^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	NDS 110, 1 (2009)	20-Nov-2008

Parent: ^{151}Tm: E=0.0; J$^{\pi}$=(11/2$^-$); $T_{1/2}$=4.17 s *11*; Q(ε)=7484 *26*; %ε+%β^+ decay=100.0

1990Ak01: ^{96}Ru(^{58}Ni,2pn) and ^{96}Ru(^{58}Ni,3p) E=250 MeV. Mass separation of α=151 products. Measured γ, γγ.

1988Ba02: source produced in ^{96}Mo(^{58}Ni,3p2n). Mass-separated. Isotopic identification was made on the basis of coincidences with Er x-rays. Measured: γγ, γ(t), Xγ.

Others: 1982No13, 1984HaZD.

^{151}Er Levels

E(level)†	J$^{\pi}$‡	E(level)†	J$^{\pi}$‡	E(level)†	J$^{\pi}$‡
0.0	(7/2$^-$)	2174.4 *5*		2921.4 *4*	
801.5 *2*	(9/2$^-$)	2212.7 *4*	(15/2$^+$)	3031.2 *2*	(11/2$^-$,13/2$^-$)
1140.3 *2*	(13/2$^+$)	2313.6 *10*		3037.3 *3*	(9/2$^-$,11/2$^-$)
1496.4 *2*	(9/2$^-$)	2329.6 *10*		3094.1 *8*	
1511.5 *3*		2449.4 *4*		3110 *3*	
1548.6 *2*	(11/2$^-$)	2451.1 *6*		3212.5 *6*	(9/2$^+$,11/2,13/2$^-$)
1683.6 *3*		2611.3 *4*		3270.5 *5*	
1720.9 *3*	(11/2$^+$)	2776.2 *5*		3288.3 *6*	
2075.3 *3*	(13/2$^+$)	2874.8 *5*		3341 *3*	
2165.1 *4*		2916.7 *3*	(11/2$^-$,13/2$^-$)	3766.8 *8*	

† From least-squares fit to Eγ′s.
‡ From 'Adopted Levels'.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*†	I(ε+β^+)†‡	Comments
(3.72×10^3 *3*)	3766.8	0.19 *7*	0.27 *9*	5.4	0.46 *16*	av Eβ=1218 *12*; εK=0.495 *6*; εL=0.0757 *9*; εM+=0.0225 *3*
(4.14×10^3 *3*)	3341	0.29 *7*	0.28 *6*	5.5	0.57 *13*	av Eβ=1413 *12*; εK=0.404 *6*; εL=0.0617 *8*; εM+=0.01831 *24*
(4.20×10^3 *3*)	3288.3	0.46 *4*	0.42 *3*	5.3	0.88 *7*	av Eβ=1437 *12*; εK=0.394 *5*; εL=0.0601 *8*; εM+=0.01784 *24*
(4.21×10^3 *3*)	3270.5	0.85 *16*	0.75 *14*	5.1	1.6 *3*	av Eβ=1445 *12*; εK=0.391 *5*; εL=0.0596 *8*; εM+=0.01768 *23*
(4.27×10^3 *3*)	3212.5	0.55 *16*	0.45 *14*	5.3	1.0 *3*	av Eβ=1472 *12*; εK=0.380 *5*; εL=0.0579 *8*; εM+=0.01718 *23*
(4.37×10^3 *3*)	3110	0.30 *3*	0.23 *2*	5.6	0.53 *5*	av Eβ=1519 *12*; εK=0.361 *5*; εL=0.0550 *8*; εM+=0.01631 *22*
(4.39×10^3 *3*)	3094.1	0.15 *3*	0.12 *2*	5.9	0.27 *5*	av Eβ=1526 *12*; εK=0.358 *5*; εL=0.0546 *8*; εM+=0.01618 *22*
(4.45×10^3 *3*)	3037.3	2.9 *4*	2.0 *3*	4.7	4.9 *6*	av Eβ=1553 *12*; εK=0.348 *5*; εL=0.0530 *7*; εM+=0.01572 *21*
(4.45×10^3 *3*)	3031.2	4.4 *4*	3.1 *3*	4.5	7.5 *7*	av Eβ=1555 *12*; εK=0.347 *5*; εL=0.0529 *7*; εM+=0.01568 *21*
(4.56×10^3 *3*)	2921.4	1.5 *2*	0.94 *12*	5.0	2.4 *3*	av Eβ=1606 *12*; εK=0.328 *5*; εL=0.0500 *7*; εM+=0.01483 *20*
(4.57×10^3 *3*)	2916.7	7.3 *6*	4.7 *4*	4.3	12 *1*	av Eβ=1608 *12*; εK=0.327 *5*; εL=0.0499 *7*; εM+=0.01479 *20*
(4.61×10^3 *3*)	2874.8	1.1 *2*	0.69 *15*	5.2	1.8 *4*	av Eβ=1628 *12*; εK=0.321 *5*; εL=0.0488 *7*; εM+=0.01448 *20*

