01=0.00083(9)											
* ^{11}Be	D : 20Ri02<0.00022%											
* ^{11}Be	J : 14Ta10=1/2											
* $^{11}\text{Be}^i$	T : from width=490(70) keV in 97Te07											
* ^{11}C	T : from 18Va04 using world data											
* ^{11}N	T : from width=780(10) keV in 19We11											
* ^{11}O	T : from width=2.31 (0.14) MeV in 20We08; other width=2.46 MeV in 19Fo10											
^{12}Li	49010	30					$(1^-, 2^-)$	17	74Bo05 I	2008	n ?	
^{12}Be	25077.8	1.9				21.46 ms 0.05	0^+	17		1966	β^- =100; β^- -n=0.50 3	
$^{12}\text{Be}^m$	27328.8	2.1	2251	1		233 ns 7	0^+	17		2007	IT=100	
^{12}B	13369.4	1.3				20.20 ms 0.02	1^+*	17		1935	β^- =100; β^- - α =0.60 2	
$^{12}\text{B}^i$	26088	19	12719	19	RQ		0^+ T=2	17	08Ch28 J			
^{12}C	0.0	0.0				STABLE	0^+	17		1919	IS=98.94 6	
$^{12}\text{C}^i$	15108	3	15108	3	RQ		1^+ T=1	17			IT=?; α ?	
$^{12}\text{C}^j$	27595.0	2.4	27595.0	2.4	RQ		0^+ T=2	17				
^{12}N	17338.1	1.0				11.000 ms 0.016	1^+*	17	09Hy01 D	1949	β^+ =100; β^+ - α =1.93 4	
$^{12}\text{N}^i$	29580	4	12242	4	2p	> 5 zs	(0^+) T=2	17	MMC142J			
^{12}O	32013	12				8.9 zs 3.3	0^+	17	19We11 T	1978	2p=100	
* $^{12}\text{Be}^m$	T : average 07Sh34=229(8) 13Jo06=247(15); other 18Ch31=270(+12-120)											
* ^{12}N	T : from 78Al01; other 20Bi15=10.92(0.11,stat)(0.01,syst)											
* $^{12}\text{N}^i$	T : from width<100 keV in 19We11											
* ^{12}O	T : from width=51(19) keV in 19We11; others 12Ja11<72 keV											
* ^{12}O	T : 09Su14=600(500) keV 95Kr03=578(205)keV											
^{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	$(1/2^-)$		19Co02 J	1983	n ?	
$^{13}\text{Be}^p$	35160	50	1500	50	RQ		$(5/2^+)$			1992		
^{13}B	16561.9	1.0				17.16 ms 0.18	$3/2^-$	00	15Bi05 TD	1956	β^- =100; β^- -n=0.266 36	
^{13}C	3125.0093	0.0002				STABLE	$1/2^-*$	01		1929	IS=1.06 6	
$^{13}\text{C}^i$	18233.8	1.1	15108.8	1.1	RQ		$3/2^-$ T=3/2	00			IT=0.82 7;n ?; α ?	
^{13}N	5345.48	0.27				9.965 m 0.004	$1/2^-*$	00		1934	β^+ =100	
$^{13}\text{N}^i$	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 2	
^{13}F	42030#	500#					$1/2^+*$				p ?	
* ^{13}Li	T : from width=125(60-40) keV in 13Ko03											
* ^{13}Be	T : from width=450(30) keV in 10Ko17; other width=300(200) keV in 95Pe12											
* ^{13}Be	J : from 10Ko17,19Co02; others J=1/2+ in 01Th01,08Ch07,13Ak02,14Ra07											
^{14}Be	39950	130				4.53 ms 0.27	0^+	01	15Bi05 TD	1973	β^- =100; β^- -n=86 6; β^- -2n=5 2;	
$^{14}\text{Be}^p$	41470	60	1520	150	RQ		(2^+)		95Bo10 I	1995	β^- -t=0.02 1; β^- - α <0.004	
^{14}B	23664	21				12.36 ms 0.29	2^-	01	15Bi05 TD	1966	β^- =100; β^- -n=6.04 23;	
$^{14}\text{B}^i$	40728	20	17065	29	RQ	4.15 zs 1.9	0^+ T=3		MMC162J	2001	IT ?	
^{14}C	3019.893	0.004				5.70 ky 0.03	0^+	01		1936	β^- =100	
$^{14}\text{C}^i$	25120	100	22100	100			(2^-) T=2	01		1989	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{14}N	2863.4168	0.0002				STABLE	1^+*	01		1920	IS=99.6205 247		
$^{14}\text{N}^i$	5176.007	0.010	2312.590	0.010			$0^+ \text{ T}=1$	01	01Ba06	E	1963	IT=100	
^{14}O	8007.781	0.025				70.621 s 0.011	0^+	01	13La23	T	1949	$\beta^+=100$	
^{14}F	31960	40				500 ys 60	2^-	14	10Go16	TJ	2010	p ?	
^{14}Be	D : $\% \beta^-$ -t, $\% \beta^- \alpha$ from 02Je11												
$^{14}\text{B}^i$	T : from width=110(50) keV in 01Ta23												
^{14}O	T : average 13La23=70.610(0.030),70.632(0.094) 12Ta.B=70.623(0.053)												
^{14}O	T : 06Bu06=70.696(0.052) 04Ba78=70.641(0.020) 01Ga59=70.560(0.049)												
^{14}O	T : 78Be61=70.684(0.077) 78Wi04=70.613(0.025) 73Cl12=70.588(0.028);												
^{14}O	T : others (outweighed): 74Az01=70.43(0.18) 72Al01=70.48(0.15)												
^{14}O	T : 72Si50=70.32(0.12)												
^{14}F	T : from width=910(100) keV in 10Go16												
^{15}Be	49830	170				790 ys 270	$(5/2^+)$	15	13Sn02	TD	2013	n=100	
^{15}B	28957	21				10.18 ms 0.35	$3/2^-$	02	15Bi05	TD	1966	$\beta^-=100;\beta^- \text{ n}=98.7 \text{ 10};$ $\beta^- \text{ 2n}<1.5$	
^{15}C	9873.1	0.8				2.449 s 0.005	$1/2^+$	02			1950	$\beta^-=100$	
^{15}N	101.4381	0.0006				STABLE	$1/2^-*$	02			1929	IS=0.3795 247	
$^{15}\text{N}^i$	11717	4	11615	4	RQ		$1/2^+ \text{ T}=3/2$	02				n ?;p ?;IT=0.00523 19	
^{15}O	2855.6	0.5				122.266 s 0.043	$1/2^-*$	02	20Bu02	T	1934	$\beta^+=100$	
$^{15}\text{O}^i$	14020#	40#	11165#	35#			$(1/2^+) \text{ T}=3/2$	02	Imme	E		p=100	
^{15}F	16567	14				1.1 zs 0.3	$1/2^+$	16	04Go15	J	1978	p=100	
^{15}Ne	40220	70		2p		770 ys 300	$(3/2^-)$	14	14Wa09	JTD	2014	2p=100	
^{15}Be	T : from width=575(200) keV in 13Sn02												
^{15}B	D : $\% \beta^- \text{ 2n}$ symmetrized from 91Ha25=99.68(+0.08-1.58); other 95Re.A=93.6(1.2)												
^{15}O	T : average 20Bu02=122.308(49) 77Az01=122.23(0.23) 60Ja12=122.1(0.1)												
^{15}F	T : from width=370(70)(+200-0) keV in 16De15												
^{15}Ne	T : from width=590(230) keV												
^{16}Be	57450	170				650 ys 130	0^+	15	12Sp01	TD	2012	2n=100	
^{16}B	37112	25				> 4.6 zs	$0^- \#$	16			2000	n ?	
^{16}C	13694	4				750 ms 6	0^+	99			1961	$\beta^-=100;\beta^- \text{ n}=99.0 \text{ 3}$	
^{16}N	5683.9	2.3				7.13 s 0.02	2^-	99	18Ki12	D	1933	$\beta^-=100;\beta^- \alpha=0.00154 \text{ 5}$	
$^{16}\text{N}^m$	5804.3	2.3	120.42	0.12		5.25 μ s 0.06	$0^- \text{ T}=1$	99	83Mi20	D	1957	IT $\approx$ 100; β^- =0.000389 25	
$^{16}\text{N}^i$	15613	7	9929	7	RQ		$0^+ \text{ T}=2$	99					
^{16}O	-4737.0021	0.0003				STABLE	0^+	99			1919	IS=99.757 11	
$^{16}\text{O}^p$	8231.60	0.27	12968.6	0.27			2^-	99	64Bo13	E		p=78 4; α =22 4;IT=0.28 3	
$^{16}\text{O}^i$	8059	4	12796	4	RQ		$0^- \text{ T}=1$	99				IT=100	
$^{16}\text{O}^j$	17984	4	22721	4	RQ		$0^+ \text{ T}=2$	99					
^{16}F	10675	5				21 zs 5	0^-	99	18Ch25	T	1964	p=100	
^{16}Ne	23987	20				> 5.7 zs	0^+	99	14Br19	T	1977	2p=100	
^{16}Be	T : from width=0.8(+0.1-0.2) MeV												
^{16}C	T : average 01Gr06=753(8) 76Al02=747(8)												
^{16}N	D : $\% \beta^- \alpha$ average 18Ki12=0.00159(6) 16Re01=0.00149(5stat)(+0-10sys)												
$^{16}\text{N}^m$	D : $\% \beta^-$ average 83Mi20=4.35(0.50)e-4 5.10(0.65)e-4 83Ga18=3.42(0.37)e-4,												
$^{16}\text{N}^m$	D : supersedes 82Ga05=3.13(0.43)e-4, 75Pa01=3.3(0.7)e-4												
^{16}F	T : from width=21.3(5.1) keV												
^{16}Ne	T : from width<80 keV (3 sigma upper limit) in 14Br19												
^{17}B	43720	200				5.08 ms 0.05	$(3/2^-)$	99	88Du09	D	1973	$\beta^-=100;\beta^- \text{ n}=63 \text{ 1};$ $\beta^- \text{ 2n}=12 \text{ 2};\beta^- \text{ 3n}=3.5 \text{ 7};$ $\beta^- \text{ 4n}=0.4 \text{ 3}$	
^{17}C	21032	17				193 ms 6	$3/2^+$	17			1968	$\beta^-=100;\beta^- \text{ n}=28.4 \text{ 13};$ $\beta^- \text{ 2n} ?$	
^{17}N	7870	15				4.173 s 0.004	$1/2^-$	99	94Do08	D	1949	$\beta^-=100;\beta^- \text{ n}=95.1 \text{ 7};$ $\beta^- \alpha=0.0025 \text{ 4}$	
^{17}O	-808.7642	0.0006				STABLE	$5/2^+*$	99			1925	IS=0.03835 96	
$^{17}\text{O}^i$	10270.02	0.17	11078.78	0.17	RQ		$1/2^- \text{ T}=3/2$	99				$\beta^- ? \text{ n} ? \text{ ;IT}=0.42 \text{ 14}$	
^{17}F	1951.70	0.25				64.370 s 0.027	$5/2^+$	99	16Br01	T	1934	$\beta^+=100$	
$^{17}\text{F}^i$	13144.7	1.9	11193.0	1.9	RQ		$1/2^- \text{ T}=3/2$	99					

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{17}Ne	16500.5	0.4			109.2 ms 0.6	$1/2^-*$	99	02Mo19 D	1963	$\beta^+=100; \beta^+p=94.4\ 29;$ $\beta^+\alpha=3.51\ 1; \beta^+p\alpha=0.014\ 4$ $p=100$	
^{17}Na	34720	60				$(1/2^+)$	17	17Br07 IJD	2017		
* ^{17}N	D : $\% \beta^-n$ from $^{76}\text{Al}02$										**
* ^{17}F	T : average $^{16}\text{Br}01=64.402(0.042)$ $^{15}\text{Gr}14=64.347(0.035)$										**
^{18}B	51790	200			<26 ns	(2^-)	16	10Sp02 IJ	2010	$n=100$ $\beta^-=100; \beta^-n=31.5\ 15;$ $\beta^-2n?$	
^{18}C	24920	30			92 ms 2	0^+	17		1969		
^{18}N	13113	19			619.2 ms 1.9	1^-	96	05Li60 TD	1964	$\beta^-=100; \beta^-n=7.0\ 15;$ $\beta^-\alpha=12.2\ 6; \beta^-2n?$ $IS=0.2045\ 102$	*
^{18}O	-782.8163	0.0006			STABLE	0^+	96		1929		
$^{18}\text{O}^i$	15495	20	16278	20		1^- T=2	AHWe				*
^{18}F	873.1	0.5			109.734 m 0.008	1^+	96	FGK204 T	1937	$\beta^+=100$	
$^{18}\text{F}^m$	1994.5	0.5	1121.36	0.15	162 ns 7	5^+	96			IT=100	
$^{18}\text{F}^i$	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	$\beta^+=100$	*
^{18}Na	25040	90			1.3 zs 0.4	$1^- \#$	15	04Ze05 TD	2004	$p=?$	
* ^{18}N	D : $\% \beta^- \alpha$ from $^{89}\text{Zn}04$										**
* ^{18}N	D : other $\% \beta^-n$ $^{94}\text{Sc}01=2.2(0.4)$ $^{95}\text{Re.A}=10.9(0.9)$ $^{91}\text{Re}02=14.3(2.0)$ (same group)										**
* ^{18}N	T : average $^{05}\text{Li}60=619(2)$ $^{99}\text{Og}03=620(14)$ $^{82}\text{O}101=624(12)$ $^{64}\text{Ch}19=630(30)$										**
* $^{18}\text{O}^i$	E : assuming 16399(5), 17025(10) levels to be IAS's of 114.90(0.18), 747(10)										**
* $^{18}\text{O}^i$	E : levels in ^{18}N (see $^{95}\text{Ti}07$)										**
* ^{18}Ne	T : average $^{15}\text{La}19=1664.00(+0.57-0.48)$ $^{13}\text{Gr}03=1664.8(1.1)$, supersedes										**
* ^{18}Ne	T : $^{07}\text{Gr}18=1665.6(1.9)$; others (outweighed): $^{75}\text{Al}27=1669(4)$ $^{75}\text{Ha}21=1687(9)$										**
^{19}B	59770	530			2.92 ms 0.13	$(3/2^-)$	18	03Yo02 TD	1984	$\beta^-=100; \beta^-n=71\ 9;$ $\beta^-2n=17\ 5; \beta^-3n<9.1$	*
^{19}C	32410	100			46.2 ms 2.3	$1/2^+$	17	88Du09 TD	1974		*
^{19}N	15856	16			336 ms 3	$1/2^-$	96	06Su12 TJD	1968	$\beta^-=100; \beta^-n=47\ 3; \beta^-2n=7\ 3$	*
^{19}O	3332.9	2.6			26.470 s 0.006	$5/2^+$	96	13Uj01 T	1936	$\beta^-=100$	*
^{19}F	-1487.4451	0.0008			STABLE	$1/2^+*$	96		1920	IS=100	
$^{19}\text{F}^i$	6052.2	0.9	7539.6	0.9		$5/2^+$ T=3/2	96			IT=100	
^{19}Ne	1752.05	0.16			17.2569 s 0.0019	$1/2^+*$	96	17Fo24 T	1939	$\beta^+=100$	*
$^{19}\text{Ne}^i$	9253	9	7501	9 RQ		$(5/2^+)$ T=3/2	96	MMC127J			*
^{19}Na	12929	11			> 1 as	$(5/2^+)$	15	10Mu12 T	1969	$p=100$	*
^{19}Mg	31840	60			5 ps 3	$1/2^- \#$	14	09Mu17 TD	2007	$2p=100$	*
* ^{19}B	D : $\% \beta^-n$, $\% \beta^-2n$ symmetrized from $^{03}\text{Yo}02=71.8(+8.3-9.1)$, $16.0(+5.6-4.8)$										**
* ^{19}C	T : average $^{88}\text{Du}09=49(4)$ $^{95}\text{Re.A}=44(4)$ $^{95}\text{Oz}02=45.5(4.0)$										**
* ^{19}C	J : from $^{01}\text{Ma}08$, $^{99}\text{Na}27$ and $^{95}\text{Ba}28$										**
* ^{19}O	T : average $^{13}\text{Uj}01=26.476(0.009)$ $^{94}\text{It.A}=26.464(0.009)$										**
* ^{19}Ne	T : average $^{17}\text{Fo}24=17.2569(0.0021)$ $^{13}\text{Uj}01=17.254(0.005)$ $^{12}\text{Tr}06=17.262(0.007)$;										**
* ^{19}Ne	T : others (outliers) $^{14}\text{Br}06=17.283(0.008)$ $^{94}\text{Ko.A}=17.296(0.005)$										**
* ^{19}Ne	T : $^{92}\text{Ge}08=18.5(0.6)$ for $q=10^+$ (bare ion)										**
* $^{19}\text{Ne}^i$	J : possible IAS of ^{19}O gs ($J=5/2^+$)										**
* ^{19}Na	T : from width <40 keV in $^{10}\text{Mu}12$, dominated by resolution of <1 eV										**
* ^{19}Mg	T : symmetrized from $^{09}\text{Mu}17=6(+2-4)$; supersedes $^{07}\text{Mu}15=4.0(1.5)$										**
^{20}B	69400	550			> 912.4 ys	$(1^-, 2^-)$	19	18Le18 TJ	2018	$n=100; \beta^-n?; \beta^-2n?$ $\beta^-=100; \beta^-n=70\ 11;$ $\beta^-2n<18.6$	*
^{20}C	37500	230			16 ms 3	0^+	17	90Mu06 TD	1981		*
^{20}N	21770	80			136 ms 3	(2^-)	18	06Su12 TD	1969	$\beta^-=100; \beta^-n=42.9\ 14;$ $\beta^-2n?$	
^{20}O	3796.2	0.9			13.51 s 0.05	0^+	98		1959		
^{20}F	-17.463	0.030			11.0062 s 0.0080	2^+	98	19Bu01 T	1935	$\beta^-=100$	*
$^{20}\text{F}^i$	6503	3	6521	3 RQ		0^+ T=2	98			$\beta^+=100$	
^{20}Ne	-7041.9322	0.0015			STABLE	0^+	98		1913	IS=90.48 3	
$^{20}\text{Ne}^i$	3230.5	2.0	10272.5	2.0 RQ		2^+ T=1	98			IT=100	
$^{20}\text{Ne}^j$	9690.9	2.8	16732.8	2.8 RQ		0^+ T=2	98			IT=100	
^{20}Na	6850.5	1.1			447.9 ms 2.3	2^+*	98	89Cl02 D	1950	$\beta^+=100; \beta^+\alpha=25.0\ 4$	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
$^{20}\text{Na}^i$	13348.9	1.2	6498.4	0.5	p	$0^+ T=2$	98		1979	p=100		
^{20}Mg	17477.7	1.9			90.4 ms 0.5	0^+	16	17Su05	T	1974	$\beta^+=100; \beta^+p=30.3$ 12	*
^{20}B	T : from width < 0.5 MeV											**
^{20}C	D : $\% \beta^-n$ average 03Yo02=65(+19-18) 90Mu06=72(14)											**
^{20}C	T : average 90Mu06=14(+6-5), supersedes 89Le16=16(+14-7) same group,											**
^{20}C	T : 95Re.A=16.7(3.5); other 03Yo02=21.8(+15.0-7.4)											**
^{20}F	T : evaluated in 19Bu01 using the world data											**
^{20}Mg	T : average 17Su05=90.0(0.6) 16Lu13=91.4(1.0)											**
^{21}B	78380	560			> 760 ys	$(3/2^-)$	19	18Le18	TJI	2018	2n=100	*
^{21}C	45640#	600#			<30ns	$1/2^+ \#$	15	93Po.A	I		n ?	
^{21}N	25230	130			85 ms 5	$(1/2^-)$	15	09Li51	TD	1970	$\beta^- = 100; \beta^-n=87$ 3; β^-2n ?	*
^{21}O	8062	12			3.42 s 0.10	$(5/2^+)$	15			1968	$\beta^- = 100; \beta^-n$?	
^{21}F	-47.6	1.8			4.158 s 0.020	$5/2^+$	15			1955	$\beta^- = 100$	
^{21}Ne	-5731.78	0.04			STABLE	$3/2^+ *$	15			1928	1S=0.27 1	
$^{21}\text{Ne}^i$	3129.0	0.3	8860.8	0.3		$5/2^+ T=3/2$	15					
^{21}Na	-2184.86	0.04			22.4550 s 0.0054	$3/2^+ *$	15	18Sh27	T	1940	$\beta^+ = 100$	*
$^{21}\text{Na}^i$	6790	4	8975	4	p	$5/2^+ T=3/2$	15					
^{21}Mg	10903.9	0.8			120.0 ms 0.4	$5/2^+ *$	15	15Lu13	D	1963	$\beta^+ = 100; \beta^+p=20.1$ 21; $\beta^+ \alpha=0.116$ 18; $\beta^+p \alpha=0.016$ 3	
^{21}Al	27090#	600#			<35ns	$5/2^+ \#$	15	93Po.A	I		p ?	
^{21}B	T : from width < 0.6 MeV											**
^{21}N	T : average 09Li51=83(8), supersedes 08Lo06=82.9(1.9), 07Su05=85(14)											**
^{21}N	T : 90Mu06=95(+15-11) 95Re.A=83.6(6.7), supersedes 91Re02=61(23)											**
^{21}N	D : $\% \beta^-n$ average 09Li51=90.5(4.2) 90Mu06=84(9) 95Re.A=78(7), supersedes											**
^{21}N	D : 91Re02=76(15)											**
^{21}Na	T : average 18Sh27=22.4615(0.0040) 17Fi07=22.4056(0.0033); others											**
^{21}Na	T : 15Gr05=22.422(0.010) 75Az01=22.47(0.03) 74Al03=22.55(0.10)											**
^{21}Mg	T : average 15Lu12=118.6(0.5) 18Wa20=121.9(0.6) 92Go10=120(5)											**
^{21}Mg	T : 73Se08=123(3) 65Ha20=121(5)											**
^{21}Mg	D : $\% \beta^+p$ average 18Wa20=19.2(30) 15Lu13=21.0(3.0)											**
^{22}C	53610	230			6.2 ms 1.3	0^+	15	03Yo02	TD	1986	$\beta^- = 100; \beta^-n=61$ 14; $\beta^-2n<37$	*
^{22}N	31760	210			23 ms 3	$0^- \#$	15			1979	$\beta^- = 100; \beta^-n=34$ 3; $\beta^-2n=12$ 3	
^{22}O	9280	60			2.25 s 0.09	0^+	15			1969	$\beta^- = 100; \beta^-n<22$	
^{22}F	2793	12			4.23 s 0.04	(4^+)	15			1965	$\beta^- = 100; \beta^-n<11$	
^{22}Ne	-8024.716	0.018			STABLE	0^+	15			1913	1S=9.25 3	
$^{22}\text{Ne}^i$	5855	10	13880	10		$4^+ T=2$	15	04Go03	E			*
^{22}Na	-5181.39	0.13			2.6019 y 0.0006	$3^+ *$	15	FGK204	T	1935	$\beta^+ = 100; e^+ = 90.57$ 8; $\epsilon=9.43$ 6	*
$^{22}\text{Na}^m$	-4598.34	0.16	583.05	0.10	243 ns 2	1^+	15			1958	IT=100	
$^{22}\text{Na}^i$	-4524.39	0.19	657.00	0.14	19.6 ps 0.7	$0^+ T=1$	15				IT=100	
^{22}Mg	-399.99	0.16			3.8745 s 0.0007	0^+	15	17Du11	T	1961	$\beta^+ = 100$	*
$^{22}\text{Mg}^i$	13644	6	14044	6	p	$(4)^+ T=2$	15	MMC12	J		$\alpha=?; p=?$	*
^{22}Al	18200#	400#			91.1 ms 0.5	$(4)^+$	15			1982	$\beta^+ = 100; \beta^+p=55$ 3; $\beta^+2p=1.10$ 11; $\beta^+ \alpha=0.038$ 17	*
^{22}Si	33640#	500#			28.7 ms 1.1	0^+	15	20Le16	TD	1987	$\beta^+ = 100; \beta^+p=62$ 5; $\beta^+2p=0.7$ 3	*
^{22}C	T : symmetrized from 03Yo02=6.1(+1.4-1.2)											**
^{22}C	D : $\% \beta^-n$ symmetrized from 03Yo02=61(+14-13)											**
$^{22}\text{Ne}^i$	E : from 16Ma.A, but T=2 assignment is not firm											**
^{22}Na	D : from 71GoYM											**
^{22}Mg	T : average 17Du11=3.87400(0.00079) 03Ha20=3.8755(0.0012)											**
$^{22}\text{Mg}^i$	J : IAS of ^{22}Al gs [J=(4)+]											**
^{22}Si	T : average 20Le16=28.6(1.4), supersedes 17Xu01=27.8(3.5), 96B11=29(2)											**
^{22}Si	D : $\% \beta^+p$ from 20Le16, based on %I(p)=5.3(1.0), 43.0(4.6) and 13.5(2.1);											**
^{22}Si	D : $\% \beta^+2p$ from 17Xu01											**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

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	$1/2^-\#$	21	03Yo02	TD 1985	$\beta^- = 100; \beta^- n = 42.6; \beta^- 2n = 8.4$; $\beta^- 3n < 3.4$	*
^{23}O	14620	120			97 ms 8	$1/2^+$	21	07Su05	TD 1970	$\beta^- = 100; \beta^- n = 7.2$	
^{23}F	3290	30			2.23 s 0.14	$5/2^+$	21	95Re.A	D 1970	$\beta^- = 100; \beta^- n < 14$	
^{23}Ne	-5154.05	0.10			37.15 s 0.03	$5/2^+*$	21	15La19	T 1936	$\beta^- = 100$	*
^{23}Na	-9529.8535	0.0018			STABLE	$3/2^+*$	21		1921	IS=100	*
$^{23}\text{Na}^i$	-1638.7	0.3	7891.2	0.3		$5/2^+ T=3/2$	21			IT=100	
$^{23}\text{Na}^j$	10060.6	2.0	19590.4	2.0	240 zs 120	$T=5/2$	21	85Ev01	T		*
^{23}Mg	-5473.67	0.03			11.3039 s 0.0032	$3/2^+*$	21	17Yo05	J 1939	$\beta^+ = 100$	
$^{23}\text{Mg}^i$	2329.3	0.6	7803.0	0.6		$5/2^+ T=3/2$	21	00Pe28	D 1981	IT $\approx$ 100; p=0.17 8	
^{23}Al	6748.1	0.3			446 ms 6	$5/2^+$	21	06Ia03	T 1969	$\beta^+ = 100; \beta^+ p = 1.22.5$	*
$^{23}\text{Al}^i$	18470	40	11720	40	p	$(5/2^+) T=5/2$	21		1997	p=0.10 5; 2p=3.6 4	
^{23}Si	23950#	500#			42.3 ms 0.4	$3/2^+\#$	21	97Bl04	TD 1986	$\beta^+ = 100; \beta^+ p \approx 88; \beta^+ 2p = 3.6.3$	*
$^{*23}\text{N}$	T : symmetrized from 03Yo02=14.1(+1.2-1.5)										**
$^{*23}\text{N}$	D : % $\beta^- n$ and % $\beta^- 2n$ symmetrized from 03Yo02=42.2(+6.3-6.5) and 8.0(+3.8-3.4)										**
$^{*23}\text{Ne}$	T : average 15La19=37.148(0.032) 07Gr18=37.11(0.06) 74Al03=37.24(0.12)										**
$^{*23}\text{Na}$	J : 00Ke09=5/2										**
$^{*23}\text{Na}^j$	T : from width=1.9(0.8) keV										**
$^{*23}\text{Mg}$	T : average 77Az01=11.317(0.011) 17Ma18=11.3027(0.0033)										**
$^{*23}\text{Al}$	D : from 11Sa15										**
$^{*23}\text{Si}$	T : also 18Wa05=40.17(1.86) for all delayed proton event > 300 keV										**
^{24}N	46940#	400#			<52ns			07 93Po.A	I	n ?	
^{24}O	18500	160			77.4 ms 4.5	0^+	07	15Ca09	TD 1970	$\beta^- = 100; \beta^- n = 43.4$	*
^{24}F	7540	100			384 ms 16	3^+	07	07Su05	T 1970	$\beta^- = 100; \beta^- n < 5.9$	*
^{24}Ne	-5951.6	0.5			3.38 m 0.02	0^+	07		1956	$\beta^- = 100[\text{gs}=0, \text{m}=100]$	
^{24}Na	-8417.901	0.017			14.9560 h 0.0015	4^+*	07	FGK204	T 1934	$\beta^- = 100$	*
$^{24}\text{Na}^m$	-7945.694	0.017	472.2074	0.0008	20.18 ms 0.10	1^+	07		1961	IT $\approx$ 100; $\beta^- = 0.05$	
$^{24}\text{Na}^i$	-2450.53	0.13	5967.37	0.13		$0^+ T=2$	07				
^{24}Mg	-13933.578	0.013			STABLE	0^+	07		1920	IS=78.965 49	
$^{24}\text{Mg}^i$	-4417.30	0.04	9516.28	0.04		$(4^+) T=1$	07				
$^{24}\text{Mg}^j$	1502.8	0.6	15436.4	0.6		$0^+ T=2$	07				
^{24}Al	-48.81	0.23			2.053 s 0.004	4^+	07		1953	$\beta^+ = 100; \beta^+ \alpha = 0.035.6$; $\beta^+ p = 0.0016.3$	
$^{24}\text{Al}^m$	376.99	0.25	425.8	0.1	130 ms 3	1^+	07		1968	IT=82.5 30; $\beta^+ = 17.5.30$; $\beta^+ \alpha = 0.028.6$	
$^{24}\text{Al}^i$	5900	3	5949	3	p	$0^+ T=2$	07				
^{24}Si	10745	19			143.2 ms 2.1	0^+	07	15Su15	T 1979	$\beta^+ = 100; \beta^+ p = 34.5.14$	*
^{24}P	34020#	500#				$1^+\#$				p ?; $\beta^+ ?$; $\beta^+ p ?$	
$^{*24}\text{O}$	T : average 15Ca09=80(5) 01Pe14=67(10); other 90Mu06=61(+32-19)										**
$^{*24}\text{F}$	J : 15Ca09=3										**
$^{*24}\text{Na}$	J : 00Ke09=4										**
$^{*24}\text{Si}$	T : average 15Su15=143.3(2.2) 97Cz02=140(8)										**
$^{*24}\text{Si}$	D : % $\beta^+ p$ average 98Cz01= 37.6(2.5) 11Ic06=33.3(1.6)										**
^{25}N	55980#	500#			<260ns	$1/2^-\#$	09	99Sa06	I	n ?; 2n ?; $\beta^- ?$	*
^{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	$\beta^- = 100; \beta^- n = 23.1.45$; $\beta^- 2n ?$	
^{25}Ne	-2036	29			602 ms 8	$1/2^+*$	09		1970	$\beta^- = 100$	
^{25}Na	-9357.8	1.2			59.1 s 0.6	$5/2^+*$	09		1943	$\beta^- = 100$	*
^{25}Mg	-13192.78	0.05			STABLE	$5/2^+*$	09		1920	IS=10.011 13	*
$^{25}\text{Mg}^i$	-5405.8	0.3	7787.0	0.3		$5/2^+ T=3/2$	09				
^{25}Al	-8915.97	0.06			7.1666 s 0.0023	$5/2^+$	09	17Lo09	T 1953	$\beta^+ = 100$	*
$^{25}\text{Al}^i$	-1014.9	1.8	7901.1	1.8		$5/2^+ T=3/2$	09	20Su.1	E		
^{25}Si	3827	10			220.6 ms 1.0	$5/2^+$	09	20Su.1	T 1963	$\beta^+ = 100; \beta^+ p = 35.2$	*
^{25}P	20190#	400#			<30ns	$1/2^+\#$	09	93Po.A	I	p ?	
$^{*25}\text{N}$	I : 240 ^{25}N events expected, but none observed in 99Sa06										**
$^{*25}\text{O}$	T : from width=88(6) keV in 16Ko11; other width=20(+60-20) keV in 13Ca18										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁵ Na	J : 00Ke09=5/2										**
* ²⁵ Mg	J : also 17Yo05,19Yo06=5/2										**
* ²⁵ Al	T : average 17Lo09=7.1657(0.0024) 75Az01=7.174(0.007)										**
* ²⁵ Si	T : symmetrized from 20Su.1=220.9(+0.8-1.2)										**
²⁶ O	34660	160			4.2 ps 3.3	0 ⁺	16	13Ko10 T	2012	2n=100	*
²⁶ F	18670	110			8.2 ms 0.9	1 ⁺	16		1979	β^- =100; β^- n=13.5 40; β^- 2n ?	
²⁶ F ^m	19310	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	82.4	0.04	4.35 μ s 0.16	1 ⁺	16	14NiZZ ET	1987	IT=100	*
²⁶ Mg	-16214.544	0.029			STABLE	0 ⁺	16		1920	IS=11.025 38	
²⁶ Al	-12210.14	0.07			717 ky 24	5 ⁺	16		1934	β^+ =100	
²⁶ Al ^m	-11981.83	0.07	228.306	0.013 MD	6346.0 ms 0.5	0 ⁺ T=1	16	13Ch51 T	1934	β^+ =100	*
²⁶ Si	-7141.00	0.11			2.2453 s 0.0007	0 ⁺	16	10Ia01 T	1960	β^+ =100	*
²⁶ Si ⁱ	5874	4	13015	4 p		(3 ⁺) T=2	16				
²⁶ P	10970#	200#			43.6 ms 0.3	(3 ⁺) ⁺	16	17Ja05 D	1983	β^+ =100; β^+ p=35.1 14; β^+ 2p=1.99 21	*
²⁶ P ^m	11130#	200#	164.4	0.1	115 ns 8	(1 ⁺)	16	17Pe09 ET	2014	IT=100	*
²⁶ S	27680#	600#			<79ns	0 ⁺	16	11Fo08 IT		2p ?	
* ²⁶ O	T : symmetrized from 13Ko10=4.5(+1.1-1.5 stat)(3 syst)										**
* ²⁶ Na	J : 00Ke09=1										**
* ²⁶ Na ^m	T : also 87DuZU=9(2)										**
* ²⁶ Al ^m	T : average 13Ch51=6345.30(0.90) 11Fi01=6346.54(0.46,stat)(0.60,syst)										**
* ²⁶ Al ^m	T : 11Sc22=6347.8(2.5) 83Ko22=6346.2(2.6) 77Al11=6339.5(4.5)										**
* ²⁶ Al ^m	T : 75Az01=6346(5) 72Ha82=6351(10) 69Fr08=6346(5)										**
* ²⁶ Si	T : other 08Ma39=2.2283(0.0027), discrepant; see discussions in 10Ia01										**
* ²⁶ P	D : % β^+ 2p average 17Ja05=1.5(0.4) 04Th09=2.16(0.24);										**
* ²⁶ P	D : % β^+ p + % β^+ 2p average 17Ja05=35(2) 04Th09=39(2)										**
* ²⁶ P	T : average 20Li06=43.6(0.3) 07Th09=43.7(0.6);										**
* ²⁶ P	T : others: 17Ja05=50(+23-12) 83Ca06,84Ca29=20(+35-15)										**
* ²⁶ P ^m	T : average 14NiZZ=120(9) 17Pe09=104(14)										**
²⁷ O	44670#	500#			<260ns	3/2 ⁺ #	99	Sa06 I		n ?;2n ?	
²⁷ F	25130	120			5.0 ms 0.2	5/2 ⁺ #	11		1981	β^- =100; β^- n=77 21; β^- 2n ?	*
²⁷ Ne	7050	90			30.9 ms 1.1	(3/2 ⁺)	11	17Ha23 T	1977	β^- =100; β^- n=2.0 5; β^- 2n ?	*
²⁷ Na	-5518	4			301 ms 6	5/2 ⁺ *	11		1968	β^- =100; β^- n=0.098 24	*
²⁷ Mg	-14586.59	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	-12384.51	0.11			4.117 s 0.014	5/2 ⁺	11	17Ma18 T	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	-659	9			260 ms 80	1/2 ⁺	11		1977	β^+ =100; β^+ p $\approx$ 0.07	
²⁷ P ⁱ	12010	30	12670	30 p		5/2 ⁺ T=5/2	11		1991	IT ?	
²⁷ S	17490#	400#			16.3 ms 0.2	(5/2 ⁺)	11	19Su14 T	1986	β^+ =100; β^+ p=61 3; β^+ 2p=3.0 6	*
* ²⁷ F	T : average 99Re16=6.5(1.1) 97Ta22=5.3(0.9) 99Di01=5.2(0.3) 98NoZW=4.9(0.2)										**
* ²⁷ F	D : % β^- n symmetrized from 99Re16=90(+10-30)										**
* ²⁷ Ne	T : average 17Ha23=29.3(2.1) 06Tr02=31.5(1.3)										**
* ²⁷ Na	J : 00Ke09=5/2										**
* ²⁷ Na	D : % β^- n average 84Gu19=0.13(0.04) 74Ro31=0.08(0.03)										**
* ²⁷ Mg	T : average 15ZaZY=9.408 (0.012) 70Re13=9.462 (0.012); Birge ratio=3.18										**
* ²⁷ Si	T : average 17Ma18=4.1117(0.0020) 75Az01=4.109 (0.004) 76Ge06=4.206(0.008);										**
* ²⁷ Si	T : Birge ratio=8.19										**
* ²⁷ S	T : others 17Ja05=15.5(1.6) 01Ca60=15.5(1.5)										**
* ²⁷ S	D : % β^+ p deduced from % β^+ p + % β^+ 2p = 64(3) and % β^+ 2p=3.0(0.6)										**
²⁸ O	52080#	700#			<100ns	0 ⁺	13	98Po.A I		2n ?; β^- =0	*
²⁸ F	33400	120			46 zs	(4 ⁻)	13	20Re06 JD	2012	n=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{28}Ne	11300	130			18.8 ms 0.2	0^+	13	17Ha23 T	1979	$\beta^- = 100; \beta^- n = 12.1$; $\beta^- 2n = 3.7.5$	*
^{28}Na	-988	10			33.1 ms 1.3	1^+*	13	17Ha23 T	1969	$\beta^- = 100; \beta^- n = 0.58.12$	*
^{28}Mg	-15019.95	0.26			20.915 h 0.009	0^+	13		1953	$\beta^- = 100$	
^{28}Al	-16850.72	0.05			2.245 m 0.005	3^+*	13	20He.A J	1934	$\beta^- = 100$	
$^{28}\text{Al}^i$	-10858.14	0.11	5992.58	0.10		$0^+ T=2$	13				
^{28}Si	-21492.7971	0.0005			STABLE	0^+	13		1920	IS=92.2545.37	
$^{28}\text{Si}^r$	-8951.75	0.05	12541.04	0.05	RQ	(3^+)	13				
$^{28}\text{Si}^i$	-12176.88	0.10	9315.92	0.10		$3^+ T=1$	13				
$^{28}\text{Si}^j$	-6265.8	1.0	15227	1		$(0^+) T=2$	13	68Mc12 D	1968	$\alpha = 90.11; p = 10.11$	
^{28}P	-7147.9	1.1			270.3 ms 0.5	3^+	13	79Ho27 D	1953	$\beta^+ = 100; \beta^+ p = 0.0013.4$; $\beta^+ \alpha = 0.00086.25$	
$^{28}\text{P}^i$	-1261	20	5887	20	p	$0^+ T=2$	13				
^{28}S	4070	160			125 ms 10	0^+	13		1982	$\beta^+ = 100; \beta^+ p = 20.7.19$	
^{28}Cl	28270#	500#			>100ns	$1^+ \#$	18Mu18	TD	2018	p=100	
* ^{28}O	I: also 11 and 37 ^{28}O events expected in 97Ta22 and 99Sa06,										**
* ^{28}O	I: respectively, but none observed										**
* ^{28}Ne	T: average 17Ha23=19.2(0.6) 15Le17=18.6(0.2) 06Tr02=20.0(0.5)										**
* ^{28}Na	T: unweighted average 17Ha23=34.6(1.0) 84Gu19=34.1(0.6) 74Ro31=30.5(0.4);										**
* ^{28}Na	T: Birge ratio=4.06										**
* ^{28}Na	J: 00Ke09=1										**
^{29}F	40150	530			2.5 ms 0.3	$(5/2^+)$	12	17Ma77 J	1989	$\beta^- = 100; \beta^- n = 60.40; \beta^- 2n ?$	*
^{29}Ne	18400	150			14.7 ms 0.4	$(3/2^-)$	12	05Tr13 T	1985	$\beta^- = 100; \beta^- n = 28.5; \beta^- 2n = 4.1$	*
^{29}Na	2680	7			43.2 ms 0.4	$3/2^+*$	12	17Ha23 T	1969	$\beta^- = 100; \beta^- n = 22.3; \beta^- 2n ?$	*
^{29}Mg	-10612.4	0.3			1.30 s 0.12	$3/2^+*$	12		1971	$\beta^- = 100$	*
^{29}Al	-18207.8	0.3			6.56 m 0.06	$5/2^+*$	12	20He.A J	1939	$\beta^- = 100$	
^{29}Si	-21895.0815	0.0006			STABLE	$1/2^+*$	12		1920	IS=4.672.16	
$^{29}\text{Si}^i$	-13605	5	8290	5		$5/2^+ T=3/2$	12			IT=100	
^{29}P	-16952.8	0.4			4.102 s 0.004	$1/2^+$	12	20Lo01 T	1941	$\beta^+ = 100$	*
$^{29}\text{P}^i$	-8571.0	2.5	8381.8	2.4	RQ	$5/2^+ T=3/2$	12		1969	IT=100	
^{29}S	-3094	13			188 ms 4	$5/2^+ \#$	12	79Vi01 D	1964	$\beta^+ = 100; \beta^+ p = 46.4.10$	
^{29}Cl	14020#	190#			5.4 zs 1.9	$(1/2^+)$	16	15Mu13 I	1993	p=100	*
^{29}Ar	37970#	440#			>100ns	$5/2^+ \#$	18Mu18	TD	2018	2p=100	
* ^{29}F	D: $\% \beta^- n$ from 99Di01, 01Pe14=100(80)										**
* ^{29}Ne	T: average 05Tr13=13.8(0.5) 06Tr02=15.1(2.6) 97No.A=15.6(0.5); others:										**
* ^{29}Ne	T: 06Tr02=16.4(1.3) 01Pe14=15(3) 99Di01=15(4) 99Re16=19(9) 97Ta22=15(3)										**
* ^{29}Ne	J: 16Ko05=(3/2)										**
* ^{29}Ne	D: $\% \beta^- n$ average 06Tr02=29(7) 99Re16, 99Di01=27(9) 01Pe14=27(9);										**
* ^{29}Ne	D: other 01Be53=17.5										**
* ^{29}Na	D: $\% \beta^- n$ average 95Re.A=27.1(1.6) 84La03=21.5(3.0) 74Ro31=15.1(1.8)										**
* ^{29}Na	D: 79De02=21(4); Birge ratio=2.88										**
* ^{29}Na	T: average 17Ha23=42.8(0.5) 84Gu19=44.9(1.2) 84La03=44(1) 74Ro31=42.9(1.5)										**
* ^{29}Na	J: 00Ke09=3/2										**
* ^{29}Mg	J: also 19Yo06=5/2										**
* ^{29}P	T: average 20Lo01=4.1055(0.0044) 80Wi13=4.084(0.022) 75Az01=4.083(0.012);										**
* ^{29}P	T: other (not used) 73Ta04=4.149(0.005)										**
* ^{29}Cl	T: from width=85(30) keV in 16Go.1										**
^{30}F	48960#	500#			<260ns		10	99Sa06 I		n ?	
^{30}Ne	23280	250			7.22 ms 0.18	0^+	10	15St14 T	1985	$\beta^- = 100; \beta^- n = 13.4$; $\beta^- 2n = 8.9.23$	*
^{30}Na	8475	5			45.9 ms 0.7	2^+*	10	17Ha23 T	1969	$\beta^- = 100; \beta^- n = 28.6.22$; $\beta^- 2n = 1.24.19$; $\beta^- \alpha = 5.5e-5.2$	*
^{30}Mg	-8881.4	1.3			317 ms 4	0^+	10	84La03 D	1971	$\beta^- = 100; \beta^- n < 0.06$	*
^{30}Al	-15864.1	1.9			3.62 s 0.06	3^+*	10	20He.A J	1961	$\beta^- = 100$	
^{30}Si	-24432.962	0.022			STABLE	0^+	10		1924	IS=3.0735.21	
^{30}P	-20200.86	0.07			2.5000 m 0.0017	$1^+* T=0$	10	18Ia01 T	1934	$\beta^+ = 100$	*
$^{30}\text{P}^i$	-19523.85	0.08	677.01	0.03		$0^+ T=1$	10				
^{30}S	-14059.25	0.21			1.1798 s 0.0003	0^+	10	18Ia01 T	1961	$\beta^+ = 100$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{30}Cl	4675	24			>100ns	$3^+\#$	10	18Mu18	TD	2018	p=100
^{30}Ar	22070#	180#			< 10 ps	0^+	16	15Mu13	IDT	2015	2p=100
^{30}Ne	T : average 15St14=7.18(0.22) 07Tr08=7.3(0.3);										**
^{30}Ne	T : others 01Pe14=7(2) 99Di01=7.5(1.5)										**
^{30}Na	T : average 17Ha23=44.1(0.8) 84La02=48(2) 84Gu19=50(3) 79De02=53(3)										**
^{30}Na	T : 74Ro01=53(3) 99Di01=50(4) 97Ta22=48(5)										**
^{30}Na	J : 00Ke09=2										**
^{30}Na	D : Pn=32.2(2.6), average 84La03=33(5) 84Gu19=30(5) 74Ro01=33.1(3.8);										**
^{30}Na	D : β^- 2n average 80De26=1.15(0.25) and 1.35(28), from Pn=32.2(2.6) and										**
^{30}Na	D : P2n/Pn=0.042(0.008) in 80De26. β^- n average 79De02=26(4) and 29.7(2.6)										**
^{30}Na	D : from Pn-2* β^- 2n=32.2(2.6)-2*1.24(0.19); β^- α from 83De23										**
^{30}Mg	T : average 17Ha23=311(8) 16Ol06=335(10) 08Hi05=314(5)										**
^{30}P	T : average 18Ia01=2.501(0.002) 80Wi13=2.498(0.004) 63Mc02=2.497(0.005)										**
^{30}S	T : average 18Ia01=1.17992(0.00034) 11So11 = 1.1759(0.0017)										**
^{31}F	56840#	540#			2# ms >260ns	$5/2^+\#$	13	99Sa06	I	1999	β^- ?; β^- n ?; β^- 2n ?
^{31}Ne	31180	270			3.4 ms 0.8	$(3/2^-)$	13			1996	β^- =100; β^- n ?; β^- 2n ?
^{31}Na	12246	14			16.8 ms 0.3	$3/2^+\#$	13	19Ni04	D	1969	β^- =100; β^- n=36.0 35;
											β^- 2n=0.73 9; β^- 3n<0.05
^{31}Mg	-3122	3			270 ms 2	$1/2^+\#$	13	17Ha23	T	1977	β^- =100; β^- n=6.2 19
^{31}Al	-14950.7	2.2			644 ms 25	$5/2^+\#$	13	16He09	J	1971	β^- =100; β^- n<1.6
^{31}Si	-22949.04	0.04			157.16 m 0.20	$3/2^+$	13	17Da28	T	1934	β^- =100
^{31}P	-24440.5444	0.0007			STABLE	$1/2^+\#$	13			1920	IS=100
$^{31}\text{P}^i$	-18059.7	2.0	6380.8	2.0		$3/2^+$ T=3/2	13				IT=100
^{31}S	-19042.53	0.23			2.5534 s 0.0018	$1/2^+$	13			1940	β^+ =100
$^{31}\text{S}^i$	-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
$^{31}\text{Cl}^i$	5256	3	12291	5	RQ	$3/2^+$ T=5/2					
^{31}Ar	11330#	200#			15.0 ms 0.3	$5/2^+\#$	13	14Ko17	T	1986	β^+ =100; β^+ p=68.3 3;
											β^+ 2p=9.0 2; β^+ p α <0.38;
											β^+ 3p=0.07 2; β^+ α <0.03;
											2p<0.0006
^{31}K	34260#	300#			> 10 ps	$3/2^+\#$		19Ko18	IT	2019	3p=100
^{31}Na	D : β^- 2n average 19Ni04=0.7(0.1) and 0.86(0.20) from Pn=37.5(3.5), average										**
^{31}Na	D : of 74Ro31=30(8) 84La03=38(6) 19Ni04=40(5), and P2n/Pn=0.023(0.005)										**
^{31}Na	D : in 80De26. β^- n from Pn-2*P2n=37.5(3.5)-2*0.73(0.09). P3n from 84Gu19										**
^{31}Na	T : average 17Ha23=16.6(0.4) 84La03=17.0(0.4) 74Ro31=16.9(0.7) 01Pe14=18(2)										**
^{31}Na	J : 00Ke09=3/2										**
^{31}Mg	D : β^- n strongly conflicting with earlier 84La03=1.7(0.3)										**
^{31}Al	J : 20He.A, 16He09=5/2										**
^{31}Si	T : other 89Ab05=157.474(0.012), the small uncertainty is not justified										**
^{31}Ar	T : average 14Ko17=15.1(0.3) 00Fy01=14.1(0.7) 92Ba01=15.1(+1.3-1.1)										**
^{32}Ne	37000#	500#			3.5 ms 0.9	0^+	11			1990	β^- =100; β^- n ?; β^- 2n ?
^{32}Na	18640	40			12.9 ms 0.3	(3^-)	11	08Tr04	TJ	1972	β^- =100; β^- n=26 6;
											β^- 2n=7.6 15
^{32}Mg	-829	3			80.4 ms 0.4	0^+	11	17Ha23	T	1977	β^- =100; β^- n=5.5 5
^{32}Al	-11099	7			32.6 ms 0.5	$1^+\#$	11	17Ha23	T	1971	β^- =100; β^- n=0.7 5
$^{32}\text{Al}^m$	-10142	7	956.6	0.5	200 ns 20	(4^+)	11			1996	IT=100
^{32}Si	-24077.69	0.30			157 y 7	0^+	20			1953	β^- =100
^{32}P	-24304.88	0.04			14.269 d 0.007	$1^+\#$	11	FGK204	T	1934	β^- =100
$^{32}\text{P}^i$	-19232.44	0.07	5072.44	0.06		0^+ T=2	11				IT=100
^{32}S	-26015.5371	0.0013			STABLE	0^+	11			1920	IS=94.85 255
$^{32}\text{S}^i$	-19014.1	0.4	7001.4	0.4		1^+ T=1	11				IT=100
$^{32}\text{S}^j$	-13967.58	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; β^+ α =0.054 8;
											β^+ p=0.026 5
$^{32}\text{Cl}^i$	-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 22
^{32}K	21990#	400#				$1^+\#$					p ?
$^{32}\text{K}^m$	22940#	410#	950#	100#		$4^+\#$		Mirror	I		p ?

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ³² Na	T : average 08Tr04=13.1(0.5) and 11.5(1.2) 84La03=13.2(0.4) 98No.A=11.5(0.8)										**
* ³² Na	D : % β^- -n average 84Gu19=32(13) 84La03=24(7), from Pn=39(6) and										**
* ³² Na	D : % β^- -2n=7.6(1.5); other 80De26=10(4); % β^- -2n average 84Gu19=8(3)										**
* ³² Na	D : 84La03=9.4(2.4) 80De26=5.5(2.5)										**
* ³² Al	T : average 17Ha23=31.7(0.3) 05Ue01=33.0(0.2); Birge ratio=3.6										**
* ³² Al	J : 18Xu05,20He.A=1										**
³³ Ne	46130#	600#			<260ns	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	4962.9	2.7			92.0 ms 1.2	3/2 ⁻ *		11 17Ha23 T	1979	β^- =100; β^- -n=14 2; β^- -2n ?	*
³³ Al	-8497	7			41.46 ms 0.09	5/2 ⁺ *		11 16He09 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	-26337.4	1.1			25.35 d 0.11	1/2 ⁺		20	1951	β^- =100	
³³ S	-26585.8583	0.0013			STABLE	3/2 ⁺		11	1926	IS=0.763 20	
³³ S ⁱ	-21106.07	0.13	5479.79	0.13	2.5038 s 0.0022	1/2 ⁺ T=3/2		11		IT=100	
³³ Cl	-21003.3	0.4				3/2 ⁺		11 15Gr14 T	1940	β^+ =100	
³³ Cl ⁱ	-15454.9	0.5	5548.4	0.4		1/2 ⁺ T=3/2		11		IT=100	
³³ Ar	-9384.3	0.4			173.0 ms 2.0	1/2 ⁺		11 10Ad03 D	1964	β^+ =100; β^+ -p=38.7 8	*
³³ K	7540#	200#			<25ns	3/2 ⁺ #		11 93Po.A I		p ?	
³³ Ca	31030#	400#				5/2 ⁺ #				p ?	
* ³³ Ne	T : estimated partial β^- decay half-life of 1# ms										**
* ³³ Ne	I : also 02Le.A < 1.5 us										**
* ³³ Mg	T : average 17Ha23=93.9(1.8) 02Mo29=90.5(1.6); other 84La03=90(20)										**
* ³³ Mg	J : also 19Yo06=3/2										**
* ³³ Al	T : average 17Ha23=41.4(0.1) 02Mo29=41.7(0.2); also 95Re.A=40.5(2.8)										**
* ³³ Ar	D : % β^+ -p average 10Ad03=38.8(1.3) 87Bo21=38.7(1.0)										**
³⁴ Ne	52840#	510#			2# ms >1.5us	0 ⁺		12 02Le.A I	2002	β^- ?; β^- -2n ?; β^- -n ?	
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	7			44.9 ms 0.4	0 ⁺		12 17Li03 TD	1979	β^- =100; β^- -n=21 7; β^- -2n<0.1	
³⁴ Al	-2997.6	2.1			53.73 ms 0.13	4 ⁻		12 19Li41 T	1977	β^- =100; β^- -n=26 4; β^- -2n ?	
³⁴ Al ^m	-2951.1	2.1	46.47	0.17	22.1 ms 0.2	1 ⁺ *		19Li41 TD	2012	β^- ≈100; β^- -n=11 4; β^- -2n ?	*
³⁴ Si	-19991.7	0.8			2.77 s 0.20	0 ⁺		12	1971	β^- =100	
³⁴ Si ^m	-15735.6	0.9	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=4.365 235	
³⁴ Cl	-24440.09	0.05			1.5267 s 0.0004	0 ⁺ T=1		12 06Ia05 T	1934	β^+ =100	*
³⁴ Cl ^m	-24293.73	0.05	146.360	0.027	31.99 m 0.03	3 ⁺ T=0		12	1965	β^+ =55.4 6;IT=44.6 6	
³⁴ Ar	-18378.29	0.08			846.46 ms 0.35	0 ⁺		12 20Ia01 T	1966	β^+ =100	*
³⁴ Ar ⁱ	-10444	5	7934	5		1 ⁺ # T=2		12	1969	IT ?	
³⁴ K	-1220#	200#			<40ns	1 ⁺ #		12 93Po.A I		p ?	
³⁴ Ca	14890#	300#			<35ns	0 ⁺		12 93Po.A I		2p ?	
* ³⁴ Na	D : % β^- -n, % β^- -2n estimated from Pn = β^- -n + 2* β^- -2n = 115(20)% in 84La03										**
* ³⁴ Na	D : by assuming β^- -n/ β^- -2n=0.3 from trends in neighboring nuclei										**
* ³⁴ Al ^m	E : from FGK204 using a least-squares fit to data in 17Li03										**
* ³⁴ Al ^m	J : 18Xu05=1										**
* ³⁴ Cl	T : average 06Ia05=1.5268(5) 83Ko22=1.5277(22) 76Wi08=1.5252(11)										**
* ³⁴ Cl	T : 73Ry01=1.526(2) 72Ha82=1.534(3)										**
* ³⁴ Ar	T : others 06Ia05=843.8(0.4) 74Ha26=844.5(3.4)										**
³⁵ Na	37830#	670#			1.5 ms 0.5	3/2 ⁺ #		11	1983	β^- =100; β^- -n ?; β^- -2n ?	*
³⁵ Mg	15640	270			11.3 ms 0.6	(3/2 ⁻ , 5/2 ⁻)		17 17Mo26 J	1989	β^- =100; β^- -n=52 46; β^- -2n ?	
³⁵ Al	-224	7			38.16 ms 0.21	(5/2 ⁺ , 3/2 ⁺)		11 17Ch36 J	1979	β^- =100; β^- -n=35.8 17; β^- -2n ?	*
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	T=5/2	(1/2 ⁻ : 9/2 ⁺) ⁺		11	1975		
³⁵ Cl	-29013.53	0.04			STABLE	3/2 ⁺ *		11	1919	IS=75.8 2	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{35}\text{Cl}^i$	-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	$\beta^+=100$	
$^{35}\text{Ar}^i$	-17474.6	0.7	5572.66	0.15		$3/2^+$ T=3/2	11			IT=100	
^{35}K	-11172.9	0.5			175.2 ms 1.9	$3/2^+$	11	06Me04	J	1976	$\beta^+=100; \beta^+p=0.37$ 15
$^{35}\text{K}^i$	-2110	40	9060	40	2p	$3/2^+$ T=5/2					
^{35}Ca	5190#	200#			25.7 ms 0.2	$1/2^+\#$	11	99Tr04	DT	1985	$\beta^+=100; \beta^+p=95.8$ 14; $\beta^+2p=4.2$ 3
^{35}Sc	27100#	400#				$7/2^-\#$					p ?
* ^{35}Na	D : β^-n was observed by 83La12, but it was not quantified										**
* ^{35}Al	T : average 17Ha23=38.4(0.3) 05Ti11=36.8(0.5) 01Nu01=38.6(0.4); others										**
* ^{35}Al	T : 95Re.A=30(4) 89Le16=170(+90-50) 88Mu08=130(+100-50)										**
* ^{35}Al	D : % β^-n average 05Ti11=38(2) 01Nu01=41(13) 95Re.A=26(4) 89Le16=40(10);										**
* ^{35}Al	D : other 88Mu08=87(+37-25)										**
* ^{35}K	T : average 18Sa.A=175(2) 98Sc19=178(8)										**
^{36}Na	45900#	690#			<180ns		12	02Le.A	I		n ?
^{36}Mg	20380	690			3.9 ms 1.3	0^+	12		1989	$\beta^-=100; \beta^-n=48$ 12; β^-2n ?	*
^{36}Al	5950	150			90 ms 40		12		1979	$\beta^-=100; \beta^-n<31; \beta^-2n$?	
^{36}Si	-12440	70			503 ms 2	0^+	12	95Re.A	D	1971	$\beta^-=100; \beta^-n=12$ 5
^{36}P	-20251	13			5.6 s 0.3	4^-	12	15Ch56	J	1971	$\beta^-=100; \beta^-n$?
^{36}S	-30664.14	0.19			STABLE	0^+	12		1938	IS=0.0158 17	
^{36}Cl	-29522.01	0.04			301.3 ky 1.5	2^+*	12		1941	$\beta^-=98.1$ 1; $\beta^+=1.9$ 1	
$^{36}\text{Cl}^i$	-25222.34	0.04	4299.667	0.014		$(0)^+ T=2$	12			IT=100	
^{36}Ar	-30231.542	0.027			STABLE	0^+	12		1920	IS=0.3336 210; $2\beta^+$?	
$^{36}\text{Ar}^i$	-23620.5	0.3	6611.0	0.3		$2^+ T=1$	12			IT=100	
$^{36}\text{Ar}^j$	-19379.4	1.2	10852.2	1.2	RQ	$0^+ T=2$	12			IT=100	
^{36}K	-17417.2	0.3			341 ms 3	2^+*	12		1967	$\beta^+=100; \beta^+p=0.048$ 14; $\beta^+\alpha=0.0034$ 13	
$^{36}\text{K}^i$	-13134.5	2.4	4282.7	2.4	p	$0^+ T=2$	12			p=100	*
^{36}Ca	-6450	40			100.9 ms 1.3	0^+	12	15Su01	T	1977	$\beta^+=100; \beta^+p=51.2$ 10
^{36}Sc	16150#	300#								p ?	
* ^{36}Mg	D : % β^-n from 99YoZW										**
* ^{36}Si	T : from 17Ha23										**
* $^{36}\text{K}^i$	E : Ensdf2012 reports 4281.9(0.8) as IAS of ^{36}Ca gs, but the small										**
* $^{36}\text{K}^i$	E : uncertainty is not justified										**
* ^{36}Ca	T : average 15Su01=100.0(2.4) 07Do17=100.1(2.3) 95Tr02,97Tr05=102(2)										**
^{37}Na	53130#	690#			1# ms >1.5us	$3/2^+\#$	12	02Le.A	I	2002	$\beta^- ?; \beta^-n ?; \beta^-2n ?$
^{37}Mg	28210	700			8 ms 4	$(3/2^-)$	12	14Ko14	J	1996	$\beta^- ?; \beta^-n ?; \beta^-2n ?$
^{37}Al	9810	180			11.4 ms 0.3	$5/2^+\#$	12	19Ab06	TD	1979	$\beta^-=100; \beta^-n=52$ 5; $\beta^-2n>1$
^{37}Si	-6570	110			141.0 ms 3.5	$(5/2^-)$	15	19Ab06	TJ	1979	$\beta^-=100; \beta^-n=17$ 13; $\beta^-2n ?$
^{37}P	-19000	40			2.31 s 0.13	$(1/2^+)$	12	15Ch56	J	1971	$\beta^-=100; \beta^-n ?$
^{37}S	-26896.43	0.20			5.05 m 0.02	$7/2^-$	12		1945	$\beta^-=100$	
^{37}Cl	-31761.55	0.05			STABLE	$3/2^+*$	12		1919	IS=24.2 2	
$^{37}\text{Cl}^i$	-21539.7	0.3	10221.8	0.3	RQ	$7/2^- T=5/2$	12		1984	IT=100	
^{37}Ar	-30947.68	0.21			35.011 d 0.019	$3/2^+*$	12		1941	$\epsilon=100$	
$^{37}\text{Ar}^i$	-25956	6	4992	6	RQ	$3/2^+ T=3/2$	12		1973		
^{37}K	-24800.20	0.09			1.23651 s 0.00094	$3/2^+*$	12	14Sh25	T	1958	$\beta^+=100$
$^{37}\text{K}^i$	-19749.9	0.8	5050.3	0.8	RQ	$3/2^+ T=3/2$	12		1973	IT=100	
^{37}Ca	-13136.1	0.6			181.0 ms 0.9	$3/2^+*$	12	19Kl06	J	1964	$\beta^+=100; \beta^+p=76.8$ 7
^{37}Sc	3780#	300#				$7/2^-\#$				p ?	
^{37}Ti	25170#	400#				$1/2^+\#$				p ?	
* ^{37}Al	T : average 19Ab06=11.3(0.4) 15St14=11.5(0.4)										**
* ^{37}Al	D : % β^-2n 15St14>1%										**
* ^{37}Si	T : average 19Ab06=138(4) 17Ha23=150(7)										**
* ^{37}K	J : also 14Kr04=3/2										**
* ^{37}Ca	T : average 15Su01=180.5(2.1) 07Do17=181.7(3.6) 97Tr05=181.1(1.0)										**
* ^{37}Ca	D : % β^+p average 15Su01=70.6(1.8) 07Do17=72.2(4.3) 97Tr05=78.4(0.8)										**
* ^{37}Ca	D : 74Se11=75(2). Ensdf2012 gives 97Tr05=82.1(0.7), which										**
* ^{37}Ca	D : differs from 97Tr05=78.4(0.8) quoted in the present evaluation										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
^{38}Na	61910#	720#			<400 ns			19Ah07	I		n ?	*	
^{38}Mg	34070#	500#			2# ms >260ns	0^+		17		1997	$\beta^- = 100\%; \beta^- n ?; \beta^- 2n ?$	*	
^{38}Al	16470#	150#			9.0 ms 0.7	$0^- \#$		17	15St14	T	1989	$\beta^- = 100\%; \beta^- n = 84.19\%; \beta^- 2n ?$	*
^{38}Si	-4170	100			63 ms 8	0^+		17	17Tr02	TD	1979	$\beta^- = 100\%; \beta^- n = 25.10$	
^{38}P	-14620	70			640 ms 140	(2^-)		17	15Ch56	J	1971	$\beta^- = 100\%; \beta^- n = 12.5$	
^{38}S	-26861	7			170.3 m 0.7	0^+		17			1958	$\beta^- = 100$	
^{38}Cl	-29798.12	0.10			37.230 m 0.014	2^-		17			1940	$\beta^- = 100$	
$^{38}\text{Cl}^m$	-29126.75	0.10	671.365	0.008	715 ms 3	5^-		17			1954	IT=100	
$^{38}\text{Cl}^i$	-21590	24	8208	24	RQ	$0^+ T=3$		17					
^{38}Ar	-34714.83	0.19			STABLE	0^+		17			1934	IS=0.0629 70	
$^{38}\text{Ar}^i$	-24083.9	0.9	10630.9	0.9		$(2^-) T=2$		17					
$^{38}\text{Ar}^j$	-15940	30	18780	30	RQ	$0^+ T=3$		17					
^{38}K	-28800.76	0.20			7.651 m 0.019	$3^+ * T=0$		17			1937	$\beta^+ = 100$	*
$^{38}\text{K}^m$	-28670.61	0.20	130.15	0.04	MD	$0^+ * T=1$		17	14Pa45	J	1953	$\beta^+ = 99.9670 43$; IT=0.0330 43	*
$^{38}\text{K}^n$	-25342.66	0.26	3458.10	0.17	21.95 μ s 0.11	(7^+)		17			1971	IT=100	
^{38}Ca	-22058.50	0.19			443.70 ms 0.25	0^+		17	15Bl02	T	1966	$\beta^+ = 100$	*
^{38}Sc	-4250#	200#			<300ns	$2^- \#$		17	94Bl10	I		p ?	
$^{38}\text{Sc}^m$	-3580#	220#	670#	100#		$5^- \#$			Mirror	I		IT ?; p ?	
^{38}Ti	11370#	300#			<120ns	0^+		17	96Bl21	I		2p ?	
^{38}Na	I : no events observed in 19Ah07											**	
^{38}Al	T : other 04Gr20=7.6(0.6) without β - γ coin gating											**	
^{38}K	J : 19Ko19, 14Kr04, 14Pa45=3											**	
$^{38}\text{K}^m$	T : average 10Ba43=924.46(0.14) 00Bb01=924.4(0.6) 83Ko22=924.15(0.31)											**	
$^{38}\text{K}^n$	T : 78Th02=928.8(2.0) 78Wi04=921.71(0.65) 76Wi08=922.3(1.1)											**	
$^{38}\text{K}^m$	T : 72Ha82=929.2(3.5) 75Sq01=925.6(0.7)											**	
^{38}Ca	T : average of 15Bl02=443.63(0.35) 11Pa38=443.77(0.36) 10Bl09=443.8(1.9)											**	
^{39}Na	69980#	740#			1# ms >400ns	$3/2^+ \#$		19Ah07	I	2019	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	*	
^{39}Mg	42780#	510#			<180ns	$7/2^- \#$		18			n ?; $\beta^- ?$	*	
^{39}Al	21490#	300#			7.6 ms 1.6	$5/2^+ \#$		18			1989	$\beta^- = 100\%; \beta^- n = 97.22\%; \beta^- 2n ?$	
^{39}Si	2320	140			41.2 ms 4.1	$(5/2^-)$		18	19Ab06	TDJ	1979	$\beta^- = 100\%; \beta^- n = 33.3\%; \beta^- 2n ?$	*
^{39}P	-12770	110			282 ms 24	$(1/2^+)$		18	19Ab06	J	1977	$\beta^- = 100\%; \beta^- n = 26.8$	*
^{39}S	-23160	50			11.5 s 0.5	$(7/2^-)$		18			1971	$\beta^- = 100$	
^{39}Cl	-29800.2	1.7			56.2 m 0.6	$3/2^+$		18			1949	$\beta^- = 100$	
^{39}Ar	-33242	5			268 y 8	$7/2^- *$		18			1950	$\beta^- = 100$	
$^{39}\text{Ar}^i$	-24161	7	9081	9	RQ	$3/2^+ T=5/2$		18	MMC149J				*
^{39}K	-33807.195	0.005			STABLE	$3/2^+ *$		18			1921	IS=93.2581 44	*
$^{39}\text{K}^i$	-27260.8	1.9	6546.4	1.9		$7/2^- T=3/2$		18				IT=100	
^{39}Ca	-27282.7	0.6			860.3 ms 0.8	$3/2^+ *$		18	19Kl06	J	1943	$\beta^+ = 100$	*
$^{39}\text{Ca}^i$	-20917#	9#	6366#	9#		$3/2^+ T=3/2$			Imme	E			
^{39}Sc	-14173	24				$7/2^- \#$		18	94Bl10	I	1988	p=100	*
$^{39}\text{Sc}^i$	-5050	40	9120	50	2p	$(3/2^+) T=5/2$		18					
^{39}Ti	2500#	200#			28.5 ms 0.9	$3/2^+ \#$		18	07Do17	TD	1990	$\beta^+ = 100\%; \beta^+ p = 93.7 28$; $\beta^+ 2p = ?$	*
^{39}V	22570#	400#				$7/2^- \#$						p ?	
^{39}Na	I : one event observed in 19Ah07											**	
^{39}Mg	T : estimated partial β^- half-life of 1# ms											**	
^{39}Si	T : average 19Ab06=38.6(1.3) 04Gr20=47.5(2.0); Birge ratio=3.7											**	
^{39}P	T : average 04Gr20=250(80) 98Wi.A=320(30) 95Re.A=190(50)											**	
$^{39}\text{Ar}^i$	J : from IAS appartenance; $3/2^+, 5/2^+$ in Ensdf2018											**	
^{39}K	J : 19Ko19, 14Kr04, 14Pa45, 13Pa11=3/2											**	
^{39}Ca	T : average 10Bl09=860.7(1.0) 77Az01=859.4(1.6) 73Al11=860.4(3.0)											**	
^{39}Sc	D : most likely a proton emitter from Sp=-597(24) keV											**	
^{39}Ti	D : $\% \beta^+ p$ includes contribution from ^{39}Sc gs ($\% p=100$); $\beta^+ 2p$ decay was											**	
^{39}Ti	D : observed in 92Mo15, but was not quantified											**	
^{40}Mg	49550#	500#			1# ms >170ns	0^+		17	14Cr02	I	2007	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	*
^{40}Al	28820#	300#			10# ms >260ns			17			1996	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	
^{40}Si	5670	120			31.2 ms 2.6	0^+		17	17Tr02	TD	1989	$\beta^- = 100\%; \beta^- n = 38.5\%; \beta^- 2n ?$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{40}P	-8140	80			150 ms 8	$(2^-, 3^-)$	17		1979	$\beta^- = 100; \beta^- n = 15.8$	21;
^{40}S	-22838	4			8.8 s 2.2	0^+	17		1971	$\beta^- = 100$	
^{40}Cl	-27560	30			1.35 m 0.03	2^-	17		1956	$\beta^- = 100$	
^{40}Ar	-35039.9000	0.0022			STABLE	0^+	17		1920	IS=99.6035	250
^{40}K	-33535.50	0.06			1.248 Gy 0.003	$4^- *$	17		1935	IS=0.0117 1; $\beta^- = 89.28$	13; *
$^{40}\text{K}^m$	-31891.86	0.06	1643.638	0.011	336 ns 12	0^+	17		1968	$\beta^+ = 10.72$	13
$^{40}\text{K}^i$	-29151.5	0.3	4384.0	0.3		$0^+ T=2$	17			IT=100	
^{40}Ca	-34846.402	0.020			STABLE	0^+	17	16An14	T	1922	IS=96.941 156; $2\beta^+ ?$
$^{40}\text{Ca}^i$	-27188.22	0.05	7658.18	0.05		$4^- T=1$	17	AHW	E		IT=100 *
$^{40}\text{Ca}^j$	-22858.4	1.0	11988	1		$0^+ T=2$	17			IT=100	
^{40}Sc	-20523.4	2.8			182.3 ms 0.7	4^-	17		1955	$\beta^+ = 100; \beta^+ p = 0.44$	7;
$^{40}\text{Sc}^i$	-16164	6	4359	6	RQ	$0^+ T=2$	17			$\beta^+ \alpha = 0.017$	5
^{40}Ti	-8990	70			52.4 ms 0.3	0^+	17	07Do17	TD	1982	IT=100
^{40}V	12470#	300#				$2^- \#$				$\beta^+ = 100; \beta^+ p = 95.8$	13
^{40}Mg	I : 5 events observed in direct two-proton removal from ^{42}Si										**
^{40}Si	T : average 17Tr02=27.6(1.4) 04Gr20=33(1); Birge ratio=3.14										**
^{40}K	J : also 14Kr04j=4										**
$^{40}\text{Ca}^i$	E : originally 7658.23(0.05), recalibrated -0.05 keV for $^{27}\text{Al}+p$										**
$^{40}\text{Ca}^i$	E : resonances										**
^{41}Mg	58100#	500#				$3/2^- \#$				$\beta^- ?; \beta^- n ?$	
^{41}Al	34590#	400#			6# ms >260ns	$5/2^+ \#$	16	97Sa14	I	1997	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$
^{41}Si	13200#	300#			20.0 ms 2.5	$7/2^- \#$	16			1989	$\beta^- = 100; \beta^- n > 55; \beta^- 2n ?$ *
^{41}P	-4980	120			101 ms 5	$1/2^+ \#$	16			1979	$\beta^- = 100; \beta^- n = 30$
^{41}S	-19009	4			1.99 s 0.05	$7/2^- \#$	16			1979	$\beta^- = 100; \beta^- n ?$
^{41}Cl	-27310	70			38.4 s 0.8	$(1/2^+)$	16			1971	$\beta^- = 100$
^{41}Ar	-33067.5	0.3			109.61 m 0.04	$7/2^-$	16			1936	$\beta^- = 100$
^{41}K	-35559.549	0.004			STABLE	$3/2^+ *$	16			1921	IS=6.7302 44 *
$^{41}\text{K}^i$	-27210	15	8349	15	RQ	$7/2^- T=5/2$	16	75Me10	J	1975	
^{41}Ca	-35137.91	0.14			99.4 ky 1.5	$7/2^- *$	16			1939	$\epsilon = 100$
$^{41}\text{Ca}^i$	-29320.8	0.5	5817.1	0.5	< 28 fs	$3/2^+ T=3/2$	16				IT=100
^{41}Sc	-28642.36	0.08			596.3 ms 1.7	$7/2^-$	16			1941	$\beta^+ = 100$
$^{41}\text{Sc}^r$	-25760.01	0.08	2882.35	0.05	RQ	$7/2^+$	16				p=59 2; IT=41 2
$^{41}\text{Sc}^i$	-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	$\beta^+ = 100; \beta^+ p = 91.1$
^{41}V	310#	200#				$7/2^- \#$					p ?
^{41}Cr	20410#	400#				$3/2^+ \#$					p ?
^{41}Si	D : $\% \beta^- n$ from Pn=103(38) in 99YoZW										**
^{41}K	J : also 14Kr04j=3/2										**
$^{41}\text{K}^i$	J : $l=3$ in ($^3\text{He}, d$); assigned as IAS of ^{41}Ar gs										**
^{42}Al	41990#	500#			3# ms >170ns		16			2007	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$
^{42}Si	16840#	300#			12.5 ms 3.5	0^+	16			1990	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$
^{42}P	1090	100			48.5 ms 1.5		16			1979	$\beta^- = 100; \beta^- n = 50$
^{42}S	-17637.7	2.8			1.016 s 0.015	0^+	16	06Wi10	D	1979	$\beta^- = 100; \beta^- n < 1$
^{42}Cl	-24830	60			6.8 s 0.3	(2^-)	16			1971	$\beta^- = 100; \beta^- n ?$
^{42}Ar	-34423	6			32.9 y 1.1	0^+	16			1952	$\beta^- = 100$
^{42}K	-35022.03	0.11			12.355 h 0.007	$2^- *$	16			1935	$\beta^- = 100$ *
$^{42}\text{K}^i$	-28570	100	6450	100		$(0^+) T=3$	16				
^{42}Ca	-38547.29	0.15			STABLE	0^+	16			1934	IS=0.647 23
$^{42}\text{Ca}^i$	-28797	10	9750	10		$(2^-) T=2$	16				
^{42}Sc	-32121.00	0.15			680.72 ms 0.26	$0^+ T=1$	16	97Ko65	T	1955	$\beta^+ = 100$ *
$^{42}\text{Sc}^m$	-31504.19	0.16	616.81	0.06	MD	7^+	16			1963	$\beta^+ = 100$
$^{42}\text{Sc}^r$	-26044.80	0.16	6076.20	0.07	RQ	$(2^+, 3^+, 4^+)$	16				IT=100
^{42}Ti	-25104.35	0.27			208.3 ms 0.4	0^+	16	15Mo01	T	1964	$\beta^+ = 100$ *
^{42}V	-7620#	200#			<55ns	$2^- \#$	16	92Bo37	I		p ?
^{42}Cr	7060#	300#			13.3 ms 1.0	0^+	16			1996	$\beta^+ \approx 100; \beta^+ p = 94.4$
^{42}K	J : 19Ko19, 14Kr04, 14Pa45=2										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)	
* ⁴² Sc	T : average 97Ko65=680.67(0.28) 76Wi08=680.98(0.62)								**	
* ⁴² Ti	T : average 15Mo01=211.7(1.9), 209.5(5.2) 09Ku19=208.14(0.45)								**	
⁴³ Al	48270#	600#			4# ms >170ns	5/2 ⁺ #	15	2007	β^- ?; β^- n ?; β^- 2n ?	
⁴³ Si	24330#	400#			30# ms >260ns	3/2 ⁻ #	15 02No11 I	2002	β^- ?; β^- n ?; β^- 2n ?	
⁴³ P	5040#	300#			35.8 ms 1.3	(1/2 ⁺)	15 04Gr20 T	1989	β^- =100; β^- n=100; β^- 2n ?	
⁴³ S	-12195	5			265 ms 13	3/2 ⁻	15 20Mo32 J	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 JT	1976	β^- =100; β^- n ?	
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 ⁺ *	15 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	-38408.87	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 μ s 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			
⁴³ Ti	-29316	6			509 ms 5	7/2 ⁻	15	1948	β^+ =100; β^+ p ?	
⁴³ Ti ^m	-29003	6	313.0	1.0	11.9 μ s 0.3	(3/2 ⁺)	15	1978	IT=100	
⁴³ Ti ⁿ	-26250	6	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 Vi	-9705	15	8210	50	RQ	3/2 ⁺ T=5/2				
⁴³ Cr	-1970#	200#			21.1 ms 0.3	(3/2 ⁺)	15 11Po01 T	1992	β^+ =100; β^+ p=79.3 30; β^+ 2p=11.6 10; β^+ 3p=0.13 +18-8; β^+ α ? p ?	
⁴³ Mn	17370#	400#				5/2 ⁻ #				
* ⁴³ P	T : average 04Gr20=36.5(1.5) 95So03=33(3)								**	
* ⁴³ S ^m	T : average 12Ch16=415(3) 09Ga05=415(5)								**	
* ⁴³ Cl	T: 06Wi10, supersedes 98WiZX=3.07(0.07); others 81Vo04=3.3(0.2)								**	
* ⁴³ Cl	T: 81HuZT=3.4(0.3)								**	
* ⁴³ Ca	J : also 15Ru02=7/2								**	
* ⁴³ Sc	J : also 11Av01=7/2								**	
* 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	T : average 11Po01=20.6(0.9) 07Do17=21.1(0.4) 01Gi01=21.6(0.7)								**	
⁴⁴ Si	29310#	500#			4# ms >360ns	0 ⁺	11	2007	β^- ?; β^- n ?; β^- 2n ?	
⁴⁴ P	11110#	400#			18.5 ms 2.5		11	1989	β^- =100; β^- n ?; β^- 2n ?	
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 μ s 0.026	0 ⁺	11	2005	IT=100	
⁴⁴ Cl	-20480	90			562 ms 106	(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	1954	β^- =100	
⁴⁴ Ca	-41468.7	0.3			STABLE	0 ⁺	11	1922	IS=2.086 110	
⁴⁴ Ca ⁱ	-29619	10	11850	10		2 ⁻ T=3	11 MMC143J			
⁴⁴ Sc	-37816.0	1.8			4.0421 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 μ s 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	-35038.3	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	-23808	7			111 ms 7	(2 ⁺)	11	1971	β^+ =100; β^+ α =?; β^+ p ?	
⁴⁴ V ^m	-23537	5	271	9	MD	(6 ⁺)	11	1997	β^+ =100	
⁴⁴ V ⁿ	-23660#	100#	150#	100#		0 ⁻ #	Mirror I			
⁴⁴ Vi	-21119	12	2689	14	p	0 ⁺ # T=2	92Bo37 D	1992	p=100	
⁴⁴ Cr	-13420	50			42.8 ms 0.6	0 ⁺	11 07Do17 TD	1987	β^+ =100; β^+ p=12 2	
⁴⁴ Mn	7460#	300#			<105ns	2 ⁻ #	11		p ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ⁴⁴ Cl	T : average 99WiZX=650(50) 95So03=434(60); Birge ratio=2.77									**
* ⁴⁴ K	J : 19Ko19,14Kr04,14Pa45=2									**
* ⁴⁴ Ca ⁱ	J : from (e,e') in 84Ra04; IAS candidate									**
* ⁴⁴ Sc	T : average 16Ga24=4.0420(0.0025) 69Sa34=4.05(0.03). others (not used)									**
* ⁴⁴ Sc	T : 69Ra16=3.927(0.008) 66Ta01=4.00(0.02)									**
* ⁴⁴ Sc	J : also 11Av01=2									**
* ⁴⁴ Sc ^p	J : also 11Av01=6									**
* ⁴⁴ Cr	T : others 14Po05=25(+6-4) 92Bo37=53(+4-3)									**
* ⁴⁴ Cr	D : % β^+ +p average 07Do17=14.0(0.9) 14Po05=10(1); Birge ratio=2.97;									**
* ⁴⁴ Cr	D : other 96Fa09>7(3)									**
⁴⁵ Si	37090#	600#			4# ms	3/2 ⁻ #				β^- ?; β^- n ?; β^- 2n ?
⁴⁵ P	15960#	500#			10# ms >200ns	1/2 ⁺ #	08		1990	β^- ?; β^- n ?; β^- 2n ?
⁴⁵ S	-3340#	300#			68 ms 2	3/2 ⁻ #	08		1989	β^- =100; β^- n $\approx$ 54; β^- 2n ?
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	-41072.3	0.7			STABLE	7/2 ⁻ *	08		1923	IS=100
⁴⁵ Sc ^m	-41059.9	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	-39010.3	0.8			184.8 m 0.5	7/2 ⁻ *	08		1941	β^+ =100
⁴⁵ Ti ^m	-38973.8	0.8	36.53	0.15	3.0 μ s 0.2	3/2 ⁻	08		2006	IT=100
⁴⁵ Ti ⁱ	-34291	3	4719	3	RQ	7/2 ⁻ T=3/2	08			
⁴⁵ V	-31886.4	0.9			547 ms 6	7/2 ⁻	08		1975	β^+ =100
⁴⁵ V ^m	-31829.6	1.1	56.8	0.6	512 ns 13	(3/2 ⁻)	08	11Ho02	T 1980	IT=100
⁴⁵ V ⁱ	-27090	9	4797	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 μ s	(3/2)	11	11Ho02	ETJ 2011	IT=100
⁴⁵ Mn	-4980#	300#			<70ns	5/2 ⁻ #	08	92Bo37	I	p ?
⁴⁵ Fe	14410#	280#			2.5 ms 0.2	3/2 ⁺ #	08	07Mi36	TD 1996	2p=70 4; β^+ =30 4; β^+ +p=18.9 35; β^+ 2p=7.8 23
* ⁴⁵ Ca	J : also 15Ru02=7/2									**
* ⁴⁵ Sc	J : also 11Av01=7/2									**
* ⁴⁵ V ^m	T : average 11Ho02=468(23) 87Ha.B=430(80) 82Ho11=539(18) 82Al.C=610(80)									**
* ⁴⁵ V ^m	T : 80Gr.A=510(50)									**
* ⁴⁵ Fe	T : average 07Mi40=2.6(0.2) (2p gated) 07Mi36=2.8(0.4) (β gated)									**
* ⁴⁵ Fe	T : 05Do20=1.6(+0.5-0.3) 02Gi09=4.7(+3.4-1.4) 02Pf02=3.2(+2.6-1.0);									**
* ⁴⁵ Fe	T : 02Gi09 supersedes 01Gi01=6(+17-3), 5.98(2.49), 4.22(1.88)									**
* ⁴⁵ Fe	D : %2p from 07Mi40; other 05Do20=57(10)%.									**
⁴⁶ P	22840#	500#			9# ms >200ns			00 90Le03	I 1990	β^- ?; β^- n ?; β^- 2n ?
⁴⁶ S	640#	400#			50 ms 8	0 ⁺	10		1989	β^- =100; β^- n ?; β^- 2n ?
⁴⁶ Cl	-13730	100			232 ms 2	2 ⁻ #	12		1989	β^- =100; β^- n=60 9; β^- 2n ?
⁴⁶ Ar	-29771.3	2.3			8.4 s 0.6	0 ⁺	00		1974	β^- =100
⁴⁶ K	-35413.9	0.7			96.30 s 0.08	2 ⁻ *	00	14Ku.A	T 1965	β^- =100
⁴⁶ Ca	-43139.6	2.2			STABLE	0 ⁺	00		1938	IS=0.004 3;2 β^- ?
⁴⁶ Sc	-41761.6	0.7			83.757 d 0.014	4 ⁺ *	00	FGK204	T 1936	β^- =100
⁴⁶ Sc ^m	-41709.6	0.7	52.011	0.001	9.4 μ s 0.8	6 ⁺	00		1966	IT=100
⁴⁶ Sc ⁿ	-41619.1	0.7	142.528	0.007	18.75 s 0.04	1 ⁻	00		1948	IT=100
⁴⁶ Sc ⁱ	-36748	4	5014	4	RQ	0 ⁺ T=3	00			
⁴⁶ Ti	-44128.27	0.09			STABLE	0 ⁺	00		1934	IS=8.25 3
⁴⁶ Ti ⁱ	-34962	7	9166	7	RQ	4 ⁺ T=2	00			
⁴⁶ Ti ⁱ	-29977	6	14151	6	RQ	0 ⁺ T=3	00			
⁴⁶ V	-37075.90	0.13			422.62 ms 0.05	0 ⁺ T=1	00	12Pa07	T 1952	β^+ =100
⁴⁶ V ^m	-36274.44	0.16	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	9143	17	RQ	(4 ⁺) T=2	10			p=?
⁴⁶ Mn	-12420	90			36.2 ms 0.4	(4 ⁺)	10		1987	β^+ =100; β^+ +p=57.0 8; β^+ 2p $\approx$ 18; β^+ α ?
⁴⁶ Mn ^m	-12270#	140#	150#	100#	1# ms	1 ⁻ #				β^+ ?

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{46}\text{Mn}^i$	-7390	50	5030	100	p		T=3					
^{46}Fe	1210#	300#				13.0 ms 2.0	0^+	10	07Do17	TD 1992	$\beta^+=100; \beta^+p=78.7\ 38;$ $\beta^+2p=?$	*
^{46}K	J : 19Ko19, 14Kr04, 14Pa45, 82To02=2											**
^{46}K	T : other 19Po06=96.5(4)											**
^{46}Ca	T : 99Be64 : Onu-BB>100 Ey											**
^{46}Sc	J : other 11Av01=4											**
^{46}V	T : average 12Pa07=422.66(0.06) 97Ko65=422.57(0.13) 77Ba01=422.28(0.23)											**
^{46}V	T : 77Al11=422.47(0.39); others 74Ha59=423.4(2.0) 73Al02=425.3(2.0)											**
^{46}Cr	T : others (outweighed) 15Mo01=223.9(9.9) 05On03=240(140) 72Zi02=260(60)											**
^{46}Mn	T : others 92Bo37=41(+7-6) 01Gi01=34.0(+4.5-3.5)											**
^{46}Mn	D : β^+2p estimated from Pp = $\beta^+p + 2\beta^+2p = 57(1)$											**
^{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											**
^{47}P	28810#	600#				4# ms >400ns	$1/2^+\#$	18	Ta17	I 2018	$\beta^-?; \beta^-n?; \beta^-2n?$	
^{47}S	7200#	400#				24# ms >200ns	$3/2^-\#$	07	89Gu03	I 1989	$\beta^-?; \beta^-n?; \beta^-2n?$	
^{47}Cl	-9580#	200#				101 ms 5	$3/2^+\#$	07			$\beta^-=100; \beta^-n<3; \beta^-2n?$	
^{47}Ar	-25367.3	1.2				1.23 s 0.03	$(3/2)^-$	07			$\beta^-=100; \beta^-n<0.2$	
^{47}K	-35712.0	1.4				17.38 s 0.03	$1/2^+*$	07	20Sm02	T 1964	$\beta^-=100$	*
^{47}Ca	-42344.7	2.2				4.536 d 0.003	$7/2^-*$	07			$\beta^-=100$	*
^{47}Sc	-44336.8	1.9				3.3492 d 0.0006	$7/2^-*$	07			$\beta^-=100$	
$^{47}\text{Sc}^m$	-43570.0	1.9	766.83	0.09		272 ns 8	$(3/2)^+$	07			IT=100	
^{47}Ti	-44937.61	0.08				STABLE	$5/2^-*$	07			IS=7.44 2	
$^{47}\text{Ti}^i$	-37588.6	0.7	7349.0	0.7			$7/2^-$ T=5/2	07				
^{47}V	-42007.07	0.11				32.6 m 0.3	$3/2^-*$	07			$\beta^+=100$	
$^{47}\text{V}^i$	-37856.72	0.16	4150.35	0.11			$5/2(^-)$ T=3/2	07			IT=100	
^{47}Cr	-34563	5				461.6 ms 1.5	$3/2^-$	07			$\beta^+=100$	*
$^{47}\text{Cr}^j$	-29803#	21#	4760#	20#			$5/2^-\#$ T=5/2					
^{47}Mn	-22570	30				88.0 ms 1.3	$5/2^-\#$	07	07Do17	TD 1987	$\beta^+=100; \beta^+p<1.7$	
$^{47}\text{Mn}^i$	-15191	17	7380	40	RQ		$7/2^-\#$ T=5/2	07		2001	p=100	
^{47}Fe	-7130#	500#				21.9 ms 0.2	$7/2^-\#$	07	07Do17	TD 1992	$\beta^+=100; \beta^+p=88.4\ 9$	
$^{47}\text{Fe}^m$	-6360#	510#	770#	100#			$3/2^+\#$		Mirror	I	IT ?	
^{47}Co	10620#	600#					$7/2^-\#$	07	Mirror	I	p ?	
^{47}K	J : 19Ko19, 14Kr04, 14Pa45, 13Pa11=1/2											**
^{47}Ca	J : also 15Ru02=7/2											**
^{47}Cr	T : average 77Ed01=460.0(1.5) 77Ho25=452(18) 85Bu07=508(10)											**
^{47}Cr	T : 88HaZB=472.0(6.3) 85HoZS=520(40) 17Ku12=460(80)											**
^{48}S	12390#	500#				10# ms >200ns	0^+	06		1990	$\beta^-?; \beta^-n?; \beta^-2n?$	
^{48}Cl	-4280#	500#				30# ms >200ns		06	89Gu03	I 1989	$\beta^-?; \beta^-n?; \beta^-2n?$	
^{48}Ar	-22355	17				415 ms 15	0^+	10	12We08	TD 2004	$\beta^-=100; \beta^-n=38\ 6$	*
^{48}K	-32284.5	0.8				6.83 s 0.14	1^-*	06		1972	$\beta^-=100; \beta^-n=1.14\ 15$	*
^{48}Ca	-44224.868	0.018				56 Ey 10	0^+	06	20Ba.A	T 1938	IS=0.187 21; $2\beta^-=?; \beta^-?$	*
^{48}Sc	-44504	5				43.67 h 0.09	6^+*	06		1937	$\beta^-=100$	
^{48}Ti	-48492.95	0.07				STABLE	0^+	06		1923	IS=73.72 3	
$^{48}\text{Ti}^i$	-37767	6	10726	6			(6^+) T=3	06				
^{48}V	-44478.0	1.0				15.9735 d 0.0025	4^+*	06		1937	$\beta^+=100$	
$^{48}\text{V}^i$	-41459.16	0.23	3018.8	0.9	RQ		$(0)^+$ T=2	06			IT=100	
^{48}Cr	-42821	7				21.56 h 0.03	0^+	06		1952	$\beta^+=100$	
$^{48}\text{Cr}^j$	-37028	7	5792.77	0.24			4^+ T=1	06		1987	IT=100	
$^{48}\text{Cr}^j$	-34061	15	8760	17	RQ		0^+ frg. T=2	06				*
^{48}Mn	-29297	7				158.1 ms 2.2	4^+	06		1987	$\beta^+=100; \beta^+p=0.28\ 4;$ $\beta^+\alpha=6e-4$	
$^{48}\text{Mn}^i$	-26260	7	3036.7	0.9	IT		0^+ T=2	06	MMC12	J	p=100	
^{48}Fe	-18010	90				45.3 ms 0.6	0^+	06	07Do17	TD 1987	$\beta^+=100; \beta^+p=15.3\ 5$	
^{48}Co	1730#	500#					$6^+\#$	06			p ?	
^{48}Ni	18180#	420#				2.8 ms 0.8	0^+	06	11Po09	TD 2000	$2p=70\ 20; \beta^+=30\ 20; \beta^+p?$	*
^{48}Ar	T : average 12We08=381(35) 412(19) 04Gr20=475(40)											**
^{48}K	J : 14Kr04, 14Pa45=1											**
^{48}K	T : average 75Mu08=6.8(0.2) 81HuZT=6.9(0.2) 78De17=6(1)											**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ⁴⁸ Ca	T : 2β ⁻ symmetrized from 20Ba.A=53(+12-8); other 15Ba11=44(+6-5)										**
* ⁴⁸ Cr ⁱ	E : strongly fragmented state; other: 10(15) keV lower										**
* ⁴⁸ Fe	D : %β ⁺ p 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	20390#	580#			4# ms >400ns	1/2 ⁻ #		08 18Ta17 I	2018	β ⁻ ?;β ⁻ n ?;β ⁻ 2n ?	
⁴⁹ Cl	740#	400#			35# ms >200ns	3/2 ⁺ #		08 89Gu03 I	1989	β ⁻ ?;β ⁻ n ?;β ⁻ 2n ?	
⁴⁹ Ar	-17060#	400#			236 ms 8	3/2 ⁻ #		08 12We08 TD	1989	β ⁻ =100;β ⁻ n=29 6;β ⁻ 2n ?	
⁴⁹ K	-29611.5	0.8			1.26 s 0.05	1/2 ⁺ *		11	1972	β ⁻ =100;β ⁻ n=86 9	
⁴⁹ Ca	-41300.00	0.18			8.718 m 0.006	3/2 ⁻ *		08	1950	β ⁻ =100	
⁴⁹ Sc	-46562.4	2.3			57.18 m 0.13	7/2 ⁻		08	1940	β ⁻ =100	
⁴⁹ Ti	-48564.01	0.08			STABLE	7/2 ⁻ *		08	1934	IS=5.41 2	
⁴⁹ V	-47962.2	0.8			330 d 15	7/2 ⁻ *		08	1940	ε=100	
⁴⁹ Vi	-41531	4	6432	4	RQ	7/2 ⁻ T=5/2					
⁴⁹ Cr	-45332.4	2.2			42.3 m 0.1	5/2 ⁻ *		08	1942	β ⁺ =100	
⁴⁹ Cr ⁱ	-40568	5	4764	5		(7/2 ⁻) T=3/2		08 85Fu03 E	1969	IT=100	
⁴⁹ Mn	-37619.9	2.2			382 ms 7	5/2 ⁻ *		08	1970	β ⁺ =100	
⁴⁹ Mn ⁱ	-32803	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	-9780#	500#			<35ns	7/2 ⁻ #		08 94Bi10 I		p ?	
⁴⁹ Ni	8530#	600#			7.5 ms 1.0	7/2 ⁻ #		08	1996	β ⁺ =100;β ⁺ p=83.4 13.2	
* ⁴⁹ K	J : 14Kr04,14Pa45,13Pa11=1/2										**
* ⁴⁹ Ca	J : 15Ru02,16Ga34=3/2										**
* ⁴⁹ Cr	T : other 18Tu03=44.0(2.7) for q=24+ (bare ion)										**
* ⁴⁹ Cr ⁱ	E : strongest component surrounded by several weak l=3 lines.										**
* ⁴⁹ Cr ⁱ	E : 85Fu03 cannot confirm IAS identity and fragmentation										**
* ⁴⁹ Mn	T : average 80Ha12=384(17) 87Ha.A=381.7(7.4) 17Ku12=380(30)										**
⁵⁰ Cl	7700#	400#			10# ms >620ns			19 09Ta24 I	2009	β ⁻ ?;β ⁻ n ?;β ⁻ 2n ?	
⁵⁰ Ar	-13230#	500#			106 ms 6	0 ⁺		19	1989	β ⁻ =100;β ⁻ n=37 7;β ⁻ 2n ?	
⁵⁰ K	-25728	8			472 ms 4	0 ⁻ *		19	1972	β ⁻ =100;β ⁻ n=28.6 24;	
										*	
										β ⁻ 2n ?	
⁵⁰ K ^m	-25556	8	172.0	0.4	125 ns 40	(2 ⁻)		19 10Da06 T	1999	IT=100	
⁵⁰ Ca	-39589.2	1.6			13.45 s 0.05	0 ⁺		19	1964	β ⁻ =100	
⁵⁰ Sc	-44537.1	2.5			102.5 s 0.5	5 ⁺		19	1959	β ⁻ =100	
⁵⁰ Sc ^m	-44280.2	2.5	256.895	0.010	350 ms 40	2 ⁺		19	1963	IT>99;β ⁻ <1	
⁵⁰ Ti	-51431.87	0.08			STABLE	0 ⁺		19	1934	IS=5.18 2	
⁵⁰ V	-49223.24	0.09			271 Py 13	6 ⁺ *		19 20Da12 T	1949	IS=0.250 10;β ⁺ ≈100;β ⁻ ?	
⁵⁰ Vi	-44410.71	0.28	4812.53	0.27	RQ	0 ⁺ T=3		10			
⁵⁰ Cr	-50261.36	0.09			STABLE	0 ⁺		19	1930	IS=4.345 13;2β ⁺ ?	
⁵⁰ Cr ⁱ	-41836	7	8425	7	RQ	6 ⁺ T=2		19			
⁵⁰ Cr ^j	-37039	6	13222	6	RQ	0 ⁺ T=3		19			
⁵⁰ Mn	-42626.89	0.12			283.21 ms 0.07	0 ⁺ * T=1		19 06Ba33 T	1952	β ⁺ =100	
⁵⁰ Mn ^m	-42401.57	0.11	225.31	0.07	MD	5 ⁺ * T=0		19	1962	β ⁺ =100	
⁵⁰ Fe	-34476	8			152.0 ms 0.6	0 ⁺		19 15Mo01 T	1977	β ⁺ =100;β ⁺ p≈0	
⁵⁰ Fe ⁱ	-25999	10	8478	13	RQ	(6 ⁺) T=2		19			
⁵⁰ Co	-17590	130			38.8 ms 0.2	(6 ⁺)		19	1987	β ⁺ =100;β ⁺ p=70.5 7;β ⁺ 2p ?	
⁵⁰ Co ⁱ	-12747	15	4840	130	2p	(0 ⁺) T=3		19		p=100	
⁵⁰ Ni	-3460#	500#			18.5 ms 1.2	0 ⁺		19 07Do17 TD	1994	β ⁺ =100;β ⁺ p=73 6;	
										β ⁺ 2p=14 5	
* ⁵⁰ K	J : 14Kr04,14Pa45=0										**
* ⁵⁰ K	D : %β ⁻ n average 83La23=28(4) 82Ca04=29(3)										**
* ⁵⁰ V	T : β ⁺ average 20Da12=277(+20-19) 19La09=267(+16-18); β ⁻ 20Da12>8900 Py										**
* ⁵⁰ Cr	T : 03Bi05>1.3Ey 85No03>0.18Ey										**
* ⁵⁰ Mn	T : average 06Ba33=283.10(0.14) 97Ko65=283.29(0.08) 76Wi08=282.72(0.26)										**
* ⁵⁰ Mn	T : 75Fr02=282.8(0.3) 74Ha59=284.0(0.4)										**
* ⁵⁰ Fe	T : average 15Mo01=152.1(0.6, beta), 150.1(2.9, gamma); others (outweighed)										**
* ⁵⁰ Fe	T : 17Ku12=145(13) 97Ko46=155(11)										**
* ⁵⁰ Ni	T : other 03Ma34=12(+3-2)										**
* ⁵⁰ Ni	D : %β ⁺ p + %β ⁺ 2p 07Do17=86.7(3.9), other 03Ma34=70(20); %β ⁺ 2p 07Do17=14(5)										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{51}Cl	14290#	700#				5# ms >200ns	$3/2^+\#$	16		1990	β^- ?; β^-n ?; β^-2n ?		
^{51}Ar	-6490#	400#				30# ms >200ns	$1/2^-\#$	16	89Gu03	I	1989	β^- ?; β^-n ?; β^-2n ?	
^{51}K	-22515	13				365 ms 5	$3/2^+*$	16			1983	β^- =100; β^-n =65 6; β^-2n ?	
^{51}Ca	-36332.3	0.5				10.0 s 0.8	$3/2^-*$	16			1980	β^- =100; β^-n ?	
^{51}Sc	-43250.4	2.5				12.4 s 0.1	$(7/2)^-$	16			1966	β^- =100; β^-n ?	
^{51}Ti	-49733.0	0.5				5.76 m 0.01	$3/2^-$	16			1947	β^- =100	
^{51}V	-52203.11	0.10				STABLE	$7/2^-*$	16	76Fu06	J	1924	IS=99.750 10	
^{51}Cr	-51450.71	0.17				27.7015 d 0.0011	$7/2^-*$	16	FGK204	T	1940	ε =100	
$^{51}\text{Cr}^i$	-44838	5	6613	5	RQ		$7/2^-$ T=5/2	16					
^{51}Mn	-48243.2	0.3				45.81 m 0.21	$5/2^-*$	16			1938	β^+ =100	
$^{51}\text{Mn}^i$	-43792.6	1.5	4450.6	1.5	RQ		$7/2^-$ T=3/2	16				IT=100	
^{51}Fe	-40189.2	1.4				305.4 ms 2.3	$5/2^-$	16	15Sh16	T	1972	β^+ =100	
^{51}Co	-27340	50				68.8 ms 1.9	$7/2^-$	16			1987	β^+ =100; β^+p <3.8	
$^{51}\text{Co}^i$	-20674	18	6670	50	p		$7/2^- \#$ T=5/2		07Do17	D		p=100	
^{51}Ni	-11650#	500#				23.8 ms 0.2	$7/2^- \#$	16	07Do17	TD	1987	β^+ =100; β^+p =87.2 8; β^+2p =0.5 2	
* ^{51}K	D : % β^-n average 06Pe16=63(8) 83La23=68(10); other 82Ca04=47(5)											**	
* ^{51}K	J : 14Pa45,14Kr04,06Pe16,13Pa11=3/2											**	
* ^{51}Ca	J : 06Pe16,15Ru0,16Ga34=3/2											**	
* ^{51}Mn	J : 15Ba49,65Sa22,68Jo18=5/2											**	
* ^{51}Mn	T : average 17Gr12=45.59(0.07) 70Er01=46.2(0.1) 66Gi02=46.5(0.2);											**	
* ^{51}Fe	T : average 15Sh16=308(5) 13Su07=301(4) 87Ha.B=305(5) 84Ay01=310(5);											**	
* ^{51}Fe	T : other 17Ku12=288(6) is ~ 7 sigma away from the average value											**	
* ^{51}Ni	D : % β^+2p from 12Au08											**	
^{52}Cl	22360#	700#				2# ms >400ns			18Ta17	I	2018	β^- ?; β^-n ?; β^-2n ?	
^{52}Ar	-1380#	600#				40# ms >620ns	0^+		15 09Ta24	I	2009	β^- ?; β^-n ?; β^-2n ?	
^{52}K	-17140	30				110 ms 4	$2^- \#$		15 06Pe16	TD	1983	β^- =100; β^-n =72.2 9.3; 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	-40524	3				8.2 s 0.2	$3(^+)$		15		1980	β^- =100; β^-n ?	
^{52}Ti	-49477.7	2.7				1.7 m 0.1	0^+		15		1966	β^- =100	
^{52}V	-51443.03	0.16				3.743 m 0.005	3^+		15		1934	β^- =100	
^{52}Cr	-55419.51	0.11				STABLE	0^+		15		1923	IS=83.789 18	
$^{52}\text{Cr}^i$	-44154.6	0.4	11264.9	0.4			3^+ T=3		15			IT=100	
^{52}Mn	-50711.39	0.13				5.591 d 0.003	6^+*		15		1938	β^+ =100	
$^{52}\text{Mn}^m$	-50333.64	0.13	377.749	0.005		21.1 m 0.2	2^+*		15		1937	β^+ =98.22 5; IT=1.78 5	
$^{52}\text{Mn}^i$	-47785	5	2926	5	RQ		0^+ T=2		15			IT=100	
^{52}Fe	-48332.10	0.18				8.275 h 0.008	0^+		15		1948	β^+ =100	
$^{52}\text{Fe}^m$	-41371.43	0.29	6960.7	0.3	MD		12^+		15		1979	β^+ =99.979 5; IT=0.021 5	
$^{52}\text{Fe}^i$	-42677.6	0.4	5654.5	0.4			6^+ T=1		15			IT=100	
$^{52}\text{Fe}^j$	-39776	6	8556	6	RQ		0^+ frg. T=2		15				
^{52}Co	-34344	5				111.7 ms 2.1	6^+		15 16Or08	TJ	1987	β^+ =100; β^+p ?	
$^{52}\text{Co}^m$	-33968	8	376	9	MD		2^+		16Or08	TJ	2016	β^+ $\approx$ 100; IT ?; β^+p ?	
$^{52}\text{Co}^i$	-31420	8	2924	9	IT		0^+ T=2		16Or03	D	2016	IT=75 23; p=?	
^{52}Ni	-22560	80				41.8 ms 1.0	0^+		15 16Or03	TD	1987	β^+ =100; β^+p =31.1 5	
^{52}Cu	-1880#	600#					$3^+\#$		Mirror	I		p ?	
* ^{52}K	T : average 06Pe16=118(6) 85Hu03=110(30) 83La23=105(5)											**	
* $^{52}\text{Mn}^m$	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) 67Pa22=8.23(0.04)											**	
* $^{52}\text{Fe}^m$	E : other 6958.0(0.4) keV from a least-squares fit to Eg in Ensdf2015											**	
* $^{52}\text{Fe}^m$	D : %IT from 05Ga20; other 79Ga02<0.4											**	
* $^{52}\text{Fe}^j$	E : probably fragmented, unresolved doublet separated by 4 keV											**	
* ^{52}Co	T : average 17Ku12=111(4) 16Or08=112(3) 15Sh16=112(4)											**	
* $^{52}\text{Co}^m$	T : average 16Or08=102(6) 13Su07=103(7)											**	
* ^{52}Ni	T : average 16Or03=42.8(3) 07Do17=40.8(2); other 94Fa06=38(5)											**	
* ^{52}Ni	D : % β^+p other 07Do17=31.4(15) 94Fa06=17.0(14)											**	
^{53}Ar	6790#	700#				20# ms >620ns	$5/2^- \#$		11 09Ta24	I	2009	β^- ?; β^-n ?; β^-2n ?	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{53}K	-12300	110				30 ms 5	$3/2^+$	09	06Pe16	JD 1983	$\beta^- = 100; \beta^- n \approx 64$	11; *
^{53}Ca	-29390	40				461 ms 90	$1/2^- \#$	14		1983	$\beta^- = 100; \beta^- n \approx 40$	10 *
^{53}Sc	-38770	18				2.4 s 0.6	$(7/2^-)$	14	10Cr02	TJ 1980	$\beta^- = 100; \beta^- n ?$	
^{53}Ti	-46881.4	2.9				32.7 s 0.9	$(3/2^-)$	09		1977	$\beta^- = 100$	
^{53}V	-51852	3				1.543 m 0.014	$7/2^-$	09		1960	$\beta^- = 100$	
^{53}Cr	-55287.62	0.12				STABLE	$3/2^- *$	09		1930	IS=9.501 17	
^{53}Mn	-54690.3	0.3				3.7 My0.4	$7/2^- *$	09		1955	$\epsilon = 100$	*
$^{53}\text{Mn}^i$	-47717	4	6973	4	RQ		$3/2^- T=5/2$	09		1976		
^{53}Fe	-50947.5	1.7				8.51 m 0.02	$7/2^-$	09		1938	$\beta^+ = 100$	*
$^{53}\text{Fe}^m$	-47907.1	1.7	3040.4	0.3		2.54 m 0.02	$19/2^-$	09		1967	IT=100	
$^{53}\text{Fe}^i$	-46698	3	4250	3			$7/2^- T=3/2$	09				
^{53}Co	-42659.4	1.7				244.6 ms 2.8	$7/2^- \#$	09	17Ku12	T 1970	$\beta^+ = 100$	*
$^{53}\text{Co}^m$	-39485.1	1.9	3174.3	0.9	MD	250 ms 10	$(19/2^-)$	09	72Ce01	D 1970	$\beta^+ = ?; p \approx 1.5$	*
$^{53}\text{Co}^i$	-38334.4	2.6	4325.0	2.0	IT		$(7/2^-) T=3/2$	09	16Su10	ED 1976	IT $\approx$ 100; p<0.9 3	
^{53}Ni	-29631	25				55.2 ms 0.7	$(7/2^-)$	13	16Su10	D 1976	$\beta^+ = 100; \beta^+ p = 22.7$	7 *
^{53}Cu	-13140#	500#				<130ns	$3/2^- \#$	13			p ?	
* ^{53}K	J : from 20Su06											**
* ^{53}Ca	D : % $\beta^- n$ 83La23=40(10)% is a lower limit											**
* ^{53}Mn	J : 15Ba49,56Do45=7/2											**
* ^{53}Fe	T : other 18Tu03=8.47(0.19) 95Ir01=8.5(0.3) for q=26+ (bare ion)											**
* ^{53}Co	T : average 17Ku12=245(3) 02Lo13=240(9) 89Ho13=240(20) 73Ko10=262(25);											**
* ^{53}Co	T : values may contain small contribution from ^{53m}Co decay											**
* $^{53}\text{Co}^m$	D : %p from 72Ce01 $\sim$ 1.5 %											**
* $^{53}\text{Co}^m$	T : average 15Sh16=237(48) 76Vi02=260(20) 72Ce01=247(12)											**
* ^{53}Ni	D : % $\beta^+ p$ average 16Su10=22(1) 07Do17=23.4(1.0); other: 76Vi02 45											**
^{54}Ar	12560#	800#				5# ms >400ns	0^+	18	Ta17	I 2018	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	
^{54}K	-5150#	400#				10 ms 5	$2^- \#$	14		1983	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
^{54}Ca	-25160	50				90 ms 6	0^+	14	08Ma01	TD 1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
^{54}Sc	-34438	14				526 ms 15	$(3)^+$	14		1990	$\beta^- = 100; \beta^- n = 16$	9
$^{54}\text{Sc}^m$	-34328	14	110.5	0.3		2.77 μ s 0.02	$(5^+, 4^+)$	14	10Cr02	J 1998	IT=100	
^{54}Ti	-45744	16				2.1 s 1.0	0^+	14		1980	$\beta^- = 100$	
^{54}V	-49898	11				49.8 s 0.5	3^+	14		1970	$\beta^- = 100$	
$^{54}\text{V}^m$	-49790	11	108.0	1.0		900 ns 500	$(5)^+$	14		1998	IT=100	
^{54}Cr	-56935.38	0.13				STABLE	0^+	14		1930	IS=2.365 7	
^{54}Mn	-55558.2	1.0				312.081 d 0.032	$3^+ *$	14	FGK204	T 1938	$\epsilon = 100; \beta^- = 0.93e-4;$ $e^+ = 1.28e-7$ 25	*
$^{54}\text{Mn}^i$	-49411.9	2.8	6146.4	3.0	RQ		$0^+ T=3$					
^{54}Fe	-56254.6	0.3				STABLE	0^+	14		1923	IS=5.845 105; $2\beta^+ ?$	
$^{54}\text{Fe}^m$	-49727.5	1.1	6527.1	1.1		364 ns 7	10^+	14		1983	IT=100	
$^{54}\text{Fe}^j$	-41387	20	14868	20	RQ		$0^+ T=3$	14				
^{54}Co	-48010.1	0.4				193.27 ms 0.06	$0^+ T=1$	14	97Ko65	T 1952	$\beta^+ = 100$	*
$^{54}\text{Co}^m$	-47812.5	0.4	197.57	0.10	MD	1.48 m 0.02	$7^+ T=0$	14		1962	$\beta^+ = 100$	
^{54}Ni	-39278	5				114.1 ms 0.3	0^+	14	17Ku12	T 1977	$\beta^+ = 100; \beta^+ p ?$	*
$^{54}\text{Ni}^m$	-32821	5	6457.4	0.9		152 ns 4	10^+	14	08Ru09	JD 2008	IT=64 2; p=36 2	
^{54}Cu	-21240#	400#				<75ns	$3^+ \#$	14	94B110	I	p ?	
^{54}Zn	-5700#	220#				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}Co	T : average 97Ko65=193.28(0.07) 74Ha59=193.4(0.4) 74Ho21=193.0(0.3)											**
* ^{54}Co	T : 77Al11=193.28(0.18); other (outweighed) 02Lo13=172(23)											**
* ^{54}Ni	T : average 17Ku12=110(2) 15Mo01=114.2(0.3), 114.3(1.8) 13Su07=113(9)											**
* ^{54}Ni	T : 08Fu04=114(5) 02Lo13=103(9) 99Re06=106(12)											**
* ^{54}Zn	T : symmetrized from 11As08=1.59(+0.60-0.35); other 05B115=3.2(+1.8-0.8)											**
* ^{54}Zn	D : %2p average 11As08=92(+6-13)% 05B115=87(+10-17)%											**
^{55}K	470#	500#				10# ms >620ns	$3/2^+ \#$	09	09Ta24	I 2009	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	
^{55}Ca	-18650	160				22 ms 2	$5/2^- \#$	09		1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
^{55}Sc	-30840	60				96 ms 2	$(7/2^-)$	08	10Cr02	TJD 1990	$\beta^- = 100; \beta^- n = 17$ 7; $\beta^- 2n ?$	*
^{55}Ti	-41832	29				1.3 s 0.1	$(1/2^-)$	10		1980	$\beta^- = 100; \beta^- n ?$	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{55}V	-49125	27				6.54 s 0.15	$7/2^-$	#	08	1977	β^- =100
^{55}Cr	-55110.32	0.23				3.497 m 0.003	$3/2^-$		08	1952	β^- =100
^{55}Mn	-57712.54	0.26				STABLE	$5/2^-$	*	08	1923	IS=100
^{55}Fe	-57481.4	0.3				2.7562 y 0.0004	$3/2^-$		09 FGK204	T 1939	ϵ =100
$^{55}\text{Fe}^i$	-49848	6	7633	6	RQ		$5/2^-$	T=5/2	09		
^{55}Co	-54030.0	0.4				17.53 h 0.03	$7/2^-$	*	09	1938	β^+ =100
$^{55}\text{Co}^i$	-49308.6	0.4	4721.44	0.10			$3/2^-$	frg. T=3/209		1981	IT=100
^{55}Ni	-45336.0	0.7				203.9 ms 1.3	$7/2^-$		08 17Ku12	T 1972	β^+ =100
$^{55}\text{Ni}^i$	-40737.0	1.2	4599	1			$7/2^-$	frg. T=3/2	13Tr09	E	
^{55}Cu	-31640	160				55.9 ms 1.5	$3/2^-$	#	08 13Tr09	T 1987	β^+ =100; β^+ p=?
^{55}Zn	-14270#	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}Mn	J : 15Ba49,15He28,79De19=5/2										**
$^{55}\text{Co}^i$	E : strongly fragmented state; other 26.69(0.15) keV higher										**
^{55}Ni	T : average 17Ku12=203(2) 02Lo13=196(5) 99Re06=204(3) 87Ha.A=212.1(3.8)										**
^{55}Ni	T : 84Ay01=208(5) 77Ho25=189(5) 76Ed.A=219(6)										**
^{55}Ni	J : $l=3$ in 14Sa46										**
$^{55}\text{Ni}^i$	E : strongly fragmented state; other 20 keV lower										**
^{55}Cu	T : average 20Gi02=55.5(1.8) 13Tr09=57(3); other 07Do17=27(8), conflicting										**
^{55}Cu	D : β^+ p in 07Do17=15.0(4.3), but it is probably a contaminant given the										**
^{55}Cu	D : short and conflicting half-life; not confirmed in 13Tr09										**
^{56}K	7980#	600#				5# ms >620ns	2^-	#	11 09Ta24	I 2009	β^- ?; β^- n ?; β^- 2n ?
^{56}Ca	-13510	250				11 ms 2	0^+		11	1997	β^- =100; β^- n ?; β^- 2n ?
^{56}Sc	-25520	260			*	26 ms 6	(1^+)		11 10Cr02	JT 1997	β^- =100; β^- n ?; β^- 2n ?
$^{56}\text{Sc}^m$	-25520#	280#	0#	100#	*	75 ms 6	$(6^+, 5^+)$		11 10Cr02	JTD 2004	β^- =100; β^- n >12; β^- 2n ?
$^{56}\text{Sc}^n$	-24750	260	775.0	0.1		290 ns 17	(4^+)		11 20Mi13	TE 2004	IT=100
^{56}Ti	-39420	100				200 ms 5	0^+		11 98Am04	D 1980	β^- =100; β^- n ?
^{56}V	-46180	180				216 ms 4	(1^+)		11 98Am04	D 1980	β^- =100; β^- n ?
^{56}Cr	-55285.1	0.6				5.94 m 0.10	0^+		11 60Dr03	D 1960	β^- =100
^{56}Mn	-56911.67	0.29				2.5789 h 0.0001	3^+	*	11	1934	β^- =100
^{56}Fe	-60607.16	0.27				STABLE	0^+		11	1923	IS=91.754 106
$^{56}\text{Fe}^i$	-49103.5	0.4	11503.7	0.3			3^+	T=3	11		
^{56}Co	-56040.5	0.5				77.236 d 0.026	4^+	*	11	1941	β^+ =100
$^{56}\text{Co}^i$	-52448	9	3593	9	RQ		(0^+)	frg. T=2	11		*
^{56}Ni	-53907.6	0.4				6.075 d 0.010	0^+		11	1952	β^+ =100
$^{56}\text{Ni}^p$	-44172.1	1.9	9735.5	1.9			7		11	2008	p $\approx$ 100
$^{56}\text{Ni}^i$	-47475.7	0.8	6431.9	0.7			4^+	T=1	11		
$^{56}\text{Ni}^j$	-43964	4	9944	4	RQ		0^+	frg. T=2			*
^{56}Cu	-38630	6				80.8 ms 0.6	(4^+)		11 01Bo54	TJD 1987	β^+ =100; β^+ p=0.40 12
$^{56}\text{Cu}^i$	-35099	10	3531	12	p		$T=2$		16Or03	D 2007	IT=51 6;p=49 6
^{56}Zn	-25390#	400#				32.4 ms 0.7	0^+		11 14Or04	TD 2001	β^+ =100; β^+ p=88.0 23
$^{56}\text{Zn}^i$	-21530#	650#	3860#	510#			3^+	# T=3			p ?
^{56}Ga	-3840#	500#					3^+	#			p ?
$^{56}\text{Sc}^n$	T : average 20Mi13=290(20) 10Cr02=290(30); other 12Ka36=350(+260-120)										**
$^{56}\text{Co}^i$	E : strongly fragmented state; other 70(9) keV lower										**
$^{56}\text{Ni}^j$	E : strongly fragmented state; others 68(6) and 98(6) keV higher										**
^{56}Cu	T : average 20Gi02=80.2(7) 17Ku12=80(2) 02Lo13=82(9) 01Bo54=93(3)										**
^{56}Cu	T : 98Ra15=78(15)										**
^{56}Zn	T : average 14Or04=32.9(0.8) 07Do17=30.0(1.7)										**
^{56}Zn	D : β^+ p average 14Or04=88.5(26) 07Do17=86.0(49)										**
^{57}K	14130#	600#				2# ms >400ns	$3/2^+$	#	18Ta17	I 2018	β^- ?; β^- n ?; β^- 2n ?
^{57}Ca	-6560#	400#				8# ms >620ns	$5/2^-$	#	10 09Ta24	I 2009	β^- ?; β^- n ?; β^- 2n ?
^{57}Sc	-21380	180				22 ms 2	$7/2^-$	#	10 10Cr02	T 1997	β^- =100; β^- n ?; β^- 2n ?
^{57}Ti	-34400	210				95 ms 8	$5/2^-$	#	10 99So20	T 1985	β^- =100; β^- n ?
^{57}V	-44440	80				350 ms 10	$(7/2^-)$		10 03Ma02	T 1980	β^- =100; β^- n ?
^{57}Cr	-52525.0	1.9				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	-60182.02	0.27				STABLE	$1/2^-$	*	98	1935	IS=2.119 29
^{57}Co	-59345.7	0.5				271.811 d 0.032	$7/2^-$	*	98 FGK204	T 1941	ϵ =100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{57}\text{Co}^i$	-52092.3	0.4	7253.3	0.6	RQ	$1/2^-$ T=5/2		MMC120J			
^{57}Ni	-56084.0	0.6			35.60 h 0.06	$3/2^-$	98		1938	$\beta^+=100$	
$^{57}\text{Ni}^i$	-50845.2	0.9	5238.8	0.7		$7/2^-$ frg. T=3/298					*
^{57}Cu	-47309.0	0.5			196.4 ms 0.7	$3/2^-$ *	98	17Ku12	T	1976	$\beta^+=100$
$^{57}\text{Cu}^i$	-42010	25	5299	25	p	$7/2^-$ T=3/2					
^{57}Zn	-32550#	200#			45.7 ms 0.6	$7/2^-$ #	98	20Gi02	T	1976	$\beta^+=100; \beta^+p=87.9$
^{57}Ga	-15410#	400#				$1/2^-$ #					p ?
^{57}Sc	T : other 03So21=13(4)										**
^{57}Ti	T : average 05Li53=98(5) 99So20=67(25) 96Do23=56(20); other										**
^{57}Ti	T : 98Am04=180(30) conflicting, not used										**
^{57}V	J : 98So03 proposed $3/2^-$, supported in 03Ma02; same group 05Li53 favors $7/2^-$										**
$^{57}\text{Ni}^i$	E : strongly fragmented state; others 98(7) keV lower 128(7) keV higher										**
$^{57}\text{Ni}^i$	E : in 79Ik04 and 104(5) keV lower, 129(5) keV higher in 78Na11										**
^{57}Cu	T : average 17Ku12=195(4) 02Lo13=183(17) 96Se01=196.3(0.7)										**
^{57}Cu	T : 87Ha.A=199.4(3.2) 84Sh28=223(16)										**
^{57}Cu	J : 10Co01=3/2										**
^{57}Zn	T : others (outweighed) 07Bl09=48(3) 02Lo13=37(5) 76Vi02=40(10)										**
^{57}Zn	D : % β^+p average 20Ci04=90(10) 07Bl09=78(17)										**
^{58}K	21930#	700#			2# ms >400ns	2^- #		18Ta17	I	2019	β^- ?; β^-n ?; β^-2n ?
^{58}Ca	-1530#	500#			4# ms >620ns	0^+		10 09Ta24	I	2009	β^- ?; β^-n ?; β^-2n ?
^{58}Sc	-15480	190			12 ms 5	3^+ #		10		1997	β^- =100; β^-n ?; β^-2n ?
$^{58}\text{Sc}^m$	-14060	190	1420.7	2.2	0.60 μ s 0.13			20Mi13	ET	2020	IT=100
^{58}Ti	-30920	180			55 ms 6	0^+		14 11Da08	T	1992	β^- =100; β^-n ?
^{58}V	-40430	100			191 ms 10	(1^+)		10		1980	β^- =100; β^-n ?
^{58}Cr	-51991.8	3.0			7.0 s 0.3	0^+		10		1980	β^- =100
^{58}Mn	-55827.6	2.7			3.0 s 0.1	1^+*		10 15He28	J	1961	β^- =100
$^{58}\text{Mn}^m$	-55755.8	2.7	71.77	0.05	65.4 s 0.5	4^+*		10 15He28	J	1961	$\beta^- \approx 100$; IT ?
^{58}Fe	-62155.3	0.3			STABLE	0^+		10		1935	IS=0.282 12
^{58}Co	-59847.3	1.2			70.844 d 0.020	2^+*		10 FGK204	T	1941	β^+ =100; e^+ =14.79 24; ϵ =85.21 24
$^{58}\text{Co}^m$	-59822.4	1.2	24.95	0.06	8.853 h 0.023	5^+		10 19Mo11	TD	1950	IT=99.99880 5; ϵ =0.00120 5
$^{58}\text{Co}^n$	-59794.2	1.2	53.15	0.07	10.5 μ s 0.3	4^+		10		1964	IT=100
$^{58}\text{Co}^i$	-54095	8	5752	8	RQ	0^+ frg. T=3		10			
^{58}Ni	-60228.9	0.3			STABLE	0^+		10 93Va19	T	1921	IS=68.0769 190; $2\beta^+$?
$^{58}\text{Ni}^i$	-51400	40	8830	40	RQ	2^+ T=2		10			
$^{58}\text{Ni}^j$	-45690	7	14539	7	RQ	0^+ T=3		10 MMC12	J		
^{58}Cu	-51667.9	0.6			3.204 s 0.007	1^+* T=0		10 11Vi03	J	1952	β^+ =100
$^{58}\text{Cu}^i$	-51464.9	0.6	202.99	0.24		0^+ T=1		10			
^{58}Zn	-42300	50			86.0 ms 1.9	0^+		14 20Ci04	D	1986	β^+ =100; $\beta^+p=0.7$ 1
^{58}Ga	-23540#	300#				2^+*		Mirror	I		p ?
$^{58}\text{Ga}^m$	-23510#	320#	30#	100#	*	5^+*		Mirror	I		p ?
^{58}Ge	-7580#	500#				0^+		Mirror	I		2p ?
$^{58}\text{Sc}^m$	T : average 20Mi13=0.6(0.2) 1.3(0.8) 0.9(0.5) 0.5(0.2) from $\gamma(t)$										**
$^{58}\text{Sc}^m$	E : 20Mi13=180.5(0.6), 247(2), 412.3(0.6), 580.9(0.4) gammas in a cascade										**
^{58}Ti	T : average 11Da08=57(10) 03So21=59(9) 99So20=47(10)										**
^{58}Co	D : from 71GoYM										**
$^{58}\text{Co}^i$	E : strongly fragmented state; other 20(8) keV lower										**
^{58}Cu	J : also 10Co01=1										**
^{58}Zn	T : average 17Ku12=86(2) 09Fu15=90(8) 05Ka46=83(10) 02Lo13=83(10)										**
^{58}Zn	T : 98Jo18=86(18)										**
^{59}K	28750#	800#			1# ms >400ns	$3/2^+*$		18Ta17	I	2018	β^- ?; β^-n ?; β^-2n ?
^{59}Ca	5810#	600#			5# ms >400ns	$5/2^-$ #		18Ta17	I	2018	β^- ?; β^-n ?; β^-2n ?
^{59}Sc	-10830	250			12# ms >620ns	$7/2^-$ #		18 09Ta24	I	2009	β^- ?; β^-n ?; β^-2n ?
^{59}Ti	-25880#	300#			28.5 ms 1.9	$5/2^-$ #		18 11Da08	T	1997	β^- =100; β^-n ?; β^-2n ?
$^{59}\text{Ti}^m$	-25770#	300#	108.5	0.5	615 ns 11	$1/2^-$ #		18 19Wi04	TJE	2012	IT=100
^{59}V	-37610	140			95 ms 6	$(5/2^-)$		18 05Li53	TJD	1985	β^- =100; $\beta^-n>3$
^{59}Cr	-48115.9	0.7			1050 ms 90	$(1/2^-)$		18 05Li53	TJ	1980	β^- =100
$^{59}\text{Cr}^m$	-47613.2	1.3	502.7	1.1	96 μ s 20	$(9/2^+)$		18		1998	IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{59}Mn	-55525.3	2.3			4.59 s 0.05	$5/2^-*$	18	15Ba49 J	1976	β^- =100	
^{59}Fe	-60665.0	0.3			44.500 d 0.012	$3/2^-*$	18	FGK204 T	1938	β^- =100	
^{59}Co	-62229.8	0.4			STABLE	$7/2^-*$	18		1923	IS=100	
^{59}Ni	-61156.8	0.4			81 ky 5	$3/2^-$	18	94Ru19 T	1951	β^+ =100	*
$^{59}\text{Ni}^i$	-53814.9	2.1	7341.9	2.1	RQ	$7/2^-$ frg. T=5/2					*
^{59}Cu	-56358.5	0.5			81.5 s 0.5	$3/2^-*$	18		1947	β^+ =100	*
$^{59}\text{Cu}^i$	-52473.0	2.2	3885.5	2.1		$3/2^-$ frg. T=3/218				IT=100	*
^{59}Zn	-47215.7	0.8			178.7 ms 1.3	$3/2^-$	18		1981	β^+ =100; β^+ p=0.10 2	*
^{59}Ga	-33760#	170#			<43ns	$3/2^-$ #	18			p ?	
^{59}Ge	-16370#	400#			13.3 ms 1.7	$7/2^-$ #	18	20Gi02 TD	2015	β^+ $\approx$ 100; β^+ p=93 7; 2p<0.2	*
^{59}Ti	T : average 11Da08=27.5(2.5) 03So21=30(3); other 99So20=58(17)										**
$^{59}\text{Ti}^m$	T : average 20Mi13=610(20) 19Wi04=618(13) 12Ka36=587(+57-51); other										**
$^{59}\text{Ti}^m$	T : 05Ga01=590(130)										**
$^{59}\text{Ti}^m$	E : other 20Mi13=108.9(0.4)										**
^{59}V	T : average 05Li53=97(2) 99So20=75(7) (supersedes 98So03=70(40)); other										**
^{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)										**
$^{59}\text{Ni}^i$	E : strongest fragmented state; others 40.1(0.3) keV higher, 17.7(0.3) keV										**
$^{59}\text{Ni}^i$	E : higher and 36.3(0.2)keV lower										**
^{59}Cu	J : 11Vi03, 11Ko36, 10Co01=3/2										**
$^{59}\text{Cu}^i$	E : strongest fragmented state; other 21(6) keV higher										**
^{59}Zn	T : average 17Ku12=174(2) 14Ro14=210(34) 02Lo13=173(14)										**
^{59}Zn	T : 84Ar12=182.2(1.8) 81Ho19=210(20)										**
^{59}Ge	T : other 16Go26 (same as 20Gi02)										**
^{59}Ge	D : 2p not observed in 20Gi02 and 16Go26; limit from 16Go26 based on the										**
^{59}Ge	D : assumption that one event is not β^+ p										**
^{60}Ca	11000#	700#			2# ms >400ns	0^+	18	Ta17 I	2018	β^- ?; β^- n ?; β^- 2n ?	
^{60}Sc	-4550#	500#			10# ms >620ns	3^+ #	09	Ta24 I	2009	β^- ?; β^- n ?; β^- 2n ?	
^{60}Ti	-22100	240			22.2 ms 1.6	0^+	14	11Da08 T	1997	β^- =100; β^- n ?; β^- 2n ?	*
^{60}V	-33090	180			122 ms 18	3^+ #	13		1985	β^- =100; β^- n ?; β^- 2n ?	
$^{60}\text{V}^m$	-33090#	230#	0#	150#	40 ms 15	1^+ #	13		1999	β^- =?; IT ?; β^- n ?; β^- 2n ?	
$^{60}\text{V}^m$	-32890	180	203.7	0.7	230 ns 24	(4^+)	13	12Ka36 ET	1999	IT=100	*
^{60}Cr	-46908.5	1.1			490 ms 10	0^+	13		1980	β^- =100; β^- n ?	
^{60}Mn	-52967.9	2.3			280 ms 20	1^+*	13	15He28 J	1978	β^- =100	
$^{60}\text{Mn}^m$	-52696.0	2.3	271.90	0.10	1.77 s 0.02	4^+*	13	15He28 J	1978	β^- =88.5 8; IT=11.5 8	*
^{60}Fe	-61413	3			2.62 My0.04	0^+	13	09Ru08 T	1957	β^- =100	*
^{60}Co	-61650.4	0.4			5.2714 y 0.0006	5^+*	13	FGK204 T	1941	β^- =100	
$^{60}\text{Co}^m$	-61591.8	0.4	58.59	0.01	10.467 m 0.006	2^+*	13		1963	IT $\approx$ 100; β^- =0.25 3	
^{60}Ni	-64473.2	0.4			STABLE	0^+	13		1921	IS=26.2231 150	
$^{60}\text{Ni}^i$	-53347	4	11126	4	RQ	5^+ T=3					
^{60}Cu	-58345.3	1.6			23.7 m 0.4	2^+*	13	11Vi03 J	1947	β^+ =100	
$^{60}\text{Cu}^i$	-55804	5	2541	5	RQ	(0^+) T=2	13			IT=100	
^{60}Zn	-54174.5	0.5			2.38 m 0.05	0^+	13		1955	β^+ =100	
$^{60}\text{Zn}^i$	-49322.3	0.9	4852.2	0.7		(2^+) T=1	13			IT=100	
$^{60}\text{Zn}^j$	-46807	24	7367	24	RQ	0^+ T=2	13				
^{60}Ga	-39590#	200#			72.4 ms 1.7	(2^+)	13	20Gi02 T	1995	β^+ =100; β^+ p=1.6 7; β^+ α <0.023 20	*
$^{60}\text{Ga}^i$	-37050#	210#	2540#	50#							
^{60}Ge	-27530#	300#			21 ms 6	0^+	13	16Ci01 TD	2005	β^+ =100; β^+ p $\approx$ 100; β^+ 2p<14	*
^{60}As	-5640#	400#				5^+ #		Mirror I		p ?	
$^{60}\text{As}^m$	-5580#	400#	60#	20#		2^+ #		Mirror I		p ?	
^{60}Ti	T : average 11Da08=22.4(2.5) 03So21=22(2)										**
$^{60}\text{V}^m$	E : 12Ka36=99.7(0.5) and 104.0(0.5) gamma rays in a cascade to gs										**
$^{60}\text{V}^m$	T : symetrized from 12Ka36=229(+25-23); others 10Da06=320(90) 99Da.A=320(90)										**
$^{60}\text{Mn}^m$	I : other isomer T=1.0(+0.3-0.2) us decays by 114 keV g-ray (not placed)										**
^{60}Fe	T : adopted from 09Ru08; others: 17Os02=2.72(0.16) 15Wa06=2.50(0.12)										**
^{60}Ga	T : average 20Gi02=70.8(2.0) 17Ku12=76(3); others 02Lo13=70(13)										**
^{60}Ga	T : 01Ma96=70(15), outweighed										**
^{60}Ge	T : symmetrized from 16Ci01=20(+7-5)										**

