^{155}Eu β^- decay (4.753 y)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 160, 1 (2019)	21-Oct-2019

Parent: ^{155}Eu: E=0.0; J$^\pi$=5/2$^+$; $T_{1/2}$=4.753 y *14*; Q(β^-)=251.8 *9*; %β^- decay=100.0

Additional information 1.

The decay scheme is due primarily to 1969Me09 and 1967Fo11. Quite helpful studies of the lowest-energy transitions (<22 keV) have been reported in 1967Fo11, 1975Ch04 (albeit from the ^{155}Tb decay), 1979Aw03 and 1990GoZS. This latter work is useful in that it utilizes a a high-resolution electrostatic spectrometer (resolution 7 to 12 eV) to study the conversion-electron spectrum.

γ-ray and x-ray emission probabilities, 1996Ch27, 2002ChZN; ^{155}Eu $T_{1/2}$ value: 1999ChZU, 1996ChZY, 2000Ch01.

Using a high-resolution electrostatic spectrometer, 1990GoZR studied the Auger electron spectrum of a ^{155}Eu source. With this instrument, 1990GoZS were able to observe the natural line widths of the K, L1, L2 and L3 atomic levels of Gd.

Others: 1990Me15, 1986Sc25, 1983Wa26, 1982Co05, 1980Gn01, 1976Me10, 1975Kr04, 1974Da24, 1974HeYW, 1972Do14, 1972Em01, 1972Su09, 1971Ge11, 1970Mo23, 1970Ra37, 1970Re08, 1969Ba72, 1969Gr32, 1968Al01, 1968Bl07, 1968Ma15, 1968Om01, 1968So02, 1967Bl11, 1967Ko17, 1967Ma27, 1966Kr01, 1966Mc07, 1966Me06, 1961Ha44, 1961Su13, 1960Su04, 1959Am16, 1959Ha07, 1959Ve18, 1958Bi32, 1958Gl56, 1956Du31, 1954Le08, 1950Ke12, 1950Wi11, 1950Ke12, 1949Ha04, 1949Ma58.

^{155}Gd Levels

E(level)†	J$^\pi$‡	$T_{1/2}$	Comments
0.0#	3/2$^-$	stable	
60.0098# *7*	5/2$^-$		
86.5462@ *9*	5/2$^+$	6.50 ns *4*	$T_{1/2}$: from the adopted values. This value is based on a number of studies of both the ^{155}Eu β^- decay and the ^{155}Tb ε decay.
105.3088@ *8*	3/2$^+$	1.16 ns *1*	$T_{1/2}$: from the adopted values. This value is based on a number of studies of both the ^{155}Eu β^- decay and the ^{155}Tb ε decay.
107.5794@ *20*	9/2$^+$		
117.9971@ *17*	7/2$^+$		
146.0698# *8*	7/2$^-$		

† Values obtained from a least-squares fit involving the listed γ-ray energies.
‡ From the Adopted Values.
# Band(A): g.s. band. Conf=3/2(521).
@ Band(B): Mixed positive-parity band. Conf=3/2(651)$^+$... . Band also contains components of other $i_{13/2}$-related Nilsson states, as well as 3/2[402] from strong ΔN=2 mixing.

β^- radiations

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(105.7 *9*)	146.0698	0.72 *7*	8.83 *5*	av Eβ=27.71 *25*
(133.8 *9*)	117.9971	1.7 *3*	8.78 *8*	av Eβ=35.50 *26*
(146.5 *9*)	105.3088	46.2 *24*	7.466 *24*	av Eβ=39.08 *26*
(165.3 *9*)	86.5462	25.5 *24*	7.89 *5*	av Eβ=44.43 *26*
(191.8 *9*)	60.0098	8.2 *4*	8.583 *23*	av Eβ=52.13 *27*
(251.8 *9*)	0.0	17.7 *11*	8.62 *3*	av Eβ=70.09 *28* E(decay): 1960Su04 report Eβ=250 keV.

