^{159}Tm ε decay 1975Ag03,1975St07

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. W. Reich	NDS 113, 157 (2012)	31-Dec-2010

Parent: ^{159}Tm: E=0; J^π=5/2$^+$; $T_{1/2}$=9.13 min *16*; Q(ε)=3997 *28*; %ε+%β^+ decay=100.0
^{159}Tm-Q(ε): From 2009AuZZ.
Additional information 1.
Decay scheme is from 1975Ag03. This scheme goes up to 1318 keV and is very incomplete since there are many unplaced γ's and the Total-Absorption γ-Spectral (TAGS) data of 1982By03 indicate that over 50% of the decays are to levels above 2 MeV. 1975St07 propose a scheme up to 566 keV; below this energy this scheme agrees with that of 1975Ag03, except it lacks two levels. α long list of unplaced γ's above 1400 keV is given by 1995AdZV and a set of more precise data on the γ's below 502 keV is given by 1997AdZY.
1970DeZF: produced by ^{162}Er(p,4nγ). Measured γ singles with Ge detectors, ce singles with Si(Li) detector, and $\gamma\gamma$ and ce-γ coincidences.
1975Ag03: produced by Er(p,xn) at 157 MeV with isotope separation; Measured γ singles with Ge detectors.
1975Bu10, 1974BuZM: produced by spallation of Ta with 660-MeV p.
Measured $T_{1/2}$(182 level) from time difference between differential and integral pulses from source in well of scintillation detector.
1975Gr44: review of previous laboratory work.
1975VaYW: abstract which gives $T_{1/2}$(59 level).
1975St07: produced by spallation of Ta target with 660-MeV p with chemical and isotope separation. Measurements with Ge and Si(Li) detectors and magnetic spectrograph and spectrometer of γ and ce singles, $\gamma\gamma$ and $\gamma\gamma$(t) coincidences.
1982By03: measured total-absorption γ-spectra (TAGS) with 3 NaI(Tl) γ detectors and a Si(Li) β^+ detector. Spectra measured with and without coincidences with β^+. Measurement gives the ε+β^+ feeding as function of the excitation energy.
1983Be17: produced by Er(p,xn) with isotope separation. Measured ce-ce and ce-γ coincidences in magnetic-lens spectrometer for ce and plastic scintillator for G.
1991AlZY: report maximum β^+ energy and Q(ε) values as determined with TAGS spectrometer (see 1982By03).
1994Po26: report maximum β^+ energy and Q(ε) values.
1995AdZV: abstract listing Eγ and Iγ values for γ's from 1400 to 2864 keV.
1997AdZY: abstract listing Eγ and Iγ values for γ's from 38 to 501 keV.

^{159}Er Levels

E(level)	J^{π}†	$T_{1/2}$‡	Comments
0	3/2$^-$		
59.249 *14*	5/2$^-$	≤0.3 ns	$T_{1/2}$: From 1983Be17; other:≤0.20 ns (1975VaYW).
144.232 *14*	7/2$^-$	<0.17 ns	$T_{1/2}$: From 1983Be17.
182.602 *24*	9/2$^+$	0.337 μs *14*	$T_{1/2}$: From 1975Bu10; others: 0.31 μs *3* (1975St07) and 0.32 μs *3* (1971LeYU).
220.330 *14*	5/2$^-$	0.210 ns *20*	$T_{1/2}$: From 1983Be17.
258.270 *22*	9/2$^-$		
271.481 *16*	5/2$^+$		
302.49 *3*	7/2$^+$	220 ps *10*	$T_{1/2}$: From 1983Be17.
307.211 *22*	7/2$^-$		
348.336 *14*	3/2$^+$		
429.05 *3*	11/2$^-$	0.55 μs *15*	$T_{1/2}$: From 1975St07.
449.44 *4*	(5/2$^-$,7/2,9/2$^-$)		
468.11 *3*	(3/2,5/2)$^+$		
555.11 *3*	(5/2)$^-$		
565.81 *7*	(7/2)$^-$		
616.01 *6*	(3/2$^+$,5/2,7/2$^+$)		
617.18 *3*	(5/2$^-$,7/2$^-$)		
717.18 *6*	(5/2$^+$,7/2)		
790.78 *6*			
890.65 *6*			

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^{159}Tm ε decay 1975Ag03,1975St07 (continued)

^{159}Er Levels (continued)

E(level)	J$^{\pi}$†
963.70 *5*	(3/2,5/2,7/2)$^{+}$
990.87 *15*	
1050.28 *12*	
1191.14 *14*	
1318.21 *15*	(7/2)

† From ^{159}Er Adopted Levels.
‡ All values are from this decay mode. The measurement methods are noted under the experimental description.

