^{152}Eu ε decay (9.3116 h)

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

Parent: ^{152}Eu: E=45.5998 *4*; $J^{\pi}=0^{-}$; $T_{1/2}$=9.3116 h *13*; Q(ε)=1874.6 *7*; %ε+%$β^{+}$ decay=27 *3*
^{152}Eu-%ε+%$β^{+}$ decay: From I(γ+ce)(344γ ^{152}Gd)/$β^{-}$=0.034 *5* (from ce(K)/$β^{-}$ in 1957Na01).
Measured:
γ: 2007Ku20, 1986Pa14, 1984Bu35, 1975Pr05, 1973MeYA, 1971Ba63, 1971Ii02, 1970Re08, 1969Va09.
ce: 1990Ka35, 1986Pa14, 1979Ar16, 1975Sc32, 1960Ma11, 1957Na01.
e+: 1985Co23.
$β^{+}$: 1959An31, 1958Al99.
γγ: 1975Pr05, 1975Sc32, 1971Ba63.
γγ(t): 1965Hu02.
γγ(θ): 1974Gu01 1960De16, 1959Wo52.

^{152}Sm Levels

The decay scheme is that given in 2007Ku20. IT is based on earlier work, but the authors have added many weak transitions, and in particular have shown that the 1041, 1086, and 1293 levels are populated in this decay. They find no evidence supporting the existence of a 1290 level, previously postulated in this decay.

E(level)	J^{π}†	$T_{1/2}$	Comments
0.0	0^{+}	stable	
121.78 *3*	2^{+}	1.43 ns *4*	$T_{1/2}$: from 1965Hu02.
366.45 *4*	4^{+}		
684.76 *4*	0^{+}		J^{π}: (563γ)(122γ)(θ) consistent with J=0 (1974Gu01).
810.44 *4*	2^{+}		
963.40 *3*	1^{-}		
1041.11 *9*	3^{-}		
1082.88 *5*	0^{+}		J^{π}: (961γ)(122γ)(θ) consistent with J=0 (1974Gu01).
1086.1 *3*	2^{+}		
1292.66 *15*	2^{+}		
1510.79 *3*	1^{-}		
1680.55 *4*	1^{-}		

† From Adopted Levels.

ε,$β^{+}$ radiations

E(decay)	E(level)	Iβ+ †	Iε†	Log *ft*	I(ε+β+)†	Comments
(239.6 *7*)	1680.55		0.171 *20*	6.78 *7*	0.171 *20*	εK=0.7906 *2*; εL=0.1608 *2*; εM+=0.04853 *6*
(409.4 *7*)	1510.79		0.87 *10*	6.60 *7*	0.87 *10*	εK=0.8172; εL=0.14112 *5*; εM+=0.04168 *2*
(837.3 *7*)	1082.88		0.150 *19*	8.04 *8*	0.150 *19*	εK=0.8333; εL=0.1292; εM+=0.03757
(956.8 *7*)	963.40		26 *3*	5.92 *7*	26 *3*	εK=0.8351; εL=0.1278; εM+=0.03712
(1235.4 *7*)	684.76		0.128 *16*	8.46 *8*	0.128 *16*	εK=0.8377; εL=0.1258; εM+=0.03642
(1798.4 *7*)	121.78	<0.0007	<0.2	>9.7[1u]	<0.2	av Eβ=376.76 *31*; εK=0.8305; εL=0.1284; εM+=0.03737 E(decay): Eβ+=770 *30* (1959An31). Iβ+: Iβ+ per parent decay: 0.0020% *5* (1959An31), 0.004% (1958Al99).
(1920.2 *7*)	0.0	0.0064 *8*	0.205 *25*	8.65 *8*	0.211 *26*	av Eβ=411.86 *31*; εK=0.8155; εL=0.1196; εM+=0.03451

Continued on next page (footnotes at end of table)

^{152}Eu ε decay (9.3116 h) (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Comments
		E(decay): Eβ+=890 *5* (1959An31), 895 *5* (1958Al99). Iβ^+: weighted average of 0.0071% *14* (1979Ar16, Iβ^+/Ice(K)(964γ)=0.64 *10*) and 0.0060% *10* (1959An31, from Iβ^+/Iβ^-); other: 0.007% (1958Al99).

