^{152}Eu β^- decay (13.517 y)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. J. Martin	NDS 114, 1497 (2013)	31-Aug-2013

Parent: ^{152}Eu: E=0.0; J$^\pi$=3$^-$; T$_{1/2}$=13.517 y *14*; Q(β^-)=1818.9 *7*; %β^- decay=27.92 *13*

^{152}Eu-%β^- decay: The absolute intensity of the 1408γ in Sm has been determined as 20.85% 9 (2007BeZP). Normalization of the photon intensities to Iγ(344γ in Gd)=100 gives Iγ(1408γ)=78.41 *10* and Σ I(γ+ce)(to Gd g.s.)=105.02 *21*. From these data one gets %β^-=27.92 *13* and thus %ε=72.08 *13*.

^{152}Gd Levels

Additional levels have been proposed at: 1) 1312 keV (1990St02,1993Ka30) depopulated by a 696.9-keV γ. However, the γ was not seen by 1992Ya12, and the two measured intensities do not agree. 2) 1485 keV (1990St02,1993Ka30) depopulated by 166.9- and 1485.9-keV γ's, suggested J^π=0$^+$. Again, the intensity measurements by the two authors disagree and the γ's were looked for but not seen by 1992Ya12. A 1485-keV E0 transition has been observed in ^{152}Tb ε decay, suggesting a possible 0$^+$ level at 1485, however; the 1485-keV γ obviously does not belong to a 0$^+$ level. 3) 1698 keV (1990St02) depopulated by 330.1- and 1698.1-keV γ's. The two γ's were looked for but not seen by 1992Ya12.

E(level)	J$^\pi$†	T$_{1/2}$‡	Comments
0.0	0$^+$		
344.2789 *12*	2$^+$	32.0 ps *27*	g=+0.53 *7* (1969Zm01) T$_{1/2}$: in this data set: T$_{1/2}$=36 ps *5* (1993Se08), 37 ps *7* (1974El03); others: 53 ps *9* (1961Bu17), ≈28 ps (1967Ab06). g-factor: for halflife=32.0 ps *27*.
615.415 *19*	0$^+$	37 ps *8*	
755.3960 *17*	4$^+$	7.3 ps *4*	J$^\pi$: $\gamma\gamma(\theta)$ (1992Ya14,1975He13), $\gamma\gamma(\theta$,H,T) (1985KrZU). T$_{1/2}$: 4 ps *5* (1993Se08).
930.546 *3*	2$^+$	7.3 ps *6*	J$^\pi$: $\gamma\gamma(\theta$,H,T) (1985KrZU), $\gamma\gamma(\theta)$ (1970Ba32). T$_{1/2}$: 5 ps *5* (1993Se08).
1047.81 *6*	0$^+$		
1109.200 *18*	2$^+$		
1123.1855 *21*	3$^-$		J$^\pi$: J=3 from $\beta\gamma(\theta)$ (1966Ci02,1965Bh03,1963Su08,1960Su07), $\gamma(\theta$,H,T) (1985KrZU).
1282.24 *4*	4$^+$		
1314.640 *24*	1$^-$		
1318.456 *20*	2$^+$		
1434.020 *4*	3$^+$		J$^\pi$: J=3 from $\gamma(\theta$,H,T) (1985KrZU,1975He13), from $\gamma\gamma(\theta)$: (1970Ba32); π=+ from $\beta\gamma(\theta)$ (1966Ci02,1965Sc06).
1550.17 *5*	4$^+$		
1605.596 *25*	2$^+$		
1643.421 *8*	2$^-$		J$^\pi$: J=2 from $\gamma(\theta$,H,T) (1985KrZU,1975He13); from $\beta\gamma(\theta)$ (1966Ci02); from $\gamma\gamma(\theta)$ (1970Ba32).
1692.40 *7*	2$^+$,3$^+$		

† From Adopted Levels.
‡ From Adopted Levels. Values from this decay are given in comments.

β^- radiations

No β^- to ^{152}Gd g.s. (Iβ(g.s.)/Iβ(to 344)<0.36×10^{-4}) (1967La13).
J^π(^{152}Eu (13.517 y))=3$^-$.