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^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02 (continued)

ε,$β^+$ radiations (continued)

E(decay)	E(level)	Iβ$^+$ ‡	Iε‡	Log *ft*†	I(ε+$β^+$)†‡	Comments
(4.71×10^3 *3*)	2776.2	0.6 *2*	0.3 *1*	5.5	0.9 *3*	av Eβ=1673 *12*; εK=0.305 *4*; εL=0.0464 *7*; εM+=0.01377 *19*
(4.87×10^3 *3*)	2611.3	1.9 *3*	0.94 *14*	5.1	2.8 *4*	av Eβ=1750 *12*; εK=0.281 *4*; εL=0.0427 *6*; εM+=0.01266 *17*
(5.03×10^3 *3*)	2451.1	0.32 *3*	0.14 *2*	6.0	0.46 *5*	av Eβ=1824 *13*; εK=0.259 *4*; εL=0.0394 *6*; εM+=0.01168 *16*
(5.03×10^3 *3*)	2449.4	1.2 *1*	0.53 *6*	5.4	1.7 *2*	av Eβ=1825 *13*; εK=0.259 *4*; εL=0.0394 *6*; εM+=0.01167 *16*
(5.15×10^3 *3*)	2329.6	0.71 *14*	0.29 *6*	5.7	1.0 *2*	av Eβ=1881 *13*; εK=0.244 *4*; εL=0.0371 *5*; εM+=0.01098 *15*
(5.17×10^3 *3*)	2313.6	0.78 *14*	0.32 *6*	5.6	1.1 *2*	av Eβ=1888 *13*; εK=0.242 *4*; εL=0.0368 *5*; εM+=0.01090 *15*
(5.27×10^3 *3*)	2212.7	0.09 *5*	0.08 *4*	8.3^{1u}	0.17 *9*	av Eβ=1903 *12*; εK=0.402 *4*; εL=0.0623 *7*; εM+=0.01852 *19*
(5.31×10^3 *3*)	2174.4	0.57 *7*	0.21 *2*	5.8	0.78 *9*	av Eβ=1953 *13*; εK=0.226 *3*; εL=0.0343 *5*; εM+=0.01016 *14*
(5.32×10^3 *3*)	2165.1	1.8 *1*	0.65 *5*	5.3	2.4 *2*	av Eβ=1958 *13*; εK=0.225 *3*; εL=0.0341 *5*; εM+=0.01012 *14*
(5.41×10^3 *3*)	2075.3	1.1 *1*	0.39 *5*	5.6	1.5 *2*	av Eβ=1999 *13*; εK=0.215 *3*; εL=0.0326 *5*; εM+=0.00968 *13*
(5.76×10^3 *3*)	1720.9	0.7 *2*	0.2 *1*	5.9	0.9 *3*	av Eβ=2166 *13*; εK=0.1812 *23*; εL=0.0275 *4*; εM+=0.00814 *11*
(5.80×10^3# *3*)	1683.6	<0.13	<0.034	>6.7	<0.16	av Eβ=2183 *13*; εK=0.1780 *23*; εL=0.0270 *4*; εM+=0.00800 *10*
(5.94×10^3 *3*)	1548.6	3.2 *8*	0.80 *20*	5.3	4.0 *10*	av Eβ=2246 *13*; εK=0.1670 *21*; εL=0.0253 *4*; εM+=0.00750 *10*
(5.97×10^3# *3*)	1511.5	0.6 *5*	0.1 *1*	6.1	0.7 *6*	av Eβ=2264 *13*; εK=0.1641 *20*; εL=0.0249 *3*; εM+=0.00737 *9*
(5.99×10^3 *3*)	1496.4	2.4 *5*	0.58 *12*	5.5	3.0 *6*	av Eβ=2271 *13*; εK=0.1630 *20*; εL=0.0247 *3*; εM+=0.00732 *9*
(6.34×10^3 *3*)	1140.3	3.5 *7*	0.70 *13*	5.5	4.2 *8*	av Eβ=2439 *13*; εK=0.1384 *17*; εL=0.02096 *25*; εM+=0.00621 *8*
(6.68×10^3 *3*)	801.5	34 *3*	5.7 *6*	4.6	40 *4*	av Eβ=2599 *13*; εK=0.1192 *14*; εL=0.01803 *21*; εM+=0.00534 *7*

