^{180}Hf(^{7}Li,3nγ) 2005Wh04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Coral M. Baglin	NDS 111,275 (2010)	1-Oct-2009

E=30 MeV; CAESAR array of six Compton-suppressed co-axial Ge detectors and two unsuppressed planar Ge LEPS; measured Eγ, Iγ, $\gamma\gamma$ coin, $\gamma\gamma(\theta)$ (DCO), $T_{1/2}$.

^{184}Re Levels

E(level)[†]	J^{π}[#]	$T_{1/2}$[‡]	Comments
0.0[@]	3^-	35.4 d *7*	$T_{1/2}$: from Adopted Levels.
56?[i]	(1^-)		E(level): from Adopted Levels; energy held fixed In least-squares fit.
74.02[d] *16*	$2^{(-)}$		
104.86[@] *12*	4^-		
141.94[d] *14*	$3^{(-)}$		
188.0463[g] *17*	$8^{(+)}$	169 d *8*	%IT=74.5 *8*; %ε=25.5 *8* E(level),$T_{1/2}$: from Adopted Levels.
237.24[@] *13*	5^-		
242.19[d] *19*	$4^{(-)}$		
256.60?[i] *20*	(3^-)		
311.69[&] *13*	4^-	<6 ns	
347.65[b] *16*	6^-	8.1 ns *8*	
368.85[d] *19*	$5^{(-)}$		
389.1 *3*	(5^+)		J^{π}: possible bandhead for ν 1/2[510] + π 9/2[514] configuration. No deexciting transition observed; either an isomeric state with $T_{1/2}$>>1 μs or, alternatively, a state whose decay is fragmented over many levels.
397.09[@] *15*	6^-		
445.98[g] *13*	(9^+)		
472.84[&] *13*	5^-		
527.53[d] *21*	$6^{(-)}$		
554.1?[i] *3*	(5^-)		
566.07[b] *18*	7^-		
584.03[@] *15*	7^-		
662.14[&] *15*	6^-		
684.63[a] *18*	(4^+)		
702.93[e] *18*	$(5^-,6^-)$	<4 ns	
709.18[d] *23*	$7^{(-)}$		
715.5[c] *3*	(8^+)		
727.86[g] *14*	(10^+)		
795.35[@] *19*	8^-		
804.4[a] *3*	(5^+)		
810.32[b] *17*	8^-		
821.98[e] *23*	$(7^-,8^-)$		
825.50 *14*	(9^-)	<5 ns	
854.1[m] *3*	(8^-)		
864.60 *24*			
878.41[&] *18*	7^-		
887.1[n] *3*	$(6^-,7^-)$		
891.2[c] *3*	(9^+)		
917.00[f] *16*	(10^-)	<5 ns	
922.15[d] *24*	(8^-)		

Continued on next page (footnotes at end of table)

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)

^{184}Re Levels (continued)

E(level)[†]	Jπ[#]	E(level)[†]	Jπ[#]	T1/2[‡]	E(level)[†]	Jπ[#]	T1/2[‡]
951.6[a] 4	(6+)	1367.4[b] 3	(10−)		1843.3[c] 5	(13+)	
955.0?[i] 4	(7−)	1385.96[&] 23	(9−)		1854.9[e] 4	(13−,14−)	
970.00[h] 18	(9+)	1400.5[e] 4	(11−,12−)		1911.52[f] 24	(14−)	
1032.23[g] 17	(11+)	1406.17[m] 23	(10−)		1927.28 22	(13−)	
1033.36[@] 21	9−	1407.8[n] 3	(10−,11−)		1971.53[l] 23	(13−)	
1055.0[e] 3	(9−,10−)	1417.6[d] 3	(10−)		2002.5?[d] 3	(12−)	
1069.32[b] 21	(9−)	1479.74[l] 18	(11−)		2060.1[g] 3	(14+)	
1074.2[m] 3	(9−)	1499.97[h] 17	(11+)		2123.4[j] 3	(14−)	
1091.7[c] 3	(10+)	1519.7 4	(10)		2160.4 3	(14)	
1097.3[n] 3	(8−,9−)	1543.18[j] 22	(12−)	<6 ns	2163.7[k] 4	(15)	
1120.80[&] 20	(8−)	1572.3[c] 4	(12+)		2181.0?[@] 4	(13−)	
1122.91[f] 18	(11−)	1579.2[@] 3	(11−)		2192.0 4	(15)	
1125.8[a] 4	(7+)	1626.40[f] 22	(13−)		2219.9[f] 3	(15−)	
1155.9[d] 3	(9−)	1675.6[&] 3	(10−)		2406.2 4	(16)	<5 ns
1185.33 17	(10−)	1677.2[b] 3	(11−)		2412.5[e] 4	(15−,16−)	
1205.8 4	(8)	1699.9[d] 3	(11−)		2432.0?[g] 3	(15+)	
1221.06[h] 17	(10+)	1700.63[g] 22	(13+)		2433.3[j] 3	(15−)	
1293.20 24	(10−)	1717.92[l] 19	(12−)		2511.6[k] 4	(16)	
1298.55[@] 24	(10−)	1803.90[h] 21	(12+)		2657.3 4	(17)	
1320.3[c] 4	(11+)	1819.5[n] 4	(12−,13−)		2991.5? 5	(18)	
1357.23[g] 19	(12+)	1826.1[j] 3	(13−)				
1361.65[f] 19	(12−)	1834.0[k] 3	(14)	<5 ns			

[†] from least-squares fit to Eγ, holding E(56 level) and E(188 level) fixed At adopted values; the 3 keV uncertainty In E(56 level) has not been included here.

[‡] from xγ(t) or γγ(t) (2005Wh04) .

[#] Authors′ values, based on deduced band structure and supported by calculated (g_K-g_R) values, alignments and available configurations.

[@] Band(A): $K^\pi=3^-$ 1/2[510]+5/2[402] band. Average (g_K-g_R)=0.74 3 (J=5-10) cf. expected value of +0.72 5 for this configuration; low alignment.

[&] Band(B): $K^\pi=4^-$ 3/2[512]+5/2[402] band. Average (g_K-g_R)=0.80 5 (J=6-10) cf. expected value of +0.80 5 for this configuration; low alignment.

[a] Band(C): $K^\pi=4^+$ 1/2[510]−9/2[514] (?) band. (g_K-g_R) >0.41 (for J=6) cf. expected value of +1.37 5 for this configuration; low alignment.

[b] Band(D): $K^\pi=6^-$ 7/2[503]+5/2[402] band. Average (g_K-g_R)=0.13 1 (J=8,9) cf. expected value of +0.15 5 for this configuration; low alignment.

[c] Band(E): $K^\pi=8^+$ 7/2[503]+9/2[514] (?) band. Average (g_K-g_R)=0.29 2 (J=10,11) cf. expected value of +0.27 5 for this configuration.

[d] Band(F): $K^\pi=2^-$ 1/2[510]−5/2[402] band. Average (g_K-g_R)=1.54 6 (J=5-12) cf. expected value of +2.10 5 for this configuration; low alignment.

[e] Band(G): $K^\pi=5^-,6^-$ 11/2[615]⊗1/2[541] (?) band. Average (g_K-g_R)=0.19 3 (J=10,12) cf. expected value of −0.02 5 for this configuration if J=6 or 0.14 3 (J=11,13) cf. −0.44 5 if J=5, thus favoring J=6 (in table 1, only the higher spin value is given for each level); large alignment (3.3-6.5) consistent with (π $h_{11/2}$)⊗(ν $i_{13/2}$) configuration.

[f] Band(H): $K^\pi=10^-$ 11/2[615]+9/2[514] (?) band. Average (g_K-g_R)=0.17 1 (J=12-15) cf. expected value of +0.16 5 for this configuration.

[g] Band(I): $K^\pi=8^+$ 11/2[615]+5/2[402] band. Average (g_K-g_R)=0.15 1 (J=10-13) cf. expected value of +0.04 5 for this

Continued on next page (footnotes at end of table)

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)

^{184}Re Levels (continued)

configuration; low alignment; transition energies close to those for 5/2[402] band In ^{183}Re.

[h] Band(J): $K^{\pi}=7^{+}$ 9/2[624]+5/2[402] (?) band. (g_K-g_R)=0.26 *3* (J=11) cf. expected value of +0.11 *5* for this configuration.

[i] Band(K): $K^{\pi}=1^{-}$ 3/2[512]−5/2[402] (?) band.

[j] Band(L): Band based on (12⁻) 1543 level. Average (g_K-g_R)=0.066 *13* (J=14,15) cf. expected value of −0.09 *5* for this configuration.