† Absolute intensity per 100 decays.

^{152}Eu ε decay (9.3116 h) (continued)

γ(^{152}Sm)

Iγ normalization: From I(γ+ce)(344γ ^{152}Gd)/β^-=0.034 *5* (from ce(K)/β^- in 1957Na01).
All the unplaced gammas from 9.3-h ^{152}Eu decay are listed in this dataset. Some of them May belong in ^{152}Gd following β^- decay.

E_γ ‡	I_γ ‡a	E_i(level)	J_i^π	E_f	J_f^π	Mult. &	α †	$I_{(\gamma+ce)}$ a	Comments
119.44# *15*	0.073# *6*	1082.88	0^+	963.40	1^-				
121.77 *3*	49.4 *8*	121.78	2^+	0.0	0^+	E2	1.155		α(K)=0.678 *10*; α(L)=0.370 *6*; α(M)=0.0854 *12*; α(N+..)=0.0212 *3* α(N)=0.0188 *3*; α(O)=0.00239 *4*; α(P)=3.00×10^{-5} *5* Mult.: From α(K)exp=0.74 *4*, K/L=1.8, and K:L1:L2:L3=110:10:26:25 (1960Ma11).
125.43# *17*	0.0025# *3*	810.44	2^+	684.76	0^+				
152.77 *16*	0.0126 *11*	963.40	1^-	810.44	2^+	[E1]	0.0872		α(K)=0.0739 *11*; α(L)=0.01043 *15*; α(M)=0.00223 *4*; α(N+..)=0.000575 *9* α(N)=0.000499 *8*; α(O)=7.19×10^{-5} *11*; α(P)=3.79×10^{-6} *6*
x160.0b *5*	0.005 *3*								
x218.1 *3*	0.0003 *2*								
218.10 *15*	0.0042 *5*	1510.79	1^-	1292.66	2^+				
244.66 *3*	0.159 *11*	366.45	4^+	121.78	2^+	E2	0.1074		α(K)=0.0808 *12*; α(L)=0.0207 *3*; α(M)=0.00465 *7*; α(N+..)=0.001176 *17* α(N)=0.001033 *15*; α(O)=0.0001395 *20*; α(P)=4.18×10^{-6} *6*
x256.99 *22*	0.007 *3*								
272.43 *5*	0.070 *4*	1082.88	0^+	810.44	2^+	(E2)	0.0761		α(K)=0.0584 *9*; α(L)=0.01382 *20*; α(M)=0.00309 *5*; α(N+..)=0.000784 *11* α(N)=0.000687 *10*; α(O)=9.37×10^{-5} *14*; α(P)=3.08×10^{-6} *5* Mult.: α(K)exp=0.10 *4*.
278.7 *3*		963.40	1^-	684.76	0^+	[E1]	0.0177		α(K)=0.01513 *22*; α(L)=0.00206 *3*; α(M)=0.000440 *7*; α(N+..)=0.0001143 *17* α(N)=9.90×10^{-5} *15*; α(O)=1.451×10^{-5} *21*; α(P)=8.27×10^{-7} *12* Iγ: The transition is obscured.
329.4@	@	1292.66	2^+	963.40	1^-				
x340.1 *3*	0.035 *13*								
x387.8 *3*	0.005 *3*								
388.3# *5*	0.0008# *3*	1680.55	1^-	1292.66	2^+				
398.00 *15*		1082.88	0^+	684.76	0^+	E0		0.0137 *20*	E_γ: from 1979Ar16. $I_{(\gamma+ce)}$: Weighted average of Ice(K)=0.013 *2* (1979Ar16) and 0.0096 *30* (1986Pa14) with Ice(K)/Σ Ice=0.878 (E0 theory). The evaluator has adjusted the value from 1986Pa14, quoted as Ice(K)/Iγ(961γ)=0.0062 *19*, to correspond to the present Ice(K)/Iγ intensity scale and adopted Iγ(961γ). Mult.: α(K)exp>0.1 (1979Ar16); ρ<0.1 (1990Ka35). I(ce(K))/Iγ(961γ)=0.0062 *19* (1986Pa14).

