^{193}Hg ε decay (3.80 h) 1974ViZS

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. Shamsuzzoha Basunia	NDS 143, 1 (2017)	31-Mar-2017

Parent: ^{193}Hg: E=0.0; $J^{\pi}=3/2^-$; $T_{1/2}$=3.80 h *15*; Q(ε)=2343 *14*; %ε+%β^+ decay=100.0

Sources from (p,xn) reactions on gold, E(p)=70, 80 MeV, isotope separation; measured Eγ, Iγ, E(ce), Ice, (Ge(Li), Si(Li) (FWHM=1.2-2.5 keV), mag spect (resolution=0.1%)), Eβ+, Iβ^+ (mag spect), $\gamma\gamma$ coin.

Other studies of ^{193}Hg decays: 1976Di15, 1976ViZM, 1975Zg01, 1970Fo08, 1970Pl01, 1962Di05, 1958Br88, 1955Br12, 1954Gi04.

1974ViZS studied 1) freshly prepared Hg sources to measure the decay curves of the transitions, and 2) Hg sources which had reached transient equilibrium (40 to 100 hours after preparation). In the first case distinction could be made between transitions following the decay of ^{193}Hg (3.80 h) and ^{193}Hg (11.8 h). In the second case the relative intensities of transitions in both decays could be measured since in the metastable state ^{193}Hg (11.8 h) decays to the ground state ^{193}Hg (3.80 h) with %IT=7.2, and all transitions now decay with a $T_{1/2}$=11.8 h.

^{193}Au Levels

The decay scheme is from 1974ViZS and is constructed from transitions showing a 3.80 h component in the pre-equilibrium sources of ^{193}Hg. For high energy levels fed directly by ε decay, the entire γ intensity is assigned to this decay. For the medium levels, which are not directly fed by ε+β^+ but are fed by γ's from both ^{193}Hg decays, the intensity of the deexciting transitions is divided according to the feeding.

E(level)†	J^{π}‡	$T_{1/2}$‡	Comments
0.0	$3/2^+$	17.65 h *15*	
38.245 *23*	$(1/2)^+$	3.81 ns *18*	$T_{1/2}$: from (ce(K)(186.56γ))(ce(L)(38.22γ))t (1970Fo08); other: 4.2 ns *6* (γ(ce)(t) 1962Ja04).
224.81 *3*	$(3/2)^+$	<0.03 ns	$T_{1/2}$: from γ(ce(K) 187)(t) (1970Fo08).
257.99 *3*	$5/2^+$	45 ps *20*	
290.20 *4*	$11/2^-$	3.9 s *3*	
381.61 *4*	$5/2^+$		
508.26 *5*	$7/2^-$	0.29 ns *2*	
539.00?# *4*			
827.67 *14*	$(1/2^+,3/2^+)$		
1089.25 *10*			
1118.97 *12*	$(3/2)^+$		
1603.15 *19*	$(3/2^-,5/2^+)$		
1658.0 *3*	$1/2^{(+)}$ to $5/2^{(+)}$		
1815.1 *3*	$(1/2,3/2),(5/2)^+$		
1861.92 *21*	$(1/2,3/2,5/2^+)$		
2014.73 *25*			
2043.3 *3*	1/2,3/2,5/2		

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

‡ From Adopted Levels.

This level is only fed by the 289.0γ from the 827.7 level. However, since the 827.7 level is seen only in this decay, and the 539.0 level is seen only in the ^{193}Hg (11.8 h) decay it is not clear to which decay the 289.0γ belongs, or whether the placement of the γ is correct.

