^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13

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

2006ShZY: ^{152}Sm(α,4nγ) E=45 MeV.
1980Zo02: ^{150}Sm(α,2nγ) E=28 MeV, ^{152}Sm(α,4nγ) E=50 MeV; measured Eγ, Iγ, Ice, $\gamma\gamma$, $\gamma(\theta)$, excit. Earlier publication: 1975Zo01.
1980Gu13: ^{150}Sm(α,2nγ) E=19, 27 MeV; measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$, excit (Iγ(19 MeV)/Iγ(27 MeV)).
1972Lo04: ^{152}Sm(α,4nγ) E=32-43 MeV; measured Eγ, Iγ, $\gamma\gamma$, $\gamma(\theta)$.
Other: 1968Ej01.
The level scheme and band structure are from 2006ShZY. These authors added to the g.s. band, the quasi-β band, and the negative parity band built on the 3$^-$ 1121.9 level proposed by 1980Zo02, and introduced seven new bands.

^{152}Gd Levels

E(level)	J$^\pi$†	E(level)	J$^\pi$†	E(level)	J$^\pi$†	E(level)	J$^\pi$†
0.0‡	0$^+$	2070		3061		4142.3‡	16$^+$
344.0‡	2$^+$	2138.6#	8$^+$	3157.5[a]	10$^-$	4195[c]	16$^+$
615.1#	0$^+$	2174&	6$^-$	3227[d]	10$^-$	4247[b]	15$^-$
756.2‡	4$^+$	2300.4‡	10$^+$	3250[c]	12$^+$	4247.2[d]	15$^-$
930.2#	2$^+$	2301[f]	7$^+$	3295[f]	11$^+$	4363	
1109[e]	2$^+$	2331.6@	9$^-$	3318[b]	11$^-$	4526&	16$^-$
1121.9@	3$^-$	2394	7$^+$	3338.4@	13$^-$	4540[a]	16$^-$
1227.5‡	6$^+$	2460[e]	8$^+$	3346.0&	12$^-$	4609.5@	17$^-$
1281.6#	4$^+$	2537.1&	8$^-$	3499.2‡	14$^+$	4746[c]	18$^+$
1433[f]	3$^+$	2692.0#	10$^+$	3508[a]	12$^-$	4835‡	18$^+$
1470.7@	5$^-$	2698[d]	8$^-$	3587[d]	13$^-$	4853[b]	17$^-$
1549[e]	4$^+$	2775[f]	9$^+$	3700[c]	14$^+$	5011[d]	17$^-$
1667.4#	6$^+$	2814.6@	11$^-$	3728[b]	13$^-$	5213&	18$^-$
1747.6‡	8$^+$	2875[a]	8$^-$	3830[f]	13$^+$	5334@	19$^-$
1808		2884.1‡	12$^+$	3898&	14$^-$	5385[c]	20$^+$
1861[f]	5$^+$	2889.9&	10$^-$	3938.9@	15$^-$	5923&	20$^-$
1880.4@	7$^-$	3011[b]	9$^-$	3975[a]	14$^-$	6082@	21$^-$
1995[e]	6$^+$	3034[d]	(11)	4104			

† From Adopted Levels.
‡ Band(A): g.s. band.
# Band(B): Quasi-β band.
@ Band(C): Negative-parity odd-spin band.
& Band(D): Negative-parity even-spin band.
[a] Band(E): Negative-parity even-spin band.
[b] Band(F): Negative-parity odd-spin band.
[c] Band(G): Positive-parity even-spin band.
[d] Band(H): Possible negative parity band.
[e] Band(I): Even-spin γ-vibrational band.
[f] Band(J): Odd-spin γ vibrational band.

^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13 (continued)

$\gamma(^{152}Gd)$

α(K)exp are from Ice(K)/Iγ (1980Zo02) normalized to α(K)(344γ)=0.0311 (E2).
All A_2 and A_4 are from 1980Zo02. DCO results are from 1980Gu13.

