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**Electron Spectra from Decay
of Fission Products**

J. K. Dickens

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Engineering Physics Division

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ELECTRON SPECTRA FROM DECAY OF FISSION PRODUCTS

J. K. Dickens

ABSTRACT

Electron spectra following decay of individual fission products ($72 \leq A \leq 162$) are obtained from the nuclear data given in the compilation using a listed and documented computer subroutine. Data are given for more than 500 radionuclides created during or after fission. The data include transition energies, absolute intensities, and shape parameters when known. An "average" beta-ray energy is given for fission products lacking experimental information on transition energies and intensities. For fission products having partial or incomplete decay information, the available data are utilized to provide best estimates of otherwise unknown decay schemes. This compilation is completely referenced and includes data available in the reviewed literature up to January 1982.

INTRODUCTION

Recent measurements¹⁻⁴ of beta-ray spectra from decay of unseparated fission products created by thermal-neutron fission of ^{235}U and $^{239,241}\text{Pu}$ have been reported. These data were measured primarily to obtain (a) information about the associated reactor antineutrino spectrum¹ for fundamental experiments involving antineutrino interactions^{5,6} and (b) information about the residual total decay energy of the fission products which are in reactor fuel elements following shutdown.²⁻⁴ The total energy is essentially a heat source to be dealt with at times following shutdown of the reactor.

The experimental data of refs. 1-4 may be utilized directly to obtain the desired information for the total fission-product decay energy and indirectly to obtain the desired information on the reactor antineutrino spectrum. Perhaps more important, however, is that these data provide *defacto* benchmarks for testing results of computer programs⁷⁻¹⁵ designed to compute total (or partial) fission-product energy releases by cumulating individual energy releases that are calculated for each one of the fission products. Such a calculational program would ultimately be applied to complex conditions once it has been proven by favorable comparisons of calculated "data" with experimental data from these controlled experiments.¹⁻⁴ To a large extent, the various computer codes yield very similar results when

each one utilizes the same evaluated data base; it is, in fact, differences in evaluated data which result in differences in calculated results (e.g., Fig. 5 of ref. 15).

There are several different sets of evaluated data presently available,¹⁶⁻²¹ and for many fission products the evaluated data agree among the various sets. For computations of beta-ray energy release as a function of time following shutdown of a reactor, various data sets give more-or-less reasonable results.²²

Calculating *beta-ray spectra* has proved to be more of a challenge, however, and much more sensitive to differences in the various evaluations. In particular, the computation of the high-energy response depends, to a large extent, upon assumptions about the decay transitions of those fission products for which there are no complete measurements of beta or gamma rays or of level structures from particle reaction experiments. These are the neutron-rich fission products well off the line of stability, having short half-lives and large values of energy available for beta decay (Q_β). Ultimately, such nuclides will be studied in detail, and the decay characteristics will be determined. For the present, estimates must be made based upon fragmentary experimental data, or else upon theoretical considerations usually based on the systematic behavior of observed beta decay.

The present compilation was prepared specifically for the purpose of obtaining spectra of beta rays due to decay of individual radionuclides produced in fission. It is an independent evaluation of existing published data and of other published compilations of existing data. There are several important points to bear in mind when using the present evaluation. The first is that of ~ 200 experimental decay schemes exhibiting detailed and *complete* results for beta-ray transitions fewer than 30 have generally available measured complete *beta-ray* spectra.²³ Nearly all of the reported E_β and A_β have been deduced from gamma-ray measurements, and these deduced E_β and A_β , as noted recently in several reports,²³⁻²⁵ could be in substantial error. Also important from the present point of view, however, is that even given the accuracy of the deduced E_β and A_β one must still compute the expected beta-ray spectrum, and this computation must be done without knowledge of the detailed shape of any individual spectrum for any one of the beta-ray transitions which make up the total spectrum. This lack of information is a second point to be considered. A third point is that deducing E_β and A_β from detailed

gamma-ray placements and intensity balances often leads to assignments of beta-ray transitions having small A_β (i.e., <1% of the total decay). Such weak beta-ray transitions may not actually exist. However, even given the accuracy of these assignments, one can group together several very weak transitions or include several weak transitions as part of a close-lying strong transition, and calculations will yield a computed total beta-ray spectrum that will be essentially indistinguishable from a total spectrum in which every postulated beta-ray transition is separately computed.

The present goal is to compute total beta-ray spectra for all important individual radio-fission products. In view of the uncertainties inherent in such computations, the present evaluation has, on the one hand, simplified many of the reported complex decay schemes, while on the other hand provided somewhat speculative information about decay schemes for those fission products lacking complete experimental decay schemes. The correct shape [i.e., the distribution of emitted beta-rays $N(E)$ vs E , for a given transition] is computed when known²⁶ or can be deduced from known spin-parity changes. For those fission products lacking any experimental information which could assist in determining a total beta-ray spectrum, an average beta-ray energy, $\langle E_\beta \rangle$, is tabulated, and this datum is used in the spectrum calculation. Specifically, it is assumed that $\langle E_\beta \rangle$ corresponds to the average energy of a single, allowed transition.²⁷

The format of the basic data in the present tabulation is easy to understand, and it allows for ease in upgrading as new experimental or better evaluated basic data become available. The subroutine is written in standard FORTRAN and should be readily adapted to any system containing a standard compiler.

LISTING OF SYMBOLS USED

A_β	Absolute intensity of a given beta-ray transition as a percentage of the total radionuclide decay
A_γ	Absolute intensity of a given gamma-ray transition as a percentage of the total radionuclide decay

a_i	Coefficients for analytic expression of S_n
B_n	First-neutron separation energy in the daughter radionuclide
E	Response kinetic energy of a measured beta ray, $0 \leq E \leq E_\beta$ (all energies are in MeV)
E_β	Beta-ray transition energy; also the maximum energy or end-point energy of the spectrum of beta rays observed for a single transition
E_γ	Transition gamma-ray energy
E_x	Energy of an excited state with respect to the ground state of a particular nuclide
$\langle E_\beta \rangle$	Average energy per decay for a given beta-ray transition obtained by integration of the spectrum of $N(E)$ vs E , i.e.: $\int N(E)E \, dE$
$\langle E_n \rangle$	Average energy of spectrum of delayed neutrons obtained in a manner similar to $\langle E_\beta \rangle$
$F(Z,W)$	Fermi function
J	Level spin
π	Level parity
P_n	Total delayed neutron intensity as a percentage of the total radionuclide decay
$\bar{Q}_\beta$	Total energy available in beta decay
S_n	Shape factor for an n-forbidden transition ($n = 0$ for an allowed transition)
W	Response total energy in units of electron mass (electron mass = 0.511 MeV)
Z	Radionuclide proton number

RELATIONSHIP TO OTHER TABULATIONS

There is only one evaluation of total beta-ray spectra from decay of fission products that I am aware of, and that is the multigroup (binned) spectra of individual fission products by England and Stamatelatos.²⁸ Beta-ray spectra for 163 fission products are tabulated for 75 response energies grouped into 0.1-MeV bins. Values for E_β and A_β were obtained from the ENDF/B-IV evaluation.¹⁹ Although not stated explicitly in the documentation,²⁸ the statistical shape factor is used for all calculations, resulting in calculated responses which will be somewhat at variance with calculations using correct shape factors. An example is given for the decay of ^{90}Y in Fig. 1.

Other evaluations¹⁶⁻²¹ are of the nuclear data similar to the present compilation, some including values of $\langle E_\beta \rangle$ for nuclides lacking experimental nuclear data. The evaluations that were used include the Table of Isotopes (Seventh Edition)²⁹ and data in the ENDSL data files³⁰ for known beta-ray decay, and values of $\langle E_\beta \rangle$ from the ENDF/B-IV evaluation¹⁹ when there was no alternate basis for determining these data.

Values of $\langle E_\beta \rangle$ deduced from the present compilation by integrating the total computed beta-ray spectrum for thirty representative fission products having completely evaluated decay schemes are presented in Table I. Also given are values of $\langle E_\beta \rangle$ given in the U.S. ENDF/B-IV file,¹⁹ the current U.K. UKFPDD-2 file,²⁰ and the current Japanese JNDC file.²¹ The four evaluated data sets are essentially independent evaluations for the tabulated isotopes. Recent measurements²³ of $\langle E_\beta \rangle$ are given in the last column of this table. One may observe that only for ^{92}Y , ^{98}Nb , and ^{139}Cs is there agreement among all four evaluated and the one experimental data set in this table. With differences indicated in this table for the evaluation of supposedly well-known decay schemes, one might expect even poorer agreement for isotopes having poorly known decay schemes. However, as shown by all of the data given in Table II for isotopes having spectral data estimated from partial information in the present file, the overall agreement is about the same as in Table I.

Fig. 1. ^{90}Y Beta-Ray Spectrum. Data were obtained using a scintillation detector described in ref. 2. Calculations are for two choices of shape factor S_1 . The dot-dash line represents the calculation using the allowed shape and is essentially equivalent to the binned spectrum for ^{90}Y given in ref. 28. The solid line represents the calculation using the shape factor for the first-forbidden unique transition given in Eq. (2) of the text.

Table I. Average beta-ray energies for representative fission products

Isotope ^a	Average beta-ray energy (MeV)				
	Present Compilation	ENDF/B-IV (ref. 19)	UKFPDD-2 (ref. 20)	JNDC (ref. 21)	Experiment (ref.23)
⁸⁴ As	4.03	3.76	4.08	2.83	3.84
⁸⁶ Br	1.96	1.78	1.78	1.95	1.93
⁸⁸ Br	3.04	3.07	2.52	2.45	1.63
⁹⁰ Rb (153 s)	2.35	1.66	1.86	1.57	1.36
⁹¹ Rb	1.57	1.33	1.51	1.48	1.36
⁹¹ Rb	3.68	3.46	3.46	2.86	3.46
⁹² Y	1.50	1.46	1.44	1.46	1.46
⁹³ Kr	2.82	2.76	3.33	2.73	2.70
⁹⁴ Y	1.93	1.72	1.79	1.81	1.78
⁹⁵ Sr	2.32	1.94	2.26	1.59	1.92
⁹⁵ Y	1.39	1.75	1.34	1.37	1.52
⁹⁷ Sr	2.68	2.35	2.63	2.60	2.28
⁹⁷ Y (3.3 s)	2.17		2.16	2.47	2.05
⁹⁸ Y (0.7 s)	3.28		3.11	3.26	3.54
⁹⁸ Nb (2.9 s)	1.99	1.87	1.97	1.97	1.97
⁹⁹ Zr	1.47	1.62	1.50	1.46	1.57
¹⁰¹ Nb	1.89	1.90	1.86	1.69	1.31
¹⁰³ Tc	0.81	0.72	0.78	0.84	
¹⁰⁸ Tc	3.34	2.62	3.32	2.25	2.21
¹²⁸ In (0.9 s)	2.80		2.80	3.05	3.26
¹³⁴ Sb (10 s)	2.90	2.95	2.91	2.28	2.38
¹³⁷ Xe	1.66	1.84	1.79	1.79	1.73
¹³⁸ I	2.72	2.12	2.81	3.29	2.27
¹³⁹ Xe	1.71	1.79	1.74	1.00	1.72
¹³⁹ Cs	1.72	1.76	1.70	1.70	1.73
¹⁴⁰ Cs	1.59	1.93	1.74	1.43	1.89
¹⁴¹ Cs	1.81	1.38	1.79	1.28	1.68
¹⁴³ Ba	1.78	1.09	1.65	1.70	1.26
¹⁴³ La	1.36	0.84	1.33	1.34	1.21
¹⁴⁴ La	1.58	1.51	1.47	1.34	0.98

^aIsomer designated by lifetime in parenthesis.

Table II. Average beta-ray energies for fission products represented by estimated spectral data in the present compilation

Isotope ^a	Average beta-ray energy (MeV)				
	Present Compilation	ENDF/B-IV (ref. 19)	UKFPDD-2 (ref. 20)	JNDC (ref. 21)	Experiment (ref. 23)
⁸³ As	1.09	1.68	1.08	2.00	1.86
⁸⁵ As	2.43	2.87	b	2.84	3.32
⁹⁰ Br	2.92	3.36	b	3.09	3.52
¹⁰⁰ Nb (3.1 s)	2.01	2.10	2.12	1.76	1.63
¹⁰² Nb (4.3 s)	2.23	2.48	2.49	2.83	1.93
¹¹³ Pd	1.43	1.06	b	1.45	
¹²⁶ Cd	1.74	1.28	1.70	1.99	1.39
¹²⁹ Sn (498 s)	1.35	1.15	b	1.18	1.24
¹³¹ Sn (50 s)	1.40	1.31	b		1.47
¹³² In	3.77	3.83	b	3.16	3.28
¹³³ Sb	0.63	0.54	0.67 ^c	0.75	
¹³⁵ Sb	2.23	2.06	b	2.48	2.39
¹⁴⁴ Cs	3.19	2.35	3.08 ^c	2.65	2.24
¹⁵² Pm (450 S)	0.86	0.42	0.90 ^c	0.86	
¹⁵⁷ Sm	0.91	0.55	0.90 ^c	0.89	

^aIsomer designated by lifetime in parenthesis.

^bTaken from ENDF/B-IV.

^cReport indicates spectral data were determined.

The comparisons of the data given in these tables are meant only to indicate the present status of evaluation and experiment. For the present goal of providing beta-ray spectra, the present compilation is easy to use and readily amenable to rapid updating, and is shown to provide beta-ray spectra which, when weighted by fission-product yields and summed, reproduce^{27,31} rather well total beta-ray spectra^{1,2} from fission of ²³⁵U discussed in the Introduction.

UNCERTAINTIES AND INACCURACIES

Uncertainties and inaccuracies associated with the basic nuclear data include ΔQ_β , ΔA_β , and ΔE_β (partly as a function of Q_β) and incorrect shape-parameter assignments. All of these will affect the resulting calculated total beta-ray spectrum in a similar manner however. The most sensitive part of the spectrum is for response energies E close to the end-point energy, e.g., $E > 2$ MeV in Fig. 1, where errors of a factor of 2 can occur as a result of a very nominal error in a nuclear data parameter. The least sensitive portion of the spectrum is for $E \sim 0.5 E_\beta$, e.g., ~ 1 MeV in Fig. 1. Experience shows that in this energy region the largest variances relate to incorrect shape parameters and are generally $< 15\%$. For complex decay schemes, various sets of A_β within given ΔA_β , and subject to the restriction $\sum A_\beta = 100\%$, result in essentially indistinguishable computed beta-ray spectra, except for the largest response energies.

No uncertainties are given in the present compilation for three reasons. The first, as alluded to in the previous paragraph, is that there is no direct method of relating an uncertainty at a given energy in the total beta-ray response to a given uncertainty in an input parameter. About the only method to determine changes in total response is to repeat the computation with a different set of parameters. The second reason is that there are large correlations among the various parameters, and it would be necessary to review each experiment to deduce the "best" complete variance—covariance matrix. The third reason is that the major "error" in most of the total response computation is likely due to the use of the allowed shape in lieu of any information to the contrary. If, however, these uncertainties could be correctly combined, the inaccuracies to an overall calculated total beta-ray spectrum would be comparable to uncertainties associated with current experimental techniques.

DISCUSSION OF THE COMPUTER PROGRAM AND TABULAR DATA

Mathematical Aspects

The computer program (see Appendix for listing) was developed to compute the electron spectrum for an n -times forbidden transition; the basic equation for the number of beta rays at a given response energy (E) can be written as:^{32,33}

$$N(W) dW = K F(Z, W) p W (W_o - W)^2 S_n(W) dW \quad (1)$$

where $W = 1 + E/mc^2$; W_o corresponds to the maximum energy beta, E_β ; $F(Z, W)$ is the Fermi function which is important for all but the lightest elements; p is the β -ray momentum; and S_n is the shape factor. K is a constant, treated here as a normalizing parameter. For Allowed transitions, characterized by $\Delta J=0, 1$ and $\Delta\pi=\pi_i\pi_f=+1$, to first order $S_o(W)=1.0$. Small deviations from unity have been reported (see the tabulation of Behrens and Szybisz).²⁶ For Allowed transitions in the present report $S_o(W)=1.0$ for all W .

Transitions for which $n \geq 1$ are Forbidden transitions and are generally associated with either more energetic transitions or with longer half lives than usually found for allowed transitions. S_n has an analytic expression for Unique Forbidden transitions which are characterized by $\Delta J = n + 1$ and $\Delta\pi = (-1)^n$. For these cases the shape factors are^{33,34}

$$S_1 = (W^2 - 1) + (W_o - W)^2 \quad (2)$$

$$S_2 = (W^2 - 1)^2 + (W_o - W)^4 + 3.33(W^2 - 1)(W_o - W)^2 \quad (3)$$

$$S_3 = (W^2 - 1)^3 + (W_o - W)^6 + 7(W^2 - 1)(W_o - W)^2[(W^2 - 1) + (W_o - W)^2] \quad (4)$$

Non-unique Forbidden transitions are characterized by $\Delta J=n$ (also $\Delta J=0$ for $n=1$) and $\Delta\pi=(-1)^n$.

