^{194}Pb ε decay (10.7 min) 1987El09

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 177, 1 (2021)	3-Sep-2021

Parent: ^{194}Pb: E=0.0; J$^\pi$=0$^+$; T$_{1/2}$=10.7 min *6*; Q(ε)=2730 *22*; %ε+%β^+ decay=100.0

^{194}Pb-T$_{1/2}$: From Adopted Levels of ^{194}Pb. It is weighted average of 10.0 min *4* (2003Su30), 12.0 min *5* (1987El09), 9.2 min *11* (1982Hi04), 11 min *2* (1960Ju01).

^{194}Pb-Q(ε): From 2021Wa16. Other: E(β^+)(max)=3.6 MeV *2* (1976WeZM) gives 4.6 MeV, in disagreement with value from 2021Wa16.

1987El09, 1987ElZY: ^{194}Pb ions were produced by bombarding natural tungsten target of five 4 mg/cm^2 foils with 125 MeV ^{16}O beam from the Holifield Heavy Ion Research Facility tandem Van de Graaff accelerator, separated with the UNISOR on-line facility, collected onto an automated tape system and then transported to a decay station. γ rays were detected with two large-volume Ge(Li) detectors and conversion electrons were detected with a Si(Li) detector. Measured Eγ, Iγ, E(ce), I(ce), $\gamma\gamma$-coin, ce-γ-coin. Deduced levels, J, π, decay branching ratios, log *ft*, conversion coefficients, γ-ray multipolarities, mixing ratios. ce data are not explicitly given in 1987El09 and are taken from 1987ElZY, a private communication with the authors of 1987El09.

Others: 2003Su30, 1982Hi04, 1978AtZZ, 1976WeZM, 1976RoZK, 1960Ju01, 1960An03. Only the 204γ was reported in earlier studies (1982Hi04, 1978AtZZ, 1960Ju01).

Total decay energy deposit of 2778 *67* (calculated by RADLIST) is in a good agreement with Q-value=2730 *22* (2021Wa16), indicating the completeness of this decay scheme.

^{194}Tl Levels

E(level)†	J$^\pi$‡	E(level)†	J$^\pi$‡	E(level)†	J$^\pi$‡	E(level)†	J$^\pi$‡
0.0	2$^-$	589.16 *4*	(2$^-$)	1178.79 *8*	(1$^-$)	1722.97 *17*	(0$^-$,1)
192.14 *4*	(0)$^-$	752.93 *6*	(0$^-$,1$^-$)	1187.55 *7*	(0$^-$,1$^-$)	1753.12 *15*	(0,1)
203.82 *3*	1$^-$	785.75 *5*	(1$^-$)	1272.20 *8*	(0$^-$,1$^-$,2$^-$)	1810.46 *12*	(1)
225.00 *4*	(2)$^-$	833.27 *4*	(1$^-$)	1519.33 *6*	1$^+$	1858.8 *10*	(0,1,2$^-$)
270.49 *4*	(3)$^-$	979.00 *11*	(1$^-$,2$^-$)	1553.09 *13*	(0,1)	2192.7 *3*	(1,2$^-$)
367.74 *4*	1$^-$	998.43 *6*	1$^{(-)}$	1602.81 *20*	(0$^-$,1,2$^-$)	2343.4 *5*	(0$^-$,1)
459.92 *4*	(2$^-$)	1010.52 *5*	(1$^-$)	1638.93 *9*	(1$^-$)		
521.52 *3*	1$^{(-)}$	1152.01 *7*	(1$^-$)	1707.61 *9*	(1$^-$)		

† From a least-squares fit to γ-ray energies.
‡ From Adopted Levels.

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
(387 *22*)	2343.4		0.269 *15*	5.90 *8*	0.269 *15*	εK=0.741 *6*; εL=0.193 *5*; εM+=0.0661 *17*
(537 *22*)	2192.7		0.17 *3*	6.43 *9*	0.17 *3*	εK=0.766 *3*; εL=0.1754 *19*; εM+=0.0589 *8*
(871 *22*)	1858.8		0.21 *5*	6.81 *11*	0.21 *5*	εK=0.7868 *9*; εL=0.1602 *6*; εM+=0.05292 *24*
(920 *22*)	1810.46		2.56 *9*	5.78 *4*	2.56 *9*	εK=0.7885 *8*; εL=0.1591 *6*; εM+=0.05245 *21*
(977 *22*)	1753.12		2.06 *9*	5.93 *4*	2.06 *9*	εK=0.7902 *7*; εL=0.1578 *5*; εM+=0.05196 *18*
(1007 *22*)	1722.97		0.65 *11*	6.46 *8*	0.65 *11*	εK=0.7910 *6*; εL=0.1572 *5*; εM+=0.05173 *17*
(1022 *22*)	1707.61		1.49 *16*	6.11 *6*	1.49 *16*	εK=0.7914 *6*; εL=0.1569 *5*; εM+=0.05162 *17*
(1091 *22*)	1638.93		1.97 *9*	6.05 *4*	1.97 *9*	εK=0.7931 *5*; εL=0.1558 *4*; εM+=0.05116 *14*
(1127 *22*)	1602.81		0.272 *17*	6.94 *4*	0.272 *17*	εK=0.7938 *5*; εL=0.1552 *4*; εM+=0.05094 *13*
(1177 *22*)	1553.09		1.40 *7*	6.27 *4*	1.40 *7*	εK=0.7948 *5*; εL=0.1545 *3*; εM+=0.05067 *12*
(1211 *22*)	1519.33		24.3 *16*	5.06 *5*	24.3 *16*	εK=0.7954 *4*; εL=0.1541 *3*; εM+=0.05049 *12*
(1458 *22*)	1272.20		0.65 *5*	6.80 *5*	0.65 *5*	εK=0.7987 *2*; εL=0.15145 *21*; εM+=0.04947 *8*
(1542 *22*)	1187.55	0.0046 *8*	5.45 *2*	5.93 *3*	5.45 *20*	av Eβ=255.9 *99*; εK=0.7993 *2*; εL=0.15070 *19*; εM+=0.04918 *8*

Continued on next page (footnotes at end of table)

