^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

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Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

@B@0@0@@@@ @B@0@1@@@@@1 18$^+$ levels at 4016 and 4087 keV.
2019Ma70 was compiled for the XUNDL database by E.A. McCutchan (NNDC, BNL).
2011Sh07 was compiled for the XUNDL database by B. Singh (McMaster).
Data are from: ^{152}Sm(α,2nγ), E(α)=24 MeV (1978We08 and 1973Kh07) and E(α)=26 MeV (1994Wu01 and 1993Wu03) and ^{154}Sm(α,4nγ), E(α) $\approx$ 40 MeV (1973Wa33). Others: ^{152}Sm(α,2nγ) −1966Lo11, 1968Ej01, 1972Re04, and 1982Da12; ^{154}Sm(α,4nγ) −1965Ej01, 1971Fe04, 1972Fe08, 1973Wa12, 1973Wa33, and 1974Go30.
The level scheme is that of 1978We08, except where noted otherwise.
Experimental methods:
1965Ej01: (α,4nγ) with E=40 MeV; measured anisotropy of ce for 5 γ's up 10$^+$ level.
1966Lo11: (α,2nγ), E(α)=18-20.5 MeV; measured ce in magnetic spectrometer including ce-γ coincidences. Report ce for 37 γ's and levels to 10$^+$ in two bands.
1968Ej01: (α,2nγ) and (α,4nγ), E(α)=36 and 40 MeV; measured ce in magnetic spectrometer; Report 8 γ's and levels to 12$^+$ in ground-state band.
1968Wi16: (α,4nγ), E=40.5 MeV.
1969FeZZ: Abstract, see 1972Fe08.
1971Fe04: (α,4nγ), E(α)=42 MeV; measured γ's in Ge detector. Report a few branching ratios.
1972Fe08: (α,4nγ), E(α)=40 MeV. Report two new levels.
1972Re04: (α,2nγ), E(α)=27-32 MeV; measured Eγ, I$\gamma(\theta)$, and $\gamma\gamma$ coincidences. Report more levels.
1973GoYQ: (α,4nγ); see 1974Go30.
1973Kh07: (α,2nγ), E(α)=24 MeV and (α,4nγ), E(α)=41-50 MeV; measured excitation functions, γ singles, and $\gamma\gamma$.
1973Wa12: (α,4nγ), E(α)=38 and 41 MeV; measured excitation functions, $\gamma(\theta)$, and $\gamma\gamma$ coincidences. Report levels to 16$^+$.
1973Wa33: Same experimental arrangement as 1973Wa12.
1974Go30: (α,4nγ), E(α)=45 MeV; measured ce with magnetic transport system and Si(Li) detector. Report α_K(exp) and E0/E2 ratios.
1976WeZP: Abstract, see 1978We08.
1978We08: (α,2nγ), E(α)=24 MeV; measured $\gamma(\theta)$ at seven angles and $\gamma\gamma$ coincidences. Report many δ values.
1982Da12: (α,2nγ); measured γ linear polarization correlation. Report J^π and δ.
1993Wu03: See 1994Wu01 for measurement arrangement. Report data for 4$^+$ band at 1646 keV.
1994Wu01: (α,2nγ), E(α)=26 MeV; measured γ singles, $\gamma\gamma$ coincidences, $\gamma(\theta)$, and DCO ratios in an array of five 30%-efficient HPGe detectors with anti-Compton shields.
2011Sh07: (α,4nγ), E=45 MeV. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$(DCO) using AFRODITE array of eight HPGe clover detectors in Anti-Compton BGO shields. No evidence of double β vibration below 1.5 MeV. Only partial results related to the excited 0$^+$ band are reported in this paper. Only levels are given for the negative parity bands.
2019Ma70: (α,2nγ), E(α)=25 MeV from iThemba laboratory, with 4 mg/cm^2-thick target. Measured Eγ, Iγ, $\gamma\gamma$, $\gamma\gamma(\theta)$ and $\gamma\gamma$(lin pol) using the AFRODITE array.

^{154}Gd Levels

E(level)[†]	J^{π}[‡]	Comments
0.0[c]	0$^+$	
123.05[c] 14	2$^+$	
371.07[c] 14	4$^+$	
680.35[d] 24	0$^+$	Level proposed by 1965Ej01.
717.79[c] 15	6$^+$	
815.47[d] 14	2$^+$	
996.33[f] 14	2$^+$	
1047.59[d] 15	4$^+$	
1127.73[f] 15	3$^+$	

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$^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$ (continued)

^{154}Gd Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$[#]	Comments
1144.63[c] 16	8^+		
1182[i]	0^+		
1241[@g]	1^-		
1251.1[g] 10	3^-		
1263.64[f] 14	4^+		
1365.90[d] 16	6^+		
1398[&h]	2^-[&]		
1404.3[g] 10	5^-		
1418[&i]	2^+[&]		
1432.47[f] 15	5^+		
1531[k]	2^+		
1560[&h]	4^-[&]		
1606.47[f] 16	6^+		
1637.36[c] 17	10^+		
1645.50[l] 16	4^+		
1661[@j]	3^+		
1674.2[g] 11	7^-		
1702[&i]	4^+[&]		
1719[&p]	2^-[&]		
1756.73[d] 17	8^+		
1770.00[m] 15	5^+		
1790[&k]	(4^+)[&]		
1796[&]	3^-[&]		J^{π}: $K^{\pi}=1^-$ octupole vibration built on the second vacuum band.
1810.34[f] 16	7^+		
1825[&h]	6^-[&]		
1836?[&]	0^+[&]		J^{π}: $K^{\pi}=0^+$ excitation built on the second vacuum band.
1911.31[l] 15	6^+		
1922[&p]	4^-[&]		
1988[&j]	5^+[&]		
2018.47[f] 16	8^+		
2040.5[g] 8	(9^-)		
2073.07[m] 15	(7^+)		
2116.7 11			
2137.4[n] 6	7^-	68 ns	
2183[@&h]	8^-[&]		
2185.18[c] 21	12^+		
2194.46[d] 19	10^+		
2215.4 8			
2245[&j]	7^+[&]		
2245.6 9			
2251.57[f] 18	9^+		
2252.6 15			J^{π}: Shown as $9^{(-)}$ on the level scheme of 1994Wu01, but no reasons were given in support of it.
2253.89[l] 15	(8^+)		
2266?[&]	4^+[&]		J^{π}: $K^{\pi}=4^+$ excitation built on second vacuum band.
2272.4 8			

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$^{152}Sm(\alpha,2n\gamma)$,$^{154}Sm(\alpha,4n\gamma)$ (continued)

^{154}Gd Levels (continued)

E(level)[†]	J$^\pi$[‡]	Comments
2300.7[&k]	(6$^+$)[&]	
2308.9[n] 6	(8$^-$)	
2324.1 11		
2392.2[&j] 7	9$^+$[&]	
2404.0[o] 8	(7$^+$)	
2440.4 10		
2453.06[m] 16	(9$^+$)	E(level): level reported and assigned by 1993Wu03, 1994Wu01.
2473.8 6	(9$^-$)	
2482.4[g] 8	(11$^-$)	
2490.43[f] 18	10$^+$	
2510[&p]	8$^-$[&]	
2556[&n]	9$^-$[&]	
2580[@]	10$^{(-)}$	
2603[&k]	(10$^+$)[&]	
2621.4[@h] 12	10$^{(-)}$	
2622.44[e] 23	12$^+$	
2667.5[l] 11	10$^+$	
2694.7 8		
2710.3[&j] 6	11$^+$[&]	
2720.0 12		
2735.2 9		
2741[&n]	10$^-$[&]	
2746.72[f] 21	11$^+$	
2776[@]	11$^{(-)}$	
2778.38[ac] 25	14$^+$	
2779.6 7		
2786.6 7		
2900[&m]	11$^+$[&]	
2951[@]	12$^{(-)}$	
2956[@]	12$^{(-)}$	
2957[&n]	11$^-$[&]	
2964.4[&k] 7	12$^+$[&]	
2981[@g]	13$^{(-)}$	
3011.33[f] 20	12$^+$	
3028.0[ae] 3	14$^+$	
3100[&h]	12$^-$[&]	
3136.3[&j] 7	13$^+$[&]	
3141[&l]	12$^+$[&]	
3152.7 10		
3159[@]	13$^{(-)}$	
3186[&n]	12$^-$[&]	
3285.1[f] 3	13$^+$	
3402[&m]	13$^+$[&]	
3405.5[c] 3	16$^+$	
3429[@n]	14$^{(-)}$	
3469.6[&k] 7	14$^+$[&]	

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^{152}Sm(α,2nγ),^{154}Sm(α,4nγ) (continued)

^{154}Gd Levels (continued)

E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]	E(level)[†]	Jπ[‡]
3491.7[ae] 3	16+	3853.1[&f] 11	15+[&]	4147.2[&f] 7	16+[&]	4736[&g]	19−[&]
3519[@g]	15(−)	3908.0[&k] 11	(16+)[&]	4244[&n]	16−[&]	4784.4[&c] 13	20+[&]
3564.2[f] 7	14+	3959[&n]	15−[&]	4291.5[&j] 9	17+[&]	5351.2[&e] 16	22+[&]
3609[h]	14−	4017.2[be] 8	18+	4422.7[&k] 11	18+[&]	5522.4[&c] 16	22+[&]
3630[@]	15(−)	4088.4[bc] 8	18+	4474.1[&f] 15	17+[&]	6123.2[&e] 19	24+[&]
3675.4[&j] 8	15+[&]	4102[&g]	17−[&]	4538[&n]	17−[&]	6295.4[&c] 19	24+[&]
3687[&n]	14−[&]	4125[&h]	16−[&]	4647.2[&e] 13	20+[&]		

[†] From a least-squares fit to the γ energies. For the rounded-to-keV Eγ's with no unc, ΔEγ=1 keV was assigned for the least-squares fit.

