

Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 109,1103 (2008)	1-Mar-2008

$Q(\beta^-) = -7.76 \times 10^3$ 4; $S(n) = 1.029 \times 10^4$ 4; $S(p) = 4.71 \times 10^3$ 4; $Q(\alpha) = 3.54 \times 10^3$ 4 2012Wa38

Note: Current evaluation has used the following Q record -7760 40 10290 40 4710 40 3550 30 2003Au03.

Assignment: $^{170}\text{Yb}(^3\text{He}, 7n)$, $E(^3\text{He}) = 80$ MeV chem, $\gamma(^{166}\text{Yb})$ (1974De09); $^{181}\text{Ta}(p, 2p14n)$, $E(p) = 660$ MeV, chem, $\gamma(^{166}\text{Er})$ (1969Ar23).

Other Reaction

$^{130}\text{Te}(^{40}\text{Ca}, 4n\gamma)$, $E = 167.5\text{--}182.5$ MeV: Te on Gd target, backed by Au; transient field technique used to determine g-factor at 5 beam energies for pre-yrast high-spin states in ^{166}Hf (1996We01). Individual values of 0.23 3, 0.21 4, 0.16 2, 0.21 3 and 0.22 3, each with an additional systematic uncertainty of 0.02 lead to an average g-factor = +0.19 4 (2005St24).

 ^{166}Hf Levels

Quasiparticle orbitals used in band labels are as follows:

A = (ν 5/2[642]), $\alpha = +1/2$.

B = (ν 5/2[642]), $\alpha = -1/2$.

C = (ν 3/2[651]), $\alpha = +1/2$.

D = (ν 3/2[651]), $\alpha = -1/2$.

E = (ν 5/2[523]), $\alpha = +1/2$.

F = (ν 5/2[523]), $\alpha = -1/2$.

g = (ν 3/2[521]), $\alpha = +1/2$.

H = (ν 3/2[521]), $\alpha = -1/2$.

a = (π 7/2[404]), $\alpha = +1/2$.

b = (π 7/2[404]), $\alpha = -1/2$.

k = (π 1/2[660]), $\alpha = +1/2$.

e = (π 9/2[514]), $\alpha = +1/2$.

f = (π 9/2[514]), $\alpha = -1/2$.

g = (π 1/2[541]), $\alpha = +1/2$.

Cross Reference (XREF) Flags

- A ^{166}Ta ε decay
 B (HI,xn γ)
 C $^{96}\text{Zr}(^{74}\text{Ge}, 4n\gamma)$
 D $^{186}\text{W}(n, 2p19n\gamma)$

E(level) [†]	J ^π [‡]	T _{1/2} [#]	XREF	Comments
0.0 ^b	0 ⁺	6.77 min 30	ABCD	$\% \varepsilon + \% \beta^+ = 100$ T _{1/2} : from 1974De09. Other: 1969Ar23. J ^π : g.s. of even-even nucleus.
158.64 ^b 5	2 ⁺	497 ps 23	ABCD	J ^π : E2 159 γ to 0 ⁺ g.s.
470.46 ^b 6	4 ⁺	16.4 ps 5	ABCD	J ^π : stretched E2 312 γ to 2 ⁺ 159 in (HI,xn γ).
809.96 ^t 6	(2 ⁺) ^a		A	J ^π : 651 γ -159 γ (θ) consistent with 2(810)-2+(159)-0+(g.s.) sequence in ε decay; γ to 0 ⁺ .
897.17 ^b 12	6 ⁺	3.24 ps 19	ABCD	J ^π : continuation of g.s. band.
1007.16 ^t 6	(3 ⁺) ^a		A C	J ^π : γ 's to 2 ⁺ and 4 ⁺ ; band assignment.
1064.99 10	(0 ⁺)		A	J ^π : E consistent with X(5) prediction for second 0 ⁺ state; 906 γ -159 γ (θ) in ε decay is consistent with 0 - 2 ⁺ - 0 ⁺ cascade.
1162.70 8			A	J ^π : γ to 4 ⁺ .
1218.76 8	2 ⁺		A	J ^π : strong γ branches to 0 ⁺ , to 2 ⁺ and to 4 ⁺ levels.

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Adopted Levels, Gammas (continued) ^{166}Hf Levels (continued)

E(level) [†]	J ^π [‡]	T _{1/2} [#]	XREF	Comments
1332.41 7	(2 ⁺ ,3,4 ⁺)		A	J ^π : γ's to 2 ⁺ and 4 ⁺ .
1404.85 7			A	J ^π : 1247γ to 2 ⁺ 159 and 398γ to (3 ⁺) 1007, so J ^π =(1 ⁺ ,2,3,4 ⁺).
1406.4 ^b 6	8 ⁺	1.05 ps 10	BCD	J ^π : continuation of g.s. band.
1418.9 ^t 14	(5 ⁺) ^a		C	J ^π : γ's to (3 ⁺) and 4 ⁺ ; band assignment.
1466.3 ^k 6	(5 ⁻) [@]		BC	J ^π : 259γ from (7 ⁻) 1726, D 996γ to 4 ⁺ 470; band assignment.
1551.39 ^l 10	(4 ⁻) ^{&}		ABC	J ^π : 289γ from (6 ⁻) 1841, 544γ to (3 ⁺) 1007; band assignment.
1603.05 21	(2 ⁺ ,3,4 ⁺)		A	J ^π : 1144γ to 2 ⁺ 159, 1133γ to 4 ⁺ 470.
1726.3 ^k 6	(7 ⁻) [@]		BC	J ^π : J=5,7 from stretched D 829γ to 6 ⁺ 897; not J=5 based on 320γ to 8 ⁺ 1406; band assignment.
1841.1 ^l 6	(6 ⁻) ^{&}		BC	J ^π : 421γ to (5 ⁺) 1419, D 944γ to 6 ⁺ , γ from (8 ⁻); band assignment.
1971.9 ^b 6	10 ⁺	0.7 ps 5	BCD	J ^π : continuation of g.s. band.
2078.5 ^k 6	(9 ⁻) [@]	1.7 ps 4	BC	
2197.3 ^l 6	(8 ⁻) ^{&}		BC	
2376.5 ^o 16	(8 ⁻)		C	
2496.7 ^k 6	(11 ⁻) [@]		BC	J ^π : stretched D 525γ to 10 ⁺ 1972; band assignment.
2539.7 ^l 6	(10 ⁻) ^{&}		BC	
2565.8 ^b 7	12 ⁺	0.9 ps 7	BC	J ^π : continuation of g.s. band.
2680.1 ^o 16	(10 ⁻)		C	J ^π : stretched Q 484γ to (8 ⁻) 2197; band assignment.
2734.6 ^d 7	12 ⁺ ^e		BC	J ^π : stretched E2 275γ from 14 ⁺ 3009; stretched Q 763γ to 10 ⁺ 1972.
2793.1 ^p 18	(11 ⁻)		C	
2910.9 ^l 6	(12 ⁻) ^{&}		BC	
2962.2 ^k 7	(13 ⁻) [@]		BC	
3009.2 ^d 7	14 ⁺ ^e	6.9 ps 7	BC	J ^π : stretched E2 443γ to 12 ⁺ 2566.
3023.9 ^f 18	(12 ⁺)		C	J ^π : 460γ to 12 ⁺ 2566; 1054γ to 10 ⁺ 1972; band assignment.
3085.8 ^o 17	(12 ⁻)		C	
3211.1 ^c 7	14 ⁽⁺⁾		BC	J ^π : stretched Q 645γ to 12 ⁺ 2566.
3231.4 ^p 18	(13 ⁻)		C	
3375.1 ^l 7	(14 ⁻) ^{&}		BC	
3449.0 ^d 8	16 ⁺ ^e		BC	
3472.6 ^k 7	(15 ⁻) [@]		BC	
3515.8 ^f 18	(14 ⁺)		C	J ^π : 952γ to 12 ⁺ 2566; 492γ to (12 ⁺) 3024; band assignment.
3585.6 ^o 18	(14 ⁻)		C	
3779.4 ^p 18	(15 ⁻)		C	
3817.4 ^g 20	(15 ⁻)		C	J ^π : 811γ to 14 ⁺ 3009; band assignment.
3835.2 ^c 8	(16 ⁺)		BC	
3920.3 ^l 8	(16 ⁻) ^{&}		BC	
3972.1 ^h 20	(15 ⁻)		C	J ^π : 965γ to 14 ⁺ 3009; band assignment.
4009.2 ^d 8	18 ⁺ ^e		BC	
4030.1 ^k 8	(17 ⁻) [@]		BC	
4064.7 ^f 19	(16 ⁺)		C	
4163.5 ^o 19	(16 ⁻)		C	
4228.5 ⁿ 19	(16 ⁻)		C	
4374.0 ^g 20	(17 ⁻)		C	J ^π : 927γ to 16 ⁺ 3449; intraband 557γ to (15 ⁻) 3817.
4400.4 ^p 21	(17 ⁻)		C	
4443.4 ^h 20	(17 ⁻)		C	J ^π : 997γ to 16 ⁺ 3449; intraband 471γ to (15 ⁻) 3972; band assignment.
4445.4 ^j 20	(14 ⁻)		C	
4459.3 ^c 9	(18 ⁺)		BC	

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Adopted Levels, Gammas (continued) ^{166}Hf Levels (continued)

