Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 111,1807 (2010)	15-Jun-2010

Q(β^-)=−6.97×10^3 *4*; S(n)=9.96×10^3 *4*; S(p)=5.15×10^3 *5*; Q(α)=3.23×10^3 *4* 2012Wa38
Note: Current evaluation has used the following Q record −6970 40 *9960* 40 *5150* 40 *3240* 30 2003Au03,2009AuZZ.
Additional information 1.
1975Sk01 used IMPAC to determine g=+0.07 *4* for the average g factor of feeding states (prerotational) in ^{156}Gd(^{16}O,4nγ).

^{168}Hf Levels

The orbitals associated with the quasiparticle labels used for bands in ^{168}Hf are the following:

Cross Reference (XREF) Flags

A ^{168}Ta ε decay
B (HI,xnγ)
C ^{186}W(n,2p17nγ)
D ^{96}Zr(^{76}Ge,4nγ)

A: ν 5/2[642], α=+1/2; B: ν 5/2[642], α=-1/2
C: ν 3/2[651], α=+1/2; D: ν 3/2[651], α=-1/2
E: ν 5/2[523], α=+1/2; F: ν 5/2[523], α=-1/2
G: ν 3/2[521], α=+1/2; H: ν 3/2[521], α=-1/2
M: ν 1/2[521], α=+1/2.
a: π 7/2[404], α=+1/2; b: π 7/2[404], α=-1/2
c: π 5/2[402], α=+1/2; d: π 5/2[402], α=-1/2
m: π 1/2[660], α=+1/2;
e: π 9/2[514], α=+1/2; f: π 9/2[514], α=-1/2
g: π 1/2[541], α=+1/2.

E(level)†	J$^\pi$#	T$_{1/2}$@	XREF	Comments
0.0d	0$^+$a	25.95 min *20*	ABCD	%ε+%β^+=100 %$\beta^+\approx$1 to 3, determined from analyses of complex β^+ spectra after successive separations of mixed ^{168}Lu-^{168}Hf source (1961Me05). J$^\pi$: g.s. of even-even nucleus. T$_{1/2}$: from 1970Ch17. Others: 26.0 min *5* (1995Tr10), 25 min *2* (1969Ar23), 25 min (1966Ha23), 22 min *2* (1961Me05).
124.10d *5*	2$^+$a	0.89 ns *4*	ABCD	J$^\pi$: 818γ-124$\gamma(\theta)$ establishes J=2; Q 124γ to 0$^+$ g.s. is not M2 from RUL.
385.92d *6*	4$^+$a	30.6 ps *15*	ABCD	T$_{1/2}$: from 2009Co03. Other: 36 ps *4* (1977Bo14) in (HI,xnγ).
757.29d *7*	6$^+$a	4.9 ps *3*	ABCD	T$_{1/2}$: from 2009Co03. Other: 5.9 ps *6* (1977Bo14) in (HI,xnγ).
875.94j *6*	2$^+$&		A	J$^\pi$: J=2 from 752γ-124$\gamma(\theta)$; E2+M1 752γ to 2$^+$ 124; 876γ to 0$^+$ g.s..
942.09k *8*	0$^+$&		A	J$^\pi$: 818γ-124$\gamma(\theta)$ in ε decay indicates a 0-2-0 cascade establishing J=0 for 942 level and J=2 for 124 level.
1030.93j *6*	3$^+$&		A	J$^\pi$: J=3 from 907γ-124$\gamma(\theta)$; E2+M1 907γ to 2$^+$ 124; 645γ to 4$^+$ 386.
1058.62k *6*	2$^+$&		A	J$^\pi$: J=2 from 935γ-124$\gamma(\theta)$; E2+M1 935γ to 2$^+$ 124; Q 673γ to 4$^+$ 385; 1059γ to 0$^+$ g.s..
1160.71j *9*	4$^{(+)}$&		A	J$^\pi$: J=4 from 775γ-262$\gamma(\theta)$; D+Q 775γ to 4$^+$ 386. See also the comment on J(1216 level).
1213.70d *15*	8$^+$a	1.46 ps *18*	BCD	T$_{1/2}$: from 2009Co03. Other: 1.98 ps *19* (1977Bo14) in (HI,xnγ); reason for discrepancy is unclear.
1284.66k *9*	(4$^+$)&		A	J$^\pi$: 527γ to 6$^+$ 757; 1161γ to 2$^+$ 124.

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Adopted Levels, Gammas (continued)

^{168}Hf Levels (continued)

E(level)[†]	Jπ[#]	$T_{1/2}$[@]	XREF	Comments
1373.11 *8*	(2)[&]		A	Jπ: 987γ to 4+ 386; 1249γ to 2+ 124; band assignment.
1386.38[j] *10*	(5+)[&]		A D	Jπ: 629γ to 6+ 757; 1000γ to 4+ 386; band assignment.
1401.53 *7*			A	Jπ: 371γ to 3+ 1031; 1277γ to 2+ 124.
1408.30 *11*	(4)[&]		A	Jπ: 1284γ to 2+ 124; band assignment.
1411.81 *7*	(≤4)		A	Jπ: 381γ to 3+ 1031; 1288γ to 2+ 124.
1497.24[l] *9*	(4−)		A D	Jπ: 740γ to 6+ 757; 1111γ to 4+ 386; band assignment.
1551.34[j] *8*	(6+)[&]		A D	Jπ: 521γ to 3+ 1031; 1165γ to 4+ 386; band assignment.
1568.51 *8*	(3)[&]		A	Jπ: 1183γ to 4+ 386; 1444γ to 2+ 124; band assignment.
1618.00 *7*	(≤4)		A	Jπ: 1494γ to 2+ 124.
1644.21? *11*	(≤4)		A	Jπ: 1520γ to 2+ 124.
1671.41 *8*	(1+,2+)		A	Jπ: 641γ to 3+ 1031; 729γ to 0+ 942.
1734.03 *7*	(2+,3,4+)		A	Jπ: 1348γ to 4+ 386; 1610γ to 2+ 124.
1735.33[c] *16*	(7−)		B D	
1736.06[d] *20*	10+[a]	0.71 ps *10*	BCD	$T_{1/2}$: from 2009Co03. Other: 1.00 ps *15* (1977Bo14).
1797.22 *15*	(4)[&]		A	Jπ: 1411γ to 4+ 386; 1673γ to 2+ 124; band assignment.
1799.52 *15*	(2+,3,4+)		A	Jπ: 1414γ to 4+ 386; 1676γ to 2+ 124.
1813.75[l] *12*	(6−)		B D	Jπ: 263γ to 6+ 1550; 316γ to (4−) 1497; band assignment.
1966.63? *12*			A	Jπ: 1581γ to 4+ 386, log *ft*=7.6 from (2−,3+), so J^{π}=(2+,3,4,5−).
1992.70[b] *20*	(6−)		B D	Jπ: (D) 1235γ to 6+ 756; band assignment.
2047.91? *14*			A	Jπ: 887γ to 4(+) 1160.
2067.01[c] *19*	(9−)		B D	
2081.44[m] *24*	(7−)		B D	Jπ: D 1324γ to 6+ 756; band assignment.
2108.71 *11*	(2+,3,4+)		A	Jπ: 1723γ to 4+ 386; 1985γ to 2+ 124.
2155.65[l] *15*	(8−)		B D	
2193.66[b] *16*	(8−)		B D	
2306.09[d] *23*	12+[a]	0.52 ps *18*	BCD	
2321.46[m] *17*	(9−)		B D	
2353.04 *9*			A	Jπ: 1322γ to 3+ 1031; 1477γ to 2+ 875.
2466.78[b] *18*	(10−)		B D	
2474.00[c] *21*	(11−)		B D	
2553.01[l] *19*	(10−)		B D	
2646.29[m] *20*	(11−)		B D	
2706.4[n] *5*	(10−)		D	
2828.21[b] *22*	(12−)		B D	
2852.4[o] *4*	(11−)		D	
2857.5[d] *3*	14+[a]	0.84 ps *18*	BCD	Jπ: stretched E2 552γ to 12+ 2306.
2937.75[c] *23*	(13−)		B D	
2976.43[l] *23*	(12−)		B D	
2990.6[e] *3*	14(+)		B D	Jπ: stretched Q 685γ to 12+ 2306.
3066.0[m] *3*	(13−)		D	
3085.3[n] *5*	(12−)		D	
3269.2[b] *3*	(14−)		B D	
3289.0[o] *4*	(13−)		D	
3310.4[d] *3*	(16+)[a]	1.82 ps *20*	B D	
3442.17[c] *25*	(15−)		B D	
3452.0[l] *3*	(14−)		B D	
3561.1[n] *6*	(14−)		D	
3589.4[m] *4*	(15−)		D	
3624.1[e] *3*	(16+)		B D	

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Adopted Levels, Gammas (continued)

^{168}Hf Levels (continued)

E(level)[†]	Jπ[#]	XREF	Comments
3777.4[b] 3	(16⁻)	B D	
3817.5[o] 4	(15⁻)	D	
3832.5[d] 3	(18⁺)[a]	B D	
3988.6[l] 3	(16⁻)	B D	
3989.6[c] 3	(17⁻)	B D	
4086.5[p] 6	(14⁻)	D	Jπ: D intraband 210γ from (15⁻) 4296.
4118.5[n] 6	(16⁻)	D	
4190.1[m] 4	(17⁻)	D	
4296.9[q] 4	(15⁻)	D	Jπ: D 1306γ to 14⁺; 855γ to 16⁺.
4322.3[e] 3	(18⁺)	B D	
4336.0[b] 4	(18⁻)	B D	
4415.3[o] 5	(17⁻)	D	
4439.9[d] 4	(20⁺)[a]	B D	
4450.4[v] 4	(15⁻)	D	
4467.7[t] 5	(15⁻)	D	Jπ: D 844γ to 16⁺ 3623; D 1610γ to 14⁺ 2856.
4528.8[p] 5	(16⁻)	D	
4577.9[c] 3	(19⁻)	B D	
4578.2[l] 3	(18⁻)	B D	
4615.7[u] 5	(16⁻)	D	
4671.5[s] 6	(16⁻)	D	
4714.9[n] 6	(18⁻)	D	
4773.3[q] 5	(17⁻)	D	
4809.7[v] 5	(17⁻)	D	
4829.5[m] 5	(19⁻)	D	
4894.5[t] 6	(17⁻)	D	
4934.0[b] 4	(20⁻)	B D	
5012.0[p] 6	(18⁻)	D	
5027.6[o] 5	(19⁻)	D	
5030.0[u] 6	(18⁻)	D	
5049.2[e] 4	(20⁺)	B D	
5124.3[d] 4	(22⁺)[a]	B D	
5139.5[s] 7	(18⁻)	D	
5146.5[f] 6	(19⁻)	D	
5168.8[r] 4	(19⁺)	D	
5197.4[c] 4	(21⁻)	B D	
5212.9[l] 3	(20⁻)	B D	
5246.3[q] 6	(19⁻)	D	
5275.1[v] 6	(19⁻)	D	
5328.5[n] 6	(20⁻)	D	
5412.6[t] 7	(19⁻)	D	
5479.0[m] 4	(21⁻)	D	
5496.5[p] 6	(20⁻)	D	
5544.8[u] 7	(20⁻)	D	
5574.3[b] 5	(22⁻)	B D	
5658.1[o] 7	(21⁻)	D	
5695.5[s] 7	(20⁻)	D	
5763.2[e] 4	(22⁺)	B D	
5768.4[q] 7	(21⁻)	D	
5801.9[f] 6	(21⁻)	D	

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Adopted Levels, Gammas (continued)

^{168}Hf Levels (continued)

E(level)†	Jπ#	XREF	E(level)†	Jπ#	XREF
5833.3[v] 7	(21⁻)	D	7860.8[b] 6	(28⁻)	B D
5853.4[c] 4	(23⁻)	B D	7919.1[o] 9	(27⁻)	D
5874.7[d] 4	(24⁺)[a]	B D	8037.6[f] 5	(27⁻)	B D
5889.3[r] 4	(21⁺)	D	8075.0‡[h] 7	(27⁻)[w]	D
5893.7[l] 4	(22⁻)	B D	8117.0[e] 4	(28⁺)	D
5942.1[n] 6	(22⁻)	D	8197.5[c] 6	(29⁻)	B D
6002.6[t] 7	(21⁻)	D	8201.6[t] 9	(27⁻)	D
6065.1[p] 7	(22⁻)	D	8209.2[u] 9	(28⁻)	D
6140.9[u] 7	(22⁻)	D	8244.8[p] 7	(28⁻)	D
6150.5[m] 4	(23⁻)	D	8270.1[n] 7	(28⁻)	D
6268.7[b] 5	(24⁻)	B D	8329.5[l] 8	(28⁻)	D
6318.4[o] 8	(23⁻)	D	8366.1[r] 11	(27⁺)	D
6329.5[s] 8	(22⁻)	D	8501.0[d] 5	(30⁺)[a]	B D
6382.3[q] 7	(23⁻)	D	8587.0[v] 10	(29⁻)	D
6461.3[v] 8	(23⁻)	D	8594.1[m] 8	(29⁻)	D
6481.4[e] 4	(24⁺)	D	8620.5[s] 9	(28⁻)	D
6495.2[f] 5	(23⁻)	D	8665.8[q] 7	(29⁻)	D
6565.5[h] 9	(23⁻)	D	8762.6[b] 6	(30⁻)	B D
6565.7[c] 5	(25⁻)	B D	8812.0[o] 11	(29⁻)	D
6627.9[l] 5	(24⁻)	B D	8845.4[h] 7	(29⁻)	D
6644.3[n] 6	(24⁻)	D	8988.1[u] 10	(30⁻)	D
6672.6[t] 8	(23⁻)	D	9040.7[e] 5	(30⁺)	D
6687.2[d] 4	(26⁺)[a]	B D	9053.6[t] 10	(29⁻)	D
6690.2[r] 4	(23⁺)	D	9102.5[p] 8	(30⁻)	D
6720.5[p] 7	(24⁻)	D	9114.2[c] 6	(31⁻)	B D
6794.5[u] 8	(24⁻)	D	9173.7[n] 9	(30⁻)	D
6892.5[m] 5	(25⁻)	D	9262.5[l] 9	(30⁻)	D
7028.5[s] 8	(24⁻)	D	9386.0[v] 14	(31⁻)	D
7029.4[b] 5	(26⁻)	B D	9500.7[d] 6	(32⁺)[a]	B D
7076.6[q] 7	(25⁻)	D	9501.5[s] 10	(30⁻)	D
7084.6[o] 8	(25⁻)	D	9552.2[m] 9	(31⁻)	D
7136.4[v] 8	(25⁻)	D	9556.7[q] 8	(31⁻)	D
7241.1[f] 5	(25⁻)	D	9661.2[h] 9	(31⁻)	D
7260.8[e] 4	(26⁺)	D	9730.5[b] 7	(32⁻)	B D
7335.5[h] 7	(25⁻)	D	9749.7[o] 12	(31⁻)	D
7346.8[c] 5	(27⁻)	B D	9962.6[t] 14	(31⁻)	D
7406.6[t] 9	(25⁻)	D	10017.0[e] 5	(32⁺)	D
7423.4[n] 5	(26⁻)	B D	10025.5[p] 8	(32⁻)	D
7439.4[l] 6	(26⁻)	D	10090.7[c] 6	(33⁻)	B D
7452.0[p] 7	(26⁻)	D	10132.0[n] 10	(32⁻)	D
7487.2[u] 9	(26⁻)	D	10226.5[l] 14	(32⁻)	D
7520.1[r] 4	(25⁺)	D	10439.5[s] 14	(32⁻)	D
7562.2[d] 5	(28⁺)[a]	B D	10513.7[q] 8	(33⁻)	D
7662.2?‡ 11	[w]	B	10530.6[h] 10	(33⁻)	D
7705.6[m] 6	(27⁻)	D	10551.4[d] 6	(34⁺)[a]	B D
7796.5[s] 9	(26⁻)	D	10567.2[m] 14	(33⁻)	D
7838.6[q] 7	(27⁻)	D	10756.5[b] 8	(34⁻)	B D
7842.8[v] 9	(27⁻)	D	10756.7[o] 16	(33⁻)	D

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Adopted Levels, Gammas (continued)

^{168}Hf Levels (continued)