[‡] Adopted from the references used in this dataset based on γ-ray multipolarities.

[#] From 1978We08.

[@] 1994Wu01 show this level on their level scheme as being populated in their (α,2n) study, but give no supporting evidence (such as γ feeding or deexcitation) for it. The level energy is that reported by these authors. This level was not reported in the earlier α-induced reaction studies, although it is seen in other types of experiments.

[&] 2011Sh07 list E(level) and J values with no arguments other than placement in band sequences (most of which do not have any interconnecting γ transitions).

[a] Level proposed by 1973Kh07 and 1973Wa33.

[b] Level proposed by 1973Kh07.

[c] Band(A): $K^\pi=0^+$ ground-state band.

[d] Band(B): First excited $K^\pi=0^+$ band. Probable β-vibrational band.

[e] Band(b): Aligned two-neutron-quasiparticle band. Cranked shell-model configuration=AB. 2011Sh07 consider this band as continuing band B.

[f] Band(C): $K^\pi=2^+$ γ-vibrational band.

[g] Band(D): $K^\pi=1^-$ odd-spin octupole-vibrational band.

[h] Band(d): $K^\pi=1^-$ even-spin octupole-vibrational band.

[i] Band(E): $K^\pi=0^+$ band. Excitation built on the g.s. band.

[j] Band(F): $K^\pi=2^+$ odd-spin band. 2011Sh07 do not give the 8^+ member of this band.

[k] Band(f): $K^\pi=2^+$ even-spin band.

[l] Band(G): $K^\pi=4^+$ even-spin band. Dominant Configuration=(π 3/2[411])+(π 5/2[413]). From single-nucleon transfer-reaction data, 2001Bu17 have established that this band has a large component of this two-quasiproton state. They propose that this band is, consequently, a hexadecapole vibration. On the other hand, 1994Wu01 (see also 1993Wu03, 1993ApZZ) propose that it is a two-phonon $K^\pi=4^+$ γ-vibrational band. This latter is not adopted in this evaluation.

[m] Band(g): $K^\pi=4^+$ odd-spin band.

[n] Band(H): $K^\pi=7^-$ band. Configuration=(ν 3/2[651])+(ν 11/2[505]).

[o] Band(I): $K^\pi=7^+$ band. Configuration=(ν 3/2[521])+(ν 11/2[505]).

[p] Band(J): $K^\pi=1^-$ band, even spin. Octupole vibration built on the second vacuum band. 2011Sh07 do not give the 6^- member of this band.

$^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$ (continued)

$\gamma(^{154}Gd)$

For most of the Eγ values of the $^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$ dataset in the preceding 2009Re14 evaluation no ΔEγ′s were listed in the original articles and therefore no ΔEγ values were adopted in these situations. The newer measurement published by 2019Ma70 list a complete set of Eγ,ΔEγ values, however with the Eγ values systematically smaller than those of 2009Re14.

The other newer measurement published by 2011Sh07 (done by essentially the same experimental setup and group as 2019Ma70) list rounded-to-keV Eγ values, which are very close to those in the 2009Re14 evaluation, with no ΔEγ values. The Eγ values of 2019Ma70 are also systematically smaller than the corresponding adopted γ values, which singularizes the 2019Ma70 Eγ values.

In order to rescale the 2019Ma70 Eγ′s, the evaluator recalibrated them using a quadratic regression between two selected sets (each of 42 values) from 2019Ma70 and 2009Re14. The recalibrated Eγ values are replacing the original values of 2019Ma70 in the γ table.

Additional information 2.

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	Comments
123.1[d] *10*	97 *5*	123.05	2^+	0.0	0^+	E2		I_γ: Value may include Iγ of 124.4γ from 1770 level. A_2=+0.05 *5*, A_4=0.00 *00* (1965Ej01). A_2=+0.21 *7*, A_4=−0.08 *8* (1972Re04). A_2=0.100 *17*, A_4=0.046 *24* (1978We08). R(DCO)=1.01 *10* (2019Ma70). δ: 0.00 *97* (1978We08).
124.5[a] *2*		1770.00	5^+	1645.50	4^+			A_2=0.05 *15*, A_4=0.20 *17* (1978We08). δ: −0.004 +∞-∞ (1978We08).
127[e]		1127.73	3^+	996.33	2^+			
131.6		2440.4		2308.9	(8^-)			
135.10[cd] *20*		815.47	2^+	680.35	0^+	E2		
137[e]		1263.64	4^+	1127.73	3^+			
141.18[a] *6*	2.45 *12*	1911.31	6^+	1770.00	5^+	E2+M1	7 *+6−3*	A_2=0.13 *3*, A_4=0.068 *39* (1978We08).
150.6		2404.0	(7^+)	2253.89	(8^+)			
158.0		2404.0	(7^+)	2245.6				
161.78[a] *4*	2.12 *11*	2073.07	(7^+)	1911.31	6^+	D+Q		A_2=0.009 *22*, A_4=0.004 *32* (1978We08).
166.0	0.79 *4*	2473.8	(9^-)	2308.9	(8^-)	D+Q	−0.44 *+13−26*	A_2=−0.93 *5*, A_4=0.16 *6* (1978We08).
167[e]		1432.47	5^+	1263.64	4^+			
172.0	2.31 *12*	2308.9	(8^-)	2137.4	7^-	D+Q		I_γ: Value is for Iγ(172.0+172.1). A_2=0.97 *4*, A_4=0.006 *54* (1978We08). δ: 0.543 *+100−7* and −0.394 *+59−72* (1978We08).
172.1	2.31 *12*	2245.6		2073.07	(7^+)			I_γ: Value is for Iγ(172.0+172.1).
173[e]		1606.47	6^+	1432.47	5^+			
180.87[a] *4*	1.42 *7*	2253.89	(8^+)	2073.07	(7^+)	D		A_2=−0.25 *3*, A_4=0.001 *43* (1978We08).
199.18[a] *8*		2453.06	(9^+)	2253.89	(8^+)			I_γ: Iγ(199.18)/Iγ(379.98)=0.65 *14* (1994Wu01).
199.3		2272.4		2073.07	(7^+)			
203.9		1810.34	7^+	1606.47	6^+			E_γ: from level-energy difference; 211 given by 2011Sh07 is wrong.

γ(^{154}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
205.4		2116.7		1911.31	6^+		
208.3[cd] *5*		2018.47	8^+	1810.34	7^+		
219.6		2473.8	(9^-)	2253.89	(8^+)		
221.0		2694.7		2473.8	(9^-)		
226.0	2.41 *12*	2137.4	7^-	1911.31	6^+	E1	A_2=−0.15 *2*, A_4=0.017 *27* (1978We08). δ: 0.031 *+48−44* and 0.017 *+49−84* (1978We08).
232.18[cd] *14*	1.30 *7*	1047.59	4^+	815.47	2^+	E2	A_2=0.22 *5*, A_4=0.16 *6* (1978We08). δ: −0.13 *+13−14* (1978We08).
246.2		2720.0		2473.8	(9^-)		
248.0[d] *10*	139 *7*	371.07	4^+	123.05	2^+	E2	α(K)exp: 0.0827 *119* (1974Go30). A_2=+0.21 *3*, A_4=−0.031 *4* (1965Ej01). A_2=+0.29 *3*, A_4=−0.03 *4* (1972Re04). A_2=0.26 *1*, A_4=0.057 *18* (1978We08). δ: −0.009 *+22−26* (1978We08). R(DCO)=1.02 *11*, A_p=0.15 *10* (2019Ma70).
260.6		2735.2		2473.8	(9^-)		
265.88[a] *7*	0.98 *13*	1911.31	6^+	1645.50	4^+		I_γ: From Iγ(141.18) and Iγ(265.88)/Iγ(141.18)=0.40 *5* (1994Wu01).
≈266.0[b]	≈1.3	2404.0	(7^+)	2137.4	7^-		
267.3[a] *1*		1263.64	4^+	996.33	2^+	E2	267.3 *1* (1994Wu01), 267.50 *17* (2019Ma70). R(DCO)=0.96 *5*, A_p=0.07 *5* (2019Ma70).
≈302.8	≈1.2	2440.4		2137.4	7^-		E_γ: peak is part of a triplet in the spectrum of 1978We08. Eγ is from the level-energy difference.
303.22[a] *9*	1.3 *3*	2073.07	(7^+)	1770.00	5^+		I_γ: From Iγ(161.78) and Iγ(303.22)/Iγ(161.78)=0.62 *14* (1994Wu01).
304.75[ga] *15*	[g]	1432.47	5^+	1127.73	3^+	E2	304.75 *15* (1994Wu01), 304.53 *17* (2019Ma70). R(DCO)=1.02 *7*, A_p=0.18 *5* (2019Ma70).
304.75[ga] *15*	0.96[g] *12*	1911.31	6^+	1606.47	6^+		I_γ: From Iγ(141.18) and Iγ(304.75)/Iγ(141.18)=0.39 *5* (1994Wu01).
[x]312.8	0.60 *4*						A_2=0.42 *8*, A_4=−0.11 *11* (1978We08).
314.2		2786.6		2473.8	(9^-)		
318[e]		2710.3	11^+	2392.2	9^+		
318.32[cd] *13*	4.51 *23*	1365.90	6^+	1047.59	4^+	E2	A_2=+0.31 *15*, A_4=−0.08 *17* (1972Re04). A_2=0.33 *2*, A_4=−0.091 *90* (1978We08). δ: −0.004 *+70−66* (1978We08). R(DCO)=0.99 *10*, A_p=0.12 *10* (2019Ma70).
[x]329.1	0.90 *11*						A_2=−0.17 *22* (1978We08).
329.92[cd] *16*		1047.59	4^+	717.79	6^+	E2	
337.35[a] *9*	0.77 *6*	1770.00	5^+	1432.47	5^+	(E0+M1+E2)	
342.44[a] *7*	2.7 *13*	2253.89	(8^+)	1911.31	6^+		I_γ: From Iγ(180.87) and Iγ(180.87)/Iγ(342.44)=0.53 *26* (1994Wu01).
343.0[a] *2*		1606.47	6^+	1263.64	4^+		343.0 *2* (1994Wu01), 342.70 *15* (2019Ma70).
343[eh]		2964.4	12^+	2621.4	$10^{(-)}$		Based on ΔJ^π(levels) this could be a M2 transitions.