E(level) [†]	J ^π [‡]	XREF	Comments
4516.0 ^{<i>l</i>} 8	(18 ⁻)&	BC	
4582.0 ^{<i>i</i>} 19	(15 ⁻)	C	J ^π : 1575γ to 14 ⁺ 3009; band assignment.
4625.2 ^{<i>k</i>} 9	(19 ⁻)@	BC	
4641.4 ^{<i>n</i>} 19	(18 ⁻)	C	J ^π : stretched Q 723γ to (16 ⁻) 3920.
4671.0 ^{<i>d</i>} 9	20 ⁺ ^{<i>e</i>}	BC	
4677.4 ^{<i>f</i>} 20	(18 ⁺)	C	
4744.9 ^{<i>j</i>} 19	(16 ⁻)	C	
4823.5 ^{<i>o</i>} 22	(18 ⁻)	C	
4937.1 ^{<i>i</i>} 19	(17 ⁻)	C	
5005.6 ^{<i>g</i>} 20	(19 ⁻)	C	
5031.3 ^{<i>h</i>} 20	(19 ⁻)	C	
5071.4 ^{<i>p</i>} 23	(19 ⁻)	C	
5086.9 ^{<i>m</i>} 22	(19 ⁻)	C	
5089.6 ^{<i>l</i>} 9	(20 ⁻)&	BC	
5121.7 ^{<i>c</i>} 9	(20 ⁺)	BC	
5157.5 ^{<i>s</i>} 21	(19 ⁺)	C	J ^π : 1151γ to 18 ⁺ 4009; band assignment.
5160.0 ^{<i>j</i>} 20	(18 ⁻)	C	
5214.3 ^{<i>n</i>} 20	(20 ⁻)	C	
5253.3 ^{<i>k</i>} 9	(21 ⁻)@	BC	
5313.0 ^{<i>f</i>} 21	(20 ⁺)	C	
5409.9 ^{<i>d</i>} 9	22 ⁺ ^{<i>e</i>}	BC	
5410.0 ^{<i>i</i>} 21	(19 ⁻)	C	
5510.5 ^{<i>o</i>} 24	(20 ⁻)	C	
5665.9 ^{<i>m</i>} 23	(21 ⁻)	C	
5672.7 ^{<i>g</i>} 22	(21 ⁻)	C	
5678.8 ^{<i>l</i>} 9	(22 ⁻)&	BC	
5687.1 ^{<i>j</i>} 21	(20 ⁻)	C	
5720.4 ^{<i>h</i>} 21	(21 ⁻)	C	
5784.4 ^{<i>p</i>} 25	(21 ⁻)	C	
5798.5 ^{<i>s</i>} 21	(21 ⁺)	C	J ^π : 1130γ to 20 ⁺ 4671; band assignment.
5851.7 ^{<i>c</i>} 10	(22 ⁺)	BC	
5897.3 ^{<i>n</i>} 22	(22 ⁻)	C	
5926.9 ^{<i>k</i>} 10	(23 ⁻)@	BC	
5986.0 ^{<i>f</i>} 23	(22 ⁺)	C	
5987.8 ^{<i>i</i>} 22	(21 ⁻)	C	
6201.2 ^{<i>d</i>} 10	24 ⁺ ^{<i>e</i>}	BC	
6243 ^{<i>o</i>} 3	(22 ⁻)	C	
6310.6 ^{<i>j</i>} 22	(22 ⁻)	C	
6331.0 ^{<i>m</i>} 24	(23 ⁻)	C	J ^π : stretched Q 1080γ to (21 ⁻) 5253; band assignment.
6356.4 ^{<i>l</i>} 10	(24 ⁻)&	BC	
6385.7 ^{<i>g</i>} 25	(23 ⁻)	C	
6441.4 ^{<i>h</i>} 23	(23 ⁻)	C	
6531 ^{<i>p</i>} 3	(23 ⁻)	C	
6536.5 ^{<i>s</i>} 24	(23 ⁺)	C	
6615.0 ^{<i>c</i>} 22	(24 ⁺)	C	
6641.3 ^{<i>n</i>} 24	(24 ⁻)	C	
6650.6 ^{<i>i</i>} 23	(23 ⁻)	C	

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Adopted Levels, Gammas (continued) ^{166}Hf Levels (continued)

E(level) [†]	J ^π [‡]	XREF	E(level) [†]	J ^π [‡]	XREF	E(level) [†]	J ^π [‡]	XREF
6665.5 ^k 10	(25 ⁻) [@]	BC	8817 ^g 3	(29 ⁻)	C	13800 ^d 4	40 ⁺ ^e	C
6978 ^o 3	(24 ⁻)	C	8871 ^h 3	(29 ⁻)	C	14096 ^l 4	(40 ⁻) ^{&}	C
7006.6 ^j 23	(24 ⁻)	C	8980.0 ^l 15	(30 ⁻) ^{&}	BC	14424 ^k 4	(41 ⁻) [@]	C
7030.1 ^d 10	26 ⁺ ^e	BC	9116 ^c 3	(30 ⁺)	C	14879 ^d 4	42 ⁺ ^e	C
7078.2 ^m 25	(25 ⁻)	C	9212 ^j 3	(30 ⁻)	C	15575? ^k 4	(43 ⁻) [@]	C
7137.4 ^l 10	(26 ⁻) ^{&}	BC	9216 ⁿ 3	(30 ⁻)	C	16006? ^d 4	(44 ⁺) ^e	C
7145 ^g 3	(25 ⁻)	C	9337.8 ^k 15	(31 ⁻) [@]	BC	0.0+x ^r		C
7199.4 ^h 25	25 ⁻	C	9635 ⁱ 3	(31 ⁻)	C	236.0+x ^r 8		C
7314 ^p 3	(25 ⁻)	C	9682 ^m 3	(31 ⁻)	C	486.0+x ^r 8		C
7342 ^s 3	(25 ⁺)	C	9734 ^g 4	(31 ⁻)	C	759.0+x ^r 10		C
7363.6 ⁱ 23	(25 ⁻)	C	9753.5 ^d 18	32 ⁺ ^e	BC	1064.1+x ^r 11		C
7392.1 ^c 23	(26 ⁺)	C	9771 ^h 3	(31 ⁻)	C	1387.7+x ^r 12		C
7444 ⁿ 3	(26 ⁻)	C	9991.2 ^l 18	(32 ⁻) ^{&}	BC	1734.9+x ^r 13		C
7481.1 ^k 11	(27 ⁻) [@]	BC	10009 ^c 3	(32 ⁺)	C	2095.8+x ^r 13		C
7713.6 ^j 24	(26 ⁻)	C	10080? ^j 3	(32 ⁻)	C	2475.9+x ^r 14		C
7770 ^o 3	(26 ⁻)	C	10167 ⁿ 4	(32 ⁻)	C	2860.7+x ^r 15		C
7894.7 ^d 11	28 ⁺ ^e	BC	10330 ^k 2	(33 ⁻) [@]	BC	3256.1+x ^r 15		C
7899 ^m 3	(27 ⁻)	C	10721 ^g 4	(33 ⁻)	C	3665.0+x ^r 16		C
7954 ^g 3	(27 ⁻)	C	10747.5 ^d 21	34 ⁺ ^e	BC	4083.1+x ^r 17		C
8007 ^h 3	(27 ⁻)	C	10933 ^c 3	(34 ⁺)	C	0.0+y ^q		C
8017.3 ^l 11	(28 ⁻) ^{&}	BC	10994 ^l 4	(34 ⁻) ^{&}	C	204.0+y ^q 8		C
8062.7 ⁱ 24	(27 ⁻)	C	11298 ^k 4	(35 ⁻) [@]	C	438.0+y ^q 8		C
8222.0 ^c 25	(28 ⁺)	C	11751 ^d 4	36 ⁺ ^e	C	697.0+y ^q 10		C
8303 ⁿ 3	(28 ⁻)	C	11928 ^c 4	(36 ⁺)	C	977.0+y ^q 11		C
8375.4 ^k 11	(29 ⁻) [@]	BC	12005 ^l 4	(36 ⁻) ^{&}	C	1274.0+y ^q 12		C
8426.4 ^j 25	(28 ⁻)	C	12289 ^k 4	(37 ⁻) [@]	C	1582.0+y ^q 13		C
8767 ^m 3	(29 ⁻)	C	12762 ^d 4	38 ⁺ ^e	C	1905.0+y ^q 13		C
8800.7 ^d 15	30 ⁺ ^e	BC	13038 ^l 4	(38 ⁻) ^{&}	C	2240.0+y ^q 14		C
8808.1 ⁱ 25	(29 ⁻)	C	13328 ^k 4	(39 ⁻) [@]	C			

[†] From least-squares fit to E γ , assigning 1 keV uncertainty to data for which the authors did not state an uncertainty.

[‡] Values given without comment are from ($^{74}\text{Ge}, 4n\gamma$) and based on deduced band structure, alignment gains, B(M1)/B(E2) ratios and comparison with structures in neighboring nuclides.

The half-lives of excited states are from recoil Doppler measurements in (HI, n γ), except as noted.

@ The interband transition between side band 1 and the ground-state band show angular distributions of pure stretched dipole type, most likely E1.

& Transitions connecting the two side bands have positive anisotropies and are interpreted as mixed M1,E2 transitions (1987B106) in (HI, xny).

^a Proposed by 1977Le08 in ε decay.

^b Band(A): K π =0⁺ g.s. band. A=26.5 if B=0.

^c Band(B): BC band (2000Ri11).

^d Band(C): AB band (2000Ri11). Yrast above J=14. Alignment gain 10 $\hbar$ at $\hbar\omega \approx 0.25$ MeV. Becomes ABCDfg band at high spin with possible admixture of ABEFfg.

^e J π established for J=12 through J=42 band members based on smooth progression of E γ for intraband cascade, J π =14⁺ for 3007 level and E2 intraband 275 γ to 2566.

^f Band(D): EFBC band (2000Ri11).

^g Band(E): AGEF band (2000Ri11).

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Adopted Levels, Gammas (continued) ^{166}Hf Levels (continued)^h Band(F): AGEH band (2000Ri11).ⁱ Band(G): $K^\pi=10^-$, $\alpha=0$ gAE band (2000Ri11). Likely configuration: ν (5/2[642]+5/2[523])+ π (1/2[541]+9/2[514]); strongly supported by measured B(M1)/B(E2) ratios.^j Band(g): $K^\pi=10^-$, $\alpha=1$ geAE band (2000Ri11). See comment on $K^\pi=10^-$ signature partner band.^k Band(H): $K^\pi=5^-$ AE band (2000Ri11). A=13.7 if B=0.^l Band(I): AF band (2000Ri11).^m Band(J): AGBC band (2000Ri11). Large alignment, consistent with four-quasineutron structure.ⁿ Band(K): AHBC band (2000Ri11).^o Band(L): BE band (2000Ri11). Low alignment at low J.^p Band(M): BF band (2000Ri11).^q Band(N): Band 1 (2000Ri11).^r Band(O): Band 2 (2000Ri11).^s Band(P): Band 3 (2000Ri11).^t Band(Q): $K^\pi=2^+$ γ -vibrational band.

