Coulomb excitation

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. J. Martin	NDS 114, 1497 (2013)	31-Aug-2013

Excitation Probabilities

1960El07	(x,x′)	X=P, E=4.5 MeV
		x=d, E=4.5 MeV
1961Be43	(x,x′)	X=P, E=4.5 MeV
		x=d, E=4.5 MeV
		x=α, E=4.5 MeV
1965Yo04	(x,x′γ)	X=^{16}O, E=43.5-48 MeV
1966Se06	(x,x′)	X=^{16}O, E=49 MeV
1968Ke04	(x,x′γ)	X=^{16}O, E=35-50 MeV
1968Ve01	(x,x′)	X=α, E=16.1 MeV
		x=d, E=12.1 MeV
1969Fr10	(x,x′γ)	X=^{16}O, E=48-60 MeV
		x=^{32}S, E=86.7, 110 MeV
1970KaZK	(x,x′γ)	X=^{16}O, E=23-35 MeV
1970Sa09	(x,x′γ)	X=α, E=7-10 MeV
		x=^{16}O, E=25-52 MeV
1971St24	(x,x′)	X=α, E=10-12 MeV
1972McYT	(x,x′γ)	X=α, E=11.3-15.0 MeV
1972Sa42	(x,x′)	X=α, 10.5-12 MeV
1973Br02	(x,x′)	See 1974Br31
1974Br31	(x,x′)	X=α, E=10-20 MeV
1974Do04	(x,x′)	X=^{16}O, E=41.0-59.1 MeV
1974Le09	(x,x′)	X=^{16}O, E=48 MeV
1974Sh12	(x,x′)	X=α, E=8-17 MeV
1974Wo01	(x,x′)	X=α, E=12 MeV
1977Fi01	(x,x′)	X=α, E=11.25-12 MeV
1977Wo03	(x,x′)	X=α, E=11.5-12 MeV

$T_{1/2}$ Measurements

1959Bi10	(x,x′γ)	X=P, E=2.8 MeV: Pulsed Beam
1966As03	(x,x′γ)	X=^{16}O, E=35 MeV: Recoil Distance
1967Wo06	(x,x′γ)	X=P, E=3.5 MeV: Pulsed Beam
1968Ri09	(x,x′)	X=P, E=3.5 MeV: Pulsed Beam
1971Di02	(x,x′γ)	X=^{40}Ar, E Not Given: Recoil Distance
1972Ru07	(x,x′γ)	X=^{35}Cl, E=100 MeV: Recoil Distance
1975Wa15	(x,x′γ)	X=^{35}Cl, E=132-143 MeV: Recoil Distance
1977Ke06	(x,x′γ)	X=^{56}Fe, E=232 MeV: Recoil Distance
		x=^{84}Kr, E=348 MeV
1977Si18	(x,x′γ)	X=^{35}Cl, E=132-143 MeV: Recoil Distance
2000Kl14	(x,x′γ)	X=^{32}S, E=105 MeV: Recoil Distance

g-factor Measurements

1958Go72	(x,x′γ)	X=P, E=2.1 MeV
1967Wo06	(x,x′γ)	X=P, E=3.5 MeV
1970Be36	(x,x′)	X=^{16}O, E=35 MeV
1972Ku10	(x,x′γ)	X=^{16}O, E=35 MeV
1987By02	(x,x′γ)	X=^{58}Ni, E=150, 220 MeV

Eγ, Iγ

2005Ku17 Superseded By 2008Ku10 And 2009KuZX
2008Ku10 (x,x′γ) X=^{152}Sm, E=652 MeV. Superseded By 2009KuZX
2009KuZX See 2008Ku10

Coulomb excitation (continued)

^{152}Sm Levels

The g-factors are from $\gamma(\theta$,H,t) (1987By02). Values are relative to the adopted value for the 122 level.

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
0.0[b]	0^+		
121.77[b] *5*	2^+		g=+0.411 *19* B(E2)↑=3.426 *19* (1977Fi01) $T_{1/2}$: Values from pulsed-beam measurements (ns): 1.45 *6* (1959Bi10), 1.41 *6* (1966As03), 1.47 *5* (1967Wo06), 1.44 *3* (1968Ri09). g: From Adopted Levels. Values from Coulomb excitation are +0.31 *3* (1958Go72, +0.28 *3* (1967Wo06), and +0.30 *3* (1972Ku10). These values are all lower than the adopted value. See discussion in 1992De29. B(E2)↑: OTHERS: 3.40 *15* (1960El07), 3.53 *10* (1961Be43), 3.31 *4* (1970KaZK), 3.39 *3* (1972Sa42), 3.46 *11* (1973Br02), 3.46 *5* (1974Sh12), 3.47 *7* (1974Wo01). these are the values quoted with uncertainties <5%. For a listing of other values, see 2001Ra27.
366.49[b] *5*	4^+	57.7 ps *6*	g=+0.41 *5* Q=−2.6 *14* (1974Le09) B(E4)↑=0.18 *3* g: Others: +0.306 *38* (1972Ku10). B(E4)↑: Weighted average of 0.20 *8* (1971St24), 0.12 *5* (1972Sa42), 0.14 *7* (1973Br02, 1974Br31), 0.21 *9* (1974Wo01), 0.21 *4* (1977Fi01). B(E2)(2^+ to 4^+)=1.90 *7*. Weighted average of 1.89 *9* (1965Go06), 1.98 *16* (1970Sa09), 1.87 *13* (1974Le09). $T_{1/2}$: Weighted average (ps) of 58.9 *18* (1971Di02), 57.4 *9* (1972Ru07), 57.7 *8* (2000Kl14). B(E2) gives $T_{1/2}$=55.2 ps *23*.
684.73[c] *6*	0^+	6.10 ps *14*	$T_{1/2}$: From 2000Kl14. Other: 6.2 ps *4* (1972Ru07).
706.98[b] *5*	6^+	10.30 ps *16*	g=+0.39 *5* B(E2)(4^+ to 6^+)=1.66 *17* (1970Sa09). $T_{1/2}$: Weighted average (ps) of 10.0 *5* (1971Di02), 10.2 *3* (1972Ru07), 10.40 *21* (2000Kl14). B(E2) gives $T_{1/2}$=10.4 ps *11*.
810.39[c] *5*	2^+	7.4 ps *4*	g=+0.37 *9* B(E2)↑=0.0228 *17* $T_{1/2}$: Weighted average of 7.5 ps *6* (2000Kl14) and 7.4 ps *5* from B(E2) with Iγ(810γ)=20.8% 4. B(E2)↑: From 1972McYT. Others: 0.023 *5* (1968Ve01), 0.020 *3* (1977Wo03).
963.34[d] *5*	1^-		
1022.96[c] *5*	4^+	8.3 ps *13*	B(E2)(2^+ to 4^+)≈0.0095 (1969Fr10). $T_{1/2}$: From 2000Kl14. Note that B(E2)(2^+ to 4^+) gives $T_{1/2}$≈4.9 ps.
1041.07[d] *5*	3^-		B(E3)↑=0.134 *14* B(E3)↑: Weighted average of 0.14 *5* (1966Se06), 0.14 *3* (1968Ke04), 0.12 *3* (1968Ve01), 0.135 *+19−18* (1977Wo03).
1083.04[e] *9*	0^+		
1085.89[f] *6*	2^+	1.09 ps *14*	g=+0.40 *10* $T_{1/2}$: From 2000Kl14. B(E2)↑: From $T_{1/2}$ and Iγ(1086γ)=40.65% 12, one gets B(E2)=0.070 *9*. The measured values are 0.068 *12* (1965Yo04), 0.119 *24* (1966Se06), 0.085 *15*(1968Ve01), 0.082 *6* (1972McYT), 0.092 *5* (1977Wo03).
1125.41[b] *6*	8^+	3.06 ps *4*	g=+0.34 *7* $T_{1/2}$: From 2000Kl14. Others(ps): 3.10 *30* (1971Di02), 3.0 *5* (1972Ru07), 3.33 *27* (1977Ke06), 3.08 *17* (1977Si18).
1221.69[d] *6*	5^-		
1233.89[g] *6*	3^+		
1292.82[e] *5*	2^+		

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Coulomb excitation (continued)

^{152}Sm Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	Comments
1310.53[c] 5	6^+		
1371.69[f] 6	4^+	1.1 ps +7−4	$T_{1/2}$: From B(E2)(2^+ to 4^+) and Iγ(1250γ)=21.5% 3. B(E2)(2^+ to 4^+)=0.0063 24 (1969Fr10).
1505.82[d] 6	7^-		
1510.9[h] 6	1^-		
1530.8[i] 3	2^-		
1559.64[g] 7	5^+		
1579.60[h] 20	3^-		B(E3)↑=0.07 2 (1968Ve01)
1609.29[b] 6	10^+	1.38 ps 13	g=+0.37 17 $T_{1/2}$: From 1977Si18.
1612.89[e] 6	4^+		
1649.49[j] 17	2^-		
1659.76[l] 13	0^+		
1666.40[c] 6	8^+		
1680.32[m] 22	1^-		
1682.6[i] 3	4^-		
1728.28[f] 6	6^+		
1730.34[k] 18	3^-		
1755.21[n] 15	0^+		J^{π}: Assigned by 2009KuZX as a $K^{\pi}=0^+$ bandhead. No other band members have been identified.
1756.99[o] 7	4^+		
1764.07[h] 20	5^-		
1768.98[q] 7	2^+		
1776.60[l] 16	2^+		
1779.27[m] 17	3^-		
1803.1[s] 4	5^-		
1821.3[j] 3	4^-		
1879.16[d] 6	9^-		
1891.62[p] 12	5^+		
1892.5[w] 5	0^+		J^{π}: Assigned by 2009KuZX as a $K^{\pi}=0^+$ bandhead. No other band members have been identified.
1906.2 4	(2^+)		
1907.20[r] 19	3^+		
1920.31[t] 15	6^-		
1930.50[i] 15	6^-		
1944.6[&]	(2^+)		
1946.06[g] 9	7^+		
1954.27 10	5^-		
1977.21[m] 20	5^-		
2004.30[e] 8	6^+		
2004.34[h] 12	7^-		
2011.85[#] 15	3^-,4,5^-		J^{π}: From Adopted Levels.
2012.2[#] 2	2^+,3,4^+		J^{π}: From Adopted Levels.
2038.4 6	(1^-)		
2040.85[o] 14	6^+		
2043.8[x] 4	0^+		
2051.6[q] 3	4^+		
2057.37[s] 22	7^-		
2070.90 20	(3^-)		
2079.54[c] 6	10^+		

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Coulomb excitation (continued)

^{152}Sm Levels (continued)

E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]
2091.49 *25*	(1⁻)	2348.76 *8*	(8⁺)	2662.48[f] *7*	10⁺	3352.30[u] *14*	12⁺
2138.12 *13*	(2⁺)	2375.63[g] *11*	9⁺	2736.26[b] *7*	14⁺	3365.09[b] *8*	16⁺
2139.73[f] *6*	8⁺	2388.3[s] *6*	9⁻	2808.9[am] *9*	11⁻	3383.48[d] *9*	15⁻
2148.86[b] *7*	12⁺	2391.7[o] *3*	8⁺	2832.7[g] *4*	11⁺	3390.92[m] *22*	13⁻
2176.67[m] *17*	7⁻	2445.91[m] *9*	9⁻	2833.31[d] *8*	13⁻	3463.53[v] *10*	16⁺
2201.74[i] *11*	8⁻	2458.7[u] *3*	8⁺	2841.92 *11*	(13⁻)	3857.29[c] *10*	16⁺
2215.4[t] *4*	8⁻	2506.34 *13*	(9⁻)	2905.20[u] *11*	10⁺	3931.7[u] *4*	14⁺
2227.75 *22*	(6⁻)	2510.89[i] *21*	10⁻	2976.80[v] *7*	14⁺	3973.3[d] *5*	17⁻
2263.9 *4*	(7⁺)	2517.43 *16*	(11⁻)	3080.6[h] *3*	13⁻	4004.85[v] *17*	18⁺
2285.7 *5*	0,1,2	2525.64[c] *6*	12⁺	3128.37[f] *21*	12⁺	4048.1[@b] *14*	18⁺
2290.38[h] *8*	9⁻	2599.37 *15*	(8⁺)	3262.9 *3*	(12⁺)	4524.9[u] *23*	16⁺
2326.96[d] *7*	11⁻	2639.92[h] *16*	11⁻	3292.80[c] *8*	14⁺	4748.50[b] *18*	20⁺

[†] From a least-squares fit to the Eγ data. above the 2137.9 *4*+ level, only states with probable J≥6 are reported. The only exception is the 2285.7 level with Jπ=0,1,2.

