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BETA-DECAY RATES OF HIGHLY IONIZED HEAVY ATOMS IN STELLAR INTERIORS*

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Beta-decay rates are computed for heavy nuclides ($26 \leqslant Z \leqslant 83$, $59 \leqslant A \leqslant 210$) at stellar temperatures of $5 \times 10^7 \leqslant T \leqslant 5 \times 10^8$ K and electron number densities of $10^{26} \leqslant n_e \leqslant 3 \times 10^{27}$ cm^{-3}. The β-decay processes considered are: (i) electron emission (β^- decay) into the continuum as well as into the bound state; (ii) positron emission (β^+ decay); and (iii) capture of the orbital and free electrons. The degree of ionization is determined by solving the Saha equation corrected for the continuum depression within a finite-temperature Thomas-Fermi model. The adopted input atomic data are based on a self-consistent mean-field method. The *ft* values for unknown β transitions are estimated from systematics. The results will be most useful for *s*-process nucleosynthesis studies.

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INTRODUCTION

Nuclear β decay plays a key role at various stages of stellar evolution and in many nucleosynthesis processes. Much-discussed examples include free-electron capture on proton and Fe-group nuclei in the collapsing core of a supernova[1] and the β^- decay of very-neutron-rich nuclei synthesized by the r process.[2] In these cases, a global knowledge of the β-strength distribution over a wide range of energies is primarily required.

Another example, which is of concern here, is more related to the individual β transitions between low-lying levels of heavy nuclei under less explosive stellar conditions such as are realized in the s process. While the search for astrophysical site(s) for the s process still continues,[3] it is clear that not only better data on neutron-capture cross sections[4] but also reliable evaluations of β-decay rates are required. A proper description of the competition between the two processes is often important for the analyses of the solar abundances in the search for the astrophysical conditions under which the s-process nuclei in the solar system were formed.[3,5]

The main difficulty here is to evaluate the β-decay nuclear matrix elements (or ft values) for unknown transitions from the low-lying nuclear excited states that are thermally populated at high temperatures (typically of $\sim 3 \times 10^8$ K or 25–30 keV for the s process). In addition, a detailed study of partially ionized heavy elements in a plasma is necessary, especially if the neutral atomic mass difference (that is the Q value for β decay) is small or even slightly negative. In that case, the nucleus and atomic electrons have to be treated as a whole system. Only by so doing can one reveal the significance of such a process as bound-state β^- decay.[6,7]

Relying on a recent formalism,[7] we present here a systematic calculation of the β-decay rates of heavy atoms in such stellar environments.

Astrophysical Parameters

In discussing β decay, one may specify the stellar environment by the temperature T, the density ρ, and the composition. Our working assumptions are: (i) the heavy nuclear species of interest is embedded as a dilute impurity in a matter composed mostly of light elements (H, He, etc.); (ii) T is sufficiently high to have the light elements fully ionized; and (iii) the electrons are only weakly degenerate and positrons can still be neglected. In addition, local thermodynamic equilibrium is assumed.

Under (i) and (ii), the charge neutrality relates the composition and ρ to the number density of free electrons (in the absence of positrons) n_e,

$$n_e \simeq \rho \cdot \sum_l (X_l Z_l / A_l)/m_u, \tag{1}$$

where Z_l, A_l, and X_l are the atomic number, mass number, and mass fraction of a fully ionized light element l, respectively, and m_u is the atomic mass unit (1.66×10^{-24} g). Because of this scaling property, it is convenient to choose T and n_e as the independent parameters.

We calculate the β-decay rates of heavy nuclei near the line of stability in the ranges $5 \times 10^7 \leqslant T \leqslant 5 \times 10^8$ K and $10^{26} \leqslant n_e \leqslant 3 \times 10^{27}$ cm^{-3}, in which the above conditions (ii) and (iii) are satisfied. The results are applicable for *s*-process conditions as well as those realized during the early phases of stellar evolution.

Method of Calculation

The Saha equation is used to determine the population of variously ionized states of a heavy element i under local thermodynamic equilibrium,[8]

$$n_{ij+1}/n_{ij} = (b_{ij+1}/b_{ij})(M_{ij+1}/M_{ij})^{3/2}\exp[-\chi_{ij}/(\kappa T) - \eta], \quad (2)$$

and

$$b_{ij} = \sum_k b_{ijk}\exp(-e^*_{ijk}/\kappa T), \quad (3)$$

where n_{ij} is the number density of the element i in its j-times ionized state, M_{ij} the mass, χ_{ij} the ionization potential, and κ the Boltzmann constant, while b_{ijk} and e^*_{ijk} are the statistical weight and excitation energy of the kth level of the j-times ionized atom. The electron degeneracy parameter η is related to n_e by

$$n_e = \int_1^\infty W(W^2-1)^{1/2} \times [1+\exp\{\beta(W-1)-\eta\}]^{-1} dW/(\pi^2 \lambdabar^3), \quad (4)$$

where $\lambdabar = \hbar/m_e c$ and $\beta = m_e c^2/\kappa T$. [The assumption (iii) corresponds to $-\beta \ll \eta \leqslant 0$.]

The β-decay rates are calculated for the following processes: continuum-state β^- decay, bound-state β^- decay, β^+ decay, orbital-electron capture, and free-electron capture. The transition rate between an initial state (I) and final state (F), specified by the nuclear *and* ionic components, is given by

$$\lambda^{(m)}_{IF} = \begin{cases} [\ln 2/(f_0 t)] f^*_{IF(m)} & \text{for } m = \underline{\text{a}}, \underline{\text{nu}}, \\ [\ln 2/(f_1 t)] f^*_{IF(m)} & \text{for } m = \underline{\text{u}}, \end{cases} \quad (5)$$

where a, nu, and u stand for the allowed, non-unique first-forbidden, and unique first-forbidden transitions, respectively. The higher-forbidden transitions are included only when terrestrially observed. The quantities $f_0 t$ and $f_1 t$ are the usual ft values,[9] while $f^*_{IF(m)}$ is a corresponding f function but in stellar environments. The decay rate for the Kth nuclear level, after summing over the initial atomic states (k) and the possible final nuclear (K') and atomic (k') states, is

$$\lambda_{i(K)} = \sum_j n_{ij}\lambda_{i(K)j} / \sum_j n_{ij}, \quad (6)$$

where

$$\lambda_{i(K)j} = [\sum_{K'kk'} b_{ijk} \times \exp(-e^*_{ijk}/\kappa T)\lambda^{(m)}_{IF}]/[\sum_k b_{ijk}\exp(-e^*_{ijk}/\kappa T)]. \quad (7)$$

The total decay rate of the nucleus i is then given by

$$\lambda_i = \sum_K [G_{iK}\exp(-E^*_{iK}/\kappa T)\lambda_{i(K)}]/[\sum_k G_{iK}\exp(-E^*_{iK}/\kappa T)] \quad (8)$$

under the assumption that the initial nuclear states are in thermal equilibrium, where G_{iK} and E^*_{iK} are the spin weight and the excitation energy of the Kth nuclear level. In a few cases, this assumption might not be warranted, as will be discussed later.

The ionic ground-state properties are calculated from a Hartree–Fock–Dirac–Slater self-consistent mean-field method.[10] A correction to the ionization potential for the perturbing effect of free electrons and other ions is made by simultaneously solving a finite-temperature Thomas-Fermi equation[11] and the Saha equation. Because of the assumptions (i) and (ii) and in the absence of positrons, however, the net correction (the continuum depression[8]) can be parameterized in terms of T and n_e. The ionic excited-state properties are obtained from a schematic hydrogen-like model.[7] The bound-electron wave functions are taken to be those of lowest-energy self-consistent configurations evaluated at a nuclear radius of $R = 1.2A^{1/3}$ fm. The continuum-electron (and positron) wave functions are obtained by interpolating the values for the neutral atom[12] and the bare nucleus.[13] It is worth stressing that a unified description of the nucleus, atomic electrons, and surrounding plasma is a must[7] to establish the energetics for low-energy transitions.

Where available, experimental data[14] were used as input for Eq. (8). The ft values of unknown transitions were estimated after a systematic search for analogous transitions in the existing experimental data. In some important cases, we have then introduced the pairing corrections within a simple BCS model.[15]

Discussion

The rates given in Tables I and II are obtained by assuming that all the initial nuclear states are thermally equilibrated within a time scale shorter than the following reaction and the dynamical time scale [Eq. (8)]. This assumption is probably justified in most cases, with a few possible exceptions[16] (see the Appendix).

The largest possible uncertainty lies in the choice of the ft values for unknown transitions. Lack of information on low-lying levels sometimes introduces uncertainties in results for high temperatures and in discussion of equilibration at relatively low temperatures. The adopted log *ft* values for unknown transitions are given in Tables III and IV.

In Fig. 1, our results are compared with those of Cosner and Truran[17] for $T = 3 \times 10^8$ K and $n_e = 10^{27}$ cm^{-3}. Most discrepancies in Fig. 1a (β^- decay) reflect the different choices for the unknown *ft* values. (The latter authors used log*ft* = 5.7, 7.5, and 8.5 for *all* unknown allowed, non-unique first-forbidden, and unique first-forbidden transitions, respectively. This approach is not adequate at least for the transitions in well-deformed nuclei, to which the Alaga selection rules apply.) This can be seen especially in the heavy mass ($A \gtrsim 140$) region, where often the ground-state decay is slow and unknown decays of low-lying excited states are expected to be more favorable. Some of the discrepancies can be traced back to an incorrect shape factor used by Cosner and Truran[17] for the unique first-forbidden transition. In the case of β^+ decay and electron capture (Fig. 1b), the difference lies not only in the estimates of unknown *ft* values, but in the treatment of ionization. However, the exact reason for the unexpectedly large deviations for some nuclei remains unidentified.

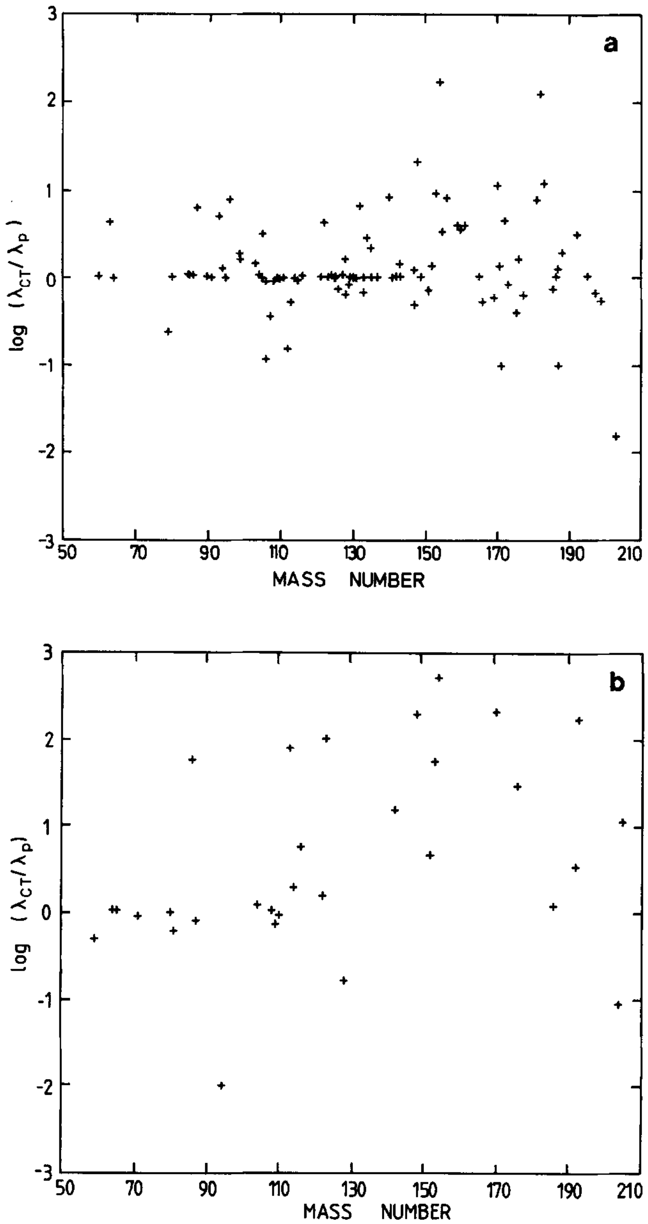

Fig. 1. Decimal logarithm of the ratios of the decay rates of Cosner and Truran[17] (λ_{CT}) to the present values (λ_p) at $T = 3 \times 10^8$ K and $n_e = 10^{27}$ cm^{-3} for (a) β^- decay and (b) electron capture plus β^+ decay. (For ^{182}Ta and ^{160}Tb, the ratios exceed 10^3.)

As expected, the present decay rates in β^- decays with low Q value are enhanced by the bound-state decay process, which was neglected by Cosner and Truran.[17] In several cases, however, the effect on the total rate is somewhat masked in Fig. 1a because of the relatively small *ft* value chosen for allowed transitions by Cosner and Truran. Figure 2 displays the maximum ratios of bound- and continuum-state β^--decay rates (that is in fully ionized atoms). The rate enhancement factors owing to bound-state β^- decay under *s*-process conditions are listed in Table V. The contributions of free- and orbital-electron capture and β^+-decay processes to the total decay rate are tabulated in Ref. 18 for $10^8 \leqslant T \leqslant 5 \times 10^8$ K and $3 \times 10^{26} \leqslant n_e \leqslant 3 \times 10^{27}$ cm^{-3}.

We have been unsuccessful in obtaining a compact formula that approximates the present results. [$\lambda_{i(K)}$ in Eq. (8) depends not only on nuclear properties but, except for β^- decays with high Q value, on T and n_e in a complicated manner!] Logarithmic interpolations of the total rates in terms of T and log(n_e) may be a way out. Some approximate analytical fits to these rates (valid in the range $10^8 \leqslant T \leqslant 5 \times 10^8$ K and at $n_e = 3 \times 10^{26}$ cm^{-3}) can be found in Ref. 19.

The expansion of the rate calculation to the higher temperature range beyond 5×10^8 K needs some care since positrons can no longer be neglected at the relatively low density ρ considered here. As a result, positron capture may well compete with β^- decay.[1] Under such conditions, n_e in Eq. (1) should be replaced by the number density of the ionization electrons, $n_e - n_+$, where n_e and n_+ are calculated from Eq. (4) as $n_e(\eta)$ and $n_e(-\eta - 2\beta)$, respectively. In addition, the inclusion of more initial states with higher excitation energies and hence of more transitions is often required.

The present results and the FORTRAN IV program, which can be accommodated even with an IBM PC, will be available from the first author (K.T.).* The request should be accompanied by a self-addressed double-density diskette.

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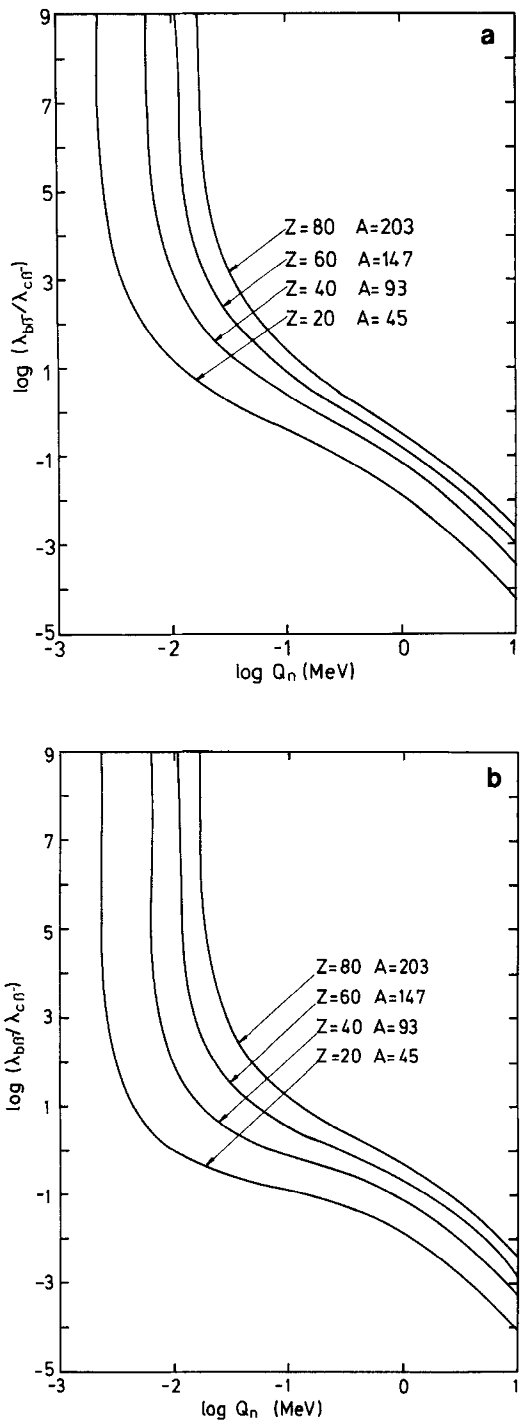

Fig. 2. Decimal logarithm of the ratios of the bound-state β^- decay rates ($\lambda_{b\beta^-}$) to the continuum-state β^--decay rates ($\lambda_{c\beta^-}$) in fully ionized atoms. (a) Allowed and non-unique first-forbidden transitions. (b) Unique first-forbidden transition. The quantity Q_n represents the neutral atomic mass difference. The creation of an electron in the orbitals up to 6*s* has been considered.

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APPENDIX: CASE STUDIES

Given here are some examples which are interesting in *s*-process and related cosmochronological studies. (If not otherwise stated, the discussions refer to β^- transitions.)

^{79}Se, ^{85}Kr. The branchings for these isotopes are important in the study of light ($A \leqslant 85$) *s*-process nuclei.[1-4] The effective β-decay rate $\lambda_\beta^*(^{79}\mathrm{Se})$ is enhanced at high T mainly because of the $^{79m}\mathrm{Se}(1/2^-, 96$ keV$) \rightarrow$ $^{79}\mathrm{Br}(3/2^-$, g.s.) decay. We adopted $\log ft = 5.0$, typical for $(\nu 2p_{1/2}) \rightarrow (\pi 2p_{3/2})$ transitions. The decay of the $1/2^-$ (or $3/2^-$) 128-keV level to the ^{79}Br ground state is probably much slower: otherwise, a similar decay of the ^{79}As $3/2^-$ ground state to the 128-keV state might have been observed.

The $^{85m}\mathrm{Kr}(1/2^-$, 305 keV) might not be thermally equilibrated[3] even at high T. If not in equilibrium, at least $0.79r$ of ^{85}Kr would β decay via the isomer, where r ($\sim$0.5) is the branching ratio of n(eutron) capture on ^{84}Kr to the isomer.[5]

^{99}Tc. The enormous enhancement of λ_β^* at high T has been discussed[2,6] for years because of its seeming conflict with the observation of Tc lines in certain red-giant stars. We adopted $\log ft$ = 5.9, 6.6, and 5.7 for the $7/2^+$ (141 keV) $\rightarrow 5/2^+$ (g.s.), and $5/2^+$ (181 keV) $\rightarrow 5/2^+$ (g.s.) and $\rightarrow 3/2^+$ (89 keV) decays, respectively. [A recent shell-model calculation[7] gives $\log ft$ = 6.6, 6.8, and 6.3, respectively, implying a somewhat longer effective half-life(t_β^*).] A recent *s*-process study[8] has shown that, despite its enhanced β decay, ^{99}Tc could indeed survive the *s* process with a $^{22}\mathrm{Ne}(\alpha, n)^{25}\mathrm{Mg}$ neutron source at $T \sim 3 \times 10^8$ K.

^{113}Cd, ^{115}Cd, ^{115}In. These nuclei concern[2,3,9,10] the analysis of the $^{114-116}$Sn abundances. The low-lying isomers in these isotopes might not be easily equilibrated at low T. In low-T ($\sim 10^8$ K) *s*-process scenarios, therefore, the isomer β-decay rates should be considered[10] in addition to the present rates, which are then essentially the values for the ground states.

^{121}Sn, ^{123}Sn, ^{124}Sb. In these cases, which may be important[11] for studying the *s*-only nuclei $^{122-124}$Te, either the isomer or the ground-state has t_β much shorter than (and the other comparable to or longer than) the *n*-capture time scale. $\lambda_\beta^*(^{121}\mathrm{Sn})$ would not be far from the present value even if the $11/2^-$ (6 keV) isomer is not equilibrated, because this isomer will not be strongly fed by n capture and its β decay is much slower than the ground-state decay. On the other hand, much of ^{123m}Sn ($3/2^+$, 30 keV) may be fed by n capture. If not equilibrated, this isomer and the ground state should be treated separately.

The $^{124m}\mathrm{Sb}(5^+$, 11 keV; t_β = 460 s) is responsible for the enhanced λ_β^*. If it is not equilibrated, the t_β^* would be close to the value for the ground-state t_β (= 60 d) since the isomer will not be significantly fed by n capture and its excitation from the ground state requires too much time. It remains unclear if a level exists above 35 keV that quickly connects the ground state and the 11-keV isomer.