ε,β^{+} radiations

E(decay)†	E(level)	Iβ^{+} &	Iε&	Log *ft*@	I(ε+β^{+})‡#&	Comments
(2.68×10^{3} *3*)	1318.21	0.038	0.25	7.3	0.29	av Eβ=750 *13*; εK=0.724 *6*; εL=0.1119 *9*; εM+=0.0333 *3*
(2.81×10^{3} *3*)	1191.14	0.043	0.23	7.4	0.27	av Eβ=807 *13*; εK=0.699 *6*; εL=0.1080 *9*; εM+=0.0321 *3*
(2.95×10^{3} *3*)	1050.28	0.068	0.28	7.3	0.35	av Eβ=870 *13*; εK=0.670 *6*; εL=0.1033 *10*; εM+=0.0307 *3*
(3.01×10^{3} *3*)	990.87	0.034	0.13	7.7	0.16	av Eβ=897 *13*; εK=0.658 *7*; εL=0.1013 *10*; εM+=0.0301 *3*
(3.03×10^{3} *3*)	963.70	0.19	0.66	7.0	0.85	av Eβ=909 *13*; εK=0.652 *7*; εL=0.1004 *10*; εM+=0.0298 *3*
(3.11×10^{3} *3*)	890.65	0.083	0.27	7.4	0.35	av Eβ=942 *13*; εK=0.635 *7*; εL=0.0978 *10*; εM+=0.0290 *3*
(3.21×10^{3} *3*)	790.78	0.045	0.12	7.7	0.17	av Eβ=987 *13*; εK=0.613 *7*; εL=0.0942 *10*; εM+=0.0280 *3*
(3.28×10^{3} *3*)	717.18	0.088	0.22	7.5	0.31	av Eβ=1020 *13*; εK=0.596 *7*; εL=0.0916 *11*; εM+=0.0272 *3*
(3.38×10^{3} *3*)	617.18	0.17	0.37	7.3	0.54	av Eβ=1065 *13*; εK=0.573 *7*; εL=0.0879 *11*; εM+=0.0261 *3*
(3.38×10^{3} *3*)	616.01	0.069	0.15	7.7	0.22	av Eβ=1066 *13*; εK=0.573 *7*; εL=0.0879 *11*; εM+=0.0261 *3*
(3.43×10^{3} *3*)	565.81	0.2	0.3	7.4	0.5	av Eβ=1088 *13*; εK=0.561 *7*; εL=0.0861 *11*; εM+=0.0256 *3*
(3.53×10^{3} *3*)	468.11	0.60	1.1	6.9	1.7	av Eβ=1133 *13*; εK=0.538 *7*; εL=0.0825 *10*; εM+=0.0245 *3*
(3.55×10^{3} *3*)	449.44	0.047	0.083	8.0	0.13	av Eβ=1141 *13*; εK=0.534 *7*; εL=0.0819 *10*; εM+=0.0243 *3*
(3.65×10^{3} *3*)	348.336	1.6	2.5	6.5	4.1	av Eβ=1187 *13*; εK=0.511 *7*; εL=0.0783 *10*; εM+=0.0232 *3*
(3.69×10^{3} *3*)	307.211	0.72	1.1	6.9	1.8	av Eβ=1206 *13*; εK=0.502 *7*; εL=0.0768 *10*; εM+=0.0228 *3*
(3.69×10^{3} *3*)	302.49	0.88	1.3	6.8	2.2	av Eβ=1208 *13*; εK=0.501 *7*; εL=0.0766 *10*; εM+=0.0227 *3*
(3.73×10^{3} *3*)	271.481	1.0	1.5	6.8	2.5	av Eβ=1222 *13*; εK=0.494 *7*; εL=0.0756 *10*; εM+=0.0224 *3*
(3.74×10^{3} *3*)	258.270	0.4	0.5	7.2	0.9	av Eβ=1228 *13*; εK=0.491 *7*; εL=0.0751 *10*; εM+=0.0223 *3*
(3.78×10^{3} *3*)	220.330	0.68	0.92	7.0	1.6	av Eβ=1245 *13*; εK=0.482 *7*; εL=0.0738 *10*; εM+=0.0219 *3*
(3.85×10^{3} *3*)	144.232	2.4	3.1	6.5	5.5	av Eβ=1280 *13*; εK=0.465 *7*; εL=0.0712 *10*; εM+=0.0211 *3*
(3.94×10^{3} *3*)	59.249	2.3	2.7	6.6	5.0	av Eβ=1319 *13*; εK=0.447 *6*; εL=0.0684 *10*; εM+=0.0203 *3*
(4.00×10^{3} *3*)	0	2.4	2.6	6.6	5.0	av Eβ=1346 *13*; εK=0.435 *6*; εL=0.0664 *9*; εM+=0.0197 *3*

† Endpoint $E_{\beta^{+}}$=2050 *100* (1975St07) with Q=3.4 *3* MeV where the larger uncertainty on the Q value is from the ambiguity of the

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^{159}Tm ε decay 1975Ag03,1975St07 (continued)

ε,β^+ radiations (continued)

lowest level with significant population. Other Q(ε) values: 3850 *100* (1991AlZY); 3670 *100* (1994Po26).

‡ These values are computed from the γ intensity balances at each level with the ground-state branch assumed to be approximately equal to those to the 59- and 144-keV levels and the sum of the feeding to the levels below 500 keV set to ≈31% as reported by 1982By03 for a band of branches centered at 300 keV. The total $\varepsilon+\beta^+$ decay accounted for is, then, 34%.

The decays from the higher-lying levels via the unplaced γ's will change the $\varepsilon+\beta^+$ feedings of these levels. These values thus represent upper limits.

@ From the comment on the I($\varepsilon+\beta^+$) values, there is a large uncertainty in these values.

& Absolute intensity per 100 decays.

γ(^{159}Er)

Iγ normalization, I(γ+ce) normalization: value is based on assumptions for ε+β^+ feeding; see that comment.