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{61}Ca	19010#	800#			1# ms	$1/2^-$				β^- ?; β^-n ?; β^-2n ?
^{61}Sc	500#	600#			7# ms >620ns	$7/2^-$	15	09Ta24	I 2009	β^- ?; β^-n ?; β^-2n ?
^{61}Ti	-16370#	300#			15 ms 4	$1/2^-$	15		1997	β^- =100; β^-n ?; β^-2n ?
$^{61}\text{Ti}^m$	-16250#	300#	125.0	0.5	200 ns 28	$5/2^-$	15	19Wi04	TEJ 2019	IT=100
$^{61}\text{Ti}^n$	-15670#	300#	700.1	0.7	354 ns 69	$9/2^+$	15	19Wi04	TEJ 2019	IT=100
^{61}V	-30180	230			48.2 ms 0.6	$(3/2^-)$	15	20On01	TDJ 1992	β^- =100; β^-n =14.5 20; β^-2n ?
^{61}Cr	-42496.5	1.9			243 ms 9	$(5/2^-)$	15	09Cr02	T 1985	β^- =100; β^-n ?
^{61}Mn	-51742.1	2.3			709 ms 8	$5/2^-$	15	15Ba49	J 1980	β^- =100; β^-n ?
^{61}Fe	-58920.5	2.6			5.98 m 0.06	$(3/2^-)$	15		1957	β^- =100
$^{61}\text{Fe}^m$	-58058.8	2.6	861.67	0.11	238 ns 5	$9/2^+$	15		1998	IT=100
^{61}Co	-62898.2	0.8			1.649 h 0.005	$7/2^-$	15		1947	β^- =100
^{61}Ni	-64222.0	0.4			STABLE	$3/2^-$	15		1934	IS=1.1399 13
^{61}Cu	-61984.1	1.0			3.343 h 0.016	$3/2^-$	15		1937	β^+ =100
$^{61}\text{Cu}^i$	-55611	7	6373	7	RQ	$3/2^-$ frg. T=5/2				
^{61}Zn	-56349	16			89.1 s 0.2	$3/2^-$	15		1955	β^+ =100
$^{61}\text{Zn}^i$	-53190#	100#	3160#	100#		$3/2^-$ # T=3/2				
$^{61}\text{Zn}^j$	-46360	70	9990	70		$3/2^-$ T=5/2	15			
^{61}Ga	-47130	40			165.9 ms 2.5	$3/2^-$	15	17Ku12	T 1987	β^+ =100; β^+p <0.25
$^{61}\text{Ga}^m$	-47040#	110#	90#	100#		$1/2^-$		Mirror	I	
$^{61}\text{Ga}^i$	-43780	30	3360	50	p	$(3/2^-)$ T=3/2	15		1987	p=100
^{61}Ge	-33790#	300#			40.7 ms 0.4	$3/2^-$	15	20Gi02	TD 1987	β^+ =100; β^+p =87 3
^{61}As	-17200#	300#				$3/2^-$		Mirror	I	p ?
$^{*61}\text{Ti}^m$	E : other 20Mi13=125.2(0.6)									**
$^{*61}\text{Ti}^m$	T : other 20Mi13=300(100)									**
$^{*61}\text{Ti}^n$	E : other 20Mi13=701.3(0.7)									**
$^{*61}\text{Ti}^n$	T : other 20Mi13=200(100)									**
$^{*61}\text{V}$	T : average 20On01=48(1) 14Su07=49(1) 11Da08=52.6(4.2) 03So02=47.0(1.2),									**
$^{*61}\text{V}$	T : supersedes 99So20=43(7)									**
$^{*61}\text{Mn}$	D : β^-n observed by 99Ha05; 13Ra17 quotes % β^-n =0.6(0.1) (unpublished)									**
$^{*61}\text{Cu}$	T : average 15Cv01=3.323(0.010) 82Gr10=3.333 (0.005) 72Cr02=3.34(0.01)									**
$^{*61}\text{Cu}$	T : 69Ri04=3.408(0.010); Birge ratio 4.1									**
$^{*61}\text{Cu}^i$	E : strongly fragmented state; other 18(7) keV higher									**
$^{*61}\text{Ga}$	T : average 17Ku12=163(5) 14Ro14=162(10) 02We07=168(3) 02Lo13=148(19)									**
$^{*61}\text{Ga}$	T : 99Oi01=140(70) 93Wi18=150(30)									**
^{62}Sc	7310#	600#			2# ms >400ns			18Ta17	I 2018	β^- ?; β^-n ?; β^-2n ?
^{62}Ti	-12200#	400#			9# ms >620ns	0^+	12	09Ta24	I 2009	β^- ?; β^-n ?; β^-2n ?
^{62}V	-25210	260			33.6 ms 2.3	3^+	12		1997	β^- =100; β^-n ?; β^-2n ?
^{62}Cr	-40853	3			206 ms 12	0^+	12		1985	β^- =100; β^-n ?
^{62}Mn	-48524	7		*	92 ms 13	1^+	12	15He28	J 1983	β^- =100; β^-n ?
$^{62}\text{Mn}^m$	-48181.0	2.6	343	6	*	4^+	12	15He28	J 1983	β^- =100; β^-n ?; IT ?
^{62}Fe	-58878.1	2.8			68 s 2	0^+	12		1975	β^- =100
^{62}Co	-61424	19			1.54 m 0.10	$(2)^+$	12		1949	β^- =100
$^{62}\text{Co}^m$	-61402	20	22	5	13.86 m 0.09	$(5)^+$	12	70Jo12	D 1957	$\beta^- \approx 100$; IT <0.5
^{62}Ni	-66746.4	0.4			STABLE	0^+	12		1934	IS=3.6345 40
^{62}Cu	-62787.5	0.6			9.672 m 0.008	1^+	12	14Un01	T 1936	β^+ =100
$^{62}\text{Cu}^i$	-58174	6	4614	6	RQ	$(0)^+$ T=3	12			*
^{62}Zn	-61168.1	0.6			9.193 h 0.015	0^+	12		1948	β^+ =100
^{62}Ga	-51987.0	0.6			116.122 ms 0.021	0^+ T=1	12	13Da16	T 1978	β^+ =100
$^{62}\text{Ga}^j$	-51415.8	0.6	571.2	0.1		$1(^+)$ T=2	12	98Vi06	EJ 1998	IT=100
^{62}Ge	-42140#	140#			82.5 ms 1.4	0^+	12	17Ku12	T 1991	β^+ =100; β^+p ?
^{62}As	-24420#	300#				1^+				*
$^{*62}\text{Mn}$	D : % β^-n 99So20~0 99Ha05>0									**
$^{*62}\text{Mn}^m$	E : symmetrized from 15Ga38=346(+3-8) keV									**
$^{*62}\text{Cu}^i$	E : Ensdf2012=4628(10) keV									**
$^{*62}\text{Ga}$	T : average 13Da16=116.15(0.13) 08Gr03=116.100(0.025) 05Hy04=116.01(0.19)									**
$^{*62}\text{Ga}$	T : 05Ca06=116.09(0.17) 04Bl03=116.19(0.04) 03Hy02=115.84(0.25)									**
$^{*62}\text{Ga}$	T : 79Da04=116.34(0.35) 78Al23=115.95(0.30); others (outweighed)									**
$^{*62}\text{Ga}$	T : 02Bl17,02Lo13=114(2) 78Ch11=116.4(1.5) 93Wi03,93Wi18=113(+6-5)									**
$^{*62}\text{Ga}$	T : 93Wi03,93Wi18=113(+6-5)									**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ⁶² Ge	T : average 14Gr10=82.9(1.4) 17Ku12=76(6)										**	
* ⁶² As	D : most likely p-unstable from estimated Sp=-1980#(420#) keV										**	
⁶³ Sc	13070#	700#			1# ms	7/2 ⁻ #				β^- ?; β^-n ?; β^-2n ?		
⁶³ Ti	-5860#	500#			10# ms >620ns	1/2 ⁻ #	09	09Ta24 I	2009	β^- ?; β^-n ?; β^-2n ?		
⁶³ V	-21740	340			19.6 ms 0.9	(3/2 ⁻ ,5/2 ⁻)	09	14Su07 TJ	1997	β^- =100; β^-n >35; β^-2n ?	*	
⁶³ Cr	-36180	70			129 ms 2	1/2 ⁻ #	09		1992	β^- =100; β^-n ?	*	
⁶³ Mn	-46887	4			275 ms 4	5/2 ⁻ *	09	15Ba49 J	1985	β^- =100; β^-n = ?	*	
⁶³ Fe	-55636	4			6.1 s 0.6	(5/2 ⁻)	09		1980	β^- =100		
⁶³ Co	-61852	19			26.9 s 0.4	7/2 ⁻	09	94It.A T	1960	β^- =100	*	
⁶³ Ni	-65512.9	0.4			101.2 y 1.5	1/2 ⁻ *	09	17Dy01 J	1951	β^- =100	*	
⁶³ Ni ^m	-65425.8	0.4	87.15	0.11	1.67 μ s 0.03	5/2 ⁻	09		1978	IT=100		
⁶³ Cu	-65579.9	0.4			STABLE	3/2 ⁻ *	09		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			153.6 ms 1.1	3/2 ⁻ #	09	20Gi02 T	1991	β^+ =100; β^+p ?	*	
⁶³ As	-33500#	200#			<43ns	3/2 ⁻ #	09	05St29 I		p ?	*	
⁶³ Se	-16850#	500#			13.2 ms 3.9	3/2 ⁻ #		20Gi02 TD	2016	β^+ =100; β^+p =89 11;2p<0.5	*	
* 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 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 Ni	J : 17Dy01=1/2										**	
* ⁶³ Cu	J : also 20De21,10Vi07,11Ko36,10Co01=3/2										**	
* ⁶³ Zn	J : also 17Wr01=3/2										**	
* ⁶³ Ge	T : from 20Gi02, supersedes 19Ru.A=153.3(0.6) (same collaboration);										**	
* ⁶³ Ge	T : others: 17Ku12=156(11) 14Ro14=149(4) 02Lo13=150(9) 93Wi03=95(+23-20)										**	
* ⁶³ As	D : most likely p-unstable from estimated Sp=-950#(240#) keV										**	
* ⁶³ Se	T : other 16Go26 (same as 20Gi02)										**	
* ⁶³ Se	D : 2p not observed in 20Gi02 and 16Go26; limit from 16Go26 based on the										**	
* ⁶³ Se	D : assumption that one event is not β^+p										**	
⁶⁴ Ti	-1480#	600#			5# ms >620ns	0 ⁺	13	13Ta14 I	2013	β^- ?; β^-n ?; β^-2n ?		
⁶⁴ V	-16320#	400#			15 ms 2	(1,2)	14		1997	β^- =100; β^-n ?; β^-2n ?		
⁶⁴ V ^m	-16240#	400#	81.0	0.7	< 1 μ s		14		2014	IT $\approx$ 100		
⁶⁴ Cr	-33640	300			43 ms 1	0 ⁺	14		1992	β^- =100; β^-n ?		
⁶⁴ Mn	-42989	4			88.8 ms 2.4	1 ⁺ *	07	12Pa39 D	1985	β^- =100; β^-n =2.7 6	*	
⁶⁴ Mn ^m	-42815	4	174.1	0.5	439 μ s 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	5 ⁺ #		08Bl05 E	2008	β^- ?;IT ?		
⁶⁴ Ni	-67099.0	0.5			STABLE	0 ⁺	07		1935	IS=0.9256 19		
⁶⁴ Cu	-65424.4	0.4			12.7004 h 0.0013	1 ⁺ *	07	FGK204 T	1936	β^+ =61.52 26; β^- =38.48 26	*	
⁶⁴ Cu ⁱ	-58598	6	6826	6		0 ⁺ frg. T=4	07	71Be29 E			*	
⁶⁴ Zn	-66004.0	0.6			STABLE	>60Py	0 ⁺	07	03Ki08 T	1922	IS=49.17 75;2 β^+ ?	*
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 μ s 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	-54316	4			63.7 s 2.5	0 ⁺	07		1972	β^+ =100		
⁶⁴ As	-39530#	200#			69.0 ms 1.4	0 ⁺ #	07	20Gi02 T	1995	β^+ =100; β^+p ?	*	
⁶⁴ Se	-26860#	500#			22.6 ms 0.2	0 ⁺	07	19Ru.A T	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	D : % β^-n other 00HaZL=33(2)										**	
* ⁶⁴ Mn ^m	J : 15He28=(4)										**	
* ⁶⁴ Mn ^m	T : average 11Li50=400(40) 05Ga.B=500(50)										**	
* ⁶⁴ Cu	J : 20De21,10Vi07=1										**	
* ⁶⁴ Cu	D : from 12Be24										**	
* ⁶⁴ Cu ⁱ	E : strongest fragment (xs=100); other 16 keV lower (xs=37)										**	
* ⁶⁴ Zn	T : for 2nu- $\epsilon\epsilon$										**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ⁶⁴ As	T : from 20Gi02, supersedes 19Ru.A=63.4(1.2) (same collaboration);										**
* ⁶⁴ As	T : others 14Ro14=72(6) 02Lo13=18(+43-7)										**
⁶⁵ Ti	5210#	700#			1# ms	1/2 ⁻ #				β^- ?; β^-n ?; β^-2n ?	
⁶⁵ V	-12110#	500#			14# ms >620ns	5/2 ⁻ #	10	09Ta24 I	2009	β^- ?; β^-n ?; β^-2n ?	
⁶⁵ Cr	-28310#	200#			27.5 ms 2.1	1/2 ⁻ #	10	11Da08 T	1997	β^- =100; β^-n ?; β^-2n ?	*
⁶⁵ Mn	-40967	4			91.9 ms 0.7	(5/2 ⁻)	10	13OI06 TJD	1985	β^- =100; β^-n =7.9 12	*
⁶⁵ Fe	-51218	5			805 ms 10	(1/2 ⁻)	10	13OI06 TD	1980	β^- =100; β^-n ?	*
⁶⁵ Fe ^m	-50824	5	393.7	0.2	1.12 s 0.15	(9/2 ⁺)	10	13OI06 E	2008	β^- ?	
⁶⁵ Fe ⁿ	-50820	5	397.6	0.2	418 ns 12	(5/2 ⁺)	10	13OI06 EJ	1998	IT=100	*
⁶⁵ Co	-59185.2	2.1			1.16 s 0.03	(7/2 ⁻)	10		1978	β^- =100	
⁶⁵ Ni	-65125.8	0.5			2.5175 h 0.0005	5/2 ⁻			1946	β^- =100	
⁶⁵ Ni ^m	-65062.4	0.5	63.37	0.05	69 μ s 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			243.94 d 0.04	5/2 ⁻ *	10	FGK204 T	1939	β^+ =100	*
⁶⁵ Zn ^m	-65858.1	0.6	53.928	0.010	1.6 μ s 0.6	1/2 ⁻	10	FGK149 J	1960	IT=100	*
⁶⁵ Ga	-62657.5	0.8			15.133 m 0.028	3/2 ⁻ *	10	19Gy04 T	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			130.3 ms 0.6	3/2 ⁻ #	10	20Gi02 T	1991	β^+ =100; β^+p ?	*
⁶⁵ As ⁱ	-43452	11	3490	90 p		(3/2 ⁻) T=3/2	10	11Ro47 J	1993	p=100	*
⁶⁵ Se	-33020#	300#			34.2 ms 0.7	3/2 ⁻ #	10	20Gi02 T	1993	β^+ =100; β^+p =87 13	*
⁶⁵ Br	-16490#	500#			<410ns	5/2 ⁻ #		16Bi05 I		p ?	
* ⁶⁵ Cr	T : average 11Da08=28(3) 03So21=27(3)										**
* ⁶⁵ Mn	T : average 13OI06=91.9(0.9) 03So21=92(1); other (recent) 11Da08=84(8),										**
* ⁶⁵ Mn	T : outweighed (not used)										**
* ⁶⁵ Mn	D : other β^-n observed by 99Ha05, but not quantified										**
* ⁶⁵ Fe	T : 19OI02=805(10). others 09Pa16=810(50) 99So20=1320(280)										**
* ⁶⁵ Fe	T : 95Am.A=760(50) supersedes 94Cz02=450(150)										**
* ⁶⁵ Fe ⁿ	E : other 10Da06=396.8, uncertainty not given, 98Gr14=364(3)										**
* ⁶⁵ Fe ⁿ	T : average 18St18=409(+29-27) 10Da06=420(13)										**
* ⁶⁵ Cu	J : 20De21, 10Vi07, 10Co01=3/2										**
* ⁶⁵ Zn	J : also 17Wr01=5/2										**
* ⁶⁵ Zn ^m	J : E2 to 5/2-										**
* ⁶⁵ Ga	T : from 19Gy04=15.133 (0.016 stat) (0.023 syst); other 57Da07=15.2(0.2)										**
* ⁶⁵ Ga	J : 17Fa09=3/2										**
* ⁶⁵ As	T : others (outweighed) 14Ro14=126(7) 02Lo13=126(16) 95Mo26=190(11)										**
* ⁶⁵ As ⁱ	J : IAS studied in 93Ba12 and 11Ro47										**
* ⁶⁵ Se	T : other 11Ro47=33(4)										**
* ⁶⁵ Se	D : % β^+p symmetrized from 11Ro47=88(+12-13)										**
⁶⁶ V	-6300#	500#			10# ms >620ns		10	09Ta24 I	2009	β^- ?; β^-n ?; β^-2n ?	
⁶⁶ Cr	-25140#	300#			23.8 ms 1.8	0 ⁺	15	11Li50 T	1997	β^- =100; β^-n ?; β^-2n ?	*
⁶⁶ Mn	-36750	11			63.8 ms 0.9	(1 ⁺)	10	18St18 TDJ	1992	β^- =100; β^-n =7.4 14; β^-2n ?	*
⁶⁶ Mn ^m	-36286	11	464.5	0.4	780 μ s 40	(5 ⁻)		11Li50 ETJ	2005	IT $\approx$ 100; β^- ?	*
⁶⁶ Fe	-50068	4			467 ms 29	0 ⁺	10	18St18 T	1985	β^- =100; β^-n ?	*
⁶⁶ Co	-56409	14			194 ms 17	(1 ⁺)	10	12Li02 J	1985	β^- =100; β^-n ?	*
⁶⁶ Co ^m	-56234	14	175.1	0.3	824 ns 22	(3 ⁺)	10	12Li02 EJ	1998	IT=100	*
⁶⁶ Co ⁿ	-55767	15	642	5	> 100 μ s	(8 ⁻)	10	98Gr14 E	1998	IT=100	
⁶⁶ Ni	-66006.3	1.4			54.6 h 0.3	0 ⁺			1948	β^- =100	
⁶⁶ Cu	-66258.3	0.6			5.120 m 0.014	1 ⁺ *	10	20De21 J	1937	β^- =100	*
⁶⁶ Cu ^m	-65104.1	1.5	1154.2	1.4	600 ns 17	(6 ⁻)	10	11Lo01 T	1972	IT=100	*
⁶⁶ Zn	-68899.2	0.7			STABLE	0 ⁺			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 ⁺			1950	β^+ =100	
⁶⁶ As	-52025	6			95.77 ms 0.23	0 ⁺ T=1	10	MMC156J	1978	β^+ =100	*
⁶⁶ As ^m	-50668	6	1356.63	0.17	1.14 μ s 0.04	5 ⁺	10	13Ru10 TJ	1995	IT=100	*
⁶⁶ As ⁿ	-49001	6	3023.8	0.3	7.98 μ s 0.26	9 ⁺	10	13Ru10 TJ	1998	IT=100	*
⁶⁶ Se	-41660#	200#			54 ms 4	0 ⁺	10	14Ro14 T	1993	β^+ =100; β^+p ?	
⁶⁶ Br	-23570#	400#			<410ns	0 ⁺ #		16Bi05 I		p ?	
* ⁶⁶ Cr	T : average 11Li50=24(2) 11Da08=23(4); other 05Ga01=10(6), outweighed										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ⁶⁶ Mn	J : 11Li50=(1+) due to large ground-state feeding from ⁶⁶ Cr (J=0+);							**
* ⁶⁶ Mn	J : large direct β^- feeding to ⁶⁶ Fe gs (J=0+) in 18St18							**
* ⁶⁶ Mn	T : average 18St18=64.1(1.1) 17Ol08=70(15) 13Li04=60(3) 03So21=64(2)							**
* ⁶⁶ Mn	T : 99Ha05=66(4); other 11Pa.A=64.2(0.8) is superseded by 18St18							**
* ⁶⁶ Mn	D : % β^- -n symmetrized from 18St18=7.3(+1.4-1.3)							**
* ⁶⁶ Mn ^m	T : other 05Ga.B=750(250)							**
* ⁶⁶ Fe	T : average 18St18=485(+39-34) 99Le67=440(60) 98Am04=440(60)							**
* ⁶⁶ Co	J : also large direct β^- feeding to ⁶⁶ Ni gs (J=0+) in 18St18							**
* ⁶⁶ Co ^m	T : symmetrized 18St18=823(+22-21)							**
* ⁶⁶ Cu	J : 20De21,10Vi07=1							**
* ⁶⁶ Cu ^m	T : average 11Lo01=601(30) 72Bl16=600(20)							**
* ⁶⁶ Ga	T : other 12Gy01=9.312(0.032) not used; Ensdf2010=9.49(0.03)							**
* ⁶⁶ As	T : average 88Bu12=95.77(0.28) 78Al23=95.78(0.39); other (recent)							**
* ⁶⁶ As	T : 14Ro14=93(4) 02Lo13=97(2) (outweighed)							**
* ⁶⁶ As	J : super-allowed β^+ -decay emitter; 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)							**
⁶⁷ V	-1740#	600#	8# ms >620ns	5/2 ⁻ #	13	13Ta14	I 2013	β^- ?; β^- -n ?; β^- -2n ?
⁶⁷ Cr	-19270#	400#	11# ms >300ns	1/2 ⁻ #	05	97Be70	I 1997	β^- ?; β^- -n ?; β^- -2n ?
⁶⁷ Mn	-33580#	200#	46.7 ms 2.3	5/2 ⁻ #	05	11Da08	TD 1997	β^- =100; β^- -n=10 5; β^- -2n ?
⁶⁷ Fe	-45708	4	394 ms 9	(1/2 ⁻)	05	02So.A	TD 1985	β^- =100; β^- -n ?
⁶⁷ Fe ^m	-45305	10	64 μ s 17	(5/2 ⁺ , 7/2 ⁺)	05	11Da08	EJ 1998	IT=100
⁶⁷ Fe ⁿ	-45260#	100#	75 μ s 21	(9/2 ⁺)	08	Bl05	TJ 2008	IT=100
⁶⁷ Co	-55322	6	329 ms 28	(7/2 ⁻)	05	08Pa33	TJ 1985	β^- =100; β^- -n ?
⁶⁷ Co ^m	-54830	6	496 ms 33	(1/2 ⁻)	09	Pa16	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	13.34 μ s 0.19	9/2 ⁺	05	14Di08	ETJ 1998	IT=100
⁶⁷ Cu	-67319.6	0.9	61.83 h 0.12	3/2 ⁻ *	05	20De21	J 1948	β^- =100
⁶⁷ Zn	-67880.4	0.8	STABLE	5/2 ⁻ *	05		1928	IS=4.04 16
⁶⁷ Zn ^m	-67787.1	0.8	9.15 μ s 0.07	1/2 ⁻	05	15Ch57	T 1953	IT=100
⁶⁷ Zn ⁿ	-67275.9	0.8	604.48	0.05	333	ns 14	05	1973
⁶⁷ Ga	-66879.2	1.2	3.2617 d 0.0004	3/2 ⁻ *	05	FGK204	T 1938	ϵ =100
⁶⁷ Ge	-62674	4	18.9 m 0.3	1/2 ⁻	05		1950	β^+ =100
⁶⁷ Ge ^m	-62656	4	13.7 μ s 0.9	5/2 ⁻	05		1978	IT=100
⁶⁷ Ge ⁿ	-61922	4	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 4	5/2 ⁻ #	05	14Ro14	T 1991	β^+ =100; β^+ -p=0.5 1
⁶⁷ Br	-32530#	300#		1/2 ⁻ #				p ?
⁶⁷ Kr	-15550#	420#	7.4 ms 2.9	3/2 ⁻ #	20	Gi02	TD 2016	2p=37 14; β^+ ?
* 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-keV level							**
* ⁶⁷ Co ^m	D : %IT from 08Pa33							**
* ⁶⁷ Ni ^m	T : average 14Di08=13.7(0.6) 98Gr14=13.3(0.2); other 02Ge16=13(1)							**
* ⁶⁷ Cu	J : 20De21,10Vi07=3/2							**
* ⁶⁷ Zn	J : also 17Wr01,16Ya02=5/2							**
* ⁶⁷ Zn ^m	T : 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 Zn ^m	T : Birge ratio=3.27							**
* ⁶⁷ Ga	J : other 17Fa09=3/2							**
* ⁶⁷ Ge ⁿ	T : average 00Ch07=101(3) 79Al04=110.9(1.4); Birge ratio=2.99							**
* ⁶⁷ Se	D : % β^+ -p from 95Bl23							**
* ⁶⁷ Kr	T : other 16Go26=7.4(3.0) (same as 20Gi02)							**
⁶⁸ Cr	-15690#	500#	10# ms >620ns	0 ⁺	12	09Ta24	I 2009	β^- ?; β^- -n ?; β^- -2n ?
⁶⁸ Mn	-28920#	300#	33.7 ms 1.5	(3)	12	15Be32	TD 1995	β^- =100; β^- -n=18 10; β^- -2n ?
⁶⁸ Fe	-43900#	190#	188 ms 4	0 ⁺	12		1985	β^- =100; β^- -n>0
⁶⁸ Co	-51643	4	200 ms 20	(7 ⁻)	12		1985	β^- =100; β^- -n ?
⁶⁸ Co ^m	-51490#	150#	150#	150#	*	1.6 s 0.3	(2 ⁻)	12 15Fl01 JD 1998
								β^- =100; β^- -n>2.6

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
$^{68}\text{Co}^n$	-51450#	150#	195#	150#	101 ns 10	(1)	12	10Da06	T	2010	IT=100	*
^{68}Ni	-63463.8	3.0			29 s 2	0^+	12			1977	β^- =100	
$^{68}\text{Ni}^m$	-61860	3	1603.51	0.28	270 ns 5	0^+	12	15Fl01	E	1984	IT=100	*
$^{68}\text{Ni}^n$	-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	20De21	J	1953	β^- =100	*
$^{68}\text{Cu}^m$	-64845.7	1.6	721.26	0.08	3.75 m 0.05	6^-*	12	20De21	J	1969	IT=86 2; β^- =14 2	*
^{68}Zn	-70007.2	0.8			STABLE	0^+	12			1922	IS=18.45 63	
^{68}Ga	-67086.1	1.4			67.842 m 0.016	1^+*	12	FGK204	T	1937	β^+ =100	
^{68}Ge	-66978.8	1.9			271.05 d 0.08	0^+	12	18Be03	T	1948	ϵ =100	*
^{68}As	-58894.5	1.8			151.6 s 0.8	3^+	12			1971	β^+ =100	
$^{68}\text{As}^m$	-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#			$\sim 40\text{ns}$	$3^+\#$	12	19Wi08	T	1995	p ?	
^{68}Kr	-25630#	500#			21.6 ms 3.3	0^+		20Gi02	TD	2016	$\beta^+=?;\beta^+\text{p}=90$ 11;p ?	*
^{68}Mn	T : average 15Be32=38.3(3.6) and 35.2(2.0) 11Da08=29(4) 03So21=28(8)										**	
^{68}Mn	T : 99Ha05=28(4).										**	
^{68}Mn	D : β^- -n observed by 99Ha05, but not quantified										**	
^{68}Mn	J : direct β^- feeding to 2+ and 4+ in 15Be32 (incomplete decay scheme)										**	
$^{68}\text{Co}^n$	J : strong feeding in 68Fe (J=0+) β^- decay and possible gamma-ray decay										**	
$^{68}\text{Co}^n$	J : to 2- in 12Li02										**	
$^{68}\text{Ni}^m$	E : average 15Fl01=1603.6(0.8) 13Re18=1603.5(0.3) from g-ray differences										**	
$^{68}\text{Ni}^n$	T : average 15Wi02=840(40) 95Br10=860(50)										**	
^{68}Cu	J : 20De21,10Vi07=1										**	
$^{68}\text{Cu}^m$	J : 20De21,10Vi07=6										**	
^{68}Ge	T : average 18Be03=271.14(0.15,NaI), 271.07(0.12,IC) 94Sc44=270.99(0.19)										**	
^{68}Ge	T : 81Wa26=270.82(0.27)										**	
$^{68}\text{As}^m$	T : symmetrized from 94Ba50=107(+23-16)										**	
^{68}Kr	D : $\% \beta^+ \text{p}$ symmetrized from 20Gi02=89(+11-10)										**	
^{69}Cr	-9630#	500#			6# ms >620ns	$7/2^+\#$	14	13Ta14	I	2013	β^- ?; β^- -n ?; β^- -2n ?	
^{69}Mn	-25360#	400#			22.1 ms 1.6	$5/2^-\#$	14	15Be32	TD	1995	β^- =100; β^- -n=40 20; β^- -2n ?	*
^{69}Fe	-39200#	200#			162 ms 7	$1/2^-\#$	14	15Li33	T	1992	β^- =100; β^- -n ?; β^- -2n ?	
^{69}Co	-50390	90		*	180 ms 20	$(7/2^-)$	14	15Li33	T	1985	β^- =100; β^- -n ?	
$^{69}\text{Co}^m$	-50213	13	170	90	MD*	$1/2^-\#$		15Li33	TD	2015	β^- =100	
^{69}Ni	-59979	4			11.4 s 0.3	$(9/2^+)$	14			1984	β^- =100	
$^{69}\text{Ni}^m$	-59658	4	321	2	3.5 s 0.4	$(1/2^-)$	14	98Gr14	E	1998	$\beta^- \approx 100$;IT<0.01	*
$^{69}\text{Ni}^n$	-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	20De21	J	1966	β^- =100	*
$^{69}\text{Cu}^m$	-62994.2	1.6	2742.0	0.7	357 ns 2	$(13/2^+)$	14	16Ku11	T	1997	IT=100	*
^{69}Zn	-68417.9	0.8			56.4 m 0.9	$1/2^-*$	14	17Wr01	J	1937	β^- =100	
$^{69}\text{Zn}^m$	-67979.3	0.8	438.636	0.018	13.747 h 0.011	$9/2^+*$	14	17Wr01	J	1970	IT=99.967 3; β^- =0.033 3	*
^{69}Ga	-69327.8	1.2			STABLE	$3/2^-*$	14			1923	IS=60.108 50	*
^{69}Ge	-67100.7	1.3			39.05 h 0.10	$5/2^-*$	14			1938	β^+ =100	
$^{69}\text{Ge}^m$	-67013.9	1.3	86.76	0.02	5.1 μs 0.2	$1/2^-$	14			1978	IT=100	
$^{69}\text{Ge}^n$	-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	$\beta^+=100$; $\beta^+\text{p}=0.052$ 8	
$^{69}\text{Se}^m$	-56395.9	1.5	38.85	0.22	2.0 μs 0.2	$5/2^-$	14			1988	IT=100	
$^{69}\text{Se}^n$	-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	
$^{69}\text{Br}^m$	-46220#	110#	40#	100#	*	$5/2^-\#$		Mirror	I			
$^{69}\text{Br}^n$	-45690#	110#	570#	100#		$9/2^+\#$		Mirror	I			
$^{69}\text{Br}^i$	-42771	19	3490	50	p	$(5/2^-)$ T=3/2	14	11Ro47	I	2011	p=100	
^{69}Kr	-32140#	300#			27.9 ms 0.8	$(5/2^-)$	15	02Gi02	DT	1995	$\beta^+=100$; $\beta^+\text{p}=94$ 5	*
^{69}Mn	T : average 15Be32=24.1(2.6) 25.8(2.8) 11Da08=18(4) 99Ha05=14(4)										**	
$^{69}\text{Ni}^m$	E : from 98Gr14; E(9/2+) in ^{73}Ge =-67 keV and ^{71}Zn =156 keV										**	
$^{69}\text{Ni}^m$	E : isotones exhibits a large variation										**	
^{69}Cu	J : 20De21,10Vi07=3/2										**	
$^{69}\text{Cu}^m$	T : average 16Ku11=351(14) 12Di03=360(20) 02Ge16=357(2)										**	
$^{69}\text{Cu}^m$	T : 98Gr14=360(50) 97Is13=360(30)										**	
$^{69}\text{Zn}^m$	T : average 17Kr01=13.742(0.014) 77He20=13.756(0.018)										**	
^{69}Ga	J : other 17Fa09=3/2										**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ⁶⁹ Se ⁿ	T : average 00Ch07=950(21) 95Po01=960(23)										**
* ⁶⁹ Kr	T : average 20Gi02=27.8(1.6) 14De41=28(1) 11Ro47=27(3); other 97Xu01=32(10)										**
* ⁶⁹ Kr	D : % β^+ p average 02Gi02=93(+7-6) 11Ro47=99(+1-11); other										**
* ⁶⁹ Kr	D : 14De41=52.5(6.5) + 2.4(0.5), conflicting										**
⁷⁰ Cr	-5640#	600#			6# ms >620ns	0 ⁺	16	13Ta14 I	2013	β^- ?; β^-n ?; β^-2n ?	
⁷⁰ Mn	-20450#	500#			19.9 ms 1.7	(4, 5)	16	15Be32 TD	2009	β^- =100; β^-n ?; β^-2n ?	
⁷⁰ Fe	-36890#	300#			61.4 ms 0.7	0 ⁺	16	17Mo02 T	1997	β^- =100; β^-n ?	*
⁷⁰ Co	-46525	11			508 ms 7	(1 ⁺)	16	17Mo02 JT	1998	β^- =100; β^-n ?; β^-2n ?	*
⁷⁰ Co ^m	-46330#	200#	200#	200#	112 ms 7	(7 ⁻)	16	FGK205 J	1985	β^- =100; IT ?; β^-n ?; β^-2n ?	
⁷⁰ Ni	-59213.9	2.1			6.0 s 0.3	0 ⁺	16		1987	β^- =100	
⁷⁰ Ni ^m	-56353.0	2.1	2860.91	0.08	232 ns 1	8 ⁺	16		1997	IT=100	
⁷⁰ Cu	-62976.4	1.1			44.5 s 0.2	6 ⁻ *	16	20De21 J	1971	β^- =100	*
⁷⁰ Cu ^m	-62875.3	1.1	101.1	0.3	33 s 2	3 ⁻ *	16	20De21 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 ⁺ *	16	20De21 J	1971	β^- =93.2.9; IT=6.8.9	
⁷⁰ Zn	-69564.7	1.9			STABLE >3.8Ey	0 ⁺	16		1922	IS=0.61 10; 2 β^- ?	*
⁷⁰ Ga	-68910.2	1.2			21.14 m 0.05	1 ⁺ *	16		1937	β^- =99.59.5; ϵ =0.41.5	*
⁷⁰ Ge	-70562.0	0.8			STABLE	0 ⁺	16		1923	IS=20.52.19	
⁷⁰ As	-64334.0	1.4			52.6 m 0.3	4 ⁺ *	16	76He24 J	1950	β^+ =100	
⁷⁰ As ^m	-64302.0	1.4	32.046	0.023	96 μ s 3	2 ⁺	16		1979	IT=100	
⁷⁰ Se	-61929.9	1.6			41.1 m 0.3	0 ⁺	16		1950	β^+ =100	
⁷⁰ Br	-51426	15			78.8 ms 0.3	0 ⁺ T=1	16	17Mo18 T	1978	β^+ =100; β^+ p ?	*
⁷⁰ Br ^m	-49134	15	2292.3	0.8	2.16 s 0.05	9 ⁺ T=0	16	17Mo18 T	1981	β^+ =100; β^+ p ?	*
⁷⁰ Kr	-41100#	200#			45.00 ms 0.14	0 ⁺	16	20Vi02 T	1995	β^+ =100; β^+ p<1.3	*
* ⁷⁰ Fe	T : others (not used): 14XuZZ=66(7) 13Ma87=61(5) 11Da08=71(10) 03So21=94(17)										**
* ⁷⁰ Co	T : others (not used) 15Pr10=470(50) 00Mu10=500(180)										**
* ⁷⁰ Cu	J : 20De21, 10Vi07, 16Bi08=6										**
* ⁷⁰ Zn	T : 2v- $\beta\beta$ >3.8 Ey 0nu-BB>32 Ey in 11Be39; 0nu-BB>6.8 Ey in 16Eb03										**
* ⁷⁰ Ga	J : also 12Pr11=1										**
* ⁷⁰ Br	T : average 17Mo18=78.42(0.51) 88Bu12=78.54(0.59) 78Al23=80.2(0.8);										**
* ⁷⁰ Br	T : other (recent) 19Si33=79.7(2.4) (outweighed)										**
* ⁷⁰ Br ^m	T : symmetrized from 17Mo18=2.157(+0.053-0.049); others (not used):										**
* ⁷⁰ Br ^m	T : 81Vo04=2.2(0.2) 02Ro25=2.2(0.3) (outweighed)										**
* ⁷⁰ Kr	T : average 20Vi02=44.99(0.14,stat)(0.06,syst) 45.16(0.68,stat)(0.20,syst);										**
* ⁷⁰ Kr	T : others (outweighed) 16De29=31(+13-7) 14Ro14=40(6) 02Bl17=42(31)										**
* ⁷⁰ Kr	T : 00Oi02=57(21)										**
⁷¹ Mn	-16620#	500#			16# ms >400ns	5/2 ⁻ #	10	10Oh02 I	2010	β^- ?; β^-n ?; β^-2n ?	
⁷¹ Fe	-31930#	400#			34.3 ms 2.6	7/2 ⁺ #	10	13Ma87 T	1997	β^- =100; β^-n ?; β^-2n ?	*
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		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			2.40 m 0.05	1/2 ⁻ *	10	17Wr01 J	1955	β^- =100	*
⁷¹ Zn ^m	-67171.1	2.4	157.7	1.3 MD	4.148 h 0.012	9/2 ⁺ *	10		1958	β^- $\approx$ 100; IT ?	*
⁷¹ Ga	-70139.1	0.8			STABLE	3/2 ⁻ *	10		1923	IS=39.892.50	*
⁷¹ Ge	-69906.7	0.8			11.43 d 0.03	1/2 ⁻ *	10		1941	ϵ =100	
⁷¹ Ge ^m	-69708.3	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 μ s 0.7	(1/2 ⁻)	10		1982	IT=100	
⁷¹ Se ⁿ	-62886.0	2.8	260.48	0.10	19.0 μ s 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			98.8 ms 0.3	(5/2 ⁻)	10	19Si33 T	1981	β^+ =100; β^+ p=2.1.7	*
⁷¹ Rb	-32290#	400#				5/2 ⁻ #				p ?	
⁷¹ Rb ^m	-32240#	410#	50#	100#		1/2 ⁻ #		Mirror I			
⁷¹ Rb ⁿ	-32030#	410#	260#	100#		9/2 ⁺ #		Mirror I			
* ⁷¹ Fe	T : average 14XuZZ=34.7(3.6) 13Ma87=42(6) 11Da08=28(5)										**
* ⁷¹ Co	D : % β^-n from 12Ra10<2.7(0.9) and 05Ma95>3(1) of the same group										**
* ⁷¹ Co	T : others 19Ly02=86(10) 12Ra10=10RaZY=80(3) 04Sa59=79(5) 03So21=97(2)										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ⁷¹ Co	T : 98Am04=210(40) 95Am.A=200(50)							**
* ⁷¹ Cu	T : average 99Pr10=19(3) 83Ru06=19.5(1.6)							**
* ⁷¹ Cu	J : 20De21,10Vi07=3/2							**
* ⁷¹ Cu ^m	T : average 98Is11=250(30) 98Gr14=275(14)							**
* ⁷¹ Zn	T : average 17Kr01=2.36(0.08) 61Th04=2.45(0.10)							**
* ⁷¹ Zn ^m	J : 17Wr01=9/2							**
* ⁷¹ Zn ^m	T : average 17Kr01=4.155(0.004) 12Re05=4.127(0.007); Birge ratio=3.47							**
* ⁷¹ Zn ^m	D : 156 keV depopulating transition not observed experimentally and							**
* ⁷¹ Zn ^m	D : only a limit of %IT<0.05 given in 70Zo01							**
* ⁷¹ Ga	J : other 17Fa09=3/2							**
* ⁷¹ Kr	T : others 14Ro14=92(9) 97Oi01=100(3) 81Ew01=97(9) 95Bl23=64(+8-5).							**
* ⁷¹ Kr	T : Values from 95Bl23 for ⁶⁷ Se and ⁷¹ Kr questioned in 97Oi01							**
* ⁷¹ Kr	D : %β ⁺ p from 97Oi01=2.1 7; other 95Bl23=5.2(0.6) conflicting not trusted							**
⁷² Mn	-11170# 600#		12# ms >620ns			13 13Ta14 I	2013	β ⁻ ?; β ⁻ n ?; β ⁻ 2n ?
⁷² Fe	-29250# 500#		17.0 ms 1.0	0 ⁺		10 13Ma87 TD	1997	β ⁻ =100; β ⁻ n ?; β ⁻ 2n ?
⁷² Co	-40300# 300#		52.5 ms 0.3	(6 ⁻ , 7 ⁻)		10 16Mo07 T	1992	β ⁻ =100; β ⁻ n>4; β ⁻ 2n ?
⁷² Co ^m	-40100# 360#	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 ?
⁷² Cu	-59783.0 1.4		6.63 s 0.03	2 ⁻ *		10 20De21 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 ⁺)		10	1968	IT=100
⁷² Ge	-72585.91 0.08		STABLE	0 ⁺		10	1923	IS=27.45 15
⁷² Ge ^m	-71894.48 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	-59061.8 1.0		78.6 s 2.4	1 ⁺		10	1970	β ⁺ =100
⁷² Br ^m	-58961.0 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#		103 ns 22	1 ⁺ #		17Su31 T	2017	p ?
⁷² Rb ^m	-38230# 510#	100# 100#		3 ⁻ #				p ?
* ⁷² Fe	T : average 14XuZZ=16.9(1.0) 13Ma87=19(4)							**
* ⁷² Co	T : others 14Xu07=52.8(1.6) 14Ra20=55(4) 05Ma59=59(2) 03Sa40=62(3)							**
* ⁷² Co	J : β ⁻ feeding of the 6+ level in ⁷² Ni and shell model							**
* ⁷² Co	D : from %β ⁻ n>6(2) in 05Ma95							**
* ⁷² Cu	J : 20De21,10Vi07=2							**
* 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)							**
* ⁷² Rb	J : 19Si33=p3/2[321] n1/2[321], K=1+; similarity with the mirror ⁷² Br							**
⁷³ Mn	-6700# 600#		12# ms >410ns	5/2 ⁻ #		19 17Su15 I	2017	β ⁻ ?
⁷³ Fe	-23990# 500#		12.9 ms 1.6	7/2 ⁺ #		19 14XuZZ T	2010	β ⁻ =100; β ⁻ n ?; β ⁻ 2n ?
⁷³ Co	-37970# 300#		42.0 ms 0.8	(7/2 ⁻)		19 20Go10 JTD	1995	β ⁻ =100; β ⁻ n=6 3; β ⁻ 2n ?
⁷³ Ni	-50108.2 2.4		84.0 ms 30	(9/2 ⁺)		19	1987	β ⁻ =100; β ⁻ n ?
⁷³ Cu	-58987.4 1.9		4.20 s 0.12	3/2 ⁻ *		19 00KoZH TD	1983	β ⁻ =100; β ⁻ n=0.029 6
⁷³ Zn	-65593.4 1.9		24.5 s 0.2	1/2 ⁻ *		19 17Ve05 T	1972	β ⁻ =100
⁷³ Zn ^m	-65397.9 1.9	195.5 0.2	13.0 ms 0.2	5/2 ⁺ *		19 18Ya11 J	1985	IT=100
⁷³ Ga	-69699.3 1.7		4.86 h 0.03	1/2 ⁻ *		19 10Ch16 J	1949	β ⁻ =100
⁷³ Ga ^m	-69699.2 1.7	0.15 0.09	< 200 ms	3/2 ⁻		19 17Ve05 E	1949	β ⁻ ?; IT ?
⁷³ Ge	-71297.53 0.06		STABLE	9/2 ⁺ *		19 49To09 J	1933	IS=7.76 8
⁷³ Ge ^m	-71284.25 0.06	13.2845 0.0015	2.91 μs 0.03	5/2 ⁺		19	1975	IT=100
⁷³ Ge ⁿ	-71230.80 0.06	66.725 0.009	499 ms 11	1/2 ⁻		19	1957	IT=100
⁷³ As	-70953 4		80.30 d 0.06	3/2 ⁻		19	1948	ε=100
⁷³ As ^m	-70525 4	427.902 0.021	5.7 μs 0.2	9/2 ⁺		19	1956	IT=100
⁷³ Se	-68227 7		7.15 h 0.09	9/2 ⁺ *		19 88Be39 J	1948	β ⁺ =100
⁷³ Se ^m	-68201 7	25.71 0.04	39.8 m 1.7	3/2 ⁻		19	1960	IT=72.6 3; β ⁺ =27.4 3
⁷³ Br	-63646 7		3.4 m 0.2	1/2 ⁻		19	1970	β ⁺ =100
⁷³ Kr	-56552 7		27.3 s 1.0	(3/2 ⁻)		19	1972	β ⁺ =100; β ⁺ p=0.25 3
⁷³ Kr ^m	-56118 7	433.55 0.13	107 ns 10	(9/2 ⁺)		19	1993	IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{73}\text{Kr}^i$	-53350#	120#	3204#	118#				T=3/2	20Ho17	E	
^{73}Rb	-46010	40			< 81 ns			3/2 ⁻ #	19 17Su31	T	1996
$^{73}\text{Rb}^m$	-45580#	110#	430#	100#				9/2 ⁺ #	Mirror	I	
$^{73}\text{Rb}^i$	-42809	20	3200	40	p			(5/2 ⁻) T=5/2	19 20Ho06	JD	1993
^{73}Sr	-31950#	400#			25.3 ms	1.4		(5/2 ⁻)	19 20Ho06	TDJ	1993
^{73}Co	D : % β^- n from 20Go10=6(3), supersedes 12Ra10<22(8) 05Ma95>9(4); other										
^{73}Co	D : 10Ho12<7.9										
^{73}Co	T : average 20Go10=43(1), supersedes 12Ra10=42(3), 14Xu07=40.4(1.3),										
^{73}Co	T : supersedes 14Xu.A=40.5(3.3), 11Da08,04Sa59=41(4) 10Ho12=41(6)										
^{73}Cu	T : average 00KhZH=4.22(0.15) 98Hu20=4.4(0.3) 83Ru06=3.9(0.3)										
^{73}Cu	J : 20De21,17De30,10Vi07,09Fi03=3/2										
^{73}Zn	J : 17Wr01,18Ya11=1/2										
$^{73}\text{Ga}^m$	E : from <0.3 keV in 17Ve05										
$^{73}\text{Rb}^i$	J : other 93Ba61=1/2-, T=3/2										
$^{73}\text{Rb}^i$	E : from 20Ho17										
^{73}Sr	T : average 20Ho06=23.1(1.4) 19Si33=28(+5-4); others: 20Ho06=23.5(1.8)										
^{73}Sr	T : 19Si33=24.3(5.3) using a least-squares fit analysis										
^{74}Fe	-20660#	500#			5 ms	5		0 ⁺	17 10Oh02	I	2010
^{74}Co	-33540#	400#			31.3 ms	1.3		7 ⁻ #	06 10Ho12	TD	1995
^{74}Ni	-48700#	200#			507.7 ms	4.6		0 ⁺	06 14Xu07	T	1987
^{74}Cu	-56006	6			1.606 s	0.009		2 ⁻ *	06 00KoZH	TD	1987
^{74}Zn	-65756.7	2.5			95.6 s	1.2		0 ⁺	06		1972
^{74}Ga	-68049.6	3.0			8.12 m	0.12		(3 ⁻)*	06 13Ma15	J	1956
$^{74}\text{Ga}^m$	-67990	3	59.571	0.014	9.5 s	1.0		(0)(⁺ #)	06		1974
^{74}Ge	-73422.451	0.013			STABLE			0 ⁺	06		1923
^{74}As	-70860.1	1.7			17.77 d	0.02		2 ⁻	06		1938
^{74}Se	-72213.210	0.015			STABLE	>2.3Ey		0 ⁺	06 20Ba08	T	1922
^{74}Br	-65288	6			25.4 m	0.3		(0 ⁻)	06		1952
$^{74}\text{Br}^m$	-65274	6	13.58	0.21	46 m	2		4 ⁺ *	06		1953
^{74}Kr	-62331.8	2.0			11.50 m	0.11		0 ⁺	06		1960
^{74}Rb	-51916	3			64.78 ms	0.03		0 ⁺ * T=1	06 11Ma66	J	1977
^{74}Sr	-40830#	100#			27.6 ms	2.6		0 ⁺	15 19Si33	T	1995
^{74}Fe	T : symmetrized from 14XuZZ=8.2(+2.6-7.1)										
^{74}Co	T : average 14Xu07=31.6(1.5) 05Ma95=30(3)										
^{74}Co	T : others (recent) 11Da08=19(7) 10Ho12=34(+6-9) outweighed (not used)										
^{74}Cu	T : average 05Va19=1.75(0.06) 00KoZH=1.68(0.03) 91Kr15=1.594(0.010)										
^{74}Cu	T : 89Wi11=1.59(0.05); others 90Be13=1.51(0.27)										
^{74}Cu	J : 20De21,17De30,10Vi07,10Fi02=2										
^{74}Rb	T : average 01Ba12=64.761(0.031) 02Oi02,01Oi04=64.90(0.09); other (recent)										
^{74}Rb	T : 19Si33=65.1(0.5) (outweighed)										
^{74}Sr	T : average 19Si33=27.7(2.8) 14He29=27(8)										
^{75}Fe	-14700#	600#			9# ms	>620ns		9/2 ⁺ #	13 13Ta14	I	2013
^{75}Co	-30560#	400#			26.5 ms	1.2		7/2 ⁻ #	13 14Xu07	T	1995
^{75}Ni	-44240#	200#			331.6 ms	3.2		9/2 ⁺ #	13 14Xu07	T	1992
^{75}Cu	-54470.2	0.7			1.224 s	0.003		5/2 ⁻ *	13 00KoZH	D	1985
$^{75}\text{Cu}^m$	-54408.5	0.8	61.7	0.4	310 ns	8		1/2 ⁻	13 16Pe14	ET	2010
$^{75}\text{Cu}^n$	-54404.0	0.8	66.2	0.4	149 ns	5		3/2 ⁻	13 16Pe14	ET	2010
^{75}Zn	-62558.9	2.0			10.2 s	0.2		7/2 ⁺ *	13 17Wr01	J	1974
$^{75}\text{Zn}^m$	-62432.0	2.0	126.94	0.09	5# s			1/2 ⁻ *	13 17Wr01	J	2011
^{75}Ga	-68460.6	0.7			126 s	2		3/2 ⁻ *	13		1960
^{75}Ge	-71856.97	0.05			82.78 m	0.04		1/2 ⁻ *	13		1939
$^{75}\text{Ge}^m$	-71717.28	0.06	139.69	0.03	47.7 s	0.5		7/2 ⁺	13		1952
$^{75}\text{Ge}^n$	-71664.78	0.08	192.19	0.06	216 ns	5		5/2 ⁺	13		1982
^{75}As	-73034.2	0.9			STABLE			3/2 ⁻ *	13		1920
$^{75}\text{As}^m$	-72730.3	0.9	303.9243	0.0008	17.62 ms	0.23		9/2 ⁺	13		1957
^{75}Se	-72169.49	0.07			119.78 d	0.03		5/2 ⁺ *	13 FGK209	T	1947
^{75}Br	-69107	4			96.7 m	1.3		3/2 ⁻	13		1948
^{75}Kr	-64324	8			4.60 m	0.07		5/2 ⁺ *	13 95Ke04	J	1960
^{75}Rb	-57218.7	1.2			19.0 s	1.2		3/2 ⁻ *	13		1975

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{75}Sr	-46620	220			85.2 ms 2.3	$(3/2^-)$	13	19Si33	T	1991	$\beta^+=100; \beta^+p=5.2$	*
^{75}Y	-31820#	300#			100# μs	$5/2^+\#$					$\beta^+ ?; \beta^+p ?; p ?$	
^{75}Co	D : $\% \beta^-n$ from 11Ho21<16											**
^{75}Co	T : from 14Xu07=26.5(1.2); others 20Go10=27(13) 11Ho21=30(11)											**
^{75}Cu	T : average 11Ho1=1.222(0.008) 91Kr15=1.224(0.003) 00KoZH=1.225(0.007)											**
^{75}Cu	D : $\% \beta^-n$ average 00KoZH=2.2(0.5) 85Re01=3.5(0.6)											**
^{75}Cu	J : 20De21, 17De30, 10Vi07, 11Ko36, 09Fi03=5/2											**
$^{75}\text{Cu}^m$	J : from 19Ic02											**
$^{75}\text{Cu}^n$	J : from 19Ic02											**
^{75}Ga	J : other 17Fa09=3/2											**
^{75}Sr	T : average 19Si33=81.7(3.4) 03Hu01=88(3).											**
^{75}Sr	T : other 01Ki13=71(+71-24) and 80(+400-40)											**
^{76}Fe	-10590#	600#			3# ms >410ns	0^+	17	Su15	I	2017	$\beta^- ?$	
^{76}Co	-25660#	500#		*	23 ms 6	(8^-)	14	14Xu07	TD	2010	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	*
$^{76}\text{Co}^m$	-25560#	510#	100#	100#	16 ms 4	(1^-)	15	So23	TJD	2015	$\beta^-=100$	
$^{76}\text{Co}^n$	-24920#	510#	740#	100#	2.99 μs 0.27	(3^+)	15	So23	TJD	2015	IT=100	*
^{76}Ni	-42190#	300#			234.6 ms 2.7	0^+	07	14Xu07	T	1995	$\beta^-=100; \beta^-n=14.0$	36
$^{76}\text{Ni}^m$	-39770#	300#	2418.0	0.5	547.8 ns 3.3	(8^+)	07	15So23	TE	2005	IT=100	
^{76}Cu	-50981.6	0.9			637.7 ms 5.5	3^-*	95	09Wi03	D	1987	$\beta^-=100; \beta^-n=7.2$	5
$^{76}\text{Cu}^m$			non-exist	RN	1.27 s 0.30	$(1, 3)$	95	90Wi12	IJT	1990	$\beta^-=100$	*
^{76}Zn	-62303.0	1.5			5.7 s 0.3	0^+	95			1974	$\beta^-=100$	
^{76}Ga	-66296.6	2.0			30.6 s 0.6	2^-*	95			1961	$\beta^-=100$	*
^{76}Ge	-73212.898	0.018			1.88 Zy 0.08	0^+	95	20Ba.A	T	1933	IS=7.75 12; $2\beta^-=100$	*
^{76}As	-72291.4	0.9			1.0933 d 0.0038	2^-*	95			1934	$\beta^-=100$	
$^{76}\text{As}^m$	-72247.0	0.9	44.425	0.001	1.84 μs 0.06	$(1)^+$	95			1966	IT=100	
^{76}Se	-75251.959	0.016			STABLE	0^+	95			1922	IS=9.23 7	
^{76}Br	-70289	9			16.2 h 0.2	1^-*	95			1952	$\beta^+=100$	
$^{76}\text{Br}^m$	-70186	9	102.58	0.03	1.31 s 0.02	$(4)^+$	95			1979	IT $\approx$ 100; $\beta^+<0.6$	
^{76}Kr	-69014	4			14.8 h 0.1	0^+	95			1954	$\beta^+=100$	
^{76}Rb	-60479.1	0.9			36.5 s 0.6	1^-*	95			1969	$\beta^+=100; \beta^+\alpha=3.8\text{e-}7$	10
$^{76}\text{Rb}^m$	-60162.2	0.9	316.93	0.08	3.050 μs 0.007	(4^+)	95	00Ch07	T	1986	IT=100	
^{76}Sr	-54250	30			7.89 s 0.07	0^+	11			1990	$\beta^+=100; \beta^+p=3.4\text{e-}3$	8
^{76}Y	-38250#	300#			28 ms 9	$1^\#$	07	19Si33	TJ	2001	$\beta^+ ?; p ?; \beta^+p ?$	*
^{76}Co	T : symmetrized from 14Xu07=21.7(+6.5-4.9)											**
^{76}Co	J : from 15So23											**
$^{76}\text{Co}^n$	E : 15So23=638.4(0.8) above $^{76}\text{Co}^m$											**
$^{76}\text{Co}^n$	T : symmetrized from 15So23=2.96(+0.29-0.25)											**
^{76}Cu	T : average 10Ho12=599(18) 05Va19=653(24) 91Kr15=641(6)											**
^{76}Cu	J : 20De21, 17De30=3											**
$^{76}\text{Cu}^m$	I : reported only in 90Wi12; not confirmed in 05Va19											**
^{76}Ga	T : average 16Do05=30.6(0.3) 85Ta01=32.6(0.6) 74Gr29=29.8(0.4) Birge B=2.7											**
^{76}Ge	T : value for $2\nu\text{-}\beta\beta$; other 15Ba11=1.65(+0.14-0.12) (evaluation).											**
^{76}Ge	T : 0nu-BB 19Al124>27Yy, 18Aa02>19Yy, 18Ag03>80Yy,											**
^{76}Ge	T : 13Ag11>30Yy combined GERDA+HDM+IGEX results; all at (90% C.L.);											**
^{76}Ge	T : others 01Ki13=15 Yy 04Ki03=11.2 Yy not trusted. See also											**
^{76}Ge	T : 02Aa.A and 02Zd02											**
^{76}Rb	J : also 11Ma66=1											**
^{76}Y	T : symemtrized from 19Si33=24(+12-6)											**
^{76}Y	J : 19Si33=p5/2[422] n3/2[312], K=1-; similarity with the mirror ^{76}Br											**
^{77}Co	-21910#	600#			15 ms 6	$7/2^\#$	20			2014	$\beta^-=100; \beta^-n ?; \beta^-2n ?;$ $\beta^-3n ?$	*
^{77}Ni	-37350#	400#			158.9 ms 4.2	$9/2^+\#$	20	14Xu07	T	1995	$\beta^-=100; \beta^-n=26$	13; $\beta^-2n ?$
^{77}Cu	-48862.8	1.2			470.3 ms 1.7	$5/2^-*$	20	20De21	J	1987	$\beta^-=100; \beta^-n=30.1$	13
^{77}Zn	-58789.2	2.0			2.08 s 0.05	$7/2^+*$	20	17Wr01	J	1977	$\beta^-=100$	
$^{77}\text{Zn}^m$	-58016.8	2.0	772.440	0.015	1.05 s 0.10	$1/2^-*$	20	17Wr01	J	1986	$\beta^-=66$ 7; IT=34 7	
^{77}Ga	-65992.4	2.4			13.2 s 0.2	$3/2^-*$	20			1968	$\beta^-=100$ [gs=12,m=88]	
^{77}Ge	-71212.87	0.05			11.211 h 0.003	$7/2^+$	20			1939	$\beta^-=100$	
$^{77}\text{Ge}^m$	-71053.16	0.08	159.71	0.06	53.7 s 0.6	$1/2^-$	20			1947	$\beta^-=81$ 2; IT=19 2	
^{77}As	-73916.3	1.7			38.79 h 0.05	$3/2^-$	20			1951	$\beta^-=100$	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{77}\text{As}^m$	-73440.8	1.7	475.48	0.04	114.0 μs 2.5	$9/2^+$	20		1957	IT=100	
^{77}Se	-74599.50	0.06			STABLE	$1/2^-*$	20		1922	IS=7.60 7	
$^{77}\text{Se}^m$	-74437.58	0.06	161.9223	0.0010	17.36 s 0.05	$7/2^+$	20		1947	IT=100	
^{77}Br	-73234.8	2.8			57.04 h 0.12	$3/2^-*$	20		1948	$\beta^+=100$	
$^{77}\text{Br}^m$	-73128.9	2.8	105.86	0.08	4.28 m 0.10	$9/2^+*$	20		1961	IT=100	
^{77}Kr	-70169.5	2.0			72.6 m 0.9	$5/2^+*$	20	19Ze02 T	1948	$\beta^+=100$	*
$^{77}\text{Kr}^m$	-70103.0	2.0	66.50	0.05	118 ns 12	$3/2^-$	20		1975	IT=100	
^{77}Rb	-64830.5	1.3			3.78 m 0.04	$3/2^-*$	20		1972	$\beta^+=100$	*
^{77}Sr	-57803	8			9.0 s 0.2	$5/2^+*$	20	13Ma15 J	1976	$\beta^+=100; \beta^+p=0.08$ 3	
^{77}Y	-46440#	200#			63 ms 17	$5/2^+ \#$	20	00We.A D	1999	$\beta^+ \approx 100; \beta^+p ?$	*
^{77}Zr	-31600#	400#			100# μs	$3/2^- \#$	20	17Su31 I	2017	$\beta^+ ?; \beta^+p ?; p ?$	
* ^{77}Co	T : symmetrized from $^{14}\text{Xu}07=13.0(+7.2-4.3)$										**
* ^{77}Ni	D : $\% \beta^-$ -n average $^{10}\text{Ho}12=30(24)$ $^{14}\text{XuZZ}=24(16)$										**
* ^{77}Cu	J : $^{20}\text{De}21, ^{17}\text{De}30, ^{11}\text{Ko}36=5/2$										**
* ^{77}Cu	D : $\% \beta^-$ -n average $^{18}\text{Ra}27=29.2(3.0)$ $^{10}\text{Ho}12=31.0(3.8)$ $^{09}\text{Ho}1=30.3(2.0)$										**
* ^{77}Cu	D : $^{09}\text{Wi}03=30.0(2.7)$; other $^{02}\text{Pf}04=15(+10-5)$										**
* ^{77}Cu	T : average $^{14}\text{XuZZ}=476.8(3.4)$ $^{09}\text{Pa}35=467.4(2.1)$ $^{09}\text{Ti}01=480(9)$ $^{91}\text{Kr}15=469(8)$										**
* ^{77}Kr	T : average $^{19}\text{Ze}02=71.25(42)$ $^{73}\text{Ba}22=75(3)$ $^{71}\text{Bo}30=74.7(0.4)$ $^{60}\text{Bu}22=71.1(0.5)$										**
* ^{77}Kr	T : $^{57}\text{Be}46=69(6)$; Birge ratio=3.46										**
* ^{77}Kr	J : $^{95}\text{Ke}04=5/2$										**
* ^{77}Rb	J : also $^{81}\text{Th}04=3/2$										**
* ^{77}Y	T : symmetrized from $^{01}\text{Ki}13=57(+22-12)$										**
^{78}Co	-15320#	700#			11# ms >410ns			17Su15 I	2017	$\beta^- ?$	
^{78}Ni	-34880#	400#			122.2 ms 5.1	0^+	09	$^{14}\text{Xu}07$ T	1995	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	
^{78}Cu	-44789	13			330.7 ms 2.0	$(6^-)*$	09	$^{14}\text{Xu}07$ T	1991	$\beta^-=100; \beta^-n=50.6$ 45;	*
										$\beta^-2n ?$	
^{78}Zn	-57483.2	1.9			1.47 s 0.15	0^+	09		1977	$\beta^-=100; \beta^-n ?$	
$^{78}\text{Zn}^m$	-54809.5	2.0	2673.7	0.6	320 ns 6	(8^+)	09	$^{12}\text{Ka}36$ ET	1998	IT=100	*
^{78}Ga	-63704.1	1.1			5.09 s 0.05	2^-*	09		1972	$\beta^-=100$	
$^{78}\text{Ga}^m$	-63205.2	1.2	498.9	0.5	110 ns 3		09	$^{10}\text{Da}06$ ET	2010	IT=100	*
^{78}Ge	-71862	4			88.0 m 1.0	0^+	09		1953	$\beta^-=100$	
^{78}As	-72817	10			90.7 m 0.2	2^-	09		1937	$\beta^-=100$	
^{78}Se	-77025.95	0.18			STABLE	0^+	09		1922	IS=23.69 22	
^{78}Br	-73452	4			6.45 m 0.04	1^+*	09	$^{73}\text{Hi}01$ D	1937	$\beta^+ \approx 100; \beta^- < 0.01$	
$^{78}\text{Br}^m$	-73271	4	180.89	0.13	119.4 μs 1.0	(4^+)	09		1958	IT=100	
^{78}Kr	-74178.3	0.3			STABLE	0^+	09	$^{94}\text{Sa}31$ T	1920	IS=0.355 3; $2\beta^+ ?$	*
^{78}Rb	-66935	3			17.66 m 0.03	0^+*	09		1968	$\beta^+=100$	*
$^{78}\text{Rb}^m$	-66888	3	46.84	0.14	910 ns 40	(1^-)	09		1996	IT=100	
$^{78}\text{Rb}^n$	-66824	3	111.19	0.22	5.74 m 0.03	4^-*	09		1968	$\beta^+=91$ 2; IT=9 2	*
$^{78}\text{Rb}^x$	-66861	12	74	12	$R=2.0$ 0.5	$spmix$					
^{78}Sr	-63174	7			156.1 s 2.7	0^+	09	$^{11}\text{Pe}29$ T	1982	$\beta^+=100$	*
^{78}Y	-52170#	300#		*	54 ms 5	(0^+)	09	$^{01}\text{Ga}24$ TJ	1992	$\beta^+=100; \beta^+p ?$	*
$^{78}\text{Y}^m$	-52170#	580#	0#	500#	5.8 s 0.6	(5^+)	09		1998	$\beta^+=100; \beta^+p ?$	
^{78}Zr	-40850#	400#			50# ms >200ns	0^+	09	$^{01}\text{Ki}13$ I	2001	$\beta^+ ?; \beta^+p ?$	*
* ^{78}Cu	D : $\% \beta^-$ -n average $^{10}\text{Ho}12=44.0(5.4)$ $^{09}\text{Wi}03=65(8)$										**
* ^{78}Cu	J : $^{20}\text{De}21, ^{17}\text{De}30, ^{11}\text{Ko}36=(6)$; other $^{12}\text{Ko}29=(5)$										**
* $^{78}\text{Zn}^m$	E : from $^{12}\text{Ko}29$; other $^{12}\text{Ka}36=2675.3(1.0)$										**
* $^{78}\text{Zn}^m$	T : average $^{12}\text{Ka}36=320(+9-8)$ $^{00}\text{Da}07=319(9)$										**
* $^{78}\text{Ga}^m$	ET : other E=559.6(0.7) keV, $T_{1/2} < 500$ ns in Ensdf2009										**
* ^{78}Kr	T : limit given here is for the K-e^+ decay (theoretically faster)										**
* ^{78}Rb	J : other $^{11}\text{Ma}66, ^{81}\text{Th}04=0$										**
* $^{78}\text{Rb}^n$	J : other $^{11}\text{Ma}66, ^{81}\text{Th}04=4$										**
* ^{78}Sr	T : average $^{11}\text{Pe}29=155(3)$ $^{97}\text{Mu}02=168(12)$ $^{92}\text{Gr}09=159(8)$										**
* ^{78}Y	T : average $^{01}\text{Ga}24=50(8)$ $^{01}\text{Ki}13=55(+9-6)$										**
* ^{78}Zr	I : other $^{00}\text{We.A} > 170$ ns, same group as $^{01}\text{Ki}13$										**
^{79}Ni	-28160#	500#			44 ms 8	$5/2^+ \#$	16		2010	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	
^{79}Cu	-42410	100			241.3 ms 2.1	$(5/2^-)*$	16	$^{14}\text{Xu}07$ T	1991	$\beta^-=100; \beta^-n=66$ 10; $\beta^-2n ?$	*
^{79}Zn	-53432.3	2.2			746 ms 42	$9/2^+*$	16		1981	$\beta^-=100; \beta^-n=1.7$ 5	*
$^{79}\text{Zn}^m$	-52330	150	1100	150	> 200 ms	$1/2^+*$	16	$^{17}\text{Wr}01$ J	2015	IT ?; $\beta^- ?$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{79}Ga	-62548.4	1.2			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	
$^{79}\text{Ge}^m$	-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	
$^{79}\text{As}^m$	-72863	5	772.81	0.06	1.21 μ s 0.01	$(9/2)^+$	16	98Gr14	T 1998	IT=100	
^{79}Se	-75917.47	0.22			327 ky 28	$7/2^+*$	16		1950	β^- =100	
$^{79}\text{Se}^m$	-75821.70	0.22	95.77	0.03	3.900 m 0.018	$1/2^-$	16	88KI03	D 1950	IT $\approx$ 100; β^- =0.056 11	*
^{79}Br	-76068.1	1.0			STABLE	$3/2^-*$	16		1920	IS=50.65 9	
$^{79}\text{Br}^m$	-75860.5	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	95Ke04	J 1948	β^+ =100	
$^{79}\text{Kr}^m$	-74312	3	129.77	0.05	50 s 3	$7/2^+*$	16	95Ke04	J 1940	IT=100	
^{79}Rb	-70802.8	1.9			22.9 m 0.5	$5/2^+*$	16		1957	β^+ =100	*
^{79}Sr	-65480	7			2.25 m 0.10	$3/2^-*$	16		1972	β^+ =100	*
^{79}Y	-57800	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 ?	
^{79}Cu	J : 17De30=(5/2)										**
^{79}Cu	T : others 10Ho12=257(+29-26) 91Kr15=188(25)										**
^{79}Cu	D : % β^- -n average 10Ho12=72(12) 91Kr15=55(17)										**
^{79}Zn	J : 17Wr01,16Ya02=9/2										**
$^{79}\text{Zn}^m$	J : 17Wr01,16Ya02=1/2										**
^{79}Ga	J : also 17Fa09=3/2										**
$^{79}\text{Se}^m$	T : average 19De24=3.884(0.009) (quoted in the text in hours is a typo)										**
$^{79}\text{Se}^m$	T : 90Ab02=3.92(0.01); Birge ratio=2.68										**
^{79}Rb	J : also 81Th04=5/2										**
^{79}Sr	J : 90Li28=3/2										**
^{80}Ni	-23240#	600#			30 ms 22	0^+	14		2014	β^- =100; β^- -n ?; β^- -2n ?	*
^{80}Cu	-36680#	300#			113.3 ms 6.4		14	14Xu07	T 1995	β^- =100; β^- -n=58 9; β^- -2n ?	*
^{80}Zn	-51648.6	2.6			562.2 ms 3.0	0^+	14	14Xu07	T 1981	β^- =100; β^- -n=1.36 12	*
^{80}Ga	-59223.7	2.9		*	1.9 s 0.1	6^-*	14	13Ve03	TJ 1974	β^- =100; β^- -n=0.86 7	*
$^{80}\text{Ga}^m$	-59201.3	2.9	22.45	0.10	1.3 s 0.2	3^-*	14	13Ve03	TJ 2011	$\beta^- \approx$ 100; β^- -n ?;IT ?	
^{80}Ge	-69535.3	2.1			29.5 s 0.4	0^+	05		1972	β^- =100	
^{80}As	-72215	3			15.2 s 0.2	1^+	05		1954	β^- =100	
^{80}Se	-77759.5	0.9			STABLE	0^+	05		1922	IS=49.80 36; $2\beta^-$?	
^{80}Br	-75889.0	1.0			17.68 m 0.02	1^+*	05		1937	β^- =91.7 2; β^+ =8.3 2	
$^{80}\text{Br}^m$	-75803.2	1.0	85.843	0.004	4.4205 h 0.0008	5^-*	05		1937	IT=100	
^{80}Kr	-77893.5	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	*
$^{80}\text{Rb}^m$	-71681.6	2.0	493.9	0.5	1.63 μ s 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	
$^{80}\text{Y}^m$	-60920	6	228.5	0.1	4.8 s 0.3	1^-	05	01No07	J 1998	IT=81 2; β^+ =19 2	*
$^{80}\text{Y}^n$	-60835	6	312.6	0.9	4.7 μ s 0.3	(2^+)	05		1997	IT=100	
^{80}Zr	-54760#	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}Cu	T : other 10Ho12=170(+110-50)										**
^{80}Cu	D : % β^- -n from 14XuZZ										**
^{80}Zn	D : % β^- -n from 19To09; others 91Kr15=1.0(0.5) 10Ho12<1.8%										**
^{80}Ga	D : % β^- -n is probably a mixture of values for ^{80}Ga and $^{80}\text{Ga}^m$										**
^{80}Rb	J : also 81Th04=1										**
$^{80}\text{Y}^m$	J : 228.5 keV M3 to 4-										**
^{80}Zr	T : average 01Ki13=5.3(+1.1-0.9) 00Re03=4.1(+0.8-0.6)										**
^{81}Ni	-16090#	700#			30# ms >410ns	$3/2^+ \#$	17	Su15	I 2017	β^- ?	
^{81}Cu	-31910#	300#			73.2 ms 6.8	$5/2^- \#$	10	14Xu07	TD 2010	β^- =100; β^- -n=81 20; β^- -2n ?	*
^{81}Zn	-46200	5			299.4 ms 2.1	$(1/2^+, 5/2^+)$	08	20Pa26	TDJ 1991	β^- =100; β^- -n=23 4; β^- -2n ?	*
^{81}Ga	-57628	3			1.217 s 0.005	$5/2^-*$	08	20Pa26	T 1976	β^- =100; β^- -n=12.5 5	*
^{81}Ge	-66291.7	2.1			9 s 2	$9/2^+ \#$	08		1972	β^- =100	*
$^{81}\text{Ge}^m$	-65612.6	2.1	679.14	0.04	6 s 2	$(1/2^+)$	08		1981	$\beta^- \approx$ 100;IT<1	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{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
$^{81}\text{Se}^m$	-76286.0	1.0	57.28 m 0.02	$7/2^+$	08		1971	IT $\approx$ 100; β^- =0.051 14
^{81}Br	-77977.1	1.0	STABLE	$3/2^-*$	08		1920	IS=49.35 9
$^{81}\text{Br}^m$	-77440.9	1.0	34.6 μ s 2.8	$9/2^+$	08		1967	IT=100
^{81}Kr	-77696.2	1.1	229 ky 11	$7/2^+*$	08 95Ke04	J	1950	ϵ =100
$^{81}\text{Kr}^m$	-77505.6	1.1	13.10 s 0.03	$1/2^-*$	08 95Ke04	J	1940	IT $\approx$ 100; ϵ =0.0025 4
^{81}Rb	-75457	5	4.572 h 0.004	$3/2^-*$	08		1949	β^+ =100 *
$^{81}\text{Rb}^m$	-75371	5	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
$^{81}\text{Sr}^m$	-71449	3	79.23 ns 50	$(5/2)^-$	08		1983	IT=100
$^{81}\text{Sr}^i$	-71439	3	6.4 μ s 0.5	$(7/2^+)$	08		1989	IT ?
^{81}Y	-65713	5	70.4 s 1.0	$(5/2^+)$	08		1981	β^+ =100
^{81}Zr	-57520	90	5.5 s 0.4	$(3/2^-)$	08		1997	β^+ =100; β^+ p=0.12 2
^{81}Nb	-46360#	400#	<44ns	$9/2^+*$	08 00We.A	I		p ?; β^+ ?; β^+ p ? *
^{81}Mo	-31460#	500#	1# ms >400ns	$5/2^+*$	15 13Su23	I	2013	β^+ ?; β^+ p ? *
^{81}Cu	D : % β^- -n from 14XuZZ							**
^{81}Zn	D : % β^- -n from 20Pa26; others 12Ma37=12(4) 91Kr15=7.5(3.0) 10Ho12=30(13)							**
^{81}Zn	T : average 20Pa26=290(4) 14Xu07=303.2(2.6) 10Pa33=304(13)							**
^{81}Ga	J : also 17Fa09=3/2							**
^{81}Ga	D : % β^- -n average 19To09=11.2(2.6) 93Ru01=12.9(0.8) 81Ho07=12.7(1.2)							**
^{81}Ga	D : 80Lu04=12.0(0.9); others 10Ho12<21 86ReZU=11.7(1.2)							**
^{81}Ge	T : derived from 81Ho24=7.6(0.6) 72De43=10.1(0.8) for a mixture of gs and							**
^{81}Ge	T : isomer that have similar T1/2							**
$^{81}\text{Ge}^m$	T : derived from 81Ho24=7.6(0.6) 72De43=10.1(0.8) for mixture of gs and							**
$^{81}\text{Ge}^m$	T : isomer that have similar T1/2							**
^{81}Rb	J : also 81Th04=3/2							**
$^{81}\text{Rb}^m$	J : also 81Th04=9/2							**
^{81}Nb	I : also 99Ja02<80 ns 01Ki13<200 ns							**
^{81}Nb	T : estimated β^+ half-life 01Ki13=100# ms							**
^{82}Ni	-10720#	800#	16# ms >410ns	0^+	19 17Su15	I	2017	β^- ?
^{82}Cu	-25730#	400#	34 ms 7		19 10Oh02	I	2010	β^- =100; β^- -n ?; β^- 2n ? *
^{82}Zn	-42314	3	177.9 ms 2.5	0^+	19 14Xu07	T	1997	β^- =100; β^- -n=69 7; β^- 2n ? *
^{82}Ga	-52930.7	2.4	600 ms 2	2^-*	19 12Ch51	J	1976	β^- =100; β^- -n=21.2 10; β^- 2n ? *
$^{82}\text{Ga}^m$	-52790.0	2.4	93.5 ns 6.7	(4^-)	19 16Al10	TJ	2009	IT=100 *
^{82}Ge	-65415.1	2.2	4.31 s 0.19	0^+	19		1972	β^- =100 *
^{82}As	-70105	4	19.1 s 0.5	(2^-)	19 04Ga44	J	1968	β^- =100
$^{82}\text{As}^m$	-69973	4	13.6 s 0.4	(5^-)	19		1970	β^- =100
^{82}Se	-77593.9	0.5	87.6 Ey 1.5	0^+	19 20Ba.A	T	1922	IS=8.82 15; β^- =100 *
^{82}Br	-77498.7	1.0	35.282 h 0.007	5^-*	19 81Th04	J	1937	IT=100
$^{82}\text{Br}^m$	-77452.8	1.0	6.13 m 0.05	2^-	19		1965	IT=97.6 3; β^- =2.4 3
^{82}Kr	-80591.795	0.006	STABLE	0^+	19		1920	IS=11.593 31
^{82}Rb	-76188	3	1.2575 m 0.0002	1^+*	19 81Th04	J	1949	β^+ =100
$^{82}\text{Rb}^m$	-76118.8	2.6	6.472 h 0.006	5^-*	19 81Th04	J	1957	$\beta^+\approx$ 100;IT<0.33
^{82}Sr	-76010	6	25.35 d 0.03	0^+	19		1952	ϵ =100
^{82}Y	-68064	5	8.30 s 0.20	1^+	19		1980	β^+ =100
$^{82}\text{Y}^m$	-67661	5	258 ns 22	4^-	19 94Mu02	T	1994	IT=100 *
$^{82}\text{Y}^n$	-67557	5	148 ns 6	6^+	19		1994	IT=100
^{82}Zr	-63614.1	1.6	32 s 5	0^+	19		1982	β^+ =100
^{82}Nb	-51810#	300#	51 ms 5	(0^+)	19		1992	β^+ =100; β^+ p ?
$^{82}\text{Nb}^m$	-50630#	300#	93 ns 20	(5^+)	19 09Ga40	ETJ	2008	IT=100 *
^{82}Mo	-40370#	400#	30# ms >400ns	0^+	19 13Su23	I	2013	β^+ ?; β^+ p ?
^{82}Cu	T : symmetrized from 14Xu07=33(+7-6)							**
^{82}Zn	T : others 16Al10=155(26) 12Ma37=228(10) outweighed (not used)							**
^{82}Ga	D : % β^- -n average 17Ve01=22(2) 16Te09=22.2(2.0) 86Wa17=19.8(1.7)							**
^{82}Ga	D : 80Lu04=21.4(2.2); other 93Ru01=31.1(4.4)% at variance (not used)							**
$^{82}\text{Ga}^m$	T : average 16Al10=89(9) 12Ka36=98(+10-9); other 09Fo05<500 ns							**
^{82}Ge	T : average 15Et01=4.04(0.27) 80Ze.A=4.5(0.4) 72De43=4.60(0.35);							**
^{82}Ge	T : other (not used) 73Kr.A=5(1)							**
^{82}Se	T : 2v- $\beta\beta$ symmetrized from 20Ba.A=87(+2-1) (evaluation); others							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ⁸² Se	T : 19Az04=86.0(0.3)(+1.9-1.3) 12Si23=96(10) 15Ba11=92(7) (evaluation);							**
* ⁸² Se	T : 0nu-BB: 19Az02>3.5 Yy 18Az05>2.4 Yy 99Pi08=83(+9-7) 98Ar10=83(12)							**
* ⁸² Se	T : 92El07=108(+26-6) 88Li11=120(10)							**
* ⁸² Y ^m	T : average 94Mu02=220(50) 93Wo04=268(25)							**
* ⁸² Nb ^m	T : 09Ga40 superseded 08Ga04=92(17); other 07Ca26=80(50)							**
⁸³ Cu	-20390#	500#	21# ms >410ns	5/2 ⁻ #		17Su15 I	2017	β^- ?; β^-n ?; β^-2n ?
⁸³ Zn	-36290#	300#	100 ms 3	3/2 ⁺ #		15 14XuZZ TD	1997	β^- =100; β^-n ≈71 29; β^-2n ? *
⁸³ Ga	-49257.1	2.6	310.0 ms 0.7	5/2 ⁻ #		15 17Ve01 TD	1976	β^- =100; β^-n =85 4; β^-2n ? *
⁸³ Ga ^m	-49059.8	2.6	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 ?
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	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	729 ns 77	(19/2 ⁻)		15 11Ru.A T	1989	IT=100 *
⁸³ Kr	-79990.643	0.009	STABLE	9/2 ⁺ *		15	1920	IS=11.500 19 *
⁸³ Kr ^m	-79981.238	0.009	156.8 ns 0.5	7/2 ⁺		15	1963	IT=100
⁸³ Kr ⁿ	-79949.086	0.009	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	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	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	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	530 ns 120	(5/2 ⁻)		15	1988	IT=100
⁸³ Zr ⁿ	-65835	6	1.8 μ s 0.1	(7/2 ⁺)		15	1988	IT=100
⁸³ Nb	-57610	160	3.9 s 0.2	9/2 ⁺ #		15	1988	β^+ =100
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) 14XuZZ=99.4(3.0) 12Ma37=117(20)							**
* ⁸³ Ga	T : average 17Ve01=312(1) 16Al10=309(6) 14Xu.A=296.1(6.4) 06Pe20=317(17)							**
* ⁸³ Ga	T : 319(24) 93Ru01=307(7) 91Kr15=308(1) 86Wa17,80Lu04,76Ru01=310(10)							**
* ⁸³ Ga	D : % β^-n others 16Ma50=56(7) 09Wi03=62.8(2.5) 80Lu04=43(7) 93Ru01=14.9(1.8)							**
* ⁸³ Br ^m	T : average 11Ru.A=862(148) 97Is13=700(100) 89Wi01=600(200)							**
* ⁸³ Kr	J : also 95Ke04=9/2							**
* ⁸³ Kr ⁿ	T : average 10Li13=1.82(0.02) 09Ka30=1.85(0.03) 71Ru17=1.83(0.02)							**
* ⁸³ Kr ⁿ	J : 95Ke04=1/2							**
* ⁸³ Rb	J : also 81Th04=5/2							**
* ⁸³ Sr	J : 90Li28=7/2							**
* ⁸³ Sr ^m	J : 90Li28=1/2							**
* ⁸³ Mo	T : symmetrized from 01Ki13=6(+30-3)							**
⁸⁴ Cu	-13720#	500#						β^- ?; β^-n ?
⁸⁴ Zn	-31830#	400#	54 ms 8	0 ⁺		10 14XuZZ TD	2010	β^- =100; β^-n =73 26; β^-2n ?
⁸⁴ Ga	-44094	30	97.6 ms 1.2	0 ⁻ #		09 19Yo03 TD	1991	β^- =100; β^-n =43 4; β^-2n =1.6 2 *
⁸⁴ Ga ^m		<i>non-exist</i>	< 85 ms	(3 ⁻ , 4 ⁻)		09 09Le26 TD		β^- ?; IT ? *
⁸⁴ Ge	-58148	3	951 ms 9	0 ⁺		09 13Ma22 T	1972	β^- =100; β^-n =10.6 6 *
⁸⁴ As	-65854	3	3.16 s 0.58	(2 ⁻)		09 16Ko24 J	1968	β^- =100; β^-n =0.28 4 *
⁸⁴ As ^m		<i>non-exist</i>	650 ms 150			09 74KrZG IT	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	6.0 m 0.2	(6 ⁻)		09	1957	β^- =100
⁸⁴ Br ⁿ	-77375	26	< 140 ns	1 ⁺		09	1970	IT=100
⁸⁴ Kr	-82439.345	0.004	STABLE	0 ⁺		09	1920	IS=56.987 15
⁸⁴ Kr ^m	-79203.27	0.18	1.83 μ s 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	20.26 m 0.04	6 ⁻ *		09	1940	IT≈100; β^+ <0.0012 *
⁸⁴ Sr	-80649.6	1.2	STABLE	0 ⁺		09	1936	IS=00.56 2; β^+ ?

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{84}Y	-73894	4			39.5 m 0.8	(6 ⁺)	09		1962	$\beta^+=100$	
$^{84}\text{Y}^m$	-73827	4	67.0	0.2	4.6 s 0.2	1 ⁺	09		1976	$\beta^+=100$	
$^{84}\text{Y}^n$	-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	$\beta^+=100$	
^{84}Nb	-61193.8	0.4			9.8 s 0.9	(1 ⁺)	09 09St04	J	1977	$\beta^+=100$	
$^{84}\text{Nb}^m$	-61145.8	1.1	48	1	176 ns 46	(3 ⁺)	09Ga40	ETJ	2009	IT=100	
$^{84}\text{Nb}^n$	-60856.1	0.6	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	$\beta^+=100;\beta^+p?$	
^{84}Tc	-37700#	400#				1 ⁺ #				$p?;\beta^+?;\beta^+p?$	
^{84}Ga	D: % β^- -n average 19Yo03=44(4) and 16Ma50=40(7) (same group as 19Yo03, but										**
^{84}Ga	D: different experiment); others 17Ve01=53(20) 10Wi03=74(14)										**
^{84}Ga	D: 09Gr06=80(15) 91Kr15=70(15)										**
$^{84}\text{Ga}^m$	I: proposed in 09Le26 (and Ensdf2009), but not confirmed in 10Wi03 data										**
$^{84}\text{Ga}^m$	I: of much bigger statistics										**
^{84}Ge	T: average 13Ma22=942(17) 93Ru01=947(11) 91Kr15=984(23)										**
^{84}Ge	D: % β^- -n average 93Ru01=10.8(0.6) 91Kr15=9.5(2.0) 91Om01=9(3)										**
^{84}As	T: from 13Ma22; others: 96WaZX=3.24(0.26) 93Ru01=4.02(0.03) 91Om01=4.5(0.2)										**
^{84}As	T: 81Ho10=4.5(0.2) 75Kr08=5.3(0.4) 68De19=5.8(0.5)										**
^{84}As	D: % β^- -n from 91Ru01; others 02Pf04=0.18(0.10) 73Kr06=0.13(0.06)										**
$^{84}\text{As}^m$	I: from 74KrZG (also 75Kr08), but not confirmed in 81Ho10										**
^{84}Rb	J: other 14Ya28=1.9(1), 81Th04=2										**
$^{84}\text{Rb}^m$	J: other 14Ya28=6.2(2), 81Th04=6										**
^{85}Zn	-25100#	500#			40# ms >400ns	5/2 ⁺ #	14 10Oh02	I	2010	$\beta^-?;\beta^-n?;\beta^-2n?$	
^{85}Ga	-39740	40			95.3 ms 1.0	(5/2 ⁻)	14 19Yo03	TD	1997	$\beta^-=100;\beta^-n=77.4$; $\beta^-2n=1.3.2$	*
^{85}Ge	-53123	4			495 ms 5	(3/2 ⁺ , 5/2 ⁺)#	14 13Ma22	T	1991	$\beta^-=100;\beta^-n=17.2.18$; $\beta^-2n?$	*
^{85}As	-63189	3			2.022 s 0.007	(5/2 ⁻)	14 12Ku06	J	1967	$\beta^-=100;\beta^-n=62.6.9$	*
^{85}Se	-72413.6	2.6			32.9 s 0.3	(5/2 ⁺)	14		1960	$\beta^-=100$	
^{85}Br	-78575	3			2.90 m 0.06	3/2 ⁻	14		1943	$\beta^-=100$	
^{85}Kr	-81480.3	2.0			10.728 y 0.007	9/2 ⁺ *	14 FGK209	T	1940	$\beta^-=100$	*
$^{85}\text{Kr}^m$	-81175.4	2.0	304.871	0.020	4.480 h 0.008	1/2 ⁻ *	14 95Ke04	J	1937	$\beta^-=78.8.5$; IT=21.2.5	
$^{85}\text{Kr}^n$	-79488.5	2.0	1991.8	0.2	1.82 μ s 0.05	(17/2 ⁺)	14 11Ru.A	T	1989	IT=100	
^{85}Rb	-82167.341	0.005			STABLE	5/2 ⁻ *	14		1921	IS=72.17.2	*
$^{85}\text{Rb}^m$	-81653.335	0.005	514.0065	0.0022	1.015 μ s 0.001	9/2 ⁺	14 19Ta19	T	1964	IT=100	*
^{85}Sr	-81103.3	2.8			64.846 d 0.006	9/2 ⁺ *	14 FGK204	T	1940	$\epsilon=100$	*
$^{85}\text{Sr}^m$	-80864.5	2.8	238.79	0.05	67.63 m 0.04	1/2 ⁻ *	14		1940	IT=86.6.4; $\beta^+=13.4.4$	*
^{85}Y	-77842	19			2.68 h 0.05	(1/2 ⁻)	14		1952	$\beta^+=100$	
$^{85}\text{Y}^m$	-77822	19	19.68	0.17	4.86 h 0.20	(9/2 ⁺)	14		1952	$\beta^+\approx 100$; IT?	
$^{85}\text{Y}^n$	-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	$\beta^+=100$	
$^{85}\text{Zr}^m$	-72883	6	292.2	0.3	10.9 s 0.3	1/2 ⁻ #	14		1976	IT=?; $\beta^+=?$	
^{85}Nb	-66280	4			20.5 s 0.7	9/2 ⁺ #	14		1988	$\beta^+=100$	*
$^{85}\text{Nb}^m$	-66130#	80#	150#	80#	3.3 s 0.9	(1/2 ⁻)	14 05Ka39	J	1988	IT=?; $\beta^+=?$	*
$^{85}\text{Nb}^n$			non-exist	RN	12 s 5		14 98Oi02	IT		$\beta^-?;$ IT?	*
^{85}Mo	-57510	16			3.2 s 0.2	(1/2 ⁺)	14 05Xu04	J	1992	$\beta^+=100;\beta^+p=0.14.2$	
^{85}Tc	-45850#	400#			<110ns	1/2 ⁻ #	14 00We.A	I		p?	*
^{85}Ru	-30630#	500#			1# ms >400ns	3/2 ⁻ #	15 13Su23	I	2013	$\beta^+?;\beta^+p?;p?$	
^{85}Ga	D: % β^- -n average 19Yo03=90(7)% 18Mi03=70(5)%										**
^{85}Ge	D: % β^- -n from 14Ag12; others 18Mi03=15(5) 91Kr15=14(3)										**
^{85}Ge	T: average 14XuZZ=495(6) 13Ma22=494(8); others 91Kr15=535(47) 91Om01=580(50)										**
^{85}As	D: % β^- -n average 14Ag12=63.1(1.0) 93Ru01=59.3(2.5)										**
^{85}As	T: average 13Ma22=2.08(0.14) 93Ru01=2.002(0.013) 91Kr15=2.032(0.012)										**
^{85}As	T: 68To19=2.028(0.012); others 73Kr06=2.05(0.05), superseded by 91Kr15										**
^{85}As	T: 76Ru01=2.08(0.05), superseded by 93Ru01 91Om01=2.0(0.1) 78Cr03=1.9(0.1)										**
^{85}Kr	J: also 95Ke04=9/2										**
^{85}Rb	J: also 14Ya28=2.5(1), 81Th04=5/2										**
$^{85}\text{Rb}^m$	T: average 19Ta19=1.0202(0.0060) 72Mi23=1.015(0.001)										**
^{85}Sr	J: 90Li28=9/2										**
$^{85}\text{Sr}^m$	J: 90Li28=1/2										**
^{85}Nb	T: average 05Ka39=17(2) 88Ku14=20.9(0.7)										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{85}\text{Nb}^m$	E : from 05Ka39 > 69 keV										**
$^{85}\text{Nb}^n$	I : activity reported in 98Oi02 and adopted in Ensdf2014 as a new isomer;										**
$^{85}\text{Nb}^n$	I : not confirmed in 05Ka39 (the same laboratory as 98Oi02)										**
^{85}Tc	I : also 99Ja02<100 ns; estimated T1/2=100# ms for β^+ decay										**
^{86}Zn	-20060#	500#				0^+					β^- ?; β^- n ?
^{86}Ga	-33760#	400#			49 ms 2		15	19Yo03	TD	1997	β^- =100; β^- n=69 6; β^- 2n=16.2 11
^{86}Ge	-49400	440			221.6 ms 11	0^+	15	14XuZZ	T	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 ?
^{86}Se	-70503.2	2.5			14.3 s 0.3	0^+	16			1973	β^- =100; β^- n ?
^{86}Br	-75632	3			55.1 s 0.4	(1^-)	15			1962	β^- =100
^{86}Kr	-83265.676	0.004			STABLE	0^+	15			1920	IS=17.279 41; 2 β^- ?
^{86}Rb	-82747.00	0.20			18.645 d 0.008	2^-*	15			1941	β^- $\approx$ 100; ϵ =0.0052 5
$^{86}\text{Rb}^m$	-82190.95	0.27	556.05	0.18	1.017 m 0.003	6^-*	15			1951	IT $\approx$ 100; β^- <0.3
^{86}Sr	-84523.100	0.005			STABLE	0^+	15			1931	IS=9.86 20
$^{86}\text{Sr}^m$	-81567.01	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
$^{86}\text{Y}^m$	-79065	14	218.21	0.09	47.4 m 0.4	(8^+)	15			1962	IT=99.31 4; β^+ =0.69 4
$^{86}\text{Y}^n$	-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
$^{86}\text{Nb}^m$	-68980#	100#	150#	100#	20# s	$(0^-, 1^-, 2^-)$	15	05Ka39	J	1994	β^+ =100; IT ?
$^{86}\text{Nb}^n$			non - exist	RN	56.3 s 8.3		15	94Sh07	IT		β^+ = ?; IT ?
^{86}Mo	-64110.9	2.9			19.1 s 0.3	0^+	15			1991	β^+ =100
^{86}Tc	-51570#	300#			55 ms 7	(0^+)	15			1992	β^+ =100; β^+ p ?
$^{86}\text{Tc}^m$	-50050#	300#	1524	10	1.10 μ s 0.12	(6^+)	15	08Ga04	T	2000	IT=100
^{86}Ru	-39770#	400#			50# ms >400ns	0^+	15	13Su23	I	2013	β^+ ?; β^+ p ?
^{86}Ga	D : % β^- n average 19Yo03=74(8) 13Mi19=60(10)										**
^{86}Ge	T : other 13Ma22=226(21), supersedes 12Ma.A=219(40)										**
^{86}Rb	J : also 14Ya28=1.9(2), 81Th04=2										**
^{86}Rb	T : average 16Ma49=18.648(0.009) 81Mi10=18.631(0.018)										**
^{86}Y	J : 07Ch07=4										**
$^{86}\text{Y}^n$	T : average 10Ru07=127(14) 00Io02=125(6)										**
$^{86}\text{Nb}^m$	I : from 94Sh07 and 05Ka39, populated in β^+ decay of ^{86}Mo (0^+)										**
$^{86}\text{Nb}^n$	I : half-life deduced in 94Sh07 by gating on Zr X-rays, which would be										**
$^{86}\text{Nb}^n$	I : consistent with decay of two isomers, one with T1/2=88 s and the										**
$^{86}\text{Nb}^n$	I : second with a half-life similar to that of ^{86}Mo , T1/2=19.1 s;										**
$^{86}\text{Nb}^n$	I : not confirmed in 05Ka39, 97Ta10 (sensitive to high-spin structures)										**
$^{86}\text{Tc}^m$	T : average 08Ga04=1.10(0.14) 00Ch07=1.11(0.21)										**
$^{86}\text{Tc}^m$	E : uncertainty estimated by GAu										**
^{87}Ga	-28870#	500#			29 ms 4	$5/2^-$ #	15	19Yo03	TD	2010	β^- =100; β^- n=81 12; β^- 2n=10.2 2.8
^{87}Ge	-43590#	300#			103 ms 4	$5/2^+$ #	15	14XuZZ	T	1997	β^- =100; β^- n ?; β^- 2n ?
^{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 ?
^{87}Se	-66426.1	2.2			5.50 s 0.06	$(3/2^+)$	15	15Ko19	J	1968	β^- =100; β^- n=0.60 12
^{87}Br	-73892	3			55.68 s 0.12	$5/2^-$	15	19Wi11	J	1943	β^- =100; β^- n=2.60 4
^{87}Kr	-80709.53	0.25			76.3 m 0.5	$5/2^+*$	15			1940	β^- =100
^{87}Rb	-84597.802	0.006			49.7 Gy 0.3	$3/2^-*$	15			1921	IS=27.83 2; β^- =100
^{87}Sr	-84880.076	0.005			STABLE	$9/2^+*$	15			1931	IS=7.00 20
$^{87}\text{Sr}^m$	-84491.547	0.006	388.5287	0.0023	2.805 h 0.009	$1/2^-*$	15	21Kr.A	T	1940	IT=99.70 8; ϵ =0.30 8
^{87}Y	-83018.4	1.1			79.8 h 0.3	$1/2^-*$	15			1940	β^+ =100
$^{87}\text{Y}^m$	-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
$^{87}\text{Zr}^m$	-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
$^{87}\text{Nb}^m$	-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		*	2.14 s 0.17	$9/2^+$ #	15	19Pa16	TD	1991	β^+ =100; β^+ p<0.7

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{87}\text{Tc}^m$	-57683	4	7	1	*	2# s	1/2 ⁻ #	09Ga40	E	β^+ ?; IT ?	*
$^{87}\text{Tc}^n$	-57619	4	71	1		647 ns 24	7/2 ⁺ #	15	2007	IT=100	
^{87}Ru	-45730#	400#				50# ms >1.5us	1/2 ⁻ #	15 95Ry03	I	1995	β^+ ?; β^+ p ?
* ^{87}As	T : average 15Ko19=560(80) 13Ma22=484(35) 93Ru01=485(40); others										**
* ^{87}As	T : 12Qu01=1450(550)(+3900-1100) 78Cr03=730(60)										**
* ^{87}Se	T : average 93Ru01=5.29(11) 70Kr05=5.85(15) 70De08=5.90(20) 71To13=5.41(10)										**
* ^{87}Se	D : % β^- n from 93Ru01										**
* ^{87}Rb	J : also 14Ya28=1.53(6)										**
* ^{87}Sr	J : 90Li28=9/2										**
* $^{87}\text{Sr}^m$	J : 90Li28=1/2										**
* $^{87}\text{Sr}^m$	T : average 21Kr.A=2.808(0.003) 97We13=2.811(0.027) 82Gr07=2.795(0.013)										**
* $^{87}\text{Sr}^m$	T : 70Le07=2.793(0.009) 68Go30=3.805(0.001); other 92An19=2.827(0.001),										**
* $^{87}\text{Sr}^m$	T : discrepant (not used)										**
* ^{87}Y	J : 07Ch07=1/2										**
* $^{87}\text{Y}^m$	J : 07Ch07=9/2										**
* ^{87}Tc	T : average 19Pa16=2.0(0.3) 01Ki13=2.2(0.2)										**
* $^{87}\text{Tc}^m$	E : 64 keV gamma ray observed in parallel to the 71 keV one, depopulating										**
* $^{87}\text{Tc}^m$	E : $^{87}\text{Tc}^n$										**
^{88}Ga	-22390#	500#									β^- ?; β^- n ?
^{88}Ge	-39520#	400#				61 ms 6	0 ⁺	14 14XuZZ	T	1997	β^- =100; β^- n ?; β^- 2n ?
^{88}As	-50450#	200#				270 ms 150		14 12Qu01	T	1994	β^- =100; β^- n ?
^{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
$^{88}\text{Br}^m$	-70446	3	270.17	0.11		5.51 μ s 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	-82609.00	0.16				17.78 m 0.03	2 ⁻ *	14 20Ch42	T	1939	β^- =100
$^{88}\text{Rb}^m$	-81235.2	0.3	1373.8	0.3		123 ns 13	(7 ⁺)	14		2000	IT=100
^{88}Sr	-87921.629	0.006				STABLE	0 ⁺	14		1923	IS=82.58 35
^{88}Y	-84299.0	1.5				106.629 d 0.024	4 ⁻ *	14 FGK204	T	1948	β^+ =100
$^{88}\text{Y}^m$	-83906.1	1.5	392.86	0.09		301 μ s 3	1 ⁺	14		1955	IT=100
$^{88}\text{Y}^n$	-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
$^{88}\text{Zr}^m$	-80741	5	2887.79	0.06		1.320 μ s 0.025	8 ⁺	14		1978	IT=100
^{88}Nb	-76170	60			*	14.50 m 0.11	(8 ⁺)	14		1964	β^+ =100
$^{88}\text{Nb}^m$	-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
^{88}Tc	-61670	4				6.4 s 0.8	(2 ⁺)	14 09Ga40	J	1991	β^+ =100; β^+ p ?
$^{88}\text{Tc}^m$	-61600	5	70	3	MD	5.8 s 0.2	(6 ⁺)	14 19Vi05	J	1993	β^+ =100; β^+ p ?
$^{88}\text{Tc}^n$	-61575	4	95	1		146 ns 12	(4 ⁺)	14 09Ga40	TJ	2009	IT=100
^{88}Ru	-54340#	300#				1.5 s 0.3	0 ⁺	14 19Pa16	TD	1994	β^+ =100; β^+ p<3.6
^{88}Rh	-36860#	400#				1# ms					β^+ ?
* ^{88}As	T : symmetrized from 12Qu01=200(5)(+200-90)										**
* $^{88}\text{Br}^m$	J : 15Cz01=(4-)										**
* $^{88}\text{Br}^m$	T : also 18Rz01=5.5(0.1)										**
* ^{88}Rb	J : also 81Th04=2										**
* ^{88}Rb	T : average 20Ch42=17.78(0.05) 89Ab22=17.773(0.033), uncertainty increased										**
* ^{88}Rb	T : to 3 σ by evaluator, 69Ra05=17.78(0.11); other 69He16=17.7(0.1)										**
* ^{88}Y	J : 07Ch07=4										**
* $^{88}\text{Y}^n$	J : 07Ch07=8										**
* $^{88}\text{Zr}^m$	T : other 17Pa35=1.40(0.07)										**
* ^{88}Ru	T : average 19Pa16=1.9(0.5) 01Ki13=1.2(+0.3-0.2)										**
^{89}Ge	-33040#	400#				60# ms >300ns	3/2 ⁺ #	13		1997	β^- ?; β^- n ?; β^- 2n ?
^{89}As	-46530#	300#				220# ms >150ns	5/2 ⁻ #	13 94Be24	I	1994	β^- ?; β^- n ?; β^- 2n ?
^{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	-86209.03	0.09				50.563 d 0.025	5/2 ⁺ *	13		1937	β^- =100
^{89}Y	-87711.2	0.3				STABLE	1/2 ⁻ *	13		1923	IS=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
$^{89}\text{Y}^m$	-86802.2	0.3	908.97	0.03	15.663 s 0.005	$9/2^+*$	13	94It.A	T	1951	IT=100	*
^{89}Zr	-84878.0	2.8			78.360 h 0.023	$9/2^+$	13	20Fe10	T	1948	$\beta^+=100$	*
$^{89}\text{Zr}^m$	-84290.2	2.8	587.82	0.10	4.161 m 0.010	$1/2^-$	13			1953	IT=93.77 12; $\beta^+=6.23$ 12	
^{89}Nb	-80626	24			2.03 h 0.07	$(9/2^+)$	13			1954	$\beta^+=100$	
$^{89}\text{Nb}^m$	-80630#	40#	0#	30#	1.10 h 0.03	$(1/2)^-$	13			1954	$\beta^+=100$	
^{89}Mo	-75015	4			2.11 m 0.10	$(9/2^+)$	13			1980	$\beta^+=100$	
$^{89}\text{Mo}^m$	-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	$\beta^+=100$	
$^{89}\text{Tc}^m$	-67332	4	62.6	0.5	12.9 s 0.8	$(1/2^-)$	13			1991	$\beta^+\approx 100$;IT ?	
^{89}Ru	-58369	24			1.32 s 0.03	$(9/2^+)$	13	19Pa16	TD	1992	$\beta^+=100$; $\beta^+p=3.1$ 2	
^{89}Rh	-45650#	360#			<120ns	$9/2^+\#$	16	16Ce02	TI		$\beta^+ ?$; $\beta^+p ?$; $p ?$	
$^{*89}\text{Rb}$	J : also 81Th04=3/2											**
$^{*89}\text{Y}$	J : 07Ch07=1/2											**
$^{*89}\text{Y}^m$	J : 07Ch07=9/2											**
$^{*89}\text{Zr}$	T : average 20Fe10=78.368(0.032) 18Ga04=78.333(0.038) 64Va03=78.43(0.08)											**
^{90}Ge	-28470#	500#			30# ms >400ns	0^+	20	10Oh02	I	2010	$\beta^- ?$; $\beta^-n ?$; $\beta^-2n ?$	
^{90}As	-40990#	400#			70# ms >300ns		20	97Be70	I	1997	$\beta^- ?$; $\beta^-n ?$; $\beta^-2n ?$	
$^{90}\text{As}^m$	-40870#	400#	124.5	0.5	220 ns 100			12Ka36	ET	2012	IT=100	*
^{90}Se	-55800	330			210 ms 80	0^+	20	12Qu01	T	1994	$\beta^-=100$; $\beta^-n ?$	*
^{90}Br	-64000	3			1.910 s 0.010		20			1959	$\beta^-=100$; $\beta^-n=25.3$ 15	
^{90}Kr	-74959.3	1.9			32.32 s 0.09	0^+	20			1951	$\beta^-=100$	
^{90}Rb	-79366	6			158 s 5	0^-*	20			1951	$\beta^-=100$	*
$^{90}\text{Rb}^m$	-79259	6	106.90	0.03	258 s 4	3^-*	20			1967	$\beta^-=97.4$ 4;IT=2.5 4	*
$^{90}\text{Rb}^x$	-79295	14	71	12	$R=2$ 1	$fsmix$						
^{90}Sr	-85950.9	1.4			28.91 y 0.03	0^+	20			1948	$\beta^-=100$	
^{90}Y	-86496.9	0.4			64.05 h 0.05	2^-*	20			1937	$\beta^-=100$	*
$^{90}\text{Y}^m$	-85814.9	0.4	682.01	0.05	3.226 h 0.011	7^+*	20	20Kr06	T	1961	IT=99.9982 2; $\beta^-=0.0018$ 2	*
^{90}Zr	-88772.55	0.12			STABLE	0^+	20			1924	IS=51.45 4	
$^{90}\text{Zr}^m$	-86453.55	0.12	2319.000	0.009	809.2 ms 2.0	5^-	20			1972	IT=100	
$^{90}\text{Zr}^n$	-85183.13	0.12	3589.418	0.015	131 ns 4	8^+	20			1977	IT=100	
^{90}Nb	-82662	3			14.60 h 0.05	8^+*	20			1951	$\beta^+=100$	*
$^{90}\text{Nb}^m$	-82540	3	122.370	0.022	63 μ s 2	6^+	20			1967	IT=100	
$^{90}\text{Nb}^n$	-82537	3	124.67	0.25	18.81 s 0.06	4^-*	20			1969	IT=100	*
$^{90}\text{Nb}^p$	-82491	3	171.10	0.10	< 1 μ s	7^+	20			1981	IT=100	
$^{90}\text{Nb}^q$	-82280	3	382.01	0.25	6.19 ms 0.08	1^+	20			1967	IT=100[gs=0,m=100]	
$^{90}\text{Nb}^r$	-80782	3	1880.21	0.20	471 ns 6	(11^-)	20	05Ch65	TJ	1978	IT=100	*
^{90}Mo	-80173	3			5.56 h 0.09	0^+	20			1953	$\beta^+=100$	
$^{90}\text{Mo}^m$	-77298	3	2874.73	0.15	1.14 μ s 0.05	8^+	20			1971	IT=100	
^{90}Tc	-70724.7	1.0			49.2 s 0.4	(8^+)	20			1974	$\beta^+=100$	
$^{90}\text{Tc}^m$	-70580.7	1.3	144.0	1.7	MD	1^+	20			1974	$\beta^+=100$	
^{90}Ru	-64884	4			11.7 s 0.9	0^+	20			1991	$\beta^+=100$	
^{90}Rh	-51630#	200#			29 ms 3	(0^+)	20	19Pa16	JTD	1994	$\beta^+=100$; $\beta^+p<0.7$	
$^{90}\text{Rh}^m$	-51630#	540#	0#	500#	0.56 s 0.02	(7^+)	20	19Pa16	JTD	2001	$\beta^+=100$; $\beta^+p=9.6$ 10	
^{90}Pd	-39710#	400#			10# ms >400ns	0^+	20	16Ce02	I	2016	$\beta^+ ?$; $\beta^+p ?$ 2p ?	
$^{*90}\text{As}^m$	T : symmetrized from 12Ka36=200(+120-90)											**
$^{*90}\text{Se}$	T : symmetrized from 12Qu01=195(7,stat)(+95-65,syst)											**
$^{*90}\text{Rb}$	J : also 81Th04=0											**
$^{*90}\text{Rb}^m$	J : also 81Th04=3											**
$^{*90}\text{Y}$	J : also 07Ch07,78Fu06=2											**
$^{*90}\text{Y}^m$	J : 07Ch07=7											**
$^{*90}\text{Y}^m$	T : average 20Kr06=3.178(0.012) 92An19=3.244(0.005) 67Gr02=3.19(0.01)											**
$^{*90}\text{Y}^m$	T : 62Ab03=3.15(0.05) 61Ca12=3.2(0.1) 61He09=3.14(0.10) 61Ha17=3.19(0.06);											**
$^{*90}\text{Y}^m$	T : Birge ratio=2.75											**
$^{*90}\text{Nb}$	J : also 09Ch25=8											**
$^{*90}\text{Nb}^n$	J : 09Ch25=4											**
$^{*90}\text{Nb}^r$	T : average 05Ch65=470(10) 81Fi02=440(20) 78Ha52=477(8); other											**
$^{*90}\text{Nb}^r$	T : 17Pa35=415(67)											**
^{91}As	-36500#	400#			100# ms >300ns	$5/2^-\#$	13	97Be70	I	1997	$\beta^- ?$; $\beta^-n ?$; $\beta^-2n ?$	
^{91}Se	-50580	430			270 ms 50	$1/2^+\#$	13			1975	$\beta^-=100$; $\beta^-n=21$ 10; $\beta^-2n ?$	

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{91}Br	-61107	4	543 ms	4		13 14Ag12	D 1974	$\beta^- = 100; \beta^-_{n=29.5} 5$
^{91}Kr	-70974.0	2.2	8.57 s	0.04		13	1951	$\beta^- = 100; \beta^-_{n=}$?
^{91}Rb	-77745	8	58.2 s	0.3		13	1951	$\beta^- = 100; \beta^-_{n=}$? *
^{91}Sr	-83652	5	9.65 h	0.06		13 19Kr10	T 1943	$\beta^- = 100$ *
^{91}Y	-86351.3	1.8	58.51 d	0.06		13	1943	$\beta^- = 100$
$^{91}\text{Y}^m$	-85795.7	1.8	49.71 m	0.04		13	1953	IT $\approx$ 100; $\beta^-_{n=}$?
^{91}Zr	-87895.59	0.09	STABLE			13	1934	IS=11.22 5
$^{91}\text{Zr}^m$	-84728.3	0.4	4.35 μ s	0.14		13	1985	IT=100
^{91}Nb	-86638.0	2.9	680 y	130		13 91Hi.A	D 1951	$\varepsilon \approx 100; e^+ = 0.0138$ 25 *
$^{91}\text{Nb}^m$	-86533.4	2.9	60.86 d	0.22		13 91Hi.A	D 1950	IT=96.6 5; $\varepsilon = 3.4$ 5; $e^+ = 0.0028$ 2 *
$^{91}\text{Nb}^n$	-84603.6	2.9	3.76 μ s	0.12		13	1974	IT=100
^{91}Mo	-82209	6	15.49 m	0.01		13	1948	$\beta^+ = 100$
$^{91}\text{Mo}^m$	-81556	6	64.6 s	0.6		13	1953	IT=50.0 16; $\beta^+ = 50.0$ 16
^{91}Tc	-75986.7	2.4	3.14 m	0.02		13	1974	$\beta^+ = 100$
$^{91}\text{Tc}^m$	-75847.4	2.4	3.3 m	0.1		13	1975	$\beta^+ \approx 100$; IT ?
^{91}Ru	-68239.8	2.2	8.0 s	0.4		13	1983	$\beta^+ = 100; \beta^+_{p=}$?
$^{91}\text{Ru}^m$	-68580	500	7.6 s	0.8		13	1983	$\beta^+ \approx 100; \beta^+_{p=}$?; IT ?
^{91}Rh	-58570#	300#	1.47 s	0.22		13 04De40	TJ 1994	$\beta^+ = 100; \beta^+_{p=}$ 1.3 5 *
$^{91}\text{Rh}^m$	-58400#	300#	1.8# s			13	2004	$\beta^+_{n=}$?; IT ?; $\beta^+_{p=}$? *
^{91}Pd	-46170#	420#	32 ms	3		13 18Pa20	TD 1995	$\beta^+ = 100; \beta^+_{p=}$ 3.1 10 *
^{91}Rb	J : other 81Th04=3/2							**
^{91}Sr	J : 90Li28=5/2							**
^{91}Sr	T : other 19Kr10=9.66(0.09)							**
^{91}Zr	J : 02Ca37=5/2							**
^{91}Nb	J : 09Ch25=9/2							**
$^{91}\text{Nb}^m$	J : 09Ch25=1/2							**
^{91}Rh	T : from 04De40=1.47(0.22) using time spectra gated by gamma rays feeding							**
^{91}Rh	T : the ^{91}Ru gs (9/2+); others: 19Pa16=1.60(0.02) 01Ki13=1.7(0.2)							**
^{91}Rh	T : 00We.A=1.74(0.14) (same group as 01Ki13) probably include both gs							**
^{91}Rh	T : and isomer							**
$^{91}\text{Rh}^m$	T : Ensdf2013 assign T1/2=1.47(0.22) from 04De40, but this value is							**
$^{91}\text{Rh}^m$	T : unambiguously associated in 04De04 with the decay of the 9/2+ gs.							**
$^{91}\text{Rh}^m$	T : 19Pa16=1.60(0.02) 01Ki13=1.7(0.2) 00We.A=1.74(0.14) probably include							**
$^{91}\text{Rh}^m$	T : both gs and isomer							**
^{91}Pd	D : % $\beta^+_{p=}$ symmetrized from 18Pa20=3.0(+1.1-0.9)							**
^{92}As	-30380#	500#	45# ms	>300ns		12 97Be70	I 1997	$\beta^-_{n=}$?; $\beta^-_{n=}$ 2n ?
^{92}Se	-46720#	400#	90# ms	>300ns	0 ⁺	12 97Be70	I 1997	$\beta^-_{n=}$?; $\beta^-_{n=}$?; $\beta^-_{n=}$ 2n ?
$^{92}\text{Se}^m$	-44780#	400#	15.7 μ s	0.7	(9 ⁻)	20Li15	ETJ 2012	IT=100 *
^{92}Br	-56233	7	314 ms	16	(2 ⁻)	12	1974	$\beta^- = 100; \beta^-_{n=}$ 33.1 25; $\beta^-_{n=}$ 2n ?
$^{92}\text{Br}^m$	-55571	7	88 ns	8		12Ka36	ET 2012	IT=100 *
$^{92}\text{Br}^n$	-55095	7	85 ns	10		12Ka36	ET 2012	IT=100 *
^{92}Kr	-68769.3	2.7	1.840 s	0.008	0 ⁺	12	1951	$\beta^- = 100; \beta^-_{n=}$ 0.0332 25
^{92}Rb	-74772	6	4.48 s	0.03	0 ⁻	12	1960	$\beta^- = 100; \beta^-_{n=}$ 0.0107 5 *
^{92}Sr	-82867	3	2.611 h	0.017	0 ⁺	12	1956	$\beta^- = 100$ *
^{92}Y	-84816	9	3.54 h	0.01	2 ⁻	12	1940	$\beta^- = 100$ *
$^{92}\text{Y}^m$	-84010#	50#	3.7 μ s	0.5	7 ⁺	12 11Ru.A	ET 2009	IT=100 *
^{92}Zr	-88459.02	0.09	STABLE		0 ⁺	12	1924	IS=17.15 3
^{92}Nb	-86453.3	1.8	34.7 My	2.4	7 ⁺	12	1938	$\beta^+ = 100$ *
$^{92}\text{Nb}^m$	-86317.8	1.8	10.116 d	0.013	(2 ⁺)	12 19Kr13	T 1959	$\beta^+ = 100$ *
$^{92}\text{Nb}^n$	-86227.5	1.8	5.9 μ s	0.2	(2 ⁻)	12	1958	IT=100
$^{92}\text{Nb}^p$	-84250.0	1.8	167 ns	4	(11 ⁻)	12	1989	IT=100
^{92}Mo	-86808.59	0.16	STABLE	>190Ey	0 ⁺	12 97Ba35	T 1930	IS=14.649 106; $2\beta^+_{n=}$?
$^{92}\text{Mo}^m$	-84048.07	0.21	190 ns	3	8 ⁺	12	1964	IT=100 *
^{92}Tc	-78926	3	4.25 m	0.15	(8 ⁺)	12	1964	$\beta^+ = 100$
$^{92}\text{Tc}^m$	-78656	3	1.03 μ s	0.06	(4 ⁺)	12 17Pa35	T 1976	IT=100 *
$^{92}\text{Tc}^n$	-78397	3	< 0.1 μ s		(3 ⁺)	12	1976	IT=100
$^{92}\text{Tc}^p$	-78215	3	< 0.1 μ s		1 ⁺	12	1976	IT=100
^{92}Ru	-74301.2	2.7	3.65 m	0.05	0 ⁺	12	1971	$\beta^+ = 100$
$^{92}\text{Ru}^m$	-71467	3	100 ns	8	(8 ⁺)	12 19Ha26	T 1980	IT=100 *

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{92}Rh	-62999	4	5.61 s 0.08	(6 ⁺)	12	19Pa16	TD 1994	$\beta^+=100; \beta^+p=2.05$ 7	*
$^{92}\text{Rh}^m$	-62950#	100#	3.18 s 0.22	(2 ⁺)	12	19Pa16	TD 2004	$\beta^+=100; \beta^+p=1.7$ 3	*
$^{92}\text{Rh}^n$	-62890#	100#	232 ns 15	(4 ⁺)	17	Pa35	ETJ 2017	IT=100	*
^{92}Pd	-54780	350	1.06 s 0.03	0 ⁺	12	19Pa16	TD 1994	$\beta^+=100; \beta^+p=1.6$ 2	
^{92}Ag	-37530#	400#	1# ms >400ns		16	16Ce02	I 2016	$\beta^+ ?; p ?$	
$^{92}\text{Se}^m$	T : other 12Ka36=10.3(+5.5-2.8)								**
$^{92}\text{Se}^m$	E : uncertainty estimated by NuBase								**
$^{92}\text{Br}^m$	T : symmetrized from 12Ka36=89(+7-8)								**
$^{92}\text{Br}^m$	E : uncertainty estimated by NuBase								**
$^{92}\text{Br}^n$	T : symmetrized from 12Ka36=84(+10-9)								**
$^{92}\text{Br}^n$	E : uncertainty estimated by NuBase								**
^{92}Rb	J : also 81Th04=0								**
^{92}Sr	T : other (recent) 19Kr10=2.66(0.06)								**
^{92}Y	J : 07Ch07=2								**
$^{92}\text{Y}^m$	T : average 11Ru.A=3.3(0.6) 09Fo05=4.2(+0.8-0.6)								**
$^{92}\text{Y}^m$	E : observed 315-keV and 419-keV gamma rays in a cascade; low energy								**
$^{92}\text{Y}^m$	E : transition may directly depopulate the isomer								**
^{92}Nb	J : 09Ch25=7								**
$^{92}\text{Nb}^m$	T : average 19Kr13=10.07(0.02) 68Re04=10.14(0.03) 62Bu16=10.16(0.03)								**
$^{92}\text{Nb}^m$	T : 59We30=10.15(0.03)								**
$^{92}\text{Mo}^m$	T : other 17Pa35=200(37)								**
$^{92}\text{Tc}^m$	T : average 17Pa35=1.02(0.17) 71Ho27=1.03(0.07)								**
$^{92}\text{Ru}^m$	T : average 19Ha26=100(10) 80No06=100(14)								**
^{92}Rh	D : $\% \beta^+p$ average 19Pa16=2.2(0.1) 12Lo08=1.9(0.1)								**
^{92}Rh	J : from 97Ka07; 01Xu05>4								**
$^{92}\text{Rh}^m$	T : also 04De40=0.53(0.37)								**
$^{92}\text{Rh}^n$	E : 55.3(0.3) keV above the (2+) isomer								**
$^{92}\text{Rh}^n$	T : from 19Ha26=232(15); other 17Pa35=230(60)								**
^{93}Se	-40860#	400#	130# ms >300ns	1/2 ⁺ #	11	97Be70	I 1997	$\beta^- ?; \beta^-n ?; \beta^-2n ?$	
$^{93}\text{Se}^m$	-40180#	400#	420 ns 100			12Ka36	ET 2012	IT=100	*
^{93}Br	-52890	430	152 ms 8	5/2 ⁻ #	11	13Mi13	TD 1981	$\beta^-=100; \beta^-n=64$ 6; $\beta^-2n ?$	*
^{93}Kr	-64136.0	2.5	1.287 s 0.010	1/2 ⁺ *	11	13Mi13	TD 1951	$\beta^-=100; \beta^-n=1.95$ 11	*
^{93}Rb	-72620	8	5.84 s 0.02	5/2 ⁻ *	11		1960	$\beta^-=100; \beta^-n=1.39$ 7	
$^{93}\text{Rb}^m$	-68197	8	111 ns 11	(27/2 ⁻)	11		2010	IT=100	
^{93}Sr	-80086	8	7.43 m 0.03	5/2 ⁺ *	11		1959	$\beta^-=100$	*
^{93}Y	-84227	10	10.18 h 0.08	1/2 ⁻ *	11		1948	$\beta^-=100$	*
$^{93}\text{Y}^m$	-83468	10	820 ms 40	9/2 ⁺ *	11		1974	IT=100	*
^{93}Zr	-87122.0	0.5	1.61 My0.05	5/2 ⁺	11		1950	$\beta^-=100$	
^{93}Nb	-87212.8	1.5	STABLE	9/2 ⁺ *	11		1932	IS=100	*
$^{93}\text{Nb}^m$	-87182.0	1.5	16.12 y 0.12	1/2 ⁻	11	20Ho10	E 1965	IT=100	
$^{93}\text{Nb}^n$	-79753	17	1.5 μ s 0.5	33/2 ⁻ #	11		2007	IT=100	*
^{93}Mo	-86807.08	0.18	4.0 ky 0.8	5/2 ⁺	11		1946	$\epsilon=100$	
$^{93}\text{Mo}^m$	-84382.13	0.18	6.85 h 0.07	21/2 ⁺	11		1950	IT=99.88 1; $\beta^+=0.12$ 1	
$^{93}\text{Mo}^n$	-77112	17	1.8 μ s 1.0	(39/2 ⁻)	11	05Fu01	T 2005	IT=100	*
^{93}Tc	-83606.1	1.0	2.75 h 0.05	9/2 ⁺	11		1948	$\beta^+=100$	
$^{93}\text{Tc}^m$	-83214.3	1.0	43.5 m 1.0	1/2 ⁻	11		1939	IT=77.4 6; $\beta^+=22.6$ 6	
$^{93}\text{Tc}^n$	-81420.9	1.0	10.2 μ s 0.3	(17/2 ⁻)	11		1973	IT=100	*
^{93}Ru	-77216.7	2.1	59.7 s 0.6	(9/2 ⁺)	11		1972	$\beta^+=100$	
$^{93}\text{Ru}^m$	-76482.3	2.1	10.8 s 0.3	(1/2 ⁻)	11		1983	$\beta^+=78.0$ 23; IT=22.0 23; $\beta^+p=0.027$ 5	
$^{93}\text{Ru}^n$	-75134.2	2.3	2.30 μ s 0.07	(21/2 ⁺)	11	17Pa35	T 1983	IT=100	*
^{93}Rh	-69011.8	2.6	13.9 s 1.6	9/2 ⁺ #	11		1994	$\beta^+=100$	
^{93}Pd	-58980	370	1.17 s 0.02	(9/2 ⁺)	11	19Pa16	TD 1994	$\beta^+=100; \beta^+p=7.4$ 2	
^{93}Ag	-46400#	400#	228 ns 16	9/2 ⁺ #	16	16Ce02	T 1994	$p=?; \beta^+ ?; \beta^+p ?$	*
$^{93}\text{Se}^m$	E : 12Ka36=208.3(0.5) and 469.9(0.5) gamma rays in cascade to gs								**
$^{93}\text{Se}^m$	T : symmetrized from 12Ka36=390(+120-80)								**
^{93}Br	D : $\% \beta^-n$ average 13Mi13=53(+11-8) 01Lh01=68(7)								**
^{93}Kr	T : average 13Mi13=1.298(0.054) 12Qu01=1.245(0.070 stat)(0.030syst)								**
^{93}Kr	T : 76Ru01=1.33(0.05) 75As04=1.27(0.02) 69Ca03=1.289(0.012)								**
^{93}Kr	J : 95Ke04=1/2								**
^{93}Kr	D : $\% \beta^-n$ other (recent) 13Mi13=1.9(+0.6-0.2)								**

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^{93}Sr	J : 90Li28=5/2								**
^{93}Y	J : 07Ch07=1/2								**
$^{93}\text{Y}^m$	J : 07Ch07=9/2								**
^{93}Nb	J : also 09Ch25=9/2								**
$^{93}\text{Nb}^n$	E : from 7435.3(2.1)+x keV in Ensdf2011; x<50 keV assumed in Nubase								**
$^{93}\text{Nb}^n$	J : week population (non-yrast) in 07Wa45, feeding the 7435.3 keV 37/2-								**
$^{93}\text{Nb}^n$	J : level; given the Weisskopf T1/2 estimates and the measured T1/2,								**
$^{93}\text{Nb}^n$	J : the depopulating 50 keV gamma transition is most likely E2								**
$^{93}\text{Mo}^n$	E : from 9670.0(2.3)+x keV in Ensdf2011; x<50 keV assumed in Nubase								**
$^{93}\text{Mo}^n$	T : symmetrized from 05Fu01=1.1(+1.5-0.4)								**
$^{93}\text{Tc}^n$	T : also 19Ha26=10(1)								**
$^{93}\text{Ru}^n$	T : average 17Pa35=2.36(0.12) 09Ga40=2.7(0.2) 83Gr33=2.6(0.3)								**
$^{93}\text{Ru}^n$	T : 83Ko07=2.6(0.2) 78Br25=2.05(0.10)								**
^{93}Ag	T : estimated from the time of flight and the assumption that the ratio								**
^{93}Ag	T : between the number of identified nuclei with the same Tz is identical								**
^{94}Se	-36800# 500#		50# ms >300ns	0^+	06	97Be70 I	1997	β^- ?; $\beta^- n$?; $\beta^- 2n$?	*
$^{94}\text{Se}^m$	-34370# 500#	2430.0 0.6	680 ns 50	(7^-)		20Li05 EJT	2020	IT=100	*
^{94}Br	-47650# 200#		70 ms 20	2^- #	06		1981	β^- =100; $\beta^- n$ =68 16; $\beta^- 2n$?	
$^{94}\text{Br}^m$	-47360# 200#	294.6 0.5	530 ns 15			12Ka36 ET	2012	IT=100	
^{94}Kr	-61348 12		212 ms 4	0^+	11	16Mi18 T	1972	β^- =100; $\beta^- n$ =1.11 7	*
^{94}Rb	-68562.8 2.0		2.702 s 0.005	$3^- *$	11	11Go37 D	1961	β^- =100; $\beta^- n$ =10.3 3	*
$^{94}\text{Rb}^m$	-68458.6 2.0	104.2 0.2	130 ns 15	(0^-)		16Mi18 ETJ	2016	IT=100	
$^{94}\text{Rb}^n$	-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	*
$^{94}\text{Y}^m$	-81149 6	1202.3 1.0	1.304 μ s 0.012	(5^+)	06	17Ki09 T	1999	IT=100	*
^{94}Zr	-87269.33 0.16		STABLE >110Py	0^+	06	99Ar25 T	1924	IS=17.38 4; $2\beta^-$?	
^{94}Nb	-86369.1 1.5		20.4 ky 0.4	6^+	06	12He11 T	1938	β^- =100	
$^{94}\text{Nb}^m$	-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	-88414.08 0.14		STABLE	0^+	06		1930	IS=9.187 33	
^{94}Tc	-84158 4		293 m 1	$7^+ *$	06		1948	β^+ =100	
$^{94}\text{Tc}^m$	-84082 5	76 3	52 m 1	$(2)^+$	06	68Ar06 D	1948	β^+ $\approx$ 100; IT<0.18	
^{94}Ru	-82584 3		51.8 m 0.6	0^+	06		1952	β^+ =100	
$^{94}\text{Ru}^m$	-79940 3	2644.1 0.4	67.5 μ s 2.8	8^+	06	19Ha26 T	1971	IT=100	*
^{94}Rh	-72908 3	*	70.6 s 0.6	(4^+)	06	06Ba55 J	1979	β^+ =100; β^+ p=1.8 5	
$^{94}\text{Rh}^m$	-72853 3	54.60 0.20	480 ns 30	(2^+)	06		2004	IT=100	
$^{94}\text{Rh}^n$	-72610# 200#	300# 200#	25.8 s 0.2	(8^+)	06		1973	β^+ =100	
^{94}Pd	-66102 4		9.1 s 0.3	0^+	06	19Pa16 TD	1982	β^+ =100; β^+ p<0.13	*
$^{94}\text{Pd}^m$	-61219 4	4883.1 0.4	515 ns 1	(14^+)	06	19Ha26 T	1995	IT=100	*
$^{94}\text{Pd}^n$	-58892 4	7209.8 0.8	206 ms 18	(19^-)		11Br01 TJ	2011	IT=100	*
^{94}Ag	-52400# 400#		27 ms 2	0^+ #	06	19Pa16 TD	1994	β^+ =100; β^+ p<0.2	
$^{94}\text{Ag}^m$	-51050# 570#	1350# 400#	470 ms 10	(7^+)	06	19Pa16 TD	1994	β^+ =100; β^+ p=17.0 6	
$^{94}\text{Ag}^n$	-45900 370	6500# 550#	400 ms 40	(21^+)	06		2002	β^+ =95.4 7; β^+ p $\approx$ 27; p=4.1 6; 2p=0.5 3	*
^{94}Cd	-40440# 500#		80# ms >760ns	0^+	16	16Ce02 I	2016	β^+ ?; β^+ p ?	
^{94}Se	I : 97Be70>300ns 95Cz.A>300ns 17Ch18 observed excited states								**
$^{94}\text{Se}^m$	E : uncertainty of 0.3 keV is assumed for all gamma rays in the cascade								**
^{94}Kr	T : average 16Mi18, 13Mi13=227(14) 03Be05=212(5) 72Am01=200(10)								**
^{94}Kr	T : 75As04=220(20); other (not used) 96Me09=330(100)								**
^{94}Rb	J : also 81Th04=3								**
^{94}Y	J : 07Ch07=2								**
$^{94}\text{Y}^m$	T : average 17Ki09=1.33(0.01) 11Ru.A=1.295(0.005) 99Ge02=1.35(0.02);								**
$^{94}\text{Y}^m$	T : Birge ratio=2.77								**
$^{94}\text{Ru}^m$	T : average 19Ha26=64(4) 71Le19=71(4); other 17Ze02=102(17) for q=44+								**
$^{94}\text{Ru}^m$	T : (bare ion); 77Ha49=68(10)								**
^{94}Pd	T : average 19Pa16=9.1(0.4) 82Ku15=9.0(0.5)								**
$^{94}\text{Pd}^m$	T : average 19Ha26=515(1) 17Pa35=495(7) 11Br01=499(13) 09Ga40=468(19)								**
$^{94}\text{Pd}^m$	T : 02La18=530(10), same as 98Gr.B=530(10) and supersedes 97Gr02=600(100);								**
$^{94}\text{Pd}^m$	T : other 95Go30=800(200)								**
$^{94}\text{Pd}^n$	E : from a least-squares fit to Eg								**
$^{94}\text{Pd}^n$	T : average 17Pa35=225(32) 11Br01=197(22)								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
$^{94}\text{Ag}^n$	D : %p=1.9(5) + 2.2(4) from 05Mu15, %2p from 06Mu03										**	
^{95}Se	-30460#	500#			70# ms >400ns	$3/2^+$ #	12	10Oh02 I	2010	β^- ?; β^-n ?; β^-2n ?		
^{95}Br	-43850#	300#			80# ms >300ns	$5/2^-$ #	10	97Be70 I	1997	β^- ?; β^-n ?; β^-2n ?		
$^{95}\text{Br}^m$	-43310#	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	95Ke04 J	1994	β^- =100; β^-n =2.87 18; β^-2n ?		
$^{95}\text{Kr}^m$	-55964	19	195.5	0.3	1.582 μs 0.022	$(7/2^+)$	10	12Ka36 T	2006	IT=100	*	
^{95}Rb	-65890	20			377.7 ms 0.8	$5/2^-*$	10		1967	β^- =100; β^-n =8.7 3	*	
$^{95}\text{Rb}^m$	-65055	20	835.0	0.6	< 500 ns	$9/2^+$ #	10		2009	IT=100		
^{95}Sr	-75117	6			23.90 s 0.14	$1/2^+*$	10		1961	β^- =100	*	
^{95}Y	-81208	7			10.3 m 0.1	$1/2^-*$	10		1959	β^- =100	*	
$^{95}\text{Y}^m$	-80120	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		
$^{95}\text{Nb}^m$	-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	-87711.87	0.12			STABLE	$5/2^+*$	10		1930	IS=15.873 30		
^{95}Tc	-86021	5			19.258 h 0.026	$9/2^+*$	10	20Sz02 T	1947	β^+ =100		
$^{95}\text{Tc}^m$	-85982	5	38.91	0.04	61.96 d 0.24	$1/2^-$	10	20Sz02 T	1959	β^+ =96.1 3; IT=3.9 3		
^{95}Ru	-83458	10			1.607 h 0.004	$5/2^+$	10	20Sz02 T	1948	β^+ =100	*	
^{95}Rh	-78341	4			5.02 m 0.10	$(9/2^+)^+$	10		1967	β^+ =100		
$^{95}\text{Rh}^m$	-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			7.4 s 0.4	$9/2^+$ #	10	19Pa16 TD	1980	β^+ =100; β^+p =0.23 5	*	
$^{95}\text{Pd}^m$	-68091	3	1875.13	0.14	13.3 s 0.2	$(21/2^+)$	10	19Pa16 TD	1982	β^+ =89 3; IT=11 3; β^+p =0.71 7	*	
^{95}Ag	-59910#	400#			1.78 s 0.06	$(9/2^+)$	10	19Pa16 TD	1994	β^+ =100; β^+p =2.3 2	*	
$^{95}\text{Ag}^m$	-59570#	400#	344.2	0.3	< 500 ms	$(1/2^-)$	10		2003	IT=100		
$^{95}\text{Ag}^n$	-57380#	400#	2531.3	1.5	< 16 ms	$(23/2^+)$	10		2003	IT=100		
$^{95}\text{Ag}^p$	-55050#	400#	4860.0	1.5	< 40 ms	$(37/2^+)$	10		2003	IT=100		
^{95}Cd	-47060#	570#			32 ms 3	$9/2^+$ #	18	Pa20 TD	2011	β^+ =100; β^+p =4.6 11	*	
$^{95}\text{Br}^m$	T : symmetrized from 12Ka36=6.7(+1.1-0.9)										**	
$^{95}\text{Kr}^m$	T : others 11Ru.A=1.28(0.05) 06Ge05=1.4(0.2)										**	
^{95}Rb	J : also 81Th04=5/2										**	
^{95}Sr	J : 90Li28=1/2										**	
^{95}Y	J : 07Ch07=1/2										**	
^{95}Ru	T : average 20Sz02=1.6033(0.0044) 70Bo22=1.632(0.021) 68Pi03=1.650(0.017)										**	
^{95}Pd	T : average 19Pa16=7.4(0.5) 12Lo08=7.5(0.5)										**	
$^{95}\text{Pd}^m$	T : average 19Pa16=13.2(0.4) 82Ku15=13.3(0.3)										**	
$^{95}\text{Pd}^m$	D : IT from 82Ku15=11(3)%										**	
^{95}Ag	T : average 19Pa16=1.80(0.07) 12Lo08=1.76(0.09)										**	
^{95}Ag	D : % β^+p average 19Pa16=2.1(0.3)% 12Lo08=2.5(0.3)%										**	
^{95}Cd	T : others 17Da07=29(8) 10St.A=73(+53-28)										**	
^{95}Cd	D : % β^+p symmetrized from 18Pa20=4.5(+1.2-1.0)										**	
^{96}Br	-38210#	300#			20# ms >300ns		08	97Be70 I	1997	β^- ?; β^-n ?; β^-2n ?		
$^{96}\text{Br}^m$	-37900#	300#	311.5	0.5	3.0 μs 0.9			12Ka36 ET	2012	IT=100	*	
^{96}Kr	-53082	19			80 ms 8	0^+	12		1994	β^- =100; β^-n =3.7 4		
^{96}Rb	-61354	3			201.5 ms 0.9	2^-*	08	93Ru01 TD	1967	β^- =100; β^-n =13.7 5; β^-2n ?	*	
$^{96}\text{Rb}^m$	-61350#	200#	0#	200#	200# ms >1ms	$1(^+\#)$	81	Bo30 JI	1981	β^- ?; IT ?; β^-n ?; β^-2n ?	*	
$^{96}\text{Rb}^n$	-60219	3	1134.6	1.1	1.80 μs 0.04	(10^-)	08		1999	IT=100	*	
^{96}Sr	-72918	8			1.059 s .008	0^+	08	12Qu01 T	1971	β^- =100; β^-n ?	*	
^{96}Y	-78330	6			5.34 s 0.05	0^-*	08		1975	β^- =100	*	
$^{96}\text{Y}^m$	-76790	6	1540	9	9.6 s 0.2	8^+*	08		1974	β^- =100	*	
$^{96}\text{Y}^n$	-76675	6	1655.0	1.1	181 ns 9	(6^+)	20	Is08 EJT	2017	IT=100		
^{96}Zr	-85438.86	0.11			23.4 Ey 1.7	0^+	08	18Ma51 T	1934	IS=2.80 2; β^- =100	*	
^{96}Nb	-85602.83	0.15			23.35 h 0.05	6^+	08		1949	β^- =100		
^{96}Mo	-88794.89	0.12			STABLE	0^+	08		1930	IS=16.673 8		
^{96}Tc	-85822	5			4.28 d 0.07	7^+*	08		1947	β^+ =100		
$^{96}\text{Tc}^m$	-85788	5	34.23	0.04	51.5 m 1.0	4^+	08		1950	IT=98.0 5; β^+ =2.0 5		
^{96}Ru	-86080.39	0.17			STABLE	>80Ey	0^+	08	13Be09 T	1931	IS=5.54 14; $2\beta^+$?	*
^{96}Rh	-79688	10			9.90 m 0.10	6^+	08		1967	β^+ =100		

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
$^{96}\text{Rh}^m$	-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	
$^{96}\text{Pd}^m$	-73652	4	2530.57	0.23	1.804 μ s	0.007	8 ⁺ #	08 17Pa35	T	1983	IT=100
^{96}Ag	-64510	90			4.45 s	0.03	(8) ⁺	08 19Pa16	TD	1982	β^+ =100; β^+ p=4.2 4
$^{96}\text{Ag}^m$	-64510#	100#	0#	50#	6.9 s	0.5	(2 ⁺)	08 12Lo08	TD	2003	β^+ =100; β^+ p=14.9 18
$^{96}\text{Ag}^n$	-62050	90	2461.4	0.3	103.2 μ s	4.5	(13 ⁻)	11Bo23	TJD	2011	IT=100
$^{96}\text{Ag}^p$	-61820	90	2686.7	0.4	1.561 μ s	0.016	(15 ⁺)	08 17Pa35	ETJ	2011	IT=100
$^{96}\text{Ag}^q$	-57560	90	6951.8	1.4	132 ns	17	(19 ⁺)	17Pa35	ETJ	2011	IT=100
^{96}Cd	-55570#	410#			1003 ms	47	0 ⁺	10 19Pa16	TD	2008	β^+ =100; β^+ p=1.6 3
$^{96}\text{Cd}^m$	-49540#	1450#	6030	1390	511 ms	26	16 ⁺	10 19Pa16	ETD	2011	β^+ =100; β^+ p=15.4 21
$^{96}\text{Cd}^n$	-49970#	410#	5605	5	198 ns	18	(12 ⁻ , 13 ⁻)	19Da02	EJ	2019	IT=100
^{96}In	-38090#	500#			1# ms	>400ns		16 16Ce02	I	2016	β^+ ?; p ?
$^{96}\text{Br}^m$	T : symmetrized from 12Ka36=2.7(+1.1-0.7)									**	
^{96}Rb	J : 81Th04=2									**	
^{96}Rb	D : % β^- -n average 93Ru01=14.7(1.0) 81Ho07=14.7(1.2) 81En05=14.2(1.2)									**	
^{96}Rb	D : 79Ri09=12.5(0.9) 69Am01=12.7(1.5)									**	
^{96}Rb	T : average 12Qu01=212(17) 03Be05=197(6) 93Ru01=201(1) 79Ri09=197(5)									**	
^{96}Rb	T : 78Wo09=203(4) 77Re05=205(4) 74Ro15=199(3.5) 71Tr02=207(3)									**	
$^{96}\text{Rb}^m$	I : non-observation in 81Th04 is not in contradiction with 81Bo30									**	
$^{96}\text{Rb}^n$	T : average 12Ka36=1.72(+0.16-0.14) 11Ru.A=1.77(0.05) 05Pi13=2.0(0.1)									**	
$^{96}\text{Rb}^n$	T : 99Ge01=1.65(0.15)									**	
^{96}Sr	T : average 12Qu01=0.950(0.035) 90Ma03=1.07(0.01) 79En02=1.10(0.02)									**	
^{96}Sr	T : 78Wo09=1.015(0.019) 75Ba36=1.06(0.04)									**	
^{96}Y	J : 07Ch07=0									**	
$^{96}\text{Y}^m$	J : 07Ch07=8									**	
^{96}Zr	T : 2v- $\beta\beta$ average 18Ma51=20.3(+4.6-0.31) 10Ar07=23.5(1.4,stat)(1.6,syst)									**	
^{96}Zr	T : 99Ar25=21(+8-4,stat + 2,syst); others 93Ka12=39(9) and 01Wi17=9.4(3.2)									**	
^{96}Zr	T : in geochemical exp., 16Fi01>24Ey; 20Ba.A,15Ba11=23(2) (evaluation)									**	
^{96}Ru	T : 2nu- $\beta^+\epsilon$ >80 Ey (theor. most probable); 2nu $\beta^+\beta^+$ >140 Ey 0nu2K>1 Zy									**	
$^{96}\text{Pd}^m$	T : average 17Pa35=1.80(0.01) 98Gr.B=1.81(0.01), supersedes 97Gr02=1.7(0.1),									**	
$^{96}\text{Pd}^m$	T : 09Ga40=1.76(0.05); others 07My02=2.10(0.21) 83Gr01=2.2(0.3)									**	
^{96}Ag	T : average 19Pa16=4.46(0.04) 03Ba39=4.40(0.06) 97Sc30=4.50(0.06)									**	
^{96}Ag	D : % β^+ p average 19Pa16=4.4(0.5) 96He25=3.7(0.9)									**	
$^{96}\text{Ag}^m$	T : average 12Lo08=6.8(1.0) 03Ba39=6.9(0.6)									**	
$^{96}\text{Ag}^m$	D : % β^+ p average 19Pa16=14.7(2.4) 12Lo08=14(3) 03Ba39=18(5)									**	
$^{96}\text{Ag}^n$	E : from a least-squares fit to Eg using 11Bo23 level scheme									**	
$^{96}\text{Ag}^n$	T : average 19Ha26=104(5) 11Bo23=100(10)									**	
$^{96}\text{Ag}^p$	E : 43.7(0.2) keV above the 2643(0.3) keV, 13+ level									**	
$^{96}\text{Ag}^p$	T : average 17Pa35=1.57(0.02) 11Bo23=1.56(0.03) 11Be34=1.45(0.07)									**	
$^{96}\text{Ag}^q$	E : 4265(2) keV above 96Agp									**	
$^{96}\text{Ag}^q$	T : average 19Ha26=120(20), supersedes 17Pa35=160(41), 11Bo23=160(30)									**	
^{96}Cd	T : average 19Pa16=1020(60) 17Da07=970(90) 10St.A=990(130)									**	
^{96}Cd	D : % β^+ p average 19Pa16=1.7(0.4) 17Da07=1.5(0.5)									**	
$^{96}\text{Cd}^m$	E : symmetrized from 5810(+1560-1220) keV									**	
$^{96}\text{Cd}^m$	T : average 19Pa16=530(30) 17Da07=450(+50-40); other 11Na34=290(+110-100)									**	
$^{96}\text{Cd}^m$	D : % β^+ p average 19Pa16=19.5(2.9) 17Da07=11(3)									**	
$^{96}\text{Cd}^n$	T : symmetrized from 19Da02=197(+19-17)									**	
$^{96}\text{Cd}^n$	E : uncertainty of 1 keV is assumed for all gamma rays in the cascade									**	
^{97}Br	-34000#	400#			40# ms	>300ns	5/2 ⁻ #	10	1997	β^- ?; β^- -n ?; β^- -2n ?	
^{97}Kr	-47420	130			62.2 ms	3.2	3/2 ⁺ #	10 11Ni01	T	1997	β^- =100; β^- -n=6.7 6; β^- -2n ?
^{97}Rb	-58519.1	1.9			169.1 ms	0.6	3/2 ⁺ *	15	1969	β^- =100; β^- -n=25.5 9; β^- -2n ?	
$^{97}\text{Rb}^m$	-58442.5	1.9	76.6	0.2	5.7 μ s	0.6	(1/2,3/2) ⁻	15	2012	IT=100	
^{97}Sr	-68581	3			432 ms	4	1/2 ⁺ *	10 02Pf04	D	1978	β^- =100; β^- -n=0.02 1
$^{97}\text{Sr}^m$	-68273	3	308.13	0.11	175.2 ns	2.1	7/2 ⁺	10 19Es04	T	1990	IT=100
$^{97}\text{Sr}^n$	-67750	3	830.83	0.23	513 ns	5	(9/2 ⁺)	10 19Es04	T	1974	IT=100
^{97}Y	-76115	7			3.75 s	0.03	1/2 ⁻ *	10	1970	β^- =100; β^- -n=0.055 4	
$^{97}\text{Y}^m$	-75447	7	667.52	0.23	1.17 s	0.03	9/2 ⁺ *	10 83Re10	D	1970	β^- >99.3;IT<0.7; β^- -n=0.11 3
$^{97}\text{Y}^n$	-72592	7	3522.6	0.4	142 ms	8	(27/2 ⁻)*	10	1986	IT=94.8 9; β^- =5.2 9	
^{97}Zr	-82936.69	0.12			16.749 h	0.008	1/2 ⁺ *	10	1951	β^- =100	
$^{97}\text{Zr}^m$	-81672.34	0.20	1264.35	0.16	104.8 ns	1.7	7/2 ⁺	10 11Ru.A	T	1976	IT=100

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{97}Nb	-85603	4	72.1 m 0.7	$9/2^+$	10		1951	$\beta^- = 100$
$^{97}\text{Nb}^m$	-84860	4	58.7 s 1.8	$1/2^-$	10		1950	IT=100
^{97}Mo	-87544.70	0.16	STABLE	$5/2^{+*}$	10		1930	IS=9.582 15
^{97}Tc	-87224	4	4.21 My0.16	$9/2^{+*}$	10	20Kr09 J	1946	$\varepsilon = 100$ *
$^{97}\text{Tc}^m$	-87127	4	91.1 d 0.6	$1/2^-$	10	98Ko27 DT	1954	IT=96.06 18; $\varepsilon = 3.94$ 18 *
^{97}Ru	-86120.6	2.8	2.8370 d 0.0014	$5/2^+$	10	09Go29 T	1946	$\beta^+ = 100$
^{97}Rh	-82600	40	30.7 m 0.6	$9/2^+$	10		1955	$\beta^+ = 100$
$^{97}\text{Rh}^m$	-82340	40	46.2 m 1.6	$1/2^-$	10		1971	$\beta^+ = 94.4$ 6;IT=5.6 6
^{97}Pd	-77806	5	3.10 m 0.09	$5/2^{+*}$	10		1969	$\beta^+ = 100$
^{97}Ag	-70904	12	25.5 s 0.3	$(9/2)^{+*}$	10		1978	$\beta^+ = 100$ *
$^{97}\text{Ag}^m$	-70290	40	100# ms	$1/2^- \#$		20Ho03 E	2019	IT ?
^{97}Cd	-60730	420	1.16 s 0.05	$(9/2^+)$	10	19Pa16 TD	1978	$\beta^+ = 100$; $\beta^+ p = 7.4$ 2 *
$^{97}\text{Cd}^m$	-59480	420	730 μ s 70	$(1/2^-)$		19Pa16 ETD2019		IT=100
$^{97}\text{Cd}^n$	-58110	720	3.86 s 0.06	$(25/2^+)$	10	19Pa16 ETD1982		$\beta^+ = 100$; $\beta^+ p = 25.1$ 5 *
^{97}In	-47390#	400#	36 ms 6	$9/2^{+*}$		18Pa20 TD	2011	$\beta^+ = 100$; $\beta^+ p = 2.3$ 13; p ? *
$^{97}\text{In}^m$	-46990#	410#	0.12 ms 0.07	$1/2^- \#$	20	18Pa20 TD	2018	p ? *
* ^{97}Kr T : average 11Ni01=60(+6-5) 03Be05=63(4) **								
* ^{97}Sr J : 90Li28=1/2 **								
* ^{97}Sr T : average 12Qu01=456(5,stat)(13,syst) 86Wa17=429(5) 87PfZX=420(20) **								
* ^{97}Sr T : 82Ga24=420(40) 78Wo09=441(15); others (not used) 81En05=390(30) **								
* ^{97}Sr T : 83Re10=403(4), superseded by 86Wa17 79En02=430(30), superseded by **								
* ^{97}Sr T : 81En05 **								
* $^{97}\text{Sr}^m$ T : average 19Es04=174.7(6.9) 15Cz01=165(4) 11Ru.A=180.9(2.8) 06Hw01=165(25) **								
* $^{97}\text{Sr}^m$ T : 83Kr11=170(10) **								
* $^{97}\text{Sr}^n$ T : average 19Es04=526(17) 18Rz01=504(8) 13Ru07=515(10) 05Zl01=526(13); **								
* $^{97}\text{Sr}^n$ T : others (not used) 12Ka36=520(+160-120) 80Mo.A=515(15) 06Hw01=255(56) **								
* $^{97}\text{Sr}^n$ T : 03Hw03=265(27), non standard technique and conflicting **								
* ^{97}Y J : 07Ch07=1/2 **								
* $^{97}\text{Y}^m$ J : 07Ch07=9/2 **								
* $^{97}\text{Y}^m$ D : % β^- -n from 83Re10=0.11(0.03); other 86Wa17<0.08 **								
* $^{97}\text{Y}^n$ J : 07Ch07=(27/2) **								
* ^{97}Zr J : 02Ca37=1/2 **								
* $^{97}\text{Zr}^m$ T : average 11Ru.A=106.1(2.1) 85Be20=102(3); others outweighed 06Hw01=97(16) **								
* $^{97}\text{Zr}^m$ T : 96Lh03=106(7) **								
* ^{97}Tc T : from 98Ko27 **								
* $^{97}\text{Tc}^m$ T : average 98Ko27=91.4(0.8), supersedes 93Ko64=92.2(1.8), 54Bo24=90.5(1.0) **								
* ^{97}Ag J : 14Fe01=(9/2) **								
* ^{97}Cd T : average 19Pa16=1.20(0.07) 11Lo09=1.10(0.08) **								
* ^{97}Cd D : other % $\beta^+ p$ 11Lo09=11.8(20) **								
* $^{97}\text{Cd}^n$ J : 11Lo09=(25/2+) **								
* ^{97}In T : other 10St.A=26(+47-10) **								
* ^{97}In D : % $\beta^+ p$ symmetrized from 18Pa20=1.7(+1.7-0.8) **								
* $^{97}\text{In}^m$ T : from 1.3<T<230 us in 18Pa20 **								
^{98}Br	-28050#	400#	15# ms >400ns		20	10Oh02 I	2010	β^- ?; $\beta^- n$?; $\beta^- 2n$?
^{98}Kr	-44120#	300#	42.8 ms 3.6	0^+	20	11Ni01 T	1997	$\beta^- = 100$; $\beta^- n = 7.0$ 10; $\beta^- 2n$? *
^{98}Rb	-54369	16	115 ms 6	$(0^-)^*$	20		1971	$\beta^- = 100$; $\beta^- n = 14.3$ 9; $\beta^- 2n = 0.054$ 8
$^{98}\text{Rb}^m$	-54296	20	96 ms 3	$(3^+)^*$	20		1980	$\beta^- = 100$; $\beta^- n$?; $\beta^- 2n$?
$^{98}\text{Rb}^n$	-54191	16	358 ns 7	(2^-)	20	FGK205 J	2009	IT=100 *
^{98}Sr	-66422	3	653 ms 2	0^+	20		1971	$\beta^- = 100$; $\beta^- n = 0.23$ 3
^{98}Y	-72289	8	548 ms 2	0^-^*	20		1970	$\beta^- = 100$; $\beta^- n = 0.33$ 3 *
$^{98}\text{Y}^m$	-72118	8	615 ns 8	2^-	20		1972	IT=100 *
$^{98}\text{Y}^n$	-71823	8	2.32 s 0.08	$(6, 7)^+$	20	17Ur03 JED	1977	$\beta^- \approx 100$; IT ?; $\beta^- n = 3.44$ 95 *
$^{98}\text{Y}^p$	-71793	8	6.90 μ s 0.054	$(4)^-$	20		1970	IT=100 *
$^{98}\text{Y}^q$	-71695	13	180 ns 7	$(3^-, 4^-)$			2017	IT=100 *
$^{98}\text{Y}^r$	-71317	8	450 ns 150	(8^+)	20		2017	IT=100
$^{98}\text{Y}^x$	-71108	8	762 ns 14	(10^-)	20		1972	IT=100 *
^{98}Zr	-81282	8	30.7 s 0.4	0^+	20		1967	$\beta^- = 100$
$^{98}\text{Zr}^m$	-74680	8	1.9 μ s 0.2	(17^-)	20		2005	IT=100
^{98}Nb	-83525	5	2.86 s 0.06	1^+	20		1960	$\beta^- = 100$
$^{98}\text{Nb}^m$	-83441	6	51.1 m 0.4	$(5)^+$	20		1948	$\beta^- \approx 100$; IT ?