† Computed from the transition-intensity balance at each level.
‡ Absolute intensity per 100 decays.

$\gamma(^{155}Gd)$

Iγ normalization: Based on a weighted average of the measurements of 1994Co02 and 1994Eg01, who report 31.1 *4* photons per 100 ^{155}Eu decays and 30.5 *3* photons per 100 ^{155}Eu decays, respectively, for Iγ(86.6γ). Using a magnetic spectrometer, 1960Su04 measure Iβ^-=13% for the g.s. β branch. Based on this value, Iγ normalization is calculated to be 0.325.

E_γ[†‡]	I_γ[†‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#@]	α[&]	Comments
10.4178 *12*	0.0116 *14*	117.9971	7/2$^+$	107.5794	9/2$^+$	M1+E2	0.033 *+9−12*	3.4×10^2 *6*	α(L)=2.7×10^2 *5*; α(M)=59 *11* α(N)=13.5 *24*; α(O)=2.0 *3*; α(P)=0.0992 *14* E_γ: adopted value. I_γ: calculated by evaluator from intensity balance at 107.6 level. δ: 0.017 *+5−8* calculated by evaluator for this dataset from subshell ratios L1/L1=1.00, L2/L1=0.237 *44*, L3/L1=0.062 *23*, M/L=0.180 *45*, M2/M1=0.153 *139*, M3/M1=0.152 *139* (1968Ba80, superseding 1967Fo11).
^{x}12.70 *25*	0.032 *21*								
^{x}13.80 *25*	0.064 *21*								
18.763 *2*	0.16 *2*	105.3088	3/2$^+$	86.5462	5/2$^+$	M1+E2	+0.274 *4*	362 *10*	α(L)=280 *8*; α(M)=64.9 *19* α(N)=14.4 *4*; α(O)=1.88 *6*; α(P)=0.01653 *24* E_γ: 18.776 *35* (1969Me09), 18.73 *3* (1975Kr04), 18.769 *15* (1976Ch04, from ^{155}Tb ε decay), 18.760 *4* (1986Sc25), 18.784 *35* (1990Me15), 18.764 *2* (1990G0ZS); others: 18.75 (1967Fo11). I_γ: 0.17 *3* (1971Ge11), 0.16 *2* (1974HeYW), 0.13 *3* (1975Kr04), 0.16 *4* (1990Me15); others: ≈ 0.1 (1959Ha07), 0.16 *4* (1969Me09). δ: calculated by evaluator for this dataset from subshell ratios: 0.293 *12* from L1/L1=1.000 *74*, L2/L1=3.741 *148*, L3/L1=5.185 *222*, M1/L1=0.444 *74*, M2/L1=1.593 *148*, M3/L1=2.259 *148*, N1/L1=0.815 *222*, N2/L1=0.815 *222* (1990GoZS); 0.260 *9* from L1/L1=1.000 *119*, L2/L1=3.349 *218*, L3/L1=4.391 *263* (1967Fo11).
21.035 *4*	0.00152 *18*	107.5794	9/2$^+$	86.5462	5/2$^+$	E2		2.60×10^3	α(L)=2.01×10^3 *3*; α(M)=471 *7* α(N)=104.1 *15*; α(O)=13.25 *19*; α(P)=0.00391 *6* E_γ: 21.02 *2* (1967Fo11), 21.030 *10* (1986Sc25), 21.036 *4* (1990GoZS). I_γ: calculated by evaluator relative to I(86.5γ)=100 using internal conversion electron intensities (1967Fo11, Table 3, p. 865) and theoretical internal coefficient values.
^{x}24.56 *30*	0.025 *25*								
26.527 *21*	1.03 *6*	86.5462	5/2$^+$	60.0098	5/2$^-$	E1		1.95	α(L)=1.531 *22*; α(M)=0.336 *5*

$\gamma(^{155}Gd)$ (continued)