E(level)†	Jπ#	XREF	E(level)†	Jπ#	XREF
11011.8[p] 8	(34⁻)	D	17336.6[d] 11	(46⁺)[a]	D
11043.2[e] 7	(34⁺)	D	17866.9[c] 16	(47⁻)	D
11117.7[c] 7	(35⁻)	B D	17890.8[h] 17	(47⁻)	D
11139.2[n] 12	(34⁻)	D	18605.6[d] 15	(48⁺)[a]	D
11437.3[h] 11	(35⁻)	D	19175.8[h] 20	(49⁻)	D
11533.2[q] 8	(35⁻)	D	0.0+x‡[g]	J≈(33)[w]	D
11638.2[d] 6	(36⁺)[a]	B D	677.2+x[g] 10	J+2	D
11828.4[b] 8	(36⁻)	B D	1399.2+x[g] 15	J+4	D
12069.5[p] 11	(36⁻)	D	2169.8+x[g] 18	J+6	D
12102.2[e] 13	(36⁺)	D	2993.9+x[g] 20	J+8	D
12179.2[c] 7	(37⁻)	B D	3871.2+x[g] 23	J+10	D
12186.2[n] 15	(36⁻)	D	4802.6+x[g] 25	J+12	D
12384.3[h] 12	(37⁻)	D	5787+x[g] 3	J+14	D
12619.2[q] 13	(37⁻)	D	6828+x[g] 3	J+16	D
12742.7[d] 7	(38⁺)[a]	B D	7926+x[g] 3	J+18	D
12931.5[b] 10	(38⁻)	B D	9079+x[g] 4	J+20	D
13255.4[c] 9	(39⁻)	B D	10294+x?[g] 4	J+22	D
13374.3[h] 13	(39⁻)	D	11567+x?[g] 4	J+24	D
13851.5[d] 9	(40⁺)[a]	D	0.0+z‡[i]	J2≈(28)[w]	D
14038.5[b] 14	(40⁻)	D	811.1+z[i] 10	J2+2	D
14342.6[c] 10	(41⁻)	B D	1673.3+z[i] 15	J2+4	D
14414.8[h] 14	(41⁻)	D	2583.6+z[i] 18	J2+6	D
14972.0[d] 10	(42⁺)[a]	D	3544.2+z[i] 20	J2+8	D
15461.7[c] 11	(43⁻)	D	4560.8+z[i] 23	J2+10	D
15512.0[h] 15	(43⁻)	D	5635.8+z[i] 25	J2+12	D
16127.5[d] 10	(44⁺)[a]	D	6771+z[i] 3	J2+14	D
16632.9[c] 12	(45⁻)	D	7966+z?[i] 3	J2+16	D
16670.0[h] 16	(45⁻)	D	9222+z?[i] 3	J2+18	D

† From least-squares fit to adopted Eγ, assigning 1 keV uncertainty to Eγ data for which the authors did not state an uncertainty and omitting uncertainly-placed transitions unless all gammas from a given level are of that character.

‡ Reported in (HI,xnγ) only. Should have been seen in (^{76}Ge,4nγ) also, but was not, so evaluator considers its existence questionable.

From angular correlation data for γ rays in projected coincidence spectra, and fits of γ-ray cascades into interconnected bands in (HI,xnγ) reactions, except as noted. Cranking-model calculations explain the band-crossing at 14^+ as resulting from alignment of the $i_{13/2}$ neutrons. For superdeformed structures, the spins of the lowest levels are estimated (by 2001Am02) based on obtaining reasonable alignments when compared to normal-deformed structures and triaxial superdeformed structures in Lu nuclides. Uncertainty in this estimate is 2 or 3 units of spin.

@ From recoil-distance Doppler-shift in (HI,xnγ), except as noted.

& From consistency of level-structure and γ-decay patterns in ^{168}Ta ε decay with predicted β-vibrational and γ-vibrational structure and high-energy quadrupole excitations.

[a] Smooth progression of level energies within g.s. band, known $J^\pi=0^+$ for g.s. and E2-multipolarity for the J=2 to 0 124γ enable assignment of definite J^π to J≤12 band members (viz. those below the first band crossing).

[b] Band(A): π=−, α=0, AF band. βc crossing at ħω=290 keV, alignment gain 6.8ħ; fg crossing at ħω=550 keV, alignment gain >3.5ħ. Partner with Am band for J≤14, but with AE band for J≥18.

[c] Band(B): π=−, α=1, AE band. βc crossing at ħω=300 keV, alignment gain 7.0ħ; fg crossing at ħω=540 keV, alignment gain 5.2ħ. Rotation aligned band. Lowest observed J=5.

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Adopted Levels, Gammas (continued)

^{168}Hf Levels (continued)

[d] Band(C): g.s. band. Band parameters: A=21.3, B=−99 (J=0,2,4 levels). Sharp AB crossing at $\hbar\omega$=265 keV (analogous to that in other N=96 nuclei), alignment gain 9.0$\hbar$; fg crossing at $\hbar\omega$=550 keV, alignment gain 6.1$\hbar$. Yrast band.

[e] Band(D): α=0 BC band. Continuation of g.s. band after βc crossing. AD crossing at $\hbar\omega$=360 keV.

[f] Band(E): π=−, α=1 band. Lowest observed member is the (19$^-$) 5145 level. Band has characteristics consistent with expectations for the BF band (2009Ya21).

[g] Band(F): Triaxial SD-1 band (2001Am02). Q(transition)≈11.4 (2001Am02; from fractional centroid shift, allowing for side-feeding). Population relative to ^{168}Hf channel=0.26% *10* (2001Am02) in (^{76}Ge,4nγ). Probable configuration=$\pi i^2_{13/2}\otimes\nu(j_{15/2}i_{13/2})$, α=1. This band decays mainly to the negative-parity normal-deformation AE and AF bands, as indicated by observed coincidence of all γ-rays in the SD-1 band with those in the AE and AF bands below J=31 and and J=30, respectively (2008Ya20).

[h] Band(G): Enhanced-deformation band (2009Ya21). Population relative to ^{168}Hf channel=0.15% *6* (2001Am02) in (^{76}Ge,4nγ). Lowest observed J is ≈23. This band was labeled as TSD-2 band in 2001Am02 but was renamed by 2008Ya20 and 2009Ya21; the latter authors also assign J values 3$\hbar$ higher than estimated by 2001Am02. Probable configuration=$\pi(i_{13/2}h_{9/2})\otimes\nu i^2_{13/2}$, α=1 (2008Ya20).

[i] Band(H): Triaxial SD-2 band (2001Am02). Population relative to ^{168}Hf channel=0.12% *5* (2001Am02) in (^{76}Ge,4nγ). This is the triaxial SD-3 band from 2001Am02 which was relabelled as triaxial SD-2 band by 2008Ya20.

[j] Band(I): K$^\pi$=2$^+$ γ-vibration band. Band parameters: A=21.7, B=−73 (J=2,4,6 members).

[k] Band(J): K$^\pi$=0$^+$ β^-vibration band. Band parameters: A=20.4, B=−164 (J=0,2,4 members).

[l] Band(K): π=−, α=0 BE band. Lowest observed J=4. Excitation energies higher than in AF band for J>10. AD crossing around $\hbar\omega$=320 keV.

[m] Band(L): π=−, α=1 AM band. Lowest observed J is 7. Energies are higher than AE sequence but lower than in Be band. βc crossing at $\hbar\omega$=320 keV, alignment gain 4.5$\hbar$.

[n] Band(M): π=−, α=0 AH band (2009Ya21). Slightly delayed βc crossing at $\hbar\omega$=300 keV, alignment gain 6.2$\hbar$. Lowest observed J=10.

[o] Band(m): π=−, α=1 AG band (2009Ya21). βc crossing at $\hbar\omega$≈300 keV, alignment gain 5.4$\hbar$.

[p] Band(N): π=−, α=0 gaAB,gcAB mixed band (2009Ya21). Lowest observed J=14. Band crossing at $\hbar\omega$≈240 keV. Likely configuration (2009Ya21): (π 1/2[541])(π 7/2[404])$\otimes$(ν 5/2[642])^2 mixed with (π 1/2[541])(π 5/2[402])$\otimes$(ν 5/2[642])^2 and having K≈3.5.

[q] Band(n): π=−, α=1 gbAB,gdAB mixed band (2009Ya21). See comment on signature partner band.

[r] Band(O): π=(+), α=1 band. Possible extension of g.s. band with an Ac alignment (2009Ya21).

[s] Band(P): K$^\pi$=(10$^-$), α=0 geBE band (2009Ya21). Likely configuration (2009Ya21): (π 1/2[541])+(π 9/2[514])+(ν 5/2[642])+(ν 5/2[523]),

[t] Band(p): K$^\pi$=(10$^-$), α=1 gfBE band (2009Ya21). See comment on signature partner band.

[u] Band(Q): K$^\pi$=(10$^-$), α=0 geAE band (2009Ya21). Strongly-coupled high-K band. Likely configuration (2009Ya21): (π 1/2[541])+(π 9/2[514])+(ν 5/2[642])+(ν 5/2[523]), consistent with measured B(M1)/B(E2) ratios. βc crossing occurs at J=23, $\hbar\omega$=315 keV, alignment gain 6.0$\hbar$. Deformation aligned band.

[v] Band(q): K$^\pi$=(10$^-$), α=1 gfAE band (2009Ya21). See comment on signature partner band.

[w] Spin estimates for the lowest levels observed by 2001Am02 in the two triaxial SD bands and the enhanced deformation band were made by 2001Am02 based on obtaining reasonable alignments when compared to normal-deformation structures and triaxial superdeformed structures in Lu nuclides; the uncertainty in this estimate was thought to be 2 or 3 units of spin. 2008Ya20 revised the value for the SD-1 band (now 12 $\hbar$ higher) and 2009Ya21 increased J for the enhanced deformation band by 3 $\hbar$, as shown here.

Adopted Levels, Gammas (continued)

$\gamma(^{168}Hf)$

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	δ[@]	α[f]	Comments
124.10	2^+	124.10[&] *5*	100[&]	0.0	0^+	E2		1.548	B(E2)(W.u.)=154 *7* Mult.: Q from $\gamma\gamma(\theta)$ in ε decay; not M2 from RUL.
385.92	4^+	261.85[&] *5*	100[&]	124.10	2^+	E2		0.1201	B(E2)(W.u.)=244 *12* Mult.: Q from $\gamma(\theta)$ in (HI,xnγ) and DCO in (^{76}Ge,4nγ); not M2 from RUL.
757.29	6^+	371.36[&] *6*	100[&]	385.92	4^+	E2		0.0426	B(E2)(W.u.)=285 *18* Mult.: Q from $\gamma(\theta)$ in (HI,xnγ); not M2 from RUL.
875.94	2^+	751.81[&] *8*	100[&] *8*	124.10	2^+	E2+M1	−10 *+3−9*	0.00754 *15*	Mult.: D+Q from $\gamma\gamma(\theta)$ in ε decay; large δ.
		875.95[&] *9*	55.7[&] *22*	0.0	0^+				
942.09	0^+	817.98[&] *7*	100[&]	124.10	2^+	(E2)		0.00620 *9*	Mult.: Q from $\gamma\gamma(\theta)$ in ε decay; $\Delta\pi$=no from level scheme.
1030.93	3^+	645.05[&] *10*	14.7[&] *17*	385.92	4^+	E2+M1	>10		Mult.,δ: D+Q, δ>+10 or <−20 from $\gamma\gamma(\theta)$ in ε decay; large δ.
		906.81[&] *7*	100[&] *8*	124.10	2^+	E2+M1	+11 *+13−4*	0.00504 *10*	Mult.: D+Q from $\gamma\gamma(\theta)$ in ε decay; large δ.
1058.62	2^+	672.75[&] *8*	61[&] *5*	385.92	4^+	(E2)		0.00953 *14*	Mult.: Q from $\gamma\gamma(\theta)$ in ε decay; $\Delta\pi$=no from level scheme.
		934.51[&] *10*	51[&] *5*	124.10	2^+	E2+M1	−8 *+4−10*	0.00477 *24*	Mult.: D+Q from $\gamma\gamma(\theta)$ in ε decay; large δ.
		1058.60[&] *10*	100[&] *7*	0.0	0^+				
1160.71	$4^{(+)}$	774.80[&] *9*	100[&]	385.92	4^+	(M1+E2)	+0.8 *+6−4*	0.0123 *24*	Mult.: D+Q from $\gamma\gamma(\theta)$ in ε decay; $\Delta\pi$=no if band assignment is correct.
1213.70	8^+	456.3 *2*	100	757.29	6^+	E2		0.0244	B(E2)(W.u.)=350 *50* Mult.: Q from $\gamma(\theta)$ in (HI,xnγ); not M2 from RUL.
1284.66	(4^+)	527.4[&] *1*	15.7[&] *20*	757.29	6^+				
		898.8[&] *2*	7.5[&] *14*	385.92	4^+				
		1160.5[&] *1*	100[&] *13*	124.10	2^+				
1373.11	(2)	987.21[&] *9*	100[&] *8*	385.92	4^+				
		1248.98[&] *10*	68[&] *7*	124.10	2^+				
1386.38	(5^+)	629.1[&] *9*	25[&] *3*	757.29	6^+				
		1000.46[&] *9*	100[&] *11*	385.92	4^+				
1401.53		370.62[&] *8*	70[&] *7*	1030.93	3^+				
		525.6[&] *1*	32[&] *4*	875.94	2^+				
		1277.4[&] *1*	100[&] *11*	124.10	2^+				
1408.30	(4)	1284.2[&] *1*	100[&]	124.10	2^+				
1411.81	(≤4)	380.88[&] *8*	21.8[&] *26*	1030.93	3^+				
		535.88[&] *7*	100[&] *8*	875.94	2^+				

$^{168}_{72}Hf_{96}$-7

Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
1411.81	(≤4)	1287.7[&] *2*	53[&] *6*	124.10	2^+			
1497.24	(4^-)	739.98[&] *11*	46[&] *6*	757.29	6^+			
		1111.29[&] *8*	100[&] *11*	385.92	4^+			
1551.34	(6^+)	165[b]		1386.38	(5^+)			
		390.65[&] *10*	11.0[&] *10*	1160.71	$4^{(+)}$			
		520.5[&] *1*	50[&] *10*	1030.93	3^+			
		1165.4[&] *1*	100[&] *13*	385.92	4^+			
1568.51	(3)	1182.57[&] *8*	93[&] *7*	385.92	4^+			
		1444.42[&] *10*	100[&] *9*	124.10	2^+			
1618.00	(≤4)	559.4[&] *1*	17.0[&] *20*	1058.62	2^+			
		742.0[&] *1*	48[&] *5*	875.94	2^+			
		1493.92[&] *8*	100[&] *8*	124.10	2^+			
1644.21?	(≤4)	1520.1[&h] *1*	100[&]	124.10	2^+			
1671.41	$(1^+,2^+)$	612.8[&] *1*	100[&] *9*	1058.62	2^+			
		640.5[&] *1*	95[&] *11*	1030.93	3^+			
		729.3[&] *1*	73[&] *9*	942.09	0^+			
		795.4[&] *2*	80[&] *9*	875.94	2^+			
1734.03	$(2^+,3,4^+)$	858.03[&] *8*	46[&] *4*	875.94	2^+			
		1348.1[&] *1*	23[&] *3*	385.92	4^+			
		1610.0[&] *1*	100[&] *17*	124.10	2^+			
1735.33	(7^-)	978.0 *2*	100	757.29	6^+			
1736.06	10^+	522.4 *2*	100	1213.70	8^+	E2	0.01734	B(E2)(W.u.)=370 *60* Mult.: Q from DCO in (^{76}Ge,4nγ); not M2 from RUL.
1797.22	(4)	1411.4[c&] *2*	100[&] *30*	385.92	4^+			Additional information 2.
		1673.0[c&] *2*	70[&] *20*	124.10	2^+			
1799.52	$(2^+,3,4^+)$	1413.5[c&] *2*	60[&] *13*	385.92	4^+			
		1675.5[c&] *2*	100[&] *23*	124.10	2^+			
1813.75	(6^-)	262.8 *2*	55 *14*	1551.34	(6^+)			
		316.0 *5*	23 *9*	1497.24	(4^-)			
		427.4 *2*	45 *5*	1386.38	(5^+)			
		1056.3 *2*	100 *14*	757.29	6^+	(E1)[d]		
1966.63?		1580.7[&h] *1*	100[&]	385.92	4^+			
1992.70	(6^-)	1235.4 *2*	100	757.29	6^+	(D)		
2047.91?		887.2[&h] *1*	100[&]	1160.71	$4^{(+)}$			