γ(^{154}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	Comments
346.7[d] *1*	100 *5*	717.79	6^+	371.07	4^+	E2	α(K)exp: 0.0306, normalized to theoretical value (1974Go30). A_2=+0.25 *3*, A_4=−0.044 *6* (1965Ej01). A_2=+0.29 *6*, A_4=−0.02 *7* (1972Re04). A_2=0.30 *1*, A_4=−0.077 *16* (1978We08). δ: −0.009 *+11−13* (1978We08). R(DCO)=1.01 *10*, A_p=0.15 *5* (2019Ma70).
378.4[a] *2*	1.34 *7*	1810.34	7^+	1432.47	5^+	E2	378.4 *2* (1994Wu01), 378.04 *14* (2019Ma70). A_2=0.38 *4*, A_4=−0.19 *4* (1978We08). δ: −0.026 *+48−44* (1978We08). A_p=0.24 *4* (2019Ma70).
379.98[a] *8*		2453.06	(9^+)	2073.07	(7^+)		
390.80[cd] *13*	6.1 *3*	1756.73	8^+	1365.90	6^+	E2	A_2=+0.39 *9*, A_4=−0.05 *9* (1972Re04). A_2=0.35 *2*, A_4=−0.099 *25* (1978We08). δ: 0.00 *5* (1978We08). R(DCO)=1.00 *10*, A_p=0.16 *10*.
404[eh]		1531	2^+	1127.73	3^+		
405.63[&cd] *14*		3028.0	14^+	2622.44	12^+	E2	R(DCO)=0.98 *4*, A_p=0.09 *30* (2011Sh07).
412.03[cd] *14*		2018.47	8^+	1606.47	6^+	E2	R(DCO)=0.99 *5*, A_p=0.16 *5* (2019Ma70).
412.8		2324.1		1911.31	6^+		
414.9		2667.5	10^+	2252.6			
426[e]		3136.3	13^+	2710.3	11^+		
426.9[cd] *1*	≤55	1144.63	8^+	717.79	6^+	E2	I_γ: Iγ(427.0+427.8)=52.4 *26*. α(K)exp: 0.0170 *22* (1974Go30). A_2=+0.29 *5*, A_4=−0.059 *1* (1965Ej01). A_2=+0.33 *5*, A_4=−0.02 *7* (1972Re04). A_2=0.32 *1*, A_4=−0.079 *15* (1978We08). δ: −0.004 *11* (1978We08). R(DCO)=1.00 *10*, A_p=0.14 *15* (2019Ma70).
428.02[cd] *13*	≤55	2622.44	12^+	2194.46	10^+	E2	I_γ: Iγ(427.0+427.8)=52.4 *26*; from intensity balances, most of this intensity depopulates the 1144 level. R(DCO)=1.00 *1* (2011Sh07).
436.73[cdh] *13*		2622.44	12^+	2185.18	12^+	M1+E2	α(K)exp: 0.0220 *45*, for 437.82γ+436.73γ (1974Go30). R(DCO)=1.01 *1* (2011Sh07).
437.82 *13*	3.39 *17*	2194.46	10^+	1756.73	8^+	E2	α(K)exp: 0.0220 *45*, for 437.82γ+436.73γ (1974Go30). A_2=0.39 *3*, A_4=−0.093 *46* (1978We08). δ: 0.022 *+81−76* (1978We08). R(DCO)=1.01 *10* (2011Sh07).
441.15[cd] *14*		2251.57	9^+	1810.34	7^+	E2	A_p=0.08 *4* (2011Sh07).
441.3	0.56 *5*	2482.4	(11^-)	2040.5	(9^-)	E2	A_2=0.55 *15*, A_4=−0.19 *4* (1978We08). δ: −0.08 *+31−21* (1978We08).

$^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$ (continued)

$\gamma(^{154}Gd)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	Comments
442[e]		3469.6	14+	3028.0	14+			
444.55[cd] *14*	1.05 *6*	815.47	2+	371.07	4+	E2		A_2=−0.080 *82*, A_4=0.20 *11* (1978We08). δ: 3.66 +∞-∞ (1978We08).
459.5		2215.4		1756.73	8+			
463.71[cd] *17*		3491.7	16+	3028.0	14+	E2		R(DCO)=1.11 *12*.
469.9	0.88 *7*	2779.6		2308.9	(8−)			A_2=0.35 *13*, A_4=−0.28 *15* (1978We08).
471.96[cd] *14*		2490.43	10+	2018.47	8+	E2		R(DCO)=0.97 *13*, A_p=0.19 *6* (2011Sh07).
479.07[a] *18*	1.13 *19*	1911.31	6+	1432.47	5+			I_γ: From Iγ(141.18) and Iγ(479.07)/Iγ(141.18)=0.46 *8* (1994Wu01). A_2=−0.39 *8*, A_4=0.067 *94* (1978We08). δ: −2.3 *+23−65* or −0.26 *+31−967* (1978We08).
492.8[cd] *1*	18.6 *9*	1637.36	10+	1144.63	8+	E2		A_2=+0.32 *6*, A_4=−0.081 *2* (1965Ej01). A_2=+0.38 *6*, A_4=+0.01 *9* (1972Re04). A_2=0.33 *1*, A_4=−0.078 *16* (1978We08). δ: 0.00 *22* (1978We08). α(K)exp: 0.0124 *21* (1974Go30). R(DCO)=1.013 *20*, A_p=0.13 *10* (2019Ma70).
495.16[cd] *15*		2746.72	11+	2251.57	9+	E2		A_p=0.16 *5* (2011Sh07).
505[e]		3469.6	14+	2964.4	12+			
506.36[a] *6*		1770.00	5+	1263.64	4+	E2		
516[e]		2710.3	11+	2194.46	10+			
517.9[a] *1*	1.99 *10*	1645.50	4+	1127.73	3+	E2+M1	−7 *3*	A_2=−0.16 *4*, A_4=0.18 *5* (1978We08). δ: −7.1 *+31−25* (1978We08).
520.73[cd] *12*		3011.33	12+	2490.43	10+			
525.4		2779.6		2253.89	(8+)			E_γ: γ placed here by 1978We08, but 1973Kh07 place it from the 4016 level.
525.4[@]		4017.2	18+	3491.7	16+			E_γ: γ placed here by 1973Kh07, but 1978We08 place it from the 2779 level.
538.42[e] *19*		3285.1	13+	2746.72	11+	E2		R(DCO)=1.23 *15*, A_p=0.15 *19* (2011Sh07).
539[e]		3675.4	15+	3136.3	13+			
546.7[b]		1911.31	6+	1365.90	6+			
547.77 *13*	4.10 *21*	2185.18	12+	1637.36	10+	E2		I_γ: Value may include Iγ of 546.7γ from 1911 level. α(K)exp: 0.0091 *16* (1974Go30). A_2=+0.50 *12*, A_4=+0.08 *12* (1972Re04). A_2=0.38 *3*, A_4=−0.15 *3* (1978We08). R(DCO)=1.01 *15*, A_p=0.14 *10* (2011Sh07).
553[e]		3564.2	14+	3011.33	12+			
557[eh]		680.35	0+	123.05	2+			
557.04 *15*	0.31 *11*	2194.46	10+	1637.36	10+	E0+M1+E2		I_γ: From Iγ(556)/Iγ(437)=0.09 *3* (1973Wa33). Mult.: α(K)exp > α(K)(M1) > α(K)(M1+E2) > α(K)(E2) signals E0 component. α(K)exp: 0.046 *12* (1974Go30). R(DCO)=0.86 *5*, A_p=−0.01 *5* (2011Sh07).