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[#]	α[f]	Comments
38.32[d] *3*	158 *11*	182.602	9/2+	144.232	7/2−	E1		0.801	α(L)=0.626 *9*; α(M)=0.1401 *20*; α(N+..)=0.0354 *5* α(N)=0.0314 *5*; α(O)=0.00383 *6*; α(P)=0.0001207 *17* E_γ: Authors′ uncertainty of 0.7 keV assumed to be typographical error. Other: 38.30 *6* (1975St07).
59.29[d] *3*	91 *5*	59.249	5/2−	0	3/2−	M1+E2	<0.33	13.3 *6*	α(K)=10.2 *5*; α(L)=2.4 *8*; α(M)=0.55 *19*; α(N+..)=0.14 *5* α(N)=0.13 *5*; α(O)=0.017 *5*; α(P)=0.00065 *3*
[x]74.88[&] *12*	2.5 *10*								E_γ: Other: 73.4 *7* (1975St07).
76.13[d] *7*	5.2 *16*	220.330	5/2−	144.232	7/2−	(M1)		6.24	α(K)=5.23 *8*; α(L)=0.789 *12*; α(M)=0.1751 *25*; α(N+..)=0.0471 *7* α(N)=0.0408 *6*; α(O)=0.00590 *9*; α(P)=0.000324 *5* E_γ: Other 75.4 *5* (1975St07).
76.13[d] *7*	5.2 *16*	348.336	3/2+	271.481	5/2+	M1		6.24	α(K)=5.23 *8*; α(L)=0.789 *12*; α(M)=0.1751 *25*; α(N+..)=0.0471 *7* α(N)=0.0408 *6*; α(O)=0.00590 *9*; α(P)=0.000324 *5* E_γ: Poor energy fit. Other: 77.1 *5* (1975St07).
84.98[d] *2*	133 *7*	144.232	7/2−	59.249	5/2−	M1+E2	<0.37	4.60 *9*	α(K)=3.67 *15*; α(L)=0.72 *15*; α(M)=0.16 *4*; α(N+..)=0.043 *10* α(N)=0.038 *9*; α(O)=0.0052 *10*; α(P)=0.000225 *11* E_γ: Authors′ uncertainty of 0.7 keV assumed to be typographical error. Other: 84.90 *10* (1975St07).
87.09[d] *6*	7.3 *20*	307.211	7/2−	220.330	5/2−	M1		4.23	α(K)=3.55 *5*; α(L)=0.534 *8*; α(M)=0.1186 *17*; α(N+..)=0.0318 *5* α(N)=0.0276 *4*; α(O)=0.00399 *6*; α(P)=0.000219 *4*
88.93[d] *4*	18.0 *13*	271.481	5/2+	182.602	9/2+	E2		4.61	α(K)=1.391 *20*; α(L)=2.46 *4*; α(M)=0.600 *9*; α(N+..)=0.1515 *22* α(N)=0.1356 *20*; α(O)=0.01585 *23*; α(P)=5.86×10^{-5} *9*
[x]91.6[&] *5*	0.6 *4*								
[x]94.0[&] *5*	1.0 *5*								
105.8 *3*	2.0 *10*	555.11	(5/2)−	449.44	(5/2−,7/2,9/2−)				
[x]112.43 *10*	2.0 *5*								
114.03[d] *3*	22.5 *25*	258.270	9/2−	144.232	7/2−	M1		1.95	α(K)=1.640 *23*; α(L)=0.246 *4*; α(M)=0.0545 *8*; α(N+..)=0.01464 *21* α(N)=0.01270 *18*; α(O)=0.00184 *3*; α(P)=0.0001011 *15*
119.82[gd] *6*	52[g] *7*	302.49	7/2+	182.602	9/2+	M1		1.697	α(K)=1.424 *20*; α(L)=0.213 *3*; α(M)=0.0473 *7*; α(N+..)=0.01270 *18* α(N)=0.01102 *16*; α(O)=0.001593 *23*; α(P)=8.78×10^{-5} *13* I_γ: For 119 doublet, total Iγ=70 *7*. Value for this γ

γ(^{159}Er) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[f]	Comments
								transition is chosen to give I(ε+β^+)=0.0 for the branch to the 9/2$^+$ level at 182 keV since it is a 2nd forbidden transition. Mult.: Reported as M1, but γ is a doublet.
119.82[gd] *6*	18[g] *12*	468.11	(3/2,5/2)$^+$	348.336	3/2$^+$	(M1,E2)	1.60 *10*	α(K)=1.1 *4*; α(L)=0.42 *21*; α(M)=0.10 *6*; α(N+..)=0.026 *13* α(N)=0.023 *12*; α(O)=0.0028 *13*; α(P)=6.E−5 *3* I_γ: For 119 doublet, total Iγ=70 *7*. Value for the other 119 γ chosen to give I(ε+β^+)=0.0 for the branch to the 9/2$^+$ level at 182 keV since it is a 2nd forbidden transition. Mult.: Reported as M1, but γ is doublet.
124.40 *10*	2.5 *5*	307.211	7/2$^-$	182.602	9/2$^+$	[E1]	0.182	α(K)=0.1519 *22*; α(L)=0.0236 *4*; α(M)=0.00522 *8*; α(N+..)=0.001366 *20* α(N)=0.001196 *17*; α(O)=0.0001622 *23*; α(P)=7.07×10^{-6} *10*
127.12[d] *6*	12.5 *13*	271.481	5/2$^+$	144.232	7/2$^-$	E1	0.1719	α(K)=0.1435 *21*; α(L)=0.0222 *4*; α(M)=0.00491 *7*; α(N+..)=0.001287 *18* α(N)=0.001127 *16*; α(O)=0.0001530 *22*; α(P)=6.70×10^{-6} *10*
127.98[d] *2*	76 *5*	348.336	3/2$^+$	220.330	5/2$^-$	E1	0.1688	α(K)=0.1410 *20*; α(L)=0.0218 *3*; α(M)=0.00482 *7*; α(N+..)=0.001263 *18* α(N)=0.001107 *16*; α(O)=0.0001502 *21*; α(P)=6.58×10^{-6} *10*
136.80[d] *6*	10.8 *11*	565.81	(7/2)$^-$	429.05	11/2$^-$	E2	0.932	α(K)=0.479 *7*; α(L)=0.348 *5*; α(M)=0.0839 *12*; α(N+..)=0.0213 *3* α(N)=0.0190 *3*; α(O)=0.00228 *4*; α(P)=2.07×10^{-5} *3*
142.23[d] *6*	3.3 *4*	449.44	(5/2$^-$,7/2,9/2$^-$)	307.211	7/2$^-$			
144.24[d] *2*	39 *2*	144.232	7/2$^-$	0	3/2$^-$	E2	0.773	α(K)=0.414 *6*; α(L)=0.275 *4*; α(M)=0.0664 *10*; α(N+..)=0.01690 *24* α(N)=0.01507 *22*; α(O)=0.00181 *3*; α(P)=1.80×10^{-5} *3*
161.09[d] *2*	59 *3*	220.330	5/2$^-$	59.249	5/2$^-$	M1+E2	0.63 *11*	α(K)=0.46 *16*; α(L)=0.13 *4*; α(M)=0.031 *11*; α(N+..)=0.0080 *25* α(N)=0.0070 *23*; α(O)=0.00091 *22*; α(P)=2.6×10^{-5} *13*
163.04[d] *3*	29.5 *20*	307.211	7/2$^-$	144.232	7/2$^-$	M1	0.710	α(K)=0.597 *9*; α(L)=0.0889 *13*; α(M)=0.0197 *3*; α(N+..)=0.00530 *8* α(N)=0.00460 *7*; α(O)=0.000665 *10*; α(P)=3.67×10^{-5} *6*
170.75[d] *9*	5.0 *7*	429.05	11/2$^-$	258.270	9/2$^-$	M1	0.624	α(K)=0.524 *8*; α(L)=0.0780 *11*; α(M)=0.01731 *25*; α(N+..)=0.00465 *7* α(N)=0.00404 *6*; α(O)=0.000584 *9*; α(P)=3.22×10^{-5} *5*
[x]179.57[d] *20*	2.1 *7*							
[x]183.0 *6*	1.4 *7*							
191.21[d] *6*	3.3 *5*	449.44	(5/2$^-$,7/2,9/2$^-$)	258.270	9/2$^-$			
196.62[d] *3*	44 *2*	468.11	(3/2,5/2)$^+$	271.481	5/2$^+$	M1(+E2)	0.34 *8*	α(K)=0.26 *10*; α(L)=0.063 *11*; α(M)=0.015 *3*; α(N+..)=0.0038 *7* α(N)=0.0034 *7*; α(O)=0.00044 *5*; α(P)=1.5×10^{-5} *7*
199.06[d] *3*	27.5 *15*	258.270	9/2$^-$	59.249	5/2$^-$	E2	0.256	α(K)=0.1643 *23*; α(L)=0.0703 *10*; α(M)=0.01675 *24*; α(N+..)=0.00429 *6* α(N)=0.00381 *6*; α(O)=0.000471 *7*; α(P)=7.73×10^{-6} *11*
206.8 *3*	6.0 *20*	555.11	(5/2)$^-$	348.336	3/2$^+$			
212.23[d] *5*	28 *3*	271.481	5/2$^+$	59.249	5/2$^-$	E1	0.0446	α(K)=0.0375 *6*; α(L)=0.00553 *8*; α(M)=0.001222 *18*;

