^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 107, 791 (2006)	15-Sep-2005

Others: 1972Kh05, 1973Ha07, 1973Re16, 1973Sa14, 1982Ko08.
Target: 95.8% enriched ^{174}Yb. Projectiles: α's, E=18-24 MeV. Measured Eγ, Iγ, $\gamma\gamma$ coin, Ice. Detectors:Ge(Li), magnetic spectrometer (1973Kh03,1973Kh02).

^{176}Hf Levels

$T_{1/2}$(3080, $J^\pi=15^+$)=0.20 ns *+12 −8* (1982Ko08). The 3080 level was observed at a projectile energy Eα=27 MeV. See also ^{176}Yb(α,4nγ).

E(level)‡	J^π†	$T_{1/2}$	E(level)‡	J^π†
0.0&	0^+		1761.53 *11*	(6^+)
88.32& *5*	2^+		1766.86 *21*	$(3,4,5)^+$
290.15& *6*	4^+		1774.6? *8*	
596.94& *7*	6^+		1785.01c *12*	$(7)^-$
997.92& *8*	8^+		1785.15 *13*	$(9)^-$
1150.01a *10*	0^+		1798.05 *11*	$(7)^-$
1226.3a *3*	2^+		1798.4e *5*	(5^+)
1247.52c *9*	2^-		1815.2 *4*	
1292.9b *3*	0^+		1830.4? *5*	
1313.22c *8*	3^-		1853.2 *10*	$(3^+,4^+,5^+)$
1333.13# *9*	6^+	9.5@ μs *2*	1860.14 *12*	$(8)^-$
1341.12d *21*	2^+		1862.0d *4*	(6^+)
1379.13b *21*	2^+		1866.3 *5*	$(5^+,6^+,7^+)$
1390.25a *14*	4^+		1878? *1*	$(5^+,6^+,7^+)$
1404.35c *8*	$(4)^-$		1903.87 *13*	$(3^-,4^-,5^-)$
1445.8d *4*	3^+		1906? *1*	$(7^+,8^+,9^+)$
1450.3? *8*			1914.19 *10*	(9^+)
1454.0? *2*	$(5^+,6^+,7^+)$		1924.6 *6*	$(2,3)^-$
1457.0? *8*			1926.74 *12*	(7^+)
1481.26& *10*	$(10)^+$		1930.84 *11*	(8^-)
1505.88 *10*	(7^+)		1932.8a *3*	$(8)^+$
1508.53c *9*	$(5)^-$		1944.48e *17*	(6^+)
1532.5 *6*			1959.76? *19*	
1540.3d *4*	(4^+)		1964.0 *3*	$^-$
1559.37# *10*	8^-	9.8@ μs *2*	1977.0? *6*	
1577.19e *12*	(3^+)		1992.53c *12*	$(8)^-$
1592.0b *3*	(4^+)		2014.32 *14*	$(9)^-$
1609.3? *4*			2024.04 *21*	$(^+)$
1628.61a *15*	6^+		2031.11 *13*	(10^-)
1643.7 *4*	1^-		2034.6? *3*	
1652.94c *8*	$(6)^-$		2034.86& *14*	(12^+)
1675.92e *17*	(4^+)		2050.15 *13*	$(^-)$
1699.98 *10*	(8^+)		2058.0? *2*	
1704.6? *3*	(2^+)		2076.8? *4*	
1709.72 *18*	(3^-)		2082.5? *6*	
1727.78d *20*	(5^+)		2085.74 *11*	(9^-)
1732.52 *11*	$(5^+,6^+,7^+)$		2086.01 *20*	$^+$

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

^{176}Hf Levels (continued)

E(level)‡	Jπ†	E(level)‡	Jπ†	E(level)‡	Jπ†	E(level)‡	Jπ†
2097.0 *5*	(+)	2194.08 *20*	(10−)	2332.6? *9*		2541.0? *5*	
2106.6[d] *4*	(7)+	2258.7 *6*	(6−,7−,8−)	2360.6? *2*		2557.0? *8*	(7+,8+,9+)
2112.95 *21*	(8+)	2261.61 *13*	(10−)	2361.1? *6*		2563.60 *23*	(12−)
2116.9[e] *3*	(7+)	2265.4? *7*		2399.03 *14*	(11+)	2565? *1*	
2137.3[c] *3*	(9)−	2285.0[d] *5*	(8+)	2399.06 *20*	(11−)	2568.51 *23*	
2147.68 *12*	(10+)	2293.91 *15*	(11−)	2432.1? *9*		2638.2 *5*	(12−)
2160.3 *6*		2295.0[a] *3*	(10)+	2446.9? *6*		2646.8 *3*	(14+)
2172.9? *6*		2304.9[e] *8*	(8+)	2458.1? *7*	(7−,8−,9−)	2681.7? *6*	
2173.9 *8*		2318.7 *5*	(9+)	2502?		2827.1 *6*	(13−)

† From Adopted Levels.
‡ Deduced by evaluator from a least-squares fit to γ-ray energies.
# The population of the 1559 level relative to that of the 1333 level is very sensitive to the projectile energy; raising the energy from 22.5 MeV to 24.0 MeV increases its value by 65% (1973Kh02).
@ From 1973Kh02.
& $K^\pi=0^+$ g.s. band.
[a] $K^\pi=0^+$ β^-Vibrational band.
[b] $K^\pi=0^+$ band.
[c] $K^\pi=2^-$ Octupole-vibrational band.
[d] $K^\pi=2^+$ mixed γ-vibrational band.
[e] $K^\pi=(3^+)$ band.

γ(^{176}Hf)

Eγ@	Iγ@	Ei(level)	J_i^π	Ef	J_f^π	Mult.†@	α‡	Comments
53.49 *7*	3.9	1559.37	8−	1505.88	(7+)	(E1)	0.367	α(L)= 0.285; α(M)= 0.0644; α(N+..)= 0.0179 Mult.: from transition-intensity balance about the 1559 level.
88.32 *5*	26.5	88.32	2+	0.0	0+	E2	5.87	α(K)= 1.21; α(L)= 3.53; α(M)= 0.878; α(N+..)= 0.251 Mult.: from α(M)exp≈0.6.
91.12 *5*	0.40	1404.35	(4)−	1313.22	3−			
105.0 *2*	0.05	2399.06	(11−)	2293.91	(11−)			
132.80 *7*	0.16	1930.84	(8−)	1798.05	(7)−			
144.45 *7*	0.19	1652.94	(6)−	1508.53	(5)−			
146.28 *5*	0.24	2050.15	(−)	1903.87	(3−,4−,5−)			
155.0[c] *5*	0.10[c]	2014.32	(9)−	1860.14	(8)−			
155.0[c] *5*	0.10[c]	2085.74	(9−)	1930.84	(8−)			
156.83 *4*	2.7	1404.35	(4)−	1247.52	2−	E2	0.671	α(K)= 0.328; α(L)= 0.261; α(M)= 0.0641; α(N+..)= 0.0183 Mult.: from α(K)exp=0.27.
163.0 *2*	0.10	2194.08	(10−)	2031.11	(10−)	(M1+E2)	0.81 *22*	α(K)= 0.6 *3*; α(L)= 0.18 *8*; α(M)= 0.042 *18*; α(N+..)= 0.012 *3* Mult.: from α(K)exp≈0.8.
[x]169.6 *5*	0.34							
172.73 *4*	11.4	1505.88	(7+)	1333.13	6+	(M1+E2)	0.67 *20*	α(K)= 0.49 *24*; α(L)= 0.14 *6*; α(M)= 0.034 *15*; α(N+..)= 0.0097 *23* Mult.: from α(K)exp=0.61 *6* (1973Kh02).