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^{152}Eu β^- decay (13.517 y) (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(126.5 *7*)	1692.40	0.0199 *12*	11.09 *3*	av Eβ=33.45 *20*
(175.5 *7*)	1643.421	1.833 *12*	9.567 *7*	av Eβ=47.38 *21* E(decay): 190 *40* (1960Sc14), 220 *40* (1957Co47). Iβ^-: Iβ^-(F-K analysis)=6.2% (1960Sc14), 9% (1957Co47). $A_2(\beta)$=+0.016 *20* in $\beta\gamma(\theta)$, indicating allowed β-decay (1966Ci02).
(213.3 *7*)	1605.596	0.1068 *22*	11.07 *1*	av Eβ=58.49 *21*
(268.7 *7*)	1550.17	0.0456 *22*	11.76 *2*	av Eβ=75.29 *22*
(384.9 *7*)	1434.020	2.432 *15*	10.537 *5*	av Eβ=112.34 *23* E(decay): 360 *30* (60sc14*), 417 *13* (1960Mu05), 360 *40* (1957Co47). Iβ^-: Iβ^-(F-K analysis)=12.9% (1960Sc14), 29% *3* (1960Mu05), 13% (1957Co47). Nonvanishing anisotropy in $\beta\gamma(\theta)$ indicates first forbidden transition (1966Ci02).
(500.4 *7*)	1318.456	0.0189 *10*	13.03 *3*	av Eβ=151.44 *25*
(536.7 *7*)	1282.24	0.0232 *12*	13.04 *3*	av Eβ=164.10 *25*
(695.7 *7*)	1123.1855	13.74 *9*	10.654 *4*	av Eβ=221.69 *26* E(decay): 690 *20* (1960Sc14), 720 *22* (1960Mu05), 710 *20* (1958Bh13), 680 20 (1957Co47). Iβ^-: (F-K analysis): 50.9% (1960Sc14), 46% *5* (1960Mu05), 64% (1958Bh13), 51% (1957Co47). $A_2(\beta)$=−0.017 *12* in $\beta\gamma(\theta)$, indicating allowed β decay (1966Ci02). Deduced C(V)M(F)/C(A)M(GT) $\beta\gamma(\theta$,circular pol.) (1969Be28,1965Bh03,1964Co33).
(709.7 *7*)	1109.200	0.264 *9*	12.40 *2*	av Eβ=226.90 *27*
(888.4 *7*)	930.546	0.284 *6*	12.71 *1*	av Eβ=295.12 *28*
(1063.5 *7*)	755.3960	0.914 *10*	12.49 *1*	av Eβ=364.69 *29* E(decay): 1022 *31* (1960Mu05), 1072 *20* (1960Sc14), 1040 *25*(1958Bh13), 1050 *20* (1957Co47). Iβ^-: (F-K analysis): 4.6% (1960Sc14), 5% *1* (1960Mu05), 9% (1958Bh13), 6% (1957Co47).
(1474.6 *7*)	344.2789	8.25 *19*	12.06 *1*	av Eβ=535.49 *30* E(decay): 1481 *2* (1978Ra10), 1483 *7* (1960La04), 1470 *10* (1958Al99). Others: 1960Sc14, 1960Mu05, 1958Bh13, 1957Co47. Spectrum has: unique shape (1960Sc14,1958Bh13,1957Co47); F-K plot is linear (1960Mu05,1958Al99,1957Na01). This branch is a 3^- to 2^+ transition. Iβ^-: (F-K analysis): 24.9% (1960Sc14), 27% (1958Bh13); others: 17.6% (1960La04), 19% *2* (1960Mu05), 21% (1957Co47). Polarization: P=−0.96 *3* (V/C) with P(^{32}P)=−1 (V/C) (1968Wa02).

† For absolute intensity per 100 decays, multiply by 0.999 *5*.

^{152}Eu β^- decay (13.517 y) (continued)

$\gamma(^{152}$Gd)

Iγ normalization: The absolute intensity of the 1408γ in Sm has been determined as 20.85% 9 (2007BeZP). Normalization of the photon intensities to Iγ(344γ in Gd)=100 gives Iγ(1408γ)=78.41 *10* and Σ I(γ+ce)(to Gd g.s.)=105.02 *21*. From these data one gets %β^-=27.92 *13* and thus %ε=72.08 *13*.

I(K x ray)=3.14 *5* (1986Me10).

I(Kα x ray)=0.00648 *22* per decay, I(Kβ x ray)=0.00176 per decay (1979De36).

For unplaced γ's see ^{152}Eu ε decay (13.517 y).

E_γ[†]	I_γ[&d]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	α[e]	Comments
172.1[f] *4*	0.0016 *8*	1282.24	4$^+$	1109.200	2$^+$	[E2]	0.369	α(K)=0.244 *4*; α(L)=0.0969 *17*; α(M)=0.0225 *4*; α(N+..)=0.00574 *10* α(N)=0.00504 *9*; α(O)=0.000684 *12*; α(P)=1.350×10^{-5} *21* E_γ,I_γ: 1990St02 report Eγ=173.17 *15* with Iγ=0.03 *1*, 1990Me15 report Eγ=172.1 *4* with Iγ=0.0016 *8*, and 1993Ka30 report Iγ=0.063 *2*; however, this transition is not reported in 17.5H Tb ε decay, nor in (α,xnγ). From the energy level difference one expects Eγ=173.08 *5*. The transition, as placed here, is thus suspect.
174.80[@] *22*	0.0052[@] *7*	930.546	2$^+$	755.3960	4$^+$			
192.60 *5*	0.0256 *8*	1123.1855	3$^-$	930.546	2$^+$	[E1]	0.0502	α(K)=0.0425 *6*; α(L)=0.00603 *9*; α(M)=0.001304 *19*; α(N+..)=0.000344 *5* α(N)=0.000297 *5*; α(O)=4.46×10^{-5} *7*; α(P)=2.59×10^{-6} *4*
195.22[@] *15*	0.0077[@] *7*	1318.456	2$^+$	1123.1855	3$^-$	E1	0.0484	α(K)=0.0410 *6*; α(L)=0.00582 *9*; α(M)=0.001259 *18*; α(N+..)=0.000332 *5* α(N)=0.000287 *4*; α(O)=4.31×10^{-5} *6*; α(P)=2.50×10^{-6} *4*
209.3	0.00064 *4*	1318.456	2$^+$	1109.200	2$^+$			E_γ,I_γ: Not resolved from the 209γ components from the 1643 level and a placement in Sm. Eγ is a rounded-off value from the level energies, and Iγ is from Iγ/Iγ(195γ+974γ+1318γ)=0.0099 *4* in 17.5-h Tb ε decay.
209.41[@] *13*	0.0045[@] *15*	1643.421	2$^-$	1434.020	3$^+$	[E1]	0.0402	α(K)=0.0341 *5*; α(L)=0.00482 *7*; α(M)=0.001041 *15*; α(N+..)=0.000275 *4* α(N)=0.000237 *4*; α(O)=3.57×10^{-5} *5*; α(P)=2.10×10^{-6} *3* E_γ,I_γ: From 2004Ca04. This transition is an unresolved doublet in all other works, with the main component being from the 1293 level in Sm, with Iγ=0.0162 *26*. A weighted average of all measurements of the doublet gives Iγ=0.0209 *20*. The component from the 1643 level in this decay and the component in Sm sum to 0.0207 *30*, in good agreement with the value measured for the doublet.
271.08 *4*	0.269[c] *7*	615.415	0$^+$	344.2789	2$^+$	E2	0.0827	α(K)=0.0621 *9*; α(L)=0.01602 *23*; α(M)=0.00365 *6*; α(N+..)=0.000943 *14* α(N)=0.000823 *12*; α(O)=0.0001159 *17*; α(P)=3.81×10^{-6} *6* Mult.: α(K)exp=0.074 *8* (1991Go22), 0.033 *13* (1967Ma29). L1/L2=1.34 *6*, L1/L3=1.85 *8* (1987BaYQ). K/L=4.2 *+65−23* (1967Ma29).
287.10[@] *12*	0.00305[@] *26*	1605.596	2$^+$	1318.456	2$^+$			
315.10 *3*	0.150 *4*	930.546	2$^+$	615.415	0$^+$	(E2)	0.0518	α(K)=0.0400 *6*; α(L)=0.00925 *13*; α(M)=0.00209 *3*; α(N+..)=0.000543 *8* α(N)=0.000473 *7*; α(O)=6.75×10^{-5} *10*; α(P)=2.52×10^{-6} *4* I_γ: The values of 1993Ka30, 1990St03, 1990Me15, and 1970Ri19 have been corrected by the evaluator for the contribution of Iγ=0.0384 *15* from the

