^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, [1] and Jun Chen[2]	NDS 169, 1 (2020)	15-Oct-2020

Parent: ^{190}Tl: E=83 *10*; $J^\pi=7^+$; $T_{1/2}$=3.6 min *3*; Q(ε)=6999 *18*; %ε+%$β^+$ decay=100.0

^{190}Tl-E,J^π,$T_{1/2}$: From ^{190}Tl Adopted Levels.

^{190}Tl-Q(ε): From 2017Wa10.

1976Bi09 (also 1974Ha10): Measured Eγ, Iγ, γγ, ce, $β^+$, $T_{1/2}$. ^{190}Tl source produced by mass separation of products from Ta(^{16}O,xn) E= 143 MeV and W(^{16}O,xn) E=124 MeV. The ce data obtained with Si(Li) and $β^+$ data with a plastic scintillator.

1991Ko03 (also 1990Zg01): Measured Eγ, Iγ, γγ, ce for part of the level scheme related to the population of the excited 0^+ band.

1994De25: Measured Eγ, Iγ, γγ. Data for selected transitions and (mostly for positive parity) levels.

1975Va20 (also 1970Va27): Measured γ, γγ, ce, $T_{1/2}$. Source produced by mass separation of products from spallation reaction on Pb with 600 MeV protons, ce data obtained with Si(Li) detector.

The decay scheme seems incomplete (in evaluators′ opinion) in view of the large gap of 4.3 MeV between Q value and the highest established level. Feedings to different levels are thus considered as poorly known, and given as limits only.

2019Ol05: ^{190}Tl ions were produced by a 500-MeV proton beam provided by the TRIUMF main cyclotron impinging on an uranium carbide target, and implanted into a mylar tape at the central focus of the GRIFFIN spectrometer. γ rays were detected with the GRIFFIN array consisting of 15 HPGe clover detectors and 7 cylindrical $LaBr_3$(Ce) crystals; conversion electrons were detected with a set of 5 in-vacuum L(n)$_2$-cooled lithium-drifted silicon detectors (PACES) and a fast 1-mm-thin plastic Zero Degree Scintillator (ZDS). Measured Eγ, Iγ, γγ-coin, γγ(t). Deduced levels, $T_{1/2}$, transition strengths. Comparisons with available data and theoretical calculations.

^{190}Hg Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0.0	0^+		
416.38 *14*	2^+	15 ps *1*	
1041.89 *17*	4^+	5 ps *4*	
1099.94 *17*	2^+		Intensity imbalance=3.0 *11*.
1278.69 *20*	0^+		
1558.77 *18*	2^+		Intensity imbalance=4.4 *5*.
1571.38 *18*	2^+		Intensity imbalance=0.8 *2*.
1657.10 *18*	3^+		Intensity imbalance=5.4 *10*.
1772.99 *19*	6^+	7 ps *4*	
1850.76[&] *20*	$(2^+,3,4^+)$		
1881.43 *22*	5^-	<40 ps	
1975.23 *20*	4^+		
2072.8[@] *4*	$(4,5,6)^+$	<0.2 ns	
2078.26 *24*	7^-		
2163.02[&] *21*	(4^+)		
2201.03 *21*	$(5)^+$		
2251.5 *3*	$(6,7)^-$		
2318.4 *4*	$(8)^-$		E(level): level proposed (evaluators) on the basis of a similar level in in-beam γ ray work, deexciting through only one transition 240.3γ, mult=M1+E2.
2318.8 *3*	$(4^-,5,6^+)$		See comment for 2318.4 level. The 240.1γ proposed by 1976Bi09 from this level is assigned to the 2318.4 level, instead. This is because 437.6γ and 1276.7γ are not reported in any of the in-beam γ ray-studies.
2335.3 *4*	(9^-)		
2343.01[&] *21*	$(4^+,5^+)$		
2365.37[&] *22*	$(4^+,5,6^+)$		
2392.0? *4*			
2424.8? *4*			
2465.1 *3*	$(8)^+$		
2509.94 *24*	6^+		

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^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25 (continued)

^{190}Hg Levels (continued)

E(level)[†]	Jπ[‡]
2573.1[@] *4*	(8)$^+$
2821.6[&] *3*	

† From least-squares fit to Eγ data.
‡ From the Adopted Levels.
# From γγ(t) measured using $LaBr_3$(Ce) (2019Ol05). Values are recommended in the Adopted Levels.
@ From 1991Ko03.
& From 1994De25.