[‡] From 2009KuZX based on band trends. Assignments are given in parens for levels not assigned to a band, and are simply plausible. These assignments agree with the adopted values for levels seen in other reactions and for which other Jπ arguments are given.

[#] 2009KuZX assign the transitions from the 2011.8 and 2012.2 levels to a single level. The division into two levels is based on (n,n′γ).

[@] The authors give two deexciting transitions, with energies 585.98 *8* and 681.54 *5*. These give inconsistent level energies of 4049.51 *12* and 4046.63 *8*, respectively. One or both of these Eγ values must be in error. The evaluator adopts E(level)=4048.1 *14*.

[&] The 902.7 *4* and 982.19 *23* transitions from the 1945 level give inconsistent E(level) values of 1943.8 *4* and 1945.53 *23*, respectively. The evaluator gives a rounded-off E(level) value of 1944.6 from Adopted Levels.

[a] The authors give two deexciting transitions, with energies 728.48 *15* and 930.64 *15*. These give inconsistent level energies of 2808.02 *16* and 2809.80 *16*, respectively. One or both of these Eγ values must be in error. The evaluator adopts E(level)=2808.9 *9*.

[b] Band(A): Kπ=0+(1) g.s. band.

[c] Band(B): Kπ=0+(2) β-vibrational band.

[d] Band(C): Kπ=0−(1) octupole vibrational band.

[e] Band(D): Kπ=0+(3) second β band.

[f] Band(E): Kπ=2+(1) γ-vibrational band (even).

[g] Band(F): Kπ=2+(1) γ-vibrational band (odd).

[h] Band(G): Kπ=1−(1) (odd).

[i] Band(H): Kπ=1−(1) (even).

[j] Band(I): Kπ=2−(1) (even).

[k] Band(J): Kπ=2−(1) (odd).

[l] Band(K): Kπ=0+(4).

[m] Band(L): Kπ=1−(2).

[n] Band(M): Kπ=0+(5).

[o] Band(N): Kπ=4+(1) (even).

[p] Band(O): Kπ=4+(1) (odd).

[q] Band(P): Kπ=2+(2) (even).

[r] Band(Q): Kπ=2+(2) (odd).

[s] Band(R): Kπ=5−(1) (odd).

[t] Band(S): Kπ=5−(1) (even).

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Coulomb excitation (continued)

^{152}Sm Levels (continued)

[u] Band(T): K=?
[v] Band(U): K=?
[w] Band(V): K^{π}=0+(6).
[x] Band(W): K^{π}=0+(7).

$\gamma(^{152}Sm)$

E_{γ} †	I_{γ} †	E_i(level)	J_i^{π}	E_f	J_f^{π}	Comments
89.17 *8*	0.0499 *21*	1310.53	6+	1221.69	5−	
119.5 *10*	0.049 *6*	1083.04	0+	963.34	1−	
121.782	46.6 *5*	121.77	2+	0.0	0+	E_{γ}: Rounded off value from Adopted Gammas. 2009KuZX report 121.47 *3*.
125.70 *14*	0.0156 *15*	810.39	2+	684.73	0+	
134.73 *21*	0.0057 *8*	1891.62	5+	1756.99	4+	
137.16 *19*	0.0049 *7*	2057.37	7−	1920.31	6−	
149.06 *16*	0.0073 *7*	2040.85	6+	1891.62	5+	
160.86 *4*	0.147 *5*	1666.40	8+	1505.82	7−	E_{γ}: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=160.58 *4*.
174.28 *12*	0.0084 *7*	2375.63	9+	2201.74	8−	
185.1 *10*	0.010 *4*	1310.53	6+	1125.41	8+	
198.83 *6*	0.0337 *14*	2525.64	12+	2326.96	11−	
200.52 *4*	0.112 *4*	2079.54	10+	1879.16	9−	
210.11 *19*	0.0081 *11*	1292.82	2+	1083.04	0+	
212.67 *3*	0.314 *10*	1022.96	4+	810.39	2+	
222.89 *13*	0.0110 *9*	1728.28	6+	1505.82	7−	
244.75 *3*	100 *3*	366.49	4+	121.77	2+	
251.74 *4*	0.090 *3*	1292.82	2+	1041.07	3−	
254.3 *25*	≤0.0014	2057.37	7−	1803.1	5−	I_{γ}: The authors report Iγ=0.0006 *8*.
255.86 *8*	0.0202 *12*	2201.74	8−	1946.06	7+	
260.60 *23*	0.0052 *7*	2139.73	8+	1879.16	9−	
269.3 *3*	0.0042 *6*	2215.4	8−	1946.06	7+	
270.0 *3*	0.0091 *13*	1292.82	2+	1022.96	4+	
272.71 *8*	0.0265 *13*	1083.04	0+	810.39	2+	
283.94 *23*	0.0047 *6*	2040.85	6+	1756.99	4+	
285.86 *10*	0.0194 *12*	1371.69	4+	1085.89	2+	
287.59 *3*	1.11 *3*	1310.53	6+	1022.96	4+	
309.17 *17*	0.0076 *7*	2510.89	10−	2201.74	8−	
316.03 *5*	0.0270 *10*	3292.80	14+	2976.80	14+	
316.08 *5*	0.170 *6*	1022.96	4+	706.98	6+	
320.23 *5*	0.0599 *23*	1612.89	4+	1292.82	2+	
325.81 *9*	0.0185 *10*	1559.64	5+	1233.89	3+	
329.45 *4*	0.144 *5*	1292.82	2+	963.34	1−	
330.5 *17*	0.0010 *8*	2388.3	9−	2057.37	7−	
330.62 *8*	0.0223 *12*	1371.69	4+	1041.07	3−	
331.5 *5*	0.0066 *19*	1891.62	5+	1559.64	5+	
340.48 *3*	67.8 *20*	706.98	6+	366.49	4+	
355.90 *3*	1.36 *4*	1666.40	8+	1310.53	6+	
356.56 *5*	0.077 *3*	1728.28	6+	1371.69	4+	
360.72 *14*	0.0094 *8*	1920.31	6−	1559.64	5+	
370.54 *15*	0.0074 *6*	1930.50	6−	1559.64	5+	
372.11 *6*	0.0400 *17*	2662.48	10+	2290.38	9−	
373.7 *4*	0.0027 *5*	1879.16	9−	1505.82	7−	
376.7 *10*	0.0173 *19*	2525.64	12+	2148.86	12+	
379.31 *14*	0.0089 *7*	1612.89	4+	1233.89	3+	
380.51 *14*	0.0274 *19*	1505.82	7−	1125.41	8+	

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Coulomb excitation (continued)

$\gamma(^{152}Sm)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Comments
385.24 *14*	0.0140 *10*	1756.99	4+	1371.69	4+	
386.41 *7*	0.0310 *14*	1946.06	7+	1559.64	5+	
391.16 *6*	0.0481 *19*	1612.89	4+	1221.69	5−	
391.27 *7*	0.0381 *16*	2004.30	6+	1612.89	4+	
394.19 *16*	0.0064 *5*	3857.29	16+	3463.53	16+	
411.65 *6*	0.074 *3*	2139.73	8+	1728.28	6+	
413.11 *3*	0.94 *3*	2079.54	10+	1666.40	8+	
418.45 *3*	34.2 *10*	1125.41	8+	706.98	6+	
429.35 *9*	0.0216 *11*	2375.63	9+	1946.06	7+	
444.03 *4*	0.681 *21*	810.39	2+	366.49	4+	
444.8 *3*	0.0041 *6*	1530.8	2−	1085.89	2+	
444.99 *19*	0.0060 *6*	2004.30	6+	1559.64	5+	
446.13 *3*	0.379 *12*	2525.64	12+	2079.54	10+	
448.18 *23*	0.0112 *11*	2326.96	11−	1879.16	9−	
451.25 *4*	0.114 *4*	2976.80	14+	2525.64	12+	
457.1 *3*	0.0028 *3*	2832.7	11+	2375.63	9+	
459.34 *8*	0.0199 *9*	3292.80	14+	2833.31	13−	
470.36 *5*	0.094 *3*	2079.54	10+	1609.29	10+	
473.75 *10*	0.0113 *6*	3857.29	16+	3383.48	15−	
476.2 *4*	0.0068 *10*	1768.98	2+	1292.82	2+	
483.86 *3*	14.8 *4*	1609.29	10+	1125.41	8+	
487.03 *9*	0.0224 *12*	3463.53	16+	2976.80	14+	
496.6 *4*	0.0017 *3*	1730.34	3−	1233.89	3+	
506.26 *9*	0.0170 *8*	2833.31	13−	2326.96	11−	
506.60 *5*	0.0663 *24*	1728.28	6+	1221.69	5−	
507.4[a] *5*	0.0036 *6*	2176.67	7−	1666.40	8+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=510.27 *16*. The entry May be a typo, otherwise the placement must be incorrect.
514.80 *6*	0.094 *3*	1221.69	5−	706.98	6+	
515.20 *10*	0.0172 *8*	2841.92	(13−)	2326.96	11−	
519.90 *20*	0.0101 *8*	1891.62	5+	1371.69	4+	
522.78 *6*	0.0466 *18*	2662.48	10+	2139.73	8+	
523.13 *6*	0.0545 *21*	1756.99	4+	1233.89	3+	
535.33 *20*	0.0112 *9*	1768.98	2+	1233.89	3+	
539.50 *3*	5.35 *16*	2148.86	12+	1609.29	10+	
540.58 *4*	0.540 *17*	1666.40	8+	1125.41	8+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=540.98 *3*.
542.1 *3*	0.0089 *11*	4004.85	18+	3463.53	16+	
550.42 *17*	0.0075 *5*	3383.48	15−	2833.31	13−	
556.49 *18*	0.0086 *6*	3292.80	14+	2736.26	14+	
562.98 *4*	1.09 *4*	684.73	0+	121.77	2+	
563.59 *16*	0.0111 *9*	1649.49	2−	1085.89	2+	
564.36 *11*	0.0114 *5*	3857.29	16+	3292.80	14+	
567.1 *3*	0.0054 *6*	2445.91	9−	1879.16	9−	
571.83 *5*	0.134 *4*	1612.89	4+	1041.07	3−	
583.04 *6*	0.075 *3*	2662.48	10+	2079.54	10+	
585.98[#a] *8*	0.0303 *12*	4048.1	18+	3463.53	16+	
587.37 *3*	1.64 *5*	2736.26	14+	2148.86	12+	
588.2 *8*	0.0021 *7*	1821.3	4−	1233.89	3+	
589.9 *10*	0.0020 *6*	3973.3	17−	3383.48	15−	
590.13 *11*	0.0320 *16*	1612.89	4+	1022.96	4+	
603.57 *3*	1.17 *4*	1310.53	6+	706.98	6+	
608.2 *5*	0.0023 *4*	3973.3	17−	3365.09	16+	
624.78 *10*	0.0244 *11*	2290.38	9−	1666.40	8+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=623.98 *7*.
628.4 *9*	0.0086 *13*	2506.34	(9−)	1879.16	9−	

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Coulomb excitation (continued)