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$\gamma(^{152}$Gd) (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	α[e]	Comments
								316γ in Sm. The value of 1980Sh15 has been excluded. Mult.: α(K)exp=0.032 *20* (1967Ma29).
324.83 *3*	0.256 *7*	1434.020	3^+	1109.200	2^+	[M1,E2]	0.062 *15*	α(K)=0.051 *15*; α(L)=0.0088 *5*; α(M)=0.00194 *7*; α(N+..)=0.00051 *3* α(N)=0.000443 *20*; α(O)=6.6×10^{-5} *6*; α(P)=3.6×10^{-6} *13* I_γ: The 324γ is placed from the 1434 and 1643 levels with Iγ(doublet)=0.275 *7*. The value of 1993Ka30 is excluded. Iγ=0.0187 *9* has been determined by 2004Ca04 for the component from the 1643 level leaving Iγ=0.256 *7* for the component from the 1434 level.
324.914[@] *26*	0.0187[@] *9*	1643.421	2^-	1318.456	2^+			
328.764[@] *26*	0.0130[@] *8*	1643.421	2^-	1314.640	1^-			
344.2785[‡] *12*	100.0 *6*	344.2789	2^+	0.0	0^+	E2	0.0397	α(K)=0.0310 *5*; α(L)=0.00678 *10*; α(M)=0.001527 *22*; α(N+..)=0.000398 *6* α(N)=0.000346 *5*; α(O)=4.97×10^{-5} *7*; α(P)=1.99×10^{-6} *3* Mult.: K:L1:L2:L3=100 *35*:12.1 *4*:6.55 *24*:4.46 *17* (1985Co08). Other: 1967Ma29. K/L=4.46 *10* (weighted average of 1985Co08, 1981Ka40, 1978Ar24, and 1967Ma29). The value of 1985Co08 used in this average comes from their subshell ratios. K/(MNO)=16.2 *6* (1983KaZJ). Particle parameters: 1969Ag02, 1968Zg02, 1967Na09.
351.66 *5*	0.040 *3*	1282.24	4^+	930.546	2^+	E2	0.0373	α(K)=0.0292 *4*; α(L)=0.00630 *9*; α(M)=0.001418 *20*; α(N+..)=0.000370 *6* α(N)=0.000321 *5*; α(O)=4.63×10^{-5} *7*; α(P)=1.88×10^{-6} *3* I_γ: From Iγ/Iγ(526γ)=0.884 *29* in 17-5-h Tb ε decay. The directly measured values are not consistent, 0.08 *2* (1993Ka30), 0.034 *3* (1990Me15), 0.07 *2* (1990St02) and 0.08 *2* (1980Sh15).
354.16[@] *15*	0.0036[@] *4*	1109.200	2^+	755.3960	4^+			
367.7891[‡] *20*	3.232 *15*	1123.1855	3^-	755.3960	4^+	E1	0.00964 *14*	α=0.00964 *14*; α(K)=0.00821 *12*; α(L)=0.001125 *16*; α(M)=0.000243 *4*; α(N+..)=6.45×10^{-5} *9* α(N)=5.55×10^{-5} *8*; α(O)=8.47×10^{-6} *12*; α(P)=5.31×10^{-7} *8* I_γ: The values of 1970No06 and 1969Va09 are excluded. Mult.: α(K)exp=0.0089 *5* (1991Go22), 0.0061 *8* (1967Ma29). δ: δ(M2/E1)=+0.015 *19* (1985KrZU), +0.1 *2* (1983Bl07); −0.03 *2* (1975He13), −0.04 *4* (1970Ba32).
387.90 *8*	0.011 *1*	1318.456	2^+	930.546	2^+	(M1+E2+E0)	0.038 *11*	α(K)=0.032 *10*; α(L)=0.0052 *7*; α(M)=0.00113 *12*; α(N+..)=0.00030 *4* α(N)=0.00026 *3*; α(O)=3.9×10^{-5} *6*; α(P)=2.2×10^{-6} *8* E_γ,I_γ: From 1990Me15. Iγ is somewhat higher than the value of 0.0064 *5* that one deduces from Iγ/Iγ(974γ)=0.124 *5* in 17.5-h Tb ε decay.
411.1165[‡] *12*	8.413 *26*	755.3960	4^+	344.2789	2^+	E2	0.0238	α(K)=0.0190 *3*; α(L)=0.00374 *6*; α(M)=0.000837 *12*;