^{134}Cs, ^{136}Cs. The possible branchings at these nuclei concern[3] the *s*-only nuclei ^{134}Ba and ^{136}Ba. The ^{134}Cs 5^+ (11 keV) $\rightarrow 4^+$ (1401 and 1970 keV) decays will be slow, as are the analogous decays of the ^{136}Cs 5^+ ground state, and will not appreciably influence λ_β^*. In contrast, we have assumed that the ^{134}Cs 3^+ (60 keV) level is different in character from the 4^+ and 5^+ levels and that its decays may be rather fast. The 1^+ (177 keV) level in ^{134}Cs might also decay fast because of the expected strong $(\nu 2d_{3/2}) \rightarrow (\pi 2d_{5/2})$ component. λ_β^* is after all considerably enhanced at high T, although the above arguments may be subject to reconsideration.[12]

As for ^{136}Cs, we have included only the ground-state decays. It may well be that a temperature dependence similar to that of $\lambda_\beta^*(^{134}\mathrm{Cs})$ appears along with the inclusion of transitions from unknown excited states.

^{148}Pm. A recent *n*-capture cross-section measurement of the *s*-only nuclei ^{148}Sm and ^{150}Sm implies that the *s*-process flow bypasses ^{148}Sm to a significant extent,[13] a fact that may be used to set constraints on *s*-process conditions. The ^{148}Pm β decays involve states with complex nuclear structure. At first glance, it might be thought that the allowed 2^- (76 keV) $\rightarrow 3^-$ (1161 keV) and $\rightarrow 1^-$ (1465 keV) decays would enhance λ_β^*. However, these final states are probably described[14] as an octupole vibra-

tion and as the coupling of a quadrupole vibration and the fundamental octupole vibration, respectively. The allowed transitions to such states are known to be highly retarded. Whether the 6^- (137 keV) isomer is equilibrated (and, if not, how much it is fed by n capture) is not yet clear.[15]

^{151}Sm, ^{152}Eu. The branching starting at ^{151}Sm is important to the derivation of constraints on s-process conditions:[1,3,16,17] a comparison of the amount of ^{152}Gd produced by this branching and the solar abundance sets a lower limit for the neutron number density for a given T. It was shown[17] that the ^{152m}Eu(0^-, 46 keV) would be quickly equilibrated with the ground state even at T as low as 10^8 K.

^{163}Dy–^{163}Ho. The importance of the ground-state β^- decay of the ground state of terrestrially stable ^{163}Dy and the reverse ^{163}Ho electron capture has been discussed[18] in connection with the unexpectedly large ^{164}Er solar abundance.[2,19] The required input nuclear data have meanwhile become fairly well known.[20] Seemingly, enough ^{164}Er can be produced by the s process.[21]

^{160}Tb, ^{170}Tm. If the β^- decay is enhanced strongly enough to overwhelm n capture, the solar abundance of the daughter s-only ^{160}Dy or ^{170}Yb could be used[22] as a reference in s-process studies of the chronometric ^{176}Lu–^{176}Hf pair. Indeed, λ_β^*(^{160}Tb) is sufficiently enhanced because of the fast decays of the $K^\pi = 1^-$ band members. We adopted $\log ft = 4.6$ for the 1^- (64 keV) $\rightarrow 2^-$ (1264 keV) decay after correcting for the BCS pairing effect upon the observed $\log ft = 4.8$ for the ^{162}Tb(1^-, g.s.) $\rightarrow$ ^{162}Dy(2^-, 1148 keV) transition which is probably an allowed, unhindered $\nu 5/2^-[523] \rightarrow \pi 7/2^-[523]$ transition. The ft values for the transitions from other members are estimated by using the intensity rule.[23]

In contrast, λ_β^* (^{170}Tm) is only modestly enhanced at high T by the non-unique first-forbidden 0^- (150 keV) $\rightarrow 0^+$ (g.s.) decay which is probably an unhindered $\nu 1/2^-[521] \rightarrow \pi 1/2^+[411]$ transition. The 2^- (39 keV) and 3^- (115 keV) decays to the 2^+ (84 keV) level will be as slow as the 1^- (g.s.) $\rightarrow 0^+$ (g.s.) decay ($\log ft = 9.1$) which is subject to the Λ-selection rule.[24] The Gamow–Teller decays of the 3^+ (183 keV) level to the ground-state band will be highly retarded since $\Delta K = 3$.

^{176}Lu. Whether or not the short-lived 1^- (127 keV; $t_\beta = 3.7$ h) isomer is equilibrated under s-process conditions is a crucial issue[25] in the ^{176}Lu–^{176}Hf chronometry. If the answer is no, the rate for ^{176}Lu decay given in Table I should be disregarded.

^{180m}Ta. It has been suggested[26] that the s process might have contributed to the production of the naturally occurring rare element ^{180m}Ta (9^-, 80 keV) via the possible tiny β-decay branches at the ^{180m}Hf (8^-, 1142 keV) and/or the $7/2^-$ (210 keV) level of ^{179}Hf. In these scenarios, it is assumed that ^{180m}Ta is *not* in equilibrium with the 1^- ground state: If they are in equilibrium, t_β^* is far too short for this element to survive (see Tables I and II). The validity of this assumption has been questioned recently.[27]

^{181}Hf. A recent suggestion[28] that ^{182}Hf is a potential chronometer for the early solar system relies crucially on a presumption that ^{182}Hf is solely produced by the r-process; namely λ_β^*(^{181}Hf) should be enhanced under s-process temperatures so much that there would be no appreciable ^{181}Hf(n, γ)^{182}Hf branch. In view of the present only modestly enhanced λ_β^*(^{181}Hf), this assumption is in doubt. The transitions favorable for enhancement are the $9/2^+$ (68 keV) $\rightarrow 7/2^+$ (g.s.) and $\rightarrow 9/2^-$ (62 keV) decays. These are probably characterized by allowed hindered $\nu 9/2^+[624] \rightarrow \pi 7/2^+[404]$ and non-unique first-forbidden unhindered $\nu 9/2^+[624] \rightarrow \pi 9/2^-[514]$ transitions, respectively. The corresponding average $\log ft$ values observed and corrected for the pairing correction are as large as 6.9 and 6.8.

^{187}Re–^{187}Os, ^{205}Tl–^{205}Pb. The non-unique first forbidden bound-state β^- transition ^{187}Re($5/2^+$ 5/2[402], g.s.) $\rightarrow$ ^{187}Os($3/2^-$ 3/2[512], 9.75 keV) is responsible for the enhanced ^{187}Re decay rate. (We adopted $\log ft = 7.5$.) The cosmochronological implications of this and the reverse ^{187}Os electron capture reactions have been discussed in detail,[29] leading to skepticism[30] about this chronometry.

The similar β transmutation between ^{205}Tl($1/2^+$, g.s.) and ^{205}Pb($1/2^-$, 2.3 keV) has been studied,[31] resurrecting the possible chronometric virtue[32] of this pair in the study of the early solar system.

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EXPLANATION OF TABLES

TABLE I. Effective Rates for β^- Decay

^{A}Z (lab s^{-1})	Parent nucleus, with the laboratory ground-state decay rate in parentheses. 1.80 E-07 means 1.80×10^{-7} s^{-1}.
n_{26}	Electron number density n_e in units of 10^{26} cm^{-3}. For example, $n_{26} = 3$ means $n_e = 3 \times 10^{26}$ cm^{-3}. Hyphens indicate no appreciable changes ($\leqslant$20%) in the rates over the entire range $10^{26} \leqslant n_e \leqslant 3 \times 10^{27}$ cm^{-3}.
T_8	Temperature T in units of 10^8 K

This table gives the total effective rates as a function of temperature for (bound- and continuum-state) β^- decays *in units of s*$^{-1}$. The laboratory values are for β^- decay. [The nuclei energetically stable against β^- decay are indicated as (stable), while (0.) means that no β^- transition has been observed.] For the nuclei marked Appdx and III, see the Appendix and Table III (note at the end), respectively.

All the effective rates are those under the condition of thermal equilibrium.

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

This table gives the total effective rates as a function of temperature for orbital-electron capture, free-electron capture, and β^+ decay. The symbols and units used are identical to those in Table I. The laboratory values are for orbital-electron capture plus β^+ decay. [The nuclei energetically stable against orbital-electron capture are indicated as (stable), while (0.) means that no electron capture has been observed.] For the nuclei marked Appdx and IV, see the Appendix and Table IV (note at the end), respectively.

TABLE III. Estimated Log *ft* Values for Unknown β^- Transitions

^{A}Z	Mass number and element
i = $J_1\pi_1(E_1^*)\ J_2\pi_2(E_2^*) \cdots$	Spin J_I, parity π_I (excitation energy E_I^* in keV) of the initial levels $I = 1, 2, \ldots$
f = $J_1\pi_1(E_1^*)\ J_2\pi_2(E_2^*) \cdots$	Spin J_F, parity π_F (excitation energy E_F^* in keV) of the final levels $F = 1, 2, \ldots$
[*I*, *F*]	Estimated log *ft* value for the transition from the initial level *I* to the final level *F*

This table gives the estimated log *ft* values for unknown β^- transitions, and spins, parities, and excitation energies of the relevant initial and final levels. To economize on space, the following abbreviations are used:

[*IF*]	=[*I*, *F*] if both *I* and $F < 10$
;	Delimits different transitions with the same log *ft* values. For example, [12;34] = *c* is equivalent to [12] = [34] = *c*
~	=from/through. For example, [1~2, 3~4] = *c* is equivalent to [13;14;23;24] = *c*
[*I*, a], [*I*, nu], or [*I*, u]	All the allowed, non-unique first-forbidden, or unique first-forbidden transitions possible from the initial level *I*, respectively

EXPLANATION OF TABLES continued

[a, F] [nu, F], or [u, F]	All the allowed, non-unique first-forbidden or unique first-forbidden transitions possible to the final level F, respectively
[a], [nu], or [u]	All the allowed, non-unique first-forbidden, or unique first-forbidden transitions possible between initial and final levels

Should there exist conflicts of [I, F] assignments, *the value defined earliest holds.* For example, in ^{60}Fe, [11] = 7.0 [a] = 7.5 means the logft is 7.0 for the allowed transition [11] and 7.5 for all other allowed transitions.

Those transitions which are thought to be negligible because of energetics and/or selection rules (including the Alaga rules) are excluded.

TABLE IV. Estimated Logft Values for Unknown $\beta^+\epsilon$ Transitions

This table gives the estimated logft values for unknown $\beta^+\epsilon$ (β^+ plus orbital-electron capture) transitions. The symbols used are identical to those in Table III.

TABLE V. β^- Rate Enhancement Due to Bound-State Decay

This table gives the rate enhancement factor $(\lambda_{b\beta^-} + \lambda_{c\beta^-})/\lambda_{c\beta^-}$, where $\lambda_{b\beta^-}$ and $\lambda_{c\beta^-}$ are the bound-state and continuum-state β^--decay rates, respectively. Selected for presentation are nuclei for which the enhancement factor is greater than 5.0 at $T = 3 \times 10^8$ K and $n_e = 10^{27}$ cm^{-3}, which are typical s-process conditions. The symbol ∞ means that the factor exceeds 2×10^5. Other notations are the same as in Table I.

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{59}Fe (1.80E-07)	-	1.80E-07	1.80E-07	1.80E-07	1.80E-07	1.81E-07	1.88E-07	
^{60}Fe (1.46E-14)	-	1.46E-14	1.46E-14	1.46E-14	1.46E-14	1.46E-14	3.85E-14	
^{60}Co (4.17E-09)	-	4.17E-09	5.56E-09	4.52E-08	1.28E-07	2.15E-07	2.92E-07	
^{61}Co (1.17E-04)	-	1.17E-04	1.17E-04	1.17E-04	1.17E-04	1.17E-04	1.17E-04	
^{63}Ni (2.20E-10)	1	3.91E-10	4.89E-10	6.44E-10	1.75E-09	4.46E-09	8.26E-09	
	3	3.16E-10	4.58E-10	6.29E-10	1.73E-09	4.44E-09	8.26E-09	
	10	3.08E-10	3.69E-10	5.95E-10	1.69E-09	4.39E-09	8.19E-09	
	30	2.20E-10	3.10E-10	5.44E-10	1.63E-09	4.23E-09	7.97E-09	
^{65}Ni (7.64E-05)	-	7.64E-05	7.64E-05	7.65E-05	7.66E-05	7.68E-05	7.72E-05	
^{66}Ni (3.51E-06)	-	3.51E-06	3.51E-06	3.51E-06	3.51E-06	3.51E-06	3.51E-06	
^{64}Cu (6.06E-06)	-	6.06E-06	6.06E-06	6.06E-06	6.04E-06	5.96E-06	5.81E-06	
^{66}Cu (2.27E-03)	-	2.27E-03	2.27E-03	2.27E-03	2.26E-03	2.25E-03	2.21E-03	
^{67}Cu (3.11E-06)	-	3.11E-06	3.11E-06	3.11E-06	3.11E-06	3.11E-06	3.11E-06	
^{69}Zn (2.06E-04)	-	2.06E-04	2.06E-04	2.06E-04	2.06E-04	2.06E-04	2.06E-04	
^{71}Zn (4.81E-03)	-	4.81E-03	4.81E-03	4.81E-03	4.76E-03	4.58E-03	4.26E-03	
^{72}Zn (4.14E-06)	-	4.14E-06	4.14E-06	4.14E-06	4.14E-06	4.14E-06	4.14E-06	
^{70}Ga (5.46E-04)	-	5.46E-04	5.46E-04	5.46E-04	5.46E-04	5.46E-04	5.46E-04	
^{72}Ga (1.37E-05)	-	1.40E-05	1.55E-05	2.04E-05	7.15E-05	2.55E-04	5.89E-04	
^{73}Ga (3.95E-05)	-	3.95E-05	3.95E-05	3.95E-05	3.97E-05	4.07E-05	4.35E-05	
^{75}Ge (1.40E-04)	-	1.40E-04	1.40E-04	1.39E-04	1.37E-04	1.29E-04	1.17E-04	
^{77}Ge (1.70E-05)	-	1.70E-05	1.70E-05	1.73E-05	2.27E-05	4.46E-05	8.83E-05	
^{78}Ge (1.33E-04)	-	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	1.33E-04	
^{76}As (7.32E-06)	-	7.52E-06	4.21E-05	4.90E-04	1.21E-03	1.90E-03	2.44E-03	
^{77}As (4.96E-06)	-	4.96E-06	4.96E-06	4.96E-06	4.97E-06	4.98E-06	5.03E-06	
^{78}As (1.27E-04)	-	1.27E-04	1.27E-04	1.27E-04	1.28E-04	1.48E-04	2.35E-04	
^{79}Se (3.38E-13)	1	2.62E-13	3.97E-12	1.00E-09	6.36E-09	1.58E-08	2.65E-08	Appdx
	3	2.54E-13	3.79E-12	9.87E-10	6.35E-09	1.56E-08	2.64E-08	
	10	2.45E-13	3.47E-12	9.58E-10	6.24E-09	1.54E-08	2.61E-08	
	30	2.37E-13	3.32E-12	8.89E-10	5.94E-09	1.50E-08	2.56E-08	
^{81}Se (6.24E-04)	-	6.24E-04	6.24E-04	6.18E-04	5.81E-04	5.20E-04	4.57E-04	
^{82}Se (stable)	-	0.	0.	1.95E-23	6.22E-18	3.48E-15	1.56E-13	
^{80}Br (6.02E-04)	-	6.02E-04	5.89E-04	4.94E-04	3.90E-04	3.12E-04	2.56E-04	
^{82}Br (5.45E-06)	-	5.45E-06	5.67E-06	1.85E-05	5.91E-05	1.12E-04	1.65E-04	
^{83}Br (8.06E-05)	-	8.06E-05	8.06E-05	8.06E-05	8.06E-05	8.06E-05	8.05E-05	
^{85}Kr (2.05E-09)	-	2.05E-09	2.05E-09	2.05E-09	2.10E-09	3.03E-09	7.79E-09	Appdx
^{87}Kr (1.52E-04)	-	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04	
^{88}Kr (6.78E-05)	-	6.78E-05	6.78E-05	6.78E-05	6.78E-05	6.78E-05	6.78E-05	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^AZ (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{86}Rb (4.22E-07)	-	4.22E-07	4.22E-07	4.22E-07	4.22E-07	4.23E-07	4.25E-07	
^{87}Rb (4.58E-19)	1	4.39E-19	5.27E-19	7.51E-19	4.84E-16	2.38E-14	2.52E-13	
	3	4.30E-19	4.98E-19	7.42E-19	4.83E-16	2.37E-14	2.52E-13	
	10	4.12E-19	4.53E-19	7.23E-19	4.80E-16	2.36E-14	2.51E-13	
	30	4.07E-19	4.53E-19	6.73E-19	4.74E-16	2.35E-14	2.49E-13	
^{88}Rb (6.49E-04)	-	6.47E-04	6.18E-04	5.25E-04	4.66E-04	4.32E-04	4.11E-04	
^{89}Sr (1.59E-07)	-	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	
^{90}Sr (7.63E-10)	-	7.63E-10	7.63E-10	7.63E-10	7.63E-10	7.63E-10	7.63E-10	
^{91}Sr (2.03E-05)	-	2.03E-05	2.03E-05	2.02E-05	2.01E-05	1.99E-05	1.96E-05	
^{92}Sr (7.10E-05)	-	7.10E-05	7.10E-05	7.10E-05	7.10E-05	7.10E-05	7.10E-05	
^{90}Y (3.00E-06)	-	3.00E-06	3.00E-06	3.00E-06	3.00E-06	2.99E-06	2.97E-06	
^{91}Y (1.37E-07)	-	1.37E-07	1.37E-07	1.37E-07	1.37E-07	1.37E-07	1.37E-07	
^{92}Y (5.44E-05)	-	5.44E-05	5.44E-05	5.44E-05	5.44E-05	5.44E-05	5.42E-05	
^{93}Y (1.89E-05)	-	1.89E-05	1.89E-05	1.89E-05	1.89E-05	1.89E-05	1.89E-05	
^{93}Zr (1.46E-14)	1	1.58E-14	2.08E-14	2.28E-14	5.48E-14	4.42E-13	1.99E-12	
	3	1.48E-14	1.85E-14	2.23E-14	5.37E-14	4.38E-13	1.98E-12	
	10	1.42E-14	1.59E-14	2.07E-14	5.18E-14	4.31E-13	1.96E-12	
	30	1.30E-14	1.35E-14	1.71E-14	4.87E-14	4.20E-13	1.93E-12	
^{95}Zr (1.25E-07)	-	1.25E-07	1.25E-07	1.25E-07	1.25E-07	1.25E-07	1.25E-07	
^{97}Zr (1.14E-05)	-	1.14E-05	1.14E-05	1.14E-05	1.14E-05	1.14E-05	1.14E-05	
^{94}Nb (1.10E-12)	-	3.71E-10	4.29E-08	4.35E-07	8.51E-07	1.11E-06	1.26E-06	
^{95}Nb (2.29E-07)	-	2.29E-07	2.29E-07	2.29E-07	2.29E-07	2.29E-07	2.29E-07	
^{96}Nb (8.23E-06)	-	8.23E-06	8.19E-06	7.84E-06	7.70E-06	8.45E-06	1.02E-05	
^{97}Nb (1.60E-04)	-	1.60E-04	1.60E-04	1.60E-04	1.60E-04	1.60E-04	1.60E-04	
^{99}Mo (2.92E-06)	-	2.92E-06	2.92E-06	3.06E-06	4.38E-06	1.04E-05	2.52E-05	
^{98}Tc (5.23E-15)	-	3.76E-10	4.45E-09	1.37E-08	2.04E-08	2.77E-08	3.61E-08	
^{99}Tc (1.03E-13)	1	1.13E-13	2.24E-13	3.11E-10	4.99E-09	2.00E-08	4.58E-08	Appdx
	3	1.11E-13	2.06E-13	3.06E-10	4.94E-09	2.00E-08	4.57E-08	
	10	1.10E-13	1.89E-13	2.95E-10	4.85E-09	1.97E-08	4.53E-08	
	30	1.05E-13	1.76E-13	2.74E-10	4.67E-09	1.93E-08	4.45E-08	
^{103}Ru (2.04E-07)	-	3.61E-06	4.37E-06	4.77E-06	4.90E-06	4.94E-06	4.96E-06	
^{105}Ru (4.34E-05)	-	4.63E-05	7.21E-05	1.17E-04	1.38E-04	1.46E-04	1.49E-04	
^{106}Ru (2.19E-08)	1	3.00E-08	1.54E-07	2.07E-07	2.14E-07	2.16E-07	2.22E-07	
	3	2.45E-08	9.84E-08	1.91E-07	2.05E-07	2.11E-07	2.18E-07	
	10	2.28E-08	4.81E-08	1.57E-07	1.85E-07	1.97E-07	2.07E-07	
	30	1.41E-08	2.23E-08	9.80E-08	1.52E-07	1.74E-07	1.88E-07	
^{104}Rh (1.63E-02)	-	1.63E-02	1.63E-02	1.49E-02	1.26E-02	1.04E-02	8.70E-03	
^{105}Rh (5.44E-06)	-	5.44E-06	5.44E-06	5.44E-06	5.42E-06	5.36E-06	5.26E-06	
^{106}Rh (2.33E-02)	-	2.33E-02	2.33E-02	2.32E-02	2.29E-02	2.19E-02	2.04E-02	