For $n=1$ and 2, S_n has the forms³³

$$S_1 = a_0 + a_1 W + a_2/W + a_3 W^2, \quad (5a)$$

$$S_2 = (W_0 - W)^2 + a_1(W^2 - 1) \quad (5b)$$

and the a_i coefficients have to be determined from the experimental beta-ray spectrum.

The Fermi function takes into account the Coulomb force on the electron. Treating the electron nonrelativistically, an approximate expression is obtained³⁵ for $F(Z,E)$:

$$F_0(Z,E) \simeq \frac{2\pi X}{1 - \exp(-X)} \quad (6)$$

where $X = Ze^2/hv$ for electrons, v being the speed of the electron far away and Z the atomic number of the daughter (product) nucleus. This expression is satisfactory (to $\pm 3\%$) for $Z < 30$ and electron energies a few MeV or less. A more generally useful approximation³⁶ can be written as

$$F(Z,E) \simeq F_0(Z,E) \left[\frac{W^2(1 + 0.000852 Z^2) - 1}{4} \right]^Y \quad (7)$$

where

$$Y = (1 - 0.0000533Z^2)^{1/2} - 1 \quad (8)$$

This approximation is satisfactory (to $\pm 2\%$) for $Z < 75$.

The Computer Program

The subroutine BETASP and related subprograms are utilized to read up to eleven records of information from the file of data, and from these to compute both a beta-ray and an antineutrino spectrum.

Variables required at entry are

- IZ = Radionuclide proton number, integer,
- IA = Isotope mass, integer, and
- DE = Response energy bin width in MeV.

At exit, the spectral data will be returned as follows:

KMX	=	Number of data;
E	=	Response energy in MeV, $0 \leq E \leq E_\beta$;
ESUM	=	Beta-ray response, $N(E)$, normalized to give $\sum N(E) = 1$;
ESUMN	=	Antineutrino response;
SSUM	=	$\int E N(E)dE$, i.e., the average beta-ray energy $\langle E_\beta \rangle$;
NAME	=	Alphanumeric isotope descriptor; and
TH	=	Radionuclide half life (sec).

After reading the appropriate data records for input IZ and IA, the program calculates the total response, including forbidden shapes for up to 3^d -forbidden unique and up to 2^d -forbidden non-unique if known parameters are included in the data table. The results are in number-per-bin-width.

An exact calculation of number-per-bin-width would require numerical integration of (1), viz.

$$\int_{E-0.5DE}^{E+0.5DE} N(W)dW$$

However, in the present routine DE is assumed small enough to treat $N(W)$ as a constant value for the DE ($dW=DE$) interval of interest.

As mentioned above, for a radionuclide having only an average energy $\langle E_\beta \rangle$ entered in the data table, the program assumes that the $\langle E_\beta \rangle$ entry corresponds to the average energy of a single, allowed transition. There is also a provision in the program to include conversion electron contributions to be summed to the beta-ray spectral data. At present, there are entries in the data file for conversion electron contributions from decay of >50 fission products.

The Data File

For a given radionuclide the file contains the following data: (a) the first record, in (3I5, A5, F10.3) format, contains,

IZ	=	isotope proton number,
IA	=	isotope mass,
NB	=	number of beta-ray transitions (≤ 10),
NAME	=	alphanumeric descriptor, and
T	=	half life in seconds.

If the IZ is input as 400 + proton number, the information is for a fission product designated as an isomer. (Comments included in the physical record are ignored during calculations.)

The second and, if needed, subsequent records, in (15, 5F8.3) format, contain

NF	=	degree of forbiddness,
EMAX	=	transition energy (MeV), i.e., the maximum beta-ray energy or the beta-ray end point,
B	=	absolute transition probability, A_β , in percent, and
$C_{1,2,3}$	=	shape coefficients, the a_i Eq. (5) [$a_0 = 1.0$ assumed] if known.

Allowed transitions are designated by $NF=0$, unique n-forbidden by $NF=+n$, non-unique n-forbidden by $NF=-n$. For a few entries $NF=-5$ for conversion electrons having $E_{ce}=EMAX$. If EMAX is negative, then $EMAX=\langle E_\beta \rangle$, an average beta-ray energy, gotten either from experimental data,²³ or from analysis²⁵ of data used to obtain³⁷ strength functions, or else from estimations given in the Evaluated Nuclear Data File,¹⁹ ENDF/B-IV. Essentially all entries are (cryptically) referenced; the full references follow the table and are from the reviewed literature available to January 1982.

DISCUSSION AND RECOMMENDATION

The purpose of this compilation is to provide the means of determining beta-ray spectra to an accuracy comparable to that expected from experimental beta-ray measurements. Nearly all of the spectroscopic data in the data file have been obtained from or made use of existing evaluations of nuclear data, or have been obtained from recent reports of experimental measurements. There are, in addition, about

30 radionuclides for which spectroscopic data were estimated from fragmentary experimental information (e.g., delayed-neutron yields, partial gamma-ray decay schemes). For these nuclides, some of which are listed in Table II, the estimated data are expected to provide a better calculated total beta-ray spectrum than would be given by any other method of determining a total beta-ray spectrum.

The strongest recommendation is for a resurgence in interest in measuring individual beta-ray spectra, especially to small response energies, E . In particular, the question of possible inaccurate and/or incomplete decay schemes being deduced from gamma-ray measurements, suggested in refs. 23 to 25, requires attention.

The data given in the main "Data Table" are available from the Radiation Shielding and Information Center of the Oak Ridge National Laboratory upon request.

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
28	72	1	NI	3.80			ENDF/B-IV
	-2.000						
29	72	1	CU	6.00			ENDF/B-IV
	-3.340						
30	72	2	ZN	167400.00		TOI-7	GAMMA (BETA)
0	0.296	86.0					
0	0.249	14.0					
31	72	9	GA	50832.00		TOI-7 (NDS 31, 103)	GAMMA (BETA)
-1	3.158	11.0		-0.2000	0.0	0.024	RMP 40, 659
-1	2.530	9.0		-0.2900	0.0	0.041	RMP 40, 659
-1	1.927	3.0					
0	1.528	9.5					
0	0.956	29.8					
0	0.667	21.0					
0	0.650	14.9					
0	0.537	0.9					
0	0.314	0.9					
28	73	1	NI	0.49			ENDF/B-IV
	-3.480						
29	73	1	CU	5.10			ENDF/B-IV
	-2.720						
30	73	1	ZN	24.00			NSE 80, 74
	-1.390						
31	73	4	GA	17500.00		TOI-7	GAMMA (BETA)
0	1.490	44.0					
0	1.190	47.0					
0	1.160	4.0					
0	0.430	5.0					
28	74	1	NI	0.65			ENDF/B-IV
	-2.570						
29	74	1	CU	0.57			ENDF/B-IV
	-3.810						
30	74	3	ZN	95.00		TOI-7	GAMMA
0	2.290	39.0					
0	2.240	4.0					
0	2.100	57.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE						
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS	
F	E_β	A_β		C_1	C_2	REMARKS
31	74	9	GA	486.00		TOI-7 GAMMA
1	4.800		5.0			
1	3.850		6.0			
-1	2.900		6.0			
0	2.450		55.0			
-1	2.230		13.0			
-1	1.900		6.0			
-1	1.700		5.0			
-1	1.200		3.0			
0	0.600		3.0			
28	75	1	NI	0.18		ENDF/B-IV
	-4.010					
29	75	1	CU	0.93		ENDF/B-IV
	-2.880					
30	75	1	ZN	10.20		NSE 80, 74
	-1.390					
31	75	8	GA	126.00		NDS 32, 211
0	3.300		44.0			
0	3.050		25.0			
0	3.000		4.6			
0	2.700		8.3			
0	2.400		9.0			
0	2.050		1.2			
0	1.800		6.9			
0	1.500		1.0			
32	75	5	GE	4968.00		NDS 32, 211
0	1.178		87.1			
0	0.979		0.9			
0	0.913		11.5			
0	0.709		0.2			
0	0.560		0.3			
29	76	1	CU	0.22		ENDF/B-IV
	-4.380					
30	76	1	ZN	5.70		NSE 80, 74
	-1.510					
31	76	8	GA	27.10		TOI-7 GAMMA
-1	6.210		14.0			
-1	5.660		10.0			
-1	5.230		10.0			
0	4.000		9.0			
0	3.850		10.0			
0	3.500		12.0			
0	2.800		12.0			
0	1.400		23.0			
29	77	1	CU	0.30		ENDF/B-IV
	-3.240					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.						

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BETA-RAY DATA TABLE							
Z	A	N _β	EL	T _½	REFERENCES AND REMARKS		
F	E _β	A _β		C ₁	C ₂	C ₃	REMARKS
30	77	2	ZN	1.40			SEE NP A285,1 AND NP A246,425;
-1	5.800		5.0				ALSO NDS 29,75
0	4.750		95.0				
31	77	1	GA	13.00			
	-2.140						NSE 80, 74
432	77	2	GE	53.00			TOI-7 GAMMA
0	2.860		58.0				
0	2.650		22.0				
32	77	10	GE	40680.00			TIC-11026
1	2.480		7.0				
0	2.220		17.2				
0	2.080		22.4				
-1	1.850		1.4				
0	1.510		19.4				
0	1.300		6.1				
0	1.140		9.7				
0	0.710		10.4				
0	0.350		6.5				
-5	0.200		3.7				
33	77	3	AS	3.352E+06			TIC-11026
0	0.684		97.1				
0	0.440		2.3				
0	0.163		0.7				
30	78	9	ZN	1.47			NDS 33, 189
0	5.150		37.6				COMM-78
0	5.030		21.9				
-1	4.890		1.1				
0	4.140		11.7				
0	3.800		16.9				
0	3.360		3.5				
0	3.180		1.4				
0	2.590		2.9				
0	2.460		3.0				
31	78	10	GA	5.10			NDS 33, 189
-1	7.520		12.5				
-1	6.950		7.2				
-1	6.570		11.2				CONDENSED 19 BETA
-1	6.300		3.0				TRANSITIONS
-1	5.760		6.4				
0	5.450		23.4				
0	5.200		20.4				
0	4.700		5.0				
0	3.890		9.5				
0	3.060		1.4				
32	78	2	GE	5220.00			TOI-7 GAMMA
0	0.703		96.0				
0	0.686		4.0				

T_½ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
33	78	9	AS	5442.00		TOI-7	GAMMA
1	4.290		34.0				
-1	3.680		17.0				
-1	2.980		13.0				
-1	2.300		5.0				
-1	1.780		3.0				
0	1.610		13.0				
-1	1.460		4.0				
0	1.050		9.0				
0	0.300		3.0				
30	79	1	ZN	0.38			
	-3.270					ENDF/B-IV	
31	79	10	GA	2.63		NP A368, 210	GAMMA
0	6.800		18.0				
0	6.300		2.0				
-1	5.700		11.0				CONDENSED >38 BETA TRANSITIONS
-1	5.300		3.0				
0	4.800		24.0				
0	4.300		10.0				
0	4.000		7.0				
0	3.600		13.0				
0	2.900		6.0				
0	2.000		6.0				
432	79	6	GE	18.40		NP A368, 210	GAMMA
0	4.090		63.0				
0	3.980		20.2				
0	3.490		2.5				
0	2.600		12.7				
0	2.220		0.9				
0	1.110		0.7				
32	79	9	GE	39.00		NP A368, 210	GAMMA
-1	4.030		8.0				
0	3.630		8.2				
0	3.430		10.9				
-1	3.320		1.0				
0	3.250		10.2				
0	2.760		12.0				
0	2.370		31.0				
0	2.300		11.0				
0	1.150		5.7				
33	79	4	AS	540.00		TOI-7	GAMMA
0	1.804		95.0				
0	1.760		1.5				
0	1.715		1.3				
0	0.804		2.3				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
31	80	10	GA	1.67			ADAPTED FROM NP A368, 210
-1	10.000		5.0				
-1	9.300		5.0				COMM-80
-1	8.400		6.0				
-1	7.300		11.0				CONDENSED >28 BETA
-1	6.800		17.0				TRANSITIONS
-1	5.800		14.0				
0	5.100		5.0				
0	4.500		7.0				
0	3.900		2.0				
0	1.800		28.0				
32	80	5	GE	24.50			NP A368, 210 GAMMA
0	2.640		37.0				
0	2.370		47.0				
0	1.960		6.4				
0	1.500		9.4				
0	0.770		0.2				
33	80	8	AS	15.30			TOI-7 GAMMA
0	5.700		56.0				
0	5.030		27.0				
0	4.240		1.0				
0	3.800		6.0				
0	3.390		7.0				
0	3.370		1.0				
0	2.900		1.5				
0	2.000		0.5				
31	81	10	GA	1.23			ADAPTED FROM NP A368, 210
1	8.300		11.0				
1	7.600		16.0				CONDENSED >30 BETA
-1	6.800		13.0				TRANSITIONS
-1	6.100		1.0				
1	5.700		4.0				
0	5.300		7.0				
0	4.800		11.0				
0	4.600		9.0				
0	4.200		16.0				
0	1.500		12.0				P(N)=12%
432	81	8	GE	7.60			NP A368, 210 GAMMA
-1	6.170		4.4				
-1	6.050		2.3				
-1	4.320		3.8				
-1	4.090		5.7				
0	3.610		39.0				
0	3.470		20.2				
0	3.270		21.1				
0	2.940		3.5				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
32	81	9	GE	7.60		NP A368, 210	GAMMA
-1	6.820		8.6				
-1	6.620		15.5				
-1	6.170		16.0				
-1	5.040		4.5				CONDENSED 13 BETA
0	4.000		14.4				TRANSITIONS
0	3.750		26.2				
0	3.540		2.3				
0	3.370		9.5				
0	1.700		3.0				
33	81	6	AS	33.00		TOI-7	GAMMA
0	3.750		67.0				
0	3.280		18.0				
0	3.260		9.0				
0	3.130		1.6				
0	2.450		1.9				
0	1.100		2.5				
34	81	3	SE	1110.00		TOI-7	GAMMA
0	1.585		98.5				
0	1.019		1.0				
0	0.757		0.5				
31	82	1	GA	0.60		COMM-82	
	-4.570						NSE 80, 74
32	82	2	GE	4.60		NP A368, 210	GAMMA
0	3.900		5.0				
0	3.600		95.0				
433	82	4	AS	14.00		TOI-7	GAMMA
0	5.500		15.0				
0	4.300		44.0				
0	3.700		19.0				
0	3.100		8.0				
33	82	5	AS	19.10		TOI-7 BETA (GAMMA)	
0	7.200		80.0				
0	6.550		10.0				
0	5.800		1.8				
0	5.500		4.0				
0	3.500		4.5				
35	82	2	BR	127100.00		TIC-11026	
0	0.440		98.6				
0	0.260		1.4				
31	83	1	GA	0.31			
	-4.230						NSE 80, 74
32	83	1	GE	1.90			
	-3.260						NSE 80, 74

$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
33	83	4	AS	13.30			DEDUCED FROM GAMMA DATA OF
-1	4.120		6.0				NP A250, 13
-1	3.000		35.0				
0	2.220		43.0				
0	1.910		16.0				
434	83	5	SE	70.00			TOI-7 GAMMA (BETA)
0	3.921		31.0				
0	2.934		13.0				
0	2.890		33.0				
0	2.261		3.0				
0	1.670		20.0				
34	83	10	SE	1350.00			TOI-7 GAMMA
-1	2.750		7.2				
-1	2.520		7.4				
-1	2.140		1.2				
-1	1.830		4.5				
1	1.180		0.5				
1	1.047		1.0				
0	0.931		32.1				
0	0.884		25.0				
0	0.840		12.8				
0	0.632		8.4				
35	83	2	BR	8604.00			TOI-7 BETA
0	0.925		98.6				
0	0.395		1.4				
31	84	1	GA	0.10			COMM-84
	-4.450						ENDF/B-IV
32	84	1	GE	1.20			NSE 80, 74
	-2.590						
33	84	6	AS	5.50			NDS 27, 339 GAMMA
-1	9.780		51.0				
1	8.320		20.0				
-1	7.660		15.0				
-1	7.080		3.0				
1	6.240		5.0				
0	4.620		6.0				
34	84	1	SE	200.00			TOI-7 BETA, GAMMA
0	1.410		100.0				
435	84	1	BR	360.00			TOI-7 BETA
0	2.200		100.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
35	84	10	BR	1908.00			TIC-11026
1	4.670		32.0				
-1	3.790		13.0				
-1	2.780		12.0				
-1	2.180		3.2				
0	1.970		8.5				
0	1.590		3.9				
-1	1.290		10.0				
-1	1.910		1.1				
0	0.750		12.0				
0	0.550		2.7				
32	85	1	GE	0.23			ENDF/R-TV
	-3.420						
33	85	2	AS	2.05			ESTIMATED FROM NP A250, 13
0	6.200		77.0				
0	2.400		23.0				P(N)=23%
34	85	10	SE	31.00			JINC 42, 1387 GAMMA
-1	6.100		26.6				
-1	5.750		5.7				
-1	5.100		2.2				CONDENSED 23 BETA
-1	4.600		2.9				TRANSITIONS
-1	4.300		5.5				
0	3.200		13.2				
0	2.400		17.5				
0	2.100		16.8				
0	1.900		17.1				
0	1.600		0.5				
35	85	6	RR	172.00			TIC-11026
0	2.495		95.8				
0	1.685		0.9				
0	1.575		0.5				
0	0.855		0.1				
0	0.765		2.3				
0	0.655		0.4				
436	85	3	KR	16128.00			TOI-7 BETA
0	0.840		79.0				
-5	0.300		7.1				
-5	0.138		3.6				TIC-11026
36	85	2	KR	3.383E+08			TOI-7 BETA
1	0.685		99.6				
0	0.171		0.4				
32	86	1	GE	0.26			ENDF/B-IV
	-2.970						
33	86	1	AS	0.90			NSE 80, 74
	-4.070						