$^{168}_{72}Hf_{96}$-8

Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
2067.01	(9⁻)	331.8 *5*	11.3 *16*	1735.33	(7⁻)	(E2)	0.0588	
		853.0 *2*	100 *11*	1213.70	8⁺	(E1)		Mult.: D from (^{76}Ge,4nγ); (E1) from (HI,xnγ).
2081.44	(7⁻)	1324.0 *5*	100	757.29	6⁺	D		
2108.71	(2⁺,3,4⁺)	1722.8[&] *1*	36[&] *7*	385.92	4⁺			
		1984.5[&] *2*	100[&] *21*	124.10	2⁺			
2155.65	(8⁻)	342.0 *2*	100 *25*	1813.75	(6⁻)	(E2)[d]	0.0537	
		420.3 *2*	75 *10*	1735.33	(7⁻)			
		942.0 *2*	50 *5*	1213.70	8⁺	(E1)[d]		Other Iγ: <25 from (HI,xnγ). Mult.: D ΔJ=0 or Q ΔJ=2 from DCO in (^{76}Ge,4nγ); (E1) from (HI,xnγ).
2193.66	(8⁻)	200.9 *5*	27 *3*	1992.70	(6⁻)			
		380.0 *2*	91 *18*	1813.75	(6⁻)	Q		Other Iγ: 58 from (HI,xnγ).
		980.0 *2*	100 *12*	1213.70	8⁺	D		
2306.09	12⁺	570.0 *2*	100	1736.06	10⁺	E2	0.01402	B(E2)(W.u.)=320 *120* Mult.: Q from DCO ratio in (^{76}Ge,4nγ); not M2 from RUL.
2321.46	(9⁻)	127.8 *5*	<29	2193.66	(8⁻)			
		240.0 *2*	59 *12*	2081.44	(7⁻)			
		586.1 *2*	65 *12*	1735.33	(7⁻)			
		1107.8 *2*	100 *18*	1213.70	8⁺	D		Other mult: (E1) from (HI,xnγ).
2353.04		1322.0[&] *1*	58[&] *11*	1030.93	3⁺			
		1477.2[&] *1*	100[&] *18*	875.94	2⁺			
2466.78	(10⁻)	145.4 *5*	11.9 *17*	2321.46	(9⁻)	(M1)	1.377	Other Iγ: 19 from (HI,xnγ). Mult.: D from (^{76}Ge,4nγ); Δπ=(no) from level scheme.
		273.2 *2*	100 *10*	2193.66	(8⁻)	(E2)	0.1053	
		311.2 *2*	34 *3*	2155.65	(8⁻)	(Q)		
		399.7 *5*	8.5 *17*	2067.01	(9⁻)			Other Iγ: 16.5 from (HI,xnγ) for (M1) γ.
2474.00	(11⁻)	406.9 *2*	43 *5*	2067.01	(9⁻)	(E2)	0.0331	
		738.0 *2*	100 *10*	1736.06	10⁺	D		
2553.01	(10⁻)	359.4 *2*	40 *4*	2193.66	(8⁻)			
		397.4 *2*	100 *12*	2155.65	(8⁻)	(E2)	0.0354	
		485.9 *5*	24 *8*	2067.01	(9⁻)	D		
		817.0 *5*	<20	1736.06	10⁺			
2646.29	(11⁻)	179.4 *5*	<33	2466.78	(10⁻)			
		324.8 *2*	100 *13*	2321.46	(9⁻)	(E2)	0.0626	
		579.1 *2*	67 *13*	2067.01	(9⁻)			
2706.4	(10⁻)	970.4 *5*	100	1736.06	10⁺			
2828.21	(12⁻)	181.4[b] *3*	<5.4	2646.29	(11⁻)	(M1)	0.739	Iγ: from (HI,xnγ). Mult.: D from (^{76}Ge,4nγ); (M1) from (HI,xnγ).
		361.6 *2*	100 *9*	2466.78	(10⁻)	(E2)	0.0460	
2852.4	(11⁻)	1116.4 *5*	100	1736.06	10⁺	D		

$^{168}_{72}Hf_{96}$-9

Adopted Levels, Gammas (continued)

$\gamma(^{168}Hf)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
2857.5	14^+	551.3 *2*	100	2306.09	12^+	E2	0.01520	B(E2)(W.u.)=240 *50* Mult.: stretched Q from $\gamma(\theta)$ in (HI,xnγ); not M2 from RUL.
2937.75	(13^-)	463.7 *2*	100 *7*	2474.00	(11^-)	(E2)	0.0234	
		631.7 *2*	73 *7*	2306.09	12^+	D		
2976.43	(12^-)	423.5 *2*	100 *16*	2553.01	(10^-)	(E2)	0.0298	
		502.5 *5*	47 *16*	2474.00	(11^-)	D		
		509.7 *5*	<26	2466.78	(10^-)			
2990.6	$14^{(+)}$	684.5 *2*	100	2306.09	12^+	Q[e]		
3066.0	(13^-)	237.6 *5*	<56	2828.21	(12^-)			
		419.8 *5*	89 *22*	2646.29	(11^-)	(E2)	0.0305	
		592.0 *5*	100 *11*	2474.00	(11^-)			
3085.3	(12^-)	233.0 *5*	<56	2852.4	(11^-)	D		
		379.0 *5*	100 *22*	2706.4	(10^-)	(E2)	0.0403	
3269.2	(14^-)	441.0 *2*	100	2828.21	(12^-)	(E2)	0.0267	
3289.0	(13^-)	436.6 *5*	100 *25*	2852.4	(11^-)	(E2)	0.0274	
		982.9 *5*	<63	2306.09	12^+	D		
3310.4	(16^+)	319.8 *2*	4.4 *4*	2990.6	$14^{(+)}$	E2	0.0655	B(E2)(W.u.)=69 *14* Mult.: Q from (HI,xnγ); not M2 from RUL.
		452.9 *2*	100 *13*	2857.5	14^+	(E2)[d]	0.0249	B(E2)(W.u.)=260 *60*
3442.17	(15^-)	451.6 *2*	10.0 *13*	2990.6	$14^{(+)}$	(E1)[d]		
		504.4 *2*	100 *13*	2937.75	(13^-)	(E2)	0.0189	
3452.0	(14^-)	475.8[b] *3*	100 *12*	2976.43	(12^-)	(E2)	0.0219	
		514.3 *5*	<20	2937.75	(13^-)			
		623.6 *5*	<20	2828.21	(12^-)			
3561.1	(14^-)	475.9 *5*	100	3085.3	(12^-)	(E2)	0.0219	
3589.4	(15^-)	523.4 *2*	100 *10*	3066.0	(13^-)			
		651.7 *5*	<50	2937.75	(13^-)			
3624.1	(16^+)	633.5 *2*	100 *13*	2990.6	$14^{(+)}$	(E2)[d]		
		766.6 *2*	24.0 *27*	2857.5	14^+	(E2)[d]		
3777.4	(16^-)	508.2 *2*	100	3269.2	(14^-)	(E2)	0.0186	
3817.5	(15^-)	528.5 *2*	100 *13*	3289.0	(13^-)	(E2)	0.01685	
		827.0 *5*	<33	2990.6	$14^{(+)}$			
3832.5	(18^+)	521.9 *2*	100	3310.4	(16^+)	(E2)[e]	0.01738	
3988.6	(16^-)	536.7 *2*	100 *13*	3452.0	(14^-)	(E2)	0.01623	
		546.6 *5*	<22	3442.17	(15^-)			
		719.3 *5*	<22	3269.2	(14^-)			
3989.6	(17^-)	365.5 *5*	<3.6	3624.1	(16^+)	D		
		547.4 *2*	100 *14*	3442.17	(15^-)	(E2)	0.01546	
4118.5	(16^-)	557.5 *5*	100	3561.1	(14^-)	(E2)	0.01479	
4190.1	(17^-)	600.7 *5*	100 *11*	3589.4	(15^-)	(E2)	0.01238	

$^{168}_{72}Hf_{96}$-10

Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]
4190.1	(17⁻)	748.0 *5*	<56	3442.17	(15⁻)		
4296.9	(15⁻)	210.4 *5*	100 *29*	4086.5	(14⁻)	(M1)	0.490
		854.7 *5*	<71	3442.17	(15⁻)		
		1306.3 *5*	<71	2990.6	14(+)	D	
		1439.4 *5*	<71	2857.5	14⁺		
4322.3	(18⁺)	698.3 *2*	100 *16*	3624.1	(16⁺)	(E2)[d]	
		1012.0 *5*	<11.4	3310.4	(16⁺)		
4336.0	(18⁻)	558.6 *2*	100	3777.4	(16⁻)	(E2)	0.01472
4415.3	(17⁻)	597.8 *2*	100	3817.5	(15⁻)	(E2)	0.01252
4439.9	(20⁺)	607.3 *2*	100	3832.5	(18⁺)	(E2)	0.01206
4450.4	(15⁻)	1140.0 *5*		3310.4	(16⁺)	D	
		1459.8 *5*		2990.6	14(+)		
		1592.9 *5*		2857.5	14⁺		
4467.7	(15⁻)	843.6 *5*	<50	3624.1	(16⁺)	D	
		1610.2 *5*	100 *20*	2857.5	14⁺	D	
4528.8	(16⁻)	231.9 *2*	100 *20*	4296.9	(15⁻)	(M1)	0.374
		442.3 *5*	<50	4086.5	(14⁻)	(E2)	0.0265
4577.9	(19⁻)	255.4 *5*	<4.2	4322.3	(18⁺)		
		588.2 *2*	100 *17*	3989.6	(17⁻)	(E2)	0.01301
4578.2	(18⁻)	588.9 *5*	<28	3989.6	(17⁻)		
		589.7 *2*	100 *11*	3988.6	(16⁻)	(E2)	0.01293
		800.8 *5*	<28	3777.4	(16⁻)		
4615.7	(16⁻)	165.3 *5*		4450.4	(15⁻)	(M1)	0.959 *16*
		1305.3 *5*		3310.4	(16⁺)		
4671.5	(16⁻)	203.9 *5*	100	4467.7	(15⁻)	(M1)	0.534 *9*
4714.9	(18⁻)	596.5 *2*	100	4118.5	(16⁻)	(E2)	0.01258
4773.3	(17⁻)	244.5 *5*	100 *14*	4528.8	(16⁻)	(M1)	0.324
		476.4 *5*	<71	4296.9	(15⁻)	(E2)	0.0219
4809.7	(17⁻)	194.0 *5*		4615.7	(16⁻)	(M1)	0.613 *10*
		359.3 *5*		4450.4	(15⁻)		
4829.5	(19⁻)	639.3 *5*	100	4190.1	(17⁻)	(E2)	
4894.5	(17⁻)	223.1 *5*	100 *13*	4671.5	(16⁻)	(M1)	0.416 *7*
		426.8 *5*	<63	4467.7	(15⁻)		
4934.0	(20⁻)	598.0 *2*	100	4336.0	(18⁻)	(E2)	0.01251
5012.0	(18⁻)	238.7 *5*		4773.3	(17⁻)	(M1)	0.346
		483.2 *5*		4528.8	(16⁻)	(E2)	0.0211
5027.6	(19⁻)	612.3 *2*	100	4415.3	(17⁻)		
5030.0	(18⁻)	220.3 *5*	100 *14*	4809.7	(17⁻)	(M1)	0.431 *7*
		414.3 *5*	<71	4615.7	(16⁻)	(E2)	0.0316
5049.2	(20⁺)	726.9 *2*	100	4322.3	(18⁺)	(E2)[d]	
5124.3	(22⁺)	684.1 *2*	100	4439.9	(20⁺)	(E2)[e]	0.00918 *13*

$^{168}_{72}Hf_{96}$-11

Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
5139.5	(18⁻)	244.9 *5*	100 *14*	4894.5	(17⁻)	(M1)	0.322	
		468.0 *5*	<71	4671.5	(16⁻)			
5146.5	(19⁻)	824.2[h] *5*	100	4322.3	(18⁺)			
5168.8	(19⁺)	846.5 *2*	100 *14*	4322.3	(18⁺)	Q(+D)		
		1336.5 *5*	<36	3832.5	(18⁺)			
5197.4	(21⁻)	619.5 *2*	100	4577.9	(19⁻)	(E2)	0.01152	
5212.9	(20⁻)	634.8 *2*	100 *13*	4577.9	(19⁻)	(E2)	0.01088	
		635.5 *5*	<33	4578.2	(18⁻)			
		877.0 *5*	<33	4336.0	(18⁻)	Q		
5246.3	(19⁻)	234.3 *5*		5012.0	(18⁻)	(M1)	0.364	
		473.0 *5*		4773.3	(17⁻)	(E2)	0.0223	
5275.1	(19⁻)	245.1 *5*	100 *20*	5030.0	(18⁻)	(M1)	0.322	
		465.4 *5*	<100	4809.7	(17⁻)			
5328.5	(20⁻)	613.6[g] *2*	100[g]	4714.9	(18⁻)			
5412.6	(19⁻)	273.1 *5*		5139.5	(18⁻)	(M1)	0.240	
		518.0 *5*		4894.5	(17⁻)			
5479.0	(21⁻)	649.5 *5*	100 *17*	4829.5	(19⁻)	(E2)	0.01032	
		901.2 *5*	<83	4577.9	(19⁻)	Q		
		1039.0 *5*	<83	4439.9	(20⁺)			
5496.5	(20⁻)	250.2 *2*	100 *16*	5246.3	(19⁻)	(M1)	0.304	
		484.5 *5*	<26	5012.0	(18⁻)			
5544.8	(20⁻)	269.7 *5*	100 *20*	5275.1	(19⁻)	(M1)	0.248	
		514.8 *5*	<100	5030.0	(18⁻)			
5574.3	(22⁻)	640.3 *2*	100	4934.0	(20⁻)	(E2)	0.01067	
5658.1	(21⁻)	630.5 *5*	100	5027.6	(19⁻)	(E2)	0.01105	
5695.5	(20⁻)	282.9 *5*	<71	5412.6	(19⁻)	(M1)	0.218	
		556.0 *5*	100 *14*	5139.5	(18⁻)			
5763.2	(22⁺)	714.1 *2*	100 *13*	5049.2	(20⁺)	(E2)[d]		
		1323.4 *2*	43 *9*	4439.9	(20⁺)			
5768.4	(21⁻)	271.9 *2*	100 *17*	5496.5	(20⁻)	(M1)	0.242	
		522.1 *5*	<28	5246.3	(19⁻)	(E2)	0.01737	
5801.9	(21⁻)	655.5 *5*		5146.5	(19⁻)			
		752.8[h] *5*		5049.2	(20⁺)			
5833.3	(21⁻)	288.5 *5*	100 *20*	5544.8	(20⁻)	(M1)	0.206	
		558.2 *5*	<100	5275.1	(19⁻)	(E2)	0.01475	
5853.4	(23⁻)	656.0 *2*	100	5197.4	(21⁻)	(E2)	0.0101	
5874.7	(24⁺)	750.0 *2*	100	5124.3	(22⁺)	(E2)		Mult.: Q from (HI,xnγ); intraband transition.
5889.3	(21⁺)	720.5 *2*	80 *13*	5168.8	(19⁺)	(E2)	0.00817 *12*	
		840.1 *2*	100 *13*	5049.2	(20⁺)	Q(+D)		
5893.7	(22⁻)	680.8 *2*	100 *10*	5212.9	(20⁻)	(E2)	0.00928 *13*	
		959.8 *5*	<50	4934.0	(20⁻)			

Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
5942.1	(22$^-$)	613.6[g] *2*	100[g]	5328.5	(20$^-$)			
6002.6	(21$^-$)	307.1 *5*	80 *10*	5695.5	(20$^-$)	(M1)	0.174	
		590.0 *2*	100 *10*	5412.6	(19$^-$)			
6065.1	(22$^-$)	296.7 *2*	100 *10*	5768.4	(21$^-$)	(M1)	0.191	
		568.6 *5*	<24	5496.5	(20$^-$)			
6140.9	(22$^-$)	307.6 *5*		5833.3	(21$^-$)	(M1)	0.174	
		596.1 *5*		5544.8	(20$^-$)	(E2)	0.01260	
6150.5	(23$^-$)	671.7 *5*	100 *20*	5479.0	(21$^-$)	(E2)	0.00956 *14*	
		953.4 *5*	<100	5197.4	(21$^-$)	Q		
		1026.3 *5*	<100	5124.3	(22$^+$)			
6268.7	(24$^-$)	694.4 *2*	100	5574.3	(22$^-$)	(E2)	0.00887 *13*	
6318.4	(23$^-$)	660.3 *2*	100	5658.1	(21$^-$)	(E2)	0.00994 *13*	
6329.5	(22$^-$)	326.9 *5*	58 *8*	6002.6	(21$^-$)	(M1)	0.1475	
		634.0 *2*	100 *17*	5695.5	(20$^-$)	(E2)	0.01091	
6382.3	(23$^-$)	317.2 *2*	100 *13*	6065.1	(22$^-$)	(M1)	0.1599	
		613.9 *2*	67 *13*	5768.4	(21$^-$)	(E2)	0.01176	
6461.3	(23$^-$)	320.4 *5*	<83	6140.9	(22$^-$)	(M1)	0.1556	
		628.0 *5*	100 *17*	5833.3	(21$^-$)	(E2)	0.01116	
6481.4	(24$^+$)	718.3 *2*	100 *13*	5763.2	(22$^+$)			
		1357.3 *2*	34 *3*	5124.3	(22$^+$)	Q		
6495.2	(23$^-$)	693.4 *5*		5801.9	(21$^-$)			
		1371.1 *5*		5124.3	(22$^+$)	D		
6565.7	(25$^-$)	712.3 *2*	100	5853.4	(23$^-$)	(E2)		
6627.9	(24$^-$)	734.1[b] *3*	100	5893.7	(22$^-$)	(E2)		
6644.3	(24$^-$)	702.2 *2*	100	5942.1	(22$^-$)	(E2)		
6672.6	(23$^-$)	343.1 *5*	86 *14*	6329.5	(22$^-$)	(M1)	0.1296	
		670.0 *5*	100 *14*	6002.6	(21$^-$)	(Q)		
6687.2	(26$^+$)	812.2 *2*	100	5874.7	(24$^+$)	(E2)[e]		
6690.2	(23$^+$)	800.9 *2*	79 *14*	5889.3	(21$^+$)	(E2)		
		926.9 *2*	100 *14*	5763.2	(22$^+$)	Q(+D)		
6720.5	(24$^-$)	338.2 *2*	100 *27*	6382.3	(23$^-$)	(M1)	0.1346	
		655.4 *5*	64 *9*	6065.1	(22$^-$)	(E2)	0.01011	
6794.5	(24$^-$)	333.2 *5*		6461.3	(23$^-$)	(M1)	0.1401	
		653.6 *5*		6140.9	(22$^-$)	(E2)	0.01018	
6892.5	(25$^-$)	742.3 *5*		6150.5	(23$^-$)	(E2)		
		1017.6 *5*		5874.7	(24$^+$)	[E1]		Mult.: DCO in ^{96}Zr(^{76}Ge,4nγ) too high for E1 ΔJ=1 transition implied by level scheme.
7028.5	(24$^-$)	355.9 *5*		6672.6	(23$^-$)	(M1)	0.1175	
		699.0 *5*		6329.5	(22$^-$)	(E2)		
7029.4	(26$^-$)	760.7 *2*	100	6268.7	(24$^-$)	(E2)		
7076.6	(25$^-$)	356.1 *5*	100 *17*	6720.5	(24$^-$)	(M1)	0.1173	

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Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]	α[f]	Comments
7076.6	(25$^-$)	694.3 *5*	83 *17*	6382.3	(23$^-$)	(E2)		
7084.6	(25$^-$)	766.2 *2*	100	6318.4	(23$^-$)	(E2)		
7136.4	(25$^-$)	341.9 *5*	100 *20*	6794.5	(24$^-$)	(M1)	0.1308	
		675.1 *5*	<100	6461.3	(23$^-$)	(E2)		
7241.1	(25$^-$)	746.2 *5*		6495.2	(23$^-$)			
		1366.3 *5*		5874.7	(24$^+$)	D		
7260.8	(26$^+$)	779.8 *2*	100 *14*	6481.4	(24$^+$)			
		1385.5 *5*	50 *7*	5874.7	(24$^+$)	Q		
7335.5	(25$^-$)	770.0[b] *5*	100	6565.5	(23$^-$)			
7346.8	(27$^-$)	781.1 *2*	100	6565.7	(25$^-$)	(E2)		
7406.6	(25$^-$)	378.1 *5*	<100	7028.5	(24$^-$)	(M1)	0.1001	
		734.0 *5*	100 *20*	6672.6	(23$^-$)	(E2)		
7423.4	(26$^-$)	779.2 *5*	100 *17*	6644.3	(24$^-$)	(E2)		
		795.5[b] *3*	100 *17*	6627.9	(24$^-$)			
7439.4	(26$^-$)	795.2 *5*		6644.3	(24$^-$)	Q		
		811.5 *5*		6627.9	(24$^-$)	(E2)		
7452.0	(26$^-$)	375.4 *5*	<42	7076.6	(25$^-$)	(M1)	0.1020	
		731.5 *2*	100 *17*	6720.5	(24$^-$)	(E2)		
7487.2	(26$^-$)	350.8 *5*		7136.4	(25$^-$)	(M1)	0.1221	
		692.7 *5*		6794.5	(24$^-$)			
7520.1	(25$^+$)	829.9 *2*	100	6690.2	(23$^+$)			
7562.2	(28$^+$)	874.8 *2*	100	6687.2	(26$^+$)	(E2)[d]		
7662.2?		975[bh] *1*	100	6687.2	(26$^+$)			
7705.6	(27$^-$)	813.3 *5*	100 *20*	6892.5	(25$^-$)	(E2)		
		1018.3 *5*	<100	6687.2	(26$^+$)	[E1]		Mult.: DCO in ^{96}Zr(^{76}Ge,4nγ) too high for E1 ΔJ=1 implied by level scheme.
7796.5	(26$^-$)	389.9 *5*		7406.6	(25$^-$)	(M1)	0.0922	
		768.0 *5*		7028.5	(24$^-$)	(E2)		
7838.6	(27$^-$)	386.6 *2*	100 *12*	7452.0	(26$^-$)	(M1)	0.0943	
		762.0 *2*	71 *12*	7076.6	(25$^-$)	(E2)		
7842.8	(27$^-$)	355.6 *5*	<100	7487.2	(26$^-$)			
		706.4 *5*	100 *20*	7136.4	(25$^-$)	(E2)		
7860.8	(28$^-$)	831.4 *2*	100	7029.4	(26$^-$)	(E2)		
7919.1	(27$^-$)	834.5 *5*	100	7084.6	(25$^-$)			
8037.6	(27$^-$)	702.1 *5*		7335.5	(25$^-$)			
		796.5 *2*		7241.1	(25$^-$)			
		1350.2 *5*		6687.2	(26$^+$)			
8075.0	(27$^-$)	739.5 *5*		7335.5	(25$^-$)	(E2)		
		1387.6[h] *5*		6687.2	(26$^+$)			
8117.0	(28$^+$)	856.4 *2*	100 *13*	7260.8	(26$^+$)			
		1429.3 *5*	<33	6687.2	(26$^+$)			

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Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ †	I_γ ‡	E_f	J_f^π	Mult.#
8197.5	(29$^-$)	850.7 *2*	100	7346.8	(27$^-$)	(E2)
8201.6	(27$^-$)	405.1 *5*		7796.5	(26$^-$)	
		795.0 *5*		7406.6	(25$^-$)	(E2)
8209.2	(28$^-$)	366.4 *5*		7842.8	(27$^-$)	
		722.0 *5*		7487.2	(26$^-$)	
8244.8	(28$^-$)	406.2 *2*	100 *15*	7838.6	(27$^-$)	
		792.8 *2*	100 *15*	7452.0	(26$^-$)	(E2)
8270.1	(28$^-$)	846.7 *5*	100	7423.4	(26$^-$)	(E2)
8329.5	(28$^-$)	890.1 *5*	100	7439.4	(26$^-$)	(E2)
8366.1	(27$^+$)	846 *1*	100	7520.1	(25$^+$)	
8501.0	(30$^+$)	938.8 *2*	100	7562.2	(28$^+$)	(E2)[d]
8587.0	(29$^-$)	377.8 *5*		8209.2	(28$^-$)	
		744.2 *5*		7842.8	(27$^-$)	
8594.1	(29$^-$)	888.5 *5*	100	7705.6	(27$^-$)	
8620.5	(28$^-$)	418.9 *5*	<83	8201.6	(27$^-$)	
		824.0 *5*	100 *17*	7796.5	(26$^-$)	(E2)
8665.8	(29$^-$)	421.0 *2*	100 *19*	8244.8	(28$^-$)	
		827.2 *2*	75 *19*	7838.6	(27$^-$)	
8762.6	(30$^-$)	901.8 *2*	100	7860.8	(28$^-$)	(E2)
8812.0	(29$^-$)	892.9 *5*	100	7919.1	(27$^-$)	(E2)
8845.4	(29$^-$)	770.4 *5*		8075.0	(27$^-$)	(E2)
		807.8 *5*		8037.6	(27$^-$)	Q
8988.1	(30$^-$)	401 *1*		8587.0	(29$^-$)	
		779 *1*		8209.2	(28$^-$)	
9040.7	(30$^+$)	923.9 *2*	100 *13*	8117.0	(28$^+$)	
		1477.6 *5*	<33	7562.2	(28$^+$)	
9053.6	(29$^-$)	433.1 *5*		8620.5	(28$^-$)	
		852.0 *5*		8201.6	(27$^-$)	
9102.5	(30$^-$)	436.7 *5*	75 *13*	8665.8	(29$^-$)	
		857.7 *5*	100 *13*	8244.8	(28$^-$)	
9114.2	(31$^-$)	916.7 *2*	100	8197.5	(29$^-$)	(E2)[d]
9173.7	(30$^-$)	903.6 *5*	100	8270.1	(28$^-$)	(E2)
9262.5	(30$^-$)	933.0 *5*	100	8329.5	(28$^-$)	(E2)
9386.0	(31$^-$)	799 *1*	100	8587.0	(29$^-$)	
9500.7	(32$^+$)	999.7 *2*	100	8501.0	(30$^+$)	(E2)[d]
9501.5	(30$^-$)	447.9 *5*		9053.6	(29$^-$)	
		881.0 *5*		8620.5	(28$^-$)	
9552.2	(31$^-$)	958.1 *5*	100	8594.1	(29$^-$)	(E2)
9556.7	(31$^-$)	454.2 *2*	71 *14*	9102.5	(30$^-$)	
		890.9 *2*	100 *14*	8665.8	(29$^-$)	(E2)
9661.2	(31$^-$)	815.8 *5*	100	8845.4	(29$^-$)	(E2)
9730.5	(32$^-$)	967.9[b] *3*	100	8762.6	(30$^-$)	(E2)
9749.7	(31$^-$)	937.6 *5*	100	8812.0	(29$^-$)	
9962.6	(31$^-$)	909	100	9053.6	(29$^-$)	
10017.0	(32$^+$)	976.2 *2*	100	9040.7	(30$^+$)	
10025.5	(32$^-$)	468.8 *2*	100 *15*	9556.7	(31$^-$)	
		923.0 *2*	100 *15*	9102.5	(30$^-$)	
10090.7	(33$^-$)	976.5 *2*	100	9114.2	(31$^-$)	
10132.0	(32$^-$)	958.3 *5*	100	9173.7	(30$^-$)	(E2)
10226.5	(32$^-$)	964 *1*	100	9262.5	(30$^-$)	
10439.5	(32$^-$)	938 *1*	100	9501.5	(30$^-$)	
10513.7	(33$^-$)	488.2 *2*	100 *15*	10025.5	(32$^-$)	
		957.0 *5*	69 *8*	9556.7	(31$^-$)	
10530.6	(33$^-$)	869.4 *5*	100	9661.2	(31$^-$)	(E2)
10551.4	(34$^+$)	1050.7 *2*	100	9500.7	(32$^+$)	(E2)[d]
10567.2	(33$^-$)	1015 *1*	100	9552.2	(31$^-$)	(E2)
10756.5	(34$^-$)	1026.0[b] *3*	100	9730.5	(32$^-$)	(E2)
10756.7	(33$^-$)	1007 *1*	100	9749.7	(31$^-$)	(E2)
11011.8	(34$^-$)	498.1 *5*	50 *7*	10513.7	(33$^-$)	
		986.3 *2*	100 *14*	10025.5	(32$^-$)	
11043.2	(34$^+$)	1026.2 *5*	100	10017.0	(32$^+$)	
11117.7	(35$^-$)	1027.0 *2*	100	10090.7	(33$^-$)	(E2)[d]
11139.2	(34$^-$)	1007.2 *5*	100	10132.0	(32$^-$)	(E2)
11437.3	(35$^-$)	906.7 *5*	100	10530.6	(33$^-$)	(E2)
11533.2	(35$^-$)	521.4 *5*	70 *10*	11011.8	(34$^-$)	
		1019.5 *2*	100 *20*	10513.7	(33$^-$)	
11638.2	(36$^+$)	1086.8 *2*	100	10551.4	(34$^+$)	(E2)[d]
11828.4	(36$^-$)	1071.9[b] *3*	100	10756.5	(34$^-$)	(E2)
12069.5	(36$^-$)	536 *1*	100 *14*	11533.2	(35$^-$)	
		1058 *1*	86 *14*	11011.8	(34$^-$)	
12102.2	(36$^+$)	1059 *1*	100	11043.2	(34$^+$)	
12179.2	(37$^-$)	1061.5 *2*	100	11117.7	(35$^-$)	(E2)
12186.2	(36$^-$)	1047 *1*	100	11139.2	(34$^-$)	
12384.3	(37$^-$)	947.0 *5*	100	11437.3	(35$^-$)	(E2)
12619.2	(37$^-$)	1086 *1*	100	11533.2	(35$^-$)	
12742.7	(38$^+$)	1104.5[b] *3*	100	11638.2	(36$^+$)	(E2)[d]
12931.5	(38$^-$)	1103.1 *5*	100	11828.4	(36$^-$)	(E2)
13255.4	(39$^-$)	1076.2 *5*	100	12179.2	(37$^-$)	(E2)
13374.3	(39$^-$)	990.0 *5*	100	12384.3	(37$^-$)	(E2)
13851.5	(40$^+$)	1108.8 *5*	100	12742.7	(38$^+$)	
14038.5	(40$^-$)	1107 *1*	100	12931.5	(38$^-$)	(E2)
14342.6	(41$^-$)	1087.2 *5*	100	13255.4	(39$^-$)	(E2)[d]

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Adopted Levels, Gammas (continued)

γ(^{168}Hf) (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[‡]	E_f	J_f^π	Mult.[#]
14414.8	(41$^-$)	1040.5 *5*	100	13374.3	(39$^-$)	(E2)
14972.0	(42$^+$)	1120.5 *5*	100	13851.5	(40$^+$)	
15461.7	(43$^-$)	1119.1 *5*	100	14342.6	(41$^-$)	(E2)
15512.0	(43$^-$)	1097.2 *5*	100	14414.8	(41$^-$)	(E2)
16127.5	(44$^+$)	1155.5 *2*	100	14972.0	(42$^+$)	
16632.9	(45$^-$)	1171.2 *5*	100	15461.7	(43$^-$)	(E2)
16670.0	(45$^-$)	1158.0 *5*	100	15512.0	(43$^-$)	
17336.6	(46$^+$)	1209.1 *5*	100	16127.5	(44$^+$)	
17866.9	(47$^-$)	1234 *1*	100	16632.9	(45$^-$)	
17890.8	(47$^-$)	1220.8 *5*	100	16670.0	(45$^-$)	
18605.6	(48$^+$)	1269	100	17336.6	(46$^+$)	
19175.8	(49$^-$)	1285 *1*	100	17890.8	(47$^-$)	
677.2+x	J+2	677.2	0.73[a] *12*	0.0+x	J≈(33)	(E2)
1399.2+x	J+4	722.0		677.2+x	J+2	(E2)
2169.8+x	J+6	770.6	0.97[a] *7*	1399.2+x	J+4	(E2)
2993.9+x	J+8	824.1	0.96[a] *7*	2169.8+x	J+6	(E2)
3871.2+x	J+10	877.3	0.89[a] *7*	2993.9+x	J+8	
4802.6+x	J+12	931.4	0.75[a] *7*	3871.2+x	J+10	
5787+x	J+14	984.4	0.66[a] *8*	4802.6+x	J+12	
6828+x	J+16	1041.4	0.54[a] *10*	5787+x	J+14	
7926+x	J+18	1097.4	0.34[a] *9*	6828+x	J+16	
9079+x	J+20	1153.5	0.23[a] *10*	7926+x	J+18	
10294+x?	J+22	1215[h]		9079+x	J+20	
11567+x?	J+24	1273[h]		10294+x?	J+22	
811.1+z	J2+2	811.1		0.0+z	J2≈(28)	
1673.3+z	J2+4	862.2	0.98[a] *13*	811.1+z	J2+2	
2583.6+z	J2+6	910.3	1.00[a] *8*	1673.3+z	J2+4	
3544.2+z	J2+8	960.6	0.89[a] *10*	2583.6+z	J2+6	
4560.8+z	J2+10	1016.6	0.89[a] *12*	3544.2+z	J2+8	
5635.8+z	J2+12	1075.0	0.67[a] *10*	4560.8+z	J2+10	
6771+z	J2+14	1135.6	0.37[a] *12*	5635.8+z	J2+12	
7966+z?	J2+16	1195[h]		6771+z	J2+14	
9222+z?	J2+18	1256[h]		7966+z?	J2+16	

[†] From (HI,xnγ), except as noted.
[‡] Photon branching from each level, relative to 100 for the strongest branch, except as noted; values are from (^{76}Ge,4nγ), unless indicated to the contrary.
[#] From DCO ratio in (^{76}Ge,4nγ), assigning Δπ=(no) for intraband transitions, except as noted.