TABLE I. Effective Rates for β^- Decay
See page 383 for Explanation of Tables

^AZ (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{107}Pd (3.38E-15)	1	4.16E-15	8.19E-15	1.37E-12	3.20E-11	4.15E-10	2.29E-09	
	3	3.77E-15	6.35E-15	1.30E-12	3.13E-11	4.12E-10	2.28E-09	
	10	3.54E-15	5.13E-15	1.14E-12	2.98E-11	4.01E-10	2.23E-09	
	30	2.51E-15	3.89E-15	9.09E-13	2.73E-11	3.83E-10	2.16E-09	
^{109}Pd (1.43E-05)	-	1.43E-05	1.43E-05	1.43E-05	1.43E-05	1.42E-05	1.42E-05	
^{111}Pd (5.25E-04)	-	5.25E-04	5.25E-04	5.25E-04	5.24E-04	5.18E-04	5.07E-04	
^{112}Pd (9.13E-06)	1	1.04E-05	1.36E-05	1.54E-05	1.57E-05	1.58E-05	1.58E-05	
	3	1.03E-05	1.20E-05	1.49E-05	1.55E-05	1.57E-05	1.58E-05	
	10	1.03E-05	1.08E-05	1.38E-05	1.49E-05	1.53E-05	1.55E-05	
	30	9.64E-06	1.01E-05	1.22E-05	1.40E-05	1.47E-05	1.51E-05	
^{108}Ag (4.87E-03)	-	4.88E-03	4.87E-03	4.76E-03	4.24E-03	3.49E-03	2.80E-03	
^{110}Ag (2.83E-02)	-	1.27E-02	1.16E-02	1.11E-02	1.07E-02	1.00E-02	9.22E-03	
^{111}Ag (1.08E-06)	-	1.08E-06	1.19E-06	4.52E-06	1.00E-05	1.42E-05	1.69E-05	
^{112}Ag (6.13E-05)	-	1.33E-03	1.03E-02	2.66E-02	3.55E-02	4.06E-02	4.39E-02	
^{113}Ag (3.59E-05)	-	3.62E-05	8.71E-05	5.23E-04	8.86E-04	1.09E-03	1.21E-03	
^{113}Cd (2.44E-24)	1	2.42E-24	4.98E-22	3.18E-15	3.97E-12	2.98E-10	4.15E-09	Appdx
	3	2.39E-24	4.73E-22	3.12E-15	3.95E-12	2.98E-10	4.13E-09	
	10	2.39E-24	4.58E-22	2.99E-15	3.90E-12	2.95E-10	4.12E-09	
	30	2.29E-24	4.47E-22	2.80E-15	3.81E-12	2.92E-10	4.08E-09	
^{115}Cd (3.61E-06)	-	3.61E-06	3.61E-06	3.61E-06	3.60E-06	3.61E-06	3.74E-06	Appdx
^{117}Cd (8.02E-05)	-	8.02E-05	8.02E-05	8.02E-05	7.94E-05	7.76E-05	7.62E-05	
^{114}In (9.46E-03)	-	9.46E-03	9.46E-03	9.46E-03	9.43E-03	9.27E-03	8.89E-03	
^{115}In (4.98E-23)	-	4.98E-23	5.46E-23	1.44E-15	9.63E-13	2.49E-11	1.76E-10	Appdx
^{116}In (4.92E-02)	-	4.92E-02	4.92E-02	4.90E-02	4.79E-02	4.48E-02	4.03E-02	
^{117}In (2.75E-04)	-	2.75E-04	2.75E-04	2.75E-04	2.75E-04	2.75E-04	2.75E-04	
^{121}Sn (7.10E-06)	-	4.19E-06	2.91E-06	2.29E-06	2.09E-06	1.98E-06	1.91E-06	Appdx
^{123}Sn (6.22E-08)	-	3.73E-07	5.42E-06	2.13E-05	3.28E-05	4.04E-05	4.55E-05	Appdx
^{125}Sn (8.34E-07)	-	1.52E-06	1.73E-05	7.78E-05	1.26E-04	1.59E-04	1.83E-04	
^{126}Sn (2.20E-13)	1	2.42E-13	3.21E-13	3.99E-13	4.07E-13	4.11E-13	4.15E-13	
	3	2.38E-13	2.72E-13	3.81E-13	4.01E-13	4.08E-13	4.09E-13	
	10	2.37E-13	2.51E-13	3.40E-13	3.82E-13	3.96E-13	4.04E-13	
	30	2.25E-13	2.33E-13	2.87E-13	3.50E-13	3.76E-13	3.90E-13	
^{127}Sn (9.17E-05)	-	3.49E-04	5.20E-04	6.36E-04	6.79E-04	7.02E-04	7.16E-04	
^{122}Sb (2.90E-06)	-	2.90E-06	2.90E-06	3.80E-06	1.09E-05	2.40E-05	3.74E-05	
^{124}Sb (1.33E-07)	-	1.73E-04	4.65E-04	6.83E-04	7.60E-04	7.98E-04	8.21E-04	Appdx
^{125}Sb (8.13E-09)	-	8.13E-09	8.13E-09	8.13E-09	8.29E-09	1.20E-08	3.48E-08	
^{126}Sb (6.47E-07)	-	7.04E-06	4.74E-05	1.20E-04	1.86E-04	2.67E-04	3.54E-04	
^{127}Sb (2.08E-06)	-	2.08E-06	2.08E-06	2.08E-06	2.08E-06	2.08E-06	2.10E-06	
^{128}Sb (2.12E-05)	-	2.82E-05	8.90E-05	2.21E-04	3.23E-04	4.16E-04	5.01E-04	
^{129}Sb (4.38E-05)	-	4.38E-05	4.38E-05	4.38E-05	4.38E-05	4.38E-05	4.38E-05	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{127}Te (2.06E-05)	-	2.06E-05	2.06E-05	1.98E-05	1.77E-05	1.53E-05	1.33E-05	
^{129}Te (1.67E-04)	-	1.67E-04	1.67E-04	1.66E-04	1.59E-04	1.47E-04	1.33E-04	
^{130}Te (stable)	1	0.	0.	0.	1.61E-21	5.47E-18	7.20E-16	
	3	0.	0.	0.	1.59E-21	5.39E-18	7.12E-16	
	10	0.	0.	0.	1.52E-21	5.31E-18	7.05E-16	
	30	0.	0.	0.	1.42E-21	5.08E-18	6.85E-16	
^{131}Te (4.62E-04)	-	4.62E-04	4.62E-04	4.62E-04	4.61E-04	4.55E-04	4.42E-04	
^{132}Te (2.52E-06)	1	2.56E-06	3.43E-06	4.83E-06	4.95E-06	5.02E-06	5.06E-06	
	3	2.50E-06	2.99E-06	4.54E-06	4.87E-06	4.92E-06	4.98E-06	
	10	2.50E-06	2.67E-06	3.90E-06	4.58E-06	4.80E-06	4.90E-06	
	30	2.34E-06	2.46E-06	3.15E-06	4.09E-06	4.49E-06	4.70E-06	
^{126}I (2.83E-07)	-	2.84E-07	3.28E-07	1.44E-06	3.59E-06	5.74E-06	7.56E-06	
^{128}I (4.35E-04)	-	4.33E-04	4.09E-04	3.33E-04	2.73E-04	2.24E-04	1.87E-04	
^{129}I (1.37E-15)	1	1.17E-10	4.00E-09	2.79E-08	4.51E-08	5.65E-08	6.41E-08	
	3	1.13E-10	3.31E-09	2.58E-08	4.41E-08	5.51E-08	6.34E-08	
	10	1.13E-10	2.91E-09	2.14E-08	4.10E-08	5.35E-08	6.22E-08	
	30	1.05E-10	2.71E-09	1.65E-08	3.57E-08	4.95E-08	5.89E-08	
^{130}I (1.56E-05)	-	1.56E-05	1.59E-05	2.09E-05	2.86E-05	3.56E-05	4.12E-05	
^{131}I (9.98E-07)	-	9.98E-07	9.98E-07	1.01E-06	1.31E-06	2.30E-06	4.05E-06	
^{132}I (8.44E-05)	-	8.56E-05	9.82E-05	1.28E-04	1.44E-04	1.58E-04	1.82E-04	
^{133}I (9.21E-06)	-	9.21E-06	9.21E-06	9.21E-06	9.21E-06	9.22E-06	9.26E-06	
^{134}I (2.20E-04)	-	2.20E-04	2.20E-04	2.18E-04	2.23E-04	2.32E-04	2.44E-04	
^{135}I (2.91E-05)	-	2.91E-05	2.91E-05	2.91E-05	2.91E-05	2.91E-05	2.91E-05	
^{133}Xe (1.53E-06)	1	1.63E-06	1.87E-06	2.42E-06	2.48E-06	2.49E-06	2.47E-06	
	3	1.61E-06	1.71E-06	2.31E-06	2.44E-06	2.45E-06	2.45E-06	
	10	1.61E-06	1.63E-06	2.07E-06	2.33E-06	2.41E-06	2.41E-06	
	30	1.56E-06	1.60E-06	1.81E-06	2.15E-06	2.30E-06	2.31E-06	
^{135}Xe (2.12E-05)	-	2.12E-05	2.12E-05	2.12E-05	2.12E-05	2.12E-05	2.11E-05	
^{132}Cs (2.48E-08)	-	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	III
^{134}Cs (1.05E-08)	-	1.02E-08	3.28E-08	6.31E-07	2.11E-06	4.81E-06	8.89E-06	Appdx
^{135}Cs (7.32E-15)	1	8.12E-15	1.04E-14	6.91E-13	8.64E-11	9.77E-10	4.18E-09	
	3	7.90E-15	8.78E-15	6.65E-13	8.55E-11	9.65E-10	4.15E-09	
	10	7.92E-15	8.04E-15	6.09E-13	8.24E-11	9.52E-10	4.08E-09	
	30	7.39E-15	7.81E-15	5.52E-13	7.74E-11	9.17E-10	3.96E-09	
^{136}Cs (6.12E-07)	-	6.12E-07	6.12E-07	6.12E-07	6.12E-07	6.12E-07	6.12E-07	Appdx III
^{137}Cs (7.28E-10)	-	7.28E-10	7.28E-10	7.28E-10	7.35E-10	1.30E-09	8.84E-09	
^{139}Ba (1.39E-04)	-	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	
^{140}Ba (6.27E-07)	-	6.27E-07	6.27E-07	6.27E-07	6.27E-07	6.27E-07	6.27E-07	
^{138}La (6.38E-20)	-	5.91E-15	2.71E-11	1.97E-09	1.12E-08	6.10E-08	2.49E-07	
^{140}La (4.78E-06)	-	4.78E-06	4.87E-06	5.54E-06	5.98E-06	6.18E-06	6.29E-06	
^{141}La (4.94E-05)	-	4.94E-05	4.94E-05	4.94E-05	4.94E-05	4.93E-05	4.93E-05	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{142}La (1.24E-04)	-	1.24E-04	1.24E-04	1.24E-04	1.21E-04	1.16E-04	1.10E-04	
^{141}Ce (2.47E-07)	-	2.47E-07	2.47E-07	2.47E-07	2.47E-07	2.47E-07	2.47E-07	
^{143}Ce (5.83E-06)	-	5.79E-06	5.52E-06	5.13E-06	4.96E-06	4.87E-06	4.82E-06	
^{144}Ce (2.82E-08)	1	3.09E-08	3.53E-08	5.44E-08	5.72E-08	5.77E-08	5.83E-08	
	3	3.03E-08	3.21E-08	5.05E-08	5.53E-08	5.68E-08	5.77E-08	
	10	3.05E-08	3.06E-08	4.21E-08	5.20E-08	5.52E-08	5.59E-08	
	30	2.90E-08	3.02E-08	3.51E-08	4.58E-08	5.03E-08	5.29E-08	
^{142}Pr (1.00E-05)	-	5.12E-06	3.83E-06	2.98E-06	2.56E-06	2.29E-06	2.11E-06	
^{143}Pr (5.91E-07)	-	5.91E-07	5.91E-07	6.01E-07	6.21E-06	6.41E-07	6.58E-07	
^{144}Pr (6.68E-04)	-	6.68E-04	6.63E-04	5.49E-04	4.24E-04	3.70E-04	3.50E-04	
^{145}Pr (3.22E-05)	-	3.22E-05	3.22E-05	3.24E-05	3.29E-05	3.34E-05	3.38E-05	
^{147}Nd (7.29E-07)	-	7.29E-07	7.29E-07	7.29E-07	7.30E-07	7.36E-07	7.45E-07	
^{149}Nd (1.11E-04)	-	1.11E-04	1.11E-04	1.11E-04	1.09E-04	1.05E-04	9.95E-05	
^{150}Nd (stable)	1	0.	2.07E-18	3.23E-14	4.29E-13	1.43E-12	2.74E-12	
	3	0.	4.07E-19	2.54E-14	3.94E-13	1.35E-12	2.63E-12	
	10	0.	2.56E-20	1.30E-14	3.17E-13	1.19E-12	2.39E-12	
	30	0.	2.01E-21	3.96E-15	2.01E-13	9.03E-13	1.97E-12	
^{146}Pm (1.48E-09)	-	1.48E-09	1.48E-09	1.48E-09	1.48E-09	1.48E-09	1.48E-09	III
^{147}Pm (8.37E-09)	1	9.28E-09	1.06E-08	1.96E-08	2.09E-08	2.07E-08	2.05E-08	
	3	9.02E-09	9.66E-09	1.75E-08	2.00E-08	2.04E-08	2.03E-08	
	10	9.04E-09	9.16E-09	1.34E-08	1.83E-08	1.92E-08	1.95E-08	
	30	8.56E-09	9.04E-09	1.07E-08	1.63E-08	1.71E-08	1.81E-08	
^{148}Pm (1.49E-06)	-	1.49E-06	1.49E-06	1.51E-06	1.54E-06	1.54E-06	1.51E-06	Appdx
^{149}Pm (3.63E-06)	-	3.63E-06	3.63E-06	3.62E-06	3.61E-06	3.64E-06	3.81E-06	
^{150}Pm (7.18E-05)	-	7.18E-05	7.18E-05	7.18E-05	7.18E-05	7.18E-05	7.18E-05	III
^{151}Pm (6.78E-06)	-	6.78E-06	6.78E-06	7.24E-06	1.20E-05	2.31E-05	3.79E-05	
^{151}Sm (2.44E-10)	1	2.67E-10	4.04E-10	2.88E-09	9.06E-09	1.87E-08	2.96E-08	Appdx
	3	2.39E-10	2.93E-10	2.38E-09	8.52E-09	1.82E-08	2.91E-08	
	10	2.37E-10	2.42E-10	1.48E-09	7.51E-09	1.70E-08	2.77E-08	
	30	2.00E-10	2.30E-10	9.10E-10	6.04E-09	1.46E-08	2.54E-08	
^{153}Sm (4.11E-06)	-	4.34E-06	4.75E-06	6.02E-06	7.05E-06	7.96E-06	8.93E-06	
^{152}Eu (4.60E-10)	-	4.85E-10	1.03E-07	9.84E-06	4.19E-05	7.61E-05	1.00E-04	Appdx
^{154}Eu (2.50E-09)	-	2.50E-09	6.16E-09	2.10E-07	7.52E-07	1.25E-06	1.53E-06	
^{155}Eu (4.48E-09)	1	5.09E-09	6.11E-09	2.07E-08	5.82E-08	1.27E-07	2.12E-07	
	3	4.86E-09	5.43E-09	1.78E-08	5.56E-08	1.25E-07	2.10E-07	
	10	4.74E-09	5.02E-09	1.27E-08	5.09E-08	1.19E-07	2.03E-07	
	30	4.51E-09	4.94E-09	9.81E-09	4.27E-08	1.08E-07	1.91E-07	
^{156}Eu (5.35E-07)	-	1.17E-05	1.33E-04	3.24E-04	3.73E-04	3.78E-04	3.71E-04	
^{157}Eu (1.27E-05)	-	1.27E-05	1.27E-05	1.26E-05	1.25E-05	1.32E-05	1.55E-05	
^{157}Gd (stable)	1	7.61E-19	5.74E-14	3.67E-11	1.29E-10	2.16E-10	2.82E-10	
	3	2.52E-19	1.02E-14	2.89E-11	1.17E-10	2.04E-10	2.71E-10	
	10	5.52E-20	8.44E-16	1.13E-11	9.77E-11	1.78E-10	2.45E-10	
	30	1.29E-23	5.09E-17	3.00E-12	4.94E-11	1.31E-10	2.01E-10	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{159}Gd (1.04E-05)	-	1.04E-05	1.03E-05	1.02E-05	9.92E-06	9.58E-06	9.28E-06	
^{160}Gd (stable)	1	0.	5.43E-20	1.40E-15	1.56E-13	1.42E-12	5.02E-12	
	3	0.	8.29E-21	1.15E-15	1.44E-13	1.37E-12	4.90E-12	
	10	0.	4.62E-22	5.84E-16	1.26E-13	1.24E-12	4.58E-12	
	30	0.	1.27E-22	3.15E-16	7.59E-14	9.96E-13	4.02E-12	
^{158}Tb (2.64E-11)	-	2.64E-11	3.48E-11	5.75E-09	4.76E-08	1.27E-07	2.16E-07	
^{160}Tb (1.11E-07)	-	1.11E-07	2.49E-07	5.52E-06	1.76E-05	3.05E-05	4.16E-05	Appdx
^{161}Tb (1.16E-06)	1	1.26E-06	1.30E-06	1.69E-06	1.76E-06	1.74E-06	1.77E-06	
	3	1.25E-06	1.27E-06	1.58E-06	1.71E-06	1.72E-06	1.76E-06	
	10	1.23E-06	1.25E-06	1.39E-06	1.62E-06	1.66E-06	1.72E-06	
	30	1.23E-06	1.25E-06	1.31E-06	1.43E-06	1.56E-06	1.65E-06	
^{163}Dy (stable)	1	4.02E-11	5.20E-09	1.56E-07	1.99E-07	2.19E-07	2.38E-07	Appdx
	3	4.33E-12	7.85E-10	1.09E-07	1.79E-07	2.08E-07	2.29E-07	
	10	1.54E-15	3.99E-11	4.14E-08	1.37E-07	1.81E-07	2.09E-07	
	30	1.15E-15	9.64E-12	1.07E-08	6.56E-08	1.33E-07	1.73E-07	
^{165}Dy (8.26E-05)	-	8.26E-05	8.26E-05	8.27E-05	8.29E-05	8.29E-05	8.29E-05	
^{166}Dy (2.36E-06)	1	2.57E-06	2.71E-06	4.32E-06	4.80E-06	5.07E-06	5.47E-06	III
	3	2.54E-06	2.63E-06	3.80E-06	4.62E-06	4.97E-06	5.40E-06	
	10	2.48E-06	2.57E-06	3.10E-06	4.17E-06	4.70E-06	5.21E-06	
	30	2.48E-06	2.56E-06	2.78E-06	3.39E-06	4.23E-06	4.88E-06	
^{164}Ho (1.67E-04)	-	1.67E-04	1.65E-04	1.53E-04	1.39E-04	1.26E-04	1.13E-04	
^{166}Ho (7.18E-06)	-	1.26E-06	8.15E-07	1.84E-06	4.55E-06	7.66E-06	1.05E-05	
^{167}Ho (6.21E-05)	-	6.21E-05	6.21E-05	6.21E-05	6.21E-05	6.21E-05	6.20E-05	
^{169}Er (8.53E-07)	1	9.61E-07	1.02E-06	1.48E-06	1.34E-06	1.10E-06	9.20E-07	
	3	9.50E-07	9.89E-07	1.27E-06	1.29E-06	1.08E-06	9.01E-07	
	10	9.37E-07	9.61E-07	1.05E-06	1.14E-06	1.02E-06	8.74E-07	
	30	9.27E-07	9.59E-07	9.62E-07	9.23E-07	9.06E-07	8.14E-07	
^{171}Er (2.56E-05)	-	2.56E-05	2.56E-06	2.57E-05	2.61E-05	2.67E-05	2.77E-05	
^{172}Er (3.89E-06)	-	3.89E-06	3.89E-06	4.06E-06	4.52E-06	5.00E-06	5.36E-06	III
^{170}Tm (6.24E-08)	-	6.24E-08	6.20E-08	5.95E-08	6.77E-08	1.11E-07	1.98E-07	Appdx
^{171}Tm (1.14E-08)	1	1.04E-08	1.23E-08	6.03E-08	7.30E-08	7.26E-08	6.99E-08	
	3	9.57E-09	1.07E-08	4.11E-08	6.64E-08	6.96E-08	6.74E-08	
	10	9.16E-09	9.28E-09	2.05E-08	5.07E-08	6.16E-08	6.31E-08	
	30	8.58E-09	9.03E-09	1.46E-08	2.73E-08	4.71E-08	5.42E-08	
^{172}Tm (3.03E-06)	-	3.03E-06	3.03E-06	3.04E-06	3.06E-06	3.07E-06	3.06E-06	
^{173}Tm (2.35E-05)	-	2.25E-05	2.23E-05	2.22E-05	2.19E-05	2.12E-05	2.04E-05	
^{175}Yb (1.91E-06)	1	2.27E-06	2.46E-06	5.25E-06	6.28E-06	6.52E-06	6.63E-06	
	3	2.23E-06	2.37E-06	4.08E-06	5.86E-06	6.32E-06	6.49E-06	
	10	2.21E-06	2.28E-06	2.93E-06	4.84E-06	5.78E-06	6.19E-06	
	30	2.17E-06	2.27E-06	2.56E-06	3.39E-06	4.82E-06	5.57E-06	
^{177}Yb (1.01E-04)	-	1.01E-04	1.01E-04	1.06E-04	1.35E-04	1.93E-04	2.64E-04	
^{176}Lu (6.10E-19)	-	2.26E-18	4.16E-12	6.94E-09	9.56E-08	4.17E-07	1.15E-06	Appdx
^{177}Lu (1.20E-06)	1	1.29E-06	1.36E-06	2.06E-06	2.67E-06	3.79E-06	5.58E-06	
	3	1.29E-06	1.33E-06	1.75E-06	2.54E-06	3.72E-06	5.51E-06	
	10	1.28E-06	1.30E-06	1.48E-06	2.24E-06	3.51E-06	5.37E-06	
	30	1.26E-06	1.30E-06	1.37E-06	1.83E-06	3.15E-06	5.06E-06	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{179}Hf (stable)	1	0.	7.43E-18	1.06E-11	9.00E-10	7.32E-09	2.47E-08	
	3	0.	4.87E-18	6.35E-12	7.97E-10	6.96E-09	2.39E-08	
	10	0.	3.82E-18	2.83E-12	5.66E-10	6.02E-09	2.21E-08	
	30	0.	3.67E-18	1.28E-12	2.59E-10	4.33E-09	1.85E-08	
^{181}Hf (1.89E-07)	-	1.89E-07	2.46E-07	2.53E-06	6.39E-06	9.06E-06	1.06E-05	Appdx
^{182}Hf (2.44E-15)	1	2.52E-15	5.52E-13	2.79E-10	2.05E-09	4.78E-09	7.54E-09	
	3	2.51E-15	5.37E-13	2.22E-10	1.91E-09	4.64E-09	7.39E-09	
	10	2.47E-15	5.16E-13	1.77E-10	1.59E-09	4.26E-09	7.10E-09	
	30	2.36E-15	5.17E-13	1.53E-10	1.18E-09	3.59E-09	6.44E-09	
^{180}Ta (4.28E-06)	-	4.28E-06	4.24E-06	3.74E-06	2.97E-06	2.36E-06	1.95E-06	Appdx
^{182}Ta (6.98E-08)	-	8.47E-08	1.55E-07	2.39E-07	2.69E-07	2.77E-07	2.74E-07	
^{183}Ta (1.57E-06)	-	1.57E-06	1.57E-06	1.62E-06	1.78E-06	1.97E-06	2.14E-06	
^{184}Ta (2.21E-05)	-	2.21E-05	2.21E-05	2.19E-05	2.14E-05	2.10E-05	2.11E-05	
^{185}W (1.07E-07)	1	1.18E-07	1.20E-07	1.58E-05	1.84E-07	1.95E-07	2.05E-07	
	3	1.18E-07	1.19E-07	1.35E-07	1.74E-07	1.88E-07	2.02E-07	
	10	1.18E-07	1.16E-07	1.19E-07	1.51E-07	1.78E-07	1.96E-07	
	30	1.16E-07	1.16E-07	1.10E-07	1.25E-07	1.57E-07	1.82E-07	
^{187}W (8.06E-06)	-	8.06E-06	8.06E-06	8.23E-06	8.78E-06	9.54E-06	1.03E-05	
^{188}W (1.16E-07)	1	1.17E-07	1.25E-07	1.94E-07	2.42E-07	2.65E-07	2.88E-07	
	3	1.16E-07	1.22E-07	1.59E-07	2.25E-07	2.55E-07	2.82E-07	
	10	1.16E-07	1.18E-07	1.35E-07	1.89E-07	2.37E-07	2.72E-07	
	30	1.14E-07	1.19E-07	1.20E-07	1.47E-07	2.03E-07	2.49E-07	
^{186}Re (1.96E-06)	-	1.96E-06	1.96E-06	2.00E-06	2.09E-06	2.21E-06	2.28E-06	
^{187}Re (5.49E-19)	1	9.48E-15	2.82E-12	9.36E-10	1.91E-09	5.02E-09	1.31E-08	Appdx
	3	3.65E-18	2.76E-13	4.22E-10	1.62E-09	4.69E-09	1.26E-08	
	10	2.89E-21	5.99E-15	9.98E-11	1.03E-09	3.99E-09	1.16E-08	
	30	5.96E-19	4.25E-16	8.15E-12	3.69E-10	2.72E-09	9.52E-09	
^{188}Re (1.14E-05)	-	1.14E-05	1.14E-05	1.16E-05	1.20E-05	1.27E-05	1.36E-05	
^{189}Re (7.92E-06)	-	7.92E-06	7.92E-06	7.97E-06	8.44E-06	9.56E-06	1.11E-05	
^{191}Os (5.21E-07)	1	5.62E-07	6.99E-07	2.24E-06	3.29E-06	3.36E-06	3.26E-06	
	3	5.40E-07	6.53E-07	1.37E-06	2.87E-06	3.16E-06	3.16E-06	
	10	5.41E-07	5.88E-07	8.13E-07	1.99E-06	2.75E-06	2.93E-06	
	30	5.24E-07	5.91E-07	6.23E-07	1.06E-06	1.98E-06	2.46E-06	
^{193}Os (6.29E-06)	-	6.29E-06	6.29E-06	6.17E-06	5.86E-06	5.51E-06	5.22E-06	
^{194}Os (3.66E-09)	1	4.30E-09	6.60E-09	4.66E-08	7.51E-08	8.12E-08	8.49E-08	III
	3	3.90E-09	5.81E-09	2.40E-08	6.40E-08	7.60E-08	8.19E-08	
	10	3.89E-09	4.76E-09	9.76E-09	4.14E-08	6.44E-08	7.50E-08	
	30	3.68E-09	4.65E-09	5.51E-09	1.70E-08	4.34E-08	6.13E-08	
^{192}Ir (1.03E-07)	-	1.03E-07	1.04E-07	1.17E-07	1.45E-07	1.73E-07	1.94E-07	
^{193}Ir (stable)	1	2.94E-19	1.38E-13	1.01E-10	4.07E-10	8.90E-10	1.48E-09	
	3	7.72E-20	1.43E-14	4.09E-11	3.27E-10	8.19E-10	1.42E-09	
	10	4.33E-20	2.68E-15	7.08E-12	1.86E-10	6.63E-10	1.27E-09	
	30	3.34E-20	1.19E-15	1.17E-12	5.85E-11	4.13E-10	9.96E-10	
^{194}Ir (1.00E-05)	-	1.00E-05	1.02E-05	1.26E-05	1.63E-05	1.89E-05	2.02E-05	
^{195}Ir (7.70E-05)	-	7.70E-05	7.70E-05	7.62E-05	7.35E-05	6.99E-05	6.67E-05	