^{152}Eu ε decay (9.3116 h) (continued)

γ(^{152}Sm) (continued)

E_γ[‡]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[†]	$I_{(\gamma+ce)}$[a]	Comments
424.3[#] *4*	0.0012[#] *5*	1510.79	1^-	1086.1	2^+				
427.9	<0.0006	1510.79	1^-	1082.88	0^+				E_γ,I_γ: Limit reported by 2007Ku20. Eγ is a rounded-off value from the level energies.
443.96 *4*	0.149 *16*	810.44	2^+	366.45	4^+	(E2)	0.01772		α(K)=0.01441 *21*; α(L)=0.00259 *4*; α(M)=0.000569 *8*; α(N+..)=0.0001464 *21* α(N)=0.0001274 *18*; α(O)=1.81×10^{-5} *3*; α(P)=8.19×10^{-7} *12*
469.97[#] *20*	0.0039[#] *6*	1510.79	1^-	1041.11	3^-				
547.36 *8*	0.067 *4*	1510.79	1^-	963.40	1^-	[M1,E2]	0.014 *4*		α(K)=0.011 *4*; α(L)=0.0017 *3*; α(M)=0.00036 *7*; α(N+..)=9.5×10^{-5} *17* α(N)=8.2×10^{-5} *15*; α(O)=1.21×10^{-5} *24*; α(P)=7.0×10^{-7} *22*
562.98 *3*	1.55 *3*	684.76	0^+	121.78	2^+	E2	0.00941		α(K)=0.00779 *11*; α(L)=0.001274 *18*; α(M)=0.000278 *4*; α(N+..)=7.18×10^{-5} *10* α(N)=6.24×10^{-5} *9*; α(O)=9.00×10^{-6} *13*; α(P)=4.52×10^{-7} *7* Mult.: From α(K)exp=0.0092 *21*. α(K)exp gives mult=E2(+M1) with δ>0.8; however, placement from a J=0 level rules out any admixture.
594.7[#] *4*	0.0024[#] *7*	1680.55	1^-	1086.1	2^+				
597.50[#] *14*	0.0049[#] *7*	1680.55	1^-	1082.88	0^+				
639.15[#] *14*	0.0036[#] *7*	1680.55	1^-	1041.11	3^-				
674.46[#] *16*	0.00256[#] *22*	1041.11	3^-	366.45	4^+				
684.85 *20*		684.76	0^+	0.0	0^+	E0		0.0201 *21*	E_γ: from 1979Ar16. $I_{(\gamma+ce)}$: Weighted average of Ice(K)=0.020 *2* (1979Ar16) and 0.0163 *16* (1986Pa14) with Ice(K)/Σ Ice=0.880 (E0 theory). The evaluator has adjusted the value from 1986Pa14, quoted as Ice(K)/Iγ(563γ)=0.0094 *17*, to correspond to the present Ice(K)/Iγ intensity scale and adopted Iγ(563γ). Mult.: α(K)exp>0.5 (1979Ar16); K/L>5.9 (1975Sc32); ρ=0.26 *3* (1990Ka35).
688.68 *5*	0.458 *13*	810.44	2^+	121.78	2^+	E0+M1+E2	0.0077 *20*		α(K)=0.0065 *18*; α(L)=0.00092 *19*; α(M)=0.00020 *4*; α(N+..)=5.2×10^{-5} *11* α(N)=4.5×10^{-5} *10*; α(O)=6.7×10^{-6} *15*; α(P)=4.0×10^{-7} *12* Mult.: From α(K)exp=0.037 *4* and δ(Q/D)=+19 *+5−9* one gets mult=E0+M1+E2. δ: δ(E2/M1)=+19 *+5−4*, I(ce(K))(E0)/I(ce(K))(E2)=6.5 *3* (adopted γ's).
700.28 *14*	0.073 *5*	1510.79	1^-	810.44	2^+	[E1]	0.00208		α(K)=0.001785 *25*; α(L)=0.000233 *4*; α(M)=4.95×10^{-5} *7*; α(N+..)=1.297×10^{-5} *19* α(N)=1.119×10^{-5} *16*; α(O)=1.669×10^{-6} *24*; α(P)=1.025×10^{-7} *15*
[x]703.7[b] *3*	0.005 *3*								