$^{168}_{72}Hf_{96}$-16

Adopted Levels, Gammas (continued)

$\gamma(^{168}Hf)$ (continued)

@ From $\gamma\gamma(\theta)$ in ε decay.
& From ^{168}Ta ε decay.
[a] Relative intensity within band, normalized to ≈1.0 for the strongest γ in band.
[b] From (HI,xnγ).
[c] 1411.4γ+1413.5γ and 1673.0γ+1675.5γ form doublets in ε decay. Each γ-ray intensity may include some unresolved contribution from its second component.
[d] Inferred from level scheme in (HI,xnγ); 1983Ch44 report that J^π values were established from ce and $\gamma(\theta)$ data, but those data were not enumerated.
[e] From $\gamma(\theta)$ in (HI,xnγ), assigning $\Delta\pi$=(no) to intraband transitions.
[f] 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.
[g] Multiply placed with undivided intensity.
[h] Placement of transition in the level scheme is uncertain.

$^{168}_{72}Hf_{96}$-17

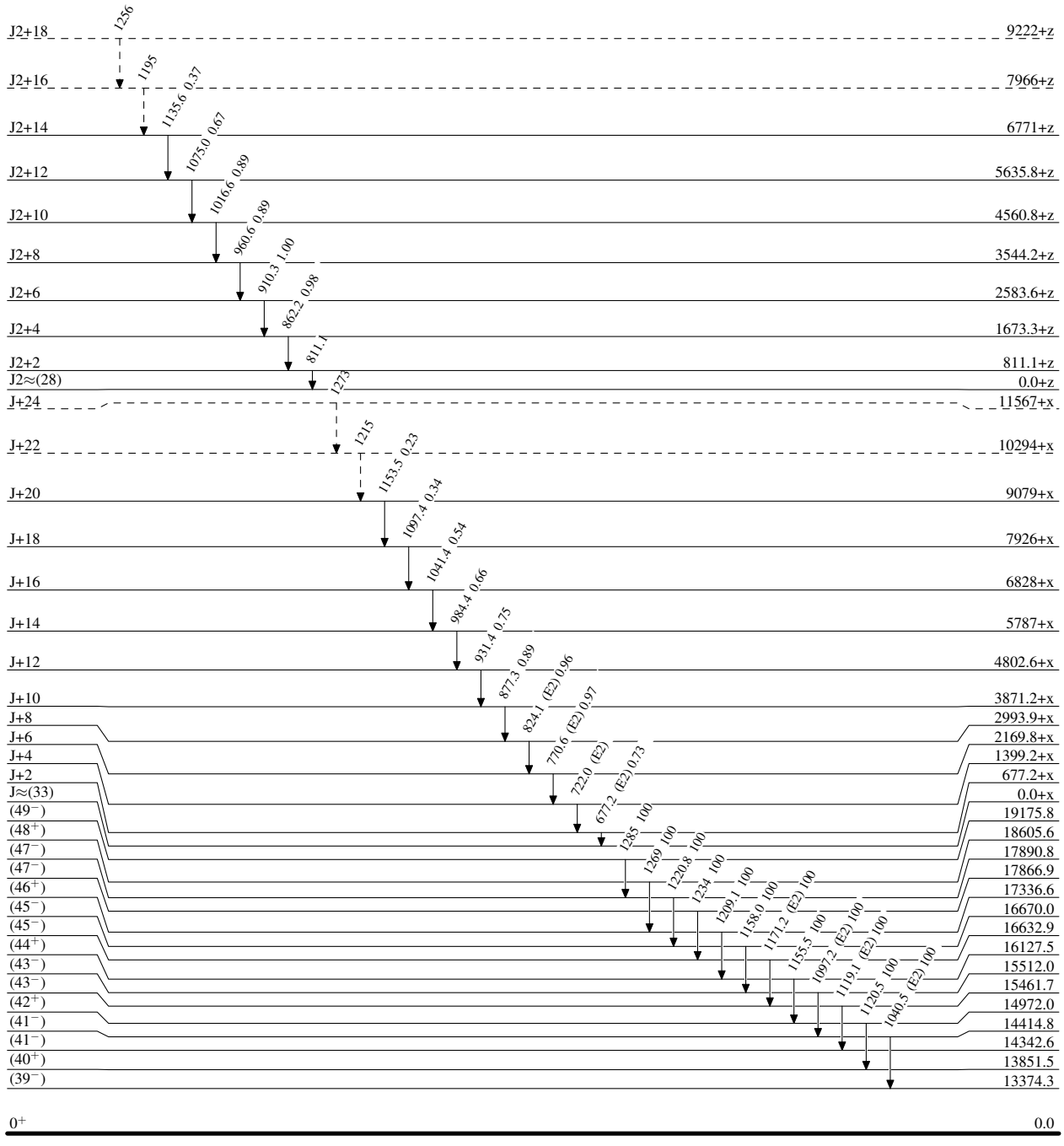
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

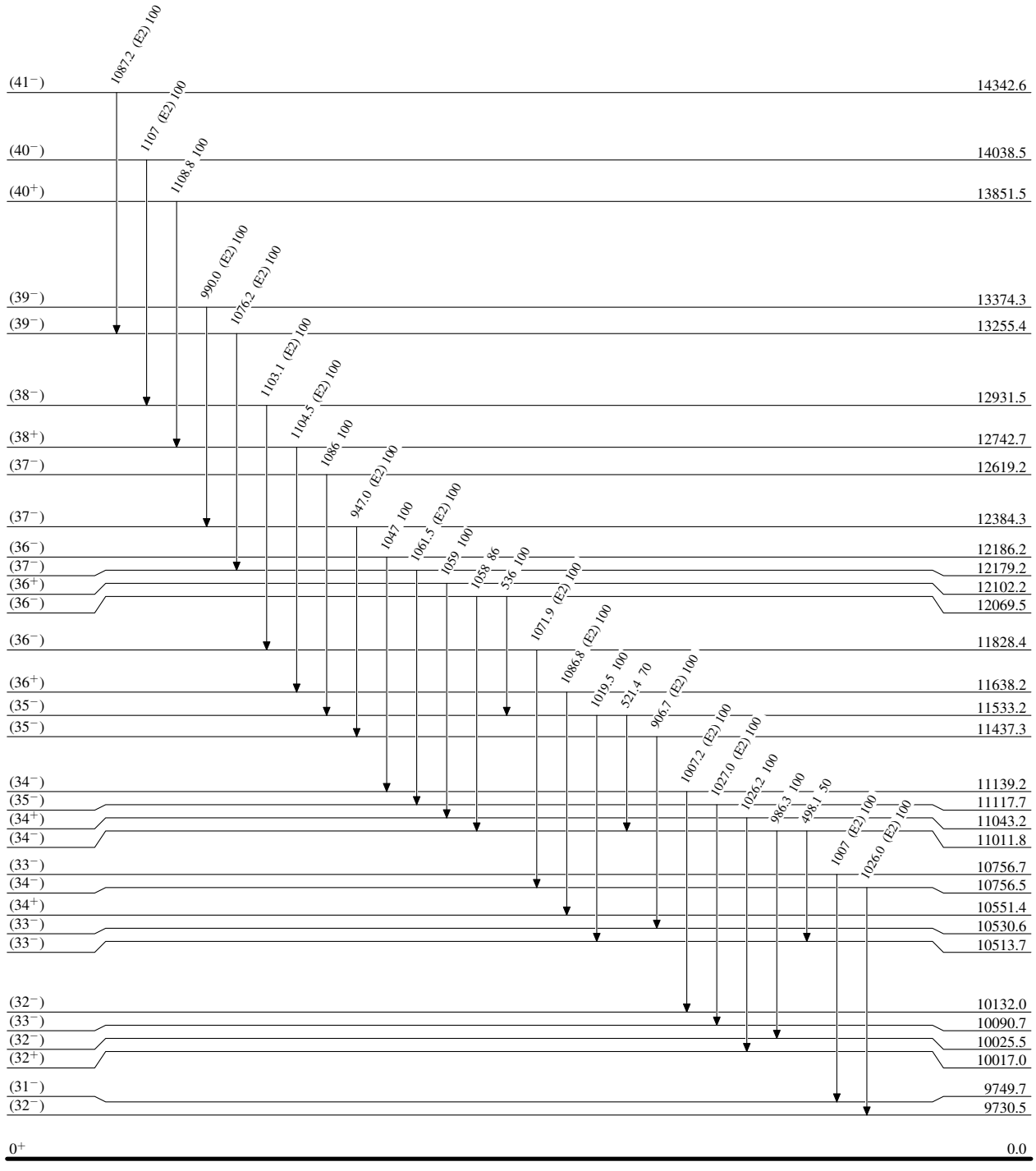


$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



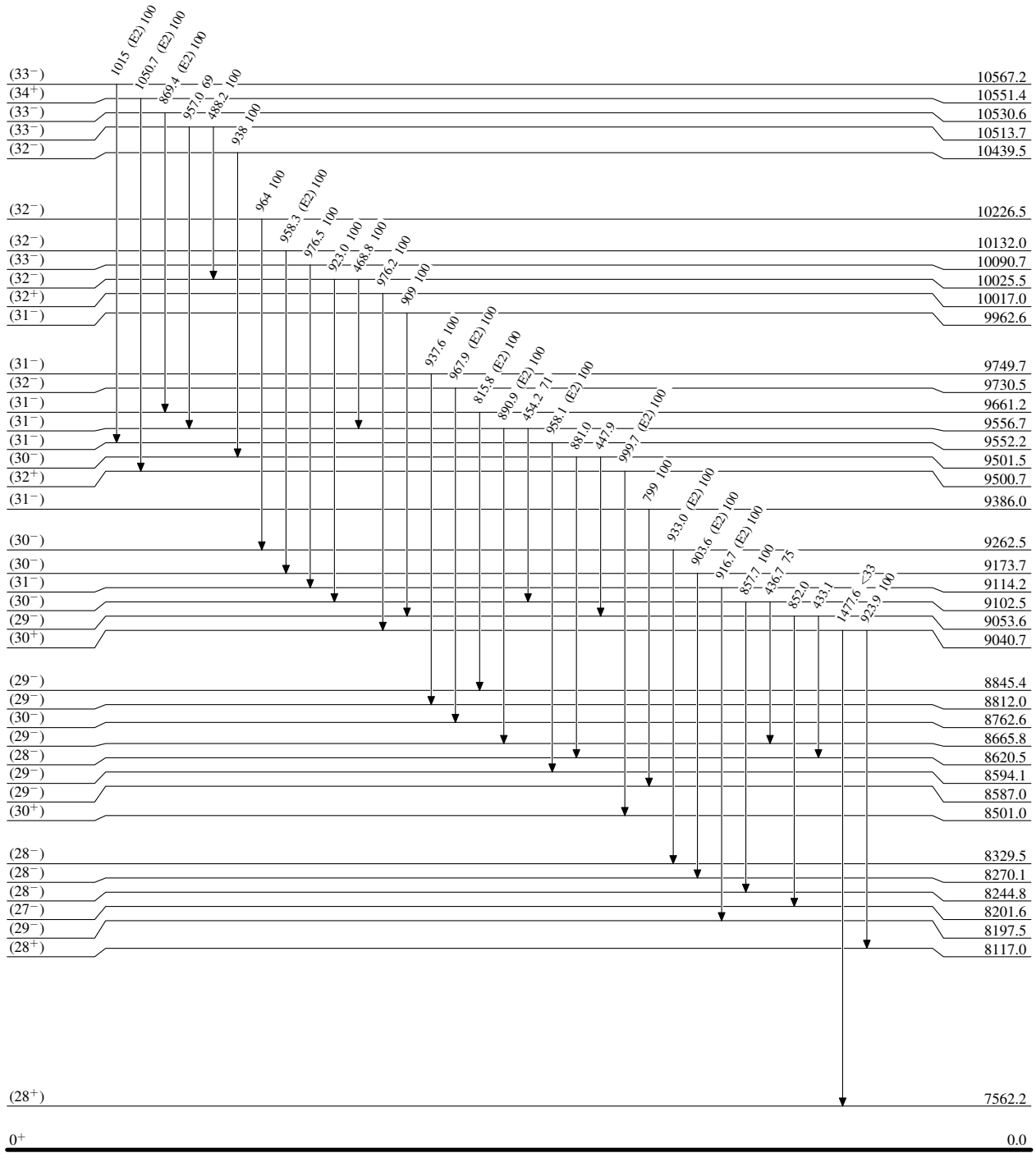
25.95 min *20*

$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{168}_{72}Hf_{96}$

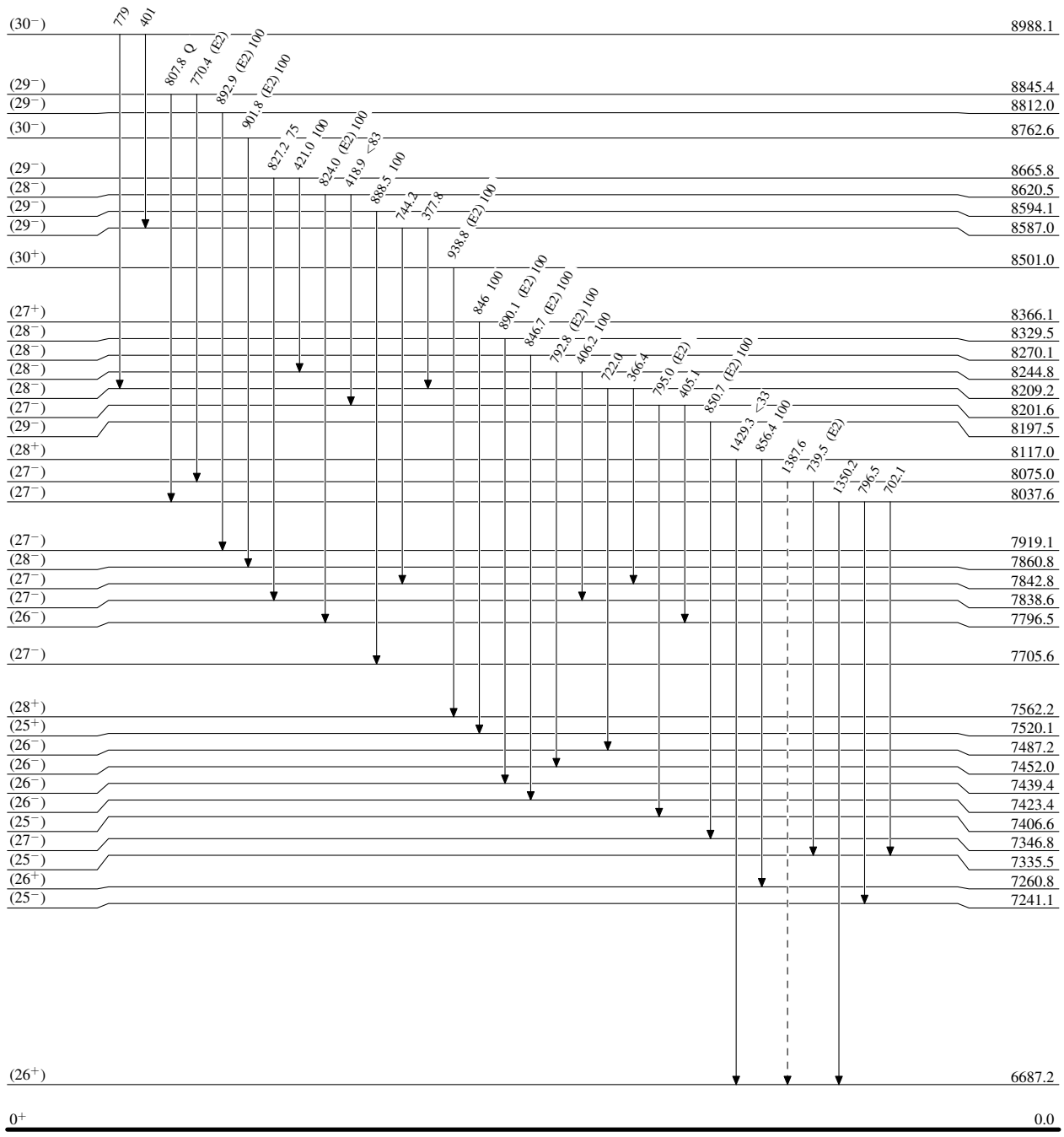
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{168}_{72}Hf_{96}$