From ENSDF

$^{154}_{64}Gd_{90}$-8

γ(^{154}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
568[e]		3853.1	15^+	3285.1	13^+			
583[e]		4147.2	16^+	3564.2	14^+			
593.19[&cd] *14*		2778.38	14^+	2185.18	12^+	E2		A_2=+0.38 *25* (1972Re04). R(DCO)=0.97 *3*, A_p=0.12 *30* (2019Ma70).
596.5[@]		4088.4	18^+	3491.7	16^+			
608.0	0.35 *6*	2215.4		1606.47	6^+			A_2=−0.21 *42*, A_4=−0.28 *53* (1978We08).
611.7[@]		4017.2	18^+	3405.5	16^+			I_γ: Iγ(611)/Iγ(525)=1.3 *3* (1973Kh07).
612.09[cd] *14*	2.01 *12*	1756.73	8^+	1144.63	8^+	E0+M1+E2	−0.69 *14*	Mult.: α(K)exp > α(K)(M1) > α(K)(M1+E2) > α(K)(E2) signals E0 component. α(K)exp: 0.053 *7* (1974Go30). A_2=0.040 *82*, A_4=−0.20 *11* (1978We08). δ: −0.69 *+12−14* (1978We08).
613[eh]		1661	3^+	1047.59	4^+			
614.55[cd] *18*		2251.57	9^+	1637.36	10^+	M1+E2		R(DCO)=0.85 *5*, A_p=−0.01 *4* (2011Sh07).
616[e]		4291.5	17^+	3675.4	15^+			
621[e]		4474.1	17^+	3853.1	15^+			
622[eh]		1988	5^+	1365.90	6^+			
627.14[cd] *18*		3405.5	16^+	2778.38	14^+	E2		α(K)exp: 0.006 *2* (1974Go30). R(DCO)=1.05 *15* (2011Sh07).
630[e]		4647.2	20^+	4017.2	18^+			
635.0		2272.4		1637.36	10^+			
636[e]		2392.2	9^+	1756.73	8^+			
642.28[a] *7*		1770.00	5^+	1127.73	3^+	E2		
647.57[a] *23*	1.74 *20*	1911.31	6^+	1263.64	4^+			I_γ: From Iγ(141.18) and Iγ(647.57)/Iγ(141.18)=0.71 *7* (1994Wu01).
648.16[cd] *13*	11.2 *6*	1365.90	6^+	717.79	6^+	E0+M1+E2	1.30 *20*	Mult.: α(K)exp > α(K)(M1) > α(K)(M1+E2) > α(K)(E2) signals E0 component. α(K)exp: 0.039 *7* (1974Go30). A_2=+0.03 *12*, A_4=−0.01 *13* (1972Re04). A_2=0.14 *1*, A_4=−0.084 *19* (1978We08). A_p=−0.05 *10* (2019Ma70). δ: 1.30 *+21−18* (1978We08).
649.5[b]		1645.50	4^+	996.33	2^+	E2		
652.61[cd] *10*		2018.47	8^+	1365.90	6^+			
656[e]		4147.2	16^+	3491.7	16^+			
665.86[a] *14*	1.17 *6*	1810.34	7^+	1144.63	8^+	E2+M1	−3.2 *+7−10*	665.86 *14* (1994Wu01), 665.78 *14* (2019Ma70). A_2=0.25 *6*, A_4=0.30 *8* (1978We08). δ: −3.17 *+67−99* (1978We08). R(DCO)=0.92 *4*, A_p=−0.11 *3* (2019Ma70).

$^{154}_{64}$Gd$_{90}$-9

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ) (continued)

γ(^{154}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	Comments
676.52[cd] *13*	8.0 *4*	1047.59	4^+	371.07	4^+	E0+M1+E2	+2.9 *4*	A_2=0.009 *49*, A_4=−0.037 *24* (1978We08). Mult.: α(K)exp > α(K)(M1) > α(K)(M1+E2) > α(K)(E2) signals E0 component. α(K)exp: 0.040 *4* (1974Go30). δ: 2.9 *+210−90* (1978We08). A_2=0.013 *29*, A_4=−0.166 *38*, A_p=−0.153 *52* (1982Da12). δ: −3.53 *+83−100* (1982Da12). R(DCO)=0.85 *12*, A_p=−0.04 *10* (2019Ma70).
680		680.35	0^+	0.0	0^+			E_γ: From 1965Ej01.
683.0[@]		4088.4	18^+	3405.5	16^+			I_γ: Iγ(683)/Iγ(596)=2.7 *8* (1973Kh07).
692.34[cd] *14*	4.74 *24*	815.47	2^+	123.05	2^+	E0+M1+E2	7.5 *4*	
695.5		2735.2		2040.5	(9^-)			
696[e]		4784.4	20^+	4088.4	18^+			
704[e]		5351.2	22^+	4647.2	20^+			
707.5		2779.6		2073.07	(7^+)			
712.4		3152.7		2440.4				
713.3[&]		3491.7	16^+	2778.38	14^+			I_γ: Iγ(713)/Iγ(463)=0.31 *3* (1973Kh07) and 0.71 *16* (1973Wa33).
714.75[a] *13*	2.35 *12*	1432.47	5^+	717.79	6^+	M1+E2		714.75 *15* (1994Wu01), 714.59 *14* (2019Ma70). R(DCO)=0.69 *5*, A_p=−0.01 *5* (2019Ma70). A_2=−0.009 *49*, A_4=−0.020 *60* (1978We08). δ: −0.10 *+17−20* or −6.9 *42*−∞ (1978We08).
716[eh]		1531	2^+	815.47	2^+			
738[e]		5522.4	22^+	4784.4	20^+			
741[e]		4147.2	16^+	3405.5	16^+			
756.66[a] *8*	2.56 *13*	1127.73	3^+	371.07	4^+	E2+M1	−6.1 *3*	756.66 *8* (1994Wu01), 756.67 *14* (2019Ma70). A_2=−0.13 *5*, A_4=−0.001 *58* (1978We08). δ: 0.16 *+22−19* or 21 +∞−*17* (1978We08). R(DCO)=0.88 *3*, A_p=−0.05 *2* (2019Ma70).
770[e]		2964.4	12^+	2194.46	10^+			
772[e]		6123.2	24^+	5351.2	22^+			
773[e]		6295.4	24^+	5522.4	22^+			
779[e]		2964.4	12^+	2185.18	12^+			
815.44[@cd] *19*		815.47	2^+	0.0	0^+	E2		A_2=0.11 *28*, A_4=0.061 *36* (1978We08). δ: −0.02 ∞ (1978We08).
826.3[cd] *14*		3011.33	12^+	2185.18	12^+			
841[e]		3028.0	14^+	2185.18	12^+			
[x]842.6								E_γ: Placed from the 14^+, 3027 level. However, this is not confirmed in (^{9}Be,5nγ).

$^{154}_{64}$Gd$_{90}$-10

γ(^{154}Gd) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	δ [#]	Comments
								I_γ: Iγ(842)/Iγ(405)=0.25 *3* (1973Wa33) and<0.12 (1973Kh07). 1989Mo20, in (^{9}Be,5nγ), do not report this γ.
843.6	1.32 *8*	3152.7		2308.9	(8⁻)			A_2=−0.08 *7*, A_4=0.30 *8* (1978We08).
845.5	2.16 *12*	2482.4	(11⁻)	1637.36	10⁺	E1		A_2=−0.21 *4*, A_4=0.052 *43* (1978We08). δ: 0.05 *5* or −0.017 *35* (1978We08).
846[eh]		1661	3⁺	815.47	2⁺			
846[eh]		2603	(10⁺)	1756.73	8⁺			
847[e]		3469.6	14⁺	2622.44	12⁺			
850[eh]		1531	2⁺	680.35	0⁺			
852.83[cd] *15*		2490.43	10⁺	1637.36	10⁺	M1+E2		R(DCO)=0.6 *4*, A_p=−0.13 *3* (2011Sh07).
873.26[a] *6*	5.8 *3*	996.33	2⁺	123.05	2⁺	E2+M1	−9.4 *4*	873.26 *6* (1994Wu01), 873.06 *14* (2019Ma70). A_2=−0.17 *3*, A_4=−0.085 *43* (1978We08).
873.3[g]	5.8[g] *3*	2786.6		1911.31	6⁺			
873.83[cd] *14*		2018.47	8⁺	1144.63	8⁺			
879[eh]		2245	7⁺	1365.90	6⁺			
880[e]		3908.0	(16⁺)	3028.0	14⁺			
886[e]		4291.5	17⁺	3405.5	16⁺			
886.5[fh]		2253.89	(8⁺)	1365.90	6⁺			
886.5[fh]		2694.7		1810.34	7⁺			
888.69[a] *13*	3.73 *19*	1606.47	6⁺	717.79	6⁺	E2+M1	>1.8	888.69 *13* (1994Wu01), 888.53 *13* (2019Ma70). A_2=−0.29 *2*, A_4=−0.14 *3* (1978We08). δ: −3.1 +*13*−∞ or >7 (1978We08). R(DCO)=0.77 *20*, A_p=−0.02 *1* (2019Ma70).
892.62[a] *12*	5.9 *3*	1263.64	4⁺	371.07	4⁺	E2+M1	−3.8 *3*	892.62 *12* (1994Wu01), 892.64 *13* (2019Ma70). A_2=−0.26 *2*, A_4=−0.004 *20* (1978We08). δ: −1.96 +*78*−*115* (1978We08). R(DCO)=0.91 *3*, A_p=−0.13 *5* (2019Ma70).
896.2	4.64 *24*	2040.5	(9⁻)	1144.63	8⁺	D		A_2=−0.28 *2*, A_4=0.053 *29* (1978We08). δ: −0.017 *35* or 0.00 *4* (1978We08).
897[e]		3675.4	15⁺	2778.38	14⁺			
924.38[cd] *14*	2.54 *14*	1047.59	4⁺	123.05	2⁺	E2		A_2=0.16 *4*, A_4=−0.18 *5* (1978We08). δ: −0.2 +*13*−*27* (1978We08). R(DCO)=0.88 *30*, A_p=0.11 *20* (2019Ma70).
931[e]		4422.7	18⁺	3491.7	16⁺			
940[eh]		1988	5⁺	1047.59	4⁺			
943.0		2308.9	(8⁻)	1365.90	6⁺			
951[e]		3136.3	13⁺	2185.18	12⁺			
956.4	2.95 *17*	1674.2	7⁻	717.79	6⁺	E1		A_2=−0.43 *6*, A_4=0.049 *48* (1978We08).