[k] Band(M): Band based on (14) 1834 level. (g_K-g_R)=0.05 *3* (J=16) cf. expected value of −0.12 *5* for this configuration.

[l] Band(N): Band based on (11⁻) 1480 level. (g_K-g_R)>0.13 (J=13) cf. expected value of +0.22 *5* for this configuration.

[m] Band(O): Band based on (8⁻) 854 level.

[n] Band(P): Band based on (6⁻,7⁻) 887 level. In table 1, only the higher spin value is given for each level.

γ(^{184}Re)

E_γ	I_γ	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
67.9 *2*	21 *5*	141.94	3$^{(-)}$	74.02	2$^{(-)}$	[M1]	2.75 *5*	
74.0 *2*	6 *5*	74.02	2$^{(-)}$	0.0	3⁻			
91.5 *2*	11.4 *5*	917.00	(10⁻)	825.50	(9⁻)	(M1,E2)	6.3 *4*	α(exp)=3.8 *10* Mult.: not E1 from α(exp), but α(exp)<α(K)(E2) and <α(K)(M1).
100.3 *2*	13 *5*	242.19	4$^{(-)}$	141.94	3$^{(-)}$			
104.9 *2*	50 *15*	104.86	4⁻	0.0	3⁻			
110.4 *2*	11.7 *4*	347.65	6⁻	237.24	5⁻	M1[‡]	3.89	α(exp)=3.3 *3* Mult.: from α(exp) and R(DCO)=1.05 *18* (gated on ΔJ=1, 105γ).
119.1 *2*	5.3 *2*	821.98	(7⁻,8⁻)	702.93	(5⁻,6⁻)	(Q)		Mult.: R(DCO)=1.25 *22*; gated on ΔJ=1, 334γ.
119.8 *2*	0.71 *8*	804.4	(5⁺)	684.63	(4⁺)			
126.7 *2*	18.3 *8*	368.85	5$^{(-)}$	242.19	4$^{(-)}$	D		Mult.: R(DCO)=0.93 *14*; gated on ΔJ=1, 100γ.
132.5 *2*	45.9 *16*	237.24	5⁻	104.86	4⁻	D+Q		Mult.: R(DCO)=0.78 *3*; gated on ΔJ=1, 105γ.
141.9 *2*	1.11 *14*	141.94	3$^{(-)}$	0.0	3⁻			
147.2 *2*	0.69 *7*	951.6	(6⁺)	804.4	(5⁺)			
149.4 *2*	3.77 *15*	715.5	(8⁺)	566.07	7⁻	E1[‡]	0.1360	α(exp)=0.39 *12* Mult.: from α(exp).
158.7 *2*	8.6 *4*	527.53	6$^{(-)}$	368.85	5$^{(-)}$	D		Mult.: R(DCO)=1.02 *10*; gated on ΔJ=1, 127γ.
159.9 *2*	17.3 *6*	397.09	6⁻	237.24	5⁻	D		Mult.: R(DCO)=0.95 *5*; gated on ΔJ=1, 133γ.
161.1 *2*	5.4 *2*	472.84	5⁻	311.69	4⁻	D		Mult.: R(DCO)=1.03 *11*; gated on ΔJ=1, 312γ.
169.1 *2*	0.30 *10*	566.07	7⁻	397.09	6⁻			
174.2[@] *2*	0.45 *7*	1125.8	(7⁺)	951.6	(6⁺)			
175.8 *2*	1.86 *8*	891.2	(9⁺)	715.5	(8⁺)			
181.5 *2*	1.09 *6*	1543.18	(12⁻)	1361.65	(12⁻)			
181.8 *2*	6.1 *3*	709.18	7$^{(-)}$	527.53	6$^{(-)}$	D		Mult.: R(DCO)=1.06 *14*; gated on ΔJ=1, 159γ.
184.2 *2*	1.56 *12*	887.1	(6⁻,7⁻)	702.93	(5⁻,6⁻)			
187.0 *2*	11.7 *4*	584.03	7⁻	397.09	6⁻	D		Mult.: R(DCO)=0.98 *11*; gated on ΔJ=1, 133γ.
189.5 *2*	4.5 *2*	662.14	6⁻	472.84	5⁻	D+Q		Mult.: R(DCO)=0.68 *11*; gated on ΔJ=1, 312γ.
200.6 *2*	0.7 *4*	256.60?	(3⁻)	56?	(1⁻)			
200.6 *2*	1.28 *6*	1091.7	(10⁺)	891.2	(9⁺)			
206.0 *2*	26.1 *9*	1122.91	(11⁻)	917.00	(10⁻)			
206.9 *2*	8.5 *6*	311.69	4⁻	104.86	4⁻			

Continued on next page (footnotes at end of table)

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)

γ(^{184}Re) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
211.4 *2*	7.2 *3*	795.35	8^-	584.03	7^-	D	Mult.: R(DCO)=1.08 *19*; gated on ΔJ=1, 133γ.
213.0 *2*	4.1 *2*	922.15	(8^-)	709.18	$7^{(-)}$	(D)	Mult.: R(DCO)=1.01 *23*; gated on ΔJ=1, 182γ.
216.4 *2*	2.12 *12*	878.41	7^-	662.14	6^-	D+Q	Mult.: R(DCO)=0.53 *10*; gated on ΔJ=1, 312γ.
218.5 *2*	33.0 *11*	566.07	7^-	347.65	6^-	D(+Q)	Mult.: R(DCO)=0.80 *6*; gated on ΔJ=1, 105γ.
226.3 *2*	1.48 *10*	810.32	8^-	584.03	7^-		
226.8 *2*	2.8 *3*	368.85	$5^{(-)}$	141.94	$3^{(-)}$		
228.6 *2*	1.09 *5*	1320.3	(11^+)	1091.7	(10^+)		
233.0 *2*	9.4 *3*	1055.0	$(9^-,10^-)$	821.98	$(7^-,8^-)$	Q	Mult.: R(DCO)=1.38 *9*; gated on ΔJ=1, 334γ.
233.8 *2*	2.36 *12*	1155.9	(9^-)	922.15	(8^-)		
235.7 *2*	1.96 *14*	472.84	5^-	237.24	5^-		
237.3 *2*	7.9 *4*	237.24	5^-	0.0	3^-		
238.1 *2*	4.4 *2*	1033.36	9^-	795.35	8^-	D	Mult.: R(DCO)=1.01 *11*; gated on ΔJ=1, 211γ.
238.3 *2*	0.92 *10*	1717.92	(12^-)	1479.74	(11^-)		
238.8 *2*	9.8 *3*	1361.65	(12^-)	1122.91	(11^-)	D	Mult.: R(DCO)=1.05 *6*; gated on ΔJ=1, 206γ.
242.5 *2*	1.37 *8*	1120.80	(8^-)	878.41	7^-	D(+Q)	Mult.: R(DCO)=0.79 *22*; gated on ΔJ=1, 216γ.
242.8 *2*	3.6 *2*	347.65	6^-	104.86	4^-		
244.5 *2*	4.1 *2*	810.32	8^-	566.07	7^-		
251.1 *2*	0.74 *6*	1221.06	(10^+)	970.00	(9^+)		
251.1 *2*	1.17 *6*	2657.3	(17)	2406.2	(16)		
252.0 *2*	0.36 *4*	1572.3	(12^+)	1320.3	(11^+)		
253.5[@] *2*	0.18 *7*	1971.53	(13^-)	1717.92	(12^-)		
257.9 *2*	40 *15*	445.98	(9^+)	188.0463	$8^{(+)}$		
259.0 *2*	1.21 *11*	1069.32	(9^-)	810.32	8^-		
259.8 *2*	1.52 *9*	1293.20	(10^-)	1033.36	9^-		
261.8 *2*	1.35 *9*	1417.6	(10^-)	1155.9	(9^-)		
264.8 *2*	3.27 *14*	1626.40	(13^-)	1361.65	(12^-)	D	Mult.: R(DCO)=1.15 *7*; gated on ΔJ=1, 239γ.
265.2 *2*	0.86 *7*	1385.96	(9^-)	1120.80	(8^-)		
265.3 *2*	1.70 *10*	1298.55	(10^-)	1033.36	9^-		
268.5 *2*	0.58 *11*	1185.33	(10^-)	917.00	(10^-)		
271.0 *2*	0.22 *4*	1843.3	(13^+)	1572.3	(12^+)		
275.4 *2*	1.85 *12*	1097.3	$(8^-,9^-)$	821.98	$(7^-,8^-)$		
279.0 *2*	0.50 *6*	1499.97	(11^+)	1221.06	(10^+)		
282.0 *2*	24.2 *8*	727.86	(10^+)	445.98	(9^+)		
282.3 *2*	0.62 *7*	1699.9	(11^-)	1417.6	(10^-)		
282.8 *2*	3.34 *14*	1826.1	(13^-)	1543.18	(12^-)		
285.1 *2*	1.37 *8*	1911.52	(14^-)	1626.40	(13^-)	D+Q	Mult.: R(DCO)=0.71 *19*; gated on ΔJ=1, 265γ.
285.4 *2*	2.2 *2*	527.53	$6^{(-)}$	242.19	$4^{(-)}$		
288.0 *2*	1.53 *11*	854.1	(8^-)	566.07	7^-	D	Mult.: R(DCO)=1.05 *11*; gated on ΔJ=1, 219γ.
289.6 *2*	0.37 *5*	1675.6	(10^-)	1385.96	(9^-)		
290.8 *2*	6.8 *3*	1834.0	(14)	1543.18	(12^-)		
292.2 *2*	7.9 *4*	397.09	6^-	104.86	4^-		
294.4 *2*	1.75 *11*	821.98	$(7^-,8^-)$	527.53	$6^{(-)}$		
294.4 *2*	1.02 *9*	1479.74	(11^-)	1185.33	(10^-)		
297.3 *2*	1.05 *8*	2123.4	(14^-)	1826.1	(13^-)		
297.5 *2*	0.7 *1*	554.1?	(5^-)	256.60?	(3^-)		
302.7[@] *2*	0.16 *6*	2002.5?	(12^-)	1699.9	(11^-)		
304.5 *2*	7.9 *3*	1032.23	(11^+)	727.86	(10^+)		
305.9 *2*	2.24 *14*	702.93	$(5^-,6^-)$	397.09	6^-		
308.3 *2*	0.51 *5*	2219.9	(15^-)	1911.52	(14^-)		
310.0 *2*	0.32 *5*	2433.3	(15^-)	2123.4	(14^-)		
310.5 *2*	0.21 *5*	1407.8	$(10^-,11^-)$	1097.3	$(8^-,9^-)$		
311.6 *2*	12.9 *11*	311.69	4^-	0.0	3^-		
313.8 *2*	3.4 *3*	702.93	$(5^-,6^-)$	389.1	(5^+)		
318.7 *2*	1.32 *10*	1205.8	(8)	887.1	$(6^-,7^-)$		
325.2 *2*	2.73 *13*	1357.23	(12^+)	1032.23	(11^+)	D	Mult.: R(DCO)=0.99 *9*; gated on ΔJ=1, 258γ.

