^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 117, 1 (2014)	1-Oct-2013

Parent: ^{148}Ho: E=0.0+x; $J^\pi=(5^-)$; $T_{1/2}$=9.59 s *15*; Q(ε)=9860 *80*; %ε+%β^+ decay=100.0
Others: 1981GaZS, 1979To01.
Measured: γ, $\gamma\gamma$, K x ray, delayed protons (1988To03), γ, $\gamma\gamma$, Xγ (1989Ta11), ce (1996Ga24).

^{148}Dy Levels

Delayed proton emission probability=0.08% 1 (1988To03).

E(level)[†]	J^π[‡]	Comments
0.0	0^+	
1677.81 *17*	2^+	
1688.31 *17*	3^-	
2349.65 *21*	5^-	J^π: E2 to 3^- and log *ft*=5.8 from $(5)^-$.
2427.82 *19*	4^+	
2732.25 *23*	6^+	
2739.30 *25*	7^-	
2833.7 *3*	8^+	
2853.97 *25*	$(5,6)^-$	J^π: log *ft*=5.5 and M1 to 5^-.
2969.56 *22*	$(5,6,7)^-$[#]	
2995.27 *22*	$(4)^-$	
3115.6 *3*	$(6,7)^-$	J^π: log *ft*=6.2, M1 to 7^-.
3171.7 *3*	$(5,6,7)^-$[#]	
3188.57 *24*	$(5,6,7)^-$[#]	
3279.7 *3*	$(6)^-$	
3323.2 *3*	$(6)^-$	
3327.7 *5*	$(5)^-$	
3405.1 *5*	$(8)^-$	
3755.6 *3*	$(5,6,7)^-$[#]	
4289.47 *23*	$(5,6,7)^-$[#]	
4392.8 *3*	$(5,6,7)^-$[#]	
4459.9 *5*	$(5,6,7)^-$[#]	
4634.3 *5*	$(5,6,7)^-$[#]	
4762.0 *4*	$(5,6,7)^-$[#]	
5054.7 *5*	$(5,6,7)^-$[#]	
5261.0 *5*	$(5,6,7)^-$[#]	

[†] From a least-squares fit to Eγ data.
[‡] Adopted values, supported by log *ft* values and γ branchings.
[#] From log *ft* values for ε decay from $(5)^-$.

^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24 (continued)

ε,β⁺ radiations

ε feeding was determined on the assumption of no ε decay to ^{148}Dy ground state. log *ft* values calculated by setting parent level energy=0.0.