$\gamma(^{166}\text{Hf})$								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\ddagger\#}$	E_f	J_f^π	Mult. [‡]	α^b	Comments
158.64	2 ⁺	158.64@ 4	100@	0.0	0 ⁺	E2	0.636	B(E2)(W.u.)=128 7 Mult.: stretched Q from $\gamma(\theta)$ in (HI,xn γ); not M2 from RUL.
470.46	4 ⁺	311.87@ 5	100@	158.64	2 ⁺	E2	0.0706	B(E2)(W.u.)=202 7
809.96	(2 ⁺)	651.26@ 5	93.6@ 20	158.64	2 ⁺			
		810.0@ 3	100@ 9	0.0	0 ⁺			
897.17	6 ⁺	426.7@ 1	100@	470.46	4 ⁺	E2	0.0292	B(E2)(W.u.)=221 13
1007.16	(3 ⁺)	536.81@ 7	15.7@ 16	470.46	4 ⁺			
		848.41@ 6	100@ 7	158.64	2 ⁺			
1064.99	(0 ⁺)	906.35@ 9	100@	158.64	2 ⁺	(E2)	0.00500	Mult.: Q from 906 γ -159 $\gamma(\theta)$ in ε decay.
1162.70		692.23@ 6	100@	470.46	4 ⁺			
1218.76	2 ⁺	748.25@ 7	100@ 7	470.46	4 ⁺			
		1060.2@ 1	77@ 10	158.64	2 ⁺			
		1218.8@ 3	33@ 13	0.0	0 ⁺			
1332.41	(2 ⁺ ,3,4 ⁺)	861.97@ 7	92@ 5	470.46	4 ⁺			
		1173.74@ 7	100@ 7	158.64	2 ⁺			
1404.85		397.6@ 1	51@ 5	1007.16	(3 ⁺)			
		594.65@ 10	100@ 16	809.96	(2 ⁺)			
		1246.37@ 7	95@ 5	158.64	2 ⁺			
1406.4	8 ⁺	509.5 3	100	897.17	6 ⁺	E2	0.0185	B(E2)(W.u.)=280 30
1418.9	(5 ⁺)	413 ^a		1007.16	(3 ⁺)			
		949 ^a		470.46	4 ⁺			
1466.3	(5 ⁻)	995.8 10	100	470.46	4 ⁺	D		
1551.39	(4 ⁻)	544.27@ 10	59@ 11	1007.16	(3 ⁺)			
		1080.86@ 12	100@ 13	470.46	4 ⁺	D		
1603.05	(2 ⁺ ,3,4 ⁺)	1132.75@ 11	100@ 12	470.46	4 ⁺			
		1444.4@ 2	92@ 4	158.64	2 ⁺			
1726.3	(7 ⁻)	259 ^a		1466.3	(5 ⁻)			
		320 ^a		1406.4	8 ⁺			

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Adopted Levels, Gammas (continued)

$\gamma(^{166}\text{Hf})$ (continued)								
$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\ddagger\#}$	E_f	J_f^π	Mult. ‡	α^b	Comments
1726.3	(7 ⁻)	829.3 3	100	897.17	6 ⁺	D		
1841.1	(6 ⁻)	289.2 3	34 7	1551.39	(4 ⁻)			
		374.7 3	100 10	1466.3	(5 ⁻)			
		421 ^a		1418.9	(5 ⁺)			
		944.3 3	90 10	897.17	6 ⁺	D		
1971.9	10 ⁺	565.5 3	100	1406.4	8 ⁺	E2	0.0129	B(E2)(W.u.)=250 +640-110
2078.5	(9 ⁻)	352.2 3	28 3	1726.3	(7 ⁻)	E2	0.0495	B(E2)(W.u.)=250 60
		672.2 3	100 5	1406.4	8 ⁺	D		
2197.3	(8 ⁻)	356.3 3	100 10	1841.1	(6 ⁻)			
		471.0 3	80 8	1726.3	(7 ⁻)			
2376.5	(8 ⁻)	537 ^a		1841.1	(6 ⁻)			
2496.7	(11 ⁻)	418.1 3	100 10	2078.5	(9 ⁻)	(E2)	0.0308	
		524.7 3	62 6	1971.9	10 ⁺	D		
2539.7	(10 ⁻)	342.5 3	100 10	2197.3	(8 ⁻)			
		461.2 3	87 9	2078.5	(9 ⁻)			
2565.8	12 ⁺	594.0 3	100	1971.9	10 ⁺	E2	0.01271	B(E2)(W.u.)=155 +550-70
2680.1	(10 ⁻)	304 ^a		2376.5	(8 ⁻)			
		484 ^a		2197.3	(8 ⁻)	Q&		
2734.6	12 ⁺	168 ^a		2565.8	12 ⁺			
		762.7 3	100	1971.9	10 ⁺	(E2)	0.00721	
2793.1	(11 ⁻)	716 ^a	100	2078.5	(9 ⁻)			
2910.9	(12 ⁻)	371.3 3	100 10	2539.7	(10 ⁻)	(E2)	0.0427	
		414.0 3	47 4	2496.7	(11 ⁻)			
2962.2	(13 ⁻)	396.4 3	8.2 16	2565.8	12 ⁺			
		465.4 3	100 5	2496.7	(11 ⁻)	(E2)	0.0232	
3009.2	14 ⁺	274.6 3	22.3 24	2734.6	12 ⁺	E2	0.1037	B(E2)(W.u.)=168 17
		443.4 3	100 5	2565.8	12 ⁺	E2	0.0264	B(E2)(W.u.)=70 7
3023.9	(12 ⁺)	460 ^a		2565.8	12 ⁺			
		1054 ^a		1971.9	10 ⁺			
3085.8	(12 ⁻)	406 ^a		2680.1	(10 ⁻)			
		547 ^a		2539.7	(10 ⁻)			
3211.1	14 ⁽⁺⁾	645.3 3	100	2565.8	12 ⁺	(E2)	0.01048	
3231.4	(13 ⁻)	438 ^a		2793.1	(11 ⁻)			
		737 ^a		2496.7	(11 ⁻)	Q&		
3375.1	(14 ⁻)	413 ^a		2962.2	(13 ⁻)			
		464.2 3	100	2910.9	(12 ⁻)	(E2)	0.0234	
3449.0	16 ⁺	439.8 3	100	3009.2	14 ⁺	(E2)	0.0269	
3472.6	(15 ⁻)	261 ^a		3211.1	14 ⁽⁺⁾			
		510.4 3	100	2962.2	(13 ⁻)	(E2)	0.0184	
3515.8	(14 ⁺)	492 ^a		3023.9	(12 ⁺)			
		952 ^a		2565.8	12 ⁺			
3585.6	(14 ⁻)	500 ^a	100	3085.8	(12 ⁻)			
3779.4	(15 ⁻)	548 ^a		3231.4	(13 ⁻)			
		819 ^a		2962.2	(13 ⁻)	Q&		
3817.4	(15 ⁻)	811 ^a		3009.2	14 ⁺			
3835.2	(16 ⁺)	624 ^a	100	3211.1	14 ⁽⁺⁾			
3920.3	(16 ⁻)	448 ^a		3472.6	(15 ⁻)			
		545.2 3	100	3375.1	(14 ⁻)	(E2)	0.01561	
3972.1	(15 ⁻)	965 ^a	100	3009.2	14 ⁺			
4009.2	18 ⁺	560.2 3	100	3449.0	16 ⁺	(E2)	0.01462	
4030.1	(17 ⁻)	557.5 3	100	3472.6	(15 ⁻)	(E2)	0.01479	
4064.7	(16 ⁺)	549 ^a		3515.8	(14 ⁺)			
		856 ^a		3211.1	14 ⁽⁺⁾			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{166}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\dagger\#}$	E_f	J_f^π	Mult. [‡]	α^b
4163.5	(16 ⁻)	578 ^a	100	3585.6	(14 ⁻)		
4228.5	(16 ⁻)	643 ^a	100	3585.6	(14 ⁻)		
4374.0	(17 ⁻)	557		3817.4	(15 ⁻)		
		927		3449.0	16 ⁺		
4400.4	(17 ⁻)	621 ^a	100	3779.4	(15 ⁻)		
4443.4	(17 ⁻)	471 ^a		3972.1	(15 ⁻)		
		997 ^a		3449.0	16 ⁺		
4459.3	(18 ⁺)	623 ^a	100	3835.2	(16 ⁺)		
4516.0	(18 ⁻)	595.7 3	100	3920.3	(16 ⁻)		
4582.0	(15 ⁻)	137 ^a		4445.4	(14 ⁻)		
		1373 ^a		3211.1	14 ⁽⁺⁾		
		1575 ^a		3009.2	14 ⁺		
4625.2	(19 ⁻)	595.1 3	100	4030.1	(17 ⁻)		
4641.4	(18 ⁻)	413 ^a		4228.5	(16 ⁻)		
		478 ^a		4163.5	(16 ⁻)		
		723 ^a		3920.3	(16 ⁻)	Q&	
4671.0	20 ⁺	661.8 3	100	4009.2	18 ⁺		
4677.4	(18 ⁺)	613 ^a		4064.7	(16 ⁺)		
		844 ^a		3835.2	(16 ⁺)		
4744.9	(16 ⁻)	163 ^a		4582.0	(15 ⁻)		
		299 ^a		4445.4	(14 ⁻)		
		1298 ^a		3449.0	16 ⁺	D&	
4823.5	(18 ⁻)	660 ^a	100	4163.5	(16 ⁻)		
4937.1	(17 ⁻)	192 ^a		4744.9	(16 ⁻)		
		355 ^a		4582.0	(15 ⁻)		
		1491 ^a		3449.0	16 ⁺		
5005.6	(19 ⁻)	562 ^a		4443.4	(17 ⁻)		
		632 ^a		4374.0	(17 ⁻)		
		999 ^a		4009.2	18 ⁺		
5031.3	(19 ⁻)	588 ^a		4443.4	(17 ⁻)		
		657 ^a		4374.0	(17 ⁻)		
		1025 ^a		4009.2	18 ⁺	D&	
5071.4	(19 ⁻)	671 ^a	100	4400.4	(17 ⁻)		
5086.9	(19 ⁻)	1059 ^a	100	4030.1	(17 ⁻)	(Q)&	
5089.6	(20 ⁻)	573.6 3	100	4516.0	(18 ⁻)		
5121.7	(20 ⁺)	662.3 3	100	4459.3	(18 ⁺)		
5157.5	(19 ⁺)	1151 ^a	100	4009.2	18 ⁺		
5160.0	(18 ⁻)	223 ^a		4937.1	(17 ⁻)		
		415 ^a		4744.9	(16 ⁻)		
		1153 ^a		4009.2	18 ⁺		
5214.3	(20 ⁻)	573 ^a		4641.4	(18 ⁻)		
		700 ^a		4516.0	(18 ⁻)	Q&	
5253.3	(21 ⁻)	628.1 3	100	4625.2	(19 ⁻)	(E2)	0.01115
5313.0	(20 ⁺)	636 ^a		4677.4	(18 ⁺)		
		856 ^a		4459.3	(18 ⁺)		
5409.9	22 ⁺	738.9 3	100	4671.0	20 ⁺	[E2]	0.00779
5410.0	(19 ⁻)	250 ^a		5160.0	(18 ⁻)		
		473 ^a		4937.1	(17 ⁻)		
5510.5	(20 ⁻)	687 ^a	100	4823.5	(18 ⁻)		
5665.9	(21 ⁻)	579 ^a		5086.9	(19 ⁻)		
		1043		4625.2	(19 ⁻)		