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{98}Mo	-88115.98	0.17			STABLE	>100Ty		0 ⁺	20 52Fr23 T	1930	IS=24.292 80;2 β^- ?	*
^{98}Tc	-86432	3			4.2 My0.3			6 ⁺ *	20 20Kr09 J	1955	β^- =100; β^+ =0	
$^{98}\text{Tc}^m$	-86341	3	90.77	0.16	14.7 μ s 0.5	(2,3) ⁻			20	1976	IT=100	
^{98}Ru	-88225	6			STABLE			0 ⁺	20	1944	IS=1.87 3	
^{98}Rh	-83175	12			8.72 m 0.12	(2) ⁺			20	1955	β^+ =100	
$^{98}\text{Rh}^m$	-83119	12	56.3	1.0	3.6 m 0.2	(5 ⁺)			20	1966	IT=89 5; β^+ =11 5	
^{98}Pd	-81321	5			17.7 m 0.4	0 ⁺			20	1955	β^+ =100	
^{98}Ag	-73070	30			47.5 s 0.3	(6) ⁺ *			20	1978	β^+ =100; β^+ p=0.0012 5	*
$^{98}\text{Ag}^m$	-72960	30	107.28	0.10	161 ns 7	(4 ⁺)			20	1998	IT=100	
^{98}Cd	-67640	50			9.29 s 0.10	0 ⁺			20	1978	β^+ =100; β^+ p<0.029	*
$^{98}\text{Cd}^m$	-65210	50	2428.3	0.4	154 ns 16	(8 ⁺)			20 17Pa35 T	1996	IT=100	
$^{98}\text{Cd}^n$	-61010	50	6635	2	224 ns 5	(12 ⁺)			20	2004	IT=100	
^{98}In	-53910#	300#			30 ms 1	(0 ⁺)			20	1994	β^+ =100; β^+ p≤0.13	
$^{98}\text{In}^m$	-53090#	790#	820	730	890 ms 20	(9 ⁺)			20	2001	β^+ =100; β^+ p=44 2	
* ^{98}Kr	T : average 11Ni01=42(4) 03Be05=46(8)										**	
* $^{98}\text{Rb}^n$	J : 178.5 keV gamma to (0-) and Weisskopf estimates for E1,M1 and E2										**	
* ^{98}Y	J : 07Ch07=0										**	
* $^{98}\text{Y}^m$	T : average 17Ur03=640(20) 11Ru.A=610(9); other: 70Gr38=620(80)										**	
* $^{98}\text{Y}^n$	J : other: 07Ch07=(4,5) hfs										**	
* $^{98}\text{Y}^n$	D : % β^- -n from 81En05										**	
* $^{98}\text{Y}^p$	T : average 17Ur03=6.95(0.06) 11Ru.At=6.87(0.05)										**	
* $^{98}\text{Y}^q$	E : 564.0+x keV is proposed in 17Ur03; x=30(10) is estimated by Nubase										**	
* $^{98}\text{Y}^x$	T : average 11Ru.At=806(21) 17Ur03=720(20) 70Gr38=830(100)										**	
* ^{98}Mo	T : Onu-BB 52Fr23>100 Ty (theoretically faster, see text)										**	
* ^{98}Ag	D : % β^+ p symmetrized from 96He25=0.0011(+5-4)										**	
* ^{98}Ag	J : 14Fe01=(5,6)										**	
* ^{98}Cd	T : average 92Pl01=9.2(0.3) 19Pa16=9.3 (0.1)										**	
^{99}Kr	-38400#	400#			40 ms 11	5/2 ⁻ #		17 03Be05 TD	1997	β^- =100; β^- n=11 7; β^- 2n ?	*	
^{99}Rb	-51121	4			54 ms 4	(3/2 ⁺)		17 02Pf04 D	1971	β^- =100; β^- n=17.3 25; β^- 2n ?		
^{99}Sr	-62519	5			269.2 ms 1.0	3/2 ⁺ *		17 93Ru01 D	1975	β^- =100; β^- n=0.100 19	*	
^{99}Y	-70644	7			1.484 s 0.007	5/2 ⁺ *		17	1975	β^- =100; β^- n=1.77 19		
$^{99}\text{Y}^m$	-68502	7	2141.65	0.19	8.2 μ s 0.4	(17/2 ⁺)		17	1985	IT=100	*	
^{99}Zr	-77617	10			2.1 s 0.1	1/2 ⁺ *		17	1970	β^- =100	*	
$^{99}\text{Zr}^m$	-77365	10	251.96	0.09	336 ns 5	7/2 ⁺		17 20Bo04 T	1970	IT=100	*	
^{99}Nb	-82335	12			15.0 s 0.2	9/2 ⁺ *		17	1950	β^- =100	*	
$^{99}\text{Nb}^m$	-81970	12	365.27	0.08	2.5 m 0.2	1/2 ⁻		17	1960	β^- ≈100;IT=?		
^{99}Mo	-85970.11	0.23			65.932 h 0.005	1/2 ⁺ *		17 FGK209 T	1948	β^- =100	*	
$^{99}\text{Mo}^m$	-85872.33	0.23	97.785	0.003	15.5 μ s 0.2	5/2 ⁺		17	1958	IT=100		
$^{99}\text{Mo}^n$	-85286.01	0.30	684.10	0.19	760 ns 60	11/2 ⁻		17	1975	IT=100		
^{99}Tc	-87327.9	0.9			211.1 ky 1.2	9/2 ⁺ *		17 20Kr09 J	1938	β^- =100	*	
$^{99}\text{Tc}^m$	-87185.2	0.9	142.6836	0.0011	6.0066 h 0.0002	1/2 ⁻ *		17 FGK209 T	1958	IT≈100; β^- =0.0037 6		
^{99}Ru	-87625.4	0.3			STABLE	5/2 ⁺ *		17	1931	IS=12.76 14	*	
^{99}Rh	-85585	19			16.1 d 0.2	1/2 ⁻		17	1952	β^+ =100		
$^{99}\text{Rh}^m$	-85521	19	64.4	0.5	4.7 h 0.1	9/2 ⁺ *		17	1952	β^+ ≈100;IT ?		
^{99}Pd	-82183	5			21.4 m 0.2	(5/2 ⁺)		17	1955	β^+ =100		
^{99}Ag	-76712	6			2.07 m 0.05	(9/2 ⁺)		17	1967	β^+ =100	*	
$^{99}\text{Ag}^m$	-76206	6	506.2	0.4	10.5 s 0.5	(1/2 ⁻)		17	1978	IT=100	*	
^{99}Cd	-69931.1	1.6			17 s 1	5/2 ⁺ #		17 19Pa16 TD	1978	β^+ =100; β^+ p=0.21 2; β^+ α <1e-4		
^{99}In	-61380#	300#			3.11 s 0.06	9/2 ⁺ #		17 19Pa16 TD	1994	β^+ =100; β^+ p=0.29 3		
$^{99}\text{In}^m$	-60980#	340#	400#	150#	1# s	1/2 ⁻ #				β^+ ?; β^+ p ?;IT ?		
^{99}Sn	-47980#	580#			24 ms 4	9/2 ⁺ #		17 18Pa20 TD	2011	β^+ =100; β^+ p=5 3	*	
* ^{99}Kr	T : other 11Ni01=13(+34-6)										**	
* ^{99}Sr	J : 91Li05,90Li28=3/2										**	
* ^{99}Sr	T : average 86ReZU=269(1) 83Re10=274(4) 83Wo10=266(6)										**	
* ^{99}Y	J : 07Ch07=5/2										**	
* ^{99}Y	T : other (recent) 19Do02=1.27(0.25)										**	
* $^{99}\text{Y}^m$	T : average 13RuZX=8.0(0.5) 85Me09=8.6(0.8); other: 99Ge01=11(2)										**	
* ^{99}Zr	J : 02Ca37=1/2										**	
* $^{99}\text{Zr}^m$	J : 130.2-keV gamma ray, E2 to 3/2+										**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ⁹⁹ Zr ^m	T : other 04Hw02=316(48) 99Ge01=400(20) 79Se01=292(20) 70Gr38=400(80)								**
* ⁹⁹ Nb	J : 09Ch25=9/2								**
* ⁹⁹ Mo	J : 74Ru05=1/2								**
* ⁹⁹ Tc	J : 20Kr09,58Lo62=9/2								**
* ⁹⁹ Ru	J : 13Ma15=5/2								**
* ⁹⁹ Ag	J : 14Fe01=(9/2)								**
* ⁹⁹ Ag ^m	J : 14Fe01=(1/2)								**
* ⁹⁹ Sn	D : % β^+ p symmetrized from 18Pa20=3.9(+3.4-1.7)								**
¹⁰⁰ Kr	-34470#	400#	12 ms 8	0 ⁺	11	11Ni01	TD 1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
¹⁰⁰ Rb	-46266	13	51.3 ms 1.6	4 ⁻ #	08	20Mu.A	T 1978	$\beta^- = 100; \beta^- n = 5.6 \text{ } 12; \beta^- 2n = 0.15 \text{ } 5$	*
¹⁰⁰ Sr	-59818	7	202.1 ms 1.7	0 ⁺	08	02Pf04	D 1978	$\beta^- = 100; \beta^- n = 1.11 \text{ } 34$	*
¹⁰⁰ Sr ^m	-58199	7	1618.72 0.20	122 ns 9	(4 ⁻)	12Ka36	T 1995	IT=100	*
¹⁰⁰ Y	-67321	11	&	940 ms 30	4 ⁺ *	08 10Ba31	J 1977	$\beta^- = 100; \beta^- n ?$	*
¹⁰⁰ Y ^m	-67177	11	144 16 MD &	727 ms 6	1 ⁺ #	08 93Ru01	D 1977	$\beta^- = 100; \beta^- n = 1.08 \text{ } 6$	*
¹⁰⁰ Zr	-76373	8	7.1 s 0.4	0 ⁺	08		1970	$\beta^- = 100$	
¹⁰⁰ Nb	-79791	8	1.5 s 0.2	1 ⁺	08		1967	$\beta^- = 100$	
¹⁰⁰ Nb ^m	-79478.5	2.0	313 8 MD	2.99 s 0.11	(5 ⁺)	08	1967	$\beta^- = 100$	
¹⁰⁰ Nb ⁿ	-79444	11	347 8	460 ns 60	(4 ⁻ , 5 ⁻)	08	1986	IT=100	*
¹⁰⁰ Nb ^p	-79057	11	734 8	12.43 μ s 0.26	(8 ⁻)	08 11Ru.A	T 1980	IT=100	*
¹⁰⁰ Mo	-86193.0	0.3	7.07 Ey 0.14	0 ⁺	08 20Ba.A	T 1930	IS=9.744 65; 2 $\beta^- = 100$		*
¹⁰⁰ Tc	-86021.0	1.4	15.46 s 0.19	1 ⁺	08		1952	$\beta^- \approx 100; \epsilon = 0.0018 \text{ } 9$	
¹⁰⁰ Tc ^m	-85820.3	1.4	200.67 0.04	8.32 μ s 0.14	(4 ⁺)	08	1958	IT=100	
¹⁰⁰ Tc ⁿ	-85777.1	1.4	243.95 0.04	3.2 μ s 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	$\beta^+ = 100; \epsilon = 95.1 \text{ } 5; e^+ = 4.9 \text{ } 5$	
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 $\approx$ 98.3; $\beta^+ \approx 1.7$	
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	$\epsilon = 100$	
¹⁰⁰ Ag	-78138	5		2.01 m 0.09	(5 ⁺) ⁺ *	08	1970	$\beta^+ = 100$	*
¹⁰⁰ Ag ^m	-78122	5	15.52 0.16	2.24 m 0.13	(2 ⁺)	08	1980	$\beta^+ = ?; IT ?$	
¹⁰⁰ Cd	-74194.6	1.7		49.1 s 0.5	0 ⁺	10	1970	$\beta^+ = 100$	
¹⁰⁰ In	-64178.1	2.2		5.62 s 0.06	6 ⁺ #	14 19Pa16	TD 1982	$\beta^+ = 100; \beta^+ p = 1.66 \text{ } 3$	
¹⁰⁰ Sn	-57150	240		1.18 s 0.08	0 ⁺	14 19Lu08	T 1994	$\beta^+ = 100; \beta^+ p < 17$	*
¹⁰⁰ Sn ^m	-52650#	310#	4500# 200#	100# ns	6 ⁺ #	11Hi.A	ETJ	p ?	
* ¹⁰⁰ Kr	T : symmetrized from 11Ni01=7(+11-3)								**
* ¹⁰⁰ Rb	T : average 20Mu.A=50(5) 11Ni01=48(3) 87PfZX=53(2)								**
* ¹⁰⁰ Rb	D : % $\beta^- n$ from 93Ru01; % $\beta^- 2n$ from P2n/Pn=0.027 7 in 81JoZV and % $\beta^- n$								**
* ¹⁰⁰ Sr	T : average 11Ni01=181(+16-13) 93Ru01=165(24) 87PfZX=207(10) 86Wa17=204(2)								**
* ¹⁰⁰ Sr	T : 86Wo01=193(4) 83Mu19=214(8) 78Ko29=170(80) 85IaZZ=200(20)								**
* ¹⁰⁰ Sr ^m	T : other 95Pf04=85(7)								**
* ¹⁰⁰ Y	J : 10Ba31=4+ and p5/2[422] n3/2[411], K=4+ configuration by the measured								**
* ¹⁰⁰ Y	J : magnetic moment; other 07Ch07=(3), Ensdf2008 assigns J=(3,4,5) and								**
* ¹⁰⁰ Y	J : associate this state with an excited isomer								**
* ¹⁰⁰ Y	T : from $\beta^- - \gamma(t)$ in 77Kh03, where low- and high-spin β^- decaying								**
* ¹⁰⁰ Y	T : isomers were resolved; recent (from $\beta(t)$) 09Pe06=660(+150-120)								**
* ¹⁰⁰ Y	T : and 12Qu01=845(80,stat)(55,syst) include both gs and isomer								**
* ¹⁰⁰ Y ^m	T : average 96Me09=710(30) 86Wo01=735(7) 83Mu14=682(18) 73Kh03=550(150)								**
* ¹⁰⁰ Y ^m	T : from data dominated by the ¹⁰⁰ Sr ($J^\pi=0^+$) isobar and hence								**
* ¹⁰⁰ Y ^m	T : a preferable feeding to the low-spin isomer								**
* ¹⁰⁰ Y ^m	J : direct β^- feeding to 0+ states in ¹⁰⁰ Zr in 86Wo01;								**
* ¹⁰⁰ Y ^m	J : p5/2[422] n3/2[411], K=1+ configuration								**
* ¹⁰⁰ Y ^m	D : % $\beta^- n$ other (after 93Ru01) 96Me09=1.8(0.6) 02Pf04=1.16(0.32), compilation								**
* ¹⁰⁰ Nb ⁿ	E : 34.3 keV above the 5+ isomer								**
* ¹⁰⁰ Nb ⁿ	J : a cascade of two M1 gamma rays from 6- and absence of gamma from 8-								**
* ¹⁰⁰ Nb ^p	E : 420.7 keV above the 5+ isomer								**
* ¹⁰⁰ Nb ^p	J : 28 keV gamma, (E2) to (6-)								**
* ¹⁰⁰ Mo	T : 2v- $\beta\beta$ symmetrized from 20Ba.A=7.06(+0.15-0.13) (evaluation); others								**
* ¹⁰⁰ Mo	T : (recent) 20Ar09=7.12(+0.18-0.14,stat)(0.10,syst)								**

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁰⁰ Mo	T : 19Ar04=6.81(0.01,stat)(+0.38-0.40,syst)								**
* ¹⁰⁰ Mo	T : 17Ar18=6.90(0.15,stat)(0.37,syst) 15Ba11=7.1(0.4) (evaluation)								**
* ¹⁰⁰ Ag	J : 14Fe01=(5)								**
* ¹⁰⁰ Sn	T : also 12Hi07=1.16(0.20) 08Ba53=0.55(+0.70-0.31) 96Ki23=0.94(+0.54-0.26)								**
¹⁰¹ Kr	-28580#	500#	9# ms >400ns	5/2 ⁺ #	10	10Oh02 I	2010	β^- ?; β^- n ?; β^- 2n ?	
¹⁰¹ Rb	-42567	20	31.8 ms 3.3	3/2 ⁺ #	06	11Ni01 T	1992	β^- =100; β^- n=28 4; β^- 2n ?	*
¹⁰¹ Sr	-55325	8	113.7 ms 1.7	(5/2 ⁻)	06	02Pf04 D	1983	β^- =100; β^- n=2.75 35	*
¹⁰¹ Y	-65055	7	426 ms 20	5/2 ⁺ *	06	02Pf04 D	1983	β^- =100; β^- n=2.3 8	*
¹⁰¹ Y ^m	-63850	7	1205.0 1.0	870 ns 90	13/2 ⁻ #	09Fo05 ETD	2009	IT=100	*
¹⁰¹ Zr	-73161	8	2.29 s 0.08	3/2 ⁺ *	06		1972	β^- =100	*
¹⁰¹ Nb	-78891	4	7.1 s 0.3	5/2 ⁺ *	06		1970	β^- =100	*
¹⁰¹ Mo	-83520.0	0.3	14.61 m 0.03	1/2 ⁺	06		1941	β^- =100	
¹⁰¹ Mo ^m	-83506.5	0.3	13.497 0.009	226 ns 7	3/2 ⁺	06	1977	IT=100	
¹⁰¹ Mo ⁿ	-83463.0	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 μ s 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 μ s 0.4	11/2 ⁻	06	1974	IT=100	
¹⁰¹ Rh	-87412	6	4.07 y 0.05	1/2 ⁻	06	18Sh09 T	1948	ϵ =100	
¹⁰¹ Rh ^m	-87255	6	157.32 0.03	4.343 d 0.010	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		1966	β^+ =100	*
¹⁰¹ Ag ^m	-81060	5	274.1 0.3	3.10 s 0.10	(1/2 ⁻)*	06	1975	IT=100	*
¹⁰¹ Cd	-75836.5	1.5	1.36 m 0.05	5/2 ⁺ *	06	18Yo07 J	1969	β^+ =100	
¹⁰¹ In	-68545	12	15.1 s 1.1	(9/2 ⁺)	06	19Pa16 D	1988	β^+ =100; β^+ p<1.7	*
¹⁰¹ In ^m	-67910	40	640 40 MD	10# s	1/2 ⁻ #	20Ho03 E	2019	β^+ ?; IT ?	*
¹⁰¹ Sn	-60310	300	2.22 s 0.05	(7/2 ⁺)	07	19Pa16 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) 87PfZX=104(15)								**
* ¹⁰¹ Y	T : average 96Me09=400(20) 86Wa17=440(20) 83Wo10=500(50); others								**
* ¹⁰¹ Y	T : 09Pe06=510(+76-67) 12Qu01=480(+143-114) 93Ru01=279(9), outlier								**
* ¹⁰¹ Y	J : 07Ch07=5/2								**
* ¹⁰¹ Y ^m	T : symmetrized from 09Fo05=860(+90-80); other 12Ka36=187(+49-38)								**
* ¹⁰¹ Y ^m	E : E(13/2 ⁺)=724.98(10) keV from 05Lu21 + 480(1) keV from 09Fo05								**
* ¹⁰¹ Y ^m	I : 09Fo05=129,164,204,230 and 480 gamma rays in a cascade to gs, the first								**
* ¹⁰¹ Y ^m	I : four in agreement with SF data of 05Lu21; other 12Ka36=128.0(0.5) and								**
* ¹⁰¹ Y ^m	I : 203.5(0.5) gamma rays in a cascade to gs, but limited statistics								**
* ¹⁰¹ Zr	T : average 19Do02=2.27(0.12) 72Th08=2.3(0.1)								**
* ¹⁰¹ Zr	J : 02Ca37=3/2								**
* ¹⁰¹ Nb	J : 09Ch25=5/2								**
* ¹⁰¹ Rh ^m	T : average 68Li08=4.39(0.08) 66Ar05=4.34(0.01)								**
* ¹⁰¹ Rh ^m	T : 65Er04=4.43(0.06); Birge ratio=3.22								**
* ¹⁰¹ Ag	J : other 14Fe01=9/2								**
* ¹⁰¹ Ag ^m	J : 14Fe01=(1/2)								**
* ¹⁰¹ In	T : average 97Sz04=14.9(1.2) 88Hu07=16(3)								**
* ¹⁰¹ In ^m	E : average 20Ho03=608(57) 19Xu13=659(50)								**
* ¹⁰¹ Sn	D : % β^+ p average 19Pa16=23.6(0.8) 12Lo08=22(1) 10St.A=20(1)								**
* ¹⁰¹ Sn	J : from 10Da17								**
¹⁰² Rb	-37250	80	37 ms 4	(4 ⁺)	09	16Wa16 JD	1995	β^- =100; β^- n=65 22; β^- 2n ?	*
¹⁰² Sr	-52160	70	69 ms 6	0 ⁺	09		1986	β^- =100; β^- n=5.5 15	*
¹⁰² Y	-61173	4	360 ms 40	(5 ⁻)	09	17Br12 ID	1980	β^- =100; β^- n<2.6	*
¹⁰² Y ^m	-61070#	100#	300 ms 100	(0 ⁻ , 1 ⁻)	09		1983	β^- =100; β^- n<2.6; IT ?	*
¹⁰² Zr	-71581	9	2.01 s 0.08	0 ⁺	09	19Do02 T	1970	β^- =100	
¹⁰² Nb	-76298.3	2.5	4.3 s 0.4	(4 ⁺)	09		1972	β^- =100	
¹⁰² Nb ^m	-76204	8	94 7 MD	(1 ⁺)	09	19Do02 T	1976	β^- =100; IT ?	*
¹⁰² Mo	-83561	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	-84520#	50#	50# 50# *	4.35 m 0.07	(4 ⁺)	09	1954	β^- $\approx$ 100; IT ?	*
¹⁰² Ru	-89106.4	0.4	STABLE	0 ⁺	09		1931	IS=31.55 14	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{102}Rh	-86783	6	207.0 d 1.5	2^-*	09	98Sh21 T	1941	$\beta^+=78.5; \beta^-=22.5$	*
$^{102}\text{Rh}^m$	-86642	6	3.742 y 0.010	6^+*	09	99Gi14 J	1962	$\beta^+\approx 100; IT=0.233$	24
^{102}Pd	-87903.0	0.4	STABLE	0^+	09	16Le16 T	1935	$IS=1.02$	$1; 2\beta^+ ?$
^{102}Ag	-82247	8	12.9 m 0.3	5^+*	09		1960	$\beta^+=100$	
$^{102}\text{Ag}^m$	-82238	8	7.7 m 0.5	2^+*	09		1967	$\beta^+=51.5; IT=49.5$	
^{102}Cd	-79659.7	1.7	5.5 m 0.5	0^+	09		1969	$\beta^+=100$	
^{102}In	-70695	5	23.3 s 0.1	(6^+)	09	95Sz01 J	1981	$\beta^+=100; \beta^+p=0.0093$	13
^{102}Sn	-64930	100	3.8 s 0.2	0^+	09		1994	$\beta^+=100$	*
$^{102}\text{Sn}^m$	-62910	100	367 ns 8	(6^+)	09	98Li50 E	1996	$IT=100$	*
^{102}Sb	-51100#	400#						p ?	
* ^{102}Rb	T : average $15\text{Lo}04=37(10)$ $11\text{Ni}01=35(+15-8)$ $87\text{PfZX}=37(5)$								**
* ^{102}Rb	D : other $\beta^-n=18(8)$ in 87PfZX								**
* ^{102}Sr	T : also $11\text{Ni}01=85(15)$								**
* ^{102}Y	J : direct β^- feeding of 4- and 5- levels in ^{102}Zr in $17\text{Br}12$;								**
* ^{102}Y	J : $p5/2[422]n5/2[532]$, K=5- configuration from systematics								**
* ^{102}Y	T : from $91\text{Hi}02$ for the high-spin β^- decaying state								**
* ^{102}Y	D : from $\beta^-n=4.9$ 12, average $86\text{ReZS}=6.0(1.7)$ $96\text{Me}09=4.0(1.5)$,								**
* ^{102}Y	D : and by splitting equally between gs and isomer								**
* $^{102}\text{Y}^m$	J : direct β^- feeding of ^{102}Sr (0^+) - see discussion in $91\text{Hi}02$;								**
* $^{102}\text{Y}^m$	J : $p5/2[422]n5/2[532]$, K=0- configuration from systematics; other								**
* $^{102}\text{Y}^m$	J : $07\text{Ch}07=(2,3)$								**
* $^{102}\text{Y}^m$	T : from $91\text{Hi}02$ for the low-spin β^- decaying state								**
* $^{102}\text{Y}^m$	D : from $\beta^-n=4.9$ 12, average $86\text{ReZS}=6.0(1.7)$ $96\text{Me}09=4.0(1.5)$,								**
* $^{102}\text{Y}^m$	D : and by splitting equally between gs and isomer								**
* $^{102}\text{Nb}^m$	T : average $19\text{Do}02=1.33(0.27)$ $76\text{Ah}06=1.3(0.2)$								**
* $^{102}\text{Tc}^m$	J : direct β^- feeding of J=4 and 5 levels and the lack of such to the 6^+								**
* $^{102}\text{Tc}^m$	J : levels in ^{102}Ru in $70\text{Hu}02$ and $69\text{Bi}16$								**
* ^{102}Rh	T : average $98\text{Sh}21=207.3(1.7)$ $61\text{Hi}06=206(3)$								**
* ^{102}Pd	T : $16\text{Le}16$ (supersedes $13\text{Le}10$) $>8.8\text{Ey}$, $>7.6\text{Ey}$ for the first excited								**
* ^{102}Pd	T : 0^+ and 2^+ states, and $>14\text{Ey}$ for the second excited 2^+								**
* ^{102}Sn	T : $95\text{Fa}.A=4.6(1.4)$, supersedes $95\text{Sc}28=4.5(0.7)$ from the same group								**
* $^{102}\text{Sn}^m$	T : from $11\text{Hi}.A$								**
^{103}Rb	-33160#	400#	26 ms 11	$3/2^+ \#$	15	$15\text{Lo}04$ TD	2010	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	*
^{103}Sr	-47280#	200#	53 ms 10	$5/2^+ \#$	15		1997	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	
^{103}Y	-58457	11	239 ms 12	$5/2^+ \#$	09	$11\text{Ni}01$ T	1994	$\beta^-=100; \beta^-n=8.0$	17
^{103}Zr	-67809	9	1.38 s 0.07	$(5/2^-)$	09	$09\text{Pe}06$ TD	1987	$\beta^-=100; \beta^-n < 1$	
^{103}Nb	-75029	4	1.34 s 0.07	$5/2^+*$	09	$19\text{Do}02$ T	1971	$\beta^-=100; \beta^-n ?$	*
^{103}Mo	-80954	9	67.5 s 1.5	$3/2^+$	09	$09\text{Ch}09$ J	1963	$\beta^-=100$	
^{103}Tc	-84604	10	54.2 s 0.8	$5/2^+$	09		1957	$\beta^-=100$	
^{103}Ru	-87267.2	0.4	39.245 d 0.008	$3/2^+$	09	$\text{FGK}204$ T	1945	$\beta^-=100$	
$^{103}\text{Ru}^m$	-87029.0	0.8	1.69 ms 0.07	$11/2^-$	09		1964	$IT=100$	
^{103}Rh	-88031.7	2.3	STABLE	$1/2^-*$	09		1934	$IS=100$	
$^{103}\text{Rh}^m$	-87991.9	2.3	56.114 m 0.009	$7/2^+$	09		1943	$IT=100$	
^{103}Pd	-87457.0	0.9	16.991 d 0.019	$5/2^+$	09		1950	$\epsilon=100$	
^{103}Ag	-84803	4	65.7 m 0.7	$7/2^+*$	09		1954	$\beta^+=100$	
$^{103}\text{Ag}^m$	-84669	4	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	$18\text{Yo}07$ J	1960	$\beta^+=100$	
^{103}In	-74632	9	60 s 1	$(9/2^+)$	09	$97\text{Sz}04$ T	1978	$\beta^+=100$	
$^{103}\text{In}^m$	-74000	9	34 s 2	$(1/2^-)$	09		1988	$\beta^+=67; IT=33$	*
^{103}Sn	-67090#	100#	7.0 s 0.2	$5/2^+ \#$	09		1981	$\beta^+=100; \beta^+p=1.2$	1
^{103}Sb	-56670#	300#	<49ns	$5/2^+ \#$	15	$13\text{Su}23$ I	2010	p ?	
* ^{103}Rb	T : symmetrized from $15\text{Lo}04=23(+13-9)$								**
* ^{103}Y	T : average $11\text{Ni}01=234(+18-15)$ $09\text{Pe}06=260(+40-20)$ $96\text{Me}09=230(20)$								**
* ^{103}Y	T : $96\text{Lh}04=190(50)$								**
* ^{103}Y	D : β^-n average $09\text{Pe}06=8(2)$ $96\text{Me}09=8(3)$								**
* ^{103}Nb	J : $09\text{Ch}25=5/2$								**
* $^{103}\text{In}^m$	E : other $20\text{Ho}03=689(77)$								**
^{104}Rb	-27450#	500#	35# ms >550ns			$18\text{Sh}11$ IT	2018	$\beta^- ?; \beta^-n ?; \beta^-2n ?$	
^{104}Sr	-43760#	300#	50.6 ms 4.2	0^+	15	$15\text{Lo}04$ T	1997	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{104}Y	-54080#	200#				197 ms 4	$(0^+, 1^+)^\#$	15	09Pe06	D	1994	$\beta^- = 100; \beta^- n = 34 \text{ } 10; \beta^- 2n ?$	*
^{104}Zr	-65718	9				920 ms 28	0^+	07	09Pe06	TD	1990	$\beta^- = 100; \beta^- n < 1$	
^{104}Nb	-71811.0	1.8			*	0.98 s 0.05	(5^-)	07			1976	$\beta^- = 100; \beta^- n = 0.05 \text{ } 3$	*
$^{104}\text{Nb}^m$	-71801.2	1.9	9.8	2.6	MD*	4.9 s 0.3	$(0^-, 1^-)$	07	FGK207	J	1971	$\beta^- = 100; \beta^- n = 0.06 \text{ } 3$	*
^{104}Mo	-80344	9				60 s 2	0^+	07			1962	$\beta^- = 100$	
^{104}Tc	-82499	25				18.3 m 0.3	(3^-)	07			1956	$\beta^- = 100$	*
$^{104}\text{Tc}^m$	-82429	25	69.7	0.2		3.5 μ s 0.3	(5^-)	07			1981	IT=100	*
$^{104}\text{Tc}^n$	-82393	25	106.1	0.3		400 ns 20	4#	07			1999	IT=100	
^{104}Ru	-88095.8	2.5				STABLE	0^+	07			1931	IS=18.62 27; $2\beta^- ?$	*
^{104}Rh	-86959.3	2.3				42.3 s 0.4	1^+	07			1939	$\beta^- = 99.55 \text{ } 10; \beta^+ = 0.45 \text{ } 10$	
$^{104}\text{Rh}^m$	-86830.3	2.3	128.9679	0.0005		4.34 m 0.03	5^+	07			1939	IT=99.87 1; $\beta^- = 0.13 \text{ } 1$	
^{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	$\beta^+ = 100$	
$^{104}\text{Ag}^m$	-85109	4	6.90	0.22		33.5 m 2.0	$2^+ *$	07			1959	$\beta^+ \approx 100; \text{IT} < 0.07$	
^{104}Cd	-83968.4	1.7				57.7 m 1.0	0^+	07			1955	$\beta^+ = 100$	
^{104}In	-76183	6				1.80 m 0.03	$(5^+) *$	07			1977	$\beta^+ = 100$	
$^{104}\text{In}^m$	-76090	6	93.48	0.10		15.7 s 0.5	(3^+)	07	89Va05	D	1988	IT=80 5; $\beta^+ = 20 \text{ } 5$	
^{104}Sn	-71627	6				20.8 s 0.5	0^+	07			1985	$\beta^+ = 100$	
^{104}Sb	-59300#	100#				470 ms 130		07	96FaZZ	TD	1995	$\beta^+ = ?; \beta^+ p < 7; p < 7; \alpha ?$	*
^{104}Te	-49630	320				< 4 ns	0^+		18Au04	D	2018	$\alpha = 100$	*
* ^{104}Sr	T : average 15Lo04=53(5) 11Ni01=43(+9-7)											**	
* ^{104}Y	T : average 15Lo04=198(20) 11Ni01=197(4) 99Wa09=180(60); other											**	
* ^{104}Y	T : 09Pe06=260(+60-50) 99Wa09=180(60)											**	
* ^{104}Nb	T : average 19Do02=0.97(0.10) 96Me09=1.0(0.1) 82Ke05=0.99(0.07)											**	
* ^{104}Nb	T : 76Ah06=0.8(0.2); other 80BaZL=0.91, no uncertainty quoted											**	
* $^{104}\text{Nb}^m$	D : % $\beta^- n$ other 83En03=0.71%, conflicting (not used)											**	
* ^{104}Tc	J : strong β^- feeding to 2+, 2- and 4+ levels in ^{104}Ru ;											**	
* ^{104}Tc	J : expected conf=p3/2[301] n3/2[411], K=3-											**	
* $^{104}\text{Tc}^m$	J : E2 gamma to (3-) level (from Ensdf2007)											**	
* ^{104}Ru	T : 0nu-BB to 1st exc. state : 13Be09>650Ey 12An08>190Ey											**	
* ^{104}Sb	T : symmetrized from 96FaZZ=440(+150-110), supersedes 95Sc28,											**	
* ^{104}Sb	T : 95Sc33=520(+180,-130)											**	
* ^{104}Sb	D : %p from 96FaZZ, supersedes 95Sc28<1%											**	
* ^{104}Te	T : from 19Xi06; other 18Au04<18 ns											**	
^{105}Sr	-38190#	500#				39 ms 5	$5/2^+ \#$	19			1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
^{105}Y	-50570#	400#				95 ms 9	$5/2^+ \#$	19	09Pe06	D	1994	$\beta^- = 100; \beta^- n < 82; \beta^- 2n ?$	*
^{105}Zr	-61458	12				670 ms 28	$1/2^+ \#$	19	09Pe06	TD	1992	$\beta^- = 100; \beta^- n < 2$	*
^{105}Nb	-69916	4				2.91 s 0.05	$(5/2^+)$	19			1984	$\beta^- = 100; \beta^- n = 1.7 \text{ } 9$	
^{105}Mo	-77331	9				36.3 s 0.8	$(5/2^-)$	19			1962	$\beta^- = 100$	
^{105}Tc	-82290	40				7.64 m 0.06	$(3/2^-)$	19			1955	$\beta^- = 100$	
^{105}Ru	-85934.5	2.5				4.439 h 0.011	$3/2^+$	19			1945	$\beta^- = 100$	
$^{105}\text{Ru}^m$	-85913.9	2.5	20.606	0.014		340 ns 15	$5/2^+$	19			1974	IT=100	
^{105}Rh	-87851.3	2.5				35.341 h 0.019	$7/2^+$	19			1945	$\beta^- = 100$	
$^{105}\text{Rh}^m$	-87721.6	2.5	129.742	0.004		42.8 s 0.3	$1/2^-$	19			1950	IT=100	
^{105}Pd	-88417.9	1.1				STABLE	$5/2^+ *$	19			1935	IS=22.33 8	
$^{105}\text{Pd}^m$	-87928.8	1.1	489.1	0.3		35.5 μ s 0.5	$11/2^-$	19			1970	IT=100	
^{105}Ag	-87071	5				41.29 d 0.07	$1/2^- *$	19			1939	$\beta^+ = 100$	
$^{105}\text{Ag}^m$	-87046	5	25.468	0.016		7.23 m 0.16	$7/2^+$	19			1969	IT=99.66 7; $\beta^+ = 0.34 \text{ } 7$	
^{105}Cd	-84333.8	1.4				55.5 m 0.4	$5/2^+ *$	19			1950	$\beta^+ = 100$	*
$^{105}\text{Cd}^m$	-81816.2	1.5	2517.6	0.5		4.5 μ s 0.5	$(21/2^+)$	19			1976	IT=100	
^{105}In	-79641	10				5.07 m 0.07	$9/2^+ *$	19			1975	$\beta^+ = 100$	
$^{105}\text{In}^m$	-78967	10	674.09	0.25		48 s 6	$(1/2^-)$	19			1975	IT $\approx$ 100; $\beta^+ ?$	*
^{105}Sn	-73338	4				32.7 s 0.5	$(5/2^+)$	19			1981	$\beta^+ = 100; \beta^+ p = 0.011 \text{ } 4$	
^{105}Sb	-64015	22				1.12 s 0.16	$(5/2^+)$	05	96FaZZ	T	1994	$\beta^+ = 100; p < 0.1; \beta^+ p ?$	*
^{105}Te	-52810	300				633 ns 66	$(7/2^+)$	06	06Se08	T	2006	$\alpha \approx 100$	*
* ^{105}Y	T : symmetrized from 15Lo04=107(+6-9); others 11Ni01=83(+5-4)											**	
* ^{105}Y	T : 09Pe06=160(+85-60)											**	
* ^{105}Zr	J : 20Ur02=1/2+, 1/2+[411]											**	
* ^{105}Cd	J : also 18Yo07=5/2											**	
* $^{105}\text{In}^m$	E : other 20Ho03=702(27)											**	
* ^{105}Sb	T : from 96FaZZ, supersedes 95Sc28=1.30(0.15) (preliminary, the same group)											**	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
* ¹⁰⁵ Sb	D : %p from 05Li47<0.1% above 430 keV, disagrees with 96FaZZ,94Ti03 1%										**		
* ¹⁰⁵ Te	T : average 06Li41=620(70) 06Se08=700(+250-170)										**		
* ¹⁰⁵ Te	J : favorite α decay to the 171.7-keV state [J=(7/2+)] in ¹⁰¹ Sn										**		
¹⁰⁶ Sr	-34300#	600#			21 ms 8	0 ⁺	15	15Lo04	T	2010	$\beta^-=100;\beta^-n\text{?};\beta^-2n\text{?}$	*	
¹⁰⁶ Y	-45790#	500#			75 ms 6	2 ⁺ #	15	15Lo04	T	1997	$\beta^-=100;\beta^-n\text{?};\beta^-2n\text{?}$	*	
¹⁰⁶ Zr	-58750#	200#			179 ms 6	0 ⁺	15	15Lo04	T	1994	$\beta^-=100;\beta^-n<7$	*	
¹⁰⁶ Nb	-66202.7	1.4			900 ms 20	1 ⁻ #	15	14Lu07	J	1976	$\beta^-=100;\beta^-n=4.5\text{ }3$	*	
¹⁰⁶ Nb ^m	-66100#	50#	100#	50#	1.20 s 0.06	(4 ⁻)		20Ha14	TJ	1976	$\beta^-=100;IT\text{?}$	*	
¹⁰⁶ Nb ⁿ	-65997.9	1.5	204.8	0.5	820 ns 38	(3 ⁺)		14Lu07	EJ	1999	IT=100	*	
¹⁰⁶ Mo	-76128	9			8.73 s 0.12	0 ⁺	08			1969	$\beta^-=100$		
¹⁰⁶ Tc	-79776	12			35.6 s 0.6	(1,2)(⁺ #)	08			1965	$\beta^-=100$		
¹⁰⁶ Ru	-86323	5			371.8 d 0.18	0 ⁺	08			1948	$\beta^-=100$		
¹⁰⁶ Rh	-86363	5			30.07 s 0.35	1 ⁺	08			1947	$\beta^-=100$		
¹⁰⁶ Rh ^m	-86231	10	132	11	BD	(6 ⁺)	08			1955	$\beta^-=100$		
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	$\beta^+\approx100;\beta^-\text{?}$		
¹⁰⁶ Ag ^m	-86852	3	89.66	0.07	8.28 d 0.02	6 ⁺ *	08			1938	$\beta^+=100;IT\text{?}$		
¹⁰⁶ Cd	-87132.2	1.1			STABLE	>1.1Zy	0 ⁺	08	16Be11	T	1935	IS=1.245 22;2 $\beta^+\text{?}$	*
¹⁰⁶ In	-80608	12			6.2 m 0.1	7 ⁺ *	08			1962	$\beta^+=100$		
¹⁰⁶ In ^m	-80579	12	28.6	0.3	5.2 m 0.1	(2 ⁺)	08			1966	$\beta^+=100$		
¹⁰⁶ Sn	-77354	5			1.92 m 0.08	0 ⁺	08			1975	$\beta^+=100$		
¹⁰⁶ Sb	-66473	7			600 ms 200	(2 ⁺)	08			1981	$\beta^+=100$		
¹⁰⁶ Sb ^m	-66370	7	103.5	0.3	226 ns 14	(4 ⁺)	08	99So08	T	1998	IT=100	*	
¹⁰⁶ Te	-58220	100			78 μ s 11	0 ⁺	08	16Ca33	T	1981	$\alpha=100$	*	
¹⁰⁶ I	-43300#	400#									$\alpha\text{?}$		
* ¹⁰⁶ Sr	T : symmetrized from 15Lo04=20(+8-7)										**		
* ¹⁰⁶ Y	T : average 15Lo04=82(+10-5) 15NiZZ=62(9); other 11Ni01=62(+25-14)										**		
* ¹⁰⁶ Zr	T : average 15Lo04=175(7) 11Ni01=186(+11-10)										**		
* ¹⁰⁶ Nb	T : from 96Me09 using $\beta^-(t)$, predominantly from the low-spin β^-										**		
* ¹⁰⁶ Nb	T : decaying state										**		
* ¹⁰⁶ Nb ^m	T : average 20Ha14=1.10(0.05) 09Pe06=1.24(0.02) 83Sh06=1.02(0.05);										**		
* ¹⁰⁶ Nb ^m	T : Birge ratio=3.2; contain contributions from the shorter gs										**		
* ¹⁰⁶ Nb ⁿ	T : average 12Ka36=660(+110-100) 99Ge01=840(40)										**		
* ¹⁰⁶ Cd	T : for $2\nu\text{-}\epsilon\beta^+$, theoretically fastest channel; others 12Be14>210Ey										**		
* ¹⁰⁶ Cd	T : 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	-28250#	700#			25# ms >400ns	1/2 ⁺ #	10	10Oh02	I	2010	$\beta^-\text{?};\beta^-n\text{?};\beta^-2n\text{?}$		
¹⁰⁷ Y	-41970#	500#			33.5 ms 0.3	5/2 ⁺ #	15	15Lo04	T	1997	$\beta^-=100;\beta^-n\text{?};\beta^-2n\text{?}$	*	
¹⁰⁷ Zr	-54020#	300#			145.7 ms 2.4	5/2 ⁺ #	15	15Lo04	T	1994	$\beta^-=100;\beta^-n<23$	*	
¹⁰⁷ Nb	-63724	8			286 ms 8	(5/2 ⁺)	08	19Ku16	TJ	1992	$\beta^-=100;\beta^-n=7.4\text{ }8$	*	
¹⁰⁷ Mo	-72545	9			3.5 s 0.5	(1/2 ⁺)	08	19Ku16	J	1972	$\beta^-=100$	*	
¹⁰⁷ Mo ^m	-72480	9	65.4	0.2	445 ns 21	(5/2 ⁺)	08	19Ku16	J	1976	IT=100	*	
¹⁰⁷ Tc	-78750	9			21.2 s 0.2	(3/2 ⁻)	08	09Gu11	J	1965	$\beta^-=100$		
¹⁰⁷ Tc ^m	-78720	9	30.1	0.1	3.85 μ s 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	$\beta^-=100$		
¹⁰⁷ Rh	-86864	12			21.7 m 0.4	7/2 ⁺	08			1951	$\beta^-=100$		
¹⁰⁷ Rh ^m	-86596	12	268.36	0.04	> 10 μ s	1/2 ⁻	08			1986	IT=100		
¹⁰⁷ Pd	-88372.7	1.2			6.5 My0.3	5/2 ⁺	08			1958	$\beta^-=100$		
¹⁰⁷ Pd ^m	-88257.0	1.2	115.74	0.12	850 ns 100	1/2 ⁺	08			1969	IT=100		
¹⁰⁷ Pd ⁿ	-88158.1	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			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	$\beta^+=100$	*	
¹⁰⁷ In	-83567	10			32.4 m 0.3	9/2 ⁺ *	08			1949	$\beta^+=100$		
¹⁰⁷ In ^m	-82889	10	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	$\beta^+=100$		

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{107}Sb	-70653	4	4.0 s 0.2	$5/2^+\#$	08		1994	$\beta^+=100$	
^{107}Te	-60660#	100#	3.22 ms 0.09	$5/2^+\#$	08	19Au02	T 1979	$\alpha=70\ 30;\beta^+\ ?;\beta^+\text{p}\ ?$	*
^{107}I	-49430#	300#	20# μs	$5/2^+\#$				$\alpha\ ?$	
* ^{107}Y	T : other 11Ni01=41(+15-9)								**
* ^{107}Zr	T : average 15Lo04=150(3) 11Ni01=138(4); not used 09Pe06=150(+40-30)								**
* ^{107}Nb	T : average 19Ku16=270(20) 15Lo04=280(20) 09Pe06=290(11) 96Me09=300(30)								**
* ^{107}Nb	D : % β^- -n average 09Pe06=8(1) 96Me09=6.0(1.5)								**
* ^{107}Mo	J : 20Ur02,19Ku16=1/2+, 1/2+[411]								**
* $^{107}\text{Mo}^m$	T : average 06Pi14=420(30) 99Ge01=470(30); others 20Ur02=600(150)								**
* $^{107}\text{Mo}^m$	T : $^{76}\text{ChZD}=238(7)$								**
* $^{107}\text{Mo}^m$	J : 20Ur02,19Ku16=5/2+, 5/2+[413]								**
* ^{107}Ag	J : also $^{14}\text{Fe}01=1/2$								**
* ^{107}Cd	J : also $^{18}\text{Yo}07,^{13}\text{Yo}02=5/2$								**
* $^{107}\text{In}^m$	E : other $^{20}\text{Ho}03=663(22)$								**
* ^{107}Te	T : average 19Au02=3.6(0.2) $^{14}\text{Pa}11=3.1(0.1)$ $^{79}\text{Sc}22=3.6(+0.6-0.4)$								**
^{108}Y	-36780#	600#	30 ms 5	$6^- \#$	15	15Lo04	T 2010	$\beta^- =100;\beta^- \text{n}\ ?;\beta^- 2\text{n}\ ?$	*
^{108}Zr	-50950#	400#	78.5 ms 2.0	0^+	15		1997	$\beta^- =100;\beta^- \text{n}\ ?$	
$^{108}\text{Zr}^m$	-48880#	400#	2074.5 0.8	$540\ \text{ns}\ 30$	(6^+)	15	12Ka36	T 2011	IT=100
^{108}Nb	-59545	8	201 ms 4	(2^+)	15	20Ha14	T 1994	$\beta^- =100;\beta^- \text{n}=6.3\ 5;\beta^- 2\text{n}\ ?$	*
$^{108}\text{Nb}^m$	-59378	8	166.6 0.5	109 ns 2	$6^- \#$	15	12Ka36	DT 2012	IT=100
^{108}Mo	-70749	9	1.105 s 0.010	0^+	08	09Pe06	TD 1972	$\beta^- =100;\beta^- \text{n}<0.5$	*
^{108}Tc	-75923	9	5.17 s 0.07	(2^+)	08		1970	$\beta^- =100$	
^{108}Ru	-83661	9	4.55 m 0.05	0^+	08		1955	$\beta^- =100$	
^{108}Rh	-85031	14	16.8 s 0.5	1^+	08		1955	$\beta^- =100$	
$^{108}\text{Rh}^m$	-84917	12	115 18 MD	6.0 m 0.3	(5^+)	08	1969	$\beta^- =100$	
^{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	$\beta^- =97.15\ 20;\beta^+=2.85\ 20$	
$^{108}\text{Ag}^m$	-87497.3	2.4	109.466 0.007	439 y 9	6^+*	08	18Sh09	T 1969	$\beta^+=91.3\ 9;\text{IT}=8.7\ 9$
^{108}Cd	-89252.4	1.1	STABLE	$>410\text{Py}$	0^+	08	95Ge14	T 1935	IS=0.888 11; $2\beta^+\ ?$
^{108}In	-84120	9	58.0 m 1.2	7^+*	08		1949	$\beta^+=100$	
$^{108}\text{In}^m$	-84090	9	29.75 0.05	39.6 m 0.7	2^+*	08	1955	$\beta^+=100$	
^{108}Sn	-82070	5	10.30 m 0.08	0^+	08		1968	$\beta^+=100$	
^{108}Sb	-72445	5	7.4 s 0.3	(4^+)	08		1976	$\beta^+=100$	
^{108}Te	-65782	5	2.1 s 0.1	0^+	08	85Ti02	D 1974	$\beta^+=51\ 4;\alpha=49\ 4;$ $\beta^+\text{p}=2.4\ 10;\beta^+\alpha<0.065$ $\alpha\approx 99.50\ 21;\text{p}=0.50\ 21;$ $\beta^+\ ?;\beta^+\text{p}\ ?$	
^{108}I	-52770#	100#	26.4 ms 0.8	$1^+\#$	08	19Au02	TD 1991	$\alpha=100$	*
^{108}Xe	-42630	380	72 $\mu\text{s}\ 35$	0^+		18Au04	TD 2018		*
* ^{108}Y	T : other 11Ni01=25(+66-10)								**
* $^{108}\text{Zr}^m$	T : symmetrized from $^{12}\text{Ka}36=536(+26-25)$; other $^{11}\text{Su}11=620(150)$								**
* ^{108}Nb	T : average $^{20}\text{Ha}14=186(8)$ $^{15}\text{Lo}04=195(6)$ $^{09}\text{Pe}06=210(5)$								**
* ^{108}Nb	D : % β^- -n other $^{20}\text{Ha}14=18(11)$								**
* ^{108}Mo	T : average $^{09}\text{Pe}06=1.110(0.011)$ $^{95}\text{Jo}02=1.090(0.020)$								**
* $^{108}\text{Ag}^m$	T : average $^{18}\text{Sh}09=448(27)$ $^{04}\text{Sh}04=438(9)$								**
* ^{108}Xe	T : average $^{19}\text{Xi}06=30(+57-12)$ $^{18}\text{Au}04=58(+106-23)$								**
^{109}Y	-32480#	700#	25 ms 5	$5/2^+\#$	16	15Lo04	T 2010	$\beta^- =100;\beta^- \text{n}\ ?;\beta^- 2\text{n}\ ?$	
^{109}Zr	-45730#	500#	56 ms 3	$5/2^+\#$	16		1997	$\beta^- =100;\beta^- \text{n}\ ?;\beta^- 2\text{n}\ ?$	
^{109}Nb	-56690	430	106.9 ms 4.9	$3/2^- \#$	16	15Lo04	T 1994	$\beta^- =100;\beta^- \text{n}=31\ 5$	*
$^{109}\text{Nb}^m$	-56380	430	312.5 0.4	115 ns 8	$7/2^+\#$	16	12Ka36	T 2011	IT=100
^{109}Mo	-66659	11	700 ms 14	($1/2^+$)	16	09Pe06	TD 1992	$\beta^- =100;\beta^- \text{n}=1.3\ 6$	*
$^{109}\text{Mo}^m$	-66589	11	69.7 0.5	210 ns 60	$5/2^+\#$	16	12Ka36	ET 2012	IT=100
^{109}Tc	-74283	10	905 ms 21	($5/2^+$)	16	19Do02	T 1976	$\beta^- =100;\beta^- \text{n}=0.08\ 2$	*
^{109}Ru	-80738	9	34.4 s 0.2	($5/2^+$)	16		1967	$\beta^- =100$	
$^{109}\text{Ru}^m$	-80642	9	96.14 0.15	680 ns 30	($5/2^-$)	16	1976	IT=100	
^{109}Rh	-84999	4	80.8 s 0.7	$7/2^+$	16		1972	$\beta^- =100$	
$^{109}\text{Rh}^m$	-84773	4	225.873 0.019	1.66 $\mu\text{s}\ 0.04$	$3/2^+$	16	1987	IT=100	
^{109}Pd	-87606.5	1.1	13.59 h 0.12	$5/2^+$	16		1937	$\beta^- =100$	
$^{109}\text{Pd}^m$	-87493.1	1.1	113.4000 0.0014	380 ns 50	$1/2^+$	16	1978	IT=100	
$^{109}\text{Pd}^n$	-87417.5	1.1	188.9903 0.0010	4.703 m 0.009	$11/2^-$	16	1957	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{109}Ag	-88719.4	1.3	STABLE	$1/2^-*$	16		1924	IS=48.161 8	*
$^{109}\text{Ag}^m$	-88631.4	1.3	88.0337 0.0010	$7/2^+*$	16		1967	IT=100	
^{109}Cd	-88504.3	1.5	461.3 d 0.5	$5/2^+*$	16	FGK209 T	1950	$\varepsilon=100$	*
$^{109}\text{Cd}^m$	-88444.7	1.5	59.60 0.07	$1/2^+$	16		1956	IT=100	
$^{109}\text{Cd}^n$	-88041.2	1.5	463.10 0.11	$11/2^-$	16		1964	IT=100	
^{109}In	-86490	4	4.159 h 0.010	$9/2^+*$	16		1948	$\beta^+=100$	*
$^{109}\text{In}^m$	-85840	4	649.79 0.10	$1/2^-$	16		1966	IT=100	*
$^{109}\text{In}^n$	-84388	4	2101.86 0.11	$19/2^+$	16		1963	IT=100[gs=100,m=0]	*
^{109}Sn	-82630	8	18.1 m 0.2	$5/2^+*$	16		1966	$\beta^+=100$	*
^{109}Sb	-76251	5	17.2 s 0.5	$5/2^+ \#$	16		1976	$\beta^+=100$	
^{109}Te	-67715	4	4.4 s 0.2	$(5/2^+)$	16		1967	$\beta^+=96.1\ 13; \alpha=3.9\ 13;$ $\beta^+p=9.4\ 31; \beta^+ \alpha<0.0049$	*
^{109}I	-57673	7	92.8 μs 0.8	$(1/2^+, 3/2^+)$	16		1984	$p=99.986\ 4; \alpha=0.014\ 4$	*
^{109}Xe	-46170	300	13 ms 2	$(7/2^+)$	16		2006	$\alpha \approx 100; \beta^+ ?; \beta^+ p ?$	
* ^{109}Nb	T : average 15Lo04=110(6) 11Ni01=100(+9-8); other 09Pe06=130(20)								**
* ^{109}Nb	D : % β^-n other 09Pe06<15 conflicting								**
* $^{109}\text{Nb}^m$	T : symmetrized from 12Ka36=114(+8-7); other 11Wa03=150(30)								**
* $^{109}\text{Nb}^m$	J : from 11Wa03, based on conf=p7/2[413], K=7/2+ and oblate shape								**
* ^{109}Mo	T : others 15Lo04=700(+40-60), 92Ay02=530(60)								**
* ^{109}Mo	J : 20Ur02=1/2+, 1/2+[411]								**
* $^{109}\text{Mo}^m$	T : symmetrized from 12Ka36=194(+76-49)								**
* $^{109}\text{Mo}^m$	J : 20Ur02=5/2+, 5/2+[413]								**
* ^{109}Tc	T : average 19Do02=870(70) 09Pe06=1040(110) 96Me09=820(100) 92PeZX=870(40)								**
* ^{109}Tc	T : 69WiZX=930(30) 90Al43=900(100)								**
* ^{109}Ag	J : 50Cr26,37Ja01=1/2								**
* ^{109}Cd	J : also 18Yo07,13Yo02=5/2								**
* ^{109}In	J : 58Ma43,59Ma19=9/2								**
* $^{109}\text{In}^m$	E : other 20Ho03=651(27)								**
* $^{109}\text{In}^n$	E : other 20Ho03=2098(11)								**
* ^{109}Sn	J : 87Eb01=5/2, but in conflict with 74Ho17=7/2								**
* ^{109}I	T : other (not used) 19Xi06=89.3(6.0)								**
^{110}Zr	-42220#	500#							
^{110}Nb	-52310	840							
$^{110}\text{Nb}^m$	-52210#	840#	100# 50#						*
^{110}Mo	-64536	24							
^{110}Tc	-71035	9							
^{110}Ru	-80073	9							
^{110}Rh	-82829	18							
$^{110}\text{Rh}^m$	-82610#	150#	220# 150#						*
^{110}Pd	-88330.9	0.6							
^{110}Ag	-87457.3	1.3							
$^{110}\text{Ag}^m$	-87456.2	1.3	1.112 0.016						
$^{110}\text{Ag}^n$	-87339.7	1.3	117.59 0.05						
^{110}Cd	-90348.0	0.4							
^{110}In	-86470	12							
$^{110}\text{In}^m$	-86408	12	62.08 0.04						
^{110}Sn	-85842	14							
^{110}Sb	-77450	6							
^{110}Te	-72230	7							
^{110}I	-60470	60							
^{110}Xe	-51920	100							
* ^{110}Nb	T : 20Ha14 $\beta - \gamma(t)$ gated on gamma's depopulating 5+ and 6+ levels;								**
* ^{110}Nb	T : others 15Lo04=82(2) 11Ni01=86(6) 11Wa26=81(6), 75(9)								**
* ^{110}Nb	T : 96Me09=170(20) both for the gs and isomer								**
* ^{110}Nb	D : % β^-n from 96Me09 includes both gs and isomer								**
* $^{110}\text{Nb}^m$	T : 20Ha14 beta-gamma time gated on gamma depopulating 2+ following								**
* $^{110}\text{Nb}^m$	T : 110Zr->110Nb->110Mo decay; only low spin levels are populated								**
* $^{110}\text{Nb}^m$	D : % β^-n from 96Me09 includes both gs and isomer								**
* ^{110}Pd	T : 16Le16 supersedes 13Le10								**
^{110}Zr	-42220#	500#							
^{110}Nb	-52310	840							
$^{110}\text{Nb}^m$	-52210#	840#	100# 50#						*
^{110}Mo	-64536	24							
^{110}Tc	-71035	9							
^{110}Ru	-80073	9							
^{110}Rh	-82829	18							
$^{110}\text{Rh}^m$	-82610#	150#	220# 150#						*
^{110}Pd	-88330.9	0.6							
^{110}Ag	-87457.3	1.3							
$^{110}\text{Ag}^m$	-87456.2	1.3	1.112 0.016						
$^{110}\text{Ag}^n$	-87339.7	1.3	117.59 0.05						
^{110}Cd	-90348.0	0.4							
^{110}In	-86470	12							
$^{110}\text{In}^m$	-86408	12	62.08 0.04						
^{110}Sn	-85842	14							
^{110}Sb	-77450	6							
^{110}Te	-72230	7							
^{110}I	-60470	60							
^{110}Xe	-51920	100							
* ^{110}Nb	T : 20Ha14 $\beta - \gamma(t)$ gated on gamma's depopulating 5+ and 6+ levels;								**
* ^{110}Nb	T : others 15Lo04=82(2) 11Ni01=86(6) 11Wa26=81(6), 75(9)								**
* ^{110}Nb	T : 96Me09=170(20) both for the gs and isomer								**
* ^{110}Nb	D : % β^-n from 96Me09 includes both gs and isomer								**
* $^{110}\text{Nb}^m$	T : 20Ha14 beta-gamma time gated on gamma depopulating 2+ following								**
* $^{110}\text{Nb}^m$	T : 110Zr->110Nb->110Mo decay; only low spin levels are populated								**
* $^{110}\text{Nb}^m$	D : % β^-n from 96Me09 includes both gs and isomer								**
* ^{110}Pd	T : 16Le16 supersedes 13Le10								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{111}Zr	-36480#	600#	24.0 ms 0.5	$5/2^+\#$	15	15Lo04 T	2010	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
^{111}Nb	-48960#	300#	54 ms 2	$3/2^-\#$	15		1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
^{111}Mo	-59940	13	193.6 ms 4.4	$1/2^+\#$	15	15Lo04 T	1994	$\beta^- = 100; \beta^- n < 12$	*
$^{111}\text{Mo}^m$	-59840#	50#	100#	50#	~ 200 ms		2011	$\beta^- = 100; \beta^- n ?$	
^{111}Tc	-69025	11	350 ms 11	$5/2^+\#$	09	09Pe06 T	1988	$\beta^- = 100; \beta^- n = 0.85$	20 *
^{111}Ru	-76785	10	2.12 s 0.07	$5/2^+$	09		1971	$\beta^- = 100$	
^{111}Rh	-82304	7	11 s 1	$(7/2^+)$	09		1975	$\beta^- = 100$	
^{111}Pd	-85985.9	0.7	23.56 m 0.09	$5/2^+$	09	15Kr07 T	1937	$\beta^- = 100$	*
$^{111}\text{Pd}^m$	-85813.7	0.7	172.18	0.08	5.563 h 0.013		1952	$IT = 76.8$ 10; $\beta^- = 23.2$	10
^{111}Ag	-88215.4	1.5	7.433 d 0.010	$1/2^-\#$	09	16Co01 T	1937	$\beta^- = 100$	*
$^{111}\text{Ag}^m$	-88155.6	1.5	59.82	0.04	64.8 s 0.8		1957	$IT = 99.3$ 2; $\beta^- = 0.7$	2
^{111}Cd	-89252.2	0.4	STABLE	$1/2^+\#$	09		1925	$IS = 12.795$	12 *
$^{111}\text{Cd}^m$	-88856.0	0.4	396.214	0.021	48.50 m 0.09		1945	$IT = 100$	*
^{111}In	-88392	3	2.8048 d 0.0001	$9/2^+\#$	09	FGK209 T	1947	$\varepsilon = 100$	
$^{111}\text{In}^m$	-87855	3	536.99	0.07	7.7 m 0.2		1966	$IT = 100$	
^{111}Sn	-85939	5	35.3 m 0.6	$7/2^+\#$	09		1949	$\beta^+ = 100$	
$^{111}\text{Sn}^m$	-85684	5	254.71	0.04	12.5 μ s 1.0		1972	$IT = 100$	
^{111}Sb	-80837	9	75 s 1	$(5/2^+)$	09		1972	$\beta^+ = 100$	
^{111}Te	-73587	6	26.2 s 0.6	$(5/2^+)$	09	05Sh24 T	1967	$\beta^+ = 100; \beta^+ p = ?$	*
^{111}I	-64954	5	2.5 s 0.2	$5/2^+\#$	09		1977	$\beta^+ \approx 100; \alpha \approx 0.088$	9; $\beta^+ p ?$ *
^{111}Xe	-54520#	120#	740 ms 200	$5/2^+\#$	09	12Ca03 D	1979	$\beta^+ = 89.6$ 1.9; $\alpha = 10.4$ 1.9; $\beta^+ p ?$	
^{111}Cs	-42900#	200#	1# μ s	$3/2^+\#$				$p ?$	
* ^{111}Mo	T : average 15Lo04=196(5) 11Ku16=186(9); other 09Pe06=200(+41-36)								**
* ^{111}Tc	T : other 96Me09=290(20), supersedes 88Pe13=300(30)								**
* ^{111}Pd	T : average 15Kr07=23.6(0.1) 77Kr14=23.4(0.2)								**
* ^{111}Ag	T : average 16Co01=7.423(0.013) 74Ro18=7.450(0.017)								**
* ^{111}Cd	J : also 13Yo02=1/2								**
* $^{111}\text{Cd}^m$	J : also 13Yo02=11/2								**
* ^{111}Te	T : others (not used) 67Ka01=19.0(7) 67Bo41=19.5(5), outliers								**
* ^{111}I	D : % α from 78Ro19								**
^{112}Zr	-32420#	700#	43 ms 21	0^+	15	15Lo04 T	2010	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
^{112}Nb	-44070#	300#	38 ms 2	$1^+\#$	15	15Lo04 T	1997	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
^{112}Mo	-57480#	200#	125 ms 5	0^+	15	15Lo04 T	1994	$\beta^- = 100; \beta^- n ?$	
^{112}Tc	-65259	6	323 ms 6	(2^+)	15	15Lo04 T	1990	$\beta^- = 100; \beta^- n = 1.5$	2 *
$^{112}\text{Tc}^m$	-64907	6	352.3	0.7	150 ns 17		2010	$IT = 100$	*
^{112}Ru	-75631	10	1.75 s 0.07	0^+	15		1970	$\beta^- = 100$	
^{112}Rh	-79730	40	3.4 s 0.4	(1^+)	15	99Lh01 T	1972	$\beta^- = 100$	*
$^{112}\text{Rh}^m$	-79390	60	340	70	6.73 s 0.15		1987	$\beta^- = 100$	*
^{112}Pd	-86321	7	21.04 h 0.17	0^+	15		1951	$\beta^- = 100$	
^{112}Ag	-86583.7	2.4	3.130 h 0.008	$2^-\#$	15		1938	$\beta^- = 100$	
^{112}Cd	-90574.86	0.25	STABLE	0^+	15		1925	$IS = 24.109$	7
^{112}In	-87990	4	14.88 m 0.15	$1^+\#$	15		1947	$\beta^+ = 62$ 4; $\beta^- = 38$	4
$^{112}\text{In}^m$	-87833	4	156.592	0.025	20.67 m 0.08		1953	$IT = 100$	
$^{112}\text{In}^n$	-87639	4	350.80	0.05	690 ns 50		1976	$IT = 100$	
$^{112}\text{In}^p$	-87376	4	613.82	0.06	2.81 μ s 0.03		1976	$IT = 100$	
^{112}Sn	-88655.05	0.29	STABLE	0^+	15		1927	$IS = 0.97$ 1; $2\beta^+ ?$	
^{112}Sb	-81599	18	53.5 s 0.6	(3^+)	15		1959	$\beta^+ = 100$	
$^{112}\text{Sb}^m$	-80773	18	825.9	0.4	536 ns 22		1976	$IT = 100$	
^{112}Te	-77568	8	2.0 m 0.2	0^+	15		1976	$\beta^+ = 100$	
^{112}I	-67063	10	3.34 s 0.08	$1^+\#$	15	78Ro19 D	1977	$\beta^+ \approx 100; \alpha \approx 0.0012$;	*
^{112}Xe	-60026	8	2.7 s 0.8	0^+	15		1978	$\beta^+ p = 0.88$ 10; $\beta^+ \alpha = 0.104$	12 *
^{112}Cs	-46420#	120#	490 μ s 30	$1^+\#$	15		1994	$p \approx 100; \alpha < 0.26$	
* ^{112}Zr	T : symmetrized from 15Lo04=30(+30-10)								**
* ^{112}Nb	T : other 11Ni01=33(+9-6) same group								**
* ^{112}Tc	D : % $\beta^- n$ from 99Wa09=1.5(0.2), supersedes 96Me09=2.6(0.5); other 09Pe06=4(1)								**
* ^{112}Tc	T : others 09Pe06=290(11); 99Wa09=290(20), supersedes 96Me09=230(20)								**
* $^{112}\text{Tc}^m$	E : 12Ka36=93.1(0.5) keV and 259.2(0.5) keV gamma rays in cascade to gs								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ¹¹² Tc ^m	T : from 10Br15=150(17); other 12Ka36=218(+60-43)										**	
* 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 the same group										**	
* ¹¹² Xe	D : % α symmetrized from 94Pa11=0.8(+1.1-0.5); other 78Ro19~0.84										**	
¹¹³ Zr	-26340#	300#			15# ms >550 ns	3/2 ⁺	18Sh11	IT	2018	β^- ?; β^-n ?; β^-2n ?		
¹¹³ Nb	-40210#	400#			32 ms 4	3/2 ⁻ #	15		1997	β^- =100; β^-n ?; β^-2n ?		
¹¹³ Mo	-52650#	300#			80 ms 2	5/2 ⁺ #	15		1994	β^- =100; β^-n ?		
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	50	131	33	510 ms 30	(7/2 ⁻)	10	98Ku17	E	1998	β^- = ?; IT= ?	
¹¹³ Rh	-78767	7			2.80 s 0.12	(7/2 ⁺)	10	93Pe11	J	1971	β^- =100	
¹¹³ Pd	-83590	7			93 s 5	(5/2 ⁺)	10		1954	β^- =100		
¹¹³ Pd ^m	-83509	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	-89043.29	0.24			8.04 Py 0.05	1/2 ⁺ *	10		1925	IS=12.227 7; β^- =100		
¹¹³ Cd ^m	-88779.75	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=4.281 52		
¹¹³ In ^m	-88975.42	0.19	391.699	0.003	1.6579 h 0.0004	1/2 ⁻ *	10		1939	IT=100		
¹¹³ Sn	-88328.1	1.6			115.08 d 0.04	1/2 ⁺ *	10	FGK209	T	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-5#; $\beta^+\alpha$?		
¹¹³ Xe	-62204	7			2.74 s 0.08	5/2 ⁺ #	10	85Ti02	D	1973	$\beta^+\approx$ 100; α =?; β^+p =7 4; $\beta^+\alpha\approx$ 0.007 4	
¹¹³ Xe ^m	-61800	7	403.6	1.4	6.9 μ s 0.3	(11/2 ⁻)	13	Pr01	ETJ	2013	IT=100	
¹¹³ Cs	-51765	9			16.94 μ s 0.09	(3/2 ⁺)	15	16Ho16	T	1984	p=100	
¹¹³ Ba	-39710#	300#			30# ms	5/2 ⁺ #					p ?; α ?	
* ¹¹³ Tc ^m	T : symmetrized from 12Ka36=526(+16-15); other 10Br15=500(100)										**	
* ¹¹³ Ru ^m	E : above the 98-keV level and below 164-keV level										**	
* ¹¹³ Cd	T : from 07Be61=8.037(0.005,stat)(0.05,syst);										**	
* ¹¹³ Cd	T : other (recent) 09Da03=8.00(0.11)(syt 0.24) outweighed										**	
* ¹¹³ Cd	J : also 13Yo02=1/2										**	
* ¹¹³ Cd ^m	T : average 11Ko01=13.97(0.13) 72Wa11=14.6(0.5) 65Fl02=13.6(0.2)										**	
* ¹¹³ Cd ^m	J : also 13Yo02=11/2										**	
* ¹¹³ In ^m	T : from Ensdf2010=99.476(0.023) m										**	
* ¹¹³ Xe	D : % α =0.0024-0.0204 from estimated limit for the reduced width in 85Ti02;										**	
* ¹¹³ Xe	D : % β^+p and % $\beta^+\alpha$ derived from β^+p/α =605(35) and										**	
* ¹¹³ Xe	D : $\beta^+p/\beta^+\alpha$ =500-1500 in 85Ti02										**	
* ¹¹³ Cs	T : average 16Ho16=16.9(0.1) (>10000 events) 15Wa02=17.1(0.2) (18000 events)										**	
¹¹⁴ Nb	-34960#	500#			17 ms 5	2 ⁻ #	15		2010	β^- =100; β^-n ?; β^-2n ?		
¹¹⁴ Mo	-49680#	300#			58 ms 2	0 ⁺	15		1997	β^- =100; β^-n ?		
¹¹⁴ Tc	-58600	430		*	121 ms 9	5 ⁺ #	12	15Lo04	T	1994	β^- =100; β^-n =1.3 4	
¹¹⁴ Tc ^m	-58437	13	160	430	MD*	90 ms 20	1 ⁺ #	12	11Ri01	TD	2011	β^- $\approx$ 100; IT ?; β^-n =1.3 4
¹¹⁴ Ru	-70221	4			540 ms 30	0 ⁺	12	06Mo07	T	1991	β^- =100; β^-n ?; β^-2n ?	
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	-83490	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	5	198.9	1.0	1.50 ms 0.05	(6 ⁺)	12	90Pe10	TED	1990	IT=100	
¹¹⁴ Cd	-90014.93	0.28			STABLE	>92Py	0 ⁺	12	95Ge14	T	1925	IS=28.754 81; 2 β^- ?
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[gs=0,m=100]		
¹¹⁴ Sn	-90559.735	0.029			STABLE	0 ⁺	12		1927	IS=0.66 1		
¹¹⁴ Sn ^m	-87472.37	0.08	3087.37	0.07	733 ns 14	7 ⁻	12		1980	IT=100		

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{114}Sb	-84497	20	3.49 m 0.03	3^+	12		1959	$\beta^+=100$
$^{114}\text{Sb}^m$	-84002	20	219 μs 12	(8^-)	12		1973	IT=100
^{114}Te	-81890	24	15.2 m 0.7	0^+	12		1968	$\beta^+=100$
^{114}I	-72639	20	2.01 s 0.15	1^+	12	20Ay05	TD 1977	$\beta^+=100; \beta^+_{\text{p}} ?; \alpha \approx 7.7\text{e-}9\#$
$^{114}\text{I}^m$	-72373	20	6.2 s 0.5	(7^-)	12		1995	$\beta^+ = ?; \text{IT} = ?$
^{114}Xe	-67086	11	10.0 s 0.4	0^+	12		1977	$\beta^+=100$
^{114}Cs	-54690	90	570 ms 20	(1^+)	12		1978	$\beta^+ \approx 100; \alpha = 0.018\ 6;$ $\beta^+_{\text{p}} = 8.7\ 13; \beta^+_{\text{p}} \alpha = 0.19\ 3$
^{114}Ba	-45910	100	460 ms 125	0^+	12	16Ca33	T 1995	$\beta^+ \approx 100; \beta^+_{\text{p}} = 20\ 10; \alpha = 0.9\ 3;$ 12C<0.0034
* ^{114}Tc	T : average 15Lo04=120(10) 11Ro01=110(20) 99Wa09=150(30)							**
* ^{114}Tc	T : other: 06Mo07=91(+62-35) probably mixture of gs and isomer							**
* ^{114}Tc	D : % β^- -n from 99Wa09, value in a mixture of gs and isomer							**
* $^{114}\text{Tc}^m$	D : % β^- -n from 99Wa09, value in a mixture of gs and isomer							**
* ^{114}Ru	T : average 06Mo07=510(+69-65) 92Jo05=530(60) 91Le09=570(50)							**
* $^{114}\text{Ag}^m$	E : 34.5(0.5), 43.9(0.5), 47.4(0.5), 73.1(0.5) in a cascade to gs in 90Pe10							**
* ^{114}I	T : average 20Ay05=1.89(0.23) 77Ki11=2.1(0.2)							**
* $^{114}\text{I}^m$	J : from M3 to (4-) following by E2 to (2)- following by E1 to 1+							**
* ^{114}Ba	T : average 16Ca33=380(+190-110) 97Ja12=430(+300-150)							**
^{115}Nb	-30880#	500#	23 ms 8	$3/2^- \#$	15		2010	$\beta^- = 100; \beta^-_{\text{n}} ?; \beta^-_{\text{2n}} ?$
^{115}Mo	-44550#	400#	45.5 ms 2.0	$3/2^+ \#$	15		2010	$\beta^- = 100; \beta^-_{\text{n}} ?; \beta^-_{\text{2n}} ?$
^{115}Tc	-55800#	200#	78 ms 2	$5/2^+ \#$	15		1994	$\beta^- = 100; \beta^-_{\text{n}} ?$
^{115}Ru	-66105	25	318 ms 19	$(1/2^+)$	12		1992	$\beta^- = 100; \beta^-_{\text{n}} ?$
$^{115}\text{Ru}^m$	-66110	90	76 ms 6	$(7/2^-)$	12	10Ku25	ETJ 2010	IT= ?; $\beta^- = ?$
^{115}Rh	-74229	7	1.03 s 3	$(7/2^+)$	12	92PeZX	T 1988	$\beta^- = 100; \beta^-_{\text{n}} ?$
^{115}Pd	-80426	14	25 s 2	$(1/2^+)$	12		1958	$\beta^- = 100$
$^{115}\text{Pd}^m$	-80337	14	50 s 3	$(7/2^-)$	12		1987	$\beta^- = 92.0\ 20; \text{IT} = 8.0\ 20$
^{115}Ag	-84983	18	20.0 m 0.5	$1/2^-$	12		1949	$\beta^- = 100$
$^{115}\text{Ag}^m$	-84942	18	18.0 s 0.7	$7/2^+$	12		1958	$\beta^- = 79.0\ 3; \text{IT} = 21.0\ 3$
^{115}Cd	-88084.5	0.7	53.46 h 0.05	$1/2^+ *$	12		1939	$\beta^- = 100$
$^{115}\text{Cd}^m$	-87903.5	0.9	44.56 d 0.24	$11/2^- *$	12		1959	$\beta^- \approx 100; \text{IT} ?$
^{115}In	-89536.357	0.012	441 Ty 25	$9/2^+ *$	12		1924	IS=95.719 52; $\beta^- = 100$
$^{115}\text{In}^m$	-89200.113	0.021	4.486 h 0.004	$1/2^- *$	12		1961	IT=95.0 7; $\beta^- = 5.0\ 7$
^{115}Sn	-90033.846	0.015	STABLE	$1/2^+ *$	12		1927	IS=0.34 1
$^{115}\text{Sn}^m$	-89421.04	0.04	3.26 μs 0.08	$7/2^+$	12		1967	IT=100
$^{115}\text{Sn}^n$	-89320.21	0.12	159 μs 1	$11/2^-$	12		1958	IT=100
^{115}Sb	-87003	16	32.1 m 0.3	$5/2^+$	12		1958	$\beta^+ = 100$
$^{115}\text{Sb}^m$	-84207	16	159 ns 3	$(19/2)^-$	12		1977	IT=100
^{115}Te	-82063	28	5.8 m 0.2	$7/2^+$	12		1961	$\beta^+ = 100$
$^{115}\text{Te}^m$	-82053	30	6.7 m 0.4	$(1/2^+)$	12	74Ch51	E 1974	$\beta^+ \approx 100; \text{IT} ?$
$^{115}\text{Te}^n$	-81783	28	7.5 μs 0.2	$11/2^-$	12		1972	IT=100
^{115}I	-76338	29	1.3 m 0.2	$5/2^+ \#$	12		1969	$\beta^+ = 100$
^{115}Xe	-68657	12	18 s 3	$(5/2^+)$	12		1969	$\beta^+ = 100; \beta^+_{\text{p}} = 0.34\ 6$
^{115}Cs	-59700#	100#	1.4 s 0.8	$9/2^+ \#$	12		1978	$\beta^+ = 100; \beta^+_{\text{p}} \approx 0.07$
^{115}Ba	-48920#	200#	450 ms 50	$5/2^+ \#$	12	97Ja12	D 1997	$\beta^+ = 100; \beta^+_{\text{p}} > 15$
* $^{115}\text{Ru}^m$	E : 20 keV above the 61.7-keV level in 10Ku25							**
* ^{115}Rh	T : average 92PeZX=1.04(0.03) 88Ay01=0.99(0.05)							**
* ^{115}Cd	J : also 13Yo02=1/2							**
* $^{115}\text{Cd}^m$	J : also 13Yo02=1 1/2							**
* $^{115}\text{Te}^m$	E : less than 20 keV in 74Ch51							**
* ^{115}Xe	T : average 71Ho07=18(4) 69Ha03=19(5)							**
^{116}Nb	-25230#	300#	12# ms >550ns	$1^- \#$	18Sh11	I 2018		$\beta^- ?; \beta^-_{\text{n}} ?; \beta^-_{\text{2n}} ?$
^{116}Mo	-41210#	500#	32 ms 4	0^+	15		2010	$\beta^- = 100; \beta^-_{\text{n}} ?; \beta^-_{\text{2n}} ?$
^{116}Tc	-51210#	300#	57 ms 3	$2^+ \#$	15		1997	$\beta^- = 100; \beta^-_{\text{n}} ?; \beta^-_{\text{2n}} ?$
^{116}Ru	-64069	4	204 ms 6	0^+	15		1994	$\beta^- = 100; \beta^-_{\text{n}} ?$
^{116}Rh	-70740	70	685 ms 39	1^+	10	06Mo07	TD 1970	$\beta^- = 100; \beta^-_{\text{n}} < 2.1$
$^{116}\text{Rh}^m$	-70540#	170#	570 ms 50	(6^-)	10	01Wa04	T 1987	$\beta^- = 100; \beta^-_{\text{n}} < 2.1$
^{116}Pd	-79831	7	11.8 s 0.4	0^+	10		1970	$\beta^- = 100$
^{116}Ag	-82543	3	3.83 m 0.08	(0^-)	10	09Ba52	TJ 1958	$\beta^- = 100$

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
$^{116}\text{Ag}^m$	-82495	3	47.90	0.10	20 s 1	(3 ⁺)	10 05Ba94	TJD 2005	β^- =93 4;IT=7 4
$^{116}\text{Ag}^n$	-82413	3	129.80	0.22	9.3 s 0.3	(6 ⁻)	10 05Ba94	TJD 1970	β^- =92 4;IT=8 4
^{116}Cd	-88712.49	0.16			26.9 Ey 0.9	0 ⁺	10 20Ba.A	T 1925	IS=7.512 54;2 β^- =100
^{116}In	-88249.76	0.22			14.10 s 0.03	1 ⁺	10 13Wr01	D 1937	β^- ≈100;ε=0.0237 43
$^{116}\text{In}^m$	-88122.49	0.22	127.267	0.006	54.29 m 0.17	5 ⁺ *	10	1945	β^- =100
$^{116}\text{In}^n$	-87960.10	0.22	289.660	0.006	2.18 s 0.04	8 ⁻ *	10	1950	IT=100[gs=0,m=100]
^{116}Sn	-91525.98	0.10			STABLE	0 ⁺	10	1922	IS=14.54 9
$^{116}\text{Sn}^m$	-89160.00	0.10	2365.975	0.021	348 ns 19	5 ⁻	10	1964	IT=100
$^{116}\text{Sn}^n$	-87978.82	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
$^{116}\text{Sb}^m$	-86728	5	93.99	0.05	194 ns 4	1 ⁺	10	1976	IT=100
$^{116}\text{Sb}^n$	-86440	40	390	40	60.3 m 0.6	8 ⁻ *	10	1949	β^+ =100
^{116}Te	-85264	24			2.49 h 0.04	0 ⁺	10	1958	β^+ =100
^{116}I	-77420	80			2.91 s 0.15	1 ⁺	10	1976	β^+ =100
$^{116}\text{I}^m$	-76990	80	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; β ⁺ α=0.049 25
$^{116}\text{Cs}^m$	-61940#	120#	100#	60#	3.85 s 0.13	(7 ⁺)	10	1975	β ⁺ =100;β ⁺ p=0.44 7; β ⁺ α=0.0034 23
^{116}Ba	-54380#	200#			1.3 s 0.2	0 ⁺	10	1997	β ⁺ =100;β ⁺ p=3 1
^{116}La	-40050#	320#			10# ms		10		β ⁺ ?;β ⁺ p ?;p ?
* ^{116}Rh	T : average 06Mo07=688(+52-50) 88Ay02=680(60)								
* ^{116}Rh	D : %β ⁻ n from 06Mo07, a mixture of gs and isomer								
* $^{116}\text{Rh}^m$	D : %β ⁻ n from 06Mo07, a mixture of gs and isomer								
* ^{116}Ag	T : from 09Ba52=230(5) s								
* ^{116}Cd	T : value for 2v-ββ; others (recent)18Ba44=26.3(0.1,stat)(+1.1-1.2,syst)								
* ^{116}Cd	T : 17Ar01=27.4(0.4,stat)(1.8,syst) 15Ba11=28.7(1.3) (evaluation)								
* ^{116}In	D : %ε average 13Wr01=0.0246(44stat)(39syst) 98Bh04=0.0227(0.0063)								
* ^{116}In	T : also 13Wr01=14.9(0.8)								
* ^{116}Cs	D : %β ⁺ p from 77Bo28; Ensdf2010=2.8(0.7)% in error								
* $^{116}\text{Cs}^m$	D : %β ⁺ p average 77Bo28=0.66(0.13) 78Da07=0.36(0.08)%; Birge ratio=1.97								
* $^{116}\text{Cs}^m$	D : %β ⁺ α average 78Da07=0.008(0.002)% and 0.0022(0.0010), from								
* $^{116}\text{Cs}^m$	D : %β ⁺ p=0.44(0.07) and β ⁺ p/β ⁺ α=200(80) in 85Ti02;								
* $^{116}\text{Cs}^m$	D : Birge ratio=2.6								
* $^{116}\text{Cs}^m$	J : direct β ⁺ feedings to 6+ and 8+ levels in ^{116}Xe in 80Ma16								
* ^{116}La	T : estimate for β ⁺ decay; no p decay within 20 us-20 ms								
^{117}Mo	-35690#	500#			22 ms 5	3/2 ⁺ #	15	2010	β ⁻ =100;β ⁻ n ?;β ⁻ 2n ?
^{117}Tc	-48140#	400#			44.5 ms 3.0	5/2 ⁺ #	15	1997	β ⁻ =100;β ⁻ n ?;β ⁻ 2n ?
^{117}Ru	-59490	430			151 ms 3	3/2 ⁺ #	15	1994	β ⁻ =100;β ⁻ n ?
$^{117}\text{Ru}^m$	-59310	430	185.0	0.4	2.49 μs 0.06	7/2 ⁻ #	15	2012	IT=100
^{117}Rh	-68897	9			421 ms 30	7/2 ⁺ #	11 06Mo07	TD 1991	β ⁻ =100;β ⁻ n<7.6
$^{117}\text{Rh}^m$	-68576	9	321.2	1.0	138 ns 17	3/2 ⁺ #	13La25	ET 2013	IT=100
^{117}Pd	-76424	7			4.3 s 0.3	(3/2 ⁺)	11 04Ur04	J 1968	β ⁻ =100
$^{117}\text{Pd}^m$	-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
$^{117}\text{Ag}^m$	-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			2.503 h 0.005	1/2 ⁺ *	11 19Gi09	T 1939	β ⁻ =100
$^{117}\text{Cd}^m$	-86282.0	1.0	136.4	0.2	3.441 h 0.009	11/2 ⁻ *	11 19Gi09	T 1966	β ⁻ =100
^{117}In	-88943	5			43.2 m 0.3	9/2 ⁺ *	11	1937	β ⁻ =100
$^{117}\text{In}^m$	-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	-90397.7	0.5			STABLE	1/2 ⁺ *	11 20Yo.A	J 1923	IS=7.68 7
$^{117}\text{Sn}^m$	-90083.1	0.5	314.58	0.04	13.939 d 0.024	11/2 ⁻ *	12 20Yo.A	J 1950	IT=100
$^{117}\text{Sn}^n$	-87991.3	0.6	2406.4	0.4	1.75 μs 0.07	(19/2 ⁺)	11	1979	IT=100
^{117}Sb	-88640	8			2.97 h 0.02	5/2 ⁺ *	11 21Da02	T 1947	β ⁺ =100
$^{117}\text{Sb}^m$	-85509	8	3130.76	0.19	355 μs 17	(25/2 ⁺)	11	1970	IT=100
$^{117}\text{Sb}^n$	-85409	8	3230.7	0.2	290 ns 5	(23/2 ⁻)	11	1987	IT=100
^{117}Te	-85096	13			62 m 2	1/2 ⁺ *	11	1958	β ⁺ =100;ε=75 1;ε ⁺ =25 1
$^{117}\text{Te}^m$	-84800	13	296.1	0.5	103 ms 3	(11/2 ⁻)	11 99Mo30	J 1963	IT=100
^{117}I	-80439	26			2.22 m 0.04	(5/2 ⁺)	11	1969	β ⁺ =100;ε ⁺ ≈77
^{117}Xe	-74185	10			61 s 2	5/2 ⁺ *	11 90NeZY	J 1969	β ⁺ =100;β ⁺ p=0.0029 6

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{117}Cs	−66490	60			*	8.4 s 0.6	$9/2^+\#$	11		1972	$\beta^+=100$		
$^{117}\text{Cs}^m$	−66340#	100#	150#	80#	*	6.5 s 0.4	$3/2^+\#$	11		1978	$\beta^+=100$		
$^{117}\text{Cs}^s$	−66440	80	50	50		$R=?$	$spmix$						
^{117}Ba	−57460	250				1.75 s 0.07	$(3/2^+)$	11	97Ja12	D	1977	$\beta^+=100;\beta^+p=13.3$; $\beta^+\alpha=0.0248$	
^{117}La	−46270#	200#				21.7 ms 1.8	$(3/2^+)$	11	11Li28	TJ	2001	$p\approx 100;\beta^+?$; $\beta^+p?$	
$^{117}\text{La}^m$			<i>non-exist</i>			RN	10 ms 5	$(9/2^+)$	11	01So02	I		
$^{*117}\text{Ru}^m$	T : symmetrized from 12Ka36=2.487(+0.058-0.055); other 12LaZT=2.0(0.3)												
$^{*117}\text{Rh}$	T : average 06Mo07=394(+47-43) 91Pe10=440(40)												
$^{*117}\text{Ag}$	T : symmetrized from 72.8(+2.0-0.7)												
$^{*117}\text{Ag}^m$	J : E3 to 1/2-#												
$^{*117}\text{Cd}$	J : 13Yo02=1/2												
$^{*117}\text{Cd}^m$	J : 13Yo02=11/2												
$^{*117}\text{Sn}^m$	T : average 16Do10=13.91(0.03) 14Un01=14.00 (0.05) 03Po21=13.98 (0.07)												
$^{*117}\text{Xe}$	J : 90NeZY=5/2												
$^{*117}\text{Ba}$	D : $\% \beta^+p$ from 97Ja12. $\beta^+p/\beta^+\alpha=350\text{--}1200$ from 85Ti02 yields												
$^{*117}\text{Ba}$	D : $\% \beta^+\alpha=0.011\%\text{--}0.037\%$												
$^{*117}\text{La}$	T : average 11Li28=20.1(2.5) 01Ma69=24(3) 01So02=22(5)												
$^{*117}\text{La}^m$	I : reported in 01So02 with E=121(10) keV, but not confirmed in 11Li28												
^{118}Mo	−32370#	500#				21 ms 6	0^+	15	15Lo04	TD	2015	$\beta^-=100;\beta^-n?$; $\beta^-2n?$	
^{118}Tc	−43290#	400#				30 ms 4	$2^+\#$	15			2010	$\beta^-=100;\beta^-n?$; $\beta^-2n?$	
^{118}Ru	−57000#	200#				99 ms 3	0^+	15			1994	$\beta^-=100;\beta^-n?$	
^{118}Rh	−64887	24			*	282 ms 9	$1^+\#$	06	15Lo04	T	1994	$\beta^-=100;\beta^-n=3.114$	
$^{118}\text{Rh}^m$	−64690#	150#	200#	150#	*	310 ms 30	$6^-\#$	06	00Jo18	T	1994	$\beta^-\approx 100;\text{IT}?$; $\beta^-n=3.114$	
^{118}Pd	−75388.4	2.5				1.9 s 0.1	0^+	06			1969	$\beta^-=100$	
^{118}Ag	−79553.8	2.5				3.76 s 0.15	(2^-)	95	93Ja03	J	1967	$\beta^-=100$	
$^{118}\text{Ag}^m$	−79508.0	2.5	45.79	0.09		$\sim 0.1\mu\text{s}$	$(1,2)^-$	95	93Ja03	J	1989	IT=100	
$^{118}\text{Ag}^n$	−79426.2	2.5	127.63	0.10		2.0 s 0.2	(5^+)	95	FGK208	JD	1971	$\beta^-=59.3;\text{IT}=41.3$	
$^{118}\text{Ag}^p$	−79274.4	2.5	279.37	0.20		$\sim 0.1\mu\text{s}$	(3^+)	95	93Ja03	TJ	1989	IT=100	
^{118}Cd	−86702	20				50.3 m 0.2	0^+	95			1961	$\beta^-=100$	
^{118}In	−87228	8			*	5.0 s 0.5	1^+	95			1949	$\beta^-=100$	
$^{118}\text{In}^m$	−87130#	50#	100#	50#	*	4.364 m 0.007	5^+*	95	94It.A	T	1964	$\beta^-=100$	
$^{118}\text{In}^n$	−86990#	50#	240#	50#		8.5 s 0.3	8^-*	95			1969	IT=98.63[gs=0,m=98.6]; $\beta^-=1.43$	
^{118}Sn	−91652.8	0.5				STABLE	0^+	95			1924	IS=24.229	
$^{118}\text{Sn}^m$	−89077.9	0.5	2574.91	0.04		230 ns 10	7^-	95			1961	IT=100	
$^{118}\text{Sn}^n$	−88544.7	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	$\beta^+=100$	
$^{118}\text{Sb}^m$	−87945	3	50.814	0.021		20.6 μs 0.6	3^+	95			1975	IT=100	
$^{118}\text{Sb}^n$	−87746	5	250	6	BD	5.01 h 0.03	8^-*	95	21Da02	T	1947	$\beta^+=100$	
^{118}Te	−87691	18				6.00 d 0.02	0^+	95			1948	$\varepsilon=100$	
^{118}I	−80971	20				13.7 m 0.5	(2^-)	95			1957	$\beta^+=100$	
$^{118}\text{I}^m$	−80782	20	188.8	0.7		8.5 m 0.5	(7^-)	95	03Mo36	E	1968	$\beta^+\approx 100;\text{IT}?$	
^{118}Xe	−78079	10				3.8 m 0.9	0^+	95			1965	$\beta^+=100$	
^{118}Cs	−68409	13			*	14 s 2	2^+*	95			1969	$\beta^+=100;\beta^+p=0.02114$; $\beta^+\alpha=0.00125$	
$^{118}\text{Cs}^m$	−68310#	60#	100#	60#	*	17 s 3	(7^-)	95	93Be46	J	1972	$\beta^+=100;\beta^+p=0.02114$; $\beta^+\alpha=0.00125$	
$^{118}\text{Cs}^s$	−68404	12	5	4		$R<0.1$	$spmix$						
^{118}Ba	−62200#	200#				5.2 s 0.2	0^+	06	97Ja12	T	1997	$\beta^+=100$	
^{118}La	−49620#	300#				200# ms	$1^-\#$					$\beta^+?$; $\beta^+p?$	
$^{*118}\text{Mo}$	T : symmetrized from 15Lo04=19(+7-4)												
$^{*118}\text{Rh}$	T : average 15Lo04=285(10) 06Mo07=266(+22-21) from $\beta^-(t)$; probably contain												
$^{*118}\text{Rh}$	T : contributions from both the low- and high-spin β^- decaying states												
$^{*118}\text{Rh}$	J : direct β^- feeding to 0+ state in ^{118}Pd in 06Wa10												
$^{*118}\text{Rh}$	D : $\% \beta^-n$ from 06Mo07, probably a mixture of gs and isomer												
$^{*118}\text{Rh}^m$	T : from $\beta-\gamma(t)$ using 575-keV gamma ray, depopulating the 4+												
$^{*118}\text{Rh}^m$	T : level in ^{118}Pd , in 00Jo18; most-likely dominated by the												
$^{*118}\text{Rh}^m$	T : high-spin β^- decaying state												
$^{*118}\text{Rh}^m$	J : direct β^- feeding to 6- level in ^{118}Pd in 06Wa10												
$^{*118}\text{Rh}^m$	D : $\% \beta^-n$ from 06Mo07, probably a mixture of gs and isomer												

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ¹¹⁸ Ag ⁿ	J : 127.6-keV gamma-ray E3 to (2-)								**	
* ¹¹⁸ Ag ⁿ	D : from Ig(127keV, ¹¹⁸ Ag)/Ig(48 keV, ¹¹⁸ Cd)=0.124(0.015) in 73FoZF								**	
* ¹¹⁸ In ⁿ	E : 138.2(0.5) keV above ¹¹⁸ In ^m								**	
* ¹¹⁸ Sb ^m	J : E2 to 1+								**	
* ¹¹⁸ Sb ⁿ	T : average 21Da02=5.18(0.05) 74Ca06=5.00(0.02) 72Pa13=5.11(0.06)								**	
* ¹¹⁸ Sb ⁿ	T : 68Ki06=5.15(0.05) 67Ha27=4.96(0.02); Birge ratio=2.68								**	
* ¹¹⁸ Im	E : from a least-squares fit to level scheme of 03Mo36								**	
* ¹¹⁸ Cs	D : from %β ⁺ p=0.042(6), %β ⁺ α=0.0024(4) for mixture of gs and isomer								**	
¹¹⁹ Mo	-26580#	300#		12# ms >550ns	3/2 ⁺ #	18Sh11	I	2018	β ⁻ ?;β ⁻ n?;β ⁻ 2n?	
¹¹⁹ Tc	-40170#	500#		22 ms 3	5/2 ⁺ #	15		2010	β ⁻ =100;β ⁻ n?;β ⁻ 2n?	
¹¹⁹ Ru	-52080#	300#		69.5 ms 2.0	3/2 ⁺ #	15		1997	β ⁻ =100;β ⁻ n?;β ⁻ 2n?	
¹¹⁹ Ru ^m	-51850#	300#	227.1	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	-71407	8		920 ms 80	3/2 ⁺ #	09 06Mo07	TD	1991	β ⁻ =100;β ⁻ n?	*
¹¹⁹ Pd ^m	-71110#	150#	300#	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#	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	2.20 m 0.02	11/2 ⁻ *	09 13Yo02	J	1974	β ⁻ =100	
¹¹⁹ In	-87699	7		2.4 m 0.1	9/2 ⁺ *	09		1949	β ⁻ =100	
¹¹⁹ In ^m	-87388	7	311.37	18.0 m 0.3	1/2 ⁻ *	09 76Sc30	D	1973	β ⁻ =97.4 4;IT=2.6 4	*
¹¹⁹ In ⁿ	-87045	7	654.27	130 ns 15	(3/2) ⁺	09		1974	IT=100	
¹¹⁹ In ^p	-85042	7	2656.9	265 ns 10	(25/2 ⁺)	09 20Bi06	T	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	293.1 d 0.7	11/2 ⁻ *	09 20Yo.A	J	1950	IT=100	
¹¹⁹ Sn ⁿ	-87938.0	1.2	2127.0	9.6 μs 1.2	(19/2 ⁺)	09		1992	IT=100	
¹¹⁹ Sn ^p	-87696.0	0.8	2369.0	96 ns 9	23/2 ⁺	16Is03	ETJ	2016	IT=100	
¹¹⁹ Sb	-89476	7		38.19 h 0.22	5/2 ⁺ *	09		1947	ε=100	
¹¹⁹ Sb ^m	-86922	7	2553.6	130 ns 3	19/2 ⁻	09 91Io02	J	1991	IT=100	
¹¹⁹ Sb ⁿ	-86634	7	2841.7	835 ms 81	25/2 ⁺	09 19Mi18	ET	1979	IT=100	*
¹¹⁹ Te	-87183	7		16.05 h 0.05	1/2 ⁺ *	09		1948	β ⁺ =100;ε=97.94 5; e ⁺ =2.06 5	
¹¹⁹ Te ^m	-86922	7	260.96	4.70 d 0.04	11/2 ⁻ *	09		1960	β ⁺ =100;ε=99.59 4; e ⁺ =0.41 4	
¹¹⁹ I	-83778	22		19.1 m 0.4	5/2 ⁺	09		1954	β ⁺ =100;e ⁺ =51 4;ε=49 4	
¹¹⁹ Xe	-78794	10		5.8 m 0.3	5/2 ⁺ *	09 90NeZY	J	1965	β ⁺ =100;e ⁺ =79 5;ε=21 5	*
¹¹⁹ Cs	-72305	14		43.0 s 0.2	9/2 ⁺ *	09 75Ho09	D	1969	β ⁺ =100;β ⁺ α<2e-6	
¹¹⁹ Cs ^m	-72260#	30#	50#	30.4 s 0.1	3/2 ⁺ *	09		1978	β ⁺ =100	
¹¹⁹ Cs ^x	-72289	9	16	11	R = 0.50 0.25	spmix				
¹¹⁹ Ba	-64590	200		5.4 s 0.3	(5/2 ⁺)	09		1974	β ⁺ =100;β ⁺ p=25 2	
¹¹⁹ La	-55020#	300#		1# s	11/2 ⁻ #				β ⁺ ?	
¹¹⁹ Ce	-43820#	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+ levels in ¹¹³ Ag=43 keV ¹¹⁵ Ag=41 keV and									**
* ¹¹⁹ Ag ^m	E : ¹¹⁷ Ag=28 keV									**
* ¹¹⁹ In ^m	D : %IT symmetrized from 76Sc30=2.5(+0.5-0.3); other 61Gi06~5									**
* ¹¹⁹ In ^p	T : average 20Bi06=270(11) 02Lu15=240(25)									**
* ¹¹⁹ Sb ⁿ	T : average 19Mi18=776(181) 79Sh03=850(90)									**
* ¹¹⁹ Sb ⁿ	E : based on 19Mi18=2799(30) keV and known states in ¹¹⁹ Sn see 87Lu06;									**
* ¹¹⁹ Sb ⁿ	E : other Ensdf2009=x keV above 2841.7(0.4)-keV level, conflicting									**
* ¹¹⁹ Sb ⁿ	J : from 87Lu06									**
* ¹¹⁹ Xe	J : 90NeZY=5/2									**
¹²⁰ Tc	-35000#	500#		21 ms 5	3 ⁺ #	17		2010	β ⁻ =100;β ⁻ n?;β ⁻ 2n?	
¹²⁰ Ru	-49720#	400#		45 ms 2	0 ⁺	17		2010	β ⁻ =100;β ⁻ n?	
¹²⁰ Rh	-58620#	200#		129.6 ms 4.2	8 ⁻ #	17 15Lo04	T	1994	β ⁻ =100;β ⁻ n<9.3;β ⁻ 2n?	*
¹²⁰ Rh ^m	-58460#	200#	157.2	295 ns 16	6#	17 12Ka36	ETD	2012	IT=100	*
¹²⁰ Pd	-70279.6	2.3		492 ms 33	0 ⁺	17 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	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)
$^{120}\text{Ag}^m$	-75650#	50#	0#	50#	*	940 ms 100	(0 ⁻ , 1 ⁻)	12Ba58 TJD 2012 $\beta^- = ?; \text{IT} ?; \beta^- \text{n} ?$
$^{120}\text{Ag}^n$	-75449	4	203.2	0.2		384 ms 22	7(1 ⁻)	02 12Ba58 EJD 1971 $\text{IT}=68 \text{ 10}; \beta^- = 32 \text{ 10}; \beta^- \text{n} ?$ *
^{120}Cd	-83957	4				50.80 s 0.21	0 ⁺	02 1973 $\beta^- = 100$
^{120}In	-85730	40			*	3.08 s 0.08	1 ⁺	02 1958 $\beta^- = 100$
$^{120}\text{In}^m$	-85680#	50#	50#	60#	*&	46.2 s 0.8	5 ⁺ *	02 1960 $\beta^- = 100$
$^{120}\text{In}^n$	-85430#	200#	300#	200#	*&	47.3 s 0.5	8 ⁻ *	02 1960 $\beta^- = 100$
^{120}Sn	-91097.7	0.9				STABLE	0 ⁺	02 1926 $\text{IS}=32.58 \text{ 9}$
$^{120}\text{Sn}^m$	-88616.1	0.9	2481.63	0.06		11.8 μs 0.5	7 ⁻	02 1960 $\text{IT}=100$
$^{120}\text{Sn}^n$	-88195.5	0.9	2902.22	0.22		6.26 μs 0.11	10 ⁺	02 FGK128 J 1987 $\text{IT}=100$ *
^{120}Sb	-88417	7			*	15.89 m 0.04	1 ⁺ *	02 1937 $\beta^+ = 100$
$^{120}\text{Sb}^m$	-88420#	100#	0#	100#	*	5.76 d 0.02	8 ⁻ *	02 1958 $\beta^+ = 100$
$^{120}\text{Sb}^n$	-88339	7	78.16	0.05		246 ns 2	(3 ⁺)	02 1976 $\text{IT}=100$
$^{120}\text{Sb}^p$	-86090#	100#	2328#	100#		400 ns 8	13 ⁺	02 1983 $\text{IT}=100$ *
^{120}Te	-89362.2	1.8				STABLE	>1.6Zy	02 18Al23 T 1936 $\text{IS}=0.09 \text{ 1}; 2\beta^+ ?$
^{120}I	-83747	15				81.67 m 0.18	2 ⁻	02 06Ph01 T 1957 $\beta^+ = 100$ *
$^{120}\text{I}^m$	-83674	15	72.61	0.09		242 ns 5	3 ⁺	02 11Mo27 TJ 1974 $\text{IT}=100$ *
$^{120}\text{I}^n$	-83430	150	320	150	BD	53 m 4	(7 ⁻)	02 1967 $\beta^+ = 100$
^{120}Xe	-82172	12				46.0 m 0.6	0 ⁺	02 06Ph01 T 1965 $\beta^+ = 100$
^{120}Cs	-73889	10			*	60.4 s 0.6	2 ⁺ *	02 06Ph01 T 1969 $\beta^+ = 100; \beta^+ \alpha < 2.0\text{e-}5 \text{ 4}; \beta^+ \text{p} < 7\text{e-}6 \text{ 3}$ *
$^{120}\text{Cs}^m$	-73790#	60#	100#	60#	*	57 s 6	(7 ⁻)	02 75Ho09 D 1977 $\beta^+ = 100; \beta^+ \alpha < 2.0\text{e-}5 \text{ 4}; \beta^+ \text{p} < 7\text{e-}6 \text{ 3}$ *
$^{120}\text{Cs}^x$	-73884	9	5	4		$R < 0.1$	spmix	
^{120}Ba	-68890	300				24 s 2	0 ⁺	02 92Xu04 T 1974 $\beta^+ = 100$
^{120}La	-57570#	300#				2.8 s 0.2	1 ⁻ #	02 1984 $\beta^+ = 100; \beta^+ \text{p} = ?$
^{120}Ce	-49730#	500#				250# ms	0 ⁺	$\beta^+ ?; \beta^+ \text{p} ?$
* ^{120}Rh	T : average 15Lo04=131(5) 06Mo07=136(+14-13)) 04Wa26=120(10)							**
* ^{120}Rh	D : % $\beta^- \text{n}$ from 20Sh.A<8.9(0.4); other 06Mo07<5.4							**
* $^{120}\text{Rh}^m$	E : 12Ka36=59.1(0.5) and 98.1(0.5) gamma rays in a cascade to gs							**
* $^{120}\text{Rh}^n$	T : symmetrized from 12Ka36=294(+16-15)							**
* ^{120}Ag	T : others 83Re05=1.25(0.03) 71Fo22=1.17(0.05) not used (outliers)							**
* ^{120}Ag	D : % $\beta^- \text{n}$ from 83Re05							**
* $^{120}\text{Ag}^n$	T : average 12Ba58=440(50) 03Wa13=400(30) 71Fo22=320(40)							**
* $^{120}\text{Ag}^p$	J : 203 keV E3 gamma-ray to 4(+)							**
* $^{120}\text{Sn}^n$	J : 67.2-keV gamma-ray depopulating transition E2 to 8+							**
* $^{120}\text{Sb}^p$	E : 2328.3(0.6) keV above $^{120}\text{Sb}^m$							**
* ^{120}I	T : average 06Ph01=82.1(0.6) 00Ho19=81.7(0.2) 65An05=81.0(0.6)							**
* $^{120}\text{I}^m$	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 : % $\beta^+ \alpha$ and % $\beta^+ \text{p}$ are for both the gs and isomer in 75Ho09							**
* $^{120}\text{Cs}^m$	D : % $\beta^+ \alpha$ and % $\beta^+ \text{p}$ are for both the gs and isomer in 75Ho09							**
^{121}Tc	-31540#	500#				22 ms 6	5/2 ⁺ #	15 2015 $\beta^- = 100; \beta^- \text{n} ?; \beta^- 2\text{n} ?$
^{121}Ru	-44620#	400#				29 ms 2	3/2 ⁺ #	15 2010 $\beta^- = 100; \beta^- \text{n} ?; \beta^- 2\text{n} ?$
^{121}Rh	-56250	620				74 ms 4	7/2 ⁺ #	10 15Lo04 T 1994 $\beta^- = 100; \beta^- \text{n} > 11$ *
^{121}Pd	-66182	3				290 ms 1	3/2 ⁺ #	10 15Lo04 T 1994 $\beta^- = 100; \beta^- \text{n} < 0.8$ *
$^{121}\text{Pd}^m$	-66047	3	135.5	0.5		460 ns 90	7/2 ⁺ #	10 12Ka36 ETD2007 $\text{IT}=100$ *
$^{121}\text{Pd}^n$	-66022	14	160	14		460 ns 90	11/2 ⁻ #	12Ka36 ETD2007 $\text{IT}=100$ *
^{121}Ag	-74403	12			*	777 ms 10	7/2 ⁺ #	10 83Re05 D 1982 $\beta^- = 100; \beta^- \text{n} = 0.080 \text{ 13}$ *
$^{121}\text{Ag}^m$	-74383#	23#	20#	20#	*	200# ms	1/2 ⁻ #	$\beta^- ?; \text{IT} ?; \beta^- \text{n} ?$
^{121}Cd	-81073.8	1.9				13.5 s 0.3	3/2 ⁺ *	10 13Yo02 J 1965 $\beta^- = 100$
$^{121}\text{Cd}^m$	-80858.9	1.9	214.86	0.15		8.3 s 0.8	11/2 ⁻ *	10 13Yo02 J 1982 $\beta^- = 100$
^{121}In	-85835	27				23.1 s 0.6	9/2 ⁺ *	10 1960 $\beta^- = 100$
$^{121}\text{In}^m$	-85521	27	313.68	0.07		3.88 m 0.10	1/2 ⁻ *	10 1974 $\beta^- = 98.8 \text{ 2}; \text{IT}=1.2 \text{ 2}$
$^{121}\text{In}^n$	-83290#	100#	2550#	100#		7.3 μs 2	(25/2 ⁺)	20Bi06 TDJ 2002 $\text{IT}=100$ *
^{121}Sn	-89196.6	1.0				27.03 h 0.04	3/2 ⁺ *	10 1948 $\beta^- = 100$
$^{121}\text{Sn}^m$	-89190.3	1.0	6.31	0.06		43.9 y 0.5	11/2 ⁻ *	10 1962 $\text{IT}=77.6 \text{ 20}; \beta^- = 22.4 \text{ 20}$
$^{121}\text{Sn}^n$	-87197.9	1.0	1998.68	0.13		5.3 μs 0.5	19/2 ⁺	10 16Is03 E 1995 $\text{IT}=100$ *
$^{121}\text{Sn}^p$	-86974.6	1.0	2222.0	0.2		520 ns 50	23/2 ⁺	16Is03 EJT 2012 $\text{IT}=100$ *
$^{121}\text{Sn}^q$	-86362.7	1.0	2833.9	0.2		167 ns 25	27/2 ⁻	10 16Is03 EJ 1995 $\text{IT}=100$ *
^{121}Sb	-89599.2	2.5				STABLE	5/2 ⁺ *	10 1922 $\text{IS}=57.21 \text{ 5}$
$^{121}\text{Sb}^m$	-86848	17	2751	17		179 μs 6	(25/2 ⁺)	10 09Wa02 EJ 2008 $\text{IT}=100$ *