$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
34	86	6	SE	14.10		JINC 42, 1387	GAMMA
-1	5.100		6.9				
-1	4.900		1.2				
-1	4.700		0.5				
-1	4.000		1.1				
0	2.700		69.2				
0	2.400		21.1				
35	86	9	BR	55.50		NDS 25, 553	GAMMA
1	7.600		15.0				
-1	6.050		11.0				
-1	5.260		5.0				
-1	4.700		6.0				
0	4.500		5.0				
0	3.300		50.0				
0	2.150		4.6				
0	1.400		3.4				
0	0.530		0.1				
37	86	2	RB	1.612E+06		NDS 25,553	BETA
1	1.772		91.2				
-1	0.695		8.8				ZAED
32	87	1	GE	0.13		COMM-84	ENDF/B-IV
	-3.760						
33	87	1	AS	0.73		T FROM ZP A287, 45	
	-3.730					NSE 80, 74	
34	87	1	SE	5.60		COMM-87	NSE 80, 74
	-2.840						
35	87	10	BR	55.70		TOI-7	GAMMA
-1	6.000		4.0				
-1	5.000		25.0				CONDENSED >58 BETA
-1	4.500		11.0				TRANSITIONS
-1	3.600		15.0				
0	3.200		3.0				
0	2.300		7.0				
0	2.000		2.0				
0	1.700		12.0				
0	1.400		13.0				
0	0.700		8.0				
36	87	8	KR	4579.00		TOI-7	BETA (GAMMA)
-1	3.889		31.0				
-1	3.487		40.0				
1	3.035		7.1				
-1	2.150		0.7				
0	1.475		6.1				
0	1.335		9.2				
0	0.930		6.0				
-5	0.390		0.2				TIC-11026
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N _β	EL	T _½	REFERENCES AND REMARKS		
F	E _β	A _β		C ₁	C ₂	C ₃	REMARKS
438	87	1	SR	10100.00		TIC-11026	
-5	0.380	17.4					
33	88	1	AS	0.13			ENDF/B-IV
	-4.540						
34	88	1	SE	1.50		COMM-87	NSE 80, 74
	-2.210						
35	88	10	BR	16.60		TOI-7 GAMMA	
1	8.600	33.0					G.S. BRANCHING FROM
-1	7.830	26.0					JDP 38, 9
-1	7.030	8.5					
-1	5.600	6.0					CONDENSED >20 BETA
0	4.300	3.5					TRANSITIONS
0	3.900	6.0					
0	3.550	5.0					
0	2.250	5.0					
0	2.000	2.0					
0	1.000	5.0					
36	88	9	KR	10224.00		TOI-7 GAMMA (BETA)	
1	2.913	14.0					
-1	2.717	2.0					
-1	2.051	1.3					
-1	1.730	1.2					
-1	1.200	2.5					
0	0.681	9.1					
0	0.521	67.0					
0	0.375	2.9					
-5	0.180	1.5					
37	88	6	RB	1068.00		TOI-7 GAMMA (BETA)	
1	5.320	77.0					
1	3.480	4.3					
0	2.590	14.0					
-1	2.100	1.1					
0	0.830	2.4					
0	0.500	1.2					
33	89	1	AS	0.13		COMM-84	ENDF/B-IV
	-3.750						
34	89	1	SE	0.41			NSE 80, 74
	-3.330						

T_½ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
35	89	10	BR	4.40		ZP A300, 289	GAMMA
-1	8.100	28.0					
-1	7.700	1.4					COMM-89
-1	7.100	10.4					
-1	6.600	8.6					CONDENSED >45 BETA
-1	6.000	10.7					TRANSITIONS
0	4.800	3.8					
0	3.900	14.5					
0	3.800	6.4					
0	3.600	3.2					
0	1.500	13.0					
36	89	10	KR	191.00		TOI-7 GAMMA	
-1	4.930	23.0					COMM-89A
-1	4.400	8.1					
-1	3.600	9.3					CONDENSED 47 BETA
0	3.240	11.0					TRANSITIONS
0	2.930	6.3					
0	2.530	7.0					
0	2.330	17.0					
0	2.000	7.2					
0	1.500	8.0					
0	0.900	3.1					
37	89	7	RB	912.00		TOI-7 GAMMA (BETA)	
-1	4.510	25.0		-0.0038			SHAPE ZP A294, 35
-1	2.500	1.0					
0	2.209	33.0					
0	1.920	2.9					
0	1.780	2.2					
0	1.260	33.0					
0	0.980	2.0					
38	89	1	SR	4.368E+06		TOI-7 BETA	
1	1.488	100.0					ZAED
34	90	1	SE	0.55			
	-2.480						ENDF/B-IV
35	90	10	BR	1.92		ZP A300, 289	GAMMA
-1	9.800	13.3					
-1	9.100	11.2					COMM-90
-1	8.400	7.4					
-1	7.600	15.5					CONDENSED >36 BETA
-1	7.100	10.6					TRANSITIONS
-1	6.500	9.3					
-1	6.000	1.2					
-1	5.200	3.4					
-1	4.200	3.5					
0	1.800	24.6					P(N)=24.6%