E_γ [†‡]	I_γ [†‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ [#@]	α [&]	Comments
									α(N)=0.0739 *11*; α(O)=0.00966 *14*; α(P)=0.000328 *5* E_γ: 26.49 *5* (1975Kr04), 26.530 *23* (1986Sc25), 26.532 *21* (1990Me15); other: 26.513 *21* (1969Me09). I_γ: 1.00 *10* (1971Ge11), 1.10 *13* (197Kr04), 1.03 *6* (1990Me15); others: ≈ 4 (1959Ha07), ≈ 1 (1968Al01), 26.513 *21* (1969Me09).
31.444 *7*	0.023 *5*	117.9971	7/2$^+$	86.5462	5/2$^+$	M1+E2	0.370 *14*	50 *3*	α(L)=39.1 *22*; α(M)=9.1 *6* α(N)=2.03 *12*; α(O)=0.267 *15*; α(P)=0.00335 *6* E_γ: 31.55 *10* (1970Re08), 31.444 *7* (1986Sc25), 31.4 *1* (1990GoZS); other: 31.4 (1) (1969Me09). I_γ: 0.03 *2* (1970Re08), 0.023 *5* (1990Me15); other: 0.023 *5* (1969Me09).
[x]40.75 *20*	0.086 *9*								
45.2989 *10*	4.27 *12*	105.3088	3/2$^+$	60.0098	5/2$^-$	E1		0.437	α(L)=0.343 *5*; α(M)=0.0747 *11* α(N)=0.01665 *24*; α(O)=0.00231 *4*; α(P)=9.60×10^{-5} *14* E_γ: 45.29 *1* (1957Bo15), 45.299 *2* (1970Re08), 45.2972 *13* (1970Ra37), 45.27 *5* (1975Kr04), 45.300 *1* (1986Sc26), 45.295 *13* (1990Me15); other: 45.299 *13* (1969Me09). I_γ: 3.6 *7* (1970Re08), 4.1 *3* (1971Ge11), 3.95 *40* (1975Kr04), 3.95 *40* (1975Kr04), 4.21 *20* (1990Me15), 4.36 *12* (194Eg01), 4.3 *10* (1996Ch27); others: 2.3 (1959Ha07), 2.8 *7* (1968Al01), 4.18 *19* (1969Me09). δ: from $\gamma\gamma(\theta)$, 1975Kr04 report δ=−0.035 *25*. From the $T_{1/2}$ value for this level and its γ+ce branching, this δ value implies B(M2)(W.u.)>13, which exceeds RUL of 1. For B(M2)(W.u.)≤1, δ≤0.0027.
57.9873 *17*	0.216 *18*	117.9971	7/2$^+$	60.0098	5/2$^-$	E1		1.238	α(K)=1.020 *15*; α(L)=0.1712 *24*; α(M)=0.0372 *6* α(N)=0.00834 *12*; α(O)=0.001181 *17*; α(P)=5.30×10^{-5} *8* E_γ: 57.970 *26* (1970Re08), 57.9805 *20* (1970Ra37), 57.99 *4* (1975Kr04), 57.989 *1* (1986Sc25), 57.986 *30* (1990Me15); other: 57.983 *30* (1969Me09). I_γ: 0.20 *3* (1968Al01), 0.22 *5* (1970Re08), 0.22 *3* (1975Kr04), 0.221 *18* (1990Me15), 0.213 *30* (1994Eg01); other: 0.217 *18* (1969Me09).
60.0089 *10*	3.80 *10*	60.0098	5/2$^-$	0.0	3/2$^-$	M1+E2	−0.198 *8*	9.14	α(K)=7.25 *11*; α(L)=1.48 *4*; α(M)=0.329 *9* α(N)=0.0749 *20*; α(O)=0.0110 *3*; α(P)=0.000543 *8* E_γ: 60.00 *2* (1959Ha07), 59.97 *20* (1967Fo11), 60.006 *4* (1970Re08), 60.0100 *18* (1970Ra37), 60.01 *4* (1975Kr04), 60.012 *3* (1976Me10), 60.008 *2* (1986Sc25), 60.022 *15*, (1990Me15), 60.0086 *10* (1990GoZS); other: 60.019 *15* (1969Me09). I_γ: 3.8 *2* (1968Al01), 4.3 *3* (1970Re08), 3.9 *9* (1971Ge11), 3.8 *4* (1975Kr04), 3.60 *10* (1990Me15), 3.99 *12* (1994Eg01), 3.9 *9* (1996Ch27); others: 4.0 (1959Ha07), 5.1 *20* (1967Bl11), 3.60 *8* (1969Me09). δ: calculated by evaluator for this dataset: 0.198 *8* from K/L1=6.81