E(decay)	E(level)	Iβ⁺ †	Iε†	Log *ft*	I(ε+β⁺)†	Comments
(4.60×10³ *8*)	5261.0	1.13 *10*	0.60 *6*	5.54 *6*	1.73 *15*	av Eβ=1628 *39*; εK=0.291 *14*; εL=0.0433 *20*; εM+=0.0127 *6*
(4.81×10³ *8*)	5054.7	0.85 *10*	0.38 *5*	5.78 *6*	1.23 *14*	av Eβ=1724 *39*; εK=0.260 *12*; εL=0.0388 *18*; εM+=0.0114 *6*
(5.10×10³ *8*)	4762.0	1.81 *14*	0.65 *6*	5.59 *5*	2.46 *19*	av Eβ=1861 *40*; εK=0.223 *10*; εL=0.0332 *15*; εM+=0.0097 *5*
(5.23×10³ *8*)	4634.3	1.37 *13*	0.46 *5*	5.77 *6*	1.83 *17*	av Eβ=1920 *40*; εK=0.209 *10*; εL=0.0310 *14*; εM+=0.0091 *4*
(5.40×10³ *8*)	4459.9	0.87 *10*	0.25 *3*	6.05 *6*	1.12 *13*	av Eβ=2002 *40*; εK=0.191 *9*; εL=0.0283 *13*; εM+=0.0083 *4*
(5.47×10³ *8*)	4392.8	2.15 *20*	0.61 *6*	5.69 *6*	2.76 *25*	av Eβ=2033 *40*; εK=0.184 *8*; εL=0.0274 *12*; εM+=0.0080 *4*
(5.57×10³ *8*)	4289.47	9.5 *3*	2.50 *14*	5.09 *4*	12.0 *4*	av Eβ=2082 *40*; εK=0.175 *8*; εL=0.0260 *12*; εM+=0.0076 *4*
(6.10×10³ *8*)	3755.6	3.0 *3*	0.58 *5*	5.81 *5*	3.6 *3*	av Eβ=2333 *40*; εK=0.135 *6*; εL=0.0200 *9*; εM+=0.00586 *25*
(6.45×10³ *8*)	3405.1	0.92 *14*	0.144 *23*	6.46 *8*	1.06 *16*	av Eβ=2499 *40*; εK=0.114 *5*; εL=0.0170 *7*; εM+=0.00497 *20*
(6.53×10³ *8*)	3327.7	1.88 *11*	0.284 *21*	6.17 *4*	2.16 *13*	av Eβ=2536 *40*; εK=0.110 *5*; εL=0.0164 *7*; εM+=0.00480 *19*
(6.54×10³ *8*)	3323.2	2.28 *13*	0.344 *24*	6.09 *4*	2.62 *15*	av Eβ=2538 *40*; εK=0.110 *5*; εL=0.0163 *7*; εM+=0.00479 *19*
(6.58×10³ *8*)	3279.7	2.05 *14*	0.303 *24*	6.15 *5*	2.35 *16*	av Eβ=2559 *40*; εK=0.108 *5*; εL=0.0160 *7*; εM+=0.00470 *19*
(6.67×10³ *8*)	3188.57	2.23 *17*	0.31 *3*	6.15 *5*	2.54 *19*	av Eβ=2602 *40*; εK=0.104 *4*; εL=0.0154 *6*; εM+=0.00451 *18*
(6.69×10³ *8*)	3171.7	2.28 *15*	0.319 *24*	6.14 *4*	2.60 *17*	av Eβ=2610 *40*; εK=0.103 *4*; εL=0.0153 *6*; εM+=0.00447 *18*
(6.74×10³ *8*)	3115.6	2.24 *16*	0.305 *25*	6.17 *5*	2.55 *18*	av Eβ=2637 *40*; εK=0.100 *4*; εL=0.0149 *6*; εM+=0.00436 *17*
(6.86×10³ *8*)	2995.27	0.82 *20*	0.11 *3*	6.65 *11*	0.93 *23*	av Eβ=2694 *40*; εK=0.095 *4*; εL=0.0141 *6*; εM+=0.00414 *16*
(6.89×10³ *8*)	2969.56	6.7 *8*	0.85 *11*	5.74 *6*	7.6 *9*	av Eβ=2706 *40*; εK=0.094 *4*; εL=0.0140 *6*; εM+=0.00409 *16*
(7.01×10³ *8*)	2853.97	13.5 *3*	1.61 *7*	5.48 *3*	15.1 *3*	av Eβ=2761 *40*; εK=0.090 *4*; εL=0.0133 *5*; εM+=0.00389 *15*
(7.03×10³ *8*)	2833.7	0.71 *21*	0.084 *25*	6.77 *13*	0.79 *23*	av Eβ=2771 *40*; εK=0.089 *4*; εL=0.0132 *5*; εM+=0.00386 *15*
(7.12×10³ *8*)	2739.30	2.34 *22*	0.26 *3*	6.28 *5*	2.60 *24*	av Eβ=2816 *40*; εK=0.085 *3*; εL=0.0126 *5*; εM+=0.00371 *14*
(7.13×10³ *8*)	2732.25	3.1 *3*	0.34 *3*	6.16 *5*	3.4 *3*	av Eβ=2819 *40*; εK=0.085 *3*; εL=0.0126 *5*; εM+=0.00370 *14*
(7.43×10³ *8*)	2427.82	3.6 *3*	0.36 *3*	6.19 *5*	4.0 *3*	av Eβ=2965 *41*; εK=0.075 *3*; εL=0.0111 *4*; εM+=0.00326 *12*
(7.51×10³ *8*)	2349.65	9.2 *9*	0.87 *9*	5.81 *5*	10.1 *10*	av Eβ=3002 *41*; εK=0.073 *3*; εL=0.0108 *4*; εM+=0.00315 *11*

† Absolute intensity per 100 decays.

^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24 (continued)

γ(^{148}Dy)

Iγ normalization: Σ Ti(g.s.)=100.