$^{154}_{64}$Gd$_{90}$-11

γ(^{154}Gd) (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
								δ: −0.070 *71* (1978We08). A_2=−0.246 *50*, A_4=−0.014 *63*, A_p=0.254 *120* (1982Da12). δ: −0.035 *+84−49* (1982Da12).
[x]957.3	2.14 *13*							A_2=−0.10 *6*, A_4=0.003 *58* (1978We08).
975[eh]		1790	(4$^+$)	815.47	2$^+$			
985.3[cdh] *3*		2622.44	12$^+$	1637.36	10$^+$			I_γ: Iγ(984)/Iγ(427)=0.041 *9* (1973Kh07).
993.0	1.87 *12*	2137.4	7$^-$	1144.63	8$^+$	E1(+M2)	−0.16 *+16−23*	A_2=0.049 *78*, A_4=0.003 *87* (1978We08). δ: from 1978We08.
994.86[cd] *14*	3.49 *19*	1365.90	6$^+$	371.07	4$^+$	E2		A_2=0.21 *5*, A_4=0.041 *56* (1978We08). δ: 0.04 *+21−23* (1978We08). R(DCO)=0.95 *20*, A_p=0.03 *10* (2019Ma70).
996.36[a] *17*	2.33 *13*	996.33	2$^+$	0.0	0$^+$	E2		996.36 *17* (1994Wu01), 996.13 *14* (2019Ma70). A_2=0.19 *5*, A_4=0.046 *60* (1978We08). δ: 0.00 *89* (1978We08). R(DCO)=0.95 *4* (2019Ma70).
1004.80[a] *8*	8.8 *4*	1127.73	3$^+$	123.05	2$^+$	E2+M1	−7.4 *4*	1004.80 *8* (1994Wu01), 1004.60 *13* (2019Ma70). A_2=−0.11 *2*, A_4=0.092 *20* (1978We08). δ: −6.0 *+11−16* (1978We08). A_2=−0.042 *27*, A_4=−0.012 *36*, A_p=0.156 *58* (1982Da12). δ: 6.14 *+169−237* (1982Da12). R(DCO)=0.93 *2*, A_p=−0.05 *4* (2019Ma70).
[x]1033.2	4.67 *13*							A_2=−0.31 *3*, A_4=0.052 *37* (1978We08).
1033.2	4.69 *24*	1404.3	5$^-$	371.07	4$^+$	E1		E_γ: γ observed by 1978We08 and placed by evaluator. A_2=−0.312 *40*, A_4=−0.100 *50*, A_p=0.433 *112* (1982Da12). δ: 0.012 *+33−12* (1982Da12).
1039.09[cd] *13*	4.52 *24*	1756.73	8$^+$	717.79	6$^+$	E2		A_2=0.35 *4*, A_4=−0.002 *47* (1978We08). δ: −0.06 *+15−13* (1978We08).
1049.86[@h] *18*	0.20 *2*	2194.46	10$^+$	1144.63	8$^+$			I_γ: From Iγ(1050)/Iγ(437)=0.058 *6* (1973Kh07).
1061.38[a] *6*	6.8 *3*	1432.47	5$^+$	371.07	4$^+$	E2+M1	−4.3 *+12−26*	A_2=−0.34 *3*, A_4=0.20 *4* (1978We08). δ: −4.3 *+12−26* (1978We08). R(DCO)=0.72 *1*, A_p=0.01 *2* (2019Ma70). 1061.38 *6* (1994Wu01), 1061.20 *13* (2019Ma70).
1073[e]		2710.3	11$^+$	1637.36	10$^+$			
1088.1		2694.7		1606.47	6$^+$			
1092.46[a] *6*	5.17 *27*	1810.34	7$^+$	717.79	6$^+$	E2+M1	−2.7 *+5−6*	1092.46 *6* (1994Wu01), 1092.58 *13* (2019Ma70). A_2=−0.61 *4*, A_4=0.26 *3* (1978We08). δ: −2.71 *+46−61* (1978We08). R(DCO)=0.53 *2*, A_p=0.06 *3* (2019Ma70).
1100.0[e] *12*		3285.1	13$^+$	2185.18	12$^+$	M1+E2		R(DCO)=0.57 *1* (2011Sh07).
1106.82[cd] *14*		2251.57	9$^+$	1144.63	8$^+$	M1+E2		R(DCO)=0.57 *1* (2011Sh07).

From ENSDF

$^{154}_{64}$Gd$_{90}$-12

γ(^{154}Gd) (continued)

E_γ [†]	I_γ [‡]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	Comments
1109.0 [bh]		2473.8	(9$^-$)	1365.90	6$^+$		Based on ΔJ^π(levels) this could be an E3 transitions.
1109.33 [cd] *18*		2746.72	11$^+$	1637.36	10$^+$	M1+E2	R(DCO)=0.57 *1*, A_p=0.16 *8* (2011Sh07).
1110.0 [b]		2253.89	(8$^+$)	1144.63	8$^+$		
1128 [a]		1251.1	3$^-$	123.05	2$^+$	E1	E_γ: from 1982Da12. A_2=−0.181 *34*, A_4=−0.066 *46*, A_p=0.435 *112* (1982Da12). δ: −0.049 *+27* (1982Da12).
1140.54 [a] *12*		1263.64	4$^+$	123.05	2$^+$	E2	1140.54 *12* (1994Wu01), 1140.54 *14* (2019Ma70). R(DCO)=0.89 *8* (2019Ma70).
1193.4 [a] *4*	0.81 *21*	1911.31	6$^+$	717.79	6$^+$		I_γ: From Iγ(141.18) and Iγ(1193.4)/Iγ(141.18)=0.33 *5* (1994Wu01).
1235.11 [a] *19*		1606.47	6$^+$	371.07	4$^+$		1235.11 *19* (1994Wu01), 1235.18 *15* (2019Ma70).
1247 [e]		2392.2	9$^+$	1144.63	8$^+$		
1253 [eh]		2300.7	(6$^+$)	1047.59	4$^+$		
1300.50 *16*		2018.47	8$^+$	717.79	6$^+$	E2	R(DCO)=0.93 *7* (2019Ma70).
1345.73 [cd] *19*		2490.43	10$^+$	1144.63	8$^+$	E2	R(DCO)=1.04 *11*, A_p=0.19 *24* (2011Sh07).
1374.35 [cd] *18*		3011.33	12$^+$	1637.36	10$^+$		
1379 [e]		3564.2	14$^+$	2185.18	12$^+$		
1419.7	1.21 *8*	2137.4	7$^-$	717.79	6$^+$	E1	A_2=0.11 *9*, A_4=−0.02 *11* (1978We08).
1421.3	2.93 *6*	2786.6		1365.90	6$^+$		A_2=0.066 *41*, A_4=−0.100 *52* (1978We08).
1541.2		1911.31	6$^+$	371.07	4$^+$		

[†] Values given are from 1978We08, unless otherwise noted. In 1978We08, some γ's do not appear in their γ data table, but do appear in their decay-scheme table.

[‡] From 1978We08 for the (α,2nγ) reaction at 24 MeV, unless otherwise noted. For the values from 1978We08, the evaluator has added a 5% uncertainty, since the authors indicate there is an additional uncertainty of ≥ 5%. Other (α,2nγ) values are given by 1972Re04 and 1968Ej01, and (α,4nγ) values are given by 1973Wa33 and 1968Ej01. ce intensities for (α,2nγ) are given by 1966Lo11.

[#] Assignments are from adopted γ radiations and include results of all experiments. For these α-induced reaction studies, the multipolarity and δ information are given as follows: for the ^{152}Sm(α,2nγ) reaction, by $\gamma(\theta)$ data (1978We08), as well as by DCO and polarization measurements (2019Ma70); and for the ^{154}Sm(α,4nγ) reaction, by α data (1974Go30).

[@] From 1973Kh07.

[&] From 1973Kh07 and 1973Wa33.

[a] From 1994Wu01 and 1993Wu03 (including ΔEγ).

[b] Spectral peak is a doublet (1978We08); Eγ from level energies.

[c] From 2019Ma70 (recalibrated by evaluator as described above).

[d] Unc from 2019Ma70.

[e] From 2011Sh07.

[f] Multiply placed.

[g] Multiply placed with undivided intensity.