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$\gamma(^{152}Gd)$ (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	α[e]	Comments
								α(N+..)=0.000219 *3* α(N)=0.000190 *3*; α(O)=2.77×10^{-5} *4*; α(P)=1.246×10^{-6} *18* I_γ: The values of 1970No06 and 1970Ri19 are excluded. Mult.: α(K)exp=0.0186 *7* (1991Go22),0.0193 *7* (1985Co08), 0.0217 *19* (1981Ka40), 0.0188 *11* (1979De22), 0.0179 *16* (1967Ma29). The ce(K) intensities used to generate these values have been corrected for the presence of the L1 line of the 368γ. K/L=4.9 *3*, a weighted average from 1991Go22 and 1967Ma29. Mult.: 2008ZaZY report δ=+0.032 *22*; however, this is inconsistent with the RUL limit of B(M3)(W.u.)<10 which requires δ<4×10^{-5}.
440.86 *10*	0.0235 *16*	1550.17	4$^+$	1109.200	2$^+$	[E2]	0.0196	α(K)=0.01574 *22*; α(L)=0.00299 *5*; α(M)=0.000668 *10*; α(N+..)=0.0001751 *25* α(N)=0.0001518 *22*; α(O)=2.22×10^{-5} *4*; α(P)=1.042×10^{-6} *15* I_γ: 1993Ka30 report a doublet at this energy with Iγ=0.054 *5*, but show no placement for either component. 1990Me15 report a single peak with Iγ=0.041 *7*. The transition is not reported in any of the other sources, but May have been masked by the strong 444γ in Sm. A weighted average of these two values is 0.050 *6*. from Iγ/Iγ(795γ+1206γ)=0.159 *6* in 17.5-h Tb ε decay one expects Iγ(441γ)=0.0235 *16*. The evaluator adopts the value from the Tb ratio.
482.4	0.0088 *4*	1605.596	2$^+$	1123.1855	3$^-$	[E1]	0.00511 *8*	α=0.00511 *8*; α(K)=0.00436 *7*; α(L)=0.000589 *9*; α(M)=0.0001270 *18*; α(N+..)=3.38×10^{-5} *5* α(N)=2.91×10^{-5} *4*; α(O)=4.46×10^{-6} *7*; α(P)=2.86×10^{-7} *4* E_γ,I_γ: The 482γ is placed in Sm and Gd. For the component from the 1606 level, Eγ is from the level energy difference and Iγ is from Iγ/Iγ(990γ+1261γ)=0.0360 *11* in 17.5-h Tb ε decay.
493.78	0.0367 *16*	1109.200	2$^+$	615.415	0$^+$	[E2]	0.01442	α(K)=0.01171 *17*; α(L)=0.00211 *3*; α(M)=0.000469 *7*; α(N+..)=0.0001233 *18* α(N)=0.0001068 *15*; α(O)=1.577×10^{-5} *22*; α(P)=7.85×10^{-7} *11* E_γ,I_γ: The 493γ is placed from the 1579 level in Sm and from the 1109 level in Gd, with Iγ(doublet)=0.149 *8*. The value of 1993Ka30 is excluded. Eγ is given as a rounded-off value from the level energies, and Iγ is deduced from Iγ/Iγ(764γ)=0.0516 *19* in 17.5-h Tb ε decay. Iγ=0.114 *5* for the component in Sm along with Iγ for the doublet yields Iγ=0.035 *10* for the component in Gd, consistent with the value using the Tb decay ratio.
496.4	0.0221 *9*	1605.596	2$^+$	1109.200	2$^+$	E0+M1+E2	0.020 *6*	α(K)=0.017 *6*; α(L)=0.0026 *5*; α(M)=0.00056 *10*; α(N+..)=0.00015 *3* α(N)=0.000128 *24*; α(O)=2.0×10^{-5} *4*; α(P)=1.2×10^{-6} *5* E_γ,I_γ: The transition is placed in both Sm and Gd. For the component from the 1606 level, Eγ is from the level energy difference, and Iγ is deduced from Iγ/Iγ(990γ+1261γ)=0.0906 *25* in 17.5-h Tb ε decay.
503.467[#] *9*	0.573 *7*	1434.020	3$^+$	930.546	2$^+$	(E2)	0.01370	α(K)=0.01115 *16*; α(L)=0.00199 *3*; α(M)=0.000442 *7*; α(N+..)=0.0001164 *17*

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^{152}Eu β^- decay (13.517 y) (continued)