^{194}Pb ε decay (10.7 min) 1987El09 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I($\varepsilon+\beta^+$)†‡	Comments
(1551 *22*)	1178.79	0.00100 *19*	1.12 *6*	6.62 *4*	1.12 *6*	av Eβ=259.9 *99*; εK=0.7993 *2*; εL=0.15063 *19*; εM+=0.04916 *8*
(1578 *22*)	1152.01	0.0023 *4*	2.09 *17*	6.36 *5*	2.09 *17*	av Eβ=271.8 *99*; εK=0.79943 *9*; εL=0.15040 *19*; εM+=0.04907 *7*
(1719 *22*)	1010.52	0.013 *2*	5.0 *3*	6.06 *4*	5.0 *3*	av Eβ=334.6 *98*; εK=0.79945 *9*; εL=0.14924 *18*; εM+=0.04863 *7*
(1732 *22*)	998.43	0.011 *2*	4.0 *3*	6.17 *5*	4.0 *3*	av Eβ=340.0 *98*; εK=0.7994 *1*; εL=0.14914 *18*; εM+=0.04859 *7*
(1751 *22*)	979.00	0.0019 *2*	0.60 *1*	7.00 *3*	0.60 *10*	av Eβ=348.5 *97*; εK=0.7993 *2*; εL=0.14898 *19*; εM+=0.04853 *7*
(1897 *22*)	833.27	0.0080 *12*	1.28 *14*	6.74 *6*	1.29 *14*	av Eβ=412.6 *97*; εK=0.7979 *4*; εL=0.14775 *20*; εM+=0.04808 *7*
(1944 *22*)	785.75	0.184 *18*	24.2 *11*	5.49 *4*	24.4 *11*	av Eβ=433.4 *97*; εK=0.7972 *4*; εL=0.14734 *20*; εM+=0.04793 *8*
(1977 *22*)	752.93	0.0159 *17*	1.84 *13*	6.62 *4*	1.86 *13*	av Eβ=447.8 *97*; εK=0.7966 *5*; εL=0.14704 *21*; εM+=0.04783 *8*
(2141 *22*)	589.16	0.0032 *4*	0.95 *10*	8.20^{1u} *6*	0.95 *10*	av Eβ=527.6 *94*; εK=0.7896; εL=0.15577 *23*; εM+=0.05123 *9*
(2208 *22*)	521.52	0.065 *6*	3.50 *21*	6.44 *4*	3.56 *21*	av Eβ=549.1 *97*; εK=0.7901 *9*; εL=0.14471 *25*; εM+=0.04701 *9*
(2270 *22*)	459.92	0.018 *3*	3.4 *6*	7.75^{1u} *9*	3.4 *6*	av Eβ=582.2 *93*; εK=0.7896; εL=0.15446 *22*; εM+=0.05073 *9*
(2362 *22*)	367.74	0.068 *25*	2.4 *9*	6.66 *16*	2.5 *9*	av Eβ=616.3 *97*; εK=0.7836 *11*; εL=0.1429 *3*; εM+=0.04639 *10*
(2505# *22*)	225.00	<0.002	<0.2	>9.2^{1u}	<0.2	av Eβ=681.0 *94*; εK=0.7879 *3*; εL=0.15216 *22*; εM+=0.04987 *8*
(2526 *22*)	203.82	0.18 *7*	4.4 *17*	6.46 *18*	4.6 *18*	av Eβ=688.1 *97*; εK=0.7745 *14*; εL=0.1407 *4*; εM+=0.04564 *11*
(2538 *22*)	192.14	0.14 *1*	3.3 *2*	6.60 *4*	3.4 *2*	av Eβ=693.3 *97*; εK=0.7737 *15*; εL=0.1405 *4*; εM+=0.04558 *11*
(2730# *22*)	0.0	<0.025	<1.5	>8.4^{1u}	<1.5	av Eβ=775.4 *93*; εK=0.7842 *5*; εL=0.14990 *23*; εM+=0.04905 *9* Iβ^+: corresponding to log $f^{1u}t$>8.5 for a possible first-forbidden unique transition.

† From γ+ce intensity balance at each level, unless otherwise noted.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{194}Tl)

Iγ normalization: From I(γ+ce to g.s.)=99.25% *75*, assuming ε+β^+ feeding to g.s. as <1.5% corresponding to log $f^{1u}t$>8.5 for a possible first-forbidden unique transition. Total unassigned γ intensity is ≈8%.

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	$I_{(\gamma+ce)}$[a]	Comments
45.5 *10*	≈0.19	270.49	(3)⁻	225.00	(2)⁻	[M1]		15.7 *11*	≈3.1	%Iγ≈0.030 ce(L)/(γ+ce)=0.72 *4*; ce(M)/(γ+ce)=0.168 *15* ce(N)/(γ+ce)=0.043 *4*; ce(O)/(γ+ce)=0.0083 *8*; ce(P)/(γ+ce)=0.00078 *8* α(L)=12.1 *9*; α(M)=2.82 *20* α(N)=0.71 *5*; α(O)=0.138 *10*; α(P)=0.0131 *9* E_γ,$I_{(\gamma+ce)}$: from (189.4γ)(203.8γ) (1987El09). I_γ: from I(γ+ce) and theoretical α(total).
66.7 *10*	≈0.11	270.49	(3)⁻	203.82	1⁻	[E2]		37 *3*	≈4.3	%Iγ≈0.019 ce(L)/(γ+ce)=0.73 *4*; ce(M)/(γ+ce)=0.191 *19* ce(N)/(γ+ce)=0.048 *5*; ce(O)/(γ+ce)=0.0082 *9*; ce(P)/(γ+ce)=0.000234 *25* α(L)=27.3 *21*; α(M)=7.2 *6* α(N)=1.79 *14*; α(O)=0.307 *24*; α(P)=0.0088 *7* E_γ,$I_{(\gamma+ce)}$: from (189.4γ)(225.0γ) (1987El09). I_γ: from I(γ+ce) and theoretical α(total).
92.2 *2*	0.44 *4*	459.92	(2⁻)	367.74	1⁻	[M1,E2]		9.6 *13*		%Iγ=0.073 *7* α(K)=5 *5*; α(L)=3.7 *22*; α(M)=0.9 *6* α(N)=0.24 *15*; α(O)=0.042 *25*; α(P)=0.00184 *19*
ˣ115.18 *4*	0.57 *3*									%Iγ=0.095 *6*
ˣ140.0 *2*	0.45 *14*									%Iγ=0.075 *24*
142.94 *10*	1.72 *18*	367.74	1⁻	225.00	(2)⁻	[M1,E2]		2.2 *9*		%Iγ=0.29 *3* α(K)=1.4 *11*; α(L)=0.60 *18*; α(M)=0.15 *5* α(N)=0.038 *13*; α(O)=0.0069 *20*; α(P)=0.00039 *8*
153.8 *2*	1.51 *16*	521.52	1⁽⁻⁾	367.74	1⁻	(M1)		2.52		%Iγ=0.25 *3* α(K)=2.06 *3*; α(L)=0.352 *5*; α(M)=0.0822 *12* α(N)=0.0208 *3*; α(O)=0.00403 *6*; α(P)=0.000381 *6*
163.90 *10*	2.57 *6*	367.74	1⁻	203.82	1⁻	M1+E2	≈1	≈1.468		%Iγ=0.427 *15* α(K)≈0.994; α(L)≈0.358; α(M)≈0.0895 α(N)≈0.0225; α(O)≈0.00408; α(P)≈0.000249 Mult.: α(L2)exp≈0.10, K/L2>5, L2>L1, L2>L3.
175.68 *12*	2.12 *10*	367.74	1⁻	192.14	(0)⁻	M1		1.731		%Iγ=0.352 *19* α(K)=1.416 *20*; α(L)=0.241 *4*; α(M)=0.0564 *8* α(N)=0.01423 *21*; α(O)=0.00276 *4*; α(P)=0.000261 *4* Mult.: α(L1)exp=0.20 *3*, K/L≈5.8, L1>L2, L1>L3.
189.0[‡] *4*	≈0.7[‡]	1187.55	(0⁻,1⁻)	998.43	1⁽⁻⁾	[M1,E2]		1.0 *5*		%Iγ≈0.12 α(K)=0.7 *5*; α(L)=0.212 *17*; α(M)=0.053 *7* α(N)=0.0132 *17*; α(O)=0.00242 *18*; α(P)=0.00016 *6*