$^{152}_{62}Sm_{90}$-4

^{152}Eu ε decay (9.3116 h) (continued)

γ(^{152}Sm) (continued)

E_γ[‡]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	δ[&]	α[†]	$I_{(\gamma+ce)}$[a]	Comments
716.84[#] *21*	0.0084[#] *13*	1680.55	1−	963.40	1−					
[x]796.1 *3*	0.024 *10*									
810.49 *7*	0.167 *7*	810.44	2+	0.0	0+	(E2)		0.00393		α(K)=0.00331 *5*; α(L)=0.000487 *7*; α(M)=0.0001050 *15*; α(N+..)=2.74×10^{-5} *4* α(N)=2.37×10^{-5} *4*; α(O)=3.48×10^{-6} *5*; α(P)=1.96×10^{-7} *3*
826.01 *6*	0.204 *12*	1510.79	1−	684.76	0+					I_γ: Value of 0.0050 *25* reported by 1973MeXQ is probably a typo.
841.63 *4*	100 *2*	963.40	1−	121.78	2+	E1		1.44×10^{-3}		α(K)=0.001234 *18*; α(L)=0.0001597 *23*; α(M)=3.39×10^{-5} *5*; α(N+..)=8.89×10^{-6} *13* α(N)=7.67×10^{-6} *11*; α(O)=1.147×10^{-6} *16*; α(P)=7.12×10^{-8} *10* Mult.: α(K)exp=0.00123 *12*; K/L=5.5 *15* (1975Sc32).
870.14 *5*	0.633 *15*	1680.55	1−	810.44	2+					
[x]915.7 *4*	0.07 *1*									I_γ: from 1971Ba63.
919.27[#] *24*	0.0045[#] *7*	1041.11	3−	121.78	2+					
926.3[@]	[@]	1292.66	2+	366.45	4+					
961.14 *14*	0.90 *5*	1082.88	0+	121.78	2+	[E2]		0.00270		α(K)=0.00229 *4*; α(L)=0.000325 *5*; α(M)=6.99×10^{-5} *10*; α(N+..)=1.83×10^{-5} *3* α(N)=1.579×10^{-5} *23*; α(O)=2.34×10^{-6} *4*; α(P)=1.361×10^{-7} *19* I_γ: From 2007Ku20. Others: 1.49 *14* (1973MeXQ), 1.5 *4* (1971Ba63). the transition is not seen by 1975Pr05. Mult.: α(K)exp=0.0017 *17*.
963.38 *4*	82.1 *15*	963.40	1−	0.0	0+	[E1]		1.11×10^{-3}		α(K)=0.000951 *14*; α(L)=0.0001225 *18*; α(M)=2.60×10^{-5} *4*; α(N+..)=6.82×10^{-6} *10* α(N)=5.88×10^{-6} *9*; α(O)=8.81×10^{-7} *13*; α(P)=5.50×10^{-8} *8* E_γ: from 1984Bu35.
964.1[@]	[@]	1086.1	2+	121.78	2+					
995.84 *5*	0.460 *20*	1680.55	1−	684.76	0+					
[x]1039.2 *5*	0.057 *12*									
1082.8 *5*		1082.88	0+	0.0	0+	E0			0.0012 *6*	E_γ: from 1979Ar16. $I_{(\gamma+ce)}$: From Ice(K)=0.0010 *5* (1979Ar16) and Ice(K)/Ice=0.880 (E2 theory). Mult.: α(K)exp>0.1 (1979Ar16); ρ<0.016 (1990Ka35).
1085.9[@]	[@]	1086.1	2+	0.0	0+					
[x]1137.5 *3*	0.09 *6*									
[x]1207.3 *6*	0.020 *7*									
1292.8[@]	[@]	1292.66	2+	0.0	0+					