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{121}Te	-88543	26	19.31 d 0.07	$1/2^+$	10	19Jo03	T 1939	$\beta^+=100$	*
$^{121}\text{Te}^m$	-88249	26	164.7 d 0.5	$11/2^-$	10	19Jo03	T 1940	$\text{IT}=88.6\ 11; \beta^+=11.4\ 11$	*
^{121}I	-86246	5	2.12 h 0.01	$5/2^+*$	10		1950	$\beta^+=100$	
$^{121}\text{I}^m$	-83869	5	9.0 μs 1.4	$21/2^+\#$	10		1982	$\text{IT}=100$	
^{121}Xe	-82481	10	40.1 m 2.0	$5/2^+*$	10	90NeZY	J 1952	$\beta^+=100$	*
^{121}Cs	-77102	14	155 s 4	$3/2^+*$	10		1969	$\beta^+=100$	
$^{121}\text{Cs}^m$	-77034	14	122 s 3	$9/2^+*$	10	91Ge02	D 1981	$\beta^+\approx 83; \text{IT}\approx 17$	
$^{121}\text{Cs}^x$	-77056	16	46	8	$R=2\ 1$				
^{121}Ba	-70740	140	29.7 s 1.5	$5/2^+*$	10	75Bo11	D 1975	$\beta^+=100; \beta^+p=0.02\ 1$	*
^{121}La	-62190#	300#	5.3 s 0.2	$11/2^- \#$	10		1988	$\beta^+=100; \beta^+p?$	
^{121}Ce	-52690#	400#	1.1 s 0.1	$5/2^+(\#)$	10		1997	$\beta^+=100; \beta^+p\approx 1$	
^{121}Pr	-41550#	500#	12 ms 5	$(3/2)^+(\#)$	10		2005	$p\approx 100$	*
* ^{121}Rh	T : average 15Lo04=76(5) 20Sh.A=71(7)								**
* ^{121}Rh	D : $\% \beta^-n$ from 20Sh.A>11.5(0.6)								**
* ^{121}Pd	T : other 06Mo07=285(24)								**
* $^{121}\text{Pd}^m$	T : symmetrized from 12Ka36=460(+85-92) assuming two isomers in a cascade;								**
* $^{121}\text{Pd}^m$	T : other 12LaZT=630(50) assuming a single-decaying isomer								**
* $^{121}\text{Pd}^n$	T : symmetrized from 12Ka36=463(+83-94) assuming two isomers in a cascade;								**
* $^{121}\text{Pd}^n$	E : x keV above $^{121}\text{Pd}^m$, with x<50 keV estimated by nubase								**
* ^{121}Ag	T : average 06Mo07=661(+75-72) 83Re05=780(10); others 82Fo10=720(100)								**
* ^{121}Ag	T : 95Fe12=1043(80)								**
* $^{121}\text{In}^n$	T : others (not used) 10Re01=17(2) μs 02Lu15=350(50)ns								**
* $^{121}\text{Sn}^n$	E : from a least-squares fit to the level scheme in 16Is03								**
* $^{121}\text{Sn}^p$	E : from a least-squares fit to the level scheme in 16Is03								**
* $^{121}\text{Sn}^q$	E : from a least-squares fit to the level scheme in 16Is03; other								**
* $^{121}\text{Sn}^q$	E : 2832.7(0.5) from a least-squares fit to the level scheme in 12As05								**
* $^{121}\text{Sb}^m$	E : x keV above the 2721.6(0.4) level with x<60 in 08Jo03								**
* ^{121}Te	T : average 19Jo03=19.38(0.03) 08Ea01=19.2 (0.1) 95Si30=19.16(0.05);								**
* ^{121}Te	T : Birge ratio=2.8								**
* $^{121}\text{Te}^m$	T : average 19Jo03=165.1(0.7) 08Ea01=164.2 (0.8)								**
* ^{121}Xe	J : 90NeZY=5/2								**
* ^{121}Ba	J : 88We14=5/2								**
* ^{121}Pr	T : symmetrized from 05Ro19=10(+6-3)								**
^{122}Tc	-26310#	300#	13# ms >550ns	$1^+\#$	18	Sh11	I 2018	$\beta^-?; \beta^-n?; \beta^-2n?$	
^{122}Ru	-41780#	500#	25 ms 1	0^+	15		2010	$\beta^-=100; \beta^-n?; \beta^-2n?$	
^{122}Rh	-51880#	300#	51 ms 6	$7^- \#$	13	15Lo04	T 1997	$\beta^-=100; \beta^-n<3.9; \beta^-2n?$	*
$^{122}\text{Rh}^m$	-51610#	300#	830 ns 120	$4^+\#$	13	12Ka36	ETD2012	$\text{IT}=100$	*
^{122}Pd	-64616	20	193 ms 5	0^+	14	15Lo04	T 1994	$\beta^-=100; \beta^-n<2.5$	*
^{122}Ag	-71110	40	529 ms 13	(3^+)	07		1978	$\beta^-=100; \beta^-n=0.186\ 10$	*
$^{122}\text{Ag}^m$	-71030#	60#	550 ms 50	(1^-)	07		2000	$\beta^-=100; \text{IT}?: \beta^-n=?$	*
$^{122}\text{Ag}^n$	-71030#	60#	200 ms 50	(9^-)	07	95Za01	D 2000	$\beta^-=100; \text{IT}?: \beta^-n?$	*
$^{122}\text{Ag}^p$	-70940#	60#	6.3 μs 1.0	(1^+)	13	La11	TJE 2013	$\text{IT}=100$	*
^{122}Cd	-80612.4	2.3	5.24 s 0.03	0^+	07		1973	$\beta^-=100$	
^{122}In	-83570	50	1.5 s 0.3	1^+	07		1963	$\beta^-=100$	
$^{122}\text{In}^m$	-83530#	80#	10.3 s 0.6	5^+*	07		1979	$\beta^-=100$	
$^{122}\text{In}^n$	-83280	130	10.8 s 0.4	8^-*	07		1979	$\beta^-=100$	
^{122}Sn	-89940.0	2.4	STABLE	0^+	07		1928	$\text{IS}=4.63\ 3; 2\beta^-?$	*
$^{122}\text{Sn}^m$	-87531.0	2.4	2409.03	0.04	7.5 μs 0.9	7-	07	$\text{IT}=100$	
$^{122}\text{Sn}^n$	-87174.5	2.4	2765.5	0.3	62 μs 3	10^+	07	14Is04	EJ 1992
$^{122}\text{Sn}^p$	-85218.8	2.4	4721.2	0.3	139 ns 9	15^-	14Is04	EJT 2012	$\text{IT}=100$
^{122}Sb	-88334.2	2.5	2.7238 d 0.0002	2^-*	07		1939	$\beta^-=97.59\ 12; \beta^+=2.41\ 12$	
$^{122}\text{Sb}^m$	-88272.8	2.5	1.86 μs 0.08	3^+	07		1962	$\text{IT}=100$	
$^{122}\text{Sb}^n$	-88196.7	2.5	137.4726	0.0008	530 μs 30	5^+	07	$\text{IT}=100$	
$^{122}\text{Sb}^p$	-88170.6	2.5	163.5591	0.0017	4.191 m 0.003	8^-	07	$\text{IT}=100$	
^{122}Te	-90313.3	1.4	STABLE	0^+	07		1932	$\text{IS}=2.55\ 12$	
^{122}I	-86079	5	3.63 m 0.06	1^+	07	12At01	D 1950	$\beta^+=100; e^+=78\ 2; e=22\ 2$	*
$^{122}\text{I}^m$	-85764	5	193.3 ns 0.9	7^-	07	19Mo28	TJ 2004	$\text{IT}=100$	
$^{122}\text{I}^n$	-85700	5	79.1 μs 1.2	7^-	07	19Mo28	TJ 2004	$\text{IT}=100$	
$^{122}\text{I}^p$	-85685	5	394.1	0.5	78.2 μs 0.4	(8^+)	07	19Mo28	TJ 2004
$^{122}\text{I}^q$	-85635	5	146.5 ns 1.2	8^-	07	19Mo28	TJ 2004	$\text{IT}=100$	
^{122}Xe	-85355	11	20.1 h 0.1	0^+	07		1952	$e=100$	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{122}Cs	-78140	30			21.18 s 0.19	1^+*	07	75Ho09 D	1969	$\beta^+=100; \beta^+ \alpha < 2e-7$	
$^{122}\text{Cs}^m$	-78090	30	45.87	0.12	$> 1 \mu\text{s}$	3^+	07		1987	IT=100	
$^{122}\text{Cs}^n$	-78005	9	140	30 MD	3.70 m 0.11	8^-*	07		1969	$\beta^+=100$	
$^{122}\text{Cs}^p$	-78010	30	127.07	0.16	360 ms 20	5^-	07		1969	IT=100	
$^{122}\text{Cs}^x$	-78130	30	14	7	$R = 0.10$ 0.05	$spmix$					
^{122}Ba	-74609	28			1.95 m 0.15	0^+	07		1974	$\beta^+=100$	
^{122}La	-64540#	300#			8.6 s 0.5	(1^-)	07		1984	$\beta^+=100; \beta^+p=?$	*
^{122}Ce	-57870#	400#			2# s	0^+	07		2005	$\beta^+ ?; \beta^+p ?$	
^{122}Pr	-44780#	500#			500# ms					$\beta^+ ?; \beta^+p ?$	
* ^{122}Rh	D : $\% \beta^- n$ from 20Sh.A < 3.87(6)										**
* $^{122}\text{Rh}^m$	E : 12Ka36=63.9(0.5) and 207.1(0.5) gamma rays in a cascade to gs										**
* $^{122}\text{Rh}^n$	T : symmetrized from 12Ka36=820(+130-110)										**
* ^{122}Pd	T : average 15Lo04=195(5) 06Mo07=175(16)										**
* ^{122}Ag	D : $\% \beta^- n$ from 83Re05, probably includes gs and isomers										**
* $^{122}\text{Ag}^m$	D : $\beta^- n$ was observed by 00Kr18, but it was not quantified										**
* $^{122}\text{Ag}^n$	J : direct β^- decay feeding of 8- level in ^{122}Cd in 95Za01;										**
* $^{122}\text{Ag}^p$	J : 00Kr18=9 from hfs										**
* $^{122}\text{Ag}^p$	E : 91-keV above $^{122}\text{Ag}^m$ in 13La11										**
* ^{122}Sn	T : 0nu-BB 18No01 > 13 Ty										**
* $^{122}\text{Sn}^n$	E : from a least-squares fit to the level scheme of 14Is04; other										**
* $^{122}\text{Sn}^n$	E : 2765.3(0.4) from a least-squares fit to the level scheme of 12As05										**
* $^{122}\text{Sn}^n$	T : other 17Ki09=60.8(+8.3-7.0)										**
* $^{122}\text{Sn}^p$	T : average 14Is04=134(12) 12As05=146(15)										**
* $^{122}\text{Sn}^p$	E : from a least-squares fit to the level scheme in 14Is04; other										**
* $^{122}\text{Sn}^p$	E : 4720.2(0.45) from a least-squares fit to the level scheme in 12As05										**
* ^{122}I	T : others 12At01=4.15(+0.30-0.25) for $^{122}\text{I}^{+53}$ and										**
* ^{122}I	T : 3.13(+0.15-0.13) for $^{122}\text{I}^{+52}$										**
* ^{122}La	J : significant direct β^+ feeding to 2+ in ^{122}Ba in 92Mo13										**
^{123}Ru	-36550#	500#			19 ms 2	$3/2^+\#$	15		2010	$\beta^-=100; \beta^- n ?; \beta^- 2n ?$	
^{123}Rh	-49190#	400#			42 ms 4	$7/2^+\#$	15	20Sh.A D	2010	$\beta^-=100; \beta^- n > 24; \beta^- 2n ?$	
^{123}Pd	-60430	790			108 ms 1	$3/2^+\#$	15	14SmZZ TD	1994	$\beta^-=100; \beta^- n = 10.6$	*
$^{123}\text{Pd}^m$	-60330#	790#	100#	50#	100# ms	$11/2^-\#$	15	19Ch24 ID	2019	$\beta^- \approx 100; IT ?$	
^{123}Ag	-69570	30			294 ms 5	$(7/2^+)*$	17	06Mo07 TD	1976	$\beta^-=100; \beta^- n = 0.56.5$	*
$^{123}\text{Ag}^m$	-69510	30	59.5	0.5	100# ms	$(1/2^-)*$	19	Ch24 E	2019	$\beta^-=100; \beta^- n ?$	*
$^{123}\text{Ag}^n$	-68120#	30#	1450#	14#	202 ns 20	$(17/2^-)$	17	13La11 ETD	2013	IT=100	*
$^{123}\text{Ag}^p$	-68100	30	1472.8	0.8	393 ns 16	$(17/2^-)$	17	13La11 ET	2009	IT=100	*
^{123}Cd	-77414.2	2.7			2.10 s 0.02	$3/2^+*$	04	13Yo02 J	1983	$\beta^- = 100$	
$^{123}\text{Cd}^m$	-77271	3	143	4	1.82 s 0.03	$11/2^-*$	04	13Yo02 J	1986	$\beta^- = ?; IT ?$	
^{123}In	-83429	20			6.17 s 0.05	$9/2^+*$	04		1960	$\beta^- = 100$	
$^{123}\text{In}^m$	-83102	20	327.21	0.04	47.4 s 0.4	$1/2^-*$	04		1960	$\beta^- = 100$	
$^{123}\text{In}^n$	-81351	20	2078.1	0.6	1.4 μs 0.2	$(17/2^-)$	04	Sc42 ETJ	2004	IT=100	*
$^{123}\text{In}^p$	-81326#	24#	2103#	14#	$> 100 \mu\text{s}$	$(21/2^-)$	10	10Re01 EJT	2010	IT=100	*
^{123}Sn	-87814.7	2.5			129.2 d 0.4	$11/2^-*$	04		1948	$\beta^- = 100$	
$^{123}\text{Sn}^m$	-87790.1	2.5	24.6	0.4	40.06 m 0.01	$3/2^+*$	04		1948	$\beta^- = 100$	
$^{123}\text{Sn}^n$	-85869.8	2.5	1944.90	0.12	7.4 μs 2.6	$19/2^+$	04	16Is03 EJ	1992	IT=100	
$^{123}\text{Sn}^p$	-85662.0	2.5	2152.66	0.19	6 μs	$23/2^+$	04	16Is03 EJ	1994	IT=100	
$^{123}\text{Sn}^q$	-85102.2	2.5	2712.47	0.21	34 μs	$27/2^-$	04	16Is03 EJ	1994	IT=100	
^{123}Sb	-89222.9	1.4			STABLE	$7/2^+*$	04		1922	IS=42.79.5	
$^{123}\text{Sb}^m$	-86985.1	1.4	2237.8	0.3	214 ns 3	$19/2^-$	09	Wa02 ETJ	2005	IT=100	*
$^{123}\text{Sb}^n$	-86609.5	1.5	2613.4	0.4	65 μs 1	$23/2^+$	09	Wa02 ETJ	2007	IT=100	*
^{123}Te	-89171.0	1.4			STABLE	$> 2\text{Py}$	04	03Al02 T	1932	IS=0.89.3; $\epsilon=100$	
$^{123}\text{Te}^m$	-88923.5	1.4	247.47	0.04	119.2 d 0.1	$11/2^-$	04		1951	IT=100	
^{123}I	-87943	4			13.2232 h 0.0015	$5/2^+*$	04	FGK209 T	1949	$\beta^+ = 100$	
^{123}Xe	-85248	10			2.08 h 0.02	$1/2^+*$	04	90NeZY J	1952	$\beta^+ = 100$	*
$^{123}\text{Xe}^m$	-85063	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	$\beta^+ = 100$	
$^{123}\text{Cs}^m$	-80888	12	156.27	0.05	1.64 s 0.12	$11/2^-$	04		1972	IT=100	*
$^{123}\text{Cs}^n$	-80792	13	252	6	114 ns 5	$(9/2^+)$	04	GAu127 E	2000	IT=100	*
$^{123}\text{Cs}^x$	-81037	13	7	4	$R < 0.1$	$spmix$					
^{123}Ba	-75655	12			2.7 m 0.4	$5/2^+*$	04		1962	$\beta^+ = 100$	*
$^{123}\text{Ba}^m$	-75534	12	120.95	0.08	830 ns 60	$1/2^+\#$	04		1991	IT=100	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{123}La	-68650#	200#			17 s 3	$11/2^-$ #	04		1978	$\beta^+=100$		
^{123}Ce	-60290#	300#			3.8 s 0.2	$(5/2)^{+}(\#)$	04		1984	$\beta^+=100; \beta^+p=?$		
^{123}Pr	-50230#	400#			800# ms	$3/2^{+}\#$				$\beta^+ ?; \beta^+p ?$		
* ^{123}Pd	T : from 15Lo04=108(1); others 06Mo07=174(+38-34) 14SmZZ=170(+49-52)										**	
* ^{123}Ag	J : 00Kr18=(7/2), $g_{9/2}$; hfs comparison to $^{107,107m}\text{Ag}$										**	
* ^{123}Ag	D : $\% \beta^-n$ average 06Mo07=1.0(0.5) 93Ru01=0.55(0.05) 14TeZY=0.60(0.25);										**	
* ^{123}Ag	D : probably includes gs and isomer										**	
* ^{123}Ag	T : average 06Mo07=272(24) 95Fe12=293(7) 86Ma42=300(20) 83Re05=300(10);										**	
* ^{123}Ag	T : others 89Hu10=350(40) 76Lu02=390(30) 14TeZY=396(15)										**	
* $^{123}\text{Ag}^m$	J : 00Kr18=(1/2), $p_{1/2}$; hfs comparison to $^{107,107m}\text{Ag}$										**	
* $^{123}\text{Ag}^n$	E : 13La11=1365+x keV above $^{123}\text{Ag}^m$; x=50# keV estimated by Nubase										**	
* $^{123}\text{Ag}^p$	T : average 13La11=393(16) 09St28=396(37); other 05WaZY=330(20)										**	
* $^{123}\text{In}^n$	E : from a least-squares fit to gamma-ray energies in 04Sc42										**	
* $^{123}\text{In}^p$	E : from 2078.1+x keV; x=50# keV estimated by Nubase										**	
* $^{123}\text{Sn}^n$	E : from a least-squares fit to the level scheme in 16Is03										**	
* $^{123}\text{Sn}^p$	E : from a least-squares fit to the level scheme in 16Is03										**	
* $^{123}\text{Sn}^q$	E : from a least-squares fit to the level scheme in 16Is03										**	
* $^{123}\text{Sb}^m$	E : from a least-squares fit to gamma-ray energies in 09Wa02										**	
* $^{123}\text{Sb}^n$	E : from a least-squares fit to gamma-ray energies in 09Wa02										**	
* ^{123}Xe	J : 90NeZY=1/2										**	
* $^{123}\text{Cs}^m$	J : E3 to 5/2+ followed by E2 to 1/2+										**	
* $^{123}\text{Cs}^n$	E : from 231.63 + x; x<40 keV estimated by Nubase										**	
* ^{123}Ba	J : also 88We14=5/2										**	
^{124}Ru	-33590#	600#			15 ms 3	0^+	15		2010	$\beta^-=100; \beta^-n ?; \beta^-2n ?$		
^{124}Rh	-44710#	400#			30 ms 2	$2^{+}\#$	15	20Sh.A	D	2010	$\beta^-=100; \beta^-n<31; \beta^-2n ?$	
^{124}Pd	-58400#	300#			88 ms 15	0^+	14	14SmZZ	TD	1997	$\beta^-=100; \beta^-n=17.5$	
$^{124}\text{Pd}^m$	-57400#	850#	1000#	800#	> 20 μs		14	12Ka36	ET	2012	IT $\approx$ 100	
^{124}Ag	-66230	250		*	177.9 ms 2.6	(2^-)	15	14Ba18	J	1984	$\beta^-=100; \beta^-n=1.3.9$	
$^{124}\text{Ag}^m$	-66180#	260#	50#	50#	144 ms 20	9^- #	15	14Ba18	TDJ	1995	$\beta^-=100; \beta^-n ?$	
$^{124}\text{Ag}^n$	-66070	250	155.6	0.5	140 ns 50	(1^+)	15	13La11	TJ	2012	IT=100	
$^{124}\text{Ag}^p$	-66000	250	231.1	0.7	1.48 μs 0.15	(1^-)	15	13La11	TJ	2012	IT=100	
^{124}Cd	-76699.4	2.6			1.25 s 0.02	0^+	08		1974	$\beta^-=100$		
^{124}In	-80870	30		*	3.12 s 0.09	$3^{+}*$	08		1964	$\beta^-=100$		
$^{124}\text{In}^m$	-80890	50	-20	60	BD*	8^-*	08	14Le20	T	1974	$\beta^-\approx 100; \text{IT} ?$	
^{124}Sn	-88231.5	1.3			STABLE	>100Py	0^+	08	52Ka41	T	1922	IS=5.79.5; $2\beta^- ?$
$^{124}\text{Sn}^m$	-86026.9	1.3	2204.620	0.023	270 ns 60	5^-	08	FGK127	J	1979	IT=100	
$^{124}\text{Sn}^n$	-85906.5	1.3	2324.96	0.04	3.1 μs 0.5	7^-	08	14Is04	EJ	1979	IT=100	
$^{124}\text{Sn}^p$	-85574.9	1.3	2656.6	0.3	51 μs 3	10^+	08	14Is04	EJ	1992	IT=100	
$^{124}\text{Sn}^q$	-83679.1	1.3	4552.4	0.3	260 ns 25	15^-		14Is04	EJ	2012	IT=100	
^{124}Sb	-87619.1	1.4			60.20 d 0.03	3^-*	08		1939	$\beta^-=100$		
$^{124}\text{Sb}^m$	-87608.2	1.4	10.8627	0.0008	93 s 5	5^+	08		1947	IT=75.5; $\beta^-=25.5$		
$^{124}\text{Sb}^n$	-87582.3	1.4	36.8440	0.0014	20.2 m 0.2	$(8)^-$	08		1947	IT=100[gs=0, m=100]		
$^{124}\text{Sb}^p$	-87578.3	1.4	40.8038	0.0007	3.2 μs 0.3	(3^+)	08	FGK208	J	1989	IT=100	
^{124}Te	-90524.1	1.4			STABLE	0^+	08		1932	IS=4.74.14		
^{124}I	-87364.6	2.3			4.1760 d 0.0003	2^-*	08	92Wo03	T	1938	$\beta^+=100$	
^{124}Xe	-87667.4	1.4			STABLE	>200Ty	0^+	08	89Ba22	T	1922	IS=0.095.5; $2\beta^+ ?$
^{124}Cs	-81741	9			30.9 s 0.4	$1^{+}*$	08		1969	$\beta^+=100$		
$^{124}\text{Cs}^m$	-81278	9	462.63	0.14	6.41 s 0.07	$(7)^+$	08	17Ra20	D	1983	IT=99.89.2; $\beta^+=0.11.2$	
$^{124}\text{Cs}^n$	-81711	22	30	20	$R=?$	$spmix$						
^{124}Ba	-79090	12			11.0 m 0.5	0^+	08		1967	$\beta^+=100$		
^{124}La	-70260	60		*&	29.21 s 0.17	$(7,8^-)$	08	92Id01	J	1978	$\beta^+=100$	
$^{124}\text{La}^m$	-70160#	120#	100#	100#	21 s 4	2^- #	08		1992	$\beta^+=100$		
^{124}Ce	-64920#	300#			9.1 s 1.2	0^+	08	97As05	T	1978	$\beta^+=100$	
^{124}Pr	-53150#	400#			1.2 s 0.2		08		1986	$\beta^+=100; \beta^+p=?$		
^{124}Nd	-44830#	500#			500# ms	0^+				$\beta^+ ?; \beta^+p ?$		
* ^{124}Pd	T : from 15Lo04; others 06Mo07=38(+38-19) 14SmZZ=0.144(+25-24)										**	
* ^{124}Ag	T : average 15Lo04=180(3) 95Fe12=172(5); others 14Ba18=191(28) 84Hi03=170(30)										**	
* ^{124}Ag	D : $\% \beta^-n$ from 06Mo07, probably includes gs and isomer										**	
* $^{124}\text{Ag}^m$	J : β^- feeding to 8+ and 10+ levels in ^{124}Cd in 14Ba18 would be										**	
* $^{124}\text{Ag}^n$	J : consistent with J=9; 14Ba18 assumes J=(8-)										**	
* $^{124}\text{Ag}^p$	E : 12Ka36=75.5(0.5) and 155.6(0.5) gamma rays in a cascade to gs										**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹²⁴ Ag ^p	T : average 13La11=1.46(0.20) 12Ka36=1.62(+0.29-0.24) 05WaZY=1.3(0.3)							**
* ¹²⁴ In ^m	T : from 14Le20; others 86Go10=3.7(0.2) 74Fo23=2.4(0.3)							**
* ¹²⁴ Sn ^m	J : E1 to 4+; L(p,p)=5 for ¹²⁴ Sn ^m							**
* ¹²⁴ Sn ⁿ	T : from 17Ki09=2.83(0.12); other 79Fo10=3.1(0.5)							**
* ¹²⁴ Sn ^p	T : average 17Ki09=55.0(+4.7-4.1) 92Br06=45(5)							**
* ¹²⁴ Sn ^q	T : average 14Is04=260(30) 12As05=260(25)							**
* ¹²⁴ Sb ^p	J : E2 to 5+							**
* ¹²⁴ I	T : other (similar precision) 16Lu16=4.1758(14) 21Pi01=1.179(0.006)							**
* ¹²⁴ Xe	T : 2nu-εε 16Ab03(XMASS)>4.7 Zy (at 90% C.L.); 17Ap02(XENON)>0.65 Zy;							**
* ¹²⁴ Xe	T : 2nu-ε(K)ε(K) 19Ap03=18(5,stat)(1,syst) Zy							**
* ¹²⁴ Cs ^m	T : from 14Le20; other 83We07=6.3(0.2)							**
* ¹²⁴ Ce	T : average 97As05=10.8(1.5) 78Bo32=6(2)							**
¹²⁵ Ru	-28370#	300#	12# ms >550ns	3/2 ⁺ #	18Sh11	I	2018	β ⁻ ?; β ⁻ n ?; β ⁻ 2n ?
¹²⁵ Rh	-41830#	500#	26.5 ms 2.0	7/2 ⁺ #	15		2010	β ⁻ =100; β ⁻ n ?; β ⁻ 2n ?
¹²⁵ Pd	-53960#	400#	60 ms 6	3/2 ⁺ #	15	14SmZZ	TD 2008	β ⁻ =100; β ⁻ n=12 4
¹²⁵ Pd ^m	-53860#	400#	50# ms	11/2 ⁻ #	19Ch24	ID	2019	β ⁻ ≈100; IT ?
¹²⁵ Pd ⁿ	-52160#	400#	144 ns 4	(23/2 ⁺)	15	19Wa14	ETJ 2019	IT=100
¹²⁵ Ag	-64520	430	160 ms 5	(9/2 ⁺)*	15	14SmZZ	TD 1994	β ⁻ =100; β ⁻ n=11.8 10
¹²⁵ Ag ^m	-64420	430	50# ms	(1/2 ⁻)*	19Ch24	E	2019	β ⁻ ?; IT ?; β ⁻ n ?
¹²⁵ Ag ⁿ	-63020	430	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	480 ms 30	11/2 ⁻ *	11	13Yo02	J 1986	β ⁻ =100
¹²⁵ Cd ⁿ	-71700	5	19 μs 3	(19/2 ⁺)	11	Si32	EJT 2011	IT=100
¹²⁵ In	-80412.3	1.8	2.36 s 0.04	9/2 ⁺ *	11		1967	β ⁻ =100
¹²⁵ In ^m	-80060	12	12.2 s 0.2	1/2 ⁻ *	11		1974	β ⁻ =100
¹²⁵ In ⁿ	-78402.9	1.9	9.4 μs 0.6	(19/2 ⁺)	11		1998	IT=100
¹²⁵ In ^p	-78251.1	2.0	5.0 ms 1.5	(23/2 ⁻)	11		1998	IT=100
¹²⁵ Sn	-85893.7	1.3	9.634 d 0.015	11/2 ⁻ *	11	20Yo.A	J 1939	β ⁻ =100
¹²⁵ Sn ^m	-85866.2	1.3	9.77 m 0.25	3/2 ⁺ *	11	20Yo.A	J 1939	β ⁻ =100
¹²⁵ Sn ⁿ	-84000.9	1.3	6.2 μs 0.2	19/2 ⁺	11	08Lo07	J 2000	IT=100
¹²⁵ Sn ^p	-83834.2	1.4	650 ns 60	23/2 ⁺	11	16Is03	T 2008	IT=100
¹²⁵ Sn ^q	-83270.2	1.4	230 ns 17	27/2 ⁻	11	08Lo07	T 2000	IT=100
¹²⁵ Sb	-88255.1	2.5	2.7576 y 0.0011	7/2 ⁺ *	11	FGK209	T 1951	β ⁻ =100
¹²⁵ Sb ^m	-86283.9	2.5	4.1 μs 0.2	15/2 ⁻	11		2007	IT=100
¹²⁵ Sb ⁿ	-86143.0	2.5	28.5 μs 0.5	19/2 ⁻	11	FGK128	J 2007	IT=100
¹²⁵ Sb ^q	-85784.1	2.5	277.0 ns 6.4	(23/2 ⁺) ⁺	11	19Bi04	T 2007	IT=100
¹²⁵ Te	-89021.8	1.4	STABLE	1/2 ⁺ *	11		1931	IS=7.07 15
¹²⁵ Te ^m	-88877.0	1.4	57.40 d 0.15	11/2 ⁻	11		1949	IT=100
¹²⁵ I	-88836.0	1.4	59.392 d 0.008	5/2 ⁺ *	11	FGK209	T 1947	ε=100
¹²⁵ Xe	-87199.4	1.4	16.87 h 0.08	1/2 ⁺ *	11	19Sz01	T 1950	β ⁺ =100
¹²⁵ Xe ^m	-86946.8	1.4	56.9 s 0.9	9/2 ⁻ *	11		1954	IT=100
¹²⁵ Xe ⁿ	-86903.5	1.4	140 ns 30	7/2 ⁺	11		1979	IT=100
¹²⁵ Cs	-84090	8	44.35 m 0.29	1/2 ⁺ *	11	19Sz01	T 1954	β ⁺ =100
¹²⁵ Cs ^m	-83824	8	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	-79549#	23#	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	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#	13 s 10	(1/2 ⁺)	11	07Su07	ETJ 2007	IT=100
¹²⁵ Pr	-58070#	300#	3.3 s 0.7	3/2 ⁺ #	11		2002	β ⁺ =100; β ⁺ p ?
¹²⁵ Nd	-48070#	400#	650 ms 150	(5/2)(⁺ #)	11		1999	β ⁺ =100; β ⁺ p>0
* ¹²⁵ Pd	T : average 15Lo04=57(10) 14SmZZ=61(+8-7)							**
* ¹²⁵ Ag	J : 00Kr18=(9/2) g _{9/2} ; hfs comparison to ^{107,107m} Ag							**
* ¹²⁵ Ag	T : average 15Lo04=150(8) 14SmZZ=163(+11-9) 95Fe12=166(7)							**
* ¹²⁵ Ag ^m	J : 00Kr18=(1/2) p _{1/2} ; hfs comparison to ^{107,107m} Ag							**
* ¹²⁵ Cd ⁿ	E : 11Si32=1461.8(0.7) keV above ¹²⁵ Cd ^m							**
* ¹²⁵ Sn	T : average 20Gu04=9.63(0.02) 68Er03=9.67(0.04) 66La13=9.625(0.025)							**
* ¹²⁵ Sn ^m	T : unweighted average 20Gu04=10.01(0.08) 68Er03=9.52(0.05);							**
* ¹²⁵ Sn ^m	T : Birge ratio=5.19							**
* ¹²⁵ Sn ^p	J : E2 to 19/2+							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹²⁵ Sn ^g	J : E2 to 23/2-							**
* ¹²⁵ Sn ^g	T : average 08Lo07=230(20) 00Zh47=230(30)							**
* ¹²⁵ Sb	T : evaluated by FGK209=1007.2(0.4) d using the world data; other							**
* ¹²⁵ Sb	T : Ensdf2011=2.75856(0.00025) based on old data, but the small							**
* ¹²⁵ Sb	T : uncertainty is not justified							**
* ¹²⁵ Sb ⁿ	J : E2 to 15/2-							**
* ¹²⁵ Sb ⁿ	T : average 19Bi04=28.8(0.6) 07Ju06=28.0(0.7)							**
* ¹²⁵ Sb ^g	T : average 19Bi04=278(7) 07Ju06=272(16)							**
* ¹²⁵ Ba ^m	E : 67.7(0.4) keV above 5/2+ level, estimated at 50#(20#) keV by Nubase							**
* ¹²⁵ Ce ^m	T : symmetrized from 07Su07=134(+641-61) s for a fully ionized ion and							**
* ¹²⁵ Ce ^m	T : α_T =38.1 for a 93.6(0.4) keV, E3 transition;							**
* ¹²⁵ Ce ^m	T : Ensdf2011=3.4(2.7) s							**
¹²⁶ Rh	-37200# 500#		19 ms 3	1 ⁻ #	15		2010	β^- =100; β^- -n ?; β^- -2n ?
¹²⁶ Pd	-51790# 400#		48.6 ms 0.8	0 ⁺	15 14SmZZ D		2008	β^- =100; β^- -n=22 9 *
¹²⁶ Pd ^m	-49770# 400#	2023.5 0.7	330 ns 40	(5 ⁻)	15 13Wa24 ETJ		2013	IT=100
¹²⁶ Pd ⁿ	-49680# 400#	2109.7 0.9	440 ns 30	(7 ⁻)	15 13Wa24 ETJ		2013	IT=100
¹²⁶ Pd ^p	-49380# 400#	2406.0 1.0	23.0 ms 0.8	(10 ⁺)	15 13Wa24 ETJ		2014	B=72 8;IT=28 8
¹²⁶ Ag	-60720# 200#		52 ms 10	3 ⁺ #	15 14Ba18 TD		1994	β^- =100; β^- -n=13.7 11 *
¹²⁶ Ag ^m	-60620# 220#	100# 100#	108.4 ms 2.4	9 ⁻ #	15 14Ba18 TD		1995	β^- =100;IT ?; β^- -n ? *
¹²⁶ Ag ⁿ	-60470# 200#	254.8 0.5	27 μ s 6	1 ⁻ #	15 13La11 JTD		2012	IT=100
¹²⁶ Cd	-72255.7 2.3		512 ms 5	0 ⁺	03 18Ha30 T		1978	β^- =100 *
¹²⁶ In	-77809 4		1.53 s 0.01	3 ⁺ *	03		1974	β^- =100
¹²⁶ In ^m	-77719 5	90 7 MD	1.64 s 0.05	8 ⁻ *	03		1970	β^- =100
¹²⁶ In ⁿ	-77566 4	243.3 0.2	22 μ s 2	1 ⁻	04Sc42 ETJ		2003	IT=100
¹²⁶ Sn	-86015 11		230 ky 14	0 ⁺	03		1962	β^- =100
¹²⁶ Sn ^m	-83796 11	2218.99 0.08	6.1 μ s 0.7	7 ⁻	03 12As05 T		1979	IT=100 *
¹²⁶ Sn ⁿ	-83451 11	2564.5 0.5	7.6 μ s 0.3	10 ⁺	03 12As05 TJ		2000	IT=100 *
¹²⁶ Sn ^p	-81668 11	4347.4 0.4	114 ns 2	15 ⁻	14Is04 EJT		2012	IT=100 *
¹²⁶ Sb	-86390 30		12.35 d 0.06	8 ⁻	03 76Sm01 J		1956	β^- =100
¹²⁶ Sb ^m	-86370 30	17.7 0.3	19.15 m 0.08	5 ⁺	03 76Sm01 JD		1956	β^- =86 4;IT=14 4
¹²⁶ Sb ⁿ	-86350 30	40.4 0.3	$\sim$ 11 s	3 ⁻	03 76Sm01 JD		1976	IT=100[gs=0,m=100]
¹²⁶ Sb ^p	-86290 30	104.6 0.3	553 ns 5	3 ⁺	03 76Sm01 JD		1976	IT=100
¹²⁶ Sb ^g	-84580 30	1810.7 1.7	90 ns 16	(13 ⁺)	19Bi04 EJT		2019	IT=100
¹²⁶ Te	-90064.2 1.4		STABLE	0 ⁺	03		1924	IS=8.84 25
¹²⁶ I	-87910 4		12.93 d 0.05	2 ⁻ *	03		1938	β^+ =52.7 5; β^- =47.3 5
¹²⁶ I ^m	-87799 4	111.00 0.23	128 ns	3 ⁺	12Mo.A EJT		2012	IT=100
¹²⁶ Xe	-89146.387 0.006		STABLE	0 ⁺	03		1922	IS=0.089 3; $2\beta^+$? *
¹²⁶ Cs	-84351 10		1.64 m 0.02	1 ⁺ *	03		1954	β^+ =100
¹²⁶ Cs ^m	-84078 10	273.0 0.7	$\sim$ 1 μ s	(4 ⁻)	03 91TaZX TD		1993	IT=100 *
¹²⁶ Cs ⁿ	-83755 10	596.1 1.1	171 μ s 14	8 ⁻ #	03 07Wa09 J		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	1 ⁻ #	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)	03 88Ba42 T		1983	β^+ =100; β^+ p=? *
¹²⁶ Nd	-53380# 300#		1# s >200ns	0 ⁺	03 00So11 I		2000	β^+ ?; β^+ p ?
¹²⁶ Pm	-39750# 500#		500# ms					β^+ ?; β^+ p ?
* ¹²⁶ Pd	T : from 15Lo04,14Wa26=48.6(0.8); other 14SmZZ=56(+11-9)							**
* ¹²⁶ Ag	D : % β^- -n from 14SmZZ, probably includes gs and isomer							**
* ¹²⁶ Ag ^m	T : average 14Ba18=92(9) 15Lo04=98(5) 14SmZZ=114(3) 95Fe12=107(12)							**
* ¹²⁶ Cd	T : average 18Ha30=515(17) 15Lo04=513(6) 78Ga18=506(15);other 86Go10=600(30)							**
* ¹²⁶ Sn ^m	T : average 12As05=6.6(1.4) 10Il01=5.9(0.8)							**
* ¹²⁶ Sn ⁿ	T : average 12As05=7.7(0.5) 10Il01=7.5(0.3)							**
* ¹²⁶ Sn ^p	T : other 12As05=160(20) not used (at variance)							**
* ¹²⁶ Xe	T : 2nu- $\epsilon\epsilon$ 16Ab03>4.7Zy (90% CL); 2nu- ϵ (K) ϵ (K) 19Ab04>19 Zy							**
* ¹²⁶ Cs ⁿ	T : 91TaZX $\leq$ 1 us; 218-keV and 241-keV gamma-ray transition below							**
* ¹²⁶ Cs ^m	T : the (4-) isomer show the same lifetime, 166(15) us and 176(15) us,							**
* ¹²⁶ Cs ^m	T : respectively, which is identical to ¹²⁶ Cs ⁿ							**
* ¹²⁶ Cs ⁿ	D : 112-keV and 223-keV gamma rays to 5- and 6- members of K=4- band in							**
* ¹²⁶ Cs ⁿ	D : 93Ko25 and 91TaZX							**
* ¹²⁶ La ^m	T : 97As05: "by far shorter than 50 s"							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ¹²⁶ Pr	T : average 95Os03=3.14(0.22) 88Ba42=3.0(0.4) 83Ni05=3.2(0.6)								**	
¹²⁷ Rh	-33730#	600#	28 ms	14	7/2 ⁺ #	15 15Lo04	TD 2015	β^- =100; β^- -n ?; β^- -2n ?	*	
¹²⁷ Pd	-47220#	500#	38 ms	2	11/2 ⁻ #	15 14SmZZ	TD 2010	β^- =100; β^- -n<19; β^- -2n ?	*	
¹²⁷ Pd ^m	-45500#	500#	1717.91	0.23	39 μ s	6	ETJ 2019	IT=100		
¹²⁷ Ag	-58650#	200#	89 ms	2	(9/2 ⁺)*	11 14SmZZ	D 1995	β^- =100; β^- -n=14.6 15	*	
¹²⁷ Ag ^m	-58630#	200#	20#	ms	(1/2 ⁻)*	00Kr18	J	β^- ?;IT ?		
¹²⁷ Ag ⁿ	-56710#	200#	1938	17	(27/2 ⁺)	21Wa.A	DJT 2021	β^- =91.2 8;IT=8.8 8	*	
¹²⁷ Cd	-68741	6	480 ms	100	3/2 ⁺ *	11 13Yo02	J 1986	β^- =100; β^- -n ?	*	
¹²⁷ Cd ^m	-68456	4	285	8	MD	360 ms	40	13Yo02 J 2019	β^- =100	*
¹²⁷ Cd ⁿ	-66896	10	1845	8	(19/2 ⁺)	10Na17	ETJ 2010	IT=100	*	
¹²⁷ In	-76880	10	1.086 s	0.007	9/2 ⁺ *	11 93Ru01	TD 1975	β^- =100; β^- -n<0.03	*	
¹²⁷ In ^m	-76486	15	394	18	1/2 ⁻ #	11 93Ru01	TD 1974	β^- =100; β^- -n=0.70 4	*	
¹²⁷ In ⁿ	-75110	40	1770	40	MD	1.04 s	0.10	11 18Ba08 E 2004	β^- =100; β^- -n ?	
¹²⁷ In ^p	-74515	10	2364.7	0.9	9 μ s	2	(29/2 ⁺)	11 04Sc42 ETJ 2004	IT=100	
¹²⁷ Sn	-83470	9	2.10 h	0.04	11/2 ⁻ *	11 20Yo.A	J 1951	β^- =100		
¹²⁷ Sn ^m	-83465	9	5.07	0.06	4.13 m	0.03	3/2 ⁺ *	11 20Yo.A J 1962	β^- =100	
¹²⁷ Sn ⁿ	-81643	9	1826.67	0.16	4.52 μ s	0.15	19/2 ⁺	11 08Lo07 J 2000	IT=100	
¹²⁷ Sn ^p	-81539	9	1930.97	0.17	1.26 μ s	0.15	(23/2 ⁺)	11 2004	IT=100	
¹²⁷ Sn ^q	-80918	9	2552.4	1.0	250 ns	30	(27/2 ⁻)	11 08Lo07 J 2008	IT=100	
¹²⁷ Sb	-86698	5	3.85 d	0.05	7/2 ⁺	11	1939	β^- =100		
¹²⁷ Sb ^m	-84778	5	1920.19	0.21	11.7 μ s	0.1	15/2 ⁻	11 19Bi04 T 1974	IT=100	*
¹²⁷ Sb ⁿ	-84373	5	2324.7	0.4	269 ns	5	23/2 ⁺	11 19Bi04 T 2005	IT=100	*
¹²⁷ Te	-88280.5	1.4	9.35 h	0.07	3/2 ⁺	11	1938	β^- =100		
¹²⁷ Te ^m	-88192.3	1.4	88.23	0.07	106.1 d	0.7	11/2 ⁻	11 17Ni03 D 1940	IT=97.86 3; β^- =2.14 3	
¹²⁷ I	-88983	4	STABLE		5/2 ⁺ *	11	1920	IS=100		
¹²⁷ Xe	-88321	4	36.342 d	0.003	1/2 ⁺ *	11 FGK209	T 1950	ϵ =100	*	
¹²⁷ Xe ^m	-88024	4	297.10	0.08	69.2 s	0.9	9/2 ⁻ *	11 90NeZY J 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 μ s	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	β^+ $\approx$ 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	36.9	1.1	> 10 μ s	(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#	2# μ s	(11/2 ⁻)	11 98Mo30 J 1998	IT ?		
¹²⁷ Nd	-55910#	300#	1.8 s	0.4	5/2 ⁺ #	11	1983	β^+ =100; β^+ -p=?		
¹²⁷ Pm	-45310#	400#	1# s	3/2 ⁺ #				β^+ ?;p ?		
* ¹²⁷ Rh	T : symmetrized from 15Lo04=20(+20-7)								**	
* ¹²⁷ Pd	T : from 15Lo04; other 14SmZZ=73(+24-23)								**	
* ¹²⁷ Ag	T : from 15Lo04; other 96Wo.A=79(3), supersedes 95Fe12=109(25), same group								**	
* ¹²⁷ Ag	J : 00Kr18=(9/2) g _{9/2} ; hfs comparison to ^{107,107m} Ag								**	
* ¹²⁷ Ag ^m	J : 00Kr18=(1/2) p _{1/2} ; hfs comparison to ^{107,107m} Ag								**	
* ¹²⁷ Ag ⁿ	E : from 21Wa.A=150(+14-20) keV above the 1792.2(0.9) keV								**	
* ¹²⁷ Cd	T : symmetrized 19Lo04=450(+120-80); other 15Lo04=330(20) mixed states								**	
* ¹²⁷ Cd ^m	T : from 19Lo04								**	
* ¹²⁷ Cd ⁿ	E : 1560.1(0.5) keV above ¹²⁷ Cd ^m								**	
* ¹²⁷ Cd ⁿ	T : others 21Wa.A=18(1) 12Ka36=11.0(+9.2-3.5)								**	
* ¹²⁷ In	T : average 93Ru01=1.083(0.007) 86Go10=1.22(0.05) 83Sh07=0.99(0.10)								**	
* ¹²⁷ In	T : 81En05=1.10(0.04); others 80Lu04=1.12(0.02), superseded by 93Ru01,								**	
* ¹²⁷ In	T : 02Pf04=1.090(0.010), compilation								**	
* ¹²⁷ In ^m	T : average 93Ru01=3.580(0.025) 86ReZU=3.70(0.04) 83Sh07=3.76(0.31)								**	
* ¹²⁷ In ^m	T : 80De35=3.7(0.1); other 02Pf04=3.67(4), compilation								**	
* ¹²⁷ In ^m	D : % β^- -n average 93Ru01=0.72(0.04) 86ReZU=0.54(0.11)								**	
* ¹²⁷ Sb ^m	T : other 74Ap01=11(1)								**	
* ¹²⁷ Sb ⁿ	T : others 09Wa24=234(12) 05Po03=165(20) outlier, not used								**	
* ¹²⁷ Xe	J : 90NeZY=1/2								**	
* ¹²⁷ Xe ^m	J : 90NeZY=9/2								**	
* ¹²⁷ Ce ⁿ	E : 95Os03=29.56(0.05) keV above ¹²⁷ Ce ^m								**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹²⁷ Pr ^m	T : estimated by FGK208 from BE3(11/2- to 5/2+)=41.2(2.0) [W.u.] in								**
* ¹²⁷ Pr ^m	T : ¹³¹ Pr								**
¹²⁸ Rh	-27340#	300#	8# ms >550ns		18Sh11	I	2018	β^- ?; β^-n ?; β^-2n ?	
¹²⁸ Pd	-44390#	500#	35 ms 3	0 ⁺	16 15Lo04	T	2010	β^- =100; β^-n ?	*
¹²⁸ Pd ^m	-42240#	500#	5.8 μ s 0.8	(8 ⁺)	16		2013	IT=100	
¹²⁸ Ag	-54710#	300#	60 ms 3	3 ⁺ #	15 14SmZZ	TD	2000	β^- =100; β^-n =20 5; β^-2n ?	*
¹²⁸ Cd	-67238	6	246 ms 2	0 ⁺	15 16Du13	T	1986	β^- =100; β^-n ?	*
¹²⁸ Cd ^m	-65368	6	270 ns 7	(5 ⁻)	15		2009	IT=100	
¹²⁸ Cd ⁿ	-64523	6	3.56 μ s 0.06	(10 ⁺)	15		2009	IT=100	
¹²⁸ Cd ^p	-62951	6	6.3 ms 0.8	(15 ⁻)	17Ju02	ETJ	2016	IT=100	
¹²⁸ In	-74190.1	1.3	816 ms 27	(3 ⁺)	15 93Ru01	D	1975	β^- =100; β^-n =0.038 3	*
¹²⁸ In ^m	-73942.2	1.3	23 μ s 2	(1 ⁻)	15 04Sc42	J	1988	IT=100	
¹²⁸ In ⁿ	-73905.0	2.0	285.1	2.2 MD	15 20Ne06	E	1986	β^- =100; IT ?; β^-n ?	
¹²⁸ In ^p	-72392.5	1.4	1797.6	1.6 MD	20Ne06	EJT	2020	$\beta^- \approx 100$; IT ?; β^-n ?	
¹²⁸ Sn	-83361	18	59.07 m 0.14	0 ⁺	15		1956	β^- =100	
¹²⁸ Sn ^m	-81270	18	6.5 s 0.5	7 ⁻	15		1979	IT=100	*
¹²⁸ Sn ⁿ	-80869	18	2.91 μ s 0.14	10 ⁺	15		1981	IT=100	*
¹²⁸ Sn ^p	-79262	18	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	10.41 m 0.18	5 ⁺	15		1955	β^- =96.4 10; IT=3.6 10	*
¹²⁸ Sb ⁿ	-83013	19	500 ns 20	(11 ⁺)	19Bi04	ETJ	2019	IT=100	
¹²⁸ Sb ^p	-82860	19	217 ns 7	(13 ⁺)	19Bi04	ETJ	2019	IT=100	
¹²⁸ Te	-88993.8	0.7	2.25 Yy 0.09	0 ⁺	15 20Ba.A	T	1924	IS=31.74 8; β^- =100	
¹²⁸ Te ^m	-86203.0	0.8	363 ns 27	(10 ⁺)	15 04Va03	T	1998	IT=100	*
¹²⁸ I	-87738	4	24.99 m 0.02	1 ⁺ *	15		1934	β^- =93.1 8; β^+ =6.9 8	
¹²⁸ I ^m	-87600	4	845 ns 20	4 ⁻	15		1982	IT=100	
¹²⁸ I ⁿ	-87571	4	175 ns 15	(6 ⁻)	15		1991	IT=100	
¹²⁸ Xe	-89860.534	0.005	STABLE	0 ⁺	15		1922	IS=1.910 13	
¹²⁸ Xe ^m	-87073.3	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	-85369.2	1.6	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#	< 1.4 m	(1 ⁺ , 2 ⁻)	15 97Ha30	T	1995	β^+ =100; IT ?	
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	-60530#	200#	5# s	0 ⁺	15		1985	β^+ ?	*
¹²⁸ Pm	-48220#	300#	1.0 s 0.3	4 ⁺ #	15 93Li40	D	1999	$\beta^+ \approx 100$; β^+p =?; $p=0$	*
¹²⁸ Sm	-39150#	500#	500# ms	0 ⁺				β^+ ?; β^+p ?	
* ¹²⁸ Pd	T : other 14SmZZ<262 ms								**
* ¹²⁸ Ag	T : average 15Lo04=59(5) 14SmZZ=73(+10-9) 96Wo.A=58(5) 95Kr.A=60(10)								**
* ¹²⁸ Cd	T : average 16Du13=246.2(2.1) 15Lo04t=245(5)								**
* ¹²⁸ In	T : average 15Lo04=810(30) 86Go10=840(60)								**
* ¹²⁸ In	D : % β^-n from 93Ru01, probably includes gs and isomer								**
* ¹²⁸ Sn ^m	J : E3 to 4+								**
* ¹²⁸ Sn ⁿ	J : E2 to 8+								**
* ¹²⁸ Sb ^m	E : less than 20 keV above the ground state; see Ensdf2015 for details								**
* 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 : β^+p observed in 85Wi07, but was not quantified								**
* ¹²⁸ Nd	T : 83Ni05=4(2)s, but 85Wi07 associated it with decay of ¹²⁸ Pr								**
* ¹²⁸ Pm	D : %p 93Li40=0								**
¹²⁹ Pd	-37880#	600#	31 ms 7	7/2 ⁻ #	15		2015	β^- =100; β^-n ?; β^-2n ?	
¹²⁹ Ag	-51870#	400#	49.9 ms 3.5	9/2 ⁺ #	14 14SmZZ	D	2000	β^- =100; β^-n <20	*
¹²⁹ Ag ^m	-51850#	400#	10# ms	1/2 ⁻ #	14			β^- ?; β^-n ?	*
¹²⁹ Cd	-63122	5	147 ms 3	11/2 ⁻ *	14 16Du13	T	2003	β^- =100; β^-n =?	*
¹²⁹ Cd ^m	-62779	6	157 ms 8	3/2 ⁺ *	14 20Ma09	E	1986	β^- =100; β^-n =?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)	
$^{129}\text{Cd}^n$	-60839	9	2283	8	3.6 ms 0.2	(21/2 ⁺)	14 14Ta29 TJE	2014	IT=100	*
^{129}In	-72834.9	2.0			570 ms 10	9/2 ⁺	14 15Lo04 T	1975	β^- =100; β^- -n=0.23 7	*
$^{129}\text{In}^m$	-72384.2	2.0	450.73	0.16	1.23 s 0.03	1/2 ⁻	14 04Ga24 J	1976	$\beta^- \approx 100$;IT ?; β^- -n=3.6 4	*
$^{129}\text{In}^n$	-71146.9	2.0	1687.97	0.25	11.2 μ s 0.2	(17/2 ⁻)	14 14Ta.A T	2003	IT=100	
$^{129}\text{In}^p$	-71180	50	1650	50 BD	670 ms 100	(23/2 ⁻)	14 04Ga24 ETJ	2004	$\beta^- \approx 100$;IT ?	
$^{129}\text{In}^q$	-70890	50	1941	50	110 ms 15	(29/2 ⁺)	14	2004	IT $\approx$ 100; β^- ?	*
^{129}Sn	-80591	17			2.23 m 0.04	3/2 ⁺ *	14 20Yo.A J	1962	β^- =100	
$^{129}\text{Sn}^m$	-80556	17	35.15	0.05	6.9 m 0.1	11/2 ⁻ *	14 20Yo.A J	1962	β^- =100	
$^{129}\text{Sn}^n$	-78829	17	1761.6	1.0	3.49 μ s 0.11	(19/2 ⁺)	14 08Lo07 T	2000	IT=100	*
$^{129}\text{Sn}^p$	-78788	17	1802.6	1.0	2.22 μ s 0.13	23/2 ⁺	14 08Lo07 TJ	2000	IT=100	*
$^{129}\text{Sn}^q$	-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	
$^{129}\text{Sb}^m$	-82778	21	1851.31	0.06	17.7 m 0.1	19/2 ⁻	14 19Bi04 J	1982	β^- =85;IT=15	
$^{129}\text{Sb}^n$	-82768	21	1861.06	0.05	2.23 μ s 0.17	15/2 ⁻	14 19Bi04 TJ	1987	IT=100	*
$^{129}\text{Sb}^p$	-82490	21	2139.4	0.3	0.89 μ s 0.03	23/2 ⁺	14 19Bi04 TJ	2003	IT=100	
^{129}Te	-87004.9	0.7			69.6 m 0.3	3/2 ⁺	14	1939	β^- =100	
$^{129}\text{Te}^m$	-86899.4	0.7	105.51	0.03	33.6 d 0.1	11/2 ⁻	14	1940	IT=64 7; β^- =36 7	
^{129}I	-88507	3			16.14 My 0.12	7/2 ⁺ *	14 18Ga37 T	1951	β^- =100	
^{129}Xe	-88696.070	0.005			STABLE	1/2 ⁺ *	14	1920	IS=26.401 138	
$^{129}\text{Xe}^m$	-88459.93	0.03	236.14	0.03	8.88 d 0.02	11/2 ⁻ *	14 90NeZY J	1951	IT=100	*
^{129}Cs	-87499	5			32.06 h 0.06	1/2 ⁺ *	14	1950	β^+ =100	
$^{129}\text{Cs}^m$	-86924	5	575.40	0.14	718 ns 21	(11/2 ⁻)	14	1977	IT=100	
^{129}Ba	-85061	11			2.23 h 0.11	1/2 ⁺	14	1950	β^+ =100	
$^{129}\text{Ba}^m$	-85053	11	8.42	0.06	2.135 h 0.010	7/2 ⁺	14	1950	$\beta^+ \approx 100$;IT=?	
^{129}La	-81324	21			11.6 m 0.2	(3/2 ⁺)	14	1963	β^+ =100	
$^{129}\text{La}^m$	-81152	21	172.33	0.20	560 ms 50	(11/2 ⁻)	14	1969	IT=100	
^{129}Ce	-76288	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	
$^{129}\text{Pr}^m$	-69390	30	382.57	0.24	26# μ s 11#	(11/2 ⁻)	14 FGK208 T	1997	IT=100	*
^{129}Nd	-62380#	200#			6.8 s 0.6	7/2 ⁻ #	14 10Xu12 T	1977	β^+ =100; β^+ -p=?	*
$^{129}\text{Nd}^m$	-62330#	220#	50#	100#	2.6 s 0.4	1/2 ⁺ #	14	2010	β^+ =100; β^+ -p=?	
^{129}Pm	-53180#	300#			2.4 s 0.9	5/2 ⁺ #	14	2004	β^+ =100; β^+ -p ?;p ?	
^{129}Sm	-42330#	500#			550 ms 100	(1/2 ⁺ ,3/2 ⁺)	14	1999	β^+ =100; β^+ -p=?	
* ^{129}Ag	T : average 15Lo04=52(4) 00Kr18=46(+5-9)									**
* ^{129}Ag	D : β^- -n was observed by 00Kr18, but it was not quantified									**
* $^{129}\text{Ag}^m$	T : 00Kr18=158(60) ms is not convincing; not adopted in 02Pf04 (same group)									**
* ^{129}Cd	T : from 16Du13=147(3) gated by gammas's in the high-spin decay; others									**
* ^{129}Cd	T : 15Ta13=155(3) 09Ar04=104(6)									**
* ^{129}Cd	D : β^- -n was observed by 05Kr20, but it was not quantified									**
* ^{129}Cd	J : 13Yo02=11/2									**
* $^{129}\text{Cd}^m$	D : β^- -n was observed by 05Kr20, but it was not quantified									**
* $^{129}\text{Cd}^m$	T : from 16Du13=157(8) gated by gammas's in the low-spin decay; others									**
* $^{129}\text{Cd}^m$	T : 15Ta13=146(8) 15Lo04=154.5(2.0), mixture of two states, 09Ar04=242(8)									**
* $^{129}\text{Cd}^m$	J : 13Yo02=3/2									**
* $^{129}\text{Cd}^n$	E : 14Ta29=1940.0(1.4) keV above $^{129}\text{Cd}^m$									**
* ^{129}In	J : from 04Ga24									**
* $^{129}\text{In}^m$	E : from a least-squares fit to the level scheme in 15Ta13; others									**
* $^{129}\text{In}^m$	E : 13Ka08=459(5) 18Ba08=444(15), direct mass measurements									**
* $^{129}\text{In}^q$	E : 281.0(0.2) keV gamma above $^{129}\text{In}^p$									**
* $^{129}\text{Sn}^n$	T : average 08Lo07=3.4(0.4) 04Ga24=3.2(0.2) 00Pi03=3.7(0.2)									**
* $^{129}\text{Sn}^n$	T : 00Ge07=3.6(0.2)									**
* $^{129}\text{Sn}^p$	T : average 08Lo07=2.4(4) 04Ga24=2.0(2) 00Ge07=2.4(2)									**
* $^{129}\text{Sb}^n$	T : average 19Bi04=2.3(0.3) 03Ge04=2.2(0.2)									**
* $^{129}\text{Xe}^m$	J : 90NeZY=11/2									**
* $^{129}\text{Pr}^m$	T : estimated by FGK208 from BE3(11/2- to 5/2+)=41.2(2.0) [W.u.] in									**
* $^{129}\text{Pr}^m$	T : ^{131}Pr using the known branching intensities and α_T									**
* ^{129}Nd	T : average 10Xu12=6.7(0.7) 97Gi07=7(1); other 85Wi07=4.9(0.2) is									**
* ^{129}Nd	T : for a mixture between the gs and the isomer									**
^{130}Pd	-32730#	300#			27# ms >550ns	0 ⁺	18Sh11 I	2018	β^- ?; β^- -n ?; β^- -2n ?	
^{130}Ag	-45900#	420#			40.6 ms 4.5	1 ⁻ #	15 15Lo04 T	2000	β^- =100; β^- -n ?; β^- -2n ?	*
^{130}Cd	-61118	22			126.8 ms 1.8	0 ⁺	08 16Du13 T	1986	β^- =100; β^- -n=3.5 10	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{130}\text{Cd}^m$	-58988	22	2129.6	1.0					
^{130}In	-69906.5	1.8			*				
$^{130}\text{In}^m$	-69840.0	2.0	66.5	2.7	MD*				
$^{130}\text{In}^n$	-69521.1	2.1	385.4	2.6	MD				
$^{130}\text{In}^p$	-69518.2	1.8	388.3	0.2					
^{130}Sn	-80132.2	1.9							
$^{130}\text{Sn}^m$	-78185.3	1.9	1946.88	0.10					
$^{130}\text{Sn}^n$	-77697.4	1.9	2434.79	0.12					
^{130}Sb	-82286	14							
$^{130}\text{Sb}^m$	-82281	14	4.80	0.20					
$^{130}\text{Sb}^n$	-82201	14	84.67	0.04					
$^{130}\text{Sb}^p$	-80778	14	1508	1					
$^{130}\text{Sb}^q$	-80741	14	1544.7	0.5					
^{130}Te	-87352.960	0.011							
$^{130}\text{Te}^m$	-85206.55	0.04	2146.41	0.04					
$^{130}\text{Te}^n$	-84685.8	0.8	2667.2	0.8					
$^{130}\text{Te}^p$	-82979.1	0.9	4373.9	0.9					
^{130}I	-86936	3							
$^{130}\text{I}^m$	-86896	3	39.9525	0.0013					
$^{130}\text{I}^n$	-86866	3	69.5865	0.0007					
$^{130}\text{I}^p$	-86854	3	82.3960	0.0019					
$^{130}\text{I}^q$	-86851	3	85.1099	0.0010					
^{130}Xe	-89880.474	0.009			STABLE				
^{130}Cs	-86900	8							
$^{130}\text{Cs}^m$	-86737	8	163.25	0.11					
$^{130}\text{Cs}^x$	-86873	17	27	15	$R=0.2$	0.1	$fsmix$		
^{130}Ba	-87256.78	0.29			STABLE	$\sim 1Zy$			
$^{130}\text{Ba}^m$	-84781.7	0.3	2475.12	0.18					
^{130}La	-81627	26							
$^{130}\text{La}^m$	-81413	26	214.0	0.5					
^{130}Ce	-79423	28							
$^{130}\text{Ce}^m$	-76969	28	2453.6	0.3					
^{130}Pr	-71180	60							
$^{130}\text{Pr}^m$	-71080#	120#	100#	100#					
^{130}Nd	-66596	28							
^{130}Pm	-55470#	200#							
^{130}Sm	-47700#	400#							
^{130}Eu	-33510#	540#							
^{130}Ag	T : average 15Lo04=42(5) 05Kr20=35(10)								**
^{130}Cd	T : average 16Du13=126(4) 15Lo04=127(2)								**
$^{130}\text{Cd}^m$	T : average 12Ka36=248(+21-19) 07Ju05=220(30)								**
$^{130}\text{Cd}^m$	E : 12Ka36=128.0(0.5), 138.0(0.5), 538.2(0.5) and 1325.4(0.5)-keV								**
$^{130}\text{Cd}^m$	E : gamma rays in a cascade to gs								**
^{130}In	T : average 15Lo04=284(10) 93Ru01=256(9) 86ReZU=278(7)								**
^{130}In	D : % β^- -n average 93Ru01=1.49(0.22) 86Wa17=0.90(0.05), Birge ratio=2.615;								**
^{130}In	D : other 86ReZU=0.91(10), same as 86Wa17								**
$^{130}\text{In}^m$	D : % β^- -n average 93Ru01=2.03(0.12) 86Wa17=1.67(0.09), includes both								**
$^{130}\text{In}^m$	D : $^{130}\text{In}^m$ and $^{130}\text{In}^n$ isomers								**
$^{130}\text{In}^m$	J : 81Fo02=(10-); direct β^- decay to 9- agrees with 8-,9- or 10-								**
$^{130}\text{In}^n$	D : % β^- -n average 93Ru01=2.03(0.12) 86Wa17=1.67(0.09), includes both								**
$^{130}\text{In}^n$	D : $^{130}\text{In}^m$ and $^{130}\text{In}^n$ isomers								**
$^{130}\text{In}^p$	T : average 16Ju03=4.4(0.2) 12Ka36=5.25(+0.40-0.35); other 04Sc42=3.1(0.3)								**
$^{130}\text{Sb}^q$	T : from 19Bi04; other 02Ge07=1.8(0.2)								**
$^{130}\text{Te}^m$	T : other 72Ke28=115(11)								**
$^{130}\text{Te}^n$	T : other 98Zh09=4.2(0.9), conflicting data, not used								**
$^{130}\text{Te}^p$	T : others 04Br19=45 98HoZP=261(33)								**
$^{130}\text{I}^n$	J : E1 to 5+								**
$^{130}\text{I}^q$	J : E1 to 5+								**
$^{130}\text{Ba}^m$	T : others 66Br14=8.8(0.2) 69Wa.A=13.5(1.0)								**
$^{130}\text{La}^m$	T : average 14Io01=760(90) 12Ta18=740(30)								**
$^{130}\text{Pr}^m$	J : evidence for a low-spin component in ^{130}Pr activity in 88Ba42								**
^{130}Nd	T : others 00Xu08=13(3) 77Bo02=28(3) conflicting, not used								**
^{130}Eu	T : symmetrized from 0.90(+0.49-0.29)								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{131}Pd	-25740#	300#	20# ms >550ns	$7/2^-$ #	18Sh11	I	2018	β^- ?; β^-n ?; β^-2n ?
^{131}Ag	-40750#	500#	35 ms 8	$9/2^+$ #	15		2013	β^- =100; β^-n ?; β^-2n =10
^{131}Cd	-55212	19	98 ms 2	$7/2^-$ #	06 15Lo04	T	2000	β^- =100; β^-n =3.5 10; β^-2n ? *
^{131}In	-68024.4	2.2	261.5 ms 2.8	$9/2^+$	06 19Du12	TDJ	1976	β^- =100; β^-n =2.25 21 *
$^{131}\text{In}^m$	-67648.4	2.5	376 3 MD	$1/2^-$	06 19Or.A	E	1984	β^- =100; β^-n =2.25 21; IT ? *
$^{131}\text{In}^n$	-64280	90	322 ms 41	$(21/2^+)$	06 19Du12	TD	1984	β^- =100; β^-n =12 7; IT ? *
$^{131}\text{In}^p$	-64240.8	2.3	669 ns 34	$(17/2^+)$	09Go40	TJ	2009	IT=100 *
^{131}Sn	-77265	4	56.0 s 0.5	$3/2^+$ *	06 20Yo.A	J	1963	β^- =100
$^{131}\text{Sn}^m$	-77200	4	58.4 s 0.5	$11/2^-$ *	06 04Fo06	E	1977	β^- =100; IT ? *
$^{131}\text{Sn}^n$	-72595	4	316 ns 5	$(23/2^-)$	06 19Du12	T	2001	IT=100 *
^{131}Sb	-81981.4	2.1	23.03 m 0.04	$7/2^+$	06		1956	β^- =100
$^{131}\text{Sb}^m$	-80305.3	2.1	64.2 μ s 2.6	$15/2^-$	06 19Bi04	T	1969	IT=100 *
$^{131}\text{Sb}^n$	-80294.2	2.3	4.3 μ s 0.8	$19/2^-$	06 00Ge18	TJ	2000	IT=100
$^{131}\text{Sb}^p$	-79815.8	2.6	0.97 μ s 0.03	$23/2^+$	06 19Bi04	T	2000	IT=100 *
^{131}Te	-85211.02	0.06	25.0 m 0.1	$3/2^+$	06		1939	β^- =100
$^{131}\text{Te}^m$	-85028.76	0.06	32.48 h 0.11	$11/2^-$	06 08Ea01	T	1940	β^- =74.1 5; IT=25.9 5
$^{131}\text{Te}^n$	-83271.0	0.4	93 ms 12	$(23/2^+)$	06		1998	IT=100
^{131}I	-87442.7	0.6	8.0249 d 0.0006	$7/2^+$ *	06 FGK209	T	1939	β^- =100
$^{131}\text{I}^m$	-85524.3	0.7	24 μ s 1	$19/2^-$	09Wa11	EJT	2009	IT=100
^{131}Xe	-88413.575	0.005	STABLE	$3/2^+$ *	06		1920	IS=21.232 51
$^{131}\text{Xe}^m$	-88249.645	0.009	11.948 d 0.012	$11/2^-$ *	06 FGK209	T	1966	IT=100 *
^{131}Cs	-88055.57	0.18	9.689 d 0.016	$5/2^+$ *	06		1947	ϵ =100
^{131}Ba	-86679.0	0.4	11.52 d 0.01	$1/2^+$ *	06 12Da04	T	1947	β^+ =100
$^{131}\text{Ba}^m$	-86491.0	0.4	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
$^{131}\text{La}^m$	-83464	28	170 μ s 7	$11/2^-$	06		1966	IT=100
^{131}Ce	-79710	30	10.3 m 0.3	$7/2^+$	06		1966	β^+ =100
$^{131}\text{Ce}^m$	-79650	30	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	TJ	1977	β^+ =100 *
$^{131}\text{Pr}^m$	-74150	50	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	-59770#	200#	6.3 s 0.8	$(11/2^-)$	06 99Ga41	T	1998	β^+ =100
^{131}Sm	-50280#	400#	1.2 s 0.2	$5/2^+$ #	06		1986	β^+ =100; β^+p =?
^{131}Eu	-39460#	400#	17.8 ms 1.9	$3/2^+$	06		1998	p =89 9; β^+ ?; β^+p ?
* ^{131}Cd	T : 15Lo04=98.0(0.2) is a typo; other 00Ha55=68(3)							**
* ^{131}In	D : % β^-n average 93Ru01=2.2(0.3) 19Du12 β^-n =2.3(0.3), value includes							**
* ^{131}In	D : gs and $^{131}\text{In}^m$							**
* ^{131}In	T : average 19Du12=265(8) 15Lo04=261(3)							**
* ^{131}In	J : from β^- decay properties in 04Fo06 and 19Du12							**
* $^{131}\text{In}^m$	T : from 19Du12							**
* $^{131}\text{In}^m$	J : from β^- decay properties in 04Fo06 and 19Du12							**
* $^{131}\text{In}^m$	D : % β^-n average 93Ru01=2.2(0.3) 19Du12 β^-n =2.3(0.3), value includes							**
* $^{131}\text{In}^m$	D : gs and $^{131}\text{In}^m$							**
* $^{131}\text{In}^n$	T : average 19Du12=323(55) 84Fo19=320(60)							**
* $^{131}\text{In}^p$	T : average 12Ka36=685(+42-39) 09Go40=630(60)							**
* $^{131}\text{Sn}^m$	J : 20Yo.A=11/2							**
* $^{131}\text{Sn}^n$	E : 4605.02(0.21) keV above $^{131}\text{Sn}^m$							**
* $^{131}\text{Sn}^n$	T : others 12Ka36=309(+24-23) 84Fo19=300(20)							**
* $^{131}\text{Sb}^m$	T : average 19Bi04=64(3) 00Ge18=65(5)							**
* $^{131}\text{Sb}^p$	J : from 00Ge18							**
* $^{131}\text{Xe}^m$	J : 90NeZY=11/2							**
* ^{131}Pr	T : average 96Gi08=1.57(0.07) 93Al03=1.48(0.02) 83Ga.A=1.58(0.05)							**
^{132}Ag	-34400#	500#	30 ms 14	6^- #	15 15Lo04	TD	2015	β^- =100; β^-n ?; β^-2n ? *
^{132}Cd	-50470	60	84 ms 5	0^+	18 00Ha55	TD	2000	β^- =100; β^-n =60 15; β^-2n ? *
^{132}In	-62410	60	202.2 ms 0.2	(7^-)	18 20Be16	TD	1973	β^- =100; β^-n =12.3 4; β^-2n ? *
^{132}Sn	-76546.6	2.0	39.7 s 0.8	0^+	18		1963	β^- =100
$^{132}\text{Sn}^m$	-71698.1	2.0	2.080 μ s 0.016	8^+	18 17Ch51	T	1986	IT=100 *
^{132}Sb	-79635.3	2.5	2.79 m 0.07	$(4)^+$	18		1956	β^- =100
$^{132}\text{Sb}^m$	-79490#	50#	4.10 m 0.05	(8^-)	18 89St06	E	1956	β^- =100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
$^{132}\text{Sb}^n$	-79380.8	2.5	254.5	0.3	102 ns	4	(6 ⁻)	18	1974	IT=100			
^{132}Te	-85188	3			3.204 d	0.013	0 ⁺	05	1948	β^- =100			
$^{132}\text{Te}^m$	-83413	3	1774.80	0.09	145 ns	8	6 ⁺	05	1973	IT=100			
$^{132}\text{Te}^n$	-83263	3	1925.47	0.09	28.5 μ s	0.9	7 ⁻	05 17Ki09	T	1979	IT=100	*	
$^{132}\text{Te}^p$	-82465	3	2723.3	0.8	3.62 μ s	0.06	(10 ⁺)	05 17Ki09	T	1979	IT=100	*	
^{132}I	-85704	4			2.295 h	0.013	4 ⁺ *	05	1948	β^- =100			
$^{132}\text{I}^m$	-85594	10	110	11	1.387 h	0.015	(8 ⁻)	05	1973	IT=86 2; β^- =14 2			
^{132}Xe	-89278.975	0.005			STABLE		0 ⁺	05	1920	IS=26.909 55			
$^{132}\text{Xe}^m$	-86526.77	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	-88434.9	1.1			STABLE	>300Ey	0 ⁺	05 96Ba24	T	1936	IS=0.10 1; $2\beta^+$?		
^{132}La	-83720	40			4.59 h	0.04	2 ⁻ *	05 18Ab02	T	1951	β^+ =100		
$^{132}\text{La}^m$	-83530	40	188.20	0.11	24.3 m	0.5	6 ⁻ *	05	1969	IT=76; β^+ =24			
^{132}Ce	-82469	20			3.51 h	0.11	0 ⁺	05	1960	β^+ =100			
$^{132}\text{Ce}^m$	-80128	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		*
$^{132}\text{Pr}^m$	-75200#	40#	30#	30#	1#	s	(5 ⁺)	05 90Ko25	J	1990	β^+ ?;IT ?		
$^{132}\text{Pr}^n$	-74980#	40#	250#	30#	2.46 μ s	0.04	(8 ⁺)	12Ta18	TJD	2012	IT=100		*
$^{132}\text{Pr}^p$	-74930#	40#	300#	30#	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 $\approx$ 5e-5		
^{132}Sm	-55140#	300#			4.0 s	0.3	0 ⁺	05		1989	β^+ =100; β^+ p ?		
^{132}Eu	-42200#	400#			100# ms		1 ⁺ #	05 93Li40	D		β^+ ?; β^+ p ?;p=0		
* ^{132}Ag	T : symmetrized from $^{15}\text{Lo}04=28(+15-12)$										**		
* ^{132}Cd	T : average $^{15}\text{Lo}04=82(4)$ $^{00}\text{Ha}55,^{01}\text{Ha}39=97(10)$										**		
* ^{132}In	T : others: $^{20}\text{Wh}02=194(5)$ $^{15}\text{Lo}04=198(2)$ $^{02}\text{Di}12=206(6)$ $^{93}\text{Ru}01=221(11)$										**		
* ^{132}In	T : $^{86}\text{Wa}17=204(6)$, $^{85}\text{Re.A}=204(6)$ (same as $^{86}\text{Wa}17$) $^{86}\text{Bj}01=186(22)$										**		
* ^{132}In	D : % β^- -n average $^{20}\text{Wh}02=12.3(0.4)$ $^{20}\text{Be}16=12(2)$ $^{93}\text{Ru}01=10.7(3.3)$; others:										**		
* ^{132}In	D : $^{86}\text{ReZU}=6.8(1.4)$ $^{80}\text{Lu}04=4.2(0.9)$										**		
* $^{132}\text{Sn}^m$	T : average $^{17}\text{Ch}51=2.15(0.16)$ $^{12}\text{Ka}36=2.088(0.017)$ $^{94}\text{Fo}14=2.03(4)$;										**		
* $^{132}\text{Sn}^m$	T : other $^{82}\text{Ka}25=1.7(2)$										**		
* $^{132}\text{Te}^n$	T : average $^{17}\text{Ki}09=28.6(+1.2-1.1)$ $^{79}\text{Si}08=28.1(1.5)$										**		
* $^{132}\text{Te}^n$	J : E1 to 6+										**		
* $^{132}\text{Te}^p$	T : average $^{17}\text{Ki}09=3.52(0.09)$ $^{01}\text{Ge}07=3.70(0.09)$ $^{79}\text{Si}08=3.9(0.3)$										**		
* ^{132}Pr	T : average $^{94}\text{Bu}18=1.47(0.12)$ $^{74}\text{Ar}27=1.6(0.3)$										**		
* $^{132}\text{Pr}^n$	E : $^{12}\text{Ta}18=219.9(0.2)$ keV above $^{132}\text{Pr}^m$										**		
* $^{132}\text{Pr}^p$	E : $^{12}\text{Ta}18=273.0(0.6)$ keV above $^{132}\text{Pr}^m$										**		
* ^{132}Nd	T : average $^{95}\text{Bu}11=1.47(0.12)$ $^{77}\text{Bo}02=1.75(0.17)$										**		
^{133}Ag	-29080#	500#					9/2 ⁺ #				β^- ?; β^- n ?		
^{133}Cd	-44140#	200#			61 ms	6	7/2 ⁻ #	11 $^{15}\text{Lo}04$	T	2010	β^- =100; β^- n=?; β^- 2n ?		*
^{133}In	-57690#	200#			163.0 ms	1.6	(9/2 ⁺)	11 $^{20}\text{Be}16$	TD	1996	β^- =100; β^- n=90 3; β^- 2n ?		*
$^{133}\text{In}^m$	-57360#	200#	330#	40#	167 ms	11	(1/2 ⁻)	11 $^{20}\text{Be}16$	TD	1996	β^- =100; β^- n=93 3		*
^{133}Sn	-70873.9	1.9			1.37 s	0.07	7/2 ⁻ *	11 $^{93}\text{Ru}01$	TD	1973	β^- =100; β^- n=0.0294 24		*
^{133}Sb	-78924	3			2.34 m	0.05	(7/2 ⁺)	11	1966	β^- =100			
$^{133}\text{Sb}^m$	-74383	9	4541	9	16.54 μ s	0.19	(21/2 ⁺)	11 $^{16}\text{Bo}19$	E	1978	IT=100		*
^{133}Te	-82937.1	2.1			12.5 m	0.3	3/2 ⁺ #	11	1940	β^- =100			
$^{133}\text{Te}^m$	-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			
$^{133}\text{Te}^n$	-81326.7	2.2	1610.4	0.5	100 ns	5	(19/2 ⁻)	11	2001	IT=100			
^{133}I	-85857	6			20.83 h	0.08	7/2 ⁺ *	11	1940	β^- =100			
$^{133}\text{I}^m$	-84223	6	1634.148	0.010	9 s	2	(19/2 ⁻)	11	1970	IT=100			
$^{133}\text{I}^n$	-84128	6	1729.137	0.010	~ 170 ns		(15/2 ⁻)	11	1984	IT=100			
$^{133}\text{I}^p$	-83363	6	2493.7	0.4	469 ns	15	(23/2 ⁺)	11	2009	IT=100			
^{133}Xe	-87643.6	2.4			5.2474 d	0.0005	3/2 ⁺ *	11 FGK209	T	1940	β^- =100		
$^{133}\text{Xe}^m$	-87410.4	2.4	233.221	0.015	2.198 d	0.013	11/2 ⁻ *	11 $^{90}\text{NeZY}$	J	1951	IT=100		*
$^{133}\text{Xe}^n$	-85497#	20#	2147#	20#	8.64 ms	0.13	(23/2 ⁺)	11 $^{17}\text{Vo}06$	EJ	2017	IT=100		*
^{133}Cs	-88070.943	0.008			STABLE		7/2 ⁺ *	11	1921	IS=100			
^{133}Ba	-87553.5	1.0			10.5379 y	0.0016	1/2 ⁺ *	11 FGK209	T	1941	ε =100		
$^{133}\text{Ba}^m$	-87265.2	1.0	288.252	0.009	38.90 h	0.06	11/2 ⁻ *	11 $^{12}\text{Da}04$	T	1941	IT=99.9896 4; 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			
$^{133}\text{Ce}^m$	-82381	16	37.2	0.7	5.1 h	0.3	9/2 ⁻ *	11	1951	β^+ =100			

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{133}Pr	-77938	12			6.5 m 0.3	$5/2^+*$	11		1970	$\beta^+=100$		
$^{133}\text{Pr}^m$	-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	$\beta^+=100$		
$^{133}\text{Nd}^m$	-72200	50	127.97	0.12	~ 70 s	$(1/2)^+$	11	95Br24 DT	1993	$\beta^+=?; \text{IT}=?$		
$^{133}\text{Nd}^n$	-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	$\beta^+=100$		
$^{133}\text{Pm}^m$	-65280	50	129.7	0.7	8# s	$(11/2^-)$	11		1996	$\beta^+ ?; \text{IT} ?$		
^{133}Sm	-57230#	300#			2.89 s 0.16	$(5/2^+)$	11		1977	$\beta^+=100; \beta^+p=?$		
$^{133}\text{Sm}^m$	-57110#	310#	120#	60#	3.5 s 0.4	$(1/2^-)$	11		1993	$\beta^+=?; \text{IT} ?; \beta^+p ?$		
^{133}Eu	-47240#	300#			200# ms	$5/2^+ \#$				$\beta^+ ?; \beta^+p ?$		
^{133}Gd	-36060#	500#			10# ms	$5/2^+ \#$				$\beta^+ ?; \beta^+p ?$		
* ^{133}Cd	T : average 15Lo04=64(8) 05Kr20=57(10)										**	
* ^{133}Cd	D : β^-n was observed in 05Kr20, but it was not quantified										**	
* ^{133}In	T : average 19Pi04, 20Be16=162(2) 15Lo04=163(7) 02Di12=165(3);										**	
* ^{133}In	T : other: 96Ho16=180(15)										**	
* ^{133}In	D : $\% \beta^-n$ from 20Be16, supersedes 19Pi04=74(5) (same experiment);										**	
* ^{133}In	D : other: 96Ho16=85(10)										**	
* $^{133}\text{In}^m$	T : from 19Pi04, 20Be16=167(11)										**	
* $^{133}\text{In}^m$	D : $\% \beta^-n$ from 20Be16, supersedes 19Pi04=80(5) (same experiment);										**	
* ^{133}Sn	T : average 06KeZZ=1.57(0.14) 93Ru01=1.20(0.05) 78Si05=1.37(0.07)										**	
* ^{133}Sn	T : 73Bo42=1.47(0.04), Birge ratio=2.57										**	
* ^{133}Sn	J : 20Ro19=7/2										**	
* $^{133}\text{Sb}^m$	E : from 4526+x keV above gs, with x<30 keV in 16Bo19										**	
* $^{133}\text{Xe}^m$	J : 90NeZY=11/2										**	
* $^{133}\text{Xe}^n$	E : from 2107+x keV in 17Vo06; x=40#(20#) estimated by Nubase										**	
* $^{133}\text{Xe}^n$	T : from 18Ka47										**	
* $^{133}\text{Ba}^m$	T : average 12Da04=38.88(0.08) 11Gr01=38.92(0.09)										**	
^{134}Cd	-39460#	300#			65 ms 15	0^+	15		2015	$\beta^-=100; \beta^-n ?; \beta^-2n ?$		
^{134}In	-51970#	200#			136 ms 4	$7^- \#$	04	15Lo04 T	1996	$\beta^-=100; \beta^-n \approx 65; \beta^-2n < 4$	*	
$^{134}\text{In}^m$	-51910#	200#	56.7	0.1	3.5 μs 0.4	(5^-)		19Ph02 ETJ	2019	IT=100		
^{134}Sn	-66434	3			0.93 s 0.08	0^+	04	75As04 TD	1974	$\beta^-=100; \beta^-n=17$ 13	*	
$^{134}\text{Sn}^m$	-65187	3	1247.4	0.5	87 ns 8	6^+	04	12Ka36 T	2000	IT=100	*	
^{134}Sb	-74019	3			674 ms 4	(0^-)	11	18Si28 T	1967	$\beta^-=100; \beta^-n ?$		
$^{134}\text{Sb}^m$	-73740	3	279	1	10.01 s 0.04	(7^-)	11	18Si28 T	1968	$\beta^-=100; \beta^-n=0.088$ 4	*	
^{134}Te	-82533.8	2.7			41.8 m 0.8	0^+	04		1948	$\beta^-=100$		
$^{134}\text{Te}^m$	-80842.5	2.7	1691.34	0.16	164.5 ns 0.7	6^+	04	17Ur03 T	1970	IT=100	*	
^{134}I	-84043	5			52.5 m 0.2	$(4)^+$	04		1948	$\beta^+=100$		
$^{134}\text{I}^m$	-83727	5	316.49	0.22	3.52 m 0.04	$(8)^-$	04		1970	IT=97.7 10; $\beta^- = 2.3$ 10		
^{134}Xe	-88125.834	0.006			STABLE	$>11\text{Py}$	0^+	04	89Ba22 T	1920	IS=10.436 35; $2\beta^- ?$	*
$^{134}\text{Xe}^m$	-86160.3	0.5	1965.5	0.5	290 ms 17	7^-	04		1968	IT=100		
$^{134}\text{Xe}^n$	-85100.6	1.5	3025.2	1.5	5 μs 1	(10^+)	04		2001	IT=100		
^{134}Cs	-86891.165	0.016			2.0650 y 0.0004	4^+*	04	FGK209 T	1940	$\beta^-=100; \varepsilon=0.00030$ 12	*	
$^{134}\text{Cs}^m$	-86752.421	0.016	138.7441	0.0026	2.912 h 0.002	8^-*	04		1975	IT=100		
^{134}Ba	-88950.00	0.25			STABLE	0^+	04		1936	IS=2.42 15		
$^{134}\text{Ba}^m$	-85992.8	0.6	2957.2	0.5	2.61 μs 0.13	10^+	04	19Ka36 JT	1982	IT=100	*	
^{134}La	-85219	20			6.45 m 0.16	1^+	04		1951	$\beta^+=100$		
$^{134}\text{La}^m$	-84780#	100#	440#	100#	29 μs 4	(6^-)	04		1985	IT=100	*	
^{134}Ce	-84833	20			3.16 d 0.04	0^+	04		1951	$\varepsilon=100$		
$^{134}\text{Ce}^m$	-81624	20	3208.6	0.4	308 ns 5	10^+	04		1980	IT=100		
^{134}Pr	-78528	20			17 m 2	2^-*	04		1967	$\beta^+=100$		
$^{134}\text{Pr}^m$	-78460	20	67.7	0.4	~ 11 m	6^-	04	11Ti10 EJ	1973	$\beta^+=100$	*	
^{134}Nd	-75646	12			8.5 m 1.5	0^+	04		1970	$\beta^+=100$		
$^{134}\text{Nd}^m$	-73353	12	2293.0	0.4	389 μs 17	8^-	04	17Pe03 TJ	1969	IT=100	*	
^{134}Pm	-66760	40			22 s 1	(5^+)	04		1977	$\beta^+=100$		
$^{134}\text{Pm}^m$	-66710#	60#	50#	50#	~ 5 s	(2^+)	04		1988	$\beta^+=100$		
$^{134}\text{Pm}^n$	-66640#	60#	120#	50#	20 μs 1	(7^-)		09Cu02 TJ	2009	IT=100	*	
^{134}Sm	-61380#	200#			9.5 s 0.8	0^+	04		1977	$\beta^+=100$		
^{134}Eu	-49800#	300#			500 ms 200		04		1989	$\beta^+=100; \beta^+p=?$		
^{134}Gd	-41530#	400#			400# ms	0^+	04			$\beta^+ ?; \beta^+p ?$		
* ^{134}In	T : average 15Lo04=126(7) 02Di12=141(5) 96Ho16=138(8)										**	
* ^{134}In	D : $\% \beta^-n$ from 96Ho16; $\% \beta^-2n$ intensity limit from 95Jo.A										**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹³⁴ Sn	T : unweighted average 93Ru01=1.050(0.011) 75As04=0.7(0.2) 15Lo04=0.89(0.2)							**
* ¹³⁴ Sn	T : 20Wu04=1.07(0.27); Birge ratio=4.15; others 90Fo03=1.2(0.1)							**
* ¹³⁴ Sn	T : 76Lu02=1.04(0.02) 02Pf04=1.12(0.08), compilation							**
* ¹³⁴ Sn ^m	T : symmetrized from 12Ka36=86(+8-7); other 00Ko15=80(15)							**
* ¹³⁴ Sb ^m	T : average 18Si28=9.87(0.08) 93Ru01=10.07(0.05)							**
* ¹³⁴ Te ^m	T : average 17Ur03=165.1(1.0) 01Mi22=165(6) 95Om01=164(1) 70Jo20=163(7)							**
* ¹³⁴ Te ^m	T : 74CIZX=163(4) 74Su04=170(4) 76ChZD=161(4); others 17Ki09=190(10)							**
* ¹³⁴ Te ^m	T : 74Bl03=196(7) 04Hw02=197(20)							**
* ¹³⁴ Xe	T : others 0nu-BB 89Ba22>58Zy and >26Zy for 0+>0+ and 0+>2+ respectively							**
* ¹³⁴ Cs	D : %E from 75Va12							**
* ¹³⁴ Ba ^m	T : average 19Ka36=2.51(0.30) 82BeZY=2.63(0.14)							**
* ¹³⁴ La ^m	E : from 336.44(17)+x keV; x=100#(100#) keV estimated by Nubase							**
* ¹³⁴ Pr ^m	E : from a least-squares fit to the level scheme of 11Ti10							**
* ¹³⁴ Nd ^m	T : average 17Pe03=380(20) 72Pa26=410(30)							**
* ¹³⁴ Pm ⁿ	E : 70.7(0.2) keV above a 6+ state that decays via a low-energy gamma to 5+							**
¹³⁵ Cd	-32820#	400#		5/2 ⁻ #				β^- ?; β^- n ?
¹³⁵ In	-47110#	300#	103 ms 3	9/2 ⁺ #	16	20PhZZ TD	2002	β^- =100; β^- n= ?; β^- 2n ? *
¹³⁵ Sn	-60632	3	515 ms 5	7/2 ⁻ #	16	15Lo04 T	1994	β^- =100; β^- n=21 3; β^- 2n ?
¹³⁵ Sb	-69690.3	2.6	1.668 s 0.009	(7/2 ⁺)	16	20Wa04 D	1964	β^- =100; β^- n=19.1 5 *
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	(19/2 ⁻)	08		1980	IT=100
¹³⁵ I	-83779.2	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	11/2 ⁻ *	08	90NeZY J	1960	IT≈100; β^- =0.30 17 *
¹³⁵ Cs	-87582.0	0.4	1.33 My 0.19	7/2 ⁺ *	08	16Ma05 T	1949	β^- =100 *
¹³⁵ Cs ^m	-85949.1	1.6	1632.9 1.5	19/2 ⁻ *	08		1962	IT=100
¹³⁵ Ba	-87850.65	0.25		3/2 ⁺ *	08		1932	IS=6.59 10
¹³⁵ Ba ^m	-87582.43	0.25	268.218 0.020	11/2 ⁻	08	12Da04 T	1948	IT=100
¹³⁵ Ba ⁿ	-85462.7	0.6	2388.0 0.5	(23/2 ⁺)	18	Ka47 ETJ	2018	IT=100
¹³⁵ La	-86643	9	18.91 h 0.02	5/2 ⁺ *	08	18Ab02 T	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	(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	(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	(1/2 ⁺)	08		1970	β^+ ≈100; IT ?
¹³⁵ Pm	-70060	80	49 s 3	(3/2 ⁺ , 5/2 ⁺)	08		1975	β^+ =100
¹³⁵ Pm ^m	-69830#	50#	240# 100#	(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 Eu	-54150#	200#	1.5 s 0.2	5/2 ⁺ #	16		1989	β^+ =100; β^+ p ?
¹³⁵ Gd	-44250#	400#	1.1 s 0.2	(5/2 ⁺)	16		1996	β^+ =100; β^+ p≈2
¹³⁵ Tb	-33050#	400#	1.01 ms 0.28	(7/2 ⁻)	16		2004	p≈100; β^+ ? *
* ¹³⁵ In	T : average 20PhZZ=104(4) 15Lo04=103(5) 02Di12=92(10)							**
* ¹³⁵ In	D : β^- n was observed in 02Di12 and 20PhZZ, but was not quantified							**
* ¹³⁵ Sb	D : % β^- n average 20Wa04=14.6(0.4,stat)(1.2,syst) 17AgZZ=24.5(1.0)							**
* ¹³⁵ Sb	D : 93Ru01=21.0(1.1) 02Sh08=22(3) 78Cr03=14(1) 93Ru01=22(4),							**
* ¹³⁵ Sb	D : supersedes 77Ru04=19.9(2.1); Birge ratio=3.46							**
* ¹³⁵ Sb	T : average 93Ru01=1.662(0.010) 68To18=1.696(0.021); other (recent)							**
* ¹³⁵ Sb	T : 20Wu04=1.57(0.23), outweighed							**
* ¹³⁵ Xe ^m	D : % β^- ranging from 0.004% to 0.6%							**
* ¹³⁵ Xe ^m	J : 90NeZY=11/2							**
* ¹³⁵ Cs	T : average 16Ma05=1.6(0.6) by AMS and 1.3(0.2) ICPMS							**
* ¹³⁵ Pr	J : 19Fr08,72Ek04=3/2							**
* ¹³⁵ Pm ^m	E : from TNN of 11/2 ⁻ level in Pm isotopes: ¹³³ Pm: 130 keV							**
* ¹³⁵ Pm ^m	E : ¹³⁷ Pm: 150(50) keV ¹³⁹ Pm: 189 keV ¹⁴¹ Pm: 629 keV							**
* ¹³⁵ Tb	T : symmetrized from 04Wo07=940(+330-220) us							**
¹³⁶ In	-40970#	300#	86 ms 9	7 ⁻ #	18	15Lo04 TD	2015	β^- =100; β^- n= ?; β^- 2n ? *
¹³⁶ Sn	-56170#	200#	355 ms 18	0 ⁺	18	20Ju02 T	1994	β^- =100; β^- n=28 3; β^- 2n ? *
¹³⁶ Sb	-64507	6	923 ms 14	(1 ⁻)	18	20Wa04 D	1976	β^- =100; β^- n=24.7 5; *

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
$^{136}\text{Sb}^m$	-64238	6	269.3	0.5	570 ns	5	(6 ⁻)	18 12Ka36 T 2001 $\beta^- 2n=0.14$ 3 IT=100 *
^{136}Te	-74425.3	2.3			17.63 s	0.09	0 ⁺	18 18Ca22 D 1974 $\beta^- =100; \beta^- n=1.37$ 4 *
^{136}I	-79545	14			83.4 s	0.4	(1 ⁻)	18 1949 $\beta^- =100$
$^{136}\text{I}^m$	-79339	5	206	15	46.6 s	1.1	(6 ⁻)	18 1959 $\beta^- =100$
^{136}Xe	-86429.170	0.007			2.18 Zy	0.05	0 ⁺	18 20Ba.A T 1920 $1S=8.857$ 72; $2\beta^- =100$ *
$^{136}\text{Xe}^m$	-84537.43	0.07	1891.74	0.07	2.92 μ s	0.03	6 ⁺	18 17Ki09 T 1969 IT=100 *
^{136}Cs	-86338.9	1.9			13.01 d	0.05	5 ⁺ *	18 1951 $\beta^- =100$ *
$^{136}\text{Cs}^m$	-85821.0	1.9	517.9	0.1	17.5 s	0.2	8 ⁻ *	18 1981 IT=?; β^- ? *
^{136}Ba	-88887.08	0.24			STABLE		0 ⁺	18 1932 $1S=7.85$ 24
$^{136}\text{Ba}^m$	-86856.55	0.24	2030.535	0.018	308.4 ms	1.9	7 ⁻	19 1965 IT=100
$^{136}\text{Ba}^n$	-85529.9	0.3	3357.19	0.25	91 ns	2	10 ⁺	19 2004 IT=100
^{136}La	-86040	50			9.87 m	0.03	1 ⁺ *	19 1950 $\beta^+ =100$ *
$^{136}\text{La}^m$	-85780	50	259.5	0.3	114 ms	5	(7 ⁻)	19 1966 IT=100
$^{136}\text{La}^n$	-83520	50	2520.6	0.4	187 ns	27	(14 ⁺)	19 2015 IT=100
^{136}Ce	-86508.5	0.3			STABLE	>32Py	0 ⁺	19 11Be02 T 1936 $1S=0.186$ 2; $2\beta^+ ?$ *
$^{136}\text{Ce}^m$	-83413.5	0.7	3095.0	0.6	1.96 μ s	0.09	10 ⁺	19 13Va10 T 1991 IT=100 *
^{136}Pr	-81340	11			13.1 m	0.1	2 ⁺ *	19 1968 $\beta^+ =100$ *
^{136}Nd	-79199	12			50.65 m	0.33	0 ⁺	19 1968 $\beta^+ =100$
^{136}Pm	-71170	70		*	107 s	6	7 ⁺ #	19 73PaZV T 1988 $\beta^+ =100$ *
$^{136}\text{Pm}^m$	-71070	90	100	120	90 s	35	2 ⁺ #	19 89Vi04 T 1982 $\beta^+ =100$ *
$^{136}\text{Pm}^n$	-71130	70	42.7	0.2	1.5 μ s	0.1	7 ⁻ #	19 08Ri05 ET 1987 IT=100 *
^{136}Sm	-66811	12			47 s	2	0 ⁺	19 1982 $\beta^+ =100$
$^{136}\text{Sm}^m$	-64546	12	2264.7	1.1	15 μ s	1	(8 ⁻)	19 1994 IT=100
^{136}Eu	-56240#	200#		*	3.3 s	0.3	6 ⁺ #	19 1987 $\beta^+ =100; \beta^+ p \approx 0.09$ *
$^{136}\text{Eu}^m$	-56140#	220#	100#	100#	3.8 s	0.3	1 ⁺ #	19 1987 $\beta^+ =100; \beta^+ p \approx 0.09$ *
^{136}Gd	-49090#	300#			1# s	>200ns	0 ⁺	19 2000 $\beta^+ ?; \beta^+ p ?$
^{136}Tb	-35900#	500#			200# ms		5 ⁻ #	19 $\beta^+ ?; \beta^+ p ?$
* ^{136}In	T : symmetrized from 15Lo04=85(+10-8)							**
* ^{136}Sn	D : % β^- -n average 11Ar18=27(4) 02Sh08=30(5)							**
* ^{136}Sn	T : average 20Ju02=361(5) (supersedes 15Lo04=350(5)) 11Ar18=300(15);							**
* ^{136}Sn	T : Birge ratio=3.86							**
* ^{136}Sb	D : % β^- -n average 20Wa04=17.6(1.0,stat)(2.7,syst) 18Ca22=32.2(1.5)							**
* ^{136}Sb	D : 15CaZM=19.2(1.8) 93Ru01=16.3(3.2); Birge ratio=3.97; % $\beta^- 2n$ from 18Ca22							**
* $^{136}\text{Sb}^m$	T : others 15Lo08=489(40) 07Si27=480(100) 01Mi22=570(50)							**
* ^{136}Te	D : % β^- -n average 18Ca22=1.47(0.06) 93Ru01=1.31(0.05) 12Ma63=1.34(0.13)							**
* ^{136}Xe	T : value for 2v- $\beta\beta$; other 19Ga11=2.23(0.08) 14Al03=2.165(0.061)							**
* ^{136}Xe	T : 12Ga17=2.38(0.14) 15Ba11=2.19(0.06) (evaluation); Onu-BB: 18Al05>18 Yy							**
* ^{136}Xe	T : 16As01>2.5 Yy 13Ga07>19 Yy 12Au03>16 Yy 02Be74>10Zy (all at 90% C.L.)							**
* $^{136}\text{Xe}^m$	T : average 17Ki09=2.92(0.03) 70Jo20=2.80(0.37), 3.40(0.35)							**
* $^{136}\text{Xe}^m$	T : 74ClZX=2.78(0.17), 3.35(0.47) 70Ca25=2.8(0.2), 3.0(0.3)							**
* $^{136}\text{Xe}^m$	T : 70Gr38=3.10(0.38) 69Wa29=3.4(0.4)							**
* ^{136}Cs	J : 81Th06,76Fu06,71Da01=5							**
* $^{136}\text{Cs}^m$	J : 81Th06=8							**
* $^{136}\text{Cs}^m$	E : also 83We07=518(5)							**
* ^{136}La	J : 76Fu06,73In04=1							**
* ^{136}Ce	T : for 2K cature-2nu; see also 17Be21							**
* $^{136}\text{Ce}^m$	T : average 13Va10=1.9(0.1) 75Yo01=2.2(0.2)							**
* ^{136}Pr	J : 19Fr08,76Fu06,72Ek04=2							**
* ^{136}Pm	J : expected conf=p5/2[532] n9/2[514], K=7+ (prolate shape); supported by the							**
* ^{136}Pm	J : observed direct feeding to I=6,7 levels following $^{136}\text{Pm} \beta^+$ decay							**
* $^{136}\text{Pm}^m$	T : from 30 s < T1/2 < 150 s in 89Vi04; other 88Ke03=300(50)s, but according							**
* $^{136}\text{Pm}^m$	T : to the authors the value is poorly defined							**
* $^{136}\text{Pm}^m$	J : expected p5/2[532] n9/2[514], K=2+ (prolate shape); supported by the							**
* $^{136}\text{Pm}^m$	J : observed direct feeding to I=2,3 levels following $^{136}\text{Pm} \beta^+$ decay							**
* $^{136}\text{Pm}^n$	E : 08Ri05=42.7(0.2) keV above a long lived state that could be either the							**
* $^{136}\text{Pm}^n$	E : gs or the isomer							**
* $^{136}\text{Pm}^n$	J : expected conf=p5/2[413] n9/2[514], K=7- (prolate shape); 42.7g E1,							**
* $^{136}\text{Pm}^n$	J : consistent with the measured half-life							**
* ^{136}Eu	J : expected conf=p5/2[413] n7/2[404], K=6+ (prolate shape)							**
* ^{136}Eu	J : expected conf=p5/2[413] n7/2[404], K=1+ (prolate shape)							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
^{137}In	-35830#	400#	70 ms	40	9/2 ⁺ #	15 15Lo04	TD 2015	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*		
^{137}Sn	-50150#	300#	249 ms	15	5/2 ⁻ #	07 11Ar18	TD 1994	$\beta^- = 100; \beta^- n = 48 \text{ 6}; \beta^- 2n ?$	*		
^{137}Sb	-60060	50	497 ms	21	7/2 ⁺ #	07 20Wu04	T 1994	$\beta^- = 100; \beta^- n = 49 \text{ 6}; \beta^- 2n ?$	*		
^{137}Te	-69303.8	2.1	2.49 s	0.05	3/2 ⁻ #	07 17AgZZ	D 1975	$\beta^- = 100; \beta^- n = 2.94 \text{ 14}$	*		
^{137}I	-76356	8	24.13 s	0.12	7/2 ⁺ #	07 20Cz01	D 1943	$\beta^- = 100; \beta^- n = 7.51 \text{ 11}$	*		
^{137}Xe	-82383.41	0.10	3.818 m	0.013	7/2 ⁻ *	07 89Bo03	J 1943	$\beta^- = 100$	*		
^{137}Cs	-86545.8	0.3	30.04 y	0.04	7/2 ⁺ *	07 FGK204	T 1951	$\beta^- = 100$			
^{137}Ba	-87721.40	0.25	STABLE		3/2 ⁺ *	07	1932	IS=11.23 23			
$^{137}\text{Ba}^m$	-87059.74	0.25	661.659	0.003	2.552 m	0.001	11/2 ⁻ *	07	1965	IT=100	
$^{137}\text{Ba}^n$	-85372.3	0.6	2349.1	0.5	589 ns	20	(19/2 ⁻)	07 17Vo01	T 1973	IT=100	
^{137}La	-87140.9	1.6	60 ky	20	7/2 ⁺ *	07	1948	$\epsilon = 100$		*	
$^{137}\text{La}^m$	-85271.4	1.6	1869.50	0.21	342 ns	25	19/2 ⁻	07	1982	IT=100	
^{137}Ce	-85918.8	0.4	9.0 h	0.3	3/2 ⁺ *	07	1948	$\beta^+ = 100$			
$^{137}\text{Ce}^m$	-85664.5	0.4	254.29	0.05	34.4 h	0.3	11/2 ⁻ *	07	1958	IT=99.21 4; $\beta^+ = 0.79 \text{ 4}$	
^{137}Pr	-83202	8	1.28 h	0.03	5/2 ⁺ *	07	1958	$\beta^+ = 100$		*	
$^{137}\text{Pr}^m$	-82641	8	561.22	0.23	2.66 μs	0.07	11/2 ⁻	07	1987	IT=100	
^{137}Nd	-79584	12	38.5 m	1.5	1/2 ⁺ *	07	1970	$\beta^+ = 100$			
$^{137}\text{Nd}^m$	-79065	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	$\beta^+ ?$			
$^{137}\text{Pm}^m$	-73910	40	160	50	BD &	2.4 m	0.1	11/2 ⁻	07	1973	$\beta^+ = 100$
^{137}Sm	-67992	29	45 s	1	(9/2 ⁻)	07	1986	$\beta^+ = 100$			
$^{137}\text{Sm}^m$	-67890#	60#	100#	50#	20# s		1/2 ⁺ #			$\beta^+ ?$	
^{137}Eu	-60146	4	8.4 s	0.5	5/2 ⁺ #	07 88Be.A	T 1982	$\beta^+ = 100$			
^{137}Gd	-51210#	300#	2.2 s	0.2	(7/2 ⁺)#	07	1999	$\beta^+ = 100; \beta^+ p = ?$			
^{137}Tb	-40970#	400#	600# ms		3/2 ⁺ #			$p ?; \beta^+ ?$			
* ^{137}In	T : symmetrized from 15Lo04=65(+40-30)								**		
* ^{137}Sn	T : average 11Ar18=273(7) 20Wu04=204(12) 20Ju02=238(8), supersedes								**		
* ^{137}Sn	T : 15Lo04=230(30), 02Sh08=190(60); Birge ratio=3.09								**		
* ^{137}Sn	D : % $\beta^- n$ average 11Ar18=50(8) 02Sh08=58(15) 20Ju02d=32(15)								**		
* ^{137}Sb	T : average 20Wu04=566(52) 11Ar18=492(25) 02Sh08=450(50)								**		
* ^{137}Sb	D : % $\beta^- n$ average 11Ar18=49(8)% 02Sh08=49(10)%								**		
* ^{137}Te	J : TNN of N=85 isotones. Ensdf2007=(7/2-) from shell-model prediction								**		
* ^{137}Te	D : % $\beta^- n$ average 17AgZZ=2.6(0.3) 93Ru01=3.04(0.16)								**		
* ^{137}I	T : from 93Ru01, supersedes 74Ru08=24.5(0.2) (same group)								**		
* ^{137}I	D : % $\beta^- n$ average 20Cz01=6.66(0.34) 17Ra10=7.9(0.5) 16Ag03=7.76(0.14)								**		
* ^{137}I	D : 93Ru01=7.14(0.23)								**		
* ^{137}Xe	J : 89Bo03, 90NeZY=7/2								**		
* $^{137}\text{Ba}^n$	J : from 19Ka04								**		
* ^{137}Pr	J : 19Fr08, 72Ek04=3/2								**		
^{138}Sn	-45510#	400#	148 ms	9	0 ⁺	17 20Wu04	T 2010	$\beta^- = 100; \beta^- n = 36 \text{ 12}; \beta^- 2n ?$	*		
$^{138}\text{Sn}^m$	-44170#	400#	210 ns	45	(6 ⁺)	17	2014	IT=100			
^{138}Sb	-54650#	300#	333 ms	7	(3 ⁻)	17 20Wu04	T 1994	$\beta^- = 100; \beta^- n = 72 \text{ 8}; \beta^- 2n ?$	*		
^{138}Te	-65696	4	1.46 s	0.25	0 ⁺	17 20Wu04	T 1975	$\beta^- = 100; \beta^- n = 4.80 \text{ 23}$	*		
^{138}I	-71980	6	6.26 s	0.03	(1 ⁻)	17 20Cz01	D 1949	$\beta^- = 100; \beta^- n = 5.33 \text{ 11}$	*		
$^{138}\text{I}^m$	-71912	6	1.26 μs	0.16	(3 ⁻)	17	2007	IT=100			
^{138}Xe	-79972.2	2.8	14.14 m	0.07	0 ⁺	17	1943	$\beta^- = 100$			
^{138}Cs	-82887	9	33.5 m	0.2	3 ⁻ *	17	1943	$\beta^- = 100$	*		
$^{138}\text{Cs}^m$	-82807	9	79.9	0.3	2.91 m	0.10	6 ⁻ *	17	1971	IT=81 3; $\beta^- = 19 \text{ 3}$	
$^{138}\text{Cs}^x$	-82847	25	40	23	R=?	<i>fsmix</i>					
^{138}Ba	-88261.81	0.25	STABLE		0 ⁺	17	1925	IS=71.70 29			
$^{138}\text{Ba}^m$	-86171.27	0.25	2090.536	0.021	850 ns	100	6 ⁺	17	1971	IT=100	
^{138}La	-86513.4	0.4	103 Gy	1	5 ⁺ *	17	1947	IS=0.0 8881; $\beta^+ = 65.5 \text{ 4}; \beta^- = 34.5 \text{ 4}$	*		
$^{138}\text{La}^m$	-86440.8	0.4	72.57	0.03	116 ns	5	(3 ⁺)	17	1975	IT=100	
$^{138}\text{La}^n$	-85774.6	0.4	738.80	0.20	2.0 μs	0.3	7 ⁻	17 14As02	TJ 2014	IT=100	
^{138}Ce	-87565.9	0.5	STABLE	>44Py	0 ⁺	17	1936	IS=0.251 2; $2\beta^+ ?$	*		
$^{138}\text{Ce}^m$	-85436.6	0.5	2129.28	0.12	8.73 ms	0.20	7 ⁻	17	1960	IT=100	
^{138}Pr	-83129	10	1.45 m	0.05	1 ⁺	17	1951	$\beta^+ = 100$			
$^{138}\text{Pr}^m$	-82779	16	350	19	BD	2.12 h	0.04	7 ⁻ *	17	1958	$\beta^+ = 100$
^{138}Nd	-82017	12	5.04 h	0.09	0 ⁺	17	1965	$\beta^+ = 100$		*	
$^{138}\text{Nd}^m$	-78843	12	3174.5	0.4	370 ns	5	10 ⁺	17	1975	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{138}Pm	-74914	12	3.24 m 0.05	3^- #	17		1973	$\beta^+=100$	*
$^{138}\text{Pm}^m$		<i>non-exist</i>	10 s 2	1^+ #	17	83Al06	IT	$\beta^+=100$	*
^{138}Sm	-71498	12	3.1 m 0.2	0^+	17		1982	$\beta^+=100$	*
^{138}Eu	-61750	28	5# s	2^- #	17	FGK205	EJ	$\beta^+?$	*
$^{138}\text{Eu}^m$	-61650#	60#	100# 50#	7^- #	17	FGK205	EJ	$\beta^+=100$	*
^{138}Gd	-55660#	200#	4.7 s 0.9	0^+	17		1985	$\beta^+=100$	*
$^{138}\text{Gd}^m$	-53430#	200#	2232.6 1.1	$6.2 \mu\text{s}$ 0.2	(8 $^-$)	17	1997	IT=100	*
^{138}Tb	-43600#	300#	800# ms >200ns	2^+ #	17		1993	$\beta^+?; \beta^+p?; p=0$	*
^{138}Dy	-34930#	500#	200# ms	0^+				$\beta^+?; \beta^+p?$	*
^{138}Sn	T : average 20Wu04=158(15) 20Ju02t=142(12), supersedes 15Lo04=140(+30-20)								**
^{138}Sb	T : average 20Wu04=326(8) 15Le14=346(19) 11Ar18=350(15)								**
^{138}Te	D : $\% \beta^-$ n from 17AgZZ; other 75As04=6.3(2.1)								**
^{138}Te	T : average 20Wu04=1.50(0.32) 75As04=1.4(0.4); other 06KeZZ=1.151(0.028)								**
^{138}I	D : $\% \beta^-$ n average 20Cz01=6.07(0.34) 17AgZZ=4.98(0.18) 11Go37=5.32(0.20)								**
^{138}I	D : 93Ru01=5.56(0.22)								**
^{138}Cs	J : 67St22,78Sc27,79Bo01=3								**
^{138}Cs	J : 81Th06=6								**
^{138}La	J : 55So31,72Fi14=5								**
^{138}Ce	T : see also 17Be21t								**
$^{138}\text{Pr}^m$	J : 72Ek04=7								**
^{138}Pm	J : expected conf=p5/2[532]n1/2[400],K=3- (deformed shape)								**
$^{138}\text{Pm}^m$	I : not confirmed in 00Be42								**
$^{138}\text{Eu}^m$	J : from the expected conf=p5/2[413] n9/2[514],K=2- (deformed shape);								**
$^{138}\text{Eu}^m$	J : from systematics (p5/2[413] at Z=63 and n9/2[514] at N=75);								**
$^{138}\text{Eu}^m$	J : Ensdf2017=(1-)								**
$^{138}\text{Eu}^m$	J : from the expected conf=p5/2[413] n9/2[514],K=7- (deformed shape);								**
$^{138}\text{Eu}^m$	J : from systematics (p5/2[413] at Z=63 and n9/2[514] at N=75);								**
$^{138}\text{Eu}^m$	J : Ensdf17 J=(6-) as a ground state, but the proposed								**
$^{138}\text{Eu}^m$	J : conf=p5/2[532] n7/2[404] violates the GM rule								**
^{139}Sn	-39310#	400#	120 ms 38	$5/2^-$ #	16	20Wu04	T	$\beta^-=100; \beta^-n?; \beta^-2n?$	*
^{139}Sb	-50050#	400#	182 ms 9	$7/2^+$ #	16	20Wu04	T	$\beta^-=100; \beta^-n=90\ 10; \beta^-2n?$	*
^{139}Te	-60205	4	724 ms 81	$5/2^-$ #	16	20Wu04	TD	$\beta^-=100; \beta^-n?$	*
^{139}I	-68471	4	2.280 s 0.011	$7/2^+$ #	16	17AgZZ	D	$\beta^-=100; \beta^-n=9.74\ 24$	*
^{139}Xe	-75644.6	2.1	39.68 s 0.14	$3/2^-*$	16		1951	$\beta^-=100$	*
^{139}Cs	-80701	3	9.27 m 0.05	$7/2^+*$	16		1939	$\beta^-=100$	*
^{139}Ba	-84913.92	0.25	82.93 m 0.09	$7/2^-*$	16		1937	$\beta^-=100$	*
^{139}La	-87222.4	0.6	STABLE	$7/2^+*$	16		1924	IS=99.9 1119	*
$^{139}\text{La}^m$	-85422.0	0.7	1800.4 0.4	$315\ \text{ns}\ 35$	(17/2 $^+$)		2012	IT=100	*
^{139}Ce	-86957.7	2.1	137.642 d 0.020	$3/2^+*$	16	FGK204	T	$\varepsilon=100$	*
$^{139}\text{Ce}^m$	-86203.5	2.1	754.24 0.08	$57.58\ \text{s}\ 0.32$	$11/2^-$	16	1967	IT=100	*
^{139}Pr	-84829	4	4.41 h 0.04	$5/2^+*$	16		1951	$\beta^+=100$	*
^{139}Nd	-82017	28	29.7 m 0.5	$3/2^+*$	16		1951	$\beta^+=100$	*
$^{139}\text{Nd}^m$	-81786	28	231.16 0.05	$5.50\ \text{h}\ 0.20$	$11/2^-*$	16	1951	$\beta^+=87.0\ 10; \text{IT}=13.0\ 10$	*
$^{139}\text{Nd}^m$	-79400	28	2616.9 0.6	276.8 ns 1.8	$23/2^+$	16	1980	IT=100	*
^{139}Pm	-77501	14	4.15 m 0.05	(5/2 $^+$)	16		1967	$\beta^+=100$	*
$^{139}\text{Pm}^m$	-77312	14	180 ms 20	(11/2 $^-$)	16		1975	IT $\approx$ 100; $\beta^+?$	*
^{139}Sm	-72380	11	2.57 m 0.10	$1/2^+*$	16		1971	$\beta^+=100$	*
$^{139}\text{Sm}^m$	-71923	11	457.38 0.23	$10.7\ \text{s}\ 0.6$	$11/2^-$	16	1973	IT=93.7 5; $\beta^+=6.3\ 5$	*
^{139}Eu	-65398	13	17.9 s 0.6	(11/2 $^-$)	16		1975	$\beta^+=100$	*
$^{139}\text{Eu}^m$	-65250	13	148.3 0.3	$10\ \mu\text{s}\ 2$	(7/2 $^+$)	16	2011	IT=100	*
^{139}Gd	-57630#	200#	5.7 s 0.3	$9/2^-$ #	16	99Xi04	T	$\beta^+=100; \beta^+p=?$	*
$^{139}\text{Gd}^m$	-57380#	250#	4.8 s 0.9	$1/2^+*$	16		1983	$\beta^+=100; \beta^+p=?$	*
^{139}Tb	-48130#	300#	1.6 s 0.2	$5/2^-$ #	16		1999	$\beta^+=100; \beta^+p?$	*
^{139}Dy	-37700#	500#	600 ms 200	(7/2 $^+$)	01		1999	$\beta^+=100; \beta^+p\approx 11$	*
^{139}Sn	T : average 20Wu04=114(49) 15Lo04=130(60)								**
^{139}Sb	T : other 11Ar18=93(+14-3)								**
^{139}Te	T : others (not trusted) 11Ar18=1600(300) 06KeZZ=598(20)								**
^{139}I	D : $\% \beta^-$ n average 17AgZZ=9.27(0.33) 93Ru01=10.3(0.4) 81Ho07=10.0(1.1)								**
^{139}I	D : 75As04=10.2(0.9)								**
^{139}Xe	J : also 90NeZY=3/2								**
^{139}Cs	J : 79Bo01,79Ek02,81Th06,87Co19=7/2								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹³⁹ Ba	J : 83Mu12=7/2							**
* ¹³⁹ La	J : 71Ch02=7/2							**
* ¹³⁹ Ce	J : 73In04=3/2							**
* ¹³⁹ Pr	J : 72Ek04=5/2							**
* ¹³⁹ Nd	J : 72Ek04=3/2							**
* ¹³⁹ Nd ^m	J : 72Ek04=1 1/2							**
* ¹³⁹ Nd ⁿ	T : average 13Va10=278(2) 08Fe02=272(4)							**
* ¹³⁹ Sm	J : 92Le09=1/2							**
* ¹³⁹ Gd	T : average 99Xi04=5.8(0.9) 88Be.A=5.8(0.4); other 83Ni05=4.9(1.0)							**
* ¹³⁹ Gd	T : not used since it corresponds to a mixture of gs and the isomer							**
* ¹³⁹ Gd	D : β^+ p were observed in 83Ni05 and it is assumed that they are							**
* ¹³⁹ Gd	D : associated with both the ground state and the isomer							**
* ¹³⁹ Gd ^m	D : β^+ p were observed in 83Ni05 and it is assumed that they are							**
* ¹³⁹ Gd ⁿ	D : associated with both the ground state and the isomer							**
¹⁴⁰ Sn	-34490# 300#		50# ms >550ns	0 ⁺	18Sh11	I	2018	β^- ?; β^- n ?; β^- 2n ?
¹⁴⁰ Sb	-44390# 600#		170 ms 6	(3 ⁻)	18 20Wu04	T	2010	β^- =100; β^- n=23 4; β^- 2n=7.6 25
¹⁴⁰ Sb ^m	-44060# 600#	330# 30#	41 μ s 8	(6 ⁻ , 7 ⁻)	18 16Lo01	ETJ	2016	IT=100
¹⁴⁰ Te	-56367 14		351 ms 5	0 ⁺	18 20Wu04	TD	1994	β^- =100; β^- n=?
¹⁴⁰ I	-63606 12		588 ms 10	(2 ⁻)	18 17Mo19	J	1972	β^- =100; β^- n=7.60 28; β^- 2n ?
¹⁴⁰ Xe	-72986.5 2.3		13.60 s 0.10	0 ⁺	18		1951	β^- =100
¹⁴⁰ Cs	-77050 8		63.7 s 0.3	1 ⁻ *	18		1950	β^- =100
¹⁴⁰ Cs ^m	-77036 8	13.931 0.021	471 ns 51	(2 ⁻)	18		1974	IT=100
¹⁴⁰ Ba	-83268 8		12.7534 d 0.0021	0 ⁺	18 FGK204	T	1939	β^- =100
¹⁴⁰ La	-84312.1 0.6		40.289 h 0.004	3 ⁻ *	18 FGK209	T	1935	β^- =100
¹⁴⁰ Ce	-88074.2 1.3		STABLE	0 ⁺	18		1925	IS=88.449 51
¹⁴⁰ Ce ^m	-85966.3 1.3	2107.854 0.024	7.3 μ s 1.5	6 ⁺	18		1966	IT=100
¹⁴⁰ Pr	-84686 6		3.39 m 0.01	1 ⁺ *	18		1938	β^+ =100; e^+ =48.7 22; ϵ =51.3 22
¹⁴⁰ Pr ^m	-84558 6	127.8 0.3	350 ns 20	5 ⁺	18		1964	IT=100
¹⁴⁰ Pr ⁿ	-83922 6	763.7 0.5	3.05 μ s 0.20	(7 ⁻)	18		1964	IT=100
¹⁴⁰ Nd	-84257 3		3.37 d 0.02	0 ⁺	18		1949	ϵ =100
¹⁴⁰ Nd ^m	-82035 3	2221.65 0.09	600 μ s 50	7 ⁻	18		1962	IT=100
¹⁴⁰ Nd ⁿ	-76822 3	7435.1 0.4	1.22 μ s 0.06	20 ⁺	08Fe02	TJ	2008	IT=100
¹⁴⁰ Pm	-78212 24		9.2 s 0.2	1 ⁺	18		1966	β^+ =100
¹⁴⁰ Pm ^m	-77783 13	429 28 BD	5.95 m 0.05	8 ⁻	18		1966	β^+ =100
¹⁴⁰ Sm	-75456 12		14.82 m 0.12	0 ⁺	18		1967	β^+ =100
¹⁴⁰ Eu	-66990 50		1.51 s 0.02	1 ⁺	18 91Fi03	TD	1982	β^+ =100; e^+ =95.1 7; ϵ =4.9 7
¹⁴⁰ Eu ^m	-66780 50	210 14	125 ms 2	(5 ⁻)	18 91Fi03	TDE	1988	IT $\approx$ 100; β^+ <1
¹⁴⁰ Eu ⁿ	-66320 50	669 14	299.8 ns 2.1	(8 ⁺)	18		2002	IT=100
¹⁴⁰ Gd	-61782 28		15.8 s 0.4	0 ⁺	18 91Fi03	TD	1985	β^+ =100; e^+ =67 8; ϵ =33 8
¹⁴⁰ Tb	-50480 800		2.29 s 0.15	(7 ⁺)	18 91Fi03	D	1986	β^+ =100; ϵ <3; β^+ p=0.26 13
¹⁴⁰ Dy	-42830# 400#		700# ms	0 ⁺	18		2002	β^+ ?; β^+ p ?
¹⁴⁰ Dy ^m	-40660# 400#	2166.1 0.5	7.0 μ s 0.5	8 ⁻	18 15Ko14	JE	2002	IT=100
¹⁴⁰ Ho	-29320# 500#		6 ms 3	8 ⁺ #	18		1999	p=?; β^+ ?; β^+ p ?
* ¹⁴⁰ Sb	T : average 20Wu04=169(7) 17Mo12=173(12)							**
* ¹⁴⁰ Sb ^m	E : 16Lo01=298.2+x keV; x=30#(30#) keV estimated by the authors							**
* ¹⁴⁰ Te	T : average 20Wu04=360(21) 17Mo19=350(5); other 06KeZZ=334(14)							**
* ¹⁴⁰ I	T : average 20Wu04=553(46) 76Lu02=590(10); others 76Ah01=860(40)							**
* ¹⁴⁰ I	T : 75Kr17=870(40) 74Kr21=880(130) 70HeZH=860(140) 70WiZN=880(120)							**
* ¹⁴⁰ I	D : β^- n from 17AgZZ=7.60(0.28); other (recent)20Wa04=7.6(0.9,sta)(2.7,syst)							**
* ¹⁴⁰ Cs	J : 79Ek02,79Bo01=1							**
* ¹⁴⁰ La	J : 76Fu06=3							**
* 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 : ϵ^+ =42.4(2.3); ϵ =57.6(2.3) for q=58+ (H-like ion) and							**
* ¹⁴⁰ Pr	D : ϵ^+ =51.2(3.1); ϵ =48.8(3.1) for q=57+ (He-like ion)							**
* ¹⁴⁰ Pr	D : e^+ decay for the ground state (neutral atom) from 72Ev01							**
* ¹⁴⁰ Nd ⁿ	T : average 13Va10=1.2(0.1) 08Fe02=1.23(0.07)							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
* ¹⁴⁰ Eu ^m	E : from 185.3+x keV and x<50 keV in 91Fi03										**		
* ¹⁴⁰ Eu ⁿ	E : from 459.5(0.3) keV above ¹⁴⁰ Eu ^m										**		
* ¹⁴⁰ Ho	D : %p observed in 99Ry04										**		
¹⁴¹ Sb	−39540#	500#			103 ms	29		18 20Wu04	TD 2018	$\beta^-=100;\beta^-_n ?;\beta^- 2n ?$	*		
¹⁴¹ Te	−50670#	400#			193 ms	16		14 20Wu04	TD 1994	$\beta^-=100;\beta^-_n ?;\beta^- 2n ?$			
¹⁴¹ I	−59927	16			420 ms	7		14 20Wu04	TD 1974	$\beta^-=100;\beta^-_n=21.2$	30 *		
¹⁴¹ Xe	−68197.3	2.9			1.73 s	0.01		14 90NeZY	J 1951	$\beta^-=100;\beta^-_n=0.044$	5 *		
¹⁴¹ Cs	−74477	9			24.84 s	0.16		14 93Ru01	TD 1962	$\beta^-=100;\beta^-_n=0.0342$	14 *		
¹⁴¹ Ba	−79732	5			18.27 m	0.07			14	$\beta^-=100$			
¹⁴¹ La	−82930	4			3.92 h	0.03			14	$\beta^-=100$			
¹⁴¹ Ce	−85431.1	1.3			32.505 d	0.010		14 FGK204	T 1948	$\beta^-=100$			
¹⁴¹ Pr	−86014.5	1.5			STABLE			14	1924	IS=100			
¹⁴¹ Nd	−84192	3			2.49 h	0.03		14	1949	$\beta^+=100;\epsilon=97.28$	16; *		
										$e^+=2.72$	16		
¹⁴¹ Nd ^m	−83435	3	756.51	0.05	62.0 s	0.8		14 70Ab05	D 1960	IT≈100; $\beta^+=0.032$	8		
¹⁴¹ Pm	−80523	14			20.90 m	0.05		14	1952	$\beta^+=100$			
¹⁴¹ Pm ^m	−79894	14	628.62	0.07	630 ns	20		14	1970	IT=100			
¹⁴¹ Pm ⁿ	−77992	14	2530.75	0.17	> 2 μ s			(23/2 ⁺)	14 85Ar19	TDJ 1985	IT=100		
¹⁴¹ Sm	−75934	9			10.2 m	0.2		1/2 ⁺ *	14	$\beta^+=100$			
¹⁴¹ Sm ^m	−75758	9	175.9	0.3	22.6 m	0.2		11/2 ⁻ *	14	$\beta^+=99.69$	3;IT=0.31	3	
¹⁴¹ Eu	−69926	13			40.7 s	0.7		5/2 ⁺	14	$\beta^+=100$			
¹⁴¹ Eu ^m	−69830	13	96.45	0.07	2.7 s	0.3		11/2 ⁻	14	IT=86	3; $\beta^+=14$	3 *	
¹⁴¹ Gd	−63224	20			14 s	4		(1/2 ⁺)	14	$\beta^+=100;\beta^+p=0.03$	1 *		
¹⁴¹ Gd ^m	−62846	20	377.76	0.09	24.5 s	0.5		(11/2 ⁻)	14	$\beta^+=89$	2;IT=11	2 *	
¹⁴¹ Tb	−54540	110		*	3.5 s	0.2		(5/2 ⁻)	14	$\beta^+=100$			
¹⁴¹ Tb ^m	−54540#	230#	0#	200#	7.9 s	0.6		11/2 ⁻ #	14 88Be.A	I 1988	$\beta^+=100$		
¹⁴¹ Dy	−45380#	300#			900 ms	140		(9/2 ⁻)	14	$\beta^+=100;\beta^+p=?$			
¹⁴¹ Ho	−34360#	400#			4.1 ms	0.1		(7/2 ⁻)	14	$p\approx 100;\beta^+ ?;\beta^+p ?$			
¹⁴¹ Ho ^m	−34290#	400#	66	2	7.3 μ s	0.3		(1/2 ⁺)	14	p=100			
* ¹⁴¹ I	D : % β^-_n from 80A115										**		
* ¹⁴¹ I	T : average 20Wu04=418(8) 80A115=430(20); others 74Kr21=410(80)										**		
* ¹⁴¹ I	T : 76Lu02=480(30) 70HeZX=430(80)										**		
* ¹⁴¹ Xe	J : also 90NeZY=5/2										**		
* ¹⁴¹ Cs	T : average 93Ru01=24.34(0.12) 86Ok03=24.98(0.13) 76Ot03=24.94(0.06),										**		
* ¹⁴¹ Cs	T : Birge ratio=3.26										**		
* ¹⁴¹ Nd	D : %e ⁺ average 72Ev01=2.72(0.20) 66Gr05=2.73(0.27)										**		
* ¹⁴¹ Eu ^m	D : symmetrized from %IT=87(+2-4) and % $\beta^+=13(+4-2)$										**		
* ¹⁴¹ Gd	J : weak J^π arguments in Ensdf2001										**		
* ¹⁴¹ Gd ^m	J : weak J^π arguments in Ensdf2001										**		
¹⁴² Sb	−33610#	300#			80 ms	50		20Wu04	T 2018	$\beta^-=100;\beta^-_n ?;\beta^- 2n ?$	*		
¹⁴² Te	−46550#	500#			147 ms	8		11 20Wu04	TD 1994	$\beta^-=100;\beta^-_n ?;\beta^- 2n ?$			
¹⁴² I	−54803	5			235 ms	11		11 20Wu04	TD 1975	$\beta^-=100;\beta^-_n ?;\beta^- 2n ?$	*		
¹⁴² Xe	−65229.6	2.7			1.23 s	0.02		0 ⁺	11	$\beta^-=100;\beta^-_n=0.37$	3 *		
¹⁴² Cs	−70515	7			1.687 s	0.010		0 ⁻ *	11 93Ru01	TD 1962	$\beta^-=100;\beta^-_n=0.089$	3 *	
¹⁴² Ba	−77842	6			10.6 m	0.2		0 ⁺	11	$\beta^-=100$			
¹⁴² La	−80024	6			91.1 m	0.5		2 ⁻	11 19Kr10	T 1953	$\beta^-=100$	*	
¹⁴² La ^m	−79878	6	145.82	0.08	870 ns	170		(4) ⁻	11	IT=100			
¹⁴² Ce	−84532.9	2.4			STABLE	>2.9Ey		0 ⁺	11 19Be29	T 1925	IS=11.114	51; $\alpha ?;2\beta^- ?$	*
¹⁴² Pr	−83786.4	1.5			19.12 h	0.04		2 ⁻ *	11	$\beta^-\approx 100;\epsilon=0.0164$	8		
¹⁴² Pr ^m	−83782.7	1.5	3.694	0.003	14.6 m	0.5		5 ⁻ *	11	IT=100			
¹⁴² Nd	−85950.1	1.3			STABLE			0 ⁺	11	IS=27.153	40		
¹⁴² Nd ^m		non-exist		EU	16.5 μ s			6 ⁺	14 87Pr09	I 1964	IT=100	*	
¹⁴² Pm	−81142	24			40.5 s	0.5		1 ⁺	11 91Fi03	TD 1959	$\beta^+=100;e^+=77.1$	27; *	
										$\epsilon=22.9$	27		
¹⁴² Pm ^m	−80259	24	883.17	0.16	2.0 ms	0.2		(8) ⁻	11	IT=100			
¹⁴² Pm ⁿ	−78313	24	2828.7	0.6	67 μ s	5		(13 ⁻)	11	IT=100			
¹⁴² Sm	−78981.9	1.9			72.49 m	0.05		0 ⁺	11 91Fi03	TD 1959	$\beta^+=100;e^+<5$		
¹⁴² Sm ^m	−76609.8	1.9	2372.1	0.4	170 ns	2		7 ⁻	11	IT=100			
¹⁴² Sm ⁿ	−75319.7	2.0	3662.2	0.7	480 ns	60		10 ⁺	11	IT=100			

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{142}Eu	-71310	30	2.36 s 0.10	1^+	11	91Fi03	TD 1966	$\beta^+=100; e^+=89.9$ 16; $\varepsilon=10.1$ 16	*
$^{142}\text{Eu}^m$	-70856	12	450 30 BD	8^-	11		1966	$\beta^+=100$	
^{142}Gd	-66960	28	70.2 s 0.6	0^+	11		1986	$\beta^+=100; \varepsilon=52.5; e^+=48.5$	
^{142}Tb	-56560	700	597 ms 17	1^+	11	91Fi03	TD 1991	$\beta^+=100; e^+=96.8$ 4; $\varepsilon=3.2$ 4; $\beta^+p=0.0022$ 11	
$^{142}\text{Tb}^m$	-56280	700	279.7 0.4	5^-	11		1986	IT=100	
$^{142}\text{Tb}^n$	-55910	700	652.1 0.6	8^+	11		1989	IT=100	
^{142}Dy	-50120#	730#	2.3 s 0.3	0^+	11	91Fi03	TD 1986	$\beta^+=100; e^+=90.4; \varepsilon=10.4$; $\beta^+p=0.06$ 3	
^{142}Ho	-37250#	400#	400 ms 100	$(7^-, 8^+)$	11		2001	$\beta^+\approx 100; \beta^+p=?; p\approx 0$	*
^{142}Er	-27930#	500#	10# μs	0^+				p ?	
* ^{142}Sb	T : symmetrized from 20Wu04=53(+69-31)								**
* ^{142}I	T : other 06KeZZ=222(12)								**
* ^{142}Xe	D : $\% \beta^-n$ average 03Be05=0.21(0.06) 75As04=0.406(0.034) 69Ta04=0.45(0.08)								**
* ^{142}Cs	T : average 03Be05=1.65(0.04) 93Ru01=1.684(0.014) 81En05=1.75(0.06)								**
* ^{142}Cs	T : 77Re05=1.70(0.02) 69Ca03=1.68(0.02)								**
* ^{142}Cs	D : $\% \beta^-n$ average 93Ru01=0.0896(0.0036) 81En05=0.082(0.008)								**
* ^{142}Cs	D : 80ReZQ=0.090(0.005)								**
* ^{142}La	T : other (recent) 19Kr10=91.8(1.2)								**
* ^{142}Ce	T : lower limit is for α decay; $2\nu\text{-}\beta\beta$ 11Be02>300Py 01Da22>260 Py								**
* $^{142}\text{Nd}^m$	I : originally reported in 64Kr02, but not confirmed in the pulsed-beam								**
* $^{142}\text{Nd}^m$	I : data of 87Pr09								**
* ^{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) 39.6(1.4) for q=59+ (He-like ion)								**
* ^{142}Pm	T : 19Oz03=55(3) for q=60+ (H-like ion)								**
* ^{142}Pm	D : $\% e^+=71.0$ (1.3); $\% \varepsilon=29.0$ (1.3) for q=60+ (H-like ion) and								**
* ^{142}Pm	D : $\% e^+=79.8$ (1.0); $\% \varepsilon=20.2$ (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 : $\% p$ 93Li40=0								**
^{143}Te	-40530#	500#	120 ms 8	$7/2^+\#$	12	20Wu04	TD 2010	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	
^{143}I	-50790#	200#	182 ms 8	$7/2^+\#$	12	20Wu04	TD 1994	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	*
^{143}Xe	-60203	5	511 ms 6	$5/2^-*$	12	03Be05	D 1951	$\beta^-=100; \beta^-n=1.00$ 15	
^{143}Cs	-67676	8	1.802 s 0.008	$3/2^+*$	12	93Ru01	TD 1962	$\beta^-=100; \beta^-n=1.62$ 6	*
^{143}Ba	-73937	7	14.5 s 0.3	$5/2^-*$	12		1962	$\beta^-=100$	
^{143}La	-78171	7	14.2 m 0.1	$(7/2^+)^+$	12		1951	$\beta^-=100$	
^{143}Ce	-81606.4	2.4	33.039 h 0.006	$3/2^-*$	12		1948	$\beta^-=100$	
^{143}Pr	-83068.2	1.8	13.57 d 0.02	$7/2^+*$	12		1948	$\beta^-=100$	
^{143}Nd	-84002.3	1.3	STABLE >3.1Ey	$7/2^-*$	12	17Wi01	T 1933	IS=12.173 26	
^{143}Pm	-82960.7	2.9	265 d 7	$5/2^+$	12		1952	$\varepsilon=100; e^+<5.7e-6$	
^{143}Sm	-79517.1	2.7	8.75 m 0.06	$3/2^+*$	12		1956	$\beta^+=100; e^+=40.0$ 20; $\varepsilon=60.0$ 20	*
$^{143}\text{Sm}^m$	-78763.1	2.7	753.99 0.16	$11/2^-$	12		1960	IT $\approx$ 100; $\beta^+=0.24$ 5	
$^{143}\text{Sm}^n$	-76723.3	3.0	2793.8 1.3	$23/2^-$	12	FGK128	J 1969	IT=100	*
^{143}Eu	-74241	11	2.59 m 0.02	$5/2^+*$	12		1965	$\beta^+=100$	
$^{143}\text{Eu}^m$	-73851	11	50.0 μs 0.5	$11/2^-$	12		1978	IT=100	
^{143}Gd	-68230	200	39 s 2	$1/2^+$	12	78Fi02	D 1975	$\beta^+=100; \beta^+p=?; \beta^+\alpha=?$	*
$^{143}\text{Gd}^m$	-68080	200	152.6 0.5	$11/2^-$	12	78Fi02	D 1973	$\beta^+=100; \beta^+p=?; \beta^+\alpha=?$	*
^{143}Tb	-60420	50	12 s 1	$(11/2^-)$	12		1985	$\beta^+=100$	
$^{143}\text{Tb}^m$	-60420#	110#	0# 100#	$5/2^+\#$	12	86Re11	T 1986	$\beta^+ ?$	
^{143}Dy	-52169	13	5.6 s 1.0	$(1/2^+)$	12	03Xu04	J 1983	$\beta^+=100; \beta^+p=?$	*
$^{143}\text{Dy}^m$	-51858	13	310.7 0.6	$(11/2^-)$	12	03Xu04	EJD 2003	$\beta^+=100; \beta^+p=?$	
$^{143}\text{Dy}^n$	-51763	13	406.3 0.8	$(7/2^-)$	12	05Ri17	DEJ 2005	IT=100	*
^{143}Ho	-42050#	300#	300# ms >200ns	$11/2^- \#$	12	00So11	I 2000	$\beta^+ ?; \beta^+p ?$	
^{143}Er	-31160#	400#	200# ms	$9/2^- \#$	12		2005	$\beta^+ ?; \beta^+p ?$	
* ^{143}I	T : other 06KeZZ=130(45)								**
* ^{143}Cs	T : average 03Be05=1.77(0.03) 93Ru01=1.809(0.009) 81En05=1.83(0.04)								**
* ^{143}Cs	T : 79Ri09=1.765(0.030) 77Re05=1.79(0.02)								**
* ^{143}Sm	D : $\% e^+$ from 72Ev01								**
* $^{143}\text{Sm}^n$	J : E3 to 17/2+								**
* ^{143}Gd	D : $\% \beta^+p$ and $\% \beta^+\alpha$ from 78Fi02 for $^{143}\text{Gd}, ^{143}\text{Gd}^m=0.001$;								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁴³ Gd	D : 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) keV above ¹⁴³ Dy ^m								**
* ¹⁴³ Dy ⁿ	J : from depopulating 95.6-keV gamma being most likely E2 in 05Ri17								**
¹⁴⁴ Te	-36220# 300#		93 ms 60	0 ⁺	18	20Wu04 TD	2015	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
¹⁴⁴ I	-45330# 400#		94 ms 8	1 ⁻ #	01	20Wu04 TD	1994	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
¹⁴⁴ Xe	-56872 5		388 ms 7	0 ⁺	01	03Be05 TD	2003	$\beta^- = 100; \beta^- n = 3.0 3$	
¹⁴⁴ Cs	-63271 20		994 ms 6	1 ⁻ *	10	20Cz01 D	1967	$\beta^- = 100; \beta^- n = 2.98 6$	*
¹⁴⁴ Cs ^m	-63179 20	92.2 0.5	1.1 μ s 0.1	(4 ⁻)	10		2009	IT=100	
¹⁴⁴ Cs ⁿ		<i>non-exist</i>	< 1 s	(> 3 ⁻)	10	78MoZQ IJT	1978	$\beta^- = ?; IT ?; \beta^- n ?$	*
¹⁴⁴ Ba	-71767 7		11.73 s 0.08	0 ⁺	01	19KoZX T	1967	$\beta^- = 100$	*
¹⁴⁴ La	-74850 13		44.0 s 0.7	(3 ⁻)	01	FGK205 T	1967	$\beta^- = 100$	*
¹⁴⁴ Ce	-80431.9 2.8		284.886 d 0.025	0 ⁺	01	FGK209 T	1945	$\beta^- = 100$	
¹⁴⁴ Pr	-80750.6 2.7		17.28 m 0.05	0 ⁻	01		1951	$\beta^- = 100$	
¹⁴⁴ Pr ^m	-80691.6 2.7	59.03 0.03	7.2 m 0.3	3 ⁻	01		1970	IT $\approx$ 100; $\beta^- \approx$ 0.07	
¹⁴⁴ Nd	-83748.0 1.3		2.29 Py 0.16	0 ⁺	01		1924	IS=23.798 19; α =100	
¹⁴⁴ Pm	-81416.1 2.9		363 d 14	5 ⁻	01	94Hi05 D	1952	$\epsilon = 100; e^+ < 8e-5$	
¹⁴⁴ Pm ^m	-80575.2 2.9	840.90 0.05	780 ns 200	(9 ⁺)	01		1993	IT=100	
¹⁴⁴ Pm ⁿ	-72820 4	8595.8 2.2	$\sim 2.7 \mu$ s	(27 ⁺)	01		1994	IT=100	
¹⁴⁴ Sm	-81965.6 1.5		STABLE	0 ⁺	01		1933	IS=3.08 4; $2\beta^+ ?$	*
¹⁴⁴ Sm ^m	-79642.0 1.5	2323.60 0.08	880 ns 25	6 ⁺	01		1972		
¹⁴⁴ Eu	-75619 11		10.2 s 0.1	1 ⁺	01		1965	$\beta^+ = 100$	
¹⁴⁴ Eu ^m	-74491 11	1127.6 0.6	1.0 μ s 0.1	8 ⁻	01	FGK127 J	1976	IT=100	*
¹⁴⁴ Gd	-71760 28		4.47 m 0.06	0 ⁺	01		1968	$\beta^+ = 100$	
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	$\beta^+ = 100$	
¹⁴⁴ Tb ^m	-61971 28	396.9 0.5	4.25 s 0.15	6 ⁻	01		1982	IT=66; $\beta^+ = 34$	*
¹⁴⁴ Tb ⁿ	-61892 28	476.2 0.5	2.8 μ s 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	$\beta^+ = 100; \beta^+ p = ?$	
¹⁴⁴ Ho	-44610 8		700 ms 100	(5 ⁻)	08		1986	$\beta^+ = 100; \beta^+ p = ?$	
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 >200ns	0 ⁺	06		2003	$\beta^+ ?$	
¹⁴⁴ Tm	-22160# 400#		2.3 μ s 0.9	(10 ⁺)	08		2005	$p = ?; \beta^+ ?$	*
* ¹⁴⁴ Cs	D : % β^- n average 20Cz01=2.95(0.24) 93Ru01=3.17(0.13) 79Ri09=2.95(0.25)								**
* ¹⁴⁴ Cs	D : 80ReZQ=3.12(0.11), 2.67(0.12)								**
* ¹⁴⁴ Cs	T : other (recent) 17Wu04=932(76)								**
* ¹⁴⁴ Cs ⁿ	I : introduced in 78MoZQ, but no β^- decaying isomer was observed in later								**
* ¹⁴⁴ Cs ^m	I : studies; most likely this is ¹⁴⁴ Cs ^m								**
* ¹⁴⁴ Ba	T : average 19KoZX=11.6(0.1) 82Ch22=11.5(0.2) 79En02=12.0(0.4)								**
* ¹⁴⁴ Ba	T : 76AmZW=11.9(0.6) 78Wo09=12.3(0.4) 74Gr29=11.1(0.5)								**
* ¹⁴⁴ Ba	T : 69WiZX=12.3(0.2) 69Ru14=11.9(0.3)								**
* ¹⁴⁴ La	T : other Ensdf2001=40.8(0.4) is likely affected by ¹⁴⁴ Ba impurities								**
* ¹⁴⁴ Sm	T : 0nu-BB 18No01>1 Py								**
* ¹⁴⁴ Eu ^m	J : E2 to 6-								**
* ¹⁴⁴ Tb ^m	T : other 03Li42=12(2) s for q=65+ (bare ion)								**
* ¹⁴⁴ Tb ^m	J : E3 to 3+								**
* ¹⁴⁴ Tm	T : symmetrized from 05Gr32,05Bi24=1.9(+1.2-0.5) us								**
¹⁴⁵ Te	-30010# 300#		75# ms >550ns	0 ⁺	18	18Sh11 I	2018	$\beta^- ?; \beta^- n ?; \beta^- 2n ?$	
¹⁴⁵ I	-41130# 500#		89.7 ms 9.3	7/2 ⁺ #	10	20Wu04 TD	2010	$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	
¹⁴⁵ Xe	-51493 11		188 ms 4	3/2 ⁻ #	09		2003	$\beta^- = 100; \beta^- n = 5.0 6; \beta^- 2n ?$	
¹⁴⁵ Cs	-60054 9		582 ms 4	3/2 ⁺ *	09	20Cz01 D	1971	$\beta^- = 100; \beta^- n = 12.8 3$	*
¹⁴⁵ Cs ^m	-59291 9	762.9 0.4	500 ns 100	13/2#	15	YaZW TD	2015	IT=100	*
¹⁴⁵ Ba	-67516 8		4.31 s 0.16	5/2 ⁻ *	09		1974	$\beta^- = 100$	
¹⁴⁵ La	-72835 12		24.8 s 2.0	(5/2 ⁺)	09		1974	$\beta^- = 100$	
¹⁴⁵ Ce	-77070 30		3.01 m 0.06	5/2 ⁻ #	09		1954	$\beta^- = 100$	
¹⁴⁵ Pr	-79626 7		5.984 h 0.010	7/2 ⁺	09		1954	$\beta^- = 100$	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{145}Nd	-81432.0	1.3			STABLE	>60Py		09 65Is01	T 1933	IS=8.293 12; α ?
^{145}Pm	-81267.5	2.8			17.7 y	0.4		09	1951	ε =100; α =2.8e-7
^{145}Sm	-80651.4	1.5			340 d	3		09	1947	ε =100
$^{145}\text{Sm}^m$	-71836.4	1.8	8815	1	3.52 μ s	0.16		09 20Ge08	EJT 1993	IT=100
^{145}Eu	-77992	3			5.93 d	0.04		09	1951	β^+ =100
$^{145}\text{Eu}^m$	-77276	3	716.0	0.3	490 ns	30		09	1975	IT=100
^{145}Gd	-72927	20			23.0 m	0.4		09	1959	β^+ =100
$^{145}\text{Gd}^m$	-72178	20	749.1	0.2	85 s	3		09	1969	IT=94.3 5; β^+ =5.7 5
^{145}Tb	-66400	110			30.9 s	0.6	*&	09	1981	β^+ =100
$^{145}\text{Tb}^m$	-65540	200	860	230	BD*&			09	1993	β^+ ?
^{145}Dy	-58243	7			9.5 s	1.0		09 93Al03	T 1982	β^+ =100; β^+ p=?
$^{145}\text{Dy}^m$	-58125	7	118.2	0.2	14.1 s	0.7		09	1982	β^+ =100; β^+ p $\approx$ 50
^{145}Ho	-49120	7			2.4 s	0.1	*	09	1987	β^+ =100
$^{145}\text{Ho}^m$	-49020#	100#	100#	100#	100# ms		*			β^+ ?;IT ?
^{145}Er	-39240#	200#			900 ms	200		09 10Ma20	T 1989	β^+ =100; β^+ p=?
$^{145}\text{Er}^m$	-39040#	200#	205	4	1.0 s	0.3	p	10Ma20	T 2010	β^+ =100;IT ?; β^+ p=?
^{145}Tm	-27580#	200#			3.17 μ s	0.20		09	1998	p=100
* ^{145}Cs	T : average 20Wu04=612(20) 17Wu04t=613(+32-24) 03Be05=558(9) 93Ru01=579(6)									
* ^{145}Cs	T : 82Ra13=594(13) 81En05=610(30) 79Ri09=616(20) 79En02=605(30)									
* ^{145}Cs	T : 78Wo09=590(20) 77Re05=580(14) 74Ro15=611(21) 71Tr02=563(27)									
* ^{145}Cs	D : % β^- -n average 20Cz01=13.53(0.90) 93Ru01=14.4(0.6) 80ReZQ=13.3(1.4)									
* ^{145}Cs	D : 79Ri09=12.2(0.9) 78Cr03=12.5(3.0) 74Ro15=12.1(0.4)									
* $^{145}\text{Cs}^m$	E : 16Ya.A=762.9(0.4) keV									
* $^{145}\text{Sm}^m$	T : other 93Fe14=0.96(+0.19-0.15)									
* ^{145}Dy	T : average 93Al03=10.5(1.5) 93To04=6(2) 84Sc.C=10(1)									
* ^{145}Er	T : 10Ma20=900(200) 89Vi02=900(300) for a mixture between gs and the isomer									
^{146}I	-35540#	300#			94 ms	26		20Wu04	TD 2018	β^- =100; β^- -n ?; β^- 2n ?
^{146}Xe	-47955	24			146 ms	6		16 20Wu04	TD 1989	β^- =100; β^- -n=6.9 15
^{146}Cs	-55310.4	2.9			321.6 ms	0.9		16 93Ru01	TD 1971	β^- =100; β^- -n=14.2 4; β^- 2n ?
$^{146}\text{Cs}^m$	-55263.7	2.9	46.7	0.1	1.25 μ s	0.05		16 15YaZW	TD 2015	IT=100
^{146}Ba	-64866.3	1.8			2.15 s	0.04		16 19KoZX	T 1970	β^- =100
^{146}La	-69221.2	1.7			9.9 s	0.1	*&	16	1970	β^- =100
$^{146}\text{La}^m$	-69079.7	1.7	141.5	2.4	6.08 s	0.22	MD*&	16 20Or02	E 1969	β^- =100
^{146}Ce	-75626	15			13.49 m	0.16		16	1953	β^- =100
^{146}Pr	-76670	30			24.09 m	0.10		16	1953	β^- =100
^{146}Nd	-80925.9	1.3			STABLE	>1.6Ey		16 15St09	T 1924	IS=17.189 32;2 β^- ?; α ?
^{146}Pm	-79454	4			5.53 y	0.05		16	1960	ε =66.0 13; β^- =34.0 13
^{146}Sm	-80996	3			68 My	7		16	1953	α =100
^{146}Eu	-77118	6			4.61 d	0.03		16	1957	β^+ =100
$^{146}\text{Eu}^m$	-76452	6	666.33	0.11	235 μ s	3		16	1962	IT=100
^{146}Gd	-76086	4			48.27 d	0.09		16	1957	ε =100
^{146}Tb	-67760	40			8 s	4	*	16	1974	β^+ =100
$^{146}\text{Tb}^m$	-67610#	110#	150#	100#	24.1 s	0.5	*	16 93Al03	T 1974	β^+ =100
$^{146}\text{Tb}^n$	-66830#	110#	930#	100#	1.18 ms	0.02		16	1989	IT=100
^{146}Dy	-62555	7			33.2 s	0.7		16 93Al03	T 1981	β^+ =100
$^{146}\text{Dy}^m$	-59621	7	2934.5	0.4	150 ms	20		16	1982	IT=100
^{146}Ho	-51238	7			3.32 s	0.22		16	1982	β^+ =100; β^+ p=?
^{146}Er	-44322	7			1.7 s	0.6		16	1993	β^+ =100; β^+ p=?
^{146}Tm	-31060#	200#			155 ms	20		05Ro40	TJD 1993	p $\approx$ 100; β^+ ?; β^+ p ?
$^{146}\text{Tm}^m$	-30750#	200#	304	6	73 ms	7	p	16 06Ta08	TJ 1993	p=100; β^+ ?; β^+ p ?
$^{146}\text{Tm}^n$	-30620#	200#	437	7	200 ms	3	p	16 06Ta08	TJ 1993	p=?; β^+ ?; β^+ p ?
* ^{146}Xe	T : average 20Wu04=147(13) 03Be05=146(6)									
* ^{146}Cs	T : average 20Wu04=318(16) 17Wu04=288(13) 03Be05=300(20) 93Ru01=321(2)									
* ^{146}Cs	T : 83Re10=322(1) 79Ri09=325(10)									
* ^{146}Cs	D : % β^- -n average 93Ru01=15.1(0.6) 81En05=13.1(1.3) 79Ri09=13.2(0.8)									
* ^{146}Cs	D : 74Ro15=14.2(1.7)									
* $^{146}\text{Cs}^m$	E : from 16Ya.A=46.7(0.1)									
* ^{146}Ba	D : % β^- -n 93Ru01<0.02% not relevant, since Q(β^- -n) is negative									
* ^{146}Ba	T : average 19KoZX=2.06(0.07) 85Ch16=2.22(0.07) 78Wo09=2.18(0.11)									
* ^{146}Ba	T : 76AmZW=2.14(0.37) 79En02=2.2(0.3). other: 17Wu04=2.56(0.29)									
* ^{146}La	D : % β^- -n 93Ru01<0.007% not relevant, since Q(β^- -n) is negative									