γ(^{194}Tl) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	Comments
189.44 *5*	9.3 *13*	459.92	(2⁻)	270.49	(3)⁻	(M1(+E2))	<0.1	1.396	%Iγ=1.54 *22* α(K)=1.141 *17*; α(L)=0.195 *3*; α(M)=0.0456 *7* α(N)=0.01152 *17*; α(O)=0.00224 *4*; α(P)=0.000211 *3*
192.02 *5*	27.7 *6*	192.14	(0)⁻	0.0	2⁻	E2		0.471	%Iγ=4.60 *15* α(K)=0.186 *3*; α(L)=0.213 *3*; α(M)=0.0554 *8* α(N)=0.01388 *20*; α(O)=0.00242 *4*; α(P)=9.85×10^{-5} *14* Mult.: K/L=5.6 *4*, α(K)exp=0.18 *2*.
[x]194.9 *2*	0.77 *12*								%Iγ=0.128 *21*
203.80 *6*	100 *4*	203.82	1⁻	0.0	2⁻	M1(+E2)	<0.3	1.11 *4*	%Iγ=16.6 *6* α(K)=0.90 *4*; α(L)=0.1591 *23*; α(M)=0.0373 *6* α(N)=0.00942 *15*; α(O)=0.00182 *3*; α(P)=0.000168 *5* Mult.: K/L=5.6 *4*, α(K)exp=1.1 *2*.
220.05[#e] *12*	2.0 *2*	1858.8	(0,1,2⁻)	1638.93	(1⁻)	[D,E2]		0.5 *4*	%Iγ=0.33 *4*
225.00 *8*	31 *3*	225.00	(2)⁻	0.0	2⁻	M1(+E2)	<0.3	0.84 *3*	%Iγ=5.1 *5* α(K)=0.69 *3*; α(L)=0.1199 *18*; α(M)=0.0281 *4* α(N)=0.00710 *10*; α(O)=0.001373 *20*; α(P)=0.000127 *4* Mult.: K/L=5.6 *7*, α(K)exp=0.72 *6*.
244.93[@] *10*	1.22 *8*	998.43	1$^{(-)}$	752.93	(0⁻,1⁻)	[M1,E2]		0.45 *24*	%Iγ=0.203 *15* α(K)=0.33 *23*; α(L)=0.086 *9*; α(M)=0.0211 *12* α(N)=0.0053 *3*; α(O)=0.00099 *11*; α(P)=7.E−5 *4*
257.95[@] *10*	1.47 *12*	1010.52	(1⁻)	752.93	(0⁻,1⁻)	[M1,E2]		0.38 *21*	%Iγ=0.244 *21* α(K)=0.29 *20*; α(L)=0.073 *10*; α(M)=0.0177 *15* α(N)=0.0045 *4*; α(O)=0.00083 *12*; α(P)=6.E−5 *3*
267.92[#e] *10*	0.91 *3*	459.92	(2⁻)	192.14	(0)⁻	[E2]		0.1564	%Iγ=0.151 *7* α(K)=0.0839 *12*; α(L)=0.0544 *8*; α(M)=0.01396 *20* α(N)=0.00350 *5*; α(O)=0.000620 *9*; α(P)=3.01×10^{-5} *5*
270.52 *4*	12.8 *7*	270.49	(3)⁻	0.0	2⁻	M1(+E2)	<0.25	0.510 *13*	%Iγ=2.13 *13* α(K)=0.416 *12*; α(L)=0.0716 *12*; α(M)=0.0167 *3* α(N)=0.00423 *7*; α(O)=0.000819 *14*; α(P)=7.67×10^{-5} *18* Mult.: K/L=6.0 *6*, α(K)exp=0.54 *12*.
292.98[c#e] *6*	5.2[c] *3*	752.93	(0⁻,1⁻)	459.92	(2⁻)	[M1,E2]		0.27 *15*	%Iγ=0.86 *6* α(K)=0.21 *14*; α(L)=0.048 *10*; α(M)=0.0117 *19* α(N)=0.0029 *5*; α(O)=0.00055 *12*; α(P)=4.3×10^{-5} *21*
292.98[c#e] *6*	5.2[c] *3*	1272.20	(0⁻,1⁻,2⁻)	979.00	(1⁻,2⁻)	[M1,E2]		0.27 *15*	%Iγ=0.86 *6* α(K)=0.21 *14*; α(L)=0.048 *10*; α(M)=0.0117 *19* α(N)=0.0029 *5*; α(O)=0.00055 *12*; α(P)=4.3×10^{-5} *21*
296.40 *6*	3.01 *7*	521.52	1$^{(-)}$	225.00	(2)⁻	(M1)		0.405	%Iγ=0.500 *18* α(K)=0.332 *5*; α(L)=0.0561 *8*; α(M)=0.01308 *19* α(N)=0.00330 *5*; α(O)=0.000642 *9*; α(P)=6.07×10^{-5} *9*
311.84 *5*	1.41 *10*	833.27	(1⁻)	521.52	1$^{(-)}$	(M1+E2)	1.0 *3*	0.23 *5*	%Iγ=0.234 *18* α(K)=0.17 *4*; α(L)=0.040 *4*; α(M)=0.0096 *7* α(N)=0.00241 *17*; α(O)=0.00045 *4*; α(P)=3.6×10^{-5} *6*

$^{194}_{81}$Tl$_{113}$-4

γ(^{194}Tl) (continued)