^{193}Hg ε decay (3.80 h) 1974ViZS (continued)

ε,β^+ radiations

The study of β^+ spectrum shows only one major β^+ group with E(β^+)=1287 *15* (1974ViZS,1976Di15). From the intensity balance in the level scheme shown (Σ Ti(to ^{193}Au g.s.) − Ti(^{193}Hg IT decay)≈0) 1974ViZS has deduced that this β^+ group does not go directly to ^{193}Au g.s. From intensity balance in the level scheme it appears that the group feeds the 224.8 level, resulting in Q+=2534 *15*. 2017Wa10 evaluation of atomic masses adopted Q+=2343 *14*, corresponding to feeding both the ground and first excited states, and was adopted in this evaluation.

The fact that there is no significant direct ε+β^+ decay from the 3/2$^-$ ^{193}Hg to the 3/2$^+$ g.s. and 1/2$^+$ level in ^{193}Au seems surprising. However, no systematics for these transitions has been established. In α=189 and α=191 the log *ft*′s for these transitions have not been measured. In α=195 and α=197 J$^\pi$(Hg)=1/2$^-$ and the log *ft*′s for the transitions to the 3/2$^+$ Au g.s. are 7.3 and≥8.0.

E(decay)	E(level)	Iβ^+ ‡	Iε‡	Log *ft*	I(ε+β^+)†‡	Comments
(300 *14*)	2043.3		1.6 *4*	6.12 *13*	1.6 *4*	εK=0.723 *7*; εL=0.206 *5*; εM+=0.0706 *19*
(328 *14*)	2014.73		2.1 *5*	6.10 *12*	2.1 *5*	εK=0.735 *6*; εL=0.198 *4*; εM+=0.0675 *15*
(481 *14*)	1861.92		4.0 *6*	6.22 *8*	4.0 *6*	εK=0.7670 *19*; εL=0.1748 *14*; εM+=0.0582 *6*
(528 *14*)	1815.1		3.4 *7*	6.39 *10*	3.4 *7*	εK=0.7725 *16*; εL=0.1708 *11*; εM+=0.0567 *5*
(685 *14*)	1658.0		2.6 *6*	6.76 *11*	2.6 *6*	εK=0.7847 *9*; εL=0.1620 *6*; εM+=0.05324 *23*
(740 *14*)	1603.15		3.6 *6*	6.69 *8*	3.6 *6*	εK=0.7876; εL=0.1600 *5*; εM+=0.05243 *20*
(1224 *14*)	1118.97		24 *3*	6.34 *6*	24 *3*	εK=0.8010; εL=0.15030 *17*; εM+=0.04869 *7*
(1254 *14*)	1089.25		3.2 *21*	7.2 *3*	3.2 *21*	εK=0.8014; εL=0.14997 *16*; εM+=0.04856 *6*
(1515 *14*)	827.67	0.0072 *14*	9.2 *13*	6.95 *7*	9.2 *13*	av Eβ=243 *7*; εK=0.8041; εL=0.1475; εM+=0.04763
(1961 *14*)	381.61	0.12 *6*	13 *6*	7.03 *21*	13 *6*	av Eβ=440 *7*; εK=0.8006; εL=0.1438; εM+=0.04628
(2118 *14*)	224.81	0.56 *7*	34 *4*	6.68 *6*	35 *4*	av Eβ=508 *7*; εK=0.7960; εL=0.14225 *16*; εM+=0.04573 *6* E(decay): E(β^+)=1287 *15* (1974ViZS,1976Di15,1976DiZM).
(2305 *14*)	38.245	<0.41	<15	>7.1	<15	av Eβ=590 *7*; εK=0.7878; εL=0.14005 *19*; εM+=0.04499 *7*

† From intensity balance in the level scheme.

‡ Absolute intensity per 100 decays.

γ(^{193}Au)

Iγ normalization: From Σ Ti(to ^{193}Au g.s.)=100, assuming no g.s. feeding. Deduced value of Iγ normalization=6.7 *7* is in good agreement with the Iγ normalization=6.8 obtained by applying the half-life correction to the equilibrium counting rate of 100 disintegrations of ^{193}Hg (11.8 h).

All data are from 1974ViZS, unless otherwise noted. The transitions listed showed a 3.80 h component in the pre-equilibrium sources.