γ(^{152}Gd) (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ	α[e]	$I_{(\gamma+ce)}$[d]	Comments
										α(N)=0.0001007 *14*; α(O)=1.490×10^{-5} *21*; α(P)=7.48×10^{-7} *11* I_γ: The value of 1993Ka30 is excluded. Mult.: α(K)exp=0.0170 *26* (1991Go22), 0.018 *6* (1967Ma29).
520.24 *4*	0.201 *6*	1643.421	2$^-$	1123.1855	3$^-$	[M1,E2]		0.018 *6*		α(K)=0.015 *5*; α(L)=0.0023 *5*; α(M)=0.00049 *10*; α(N+..)=0.00013 *3* α(N)=0.000113 *22*; α(O)=1.7×10^{-5} *4*; α(P)=1.1×10^{-6} *4* I_γ: The value of 1993Ka30 is excluded.
526.88 *5*	0.045 *3*	1282.24	4$^+$	755.3960	4$^+$	E0+M1+E2		0.017 *5*		α(K)=0.014 *5*; α(L)=0.0022 *5*; α(M)=0.00048 *9*; α(N+..)=0.00013 *3* α(N)=0.000109 *21*; α(O)=1.7×10^{-5} *4*; α(P)=1.0×10^{-6} *4*
534.25 *5*	0.154 *4*	1643.421	2$^-$	1109.200	2$^+$	[E1]		0.00407 *6*		α=0.00407 *6*; α(K)=0.00347 *5*; α(L)=0.000467 *7*; α(M)=0.0001005 *14*; α(N+..)=2.68×10^{-5} *4* α(N)=2.30×10^{-5} *4*; α(O)=3.54×10^{-6} *5*; α(P)=2.29×10^{-7} *4* I_γ: The 534γ is placed in Sm and Gd with Iγ=0.1609 *38*. The component from the 1769 level in Sm has Iγ=0.0065 *5* leaving Iγ=0.154 *4* for the component from the 1643 level.
557.8	0.0110 *13*	1605.596	2$^+$	1047.81	0$^+$	[E2]		0.01051		α(K)=0.00862 *12*; α(L)=0.001477 *21*; α(M)=0.000326 *5*; α(N+..)=8.61×10^{-5} *12* α(N)=7.44×10^{-5} *11*; α(O)=1.109×10^{-5} *16*; α(P)=5.84×10^{-7} *9* E_γ,I_γ: The transition is placed in both Sm and Gd. For the component from the 1606 level, Eγ is from the level energy difference, and Iγ is deduced from Iγ/Iγ(990γ+1261γ)=0.045 *5* in 17.5-h Tb ε decay.
563.1	0.00113 *8*	1318.456	2$^+$	755.3960	4$^+$					E_γ,I_γ: The 563γ is doubly placed with a second component reported in Sm with Iγ=0.076 *7* from the 684 level (2007Ku20). Eγ is α rounded-off value from the level energies and Iγ is from Iγ/Iγ(974γ)=0.0222 *8* in 17.5-h Tb ε decay.
586.2648[‡] *26*	1.710 *13*	930.546	2$^+$	344.2789	2$^+$	E0+M1+E2		0.013 *4*		α(K)=0.011 *4*; α(L)=0.0016 *4*; α(M)=0.00036 *8*; α(N+..)=9.5×10^{-5} *21* α(N)=8.2×10^{-5} *18*; α(O)=1.3×10^{-5} *3*; α(P)=8.E−7 *3* I_γ: The value of 1.37 *4* given in 1993Ka30 is probably a misprint. the evaluator assumes that the value should be 1.73 *4* and includes it in the weighted average. Mult.: α(K)exp=0.0199 *10* (1991Go22), 0.0225 *10* (1985Co08), 0.0177 *18* (1979De22), 0.027 *5* (1967Ma29). K/L=12 +*7*−*4* (1967Ma29) I(ce(K))(E0)/I(ce(K))(E2)=1.74 *9* from α(K)exp and δ (evaluator); other: 1.7 *2* (1990Ka35).

From ENSDF

$^{152}_{64}Gd_{88}$-6

^{152}Eu β^- decay (13.517 y) (continued)

γ(^{152}Gd) (continued)

E_γ [†]	I_γ [&d]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [a]	δ	α [e]	$I_{(\gamma+ce)}$ [d]	Comments
										δ: −3.05 *14*. Other: −5.5 +*22*−*50* (1985KrZU), −2.0 *5* (1970Ba32). α: From α(K)exp, δ=−3.05 *14*, and Ice(E0)/Ice(M1+E2)=2.43 *16*.
615.41 *5*		615.415	0^+	0.0	0^+	E0			0.0376 *12*	E_γ: 1985Co08 report Eγ=615.406 *11* based on calibration using data of 1990Me15. The value given here reflects the evaluator′s changes to the uncertainties of 1990Me15. See the comment on Eγ. $I_{(\gamma+ce)}$: from I(ce(K))=0.0330 *10* (1991Go22,1985Co08,1979De22, 1967Ma29) and Ice(K)/Ice=0.877 (E0 theory). Mult.: no γ seen. ρ=0.25 *15* (1990Ka35).
675.0	0.080 *3*	1605.596	2^+	930.546	2^+	M1+E2	+2.2 *4*	0.0075 *4*		α=0.0075 *4*; α(K)=0.0063 *4*; α(L)=0.00096 *4*; α(M)=0.000211 *8*; α(N+..)=5.61×10^{-5} *21* α(N)=4.83×10^{-5} *18*; α(O)=7.3×10^{-6} *3*; α(P)=4.37×10^{-7} *25* E_γ,I_γ: The transition is placed in both Sm and Gd. For the component from the 1606 level, Eγ is from the level energy difference, and Iγ is deduced from Iγ/Iγ(990γ+1261γ)=0.329 *9* in 17.5-h Tb ε decay.
678.623[‡] *5*	1.777 *12*	1434.020	3^+	755.3960	4^+	M1+E2	+4.1 +*17*−*11*	0.00680 *25*		α=0.00680 *25*; α(K)=0.00566 *22*; α(L)=0.00089 *3*; α(M)=0.000196 *6*; α(N+..)=5.19×10^{-5} *15* α(N)=4.47×10^{-5} *13*; α(O)=6.76×10^{-6} *21*; α(P)=3.90×10^{-7} *17* I_γ: The values of 1970Ri19 and 1990St02 are excluded. Mult.: α(K)exp=0.0058 *4* (1991Go22), 0.0048 *8* (1967Ma29). δ: +4.1 +*17*−*11* (1985KrZU), >+13 or <−16 (1975He13), >+12.5 or <−9.1 (1970Ba32).
703.01[b]	0.0145[b] *11*	1318.456	2^+	615.415	0^+	[E2]		0.00599 *9*		α=0.00599 *9*; α(K)=0.00498 *7*; α(L)=0.000788 *11*; α(M)=0.0001727 *25*; α(N+..)=4.58×10^{-5} *7* α(N)=3.95×10^{-5} *6*; α(O)=5.96×10^{-6} *9*; α(P)=3.42×10^{-7} *5*
703.55[b] *6*	0.010[b] *1*	1047.81	0^+	344.2789	2^+					
712.83 *5*	0.359 *9*	1643.421	2^-	930.546	2^+	[E1]		0.00220 *3*		α=0.00220 *3*; α(K)=0.00188 *3*; α(L)=0.000250 *4*; α(M)=5.37×10^{-5} *8*; α(N+..)=1.434×10^{-5} *20* α(N)=1.232×10^{-5} *18*; α(O)=1.90×10^{-6} *3*; α(P)=1.257×10^{-7} *18*