ε,β$^+$ radiations

The 1099.9, 1558.8 and 1656.9 levels have an apparent ε,β$^+$ feeding of 16% *10*, 4.2% *11*, 5.3% *4*, 6.5% *10*, respectively. The spin values, however, do not permit such feeding. There must be additional γ transitions from higher levels feeding these levels.
The ε, β$^+$ feedings are considered tentative. The present decay scheme suggests significant β$^+$ component, whereas the reported value is 2.6% +*26*−*9* (1975Va20). It is possible that the ε decay proceeds to higher unobserved levels. 1976Bi09 do not give the intensity of the annihilation radiation but the presented γ-ray spectrum shows that the intensity of the 511-keV line is ≈10%.

E(decay)	E(level)	Iβ$^+$ [†]	Iε[†]	Log *ft*	I(ε+β$^+$)[†]	Comments
(4260 *21*)	2821.6	<0.3	<0.5	>7.3	<0.8	av Eβ=1462.4 *98*; εK=0.553 *4*; εL=0.0969 *7*; εM+=0.03112 *20*
(4509 *21*)	2573.1	<0.59	<1.0	>7.1	<1.6	av Eβ=1574.9 *99*; εK=0.514 *4*; εL=0.0899 *6*; εM+=0.02886 *20*
(4572 *21*)	2509.94	<0.53	<0.87	>7.2	<1.4	av Eβ=1603.6 *99*; εK=0.505 *4*; εL=0.0882 *6*; εM+=0.02830 *20*
(4617 *21*)	2465.1	<2.0	<3.2	>6.6	<5.2	av Eβ=1623.9 *99*; εK=0.498 *4*; εL=0.0869 *6*; εM+=0.02790 *20*
(4657[‡] *21*)	2424.8?	<0.63	<0.97	>7.2	<1.6	av Eβ=1642.2 *99*; εK=0.491 *4*; εL=0.0858 *6*; εM+=0.02755 *19*
(4690[‡] *21*)	2392.0?	<0.76	<1.1	>7.1	<1.9	av Eβ=1657.2 *99*; εK=0.486 *4*; εL=0.0849 *6*; εM+=0.02726 *19*
(4717 *21*)	2365.37	<1.0	<1.5	>7.0	<2.5	av Eβ=1669.3 *99*; εK=0.482 *4*; εL=0.0842 *6*; εM+=0.02703 *19*
(4739 *21*)	2343.01	<0.94	<1.4	>7.0	<2.3	av Eβ=1679.4 *99*; εK=0.479 *4*; εL=0.0836 *6*; εM+=0.02683 *19*
(4747 *21*)	2335.3	<0.42	<1.6	>8.9[1u]	<2.0	av Eβ=1639.9 *95*; εK=0.6381 *25*; εL=0.1148 *5*; εM+=0.03702 *16*
(4763[‡] *21*)	2318.8	<1.00	<1.4	>7.0	<2.4	av Eβ=1690.5 *99*; εK=0.475 *4*; εL=0.0830 *6*; εM+=0.02662 *19*
(4764 *21*)	2318.4	<2.2	<3.1	>6.7	<5.3	av Eβ=1690.7 *99*; εK=0.475 *4*; εL=0.0830 *6*; εM+=0.02662 *19*
(4831 *21*)	2251.5	<2.7	<3.7	>6.6	<6.4	av Eβ=1721.1 *99*; εK=0.465 *4*; εL=0.0812 *6*; εM+=0.02604 *19*
(4881[‡] *21*)	2201.03	<3.0	<3.8	>6.6	<6.8	av Eβ=1744.1 *99*; εK=0.458 *4*; εL=0.0798 *6*; εM+=0.02561 *19*
(4919[‡] *21*)	2163.02	<1.2	<1.4	>7.0	<2.6	av Eβ=1761.5 *99*; εK=0.452 *4*; εL=0.0788 *6*; εM+=0.02529 *19*
(5004 *21*)	2078.26	<6.9	<8.1	>6.3	<15	av Eβ=1800.2 *99*; εK=0.440 *4*; εL=0.0767 *6*; εM+=0.02459 *18*
(5009[‡] *21*)	2072.8	<0.60	<0.70	>7.4	<1.3	av Eβ=1802.7 *99*; εK=0.439 *4*; εL=0.0765 *6*; εM+=0.02454 *18*
(5107[‡] *21*)	1975.23	<0.52	<0.58	>7.5	<1.1	av Eβ=1847.3 *99*; εK=0.425 *3*; εL=0.0740 *6*; εM+=0.02375 *18*
5.20×10^3 *30*	1772.99	<8.7	<8.3	>6.3	<17	av Eβ=1940 *10*; εK=0.397 *3*; εL=0.0691 *6*; εM+=0.02216 *17*