E_γ	I_γ [†f]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	δ [‡e]	α [d]	$I_{(\gamma+ce)}$ [f]	Comments
32.21 *3*		290.20	11/2$^-$	257.99	5/2$^+$	E3		9.29×10^4	0.5 *2*	ce(L)/(γ+ce)=0.699 *9*; ce(M)/(γ+ce)=0.232 *5* ce(N)/(γ+ce)=0.0592 *13*; ce(O)/(γ+ce)=0.00907 *20*; ce(P)/(γ+ce)=7.33×10^{-6} *16* α(L)=6.50×10^4 *10*; α(M)=2.16×10^4 *4* α(N)=5.50×10^3 *9*; α(O)=843 *13*; α(P)=0.681 *10* $I_{(\gamma+ce)}$: From Ti(32.21γ)=Ti(218.07γ). Mult.: see ^{193}Hg (11.8 h) decay.
38.24 *3*		38.245	(1/2)$^+$	0.0	3/2$^+$	M1+E2	0.42 *+5−4*	88 *14*	7.7 *10*	ce(L)/(γ+ce)=0.75 *9*; ce(M)/(γ+ce)=0.19 *4* ce(N)/(γ+ce)=0.046 *10*; ce(O)/(γ+ce)=0.0076 *17*; ce(P)/(γ+ce)=0.000119 *19* α(L)=67 *11*; α(M)=17 *3* α(N)=4.1 *7*; α(O)=0.68 *11*; α(P)=0.0106 *4* Mult.: L1:L2:L3=205 *12*: 320 *20*: 330 *20*; M1:M2:M3=43 *5*: 85 *9*: 95 *9*. δ: from L1/L3=0.50 *10*, weighted average from 1974ViZS and 1970Fo08 (^{193}Au IT decay). $I_{(\gamma+ce)}$: Ti(from equilibrium source) − Ti(attributed to ^{193}Hg(11.8 h) decay). I(γ+ce)=Σ Ice + Iγ=11.7 *8*.
126.56 *10*	0.008 [@] *4*	508.26	7/2$^-$	381.61	5/2$^+$	(E1)		0.229		%Iγ=0.05 *3* α(K)=0.185 *3*; α(L)=0.0336 *5*; α(M)=0.00781 *11* α(N)=0.00191 *3*; α(O)=0.000332 *5*; α(P)=1.574×10^{-5} *23* Mult.: from ^{193}Hg (11.8 h) decay.
186.56 *3*		224.81	(3/2)$^+$	38.245	(1/2)$^+$	M1+E2	0.26 *5*	1.186 *25*	4.9 *4*	ce(K)/(γ+ce)=0.440 *7*; ce(L)/(γ+ce)=0.0784 *14*; ce(M)/(γ+ce)=0.0183 *4* ce(N)/(γ+ce)=0.00456 *9*; ce(O)/(γ+ce)=0.000831 *16*; ce(P)/(γ+ce)=5.26×10^{-5} *15* α(K)=0.963 *24*; α(L)=0.171 *3*; α(M)=0.0401 *7*

$^{193}_{79}$Au$_{114}$-3

γ(^{193}Au) (continued)