^{152}Eu β^- decay (13.517 y) (continued)

γ(^{152}Gd) (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ	α[e]	Comments
									I_γ: The values of 1993Ka30 and 1970Ri19 are excluded. δ: δ=+0.06 +*19*−*15* (1985KrZU).
764.88 *4*	0.712 *16*	1109.200	2$^+$	344.2789	2$^+$	M1+E2(+E0)		0.0070 *6*	α(K)=0.0058 *17*; α(L)=0.00083 *20*; α(M)=0.00018 *4*; α(N+..)=4.8×10^{-5} *12* α(N)=4.1×10^{-5} *10*; α(O)=6.4×10^{-6} *16*; α(P)=4.1×10^{-7} *13* I_γ: The values of 1980Sh15 and 1975LeZH are excluded. Mult.: δ(E2/M1)=+4.30 +*7*−*6* (1990Ka35). Mult.: α(K)exp=0.0063 *8* (1991Go22), 0.0055 *16* (1990Ka35, 0.0052 *14* (1983KaZJ). δ: 4.30 +*7*−*6* (1990Ka35). Ice(E0)/Ice(E2)=0.44 *17* from the measured and theoretical α(K) values.
778.9045[‡] *24*	48.62 *22*	1123.1855	3$^-$	344.2789	2$^+$	E1		0.00184 *3*	α=0.00184 *3*; α(K)=0.001576 *22*; α(L)=0.000208 *3*; α(M)=4.47×10^{-5} *7*; α(N+..)=1.195×10^{-5} *17* α(N)=1.026×10^{-5} *15*; α(O)=1.585×10^{-6} *23*; α(P)=1.054×10^{-7} *15* Mult.: α(K)exp=0.00150 *6* (1991Go22), 0.00168 *6* (1985Co08), 0.00158 *8* (1981Ka40), 0.00141 *8* (1979De22), 0.00168 *19* (1967Ma29) K/L=7.5 *10* (1991Go22), 8.3 +*27*−*16* 1967Ma29). K/Mn+=30 +*10*−*6* (1991Go22). δ: +0.003 *6* (1975He13), −0.050 +*9*−*8* (1985KrZU), −0.02 *2* 1983Bl07), +0.01 *1* (1970Ba32), +0.026 *10* (2008ZaZY).
794.78 *5*	0.099 *6*	1550.17	4$^+$	755.3960	4$^+$	M1(+E2)	−0.4 +*7*−*12*	0.0075 *20*	α=0.0075 *20*; α(K)=0.0064 *18*; α(L)=0.00088 *21*; α(M)=0.00019 *5*; α(N+..)=5.1×10^{-5} *12* α(N)=4.4×10^{-5} *10*; α(O)=6.8×10^{-6} *17*; α(P)=4.6×10^{-7} *14*
850.10[@] *13*	0.0029[@] *3*	1605.596	2$^+$	755.3960	4$^+$				
930.59 *5*	0.274 *7*	930.546	2$^+$	0.0	0$^+$	(E2)		0.00320 *5*	α=0.00320 *5*; α(K)=0.00270 *4*; α(L)=0.000396 *6*; α(M)=8.63×10^{-5} *12*; α(N+..)=2.30×10^{-5} *4* α(N)=1.98×10^{-5} *3*; α(O)=3.02×10^{-6} *5*; α(P)=1.87×10^{-7} *3*
937.05 *15*	0.010 *3*	1692.40	2$^+$,3$^+$	755.3960	4$^+$	[M1,E2]		0.0043 *11*	α=0.0043 *11*; α(K)=0.0036 *10*; α(L)=0.00050 *12*; α(M)=0.000109 *25*; α(N+..)=2.9×10^{-5} *7* α(N)=2.5×10^{-5} *6*; α(O)=3.9×10^{-6} *10*; α(P)=2.6×10^{-7} *8*
970.22[@] *9*	0.0045[@] *12*	1314.640	1$^-$	344.2789	2$^+$	E1+M2	−0.021 *12*	0.001207 *19*	α=0.001207 *19*; α(K)=0.001035 *16*; α(L)=0.0001354 *21*; α(M)=2.91×10^{-5} *5*;