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁴⁶ La	T : average FGK205=9.9(0.1) 78MoYW=10.0(0.4) 74Ar17=11(1) 79En02=9.0(0.6)								**
* ¹⁴⁶ La	J : region of deformation p5/2[413] n5/2[523], K=5-;								**
* ¹⁴⁶ La	J : Ensdf2016=(6-) based on shell model								**
* ¹⁴⁶ La ^m	T : average FGK205=6.1(0.3) 78MoYW=6.2(0.6) 81GoZN=6.0(0.4)								**
* ¹⁴⁶ La ^m	J : region of deformation p5/2[413] n1/2[530] or n5/2[523], K=1- or 2-;								**
* ¹⁴⁶ La ^m	J : Ensdf2016=(2-) based on shell model								**
* ¹⁴⁶ Nd	T : partial α half-life 15St09>1.6 Ey; other 0nu-BB 18No01>45 Ey								**
* ¹⁴⁶ Sm	T : from 12Ki16t=68(7); others 87Me08=103.1(4.5) 66Fr11=102.6(4.8)								**
* ¹⁴⁶ Tb ⁿ	E : 779.57 keV above ¹⁴⁶ Tb ^m from Ensdf2016								**
* ¹⁴⁶ Tm	T : other 05Bb02=190(80) ms								**
* ¹⁴⁶ Tm ^m	T : average 06Ta08=68(3), supersedes 05Bb02=75(3), 05Ro40=82(4);								**
* ¹⁴⁶ Tm ^m	T : Birge ratio=2.8								**
* ¹⁴⁶ Tm ⁿ	T : average 07DaZU=213(9) 06Ta08=198(3)								**
¹⁴⁷ I	-31200#	300#	60# ms >550ns	3/2 ⁻ #	18Sh11	I	2018	β^- ?; β^-n ?; β^-2n ?	
¹⁴⁷ Xe	-42400#	200#	88 ms 14	3/2 ⁻ #	09 20Wu04	T	1994	β^- =100; β^-n <8; β^-2n ?	*
¹⁴⁷ Cs	-51920	8	230.5 ms 0.9	(3/2 ⁺)	09 93Ru01	TD	1978	β^- =100; β^-n =28.5 15	*
¹⁴⁷ Cs ^m	-51219	8	190 ns 20	13/2#	15YaZW	TD	2015	IT=100	*
¹⁴⁷ Ba	-60264	20	893 ms 1	5/2 ⁻	09 13Rz01	J	1978	β^- =100; β^-n =0.07 5	*
¹⁴⁷ La	-66678	11	4.026 s 0.020	(5/2 ⁺)	09 96Ur02	J	1979	β^- =100; β^-n =0.041 3	*
¹⁴⁷ Ce	-72014	9	56.4 s 1.0	(5/2 ⁻)	09		1964	β^- =100	
¹⁴⁷ Pr	-75444	16	13.39 m 0.04	3/2 ⁺	09 15Ru09	T	1964	β^- =100	*
¹⁴⁷ Nd	-78146.8	1.3	10.98 d 0.01	5/2 ⁻ *	09		1947	β^- =100	
¹⁴⁷ Pm	-79042.0	1.3	2.6234 y 0.0002	7/2 ⁺ *	09		1947	β^- =100	
¹⁴⁷ Sm	-79266.0	1.3	106.6 Gy 0.5	7/2 ⁻ *	09 FGK204	T	1933	IS=15.00 14; α =100	
¹⁴⁷ Eu	-77544.6	2.6	24.1 d 0.6	5/2 ⁺ *	09		1951	β^+ $\approx$ 100; α =0.0022 6	
¹⁴⁷ Eu ^m	-76919.3	2.6	765 ns 15	11/2 ⁻	09		1970	IT=100	
¹⁴⁷ Gd	-75356.9	1.9	38.06 h 0.12	7/2 ⁻ *	09		1957	β^+ =100	
¹⁴⁷ Gd ^m	-66769.1	2.0	510 ns 20	49/2 ⁺	09 20Br06	J	1982	IT=100	
¹⁴⁷ Tb	-70743	8	1.64 h 0.03	(1/2 ⁺)	09		1969	β^+ =100	
¹⁴⁷ Tb ^m	-70692	8	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 $\approx$ 0.05	
¹⁴⁷ Dy ^m	-63446	9	55.2 s 0.5	(11/2 ⁻)	09		1976	β^+ =68.9 23; IT=31.1 23	
¹⁴⁷ Dy ⁿ	-60789	9	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	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#	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	360 μ s 40	3/2 ⁺	09		1984	p =100	
* ¹⁴⁷ Xe	T : other 03Be05=100(+100-50)								**
* ¹⁴⁷ Cs	T : average 20Wu04=255(5) 17Wu04=234(14) 93Ru01=235(3) 86ReZU=229(1)								**
* ¹⁴⁷ Cs	T : 79Ri09=214(30) 78Ko29=235(10)								**
* ¹⁴⁷ Cs	D : % β^-n average 93Ru01=30.7(2.0) 86ReZU=26.4(2.9) 79Ri09=25.4(3.2)								**
* ¹⁴⁷ Cs ^m	E : from 16Ya.A=701.4(0.4)								**
* ¹⁴⁷ Ba	T : average 17Wu04=921(47) 93Ru01=894(10) 86Wa17=893(1), supersedes 86ReZU								**
* ¹⁴⁷ Ba	D : % β^-n unweighted average 93Ru01=0.110(0.016) 86Wa17=0.019(1);								**
* ¹⁴⁷ Ba	D : Birge ratio=5.68; other 81En05=5.21(52), outlier								**
* ¹⁴⁷ La	T : average 93Ru01=4.100(0.021) 86Wa17=4.015(0.008) 81En05=4.10(0.25);								**
* ¹⁴⁷ La	T : Birge ratio=2.68								**
* ¹⁴⁷ La	D : % β^-n average 93Ru01=0.043(0.004) 86Wa17=0.035(0.006)								**
* ¹⁴⁷ Pr	J : from 15Wa28								**
* ¹⁴⁷ Tb ^m	T : average 93Al03=1.92(0.07) 73Bo13=1.83(0.06)								**
¹⁴⁸ Xe	-38650#	300#	85 ms 15	0 ⁺	14 20Wu04	TD	2010	β^- =100; β^-n ?; β^-2n ?	
¹⁴⁸ Cs	-46911	13	151.8 ms 1.0	(2 ⁻)	14 20Wu04	T	1978	β^- =100; β^-n =28.7 21; β^-2n ?	*
¹⁴⁸ Cs ^m	-46866	13	4.8 μ s 0.2	4 ⁻ #	15YaZW	TD	2015	IT=100	*
¹⁴⁸ Ba	-57544.9	1.5	620 ms 5	0 ⁺	14 17Wu04	T	1979	β^- =100; β^-n =0.4 3	*
¹⁴⁸ La	-62709	19	1.414 s 0.025	(2 ⁻)	14 17Wu04	T	1969	β^- =100; β^-n =0.18 7	*
¹⁴⁸ Ce	-70398	11	56.8 s 0.3	0 ⁺	14		1964	β^- =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{148}Pr	-72535	15	2.29 m 0.02	1^-	14		1964	β^- =100	
$^{148}\text{Pr}^m$	-72458	15	2.01 m 0.07	(4)	14		1964	β^- =64 10;IT=36 10	
^{148}Nd	-77408.1	2.1	STABLE >3.0Ey	0^+	14	82Be20	T 1937	IS=5.756 21; $2\beta^-$?; α ?	*
^{148}Pm	-76866	6	5.368 d 0.007	1^-*	14		1947	β^- =100	
$^{148}\text{Pm}^m$	-76728	6	41.29 d 0.11	$5^-,6^-$	14		1951	β^- =95.8 6;IT=4.2 6	
^{148}Sm	-79336.1	1.2	6.3 Py 1.3	0^+	14	16Ca43	T 1933	IS=11.25 9; α =100	*
^{148}Eu	-76297	10	54.5 d 0.5	5^-*	14		1951	β^+ =100; α =9.4e-7 28	
$^{148}\text{Eu}^m$	-75577	10	162 ns 8	9^+	14		1980	IT=100	
^{148}Gd	-76269.4	1.5	71.3 y 1.0	0^+	14	03Fu10	T 1953	α =100; $2\beta^+$?	*
^{148}Tb	-70537	12	60 m 1	2^-	14		1960	β^+ =100	
$^{148}\text{Tb}^m$	-70447	12	2.20 m 0.05	(9) $^+$	14		1973	β^+ =100	
$^{148}\text{Tb}^n$	-61918	12	1.310 μ s 0.007	(27) $^+$	14		1980	IT=100	
^{148}Dy	-67859	9	3.3 m 0.2	0^+	14		1974	β^+ =100	
$^{148}\text{Dy}^m$	-64940	9	471 ns 20	10^+	14		1978	IT=100	
^{148}Ho	-57990	80	2.2 s 1.1	(1) $^+$	14		1979	β^+ =100	
$^{148}\text{Ho}^m$	-57740#	130#	9.49 s 0.12	(5) $^-$	14	93Al03	T 1979	β^+ =100; β^+ p=0.08 1	*
$^{148}\text{Ho}^n$	-57050#	130#	2.36 ms 0.06	(10) $^+$	14		1984	IT=100[gs=0,m=100]	*
^{148}Er	-51479	10	4.6 s 0.2	0^+	14		1982	β^+ =100; β^+ p $\approx$ 0.15	
$^{148}\text{Er}^m$	-48566	10	13 μ s 3	(10) $^+$	14		1982	IT=100	
^{148}Tm	-38765	10	700 ms 200	(10) $^+$	14		1982	β^+ =100; β^+ p ?	
^{148}Yb	-30230#	400#	250# ms	0^+				β^+ ?; β^+ p ?	
* ^{148}Cs	T : average 20Wu04=144(9) 18Li06=158(6) 17Li06=152(1) 17Wu04=144(5)								**
* ^{148}Cs	T : 93Ru01=140(12) 86Hi08=158(7); others 86Wa17=130(10) 78Ko29=130(40)								**
* ^{148}Cs	J : direct β^- decay feeding to 1- and 3- levels in ^{148}Ba in 18Li06								**
* ^{148}Cs	D : % β^- -n average 86RuZU=25.1(2.5) 93Ru01=24(17) 18Li06=38(4)								**
* $^{148}\text{Cs}^m$	E : from 16Ya.A=45.2(0.1)								**
* ^{148}Ba	T : average 17Wu04=621(11) 86Wa17=620(5) 84Ch02=607(25) 82Ga24=630(50)								**
* ^{148}La	T : average 17Wu04=1.27(+0.10-0.09) 93Ru01=1.428(0.012) 86Wa17=1.40(0.02)								**
* ^{148}La	T : 83Mu19=1.34(0.02) 82Ga24=1.55(0.03) 69Wi.A=1.29(0.08);								**
* ^{148}La	T : Birge ratio=2.83								**
* ^{148}La	D : % β^- -n unweighted average 93Ru01=0.24(0.02) 86Wa17=0.11(0.01);								**
* ^{148}La	D : Birge ratio=5.81								**
* ^{148}Nd	T : lower limit is for $2\beta^-$ decay								**
* ^{148}Sm	T : symmetrized from 16Ca43=6.4(+1.2-1.3)								**
* ^{148}Gd	T : average 03Fu10=70.9(1.0) 81Pr06=74.6(3.0)								**
* $^{148}\text{Ho}^m$	T : average 93Al03=9.30(0.20) 89Ta11=9.59(0.15)								**
* $^{148}\text{Ho}^n$	E : 694.4 keV above $^{148}\text{Ho}^m$ from Ensdf2014								**
^{149}Xe	-33000#	300#	50# ms >550ns	$3/2^-$ #	18Sh11	I	2018	β^- ?; β^- -n ?; β^- 2n ?	
^{149}Cs	-43300#	400#	112.3 ms 2.5	$3/2^+$ #	17	17Li06	TD 1979	β^- =100; β^- -n=25 4; β^- 2n ?	*
^{149}Ba	-52830.6	2.5	349 ms 4	$3/2^-$ #	04	20Wu04	T 1993	β^- =100; β^- -n=3.9 12	*
^{149}La	-60220	200	1.071 s 0.022	(3/2) $^-$	07	17Wu04	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	-76064.4	2.2	53.08 h 0.05	$7/2^+*$	04		1947	β^- =100	
$^{149}\text{Pm}^m$	-75824.2	2.2	35 μ s 3	$11/2^-$	04		1966	IT=100	
^{149}Sm	-77135.9	1.2	STABLE >2Py	$7/2^-*$	04		1933	IS=13.82 10; α ?	
^{149}Eu	-76441	4	93.1 d 0.4	$5/2^+*$	04		1959	ε =100	
$^{149}\text{Eu}^m$	-75945	4	2.45 μ s 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	
$^{149}\text{Tb}^m$	-71453	4	4.16 m 0.04	$11/2^-$	04		1962	β^+ $\approx$ 100; α =0.022 3	
^{149}Dy	-67694	9	4.20 m 0.14	$7/2^-$	04		1958	β^+ =100	
$^{149}\text{Dy}^m$	-65033	9	490 ms 15	$27/2^-$	04	80Da18	J 1976	IT=99.3 3; β^+ =0.7 3	*
^{149}Ho	-61646	12	21.1 s 0.2	(11/2) $^-$	04		1979	β^+ =100	
$^{149}\text{Ho}^m$	-61597	12	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	
$^{149}\text{Er}^m$	-53000	28	8.9 s 0.2	(11/2) $^-$	04		1984	β^+ =96.5 7;IT=3.5 7; β^+ p=0.18 7	
$^{149}\text{Er}^n$	-51131	28	610 ns 80	(19/2) $^+$	04		1987	IT=100	
$^{149}\text{Er}^p$	-50440	30	4.8 μ s 0.1	(27/2) $^-$	04	87Br14	EJD 1987	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{149}Tm	-43940#	200#	900 ms 200	$11/2^-$	04		1987	$\beta^+=100; \beta^+p=0.26$	15 *
$^{149}\text{Tm}^m$	-43840#	210#	500# ms	$1/2^+ \#$				$\beta^+ ?; \beta^+p ?$	*
^{149}Yb	-33330#	300#	700 ms 200	$(1/2^+)$	04	05Xu04 J	2001	$\beta^+=100; \beta^+p \approx 100$	*
^{149}Cs	T : average 20Wu04=113(6) 17Wu04=113(8) 00KoZH=112(3), 114(16); other								**
^{149}Cs	T : 18Li06=80(3) 17Li06=80(4), outliers								**
^{149}Ba	T : average 20Wu04=368(19) 17Wu04=352(6) 93Ru01=324(18) 86Wa17=346(6)								**
^{149}Ba	D : $\% \beta^-n$ from 93Ru01; other 86Wa17=0.43(12), discrepant								**
^{149}La	T : average 17Wu04=1.11(0.04) 93Ru01=1.066(0.034) 86Wa17=1.04(0.04)								**
^{149}La	D : $\% \beta^-n$ average 93Ru01=1.74(0.13) 86Wa17=1.17(12), Birge ratio=3.22								**
$^{149}\text{Dy}^m$	T : other 03Li42=11(1) s for q=66+ (bare ion)								**
$^{149}\text{Er}^p$	E : 661+x keV above $^{149}\text{Er}^n$ and x<60 keV in 87Br14								**
^{149}Tm	D : symmetrized from $\beta^+p=0.2(+0.2-0.1)\%$								**
^{149}Tm	J : favorite α decay from ^{153}Lu (J=11/2-)								**
$^{149}\text{Tm}^m$	I : probably fed by α -decaying isomer in ^{153}Lu								**
^{149}Yb	J : (1/2+, 3/2+) in Ensdf2004 and 1/2 in 05Xu04; 06Xu07=(1/2-), however,								**
^{149}Yb	J : no 1/2- gs or isomer for N=79 isotones								**
^{150}Xe	-28990#	300#	40# ms >550ns	0^+	18Sh11	I	2018	$\beta^- ?; \beta^-n ?; \beta^-2n ?$	
^{150}Cs	-38170#	400#	81.0 ms 2.6	(2^-)	17	18Li06 TD	1979	$\beta^-=100; \beta^-n \approx 44; \beta^-2n ?$	*
^{150}Ba	-49890	6	258 ms 5	0^+	17	02Pf04 TD	1994	$\beta^-=100; \beta^-n=1.0$	5 *
^{150}La	-56311.1	2.5	504 ms 15	(3^+)	13	17Wu04 T	1993	$\beta^-=100; \beta^-n=2.7$	3 *
^{150}Ce	-64847	12	6.05 s 0.07	0^+	13	15Ko23 T	1970	$\beta^-=100$	
^{150}Pr	-68301	9	6.19 s 0.16	1^-	13	15Ko23 J	1970	$\beta^-=100$	
^{150}Nd	-73680.0	1.1	9.3 Ey 0.7	0^+	13	20Ba.A T	1937	IS=5.638 28; $2\beta^-=100$	
^{150}Pm	-73597	20	2.698 h 0.015	(1^-)	13		1952	$\beta^-=100$	
^{150}Sm	-77051.3	1.1	STABLE	0^+	13		1934	IS=7.37 9	
^{150}Eu	-74792	6	36.9 y 0.9	5^-	13		1950	$\beta^+=100$	
$^{150}\text{Eu}^m$	-74750	6	12.8 h 0.1	0^-*	13		1953	$\beta^-=89$ 2; $\beta^+=11$ 2; IT ?	
^{150}Gd	-75764	6	1.79 My 0.08	0^+	13		1953	$\alpha=100; 2\beta^+ ?$	
^{150}Tb	-71106	7	3.48 h 0.16	(2^-)	13		1959	$\beta^+ \approx 100; \alpha ?$	
$^{150}\text{Tb}^m$	-70645	26	5.8 m 0.2	9^+	13		1993	$\beta^+ \approx 100; \text{IT} ?$	
^{150}Dy	-69310	4	7.17 m 0.05	0^+	13		1959	$\beta^+=66.4$ 18; $\alpha=33.6$ 18	*
^{150}Ho	-61946	14	76.8 s 1.8	(2^-)	13	93Al03 T	1963	$\beta^+=100$	*
$^{150}\text{Ho}^m$	-61950	50	23.3 s 0.3	$(9)^+$	13		1980	$\beta^+=100$	
$^{150}\text{Ho}^n$	-54050	50	787 ns 36	(28^-)	13	06Fu06 JTE	2006	IT=100	*
^{150}Er	-57831	17	18.5 s 0.7	0^+	13		1982	$\beta^+=100$	
$^{150}\text{Er}^m$	-55035	17	2.55 μ s 0.10	10^+	13		1984	IT=100	
^{150}Tm	-46490#	200#	3# s	(1^+)	88Ni02	JI	1982	$\beta^+=100$	
$^{150}\text{Tm}^m$	-46350#	240#	2.20 s 0.06	(6^-)	13		1981	$\beta^+=100; \beta^+p=1.1$	3 *
$^{150}\text{Tm}^n$	-45680#	240#	5.2 ms 0.3	$10^+ \#$	13		1984	IT=100[gs=0, m=100]	*
^{150}Yb	-38830#	300#	700# ms >200ns	0^+	13		2000	$\beta^+ ?$	
^{150}Lu	-24770#	300#	45 ms 3	(5^-)	13	03Gi10 J	1993	$p \approx 100; \beta^+ ?$	
$^{150}\text{Lu}^m$	-24750#	300#	40 μ s 7	(8^+)	13	03Gi10 J	1998	p=100	*
^{150}Cs	T : average 20Wu04=90(15) 18Li06=80(3) 17Wu04=84.4(8.2) 00KoZH=82(7)								**
^{150}Cs	D : $\% \beta^-n$ other 00KoZH=20(10)								**
^{150}Cs	J : direct β^- decay feeding to 1- and 3- levels in ^{150}Ba in 18Li06								**
^{150}Ba	T : average 20Wu04=245(16) 17Wu04=259(5); other 02Pf04 300, compilation								**
^{150}La	T : average 17Wu04=510(+10-22) 95Ok02=510(30)								**
^{150}Dy	D : $\% \alpha$ average 74To07=31(3), 36(3) 73Bi06=32(5) 77Ha48=36(5)								**
^{150}Ho	T : average 93Al03=78(2) 82No08=72(4)								**
$^{150}\text{Ho}^n$	E : 7912.1(2.3) keV above $^{150}\text{Ho}^m$ from Ensdf2013								**
$^{150}\text{Tm}^m$	D : $\% \beta^+p$ symmetrized from 88Ni02=1.2(+2-4)								**
$^{150}\text{Tm}^n$	E : 671.3(1.0) keV above $^{150}\text{Tm}^m$ from Ensdf2013								**
$^{150}\text{Lu}^m$	T : symmetrized from 03Gi10=39(+8-6)								**
^{151}Cs	-34280#	500#	59 ms 19	$3/2^+ \#$	17	20Wu04 TD	1979	$\beta^-=100; \beta^-n ?; \beta^-2n ?$	*
^{151}Ba	-44940#	400#	167 ms 5	$3/2^- \#$	17	17Wu04 T	1994	$\beta^-=100; \beta^-n ?$	*
^{151}La	-53310	440	465 ms 24	$1/2^+ \#$	17	17Wu04 TD	1994	$\beta^-=100; \beta^-n ?$	*
^{151}Ce	-61225	18	1.76 s 0.06	$(3/2^-)$	09	10Si03 J	1997	$\beta^-=100$	*
^{151}Pr	-66780	12	18.90 s 0.07	$(3/2^-)$	09		1990	$\beta^-=100$	
$^{151}\text{Pr}^m$	-66745	12	50 μ s 8	$(7/2^+)$	09	12Ma03 T	2006	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{151}Nd	-70943.2	1.1	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	-74576.5	1.1	94.6 y 0.6	$5/2^+*$	09	15Be23 T	1947	β^- =100
$^{151}\text{Sm}^m$	-74315.4	1.1	1.4 μs 0.1	$(11/2)^-$	09		1973	IT=100
^{151}Eu	-74653.1	1.2	4.6 Ey 1.2	$5/2^+*$	09	14Ca13 T	1933	IS=47.81 6; α =100
$^{151}\text{Eu}^m$	-74456.9	1.2	58.9 μs 0.5	$11/2^-$	09		1958	IT=100
^{151}Gd	-74188.9	3.0	123.9 d 1.0	$7/2^+*$	09		1950	ε =100; α ≈1.1e-6 6
^{151}Tb	-71624	4	17.609 h 0.001	$1/2^+*$	09		1953	β^+ 99.9905 15; α =0.0095 15
$^{151}\text{Tb}^m$	-71524	4	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^+ =94.4 6; α =5.6 4
^{151}Ho	-63623	8	35.2 s 0.1	$11/2^+*$	09	87NeZZ J	1963	β^+ =88 3; α =22 3
$^{151}\text{Ho}^m$	-63582	8	47.2 s 1.3	$1/2^+*$	09	87NeZZ J	1963	α =77 18; β^+ =23 18
^{151}Er	-58266	16	23.5 s 2.0	$(7/2)^-$	09		1970	β^+ =100
$^{151}\text{Er}^m$	-55680	16	580 ms 20	$(27/2)^-$	09		1980	IT=95.3 3; β^+ =4.7 3
$^{151}\text{Er}^n$	-47979	16	420 ns 50	$(65/2^-, 61/2^+)$	09	09Fu05 J	1990	IT=100
^{151}Tm	-50772	19	4.17 s 0.11	$(11/2)^-$	09		1982	β^+ =100
$^{151}\text{Tm}^m$	-50679	20	6.6 s 2.0	$(1/2^+)$	09		1987	β^+ =100
$^{151}\text{Tm}^n$	-48116	19	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=?
$^{151}\text{Yb}^m$	-40800#	320#	1.6 s 0.5	$(11/2)^-$	09	86To12 T	1986	β^+ ≈100; β^+ p=?;IT ?
$^{151}\text{Yb}^n$	-38910#	330#	2.6 μs 0.7	$19/2^-$	09		1993	IT=100
$^{151}\text{Yb}^p$	-38250#	330#	20 μs 1	$27/2^-$	09		1987	IT=100
^{151}Lu	-30300#	300#	78.4 ms 0.9	$11/2^-$	09	15Ta12 TJ	1982	p=?; β^+ =?
$^{151}\text{Lu}^m$	-30240#	300#	16.0 μs 0.5	$3/2^+$	09	17Wa18 T	1998	p=100
* ^{151}Cs	T : average 20Wu04=48(28) 17Wu04=69(26)							**
* ^{151}Ba	T : average 20Wu04=166(11) 17Wu04=167(5)							**
* ^{151}La	T : symmetrized from 457(+30-18); other 20Wu04=510(330)							**
* ^{151}Ce	T : average 17Wu04=1.71(0.09) 06Ko25=1.76 (0.06)							**
* ^{151}Ce	I : isomer with T1/2=1.02(0.06)s suggested in Ensdf2009, but no sufficient							**
* ^{151}Ce	I : experimental evidence exists, so it is not trusted by Nubase							**
* ^{151}Sm	T : other (recent) 09He22=96.6(2.4)							**
* ^{151}Eu	J : 90Al34=5/2							**
* ^{151}Gd	D : % α symmetrized from α /KXrays=0.8(+0.8-0.4)e-8 in 65Si06							**
* $^{151}\text{Tb}^m$	J : E3 to 5/2+ following by E2 to 1/2+							**
* $^{151}\text{Ho}^m$	D : % α symmetrized from α =80(+15-20)							**
* $^{151}\text{Er}^m$	T : other 03Li42=19(3) s for q=68+ (bare ion)							**
* ^{151}Yb	T : derived from 1.6(0.1)s for a mixture of gs and isomer that have almost							**
* ^{151}Yb	T : the same half-life							**
* $^{151}\text{Yb}^m$	E : 740# keV estimated in 90Ak01							**
* $^{151}\text{Yb}^n$	E : 1790+x keV above $^{151}\text{Yb}^m$ in 93Ni05; x=100#(100#)							**
* $^{151}\text{Yb}^p$	E : 657 keV above $^{151}\text{Yb}^n$ in 93Ni05							**
* ^{151}Lu	T : average 15Ta12=78(1) 99Bi14=80(2)							**
* $^{151}\text{Lu}^m$	T : average 17Wa18=15.4(0.8) 15Ta12=17(1) 99Bi14=16(1)							**
^{152}Cs	-29130#	500#	17# ms			18 87Ra12 I	1987	β^- ?; β^- n ?
^{152}Ba	-41610#	400#	139 ms 8	0^+		17 17Wu04 TD	2010	β^- =100; β^- n ?
^{152}La	-49290#	300#	287 ms 16	2^-	#	17 17Wu04 TD	1994	β^- =100; β^- n ?
^{152}Ce	-58980#	200#	1.42 s 0.02	0^+		13 17Wu04 T	1990	β^- =100
^{152}Pr	-63758	19	3.57 s 0.11	4^+		13 99To04 J	1983	β^- =100
$^{152}\text{Pr}^m$	-63643	19	4.16 μs 0.10	(1^+)		13 18Al14 TJE	1990	IT=100
^{152}Nd	-70150	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
$^{152}\text{Pm}^m$	-71110	80	7.52 m 0.08	$4(-)$		13	1971	β^- =100
$^{152}\text{Pm}^n$		non-exist	13.8 m 0.2	(8)		13	1971	β^- =100;IT ?
^{152}Sm	-74763.0	1.0	STABLE	0^+		13	1933	IS=26.74 9
^{152}Eu	-72888.5	1.2	13.517 y 0.006	3^-*		13 FGK209 T	1938	β^+ =72.08 13; β^- =27.92 13
$^{152}\text{Eu}^m$	-72842.9	1.2	9.3116 h 0.0013	0^-*		13	1958	β^- =73 3; β^+ =27 3
$^{152}\text{Eu}^n$	-72823.2	1.2	940 ns 80	1^-		13	1978	IT=100
$^{152}\text{Eu}^p$	-72810.3	1.2	165 ns 10	1^+		13	1978	IT=100
$^{152}\text{Eu}^q$	-72798.7	1.2	384 ns 10	4^+		13	1970	IT=100
$^{152}\text{Eu}^r$	-72740.6	1.2	95.8 m 0.4	8^-		13 15Hu02 T	1963	IT=100
^{152}Gd	-74707.3	1.0	108 Ty 8	0^+		13	1938	IS=0.20 3; α =100;2 β^+ ?

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{152}Tb	-70720	40	17.5 h 0.1	2^-*	13		1959	$\beta^+=100; \alpha?$	
$^{152}\text{Tb}^m$	-70380	40	342.15 0.16	960 ns 10	5^-	13	1972	IT=100	
$^{152}\text{Tb}^n$	-70220	40	501.74 0.19	4.2 m 0.1	8^+	13	1971	IT=78.9 6; $\beta^+=21.1$ 6	
^{152}Dy	-70118	5	2.38 h 0.02	0^+	13		1958	$\varepsilon=99.900$ 7; $\alpha=0.100$ 7	
^{152}Ho	-63605	13	161.8 s 0.3	2^-*	13		1963	$\beta^+=88$ 3; $\alpha=12$ 3	
$^{152}\text{Ho}^m$	-63445	13	160 3 AD	49.8 s 0.2	9^+*	13	1963	$\beta^+=89.2$ 17; $\alpha=10.8$ 17	*
$^{152}\text{Ho}^n$	-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	$\alpha=90$ 4; $\beta^+=10$ 4	
^{152}Tm	-51720	50	8.0 s 1.0	$(2)^-$	13		1980	$\beta^+=100$	
$^{152}\text{Tm}^m$	-51820	240	-100 250 *	5.2 s 0.6	$(9)^+$	13	1980	$\beta^+=100$	
$^{152}\text{Tm}^n$	-49270	250	2455 250	301 ns 7	(17^+)	13 18Na20 T	1986	IT=100	*
^{152}Yb	-46270	150	3.03 s 0.06	0^+	13		1982	$\beta^+=100$	
$^{152}\text{Yb}^m$	-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		$\beta^+=100; \beta^+p=15$ 7	*
* ^{152}Ba	T : other 20Wu04=148(21)								**
* ^{152}La	T : symmetrized from 17Wu04=298(+6-23); other 20Wu04=270(100)								**
* ^{152}Pr	T : average 90An31=3.7(0.2) 85Br08=3.8(0.2) 83Hi05=3.24(0.19)								**
* $^{152}\text{Pr}^m$	T : average 18Al14=4.7(0.3) 95Ya21=4.1(0.1). other: 90Ta07=1.0(0.3)								**
* $^{152}\text{Pm}^m$	J : parity from 77Ya07 based on log ft values not unambiguous; see 71Da19;								**
* $^{152}\text{Pm}^n$	J : alternative K=4+ and the same configuration as the gs is possible								**
* $^{152}\text{Pm}^n$	I : introduced in 71Da19, but the suggested 1941-keV and 2172-keV levels								**
* $^{152}\text{Pm}^n$	I : in the daughter ^{152}Sm nuclide that are fed by the isomer,								**
* $^{152}\text{Pm}^n$	I : do not exist (1941 keV) or don't have high spin (1,2+ for 2172 keV)								**
* $^{152}\text{Pm}^n$	I : in Ensdf2013; not confirmed in 77Ya07								**
* $^{152}\text{Ho}^m$	E : Ensdf13=160(1) from α decay, but uncertainty not trusted								**
* $^{152}\text{Tm}^n$	E : 2555.05(0.19) above $^{152}\text{Tm}^m$								**
* $^{152}\text{Tm}^n$	T : average 18Na20=304(8) 86Mc14=294(12)								**
* ^{152}Lu	T : average 88Ni02=600(100) 87To02=700(100)								**
^{153}Ba	-36470#	400#	113 ms 39	$5/2^- \#$	20 20Wu04 TD	2016		$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
^{153}La	-46060#	300#	245 ms 18	$1/2^+ \#$	20 17Wu04 TD	1994		$\beta^- = 100; \beta^- n ?; \beta^- 2n ?$	*
^{153}Ce	-54910#	200#	865 ms 25	$3/2^- \#$	20 17Wu04 TD	1994		$\beta^- = 100; \beta^- n ?$	
^{153}Pr	-61568	12	4.28 s 0.11	$3/2^- \#$	20 90An31 T	1987		$\beta^- = 100; \beta^- n ?$	*
^{153}Nd	-67330.4	2.7	31.6 s 1.0	$(3/2)^-$	20		1987	$\beta^- = 100$	
$^{153}\text{Nd}^m$	-67138.7	2.7	191.71 0.16	$(5/2)^+$	20 10Si03 TJ	1996		IT=100	*
^{153}Pm	-70648	9	5.25 m 0.02	$5/2^-$	20		1962	$\beta^- = 100$	
^{153}Sm	-72560.1	1.0	46.2846 h 0.0023	$3/2^+*$	20 FGK209 T	1938		$\beta^- = 100$	
$^{153}\text{Sm}^m$	-72461.7	1.0	98.39 0.10	10.6 ms 0.3	$11/2^-$	20	1971	IT=100	
^{153}Eu	-73367.5	1.2	STABLE	$>550\text{Py}$	$5/2^+*$	20 12Da16 T	1933	IS=52.19 6	*
$^{153}\text{Eu}^m$	-71596.5	1.3	1771.0 0.4	475 ns 10	$19/2^-$	20	2000	IT=100	
^{153}Gd	-72882.9	1.0	240.6 d 0.7	$3/2^-*$	20 14Un01 T	1947		$\varepsilon=100$	*
$^{153}\text{Gd}^m$	-72787.7	1.0	95.1737 0.0008	3.5 μs 0.4	$9/2^+$	20	1979	IT=100	
$^{153}\text{Gd}^n$	-72711.7	1.0	171.188 0.004	76.0 μs 1.4	$(11/2^-)$	20	1967	IT=100	
^{153}Tb	-71314	4	2.34 d 0.01	$5/2^+*$	20		1957	$\beta^+=100$	
$^{153}\text{Tb}^m$	-71151	4	163.175 0.005	186 μs 4	$11/2^-$	20	1965	IT=100	
^{153}Dy	-69143	4	6.4 h 0.1	$7/2^-*$	20		1958	$\beta^+=99.9906$ 14; $\alpha=0.0094$ 14	
^{153}Ho	-65012	5	2.01 m 0.03	$11/2^-*$	20		1963	$\beta^+=99.949$ 25; $\alpha=0.051$ 25	
$^{153}\text{Ho}^m$	-64943	5	68.7 0.3	$1/2^+*$	20		1963	$\beta^+=99.82$ 8; $\alpha=0.18$ 8	
$^{153}\text{Ho}^n$	-62240	5	2772.3 1.4	229 ns 2	$31/2^+$	20 16Pr06 J	1980	IT=100	
^{153}Er	-60467	9	37.1 s 0.2	$7/2^-*$	20 85Ah.A J	1963		$\alpha=53$ 3; $\beta^+=47$ 3	*
$^{153}\text{Er}^m$	-57669	9	2798.2 1.0	373 ns 9	$(27/2^-)$	20	1979	IT=100	
$^{153}\text{Er}^n$	-55219	9	5248.1 1.0	248 ns 32	$(41/2^-)$	20	1979	IT=100	
^{153}Tm	-53973	12	1.48 s 0.01	$(11/2^-)$	20		1964	$\alpha=91$ 3; $\beta^+=9$ 3	
$^{153}\text{Tm}^m$	-53930	12	43.2 0.2	2.5 s 0.2	$(1/2^+)$	20	1988	$\alpha=92$ 3; $\beta^+=8$ 3	
^{153}Yb	-47160#	200#	4.2 s 0.2	$7/2^-$	20 88Wi05 D	1977		$\beta^+=?; \alpha?; \beta^+p=0.008$ 2	
$^{153}\text{Yb}^m$	-44530#	210#	2630# 50#	15 μs 1	$27/2^-$	20	1989	IT=100	*
^{153}Lu	-38380	150	900 ms 200	$11/2^-$	20 97Ir01 D	1989		$\alpha=?; \beta^+?; p=0$	*
$^{153}\text{Lu}^m$	-38300	150	80 5 IT	1# s	$1/2^+$	20 97Ir01 EDJ	1997	$\alpha?; \beta^+?; IT?; p=0$	
$^{153}\text{Lu}^n$	-35880	150	2502.5 0.4	>100 ns	$23/2^-$	20	1993	IT=100	
$^{153}\text{Lu}^p$	-35750	150	2632.9 0.5	15 μs 3	$27/2^-$	20	1993	IT=100	
^{153}Hf	-27300#	300#	400# ms $>200\text{ns}$	$1/2^+ \#$	20 00So11 I	2000		$\beta^+?$	

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{153}\text{Hf}^m$	-26550# 320#	750# 100#	500# ms	11/2 ⁻ #				β^+ ?; IT ?	
* ^{153}Ba	T : average 20Wu04=109(59) 17Wu04=116(52)								**
* ^{153}La	T : other 20Wu04=210(120)								**
* ^{153}Pr	T : other 17Wu04=4.68(0.70) 87Gr12=4.3(0.2)								**
* $^{153}\text{Nd}^m$	T : average 10Si03=1.17(0.07) 96Ya12=1.06(0.05)								**
* ^{153}Eu	J : 85Ah03,90Al34=5/2								**
* ^{153}Gd	T : unweighted average 14Un01=239.29(0.10) 72Em01=241.6(0.2),240.9(0.6);								**
* ^{153}Gd	T : Birge ratio=7.4; other (discrepant) 89Po21=226.7(4.2)								**
* ^{153}Er	J : also 89Ot.A								**
* $^{153}\text{Yb}^m$	E : from 93Mc03=2579 (23/2-)+x keV; x=50#(50#) keV by Nubase, probably								**
* $^{153}\text{Yb}^m$	E : overlaps with 51-keV E1								**
* ^{153}Lu	D : %p from 97Ir01=0								**
^{154}Ba	-32920# 500#		53 ms 48	0 ⁺	17	17Wu04 TD	2017	β^- =100	
^{154}La	-41530# 300#		161 ms 15	2 ⁻ #	17	17Wu04 TD	2017	β^- =100; β^- -n ?; β^- -2n ?	*
^{154}Ce	-52220# 200#		722 ms 14	0 ⁺	17	17Wu04 TD	1994	β^- =100; β^- -n ?	
^{154}Pr	-57860 100		2.30 s 0.09	(3 ⁺)	09	17Wu04 T	1988	β^- =100; β^- -n ?	*
^{154}Nd	-65579.6 1.0		25.9 s 0.2	0 ⁺	09		1970	β^- =100	
$^{154}\text{Nd}^m$	-64281.7 1.1	1297.9 0.4	3.2 μ s 0.3	(4 ⁻)	09	09Si21 ETJ	1970	IT=100	*
^{154}Pm	-68267 25		2.68 m 0.07	(4 ⁺)	09	12So10 J	1958	β^- =100	
$^{154}\text{Pm}^m$	-68490 40	-230 50	1.73 m 0.10	(1 ⁻)	09	12So10 J	1958	β^- =100	
^{154}Sm	-72455.6 1.3		STABLE >2.3Ey	0 ⁺	09		1933	IS=22.74 14; $2\beta^-$?	*
^{154}Eu	-71738.4 1.2		8.592 y 0.003	3 ⁻ *	09	FGK209 T	1947	β^- =99.982 12; ϵ =0.018 12	
$^{154}\text{Eu}^m$	-71670.2 1.2	68.1702 0.0004	2.2 μ s 0.1	2 ⁺	09		1964	IT=100	
$^{154}\text{Eu}^n$	-71593.1 1.2	145.3 0.3	46.3 m 0.4	(8 ⁻)	09		1975	IT=100	
^{154}Gd	-73706.4 1.0		STABLE	0 ⁺	09		1938	IS=2.18 2	
^{154}Tb	-70160 50		9.994 h 0.039	3 ⁻ *	09	09Gy01 T	1972	β^+ =100; β^- ?	
$^{154}\text{Tb}^m$	-70030# 70#	130# 50#	21.5 h 0.4	0 ⁻ *	09		1950	β^+ $\approx$ 100;IT ?; β^- ?	
$^{154}\text{Tb}^n$	-69960# 160#	200# 150#	22.7 h 0.5	7 ⁻	09		1972	β^+ $\approx$ 100;IT ?	
$^{154}\text{Tb}^p$	-69760# 160#	405# 150#	513 ns 4.2		09		1982	IT=100	*
^{154}Dy	-70394 7		3.0 My 1.5	0 ⁺	09		1961	α =100; $2\beta^+$?	
^{154}Ho	-64639 8		11.76 m 0.19	2 ⁻ *	09		1966	β^+ =99.981 5; α =0.019 5	
$^{154}\text{Ho}^m$	-64397 27	243 28	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	β^+ $\approx$ 100; α =0.47 13	
^{154}Tm	-54427 14		8.1 s 0.3	(2 ⁻)	09		1964	α =54 5; β^+ =46 5	
$^{154}\text{Tm}^m$	-54350 50	70 50	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	-39670# 200#		1# s	(2 ⁻)	09		1981	β^+ ?; α ?	
$^{154}\text{Lu}^m$	-39600# 200#	62 12	1.12 s 0.08	(9 ⁺)	09	88Vi02 D	1981	β^+ $\approx$ 100; β^+ p=?; β^+ α =?; α ?	*
$^{154}\text{Lu}^n$	-36950# 220#	2724# 100#	35 μ s 3	(17 ⁺)	09		1990	IT=100	*
^{154}Hf	-32730# 300#		2 s 1	0 ⁺	09		1981	β^+ $\approx$ 100; α $\approx$ 0	
$^{154}\text{Hf}^m$	-30010# 300#	2721# 50#	9 μ s 4	(10 ⁺)	09		1989	IT=100	*
* ^{154}La	T : other 20Wu04=221(89)								**
* ^{154}Pr	T : average 17Wu04=2.29(0.20) 88Ka16=2.3(0.1)								**
* $^{154}\text{Nd}^m$	E : from a least-squares fit to gamma-ray energies in 09Si21								**
* $^{154}\text{Nd}^m$	I : other Ensdf2009 quotes this isomer twice: 233.2+x keV (1.3 us) and								**
* $^{154}\text{Nd}^m$	I : 1349 keV (5-, >1 us); not trusted								**
* ^{154}Sm	T : 2v- $\beta\beta$ to 2+ from 96De60								**
* ^{154}Tb	J : 70Ad09=3; conf p3/2[411]n3/2[521], K=3- and GM rule								**
* $^{154}\text{Tb}^p$	E : 82Be46=53.9,60.4 abd 90.1-keV gammas show 500 ns half-life; assumed by								**
* $^{154}\text{Tb}^p$	E : Nubase above $^{154}\text{Tb}^n$ since the level is populated in the								**
* $^{154}\text{Tb}^p$	E : ($^{11}\text{B},5n$) reaction that favors high spin								**
* $^{154}\text{Lu}^m$	D : % β^+ p and % β^+ α modes observed in 88Vi02; β^+ p confirmed in 90Sh.A								**
* $^{154}\text{Lu}^n$	E : 2431.3 + 130.4 + z keV above $^{154}\text{Lu}^m$; z=100#(100#) keV								**
* $^{154}\text{Hf}^m$	E : 93Mc03=2671+x keV; x=50#(50#) keV by Nubase								**
^{155}La	-37930# 400#		101 ms 28	1/2 ⁺ #	19	17Wu04 T	2016	β^- =100; β^- -n ?; β^- -2n ?	*
^{155}Ce	-47780# 300#		313 ms 7	5/2 ⁻ #	19		1994	β^- =100; β^- -n ?	
^{155}Pr	-55415 17		1.47 s 0.3	3/2 ⁻ #	19		1992	β^- =100; β^- -n ?	
^{155}Nd	-62284 9		8.9 s 0.2	(3/2 ⁻)	19		1986	β^- =100	
^{155}Pm	-66940 5		41.5 s 0.2	(5/2 ⁻)	19		1982	β^- =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{155}Sm	-70191.2	1.3	22.18 m 0.06	$3/2^-*$	19		1951	β^- =100
$^{155}\text{Sm}^m$	-70174.7	1.3	16.5467 0.0019	$5/2^+$	19		2010	IT=100
$^{155}\text{Sm}^n$	-69653.2	1.3	538.03 0.19	$11/2^-$	19	10Si03 TJ	2010	IT=100
^{155}Eu	-71818.3	1.3	4.742 y 0.008	$5/2^+*$	19	14Un01 T	1947	β^- =100
^{155}Gd	-72070.3	1.0	STABLE	$3/2^-*$	19		1933	IS=14.80 9
$^{155}\text{Gd}^m$	-71949.2	1.0	121.10 0.19	$11/2^-$	19		1967	IT=100
^{155}Tb	-71250	10	5.32 d 0.06	$3/2^+*$	19		1957	ε =100
^{155}Dy	-69156	10	9.9 h 0.2	$3/2^-*$	19		1958	β^+ =100
$^{155}\text{Dy}^m$	-68922	10	234.33 0.03	$11/2^-$	19		1970	IT=100
^{155}Ho	-66040	17	48 m 2	$5/2^+*$	19		1959	β^+ =100
$^{155}\text{Ho}^m$	-65898	17	141.87 0.11	$11/2^-$	19		1984	IT=100
^{155}Er	-62209	6	5.3 m 0.3	$7/2^-$	19	FGK211 J	1969	β^+ =99.978 7; α =0.022 7
^{155}Tm	-56626	10	21.6 s 0.2	$11/2^-$	19		1971	β^+ =99.17 17; α =0.83 17
$^{155}\text{Tm}^m$	-56585	12	41 6 AD	$1/2^+$	19		1990	$\beta^+\approx 100$; α ?
^{155}Yb	-50503	17	1.793 s 0.020	$(7/2^-)$	19		1964	α =89 5; β^+ =11 5
^{155}Lu	-42545	19	68 ms 2	$11/2^-$	19		1965	α =90 2; β^+ =10 2
$^{155}\text{Lu}^m$	-42524	20	21 4 AD	$1/2^+$	19		1967	α =76 16; β^+ =24 16
$^{155}\text{Lu}^n$	-40765	19	1780.3 1.8 AD	$25/2^- \#$	19		1981	$\alpha\approx 100$; IT ?
^{155}Hf	-34310#	300#	843 ms 30	$7/2^- \#$	19		1981	$\beta^+\approx 100$; α ?
^{155}Ta	-23990#	300#	3.2 ms 1.3	$11/2^-$	19	07Pa27 T	2007	p=100
* ^{155}La	T: other 20Wu04=94(59)							**
* ^{155}Eu	T: average 14Un01=1731(3) d 98Si12=1739(8) d, supersedes 83Wa26=1737(23) d,							**
* ^{155}Eu	T: 93Th04=1735(22) d							**
* ^{155}Er	J: favored α decay to ^{151}Dy , J=7/2-							**
* ^{155}Ta	T: symmetrized from 07Pa27=2.9(+1.5-1.1); other 99Uu01=12(+4-3) us							**
* ^{155}Ta	T: strongly conflicting result - most likely $^{159}\text{Re}^m$ decay							**
* ^{155}Ta	D: E(p): 07Pa27=1444(15) keV 99Uu01=1776(10) keV, the later similar to							**
* ^{155}Ta	D: E(p)=1805(20) keV for $^{159}\text{Re}^m$. The energy balance							**
* ^{155}Ta	D: Qp($^{159}\text{Re}^m$)+Q α (^{158}W)=Q α ($^{159}\text{Re}^m$)+							**
* ^{155}Ta	D: Qp(^{155}Ta)= 8422 keV supports the 07Pa27 data							**
^{156}La	-33050#	400#	84 ms 78	$4^+ \#$	17	17Wu04 TD	2017	β^- =100; β^- -n?
^{156}Ce	-44820#	300#	233 ms 9	0^+	17	17Wu04 TD	2017	β^- =100; β^- -n?
^{156}Pr	-51449.3	1.0	444 ms 6	$1^+ \#$	17	17Wu04 TD	1992	β^- =100; β^- -n?
^{156}Nd	-60202.1	1.3	5.06 s 0.13	0^+	12	07Sh05 T	1987	β^- =100
$^{156}\text{Nd}^m$	-58770.8	1.4	1431.3 0.4	(5^-)	12	09Si21 ET	1998	IT=100
^{156}Pm	-64166.8	1.2	27.4 s 0.5	4^+	12	16Ko.A TJ	1986	β^- =100
$^{156}\text{Pm}^m$	-64016.5	1.2	150.30 0.10	$1^+ \#$	12	07Sh05 ETD	2007	IT $\approx$ 98; β^- $\approx$ 2
^{156}Sm	-69361	9	9.4 h 0.2	0^+	12		1951	β^- =100
$^{156}\text{Sm}^m$	-67963	9	1397.55 0.09	5^-	12		1974	IT=100
^{156}Eu	-70083	4	15.19 d 0.08	0^+*	12		1947	β^- =100
^{156}Gd	-72535.3	1.0	STABLE	0^+	12		1933	IS=20.47 3
$^{156}\text{Gd}^m$	-70397.7	1.0	2137.60 0.05	7^-	12		1969	IT=100
^{156}Tb	-70091	4	5.35 d 0.10	3^-*	12		1950	$\beta^+\approx 100$; β^- ?
$^{156}\text{Tb}^n$	-70003	4	88.4 0.2	(0^+)	12		1950	IT=?; β^+ =?
$^{156}\text{Tb}^m$	-69990#	50#	100# 50#	(7^-)	12		1970	IT=?; β^- ?
* ^{156}Dy	-70529.4	1.0	STABLE	0^+	12	58Ri23 T	1948	IS=0.056 3; α ?; $2\beta^+$?
^{156}Ho	-65540	40	56 m 1	4^-*	12		1957	β^+ =100
$^{156}\text{Ho}^m$	-65490	40	52.37 0.30	1^-*	12		1995	IT $\approx$ 100; β^+ ?
$^{156}\text{Ho}^n$	-65304	28	230 50 MD	9^+	12		1975	$\beta^+\approx 75$; IT ?
^{156}Er	-64212	25	19.5 m 1.0	0^+	12	96By.A D	1967	β^+ =100; α =1.2e-5 3
^{156}Tm	-56834	14	83.8 s 1.8	2^-	12		1971	$\beta^+\approx 100$; α =0.064 10
$^{156}\text{Tm}^m$	-56430#	200#	400# 200# EU	(11^-)	12		1985	IT=100
^{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 =100; β^+ ?
$^{156}\text{Lu}^m$	-43680	240	10 250 *	10^+	12	18Le10 J	1979	$\alpha\approx 100$; β^+ ?
$^{156}\text{Lu}^n$	-41090	250	2611 250	19^-	18	Le10 ETJ	2018	IT=100
^{156}Hf	-37820	150	23 ms 1	0^+	12	96Pa01 D	1979	$\alpha\approx 100$; β^+ ?
$^{156}\text{Hf}^m$	-35860	150	1958.8 1.0 AD	(8^+)	12	96Pa01 T	1979	$\alpha\approx 100$; IT ?
^{156}Ta	-26000#	300#	106 ms 4	(2^-)	12		1992	p=71 3; β^+ =29 3
$^{156}\text{Ta}^m$	-25910#	300#	94 8 AD	(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.							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J ^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁵⁶ Nd	T : other: 17Wu04=5.2(1.4)							**	
* ¹⁵⁶ Pm	T : unweighed average 16Ko.A=27.78(0.07) 87Gr12=26.70(0.10);							**	
* ¹⁵⁶ Pm	T : Birge ratio=8.85							**	
* ¹⁵⁶ Pm ^m	E : other 20Or03=152.2(2.7) (PI-ICR)							**	
* ¹⁵⁶ Sm ^m	T : other (recent) 09Si21=186(44)							**	
* ¹⁵⁶ Eu	J : 90Al34=0							**	
* ¹⁵⁶ Tb ⁿ	E : from 49.630+x keV; x=50#(50#) keV estimated by Nubase							**	
* ¹⁵⁶ Dy	T : the lower limit is for α decay							**	
* ¹⁵⁶ Ho ^m	E : uncertainty estimated by Nubase							**	
* ¹⁵⁶ Tm ^m	E : 203.6 keV above unknown level							**	
* ¹⁵⁶ Lu ⁿ	E : 18Le10=2601.0(1.4) keV above ¹⁵⁶ Lu ^m							**	
* ¹⁵⁶ Hf ^m	T : average 96Pa01=520(10) 81Ho.A=444(17)							**	
¹⁵⁷ La	−29070#	300#	30# ms >550ns	1/2 ⁺ #	18Sh11	I	2018	β [−] ?;β [−] n ?	
¹⁵⁷ Ce	−39930#	400#	175 ms 41	7/2 ⁺ #	17 17Wu04	TD	2017	β [−] =100;β [−] n ?	
¹⁵⁷ Pr	−48435	3	307 ms 21	3/2 [−] #	17 17Wu04	TD	2017	β [−] =100;β [−] n ?	
¹⁵⁷ Nd	−56494.1	2.1	1.15 s 0.03	5/2 [−] #	17 17Wu04	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	−70823.9	1.0	STABLE	3/2 [−] *	16		1933	IS=15.65 4	
¹⁵⁷ Gd ^m	−70760.0	1.0	63.916 0.005	460 ns 40	5/2 ⁺	16	1964	IT=100	
¹⁵⁷ Gd ⁿ	−70397.4	1.0	426.539 0.023	18.5 μs 2.3	11/2 [−]	16	1961	IT=100	
¹⁵⁷ Tb	−70763.8	1.0	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 96By.A	D	1974	β ⁺ =100;α=7.5e-4 25	
¹⁵⁷ Tm ^m	−58610#	60#	100# 50#	1.6 s	7/2 [−] #	08VaZV	TJ	2008	β ⁺ ?; IT ?
¹⁵⁷ Yb	−53420	11	38.6 s 1.0	7/2 [−] *	16		1970	β ⁺ ≈100;α=?	
¹⁵⁷ Lu	−46440	12	7.7 s 2.0	(1/2 ⁺)	16		1977	β ⁺ ?;α=?	
¹⁵⁷ Lu ^m	−46419	12	20.9 2.0 AD	4.79 s 0.12	(11/2 [−])	16	1972	β ⁺ =92.3 19;α=7.7 19	
¹⁵⁷ Hf	−38860#	200#	115 ms 1	7/2 [−]	16		1965	α=94 4;β ⁺ =14 4	
¹⁵⁷ Ta	−29600	150	10.1 ms 0.4	1/2 ⁺	16		1979	α=96.6 12;p=3.4 12;β ⁺ ?	
¹⁵⁷ Ta ^m	−29570	150	22 5 AD	4.3 ms 0.1	11/2 [−]	16	1996	α≈100;β ⁺ ?;p=0	
¹⁵⁷ Ta ⁿ	−28000	150	1593 9 AD	1.7 ms 0.1	25/2 [−] #	16	1996	α=100	
¹⁵⁷ W	−19690#	400#	275 ms 40	(7/2 [−])	16 10Bi03	D	2010	β ⁺ =100;α=0	
¹⁵⁷ W ^p	−19370#	400#	320 30 AD	(9/2 [−])	16		2010	IT ?	
* ¹⁵⁷ Pr	T : symmetrized from 17Wu04=295(+29-11)							**	
* ¹⁵⁷ Lu	T : unweighted average 91To09=5.7(0.5) 91Le15,92Po14=9.6(0.8);							**	
* ¹⁵⁷ Lu	T : Birge ratio=4.13							**	
* ¹⁵⁷ Lu ^m	D : %α average 91To09=18(5) 79Ho10=6(2); Birge ratio=2.23							**	
* ¹⁵⁷ Hf	J : favored α decay to J=7/2- gs in ¹⁵³ Yb							**	
¹⁵⁸ Ce	−36540#	400#	99 ms 93	0 ⁺	17		2016	β [−] =100;β [−] n ?	
¹⁵⁸ Pr	−44150#	300#	181 ms 14	5 [−] #	17		2016	β [−] =100;β [−] n ?	
¹⁵⁸ Nd	−53835.1	1.3	810 ms 30	0 ⁺	17 17Wu04	TD	1992	β [−] =100	
¹⁵⁸ Nd ^m	−52187.0	1.9	339 ms 20	(6 [−])	17		2016	IT=100	
¹⁵⁸ Pm	−59106.1	0.9	4.8 s 0.5	(0 ⁺ , 1 ⁺)#	17		1987	β [−] =100	
¹⁵⁸ Pm ^m	−58960#	50#	150# 50#	> 16 μs	5 ⁺ #	17 15YoZX	EDT2015	IT=?;β [−] ?	
¹⁵⁸ Sm	−65252	5	5.30 m 0.03	0 ⁺	17		1970	β [−] =100	
¹⁵⁸ Eu	−67270.5	2.0	45.9 m 0.2	1 [−] *	17		1951	β [−] =100	
¹⁵⁸ Gd	−70690.0	1.0	STABLE	0 ⁺	17		1933	IS=24.84 8	
¹⁵⁸ Tb	−69470.9	1.3	180 y 11	3 [−] *	04		1957	β ⁺ =83.4 7;β [−] =16.6 7	
¹⁵⁸ Tb ^m	−69360.6	1.8	110.3 1.2	10.70 s 0.17	0 [−]	17	1957	IT≈100;β [−] ?;β ⁺ ?	
¹⁵⁸ Tb ⁿ	−69082.5	1.3	388.39 0.11	400 μs 40	7 [−]	17	1961	IT=100	
¹⁵⁸ Dy	−70407.2	2.3	STABLE	0 ⁺	17		1938	IS=0.095 3;α ?;2β ⁺ ?	
¹⁵⁸ Ho	−66187	27	11.3 m 0.4	5 ⁺ *	17		1961	β ⁺ ≈100;α ?	

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Nuclide	Mass excess (keV)	Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{158}\text{Ho}^m$	-66120	27	67.20	0.01	28 m 2	2^-*	17	1960	IT $\approx$ 91 6; $\beta^+\approx$ 9 6	*
$^{158}\text{Ho}^n$	-66095	27	91.595	0.012	140 ns 25	(2^-)	17	2005	IT=100	*
$^{158}\text{Ho}^p$	-66010#	80#	180#	70#	21.3 m 2.3	(9^+)	17	1970	$\beta^+\approx$ 100;IT ?	
^{158}Er	-65304	25			2.29 h 0.06	0^+	17	1961	$\varepsilon=100$	
^{158}Tm	-58703	25			3.98 m 0.06	2^-*	17	1970	$\beta^+=100$	
$^{158}\text{Tm}^m$	-58600#	60#	100#	50#	~ 20 s	$5^- \#$	17 81Dr07	IT 1981	IT ?; ε ?	*
^{158}Yb	-56010	8			1.49 m 0.13	0^+	17	1967	$\beta^+\approx$ 100; $\alpha\approx$ 0.0021 12	
^{158}Lu	-47212	15			10.6 s 0.3	$(2)^-$	17	1979	$\beta^+=99.09$ 20; $\alpha=0.91$ 20	
^{158}Hf	-42102	17			2.85 s 0.07	0^+	17	1965	$\beta^+=55.7$ 19; $\alpha=44.3$ 19	
^{158}Ta	-31120#	200#			49 ms 4	$(2)^-$	17 97Da07	TD 1979	$\alpha\approx$ 100; β^+ ?	*
$^{158}\text{Ta}^m$	-30980#	200#	141	11	AD	$(9)^+$	17 97Da07	ETJ 1979	$\alpha=95$ 5; β^+ ?;IT ?	*
$^{158}\text{Ta}^n$	-28310#	200#	2808	16	6.1 μ s 0.1	(19^-)	17	2014	IT=98.6 2; $\alpha=1.4$ 2	*
^{158}W	-23690#	300#			1.43 ms 0.18	0^+	17 19Hi06	T 1981	$\alpha=100$	*
$^{158}\text{W}^m$	-21800#	300#	1889	8	AD	(8^+)	17	1995	$\alpha=100$;IT ?	
* ^{158}Nd T : symmetrized from 17Wu04=820(+15-36)										**
* $^{158}\text{Pm}^m$ E : 15YoZX=121+x (121-keV gamma ray below the isomer); x=30#(50#) by Nubase										**
* ^{158}Eu J : 90A134=1										**
* ^{158}Tb J : 68Ea04=3										**
* $^{158}\text{Ho}^m$ D : %IT from Ensdf2017>81										**
* $^{158}\text{Ho}^n$ J : E1 from 1+; not fed directly in ^{158}Er (J=0+) β^+ decay										**
* $^{158}\text{Tm}^m$ I : 20 s activity, following observation of gammas in ^{158}Er ε decay										**
* $^{158}\text{Tm}^m$ I : in 81Dr07, is adopted. Note, that 20 ns appears in the level scheme										**
* $^{158}\text{Tm}^m$ I : in Fig. 2 (81Dr07), which seems to be a misprint. This is a spin-trap										**
* $^{158}\text{Tm}^m$ I : isomer and the suggested 20 ns half-life in Ensdf17 is unrealistic.										**
* $^{158}\text{Tm}^m$ I : The configuration is the same as that for the ground state,										**
* $^{158}\text{Tm}^m$ I : p7/2[404] n3/2[521], but K=5-. 75Ag01 also cannot rule out the										**
* $^{158}\text{Tm}^m$ I : existence of two ε -decaying states										**
* ^{158}Ta T : average 97Da07=72(12) 96Pa01=46(4); Birge ratio B=2.06										**
* $^{158}\text{Ta}^m$ T : average 97Da07=37.7(1.5) 96Pa01=35(1) 79Ho10=36.8(1.6)										**
* $^{158}\text{Ta}^n$ E : from Ensdf2017=2664.5(0.4) keV above $^{158}\text{Ta}^m$										**
* ^{158}W T : average 19Hi06=1.9(+1.2-0.6) 00Ma95=1.5(0.2) 96Pa01=0.9(+0.4-0.3)										**
^{159}Ce	-31340#	500#				$1/2^- \#$			β^- ?; β^- n ?	
^{159}Pr	-40770#	400#			134 ms 43	$3/2^- \#$	17 17Wu04	TD 2017	β^- =100; β^- n ?	
^{159}Nd	-49724	30			500 ms 30	$7/2^+ \#$	17 17Wu04	TD 2012	β^- =100; β^- n ?	*
^{159}Pm	-56554	10			1.49 s 0.13	$(5/2^-)$	12 17Wu04	T 1998	β^- =100	*
$^{159}\text{Pm}^m$	-55089	10	1465.0	0.5	4.42 μ s 0.17	$17/2^+ \#$	15YoZX	ETD2015	IT=100	*
^{159}Sm	-62208	6			11.37 s 0.15	$5/2^-$	12	1986	β^- =100	
$^{159}\text{Sm}^m$	-60932	6	1276.5	0.8	116 ns 8	$(15/2^+)$	12 17Pa25	EJ 2009	IT=100	*
^{159}Eu	-66043	4			18.1 m 0.1	$5/2^+*$	12	1961	β^- =100	*
^{159}Gd	-68561.9	1.0			18.479 h 0.004	$3/2^-*$	12	1949	β^- =100	
^{159}Tb	-69532.6	1.1			STABLE	$3/2^+*$	12 12Vi10	J 1933	IS=100	
^{159}Dy	-69167.2	1.4			144.4 d 0.2	$3/2^-*$	12	1951	$\varepsilon=100$	
$^{159}\text{Dy}^m$	-68814.4	1.4	352.77	0.14	122 μ s 3	$11/2^-$	12	1965	IT=100	
^{159}Ho	-67330	3			33.05 m 0.11	$7/2^-*$	12	1958	$\beta^+=100$	
$^{159}\text{Ho}^m$	-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	$\beta^+=100$	
$^{159}\text{Er}^m$	-64378	4	182.602	0.024	337 ns 14	$9/2^+$	12	1971	IT=100	
$^{159}\text{Er}^n$	-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	$\beta^+=100$	
^{159}Yb	-55834	18			1.67 m 0.09	$5/2^-*$	12	1975	$\beta^+=100$	
^{159}Lu	-49710	40			12.1 s 1.0	$1/2^+$	12 FGK12a	J 1980	$\beta^+\approx$ 100; $\alpha=$?	*
$^{159}\text{Lu}^m$	-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	$\beta^+=65$ 7; $\alpha=35$ 7	
^{159}Ta	-34439	20			1.04 s 0.09	$1/2^+$	12 97Da07	T 1979	$\beta^+=66$ 5; $\alpha=34$ 5	*
$^{159}\text{Ta}^m$	-34375	19	64	5	AD	$11/2^-$	12	1994	$\alpha=55$ 1; $\beta^+=45$ 1	
^{159}W	-25430#	300#			8.2 ms 0.7	$7/2^- \#$	12 96Pa01	TD 1981	$\alpha\approx$ 100; β^+ ?	*
^{159}Re	-14810#	310#			40# μ s	$1/2^+ \#$		2006	p ?; α ?	
$^{159}\text{Re}^m$	-14600#	300#	210#	50#	20 μ s 4	$11/2^-$	12 07Pa27	TD 2006	p=92.5 35; $\alpha=7.5$ 35	*
* ^{159}Nd T : symmetrized from 17Wu04=485(+39-20)										**
* ^{159}Pm T : average 17Wu04=1.48(0.18) 05Ic02=1.5(0.2), supersedes 01AsZY										**
* $^{159}\text{Pm}^m$ J : 99.6-keV gamma to (15/2-), conf=p5/2[532] n(5/2[523],7/2[633]), K=17/2+										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁵⁹ Sm ^m	E : average 17Pa25=1275.9(1.4) 09Ur04=1276.8(1.0)								**
* ¹⁵⁹ Sm ^m	T : from 09Ur04; other 17Pa25=50(17)								**
* ¹⁵⁹ Eu	J : 90A134=5/2								**
* ¹⁵⁹ Lu	J : favored α decay from ¹⁶³ Ta (J=1/2+)								**
* ¹⁵⁹ Ta	T : average 97Da07=0.83(0.18) 96Pa01=1.10(0.10)								**
* ¹⁵⁹ W	T : others 19Hi06=10.3(+2.1-1.5) 81Ho10=7.3(2.7)								**
* ¹⁵⁹ Re ^m	T : average 07Pa27=16(9) 06Jo10=21(4)								**
¹⁶⁰ Pr	-36200# 400#		170 ms 140	1 ⁺ #	17	17Wu04 TD	2017	β^- =100; β^- -n ?	
¹⁶⁰ Nd	-46720 50		439 ms 37	0 ⁺	17	17Wu04 TD	1985	β^- =100; β^- -n ?	
¹⁶⁰ Nd ^m	-45610 50	1107.9 0.9	1.63 μ s 0.21	(4 ⁻)	17	16Id02 ETJ	2016	IT=100	
¹⁶⁰ Pm	-52894.6 2.0		725 ms 57	6 ⁻ #	17	17Wu04 TD	2012	β^- =100; β^- -n ?	*
¹⁶⁰ Pm ^m	-52704 11	191 11 MD	> 700 ms	1 ⁻ #	20	0Or03 EJT	2020	β^- - ?; IT ?; β^- -n ?	
¹⁶⁰ Sm	-60233.2 2.0		9.6 s 0.3	0 ⁺	05		1986	β^- =100	
¹⁶⁰ Sm ^m	-58871.9 2.0	1361.3 0.4	120 ns 46	(5 ⁻)	09	Si21 ETJ	2009	IT=100	
¹⁶⁰ Sm ^m	-57475.9 2.0	2757.3 0.4	1.8 μ s 0.4	(11 ⁺)	16	Pa01 ETJ	2016	IT=100	
¹⁶⁰ Eu	-63493.4 0.9		42.6 s 0.5	(5 ⁻)	05	18Ha19 TJ	1973	β^- =100	
¹⁶⁰ Eu ^m	-63400.4 0.8	93.0 1.2 MD	30.8 s 0.5	(1 ⁻)	05	18Ha19 ETJ	2016	β^- =100	
¹⁶⁰ Gd	-67942.1 1.1		STABLE >31Ey	0 ⁺	05	01Da22 T	1933	IS=21.86 3; β^- - ?	*
¹⁶⁰ Tb	-67836.5 1.1		72.3 d 0.2	3 ⁻ *	05		1943	β^- =100	
¹⁶⁰ Dy	-69672.4 0.7		STABLE	0 ⁺	05		1938	IS=2.329 18	
¹⁶⁰ Ho	-66382 15		25.6 m 0.3	5 ⁺ *	05		1950	β^+ =100	
¹⁶⁰ Ho ^m	-66322 15	59.98 0.03	5.02 h 0.05	2 ⁻ *	05		1955	IT=73 3; β^+ =27 3	
¹⁶⁰ Ho ⁿ	-66185 22	197 16	$\sim$ 3 s	(9 ⁺)	05	88Bh05 TD	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 30	67 14	74.5 s 1.5	(5 ⁺)	05		1983	IT=85 5; β^+ =15 5	*
¹⁶⁰ Tm ⁿ	-60090# 60#	215# 52#	$\sim$ 200 ns	(8)	05		1986	IT=100	*
¹⁶⁰ Yb	-58163 5		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 ?	
¹⁶⁰ Lu ^m	-50270# 120#	0# 100#	40 s 1		05		1980	β^+ $\approx$ 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 TD	1979	β^+ ?; α =?	*
¹⁶⁰ Ta ^m	-35710 240	110 250	1.55 s 0.04	(9,10) ⁺	05	96Pa01 TD	1979	β^+ ?; α =?	*
¹⁶⁰ W	-29330 150		90 ms 5	0 ⁺	05	96Pa01 TD	1979	α =87 8; β^+ ?	*
¹⁶⁰ Re	-16880# 300#		611 μ s 7	(4 ⁻)	05	11Da12 TJD	1992	p=89 1; α =11 1	*
¹⁶⁰ Re ^m	-16700# 300#	177 15	2.8 μ s 0.1	(9 ⁺)	11	Da01 JT	2011	IT=100	
* ¹⁶⁰ Pm	T : the value of 17Wu04 probably includes both the gs and isomer								**
* ¹⁶⁰ Gd	T : value quoted at 68% CL								**
* ¹⁶⁰ Ho ⁿ	E : from 169.61 keV + x with x<55 keV from Ensdf2005								**
* ¹⁶⁰ Tm ^m	E : from 42.10+x keV above gs; x<50 keV from Ensdf2005								**
* ¹⁶⁰ Tm ⁿ	E : 98.2 keV+x keV above ¹⁶⁰ Tm ^m ; x=50#(50#) keV by Nubase								**
* ¹⁶⁰ Ta	J : favored α decay to ¹⁵⁶ Lu [J=(2-)]								**
* ¹⁶⁰ Ta ^m	J : favored α decay to ¹⁵⁶ Lu ^m [J=10+]								**
* ¹⁶⁰ W	T : average 96Pa01=91(5) 81Ho10=81(15)								**
* ¹⁶⁰ Re	J : other 92Pa05=(2-)								**
¹⁶¹ Pr	-32490# 500#		90# ms >550ns	3/2 ⁻ #	18	Fu08 I	2018	β^- ?; β^- -n ?	
¹⁶¹ Nd	-42230# 400#		215 ms 76	1/2 ⁻ #	17	17Wu04 TD	2012	β^- =100; β^- -n ?	
¹⁶¹ Pm	-50087 9		1.05 s 0.15	(5/2 ⁻)	17	17Wu04 TD	2012	β^- =100; β^- -n ?	
¹⁶¹ Pm ^m	-49121 9	965.9 0.9	0.89 μ s 0.09	(13/2 ⁺)	17	15YoZX TJ	2015	IT=100	
¹⁶¹ Sm	-56672 7		4.8 s 0.4	7/2 ⁺ #	11		1998	β^- =100	
¹⁶¹ Sm ^m	-55284 7	1388.1 0.6	2.6 μ s 0.4	(17/2 ⁻)	17	Pa25 ETJ	2017	IT=100	
¹⁶¹ Eu	-61792 10		26.2 s 2.3	5/2 ⁺ #	11	17Wu04 T	1986	β^- =100	*
¹⁶¹ Gd	-65506.1 1.5		3.646 m 0.003	5/2 ⁻	11	94It.A T	1949	β^- =100	
¹⁶¹ Tb	-67461.8 1.2		6.948 d 0.005	3/2 ⁺ *	11	FGK204 T	1949	β^- =100	
¹⁶¹ Dy	-68055.5 0.7		STABLE	5/2 ⁺ *	11		1934	IS=18.889 42	
¹⁶¹ Dy ^m	-67569.9 0.7	485.56 0.16	760 ns 170	11/2 ⁻	11	12Sw01 T	2012	IT=100	
¹⁶¹ Ho	-67196.3 2.2		2.48 h 0.05	7/2 ⁻ *	11		1954	ϵ =100	
¹⁶¹ Ho ^m	-66985.2 2.2	211.15 0.03	6.76 s 0.07	1/2 ⁺	11		1965	IT=100	
¹⁶¹ Er	-65201 9		3.21 h 0.03	3/2 ⁻ *	11		1954	β^+ =100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
$^{161}\text{Er}^m$	-64805	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	$\beta^+=100$		
$^{161}\text{Tm}^m$	-61891	28	7.51	0.24	5# m	(1/2 ⁺)	11		1981	$\beta^+ ?$;IT ?		
$^{161}\text{Tm}^n$	-61821	28	78.20	0.03	110 ns 3	7/2 ⁻	11		1981	IT=100		
^{161}Yb	-57834	15			4.2 m 0.2	3/2 ⁻ *	11		1974	$\beta^+=100$		
^{161}Lu	-52562	28			77 s 2	1/2 ⁺ *	11		1973	$\beta^+=100$		
$^{161}\text{Lu}^m$	-52380#	28#	182#	5#	7.3 ms 0.4	(9/2 ⁻)	11		1973	IT $\approx$ 100; $\beta^+ ?$	*	
^{161}Hf	-46316	23			18.4 s 0.4	(7/2 ⁻)	15		1973	$\beta^+=99.71$ 5; $\alpha=0.29$ 5		
$^{161}\text{Hf}^m$	-45987	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	$\beta^+ ?$; $\alpha ?$		
$^{161}\text{Ta}^m$	-38717	12	61	23	AD*	(11/2 ⁻)	11	12Th13 D	1979	$\beta^+=93$ 3; $\alpha=7$ 3		
^{161}W	-30510#	200#			409 ms 16	7/2 ⁻ #	11	96Pa01 T	1973	$\alpha=73$ 3; $\beta^+=27$ 3	*	
^{161}Re	-20840	150			440 μs 1	1/2 ⁺	11	06La16 T	1979	p $\approx$ 100; $\alpha ?$		
$^{161}\text{Re}^m$	-20720	150	123.7	1.3	IT	11/2 ⁻	11		1979	$\alpha=93.0$ 3;p=7.0 3		
^{161}Os	-10200#	400#			640 μs 60	(7/2 ⁻)	11		2010	$\alpha\approx 100$		
$^{161}\text{Pm}^m$ J : from 727.5-keV gamma to (11/2 ⁻), 609.2-keV gamma to (13/2 ⁻);												**
$^{161}\text{Pm}^m$ J : conf=p5/2[532] n(1/2[521],7/2[633]), K=13/2+												**
^{161}Eu T : average 17Wu04=30.1(9.0) 90An31=24(4) 86Ma12=27(3)												**
^{161}Er T : other 16Ba65=3.20(0.09)												**
$^{161}\text{Lu}^m$ E : 166.5(0.8) keV above the 3/2+ member of the p1/2[411] band at x keV;												**
$^{161}\text{Lu}^m$ E : x=15#(5#) keV estimated by Nubase												**
^{161}W T : average 96Pa01=409(18) 79Ho10=410(40)												**
^{162}Nd	-39010#	400#			310 ms 200	0 ⁺	17	17Wu04 TD	2012	$\beta^- =100$		
^{162}Pm	-46040#	300#			630 ms 180	2 ⁺ #	17	17Wu04 TD	2012	$\beta^- =100$; $\beta^- \text{ n } ?$		
^{162}Sm	-54379	4			2.7 s 0.3	0 ⁺	07	17Wu04 T	2005	$\beta^- =100$		
$^{162}\text{Sm}^m$	-53370	4	1009.4	0.5	1.78 μs 0.07	(4 ⁻)		17Yo01 ETJ	2017	IT=100	*	
^{162}Eu	-58722.9	1.3			~ 10 s	1 ⁺ #	07	17Wu04 T	1987	$\beta^- =100$		
$^{162}\text{Eu}^m$	-58565.0	1.3	158.0	1.7	MD	(6 ⁺)	07	18Ha19 TJ	2016	$\beta^- =100$		
^{162}Gd	-64281	4			8.4 m 0.2	0 ⁺	07		1967	$\beta^- =100$		
^{162}Tb	-65879.5	2.0			7.60 m 0.15	(1 ⁻)	16		1965	$\beta^- =100$		
$^{162}\text{Tb}^m$	-65594.0	2.5	286	3	10# m	4 ⁻ #		20Or03 EJ	2020	$\beta^- ?$; IT ?		
^{162}Dy	-68181.2	0.7			STABLE	0 ⁺	07		1934	IS=25.475 36		
$^{162}\text{Dy}^m$	-65993.1	0.8	2188.1	0.3	8.3 μs 0.3	8 ⁺		11Sw02 ETD	2011	IT=100		
^{162}Ho	-66041	3			15.0 m 1.0	1 ⁺ *	07		1957	$\beta^+=100$		
$^{162}\text{Ho}^m$	-65935	3	105.87	0.06	67.0 m 0.7	6 ⁻ *	07		1961	IT=62; $\beta^+=38$		
^{162}Er	-66334.2	0.8			STABLE	>140Ty	07	56Po16 T	1938	IS=0.139 5; $\alpha ?$; $2\beta^+ ?$	*	
$^{162}\text{Er}^m$	-64308.2	0.8	2026.01	0.13	88 ns 16	7(-)	07	12Sw01 TJ	1974	IT=100		
^{162}Tm	-61477	26			21.70 m 0.19	1 ⁻ *	07		1963	$\beta^+=100$		
$^{162}\text{Tm}^m$	-61350	50	130	40	24.3 s 1.7	5 ⁺	07	74De47 EDJ	1974	IT=81 4; $\beta^+=19$ 4	*	
^{162}Yb	-59821	15			18.87 m 0.19	0 ⁺	07		1963	$\beta^+=100$		
^{162}Lu	-52830	80			1.37 m 0.02	1 ⁻ *	07		1978	$\beta^+=100$		
$^{162}\text{Lu}^m$	-52710#	220#	120#	200#	*	1.5 m	07		1980	$\beta^+\approx 100$;IT ?		
$^{162}\text{Lu}^n$	-52530#	220#	300#	200#	EU	1.9 m	07		1980	$\beta^+ ?$;IT ?	*	
^{162}Hf	-49168	9			39.4 s 0.9	0 ⁺	07		1982	$\beta^+=99.992$ 1; $\alpha=0.008$ 1		
^{162}Ta	-39780	60			3.57 s 0.12	3 ⁻ #	16		1985	$\beta^+=99.926$ 10; $\alpha=0.074$ 10		
$^{162}\text{Ta}^m$	-39660#	80#	120#	50#	*	5# s				$\beta^+ ?$;IT ?; $\alpha ?$		
^{162}W	-33999	18			1.19 s 0.12	0 ⁺	16		1973	$\beta^+ ?$; $\alpha=45.2$ 16		
^{162}Re	-22450#	200#			107 ms 13	(2) ⁻	07		1979	$\alpha=94$ 6; $\beta^+ ?$		
$^{162}\text{Re}^m$	-22280#	200#	175	9	AD	(9) ⁺	07		1979	$\alpha=91$ 5; $\beta^+ ?$		
^{162}Os	-14500#	300#			2.1 ms 0.1	0 ⁺	07		1989	$\alpha=100$		
$^{162}\text{Sm}^m$ T : other 17Pa25=1.7(0.2)												**
^{162}Eu T : 17Wu04=11.8(1.4) 87Gr12=10.6(1.0) but values include both gs and isomer												**
^{162}Eu J : from 18Ha19; conf p5/2[413]n7/2[633],K=1+												**
^{162}Er T : the lower limit is for α decay												**
$^{162}\text{Tm}^m$ E : from 66.90+x keV; x<125 keV from 74De47												**
$^{162}\text{Lu}^n$ I : existence is tentative and needs confirmation												**
^{163}Nd	-34080#	500#			80# ms >550ns	5/2 ⁻ #		18Fu08 I	2018	$\beta^- ?$; $\beta^- \text{ n } ?$		
^{163}Pm	-42960#	400#			255 ms 25	5/2 ⁻ #	17	19Ki.A T	2012	$\beta^- =100$; $\beta^- \text{ n } ?$	*	
^{163}Sm	-50600	7			1.3 s 0.5	1/2 ⁻ #	17	17Wu04 TD	2012	$\beta^- =100$	*	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{163}Eu	-56573.8	0.9	7.7 s 0.4	$5/2^+ \#$	10	08Os02 T	2007	$\beta^- = 100$
$^{163}\text{Eu}^m$	-55609.3	1.0	911 ns 24	$(13/2^-)$	17	Pa25 TJE	2017	IT=100
^{163}Gd	-61388.6	0.8	68 s 3	$7/2^+$	10	20Za04 J	1982	$\beta^- = 100$
$^{163}\text{Gd}^m$	-61250.4	0.8	23.5 s 1.0	$1/2^-$	14	Ha38 TD	2014	IT= ?; β^- ?
^{163}Tb	-64596	4	19.5 m 0.3	$3/2^+$	10		1966	$\beta^- = 100$
^{163}Dy	-66380.9	0.7	STABLE	$5/2^- *$	10		1934	IS=24.896 42
^{163}Ho	-66378.0	0.7	4.570 ky 0.025	$7/2^- *$	10		1957	$\varepsilon = 100$
$^{163}\text{Ho}^m$	-66080.1	0.7	1.09 s 0.03	$1/2^+$	10		1957	IT=100
$^{163}\text{Ho}^n$	-64268.6	0.8	800 ns 150	$(23/2^+)$	12	Sw01 ETJ	2012	IT=100
^{163}Er	-65167	5	75.0 m 0.4	$5/2^- *$	10		1953	$\beta^+ = 100$
$^{163}\text{Er}^m$	-64722	5	580 ns 100	$(11/2^-)$	10		1974	IT=100
^{163}Tm	-62728	6	1.810 h 0.005	$1/2^+ *$	10		1959	$\beta^+ = 100$
$^{163}\text{Tm}^m$	-62641	6	380 ns 30	$(7/2^-)$	10		1975	IT=100
^{163}Yb	-59294	15	11.05 m 0.35	$3/2^- *$	10		1967	$\beta^+ = 100$
^{163}Lu	-54791	28	3.97 m 0.13	$1/2^+ *$	10		1979	$\beta^+ = 100$
^{163}Hf	-49269	26	40.0 s 0.6	$(5/2^-)$	15		1982	$\beta^+ = 100; \alpha$?
^{163}Ta	-42530	40	10.6 s 1.8	$1/2^+$	10	FGK12a J	1985	$\beta^+ \approx 100; \alpha$?
$^{163}\text{Ta}^m$	-42400#	40#	10# s	$9/2^-$		FGK12a J		$\beta^+ ?; \alpha ?; \text{IT} ?$
^{163}W	-34910	60	2.63 s 0.09	$7/2^-$	10		1973	$\beta^+ ?; \alpha = 14.2$
$^{163}\text{W}^m$	-34430	60	154 ns 3	$13/2^+$	10		2010	IT=100
^{163}Re	-26002	19	390 ms 70	$1/2^+$	10		1979	$\beta^+ ?; \alpha = 32.3$
$^{163}\text{Re}^m$	-25882	19	214 ms 5	$11/2^-$	10		1979	$\alpha = 66.4; \beta^+ ?$
^{163}Os	-16340#	300#	5.7 ms 0.5	$7/2^-$	10	13Dr06 J	1981	$\alpha \approx 100; \beta^+ ?$
^{163}Ir	-5310#	400#		$1/2^+ \#$				p ?
* ^{163}Pm	T : other 17Wu04=430(350)							**
* ^{163}Sm	T : symmetrized from 17Wu04=1.23(+0.51-0.47)							**
* $^{163}\text{Eu}^m$	T : average 17Pa25=990(40) 17Yo01=869(29)							**
* $^{163}\text{Gd}^m$	J : 20Za04=1/2-							**
* ^{163}Ho	T : other: 92Ju01=47(+5-4) d for q=66+ (bare ion)							**
* ^{163}Ta	J : favored α decay from $^{167}\text{Re}^m$ (J=1/2+)							**
* $^{163}\text{Ta}^m$	J : favored α decay from ^{167}Re (J=9/2-)							**
* ^{163}Os	T : average 19Hi06=6.2(+1.3-0.9) 96Bi07=5.5(0.6)							**
^{164}Pm	-38360#	400#	300# ms >550ns	$5^- \#$	18	Fu08 I	2018	$\beta^- ?; \beta^- \text{ n} ?$
^{164}Sm	-47925	4	1.43 s 0.24	0^+	17		2012	$\beta^- = 100; \beta^- \text{ n} ?$
$^{164}\text{Sm}^m$	-46440	4	600 ns 140	(6^-)	17		2014	IT=100
^{164}Eu	-53232.1	2.1	4.16 s 0.19	$3^- \#$	17	17Wu04 T	2007	$\beta^- = 100$
^{164}Gd	-59693.7	1.0	45 s 3	0^+	17		1988	$\beta^- = 100$
$^{164}\text{Gd}^m$	-58597.9	1.1	589 ns 18	(4^-)	17	18Ga18 T	2017	IT=100
^{164}Tb	-62105.0	1.9	3.0 m 0.1	(5^+)	17		1968	$\beta^- = 100$
$^{164}\text{Tb}^m$	-61960	12	2# m	$2^+ \#$	20	Or03 EJ	2020	$\beta^- ?; \text{IT} ?$
^{164}Dy	-65967.6	0.7	STABLE	0^+	17		1934	IS=28.260 54
^{164}Ho	-64980.5	1.4	28.8 m 0.5	$1^+ *$	17		1938	$\varepsilon = 61.1; \beta^+ = 39.1$
$^{164}\text{Ho}^m$	-64840.7	1.4	36.6 m 0.3	$6^- *$	17		1966	IT=100
^{164}Er	-65942.6	0.7	STABLE	0^+	17		1938	IS=1.601 3; $\alpha ?; 2\beta^+ ?$
^{164}Tm	-61909	25	2.0 m 0.1	$1^+ *$	17		1960	$\beta^+ = 100; \varepsilon = 61.1; e^+ = 39.1$
$^{164}\text{Tm}^m$	-61889	28	5.1 m 0.1	$6^- *$	17		1971	IT $\approx$ 80; $\beta^+ \approx$ 20
^{164}Yb	-61012	15	75.8 m 1.7	0^+	17		1960	$\varepsilon = 100$
^{164}Lu	-54642	28	3.14 m 0.03	$1^- *$	17		1977	$\beta^+ = 100$
^{164}Hf	-51818	16	111 s 8	0^+	17		1981	$\beta^+ = 100$
^{164}Ta	-43283	28	14.2 s 0.3	(3^+)	17		1982	$\beta^+ = 100$
^{164}W	-38236	10	6.3 s 0.2	0^+	17		1973	$\beta^+ = 96.2 \text{ 12}; \alpha = 3.8 \text{ 12}$
^{164}Re	-27470	50	719 ms 89	(2^-)	17		1979	$\alpha = ?; \beta^+ ?$
$^{164}\text{Re}^m$	-27520	240	890 ms 130	$(9, 10)^+$	17	09Ha42 TD	2009	$\beta^+ ?; \alpha = 3.1$
^{164}Os	-20420	150	21 ms 1	0^+	17		1981	$\alpha = 96.4; \beta^+ ?$
^{164}Ir	-7480#	320#	1# ms	$2^- \#$	17			p ?; $\alpha ?; \beta^+ ?$
$^{164}\text{Ir}^m$	-7220#	300#	70 μ s 10	(9^+)	17	14Dr02 TD	2001	p= ?; $\alpha = 4.2; \beta^+ ?$
* ^{164}Eu	T : average 17Wu04=3.80(0.56) 08Os02=4.2(0.2)							**
* $^{164}\text{Gd}^m$	T : average 18Ga18=605(30) 17Yo01=580(23); other 17Pa25=530(100)							**
* $^{164}\text{Tm}^m$	E : from 87Dr07<40 keV							**
* ^{164}Re	T : average 09Ha42=848(+140-105) 96Pa01=380(160) 81Ho10=880(240)							**
* ^{164}Re	J : favored α decay to ^{160}Ta [J=(2)-]							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁶⁴ Re ^m	T : symmetrized from 09Ha42=864(+150-110)							**
* ¹⁶⁴ Re ^m	J : favored α decay to ¹⁶⁰ Ta ^m [J=(9,10)+]							**
* ¹⁶⁴ Ir ^m	T : from p(t) in 14Dr02; others 14Dr02=69(+41-29) (α (t))							**
* ¹⁶⁴ Ir ^m	T : 02Ma61=58(+46-18) 01Ke05=110(+60-30)							**
¹⁶⁵ Pm	-34670#	500#	260# ms >550ns	5/2 ⁻ #	18Fu08	I	2018	β^- ?; β^- -n ?
¹⁶⁵ Sm	-43510#	400#	980 ms 210	5/2 ⁻ #	17 17Wu04	TD	2012	β^- =100; β^- -n ?
¹⁶⁵ Eu	-50729	5	2.53 s 0.25	5/2 ⁺ #	08 17Wu04	T	2007	β^+ =100; β^- -n ?
¹⁶⁵ Gd	-56525.8	1.3	11.6 s 1.0	1/2 ⁻ #	06 17Wu04	T	1998	β^- =100
¹⁶⁵ Tb	-60588.8	1.5	2.11 m 0.10	(3/2 ⁺)	06		1983	β^- =100
¹⁶⁵ Tb ^m	-60382	5	0.81 μ s 0.08	(7/2 ⁻)	17Gu08	TDE	2017	IT=100
¹⁶⁵ Dy	-63612.3	0.7	2.332 h 0.004	7/2 ⁺ *	20		1935	β^- =100
¹⁶⁵ Dy ^m	-63504.1	0.7	1.257 m 0.006	1/2 ⁻	06		1963	IT=97.76 11; β^- =2.24 11
¹⁶⁵ Ho	-64898.0	0.8	STABLE	7/2 ⁻ *	06		1934	IS=100
¹⁶⁵ Ho ^m	-64536.3	0.8	361.675 0.011	3/2 ⁺	06		1958	IT=100
¹⁶⁵ Ho ⁿ	-64182.7	0.8	715.33 0.02	7/2 ⁺	06		1958	IT=100
¹⁶⁵ Er	-64521.4	0.9	10.36 h 0.04	5/2 ⁻ *	06		1950	ε =100
¹⁶⁵ Er ^m	-63970.1	1.1	250 ns 30	11/2 ⁻	06		1970	IT=100
¹⁶⁵ Er ⁿ	-62698.4	1.1	370 ns 40	(19/2)	12Sw01	EJT	2012	IT=100
¹⁶⁵ Tm	-62930.0	1.7	30.06 h 0.03	1/2 ⁺ *	06		1953	β^+ =100
¹⁶⁵ Tm ^m	-62849.6	1.7	80 μ s 3	7/2 ⁺	06		1967	IT=100
¹⁶⁵ Tm ⁿ	-62769.5	1.7	9.0 μ s 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	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	30# s	(9/2 ⁻)	FGK12a	J		β^+ ?; α ?
¹⁶⁵ W	-38861	26	5.1 s 0.5	(5/2 ⁻)	06		1975	β^+ =100; α ?
¹⁶⁵ Re	-30659	24	1.6 s 0.6	(1/2 ⁺)	15		1981	β^+ =86 8; α =14 8
¹⁶⁵ Re ^m	-30632	12	1.74 s 0.06	(11/2 ⁻)	15		1978	β^+ =87 1; α =13 1
¹⁶⁵ Os	-21750#	200#	71 ms 3	(7/2 ⁻)	14		1978	α =90 2; β^+ =10 2
¹⁶⁵ Ir	-11600#	160#	50# ns	1/2 ⁺ #	06			p ?; α ?
¹⁶⁵ Ir ^m	-11420	150	325 μ s 33	(11/2 ⁻)	06 14Dr02	TD	1997	p=88 2; α =12 2
¹⁶⁵ Pt	-320#	400#	370 μ s 180	7/2 ⁻ #	19Hi06	T	2019	α =100
* ¹⁶⁵ Eu	T : average 17Wu04=2.14(0.45) 08Os02=2.7(0.3)							**
* ¹⁶⁵ Gd	T : average 17Wu04=12.5(1.3) 98Ic02=9.3(2.3) and 11.2(2.3)							**
* 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 Ir ^m	T : average 14Dr02=340(40) 97Da07=290(60)							**
* ¹⁶⁵ Pt	T : symmetrized from 19Hi06=260(+260-90)							**
¹⁶⁶ Sm	-40450#	400#	800 ms 630	0 ⁺	17 17Wu04	TD	2017	β^- =100
¹⁶⁶ Eu	-46750#	100#	1.24 s 0.12	0 ⁻ #	14 17Wu04	T	2007	β^- =100; β^- -n ?
¹⁶⁶ Gd	-54370.9	1.6	5.1 s 0.8	0 ⁺	15 17Wu04	T	2005	β^- =100
¹⁶⁶ Gd ^m	-52769.4	1.9	950 ns 60	(6 ⁻)	15		2014	IT=100
¹⁶⁶ Tb	-57808.8	1.5	27.1 s 1.5	(1 ⁻)	08 17Wu04	T	1996	β^- =100
¹⁶⁶ Tb ^m	-57649.8	2.1	3.5 μ s 0.4	4 ⁻ #	17GuZW	EJT	2017	IT=100
¹⁶⁶ Dy	-62584.5	0.8	81.6 h 0.1	0 ⁺	08		1949	β^- =100
¹⁶⁶ Ho	-63070.3	0.8	26.812 h 0.007	0 ⁻ *	08 FGK204	T	1936	β^- =100
¹⁶⁶ Ho ^m	-63064.3	0.8	1.1326 ky 0.0039	7 ⁻	08 18Pe02	T	1952	β^- =100
¹⁶⁶ Ho ⁿ	-62879.4	0.8	185 μ s 15	3 ⁺	08		1960	IT=100
¹⁶⁶ Er	-64924.1	0.3	STABLE	0 ⁺	08		1934	IS=33.503 36
¹⁶⁶ Tm	-61886	12	7.70 h 0.03	2 ⁺ *	08		1948	β^+ =100
¹⁶⁶ Tm ^m	-61764	14	348 ms 21	(6 ⁻)	08 96Dr07	TDJ	1996	IT=100
¹⁶⁶ Tm ⁿ	-61642	14	2 μ s 1	(6 ⁻)	08 96Dr07	EDT	1995	IT=100
¹⁶⁶ Yb	-61594	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	1.41 m 0.10	3 ⁻ *	08		1974	β^+ =58 5; IT=42 5
¹⁶⁶ Lu ⁿ	-55980	30	2.12 m 0.10	0 ⁻ *	08		1974	β^+ =90 6; IT ?
¹⁶⁶ Hf	-53859	28	6.77 m 0.30	0 ⁺	08		1965	β^+ =100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{166}Ta	-46098	28	34.4 s 0.5	(2) ⁺	08		1977	$\beta^+=100$
^{166}W	-41887	9	19.2 s 0.6	0 ⁺	08		1975	$\beta^+=99.965\ 12; \alpha=0.035\ 12$
^{166}Re	-31840	90	2.25 s 0.21	(7 ⁺)	08	92Me10 J	1978	$\beta^+=88\ 7; \alpha=12\ 7$
$^{166}\text{Re}^p$	-31560#	100#	3# s	3 ⁻ #	08			$\beta^+ ?; \alpha ?; \text{IT} ?$
^{166}Os	-25432	18	213 ms 5	0 ⁺	16	08Bi15 D	1977	$\alpha=83\ 4; \beta^+=17\ 4$
^{166}Ir	-13310#	200#	10.5 ms 2.2	(2) ⁻	08		1981	$\alpha=93\ 3; p=7\ 3$
$^{166}\text{Ir}^m$	-13130#	200#	15.1 ms 0.9	(9) ⁺	08		1996	$\alpha=98.2\ 6; p=1.8\ 6$
^{166}Pt	-4780#	300#	294 μs 62	0 ⁺	08	19Hi06 T	1996	$\alpha=100$
^{166}Eu T : symmetrized from $^{17}\text{Wu04}=1.27(+0.09-0.14)$; other $08\text{Os02}=1.7(0.3)$								
^{166}Gd T : average $^{17}\text{Wu04}=5.4(1.2)$ $05\text{Ic02}=00\text{As.A}=4.8(1.0)$								
^{166}Tb T : average $^{17}\text{Wu04}=28.3(2.0)$ $05\text{Ic02}=00\text{As.A}=25.6(2.2)$								
$^{166}\text{Tm}^m$ E : from $^{96}\text{Dr07}=109.3+x$ keV with $x<25$ keV								
$^{166}\text{Tm}^m$ T : average $^{96}\text{Dr07}=340(25)$ (34.4(t)) $370(40)$ (74.9(t))								
$^{166}\text{Tm}^n$ E : $^{96}\text{Dr07}=121.710$ keV above $^{166}\text{Tm}^m$								
$^{166}\text{Tm}^n$ T : other $02\text{Ca46}=36(2)$ ns (adopted in Ensdf2008)								
$^{166}\text{Lu}^n$ D : β^+ from $^{74}\text{De09}>80\%$								
^{166}Re D : β^+ and α decays were observed; α from Ensdf2008 <24								
^{166}Os D : α average $08\text{Bi15}=84(4)$ $81\text{Ho10}=72(13)$								
^{166}Pt T : average $^{19}\text{Hi06}=260(+100-60)$ $^{96}\text{Bi07}=300(100)$								
^{167}Sm	-35330#	500#	190# ms $>550\text{ns}$	$7/2^-$ #	18	Fu08 I	2018	$\beta^- ?; \beta^- n ?$
^{167}Eu	-43770#	400#	1.33 s 0.51	$5/2^+$ #	17	$^{17}\text{Wu04}$ TD	2012	$\beta^-=100; \beta^- n ?$
^{167}Gd	-50776	5	4.2 s 0.3	$5/2^-$ #	17	$^{17}\text{Wu04}$ TD	2012	$\beta^-=100$
^{167}Tb	-55883.1	1.9	18.9 s 1.6	(3/2 ⁺)	00	$^{17}\text{Wu04}$ T	1999	$\beta^-=100$
$^{167}\text{Tb}^m$	-55683	6	1.2 μs 0.1	(7/2 ⁻)		$^{17}\text{Gu08}$ TEJ	2017	IT=100
^{167}Dy	-59911	4	6.20 m 0.08	(1/2 ⁻)	00		1960	$\beta^-=100$
^{167}Ho	-62279	5	3.1 h 0.1	$7/2^-$	00		1955	$\beta^-=100$
$^{167}\text{Ho}^m$	-62020	5	6.0 μs 1.0	$3/2^+$	00		1977	IT=100
^{167}Er	-63289.26	0.29	STABLE	$7/2^+*$	00		1934	IS=22.869 9
$^{167}\text{Er}^m$	-63081.46	0.29	2.269 s 0.006	$1/2^-$	00		1986	IT=100
^{167}Tm	-62543.1	1.3	9.25 d 0.02	$1/2^+*$	00		1948	$\varepsilon=100$
$^{167}\text{Tm}^m$	-62363.6	1.3	1.16 μs 0.06	$7/2^-$	00		1964	IT=100
$^{167}\text{Tm}^n$	-62250.3	1.3	0.9 μs 0.1	$7/2^-$	00		1965	IT=100
^{167}Yb	-60590	4	17.5 m 0.2	$5/2^-*$	00		1954	$\beta^+=100$
$^{167}\text{Yb}^m$	-60018	4	~ 180 ns	$11/2^-$	00		1976	IT=100
^{167}Lu	-57530	40	51.5 m 1.0	$7/2^+*$	06		1958	$\beta^+=100$
$^{167}\text{Lu}^m$	-57480#	60#	> 1 m	$1/2^+*$	06		1998	IT ?; $\beta^+ ?$
^{167}Hf	-53468	28	2.05 m 0.05	(5/2 ⁻)	00		1969	$\beta^+=100$
^{167}Ta	-48351	28	1.33 m 0.07	(3/2 ⁺)	00		1982	$\beta^+=100$
^{167}W	-42093	19	19.9 s 0.5	(5/2 ⁻)	00		1985	$\beta^+=99.96\ 1; \alpha=0.04\ 1$
$^{167}\text{W}^m$	-41967	19	$> 1\# \mu\text{s}$	(13/2 ⁺)		$^{92}\text{Th06}$ EJI		IT ?; $\beta^+ ?$
^{167}Re	-34830#	40#	3.4 s 0.4	$9/2^-$	00	$^{10}\text{An01}$ J	1992	$\alpha\approx 100; \beta^+=?$
$^{167}\text{Re}^m$	-34700	40	5.9 s 0.3	$1/2^+$	00	$^{11}\text{Ko.B}$ EJ	1984	$\beta^+ ?; \alpha=?$
^{167}Os	-26500	80	839 ms 5	$7/2^-$	09	$^{10}\text{Sc02}$ TJD	1977	$\alpha=51\ 4; \beta^+ ?$
$^{167}\text{Os}^m$	-26070	80	672 ns 7	$13/2^+$	09	$^{10}\text{Sc02}$ EJD	2009	IT=100
^{167}Ir	-17072	18	29.3 ms 0.6	$1/2^+$	02	$^{05}\text{Sc22}$ TD	1981	$\alpha=43.5\ 19; p=38.6\ 12; \beta^+ ?$
$^{167}\text{Ir}^m$	-16897	18	28.5 ms 0.5	$11/2^-$	02	$^{05}\text{Sc22}$ TD	1995	$\alpha=89\ 3; \beta^+ ?; p=0.41\ 6$
^{167}Pt	-6750#	310#	915 μs 123	$7/2^-$ #	00	$^{19}\text{Hi06}$ T	1996	$\alpha=100$
^{167}Gd T : symmetrized from $^{17}\text{Wu04}=4.26(+0.18-0.32)$								
^{167}Tb T : average $^{17}\text{Wu04}=18.6(2.0)$ $^{99}\text{As03}=19.4(2.7)$								
$^{167}\text{Tm}^m$ J : E2 transition to $3/2^+$								
$^{167}\text{Yb}^m$ J : M1 transition to $9/2^-$ and E1 transition to $13/2^+$								
^{167}W J : population of $J=5/2^+, 7/2^+$ states in ^{167}Ta following β^+ decay;								
^{167}W J : favorite α decay to ^{163}Hf [$J=(5/2^-)$]								
$^{167}\text{W}^m$ I : floated $J=13/2^+$ level observed in $^{92}\text{Th06}$; FGK208=likely E3 to $7/2^-$								
^{167}Os D : α average $^{10}\text{Sc02}=51(5)$ $^{96}\text{Pa01}=49(7)$ $^{81}\text{Ho10}=58(12)$								
$^{167}\text{Os}^m$ J : $^{10}\text{Sc02}=M2$ to $9/2^-$ followed by $M1$ to $7/2^-$								
$^{167}\text{Os}^m$ E : from a least-squares fit to the level scheme of $^{10}\text{Sc02}$								
^{167}Ir T : from p(t); others $^{05}\text{Sc22}=30.9(1.3)$ ($\alpha(t)$) $^{97}\text{Da07}=35.2(2.0)$								
^{167}Ir D : α average $^{05}\text{Sc22}=39.3(1.3)$ $^{97}\text{Da07}=32(4)$; α average								
^{167}Ir D : $^{05}\text{Sc22}=43(2)$ $^{97}\text{Da07}=48(6)$								
$^{167}\text{Ir}^m$ T : average $^{04}\text{Ke06}=25.7(0.8)$ $^{05}\text{Sc22}=28.7(3.3)$ ($\alpha(t)$) and								

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁶⁷ Ir ^m	T : 28.8(1.3) (p(t)) 97Da07=30.0(0.6)							**
* ¹⁶⁷ Ir ^m	D : %p average 05Sc22=0.42(0.08) 97Da07=0.4(0.1); %α average							**
* ¹⁶⁷ Ir ^m	D : 05Sc22=90(3) 97Da07=80(10)							**
* ¹⁶⁷ Pt	T : average 19Hi06=1100(200) 04Ke06=900(+300-200) 96Bi07=700(200)							**
¹⁶⁸ Sm	-31640# 300#		340# ms >550ns	0 ⁺ #	18Fu08	I	2018	β ⁻ ?; β ⁻ n ?
¹⁶⁸ Eu	-39250# 400#		200 ms 100	6 ⁻ #	17 17Wu04	TD	2012	β ⁻ =100; β ⁻ n ?
¹⁶⁸ Gd	-48150# 300#		3.03 s 0.16	0 ⁺	17 17Wu04	TD	1985	β ⁻ =100
¹⁶⁸ Tb	-52781 4		9.4 s 0.4	(4 ⁻)	10 17Wu04	T	1999	β ⁻ =100
¹⁶⁸ Tb ^m	-52570 4	211 1	0.71 μs 0.03	(6 ⁺)	17Gu24	ETJ	2017	IT=100
¹⁶⁸ Dy	-58560 140		8.7 m 0.3	0 ⁺	10		1982	β ⁻ =100
¹⁶⁸ Dy ^m	-57180 140	1378.2 0.6	0.57 μs 0.7	(4 ⁻)	10 19Zh49	ETJ	2019	IT=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	ETJ	1990	IT≈100; β ⁻ ?
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	-62989.23 0.26		STABLE	0 ⁺	10		1934	IS=26.978 18
¹⁶⁸ Er ^m	-61895.19 0.26	1094.0383 0.0016	109.0 ns 0.7	4 ⁻	10		1974	IT=100
¹⁶⁸ Tm	-61312.4 1.7		93.1 d 0.2	3 ⁺ *	10		1949	β ⁺ ≈100; β ⁻ =0.010 7
¹⁶⁸ Yb	-61579.87 0.09		STABLE >130Ty	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	-56908 6	160 40	6.7 m 0.4	3 ⁺ *	10 99Ba65	E	1960	β ⁺ ≈100; IT ?
¹⁶⁸ Hf	-55361 28		25.95 m 0.20	0 ⁺	10		1961	β ⁺ =100; ε≈98; e ⁺ ≈2
¹⁶⁸ Ta	-48394 28		2.0 m 0.1	(3 ⁺)	10 FGK208	J	1969	β ⁺ =100
¹⁶⁸ W	-44893 13		50.9 s 1.9	0 ⁺	10		1971	β ⁺ ≈100; α=0.0032 10
¹⁶⁸ Re	-35790 30		4.4 s 0.1	(7 ⁺)	10 16Ha36	J	1992	β ⁺ ≈100; α≈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	α≈100; β ⁺ ?; β ⁺ p ?
¹⁶⁸ Ir ^m	-18620 240	40 250	163 ms 16	(9, 10) ⁺	10 09Ha42	TD	1996	α=77 9; β ⁺ ?; β ⁺ p ?
¹⁶⁸ Pt	-11010 150		2.02 ms 0.10	0 ⁺	10		1981	α≈100; β ⁺ ?
¹⁶⁸ Au	2530# 400#							p ?
* ¹⁶⁸ Gd	I : first observed by 85Si25 in fission of ²⁵² Cf							**
* ¹⁶⁸ Tb	T : average 17Wu04=9.49(0.39) 99As03=8.2(1.3)							**
* ¹⁶⁸ Yb	T : the lower limit is for α decay;							**
* ¹⁶⁸ Yb	T : 2β ⁺ 19Be27>0.1 Py to 1 Ey; 0nu-BB 19Be27>1.9 Ey							**
* ¹⁶⁸ Lu ^m	E : 19Hu15=160(40) 72Ch44=220(130); others 97Ba26=202.81(0.12) (tentative)							**
* ¹⁶⁸ Lu ^m	E : 99Ba65=202.5(0.4) (tentative)							**
* ¹⁶⁸ Ta	T : other 02At01=5.2(0.7) for q=73+ (bare ion)							**
* ¹⁶⁸ Ta	J : direct β ⁺ feeding to 4+ states in ¹⁶⁸ Hf and expected configuration							**
* ¹⁶⁸ Ta	J : p1/2[541] (Z=73) n5/2[523] (N=95), K=3+							**
* ¹⁶⁸ Ir	T : symmetrized from 09Ha42=222(+60-40)							**
* ¹⁶⁸ Ir	J : favored α decay to ¹⁶⁴ Re [J=(2)-]							**
* ¹⁶⁸ Ir ^m	T : average 09Ha42=160(+30-20) and 153(+40-30) 96Pa01=161(21)							**
* ¹⁶⁸ Ir ^m	J : favored α decay to ¹⁶⁴ Re ^m [J=(9,10)+]							**
¹⁶⁹ Eu	-35660# 500#		420# ms >550ns	5/2 ⁺ #	18Fu08	I	2018	β ⁻ ?
¹⁶⁹ Gd	-43890# 400#		750 ms 210	7/2 ⁻ #	17 17Wu04	TD	2012	β ⁻ =100; β ⁻ n ?
¹⁶⁹ Tb	-50480# 300#		5.13 s 0.32	3/2 ⁺ #	17 17Wu04	TD	2012	β ⁻ =100; β ⁻ n ?
¹⁶⁹ Dy	-55600 300		39 s 8	(5/2 ⁻)	08		1990	β ⁻ =100
¹⁶⁹ Dy ^m	-55430 300	166.1 0.5	1.26 μs 0.17	(1/2 ⁻)	08 19Zh49	ETJ	2019	IT=100
¹⁶⁹ Ho	-58796 20		4.72 m 0.10	7/2 ⁻	08		1963	β ⁻ =100
¹⁶⁹ Ho ^m	-57410 20	1386.2 0.4	118 μs 6	(19/2 ⁺)	10Dr05	ETJ	2010	IT=100
¹⁶⁹ Er	-60921.2 0.3		9.392 d 0.018	1/2 ⁻ *	08		1956	β ⁻ =100
¹⁶⁹ Er ^m	-60829.2 0.3	92.05 0.10	285 ns 20	(5/2 ⁻)	08		1969	IT=100
¹⁶⁹ Er ⁿ	-60677.5 0.3	243.69 0.17	200 ns 10	7/2 ⁺	08		1969	IT=100
¹⁶⁹ Tm	-61274.7 0.7		STABLE	1/2 ⁺ *	08		1934	IS=100
¹⁶⁹ Tm ^m	-60958.6 0.7	316.1463 0.0001	659.9 ns 2.3	7/2 ⁺	08		1950	IT=100
¹⁶⁹ Yb	-60375.53 0.18		32.014 d 0.005	7/2 ⁺ *	08 FGK209	T	1946	ε=100
¹⁶⁹ Yb ^m	-60351.33 0.18	24.1999 0.0016	46 s 2	1/2 ⁻ *	08		1949	IT=100
¹⁶⁹ Lu	-58083 3		34.06 h 0.05	7/2 ⁺ *	08		1955	β ⁺ =100
¹⁶⁹ Lu ^m	-58054 3	29.0 0.5	160 s 10	1/2 ⁻ *	08		1965	IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

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	$\beta^+=100$
^{169}Ta	-50290	28	4.9 m 0.4	$(5/2^+)$	08 98Zh03	J	1969	$\beta^+=100$
^{169}W	-44918	15	74 s 6	$5/2^- \#$	08		1985	$\beta^+=100$
^{169}Re	-38409	11	8.1 s 0.5	$(9/2^-)$	15 92Me10	D	1978	$\beta^+=?; \alpha=0.005\ 3$
$^{169}\text{Re}^m$	-38234	13	15.1 s 1.5	$(1/2^+, 3/2^+)$	15		1984	$\beta^+ ?; \alpha = ?; \text{IT} ?$
^{169}Os	-30723	26	3.46 s 0.11	$(5/2^-)$	08 96Pa01	T	1972	$\beta^+=86.3\ 8; \alpha=13.7\ 8$
^{169}Ir	-22093	23	353 ms 4	$(1/2^+)$	08 12Th13	D	1978	$\alpha=53\ 7; \beta^+ ?$
$^{169}\text{Ir}^m$	-21940	12	280 ms 1	$(11/2^-)$	08 12Th13	TD	1984	$\alpha=79\ 5; \beta^+ ?; \text{p} ?$
^{169}Pt	-12460#	200#	6.99 ms 0.09	$(7/2^-)$	08 09Go16	T	1981	$\alpha \approx 100; \beta^+ ?$
^{169}Au	-1790#	300#	150# μs	$1/2^+ \#$				$\text{p} ?; \alpha ?; \beta^+ ?$
^{169}Dy	T : other 17Wu04=78(37)							**
^{169}Re	D : % α derived from 92Me10=0.001 - 0.01							**
^{169}Re	J : favored α decay from $^{173}\text{Ir}^m$ [J=11/2-] to (11/2-) level							**
^{169}Re	J : at 136.2 keV							**
$^{169}\text{Re}^m$	J : favored α decay from ^{173}Ir [J=(1/2+, 3/2+)]							**
^{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 : other 12Th13=570(30)							**
^{169}Ir	D : % α average of 12Th13=57(9) 05Sc22=42(15) 99Po09=50(18)							**
$^{169}\text{Ir}^m$	D : % α average 12Th13=78(6) 99Po09=84(8) 96Pa01=72(13); other							**
$^{169}\text{Ir}^m$	D : 05Sc22=59(4) at variance, not used							**
$^{169}\text{Ir}^m$	T : others 05Sc22, 07Sa33=280(3) 99Po09=323(+90-66) 96Pa01=308(22)							**
$^{169}\text{Ir}^m$	T : 78Ca11=400(100) 78Sc26=400(200)							**
^{169}Pt	T : average 09Go16=6.99(0.10) 04Ke06=7.0(0.2)							**
^{170}Eu	-30860#	500#						$\beta^- ?; \beta^- \text{n} ?$
^{170}Gd	-40850#	500#	420 ms 130	0^+	18 17Wu04	TD	2012	$\beta^- =100; \beta^- \text{n} ?$
^{170}Tb	-46710#	300#	960 ms 78	$2^- \#$	18 17Wu04	TD	2012	$\beta^- =100; \beta^- \text{n} ?$
^{170}Dy	-53710#	200#	54.9 s 8.0	0^+	18 17Wu04	TD	2010	$\beta^- =100$
$^{170}\text{Dy}^m$	-52070#	200#	0.99 μs 0.04	(6^+)	18		2016	IT=100
^{170}Ho	-56240	50	2.76 m 0.05	(6^+)	18		1960	$\beta^- =100$
$^{170}\text{Ho}^m$	-56140	60	43 s 2	(1^+)	18		1960	$\beta^- =100$
^{170}Er	-60107.5	1.4	STABLE	0^+	18 18Be25	T	1934	IS=14.910 36; $2\beta^- ?; \alpha ?$
^{170}Tm	-59795.3	0.7	128.6 d 0.3	$1^- \#$	18		1936	$\beta^- =99.869\ 10; \varepsilon=0.131\ 10$
$^{170}\text{Tm}^m$	-59612.1	0.7	4.12 μs 0.13	3^+	18 96Ho12	J	1967	IT=100
^{170}Yb	-60763.929	0.010	STABLE	0^+	18		1938	IS=2.982 39
$^{170}\text{Yb}^m$	-59505.47	0.14	370 ns 15	4^-	18		1981	IT=100
^{170}Lu	-57306	17	2.012 d 0.030	$0^+ \#$	18		1951	$\beta^+ =100$
$^{170}\text{Lu}^m$	-57213	17	670 ms 100	4^-	18		1965	IT=100
^{170}Hf	-56254	28	16.01 h 0.13	0^+	18		1961	$\varepsilon=100$
^{170}Ta	-50138	28	6.76 m 0.06	(3^+)	18		1969	$\beta^+ =100$
^{170}W	-47291	13	2.42 m 0.04	0^+	18		1971	$\beta^+ =100$
^{170}Re	-38904	11	> 1# s	$(8^-, 9^-) \#$			1974	$\beta^+ =100$
$^{170}\text{Re}^m$	-38831	12	9.2 s 0.2	(5^+)	18 20Cu04	E	1974	$\beta^+ =?; \text{IT} ?$
$^{170}\text{Re}^n$	-38694	11	130 ns 10	$(6, 7, 8, 9)$	18 19Mo.B	ET	1974	IT=100
^{170}Os	-33926	10	7.37 s 0.18	0^+	18		1972	$\beta^+ =90.5\ 10; \alpha=9.5\ 10$
^{170}Ir	-23180#	100#	910 ms 150	(3^-)	18 02Ro17	TD	1977	$\beta^+ ?; \alpha=5.2\ 17$
$^{170}\text{Ir}^m$	-23140	90	811 ms 18	(8^+)	18		1977	$\alpha=38\ 5; \beta^+ ?; \text{IT} ?$
^{170}Pt	-16299	18	13.93 ms 0.16	0^+	18 04Ke06	T	1981	$\alpha \approx 100; \beta^+ ?$
^{170}Au	-3700#	200#	290 μs 50	(2^-)	18 04Ke06	TD	2002	$\text{p}=89\ 10; \alpha=11\ 10$
$^{170}\text{Au}^m$	-3420#	200#	620 μs 50	(9^+)	18 04Ke06	TD	2002	$\text{p}=58\ 5; \alpha=42\ 5$
^{170}Hg	5420#	300#	310 μs 250	0^+	19Hi06	T	2019	$\alpha=100$
^{170}Gd	T : symmetrized from 17Wu04=410(+140-120)							**
^{170}Tb	T : other 16So13=910(+180-130)							**
$^{170}\text{Lu}^m$	J : M2 to 2+							**
$^{170}\text{Re}^m$	I : introduced in 20Cu04 from Q-value differences between the low-spin							**
$^{170}\text{Re}^m$	I : gs and high-spin isomer in α decay of ^{174}Ir							**
$^{170}\text{Re}^m$	I : using the 19Mo.B decay scheme							**
$^{170}\text{Re}^n$	J : favored α decay from (6,7,8,9) isomer in $^{174}\text{Ir}^m$							**
^{170}Ir	T : symmetrized from 02Ro17=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 04Ke06=286(+50-40)							**
^{170}Au	J : favored α decay to ^{166}Re [J=(2)-]							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁷⁰ Au ^m	T : symmetrized from 04Ke06=617(+50-40); other 02Ma61=570(+310-150)								**
* ¹⁷⁰ Au ^m	D : %p other 02Ma61=75(15)%								**
* ¹⁷⁰ Au ^m	J : favored α decay to ¹⁶⁶ Re ^m [J=(9)+]								**
* ¹⁷⁰ Hg	T : symmetrized from 19Hi06=80(+400-40)								**
¹⁷¹ Gd	-36210#	500#							
¹⁷¹ Tb	-43770#	400#	300# ms >550ns	9/2 ⁺ #	18Fu08	I	2018	β^- ?; β^- n ?	
¹⁷¹ Dy	-50010#	200#	1.23 s 0.10	3/2 ⁺ #	18 17Wu04	TD	2012	β^- =100; β^- n ?	*
¹⁷¹ Ho	-54520	600	4.07 s 0.40	7/2 ⁻ #	18 17Wu04	TD	2012	β^- =100	
¹⁷¹ Er	-57717.8	1.4	53 s 2	7/2 ⁻ #	18		1989	β^- =100	
¹⁷¹ Er ^m	-57519.2	1.4	7.516 h 0.002	5/2 ⁻ *	18		1938	β^- =100	
¹⁷¹ Tm	-59210.3	1.0	210 ns 10	1/2 ⁻	18		1969	IT=100	
¹⁷¹ Tm ^m	-58785.3	1.0	1.92 y 0.01	1/2 ⁺ *	18		1948	β^- =100	
¹⁷¹ Tm ⁿ	-57535.9	1.0	2.60 μ s 0.02	7/2 ⁻	18		1948	IT=100	
¹⁷¹ Tm ⁿ	-57535.9	1.0	1.7 μ s 0.2	19/2 ⁺	18		2009	IT=100	
¹⁷¹ Yb	-59306.818	0.013	STABLE	1/2 ⁻ *	18		1934	IS=14.086 140	
¹⁷¹ Yb ^m	-59211.536	0.013	95.282	0.002	5.25 ms 0.24	7/2 ⁺	18	1968	IT=100
¹⁷¹ Yb ⁿ	-59184.402	0.013	122.416	0.002	265 ns 20	5/2 ⁻	18	1968	IT=100
¹⁷¹ Lu	-57828.5	1.9	8.247 d 0.023	7/2 ⁺ *	18		1951	β^+ =100	
¹⁷¹ Lu ^m	-57757.4	1.9	71.13	0.08	79 s 2	1/2 ⁻ *	18	1965	IT=100
¹⁷¹ Hf	-55431	29	12.1 h 0.4	7/2 ⁺ *	18		1951	β^+ =100	*
¹⁷¹ Hf ^m	-55409	29	21.93	0.09	29.5 s 0.9	1/2 ⁻ *	18	1997	IT $\approx$ 100; β^+ ?
¹⁷¹ Ta	-51720	28	23.3 m 0.3	(5/2 ⁺)	18		1969	β^+ =100	*
¹⁷¹ W	-47086	28	2.38 m 0.04	(5/2 ⁻)	18		1983	β^+ =100	
¹⁷¹ Re	-41250	28	15.2 s 0.4	(9/2 ⁻)	18		1987	β^+ =100	
¹⁷¹ Os	-34297	18	8.3 s 0.2	(5/2 ⁻)	18		1972	β^+ ?; α =1.80 21	
¹⁷¹ Ir	-26410	40	3.1 s 0.3	1/2 ⁺	18 11Ko.B	TJ	1967	β^+ ?; α =15 2	*
¹⁷¹ Ir ^m	-26250#	40#	164#	11#	1.47 s 0.06	(11/2 ⁻)	18 11Ko.B	T	1967
¹⁷¹ Pt	-17470	80	45.5 ms 2.5	7/2 ⁻	18 10Sc02	JD	1981	α =54 5; β^+ ?; p ?	*
¹⁷¹ Pt ^m	-17060	80	412.6	1.0	901 ns 9	13/2 ⁺	18 FGK128	J	2010
¹⁷¹ Au	-7562	21	22.3 μ s 2.4	1/2 ⁺	18 04Ke06	TJ	1997	p $\approx$ 100; α ?	*
¹⁷¹ Au ^m	-7308	18	255	10	p	1.036 ms 0.016	11/2 ⁻	18 04Ke06	TDJ
¹⁷¹ Hg	3340#	310#	70 μ s 30	3/2 ⁻ #	04 04Ke06	TD	2004	α $\approx$ 100; β^+ ?	*
* ¹⁷¹ Tb	T : symmetrized from 17Wu04=1.24(+0.09-0.10)								**
* ¹⁷¹ Hf	J : 00Ye02=7/2								**
* ¹⁷¹ Hf	J : 00Ye02=1/2								**
* ¹⁷¹ Ta	T : Ensdf18 assign this lifetime to an excited state (J^π =5/2-) that is								**
* ¹⁷¹ Ta	T : 31.2 keV above the proposed ground state (J^π =5/2+)								**
* ¹⁷¹ Ir	T : other 02Ro17=3.2(+1.3-0.7)								**
* ¹⁷¹ Ir	D : % α from 13An10=15(2)								**
* ¹⁷¹ Ir ^m	D : % α 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	D : % α average 10Sc02=83(3) 04GoZZ=96(5)								**
* ¹⁷¹ Pt ^m	J : M2 to 9/2- followed by M1 to 7/2- gs								**
* 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 : %p average 04Ke06=34(4) 97Da07=46(4)								**
* ¹⁷¹ Hg	T : symmetrized from 04Ke06=59(+36-16)								**
¹⁷² Gd	-32970#	300#	160# ms >550ns	0 ⁺ #	18Fu08	I	2018	β^- ?; β^- n ?	
¹⁷² Tb	-39690#	500#	760 ms 190	6 ⁺ #	17 17Wu04	TD	2012	β^- =100; β^- n ?	
¹⁷² Dy	-47760#	300#	3.4 s 0.2	0 ⁺	13 16Wa19	TD	2012	β^- =100	
¹⁷² Dy ^m	-46480#	300#	1278	1	710 ms 50	(8 ⁻)	16Wa19	ETJ	2016
¹⁷² Ho	-51480#	200#	25 s 3	0 ⁺ #	15		1991	β^- =100	*
¹⁷² Er	-56483	4	49.3 h 0.5	0 ⁺	15		1956	β^- =100	
¹⁷² Er ^m	-54982	4	1500.9	0.3	579 ns 62	(6 ⁺)	15 10Dr02	ETJ	2006
¹⁷² Tm	-57374	5	63.6 h 0.3	2 ⁻	15		1956	β^- =100	
¹⁷² Tm ^m	-56898	5	476.2	0.2	132 μ s 7	(6 ⁺)	15	2008	IT=100
¹⁷² Yb	-59255.456	0.014	STABLE	0 ⁺	95		1934	IS=21.686 130	
¹⁷² Yb ^m	-57705.03	0.06	1550.43	0.06	3.6 μ s 0.1	6 ⁻	95	1969	IT=100
¹⁷² Lu	-56736.1	2.3	6.70 d 0.03	4 ⁻ *	95		1951	β^+ =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
$^{172}\text{Lu}^m$	-56694.2	2.3	41.86 0.04	3.7 m 0.5	1^-*	95	1962	IT=100; β^+ ?
$^{172}\text{Lu}^n$	-56670.3	2.3	65.79 0.04	332 ns 20	$(1)^+$	95	1965	IT=100
$^{172}\text{Lu}^p$	-56626.7	2.3	109.41 0.10	440 μs 12	$(1)^+$	95	1965	IT=100
$^{172}\text{Lu}^q$	-56522.5	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
$^{172}\text{Hf}^m$	-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	-41570	40	*	55 s 5	(2^+)	16 FGK208 J	1977	β^+ =100
$^{172}\text{Re}^m$	-41460#	60#	110# 50# *	15 s 3	(7^+)	16 FGK208 J	1972	β^+ =100
^{172}Os	-37244	13		19.2 s 0.9	0^+	95 95Hi02 D	1971	β^+ =98.81 17; α =1.19 17
^{172}Ir	-27380	30		4.4 s 0.3	$(3^-, 4^-)$	16	1967	β^+ $\approx$ 98; α $\approx$ 2
$^{172}\text{Ir}^m$	-27240	30	139 10 AD	2.19 s 0.07	(7^+)	16	1967	β^+ =90.5 11; α =9.5 11
^{172}Pt	-21107	10		97.6 ms 1.3	0^+	10 10An02 D	1981	α =96 3; β^+ ?
^{172}Au	-9320	60	*	28 ms 4	$(2)^-$	10	1993	α $\approx$ 100;p ?; β^+ ?
$^{172}\text{Au}^m$	-9160	240	160 250 AD*	11.0 ms 1.0	$(9, 10)^+$	10 09Ha42 T	1993	α $\approx$ 100;p ?
^{172}Hg	-1060	150		231 μs 9	0^+	10	1999	α $\approx$ 100; β^+ ?
* ^{172}Ho T : other 17Wu04=27(11)								
* ^{172}Re J : direct β^+ feeding to 2+; conf=p9/2[514]n5/2[523] (N=97), K=2+								
* $^{172}\text{Re}^m$ J : direct β^+ feeding to 6+ and 8+; conf=p9/2[514]n5/2[523] (N=97), K=7+								
* ^{172}Os D : % α average 04GoZZ=1.4(0.3) 95Hi02=1.1(0.2)								
* ^{172}Pt D : % α average 10An02=97(3) 04GoZZ=94(6) 99Po09=94(12)								
* ^{172}Au T : symmetrized from 09Ha42=22(+6-4)								
* ^{172}Au J : favored α decay to ^{168}Ir [J=(2)-]								
* $^{172}\text{Au}^m$ T : average 09Ha42=9(+2-1) 09Ha42=8(+5-2) (independent measurements);								
* $^{172}\text{Au}^m$ T : others 96Pa01=6.3(1.5) 93Se09=4(1)								
* $^{172}\text{Au}^m$ J : favored α decay to $^{168}\text{Ir}^m$ [J=(9,10)+]								
^{173}Tb	-36510#	500#		400# ms >550ns	$3/2^+ \#$	18Fu08 I	2018	β^- ?; β^- n ?
^{173}Dy	-43740#	400#		1.43 s 0.20	$9/2^+ \#$	17 17Wu04 TD	2012	β^- =100; β^- n ?
^{173}Ho	-49350#	300#		7.1 s 0.4	$7/2^- \#$	17 20Li28 TD	2012	β^- =100
$^{173}\text{Ho}^m$	-48950#	300#	405 1	3.7 μs 1.2	$1/2^+ \#$	17 20Li28 TD	2020	IT=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
$^{173}\text{Tm}^m$	-55938	4	317.73 0.20	10.7 μs 1.7	$7/2^-$	95 12Hu10 TJ	1972	IT=100
$^{173}\text{Tm}^n$	-54350	4	1905.7 0.4	250 ns 69	$19/2^-$	95 12Hu10 ETJ	2012	IT=100
$^{173}\text{Tm}^p$	-52208	4	4047.9 0.5	121 ns 28	$35/2^-$	95 12Hu10 ETJ	2012	IT=100
^{173}Yb	-57551.234	0.011		STABLE	$5/2^-*$	95	1934	IS=16.103 63
$^{173}\text{Yb}^m$	-57152.3	0.5	398.9 0.5	2.9 μs 0.1	$1/2^-$	95	1963	IT=100
^{173}Lu	-56881.0	1.6		1.37 y 0.01	$7/2^+*$	95	1951	ε =100
$^{173}\text{Lu}^m$	-56757.3	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
$^{173}\text{Hf}^m$	-55305	28	107.16 0.05	180 ns 8	$5/2^-$	06	1973	IT=100
$^{173}\text{Hf}^n$	-55215	28	197.47 0.10	160 ns 40	$7/2^+$	06	1973	IT=100
^{173}Ta	-52397	28		3.14 h 0.13	$5/2^-$	95	1960	β^+ =100
$^{173}\text{Ta}^m$	-52224	28	173.10 0.21	205.2 ns 5.6	$9/2^-$	95 95Ca27 E	1977	IT=100
$^{173}\text{Ta}^n$	-50680	28	1717.2 0.4	132 ns 3	$21/2^-$	06Th07 TJ	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	β^+ =99.6 2; α =0.4 2
^{173}Ir	-30268	11		9.0 s 0.8	$(1/2^+, 3/2^+)$	15 01Ko44 J	1967	β^+ =96.5 20; α =3.5 20
$^{173}\text{Ir}^m$	-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^+ ?
$^{173}\text{Au}^m$	-12618	12	214 21 AD	12.2 ms 0.1	$(11/2^-)$	15 99Po09 D	1984	α =89 11; β^+ ?
^{173}Hg	-2660#	200#		800 μs 80	$(7/2^-)$	15	1999	α =100
* ^{173}Ho T : average 20Li28=7.5(0.7) 17Wu04=6.9(0.5)								
* $^{173}\text{Tm}^m$ T : average 12Hu10=11.1(2.8) 72Pu02=10.4(2.1)								
* $^{173}\text{Ta}^m$ T : average 17Wo02=202(6) 91Ku12=225(15)								
* $^{173}\text{Ta}^n$ T : other 17Wo02=148(9)								
* ^{173}Ir J : α decay from ^{177}Au (J=1/2+)								
* ^{173}Ir D : % α from Ensdf2015<7								