$^{155}_{64}Gd_{91}$-3

^{155}Eu β^- decay (4.753 y) (continued)

$\gamma(^{155}$Gd) (continued)

E_γ[†‡]	I_γ[†‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#@]	α[&]	Comments
									36, L1/L1=1.000 *4*, L2/L1=0.295 *13*, L3/L1=0.249 *12* (1967Fo11); −0.19 *3* (1975Kr0, $\gamma\gamma(\theta)$), −0.20 *3* (1961Su13, $\gamma\gamma(\theta)$).
86.0591 *10*	0.50 *5*	146.0698	7/2⁻	60.0098	5/2⁻	M1+E2	−0.184 *23*	3.14	α(K)=2.59 *4*; α(L)=0.435 *16*; α(M)=0.096 *4* α(N)=0.0219 *9*; α(O)=0.00331 *11*; α(P)=0.000192 *3* E_γ: 86.01 *20* (1967Fo11), 86.062 *23* (1970Re08), 86.062 *5* (1970Ra37), 86.03 *7* (1975Kr04), 86.059 *1* (1986Sc25); other: 86.0 (1969Me05). I_γ: 0.50 *5* (1968Al01), 0.49 *5* (1970Re08), 0.54 *11* (1975Kr04). δ: 0.19 *4* (1975Kr04, $\gamma\gamma(\theta)$) for this dataset. Since the δ values for the other ΔJ=1 transitions in the g.s. band are found (1992Ku15, 1998St28) to be negative, the evaluator has assumed that the sign of this one is negative also. This is confirmed by the negative adopted from $\gamma\gamma(\theta)$ (1959De29, Coulomb Ex. dataset).
86.5463 *10*	100	86.5462	5/2⁺	0.0	3/2⁻	E1		0.431	α(K)=0.360 *5*; α(L)=0.0555 *8*; α(M)=0.01203 *17* α(N)=0.00271 *4*; α(O)=0.000394 *6*; α(P)=1.97×10^{-5} *3* E_γ: 86.54 *1* (1959Ha07), 86.52 *20* (1967Fo11), 86.541 *3* (1970Re08), 86.5452 *33* (1970Ra37), 86.53 *3* (1975Kr04), 86.547 *1* (1986Sc25), 86.554 *15* (1990Me15); other: 86.539 *15* (1986Me09). I_γ: 100 (1959Ha07), 100 (1967Bl11), 100 (1969Al01), 100 (1970Re08), 100 (1971Ge11), 100 (1975Kr04), 100 (1990Me15), 100 (1994Eg01), 100 (1996Ch26); other: 100 (1969Me09), Mult.: 1975Kr04 indicate δ(M2/E1)=0.02 *5*.
105.3087 *10*	68.8 *14*	105.3088	3/2⁺	0.0	3/2⁻	E1		0.254	α(K)=0.213 *3*; α(L)=0.0320 *5*; α(M)=0.00693 *10* α(N)=0.001568 *22*; α(O)=0.000230 *4*; α(P)=1.201×10^{-5} *17* E_γ: 105.32 *3* (1957Bo15), 105.28 *20* (1967Fo11), 105.302 *4* (1970Re08), 105.308 *3* (1970Ra37), 105.30 *3* (1975Kr04), 105.309 *1* (1986Sc25), 105.338 *15* (1990Me15); other: 105.315 *15* (1969Me09). I_γ: 65.7 *65* (1967Bl11), 67.9 *35* (1968Al01), 68.3 *27* (1970Re08), 68 *4* (1971Ge11), 69.9 *35* (1975Kr04), 69.1 *9* (1982Co05), 66.8 *27* (1990Me15), 68.5 *14* (1994Eg01), 69.5 *16* (1996Ch27); other: 64 (1959Ha07).
[x]107.60 *20*	<0.0013								I_γ: from 1969Me09.
146.0706 *10*	0.166 *10*	146.0698	7/2⁻	0.0	3/2⁻	E2		0.649	α(K)=0.398 *6*; α(L)=0.194 *3*; α(M)=0.0453 *7* α(N)=0.01014 *15*; α(O)=0.001360 *19*; α(P)=2.12×10^{-5} *3* E_γ: 146.061 *5* (1970Re08), 146.04 *10* (1974Kr04), 146.071 *1* (1986Sc25), 146.090 *90* (1990Me15). I_γ: 0.16 *5* (1967Bl11), 0.19 *2* (1970Re08), 0.14 *2* (1975Kr04), 0.167 *10* (1990Me15); other: 0.169 *9* (1969Me09).