E_γ	I_γ[†f]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡e]	α[d]	Comments
									α(N)=0.00997 *17*; α(O)=0.00182 *3*; α(P)=0.000115 *3* Mult.,δ: L1:L2:L3=31 *3*: 4.5 *5*: 1.1 *2*, K/L=6.0 *7*. $I_{(\gamma+ce)}$: Σ Ice + Iγ; Iγ=2.22 *21* deduced from Ice(K)=2.20 *15* and α(K)=0.99 *2*.
218.07 *4*	0.4[@] *1*	508.26	7/2⁻	290.20	11/2⁻	E2		0.280	%Iγ=2.7 *8* α(K)=0.1370 *20*; α(L)=0.1073 *15*; α(M)=0.0274 *4* α(N)=0.00677 *10*; α(O)=0.001111 *16*; α(P)=1.411×10^{-5} *20* Mult.: from ^{193}Hg (11.8 h) decay.
219.75 *4*	0.07[#] *2*	257.99	5/2⁺	38.245	(1/2)⁺	E2		0.273	%Iγ=0.47 *15* α(K)=0.1344 *19*; α(L)=0.1039 *15*; α(M)=0.0266 *4* α(N)=0.00655 *10*; α(O)=0.001076 *15*; α(P)=1.385×10^{-5} *20* Mult.: see ^{193}Hg (11.8 h) decay.
224.81 *4*	0.15 *3*	224.81	(3/2)⁺	0.0	3/2⁺	(E2)		0.253	%Iγ=1.01 *23* α(K)=0.1270 *18*; α(L)=0.0946 *14*; α(M)=0.0242 *4* α(N)=0.00596 *9*; α(O)=0.000980 *14*; α(P)=1.312×10^{-5} *19* I_γ: other: Iγ(224.8γ)/Iγ(185.6γ)<0.052 (1970Fo08).
258.00 *4*	1.3[#] *3*	257.99	5/2⁺	0.0	3/2⁺	M1+E2	0.62 *4*	0.407 *11*	%Iγ=8.7 *20* α(K)=0.323 *10*; α(L)=0.0645 *10*; α(M)=0.01528 *22* α(N)=0.00380 *6*; α(O)=0.000681 *11*; α(P)=3.81×10^{-5} *12* Mult.,δ: from ^{193}Hg (11.8 h) decay.
289.0[h]	0.16 *8*	827.67	(1/2⁺,3/2⁺)	539.00?					%Iγ=1.1 *6* I_γ: estimated from coincidence data. It is not clear whether this γ belongs in this decay or the ^{193}Hg (11.8 h) decay. See comment with the 539.0 level. 2014Th02 (p,2nγ) do not support this placement. Not adopted by evaluator.
381.60 *4*	2.3 *7*	381.61	5/2⁺	0.0	3/2⁺	M1+E2	1.2 *+5−3*	0.102 *19*	%Iγ=15 *5* α(K)=0.079 *17*; α(L)=0.0171 *17*; α(M)=0.0041 *4* α(N)=0.00102 *9*; α(O)=0.000180 *18*; α(P)=9.2×10^{-6} *20* I_γ: from Iγ=3.1 *6* in equilibrium source less Iγ=0.8 *2* attributed to ^{193}Hg (11.8 h) decay. Mult.,δ: α(K)exp=0.081 *14*, K/L1=5.7 *10*.
ˣ429.51[c] *5*						(M1+E2)		0.08 *5*	α(K)=0.07 *4*; α(L)=0.013 *5*; α(M)=0.0030 *10* α(N)=0.00075 *23*; α(O)=0.00014 *5*; α(P)=8.E−6 *5* Mult.: α(K)exp=0.046 *12*; theory: α(K)(M1)=0.072, α(K)(E2)=0.024.
446.5 *5*	0.10 *3*	827.67	(1/2⁺,3/2⁺)	381.61	5/2⁺				%Iγ=0.67 *22*
ˣ567.2[&] *5*	0.007 *3*								%Iγ=0.047 *21*
580.97 *8*	0.6 *3*	1089.25		508.26	7/2⁻				%Iγ=4.0 *21* Mult.: α(K)exp=0.010 *7*.
789.21 *20*	0.65 *13*	827.67	(1/2⁺,3/2⁺)	38.245	(1/2)⁺	(M1)		0.0258	%Iγ=4.4 *10* α(K)=0.0214 *3*; α(L)=0.00343 *5*; α(M)=0.000792 *11*

γ(^{193}Au) (continued)