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J ^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ¹⁷³ Ir ^m	J : favored α decay from ¹⁷⁷ Au ^m (J=11/2-)								**	
* ¹⁷³ Au	T : average 12Th13=26.3(1.2) 99Po09=25(1)								**	
* ¹⁷³ Au	D : %α symmetrized from 99Po09=94(+6-19)%								**	
* ¹⁷³ Au ^m	D : %α symmetrized from 99Po09=92(+8-13)%								**	
¹⁷⁴ Tb	-31970#	500#	240# ms >550ns	2 ⁻ #	18Fu08	I	2018	β ⁻ ?;β ⁻ n ?		
¹⁷⁴ Dy	-41130#	500#	1# s >300ns	0 ⁺	13 12Ku26	I	2012	β ⁻ ?;β ⁻ n ?		
¹⁷⁴ Ho	-45870#	300#	3.7 s 0.4	(8 ⁻)	17 20Li28	JTD	2012	β ⁻ =100	*	
¹⁷⁴ Er	-51950#	300#	3.2 m 0.2	0 ⁺	99		1989	β ⁻ =100	*	
¹⁷⁴ Er ^m	-50840#	300#	3.9 s 0.3	8 ⁻	17Wu04	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 0.7	0 ⁺	06Ch10	TJD	2006	IT≈100;β ⁻ <1.5	*	
¹⁷⁴ Tm ⁿ	-51770	40	2091.7 0.3	14 ⁻	13Hu08	EJT	2013	IT=100		
¹⁷⁴ Yb	-56944.521	0.011	STABLE	0 ⁺	99		1934	IS=32.025 80		
¹⁷⁴ Yb ^m	-55426.373	0.017	830 μs 40	6 ⁺	99		1964	IT=100		
¹⁷⁴ Yb ⁿ	-55179.3	0.5	256 ns 11	7 ⁻	05Dr05	EJT	2005	IT=100		
¹⁷⁴ Lu	-55570.3	1.6	3.31 y 0.05	1 ⁻ *	99 98Ge13	J	1951	β ⁺ =100		
¹⁷⁴ Lu ^m	-55399.5	1.6	142 d 2	6 ⁻ *	99 98Ge13	J	1960	IT=99.38 2;ε=0.62 2		
¹⁷⁴ Lu ⁿ	-55329.5	1.6	395 ns 15	3 ⁺	99		1980	IT=100	*	
¹⁷⁴ Lu ^p	-55205.1	1.6	145 ns 3	4 ⁻	99		1980	IT=100	*	
¹⁷⁴ Lu ^q	-53714.6	1.7	1855.7 0.5	13 ⁺	09Ko19	ETJ	2009	IT=100		
¹⁷⁴ Lu ^r	-51501.9	1.8	97 ns 10	(21 ⁺)	09Ko19	ETJ	2009	IT=100		
¹⁷⁴ Lu ^s	-49720.7	1.8	242 ns 19	(26 ⁻)	09Ko19	ETJ	2009	IT=100		
¹⁷⁴ Hf	-55844.6	2.3	2.0 Py 0.4	0 ⁺	04		1939	IS=0.16 12;α=100;2β ⁺ ?		
¹⁷⁴ Hf ^m	-54295.3	2.3	138 ns 4	6 ⁺	04 15Ko14	EJ	1976	IT=100		
¹⁷⁴ Hf ⁿ	-54047.0	2.3	2.39 μs 0.04	8 ⁻	04 15Ko14	EJ	1974	IT=100		
¹⁷⁴ Hf ^p	-52532.5	2.3	3.7 μs 0.2	14 ⁺	04 15Ko14	EJ	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		non – exist	EU	> 187 ns	99		1976	IT=100	*	
¹⁷⁴ W ⁿ		non – exist	EU	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 >1us	7 ⁺ #	12Gu14	T	2012	IT ?;β ⁺ ?	
¹⁷⁴ Os	-39995	10	44 s 4	0 ⁺	99		1971	β ⁺ ≈100;α=0.024 7	*	
¹⁷⁴ Ir	-30786	11	7.9 s 0.6	(2 ⁺ ,3 ⁻)	99 20Cu04	J	1967	β ⁺ =99.5 3;α=0.5 3	*	
¹⁷⁴ Ir ^m	-30662	11	4.9 s 0.3	(6,7,8,9)	99 20Cu04	JE	1992	β ⁺ =97.5 3;α=2.5 3		
¹⁷⁴ Pt	-25318	10	862 ms 8	0 ⁺	99 04GoZZ	TD	1966	α=74.9 24;β ⁺ ?	*	
¹⁷⁴ Au	-14060#	100#	139 ms 3	(3 ⁻)	99 02Ro17	TD	1983	α=90 6;β ⁺ ?	*	
¹⁷⁴ Au ^m	-13930	90	162 ms 2	(9 ⁺)	04GoZZ	DTJ	1995	α=?;β ⁺ ?	*	
¹⁷⁴ Hg	-6641	19	2.0 ms 0.4	0 ⁺	99 99Se14	T	1997	α≈100;β ⁺ ?	*	
* ¹⁷⁴ Ho	T : other 17Wu04=3.2(1.1)								**	
* ¹⁷⁴ Er ^m	T : average 17Wu04=3.37(0.73) 09Dr06=4.02(0.35)								**	
* ¹⁷⁴ Er ^m	E : from 15Ko14								**	
* ¹⁷⁴ Tm	J : direct β ⁻ feeding to 5-; conf=p1/2[411] n7/2[514] (N=105), K=4-								**	
* ¹⁷⁴ Tm ^m	E : uncertainty estimated by Nubase								**	
* ¹⁷⁴ Lu ⁿ	J : E1 to 2- and 3-, and no gamma to 1-								**	
* ¹⁷⁴ Lu ^p	J : E1 to 3+ and 4+ and no gamma to 1-								**	
* ¹⁷⁴ W ^m	I : not confirmed in 06Ta13, where the half-life is associated with a								**	
* ¹⁷⁴ W ^m	I : different level								**	
* ¹⁷⁴ W ⁿ	I : not confirmed in 06Ta13, where the half-life is associated with a								**	
* ¹⁷⁴ W ⁿ	I : different level								**	
* ¹⁷⁴ W ^p	E : derived from a least-squares fit to gamma-ray energies in 15Ko14								**	
* ¹⁷⁴ W ^q	E : derived from a least-squares fit to gamma-ray energies in 15Ko14								**	
* ¹⁷⁴ Os	D : %α symmetrized from 71Bo06=0.020(+10-4)%								**	
* ¹⁷⁴ Ir	J : favored α decay from ¹⁷⁸ Au [J=(2+,3-)] in 20Cu04								**	
* ¹⁷⁴ Pt	T : average 04GoZZ=857(3) 14Pe02=930(30) 96Pa01=890(20) 82En03=900(10);								**	
* ¹⁷⁴ Pt	T : Birge ratio=2.85								**	
* ¹⁷⁴ Pt	D : %α average 04GoZZ=74(3) 96Pa01=67(6) 79Ha10=83(5)								**	
* ¹⁷⁴ Au	T : others 83Sc24=120(20) 84ScZQ=123(20), 119(26)								**	
* ¹⁷⁴ Au	J : favored alpha decay to ¹⁷⁰ Ir [J=(3-)]								**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁷⁴ Au ^m	J : non-favored alpha decay to ¹⁷⁰ Ir ^m [J=(8+)]							**
* ¹⁷⁴ Au ^m	T : average 04GoZZ=162(4),171(7) and 163(2) 96Pa01t=171(29)							**
* ¹⁷⁴ Hg	T : symmetrized from 99Se14=1.9(+0.4-0.3); other 97Uu01=2.1(+1.8-0.7)							**
¹⁷⁵ Dy	-36730#	500#	390# ms >550ns	1/2 ⁻ #	18Fu08	I	2018	β^- ?; β^-n ?
¹⁷⁵ Ho	-43300#	400#	1.88 s 0.55	7/2 ⁻ #	17 17Wu04	TD	2012	β^- =100; β^-n ?
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	7/2 ⁻	04 12Hu10	ETJ	2012	IT=100
¹⁷⁵ Tm ^m	-50790	50	1517.7 1.2	23/2 ⁺	04 12Hu10	ETJ	2012	IT=100
¹⁷⁵ Yb	-54695.56	0.07	4.185 d 0.001	7/2 ⁻ *	04 12FI05	J	1945	β^- =100
¹⁷⁵ Yb ^m	-54180.69	0.07	514.866 0.004	1/2 ⁻	04		1972	IT=100
¹⁷⁵ Lu	-55165.7	1.2	STABLE	7/2 ⁺ *	04		1934	IS=97.401 13
¹⁷⁵ Lu ^m	-54812.2	1.2	353.48 0.13	5/2 ⁻	04		1965	IT=100
¹⁷⁵ Lu ⁿ	-53773.3	1.3	1392.4 0.4	19/2 ⁺	04 15Ko14	EJ	1998	IT=100
¹⁷⁵ Hf	-54481.8	2.3	70.65 d 0.19	5/2 ⁻	04 12Fa07	T	1949	ϵ =100
¹⁷⁵ Hf ^m	-54355.9	2.3	125.89 0.12	1/2 ⁻	04		1964	IT=100
¹⁷⁵ Hf ⁿ	-53048.4	2.3	1433.41 0.12	19/2 ⁺	04 95Gj01	J	1990	IT=100
¹⁷⁵ Hf ^p	-51466.2	2.3	3015.6 0.4	35/2 ⁻	04 95Gj01	J	1980	IT=100
¹⁷⁵ Hf ^q	-49845.6	2.6	4636.2 1.2	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	222 ns 8	9/2 ⁻	04 96Ko17	JT	1972	IT=100
¹⁷⁵ Ta ⁿ	-52070	28	339.2 1.3	(1/2) ⁺	04		1969	IT=100
¹⁷⁵ Ta ^p	-50841	28	1567.6 0.3	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	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	(1/2 ⁺)	04 19Gi11	J	1967	β^+ =99.15 28; α =0.85 28
¹⁷⁵ Ir ^m	-33350#	40#	50# 40#	9/2 ⁻ #	04 10Wa02	TI	1967	β^+ = ?; IT ?
¹⁷⁵ Ir ⁿ	-33298	12	97.4 0.7	(5/2 ⁻)	19Gi11	ETJ	2019	IT=100
¹⁷⁵ Pt	-25709	19	2.43 s 0.04	(7/2 ⁻)	04 14Pe02	T	1966	α =64 5; β^+ ?
¹⁷⁵ Au	-17400	40	200 ms 3	1/2 ⁺	04 17Ba46	T	1975	α =88 4; β^+ ?
¹⁷⁵ Au ^m	-17240#	40#	164# 11# AD	(11/2 ⁻)	04 17Ba46	T	1975	α =75 4; β^+ ?
¹⁷⁵ Hg	-7970	80	10.2 ms 0.3	(7/2 ⁻)	09 17Ba46	T	1983	α ≈100; β^+ ?
¹⁷⁵ Hg ^m	-7480	80	340 ns 30	(13/2 ⁺)	09		2009	IT=100
* ¹⁷⁵ Tm	J : l=0 in (t,α), but cannot distinguish between J=1/2 or 3/2							**
* ¹⁷⁵ Ir	T : average 10Wa02=8.8(0.5) 92Sc16=7.2(1.3), 11(3) 92Bo21=13(2); other:							**
* ¹⁷⁵ Ir	T : 67Si02=4.5(1.0)							**
* ¹⁷⁵ Ir ^m	J : from 19Gi11; prolate-deformed p9/2[514] state							**
* ¹⁷⁵ Au	T : average 17Ba46=200(3) 13An10=207(7) 11Ko.B=188(12)							**
* ¹⁷⁵ Au	J : favored α decay from ¹⁷⁹ Tl (J=1/2+)							**
* ¹⁷⁵ Au	D : %α average 13An10=90(7) 11Ko.B=87(4)							**
* ¹⁷⁵ Au ^m	T : others 11Ko.B=124(8), supersedes 01Ko44=143(8), 10An01=138(5)							**
* ¹⁷⁵ Au ^m	T : 02Ro17=158(3) 96Pa01=185(30) 83Sc24=200(22) for mixture gs and isomer							**
* ¹⁷⁵ Au ^m	J : favored α decay to ¹⁷¹ Ir ^m [J=(11/2-)]							**
* ¹⁷⁵ Au ^m	D : %α from 11Ko.B=75(4), corrected for %α=64(5) for the							**
* ¹⁷⁵ Au ^m	D : ¹⁷⁵ Pt daughter							**
* ¹⁷⁵ Hg	T : average 17Ba46=9.6(0.4) 02Ro17=10.8(0.4)							**
¹⁷⁶ Dy	-33610#	500#	440# ms >550ns	0 ⁺	18Fu08	I	2018	β^- ?; β^-n ?
¹⁷⁶ Ho	-39390#	500#	1# s >300ns	4 ⁺ #	13 12Ku26	I	2012	β^- ?; β^-n ?
¹⁷⁶ Er	-46630#	400#	12# s >300ns	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	-53491.322	0.014	STABLE	0 ⁺	06 96De60	T	1934	IS=12.995 83; 2 β^- ?; α ?
¹⁷⁶ Yb ^m	-52441.5	0.6	1049.8 0.6	8 ⁻ *	06		1967	IT= ?; β^- <10#
¹⁷⁶ Lu	-53382.3	1.2	37.01 Gy 0.17	7 ⁻ *	06 06Al03	T	1935	IS=2.599 13; β^- =100; β^+ =0.45 26
¹⁷⁶ Lu ^m	-53259.5	1.2	122.845 0.004	1 ⁻ *	06		1935	β^- ≈100; ϵ =0.095 16
¹⁷⁶ Lu ⁿ	-51867.8	1.3	1514.5 0.5	12 ⁺	06		2000	IT=100
¹⁷⁶ Lu ^p	-51794.5	1.3	1587.8 0.6	14 ⁺	06 15Ko14	EJ	2000	IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{176}Hf	-54576.4	1.5			STABLE	0^+	06		1934	IS=5.26 70	
$^{176}\text{Hf}^m$	-53243.3	1.5	1333.07	0.07	9.6 μs 0.3	6^+	06		1964	IT=100	
$^{176}\text{Hf}^n$	-53017.1	1.5	1559.31	0.09	9.9 μs 0.2	8^-	06		1967	IT=100	
$^{176}\text{Hf}^p$	-51710.6	1.7	2865.8	0.7	401 μs 6	14^-	06		1975	IT=100	
$^{176}\text{Hf}^q$	-49712.8	1.7	4863.6	0.9	43 μs 4	22^-	06	10Mu13 JT	1976	IT=100	
^{176}Ta	-51370	30			8.09 h 0.05	$(1)^-$	06		1948	$\beta^+=100$	
$^{176}\text{Ta}^m$	-51270	30	103.0	1.0	1.08 ms 0.07	7^+	06	78Du06 ET	1971	IT=100	*
$^{176}\text{Ta}^n$	-49900	30	1474.0	1.4	3.8 μs 0.4	14^-	06		1978	IT=100	*
$^{176}\text{Ta}^p$	-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	$\varepsilon=100$	
^{176}Re	-45063	28			5.3 m 0.3	(3^+)	06		1967	$\beta^+=100$	
^{176}Os	-42131	11			3.6 m 0.5	0^+	06		1970	$\beta^+=100$	
^{176}Ir	-33882	8		*	8.7 s 0.5	(3^+)	06	FGK208 J	1967	$\beta^+=96.9\ 6;\alpha=3.1\ 6$	*
$^{176}\text{Ir}^m$	-33830#	50#	50#	50#	10# s	(7^+)	06	FGK208 IJ		$\beta^+=?;\text{IT}?$	*
^{176}Pt	-28934	13			6.33 s 0.15	0^+	06		1966	$\beta^+?;\alpha=40\ 2$	
^{176}Au	-18520	30		*	1.05 s 0.01	$(3^-, 4^-)$	06	14An10 JD	1975	$\alpha=75\ 8;\beta^+?$	
$^{176}\text{Au}^m$	-18380	30	139	13	AD*	$(8^+, 9^+)$	06	14An10 DJ	2002	$\alpha=?;\beta^+?$	*
^{176}Hg	-11785	11			20.3 ms 1.4	0^+	06		1983	$\alpha=90\ 9;\beta^+?$	*
^{176}Tl	580	80			6.2 ms 2.3	$(3^-, 4^-)$	09	04Ke06 TD	2004	$p\approx 100;\alpha?;\beta^+?$	*
* $^{176}\text{Yb}^m$ J : 12FI05=8											**
* ^{176}Lu T : average 37.20(0.23), evaluated by FGK using the world counting data,											**
* ^{176}Lu T : 06Al03=37.13(0.26), using the world data on age comparison of											**
* ^{176}Lu T : terrestrial minerals, 06Al03=35.40(0.80), using the world data on											**
* ^{176}Lu T : age comparison of meteorites											**
* ^{176}Lu D : $\% \beta^+$ from 05Am04<0.9											**
* $^{176}\text{Ta}^m$ T : average 78Du06=1.05(0.10) 71Go21=1.1(0.1)											**
* $^{176}\text{Ta}^n$ E : 1371(1) keV above $^{176}\text{Ta}^m$											**
* $^{176}\text{Ta}^p$ E : 2771(1) keV above $^{176}\text{Ta}^m$											**
* ^{176}Ir J : 205.2-keV gamma, most likely E2, from (1+) state populated by favored											**
* ^{176}Ir J : α decay from ^{180}Au gs [J=(1+)]											**
* $^{176}\text{Ir}^m$ J : direct β^+ feeding to J=6 and 7 states in ^{176}Os implies existence											**
* $^{176}\text{Ir}^m$ J : of a higher-spin β^+ decaying isomer											**
* $^{176}\text{Au}^m$ T : from 04GoZZ; other 02Ro17=840(+170-140)											**
* ^{176}Hg D : $\% \alpha$ symmetrized from 99Po09=94(+6-12)%											**
* ^{176}Tl T : symmetrized from 04Ke06=5.2(+3.0-1.4)											**
* ^{176}Tl J : $I_p=0$ to ^{175}Hg (J=7/2-) in 04Ke06											**
^{177}Ho	-36280#	500#			1# s >550ns	$7/2^-$ #	19	18Fu08 I	2018	$\beta^-=100;\text{n}?$	
^{177}Er	-42860#	500#			8# s >300ns	$1/2^-$ #	19	12Ku26 I	2012	$\beta^-?$	
^{177}Tm	-47570#	200#		*	95 s 7	$1/2^+$ #	19		1989	$\beta^-=100$	
$^{177}\text{Tm}^m$	-47470#	220#	100#	100#	77 s 11	$7/2^-$ #	19		1989	$\beta^-=100$	
^{177}Yb	-50986.40	0.22			1.911 h 0.003	$9/2^+*$	19		1945	$\beta^-=100$	*
$^{177}\text{Yb}^m$	-50654.9	0.4	331.5	0.3	6.41 s 0.02	$1/2^+*$	19		1962	IT=100	*
^{177}Lu	-52383.9	1.2			6.6443 d 0.0009	$7/2^+*$	19		1945	$\beta^-=100$	
$^{177}\text{Lu}^m$	-52233.5	1.2	150.3984	0.0010	130.1 ns 2.4	$9/2^-$	19		1949	IT=100	
$^{177}\text{Lu}^n$	-51814.2	1.2	569.6721	0.0015	155 μs 7	$1/2^+$	19		1965	IT=100	
$^{177}\text{Lu}^p$	-51413.7	1.2	970.1757	0.0024	160.4 d 0.3	$23/2^+*$	19		1962	$\beta^-=77.30\ 8;\text{IT}=22.70\ 8$	
$^{177}\text{Lu}^q$	-49612.2	1.3	2771.7	0.5	625 ns 62	$33/2^+$	19		2004	IT=100	
$^{177}\text{Lu}^r$	-48853.5	1.3	3530.4	0.6	6 μs 2	$39/2^-$	19		2003	IT=100	*
^{177}Hf	-52880.7	1.4			STABLE >1.3Ey	$7/2^+*$	19	20Da04 T	1934	IS=18.60 16	*
$^{177}\text{Hf}^m$	-51565.2	1.4	1315.4502	0.0008	1.09 s 0.05	$23/2^+$	19		1966	IT=100	
$^{177}\text{Hf}^n$	-51538.3	1.7	1342.4	1.0	55.9 μs 1.2	$(19/2^-)$	19		1976	IT=100	
$^{177}\text{Hf}^p$	-50140.7	1.4	2740.02	0.15	51.4 m 0.5	$37/2^-$	19		1971	IT=100	*
^{177}Ta	-51715	3			56.36 h 0.13	$7/2^+*$	19		1948	$\beta^+=100$	
$^{177}\text{Ta}^m$	-51642	3	73.16	0.07	410 ns 7	$9/2^-$	19		1973	IT=100	
$^{177}\text{Ta}^n$	-51529	3	186.16	0.06	3.62 μs 0.10	$5/2^-$	19		1971	IT=100	
$^{177}\text{Ta}^p$	-50360	3	1354.8	0.3	5.30 μs 0.11	$21/2^-$	19		1971	IT=100	
$^{177}\text{Ta}^q$	-47059	3	4656.3	0.8	133 μs 4	$49/2^-$	19		1994	IT=100	
^{177}W	-49702	28			132.4 m 2.0	$1/2^-$	19		1950	$\beta^+=100$	
^{177}Re	-46269	28			14 m 1	$5/2^-$	19		1957	$\beta^+=100$	
$^{177}\text{Re}^m$	-46170#	60#	100#	50#	> 100 ns	$9/2^-$	19			IT=100	
$^{177}\text{Re}^n$	-46184	28	84.70	0.10	50 μs 10	$5/2^+$	19		1972	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{177}Os	-41956	15			3.0 m 0.2	$1/2^-$	19		1970	$\beta^+=100$	
^{177}Ir	-36047	20			29.8 s 1.7	$5/2^-$	19		1967	$\beta^+\approx 100; \alpha=0.06$	
$^{177}\text{Ir}^m$	-35950#	50#	100#	50#	> 100 ns	$(9/2^-)$	19			IT=100	
$^{177}\text{Ir}^n$	-35866	20	180.9	0.4	> 100 ns	$5/2^+$	19		1991	IT=100	
^{177}Pt	-29370	15			10.0 s 0.4	$5/2^-$	19		1966	$\beta^+=94.3$ 5; $\alpha=5.7$ 5	
$^{177}\text{Pt}^m$	-29223	15	147.5	0.4	2.35 μs 0.04	$1/2^-$	19	19Gi11	T 1979	IT=100	
^{177}Au	-21546	10			1.501 s 0.020	$1/2^+*$	19		1968	$\alpha=40$ 6; $\beta^+=60$ 6	
$^{177}\text{Au}^m$	-21356	10	190	7	AD	$11/2^-*$	19	20Ba17	J 1975	$\alpha=60$ 10; $\beta^+?$	
^{177}Hg	-12780	80			117 ms 7	$7/2^-*$	19		1975	$\alpha\approx 100; \beta^+?$	
$^{177}\text{Hg}^m$	-12460	80	323.2	1.3		$13/2^+$	19		2003	IT=100	
^{177}Tl	-3340	22			18 ms 5	$(1/2^+)$	19		1999	$\alpha=73$ 13; p?	
$^{177}\text{Tl}^m$	-2533	12	807	18	p	$(11/2^-)$	19		1997	p=51 8; $\alpha=49$ 8	
* ^{177}Yb	J: 12Fi05=9/2										
* $^{177}\text{Yb}^m$	J: 12Fi05=1/2										
* $^{177}\text{Lu}^r$	T: other: 04Al04=7(2) m, not trusted										
* ^{177}Hf	J: 95Ji15=7/2										
* $^{177}\text{Hf}^p$	T: other 04Al04=76(+16-9) from decay growth										
* ^{177}Au	J: 18Cu04=1/2										
* ^{177}Hg	J: 19Se04=7/2										
^{178}Ho	-32130#	500#			750# ms > 550ns	$2^+ \#$		18Fu08	I 2018	$\beta^-?: \beta^-n?$	
^{178}Er	-40260#	600#			4# s > 300ns	0^+		13 12Ku26	I 2012	$\beta^-?$	
^{178}Tm	-44240#	300#			10# s > 300ns	$1^- \#$		11 09St16	I 2008	$\beta^-?: \beta^-n?$	
^{178}Yb	-49677	7			74 m 3	0^+		09		1973	
^{178}Lu	-50337.9	2.3			28.4 m 0.2	1^+*		09		1957	
$^{178}\text{Lu}^m$	-50214	3	123.8	2.6	RQ	9^-*		09		1951	
^{178}Hf	-52435.4	1.4			STABLE	0^+		09		1934	
$^{178}\text{Hf}^m$	-51288.0	1.4	1147.416	0.006		8^-		09		1960	
$^{178}\text{Hf}^n$	-49989.3	1.4	2446.09	0.08		16^+		09		1968	
$^{178}\text{Hf}^p$	-49863.0	1.4	2572.4	0.3		14^-		09		1977	
^{178}Ta	-50600#	50#			2.36 h 0.08	7^-		09		1950	
$^{178}\text{Ta}^m$	-50498	15	100#	50#	*	(1^+)		09 96Ko13	E 1950	$\beta^+=100$	
$^{178}\text{Ta}^n$	-49130#	50#	1467.82	0.16		15^-		09 96Ko13	ETJ 1979	IT=100	
$^{178}\text{Ta}^p$	-47700#	50#	2901.9	0.7		21^-		09 96Ko13	ETJ 1996	IT=100	
^{178}W	-50407	15			21.6 d 0.3	0^+		09		1950	
$^{178}\text{W}^m$	-43834	15	6572.7	0.3		25^+		09		1998	
^{178}Re	-45653	28			13.2 m 0.2	(3^+)		09		1957	
^{178}Os	-43544	14			5.0 m 0.4	0^+		09		1967	
^{178}Ir	-36254	19			12 s 2	$3^+ \#$		09		1972	
^{178}Pt	-31997	10			20.7 s 0.7	0^+		09		1966	
^{178}Au	-22303	10			3.4 s 0.5	$(2^+, 3^-)*$		09 20Cu04	TDJ 1968	$\beta^+=84$ 1; $\alpha=16$ 1	
$^{178}\text{Au}^m$	-22253	10	50.3	0.2		$(4^-, 5^+)$		19Mo.B	ETD2019	IT=100	
$^{178}\text{Au}^n$	-22117	10	186	14	MD	$(7^+, 8^-)$		20Cu04	TDJ 2015	$\beta^+=82$ 1; $\alpha=18$ 1	
$^{178}\text{Au}^p$	-22060	17	243	14		$(5^+, 6)$		19Mo.B	ETD2019	IT=100	
$^{178}\text{Au}^q$	-21938	24	365	21	AD						
^{178}Hg	-16315	11			266.5 ms 2.4	0^+		09 12Ve04	D 1971	$\alpha=89$ 4; $\beta^+?$	
^{178}Tl	-4610#	100#			255 ms 9	$(4^-, 5^-)$		09 13Li49	TJD 1997	$\alpha=62$ 2; $\beta^+=38$ 2;	
										$\beta^+ \text{SF}=0.15$ 6	
^{178}Pb	3573	23			250 μs 80	0^+		09 16Ba60	T 2001	$\alpha\approx 100; \beta^+?$	
* $^{178}\text{Ta}^m$	E: K=1+ state (p9/2-[514]+n7/2-[514]) is expected 120 keV above the 7- gs,										
* $^{178}\text{Ta}^m$	E: based on E=220 keV for K=8+ (p9/2-[514]+n7/2-[514]) and										
* $^{178}\text{Ta}^m$	E: Gallagher-Moszkowski splitting energy of 100 keV										
* $^{178}\text{Ta}^m$	J: log ft=4.7 in ^{178}W β^- decay consistent with n7/2[514] -> p9/2[514]										
* $^{178}\text{Ta}^n$	E: from a least-squares fit to gamma rays in 96Ko13										
* $^{178}\text{Ta}^n$	T: average 96Ko13=58(4) 79Du02=60(5)										
* $^{178}\text{Ta}^p$	E: from a least-squares fit to gamma rays in 96Ko13										
* $^{178}\text{Au}^m$	E: 50.3(0.2)-keV E2 above ^{178}Au										
* $^{178}\text{Au}^n$	E: from 20Cu04 using directly measured masses, supersedes 15Ma.A										
* $^{178}\text{Au}^p$	E: 56.6(0.4)-keV E2 above $^{178}\text{Au}^n$										
* ^{178}Tl	T: average 13Li49=252(20) 02Ro17=254(+11-9)										
* ^{178}Pb	T: from $\tau=266(+184-77)$, average of four events in 16Ba60 at 365, 127,										
* ^{178}Pb	T: 588 and 166 us and two events in 01Ro.B at 202 and 147 us										

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
^{179}Er	-36080#	500#	3# s >550ns	3/2 ⁻ #		18Fu08 I	2018	β^- ?; β^-n ?
^{179}Tm	-41900#	400#	18# s >300ns	1/2 ⁺ #	13	12Ku26 I	2012	β^- ?; β^-n ?
^{179}Yb	-46640#	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
$^{179}\text{Lu}^m$	-48467	5	3.1 ms 0.9	1/2 ⁺	09		1982	IT=100
^{179}Hf	-50463.0	1.4	STABLE	9/2 ⁺ *	09		1934	IS=13.62 11
$^{179}\text{Hf}^m$	-50088.0	1.4	18.67 s 0.04	1/2 ⁻	09		1962	IT=100
$^{179}\text{Hf}^n$	-49356.6	1.4	1106.412	0.033	25.00 d 0.17	09 19Kr06 ET	1970	IT=100
$^{179}\text{Hf}^p$	-46687.8	2.5	3775.2	2.1	15 μ s 5	(43/2 ⁺)	09	2000 IT=100
^{179}Ta	-50357.5	1.5	1.82 y 0.03	7/2 ⁺	09		1950	ϵ =100
$^{179}\text{Ta}^m$	-50326.8	1.5	1.42 μ s 0.08	9/2 ⁻	09		1964	IT=100
$^{179}\text{Ta}^n$	-49837.3	1.5	520.23	0.18	280 ns 80	1/2 ⁺	09 FGK128 J	1974 IT=100
$^{179}\text{Ta}^p$	-49104.9	1.5	1252.60	0.23	322 ns 16	21/2 ⁻	09 97Ko13 J	1982 IT=100
$^{179}\text{Ta}^q$	-49040.3	1.6	1317.2	0.4	9.0 ms 0.2	25/2 ⁺	09 97Ko13 J	1982 IT=100
$^{179}\text{Ta}^r$	-49029.5	1.6	1328.0	0.4	1.6 μ s 0.4	23/2 ⁻	09 97Ko13 J	1982 IT=100
$^{179}\text{Ta}^x$	-47718.2	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
$^{179}\text{W}^m$	-49073	15	6.40 m 0.07	1/2 ⁻	09		1950	IT $\approx$ 100; β^+ =0.29 4
$^{179}\text{W}^n$	-47663	15	1631.90	0.08	390 ns 30	21/2 ⁺	09 94Wa05 J	1978 IT=100
$^{179}\text{W}^p$	-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
$^{179}\text{Re}^m$	-46519	25	65.35	0.09	95 μ s 25	(5/2 ⁻)	09	1972 IT=100
$^{179}\text{Re}^n$	-44760#	60#	1822#	50#	408 ns 12	(23/2 ⁺)	09	1972 IT=100
$^{179}\text{Re}^p$	-41176	25	5408.0	0.5	466 μ s 15	(47/2, 49/2 ⁺)	09 15Ko14 J	1989 IT=100
^{179}Os	-43020	16	6.5 m 0.3	1/2 ⁻	09		1968	β^+ =100
$^{179}\text{Os}^m$	-42875	16	145.41	0.12	500 ns	(7/2 ⁻)	09	1983 IT=100
$^{179}\text{Os}^n$	-42777	16	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	β^+ $\approx$ 100; α =0.24 3
^{179}Au	-24989	12	7.1 s 0.3	1/2 ⁺ *	09 18Cu04 J	1968		β^+ =78.0 9; α =22.0 9
$^{179}\text{Au}^m$	-24900	12	89.5	0.3	327 ns 5	(3/2 ⁻)	11Ve01 ETD2011	IT=100
$^{179}\text{Au}^n$	-24856	19	133.5	15.0	(9/2 ⁻)	09 11Ve01 EJD 1980		IT ?
^{179}Hg	-16933	28	1.05 s 0.03	7/2 ⁻ *	09 12Ve04 D	1970		α =75 4; β^+ =25 4; β^+ p $\approx$ 0.15
$^{179}\text{Hg}^m$	-16762	28	171.4	0.4	6.4 μ s 0.9	13/2 ⁺	09 02Je09 J	2002 IT=100
^{179}Tl	-8270	40	437 ms 9	1/2 ⁺ *	09		1983	α =60 2; β^+ ?
$^{179}\text{Tl}^m$	-7450#	40#	825#	10#	1.41 ms 0.02	(11/2 ⁻)	09 18Ba46 TJ	1983 α $\approx$ 100; IT ?; β^+ ?
$^{179}\text{Tl}^n$	-7370	40	904.5	0.9	119 ns 14	(9/2 ⁻)	09 18Ba46 TJD 2018	IT=100
^{179}Pb	2050	80	2.7 ms 0.2	(9/2 ⁻)	10 18Ba46 TJD 2010			α =100
* $^{179}\text{Hf}^n$	T : average 19Kr06=24.91(0.27) 70KaZV=25.3(0.3) 73Ch18=24.8(0.3).							**
* $^{179}\text{Hf}^n$	T : other 70Hu04=29(1)							**
* $^{179}\text{Re}^n$	E : from 1772.20(0.22)+x keV; x=50#(50#) estimated by Nubase							**
* $^{179}\text{Au}^m$	E : from 19Mo.B							**
* $^{179}\text{Au}^m$	T : average 19Mo.B=304(9) 11Ve01=328(2); Birge ratio=2.6							**
* $^{179}\text{Au}^p$	E : from 44(15) above 89.5 keV level							**
* ^{179}Hg	J : 19Se04=7/2							**
* ^{179}Tl	T : average 17Ba46=426(10) 11Ko.B=489(21); other 02Ro17=415(55)							**
* ^{179}Tl	T : 13An10t=265(10) 98To14=230(40) 83Sc24=160(+90-40)							**
* ^{179}Tl	J : 17Ba04=1/2; favored α decay to ^{175}Au (J=1/2+)							**
* ^{179}Tl	D : % α from 13An10							**
* $^{179}\text{Tl}^m$	J : from favored α decay to $^{175}\text{Au}^m$ [J=(11/2-)]							**
* $^{179}\text{Tl}^m$	T : average 18Ba46=1.40(0.03) 11Ko.B=1.36(0.04) 10An01=1.46(0.04)							**
* $^{179}\text{Tl}^n$	T : symmetrized from 18Ba46=114(+18-10)							**
* ^{179}Pb	T : other 10An01=3.5(+1.4-0.8)							**
^{180}Er	-33180#	500#	2# s >550ns	0 ⁺		18Fu08 I	2018	β^- ?; β^-n ?
^{180}Tm	-38170#	400#	3# s >300ns		15		2012	β^- ?; β^-n ?
^{180}Yb	-44720#	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
$^{180}\text{Lu}^m$	-46670	70	$\sim$ 1 s	3 ⁻	15 95Me03 JT	1995		IT ?; β^- ?
$^{180}\text{Lu}^n$	-46060	70	> 1 ms	(9 ⁻)	15 01Wh02 EJT	2001		IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)
^{180}Hf	-49779.5	1.4			STABLE	0^+	15	1934	IS=35.08 33
$^{180}\text{Hf}^m$	-48637.9	1.4	1141.552	0.015	5.53 h 0.02	8^-	15	1951	IT $\approx$ 100; β^- =0.31 8
$^{180}\text{Hf}^n$	-48405.1	1.4	1374.36	0.04	570 μs 20	4^-	15 15Ko14 J	1990	IT=100
$^{180}\text{Hf}^p$	-47294.0	1.5	2485.5	0.5	940 ns 110	12^+	15 16Ta23 T	2000	IT=100
$^{180}\text{Hf}^q$	-46180.5	1.7	3599.0	1.0	90 μs 10	(18 $^-$)	15	1999	IT=100
^{180}Ta	-48933.6	2.1			8.154 h 0.006	1^+	15	1938	ϵ =85 3; β^- =15 3
$^{180}\text{Ta}^m$	-48858.3	1.6	75.3	1.4 RQ	STABLE >45 Py	9^-	15 17Le01 T	1940	IS=0.01201 32; β^- ?
$^{180}\text{Ta}^n$	-47481.2	2.1	1452.39	0.22	31.2 μs 1.4	15^-	15	1996	IT=100
$^{180}\text{Ta}^p$	-45254.7	2.3	3678.9	1.0	2.0 μs 0.5	(22 $^-$)	15	2000	IT=100
$^{180}\text{Ta}^q$	-44761.4	2.6	4172.2	1.6	17 μs 5	(24 $^+$)	15 00Wh04 EJ	2000	IT=100
^{180}W	-49636.2	1.4			1.59 Ey 0.5	0^+	15 14Mu.A TD	1937	IS=0.12 1; α $\approx$ 100; $2\beta^+$?
$^{180}\text{W}^m$	-48107.1	1.4	1529.05	0.04	5.47 ms 0.09	8^-	15	1978	IT=100
$^{180}\text{W}^n$	-46371.5	1.4	3264.7	0.3	2.33 μs 0.19	14^-	15 15Ko14 TEJ	1966	IT=100
^{180}Re	-45837	21			2.46 m 0.03	(1) $^-$	15	1955	β^+ =100
$^{180}\text{Re}^m$	-45750#	40#	90#	30#	> 1# μs	(4 $^+$, 5 $^+$)	05E110 J	2005	IT $\approx$ 100; β^+ ?
$^{180}\text{Re}^n$	-42280#	40#	3561#	30#	9.0 μs 0.7	21^-	15 05E110 TJD	2005	IT=100
^{180}Os	-44356	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	-34430	10			56 s 3	0^+	15 20Cu02 D	1966	β^+ =99.48 5; α =0.52 5
^{180}Au	-25626	5			7.9 s 0.3	(1 $^+$)*	15 20Ha24 JTD	1977	β^+ =99.42 10; α =0.58 10
^{180}Hg	-20251	13			2.59 s 0.01	0^+	15	1970	β^+ =52 2; α =48 2
^{180}Tl	-9390	70			1.09 s 0.01	(4 $^-$)*	15 17Ba04 J	1987	β^+ =93 3; α =7 3; β^+ SF=0.0032 2
^{180}Pb	-1941	12			4.1 ms 0.3	0^+	15	1996	α =100
* $^{180}\text{Hf}^n$	T : other 16Ta23=520(80)								**
* $^{180}\text{Hf}^n$	I : 99Da09 (same group as 16Ta23) reported a 15(5)us, J=(10+) isomer at								**
* $^{180}\text{Hf}^n$	I : 2425.8(1.0) keV, but it was retracted by 16Ta23								**
* ^{180}W	T : others partial α half-life 04Co26=1.8(0.2) Ey; $2\beta^+$ 03Da09>80 Py								**
* $^{180}\text{Re}^n$	E : 3471.8(0.6) keV above $^{180}\text{Re}^m$ in 05E110								**
* ^{180}Au	T : average 20Ha24=7.2(0.5) 77Hu05=8.1(0.3); other 93BoZK=9.7(0.6)								**
* ^{180}Tl	D : % α 03An27=(2-12)%; % β^+ SF from 13E108, supersedes								**
* ^{180}Tl	D : 10An13=0.0036(0.0007); other 98To14~1.0e-4								**
^{181}Tm	-35440#	500#			7# s >300ns	1/2 $^+$ #	13 12Ku26 I	2012	β^- ?; β^- n ?
^{181}Yb	-41090#	300#			1# m >300ns	3/2 $^-$ #	13 09St16 I	2000	β^- ?
^{181}Lu	-44800	130			3.5 m 0.3	7/2 $^+$ #	06	1982	β^- =100
^{181}Hf	-47403.0	1.4			42.39 d 0.06	1/2 $^-$	06	1935	β^- =100
$^{181}\text{Hf}^m$	-46807.7	1.4	595.27	0.04	80 μs 5	9/2 $^+$	06 01Sh36 T	2001	IT=100
$^{181}\text{Hf}^n$	-46359.5	1.6	1043.5	0.8	$\sim$ 100 μs	(17/2 $^+$)	06	2001	IT=100
$^{181}\text{Hf}^p$	-45661.1	1.9	1741.9	1.3	1.5 ms 0.5	(25/2 $^-$)	06	2001	IT=100
^{181}Ta	-48439.1	1.6			STABLE	7/2 $^+$ *	06	1932	IS=99.98799 32
$^{181}\text{Ta}^m$	-48432.9	1.6	6.237	0.020	6.05 μs 0.12	9/2 $^-$ *	06	1979	IT=100
$^{181}\text{Ta}^n$	-47823.9	1.6	615.19	0.03	18 μs 1	1/2 $^+$	06	1948	IT=100
$^{181}\text{Ta}^p$	-47011	14	1428	14	140 ns 36	19/2 $^+$ #	98Sa60 ITD	1998	IT=100
$^{181}\text{Ta}^q$	-46955.7	1.6	1483.43	0.21	25.2 μs 1.8	21/2 $^-$	06 98Wh02 T	1998	IT=100
$^{181}\text{Ta}^r$	-46211.2	1.8	2227.9	0.9	210 μs 20	29/2 $^-$	06 98Wh02 J	1998	IT=100
^{181}W	-48233.9	1.4			120.956 d 0.019	9/2 $^+$	06 14Un01 T	1947	ϵ =100
$^{181}\text{W}^m$	-47868.4	1.4	365.55	0.13	14.59 μs 0.15	5/2 $^-$	06	1968	IT=100
$^{181}\text{W}^n$	-46580.9	1.4	1653.0	0.3	200 ns 13	21/2 $^+$	06 93YeZX ET	1973	IT=100
^{181}Re	-46517	13			19.9 h 0.7	5/2 $^+$ *	06	1957	β^+ =100
$^{181}\text{Re}^m$	-46254	13	262.91	0.11	156.7 ns 1.9	9/2 $^-$	06	1967	IT=100
$^{181}\text{Re}^n$	-44861	13	1656.37	0.14	250 ns 10	21/2 $^-$	06	1974	IT=100
$^{181}\text{Re}^p$	-44636	13	1880.57	0.16	11.5 μs 0.9	25/2 $^+$	06	2000	IT=100
$^{181}\text{Re}^q$	-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
$^{181}\text{Os}^m$	-43501	25	49.20	0.14	2.7 m 0.1	7/2 $^-$	06	1966	β^+ =100
$^{181}\text{Os}^n$	-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
$^{181}\text{Ir}^m$	-39174	5	289.33	0.13	298 ns	5/2 $^+$	06	1992	IT=100
$^{181}\text{Ir}^n$	-39097	5	366.30	0.22	126 ns 6	9/2 $^-$	06	1992	IT=100
^{181}Pt	-34381	14			52.0 s 2.2	1/2 $^-$ *	06 95Bi01 D	1966	β^+ $\approx$ 100; α =0.074 10
$^{181}\text{Pt}^m$	-34264	14	116.65	0.08	> 300 ns	7/2 $^-$	06 90De03 J	1992	IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{181}Au	-27871	20	13.7 s 1.4	(5/2 ⁻)	06		1968	$\beta^+=97.3\ 5;\alpha=2.7\ 5$	*
$^{181}\text{Au}^p$	-27660#	200#		(11/2 ⁻)	06				
^{181}Hg	-20661	15	3.6 s 0.1	1/2 ⁻ *	06		1969	$\beta^+=73\ 2;\alpha=27\ 2;$ $\beta^+p=0.014\ 3;\beta^+\alpha=9e-6\ 3$	*
$^{181}\text{Hg}^m$	-20450	50						IT=100	
^{181}Tl	-12799	9	2.9 s 0.1	1/2 ⁺ *	09	18Cu04	TD	$\beta^+ ?;\alpha=8.6\ 6$	*
$^{181}\text{Tl}^m$	-11963	9	1.40 ms 0.03	(9/2 ⁻)	09	09An14	JD	IT=99.60 4; $\alpha=0.40\ 6;\beta^+ ?$	
^{181}Pb	-3110	90	39.0 ms 0.8	(9/2 ⁻)	06	09An20	TJ	$\alpha\approx 100;\beta^+ ?$	*
$^{181}\text{Pb}^m$				13/2 ⁺ #		96To01	I		
<i>non-exist</i> RN									
* $^{181}\text{Ta}^p$	E : 1403.2(0.6)+x keV with x<50 keV in 98Sa60								**
* $^{181}\text{Ta}^p$	J : most likely E1 for the depopulating gamma to the 1403.2-keV (J=17/2-)								**
* $^{181}\text{Ta}^p$	J : level, as proposed in 98Dr09, and hence J=19/2+; 98Sa60 suggests								**
* $^{181}\text{Ta}^p$	J : J=15/2- for the 1403.2-keV level, but then J=19/2+ seems unlikely,								**
* $^{181}\text{Ta}^p$	J : since the depopulating gamma would be M2 and much longer half-life								**
* $^{181}\text{Ta}^p$	J : would be expected								**
* $^{181}\text{Ta}^q$	T : average 98Wh02=25(2) 98Dr09=23(+6-2)								**
* ^{181}W	T : average 14Un01=121.03(0.07) 73My02=120.95(0.02); other								**
* ^{181}W	T : 72Em01=121.53(0.09), outlier								**
* ^{181}Pt	J : 99Le52=1/2								**
* ^{181}Au	J : favored α decay to ^{177}Ir (J=5/2-)								**
* ^{181}Hg	J : 19Se04=1/2								**
* ^{181}Hg	D : % β^+p from I(p)/I(α)=5.0(0.8)e-4 in 71Ho07;								**
* ^{181}Hg	D : % $\beta^+\alpha$ from I(α)/I(β^+)=1.2e-7 in 75Ho02								**
* ^{181}Tl	J : 17Ba04=1/2								**
* ^{181}Tl	T : others 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}Tm	-31490#	500#						$\beta^- ?;\beta^-n ?$	
^{182}Yb	-38900#	400#	30# s >300ns	0 ⁺	15	12Ku26	I	$\beta^- ?$	
^{182}Lu	-41770#	200#	2.0 m 0.2	1 ⁻ #	15		1982	$\beta^-=100$	
^{182}Hf	-46050	6	8.90 My 0.09	0 ⁺	15		1961	$\beta^-=100$	
$^{182}\text{Hf}^m$	-44877	6	61.5 m 1.5	8 ⁻	15	15Ko14	J	$\beta^-=54\ 2;\text{IT}=46\ 2$	*
$^{182}\text{Hf}^n$	-43479	6	40 μ s 10	(13 ⁺)	15		1999	IT=100	
^{182}Ta	-46430.7	1.6	114.74 d 0.12	3 ⁻	15		1938	$\beta^-=100$	
$^{182}\text{Ta}^m$	-46414.4	1.6	16.273	5 ⁺	15		1968	IT=100	
$^{182}\text{Ta}^n$	-45911.1	1.6	519.577	10 ⁻	15		1947	IT=100	
^{182}W	-48246.1	0.7	STABLE	0 ⁺	15	04Co26	T	IS=26.50 16; $\alpha ?$	*
$^{182}\text{W}^m$	-46015.5	0.7	1.3 μ s 0.1	10 ⁺	15	15Ko14	J	IT=100	
^{182}Re	-45450	100	64.2 h 0.5	7 ⁺ *	15		1950	$\beta^+=100$	
$^{182}\text{Re}^m$	-45386	20	14.14 h 0.45	2 ⁺ *	15		1950	$\beta^+=100$	
$^{182}\text{Re}^n$	-45150	140	585 ns 30	(2 ⁻)	15		1969	IT=100	*
$^{182}\text{Re}^p$	-44930	140	780 ns 90	(4 ⁻)	15		1984	IT=100	*
^{182}Os	-44609	22	21.84 h 0.20	0 ⁺	15		1950	$\epsilon=100$	
$^{182}\text{Os}^m$	-42778	22	780 μ s 70	8 ⁻	15	15Ko14	J	IT=100	
$^{182}\text{Os}^n$	-37560	22	150 ns 10	25 ⁺	15	15Ko14	J	IT=100	
^{182}Ir	-39052	21	15.0 m 1.0	3 ⁺	15		1961	$\beta^+=100$	
$^{182}\text{Ir}^m$	-38981	21	170 ns 40	(5 ⁺)	15		1990	IT=100	
$^{182}\text{Ir}^n$	-38876	21	130 ns 50	(6 ⁻)	15		1990	IT=100	
^{182}Pt	-36168	13	2.67 m 0.12	0 ⁺	15		1963	$\beta^+=0.962\ 2;\alpha=0.038\ 2$	
^{182}Au	-28304	19	15.5 s 0.4	(2 ⁺)*	15	20Ha24	J	$\beta^+\approx 100;\alpha=0.13\ 5$	
$^{182}\text{Au}^m$	-28180	30	10# s	5 ⁻ #				$\beta^+ ?; \text{IT} ?$	*
^{182}Hg	-23577	10	10.83 s 0.06	0 ⁺	15	71Ho07	D	$\beta^+=86.2\ 9;\alpha=13.8\ 9;$ $\beta^+p<1e-5$	*
^{182}Tl	-13327	12		(4 ⁻)*	10	16Va01	TD	$\beta^+\approx 100;\alpha>0.49;$ $\beta^+\text{SF}<3.4e-6$	*
$^{182}\text{Tl}^m$	-13280#	50#		(7 ⁺)*		91Bo02	TD	$\beta^+\approx 100;\alpha=2.5\ 14;\text{IT} ?$	*
$^{182}\text{Tl}^p$	-12830#	100#		(10 ⁻)					
^{182}Pb	-6825	12	55 ms 5	0 ⁺	15		1986	$\alpha\approx 100;\beta^+ ?$	
* $^{182}\text{Hf}^m$	J : E1 to 8+								**
* ^{182}W	T : 04Co26>7.7Zy; others 03Da05>170Ey 03Ce01>25Ey 97Ge15>8.3Ey								**
* $^{182}\text{Re}^n$	E : 235.732(0.022) keV above $^{182}\text{Re}^m$								**
* $^{182}\text{Re}^p$	E : 461.3(0.1) keV above $^{182}\text{Re}^m$								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
* ¹⁸² Au ^m	I : direct β^+ feeding to 4+ and 5+ levels in ¹⁸² Pt (99Da18)										**
* ¹⁸² Au ^m	I : indicates the existence of an isomer										**
* ¹⁸² Hg	D : % α average 97Ba21=13.3(0.5) 80Sc09=15.2(0.8); β^+ p 71Ho07<1e-5										**
* ¹⁸² Tl	J : 17Ba04=(4)										**
* ¹⁸² Tl ^m	J : 17Ba04=(7)										**
* ¹⁸² Tl ^m	D : % α from 91Bo01<5%										**
¹⁸³ Yb	-35000#	400#		30# s	>300ns	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 $\approx$ 100; β^- ?	*	
¹⁸³ Ta	-45293.5	1.6		5.1 d	0.1	7/2 ⁺ *	16	1950	β^- =100		
¹⁸³ Ta ^m	-45220.3	1.6	73.164 0.014	106 ns	10	9/2 ⁻	16	1967	IT=100		
¹⁸³ Ta ⁿ	-43959	14	1335 14	900 ns	300	(19/2 ⁺)	16 09Sh17 ETJ	2009	IT=100	*	
¹⁸³ W	-46365.7	0.7		STABLE	>670Ey	1/2 ⁻ *	16	1930	IS=14.31 4; α ?		
¹⁸³ W ^m	-46056.2	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 15Ko14 J	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	1958	β^+ =85 2;IT=15 2		
¹⁸³ Ir	-40202	25		58 m	5	5/2 ⁻	16 61Di04 T	1961	β^+ $\approx$ 100; α ?	*	
¹⁸³ Pt	-35773	14		6.5 m	1.0	1/2 ⁻ *	16	1963	β^+ $\approx$ 100; α =0.0096 5	*	
¹⁸³ Pt ^m	-35738	14	34.74 0.07	43 s	5	7/2 ⁻ *	16	1979	β^+ =96.9 8;IT=3.1 8; α ?	*	
¹⁸³ Pt ⁿ	-35577	14	195.90 0.10	> 150 ns		9/2 ⁺	16	1990	IT=100		
¹⁸³ Au	-30191	9		42.8 s	1.0	5/2 ⁻ *	16	1968	β^+ =99.45 25; α =0.55 25	*	
¹⁸³ Au ^m	-30118	9	73.10 0.01	> 1 μ s		(1/2 ⁺)	16 17Ve04 E	1984	IT=100		
¹⁸³ Au ^p	-29960	9	230.6 0.6	< 1 μ s		(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 6	*	
¹⁸³ Hg ^m	-23601	13	204 14 AD	> 5# μ s		13/2 ⁺ #	81Mi12 I	1981	IT ?; β^+ ?	*	
¹⁸³ Tl	-16587	9		6.9 s	0.7	1/2 ⁺ *	16	1980	β^+ =?; α ?	*	
¹⁸³ Tl ^m	-15959	9	628.7 0.5 IT	53.3 ms	0.3	(9/2 ⁻)	16 11Ve.A E	1980	IT ?; α =1.5 3; β^+ ?	*	
¹⁸³ Tl ⁿ	-15612	9	975.3 0.6	1.48 μ s	0.10	(13/2 ⁺)	16	2001	IT=100		
¹⁸³ Pb	-7580	29		535 ms	30	3/2 ⁻ *	16	1980	α $\approx$ 100; β^+ ?	*	
¹⁸³ Pb ^m	-7486	28	94 8 AD	415 ms	20	13/2 ⁺ *	16	1980	α $\approx$ 100; β^+ ?;IT ?	*	
* ¹⁸³ Hf ^m	T : symmetrized from 10Re07=10(+48-5), value for q=71+ (H+ like ion); the										**
* ¹⁸³ Hf ^m	T : actual half-life could be shorter										**
* ¹⁸³ Ta ⁿ	E : from 1310.16 + x keV with x<50 keV in 09Sh17										**
* ¹⁸³ Os ^m	J : 75Ru06,78Ru04=1/2										**
* ¹⁸³ Ir	T : average 61Di04=55(7) 61La05=60(6)										**
* ¹⁸³ Pt	J : 92Hi07,99Le52=1/2										**
* ¹⁸³ Pt ^m	J : 99Le52=7/2										**
* ¹⁸³ Au	J : 89Wa11,94Pa37=5/2										**
* ¹⁸³ Hg	J : 72Bo09,76Bo09,19Se04=1/2										**
* ¹⁸³ Hg	D : % β^+ p from 71Ho07=l(p)/l(a)=2.2(0.3)e-5										**
* ¹⁸³ Hg ^m	I : lack of 6073 α -gamma coincidences in ¹⁸⁷ Pb ^m decay										**
* ¹⁸³ Tl	J : 17Ba04j,13Ba41=1/2+										**
* ¹⁸³ Tl ^m	E : uncertainty estimated by Nubase										**
* ¹⁸³ Pb	J : 09Se13=3/2										**
* ¹⁸³ Pb ^m	J : 09Se13=13/2										**
¹⁸⁴ Yb	-32600#	500#		7# s	>300ns	0 ⁺	13 12Ku26 I	2012	β^- ?		
¹⁸⁴ Lu	-36300#	200#		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 $\approx$ 100; 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	-45705.5	0.7		STABLE	>8.9Zy	0 ⁺	10 04Co26 T	1930	IS=30.64 2; α ?		
¹⁸⁴ W ^m	-44420.5	0.7	1284.997 0.008	8.33 μ s	0.18	5 ⁻	10	1969	IT=100		
¹⁸⁴ W ⁿ	-41577.8	0.9	4127.7 0.5	188 ns	38	(14 ⁺)	10 15Ko14 JE	2004	IT=100		
¹⁸⁴ Re	-44220	4		35.4 d	0.7	3 ⁻	10	1940	β^+ =100		

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{184}\text{Re}^m$	-44032	4	188.0463	0.0017	169 d 8	8^+	10		1964	IT=74.5 8; ϵ =25.5 8	
^{184}Os	-44252.6	0.8			11.2 Ty 2.3	0^+	10	14Pe22	T	1937	IS=0.02 2; α ?; $2\beta^+$?
^{184}Ir	-39611	28			3.09 h 0.03	5^-	10		1960	β^+ =100	
$^{184}\text{Ir}^m$	-39385	28	225.65	0.11	470 μ s 30	3^+	10		1988	IT=100	
$^{184}\text{Ir}^n$	-39283	28	328.40	0.24	350 ns 90	7^+	10		1988	IT=100	
^{184}Pt	-37332	15			17.3 m 0.2	0^+	10	95Bi01	D	1963	$\beta^+\approx 100$; $\alpha=0.0017$ 7
$^{184}\text{Pt}^m$	-35492	15	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	95Bi01	D	1969	$\beta^+\approx 100$; $\alpha\approx 0.013$ 3
$^{184}\text{Au}^m$	-30251	22	68.46	0.04	47.6 s 1.4	2^+*	10	95Bi01	D	1969	$\beta^+=?$; $IT=30$ 10; $\alpha\approx 0.013$ 3
^{184}Hg	-26345	10			30.87 s 0.26	0^+	10	80Sc09	D	1969	$\beta^+=98.89$ 6; $\alpha=1.11$ 6
^{184}Tl	-16883	10		*	9.5 s 0.2	2^-*	10	16Va01	TJD	1976	$\beta^+=98.78$ 30; $\alpha=1.22$ 30
$^{184}\text{Tl}^m$	-16930	30	-50	30	AD*	(7^+)		16Va01	JTD	2016	$\beta^+=99.53$ 6; IT ?; $\alpha=0.47$ 6
$^{184}\text{Tl}^n$	-16430	30	450	30	AD	(10^-)	10	15Va10	TD	1984	IT ≈ 100 ; $\alpha=0.089$ 19
^{184}Pb	-11052	13			490 ms 25	0^+	10	04An07	D	1980	$\alpha=80$ 11; β^+ ?
^{184}Bi	1250#	120#			6.6 ms 1.5	$3^+\#$	10		2003	$\alpha=100$	
$^{184}\text{Bi}^m$	1400#	160#	150#	100#	13 ms 2	$10^-\#$	10		2002	$\alpha=100$	
* $^{184}\text{Hf}^m$	E : other 10Re07=1264(10)										**
* $^{184}\text{Hf}^m$	T : other 12Re19=113(+60-47) 10Re07=113(+74-40) for q=72+ (bare ion)										**
* $^{184}\text{Hf}^m$	J : from 15Ko14										**
* $^{184}\text{Hf}^n$	T : symmetrized from 12Re19=12(+8-6) for q=72+; supersedes 10Re07=12(+10-4)										**
* $^{184}\text{Re}^m$	J : E5 to 3-										**
* ^{184}Os	T : α decay half-life from 14Pe22; other $2\beta^+$ 13Be07>25Py										**
* $^{184}\text{Ir}^n$	J : M2 to 5-										**
* $^{184}\text{Pt}^m$	T : other 17Pr03=0.86(0.10)										**
* ^{184}Hg	D : % α other 70Ha18=1.25(0.20)										**
* $^{184}\text{Tl}^m$	T : average 76Co24=11(1), based on ce-gamma-time events below 8+ state in										**
* $^{184}\text{Tl}^m$	T : ^{180}Hg , 16Va01=10.1(0.5), using laser-ionization data										**
* ^{184}Pb	D : % α average 04An07=80(15) 03Va16=80(15)										**
^{185}Yb	-28480#	500#			5# s >300ns	$9/2^-\#$	13	12Ku26	I	2012	β^- ?
^{185}Lu	-33960#	300#			20# s >300ns	$7/2^+\#$	13	09St16	I	2009	β^- ?
^{185}Hf	-38320	60			3.5 m 0.6	$(9/2^-)$	06		1993	β^- =100	
^{185}Ta	-41394	14			49.4 m 1.5	$(7/2^+)$	06		1950	β^- =100	
$^{185}\text{Ta}^m$	-40988	14	406	1	900 ns 300	$(3/2^+)$	06	07Sh42	ETJ	2007	IT=100
$^{185}\text{Ta}^n$	-40121	14	1273.4	0.4	11.8 ms 1.4	$21/2^-$	06	09La17	EJT	1999	IT=100
^{185}W	-43387.9	0.7			75.1 d 0.3	$3/2^-*$	06		1940	β^- =100	
$^{185}\text{W}^m$	-43190.5	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 5	
$^{185}\text{Re}^m$	-41694.9	0.9	2124.1	0.4	200 ns 4	$25/2^+$	06	06Le.A	EJT	1997	IT=100
^{185}Os	-42805.9	0.8			92.95 d 0.09	$1/2^-$	06	12Kr05	T	1947	ϵ =100
$^{185}\text{Os}^m$	-42703.5	0.8	102.37	0.11	3.0 μ s 0.4	$7/2^-$	06	FGK128	J	1970	IT=100
$^{185}\text{Os}^n$	-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	
$^{185}\text{Ir}^m$	-38140	40	2197	23	120 ns 20	$(23/2, 25/2)\#$	06		1979	IT=100	
^{185}Pt	-36688	26			70.9 m 2.4	$9/2^+*$	06	91Bi04	D	1960	$\beta^+\approx 100$; $\alpha=0.0050$ 20
$^{185}\text{Pt}^m$	-36585	26	103.41	0.05	33.0 m 0.8	$1/2^-*$	06		1970	$\beta^+\approx 100$; IT ?	
$^{185}\text{Pt}^n$	-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	$\beta^+=99.74$ 6; $\alpha=0.26$ 6	
$^{185}\text{Au}^m$	-31810#	50#	50#	50#	6.8 m 0.3	$1/2^+\#$	06		1960	$\beta^+\approx 100$; IT ?	
^{185}Hg	-26184	14			49.1 s 1.0	$1/2^-*$	06		1960	$\beta^+=94$ 1; $\alpha=6$ 1	
$^{185}\text{Hg}^m$	-26080	14	103.7	0.4	21.6 s 1.5	$13/2^+*$	06	13Sa43	E	1970	IT=54 10; $\beta^+=46$ 10; $\alpha\approx 0.03$
^{185}Tl	-19758	21			19.5 s 0.5	$1/2^+*$	06	13Ba41	J	1976	$\beta^+\approx 100$; α ?
$^{185}\text{Tl}^m$	-19303	21	454.8	1.5	IT	$9/2^-*$	06	13Ba41	J	1976	IT ≈ 100 ; $\alpha=?$; β^+ ?
^{185}Pb	-11541	16		*	6.3 s 0.4	$3/2^-*$	06		1975	$\beta^+=66$ 25; $\alpha=34$ 25	
$^{185}\text{Pb}^m$	-11470	50	70	50	AD*	$13/2^+*$	06	02An15	T	1975	$\alpha=50$ 25; β^+ ?
^{185}Bi	-2240#	80#			2# ms	$9/2^-\#$		96Da06	J	1996	p ?; α ?
$^{185}\text{Bi}^m$	-2156	13	80#	80#	58 μ s 4	$1/2^+$	06		1996	p=90 2; $\alpha=10$ 2	
$^{185}\text{Bi}^n$	-2060#	110#	180#	80#	EU	$13/2^+\#$		04An07	ITD	2004	p=?; $\alpha=?$
* ^{185}Hf	J : β^- decay to J=9/2+ in ^{185}Ta										**
* $^{185}\text{Re}^m$	T : others: 97Sh37=123(23) 02Pf01=120(15)										**
* $^{185}\text{Re}^m$	E : from 15Ko14										**
* $^{185}\text{Os}^m$	J : E1 from 9/2+										**

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁸⁵ Ir ^m	E : 2157.3(0.5) + x keV; x<80 keV								**
* ¹⁸⁵ Pt	J : 92Hi07,99Le52=9/2								**
* ¹⁸⁵ Pt	D : % α from E(a)=4444(10) keV in 91Bi04								**
* ¹⁸⁵ Pt ^m	J : 92Hi07,99Le52=1/2								**
* ¹⁸⁵ Hg	J : 19Se04=1/2								**
* ¹⁸⁵ Hg ^m	J : 19Se04=13/2								**
* ¹⁸⁵ Pb	J : 09Se13=3/2								**
* ¹⁸⁵ Pb ^m	T : average 02An15=4.3(0.2) 80Sc09=3.73(0.24) (excluding the 6.1 s activity)								**
* ¹⁸⁵ Pb ^m	J : 09Se13=13/2								**
* ¹⁸⁵ Bi	T : estimated from J=9/2- isomers in odd Bi and Tl isotopes								**
* ¹⁸⁵ Bi ⁿ	E : 100 keV above ¹⁸⁵ Bi ^m								**
¹⁸⁶ Lu	-30320#	400#		6# s >300ns		13 12Ku26	I 2012	β^- ?; β^- n ?	
¹⁸⁶ Hf	-36420	50		2.6 m 1.2	0 ⁺	03		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	3#	03		β^- =100	*
¹⁸⁶ Ta ^m	-38270	60	336 20	1.54 m 0.05	9 ⁺ #	04Xu08	T 2010	β^- ?; IT ?	*
¹⁸⁶ W	-42508.6	1.2		STABLE >4.1Ey	0 ⁺	03 03Da09	T 1930	IS=28.43 19;2 β^- ?; α ?	*
¹⁸⁶ W ^m	-40991.4	1.3	1517.2 0.6	18 μ s 1	7 ⁻	03 12La.A	J 1998	IT=100	
¹⁸⁶ W ⁿ	-38965.8	2.4	3542.8 2.1	2.0 s 0.2	16 ⁺	03 12La.A	TJ 1998	IT=100	
¹⁸⁶ Re	-41927.3	0.8		3.7185 d 0.0005	1 ⁻ *	03 FGK204	T 1939	β^- =92.53 10; ϵ =7.47 10	
¹⁸⁶ Re ^m	-41779.1	0.9	148.2 0.5	~ 200 ky	(8 ⁺)	03 15Ma60	E 1972	IT $\approx$ 100; β^- ?	
¹⁸⁶ Os	-43000.0	0.8		2.0 Py 1.1	0 ⁺	03		IS=1.59 64; α =100	
¹⁸⁶ Ir	-39172	17		16.64 h 0.03	5 ⁺ *	03		β^+ =100	
¹⁸⁶ Ir ^m	-39171	17	0.8 0.4	1.92 h 0.05	2 ⁻	03 91Be25	ET 1962	β^+ $\approx$ 75; IT $\approx$ 25	*
¹⁸⁶ Pt	-37864	22		2.08 h 0.05	0 ⁺	03		β^+ =100; α $\approx$ 1.4e-4	
¹⁸⁶ Au	-31715	21		10.7 m 0.5	3 ⁻ *	03		β^+ =100; α =0.0008 2	
¹⁸⁶ Au ^m	-31670#	40#	50# 30#	> 1 μ s	6 ⁻ #			IT ?; β^+ ?	*
¹⁸⁶ Au ⁿ	-31487	21	227.77 0.07	110 ns 10	2 ⁺	03		IT=100	
¹⁸⁶ Hg	-28539	12		1.38 m 0.06	0 ⁺	03		β^+ $\approx$ 100; α =0.016 5	
¹⁸⁶ Hg ^m	-26322	12	2217.3 0.4	82 μ s 5	(8 ⁻)	03		IT=100	
¹⁸⁶ Tl	-19883	21		3.5 s 0.5	(2 ⁻)	03 20St11	TDJ 1975	β^+ ?; α =?	*
¹⁸⁶ Tl ^m	-19860	30	20 40	27.5 s 1.0	7 ⁺ *	03 13Ba41	J 1975	β^+ $\approx$ 100; α $\approx$ 0.006	
¹⁸⁶ Tl ⁿ	-19490	30	390 40 MD	3.40 s 0.09	10 ⁻ *	03 20St11	TD 1977	IT<94.1 3; β^+ >5.9 3	*
¹⁸⁶ Pb	-14681	11		4.82 s 0.03	0 ⁺	03		β^+ ?; α =40 8	
¹⁸⁶ Bi	-3145	17		14.8 ms 0.7	(3 ⁺)	03 13La02	D 1997	α $\approx$ 100; β^+ =?; β^+ SF $\approx$ 0.011	*
¹⁸⁶ Bi ^m	-2980#	100#	170# 100#	9.8 ms 0.4	(10 ⁻)	03 13La02	D 1984	α $\approx$ 100; β^+ =?; β^+ SF $\approx$ 0.011	*
¹⁸⁶ Po	4102	18		34 μ s 12	0 ⁺	13 13An13	T 2005	α $\approx$ 100; p ?	*
* ¹⁸⁶ Hf ^m	T : for q=72+ (bare ion) in 10Re07; the actual half-life could be shorter								**
* ¹⁸⁶ Ta	J : direct β^- feeding to 3- in ¹⁸⁶ Hf; conf p7/2[404]n1/2[510], K=3- or								**
* ¹⁸⁶ Ta	J : p9/2[514]n3/2[512], K=3+								**
* ¹⁸⁶ Ta ^m	T : other 12Re19=3.0(+1.5-0.8) q=72+(H+ like ion); supersedes								**
* ¹⁸⁶ Ta ^m	T : 10Re07=3.4(+2.4-1.4)								**
* ¹⁸⁶ Ta ^m	E : from 10Re07								**
* ¹⁸⁶ W	T : the limit given is for 2 β^- decay; α decay 04Co26>8.2 Zy								**
* ¹⁸⁶ W	T : 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 Au ^m	I : floated strongly-coupled band in 92Ja01; conf p3/2[532]n9/2[624], K=6-,								**
* ¹⁸⁶ Au ^m	I : same as the ground state where K=3-								**
* ¹⁸⁶ Tl	T : symmetrized from 20St11=3.4(+0.5-0.4)								**
* ¹⁸⁶ Tl ⁿ	E : 374.2(0.1) keV above ¹⁸⁶ Tl ^m								**
* ¹⁸⁶ Tl ⁿ	J : 13Ba41=10								**
* ¹⁸⁶ Bi	T : average 03An27=14.8(0.8) 97Ba21=15.0(1.7)								**
* ¹⁸⁶ Bi	D : % β^+ SF 13La02=0.022 13 for both isomers								**
* ¹⁸⁶ Bi ^m	T : from 03An27								**
* ¹⁸⁶ Bi ^m	D : % β^+ SF 13La02=0.022 13 for both isomers								**
* ¹⁸⁶ Po	T : symmetrized from 13An13=28(+16-6)								**
¹⁸⁷ Lu	-27770#	400#		7# s >300ns	7/2 ⁺ #	13 12Ku26	I 2012	β^- ?	
¹⁸⁷ Hf	-33000#	200#		14# s >300ns	9/2 ⁻ #	09 99Be63	I 1999	β^- ?	
¹⁸⁷ Hf ^m	-32500#	360#	500# 300#	270 ns 80	3/2 ⁻ #	09A130	TD 2009	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{187}Ta	-36900	60	2.3 m 6	(7/2 ⁺)	09	10Re07 T	1999	β^- =100	*
$^{187}\text{Ta}^m$	-35110	60	1778 1	7.3 s 0.9	(25/2 ⁻)	20Wa29 ETJ	2010	IT $\approx$ 100; β^- ?	*
$^{187}\text{Ta}^n$	-33970	60	2935 14	> 5 m	41/2 ⁺ #	10Re07 ET	2010	β^- ?; IT ?	*
^{187}W	-39904.0	1.2	23.809 h 0.025	3/2 ⁻ *	09	19Kr02 T	1940	β^- =100	*
$^{187}\text{W}^m$	-39493.9	1.2	410.06 0.04	1.38 μ s 0.07	11/2 ⁺	09 08Bo26 J	2008	IT=100	*
^{187}Re	-41216.5	0.7	41.6 Gy 0.02	5/2 ⁺ *	09	01Be81 T	1931	IS=62.60 5; β^- =100; α =0	*
$^{187}\text{Re}^m$	-41010.3	0.7	206.2473 0.0010	555.3 ns 1.7	9/2 ⁻	09	1949	IT=100	
$^{187}\text{Re}^n$	-39534.5	0.9	1682.0 0.6	354 ns 62	21/2 ⁺	09 16Re02 ETJ	2003	IT=100	
^{187}Os	-41219.0	0.7	STABLE	>3.2Py	1/2 ⁻ *	09	1931	IS=1.96 17; α ?	*
$^{187}\text{Os}^m$	-41118.6	0.7	100.45 0.04	112 ns 6	7/2 ⁻	09	1964	IT=100	
$^{187}\text{Os}^n$	-40961.9	0.7	257.10 0.07	231 μ s 2	11/2 ⁺	09	1964	IT=100	
^{187}Ir	-39549	28	10.5 h 0.3	3/2 ⁺ *	09		1958	β^+ =100	
$^{187}\text{Ir}^m$	-39363	28	186.16 0.04	30.3 ms 0.6	9/2 ⁻	09	1963	IT=100	
$^{187}\text{Ir}^n$	-39115	28	433.75 0.06	152 ns 12	11/2 ⁻	09	1969	IT=100	
$^{187}\text{Ir}^p$	-37061	28	2487.7 0.4	1.8 μ s 0.5	29/2 ⁻	10Mo09 ETJ	2010	IT=100	
^{187}Pt	-36685	24	2.35 h 0.03	3/2 ⁻ *	09		1961	β^+ =100	*
$^{187}\text{Pt}^m$	-36511	24	174.38 0.22	311 μ s 15	11/2 ⁺	09	1976	IT=100	*
^{187}Au	-33029	22	8.3 m 0.2	1/2 ⁺ *	09		1955	β^+ $\approx$ 100; α ?	
$^{187}\text{Au}^m$	-32909	22	120.33 0.14	2.3 s 0.1	9/2 ⁻ *	09 20Ba29 J	1983	IT=100	
^{187}Hg	-28119	13	1.9 m 0.3	3/2 ⁻ *	09	70Ha18 TD	1960	β^+ =100; α ?	*
$^{187}\text{Hg}^m$	-28060	15	58 14 MD	2.4 m 0.3	13/2 ⁺ *	09 70Ha18 D	1970	β^+ =100; α ?	*
^{187}Tl	-22445	8	$\sim$ 51 s	1/2 ⁺	09		1976	β^+ $\approx$ 100; α ?	
$^{187}\text{Tl}^m$	-22111	8	334 3 AD	15.60 s 0.12	9/2 ⁻ *	09 13Ba41 J	1976	IT=?; β^+ =?; α =0.15 5	
$^{187}\text{Tl}^n$	-20570#	50#	1875# 50#	1.11 μ s 0.7		09 00By02 T	2000	IT=100	*
$^{187}\text{Tl}^p$	-19863	8	2582.5 0.3	693 ns 38	29/2 ⁺ #	09	2000	IT=100	
^{187}Pb	-14987	5	*	15.2 s 0.3	3/2 ⁻ *	09	1972	β^+ =90.5 20; α =9.5 20	*
$^{187}\text{Pb}^m$	-14968	11	19 10 MD*	18.3 s 0.3	13/2 ⁺ *	09	1972	β^+ =88 2; α =12 2	*
^{187}Bi	-6383	10	37 ms 2	(9/2 ⁻)	09		1999	α =100	*
$^{187}\text{Bi}^m$	-6275	12	108 8 AD	370 μ s 20	1/2 ⁺	09	1984	α =100	*
$^{187}\text{Bi}^n$	-6131	10	252 3	7 μ s 5	(13/2 ⁺)	09 02Hu14 ETJ	2002	IT=100	*
^{187}Po	2820	30	*	1.40 ms 0.25	1/2 ⁻ , 5/2 ⁻	09	2005	$\alpha\approx$ 100; β^+ ?	*
$^{187}\text{Po}^m$	2830	40	4 27 AD*	0.5 ms	13/2 ⁺ #	06An11 ETD	2006	$\alpha\approx$ 100; β^+ ?	*
* ^{187}Ta	J : from 20Wa29								**
* $^{187}\text{Ta}^m$	TE : other 10Re07=22(9) s for q=73+ (bare ion); E=1789(13) keV in 10Re07								**
* $^{187}\text{Ta}^n$	T : from 10Re07 for q=73+ (bare ion)								**
* ^{187}W	T : average 19Kr0=23.80(0.03) 64An02=23.72(0.06) 57Wr37=24.04(0.09)								**
* ^{187}W	T : 53Ei02=23.85(0.08)								**
* $^{187}\text{W}^m$	J : E1 to 9/2 ⁻ ; l(d,p)=(6)								**
* ^{187}Re	T : recommended in 01Be81, based on 96Sm.A data, in agreement								**
* ^{187}Re	T : with 01Ga01=41.2(1.1) (direct measurement); other: 96Bo37=32.9(2.0) y								**
* ^{187}Re	T : for q=75+ (bare ion)								**
* ^{187}Os	T : from 20Be23 for T1/2(α ,1/2 ⁻ ->3/2 ⁻)								**
* ^{187}Pt	J : 92Hi07=3/2								**
* $^{187}\text{Pt}^m$	J : M2 to 7/2 ⁻								**
* ^{187}Hg	T : from 70Ha18; other 98Ru04=2.4 m, but no uncertainty given								**
* $^{187}\text{Hg}^m$	T : from 70Ha18; other 98Ru04=2.2 m, but no uncertainty given								**
* $^{187}\text{Tl}^n$	E : 1433.23(0.19)+191+201+x keV; x=50#(50#) keV estimated by Nubase								**
* ^{187}Pb	J : 09Se13=3/2								**
* $^{187}\text{Pb}^m$	J : 09Se13=13/2								**
* ^{187}Bi	J : favored α decay to $^{183}\text{Tl}^m$ [J=(9/2 ⁻)]								**
* $^{187}\text{Bi}^m$	J : favored α decay to ^{183}Tl (J=1/2 ⁺)								**
* $^{187}\text{Bi}^n$	T : symmetrized from 02Hu14=3.2(+7.6-2.0)								**
* $^{187}\text{Bi}^n$	E : 02Hu14=252 keV gamma at the focal plane of RITU separator;								**
* $^{187}\text{Bi}^n$	E : uncertainty estimated by Nubase								**
* ^{187}Po	J : favored α decay to J=1/2 ⁻ , 5/2 ⁻ level in ^{183}Pb								**
^{188}Lu	-23820#	400#	1# s >300ns		18	12Ku26 I	2012	β^- ?; β^- n ?	
^{188}Hf	-30830#	300#	7# s >300ns	0 ⁺	18	99Be63 I	1999	β^- ?	
^{188}Ta	-33910#	200#	19.6 s 2.0	(1 ⁻)	18		1999	β^- =100	
$^{188}\text{Ta}^m$	-33810#	200#	99 33	19.6 s 2.0	(7 ⁻)	18	2005	IT ?; β^- ?	
$^{188}\text{Ta}^n$	-33520#	200#	391 33	3.6 μ s 0.4	10 ⁺ #	18	2005	IT=100	
^{188}W	-38668	3	69.77 d 0.05	0 ⁺	18	14Un01 T	1951	β^- =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
$^{188}\text{W}^m$	-36741	3	1926.7	0.8	109.5 ns	3.5	8 ⁻	18	2010	IT=100
^{188}Re	-39016.9	0.7			17.005 h	0.003	1 ⁻ *	18	1939	β^- =100
$^{188}\text{Re}^m$	-38844.8	0.7	172.0848	0.0024	18.59 m	0.04	6 ⁻	18	1953	IT=100
^{188}Os	-41137.3	0.7			STABLE	>3.3Ey	0 ⁺	18	1931	IS=13.24 27; α ?
^{188}Ir	-38345	9			41.5 h	0.5	1 ⁻ *	18	1950	β^+ =100
$^{188}\text{Ir}^m$	-37381	25	964	23	4.15 ms	0.15	11 ⁻ #	18	1971	IT $\approx$ 100; β^+ ?
^{188}Pt	-37821	5			10.16 d	0.18	0 ⁺	18	1954	ϵ =100; α =2.6e-5 3
^{188}Au	-32371.3	2.7			8.84 m	0.06	1 ⁻ *	18	1955	β^+ =100
^{188}Hg	-30198	7			3.25 m	0.15	0 ⁺	18	1960	β^+ =100; α =3.7e-5 8
$^{188}\text{Hg}^m$	-27474	7	2724.1	0.4	142 ns	14	12 ⁺	18 83Ha15	T 1983	IT=100
^{188}Tl	-22336	30		*	71 s	2	2 ⁻ #	18	1970	β^+ =100
$^{188}\text{Tl}^m$	-22308	9	30	30 MD*	71.5 s	1.5	7 ⁺ *	18 13Ba41	J 1970	β^+ =100
$^{188}\text{Tl}^n$	-22040	40	299	30	41 ms	4	9 ⁻	18	1981	IT $\approx$ 100; β^+ ?
^{188}Pb	-17811	10			25.1 s	0.1	0 ⁺	18	1972	β^+ =91.5 5; α =8.5 5
$^{188}\text{Pb}^m$	-15234	10	2577.2	0.4	800 ns	20	8 ⁻	18	1999	IT=100
$^{188}\text{Pb}^n$	-15101	10	2709.8	0.5	94 ns	12	12 ⁺	18	2004	IT=100
$^{188}\text{Pb}^p$	-13028	10	4783.4	0.7	440 ns	60	(19 ⁻)	18	2000	IT=100
^{188}Bi	-7195	11		&	60 ms	3	(3 ⁺)	18 13La02	TD 1980	$\alpha\approx$ 100; β^+ ?; β^+ SF=0.0014 7
$^{188}\text{Bi}^m$	-7130	30	66	30 AD	> 5 μ s		7 ⁺ #	18	1984	IT ?; α ?; β^+ ?
$^{188}\text{Bi}^n$	-7040	30	153	30 AD &	265 ms	15	(10 ⁻)	18 13La02	TD 1984	$\alpha\approx$ 100; β^+ ?; β^+ SF=0.0046 9
^{188}Po	-544	20			270 μ s	30	0 ⁺	18	1999	$\alpha\approx$ 100; β^+ ?
* ^{188}Os	T : from 20Be23 for T1/2(α ,0 ⁺ ->2 ⁺)									
* $^{188}\text{Ir}^m$	E : 923.53(0.22) + x; x<80 keV									
* $^{188}\text{Hg}^m$	T : average 83Ha15=134(15) 04GI04=187(35)									
* $^{188}\text{Tl}^m$	J : 92Me07,13Ba41=7									
* $^{188}\text{Tl}^n$	E : 268.8(0.2) keV above $^{188}\text{Tl}^m$ from 91Va04									
* ^{188}Bi	D : % β^+ SF from 20An12=0.0004(0.0002)-0.0018(0.0007); other									
* ^{188}Bi	D : 13La02=0.0032(0.0016) for both β^+ SF decaying isomers									
* ^{188}Bi	J : from 20An12									
* $^{188}\text{Bi}^n$	D : % β^+ SF from 20An12; other 13La02=0.0032(0.0016) for both β^+ SF decaying									
^{189}Hf	-27150#	300#			400# ms	>300ns	3/2 ⁻ #	17 09A130	I 2009	β^- =100
^{189}Ta	-31960#	200#			20# s	>300ns	7/2 ⁺ #	17 99Be63	I 1999	β^- =100
$^{189}\text{Ta}^m$	-30310#	220#	1650#	100#	1.6 μ s	0.2	21/2 ⁻ #	09A130	TD 2009	IT=100
^{189}W	-35810#	200#			11.6 m	0.2	9/2 ⁻ #	17	1963	β^- =100
^{189}Re	-37979	8			24.3 h	0.4	5/2 ⁺	17	1963	β^- =100
$^{189}\text{Re}^m$	-37854	9	125	3	2# μ s		9/2 ⁻	FGK209	TIJ	IT ?
$^{189}\text{Re}^n$	-36208	8	1770.9	0.6	223 μ s	14	29/2 ⁺	17 16Re02	JTE 2016	IT=100
^{189}Os	-38986.8	0.7			STABLE	>3.3Py	3/2 ⁻ *	17	1931	IS=16.15 23; α ?
$^{189}\text{Os}^m$	-38956.0	0.7	30.82	0.02	5.81 h	0.10	9/2 ⁻	17	1960	IT $\approx$ 100; β^- ?
^{189}Ir	-38450	13			13.2 d	0.1	3/2 ⁺ *	17	1955	ϵ =100
$^{189}\text{Ir}^m$	-38078	13	372.17	0.04	13.3 ms	0.3	11/2 ⁻	17	1960	IT=100
$^{189}\text{Ir}^n$	-36117	13	2332.8	0.3	3.7 ms	0.2	25/2 ⁺	17 75Ke06	J 1975	IT=100
^{189}Pt	-36469	10			10.87 h	0.12	3/2 ⁻ *	17	1955	β^+ =100
$^{189}\text{Pt}^m$	-36296	10	172.79	0.06	464 ns	25	9/2 ⁻	17	1970	IT=100
$^{189}\text{Pt}^n$	-36278	10	191.4	0.2	143 μ s	5	(13/2 ⁺)	17	1976	IT=100
^{189}Au	-33582	20			28.7 m	0.4	1/2 ⁺ *	17	1955	β^+ =100; α <3e-5
$^{189}\text{Au}^m$	-33335	20	247.25	0.16	4.59 m	0.11	11/2 ⁻ *	17	1966	$\beta^+\approx$ 100;IT ?
$^{189}\text{Au}^n$	-33257	20	325.12	0.16	190 ns	15	9/2 ⁻	17	1975	IT=100
$^{189}\text{Au}^p$	-31027	20	2554.8	0.8	242 ns	10	31/2 ⁺	17	1975	IT=100
^{189}Hg	-29630	30			7.6 m	0.2	3/2 ⁻ *	17	1955	β^+ =100; α ?
$^{189}\text{Hg}^m$	-29548	18	80	30 MD	8.6 m	0.2	13/2 ⁺ *	17	1966	β^+ =100; α ?
^{189}Tl	-24616	8			2.3 m	0.2	1/2 ⁺	17	1972	β^+ =100
$^{189}\text{Tl}^m$	-24331	8	285	6 AD	1.4 m	0.1	9/2 ⁻ *	17	1972	$\beta^+\approx$ 100;IT ?
^{189}Pb	-17844	14			39 s	8	3/2 ⁻ *	17 09Sa09	T 1972	β^+ =99.58 15; α =0.42 15
$^{189}\text{Pb}^m$	-17804	14	40	4 AD	50.5 s	2.1	13/2 ⁺ *	17 09Sa09	T 2009	$\beta^+\approx$ 100; $\alpha\approx$ 0.4;IT ?
$^{189}\text{Pb}^n$	-15369	15	2475	4	26 μ s	5	31/2 ⁻	17 09Dr03	J 2005	IT=100
^{189}Bi	-10065	21			688 ms	5	9/2 ⁻ *	17	1973	$\alpha\approx$ 100; β^+ ?
$^{189}\text{Bi}^m$	-9881	21	184	5 AD	5.0 ms	0.1	1/2 ⁺	17	1984	α =83 5; IT=17 5
$^{189}\text{Bi}^n$	-9707	21	357.6	0.5	880 ns	50	13/2 ⁺	17	2001	IT=100
^{189}Po	-1422	22			3.5 ms	0.5	(5/2 ⁻)	17	1999	$\alpha\approx$ 100; β^+ ?

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Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁸⁹ Ta ^m	T : other 11St1=0.58(0.22), possibly a different isomer							**
* ¹⁸⁹ Ta ^m	E : 11St1=154,284,343,389,482 keV gammas in a mutual coincidence; other							**
* ¹⁸⁹ Ta ^m	E : 09A130=57,83,134,154,199,246,284,389,481 keV gammas in singles							**
* ¹⁸⁹ Re ^m	IJ : M2 to 5/2+; existence of a similar isomer in ¹⁸⁷ Re							**
* ¹⁸⁹ Re ^m	T : estimated from B(M2)=0.7 (W.u.) for ¹⁸⁷ Re ^m							**
* ¹⁸⁹ Os	T : from 20Be23 for T1/2(α ,3/2 ⁻ →3/2 ⁻)							**
* ¹⁸⁹ Pt	J : 75Ru06,92Hi07=3/2							**
* ¹⁸⁹ Hg ^m	J : 79Da06=13/2							**
* ¹⁸⁹ Tl ^m	J : 85Bo46,13Ba41=9/2							**
* ¹⁸⁹ Pb	J : 09Se13=3/2							**
* ¹⁸⁹ Pb	D : % α from 74Ho26							**
* ¹⁸⁹ Pb ^m	T : average 09Sa09=50(3) 72Ga27=51(3)							**
* ¹⁸⁹ Pb ^m	J : 09Se13=13/2							**
* ¹⁸⁹ Pb ⁿ	E : 2434.50(0.18) keV above ¹⁸⁹ Pb ^m							**
* ¹⁸⁹ Pb ⁿ	T : symmetrized from $\tau=32(+10-2)$ us in 05Ba51							**
* ¹⁸⁹ Bi	J : 17Ba12,12Ba32,95Ba75=(9/2); favored α decay to ¹⁸⁵ Tl ^m							**
* ¹⁸⁹ Bi	J : [J=(9/2-)]							**
* ¹⁸⁹ Bi ^m	J : favored α decay to ¹⁸⁵ Tl (J=1/2+)							**
* ¹⁸⁹ Bi ⁿ	J : M2 to 9/2-							**
¹⁹⁰ Hf	-24800#	400#		600# ms >300ns	0 ⁺	13 12Ku26 I	2012	β^- ?
¹⁹⁰ Ta	-28720#	200#		5.3 s 0.7	(3)	10 09A130 TJD	2009	β^- =100
¹⁹⁰ W	-34370	40		30.0 m 1.5	0 ⁺	20	1976	β^- =100
¹⁹⁰ W ^m	-32630	40	1743.6	111 ns 17	8 ⁺	10La16 ETJ	2010	IT=100
¹⁹⁰ W ⁿ	-32530	40	1840.6	166 μ s 6	10 ⁻	20 10La16 ETJ	2000	IT=100
¹⁹⁰ Re	-35583	5		3.0 m 0.2	(2) ⁻	20	1955	β^- =100
¹⁹⁰ Re ^m	-35379	11	204	3.1 h 0.2	(6) ⁻	20 12Re19 E	1962	β^- =54.4 20;IT=45.6 20
¹⁹⁰ Os	-38707.8	0.6		STABLE >12Ey	0 ⁺	20	1931	IS=26.26 20; α ?
¹⁹⁰ Os ^m	-37002.1	0.6	1705.7	9.86 m 0.03	10 ⁻	20 12Kr05 T	1950	IT=100
¹⁹⁰ Ir	-36753.6	1.4		11.78 d 0.10	4 ⁻	20	1947	β^+ =100; e^+ <0.002
¹⁹⁰ Ir ^m	-36727.5	1.4		1.120 h 0.003	1 ⁻	20	1964	IT=100
¹⁹⁰ Ir ⁿ	-36717.4	1.4	36.154	> 2 μ s	4 ⁺	20	1996	IT=100
¹⁹⁰ Ir ^p	-36377.2	1.4	376.4	3.087 h 0.012	11 ⁻	20	1950	β^+ =91.4 2;IT=8.6 2
¹⁹⁰ Pt	-37306.5	0.7		483 Gy 3	0 ⁺	20 FGK209 T	1949	IS=0.012 2; α =100;2 β^+ ?
¹⁹⁰ Au	-32834	3		42.8 m 1.0	1 ⁻ *	20	1959	β^+ =100; α <1e-6
¹⁹⁰ Au ^m	-32630#	150#	200#	125 ms 20	11 ⁻ #	20	1982	IT $\approx$ 100; β^+ ?
¹⁹⁰ Hg	-31371	16		20.0 m 0.5	0 ⁺	20	1959	β^+ =100; α ?
¹⁹⁰ Tl	-24366	7		2.6 m 0.3	2 ⁻ *	20 13Ba41 J	1970	β^+ =100
¹⁹⁰ Tl ^m	-24296	5	70	3.6 m 0.3	7 ⁺ *	20 13Ba41 J	1970	β^+ =100
¹⁹⁰ Tl ⁿ		non-exist		750 μ s 40	(8) ⁻	20	1981	IT=100
¹⁹⁰ Tl ^p	-24052	16	306	60# ms	(9) ⁻	20 91Va04 EJT	1991	IT=100
¹⁹⁰ Pb	-20417	13		71 s 1	0 ⁺	20	1972	β^+ =99.60 4; α =0.40 4
¹⁹⁰ Pb ^m	-17802	13	2614.8	150 ns 14	10 ⁺	20 01Dr05 J	1998	IT=100
¹⁹⁰ Pb ⁿ	-17750#	50#	2665#	24.3 μ s 2.1	(12 ⁺)	20	1998	IT=100
¹⁹⁰ Pb ^p	-17759	13	2658.2	7.7 μ s 0.3	11 ⁻	20 01Dr05 JT	1985	IT=100
¹⁹⁰ Bi	-10596	21		6.3 s 0.1	(3 ⁺)*	20 20An12 D	1972	α =77 21; β^+ =23 21; β^+ SF=6e-6 5
¹⁹⁰ Bi ^m	-10470	30	120	6.2 s 0.1	10 ⁻ *	20 20An12 D	1988	α =70 9; β^+ ?; β^+ SF=4e-6 3
¹⁹⁰ Bi ⁿ	-10475	26	121	175 ns 8	(5) ⁻	09An11 ET	2009	IT=100
¹⁹⁰ Bi ^p	-10200	50	394	1.3 μ s 0.8	(8) ⁻	20 09An11 EJT	2001	IT=100
¹⁹⁰ Po	-4563	13		2.45 ms 0.05	0 ⁺	20	1996	α =100; β^+ ?
* ¹⁹⁰ W ⁿ	T : others 11St21=108(9) 09A130=106(18)us 05Ca02=60(+1500-30)us 00Po26<3.1ms							**
* ¹⁹⁰ W ⁿ	E : other 00Po26=2381							**
* ¹⁹⁰ Os	T : from 20Be23 for T1/2(α ,0 ⁺ →2 ⁺)							**
* ¹⁹⁰ Os ^m	J : M2 + E3 to the 8+ member of the K=0+ gs band							**
* ¹⁹⁰ Ir ^m	J : M3 to 4-; I(d,t)=1							**
* ¹⁹⁰ Ir ^p	J : M4 to 7+; conf=p11/2[505]n11/2[615]; log ft=4.94 to ¹⁹⁰ Os ^m							**
* ¹⁹⁰ Ir ^p	J : [J=10-], conf=n9/2[505]n11/2[615], consistent with							**
* ¹⁹⁰ Ir ^p	J : n9/2[505]→p11/2-[505] transition							**
* ¹⁹⁰ Tl	J : also 92Me07=2							**
* ¹⁹⁰ Tl ^m	J : also 92Me07=7							**
* ¹⁹⁰ Tl ⁿ	I : introduced in 81Kr20, but not confirmed in 91Va04 and 05Xi06							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁹⁰ Tl ^p	E : 236(7) keV above ¹⁹⁰ Tl ^m							**
* ¹⁹⁰ Tl ^p	T : from BM2=5.2(0.6)e-6 (W.u.) for a similar isomer in ¹⁸⁸ Tl; other							**
* ¹⁹⁰ Tl ^p	T : 91Va04>1 us							**
* ¹⁹⁰ Pb ^m	T : uncertainty from 12Dr.A							**
* ¹⁹⁰ Pb ⁿ	E : x keV above ¹⁹⁰ Pb ^m ; x=50#(50#)							**
* ¹⁹⁰ Pb ⁿ	T : uncertainty from 12Dr.A							**
* ¹⁹⁰ Pb ^p	T : average 01Dr05=7.2(0.6) 85St16=7.9(0.4)							**
* ¹⁹⁰ Bi	D : % α symmetrized from 91Va04=90(+10-30)%; % β^+ SF from T1/2(β^+ SF)							**
* ¹⁹⁰ Bi	D : 20An12=2.8(+13.4-2.1)e7 s and T1/2 20An12=5.7(8)s							**
* ¹⁹⁰ Bi	J : 17Ba12=(3); favored α decay to J=3+ in ¹⁸⁶ Tl							**
* ¹⁹⁰ Bi	T : other 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 ^m	J : 17Ba12=(10); favored α decay to ¹⁸⁶ Tl ⁿ (J=10-)							**
* ¹⁹⁰ Bi ^m	D : % β^+ SF from T1/2(β^+ SF) 20An12=4.7(+22.6-3.5)e7 s and T1/2 20An12=5.9(6)s							**
* ¹⁹⁰ Bi ⁿ	J : E1 and M1(+E2) gammas in cascade to (3+), absence of gamma to (3+)							**
* ¹⁹⁰ Bi ⁿ	E : 45(15) + 76 keV above ¹⁹⁰ Bi							**
* ¹⁹⁰ Bi ^p	E : 274(1) keV above ¹⁹⁰ Bi ^m							**
* ¹⁹⁰ Bi ^p	T : symmetrized from 09An11=1.0(+1.0-0.5)							**
¹⁹¹ Ta	-26520#	300#		460# ms >300ns	7/2 ⁺ #	11 09St16 I	2009	β^- ?
¹⁹¹ W	-31180	40		14# s >300ns	3/2 ⁻ #	07 99Be63 I	1999	β^- ?
¹⁹¹ W ^m	-30950#	40#	235# 10#	340 ns 14	9/2 ⁻ #	11St21 ETD2009		IT=100
¹⁹¹ Re	-34350	10		9.8 m 0.5	(3/2 ⁺)	07 97Hi06 J	1963	β^- =100
¹⁹¹ Re ^m	-34205	10	145 3	20# μ s	9/2 ⁻	FGK209 TIJ		IT ?
¹⁹¹ Re ⁿ	-32749	10	1601.5 0.4	50.6 μ s 3.5	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 μ s	9/2 ⁻	07	1976	IT=100
¹⁹¹ Pt ⁿ	-35549	4	149.035 0.022	95 μ s 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 20Ba17 J	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	1954	β^+ =100; α ?
¹⁹¹ Hg ^m	-30460	30	128 22	50.8 m 1.5	13/2 ⁺ *	07 01Sc41 E	1954	β^+ =100;IT ?; α ?
¹⁹¹ Tl	-26283	7		20# m	1/2 ⁺ *	07	1974	β^+ ?
¹⁹¹ Tl ^m	-25986	7	297 7 BD	5.22 m 0.16	9/2 ⁻ *	07	1970	β^+ =100
¹⁹¹ Pb	-20291	7		1.33 m 0.08	3/2 ⁻	07 10Co13 JD	1974	β^+ $\approx$ 100; α =0.51 5
¹⁹¹ Pb ^m	-20234	8	58 10 AD	2.18 m 0.08	13/2 ⁺ *	07 17Al34 E	1975	β^+ $\approx$ 100; α $\approx$ 0.02
¹⁹¹ Pb ⁿ	-17632	12	2659 10	180 ns 80	33/2 ⁺	07 99La06 JT	1999	IT=100
¹⁹¹ Bi	-13239	7		12.4 s 0.3	9/2 ⁻ *	16	1972	α =51 10; β^+ ?
¹⁹¹ Bi ^m	-12997	9	242 4 AD	125 ms 8	1/2 ⁺	16	1981	α =68 5;IT ?; β^+ ?
¹⁹¹ Bi ⁿ	-12809	7	429.7 0.5	562 ns 10	13/2 ⁺	16 15Ny02 J	2001	IT=100
¹⁹¹ Bi ^p	-11364#	26#	1875# 25#	400 ns 40	25/2 ⁻ #	16	2016	IT=100
¹⁹¹ Po	-5069	7		22 ms 1	3/2 ⁻	07	1993	α $\approx$ 100; β^+ ?
¹⁹¹ Po ^m	-5008	12	61 11 AD	93 ms 3	13/2 ⁺	07	1999	α $\approx$ 100; β^+ ?
¹⁹¹ At	3864	16		2.1 ms 0.8	1/2 ⁺	07 03Ke08 T	2003	α $\approx$ 100; β^+ ?
¹⁹¹ At ^m	3922	18	58 20 AD	2.2 ms 0.4	(7/2 ⁻)	07 03Ke08 T	2003	α $\approx$ 100; β^+ ?
* ¹⁹¹ W ^m	T : average 11St21=360(20) 09Al30=320(20) ns							**
* ¹⁹¹ Re	J : measured (r, α) cross sections in 77Hi06 favor J=3/2 over 1/2							**
* ¹⁹¹ Re ^m	IJ : M2 to 5/2+ at 97(3) keV; existence of a similar isomer in ¹⁸⁷ Re							**
* ¹⁹¹ Re ^m	T : estimated from B(M2)=0.7 (W.u.) from ¹⁸⁷ Re							**
* ¹⁹¹ Re ⁿ	T : other 11St21=77(33)us							**
* ¹⁹¹ Os ^m	T : other 12Kr05=13.6(0.2) from the decay growth, less accurate							**
* ¹⁹¹ Os ^m	J : M3 + E4 to 9/2-							**
* ¹⁹¹ Ir ^m	J : E3 to 5/2+							**
* ¹⁹¹ Ir ⁿ	T : average 12Dr02=5.8(0.6) 79Lu01=5.5(0.7)							**
* ¹⁹¹ Ir ⁿ	E : from a least-squares fit to gamma-ray energies using data of 12Dr02							**
* ¹⁹¹ Pt	J : 92Hi07=3/2							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ¹⁹¹ Pt ^m	J : E2 to 5/2-							**
* ¹⁹¹ Pt ^m	T : other 2 us, estimated from B(E2)=0.088(5) (W.u.) in ¹⁸⁹ Pt							**
* ¹⁹¹ Pt ⁿ	J : M2 to 9/2-							**
* ¹⁹¹ Au ⁿ	J : E2 to 27/2+; measured magnetic moment							**
* ¹⁹¹ Hg ^m	E : original uncertainty (8 keV) increased by 20 keV for gs+m lines in trap							**
* ¹⁹¹ Tl	J : 92Me07=1/2							**
* ¹⁹¹ Tl ^m	J : 13Ba41,12Ba32=9/2							**
* ¹⁹¹ Pb	J : favored α decay to ¹⁸⁷ Hg ^m (J=3/2-)							**
* ¹⁹¹ Pb	D : % α other 74Ho26=0.013(0.005)							**
* ¹⁹¹ Pb ^m	J : 91Du07=13/2							**
* ¹⁹¹ Pb ⁿ	E : 2602.31(0.24) above ¹⁹¹ Pb ^m							**
* ¹⁹¹ Pb ⁿ	T : symmetrized from 99La06=150(+100-50)							**
* ¹⁹¹ Bi	J : 17Ba12=(9/2); favored α decay to ¹⁸⁷ Tl ^m (J=9/2-)							**
* ¹⁹¹ Bi ^m	J : favored α decay to ¹⁸⁷ Tl (J=1/2+)							**
* ¹⁹¹ Bi ^p	E : 1825.1 + x keV; x=50#(25#) keV							**
* ¹⁹¹ Po	J : favored α decay to ¹⁸⁷ Pb (J=3/2-)							**
* ¹⁹¹ Po ^m	J : favored α decay to ¹⁸⁷ Pb ^m (J=13/2+)							**
* ¹⁹¹ At	T : symmetrized from 03Ke08=1.7(+1.1-0.5)							**
* ¹⁹¹ At	J : favored α decay to ¹⁸⁷ Bi ^m (J=1/2+)							**
* ¹⁹¹ At ^m	T : symmetrized from 03Ke08=2.1(+0.4-0.3)							**
¹⁹² Ta	-23100#	400#	2.2 s	0.7	(2)	12 09Al30 T	2009	β^- =100; β^- -n ?
¹⁹² W	-29620#	200#	40#	s >300ns	0 ⁺	12	1999	β^- ?
¹⁹² Re	-31590	70	15.4 s	0.5	(0 ⁻)	12 20Wa.A TJ	1965	β^- =100
¹⁹² Re ^m	-31430	70	88 μ s	8		12 11St21 ETD	2005	IT=100
¹⁹² Re ⁿ	-31320	70	< 500 ms			12 20Wa.A IT	2012	β^- ?;IT ?
¹⁹² Os	-35882.3	2.3	STABLE	>53Ey	0 ⁺	12 13Be07 T	1931	IS=40.78 32; $2\beta^-$?; α ?
¹⁹² Os ^m	-33866.9	2.3	5.94 s	0.09	10 ⁻	12 13Dr05 J	1965	IT $\approx$ 100; β^- ?
¹⁹² Os ⁿ	-31302.0	2.5	205 ns	7	(20 ⁺)	12 13Dr05 ETJ	2004	IT=100
¹⁹² Ir	-34835.6	1.3	73.820 d	0.014	4 ⁺ *	12 FGK209 T	1937	β^- =95.24 4; ϵ =4.76 4
¹⁹² Ir ^m	-34778.9	1.3	1.45 m	0.05	1 ⁻	12	1937	IT $\approx$ 100; β^- =0.0175
¹⁹² Ir ⁿ	-34667.5	1.3	168.14	0.12	(11 ⁻)	12	1959	IT=100
¹⁹² Pt	-36288.5	2.6	STABLE	>60Py	0 ⁺	12 11Be08 T	1935	IS=0.782 24; α ?
¹⁹² Pt ^m	-34116.1	2.6	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	29 ms		5 ⁺	12	1976	IT=100
¹⁹² Au ⁿ	-32340	16	160 ms	20	11 ⁻	12	1976	IT=100
¹⁹² Hg	-32011	16	4.85 h	0.20	0 ⁺	12	1952	ϵ =100; α ?
¹⁹² Tl	-25870	30	9.6 m	0.4	2 ⁻ *	12 13Ba41 J	1961	β^+ =100
¹⁹² Tl ^m	-25670	30	10.8 m	0.2	7 ⁺ *	12 13Ba41 J	1961	β^+ =100
¹⁹² Tl ⁿ	-25420	30	296 ns	5	(8 ⁻)	12	1980	IT=100
¹⁹² Tl ^p	-25695	25	180	40	(3 ⁺)	12 91Va04 E	1991	α =100
¹⁹² Pb	-22552	6	3.5 m	0.1	0 ⁺	12	1974	β^+ $\approx$ 100; α =0.0059 7
¹⁹² Pb ^m	-19971	6	166 ns	6	10 ⁺	12 07Io03 J	1985	IT=100
¹⁹² Pb ⁿ	-19927	6	1.09 μ s	0.04	12 ⁺	12 07Io03 J	1979	IT=100
¹⁹² Pb ^p	-19809	6	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	39.6 s	0.4	10 ⁻ *	12	1966	β^+ =90 3; α =10 3
¹⁹² Po	-8066	11	32.2 ms	0.3	0 ⁺	12	1977	$\alpha\approx$ 100; β^+ ?
¹⁹² Po ^m	-5771	11	2294.6	1.0	11 ⁻	12	1999	IT=100
¹⁹² At	2926	28	11.5 ms	0.6	3 ⁺ #	12 13An03 D	2006	α =100; β^+ ?; β^+ SF<0.51
¹⁹² At ^m	2926	28	88 ms	6	(9 ⁻ , 10 ⁻)	12 13An03 DT	2006	α =100; β^+ ?; β^+ SF<0.51
* ¹⁹² Re	T : average 20Wa.A=15.1(0.6) 12Al05=16(2) 79Ka.B=16(1)							**
* ¹⁹² Re ^m	T : average 11St21=85(10) 09Al30=93(15); other 05Ca02=120(+210-50)us							**
* ¹⁹² Re ^m	E : 159.3 keV gamma and X rays seen only in 11St21							**
* ¹⁹² Re ⁿ	T : not observed in 20Wa.A, based on the extraction time of the isotope							**
* ¹⁹² Re ⁿ	T : separation system; other 12Re19=61(+40-20) s for q=75+ (bare ions)							**
* ¹⁹² Os	T : lower limit is for $2\beta^-$; T1/2(α ,0 ⁺ ->2 ⁺) 20Be23 >5.8Ey							**
* ¹⁹² Os ^m	T : average 79KaYT=5.9(0.1) 73Pa21=6.1(0.2); other 15Ak02=10.5(+1.0-0.9) s							**
* ¹⁹² Os ^m	T : from τ =15.1(+1.5-1.3) s for q=75+ (H-like)							**
* ¹⁹² Os ⁿ	T : from 13Dr05 τ =295(10) ns							**
* ¹⁹² Pt ^m	J : E2 to 8- band member							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁹² Au ^m	J : E3 to 2-; M2 to 3-									**
* ¹⁹² Au ⁿ	J : E3 to 8+									**
* ¹⁹² Tl	J : also 92Me07=2									**
* ¹⁹² Tl ^m	J : also 92Me07=7									**
* ¹⁹² Tl ^m	E : from 91Va04=168+x keV, 15 keV <x< 40 keV									**
* ¹⁹² Tl ⁿ	E : 250.6(0.2) keV above ¹⁹² Tl ^m									**
* ¹⁹² Bi	J : 17Ba12=(3)									**
* ¹⁹² Bi ^m	J : 17Ba12=(10); favored α decay to ¹⁸⁸ Tl (J=10-)									**
* ¹⁹² Po ^m	J : E1 to 10+									**
* ¹⁹² Po ^m	E : uncertainty estimated by the evaluator									**
* ¹⁹² At	D : % β^+ SF 13An03=0.42(0.09) for both isomers									**
* ¹⁹² At ^m	T : other 13An03=110(+26-18)									**
¹⁹³ Ta	-20810#	400#			220# ms >300ns	7/2 ⁺ #	17 12Ku26 I	2012	β^- ?; β^- n ?	
¹⁹³ W	-26190#	200#			30# s >300ns	1/2 ⁻ #	17 09St16 I	2009	β^- ?	
¹⁹³ Re	-30230	40			3# m >300ns	5/2 ⁺ #	17 99Be63 I	1999	β^- ?	
¹⁹³ Re ^m	-30080	40	146.0	0.2	69 μ s 6	(9/2 ⁻)	17 11St21 ETJ	2005	IT=100	*
¹⁹³ Os	-33394.4	2.3			29.830 h 0.018	3/2 ⁻	17	1940	β^- =100	
¹⁹³ Os ^m	-33078.8	2.3	315.6	0.3	121 ns 28	(9/2 ⁻)	17	2011	IT=100	
¹⁹³ Ir	-34536.3	1.3			STABLE	3/2 ⁺ *	17	1935	IS=62.7 2	
¹⁹³ Ir ^m	-34456.1	1.3	80.238	0.006	10.53 d 0.04	11/2 ⁻	17	1957	IT=100	
¹⁹³ Ir ⁿ	-32257.4	1.4	2278.9	0.5	124.8 μ s 2.1	31/2 ⁺	17	2012	IT=100	
¹⁹³ Pt	-34479.7	1.4			50 y 6	1/2 ⁻ *	17	1948	ϵ =100	*
¹⁹³ Pt ^m	-34329.9	1.4	149.78	0.04	4.33 d 0.03	13/2 ⁺ *	17 86Sc04 J	1949	IT=100	
¹⁹³ Au	-33405	9			17.65 h 0.15	3/2 ⁺ *	17	1948	β^+ =100; α ?	
¹⁹³ Au ^m	-33115	9	290.20	0.04	3.9 s 0.3	11/2 ⁻ *	17 20Ba17 J	1955	IT $\approx$ 100; β^+ $\approx$ 0.03	
¹⁹³ Au ⁿ	-30918	9	2486.7	0.6	150 ns 50	31/2 ⁺	17 07Ok05 J	1985	IT=100	
¹⁹³ Hg	-31062	16			3.80 h 0.15	3/2 ⁻ *	17	1952	β^+ =100	
¹⁹³ Hg ^m	-30921	16	140.76	0.05	11.8 h 0.2	13/2 ⁺ *	17	1973	β^+ =92.8 5; IT=7.2 5	
¹⁹³ Tl	-27477	7			21.6 m 0.8	1/2 ⁺ *	17	1960	β^+ =100	
¹⁹³ Tl ^m	-27105	8	372	4	2.11 m 0.15	9/2 ⁻ *	17	1963	IT $\approx$ 75; β^+ $\approx$ 25	*
¹⁹³ Pb	-22229	10			4# m	3/2 ⁻ #	17	1974	β^+ = ?	*
¹⁹³ Pb ^m	-22137	7	93	12 AD	5.8 m 0.2	13/2 ⁺ *	17 17Al34 E	1974	β^+ =100	*
¹⁹³ Pb ⁿ	-19522	16	2707	13	180 ns 15	33/2 ⁺	17 04Io01 J	1991	IT=100	*
¹⁹³ Bi	-15885	8			63.6 s 3.0	9/2 ⁻ *	17	1971	β^+ =96.5 15; α =3.5 15	*
¹⁹³ Bi ^m	-15580	9	305	6 AD	3.20 s 0.14	1/2 ⁺ *	17 15He27 T	1970	α =84 16; β^+ ?	*
¹⁹³ Bi ⁿ	-15279	8	605.53	0.18	153 ns 10	13/2 ⁺	17	2004	IT=100	
¹⁹³ Bi ^p	-13535	8	2349.6	0.6	85 μ s 3	29/2 ⁺	17	2004	IT=100	
¹⁹³ Bi ^q	-13480	8	2405.1	0.7	3.02 μ s 0.08	(29/2 ⁻)	17	2004	IT=100	
¹⁹³ Po	-8325	15			399 ms 34	3/2 ⁻ *	17	1967	α $\approx$ 100; β^+ ?	*
¹⁹³ Po ^m	-8225	15	100	6 AD	245 ms 11	13/2 ⁺ *	17	1981	α $\approx$ 100; β^+ ?	*
¹⁹³ At	-67	22		*	29 ms 5	1/2 ⁺	17 03Ke08 T	2003	α $\approx$ 100	*
¹⁹³ At ^m	-59	21	8	9 AD*	21 ms 5	7/2 ⁻	17	1995	α $\approx$ 100	*
¹⁹³ At ⁿ	-25	21	42	9 AD	28 ms 4	13/2 ⁺	17 03Ke08 T	2003	IT=76 10; α =24 10	*
¹⁹³ Rn	9043	25			1.15 ms 0.27	(3/2 ⁻)	07	2006	α $\approx$ 100	*
* ¹⁹³ Re ^m	E : average 05Ca02=146.1(0.3) 11St21=145.2(0.5) 09Al30=146.1(0.2) keV									**
* ¹⁹³ Re ^m	T : average 11St21=65(9) 09Al30=72(8); other 05Ca02=75(+450-40)									**
* ¹⁹³ Pt	J : 92Hi07=1/2									**
* ¹⁹³ Tl ^m	E : 76Ha25<13 keV above 365.2-keV level due to negligible L Xray yield									**
* ¹⁹³ Tl ^m	J : 13Ba41, 12Ba32=9/2									**
* ¹⁹³ Pb	T : 4.0 m reported in the Karlsruhe charts 1981 and 1995; not traceable									**
* ¹⁹³ Pb ^m	J : 91Du07=13/2									**
* ¹⁹³ Pb ⁿ	E : 2612.5(0.5) keV above ¹⁹³ Pb ^m									**
* ¹⁹³ Bi	J : 16Ba42=9/2									**
* ¹⁹³ Bi ^m	J : 16Ba42=1/2									**
* ¹⁹³ Po	J : 13Se03, 14Se07=(3/2); favored α decay to ¹⁸⁹ Pb (J=3/2-)									**
* ¹⁹³ Po ^m	J : 13Se03, 14Se07=(13/2); favored α decay to									**
* ¹⁹³ Po ^m	J : ¹⁸⁹ Pb ^m (J=13/2+)									**
* ¹⁹³ At	T : symmetrized from 03Ke08=28(+5-4)									**
* ¹⁹³ At	J : favored α decay to ¹⁸⁹ Bi ^m (J=1/2+)									**
* ¹⁹³ At ^m	J : favored α decay to ¹⁸⁹ Bi (J=7/2-)									**
* ¹⁹³ At ⁿ	T : symmetrized from 03Ke08=27(+4-3)									**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ¹⁹³ At ⁿ	J : favored α decay to ¹⁸⁹ Bi ⁿ (J=13/2+)									**
* ¹⁹³ Rn	J : favored α decay to ¹⁸⁹ Po [J=(3/2-)]									**
¹⁹⁴ Ta	-17130#	500#		2# s >300ns			13 12Ku26 I	2012	β^- ?; β^- n ?	
¹⁹⁴ W	-24410#	300#		20# s >300ns	0 ⁺	11		2008	β^- ?	
¹⁹⁴ Re	-27260#	200#		5 s 1	1 ⁻ #	14	12Al05 T	1999	β^- =100	*
¹⁹⁴ Re ^m	-27110#	210#	150# 50#	45 μ s 18	4 ⁻ #	14	11St21 TD	2011	IT=100	*
¹⁹⁴ Re ⁿ	-26980#	200#	285 40	25 s 8	11 ⁻ #	14	12Re19 E	2012	β^- =100	*
¹⁹⁴ Re ^p	-26430#	200#	833 33	100 s 10		14	12Re19 E	2012	β^- =100	
¹⁹⁴ Os	-32435.2	2.4		6.0 y 0.2	0 ⁺	06		1951	β^- =100	
¹⁹⁴ Ir	-32531.8	1.3		19.35 h 0.07	1 ⁻ *	06	16Kr06 T	1937	β^- =100	*
¹⁹⁴ Ir ^m	-32384.7	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	(11 ⁻)	06		1968	β^- =100	*
¹⁹⁴ Pt	-34760.1	0.5		STABLE	0 ⁺	06		1935	IS=32.864 410	
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	-32184.0	2.9		447 y 28	0 ⁺	06	15Do01 T	1962	ϵ =100	*
¹⁹⁴ Tl	-26937	14		33.0 m 0.5	2 ⁻ *	06	13Ba41 J	1960	β^+ =100; α ?	*
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	-16023	5		95 s 3	3 ⁺ *	06		1971	$\beta^+\approx$ 100; α =0.46 25	*
¹⁹⁴ Bi ^m	-15880	50	150 50 MD	125 s 2	(6 ⁺ , 7 ⁺)	06		1976	$\beta^+\approx$ 100; α ?	
¹⁹⁴ Bi ⁿ	-15860	5	163 4 AD	115 s 4	10 ⁻ *	06		1988	$\beta^+\approx$ 100; α =0.20 7	*
¹⁹⁴ Po	-11005	13		392 ms 4	0 ⁺	06		1967	$\alpha\approx$ 100; β^+ ?	
¹⁹⁴ Po ^m	-8692	13	2313.4 0.3	12.9 μ s 0.5	(10 ⁻)	06	16An10 TJE	1999	IT=100	
¹⁹⁴ At	-716	24		286 ms 7	(5 ⁻)	06	13An03 TD	2009	$\alpha\approx$ 100; $\beta^+=$ 8.3#; β^+ SF=0.032#	*
¹⁹⁴ At ^m	-740	30	-20 40 AD*	323 ms 7	10 ⁻	06	13An03 T	1984	$\alpha\approx$ 100; $\beta^+=$ 8.3#; β^+ SF=0.032#	*
¹⁹⁴ Rn	5725	17		780 μ s 160	0 ⁺	07		2006	$\alpha\approx$ 100; β^+ ?	
* ¹⁹⁴ Re	T : other 09Ku28=1.0(0.5) withdrawn by authors in 14Ku23									**
* ¹⁹⁴ Re ^m	E : only 86.3 keV gamma is seen in 11St21									**
* ¹⁹⁴ Re ^m	I : assignment from 11St21; similar experiment, but with less statistics,									**
* ¹⁹⁴ Re ^m	I : in 05Ca02 also reports a us isomer with 464, 148, 128 gammas									**
* ¹⁹⁴ Re ^m	I : labeled in a singles spectrum, among others, on the top of high									**
* ¹⁹⁴ Re ^m	I : background; the assignment of these gammas to ¹⁹⁴ Re is ambiguous									**
* ¹⁹⁴ Re ⁿ	T : associated with 194,349 and 554 keV gammas following β^- decay and									**
* ¹⁹⁴ Re ⁿ	T : placed in 12Al05 in the high-spin part of ¹⁹⁴ Os level scheme									**
* ¹⁹⁴ Ir	T : average 16Kr06=19.20(0.02) 72Ge10=19.15(0.03) 72Em01=19.41(0.01);									**
* ¹⁹⁴ Ir	T : Birge ratio=8.27									**
* ¹⁹⁴ Ir ⁿ	J : direct β^- feeding to J=10+ and no feeding to 8+ and 9-; systematics									**
* ¹⁹⁴ Au ^m	J : M2 to 3- member of K=1- gs band									**
* ¹⁹⁴ Au ⁿ	J : E3 to 8+									**
* 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 keV gamma ray.									**
* ¹⁹⁴ Tl	J : also 92Me07=2									**
* ¹⁹⁴ Tl ^m	J : also 92Me07=7									**
* ¹⁹⁴ Pb ^m	J : E2 to 10+; magnetic moment									**
* ¹⁹⁴ Pb ⁿ	J : E2 to 9-; magnetic moment									**
* ¹⁹⁴ Bi	J : 17Ba12=(3); favored α decay to ¹⁹⁰ Tl (J=3+)									**
* ¹⁹⁴ Bi ⁿ	J : 17Ba12=(10); favored α decay from ¹⁹⁸ At ^m (J=10-)									**
* ¹⁹⁴ At	T : 13An03, supersedes 09An11=253(10)									**
* ¹⁹⁴ At	D : % β^+ SF 13An03=0.065(0.008) for both isomers									**
* ¹⁹⁴ At	J : favored α decay to ¹⁹⁰ Bi ⁿ [J=(5-)]									**
* ¹⁹⁴ At ^m	T : 13An03=323(7), supersedes 09An11=310(8); other 13Ny01=300(+50-40)									**
¹⁹⁵ W	-20740#	300#		30# s >160ns	3/2 ⁻ #	16	12Ku26 I	2012	β^- ?	
¹⁹⁵ Re	-25560#	300#		6 s 1	5/2 ⁺ #	14		2008	β^- =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)
¹⁹⁵ Os	-29510	60	6.5 m 1.1	(3/2 ⁻)	14 13Bi14	TD 2004	β^- =100 *
¹⁹⁵ Os ^m	-29080	60	47 s 3	(13/2 ⁺)	14 20Wa12	ETJ 2012	IT≈100; β^- ? *
¹⁹⁵ Ir	-31692.3	1.3	2.29 h 0.17	3/2 ⁺	14 13Bi14	TD 1952	β^- =100 *
¹⁹⁵ Ir ^m	-31592	5	3.74 h 0.07	11/2 ⁻	14	1968	β^- ≈100;IT ? *
¹⁹⁵ Ir ⁿ	-29338	6	4.4 μs 0.6	(27/2 ⁺)	11St21	ETJ 2011	IT=100 *
¹⁹⁵ Pt	-32793.9	0.5	STABLE >6.3Ey	1/2 ⁻ *	14 11Be08	T 1935	IS=33.775 240; α ? *
¹⁹⁵ Pt ^m	-32534.8	0.5	4.010 d 0.005	13/2 ⁺ *	14	1960	IT=100 *
¹⁹⁵ Au	-32567.1	1.1	186.01 d 0.06	3/2 ⁺ *	14 14Un01	T 1948	ε =100 *
¹⁹⁵ Au ^m	-32248.5	1.1	30.5 s 0.2	11/2 ⁻ *	14 20Ba17	J 1952	IT=100 *
¹⁹⁵ Au ⁿ	-30066#	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	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	3.6 s 0.4	9/2 ⁻ *	14	1957	IT=100 *
¹⁹⁵ Pb	-23738	5	15.0 m 1.4	3/2 ⁻	14	1957	β^+ =100 *
¹⁹⁵ Pb ^m	-23535	5	202.9	13/2 ⁺	14 91Gr12	E 1957	β^+ =100; IT ? *
¹⁹⁵ Pb ⁿ	-21979	5	1759.0	10.0 μs 0.7	14	1976	IT=100 *
¹⁹⁵ Pb ^p	-20836	5	2901.7	33/2 ⁺	14	1982	IT=100 *
¹⁹⁵ Bi	-18026	5	95 ns 20	9/2 ⁻ *	14	1971	β^+ ≈100; α =0.030 12 *
¹⁹⁵ Bi ^m	-17626	8	183 s 4	1/2 ⁺ *	14	1974	β^+ =67 17; α =33 17 *
¹⁹⁵ Bi ⁿ	-15645	5	87 s 1	(29/2 ⁻)	14 17He12	EJT 2003	IT=100 *
¹⁹⁵ Bi ^p	-15410	5	614 ns 5	29/2 ⁺	15 17He12	ETJ 2018	IT=100 *
¹⁹⁵ Po	-11117	6	1.49 μs 0.01	3/2 ⁻ *	15	1967	α =94 4; β^+ ? *
¹⁹⁵ Po ^m	-10968	7	4.64 s 0.09	13/2 ⁺ *	15 17Al34	EJ 1967	α ≈100; β^+ ?;IT ? *
¹⁹⁵ At	-3470	10	1.92 s 0.02	1/2 ⁺ *	14	1999	α ≈100; β^+ ? *
¹⁹⁵ At ^m	-3441	8	290 ms 20	7/2 ⁻ *	14	1995	α =88 4;IT=12 4; β^+ ? *
¹⁹⁵ At ^p	-3370#	40#	143 ms 3	(13/2 ⁺)	13Uu01	J	IT ? *
¹⁹⁵ Rn	5050	50	7 ms 3	3/2 ⁻	14	2001	α =100 *
¹⁹⁵ Rn ^m	5131	17	6 ms 3	13/2 ⁺	14	2001	α =100 *
* ¹⁹⁵ Os	J : E3 from (13/2 ⁺) and subsequent E2 to the ground state in 21Wa.B						**
* ¹⁹⁵ Os ^m	T : other 12Re19=32(+154-16) m for q=76+ (bare ion)						**
* ¹⁹⁵ Os ^m	E : from 21Wa.B,20Wa12=427.8(0.3); other 12Re19=454(10) keV						**
* ¹⁹⁵ Ir ^m	T : average 68Ja06,73Ja10=3.67(0.08) 68Ho01=4.00(0.15)						**
* ¹⁹⁵ Ir ^m	E : from 78Ya03,83Ci01=100(5) keV in ¹⁹⁶ Pt(<i>t</i> , α); other						**
* ¹⁹⁵ Ir ^m	E : 73Ja10=120(36) keV from β^- decay end-point energies						**
* ¹⁹⁵ Ir ^m	E : 268.4,404.4,476.4,537.8,566.7 gammas in a cascade to ¹⁹⁵ Ir ^m						**
* ¹⁹⁵ Pt	J : 92Hi07=1/2						**
* ¹⁹⁵ Au ⁿ	E : 13Dr01=2460.9 + x; x=40#(20#) estimated by Nubase						**
* 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 Tl ^m	J : 13Ba41,12Ba32=9/2						**
* ¹⁹⁵ Pb	T : from 82Hi04, determined to be within 1.2 m of the ¹⁹⁵ Pb ^m						**
* ¹⁹⁵ Pb	T : half-life						**
* ¹⁹⁵ Bi	J : 16Ba42=9/2						**
* ¹⁹⁵ Bi	D : % α from 85Co06=0.01-0.05						**
* ¹⁹⁵ Bi ^m	J : 16Ba42=1/2						**
* ¹⁹⁵ Bi ⁿ	E : uncertainty estimated by Nubase; other Esndf14=2395.5(0.5)						**
* ¹⁹⁵ Bi ^p	E : uncertainty estimated by Nubase						**
* ¹⁹⁵ Po	J : 13Se03,14Se07,17Al34=(3/2); favored α decay to ¹⁹¹ Pb (J=3/2 ⁻)						**
* ¹⁹⁵ Po ^m	J : 13Se03,14Se07,17Al34=(13/2); favored α decay to ¹⁹¹ Pb ^m						**
* ¹⁹⁵ Po ^m	J : (J=13/2 ⁺)						**
* ¹⁹⁵ At	J : 18Cu02=(1/2); favored α decay to ¹⁹¹ Bi ^m (J=1/2 ⁺)						**
* ¹⁹⁵ At ^m	E : Esndf14=33.0(1.0) is erroneous						**
* ¹⁹⁵ At ^m	J : 18Cu02=(7/2); favored α decay to ¹⁹¹ Bi (J=7/2 ⁻)						**
* ¹⁹⁵ At ^p	E : estimated 70#(40#) above ¹⁹⁵ At ^m ; 13Ny01<130 keV						**
* ¹⁹⁵ Rn	T : symmetrized from 01Uu01=6(+3-2)						**
* ¹⁹⁵ Rn ^m	T : symmetrized from 01Uu01=5(+3-2)						**
¹⁹⁶ W	-18740#	400#	25# s >300ns	0 ⁺	13 12Ku26	I 2012	β^- ? *
¹⁹⁶ Re	-22360#	300#	2.4 s 1.5		13	2008	β^- ? *
¹⁹⁶ Re ^m	-22240#	300#	3.6 μs 0.6		11St21	T 2009	IT=100 *
¹⁹⁶ Os	-28280	40	34.9 m 0.2	0 ⁺	17 77Ha32	T 1977	β^- =100 *

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
^{196}Ir	-29440	40				52.0 s 1.1	(1,2 ⁻)	07	20Mu16 TJ	1966	β^- =100	*	
$^{196}\text{Ir}^m$	-29227	20	210	40	BD	1.40 h 0.02	11 ⁻ #	07		1959	$\beta^- \approx 100$; IT ?		
^{196}Pt	-32644.5	0.5				STABLE	0 ⁺	07		1935	IS=25.211 340		
^{196}Au	-31138.7	3.0				6.165 d 0.011	2 ⁻ *	07	11Hi19 T	1937	$\beta^+ = 93.0$ 3; $\beta^- = 7.0$ 3	*	
$^{196}\text{Au}^m$	-31054	3	84.656	0.020		8.1 s 0.2	5 ⁺	07		1971	IT=100		
$^{196}\text{Au}^n$	-30543	3	595.66	0.04		9.603 h 0.022	12 ⁻ *	07	20Mo24 T	1960	IT=100		
^{196}Hg	-31825.9	2.9				STABLE	>2.5Ey	0 ⁺	07	90Bu28 T	1930	IS=0.15 1; 2 β^+ ?	
^{196}Tl	-27497	12				1.84 h 0.03	2 ⁻ *	07		1955	β^+ =100		
$^{196}\text{Tl}^m$	-27103	12	394.2	0.5		1.41 h 0.02	7 ⁺ *	07	13Ba41 J	1960	$\beta^+ = 96.2$ 4; IT=3.8 4	*	
^{196}Pb	-25348	8				37 m 3	0 ⁺	07		1957	$\beta^+ = 100$; $\alpha < 3\text{e-}5$		
$^{196}\text{Pb}^m$			<i>non-exist</i>		RN	< 1 μs	4 ⁺	07		1973	IT=100	*	
$^{196}\text{Pb}^n$	-23550	8	1797.51	0.14		140 ns 14	5 ⁻	07		1973	IT=100		
$^{196}\text{Pb}^p$	-22653	8	2694.6	0.3		270 ns 4	12 ⁺	07		1973	IT=100		
^{196}Bi	-18009	24				5.13 m 0.20	(3 ⁺)	07	87Va09 T	1976	$\beta^+ \approx 100$; $\alpha = 0.00115$ 34	*	
$^{196}\text{Bi}^m$	-17843	25	166.4	2.9	AD	0.6 s 0.5	(7 ⁺)	07		1987	IT ≈ 100 ; β^+ ?		
$^{196}\text{Bi}^n$	-17737	25	272	3	AD	4.00 m 0.05	(10 ⁻)	07	87Va09 T	1987	$\beta^+ = 74.2$ 25; IT=25.8 25; $\alpha = 0.00038$ 10	*	
^{196}Po	-13469	5				5.63 s 0.07	0 ⁺	07	16Tr07 T	1967	$\alpha = 94$ 5; β^+ ?	*	
$^{196}\text{Po}^m$	-10975	5	2493.9	0.4		856 ns 17	11 ⁻	07		1995	IT=100		
^{196}At	-3910	30			*	377 ms 4	(3 ⁺)*	07	16Tr07 TD	1967	$\alpha = 97.5$ 3; β^+ ?; β^+ SF=0.009 1	*	
$^{196}\text{At}^m$	-3950	18	-40	40	AD*	20# ms	10 ⁻ #		96En01 DI	1996	$\alpha \approx 100$	*	
$^{196}\text{At}^n$	-3750	30	157.9	0.1		11 μs 2	(5 ⁺)	07		2000	IT=100		
^{196}Rn	1975	14				4.7 ms 1.1	0 ⁺	07	01Ke06 T	1995	$\alpha \approx 100$; β^+ ?	*	
* ^{196}Re	T : symmetrized from 14Ku23=3(+1-2)											**	
* $^{196}\text{Re}^m$	E : E>72 keV (K-shell binding energy), since only K X-rays were observed											**	
* ^{196}Os	T : other 18Hi07=35.3(1.4)											**	
* ^{196}Ir	T : average 20Mu16=49(5) 68Ja06=54.5(2.0) 67Mo10=52(2) 66Vo05=50(2)											**	
* ^{196}Au	T : unweighted average 11Hi19=6.1451(0.0013) 01Li17=6.1669(0.0006)											**	
* ^{196}Au	T : 63Ik01=6.183(0.010); Birge ratio=10.86											**	
* ^{196}Tl	J : also 92Me07=2											**	
* $^{196}\text{Tl}^m$	J : also 92Me07=7											**	
* $^{196}\text{Pb}^m$	T : this is the 4+ member of the ground-state band (K=0+) and the half-life											**	
* $^{196}\text{Pb}^n$	T : is expected to be in the ps regime											**	
* ^{196}Bi	T : from 87Va09=308(12) s											**	
* $^{196}\text{Bi}^n$	T : from 87Va09=240(3) s											**	
* ^{196}Po	T : average 16Tr07t=5.75(0.12) 97Pu01=5.5(0.1) 93Wa04=5.8(0.2);											**	
* ^{196}Po	T : others (not used) 10He25=4.1(+5.6-1.5) 05Uu02=5.1(+3.1-1.4)											**	
* ^{196}Po	D : % α from 93Wa04											**	
* ^{196}At	D : % β^+ SF other 93An11=0.088											**	
* ^{196}At	T : average 16Tr07=371(5) 00Sm06=388(7)											**	
* ^{196}At	J : 18Cu02=(3)											**	
* $^{196}\text{At}^m$	I : level not adopted in Ensdf2007											**	
* ^{196}Rn	T : symmetrized from 01Ke06=4.4(+1.3-0.9)											**	
^{197}W	-14870#	400#				1# s >300ns	5/2 ⁻ #	13	12Ku26 I	2012	β^- ?		
^{197}Re	-20350#	300#				400# ms >300ns	5/2 ⁺ #	13		2009	β^- ?		
^{197}Os	-25080#	200#				93 s 7	5/2 ⁻ #	09	18Hi07 TD	2003	β^- =100	*	
$^{197}\text{Os}^m$	-24580#	280#	500#	200#		< 0.1 s	13/2 ⁺ #		18Hi07 TI		IT ?; β^- ?		
^{197}Ir	-28264	20				5.8 m 0.5	3/2 ⁺	05		1952	β^- =100		
$^{197}\text{Ir}^m$	-28149	21	115	5		8.9 m 0.3	11/2 ⁻	05		1976	$\beta^- \approx 100$; IT ?		
$^{197}\text{Ir}^n$	-26560#	500#	1700#	500#		30 μs 8			05Ca02 T	2005	IT=100	*	
$^{197}\text{Ir}^p$	-25460#	500#	2800#	500#		15 μs 9			05Ca02 T	2005	IT=100	*	
^{197}Pt	-30419.8	0.5				19.8915 h 0.0019	1/2 ⁻ *	05		1936	β^- =100		
$^{197}\text{Pt}^m$	-30020.2	0.5	399.59	0.20		95.41 m 0.18	13/2 ⁺	05		1941	IT=96.7 4; $\beta^- = 3.3$ 4		
^{197}Au	-31139.8	0.5				STABLE	3/2 ⁺ *	05		1935	IS=100		
$^{197}\text{Au}^m$	-30730.7	0.5	409.15	0.08		7.73 s 0.06	11/2 ⁻	05		1945	IT=100		
$^{197}\text{Au}^n$	-28607.3	1.1	2532.5	1.0		150 ns 5	27/2 ⁺ #		06Wh02 ETJ	2006	IT=100		
^{197}Hg	-30540	3				64.93 h 0.07	1/2 ⁻ *	05	20Le04 T	1941	ϵ =100	*	
$^{197}\text{Hg}^m$	-30241	3	298.93	0.08		23.82 h 0.04	13/2 ⁺ *	05	20Le04 TD	1943	IT=94.68 9; $\epsilon = 5.32$ 9		
^{197}Tl	-28354	14				2.84 h 0.04	1/2 ⁺ *	05		1955	β^+ =100		
$^{197}\text{Tl}^m$	-27746	14	608.22	0.08		540 ms 10	9/2 ⁻ *	05		1953	IT=100		