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{166}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\dagger\#}$	E_f	J_f^π	Mult. [‡]
5672.7	(21 ⁻)	667 ^a	100	5005.6	(19 ⁻)	
5678.8	(22 ⁻)	589.2 3	100	5089.6	(20 ⁻)	
5687.1	(20 ⁻)	277 ^a		5410.0	(19 ⁻)	
		527 ^a		5160.0	(18 ⁻)	
5720.4	(21 ⁻)	689 ^a		5031.3	(19 ⁻)	
		1052 ^a		4671.0	20 ⁺	
5784.4	(21 ⁻)	713 ^a	100	5071.4	(19 ⁻)	
5798.5	(21 ⁺)	641 ^a		5157.5	(19 ⁺)	
		1130 ^a		4671.0	20 ⁺	
5851.7	(22 ⁺)	730.0 3	100	5121.7	(20 ⁺)	
		1180 ^a		4671.0	20 ⁺	
5897.3	(22 ⁻)	683 ^a		5214.3	(20 ⁻)	
5926.9	(23 ⁻)	673.6 3	100	5253.3	(21 ⁻)	
5986.0	(22 ⁺)	673 ^a		5313.0	(20 ⁺)	
		867 ^{ac}		5121.7	(20 ⁺)	
5987.8	(21 ⁻)	301 ^a		5687.1	(20 ⁻)	
		578 ^a		5410.0	(19 ⁻)	
6201.2	24 ⁺	791.3 3	100	5409.9	22 ⁺	
6243	(22 ⁻)	733 ^a	100	5510.5	(20 ⁻)	
6310.6	(22 ⁻)	323 ^a		5987.8	(21 ⁻)	
		623 ^a		5687.1	(20 ⁻)	
6331.0	(23 ⁻)	665		5665.9	(21 ⁻)	
		1080		5253.3	(21 ⁻)	Q&
6356.4	(24 ⁻)	677.6 3	100	5678.8	(22 ⁻)	
6385.7	(23 ⁻)	713 ^a	100	5672.7	(21 ⁻)	
6441.4	(23 ⁻)	721 ^a	100	5720.4	(21 ⁻)	
6531	(23 ⁻)	747 ^a	100	5784.4	(21 ⁻)	
6536.5	(23 ⁺)	738 ^a	100	5798.5	(21 ⁺)	
6615.0	(24 ⁺)	766 ^a		5851.7	(22 ⁺)	
		1208 ^a		5409.9	22 ⁺	
6641.3	(24 ⁻)	744 ^a	100	5897.3	(22 ⁻)	
6650.6	(23 ⁻)	340 ^a		6310.6	(22 ⁻)	
		663 ^a		5987.8	(21 ⁻)	
6665.5	(25 ⁻)	738.6 3	100	5926.9	(23 ⁻)	
6978	(24 ⁻)	735 ^a	100	6243	(22 ⁻)	
7006.6	(24 ⁻)	356 ^a		6650.6	(23 ⁻)	
		696 ^a		6310.6	(22 ⁻)	
7030.1	26 ⁺	828.9 3	100	6201.2	24 ⁺	
7078.2	(25 ⁻)	747 ^a		6331.0	(23 ⁻)	
		1155 ^a		5926.9	(23 ⁻)	
7137.4	(26 ⁻)	781.0 3	100	6356.4	(24 ⁻)	
7145	(25 ⁻)	759 ^a	100	6385.7	(23 ⁻)	
7199.4	25 ⁻	758 ^a	100	6441.4	(23 ⁻)	
7314	(25 ⁻)	783 ^a	100	6531	(23 ⁻)	
7342	(25 ⁺)	806 ^a	100	6536.5	(23 ⁺)	
7363.6	(25 ⁻)	357 ^a		7006.6	(24 ⁻)	
		713 ^a		6650.6	(23 ⁻)	
7392.1	(26 ⁺)	777 ^a		6615.0	(24 ⁺)	
		1195 ^a		6201.2	24 ⁺	
7444	(26 ⁻)	803 ^a	100	6641.3	(24 ⁻)	
7481.1	(27 ⁻)	815.6 3	100	6665.5	(25 ⁻)	
7713.6	(26 ⁻)	350 ^a		7363.6	(25 ⁻)	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued) $\gamma(^{166}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\dagger\#}$	E_f	J_f^π
7713.6	(26 ⁻)	707 ^a		7006.6	(24 ⁻)
7770	(26 ⁻)	792 ^a	100	6978	(24 ⁻)
7894.7	28 ⁺	864.6 3	100	7030.1	26 ⁺
7899	(27 ⁻)	821 ^a	100	7078.2	(25 ⁻)
7954	(27 ⁻)	809 ^a	100	7145	(25 ⁻)
8007	(27 ⁻)	808 ^a	100	7199.4	25 ⁻
8017.3	(28 ⁻)	879.9 3	100	7137.4	(26 ⁻)
8062.7	(27 ⁻)	349 ^a		7713.6	(26 ⁻)
		699 ^a		7363.6	(25 ⁻)
8222.0	(28 ⁺)	830 ^a	100	7392.1	(26 ⁺)
8303	(28 ⁻)	859 ^a	100	7444	(26 ⁻)
8375.4	(29 ⁻)	894.3 3	100	7481.1	(27 ⁻)
8426.4	(28 ⁻)	364 ^a		8062.7	(27 ⁻)
		713 ^a		7713.6	(26 ⁻)
8767	(29 ⁻)	868 ^a	100	7899	(27 ⁻)
8800.7	30 ⁺	906 1	100	7894.7	28 ⁺
8808.1	(29 ⁻)	382 ^a		8426.4	(28 ⁻)
		745 ^a		8062.7	(27 ⁻)
8817	(29 ⁻)	863 ^a	100	7954	(27 ⁻)
8871	(29 ⁻)	864 ^a	100	8007	(27 ⁻)
8980.0	(30 ⁻)	962.7 10	100	8017.3	(28 ⁻)
9116	(30 ⁺)	894 ^a	100	8222.0	(28 ⁺)
9212	(30 ⁻)	404 ^a		8808.1	(29 ⁻)
		786 ^a		8426.4	(28 ⁻)
9216	(30 ⁻)	913 ^a	100	8303	(28 ⁻)
9337.8	(31 ⁻)	962.4 10	100	8375.4	(29 ⁻)
9635	(31 ⁻)	423 ^a		9212	(30 ⁻)
		827 ^a		8808.1	(29 ⁻)
9682	(31 ⁻)	915 ^a	100	8767	(29 ⁻)
9734	(31 ⁻)	917 ^a	100	8817	(29 ⁻)
9753.5	32 ⁺	952.7 10	100	8800.7	30 ⁺
9771	(31 ⁻)	900 ^a	100	8871	(29 ⁻)
9991.2	(32 ⁻)	1011.2 10	100	8980.0	(30 ⁻)
10009	(32 ⁺)	893 ^a	100	9116	(30 ⁺)
10080?	(32 ⁻)	445 ^{ac}		9635	(31 ⁻)
		867 ^{ac}		9212	(30 ⁻)
10167	(32 ⁻)	951 ^a	100	9216	(30 ⁻)
10330	(33 ⁻)	992.5 10	100	9337.8	(31 ⁻)
10721	(33 ⁻)	987 ^a	100	9734	(31 ⁻)
10747.5	34 ⁺	994 1	100	9753.5	32 ⁺
10933	(34 ⁺)	924 ^a	100	10009	(32 ⁺)
10994	(34 ⁻)	1007 ^a	100	9991.2	(32 ⁻)
11298	(35 ⁻)	972 ^a	100	10330	(33 ⁻)
11751	36 ⁺	1009 ^a	100	10747.5	34 ⁺
11928	(36 ⁺)	995 ^a	100	10933	(34 ⁺)
12005	(36 ⁻)	1011 ^a	100	10994	(34 ⁻)
12289	(37 ⁻)	991 ^a	100	11298	(35 ⁻)
12762	38 ⁺	1011 ^a	100	11751	36 ⁺
13038	(38 ⁻)	1033 ^a	100	12005	(36 ⁻)
13328	(39 ⁻)	1039 ^a	100	12289	(37 ⁻)
13800	40 ⁺	1038 ^a	100	12762	38 ⁺
14096	(40 ⁻)	1058 ^a	100	13038	(38 ⁻)

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Adopted Levels, Gammas (continued) $\gamma(^{166}\text{Hf})$ (continued)

$E_i(\text{level})$	J_i^π	$E_\gamma^\dagger$	$I_\gamma^{\ddagger\#}$	E_f	J_f^π	$E_i(\text{level})$	$E_\gamma^\dagger$	$I_\gamma^{\ddagger\#}$	E_f
14424	(41 ⁻)	1096 ^a	100	13328	(39 ⁻)	3256.1+x	396 ^a		2860.7+x
14879	42 ⁺	1079 ^a	100	13800	40 ⁺		780 ^a		2475.9+x
15575?	(43 ⁻)	1151 ^{ac}	100	14424	(41 ⁻)	3665.0+x	409 ^a		3256.1+x
16006?	(44 ⁺)	1127 ^{ac}	100	14879	42 ⁺		804 ^a		2860.7+x
236.0+x		236 ^a	100	0.0+x		4083.1+x	418 ^a		3665.0+x
486.0+x		250 ^a		236.0+x			827 ^a		3256.1+x
		486 ^a		0.0+x		204.0+y	204 ^a	100	0.0+y
759.0+x		273 ^a		486.0+x		438.0+y	234 ^a		204.0+y
		523 ^a		236.0+x			438 ^a		0.0+y
1064.1+x		305 ^a		759.0+x		697.0+y	259 ^a		438.0+y
		578 ^a		486.0+x			493 ^a		204.0+y
1387.7+x		323 ^a		1064.1+x		977.0+y	280 ^a		697.0+y
		629 ^a		759.0+x			539 ^a		438.0+y
1734.9+x		347 ^a		1387.7+x		1274.0+y	297 ^a		977.0+y
		671 ^a		1064.1+x			577 ^a		697.0+y
2095.8+x		361 ^a		1734.9+x		1582.0+y	308 ^a		1274.0+y
		708 ^a		1387.7+x			605 ^a		977.0+y
2475.9+x		380 ^a		2095.8+x		1905.0+y	323 ^a		1582.0+y
		741 ^a		1734.9+x			631 ^a		1274.0+y
2860.7+x		385 ^a		2475.9+x		2240.0+y	335 ^a		1905.0+y
		765 ^a		2095.8+x			658 ^a		1582.0+y

[†] From (HI,xn γ), unless otherwise noted.

[‡] From $\gamma(\theta)$ and/or DCO ratio in (HI,xn γ), except as noted. Q transitions are not M2 from RUL if value is shown without parentheses; $\Delta\pi=(\text{no})$ has been assigned to all other intraband stretched Q transitions.

[#] Relative photon intensity normalized to 100 for strongest photon deexciting each level; from (HI,xn γ), except as noted.

[@] From ^{166}Ta ε decay.

[&] From DCO ratios in $^{96}\text{Zr}(^{74}\text{Ge},4n\gamma)$, assigning intraband stretched Q transitions as (E2).

^a From $^{96}\text{Zr}(^{74}\text{Ge},4n\gamma)$.

^b 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.