Continued on next page (footnotes at end of table)

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)

γ(^{184}Re) (continued)

E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
329.8 *2*	2.46 *11*	2163.7	(15)	1834.0	(14)		
334.1 *2*	10.4 *4*	702.93	(5$^-$,6$^-$)	368.85	5$^{(-)}$	(D)	Mult.: R(DCO)=1.16 *14*; gated on ΔJ=1, 127γ.
334.2[@] *2*	0.25 *4*	2991.5?	(18)	2657.3	(17)		
336.8 *2*	0.85 *8*	1406.17	(10$^-$)	1069.32	(9$^-$)		
340.2 *2*	2.4 *2*	709.18	7$^{(-)}$	368.85	5$^{(-)}$		
343.5 *2*	0.85 *8*	1700.63	(13$^+$)	1357.23	(12$^+$)		
345.5 *2*	4.5 *2*	1400.5	(11$^-$,12$^-$)	1055.0	(9$^-$,10$^-$)	Q	Mult.: R(DCO)=1.09 *8*; gated on ΔJ=2, 233γ.
346.8 *2*	8.4 *4*	584.03	7$^-$	237.24	5$^-$	(Q)	Mult.: R(DCO)=1.26 *17*; gated on ΔJ=1, 211γ.
348.0 *2*	0.32 *4*	2511.6	(16)	2163.7	(15)		
350.4 *2*	0.56 *12*	662.14	6$^-$	311.69	4$^-$		
352.8 *2*	1.56 *9*	1407.8	(10$^-$,11$^-$)	1055.0	(9$^-$,10$^-$)	D+Q	Mult.: R(DCO)=0.44 *7*; gated on ΔJ=2, 233γ.
358.0 *2*	0.27 *5*	2192.0	(15)	1834.0	(14)		
359.8 *2*	5.0 *3*	1185.33	(10$^-$)	825.50	(9$^-$)		
367.7[@] *2*	0.21 *12*	472.84	5$^-$	104.86	4$^-$		
373.0 *2*	2.6 *2*	684.63	(4$^+$)	311.69	4$^-$		
376.1 *2*	0.29 *4*	1091.7	(10$^+$)	715.5	(8$^+$)		
379.6 *2*	3.8 *3*	825.50	(9$^-$)	445.98	(9$^+$)		
384.0 *2*	0.83 *8*	1927.28	(13$^-$)	1543.18	(12$^-$)		
394.6 *2*	2.24 *15*	922.15	(8$^-$)	527.53	6$^{(-)}$		
395.1 *2*	1.03 *9*	1122.91	(11$^-$)	727.86	(10$^+$)		
398.2 *2*	6.3 *3*	795.35	8$^-$	397.09	6$^-$	Q	Mult.: R(DCO)=1.37 *12*; gated on ΔJ=1, 160γ.
400.9 *2*	0.4 *1*	955.0?	(7$^-$)	554.1?	(5$^-$)		
405.5 *2*	0.94 *10*	878.41	7$^-$	472.84	5$^-$		
411.7 *2*	0.23 *5*	1819.5	(12$^-$,13$^-$)	1407.8	(10$^-$,11$^-$)		
413.1 *2*	1.78 *14*	810.32	8$^-$	397.09	6$^-$		
418.9 *2*	0.39 *6*	1819.5	(12$^-$,13$^-$)	1400.5	(11$^-$,12$^-$)		
420.2 *2*	13.7 *5*	1543.18	(12$^-$)	1122.91	(11$^-$)	D+Q	Mult.: R(DCO)=0.39 *2*; gated on ΔJ=1, 420γ.
429.1 *2*	0.38 *4*	1320.3	(11$^+$)	891.2	(9$^+$)		
444.6 *2*	3.2 *2*	1361.65	(12$^-$)	917.00	(10$^-$)		
446.7 *2*	1.85 *13*	1155.9	(9$^-$)	709.18	7$^{(-)}$		
446.8 *2*	0.39 *7*	1803.90	(12$^+$)	1357.23	(12$^+$)		
449.3 *2*	4.4 *2*	1033.36	9$^-$	584.03	7$^-$	Q	Mult.: R(DCO)=1.64 *21*; gated on ΔJ=1, 187γ.
454.4 *2*	1.68 *10*	1854.9	(13$^-$,14$^-$)	1400.5	(11$^-$,12$^-$)		
458.6 *2*	0.72 *8*	1120.80	(8$^-$)	662.14	6$^-$		
460.7 *2*	14.1 *7*	702.93	(5$^-$,6$^-$)	242.19	4$^{(-)}$		
462.6 *2*	5.4 *3*	810.32	8$^-$	347.65	6$^-$		
464.7 *2*	0.35 *7*	1519.7	(10)	1055.0	(9$^-$,10$^-$)		
465.8[@] *2*	0.76 *16*	702.93	(5$^-$,6$^-$)	237.24	5$^-$		
467.8 *2*	1.20 *10*	1499.97	(11$^+$)	1032.23	(11$^+$)	D+Q	Mult.: R(DCO)=0.71 *11*; gated on ΔJ=1, 305γ.
471.0 *2*	6.5 *3*	917.00	(10$^-$)	445.98	(9$^+$)	D(+Q)	Mult.: R(DCO)=0.79 *6*; gated on ΔJ=1, 206γ.
472.9 *2*	0.9 *2*	472.84	5$^-$	0.0	3$^-$		
493.2 *2*	4.1 *2*	1221.06	(10$^+$)	727.86	(10$^+$)	D+Q	Mult.: R(DCO)=0.62 *7*; gated on ΔJ=1, 258γ.
495.4 *2*	0.97 *10*	1417.6	(10$^-$)	922.15	(8$^-$)		
497.9 *2*	1.97 *12*	1293.20	(10$^-$)	795.35	8$^-$		
503.1 *2*	2.32 *14*	1298.55	(10$^-$)	795.35	8$^-$	Q	Mult.: R(DCO)=1.5 *3*; gated on ΔJ=1, 211γ.
503.2 *2*	5.0 *2*	1069.32	(9$^-$)	566.07	7$^-$		
503.5 *2*	2.9 *2*	1626.40	(13$^-$)	1122.91	(11$^-$)	Q	Mult.: R(DCO)=1.44 *17*; gated on ΔJ=1, 206γ.
507.5 *2*	0.63 *8*	1385.96	(9$^-$)	878.41	7$^-$		
508.1 *2*	2.6 *2*	1074.2	(9$^-$)	566.07	7$^-$		
522.5[@] *2*	0.20 *3*	1843.3	(13$^+$)	1320.3	(11$^+$)		
524.0 *2*	8.9 *4*	970.00	(9$^+$)	445.98	(9$^+$)	D	Mult.: R(DCO)=1.06 *3*; gated on ΔJ=1, 258γ.
529.9 *2*	0.70 *7*	1499.97	(11$^+$)	970.00	(9$^+$)		
539.8 *2*	20.4 *11*	727.86	(10$^+$)	188.0463	8$^{(+)}$		
544.0 *2*	0.60 *8*	1699.9	(11$^-$)	1155.9	(9$^-$)		
545.8 *2*	1.52 *10*	1579.2	(11$^-$)	1033.36	9$^-$		