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^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ †	Iε†	Log *ft*	I(ε+β+)†	Comments
(5201‡ *21*)	1881.43	<4.1	<11	>8.2[1u]	<15	av Eβ=1838.2 *95*; εK=0.585 *3*; εL=0.1047 *5*; εM+=0.03373 *16*
(5231‡ *21*)	1850.76	<0.70	<0.70	>7.4	<1.4	av Eβ=1904 *10*; εK=0.408 *3*; εL=0.0710 *6*; εM+=0.02276 *17* E(decay): from E(β+)=4180 *300* (1976Bi09). Assignment to the 1772.9 level is uncertain.

† Absolute intensity per 100 decays.
‡ Existence of this branch is questionable.

$\gamma(^{190}Hg)$

Iγ normalization: From summed I(γ+ce) to g.s.=100, with the assignment of 15% uncertainty. No direct ε,β^+ feeding is expected to g.s. About 40% of the $\varepsilon+\beta^+$ intensity may be unaccounted, but it is unlikely that this intensity affects the normalization factor, since, for 7^+ parent, the γ rays from higher unobserved levels are expected to feed levels of higher spins, above the 416, 2^+ level. 15% uncertainty is assigned to the γ-normalization factor to account for unassigned β feeding and for possible unobserved γ-feedings to the low-lying levels in ^{190}Hg.

I(K x ray)=151 *45* (1975Va20).

I(β^+)(from $\gamma^{\pm}$)=2.6% *+26−9*.

Relative intensities from mixed (3.7 min+2.6 min) activities				
Eγ	Iγ	Iγ	Iγ	Iγ
	1976Bi09 ±10%	1991Ko03	1994De25	1975Va20
142.7			0.22	
196.8	4.7			7.1 *10*
240.1	3.7			4.6 *8*
257.0	1.6			
292.6		0.03 *2*		
305.3	16			15.8 *11*
313.7	1.4			
346.5	1.3			2.0 *10*
370.3	4.6			5.9 *10*
390.1			0.20	
403.7		0.28 *8*	0.20	
416.4	100	100 *7*	100	100
428.1			0.30	
437.6	1.0			
445.1	1.1			2.2 *10*
458.7	1.0		1.0	1.0 *6*
466.1				2.0 *10*
478.3	1.2			
492.1			0.47	
506.0			0.59	
514.5			0.18	
516.8			0.7	1.5 *6*
529.5		0.18 *7*	<0.03	
534.7		0.75 *6*	0.40	
543.9	5.8		5.4	5.3 *10*
557.0	6.7		5.7	7.7 *11*
569.9			0.30	
592.6			0.40	
604.3			1.7	
615.4	4.5		3.6	3.9 *9*
620.4			0.10	
625.4	85.5	75 *5*	81.7	71 *3*
658.7			0.73	
683.8	8.0		6.3	7.7 *8*
685.8			0.60	

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692.1	4.9	3.9 *3*			5.6 *10*
731.1	38.3	31 *2*		34.5	30.5 *20*
736.8		0.34 *11*		0.40	
751.1	1.2			1.20	5.0 *25*
800.1		1.63 *14*			
808.8				0.79	
839.7	24.8				22.0 *18*
862.3		0.42 *3*		0.10	

Relative intensities from mixed (3.7 min+2.6 min) activities

Eγ	Iγ 1976Bi09 ±10%	Iγ 1991Ko03	Iγ 1994De25	Iγ 1975Va20
933.4	1.1	0.48 *15*	0.46	
1030.9		1.35 *10*		
1099.9	5.1		4.0	4.5 *11*
1121.3	1.3		0.87	
1142.5	3.8	4.2 *3*	4.0	4.8 *12*
1154.9		0.69 *6*	0.44	
1159.7			0.51	
1194.7	2.3			
1240.9	1.4		0.61	
1276.7	1.4			
1300.8			0.16	
1323.5	1.8		1.7	
1348	0.8			
1434.7			0.14	
1468.1		0.38 *3*	0.48	
1558.9	1.0	1.22 *9*	1.2	
1571.2		0.21 *12*	0.34	