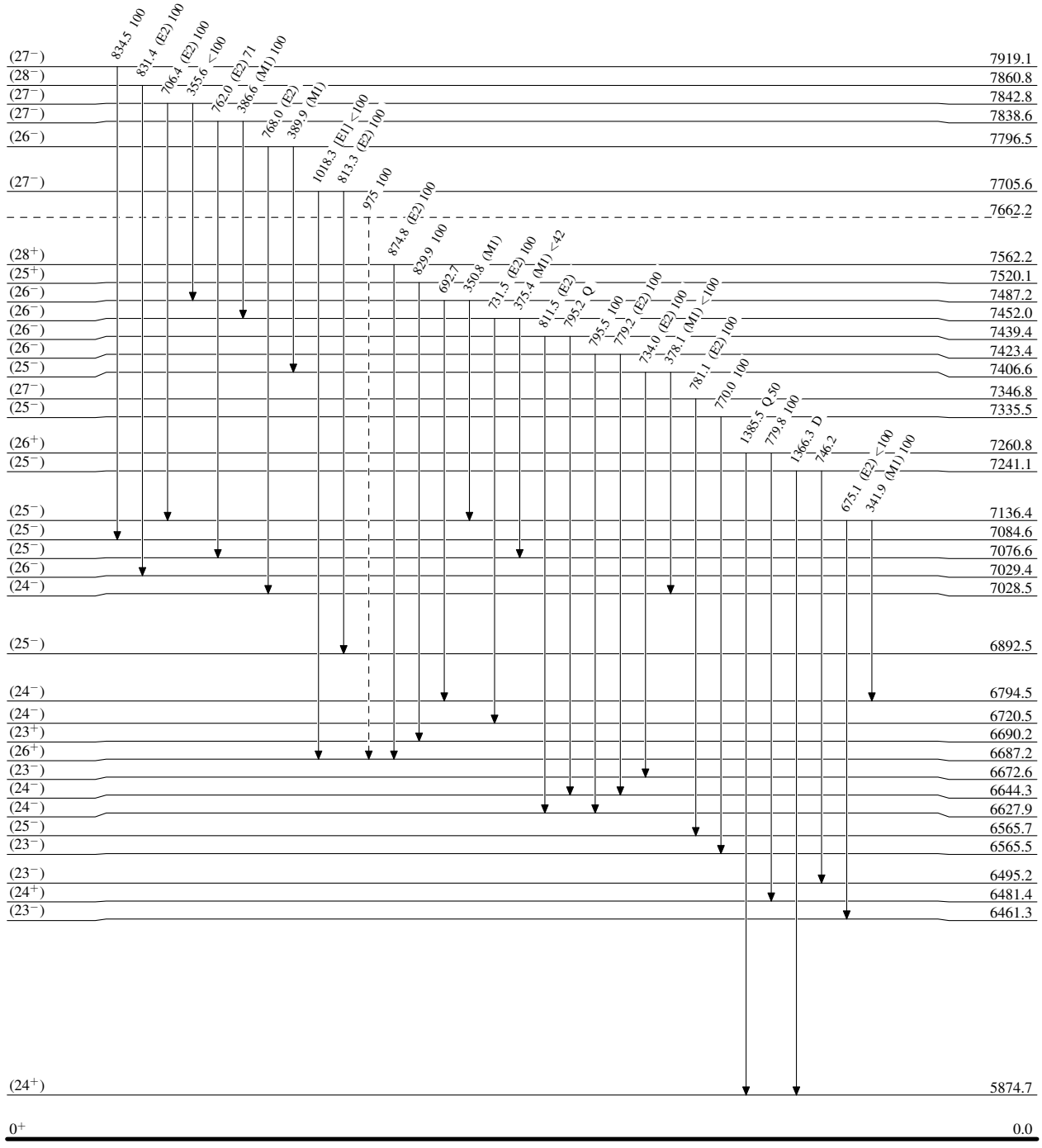
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



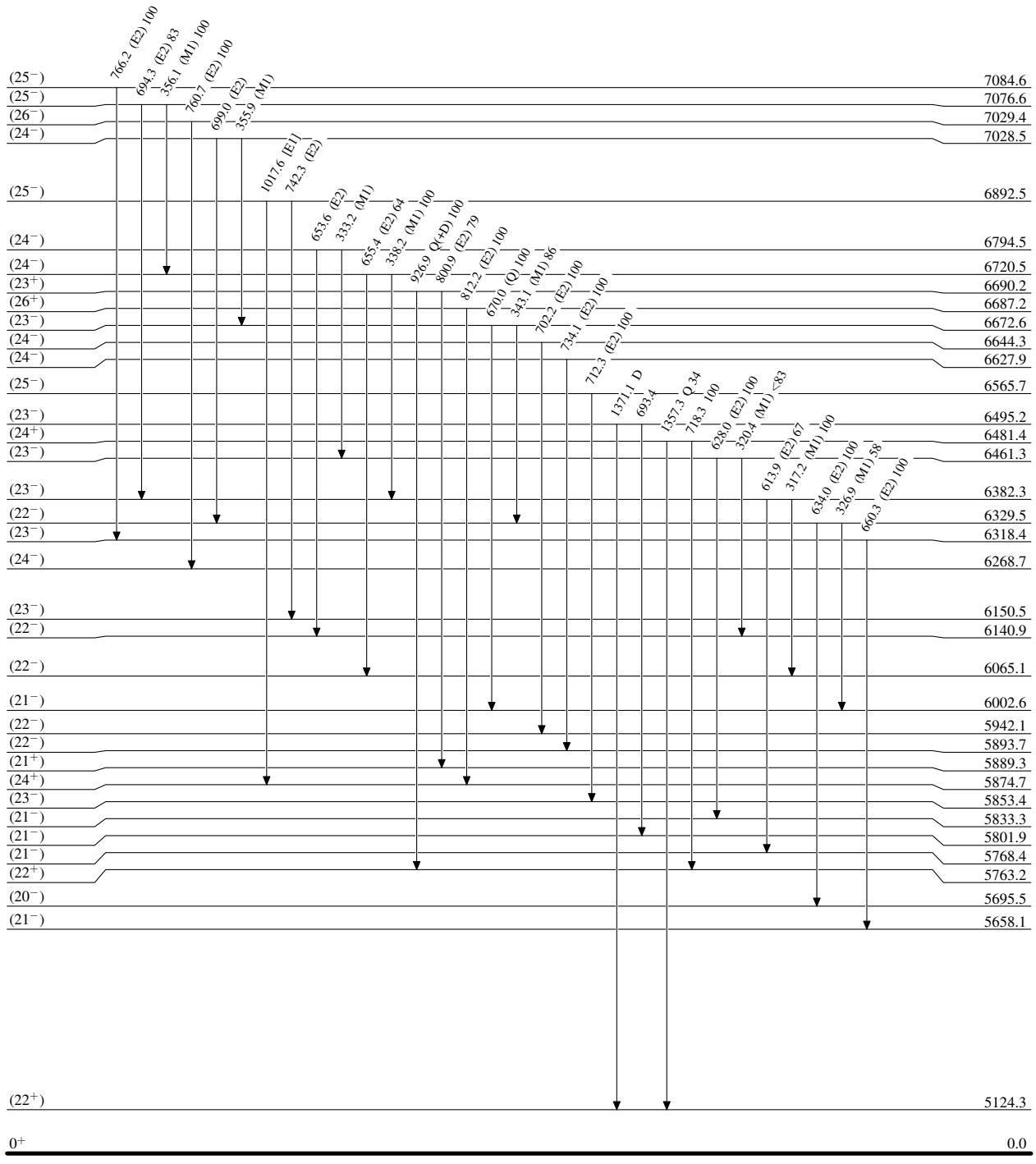
25.95 min *20*

$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



25.95 min *20*

$^{168}_{72}Hf_{96}$

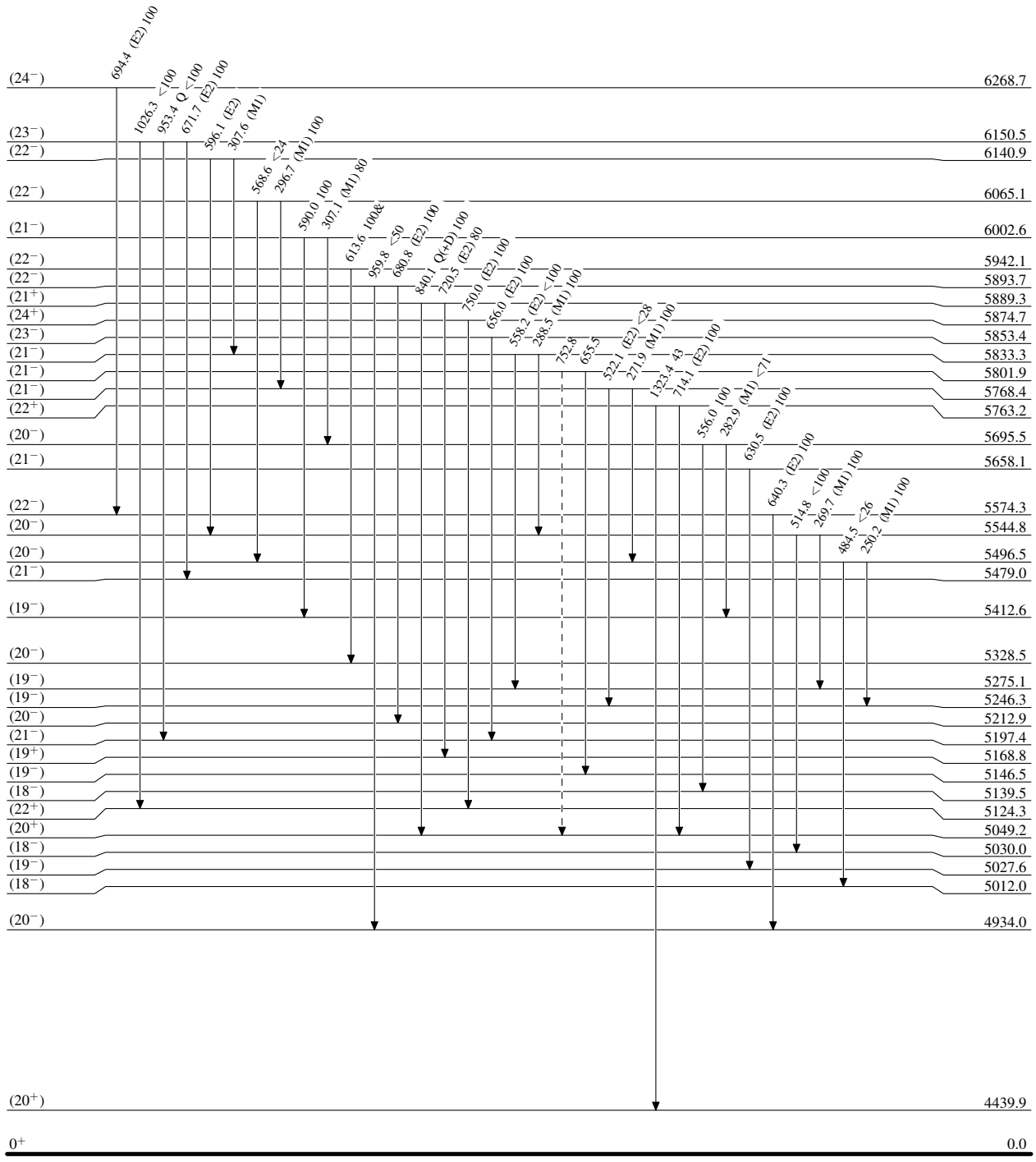
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)



$^{168}_{72}Hf_{96}$

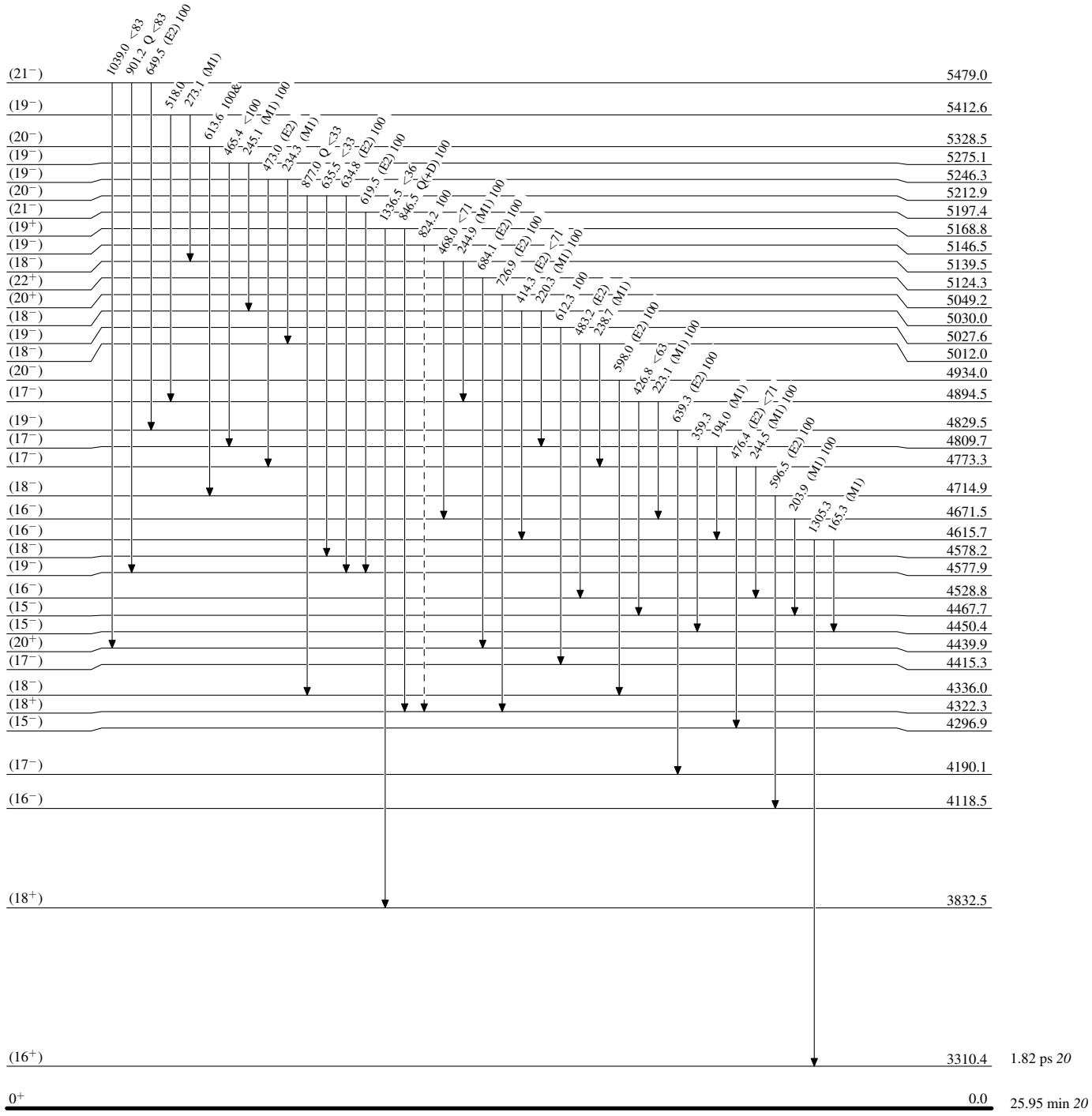
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)