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[a]	Comments
146		3157.5	10^-	3011	9^-			
158		1281.6	4^+	1121.9	3^-			
160		3318	11^-	3157.5	10^-			
191		3508	12^-	3318	11^-			
197		1667.4	6^+	1470.7	5^-			
220		3728	13^-	3508	12^-			
247		3975	14^-	3728	13^-			
258		2138.6	8^+	1880.4	7^-			
271		4247	15^-	3975	14^-			
271.1[&]		615.1	0^+	344.0	2^+			
282		3157.5	10^-	2875	8^-			
293		4540	16^-	4247	15^-			
307		3318	11^-	3011	9^-			
312		4853	17^-	4540	16^-			
315.1[@] *2*		930.2	2^+	615.1	0^+			
344.3	100	344.0	2^+	0.0	0^+	E2	0.0399	Mult.: A_2=+0.22 *4*, A_4=−0.08 *5*; ΔJ=2 from DCO.
345[b]		1470.7	5^-	1121.9	3^-			
351		3508	12^-	3157.5	10^-			
351.8	6.5	1281.6	4^+	930.2	2^+	E2	0.0375	Mult.: A_2=+0.25 *7*, A_4=−0.13 *10*; ΔJ=2 from DCO.
353.6	2.8	2889.9	10^-	2537.1	8^-	E2	0.0370	Mult.: A_2=+0.38 *11*, A_4=−0.01 *15*.
361		2692.0	10^+	2331.6	9^-			
363		1121.9	3^-	756.2	4^+			
363		2537.1	8^-	2174	6^-			
385.9	7.8	1667.4	6^+	1281.6	4^+	E2	0.0286	Mult.: A_2=+0.19 *4*, A_4=−0.14 *6*; ΔJ=2 from DCO.
410		1880.4	7^-	1470.7	5^-			
411		3728	13^-	3318	11^-			
411.1	90.6	756.2	4^+	344.0	2^+	E2	0.0239	Mult.: α(K)exp=0.0202 *17*; A_2=+0.23 *4*, A_4=−0.10 *6*; ΔJ=2 from DCO; theory: α(K)=0.00191.
427		1861	5^+	1433	3^+			
439.8[@] *2*		1667.4	6^+	1227.5	6^+	D+Q		Mult.: from DCO ratio (1980Gu13).
440		1549	4^+	1109	2^+			
440		2301	7^+	1861	5^+			
447		1995	6^+	1549	4^+			
450		3700	14^+	3250	12^+			
451.1	3.9	2331.6	9^-	1880.4	7^-	E2	0.0185	Mult.: A_2=+0.27 *4*, A_4=−0.15 *6*; ΔJ=2 from DCO.
454.5	2.8	3338.4	13^-	2884.1	12^+	D		Mult.: A_2=−0.21 *7*, A_4=+0.03 *9*.
456.0	5.0	3346.0	12^-	2889.9	10^-	(E2)	0.0179	Mult.: A_2=+0.18 *7*, A_4=−0.21 *10*.
462		3346.0	12^-	2884.1	12^+			
464		2460	8^+	1995	6^+			
467		3975	14^-	3508	12^-			
470.5	11.3	2138.6	8^+	1667.4	6^+	E2	0.0165	Mult.: α(K)exp(470.5γ+471.8γ)=0.0130 *18*; A_2=+0.50 *15*, A_4=−0.02 *16*; ΔJ=2 from DCO; theory: α(K)=0.0133.
471.8	76.0	1227.5	6^+	756.2	4^+	E2	0.0164	Mult.: α(K)exp(471.8γ+470.5γ)=0.0133 *18*; A_2=+0.21 *4*, A_4=−0.13 *5*; ΔJ=2 from DCO; theory: α(K)=0.0132.
476		2775	9^+	2301	7^+			
483.1	6.3	2814.6	11^-	2331.6	9^-	E2	0.0154	Mult.: A_2=+0.24 *4*, A_4=−0.16 *6*; ΔJ=2 from DCO.
495		4195	16^+	3700	14^+			
503		1433	3^+	930.2	2^+			
503		3318	11^-	2814.6	11^-			