γ(^{159}Er) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[f]	Comments
								α(N+..)=0.000323 *5* α(N)=0.000282 *4*; α(O)=3.91×10^{-5} *6*; α(P)=1.87×10^{-6} *3*
[x]214.13[d] *6*	3.4 *4*							
220.30[d] *2*	100	220.330	5/2$^-$	0	3/2$^-$	M1	0.308	α(K)=0.259 *4*; α(L)=0.0384 *6*; α(M)=0.00850 *12*; α(N+..)=0.00229 *4* α(N)=0.00198 *3*; α(O)=0.000287 *4*; α(P)=1.588×10^{-5} *23*
229.06[d] *7*	3.7 *7*	449.44	(5/2$^-$,7/2,9/2$^-$)	220.330	5/2$^-$			
243.27[d] *3*	21.5 *10*	302.49	7/2$^+$	59.249	5/2$^-$	(E1)	0.0314	α(K)=0.0264 *4*; α(L)=0.00387 *6*; α(M)=0.000853 *12*; α(N+..)=0.000226 *4* α(N)=0.000197 *3*; α(O)=2.75×10^{-5} *4*; α(P)=1.337×10^{-6} *19*
246.7 *3*	3.5 *15*	963.70	(3/2,5/2,7/2)$^+$	717.18	(5/2$^+$,7/2)			
247.70 *20*	≤7	468.11	(3/2,5/2)$^+$	220.330	5/2$^-$	[E1]	0.0300	α(K)=0.0252 *4*; α(L)=0.00369 *6*; α(M)=0.000814 *12*; α(N+..)=0.000215 *3* α(N)=0.000188 *3*; α(O)=2.62×10^{-5} *4*; α(P)=1.279×10^{-6} *18*
247.87[d] *3*	22.5 *10*	307.211	7/2$^-$	59.249	5/2$^-$	M1	0.223	α(K)=0.188 *3*; α(L)=0.0277 *4*; α(M)=0.00614 *9*; α(N+..)=0.001652 *24* α(N)=0.001433 *20*; α(O)=0.000207 *3*; α(P)=1.150×10^{-5} *16*
252.70 *5*	10 *3*	555.11	(5/2)$^-$	302.49	7/2$^+$	E1	0.0285	α(K)=0.0240 *4*; α(L)=0.00350 *5*; α(M)=0.000773 *11*; α(N+..)=0.000205 *3* α(N)=0.0001784 *25*; α(O)=2.49×10^{-5} *4*; α(P)=1.219×10^{-6} *17* I_γ: from 1997AdZY; other: 40 *6* from 1975Ag03.
262.90 *20*	1.00 *20*	565.81	(7/2)$^-$	302.49	7/2$^+$			
267.62[d] *9*	4.3 *8*	616.01	(3/2$^+$,5/2,7/2$^+$)	348.336	3/2$^+$			
271.42[d] *2*	121 *4*	271.481	5/2$^+$	0	3/2$^-$	E1	0.0238	α(K)=0.0201 *3*; α(L)=0.00291 *4*; α(M)=0.000643 *9*; α(N+..)=0.0001702 *24* α(N)=0.0001484 *21*; α(O)=2.08×10^{-5} *3*; α(P)=1.026×10^{-6} *15*
284.84[d] *3*	13.5 *10*	429.05	11/2$^-$	144.232	7/2$^-$	(E2)	0.0809	α(K)=0.0585 *9*; α(L)=0.01730 *25*; α(M)=0.00406 *6*; α(N+..)=0.001049 *15* α(N)=0.000928 *13*; α(O)=0.0001186 *17*; α(P)=2.98×10^{-6} *5*
289.11[d] *2*	104 *5*	348.336	3/2$^+$	59.249	5/2$^-$	E1	0.0203	α(K)=0.01713 *24*; α(L)=0.00248 *4*; α(M)=0.000547 *8*; α(N+..)=0.0001450 *21* α(N)=0.0001264 *18*; α(O)=1.773×10^{-5} *25*; α(P)=8.82×10^{-7} *13*
296.70 *20*	4.0 *10*	555.11	(5/2)$^-$	258.270	9/2$^-$			
307.50 *20*	8.5 *20*	565.81	(7/2)$^-$	258.270	9/2$^-$	(M1)	0.1248	α(K)=0.1050 *15*; α(L)=0.01543 *22*; α(M)=0.00342 *5*; α(N+..)=0.000918 *13* α(N)=0.000797 *12*; α(O)=0.0001154 *17*; α(P)=6.41×10^{-6} *9*
313.50 *15*	12.0 *25*	616.01	(3/2$^+$,5/2,7/2$^+$)	302.49	7/2$^+$			
334.75[d] *3*	8.1 *8*	555.11	(5/2)$^-$	220.330	5/2$^-$			
344.65[d] *15*	1.5 *5*	616.01	(3/2$^+$,5/2,7/2$^+$)	271.481	5/2$^+$			
348.40[d] *2*	79 *5*	348.336	3/2$^+$	0	3/2$^-$	E1	0.01287	α(K)=0.01088 *16*; α(L)=0.001556 *22*; α(M)=0.000343 *5*;