$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N _β	EL	T _½	REFERENCES AND REMARKS		
F	E _β	A _β		C ₁	C ₂	C ₃	REMARKS
36	90	5	KR	32.30			TOI-7 GAMMA (BETA)
-1	4.390		29.0				
-1	3.650		1.0				
0	2.610		63.0				
0	2.260		3.0				
0	1.310		3.0				
437	90	10	RB	258.00			PR C23, 1726
-1	5.720		16.0				
-1	4.800		8.0				CONDENSED >22 BETA
-1	4.340		3.2				TRANSITIONS
-1	4.020		4.7				
-1	3.500		1.7				
0	3.100		6.6				
0	2.960		15.0				
0	2.440		18.0				
0	2.190		12.0				
0	1.500		15.0				
37	90	10	RB	153.00			PR C23, 1726
-1	6.550		53.2				Q(BETA) FROM
-1	5.720		18.1				ZP A288, 105
-1	4.660		2.0				
-1	3.170		4.3				CONDENSED 22 BETA
0	2.410		5.7				TRANSITIONS
0	2.180		6.1				
0	1.900		2.3				
0	1.580		1.0				
0	1.360		3.9				
0	1.120		3.4				
38	90	1	SR	9.025E+08			TOI-7 BETA
1	0.546		100.0				ZAED
439	90	4	Y	11484.00			TIC-11026
-5	0.478		1.4				
-5	0.462		7.3				
-5	0.200		0.4				
-5	0.185		2.7				
39	90	1	Y	230760.00			TOI-7 BETA
1	2.288		100.0				ZAED
34	91	1	SE	0.27			NSE 80, 74
	-3.120						
35	91	1	BR	0.54			NSE 80, 74
	-3.170						
T _½ IN sec; E _β IS END-POINT ENERGY IN MeV; A _β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
36	91	10	KR	8.60		NDS 31, 181	GAMMA
-1	6.200	25.0					
-1	5.640	7.0					CONDENSED 59 BETA
-1	5.000	7.6					TRANSITIONS
0	4.580	12.9					
0	4.120	4.9					
0	3.710	10.6					
0	3.340	10.2					
0	3.150	15.6					
0	2.180	2.9					
0	1.600	2.6					
37	91	9	RB	59.60		TOI-7, T FROM PR C19, 1948	
0	5.860	5.0					
0	5.800	23.0					
0	5.400	2.0					
0	4.700	4.0					
0	3.800	10.0					
0	3.180	15.0					
0	2.200	21.0					
0	1.800	12.0					
0	1.600	5.0					
38	91	6	SR	34128.00		TOI-7 GAMMA	
1	2.705	31.0					E(BETA) ZP A294, 35
-1	2.055	3.5					
0	1.405	25.0					
0	1.125	36.0					
0	0.645	2.2					
0	0.465	1.6					
439	91	1	Y	2982.00		TIC-11026	
-5	0.550	4.9					
39	91	2	Y	5.055E+06		TOI-7 BETA	
1	1.543	99.7					
-1	0.339	0.3					
34	92	1	SE	0.25			
	-2.690						ENDF/B-IV
35	92	1	BR	0.35			
	-3.860						NSE 80, 74
36	92	6	KR	1.85		TOI-7 GAMMA	
-1	5.970	2.0					
-1	5.250	1.6					
0	4.610	88.0					
0	3.930	2.6					
0	3.360	2.0					
0	2.600	3.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
37	92	7	RB	4.57			TOI-7 GAMMA; T FROM PR C19, 1948
-1	8.110	94.0					
-1	7.300	1.3					
-1	6.500	0.8					
-1	5.700	1.0					
-1	5.100	0.8					
-1	3.000	0.6					
0	1.900	1.5					
38	92	2	SR	9436.00			NDS 30,573 BETA, GAMMA
1	1.930	3.0					T FROM PC-1980
0	0.550	97.0					
39	92	8	Y	12744.00			TOI-7 GAMMA
1	3.634	86.0					
-1	2.700	3.5					
1	2.451	2.3					
1	2.138	1.2					
-1	1.787	0.4					
-1	1.567	0.2					
1	1.294	6.5					
-1	0.810	0.1					
35	93	1	BR	0.20			COMM-84
	-3.370						ENDF/B-IV
36	93	7	KR	1.30			TOI-7 GAMMA
0	7.200	5.0					
0	6.900	41.0					CONDENSED 21 BETA
0	6.700	27.0					TRANSITIONS
0	5.500	6.0					
0	4.350	17.5					
0	2.600	1.5					
0	0.300	2.0					
37	93	7	RB	6.01			NP A238,149 GAMMA, BETA
-1	5.750	41.0					T FROM PR C19, 1948
-1	5.450	8.0					
-1	4.360	11.0					
-1	3.840	10.0					
0	2.680	1.0					
0	1.890	27.0					
0	0.600	2.0					
38	93	9	SR	446.00			TOI-7 GAMMA
-1	3.200	11.0					
-1	2.940	5.5					CONDENSED 21 BETA
-1	2.500	5.5					TRANSITIONS
0	2.150	25.0					
-1	1.700	8.0					
0	1.200	34.0					
0	0.300	11.0					
-5	0.570	0.1					
-5	0.160	13.7					TIC-11026
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
439	93	1	Y	0.82		TOI-7	
-5	0.160	42.0					
39	93	6	Y	36900.00		TOI-7 GAMMA, BETA	
1	2.850	90.0					
-1	2.580	5.0					
-1	1.900	2.0					
-1	1.400	1.0					
-1	0.670	2.0					
-5	0.250	0.2					TIC-11026
40	93	1	ZR	4.830E+13		TIC-11026	
-1	0.062	100.0					
35	94	1	BR	0.11			
	-4.570						ENDF/B-IV
36	94	1	KR	0.21			
	-2.060						NSE 80, 74
37	94	5	RB	2.73		COMM-94A	
-1	7.900	15.0					
-1	7.200	4.7					
0	5.000	70.6					
0	4.000	7.2					
0	3.000	2.5					
38	94	1	SR	76.70		TOI-7	
0	2.085	100.0					Q(BETA) ZP A294, 35
39	94	8	Y	1122.00		COMM-94	
1	4.920	54.0					Q(BETA) ZP A294, 35
-1	4.000	31.0					
1	3.620	1.5					CONDENSED >20 BETA
1	3.450	3.2					TRANSITIONS
-1	3.250	2.4					
0	2.820	4.1					
0	1.820	2.5					
0	0.800	1.3					
41	94	2	NB	6.406E+11		TIC-11026	
-2	0.470	100.0		0.5700			ZAED
-5	0.680	0.2					
35	95	1	BR	0.11		COMM-84	
	-3.120						ENDF/B-IV
36	95	1	KR	0.50			
	-3.160						ENDF/B-IV
37	95	3	RB	0.38		COMM-95	
-1	8.570	6.0					
0	5.700	85.0					
0	3.500	9.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_{β}	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_{β}	A_{β}		C_1	C_2	C_3	REMARKS
38	95	7	SR	25.10			TOI-7 GAMMA (BETA); T FROM
1	6.110	53.0					PR C19, 1948
-1	5.420	13.0					
-1	5.280	3.0					
-1	4.200	5.0					
-1	3.400	8.0					
0	3.200	15.0					
0	1.700	3.0					
39	95	6	Y	630.00			TOI-7 GAMMA, BETA
1	4.430	58.0					
-1	3.480	3.0					
-1	2.500	2.0					
-1	2.060	4.0					
0	1.250	16.0					
0	0.880	17.0					
40	95	4	ZR	5.530E+06			TOI-7 GAMMA, BETA
-1	1.120	0.1					
1	0.887	0.9					
0	0.396	44.3					
0	0.364	54.7					
441	95	2	NB	313200.00			TOI-7 GAMMA (BETA)
-1	0.958	2.5					
-5	0.225	72.0					
41	95	1	NB	3.037E+06			TOI-7 BETA, GAMMA
-2	0.159	100.0					
36	96	1	KR	0.44			ENDF/B-IV
	-2.540						
37	96	4	RR	0.20			COMM-96
-1	10.490	3.0					
-1	9.720	2.0					
0	6.600	82.5					
0	5.000	12.5					
38	96	4	SR	1.10			NP A352,1 GAMMA
-1	5.410	3.0					Q(BETA) ZP A294, 35
-1	4.860	0.5					
0	4.600	93.0					
0	3.550	3.5					
439	96	2	Y	9.80			TOI-7 GAMMA
-1	3.400	9.0					
0	2.700	91.0					
39	96	2	Y	6.30			TOI-7 BETA, GAMMA
-1	7.120	95.0					Q(BETA) ZP A294, 35
-1	5.520	5.0					
$T_{1/2}$ IN sec; E_{β} IS END-POINT ENERGY IN MeV; A_{β} IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
41	96	2	NB	84060.00			TOI-7 GAMMA
0	0.739	98.7					
0	0.310	1.3					
36	97	1	KR	0.15			ENDF/B-IV
	-3.650						
37	97	3	RB	0.17			COMM-97
1	9.335	3.5					
0	6.700	71.3					
0	5.000	25.2					
38	97	7	SR	0.44			TOI-7 GAMMA
-1	7.400	20.0					Q(BETA) FROM
-1	6.400	7.5					ZP A284, 95
-1	6.100	7.5					
-1	5.400	11.0					
-1	5.300	9.0					
0	5.200	42.0					
0	5.000	4.0					
439	97	5	Y	1.13			TOI-7 GAMMA
0	6.080	37.0					
0	5.530	4.0					
0	5.110	45.0					
0	5.080	4.0					
0	4.830	8.0					
39	97	8	Y	3.30			TOI-7 GAMMA; T FROM PR C19, 1948
-1	6.670	40.0					
-1	5.570	1.5					
-1	5.270	4.0					
-1	4.700	2.7					
0	3.930	6.0					
0	3.380	27.0					
0	3.270	15.0					
0	3.120	3.0					
40	97	5	ZR	61200.00			TOI-7 GAMMA (BETA)
-1	1.914	86.0					
-1	1.406	4.3					
-2	0.910	4.2					
0	0.551	5.0					
-1	0.410	0.4					
441	97	1	NB	60.00			TOI-7 GAMMA
-5	0.740	2.0					
41	97	2	ND	4320.00			TOI-7 GAMMA, BETA
0	1.267	98.2					
0	0.900	1.2					
36	98	1	KR	0.22			ENDF/B-IV
	-2.730						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
37	98	1	RB	0.11		COMM-98	
	-3.650						NSE 80, 74
38	98	4	SR	0.80		TOI-7	GAMMA
0	5.810	65.0					
-1	5.700	4.5					
-1	5.640	1.5					
0	5.210	29.0					
439	98	5	Y	2.10		TOI-7	GAMMA
-1	6.290	12.0					
-1	6.250	25.0					
-1	5.600	6.0					
-1	5.300	7.0					
0	3.000	50.0					
39	98	9	Y	0.65		TOI-7	GAMMA
0	8.100	51.0					
0	7.250	26.0					ZP A284, 95
0	6.880	1.6					
0	6.660	1.3					
0	6.510	2.1					
0	6.350	0.8					
0	6.230	2.2					
0	3.930	11.0					
0	3.650	4.0					
40	98	1	ZR	31.00		TOI-7	BETA (NO GAMMAS)
0	2.300	100.0					
441	98	5	NB	3078.00		TOI-7	GAMMA (BETA)
0	3.168	5.0					
0	2.445	16.0					
0	2.336	2.0					
0	2.269	1.5					
0	2.184	0.6					
41	98	5	NB	2.90		TOI-7	GAMMA, BETA
0	4.590	90.0					
0	3.860	5.0					
0	3.160	1.6					
0	2.840	2.6					
-1	2.400	0.7					
37	99	1	RB	0.08			
	-3.270						NSE 80, 74
38	99	1	SR	0.29		T FROM ZP A288, 319	
	-2.640						NSE 80, 74
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
39	99	8	Y	1.51		ZP A289, 197	GAMMA (BETA)
0	6.390	19.0					
0	6.270	20.0					
0	5.820	6.0					
0	5.670	23.0					
0	5.540	16.0					
0	5.090	3.0					
0	4.800	12.0					
0	1.500	1.0					
40	99	2	ZR	2.10		ZP A289, 197	GAMMA (BETA)
0	3.440	58.0					
0	3.500	39.0					
44	99	10	NB	156.00		JPSJ 50, 1057	
-1	3.989	64.8					
-1	3.640	1.4					
-1	3.330	5.2					
-1	3.050	9.2					
-1	2.600	2.1					
-1	2.100	1.3					
-1	1.860	1.0					
-1	1.650	1.0					
0	1.330	9.2					
0	1.140	4.8					
41	99	1	NB	15.00		TOI-7	BETA, GAMMA
0	3.390	100.0					
42	99	6	MO	237672.00		PR C3, 247; ALSO NIM 175, 535	
-1	1.214	82.0		-0.0100			ZAED
-1	0.848	1.0		0.4900	-0.0047	0.0340	ZAED
0	0.437	17.0					
-5	0.178	0.1					TIC-11026
-5	0.160	0.8					
-5	0.120	0.4					
43	99	1	TC	6.753E+13		TOI-7	BETA
-2	0.292	100.0		0.5000			ZAED
38	100	1	SR	0.17		T FROM ZP A288, 319	
	-2.000					ENDF/B-IV	
43	100	4	Y	0.94		ZP A 283, 105	
0	8.800	39.0					
0	8.450	28.0					
0	8.140	26.0					
0	7.600	7.0					
39	100	2	Y	0.55		ZP A283, 105	
0	9.000	96.0					
0	8.670	4.0					
40	100	1	ZR	7.10			
	-1.090						NSE 80, 74
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
441	100	4	NB	3.10			DEDUCED FROM DATA IN TOI-7,
-1	5.090	50.0					PR C14, 211, AND
-1	4.130	20.0					ADNDT 19, 419
0	3.810	20.0					COMM-100
0	3.660	10.0					
41	100	1	NB	1.50			
	-1.720						NSE 80, 74
43	100	4	TC	15.80		TOI-7	
0	3.203	93.0					
0	2.664	0.6					
0	2.073	6.0					
0	1.151	0.4					
38	101	1	SR	0.25			
	-3.240						ENDF/B-IV
39	101	1	Y	0.98			
	-2.460						ENDF/B-IV
40	101	1	ZR	2.10			
	-1.780						NSE 80, 74
41	101	6	NB	7.10			DEDUCED FROM DATA IN NDS 28, 343
-1	4.400	13.0					AND PR C14, 211
-1	4.330	5.0					
0	4.280	56.0					
0	4.120	8.0					
0	4.090	15.0					
0	3.760	3.0					
42	101	9	MO	877.00		NDS 28, 343	GAMMA
-1	2.603	13.0					
-1	2.523	1.0					CONDENSED >20 BETA
-1	2.220	8.0					TRANSITIONS
-1	1.700	5.0					
-1	1.500	7.0					
-1	1.150	18.0					
0	0.860	19.0					
0	0.780	27.0					
0	0.250	2.0					
43	101	4	TC	852.00		NDS 28, 343	GAMMA (BETA)
0	1.318	90.0					
0	1.080	6.5					
0	0.785	2.0					
0	0.690	2.0					
38	102	1	SR	0.41			
	-2.410						ENDF/B-IV
39	102	1	Y	0.27			
	-3.790						ENDF/B-IV
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
40	102	1	ZR	28.60			NSE 80, 74
	-1.320						
441	102	2	NB	4.30			DEDUCED FROM DATA IN PR C14, 211
-1	6.520	10.0					AND ADNDT 19, 419
0	4.780	90.0					
41	102	1	NB	1.30			NSE 80, 74
	-2.020						
42	102	3	MO	666.00			NP A337, 285 GAMMA
0	1.040	94.1					
0	0.820	1.0					
0	0.680	4.9					
443	102	9	TC	261.00			TOI-7 GAMMA (BETA)
-1	3.150	3.0					
-1	2.550	10.0					
-1	2.040	8.0					
-1	1.820	9.0					
0	1.640	3.0					
0	1.540	44.0					
0	1.440	8.0					
0	1.340	11.0					
0	1.240	3.0					
43	102	5	TC	5.30			TOI-7 BETA, GAMMA
0	4.250	41.0					
0	3.770	30.0					
0	3.310	8.0					
0	3.150	16.0					
0	2.570	5.0					
39	103	1	Y	0.37			ENDF/B-IV
	-2.770						
40	103	1	ZR	1.77			ENDF/B-IV
	-2.250						
41	103	1	NB	1.50			NSE 80, 74
	-1.510						
42	103	1	MO	67.50			NSE 80, 74
	-1.240						
43	103	8	TC	54.20			JPSJ 47, 26 GAMMA
0	2.200	41.0					
0	2.060	9.0					
0	1.990	3.0					
0	1.860	27.0					
0	1.800	3.0					
0	1.700	3.0					
0	1.640	10.0					
0	1.300	4.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
44	103	3	RU	3.400E+06		NDS 28, 403	GAMMA
-1	0.743		1.2				
0	0.227		92.1				COMM-103
0	0.112		6.7				
39	104	1	Y	0.14			
	-4.060						ENDF/B-IV
40	104	1	ZR	3.78			
	-1.510						ENDF/B-IV
441	104	1	NB	4.80			
	-2.310						NSE 80, 74
41	104	1	NB	1.00			
	-2.370						NSE 80, 74
42	104	1	MO	60.00			
	-0.548						ENDF/B-IV
43	104	8	TC	1086.00		TOI-7	GAMMA
-1	3.890		24.0				
-1	3.360		16.0				CONDENSED 32 BETA
-1	3.010		10.0				TRANSITIONS
-1	2.700		6.0				
-1	2.200		16.0				
-1	1.700		12.0				
-1	1.000		7.0				
-1	0.700		9.0				
45	104	2	RH	42.30		TOI-7	
0	2.448		98.0				
0	1.803		2.0				
40	105	1	ZR	0.56			
	-2.630						ENDF/B-IV
41	105	1	NB	1.80			
	-1.950						NSE 80, 74
42	105	1	MO	36.70			
	-1.590						NSE 80, 74
43	105	10	TC	426.00		TOI-7	GAMMA
-1	3.400		41.0				
-1	3.300		3.0				CONDENSED 25 BETA
-1	3.240		9.0				TRANSITIONS
-1	3.160		10.0				
-1	3.080		6.0				
-1	2.900		4.0				
-1	2.800		5.0				
-1	2.600		9.0				
0	1.600		8.0				
0	1.100		5.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
44	105	9	RU	15984.00		TIC-11026	
-1	1.525	0.5					
0	1.194	49.9					
-1	1.132	18.5					
0	1.112	20.0					
-1	0.948	5.2					
0	0.572	6.0					
0	0.440	0.5					
-5	0.240	0.2					
-5	0.130	0.2					
445	105	2	RH	45.00		TIC-11026	
-5	0.128	35.3					
-5	0.106	51.2					
45	105	4	RH	3.059E+06		TOI-7 GAMMA, BETA	
0	0.568	75.0					
0	0.262	5.0					
0	0.249	20.0					
-5	0.290	0.3				TIC-11026	
40	106	1	ZR	0.98			
	-1.950					ENDF/B-IV	
41	106	1	NB	0.53			
	-2.800					NSE 80, 74	
42	106	1	MO	8.40			
	-1.020					NSE 80, 74	
43	106	10	TC	37.00		NP A339, 74	GAMMA
-1	6.680	13.1					
-1	6.160	7.4					
-1	5.950	3.3					
-1	5.560	2.2					
-1	5.180	3.2					
0	4.710	23.5					
0	4.250	11.0					
0	3.900	19.0					
0	3.700	16.6					
0	3.020	0.7					
44	106	1	RU	3.171E+07		TOI-7 BETA	
0	0.039	100.0					
445	106	4	RH	7800.00		TOI-7 BETA	
-1	1.750	1.3					
-1	1.330	1.6					
0	0.925	84.0					
0	0.730	13.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
45	106	5	RH	29.80		TIC-11026	
0	3.541		78.7				
0	3.030		8.2				CONDENSED >35 BETA
0	2.407		10.4				TRANSITIONS
0	1.979		1.9				
0	1.540		0.8				
40	107	1	ZR	0.25			
	-3.060						ENDF/B-IV
41	107	1	NB	0.67			
	-2.530						ENDF/B-IV
42	107	1	MO	6.40			
	-1.870						NSE 80. 74
43	107	10	TC	21.20		RA 26, 127	
0	5.100		14.0				CONDENSED 36 BETA
0	5.000		20.0				TRANSITIONS
0	4.920		13.0				
0	4.780		9.0				
0	4.600		9.0				
0	4.400		7.0				
0	4.150		8.0				
0	3.600		5.0				
0	3.400		10.0				
0	1.500		3.0				
44	107	6	RU	252.00		TOI-7 GAMMA (BETA)	
0	3.150		75.0				
-1	2.690		2.0				
-1	2.590		5.0				
-1	2.470		2.0				
0	2.110		13.0				
0	1.880		3.0				
45	107	5	RH	1302.00		TOI-7 GAMMA (BETA)	
0	1.510		17.0				
0	1.200		69.0				
0	1.120		7.0				
0	0.940		2.0				
0	0.840		9.0				
446	107	1	PD	21.30		TOI-7 GAMMA	
-5	0.190		32.0				
46	107	1	PD	2.051E+14		TOI-7 BETA	
1	0.033		100.0				
41	108	1	NB	0.22			
	-3.720						ENDF/B-IV
42	108	1	MO	1.50			
	-1.370						NSE 80, 74
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
43	108	8	TC	5.20		NP A339, 74	GAMMA
0	7.860		45.6				
0	7.430		2.0				
0	7.390		16.2				
0	7.130		7.1				
0	6.850		2.5				
0	6.460		1.2				
0	6.270		20.7				
0	5.980		4.7				
44	108	2	RU	270.00		TOI-7	GAMMA (BETA)
0	1.150		70.0				
0	0.980		30.0				
445	108	4	RH	354.00			
-1	3.390		10.0				
-1	3.100		18.0				
-1	2.660		3.0				
0	1.570		69.0				
45	108	4	RH	16.80		TOI-7	GAMMA (BETA)
0	4.500		54.0				
0	4.070		15.0				
0	3.570		10.0				
0	3.450		21.0				
447	108	3	AG	4.000E+09		TIC-11026	
-5	0.699		0.2				
-5	0.593		0.3				
-5	0.410		0.7				
47	108	2	AG	142.00		TIC-11026	
0	1.650		95.9				
0	1.017		1.8				COMM-108
42	109	1	MO	1.00			ENDF/B-IV
	-2.390						
43	109	1	TC	1.40			NSE 80, 74
	-1.870						
444	109	1	RU	13.00			NSE 80, 74
	-1.250						
44	109	2	RU	35.00		ZP A275, 359	GAMMA
0	4.400		84.0				
0	4.040		16.0				
45	109	4	RH	80.00		TOI-7	GAMMA
0	2.575		18.0				
0	2.265		8.0				
0	2.250		62.0				
0	2.030		14.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
446 -5	109 0.163	1 44.0	PD	281.00		TOI-7	
46 0	109 1.028	1 100.0	PD	48337.00		TOI-7 BETA	
447 -5	109 0.085	1 55.0	AG	39.60		TIC-11026	
43	110 -2.200	1	TC	0.83			NSE 80, 74
44	110 -0.580	1	RU	16.00			NSE 80, 74
445 0 0 0 0	110 4.600 4.300 3.000 2.600	4 19.0 9.0 9.0 63.0	RH	28.50		TOI-7 GAMMA	
45 0 0	110 5.400 5.000	2 85.0 15.0	RH	3.00		NDS 22, 135 (GAMMA, BETA)	
447 0 -1 0 -5 -5	110 0.530 0.130 0.084 0.630 0.110	5 30.5 0.9 67.3 0.3 0.4	AG	2.156E+09		TIC-11026	CONDENSED 11 BETA TRANSITIONS
47 0 0 0	110 2.890 2.240 1.400	3 95.2 4.4 0.4	AG	24.60		TIC-11026	
43 -2.350	111	1	TC	1.34			ENDF/B-IV
44 -1.650	111	1	RU	1.54			NSE 80, 74
45 -1.020	111	1	RH	11.00			NSE 80, 74
446 1 -1 -1 -1 0	111 2.140 2.060 1.350 0.680 0.380	5 4.0 6.0 6.0 3.0 10.0	PD	19800.00		TOI-7 GAMMA	
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %:							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
46	111	3	PD	1404.00			TOI-7 (MOSTLY G.S. BETA)
0	2.140		96.0				
-1	1.400		3.0				
-1	0.700		1.0				
47	111	3	AG	643680.00			TIC-11026
-1	1.028		91.9				
1	0.783		1.1				
-1	0.687		7.0	-0.0200			ZAED
448	111	5	CD	2922.00			TIC-11026
-5	0.242		1.0				
-5	0.218		5.0				
-5	0.151		4.9				
-5	0.147		20.4				
-5	0.124		43.8				
43	112	1	TC	0.36			ENDF/B-IV
	-3.440						
44	112	1	RU	0.70			NSE 80, 74
	-1.070						
45	112	1	RH	4.70			NSE 80, 74
	-1.930						
46	112	1	PD	75960.00			NDS 29, 587 BETA
0	0.293		100.0				
47	112	5	AG	11304.00			NDS 29, 587 BETA (GAMMA)
1	3.958		54.0				
-1	3.341		21.0				
1	2.540		7.0				
-1	1.950		10.0				
-1	1.290		8.0				
44	113	1	RU	2.77			NSE 80, 74
	-1.980						
45	113	1	RH	0.90			NSE 80, 74
	-1.570						
46	113	6	PD	93.00			ADAPTED FROM NDS 33, 1 COMM-113
0	3.360		91.0				
0	3.260		0.9				
0	3.140		1.2				
0	2.790		0.7				
0	2.620		5.1				
0	2.390		1.1				
447	113	4	AG	69.00			TOI-7 GAMMA, BETA
0	1.700		25.0				
0	1.570		14.0				
0	1.430		11.0				
0	1.300		50.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
47	113	4	AG	19332.00			TOI-7 GAMMA (BETA)
-1	2.010	85.0					
-1	1.700	10.1					
-1	1.330	1.1					
-1	0.820	3.8					
448	113	1	CD	4.418E+08			TOI-7 BETA
-1	0.586	99.9					
44	114	1	RU	5.05			ENDF/B-IV
	-1.400						
45	114	1	RH	1.70			NSE 80, 74
	-2.290						
46	114	1	PD	144.00			TOI-7 (NO GAMMAS OBSERVED)
0	1.400	100.0					
47	114	4	AG	4.50			TOI-7 GAMMA (BETA)
0	4.860	90.0					
0	4.300	8.0					
0	3.710	1.2					
0	3.500	0.8					
49	114	2	IN	71.90			TIC-11026
0	1.985	99.3					
0	0.685	0.2					
45	115	1	RH	6.02			ENDF/B-IV
	-1.930						
46	115	1	PD	38.00			NSE 80, 74
	-1.360						
447	115	1	AG	18.00			NSE 80, 74
	-0.820						
47	115	9	AG	1200.00			TOI-7 GAMMA (BETA)
-1	3.180	32.2					
-1	2.950	24.1					
-1	2.820	4.5					
-1	2.680	5.7					
-1	2.530	1.9					
-1	2.420	1.6					
-1	2.090	9.3					
-1	1.800	3.5					
-1	1.000	17.2					
448	115	4	CD	3.853E+06			TIC-11026
-1	1.621	98.0					
1	0.688	1.2					
-1	0.330	0.6					
-1	0.203	0.2					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
48	115	4	CD	192240.00			TIC-11026
-1	1.111		60.1				
-1	0.851		1.3				
0	0.619		3.4				
0	0.584		33.0				
449	115	3	IN	16164.00			TIC-11026
-1	0.860		3.6				
-5	0.330		10.3				
-5	0.310		39.2				
45	116	1	RH	0.83			ENDF/B-IV
	-3.040						
46	116	3	PD	12.70			NDS 32, 287
0	2.500		79.0				
0	2.400		2.0				
0	2.220		19.0				
447	116	7	AG	10.40			NDS 32, 287
0	5.390		21.2				
0	4.690		26.0				
0	3.980		2.3				
0	3.870		6.5				
0	3.650		3.4				
0	3.400		6.7				
0	2.940		32.3				
47	116	10	PD	161.00			NDS 32, 287
-1	5.310		25.6				
-1	4.600		6.8				
-1	4.180		3.8				
-1	3.900		7.5				CONDENSED 29 BETA TRANSITIONS
-1	3.600		2.0				
0	3.300		12.4				
0	3.000		10.7				
0	2.650		17.2				
0	2.450		12.8				
0	1.900		1.2				
49	116	9	IN	3249.00			TIC-11026
0	1.009		50.8				COMM-116
0	0.871		35.5				
0	0.599		10.2				
0	0.395		0.4				
0	0.354		2.7				
0	0.304		0.4				
-5	0.388		0.3				
-5	0.133		0.2				
-5	0.110		0.9				
45	117	1	RH	0.30			ENDF/B-IV
	-2.270						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
46	117	1	PD	5.00			NSE 80, 74
	-1.700						
447	117	8	AG	5.34		NDS 25, 315	GAMMA
-1	4.050	12.0					
-1	3.900	2.0					
0	3.660	28.0					
0	3.510	2.0					
0	3.360	44.0					
0	3.100	6.0					
0	2.900	5.0					
0	2.820	1.0					
47	117	9	AG	72.80		NDS 25, 315	GAMMA
-1	4.180	19.0					
-1	4.050	15.0					
-1	3.800	13.0					
-1	3.360	5.0					
-1	2.570	7.0					
0	2.180	12.0					
0	1.880	19.0					
0	1.630	5.0					
0	1.200	5.0					
448	117	10	CD	11916.00		TIC-11026	
1	1.920	1.2					
1	1.600	1.4					CONDENSED 16 BETA TRANSITIONS
1	1.440	1.4					
1	1.230	1.5					
0	0.670	48.0					
0	0.569	30.3					
0	0.342	8.6					
0	0.250	6.7					
0	0.200	0.5					
0	0.120	0.3					
48	117	10	CD	8712.00		TOI-7	GAMMA (BETA)
-1	2.213	21.3					
-1	1.900	13.5					CONDENSED 22 BETA TRANSITIONS
-1	1.780	6.8					
-1	0.820	4.1					
0	0.640	32.2					
0	0.530	10.7					
0	0.470	1.8					
0	0.400	2.9					
0	0.220	6.5					
-5	0.250	1.1					TIC-11026
449	117	5	IN	6948.00		TIC-11026	
-1	1.772	34.5					
-1	1.613	18.3					
-5	0.310	5.9					
-5	0.280	21.7					
-5	0.130	2.4					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
49	117	5	IN	2520.00		TIC-11026	
-1	1.140		0.2				
0	0.740		99.8				
-5	0.520		0.5				
-5	0.155		1.8				
-5	0.130		11.6				
450	117	3	SN	1.175E+06		TIC-11026	
-5	0.155		8.8				
-5	0.152		26.1				
-5	0.128		76.5				
45	118	1	RH	0.30			ENDF/B-IV
	-3.480						
46	118	1	PD	3.10			NSE 80, 74
	-1.120						
447	118	3	AG	2.80		TOI-7	GAMMA (BETA)
0	4.550		26.0				
0	4.280		32.0				
-5	0.115		36.0				
47	118	4	AG	3.70		TOI-7	GAMMA
0	6.500		25.0				
0	6.010		30.0				
0	5.340		30.0				
0	5.320		15.0				
48	118	1	CD	3018.00		TOI-7	(NO GAMMA OBSERVED)
0	0.750		100.0				
449	118	3	IN	264.00		TOI-7	GAMMA (BETA)
0	2.000		24.0				
0	1.800		12.0				
0	1.320		64.0				
49	118	4	IN	5.00		TOI-7	BETA, GAMMA
0	4.200		85.0				
0	2.970		9.0				
0	2.440		5.0				
0	2.160		1.0				
46	119	1	PD	1.71			ENDF/B-IV
	-2.110						
47	119	8	AG	2.10		TOI-7	GAMMA
0	4.260		3.0				
0	4.100		8.0				
0	3.870		31.0				
0	3.820		3.0				
0	3.500		12.0				
0	2.700		12.0				
0	2.480		2.0				
0	2.100		5.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
448	119	9	CD	114.00			TOI-7 GAMMA
-1	2.290		1.4				
0	1.620		30.0				
0	1.520		23.0				
0	1.300		4.9				
0	1.270		16.0				
0	1.250		11.0				
0	1.160		8.6				
0	1.080		3.3				
0	0.970		2.3				
48	119	9	CD	162.00			TOI-7 GAMMA
-1	3.190		40.0				
-1	2.900		5.0				
-1	2.710		5.0				
-1	2.460		1.0				
-1	1.730		5.0				
0	1.580		15.0				
0	1.440		1.0				
0	1.140		25.0				
0	0.950		2.0				
449	119	2	IN	1080.00			TOI-7 GAMMA (BETA)
-1	2.668		94.0				
-5	0.300		5.0				
49	119	1	IN	126.00			TOI-7 GAMMA (BETA)
0	1.550		100.0				
46	120	1	PD	4.27			ENDF/B-IV
	-1.340						
447	120	3	AG	0.32			TOI-7 GAMMA (BETA)
0	4.200		17.0				
0	4.100		40.0				
-5	0.190		14.0				
47	120	4	AG	1.20			TOI-7 GAMMA
0	6.200		20.0				
0	5.700		30.0				
0	5.000		30.0				
0	4.880		20.0				
48	120	1	CD	50.80			NSE 80, 74
	-0.550						
449	120	6	IN	44.00			TOI-7 GAMMA (BETA)
0	3.110		19.0				
0	2.650		6.0				
0	2.240		42.0				
0	2.120		14.0				
0	1.860		16.0				
0	1.630		3.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
49	120	4	IN	3.00		TOI-7	GAMMA, BETA
0	5.600	81.0					
0	4.430	16.0					
0	3.700	2.0					
0	3.300	3.0					
46	121	1	PD	0.62			ENDF/B-IV
	-2.340						
47	121	1	AG	3.00			NSE 80, 74
	-1.610						
448	121	1	CD	4.80			NSE 80, 74
	-1.330						
48	121	1	CD	12.80			NSE 80, 74
	-1.330						
449	121	4	IN	228.00		TOI-7	
-1	3.673	26.0					
-1	3.613	70.0					
-1	2.672	3.0					
-1	0.600	1.0					
49	121	1	IN	30.00		TOI-7	
0	2.434	100.0					
450	121	1	SN	1.736E+09		TOI-7	BETA, GAMMA
1	0.354	100.0					
50	121	1	SN	97560.00		TOI-7	BETA
0	0.383	100.0					
47	122	1	AG	1.50			NSE 80, 74
	-2.340						
48	122	1	CD	5.80		TOI-7	G.S. I(BETA) > 94%
0	3.500	100.0					
449	122	2	IN	1.50		TOI-7	GAMMA (BETA)
0	6.440	71.0					
0	5.300	29.0					
49	122	1	IN	9.20		TOI-7	GAMMA, BETA
0	4.400	100.0					
51	122	3	SB	233280.00		TIC-11026	
1	1.981	25.7					
-1	1.417	67.3					COMM-122
-1	0.724	4.5					
47	123	1	AG	0.39		T FROM NDS	29,453
	-2.210						NSE 80, 74
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
48	123	1	CD	8.40			NSE 80, 74
	-1.780						
449	123	2	IN	48.00		NDS 29,453	GAMMA
-1	4.380	50.0					
-1	4.250	50.0					
49	123	3	IN	6.00		NDS 29,453	GAMMA
0	3.370	33.0					
0	3.260	64.0					
0	2.380	2.0					
450	123	1	SN	2406.00		NDS 29, 453	GAMMA (BETA)
0	1.260	100.0					
50	123	2	SN	1.115E+07		NDS 29, 453	GAMMA (BETA)
1	1.397	99.4					
1	0.311	0.6					
47	124	1	AG	0.27			ENDF/B-IV
	-3.260						
48	124	1	CD	0.90			ENDF/B-IV
	-1.015						
449	124	1	IN	3.20			NSE 80, 74
	-2.370						
49	124	1	IN	2.40		TOI-7, COMM-124	
0	5.000	100.0					
451	124	1	SB	93.00		TOI-7	
0	1.058	20.0					
51	124	10	SB	5.201E+06		TIC-11026	
-1	2.302	21.9					
-1	1.656	2.5					CONDENSED >18 BETA
-1	1.579	2.5					TRANSITIONS
-1	0.947	2.1					
-1	0.866	4.3					
-1	0.710	0.9					
0	0.611	52.8					
0	0.422	0.4					
0	0.211	9.4					
0	0.130	0.6					
47	125	1	AG	0.38			ENDF/B-IV
	-2.470						
48	125	1	CD	1.62			NSE 80, 74
	-2.100						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
449	125	6	IN	2.32		NDS 32, 497	
-1	4.860	1.4					
-1	4.620	2.0					
-1	4.540	0.5					
0	4.340	10.3					
0	4.040	85.0					
0	3.220	1.0					
49	125	1	IN	12.20		NDS 32, 497	
-1	5.100	100.0					
450	125	3	SN	570.00		TOI-7 GAMMA, BETA	
0	2.046	98.2					
0	1.457	0.3					
0	0.642	1.5					
50	125	5	SN	831168.00		TIC-11026	
1	2.350	84.0					
-1	1.260	2.7					
1	1.000	0.3					COMM-125
0	0.460	6.0					
0	0.360	6.1					
51	125	7	SB	8.552E+07		TIC-11026	
1	0.622	13.5					
-1	0.446	7.4					
1	0.303	39.9					
0	0.242	1.6					
0	0.131	18.1					
0	0.125	5.8					
0	0.950	13.6					
452	125	1	TE	5.000E+06		TIC-11026	
-5	0.105	48.2					
47	126	1	AG	0.16			ENDF/B-IV
	-3:420						
48	126	3	CD	0.51		DEDUCED FROM DATA IN PR C18, 14633	
1	4.350	12.0					
-1	4.050	4.0					
0	3.900	84.0					
49	126	9	IN	1.53		NP A323, 205 GAMMA (BETA)	
0	6.960	18.2				COMM-126	
0	6.050	4.0					
0	5.990	17.2					
-1	5.700	3.1					
-1	5.400	5.9					
0	4.750	30.7					
0	4.200	17.0					
0	3.800	3.5					
0	3.400	0.4					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
50	126	1	SN	3.000E+12		TOI-7	BETA, GAMMA
-2	0.250	100.0					
451	126	3	SB	1140.00		TOI-7	GAMMA (BETA)
0	1.907	83.0					
0	1.287	3.0					
0	0.750	1.0					
51	126	10	SB	1.071E+06		TOI-7	GAMMA (BETA)
1	1.890	16.0					
-1	1.170	15.0					
-1	0.840	15.0					
-1	0.677	4.0					CONDENSED 12 BETA TRANSITIONS
-1	0.594	9.0					
0	0.580	39.0					
-1	0.200	2.0					
-5	0.650	0.7					TIC-11026
-5	0.390	1.3					
-5	0.270	0.2					
47	127	1	AG	0.21			
	-2.730						ENDF/B-IV
48	127	1	CD	0.66			
	-2.100						ENDF/B-IV
449	127	5	IN	3.76		PR C22, 2163	
-1	6.650	14.0					
-1	6.390	70.0					
-1	5.700	2.8					
-1	5.560	7.3					
0	3.320	5.3					
49	127	10	IN	1.30		PR C22, 2163	
-1	5.840	1.5					
-2	5.680	1.2					
-1	5.530	1.2					
0	5.440	5.5					
-1	4.930	1.8					
0	4.890	79.5					
0	4.790	1.6					
0	4.580	2.8					
0	4.470	5.5					
0	4.050	0.7					
450	127	1	SN	248.00		TOI-7	BETA, GAMMA
0	2.420	100.0					
50	127	5	SN	7560.00		TOI-7	GAMMA (BETA)
1	2.910	22.0					
0	0.820	20.0					
0	0.560	20.0					
0	0.410	12.0					
0	0.360	24.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N _β	EL	T _½	REFERENCES AND REMARKS		
F	E _β	A _β	C ₁	C ₂	C ₃	REMARKS	
51	127	5	SB	330912.00		TOI-7	GAMMA, BETA
1	1.493		2.0				
-1	1.108		23.0				
-1	0.896		40.0				
-1	0.797		26.0				
-1	0.503		9.0				
452	127	1	TE	9.420E+06		TIC-11026	
1	0.725		1.8				
52	127	3	TE	33840.00		TOI-7	BETA, GAMMA
1	0.710		2.4				
0	0.690		96.7				
0	0.280		0.9				
48	128	1	CD	1.29			ENDF/B-IV
	-1.560						
449	128	1	IN	3.70			NSE 80, 74
	-3.250						
49	128	8	IN	0.90		NP A323, 205	GAMMA (BETA)
0	8.130		17.0			COMM-126	
0	7.200		13.3				
0	7.040		4.7				
0	6.670		7.0				
0	6.200		3.9				
0	5.780		18.0				
0	5.300		18.5				
0	5.020		15.4				
50	128	2	SN	3558.00		TOI-7	GAMMA, BETA
0	0.630		84.0				
0	0.430		16.0				
451	128	4	SB	606.00		TOI-7	GAMMA, BETA
0	2.450		78.0				
0	1.860		5.0				
0	1.660		12.0				
0	1.410		1.0				
51	128	5	SB	32508.00		TOI-7	GAMMA (BETA)
0	1.900		22.0				
0	1.500		17.0				
0	1.100		18.0				
0	0.800		20.0				
0	0.600		22.0				
53	128	4	I	1500.00		TIC-11026	
0	2.127		80.2				
0	1.684		13.0				COMM-128
0	1.158		1.7				
-5	0.408		0.2				
T _½ IN sec; E _β IS END-POINT ENERGY IN MeV; A _β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
48	129	1	CD	0.34			ENDF/B-IV
	-2.340						
449	129	7	IN	0.59		PR C22, 2163	
-1	6.840	2.9					
-1	6.550	4.8					
0	5.740	37.6					
0	5.480	49.7					
0	4.760	2.8					
0	4.620	0.6					
0	4.010	1.6					
49	129	4	IN	2.50		PR C22, 2163	
-1	7.800	24.0					
-1	7.500	63.0					
-1	6.600	9.6					
-1	6.500	3.7					
450	129	2	SN	498.00		ESTIMATED FROM DATA OF	
0	3.350	80.0				NP A286, 403	
0	2.300	20.0					
50	129	1	SN	138.00			
	-1.150					NSE 80, 74	
51	129	7	SB	15876.00			
1	2.200	4.0					
-1	1.780	9.0					
-1	1.520	20.0					
-1	1.100	12.0					
0	0.600	30.0					
0	0.480	20.0					
0	0.220	5.0					
452	129	2	TE	2.896E+06		TOI-7 GAMMA (BETA)	
1	1.595	33.0					
-1	0.900	4.0					
52	129	3	TE	4140.00		TOI-7 GAMMA (BETA)	
0	1.453	90.0					
0	0.966	9.0					
0	0.342	1.0					
53	129	1	I	4.954E+14		TOI-7 BETA, GAMMA	
-2	0.150	100.0		0.0100		ZAED	
48	130	1	CD	0.52			
	-1.890					ENDF/B-IV	
449	130	1	IN	0.33		NP A352, 157 GAMMA	
0	5.900	100.0					
49	130	1	IN	0.58		COMM-130	
	-2.890					ENDF/B-IV	
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
450	130	3	SN	102.00		TOI-7	GAMMA
0	3.900	73.0					
0	3.350	10.0					
0	2.960	17.0					
50	130	2	SN	222.00		TOI-7	GAMMA, BETA
0	1.300	15.0					
0	0.950	85.0					
451	130	7	SB	2400.00		TOI-7	GAMMA (BETA)
0	2.850	19.0					
0	2.600	8.0					
0	2.200	13.0					
0	1.900	6.0					
0	1.600	28.0					
0	1.100	8.0					
0	0.700	17.0					
51	130	6	SB	390.00		TOI-7	GAMMA (BETA)
0	3.390	3.0					
0	3.210	12.0					
0	3.000	14.0					
0	2.570	30.0					
0	2.100	36.0					
0	1.300	5.0					
453	130	2	I	552.00		TOI-7	
0	2.490	15.0					
0	1.910	1.2					
53	130	10	I	44496.00		TIC-11026	
-1	1.180	1.4					
0	1.040	47.5					
-1	0.820	2.3					
0	0.620	46.9					
-1	0.370	0.9					
0	0.230	0.3					
-5	0.700	0.3					
-5	0.630	0.4					
-5	0.500	0.7					
-5	0.380	0.5					
48	131	1	CD	0.12			
	-3.120						ENDF/B-IV
449	131	2	IN	0.27		PR C22, 2163	
0	8.800	50.0					
0	8.500	50.0					
49	131	1	IN	0.29		PR C22, 2163	
0	6.390	100.0					
450	131	1	SN	39.00		ZP A289, 407	
0	3.870	100.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
50	131	2	SN	50.00		ZP A289, 407	
0	3.420	80.0					COMM-131
0	2.620	20.0					
51	131	6	SB	1382.00		TOI-7	GAMMA
1	3.010	7.0					
0	2.550	8.0					CONDENSED 20 BETA
-1	2.250	8.0					TRANSITIONS
-1	1.960	6.0					
0	1.300	50.0					
0	0.700	20.0					
452	131	7	TE	108000.00		TOI-7	GAMMA, BETA
1	2.430	5.0					
0	0.780	3.0					
0	0.580	20.0					
0	0.470	37.0					
0	0.420	8.0					
0	0.260	5.0					
-5	0.170	14.0					
52	131	5	TE	1500.00		TOI-7	GAMMA, BETA
0	2.140	60.0					
0	1.690	22.0					
0	1.510	1.0					
0	1.150	13.0					
0	0.860	4.0					
53	131	4	I	694656.00		TOI-7	GAMMA, BETA
0	0.606	89.0					ZAED
0	0.334	8.0					
0	0.248	3.0					
-5	0.330	2.0					
454	131	3	XE	1.030E+06		TIC-11026	
-5	0.129	61.2					
-5	0.158	28.6					
-5	0.163	8.4					
48	132	1	CD	0.14			
	-2.470						ENDF/B-IV
49	132	2	IN	0.13			
-1	9.400	49.0					DEDUCED FROM GAMMA DATA OF
0	7.000	51.0					NP A354, 77C
50	132	1	SN	40.00		TOI-7	BETA, GAMMA
0	1.760	100.0					
451	132	4	SB	252.00		TOI-7	GAMMA
0	3.610	48.0					
0	3.110	14.0					
0	2.720	14.0					
0	2.400	24.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
51	132	7	SB	168.00		TOI-7	GAMMA (BETA)
-1	3.860	20.0					
-1	3.460	11.0					
-1	3.250	3.0					
-1	3.130	4.0					
0	3.050	13.0					
0	2.720	32.0					
0	2.180	17.0					
52	132	3	TE	275400.00		TOI-7	BETA, GAMMA T FROM RRL 39,107
0	0.215	100.0					
-5	0.223	1.6					
-5	0.195	7.1					
453	132	4	I	4980.00		TOI-7	GAMMA, BETA
-1	1.490	8.0					
-1	0.930	0.8					
-1	0.750	2.4					
-1	0.620	0.6					
53	132	6	I	8208.00		TOI-7	GAMMA, BETA
-1	2.140	16.0					
-1	1.610	13.0					CONDENSED 33 BETA TRANSITIONS
-1	1.470	13.0					
0	1.190	23.0					
0	0.970	19.0					
0	0.750	16.0					
49	133	1	IN	0.11		COMM-84	ENDF/B-IV
	-2.930						
50	133	1	SN	1.47			NSE 80, 74
	-2.260						
51	133	6	SB	162.00		DEDUCED FROM DATA IN TOI-7	
-1	2.850	7.0					COMM-133
-1	2.310	4.0					
0	2.100	12.0					
0	1.800	7.0					
0	1.500	10.0					
0	1.250	60.0					
452	133	6	TE	3324.00		TOI-7	GAMMA (BETA)
-1	2.390	32.0					
-1	2.000	1.0					
-1	1.740	10.0					
-1	1.530	10.0					
-1	1.350	30.0					
-5	0.300	10.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
52	133	6	TE	744.00		TOI-7	GAMMA (BETA)
0	2.660	26.0					
0	2.250	35.0					
0	1.640	22.0					
0	1.410	5.0					
0	1.260	9.0					
0	0.780	3.0					
53	133	5	I	74880.00		TOI-7	GAMMA, BETA
1	1.530	1.0					
0	1.230	84.0					
-1	1.020	2.0					
-1	0.890	4.0					
-1	0.500	9.0					
454	133	2	XE	189216.00		TIC-11026	
-5	0.230	26.4					
-5	0.199	63.3					
54	133	1	XE	453168.00		TOI-7	BETA, GAMMA
0	0.347	100.0					
50	134	1	SN	1.04			NSE 80, 74
	-1.890						
451	134	2	SB	10.40		TOI-7	GAMMA (BETA)
0	6.800	43.0					
0	6.100	57.0					
51	134	1	SB	0.85		TOI-7	BETA
0	8.400	100.0					Q (BETA) ZP A289,407
52	134	6	TE	2508.00		TOI-7	GAMMA
0	0.460	42.0					
0	0.300	43.0					
0	0.190	15.0					
-5	0.240	0.8					
-5	0.180	4.0					
-5	0.150	3.2					
453	134	2	I	222.00		TOI-7	GAMMA (BETA)
-1	2.500	2.0					
-5	0.240	19.0					
53	134	7	I	3156.00		TOI-7	GAMMA (BETA)
-1	2.410	12.0					
-1	2.230	4.0					
-1	1.800	18.0					
0	1.550	29.0					
0	1.290	32.0					
-1	1.070	1.0					
-1	0.780	2.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
55	134	3	CS	6.507E+07		TOI-7	GAMMA, BETA
0	0.658	70.0					
0	0.415	3.0					
0	0.089	27.0					
50	135	1	SN	0.29			ENDF/B-IV
	-2.240						
51	135	2	SB	1.71		TOI-7	(GAMMA, NEUTRON);
0	5.400	89.0					
0	1.430	14.0					P(N)=14% RUD77
52	135	3	TE	19.20		COMM-135	
-1	5.330	5.0					
0	5.060	85.0					
0	3.500	10.0					
53	135	8	I	23796.00		TOI-7	GAMMA (BETA)
1	2.185	2.0					
-1	1.450	24.0					
-1	1.210	15.0					
0	1.033	22.0					
0	0.910	9.0					
0	0.730	11.0					
0	0.460	12.0					
0	0.310	5.0					
454	135	1	XE	936.00		TOI-7	
-5	0.495	19.0					
54	135	4	XE	32774.00		TOI-7	BETA, GAMMA
0	0.905	96.0					
0	0.545	4.0					
-5	0.244	0.7					
-5	0.214	5.6					
55	135	1	CS	9.309E+13		TOI-7	BETA
-2	0.209	100.0		0.0100			ZAED
456	135	3	BA	103320.00		TIC-11026	
-5	0.267	5.4					
-5	0.262	18.7					
-5	0.230	59.9					
50	136	1	SN	0.41			ENDF/B-IV
	-1.840						
51	136	1	SB	0.82			NSE 80, 74
	-2.790						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
52	136	5	TE	17.50		NDS 26, 473	GAMMA (BETA)
-1	4.750	17.0					T FROM ZP A287,45
-1	4.460	12.0					
0	2.480	43.0					
0	1.950	5.0					
0	1.880	23.0					
453	136	6	I	46.00		NDS 26,473	GAMMA
-1	5.110	67.0					
-1	4.740	12.0					
-1	4.550	8.0					
-1	4.390	9.0					
-1	3.150	2.0					
-1	2.950	1.0					
53	136	8	I	83.00		NDS 26,473	GAMMA
-1	5.110	30.0					
-1	4.720	16.0					CONDENSED 37 BETA
-1	4.380	37.0					TRANSITIONS
-1	4.150	6.0					
0	2.730	5.0					
0	2.550	2.0					
0	2.000	2.0					
0	0.950	2.0					
55	136	6	CS	1.132E+06		NDS 26,473	GAMMA(BETA)
0	0.672	2.0					
0	0.342	95.0					
0	0.165	3.0					
-3	0.160	6.6					
-5	0.310	1.3					
-5	0.120	7.5					
456	136	4	BA	0.31		TOI-7	
-5	1.011	0.1					
-5	0.781	0.3					
-5	0.159	33.7					
-5	0.127	34.1					
51	137	1	SB	0.28			
	-2.230						ENDF/B-IV
52	137	1	TE	3.50			
	-2.020						NSE 80, 74
53	137	1	I	24.50			
	-2.250						PETTEN77
54	137	3	XE	229.20		TOI-7	GAMMA,BETA
-1	4.060	67.0					
-1	3.510	30.0					
-1	1.200	3.0					