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^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13 (continued)

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

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ	α[a]	Comments
514.3	11.6	2814.6	11^-	2300.4	10^+	D			Mult.: A_2=−0.17 *6*, A_4=+0.14 *8*.
518		3295	11^+	2775	9^+				
519		4247	15^-	3728	13^-				
519.6	65.8	1747.6	8^+	1227.5	6^+	E2		0.0128	Mult.: α(K)exp=0.0105 *10*; A_2=+0.25 *3*, A_4=−0.05 *4*; ΔJ=2 from DCO; theory: α(K)=0.0103.
523.6	12.1	3338.4	13^-	2814.6	11^-	E2		0.0125	Mult.: A_2=+0.22 *9*, A_4=−0.02 *13*.
526.7	4.1	1281.6	4^+	756.2	4^+	D+Q			Mult.: A_2=−0.34 *6*, A_4=−0.09 *8*.
533		2394	7^+	1861	5^+				
534		3830	13^+	3295	11^+				
549		5385	20^+	4835	18^+				
550		4746	18^+	4195	16^+				
552		3898	14^-	3346.0	12^-				
552.4	8.9	2692.0	10^+	2138.6	8^+	E2		0.0109	Mult.: A_2=+0.54 *13*, A_4=−0.12 *16*.
553		3587	13^-	3034	(11)				
553.6	47.3	2300.4	10^+	1747.6	8^+	E2		0.0108	Mult.: A_2=+0.21 *4*, A_4=−0.11 *4*.
557		3250	12^+	2692.0	10^+				
558		2889.9	10^-	2331.6	9^-				
565		4540	16^-	3975	14^-				
583.4	20.6	2884.1	12^+	2300.4	10^+	E2		0.00948	Mult.: A_2=+0.29 *8*, A_4=−0.08 *10*.
584.6	14.0	2331.6	9^-	1747.6	8^+	D			Mult.: A_2=−0.25 *7*, A_4=+0.16 *10*.
586.3	3.6	930.2	2^+	344.0	2^+	D+Q			Mult.: A_2=−0.37 *18*, A_4=−0.10 *25*.
589.9	4.5	2889.9	10^-	2300.4	10^+	(E1+M2)	0.33 *+8−10*		Mult.,δ: From α(K)exp=0.0067 *19* one gets mult=M1+E2 with δ>2.6, or E1+M2 with δ=0.33 *+8−10*. 1980Zo02 assigned mult=M1+E2, which gives positive parity for the 2890 level. 2006ShZY propose negative parity and thus $\Delta\pi$=yes. The revised J^π assignment is supported by 2007Ca25 in (^{36}S,α4nγ). A_2=+0.24 *6*, A_4=−0.03 *10* are consistent with either mult assignment.
600.5	6.7	3938.9	15^-	3338.4	13^-	E2		0.00882	Mult.: α(K)exp=0.0072 *11*; A_2=+0.20 *4*, A_4=−0.07 *6*; theory: α(K)=0.00722.
604		4746	18^+	4142.3	16^+				
606		4853	17^-	4247	15^-				
615.4	11.1	3499.2	14^+	2884.1	12^+	E2		0.00831	Mult.: A_2=+0.23 *4*, A_4=−0.09 *6*.
628		4526	16^-	3898	14^-				
633		1861	5^+	1227.5	6^+				
639		5385	20^+	4746	18^+				
643.5	4.4	4142.3	16^+	3499.2	14^+	E2		0.00745	Mult.: α(K)exp=0.0055 *11*; A_2=+0.21 *4*, A_4=−0.07 *5*; theory: α(K)=0.00613.
652.9	4.8	1880.4	7^-	1227.5	6^+	E1		0.00266	Mult.: α(K)exp=0.0022 *4*; A_2=−0.31 *5*, A_4=+0.06 *8*; theory: α(K)=0.00226.
657		2537.1	8^-	1880.4	7^-				
660		4247.2	15^-	3587	13^-				
670.6	3.4	4609.5	17^-	3938.9	15^-	E2		0.00675	α(K)=0.00556; α(L)=0.000893 Mult.: α(K)exp=0.0041 *21*; A_2=+0.19 *7*, A_4=+0.03 *10*; theory: α(K)=0.00556.
678		1433	3^+	756.2	4^+				
679		3011	9^-	2331.6	9^-				
687		5213	18^-	4526	16^-				
693		4835	18^+	4142.3	16^+				
696		4195	16^+	3499.2	14^+				
703		3587	13^-	2884.1	12^+				
710		5923	20^-	5213	18^-				