E_γ	I_γ[†f]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡e]	α[d]	Comments
									α(N)=0.000197 *3*; α(O)=3.63×10^{-5} *5*; α(P)=2.49×10^{-6} *4* Mult.: α(K)exp=0.017 *5*.
827.81 *20*	0.57 *10*	827.67	(1/2$^+$,3/2$^+$)	0.0	3/2$^+$	(E2)		0.00840	%Iγ=3.8 *8* α(K)=0.00667 *10*; α(L)=0.001328 *19*; α(M)=0.000315 *5* α(N)=7.81×10^{-5} *11*; α(O)=1.394×10^{-5} *20*; α(P)=7.39×10^{-7} *11* Mult.: α(K)exp=0.0068 *20*.
861.11 *17*	1.8 *3*	1118.97	(3/2)$^+$	257.99	5/2$^+$	M1+E2	+1.33 *40*	0.0124 *23*	%Iγ=12.1 *24* α(K)=0.0101 *20*; α(L)=0.0018 *3*; α(M)=0.00041 *6* α(N)=0.000102 *16*; α(O)=1.9×10^{-5} *3*; α(P)=1.15×10^{-6} *23* Mult.: From Adopted Gammas. α(K)exp=0.0061 *16*, K/L12=6.1 *13* (1974ViZS); Theory: α(K)(E2)=0.00618 *9*, K/L12=5.49 *11*; α(K)(M1+E2, δ=1.33 40)=0.0101 *20*, K/L12=5.8 *12*.
[x]920.0 *4*	0.11 *3*								%Iγ=0.74 *22*
953.7 *4*	0.14 *4*	2043.3	1/2,3/2,5/2	1089.25					%Iγ=0.9 *3*
[x]1040.5[a] *6*	0.33 *7*								%Iγ=2.2 *6*
1080.7 *3*	0.53 *8*	1118.97	(3/2)$^+$	38.245	(1/2)$^+$				%Iγ=3.6 *7*
1094.5 *4*	0.080 *24*	1603.15	(3/2$^-$,5/2$^+$)	508.26	7/2$^-$				%Iγ=0.54 *17*
1118.84 *17*	1.16 *17*	1118.97	(3/2)$^+$	0.0	3/2$^+$	(E2)		0.00462	%Iγ=7.8 *14* α(K)=0.00375 *6*; α(L)=0.000663 *10*; α(M)=0.0001549 *22* α(N)=3.85×10^{-5} *6*; α(O)=6.95×10^{-6} *10*; α(P)=4.13×10^{-7} *6*; α(IPF)=3.60×10^{-7} *6* Mult.: α(K)exp=0.0049 *12*.
1221.1 *5*	0.039 *12*	1603.15	(3/2$^-$,5/2$^+$)	381.61	5/2$^+$				%Iγ=0.26 *9*
1276.38[b] *25*	0.38 *8*	1658.0	1/2$^{(+)}$ to 5/2$^{(+)}$	381.61	5/2$^+$	(E2)		0.00360	%Iγ=2.5 *6* α(K)=0.00294 *5*; α(L)=0.000499 *7*; α(M)=0.0001162 *17* α(N)=2.89×10^{-5} *4*; α(O)=5.24×10^{-6} *8*; α(P)=3.23×10^{-7} *5*; α(IPF)=1.285×10^{-5} *19* Mult.: α(K)exp=0.0036 *13*.
1378.5 *4*	0.085 *25*	1603.15	(3/2$^-$,5/2$^+$)	224.81	(3/2)$^+$				%Iγ=0.57 *18*
1565.0 *6*	0.016 *8*	1603.15	(3/2$^-$,5/2$^+$)	38.245	(1/2)$^+$				%Iγ=0.11 *6*
1603.4[g] *3*	0.30[g] *6*	1603.15	(3/2$^-$,5/2$^+$)	0.0	3/2$^+$				%Iγ=2.0 *5* Mult.: α(K)exp=0.0026 *16*.
1603.4[g] *3*	0.30[g] *6*	1861.92	(1/2,3/2,5/2$^+$)	257.99	5/2$^+$				%Iγ=2.0 *5*
1662.1 *4*	0.087 *22*	2043.3	1/2,3/2,5/2	381.61	5/2$^+$				%Iγ=0.58 *16*