TABLE I. Effective Rates for β^- Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{195}Pt (stable)	1	0.	1.32E-22	1.58E-14	2.09E-12	1.79E-11	6.19E-11	
	3	0.	3.87E-23	6.57E-15	1.70E-12	1.65E-11	5.90E-11	
	10	0.	1.45E-23	1.15E-15	9.56E-13	1.33E-11	5.23E-11	
	30	0.	5.48E-24	1.04E-16	2.66E-13	7.90E-12	4.01E-11	
^{197}Pt (1.05E-05)	-	1.05E-05	1.06E-05	1.13E-05	1.22E-05	1.27E-05	1.29E-05	
^{196}Au (9.09E-08)	1	9.31E-08	1.04E-07	1.74E-07	2.49E-07	2.41E-07	2.22E-07	
	3	9.20E-08	1.00E-07	1.32E-07	2.19E-07	2.28E-07	2.16E-07	
	10	9.24E-08	9.50E-08	1.06E-07	1.62E-07	2.01E-07	2.02E-07	
	30	9.09E-08	9.54E-08	9.63E-08	1.12E-07	1.54E-07	1.74E-07	
^{198}Au (2.98E-06)	-	2.98E-06	3.10E-06	6.10E-06	1.20E-05	1.80E-05	2.30E-05	
^{199}Au (2.55E-06)	1	2.60E-06	2.86E-06	4.57E-06	6.75E-06	7.13E-06	7.27E-06	
	3	2.57E-06	2.77E-06	3.57F-06	5.98E-06	6.79E-06	7.08E-06	
	10	2.58E-06	2.64E-06	2.95E-06	4.55E-06	6.05E-06	6.67E-06	
	30	2.55E-06	2.66E-06	2.72E-06	3.29E-06	4.75E-06	5.82E-06	
^{203}Hg (1.71E-07)	1	5.12E-06	8.77E-06	1.35E-05	1.82E-05	1.91E-05	1.94E-05	
	3	5.09E-06	8.63E-06	1.19E-05	1.68E-05	1.85E-05	1.90E-05	
	10	5.11E-06	8.43E-06	1.10E-05	1.41E-05	1.70E-05	1.82E-05	
	30	5.06E-06	8.36E-06	1.05E-05	1.19E-05	1.46E-05	1.65E-05	
^{204}Tl (5.66E-09)	-	5.66E-09	5.68E-09	7.82E-08	1.13E-06	4.42E-06	9.92E-06	
^{205}Tl (stable)	1	8.20E-28	2.20E-11	4.22E-08	1.09E-07	1.25E-07	1.38E-07	Appdx
	3	8.02E-28	1.55E-12	1.49E-08	8.72E-08	1.12E-07	1.28E-07	
	10	8.10E-28	1.37E-14	2.12E-09	3.98E-08	8.31E-08	1.09E-07	
	30	7.92E-28	6.53E-16	1.32E-10	8.82E-09	4.27E-08	7.61E-08	
^{209}Pb (5.92E-05)	-	5.92E-05	5.92E-05	5.92E-05	5.92E-05	5.92E-05	5.92E-05	
^{210}Pb (9.85E-10)	1	1.25E-09	8.72E-09	2.25E-07	6.27E-07	7.08E-07	7.28E-07	
	3	8.23E-10	6.31E-09	8.38E-08	4.92E-07	6.45E-07	6.93E-07	
	10	6.85E-10	2.88E-09	1.80E-08	2.36E-07	4.97E-07	6.08E-07	
	30	5.35E-10	1.03E-09	5.03E-09	5.84E-08	2.69E-07	4.49E-07	
^{210}Bi (1.60E-06)	-	1.60E-06	2.12E-06	9.15E-06	1.96E-05	2.90E-05	3.66E-05	

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5
^{59}Ni (2.93E-13)	1	1.04E-13	1.88E-14	6.37E-15	7.59E-13	1.94E-11	1.37E-10
	3	1.88E-13	4.93E-14	1.66E-14	9.53E-13	2.31E-11	1.58E-10
	10	2.06E-13	1.34E-13	4.94E-14	1.60E-12	3.58E-11	2.33E-10
	30	3.19E-13	2.26E-13	1.23E-13	2.82E-12	7.02E-11	4.40E-10
^{64}Cu (9.10E-06)	1	4.97E-06	2.83E-06	2.50E-06	2.44E-06	2.39E-06	2.32E-06
	3	6.80E-06	3.54E-06	2.72E-06	2.57E-06	2.48E-06	2.39E-06
	10	7.36E-06	5.48E-06	3.41E-06	2.99E-06	2.79E-06	2.64E-06
	30	9.39E-06	7.40E-06	4.94E-06	4.04E-06	3.62E-06	3.31E-06
^{65}Zn (3.29E-08)	1	1.42E-08	2.84E-09	2.55E-09	6.15E-09	1.21E-08	1.93E-08
	3	2.29E-08	4.90E-09	4.52E-09	8.53E-09	1.52E-08	2.27E-08
	10	3.03E-08	1.67E-08	1.08E-08	1.65E-08	2.54E-08	3.53E-08
	30	3.49E-08	2.63E-08	2.45E-08	3.71E-08	5.35E-08	6.99E-08
^{70}Ga (5.48E-07)	1	5.94E-07	9.68E-08	2.28E-08	1.24E-08	8.77E-09	7.03E-09
	3	9.11E-07	2.29E-07	6.51E-08	3.61E-08	2.59E-08	2.08E-08
	10	1.20E-06	6.33E-07	1.98E-07	1.15E-07	8.39E-08	6.40E-08
	30	1.31E-06	9.63E-07	4.85E-07	3.23E-07	2.42E-07	2.00E-07
^{71}Ge (7.16E-07)	1	3.57E-07	4.47E-08	1.33E-08	7.39E-09	5.33E-09	4.23E-09
	3	5.21E-07	1.43E-07	3.81E-08	2.16E-08	1.57E-08	1.26E-08
	10	6.70E-07	3.69E-07	1.16E-07	6.92E-08	5.12E-08	4.13E-08
	30	7.40E-07	5.54E-07	2.08E-07	1.95E-07	1.48E-07	1.22E-07
^{76}As (0.)	1	9.61E-10	8.43E-10	2.16E-09	2.54E-09	2.52E-09	2.34E-09
	3	1.33E-09	2.18E-09	6.13E-09	7.40E-09	6.85E-09	6.94E-09
	10	1.65E-09	5.26E-09	1.85E-08	2.35E-08	2.12E-08	2.27E-08
	30	1.79E-09	7.48E-09	4.23E-08	6.53E-08	6.85E-08	6.63E-08
^{75}Se (6.77E-08)	1	4.31E-08	6.92E-09	1.42E-09	7.76E-10	7.57E-10	7.72E-10
	3	5.68E-08	1.75E-08	4.03E-09	2.46E-09	2.22E-09	2.28E-09
	10	6.83E-08	4.06E-08	1.21E-08	7.78E-09	7.16E-09	7.48E-09
	30	7.33E-08	5.63E-08	2.95E-08	2.16E-08	2.06E-08	2.18E-08
^{79}Br (stable)	1	0.	1.61E-22	1.10E-17	6.84E-16	7.41E-15	3.58E-14
	3	0.	4.08E-22	3.18E-17	2.03E-15	2.20E-14	1.07E-13
	10	0.	9.59E-22	9.92E-17	6.65E-15	7.30E-14	3.56E-13
	30	0.	1.46E-21	2.72E-16	1.95E-14	2.18E-13	1.02E-12
^{80}Br (5.45E-05)	1	4.75E-05	2.08E-05	1.40E-05	1.07E-05	8.44E-06	6.88E-06
	3	5.57E-05	2.82E-05	1.54E-05	1.13E-05	8.74E-06	7.07E-06
	10	6.22E-05	4.36E-05	1.98E-05	1.31E-05	9.76E-06	7.72E-06
	30	6.48E-05	5.28E-05	3.00E-05	1.79E-05	1.25E-05	9.50E-06
^{82}Br (0.)	1	8.65E-17	1.22E-13	2.16E-12	4.91E-12	7.33E-12	9.39E-12
	3	1.10E-16	3.04E-13	6.16E-12	1.44E-11	2.16E-11	2.79E-11
	10	1.31E-16	6.89E-13	1.86E-11	4.60E-11	7.03E-11	9.19E-11
	30	1.45E-16	9.56E-13	4.85E-11	1.29E-10	2.04E-10	2.71E-10
^{79}Kr (5.50E-06)	1	3.90E-06	9.82E-07	4.87E-07	4.15E-07	3.59E-07	3.08E-07
	3	4.62E-06	1.85E-06	6.77E-07	5.04E-07	4.11E-07	3.42E-07
	10	5.27E-06	3.53E-06	1.25E-06	7.97E-07	5.87E-07	4.58E-07
	30	5.52E-06	4.44E-06	2.64E-06	1.54E-06	1.06E-06	7.75E-07
^{81}Kr (1.05E-13)	1	8.21E-14	1.43E-14	1.03E-13	1.73E-12	6.62E-12	1.42E-11
	3	1.01E-13	3.53E-14	2.92E-13	5.04E-12	1.94E-11	4.22E-11
	10	1.20E-13	7.80E-14	8.65E-13	1.59E-11	6.26E-11	1.38E-10
	30	1.35E-13	1.08E-13	2.26E-12	4.38E-11	1.79E-10	4.01E-10
^{86}Rb (2.13E-11)	1	1.74E-11	3.12E-12	5.47E-13	2.71E-13	2.00E-13	2.58E-13
	3	1.97E-11	7.53E-12	1.54E-12	6.95E-13	5.87E-13	7.65E-13
	10	2.35E-11	1.58E-11	4.57E-12	2.07E-12	1.91E-12	2.50E-12
	30	2.54E-11	1.72E-11	1.20E-11	6.96E-12	5.48E-12	7.31E-12

TABLE II. Effective Rates for Electron Capture plus β^{+} Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5
^{85}Sr (1.24E-07)	1	1.06E-07	2.01E-08	3.18E-09	1.44E-09	9.60E-10	7.95E-10
	3	1.19E-07	4.73E-08	8.93E-09	4.16E-09	2.80E-09	2.34E-09
	10	1.36E-07	9.46E-08	2.60E-08	1.29E-08	9.03E-09	7.63E-09
	30	1.43E-07	1.08E-07	6.71E-08	3.59E-08	2.56E-08	2.21E-08
^{87}Sr (stable)	1	0.	0.	1.68E-19	1.58E-16	5.05E-15	4.22E-14
	3	0.	0.	4.76E-19	4.59E-16	1.49E-14	1.25E-13
	10	0.	0.	1.42E-18	1.45E-15	4.86E-14	4.14E-13
	30	0.	0.	3.76E-18	4.15E-15	1.41E-13	1.22E-12
^{94}Nb (0.)	1	1.48E-16	8.91E-15	8.33E-14	2.16E-13	3.72E-13	5.35E-13
	3	3.16E-16	2.54E-14	2.49E-13	6.39E-13	1.10E-12	1.60E-12
	10	7.90E-16	7.77E-14	8.18E-13	2.11E-12	3.67E-12	5.32E-12
	30	1.75E-15	2.13E-13	2.43E-12	6.32E-12	1.10E-11	1.60E-11
^{93}Mo (6.28E-12)	1	5.47E-12	1.41E-12	1.91E-13	8.61E-14	5.95E-14	4.98E-14
	3	5.95E-12	3.03E-12	4.21E-13	2.49E-13	1.74E-13	1.48E-13
	10	6.55E-12	5.19E-12	1.14E-12	7.86E-13	5.65E-13	4.86E-13
	30	7.06E-12	7.10E-12	3.85E-12	2.15E-12	1.62E-12	1.42E-12
^{97}Tc (8.45E-15)	1	7.80E-15	2.20E-15	4.66E-14	1.17E-12	5.13E-12	1.37E-11
	3	8.30E-15	4.55E-15	1.26E-13	3.35E-12	1.62E-11	4.06E-11
	10	8.96E-15	7.36E-15	3.34E-13	1.04E-11	5.18E-11	1.32E-10
	30	1.02E-14	9.56E-15	8.74E-13	2.76E-11	1.44E-10	3.78E-10
^{98}Tc (0.)	1	1.21E-22	3.17E-16	1.14E-13	6.69E-13	1.50E-12	2.61E-12
	3	1.29E-22	6.51E-16	2.88E-13	1.65E-12	3.65E-12	5.68E-12
	10	1.37E-22	1.04E-15	7.45E-13	4.81E-12	1.05E-11	1.61E-11
	30	1.53E-22	1.33E-15	1.92E-12	1.25E-11	2.84E-11	4.40E-11
^{97}Ru (2.79E-06)	1	2.21E-06	6.72E-07	7.82E-08	2.96E-08	1.70E-08	1.17E-08
	3	2.33E-06	1.34E-06	2.14E-07	8.49E-08	4.96E-08	3.47E-08
	10	2.48E-06	2.06E-06	5.84E-07	2.62E-07	1.58E-07	1.12E-07
	30	2.82E-06	2.58E-06	1.41E-06	6.89E-07	4.37E-07	3.20E-07
^{104}Rh (6.55E-05)	1	5.49E-05	1.82E-05	1.87E-06	5.81E-07	2.70E-07	1.54E-07
	3	5.73E-05	3.50E-05	5.10E-06	1.66E-06	7.85E-07	4.52E-07
	10	6.09E-05	5.15E-05	1.43E-05	5.10E-06	2.49E-06	1.46E-06
	30	6.88E-05	6.30E-05	3.27E-05	1.33E-05	6.86E-06	4.14E-06
^{103}Pd (4.72E-07)	1	4.30E-07	1.57E-07	1.71E-08	6.13E-09	3.40E-09	2.31E-09
	3	4.48E-07	2.91E-07	4.64E-08	1.75E-08	9.94E-09	6.83E-09
	10	4.78E-07	4.14E-07	1.31E-07	5.38E-08	3.16E-08	2.21E-08
	30	5.42E-07	4.99E-07	2.91E-07	1.40E-07	8.72E-08	6.30E-08
^{107}Ag (stable)	1	1.85E-18	3.75E-14	1.06E-12	2.87E-12	4.67E-12	6.30E-12
	3	2.06E-18	6.96E-14	2.97E-12	8.38E-12	1.39E-11	1.83E-11
	10	2.51E-18	1.06E-13	8.88E-12	2.70E-11	4.57E-11	6.25E-11
	30	3.42E-18	1.51E-13	2.18E-11	7.66E-11	1.34E-10	1.86E-10
^{108}Ag (1.13E-04)	1	1.02E-04	4.68E-05	1.38E-05	1.01E-05	7.90E-06	6.27E-06
	3	1.05E-04	7.52E-05	2.01E-05	1.22E-05	8.88E-06	6.72E-06
	10	1.11E-04	9.85E-05	3.82E-05	1.89E-05	1.21E-05	8.60E-06
	30	1.22E-04	1.14E-04	7.06E-05	3.45E-05	2.02E-05	1.34E-05
^{110}Ag (8.52E-05)	1	3.23E-05	1.19E-05	1.19E-06	3.96E-07	2.02E-07	1.25E-07
	3	3.36E-05	2.11E-05	3.22E-06	1.13E-06	5.90E-07	3.31E-07
	10	3.57E-05	2.88E-05	8.9[illegible]E-06	3.45E-06	1.87E-06	1.19E-06
	30	3.98E-05	3.40E-05	1.94E-05	8.88E-06	5.12E-06	3.36E-06
^{107}Cd (2.96E-05)	1	2.92E-05	1.28E-05	1.36E-06	4.37E-07	2.90E-07	2.12E-07
	3	3.03E-05	2.18E-05	3.56E-06	1.30E-06	7.34E-07	5.04E-07
	10	3.21E-05	2.85E-05	9.73E-06	3.83E-06	2.19E-06	1.50E-06
	30	3.53E-05	3.31E-05	2.04E-05	9.66E-06	5.85E-06	4.12E-06