$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
55	137	2	CS	9.521E+08		TIC-11026	
1	0.514	94.6					
-2	1.175	5.4		0.0050			ZAED
456	137	2	BA	153.00		TIC-11026	
-5	0.624	8.1					
-5	0.657	1.9					
52	138	1	TE	1.40			
	-1.570						NSE 80, 74
53	138	10	I	6.50		JINC 41, 1523 GAMMA	
-1	7.410	38.0					
-1	6.600	6.0					CONDENSED 27 BETA
-1	6.000	10.0					TRANSITIONS
-1	5.700	20.0					
-1	5.100	11.0					
-1	4.900	1.0					
-1	4.500	2.0					
0	4.100	3.0					
0	3.700	4.0					
0	1.800	6.0					
54	138	5	XE	846.00		TOI-7 GAMMA(BETA)	
-1	2.800	21.0					
-1	2.400	30.0					
0	0.810	35.0					
0	0.570	10.0					
0	0.500	4.0					
455	138	2	CS	174.00		TOI-7 GAMMA, BETA	
-1	3.270	21.5					
-1	2.960	3.5					
55	138	6	CS	1932.00		TOI-7 GAMMA (BETA)	
-1	3.850	9.0					
-1	3.390	12.0					
-1	3.050	21.0					
-1	2.850	41.0					
-1	2.650	14.0					
-1	2.000	3.0					
52	139	1	TE	0.42			
	-2.130						ENDF/B-IV
53	139	1	I	2.38			
	-2.210						PETTEN77
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
54	139	9	XE	39.70		TOI-7, NDS 32,1	GAMMA
-1	4.880	22.0					
-1	4.490	19.0					
-1	4.370	21.0					CONDENSED >50 BETA TRANSITIONS
-1	4.150	3.0					
-1	3.870	12.0					
-1	3.150	5.0					
0	2.580	7.0					
0	2.130	5.0					
0	0.900	6.0					
55	139	5	CS	564.00		NDS 32, 1	GAMMA (BETA)
-1	4.290	84.0					
-1	3.000	7.0					CONDENSED >60 BETA TRANSITIONS
-1	2.200	3.0					
-1	1.900	3.0					
-1	0.700	2.0					
56	139	3	BA	4972.00		IJARI 31,37; TOI-7	GAMMA
-1	2.306	72.4					
-1	2.140	27.6					
-1	0.700	0.6					NDS 32,1
52	140	1	TE	0.75			
	-1.550						ENDF/B-IV
53	140	1	I	0.60			
	-2.610						NSE 80, 74
54	140	8	XE	13.70		ADAPTED FROM PR C23, 2691	
-1	3.980	20.0					
-1	3.550	1.0					CONDENSED >20 BETA TRANSITIONS
-1	3.410	2.0					
0	2.920	6.0					
0	2.860	3.0					
0	2.630	65.0					
0	2.070	1.0					
0	1.760	2.0					
55	140	10	CS	65.50		TOI-7	GAMMA(BETA)
1	5.800	14.0					
1	5.200	20.0					CONDENSED 39 BETA TRANSITIONS
-1	4.290	7.0					
-1	3.880	2.5					
-1	3.560	8.0					
-1	3.280	11.0					
0	2.870	10.0					
0	2.150	9.0					
0	1.860	12.0					
0	1.000	7.5					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
56	140	5	BA	1.105E+06		TOI-7	GAMMA (BETA)
1	1.005		22.0				
-1	0.991		40.0				
1	0.873		4.0				
-1	0.567		10.0				
-1	0.454		24.0				
57	140	10	LA	144972.00		TIC-11026	
-1	2.164		5.2	-0.2600	0.0	0.039	RMP 40, 659
-1	1.167		20.7				CONDENSED 14 BETA
-1	1.413		5.1				TRANSITIONS
-1	1.348		44.5				
1	1.300		5.6				
1	1.280		1.2				
-1	1.240		17.0				
1	1.210		0.6				
-5	0.450		0.5				
-5	0.300		0.9				
53	141	1	I	0.48			NSE 80, 74
	-2.230						
54	141	8	XE	1.73		NDS 23, 529	GAMMA
0	6.000		49.2				
-1	5.450		1.5				CONDENSED 32 BETA
0	4.900		27.8				TRANSITIONS
0	4.400		9.8				
0	4.000		2.4				
0	3.300		5.2				
0	2.200		3.3				
0	1.500		0.8				
55	141	7	CS	24.90		NDS 23,529	GAMMA(BETA)
-1	4.980		59.0				
-1	4.430		10.0				CONDENSED 45 BETA
-1	3.730		12.0				TRANSITIONS
-1	3.100		2.0				
-1	2.200		5.0				
0	1.400		6.0				
0	0.600		6.0				
56	141	6	BA	1096.00		NDS 23,529	GAMMA
1	3.030		4.0				
-1	2.840		12.0				
-1	2.570		18.0				CONDENSED 26 BETA
-1	2.380		23.0				TRANSITIONS
-1	2.000		25.0				
0	1.200		18.0				
57	141	3	LA	14040.00		NDS 23,529	GAMMA, BETA
-1	2.430		98.0				
-1	1.080		1.6				COMM-141
-2	0.740		0.4				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
58	141	4	CE	2.812E+06		NDS 23,529	GAMMA, BETA
-1	0.582	30.0		-0.2800			ZAED
-1	0.437	70.0		-0.1400			ZAED
-5	0.140	3.3					
-5	0.100	18.6					
53	142	1	I	0.20			
	-2.790						ENDF/B-IV
54	142	1	XE	1.24			
	-1.350						NSE 80, 74
55	142	5	CS	1.69		COMM-142	
-1	7.330	25.0					
-1	6.000	12.0					
0	4.830	35.0					
0	4.190	18.0					
0	3.760	10.0					
56	142	7	RA	642.00		TOI-7	GAMMA (BETA)
-1	2.122	6.0					
-1	1.940	3.0					CONDENSED 13 BETA
-1	1.780	10.0					TRANSITIONS
-1	1.400	2.0					
0	1.120	20.0					
0	1.000	45.0					
0	0.740	14.0					
57	142	10	LA	5550.00		TIC-11026	
1	4.517	7.0					
-1	3.876	5.0					
-1	2.900	4.0					
-1	2.300	9.0					CONDENSED 25 BETA
-1	2.120	24.0					TRANSITIONS
-1	1.970	20.0					
-1	1.820	14.0					
-1	1.050	5.0					
-1	0.890	10.0					
0	0.470	2.0					
59	142	2	PR	68868.00		TIC-11026	
1	2.159	96.3					
-1	0.583	3.7					
54	143	1	XE	0.30			
	-2.010						NSE 80, 74
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
55	143	8	CS	1.78			NDS 25,603; ZP A290,359
-1	5.650	85.0					
-1	5.400	5.8					
-1	5.150	0.7					CONDENSED >22 BETA
-1	4.950	3.6					TRANSITIONS
-1	4.820	2.0					
-1	4.500	0.7					
0	3.000	0.8					
0	1.400	1.8					P(N)=1.8% ZP A290,311
56	143	7	BA	15.20			NDS 25,603 GAMMA; T=PR C19,1948
0	4.300	79.4					
-1	4.100	1.3					
-1	3.850	0.7					
-1	3.600	0.6					
0	3.350	13.4					
0	2.900	3.3					
0	2.000	1.3					
57	143	7	LA	840.00			NDS 25,603 GAMMA
-1	3.300	93.7					
-1	2.640	1.5					
-1	2.480	0.5					CONDENSED 23 BETA
-1	2.130	1.2					TRANSITIONS
-1	1.620	0.9					
-1	1.320	0.7					
0	0.780	1.5					
58	143	6	CE	118800.00			TIC-11026
-1	1.400	38.0					
-1	1.005	47.0					
-1	0.733	12.0					
-1	0.517	1.4					
-1	0.564	0.4					
-1	0.295	0.5					
59	143	1	PR	1.173E+06			NDS 25,603 BETA
-1	0.935	100.0		-0.0180	0.0100		ZAED
54	144	1	XE	1.15			
	-1.200						ENDF/B-IV
55	144	8	CS	1.00			DEDUCED FROM DATA IN NDS 27,97
-1	8.000	38.0					AND JP G6, 1291
-1	7.340	29.0					
-1	6.250	7.0					COMM-144
-1	5.800	16.0					
-1	5.520	3.0					
-1	5.090	4.0					
-1	4.310	2.0					
0	1.500	3.0					P(N)=3% ZP A290,311
56	144	1	BA	11.90			
	-1.025						PETTEN77
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
57	144	10	LA	40.90		NDS 27,97	GAMMA
-1	4.500		10.7				
-1	4.330		5.2				
-1	4.200		12.1				
-1	3.960		10.3				
-1	3.760		16.0				
-1	3.580		11.1				
-1	3.440		5.7				
-1	3.220		10.1				
0	2.800		15.3				
0	2.300		3.7				
58	144	3	CE	2.458E+07		NDS 27,97	BETA, GAMMA
-1	0.318		77.0	-0.3420			ZAED
-1	0.238		3.0				
-1	0.185		20.0				
59	144	3	PR	1038.00		NDS 27,97	BETA, GAMMA
-1	2.996		98.0	0.0300	0.0900	0.0040	ZAED
1	2.299		1.0				ZAED
-1	0.807		1.0				
54	145	1	XE	0.90			
	-1.880						NSE 80, 74
55	145	1	CS	0.58		COMM-145	
	-1.810						NSE 80, 74
56	145	8	BA	3.85		NDS 29, 533	GAMMA
0	4.950		19.0				
0	4.880		21.0				
0	4.850		10.0				
0	4.760		5.0				
0	4.600		5.0				
0	4.440		23.0				
0	4.210		8.0				
0	3.900		9.0				
57	145	8	LA	24.80		NDS 29,533	GAMMA(BETA)
0	4.110		15.0				
0	4.040		33.0				
0	3.670		16.0				CONDENSED 26 BETA
0	3.450		5.0				TRANSITIONS
0	3.270		3.0				
0	3.100		10.0				
0	2.410		7.0				
0	1.750		11.0				
58	145	4	CE	180.00		JINC 42, 1539	
0	1.750		72.0				
-1	1.690		3.0				COMM-145A
0	1.430		4.0				
0	1.320		21.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
-F	E_β	A_β		C_1	C_2	C_3	REMARKS
59	145	2	PR	21528.00		NDS 29,533	GAMMA, BETA
-1	1.805		99.0				
-1	1.000		1.0				
55	146	3	CS	0.32		COMM-146	
-1	8.080		7.0				
0	5.200		80.0				
0	4.000		13.0				
56	146	1	BA	2.18		T FROM PR C17, 2185	
	-1.090					NSE 80, 74	
457	146	5	LA	6.20		COMM-146A	
-1	6.870		5.0				
-1	6.610		3.0				
-1	5.900		2.0				
-1	4.550		1.0				
0	3.300		89.0				
57	146	3	LA	10.00		COMM-146A	
0	5.470		50.0				
0	4.700		30.0				
0	4.400		20.0				
58	146	5	CE	811.00		JINC 42, 1539	GAMMA
-1	0.852		0.7				
-1	0.819		0.8				
-1	0.811		1.3				
0	0.600		93.9				
0	0.449		3.3				
59	146	8	PR	1440.00		JP G3, 1577	GAMMA
-1	4.080		34.0				
-1	3.530		22.0				
1	2.460		4.0				
-1	2.170		2.1				
-1	2.100		29.0				
-1	1.650		2.7				
-1	1.350		4.5				
-1	0.700		1.6				
55	147	1	CS	0.21			NSE 80, 74
	-2.060						
56	147	1	BA	0.72			NSE 80, 74
	-1.590						
57	147	6	LA	4.40		DEDUCED FROM DATA IN NDS 25, 113	
-1	4.750		5.0				
-1	4.630		3.0				
-1	4.570		2.0				
-1	4.420		1.0				
-1	4.280		1.0				
0	3.000		88.0				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
58	147	4	CE	56.40			DEDUCED FROM DATA IN NDS 25, 113
-1	3.310		10.0				
-1	3.220		10.0				COMM-147A
-1	2.950		8.0				
0	2.100		72.0				
59	147	7	PR	819.00			TOI-7 GAMMA(BETA)
-1	2.700		5.0				
-1	2.390		17.0				
-1	2.220		6.0				
-1	1.930		50.0				
-1	1.390		17.0				
-1	1.100		4.0				
0	0.500		1.0				
60	147	5	ND	950400.00			NDS 25, 113 AND NP A321, 341
-1	0.806		81.0	-0.1000			ZAED
-1	0.485		0.6				
-1	0.406		0.8				
-1	0.366		15.3	-0.1000			ZAED
-1	0.211		2.3				
61	147	1	PM	8.279E+07			TOI-7 BETA
-1	0.225		100.0				
56	148	1	BA	0.47			
	-1.070						NSE 80, 74
57	148	1	LA	1.19			COMM-148
	-1.850						NSE 80, 74
58	148	1	CE	48.10			
	-0.540						NSE 80, 74
459	148	5	PR	120.00			JPSJ 47,1039 GAMMA
0	4.050		44.0				
0	3.800		44.0				
-1	3.500		0.9				
0	3.100		1.6				
0	2.900		9.5				
59	148	10	PR	136.00			JPSJ 47,1039 GAMMA
-1	4.800		30.0				
-1	4.500		31.0				
-1	4.100		1.4				
-1	3.800		6.6				
-1	3.600		6.4				
-1	3.300		2.2				
-1	3.130		11.2				
-1	2.700		4.8				
-1	2.250		1.2				
0	1.800		5.2				
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
461	148	9	PM	3.570E+06		TIC-11026	
-2	1.007	0.9					
-1	0.695	22.0					
-1	0.506	18.6					
-1	0.407	54.0					
-5	0.583	0.5					
-5	0.540	0.1					
-5	0.500	0.8					
-5	0.280	0.8					
-5	0.140	0.2					
61	148	5	PM	463968.00		TIC-11026	
-1	2.464	55.5					
-1	1.914	9.4					
0	0.999	33.7					CONDENSED 10 BETA TRANSITIONS
0	0.406	1.4					
-5	0.503	0.2					
56	149	1	BA	0.92			
	-1.640						ENDF/B-IV
57	149	1	LA	1.20			
	-1.400						ENDF/B-IV
58	149	1	CE	5.00			
	-1.120						NSE 80, 74
59	149	10	PR	150.00			DEDUCED FROM DATA IN JDP 38,9 NP A264, 1 COMM-149
-1	3.000	20.0					
-1	2.860	29.0					
1	2.780	1.0					
-1	2.750	5.0					
-1	2.680	18.0					
-1	2.600	6.0					
-1	2.400	16.0					
-1	2.100	16.0					
-5	0.240	1.0					
-5	0.085	21.0					
60	149	8	ND	6228.00		TOI-7 GAMMA, BETA	
-1	1.575	1.0					
1	1.501	3.0					
-1	1.478	26.0					
0	1.419	19.0					
-1	1.292	6.0					
0	1.152	24.0					
0	1.034	20.0					
0	0.440	1.0					
61	149	2	PM	191088.00		TOI-7 GAMMA, BETA	
-1	1.064	96.0					
-1	0.800	4.0					
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