1976Bi09 estimate that 90% of the activity is from 3.7-min activity

E_γ[‡]	I_γ[†#f]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[g]	Comments
142.7[d] *3*	0.22[d] *2*	2343.01	$(4^+,5^+)$	2201.03	$(5)^+$	[D,E2]		1.6 *14*	
196.8 *2*	5.0 *5*	2078.26	7^-	1881.43	5^-	E2		0.413	α(K)exp=0.19 *3* (1976Bi09); α(K)exp=0.20 *4* (1975Va20) α(L)exp=0.15 *3* (1975Va20); α(L)exp≤0.13 (1976Bi09) α(K)=0.176 *3*; α(L)=0.178 *3*; α(M)=0.0459 *7* α(N)=0.01141 *17*; α(O)=0.00193 *3*; α(P)=2.20×10^{-5} *4* α(K)exp gives δ(E2/M1)>5.
240.1 *3*	3.8 *4*	2318.4	$(8)^-$	2078.26	7^-	E2+M1	1.6 *5*	0.34 *8*	α(K)exp=0.34 *7* (1975Va20); α(K)exp≈0.2 (1976Bi09) α(L)exp=0.14 *6* (1975Va20); α(L)exp=0.064 *10* (1976Bi09) α(K)=0.23 *8*; α(L)=0.082 *3*; α(M)=0.0204 *4* α(N)=0.00508 *10*; α(O)=0.00089 *3*; α(P)=3.2×10^{-5} *11* Mult.,δ: from averaged K/L ratio.
240.1[i]		2318.8	$(4^-,5,6^+)$	2078.26	7^-				This γ now assigned to a different level at 2318.3, based on results from in-beam γ-ray work. Some component may, however, deexcite this level also.

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^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25 (continued)

γ(^{190}Hg) (continued)

E_γ[‡]	I_γ[†#f]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[g]	Comments
257.0 *3*	1.7 *2*	2335.3	(9⁻)	2078.26	7⁻	(E2)		0.1710	α(K)exp<0.30 (1976Bi09) α(K)=0.0919 *14*; α(L)=0.0595 *9*; α(M)=0.01520 *23* α(N)=0.00378 *6*; α(O)=0.000647 *10*; α(P)=1.166×10^{-5} *17* Mult.: α(K)exp gives mult=E1 or E2(+M1) with δ>0.9, but mult=Q from γ(θ) in in-beam γ-ray work.
292.6[c] *3*	0.03[c] *2*	1571.38	2⁺	1278.69	0⁺	[E2]		0.1147	
305.3 *2*	17.0 *17*	2078.26	7⁻	1772.99	6⁺	E1		0.0267	α(K)exp=0.019 *3* (1976Bi09); α(K)exp=0.035 *13* (1975Va20); α(L)exp<0.011 (1975Va20) α(K)=0.0220 *3*; α(L)=0.00362 *5*; α(M)=0.000838 *12* α(N)=0.000208 *3*; α(O)=3.84×10^{-5} *6*; α(P)=2.48×10^{-6} *4*
313.7[i] *3*	1.5 *2*	2392.0?		2078.26	7⁻	[D,E2]		0.18 *15*	α(K)exp≤0.17 (1976Bi09) Mult.: E1 or E2(+M1) with δ>1 from α(K)exp.