$E_γ$[†]	$I_γ$[†a]	E_i(level)	$J_i^π$	E_f	$J_f^π$	Mult.[&]	δ[&]	α[b]	Comments
[x]313.13 *5*	0.69 *9*								%Iγ=0.115 *16*
317.70 *5*	3.58 *7*	521.52	$1^{(-)}$	203.82	1^-	(M1(+E2))	<0.5	0.311 *25*	%Iγ=0.594 *19* α(K)=0.253 *23*; α(L)=0.0446 *19*; α(M)=0.0105 *4* α(N)=0.00264 *10*; α(O)=0.000510 *22*; α(P)=4.7×10^{-5} *4*
318.69 *5*	3.96 *8*	589.16	(2^-)	270.49	$(3)^-$	(M1(+E2))	<0.4	0.316 *18*	%Iγ=0.658 *22* α(K)=0.258 *16*; α(L)=0.0447 *14*; α(M)=0.0105 *3* α(N)=0.00264 *8*; α(O)=0.000512 *16*; α(P)=4.75×10^{-5} *24*
329.48 *5*	0.99 *10*	521.52	$1^{(-)}$	192.14	$(0)^-$	(M1)		0.304	%Iγ=0.164 *17* α(K)=0.249 *4*; α(L)=0.0420 *6*; α(M)=0.00979 *14* α(N)=0.00247 *4*; α(O)=0.000480 *7*; α(P)=4.54×10^{-5} *7* δ(E2/M1)<0.5, adopted $ΔJ^π$ requires M1.
[x]360.78 *3*	2.7 *3*								%Iγ=0.45 *5*
367.80 *10*	50 *4*	367.74	1^-	0.0	2^-	(M1(+E2))	<0.1	0.225	%Iγ=8.3 *7* α(K)=0.184 *3*; α(L)=0.0310 *5*; α(M)=0.00724 *11* α(N)=0.00183 *3*; α(O)=0.000355 *5*; α(P)=3.36×10^{-5} *5*
373.39 *4*	1.62 *9*	833.27	(1^-)	459.92	(2^-)	(M1(+E2))	<0.5	0.201 *16*	%Iγ=0.269 *17* α(K)=0.164 *15*; α(L)=0.0284 *15*; α(M)=0.0067 *4* α(N)=0.00168 *8*; α(O)=0.000325 *17*; α(P)=3.01×10^{-5} *23*
[x]383.60 *3*	1.67 *17*								%Iγ=0.28 *3*
385.33 *3*	1.72 *18*	589.16	(2^-)	203.82	1^-	[M1,E2]		0.13 *8*	%Iγ=0.29 *3* α(K)=0.10 *7*; α(L)=0.021 *7*; α(M)=0.0050 *15* α(N)=0.0013 *4*; α(O)=0.00024 *8*; α(P)=2.0×10^{-5} *10*
392.63[@] *10*	0.90 *14*	1178.79	(1^-)	785.75	(1^-)	(E2(+M1))	>3	0.059 *7*	%Iγ=0.149 *24* α(K)=0.040 *6*; α(L)=0.0139 *7*; α(M)=0.00348 *15* α(N)=0.00087 *4*; α(O)=0.000159 *8*; α(P)=1.01×10^{-5} *10*
417.92 *6*	14.0 *2*	785.75	(1^-)	367.74	1^-	(M1(+E2))	<0.3	0.155 *6*	%Iγ=2.32 *7* α(K)=0.127 *5*; α(L)=0.0215 *6*; α(M)=0.00503 *13* α(N)=0.00127 *4*; α(O)=0.000246 *7*; α(P)=2.32×10^{-5} *8*
438.83 *10*	1.33 *6*	1272.20	$(0^-,1^-,2^-)$	833.27	(1^-)	[M1,E2]		0.09 *5*	%Iγ=0.221 *12* α(K)=0.07 *5*; α(L)=0.014 *5*; α(M)=0.0034 *11* α(N)=0.0009 *3*; α(O)=0.00016 *6*; α(P)=1.4×10^{-5} *8*
[x]453.5 *2*	1.37 *5*								%Iγ=0.227 *11*
457.5 *2*	1.6 *4*	979.00	$(1^-,2^-)$	521.52	$1^{(-)}$	[M1,E2]		0.08 *5*	%Iγ=0.27 *7* α(K)=0.06 *4*; α(L)=0.013 *5*; α(M)=0.0030 *11* α(N)=0.0008 *3*; α(O)=0.00014 *6*; α(P)=1.2×10^{-5} *7*
460.05 *10*	18.7 *3*	459.92	(2^-)	0.0	2^-	(M1+E2)	0.9 *2*	0.084 *11*	%Iγ=3.10 *10* α(K)=0.067 *10*; α(L)=0.0129 *11*; α(M)=0.00306 *25* α(N)=0.00077 *7*; α(O)=0.000148 *13*; α(P)=1.28×10^{-5} *15*
[x]463.1 *2*	1.76 *9*								%Iγ=0.292 *17*
465.8 *2*	0.79 *8*	833.27	(1^-)	367.74	1^-	(M1)		0.1200	%Iγ=0.131 *14* α(K)=0.0986 *14*; α(L)=0.01645 *24*; α(M)=0.00383 *6* α(N)=0.000967 *14*; α(O)=0.000188 *3*; α(P)=1.78×10^{-5} *3*

γ(^{194}Tl) (continued)

Eγ[†]	Iγ[†a]	Ei(level)	Jπi	Ef	Jπf	Mult.[&]	δ[&]	α[b]	Comments
x487.6 2	3.80 8								%Iγ=0.631 21
489.0 2	1.65 7	1010.52	(1⁻)	521.52	1(−)	[M1,E2]		0.07 4	%Iγ=0.274 14 α(K)=0.05 4; α(L)=0.010 4; α(M)=0.0025 9 α(N)=0.00063 23; α(O)=0.00012 5; α(P)=1.0×10⁻⁵ 6
x498.7 2	2.8 3								%Iγ=0.46 5
521.55 5	25.2 6	521.52	1(−)	0.0	2⁻	(M1(+E2))	<0.3	0.086 3	%Iγ=4.18 15 α(K)=0.0709 25; α(L)=0.0119 4; α(M)=0.00277 8 α(N)=0.000699 19; α(O)=0.000136 4; α(P)=1.28×10⁻⁵ 5 Iγ: incorrectly quoted as 2.5 6 in 1987El09.
527.7 2	0.47 7	752.93	(0⁻,1⁻)	225.00	(2)⁻	[M1,E2]		0.06 3	%Iγ=0.078 12 α(K)=0.04 3; α(L)=0.008 4; α(M)=0.0020 8 α(N)=0.00051 19; α(O)=0.00010 4; α(P)=8.E−6 5
540.5 2	2.64 8	1519.33	1⁺	979.00	(1⁻,2⁻)	[E1]		0.00785	%Iγ=0.438 18 α(K)=0.00651 10; α(L)=0.001028 15; α(M)=0.000238 4 α(N)=5.97×10⁻⁵ 9; α(O)=1.143×10⁻⁵ 16; α(P)=1.000×10⁻⁶ 14
549.0 1	4.86 7	752.93	(0⁻,1⁻)	203.82	1⁻	(M1,E2)		0.05 3	%Iγ=0.807 24 α(K)=0.040 24; α(L)=0.008 3; α(M)=0.0018 7 α(N)=0.00045 18; α(O)=9.E−5 4; α(P)=8.E−6 4
550.6 3	1.18 6	1010.52	(1⁻)	459.92	(2⁻)	[M1,E2]		0.05 3	%Iγ=0.196 12 α(K)=0.040 24; α(L)=0.008 3; α(M)=0.0018 7 α(N)=0.00045 17; α(O)=9.E−5 4; α(P)=8.E−6 4
553.3[#e] 2	1.27 7	2192.7	(1,2⁻)	1638.93	(1⁻)				%Iγ=0.211 13
560.69 10	8.34 17	785.75	(1⁻)	225.00	(2)⁻	[M1,E2]		0.05 3	%Iγ=1.38 5 α(K)=0.038 23; α(L)=0.007 3; α(M)=0.0017 7 α(N)=0.00043 17; α(O)=8.E−5 4; α(P)=7.E−6 4
581.82 10	116 4	785.75	(1⁻)	203.82	1⁻	(M1(+E2))	<0.4	0.064 4	%Iγ=19.3 7 α(K)=0.052 3; α(L)=0.0087 4; α(M)=0.00204 9 α(N)=0.000514 22; α(O)=0.000100 5; α(P)=9.4×10⁻⁶ 5
x584.8 3	0.39 19								%Iγ=0.06 4
589.1 2	2.34 7	589.16	(2⁻)	0.0	2⁻	(M1(+E2))	<0.3	0.0628 21	%Iγ=0.389 16 α(K)=0.0515 18; α(L)=0.00860 25; α(M)=0.00200 6 α(N)=0.000505 14; α(O)=9.8×10⁻⁵ 3; α(P)=9.3×10⁻⁶ 3
x595.8 3	0.94 6								%Iγ=0.156 11
x598.7 3	0.94 7								%Iγ=0.156 13
x609.3 3	1.39 14								%Iγ=0.231 24
611.0 3	1.06 11	979.00	(1⁻,2⁻)	367.74	1⁻	[M1,E2]		0.038 21	%Iγ=0.176 19 α(K)=0.031 18; α(L)=0.0057 24; α(M)=0.0013 6 α(N)=0.00034 14; α(O)=6.E−5 3; α(P)=6.E−6 3
628.1[#e] 3	0.96 20	1638.93	(1⁻)	1010.52	(1⁻)				%Iγ=0.16 4
629.9 3	3.8 4	833.27	(1⁻)	203.82	1⁻	(M1)		0.0543	%Iγ=0.63 7 α(K)=0.0446 7; α(L)=0.00738 11; α(M)=0.001717 25 α(N)=0.000433 6; α(O)=8.43×10⁻⁵ 12; α(P)=8.00×10⁻⁶ 12
630.8[‡] 3	≈1.2[‡]	998.43	1(−)	367.74	1⁻	[M1,E2]		0.035 19	%Iγ≈0.20