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ) (continued)

γ(^{154}Gd) (continued)

[h] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{154}_{64}Gd_{90}$-14

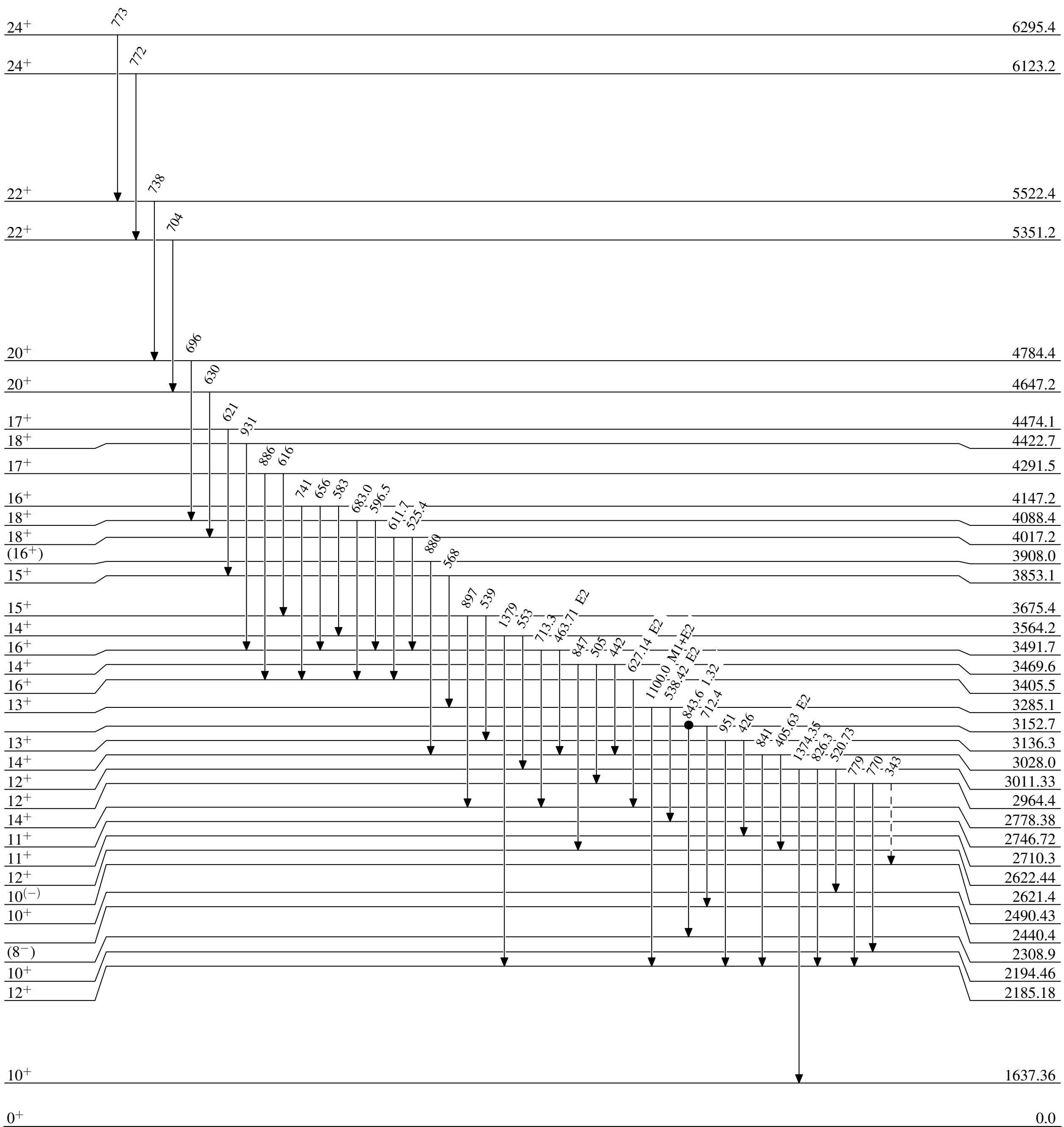
^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

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)
Coincidence

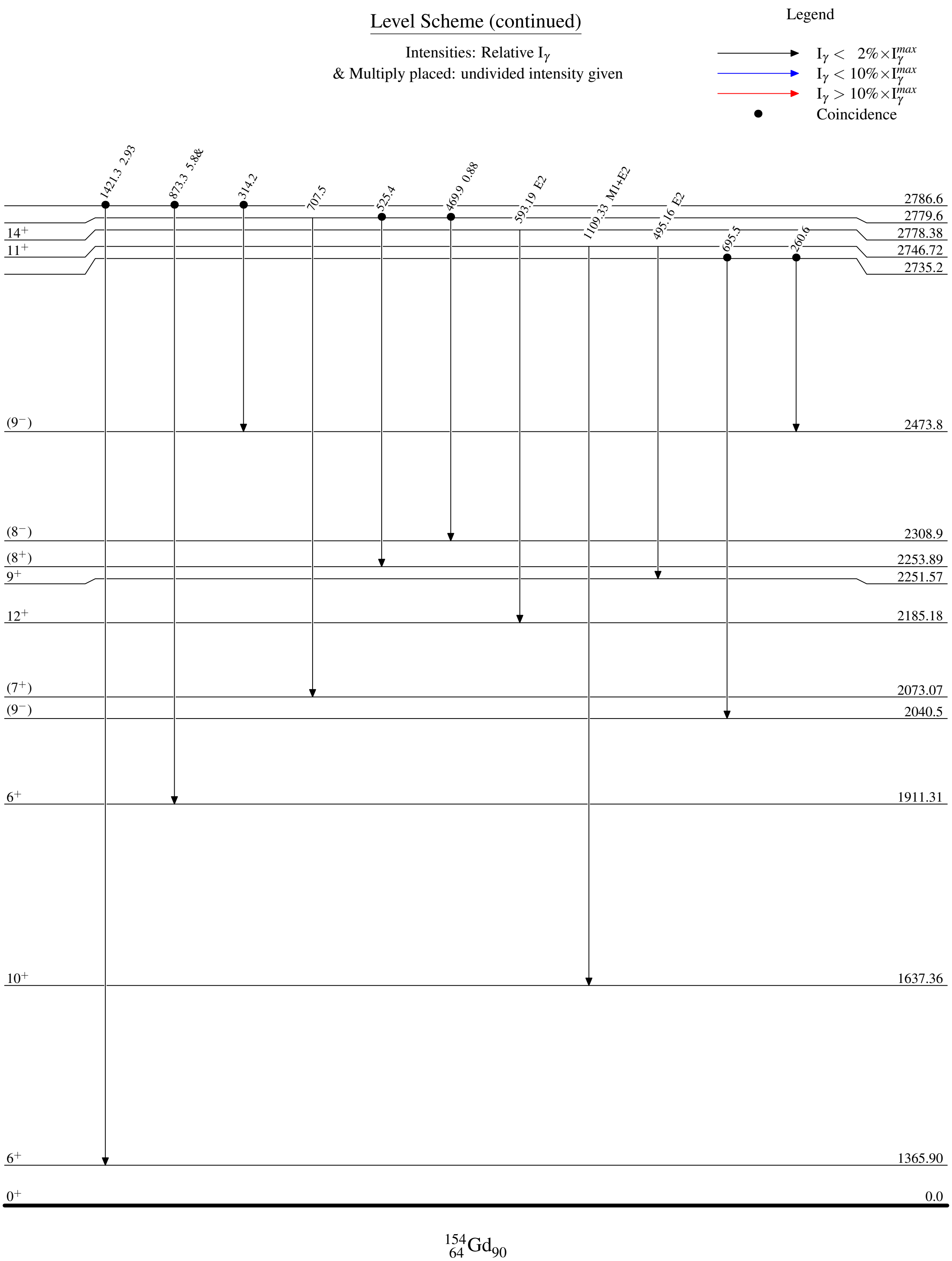


$^{154}_{64}Gd_{90}$

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



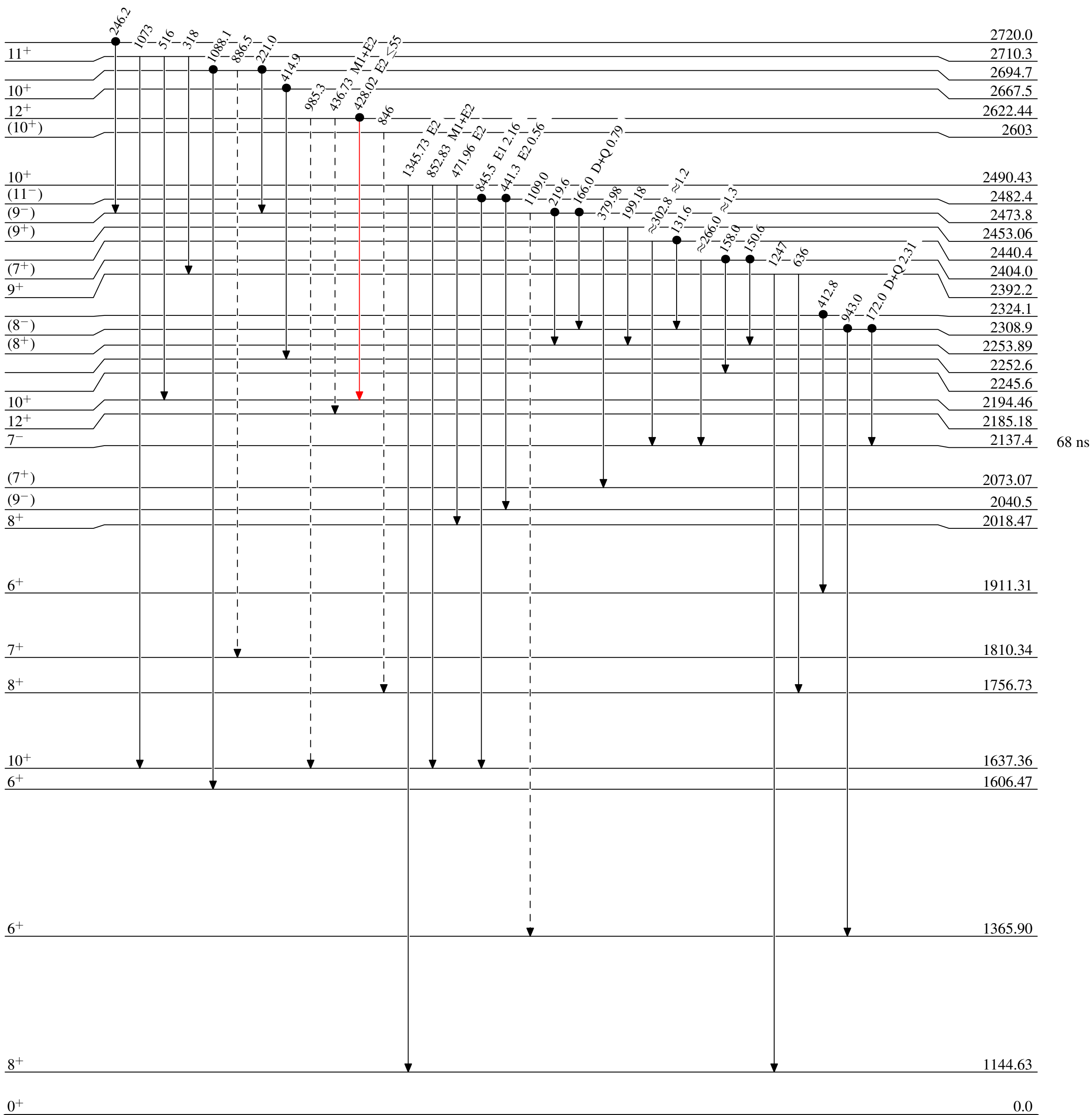
$^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