$^{152}_{62}Sm_{90}$-5

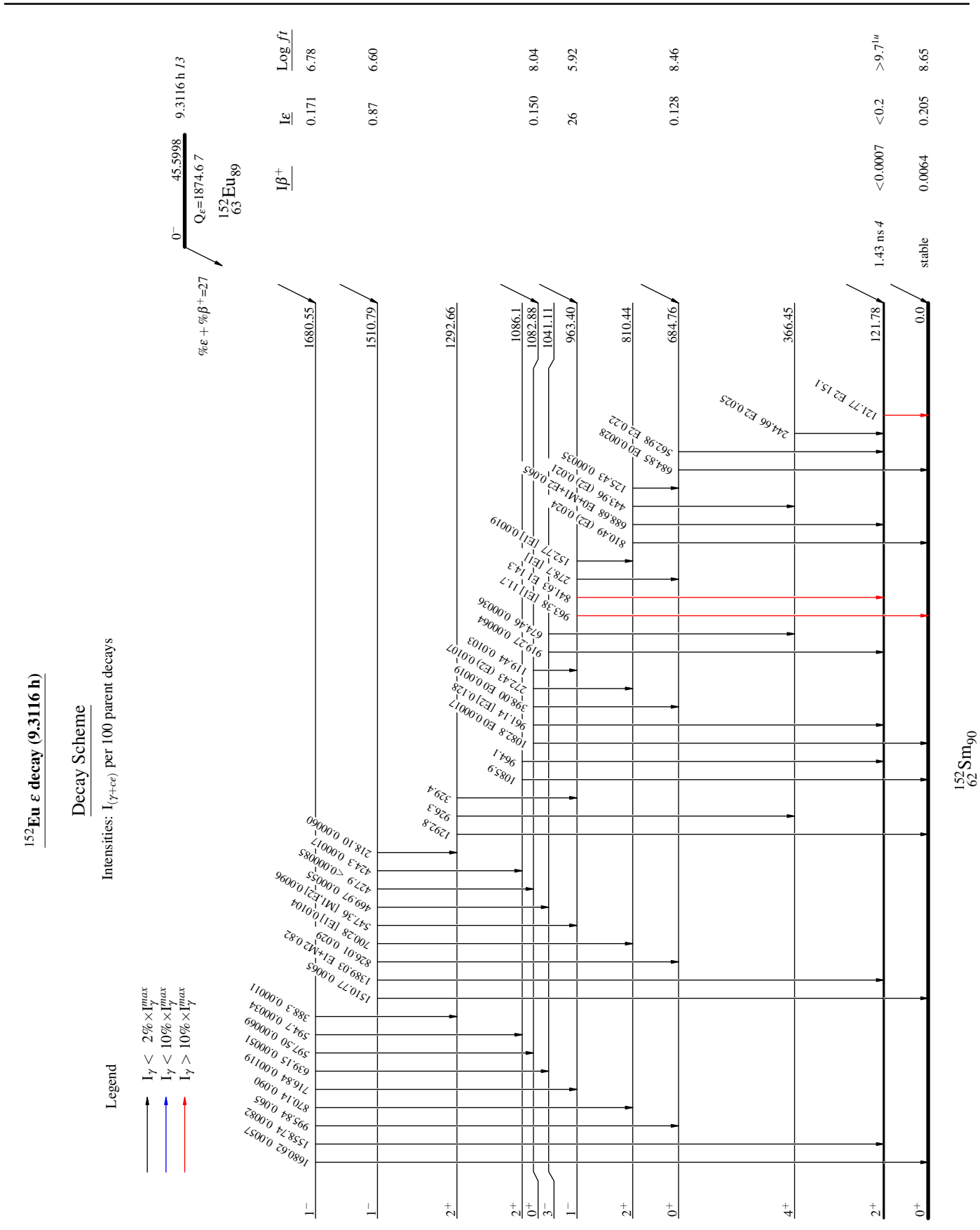
^{152}Eu ε decay (9.3116 h) (continued)