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5
^{109}Cd (1.77E-08)	1	1.72E-08	7.61E-09	8.45E-10	3.04E-10	2.34E-10	2.15E-10
	3	1.85E-08	1.32E-08	2.32E-09	9.78E-10	6.91E-10	6.37E-10
	10	2.11E-08	1.85E-08	6.67E-09	3.07E-09	2.24E-09	2.10E-09
	30	2.59E-08	2.37E-08	1.52E-08	8.35E-09	6.41E-09	6.16E-09
^{113}In (stable)	1	0.	0.	4.67E-22	3.96E-19	1.30E-17	1.16E-16
	3	0.	0.	1.29E-21	1.16E-18	3.86E-17	3.43E-16
	10	0.	0.	3.75E-21	3.71E-18	1.26E-16	1.14E-15
	30	0.	0.	8.71E-21	1.03E-17	3.68E-16	3.39E-15
^{114}In (1.83E-04)	1	1.58E-04	6.84E-05	8.55E-06	3.48E-06	2.30E-06	1.79E-06
	3	1.64E-04	1.23E-04	2.11E-05	7.97E-06	4.68E-06	3.29E-06
	10	1.73E-04	1.56E-04	5.57E-05	2.19E-05	1.25E-05	8.38E-06
	30	1.88E-04	1.78E-04	1.14E-04	5.38E-05	3.20E-05	2.17E-05
^{116}In (0.)	1	4.63E-06	1.99E-06	2.22E-07	7.11E-08	3.59E-08	2.16E-08
	3	4.81E-06	3.60E-06	5.95E-07	2.04E-07	1.05E-07	6.34E-08
	10	5.12E-06	4.60E-06	1.63E-06	6.20E-07	3.31E-07	2.06E-07
	30	5.66E-06	5.33E-06	3.39E-06	1.58E-06	9.03E-07	5.83E-07
^{113}Sn (6.97E-08)	1	6.25E-08	3.92E-08	9.98E-08	1.25E-07	1.17E-07	1.03E-07
	3	6.48E-08	6.63E-08	2.65E-07	3.56E-07	3.41E-07	3.00E-07
	10	6.88E-08	8.16E-08	7.17E-07	1.07E-06	1.07E-06	9.70E-07
	30	7.52E-08	9.34E-08	1.44E-06	2.69E-06	2.89E-06	2.72E-06
^{122}Sb (8.98E-08)	1	7.82E-08	4.30E-08	6.91E-09	1.57E-08	3.37E-08	5.13E-08
	3	8.10E-08	6.37E-08	1.60E-08	2.52E-08	4.23E-08	6.26E-08
	10	8.59E-08	7.59E-08	4.05E-08	5.42E-08	8.11E-08	1.01E-07
	30	9.36E-08	8.86E-08	7.82E-08	1.19E-07	1.71E-07	2.00E-07
^{121}Te (4.78E-07)	1	4.56E-07	2.75E-07	2.71E-08	8.30E-09	4.93E-09	4.49E-09
	3	4.74E-07	3.68E-07	7.11E-08	2.36E-08	1.40E-08	1.25E-05
	10	5.03E-07	4.52E-07	1.87E-07	7.07E-08	4.42E-08	3.96E-08
	30	5.49E-07	5.20E-07	3.60E-07	1.75E-07	1.19E-07	1.10E-07
^{123}Te (1.77E-21)	1	6.14E-25	3.72E-17	5.21E-14	5.88E-13	2.36E-12	5.84E-12
	3	7.41E-25	5.58E-17	1.45E-13	1.75E-12	6.96E-12	1.74E-11
	10	1.00E-24	8.58E-17	4.31E-13	5.66E-12	2.32E-11	5.81E-11
	30	1.46E-24	1.37E-16	1.05E-12	1.63E-11	6.88E-11	1.74E-10
^{125}I (1.33E-07)	1	1.08E-07	6.93E-08	7.11E-09	2.20E-09	1.19E-09	7.74E-10
	3	1.14E-07	9.35E-08	1.87E-08	6.32E-09	3.44E-09	2.41E-09
	10	1.26E-07	1.14E-07	4.97E-08	1.92E-08	1.11E-08	7.91E-09
	30	1.45E-07	1.36E-07	9.71E-08	4.91E-08	3.07E-08	1.93E-08
^{126}I (3.33E-07)	1	3.17E-07	2.12E-07	7.37E-08	1.26E-07	1.91E-07	2.46E-07
	3	3.27E-07	2.79E-07	1.23E-07	1.53E-07	2.09E-07	2.61E-07
	10	3.44E-07	3.24E-07	2.49E-07	2.35E-07	2.71E-07	3.11E-07
	30	3.71E-07	3.61E-07	4.24E-07	4.11E-07	4.20E-07	3.91E-07
^{128}I (2.77E-05)	1	2.59E-05	1.57E-05	1.23E-06	2.83E-07	1.10E-07	5.01E-08
	3	2.68E-05	2.08E-05	3.19E-06	7.92E-07	3.08E-07	1.52E-07
	10	2.82E-05	2.43E-05	8.22E-06	2.34E-06	9.59E-07	4.81E-07
	30	3.04E-05	2.71E-05	1.52E-05	5.69E-06	2.55E-06	1.03E-06
^{125}Xe (1.13E-05)	1	8.81E-06	6.05E-06	6.69E-07	2.54E-07	2.02E-07	2.12E-07
	3	9.10E-06	7.88E-06	1.62E-06	5.66E-07	3.60E-07	3.15E-07
	10	9.56E-06	8.89E-06	4.01E-06	1.51E-06	8.77E-07	5.66E-07
	30	1.03E-05	9.77E-06	7.14E-06	3.51E-06	2.12E-06	1.50E-06
^{127}Xe (2.20E-07)	1	2.07E-07	1.42E-07	1.46E-08	4.84E-09	3.20E-09	2.68E-09
	3	2.16E-07	1.86E-07	3.78E-08	1.38E-08	9.22E-09	7.90E-09
	10	2.30E-07	2.13E-07	9.67E-08	4.09E-08	2.90E-08	2.10E-08
	30	2.51E-07	2.39E-07	1.77E-07	9.97E-08	7.75E-08	6.88E-08

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^AZ (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{131}Cs (8.28E-07)	1	8.40E-07	6.05E-07	5.07E-08	1.63E-08	7.45E-09	4.38E-09	
	3	8.75E-07	7.72E-07	1.59E-07	4.63E-08	2.15E-08	1.29E-08	
	10	9.31E-07	8.67E-07	4.00E-07	1.37E-07	6.76E-08	4.10E-08	
	30	1.01E-06	9.65E-07	7.09E-07	3.31E-07	1.80E-07	1.15E-07	
^{132}Cs (1.22E-06)	1	1.02E-06	7.38E-07	6.55E-08	2.42E-08	1.34E-08	9.52E-09	IV
	3	1.06E-06	9.37E-07	1.97E-07	6.16E-08	3.15E-08	2.08E-08	
	10	1.11E-06	1.04E-06	4.86E-07	1.74E-07	9.06E-08	5.77E-08	
	30	1.19E-06	1.13E-06	8.46E-07	4.09E-07	2.32E-07	1.54E-07	
^{134}Cs (3.20E-14)	1	1.02E-13	4.80E-11	1.33E-10	3.57E-10	7.50E-10	1.21E-09	
	3	1.06E-13	6.12E-11	4.15E-10	9.64E-10	1.93E-09	2.97E-09	
	10	1.13E-13	6.86E-11	1.04E-09	2.78E-09	5.77E-09	8.71E-09	
	30	1.23E-13	7.60E-11	1.83E-09	6.63E-09	1.50E-08	2.37E-08	
^{131}Ba (6.69E-07)	1	5.69E-07	4.29E-07	4.63E-08	1.49E-08	9.69E-09	8.44E-09	
	3	5.89E-07	5.29E-07	1.19E-07	4.11E-08	2.55E-08	2.04E-08	
	10	6.20E-07	5.82E-07	2.91E-07	1.19E-07	7.69E-08	5.99E-08	
	30	6.67E-07	6.34E-07	4.94E-07	2.81E-07	1.46E-07	1.63E-07	
^{133}Ba (2.05E-09)	1	1.59E-07	3.75E-07	6.04E-08	1.83E-08	9.12E-09	5.73E-09	
	3	1.65E-07	4.64E-07	1.56E-07	5.18E-08	2.62E-08	1.68E-08	
	10	1.75E-07	5.13E-07	3.83E-07	1.52E-07	8.21E-08	5.36E-08	
	30	1.90E-07	5.64E-07	6.56E-07	3.61E-07	1.60E-07	1.51E-07	
^{137}La (3.66E-13)	1	3.01E-07	7.07E-07	1.26E-07	3.75E-08	1.84E-08	1.14E-08	
	3	3.13E-07	8.47E-07	3.17E-07	8.41E-08	5.29E-08	3.36E-08	
	10	3.29E-07	9.26E-07	7.60E-07	3.07E-07	1.65E-07	1.07E-07	
	30	3.53E-07	1.01E-06	1.26E-06	7.18E-07	4.03E-07	2.98E-07	
^{138}La (1.36E-19)	1	3.39E-15	1.22E-11	9.77E-11	1.89E-10	1.24E-09	5.68E-09	
	3	3.53E-15	1.47E-11	2.46E-10	3.46E-10	1.66E-09	6.57E-09	
	10	3.76E-15	1.61E-11	5.91E-10	1.10E-09	3.04E-09	9.52E-09	
	30	4.10E-15	1.78E-11	9.87E-10	2.50E-09	5.97E-09	1.72E-08	
^{137}Ce (2.14E-05)	1	2.22E-05	1.81E-05	2.11E-06	5.25E-07	2.06E-07	1.35E-07	
	3	2.30E-05	2.11E-05	5.23E-06	1.44E-06	6.66E-07	3.91E-07	
	10	2.41E-05	2.27E-05	1.22E-05	4.22E-06	2.06E-06	1.23E-06	
	30	2.58E-05	2.45E-05	1.94E-05	9.71E-06	5.24E-06	3.42E-06	
^{139}Ce (5.85E-08)	1	5.29E-08	4.17E-08	5.15E-09	1.50E-09	7.73E-10	6.28E-10	
	3	5.80E-08	5.07E-08	1.31E-08	4.22E-09	2.44E-09	1.87E-09	
	10	6.69E-08	6.01E-08	3.25E-08	1.30E-08	7.90E-09	6.09E-09	
	30	8.08E-08	7.49E-08	5.84E-08	3.29E-08	2.17E-08	1.78E-08	
^{142}Pr (1.60E-09)	1	7.82E-10	4.99E-10	5.53E-11	1.59E-11	8.77E-12	6.22E-12	
	3	8.21E-10	5.74E-10	1.36E-10	4.44E-11	2.54E-11	1.83E-11	
	10	8.79E-10	6.31E-10	3.14E-10	1.29E-10	6.18E-11	5.80E-11	
	30	9.65E-10	7.06E-10	5.03E-10	3.00E-10	2.10E-10	1.62E-10	
^{145}Pm (1.24E-09)	1	1.16E-09	9.85E-10	1.53E-10	4.36E-11	2.30E-11	1.62E-11	
	3	1.25E-09	1.12E-09	3.70E-10	1.22E-10	6.70E-11	4.78E-11	
	10	1.40E-09	1.27E-09	8.30E-10	3.57E-10	2.08E-10	1.54E-10	
	30	1.61E-09	1.50E-09	1.31E-09	6.83E-10	5.77E-10	4.39E-10	
^{146}Pm (2.52E-09)	1	2.56E-07	2.24E-07	3.21E-08	7.80E-09	3.62E-09	2.30E-09	IV
	3	2.66E-07	2.46E-07	7.52E-08	2.04E-08	9.22E-09	5.53E-09	
	10	2.78E-07	2.62E-07	1.61E-07	5.65E-08	2.67E-08	1.61E-08	
	30	2.94E-07	2.80E-07	2.34E-07	9.79E-08	6.98E-08	4.31E-08	
^{148}Pm (0.)	1	8.19E-10	7.14E-10	9.88E-11	2.11E-11	7.92E-12	3.96E-12	
	3	8.54E-10	7.87E-10	2.34E-10	5.82E-11	2.28E-11	1.61E-11	
	10	9.00E-10	8.42E-10	5.07E-10	1.65E-10	6.93E-11	3.66E-11	
	30	9.58E-10	9.14E-10	7.46E-10	2.91E-10	1.85E-10	1.01E-10	

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{145}Sm (2.36E-08)	1	2.04E-08	1.81E-08	2.75E-09	6.15E-10	2.55E-10	1.44E-10	
	3	2.14E-08	1.97E-08	6.41E-09	1.69E-09	7.31E-10	4.20E-10	
	10	2.23E-08	2.10E-08	1.34E-08	4.76E-09	2.23E-09	1.32E-09	
	30	2.39E-08	2.28E-08	1.92E-08	9.01E-09	5.90E-09	3.64E-09	
^{147}Sm (stable)	1	0.	1.15E-24	1.21E-18	1.51E-16	1.99E-15	1.04E-14	
	3	0.	3.31E-24	3.47E-18	4.47E-16	5.93E-15	3.10E-14	
	10	0.	1.09E-23	1.09E-17	1.47E-15	1.97E-14	1.03E-13	
	30	0.	3.60E-23	3.23E-17	4.42E-15	5.91E-14	3.12E-13	
^{152}Eu (1.23E-09)	1	7.03E-10	1.14E-08	1.37E-07	1.52E-07	1.46E-07	1.39E-07	
	3	7.36E-10	1.22E-08	3.00E-07	3.51E-07	2.98E-07	2.49E-07	
	10	7.69E-10	1.28E-08	5.97E-07	9.05E-07	7.71E-07	6.07E-07	
	30	8.18E-10	1.38E-08	8.19E-07	1.81E-06	1.91E-06	1.52E-06	
^{154}Eu (5.17E-13)	1	4.70E-13	1.12E-11	9.85E-11	7.61E-11	5.08E-11	3.42E-11	
	3	4.93E-13	1.20E-11	2.25E-10	2.09E-10	1.46E-10	1.00E-10	
	10	5.16E-13	1.28E-11	4.57E-10	5.80E-10	4.42E-10	3.14E-10	
	30	5.47E-13	1.38E-11	6.33E-10	1.19E-09	1.16E-09	8.60E-10	
^{153}Gd (3.32E-08)	1	2.84E-08	2.45E-08	4.77E-09	1.32E-09	7.21E-10	5.22E-10	
	3	3.14E-08	2.74E-08	9.46E-09	3.66E-09	2.08E-09	1.54E-09	
	10	3.51E-08	3.16E-08	2.26E-08	8.34E-09	6.44E-09	4.90E-09	
	30	4.17E-08	3.87E-08	3.39E-08	2.46E-08	1.75E-08	1.38E-08	
^{157}Tb (1.46E-10)	1	1.21E-10	7.15E-11	2.14E-11	9.69E-12	8.96E-12	9.64E-12	
	3	1.66E-10	1.05E-10	4.96E-11	3.04E-11	2.64E-11	2.86E-11	
	10	2.34E-10	1.75E-10	1.31E-10	8.96E-11	8.47E-11	9.31E-11	
	30	3.50E-10	3.02E-10	2.70E-10	2.58E-10	2.45E-10	2.72E-10	
^{158}Tb (1.20E-10)	1	9.43E-11	8.44E-11	1.85E-10	2.55E-10	3.25E-10	3.08E-10	
	3	1.02E-10	9.20E-11	3.75E-10	8.18E-10	9.19E-10	8.81E-10	
	10	1.13E-10	1.04E-10	7.68E-10	2.05E-09	2.75E-09	2.73E-09	
	30	1.32E-10	1.24E-10	1.02E-09	5.06E-09	7.10E-09	7.39E-09	
^{160}Tb (0.)	1	1.06E-16	1.52E-13	1.16E-12	7.22E-13	6.59E-13	5.78E-13	
	3	1.14E-16	1.65E-13	2.40E-12	2.33E-12	1.90E-12	1.70E-12	
	10	1.24E-16	1.84E-13	5.09E-12	6.06E-12	5.85E-12	5.42E-12	
	30	1.40E-16	2.13E-13	7.17E-12	1.56E-11	1.57E-11	1.52E-11	
^{157}Dy (2.38E-05)	1	2.30E-05	2.11E-05	4.32E-06	8.28E-07	2.99E-07	1.46E-07	
	3	2.40E-05	2.21E-05	9.12E-06	2.26E-06	8.52E-07	4.26E-07	
	10	2.50E-05	2.33E-05	1.69E-05	5.95E-06	2.55E-06	1.33E-06	
	30	2.62E-05	2.50E-05	2.16E-05	1.38E-05	6.54E-06	3.59E-06	
^{159}Dy (5.56E-08)	1	5.42E-08	4.92E-08	1.04E-08	2.20E-09	9.35E-10	5.70E-10	
	3	5.69E-08	5.21E-08	2.21E-08	6.03E-09	2.68E-09	1.67E-09	
	10	6.02E-08	5.58E-08	4.14E-08	1.61E-08	8.11E-09	5.26E-09	
	30	6.44E-08	6.12E-08	5.45E-08	3.79E-08	2.12E-08	1.45E-08	
^{163}Ho (4.81E-12)	1	3.71E-11	5.83E-11	1.20E-10	1.85E-10	2.65E-10	3.56E-10	Appdx
	3	1.02E-10	1.66E-10	3.39E-10	5.47E-10	7.86E-10	1.06E-09	
	10	3.56E-10	5.27E-10	1.05E-09	1.78E-09	2.60E-09	3.53E-09	
	30	1.10E-09	1.60E-09	3.06E-09	5.12E-09	7.69E-09	1.06E-08	
^{164}Ho (2.31E-04)	1	2.30E-04	2.08E-04	4.12E-05	6.81E-06	2.10E-06	8.93E-07	
	3	2.40E-04	2.17E-04	8.66E-05	1.84E-05	5.97E-06	2.60E-06	
	10	2.50E-04	2.29E-04	1.51E-04	4.91E-05	1.78E-05	8.09E-06	
	30	2.62E-04	2.45E-04	1.90E-04	1.09E-04	4.53E-05	2.18E-05	
^{163}Er (1.54E-04)	1	1.56E-04	1.44E-04	3.43E-05	5.86E-06	1.80E-06	7.72E-07	
	3	1.63E-04	1.49E-04	7.05E-05	1.57E-05	5.09E-06	1.89E-06	
	10	1.69E-04	1.57E-04	1.18E-04	4.17E-05	1.51E-05	6.92E-06	
	30	1.76E-04	1.68E-04	1.44E-04	8.94E-05	3.81E-05	1.85E-05	