γ(^{159}Er) (continued)

Eγ[†]	Iγ[†e]	Ei(level)	J^π_i	Ef	J^π_f	Mult.[‡]	α[f]	Comments
								α(N+..)=9.11×10^{-5} 13 α(N)=7.93×10^{-5} 12; α(O)=1.120×10^{-5} 16; α(P)=5.69×10^{-7} 8
358.94[d] 3	7.8 6	617.18	(5/2$^-$,7/2$^-$)	258.270	9/2$^-$	(M1)	0.0827	α(K)=0.0697 10; α(L)=0.01019 15; α(M)=0.00225 4; α(N+..)=0.000606 9 α(N)=0.000526 8; α(O)=7.62×10^{-5} 11; α(P)=4.24×10^{-6} 6
361.75[d] 5	3.5 3	790.78		429.05	11/2$^-$	(M1)	0.0811	α(K)=0.0683 10; α(L)=0.00998 14; α(M)=0.00221 3; α(N+..)=0.000594 9 α(N)=0.000515 8; α(O)=7.46×10^{-5} 11; α(P)=4.15×10^{-6} 6
[x]367.75[d] 4	11.2 7							
[x]372.64[d] 17	7.5 10							
[x]374.81[d] 2	52 4							
395.70 10	6.0 10	616.01	(3/2$^+$,5/2,7/2$^+$)	220.330	5/2$^-$			Mult.: Measurements indicate (E2).
[x]401.49[d] 14	3.0 10							
408.59 3	49 3	963.70	(3/2,5/2,7/2)$^+$	555.11	(5/2)$^-$	E1	0.00883	α(K)=0.00748 11; α(L)=0.001059 15; α(M)=0.000233 4; α(N+..)=6.21×10^{-5} 9 α(N)=5.40×10^{-5} 8; α(O)=7.66×10^{-6} 11; α(P)=3.96×10^{-7} 6
[x]415.82[d] 6	12.4 8							
422.53 5	11.9 7	890.65		468.11	(3/2,5/2)$^+$	(M1)	0.0539	α(K)=0.0455 7; α(L)=0.00661 10; α(M)=0.001462 21; α(N+..)=0.000393 6 α(N)=0.000341 5; α(O)=4.94×10^{-5} 7; α(P)=2.76×10^{-6} 4
[x]429.10[@] 20	1.3 3							Additional information 2.
434.25 15	10.0 20	1050.28		616.01	(3/2$^+$,5/2,7/2$^+$)			Iγ: includes 434.50-keV γ from 617 level.
434.40[d] 6	13.2 8	617.18	(5/2$^-$,7/2$^-$)	182.602	9/2$^+$			Iγ: includes 434.25-keV γ from 1050 level.
[x]439.3[@] 4	1.5 6							
445.70[d] 7	9.7 7	717.18	(5/2$^+$,7/2)	271.481	5/2$^+$	(M1,E2)	0.035 13	α(K)=0.029 11; α(L)=0.0047 11; α(M)=0.00106 21; α(N+..)=0.00028 6 α(N)=0.00025 5; α(O)=3.5×10^{-5} 9; α(P)=1.7×10^{-6} 8
[x]450.42[d] 5	19.7 8							
[x]453.89[d] 6	11.2 6							
[x]461.84[d] 5	22.0 15							
[x]468.28[d] 7	6.6 5							
473.00[d] 6	9.0 6	617.18	(5/2$^-$,7/2$^-$)	144.232	7/2$^-$	(M1)	0.0403	α(K)=0.0340 5; α(L)=0.00492 7; α(M)=0.001087 16; α(N+..)=0.000292 4 α(N)=0.000254 4; α(O)=3.68×10^{-5} 6; α(P)=2.06×10^{-6} 3
[x]482.75[d] 6	13.4 9							
[x]485.12[d] 7	6.9 5							