346.5[i] *3*	1.4 *2*	2424.8?		2078.26	7⁻	[D,E2]		0.13 *11*	
370.3 *3*	4.9 *5*	2251.5	(6,7)⁻	1881.43	5⁻	E2(+M1)	>7	0.0598 *17*	α(K)exp=0.036 *5* (1976Bi09); α(K)exp=0.07 *3* (1975Va20) α(K)=0.0396 *15*; α(L)=0.0153 *3*; α(M)=0.00383 *6* α(N)=0.000955 *16*; α(O)=0.000167 *3*; α(P)=5.19×10^{-6} *20*
390.1[hd] *3*	0.20[hd] *2*	2163.02	(4⁺)	1772.99	6⁺	[E2]		0.0507	
390.1[hd] *3*	0.20[hd] *2*	2365.37	(4⁺,5,6⁺)	1975.23	4⁺	[D,E2]		0.10 *8*	
403.8 *3*	0.28 *8*	1975.23	4⁺	1571.38	2⁺	E2		0.0462	α(K)exp=0.030 *4* (1991Ko03) α(K)=0.0313 *5*; α(L)=0.01127 *16*; α(M)=0.00281 *4* α(N)=0.000700 *10*; α(O)=0.0001230 *18*; α(P)=4.12×10^{-6} *6*
416.4 *2*	100	416.38	2⁺	0.0	0⁺	E2		0.0427	α(K)exp=0.0093 *14* (1976Bi09); α(L)exp=0.0106 *14* (1975Va20) K/L=2.8 *3* (1975Va20); K/L=3.2 *3* (1976Bi09) α(K)=0.0292 *5*; α(L)=0.01017 *15*; α(M)=0.00253 *4* α(N)=0.000630 *9*; α(O)=0.0001110 *16*; α(P)=3.85×10^{-6} *6*
428.1[d] *3*	0.30[d] *3*	2201.03	(5)⁺	1772.99	6⁺	[M1,E2]		0.09 *5*	
437.6 *3*	1.0 *1*	2318.8	(4⁻,5,6⁺)	1881.43	5⁻	[D,E2]		0.07 *6*	
[x]445.1 *3*	1.1[a] *1*								γ in coin with 196.8γ, 416.4γ and 625.4γ.
458.7 *3*	1.0[a] *1*	1558.77	2⁺	1099.94	2⁺	[M1,E2]		0.07 *4*	
[x]466.1 *11*	2.0 *10*								Eγ,Iγ: γ from 1975Va20 only, treated as uncertain (evaluators).
478.3 *3*	1.3 *1*	2251.5	(6,7)⁻	1772.99	6⁺	[E1]		0.0098	
492.1[d] *3*	0.47[d] *5*	2343.01	(4⁺,5⁺)	1850.76	(2⁺,3,4⁺)	[D,E2]		0.05 *4*	
506.0[d] *3*	0.59[d] *6*	2163.02	(4⁺)	1657.10	3⁺	[M1,E2]		0.06 *3*	
514.5[d] *3*	0.18[d] *2*	2365.37	(4⁺,5,6⁺)	1850.76	(2⁺,3,4⁺)	[D,E2]		0.05 *4*	
516.8 *3*	0.7 *1*	1558.77	2⁺	1041.89	4⁺	[E2]		0.0249	Eγ,Iγ: from 1994De25.
529.7 *3*	0.18 *7*	1571.38	2⁺	1041.89	4⁺	[E2]		0.0235	
534.7 *3*	0.75 *6*	2509.94	6⁺	1975.23	4⁺	[E2]		0.0229	
543.9 *2*	6.2 *6*	2201.03	(5)⁺	1657.10	3⁺	E2		0.0220	α(K)exp=0.014 *2* (1976Bi09) α(K)=0.01626 *23*; α(L)=0.00439 *7*; α(M)=0.001072 *15* α(N)=0.000268 *4*; α(O)=4.79×10^{-5} *7*; α(P)=2.16×10^{-6} *3*