Continued on next page (footnotes at end of table)

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)

γ(^{184}Re) (continued)

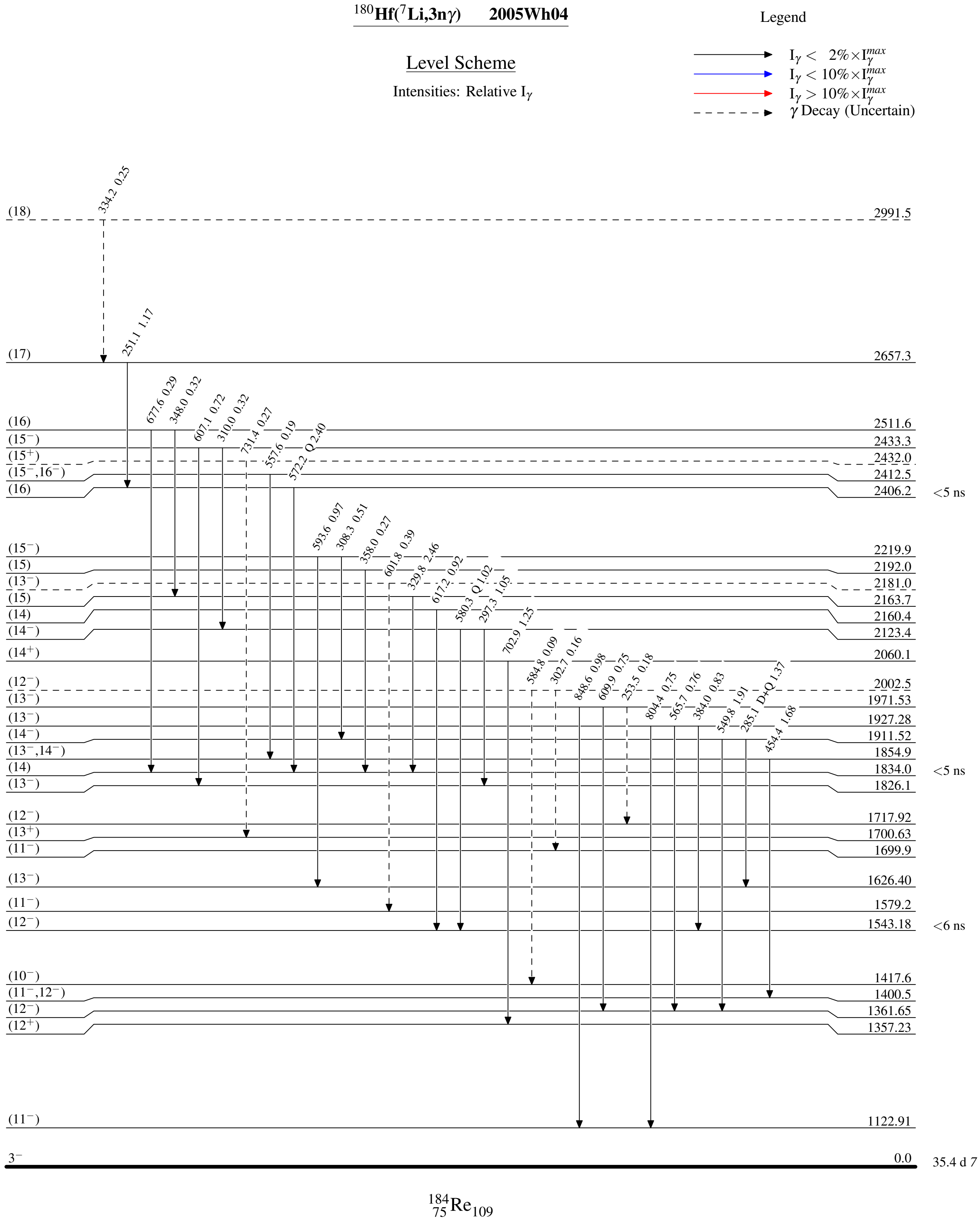
E_γ	I_γ	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	Comments
549.8 *2*	1.91 *12*	1911.52	(14⁻)	1361.65	(12⁻)		
552.9 *2*	0.91 *14*	864.60		311.69	4⁻		
554.6[@] *2*	0.23 *5*	1675.6	(10⁻)	1120.80	(8⁻)		
557.1[@] *2*	0.3 *2*	1367.4	(10⁻)	810.32	8⁻		
557.2 *2*	1.0 *2*	662.14	6⁻	104.86	4⁻		
557.6 *2*	0.19 *5*	2412.5	(15⁻,16⁻)	1854.9	(13⁻,14⁻)		
562.7 *2*	4.5 *3*	1479.74	(11⁻)	917.00	(10⁻)		
565.7 *2*	0.76 *9*	1927.28	(13⁻)	1361.65	(12⁻)		
572.2 *2*	2.40 *12*	2406.2	(16)	1834.0	(14)	Q	Mult.: R(DCO)=1.44 *15*; gated on ΔJ=1, 206γ.
579.7 *2*	4.8 *5*	684.63	(4⁺)	104.86	4⁻		
580.3 *2*	1.02 *10*	2123.4	(14⁻)	1543.18	(12⁻)	Q	Mult.: R(DCO)=1.5 *3*; gated on ΔJ=1, 206γ.
582.7 *2*	0.39 *8*	1803.90	(12⁺)	1221.06	(10⁺)		
584.8[@] *2*	0.09 *7*	2002.5?	(12⁻)	1417.6	(10⁻)		
586.3 *2*	15.8 *6*	1032.23	(11⁺)	445.98	(9⁺)		
593.6 *2*	0.97 *10*	2219.9	(15⁻)	1626.40	(13⁻)		
595.1 *2*	1.25 *14*	1717.92	(12⁻)	1122.91	(11⁻)		
595.9 *2*	2.2 *2*	1406.17	(10⁻)	810.32	8⁻		
601.8[@] *2*	0.39 *7*	2181.0?	(13⁻)	1579.2	(11⁻)		
607.1 *2*	0.72 *8*	2433.3	(15⁻)	1826.1	(13⁻)		
607.9 *2*	0.50 *9*	1677.2	(11⁻)	1069.32	(9⁻)		
609.9 *2*	0.75 *10*	1971.53	(13⁻)	1361.65	(12⁻)		
617.2 *2*	0.92 *10*	2160.4	(14)	1543.18	(12⁻)		
629.4 *2*	8.0 *3*	1357.23	(12⁺)	727.86	(10⁺)		
637.5 *2*	158 *19*	825.50	(9⁻)	188.0463	8$^{(+)}$	D+Q	Mult.: R(DCO)=0.64 *1*; gated on ΔJ=1, 206γ.
654.4 *2*	0.71 *15*	1479.74	(11⁻)	825.50	(9⁻)		
668.3 *2*	3.5 *2*	1700.63	(13⁺)	1032.23	(11⁺)		
677.6 *2*	0.29 *6*	2511.6	(16)	1834.0	(14)		
702.9 *2*	1.25 *12*	2060.1	(14⁺)	1357.23	(12⁺)		
731.4[@] *2*	0.27 *7*	2432.0?	(15⁺)	1700.63	(13⁺)		
739.2 *2*	1.7 *2*	1185.33	(10⁻)	445.98	(9⁺)		
772.0 *2*	0.43 *10*	1499.97	(11⁺)	727.86	(10⁺)		
775.0 *2*	0.98 *14*	1221.06	(10⁺)	445.98	(9⁺)		
800.7 *2*	2.7 *3*	1717.92	(12⁻)	917.00	(10⁻)		
804.4 *2*	0.75 *13*	1927.28	(13⁻)	1122.91	(11⁻)		
848.6 *2*	0.98 *14*	1971.53	(13⁻)	1122.91	(11⁻)		

[†] From R(DCO)=$\varepsilon \times$ [$I_{\gamma 2}$(145°),gated by γ1(97°)] / [$I_{\gamma 2}$(97°),gated by γ1(145°)], where ε=efficiency correction; the specific gating transition, γ1, used is indicated in comment on relevant γ ray. Expected R(DCO)≈1.0 for pure D transitions and≈1.7 for ΔJ=2, Q transitions, when gated by a ΔJ=1, pure D transition. authors consider DCO<1 to provide evidence of D contribution. assignments based on α(exp) are noted In comments on the relevant transitions.