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^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13 (continued)

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

E_γ [†]	I_γ [‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [#]	Comments
715.0	1.9	1470.7	5^-	756.2	4^+	D+Q	Mult.: A_2=−0.27 *10*, A_4=+0.24 *15*.
725		5334	19^-	4609.5	17^-		
726		2394	7^+	1667.4	6^+		
729		3061		2331.6	9^-		
733		3034	(11)	2300.4	10^+		
748		6082	21^-	5334	19^-		
764		5011	17^-	4247.2	15^-		
765		1109	2^+	344.0	2^+		
770		1995	6^+	1227.5	6^+		
773		3587	13^-	2814.6	11^-		
778.9[&]		1121.9	3^-	344.0	2^+		
790.2	2.9	2537.1	8^-	1747.6	8^+	(E1+M2)	Mult.: A_2=+0.31 *7*, A_4=+0.11 *9* and DCO (1980Gu13) give mult=D+Q with a large Q component, interpreted as M1+E2 by 1980Zo02, but required to be E1+M2 by the revised spin assignment of 2006ShZY and of 2007Ca25 in (^{36}S,α4nγ).
794		1549	4^+	756.2	4^+		
816		3700	14^+	2884.1	12^+		
826		3157.5	10^-	2331.6	9^-		
843		3728	13^-	2884.1	12^+		
864		4363		3499.2	14^+		
895		3227	10^-	2331.6	9^-		
909[b]		4247.2	15^-	3338.4	13^-		
930		930.2	2^+	0.0	0^+		
941		3830	13^+	2889.9	10^-		
946		2174	6^-	1227.5	6^+		
950		2698	8^-	1747.6	8^+		
987		3318	11^-	2331.6	9^-		
995		2875	8^-	1880.4	7^-		
995		3295	11^+	2300.4	10^+		
1018		3318	11^-	2300.4	10^+		
1025		2775	9^+	1747.6	8^+		
1052		1808		756.2	4^+		
1074		2301	7^+	1227.5	6^+		
1090		1433	3^+	344.0	2^+		
1106		1861	5^+	756.2	4^+		
1109		1109	2^+	0.0	0^+		
1131		3011	9^-	1880.4	7^-		
1167		2394	7^+	1227.5	6^+		
1206		1549	4^+	344.0	2^+		
1220		4104		2884.1	12^+		
1232		2460	8^+	1227.5	6^+		
1236		1995	6^+	756.2	4^+		
1314		2070		756.2	4^+		

[†] Energies quoted to tenths of keV are from 1980Zo02, except where noted otherwise. Energies quoted to the nearest keV are from 2006ShZY. No uncertainties are given in either of these works. the evaluator has lowered the energies of 2006ShZY by 1 keV in order to improve the correlation between the level energies from this work and those from other reaction and decay datasets.

[‡] From ^{152}Sm(α,4nγ) at E=50 MeV, 125° (1980Zo02).

[#] Deduced from $\gamma(\theta)$ (1980Zo02) and DCO ratio (DCO ratio >2 for ΔJ=2, Q and DCO ratio <2 for D or D+Q) (1980Gu13), except where noted otherwise.

[@] From 1980Gu13.

[&] Seen only in ^{150}Sm(α,2nγ) reaction.