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γ(^{159}Er) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	α[f]	Comments
496.88[d] *12*	4.0 *7*	717.18	(5/2+,7/2)	220.330	5/2−			
[x]501.10[d] *7*	17.4 *8*							
[x]518.30 *25*	17 *4*							
[x]525.6[@] *3*	5.0 *5*							
532.20 *20*	7.0 *15*	790.78		258.270	9/2−	(M1)	0.0297	α(K)=0.0251 *4*; α(L)=0.00362 *5*; α(M)=0.000800 *12*; α(N+..)=0.000215 *3* α(N)=0.000187 *3*; α(O)=2.71×10^{-5} *4*; α(P)=1.515×10^{-6} *22*
534.60 *20*	9.0 *20*	717.18	(5/2+,7/2)	182.602	9/2+			
[x]541.65 *15*	23 *4*							
[x]549.30 *20*	6.0 *15*							
[x]558.30 *15*	13 *3*							
[x]559.3[@] *5*	3.0 *15*							
[x]567.00 *15*	7.0 *15*							
572.50[h] *25*	2.5 *7*	717.18	(5/2+,7/2)	144.232	7/2−	(M1,E2)	0.018 *7*	α(K)=0.015 *6*; α(L)=0.0024 *7*; α(M)=0.00053 *14*; α(N+..)=0.00014 *4* α(N)=0.00012 *4*; α(O)=1.8×10^{-5} *5*; α(P)=9.E−7 *4*
583.5 *3*	4.0 *15*	890.65		307.211	7/2−			
[x]601.20 *20*	2.5 *5*							
[x]605.30 *15*	6.0 *12*							
617.1 *4*	3.3 *12*	617.18	(5/2−,7/2−)	0	3/2−	(M1,E2)	0.015 *6*	α(K)=0.013 *5*; α(L)=0.0019 *6*; α(M)=0.00043 *12*; α(N+..)=0.00012 *4* α(N)=0.00010 *3*; α(O)=1.4×10^{-5} *5*; α(P)=7.E−7 *3*
619.3 *3*	6.0 *20*	890.65		271.481	5/2+	(M1,E2)	0.015 *6*	α(K)=0.012 *5*; α(L)=0.0019 *6*; α(M)=0.00043 *12*; α(N+..)=0.00011 *3* α(N)=0.00010 *3*; α(O)=1.4×10^{-5} *4*; α(P)=7.E−7 *3*
[x]634.20 *15*	6.5 *15*							
[x]642.90[@] *20*	1.5 *3*							
[x]690.50[@] *20*	6.0 *15*							
[x]693.60[@] *20*	3.0 *6*							
[x]703.8[@] *3*	2.0 *5*							
[x]713.20[a] *15*	2.5 *5*							
[x]729.60[&] *20*	5.0 *10*							
[x]733.30[@] *20*	4.0 *10*							
[x]737.20[@] *20*	3.0 *8*							
[x]740.00[@] *20*	3.0 *8*							
[x]755.7[@] *3*	4.0 *8*							
[x]757.90[@] *20*	2.0 *6*							
762.1 *2*	9.0 *15*	1191.14		429.05	11/2−			E_γ: Given as 762.1 *15* (1975Ag03), but uncertainty assumed to be a typographical error since this is strongest γ in this region.
770.60 *20*	5.0 *10*	990.87		220.330	5/2−			
778.70 *20*	4.0 *8*	1050.28		271.481	5/2+			
[x]783.70[@] *20*	4.0 *8*							
[x]787.1[@] *4*	1.5 *8*							

$^{159}_{68}$Er$_{91}$-8

γ(^{159}Er) (continued)

E_γ[†]	I_γ[†e]	E_i(level)	J_i^π	E_f	J_f^π	Comments
792.3 *3*	4.0 *12*	1050.28		258.270	9/2⁻	
[x]822.40[@] *25*	2.5 *7*					
[x]829.30 *25*	6.0 *15*					
[x]843.2[&] *3*	4.0 *10*					
[x]857.6 *3*	7.0 *20*					
888.3 *3*	3.0 *8*	1191.14		302.49	7/2⁺	
[x]902.3[a] *3*	7.0 *20*					
906.1 *4*	4.0 *12*	1050.28		144.232	7/2⁻	
[x]921.80[a] *20*	7.0 *15*					
933.10 *25*	3.0 *8*	1191.14		258.270	9/2⁻	
[x]956.20[@] *25*	11.0 *25*					
990.80 *20*	5.0 *10*	990.87		0	3/2⁻	
1059.80 *20*	3.0 *10*	1318.21	(7/2)	258.270	9/2⁻	
1131.9 *4*	2.0 *6*	1191.14		59.249	5/2⁻	
1135.60 *25*	12.0 *25*	1318.21	(7/2)	182.602	9/2⁺	
[x]1146.1[@] *3*	3.0 *10*					
[x]1168.3[@] *5*	1.5 *7*					
1174.5[h] *4*	3.0 *10*	1318.21	(7/2)	144.232	7/2⁻	
[x]1190.8[&] *5*	3.0 *15*					
[x]1208.2[&] *4*	6.0 *15*					
[x]1211.0[@] *4*	6.0 *15*					
[x]1247.9[@] *3*	9.0 *20*					
[x]1261.5[a] *3*	9.0 *20*					
[x]1270.1 *3*	15.0 *20*					
[x]1297.2[b] *7*	13. *3*					
[x]1355.5[b] *7*	13. *3*					
[x]1392.7[b] *8*	7.3 *14*					
[x]1400.94[c] *9*	7.1 *5*					E_γ,I_γ: Also reported by 1975St07 as 1400.7 *8*, 8.7 *14*.
[x]1402.7[c] *3*	1.8 *5*					
[x]1427.1[b] *8*	13. *3*					
[x]1437.74[c] *16*	2.5 *4*					
[x]1441.82[c] *19*	2.7 *4*					
[x]1455.6[c] *3*	1.0 *3*					
[x]1459.47[c] *9*	6.3 *4*					
[x]1466.45[c] *8*	6.1 *3*					
[x]1469.82[c] *16*	2.25 *23*					
[x]1476.15[c] *10*	3.4 *3*					
[x]1483.94[c] *25*	1.19 *25*					
[x]1496.46[c] *9*	2.81 *17*					

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$\gamma(^{159}Er)$ (continued)