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
173.0[e]		1577.19	(3$^+$)	1404.35	(4)$^-$			
180 *1*	0.06	2194.08	(10$^-$)	2014.32	(9)$^-$			
191.6[e] *5*	0.05	1977.0?		1785.15	(9)$^-$			
194.09 *4*	2.2	1699.98	(8$^+$)	1505.88	(7$^+$)	(M1)	0.629	α(K)= 0.524; α(L)= 0.0811; α(M)= 0.0183; α(N+..)= 0.00538 Mult.: from α(K)exp=0.53.
196.0[&e] *5*	≈0.2	1508.53	(5)$^-$	1313.22	3$^-$			
196.3[&] *5*	0.15	2160.3		1964.0	$^-$			
201.82 *4*	100	290.15	4$^+$	88.32	2$^+$	E2[#]	0.282	α(K)= 0.164; α(L)= 0.0893; α(M)= 0.0218; α(N+..)= 0.00618
214.22 *4*	1.0	1914.19	(9$^+$)	1699.98	(8$^+$)	(M1+E2)	0.35 *12*	α(K)= 0.27 *13*; α(L)= 0.07 *3*; α(M)= 0.015 *6*; α(N+..)= 0.0044 *4* Mult.: from α(K)exp=0.35.
225.74 *10*	5.0	1785.15	(9)$^-$	1559.37	8$^-$	(M1)	0.414	α(K)= 0.345; α(L)= 0.0533; α(M)= 0.0120; α(N+..)= 0.00352 Mult.: from α(K)exp=0.40, using theoretical α(K)(226.25γ, M2)=1.6.
226.25 *6*	1.2	1559.37	8$^-$	1333.13	6$^+$	M2	1.99	α(K)= 1.54; α(L)= 0.342; α(M)= 0.0807; α(N+..)= 0.0239 Mult.: from α(K)exp=1.2 *2* (1967Bo08). Other value: 1.6 *3*, if 225.74γ is pure M1 (1973Kh02).
226.9 *5*	0.3	1732.52	(5$^+$,6$^+$,7$^+$)	1505.88	(7$^+$)			
229.15 *7*	0.7	2014.32	(9)$^-$	1785.15	(9)$^-$	(M1)	0.397	α(K)= 0.331; α(L)= 0.0511; α(M)= 0.0115; α(N+..)= 0.00337 Mult.: from α(K)exp≈0.4.
233.54 *10*	0.30[a]	2147.68	(10$^+$)	1914.19	(9$^+$)	(M1+E2)	0.28 *10*	α(K)= 0.21 *10*; α(L)= 0.049 *20*; α(M)= 0.011 *5*; α(N+..)= 0.00329 *9* Mult.: from α(K)exp≈0.26.
238.36[e] *7*	0.33	1628.61	6$^+$	1390.25	4$^+$			
245.97 *4*	1.9	2031.11	(10$^-$)	1785.15	(9)$^-$	(M1)	0.327	α(K)= 0.273; α(L)= 0.0420; α(M)= 0.00945; α(N+..)= 0.00277 Mult.: from α(K)exp≈0.4.
248.58 *4*	4.2	1652.94	(6)$^-$	1404.35	(4)$^-$	E2	0.143	α(K)= 0.0923; α(L)= 0.0386; α(M)= 0.00934; α(N+..)= 0.00264 Mult.: from α(K)exp≈0.13.
251.36 *10*	0.10	2399.03	(11$^+$)	2147.68	(10$^+$)			
262.78 *6*	0.62	2293.91	(11$^-$)	2031.11	(10$^-$)	(M1)	0.273	α(K)= 0.228; α(L)= 0.0350; α(M)= 0.00788; α(N+..)= 0.00231 Mult.: from α(K)exp≈0.4.
263.95 *10*	0.30	1577.19	(3$^+$)	1313.22	3$^-$			
265.15 *7*	0.40	2050.15	(−)	1785.01	(7)$^-$			
268.61[e] *12*	0.18	1944.48	(6$^+$)	1675.92	(4$^+$)			
269.64 *18*	0.11	2563.60	(12$^-$)	2293.91	(11$^-$)			
271.8[e] *3*	0.09	1675.92	(4$^+$)	1404.35	(4)$^-$			
272.88[e] *10*	≈0.1[a]	2058.0?		1785.15	(9)$^-$			

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
276.4[e] *3*	0.14	1785.01	$(7)^-$	1508.53	$(5)^-$			
287.69 *2*	0.2	2085.74	(9^-)	1798.05	$(7)^-$			
[x]288.60 *20*	0.2							
289.6[e]	0.11	1798.4	(5^+)	1508.53	$(5)^-$			
300.78 *6*	1.1	1860.14	$(8)^-$	1559.37	8^-	(M1)	0.189	α(K)= 0.158; α(L)= 0.0242; α(M)= 0.00544; α(N+..)= 0.00159 Mult.: from α(K)exp=0.17.
301.5[e] *8*	0.2	2332.6?		2031.11	(10^-)			
306.78 *4*	69.5	596.94	6^+	290.15	4^+	E2	0.0747	α(K)= 0.0520; α(L)= 0.0173; α(M)= 0.00416; α(N+..)= 0.00117 Mult.: from α(K)exp=0.049.
311.1 *3*	1.1	1964.0	$^-$	1652.94	$(6)^-$	M1	0.173	α(K)= 0.144; α(L)= 0.0221; α(M)= 0.00497; α(N+..)= 0.00145 Mult.: from α(K)exp=0.13.
330.77 *8*	0.46	2261.61	(10^-)	1930.84	(8^-)	(E2)	0.0598	α(K)= 0.0426; α(L)= 0.0132; α(M)= 0.00316; α(N+..)= 0.000889 Mult.: from α(K)exp<0.05.
334.3 *5*	0.10	2194.08	(10^-)	1860.14	$(8)^-$			
337.23 *8*	0.62	2050.15	$(^-)$	1709.72	(3^-)	(M1+E2)	0.10 *4*	α(K)= 0.08 *4*; α(L)= 0.015 *6*; α(M)= 0.0035 *14*; α(N+..)= 0.00100 *17* Mult.: from α(K)exp=0.08.
339.59 *8*	1.3	1992.53	$(8)^-$	1652.94	$(6)^-$	E2	0.0554	α(K)= 0.0397; α(L)= 0.0120; α(M)= 0.00287; α(N+..)= 0.000809 Mult.: from α(K)exp=0.041.
344.3 *5*	0.1	2638.2	(12^-)	2293.91	(11^-)			
352.4[e] *3*	≈0.2	2137.3	$(9)^-$	1785.01	$(7)^-$			
361.9[&] *8*	0.1	2295.0	$(10)^+$	1932.8	$(8)^+$			
366.87 *5*	1.1	1699.98	(8^+)	1333.13	6^+			
368.1 *2*	0.2	2399.06	(11^-)	2031.11	(10^-)			
386.3 *6*	0.11	2085.74	(9^-)	1699.98	(8^+)			
399.38 *7*	2.3	1732.52	$(5^+,6^+,7^+)$	1333.13	6^+	(M1)	0.0889	α(K)= 0.0744; α(L)= 0.0113; α(M)= 0.00254; α(N+..)= 0.000741 Mult.: from α(K)exp≈0.1.
400.99 *4*	19.2	997.92	8^+	596.94	6^+	E2	0.0347	α(K)= 0.0259; α(L)= 0.00678; α(M)= 0.00161; α(N+..)= 0.000455 Mult.: from α(K)exp=0.025.
404.7 *6*	0.16	2318.7	(9^+)	1914.19	(9^+)			
408.3[d] *2*	1.2[d]	1914.19	(9^+)	1505.88	(7^+)	[E2]	0.0330	α(K)= 0.0247; α(L)= 0.00639; α(M)= 0.00151; α(N+..)= 0.000428
408.7[d] *3*	0.5[d]	2194.08	(10^-)	1785.15	$(9)^-$	(M1)	0.0837	α(K)= 0.0700; α(L)= 0.0106; α(M)= 0.00238; α(N+..)= 0.000697 Mult.: from α(K)exp=0.057 (if α(K)(408.3γ, E2, theory)=0.024).
412.9 *2*	0.23	2112.95	(8^+)	1699.98	(8^+)			
420.86 *8*	0.65	1926.74	(7^+)	1505.88	(7^+)	(M1)	0.0775	α(K)= 0.0648; α(L)= 0.00981; α(M)= 0.00221; α(N+..)= 0.000645 Mult.: from α(K)exp=0.07.
424.96 *6*	1.4	1930.84	(8^-)	1505.88	(7^+)	(E1)	0.00945	α(K)= 0.00795; α(L)= 0.00117; α(M)= 0.000260; α(N+..)= 0.0000748 Mult.: from α(K)exp<0.008.
428.40 *7*	1.1	1761.53	(6^+)	1333.13	6^+	(M1)	0.0740	α(K)= 0.0619; α(L)= 0.00936; α(M)= 0.00210; α(N+..)= 0.000616 Mult.: from α(K)exp=0.056.

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
[x]436.85 *15*	0.14[a]							
447.66 *9*	0.75	2147.68	(10^+)	1699.98	(8^+)	(E2)	0.0258	α(K)= 0.0197; α(L)= 0.00475; α(M)= 0.00112; α(N+..)= 0.000318 Mult.: from α(K)exp=0.025.
455.1 *2*	0.42	2014.32	$(9)^-$	1559.37	8^-			
460.7 *5*	0.2	2258.7	$(6^-,7^-,8^-)$	1798.05	$(7)^-$	(M1)	0.0612	α(K)= 0.0512; α(L)= 0.00773; α(M)= 0.00174; α(N+..)= 0.000509 Mult.: from α(K)exp≈0.07.
462.0[&] *5*	0.3	1866.3	$(5^+,6^+,7^+)$	1404.35	$(4)^-$			
464.92 *7*	3.3	1798.05	$(7)^-$	1333.13	6^+	(E1)	0.00771	α(K)= 0.00649; α(L)= 0.000948; α(M)= 0.000211; α(N+..)= 0.0000610 Mult.: from α(K)exp≈0.008.
467.4[e] *3*	0.2	2265.4?		1798.05	$(7)^-$			
471.6 *2*	0.24	2031.11	(10^-)	1559.37	8^-			
483.33 *5*	5.1	1481.26	$(10)^+$	997.92	8^+	E2	0.0212	α(K)= 0.0163; α(L)= 0.00374; α(M)= 0.000874; α(N+..)= 0.000250 Mult.: from α(K)exp=0.017.
484.8[&] *2*	0.19	2399.03	(11^+)	1914.19	(9^+)			
[x]497.4 *2*	0.34							
508.9 *5*	0.24	2293.91	(11^-)	1785.15	$(9)^-$			
533.1[d] *7*	0.1[d]	2563.60	(12^-)	2031.11	(10^-)			
533.1[d] *7*	0.16[d]	2827.1	(13^-)	2293.91	(11^-)			
537.4 *2*	0.3[a]	2568.51		2031.11	(10^-)			
553.6 *1*	1.0	2034.86	(12^+)	1481.26	$(10)^+$			
554.3 *5*	0.3	2568.51		2014.32	$(9)^-$			
576.0[e] *5*	0.1[a]	2361.1?		1785.15	$(9)^-$			
594[&] *1*	0.15	1926.74	(7^+)	1333.13	6^+			
601.3[e] *6*	0.2	2082.5?		1481.26	$(10)^+$			
607.5 *5*	0.2	2112.95	(8^+)	1505.88	(7^+)			
611.4[de] *4*	0.33[d]	1609.3?		997.92	8^+			
611.4[d&] *6*	0.2[d]	1924.6	$(2,3)^-$	1313.22	3^-	M1[#]	0.0296	α(K)= 0.0246; α(L)= 0.00370
611.9 *3*		2646.8	(14^+)	2034.86	(12^+)			E_γ: from 1973Sa14. Others: 1972Fe08, 1973Re16.
618.5 *8*	0.2	2318.7	(9^+)	1699.98	(8^+)			
[x]621 *1*	0.2							
626.8 *5*	0.2[a]	2541.0?		1914.19	(9^+)			
630.7[&] *3*	0.2	1628.61	6^+	997.92	8^+			
631.5[e] *5*	0.1	2332.6?		1699.98	(8^+)			
647.0[e] *8*	0.2	2432.1?		1785.15	$(9)^-$			
655.3[e] *5*	≈0.15	2137.3	$(9)^-$	1481.26	$(10)^+$			
667.1[e] *5*	0.07	2172.9?		1505.88	(7^+)			
701.5[e] *2*	0.51	2034.6?		1333.13	6^+			
736.20 *7*	28.9	1333.13	6^+	596.94	6^+	E2	0.00786	α(K)= 0.00633; α(L)= 0.00115 Mult.: from α(K)exp=0.0072 *10* using theoretical α(K)exp(1043γ, E2)=0.0031 (1973Ha07).
[x]750.2 *5*	0.25							
[x]754.5 *5*	0.26							
767.6[e] *5*	0.26	2681.7?		1914.19	(9^+)			
783 *1*	0.17	2568.51		1785.15	$(9)^-$			

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
787.14 *15*	1.0	1785.01	$(7)^-$	997.92	8^+	E1,E2	0.0047 *21*	α(K)= 0.0038 *17*; α(L)= 0.00064 *24* Mult.: from α(K)exp≈0.0045.
793.5 *3*	0.57	1390.25	4^+	596.94	6^+			
802[&e] *1*	0.2	2502?		1699.98	(8^+)			
813.8 *3*	0.30	2295.0	$(10)^+$	1481.26	$(10)^+$	E0+E2(+M1)		Mult.: from α(K)exp=0.030.
857.1[e] *1*	0.33	1454.0?	$(5^+,6^+,7^+)$	596.94	6^+	M1+E2	0.009 *4*	α(K)= 0.008 *3*; α(L)= 0.0012 *4* Mult.: from α(K)exp=0.0068.
908[&e] *1*	0.2	1906?	$(7^+,8^+,9^+)$	997.92	8^+	M1+E2	0.008 *3*	α(K)= 0.0066 *25*; α(L)= 0.0010 *4* Mult.: from α(K)exp≈0.008.
911.8 *3*	1.8	1508.53	$(5)^-$	596.94	6^+	E1	0.00195	α(K)= 0.00165; α(L)= 0.000230 Mult.: from α(K)exp≈0.0007.
934.8[& *5*]	0.6	1932.8	$(8)^+$	997.92	8^+	E0+E2(+M1)		Mult.: from α(K)exp>0.017 for Ice(934.8γ + 935.8γ).
935.8[d& *5*]	0.8[d]	1226.3	2^+	290.15	4^+			From (936γ)(307γ)-coin, E(level)=1532.5 proposed (1973Kh03).
935.8[d& *5*]	0.8[d]	1532.5		596.94	6^+			
1023.0 *1*	3.2	1313.22	3^-	290.15	4^+	E1	0.00158	α(K)= 0.00133; α(L)= 0.000185 Mult.: from α(K)exp=0.0018.
1031.7 *3*	1.4	1628.61	6^+	596.94	6^+	E0+E2(+M1)		Mult.: from α(K)exp=0.026 (1973Kh03). Other value: 0.060 *15* (1973Ha07).
1043.0 *1*	18.5	1333.13	6^+	290.15	4^+	E2	0.00379	α(K)= 0.00312; α(L)= 0.000503 Mult.: from α(K)exp=0.0027.
1055.8[& *5*]	0.34	1652.94	$(6)^-$	596.94	6^+			
1062	0.41	1150.01	0^+	88.32	2^+	E2[#]	0.00365	α(K)= 0.00301; α(L)= 0.000483
1078.9[e *3*]	0.40	2076.8?		997.92	8^+			
1088.1 *2*	0.45	2086.01	$^+$	997.92	8^+			
1099.9 *3*	1.6	1390.25	4^+	290.15	4^+	E0+E2(+M1)		Mult.: from α(K)exp=0.021 for Ice(1099.9γ + 1100γ). α(K)exp=0.048 *10* (1973Ha07).
1100[& *1*]	0.3	2097.0	$(^+)$	997.92	8^+			
1108.7 *5*	0.5	2106.6	$(7)^+$	997.92	8^+			Mult.: Reported as E1,E2 from α(K)exp<0.0026 (1973Kh03, 1973Kh08). Level scheme requires (M1+E2).
1114.2 *1*	2.3	1404.35	$(4)^-$	290.15	4^+	E1	0.00135	α(K)= 0.00114; α(L)= 0.000158 Mult.: from α(K)exp<0.0006.
1130.4 *5*	0.50	1727.78	(5^+)	596.94	6^+			
1138.1[& *5*]	1.1	1226.3	2^+	88.32	2^+	E0+E2(+M1)	≈0.037[b]	Mult.: from α(K)exp≈0.015 for Ice(1138.1 + 1139.4).
1139.4[& *5*]	1.1	2137.3	$(9)^-$	997.92	8^+	E1	0.00130	α(K)= 0.00110; α(L)= 0.000152 Mult.: from α(K)exp≈0.0011 for Ice(1139.4γ + 1138.1γ).
1150.0 *1*		1150.01	0^+	0.0	0^+	E0		Mult.: from α(K)exp>0.025. Photons not observed (Iγ<0.1).
1155.6 *4*	0.7	1445.8	3^+	290.15	4^+	M1	0.00604	α(K)= 0.00506; α(L)= 0.000742 Mult.: from α(K)exp=0.0086.
1159.2 *2*	10.6	1247.52	2^-	88.32	2^+	(E1+M2)	0.0034[b]	Mult.: from α(K)exp=0.0019 for Ice(1159γ + 1160γ).
1160.1[e *8*]	0.7	1450.3?		290.15	4^+			

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
1166.8[&e] *8*	0.4	1457.0?		290.15	4$^+$			
1177.7[&e] *8*	0.3	1774.6?		596.94	6$^+$			
1188.1 *2*	4.0	1785.01	(7)$^-$	596.94	6$^+$	E1	0.00120	α(K)=0.001018; α(L)= 0.000140 Mult.: from α(K)exp=0.0014.
1201.8 *7*	0.4	1798.4	(5$^+$)	596.94	6$^+$			
1204.8 *6*	0.6	1292.9	0$^+$	88.32	2$^+$			
1218.4[d&] *1*	5.0[d]	1508.53	(5)$^-$	290.15	4$^+$			
1218.4[d&] *8*	0.5[d]	1815.2		596.94	6$^+$			
1224.9 *1*	7.3	1313.22	3$^-$	88.32	2$^+$	E1[#]	0.00114	α(K)=0.000964; α(L)= 0.000133
1227.5[e] *10*	1.4	1226.3	2$^+$	0.0	0$^+$	(E2)	0.00275	α(K)= 0.00228; α(L)= 0.000353 Mult.: from α(K)exp≈0.0029.
1250.1 *4*	1.0	1540.3	(4$^+$)	290.15	4$^+$	(M1+E2)	0.0038 *12*	α(K)= 0.0032 *10*; α(L)= 0.00048 *14* Mult.: from α(K)exp≈0.0026.
1252.6 *3*	2.1	1341.12	2$^+$	88.32	2$^+$	M1+E2	0.0038 *12*	α(K)= 0.0032 *10*; α(L)= 0.00047 *14* Mult.: from α(K)exp=0.0031.
1265.2[&] *5*	0.9	1862.0	(6$^+$)	596.94	6$^+$			
1281[&e] *1*	0.45	1878?	(5$^+$,6$^+$,7$^+$)	596.94	6$^+$	(M1+E2)	0.0036 *11*	α(K)= 0.0030 *9*; α(L)= 0.00045 *13* Mult.: from α(K)exp≈0.005.
1287.1[c&] *5*	0.4[c]	1577.19	(3$^+$)	290.15	4$^+$			
1287.1[c&] *5*	0.4[c]	2285.0	(8$^+$)	997.92	8$^+$			
1290.8 *2*	1.2	1379.13	2$^+$	88.32	2$^+$	E0+E2(+M1)		Mult.: from α(K)exp≈0.019.
1292.9 *3*		1292.9	0$^+$	0.0	0$^+$	E0		Mult.: from α(K)exp>0.067. Photons not observed (Iγ<0.4).
1297.2[&] *8*	0.5	2295.0	(10)$^+$	997.92	8$^+$			
1301.8[d&] *3*	1.3[d]	1390.25	4$^+$	88.32	2$^+$	(E2)	0.00245	α(K)= 0.00203; α(L)= 0.000312 Mult.: from α(K)exp=0.002 for Ice(1301.8γ doublet).
1301.8[d&] *3*	1.9[d]	1592.0	(4$^+$)	290.15	4$^+$	(E2)	0.00245	α(K)= 0.00203; α(L)= 0.000312 Mult.: from α(K)exp=0.002 for Ice(1301.8γ doublet).
1306.8 *2*	2.6	1903.87	(3$^-$,4$^-$,5$^-$)	596.94	6$^+$	E1,E2		Mult.: E1,E2 from α(K)exp≈0.0015 for Ice(1306.8γ + 1307.0γ).
1307.0[&] *8*	0.4	2304.9	(8$^+$)	997.92	8$^+$			Mult.: Reported as (E1,E2) from α(K)exp≈0.0015 for Ice(1307.0γ + 1306.8γ) (1973Kh03,1973Kh08). Level scheme requires (M1+E2).
1335.9 *4*	1.1	1932.8	(8)$^+$	596.94	6$^+$	(E2)	0.00233	α(K)= 0.00194; α(L)= 0.000296 Mult.: from α(K)exp=0.0014 for Ice(1335.9γ + 1338.6γ).
1338.6 *4*	1.8	1628.61	6$^+$	290.15	4$^+$	(E2)	0.00232	α(K)= 0.00193; α(L)= 0.000294 Mult.: from α(K)exp=0.0014 for Ice(1338.6γ + 1335.9γ + 1341.3γ).
1341.3 *3*	1.8	1341.12	2$^+$	0.0	0$^+$	(E2)	0.00231	α(K)= 0.0018; α(L)= 0.00046 Mult.: from α(K)exp=0.0014 for Ice(1335.9γ + 1338.6γ + 1341.3γ).
1347.4 *2*	1.2	1944.48	(6$^+$)	596.94	6$^+$	(M1+E2)	0.0032 *9*	α(K)= 0.0027 *8*; α(L)= 0.00040 *11* Mult.: from α(K)exp≈0.0026.
1357.4 *15*	2.8	1445.8	3$^+$	88.32	2$^+$	M1+E2	0.0032 *9*	α(K)= 0.0027 *8*; α(L)= 0.00039 *11* Mult.: from α(K)exp=0.0023.
1362.7[d&e] *2*	0.9[d]	1959.76?		596.94	6$^+$			
1362.7[d&e] *2*	0.4[d]	2360.6?		997.92	8$^+$			
1385.7 *3*	2.1	1675.92	(4$^+$)	290.15	4$^+$	(E2,E1)	0.0015 *6*	α(K)= 0.0013 *5*; α(L)= 0.00019 *7* Mult.: from α(K)exp≈0.0013.

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

E_γ[@]	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†@]	α[‡]	Comments
1419.6 *2*	1.0	1709.72	(3$^-$)	290.15	4$^+$	(E1)		Mult.: from α(K)exp≈9×10^{-4}.
1427.1 *2*	1.0	2024.04	(+)	596.94	6$^+$	(M1+E2)	0.0028 *8*	α(K)= 0.0024 *7*; α(L)= 0.00035 *10* Mult.: from α(K)exp=0.0022.
1437.7 *2*	1.6	1727.78	(5$^+$)	290.15	4$^+$	(E2)	0.00203	α(K)= 0.00169; α(L)= 0.000254 Mult.: from α(K)exp=0.0012.
1448.0[e] *6*	0.8	2446.9?		997.92	8$^+$			Mult.: (E1,E2) in 1973Kh03,1973Kh08. Mult.: from α(K)exp≈0.0014.
1460.2[e] *7*	0.8	2458.1?	(7$^-$,8$^-$,9$^-$)	997.92	8$^+$	E1		Mult.: from α(K)exp<9×10^{-4}.
1476.7 *2*	1.2	1766.86	(3,4,5)$^+$	290.15	4$^+$	M1+E2	0.0026 *7*	α(K)= 0.0022 *6*; α(L)= 0.00032 *9* Mult.: from α(K)exp 0.0021.
1489.0[d&] *3*	4.2[d]	1577.19	(3$^+$)	88.32	2$^+$	(E2)	0.00190	α(K)= 0.00158; α(L)= 0.000237 Mult.: from α(K)exp≈0.0012 for Ice(1489γ doublet).
1489.0[d&] *5*	1.0[d]	2086.01	+	596.94	6$^+$	M1+E2	0.0026 *7*	α(K)= 0.0022 *6*; α(L)= 0.00032 *8* Mult.: from α(K)exp=0.0012 for Ice(1489.0γ doublet).
1499.8 *5*	1.0	2097.0	(+)	596.94	6$^+$	(M1)	0.00321	α(K)= 0.00269; α(L)= 0.000391 Mult.: from α(K)exp=0.0043.
1508[&] *1*	2.0	1798.4	(5$^+$)	290.15	4$^+$			Mult.: from α(K)exp≈0.0016 for Ice(1508γ + 1509.7γ).
1509.7[&] *8*	1.2	2106.6	(7)$^+$	596.94	6$^+$	(M1+E2)	0.0021 *6*	α(K)= 0.0021 *6* Mult.: from α(K)exp=0.0016 for Ice(1509.7γ + 1508γ).
1520.0 *3*	1.2	2116.9	(7$^+$)	596.94	6$^+$			Mult.: from α(K)exp≈0.0009, inconsistent with J$^\pi$=(7$^+$) for 2117 level.
1525.0[&] *5*	0.4	1815.2		290.15	4$^+$			
1540.2 *5*	0.4	1830.4?		290.15	4$^+$			
1555.6 *4*	0.9	1643.7	1$^-$	88.32	2$^+$	E1[#]		
1559.5[e] *8*	0.3	2557.0?	(7$^+$,8$^+$,9$^+$)	997.92	8$^+$	(M1+E2)		Mult.: from α(K)exp=0.0017 for Ice(1559.5γ + 1563γ).
1563 *1*	0.9	1853.2	(3$^+$,4$^+$,5$^+$)	290.15	4$^+$	(M1+E2)		Mult.: from α(K)exp=0.0017 for Ice(1563γ + 1559.5γ).
1567[e] *1*	0.2	2565?		997.92	8$^+$			
1571.6 *8*	1.2	1862.0	(6$^+$)	290.15	4$^+$	(E2)		Mult.: from α(K)exp=0.0018.
1577.0 *8*	0.3	2173.9		596.94	6$^+$			
1588.3[e] *5*	0.58	1675.92	(4$^+$)	88.32	2$^+$			
1614.2[e] *3*	2.0	1903.87	(3$^-$,4$^-$,5$^-$)	290.15	4$^+$	(E1)		Mult.: from α(K)exp=8×10^{-4}.
1621.3[e] *3*	0.8	1709.72	(3$^-$)	88.32	2$^+$			Mult.: (M1+E2) multipolarity from α(K)exp≈0.0011 is not consistent with placement in level scheme.
1642.8 *6*	0.5	1643.7	1$^-$	0.0	0$^+$	E1[#]		
1670.1[e] *4*	0.70	1959.76?		290.15	4$^+$			
1704.6[e] *3*	0.93	1704.6?	(2$^+$)	0.0	0$^+$			

[†] From measured K conversion coefficients using theoretical E2 values for 201.8γ (α(K)=16.5) and 736.2γ (α(K)=0.179) for normalizing relative electron and photon intensities (1973Kh03,1973Kh02).

[‡] Conversion coefficients for γ-rays with mixed multipolarities and no δ given are average values for the individual multipolarities, unless otherwise specified.

[#] From adopted gammas.

[@] From 1973Kh03 for Eα=22.5 MeV.

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^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02 (continued)

$\gamma(^{176}Hf)$ (continued)

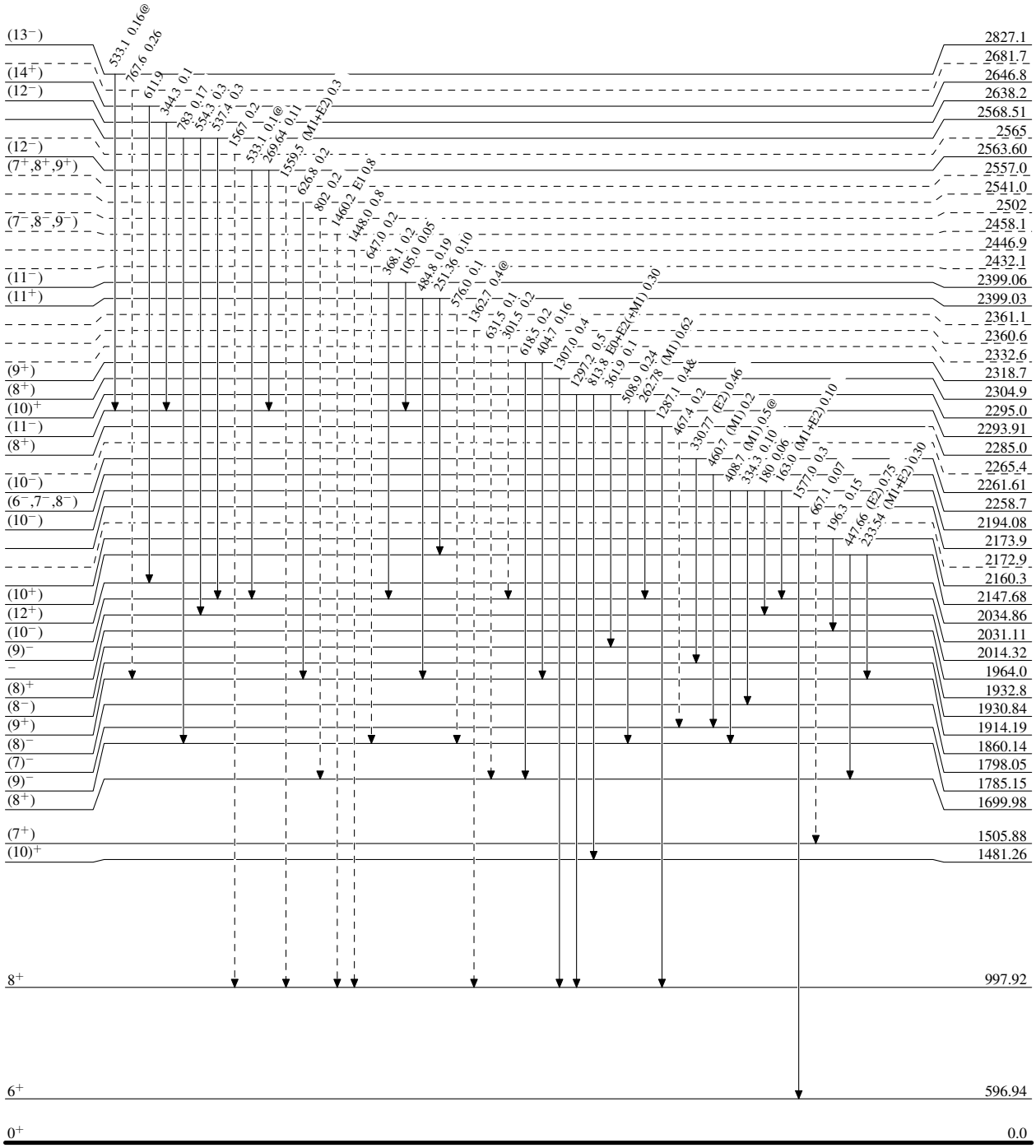
& Observed only in coincidence spectra.
[a] Complex line.
[b] From adopted gammas.
[c] Multiply placed with undivided intensity.
[d] Multiply placed with intensity suitably divided.
[e] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Level Scheme

Intensities: Relative I_γ
& 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)



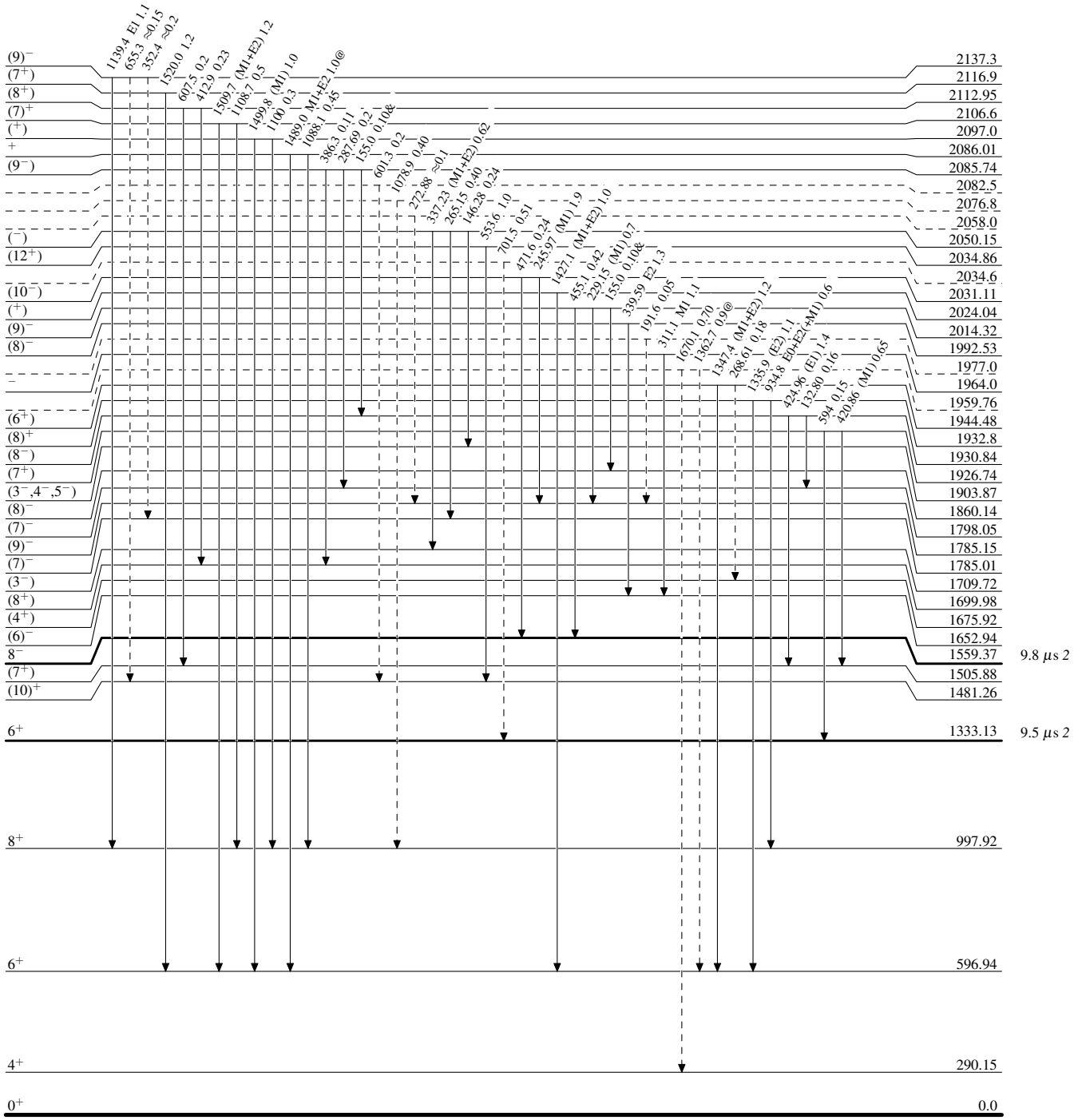
$^{176}_{72}Hf_{104}$

^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Level Scheme (continued)

Intensities: Relative I_γ
& 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)