[†] Weighted average values of the values listed in comments. Values of 1969Me09 were superseded by 1990Me15.

γ(^{155}Gd) (continued)

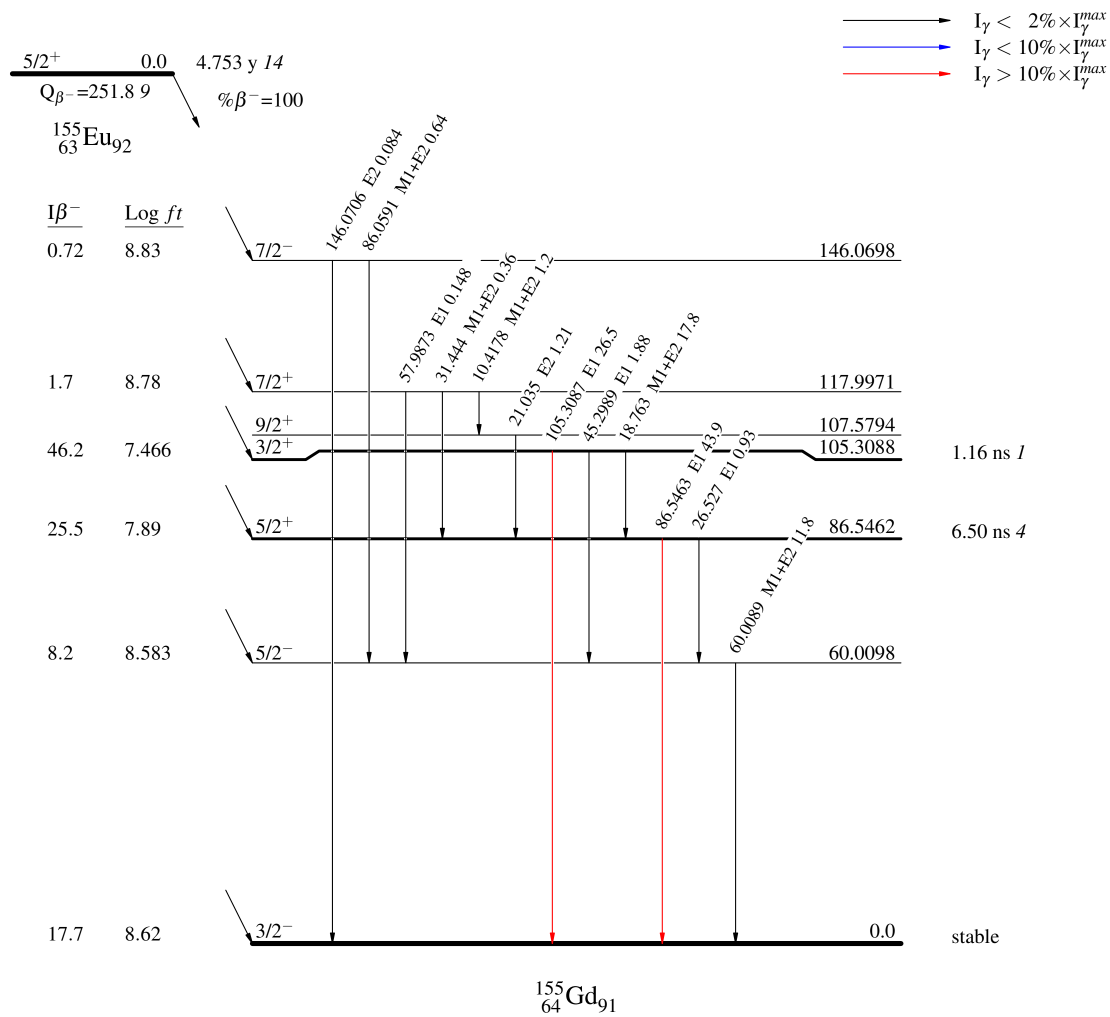
‡ Listed values for unplaced γ's are those of 1979Aw03.
# Adopted values.
@ Additional information 2.
& Additional information 3.
[a] For absolute intensity per 100 decays, multiply by 0.307 *3*.
[x] γ ray not placed in level scheme.