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
¹⁹⁷ Pb	-24745	5	8.1 m 1.7	3/2 ⁻	05		1955	$\beta^+=100$
¹⁹⁷ Pb ^m	-24426	5	319.31 0.11 IT	42.9 m 0.9	13/2 ⁺ *	05	1957	$\beta^+=81.2$; IT=19.2
¹⁹⁷ Pb ⁿ	-22831	5	1914.10 0.25	1.15 μ s 0.20	21/2 ⁻	05	1978	IT=100
¹⁹⁷ Bi	-19687	8	9.33 m 0.50	9/2 ⁻ *	05		1971	$\beta^+=100$; α ?
¹⁹⁷ Bi ^m	-19155	8	533 12 AD	5.04 m 0.16	1/2 ⁺ *	05	1966	$\alpha=55.40$; $\beta^+=45.40$; IT?
¹⁹⁷ Bi ⁿ		<i>non-exist</i>	RN	204 ns 18	(23/2 ⁻)	05		IT=100
¹⁹⁷ Bi ^p	-17284	14	2403 12	263 ns 13	(29/2 ⁻)	05 86Ch01	TJD 1986	IT=100
¹⁹⁷ Bi ^q	-16758	8	2929.5 0.5	209 ns 30	(31/2 ⁻)	05 86Ch01	TJD 1986	IT=100
¹⁹⁷ Po	-13393	10		53.6 s 0.9	(3/2 ⁻)*	05 93Wa04	T 1965	β^+ ?; $\alpha=44.7$
¹⁹⁷ Po ^m	-13197	7	196 12 MD	25.8 s 0.1	13/2 ⁺ *	05 93Wa04	T 1967	$\alpha=84.9$; β^+ ?; IT?
¹⁹⁷ At	-6355	8		388.2 ms 5.6	9/2 ⁻ *	05 05De01	T 1967	$\alpha=96.1.12$; $\beta^+=3.9.12$
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 μ s 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 AD	25.6 ms 2.5	13/2 ⁺	05 08An05	T 1996	$\alpha\approx 100$; β^+ ?
¹⁹⁷ Fr	10250	60		2.3 ms 1.9	(7/2 ⁻)	14 13Ka16	TDJ 2013	$\alpha\approx 100$
* ¹⁹⁷ Os	T: average 18Hi07=91(8) from β^- (t) and 18Hi07=101(18) by gating on							**
* ¹⁹⁷ Os	T: β^- -delayed 478.7 and 495.1 keV gammas							**
* ¹⁹⁷ Ir ⁿ	E: 279, 379, 495, 567 keV gammas in 37-73 us time window in 05Ca02							**
* ¹⁹⁷ Ir ^p	E: 279,379,458,495,567,609 keV gammas in 0-37 us time window in 05Ca02							**
* ¹⁹⁷ Hg	T: average 20Le04=64.81(0.24) 01Li17=64.94(0.07); Ensdf2005 includes							**
* ¹⁹⁷ Hg	T: 66El09=64.14(0.05) strongly conflicting, Birge ratio would be 6.7							**
* ¹⁹⁷ Tl ^m	J: 13Ba41, 12Ba32=9/2							**
* ¹⁹⁷ Pb ^m	J: 91Du07=13/2							**
* ¹⁹⁷ Bi	J: 16Ba42=9/2							**
* ¹⁹⁷ Bi ^m	J: 16Ba42=1/2							**
* ¹⁹⁷ Bi ⁿ	I: Ensdf2005 reported an isomer at 2129 keV, depopulating by 160.7 keV							**
* ¹⁹⁷ Bi ⁿ	I: gamma; not trusted by Nubase, since the time spectrum for 160.7 keV							**
* ¹⁹⁷ Bi ⁿ	I: gamma in 86Ch01 (fig.3) shows a significant prompt component							**
* ¹⁹⁷ Bi ^p	T: other 95Zh36=252.6(38.7) outweighed, not used							**
* ¹⁹⁷ Bi ^p	E: 95Zh36=2383.1 + x, with x<40 keV; 86Ch01=2360.4 + x is the same level							**
* ¹⁹⁷ Bi ^p	E: but the authors mis-assigned the 97 keV gamma, 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	J: 13Se03, 14Se07, 17Al34=(3/2)							**
* ¹⁹⁷ Po ^m	T: others not used 71Ho01=27(3) 67Le21=29(9) 67Si09=26(2)							**
* ¹⁹⁷ Po ^m	T: 10He25=14.45(+14.45-4.9) ms for 3 events, strongly conflicting							**
* ¹⁹⁷ Po ^m	J: 13Se03, 14Se07, 17Al34=(13/2); favored α decay to ¹⁹³ Pb ^m							**
* ¹⁹⁷ Po ^m	J: (J=13/2+)							**
* ¹⁹⁷ Po ^m	E: from 17Al34							**
* ¹⁹⁷ At	T: average 05De01=390(16) 99Sm07=388(6); other 14Ka23=354(+17-15)							**
* ¹⁹⁷ At	J: 18Cu02=(9/2); favored α decay to ¹⁹³ Bi (J=9/2-)							**
* ¹⁹⁷ At ^m	T: other 14Ka23=2.8(+3.8-1.0)							**
* ¹⁹⁷ At ^m	J: 18Cu02=(1/2); favored α decay to ¹⁹³ Bi ^m (J=1/2+)							**
* ¹⁹⁷ At ⁿ	T: other 99Sm07=5.5(1.4)							**
* ¹⁹⁷ At ⁿ	J: M2 to 9/2-							**
* ¹⁹⁷ Rn	T: symmetrized from 08An05=53(+7-5)							**
* ¹⁹⁷ Rn	J: favored α decay to ¹⁹³ Po (J=3/2-)							**
* ¹⁹⁷ Rn ^m	T: symmetrized from 08An05=25(+3-2); others 05Uu02=30(+150-15)							**
* ¹⁹⁷ Rn ^m	T: 96En02=19(+8-4) 95Mo14=18(+9-5)							**
* ¹⁹⁷ Rn ^m	J: favored α decay to ¹⁹³ Po ^m (J=13/2+)							**
* ¹⁹⁷ Fr	T: symmetrized from 13Ka16=0.6(+30-3)							**
¹⁹⁸ Re	-16990#	400#		1# s >300ns		16 09St16	I 2009	β^- ?; β^- n?
¹⁹⁸ Os	-23600#	200#		125 s 28	0 ⁺	16 18Hi07	TD 2008	β^- =100
¹⁹⁸ Ir	-25710#	200#		8.7 s 0.4	1 ⁻	16 20Mu16	TJ 1973	β^- =100
¹⁹⁸ Pt	-29904.0	2.1		STABLE	0 ⁺	16	1935	IS=7.356 130; 2 β^- ?; α ?
¹⁹⁸ Au	-29580.8	0.5		2.69464 d 0.00014	2 ⁻ *	16 FGK209	T 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=10.04 3
¹⁹⁸ Tl	-27529	8		5.3 h 0.5	2 ⁻ *	16	1949	β^+ =100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)
$^{198}\text{Tl}^m$	-26985	8	543.6 0.4	1.87 h 0.03	7^+*	16	1949 $\beta^+=55.9$ 23; IT=44.1 23
$^{198}\text{Tl}^n$	-26842	8	686.8 0.5	150 ns 40	$(5)^+$	16 77Kr04 EJT	1977 IT=100
$^{198}\text{Tl}^p$	-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 $\beta^+=100$
$^{198}\text{Pb}^m$	-23926	9	2141.4 0.4	4.12 μs 0.07	7^-	16 FGK128 J	1972 IT=100
$^{198}\text{Pb}^n$	-23836	9	2231.4 0.5	137 ns 10	9^-	16 FGK128 J	1989 IT=100
$^{198}\text{Pb}^p$	-23245	9	2821.7 0.6	212 ns 4	12^+	16 FGK128 J	1973 IT=100
^{198}Bi	-19374	28		10.3 m 0.3	3^+*	16 16Ly01 J	1950 $\beta^+=100$
$^{198}\text{Bi}^m$	-19085	28	290 40 MD	11.6 m 0.3	7^+*	16 16Ly01 J	1992 $\beta^+=100$
$^{198}\text{Bi}^n$	-18837	28	540 40 MD	7.7 s 0.5	10^-*	16	1972 IT=100
^{198}Po	-15473	17		1.760 m 0.024	0^+	16	1965 $\alpha=57$ 2; $\beta^+=43$ 2
$^{198}\text{Po}^m$	-12907	17	2565.92 0.20	200 ns 20	11^-	16	1990 IT=100
$^{198}\text{Po}^n$	-12730#	50#	2740# 50#	750 ns 50	12^+	16 90Ma14 T	1990 IT=100
^{198}At	-6709	5		4.47 s 0.05	3^+*	16 19Gh11 T	1967 $\alpha\approx 97.0$ 17; $\beta^+?$
$^{198}\text{At}^m$	-6442	5	266.6 2.7 IT	1.23 s 0.05	10^-*	16 19Gh11 E	1967 $\alpha=93$ 4; $\beta^+?$
^{198}Rn	-1230	13		64.4 ms 1.6	0^+	16 95Bi17 T	1984 $\alpha=93$ 7; $\beta^+?$
^{198}Fr	9580	30	*	15 ms 3	3^+*	16 13Ka16 TD	2013 $\alpha\approx 100$
$^{198}\text{Fr}^m$	9580	40	0 50 AD*	1.1 ms 0.7	(10^-)	16 13Ka16 TD	2013 $\alpha\approx 100$
^{198}Re	I: other 12Ku26>300 ns						**
^{198}Ir	T: average 20Mu16=8.9(0.4) 14Ku23=8(2) 72ScYY=8(1) 73Sz03=8(3); others						**
^{198}Ir	T: 18Hi07, 18Mu.1=9.1(0.8), superseded by 18Hi07, 14Mo15=8(3),						**
^{198}Ir	T: same as 14Ku23						**
^{198}Pt	T: Onu-BB 52Fr23>320 Ty; α 11Be08>470Py						**
$^{198}\text{Au}^n$	J: M4 to 8+; magnetic moment						**
$^{198}\text{Tl}^p$	J: E3 to 7+						**
$^{198}\text{Pb}^m$	J: E2 to 5-; magnetic moment						**
$^{198}\text{Pb}^m$	T: average 87Ca23=4.19(0.10) 18La03=4.05(0.10); others (not used)						**
$^{198}\text{Pb}^m$	T: 72Is01=3.7(0.3) 73Dj01=4 92Wa20 5.3						**
$^{198}\text{Pb}^n$	J: E2 to 7-						**
$^{198}\text{Pb}^p$	J: E2 to 10+; magnetic moment						**
$^{198}\text{Pb}^p$	T: average 87Ca23=212(4) 83St15=211(10) 18La03=212(10); others (not used)						**
$^{198}\text{Pb}^p$	T: 73Pa03=221(30) 86Ho03=240(20)						**
$^{198}\text{Bi}^n$	E: from 92Hu04=248.5(0.5) keV above $^{198}\text{Bi}^m$						**
$^{198}\text{Bi}^n$	J: 17Ba12=(10); E3 to 7+						**
$^{198}\text{Po}^n$	E: 2691.86(0.20) + x keV; x=50#(50#) by Nubase						**
^{198}At	J: 18Cu02=(3); favored α decay to ^{194}Bi (J=3+)						**
^{198}At	D: % α from 95Bi.A>94						**
^{198}At	T: others 14Ka23=3.0(0.1) 12Fo09=4.2(2.0) 05Uu02=3.8(0.4) 92Hu04=4.2(0.3)						**
^{198}At	T: 67Tr06=4.9(0.5)						**
$^{198}\text{At}^m$	J: 18Cu02=(10); favored α decay from $^{202}\text{Fr}^m$ (J=10-)						**
$^{198}\text{At}^m$	T: average 19Gh11=1.28(0.10) 14Ka23=1.24(0.06) 05Uu02=1.04(0.15); others						**
$^{198}\text{At}^m$	T: 92Hu04=1.0(0.2) 67Tr06=1.5(0.3)						**
$^{198}\text{At}^m$	D: % α from 95Bi.A>86						**
^{198}Rn	T: average 95Bi17=64(2) 90Ta30=66(+3-2) 84Ca32=50(9); others (not used)						**
^{198}Rn	T: 14Ka23=34(+11-7) 05Uu02=22(+110-10)						**
^{198}Rn	D: % α value quoted in 93Wa04 from a PhD thesis of M. Leino (1983)						**
$^{198}\text{Fr}^m$	J: favored α decay to $^{194}\text{At}^m$ (J=10-)						**
^{199}Re	-14730#	400#		250# ms >300ns	$5/2^+*$	13 12Ku26 I	2012 $\beta^-?$
^{199}Os	-20270#	200#		6 s 3	$5/2^-*$	07 14Ku23 T	2008 $\beta^-=100$
^{199}Ir	-24400	40		7 s 5	$3/2^+*$	07 14Ku23 T	1993 $\beta^-=100$
^{199}Pt	-27388.7	2.2		30.80 m 0.21	$5/2^-*$	07	1937 $\beta^-=100$
$^{199}\text{Pt}^m$	-26964.7	3.0	424 2	13.48 s 0.16	$13/2^+*$	07 18Mu.1 T	1959 IT=100
^{199}Au	-29093.8	0.5		3.139 d 0.007	$3/2^+$	07	1937 $\beta^-=100$
$^{199}\text{Au}^m$	-28544.9	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=16.94 12
$^{199}\text{Hg}^m$	-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 $\beta^+=100$
$^{199}\text{Tl}^m$	-27310	28	748.87 0.06	28.4 ms 0.2	$9/2^-*$	07	1963 IT=100
^{199}Pb	-25232	7		90 m 10	$3/2^-$	07	1950 $\beta^+=100$
$^{199}\text{Pb}^m$	-24803	8	429.5 2.7	12.2 m 0.3	$(13/2^+)$	07	1955 IT $\approx$ 100; $\beta^+=?$
$^{199}\text{Pb}^n$	-22668	8	2563.8 2.7	10.1 μs 0.2	$(29/2^-)$	07	1981 IT=100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
¹⁹⁹ Bi	-20798	11				27 m 1	9/2 ⁻ *	07		1950	$\beta^+=100$		
¹⁹⁹ Bi ^m	-20131	11	667	3	IT	24.70 m 0.15	(1/2 ⁺)	07		1950	$\beta^+=?; IT<2; \alpha \approx 0.01$		
¹⁹⁹ Bi ⁿ	-18836	25	1962	23		100 ns 30	25/2 ⁺ #	07		1974	IT=100	*	
¹⁹⁹ Bi ^p	-18250	25	2548	23		168 ns 13	29/2 ⁻ #	07		1985	IT=100	*	
¹⁹⁹ Po	-15239	5				5.47 m 0.15	3/2 ⁻ *	07	13Se03	J	1965	$\beta^+=92.5\ 3; \alpha=7.5\ 3$	*
¹⁹⁹ Po ^m	-14927	5	311.7	2.7	AD	4.17 m 0.05	13/2 ⁺ *	07		1964	$\beta^+=73.5\ 10; \alpha=24\ 1; IT=2.5\ 10$	*	
¹⁹⁹ At	-8823	5				7.02 s 0.12	9/2 ⁻ *	07	05De01	T	1967	$\alpha=89\ 6; \beta^+ ?$	*
¹⁹⁹ At ^m	-8579	5	244.0	1.0	IT	273 ms 9	1/2 ⁺ *		14Au03	TJD	2013	$IT \approx 99; \alpha \approx 1$	*
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	-1560	7				590 ms 30	3/2 ⁻	07			1980	$\alpha \approx 100; \beta^+ ?$	*
¹⁹⁹ Rn ^m	-1340	8	220	11	AD	310 ms 20	13/2 ⁺	07			1981	$\alpha \approx 100; \beta^+ ?; IT ?$	*
¹⁹⁹ Fr	6771	14				6.6 ms 2.2	1/2 ⁺ #	07	13Ka16	T	1999	$\alpha \approx 100; \beta^+ ?$	*
¹⁹⁹ Fr ^m	6817	10	45	13	AD	6.5 ms 0.9	7/2 ⁻ #		13Ka16	T	2013	$\alpha \approx 100; \beta^+ ?$	*
¹⁹⁹ Fr ⁿ	7020#	50#	250#	50#		2.2 ms 1.2	13/2 ⁺ #		13Uu01	TDJ	2013	$\alpha \approx 100; \beta^+ ?$	*
* ¹⁹⁹ Os	T : symmetrized from 14Ku23, 14Mo15=5(+4-2)											**	
* ¹⁹⁹ Ir	T : symmetrized from 14Ku23, 14Mo15=6(+5-4)											**	
* ¹⁹⁹ Pt	J : 17Hi05=5/2											**	
* ¹⁹⁹ Pt	T : other 17Hi05=31.3(1.5)											**	
* ¹⁹⁹ Pt ^m	J : 17Hi05=(13/2); E3 to 7/2-											**	
* ¹⁹⁹ Pt ^m	T : average 18Mu.1=12.4(0.7) 17Hi05=14.3(1.4) 73Ur01=13.3(0.2)											**	
* ¹⁹⁹ Pt ^m	T : 59Wa15=14.1(0.3)											**	
* ¹⁹⁹ Au ^m	J : M2 to 7/2+; $l(^3He, d)=5$											**	
* ¹⁹⁹ Pb ^m	E : 424.8(0.2) + x; x < 9.3 keV											**	
* ¹⁹⁹ Pb ⁿ	E : 2559.1(0.4) + x; x < 9.3 keV											**	
* ¹⁹⁹ Bi ⁿ	E : 1922.3 + x keV; x < 80 keV in 85Pi05											**	
* ¹⁹⁹ Bi ^p	E : 2523.2 + x keV; x < 80 keV in 85Pi05											**	
* ¹⁹⁹ Po	J : 13Se03, 14Se07=(3/2); favored α decay to ¹⁹⁵ Pb (J=3/2-)											**	
* ¹⁹⁹ Po ^m	J : 13Se03, 14Se07, 17Al34=(13/2); favored α decay to ¹⁹⁵ Pb ^m											**	
* ¹⁹⁹ Po ^m	J : (J=13/2+)											**	
* ¹⁹⁹ At	T : average 12Fo09=6.7(0.5) 05De01=6.92(0.13) 05Uu02=7.8(0.4)											**	
* ¹⁹⁹ At	T : 67Tr06=7.2(0.5)											**	
* ¹⁹⁹ At	J : 18Cu02=(9/2); favored α decay to ¹⁹⁵ Bi (J=9/2-)											**	
* ¹⁹⁹ At	D : % α symmetrized from 80Ew03=92(+3-8)%											**	
* ¹⁹⁹ At ^m	T : other 13Ja06=310(80)											**	
* ¹⁹⁹ At ^m	J : 18Cu02=(1/2); favored α decay to ¹⁹⁵ Bi ^m (J=1/2+)											**	
* ¹⁹⁹ At ^m	D : % α from 13Ja06~1											**	
* ¹⁹⁹ At ⁿ	T : from $\gamma - \gamma(t)$ by gating on gammas above and below the isomer;											**	
* ¹⁹⁹ At ⁿ	T : other 00La36=580(130)ns from recoil-time, probably includes decay of											**	
* ¹⁹⁹ At ⁿ	T : ¹⁹⁹ At ^p											**	
* ¹⁹⁹ Rn	T : others 14Ka23=340(+280-110)											**	
* ¹⁹⁹ Rn	J : favored α decay to ¹⁹⁵ Po (J=3/2-)											**	
* ¹⁹⁹ Rn ^m	J : favored α decay to ¹⁹⁵ Po ^m (J=13/2+)											**	
* ¹⁹⁹ Fr	T : average 13Ka16=4.5(+3.1-1.3) 99Ta20=12(+10-4)											**	
* ¹⁹⁹ Fr ^m	T : average 13Ka16=6.2(+1.1-0.8) 13Uu01=7(+3-2)											**	
* ¹⁹⁹ Fr ⁿ	T : symmetrized from 13Uu01=1.6(+1.6-.6)											**	
²⁰⁰ Os	-18550#	300#				7 s 4	0 ⁺	08	14Ku23	T	2005	$\beta^- = 100$	*
²⁰⁰ Ir	-21570#	200#				43 s 6	(2 ⁻ , 3 ⁻)	11	14Mo15	T	2008	$\beta^- = 100; \beta^- n ?$	*
²⁰⁰ Pt	-26599	20				12.6 h 0.3	0 ⁺	07			1957	$\beta^- = 100$	
²⁰⁰ Au	-27240	27				48.4 m 0.3	(1 ⁻)	07			1951	$\beta^- = 100$	
²⁰⁰ Au ^m	-26233	26	1010	40	BD	18.7 h 0.5	12 ⁻ *	07			1968	$\beta^- = 84\ 1; IT=16\ 1$	
²⁰⁰ Hg	-29503.3	0.5				STABLE	0 ⁺	07			1925	IS=23.14 9	
²⁰⁰ Tl	-27047	6				26.1 h 0.1	2 ⁻ *	07			1949	$\beta^+ = 100$	
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		397 ns 17	5 ⁺	07	19Ro12	T	1972	IT=100	
²⁰⁰ Pb	-26251	10				21.5 h 0.4	0 ⁺	07			1950	$\varepsilon = 100$	
²⁰⁰ Pb ^m	-24068	10	2183.3	1.1		456 ns 6	(9 ⁻)	07	18La03	T	1972	IT=100	
²⁰⁰ Pb ⁿ	-23245	10	3005.8	1.2		198 ns 3	(12 ⁺)	07	18La03	T	1975	IT=100	*
²⁰⁰ Bi	-20371	23			*	36.4 m 0.5	7 ⁺ *	07			1950	$\beta^+ = 100$	
²⁰⁰ Bi ^m	-20270#	70#	100#	70#	*	31 m 2	(2 ⁺)	07			1978	$\beta^+ < 100; IT ?$	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
$^{200}\text{Bi}^n$	-19943	23	428.20	0.10				
^{200}Po	-16942	8						
$^{200}\text{Po}^m$	-14346	8	2596.1	0.3				
$^{200}\text{Po}^n$	-14125	11	2817	7				
^{200}At	-8988	24						
$^{200}\text{At}^m$	-8875	25	112.9	2.9	AD			
$^{200}\text{At}^n$	-8644	25	343.8	3.0	AD			
^{200}Rn	-4000	6						
$^{200}\text{Rn}^m$	-1680#	21#	2320#	20#				
^{200}Fr	6130	30			*			
$^{200}\text{Fr}^m$	6180	60	50	60	AD*			
$^{200}\text{Fr}^n$	6280#	60#	150#	50#				
^{200}Os	T: symmetrized from $^{14}\text{Ku}23,^{14}\text{Mo}15=6(+4-3)$; other $^{05}\text{Ku}.A=4.6(1.3)$ same group							
^{200}Ir	J: from $^{13}\text{Mo}20=(2-,3-)$							
$^{200}\text{Pb}^m$	T: average $^{73}\text{Pa}04=480(30)$ $^{74}\text{Lu}03=480(20)$ $^{78}\text{Mc}03=480(60)$ $^{87}\text{Fa}15=424(10)$							
$^{200}\text{Pb}^n$	T: $^{88}\text{Pa}12=480(20)$ $^{89}\text{Su}12=480(30)$ $^{18}\text{La}03=476(12)$; others (not used)							
$^{200}\text{Pb}^m$	T: $^{72}\text{Is}01=540(30)$ $^{73}\text{Dj}01$ 500							
$^{200}\text{Pb}^n$	T: average $^{79}\text{Ma}37=194(6)$ $^{87}\text{Fa}15=202(5)$ $^{89}\text{Su}12=199(5)$ $^{18}\text{La}03=195(8)$;							
$^{200}\text{Pb}^n$	T: others (not used): $^{78}\text{Mc}03=180(30)$ $^{88}\text{Pa}12=152(30)$ $^{75}\text{Yo}04=158(30)$							
$^{200}\text{Po}^n$	E: $2804.5(0.6) + x$; $x < 25$ keV level							
^{200}At	T: average $^{96}\text{Ta}18=44(2)$ $^{92}\text{Hu}04=43(1)$							
^{200}At	J: $^{18}\text{Cu}02=(3)$							
$^{200}\text{At}^m$	J: $^{18}\text{Cu}02=(7)$							
$^{200}\text{At}^n$	E: $230.9(0.2)$ keV above $^{200}\text{At}^m$							
$^{200}\text{At}^n$	T: symmetrized from $^{05}\text{Uu}02=7.3(+2.6-1.5)$							
$^{200}\text{At}^n$	J: $^{18}\text{Cu}02=(10)$							
^{200}Rn	T: symmetrized from Ensdf2007=1.03(+0.20-0.11)							
^{200}Rn	D: % α symmetrized from $^{93}\text{Wa}04=86(+14-4)\%$							
$^{200}\text{Rn}^m$	E: $2300.5(0.5) + x$ keV; $x=20\#(20\#)$ keV							
$^{200}\text{Rn}^m$	T: symmetrized from $^{02}\text{Do}19=25(+11-6)$							
^{200}Fr	T: average $^{19}\text{Gh}11=52(3)$ $^{14}\text{Ka}23=46(4)$ $^{05}\text{De}01=49(4)$							
$^{200}\text{Fr}^m$	I: two events with 100 ms and $E(a)=7550$ keV correlated with $E(a)=6880$ keV							
$^{200}\text{Fr}^m$	I: assigned by evaluators to $^{196}\text{At}^m$							
$^{200}\text{Fr}^m$	T: symmetrized from $^{84}\text{Sc}13=100(+180-40)$ (2 events with $T1/2=100$ ms)							
$^{200}\text{Fr}^n$	E: $^{14}\text{Ka}23=101.13 + x$ keV; $x=50\#(50\#)$ keV by Nubase							
$^{200}\text{Fr}^n$	T: symmetrized from $^{14}\text{Ka}23=600(+500-200)$							
^{201}Os	-14840#	300#						
^{201}Ir	-19840#	200#						
^{201}Pt	-23740	50						
$^{201}\text{Pt}^m$	-22890#	160#	850#	150#				
^{201}Au	-26401	3						
$^{201}\text{Au}^m$	-25807	6	594	5				
$^{201}\text{Au}^n$	-24791	6	1610	5				
^{201}Hg	-27662.5	0.7						
$^{201}\text{Hg}^m$	-26896.3	0.7	766.22	0.15				
^{201}Tl	-27181	14						
$^{201}\text{Tl}^m$	-26262	14	919.16	0.21				
^{201}Pb	-25271	14						
$^{201}\text{Pb}^m$	-24642	14	629.1	0.3				
$^{201}\text{Pb}^n$	-22318	24	2953	20				
^{201}Bi	-21429	12						
$^{201}\text{Bi}^m$	-20583	12	846.35	0.18				
$^{201}\text{Bi}^n$	-19456	26	1973	23				
$^{201}\text{Bi}^p$	-19417	26	2012	23				
$^{201}\text{Bi}^q$	-18648	26	2781	23				
^{201}Po	-16521	5						
$^{201}\text{Po}^m$	-16097	5	423.8	2.4	AD			
^{201}At	-10789	8						
$^{201}\text{At}^m$	-10330	8	459	1				
$^{201}\text{At}^n$	-8469	8	2319.7	0.3				
^{201}Os	-14840#	300#						
^{201}Ir	-19840#	200#						
^{201}Pt	-23740	50						
$^{201}\text{Pt}^m$	-22890#	160#	850#	150#				
^{201}Au	-26401	3						
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$^{201}\text{Pb}^n$	-22318	24	2953	20				
^{201}Bi	-21429	12						
$^{201}\text{Bi}^m$	-20583	12	846.35	0.18				
$^{201}\text{Bi}^n$	-19456	26	1973	23				
$^{201}\text{Bi}^p$	-19417	26	2012	23				
$^{201}\text{Bi}^q$	-18648	26	2781	23				
^{201}Po	-16521	5						
$^{201}\text{Po}^m$	-16097	5	423.8	2.4	AD			
^{201}At	-10789	8						
$^{201}\text{At}^m$	-10330	8	459	1				
$^{201}\text{At}^n$	-8469	8	2319.7	0.3				

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
²⁰¹ Rn	−4107	10				7.0 s 0.4	3/2 [−]	07		1967	$\alpha=?;\beta^+ ?$	*	
²⁰¹ Rn ^m	−3863	7	245	12	AD	3.8 s 0.1	13/2 ⁺	07	17Al34	E	1967	$\alpha=?;\beta^+ ?$	*
²⁰¹ Fr	3589	9				62.8 ms 1.9	9/2 [−]	07	14Ka23	TD	1980	$\alpha\approx 100;\beta^+ ?$	*
²⁰¹ Fr ^m	3718	10	129	10	AD	24 ms 6	1/2 ⁺	07	20Au01	T	2005	$\alpha=100$	*
²⁰¹ Fr ⁿ	3879	9	289.5	0.4		720 ns 40	13/2 ⁺		20Au01	ETJ	2014	IT=100	*
²⁰¹ Ra	11937	20				20 ms 30	(3/2 [−])		14Ka23	TJ	2005	$\alpha=100$	*
²⁰¹ Ra ^m	12200	26	263	26	AD	6 ms 5	13/2 ⁺	07	05Uu02	T	2005	$\alpha=100$	*
* ²⁰¹ Ir	J : 13Mo20=(1/2+,3/2+,5/2+), but 3/2+ agrees with systematics at Z=77											**	
* ²⁰¹ Pt ^m	I : floating high-spin level populated in decay of high-spin isomer											**	
* ²⁰¹ Pt ^m	I : in 11St21; systematics of similar isomers in neighboring odd-N Pt											**	
* ²⁰¹ Pt ^m	I : nuclei											**	
* ²⁰¹ Au ^m	T : symmetrized from 11St21=340(+900-290)											**	
* ²⁰¹ Au ^m	J : $l(t,\alpha)$ in 81Fl05											**	
* ²⁰¹ Au ⁿ	E : 378.2 keV + 638.0 keV gammas above ²⁰¹ Au ^m											**	
* ²⁰¹ Tl ^m	J : E3 to 3/2+											**	
* ²⁰¹ Pb ⁿ	E : 2917.6(0.9) + x keV; x<70keV in 81He07											**	
* ²⁰¹ Bi ⁿ	E : 1933.3(0.4) + x keV; x<80 keV in 85Pi05											**	
* ²⁰¹ Bi ^p	E : 1972.3(0.4) + x keV; x<80 keV in 85Pi05											**	
* ²⁰¹ Bi ^q	E : 2741.0(0.3) + x keV; x<80 keV in 85Pi05											**	
* ²⁰¹ Po	J : other 13Se03,14Se07=3/2											**	
* ²⁰¹ Po ^m	J : 13Se03,14Se07=13/2											**	
* ²⁰¹ At	J : 18Cu02=(9/2); favored α decay to ¹⁹⁷ Bi (J=9/2-)											**	
* ²⁰¹ Rn	J : favored α decay to ¹⁹⁷ Pb (J=3/2-)											**	
* ²⁰¹ Rn ^m	T : other 10He25=3.24(+3.24-1.08) ms											**	
* ²⁰¹ Rn ^m	J : favored α decay to ¹⁹⁷ Pb ^m (J=13/2+)											**	
* ²⁰¹ Fr	T : average 14Ka23=64(3) 05Uu02=53(4) 05De01=67(3); others (not used)											**	
* ²⁰¹ Fr	T : 96En01=69(+16-11) 80Ew03=48(15)											**	
* ²⁰¹ Fr	J : favored α decay to ¹⁹⁷ At (J=9/2-)											**	
* ²⁰¹ Fr ^m	T : average 20Au01=37(+14-8) 14Ka23=8(+12-3) 05Uu02=19(+19-6)											**	
* ²⁰¹ Fr ^m	J : favored α decay to ¹⁹⁷ At ^m (J=1/2+)											**	
* ²⁰¹ Fr ⁿ	T : other 14Ka23=700(+500-200)											**	
* ²⁰¹ Ra	T : symmetrized from 14Ka23=8(+40-4)											**	
* ²⁰¹ Ra ^m	T : symmetrized from 05Uu02=1.6(+7.7-0.7)											**	
* ²⁰¹ Ra ^m	J : favored α decay to ¹⁹⁷ Po ^m (J=13/2+)											**	
²⁰² Os	−12530#	400#				2# s >300ns	0 ⁺	13		2009	$\beta^- ?$		
²⁰² Ir	−16640#	300#				11 s 3	(2 [−])	08	14Ku23	T	2008	$\beta^- =100$	*
²⁰² Ir ^m	−14040#	420#	2600#	300#		3.4 μ s 0.6			11St21	TD	2011	IT=100	*
²⁰² Pt	−22692	25				44 h 15	0 ⁺	08			1992	$\beta^- =100$	
²⁰² Pt ^m	−20904	25	1788.5	0.4		141 μ s 7	(7 [−])	08	11St21	T	2005	IT=100	
²⁰² Au	−24353	23				28.4 s 1.2	(1 [−])	08			1967	$\beta^- =100$	
²⁰² Hg	−27345.3	0.7				STABLE	0 ⁺	08			1920	IS=29.74 13	
²⁰² Tl	−25980.4	1.8				12.31 d 0.08	2 [−] *	08			1940	$\epsilon=100$	
²⁰² Tl ^m	−25030.2	1.8	950.19	0.10		591 μ s 3	7 ⁺	08			1958	IT=100	
²⁰² Pb	−25941	4				52.5 ky 2.8	0 ⁺	08			1954	$\epsilon=100$	
²⁰² Pb ^m	−23771	4	2169.85	0.08		3.54 h 0.02	9 [−]	08			1954	IT=90.5 5; $\beta^+=9.5$ 5	
²⁰² Pb ⁿ	−21800#	50#	4140#	50#		100 ns 3	16 ⁺	08	19Ro12	T	1986	IT=100	*
²⁰² Pb ^p	−20640#	50#	5300#	50#		108 ns 3	19 [−]	08	19Ro12	T	1987	IT=100	*
²⁰² Bi	−20751	14				1.72 h 0.05	5 ⁺ *	08			1951	$\beta^+=100;\alpha<1e-5$	
²⁰² Bi ^m	−20126	18	625	12		3.04 μ s 0.06	10 [−] #	08			1981	IT=100	*
²⁰² Bi ⁿ	−18134	18	2617	12		310 ns 50	(17 ⁺)	08			1981	IT=100	*
²⁰² Po	−17942	9				44.6 m 0.4	0 ⁺	08			1951	$\beta^+=98.08$ 7; $\alpha=1.92$ 7	
²⁰² Po ^m	−16230	15	1712	12		110 ns 15	8 ⁺	08			1971	IT=100	*
²⁰² At	−10595	28				184 s 1	3 ⁺ *	08	16Ly01	JD	1961	$\beta^+=88$ 7; $\alpha=12$ 7	*
²⁰² At ^m	−10401	28	190	40	MD	182 s 2	7 ⁺ *	08	16Ly01	JD	1992	$\beta^+=91.5$ 15; $\alpha=8.5$ 15;IT ?	*
²⁰² At ⁿ	−10010	28	590	40	MD	460 ms 50	10 [−]	08	16Ly01	J	1992	IT=99.904 11; $\alpha=0.096$ 11; $\beta^+ ?$	*
²⁰² Rn	−6275	18				9.7 s 0.1	0 ⁺	08			1967	$\alpha=78$ 8; $\beta^+ ?$	
²⁰² Rn ^m	−3970#	50#	2310#	50#		2.22 μ s 0.07	11 [−] #		02Do19	T	2002	IT=100	
²⁰² Fr	3102	6				372 ms 12	3 ⁺ *	08	14Ka23	T	1980	$\alpha\approx 100;\beta^+ ?$	*
²⁰² Fr ^m	3359	6	257	6	AD	286 ms 13	10 [−] *	08	14Ka23	T	1980	$\alpha\approx 100;IT=?;\beta^+ ?$	*
²⁰² Ra	9075	15				4.1 ms 1.1	0 ⁺	08	14Ka23	T	2005	$\alpha=100$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²⁰² Ir	T : 14Ku23=11(3) supersedes 14Mo15=15(3)							**
* ²⁰² Ir ^m	E : 311.5, 655.9, 737.2, 889.2, 967.6 gamma rays seen in decay and by							**
* ²⁰² Ir ^m	E : assuming that 655.9 and 967.6 depopulate the same level							**
* ²⁰² Pb ⁿ	E : 4091.0(0.7) + x keV; x=50#(50#) keV by Nubase							**
* ²⁰² Pb ⁿ	T : average 19Ro12=93(4) 86Ja13=110(5) 18La03=103(10)							**
* ²⁰² Pb ^p	E : 5251.0(0.5) + x keV; x=50#(50#) keV by Nubase							**
* ²⁰² Pb ^p	T : average 19Ro12=113(6) 87Fa15=107(3) 18La03=105(38)							**
* ²⁰² Bi ^m	E : 605 + x keV; x<40 keV in 81Th03							**
* ²⁰² Bi ⁿ	E : 2597.07(0.25) + x keV; x<40 keV in 81Th03							**
* ²⁰² Po ^m	E : 1691.5(0.4) + x keV; x<40 keV in 76Be12							**
* ²⁰² At	J : 18Cu02=(3); favored α decay to ¹⁹⁸ Bi (J=3+)							**
* ²⁰² At ^m	J : 18Cu02=(7); favored α decay to ¹⁹⁸ Bi ^m (J=7+)							**
* ²⁰² At ⁿ	E : from 92Hu04=391.7(0.5) keV above ²⁰² At ^m							**
* ²⁰² At ⁿ	J : also favored α decay to ¹⁹⁸ Bi ⁿ (J=10-)							**
* ²⁰² Fr	J : 13Fl09=3, 14Ly01=(3)							**
* ²⁰² Fr ^m	J : 13Fl09=10, 14Ly01=(10)							**
* ²⁰² Fr ^m	D : IT reported in 81Ri04							**
* ²⁰² Ra	T : symmetrized from 14Ka23=3.8(+1.3-0.8); others 05Uu02=16(+30-7)							**
* ²⁰² Ra	T : ⁹⁶ Le09=0.7(+3.3-0.3)							**
²⁰³ Os	-7270#	400#		300# ms >300ns	9/2 ⁺ #	13 12Ku26	I 2012	β^- ?; β^- n ?
²⁰³ Ir	-14370#	400#		7# s >300ns	3/2 ⁺ #	13 09St16	I 2009	β^- ?
²⁰³ Ir ^m	-14170#	400#	200# 50#	> 100# ns	11/2 ⁻ #	11St21	IJ	IT ?; β^- ?
²⁰³ Ir ⁿ	-12230#	400#	2140# 50#	798 ns 350	(23/2 ⁺)	11St21	TJD 2011	IT=100
²⁰³ Pt	-19510#	200#		22 s 4	(1/2 ⁻)	06 14Mo15	T 2008	β^- =100
²⁰³ Pt ^m	-18140#	200#	1367# 3#	12 s 5	13/2 ⁺ #	06 14Mo15	T 2008	β^- $\approx$ 100; IT ?
²⁰³ Pt ⁿ	-18090#	210#	1420# 50#	> 100# ns	27/2 ⁻ #	06 11St21	IJ 2008	IT=100
²⁰³ Pt ^p	-16980#	210#	2530# 50#	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 μ s 44	11/2 ⁻ #	05 11St21	TJ 2005	IT=100
²⁰³ Hg	-25269.2	1.6		46.610 d 0.010	5/2 ⁻ *	05 FGK204	T 1943	β^- =100
²⁰³ Hg ^m	-24336.1	1.6	933.14 0.23	22.1 μ s 1.0	(13/2 ⁺)	05 11St21	T 1964	IT=100
²⁰³ Hg ⁿ	-16987.9	1.7	8281.3 0.5	146 ns 30	(53/2 ⁺)	11Sz01	EJT 2011	IT=100
²⁰³ Tl	-25761.3	1.2		STABLE	1/2 ⁺ *	05	1931	IS=29.515 44
²⁰³ Tl ^m	-24277.6	1.5	1483.7 0.9	< 1 μ s	(9/2 ⁻)	20Fo05	ETJ 2020	IT=100
²⁰³ Tl ⁿ	-22200#	50#	3565# 50#	7.7 μ s 0.5	(25/2 ⁺)	05	1998	IT=100
²⁰³ Pb	-24786	7		51.924 h 0.015	5/2 ⁻	05 14Un01	T 1942	ϵ =100
²⁰³ Pb ^m	-23961	7	825.2 0.3	6.21 s 0.08	13/2 ⁺	05	1955	IT=100
²⁰³ Pb ⁿ	-21837	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	1098.21 0.09	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	5		36.7 m 0.5	5/2 ⁻ *	05	1951	β^+ =99.89 2; α =0.11 2
²⁰³ Po ^m	-16669	5	641.68 0.14	45 s 2	13/2 ⁺ *	05 13Se03	J 1969	IT $\approx$ 100; α ?
²⁰³ Po ⁿ	-15153	5	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 At ^m	-11480	11	683.4 0.3	3.5 ms 0.6	1/2 ⁺	17Au05	ETJ 2017	IT=100
²⁰³ At ⁿ	-9833	11	2330.1 0.4	9.77 μ s 0.21	29/2 ⁺	18Au01	ETJ 2018	IT=100
²⁰³ Rn	-6184	6		44.2 s 1.6	3/2 ⁻	05	1967	α =66 9; β^+ =34 9
²⁰³ Rn ^m	-5822	5	362 4 AD	26.9 s 0.5	13/2 ⁺ *	05 87Bo29	J 1967	α =75 10; β^+ =25 10
²⁰³ Fr	876	6		550 ms 10	9/2 ⁻ *	05	1967	α $\approx$ 100; β^+ ?
²⁰³ Fr ^m	1237	7	361 6	43 ms 4	1/2 ⁺	13Ja06	TJD 2013	IT=80 4; α =20 4
²⁰³ Fr ⁿ	1302	6	426.0 1.0	370 ns 50	13/2 ⁺	13Ja06	TJD 2013	IT=100
²⁰³ Ra	8601	10		36 ms 13	3/2 ⁻	05 96Le09	J 1996	α $\approx$ 100; β^+ ?
²⁰³ Ra ^m	8848	10	246 14 AD	25 ms 5	13/2 ⁺	05 96Le09	J 1996	α $\approx$ 100; β^+ ?
* ²⁰³ Ir ^m	I : floating high-spin level populated in decay of ²⁰³ Ir ⁿ							**
* ²⁰³ Ir ^m	I : in 11St21; systematics of similar isomers in neighboring odd-Z Ir							**
* ²⁰³ Ir ^m	I : nuclei							**
* ²⁰³ Ir ⁿ	E : 207.0, 841.3, 894.7 gammas in a cascade to ²⁰³ Ir ^m							**
* ²⁰³ Pt	J : from 13Mo20=(1/2-)							**
* ²⁰³ Pt ^m	E : estimated from 13Mo20							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²⁰³ Hg ^m	T : average 11St21=21.9(1.0) 86Ze03=27(5) 64Br27=21(5)							**
* ²⁰³ Tl	J : other 13Ba41=1/2							**
* ²⁰³ Tl ^m	T : not directly measured; half-life expected ~2-20 ns							**
* ²⁰³ Tl ⁿ	E : 3514.6 + x keV; x=50#(50#) keV by Nubase							**
* ²⁰³ Pb	T : average 14Un01=51.92(0.04) 01Li17=51.99(0.03) 80Ho17=51.88(0.02)							**
* ²⁰³ Pb	T : 71Ch54=52.02(0.05)							**
* ²⁰³ Pb ^p	E : 2923.4(0.7) + x keV; x=50#(50#) keV by Nubase							**
* ²⁰³ Po	J : other 13Se03,14Se07,17Al34=3/2							**
* ²⁰³ Po ^m	J : 13Se03,14Se07=13/2							**
* ²⁰³ At	J : 18Cu02=9/2							**
* ²⁰³ Rn	T : average 96Ta18=42(3) 71Ho01=45(2) 67Va17=45(5)							**
* ²⁰³ Rn	J : favored α -decay to ¹⁹⁹ Po (J=3/2-)							**
* ²⁰³ Fr	J : 17Wi11,13Fl09=9/2,14Ly01=(9/2)							**
* ²⁰³ Fr ^m	J : favored α decay to ¹⁹⁹ At ^m (J=1/2+)							**
* ²⁰³ Ra	T : symmetrized from 05Uu02=31(+17-9); others 14Ka23=50(+40-15)							**
* ²⁰³ Ra	T : 96Le09=1.1(+5.0-0.5)							**
* ²⁰³ Ra	J : favored α decay to ¹⁹⁹ Rn ^m (J=3/2-)							**
* ²⁰³ Ra ^m	T : symmetrized from 05Uu02=24(+6-4); others 14Ka23=37(+37-12)							**
* ²⁰³ Ra ^m	T : 96Le09=33(+22-10)							**
* ²⁰³ Ra ^m	J : favored α decay to ¹⁹⁹ Rn ^m (J=13/2+)							**
²⁰⁴ Ir	-9570#	400#		2# s >300ns		13 11Mo18 I	2011	β^- ?; β^- n ?
²⁰⁴ Pt	-17620#	200#		10.3 s 1.4	0 ⁺	10	2008	β^- =100
²⁰⁴ Pt ^m	-15630#	200#	1995.1	0.7	5.5 μ s 0.7	(5 ⁻)	10 11St21 E	2009 IT=100
²⁰⁴ Pt ⁿ	-15590#	200#	2035	23	55 μ s 3	(7 ⁻)	10	2009 IT=100
²⁰⁴ Pt ^p	-14430#	200#	3193	23	146 ns 14	(10 ⁺)	10	2009 IT=100
²⁰⁴ Au	-20390#	200#			38.3 s 1.3	(2 ⁻)	10 14Mo15 T	1972 β^- =100
²⁰⁴ Au ^m	-16570#	540#	3816#	500#	2.1 μ s 0.3	16 ⁺ #	10 11St21 JD	2008 IT=100
²⁰⁴ Hg	-24690.1	0.5			STABLE	0 ⁺	10	1920 IS=6.82 4;2 β^- ?
²⁰⁴ Hg ⁿ	-17464.0	0.5	7226.08	0.17	~ 485 ns	22 ⁺	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 μ s 1.0	7 ⁺	10 11Br12 EJ	1972 IT=100
²⁰⁴ Tl ⁿ	-22027.1	1.2	2319.0	0.3	2.6 μ s 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	-25109.8	1.1			STABLE	>140Py	0 ⁺	10 1932 IS=1.4 6; α ?
²⁰⁴ Pb ^m	-23835.7	1.1	1274.13	0.05	265 ns 6	4 ⁺	10	1963 IT=100
²⁰⁴ Pb ⁿ	-22923.9	1.1	2185.88	0.08	66.93 m 0.10	9 ⁻	10	1956 IT=100
²⁰⁴ Pb ^p	-22845.4	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	10			3.519 h 0.012	0 ⁺	10	1951 β^+ =99.33 3; α =0.67 3
²⁰⁴ Po ^m	-16702	10	1639.03	0.06	158.6 ns 1.8	8 ⁺	10 10Ka29 T	1970 IT=100
²⁰⁴ At	-11875	23			9.12 m 0.11	7 ⁺ *	10	1961 β^+ =96.2 2; α =3.8 2
²⁰⁴ At ^m	-11288	23	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^+ ?
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	6061	9			60 ms 9	0 ⁺	10 05Uu02 T	1995 α ≈100; β^+ ?
* ²⁰⁴ Pt	T : other 14Mo15=16(+6-5)							**
* ²⁰⁴ Pt ^m	E : 872.4(0.5),1122.7(0.5) gammas in a cascade to 0+							**
* ²⁰⁴ Pt ⁿ	E : 1995.1(0.7) + x keV; x < 80 keV							**
* ²⁰⁴ Pt ^p	E : 1157.5(0.5) gamma to ²⁰⁴ Pt ⁿ							**
* ²⁰⁴ Au	T : average 14Mo15=37.2(0.8) 84Cr01=39.8(0.9); others 17Ca12=33.7(14.9)							**
* ²⁰⁴ Au	T : 72Pa06=40(3)							**
* ²⁰⁴ Au ^m	E : 839.0, 976.6 gammas in a cascade to 12-# estimated at 2000#(500#) keV							**
* ²⁰⁴ Pb	T : also 13Be16>140Ey							**
* ²⁰⁴ Pb ^p	T : symmetrized from 78So02=450(+100-30)							**
* ²⁰⁴ Po ^m	T : average 10Ka29=161(4) 87Ra04=158(2); others 90Fa03=150(10)							**
* ²⁰⁴ Po ^m	T : 83He08=150(10) 71Ha01=140(5) 70Ya03=190(20) 70Br.A=143(5)							**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁰⁴ At	T : other 10Ka29=9.6(2)										**
* ²⁰⁴ At	J : 18Cu02=(7)										**
* ²⁰⁴ Fr	T : average 05Uu02=1.9(0.5) 92Hu04=1.7(0.3)										**
* ²⁰⁴ Fr	J : 15Vo05,14Ly01,13Vo10=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 : 15Vo05,14Ly01=7										**
* ²⁰⁴ Fr ⁿ	E : 276.1 keV above ²⁰⁴ Fr ^m from 95Bi.A										**
* ²⁰⁴ Fr ⁿ	T : 13Ja06=1.65(0.15) supersedes 05Uu02=0.8(0.2) (same group)										**
* ²⁰⁴ Fr ⁿ	J : 15Vo05=10,14Ly01=(10)										**
* ²⁰⁴ Fr ⁿ	D : % α from 14Ly01; other (not used) 94Le05=1.4(+0.8-0.4)										**
* ²⁰⁴ Ra	T : average 05Uu02=54(+19-11) 96Le09=59(+12-9); other 10He25=44(+44-15)										**
* ²⁰⁴ Ra	T : 95Le04=45(+55-21)										**
²⁰⁵ Ir	-5600#	500#			1# s >300ns	3/2 ⁺ #	20	12Ku26 I	2012	β^- ?; β^- n ?	
²⁰⁵ Pt	-12820#	300#			2# s >300ns	9/2 ⁺ #	20		2009	β^- ?	
²⁰⁵ Au	-18570#	200#			32.0 s 1.4	3/2 ⁺ #	20		1994	β^- =100	
²⁰⁵ Au ^m	-17660#	200#	907	5	6 s 2	11/2 ⁻ #	20		2009	IT=?; β^- =?	
²⁰⁵ Au ⁿ	-15720#	200#	2849.7	0.4	163 ns 5	19/2 ⁺ #	20		2011	IT=100	
²⁰⁵ Hg	-22288	4			5.14 m 0.09	1/2 ⁻ *	20		1940	β^- =100	*
²⁰⁵ Hg ^m	-20732	4	1556.4	0.3	1.09 ms 0.04	13/2 ⁺	20		1985	IT=100	
²⁰⁵ Hg ⁿ	-18971	4	3316.6	0.8	5.89 μ s 0.18	(23/2 ⁻)	20		2011	IT=100	
²⁰⁵ Tl	-23820.8	1.2			STABLE	1/2 ⁺ *	20		1931	IS=70.485 44	*
²⁰⁵ Tl ^m	-20530.2	1.2	3290.61	0.17	2.6 μ s 0.2	25/2 ⁺	20		1976	IT=100	
²⁰⁵ Tl ⁿ	-18985.2	1.9	4835.6	1.5	235 ns 10	(35/2 ⁻)	20		2004	IT=100	
²⁰⁵ Pb	-23770.2	1.1			17.0 My 0.9	5/2 ⁻	20		1954	ϵ =100	
²⁰⁵ Pb ^m	-23767.9	1.1	2.329	0.007	24.2 μ s 0.4	1/2 ⁻	20		1994	IT=100	
²⁰⁵ Pb ⁿ	-22756.4	1.1	1013.85	0.03	5.55 ms 0.02	13/2 ⁺	20		1960	IT=100	
²⁰⁵ Pb ^p	-20574.4	1.3	3195.8	0.6	217 ns 5	25/2 ⁻	20		1973	IT=100	
²⁰⁵ Bi	-21066	5			14.91 d 0.07	9/2 ⁻ *	20		1951	β^+ =100	
²⁰⁵ Bi ^m	-19569	5	1497.17	0.09	7.9 μ s 0.7	1/2 ⁺	20		1972	IT=100	
²⁰⁵ Bi ⁿ	-19001	5	2064.7	0.4	100 ns 6	21/2 ⁺	20		1978	IT=100	
²⁰⁵ Bi ^p	-18927	5	2139.0	0.7	220 ns 25	25/2 ⁺	20		1978	IT=100	
²⁰⁵ Po	-17521	10			1.74 h 0.08	5/2 ⁻ *	20		1951	β^+ =99.960 12; α =0.040 12	
²⁰⁵ Po ^m	-17378	10	143.166	0.015	310 ns 60	1/2 ⁻	20		1960	IT=100	
²⁰⁵ Po ⁿ	-16641	10	880.31	0.04	645 μ s 20	13/2 ⁺	20		1962	IT=100	
²⁰⁵ Po ^p	-16060	10	1461.21	0.21	57.4 ms 0.9	19/2 ⁻	20		1973	IT=100	
²⁰⁵ Po ^q	-14434	10	3087.2	0.4	115 ns 10	29/2 ⁻	20		1985	IT=100	
²⁰⁵ At	-12985	12			26.9 m 0.8	9/2 ⁻ *	20		1951	β^+ =90 2; α =10 2	*
²⁰⁵ At ^m	-10645	12	2339.64	0.23	7.76 μ s 0.14	29/2 ⁺	20		1982	IT=100	
²⁰⁵ Rn	-7710	5			170 s 4	5/2 ⁻ *	20		1967	β^+ =75.4 9; α =24.6 9	
²⁰⁵ Rn ^m	-7053	5	657.1	0.5	> 10 s	13/2 ⁺ #	20		2010	IT $\approx$ 100; α ?; β^+ ?	
²⁰⁵ Fr	-1310	8			3.90 s 0.07	9/2 ⁻ *	20		1964	α =98.5 4; β^+ =1.5 4	*
²⁰⁵ Fr ^m	-766	8	544.0	1.0	80 ns 20	13/2 ⁺	20		2012	IT=100	
²⁰⁵ Fr ⁿ	-701	10	609	6	1.15 ms 0.04	(1/2 ⁺)	20		2012	IT=100	
²⁰⁵ Ra	5804	23			220 ms 50	3/2 ⁻	20	96Le09 T	1987	α $\approx$ 100; β^+ ?	*
²⁰⁵ Ra ^m	6067	11	263	25	180 ms 50	13/2 ⁺	20	17A134 E	1995	α $\approx$ 100; IT ?; β^+ ?	*
²⁰⁵ Ac	14110	60			80 ms 60	9/2 ⁻	20	14Zh03 T	2014	α $\approx$ 100; β^+ ?	*
* ²⁰⁵ Hg	T : other 10Ku02=5.61(0.38) for q=80+ (bare ion)										**
* ²⁰⁵ Tl	J : other 13Ba41,12Ba32=1/2										**
* ²⁰⁵ At	J : 18Cu02=9/2										**
* ²⁰⁵ Fr	J : 14Ly01,13Vo10,15Vo05,13Fl09=9/2										**
* ²⁰⁵ Ra	T : symmetrized from 96Le09=210(+60-40)										**
* ²⁰⁵ Ra	J : favored α decay to ²⁰¹ Rn (J=3/2-)										**
* ²⁰⁵ Ra ^m	T : symmetrized from 96Le09=170(+60-40); other 10He25=68(+68-23)										**
* ²⁰⁵ Ra ^m	J : favored α decay to ²⁰¹ Rn ^m (J=13/2+)										**
* ²⁰⁵ Ac	T : symmetrized from 14Zh03=20(+97-9)										**
* ²⁰⁵ Ac	J : favored α decay to ²⁰¹ Fr (J=9/2-)										**
²⁰⁶ Pt	-9240#	300#			500# ms >300ns	0 ⁺	13	12Ku26 I	2012	β^- ?; β^- n ?	
²⁰⁶ Au	-14190#	300#			47 s 11	6 ⁺ #	16	17Ca12 TJ	2009	β^- =100	*
²⁰⁶ Hg	-20946	20			8.32 m 0.07	0 ⁺	08		1961	β^- =100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)
$^{206}\text{Hg}^m$	-18844	20	2102.4	0.3	2.088 μs 0.017	5 ⁻	08 11St21 T 1982 IT=100 *
$^{206}\text{Hg}^n$	-17224	20	3722.3	1.0	106 ns 3	(10 ⁺)	08 18La03 T 2001 IT=100 *
^{206}Tl	-22253.3	1.3			4.202 m 0.011	0 ⁻ *	08 1935 β^- =100
$^{206}\text{Tl}^m$	-19610.2	1.3	2643.10	0.18	3.74 m 0.03	(12) ⁻	08 1976 IT=100 *
^{206}Pb	-23785.5	1.1			STABLE >2.5Zy	0 ⁺	08 13Be16 T 1927 IS=24.1 30; α ?
$^{206}\text{Pb}^m$	-21585.3	1.1	2200.16	0.04	125 μs 2	7 ⁻	08 1953 IT=100
$^{206}\text{Pb}^n$	-19758.2	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
$^{206}\text{Bi}^m$	-19968	8	59.897	0.017	7.7 μs 0.2	4 ⁺	08 1957 IT=100
$^{206}\text{Bi}^n$	-18983	8	1044.8	0.7	890 μs 10	10 ⁻	08 1974 IT=100
$^{206}\text{Bi}^p$	-10795	8	9233.3	0.8	155 ns 15	(28 ⁻)	12Ci05 EJD 2012 IT=100
$^{206}\text{Bi}^q$	-9858	8	10170.5	0.8	> 2 μs	(31 ⁺)	12Ci05 EJD 2012 IT=100
^{206}Po	-18189	4			8.8 d 0.1	0 ⁺	08 1947 β^+ =94.55 5; α =5.45 5
$^{206}\text{Po}^m$	-16603	4	1585.90	0.11	232 ns 4	8 ⁺	08 1970 IT=100
$^{206}\text{Po}^n$	-15927	4	2262.09	0.12	1.05 μs 0.06	9 ⁻	08 FGK145 J 1970 IT=100
^{206}At	-12439	14			30.6 m 0.8	(6) ⁺ *	08 1961 β^+ =99.10 8; α =0.90 8 *
$^{206}\text{At}^m$	-11629	14	810	2	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	-1247	28			~ 16 s	3 ⁺ *	08 16Ly01 D 1964 α =88.4 33; β^+ =11.6 33 *
$^{206}\text{Fr}^m$	-1048	28	200	40 IT	~ 16 s	7 ⁺ *	08 16Ly01 D 1964 α =84.7 15; β^+ ?;IT ? *
$^{206}\text{Fr}^n$	-517	28	730	40	700 ms 100	10 ⁻ *	08 16Ly01 D 1983 IT=?; α =13 2 *
$^{206}\text{Fr}^x$	-1150	100	100	100 MD	$R=?$	$spmix$	
^{206}Ra	3566	18			240 ms 20	0 ⁺	08 1967 $\alpha\approx 100$; β^+ ?
^{206}Ac	13480	70			25 ms 7	3 ⁺	08 1998 $\alpha\approx 100$; β^+ ? *
$^{206}\text{Ac}^m$	13690	30	200	70 AD	41 ms 16	10 ⁻	08 1996 $\alpha\approx 100$; β^+ ? *
* ^{206}Au	T : average 17Ca12=56(17) 15Mo20=40(15)						**
* $^{206}\text{Hg}^m$	T : average 11St21(=09Si35)=2.09(0.02) 82Be38=2.15(0.21) 18La03=2.08(0.04)						**
* $^{206}\text{Hg}^n$	T : average 11St21(=09Si35)=112(4) 09Al29=96(15) 01Fo08=92(8) 01La09=90(10)						**
* $^{206}\text{Hg}^p$	T : 18La03=106(15)						**
* $^{206}\text{Tl}^m$	J : from $l(d,\alpha)$ =11 in 77Fr11						**
* $^{206}\text{Pb}^n$	T : other 18La03=203(28), outweighed not used						**
* ^{206}At	J : 18Cu02=(6)						**
* $^{206}\text{At}^m$	T : others 10Ka29=377(44) 99Fe10=410(80)						**
* $^{206}\text{At}^n$	E : 806.7(1.4) + x keV; x<6 keV estimated by Nubase						**
* ^{206}Fr	J : 14Ly01,13Vo10,15Vo05=3						**
* $^{206}\text{Fr}^m$	J : 15Vo05=7,14Ly01=(7)						**
* $^{206}\text{Fr}^n$	E : 531(2) keV above $^{206}\text{Fr}^m$ in 81Ri04						**
* $^{206}\text{Fr}^p$	J : 15Vo05=10,14Ly01=(7)						**
* $^{206}\text{Fr}^q$	D : IT reported in 81Ri04						**
* ^{206}Ac	T : symmetrized from 98Es02=22(+9-5); other 14Zh03=41(+56-15)						**
* ^{206}Ac	J : favored α decay to ^{202}At (J=3+)						**
* $^{206}\text{Ac}^m$	T : symmetrized from 98Es02=33(+22-9)						**
* $^{206}\text{Ac}^n$	J : favored α decay to $^{202}\text{At}^m$ (J=10-)						**
^{207}Pt	-4140#	400#			600# ms >300ns	9/2 ⁺ #	13 12Ku26 I 2012 β^- ?; β^- n ?
^{207}Au	-10640#	300#			3# s >300ns	3/2 ⁺ #	11 2010 β^- ?; β^- n ?
^{207}Hg	-16487	30			2.9 m 0.2	9/2 ⁺	11 20Ta03 J 1982 β^- =100
^{207}Tl	-21034	5			4.77 m 0.02	1/2 ⁺ *	11 13Ba41 J 1908 β^- =100 *
$^{207}\text{Tl}^m$	-19686	5	1348.18	0.16	1.33 s 0.11	11/2 ⁻	11 1965 IT $\approx$ 100; β^- ?
^{207}Pb	-22452.0	1.1			STABLE >1.9Zy	1/2 ⁻ *	11 13Be16 T 1927 IS=22.1 50; α ?
$^{207}\text{Pb}^m$	-20818.6	1.1	1633.356	0.004	806 ms 5	13/2 ⁺	11 1951 IT=100
^{207}Bi	-20054.6	2.4			31.22 y 0.17	9/2 ⁻	11 14Un01 T 1950 β^+ =100
$^{207}\text{Bi}^m$	-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 *
$^{207}\text{Po}^m$	-17077	7	68.557	0.014	205 ns 10	1/2 ⁻	11 1963 IT=100
$^{207}\text{Po}^n$	-16031	7	1115.076	0.017	49 μs 4	13/2 ⁺	11 1962 IT=100
$^{207}\text{Po}^p$	-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 $\beta^+\approx 90$; $\alpha\approx 10$ *
$^{207}\text{At}^m$	-11110	12	2117.3	0.6	108 ns 2	25/2 ⁺	11 1981 IT=100
^{207}Rn	-8635	5			9.25 m 0.17	5/2 ⁻ *	11 1954 β^+ =79 3; α =21 3
$^{207}\text{Rn}^m$	-7736	5	899.1	1.0	184.5 μs 0.9	13/2 ⁺	11 1974 IT=100
^{207}Fr	-2849	18			14.8 s 0.1	9/2 ⁻ *	11 1964 α =95 2; β^+ ? *

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
²⁰⁷ Ra	3510	60				1.38 s 0.18	5/2 ⁻ #	11		1967	$\alpha \approx 86; \beta^+ ?$	*	
²⁰⁷ Ra ^m	4071	10	560	60	AD	57 ms 8	13/2 ⁺	11	96Le09	T 1987	IT=85#; $\alpha = ?; \beta^+ ?$	*	
²⁰⁷ Ac	11150	60				31 ms 8	9/2 ⁻	11	98Es02	T 1994	$\alpha \approx 100$	*	
* ²⁰⁷ Tl	T : others 05Oh08=4.25(0.14) 10Ku02=4.70(0.19) for q=81+ (bare ion)											**	
* ²⁰⁷ Po	J : other 15Fi07=5/2											**	
* ²⁰⁷ At	J : 18Cu02=9/2											**	
* ²⁰⁷ Fr	J : other 17Wi11,14Ly01=9/2											**	
* 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 Ra ^m	J : favored α decay to ²⁰³ Rn ^m (J=13/2+)											**	
* ²⁰⁷ Ac	T : average 98Es02=27(+11-6) 94Le05=22(+40-9)											**	
* ²⁰⁷ Ac	J : favored α decay to ²⁰³ Fr (J=9/2-)											**	
²⁰⁸ Pt	-500#	400#				220# ms >300ns	0 ⁺	13	12Ku26	I 2012	$\beta^- ?; \beta^- n ?$		
²⁰⁸ Au	-5910#	300#				20# s >300ns	6 ⁺ #	11	10Al24	I 2010	$\beta^- ?; \beta^- n ?$		
²⁰⁸ Hg	-13270	30				135 s 10	0 ⁺	10	20Ca25	T 1994	$\beta^- = 100$	*	
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	$\beta^- = 100$		
²⁰⁸ Tl ^m	-14943.1	2.1	1807	1		1.3 μ s 0.1	(0 ⁻)		20Ca25	TEJ 2020	IT=100		
²⁰⁸ Pb	-21748.5	1.1				STABLE	>2.6Zy	0 ⁺	07	13Be16	T 1927	IS=52.4 70; $\alpha ?$	
²⁰⁸ Pb ^m	-16853.3	1.1	4895.23	0.05		535 ns 35	10 ⁺	07	17Br08	T 1998	IT=100	*	
²⁰⁸ Bi	-18870.2	2.3				368 ky 4	5 ⁺ *	07	18Sc05	J 1953	$\beta^+ = 100$		
²⁰⁸ Bi ^m	-17299.1	2.3	1571.1	0.4		2.58 ms 0.04	10 ⁻	07		1961	IT=100		
²⁰⁸ Po	-17469.2	1.7				2.898 y 0.002	0 ⁺	07	93Sa14	D 1947	$\alpha \approx 100; \beta^+ = 0.0042$ 4		
²⁰⁸ Po ^m	-15941.0	1.7	1528.22	0.04		373 ns 8	8 ⁺	07	20Br.A	T 1968	IT=100	*	
²⁰⁸ At	-12470	9				1.63 h 0.03	6 ⁺ *	07		1950	$\beta^+ = 99.45$ 6; $\alpha = 0.55$ 6	*	
²⁰⁸ At ^m	-10194	9	2276.4	1.8		1.5 μ s 0.2	16 ⁻	07		1991	IT=100		
²⁰⁸ Rn	-9655	10				24.35 m 0.14	0 ⁺	07		1955	$\alpha = 62$ 7; $\beta^+ = 38$ 7		
²⁰⁸ Rn ^m	-7827	10	1828.3	0.4		487 ns 12	8 ⁺	07		1979	IT=100	*	
²⁰⁸ Fr	-2665	12				59.1 s 0.3	7 ⁺ *	07		1964	$\alpha = 89$ 3; $\beta^+ = 11$ 3	*	
²⁰⁸ Fr ^m	-1839	12	826.3	0.5		432 ns 11	10 ⁻	07	09Dr08	TJE 2009	IT=100	*	
²⁰⁸ Ra	1728	9				1.110 s 0.045	0 ⁺	07	10He25	TD 1967	$\alpha = 87$ 3; $\beta^+ ?$	*	
²⁰⁸ Ra ^m	3875	9	2147.4	0.4		263 ns 17	(8 ⁺)	07	05Re02	T 1998	IT=100	*	
²⁰⁸ Ac	10760	60				97 ms 15	3 ⁺	07	14Ya19	T 1994	$\alpha \approx 100; \beta^+ ?$	*	
²⁰⁸ Ac ^m	11258	28	500	60	AD	28 ms 7	10 ⁻	07	96Ik01	T 1994	$\alpha \approx 100; IT ?; \beta^+ ?$	*	
²⁰⁸ Th	16690	30				2.4 ms 1.2	0 ⁺	11		2010	$\alpha \approx 100$	*	
* ²⁰⁸ Hg	T : average 20Ca25=135(10) 17Ca12=132(50); others (conflicting)											**	
* ²⁰⁸ Hg	T : 98Zh22=2460(+300-200) 94Zh02=2520(+1380-720)											**	
* ²⁰⁸ Hg ^m	E : 1296.9(0.9) + x keV; x < 83 keV											**	
* ²⁰⁸ Pb ^m	T : average 17Br08=570(50) 89Ro04=500(50)											**	
* ²⁰⁸ Po ^m	T : average 20Br.A=377(9) 76Ha56=350(20)											**	
* ²⁰⁸ At	J : 18Cu02=6											**	
* ²⁰⁸ Rn ^m	T : other 10Ka29=590(144)											**	
* ²⁰⁸ Fr	J : other 13Vo10,15Vo05=7											**	
* ²⁰⁸ Fr ^m	T : from 09Dr08, $\tau = 623(16)$; others 10Ka29=233(18), not trusted											**	
* ²⁰⁸ Fr ^m	T : 06Me03=446(14), originally assigned to ²⁰⁹ Fr, see 09Dr04											**	
* ²⁰⁸ Ra	T : others 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	J : favored α decay to ²⁰⁴ Fr (J=3+)											**	
* ²⁰⁸ Ac ^m	T : average 96Ik01=21(+28-8) 94Le05=25(+9-5)											**	
* ²⁰⁸ Ac ^m	J : favored α decay to ²⁰⁴ Fr ^m (J=10-)											**	
* ²⁰⁸ Th	T : symmetrized from 10He25=1.7(+1.7-0.6)											**	
²⁰⁹ Au	-2230#	400#				1# s >300ns	3/2 ⁺ #	15	10Al24	I 2010	$\beta^- ?; \beta^- n ?$		
²⁰⁹ Hg	-8610#	150#				6.3 s 1.1	9/2 ⁺ #	15	17Ca12	T 1998	$\beta^- = 100; \beta^- n ?$	*	
²⁰⁹ Tl	-13645	6				2.162 m 0.007	1/2 ⁺	15		1950	$\beta^- = 100; \beta^- n ?$		
²⁰⁹ Tl ^m	-12417	6	1228.1	2.0		146 ns 10	17/2 ⁺	15	17Am01	ETJ 2009	IT=100	*	
²⁰⁹ Pb	-17614.6	1.7				3.235 h 0.005	9/2 ⁺	15	21Ta01	T 1940	$\beta^- = 100$	*	
²⁰⁹ Bi	-18258.6	1.4				20.1 Ey 0.8	9/2 ⁻ *	15		1924	IS=100; $\alpha = 100$	*	
²⁰⁹ Po	-16366.0	1.8				124 y 3	1/2 ⁻ *	15		1949	$\alpha = 99.546$ 7; $\beta^+ = 0.454$ 7	*	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
$^{209}\text{Po}^m$	-12100.6	1.8	4265.4	0.3	119 ns	4	31/2 ⁻	15	1974	IT=100			
^{209}At	-12884	5			5.42 h	0.05	9/2 ⁻ *	15	17Lo13	D	1951	$\beta^+=96.14; \alpha=3.94$	*
$^{209}\text{At}^m$	-10455	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	87Bo29	J	1952	$\beta^+=83.2; \alpha=17.2$	*
$^{209}\text{Rn}^m$	-7767	10	1174.01	0.13	13.4 μs	1.3	13/2 ⁺	15			1985	IT=100	
$^{209}\text{Rn}^n$	-5304	10	3636.81	0.23	3.0 μs	0.3	35/2 ⁺	15			1985	IT=100	
^{209}Fr	-3782	12			50.5 s	0.7	9/2 ⁻ *	15			1964	$\alpha=89.3; \beta^+=11.3$	
$^{209}\text{Fr}^m$	878	12	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	$\alpha\approx 100; \beta^+?$	
$^{209}\text{Ra}^m$	2740	6	882.4	0.7	117 μs	5	13/2 ⁺	15	08Ha12	D	2008	$\alpha\approx 90; \beta^+\approx 10$	
^{209}Ac	8840	60			94 ms	10	9/2 ⁻	15	14Ya19	T	1968	$\alpha\approx 100; \beta^+?$	*
^{209}Th	16400#	100#			60# ms		5/2 ⁻ #					$\alpha?; \beta^+?$	
$^{209}\text{Th}^m$	16765	25	370#	100#	3.1 ms	1.2	13/2 ⁺	15	10He25	T	1996	$\alpha\approx 100; \beta^+?$	*
* ^{209}Hg	T : others 98Zh19=35(+9-6) 98Zh22=35(+13-8), 42(+24-11) and 36(+16-8)											**	
* $^{209}\text{Tl}^m$	T : other 09Al29=95(11)											**	
* ^{209}Pb	T : average 21Ta01=3.252(0.043) 13Su13=3.232(0.005) 72Be44=3.253(0.014);											**	
* ^{209}Pb	T : others 40Kr08=2.75(0.05) 42Ma03=3.3(1.9) 41Fa04=3.32(0.03)											**	
* ^{209}Pb	T : 59Po64=3.31(0.03) 71Pe03=3.31(0.03)											**	
* ^{209}Bi	J : others 17Ba12, 18Sc05=9/2											**	
* ^{209}Po	J : other 13Se03, 14Se07=1/2											**	
* ^{209}At	D : % α average 17Lo13=3.6(0.7) 68Gu.A=4.1(0.5)											**	
* ^{209}At	J : 18Cu02=9/2											**	
* ^{209}Rn	D : other 17Lo13 % $\beta^+=91(2)$ % $\alpha=9(2)$, likely due to Rn diffusion											**	
* $^{209}\text{Fr}^m$	T : from 09Dr04, $\tau=606(26)$;											**	
* ^{209}Ac	T : average 14Ya19=98(22) 00He17=98(+59-27) 96Ik01=82(+18-13)											**	
* ^{209}Ac	T : 94Le05=91(+21-14) 68Va04=100(50)											**	
* ^{209}Ac	J : favored α decay to ^{205}Fm (J=9/2-)											**	
* $^{209}\text{Th}^m$	T : symmetrized from 10He25=2.5(+1.7-0.7), based on 4 events from 10He25											**	
* $^{209}\text{Th}^m$	T : combined with 2 events from 96Ik01											**	
* $^{209}\text{Th}^m$	J : favored α decay to $^{205}\text{Ra}^m$ (J=13/2+)											**	
^{210}Au	2680#	400#			10# s	>300ns	6 ⁺ #	14	10Al24	I	2010	$\beta^-?; \beta^-n?$	
^{210}Hg	-5300#	200#			64 s	12	0 ⁺	14	17Ca12	TD	1998	$\beta^-=100; \beta^-n=2.222$	
$^{210}\text{Hg}^m$	-4640#	200#	663	2	2.1 μs	0.7	(3 ⁻)	14			2013	IT=100	
$^{210}\text{Hg}^n$	-3890#	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	$\beta^-=100; \beta^-n=0.0096$	*
$^{210}\text{Tl}^m$	-8050#	200#	1200#	200#	1# m	>3 us	9 ⁺ , 10 ⁺		18Br15	ID	2018	$\beta^-?; \text{IT}?$	*
^{210}Pb	-14728.4	1.4			22.20 y	0.22	0 ⁺	14			1900	$\beta^-=100; \alpha=1.9\text{e-}64$	
$^{210}\text{Pb}^m$	-13533.8	1.4	1194.61	0.18	92 ns	10	6 ⁺		18Br15	ETJ	2018	IT=100	
$^{210}\text{Pb}^n$	-13453.6	1.4	1274.8	0.3	201 ns	17	8 ⁺	14			1980	IT=100	
^{210}Bi	-14791.9	1.4			5.012 d	0.005	1 ⁻ *	14			1905	$\beta^-=100; \alpha=13.2\text{e-}510$	
$^{210}\text{Bi}^m$	-14520.6	1.4	271.31	0.11	3.04 My	0.06	9 ⁻	14			1953	$\alpha=100$	
^{210}Po	-15953.1	1.1			138.376 d	0.002	0 ⁺	14			1898	$\alpha=100$	
$^{210}\text{Po}^m$	-14396.1	1.1	1556.97	0.03	98.9 ns	2.5	8 ⁺	14			1968	IT=100	
$^{210}\text{Po}^n$	-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	$\beta^+=99.82520; \alpha=0.17520$	*
$^{210}\text{At}^m$	-9422	8	2549.6	0.2	482 ns	6	(15 ⁻)	14			1970	IT=100	
$^{210}\text{At}^n$	-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	$\alpha=96.1; \beta^+?$	
$^{210}\text{Rn}^m$	-7900	30	1710	30	644 ns	40	8 ⁺	14	05Po10	JT	1979	IT=100	
$^{210}\text{Rn}^n$	-5750	30	3857	30	1.06 μs	0.05	17 ⁻	14	05Po10	JT	1979	IT=100	*
$^{210}\text{Rn}^p$	-3090	30	6514	30	1.04 μs	0.07	23 ⁺	14	05Po10	JT	1986	IT=100	*
^{210}Fr	-3344	13			3.18 m	0.06	6 ⁺ *	14	05Ku06	D	1964	$\alpha=71.4; \beta^+?$	
$^{210}\text{Fr}^m$	1073	13	4417.2	1.0	475 ns	6	(23 ⁺)		16Ma41	ETJ	2016	IT=100	*
^{210}Ra	443	9			4.0 s	0.1	0 ⁺	14	08Ha12	T	1967	$\alpha\approx 100; \beta^+?$	*
$^{210}\text{Ra}^m$	2494	9	2050.9	0.7	2.29 μs	0.03	8 ⁺	14	04Re04	TJ	1998	IT=100	*
^{210}Ac	8760	60			350 ms	40	7 ⁺ #	14	00He17	T	1968	$\alpha\approx 100; \beta^+?$	*
^{210}Th	14060	19			16.0 ms	3.6	0 ⁺	14			1995	$\alpha\approx 100; \beta^+?$	
* $^{210}\text{Hg}^n$	E : 1366 + x keV; x<80 from 13Go10											**	
* ^{210}Tl	D : % β^-n symmetrized from 61St20=0.007(+7-4)%											**	
* $^{210}\text{Tl}^m$	DIJ : direct β^- to 10+ in ^{210}Pb in 18Br15; conf=ph11/2 ng9/2											**	
* ^{210}At	J : 18Cu02=(5)											**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²¹⁰ Rn ⁿ	E : 2147.4(0.2) keV above the 8+ level at 1664.6(0.1)							**
* ²¹⁰ Rn ^p	E : 4803.7(0.4) keV above the 8+ level at 1664.6(0.1)							**
* ²¹⁰ Fr ^m	E : uncertainty estimated by evaluator							**
* ²¹⁰ Ra	T : others 07Le14=2.5(+1.4-0.7) and 3.5(+4.8-1.3) 68Lo15=3.6(0.2)							**
* ²¹⁰ Ra	T : 67Va22=3.8(0.2)							**
* ²¹⁰ Ra ^m	T : average 13Ba29=2.1(0.1) 06Ha17=2.28(0.08) 04Re04=2.1(0.1)							**
* ²¹⁰ Ra ^m	T : 04He25=2.36(0.04); other 99Co13=2.24							**
* ²¹⁰ Ac	T : average 00He17=335(+64-46) 68Va04=350(50)							**
²¹¹ Hg	−390# 200#		26.4 s 8.1	9/2 ⁺ #	13	17Ca12	TD 2010	$\beta^- = 100; \beta^- n = 6.3$ 63
²¹¹ Tl	−6080 40		81 s 16	1/2 ⁺	13	14Mo02	TJ 1998	$\beta^- = 100; \beta^- n = 2.2$ 22
²¹¹ Tl ^m	−4840# 110#	1244# 100#	580 ns 80	17/2 ⁺ #		19Go10	ETJ 2019	IT=100
²¹¹ Pb	−10493.0 2.3		36.1628 m 0.0025	9/2 ⁺ *	13	17Lo.1	T 1904	$\beta^- = 100$
²¹¹ Pb ^m	−8774 23	1719 23	159 ns 28	(27/2 ⁺)	13	05La01	JT 2005	IT=100
²¹¹ Bi	−11859 5		2.14 m 0.02	9/2 [−] *	13	18Ba03	J 1905	$\alpha \approx 100; \beta^- = 0.276$ 4
²¹¹ Bi ^m	−10602 11	1257 10	1.4 μ s 0.3	(25/2 [−])	13		1998	IT=100
²¹¹ Po	−12432.5 1.3		516 ms 3	9/2 ⁺ *	15		1913	$\alpha = 100$
²¹¹ Po ^m	−10970 5	1462 5	25.2 s 0.6	(25/2 ⁺)	15		1954	$\alpha = 99.984$ 4; 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 μ s 0.7	(43/2 ⁺)	15		1998	IT $\approx$ 100; α ?
²¹¹ At	−11647.2 2.7		7.214 h 0.007	9/2 [−] *	13		1940	$\varepsilon = 58.20$ 8; $\alpha = 41.80$ 8
²¹¹ At ^m	−6832.7 2.7	4814.5 0.5	4.23 μ s 0.07	(39/2 [−])	13		1971	IT=100
²¹¹ Rn	−8755 7		14.6 h 0.2	1/2 [−] *	13		1952	$\beta^+ = 72.6$ 17; $\alpha = 27.4$ 17
²¹¹ Rn ⁿ	−7152# 16#	1603# 14#	596 ns 28	17/2 [−]	13	81Po08	EJT 1981	IT=100
²¹¹ Rn ⁿ	150# 21#	8905# 20#	201 ns 4	63/2 [−]	13	85Po06	EJT 1981	IT=100
²¹¹ Fr	−4140 12		3.10 m 0.02	9/2 [−] *	13	05Ku06	D 1964	$\alpha = 87$ 3; $\beta^+ = 13$ 3
²¹¹ Fr ^m	−1717 12	2423.16 0.24	146 ns 14	29/2 ⁺	13	86By01	ETJ 1986	IT=100
²¹¹ Fr ⁿ	517 12	4657.3 0.4	124.5 ns 1.2	45/2 [−]	13	16Ma41	T 1986	IT=100
²¹¹ Ra	832 5		12.6 s 1.2	5/2 [−] *	13	19Zh54	T 1967	$\alpha \approx 100; \beta^+ ?$
²¹¹ Ra ^m	2030 5	1198.1 0.8	9.5 μ s 0.3	13/2 ⁺	13	13Ba29	T 2004	IT=100
²¹¹ Ac	7140 50		213 ms 25	9/2 [−]	13	00He17	T 1968	$\alpha \approx 100; \beta^+ ?$
²¹¹ Th	13880 90		48 ms 20	5/2 [−] #	13		1995	$\alpha \approx 100; \beta^+ ?$
²¹¹ Pa	22050 70		6 ms 3	9/2 [−]	13	20Au04	TD 2006	$\alpha \approx 100; \beta^+ ?; p ?$
* ²¹¹ Tl	T : average 17Ca12=77(18) 14Mo02, 12Be28=88(+46-29)							**
* ²¹¹ Tl ^m	E : 144 keV + x keV; x=1100#(100#) keV by Nubase from interpretation in							**
* ²¹¹ Tl ^m	E : 19Go10 and similarity with ²⁰⁹ Tl ^m							**
* ²¹¹ Pb	T : others 16Ai01=36.164(0.013) 15Ko09=36.165(0.037)							**
* ²¹¹ Pb ^m	E : 1679.1 + x keV; x<80 keV estimated by Nubase							**
* ²¹¹ Po	J : 13Se03, 14Se07, 15Fi07=9/2							**
* ²¹¹ At	J : 18Cu02=9/2							**
* ²¹¹ Rn	J : other 83Ah03=5/2 (same group)							**
* ²¹¹ Rn ^m	E : 1577.8 + x keV; x<50 keV from 81Po08							**
* ²¹¹ Rn ⁿ	E : from 8880#(14#) + y keV; y<50 keV from 85Po06							**
* ²¹¹ Fr	J : other 14Ly01=9/2							**
* ²¹¹ Fr ⁿ	J : from 86By01							**
* ²¹¹ Ra	T : average 19Zh54=10(3) 07Le14=9(5) 68Lo15=12(2) 67Va22=15(2)							**
* ²¹¹ Ra	D : % α estimated by Nubase							**
* 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)							**
* ²¹¹ Pa	T : symmetrized from 20Au04=3.8(+4.6-1.4)							**
* ²¹¹ Pa	J : favored α decay to ²⁰⁷ Ac (J=9/2 [−])							**
²¹² Hg	3020# 300#		30# s >300ns	0 ⁺	20	10A124	I 2010	$\beta^- ?; \beta^- n ?$
²¹² Tl	−1550# 200#		31 s 8	(5 ⁺)	20	17Ca12	TD 1998	$\beta^- = 100; \beta^- n = 1.8$ 18
²¹² Pb	−7548.9 1.8		10.627 h 0.006	0 ⁺	20	17Ko16	T 1905	$\beta^- = 100$
²¹² Pb ^m	−6213.9 2.7	1335 2	6.0 μ s 0.8	8 ⁺ #	20	12Re.B	E 1998	IT=100
²¹² Bi	−8117.9 1.9		60.55 m 0.06	1 [−] *	20	89Ha.A	D 1905	$\beta^- = 64.06$ 6; $\alpha = 35.94$ 6;
								$\beta^- \alpha \approx 0.014$
²¹² Bi ^m	−7870 30	250 30	25.0 m 0.2	(8 [−] , 9 [−])	20		1978	$\alpha = 67$ 1; $\beta^- = 33$ 1; $\beta^- \alpha = 30$ 1
²¹² Bi ⁿ	−6639 30	1479 30	7.0 m 0.3	(18 [−])	20	13Ch12	D 1978	$\beta^- = ?; IT ?$

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{212}Po	-10369.4	1.2				294.4 ns 0.8	0^+	20	17Ap03 T	1906	$\alpha=100$	*
$^{212}\text{Po}^m$	-7446	5	2923	4	AD	45.1 s 0.6	(18^+)	20		1962	$\alpha=99.93\ 2; \text{IT}?$	
^{212}At	-8628.1	2.4				314 ms 3	(1^-)	20		1954	$\alpha\approx 100; \beta^+?; \beta^-?$	
$^{212}\text{At}^m$	-8405.2	2.4	222.9	0.9	AD	119 ms 3	(9^-)	20		1970	$\alpha\approx 100; \text{IT}?$	
$^{212}\text{At}^n$	-3856.7	2.8	4771.4	1.5		152 μs 5	(25^-)	20		1998	$\text{IT}=100$	
^{212}Rn	-8659	3				23.9 m 1.2	0^+	20		1950	$\alpha=100$	
$^{212}\text{Rn}^m$	-7019	3	1639.68	0.15		118 ns 14	6^+	20		1971	$\text{IT}=100$	
$^{212}\text{Rn}^n$	-6965	3	1694.1	0.3		910 ns 30	8^+	20		1971	$\text{IT}=100$	
$^{212}\text{Rn}^p$	-2485	3	6174.2	0.3		102 ns 4	22^+	20	09Dr12 J	1977	$\text{IT}=100$	
$^{212}\text{Rn}^q$	-80	3	8579.2	0.4		154 ns 14	30^+	20	09Dr12 J	1977	$\text{IT}=100$	
^{212}Fr	-3516	9				20.0 m 0.6	5^+*	20		1950	$\beta^+=57\ 2; \alpha=43\ 2$	
$^{212}\text{Fr}^m$	-1965	9	1551.4	0.3		31.9 μs 0.7	11^+	20	86By01 J	1977	$\text{IT}=100$	
$^{212}\text{Fr}^n$	-1024	9	2492.2	0.4		604 ns 28	15^-	20	86By01 J	1977	$\text{IT}=100$	
$^{212}\text{Fr}^p$	2339	9	5854.7	0.6		312 ns 21	27^-	20	86By01 J	1986	$\text{IT}=100$	
$^{212}\text{Fr}^q$	5017	9	8533.4	1.1		23.6 μs 2.1	$34^+\#$	20		1990	$\text{IT}=100$	
^{212}Ra	-199	10				13.0 s 0.2	0^+	20		1967	$\alpha=?; \beta^+?$	
$^{212}\text{Ra}^m$	1759	10	1958.4	2.0		9.3 μs 0.9	8^+	20		1986	$\text{IT}=100$	
$^{212}\text{Ra}^n$	2414	10	2613.3	2.0		850 ns 130	11^-	20	13Ba29 T	1986	$\text{IT}=100$	
^{212}Ac	7300	22				895 ms 28	7^+*	20	14Ya19 T	1968	$\alpha\approx 100; \beta^+?$	*
^{212}Th	12111	10				31.7 ms 1.3	0^+	20		1980	$\alpha\approx 100; \beta^+?$	
^{212}Pa	21600	90				5.8 ms 1.9	$3^+\#$	20	20Au04 T	1997	$\alpha=100$	*
$^{*212}\text{Tl}$	T : other 14Mo02, 12Be28=96(+42-38)											**
$^{*212}\text{Pb}$	T : average 17Ko06=10.622(0.007) 55To11=10.643 (0.012)											**
$^{*212}\text{Pb}^m$	T : 12Go19=6.0(0.8) supersedes 12Re.B=5.0(0.3); other 98Pf02=5(1)											**
$^{*212}\text{Bi}$	J : 17Ba12=1											**
$^{*212}\text{Po}$	T : average 17Ap03=293.9(1.0,stat)(0.6,syst) 13Be31=294.7(0.8,stat)(0.6,syst)											**
$^{*212}\text{Ac}$	T : average 14Ya19=880(35) 00He17=880(110) 68Va04=930(50);											**
$^{*212}\text{Ac}$	T : other 19Zh23=1.6(+0.9-0.4)											**
$^{*212}\text{Ac}$	J : 17Gr18, 16Fe11=(7); favored α decay to ^{208}Fr ($J=7+$)											**
$^{*212}\text{Pa}$	T : average 20Au04=4.5(+2.7,-1.3) 14Ya10=5.1(+5.1-1.7), combining											**
$^{*212}\text{Pa}$	T : 14Ya10 and 97Mi03											**
^{213}Hg	8200#	300#				15# s >300ns	$9/2^+\#$	11	10A124 I	2010	$\beta^-?; \beta^-n?$	
^{213}Tl	1784	27				23.8 s 4.4	$1/2^+\#$	12	17Ca12 TD	2010	$\beta^-=100; \beta^-n=7.6\ 34$	*
$^{213}\text{Tl}^m$	2460#	300#	680#	300#		4.1 μs 0.5			19Go10 TDE2019		$\text{IT}=100$	*
$^{213}\text{Tl}^n$	3030#	100#	1250#	100#		0.6 μs 0.3	$17/2^+\#$		19Go10 TDE2019		$\text{IT}=100$	*
^{213}Pb	-3204	7				10.2 m 0.3	$(9/2^+)$	07		1964	$\beta^-=100$	
$^{213}\text{Pb}^m$	-1873	7	1331.0	1.7		260 ns 20	$(21/2^+)$		20Do.A JTD	2020	$\text{IT}=100$	
^{213}Bi	-5232	5				45.60 m 0.04	$9/2^-*$	07	18Ba03 J	1947	$\beta^-=97.91\ 3; \alpha=2.09\ 3$	*
$^{213}\text{Bi}^m$	-3879	22	1353	21		> 168 s	$25/2^- \#$		08Ch.A T	2008	$\beta^-?; \text{IT}?$	*
^{213}Po	-6654	3				3.705 μs 0.001	$9/2^+$	07	20Ko06 T	1947	$\alpha=100$	*
^{213}At	-6580	5				125 ns 6	$9/2^-$	07		1968	$\alpha=100$	
$^{213}\text{At}^m$	-5222	24	1358	23		110 ns 17	$25/2^- \#$	07		1980	$\text{IT}=100$	*
$^{213}\text{At}^n$	-3582	27	2998	27		45 μs 4	$49/2^+\#$	07	03LaZZ TEJ	2003	$\text{IT}=100$	*
^{213}Rn	-5696	3				19.5 ms 0.1	$9/2^+\#$	07		1967	$\alpha=100$	*
$^{213}\text{Rn}^m$	-4014	10	1682	10		1.00 μs 0.21	$(25/2^+)$	07		1988	$\text{IT}=100$	*
$^{213}\text{Rn}^n$	-3491	10	2205	10		1.36 μs 0.07	$(31/2^-)$	07		1988	$\text{IT}=100$	*
$^{213}\text{Rn}^p$	269	14	5965	14		164 ns 11	$(55/2^+)$	07		1988	$\text{IT}=100$	*
^{213}Fr	-3554	5				34.14 s 0.06	$9/2^-*$	07	13Fi08 T	1964	$\alpha=99.44\ 5; \beta^+=0.56\ 5$	*
$^{213}\text{Fr}^m$	-1964	5	1590.41	0.18		505 ns 14	$21/2^-$	07		1971	$\text{IT}=100$	
$^{213}\text{Fr}^n$	-1016	5	2537.62	0.23		238 ns 6	$29/2^+$	07		1971	$\text{IT}=100$	
$^{213}\text{Fr}^p$	4541	5	8094.8	0.7		3.1 μs 0.2	$(65/2^-)$	07		1989	$\text{IT}=100$	
^{213}Ra	346	10				2.73 m 0.05	$1/2^-*$	07	17Lo13 D	1955	$\alpha=87\ 2; \beta^+=13\ 2$	
$^{213}\text{Ra}^m$	2114	11	1768	4	AD	2.20 ms 0.05	$(17/2^-)$	07	06Ku26 TD	1976	$\text{IT}\approx 99; \alpha=0.6\ 4$	
^{213}Ac	6141	12				738 ms 16	$9/2^-*$	07		1968	$\alpha\approx 100; \beta^+?$	*
^{213}Th	12120	9				144 ms 21	$5/2^-$	07		1968	$\alpha\approx 100; \beta^+?$	*
$^{213}\text{Th}^m$	13300	9	1180.0	1.4		1.4 μs 0.4	$(13/2^+)$		07Kh22 TDJ	2007	$\text{IT}=100$	*
$^{213}\text{Th}^p$	12380#	50#	260#	50#								
^{213}Pa	19650	60				7.4 ms 2.4	$9/2^-$	07	20Au04 TD	1995	$\alpha=100$	*
$^{*213}\text{Tl}$	T : others 14Mo02, 12Be28=46(+55-26) 10Ch19=101(+484-46)											**
$^{*213}\text{Tl}^m$	E : 380 keV + x; x=300#(300#) keV by Nubase											**
$^{*213}\text{Tl}^n$	E : 698 keV + x; x=550#(100#) keV by Nubase from interpretation in											**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)			
* ²¹³ Tl ⁿ	E : 19Go10 and similarity with ²⁰⁹ Tl ^m							**			
* ²¹³ Bi	T : average 21Ta01=45.60(0.09) 13Ma13=45.62(0.06) 73Po16=45.59(0.06)							**			
* ²¹³ Bi ^m	E : from 12Ch19							**			
* ²¹³ Po	T : average 20Ko06=3.709(12) 18Al32=3.705(1) 13Su13=3.708(8); other							**			
* ²¹³ Po	T : 18Sa45=3.5(0.5)							**			
* ²¹³ At ^m	E : 1318.1(0.6) + x keV; 20<x<100 keV from 80Sj01							**			
* ²¹³ At ⁿ	E : 1615(2) + y keV above ²¹³ At ^m ; y~50 keV in 03LaZZ							**			
* ²¹³ Rn	T : other 19Mi08=16(1)							**			
* ²¹³ Rn	J : other 83Ah03=1/2, inconsistent with the excited structures							**			
* ²¹³ Rn ^m	E : 1664.0(1.0) + x keV; x<35 keV from 88St10							**			
* ²¹³ Rn ⁿ	E : 522.7 keV above ²¹³ Rn ^m from 88St10							**			
* ²¹³ Rn ^p	E : 4265 + y keV above ²¹³ Rn ^m ; y<35 keV from 88St10							**			
* ²¹³ Fr	T : others: 16Pr08=33.2(2.0) and 28.4(3.5) 19Mi08=20(+48-8)							**			
* ²¹³ Fr	D : %β ⁺ other 17Lo13=0.25(0.15), discrepant likely due to Rn diffusion							**			
* ²¹³ Ac	J : 17Gr18,16Fe11=(9/2); favored α decay to ²⁰⁹ Fr (J=9/2-)							**			
* ²¹³ Th	J : favored α decay to ²⁰⁹ Ra (J=5/2-)							**			
* ²¹³ Th ^m	E : from 381(1) keV and 799(1) keV gammas in cascade; uncertainties							**			
* ²¹³ Th ⁿ	E : in gamma-ray energies were estimated by Nubase							**			
* ²¹³ Pa	T : average 20Au04=4.9(+5.9-1.8) 95Ni05=5.3(+4.0-1.6)							**			
* ²¹³ Pa	J : favored α decay to ²⁰⁹ Ac (J=9/2-)							**			
²¹⁴ Hg	11770#	400#		8# s >300ns	0 ⁺	11 10Al24 I	2010	β ⁻ ?;β ⁻ n ?			
²¹⁴ Tl	6470#	200#		11.0 s 2.4	5 ⁺ #	11 17Ca12 TD	2010	β ⁻ =100;β ⁻ n=34 12			
²¹⁴ Pb	-183.0	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	β ⁻ =99.979 1;α=0.021 1; β ⁻ α≈0.003			
²¹⁴ Bi ^m	-660	30	539	30	> 93 s	8 ⁻ #	08Ch.A TE	2008	β ⁺ ?; IT ?		
²¹⁴ Po	-4470.0	1.4		163.47 μs 0.03	0 ⁺	09 16Al28 T	1912	α=100	*		
²¹⁴ At	-3379	4		558 ns 10	1 ⁻	09	1949	α=100			
²¹⁴ At ^m	-3321	8	59	9	AD	265 ns 30	09	1982	α≈100;IT ?		
²¹⁴ At ⁿ	-3147	5	232	5	AD	760 ns 15	9 ⁻	09	1982	α≈100;IT ?	
²¹⁴ Rn	-4320	9		259 ns 3	0 ⁺	09 19Pa45 T	1970	α=100	*		
²¹⁴ Rn ^m	275	9	4595.4	1.8		245 ns 30	(22 ⁺)	09	1983	IT=100	
²¹⁴ Fr	-958	9		5.51 ms 0.13	(1 ⁻)*	09 19Mi06 T	1967	α=100	*		
²¹⁴ Fr ^m	-837	8	121	5	AD	3.35 ms 0.05	(8 ⁻)	09	1962	α=100	
²¹⁴ Fr ⁿ	-320	10	638	5		103 ns 4	(11 ⁺)	09	1993	IT=100	*
²¹⁴ Fr ^p	5620#	100#	6577#	100#		108 ns 7	(33 ⁺)	09	1994	IT=100	*
²¹⁴ Ra	93	5		2.437 s 0.016	0 ⁺	09 15Kh09 T	1967	α=99.941 4;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=99.91 7;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 ^s	6670	5	6577.0	1.8		128 ns 4	(25 ⁻)	09	1992	IT=100	
²¹⁴ Ac	6433	14		8.2 s 0.2	5 ⁺ *	09	1968	α=93 4;β ⁺ =7 4	*		
²¹⁴ Th	10695	11		87 ms 10	0 ⁺	09	1968	α≈100;β ⁺ ?			
²¹⁴ Th ^m	12876	11	2181.0	2.7		1.24 μs 0.12	8 ⁺ #	09	2007	IT=100	
²¹⁴ Pa	19460	80		17 ms 3	7 ⁺ #	09 95Ni05 D	1995	α≈100			
* ²¹⁴ Pb ^m	E : 1365 + x keV; x=20-90 keV from 12Go19							**			
* ²¹⁴ Po	T : average 16Al28=163.47(0.03) 13Be31=163.6(0.3) 12Su11=164.2(0.6)							**			
* ²¹⁴ Rn	T : from 19Pa45; other 70Va13=270(20)							**			
* ²¹⁴ Fr	T : average 19Mi08=6.0(0.2) 15Kh09=5.9(0.4) 05Li17=4.6(0.7)							**			
* ²¹⁴ Fr	T : 68To10=5.0(0.2) 68Va18=5.5(0.5)							**			
* ²¹⁴ Fr	J : 16Fa11=(1)							**			
* ²¹⁴ Fr ⁿ	E : 516.6(6) keV above ²¹⁴ Fr ^m							**			
* ²¹⁴ Fr ^p	E : 6477 + y keV; y=100#(100#) keV estimated by Nubase							**			
* ²¹⁴ Ra	T : average 15Kh09=2.36(0.06) 12No08=2.435(0.020) 73Be33=2.46(0.03)							**			
* ²¹⁴ Ac	J : 17Gr18,16Fe11=5							**			
* ²¹⁴ Ac	D : %β ⁺ from 68Va04<14 %							**			

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{215}Hg	17110#	400#			600# ms >300ns	$9/2^+$	13	10Al24 I	2010	β^- ?; β^-n ?	
^{215}Tl	10030#	300#			9.7 s 3.8	$1/2^+$	13	17Ca12 TD	2010	β^- =100; β^-n =4.6 46	
^{215}Pb	4340	50			142 s 11	$9/2^+$	13	17Ca12 T	1998	β^- =100	*
^{215}Bi	1629	6			7.62 m 0.13	$(9/2^-)$	13	14Mo02 T	1953	β^- =100	*
$^{215}\text{Bi}^m$	2996#	21#	1367#	20#	36.9 s 0.6	$(25/2^-)$	13		2001	IT=76.9 5; β^- =23.1 5	*
^{215}Po	-541.8	2.1			1.781 ms 0.005	$9/2^+$	13		1911	α =100; β^- =2.3e-4 2	
^{215}At	-1257	7			37 μ s 3	$9/2^-$	13	18Sa45 T	1944	α =100	*
^{215}Rn	-1169	6			2.30 μ s 0.10	$9/2^+$	13		1952	α =100	*
^{215}Fr	318	7			90 ns 4	$9/2^-$	13	19Mi08 T	1970	α =100	*
^{215}Ra	2532	7			1.669 ms 0.009	$9/2^+$	13	18Di11 T	1967	α =100	*
$^{215}\text{Ra}^m$	4410	7	1877.8	0.3	7.31 μ s 0.13	$(25/2^+)$	13	04He25 T	1983	IT=100	*
$^{215}\text{Ra}^n$	4779	7	2246.9	0.4	1.39 μ s 0.07	$(29/2^-)$	13		1998	IT=100	
$^{215}\text{Ra}^p$	6340#	50#	3807#	50#	555 ns 10	$(43/2^-)$	13		1987	IT=100	*
^{215}Ac	6031	12			171 ms 10	$9/2^-$	13	17Su18 TD	1968	$\alpha \approx 100$; β^+ =0.09 2	*
$^{215}\text{Ac}^m$	7827	12	1796.0	0.9	185 ns 30	$(21/2^-)$	13		1983	IT=100	
$^{215}\text{Ac}^n$	8520#	50#	2488#	50#	335 ns 10	$(29/2^+)$	13		1983	IT=100	*
^{215}Th	10921	6			1.35 s 0.14	$(1/2^-)$	13	19Zh54 T	1968	α =100	*
$^{215}\text{Th}^m$	12390#	50#	1471#	50#	770 ns 60	$9/2^+$	13		2005	IT=100	*
^{215}Pa	17800	80			14 ms 2	$9/2^-$	13		1979	α =100	*
^{215}U	24890	100			1.4 ms 0.9	$5/2^-$	15	15Ya13 T	2015	α =?; β^+ ?	*
* ^{215}Pb	T : average 17Ca12=98.4(30.8) 13De20=147(12) 14Mo02=160(40);										**
* ^{215}Pb	T : other 96Ry.B=36(1)										**
* ^{215}Bi	T : average 14Mo02=7.6(0.2) 90Ru02=7.7(0.2) 89Bu09=7.5(0.4) 65Nu03=7.4(0.6)										**
* $^{215}\text{Bi}^m$	E : 1347.5(0.2) + x keV; x=20#(20#) keV estimated by Nubase										**
* ^{215}At	T : other 51Me10=100(20)										**
* ^{215}Rn	T : other 18Sa45=2.5(0.3)										**
* ^{215}Fr	T : average 19Mi08=101(15) 84De16=86(5) 84Sc25=104(16) 74No02-120(20)										**
* ^{215}Ra	T : average 18Di11=1.64(0.08) 18Br13=1.66(0.07) 15Kh09=1.70(0.06)										**
* ^{215}Ra	T : 05Li17=1.64(0.04) 00He17=1.67(0.01); other 20Su02=1.51(+0.40-0.26)										**
* $^{215}\text{Ra}^m$	T : average 04He25=7.6(0.2) 98St24=6.9(0.3) 88Fu10=7.2(0.2)										**
* $^{215}\text{Ra}^p$	E : 3756.6(0.4) + x keV; x=50#(50#) keV estimated by Nubase										**
* ^{215}Ac	T : other 17Su18=193(+97-49)										**
* ^{215}Ac	J : 17Gr18, 16Fe11=9/2										**
* $^{215}\text{Ac}^n$	E : 2438 + x keV; x=50#(50#) from Ensdf'2001										**
* ^{215}Th	T : average 19Zh54=1.5(2) 68Va18=1.2(2); other 07Le14=0.63(+1.26-0.21)										**
* $^{215}\text{Th}^m$	E : 1421.3(0.3) + x keV; x=50#(50#) keV estimated by Nubase										**
* ^{215}Pa	J : favored α decay to ^{211}Ac (J=9/2-)										**
* ^{215}U	T : symmetrized from 15Ya13=0.73(+1.33-0.29) ms										**
^{216}Hg	20920#	400#			2# s >300ns	0^+	11	10Al24 I	2010	β^- ?; β^-n ?	
^{216}Tl	14870#	300#			5.9 s 3.3	5^+	11	17Ca12 TD	2010	β^- =100; β^-n <11.5	
^{216}Pb	7510#	200#			1.66 m 0.20	0^+	15	17Ca12 TD	2010	β^- =100	
$^{216}\text{Pb}^m$	9020#	200#	1514	20	400 ns 40	8^+	15	12Go19 EJT	2012	IT=100	*
^{216}Bi	5874	11			2.21 m 0.04	$(6^-, 7^-)$	07	14Mo02 T	1989	β^- =100	*
$^{216}\text{Bi}^m$	5898	15	24	19	6.6 m 2.1	3^-	07		1989	β^- =100	
^{216}Po	1782.3	1.8			144.0 ms 0.6	0^+	07	17Na22 T	1910	α =100; $2\beta^-$?	*
^{216}At	2257	4			300 μ s 30	1^-	07		1948	$\alpha \approx 100$; β^- ?; ϵ ?	
$^{216}\text{At}^m$	2417	10	161	11	100# μ s	9^-	07		1971	α =100	
^{216}Rn	253	6			29 μ s 4	0^+	07	18Sa45 T	1949	α =100	*
^{216}Fr	2971	4			700 ns 20	(1^-)	07		1970	α =100; β^+ ?	
$^{216}\text{Fr}^m$	3190	6	219	6	850 ns 30	(9^-)	07	Ku30 TJD	2007	$\alpha \approx 100$; β^+ ?	
^{216}Ra	3291	8			172 ns 7	0^+	07	19Pa45 T	1972	α =100; ϵ <1e-8	*
^{216}Ac	8150	9			440 μ s 16	(1^-)	07		1967	α =100; β^+ ?	
$^{216}\text{Ac}^m$	8188	10	38	5	441 μ s 7	(9^-)	07		1966	α =100; β^+ ?	
$^{216}\text{Ac}^n$	8570#	100#	422#	100#	~ 300 ns		07		2006	IT=100	*
^{216}Th	10299	11			26.28 ms 0.16	0^+	07	19Zh54 T	1968	$\alpha \approx 100$; β^+ ?	*
$^{216}\text{Th}^m$	12340	12	2041	8	135.4 μ s 2.9	8^+	07	19Zh54 T	1983	IT=97.2 9; α =2.8 9	*
$^{216}\text{Th}^n$	12947	14	2648	8	580 ns 26	(11^-)	07	01Ha46 JT	1983	IT=100	*
$^{216}\text{Th}^p$	13981	14	3682	8	740 ns 70	(14^+)	07	05Ku31 TE	2001	IT=100	*
^{216}Pa	17824	25			105 ms 12	5^+	07	19Zh23 T	1972	$\alpha \approx 100$; β^+ ?	*
^{216}U	23066	28			6.9 ms 2.9	0^+	15	15Ma37 T	2015	α =100	*
$^{216}\text{U}^m$	25320	30	2250	40	1.4 ms 0.9	8^+	15	15Ma37 T	2015	α =100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²¹⁶ Pb ^m	E : 1459 + x keV; x=20-90 keV from 12Go19							**
* ²¹⁶ Bi	T : average 14Mo02=2.21(25) 00Ku06=2.25(0.05) 96Ry.B=2.17(0.05);							**
* ²¹⁶ Bi	T : other 90Ru02=3.6(0.4)							**
* ²¹⁶ Po	T : others 19Mi18=145(11) 18Ba44=136(6) 03Da24=144(8) 63Di05=145(2)							**
* ²¹⁶ Rn	T : other 61Ru06=45(5)							**
* ²¹⁶ Ra	T : average 19Pa45=161(11) 17Su18=167(53) 73No09=182(10)							**
* ²¹⁶ Ac ⁿ	E : 322 + x keV, x=100#(100#) keV by Nubase							**
* ²¹⁶ Th	T : average 19Zh54=26.3(0.5) 05Ku31=26.0(0.2) 01Ha46=25.4(0.8)							**
* ²¹⁶ Th	T : 00He17=27.0(0.3) 68Va18=28(2); others 14Ya19=29(+13-7)							**
* ²¹⁶ Th	T : 05Li17=30(9) 00He17=30(3)							**
* ²¹⁶ Th ^m	T : average 19Zh54=126(14) 05Ku31=135(4) 01Ha46=128(8) 00He17=140(5)							**
* ²¹⁶ Th ^m	J : favored α decay to ²¹⁴ Rn ^m (J=8+)							**
* ²¹⁶ Th ⁿ	E : 05Ku31=606.8(0.1) keV above ²¹⁶ Th ^m							**
* ²¹⁶ Th ⁿ	T : average 05Ku31=570(30) 01Ha46=615(55)							**
* ²¹⁶ Th ^p	E : 05Ku31=1641.4(0.7) keV above ²¹⁶ Th ^m							**
* ²¹⁶ Pa	T : average 19Zh23=92(+50-24) 96An21=105(12); others 98Ik01=150(70-40),							**
* ²¹⁶ Pa	T : 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)							**
²¹⁷ Tl	18660#	400#		2# s >300ns	1/2 ⁺ #	18 10Al24 I	2010	β^- ?; β^- n ?
²¹⁷ Pb	12260#	300#		19.9 s 5.3	9/2 ⁺ #	18 17Ca12 TD	2010	β^- =100
²¹⁷ Bi	8730	18		98.5 s 1.3	9/2 ⁻ #	18	1998	β^- =100
²¹⁷ Bi ^m	10221	27	1491 20	3.0 μ s 0.2	25/2 ⁻ #	18	2012	IT=100
²¹⁷ Po	5883	7		1.53 s 0.05	(9/2 ⁺)*	18 04Li28 TJ	1956	α =97.5 14; β^- =2.5 14
²¹⁷ At	4395	5		32.6 ms 0.3	9/2 ⁻ *	18 19Ba22 J	1947	α =99.992 2; β^- =0.008 2
²¹⁷ Rn	3659	4		593 μ s 38	9/2 ⁺	18 18Sa45 T	1949	α =100
²¹⁷ Fr	4315	7		22 μ s 5	9/2 ⁻	18	1968	α =100
²¹⁷ Ra	5890	7		1.95 μ s 0.12	(9/2 ⁺)	18 19Mi08 T	1970	α =100
²¹⁷ Ac	8702	11		69 ns 4	9/2 ⁻	18	1972	α ≈100; β^+ ?
²¹⁷ Ac ^m	10715	18	2012 20	740 ns 40	29/2 ⁺	18 85De14 DJT	1973	IT=95.49 18 10; α =4.51 18
²¹⁷ Th	12206	11		248 μ s 4	9/2 ⁺ #	18 19Zh54 T	1968	α =100
²¹⁷ Th ^m	12879	11	673.3 0.1	141 ns 50	(15/2 ⁻)	18	1989	IT=100
²¹⁷ Th ⁿ	14510	30	2307 32	71 μ s 14	(25/2 ⁺)	05Ku31 ETJ	2002	IT=100
²¹⁷ Pa	17055	12		3.8 ms 0.2	9/2 ⁻	18	1968	α =100; β^- ?
²¹⁷ Pa ^m	18915	13	1860 7 AD	1.08 ms 0.03	(23/2 ⁻)	18	1979	α =73 4; IT ?
²¹⁷ U	22970#	80#		850 μ s 710	1/2 ⁻ #	18 05Le42 T	2000	α ≈100; β^- ?
* ²¹⁷ Bi ^m	E : 1436 + x keV; x=20-90 keV from 12Go19							**
* ²¹⁷ Po	T : average 03Ku25=1.53(0.03) 96Ry.B=1.47(0.05); other 04Li28=1.6(0.2)							**
* ²¹⁷ Po	J : 15Fi07=(9/2,11/2)							**
* ²¹⁷ Po	D : % β^- from 77Vy02<5							**
* ²¹⁷ At	D : % β^- average 97Ch53=0.0067(24)% 69Le.A=0.012(4)%							**
* ²¹⁷ Rn	T : average 18Sa45=670(60) 61Ru06=540(50)							**
* ²¹⁷ Ra	T : average 19Mi08=2.5(0.2) 19Ya04=1.4(+0.4-0.3) 90An19=1.7(0.3)							**
* ²¹⁷ Ra	T : 70Va13=1.6(0.2) 70To07=4(2)							**
* ²¹⁷ Ac	T : others 19Mi08=150(+370-60) 82GoZU=75(3) 73No09=111(7)							**
* ²¹⁷ Th	T : average 19Zh54=249(11) 15Kh09=259(12) 05Ku31=257(2) 02He29=237(2)							**
* ²¹⁷ Th	T : 00He17=248(3) 00Ni02=261(+22-18) 73Ha32=252(7); Birge ratio=2.95;							**
* ²¹⁷ Th	T : other 05Li17=310(70)							**
* ²¹⁷ Th ⁿ	T : symmetrized from 05Ku31=67(+17-11); other 02Mu.A=20(5)							**
* ²¹⁷ Th ⁿ	E : 2251.9 + x keV; x<110 keV in 05Ku31, due to the observed weak Kx rays							**
* ²¹⁷ Pa	J : favored α decay to ²¹³ Ac (J=9/2-)							**
* ²¹⁷ U	T : symmetrized from 05Le42=0.19(+1.13-0.10) ms; other 00Ma65=15.6(+21.3-5.7)							**
²¹⁸ Tl	23710#	400#		1# s	6 ⁺ #			β^- ?; β^- n ?
²¹⁸ Pb	15630#	300#		14.8 s 6.8	0 ⁺	19 17Ca12 TD	2009	β^- =100
²¹⁸ Bi	13216	27		33 s 1	8 ⁻ #	19 04De16 JT	1998	β^- =100
²¹⁸ Po	8356.7	2.0		3.097 m 0.012	0 ⁺	19	1904	α =99.980 2; β^- =0.020 2
²¹⁸ At	8100	12		1.28 s 0.06	(2 ⁻ , 3 ⁻)*	19 19Ba22 J	1943	α ≈100; β^- ?
²¹⁸ Rn	5217.4	2.3		33.75 ms 0.15	0 ⁺	19	1948	α =100
²¹⁸ Fr	7059	4		1.4 ms 0.5	1 ⁻	19 82Ew01 T	1949	α =100

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{218}\text{Fr}^m$	7147	5	87	4	AD	21.9 ms 0.5	(8^-)	19	99Sh03 J	1982	$\alpha \approx 100$; IT ?	
^{218}Ra	6646	10				25.91 μs 0.14	0^+	19		1970	$\alpha = 100$	
^{218}Ac	10850	60			*	1.00 μs 0.04	(1^-)	19	19Ya04 T	1970	$\alpha = 100$	*
$^{218}\text{Ac}^m$	10900	90	50	70	*	> 100# ns	$8^- \#$				IT ?; α ?; β^+ ?	
$^{218}\text{Ac}^n$	11460#	110#	607#	86#		103 ns 11	(11^+)	19		1994	IT=100	*
^{218}Th	12367	11				122 ns 5	0^+	19		1973	$\alpha = 100$	
^{218}Pa	18650	18				108 μs 5	$8^- \#$	19	20Zh01 TDJ	1979	$\alpha = 100$	*
$^{218}\text{Pa}^m$	18731	20	81	19	AD	150 μs 50	$1^- \#$	19	20Zh01 TDJ	1979	$\alpha = 100$	*
^{218}U	21895	14				354 μs 91	0^+	19	18Ya01 T	1992	$\alpha = 100$	*
$^{218}\text{U}^m$	24004	18	2109	17	AD	408 μs 125	$8^+ \#$	19	18Ya01 T	2005	$\alpha \approx 100$; IT=?	*
* ^{218}Bi	T : others 17Ca12=38.5(21.6) 14Mo02=33(6)											**
* ^{218}Fr	T : symmetrized from 82Ew01=1.3(+0.5-0.4)											**
* ^{218}Ac	T : average 19Ya04=1.04(0.12) 15Kh09=0.96(0.05) 89Mi17=1.06(0.09)											**
* ^{218}Ac	T : 83Sc23=1.12(0.11) 17Su18=0.98(0.12). others 19Mi08=1.5(0.1), 1.8(0.1)											**
* $^{218}\text{Ac}^n$	E : 507.0(0.3) + x keV above $^{218}\text{Ac}^m$; x=50#(50#) keV by Nubase											**
* ^{218}Pa	T : average 20Zh01=107(5) 00He17=113(10), supersedes 96An21=110(20)											**
* $^{218}\text{Pa}^m$	T : symmetrized from 20Zh01=135(+62-32)											**
* ^{218}U	T : average 18Ya01=131(+179-48) 05Le42=510(+170-100)											**
* $^{218}\text{U}^m$	T : average 18Ya01=134(+244-53) 05Le42=560(+260-140); other (not used)											**
* $^{218}\text{U}^m$	T : 15Ma37=280(+1300-120)											**
^{219}Pb	20620#	400#				3# s >300ns	$11/2^+ \#$	11	10Al24 I	2009	β^- ?	
^{219}Bi	16320#	200#				8.7 s 2.9	$9/2^- \#$	12	17Ca12 T	2009	$\beta^- = 100$; β^-_n ?	*
^{219}Po	12681	16				10.3 m 1.0	$9/2^+ \#$	15	15Fi07 T	1998	$\beta^- = 71.8$ 20; $\alpha = 28.2$ 20	*
^{219}At	10396	3				56 s 3	$(9/2^-) *$	16	19Ba22 J	1953	$\alpha = 93.6$ 10; $\beta^- = 6.4$ 10	*
^{219}Rn	8829.3	2.1				3.96 s 0.01	$5/2^+ *$	01		1903	$\alpha = 100$	
^{219}Fr	8617	7				22.5 ms 1.7	$9/2^- *$	01	18Sa45 T	1948	$\alpha = 100$	*
^{219}Ra	9394	7				9 ms 2	$(7/2)^+$	01	18Sa45 TJD	1952	$\alpha = 100$	*
$^{219}\text{Ra}^m$	9411	7	16.7	0.8		10 ms 3	$(11/2)^+$	01	18Sa45 TJD	2018	$\alpha \approx 100$; IT ?	
^{219}Ac	11570	50				9.4 μs 1.0	$9/2^-$	01	19Mi08 T	1970	$\alpha = 100$; β^+ ?	*
^{219}Th	14460	60				1.023 μs 0.018	$9/2^+ \#$	12	19Ya04 T	1973	$\alpha = 100$; β^+ ?	*
^{219}Pa	18580	70				56 ns 9	$9/2^-$	01	17Su18 TD	2005	$\alpha = 100$; β^+ ?	*
^{219}U	23296	13				60 μs 7	$9/2^+ \#$	01	19Zh54 T	1993	$\alpha = 100$; β^+ ?	*
^{219}Np	29440	90				570 μs 450	$9/2^- \#$	16	18Ya01 T	2015	$\alpha = 100$	*
* ^{219}Bi	T : other 12Be28=22(7)											**
* ^{219}Po	T : from 15Fi07=620(59) s											**
* ^{219}At	J : 19Ba22=(9/2)											**
* ^{219}At	D : % α from 15Fi07											**
* ^{219}Fr	T : average 18Sa45=28(3) 51Me10=20(2)											**
* ^{219}Fr	J : 15De28, 20Ba29=9/2											**
* ^{219}Ra	T : from 18Sa45=8(2) and 10(3) for E(α)=7.98 MeV and 7.66 MeV											**
* $^{219}\text{Ra}^m$	T : from 18Sa45 for E(α)=7.68 MeV											**
* ^{219}Ac	T : average 19Mi08=7.6(+2.1-1.4) 89Mi17=11.8(1.5) 70Bo13=7(2)											**
* ^{219}Th	T : average 19Ya04=1.03(0.03) 18Br13=0.94(0.08) 17Su18=1.09(0.08)											**
* ^{219}Th	T : 15Kh09=0.97(0.04) 73Ha32=1.05(0.03); others 20Su02=0.94(+0.21-0.15)											**
* ^{219}Th	T : 19Zh54=1.24(0.68-0.32)											**
* ^{219}Pa	T : average 17Su18=60(+28-15) 87Fa.A=53(10)											**
* ^{219}U	T : others 93An07=42(+34-13) 05Le42=80(+100-30)											**
* ^{219}Np	T : symmetrized from 18Ya01=150(+720-70)											**
^{220}Pb	24130#	400#				1# s >300ns	0^+	11	10Al24 I	2010	β^- ?	
^{220}Bi	20960#	300#				9.5 s 5.7	$1^- \#$	11	17Ca12 TD	2010	$\beta^- = 100$; β^-_n ?	*
^{220}Po	15263	18				10# s >300ns	0^+	11	98Pf02 I	1998	β^- ?	
^{220}At	14376	14				3.71 m 0.04	$3^- \#$	11		1989	$\beta^- = 92$ 2; $\alpha = 8$ 2	
^{220}Rn	10612.0	1.8				55.6 s 0.1	0^+	11		1900	$\alpha = 100$; $2\beta^-$?	*
^{220}Fr	11482	4				27.4 s 0.3	$1^+ *$	11		1948	$\alpha \approx 100$; $\beta^- = 0.35$ 5	*
^{220}Ra	10272	8				18.1 ms 1.2	0^+	11	18Sa45 T	1949	$\alpha = 100$	*
^{220}Ac	13744	6				26.36 ms 0.19	(3^-)	11	97Sh09 J	1970	$\alpha = 100$; β^+ ?	*
^{220}Th	14690	14				10.2 μs 0.3	0^+	11	19Pa45 T	1973	$\alpha = 100$; ε ?	*
^{220}Pa	20278	15			*	0.85 μs 0.06	$1^- \#$	11	20Ma27 T	2005	$\alpha = 100$; β^+ ?	*
$^{220}\text{Pa}^m$	20304	22	26	23	AD*	410 ns 180			18Hu13 ET	2018	$\alpha = 100$	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{220}\text{Pa}^n$	20570	50	290	50	AD	260 ns 210		18Hu13	ET 2018	$\alpha=100$	*
^{220}U	23010#	100#				60# ns	0^+			$\alpha ?; \beta^+ ?$	
^{220}Np	30480	30				29 ns 11	1^-	19Zh23	TD 2019	$\alpha=100$	*
^{220}Rn	T : other 18Ba44=58(4)										**
^{220}Fr	J : other 14Ly01=1										**
^{220}Ra	T : average 18Sa45=19(3) 00He17=18(2) 90An19=17(2) 61Ru06=23(5)										**
^{220}Ac	T : average 90An19=26.4(0.2) 70Bo13=26.1(0.5)										**
^{220}Th	T : average 19Pa45=10.4(0.4) 73Ha32=9.7(0.6)										**
^{220}Pa	T : average 20Ma27=0.73(0.11) 19Ya04=0.91(0.10) 17Hu08=0.90(0.13);										**
^{220}Pa	T : others 19Zh54=0.98(+0.40-0.22) 87Fa.A=0.780(0.16)										**
$^{220}\text{Pa}^m$	T : symmetrized from 18Hu13=308(+250-95)										**
$^{220}\text{Pa}^n$	T : symmetrized from 18Hu13=69(+330-30)										**
^{220}Np	T : symmetrized 19Zh23=25(+14-7)										**
^{221}Bi	24200#	300#				2# s >300ns	$9/2^-$	11 10A124	I 2009	$\beta^- ?; \beta^- n ?$	
^{221}Po	19774	20				2.2 m 0.7	$9/2^+$	13	2010	$\beta^- =100$	*
^{221}At	16783	14				2.3 m 0.2	$3/2^-$	07	1989	$\beta^- =100$	
^{221}Rn	14471	6				25.7 m 0.5	$7/2^+$	07 97Li23	T 1956	$\beta^- =78.1; \alpha=22.1$	*
^{221}Fr	13277	5				4.801 m 0.005	$5/2^-$	07 13Su13	T 1947	$\alpha \approx 100; \beta^- =0.0048.15;$ $14C=8.8e-11.11$	*
^{221}Ra	12964	5				25 s 4	$5/2^+$	07 18Sa45	T 1949	$\alpha=100; 14C=1.2e-10.9$	*
^{221}Ac	14530	60				52 ms 2	$9/2^-$	07	1968	$\alpha=100$	
^{221}Th	16940	8				1.75 ms 0.02	$7/2^+$	07 14Lo10	T 1970	$\alpha=100$	*
^{221}Pa	20370	60				5.9 μ s 1.7	$9/2^-$	07	1983	$\alpha=100$	*
^{221}U	24520	70				660 ns 140	$9/2^+$	15	2015	$\alpha \approx 100; \beta^+ ?$	
^{221}Np	29910#	200#				30# ns	$9/2^-$			$\alpha ?$	
^{221}Pu	35930#	300#				100# μ s	$9/2^+$			$\alpha ?; SF ?$	
^{221}Po	T : symmetrized from 10Ch19=112(+58-28) s										**
^{221}Rn	J : other 83Ah03=5/2										**
^{221}Fr	D : $\% \beta^-$ from 97Ch53; $\%^{14}\text{C}$ from 94Bo28										**
^{221}Fr	T : average 13Su13=4.806(0.006) 10Wa42=4.768(0.017) 07Je07=4.79(0.02)										**
^{221}Fr	J : other 14Ly01, 15De28=5/2										**
^{221}Ra	T : average 18Sa45=16(2) 58To25=28(2) 51Me10=30(2); Birge ratio=3.79										**
^{221}Ra	D : $\%^{14}\text{C}$ from 94Bo28										**
^{221}Th	T : average 14Lo10=1.78(0.03) 01Ko07=1.73(0.03) 70To07=1.68(0.06); others										**
^{221}Th	T : 19Mi08=1.0(0.2) 19Ya04=2.28(+0.70-0.43) 05Li17=2.3(0.4)										**
^{221}Th	T : 00He17=2.0(+0.3-0.2)										**
^{221}Pa	T : other 19Mi08=3.5(+8.5-1.4)										**
^{222}Bi	28950#	300#				3# s >300ns	1^-	10A124	I 2009	$\beta^- ?; \beta^- n ?$	
^{222}Po	22490	40				9.1 m 7.2	0^+	11	2010	$\beta^- =100$	*
^{222}At	20953	16				54 s 10		11	1989	$\beta^- =100$	
^{222}Rn	16372.0	1.9				3.8215 d 0.0002	0^+	11 15Be07	T 1899	$\alpha=100$	*
^{222}Fr	16378	7				14.2 m 0.3	2^-	11	1975	$\beta^- =100$	
^{222}Ra	14320	4				33.6 s 0.4	0^+	11 12Po13	T 1948	$\alpha=100; 14C=3.0e-8.10$	*
^{222}Ac	16622	5			*	5.0 s 0.5	1^-	11	1949	$\alpha=99.1; \beta^+=1.1$	
$^{222}\text{Ac}^m$	16700	21	78	21	AD*	1.05 m 0.05	5^+	11 72Es03	DTJ 1972	$\alpha \approx 98.6.4; \beta^+ \approx 1.4.4; IT ?$	*
^{222}Th	17203	10				2.24 ms 0.03	0^+	11	1970	$\alpha=100; \epsilon ?$	
^{222}Pa	22060	90				3.8 ms 0.2	1^-	11 19Mi08	T 1970	$\alpha=100$	*
^{222}U	24270	50				4.7 μ s 0.7	0^+	15	1983	$\alpha=100; \beta^+ ?$	
^{222}Np	31270	40				480 ns 190	1^-	20Ma27	TD 2020	$\alpha=100$	*
^{222}Pu	35060#	300#				10# μ s	0^+			$\alpha ?; SF ?$	
^{222}Po	T : symmetrized from 10Ch19=145(+694-66) s										**
^{222}Rn	T : rounded from 15Be07=3.82146(16stat, 4syst)=3.82146(0.00016)										**
^{222}Ra	T : others (not used) 95Ko54=36.17(0.10) 82Bo04=43(4)										**
$^{222}\text{Ac}^m$	D : $\% \beta^+$ from 0.7 < 72Es03 < 2										**
^{222}Pa	T : average 19Mi08=4.5(0.3) 95Ni.A=3.3(0.3) 79Sc09=2.9(+0.6-0.4); other										**
^{222}Pa	T : 70Bo13=5.7(0.5) conflicting (not used)										**
^{222}Np	T : symmetrized from 20Ma27=380(+260-110)										**

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
²²³ Bi	32240#	400#				1# s >300ns	9/2 ⁻ #	11	10AI24	I	2009	β^- ?; β^- -n ?	
²²³ Po	27080#	200#				6# s >300ns	11/2 ⁺ #	11	10AI24	I	2010	β^- ?	
²²³ At	23428	14				50 s 7	3/2 ⁻ #	01			1989	$\beta^- \approx 100$; α ?	
²²³ Rn	20390	8				24.3 m 0.4	7/2 ⁺ *	01			1964	$\beta^- = 100$; α ?	*
²²³ Fr	18382.3	1.9				22.00 m 0.07	3/2 ⁻ *	01			1939	$\beta^- \approx 100$; $\alpha = 0.006$	
²²³ Ra	17233.2	2.1				11.4352 d 0.0010	3/2 ⁺ *	01	15Ko06	T	1905	$\alpha = 100$; 14C=8.9e-8 4	*
²²³ Ac	17825	7				2.10 m 0.05	(5/2 ⁻)	01			1948	$\alpha \approx 99$; ϵ ?	
²²³ Th	19385	8				600 ms 20	(5/2 ⁺)	01			1952	$\alpha = 100$	
²²³ Pa	22340	80				5.3 ms 0.3	9/2 ⁻	01	19Mi08	T	1970	$\alpha = 100$; β^+ ?	*
²²³ U	26050	60				65 μ s 12	7/2 ⁺ #	01	20Su02	T	1991	$\alpha = 100$; β^+ ?	*
²²³ Np	30660	80				2.5 μ s 0.8	(9/2 ⁻)		17Su18	TJD	2017	$\alpha = 100$	*
²²³ Pu	36120#	300#				10# μ s	9/2 ⁺ #					α ?; SF ?	
²²³ Am	42700#	300#				10 ms 9	9/2 ⁻ #		15De22	TI	2015	$\alpha \approx 100$; β^+ ?	*
* ²²³ Rn	J : other 83Ah03=3/2											**	
* ²²³ Ra	T : average 15Ko06=11.4362(0.0050) 15Be13=11.447(0.006) 15Be13=11.445(0.013)											**	
* ²²³ Ra	T : 15Co02=11.4358(0.0028) 65Ki05=11.4346(0.0011)											**	
* ²²³ Ra	J : other 18Ly01=3/2											**	
* ²²³ Pa	T : average 19Mi08=7(1) 99Ho28=4.9(0.4) 95Ni.A=5.0(1.0) 70Bo13=6.5(1.0)											**	
* ²²³ Pa	J : favored α decay to ²¹⁹ Ac (J=9/2-)											**	
* ²²³ U	T : symmetrized from 20Su02=62(+14-10); other 91An10=18(+10-5)											**	
* ²²³ Np	T : symmetrized from 17Su18=2.15(+1.00-0.52)											**	
* ²²³ Am	T : symmetrized from 15De22=5.2(+12.0-4.4)											**	
²²⁴ Bi	37070#	400#				1# s >300ns	1 ⁻ #	15	10AI24	I	2010	β^- ?; β^- -n ?	
²²⁴ Po	29910#	200#				3# m >300ns	0 ⁺	15	10AI24	I	2010	β^- ?	
²²⁴ At	27711	22				2.5 m 1.5	2 ⁺ #	15	10Ch19	T	2010	$\beta^- = 100$	*
²²⁴ Rn	22445	10				107 m 3	0 ⁺	15			1964	$\beta^- = 100$	
²²⁴ Fr	21749	11				3.33 m 0.10	1 ⁻ *	15			1969	$\beta^- = 100$	
²²⁴ Fr ^x	21850#	100#	100#	100#	MD	contamnt							
²²⁴ Ra	18825.8	1.8				3.6316 d 0.0014	0 ⁺	15	21Be.A	T	1902	$\alpha = 100$; 14C=4.0e-9 12	*
²²⁴ Ac	20234	4				2.78 h 0.16	(0 ⁻)	15			1948	$\beta^+ = 90.5$ 17; $\alpha = 9.5$ 17; β^- ?	*
²²⁴ Th	19996	10				1.04 s 0.02	0 ⁺	15			1949	$\alpha = 100$; 2 β^+ ?	
²²⁴ Pa	23862	8				844 ms 19	(5 ⁻)	15			1958	$\alpha \approx 100$; β^+ ?	*
²²⁴ U	25743	15				396 μ s 17	0 ⁺	15	14Lo10	T	1991	$\alpha = 100$; β^+ ?	
²²⁴ Np	32032	29				48 μ s 19	2 ⁻ #		18Hu13	T	2018	$\alpha = 100$	*
²²⁴ Pu	35280#	300#				10# μ s	0 ⁺					α ?; SF ?	
²²⁴ Am	43260#	400#				1# ms						α ?; SF ?	
* ²²⁴ At	T : symmetrized from 10Ch19=76(+138-23) s, value for q=84+ ions											**	
* ²²⁴ Ra	T : average 21Be.A=3.6321(0.0028, NIST-IC) 3.6323(0.0027, NIST-Ge)											**	
* ²²⁴ Ra	T : 3.6262(0.0048, NPL-Ge) 04Sc04=3.6319(0.0023, PT β^- -IC)											**	
* ²²⁴ Ac	D : % α symmetrized from 51Me10=9.1(+2.0-1.4)%											**	
* ²²⁴ Pa	T : average 97Wi15=850(20) 96Li05=790(60); other 70Bo13=950(150)											**	
* ²²⁴ Pa	J : favored α decay to J=(5-) level at 68.71 keV in ²²⁰ Ac											**	
* ²²⁴ Np	T : symmetried from 18Hu13=38(+26-11)											**	
²²⁵ Po	34580#	300#				10# s >300ns	3/2 ⁺ #	11	10AI24	I	2010	β^- ?	
²²⁵ At	30300#	300#				3# s >300ns	1/2 ⁺ #	11	10AI24	I	2010	β^- ?; β^- -n ?	
²²⁵ Rn	26534	11				4.66 m 0.04	7/2 ⁻ *	09			1969	$\beta^- = 100$	*
²²⁵ Fr	23821	12				3.95 m 0.14	3/2 ⁻ *	09			1969	$\beta^- = 100$	
²²⁵ Ra	21993.0	2.6				14.82 d 0.19	1/2 ⁺ *	09	87Mi10	T	1947	$\beta^- = 100$	*
²²⁵ Ac	21637	5				9.9190 d 0.0021	3/2 ⁻	09	20Ko06	T	1947	$\alpha = 100$; 14C=5.3e-10 13	*
²²⁵ Th	22310	5				8.75 m 0.04	3/2 ⁺	09	89Ac01	J	1949	$\alpha \approx 90$; ϵ ?	*
²²⁵ Pa	24360	80				1.71 s 0.10	5/2 ⁻ #	09			1958	$\alpha = 100$	*
²²⁵ U	27372	10				62 ms 4	5/2 ⁺ #	09	19Mi08	T	1989	$\alpha = 100$	*
²²⁵ Np	31620	90				6.5 ms 3.5	9/2 ⁻ #	09	15De22	T	1994	$\alpha = 100$; β^+ ?	*
²²⁵ Pu	36300#	300#				100# μ s	7/2 ⁺ #					α ?; SF ?	
²²⁵ Am	42390#	400#				100# μ s	9/2 ⁻ #					α ?; SF ?	
* ²²⁵ Rn	J : other 83Ah03=1/2											**	
* ²²⁵ Ra	J : other 18Ly01=1/2											**	
* ²²⁵ Ra	T : average 87Mi10=15.02(0.56) 50Ha52=14.8(0.2)											**	
* ²²⁵ Ac	T : average 20Ko06=9.9179(0.0030) 12Po14=9.920(0.003)											**	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²²⁵ Ac	J : also favored α decay to J=3/2- level at 552.1 keV in ²²¹ Fr										**
* ²²⁵ Th	J : favored α decay to J=3/2+ level at 321.4 keV in ²²¹ Ra										**
* ²²⁵ Th	D : % α from 51Me10										**
* ²²⁵ Th	T : from 87Mi10; other 51Me10=8.0(0.5)										**
* ²²⁵ Pa	T : average 70Bo13=1.8(0.3) 78IbZZ=1.7(0.1)										**
* ²²⁵ U	T : average 19Mi08=63(7) 00He17=59(+5-2); others 03Ni10=135(+93-39)										**
* ²²⁵ U	T : 01Ku07=84(4) 94An02=68(+45-20) 92To02=95(15) 89He13=80(+40-10)										**
* ²²⁵ Np	T : average 15De22=3.8(+7.6-2.7)(²³³ Bk decay) 3.3(+7.6-0.7)										**
* ²²⁵ Np	T : (²²⁹ Am decay); other: 19Mi08=0.31(+0.75-0.13)										**
²²⁶ Po	37550#	400#			1# m >300ns	0 ⁺	11	10Al24 I	2010	β^- ?	
²²⁶ At	34660#	300#			7# m >300ns	2 ⁺ #	11	10Al24 I	2010	β^- ?; β^- -n ?	
²²⁶ Rn	28747	10			7.4 m 0.1	0 ⁺	96		1969	β^- =100	
²²⁶ Fr	27521	6			48.5 s 0.7	1 ⁻ *	96	86Bo35 T	1969	β^- =100	*
²²⁶ Ra	23667.6	1.9			1.600 ky 0.007	0 ⁺	96	90We01 D	1898	α =100;14C=2.6e-9 6;2 β^- ?	*
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;18O<3.2e-12	*
²²⁶ Pa	26034	11			1.8 m 0.2	1 ⁻ #	96		1949	α =74 5; β^+ =26 5	
²²⁶ U	27329	11			269 ms 6	0 ⁺	14	01Ca.B T	1973	α =100	*
²²⁶ Np	32820	100			35 ms 10		96	19Mi08 T	1990	α =100; β^+ ?	*
²²⁶ Pu	35630#	200#			10# ms	0 ⁺				α ?;SF ?	
²²⁶ Am	42970#	300#			100# μ s					α ?;SF ?	
* ²²⁶ Fr	T : average 75Ra03=48(1) 86Bo35=49(1)										**
* ²²⁶ Ra	D : % ¹⁴ C average 90We01=2.3(0.8)e-9% 86Ba26=2.9(1.0)e-9%										**
* ²²⁶ Ra	D : 85Ho21=3.2(1.6)e-9%										**
* ²²⁶ Th	T : from 12Po13; others 87Mi10=30.57(0.10) 95Ko54=30.83(0.01)										**
* ²²⁶ U	T : average 01Ca.B=258(13) 00He17=281(9) 99Gr28=260(10); other										**
* ²²⁶ U	T : 18Mi11=400(100)										**
* ²²⁶ Np	T : average 19Mi08=48(5) 90Ni05=35(10); other 95Le15=58(+70-20)										**
²²⁷ Po	42280#	400#			2# s >300ns	5/2 ⁺ #	16		2010	β^- ?	
²²⁷ At	37430#	300#			5# s >300ns	1/2 ⁺ #	16		2010	β^- ?; β^- -n ?	
²²⁷ Rn	32886	14			20.2 s 0.4	(3/2 ⁺)*	16	83Ah03 J	1986	β^- =100	
²²⁷ Fr	29682	6			2.47 m 0.03	1/2 ⁺ *	16		1972	β^- =100	
²²⁷ Ra	27177.5	1.9			42.2 m 0.5	3/2 ⁺ *	16		1953	β^- =100	*
²²⁷ Ac	25849.5	1.9			21.772 y 0.003	3/2 ⁻ *	16		1851	β^- =98.62 36; α =1.38 36	*
²²⁷ Th	25804.8	2.1			18.693 d 0.004	(1/2 ⁺)	16	19Ko06 T	1906	α =100	*
²²⁷ Pa	26830	7			38.3 m 0.3	(5/2 ⁻)	16		1948	α =85 2; ϵ =15 2	
²²⁷ U	29045	9			1.1 m 0.1	(3/2 ⁺)	16		1952	α =100; β^+ ?	
²²⁷ Np	32580	80			510 ms 60	5/2 ⁺ #	16		1990	α $\approx$ 100; β^+ ?	
²²⁷ Pu	36770#	100#			2# s	5/2 ⁺ #				α ?	
²²⁷ Am	42180#	200#			20# ms	9/2 ⁻ #				α ?;SF ?	
* ²²⁷ Ra	J : 18Ly01,88Ah02,83Ah03,87We03=3/2										**
* ²²⁷ Ac	J : other 17Gr18,16Fe11=3/2										**
* ²²⁷ Th	T : average 19Ko06=18.681(0.009) 15Co11=18.695(0.004)										**
²²⁸ At	41880#	400#			1# m >300ns	3 ⁺ #	14	10Al24 I	2010	β^- ?; β^- -n ?	
²²⁸ Rn	35243	18			65 s 2	0 ⁺	14		1989	β^- =100	
²²⁸ Fr	33384	7			38 s 1	2 ⁻ *	14		1972	β^- =100	
²²⁸ Fr ^m	34390	30	1004	30	180 s 110			08Ch.A TIE	2008	IT ?; β^- ?	*
²²⁸ Ra	28940.2	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 Ac ^m	29430	30	539	30	180 s 70			08Ch.A TIE	2008	IT ?; β^- ?	*
²²⁸ Th	26770.9	1.8			1.9125 y 0.0007	0 ⁺	14	93Bo20 D	1905	α =100;20O=1.13e-11 22	*
²²⁸ Pa	28924	4			22 h 1	3 ⁺	14		1948	β^+ =98.15 17; α =1.85 17	
²²⁸ U	29220	13			9.1 m 0.2	0 ⁺	14	61Ru05 TD	1949	α =97.5 1.4; ϵ =2.5 14	*
²²⁸ Np	33830#	100#			61.4 s 1.4	4 ⁺ #	14	94Kr13 D	1994	ϵ =59 7; α =41 7; β^+ SF=0.012 6	*
²²⁸ Pu	36108	23			2.1 s 1.3	0 ⁺	14	03Ni10 T	1994	α $\approx$ 100; β^+ ?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
²²⁸ Am	42850#	200#	100# ms					α ?;SF ?
* ²²⁸ Fr ^m	T : symmetrized from 08Ch.A=94(+170-29) s							**
* ²²⁸ Ac ^m	T : symmetrized from 08Ch.A=149(+95-42) s							**
* ²²⁸ Th	T : average 14Un01=698.4(0.4) 71Jo14=698.77(0.32) 56Ki16=697.6(0.7)							**
* ²²⁸ U	D : % ϵ from 61Ru05<5%							**
* ²²⁸ Np	D : % β^+ SF from 94Kr13=0.020(9) relative to % ϵ =59(7); % α =40(+8-6)							**
* ²²⁸ Np	D : % β^+ =60(+6-8), derived from β^+/α =1.5(4) in 94Kr13							**
* ²²⁸ Pu	T : symmetrized from 03Ni10=1.1(+2.0-0.5)							**
²²⁹ At	44890#	400#	1# s >300ns	1/2 ⁺ #	11	10A124 I	2010	β^- ?; β^- n ?
²²⁹ Rn	39362	13	11.9 s 1.3	(5/2 ⁺)*	09	83Ah03 J	2009	β^- =100
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	77Th04 J	1952	β^- =100
²²⁹ Th	29585.5	2.4	7.916 ky 0.017	5/2 ⁺ *	08	18Es07 T	1947	α =100
²²⁹ Th ^m	29585.5	2.4	7 μ s 1	(3/2 ⁺)	08	19Ya18 E	1994	IT=100
²²⁹ Pa	29897	3	1.55 d 0.04	5/2 ⁺	08	18Gr09 TD	1949	ϵ =99.51 5; α =0.49 5
²²⁹ Pa ^m	29909	3	420 ns 30	3/2 ⁻	08	15Ah04 EJD	1982	IT=100
²²⁹ U	31211	6	57.8 m 0.5	3/2 ⁺	08	15Ah04 T	1949	β^+ $\approx$ 80; α $\approx$ 20
²²⁹ Np	33800	100	4.00 m 0.18	5/2 ⁺ #	08	04Sa05 TD	1968	α =68 11; β^+ ?
²²⁹ Np ^p	33960#	110#		5/2 ⁻ #				
²²⁹ Pu	37390	60	91 s 26	3/2 ⁺ #	08	10Kh06 TD	1994	α $\approx$ 50 20; β^+ $\approx$ 50 20;SF<7
²²⁹ Am	42180	110	1.8 s 1.5	5/2 ⁻ #	15		2015	α $\approx$ 100; β^+ ?
²²⁹ Am ^p	42440#	230#	260#	200#				
* ²²⁹ Rn	T : symmetrized from 09Ne03=12.0(+1.2-1.3)							**
* ²²⁹ Fr	T : 92Bo05=50.2(0.4); Ensdf2008=50.2(2.0) is misprint							**
* ²²⁹ Fr	J : strong β^- feeding to 1/2 ⁺ (142.8 keV) and 1/2 ⁻ (479.2 keV) in 92Bo05							**
* ²²⁹ Ra	J : other 18Ly01=5/2							**
* ²²⁹ Th	T : average 18Es07=7.825(0.087) 14Va04=7.917(0.024) 11Ki16=7.932(0.028)							**
* ²²⁹ Th	T : 89Go19=7.880(0.060); other 50Ha52=7.340(0.080)							**
* ²²⁹ Th ^m	T : 17Se01=7(1) us from internal conversion vs time (nickel alloy surface);							**
* ²²⁹ Th ^m	T : others 19Sh38=10(8) (oxide or hydroxide source) 16We07>60 s							**
* ²²⁹ Th ^m	T : (for 2+ charge state) 09In01(1 m<T1/2<3 m) 09Ki14<2 h							**
* ²²⁹ Th ^m	T : 03Mi02 (same group as 09Ki14)=13.9(3.0)h 01Br20(T1/2<6 h or T1/2>20 d)							**
* ²²⁹ Th ^m	T : 94He08=70(50)h. 19Ve05 (metallic host) excludes 4 us<T1/2<50 us isomer							**
* ²²⁹ Th ^m	E : rounded from 8.15(0.10) eV, average 20Si22=8.10(0.17) eV							**
* ²²⁹ Th ^m	E : 20Ge.A=8.09(+0.14-0.19) eV 19Se13=8.28(0.03,stat)(0.16,syst) eV							**
* ²²⁹ Th ^m	E : 19Ya18=8.30(0.45,stat)(0.81,syst) eV 07Be16=8.1(0.5) eV, recalibrated							**
* ²²⁹ Th ^m	E : in 19Ye18 from 7.5(0.5) eV; others 16We07 (6.3<E<18.3) eV							**
* ²²⁹ Th ^m	E : 94He08=3.5(1.0) eV							**
* ²²⁹ Pa	T : average 87Ah05=1.50(0.05) 18Gr09=1.67(0.08), determined by evaluator							**
* ²²⁹ Pa	T : as unweighted average (Birge ratio=4.88) from 8 values in 18Gr09							**
* ²²⁹ Pa	D : % α average 87Ah05=0.48(0.05) 18Gr09=0.53(0.10)							**
* ²²⁹ Pa ^m	D : from 98Le15							**
* ²²⁹ Pa ^m	T : from 82Ah08, time-difference between Pa K x rays and 80-400 eV electrons							**
* ²²⁹ U	J : favored α decay to ²²⁵ Th (J=3/2 ⁺)							**
* 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 Am	T : symmetrized from 15De22=0.9(+2.1-0.7); also 15De22=6.4(+14.9-5.4)							**
²³⁰ Rn	42170#	200#	24# s >300ns	0 ⁺	12	10A124 I	2010	β^- ?
²³⁰ Fr	39487	7	19.1 s 0.5	2 ⁺ #	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	30862.5	1.2	75.4 ky 0.3	0 ⁺	12		1907	IS=0.02 2; α =100;SF<4e-12; 24Ne=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 ?
²³⁰ Np	35240	60	4.6 m 0.3	4 ⁺ #	12		1968	β^+ <97; α >3