From ENSDF

$^{152}_{64}Gd_{88}$-8

^{152}Eu β^- decay (13.517 y) (continued)

γ(^{152}Gd) (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	δ	α[e]	Comments
									α(N+..)=7.78×10^{-6} α(N)=6.67×10^{-6} *11*; α(O)=1.034×10^{-6} *16*; α(P)=6.96×10^{-8} *11*
974.09 *5*	0.051 *3*	1318.456	2$^+$	344.2789	2$^+$	M1+E2	+0.58 *7*	0.0039 *10*	α=0.0039 *10*; α(K)=0.0033 *9*; α(L)=0.00046 *11*; α(M)=0.000100 *22*; α(N+..)=2.7×10^{-5} *6* α(N)=2.3×10^{-5} *6*; α(O)=3.5×10^{-6} *9*; α(P)=2.3×10^{-7} *7*
990.18 *5*	0.118 *5*	1605.596	2$^+$	615.415	0$^+$	E2		0.00281	α(K)=0.00237 *4*; α(L)=0.000344 *5*; α(M)=7.48×10^{-5} *11*; α(N+..)=1.99×10^{-5} *3* α(N)=1.714×10^{-5} *24*; α(O)=2.62×10^{-6} *4*; α(P)=1.642×10^{-7} *23* I_γ: The value of 1975LeZH is excluded.
1089.737[‡] *5*	6.52 *3*	1434.020	3$^+$	344.2789	2$^+$	M1+E2	+22 *+13−6*	0.00231 *4*	α=0.00231 *4*; α(K)=0.00195 *3*; α(L)=0.000278 *4*; α(M)=6.04×10^{-5} *9*; α(N+..)=1.611×10^{-5} *23* α(N)=1.384×10^{-5} *20*; α(O)=2.13×10^{-6} *3*; α(P)=1.354×10^{-7} *20* Mult.: α(K)exp=0.00217 *9* (1985Co08), 0.0038 *3* (1981Ka40). δ: From 1975He13. Others: +20 *+23−8* (1985KrZU). >+17, <−13 (1970Ba32). 1970Ba32 also give a small solution but that is ruled out by α(K)exp.
1109.18 *5*	0.709 *24*	1109.200	2$^+$	0.0	0$^+$	E2		0.00222 *4*	α=0.00222 *4*; α(K)=0.00188 *3*; α(L)=0.000267 *4*; α(M)=5.80×10^{-5} *9*; α(N+..)=1.589×10^{-5} *23* α(N)=1.330×10^{-5} *19*; α(O)=2.04×10^{-6} *3*; α(P)=1.304×10^{-7} *19*; α(IPF)=4.21×10^{-7} *6*
1206.09 *16*	0.049 *5*	1550.17	4$^+$	344.2789	2$^+$	[E2]		0.00188 *3*	α=0.00188 *3*; α(K)=0.001593 *23*; α(L)=0.000223 *4*; α(M)=4.83×10^{-5} *7*; α(N+..)=1.91×10^{-5} *3* α(N)=1.109×10^{-5} *16*; α(O)=1.708×10^{-6} *24*; α(P)=1.104×10^{-7} *16*; α(IPF)=6.18×10^{-6} *9*
1261.35 *5*	0.126 *5*	1605.596	2$^+$	344.2789	2$^+$	M1		0.00265 *4*	α=0.00265 *4*; α(K)=0.00225 *4*; α(L)=0.000303 *5*; α(M)=6.53×10^{-5} *10*; α(N+..)=3.26×10^{-5} *5* α(N)=1.505×10^{-5} *21*; α(O)=2.35×10^{-6} *4*; α(P)=1.620×10^{-7} *23*; α(IPF)=1.508×10^{-5} *22* Mult.: α(K)exp=0.0073 *31* (1967La13) does not agree with α(K)exp=0.0019 *2* measured in 17.5-h Tb ε decay. The Tb decay value gives mult=M1 while the value of 1967La13 would require an E0 component.
1299.142[‡] *8*	6.14 *3*	1643.421	2$^-$	344.2789	2$^+$	E1+M2		0.000788 *14*	α=0.000788 *14*; α(K)=0.000615 *12*; α(L)=7.97×10^{-5} *16*; α(M)=1.71×10^{-5} *4*; α(N+..)=7.62×10^{-5} *11* α(N)=3.92×10^{-6} *8*; α(O)=6.10×10^{-7} *12*; α(P)=4.16×10^{-8} *9*; α(IPF)=7.16×10^{-5} *10* Mult.: α(K)exp=0.0056 *5* (1991Go22). The authors′ Ice(K) value has been corrected by the evaluator for the contribution from the 1292.8γ in Sm following Eu ε decay. δ: +0.043 *17* (1985KrZU), −0.00 *8* (1983Bl07), +0.00 *3* (1975He13), −0.05 *5* (1970Ba32).
1314.6	0.0072 *20*	1314.640	1$^-$	0.0	0$^+$	E1		0.000773 *11*	α=0.000773 *11*; α(K)=0.000595 *9*; α(L)=7.69×10^{-5} *11*;

$^{152}_{64}$Gd$_{88}$-9

^{152}Eu β^- decay (13.517 y) (continued)

$\gamma(^{152}Gd)$ (continued)