$^{194}_{81}$Tl$_{113}$-6

$\gamma(^{194}Tl)$ (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	δ[&]	α[b]	Comments
									α(K)=0.028 *16*; α(L)=0.0052 *22*; α(M)=0.0012 *5* α(N)=0.00031 *13*; α(O)=5.9×10^{-5} *25*; α(P)=5.E−6 *3*
640.55[@] *8*	3.4 *5*	833.27	(1$^-$)	192.14	(0)$^-$	[M1]		0.0519	%Iγ=0.56 *9* α(K)=0.0427 *6*; α(L)=0.00706 *10*; α(M)=0.001643 *23* α(N)=0.000415 *6*; α(O)=8.06×10^{-5} *12*; α(P)=7.66×10^{-6} *11*
642.79 *8*	5.2 *6*	1010.52	(1$^-$)	367.74	1$^-$	(M1)		0.0515	%Iγ=0.86 *11* α(K)=0.0423 *6*; α(L)=0.00700 *10*; α(M)=0.001628 *23* α(N)=0.000411 *6*; α(O)=7.99×10^{-5} *12*; α(P)=7.59×10^{-6} *11*
^{x}652.8 *1*	2.7 *3*								%Iγ=0.45 *5*
^{x}654.7 *1*	0.86 *22*								%Iγ=0.14 *4*
^{x}663.9 *1*	1.00 *6*								%Iγ=0.166 *11*
666.05 *8*	10.19 *28*	1187.55	(0$^-$,1$^-$)	521.52	1$^{(-)}$	(M1(+E2))	<0.4	0.0447 *24*	%Iγ=1.69 *7* α(K)=0.0367 *20*; α(L)=0.0061 *3*; α(M)=0.00142 *7* α(N)=0.000360 *16*; α(O)=7.0×10^{-5} *3*; α(P)=6.6×10^{-6} *4* I_γ: authors′ ΔIγ of 0.18 increased to 0.28.
685.93 *10*	3.84 *7*	1519.33	1$^+$	833.27	(1$^-$)				%Iγ=0.638 *20*
752.8 *2*	9.2 *4*	752.93	(0$^-$,1$^-$)	0.0	2$^-$	[M1,E2]		0.023 *12*	%Iγ=1.53 *8* α(K)=0.018 *10*; α(L)=0.0033 *14*; α(M)=0.0008 *3* α(N)=0.00019 *8*; α(O)=3.7×10^{-5} *16*; α(P)=3.4×10^{-6} *17*
754.4 *2*	2.7 *3*	979.00	(1$^-$,2$^-$)	225.00	(2)$^-$	[M1,E2]		0.023 *12*	%Iγ=0.45 *5* α(K)=0.018 *10*; α(L)=0.0033 *14*; α(M)=0.0008 *3* α(N)=0.00019 *8*; α(O)=3.7×10^{-5} *16*; α(P)=3.4×10^{-6} *17*
773.46 *20*	2.53 *8*	998.43	1$^{(-)}$	225.00	(2)$^-$	(M1(+E2))	<0.7	0.028 *4*	%Iγ=0.420 *17* α(K)=0.023 *3*; α(L)=0.0039 *5*; α(M)=0.00091 *10* α(N)=0.000229 *24*; α(O)=4.4×10^{-5} *5*; α(P)=4.2×10^{-6} *5*
774.9 *3*	0.69 *3*	979.00	(1$^-$,2$^-$)	203.82	1$^-$	(M1)		0.0317	%Iγ=0.115 *6* α(K)=0.0261 *4*; α(L)=0.00429 *6*; α(M)=0.000997 *14* α(N)=0.000252 *4*; α(O)=4.89×10^{-5} *7*; α(P)=4.65×10^{-6} *7*
784.2 *4*	1.9 *9*	1152.01	(1$^-$)	367.74	1$^-$	[M1,E2]		0.021 *11*	%Iγ=0.32 *15* α(K)=0.017 *9*; α(L)=0.0029 *13*; α(M)=0.0007 *3* α(N)=0.00017 *7*; α(O)=3.4×10^{-5} *14*; α(P)=3.0×10^{-6} *15*
785.54[d] *10*	2.4[d] *14*	785.75	(1$^-$)	0.0	2$^-$	[M1,E2]		0.020 *11*	%Iγ=0.40 *24* α(K)=0.017 *9*; α(L)=0.0029 *12*; α(M)=0.0007 *3* α(N)=0.00017 *7*; α(O)=3.3×10^{-5} *14*; α(P)=3.0×10^{-6} *15*
785.54[d] *10*	1.9[d] *12*	1010.52	(1$^-$)	225.00	(2)$^-$	[M1,E2]		0.020 *11*	%Iγ=0.32 *20* α(K)=0.017 *9*; α(L)=0.0029 *12*; α(M)=0.0007 *3* α(N)=0.00017 *7*; α(O)=3.3×10^{-5} *14*; α(P)=3.0×10^{-6} *15*
786.7[#e] *2*	0.6 *3*	979.00	(1$^-$,2$^-$)	192.14	(0)$^-$				%Iγ=0.10 *5*
794.85 *7*	6.8 *7*	998.43	1$^{(-)}$	203.82	1$^-$	(M1,E2)		0.020 *10*	%Iγ=1.13 *12* α(K)=0.016 *9*; α(L)=0.0028 *12*; α(M)=0.0007 *3* α(N)=0.00017 *7*; α(O)=3.2×10^{-5} *14*; α(P)=2.9×10^{-6} *15*
806.52 *7*	5.90 *19*	1010.52	(1$^-$)	203.82	1$^-$	[M1,E2]		0.019 *10*	%Iγ=0.98 *4*