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²³⁰ Pu	36932	14			105 s 10	0 ⁺	12	18Mi11 T	1990	$\alpha \approx 100; \beta^+ ?$	*
²³⁰ Am	42870#	140#			40 s 9	1 ⁻ #	12	17Wi13 TD	2003	$\beta^+ \approx 100; \beta^+ \text{SF} > 30$	*
* ²³⁰ Pu	T : average 18Mi11=200(+77-43) 01Ca.B=102(10)										**
* ²³⁰ Am	T : average 17Wi13=36(+15-8) 16Ka13td=32(+22-9)										**
²³¹ Rn	46550#	300#			2# s >300ns	1/2 ⁺ #	13	10Al24 I	2010	$\beta^- ?$	
²³¹ Fr	42081	8			17.6 s 0.6	(1/2 ⁺)	13	14Bu06 J	1985	$\beta^- = 100$	
²³¹ Ra	38216	11			104 s 1	(5/2 ⁺)*	13	06Bo33 T	1983	$\beta^- = 100$	*
²³¹ Ra ^m	38282	11	66.21	0.09	~ 53 μ s	(1/2 ⁺)	13		2001	IT=100	
²³¹ Ac	35763	13			7.5 m 0.1	1/2 ⁺	13		1973	$\beta^- = 100$	
²³¹ Th	33815.8	1.2			25.52 h 0.01	5/2 ⁺	13		1911	$\beta^- = 100$	
²³¹ Pa	33424.3	1.8			32.65 ky 0.20	3/2 ⁻ *	13	20Je01 T	1918	IS=100; α =100;SF<3e-10; 24Ne=13.4e-10 17;...	*
²³¹ U	33806.0	2.7			4.2 d 0.1	5/2 ⁺ #	13		1949	$\epsilon \approx 100; \alpha = 0.004$ 1	
²³¹ Np	35620	50			48.8 m 0.2	5/2 ⁺ #	13		1950	$\beta^+ = 98$ 1; $\alpha = 2$ 1	
²³¹ Pu	38309	22			8.6 m 0.5	(3/2 ⁺)	13		1999	$\beta^+ ?; \alpha = 13$ 5	*
²³¹ Am	42410#	300#			1# m	5/2 ⁻ #				$\beta^+ ?; \alpha ?$	
²³¹ Cm	47270#	300#			20# s	3/2 ⁺ #				$\beta^+ ?; \alpha ?$	
* ²³¹ Ra	J : 18Ly01=(5/2)										**
* ²³¹ Pa	T : average 20Je01=32.57(0.13) 69Ro33=32.765(0.110) 68Br04=32.340(0.115)										**
* ²³¹ Pa	T : 61Ki05=32.643(260) 49Va02=34.3(0.3); Birge ratio=3.12										**
* ²³¹ Pu	D : % α symmetrized from 99La14=10(+7-3)%; β^+ not observed directly										**
²³² Fr	46073	14			5.5 s 0.6	(5)	06	04Pe17 J	1990	$\beta^- = 100; \beta^- \text{SF} ?$	
²³² Ra	40497	9			4.0 m 0.3	0 ⁺	06	08Ch.A T	1983	$\beta^- = 100$	*
²³² Ac	39154	13			1.98 m 0.08	(1 ⁺)	06		1986	$\beta^- = 100$	
²³² Th	35446.7	1.4			14.0 Gy 0.1	0 ⁺	06	95Bo18 D	1898	IS=99.98 2; α =100; SF=1.1e-9 4; 24Ne ⁺ 26Ne<2.78e-10;2 $\beta^- ?$	*
²³² Pa	35947	8			1.32 d 0.02	(2 ⁻)	06		1949	$\beta^- \approx 100; \epsilon ?$	
²³² U	34609.4	1.8			68.9 y 0.4	0 ⁺	06		1949	$\alpha = 100; 24\text{Ne} = 8.9\text{e}-10$ 7; SF=2.7e-12 6;28Mg<5e-12	*
²³² Np	37360#	100#			14.7 m 0.3	(5 ⁻)	06		1950	$\beta^+ \approx 100; \alpha ?$	*
²³² Pu	38361	17			33.7 m 0.5	0 ⁺	06		1973	$\epsilon = ?; \alpha < 20$	*
²³² Am	43420#	300#			1.31 m 0.04	1 ⁻ #	06	90Ha28 D	1967	$\beta^+ \approx 97; \alpha ?; \beta^+ \text{SF} = 0.069$ 10	
²³² Cm	46330#	200#			10# s	0 ⁺				$\beta^+ ?; \alpha ?$	
* ²³² Ra	T : average 08Ch.A=4.00(0.33) 86Gi08=4.2(0.8)										**
* ²³² Th	D : % ²⁴ Ne+ ²⁶ Ne from 95Bo18; %SF from 00Ho27										**
* ²³² Np	J : favored α decay from ²³⁶ Am (J=5-)										**
* ²³² Pu	T : average 00La25=33.1(0.8) 73Ja06=34.1(0.7)										**
²³³ Fr	48920	20			900 ms 100	1/2 ⁺ #	20		2010	$\beta^- = 100; \beta^- \text{n} ?$	
²³³ Ra	44334	9			30 s 5	1/2 ⁺ #	20		1990	$\beta^- = 100$	
²³³ Ac	41308	13			143 s 10	(1/2 ⁺)	20		1983	$\beta^- = 100$	
²³³ Th	38731.6	1.4			21.83 m 0.04	1/2 ⁺	20		1935	$\beta^- = 100$	
²³³ Th ^m	38737.7	1.4	6.06	0.02	2# s	7/2 ⁻ #				IT ?; $\beta^- ?$	*
²³³ Pa	37489.4	1.3			26.975 d 0.013	3/2 ⁻ *	20		1938	$\beta^- = 100$	
²³³ U	36919.1	2.3			159.19 ky 0.15	5/2 ⁺ *	20		1947	$\alpha = 100; \text{SF} < 6\text{e}-11$; 24Ne=7.2e-11 9; 28Mg<1.3e-13	*
²³³ Np	37950	50			36.2 m 0.1	5/2 ⁺ #	20	50Ma14 D	1950	$\beta^+ \approx 100; \alpha \approx 0.0007$	*
²³³ Np ^p	38000#	60#	50#	30#		(5/2 ⁻)					
²³³ Pu	40050	50			20.9 m 0.4	5/2 ⁺ #	20		1957	$\beta^+ \approx 100; \alpha = 0.12$ 5	
²³³ Am	43290#	110#			3.2 m 0.8	5/2 ⁻ #	20	00Sa52 TD	2000	$\beta^+ ?; \alpha = 4.5$ 9	*
²³³ Cm	47290	80			27 s 10	3/2 ⁺ #	20	10Kh06 TD	2001	$\alpha = 20$ 10; $\beta^+ = 80$ 10	*
²³³ Bk	52770#	230#			40 s 30	3/2 ⁻ #	20	15De22 TD	2015	$\alpha \approx 82; \beta^+ ?$	*
* ²³³ Th ^m	J : from expected conf=n7/2[743]										**
* ²³³ Th ^m	T : from B(E3:7/2- ->1/2+)(²³³ Th)=B(E3: 1/2+ -> 7/2-)(²³⁵ U)/4 with										**
* ²³³ Th ^m	T : T1/2(²³⁵ U)=25.7(0.1) m and α_T (²³⁵ U)=2.79(0.05)e20										**
* ²³³ Th ^m	T : and α_T (²³³ Th)=3.36(0.09)e9										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²³³ Np	D : % α observed in 50Ma14 with $\beta^+/\alpha=1.5e5$									**
* ²³³ Am	D : % α combining 10Kh06<6 and 00Sa52>3									**
* ²³³ Cm	T : symmetrized from 10Kh06=23(+13-6)									**
* ²³³ Bk	T : symmetrized from 15De22=21(+48-17)									**
²³⁴ Ra	46931	8			30 s 10	0 ⁺	07		1990	$\beta^- = 100; \beta^- \text{ SF ?}$
²³⁴ Ac	44841	14			45 s 2	1 ⁺ #	07	08Ch.A T	1986	$\beta^- = 100$
²³⁴ Ac ^m	44980	30	140	30	> 93 s			08Ch.A TE	2008	$\beta^- ?; \text{IT ?}$
²³⁴ Ac ⁿ	45460	30	620	30	180 s 70			08Ch.A TE	2008	$\beta^- ?; \text{IT ?}$
²³⁴ Th	40613.0	2.6			24.107 d 0.024	0 ⁺	07	18Pa45 T	1900	$\beta^- = 100; \alpha ?$
²³⁴ Pa	40339	4			6.70 h 0.05	4 ⁺	07		1913	$\beta^- = 100$
²³⁴ Pa ^m	40417.9	2.8	79	3	1.159 m 0.011	(0 ⁻)	07	73Go40 E	1951	$\beta^+ \approx 100; \text{IT} = 0.16 \text{ 4}$
²³⁴ U	38145.0	1.1			245.5 ky 0.6	0 ⁺	07		1912	$\text{IS} = 0.0054 \text{ 5}; \alpha = 100;$ $\text{SF} = 1.64e-9 \text{ 22};$ $28\text{Mg} = 1.4e-11 \text{ 3};$ $24\text{Ne}^+ 26\text{Ne} = 9e-12 \text{ 7}$
²³⁴ U ^m	39566.3	1.1	1421.257	0.017	33.5 μ s 2.0	6 ⁻	07		1963	$\text{IT} = 100$
²³⁴ Np	39955	8			4.4 d 0.1	(0 ⁺)	07		1949	$\beta^+ = 100$
²³⁴ Pu	40350	7			8.8 h 0.1	0 ⁺	07		1949	$\epsilon \approx 94; \alpha \approx 6$
²³⁴ Am	44460#	160#			2.32 m 0.08	0 ⁻ #	07	90Ha02 D	1967	$\beta^+ \approx 100; \alpha = 0.039 \text{ 12};$ $\beta^+ \text{ SF} = 0.0066 \text{ 18}$
²³⁴ Cm	46722	17			52 s 9	0 ⁺	07	10Kh06 D	2001	$\beta^+ \approx 71; \alpha \approx 27; \text{SF} \approx 2$
²³⁴ Bk	53400#	150#			20 s 5	3 ⁻ #	07	16Ka13 T	2003	$\alpha > 80; \beta^+ < 20$
* ²³⁴ Ac	I : 08Ch.A reports two isomers with T1/2>93 s and T1/2=149(+95-42) s									**
* ²³⁴ Ac ⁿ	T : symmetrized from 08Ch.A=145(+95-42)									**
* ²³⁴ Th	T : average 18Pa45=24.157(0.073) 48Kn23=24.101(0.025) 39Sa11=24.1(0.2)									**
* ²³⁴ Pa ^m	E : from 73Go40<10 keV above (3+) level at 73.92(0.02)									**
* 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)									**
²³⁵ Ra	51130#	300#			5# s	5/2 ⁺ #				$\beta^- ?$
²³⁵ Ac	47357	14			62 s 4	1/2 ⁺ #	14	08Ch.A T	2006	$\beta^- = 100$
²³⁵ Th	44018	13			7.2 m 0.1	1/2 ⁺ #	14		1969	$\beta^- = 100$
²³⁵ Pa	42289	14			24.4 m 0.2	3/2 ⁻	14	77Th04 J	1950	$\beta^- = 100$
²³⁵ U	40918.8	1.1			704 My1	7/2 ⁻ *	14		1935	$\text{IS} = 0.7204 \text{ 6}; \alpha = 100;$ $\text{SF} = 7e-9 \text{ 2}; 20\text{Ne} = 8e-10 \text{ 4};$ $25\text{Ne} \approx 8e-10; 28\text{Mg} = 8e-10$
²³⁵ U ^m	40918.9	1.1	0.0767	0.0001	25.7 m 0.1	1/2 ⁺	14	18Po07 E	1966	$\text{IT} = 100$
²³⁵ U ⁿ	43420	300	2500	300	3.6 ms 1.8		14		2007	$\text{SF} \approx 100; \text{IT ?}$
²³⁵ Np	41043.0	1.4			396.1 d 1.2	5/2 ⁺	14		1949	$\epsilon = 99.99740 \text{ 13};$ $\alpha = 0.00260 \text{ 13}$
²³⁵ Pu	42182	21			25.3 m 0.5	(5/2 ⁺)	14		1957	$\beta^+ = 99.9972 \text{ 7}; \alpha = 0.0028 \text{ 7}$
²³⁵ Am	44620	50			10.3 m 0.6	5/2 ⁻ #	14		1996	$\beta^+ = 99.60 \text{ 5}; \alpha = 0.40 \text{ 5}$
²³⁵ Cm	48010#	100#			7 m 3	5/2 ⁺ #	14	20Kh10 TD	1981	$\beta^+ ?; \alpha = 4 \text{ 3}$
²³⁵ Bk	52770#	400#			1# m	3/2 ⁻ #				$\beta^+ ?; \alpha ?$
* ²³⁵ U ^m	E : rounded from 18Po07=0.076737 (0.000018) keV									**
* ²³⁵ U ^m	T : from 16Ch11; value depends on the chemical environment									**
* ²³⁵ Cm	T : symmetrized from 20Kh10=300(+250-100)s									**
* ²³⁵ Cm	D : % α determined from 0<% α <8 in 20Kh10									**
²³⁶ Ac	51220	40			4.5 m 3.6	3 ⁺ #	15	10Ch19 T	2010	$\beta^- = 100$
²³⁶ Th	46255	14			37.3 m 1.5	0 ⁺	15		1973	$\beta^- = 100$
²³⁶ Pa	45334	14			9.1 m 0.1	1 ⁽⁻⁾	06		1963	$\beta^- = 100; \beta^- \text{ SF} = 6e-8 \text{ 4}$
²³⁶ U	42444.6	1.1			23.42 My0.04	0 ⁺	06		1951	$\alpha = 100; \text{SF} = 9.4e-8 \text{ 4}$
²³⁶ U ^m	43497.1	1.3	1052.5	0.6	100 ns 4	4 ⁻	06		1973	$\text{IT} = 100$
²³⁶ U ⁿ	45195	3	2750	3	120 ns 2	(0 ⁺)	06		1969	$\text{IT} = 87 \text{ 6}; \text{SF} = 13 \text{ 6}; \alpha ?$
²³⁶ Np	43380	50			153 ky 5	(6 ⁻)	06		1949	$\epsilon = 86.3 \text{ 8}; \beta^- = 13.5 \text{ 8};$ $\alpha = 0.16 \text{ 4}$
²³⁶ Np ^m	43438	7	60	50	IT*	(1 ⁻)	06		1949	$\epsilon = 50 \text{ 3}; \beta^- = 50 \text{ 3}$

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{236}\text{Np}^p$	43616	14	240	50	AD	(3^-)	06				
^{236}Pu	42901.5	1.8			2.858 y 0.008	0^+	06	90Og01 D	1949	$\alpha=100$;SF=1.9e-7 4; 28Mg=2e-12;2 β^+ ?	
$^{236}\text{Pu}^m$	44087.0	1.8	1185.45	0.15	1.2 μs 0.3	5^-	06		2005	IT=100	
^{236}Am	46040#	120#			3.6 m 0.1	5^-	06	04Sa05 D	1998	$\beta^+\approx 100$; $\alpha=4.0\text{e-}3$ 1	
$^{236}\text{Am}^m$	46090#	130#	50#	50#	2.9 m 0.2	(1^-)	06		2004	$\beta^+\approx 100$; α ?	
^{236}Cm	47853	18			6.8 m 0.8	0^+	06	10Kh06 TD	2010	$\beta^+=82$ 2; $\alpha=18$ 2;SF ?	
^{236}Bk	53540#	360#			26 s 10	$4^+\#$	16	17Ko02 TD	2017	$\beta^+\approx 100$; α ?; β^+ SF=0.04 2	*
* ^{236}Ac	T : symmetrized from 10Ch19=72(+345-33) s										**
* ^{236}Pa	D : β^- SF decay questioned in 90Ha02										**
* ^{236}Bk	T : symmetrized from 17Ko02=22(+13-6); other 20Po07~19										**
^{237}Ac	54020#	400#			23# s	$1/2^+\#$				β^- ?	
^{237}Th	49955	16			4.8 m 0.5	$5/2^+\#$	06		1993	$\beta^-=100$	
^{237}Pa	47528	13			8.7 m 0.2	$1/2^+$	06	77Th04 J	1954	$\beta^-=100$	
^{237}U	45390.1	1.2			6.752 d 0.002	$1/2^+$	06		1940	$\beta^-=100$	
$^{237}\text{U}^m$	45664.1	1.6	274.0	1.0	155 ns 6	$7/2^-$	06		1968	IT=100	*
^{237}Np	44871.6	1.1			2.144 My0.007	$5/2^+\#$	06	89Pr.A D	1948	$\alpha=100$;SF<2e-10; 30Mg<4e-12	*
$^{237}\text{Np}^m$	45816.8	1.1	945.20	0.10	710 ns 40	$13/2^-$	06	90St29 JED	1990	IT=100	*
^{237}Pu	45091.7	1.7			45.64 d 0.04	$7/2^-$	06		1949	$\varepsilon=99.9958$ 4; $\alpha=0.0042$ 4	
$^{237}\text{Pu}^m$	45237.2	1.7	145.543	0.008	180 ms 20	$1/2^+$	06		1972	IT=100	
$^{237}\text{Pu}^n$	47990	250	2900	250	1.1 μs 0.1		06		1970	SF ≈ 100 ; IT ?	
^{237}Am	46570#	60#			73.6 m 0.8	$5/2^-$	06		1970	$\beta^+=99.975$ 3; $\alpha=0.025$ 3	
^{237}Cm	49250	70			> 10# m	$5/2^+\#$	06	06As03 DT	2002	β^+ ?; α = ?	*
$^{237}\text{Cm}^p$	49450#	170#	200#	150#		$7/2^- \#$		20Kh10 E			*
^{237}Bk	53210#	230#			2# m	$3/2^- \#$				β^+ ?; α ?	
^{237}Cf	57940	100			0.8 s 0.2	$5/2^+\#$	06	10Kh06 TD	1995	$\alpha=70$ 10;SF=30 10; β^+ ?	*
* $^{237}\text{U}^m$	J : E1 to 5/2+										**
* ^{237}Np	D : also cluster (Z=10-14) emission 92Mo03<1.8e-12%										**
* $^{237}\text{Np}^m$	J : multiple decay branches in 90St29 agree with J=11/2,13/2-, but the										**
* $^{237}\text{Np}^m$	J : absence of gamma rays to J=7/2- and 9/2+ argues against J=11/2										**
* ^{237}Cm	T : partial T1/2(α) 06As03=1100 m and by assuming % α =1										**
* $^{237}\text{Cm}^p$	E : 50(1) keV E1 gamma above the ^{237}Cm gs in 20Kh10										**
* ^{237}Cf	T : other (not used) 95La09=2.1(0.3)										**
^{238}Th	52530#	280#			9.4 m 2.0	0^+	15		1999	$\beta^-=100$	
^{238}Pa	50894	16			2.28 m 0.09	$3^- \#$	15	85Ba57 D	1968	$\beta^-=100$; β^- SF<2.6e-6	
^{238}U	47307.7	1.5			4.463 Gy 0.003	0^+	15	18Pa45 T	1896	IS=99.2742 10; $\alpha=100$; SF=5.44e-5 7; 2 $\beta^-=2.2\text{e-}10$ 3	*
$^{238}\text{U}^m$	49865.6	1.6	2557.9	0.5	280 ns 6	0^+	15		1979	IT=97.4 4;SF=2.6 4	
^{238}Np	47454.6	1.1			2.099 d 0.002	$2^+\#$	15		1949	$\beta^-=100$	
$^{238}\text{Np}^m$	49760#	200#	2300#	200#	112 ns 39		15		1970	SF ≈ 100 ;IT ?	
^{238}Pu	46163.1	1.1			87.7 y 0.1	0^+	15	89Wa10 D	1949	$\alpha=100$;SF=1.9e-7 1; 32Si $\approx 1.4\text{e-}14$; 28Mg+30Mg $\approx 6\text{e-}15$	*
^{238}Am	48420	60			98 m 3	1^+	15	72Ah04 TD	1950	$\beta^+=100$; $\alpha=1.0\text{e-}4$ 4	
$^{238}\text{Am}^m$	50920#	210#	2500#	200#	35 μs 18		15		1967	SF ≈ 100 ;IT ?	
^{238}Cm	49445	12			2.2 h 0.4	0^+	15		1994	ε ?; $\alpha=3.84$ 18; SF=0.048 2	
^{238}Bk	54220#	260#			2.40 m 0.08	$1\#$	15	94Kr03 TD	1994	$\beta^+\approx 100$; α ?; β^+ SF=0.048 2	
^{238}Cf	57280#	300#			21.1 ms 1.3	0^+	15	10Kh06 D	1995	SF=97.5 14; $\alpha=2.5$ 14	*
* ^{238}U	T : average 18Pa45=4.456(0.021),										**
* ^{238}U	T : 4.468(0.005), adjusted in 04Sc03 from 71Ja07=4.4683(0.0024),										**
* ^{238}U	T : 4.457(0.004), adjusted in 04Sc03 from 59St45=4.460(0.005),										**
* ^{238}U	T : 4.51(0.02), adjusted in 04Sc03 from 55Ko13=4.507(0.009),										**
* ^{238}U	T : 4.495(0.018), adjusted in 04Sc03 from 49Ki26=4.490(0.005).										**
* ^{238}U	D : %2 $\beta^-=2.2(3)\text{e-}10\%$, derived from T1/2(2v- $\beta\beta$)=2.0(0.6) Zy in 91Tu02;										**
* ^{238}U	D : %SF=5.44(0.07)e-5%, derived from T1/2(SF)=8.2(0.1) Py in 00Ho27										**
* ^{238}Cf	D : % α from 10Kh06<5%										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²³⁹ Th	56500#	400#			1# m	7/2 ⁺ #				β^- ?	
²³⁹ Pa	53340#	200#			1.8 h 0.5	1/2 ⁺ #	14		1995	β^- =100	
²³⁹ U	50572.7	1.5			23.45 m 0.02	5/2 ⁺	14		1937	β^- =100	
²³⁹ U ^m	50706.5	1.5	133.7991	0.0010	780 ns 40	1/2 ⁺	14		1975	IT=100	
²³⁹ U ⁿ	53070#	900#	2500#	900#	> 250 ns		14	94Ob0	IIT	1994	SF ?; IT ?
²³⁹ Np	49311.0	1.3			2.356 d 0.003	5/2 ⁺ *	14		1940	β^- =100; α ?	
²³⁹ Pu	48588.2	1.1			24.11 ky 0.03	1/2 ⁺ *	14		1946	α =100;SF=3.1e-10 6	
²³⁹ Pu ^m	48979.8	1.1	391.584	0.003	193 ns 4	7/2 ⁻	14		1955	IT=100	
²³⁹ Pu ⁿ	51690	200	3100	200	7.5 μ s 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	ϵ =99.990 1; 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	150			2.5 h 0.4	7/2 ⁻ #	14	02Sh.C	TD	1952	β^+ $\approx$ 100; α =6.2e-3 14
²³⁹ Cm ^p	51390#	180#	240#	100#	> 100# ns	1/2 ⁺					IT ?; β^+
²³⁹ Bk	54250#	210#		*	100# s	(7/2 ⁺)	14	10An08	TD	1989	β^+ $\approx$ 100; α <0.01;SF<0.01
²³⁹ Bk ^p	54290#	210#	41	11	> 30# μ s	(3/2 ⁻)		89Ha27	J	1989	IT ?; β^+ ?
²³⁹ Cf	58200#	120#			28 s 2	5/2 ⁺ #	14	20Kh10	TD	1981	α =65 3; β^+ ?
²³⁹ Es	63630#	300#			1# s	3/2 ⁻ #					α ?; β^+ ?;SF ?
* ²³⁹ U ⁿ	T : other 94Ob01<0.3 ns is less likely										**
* ²³⁹ Am	J : favored α decay to J=5/2- level at 49.10 keV in ²³⁵ Np										**
* ²³⁹ Cm ^p	E : 146 keV in ²³⁷ Pu, N=143 isotope										**
* ²³⁹ Bk	J : from 89Ha27										**
* ²³⁹ Cf	T : other 81Mu12=39(+37-12)										**
²⁴⁰ Pa	57010#	200#			20# s	3 ⁺ #				β^- ?	
²⁴⁰ U	52715.5	2.6			14.1 h 0.1	0 ⁺	08		1953	β^- =100; α ?	
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	1948	β^- =99.88 1;IT=0.12 1
²⁴⁰ Pu	50125.3	1.1			6.561 ky 0.007	0 ⁺	08	18Be29	D	1949	α =100;SF=5.796e-6 39; 34Si<1.3e-11
²⁴⁰ Pu ^m	51434.0	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; α $\approx$ 1.9e-4 7	
²⁴⁰ Am ^m	54510	200	3000	200	940 μ s 40		08		1967	SF $\approx$ 100;IT ?	
²⁴⁰ Cm	51724.2	1.9			30.4 d 3.7	0 ⁺	08	08Qi03	T	1949	α $\approx$ 100; ϵ ?;SF=3.9e-6 8
²⁴⁰ Bk	55660#	150#			4.8 m 0.8	7 ⁻ #	08	83Ga05	D	1980	β^+ ?; α ?; β^+ SF=0.0020 13
²⁴⁰ Bk ^p	55900#	180#	240#	100#		am					
²⁴⁰ Cf	57989	18			40.3 s 0.9	0 ⁺	08	10As.A	T	1970	α =98.5 2;SF=1.5 2; β^+ ?
²⁴⁰ Es	64230#	370#			6.0 s 1.7	4 ⁻ #		17Ko02	TD	2017	α =70 1; β^+ =30 1; β^+ SF=0.16 6
* ²⁴⁰ Pu	D : also %SF=5.632(0.062)e-6 from T1/2(SF)=116.5(1.3) Gy in 13Sa65										**
* ²⁴⁰ Pu ^m	J : M1 to 4- and 6-										**
* ²⁴⁰ Cm	T : from 08Qi03; other Ensdf2009=27(1), based on 49Se01=26.8 and 67Ba42=28										**
* ²⁴⁰ Cm	T : values that are reported without uncertainties										**
* ²⁴⁰ Bk	D : % β^+ SF symmetrized from 83Ga05=0.0013(+18-7)%										**
* ²⁴⁰ Cf	D : α , %SF from 10Kh06; other α $\sim$ 9, %SF $\sim$ 2 in 95La09										**
* ²⁴⁰ Es	T : average 20Po07=4.7(+3.8-1.4) 17Ko02=6(2); other 20Kh08=8(+6-2)										**
²⁴¹ Pa	59740#	300#			28# m	1/2 ⁺ #				β^- ?	
²⁴¹ U	56200#	200#			4# m	7/2 ⁺ #	15			β^- ?	
²⁴¹ Np	54320	100			13.9 m 0.2	(5/2 ⁺)	15		1959	β^- =100; α ?	
²⁴¹ Pu	52955.1	1.1			14.329 y 0.029	5/2 ⁺ *	15		1949	β^- $\approx$ 100; α =0.00245 8; SF<2.4e-14	*
²⁴¹ Pu ^m	53116.8	1.1	161.6853	0.0009	880 ns 50	1/2 ⁺	15		1975	IT=100	
²⁴¹ Pu ⁿ	55160	200	2200	200	20.5 μ s 2.2		15		1970	SF=100	
²⁴¹ Am	52934.3	1.1			432.6 y 0.6	5/2 ⁻ *	15		1949	α =100;SF=3.6e-10 9	
²⁴¹ Am ^m	55130	200	2200	200	1.2 μ s 0.3		15	71Br39	E	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	55980#	170#			4.6 m 0.4	(7/2 ⁺)	15		2003	β^+ =?; α ?	
²⁴¹ Bk ^p	56030#	170#	51	3	> 25# μ s	(3/2 ⁻)	15			IT ?	
²⁴¹ Cf	59330#	170#			2.35 m 0.18	7/2 ⁻ #	15	20Kh10	D	1970	β^+ ?; α =15 1

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁴¹ Cf ^p	59480#	200#	150#	100#	Nm		1/2 ⁺ #	15				
²⁴¹ Es	63890#	230#				5.1 s 0.8	3/2 ⁻ #	15	20Kh08	TD 1996	$\alpha \approx 100; \beta^+ ?$	*
²⁴¹ Es ^p	64120#	250#	230#	100#			<i>am</i>					
²⁴¹ Fm	69220#	300#				730 μ s 60	5/2 ⁺ #	15	08Kh10	TD 2008	SF=?; $\alpha < 14; \beta^+ < 12$	
* ²⁴¹ Pu	D : % α from $\beta^-/\alpha=2.45(0.08)$ e-5 in 68Ah01											**
* ²⁴¹ Cf	T : from 10As.A=141(11) s; other 70Si19=3.78(0.70) m											**
* ²⁴¹ Es	T : symmetrized from 20Kh08=4.3(+2.4-1.2); other 96Ni09=8(+6-4)											**
²⁴² U	58620#	200#				16.8 m 0.5	0 ⁺	02		1979	$\beta^- = 100$	
²⁴² Np	57420	200			*	2.2 m 0.2	(1 ⁺)	02		1979	$\beta^- = 100$	
²⁴² Np ^m	57470#	210#	50#	50#	*	5.5 m 0.1	(6 ⁺)	02		1981	$\beta^- = 100$	
²⁴² Pu	54716.9	1.2				375 ky 2	0 ⁺	02	18Be29	D 1950	$\alpha=100; SF=5.510$ e-4 41	*
²⁴² Am	55468.0	1.1				16.02 h 0.02	1 ⁻ *	02		1949	$\beta^- = 82.7$ 3; $\epsilon = 17.3$ 3	
²⁴² Am ^m	55516.6	1.1	48.60	0.05		141 y 2	5 ⁻	02		1950	IT=99.55 2; $\alpha=0.45$ 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=?	
²⁴² Cm	54803.7	1.1				162.8 d 0.2	0 ⁺	02		1949	$\alpha=100; SF=6.2$ e-6 3; 34Si=1.1e-14 4 2; $\beta^+ ?$	*
²⁴² Cm ^m	57600	100	2800	100		180 ns 70		02		1971	SF ?; IT ?	
²⁴² Bk	57750#	140#				7.0 m 1.3	3 ⁺ #	02	80Ga07	D 1972	$\beta^+ \approx 100; \beta^+ SF < 3$ e-5; $\alpha ?$	
²⁴² Bk ^m	59750#	240#	2000#	200#		600 ns 100		02		1972	SF $\approx$ 100; IT ?	
²⁴² Bk ^p	57900	90	150#	100#			4 ⁻					
²⁴² Cf	59387	13				3.49 m 0.15	0 ⁺	02	70Si19	T 1967	$\alpha=61$ 3; $\beta^+=39$ 3; SF<0.014	*
²⁴² Es	64800#	260#				17.8 s 1.6	2 ⁺ #	02	10An08	TD 1994	$\alpha=57$ 3; $\beta^+=43$ 3; $\beta^+ SF=0.6$ 2	*
²⁴² Fm	68400#	400#				800 μ s 200	0 ⁺	02		1975	SF $\approx$ 100; $\alpha ?$	*
* ²⁴² Pu	D : %SF other 13Sa65=5.564(0.072)e-4 from T1/2(SF) 13Sa65=67.4(0.9) Gy											**
* ²⁴² Cm	D : % ³⁴ Si symmetrized from 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)											**
* ²⁴² Cf	T : 67Il01=3.7(0.3)											**
* ²⁴² Cf	D : % α from 11Ve03; other 81Mu12=80(20)											**
* ²⁴² Es	T : others 00Sh10=11(3) 96Ni09=16(+6-4)											**
* ²⁴² Es	D : % $\beta^+ SF$ from 00Sh10; other 10An08=1.3(+1.2-0.7)											**
* ²⁴² Fm	T : 08Kh10 excludes 4 us-1s (conflicting)											**
²⁴³ U	62480#	300#				16# m	9/2 ⁻ #				$\beta^- ?$	
²⁴³ Np	59810#	30#				1.85 m 0.15	5/2 ⁺ #	14		1979	$\beta^- = 100$	
²⁴³ Np ^p	59926	10	120#	30#	Nm		5/2 ⁻ #					
²⁴³ Pu	57754.6	2.5				4.9553 h 0.0025	7/2 ⁺	14	19Le09	T 1951	$\beta^- = 100$	*
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				7.350 ky 0.009	5/2 ⁻ *	14	20Ma.A	T 1950	$\alpha=100; SF=3.7$ e-9 9	*
²⁴³ Am ^m	59480	200	2300	200		5.5 μ s 0.5		14		1970	SF $\approx$ 100; IT ?	
²⁴³ Cm	57181.9	1.5				29.1 y 0.1	5/2 ⁺ *	14		1950	$\alpha \approx 100; \epsilon = 0.29$ 3; SF=5.3e-9 9	
²⁴³ Cm ^m	57269.3	1.5	87.4	0.1		1.08 μ s 0.03	1/2 ⁺	14		1971	IT=100	
²⁴³ Cm ^p	57285	15	103	15	AD		(7/2 ⁺)	14		1984	IT ?	
²⁴³ Bk	58690	5			*	4.6 h 0.2	3/2 ⁻	14	18Ah01	J 1950	$\beta^+ \approx 100; \alpha \approx 0.15$	
²⁴³ Bk ^p	58710	19	20	20	AD*	> 30# μ s	(7/2 ⁺)				IT $\approx$ 100; $\beta^+ ?$	
²⁴³ Cf	60990#	180#				10.8 m 0.3	(1/2 ⁺)	14	18Ko05	T 1967	$\beta^+ \approx 86$ 3; $\alpha \approx 14$ 3	*
²⁴³ Es	64750#	210#			*	22.1 s 1.4	(7/2 ⁺)	14	10An08	JTD 1973	$\alpha=61$ 6; $\beta^+ ?$; SF<1	*
²⁴³ Es ^m	64800#	220#	50#	50#	*	> 50# μ s	3/2 ⁻ #		10An08	I	IT ?; $\alpha ?$; $\beta^+ ?$	
²⁴³ Fm	69320#	130#				231 ms 9	7/2 ⁻ #	14	20Kh10	D 1981	$\alpha=91$ 3; SF=9 3; $\beta^+ ?$	*
* ²⁴³ Pu	T : average 19Le09=4.948(10) 69Ho10=4.958(5) 68Di09=4.955(3)											**
* ²⁴³ Am	T : average 20Ma.A=7342(14), 7345(14) y 07Ag02=7364(22) y, deduced from											**
* ²⁴³ Am	T : T1/2(²⁴³ Am)=7357(23) y and T1/2(²⁴¹ Am)=432.6(0.6) y,											**
* ²⁴³ Am	T : 74Po17=7380(34) y 68Br22=7336.9(57.2), 7390(50) y											**
* ²⁴³ Cf	T : average 18Ko05=10.9(0.5) 67Fi04=12.5(1.0) 67Si08=10.3(0.5)											**
* ²⁴³ Cf	D : % α , % β^+ from I(7060 α)/I(7171 α) $\approx$ 2.5 in											**
* ²⁴³ Cf	D : 67Fi04 and ($\beta^+ + \alpha$)/I(7060 α)=10(2) in 67Si08											**
* ²⁴³ Es	T : average 19Br06=24(3) 10An08=23(3) 89Ha27=21(5) 73Es02=21(2)											**
* ²⁴³ Es	J : from 10An08											**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁴³ Es	D : % α from 10An08; SF was not observed										**
* ²⁴³ Fm	D : % β^+ 20Kh10,08Kh10<10%										**
²⁴⁴ Np	63240#	100#			2.29 m 0.16	7 ⁻ #	17		1987	β^- =100	
²⁴⁴ Pu	59806.0	2.3			81.3 My0.3	0 ⁺	17		1954	α =99.877 6;SF=0.123 6; $2\beta^- < 7.3e-9$	
²⁴⁴ Pu ^m	61022.0	2.4	1216.0	0.5	1.75 s 0.12	8 ⁻	17	15Ko14 E	2016	IT=100	
²⁴⁴ Am	59879.1	1.5			10.01 h 0.03	(6 ⁻)	17	19Tr05 T	1950	β^- =100	
²⁴⁴ Am ^m	59968.4	1.4	89.3	1.6 RQ	26.13 m 0.43	1 ⁺	17	19Tr05 T	1950	β^- =99.9636 13; ϵ =0.0364 13	
²⁴⁴ Am ⁿ	61880#	200#	2000#	200#	900 μ s 150		17		1967	SF $\approx$ 100;IT ?	
²⁴⁴ Am ^p	62080#	200#	2200#	200#	$\sim$ 6.5 μ s		17		1969	SF $\approx$ 100;IT ?	
²⁴⁴ Cm	58451.8	1.1			18.11 y 0.03	0 ⁺	17		1950	α =100;SF=1.37e-4 2	
²⁴⁴ Cm ^m	59492.0	1.1	1040.181	0.011	34 ms 2	6 ⁺	17		1963	IT=100	
²⁴⁴ Cm ⁿ	59550#	900#	1100#	900#	> 500 ns		17		1969	SF $\approx$ 100;IT ?	
²⁴⁴ Bk	60714	14			5.02 h 0.03	4 ⁻	17	18Ah01 J	1972	β^+ ?; α =0.006 3	
²⁴⁴ Bk ^m	62210#	500#	1500#	500#	820 ns 60		17		1972	SF $\approx$ 100;IT ?	
²⁴⁴ Bk ^p	60850#	50#	140#	50#		<i>am</i>					
²⁴⁴ Cf	61478.1	2.6			19.5 m 0.5	0 ⁺	17	18Ko05 TD	1956	α =75 6; ϵ =25 6	*
²⁴⁴ Es	66030#	180#			37 s 4	6 ⁺ #	17	02Sh02 D	1973	β^+ =95 3; α =5 3; β^+ SF=0.011 4	*
²⁴⁴ Fm	68960#	200#			3.12 ms 0.08	0 ⁺	17	08Kh10 D	1967	SF>97; β^+ <2; α <1	
²⁴⁴ Md	75600#	370#			0.36 s 0.14	3 ⁺ #		20Kh08 IDT	2020	α $\approx$ 100; β^+ ?; β^+ SF<14	*
²⁴⁴ Md ^m	75800#	400#	200#	150#	$\sim$ 9 μ s	7 ⁺ #		20Kh08 ITD	2020	IT=?; β^+ ?	*
* ²⁴⁴ Cf	T : average 18Ko05=19.3(1.2) 67Si08=19.4(0.6) 67Fi04=20.4(1.6)										**
* ²⁴⁴ Es	D : % α symmetrized from 73Es02=4(+3-2)%; %SF from										**
* ²⁴⁴ Es	D : β^+ SF/ β^+ =1.2(0.4)e-4 in 02Sh02										**
* ²⁴⁴ Md	T : symmetrized from 20Kh08=0.30(+0.19-0.09); other 20Po07=0.4(+0.4-0.1),										**
* ²⁴⁴ Md	T : suggested in 21He.A to be associated with ²⁴⁵ Md decay										**
* ²⁴⁴ Md	I : reported in both 20Po07 and 20Kh08, but 21He.A conclude that 20Po07										**
* ²⁴⁴ Md	I : results are associated with ²⁴⁵ Md. Also, 20Po07 assigned this										**
* ²⁴⁴ Md	I : level as an isomer. The proposed ground state in 20Po07, associated										**
* ²⁴⁴ Md	I : with E(α)=8.3 MeV and T1/2 $\sim$ 6 s, is tentative and not										**
* ²⁴⁴ Md	I : trusted by Nubase. It was not confirmed in 20Kh08										**
* ²⁴⁴ Md ^m	D : possible % β^+ $\sim$ 44 in 20Kh08 is speculative										**
²⁴⁵ Np	65850#	200#			6# 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 Pu ⁿ	65180	400	2000	400	90 ns 30		11		1971	SF $\approx$ 100;IT ?	
²⁴⁵ Am	61900.4	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	61004.5	1.1			8.25 ky 0.07	7/2 ⁺ *	11	12Ch30 T	1954	α =100;SF=6.1e-7 9	
²⁴⁵ Cm ^m	61360.4	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	ϵ =99.88 10; α =0.12 1	
²⁴⁵ Bk ^p	61860#	30#	50#	30# *	> 20# μ s	(7/2 ⁺)				IT ?; ϵ ?	
²⁴⁵ Cf	63385.2	2.4			45.0 m 1.5	1/2 ⁺	11		1956	β^+ =64.7 25; α =35.3 25	
²⁴⁵ Cf ^p	63442	5	57	4	> 100# ns	(7/2 ⁺)	11	11Lo06 E	2004	IT=100	
²⁴⁵ Es	66320#	170#			1.11 m 0.06	(3/2 ⁻)	11	19Br06 TD	1967	β^+ =51 6; α =49 6	*
²⁴⁵ Es ^m	66350#	170#	30#	15# *	> 50# μ s	7/2 ⁺ #	11		1967	IT ?; β^+ ?; α ?	
²⁴⁵ Es ^p	66600	160	283#	15# IT		(7/2 ⁻)	11		2005	IT=100	*
²⁴⁵ Es ^q	66640#	190#	330#	100#		(1/2 ⁻)					
²⁴⁵ Fm	70190#	200#			4.2 s 1.3	1/2 ⁺ #	11	20Kh10 D	1967	α $\approx$ 100; β^+ <7;SF<0.3	
²⁴⁵ Md	75330#	260#			0.38 s 0.10	(7/2 ⁻)	11	20Kh08 TD	1996	α $\approx$ 100; β^+ ?	*
²⁴⁵ Md ^m	75430#	280#	100#	100# *&	0.90 ms 0.25	1/2 ⁻ #	11	20Kh08 TD	1996	SF $\approx$ 100; α ?	*
* ²⁴⁵ Es	T : average 19Br06=1.08(10) 08Ga25=0.92(+0.20-0.14) 89Ha27=1.1(0.1)										**
* ²⁴⁵ Es	T : 67Mi06=1.33(0.15)										**
* ²⁴⁵ Es	D : % α average 19Br06=54(7) 73Es01=40(10); other 67Mi06=17(4)										**
* ²⁴⁵ Es ^p	E : 253.2 keV above ²⁴⁵ Es ^m										**
* ²⁴⁵ Md	T : average 20Kh08=0.33(+0.15-0.08) 96Ni09=0.35(+0.23-0.16)										**
* ²⁴⁵ Md ^m	T : from 96Ni09; other 20Kh08=0.9(+0.6-0.3)										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{246}Pu	65395	15			10.84 d 0.02	0^+	11		1955	$\beta^- = 100$	
^{246}Am	64994#	18#			39 m 3	7^-	11		1955	$\beta^- = 100$	*
$^{246}\text{Am}^m$	65024	15	30#	10#	25.0 m 0.2	$2(-)$	11		1955	$\beta^- \approx 100$; IT ?	*
$^{246}\text{Am}^n$	66990#	800#	2000#	800#	73 μs 10		11		1972	SF ≈ 100 ; IT ?	
^{246}Cm	62616.9	1.5			4.706 ky 0.040	0^+	11		1954	$\alpha = 99.97385$ 7; SF = 0.02615 7	
$^{246}\text{Cm}^m$	63796.6	1.5	1179.66	0.13	1.12 s 0.24	8^-	11	19Sh34	ETJ 2012	IT = 100	
^{246}Bk	63970	60			1.80 d 0.02	$2(-)$	11		1954	$\beta^+ \approx 100$; α ?	
^{246}Cf	64090.2	1.5			35.7 h 0.5	0^+	11		1951	$\alpha = 100$; SF = 2.4e-4 4; ϵ ?	
^{246}Es	67820	90			7.5 m 0.5	4^- #	11		1954	$\beta^+ = 90.1$ 18; $\alpha = 9.9$ 18; β^+ SF ≈ 0.003	
$^{246}\text{Es}^p$	68010	100	190	50		2^- #		08An16	E		*
$^{246}\text{Es}^q$	68200	90	379.5	2.0				19Vo03	E		
^{246}Fm	70191	14			1.54 s 0.04	0^+	11	11Ve03	TD 1966	$\alpha = 93.2$ 6; SF = 6.8 6; $\epsilon < 1.3$	*
^{246}Md	76120#	260#			0.92 s 0.18	1^- #	11	10An08	TD 1996	$\alpha = 100$	*
$^{246}\text{Md}^m$	76170#	260#	60	60	AD*	4^- #	11	10An08	TD 2010	$\alpha = 57$ 3; $\beta^+ > 77$; β^+ SF > 10 ; $\alpha < 23$	
* ^{246}Am J : direct β^- feeding to $^{246}\text{Cm}^m$ (K=8-)											**
* $^{246}\text{Am}^m$ D : other %IT < 0.02 in Ensdf2011, based on the observation of 6+ to 4+											**
* $^{246}\text{Am}^m$ D : gamma in ^{246}Cm , is not trusted by Nubase											**
* $^{246}\text{Es}^p$ E : other 19Vo03 = 151.9(2.0) keV											**
* ^{246}Fm D : %SF others 67Nu01 = 4.5(1.3) 96Ni09 = 15(5)											**
* ^{246}Md T : average 10An08 = 0.9(0.2) 96Ni09 = 1.0(0.4)											**
^{247}Pu	69210#	200#			2.27 d 0.23	$1/2^+$ #	15		1983	$\beta^- = 100$	
^{247}Am	67150#	100#			23.0 m 1.3	$5/2^+$ #	15		1967	$\beta^- = 100$	
^{247}Cm	65533	4			15.6 My 0.5	$9/2^-$ *	15		1954	$\alpha = 100$	
$^{247}\text{Cm}^m$	65760	4	227.38	0.19	26.3 μs 0.3	$5/2^+$	15		1968	IT = 100	
$^{247}\text{Cm}^n$	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	66109	14			3.11 h 0.03	$(7/2^+)$	15		1954	$\epsilon = 99.965$ 5; $\alpha = 0.035$ 5	
^{247}Es	68578	19			4.55 m 0.26	$(7/2^+)$	15	89Ha27	J 1967	$\beta^+ \approx 93$; $\alpha \approx 7$; SF ?	
$^{247}\text{Es}^m$	68630#	50#	50#	50#	> 20# μs	$(3/2^-)$				IT ?; β^+ ?; α ?	
^{247}Fm	71670#	180#			31 s 1	$(7/2^+)$	15		1967	$\alpha \approx 64$; β^+ ?	
$^{247}\text{Fm}^m$	71720#	180#	49	8	AD	$(1/2^+)$	15		1967	$\alpha = 88$ 2; β^+ ?; IT ?	*
^{247}Md	75940#	210#			1.19 s 0.09	$7/2^-$ #	15	10An08	TJD 1981	$\alpha \approx 100$; SF < 0.1	*
$^{247}\text{Md}^m$	76200#	210#	260	40	AD	$1/2^-$ #	15	10An08	TJD 1993	$\alpha = 79$ 5; SF = 21 5	
* $^{247}\text{Fm}^m$ D : %IT from 06He27 = 12(2), but no direct gamma-ray decay was observed											**
* ^{247}Md T : average 10An08 = 1.2(0.1) 93Ho.A = 1.12(0.22)											**
^{248}Am	70560#	200#			3# m	3^+ #	14			β^- ?	
^{248}Cm	67392.7	2.4			348 ky 6	0^+	14		1956	$\alpha = 91.61$ 16; SF = 8.39 16; $2\beta^-$?	
$^{248}\text{Cm}^m$	68850.8	2.6	1458.1	1.0	146 μs 18	8^- #		19Sh34	ETJ 2012	IT = 100	
^{248}Bk	68130	50			> 9 y	6^+ #	14		1956	α ?; ϵ ?	
$^{248}\text{Bk}^m$	68108	21	-20	50	23.7 h 0.2	$1(-)$	14		1956	$\beta^- = 70$ 5; $\epsilon = 30$ 5; α ?	
$^{248}\text{Bk}^p$	68180#	70#	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 = 3.5e-4 18	*
^{248}Fm	71898	8			34.5 s 1.2	0^+	14		1958	$\alpha \approx 100$; β^+ ?; SF = 0.10 5	
$^{248}\text{Fm}^m$	73100#	100#	1200#	100#	10.1 ms 0.6	6^+ #	14		2010	IT ?; α ?; β^+ ?	
^{248}Md	76950#	180#			7 s 3		14		1973	$\beta^+ = 80$ 10; $\alpha = 20$ 10; β^+ SF < 0.05	
^{248}No	80690#	220#			< 2us	0^+	14	03Be18	I 2003	SF ?	
* ^{248}Es D : % β^+ SF from 01Sh09; other 80Ga07 = 3e-5%											**
^{249}Am	73100#	300#			3# m	$5/2^+$				β^- ?	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{249}Cm	70750.7	2.4			64.15 m 0.03	$1/2^+$	11		1956	β^- =100	
$^{249}\text{Cm}^m$	70799.5	2.4	48.76	0.04	23 μs	$7/2^+$	11		1966	α =100	
^{249}Bk	69846.3	1.2			327.2 d 0.3	$7/2^{+*}$	11	14Ch47	T 1954	$\beta^- \approx 100; \alpha=0.00145$ 8; SF=47e-9 2	
$^{249}\text{Bk}^m$	69855.1	1.2	8.777	0.014	300 μs	$3/2^-$	11	60As06	T 1960	IT=100	
^{249}Cf	69722.7	1.2			351 y 2	$9/2^-$	11		1954	$\alpha=100$;SF=5.0e-7 4	
$^{249}\text{Cf}^m$	69867.7	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	$\beta^+ \approx 100; \alpha=0.57$ 8	
^{249}Fm	73519	6			1.6 m 0.1	$7/2^+$	11	11Lo06	J 1960	$\beta^+ ?; \alpha=33$ 9	*
^{249}Md	77180	160		*	25.6 s 0.9	$(7/2^-)$	11	19Br06	TD 1973	$\alpha=75$ 5; $\beta^+ ?$	*
$^{249}\text{Md}^m$	77280#	190#	100#	100#	1.9 s 0.9	$(1/2^-)$	11	01He35	TJD 2001	$\alpha=100$	*
^{249}No	81790#	280#			57 μs 12	$5/2^{+*}$	11	03Be18	T 2003	$\beta^+ ?; \alpha ?$	*
^{249}Fm	T : from 04He28; others 66Ak01=2.6(0.7) 59Pe27=2.5(1.0)										**
^{249}Md	T : average 19Br06=26(1) 09He20=23(3) 73Es01=24(4)										**
$^{249}\text{Md}^m$	T : symmetrized from 01He35=1.5(+1.2-0.5)										**
^{249}No	T : symmetrized from 03Be18=54.0(+13.9-9.2)										**
^{250}Cm	72990	10			8300# y	0^+	01		1966	SF $\approx$ 74; $\alpha ?; \beta^- ?$	
^{250}Bk	72952.0	2.9			3.212 h 0.005	2^-	01		1954	β^- =100	
$^{250}\text{Bk}^m$	72987.6	2.9	35.59	0.10	29 μs 1	4^+	01	08Ah02	EJ 1966	IT=100	
$^{250}\text{Bk}^n$	73038	3	85.6	1.6	213 μs 8	7^+	01	08Ah02	J 1972	IT=100	*
$^{250}\text{Bk}^p$	73163.8	2.9	211.80	0.20		2^+	01	08Ah02	EJ	IT=100	
^{250}Cf	71170.3	1.5			13.08 y 0.09	0^+	01		1954	$\alpha=99.923$ 3;SF=0.077 3	
^{250}Es	73230#	100#		*	8.6 h 0.1	$6(^+)$	01		1956	$\beta^+ \approx 100; \alpha ?$	
$^{250}\text{Es}^m$	73430#	180#	200#	150#	2.22 h 0.05	$1(^-)$	01		1970	$\beta^+ \approx 100; \alpha ?$	
^{250}Fm	74072	8			31.0 m 1.1	0^+	01	18Mi11	T 1954	$\alpha \approx 100$;SF=0.0069 10; $\varepsilon ?$	*
$^{250}\text{Fm}^m$	75271	8	1199.2	1.0	1.92 s 0.05	(8^-)	01	08Gr17	ETJ 1973	IT $\approx$ 100; $\alpha ?; \beta^+ ?$;SF ?	*
^{250}Md	78400	90			54 s 4	2^- #	01	08An16	TD 1973	$\beta^+ \approx 93.0$ 8; $\alpha=7.0$ 8; β^+ SF=0.026 15	*
$^{250}\text{Md}^m$	78520	90	120	40	AD	7^+ #		19Vo03	TI 2019	$\alpha= ?; \beta^+ ?; \text{IT} ?$	
^{250}No	81570#	200#			5.08 μs 0.27	0^+	06	18Sv02	T 2003	SF $\approx$ 100; $\alpha ?; \beta^+ ?$	*
$^{250}\text{No}^m$	82620#	280#	1050#	200#	36.3 μs 2.3	(6^+)	06	20Ka02	TD 2001	SF $\approx$ 100;IT=?: $\alpha ?$	*
$^{250}\text{Bk}^n$	E : from a least-squares fit to gamma-ray data in 08Ah02										**
^{250}Fm	T : average 18Mi11=32.5(1.8) 08Ga25=28.4(+3.9-3.0) 06Ba09=30.4(1.5);										**
^{250}Fm	T : others 06Fo02=18(+13-6) 66Ak01=30(3)										**
$^{250}\text{Fm}^m$	T : others 07Gr17=1.93(0.15), superseded by 08Gr17, 73Gh03=1.8(0.1)										**
^{250}Md	T : average 19Vo03=59.5(9.1) 08An16=50(+10-7) 73Es01=52(6); other										**
^{250}Md	T : 08Ga25=25(+10-5) in conflict										**
^{250}Md	D : $\% \beta^+$ SF symmetrized from 80Ga07=0.02(+0.02-0.01); other										**
^{250}Md	D : $\% \alpha$ 06Fo02=9(+19-7)%										**
^{250}No	T : average 17Sv02, 18Sv02=5.1(0.3) 06Pe17=3.7(+1.1-0.8) 03Be18=5.6(+0.9-0.7)										**
$^{250}\text{No}^m$	T : average 20Ka02=34.4(+3.9-3.2) 18Sv02, 17Sv02=36(3) 06Pe17=43(+22-15)										**
$^{250}\text{No}^n$	T : 03Be18=46(+22-14) 01Og08=36(+11-6)										**
^{251}Cm	76648	23			16.8 m 0.2	$(3/2^+)$	13		1978	β^- =100	*
^{251}Bk	75228	11			55.6 m 1.1	$(3/2^-)$	13		1967	β^- =100	
$^{251}\text{Bk}^m$	75264	11	35.5	1.3	58 μs 4	$(7/2^+)$	13		1966	IT=100	
^{251}Cf	74135	4			898 y 44	$1/2^+$	13		1954	$\alpha \approx 100$;SF ?	
$^{251}\text{Cf}^m$	74505	4	370.47	0.03	1.3 μs 0.1	$11/2^-$	13		1971	IT=100	
^{251}Es	74512	5			33 h 1	$3/2^-$	13		1956	$\varepsilon=99.5$ 2; $\alpha=0.5$ 2	
$^{251}\text{Es}^m$	74520	5	8.4	1.0	> 200# μs	$(7/2^+)$	13			IT ?; $\varepsilon ?$	
^{251}Fm	75959	14			5.30 h 0.08	$9/2^-$	13		1957	$\beta^+ \approx 98.20$ 13; $\alpha=1.80$ 13	
$^{251}\text{Fm}^m$	76159	14	200.0	0.1	21.8 μs 0.8	$5/2^+$	13	18Re07	TJ 1970	IT=100	*
^{251}Md	78967	19			4.21 m 0.23	$(7/2^-)$	13	06Ch52	TD 1973	$\beta^+ ?; \alpha=10$ 1	*
$^{251}\text{Md}^p$	79020	18	53	8	AD	$(1/2^-)$	13		2006	$\alpha ?; \text{IT} ?$	
^{251}No	82850#	180#			20# s	$(7/2^+)$	13	06He27	J 1967	$\alpha=83$ 16; $\beta^+ ?$;SF<0.3	*
$^{251}\text{No}^m$	82960#	180#	106	6	IT	$(1/2^+)$	13		1997	$\alpha=100$	
$^{251}\text{No}^n$	83980#	180#	1128.0	1.0	> 1.7 μs	$17/2^-$ #	13	06He27	ITD 2006	IT ?	*
^{251}Lr	87830#	200#			300# μs					$\beta^+ ?; \alpha ?$	
^{251}Cm	J : direct β^- feeding to ^{251}Bk gs (J=3/2-) and 269.1-keV level										**
^{251}Cm	J : (J=5/2+); expected conf=n3/2[622]										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁵¹ Fm ^m	T : average 18Re07=23.7(1.1) 11As03=21.1(1.9) 06He20=21(3) 71Di03=15.2(2.3)										**
* ²⁵¹ Md	T : average 06Ch52=4.27(0.26) 73Es01=4.0(0.5)										**
* ²⁵¹ No	D : % α symmetrized from 01He35=91(+9-22)%										**
* ²⁵¹ No ⁿ	E : 142.4(0.5) + 203.1(0.5) + 782.5(0.6) keV gammas in a cascade to 7/2+ gs										**
* ²⁵¹ No ⁿ	J : expected conf=n ³ (1/2[631],7/2[624],9/2[734]),K=17/2-										**
²⁵² Cm	79060#	300#			1# m	0 ⁺	06			β^- ?; α ?	
²⁵² Bk	78540#	200#			1.8 m 0.5		06 92Kr.A	TD	1988	β^- ?; α ?	
²⁵² Cf	76034.6	2.4			2.645 y 0.008	0 ⁺	06 18Be29	D	1954	α =96.8972 27; SF=3.1028 27	
²⁵² Es	77290	50			471.7 d 1.9	(4 ⁺)	06 FGK12a	J	1956	α =78 2; ϵ =22 2	*
²⁵² Fm	76817	5			25.39 h 0.04	0 ⁺	06		1956	α ≈100;SF=0.0023 2;2 β^+ ?	
²⁵² Md	80470	90			2.3 m 0.8	1 ⁺ #	06		1973	β^+ ≈100; α ?	
²⁵² Md ^p	80550	80	80	120		am					
²⁵² No	82871	9			2.467 s 0.016	0 ⁺	06 11Ga19	T	1967	α =67.6 5;SF=31.3 4; β^+ =1.1 3	*
²⁵² No ^m	84125	9	1254.1	1.6	109.1 ms 2.5	(8 ⁻)	11Lo06	T	2007	IT=100	*
²⁵² Lr	88540#	190#			369 ms 75	7-#	06 08Ne01	TD	2001	α ≈98;SF≈2; β^+ ?	*
²⁵² Lr ^p	88710#	190#	170	30	AD						
* ²⁵² Es	J : strong direct ϵ feeding to 3+ level at 969.8 keV in ²⁵² Cf and the										**
* ²⁵² Es	J : expected p7/2[633]->n7/2[613] configuration change										**
* ²⁵² No	T : average 11Ga19=2.47(0.02) 06Le29=2.46(0.05) (α (t)) 2.54(0.07)										**
* ²⁵² No	T : (SF(t)) 12Su22=2.43(0.13) 01Og08=2.44(0.04); others 12Sv02=2.3(0.1)										**
* ²⁵² No	T : 04He28=2.52(0.22) 03Be18=2.38(+0.26-0.22)										**
* ²⁵² No	D : %SF average 01Og08=32.2(0.5)% 11Ga19=29.3(0.9)% 03Be18=32(3)										**
* ²⁵² No	D : 77Be09=26.9(1.9); % β^+ and % α from β^+/α =0.016(0.005) in										**
* ²⁵² No	D : in 02He01; other α /SF=3.3(0.8) in 06Le29 in conflict										**
* ²⁵² No ^m	E : from a least-squares fit to the gamma rays in 07Su19										**
* ²⁵² No ^m	T : average 11Lo06=110(8) 08Ro21=109(6) 12Su22=109(3), supersedes										**
* ²⁵² No ^m	T : 07Su19=110(10)										**
* ²⁵² Lr	T : average 08Ne01=270(+180-80) 01He35=360(+110-70)										**
* ²⁵² Lr	D : %SF 76Og02~2%										**
²⁵³ Bk	80930#	360#			60# m	3/2 ⁻ #	13 91Kr.A	I	1991	β^- ?	
²⁵³ Cf	79302	4			17.81 d 0.08	(7/2 ⁺)	13		1954	β^- =99.69 4; α =0.31 4	
²⁵³ Es	79010.5	1.2			20.47 d 0.03	7/2 ⁺ *	13 05Ah03	D	1954	α =100;SF=8.7e-6 3	*
²⁵³ Es ^m	79117	4	106	4	> 10# μ s	3/2 ⁻ #	13 93Mo18	IJ		IT ?	
²⁵³ Fm	79345.5	1.5			3.00 d 0.12	1/2 ⁺	13		1957	ϵ =88 1; α =12 1	*
²⁵³ Fm ^m	79486	6	140	6	> 100# ns	7/2 ⁺ #				IT ?	*
²⁵³ Fm ⁿ	79697	6	351	6	560 ns 60	11/2 ⁻ #	13 11An13	ETJ	2011	IT=100	*
²⁵³ Md	81170#	30#			12 m 8	(7/2 ⁻)	13 05He27	D	1992	β^+ ≈100; α ≈0.7	*
²⁵³ Md ^p	81230#	40#	60	30	1# m	1/2 ⁻ #	13		1971	α ?;IT ?	
²⁵³ No	84359	7			1.57 m 0.02	9/2 ⁻ *	13 18Ra11	J	1967	α =55 3; β^+ ?;SF ?	*
²⁵³ No ^m	84527	7	167.5	0.5	30.3 μ s 1.6	5/2 ⁺	13 09He23	T	1973	α =100	*
²⁵³ No ⁿ	85560	110	1196	107	706 μ s 24	19/2 ⁺ #	11Lo06	TJ	2011	IT=100	*
²⁵³ No ^p	85620	110	1256	113	552 μ s 15	25/2 ⁺ #	13 11Lo06	JD	2011	IT=100	*
²⁵³ Lr	88520	160			632 ms 46	(7/2 ⁻)	13 01He35	TJD	1985	α =90 10;SF=1.0 6; β^+ ?	*
²⁵³ Lr ^m	88560#	190#	30#	100#	1.32 s 0.14	(1/2 ⁻)	13 09He20	TJD	1985	α =90 10;SF=12 3; β^+ ?; IT ?	*
²⁵³ Rf	93640#	410#			13 ms 5	(7/2 ⁺)(+ #)	06 97He29	TJD	1997	SF≈100; α ?	*
²⁵³ Rf ^m	93840#	440#	200#	150#	52 μ s 14	(1/2 ⁺)(+ #)	06 97He29	TJD	1995	SF≈100; α ?	*
* ²⁵³ Es	D : %SF from α /SF=1.15(0.03)e7 in 65Me02										**
* ²⁵³ Fm	J : favored α decay to 416.6-keV level in ²⁴⁹ Cf (J=1/2+)										**
* ²⁵³ Fm ^m	E : from 130-150 keV in 11An13										**
* ²⁵³ Fm ⁿ	E : 211 keV above ²⁵³ Fm ^m										**
* ²⁵³ Md	T : symmetrized from 92Ka08=6.4(+11.6-3.6)										**
* ²⁵³ No	T : average 18Ac08=1.67(0.09) 17Mi01=1.7(0.2) 09He23=1.56(0.02)										**
* ²⁵³ No	T : 09Qi04=1.57(+0.18-0.15) 67Mi03=95(10) 67Gh01=105(20)										**
* ²⁵³ No	D : ϵ /e ⁺ =0.45(0.03) in 11An13										**
* ²⁵³ No ^m	T : average 09He23=28(3) 07Lo11=31.1(2.1) 73Be33=31.3(4.1); others										**
* ²⁵³ No ^m	T : 11An13=22.7(0.5) 10Si14=24(2) outliers										**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁵³ No ⁿ	E : greater than 1011 keV and less than 1380 keV											**
* ²⁵³ No ⁿ	T : 11Lo06=706(24); others: 07Lo11=970(210), 11An13=627(5) (r-ce-g(t))											**
* ²⁵³ No ⁿ	T : 650(15) (r-ce-802,713,209g(t))											**
* ²⁵³ No ^p	E : less than 120 keV above ²⁵³ No ⁿ in 11Lo06t											**
* ²⁵³ No ^p	T : from 11An13 using (r-ce-K x rays(t))											**
* ²⁵³ Lr	T : average 09He20=670(60) 11An13=552(15) 01He35=570(+70-60)											**
* ²⁵³ Lr	D : %SF from 17He08; other 01He35=1.3(+3.0-1.0)%											**
* ²⁵³ Lr ^m	T : 09He20 supersedes 01He35=1.49(+0.30-0.21); other 10He11=1.2(+0.7-0.4)											**
* ²⁵³ Lr ^m	D : %SF from 17He08; other 01He35=8(5)%											**
* ²⁵³ Rf	T : symmetrized from 97He29=11(+6-3)											**
* ²⁵³ Rf ^m	T : symmetrized from 97He29=48(+17-10)											**
²⁵⁴ Bk	84390#	300#				1# m			19			β^- ?
²⁵⁴ Cf	81341	11				60.5 d 0.2	0 ⁺		19	1955	SF=99.69 2; α =0.31 2;	
											$2\beta^-$?	
²⁵⁴ Es	81994.2	2.9				275.7 d 0.5	7 ⁺		19	1954	α ≈100; ϵ ?; β^- =1.74e-4 8;	*
											SF<3e-6	
²⁵⁴ Es ^m	82074.5	2.7	80.4	1.1	AD	39.3 h 0.2	2 ⁺ *		19 FGK207 E	1954	β^- =98 2;IT<3; α =0.32 1;	*
											ϵ =0.076 7;SF<0.045	
²⁵⁴ Fm	80902.5	1.8				3.240 h 0.002	0 ⁺		19	1954	α =99.9408 3;SF=0.0592 3	
²⁵⁴ Md	83450#	100#				10 m 3	0 ⁻ #		19	1970	β^+ ≈100; α ?	
²⁵⁴ Md ^m	83500#	140#	50#	100#	*	28 m 8	3 ⁻ #		19	1970	β^+ ≈100; α ?	
²⁵⁴ No	84723	10				51.2 s 0.4	0 ⁺		19	1966	α =90 1; β^+ =10 1;SF=0.17 2	*
²⁵⁴ No ^m	86019	10	1296.4	1.1		264.9 ms 1.4	(8 ⁻)		19	1973	IT=100;SF=0.020 12;	
											α <0.01	
²⁵⁴ No ⁿ	87940#	300#	3217#	300#		184 μ s 3	16 ⁺ #		19 10He10 EJT	2006	IT=100;SF≤0.012	*
²⁵⁴ Lr	89650	90				12.0 s 0.9	4 ⁺ #		19 19Vo03 T	1981	α =71.7 19; β^+ =28.3 19;	*
											SF<0.1	
²⁵⁴ Lr ^m	89750	90	107	23	AD	20.3 s 4.1	1 ⁺ #		19 19Vo03 TE	2019	α =?; β^+ ?;IT ?	
²⁵⁴ Rf	93200#	280#				22.9 μ s 1.0	0 ⁺		19 20Kh01 T	1997	SF≈100; α <1.5	*
²⁵⁴ Rf ^m	94500#	340#	1300#	200#		4.3 μ s 0.7	8 ⁻ #		19 15Da12 JTD	2015	IT≈100;SF<10	*
²⁵⁴ Rf ⁿ	95200#	570#	2000#	500#		247 μ s 73	16 ⁺ #		19 15Da12 JT	2015	IT≈100;SF<40	
* ²⁵⁴ Es	J : favored α decay to ²⁵⁰ Bk ⁿ (J=7+)											**
* ²⁵⁴ Es ^m	T : other 19De11=51.8(16.1), probably a mixture between gs and isomer decays											**
* ²⁵⁴ No	T : other (recent) 18Mi11=54(4)											**
* 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	E : 10He10=2917(3) + x keV; x=300#(300#); 10Cl01=2930(2), but their level											**
* ²⁵⁴ No ⁿ	E : scheme is disputed											**
* ²⁵⁴ Lr	T : average 19Vo03=11.9(0.9)(GSI) 01Ga20=13.4(4.2)(IMP); others (not used)											**
* ²⁵⁴ Lr	T : 08Ga25=17.8(+1.9-1.6)(LBNL) 08An16=18.4(1.8)(GSI)											**
* ²⁵⁴ Lr	T : 89Mu09=10.0(+4.5-2.4)(GSI) 85He22=13(+3-2)(GSI) 06Fo02=22(+9-6)(LBNL),											**
* ²⁵⁴ Lr	T : presumably affected by the longer-lived isomer											**
* ²⁵⁴ Lr	D : other (not used) % α =60(+11-15) % β^+ =40(+15-11) in 06Fo02											**
* ²⁵⁴ Rf	T : average 20Kh01=20(3) 15Da12=23.2(1.1) 97He29=23(3); other											**
* ²⁵⁴ Rf	T : 08Dr05=29.6(+0.7-0.6)											**
* ²⁵⁴ Rf ^m	T : average 15Da12=4.7(1.1) 20Kh01=4(1)											**
²⁵⁵ Cf	84810#	200#				85 m 18	(7/2 ⁺)		13	1981	β^- =100;SF ?; α ?	
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 Fm ^p	84031	4	231.1	0.2			9/2 ⁺		13	2013	IT=100	
²⁵⁵ Md	84842	6				27 m 2	7/2 ⁻		13	1958	β^+ =93 1; α =7 1;SF ?	*
²⁵⁵ Md ^p	84850#	70#	10#	70#	*	2# m	1/2 ⁻ #		13		α ?;IT ?	
²⁵⁵ No	86812	14				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 ⁻ #				IT ?; α ?	
²⁵⁵ No ^p	86910#	70#	100#	70#	Nm	> 100 ns	7/2 ⁺ #				IT ?	
²⁵⁵ Lr	89947	18				31.1 s 1.1	(1/2 ⁻)		13 06Ch52 TJ	1971	α =99.7 1; β^+ =0.3 1;SF ?	
²⁵⁵ Lr ^m	89988	19	41	8	AD	2.54 s 0.05	(7/2 ⁻)		13 06Ch52 J	2006	IT ?; α ≈40	
²⁵⁵ Lr ⁿ	90743	22	796	12		< 1 μ s	(15/2 ⁺)		13	2009	IT≈100	*

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
$^{255}\text{Lr}^p$	91412	22	1465	12		1.78 ms 0.05	$(25/2^+)$	13		2008	$IT \approx 100; \alpha < 0.15$	
^{255}Rf	94330#	180#				1.63 s 0.05	$(9/2^-)$	13	15An05	D 1975	$\alpha = 52.8 \text{ 22}; SF = 47.2 \text{ 22};$ $\beta^+ < 6$	
$^{255}\text{Rf}^m$	94480#	180#	150	22	AD	43 μs 9	$(5/2^+)$	15An05	ETJ	2015	$IT = 100$	
$^{255}\text{Rf}^n$	95380#	200#	1050	87		16 μs 5	$19/2^+ \#$	20Mo11	TED2020		$IT = 100$	
$^{255}\text{Rf}^p$	95630#	200#	1300	87		41 μs 10	$25/2^+ \#$	20Mo11	TED2020		$IT = 100$	
^{255}Db	99600#	280#			*	54 ms	$9/2^+ \#$	13	17He08	TD 1976	$SF \approx 67; \alpha ?$	
$^{255}\text{Db}^m$	99700#	300#	100#	100#	*	2.8 ms	$1/2^- \#$	17He08	TD	1976	$SF \approx 100; \alpha ?$	
^{255}Md	J : favored α decay to 7/2- level at 461.5 keV in ^{251}Es											**
$^{255}\text{Lr}^n$	E : 740.0 keV above 9/2+ level, which is <30 keV above $^{255}\text{Lr}^m$											**
$^{255}\text{Lr}^p$	E : 1408.6 keV above 9/2+, which is <30 keV above $^{255}\text{Lr}^m$											**
$^{255}\text{Lr}^p$	T : average 09Je02=1.70(0.03) 08An16=1.81(0.02) (Birge ratio=3.05); other											**
$^{255}\text{Lr}^p$	T : 08Ha31=1.4(0.1)											**
^{255}Rf	T : average 20Mo11=1.60(0.07) 06He27=1.68(0.09) 01He35=1.64(0.11);											**
^{255}Rf	T : other 20Kh01=1.9(0.2)											**
^{255}Rf	D : %SF average 20Mo11=51(7) 19Kh01=53(8) 15An05=45(3) 97He29=45(6)											**
^{255}Rf	D : 97He29=52(6); % β^+ from 15An05											**
^{255}Rf	J : favored α decay to the (9/2-) level at 203.6 keV in ^{251}No											**
$^{255}\text{Rf}^m$	T : other 20Kh01>30 us											**
$^{255}\text{Rf}^n$	T : symmetrized from 20Mo11=15(+6-4)											**
$^{255}\text{Rf}^n$	E : 900-1200 keV above the gs in 20Mo11											**
$^{255}\text{Rf}^p$	T : symmetrized from 20Mo11=38(+12-7)											**
$^{255}\text{Rf}^p$	E : 1150-1450 keV above the gs in 20Mo11											**
^{255}Db	T : other 83OgZW=1.6(+0.6-0.4)											**
^{256}Cf	87040#	310#				12.3 m 1.2	0^+	17		1980	$SF = 100; \alpha ?; 2\beta^- ?$	
^{256}Es	87190#	100#			* &	7.6 h	$7^+ \#$	17		1976	$\beta^- \approx 100; \beta^- SF = 0.002$	
$^{256}\text{Es}^m$	87190#	140#	0#	100#	* &	25.4 m 1.2	$0^+ \#$	17	81Lo15	T 1981	$\beta^- = 100$	
^{256}Fm	85485	3				157.1 m 1.3	0^+	17		1955	$SF = 91.9 \text{ 3}; \alpha = 8.1 \text{ 3}$	
^{256}Md	87460#	120#			*	77.7 m 1.8	(1^-)	17		1955	$\beta^+ = 90.8 \text{ 7}; \alpha = 9.2 \text{ 7}; SF < 3$	
$^{256}\text{Md}^m$	87620	70	160#	100#	*	100# m	$7^- \#$				$\beta^+ ?; \alpha ?; SF ?$	
$^{256}\text{Md}^p$	87700#	120#	240#	140#			<i>am</i>					
^{256}No	87823	8				2.91 s 0.05	0^+	17		1963	$\alpha = 99.45 \text{ 5}; SF = 0.55 \text{ 5}; \epsilon ?$	
^{256}Lr	91750	80				27.9 s 1.0	$(0^-, 3^-) \#$	17		1965	$\alpha = 85 \text{ 10}; \beta^+ = 15 \text{ 10}; SF < 0.03$	
$^{256}\text{Lr}^p$	91980#	90#	230#	40#				17				
^{256}Rf	94222	18				6.60 ms 0.05	0^+	17	20Mo11	T 1975	$SF = 99.69 \text{ 10}; \alpha = 0.31 \text{ 10}$	
$^{256}\text{Rf}^m$	95340#	100#	1120#	100#		25 μs 2	$4^- \#$	17	15Ko14	J 2009	$IT = 100; SF ?$	
$^{256}\text{Rf}^n$	95620#	100#	1400#	100#		17 μs 2	$8^- \#$	17		2009	$IT = 100; SF ?$	
$^{256}\text{Rf}^p$	96620#	200#	2400#	200#		27 μs 5		17		2009	$IT = 100; SF ?$	
^{256}Db	100300#	190#				1.7 s 0.4	$9^- \#$	17	01He35	TD 2001	$\alpha = 70 \text{ 11}; \beta^+ = 30 \text{ 11}; SF ?$	
$^{256}\text{Es}^m$	T : 81Lo15=25.4(2.4), but the uncertainty is 2 standard deviations											**
^{256}No	D : %SF symmetrized from 90Ho03=0.53(+6-3)											**
^{256}Rf	T : average 20Mo11=6.75(0.49) 20Ku23=6.90(0.23) 18Sv02=5.75(0.17)											**
^{256}Rf	T : 13Ri07, 12Gr12=6.9(0.2) 11Ro20=6.9(0.4) 10St14=5.1(1.0-0.7)											**
^{256}Rf	T : 09Je01=6.67(0.09) 08Dr05=6.70(0.09) 97He29=6.2(0.2) 84Og02=6.7(0.2)											**
^{256}Rf	D : % α average 20Ku23=0.29(+0.13-0.10) 97He29=0.32(0.017); other											**
^{256}Rf	D : %SF 10St14=97(+2-6)%											**
$^{256}\text{Rf}^p$	T : other 20Mo10=18(7)											**
^{256}Db	T : symmetrized from 01He35=1.6(+0.5-0.3); other 83Og.A=2.6(+1.4-0.8)											**
^{257}Es	89400#	410#				7.7 d 0.2	$7/2^+ \#$	13		1987	$\beta^- = 100; \alpha ?$	
^{257}Fm	88590	4				100.5 d 0.2	$9/2^+$	13	13As02	J 1964	$\alpha = 99.790 \text{ 4}; SF = 0.210 \text{ 4}$	
^{257}Md	88992.5	1.6				5.52 h 0.05	$(7/2^-)$	13		1965	$\epsilon = 85 \text{ 3}; \alpha = 15 \text{ 3}; SF ?$	
^{257}No	90247	6				24.5 s 0.5	$(3/2^+)$	13	02Ho11	D 1967	$\alpha = 85 \text{ 8}; \beta^+ = 15 \text{ 8}; SF ?$	
$^{257}\text{No}^p$	90550#	120#	300#	120#			$9/2^+ \#$					
^{257}Lr	92670#	40#			*	6.0 s 0.4	$7/2^- \#$	13	16He08	J 1971	$\alpha \approx 100; \beta^+ ?; SF ?$	
$^{257}\text{Lr}^m$	92770#	60#	100#	50#	*	0.27 s 0.12	$1/2^- \#$		16He08	TI 2018	$\alpha ?; IT ?$	
$^{257}\text{Lr}^p$	92820#	110#	150#	100#			<i>am</i>	13				
^{257}Rf	95866	11				5.0 s 0.2	$(1/2^+)$	13	13Ri07	T 1969	$\alpha = 89.3 \text{ 14}; \beta^+ = 9.4 \text{ 14};$ $SF = 1.3 \text{ 3}$	
$^{257}\text{Rf}^m$	95940	10	73	11	AD	4.5 s 0.2	$11/2^- \#$	13	10St14	TJ 1997	$\alpha = 88.5 \text{ 15}; \beta^+ = 11.5 \text{ 15};$	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)		
											SF ?		
²⁵⁷ Rf ⁿ	97022	10	1155	11	AD	106 μs 6	21/2 ⁺ #	13	13Ri07	TJ	2009	IT=100	*
²⁵⁷ Db	100150	160			*	2.3 s 0.2	9/2 ⁺ #	13	09He20	T	1985	α>94;SF<6;β ⁺ ?	*
²⁵⁷ Db ^m	100290#	200#	140#	110#	*	670 ms 60	(1/2 ⁻)	13	09He20	T	1985	α>87;SF<13;β ⁺ ?	*
* ²⁵⁷ Lr	T : average 10St14=6.3(+0.9-0.7) and 5.8(0.5); others (not used)											**	
* ²⁵⁷ Lr	T : 97He29=3.3(+0.5-0.4), 4.3(+1.3-0.8) 76Be.A=0.646(0.025)											**	
* ²⁵⁷ Lr	T : 71Es01=0.6(0.1)											**	
* ²⁵⁷ Lr ^m	J : direct β ⁺ decay feeding from ²⁵⁷ Rf (J=1/2+)											**	
* ²⁵⁷ Lr ^m	T : symmetrized from 16He08=0.203(+0.164-0.063)											**	
* ²⁵⁷ Rf	J : favorite α decay to the (1/2+) level at 670 keV in ²⁵³ No											**	
* ²⁵⁷ Rf	T : average 13Ri07=6.1(0.5) 10St14=5.5(0.4) 10Be16=4.8(0.2) 09Qi04=4.7(0.3);											**	
* ²⁵⁷ Rf	T : others 85So03=3.8(0.8) 74Be.A=4.8(0.3) 71Gh03=4.8(0.5)											**	
* ²⁵⁷ Rf	D : %β ⁺ from 16He08, stated that 10St14=19.4(1.4) is a misprint; other											**	
* ²⁵⁷ Rf	D : 09Qi04=2(1)%											**	
* ²⁵⁷ Rf ⁿ	E : other 97He29=118(4) keV from direct comparison of two alpha lines											**	
* ²⁵⁷ Rf ⁿ	T : average 13Ri07=4.7(0.4) 10St14=4.9(0.7) 10Be16=4.6(0.3) 97He29=3.9(0.4)											**	
* ²⁵⁷ Rf ⁿ	T : 08Dr05=4.1(+0.7-0.6) 09Qi04=4.1(+2.4-1.3)											**	
* ²⁵⁷ Rf ⁿ	D : %β ⁺ from 16He08											**	
* ²⁵⁷ Rf ⁿ	E : 1082(2) keV above ²⁵⁷ Rf ⁿ in 10Be16											**	
* ²⁵⁷ Rf ⁿ	T : others 10Be16=134.9 (7.7), reanalyzed in 13Ri07 to 10Be16=110(5)											**	
* ²⁵⁷ Rf ⁿ	T : 20Mo10=105(19) 09Je01=109(13) (same group as 13Ri07)											**	
* ²⁵⁷ Rf ⁿ	T : 09Qi04=160(+42-31)											**	
* ²⁵⁷ Db	T : from 09He20, supersedes 01He35=1.50(+0.19-0.15); 10He11=1.5(+0.9-0.4)											**	
* ²⁵⁷ Db ^m	T : from 09He20, supersedes 01He35=760(+150-110); 10He11=360(+220-90)											**	
* ²⁵⁷ Db ^m	J : favorite α decay to ²⁵³ Lr ^m [J=(1/2-)]											**	
²⁵⁸ Es	92700#	400#				4# m						β ⁻ ?;α ?	
²⁵⁸ Fm	90430#	200#				370 μs 14	0 ⁺	17	86Hu05	T	1971	SF≈100;α ?	
²⁵⁸ Md	91690	3			*	51.59 d 0.29	8 ⁻ #	17	93Mo18	D	1970	α≈100;β ⁺ <0.0015; β ⁻ <0.0015	*
²⁵⁸ Md ^m	91690#	200#	0#	200#	*	57.0 m 0.9	1 ⁻ #	17	93Mo18	D	1980	ε=85 15;SF<15;β ⁻ ?; α<1.2	*
²⁵⁸ No	91480#	100#				1.23 ms 0.12	0 ⁺	17	18Br13	T	1989	SF≈100;α ?	*
²⁵⁸ Lr	94780#	100#				3.92 s 0.33		17	14Ha04	TD	1971	α=97.4 18;β ⁺ =2.6 18	
²⁵⁸ Lr ^p	95020#	140#	240#	100#			am						
²⁵⁸ Rf	96344	16				12.5 ms 0.5	0 ⁺	17	20Mo11	T	1969	SF=95.1 16;α=4.9 16	*
²⁵⁸ Rf ^m	97540#	300#	1200#	300#		3.4 ms 1.7		17	16He15	ITD	2016	IT= ?;α ?;β ⁺ ?	*
²⁵⁸ Rf ⁿ	97840#	500#	1500#	500#		15 μs 10		17	16He15	ITD	2016	IT ?; SF ?	
²⁵⁸ Db	101510	90			&	2.17 s 0.36	0 ⁻ #	17	19Vo03	TJ	1985	α=64 10;β ⁺ =36 10	*
²⁵⁸ Db ^m	101560	90	53	14	AD &	4.41 s 0.21	5 ⁺ #	17	19Vo03	TEJ	1981	α=77 8;β ⁺ =23 8;SF ?	*
²⁵⁸ Sg	105300#	410#				2.7 ms 0.5	0 ⁺	17	17He08	TD	1997	SF≈100;α ?	*
* 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<15 derived from 93Mo18 “the sum of SF and β ⁻ decay branches < 30%”											**	
* ²⁵⁸ No	T : average 18Br13=1.24(+0.16-0.14) 89Hu09=1.2(0.2)											**	
* ²⁵⁸ Rf	T : average 20Mo11=8.79(1.12) 19He17=14.2(+1.2-0.4) 16He15=10.0(1.1)											**	
* ²⁵⁸ Rf	T : 08Ga08=14.7(+1.2-1.0) 85So03=13(3) 69Gh01=11(2); other											**	
* ²⁵⁸ Rf	T : 20Ku23=12(+16-10)											**	
* ²⁵⁸ Rf ^m	T : symmetrized from 16He15=2.4(+2.4/-0.8)											**	
* ²⁵⁸ Db	T : others 16He15=3.6(0.3), 2.8(0.6) 09He20=1.9(0.5)											**	
* ²⁵⁸ Db	D : from 09He20											**	
* ²⁵⁸ Db ^m	T : others 16He15=4.4(1.0) 09He20=4.3(0.5) 06Fo02=4.8(+1.0-0.8)											**	
* ²⁵⁸ Db ^m	T : 01Ga20=4.3(1.1) 85He22=4.4(+0.9-0.6)											**	
* ²⁵⁸ Db ^m	D : from 09He20; others %β ⁺ 06Fo02=39(+11-9) 85He22=33(+9-5)											**	
* ²⁵⁸ Sg	T : symmetrized from 17He08=2.6(+0.6-0.4), determined by combining data											**	
* ²⁵⁸ Sg	T : from 09Fo02, 02Pa.A and 97He29											**	
²⁵⁹ Fm	93700#	280#				1.5 s 0.2		13			1980	SF=100	
²⁵⁹ Md	93560#	100#				1.60 h 0.06	7/2 ⁻ #	13			1982	SF≈100;α ?	
²⁵⁹ No	94079	6				58 m 5	9/2 ⁺	13	13As02	J	1973	α=75 4;ε=25 4;SF<10	
²⁵⁹ No ^p	94310#	150#	230#	150#									

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁵⁹ Lr	95850#	70#				6.2 s 0.3	1/2 ⁻ #	13		1971	$\alpha=78\ 2; \text{SF}=22\ 2; \beta^+ ?$	
²⁵⁹ Lr ^p	96200#	170#	350#	150#								
²⁵⁹ Rf	98370#	70#				2.63 s 0.26	3/2 ⁺ #	13	08Ga08	T 1969	$\alpha=85\ 4; \beta^+=15\ 4; \text{SF}<3$	
²⁵⁹ Rf ^p	98430#	100#	60	70	Nm		(7/2 ⁺)					*
²⁵⁹ Rf ^q	98570#	110#	210	90	Nm		(9/2 ⁺)					
²⁵⁹ Db	101990	60				510 ms 160	9/2 ⁺ #	13	01Ga20	D 2001	$\alpha=100$	
²⁵⁹ Sg	106520#	180#				402 ms 56	(11/2 ⁻)	13	15An05	TJD 1985	$\alpha \approx 100; \text{SF} ?; \beta^+ ?$	
²⁵⁹ Sg ^m	106610#	180#	87	22	AD	226 ms 27	(1/2 ⁺)		15An05	TJD 2015	$\alpha \approx 97\ 1; \text{SF} \approx 3\ 1; \beta^+ ?$	
* ²⁵⁹ Rf	T : average 08Ga08=2.5(+0.4-0.3) 94Gr08=1.7(+0.8-0.5);											**
* ²⁵⁹ Rf	T : others 06Gr24=1.9(+1.3-0.5) 04Fo08=2.2(+1.7-0.8) 03Gi05=4.0(+7.3-1.6)											**
* ²⁵⁹ Rf	T : 98Ho13=2.6(+1.4-0.7) 85So03=3.4(1.7) 81Be03=3.0(1.3)											**
* ²⁵⁹ Rf	T : 73Dr10=3.2(0.8) 69Gh01=3.2(0.8); 10Ni14(1 event)=107 ms											**
* ²⁵⁹ Rf	I : 08Ga08 suggest existence of an isomer formed only in direct production											**
* ²⁵⁹ Rf	D : % β^+ 08Ga08=15(4)% to ²⁵⁹ Lr followed by SF; %SF 17He08<3%											**
²⁶⁰ Fm	95770#	440#			EU	1# m	0 ⁺				SF ?	*
²⁶⁰ Md	96550#	320#				27.8 d 0.8		99	92Lo.B	TD 1989	$\text{SF} \approx 100; \alpha < 5; \epsilon < 5; \beta^- < 3.5$	
²⁶⁰ No	95610#	200#				106 ms 8	0 ⁺	99		1985	SF=100	
²⁶⁰ Lr	98280#	130#				3.0 m 0.5		99		1971	$\alpha=80\ 20; \beta^+=20\ 20$	
²⁶⁰ Rf	99150#	200#				21 ms 1	0 ⁺	99	85So03	T 1985	$\text{SF} \approx 100; \alpha ?; \beta^+ ?$	
²⁶⁰ Db	103670#	90#				1.52 s 0.13		99	77Be36	TD 1970	$\alpha=90.4\ 6; \text{SF}=9.6\ 6; \beta^+ ?$	
²⁶⁰ Db ^p	103770#	180#	100#	150#								*
²⁶⁰ Sg	106547	21				4.95 ms 0.33	0 ⁺	99	09He20	TD 1984	SF=71 3; $\alpha=29\ 3$	
²⁶⁰ Bh	113120#	200#				41 ms 14		16	08Ne01	TD 2008	$\alpha \approx 100; \beta^+ ?; \text{SF} ?$	
* ²⁶⁰ Fm	I : T1/2~4 ms and %SF=100 mode were reported in the 92Lo.B, but the											**
* ²⁶⁰ Fm	I : results were not confirmed in the subsequent experiment by same											**
* ²⁶⁰ Fm	I : group (97Lo.A)											**
* ²⁶⁰ Md	T : from 92Lo.B supersedes 86Hu01=31.8(0.5), same group											**
* ²⁶⁰ No	T : other 19De11=155(+212-57)											**
* ²⁶⁰ Rf	T : others 08Ga08=22.2(+3.0-2.4) 08Go.A=21(+7.3,-4.3) 13Mu08=12(11)											**
* ²⁶⁰ Db	T : others 04Mo26=1.5(+0.8-0.4) 04Ga29=0.89(+0.79-0.35) 70Gh02=1.6(0.3)											**
* ²⁶⁰ Db	T : 71Dr01=1.4(+0.6)0.3)											**
* ²⁶⁰ Sg	T : supersedes 85Mu11=3.6(+0.9-0.6)											**
* ²⁶⁰ Sg	D : other 85Mu11 %SF=50(+30-20)% and % α =50(+20-30)%											**
* ²⁶⁰ Bh	T : symmetrized from 08Ne01=35(+19-9)											**
²⁶¹ Md	98580#	510#				40# m	7/2 ⁻ #				$\alpha ?$	
²⁶¹ No	98460#	200#				3# h					$\alpha ?$	
²⁶¹ Lr	99560#	200#				39 m 12	1/2 ⁻ #	99		1987	SF $\approx$ 100; $\alpha ?$	
²⁶¹ Rf	101320	70			*&	2.1 s 0.2	3/2 ⁺ #	15	11Ha13	TD 1970	SF=82 4; $\alpha=18\ 4$	
²⁶¹ Rf ^m	101390#	120#	70#	100#	*&	74 s 5	11/2 ⁻ #	15	13Mu08	T 1970	$\alpha \approx 100; \beta^+ ?; \text{SF} ?$	
²⁶¹ Rf ^p	101550#	120#	230#	100#								*
²⁶¹ Db	104310#	110#				4.7 s 1.0	9/2 ⁺ #	99	13Su04	TD 1970	SF=73 11; $\alpha=27\ 11$	
²⁶¹ Db ^p	104590#	230#	280#	200#								*
²⁶¹ Sg	108005	18				183 ms 5	(3/2 ⁺)	99	10St14	TJD 1984	$\alpha=98.1\ 4; \beta^+=1.3\ 3; \text{SF}=0.6\ 2$	
²⁶¹ Sg ^m	108110#	50#	100#	50#		9.3 μ s 1.8	7/2 ⁺ #	99	10Be16	T 2010	IT=100	
²⁶¹ Bh	113080	180				12.8 ms 3.2	(5/2 ⁻)	99	10He11	TJD 1989	$\alpha \approx 100; \text{SF} ?$	
* ²⁶¹ Rf	T : average 12Ha05=2.6(+0.7-0.5) 11Ha13=1.9(0.4) ($\alpha(t)$) and											**
* ²⁶¹ Rf	T : 1.8(0.4) (SF(t)) 08Go.A=2.2(+0.9-0.5) 08Dv02=3(1) 96La11=2.1(0.2);											**
* ²⁶¹ Rf	T : others 02Ho11=4.2(+3.4-1.3), 13Mu08=3.9(3.0) 15Mo25=4.7(+3.6-1.4)											**
* ²⁶¹ Rf	T : 08Mo09=2 events at 2.97 and 8.3s 94La22=1.2(+1.0-0.5) originally											**
* ²⁶¹ Rf	T : attributed to ²⁶² Rf, but re-assigned in 08Go.A and 11Ha13 to											**
* ²⁶¹ Rf	T : ²⁶¹ Rf											**
* ²⁶¹ Rf	D : %SF average 11Ha13=73(6) 12Ha05=82(9) 13Mu08=88(5); other 08Dv02=91											**
* ²⁶¹ Rf ^m	T : average 02Ho11=78(+11-6) 00Sy01=74(+7-6) 71Gh01=65(10); others											**
* ²⁶¹ Rf ^m	T : 13Mu08=19(+5-3) 12Ha05=59(42) 08Dv02=20(+110-10) 08Ga08=71(+342-33)											**
* ²⁶¹ Db	T : average 13Su04=4.7(+3.6-1.4) 10St14=4.1(+1.4-0.8); others											**
* ²⁶¹ Db	T : 04Ga29=1.70(+0.79-0.49) 71Fl02=1.8(0.6) 71Gh01=1.8(0.6)											**
* ²⁶¹ Db	D : from 13Su04 where 11 SF and 4 α events were observed;											**
* ²⁶¹ Db	D : uncertainty estimated by Nubase											**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)
* ²⁶¹ Sg	T : average 10St14=184(5), supersedes 09He20=195(15), 10Be16=178(14)							**
* ²⁶¹ Sg ^m	T : symmetrized from 10Be16=9.0(+2.0-1.5)							**
* ²⁶¹ Bh	T : symmetrized from 10He11=11.8(+3.9-2.4); others 06Fo02=10(+14-5)							**
* ²⁶¹ Bh	T : 08Ne08=6.7(+3.8-1.8) 89Mu09=11.8(+5.3-2.8), superseded by 10He11							**
* ²⁶¹ Bh	D : no SF decays were observed in 10He11 (%SF<5)							**
²⁶² Md	101670#	450#	3# m					SF ?; α ?
²⁶² No	100100#	360#	~ 5 ms	0 ⁺	01		1988	SF=100; α ?
²⁶² Lr	102110#	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#	47 ms 5	(8 ⁻ , 9 ⁻)#		85So03	TD 1978	SF=100
²⁶² Db	106250#	140#	34 s 4		01	14Ha04	TD 1971	SF=52 4; α =48 4; β^+ ?
²⁶² Db ^p	106300#	160#						α ?
²⁶² Sg	108369	22	10.3 ms 1.7	0 ⁺	01	17He08	D 2001	SF=94 6; α ?
²⁶² Sg ^p	109230	110	860	9 ⁻ #				
²⁶² Bh	114250	90	84 ms 11		01	09He20	T 1981	α ≈100; SF<20
²⁶² Bh ^m	114470	110	9.5 ms 1.6		01	06Fo02	T 1981	α ≈100; SF ?
* ²⁶² Rf	T : symmetrized from 08Go.A=210(+128-58), 7 SF events; others 85So03=1.3(1)							**
* ²⁶² Rf	T : 96La11=2.1(0.2) 94La22=1.2(+1.0-0.5) 98Tu01=2.5(+2.4-1.6). 11Ha13 and							**
* ²⁶² Rf	T : 08Go.A suggested that the long-lived activities belong to ²⁶¹ Rf							**
* ²⁶² Rf ^m	I : assigned as a K isomer in 96La11							**
* ²⁶² Db	T : symmetrized from 14Ha04=33.8(+4.4-3.5); other 15Mo25=39(+53-14)							**
* ²⁶² Sg	T : average 06Gr24=15(+5-3) 17He08=8.5(+2.3-1.5), determined by merging							**
* ²⁶² Sg	T : data from 01Ho06 and 12Ac04							**
* ²⁶² Sg ^p	J : favored α decay from ²⁶⁶ Hs ^m (J=9-#)							**
* ²⁶² Bh	T : average 09He20=83(14), supersedes 89Mu09=102(26) 06Fo02=84(+21-16);							**
* ²⁶² Bh	T : other 08Ne08=120(+55-29)							**
* ²⁶² Bh ^m	T : average 06Fo02=9.6(+3.6-2.4) 97Ho14(11 events)=12.2(+5.5-2.8)							**
* ²⁶² Bh ^m	T : 89Mu09=8.0(2.1); others 09He20=22(4) 08Ne08(4 events)=16(+14-5)							**
²⁶³ No	103130#	490#	20# m					α ?; SF ?
²⁶³ Lr	103670#	220#	5# h	1/2 ⁻ #				α ?
²⁶³ Rf	104760#	150#	11 m 3		99	03Kr20	TD 2003	SF≈100; α ?
²⁶³ Rf ^p	105060#	250#	300#					
²⁶³ Db	107110#	170#	29 s 9	9/2 ⁺ #	99	92Kr01	DT 1992	SF=56 14; α =37 14; β^+ =6.9 16
²⁶³ Db ^p	107370#	260#	260#					
²⁶³ Sg	110200#	100#		3/2 ⁺ #	99	06Gr24	TD 1974	α =87 8; SF=13 8
²⁶³ Sg ^m	110250#	100#	51	7/2 ⁺ #	99	04Fo08	T 1995	α ≈100; SF ?; IT ?
²⁶³ Sg ^p	110290#	100#	100					
²⁶³ Bh	114500#	310#	200# ms	5/2 ⁻ #	99			α ?
²⁶³ Hs	119680#	200#	0.9 ms 0.4	3/2 ⁺ #	99	09Dr02	TD 2009	α ≈100; SF ?
²⁶³ Hs ^m	120000#	200#	330	11/2 ⁻ #				α ≈100; 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 : other 08Dv02=8(+40-4) s using one SF event							**
* ²⁶³ Db	D : %SF symmetrized from 92Kr01=57(+13-15)%; % β^+ average 03Kr20=3(+4-1)%							**
* ²⁶³ Db	D : 93Gr.C=8(2)%							**
* ²⁶³ Db	T : symmetrized from 92Kr01=27(+10-7); other 98Ik02=54(+98-21) from SF(t)							**
* ²⁶³ Sg	T : average 06Gr24=820(+370-190) 94Gr08=553(+336-152) 74Gh04=900(200), all							**
* ²⁶³ Sg	T : produced in direct reaction population							**
* ²⁶³ Sg ^m	T : average 04Fo08=290(+170-90) 04Mo40=549(+300-143) 03Gi05=222(+404-87)							**
* ²⁶³ Sg ^m	T : 98Ho13=310(+160-80), all produced via α decay of ²⁶⁷ Hs;							**
* ²⁶³ Sg ^m	T : other 10Ni14= τ =702 ms via α decay of ²⁶⁷ Hs							**
* ²⁶³ Hs	T : symmetrized from 09Dr02=0.74(+0.48-0.21) 6 events observed							**
* ²⁶³ Hs	D : no SF observed in 09Dr02 (%SF<8.4)							**
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	109260#	240#	3# m					α ?

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁶⁴ Sg	110780#	280#			78 ms 25	0 ⁺		06 17He08	TD 2006	SF>80; α ?	*
²⁶⁴ Bh	115960#	180#			1.07 s 0.21			99 04Mo26	TD 1995	$\alpha \approx 86$; SF ≈ 14 ; β^+ ?	*
²⁶⁴ Bh ^p	116290#	230#	330#	150#		<i>am</i>					
²⁶⁴ Hs	119563	29			0.7 s 0.3	0 ⁺		99 17He08	TD 1986	$\alpha=70$ 30; SF=30 30	*
* ²⁶⁴ Sg	T : symmetrized from 17He08=68(+32-16), determined by merging data from										**
* ²⁶⁴ Sg	T : 10Ni14, 06Ni10 and 06Gr24										**
* ²⁶⁴ Sg	D : no α observed in 17He08 ($\% \alpha < 36$)										**
* ²⁶⁴ Bh	T : average 04Mo26=0.9(+0.3-0.2) 04Ga29=1.17(+0.88-0.44)										**
* ²⁶⁴ Bh	T : 02Ho11=1.02(+0.69-0.29)										**
* ²⁶⁴ Hs	T : symmetrized from 17He08=0.63(+0.34-0.16), determined by merging data										**
* ²⁶⁴ Hs	T : from 87Mu15 and 11Sa41										**
* ²⁶⁴ Hs	D : %SF symmetrized from 17He08=20(+40-20), determined by merging data										**
* ²⁶⁴ Hs	D : from 87Mu15 and 11Sa41										**
²⁶⁵ Lr	108230#	550#			10# h	1/2 ⁻ #				α ?; SF ?	
²⁶⁵ Rf	108690#	360#			1.6 m 0.6	9/2 ⁺ #	15 16Ho09	TD 2010		SF ≈ 100 ; α ?	*
²⁶⁵ Db	110380#	220#			15# m	9/2 ⁺ #				α ?	
²⁶⁵ Sg	112790#	140#		*	9.2 s 1.6	11/2 ⁻ #	15 12Ha05	TD 1994		$\alpha > 50$; SF ?	*
²⁶⁵ Sg ^m	112790#	130#	-10#	160#	16.4 s 2.4		15 12Ha05	TD 1994		$\alpha > 50$; SF ?	*
²⁶⁵ Bh	116400#	240#			1.19 s 0.52	5/2 ⁻ #	99 04Ga29	TD 2004		α = ?	*
²⁶⁵ Hs	120900	24			1.96 ms 0.16	3/2 ⁺ #	99 09He20	T 1984		$\alpha \approx 100$; SF ?	*
²⁶⁵ Hs ^m	121130	24	229	22	360 μ s 150	11/2 ⁻ #	99 09He20	T 1995		$\alpha \approx 100$; IT ?	*
²⁶⁵ Mt	126620#	440#			2# ms					α ?	
* ²⁶⁵ Rf	T : average 17Og01, 15Uf02=1.0(+1.2-0.3) 16Ho09=61(+84-22)s; other										**
* ²⁶⁵ Rf	T : 10El06=105(+503-48) s, one SF at 152 s										**
* 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 Sg ^m	T : others 08Dv02=15(+7-4) 06Dv01=14.9(+9.1-4.1) 98Tu01=7.4(+3.3-2.7)										**
* ²⁶⁵ Sg ^m	T : 08Mo09 2 events at 23 and 80 s										**
* ²⁶⁵ Bh	T : symmetrized from 04Ga29=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 09He20=300(+200-100); other 99He11=750(+170-120)										**
²⁶⁶ Lr	111660#	540#			22 h 14		19 19Kh04	TD 2014		SF=100	*
²⁶⁶ Rf	110140#	410#			4# h	0 ⁺				α ?; SF ?	
²⁶⁶ Db	112740#	280#			80 m 70		19 17Og01	T 2007		α ?; SF=?; β^+ ?	*
²⁶⁶ Sg	113620#	250#			390 ms 110	0 ⁺	19 17He08	D 2006		SF>90	*
²⁶⁶ Bh	118100#	160#			10.6 s 2.2		19 20Ha27	T 2000		$\alpha \approx 100$; β^+ ?; SF ?	*
²⁶⁶ Hs	121140	27			3.0 ms 0.6	0 ⁺	19 12Ac04	TD 2001		$\alpha=76$ 9; SF=24 9	*
²⁶⁶ Hs ^m	122240	90	1100	90	280 ms 220	9 ⁻ #	12Ac04	T 2011		$\alpha \approx 100$	*
²⁶⁶ Mt	127670	100			2.0 ms 0.5		19 09Ne02	T 1982		$\alpha \approx 100$; SF ?	*
²⁶⁶ Mt ^m	128810	120	1140	90	6 ms 3		97Ho14	TD 1984		$\alpha=100$	*
* ²⁶⁶ Lr	T : symmetrized from 19Kh04, 14Kh04=11(+21-5)										**
* ²⁶⁶ Db	T : symmetrized from 17Og01, 07Og02=22(+105-10), one event at 31.74 m										**
* ²⁶⁶ Sg	T : average 13Og03=280(+190-80) 08Dv02=360(+250-100), supersedes										**
* ²⁶⁶ Sg	T : 06Dv01=444(+444-148); others 98Tu01=21(+20-12) s 94La22=10-30 s										**
* ²⁶⁶ Bh	T : symmetrized from 20Ha27=10.0(+2.6-1.7); others: 15Mo25=2.2(+2.9-0.8)										**
* ²⁶⁶ Bh	T : 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 12Ac04=74(+354-34); the possibility in 01Ho06 that										**
* ²⁶⁶ Hs ^m	T : 01Ho06=6.3(+8.6-2.3) is ruled out by the 12Ac04 data										**
* ²⁶⁶ Hs ^m	J : from 15Ko14, expected conf=n ² (7/2[613], 11/2[735])										**
* ²⁶⁶ Mt	T : average 09Ne02=3.3(+2.5-1.0) 97Ho14=1.7(+0.6-0.4)										**
* ²⁶⁶ Mt ^m	T : symmetrized from 97Ho14=3.4(+4.7-1.3), 3 events at 7.8, 2.0 and 5.0 ms										**
²⁶⁷ Rf	113440#	580#			2.5 h 1.5		05 17Og01	TD 2004		SF=100	*
²⁶⁷ Rf ^p	113520#	580#	80#	100#							
²⁶⁷ Db	114010#	370#			2.0 h 1.1	9/2 ⁺ #	05 17Og01	TD 2004		SF=100	*
²⁶⁷ Sg	115810#	260#			1.8 m 0.7		08Dv02	TD 2008		SF=83; α =17	*
²⁶⁷ Sg ^p	115830#	270#	20#	50#							

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁶⁷ Bh	118770#	260#				22 s 10	5/2 ⁻ #	05		2000	$\alpha=100$	*
²⁶⁷ Hs	122660#	100#			*	55 ms 11		05	04Mo40 T	1995	$\alpha>80$;SF ?	*
²⁶⁷ Hs ^m	122700#	100#	39	24	AD*	990 μ s 90		05	04Fo08 TD	2004	$\alpha=?$;IT ?	*
²⁶⁷ Mt	127790#	500#				10# ms					$\alpha ?$	
²⁶⁷ Ds	133880#	200#				10 μ s 8	3/2 ⁺ #	05	95Gh04 T	1995	$\alpha=100$	*
* ²⁶⁷ Rf	T : symmetrized from 17Og01,06Og05=1.3(+2.3-0.5), supersedes 04Og12 one											**
* ²⁶⁷ Rf	T : event at 2.3 h											**
* ²⁶⁷ Db	T : symmetrized from 17Og01=1.3(+1.6-0.5)											**
* ²⁶⁷ Sg	T : symmetrized from 08Dv02=80(+60-20) s; other 99Og.B=19 ms not trusted											**
* ²⁶⁷ Bh	T : symmetrized from 00Wi15=17(+14-6); other 00Ei05=14(+9-4)											**
* ²⁶⁷ Hs	T : symmetrized from 04Mo40=52(+13-8), combining the 04Mo40 ($\tau=77(+31-7)$)											**
* ²⁶⁷ Hs	T : and 98Ho13 ($\tau=72(+28-16)$) data											**
* ²⁶⁷ Hs ^m	T : 04Fo08(2 events)=940(+120-45)us; other 04Mo40(1 event)=0.80(+3.8-0.37)s											**
* ²⁶⁷ Ds	T : 95Gh04=2.8(+13.0-1.3), one event with $\tau=4$ us											**
²⁶⁸ Rf	115480#	660#				1# h	0 ⁺				$\alpha ?$;SF ?	
²⁶⁸ Db	117060#	530#				29 h 3		19	17Og01 T	2004	SF $\approx$ 100; $\beta^+ ?$; $\alpha ?$	*
²⁶⁸ Db ^p	117210#	540#	150	80								
²⁶⁸ Sg	116800#	470#				2# m	0 ⁺				$\alpha ?$;SF ?	
²⁶⁸ Bh	120710#	380#				190# s					$\alpha ?$;SF ?	
²⁶⁸ Hs	122970#	300#				1.4 s 1.1	0 ⁺		10Ni14 TD	2010	$\alpha\approx$ 100	*
²⁶⁸ Mt	129150#	230#				23 ms 7		19	04Mo26 T	1995	$\alpha=100$	*
²⁶⁸ Ds	133650#	300#				100# μ s	0 ⁺				$\alpha ?$	
* ²⁶⁸ Db	T : symmetrized from 17Og01=28.3(+3.3-2.6); others 16Fo10=28(3)											**
* ²⁶⁸ Db	T : 13Ru11=26(+7-5) 13Og01=25.9(+6.2-4.2),supersedes 12Og02=27.9(+7.8-5.0)											**
* ²⁶⁸ Db	T : 05Og02=29(+9-6) 04Og03=16(+19-6), 07St18=28(+11-4)											**
* ²⁶⁸ Hs	T : symmetrized from 10Ni14=0.38(+1.8-0.17)											**
* ²⁶⁸ Mt	T : symmetrized from 04Mo26=21(+8-5), 14 events; other 02Ho11=42(+29,-12),											**
* ²⁶⁸ Mt	T : 6 events											**
²⁶⁹ Db	119150#	620#				3# h	9/2 ⁺ #				$\alpha ?$;SF ?	
²⁶⁹ Sg	119690#	370#				5 m 2		19	17Og01 T	2010	$\alpha\approx$ 100;SF ?	*
²⁶⁹ Bh	121480#	370#				1# m	5/2 ⁻ #				$\alpha ?$	
²⁶⁹ Hs	124490#	130#				15 s 7	9/2 ⁺ #	05	15Mo25 T	1996	$\alpha=100$	*
²⁶⁹ Mt	129300#	310#				100# ms					$\alpha ?$	
²⁶⁹ Ds	134830	30				230 μ s 110		05	95Ho03 T	1995	$\alpha=100$	*
* ²⁶⁹ Sg	T : average 17Og01,15Ut02=3.1(+3.7-1.1)m 16Ho09=185(+254-68)s; other											**
* ²⁶⁹ Sg	T : 10Ei06=128(+613-58) s, one alpha event at 185 s											**
* ²⁶⁹ Hs	T : symmetrized from 15Mo25,13Su04=12(+9-4)											**
* ²⁶⁹ Ds	T : symmetrized from 95Ho03=170(+160-60)											**
²⁷⁰ Db	122400#	580#				1.7 h 1.0		19	14Kh04 TD	2010	SF $\approx$ 87; $\alpha\approx$ 13	*
²⁷⁰ Sg	121430#	460#				3# m	0 ⁺				$\alpha ?$;SF ?	
²⁷⁰ Bh	124230#	300#				3.8 m 3.0		19	17Og01 TD	2007	$\alpha=100$	*
²⁷⁰ Bh ^p	124920#	360#	690#	200#								
²⁷⁰ Hs	125110#	250#				9 s 4	0 ⁺	19	13Og03 TD	2003	$\alpha\approx$ 100;SF ?	*
²⁷⁰ Mt	130710#	190#				800 ms 400		19	15Mo25 TD	2004	$\alpha\approx$ 100	*
²⁷⁰ Ds	134680	40				205 μ s 48	0 ⁺	19	12Ac04 TD	2001	$\alpha\approx$ 100;SF ?	*
²⁷⁰ Ds ^m	136070	60	1390	60	AD	4.3 ms 1.2	10 ⁻ #	19	12Ac04 T	2001	$\alpha\approx$ 70;IT $\approx$ 30	*
* ²⁷⁰ Db	T : symmetrized from 14Kh04=1.0(+1.5-0.4), combines 14Kh04 and 13Og04 data;											**
* ²⁷⁰ Db	T : other 19Kh04,14Kh04=1.0(+1.9-0.4)											**
* ²⁷⁰ Bh	T : symmetrized from 17Og01=61(+292-28)											**
* ²⁷⁰ Hs	T : symmetrized from 13Og03=7.6(+4.9-2.2); other 03Tu05=3.6(+0.8-1.4)											**
* ²⁷⁰ Mt	T : symmetrized from 15Mo25=0.48(+0.66-0.18)s											**
* ²⁷⁰ Ds	T : average 12Ac04=200(+70-40) 01Ho06=100(+140-40)											**
* ²⁷⁰ Ds ^m	T : symmetrized from 12Ac04=3.9(+1.5-0.8); other 01Ho06=6.0(+8.2-2.2)											**
* ²⁷⁰ Ds ^m	J : from 15Ko14, expected conf=n ² (9/2[615],11/2[725]),K=10-											**
²⁷¹ Sg	124620#	590#				2.2 m 1.1		06	17Og01 TD	2004	$\alpha=42$ 23;SF=58 23	*

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁷¹ Bh	125860#	380#			2.9 s 1.9			05 17Og01	TD 2013	$\alpha=100$	*
²⁷¹ Hs	127690#	280#			10# s				2008	α ?;SF ?	
²⁷¹ Mt	131100#	330#			400# ms					α ?	
²⁷¹ Ds	135950#	100#			144 ms 53			05 16Ho09	TD 1998	SF=75; α =25	*
²⁷¹ Ds ^m	136020#	100#	68	27	AD*&	1.7 ms 0.4		05	1995	$\alpha=100$	*
* ²⁷¹ Sg	T : symmetrized from 17Og01=1.6(+1.5-0.5)										**
* ²⁷¹ Bh	T : symmetrized from 17Og01=1.5(+2.8-0.6)										**
* ²⁷¹ Ds	T : average 16Ho09=96(+96-32) 04Mo40=86(+117-22)										**
* ²⁷¹ Ds ^m	T : symmetrized from 04Mo40=1.63(+0.44-0.29), combining the 04Mo40										**
* ²⁷¹ Ds ^m	T : ($\tau=2.9(+1.3-0.7)$) and 98Ho13 ($\tau=1.8(+0.8-0.4)$) data										**
²⁷² Sg	126520#	690#			4# m	0 ⁺				α ?;SF ?	
²⁷² Bh	128790#	530#			11.3 s 1.8			19 16Fo10	T 2004	$\alpha \approx 100$	*
²⁷² Hs	129000#	510#			10# s	0 ⁺				α ?;SF ?	
²⁷² Mt	133480#	490#			400# ms					α ?;SF ?	
²⁷² Ds	136080#	420#			200# ms	0 ⁺				SF ?	
²⁷² Rg	142770#	230#			4.2 ms 1.1			19 15Mo25	T 1995	$\alpha=100$	*
* ²⁷² Bh	T : symmetrized from 16Fo10=10.5(+1.5-1.1); other 17Og01=10.6(+1.6-1.1),										**
* ²⁷² Bh	T : same raw data as 16Fo10										**
* ²⁷² Rg	T : symmetrized from 15Mo25=3.8(+1.4-0.8); other: 02Ho11=1.6(+1.1-0.5)										**
²⁷³ Sg	129920#	400#			5# m					SF ?	
²⁷³ Bh	130680#	660#			1# m					α ?;SF ?	
²⁷³ Hs	131770#	370#			1060 ms 500			15 17Og01	T 2010	$\alpha \approx 100$; SF ?	*
²⁷³ Hs ^p	131970#	390#	200#	100#						α ?;SF ?	
²⁷³ Mt	134780#	420#			800# ms					α ?;SF ?	
²⁷³ Ds	138290#	140#			240 μ s 100			05 15Mo25	T 1996	$\alpha \approx 100$	*
²⁷³ Ds ^m	138490#	140#	198	20	EU	120 ms		05	1996	$\alpha=100$	
²⁷³ Rg	142890#	400#			2# ms					α ?	
* ²⁷³ Hs	T : symmetrized from 17Og01,15Ut02=760(+710-240); other 16Ho09=765(+765-255)										**
* ²⁷³ Ds	T : symmetrized 15Mo25,13Su04=190(+140-60)										**
²⁷⁴ Bh	133760#	580#			57 s 27			19 17Og01	TD 2010	$\alpha=100$	*
²⁷⁴ Hs	133410#	470#			500# ms	0 ⁺				α ?;SF ?	
²⁷⁴ Mt	137250#	380#			850 ms 540			19 17Og01	TD 2007	$\alpha=100$	*
²⁷⁴ Ds	139200#	390#			10# ms	0 ⁺				α ?;SF ?	
²⁷⁴ Rg	144610#	210#			20 ms 11			05 15Mo25	TD 2004	$\alpha \approx 100$	*
* ²⁷⁴ Bh	T : symmetrized from 17Og01=44(+34-13) (recommended), based on										**
* ²⁷⁴ Bh	T : 14Kh04=30(+54-12) 13Og04=54(+65-19)										**
* ²⁷⁴ Mt	T : symmetrized from 17Og01=440(+810-170)ms, based on data from 07Og02										**
* ²⁷⁴ Rg	T : symmetrized from $\tau=18(+24-7)$ in 15Mo25										**
²⁷⁵ Bh	135780#	600#			1# m	5/2 ⁻ #				SF ?	
²⁷⁵ Hs	136490#	590#			280 ms 130			05 17Og01	TD 2004	$\alpha=100$	*
²⁷⁵ Hs ^p	136750#	600#	260#	100#							
²⁷⁵ Mt	138770#	390#			31 ms 17			05 17Og01	TD 2004	$\alpha=100$	*
²⁷⁵ Ds	141670#	340#			10# ms					α ?;SF ?	
²⁷⁵ Rg	145400#	450#			5# ms					α ?	
* ²⁷⁵ Hs	T : symmetrized 17Og01=200(+180-60); other 16Ho09=201(+201-67)										**
* ²⁷⁵ Mt	T : symmetrized from 17Og01=20(+24-7)										**
²⁷⁶ Bh	138950#	600#			60# s					α ?;SF ?	
²⁷⁶ Hs	138190#	720#			100# ms	0 ⁺				α ?;SF ?	
²⁷⁶ Mt	141310#	530#			700 ms 80			19 16Fo10	T 2004	$\alpha=100$	*
²⁷⁶ Mt ^m	141560#	540#	250	80	AD*	7 s 3		19 17Og01	TD 2012	$\alpha=100$	*
²⁷⁶ Ds	142540#	550#			16# ms	0 ⁺				α ?;SF ?	
²⁷⁶ Rg	147390#	630#			10# ms					α ?;SF ?	
²⁷⁶ Cn	150360#	500#			100# μ s	0 ⁺				α ?;SF ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
* ²⁷⁶ Mt	T : symmetrized from 16Fo10=690(+90-70); other 17Og01=520(100)										**
* ²⁷⁶ M ^m	T : symmetrized from 17Og01=4(+5-1)										**
²⁷⁷ Bh	141100#	600#			10# s					α ?;SF ?	
²⁷⁷ Hs	141380#	450#		*	12 ms 9		14	16Ho09	TD 2010	SF≈100; α ?	*
²⁷⁷ Hs ^m	141480#	460#	100#	100#	130 s 100		14	12Ho12	TD 2012	SF=100	*
²⁷⁷ Hs ^p	142000#	490#	620#	200#							
²⁷⁷ Mt	143010#	660#			9 s 6		14	17Og01	TD 2013	SF=100; α ?	*
²⁷⁷ Ds	145090#	390#			6 ms 3		15	17Og01	T 2010	α ≈100;SF ?	*
²⁷⁷ Rg	148410#	470#			4# ms					α ?;SF ?	
²⁷⁷ Cn	152330#	150#			790 μ s 330		05	15Mo25	TD 1996	α =100	*
* ²⁷⁷ Hs	T : symmetrized from 16Ho09=3.1(+14.9-1.4) 10Du06=3.0(+14.4-1.4)										**
* ²⁷⁷ Hs	T : 17Og01=3(+15-1); other 99Og10 one SF event at 16.5m, not trusted										**
* ²⁷⁷ Hs ^m	T : symmetrized from 12Ho12=34(+166-16) (SF 1 event)										**
* ²⁷⁷ Mt	T : symmetrized from 17Og01,13Og04=5(+9-2)										**
* ²⁷⁷ Ds	T : symmetrized from 17Og01,15U02=4.1(+3.7-1.3); other 16Ho09=4.1(+4.1-1.4)										**
* ²⁷⁷ Cn	T : symmetrized from 15Mo25,13Su04=610(+460-180)										**
²⁷⁸ Bh	144370#	400#			2# s		19	16Ho09	TD 2016	SF≈100; α ?	*
²⁷⁸ Hs	143220#	300#			2# s	0 ⁺	19	16Ho09	TD 2016	SF≈100; α ?	*
²⁷⁸ Mt	145770#	580#			6 s 3		19	17Og01	TD 2010	α =100	*
²⁷⁸ Mt ^p	146160#	590#	390#	100#							
²⁷⁸ Ds	146250#	510#			270# ms	0 ⁺				α ?;SF ?	
²⁷⁸ Rg	150520#	390#			8 ms 5		19	17Og01	TD 2007	α =100	*
²⁷⁸ Cn	152840#	440#			2# ms	0 ⁺				α ?;SF ?	
²⁷⁸ Nh	159030#	220#			2.3 ms 1.3		19	15Mo25	TD 2004	α ≈100	*
* ²⁷⁸ Bh	T : 16Ho09=690(+3300,-310)s not trusted by evaluator, based on TNN										**
* ²⁷⁸ Hs	T : 16Ho09=690(+3300,-310)s not trusted by evaluator, based on TNN										**
* ²⁷⁸ Mt	T : symmetrized from 17Og01=4.5(+3.5-1.3) (recommended), based on data from										**
* ²⁷⁸ Mt	T : 14Kh04=3.6(+6.5-1.4) 13Og04=5.2(+6.2-1.8)										**
* ²⁷⁸ Rg	T : symmetrized from 17Og01,07Og02=4.2(+7.5-1.7)										**
* ²⁷⁸ Nh	T : symmetrized from τ =2.0(+2.7-0.7) in 15Mo25,08Mo09										**
²⁷⁹ Hs	146500#	600#			1# s					α ?;SF ?	
²⁷⁹ Mt	147590#	670#			20# s					α ?;SF ?	
²⁷⁹ Ds	149020#	610#			210 ms 40		05	17Og01	TD 2004	SF=88 5; α =12 5	*
²⁷⁹ Ds ^p	149250#	610#	230#	100#							
²⁷⁹ Rg	151720#	420#			170 ms 110		05	17Og01	TD 2004	α =100	*
²⁷⁹ Rg ^p	151760#	430#	40#	100#							
²⁷⁹ Cn	155020#	400#			60# μ s					α ?;SF ?	
²⁷⁹ Nh	159460#	600#			1# ms					α ?;SF ?	
* ²⁷⁹ Ds	T : from 17Og01=210(40); other 16Ho09=290(+69-47)										**
* ²⁷⁹ Ds	D : %SF symmetrized from 17Og01=89(+4-6)										**
* ²⁷⁹ Rg	T : symmetrized from 17Og01=90(+170-40)										**
²⁸⁰ Hs	148420#	600#			100# ms	0 ⁺				α ?;SF ?	
²⁸⁰ Mt	150510#	600#			10# s					α ?;SF ?	
²⁸⁰ Ds	150320#	750#			25 ms 20	0 ⁺	19	17Ka66	TDI 1999	SF=100	*
²⁸⁰ Rg	153890#	530#			4.3 s 0.5		19	17Og01	T 2004	α =100	*
²⁸⁰ Cn	155650#	580#			5# ms	0 ⁺				α ?;SF ?	
²⁸⁰ Nh	161240#	400#			10# ms					α ?;SF ?	
* ²⁸⁰ Ds	I : the identification in 17Ka66 is tentative and it needs to be confirmed										**
* ²⁸⁰ Ds	T : symmetrized from 17Ka66=6.7(+31.9-3); others 01Og01-3 events at 6.93 s,										**
* ²⁸⁰ Ds	T : 14.3 s and 7.4 s yield 6.6(+9.0-2.4) s, but data were later reassigned										**
* ²⁸⁰ Ds	T : to the ²⁹³ Lv chain										**
* ²⁸⁰ Rg	T : symmetrized from 17Og01=4.2(+0.6,-0.4); other 16Fo10=4.4(+0.5-0.4)										**
²⁸¹ Mt	152400#	600#			1# s					α ?;SF ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁸¹ Ds	153270#	490#		*	14 s 3			05 17Ka66	T 2004	SF=90 7; α =10 7	*
²⁸¹ Ds ^m	153350#	460#	80#	240#	0.9 s 0.7			12Ho12	TD 2012	α =100	*
²⁸¹ Ds ^p	153340#	500#	70#	100#							
²⁸¹ Rg	155330#	770#			19 s 5			10 17Og01	TD 2010	SF=87 8; α =13 8	*
²⁸¹ Cn	157950#	400#			180 ms 80			15 17Og01	T 2010	α ≈100;SF ?	*
²⁸¹ Nh	161810#	300#			100# ms					α ?;SF ?	
* ²⁸¹ Ds	T : average 17Ka66=9.9(+13.6-3.6) 17Og01=12.7(+4.0-2.5);										**
* ²⁸¹ Ds	T : other 16Ho09=13.0(+4.5-2.7)										**
* ²⁸¹ Ds	D : %SF symmetrized from 17Og01=93(+5-9)										**
* ²⁸¹ Ds ^m	T : symmetrized from 12Ho12=0.25(+1.18-0.11) s										**
* ²⁸¹ Rg	T : symmetrized from 17Og01=17(+6-3); other 16Fo16=21(+10-5)										**
* ²⁸¹ Rg	D : %SF symmetrized from 17Og01=88(+7-9)										**
* ²⁸¹ Cn	T : symmetrized from 17Og01,15Ut02=130(+120-40); other:										**
* ²⁸¹ Cn	T : 16Ho09=128(+128-43) (analyzing same data as 17Og01)										**
²⁸² Mt	155460#	450#			100# ms			19 16Ho09	TD 2016	α ≈100; SF ?	*
²⁸² Ds	154790#	300#			4.2 m 3.3	0 ⁺		19 16Ho09	TD 2016	α ≈100; SF ?	*
²⁸² Rg	157740#	590#			130 s 50			19 17Og01	TD 2010	α =100	*
²⁸² Cn	158830#	550#			1.1 ms 0.3	0 ⁺		19 16Ho09	TD 2004	SF≈100; α ?	*
²⁸² Nh	163730#	400#			140 ms 90			19 17Og01	TD 2007	α =100	*
* ²⁸² Mt	T : 16Ho09=67(+320-30)s not trusted by evaluator, based on TNN										**
* ²⁸² Ds	T : symmetrized from 16Ho09=67(+320-30)s										**
* ²⁸² Rg	T : symmetrized from 17Og01=100(+70-30)										**
* ²⁸² Cn	T : symmetrized from 16Ho09=0.96(0.35-0.20); other: 17Og01=0.91(0.33-0.19)										**
* ²⁸² Nh	T : symmetrized from 17Og01,07Og02=73(+134-29)										**
²⁸³ Ds	157830#	500#			1# m					α ?;SF ?	
²⁸³ Rg	159380#	680#			2# m					α ?;SF ?	
²⁸³ Cn	161340#	620#			4.7 s 0.8			06 16Ho09	TD 2004	α =81;SF=19	*
²⁸³ Nh	164560#	440#			140 ms 90			05 17Og01	TD 2004	α =100	*
* ²⁸³ Cn	T : symmetrized from 16Ho09=4.48(+0.98-0.68); other 17Og01=4.2(+1.1-0.7)										**
* ²⁸³ Nh	T : symmetrized from 17Og01=75(+136-30)										**
²⁸⁴ Ds	159460#	500#			1# m	0 ⁺				α ?;SF ?	
²⁸⁴ Rg	161970#	500#			1# m					α ?;SF ?	
²⁸⁴ Cn	162420#	760#			102 ms 17	0 ⁺		19 17Og01	TD 2004	SF=100	*
²⁸⁴ Nh	166590#	530#			0.97 s 0.11			19 17Og01	TD 2004	α =100	*
²⁸⁴ Fl	168780#	660#			3.1 ms 1.3	0 ⁺		19 17Og01	TD 2015	SF≈100; α ?	*
* ²⁸⁴ Cn	T : symmetrized from 17Og01=98(20-14); other 16Ho09=118(+24-17)										**
* ²⁸⁴ Nh	T : symmetrized from 17Og01=0.97(0.12-0.10); other 16Fo10=0.97(0.12-0.10)										**
* ²⁸⁴ Fl	T : symmetrized from 17Og01=2.5(+1.8-0.8); other 16Ho09=2.0(+2.7,-0.7)										**
²⁸⁵ Rg	163730#	600#			30# s					α ?;SF ?	
²⁸⁵ Cn	165090#	510#		*	30 s 8			05 17Og01	TD 2004	α =100	*
²⁸⁵ Cn ^m	165620#	460#	530#	270#	15 s 12			12Ho12	TD 2012	α =100	*
²⁸⁵ Nh	167770#	780#			4.6 s 1.1			10 17Og01	TD 2010	α =100	*
²⁸⁵ Fl	170930#	400#			210 ms 100			15 17Og01	T 2010	α ≈100;SF<20	*
* ²⁸⁵ Cn	T : symmetrized from 17Og01=28(+9-6); other 16Ho09=28.9(+10.1-5.9)										**
* ²⁸⁵ Cn ^m	T : symmetrized from 12Ho12=4.0(+19.1-1.8) s										**
* ²⁸⁵ Nh	T : symmetrized from 07Og01=4.2(+1.4-0.8); other 16Fo16=2.9(+1.4-0.7),										**
* ²⁸⁵ Nh	T : reanalyzed data of 13Og04=4.2(+1.4-0.8), 12Og06=4.9(+6.7-1.8),										**
* ²⁸⁵ Nh	T : 10Og01=5.5(+5.0-1.8)										**
* ²⁸⁵ Fl	T : symmetrized from 17Og01,15Ut02=150(+140-50); other: 16Ho09=152(+152-51),										**
* ²⁸⁵ Fl	T : analyzed same data as 17Og01										**
²⁸⁶ Rg	166510#	460#			10# s			19 16Ho09	TD 2016	α ≈100;SF ?	*
²⁸⁶ Cn	166450#	700#			30 s 30	0 ⁺		19 17Ka66	T 2016	α ≈100;SF ?	*
²⁸⁶ Nh	169960#	590#			12 s 5			19 17Og01	TD 2010	α =100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
²⁸⁶ Fl	171610#	550#	130 ms 30	0 ⁺	19	17Og01	TD 2004	$\alpha=59$ 11;SF=41 11	*
* ²⁸⁶ Rg	T : 16Ho09=640(+3100-300)s not trusted by evaluator, based on TNN								**
* ²⁸⁶ Cn	T : symmetrized from 17Ka66=8.4(+40.5-3.9); other: 16Ho09=640(+3100-300)s								**
* ²⁸⁶ Nh	T : symmetrized from 17Og01=9.5(+6.3-2.7) (recommended), based on data from								**
* ²⁸⁶ Nh	T : 14Kh04=2.9(+5.5-1.1) 13Og04=13(+12-4)								**
* ²⁸⁶ Fl	T : symmetrized from 17Og01=120(+40-20); other: 16Ho09=166(+40-27)								**
* ²⁸⁶ Fl	D : % α symmetrized from 17Og01=60(+10-11); other: 16Ho09=52%								**
²⁸⁷ Cn	169370#	700#	30# s					α ?;SF ?	
²⁸⁷ Nh	171460#	710#	20# s					α ?;SF ?	
²⁸⁷ Fl	173930#	620#	510 ms 120		05	17Og01	T 2004	$\alpha\approx 100$; SF ?	*
²⁸⁷ Mc	177750#	440#	60 ms 30		05	17Og01	TD 2004	$\alpha=100$	*
* ²⁸⁷ Fl	T : symmetrized from 17Og01=480(+140-90); other: 16Ho09=540(+170-100)								**
* ²⁸⁷ Mc	T : symmetrized from 17Og01=37(+44-13)								**
²⁸⁸ Cn	170930#	700#	10# s	0 ⁺				α ?;SF ?	
²⁸⁸ Nh	173970#	700#	20# s					α ?;SF ?	
²⁸⁸ Fl	174920#	760#	653 ms 113	0 ⁺	19	16Ho09	TD 2004	$\alpha\approx 100$; SF ?	*
²⁸⁸ Mc	179670#	540#	177 ms 20		19	17Og01	TD 2004	$\alpha=100$	*
* ²⁸⁸ Fl	T : average 16Ho09=644(+136-97) 17Ka66=274(+500-108);								**
* ²⁸⁸ Fl	T : other: 17Og01=660(+140-100)								**
* ²⁸⁸ Mc	T : symmetrized from 17Og01=174(+22-18); other 16Fo10=170(20)								**
²⁸⁹ Nh	175550#	500#	30# s					α ?;SF ?	
²⁸⁹ Fl	177470#	510#	2.1 s 0.6		05	17Og01	TD 2004	$\alpha\approx 100$;SF ?	*
²⁸⁹ Fl ^m	178220#	470#	1.1 s 0.8			12Ho12	TD 2012	$\alpha=100$	*
²⁸⁹ Mc	180680#	780#	410 ms 150		10	17Og01	T 2010	$\alpha=100$	*
²⁸⁹ Lv	184460#	500#	16# ms		00	02Ni10	I	α ?	*
* ²⁸⁹ Fl	T : symmetrized from 17Og01=1.9(+0.7-0.4); others 16Ho09=1.87(+0.65-0.38)								**
* ²⁸⁹ Fl	T : 17Ka66=3.9(+5.3-1.4)								**
* ²⁸⁹ Fl ^m	T : symmetrized from 12Ho12=0.28(+1.35-0.13) s								**
* ²⁸⁹ Mc	T : symmetrized from 17Og01=330(+120-80); other 16Fo16=270(+120-60),								**
* ²⁸⁹ Mc	T : reanalyzed data of 13Og04=330(+120-80), 12Og06=430(+590-160),								**
* ²⁸⁹ Mc	T : 10Og01=220(+260-80)								**
* ²⁸⁹ Lv	T : 99Ni03=600(+860-300), α decay retracted by authors in 02Ni10								**
²⁹⁰ Nh	178320#	470#	8 s 6		19	16Ho09	TD 2016	$\alpha\approx 100$; SF ≤ 50	*
²⁹⁰ Fl	178730#	700#	80 s 60	0 ⁺	19	16Ho09	TD 2016	$\alpha\approx 100$; SF ?; $\beta^+<50$	*
²⁹⁰ Mc	182790#	590#	840 ms 360		19	17Og01	T 2010	$\alpha=100$	*
²⁹⁰ Lv	185030#	550#	9 ms 3	0 ⁺	19	17Og01	T 2004	$\alpha\approx 100$; SF ?	*
* ²⁹⁰ Nh	T : symmetrized from 16Ho09=2.0(+9.6-0.9)								**
* ²⁹⁰ Fl	T : symmetrized from 16Ho09=21(+101-10); other 16Ho09=19(+91-9) β^+ branch								**
* ²⁹⁰ Mc	T : symmetrized from 17Og01=650(+490,-200) (recommended); based on data								**
* ²⁹⁰ Mc	T : from 13Og04=240(+280-90) 14Kh04=1300(+2300-500)								**
* ²⁹⁰ Lv	T : symmetrized from 17Og01=8.3(+3.5-1.9); other 16Ho09=8.3(+3.6-1.9)								**
²⁹¹ Fl	181500#	700#	10# s					α ?;SF ?	
²⁹¹ Mc	184180#	740#	1# s					α ?;SF ?	
²⁹¹ Lv	187240#	620#	26 ms 12		05	17Og01	T 2004	$\alpha\approx 100$;SF ?	*
²⁹¹ Ts	191650#	600#	2# ms					α ?;SF ?	
* ²⁹¹ Lv	T : symmetrized from 17Og01=19(+17-6); other 16Ho09=18(+25-7)								**
²⁹² Mc	186600#	700#	5# s					α ?;SF ?	
²⁹² Lv	188130#	760#	16 ms 6	0 ⁺	19	17Og01	T 2004	$\alpha\approx 100$; SF ?	*
²⁹² Ts	193620#	670#	10# ms					α ?;SF ?	
* ²⁹² Lv	T : average 17Og01=13(+7-4) 17Ka66=11.9(+21.7-2.6);								**
* ²⁹² Lv	T : other 16Ho09=12.8(+7.0-3.3)								**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens Reference	Year of discovery	Decay modes and intensities (%)	
^{293}Lv	190570#	520#			70 ms 30		05 17Og01 T	2004	$\alpha \approx 100$; SF ?	*
$^{293}\text{Lv}^m$	191290#	470#	720#	290#	80 ms 60		12Ho12 TD	2012	$\alpha \approx 100$	*
^{293}Ts	194430#	780#			25 ms 6		10 17Og01 TD	2010	$\alpha \approx 100$	*
^{293}Og	198800#	710#		RN	1# ms		00 02Ni10 I	2010	α ?	*
* ^{293}Lv	T : symmetrized from 17Og01, 15Og05=57(+43-17); others 16Ho09=57(+46-18)									**
* ^{293}Lv	T : 17Ka66t=188(+342-74)									**
* $^{293}\text{Lv}^m$	T : symmetrized from 12Ho12=20(+96-9)									**
* ^{293}Ts	T : symmetrized from 17Og01, 15Og05=22(+8-4); other: 16Fo16=18(+8-4),									**
* ^{293}Ts	T : reanalyzed data of 13Og04=22(+8-4), 12Og06=27(+12-6),									**
* ^{293}Ts	T : 10Og01=14(+11-4)									**
* ^{293}Og	T : 99Ni03=120(+180-60) α decay retracted by authors in 02Ni10									**
^{294}Ts	196400#	590#			70 ms 30		19 17Og01 TD	2010	$\alpha \approx 100$	*
^{294}Og	199320#	550#			0.7 ms 0.3	0^+	05 18Br13 T	2004	$\alpha \approx 100$; SF ?	*
* ^{294}Ts	T : symmetrized from 17Og01, 15Og05=51(+38-16) (recommended); based on data									**
* ^{294}Ts	T : from 14Kh04=51(+94-20) 13Og04=50(+60-18)									**
* ^{294}Og	T : symmetrized from 18Br13=0.58(+0.44-0.18), supersedes									**
* ^{294}Og	T : 17Og01=0.69(+0.64-0.22) 16Ho09=0.69(+69-23)									**
^{295}Og	201370#	660#			680 ms 540		16Ho09 TD	2006	$\alpha \approx 100$	*
* ^{295}Og	T : symmetrized from 16Ho09=181(+866-83)									**