E_γ[‡]	I_γ[@ b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[†]	$I_{(\gamma+ce)}$[b]	Comments
(10.5)	0.51 *4*	1688.31	3^-	1677.81	2^+	[E1]	26.1	13.8 *11*	ce(L)/(γ+ce)=0.747 *7*; ce(M)/(γ+ce)=0.176 *3*; ce(N+)/(γ+ce)=0.0405 *8* ce(N)/(γ+ce)=0.0370 *7*; ce(O)/(γ+ce)=0.00348 *7*; ce(P)/(γ+ce)=6.89×10^{-5} *14* E_γ,I_γ: from balance of Ti(10.5γ)/Ti(1688γ)=0.167 *13*, measured by 1989Ta11.
94.5 *2*	0.44 *5*	2833.7	8^+	2739.30	7^-	E1	0.359 *6*		α(K)=0.299 *5*; α(L)=0.0468 *8*; α(M)=0.01027 *16*; α(N+..)=0.00266 *4* α(N)=0.00233 *4*; α(O)=0.000316 *5*; α(P)=1.369×10^{-5} *21* E_γ: from 1988To03.
101.5 *3*	0.11 *6*	2833.7	8^+	2732.25	6^+	E2	2.57 *5*		α(K)=1.081 *18*; α(L)=1.142 *23*; α(M)=0.273 *6*; α(N+..)=0.0687 *14* α(N)=0.0613 *12*; α(O)=0.00737 *15*; α(P)=4.49×10^{-5} *7*
115.6 *3*	1.30 *5*	2969.56	$(5,6,7)^-$	2853.97	$(5,6)^-$	M1[a]	1.58 *3*		α(K)=1.332 *22*; α(L)=0.196 *4*; α(M)=0.0430 *7*; α(N+..)=0.01148 *19* α(N)=0.00994 *16*; α(O)=0.001454 *23*; α(P)=8.30×10^{-5} *14* α(K)exp=1.3 *3* (1996Ga24).
164.1 *3*	0.37 *5*	3279.7	$(6)^-$	3115.6	$(6,7)^-$	M1[a]	0.588		α(K)=0.495 *8*; α(L)=0.0724 *11*; α(M)=0.01589 *24*; α(N+..)=0.00425 *7* α(N)=0.00368 *6*; α(O)=0.000538 *8*; α(P)=3.08×10^{-5} *5* α(K)exp=4.2×10^{-1} *12* (1996Ga24).
261.5 *5*	0.27 *7*	3115.6	$(6,7)^-$	2853.97	$(5,6)^-$				
282.2 *5*	0.20 *5*	3115.6	$(6,7)^-$	2833.7	8^+				
304.5 *2*	1.50 *7*	2732.25	6^+	2427.82	4^+	E2	0.0616		α(K)=0.0463 *7*; α(L)=0.01189 *17*; α(M)=0.00274 *4*; α(N+..)=0.000706 *10* α(N)=0.000621 *9*; α(O)=8.18×10^{-5} *12*; α(P)=2.42×10^{-6} *4*
353.6 *4*	0.54 *8*	3323.2	$(6)^-$	2969.56	$(5,6,7)^-$	M1[a]	0.0730		α(K)=0.0617 *9*; α(L)=0.00884 *13*; α(M)=0.00194 *3*; α(N+..)=0.000518 *8* α(N)=0.000448 *7*; α(O)=6.58×10^{-5} *10*; α(P)=3.80×10^{-6} *6* α(K)exp=8×10^{-2} *5* (1996Ga24).
376.1 *5*	0.57 *8*	3115.6	$(6,7)^-$	2739.30	7^-	M1[a]	0.0621		α(K)=0.0525 *8*; α(L)=0.00751 *11*; α(M)=0.001644 *24*; α(N+..)=0.000439 *7* α(N)=0.000380 *6*; α(O)=5.58×10^{-5} *8*; α(P)=3.23×10^{-6} *5* α(K)exp=5.5×10^{-2} *26* (1996Ga24).
382.6 *2*	2.76 *13*	2732.25	6^+	2349.65	5^-	E1	0.00951 *14*		α=0.00951 *14*; α(K)=0.00808 *12*; α(L)=0.001126 *16*; α(M)=0.000246 *4*; α(N+..)=6.50×10^{-5} *10* α(N)=5.64×10^{-5} *8*; α(O)=8.10×10^{-6} *12*; α(P)=4.34×10^{-7} *6*
389.6 *2*	5.11 *9*	2739.30	7^-	2349.65	5^-	E2[a]	0.0299		α(K)=0.0234 *4*; α(L)=0.00505 *8*; α(M)=0.001150 *17*; α(N+..)=0.000299 *5*

From ENSDF

$^{148}_{66}Dy_{82}$-3

^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24 (continued)