[‡] From α(exp) deduced from intensity balance (2005Wh04).

[#] 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.

[@] Placement of transition in the level scheme is uncertain.

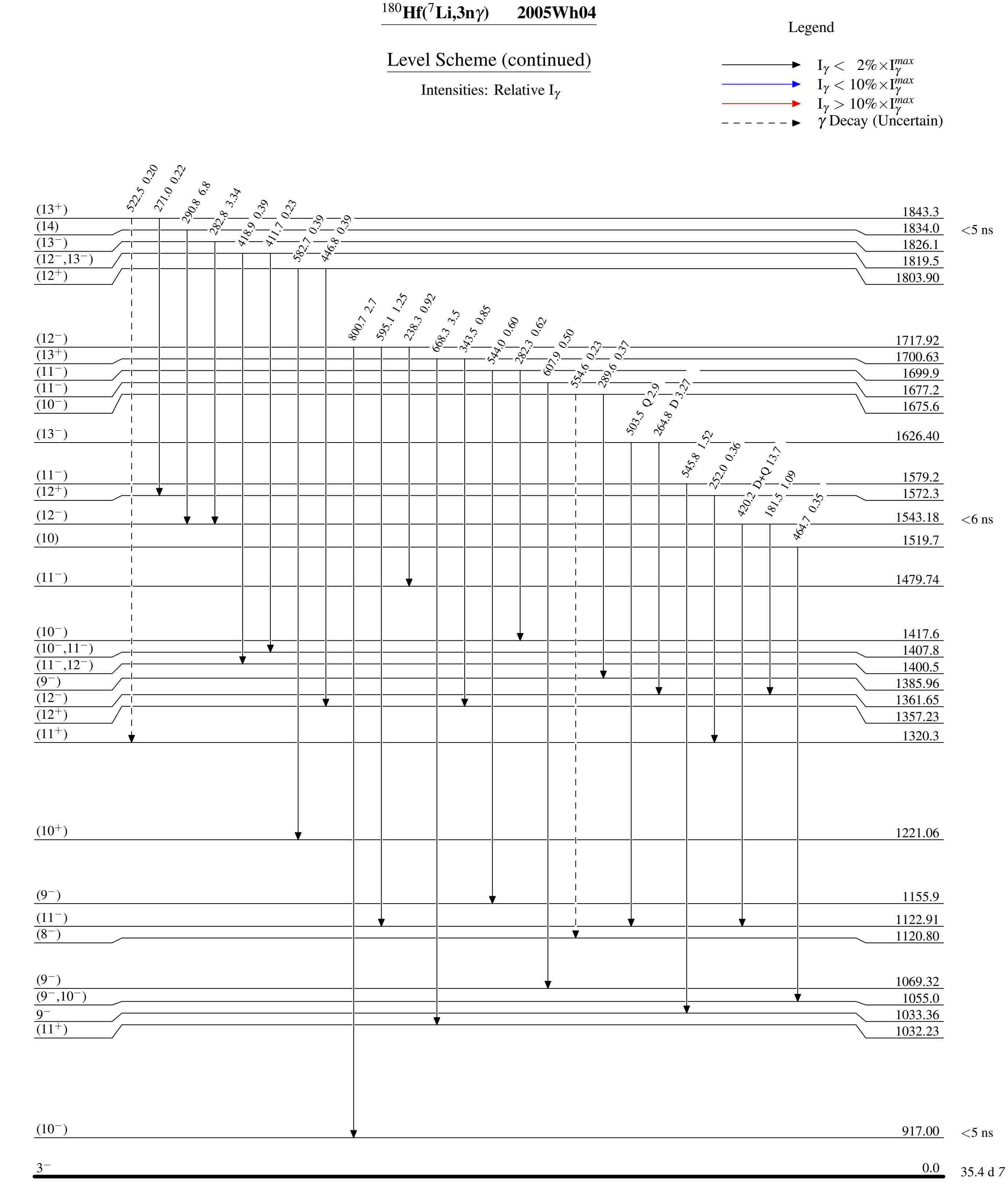


^{180}Hf(^{7}Li,3nγ) 2005Wh04
Level Scheme
Intensities: Relative Iγ
Legend
Iγ < 2%×Iγ^max
Iγ < 10%×Iγ^max
Iγ > 10%×Iγ^max
γ Decay (Uncertain)
334.2 0.25
(18) 2991.5
251.1 1.17
(17) 2657.3
677.6 0.29
348.0 0.32
607.1 0.72
310.0 0.32
731.4 0.27
557.6 0.19
572.2 Q 2.40
(16) 2511.6
(15⁻) 2433.3
(15⁺) 2432.0
(15⁻,16⁻) 2412.5
(16) 2406.2 <5 ns
593.6 0.97
308.3 0.51
358.0 0.27
601.8 0.39
329.8 2.46
617.2 0.92
580.3 Q 1.02
297.3 1.05
702.9 1.25
(15⁻) 2219.9
(15) 2192.0
(13⁻) 2181.0
(15) 2163.7
(14) 2160.4
(14⁻) 2123.4
(14⁺) 2060.1
584.8 0.09
302.7 0.16
848.6 0.98
609.9 0.75
253.5 0.18
804.4 0.75
565.7 0.76
384.0 0.83
549.8 1.91
285.1 D+Q 1.37
454.4 1.68
(12⁻) 2002.5
(13⁻) 1971.53
(13⁻) 1927.28
(14⁻) 1911.52
(13⁻,14⁻) 1854.9
(14) 1834.0 <5 ns
(13⁻) 1826.1
(12⁻) 1717.92
(13⁺) 1700.63
(11⁻) 1699.9
(13⁻) 1626.40
(11⁻) 1579.2
(12⁻) 1543.18 <6 ns
(10⁻) 1417.6
(11⁻,12⁻) 1400.5
(12⁻) 1361.65
(12⁺) 1357.23
(11⁻) 1122.91
3⁻ 0.0 35.4 d 7
$^{184}_{75}$Re$_{109}$

^{180}Hf(^{7}Li,3nγ) 2005Wh04

Level Scheme (continued)