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)
- Coincidence

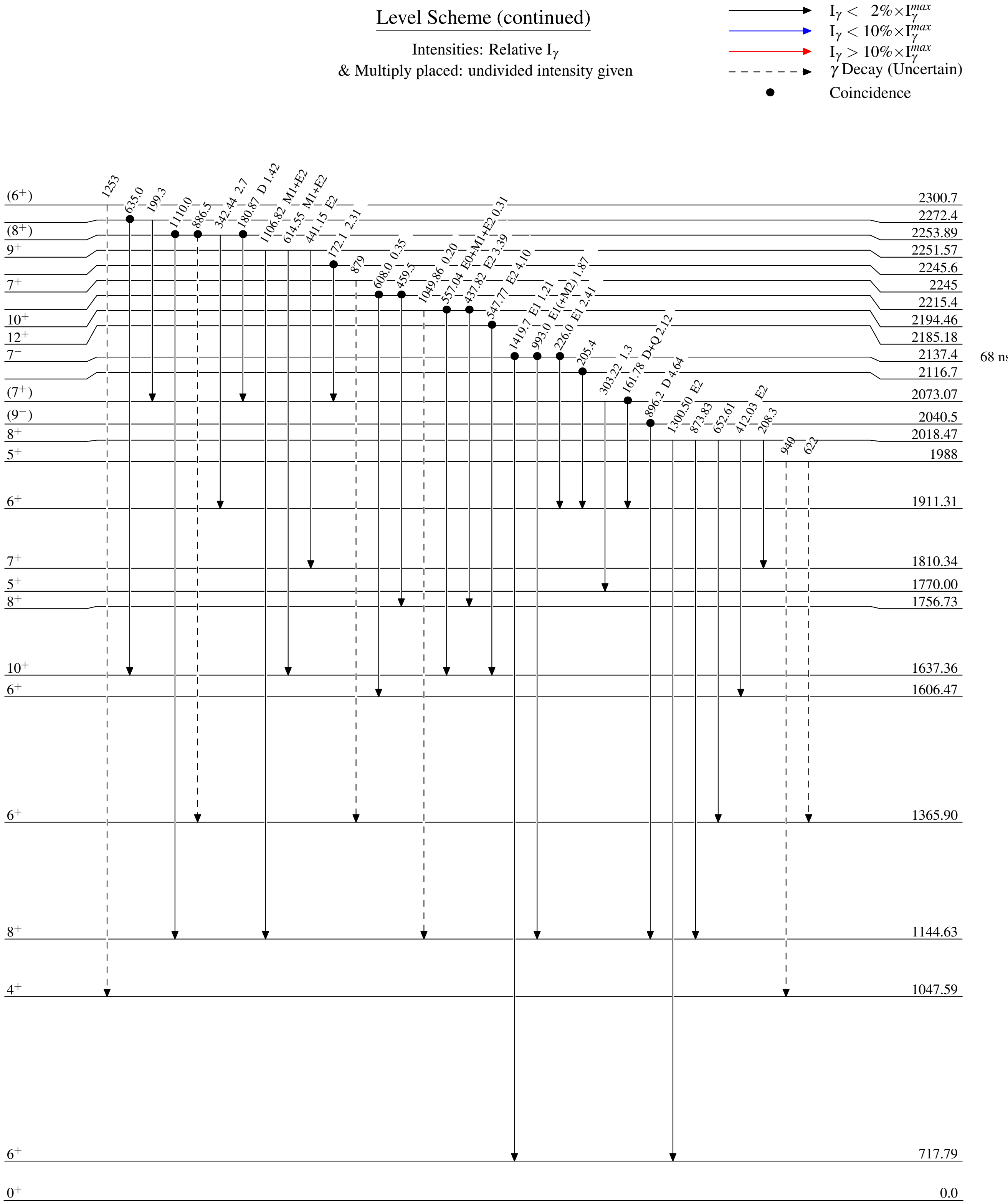


$^{154}_{64}Gd_{90}$

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given

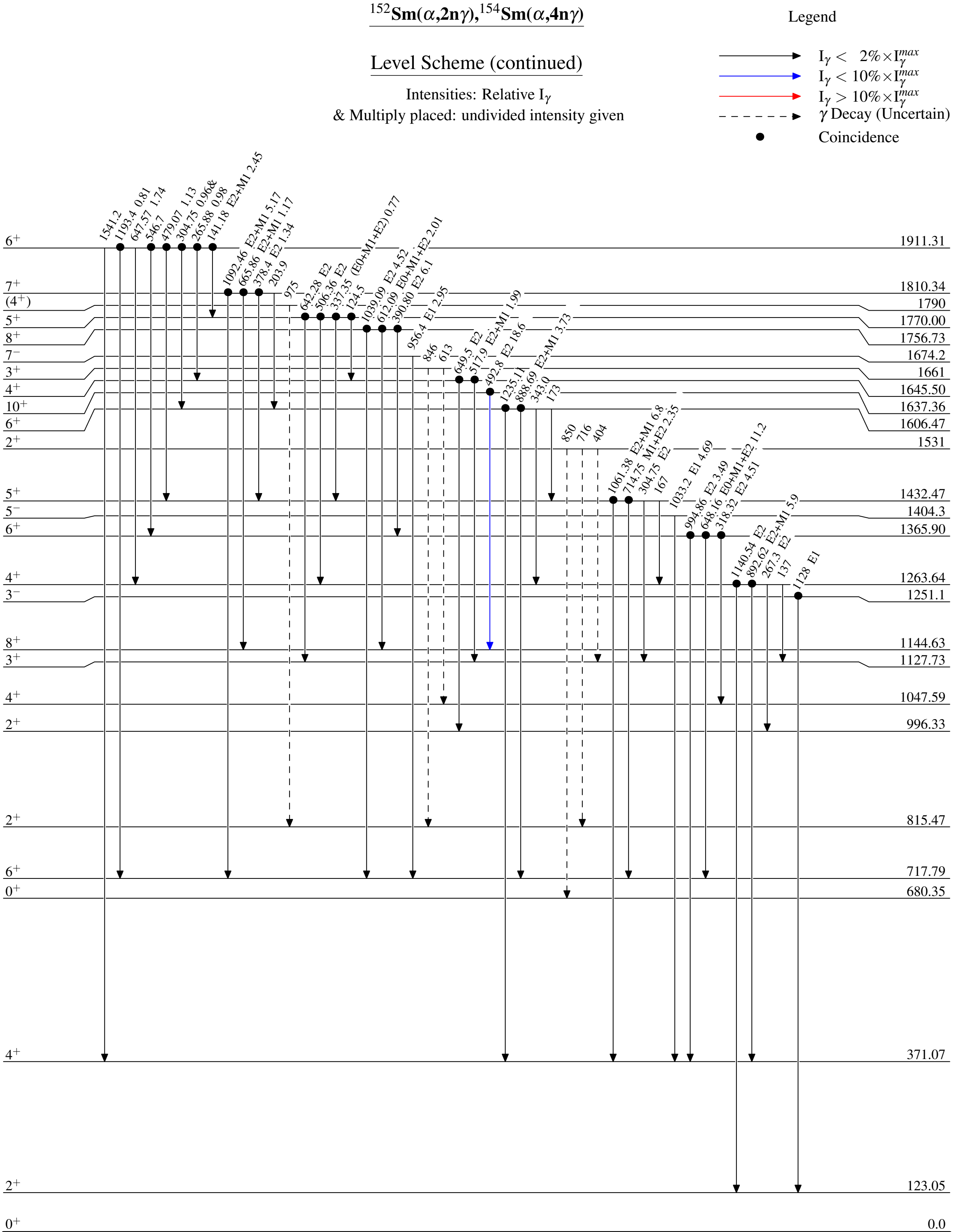


$^{154}_{64}Gd_{90}$

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

Level Scheme (continued)

Intensities: Relative I_γ
& Multiply placed: undivided intensity given



^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)

Level Scheme (continued)

