^{190}Hg ε decay (20.0 min) 1976Bi09

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}Hg: E=0.0; $J^{\pi}=0^+$; $T_{1/2}$=20.0 min *5*; Q(ε)=1463 *16*; %ε+%$β^+$ decay=100.0

^{190}Hg-$T_{1/2}$: From ^{190}Hg Adopted Levels.

^{190}Hg-Q(ε): From 2017Wa10. Other: Q value from $β^+$ data is reported as 2100 *80* (1974DiZQ); also quoted as 1910 *80* (1973ViZJ) by the same group. The value of 2100 *80* later revised to 3070 *300* (priv. comm. to 1976Bi09 from authors of 1974DiZQ). The original value of 1910 is closer to the 2017Wa10 evaluation of 1463 keV *16* (2017Wa10), and with reported %$β^+$<1 (1959Al94), ≈2 (1961Ja17). Q value of 3070 keV will produce a significantly larger %$β^+$ component which is not seen in the intensity of annihilation radiation shown in the γ-ray spectrum by 1976Bi09.

1976Bi09 (also 1988KoZW): ^{190}Hg source from ^{190}Pb ε decay. Mass separated ^{190}Pb obtained from ^{181}Ta(^{16}O,7n) and W(^{16}O,xn) E=143 MeV. Measured Eγ, Iγ, γγ-coin.

Others:

γ: 1968Ki04, 1964Ja05, 1960Al20, 1960Po07, 1959Al94.

ce: 1968Ki04, 1964Ja05 (magnetic spectrometer), 1954Gi04.

(ce)(ce)(t) and (ce)γ(t): 1985Ab03.

$β^+$: 1974DiZQ (also 1973ViZJ), 1961Ja17, 1959Al94.

Q value from $β^+$ data: 1974DiZQ (also 1973ViZJ).

$T_{1/2}$ and production of ^{190}Hg: 1969Na10, 1968Ki04, 1964Ja05, 1961Ja25, 1961Ja17, 1961An02, 1960Al20, 1960Po07, 1959Al94, 1954Gi04.

Except for the 29.1 and 171.6 levels, the decay scheme of ^{190}Hg to ^{190}Au is considered as poorly known.

^{190}Au Levels

E(level)†	J^{π}‡	$T_{1/2}$	Comments
0.0	1^-		
29.1 *2*	1^-,2^-	0.55 ns *4*	$T_{1/2}$: from ce(L)(28.9γ)(γ,ce(L))(142.6γ)(t) (1985Ab03).
122.0? *3*			
129.6 *2*	$(0,1,2)^-$		
165.4? *3*	$(1^-,2^-)$		
171.6 *2*	1^+	0.16 ns *2*	$T_{1/2}$: from ce(K)(142.6γ)(K x ray)(t) (1985Ab03).
284.5 *2*	$(0,1,2)^-$		
347.7? *5*			
414.0 *3*			
417.9? *4*			
419.9? *3*			
421.8? *4*			
431.0? *4*			
545.4? *3*			

† From least-squares fit to Eγ values; uncertainty on Eγ assumed as 0.3 keV.

‡ From the Adopted Levels.

γ(^{190}Au)

Iγ normalization: from summed I(γ+ce) to 28.9 level + summed I(γ+ce) to g.s. from levels above 28.9 level=96 *4*, assuming <10% ε,$β^+$ feeding to g.s. corresponding to log *ft*>5.9 for first-forbidden transition for Q(ε)=1463 *16*.

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^{190}Hg ε decay (20.0 min) 1976Bi09 (continued)

γ(^{190}Au) (continued)