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γ(^{190}Hg) (continued)

E_γ ‡	I_γ †#f	E_i(level)	J_i^π	E_f	J_f^π	Mult. @	δ @	α g	Comments
557.0 b 2	7.0 7	1657.10	3+	1099.94	2+	E2+M1	3.5 10	0.024 3	α(K)exp=0.019 3 (1976Bi09); α(K)exp=0.014 6 (1975Va20) α(K)=0.019 3; α(L)=0.0045 4; α(M)=0.00109 8 α(N)=0.000271 19; α(O)=4.9×10^{-5} 4; α(P)=2.5×10^{-6} 4
569.9 d 3	0.30 d 3	2343.01	(4+,5+)	1772.99	6+	[D,E2]		0.04 3	
592.6 d 3	0.40 d 4	2365.37	(4+,5,6+)	1772.99	6+	[D,E2]		0.03 2	
604.3 d 3	1.7 d 2	2163.02	(4+)	1558.77	2+	[E2]		0.0173	
615.3 b 3	4.7 5	1657.10	3+	1041.89	4+	E2+M1	1.3 2	0.030 3	α(K)exp=0.024 3 (1976Bi09); α(K)exp<0.04 (1975Va20) α(K)=0.024 3; α(L)=0.0046 4; α(M)=0.00109 8 α(N)=0.000272 19; α(O)=5.1×10^{-5} 4; α(P)=3.3×10^{-6} 4
620.4 d 3	0.10 d 1	2821.6		2201.03	(5)+	[D,E2]		0.029 24	
625.4 2	90 9	1041.89	4+	416.38	2+	E2		0.01602	α(K)exp=0.0130 13 (1991Ko03); α(K)exp=0.0123 18 (1976Bi09) α(K)exp=0.0144 16 (1975Va20); α(L)exp≤0.0033 (1976Bi09) α(L)exp=0.0037 12 (1975Va20) α(K)=0.01216 17; α(L)=0.00294 5; α(M)=0.000712 10 α(N)=0.0001778 25; α(O)=3.21×10^{-5} 5; α(P)=1.613×10^{-6} 23
658.7 d 3	0.73 d 7	2821.6		2163.02	(4+)	[D,E2]		0.025 20	
683.5 2	7.8 8	1099.94	2+	416.38	2+	E2+M1	2.0 +10−5	0.019 3	α(K)exp=0.015 3 (1976Bi09); α(K)exp<0.02 (1975Va20) α(K)=0.015 3; α(L)=0.0029 4; α(M)=0.00070 8 α(N)=0.000174 20; α(O)=3.2×10^{-5} 4; α(P)=2.0×10^{-6} 4
685.8 d 3	0.60 d 6	2343.01	(4+,5+)	1657.10	3+	[D,E2]		0.022 18	
692.1 2	5.2 5	2465.1	(8)+	1772.99	6+	E2		0.01283	α(K)exp=0.0094 10 (1991Ko03) α(K)=0.00990 14; α(L)=0.00224 4; α(M)=0.000538 8 α(N)=0.0001343 19; α(O)=2.44×10^{-5} 4; α(P)=1.312×10^{-6} 19 δ(E2/M1)>7.
731.1 2	41 4	1772.99	6+	1041.89	4+	E2		0.01141	α(K)exp=0.0092 9 (1991Ko03); α(K)exp=0.0082 13 (1976Bi09) α(K)exp=0.0066 20 (1975Va20) α(K)=0.00887 13; α(L)=0.00194 3; α(M)=0.000464 7 α(N)=0.0001160 17; α(O)=2.12×10^{-5} 3; α(P)=1.175×10^{-6} 17 δ(E2/M1)>4 from α(K)exp.
736.9 3	0.34 11	2509.94	6+	1772.99	6+	E0+M1+E2		0.080 e 8	α(K)exp=0.067 7 (1991Ko03)
751.1 d 3	1.20 d	1850.76	(2+,3,4+)	1099.94	2+	[D,E2]		0.018 14	
800.1 c 3	1.63 c 14	2573.1	(8)+	1772.99	6+	E2		0.00945	α(K)exp=0.0067 14 (1991Ko03) α(K)=0.00743 11; α(L)=0.001541 22; α(M)=0.000368 6