γ(^{194}Tl) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	δ[&]	α[b]	Comments
									α(K)=0.016 *8*; α(L)=0.0027 *12*; α(M)=0.0006 *3* α(N)=0.00016 *7*; α(O)=3.1×10^{-5} *13*; α(P)=2.8×10^{-6} *14*
811.49 *10*	2.38 *11*	1178.79	(1$^-$)	367.74	1$^-$	(M1,E2)		0.019 *10*	%Iγ=0.395 *21* α(K)=0.015 *8*; α(L)=0.0027 *11*; α(M)=0.0006 *3* α(N)=0.00016 *7*; α(O)=3.1×10^{-5} *13*; α(P)=2.8×10^{-6} *14*
818.0 *2*	4.99 *22*	1010.52	(1$^-$)	192.14	(0)$^-$	(M1)		0.0276	%Iγ=0.83 *5* α(K)=0.0227 *4*; α(L)=0.00372 *6*; α(M)=0.000866 *13* α(N)=0.000219 *3*; α(O)=4.25×10^{-5} *6*; α(P)=4.04×10^{-6} *6*
819.50 *20*	13.8 *3*	1187.55	(0$^-$,1$^-$)	367.74	1$^-$	[M1,E2]		0.018 *9*	%Iγ=2.29 *8* α(K)=0.015 *8*; α(L)=0.0026 *11*; α(M)=0.00062 *25* α(N)=0.00016 *7*; α(O)=3.0×10^{-5} *13*; α(P)=2.7×10^{-6} *13*
833.4 *3*	0.9 *3*	833.27	(1$^-$)	0.0	2$^-$	[M1,E2]		0.018 *9*	%Iγ=0.15 *5* α(K)=0.014 *8*; α(L)=0.0025 *11*; α(M)=0.00059 *24* α(N)=0.00015 *6*; α(O)=2.9×10^{-5} *12*; α(P)=2.6×10^{-6} *13*
852.94 *10*	2.71 *11*	1638.93	(1$^-$)	785.75	(1$^-$)	(E2(+M1))	>2	0.0103 *17*	%Iγ=0.450 *22* α(K)=0.0082 *14*; α(L)=0.00160 *20*; α(M)=0.00038 *5* α(N)=9.6×10^{-5} *12*; α(O)=1.82×10^{-5} *23*; α(P)=1.54×10^{-6} *24*
^{x}881.1 *1*	1.61 *13*								%Iγ=0.267 *23*
^{x}911.0 *1*	1.33 *7*								%Iγ=0.221 *13*
926.97 *9*	7.62 *16*	1152.01	(1$^-$)	225.00	(2)$^-$	(M1(+E2))	<0.7	0.0179 *21*	%Iγ=1.27 *5* α(K)=0.0147 *18*; α(L)=0.0024 *3*; α(M)=0.00057 *6* α(N)=0.000143 *15*; α(O)=2.8×10^{-5} *3*; α(P)=2.6×10^{-6} *3*
962.64 *12*	6.70 *17*	1187.55	(0$^-$,1$^-$)	225.00	(2)$^-$	(E2)		0.00683	%Iγ=1.11 *4* α(K)=0.00545 *8*; α(L)=0.001056 *15*; α(M)=0.000251 *4* α(N)=6.31×10^{-5} *9*; α(O)=1.199×10^{-5} *17*; α(P)=1.010×10^{-6} *15*
998.47 *10*	12.5 *10*	998.43	1$^{(-)}$	0.0	2$^-$	(M1(+E2))	<0.7	0.0149 *17*	%Iγ=2.08 *17* α(K)=0.0122 *15*; α(L)=0.00202 *21*; α(M)=0.00047 *5* α(N)=0.000118 *12*; α(O)=2.30×10^{-5} *24*; α(P)=2.17×10^{-6} *25*
1010.54 *10*	6.5 *3*	1010.52	(1$^-$)	0.0	2$^-$	[M1,E2]		0.011 *5*	%Iγ=1.08 *6* α(K)=0.009 *5*; α(L)=0.0015 *6*; α(M)=0.00036 *14* α(N)=9.E−5 *4*; α(O)=1.8×10^{-5} *7*; α(P)=1.6×10^{-6} *8*
^{x}1015.2 *2*	5.0 *4*								%Iγ=0.83 *7*
1059.38 *10*	23.8 *4*	1519.33	1$^+$	459.92	(2$^-$)	(E1)		0.00216	%Iγ=3.95 *12* α(K)=0.00181 *3*; α(L)=0.000272 *4*; α(M)=6.26×10^{-5} *9* α(N)=1.574×10^{-5} *22*; α(O)=3.04×10^{-6} *5*; α(P)=2.79×10^{-7} *4*
1068.47 *10*	2.45 *23*	1272.20	(0$^-$,1$^-$,2$^-$)	203.82	1$^-$	(M1)		0.01390	%Iγ=0.41 *4* α(K)=0.01147 *16*; α(L)=0.00187 *3*; α(M)=0.000433 *6* α(N)=0.0001093 *16*; α(O)=2.13×10^{-5} *3*; α(P)=2.03×10^{-6} *3*
1118.44 *10*	3.9 *5*	1707.61	(1$^-$)	589.16	(2$^-$)	(M1,E2)		0.009 *4*	%Iγ=0.65 *9* α(K)=0.007 *3*; α(L)=0.0012 *5*; α(M)=0.00028 *11* α(N)=7.E−5 *3*; α(O)=1.4×10^{-5} *6*; α(P)=1.3×10^{-6} *6*; α(IPF)=4.6×10^{-7} *13*