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^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13 (continued)

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

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

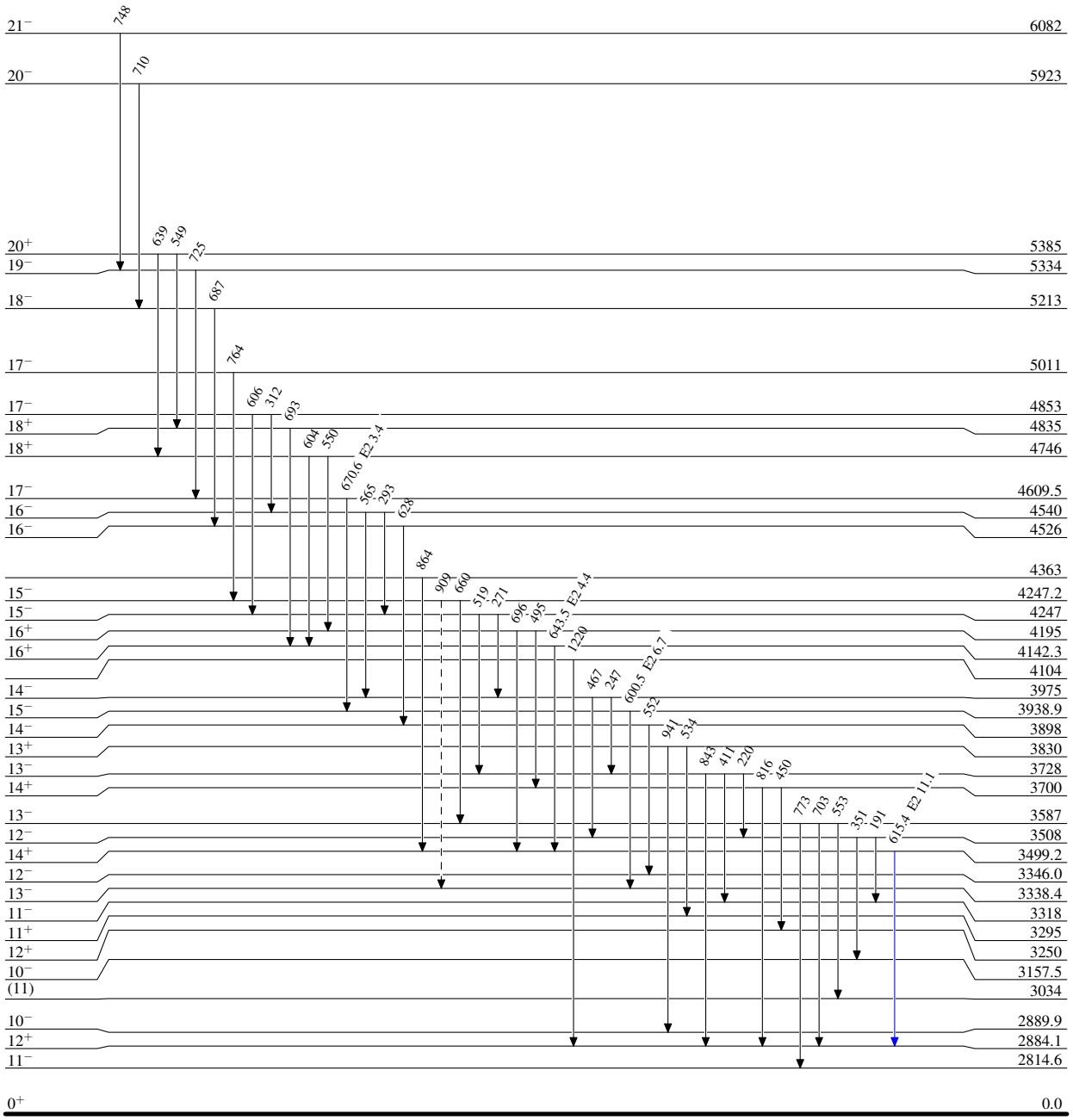
^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13

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)

Level Scheme

Intensities: Relative I_γ



$^{152}_{64}Gd_{88}$

^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13

Level Scheme (continued)