$^{190}_{80}Hg_{110}$-7

γ(^{190}Hg) (continued)

E_γ[‡]	I_γ[†#f]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	δ[@]	α[g]	Comments
									α(N)=9.19×10^{-5} *13*; α(O)=1.684×10^{-5} *24*; α(P)=9.82×10^{-7} *14* δ(E2/M1)>4.
808.0[d] *3*	0.79[d]	1850.76	(2$^+$,3,4$^+$)	1041.89	4$^+$	[D,E2]		0.015 *12*	
839.7 *2*	26 *3*	1881.43	5$^-$	1041.89	4$^+$	E1		0.00318	α(K)exp=0.0023 *4* (1976Bi09) α(K)=0.00266 *4*; α(L)=0.000402 *6*; α(M)=9.22×10^{-5} *13* α(N)=2.30×10^{-5} *4*; α(O)=4.32×10^{-6} *6*; α(P)=3.20×10^{-7} *5*
862.2 *3*	&	1278.69	0$^+$	416.38	2$^+$				
933.4 *3*	0.48 *15*	1975.23	4$^+$	1041.89	4$^+$	E0+M1+E2		0.066[e] *7*	α(K)exp=0.055 *6* (1991Ko03)
1030.9[c] *3*	1.35[c] *10*	2072.8	(4,5,6)$^+$	1041.89	4$^+$	M1+E2	1.1 *3*	0.0095 *14*	α(K)exp=0.0078 *12* (1991Ko03) α(K)=0.0078 *12*; α(L)=0.00131 *17*; α(M)=0.00031 *4* α(N)=7.7×10^{-5} *10*; α(O)=1.44×10^{-5} *18*; α(P)=1.06×10^{-6} *16*
1099.9 *3*	4.8 *5*	1099.94	2$^+$	0.0	0$^+$	E2		0.00502	α(K)exp=0.0032 *5* (1976Bi09) α(K)=0.00406 *6*; α(L)=0.000733 *11*; α(M)=0.0001722 *25* α(N)=4.31×10^{-5} *6*; α(O)=8.00×10^{-6} *12*; α(P)=5.32×10^{-7} *8*
1121.1[d] *3*	0.87[d] *9*	2163.02	(4$^+$)	1041.89	4$^+$				
1142.5 *3*	3.8[a] *4*	1558.77	2$^+$	416.38	2$^+$	E2(+M1)	>2	0.0053 *7*	α(K)exp=0.0043 *6* (1991Ko03) α(K)=0.0043 *6*; α(L)=0.00075 *8*; α(M)=0.000176 *18* α(N)=4.4×10^{-5} *5*; α(O)=8.2×10^{-6} *9*; α(P)=5.7×10^{-7} *8*; α(IPF)=8.9×10^{-7} *7*
1155.0 *3*	0.69 *6*	1571.38	2$^+$	416.38	2$^+$	E0+M1+E2		0.052[e] *7*	α(K)exp=0.043 *6* (1991Ko03)
1159.7[d] *3*	0.51[d] *5*	2201.03	(5)$^+$	1041.89	4$^+$				
[x]1194.7 *3*	2.3[a] *3*								γ in coin with 305.3γ, 416.4γ and 625.4γ.
1240.9[b] *3*	1.5 *2*	1657.10	3$^+$	416.38	2$^+$	(E2)		0.00399	α(K)exp<0.0063 (1976Bi09) α(K)=0.00325 *5*; α(L)=0.000565 *8*; α(M)=0.0001320 *19* α(N)=3.30×10^{-5} *5*; α(O)=6.16×10^{-6} *9*; α(P)=4.24×10^{-7} *6*; α(IPF)=8.17×10^{-6} *12* Mult.: E2(+M1) with δ>1 or mult=E1 from α(K)exp.
1276.7 *3*	1.4 *2*	2318.8	(4$^-$,5,6$^+$)	1041.89	4$^+$				α(K)exp≤0.012 (1976Bi09)
1278.7[c] *3*	c&	1278.69	0$^+$	0.0	0$^+$	E0			α(K)exp>0.30 (1991Ko03)
1300.8[d] *3*	0.16[d] *2*	2343.01	(4$^+$,5$^+$)	1041.89	4$^+$				
1323.4[d] *3*	1.7[d] *2*	2365.37	(4$^+$,5,6$^+$)	1041.89	4$^+$				
[x]1348 *1*	0.8[a] *1*								
1434.7[d] *3*	0.14[d]	1850.76	(2$^+$,3,4$^+$)	416.38	2$^+$				
1468.1 *3*	0.38 *3*	2509.94	6$^+$	1041.89	4$^+$	[E2]		0.00296	
1558.8 *3*	1.22 *9*	1975.23	4$^+$	416.38	2$^+$				
1558.9 *3*	1.0[a] *1*	1558.77	2$^+$	0.0	0$^+$				
1571.2 *3*	0.21 *12*	1571.38	2$^+$	0.0	0$^+$				

$\gamma(^{190}\mathrm{Hg})$ (continued)

† From 1976Bi09, unless otherwise stated. For comparison of relative intensities available from 1975Va20, 1976Bi09, 1991Ko03, and 1994De25 from a source of mixed (both isomers) activities, see the table below. In adopted gammas, branching ratios have been deduced by considering intensity data from all the four studies. Intensity division among two isomers based on comparison of spectra from two different sources, one (derived mainly from ^{190}Pb ε decay) for which I(2.6 min, 2^-)/I(3.7-min, 7^+)≈2 and the other (^{190}Tl produced directly from HI reaction) where I(2.6 min, 2^-)/I(3.7-min, 7^+)≈0.1. The Iγ values given by 1975Va20 and 1974Ha10 are for a source containing both isomers but with the main contribution from the 3.7-min, (7^+) isomer.

‡ Generally from 1976Bi09. Averages taken when values are also available from 1994De25. Uncertainty of 0.2 keV for strong γ rays (Iγ≥5) and 0.3 keV for weaker and poorly resolved lines (evaluators).

Uncertainty≈10% (1976Bi09). The separate intensities for the two isomers obtained by 1976Bi09 from solutions of coupled algebraic equations for data from two sources described above.

@ From α(K)exp (1976Bi09,1975Va20). The ce data are normalized to 416.4γ treated as E2, α(K)=0.0292. 1976Bi09 used α(K)=0.030 for 416.4γ. The uncertainties on α(K)exp and α(L)exp values are not given by 1976Bi09. The evaluators assume 15% on α(K)exp and α(L)exp values. The α(K)exp and α(L)exp values deduced from 1975Va20 are based on ce and Iγ data given by 1975Va20 for a source containing both the activities. The ce data are also available from 1991Ko03.