† All values are considered as approximate due to large energy gap of about 3.7 MeV between Q value and highest known populated level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{151}Er)

Iγ normalization: Σ(I(γ+ce)(γ′s to g.s.))=100. No ε decay to g.s. is expected. Unplaced intensity of≈7 units (γ rays above 1100 keV) is considered in this normalization. Iγ normalization=0.66 *3* if unplaced intensity is ignored.
Some of the unplaced γ rays above 1000 keV may belong to the decay of the 8-s isomer.

$E_γ$†	$I_γ$†@	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.‡	α&	Comments
136.9 *4*	0.24 *3*	2212.7	(15/2$^+$)	2075.3	(13/2$^+$)	(M1)	1.162 *19*	α(K)=0.975 *16*; α(L)=0.1457 *24*; α(M)=0.0323 *6*; α(N+..)=0.00869 *15*

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^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02 (continued)

γ(^{151}Er) (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [&]	Comments
								α(N)=0.00754 13; α(O)=0.001090 18; α(P)=6.01×10^{-5} 10
[x]214.5 4	0.12 4							
[x]219.9 4	0.076 8							
224.9 4	0.42 9	1720.9	(11/2$^+$)	1496.4	(9/2$^-$)	[E1]	0.0384	α(K)=0.0323 5; α(L)=0.00475 7; α(M)=0.001048 16; α(N+..)=0.000277 4 α(N)=0.000242 4; α(O)=3.37×10^{-5} 5; α(P)=1.620×10^{-6} 24
[x]241.3 6	0.17 4							
[x]272.9 6	0.33 7							
[x]332.7 6	0.57 12							
338.3 6	0.29 9	1140.3	(13/2$^+$)	801.5	(9/2$^-$)	(M2)	0.373	α(K)=0.301 5; α(L)=0.0556 9; α(M)=0.01269 20; α(N+..)=0.00341 6 α(N)=0.00297 5; α(O)=0.000424 7; α(P)=2.21×10^{-5} 4
353.5 6	0.44 11	2075.3	(13/2$^+$)	1720.9	(11/2$^+$)	(M1)	0.0861	α(K)=0.0725 11; α(L)=0.01061 16; α(M)=0.00235 4; α(N+..)=0.000632 10 α(N)=0.000548 8; α(O)=7.94×10^{-5} 12; α(P)=4.42×10^{-6} 7
354.2[#a] 6	0.42 13	1496.4	(9/2$^-$)	1140.3	(13/2$^+$)			
[x]380.0 3	0.79 8							
408.3[#a] 3	0.57 6	1548.6	(11/2$^-$)	1140.3	(13/2$^+$)			
[x]417.1 3	0.57 6							
[x]446.7 4	0.54 5							
[x]478.6 6	1.07 21							
526.7 4	2.23 12	2075.3	(13/2$^+$)	1548.6	(11/2$^-$)	[E1]	0.00498	α(K)=0.00423 6; α(L)=0.000590 9; α(M)=0.0001297 19; α(N+..)=3.46×10^{-5} 5 α(N)=3.01×10^{-5} 5; α(O)=4.29×10^{-6} 6; α(P)=2.27×10^{-7} 4
580.6 3	2.7 3	1720.9	(11/2$^+$)	1140.3	(13/2$^+$)	(M1)	0.0238	α(K)=0.0201 3; α(L)=0.00289 4; α(M)=0.000639 9; α(N+..)=0.0001719 25 α(N)=0.0001491 21; α(O)=2.16×10^{-5} 3; α(P)=1.212×10^{-6} 17
[x]677.6 4	0.24 5							
692.8[#a] 7	0.66 6	1496.4	(9/2$^-$)	801.5	(9/2$^-$)			
718.0[#a] 4	0.67 7	2212.7	(15/2$^+$)	1496.4	(9/2$^-$)			
765.8 4	0.75 4	2449.4		1683.6				
801.5 3	100 5	801.5	(9/2$^-$)	0.0	(7/2$^-$)	[M1]	0.01062	α(K)=0.00898 13; α(L)=0.001278 18; α(M)=0.000282 4; α(N+..)=7.58×10^{-5} 11 α(N)=6.57×10^{-5} 10; α(O)=9.55×10^{-6} 14; α(P)=5.38×10^{-7} 8
818.6 10	0.58 9	3031.2	(11/2$^-$,13/2$^-$)	2212.7	(15/2$^+$)			