E_γ[†]	I_γ[&d]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[a]	δ	α[e]	Comments
									α(M)=1.649×10^{-5} *23*; α(N+..)=8.45×10^{-5} *1* α(N)=3.79×10^{-6} *6*; α(O)=5.88×10^{-7} *9*; α(P)=4.01×10^{-8} *6*; α(IPF)=8.01×10^{-5} *12* E_γ,I_γ: The 1315γ is placed in Sm and in Gd with the Sm component dominant. For the component from the 1315 level, Eγ is α rounded-off value from the level energies, and Iγ is from Iγ/Iγ(970γ)=1.62 *5*, a weighted average of values in 17.5-h Tb ε decay and 9.3-h Eu β^- decay.
1318.38[@] *17*	0.0059[@] *5*	1318.456	2$^+$	0.0	0$^+$				
1348.10 *7*	0.065 *3*	1692.40	2$^+$,3$^+$	344.2789	2$^+$	M1+E2	−13 *+4−7*	0.001541 *22*	α=0.001541 *22*; α(K)=0.001285 *19*; α(L)=0.000177 *3*; α(M)=3.83×10^{-5} *6*; α(N+..)=4.03×10^{-5} *6* α(N)=8.80×10^{-6} *13*; α(O)=1.359×10^{-6} *20*; α(P)=8.92×10^{-8} *13*; α(IPF)=3.00×10^{-5} *5* I_γ: The values of 1993Ka30 and 1970Ri19 are excluded.
1605.62 *7*	0.0296 *14*	1605.596	2$^+$	0.0	0$^+$	E2		0.001190 *17*	α=0.001190 *17*; α(K)=0.000919 *13*; α(L)=0.0001243 *18*; α(M)=2.68×10^{-5} *4*; α(N+..)=0.000119 α(N)=6.16×10^{-6} *9*; α(O)=9.55×10^{-7} *14*; α(P)=6.38×10^{-8} *9*; α(IPF)=0.0001125 *16* Mult.: α(K)exp=0.00096 *9* (1967La13).

† Calibration standard values from 2000He14 are adopted where available. Additional precise values are available from 1986Wa33 and these values, adjusted by the evaluator to incorporate the energy standards of 2000He14, are adopted as noted. 2004Ca04 report values for very weak transitions not seen by other works, and resolve the 209γ doublet whose other placement is in Sm. these energies are noted. For unresolved doublets, energies are taken from 9.3-h Eu β^- decay, or from 17.5-h Tb ε decay, as noted. other values are weighted averages of data from 1992Le19, 1990Me15, and 1990St02. For the data of 1990Me15, the evaluator has assigned a minimum uncertainty of 50 eV. See comment in 13-Y ^{152}Eu ε decay.

‡ From 2000He14.

From 1986Wa33.

@ From 2004Ca04.

& Values are weighted averages of data of 2007Ku20, 2004Ca04, 1998Hw07, 1993Ka30, 1992Ya12, 1990Me15, 1990St02, 1989Da12, 1986Me10, 1984Iw03, 1980Sh15, 1979De21, 1977Ge12, 1975LeZH, 1972Bb05, 1971Ba63, 1970No06, 1970Ri19, and 1969Va09 normalized to Iγ=100 for the 344γ. Some of the values adopted here differ from those of 2004VaZW, an evaluation of data published prior to 2004. Some of these differences are a result of inclusion here of the new work, 2007Ku20, and one older reference, 1975LeZH. Another difference is one of policy. In 2004VaZW, the uncertainties in the work of 1998Hw07 were increased by a factor of two. This was not done in the present evaluation. also, In the present evaluation, for the data from 1990Me15, an uncertainty of 2% has been added In quadrature to take into account the uncertainty In the efficiency calibration. Intensities for some weak transitions have been given by 2004Ca04, and these are noted. Transitions indicated As being excluded In individual cases are outliers As determined using CHAUVENET′s criterion. for some unresolved doublets, the evaluator has adopted values based on branching In 17.5-H Tb ε decay, As noted.

a From Adopted Gammas. Mult data measured in this decay are given in comments. The α(K)exp data are from the adopted Iγ values and Ice(K) values of authors as noted for each transition, and normalized to α(K)(344γ)=0.03103, the theory value for mult=E2.

$^{152}_{64}Gd_{88}$-10

γ(^{152}Gd) (continued)

[b] The 703γ is placed from the 1047 and 1318 levels with Iγ(doublet)=0.020 *5*. The doublet is resolved in Tb ε decay, and from Iγ/Iγ(974γ)=0.284 *12* for the 1318 level, one gets Iγ=0.0145 *11* for placement of the 703γ from that level, leaving Iγ=0.0055 *51* for placement from the 1047 level. From the decay scheme, one has the requirement that Iγ(703γ from 1047) must be greater than or equal to Iγ(558γ from 1605)=0.0108 *11*. From these two approaches one gets Iγ(703γ from 1047)=0.0102 *5*. The evaluator adopts α conservative value of 0.010 *1*. Eγ for placement from the 1047 level is from 9.3-h Eu β^- decay and for placement from the 1318 level is from the E(level) difference.

[c] A weighted average of all the measurements of the 269γ in Sm and the 271γ in Gd is 0.299 *7*. Iγ for the 269γ in Sm has been determined as 0.0295 *19* leaving Iγ(271γ in Gd)=0.269 *7*. The value of 1993Ka30 for the doublet has been excluded.

[d] For absolute intensity per 100 decays, multiply by 0.2659 *12*.

[e] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

[f] Placement of transition in the level scheme is uncertain.

^{152}Eu β^- decay (13.517 y)

Decay Scheme

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