γ(^{148}Dy) (continued)

E_γ[‡]	I_γ[@ b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[†]	Comments
								α(N)=0.000262 *4*; α(O)=3.54×10^{-5} *5*; α(P)=1.270×10^{-6} *18* α(K)exp=1.9×10^{-2} *5* (1996Ga24).
425.7 *4*	0.42 *8*	3279.7	(6)$^-$	2853.97	(5,6)$^-$			
x435.4# *6*	0.6# *1*							
504.3 *2*	18.62 *11*	2853.97	(5,6)$^-$	2349.65	5$^-$	M1[a]	0.0291	α(K)=0.0246 *4*; α(L)=0.00348 *5*; α(M)=0.000762 *11*; α(N+..)=0.000204 *3* α(N)=0.0001764 *25*; α(O)=2.59×10^{-5} *4*; α(P)=1.504×10^{-6} *22* α(K)exp=2.3×10^{-2} *5* (1996Ga24).
x540.5 *5*	0.46 *11*							
542.0 *5*	0.67 *11*	2969.56	(5,6,7)$^-$	2427.82	4$^+$			
567.3 *2*	1.16 *8*	2995.27	(4)$^-$	2427.82	4$^+$			
583.7# *3*	0.4# *1*	3323.2	(6)$^-$	2739.30	7$^-$			
620 *1*	2.79 *80*	2969.56	(5,6,7)$^-$	2349.65	5$^-$			
661.3 *2*	58.94 *16*	2349.65	5$^-$	1688.31	3$^-$	E2[a]	0.00758 *11*	α=0.00758 *11*; α(K)=0.00624 *9*; α(L)=0.001045 *15*; α(M)=0.000233 *4*; α(N+..)=6.13×10^{-5} *9* α(N)=5.34×10^{-5} *8*; α(O)=7.52×10^{-6} *11*; α(P)=3.56×10^{-7} *5* α(K)exp=5.9×10^{-3} *13* (1996Ga24).
665.8 *4*	1.06 *16*	3405.1	(8)$^-$	2739.30	7$^-$			
739.5 *2*	5.73 *10*	2427.82	4$^+$	1688.31	3$^-$	E1	0.00224 *4*	α=0.00224 *4*; α(K)=0.00191 *3*; α(L)=0.000257 *4*; α(M)=5.59×10^{-5} *8*; α(N+..)=1.486×10^{-5} *21* α(N)=1.288×10^{-5} *18*; α(O)=1.87×10^{-6} *3*; α(P)=1.059×10^{-7} *15*
750.0 *2*	3.62 *9*	2427.82	4$^+$	1677.81	2$^+$	E2	0.00567 *8*	α=0.00567 *8*; α(K)=0.00470 *7*; α(L)=0.000754 *11*; α(M)=0.0001673 *24*; α(N+..)=4.42×10^{-5} *7* α(N)=3.84×10^{-5} *6*; α(O)=5.46×10^{-6} *8*; α(P)=2.70×10^{-7} *4*
x760.4 *3*	0.47 *7*							
765.9 *2*	2.06 *10*	3115.6	(6,7)$^-$	2349.65	5$^-$			
x917.3 *4*	0.32 *11*							
930.0 *3*	1.34 *10*	3279.7	(6)$^-$	2349.65	5$^-$			
x961.2# *3*	0.8# *1*							
973.6 *2*	1.64 *5*	3323.2	(6)$^-$	2349.65	5$^-$			
x996.0 *4*	0.45 *11*							
1101.0 *3*	2.92 *13*	4289.47	(5,6,7)$^-$	3188.57	(5,6,7)$^-$			
x1176.4# *6*	1.1# *3*							
x1202.2 *4*	0.49 *12*							
1281.3 *2*	5.66 *17*	2969.56	(5,6,7)$^-$	1688.31	3$^-$			I_γ: derived from coincidence data.
1307.0 *2*	1.44 *13*	2995.27	(4)$^-$	1688.31	3$^-$			
1320.0 *2*	2.54 *16*	4289.47	(5,6,7)$^-$	2969.56	(5,6,7)$^-$			
1328.3 *5*	0.79 *17*	3755.6	(5,6,7)$^-$	2427.82	4$^+$			
x1391.8 *4*	0.71 *14*							
1397.3 *3*	1.67 *17*	4392.8	(5,6,7)$^-$	2995.27	(4)$^-$			
1405.9 *2*	2.82 *18*	3755.6	(5,6,7)$^-$	2349.65	5$^-$			
1483.4 *2*	2.60 *16*	3171.7	(5,6,7)$^-$	1688.31	3$^-$			