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

E_γ ‡	I_γ ‡[a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.&	δ&	α†	Comments
1389.03 *4*	5.75 *12*	1510.79	1^-	121.78	2^+	E1+M2	−0.025 *12*	7.03×10^{-4} *11*	α(K)=0.000494 *8*; α(L)=6.28×10^{-5} *10*; α(M)=1.332×10^{-5} *20*; α(N+..)=0.0001329 *19* α(N)=3.01×10^{-6} *5*; α(O)=4.53×10^{-7} *7*; α(P)=2.87×10^{-8} *5*; α(IPF)=0.0001294 *19* Mult.: α(K)exp=0.00051 *13*. δ: from $\gamma\gamma(\theta)$ (weighted average from 1960De16 and 1959Wo52). Looked for monoenergetic positrons, $I\beta^+/I\gamma(1389)<3.4\times10^{-7}$ (1985Co23).
[x]1406.5 *5*	0.005 *3*								
[x]1420 *1*	0.004 *3*								
1510.77 *5*	0.0456 *18*	1510.79	1^-	0.0	0^+				
1558.74 *6*	0.057 *2*	1680.55	1^-	121.78	2^+				
1680.62 *10*	0.039 *2*	1680.55	1^-	0.0	0^+				

† Additional information 1.
‡ Weighted average of data of 2007Ku20, 1975Pr05, 1973MeXQ, and 1971Ba63, except for the E0 transitions where data are from 1979Ar16. For the data of 1973MeXQ, see the comment in the ^{152}Eu β^- (9.3-h) dataset. New transitions reported only by 2007Ku20 are noted.
# Reported only by 2007Ku20.
@ Reported by 2007Ku20; however, the transition is obscured. The energy is a rounded-off value from 13-y Eu decay.
& From Adopted Gammas. Mult data from this dataset are given in comments. The α(K)exp values have been deduced from the adopted Iγ values with Ice(K) obtained as weighted averages of data of 1960Ma11, 1975Sc32, and 1979Ar16 normalized to α(K)(E2)=0.03103 for the 344γ in Gd.
[a] For absolute intensity per 100 decays, multiply by 0.142 *16*.
[b] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{152}_{62}Sm_{90}$-6


152Eu ε decay (9.3116 h)
Decay Scheme
Intensities: I(γ+ce) per 100 parent decays
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
0⁻
45.5998
Qε=1874.6 7
152 63 Eu89
%ε + %β+=27
Iβ+
Iε
Log ft
9.3116 h 13
0.171 6.78
0.87 6.60
0.150 8.04
26 5.92
0.128 8.46
<0.0007 >9.7lu
<0.2
1.43 ns 4
0.0064 8.65
0.205
stable
1680.55
1510.79
1292.66
1086.1
1082.88
1041.11
963.40
810.44
684.76
366.45
121.78
0.0
1680.62 0.0057
1558.74 0.0082
995.84 0.065
870.14 0.090
716.84 0.0011
639.15 0.0051
597.50 0.00069
594.7 0.00034
388.3 0.00011
1510.77 0.0065
1389.03 E1+M2 0.82
826.01 0.029
700.28 [E1] 0.0104
547.36 [M1,E2] 0.0096
469.97 0.00035
427.9 <0.000085
424.3 0.00017
218.10 0.00060
1292.8
936.3
329.4
1085.9
964.1
1082.8 E0 0.00017
961.14 [E2] 0.128
398.00 E0 0.0019
272.43 (E2) 0.0107
119.44 0.0103
919.27 0.00064
674.46 0.00036
963.38 [E1] 11.7
841.63 E1 14.3
278.7 [E1]
152.77 [E1] 0.0019
810.49 (E2) 0.024
688.68 E0+M1+E2 0.065
443.96 (E2) 0.021
125.43 0.00035
684.85 E0 0.0028
562.98 E2 0.22
244.66 E2 0.025
121.77 E2 1.51
152 62 Sm90