& γ mainly from 2.6-min activity.

a γ with 3.7-min ^{190}Tl and/or 2.6-min ^{190}Tl Iγ is from the source containing ≈90% of 3.7-min isomer and ≈10% of 2.6-min isomer.

b γ ray may occur in 2.6-min ^{190}Tl decay also.

c From 1991Ko03. The γ ray belongs to either or both the isomers.

d From 1994De25 only. The γ ray belongs to either or both the isomers. Uncertainty of 10% assigned to intensity (evaluators).

e Deduced from α(K)exp+1.2(α(K)exp).

f For absolute intensity per 100 decays, multiply by 0.91 *14*.

g 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.

h Multiply placed with undivided intensity.

i Placement of transition in the level scheme is uncertain.

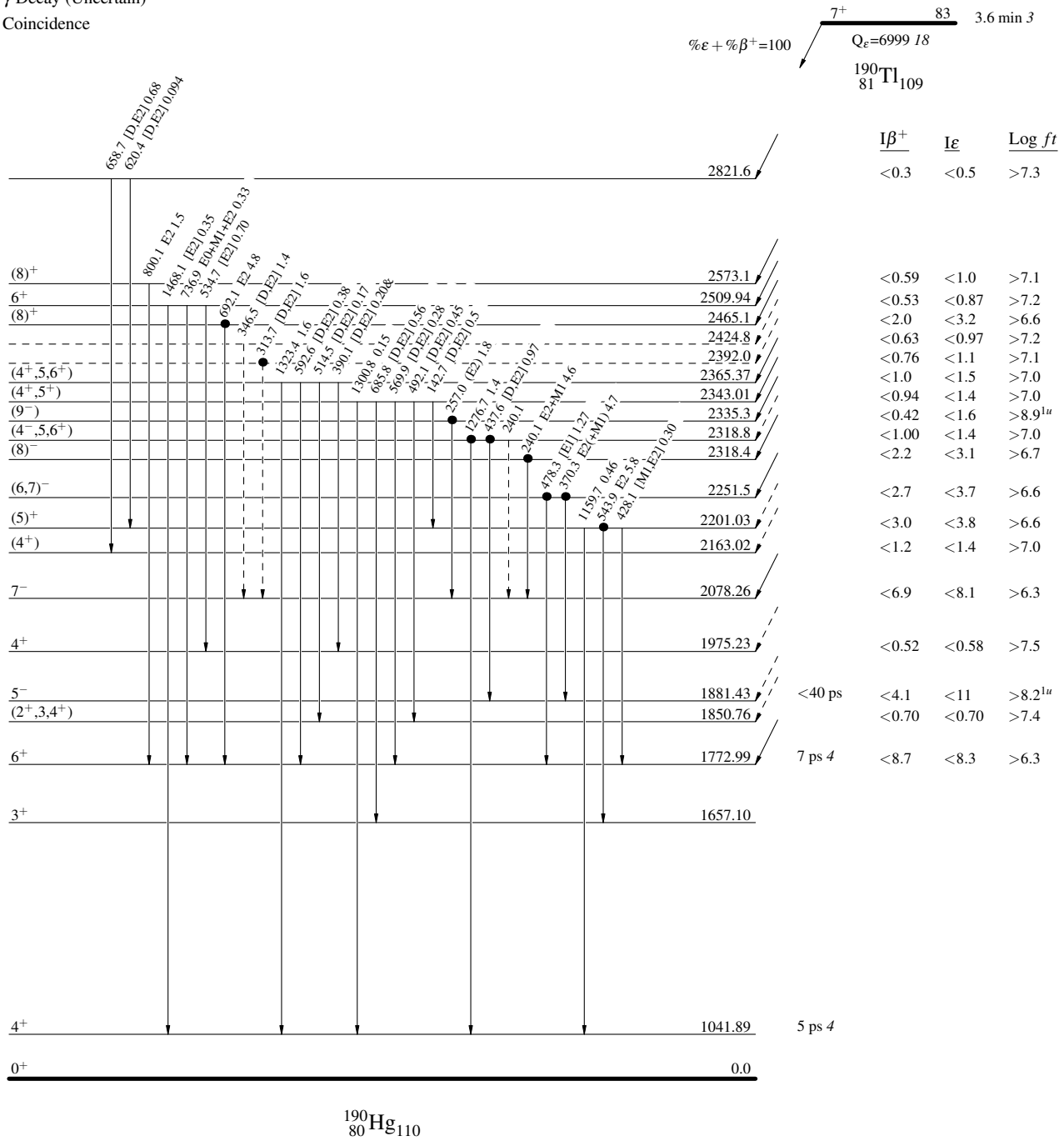
x γ ray not placed in level scheme.

^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25

Decay Scheme

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

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



^{190}Tl ε decay (3.6 min) 1976Bi09,1991Ko03,1994De25

Decay Scheme (continued)

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