Intensities: Relative I_γ

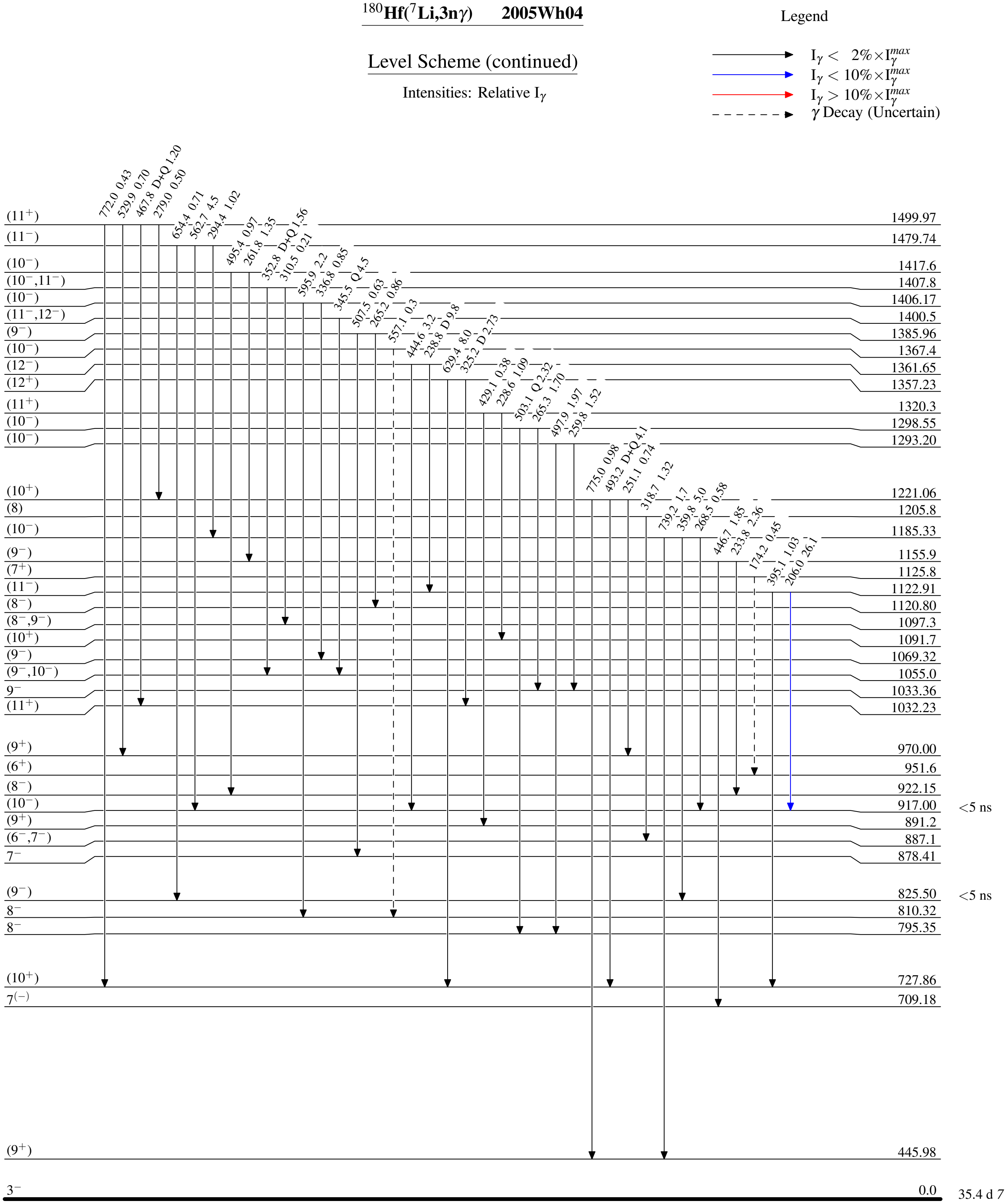


$^{184}_{75}Re_{109}$

^{180}Hf(^{7}Li,3nγ) 2005Wh04

Level Scheme (continued)

Intensities: Relative I_γ

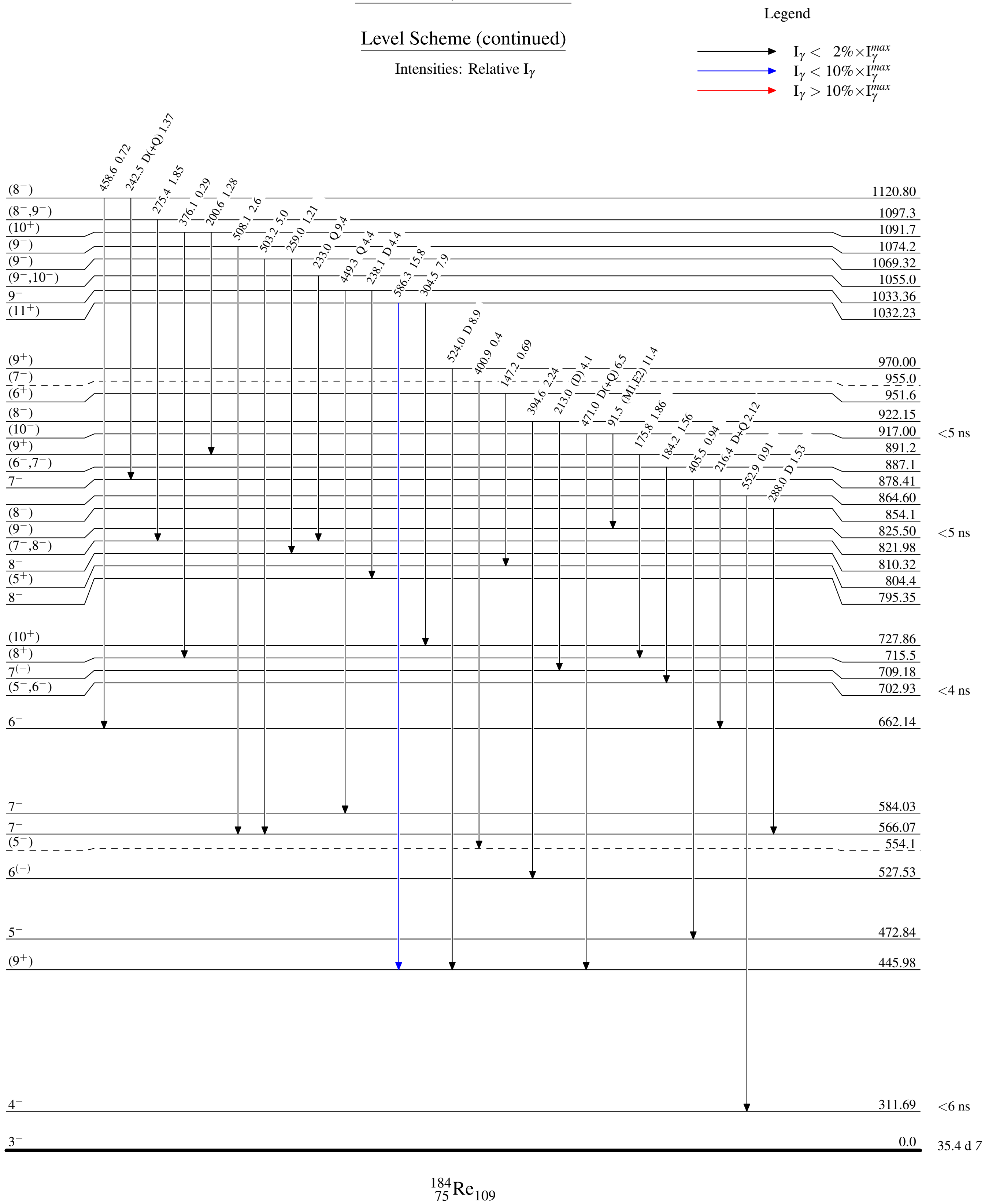


$^{184}_{75}Re_{109}$

^{180}Hf(^{7}Li,3nγ) 2005Wh04

Level Scheme (continued)