Intensities: Relative I_γ

& Multiply placed: undivided intensity given

Legend

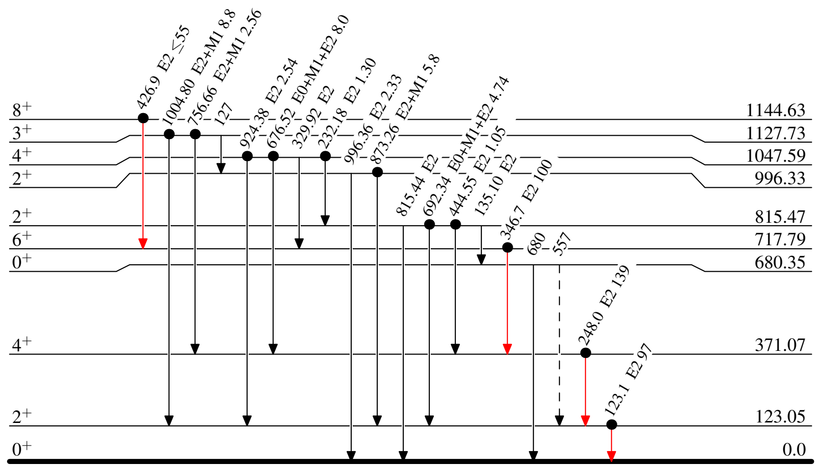
$I_\gamma < 2\% \times I_\gamma^{max}$

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

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

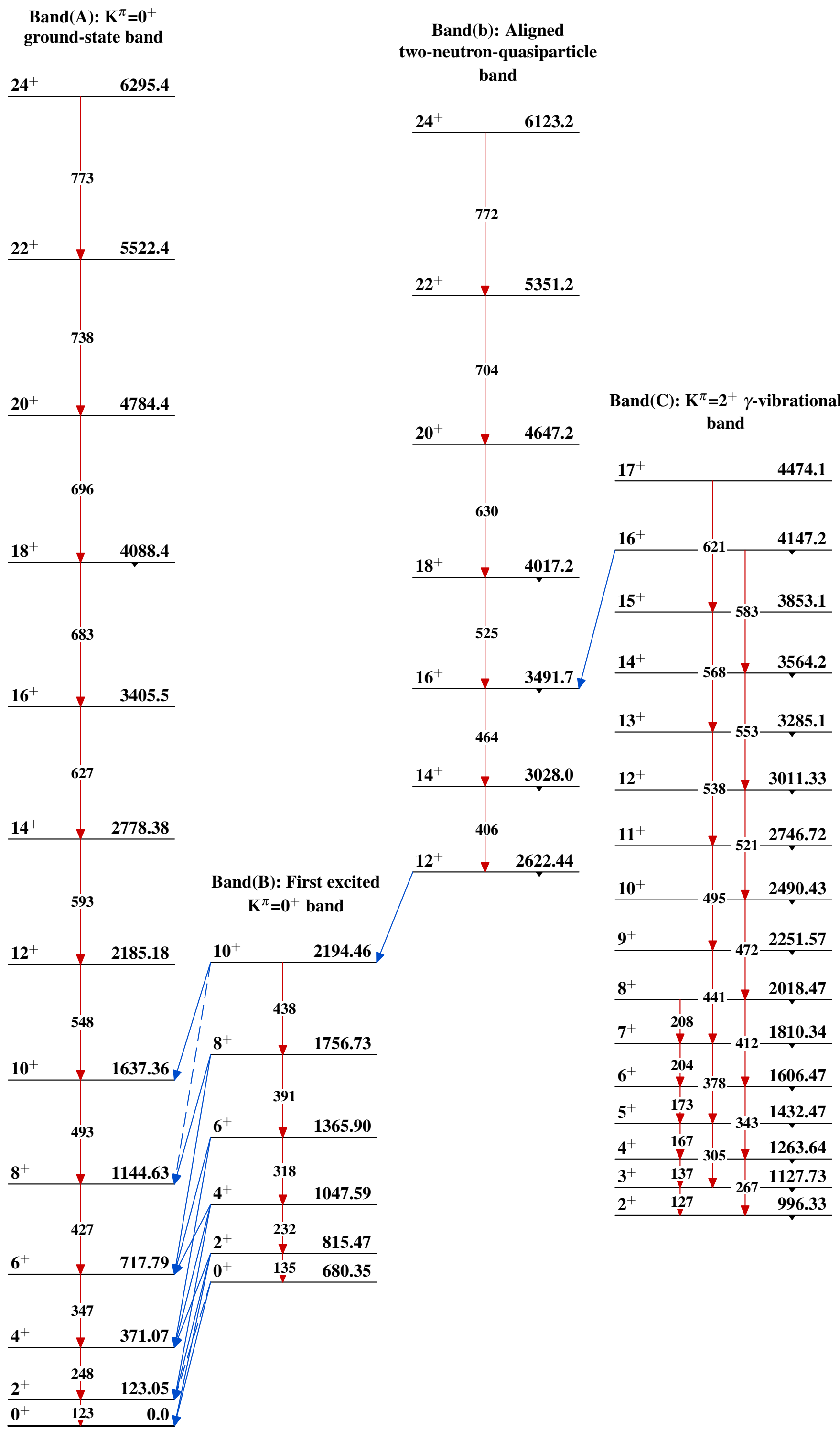
γ Decay (Uncertain)

Coincidence



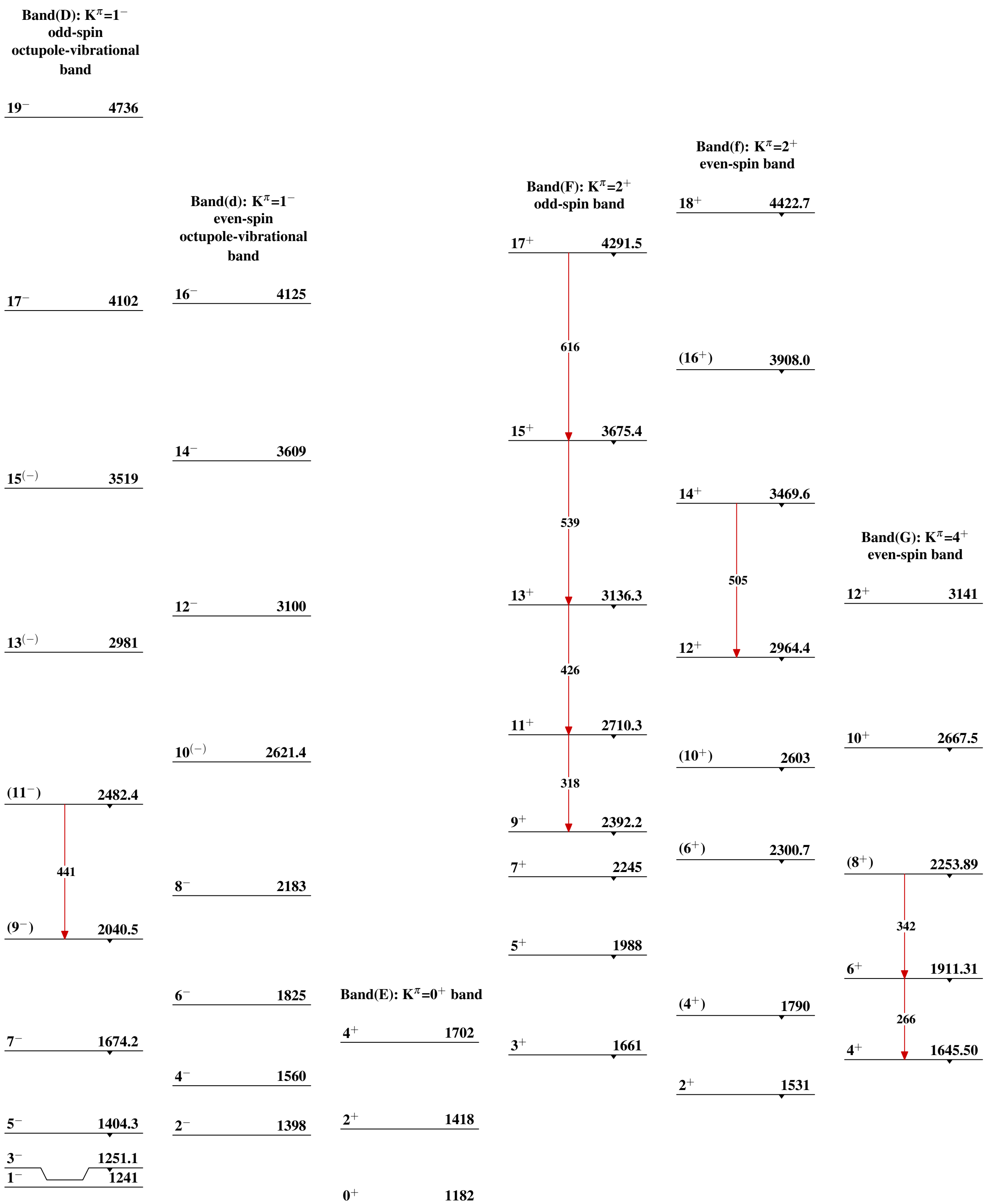
$^{154}_{64}Gd_{90}$

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ)



$^{154}_{64}Gd_{90}$

^{152}Sm(α,2nγ),^{154}Sm(α,4nγ) (continued)



$^{154}_{64}Gd_{90}$

$^{152}Sm(\alpha,2n\gamma),^{154}Sm(\alpha,4n\gamma)$ (continued)