$^{155}_{64}$Gd$_{91}$-5

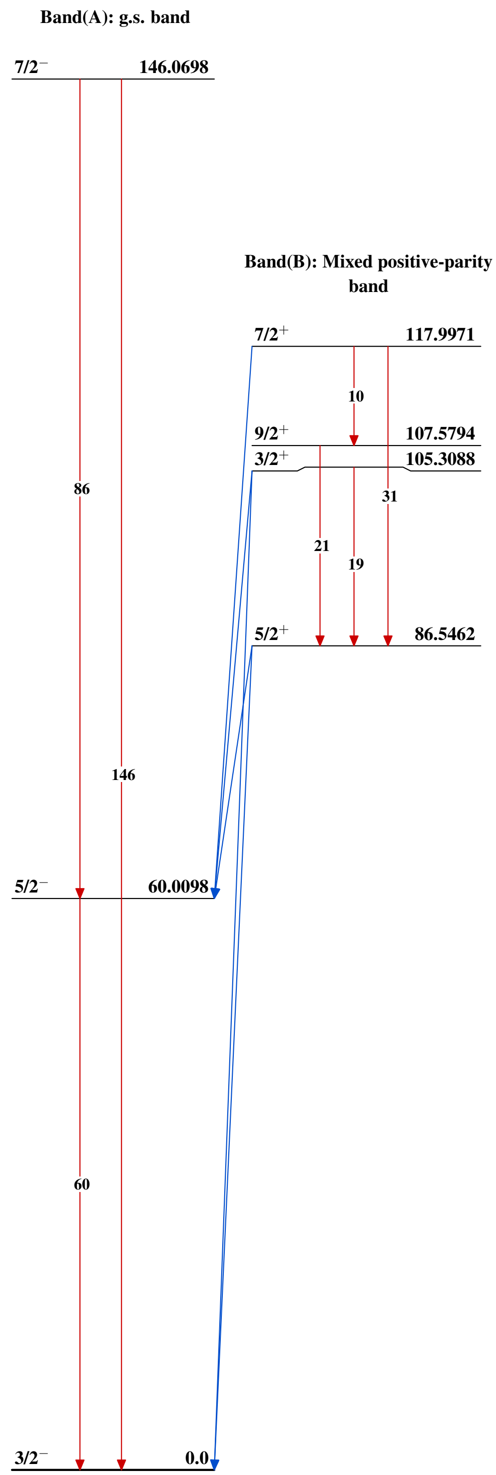
^{155}Eu β^- decay (4.753 y)

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{155}Eu β^- decay (4.753 y)



$^{155}_{64}Gd_{91}$