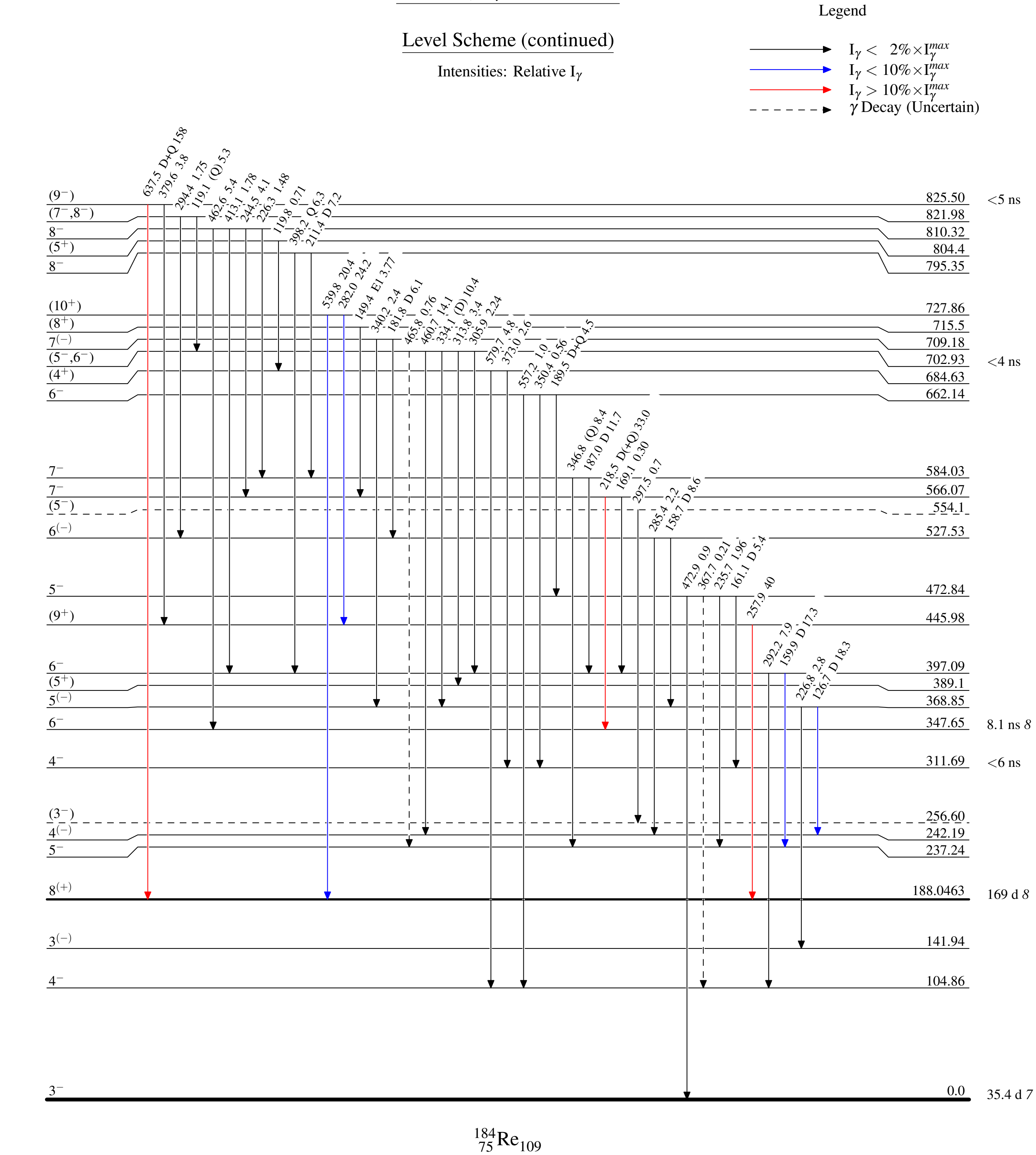
Intensities: Relative I_γ



$^{180}Hf(^{7}Li,3n\gamma)$ 2005Wh04

Level Scheme (continued)

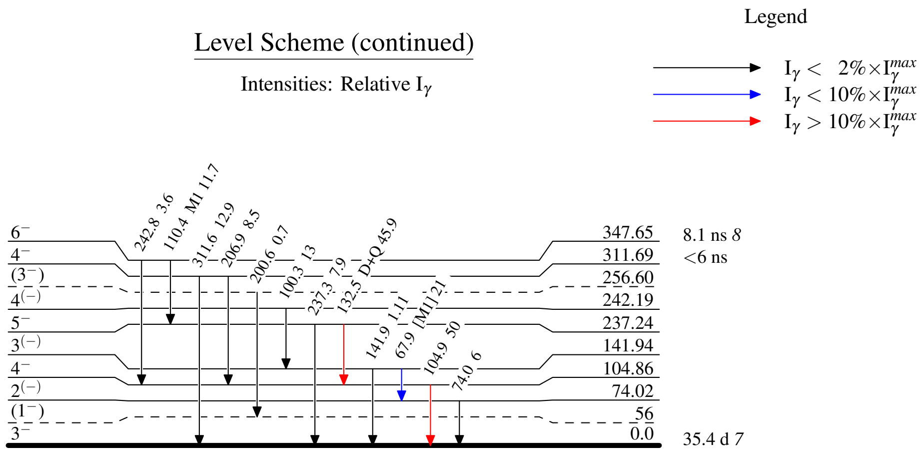
Intensities: Relative I_γ



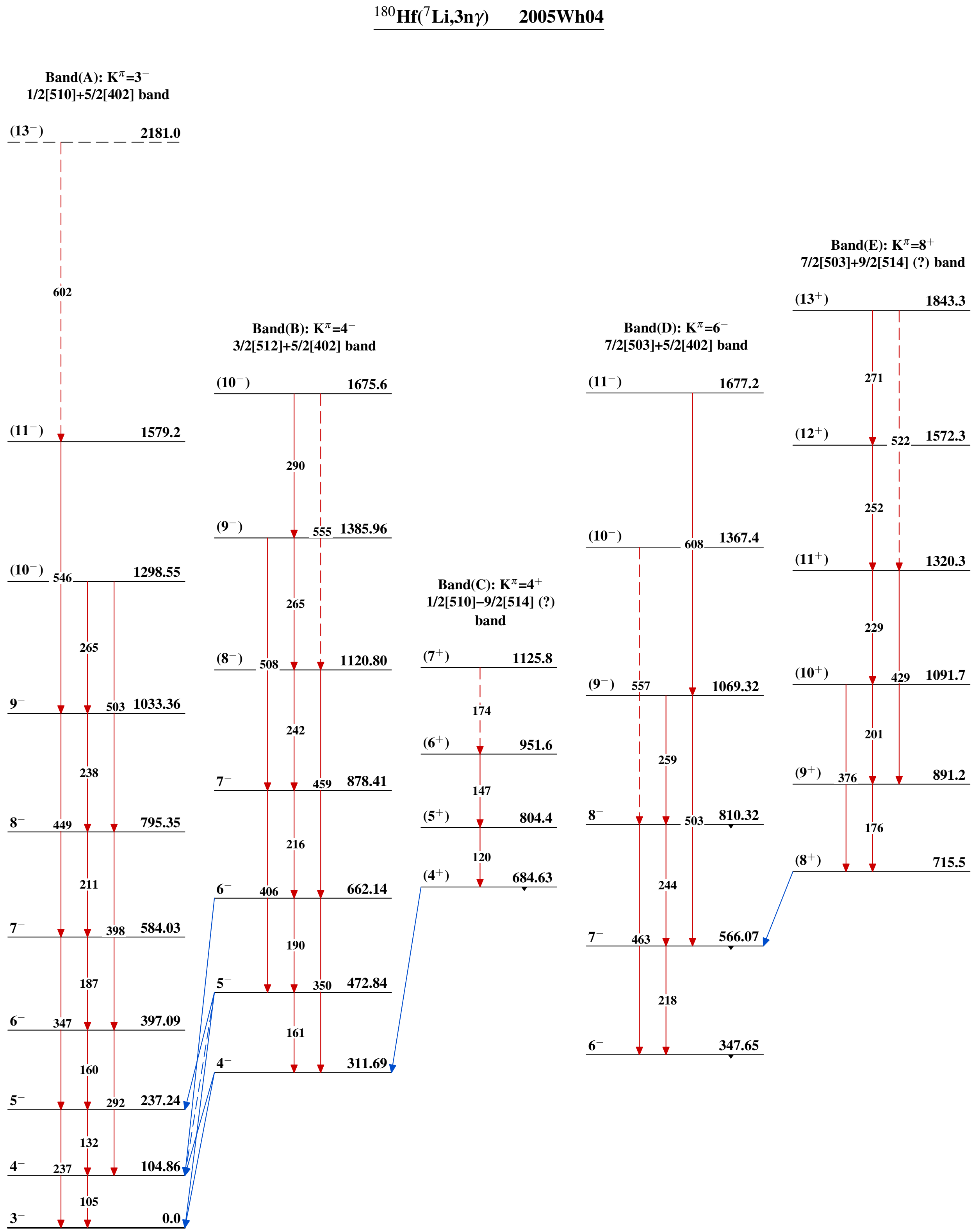
^{180}Hf(^{7}Li,3nγ) 2005Wh04

Level Scheme (continued)