BETA-RAY DATA TABLE							
Z	A	N _β	EL	T _½	REFERENCES AND REMARKS		
F	E _β	A _β		C ₁	C ₂	C ₃	REMARKS
57	150 -2.140	1	LA	0.65			ENDF/B-IV
58	150 -0.700	1	CE	4.00			NSE 80, 74
59	150 -1.250	1	PR	6.20			NSE 80, 74
61	150	10	PM	9648.00		TOI-7	
-1	3.170		7.6				
-1	2.760		1.7				
-1	2.460		1.3				
0	2.330		28.7				CONDENSED >26 BETA TRANSITIONS
0	1.840		25.6				
0	1.540		6.1				
0	1.430		19.4				
0	1.200		5.5				
0	0.700		2.9				
0	0.450		1.2				
57	151 -1.680	1	LA	0.95			ENDF/B-IV
58	151 -1.180	1	CE	1.00			ENDF/B-IV
59	151 -0.960	1	PR	4.00			NSE 80, 74
60	151	9	ND	744.00		TOI-7	GAMMA(BETA)
-1	2.320		5.0				
-1	2.180		10.0				
-1	2.120		5.0				
-1	2.010		5.0				
-1	1.900		8.0				
-1	1.590		30.0				
-1	1.310		6.0				
0	1.140		24.0				
0	0.750		7.0				
61	151	5	PM	102240.00		TOI-7	GAMMA
-1	1.100		20.0				
-1	1.020		12.0				CONDENSED 31 BETA TRANSITIONS
-1	0.840		49.0				
0	0.740		9.0				
0	0.310		10.0				
62	151	1	SM	2.745E+09		TOI-7	BETA
-1	0.076		100.0				
58	152 -0.794	1	CE	7.66			ENDF/B-IV