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^{A}Z (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{165}Er (1.85E-05)	1	1.59E-05	1.44E-05	3.23E-06	5.33E-07	1.70E-07	7.90E-08	
	3	1.68E-05	1.51E-05	6.68E-06	1.43E-06	4.83E-07	1.97E-07	
	10	1.77E-05	1.62E-05	1.13E-05	3.84E-06	1.44E-06	7.19E-07	
	30	1.87E-05	1.77E-05	1.42E-05	8.38E-06	3.69E-06	1.95E-06	
^{170}Tm (8.98E-10)	1	9.18E-11	8.21E-11	2.30E-11	1.35E-11	1.80E-11	2.22E-11	
	3	9.74E-11	8.66E-11	4.64E-11	3.60E-11	5.12E-11	6.40E-11	
	10	1.04E-10	9.36E-11	7.63E-11	9.53E-11	1.52E-10	2.01E-10	
	30	1.10E-10	1.04E-10	9.19E-11	2.03E-10	3.85E-10	5.41E-10	
^{169}Yb (2.51E-07)	1	2.29E-07	2.32E-07	8.94E-08	1.95E-08	7.42E-09	3.44E-09	
	3	2.42E-07	2.43E-07	1.74E-07	5.17E-08	2.10E-08	1.11E-08	
	10	2.53E-07	2.58E-07	2.72E-07	1.34E-07	6.18E-08	3.46E-08	
	30	2.65E-07	2.79E-07	3.17E-07	2.76E-07	1.54E-07	9.22E-08	
^{176}Lu (0.)	1	1.00E-21	2.23E-15	1.20E-12	3.86E-12	1.16E-11	3.03E-11	
	3	1.07E-21	2.38E-15	2.28E-12	1.02E-11	3.27E-11	8.80E-11	
	10	1.15E-21	2.60E-15	3.52E-12	2.65E-11	9.65E-11	2.75E-10	
	30	1.23E-21	2.93E-15	4.27E-12	5.44E-11	2.42E-10	7.35E-10	
^{175}Hf (1.15E-07)	1	1.09E-07	9.57E-08	3.28E-08	6.06E-09	2.08E-09	1.04E-09	
	3	1.17E-07	1.02E-07	6.05E-08	1.59E-08	5.88E-09	3.04E-09	
	10	1.23E-07	1.12E-07	8.95E-08	4.07E-08	1.73E-08	9.53E-09	
	30	1.33E-07	1.25E-07	1.10E-07	8.17E-08	4.34E-08	2.57E-08	
^{179}Ta (1.29E-08)	1	1.28E-08	9.42E-09	3.02E-09	5.74E-10	2.51E-10	2.00E-10	
	3	1.46E-08	1.10E-08	5.61E-09	1.54E-09	6.34E-10	5.91E-10	
	10	1.66E-08	1.36E-08	8.64E-09	4.12E-09	2.23E-09	1.93E-09	
	30	2.01E-08	1.76E-08	1.28E-08	9.14E-09	6.05E-09	5.55E-09	
^{180}Ta (2.07E-05)	1	1.96E-05	1.76E-05	5.77E-06	8.29E-07	2.16E-07	8.40E-08	
	3	2.06E-05	1.83E-05	1.02E-05	2.14E-06	4.94E-07	2.43E-07	
	10	2.12E-05	1.93E-05	1.36E-05	5.29E-06	1.75E-06	7.48E-07	
	30	2.18E-05	2.06E-05	1.65E-05	9.97E-06	4.22E-06	1.96E-06	
^{181}W (6.63E-08)	1	6.52E-08	5.50E-08	2.19E-08	4.12E-09	1.41E-09	7.17E-10	
	3	7.06E-08	5.97E-08	3.80E-08	1.07E-08	3.93E-09	2.09E-09	
	10	7.57E-08	6.74E-08	5.31E-08	2.69E-08	1.18E-08	6.60E-09	
	30	8.40E-08	7.82E-08	6.86E-08	5.28E-08	2.96E-08	1.80E-08	
^{186}Re (1.66E-07)	1	1.51E-07	1.35E-07	5.31E-08	9.87E-09	2.84E-09	1.18E-09	
	3	1.58E-07	1.41E-07	9.47E-08	2.50E-08	7.89E-09	3.41E-09	
	10	1.63E-07	1.50E-07	1.25E-07	5.97E-08	2.26E-08	1.05E-08	
	30	1.69E-07	1.61E-07	1.44E-07	1.07E-07	5.37E-08	2.72E-08	
^{185}Os (8.57E-08)	1	7.35E-08	6.25E-08	2.76E-08	6.77E-09	2.40E-09	1.56E-09	
	3	7.77E-08	6.66E-08	4.68E-08	1.70E-08	7.71E-09	4.84E-09	
	10	8.18E-08	7.33E-08	6.21E-08	4.00E-08	2.20E-08	1.37E-08	
	30	8.83E-08	8.22E-08	7.29E-08	7.07E-08	5.17E-08	3.55E-08	
^{187}Os (stable)	1	1.10E-13	3.15E-13	1.13E-12	2.21E-12	3.03E-12	4.45E-12	Appdx
	3	3.26E-13	8.75E-13	2.83E-12	6.11E-12	9.27E-12	1.31E-11	
	10	9.98E-13	2.80E-12	7.84E-12	1.77E-11	2.91E-11	4.24E-11	
	30	3.15E-12	8.32E-12	2.14E-11	4.58E-11	7.99E-11	1.21E-10	
^{192}Ir (4.97E-09)	1	4.69E-09	4.10E-09	2.51E-09	6.62E-10	2.58E-10	1.37E-10	
	3	4.90E-09	4.33E-09	3.89E-09	1.64E-09	7.19E-10	3.94E-10	
	10	5.11E-09	4.69E-09	4.98E-09	3.76E-09	2.03E-09	1.20E-09	
	30	5.41E-09	5.15E-09	5.67E-09	6.37E-09	4.70E-09	3.09E-09	
^{191}Pt (2.77E-06)	1	2.05E-06	1.50E-06	9.17E-07	3.94E-07	2.28E-07	1.51E-07	
	3	2.11E-06	1.56E-06	1.35E-06	9.60E-07	6.27E-07	4.34E-07	
	10	2.17E-06	1.66E-06	1.67E-06	2.13E-06	1.75E-06	1.31E-06	
	30	2.25E-06	1.78E-06	1.85E-06	3.46E-06	3.95E-06	3.33E-06	

TABLE II. Effective Rates for Electron Capture plus β^+ Decay

See page 383 for Explanation of Tables

^AZ (lab s^{-1})	n_{26}	T_8 0.5	1	2	3	4	5	
^{193}Pt (4.39E-10)	1	4.95E-10	1.23E-10	2.57E-11	2.65E-11	2.81E-11	3.04E-11	
	3	6.06E-10	2.62E-10	7.76E-11	7.27E-11	8.04E-11	8.90E-11	
	10	7.77E-10	5.26E-10	2.45E-10	2.13E-10	2.51E-10	2.87E-10	
	30	1.07E-09	8.99E-10	6.31E-10	5.90E-10	6.92E-10	8.13E-10	
^{195}Au (4.38E-08)	1	4.31E-08	2.85E-08	1.58E-08	4.14E-09	1.67E-09	9.79E-10	
	3	4.72E-08	3.47E-08	2.44E-08	1.03E-08	4.68E-09	2.85E-09	
	10	5.38E-08	4.51E-08	3.56E-08	2.44E-08	1.37E-08	8.97E-09	
	30	6.55E-08	5.95E-08	5.02E-08	4.64E-08	3.40E-08	2.43E-08	
^{196}Au (1.21E-06)	1	1.12E-06	9.87E-07	5.61E-07	1.03E-07	2.75E-08	1.07E-08	
	3	1.15E-06	1.03E-06	7.96E-07	2.47E-07	7.53E-08	3.07E-08	
	10	1.17E-06	1.09E-06	9.58E-07	5.35E-07	2.08E-07	9.25E-08	
	30	1.20E-06	1.16E-06	1.05E-06	8.39E-07	4.61E-07	2.32E-07	
^{198}Au (0.)	1	4.89E-13	2.56E-10	3.66E-09	2.09E-09	1.04E-09	6.15E-10	
	3	5.05E-13	2.70E-10	5.24E-09	5.04E-09	2.86E-09	1.77E-09	
	10	5.24E-13	2.93E-10	6.43E-09	1.10E-08	7.97E-09	5.36E-09	
	30	5.49E-13	3.20E-10	7.24E-09	1.78E-08	1.80E-08	1.37E-08	
^{197}Hg (3.00E-06)	1	2.97E-06	2.52E-06	1.50E-06	3.04E-07	8.82E-08	3.80E-08	
	3	3.06E-06	2.67E-06	2.09E-06	7.22E-07	2.42E-07	1.09E-07	
	10	3.19E-06	2.92E-06	2.54E-06	1.55E-06	6.69E-07	3.31E-07	
	30	3.37E-06	3.30E-06	2.88E-06	2.44E-06	1.50E-06	8.41E-07	
^{204}Tl (1.51E-10)	1	1.41E-10	1.07E-10	6.19E-10	1.81E-09	2.02E-09	1.92E-09	
	3	1.48E-10	1.19E-10	8.30E-10	3.67E-09	5.50E-09	5.50E-09	
	10	1.59E-10	1.40E-10	9.85E-10	8.73E-09	1.49E-08	1.65E-08	
	30	1.77E-10	1.71E-10	1.11E-09	1.32E-08	3.24E-08	4.12E-08	
^{205}Pb (1.57E-15)	1	2.14E-09	7.72E-10	1.83E-10	1.61E-10	1.69E-10	1.88E-10	Appdx
	3	2.59E-09	1.50E-09	5.62E-10	4.42E-10	4.91E-10	5.55E-10	
	10	3.63E-09	3.34E-09	1.77E-09	1.45E-09	1.59E-09	1.82E-09	
	30	5.71E-09	6.70E-09	4.73E-09	4.31E-09	4.58E-09	5.29E-09	

TABLE III. Estimated Log*ft* Values for Unknown β^- Transitions

See page 383 for Explanation of Tables

^{59}Fe i=1/2-(287)
f=3/2-(1099) 3/2-(1292) 1/2-(1434)
[a]=5.5

^{60}Fe i=2+(824)
f=2+(59) 3+(288) 3+(506) 2+(543) 3+(615)
[11]=7.0 [a]=7.5

^{60}Co i=4+(277) 3+(288)
f=2+(1333) 2+(2159) 4+(2506) 3+(2626)
[1,a]=7.5 [21]=7.6 [22]=7.3

^{63}Ni i=5/2-(87) 3/2-(156)
f=3/2-(0)
[11]=6.5 [21]=5.5

^{65}Ni i=1/2-(64) 3/2-(311)
f=3/2-(0) 1/2-(771)
[11]=6.6 [12]=6.0 [2,a]=5.7

^{64}Cu i=1+(344)
f=0+(0)
[11]=5.7

^{66}Cu i=2+(186) 3+(275)
f=2+(1039)
[11]=5.5 [21]=6.0

^{72}Ga i=2-(16) 1+(161)
f=0+(0) 2+(834)
[12]=7.5 [21]=4.6

^{73}Ga i=5/2-(198) 3/2-(216)
f=1/2-(67) 5/2-(354) 3/2-(364)
[12]=6.0 [13]=5.6 [2,1-2]=5.4

^{75}Ge i=9/2+(200) 1/2-(254) 5/2-(317)
f=3/2-(0) 9/2+(304)
[12]=6.0 [21]=5.5 [31]=5.7

^{77}Ge i=9/2+(223)
f=9/2+(476)
[11]=5.5

^{76}As i=1+(45) 1+(87) 1+(120) 1-(122) 3-(165)
1+(204) 4-(211) 3-(236) 2+(265) 2+(308)
f=0+(0) 2+(559)
[1-3,a]=5.1 [72]=9.5 [a]=5.7 [nu]=7.5

^{77}As i=1/2-(195) 3/2-(216) 5/2-(264)
f=1/2-(0) 3/2-(239)
[1,a]=6.0 [21]=5.7 [22]=6.9 [32]=7.0

^{78}As i=1+(277)
f=0+(0)
[11]=4.7

^{79}Se i=1/2-(96) 9/2+(137) 5/2-(365)
f=3/2-(0) 9/2+(207) 5/2-(217) 3/2-(261)
3/2-(397)
[11]=5.0 [31]=6.5 [33]=5.8 [a]=6.0

^{82}Se i=2+(654)
f=2-(46) 1+(78)
[11]=8.0 [12]=6.9

^{80}Br i=2-(37) 5-(86) 6-(145) 2+(256) 2+(271)
3-(281) 2+(300)
f=0+(0) 2+(617) 2+(1256) 4+(1436)
[11]=8.9 [12]=7.9 [13]=8.0 [34]=8.5
[a]=5.7 [nu]=7.5

^{82}Br i=1+(78)
f=0+(0) 2+(776)
[11]=5.5 [12]=6.0

^{83}Br i=5/2-(357)
f=7/2+(9) 5/2-(562)
[11]=8.0 [12]=6.4

^{86}Rb i=1+(488)
f=0+(0) 2+(1077) 2+(1854)
[11]=6.0 [a]=6.7

^{87}Rb i=5/2-(403) 1/2-(845)
f=9/2+(0) 1/2-(388)
[11]=9.5 [22]=6.0

^{88}Rb i=3-(28) 1-(196) 4-(268)
f=0+(0) 2+(1836) 3-(2734)
[12]=7.8 [13]=7.0 [21]=7.2 [33]=6.9

^{91}Sr i=3/2+(94)
f=1/2-(0) 5/2+(1305)
[11]=8.5 [12]=6.8

^{90}Y i=3-(202)
f=2+(2186)
[11]=7.8

^{92}Y i=3-(242)
f=2+(934) 3-(2340)
[11]=8.5 [12]=6.5

^{93}Zr i=3/2+(267)
f=1/2-(30)
[11]=8.4

^{94}Nb i=4+(59) 5+(113) 2-(140)
f=0+(0) 2+(871) 4+(1574)
[32]=7.5 [31]=9.5 [a]=6.5

^{96}Nb i=5+(43) 4+(142) 3+(180) 7+(233)
f=2+(778) 4+(1628) 5+(2438) 6+(2441)
[13;31]=6.5 [22]=6.0 [44]=5.2

^{99}Mo i=5/2+(98) 7/2+(236) 3/2+(351)
f=9/2+(0) 7/2+(141) 1/2-(142) 5/2+(181)
[12]=7.0 [14]=6.5 [2,1-2]=5.0 [33]=7.5 [34]=6.3

^{98}Tc i=5+(22) 2-(139)
f=0+(0) 2+(652) 4+(1398)
[13]=7.0 [21]=10.0 [22]=7.5

^{99}Tc i=7/2+(141) 5/2+(181)
f=5/2+(0) 3/2+(90) 5/2+(322) 7/2+(341)
[11]=5.9 [1,a]=6.0 [21]=6.6 [22]=6.2 [23]=5.7

^{103}Ru i=5/2+(3) 3/2+(136) 1/2+(174) 7/2+(213)
11/2-(238) 7/2-(297)
f=1/2-(0) 7/2+(40) 9/2+(93) 3/2-(295) 5/2-(357)
5/2+(537) 3/2+(652)
[12;37;46;65]=5.7 [16]=6.5 [21]=8.2 [26]=6.2
[24;3,nu;53;62]=7.5 [42]=6.0 [52]=9.6

^{105}Ru i=5/2+(21) 3/2+(108) 5/2+(164) 7/2+(230)
f=7/2+(0) 5/2+(724)
[11]=6.0 [22]=6.2 [a,2]=5.7

^{106}Ru i=2+(270)
f=1+(0)
[11]=5.7

TABLE III. Estimated Log*ft* Values for Unknown β^- Transitions

See page 383 for Explanation of Tables

^{104}Rh i=2-(51) 2+(97) 1+(181) 1-(186) 1+(213)
f=0+(0) 2+(556) 0+(1334) 2+(1342)
[11]=9.5 [31]=5.2 [32]=5.9 [33]=5.4
[a,1-3;24]=5.7 [nu,1-3;14]=7.5

^{105}Rh i=1/2-(130) 9/2+(149)
f=5/2+(0) 3/2+(281) 7/2+(306) 1/2+(345)
[11]=9.5 [12]=7.5 [14]=8.0 [23]=5.5

^{107}Pd i=1/2+(116) 11/2-(215) 5/2+(303) 7/2+(312)
f=1/2-(0) 7/2+(93) 9/2+(126)
[11]=7.3 [22]=9.7 [23]=8.3 [31]=9.5
[32]=5.3 [a]=5.5

^{109}Pd i=1/2+(112) 11/2-(188) 7/2+(245) 1/2+(262)
3/2+(291)
f=1/2-(0) 7/2+(88) 9/2+(133) 3/2-(311)
[11]=7.0 [22]=9.7 [23]=8.3 [32]=6.0
[33]=5.7 [nu]=7.5

^{112}Pd i=2+(349)
f=2-(0) 1+(19)
[11]=8.0 [12]=6.0

^{108}Ag i=2-(79) 1+(193) 2+(207) 3+(215) 2+(295)
f=0+(0) 2+(633)
[11]=9.5 [21]=5.0 [22]=5.5 [a]=5.7
[nu]=7.5

^{110}Ag i=2-(1) 3+(119) 3+(191) 2-(198) 1-(237)
f=0+(0) 2+(658)
[a]=5.7 [nu]=7.5 [u]=9.5

^{111}Ag i=9/2+(130) 3/2-(290)
f=1/2+(0) 5/2+(245) 3/2+(342) 11/2-(396)
7/2+(417)
[15]=5.5 [nu]=7.5

^{112}Ag i=1+(19)
f=0+(0)
[11]=4.5

^{113}Cd i=3/2+(298) 5/2+(316) 7/2+(458)
f=9/2+(0) 1/2-(392) 3/2-(647)
[31]=5.3 [1,nu]=7.5 [22]=9.5

^{115}Cd i=3/2+(230) 5/2+(361)
f=1/2-(336) 3/2-(597) 3/2+(828)
1/2+(864)
[21]=9.5 [22]=7.5 [23]=5.3 [a]=5.7
[nu]=7.3

^{117}Cd i=3/2+(290)
f=1/2-(315) 3/2+(660)
[11]=7.5 [12]=5.7

^{114}In i=4+(221) 2+(288)
f=2+(1300) 4+(2188)
[12]=5.7 [21]=6.0

^{116}In i=4+(223) 2+(273) 5+(313)
f=2+(1294) 2+(2112) 2+(2225) 4+(2391)
4+(2529) 4+(2801)
[a]=5.7

^{123}Sn i=1/2+(151)
f=1/2+(713)
[11]=5.7

^{125}Sn i=1/2+(215)
f=1/2+(922)
[11]=5.7

^{127}Sn i=1/2+(257)
f=3/2+(778)
[11]=5.7

^{122}Sb i=3+(61) 3-(78) 1+(122) 5+(137) 2+(167) 4-(193)
4+(210) 3+(256) 5-(264) 3-(283)
f=0+(0) 2+(564) 4+(1181) 2+(1257) 0+(1357)
[12;43;nu]=7.5 [1,a]=8.0 [31]=5.4 [32]=5.8
[3,a]=6.0 [5,a]=6.5 [a]=7.0

^{125}Sb i=5/2+(332)
f=3/2+(35) 9/2-(321) 3/2+(443) 5/2+(463)
[11]=5.6 [12]=9.5 [a]=6.0

^{126}Sb i=3-(40) 3-(83) 3+(105) 2+(128)
f=2+(666) 4+(1361) 2+(1420)
[a]=5.7 [nu]=7.5

^{127}Sb i=5/2+(491)
f=3/2+(0) 9/2-(341) 5/2+(473) 3/2+(503)
[11]=5.4 [12]=9.5 [a]=5.7

^{128}Sb i=4+(66) 3+(98) 2+(173)
f=2+(743) 4+(1497)
[12]=6.4 [a]=6.0

^{127}Te i=1/2+(61) 9/2-(341)
f=7/2+(58) 3/2+(203) 1/2+(375) 5/2+(418)
[21]=7.5 [24]=9.5 [a]=6.2

^{129}Te i=1/2+(181)
f=3/2+(278)
[11]=5.7

^{130}Te i=2+(840)
f=2+(48)
[11]=7.3

^{131}Te i=1/2+(296)
f=3/2+(493) 1/2+(876) 3/2+(1098) 3/2+(1298)
[12]=6.0 [a]=7.0

^{126}I i=1+(56)
f=0+(0)
[11]=6.1

^{128}I i=2+(27) 3+(85) 4+(128) 2-(134) 4-(138) 3-(144)
3+(152) 2+(161) 3+(180) 1+(221)
4+(233) 5-(234) 5-(294) 2+(296)
f=0+(0) 2+(443) 2+(969) 4+(1033)
[12]=6.6 [13]=7.3 [2,a;7-8,2]=6.5,[34]=7.0
[41]=9.5 [54;nu,2]=8.0 [92;10,1;11,4;14,2]=5.7
[12-13,4]=7.5

^{129}I i=5/2+(28) 3/2+(278)
f=1/2+(0) 3/2+(40) 3/2+(318) 5/2+(322) 1/2+(411)
[12]=5.9 [21]=6.5 [22]=7.0 [a]=6.2

^{131}I i=5/2+(150)
f=3/2+(0) 9/2-(341) 5/2+(364) 3/2+(405)
7/2+(637) 5/2+(723)
[11]=5.5 [12]=9.5 [a]=6.0

^{132}I i=5+(22) 3+(50) 2+(162) 1+(278)
f=0+(0) 2+(668) 4+(1440)
[a,3]=6.3 [32]=6.7 [41]=4.7

^{133}I i=5/2+(312)
f=3/2+(0)
[11]=6.6

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See page 383 for Explanation of Tables