Intensities: Relative I_γ

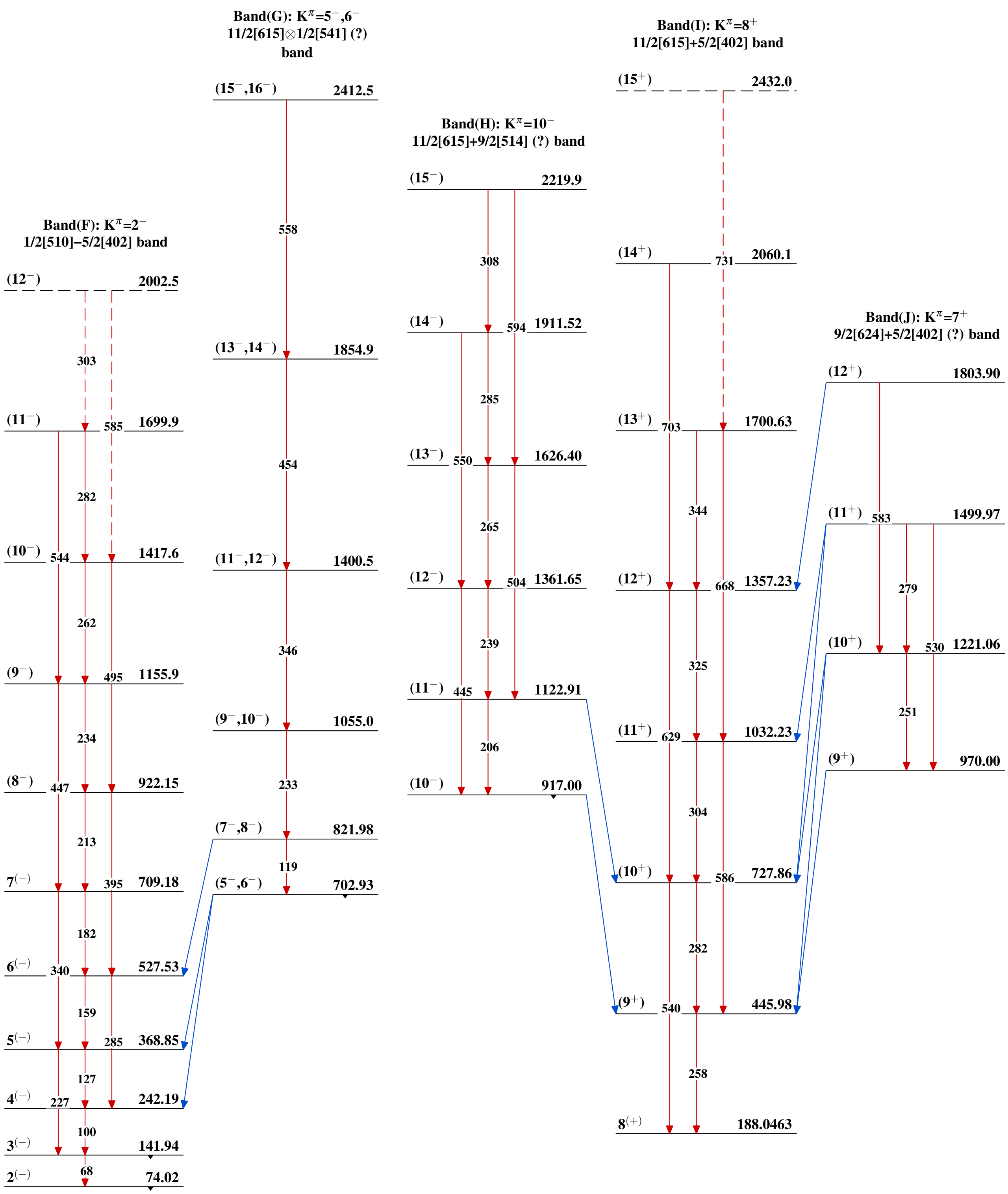


$^{184}_{75}Re_{109}$


^{180}Hf(^{7}Li,3nγ) 2005Wh04
Band(A): $K^{\pi}=3^{-}$
1/2[510]+5/2[402] band
Band(B): $K^{\pi}=4^{-}$
3/2[512]+5/2[402] band
Band(C): $K^{\pi}=4^{+}$
1/2[510]−9/2[514] (?) band
Band(D): $K^{\pi}=6^{-}$
7/2[503]+5/2[402] band
Band(E): $K^{\pi}=8^{+}$
7/2[503]+9/2[514] (?) band
(13⁻) 2181.0
(11⁻) 1579.2
(10⁻) 1298.55
9⁻ 1033.36
8⁻ 795.35
7⁻ 584.03
6⁻ 397.09
5⁻ 237.24
4⁻ 104.86
3⁻ 0.0
(10⁻) 1675.6
(9⁻) 1385.96
(8⁻) 1120.80
7⁻ 878.41
6⁻ 662.14
5⁻ 472.84
4⁻ 311.69
(7⁺) 1125.8
(6⁺) 951.6
(5⁺) 804.4
(4⁺) 684.63
(11⁻) 1677.2
(10⁻) 1367.4
(9⁻) 1069.32
8⁻ 810.32
7⁻ 566.07
6⁻ 347.65
(13⁺) 1843.3
(12⁺) 1572.3
(11⁺) 1320.3
(10⁺) 1091.7
(9⁺) 891.2
(8⁺) 715.5
602 546 265 503 449 238 398 211 187 347 160 292 132 237 105
290 555 265 508 242 459 216 406 190 350 161
174 147 120
608 557 259 503 244 463 218
271 522 252 229 429 201 376 176

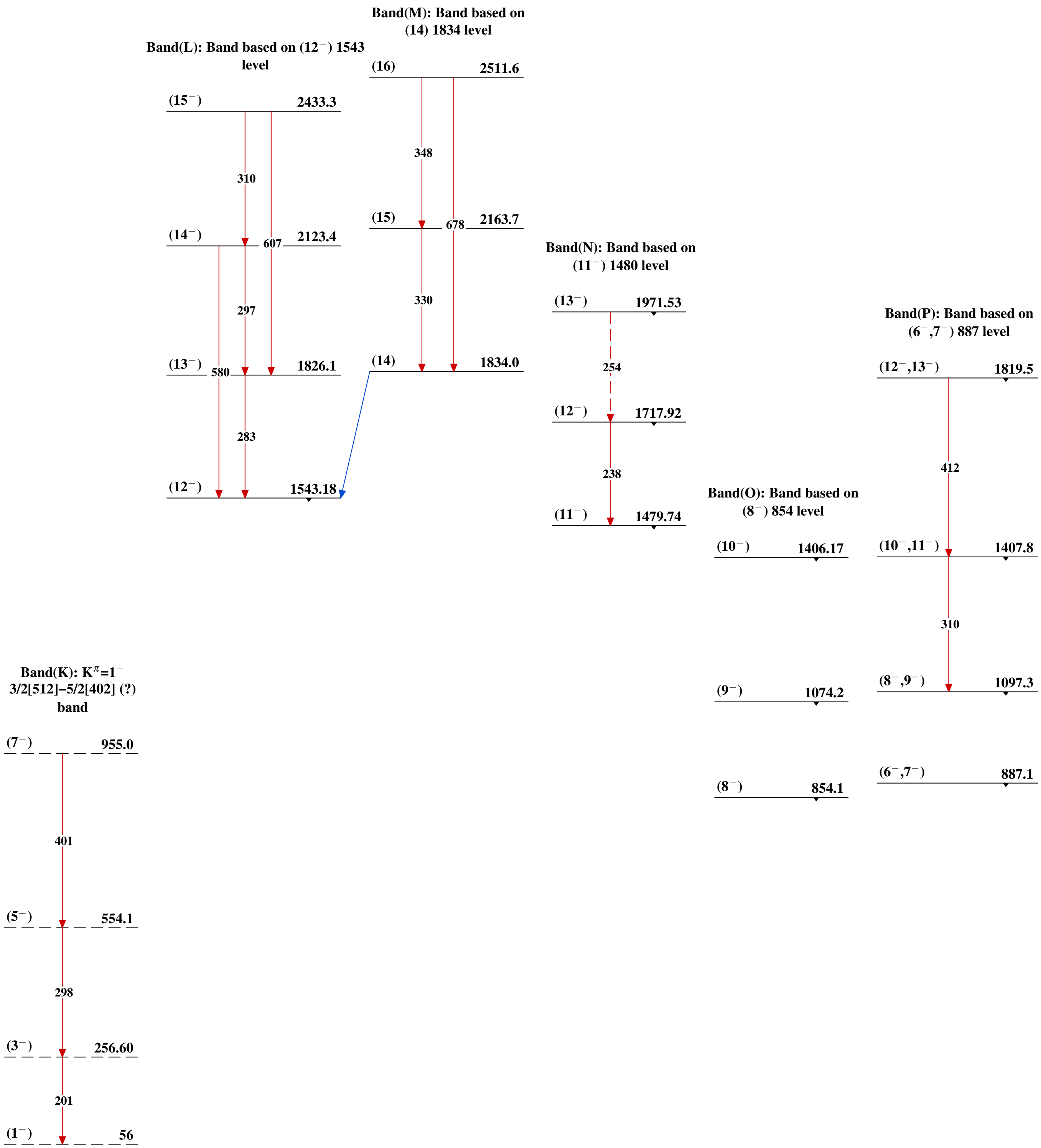
$^{184}_{75}Re_{109}$

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)



$^{184}_{75}Re_{109}$

^{180}Hf(^{7}Li,3nγ) 2005Wh04 (continued)



$^{184}_{75}Re_{109}$