From ENSDF

$^{148}_{66}Dy_{82}$-4

^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24 (continued)

γ(^{148}Dy) (continued)

E_γ[‡]	I_γ[@ b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[†]	Comments
1500.3 *2*	5.46 *13*	3188.57	(5,6,7)$^-$	1688.31	3$^-$			
[x]1504.3[#] *6*	1.3[#] *2*							
[x]1600.4[#] *4*	0.8[#] *2*							
1639.4 *4*	2.16 *12*	3327.7	(5)$^-$	1688.31	3$^-$			
1661.5 *8*	0.51 *12*	4392.8	(5,6,7)$^-$	2732.25	6$^+$			
1677.8 *2*	17.4 *11*	1677.81	2$^+$	0.0	0$^+$	E2	0.001243 *18*	α=0.001243 *18*; α(K)=0.000939 *14*; α(L)=0.0001290 *18*; α(M)=2.81×10^{-5} *4*; α(N+..)=0.000147 α(N)=6.49×10^{-6} *9*; α(O)=9.49×10^{-7} *14*; α(P)=5.42×10^{-8} *8*; α(IPF)=0.0001400 *20*
1688.3 *2*	82.47 *30*	1688.31	3$^-$	0.0	0$^+$	E3	0.00212 *3*	α=0.00212 *3*; α(K)=0.001724 *25*; α(L)=0.000257 *4*; α(M)=5.67×10^{-5} *8*; α(N+..)=8.62×10^{-5} *12* α(N)=1.308×10^{-5} *19*; α(O)=1.90×10^{-6} *3*; α(P)=1.034×10^{-7} *15*; α(IPF)=7.11×10^{-5} *10*
1861.5 *4*	1.18 *14*	4289.47	(5,6,7)$^-$	2427.82	4$^+$			
1939.7 *3*	4.62 *17*	4289.47	(5,6,7)$^-$	2349.65	5$^-$			
2043.4 *4*	0.58 *13*	4392.8	(5,6,7)$^-$	2349.65	5$^-$			
2110.2 *4*	1.12 *13*	4459.9	(5,6,7)$^-$	2349.65	5$^-$			
2284.6 *4*	1.56 *13*	4634.3	(5,6,7)$^-$	2349.65	5$^-$			
2291.4 *4*	1.73 *14*	5261.0	(5,6,7)$^-$	2969.56	(5,6,7)$^-$			
2412.4 *4*	1.94 *15*	4762.0	(5,6,7)$^-$	2349.65	5$^-$			
2600.9 *4*	0.75 *11*	4289.47	(5,6,7)$^-$	1688.31	3$^-$			
2705.0 *4*	1.23 *14*	5054.7	(5,6,7)$^-$	2349.65	5$^-$			
2945.8 *10*	0.27 *10*	4634.3	(5,6,7)$^-$	1688.31	3$^-$			
3073.4 *6*	0.52 *11*	4762.0	(5,6,7)$^-$	1688.31	3$^-$			

[†] Additional information 1.
[‡] From 1989Ta11, unless indicated otherwise.
[#] Observed only in 1988To03.
[@] Relative intensity (1989Ta11).
[&] From adopted gammas supported by ce data from this data set.
[a] From ce data (1996Ga24).
[b] For absolute intensity per 100 decays, multiply by 1.00 *1*.
[x] γ ray not placed in level scheme.