$\gamma(^{152}Sm)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	Comments
628.82 *3*	0.377 *11*	3365.09	16+	2736.26	14+		
629.0 *19*	0.0041 *13*	2510.89	10−	1879.16	9−		
633.85 *5*	0.090 *3*	2139.73	8+	1505.82	7−		
638.00 *18*	0.0106 *7*	2517.43	(11−)	1879.16	9−		
639.47 *18*	0.0073 *5*	4004.85	18+	3365.09	16+		
644.69 *25*	0.0046 *4*	1730.34	3−	1085.89	2+		
647.14 *7*	0.0267 *10*	3383.48	15−	2736.26	14+		
656.42 *3*	1.88 *6*	1022.96	4+	366.49	4+	E0+M1+E2	δ: δ(E2/M1)=+2.1 *3* (1974Do04). Other: +2.9 *+19−9* (1969Fr10).
657.39 *23*	0.0086 *7*	1891.62	5+	1233.89	3+		
663.19 *9*	0.075 *3*	1371.69	4+	706.98	6+		E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=664.71 *4*. The entry May be a typo. The transition is seen with this placement in other datasets.
667.5 *4*	0.0053 *6*	1977.21	5−	1310.53	6+		
670.7 *3*	0.0052 *6*	2176.67	7−	1505.82	7−		
671.08 *6*	0.097 *4*	1756.99	4+	1085.89	2+		
672.5 *6*	0.0015 *3*	1906.2	(2+)	1233.89	3+		
674.66 *4*	0.225 *7*	1041.07	3−	366.49	4+		
681.54[#] *5*	0.0498 *17*	4048.1	18+	3365.09	16+		
682.11 *9*	0.0393 *16*	2348.76	(8+)	1666.40	8+		
682.21 *17*	0.0230 *16*	2290.38	9−	1609.29	10+		E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=681.09 *6*.
683.07 *20*	0.0174 *12*	1768.98	2+	1085.89	2+		
684.44 *6*	0.098 *3*	2833.31	13−	2148.86	12+		
688.65 *4*	1.71 *5*	810.39	2+	121.77	2+	E0+M1+E2	δ: δ(E2/M1)=19 *+5−4*. Others: >+13 (1969Fr10), +13 *+28−5* (1972McYT), +8 *+6−3* (1974Do04).
692.52 *15*	0.0183 *9*	2841.92	(13−)	2148.86	12+		
693.98 *13*	0.0227 *11*	2004.30	6+	1310.53	6+		
696.42 *12*	0.0206 *10*	1659.76	0+	963.34	1−		
701.86 *15*	0.0070 *4*	4748.50	20+	4048.1	18+		
717.78 *4*	0.208 *6*	2326.96	11−	1609.29	10+		
718.90 *13*	0.094 *4*	1085.89	2+	366.49	4+		
719.56 *20*	0.0106 *7*	2599.37	(8+)	1879.16	9−		
721.9 *6*	0.0030 *5*	2388.3	9−	1666.40	8+		
722.3 *3*	0.0053 *5*	2227.75	(6−)	1505.82	7−		
726.88 *18*	0.0057 *4*	3463.53	16+	2736.26	14+		
727.98 *9*	0.0593 *24*	1768.98	2+	1041.07	3−		
728.48[&] *15*	0.0139 *7*	2808.9	11−	2079.54	10+		
732.41 *11*	0.0249 *12*	1954.27	5−	1221.69	5−		
735.58 *17*	0.0236 *13*	1776.60	2+	1041.07	3−		
738.2 *6*	0.0027 *5*	1779.27	3−	1041.07	3−		E_γ: Authors′ value of 748.2 *6* appears to be a misprint. Eγ=738.8 *7* from the least-squares fit, and Eγ=737.84 *7* in (n,n′γ). The evaluator assumes that the energy should be 738.2.
753.83 *3*	0.384 *12*	1879.16	9−	1125.41	8+		
755.5 *3*	0.0051 *5*	1977.21	5−	1221.69	5−		
756.71 *19*	0.0149 *9*	1779.27	3−	1022.96	4+		
759.7 *3*	0.0143 *14*	2375.63	9+				E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=766.35 *10*. The entry May be a typo. The transition is seen in (α,2nγ) with this placement.
759.9[a] *8*	0.0037 *9*	2905.20	10+	2148.86	12+		E_γ: Poor fit. Not included in the least-squares

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Coulomb excitation (continued)

$\gamma(^{152}Sm)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Comments
						adjustment for the level energies. This adjustment gives Eγ=756.34 *10*. The entry May be a typo, otherwise the placement must be incorrect.
765.82[a] *7*	0.0311 *11*	3292.80	14+	2525.64	12+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=767.16 *6*. The entry May be a typo, otherwise the placement must be incorrect.
769.4 *5*	0.0041 *6*	1579.60	3−	810.39	2+	
779.8 *5*	0.0021 *3*	1821.3	4−	1041.07	3−	
779.97 *12*	0.0247 *11*	2445.91	9−	1666.40	8+	
782.37 *23*	0.0132 *9*	2004.30	6+	1221.69	5−	
783.9 *4*	0.0035 *4*	2290.38	9−	1505.82	7−	
790.30 *20*	0.0162 *10*	2011.85	3−,4,5−	1221.69	5−	
791.86 *14*	0.0301 *15*	1755.21	0+	963.34	1−	
798.82 *3*	0.579 *18*	1505.82	7−	706.98	6+	
803.0 *3*	0.0116 *9*	1612.89	4+	810.39	2+	
805.59 *12*	0.067 *3*	1768.98	2+	963.34	1−	
810.41 *6*	0.634 *23*	810.39	2+	0.0	0+	
813.1 *3*	0.0186 *15*	1776.60	2+	963.34	1−	
817.8 *3*	0.0042 *4*	2051.6	4+	1233.89	3+	
818.8 *3*	0.0053 *5*	2040.85	6+	1221.69	5−	
821.0 *6*	0.0042 *6*	1907.20	3+	1085.89	2+	
821.53 *7*	0.076 *3*	1946.06	7+	1125.41	8+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=820.64 *8*.
826.1 *10*	0.0016 *2*	1510.9	1−	684.73	0+	
827.6 *3*	0.0079 *6*	2976.80	14+	2148.86	12+	
841.55 *5*	0.311 *13*	963.34	1−	121.77	2+	
843.36 *17*	0.0219 *12*	2348.76	(8+)	1505.82	7−	
[x]844.9 *4*	0.0051 *5*					E_γ: Placed by authors from the 1659 *0+* level; however, Iγ/Iγ(696γ) is a factor of ten higher than the adopted value from 4.12-min β^- decay. also, the energy fit is poor.
848.6 *3*	0.0086 *7*	2070.90	(3−)	1221.69	5−	
852.13 *7*	0.138 *5*	1559.64	5+	706.98	6+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=852.66 *5*.
855.17 *4*	0.502 *16*	1221.69	5−	366.49	4+	
866.2 *4*	0.0065 *7*	2176.67	7−	1310.53	6+	
867.55 *6*	0.258 *8*	1233.89	3+	366.49	4+	
869.9 *3*	0.0107 *8*	1680.32	1−	810.39	2+	
879.0 *10*	0.0306 *17*	2004.30	6+	1125.41	8+	
879.02 *17*	0.0331 *17*	2004.34	7−	1125.41	8+	
880.53 *20*	0.0062 *4*	3857.29	16+	2976.80	14+	
883.8 *4*	0.0041 *4*	1907.20	3+	1022.96	4+	
885.9 *3*	0.0088 *6*	2391.7	8+	1505.82	7−	
901.09 *4*	1.01 *3*	1022.96	4+	121.77	2+	
902.7[@] *4*	0.0070 *7*	1944.6	(2+)	1041.07	3−	
905.71 *4*	0.328 *10*	1612.89	4+	706.98	6+	
908.62 *24*	0.0236 *15*	2517.43	(11−)	1609.29	10+	
913.43 *13*	0.0358 *16*	1954.27	5−	1041.07	3−	
915.79 *16*	0.0277 *13*	2525.64	12+	1609.29	10+	
919.23 *5*	0.496 *17*	1041.07	3−	121.77	2+	
919.4 *3*	0.0065 *5*	1730.34	3−	810.39	2+	
926.52 *5*	0.382 *12*	1292.82	2+	366.49	4+	
929.4 *5*	0.0030 *3*	1892.5	0+	963.34	1−	
930.64[&] *15*	0.0186 *9*	2808.9	11−	1879.16	9−	
931.7 *3*	0.0078 *7*	3080.6	13−	2148.86	12+	
939.80 *9*	0.0575 *21*	2445.91	9−	1505.82	7−	

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Coulomb excitation (continued)

$\gamma(^{152}Sm)$ (continued)

E_γ[†]	I_γ[†]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[‡]	Comments
942.9 *5*	0.0045 *6*	1906.2	(2+)	963.34	1−			
944.01 *4*	0.717 *22*	1310.53	6+	366.49	4+			
944.8 *10*	0.0019 *6*	1755.21	0+	810.39	2+			
953.8 *3*	0.0106 *9*	1977.21	5−	1022.96	4+			
953.84 *9*	0.080 *3*	2079.54	10+	1125.41	8+			
955.03 *20*	0.0170 *10*	2176.67	7−	1221.69	5−			
958.35 *11*	0.084 *3*	1768.98	2+	810.39	2+			
958.9 *3*	0.35 *3*	1083.04	0+	121.77	2+			E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=961.27 *8*. The entry May be a typo. The transition is seen with this placement in other datasets.
959.23 *5*	0.298 *9*	1666.40	8+	706.98	6+			
963.32 *7*	0.245 *12*	963.34	1−	0.0	0+			
964.29 *7*	1.68 *6*	1085.89	2+	121.77	2+	M1+E2	−9.3 *6*	δ: Others: −27 +*11*−*55* (1969Fr10), <−8 (1974Do04).
965.0 *7*	0.0024 *3*	2051.6	4+	1085.89	2+			
967.9 *3*	0.0225 *16*	1779.27	3−	810.39	2+			
970.64 *20*	0.0189 *11*	2011.85	3−,4,5−	1041.07	3−			
979.51 *20*	0.0120 *7*	3128.37	12+	2148.86	12+			
982.19[@] *23*	0.0150 *10*	1944.6	(2+)	963.34	1−			
982.3 *3*	0.0110 *9*	2004.30	6+	1022.96	4+			
989.7 *6*	0.0063 *8*	2012.2	2+,3,4+	1022.96	4+			
995.6 *3*	0.0069 *5*	1680.32	1−	684.73	0+			
1000.50 *11*	0.0423 *17*	2506.34	(9−)	1505.82	7−			
1005.15 *4*	1.42 *4*	1371.69	4+	366.49	4+	M1+E2	−3.1 +*2*−*3*	δ: Others: <−5.3 (1969Fr10), >9.5 (1974Do04).
1005.7 *3*	0.0096 *9*	2227.75	(6−)	1221.69	5−			
1014.28 *4*	0.463 *14*	2139.73	8+	1125.41	8+			
1021.41 *4*	0.96 *3*	1728.28	6+	706.98	6+			
1026.32 *25*	0.0115 *8*	3352.30	12+	2326.96	11−			
1026.48 *14*	0.0287 *14*	2905.20	10+	1879.16	9−			
1030.21 *24*	0.0142 *9*	2070.90	(3−)	1041.07	3−			
1030.63 *14*	0.0373 *17*	2639.92	11−	1609.29	10+			
1050.6 *3*	0.0114 *8*	2091.49	(1−)	1041.07	3−			
1052.98 *9*	0.0557 *21*	2662.48	10+	1609.29	10+			
1056.75 *22*	0.0383 *22*	1764.07	5−	706.98	6+			
1063.95 *21*	0.0119 *7*	3390.92	13−	2326.96	11−			
1080.4 *4*	0.0040 *3*	2043.8	0+	963.34	1−			
1080.7 *11*	0.0012 *3*	1892.5	0+	810.39	2+			
1084.32 *11*	0.0523 *21*	1768.98	2+	684.73	0+			
1085.87 *12*	1.14 *6*	1085.89	2+	0.0	0+			
1094.37 *23*	0.0156 *10*	2599.37	(8+)	1505.82	7−			
1095.9 *4*	0.0187 *17*	1803.1	5−	706.98	6+			
1096.95 *22*	0.0187 *11*	1907.20	3+	810.39	2+			
1096.96 *12*	0.0214 *9*	2138.12	(2+)	1041.07	3−			
1112.11 *6*	0.78 *3*	1233.89	3+	121.77	2+			
1113.8 *3*	0.0057 *4*	3262.9	(12+)	2148.86	12+			
1116.9 *6*	0.0034 *4*	2138.12	(2+)	1022.96	4+			
1127.8 *4*	0.0093 *8*	2091.49	(1−)	963.34	1−			
1138.3 *5*	0.0069 *7*	2263.9	(7+)	1125.41	8+			
1165.04 *10*	0.0468 *17*	2290.38	9−	1125.41	8+			
1170.5 *4*	0.047 *5*	1292.82	2+	121.77	2+			
1193.12 *5*	0.393 *12*	1559.64	5+	366.49	4+			

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Coulomb excitation (continued)

γ(^{152}Sm) (continued)