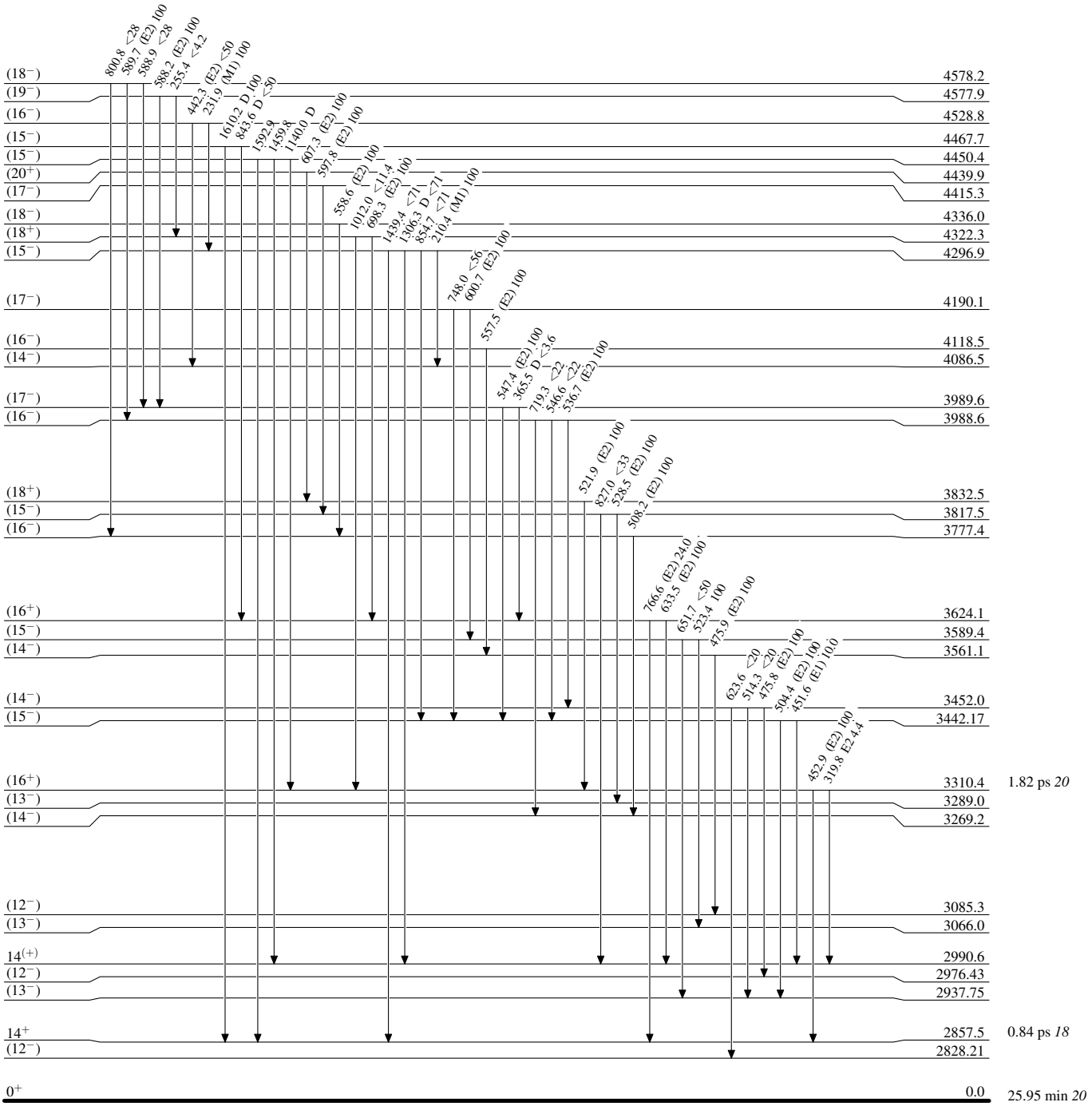


$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

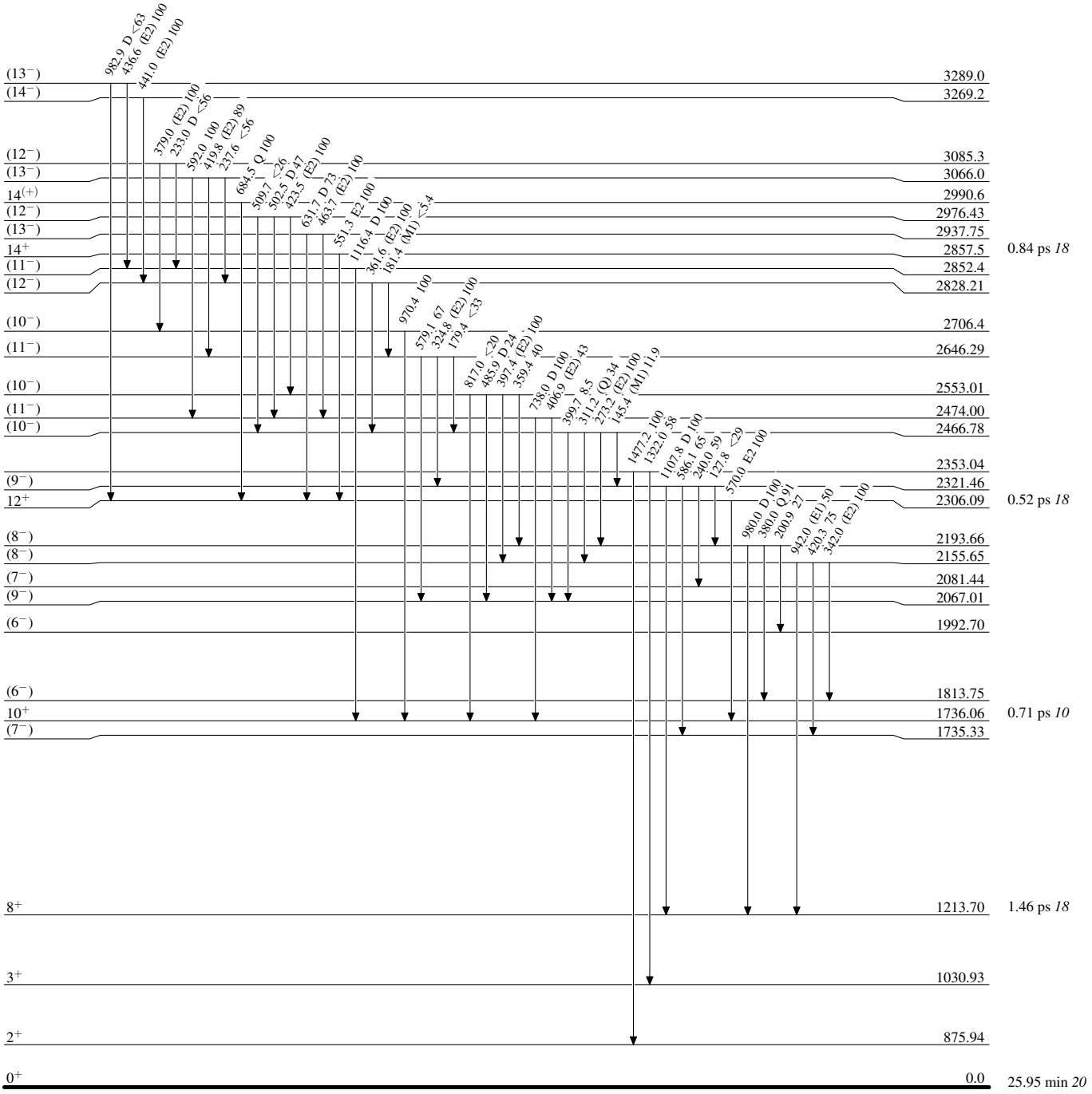


$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



$^{168}_{72}Hf_{96}$

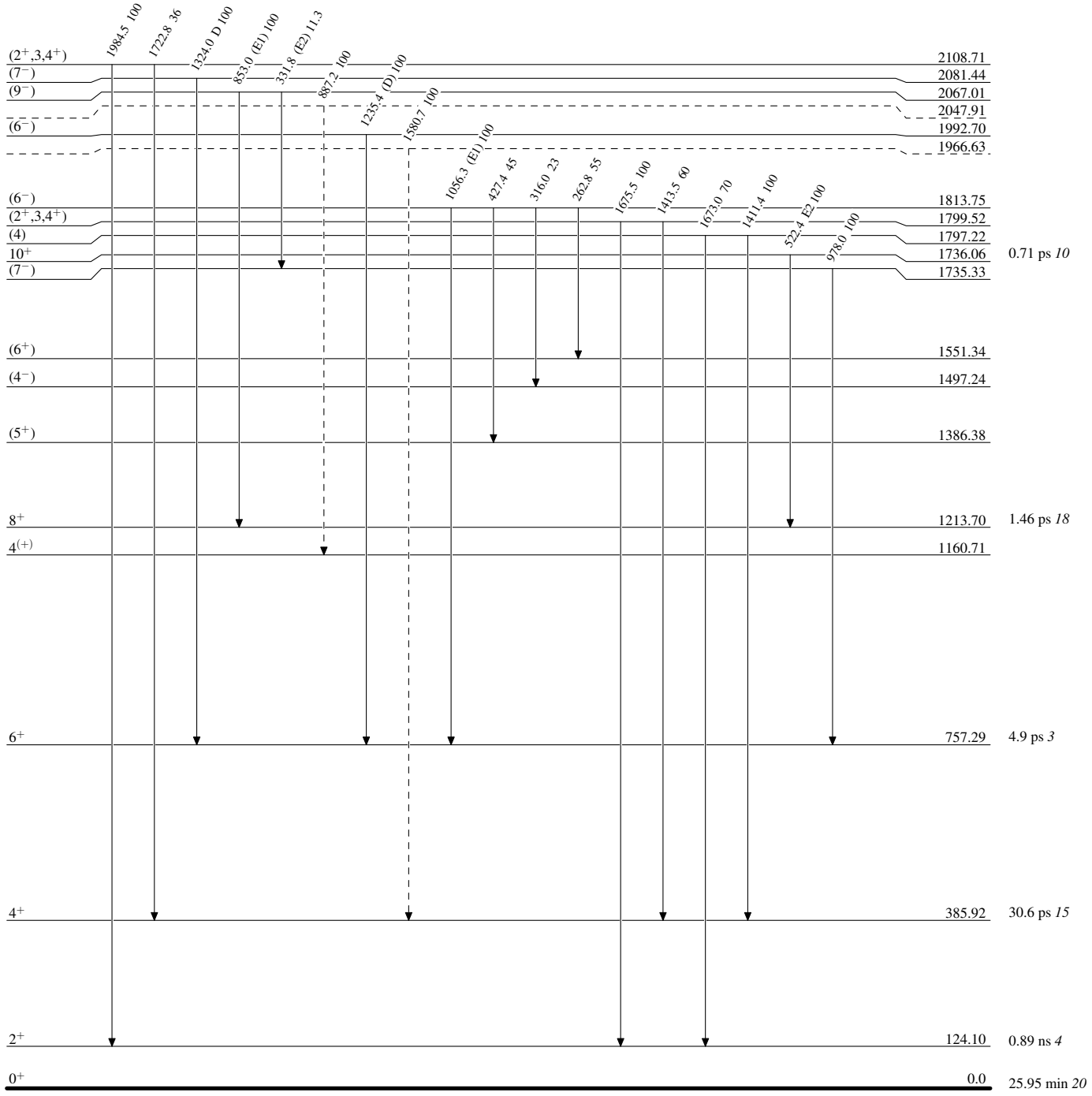
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

γ Decay (Uncertain)



$^{168}_{72}Hf_{96}$

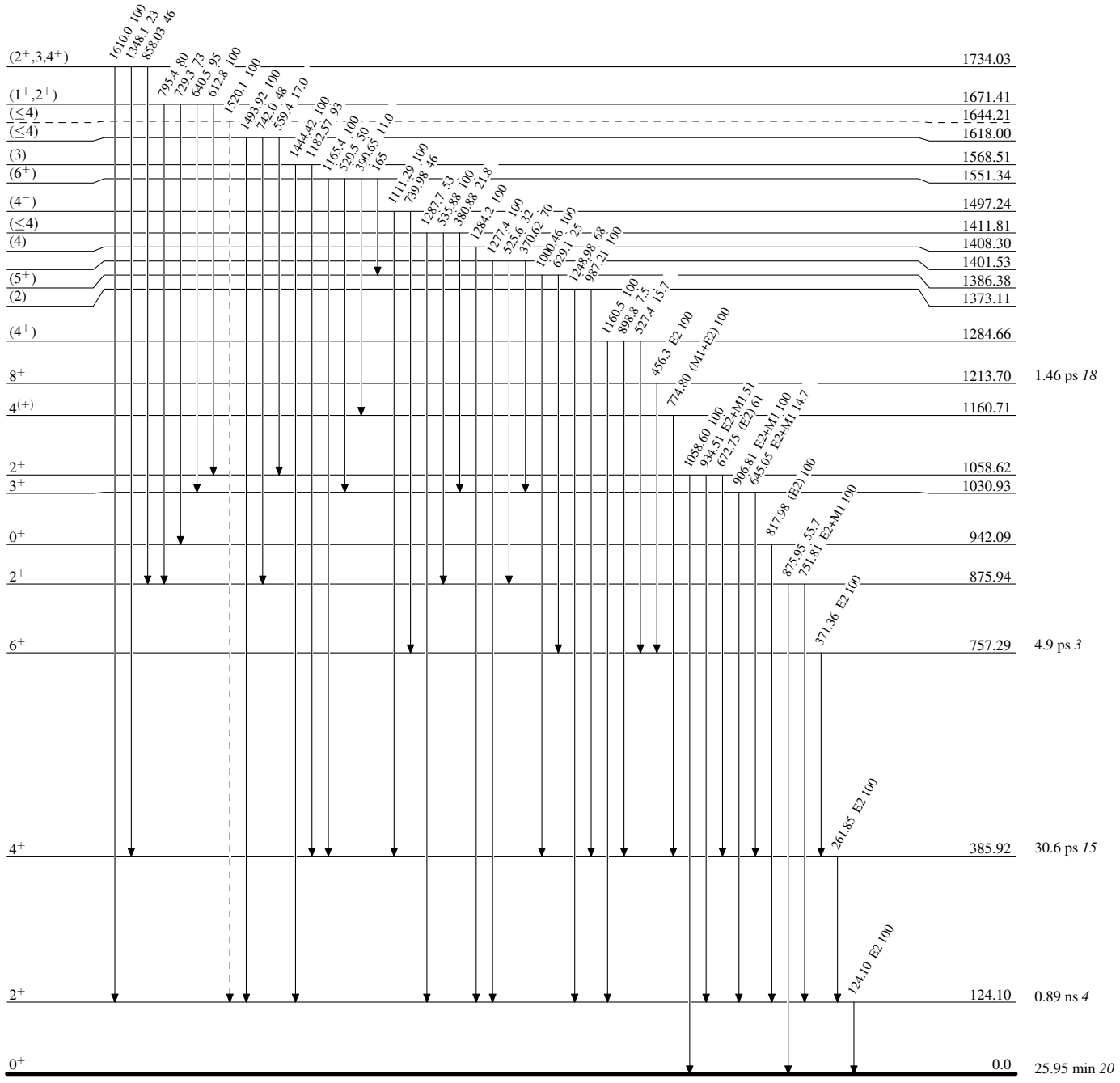
Adopted Levels, Gammas

Legend

Level Scheme (continued)