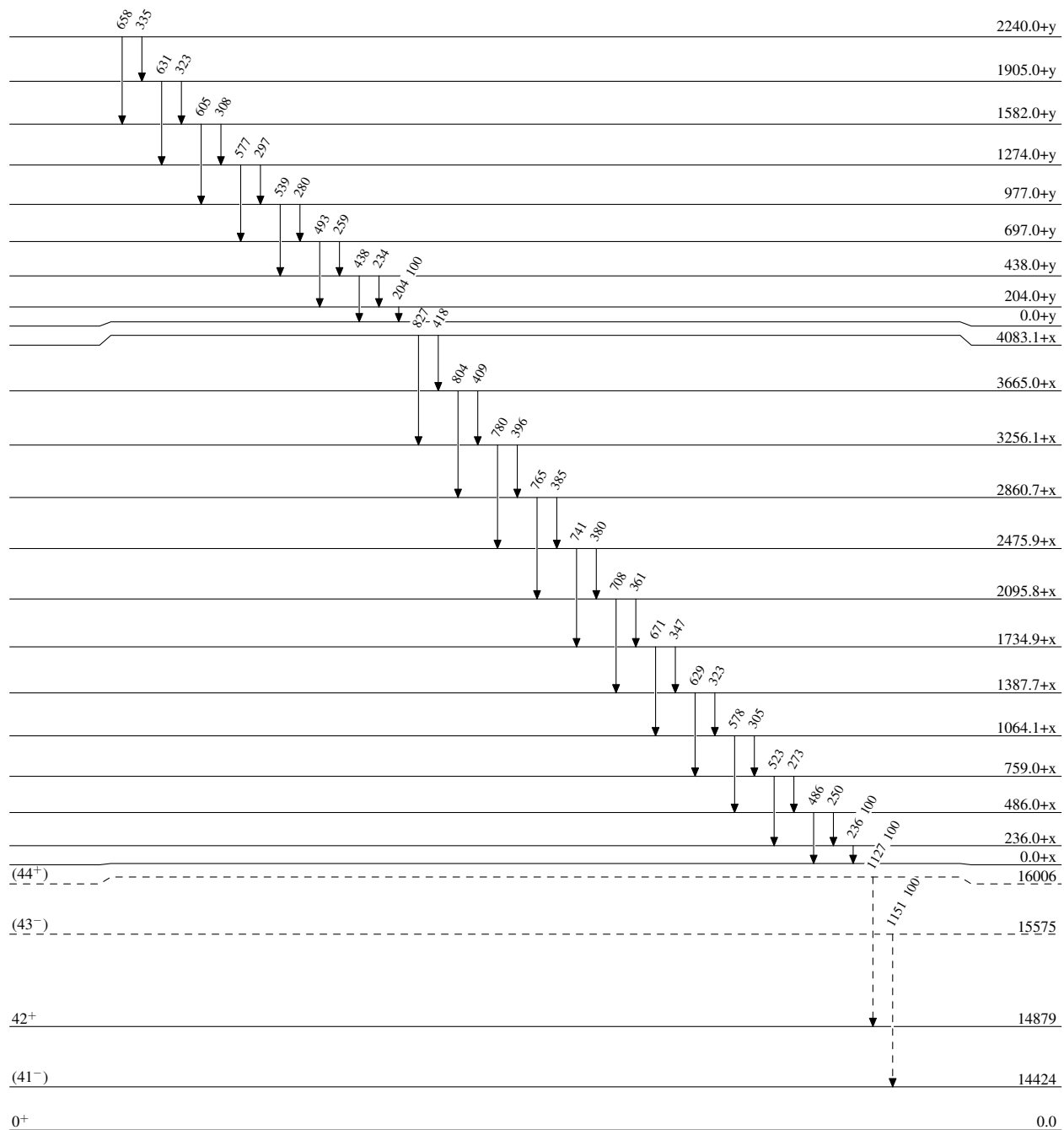
^c Placement of transition in the level scheme is uncertain.

Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

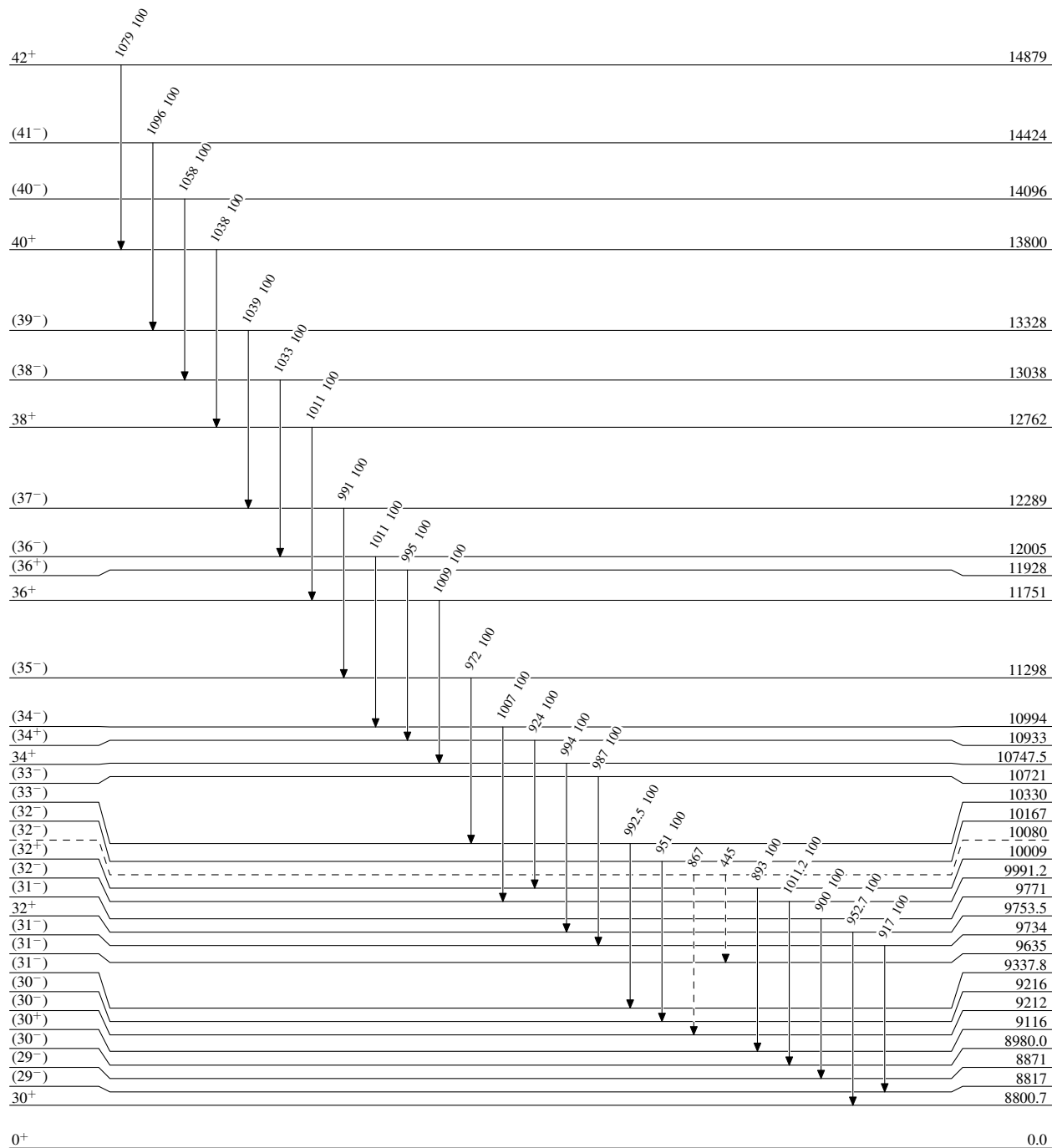
-----► γ Decay (Uncertain)


Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)