E_γ [†]	I_γ [†]	E_i(level)	J^π_i	E_f	J^π_f	Comments
1194.8 *6*	0.0021 *2*	3931.7	14+	2736.26	14+	
1201.7 *6*	0.0029 *3*	2012.2	2+,3,4+	810.39	2+	
1203.32 *16*	0.0187 *8*	3352.30	12+	2148.86	12+	
1213.0 *10*	0.0036 *7*	1920.31	6−	706.98	6+	
1213.09 *21*	0.059 *3*	1579.60	3−	366.49	4+	
1223.47 *9*	0.0703 *25*	2348.76	(8+)	1125.41	8+	
1224.8 *3*	0.0320 *19*	1930.50	6−	706.98	6+	
1228.2 *6*	0.0027 *3*	2038.4	(1−)	810.39	2+	
1234 *4*	0.0004 *3*	2043.8	0+	810.39	2+	
1238.70 *7*	0.158 *5*	1946.06	7+	706.98	6+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=1239.07 *8*.
1246.2 *4*	0.042 *3*	1612.89	4+	366.49	4+	
1250.12 *12*	0.377 *15*	1371.69	4+	121.77	2+	
1250.25 *16*	0.0357 *15*	2375.63	9+	1125.41	8+	
1260.4[a] *10*	0.0014 *2*	1944.6	(2+)	684.73	0+	E_γ: In (n,n′γ) a doublet is proposed at 1945 with the 1260γ being placed from the second member of the doublet. See Adopted Levels.
1292.8 *3*	0.111 *11*	1292.82	2+	0.0	0+	
1295.98 *17*	0.0333 *16*	2905.20	10+	1609.29	10+	
1297.29 *13*	0.11 *8*	2004.34	7−	706.98	6+	
1297.4 *10*	≤0.15	2004.30	6+	706.98	6+	I_γ: The authors report Iγ=0.07 *8*.
1316.1 *3*	0.0284 *17*	1682.6	4−	366.49	4+	
1322.4 *5*	0.0038 *3*	2285.7	0,1,2	963.34	1−	
1327.7 *5*	0.0032 *3*	2138.12	(2+)	810.39	2+	
1334.7 *3*	0.0177 *11*	2040.85	6+	706.98	6+	
1349.7 *5*	0.0081 *7*	2057.37	7−	706.98	6+	
1353.2 *11*	0.0008 *1*	2038.4	(1−)	684.73	0+	
1361.31 *11*	0.198 *7*	1728.28	6+	366.49	4+	
1367.2 *17*	0.018 *3*	1730.34	3−	366.49	4+	
1387.4 *5*	0.0218 *19*	1756.99	4+	366.49	4+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=1390.49 *5*. The entry May be a typo. The transition is seen with this placement in other datasets.
1389.1 *7*	0.045 *5*	1510.9	1−	121.77	2+	
1398.7 *4*	0.0314 *20*	1764.07	5−	366.49	4+	
1409.2 *5*	0.026 *4*	1530.8	2−	121.77	2+	
1432.93 *19*	0.0412 *18*	2139.73	8+	706.98	6+	
1437.0 *5*	0.0134 *12*	1803.1	5−	366.49	4+	
1454.0 *8*	0.0015 *2*	2138.12	(2+)	684.73	0+	
1454.9 *4*	0.0129 *8*	1821.3	4−	366.49	4+	
1457.7 *7*	0.017 *3*	1579.60	3−	121.77	2+	
1474.0 *3*	0.0130 *8*	2599.37	(8+)	1125.41	8+	
1528.0 *22*	0.010 *4*	1649.49	2−	121.77	2+	
1536.73 *14*	0.0397 *15*	2662.48	10+	1125.41	8+	
[x]1538 *4*	0.007 *4*					E_γ: Placed by authors from the 1659 *0*+ level; however, Iγ/Iγ(696γ) is a factor of 28 higher than the adopted value from 4.12-min β^- decay. also, the energy fit is poor.
1542.7 *6*	0.0114 *10*	1907.20	3+	366.49	4+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=1540.71 *18*.
1557.1 *4*	0.0155 *10*	2263.9	(7+)	706.98	6+	
1635.36 *14*	0.0648 *24*	2004.30	6+	366.49	4+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=1637.84 *11*. The entry May be a typo.
1645.7 *5*	0.048 *4*	2012.2	2+,3,4+	366.49	4+	
1654.6 *6*	0.0059 *5*	3262.9	(12+)	1609.29	10+	
1742.0 *3*	0.0107 *6*	3352.30	12+	1609.29	10+	

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Coulomb excitation (continued)

$\gamma(^{152}Sm)$ (continued)

E_γ [†]	I_γ [†]	E_i(level)	J^π_i	E_f	J^π_f	Comments
1751.7 *3*	0.0257 *13*	2458.7	8^+	706.98	6^+	
1779.05 *17*	0.0439 *17*	2905.20	10^+	1125.41	8^+	
1783.2 *5*	0.0084 *7*	3931.7	14^+	2148.86	12^+	
1784.1 *9*	0.053 *4*	1906.2	(2^+)	121.77	2^+	
1785.8 *8*	0.019 *3*	1907.20	3^+	121.77	2^+	
1788.6 *23*	0.0010 *4*	4524.9	16^+	2736.26	14^+	
1889.4 *12*	0.024 *4*	2012.2	2^+,3,4^+	121.77	2^+	
1895.1[a] *5*	0.0118 *8*	2599.37	(8^+)	706.98	6^+	E_γ: Poor fit. Not included in the least-squares adjustment for the level energies. This adjustment gives Eγ=1892.37 *14*. The entry May be a typo, otherwise the placement must be incorrect.

† From 2009KuZX, except where noted otherwise. The Iγ are normalized to Iγ=100 for the 244γ from the 366 level. The data are unpublished and should be considered as preliminary.

‡ From Adopted Gammas, and given only in cases where data from Coulomb excitation are available. The Coulomb excitation values are given in comments. Note that for the 656γ the adopted value is from Coulomb excitation.

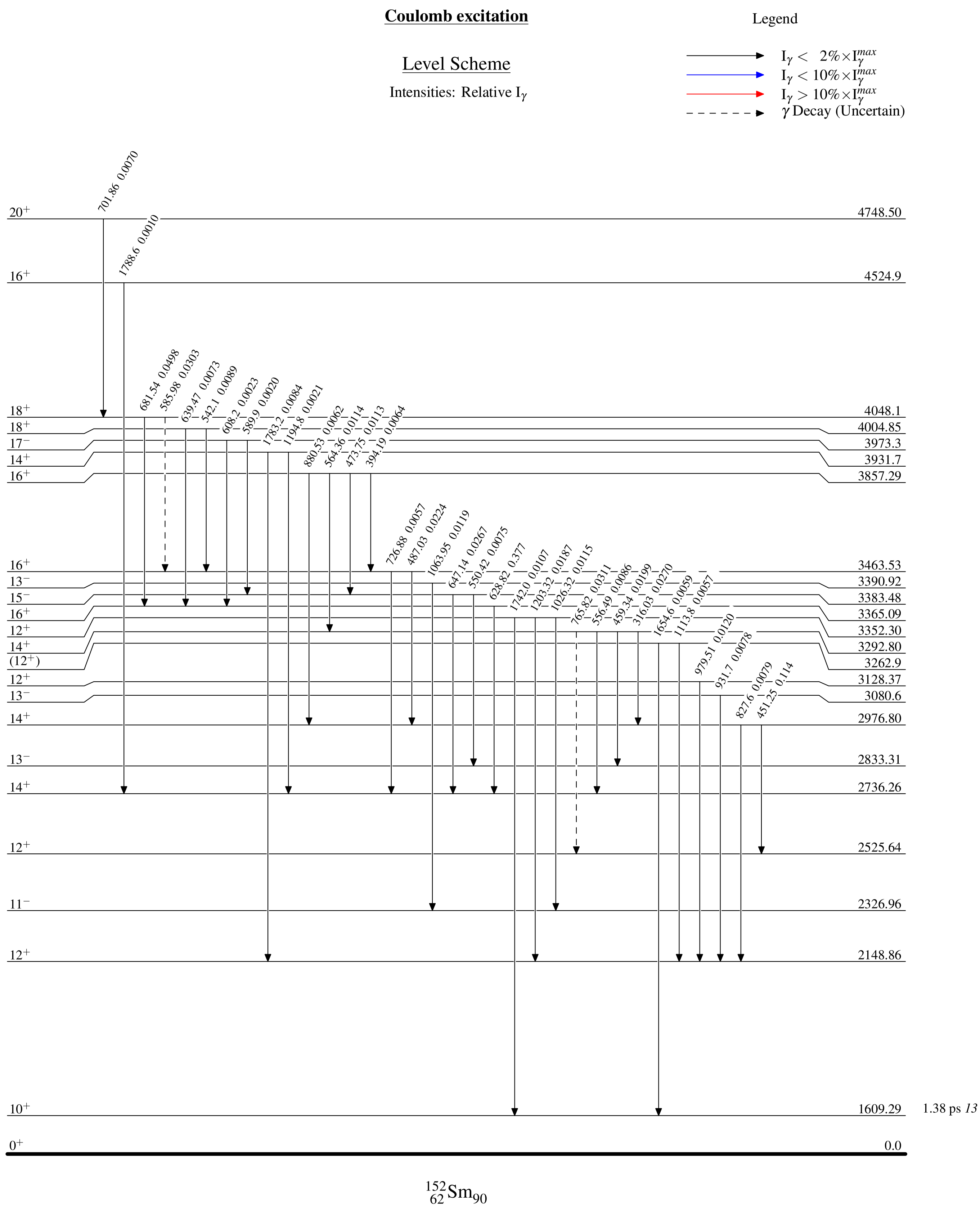
See comment on 4048 level.

@ See comment on the 1944.6 level.

& See comment on the 2809 level.

a Placement of transition in the level scheme is uncertain.

x γ ray not placed in level scheme.


Coulomb excitation
Level Scheme
Intensities: Relative I_γ
Legend
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)
701.86 0.0070
1788.6 0.0010
681.54 0.0498
585.98 0.0303
639.47 0.0073
542.1 0.0089
608.2 0.0023
589.9 0.0020
1783.2 0.0084
1194.8 0.0021
880.53 0.0062
564.36 0.0114
473.75 0.0113
394.19 0.0064
726.88 0.0057
487.03 0.0224
1063.95 0.0119
647.14 0.0267
550.42 0.0075
628.82 0.377
1742.0 0.0107
1203.32 0.0187
1026.32 0.0115
765.82 0.0311
556.49 0.0086
459.34 0.0199
316.03 0.0270
1654.6 0.0059
1113.8 0.0057
979.51 0.0120
931.7 0.0078
827.6 0.0079
451.25 0.114
20+ 4748.50
16+ 4524.9
18+ 4048.1
18+ 4004.85
17− 3973.3
14+ 3931.7
16+ 3857.29
16+ 3463.53
13− 3390.92
15− 3383.48
16+ 3365.09
12+ 3352.30
14+ 3292.80
(12+) 3262.9
12+ 3128.37
13− 3080.6
14+ 2976.80
13− 2833.31
14+ 2736.26
12+ 2525.64
11− 2326.96
12+ 2148.86
10+ 1609.29 1.38 ps 13
0+ 0.0
$^{152}_{62}Sm_{90}$