E_γ [†]	I_γ [†e]	E_i(level)	Comments
[x]1500.14[c] *8*	3.76 *19*		
[x]1507.38[c] *10*	2.53 *18*		
[x]1513.26[c] *20*	2.4 *3*		
[x]1528.81[c] *20*	1.61 *21*		
[x]1553.2[b] *8*	13. *3*		
[x]1582.59[c] *22*	4.3 *7*		
[x]1591.17[c] *19*	1.6 *4*		
[x]1595.15[c] *13*	3.7 *3*		
[x]1598.92[c] *12*	4.19 *24*		
[x]1602.66[c] *11*	7.4 *3*		
[x]1610.22[c] *17*	2.3 *3*		
[x]1645.82[c] *14*	2.46 *19*		
[x]1652.7[c] *4*	0.69 *16*		
[x]1659.30[c] *19*	1.06 *15*		
[x]1666.88[c] *24*	1.49 *23*		
[x]1686.0[c] *4*	1.6 *3*		
[x]1715.41[c] *18*	5.6 *4*		
[x]1722.33[c] *24*	1.9 *3*		
[x]1734.1[c] *4*	1.4 *3*		
[x]1741.36[c] *26*	1.35 *22*		
[x]1749.42[c] *24*	2.8 *3*		
[x]1752.75[c] *24*	2.8 *3*		
[x]1761.96[c] *22*	3.8 *4*		
[x]1774.94[c] *25*	2.6 *4*		
[x]1806.63[c] *6*	3.32 *20*		
[x]1810.94[c] *10*	2.37 *19*		
[x]1814.67[c] *19*	1.03 *14*		
[x]1828.80[c] *21*	1.0 *2*		
[x]1838.8[b] *6*	19. *5*		
[x]1856.99[c] *24*	0.88 *14*		
[x]1861.83[c] *24*	1.6 *3*		
[x]1864.44[c] *15*	2.5 *3*		
[x]1891.0[b] *7*	17. *4*		
[x]1916.53[c] *12*	1.96 *16*		
[x]1919.34[c] *11*	2.19 *16*		
[x]1924.40[c] *5*	6.5 *3*		E_γ,I_γ: Also reported by 1975St07 as 1924.9 *12*, 7 *3*.
[x]1927.15[c] *10*	2.91 *20*		
[x]1935.9[c] *3*	1.34 *25*		
[x]1938.99[c] *13*	3.7 *3*		

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γ(^{159}Er) (continued)

$E_γ$[†]	$I_γ$[†e]	E_i(level)	Comments
[x]1943.1[c] *3*	0.67 *15*		
[x]1951.77[c] *16*	2.28 *25*		
[x]1956.64[c] *16*	1.72 *20*		
[x]1961.40[c] *4*	12.3 *4*		$E_γ$,$I_γ$: Also reported by 1975St07 as 1961.5 *9*, 9 *3*.
[x]1974.4[c] *4*	0.89 *2*		
[x]1978.34[c] *14*	2.37 *25*		
[x]1984.11[c] *9*	2.70 *25*		
[x]1990.23[c] *15*	1.6 *3*		
[x]1997.5[c] *3*	0.80 *15*		
[x]2002.6[b] *7*	17. *4*		
[x]2024.87[c] *16*	2.50 *20*		
[x]2031.79[c] *11*	3.08 *20*		
[x]2086.03[c] *17*	1.00 *13*		
[x]2090.6[b] *8*	7. *3*		
[x]2095.13[c] *20*	1.04 *12*		
[x]2110.8[c] *8*	0.42 *20*		
[x]2116.35[c] *25*	2.6 *4*		
[x]2131.51[c] *17*	1.9 *3*		
[x]2157.60[c] *12*	1.43 *15*		
[x]2169.26[c] *11*	2.34 *14*		
[x]2173.32[c] *24*	1.43 *15*		
[x]2177.23[c] *5*	8.0 *3*		$E_γ$,$I_γ$: Also reported by 1975St07 as 2177.2 *12*, 7 *3*.
[x]2189.29[c] *21*	1.88 *25*		
[x]2195.7[c] *4*	0.94 *20*		
[x]2202.2[c] *4*	0.94 *20*		
[x]2208.71[c] *6*	8.8 *4*		$E_γ$,$I_γ$: Also reported by 1975St07 as 2208.7 *10*, 7 *3*.
[x]2223.28[c] *9*	6.4 *3*		
[x]2227.9[c] *4*	1.4 *30*		
[x]2235.79[c] *17*	1.12 *16*		
[x]2241.26[c] *11*	1.79 *15*		
[x]2246.90[c] *13*	1.93 *15*		
[x]2251.13[c] *12*	2.32 *15*		
[x]2255.86[c] *19*	1.39 *14*		
[x]2259.98[c] *22*	1.13 *13*		
[x]2265.32[c] *11*	1.87 *25*		
[x]2273.09[c] *16*	1.61 *20*		
[x]2279.11[c] *25*	1.07 *15*		
[x]2284.28[c] *14*	2.14 *20*		
[x]2298.63[c] *18*	1.87 *20*		

γ(^{159}Er) (continued)

E_γ [†]	I_γ [†e]	E_i(level)	Comments
[x]2303.27[c] *21*	1.38 *15*		
[x]2309.53[c] *17*	1.43 *15*		
[x]2324.29[c] *10*	2.51 *14*		
[x]2332.09[c] *6*	3.71 *20*		
[x]2337.21[c] *7*	2.34 *18*		
[x]2343.20[c] *11*	1.24 *14*		
[x]2368.44[c] *16*	0.92 *12*		
[x]2377.0[c] *3*	0.57 *11*		
[x]2381.12[c] *14*	1.37 *15*		
[x]2408.38[c] *24*	0.99 *11*		
[x]2411.38[c] *16*	1.54 *15*		
[x]2422.33[c] *6*	5.67 *22*		E_γ,I_γ: Also reported by 1975St07 as 2422.3 *8*, 7 *3*.
[x]2430.74[c] *27*	0.84 *12*		
[x]2434.2[c] *7*	0.9 *3*		
[x]2436.3[c] *7*	1.1 *3*		
[x]2439.97[c] *9*	3.75 *20*		
[x]2466.82[c] *19*	1.06 *12*		
[x]2470.72[c] *20*	0.79 *10*		
[x]2508.01[c] *15*	0.93 *10*		
[x]2515.4[c] *3*	0.42 *8*		
[x]2521.5[c] *4*	0.48 *8*		
[x]2540.37[c] *22*	0.75 *9*		
[x]2549.62[c] *14*	0.97 *10*		
[x]2600.6[c] *3*	0.53 *10*		
[x]2615.21[c] *14*	0.79 *9*		
[x]2624.32[c] *19*	0.52 *8*		
[x]2644.70[c] *21*	0.89 *9*		
[x]2651.8[c] *3*	0.68 *7*		
[x]2659.73[c] *17*	1.07 *9*		
[x]2721.33[c] *14*	0.79 *10*		
[x]2731.0[c] *4*	0.42 *9*		
[x]2734.2[c] *4*	0.38 *9*		
[x]2775.0[b] *8*	9. *3*		
[x]2864.3[c] *4*	0.45 *8*		