0⁺

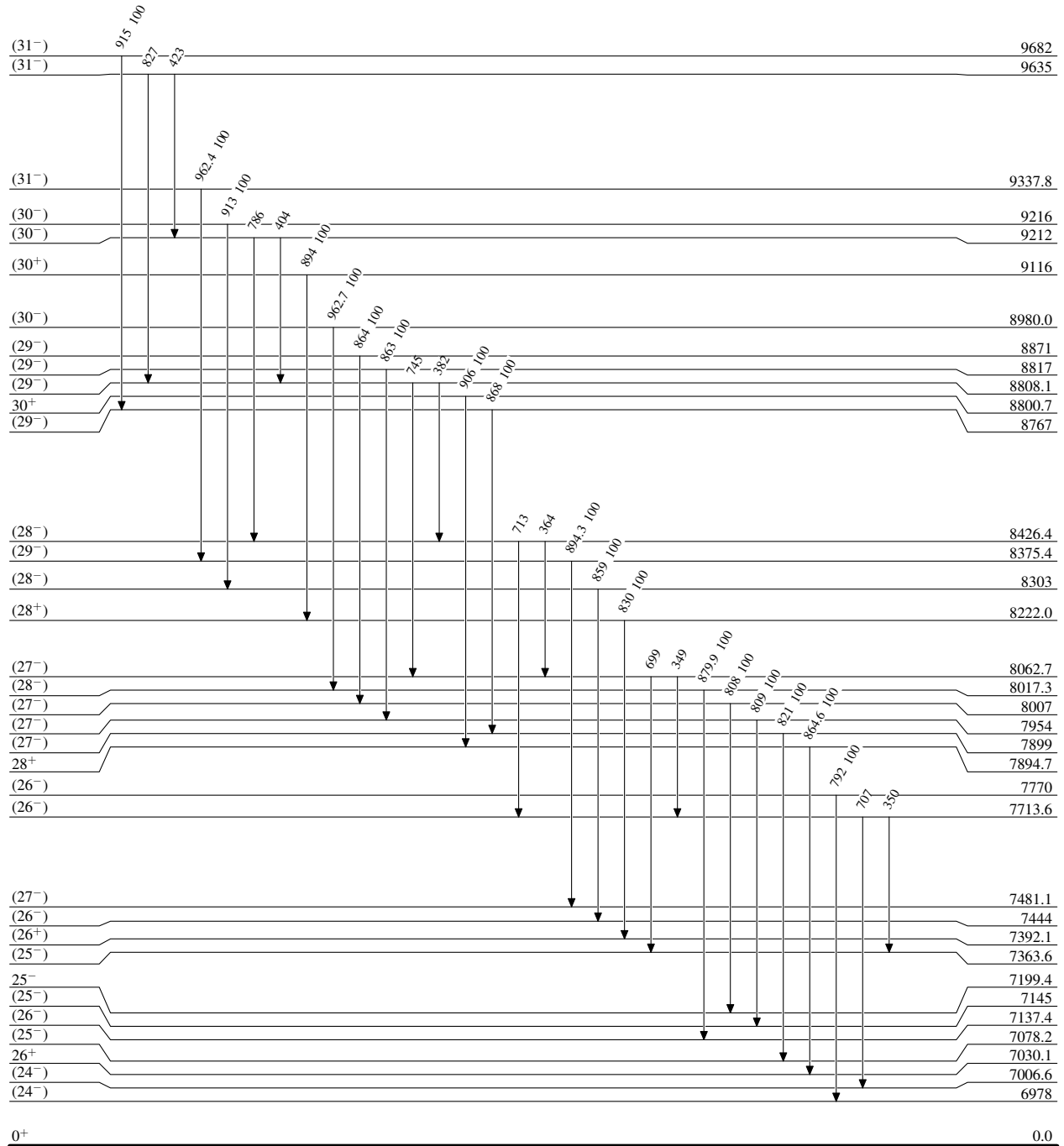
0.0

6.77 min 30

 $^{166}_{72}\text{Hf}_{94}$

Adopted Levels, Gammas**Level Scheme (continued)**

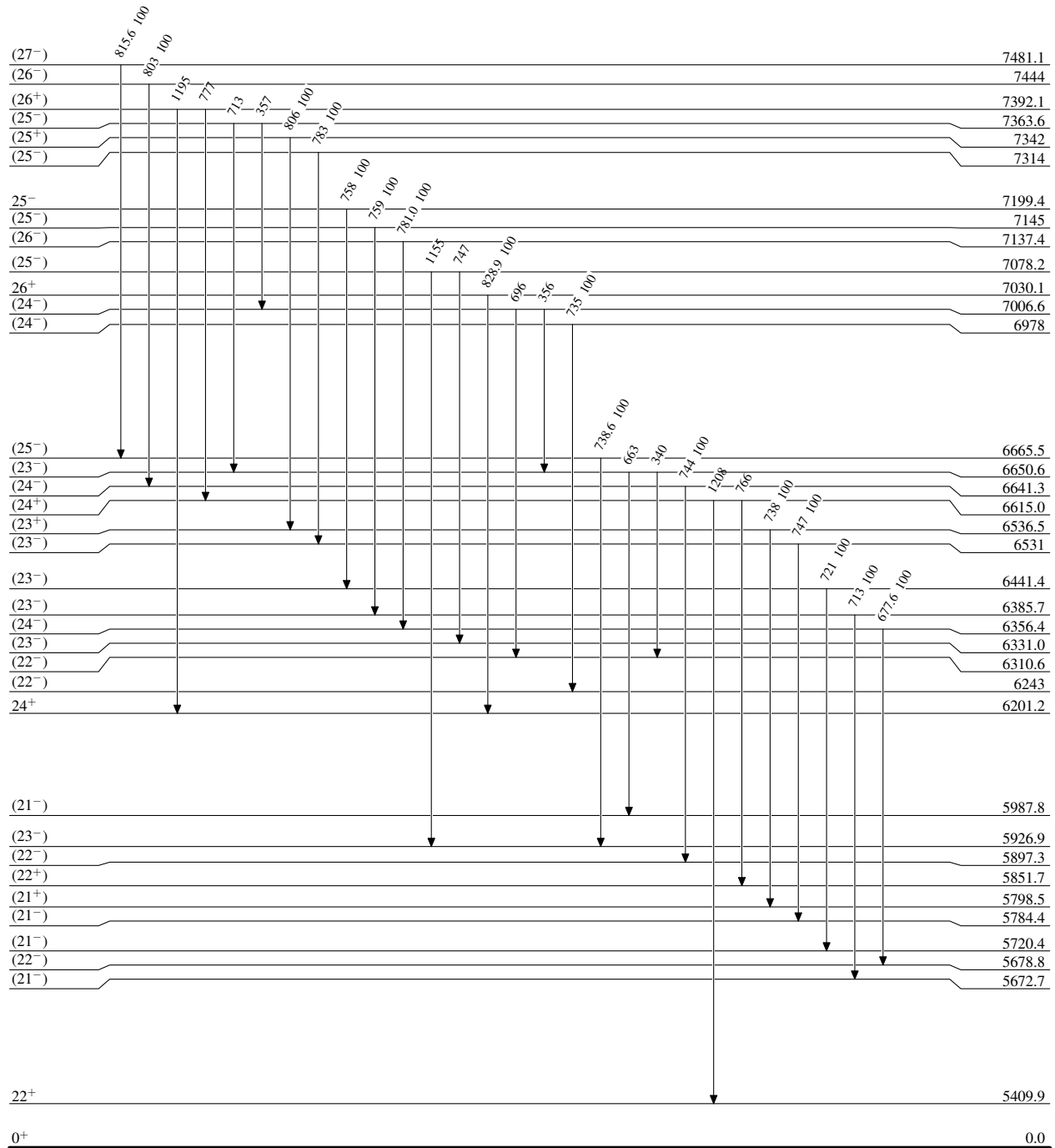
Intensities: Relative photon branching from each level



6.77 min 30

Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level

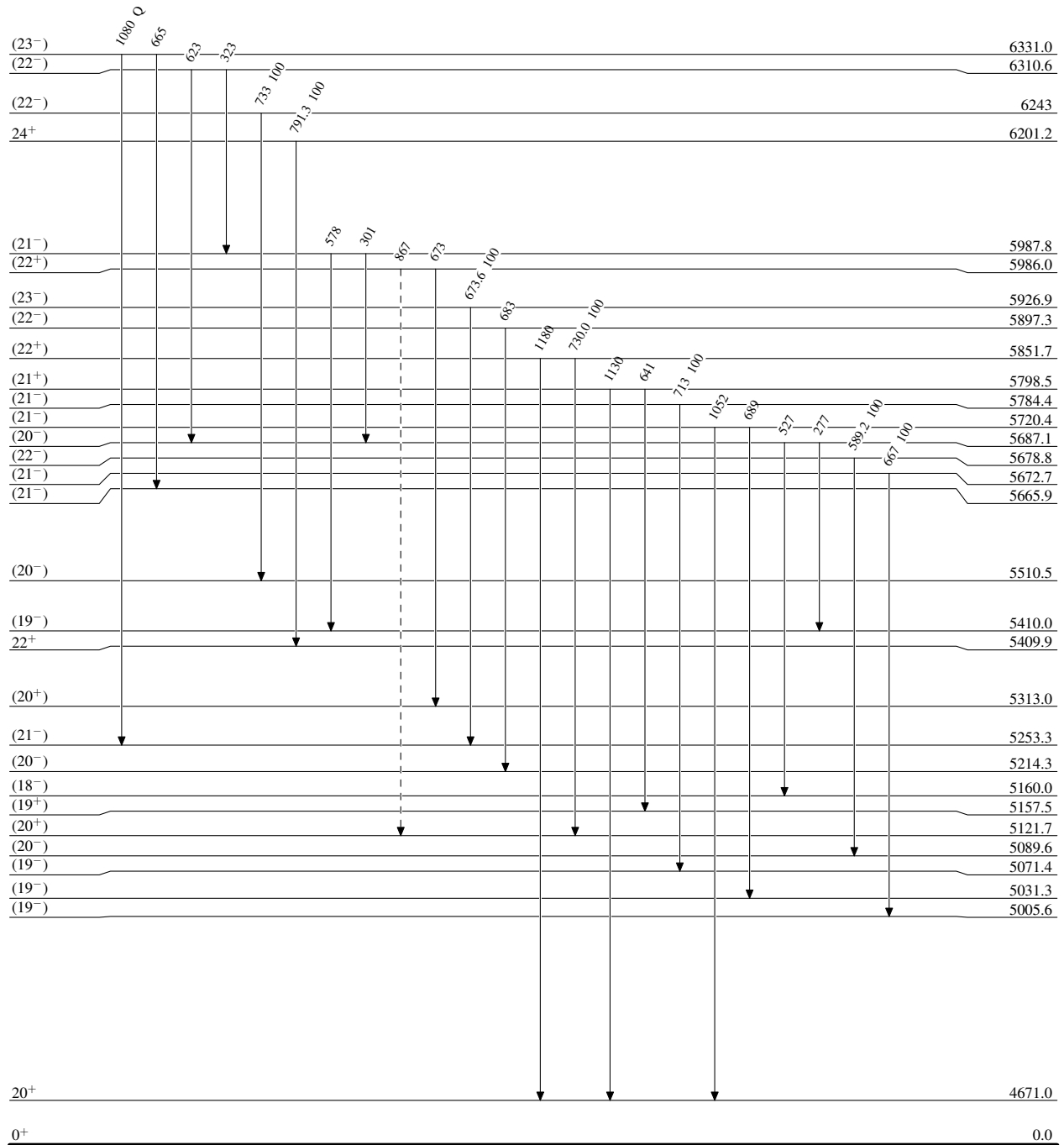


Adopted Levels, Gammas

Legend

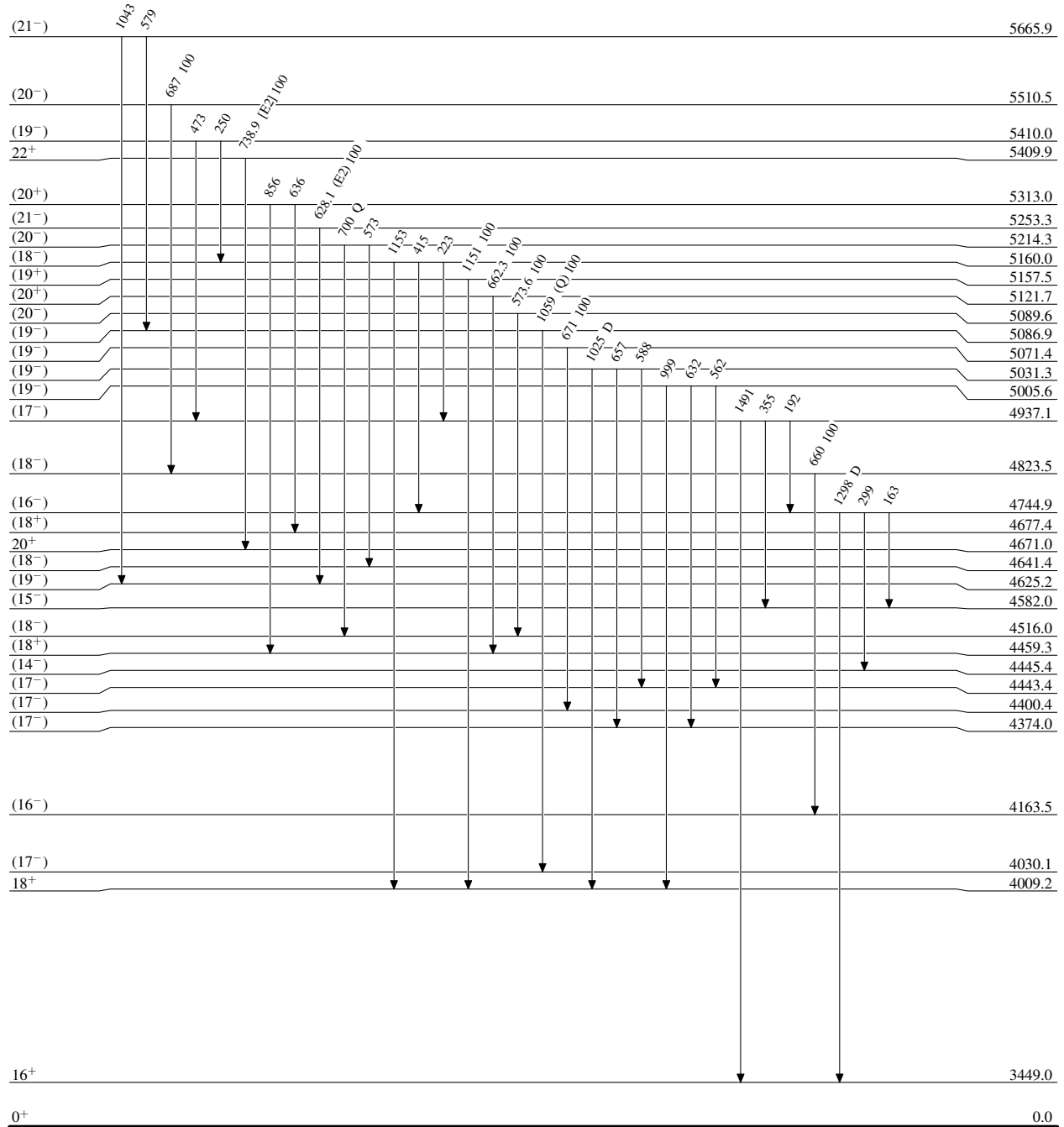
Level Scheme (continued)