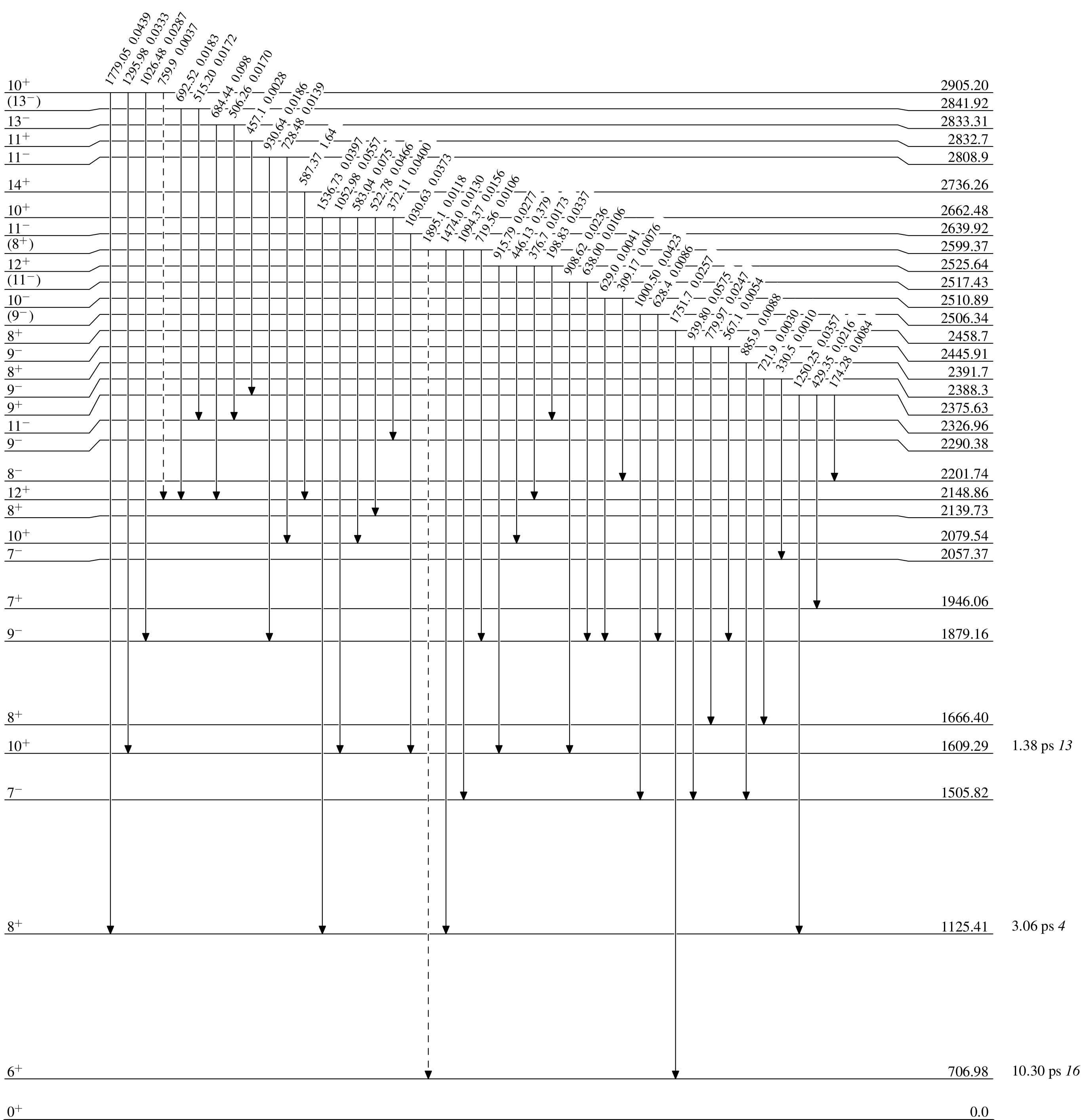
Coulomb excitation

Level Scheme (continued)