E_γ	I_γ[†][@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	α[&]	Comments
28.9	1.4	29.1	$1^-,2^-$	0.0	1^-	M1+E2	0.071 *5*	58.7 *16*	α(L)=45.0 *12*; α(M)=10.6 *3* α(N)=2.64 *8*; α(O)=0.474 *12*; α(P)=0.0273 *4* I_γ: from intensity balance deduced Iγ=2.0 instead of reported value of 1.4. Mult.,δ: from (L1+L2):L3:M1:M2:M3:N:O= 1000:88:194:40:30:50:20 (1964Ja05). α(L)exp=56 (1968Ki04). Uncertainties are probably 10%.
[x]48.5	0.4								γ in coin with Au K x ray. Probable mult=D, since with α(K)(E2)=149 detection would be difficult in γ-ray spectrum.
100.8	0.6	129.6	$(0,1,2)^-$	29.1	$1^-,2^-$	M1(+E2)	>1.1	5.5 *5*	α(K)=1.8 *12*; α(L)=2.8 *6*; α(M)=0.71 *15* α(N)=0.18 *4*; α(O)=0.028 *6*; α(P)=2.3×10^{-4} *14* α(K)exp=5.4 (1968Ki04), K/L1≈6 (1964Ja05).
112.6[c]		284.5	$(0,1,2)^-$	171.6	1^+	[E1]		0.307	α(K)=0.248 *4*; α(L)=0.0459 *7*; α(M)=0.01070 *15* α(N)=0.00262 *4*; α(O)=0.000453 *7*; α(P)=2.07×10^{-5} *3*
122.0[c]	0.4	122.0?		0.0	1^-	[D,E2]		2.3 *20*	
125.5[c]	<0.1	545.4?		419.9?		[D,E2]		2.0 *18*	
129.6[a]	2.3[a]	129.6	$(0,1,2)^-$	0.0	1^-	(M1)		3.46	α(K)=2.84 *4*; α(L)=0.475 *7*; α(M)=0.1103 *16* α(N)=0.0275 *4*; α(O)=0.00505 *7*; α(P)=0.000341 *5* I_γ: ≥1.5, from the intensity balance. α(K)exp(for doublet)=3.2 (1968Ki04), K/L1≈10 (1964Ja05).
129.6[b]	≤0.8[b]	414.0		284.5	$(0,1,2)^-$	[D,E2]		1.8 *16*	I_γ: from intensity balance.
133.4[c]	≈0.5	417.9?		284.5	$(0,1,2)^-$	[D,E2]		1.7 *15*	
135.4[c]	≈1.0	419.9?		284.5	$(0,1,2)^-$	[D,E2]		1.6 *14*	
137.3[c]	≈0.8	421.8?		284.5	$(0,1,2)^-$	[D,E2]		1.6 *14*	
142.6	100	171.6	1^+	29.1	$1^-,2^-$	E1		0.1689	α(K)=0.1372 *20*; α(L)=0.0244 *4*; α(M)=0.00567 *8* α(N)=0.001392 *20*; α(O)=0.000243 *4*; α(P)=1.187×10^{-5} *17* α(K)(E1)=0.137 used to normalize ce data for other transitions. K/L=10, L2/L3≈1 (1964Ja05).
146.5[c]	0.5	431.0?		284.5	$(0,1,2)^-$	[D,E2]		1.3 *11*	
154.7	3.7	284.5	$(0,1,2)^-$	129.6	$(0,1,2)^-$	M1(+E2)	<0.9	1.8 *3*	α(K)=1.4 *4*; α(L)=0.33 *4*; α(M)=0.079 *13* α(N)=0.020 *3*; α(O)=0.0034 *4*; α(P)=0.00017 *4* α(K)exp=1.6 (1968Ki04), K/L≥6 (1964Ja05). Mult=M1 from K/L.
[x]162.5[#]	0.1								γ probably in coin with Au K x ray.

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^{190}Hg ε decay (20.0 min) 1976Bi09 (continued)

γ(^{190}Au) (continued)

E_γ	I_γ [†] [@]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	δ [‡]	α [&]	Comments
165.4 [c]	1.4	165.4?	(1⁻,2⁻)	0.0	1⁻	E2+M1	1.4 +16−6	1.07 28	α(K)=0.66 32; α(L)=0.31 3; α(M)=0.078 10 α(N)=0.0193 23; α(O)=0.0032 3; α(P)=7.6×10^{-5} 39 α(K)exp=0.7 (1968Ki04).
171.5	7.0	171.6	1⁺	0.0	1⁻	(E1)		0.1059	α(K)=0.0865 13; α(L)=0.01497 21; α(M)=0.00347 5 α(N)=0.000855 12; α(O)=0.0001502 21; α(P)=7.68×10^{-6} 11 Mult.: α(K)exp=0.010 (1968Ki04), too low as compared to α(K)(E1)=0.087. The line may be contributed by an impurity. The value of Iγ=5.0 2 (1968Ki04) is also not in good agreement.
182.3 [c]	0.4	347.7?		165.4?	(1⁻,2⁻)	[D,E2]		0.7 6	
242.6		414.0		171.6	1⁺	[D,E2]		0.32 27	
255.3 [c]		284.5	(0,1,2)⁻	29.1	1⁻,2⁻	[M1,E2]		0.34 18	α(K)=0.26 17; α(L)=0.064 7; α(M)=0.0154 10 α(N)=0.0038 3; α(O)=0.00067 8; α(P)=3.0×10^{-5} 21
284.8 [a]	0.9 [a]	284.5	(0,1,2)⁻	0.0	1⁻	[M1,E2]		0.25 14	α(K)=0.19 13; α(L)=0.045 8; α(M)=0.0107 14 α(N)=0.0027 4; α(O)=0.00047 9; α(P)=2.2×10^{-5} 15
284.8 [a]	0.9 [a]	414.0		129.6	(0,1,2)⁻	[D,E2]		0.20 17	
373.8 [c]	0.4	545.4?		171.6	1⁺	[D,E2]		0.10 8	
384.5	0.3	414.0		29.1	1⁻,2⁻	[D,E2]		0.09 8	
[x]637.9 [#]	0.9								

[†] Uncertainty of ≈20% assumed by the evaluator. Intensities for six γ rays reported by 1968Ki04 are in general agreement.
[‡] From α(K)exp, unless otherwise noted. ce data normalized to 142.6γ treated as E1 with α(K)=0.137. Uncertainties on α(K)exp values assumed as ≈30% (evaluator). The same values are recommended in the Adopted Gammas.
[#] Questionable assignment of this γ ray to ^{190}Au decay.
[@] For absolute intensity per 100 decays, multiply by ≈0.67.
[&] 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] Multiply placed with undivided intensity.
[b] Multiply placed with intensity suitably divided.
[c] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

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Decay Scheme

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