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^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02 (continued)

γ(^{151}Er) (continued)

E_γ [†]	I_γ [†@]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	α [&]	Comments
850.1 *7*	0.69 *23*	3766.8		2916.7	(11/2⁻,13/2⁻)			
[x]865.5 *7*	0.49 *5*							
[x]893.5 *6*	0.41 *4*							
919.3 *4*	0.45 *9*	1720.9	(11/2⁺)	801.5	(9/2⁻)			
[x]929.1 *4*	0.22 *5*							
935.1 *7*	0.40 *8*	2075.3	(13/2⁺)	1140.3	(13/2⁺)			
956.1 *7*	0.27 *5*	3031.2	(11/2⁻,13/2⁻)	2075.3	(13/2⁺)			
[x]962.4 *7*	0.42 *9*							
1071.3 *10*	0.32 *6*	2212.7	(15/2⁺)	1140.3	(13/2⁺)			
1092.7 *4*	0.63 *10*	2776.2		1683.6				
[x]1097.4 *6*	0.79 *24*							
1123.2 *4*	1.33 *7*	3288.3		2165.1				
1140.2 *3*	15.6 *8*	1140.3	(13/2⁺)	0.0	(7/2⁻)	E3	0.00539	α(K)=0.00440 *7*; α(L)=0.000771 *11*; α(M)=0.0001742 *25*; α(N+..)=4.66×10^{-5} *7* α(N)=4.04×10^{-5} *6*; α(O)=5.67×10^{-6} *8*; α(P)=2.66×10^{-7} *4*; α(IPF)=2.46×10^{-7} *5*
1199.0 *10*	0.32 *16*	2921.4		1720.9	(11/2⁺)			
1326.2 *5*	1.64 *16*	2874.8		1548.6	(11/2⁻)			
1363.6 *3*	4.98 *25*	2165.1		801.5	(9/2⁻)			
1368.0 *4*	0.94 *9*	2916.7	(11/2⁻,13/2⁻)	1548.6	(11/2⁻)			
1372.9 *4*	1.22 *12*	2174.4		801.5	(9/2⁻)			
1411.4[#a] *7*	0.57 *9*	2212.7	(15/2⁺)	801.5	(9/2⁻)			
[x]1455.5 *5*	0.84 *13*							
1483.0 *7*	0.84 *21*	3031.2	(11/2⁻,13/2⁻)	1548.6	(11/2⁻)			
1488.5 *4*	1.5 *4*	3037.3	(9/2⁻,11/2⁻)	1548.6	(11/2⁻)			
1495.8 *4*	7.3 *7*	1496.4	(9/2⁻)	0.0	(7/2⁻)			
1511.5 *3*	2.8 *8*	1511.5		0.0	(7/2⁻)			
1525.9 *4*	1.8 *4*	3037.3	(9/2⁻,11/2⁻)	1511.5				
1535.6 *3*	2.3 *5*	3031.2	(11/2⁻,13/2⁻)	1496.4	(9/2⁻)			
1548.5 *3*	13.2 *13*	1548.6	(11/2⁻)	0.0	(7/2⁻)			
1549.6 *9*	1.52 *16*	3270.5		1720.9	(11/2⁺)			
1586.5 *6*	0.6 *3*	3270.5		1683.6				
1635.5 *8*	0.7 *4*	2776.2		1140.3	(13/2⁺)			
1683.5 *4*	1.85 *19*	1683.6		0.0	(7/2⁻)			
[x]1685.7 *6*	0.83 *17*							
[x]1761.7 *7*	0.80 *8*							
[x]1764.2 *4*	2.43 *15*							
1777.1 *10*	1.0 *3*	2916.7	(11/2⁻,13/2⁻)	1140.3	(13/2⁺)			
1809.8 *3*	4.2 *6*	2611.3		801.5	(9/2⁻)			
1890.8 *3*	3.19 *23*	3031.2	(11/2⁻,13/2⁻)	1140.3	(13/2⁺)			
1953.7 *7*	0.41 *6*	3094.1		1140.3	(13/2⁺)			
2071.7 *7*	1.0 *4*	3212.5	(9/2⁺,11/2,13/2⁻)	1140.3	(13/2⁺)			
2073.3 *6*	1.1 *5*	2874.8		801.5	(9/2⁻)			
2115.1 *3*	16.9 *9*	2916.7	(11/2⁻,13/2⁻)	801.5	(9/2⁻)			
2120.1 *4*	2.29 *14*	2921.4		801.5	(9/2⁻)			
[x]2140.2 *7*	0.41 *12*							
[x]2199.6 *7*	0.80 *8*							
2229.7 *4*	4.4 *7*	3031.2	(11/2⁻,13/2⁻)	801.5	(9/2⁻)			
2236.0 *4*	2.5 *4*	3037.3	(9/2⁻,11/2⁻)	801.5	(9/2⁻)			
[x]2244.8 *7*	0.64 *16*							
2313.6 *10*	1.8 *3*	2313.6		0.0	(7/2⁻)			