Intensities: Relative I_γ

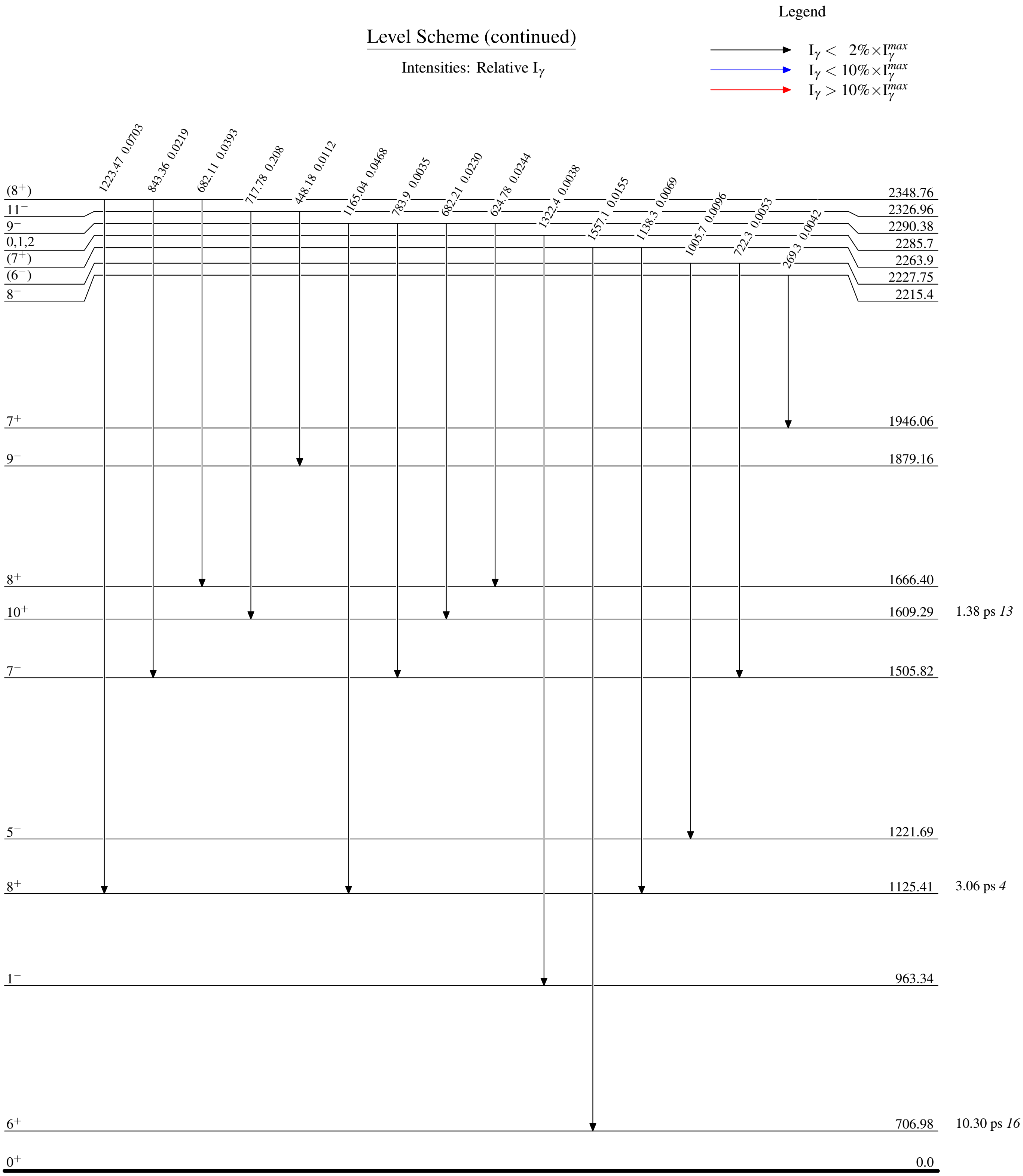
Legend

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



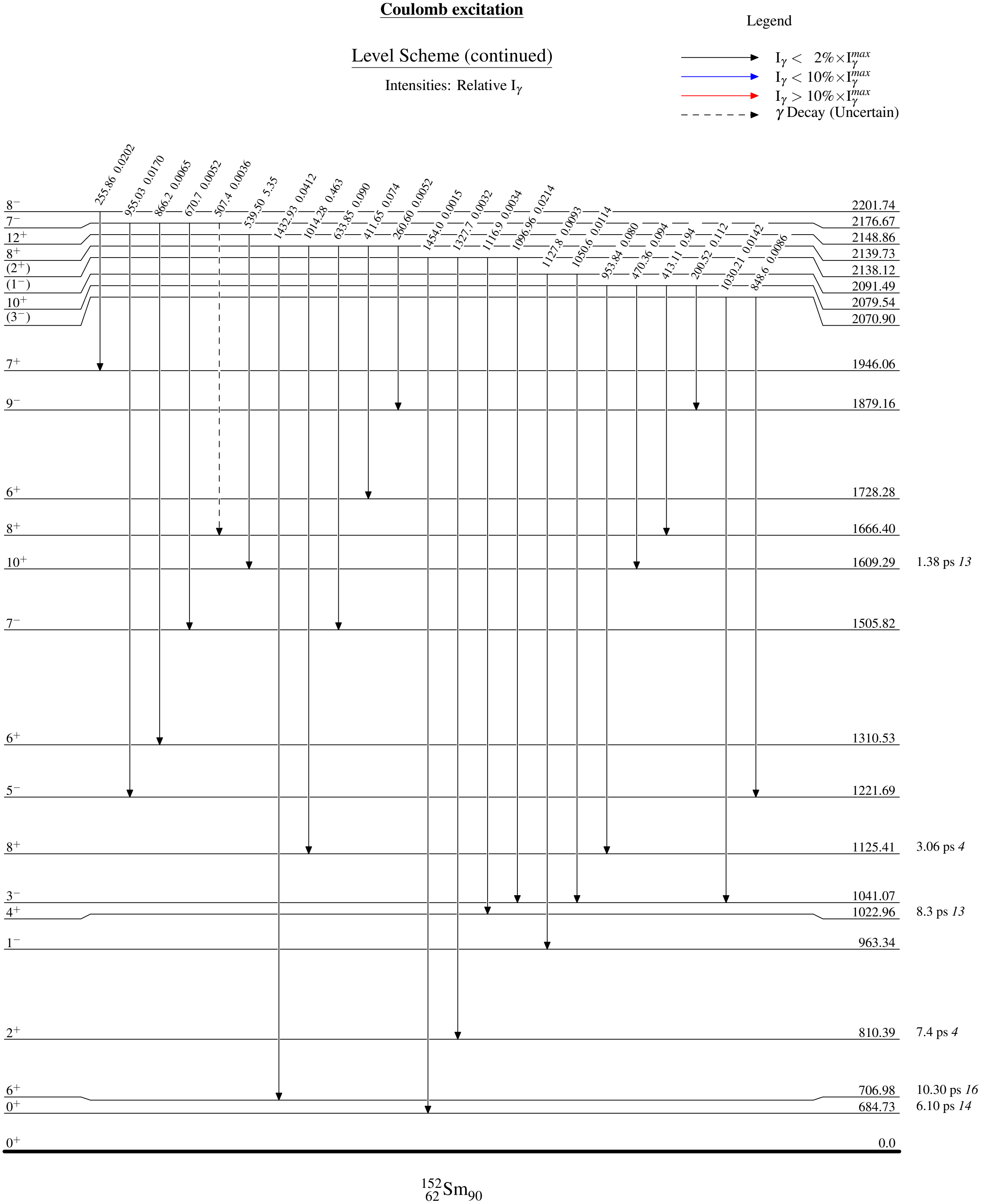
$^{152}_{62}Sm_{90}$

Coulomb excitation

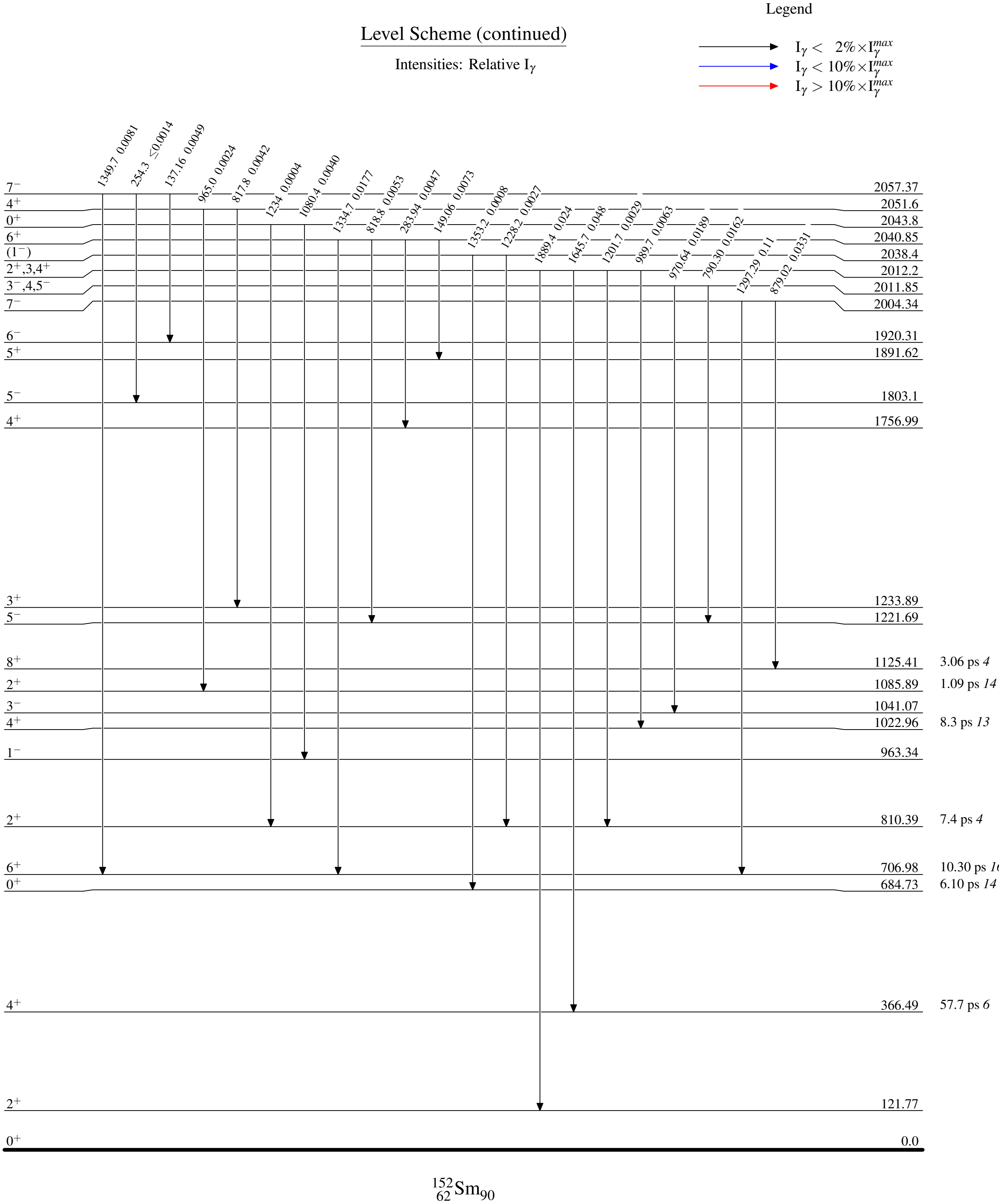


$^{152}_{62}Sm_{90}$

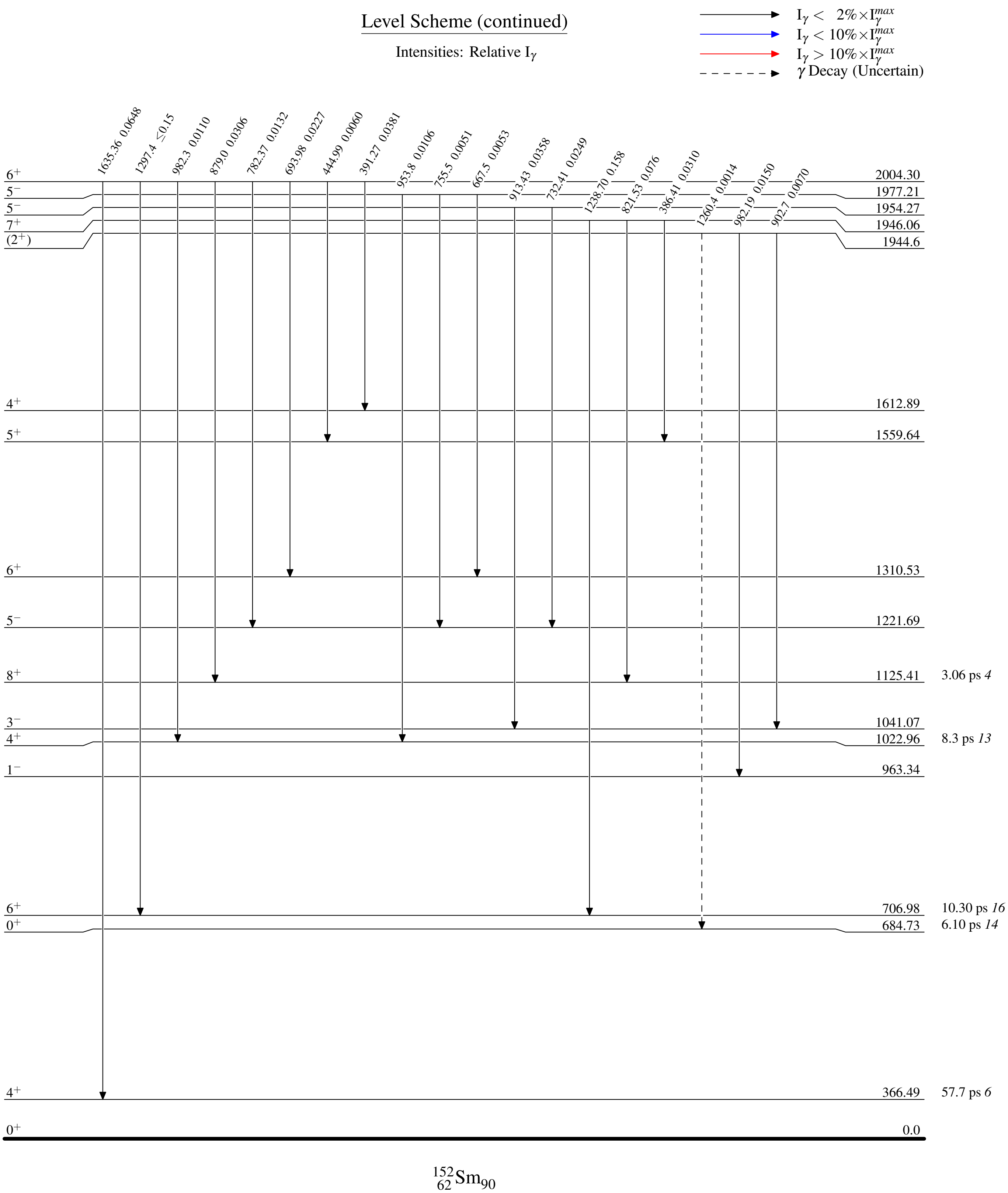
Coulomb excitation



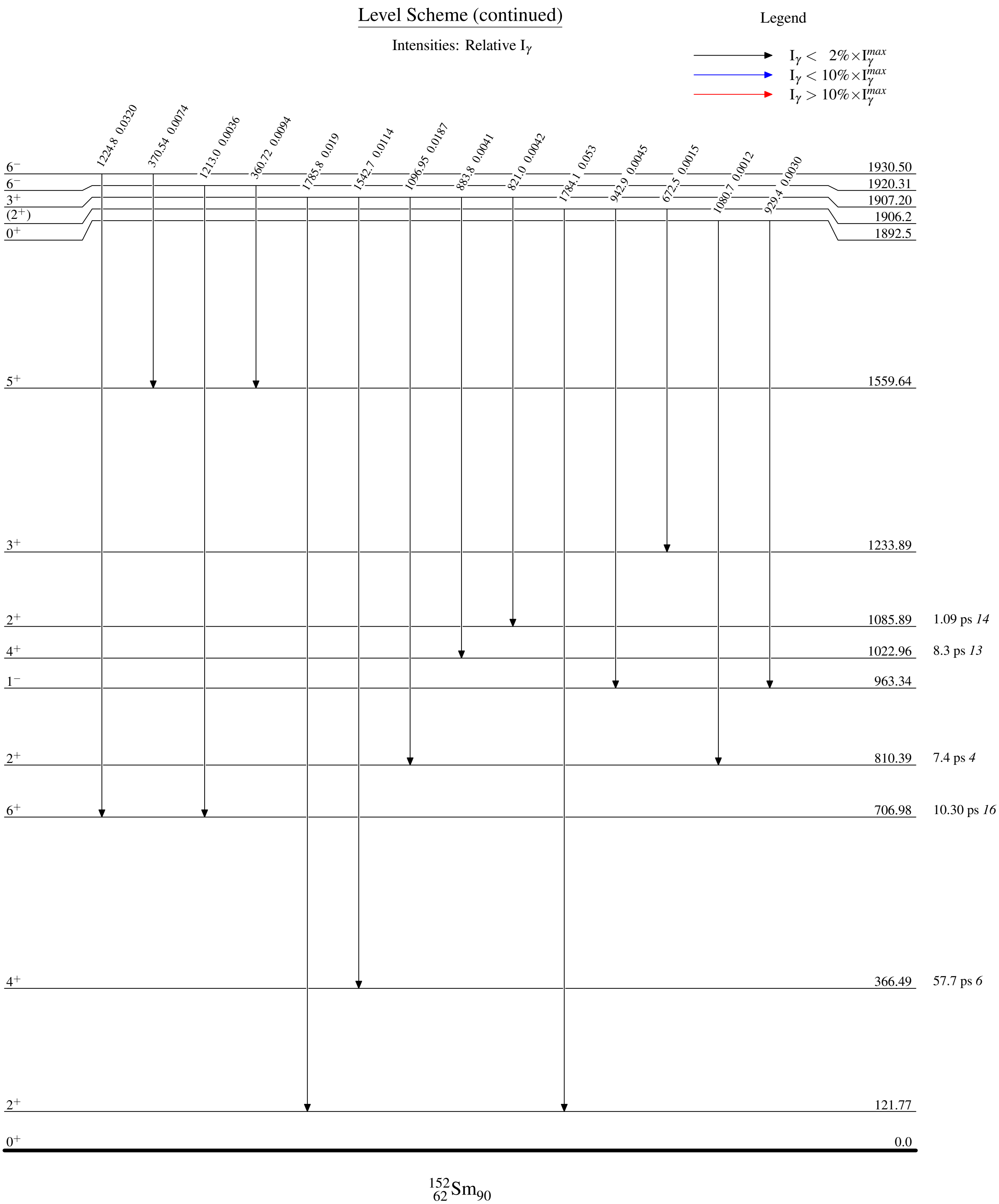
Coulomb excitation



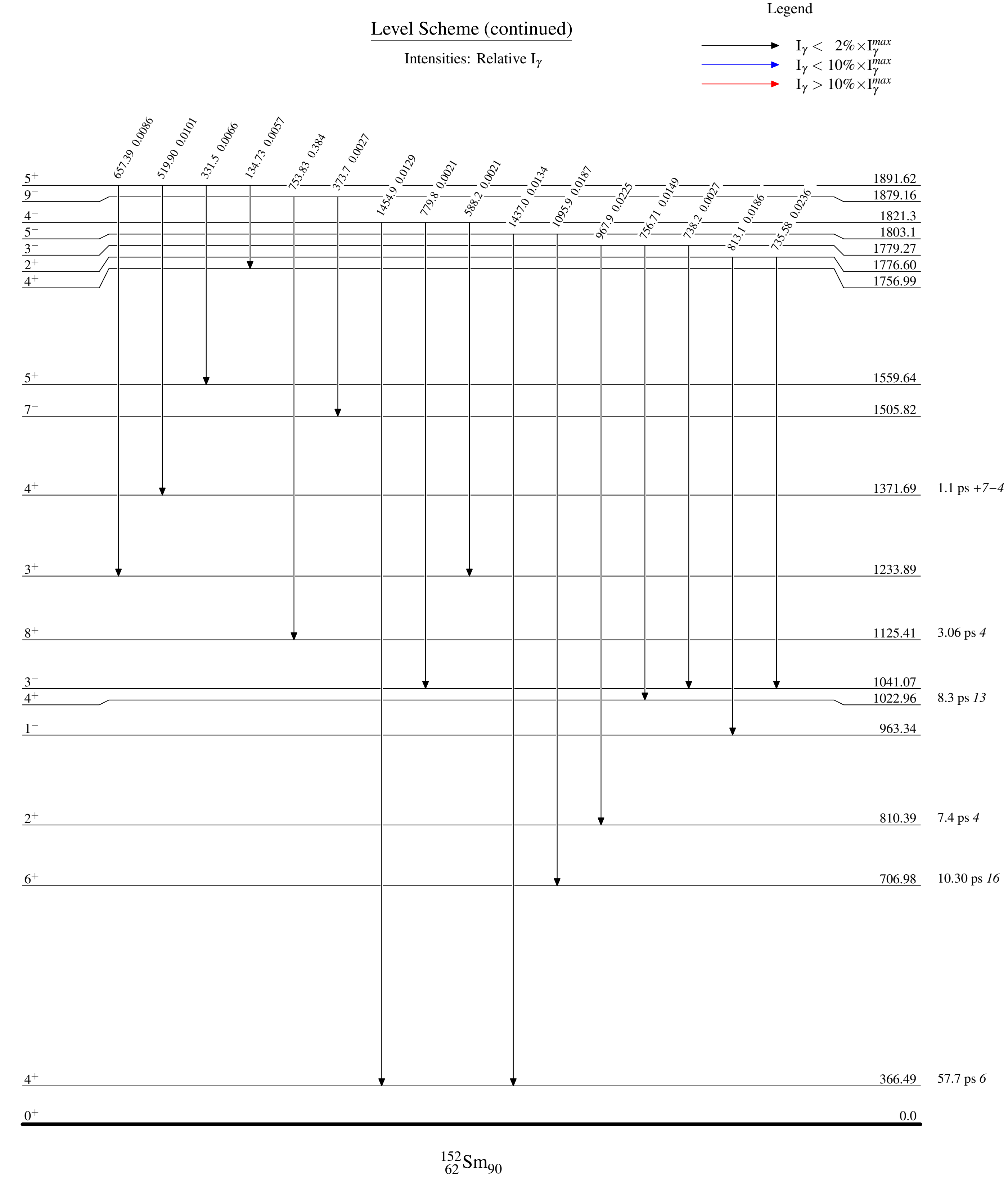
Coulomb excitation



Coulomb excitation