Intensities: Relative photon branching from each level

-----► γ Decay (Uncertain)


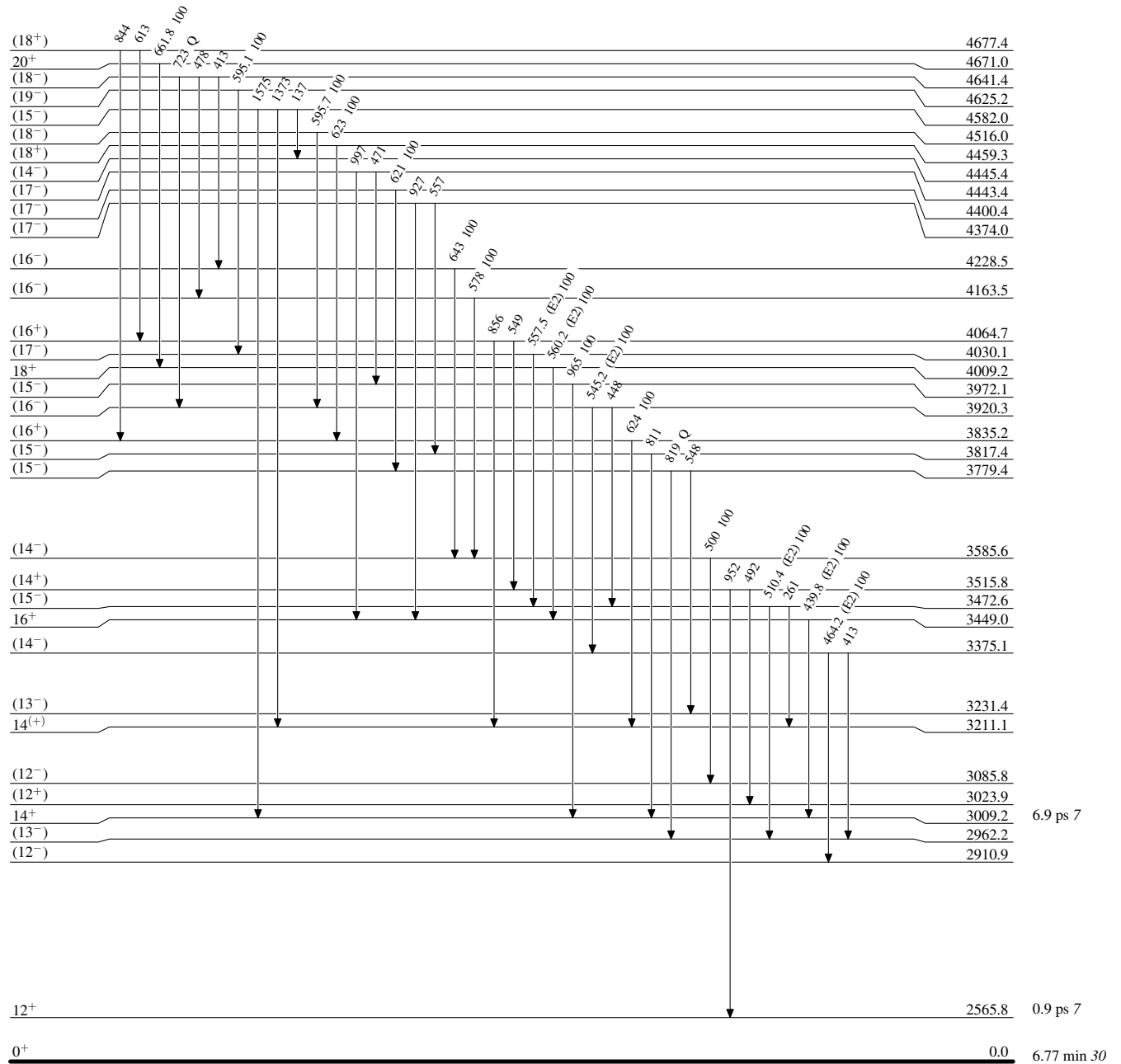
Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level



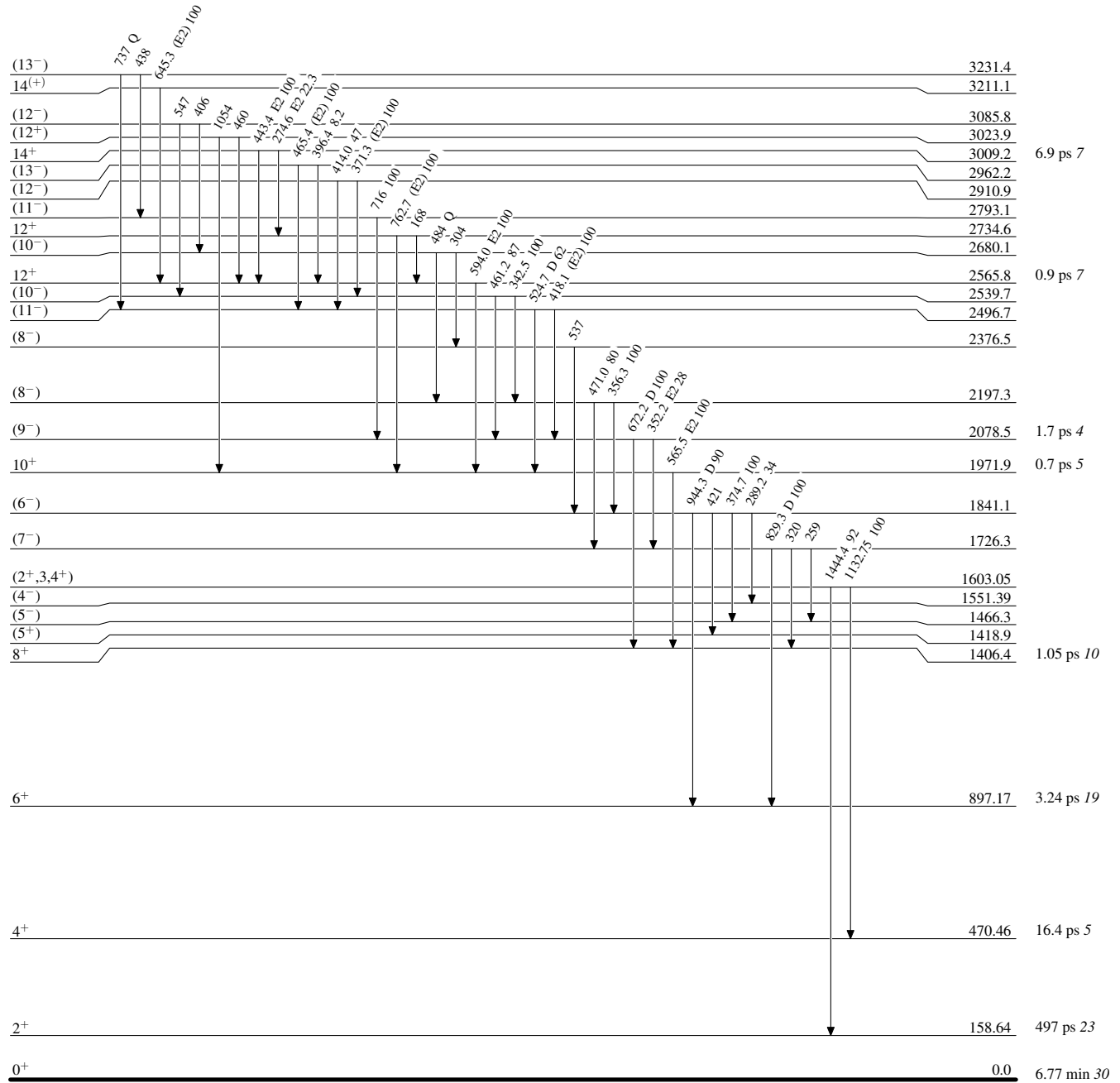
Adopted Levels, GammasLevel Scheme (continued)

Intensities: Relative photon branching from each level



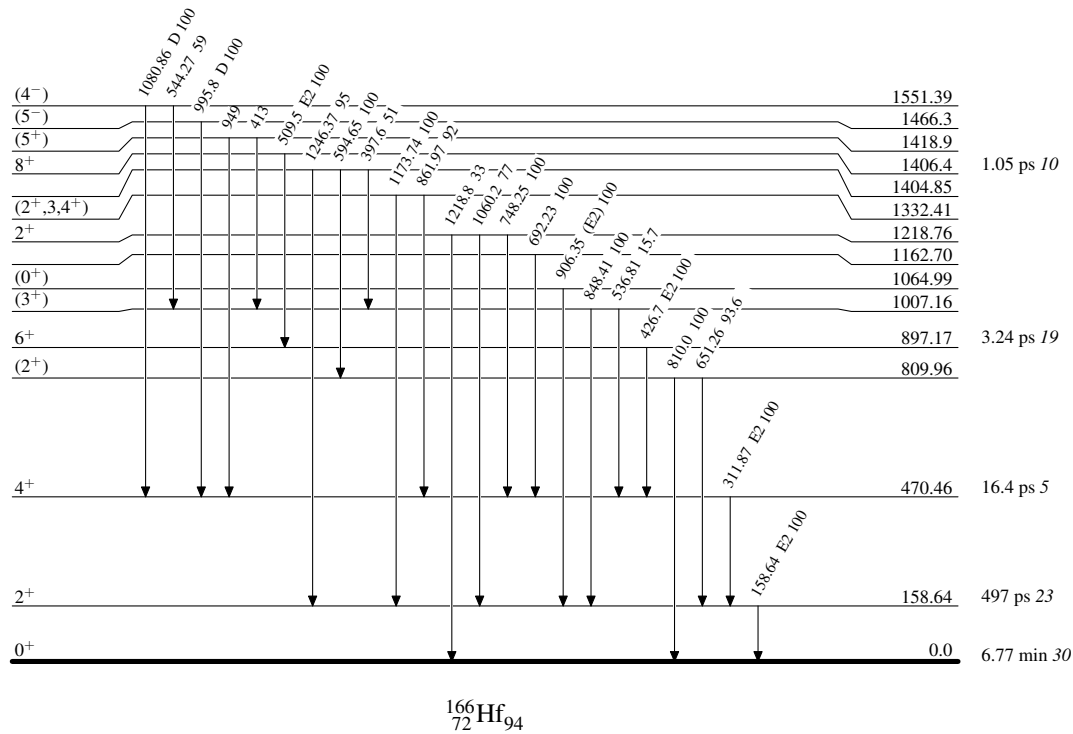
Adopted Levels, Gammas**Level Scheme (continued)**