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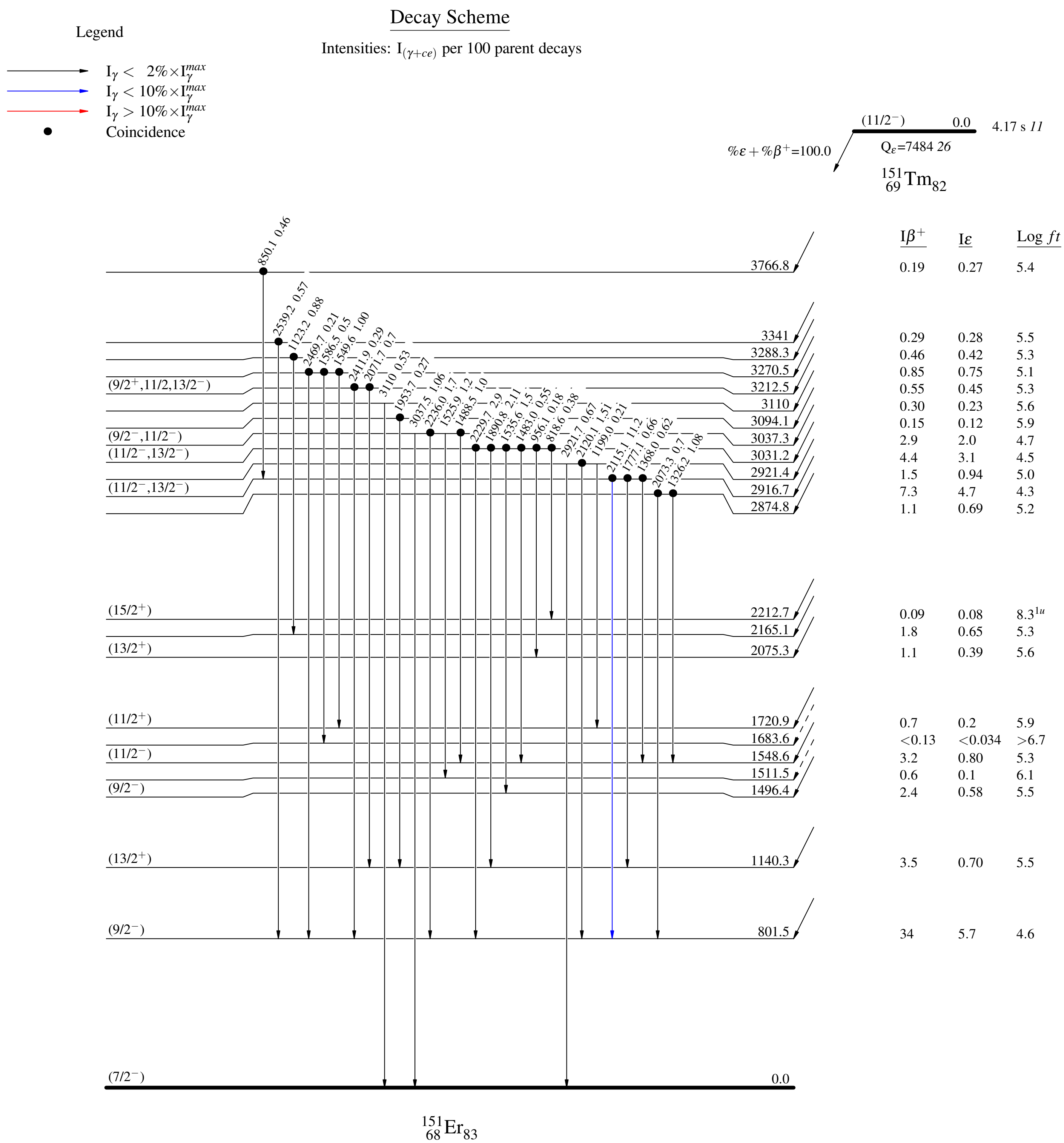
^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02 (continued)