From ENSDF

γ(^{194}Tl) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[&]	α[b]	Comments
1152.04 9	2.88 9	1152.01	(1⁻)	0.0	2⁻	[M1,E2]	0.008 4	%Iγ=0.478 20 α(K)=0.007 3; α(L)=0.0011 5; α(M)=0.00026 10 α(N)=6.6×10⁻⁵ 25; α(O)=1.3×10⁻⁵ 5; α(P)=1.2×10⁻⁶ 5; α(IPF)=1.5×10⁻⁶ 5
1178.6 2	3.32 14	1178.79	(1⁻)	0.0	2⁻	[M1,E2]	0.008 4	%Iγ=0.55 3 α(K)=0.006 3; α(L)=0.0011 4; α(M)=0.00025 9 α(N)=6.2×10⁻⁵ 23; α(O)=1.2×10⁻⁵ 5; α(P)=1.1×10⁻⁶ 5; α(IPF)=3.3×10⁻⁶ 9
1185.35 15	4.04 20	1553.09	(0,1)	367.74	1⁻			%Iγ=0.67 4
1200.9 3	0.94 13	1722.97	(0⁻,1)	521.52	1⁽⁻⁾			%Iγ=0.156 22
1231.5 2	4.3 2	1753.12	(0,1)	521.52	1⁽⁻⁾			%Iγ=0.71 4
1271.98 25	4.60 10	1638.93	(1⁻)	367.74	1⁻	[M1,E2]	0.0065 25	%Iγ=0.76 3 α(K)=0.0053 21; α(L)=0.0009 4; α(M)=0.00021 8 α(N)=5.2×10⁻⁵ 18; α(O)=1.0×10⁻⁵ 4; α(P)=9.E−7 4; α(IPF)=1.6×10⁻⁵ 5
1294.4 2	11.7 4	1519.33	1⁺	225.00	(2)⁻	(E1)	1.57×10⁻³	%Iγ=1.94 9 α(K)=0.001275 18; α(L)=0.000190 3; α(M)=4.36×10⁻⁵ 7 α(N)=1.096×10⁻⁵ 16; α(O)=2.12×10⁻⁶ 3; α(P)=1.97×10⁻⁷ 3; α(IPF)=5.11×10⁻⁵ 8
1315.6 2	3.4 4	1519.33	1⁺	203.82	1⁻			%Iγ=0.56 7
1339.6 2	2.1 7	1707.61	(1⁻)	367.74	1⁻	[M1,E2]	0.0058 21	%Iγ=0.35 12 α(K)=0.0047 18; α(L)=0.0008 3; α(M)=0.00018 7 α(N)=4.6×10⁻⁵ 16; α(O)=9.E−6 3; α(P)=8.E−7 3; α(IPF)=3.1×10⁻⁵ 8
1349.25 20	4.38 18	1553.09	(0,1)	203.82	1⁻			%Iγ=0.73 4
1414.3 5	1.4 3	1638.93	(1⁻)	225.00	(2)⁻	[M1,E2]	0.0051 18	%Iγ=0.23 5 α(K)=0.0042 15; α(L)=0.00068 23; α(M)=0.00016 6 α(N)=4.0×10⁻⁵ 14; α(O)=8.E−6 3; α(P)=7.E−7 3; α(IPF)=5.4×10⁻⁵ 14
1482.9 2	2.4 2	1707.61	(1⁻)	225.00	(2)⁻			%Iγ=0.40 4
1515[‡] 1	≈0.5[‡]	1707.61	(1⁻)	192.14	(0)⁻			%Iγ≈0.08
1519.45 13	101 8	1519.33	1⁺	0.0	2⁻			%Iγ=16.8 12
[x]1546.0 2	3.0 10							%Iγ=0.50 17
1549.4 2	8.1 3	1753.12	(0,1)	203.82	1⁻			%Iγ=1.34 6
1585.3 2	2.47 10	1810.46	(1)	225.00	(2)⁻			%Iγ=0.410 20
1602.8 2	1.64 9	1602.81	(0⁻,1,2⁻)	0.0	2⁻			%Iγ=0.272 17
1618.5 2	3.34 11	1810.46	(1)	192.14	(0)⁻			%Iγ=0.555 23
1639.29 20	3.12 10	1638.93	(1⁻)	0.0	2⁻			%Iγ=0.518 22
1655 1	1.25 25	1858.8	(0,1,2⁻)	203.82	1⁻			%Iγ=0.21 5
1671 1	0.31 16	2192.7	(1,2⁻)	521.52	1⁽⁻⁾			%Iγ=0.05 3
1723.2 2	3.0 6	1722.97	(0⁻,1)	0.0	2⁻			%Iγ=0.50 10
1810.4 2	9.61 15	1810.46	(1)	0.0	2⁻			%Iγ=1.60 5

$^{194}_{81}$Tl$_{113}$-9

γ(^{194}Tl) (continued)

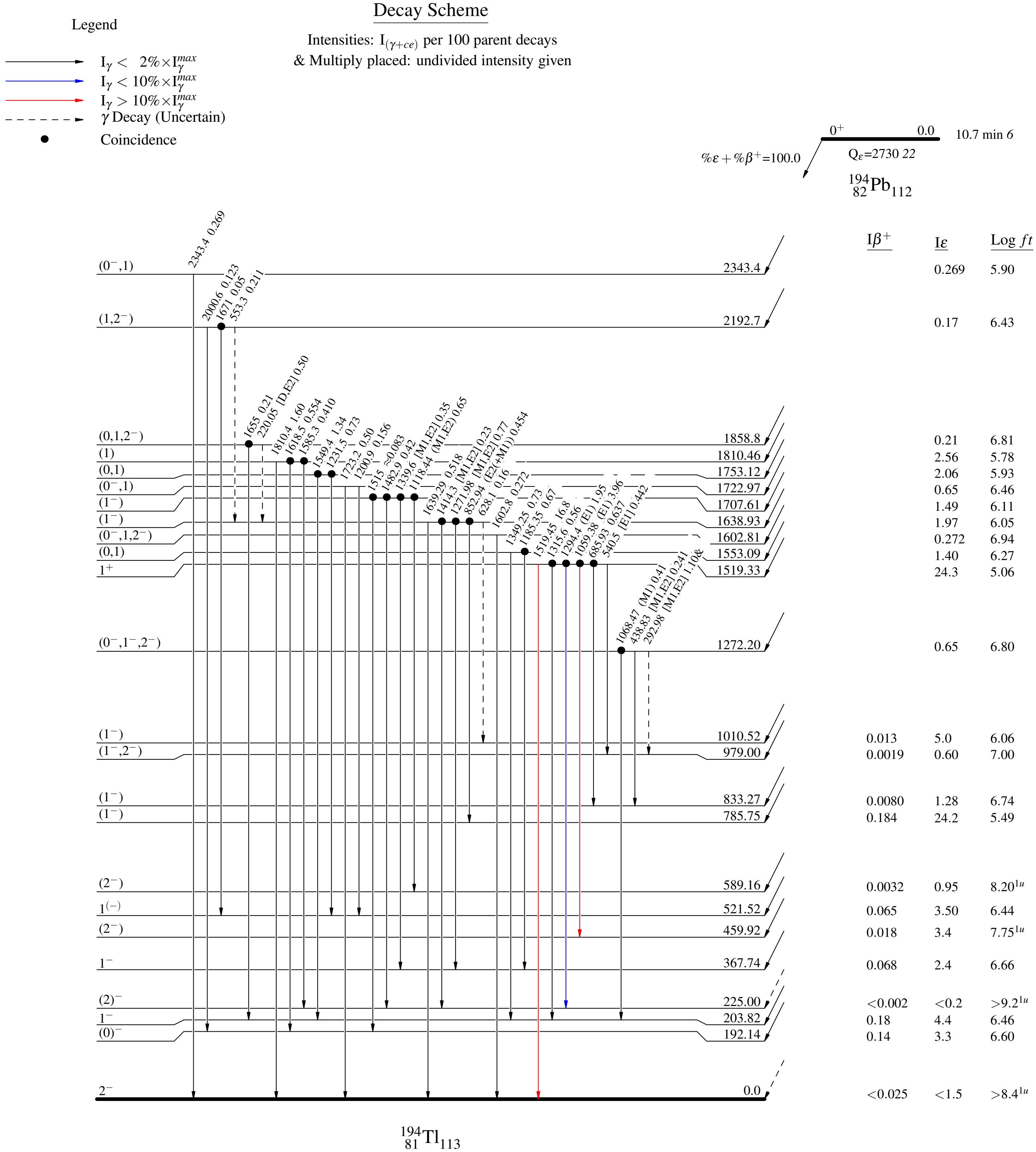
E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
2000.6 *3*	0.74 *5*	2192.7	(1,2$^-$)	192.14	(0)$^-$	%Iγ=0.123 *9*
2343.4 *5*	1.62 *7*	2343.4	(0$^-$,1)	0.0	2$^-$	%Iγ=0.269 *14*
[x]2386.2 *5*	0.76 *16*					%Iγ=0.13 *3*
[x]2392.3 *6*	0.64 *13*					%Iγ=0.106 *22*
[x]2480.9 *6*	0.40 *9*					%Iγ=0.066 *15*