T_½ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
59	152	1	PR	8.32			ENDF/B-IV
	-1.620						
60	152	2	ND	684.00			TOI-7 BETA(GAMMA)
0	1.150	40.0					
0	0.860	60.0					
461	152	8	PM	450.00			DEDUCED FROM DATA IN TOI-7
-2	3.550	25.0					
0	3.100	10.0					
-2	2.760	7.0					
0	2.450	1.0					
-2	2.390	1.0					
0	2.240	5.0					
0	2.100	5.0					
0	1.670	46.0					
61	152	5	PM	246.00			TOI-7 GAMMA, BETA
0	3.470	61.0					
0	3.350	19.0					COMM-152
0	2.400	12.0					
0	1.810	4.0					
0	1.400	4.0					
58	153	1	CE	1.72			ENDF/B-IV
	-1.400						
59	153	1	PR	4.50			ENDF/B-IV
	-1.200						
60	153	1	ND	67.54			ENDF/B-IV
	-0.792						
61	153	4	PM	324.00			TOI-7 GAMMA(BETA)
0	1.760	55.0					
0	1.710	3.0					
0	1.670	34.0					
0	1.610	8.0					
62	153	3	SM	168480.00			TOI-7 GAMMA, BETA
0	0.805	21.0					
0	0.702	45.0					
0	0.632	34.0					
59	154	1	PR	1.31			ENDF/B-IV
	-1.860						
60	154	1	ND	40.00			ENDF/B-IV
	-0.380						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
461	154	6	PM	165.00		TOI-7	GAMMA(BETA)
0	2.600		10.0				
0	2.460		8.0				
0	2.300		21.0				
0	2.150		12.0				
0	2.050		36.0				
0	1.630		13.0				
61	154	7	PM	102.00		TOI-7	GAMMA(BETA)
0	3.080		12.0				
0	2.880		9.0				
0	2.520		11.0				
0	2.110		3.0				
0	1.910		60.0				
0	1.650		1.0				
0	1.400		4.0				
63	154	10	EU	2.760E+08		TIC-11026	
-1	1.844		11.4	-0.2100	0.00	0.035	RMP 40, 659
-1	1.596		0.3				CONDENSED 24 BETA
-1	0.971		2.3				TRANSITIONS
-1	0.839		17.5				
-1	0.710		0.9				
0	0.569		36.7				
0	0.425		0.4				
0	0.340		2.5				
0	0.247		27.9				
-5	0.119		21.8				
59	155	1	PR	1.89			
	-1.450						ENDF/B-IV
60	155	1	ND	26.06			
	-0.934						ENDF/B-IV
61	155	1	PM	36.56			
	-0.747						ENDF/B-IV
62	155	3	SM	1332.00		TOI-7	GAMMA(BETA)
0	1.525		93.2				
-1	1.384		4.3				
-1	1.322		2.2				
63	155	2	EU	1.565E+08		TOI-7	GAMMA, BETA
-1	0.246		13.0				
-1	0.140		87.0				
60	156	1	ND	19.60			
	-0.594						ENDF/B-IV
61	156	1	PM	13.10			
	-1.270						ENDF/B-IV
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
62	156	2	SM	33840.00			JP G7, 837
0	0.692	55.0					
0	0.423	45.0					
63	156	8	EU	1.306E+06			TOI-7 GAMMA, BETA
-1	2.453	31.0					
-1	1.403	1.4					
-1	1.250	9.5					
-1	1.117	2.3					
0	0.487	30.0					
-1	0.430	6.0					
-1	0.266	14.0					
0	0.180	5.8					
60	157	1	ND	4.15			ENDF/B-IV
	-1.160						
61	157	1	PM	5.00			ENDF/B-IV
	-0.977						
62	157	5	SM	486.00			ADAPTED FROM JINC 42, 1547
0	2.400	53.0					
0	2.200	37.0					COMM-157
0	2.100	3.0					
0	1.700	2.0					
0	1.100	5.0					
63	157	6	EU	54468.00			TOI-7 GAMMA
0	1.300	41.0					
-1	1.240	9.0					
-1	0.930	15.0					
0	0.890	22.0					
-1	0.840	5.0					
-1	0.680	7.0					
61	158	1	PM	3.80			ENDF/B-IV
	-1.590						
62	158	1	SM	331.00			T FROM JINC 42, 1547
	-0.241						ENDF/B-IV
63	158	8	EU	2754.00			TOI-7 GAMMA, BETA
-1	3.400	5.0					
0	2.450	50.0					
-1	2.150	6.0					
-1	1.600	11.0					
-1	1.450	15.0					
-1	1.400	4.0					
0	1.100	6.0					
-1	0.950	3.0					
61	159	1	PM	4.23			ENDF/B-IV
	-1.260						
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
62	159	1	SM	2.70			ENDF/B-IV
	-0.701						
63	159	8	EU	1086.00		TOI-7	GAMMA, BETA
0	2.540	24.0					
0	2.490	37.0					
0	2.410	13.0					
0	2.330	1.0					
0	1.900	13.0					
0	1.700	6.0					
0	1.500	4.0					
0	1.110	2.0					
64	159	3	GD	66960.00		TOI-7	BETA, GAMMA
-1	0.975	63.0					
-1	0.917	26.0					
0	0.612	11.0					
62	160	1	SM	73.00			ENDF/B-IV
	-0.598						
63	160	2	EU	50.00		TOI-7	BETA, GAMMA
-1	4.200	52.0					
0	2.200	48.0					
63	161	1	EU	42.00			ENDF/B-IV
	-0.739						
64	161	4	GD	219.00		TOI-7	GAMMA(BETA)
-1	1.645	6.0					
0	1.542	85.0					
0	1.479	5.0					
0	1.375	4.0					
65	161	3	TD	596200.00		TOI-7	GAMMA, BETA
0	0.590	10.0					
0	0.520	66.0					
-1	0.460	23.0					
63	162	1	EU	270.00			ENDF/B-IV
	-1.250						
64	162	3	GD	620.00		TIC-11026	
0	0.960	100.0					
-5	0.390	0.3					
-5	0.350	0.3					

$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.

BETA-RAY DATA TABLE							
Z	A	N_β	EL	$T_{1/2}$	REFERENCES AND REMARKS		
F	E_β	A_β		C_1	C_2	C_3	REMARKS
65	162	10	TB	466.00			TIC-11026
-1	2.530		0.4				
0	1.380	99.0					
0	1.250		0.1				
0	0.840		0.3				
0	0.760		0.3				
-5	0.830		0.2				
-5	0.750		0.2				
-5	0.210		1.7				
-5	0.175		0.3				
-5	0.130		1.3				
100000000							
$T_{1/2}$ IN sec; E_β IS END-POINT ENERGY IN MeV; A_β IN %.							

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DATA TABLE REFERENCES AND FOOTNOTES

- ADNDT 19, 177 A. H. Wapstra and K. Bos, *At. Data and Nucl. Data Tables* 19, 117 (1977).
- ADNDT 19, 419 E. A. C. Crouch, *At. Data and Nucl. Data Tables* 19, 419 (1977).
- BNL-29694 R. L. Gill, R. E. Chrien, M. Shmid, G. M. Gowdy, H. J. Liou, D. S. Brenner, F. K. Wohn, K. Sistemich, H. Yamamoto, C. Chung, and W. B. Walters, "Band Structure in ^{148}Ce from the Decay of Mass-Separated ^{148}La ," Brookhaven National Laboratory Report No. BNL-29694 (1981).
- COMM-78 A_β normalized to give $\Sigma A_\beta = 100\%$.
- COMM-80 A_β consistent with NP A368, 210; low-energy group added to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-82 Some information is available in NP A368, 210.
- COMM-84 In ENDF/B-IV, tabulated $\langle E_\beta \rangle$ includes the energy contributed by delayed-neutron emission; as much as possible the delayed-neutron energies, $\langle E_n \rangle$, for 27 fission products are given in RUD77. The tabulated $\langle E_n \rangle$ are approximately related to the available energy for neutron emission by $\langle E_n \rangle = 0.19 (Q_\beta - B_n)^{0.7}$. P_n values are needed to estimate the energy contributed by delayed-neutron emission, and these were obtained from RUD77 or else estimated from the approximate methods of ZP 263, 435. Q_β and B_n values were obtained from ADNDT 19, 177 when available, otherwise from ENDF/B-IV. Most corrections to listed $\langle E_\beta \rangle$ are less than 0.1 MeV. The largest corrections are for ^{84}Ga (0.71), ^{87}Ge (0.31), ^{89}As (0.46), ^{93}Br (0.32), ^{95}Br (0.97), and ^{133}In (0.41), where the number in parentheses is the computed total neutron energy, P_n times $\langle E_n \rangle$, in MeV.
- COMM-87 Some information is available in JINC 42, 1387.

- COMM-89 Reapportioned unplaced A_γ (of 6.6%) among four groups given by $E_\beta = 3.9, 4.8, 6.0,$ and 6.5 MeV to preserve intensity totals.
- COMM-89A J^π of ground state of ^{89}Kr assumed $5/2^+$, i.e., 53d neutron in $d_{5/2}$ shell. See J^π for ^{87}Kr and ^{91}Se .
- COMM-90 Reapportioned unplaced A_γ (of 5.4%) to preserve intensity totals.
- COMM-94 For ^{94}Y , A_γ ($E_\gamma = 0.919$ MeV) of $(56 \pm 3)\%$ by RRL 21, 151 is likely too large. More recently PR C22, 152 uses $(49 \pm 2)\%$. Analysis of ^{235}U fission-product beta-ray data of NUREG-39 by PRL 46, 1061 as well as study of $^{245}\text{Cm}(n_{\text{thermal}}, f)$ yields by PR C23, 331 supports an A_γ of 44%, in agreement with earliest measurements of this A_γ by JINC 10, 183.
- COMM-94A Q_β and known highest energy E_β from ZP A294, 35; P_n from ZP A290, 311; B_n estimated from data in PR C19, 1504; gamma-ray data given in PR C22, 252 yield information on ^{94}Sr level structure. PR C22, 252 quotes unpublished work giving three high-energy transitions as: (1) $E_\beta = 8.4$ MeV, $A_\beta = 7.2\%$; (2) $E_\beta = 7.9$ MeV, $A_\beta = 38\%$; and (3) $E_\beta = 7.2$ MeV, $A_\beta = 4.7\%$ all deduced from gamma-ray measurements. $E_\beta = 8.4$ MeV not observed by ZP A294, 35. $A_\beta(E_\beta = 7.9$ MeV) inconsistent with measured total β -ray spectrum of NSE 80, 74. Present assignments are best estimates of E_β and A_β as consistent with above references as can be deduced from these partially discrepant data.
- COMM-95 Q_β and B_n values estimated from data in PR C19, 1504; P_n from ZP A290, 311; known high-energy E_β from ZP A294, 35; approximate low-energy E_β from PL 86B, 21; estimated A_β for high-energy beta for forbidden transition, remaining E_β, A_β to give $\langle E_\beta \rangle$ consistent with NSE 80, 74. See also ZP A273, 283 for partial decay scheme.