Coulomb excitation



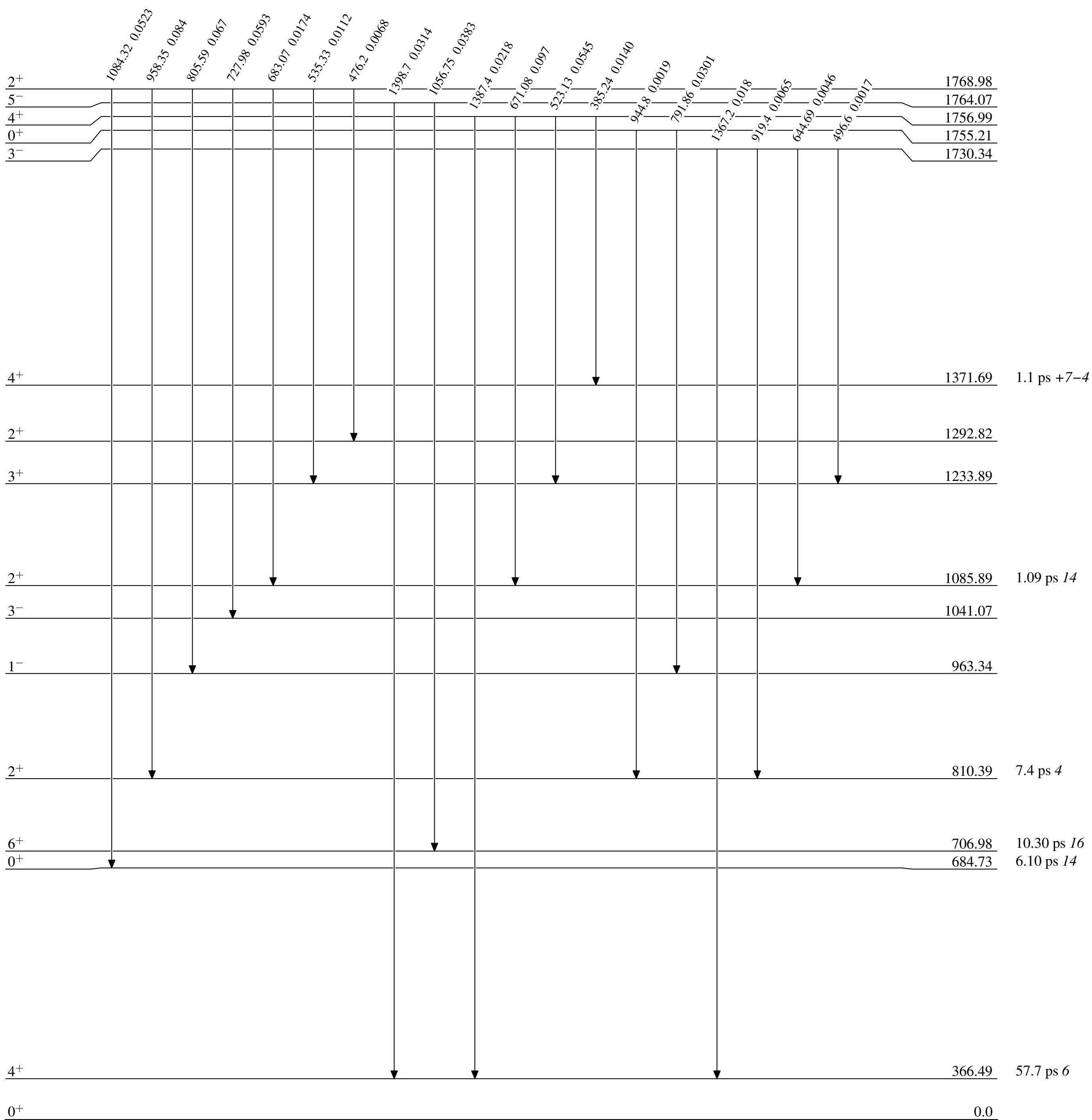
Coulomb excitation

Legend

Level Scheme (continued)

Intensities: Relative I_γ

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

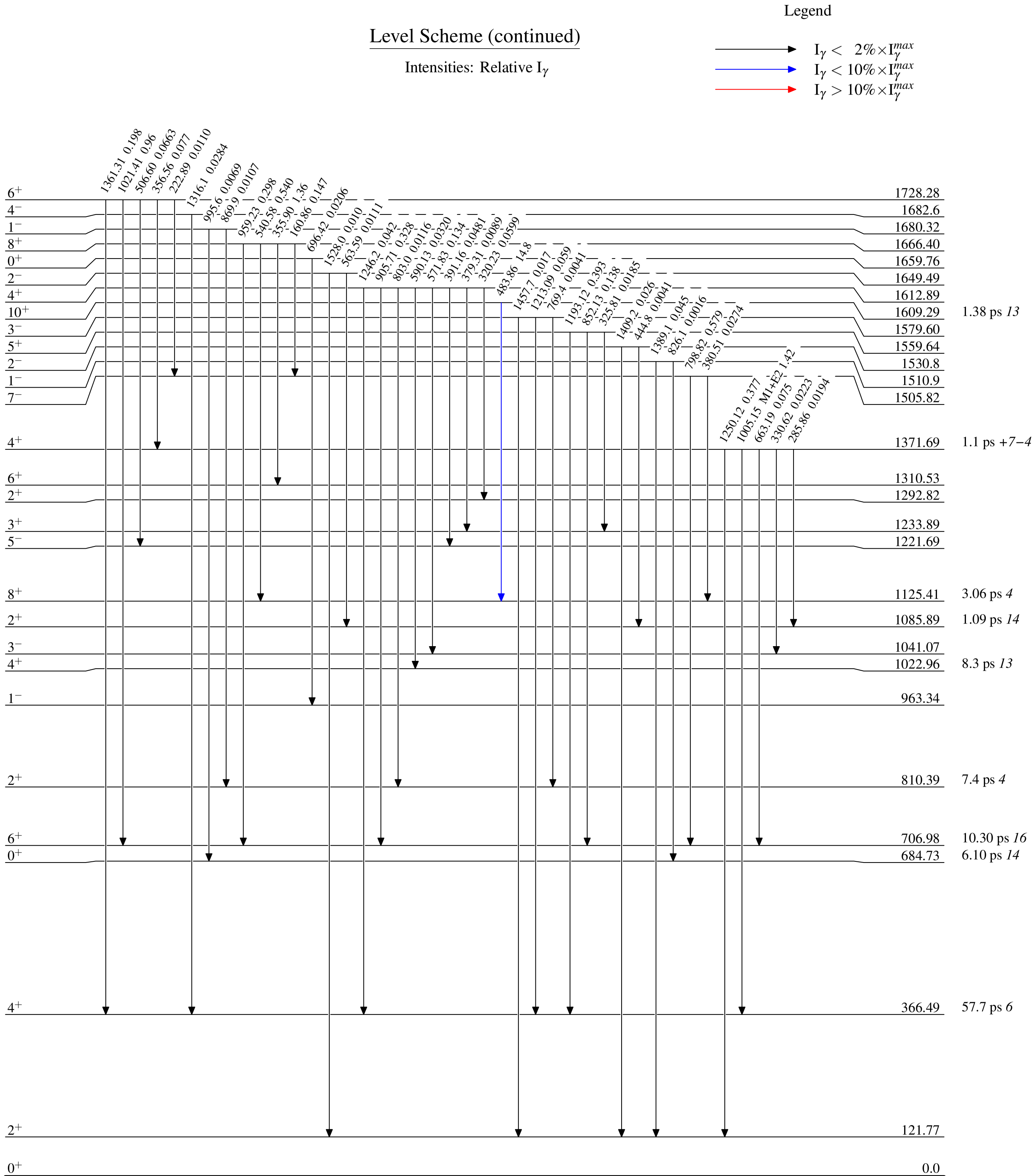


$^{152}_{62}Sm_{90}$

Coulomb excitation

Level Scheme (continued)

Intensities: Relative I_γ



$^{152}_{62}Sm_{90}$

Coulomb excitation

Level Scheme (continued)

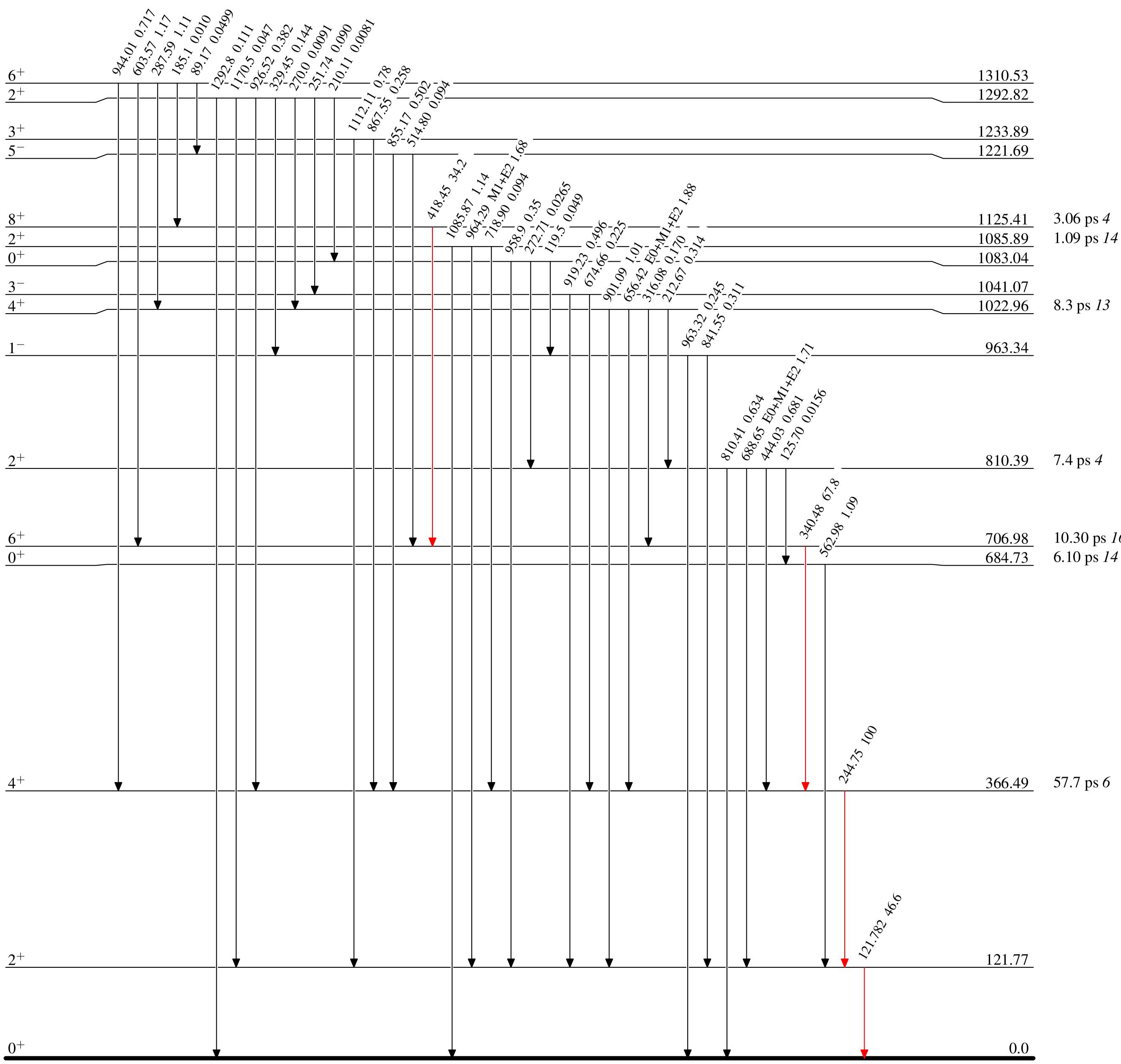
Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