γ(^{193}Au) (continued)

E_γ	I_γ [†f]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1756.7 *5*	0.045 *14*	2014.73		257.99	5/2$^+$	%Iγ=0.30 *10*
1776.4 *4*	0.12 *3*	1815.1	(1/2,3/2),(5/2)$^+$	38.245	(1/2)$^+$	%Iγ=0.80 *22*
1815.6 *4*	0.37 *9*	1815.1	(1/2,3/2),(5/2)$^+$	0.0	3/2$^+$	%Iγ=2.5 *7*
1824.3 *4*	0.075 *22*	1861.92	(1/2,3/2,5/2$^+$)	38.245	(1/2)$^+$	%Iγ=0.50 *16*
1862.2 *4*	0.21 *4*	1861.92	(1/2,3/2,5/2$^+$)	0.0	3/2$^+$	%Iγ=1.4 *3*
1976.6 *4*	0.25 *6*	2014.73		38.245	(1/2)$^+$	%Iγ=1.7 *5*
2014.6 *4*	0.008 *2*	2014.73		0.0	3/2$^+$	%Iγ=0.054 *15*

[†] Intensity determined in the ^{193}Hg (11.8 h) source in equilibrium with the ^{193}Hg (3.80 h) decay. Intensity per 100 disintegrations of ^{193}Hg (11.8 h). Applying the half-life correction for transient equilibrium, the intensity is per 148 ^{193}Au (3.80 h) decays.

[‡] From α(K)exp and/or ce subshell ratios, except where noted. The photon and ce intensity scales were normalized through the theoretical α(K) of 218.07, 219.75, 573.25 and 932.37 transitions (1974ViZS).

[#] From the decay scheme of 1974ViZS 2.3% of the decay from the 258 level follows decay from levels seen in ^{193}Hg (3.80 h) g.s., 98% follows decay from ^{193}Hg (11.8 h) isomer. From intensity balance there is no direct ε feeding to this level.

[@] Iγ divided on the basis of feeding from high levels as shown on the level scheme. From intensity balance there is no direct ε feeding. For the 508.23 level 7% of decay is from 3.80 h decay, 93% from 11.8 h decay.

[&] γ belongs in this decay from composite $T_{1/2}$. Placed from the 2043 level by 1974ViZS feeding the 1477 level where the deexciting γ shows no composite $T_{1/2}$. However, this γ is weak and would contribute only≈10% or less to the deexciting G. Possible spin assigments for these levels – make the placement unlikely. The list as unplaced.

[a] Multiply placed γ by 1974ViZS in composite level scheme. γ placed from the 2043 level to a 1004 level in ^{193}Hg(3.80 h) decay. However, the multiply placed 746.11γ from the 1004 level is weaker than the 1040γ and is not shown as possessing a composite $T_{1/2}$.

[b] γ shows composite $T_{1/2}$. Placement here supported by γγ results. 1974ViZS also shows the γ from the 2139 level in the ^{193}Hg(11.8 h) decay with no γγ support for that placement. The evaluator has included total Iγ in this decay.

[c] γ is shown as exhibiting composite $T_{1/2}$ in pre-equilibrium source, but appears to be in coincidence only with γ′s from ^{193}Hg(11.8 h) decay.

[d] Additional information 1.

[e] If No value given it was assumed δ=1.00 for E2/M1, δ=1.00 for E3/M2 and δ=0.10 for the other multipolarities.

[f] For absolute intensity per 100 decays, multiply by 6.7 *7*.

[g] Multiply placed with undivided intensity.

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

[x] γ ray not placed in level scheme.

^{193}Hg ε decay (3.80 h) 1974ViZS

Decay Scheme

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