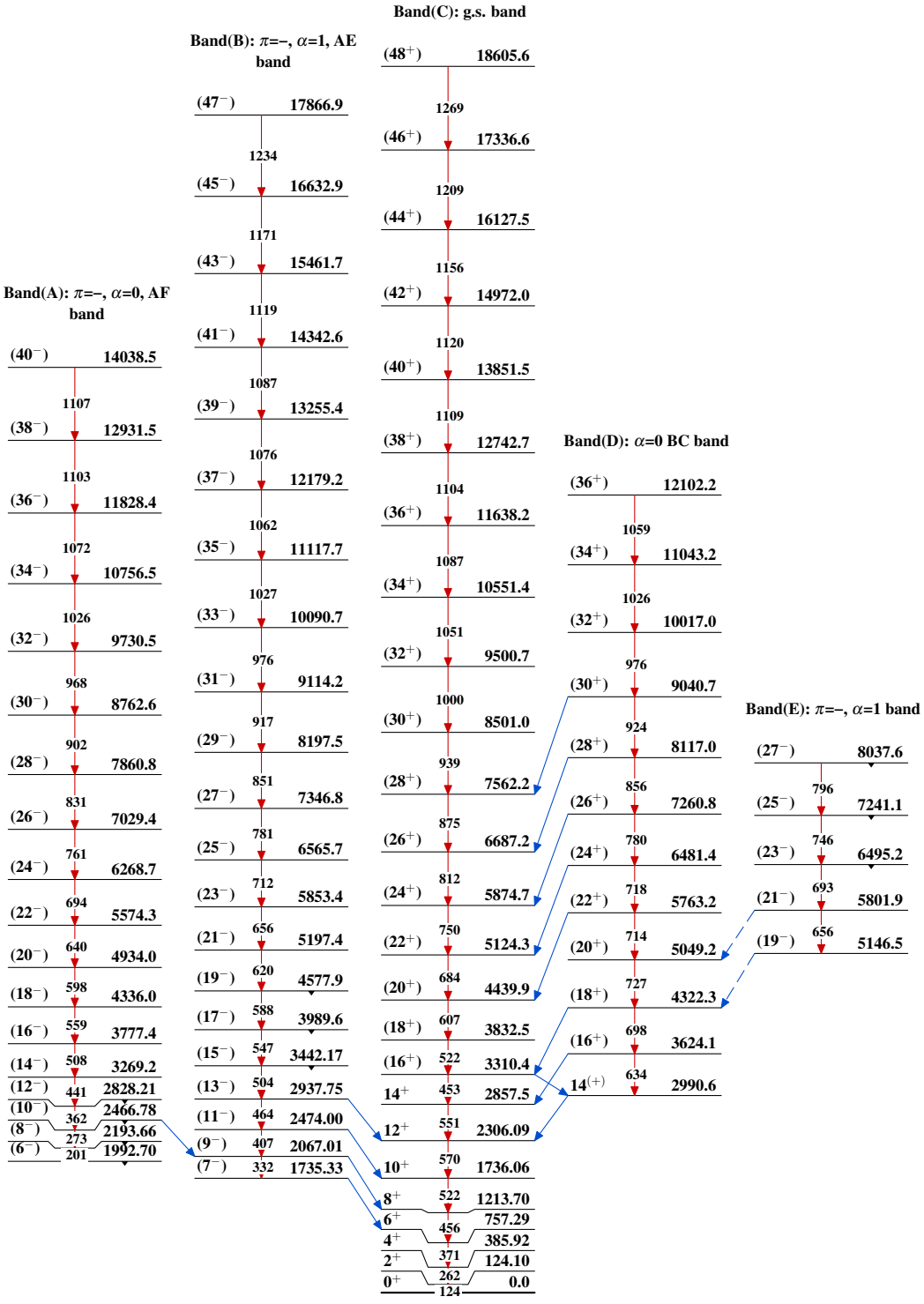
Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)



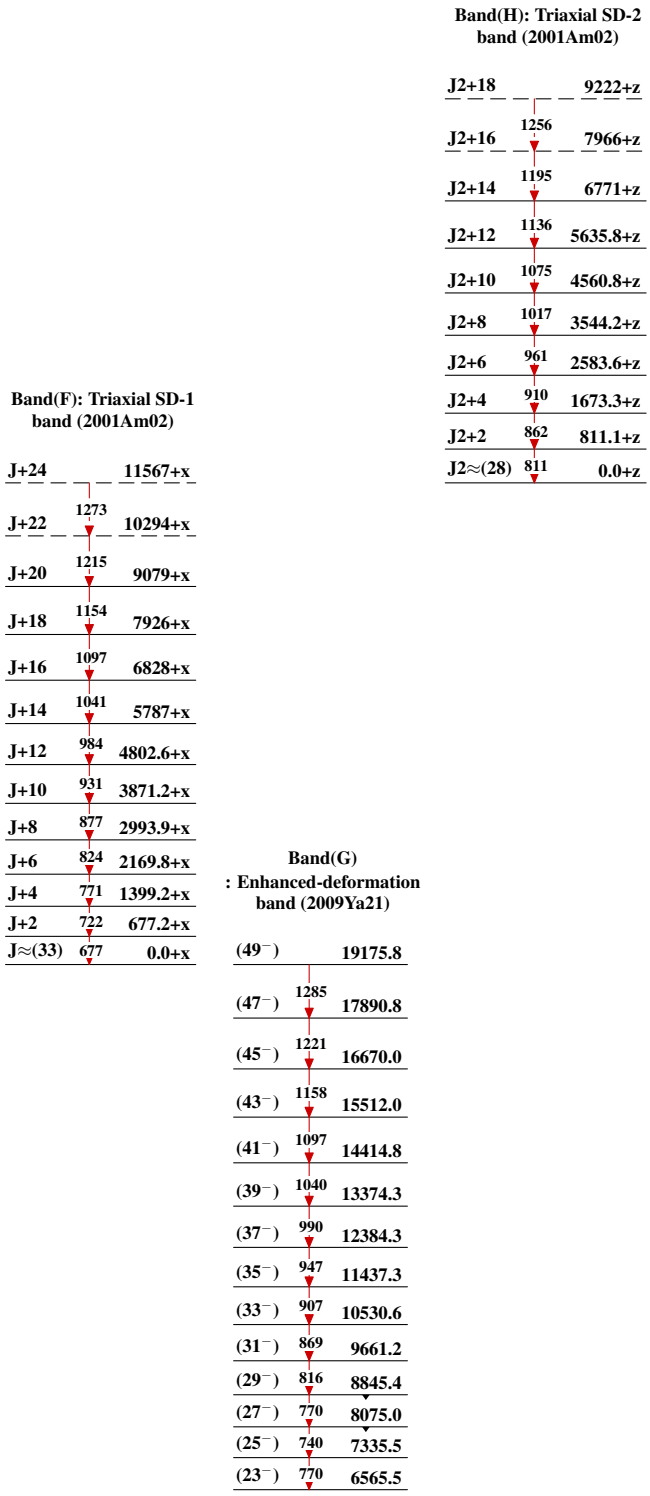
$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas



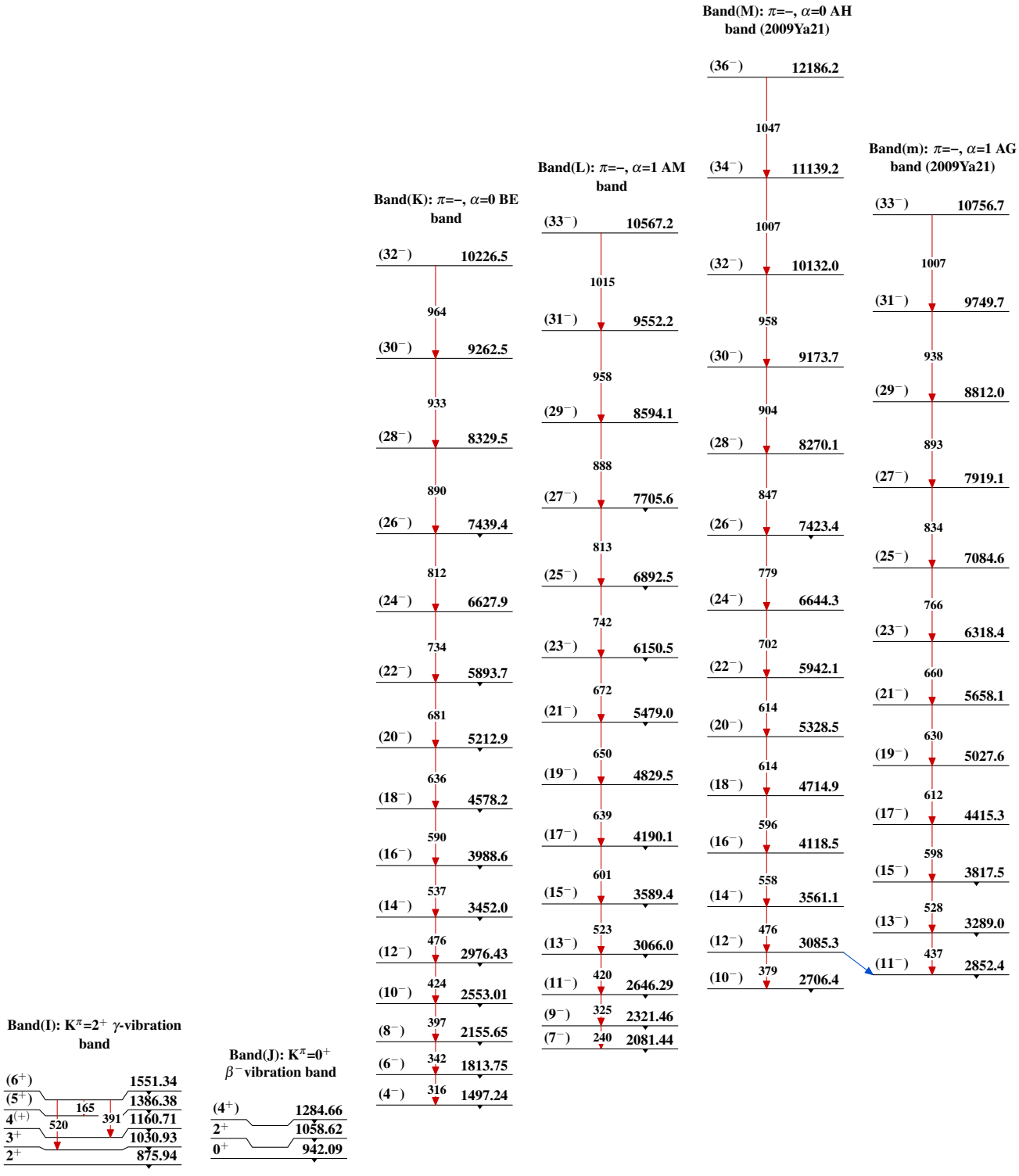
$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas (continued)

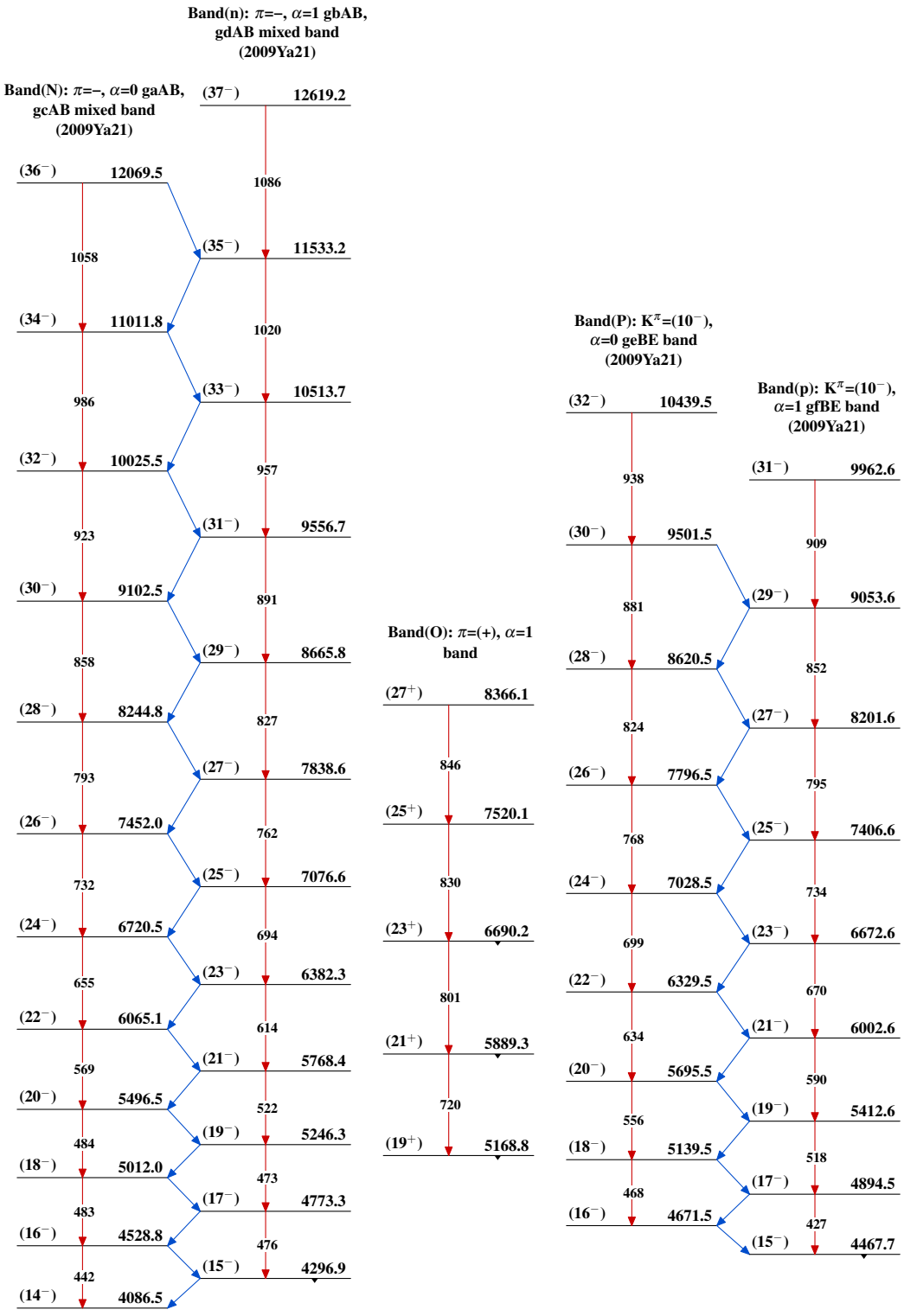


$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas (continued)

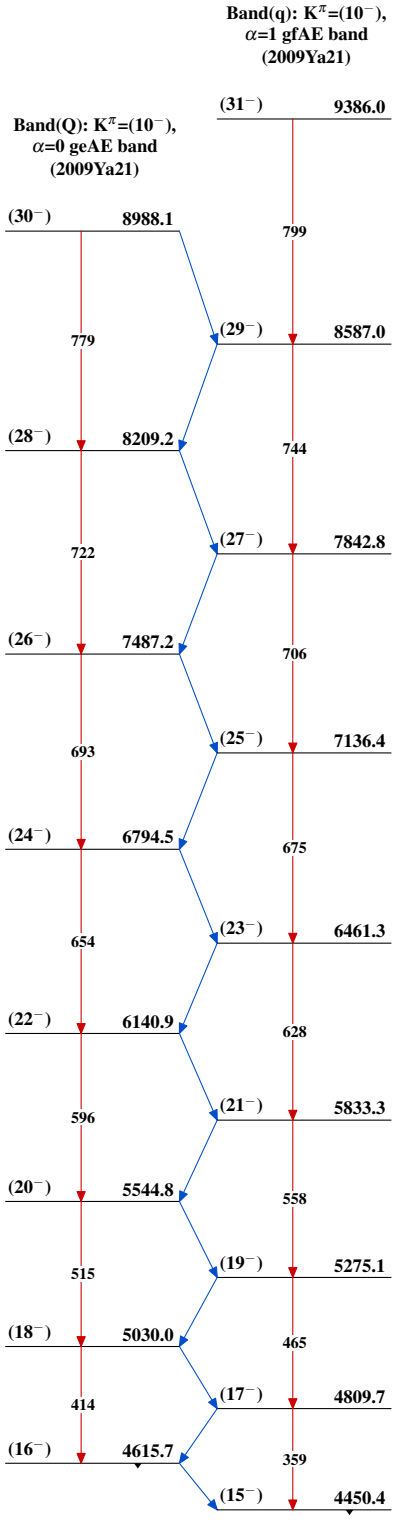


Adopted Levels, Gammas (continued)



$^{168}_{72}Hf_{96}$

Adopted Levels, Gammas (continued)



$^{168}_{72}Hf_{96}$