γ(^{151}Er) (continued)

E_γ[†]	I_γ[†@]	E_i(level)	J_i^π	E_f	J_f^π
2329.6 *10*	1.55 *24*	2329.6		0.0	(7/2$^-$)
2411.9 *10*	0.44 *14*	3212.5	(9/2$^+$,11/2,13/2$^-$)	801.5	(9/2$^-$)
2449.5 *6*	1.79 *18*	2449.4		0.0	(7/2$^-$)
2451.1 *6*	0.70 *7*	2451.1		0.0	(7/2$^-$)
2469.7 *9*	0.32 *4*	3270.5		801.5	(9/2$^-$)
2539.2 *25*	0.87 *18*	3341		801.5	(9/2$^-$)
2921.7 *25*	1.01 *25*	2921.4		0.0	(7/2$^-$)
3037.5 *25*	1.6 *3*	3037.3	(9/2$^-$,11/2$^-$)	0.0	(7/2$^-$)
3110 *3*	0.81 *6*	3110		0.0	(7/2$^-$)

[†] From 1990Ak01. 1988Ba02 report nine most intense γ rays.
[‡] From 'adopted gammas'.
[#] γ not reported by 1997Co24 in ^{151}Er IT decay (0.58 s) study, where the level was also populated. 1997Co24 state that some of the γ-transition placements by 1990Ak01 are in conflict with their work. apparently, the details of work by 1997Co24 are in a thesis by R. Collatz, KFA Julich (1994) (reference 8 in 1997Co24).
[@] For absolute intensity per 100 decays, multiply by 0.66 *3*.
[&] 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.
[a] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02



^{151}Tm ε decay (4.17 s) 1990Ak01,1988Ba02

Decay Scheme (continued)

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