^{134}I i=5+(44) 3+(80) 3+(181) 2+(210)
f=2+(847) 4+(1731) 4+(2867)
[12]=7.5 [41]=6.5 [a,3]=5.7 [a,1]=6.8

^{133}Xe i=11/2-(233) 1/2+(263)
f=7/2+(0) 3/2+(384) 1/2+(437) 11/2+(633)
[11]=9.9 [14]=8.5 [a]=6.2

^{135}Xe i=1/2+(288)
f=3/2+(408)
[11]=7.0

^{134}Cs i=5+(11) 3+(60) 2+(174) 3-(176) 1+(177)
3+(190) 4-(194) 2+(198) 5+(210) 3+(234)
5-(268) 3+(271) 2+(291)
f=0+(0) 2+(60) 2+(1168) 4+(1401) 3+(1643)
4+(1970)
[14]=9.0 [16;72]=9.5 [23;94]=7.0 [25;32]=8.2
[24]=8.4 [26;3,a]=8.5 [4,2~5;62]=8.0
[51]=5.5 [10,2]=6.2 [12,2]=6.0 [13,2]=5.7
[a,2;53]=6.5 [nu,4]=7.5

^{135}Cs i=5/2+(250) 3/2+(408)
f=3/2+(0) 1/2+(221) 5/2+(481)
[11]=6.1 [2,a]=7.0

^{137}Cs i=5/2+(455)
f=3/2+(0)
[11]=5.6

^{138}La i=3+(73) 2+(116) 3+(161) 2+(192) 1+(293)
f=0+(0) 2+(789)
[1~2,2]=6.5 [3~4,2]=7.5 [51]=5.0

^{140}La i=2-(30) 5-(35) 1-(44) 6-(49) 4-(63) 6-(104)
2-(163) 4-(272) 7-(285) 3-(318) 5-(322)
f=0+(0) 2+(1596) 0+(1903) 4+(2084) 6+(2108)
2+(2348)
[u,1]=10.6 [1,nu]=9.0 [13]=10.0 [24]=9.5
[33]=9.8 [45;54]=8.5 [65]=7.6
[nu,1~5]=8.0

^{141}La i=5/2+(190)
f=7/2-(0)
[11]=7.5

^{142}La i=1-(78) 3-(147) 2-(155)
f=0+(0) 2+(641) 4+(1219) 2+(1536) 3-(1652)
2+(2004) 0+(2030)
[nu,4]=8.7 [nu,6]=8.6 [31]=10.5
[a;nu]=9.0

^{143}Ce i=7/2-(19) 5/2-(56)
f=7/2+(0)
[nu]=7.5

^{144}Ce i=2+(397)
f=3-(59)
[11]=7.5

^{142}Pr i=3-(18) 4-(72) 1-(85) 4-(145) 3-(177)
2-(201)
f=0+(0) 2+(1576) 3-(2084)
[12;61]=10.0 [13;63]=8.4 [23;32;62]=8.0
[31]=7.6 [a]=7.5

^{143}Pr i=5/2+(57) 3/2+(351)
f=7/2-(0) 3/2-(742)
[nu]=7.5 [21]=9.5

^{144}Pr i=1-(80) 2-(100) 1-(134)
f=0+(0) 2+(696) 3-(1511) 2+(1561) 2+(2085)
1-(2186)
[nu,1]=6.5 [32]=7.0 [21]=9.2
[a]=6.3 [nu]=7.1

^{145}Pr i=5/2+(63)
f=7/2-(0) 3/2-(67) 5/2-(72) 3/2-(507)
3/2-(780) 5/2-(937) 7/2-(1051) 3/2+(1085)
[11]=7.0 [1,2~3]=8.6 [18]=6.5 [nu]=8.1

^{147}Nd i=7/2-(50) 5/2-(128) 1/2-(215)
f=7/2+(0) 5/2+(91) 3/2+(411) 5/2+(531)
[11]=7.6 [14]=7.8 [22]=7.4 [24]=7.0 [32]=9.5
[33]=7.5

^{149}Nd i=7/2-(109) 5/2-(138) 3/2-(165) 9/2-(221)
3/2-(258) 9/2+(271)
f=5/2+(114) 7/2+(189) 7/2-(270)
[13;43]=6.7 [2~3,1;51]=8.5 [62]=5.7

^{150}Nd i=2+(130)
f=1-(0)
[11]=8.7

^{147}Pm i=5/2+(91)
f=7/2-(0) 5/2-(121) 3/2-(197)
[11]=8.7 [12]=7.9 [13]=9.0

^{148}Pm i=2-(76)
f=0+(0) 2+(550) 3-(1161) 4+(1180) 2+(1455)
1-(1465)
[a]=8.0 [nu]=9.0 [u]=11.0

^{149}Pm i=5/2+(114) 7/2+(189) 5/2+(211) 11/2-(240)
7/2-(270)
f=7/2-(0) 5/2-(23) 7/2-(277) 9/2-(286)
[2,1~2]=7.1 [nu,1]=8.8 [1,nu;3,nu]=7.9
[24]=8.0 [a]=6.5

^{151}Pm i=7/2+(65) 5/2-(117) 7/2-(175) 9/2+(197)
3/2+(256) 9/2-(258) 5/2+(324)
f=5/2-(0) 3/2-(5) 7/2-(66) 5/2-(70) 9/2+(92)
3/2-(105) 5/2+(168) 5/2-(168) 9/2-(175)
7/2-(209)
[11;1,u]=9.0 [13;1,10]=8.5 [1,a]=8.0
[1,nu]=8.8 [2~3,a]=6.0 [a]=7.0

^{151}Sm i=3/2-(5) 7/2-(66) 5/2-(70) 9/2+(92) 3/2-(105)
5/2+(168) 5/2-(168) 9/2-(175) 7/2-(209)
1/2-(285) 9/2-(295)
f=5/2+(0) 7/2+(22) 11/2-(196) 3/2+(197)
[u,1~2]=11.0 [21;91]=8.3 [22;92]=7.6
[31;71]=7.8 [32;72]=9.0 [nu,1~2;10,4]=8.0
[a,1~3]=6.0

^{153}Sm i=5/2+(8) 3/2-(36) 7/2+(54) 9/2+(65) 5/2-(91)
11/2-(98) 3/2-(127) 7/2-(174) 5/2-(183)
5/2+(195) 7/2+(262) 7/2-(266) 3/2+(277)
f=5/2+(0) 7/2+(83) 5/2-(97) 3/2+(103) 7/2-(152)
5/2+(173) 7/2+(270)
[11;31]=7.8 [12]=7.0 [42]=8.0 [8,a]=6.0
[9,a]=5.5 [12~13,a;a,3]=5.7 [a,1]=7.3
[nu,1]=7.7 [62]=9.6 [26;56]=6.9 [47]=7.5
[1,a;3,a;10,4;11,6;24]=6.7

TABLE III. Estimated Log *ft* Values for Unknown β^- Transitions

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^{152}Eu i=1-(65) 3-(77) 1+(78) 4-(90) 4+(90) 5+(108)
1-(109) 2-(111) 4+(125) 4-(142)
4-(151) 1+(158) 4+(161) 4-(181) 4-(203)
f=0+(0) 2+(344) 0+(615) 4+(755) 2+(931)
0+(1048) 2+(1109) 3-(1123) 6+(1227)
4+(1282) 1-(1315)
[a]=5.7 [nu]=7.5 [u]=9.6

^{154}Eu i=2+(68) 1-(83) 3+(100) 4+(101) 4+(108)
2-(123) 3+(127)
f=0+(0) 2+(123) 2+(996) 1-(1241) 4+(1646)
[12;64]=7.7 [13]=7.0 [21]=8.4 [24]=7.3
[32]=8.2 [33]=7.5 [a,5]=6.8 [62]=8.5

^{155}Eu i=7/2+(77) 5/2-(104) 7/2-(169) 3/2+(246)
5/2+(307) 7/2+(391)
f=3/2-(0) 5/2-(60) 5/2+(87) 3/2+(105)
9/2+(108) 7/2+(118)
[12]=8.7 [15]=8.3 [16]=8.0 [21;32]=6.0
[22]=6.4 [41]=7.0 [43]=7.4 [44]=6.7
[62]=8.5 [a,3~5;66;nu,1~2]=5.7

^{156}Eu i=1+(23) 2+(48) 1-(88) 2-(126) 1+(291)
f=0+(0) 2+(89) 0+(1050) 0+(1168) 1-(1242)
1-(1366)
[11;13]=6.3 [14]=7.0 [22]=6.5 [31]=8.3
[nu,2]=8.5 [35]=7.2 [36]=7.3 [45]=7.5
[5,1~2]=6.2

^{157}Eu i=7/2+(77) 9/2+(177) 5/2-(198) 7/2-(263)
11/2+(296)
f=3/2-(0) 5/2-(55) 5/2+(64) 7/2+(116)
7/2-(132) 9/2+(182)
[1,a;56]=7.7 [24]=7.8 [26]=7.9 [32]=6.4
[a]=6.0

^{157}Gd i=5/2-(54) 5/2+(64) 7/2+(115) 7/2-(131)
9/2+(180) 9/2-(226)
f=3/2+(0) 5/2+(61) 7/2+(144)
[11]=7.9 [21;32;53]=7.1 [42;63]=7.5

^{159}Gd i=5/2-(51) 5/2+(68) 7/2+(119) 7/2-(122)
5/2-(146) 9/2+(186) 9/2-(212) 7/2-(228)
f=3/2+(0) 5/2+(58) 7/2+(138) 5/2+(348)
5/2-(363)
[11;2,1~3]=7.2 [12]=6.7 [42]=7.0 [43]=7.3
[55]=5.8 [85]=6.3 [nu,1~2]=8.0
[a,2~3;73]=7.5

^{160}Gd i=2+(75) 4+(248)
f=3-(0) 4+(64)
[11]=12.2 [21]=12.0 [22]=8.5

^{158}Tb i=4-(74) 0-(110) 1-(114) 5+(130) 5-(163)
2-(180) 3-(209) 6+(219) 6-(268)
f=0+(0) 2+(99) 4+(317) 6+(638)
[21]=6.8 [31]=7.2 [32]=7.0 [6~7,nu]=8.0
[nu,3;94]=12.0 [a]=10.0

^{160}Tb i=1-(64) 4+(64) 4-(79) 0-(79) 2-(106)
5+(127) 1-(133) 1+(139) 2-(139) 3-(156)
2+(168) 3+(200) 1+(233) 3-(237) 4-(244)
4-(258) 2+(269) 4-(279)
f=0+(0) 2+(87) 4+(284) 2-(1265) 1-(1286)
3-(1287) 5+(1288)
[11]=8.3 [14]=4.6 [23]=9.0 [36]=9.1 [41]=7.0
[45]=7.5 [54]=5.1 [75]=6.0 [67;7~8,1;94]=8.0
[10,4;11~12,2;13,1;14,4;15~18,a]=5.7

^{161}Tb i=5/2+(56) 7/2+(134) 9/2+(231) 5/2+(315)
7/2+(394) 7/2-(417)
f=5/2+(0) 5/2-(26) 7/2+(44) 3/2-(75) 7/2-(103)
5/2-(132) 9/2-(201)
[11]=8.2 [13]=7.8 [14;16]=7.0 [21]=9.1 [23]=8.1
[26]=7.5 [33]=8.8 [35]=8.5 [42]=6.2 [52]=6.5
[62]=4.9 [65]=5.3 [67]=5.7

^{163}Dy i=5/2-(0) 7/2-(73) 9/2-(167)
f=7/2-(0) 9/2-(100)
[11]=4.9 [21]=5.5 [22]=5.0 [31]=6.5 [32]=5.3

^{165}Dy i=9/2+(83) 3/2-(159) 5/2-(181) 5/2-(184)
11/2+(186) 7/2-(262) 7/2-(298)
f=7/2-(0) 11/2-(210) 3/2+(362)
[11]=6.2 [2~5,nu]=6.5 [6~7,1]=5.7

^{166}Dy i=2+(63) 4+(272)
f=0-(0) 2-(54) 1-(82) 3+(191) 4+(261)
5+(264) 5+(348) 4+(372) 1-(373) 1+(426)
[11]=10.0 [1,2~3]=8.0 [a]=5.7

^{164}Ho i=2+(37) 3+(94) 6-(140) 4+(166) 6+(191) 7-(204)
3-(234) 5+(262) 8-(275) 4-(294)
f=2+(91) 4+(299) 6+(614) 2+(860) 3+(946)
8+(1025) 4+(1058)
[a,1~2;14;53;45;87]=5.7 [u,1~2;93]=9.6
[nu,1~3;nu,6]=7.5

^{166}Ho i=2-(54) 1-(82) 3-(171) 4-(180) 3+(191) 4+(261)
5+(264) 6+(294)
f=0+(0) 2+(81) 4+(265) 6+(545) 2+(786) 3+(859)
4+(956) 5+(1075) 6+(1216)
[11;44]=9.6 [1~2,2]=7.0 [21]=6.5 [nu,2~3]=7.5
[55]=7.9 [56;6,6~7;7,7~8;8,8~9]=8.0

^{167}Ho i=3/2+(259) 5/2+(320)
f=1/2-(208) 3/2-(265) 5/2-(282)
[nu]=8.0

^{169}Er i=3/2-(65) 5/2-(75) 5/2-(92) 7/2-(177) 7/2-(224)
9/2-(242) 7/2+(244) 9/2+(317)
f=1/2+(0) 3/2+(8) 5/2+(118) 7/2+(139)
7/2-(379)
[11]=7.0 [12]=7.4 [13;2,2~3;5~8,nu]=7.5
[32;43]=8.5 [35]=6.4 [45]=6.8

^{171}Er i=7/2-(78) 9/2-(176) 1/2-(198) 3/2-(255)
5/2-(279)
f=1/2+(0) 3/2+(5) 7/2-(425)
[1~2,a]=6.4 [nu,1;52]=6.5

^{172}Er i=2+(78) 4+(256)
f=2-(0) 3-(63) 4-(146) 1+(610)
[14]=5.5 [21]=8.0 [nu]=7.5

^{170}Tm i=2-(39) 3-(115) 0-(150) 2-(172) 3+(183) 4-(184)
2-(205) 2-(220) 1-(237) 4+(254) 3-(271)
f=0+(0) 2+(84) 4+(277)
[11]=11.3 [12]=9.0 [2,nu]=9.3 [31;82]=7.0
[u,2;7~8,1]=9.6 [42]=8.5 [72;a]=8.0 [nu]=7.5

^{171}Tm i=3/2+(5) 5/2+(117) 7/2+(129) 7/2-(425)
f=1/2-(0) 3/2-(67) 5/2-(76) 5/2-(122) 7/2-(208)
[11]=6.8 [12]=7.0 [21]=9.6 [4,4~5]=6.4
[nu,2~3]=7.5

^{172}Tm i=3-(63) 4-(146)
f=2+(79) 4+(260) 2+(1466) 3+(1549)
[nu,1~2]=8.6 [nu]=6.7 [21]=10.5

TABLE III. Estimated Log*ft* Values for Unknown β^- Transitions

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^{173}Tm i=3/2+(3) 5/2+(119) 7/2-(318)
f=5/2-(0) 1/2-(399) 3/2-(462)
[12]=6.8 [13]=6.3 [23;31]=6.5

^{175}Yb i=9/2-(105) 11/2-(232) 9/2+(268)
f=7/2+(0) 9/2+(114) 11/2+(252) 9/2-(396)
[12]=6.2 [14]=5.4 [24]=5.2 [31]=6.3
[32]=6.9 [33]=7.0 [nu,1~3]=7.5

^{177}Yb i=7/2-(105) 11/2+(125) 9/2-(222)
f=9/2+(122) 9/2-(150)
[12]=4.8 [21]=6.5 [32]=5.0

^{176}Lu i=1+(198) 2+(237) 3-(239) 0-(241) 3+(303)
2-(309) 1+(342)
f=0+(0) 2+(88) 4+(290) 0+(1150)
[11;22]=6.4 [12]=6.3 [14]=7.9
[52]=6.6 [53]=6.7 [62]=7.5 [71]=5.1
[nu,1~3]=7.0

^{177}Lu i=9/2+(122) 9/2-(150) 11/2+(269) 11/2-(289)
f=7/2-(0) 9/2-(113) 11/2-(250) 9/2+(321)
[11]=7.2 [12]=6.7 [14]=6.5 [22]=6.2
[42]=5.7 [43]=6.4 [2,a]=5.4 [3,nu]=7.5

^{179}Hf i=11/2+(123) 7/2-(214)
f=7/2+(0) 9/2-(31) 9/2+(134)
[12]=7.5 [21]=6.9 [22]=4.6 [23]=7.4

^{181}Hf i=3/2-(46) 9/2+(68) 5/2-(99) 11/2+(170)
7/2-(207) 3/2-(252) 13/2+(298)
f=7/2+(0) 9/2-(6) 9/2+(136) 11/2-(159)
5/2+(482) 1/2+(615) 3/2+(619)
[15]=8.3 [21;24]=6.9 [22]=6.8
[23]=7.8 [31]=8.5 [35]=8.0
[4~5,2;66]=7.0 [65]=7.2
[1,nu;37;nu,4;51]=7.5

^{182}Hf i=2+(98) 4+(322)
f=3-(0) 5+(17) 4+(150) 3+(250)
[11]=10.0 [14]=8.0 [2,2~3]=8.5

^{180}Ta i=2+(41) 3+(110) 4+(189)
f=2+(104) 4+(338)
[11]=6.9 [a]=7.0

^{182}Ta i=5+(17) 4-(98) 4-(114) 6+(163) 2-(270)
f=4+(329) 6+(681) 2-(1289) 3-(1374) 4-(1553)
[a,1~2;34]=9.0 [15]=6.8 [24]=8.4 [25]=7.5
[53]=7.8

^{183}Ta i=9/2-(73) 9/2+(143)
f=7/2-(207) 11/2+(309) 7/2-(453)
[11]=8.3 [12;21]=6.9

^{184}Ta i=3-(48) 2-(89) 1-(228)
f=0+(0) 3+(1425) 2+(1431) 4-(1699)
[12]=8.0 [14]=7.0 [23]=8.5 [31]=6.8

^{185}W i=1/2-(24) 5/2-(66) 3/2-(93) 7/2-(174)
5/2-(188) 7/2-(244)
f=5/2+(0) 7/2+(125)
[11]=10.0 [22;41]=8.0 [31]=8.5 [nu]=7.5

^{187}W i=5/2-(77) 1/2-(146) 7/2-(201) 3/2-(205)
f=5/2+(0) 7/2+(134) 1/2+(512) 3/2+(589)
5/2-(686)
[23]=7.0 [43]=7.3 [a]=6.5
[1,1~2;2~3,nu]=6.5

^{188}W i=2+(143)
f=1-(0) 2-(64)
[nu]=7.5

^{186}Re i=2-(59) 3-(99) 3-(146) 4-(174) 6-(186) 2-(211)
4-(269) 4-(274)
f=0+(0) 2+(137) 4+(434) 2+(768) 6+(869)
[11;42;53]=9.6 [nu]=7.5

^{187}Re i=5/2+(0) 7/2+(134) 9/2-(211) 9/2+(301)
11/2-(390) 11/2+(509) 1/2+(512)
f=1/2-(0) 3/2-(10) 3/2-(74) 5/2-(75) 7/2-(101)
7/2-(191) 11/2+(257)
[35]=5.8 [36]=6.0 [a]=5.7 [6,u]=9.6
[12;2,4~5;4,5~6;57;7,nu]=7.5

^{188}Re i=2-(64) 3-(156) 3-(169) 4-(183) 2-(205) 2-(257)
4-(285) 4-(287) 1-(291)
f=0+(0) 2+(155) 4+(478) 2+(633) 3+(790)
[1~4,nu]=8.0 [nu]=7.5

^{189}Re i=9/2-(125) 7/2+(146)
f=9/2-(31) 5/2-(70) 7/2-(217)
[2,2~3]=7.5 [a]=6.5

^{191}Os i=3/2-(74) 1/2-(85) 5/2-(134) 3/2-(142) 5/2-(273)
f=3/2+(0) 1/2+(82) 5/2+(129) 3/2+(179)
[11;22]=7.2 [21;41]=8.5 [31]=7.8
[13;2~3,nu;42;54]=7.5

^{193}Os i=1/2-(41) 5/2-(73) 3/2-(103)
f=3/2+(0) 1/2+(73)
[12]=7.5 [31]=8.0 [11;21]=7.8

^{194}Os i=2+(200)
f=1-(0) 1-(83)
[nu]=7.5

^{193}Ir i=3/2+(0) 1/2+(73) 5/2+(139)
3/2+(180)
f=1/2-(0) 3/2-(2) 5/2-(14)
[11;3,nu]=7.5 [12;41]=7.4 [21]=7.2

^{194}Ir i=0-(43) 1-(83) 1-(84) 2-(112) 5+(112)
f=0+(0) 2+(328) 2+(622) 4+(811)
[11]=7.3 [22]=8.2 [31]=7.5 [42]=8.5
[21;32;54]=8.0