- COMM-96 Q_β and B_n values estimated from data in PR C19, 1504; P_n from ZP A290, 311; known high-energy E_β from ZP A294, 35; estimated A_β for high-energy beta rays for forbidden transitions, remaining E_β and A_β to give $\langle E_\beta \rangle$ consistent with NSE 80, 74. See also PR C22, 252 for partial decay scheme.
- COMM-97 Q_β and B_n values estimated from data in PR C19, 1504; P_n from ZP A290, 311; known high-energy E_β from ZP A294, 35; estimated A_β for high-energy beta for forbidden transition, remaining E_β and A_β to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-98 Data indicative of two isomers of ^{98}Rb are reported in NP A339, 415. Both isomers likely have negative parity and decay to much higher lying states than observed in reference.
- COMM-100 J^π probably 4^- to 6^- .
- COMM-103 A_β adjusted to A_γ ($E_\gamma = 497$ keV) of IJARI 32, 573.
- COMM-108 Electron capture decay of ^{108}Ag is not included.
- COMM-113 Interpret statement in NDS 33, 1 that total gamma feeding to ^{113}Pd ground state is 9%.
- COMM-116 A_β ($E_\beta = 870$ keV) as given in TOI-7.
- COMM-122 Electron capture decay of ^{122}Sb not included.
- COMM-124 Combined decay to two states 0.1 MeV apart.
- COMM-125 Lowest energy beta-rays omitted ($A_\beta < 1\%$).
- COMM-126 High-spin isomers of ^{126}In and ^{128}In reported by NP A323, 205 not included in this compilation.

- COMM-128 Electron capture decay of ^{128}I not included.
- COMM-130 NP A352, 157 postulate two isomers both having $T_{1/2} = 0.5$ sec. Until clarified, compilation will use $\langle E_\beta \rangle$ only.
- COMM-131 A_β estimated to give about equal $\log(ft)$ values and give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-133 Assume 0% ground-state transition and 0% direct population of 15-m isomeric level.
- COMM-135 $E_\beta = 5.33$ and 5.06 from ZP A289, 407. Infer $A_\beta(5.33 \text{ MeV}) \ll A_\beta(5.06 \text{ MeV})$ from data exhibited in ZP A289, 407. Add low-energy E_β to adjust $\langle E_\beta \rangle$ consistent with NSE 80, 74. See also JDP 38, 9.
- COMM-141 A_β adjusted to $A_\gamma(E_\gamma = 1354 \text{ keV})$ of IJARI 32, 377.
- COMM-142 $E_\beta = 7.33$ and 6.00 MeV reported by ZP A301, 165. Four E_β in NDS 25, 53 assumed low in energy by $\sim 10\%$. J^π of ^{142}Cs ground state probably 0^- (parity seems certain). Low-energy portion of ^{142}Ba decay scheme given in JP G6, 1291. Postulate five β -ray transitions, two highest-energy are forbidden, the other three as allowed transitions. A_β determined to give consistent $\log(ft)$ values and also to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-144 J^π probably 1^- .
- COMM-145 Q_β from ZP A300, 249 is $(7.96 \pm .08) \text{ MeV}$, and that from ZP A301, 165 is $(7.36 \pm 0.07) \text{ MeV}$. This difference is much larger than comparisons of other measured (see ZP A300, 249 for comparisons) suggesting an unaccounted for error in one (or both) of these experiments for decay of ^{145}Cs .
- COMM-145A JINC 42, 1539 reports no beta rays having $E_\beta > 1.8 \text{ MeV}$; ZP A299, 209 reports 18% beta rays having 2.35 MeV . Latter experiment may include contributions for other Ce isotopes.

- COMM-146 Q_β is from ZP A300, 249; B_n is from PR C19, 1504; P_n and $T_{1/2}$ from ZP A290, 311; high-energy E_β from ZP A301, 165; A_β for this β -ray inferred to be weak from data shown in ZP A301, 165 consistent with first-forbidden transition directly populating the $J^\pi = 2^+$, $E_x = 1256$ keV level (JP G6, 1291). E_β and A_β for low-energy allowed transitions represents P_n times $\langle E_n \rangle$; A_β ($E_\beta = 8.08$ MeV) maximum for a first-forbidden transition; E_β and A_β for remaining entry to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-146A ZP A289, 407 gives data for two isomers of ^{146}La . The 10-sec isomer is probably high-spin and not fed by decay of ^{146}Ba . The three E_β reported are all probably allowed transitions; A_β of these were adjusted to give approximately equal $\log(ft)$ values. The 6-sec isomer has $J^\pi = 1^-$ most likely. The observed A_β are likely weaker than inferred from the text of ZP A289, 407. The transitions are very probably forbidden. An additional low-energy transition is postulated to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-147 Parity of ^{147}La is probably positive and parities of low-lying ^{147}Ce states are probably negative. Observed β -ray transitions must be forbidden. Postulate a ground-state β -ray transition, and adjusted A_β to give $\log(ft)$ values consistent with first-forbidden transitions in this mass region. Low-energy E_β , A_β to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.
- COMM-147A Three highest-energy β -ray transitions following decay of ^{147}Ce reported in ZP A285, 287 are probably forbidden since parity of ^{147}Ce ground state is probably negative while parities of low-lying ^{147}Pr states are probably positive. A_β for these three transitions adjusted to give $\log(ft)$ values consistent with first-forbidden transitions in this mass region. Low-energy E_β and A_β postulated to give $\langle E_\beta \rangle$ consistent with NSE 80, 74.

- COMM-148 T(1/2) from unpublished work, BNL-29694. There is a proposed decay scheme in this reference. $\langle E_\beta \rangle$ of the β -ray spectrum using this proposed decay scheme is ~ 0.7 MeV larger than measured $\langle E_\beta \rangle$ of NSE 80, 74.
- COMM-149 TOI-7 and NDS 19, 337 base A_β for ^{149}Pr on reported $(55 \pm 20)\%$ ground-state branching of NP A99, 473. This ground-state branching is too large according to A_γ of JDP 38, 9. It appears that NP A99, 473 did not consider conversion electron contributions, which would result in a revision of the deduced ground-state beta branching to $(28 \pm 20)\%$.
- COMM-152 15-min isomer not included in this compilation.
- COMM-157 Assumed level structure of ^{157}Eu similar to ^{155}Eu . Also assumed no ground- or first-excited-state direct beta transitions. Weak γ rays reported by JINC 42, 1547 not placed.
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APPENDIX: FORTRAN SUBROUTINE BETASP

The description of this subroutine is given in the main body of the text. The data file is to be placed on "Unit 28" for sequential input. The records of the data file are discussed in the subsection, "The Data File," and the only item of clarification here is that all of the "empty" lines shown in the table of this report were *added* to the actual data file solely for the purpose of providing added clarity to the printed output for this report; these "empty" lines do not exist in the file available from the Oak Ridge National Laboratory Radiation Shielding Information Center (RSIC).

This subroutine, as well as a short main routine for illustrative purposes (and not listed here), accompany the data transmitted by RSIC, along with documentation needed to extract the information from the medium of transmittal.

```

      SUBROUTINE BETASP(IZ,IA,DE,KMX,E,ESUM,ESUMN,SSUM,SSUMN,NAME,TH)
C  PURPOSE IS TO COMPUTE BETA-RAY SPECTRUM
C  IZ=PROTON NUMBER OF BETA EMITTER, INPUT
C  IZ+400 IMPLIES ISOMER OF BETA EMITTER
C  IA=MASS NUMBER OF BETA EMITTER
C  DE=BINWIDTH ENERGY, MEV, INPUT NUMBER
C  E=ENERGY OF BIN(S) OF SPECTRUM, MEV, MIDPOINT
C  ESUM=YIELD (PER BIN) TOTAL SPECTRUM
C  ESUMN=NEUTRINO SPECTRUM
C  SSUM=TOTAL BETA ENERGY -- SUM OF YIELD*ENERGY
C  SSUMN=TOTAL NEUTRINO ENERGY
C  NAME=ALPHANUMERIC DESCRIPTOR OF BETA EMITTER
C  TH=HALF LIFE, SEC
C
      DIMENSION EMAX(10),IF(10),B(10),CA(10),CB(10),CC(10)
      DIMENSION ENE(1500),E(1500),ESUM(1500),ESUMN(1500),ENEN(1500)
      DATA NSTR/5H ISOM/,NON/5H /
      DO 12 I=1,1500
      ESUMN(I)=0.0
12  ESUM(I)=0.0
      KMX=0
      SSUM=0.0
      SSUMN=0.0
      CALL SEARCH(IZ,IA,NB,NAME,EMAX,IF,B,CA,CB,CC,TH)
      IF (NB.GT.0) GO TO 7
15  WRITE(6,17) IZ,IA
17  FORMAT(' ****ERROR BETASP, IZ='I4,', IA='I5/')
      TH=-1.0
      RETURN
      7  NAMZ=NON
      IF (IZ.LT.400) GO TO 1
      IZ=IZ-400
      NAMZ=NSTR
      1  Z=FLOAT(IZ)+1.0
      IF (EMAX(1).LT.0.0) GO TO 34
      DO 8 N=1,NB
      BR=0.01*B(N)
      IF (IF(N)+3) 40,41,41
40  CONTINUE
C  TO HANDLE CONV. ELECTRONS, UNSMEARED
      M=IFIX(EMAX(N)/DE) +1
      ESUM(M)=ESUM(M)+BR
      E(M)=DE*(FLOAT(M)-0.5)
      IF (KMX.LT.M) KMX=M
      GO TO 8
41  CONTINUE
      W0=1.0+EMAX(N)/0.511
      E(1)=0.5*DE
      S=0.
      K=1
      SN=0.
      2  EKK=E(K)
      DEK=DE
      IF ((E(K)+0.5*DE) .LT. EMAX(N)) GO TO 5
      EKK=0.5*(E(K)-0.5*DE+EMAX(N))

```

```

DEK=EMAX(N)-E(K)+0.5*DE
E(K)=EKK
5  W=1. +EKK/0.511
   WW=W*W-1.0
   WA=(WO-W)**2
   ENP=WW*FZE(Z,EKK)*WA
   P=SQRT(WW)
   EKN=EMAX(N)-EKK
   WN=1.0+EKN/0.511
   WWN=WN*WN-1.0
   WAN=(WO-WN)**2
   ENPN=WWN*FZE(Z,EKN)*WAN
   PN=SQRT(WWN)
   JJ=IF(N)+3
   IF(JJ.GT.0) GO TO (18,19,20,21,22,23) JJ
   GO TO 8
18  FORB=WA+CA(N)*WW
   FORBN=WAN+CA(N)*WWN
   GO TO 30
19  FORB=1.0+CA(N)*W+CB(N)/W+CC(N)*W**2
   FORBN=1.0+CA(N)*WN+CB(N)/WN+CC(N)*WN**2
   GO TO 30
20  FORB=1.0
   FORBN=1.0
   GO TO 30
21  FORB=WW+WA
   FORBN=WWN+WAN
   GO TO 30
22  FORB=WW*WW+WA*WA+10.0*WW*WA/3.0
   FORBN=WWN**2+WAN**2+10.0*WWN*WAN/3.0
   GO TO 30
23  FORB=WW**3+WA**3+7.0*WW*WA*(WW+WA)
   FORBN=WWN**3+WAN**3+7.0*WWN*WAN*(WWN+WAN)
30  CONTINUE
   ENE(K)=ENP*W*FORB/P
   ENE(K)=ENE(K)*DEK/DE
   S=S+ENE(K)
   ENEN(K)=ENPN*WN*FORBN/PN
   ENEN(K)=ENEN(K)*DEK/DE
   SN=SN+ENEN(K)
   E(K+1)=E(K)+DE
   K=K+1
   IF ((E(K-1)+0.5*DE).LT.(EMAX(N)-.00001)) GO TO 2
   KM=K-1
   IF (KM.LT.KM) KM=KM
   DO 29 K=1,KM
   ENE(K)=ENE(K)/S
   ENEN(K)=ENEN(K)/SN
   ESUM(K)=ESUM(K)+BR*ENE(K)
   ESUMN(K)=ESUMN(K)+BR*ENEN(K)
29  CONTINUE
   8  CONTINUE
   DO 32 K=1,KMX
   SSUMN=SSUMN+E(K)*ESUMN(K)
32  SSUM=SSUM+E(K)*ESUM(K)

```

```

4   RETURN
34  SSUM=-EMAX(1)
    EX=EMAXF(SSUM)
    EMAX(1)=EX
    SSUM=0.0
    B(1)=100.
    GO TO 1
    END

C
C
C
    SUBROUTINE SEARCH(IZ,IA,NB,NM,EMAX,IF,B,CA,CB,CC,T)
    DOUBLE PRECISION FILNM
    DIMENSION EMAX(1),IF(1),B(1),CA(1),CB(1),CC(1)
    COMMON /DB/ FILNM
    DATA NX/1/

C
C
C
    DATA ON UNIT 28

    IF (NX.EQ.0) GO TO 1
    NX=0
    6   OPEN (UNIT=28,FILE=FILNM,ACCESS='SEQIN')
C   STATEMENT 6 SHOULD BE APPROPRIATE COMMAND TO RESET UNIT 28
C
    1   READ (28,10) I,J,N,NM,I
        IF (I.GT.500) GO TO 7
C   STATEMENT SHOULD BE APPROPRIATE COMMAND TO GO TO 7 AT END OF FILE
    IF (I.EQ.IZ) GO TO 3
    4   DO 2 K=1,N
    2   READ (28,11) L
        GO TO 1
    3   IF (J.NE.IA) GO TO 4
        DO 5 K=1,N
    5   READ (28,11) IF(K),EMAX(K),B(K),CA(K),CB(K),CC(K)
CCC  IF EMAX NEGATIVE, THEN EMAX=AVERAGE BETA ENERGY AND NO
CCC  SPECTRAL INFORMATION IS AVAILABLE.
        NB=N
        RETURN
    7   IF (NX.EQ.1) GO TO 9
        NX=1
        GO TO 6
    9   NB=-1
        RETURN
    10  FORMAT(3I5,A5,F10.3)
    11  FORMAT(I5,5F8.3)
        END

C
C
C
    FUNCTION FZE(Z,E)
C   COMPUTE COULOMB CORRECTION TO FIRST ORDER.
    DATA D1/1.0/,ESQOH/2.18E8/,C/2.988E+10/,PIE/6.2832/
    FZE=0.0
    IF (E.LE.0.0) RETURN
    GAMM=1.0+E/0.511

```

```

G=Z/137.0
S=SQRT(1.0-G*G) -1.0
VEE=C*SQRT(1.0-1.0/GAMM**2)
CC=(GAMM*GAMM*(1.0+16.0*G*G) -1.0)/4.
ZZ=Z*ESQOH/VEE
FZE=ZZ*PIE*CC**S/(D1-EXP(-ZZ))
RETURN
END

C
C
C
      FUNCTION EBAVE(EBETA)
C  TO GET AVERAGE BETA-RAY ENERGY FOR AN ALLOWED TRANSITION HAVING
C  EBETA(MAX) IN MEV.  FORMULA USED IS THAT OF REICH, HELMER, AND
C  PUTNAM, ANCR-1157(1974).  SEE ALSO BNL-NCS-50545, V.I (1976) P. XIV
      X=EBETA/0.511
      EHAT=0.25*EBETA*(10.+8.*X+2.*X*X)/(10.+5.*X+X*X)
      EBAVE=EHAT
      RETURN
      END

C
C
C
      FUNCTION EMAXF(EBHAT)
C  PURPOSE IS TO GET EBETA(MAX) FOR INPUT AVERAGE BETA ENERGY, I.E.
C  TO "INVERT" FUNCTION EBAVE(EBETA)
      DIMENSION FX(150)
      DATA NT/1/
      IF (EBHAT.LT.0.01) GO TO 7
      IF (NT.GT.1) GO TO 2
C  FIRST PASS SET UP FX-ARRAY
      X=0.1
      DO 1 I=1,150
      FX(I)=EBAVE(X)
1    X=X+0.1
      NT=2
2    J=2
3    IF (EBHAT.LT.FX(J)) GO TO 4
      J=J+1
      IF (J.LE.150) GO TO 3
      WRITE (6,100)
100  FORMAT(' ***** ERROR FUNCTION EMAXF *****'/)
      STOP
4    J=J-1
      D=FX(J+1)-FX(J)
      R=(EBHAT-FX(J))/D
      X=0.1*(FLOAT(J) +R)
      Y=X
      CX=EBAVE(X)
      X=Y-0.1*(CX-EBHAT)/D
      EMAXF=X
      RETURN
7    EMAXF=3.99*EBHAT
      RETURN
      END

```

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