† From 1987El09.
‡ Energy and intensity from $\gamma\gamma$ only (1987El09).
\# Tentative placement suggested by evaluators on the basis of energy sums, not included in deducing γ-ray intensity balance.
@ Poor fit. Uncertainty has been increased to 0.2 keV in the fitting.
& Deduced from ce data (1987ElZY), given under comments where available. Conversion coefficients are available for only a few transitions, as listed here. For this reason, evaluators have placed those assignments in parentheses, for which supporting numerical data are not available. The same values are adopted in Adopted Levels.
a For absolute intensity per 100 decays, multiply by 0.166 *5*.
b 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.
c Multiply placed with undivided intensity.
d Multiply placed with intensity suitably divided.
e Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

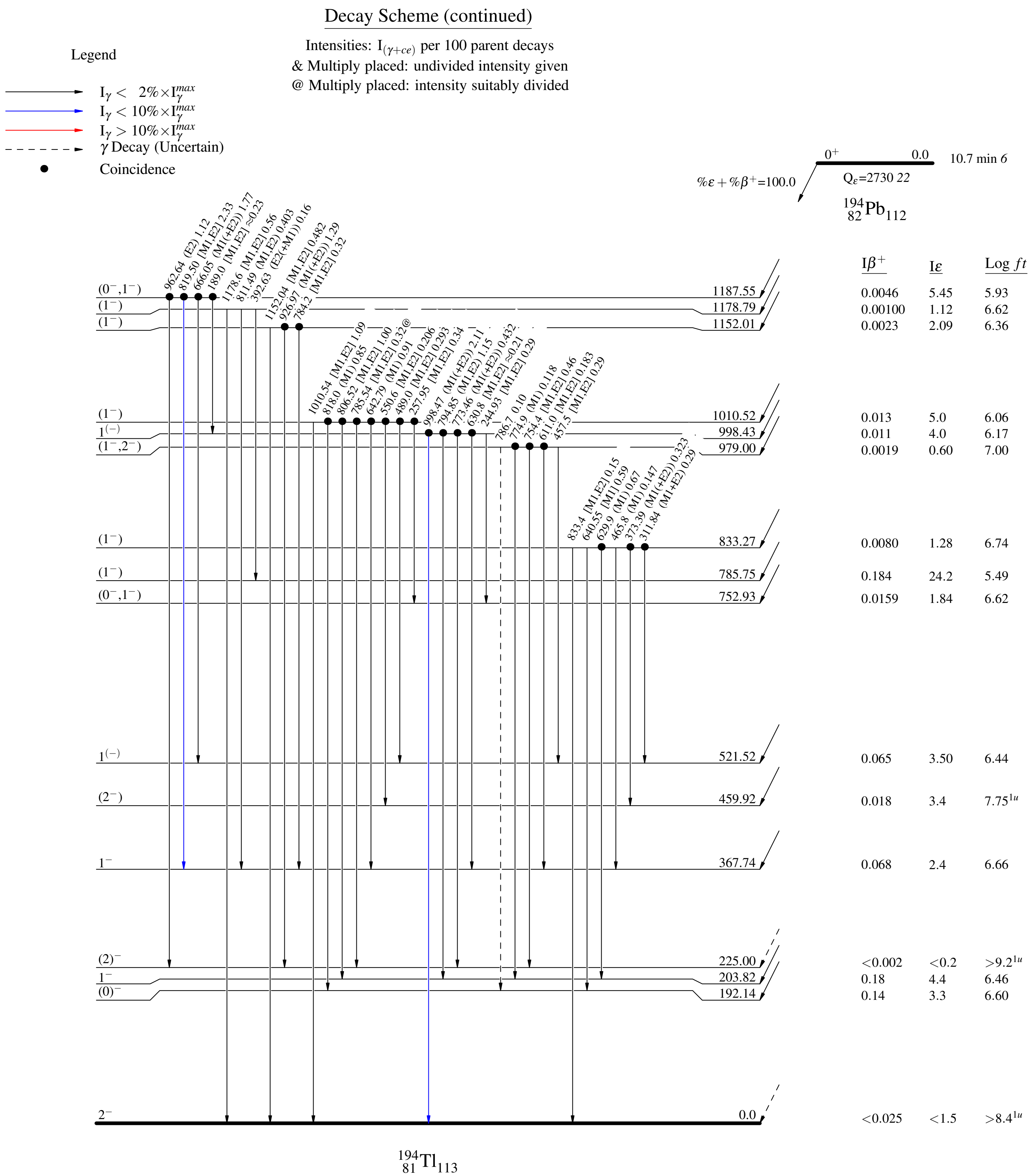
^{194}Pb ε decay (10.7 min) 1987El09

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
& Multiply placed: undivided intensity given



^{194}Pb ε decay (10.7 min) 1987El09



^{194}Pb ε decay (10.7 min) 1987El09

Decay Scheme (continued)

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

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)
- Coincidence