^{195}Ir i=5/2+(139) 3/2+(182) 7/2-(301)
f=1/2-(0) 3/2-(99) 5/2-(130)
[1,nu;21]=7.0 [22]=6.5 [33]=7.5

^{195}Pt i=3/2-(199) 3/2-(211) 1/2-(222) 5/2-(239)
5/2-(389)
f=3/2+(0) 1/2+(61)
[11]=8.3 [21]=7.4 [41]=7.7 [22;nu,1]=7.5

^{197}Pt i=5/2-(53) 1/2-(99) 3/2-(131) 5/2-(299)
f=3/2+(0) 1/2+(77)
[11]=6.3 [21]=7.1 [32]=6.5 [41]=7.5

^{198}Au i=1-(55) 0-(91) 2-(193) 1-(236) 2-(247)
1-(259) 2-(261)
f=0+(0) 2+(412)
[1~2,1]=6.4 [32;52;61;72]=7.5 [41]=7.0

^{199}Au i=1/2+(77)
f=1/2-(0) 3/2-(208)
[11]=6.4 [12]=7.5

TABLE III. Estimated Log*ft* Values for Unknown β^- Transitions

See page 383 for Explanation of Tables

^{203}Hg i=1/2-(5) 3/2-(46) 3/2-(220)
f=1/2+(0) 3/2+(279)
[11]=5.2 [12]=6.4 [21]=6.5 [22]=7.0 [nu]=7.5

^{204}Tl i=1-(140) 0-(146) 1-(300)
f=0+(0)
[11]=5.4 [21]=5.1 [31]=7.5

^{205}Tl i=1/2+(0) 3/2+(204)
f=5/2-(0) 1/2-(2) 3/2-(263)
[11]=12.0 [12]=5.4 [21]=6.7 [22]=6.4 [23]=7.5

^{210}Bi i=0-(47)
f=0+(0)
[11]=5.8

Note:

a) Nuclei for which the calculated rates are essentially the same as those calculated only with the experimentally known ft-values:

^{61}Co ^{66}Ni ^{67}Cu ^{69}Zn ^{71}Zn ^{72}Zn ^{70}Ga ^{78}Ge ^{81}Se ^{85}Kr ^{87}Kr ^{88}Kr ^{89}Sr ^{90}Sr
^{92}Sr ^{91}Y ^{93}Y ^{95}Zr ^{97}Zr ^{95}Nb ^{97}Nb ^{111}Pd ^{115}In ^{117}In ^{121}Sn ^{126}Sn ^{129}Sb ^{132}Te
^{135}I ^{139}Ba ^{140}Ba ^{141}Ce ^{192}Ir ^{196}Au ^{209}Pb ^{210}Pb

b) Nuclei for which only the experimentally known ft-values are used:

^{106}Rh ^{113}Ag ^{124}Sb ^{130}I ^{132}Cs ^{136}Cs ^{146}Pm ^{150}Pm

The calculated rates for the last four nuclei are highly questionable as only the ground-state decays are included.

c) Nuclei for which the initial level schemes are obtained from systematics:

^{166}Dy ^{172}Er ^{194}Os

TABLE IV. Estimated Log*ft* Values for Unknown β^+ ϵ Transitions

See page 383 for Explanation of Tables

```
59Ni i=5/2-(339)
     f=7/2-(0)
     [11]=5.1

64Cu i=2+(159) 2+(278) 1+(343)
     f=0+(0) 2+(1346)
     [1-2,2]=6.3 [31]=5.7 [32]=6.0

65Zn i=1/2-(54) 3/2-(115) 3/2-(207)
     f=3/2-(0) 1/2-(771) 5/2-(1116)
     [11]=5.6 [1-2,2]=5.5 [21]=5.2
     [31]=5.9 [33]=6.5 [a]=6.0

71Ge i=5/2-(175)
     f=3/2-(0)
     [11]=6.0

76As i=2-(0) 1+(46) 1+(87) 2+(121) 3-(165)
       4-(210) 3+(264) 2+(307)
     f=0+(0) 2+(563)
     [11]=9.6 [12;52]=7.5 [21]=5.1 [2-3,2]=6.0
     [31]=5.7 [82]=7.0 [62]=10.6 [a]=6.5

75Se i=7/2+(112) 9/2+(133) 3/2-(287) 1/2-(293)
     f=3/2-(0) 1/2-(199) 9/2+(304)
     [13]=5.4 [23]=5.7 [32]=5.6 [41]=5.5

79Br i=9/2+(207) 5/2-(217) 3/2-(261) 1/2-(307)
     f=7/2+(0) 1/2-(96)
     [11]=8.2 [21]=7.5 [32]=5.9 [42]=7.2

80Br i=2-(37) 2+(256) 2+(271) 3-(281) 2+(300)
     f=0+(0) 2+(666)
     [11]=9.6 [12]=8.0 [42]=7.5 [a]=5.7

82Br i=2-(46) 1+(78)
     f=0+(0)
     [11]=9.5 [21]=5.5

79Kr i=7/2+(130) 5/2-(147) 3/2-(183)
       5/2-(291)
     f=3/2-(0) 9/2+(207) 1/2-(307)
     [12]=8.0 [21]=6.1 [33]=5.1
     [41]=5.7

81Kr i=9/2+(50) 1/2-(190)
     f=3/2-(0) 5/2-(276)
     [12]=10.5 [21]=5.0

86Rb i=1+(488)
     f=0+(0)
     [11]=5.3

85Sr i=7/2+(232)
     f=9/2+(514)
     [11]=6.0

94Nb i=3+(41) 2-(140)
     f=0+(0) 2+(918)
     [12]=6.5 [21]=9.5 [22]=7.5

97Tc i=1/2-(97) 7/2+(216) 5/2+(325)
     f=5/2+(0)
     [11]=9.5 [21]=5.7 [31]=6.4

98Tc i=2-(139)
     f=0+(0) 2+(787)
     [11]=10.0 [12]=7.5

97Ru i=3/2+(189)
     f=5/2+(325)
     [11]=6.0

104Rh i=2-(51) 2+(97) 5+(129) 1+(181) 1-(186) 1+(213)
      f=0+(0) 2+(358) 4+(889) 2+(893) 0+(988)
      [11]=9.5 [22]=6.0 [24]=6.5 [33;nu]=7.5 [a]=5.7

103Pd i=3/2+(119) 7/2+(244) 5/2+(267)
      f=1/2-(0) 7/2+(40) 9/2+(93)
      [11]=8.0 [23]=6.1 [32]=5.7

107Ag i=7/2+(93) 3/2-(325)
      f=5/2+(0) 1/2+(116)
      [11]=6.2 [nu]=8.5

108Ag i=2-(79) 1+(193) 2+(207) 3+(215) 2+(295)
        3-(338)
      f=0+(0) 2+(434) 2+(931) 4+(1048) 0+(1053)
        2+(1441)
      [11]=9.5 [21]=5.0 [22]=5.5 [a]=5.7
      [nu]=7.5

110Ag i=2-(1) 3+(119) 3+(191) 2-(198) 1-(237)
      f=0+(0) 2+(374)
      [a]=6.5 [nu]=7.5 [u]=9.5

107Cd i=7/2+(205) 5/2+(321)
      f=7/2+(93) 9/2+(126)
      [12]=5.5 [21]=5.2

109Cd i=1/2+(60) 7/2+(204)
      f=1/2-(0) 7/2+(88) 9/2+(133)
      [11]=7.5 [22]=5.7 [23]=5.3

113In i=1/2-(391)
      f=1/2+(0)
      [11]=7.0

114In i=4+(221) 2+(288)
      f=2+(558) 2+(1209) 4+(1283)
      [13]=7.0 [a]=6.0

116In i=1+(0) 2+(273)
      f=0+(0) 2+(514)
      [11]=4.8 [22]=6.0

122Sb i=3+(61) 3-(78) 1+(122) 2+(167) 4-(193) 3+(256)
        3-(283)
      f=0+(0) 2+(1141)
      [31]=5.0 [32]=5.8 [42]=6.5
      [52]=9.5 [62]=8.0 [a;nu]=7.5

121Te i=3/2+(212)
      f=5/2+(0)
      [11]=5.2

123Te i=3/2+(159)
      f=5/2+(160)
      [11]=5.5

125I  i=3/2+(188) 1/2+(243)
      f=1/2+(0)
      [11]=6.2 [21]=6.0

126I  i=1+(56)
      f=0+(0)
      [11]=6.1
```

TABLE IV. Estimated Log *ft* Values for Unknown $\beta^+ \epsilon$ Transitions

See page 383 for Explanation of Tables

^{128}I i=2+(27) 3+(85) 2-(134) 4-(138) 3-(144)
3+(152) 2+(161) 3+(180) 1+(221) 2+(296)
f=0+(0) 2+(743)
[1-2,2;62]=6.0 [31;42]=9.5 [nu,2]=8.0
[72]=5.9 [a,2]=5.7

^{125}Xe i=3/2+(112) 9/2-(253)
f=5/2+(0) 7/2+(114)
[11]=5.7 [22]=7.5

^{127}Xe i=3/2+(125) 9/2-(297)
f=5/2+(0) 7/2+(58)
[11]=5.7 [22]=8.0

^{131}Cs i=1/2+(124) 5/2+(134) 3/2+(216)
f=3/2+(0) 1/2+(80)
[12]=6.5 [21]=5.7 [31]=6.0

^{134}Cs i=3+(60) 2+(174) 3-(176) 1+(177) 3+(190)
4-(194) 2+(198) 3+(234) 3+(271) 2+(291)
f=0+(0) 2+(847)
[12;52]=6.5 [2-3,2]=7.5 [41]=4.9 [62]=9.5
[a]=6.0

^{131}Ba i=3/2+(108) 9/2-(188) 3/2+(286) 5/2+(317)
f=5/2+(0) 7/2+(79)
[11]=6.1 [22]=7.5 [31]=6.2 [41]=6.5

^{133}Ba i=3/2+(12) 5/2+(291) 3/2+(302)
f=5/2+(81)
[11]=5.5 [21]=6.2 [31]=5.7

^{137}La i=5/2+(11)
f=3/2+(0)
[11]=5.3

^{138}La i=3+(73) 2+(116) 3+(161) 2+(192) 1+(293)
f=0+(0) 2+(1436)
[1-2,2]=6.5 [3-4,2]=7.5 [51]=4.7

^{137}Ce i=1/2+(160)
f=1/2+(1171)
[11]=5.7

^{142}Pr i=3-(18) 1-(85) 3-(177) 2-(201)
f=0+(0) 2+(641)
[12]=8.0 [21]=7.8 [3-4,2]=7.5

^{145}Pm i=7/2+(61)
f=7/2-(0) 5/2-(73)
[11]=7.8 [12]=7.5

^{148}Pm i=1-(0) 2-(76)
f=0+(0) 2+(302)
[11]=9.1 [22]=9.5

^{147}Sm i=7/2-(0) 5/2-(121) 3/2-(197)
f=7/2+(0) 5/2+(91)
[11]=7.4 [21]=10.3 [31]=11.8 [nu]=7.5

^{152}Eu i=1-(65) 3-(77) 1+(78) 4-(90) 4+(90) 5+(108)
1-(109) 2-(111) 4+(124) 4-(142) 4-(151)
1+(158) 4+(161) 4-(181) 4-(203)
f=0+(0) 2+(122) 4+(366) 0+(685) 6+(707)
2+(811) 1-(963) 4+(1023) 3-(1041) 0+(1083)
3+(1234) 1-(1511)
[1-4,a]=5.7 [5-7,a]=6.0 [a]=6.2 [nu]=7.5

^{154}Eu i=2+(68) 1-(83) 3+(100) 2-(123)
f=0+(0) 2+(82)
[12]=7.7 [32]=8.2 [nu]=8.5

^{153}Gd i=5/2-(42) 7/2-(93) 5/2-(110) 3/2-(129) 1/2-(195)
3/2+(212) 3/2-(250)
f=5/2+(0) 5/2-(97) 3/2+(103) 7/2-(152)
[1,a;22]=6.7 [3-4,2]=6.0 [61]=7.0 [72]=5.7
[nu,1;53]=7.5

^{157}Tb i=5/2+(61) 7/2+(144) 9/2+(252) 5/2-(326)
f=3/2-(0) 5/2-(55) 5/2+(64) 7/2+(116)
[11]=7.7 [1,2-3]=7.5 [23]=8.4 [24]=7.4 [34]=8.2
[4,a]=6.5

^{158}Tb i=0-(110) 1-(114) 2-(180) 3-(209)
f=0+(0) 2+(80) 4+(261)
[11;22]=7.0 [21]=7.3 [nu]=7.5

^{160}Tb i=1-(64) 0-(79) 2-(106) 1-(133) 1+(139) 2-(140)
3-(156) 2+(168) 5-(177) 3+(200) 1+(233)
3-(237) 4-(244) 4-(258) 2+(269) 4-(279)
f=0+(0) 2+(75) 4+(249)
[nu,1;32;6-7,2;93;12,2;13-14,3;16,3]=8.5
[5,a;82;10,2;11,1;15,2]=7.0

^{157}Dy i=5/2-(61) 7/2-(148) 5/2-(341)
f=5/2-(326)
[11]=5.7 [21]=5.5 [31]=5.4

^{159}Dy i=5/2-(57) 7/2-(137) 5/2+(178) 7/2+(209)
9/2-(236) 5/2-(310)
f=3/2+(0) 5/2+(58) 7/2+(138) 5/2-(363)
[12]=7.2 [14]=5.8 [24]=6.0 [64]=6.2
[a,1-2;43]=7.0 [nu,1;22;53]=7.5

^{163}Ho i=7/2-(0) 9/2-(100) 11/2-(222)
f=5/2-(0) 7/2-(73) 9/2-(167)
[11]=5.0 [22;33]=5.1

^{164}Ho i=2+(37) 3+(94) 6-(140) 4+(166) 6+(191) 7-(204)
5+(262)
f=2+(73) 4+(242) 6+(501)
[11]=5.2 [21;42;53;72]=5.7 [nu]=7.5

^{163}Er i=7/2-(84) 3/2-(104) 5/2-(164) 9/2-(190)
7/2-(250)
f=7/2-(0) 1/2+(298) 3/2+(360)
[11]=5.4 [22;33]=6.5 [41]=5.0 [51]=5.7

^{165}Er i=5/2+(47) 7/2+(63) 7/2-(77) 9/2+(98) 5/2-(296)
f=7/2-(0) 9/2-(95) 11/2-(210)
[4,2-3]=7.5 [31]=5.1 [32]=5.4 [51]=5.7
[nu]=7.2

^{170}Tm i=2-(39) 3-(115) 0-(150) 2-(172) 3+(183) 2-(220)
1-(237) 4+(254) 3-(271)
f=0+(0) 2+(79) 4+(260)
[11]=10.6 [1-2,2]=10.0 [31;62]=7.0 [u,1]=9.6
[nu,1-2;93]=7.5 [52;83]=8.0

^{169}Yb i=1/2-(24) 9/2+(71) 3/2-(87) 5/2-(99) 5/2-(191)
7/2-(279)
f=1/2+(0) 7/2-(379)
[22]=7.3 [31]=7.0 [a;nu]=6.5

^{176}Lu i=1-(127) 1+(198) 2+(237) 3-(239) 0-(241) 1+(342)
f=0+(0) 2+(82)
[11]=7.0 [21;32]=6.8 [42;51]=7.5 [61]=4.6

TABLE IV. Estimated Log*ft* Values for Unknown $\beta^+ \epsilon$ Transitions

See page 383 for Explanation of Tables

```
175Hf i=7/2-(82) 9/2-(186) 3/2-(196) 7/2+(207)
        5/2-(213) 9/2+(258)
      f=7/2+(0) 5/2+(343) 5/2-(354) 7/2+(433)
      [12]=7.2 [24]=6.5 [33;a,1]=7.5 [52]=7.0

179Ta i=9/2-(31) 9/2+(134) 11/2-(181) 5/2+(239)
        11/2+(295)
      f=9/2+(0) 11/2+(123) 7/2-(214)
      [12]=7.4 [13]=4.8 [21]=7.2 [22]=7.9
      [a]=6.5 [nu]=7.5

180Ta i=2+(41) 3+(110) 4+(189)
      f=2+(93) 4+(309)
      [a]=6.0
181W  i=11/2+(113) 13/2+(251)
      f=9/2-(6) 9/2+(136) 11/2-(159)
      [12]=7.4 [nu]=7.5

186Re i=2-(59) 3-(99) 3-(146) 4-(174) 2-(211)
        4-(269) 4-(274)
      f=2+(123) 4+(397)
      [11;3,nu;6-7,2]=7.5 [nu,1;42]=8.5

185Os i=3/2-(37) 5/2-(97) 7/2-(102) 3/2-(128)
        7/2-(198) 5/2-(222)
      f=5/2+(0) 1/2+(646) 3/2+(717) 5/2+(767)
      [12;3-4,1;54;61]=7.5 [23]=7.8

187Os i=3/2-(10) 3/2-(74) 5/2-(75) 7/2-(101)
        5/2-(188) 7/2-(191) 11/2+(257) 7/2-(333)
      f=5/2+(0) 7/2+(134) 9/2-(211)
      [11]=7.3 [2-5,1]=8.0 [5-8,nu]=7.5 [83]=5.7

192Ir i=1+(58)
      f=0+(0) 2+(206) 2+(489)
      [a]=8.5

191Pt i=5/2-(10) 9/2-(101) 13/2+(149)
        11/2+(173)
      f=3/2+(0) 11/2-(171)
      [22]=5.0 [un]=7.5

193Pt i=3/2-(2) 5/2-(14) 3/2-(114) 13/2+(150) 3/2-(188)
        11/2+(199) 5/2-(232) 3/2-(270)
      f=3/2+(0) 1/2+(73) 11/2-(80)
      [11]=7.0 [21;63]=7.2 [43]=6.7 [nu,1;82]=7.5

195Au i=1/2+(61) 3/2+(242) 5/2+(262)
      f=1/2-(0) 3/2-(99)
      [11]=6.5 [1-2,2]=7.5 [nu]=8.5
196Au i=5+(85) 7+(232)
      f=5-(1271) 6-(1374)
      [11;22]=8.5

198Au i=1-(55) 0-(91) 2-(193) 1-(236) 2-(247) 1-(259)
        2-(261)
      f=0+(0) 2+(407)
      [1-2,1]=6.8 [32;52;72]=8.0 [nu,1]=7.5

197Hg i=5/2-(134) 3/2-(152) 13/2+(299)
      f=3/2+(0) 1/2+(77) 3/2+(269) 11/2-(409)
      [nu,1;34]=6.3 [13;22]=7.5

204Tl i=1-(140) 0-(146) 1-(300)
      f=0+(0)
      [11]=6.0 [21]=5.7 [31]=7.5

205Pb i=1/2-(2) 3/2-(263)
      f=1/2+(0)
      [11]=5.4 [21]=6.5
```

Note

a) Nuclei for which the calculated rates are essentially the same as those calculated only with the experimentally known ft-values:

^{70}Ga ^{87}Sr ^{93}Mo ^{113}Sn ^{139}Ce ^{145}Sm

b) Nuclei for which only the experimentally known ft-values are used:

^{132}Cs ^{146}Pm

The calculated rates for these two nuclei are highly questionable as only the ground-state decays are included.

TABLE V. β^- Rate Enhancement Due to Bound-State Decay

See page 383 for Explanation of Tables

^AZ	n_{26}	T_8 = 1	3	5
^{106}Ru	1	11	17	13
	3	7	16	13
	10	3	15	12
	30	1.8	12	11
^{150}Nd	-	∞	∞	∞
^{157}Gd	-	∞	∞	10^5
^{160}Gd	1	7.3×10^2	14	15
	3	1.1×10^2	13	15
	10	6.2	11	14
	30	1.9	6.8	12
^{163}Dy	1	1.1×10^3	1.7×10^2	61
	3	1.7×10^2	1.6×10^2	59
	10	8.5	1.2×10^2	53
	20	2.3	54	44
^{171}Tm	1	1.9	15	15
	3	1.6	13	14
	10	1.4	9.9	13
	30	1.5	5.2	11
^{179}Hf	1	3.4	34	37
	3	2.2	29	35
	10	1.7	20	32
	30	1.9	8.6	27
^{187}Re	1	5×10^4	66	18
	3	5.9×10^3	55	17
	10	1.3×10^2	34	16
	30	10	12	13
^{194}Os	1	2.3	32	20
	3	2.0	27	19
	10	1.7	16	18
	30	1.8	6.4	14
^{193}Ir	1	1.5×10^3	94	43
	3	1.4×10^2	74	41
	10	25	40	36
	30	13	12	28
^{195}Pt	1	∞	5.7×10^2	55
	3	5×10^4	4.6×10^2	52
	10	3.3×10^3	2.5×10^2	46
	30	3.1×10^3	68	35
^{205}Tl	1	∞	1.4×10^3	77
	3	10^5	1.1×10^3	72
	10	1.1×10^3	4.8×10^2	61
	30	53	105	42
^{210}Pb	1	55	7.1×10^3	8.3×10^3
	3	36	5.0×10^3	8.3×10^3
	10	14	2.0×10^3	6.7×10^3
	30	5.6	4.4×10^2	4.8×10^3