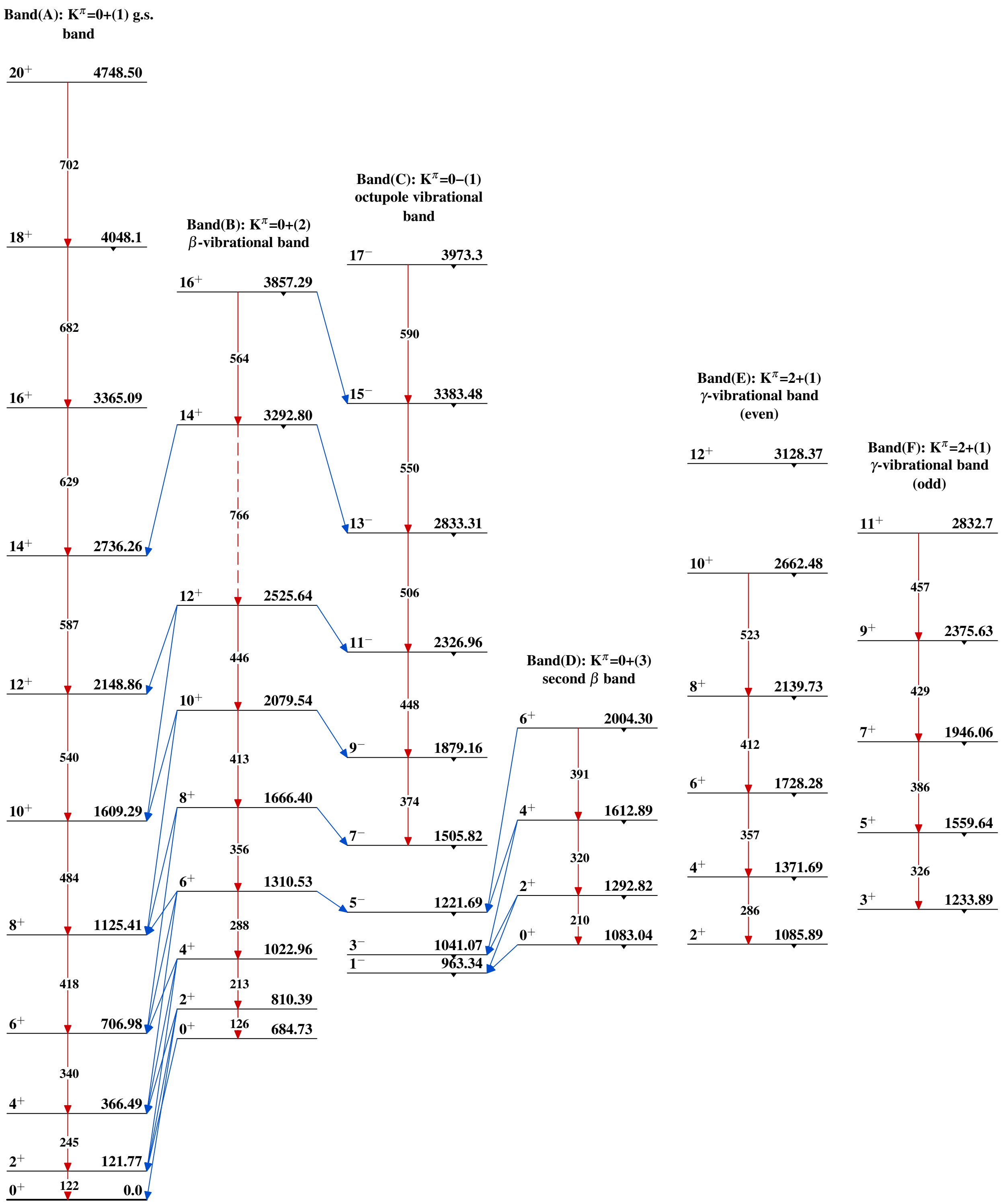
$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$



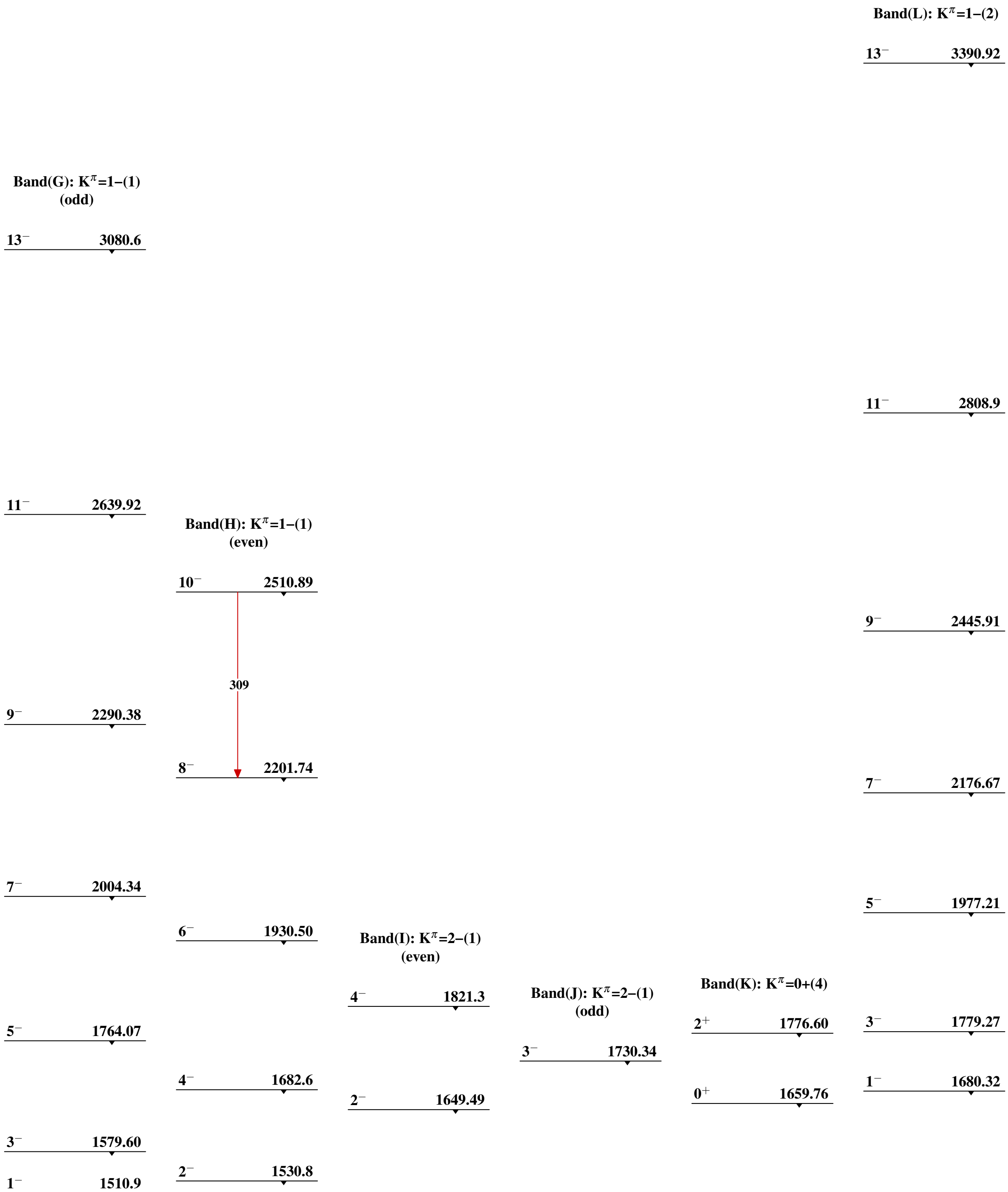
$^{152}_{62}Sm_{90}$

Coulomb excitation



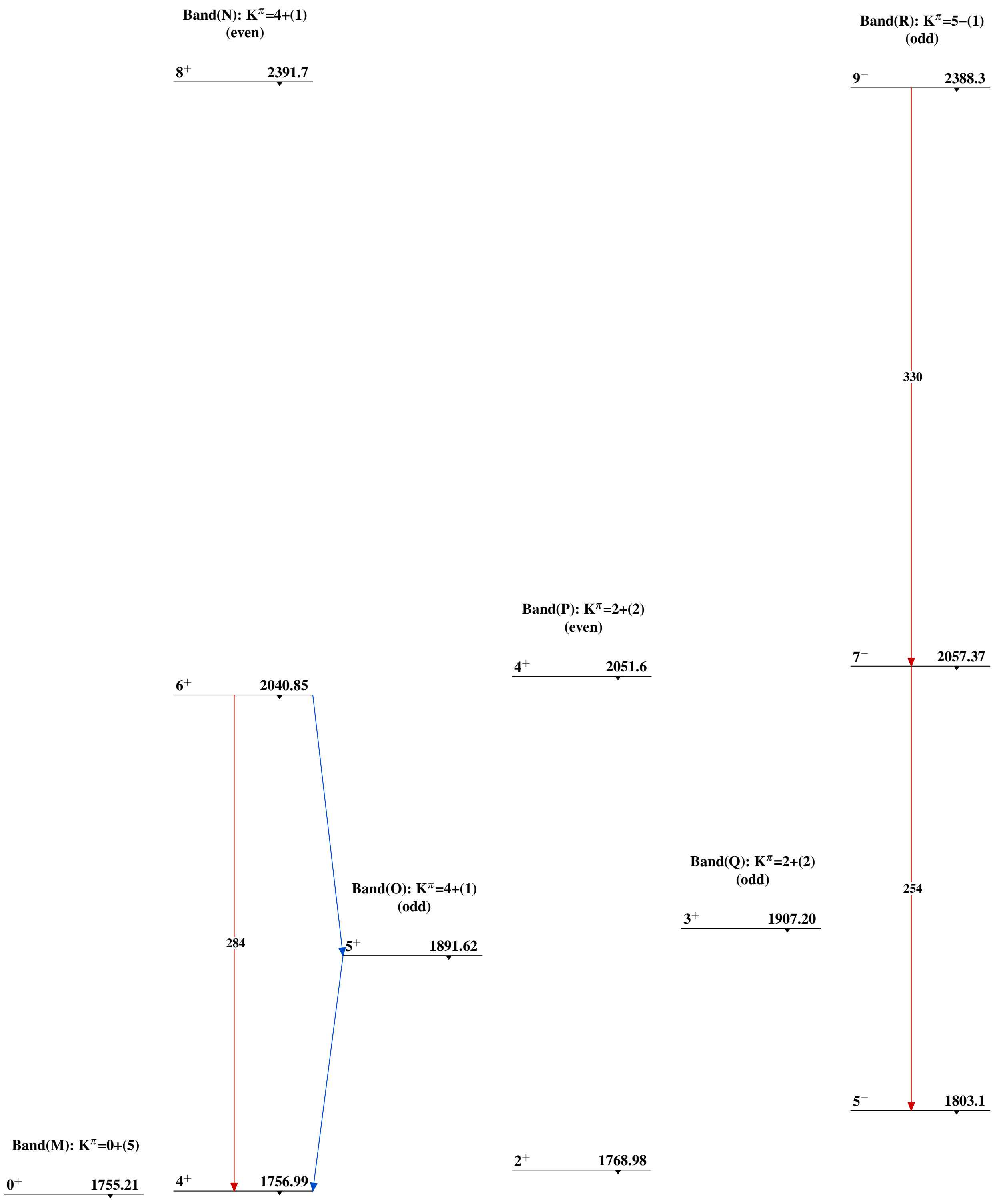
$^{152}_{62}Sm_{90}$

Coulomb excitation (continued)



$^{152}_{62}Sm_{90}$

Coulomb excitation (continued)



$^{152}_{62}Sm_{90}$

Coulomb excitation (continued)