From ENSDF

$^{148}_{66}Dy_{82}$-5

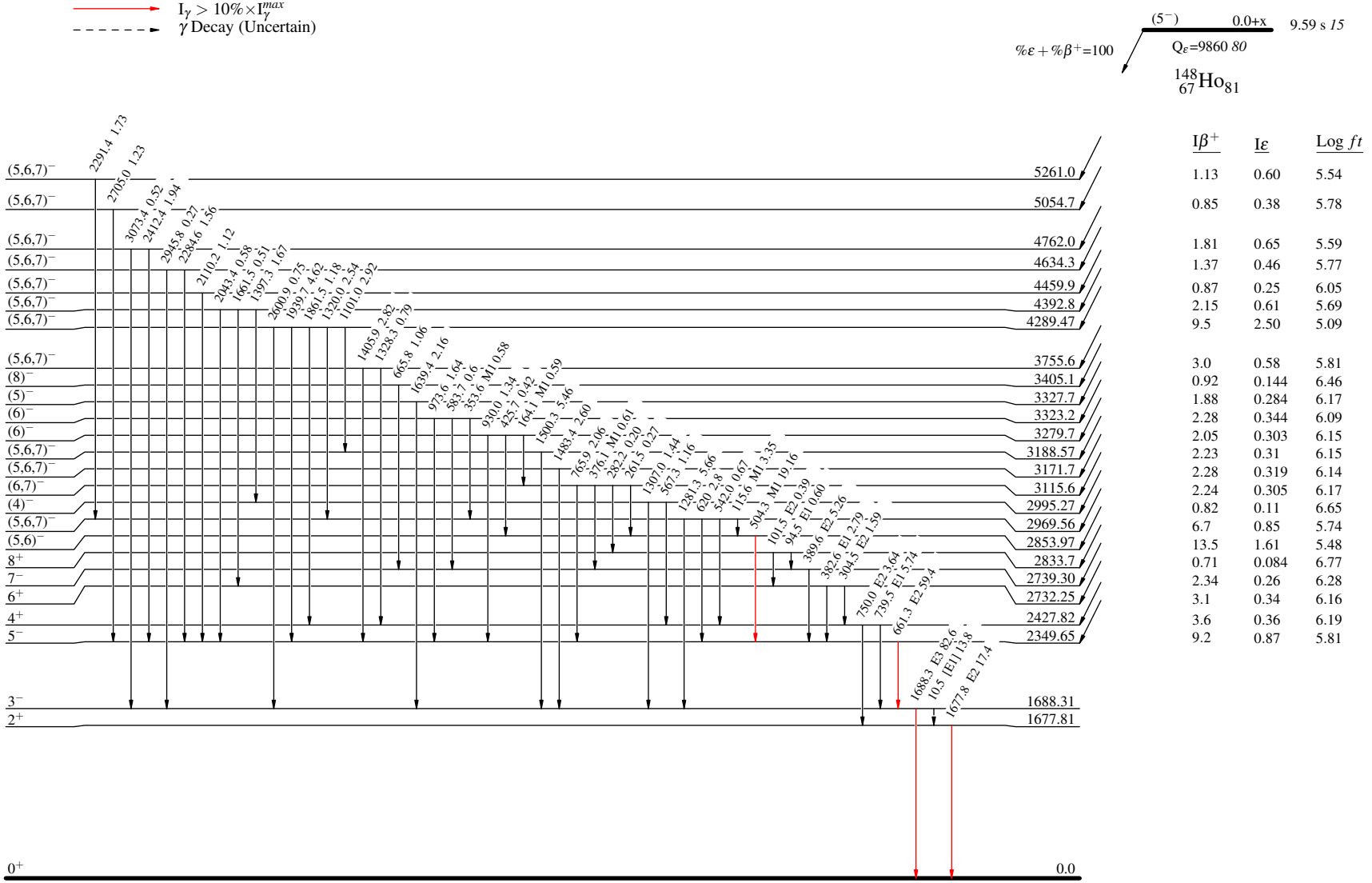
^{148}Ho ε decay (9.59 s) 1988To03,1989Ta11,1996Ga24

Decay Scheme

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

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)



	Iβ⁺	Iε	Log *ft*
5261.0	1.13	0.60	5.54
5054.7	0.85	0.38	5.78
4762.0	1.81	0.65	5.59
4634.3	1.37	0.46	5.77
4459.9	0.87	0.25	6.05
4392.8	2.15	0.61	5.69
4289.47	9.5	2.50	5.09
3755.6	3.0	0.58	5.81
3405.1	0.92	0.144	6.46
3327.7	1.88	0.284	6.17
3323.2	2.28	0.344	6.09
3279.7	2.05	0.303	6.15
3188.57	2.23	0.31	6.15
3171.7	2.28	0.319	6.14
3115.6	2.24	0.305	6.17
2995.27	0.82	0.11	6.65
2969.56	6.7	0.85	5.74
2853.97	13.5	1.61	5.48
2833.7	0.71	0.084	6.77
2739.30	2.34	0.26	6.28
2732.25	3.1	0.34	6.16
2427.82	3.6	0.36	6.19
2349.65	9.2	0.87	5.81

$^{148}_{66}Dy_{82}$

From ENSDF

$^{148}_{66}Dy_{82}$-6