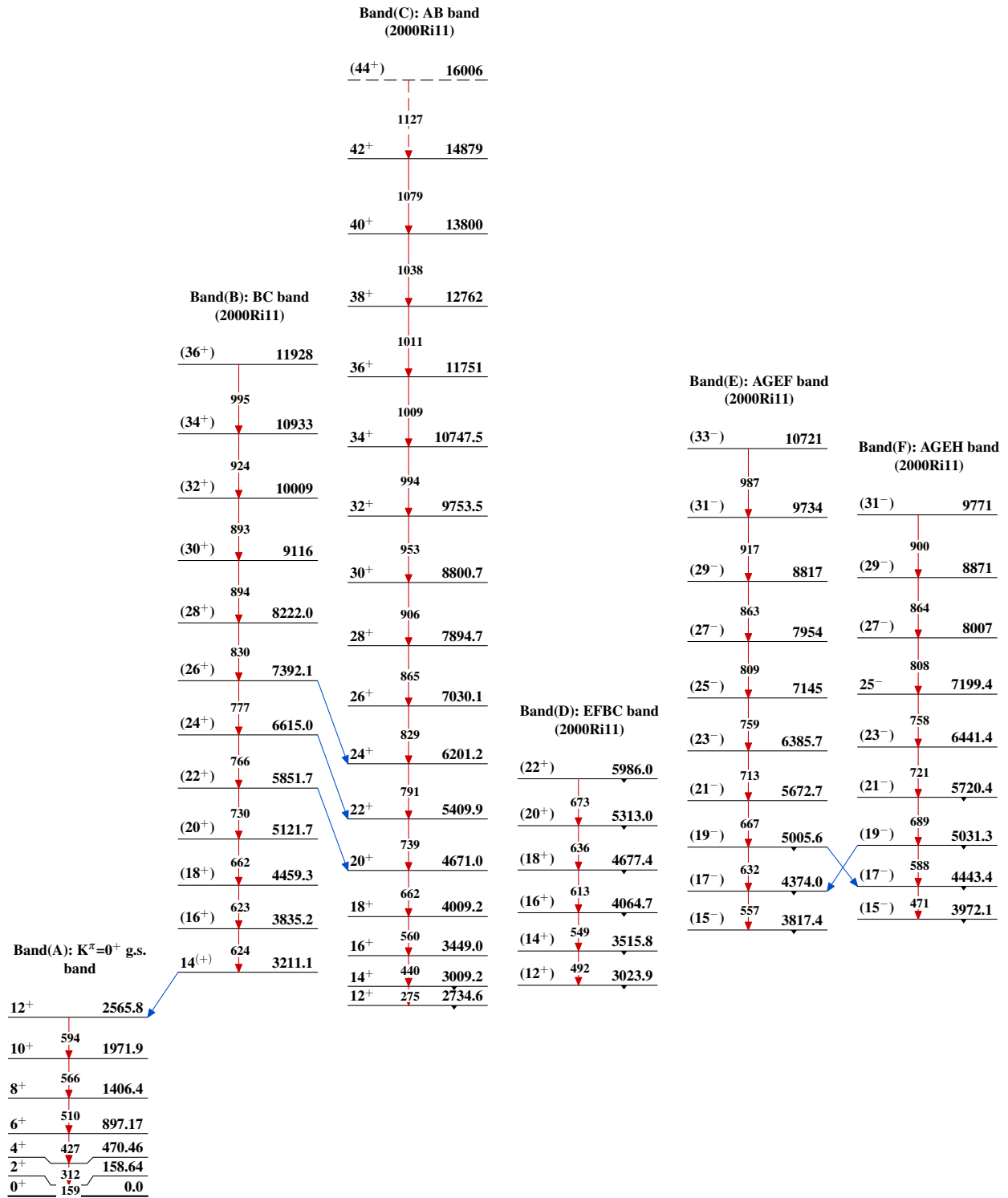
Intensities: Relative photon branching from each level

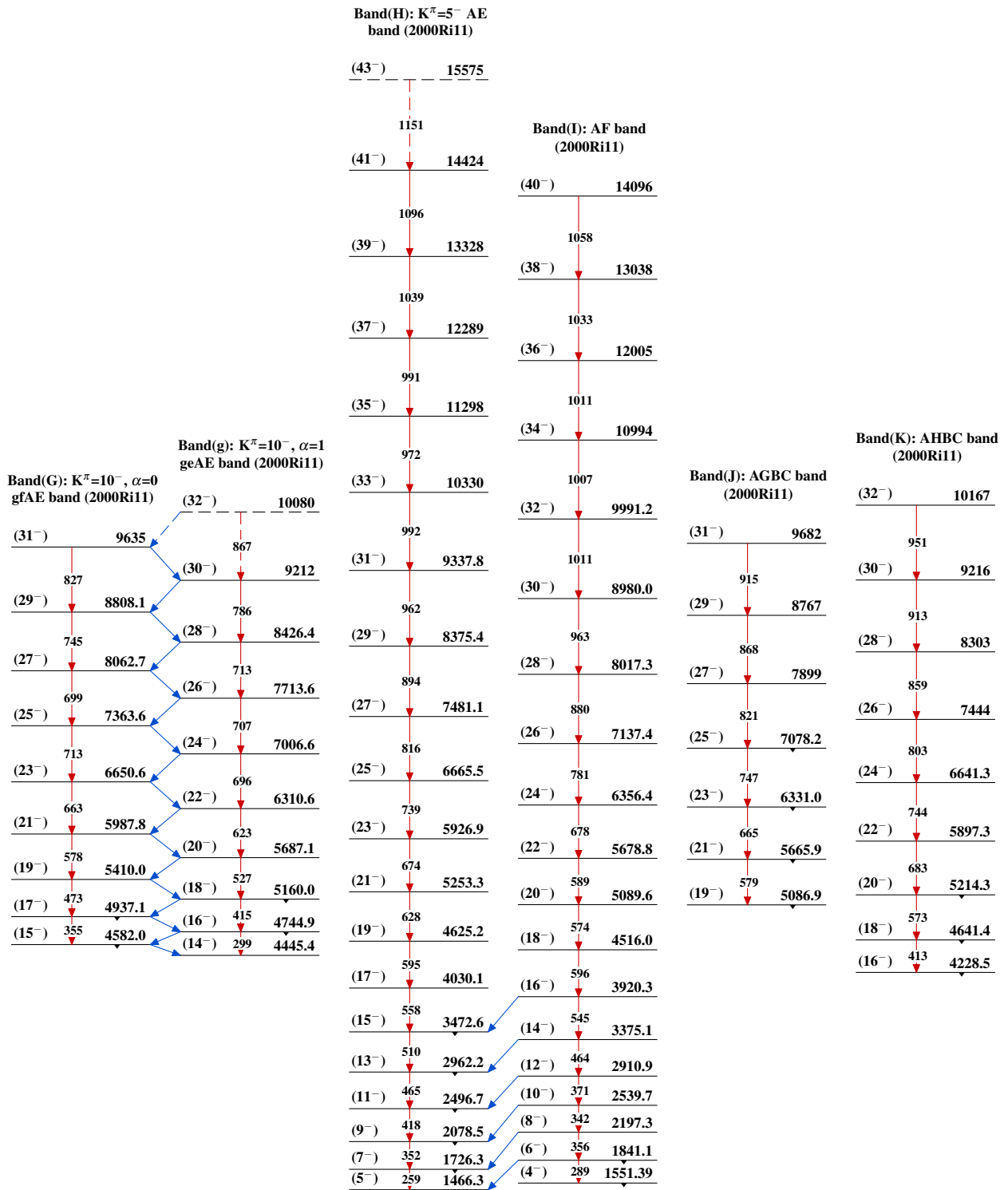


Adopted Levels, Gammas**Level Scheme (continued)**

Intensities: Relative photon branching from each level



Adopted Levels, Gammas

Adopted Levels, Gammas (continued)

Adopted Levels, Gammas (continued)

Band(N): Band 1 (2000Ri11)

	2240.0+y
335	1905.0+y
658	
323	1582.0+y
631	
308	1274.0+y
605	
297	977.0+y
577	
280	697.0+y
539	
259	438.0+y
493	
204	204.0+y
	0.0+y

Band(O): Band 2 (2000Ri11)

	4083.1+x
418	3665.0+x
827	
409	3256.1+x
804	
396	2860.7+x
780	
385	2475.9+x
765	
380	2095.8+x
741	
361	1734.9+x
708	
347	1387.7+x
671	
323	1064.1+x
629	
305	759.0+x
578	
273	486.0+x
523	
250	236.0+x
486	
236	0.0+x

Band(L): BE band
(2000Ri11)

(26 ⁻)	7770
792	
(24 ⁻)	6978
735	
(22 ⁻)	6243
733	
(20 ⁻)	5510.5
687	
(18 ⁻)	4823.5
660	
(16 ⁻)	4163.5
578	
(14 ⁻)	3585.6
500	
(12 ⁻)	3085.8
406	
(10 ⁻)	2680.1
304	
(8 ⁻)	2376.5

Band(M): BF band
(2000Ri11)

(25 ⁻)	7314
783	
(23 ⁻)	6531
747	
(21 ⁻)	5784.4
713	
(19 ⁻)	5071.4
671	
(17 ⁻)	4400.4
621	
(15 ⁻)	3779.4
548	
(13 ⁻)	3231.4
438	
(11 ⁻)	2793.1

Band(P): Band 3
(2000Ri11)

(25 ⁺)	7342
806	
(23 ⁺)	6536.5
738	
(21 ⁺)	5798.5
641	
(19 ⁺)	5157.5

Band(Q): K^π=2⁺
γ-vibrational band

(5 ⁺)	1418.9
413	
(3 ⁺)	1007.16
809.96	
(2 ⁺)	