[†] From 1975Ag03, unless otherwise noted. Other: 1975St07.

[‡] From ^{159}Er Adopted Gammas. They are from 1975St07 and based on α_K(exp) and L-subshell ratios, and from evaluator′s interpretation of α_K(exp) data of

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γ(^{159}Er) (continued)

1975Ag03.

[#] From ^{159}Er Adopted Gammas. They are based on the data from 1975St07.

[@] Assignment to decay of ^{159}Tm is uncertain (1975Ag03) and transition is not reported by 1975St07.

[&] Assignment to decay of ^{159}Tm is uncertain (1975Ag03). Transition is reported by 1975St07 with quite different intensity.

[a] Assignment to decay of ^{159}Tm is uncertain (1975Ag03), but transition is reported by 1975St07 with similar intensity.

[b] From 1975St07.

[c] From 1995AdZV.

[d] From 1997AdZY.

[e] For absolute intensity per 100 decays, multiply by 0.016.

[f] 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.

[g] Multiply placed with intensity suitably divided.

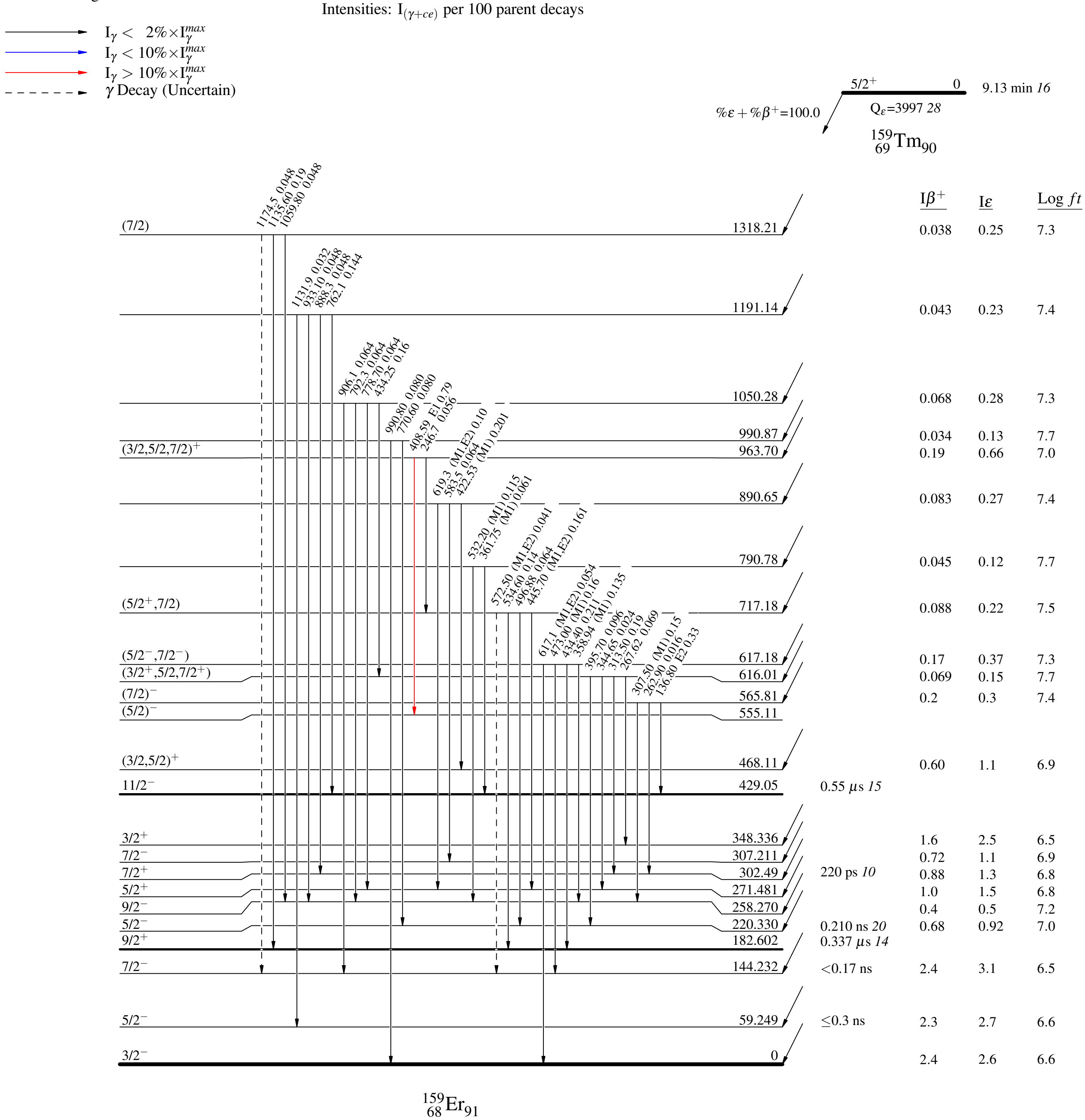
[h] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

^{159}Tm ε decay 1975Ag03,1975St07

Decay Scheme

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



^{159}Tm ε decay 1975Ag03,1975St07

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided