Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Update	Balraj Singh	ENSDF	31-Mar-2015

Q(β^-)=−5070 *40*; S(n)=9040 *40*; S(p)=5861 *25*; Q(α)=2754 *25* 2012Wa38
S(2n)=16290 *40*, S(2p)=10215 *25* (2012Wa38).

Additional information 1.

Cross section data for ^{176}Yb(α,xnγ): 1992Ro24 (E=threshold−84.3 MeV), 1983Ma32 (E=50-120 MeV).

Nuclear structure calculations: 1994Ze07, 1994Ze06, 1994Sa13, 1994Ja03, 1992Wu05, 1992Sa16, 1991Su08, 1991Ha11, 1991Ha09, 1991Ch49, 1989Hu05, 1988Ku21, 1987Ku24, 1987Ba82, 1984El04, 1981Mi07, 1980Xu01, 1980Ku01, 1980Du05, 1980An13, 1979Li04, 1979Ha44, 1978Ab07, 1977Mo03, 1976Ra04, 1976Mo31, 1974St06, 1972Wa14, 1972Sk04, 1972Pr17, 1971Gu20, 1971Fr02, 1964Ha44.

^{172}Hf Levels

g factor=+0.14 *4* (1975Sk01) for levels above 8^+, 1037 and $T_{1/2}\approx$0.5 ps. Technique: IMPAC.

While the triaxiality in SD bands is not ruled out, it remains unclear whether the SD bands observed in ^{172}Hf should be associated with a triaxial SD minimum as suggested by UC (ultimate cranker code) calculations or with a near-prolate SD minimum suggested by the CRMF calculations in ^{175}Hf.

Cross Reference (XREF) Flags

A	^{172}Hf IT decay (163 ns)	D	^{181}Ta(π^-,9nγ)
B	^{172}Ta ε decay (36.8 min)	E	Yb(α,xnγ)
C	^{128}Te(^{48}Ca,4nγ):SD	F	(HI,xnγ)

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
0.0#	0^+	1.87 y *3*	AB DEF	%ε=100 $T_{1/2}$: from 1971Ch57. Others:1.90 y *30* (1973Or02), ≈5 y (1960Na11,1951Wi08). $\Delta<r^2>(^{172}Hf-^{178}Hf)=-0.242$ fm^2 *16* (isotope-shift measurement,1992Ri04).
95.22# *4*	2^+	1.55 ns *10*	AB DEF	μ=0.50 *10* (2009Be42) g=0.25 *5* (2009Be42) μ: from g factor=0.25 *5*, weighted average of 0.23 *6* and 0.28 *8* at two different magnetic fields (2009Be42), perturbed angular correlation in a magnetic field. Jπ: E2 γ to g.s. $T_{1/2}$: (95γ)(214γ)(t) (1967Ab06).
309.24# *5*	4^+		AB DEF	Jπ: ΔJ=2, E2 γ to 2^+.
628.33# *7*	6^+		AB DEF	Jπ: ΔJ=2, E2 γ to 4^+.
871.30@ *12*	0^+		B	Jπ: E0 transition to g.s.
952.43@ *8*	2^+		B	Jπ: E0+M1+E2 γ to 2^+.
1031.06 *18*	(4^+,5,6^+)		B	Jπ: γ's to 4^+ and 6^+.
1037.47# *8*	8^+		A DEF	μ=1.1 *3* (1989Ra17) Jπ: ΔJ=2, E2 γ to 6^+. μ: Transient magnetic field IMPAC, average value for prerotational states above 1037-keV 8^+ level.
1075.29& *8*	$(2)^+$		B	Jπ: M1,E2 γ to g.s. Possible γ-band bandhead.
1129.52@ *10*	4^+		B E	Jπ: E0+M1+E2 γ to 4^+.
1180.87& *8*	(3^+)		B	Jπ: (E2) γ to 2^+, γ to 4^+ and E1 γ from (4^-).
1295.6 *4*	0^+		B	Jπ: E0 transition to g.s.

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Adopted Levels, Gammas (continued)

^{172}Hf Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
1304.66[&] *9*	(4+)		AB F	Jπ: γ's to 2+ and 4+, γ from (6+).
1335.66[a] *11*	0+		B	Jπ: E0 transition to g.s.
1359.33 *14*	(2+,3,4+)		B	Jπ: γ's to 2+ and 4+.
1372.85? *7*			B	Jπ: possible 2− state similar to that in ^{176}Hf and ^{178}W (1973Ca10).
1394.0 *3*			E	
1397.48[a] *7*	2+		B	Jπ: E0+M1+E2 γ's to 2+.
1418.55[b] *7*	(4−)	≈1 ns	B EF	Jπ: ΔJ=(0), (E1) γ to 4+. $T_{1/2}$: from γ(t) (1977HaXK).
1462.88[&] *13*	(5+)		AB F	Jπ: γ's to 4+ and 6+. Possible band member.
1471.73 *8*	(4+,5)		B	Jπ: γ's to 4+ and 6+. Possible ε feeding from (3−).
1482.27 *7*	(2+,3,4+)		B	Jπ: γ's to 2+ and 4+.
1495.78 *7*	(2 to 5)		B	Jπ: γ's to 4+. Possible γ to (2)+ disfavors J=5,6. Possible ε feeding from (3−).
1503.51[c] *7*	(5−)		AB EF	Jπ: ΔJ=1 γ to 4+, γ to 6+.
1521.22[#] *10*	10+		DEF	Jπ: ΔJ=2, E2 γ to 8+.
1534.3?[a] *4*	(4+)		B	Jπ: (E0+M1+E2) γ to 4+.
1574.9 *2*	(2+,3,4+)		B	Jπ: γ's to 2+ and 4+.
1597.62[b] *9*	(6−)		A EF	Jπ: ΔJ=(2) γ to (4−), γ to (5−).
1600.63 *8*	4+		B	Jπ: E0+M1+E2 γ to 4+.
1621.5[&] *2*	(6+)		A F	
1639.69 *7*	(3−)		B	Jπ: M1+E2 γ to (4−), γ to 2+.
1677.0 *3*	(6,7,8+)		E	Jπ: γ to 6+.
1684.46 *7*	(2 to 5)		B	Jπ: γ to 4+. Possible ε feeding from (3−) suggests 2,3,4,5+.
1684.73[d] *9*	(6+)	4.8 ns *4*	A EF	μ=+5.6 *6* (1989Ra17,1980Wa23) The γ-ray branching ratios suggest that there are two separate levels within ≈0.2 keV near this energy, one populated in ^{172}Ta ε decay and the other in (HI,xnγ) and (α,xnγ). Jπ: γ's to 4+ and 8+. A 2-quasiparticle isomer with $J^\pi=6^+$ is observed from ^{170}Hf to ^{182}Hf (1977Wa16). Possible configuration=((π 7/2[404])(π 5/2[402])). $T_{1/2}$: from γ(t) (1980Wa23). Others: 4.5 ns *10* (1976HaXB), ≤16 ns (1977Wa16). $T_{1/2}$>200 ns (1973Re16) corresponds to that of the 2006 level. μ: from γ(θ,H,t) (1980Wa23).
1722.8? *3*	(6,7,8+)		F	Jπ: γ to 6+.
1727.49[c] *11*	(7−)		A EF	Jπ: ΔJ=(1) γ to 6+, γ to 8+.
1738.9 *3*	(8,9,10+)		E	Jπ: γ to 8+.
1791.04 *19*	(2+,3,4+)		B	Jπ: γ's to 2+ and 4+.
1852.48[b] *11*	(8−)		EF	Jπ: ΔJ=(2) γ to (6−), γ to (7−).
1856.78[f] *12*	(6−)	<16 ns	A EF	Jπ: γ's to (6+) and (5−). γ from (8−). Possible 2-quasineutron with configuration=((ν 7/2[633])(ν 5/2[512])) (1994Wa07). $T_{1/2}$: from γ(t) (1977Wa16).
1878.16[d] *12*	(7+,8+,9+)		A EF	Jπ: (E1) γ from (8−).
1965.15[f] *15*			EF	
1968.09[c] *13*	(9−)		EF	Jπ: ΔJ=1 γ to 8+, γ to 10+ and possible ΔJ=(2) γ to (7−).
2005.84[e] *11*	(8−)	163 ns *3*	A EF	μ=+7.95 *7* (1989Ra17,1980Wa23) Jπ: γ's to 8+, (6+) and (6−). A 2-quasiparticle isomer with $J^\pi=8^-$ is observed from ^{170}Hf to ^{182}Hf (1977Wa16). Possible configuration=((π 7/2[404])(π 9/2[514])). $T_{1/2}$: from γ(t) (1980Wa23). Others: 155 ns *20* from γγ(t) in (α,xnγ) (1976HaXC); 163 ns *6* in (HI,xnγ) (1977Wa16). μ: γ(θ,H,t) in (α,xnγ)(1980Wa23). The corrections for diamagnetism and

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Adopted Levels, Gammas (continued)

^{172}Hf Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
			Knight shift are not included.
2034.4[g] *3*	(8,9,10$^+$)	E	Jπ: γ to 8$^+$.
2064.67[#] *13*	12$^+$	DEF	Jπ: ΔJ=2, E2 γ to 10$^+$.
2093.68[d] *19*	(8$^+$)	F	
2095.5[f] *2*		EF	
2155.5 *4*		E	Jπ: γ to 10$^+$.
2186.28[b] *14*	(10$^-$)	EF	Jπ: ΔJ=(2) γ to (8$^-$).
2235.94[e] *14*		EF	
2246.5[f] *2*		F	
2329.83[d] *24*	(9$^+$)	F	
2336.94[c] *13*	(11$^-$)	EF	Jπ: ΔJ=(2), (E2) γ to (9$^-$) and ΔJ=1 γ to 10$^+$.
2416.40[f] *23*		EF	
2426.36[g] *23*		EF	
2450.80 *22*	(2$^+$,3,4$^+$)	B	Jπ: γ's to 2$^+$ and 4$^+$.
2488.20[e] *16*		EF	
2584.6[d] *4*	(10$^+$)	F	
2598.26[b] *17*	(12$^-$)	EF	
2607.7 *10*		E	
2611.91[f] *25*		EF	
2654.11[#] *16*	14$^+$	DEF	Jπ: ΔJ=2, E2 γ to 12$^+$.
2760.25[e] *18*		EF	
2777.50[c] *20*	(13$^-$)	EF	Jπ: ΔJ=(2) γ to (11$^-$) and ΔJ=1 γ to 12$^+$.
2823.1[f] *3*		F	
2855.2[d] *5*	(11$^+$)	F	
2900.4[g] *4*		EF	
3050.23[e] *21*		EF	
3060.0[f] *3*		F	
3085.50[b] *23*	(14$^-$)	EF	
3277.20[#] *19*	(16$^+$)	DEF	Jπ: ΔJ=2, (E2) γ to 14$^+$.
3285.7[c] *3*	(15$^-$)	EF	Jπ: ΔJ=(2) γ to (13$^-$).
3305.1[f] *4*		F	
3355.75[e] *23*		F	
3449.0[g] *6*		EF	
3643.1[b] *3*	(16$^-$)	EF	
3673.0[e] *3*		F	
3858.1[c] *4*	(17$^-$)	EF	Jπ: ΔJ=2, (E2) γ to (15$^-$).
3919.4[#] *3*	(18$^+$)	EF	Jπ: ΔJ=2, E2 γ to (16$^+$).
3997.4[e] *4*		F	
4061.8[g] *7*		F	
4264.2[b] *5*	(18$^-$)	EF	
4492.3[c] *5*	(19$^-$)	F	Jπ: ΔJ=2, (E2) γ to (17$^-$).
4575.9[#] *6*	(20$^+$)	EF	Jπ: ΔJ=2, (E2) γ to (18$^+$).
4730.8[g] *12*		F	
4942.1[b] *5*	(20$^-$)	F	
5183.9[c] *5*	(21$^-$)	F	Jπ: ΔJ=(2) γ to (19$^-$).
5274.3[#] *6*	(22$^+$)	F	Jπ: ΔJ=2, (E2) γ to (20$^+$).
5670.2[b] *7*	(22$^-$)	F	
5931.0[c] *7*	(23$^-$)	F	Jπ: ΔJ=(2) γ to (21$^-$).

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Adopted Levels, Gammas (continued)

^{172}Hf Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
6032.3[#] *8*	(24+)	F	Jπ: ΔJ=(2) γ to (22+).
6445.2?[b] *13*	(24−)	F	
6724.9[c] *9*	(25−)	F	
6849.0[#] *9*	(26+)	F	Jπ: ΔJ=(2) γ to (24+).
7275.2[b] *16*	(26−)	F	
7312.1[c] *10*	(27−)	F	
7724.7[#] *11*	(28+)	F	Jπ: ΔJ=(2) γ to (26+).
8106.4[c] *10*	(29−)	F	
8149.2[b] *19*	(28−)	F	
8642.7[#] *15*	(30+)	F	
8954.3[c] *10*	(31−)	F	
9070.2[b] *22*	(30−)	F	
9600.7[#] *18*	(32+)	F	
9860.0[c] *11*	(33−)	F	
10594.7[#] *20*	(34+)	F	
10823.0[c] *15*	(35−)	F	
11611.7[#] *23*	(36+)	F	
11841.0[c] *18*	(37−)	F	
12643.7[#] *25*	(38+)	F	
x[h]	J	A	
776+x[h]	J+2	A	
1589+x[h]	J+4	A	
2447+x[h]	J+6	A	
3356+x[h]	J+8	A	
4317+x[h]	J+10	A	
5335+x[h]	J+12	A	
6414+x[h]	J+14	A	
7553+x[h]	J+16	A	
8756+x[h]	J+18	A	
10024+x[h]	J+20	A	
11356+x[h]	J+22	A	
12753+x[h]	J+24	A	
14212+x[h]	J+26	A	
y[i]	J1	A	
793+y[i]	J1+2	A	
1633+y[i]	J1+4	A	
2519+y[i]	J1+6	A	
3451+y[i]	J1+8	A	
4433+y[i]	J1+10	A	
5470+y[i]	J1+12	A	
6563+y[i]	J1+14	A	
7712+y[i]	J1+16	A	
8914+y[i]	J1+18	A	
10156+y[i]	J1+20	A	
11443+y[i]	J1+22	A	
z[j]	J2	A	
877+z[j]	J2+2	A	

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Adopted Levels, Gammas (continued)

^{172}Hf Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
1809+z[j]	J2+4	A	4936+z[j]	J2+10	A	8603+z[j]	J2+16	A
2795+z[j]	J2+6	A	6097+z[j]	J2+12	A	9951+z[j]	J2+18	A
3833+z[j]	J2+8	A	7319+z[j]	J2+14	A	11364+z[j]	J2+20	A

† From least-squares fit to Eγ data, 0.2 or 1 keV uncertainty on Eγ values when not given.
‡ For levels populated in (HI,xnγ) and/or (α,xnγ), ascending spins are assumed as the excitation energy increases. When no γ(θ) or γγ(θ) data are available, J^{π}'s are tentative and are based on probable band assignments to levels observed in a cascade of γ-ray transitions. In such cases no J^{π} arguments are given.
# Band(A): (π=+,α=0) g.s. band.
@ Band(B): $K^{\pi}=0^{+}$ band.
& Band(C): $K^{\pi}=2^{+}$ γ band.
a Band(D): $K^{\pi}=0^{+}$ band.
b Band(E): (π=−,α=0) band.
c Band(F): (π=−,α=1) band.
d Band(G): ΔJ=(1), $K^{\pi}=(6^{+})$ band.
e Band(H): ΔJ=(1), $K^{\pi}=(8^{-})$ band.
f Band(I): band 1, ΔJ=(1).
g Band(J): band 2, ΔJ=(2).
h Band(K): SD-1 band. Q(transition)=13.6 *9* (2011Mu02) from DSAM measurements. Percent population=0.7 *2* (2007Zh46).
i Band(L): SD-2 band. Q(transition)=11.6 *10* (2011Mu02) from DSAM measurements. Percent population=0.5 *1* (2007Zh46).
j Band(M): SD-3 band. F(τ) curve was obtained for four members of this band, but due to low intensity it could not be fitted well to obtain quadrupole moment. Percent population=0.4 *1* (2007Zh46).

Adopted Levels, Gammas (continued)

$\gamma(^{172}Hf)$

No linking transitions between SD bands were found, thus no indication of wobbling mode in these bands.

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α[&]	$I_{(\gamma+ce)}$	Comments
95.22	2^+	95.23 *4*	100	0.0	0^+	E2[†‡]	4.34		B(E2)(W.u.)=154 *11*
309.24	4^+	214.02 *4*	100	95.22	2^+	E2[†]	0.232		
628.33	6^+	319.09 *4*	100	309.24	4^+	E2[†‡]	0.067		
871.30	0^+	776.08 *11*	100 *2*	95.22	2^+	(E2)[‡]			
		871.5 *10*		0.0	0^+	E0[‡]		2.8 *4*	X(E0/E2)=0.121 *18* (1973Ca10).
952.43	2^+	643.26 *13*	52 *2*	309.24	4^+				
		857.21 *10*	100 *3*	95.22	2^+	E0+M1+E2[‡]	0.058 *3*		X(E0/E2)=0.156 *21* (1973Ca10).
		952.25 *17*	44 *2*	0.0	0^+				
1031.06	$(4^+,5,6^+)$	402.0 *8*	63 *9*	628.33	6^+				
		721.90 *20*	100 *12*	309.24	4^+				
1037.47	8^+	409.16 *4*	100	628.33	6^+	E2[†]			
1075.29	$(2)^+$	980.01 *10*	100.0 *14*	95.22	2^+				
		1075.30 *12*	94.2 *23*	0.0	0^+	M1,E2[‡]			
1129.52	4^+	500.7 *10*	24 *4*	628.33	6^+				
		820.44 *13*	100 *4*	309.24	4^+	E0+M1+E2[‡]	0.062 *3*		X(E0/E2)=0.154 *32* (1973Ca10).
		1034.39 *21*	64 *3*	95.22	2^+				
1180.87	(3^+)	872.1 *7*	18 *7*	309.24	4^+				
		1085.58 *9*	100 *3*	95.22	2^+	(E2)[‡]			
1295.6	0^+	424.7 *5*		871.30	0^+	E0[‡]		22 *4*	
		1199.8 *5*	100 *15*	95.22	2^+				
		1296.2 *10*		0.0	0^+	E0[‡]		74 *7*	X(E0/E2)=19 *4* (1973Ca10).
1304.66	(4^+)	995.50 *15*	100 *6*	309.24	4^+				
		1209.9 *5*	73 *30*	95.22	2^+				
1335.66	0^+	260.6[a] *10*	7 *7*	1075.29	$(2)^+$	[E2]	0.123		
		382.6 *4*	19 *2*	952.43	2^+				
		464.1 *5*		871.30	0^+	E0[‡]		7.2 *3*	
		1240.49 *10*	100 *5*	95.22	2^+				
		1334.5 *12*		0.0	0^+	E0[‡]		20.8 *13*	X(E0/E2)=6.0 *7* (1973Ca10).
1359.33	$(2^+,3,4^+)$	1050.06 *14*	100 *3*	309.24	4^+				
		1264.2 *4*	89 *6*	95.22	2^+				
1372.85?		1277.62[a] *5*	100	95.22	2^+				
1394.0		765.7	100	628.33	6^+				
1397.48	2^+	445.0 *4*	23 *4*	952.43	2^+	E0+M1+E2[‡]	0.20 *3*		
		1302.25 *5*	100 *3*	95.22	2^+	E0+M1+E2[‡]	0.098 *3*		
		1398.0[a] *5*	3 *3*	0.0	0^+				

Adopted Levels, Gammas (continued)

γ(^{172}Hf) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	α[&]	Comments
1418.55	(4⁻)	113.9[a] *7*	1.5 *15*	1304.66	(4⁺)	[E1]		0.26	B(E1)(W.u.)≈1.74×10⁻⁶
		237.63 *11*	13.4 *3*	1180.87	(3⁺)	E1[‡]		0.038	B(E1)(W.u.)≈1.71×10⁻⁶
		289.29 *15*	11.4 *3*	1129.52	4⁺	[E1]			B(E1)(W.u.)≈8.06×10⁻⁷
		790.8[a] *6*	0.6 *6*	628.33	6⁺	[M2]			B(M2)(W.u.)≈0.015
		1109.27 *9*	100 *4*	309.24	4⁺	(E1)[‡]			B(E1)(W.u.)≈1.25×10⁻⁷
1462.88	(5⁺)	834.3 *2*	62 *25*	628.33	6⁺				
		1153.67 *18*	100 *7*	309.24	4⁺				
1471.73	(4⁺,5)	843.8 *3*	84 *6*	628.33	6⁺				
		1162.47 *6*	100 *11*	309.24	4⁺				
1482.27	(2⁺,3,4⁺)	1172.8 *4*	21 *3*	309.24	4⁺				
		1387.04 *5*	100 *6*	95.22	2⁺				
1495.78	(2 to 5)	366.1 *4*	12.1 *8*	1129.52	4⁺				
		419.7 *9*	≤5	1075.29	(2)⁺				
		1186.54 *5*	100 *4*	309.24	4⁺				
1503.51	(5⁻)	875.5[@] *3*	85[@] *11*	628.33	6⁺				
		1194.25 *5*	100 *7*	309.24	4⁺	D[†]			
		1408.9[a] *10*	4 *4*	95.22	2⁺				E_γ: from ^{172}Ta ε decay only. ΔJ^π requires mult=[E3].
1521.22	10⁺	483.79 *7*	100	1037.47	8⁺	E2[†]			
1534.3?	(4⁺)	1225.1[a] *4*	100	309.24	4⁺	(E0+M1+E2)[‡]		≤0.09	
1574.9	(2⁺,3,4⁺)	1266.0 *5*	100 *6*	309.24	4⁺				
		1479.57 *25*	92 *5*	95.22	2⁺				
1597.62	(6⁻)	94.15 *10*	24 *12*	1503.51	(5⁻)	[M1]			
		179.16 *10*	100 *60*	1418.55	(4⁻)	[E2][#]		0.42	
1600.63	4⁺	1291.39 *6*	100	309.24	4⁺	E0+M1+E2[‡]		0.049 *18*	
1621.5	(6⁺)	993.1	100	628.33	6⁺				
1639.69	(3⁻)	221.13 *15*	16.5 *7*	1418.55	(4⁻)	M1+E2[‡]	0.6 *3*	0.38 *4*	δ: from ce data.
		280.0[a] *6*	2 *2*	1359.33	(2⁺,3,4⁺)				
		335.2 *4*	8.6 *7*	1304.66	(4⁺)				
		458.7 *3*	6.9 *5*	1180.87	(3⁺)				
		564.19 *24*	7.8 *5*	1075.29	(2)⁺				
		1330.41 *6*	100 *4*	309.24	4⁺				
		1544.60 *10*	81 *4*	95.22	2⁺				
1677.0	(6,7,8⁺)	1048.4	100	628.33	6⁺				
1684.46	(2 to 5)	379.79 *20*	43 *3*	1304.66	(4⁺)				
		503.0 *5*	64 *6*	1180.87	(3⁺)				
		653.6[a] *6*	24 *24*	1031.06	(4⁺,5,6⁺)				
		1375.22 *5*	100 *6*	309.24	4⁺				
1684.73	(6⁺)	63.2	≈0.5	1621.5	(6⁺)	[M1]		2.62	B(M1)(W.u.)≈2.5×10⁻⁵
		87.5	4.4 *15*	1597.62	(6⁻)	[E1]		0.51	B(E1)(W.u.)=3.0×10⁻⁶ *11*
		180.9	4.6 *7*	1503.51	(5⁻)	[E1]		0.077	B(E1)(W.u.)=3.5×10⁻⁷ *7*

$^{172}_{72}Hf_{100}$-7

Adopted Levels, Gammas (continued)

γ(^{172}Hf) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	α[&]	Comments
1684.73	(6$^+$)	221.6	1.9 *5*	1462.88	(5$^+$)	[M1]		0.44	B(M1)(W.u.)=8.0×10^{-6} *23*
		380.0	2.7 *6*	1304.66	(4$^+$)	[E2]		0.040	B(E2)(W.u.)=0.0071 *17*
		647.4	4.0 *9*	1037.47	8$^+$				B(E2)(W.u.)=0.00073 *18*
		1056.26 *16*	100 *5*	628.33	6$^+$	D+Q[†]			If M1, B(M1)(W.u.)=3.9×10^{-6} *4*. If E2, B(E2)(W.u.)=0.0016 *2*.
		1375.5 *3*	54 *4*	309.24	4$^+$				B(E2)(W.u.)=0.00023 *3*
1722.8?	(6,7,8$^+$)	1094.46 *25*	100	628.33	6$^+$				
1727.49	(7$^-$)	690.3 *4*	35 *8*	1037.47	8$^+$				
		1099.05 *15*	100 *12*	628.33	6$^+$	D[†]			
1738.9	(8,9,10$^+$)	701.4	100	1037.47	8$^+$				
1791.04	(2$^+$,3,4$^+$)	839.0 *3*	49 *8*	952.43	2$^+$				
		1481.6 *8*	41 *6*	309.24	4$^+$				
		1695.58 *24*	100 *13*	95.22	2$^+$				
1852.48	(8$^-$)	124.98 *10*	25 *7*	1727.49	(7$^-$)	[M1]		2.17	
		175.4 *3*		1677.0	(6,7,8$^+$)				E_γ: from (α,xnγ) only.
		254.86 *10*	100 *50*	1597.62	(6$^-$)	[E2][#]		0.132	
1856.78	(6$^-$)	171.92 *20*	37 *10*	1684.73	(6$^+$)	[E1]		0.087	B(E1)(W.u.)>6.5×10^{-7}
		353.32 *15*	100 *28*	1503.51	(5$^-$)	[M1]		0.123	B(M1)(W.u.)>2.0×10^{-5}
1878.16	(7$^+$,8$^+$,9$^+$)	193.41 *10*	100	1684.73	(6$^+$)	[M1]		0.63	
1965.15		108.27 *10*	100	1856.78	(6$^-$)				
1968.09	(9$^-$)	242.0 *10*	<28	1727.49	(7$^-$)	[E2][#]		0.156	
		447.5 *4*	51 *18*	1521.22	10$^+$				
		930.65 *15*	100 *8*	1037.47	8$^+$	D(+Q)[†]	<0.14		
2005.84	(8$^-$)	127.67 *10*	100	1878.16	(7$^+$,8$^+$,9$^+$)	(E1)[†]		0.19	B(E1)(W.u.)=4.9×10^{-7} *1* Mult.: from α(exp) deduced from delayed γ-ray intensities in (HI,xnγ).
		149.4	0.6 *3*	1856.78	(6$^-$)	[E2]		0.80	B(E2)(W.u.)=0.0038 *19*
		278.2	2.0 *5*	1727.49	(7$^-$)	[M1]		0.23	B(M1)(W.u.)=9.6×10^{-8} *24*
		321.0	2.3 *6*	1684.73	(6$^+$)	[M2]		0.61	B(M2)(W.u.)=0.032 *9*
		408.4	3.3 *11*	1597.62	(6$^-$)	[E2]		0.033	B(E2)(W.u.)=0.00014 *5*
		968.2	1.3 *4*	1037.47	8$^+$	[E1]			B(E1)(W.u.)=1.5×10^{-11} *5*
2034.4	(8,9,10$^+$)	996.9	100	1037.47	8$^+$				
2064.67	12$^+$	543.43 *9*	100	1521.22	10$^+$	E2[†]			
2093.68	(8$^+$)	215.52 *15*	100	1878.16	(7$^+$,8$^+$,9$^+$)				
2095.5		128.3[a]		1968.09	(9$^-$)				E_γ: from (α,xnγ) only.
		130.03 *15*	100 *44*	1965.15					
2155.5		634.3	100	1521.22	10$^+$				
2186.28	(10$^-$)	218.25 *20*	9 *3*	1968.09	(9$^-$)				
		333.79 *10*	100 *4*	1852.48	(8$^-$)	[E2][#]		0.058	
2235.94		230.08 *10*	100	2005.84	(8$^-$)				
2246.5		150.84 *14*	100	2095.5					
		281.8		1965.15					E_γ: from (α,xnγ) only.

$^{172}_{72}Hf_{100}$-8

Adopted Levels, Gammas (continued)

γ(^{172}Hf) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	δ	α[&]	Comments
2329.83	(9$^+$)	236.16 *15*	100	2093.68	(8$^+$)				
2336.94	(11$^-$)	368.7 *2*	75 *3*	1968.09	(9$^-$)	(E2)[†]		0.044	
		815.76 *9*	100 *7*	1521.22	10$^+$	D(+Q)[†]	≈−0.07		
2416.40		169.90 *10*	100	2246.5					
2426.36		391.9		2034.4	(8,9,10$^+$)				E_γ: from (α,xnγ) only.
		905.20 *25*	100	1521.22	10$^+$				
2450.80	(2$^+$,3,4$^+$)	988.9 *10*	42 *9*	1462.88	(5$^+$)				
		1147.2 *5*	36 *9*	1304.66	(4$^+$)				
		1419.8 *4*	93 *75*	1031.06	(4$^+$,5,6$^+$)				
		2141.2 *8*	49 *16*	309.24	4$^+$				
		2355.1 *3*	100 *14*	95.22	2$^+$				
2488.20		252.26 *10*	100 *25*	2235.94					
		482.42 *20*	20 *10*	2005.84	(8$^-$)				
2584.6	(10$^+$)	254.8 *3*	100	2329.83	(9$^+$)				
2598.26	(12$^-$)	411.98 *10*	100	2186.28	(10$^-$)				
2607.7		543[a]	100	2064.67	12$^+$				
2611.91		195.49 *10*	100 *46*	2416.40					
		365.8 *3*	69 *15*	2246.5					
2654.11	14$^+$	589.42 *9*	100	2064.67	12$^+$	E2[†]			
2760.25		272.04 *10*	100 *25*	2488.20					
		524.26 *25*	19 *13*	2235.94					
2777.50	(13$^-$)	440.65 *20*	100 *5*	2336.94	(11$^-$)	[#]			
		712.68 *25*	23 *6*	2064.67	12$^+$	D(+Q)[†]	<0.14		
2823.1		211.23 *15*	100 *50*	2611.91					
		406.5 *3*	70 *30*	2416.40					
2855.2	(11$^+$)	270.6 *3*	100	2584.6	(10$^+$)				
2900.4		474.1 *4*	100 *22*	2426.36		(E2)[†]			
		835.8 *5*	71 *36*	2064.67	12$^+$				
3050.23		289.87 *15*	100 *27*	2760.25					
		562.13 *25*	27 *18*	2488.20					
3060.0		237.02 *20*	86 *43*	2823.1					
		448.0 *3*	100 *43*	2611.91					
3085.50	(14$^-$)	487.24 *15*	100	2598.26	(12$^-$)	[#]			
3277.20	(16$^+$)	623.09 *10*	100	2654.11	14$^+$	(E2)[†]			
3285.7	(15$^-$)	508.2 *2*	100	2777.50	(13$^-$)	[#]			
3305.1		245.2 *3*	44 *22*	3060.0					
		482.0 *3*	100 *44*	2823.1					
3355.75		305.47 *20*	100 *33*	3050.23					
		595.62 *20*	67 *22*	2760.25					
3449.0		548.9 *5*		2900.4					
		794		2654.11	14$^+$				

$^{172}_{72}Hf_{100}$-9

Adopted Levels, Gammas (continued)

γ(^{172}Hf) (continued)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.
3643.1	(16$^-$)	557.6 *2*	100	3085.50	(14$^-$)	(E2)†
3673.0		317.62 *25*	100 *40*	3355.75		
		622.6 *3*	100 *40*	3050.23		
3858.1	(17$^-$)	572.4 *3*	100	3285.7	(15$^-$)	(E2)†
3919.4	(18$^+$)	642.2 *2*	100	3277.20	(16$^+$)	E2†
3997.4		324.9 *4*	100 *60*	3673.0		
		641.2 *4*	80 *40*	3355.75		
4061.8		612.8 *4*	100	3449.0		
4264.2	(18$^-$)	621.1 *3*	100	3643.1	(16$^-$)	
4492.3	(19$^-$)	634.2 *2*	100	3858.1	(17$^-$)	(E2)†
4575.9	(20$^+$)	656.5 *5*	100	3919.4	(18$^+$)	(E2)†
4730.8		669	100	4061.8		
4942.1	(20$^-$)	677.9 *2*	100	4264.2	(18$^-$)	#
5183.9	(21$^-$)	691.6 *2*	100	4492.3	(19$^-$)	#
5274.3	(22$^+$)	698.4 *2*	100	4575.9	(20$^+$)	(E2)†
5670.2	(22$^-$)	728.1 *5*	100	4942.1	(20$^-$)	
5931.0	(23$^-$)	747.1 *5*	100	5183.9	(21$^-$)	#
6032.3	(24$^+$)	758.0 *4*	100	5274.3	(22$^+$)	#
6445.2?	(24$^-$)	775.0 *10*	100	5670.2	(22$^-$)	#
6724.9	(25$^-$)	793.9 *5*	100	5931.0	(23$^-$)	
6849.0	(26$^+$)	816.7 *5*	100	6032.3	(24$^+$)	#
7275.2	(26$^-$)	830		6445.2?	(24$^-$)	
7312.1	(27$^-$)	587.2		6724.9	(25$^-$)	
7724.7	(28$^+$)	875.7 *5*	100	6849.0	(26$^+$)	#
8106.4	(29$^-$)	794.3		7312.1	(27$^-$)	
8149.2	(28$^-$)	874		7275.2	(26$^-$)	
8642.7	(30$^+$)	918.0 *10*	100	7724.7	(28$^+$)	
8954.3	(31$^-$)	847.9		8106.4	(29$^-$)	
9070.2	(30$^-$)	921[a]		8149.2	(28$^-$)	
9600.7	(32$^+$)	958		8642.7	(30$^+$)	
9860.0	(33$^-$)	905.7		8954.3	(31$^-$)	
10594.7	(34$^+$)	994		9600.7	(32$^+$)	
10823.0	(35$^-$)	963[a]		9860.0	(33$^-$)	
11611.7	(36$^+$)	1017[a]		10594.7	(34$^+$)	
11841.0	(37$^-$)	1018[a]		10823.0	(35$^-$)	
12643.7	(38$^+$)	1032[a]		11611.7	(36$^+$)	
776+x	J+2	776		x	J	
1589+x	J+4	813		776+x	J+2	
2447+x	J+6	858		1589+x	J+4	
3356+x	J+8	909		2447+x	J+6	
4317+x	J+10	961		3356+x	J+8	
5335+x	J+12	1018		4317+x	J+10	
6414+x	J+14	1079		5335+x	J+12	
7553+x	J+16	1139		6414+x	J+14	
8756+x	J+18	1203		7553+x	J+16	
10024+x	J+20	1268		8756+x	J+18	
11356+x	J+22	1332		10024+x	J+20	
12753+x	J+24	1397		11356+x	J+22	
14212+x	J+26	1459		12753+x	J+24	
793+y	J1+2	793		y	J1	
1633+y	J1+4	840		793+y	J1+2	
2519+y	J1+6	886		1633+y	J1+4	
3451+y	J1+8	932		2519+y	J1+6	
4433+y	J1+10	982		3451+y	J1+8	
5470+y	J1+12	1037		4433+y	J1+10	
6563+y	J1+14	1093		5470+y	J1+12	
7712+y	J1+16	1149		6563+y	J1+14	
8914+y	J1+18	1202		7712+y	J1+16	
10156+y	J1+20	1242[a]		8914+y	J1+18	
11443+y	J1+22	1287[a]		10156+y	J1+20	
877+z	J2+2	877		z	J2	
1809+z	J2+4	932		877+z	J2+2	
2795+z	J2+6	986		1809+z	J2+4	
3833+z	J2+8	1038		2795+z	J2+6	
4936+z	J2+10	1103		3833+z	J2+8	
6097+z	J2+12	1161		4936+z	J2+10	
7319+z	J2+14	1222		6097+z	J2+12	
8603+z	J2+16	1284		7319+z	J2+14	
9951+z	J2+18	1348		8603+z	J2+16	
11364+z	J2+20	1413		9951+z	J2+18	

† From γ(θ) and/or γγ(θ) (DCO) in (HI,xnγ). ΔJ=2 transitions are assigned E2 from RUL (for E2 and M2), assuming timing resolution of a few nanoseconds in γγ coin.

$^{172}_{72}Hf_{100}$-10

Adopted Levels, Gammas (continued)

$\gamma(^{172}Hf)$ (continued)

‡ From ce data in ^{172}Ta ε decay.
# $I\gamma(30°)/I\gamma(90°)$ relative to that of 214γ (assumed E2) is consistent with $\Delta J=2$ transition.
@ From (HI,xnγ). In ^{172}Ta ε decay, the 871.2 γ-ray peak was seen as a wide structure and was interpreted (1973Ca10) as mixed with an impurity. It is possible that the broadening was partly due to 875γ. It is assumed that the 1503 level is the same in the two studies (^{172}Ta ε decay and (HI,xnγ)).
& 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] Placement of transition in the level scheme is uncertain.

$^{172}_{72}Hf_{100}$-11

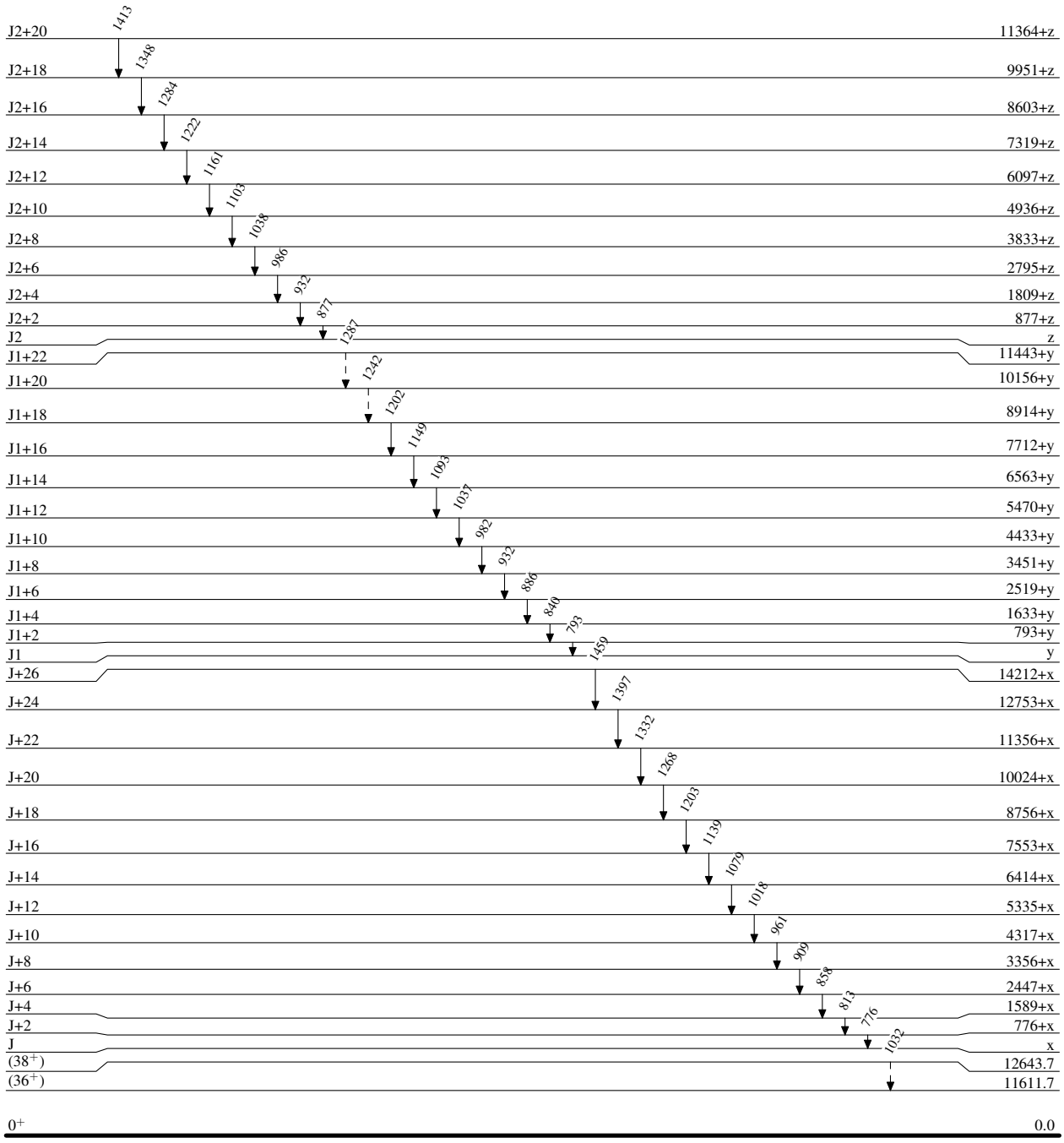
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{172}_{72}Hf_{100}$

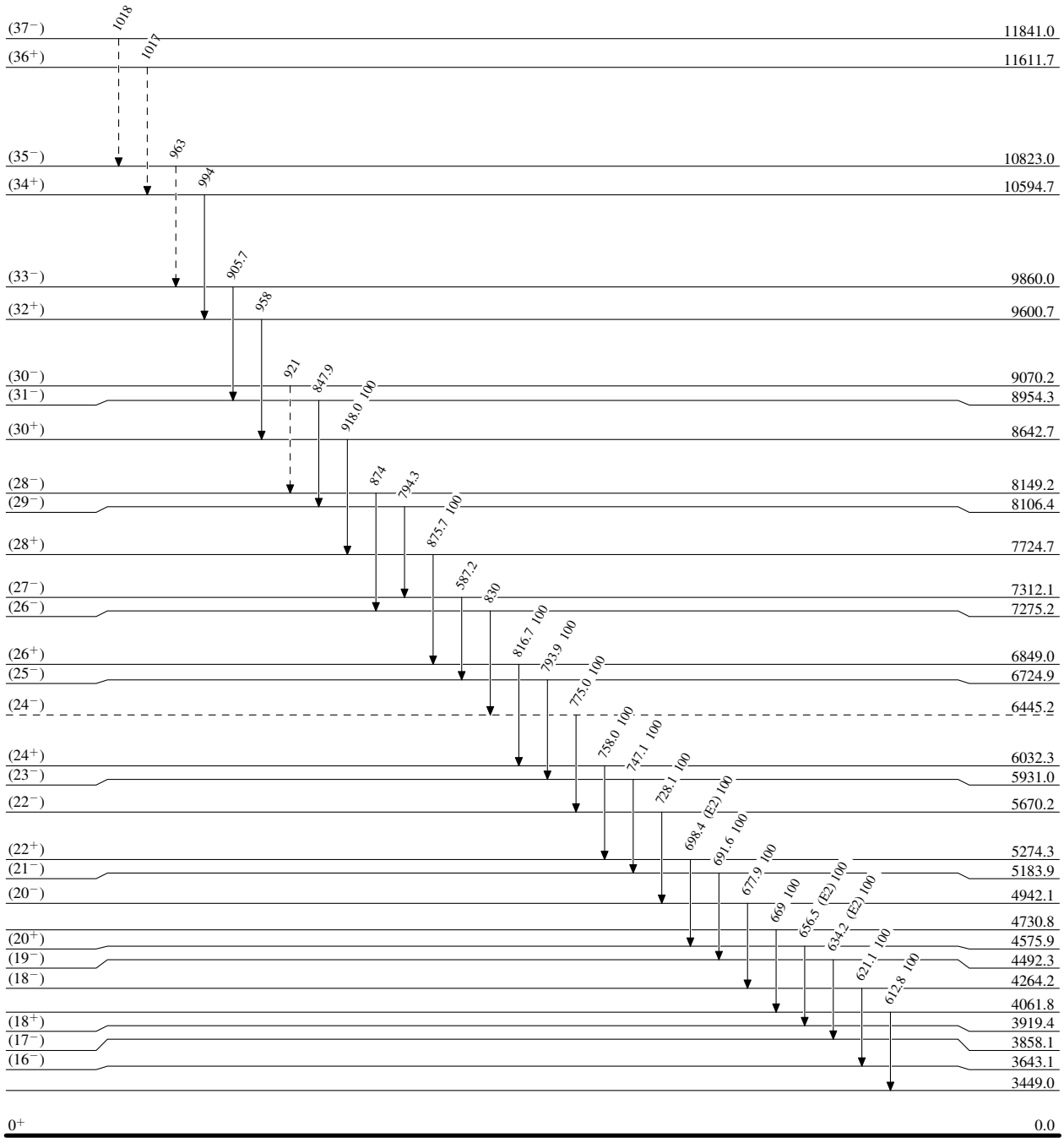
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)



$^{172}_{72}Hf_{100}$

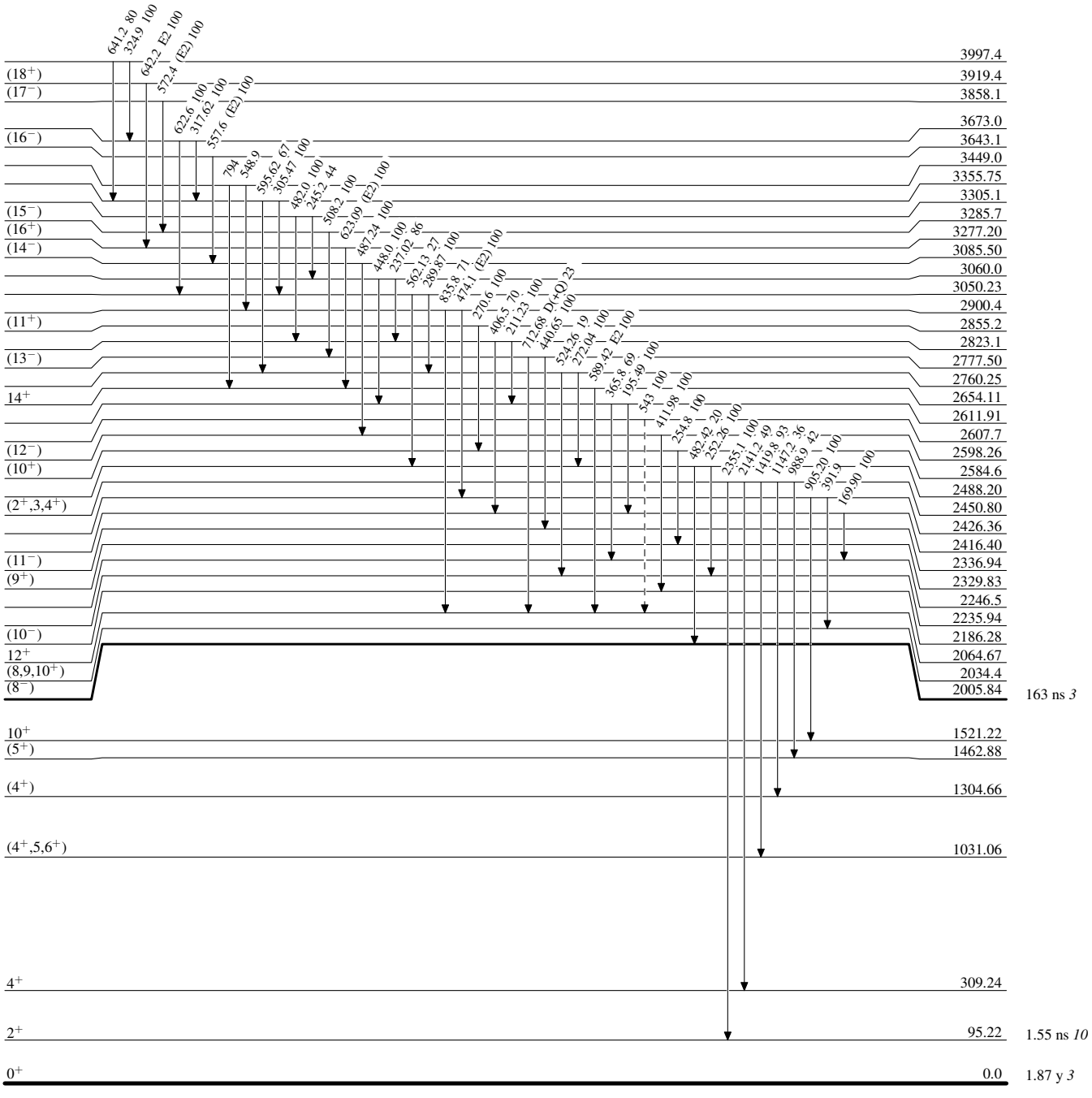
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{172}_{72}Hf_{100}$

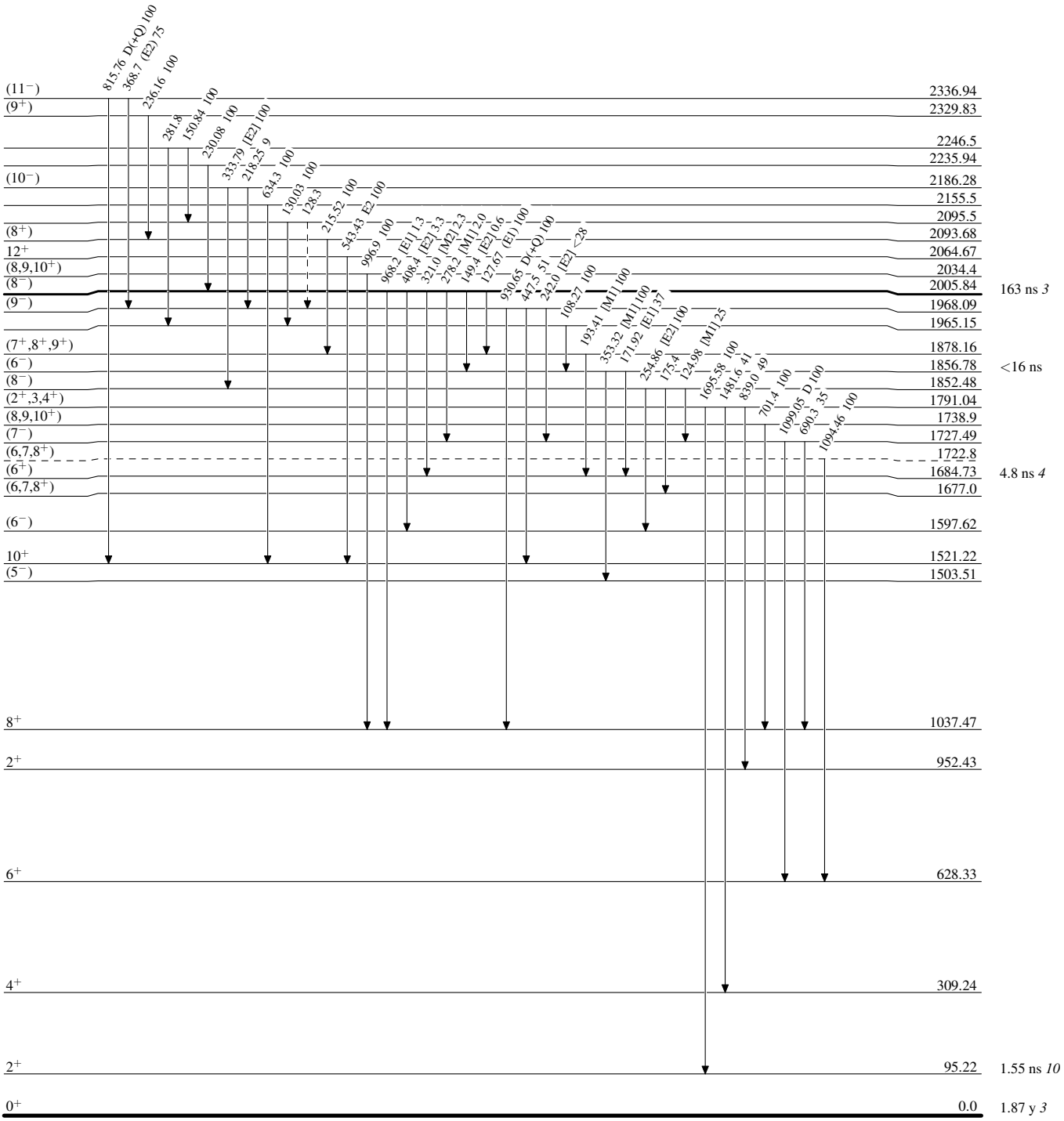
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{172}_{72}Hf_{100}$

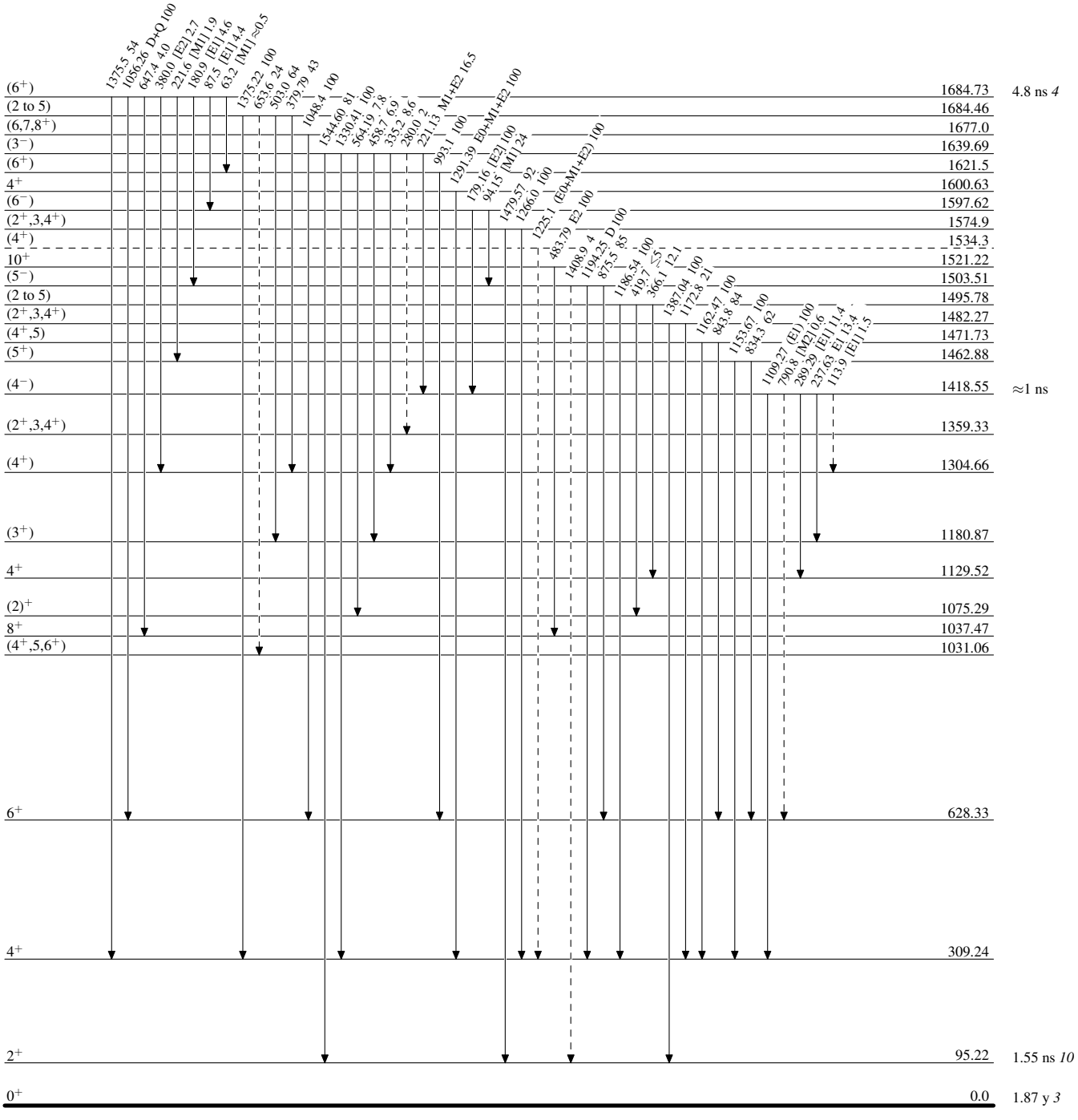
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{172}_{72}Hf_{100}$

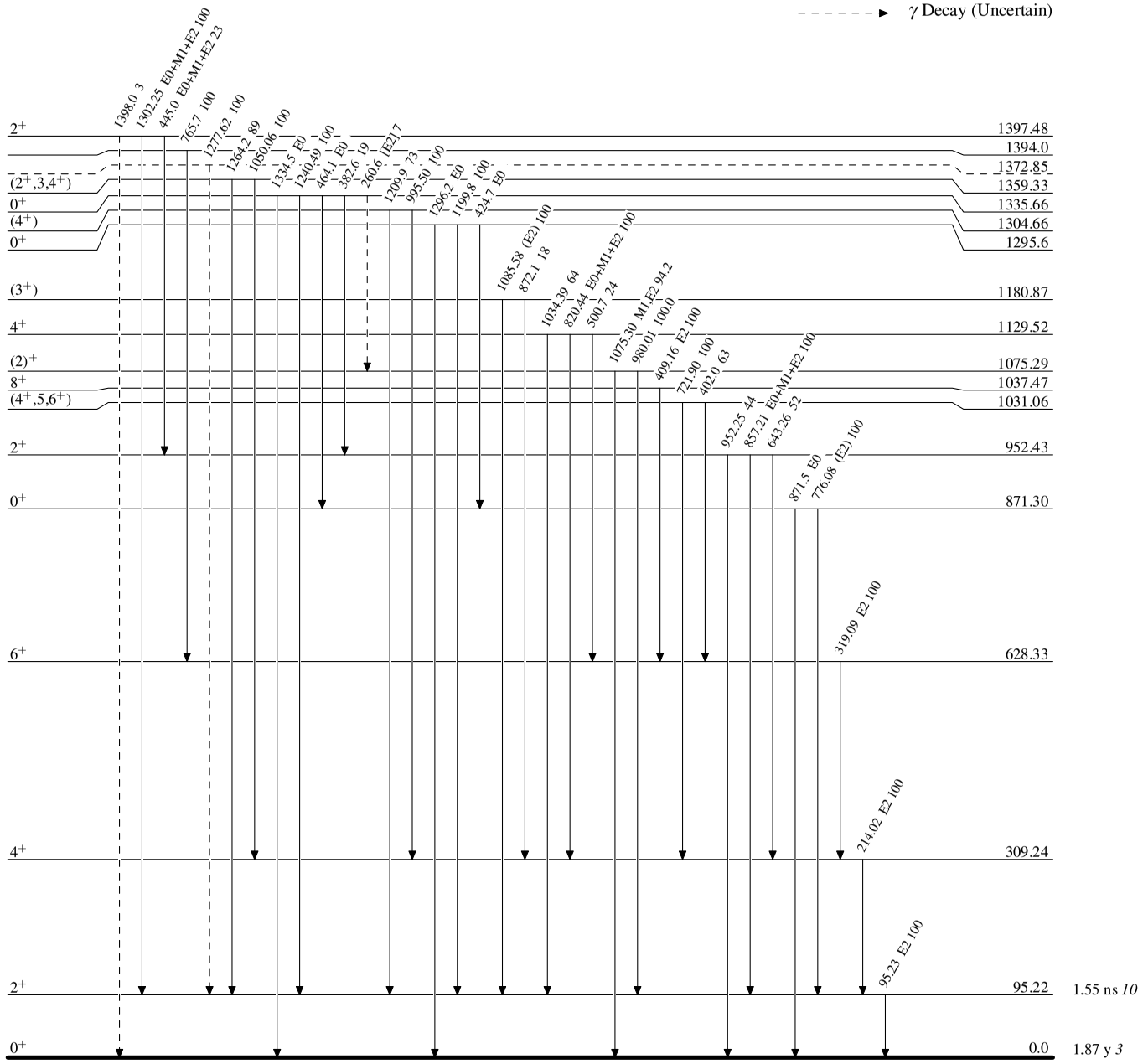
Adopted Levels, Gammas

Legend

Level Scheme (continued)

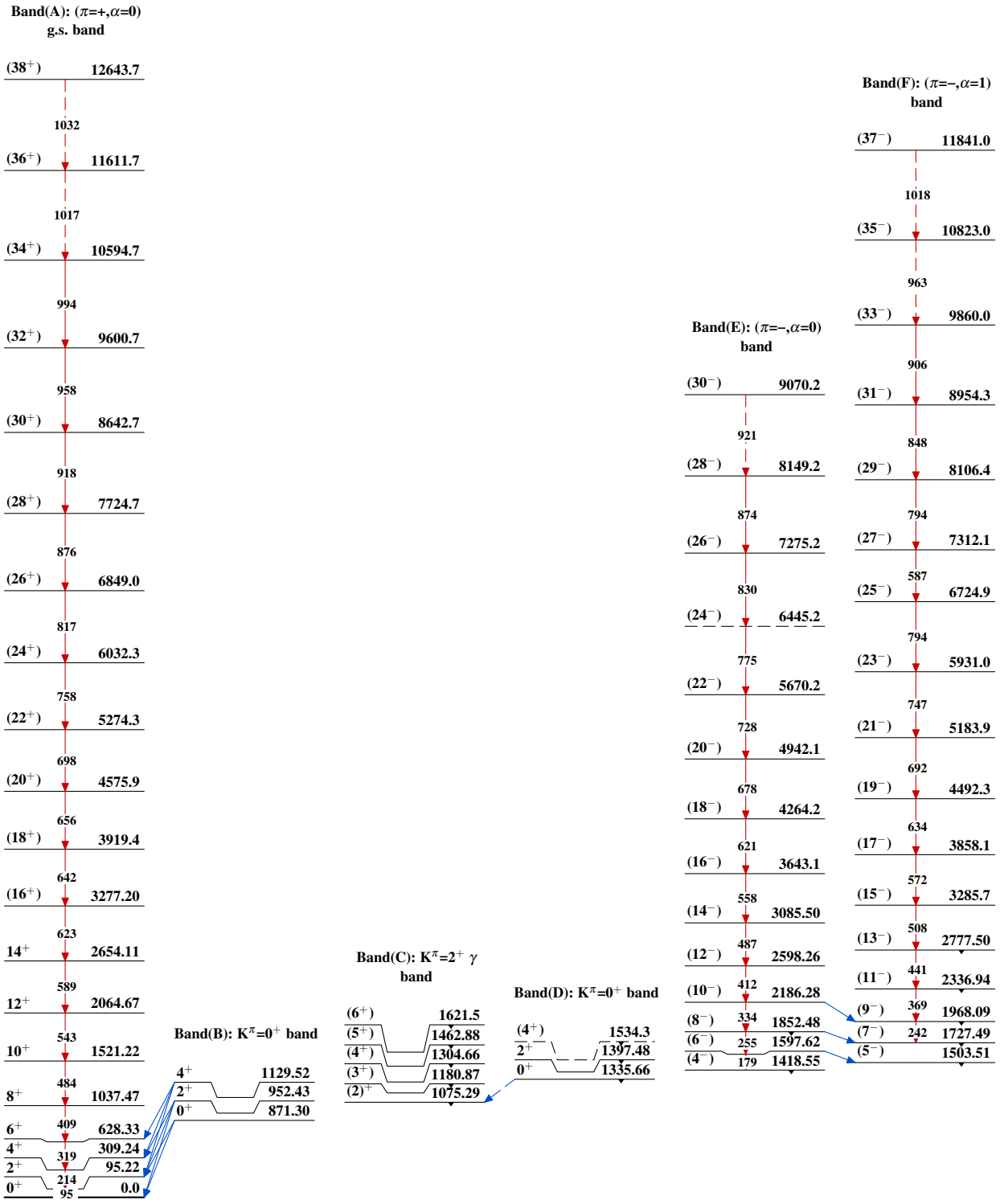
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



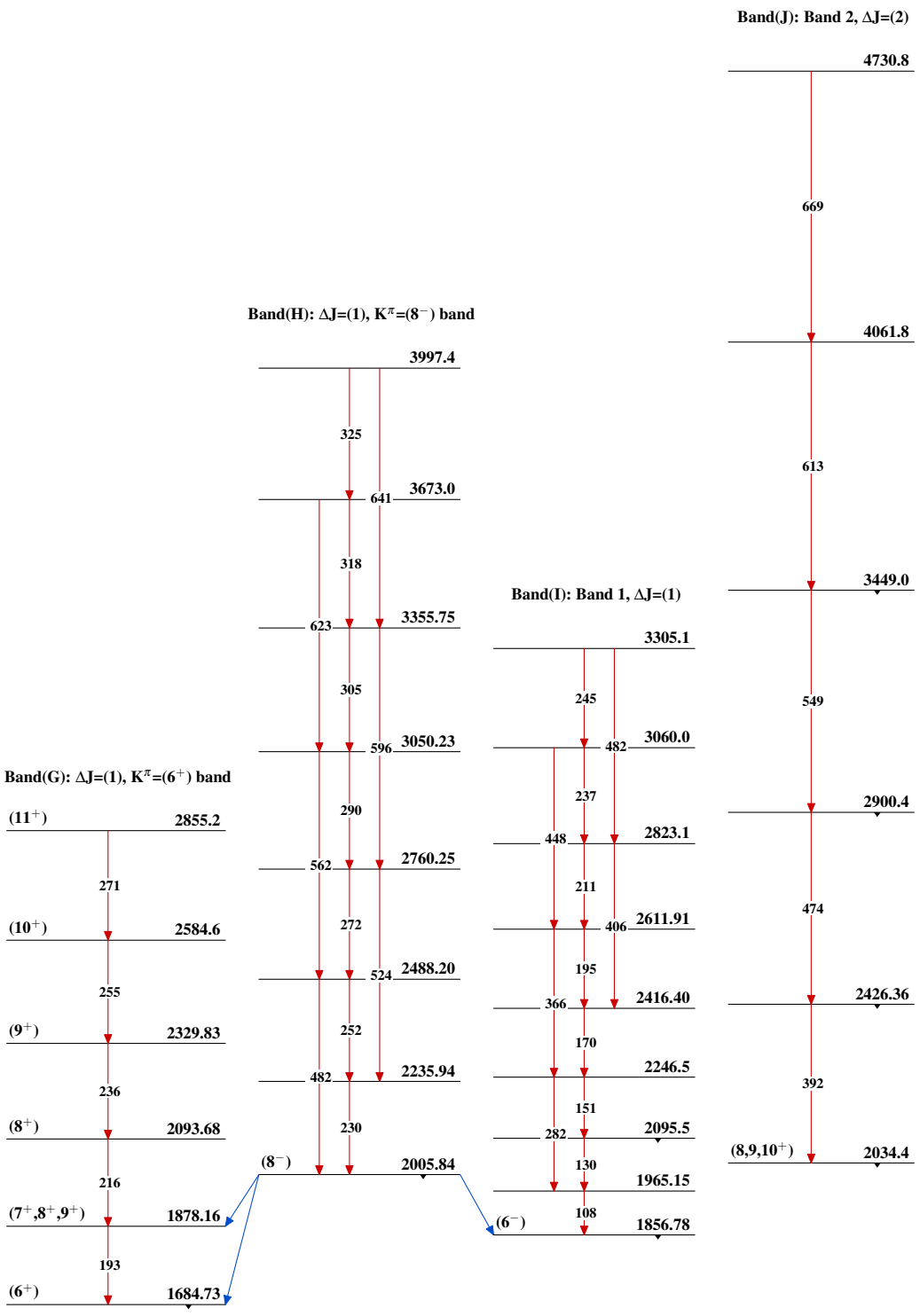
$^{172}_{72}Hf_{100}$

Adopted Levels, Gammas



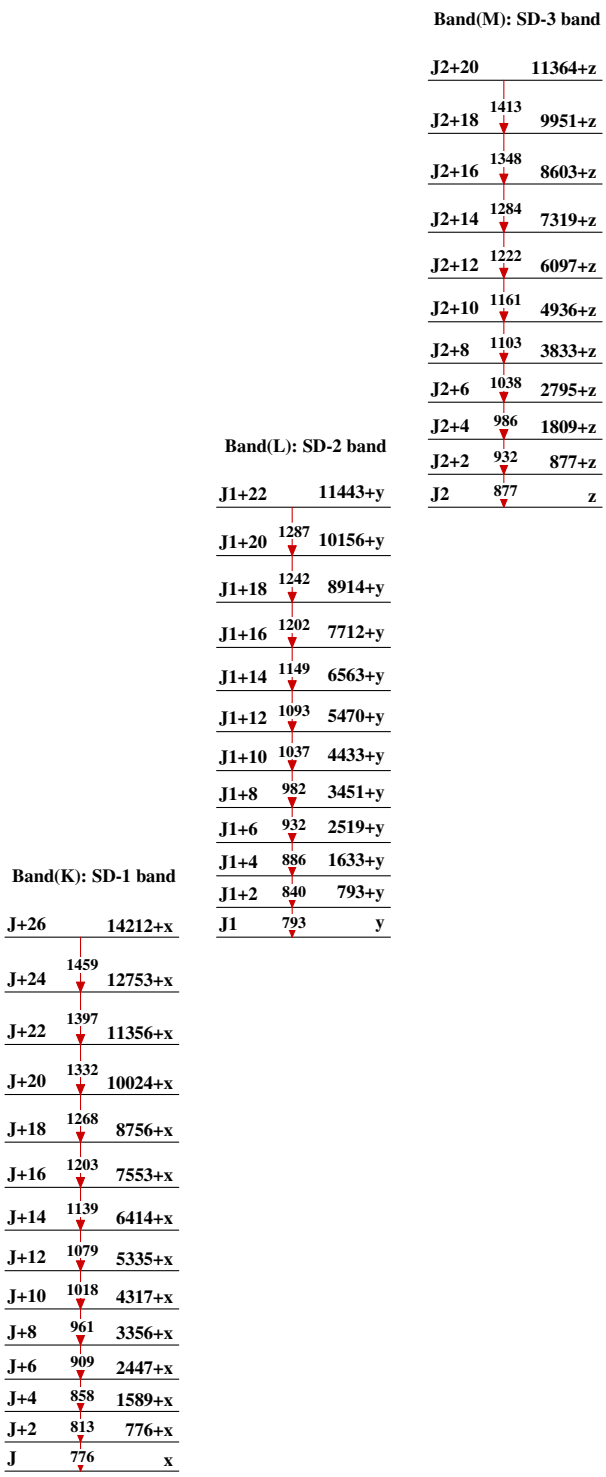
$^{172}_{72}Hf_{100}$

Adopted Levels, Gammas (continued)



$^{172}_{72}Hf_{100}$

Adopted Levels, Gammas (continued)



$^{172}_{72}Hf_{100}$