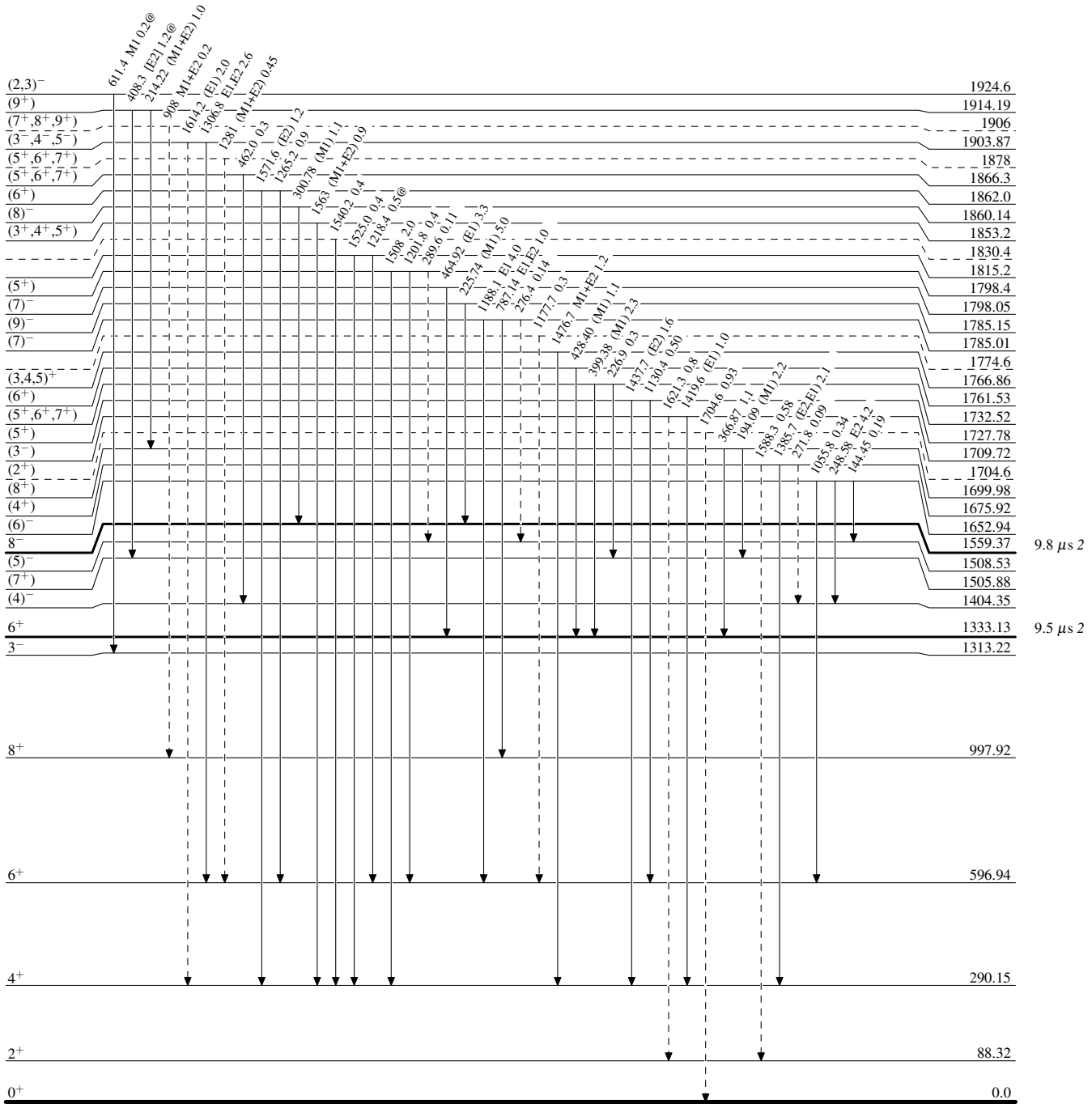
$^{176}_{72}Hf_{104}$

^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Level Scheme (continued)

Intensities: Relative I_γ
& 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)



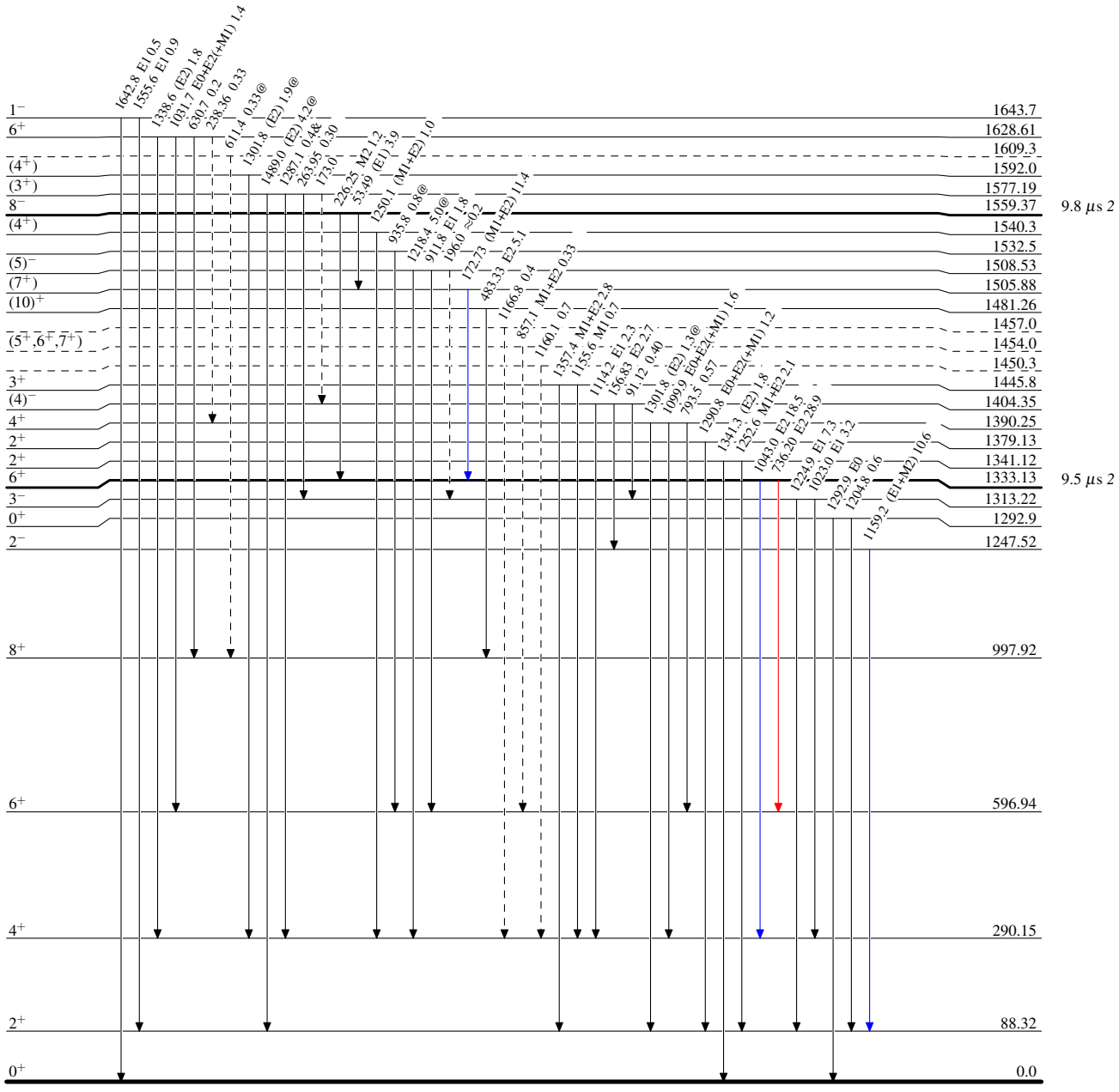
$^{176}_{72}Hf_{104}$

^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided

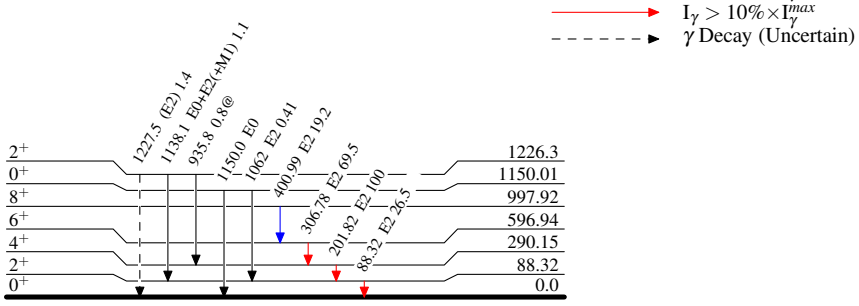
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



^{174}Yb(α,2nγ) 1973Kh03,1973Kh08,1973Kh02

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given
@ Multiply placed: intensity suitably divided



$^{176}_{72}Hf_{104}$