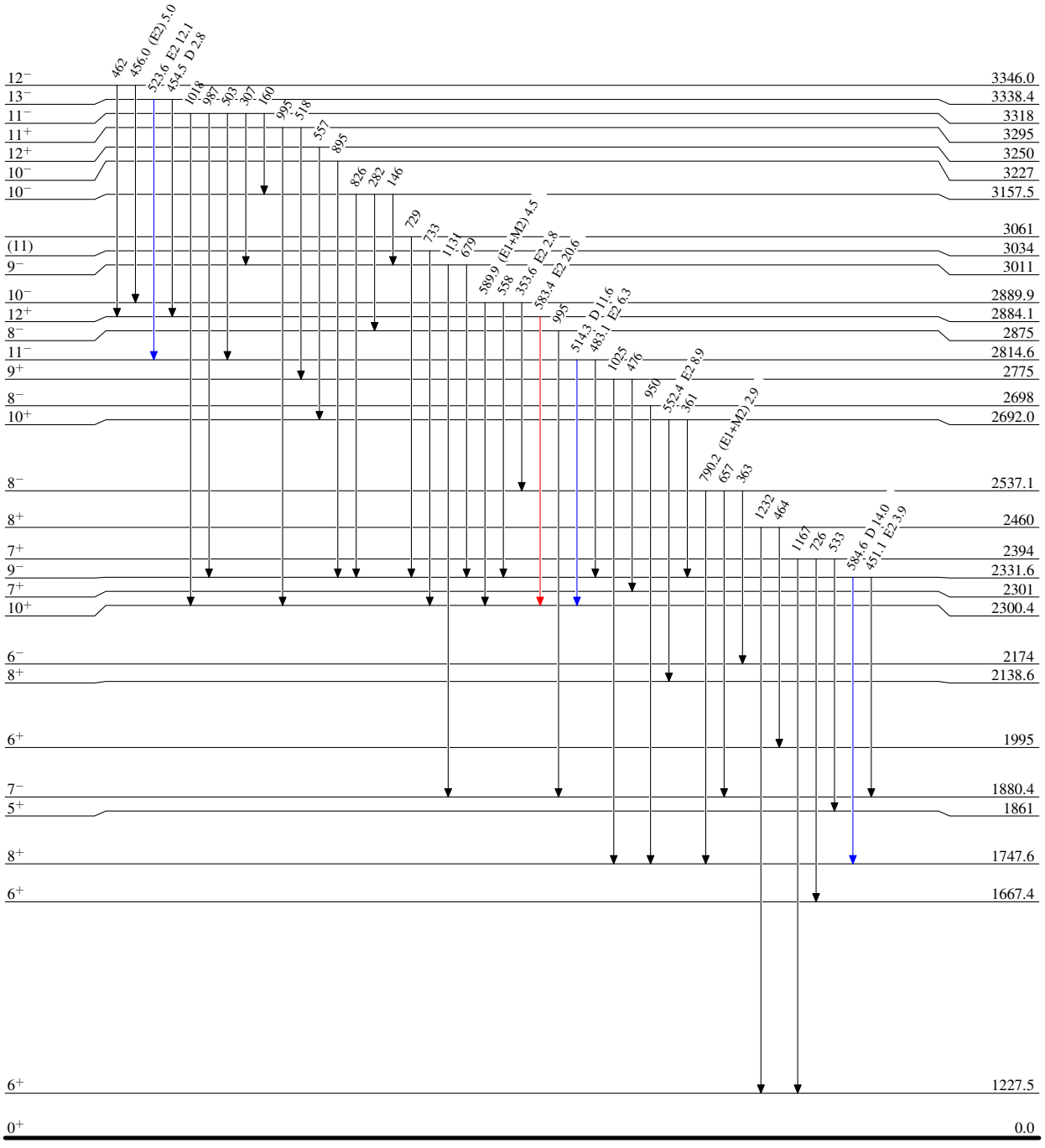
Intensities: Relative I_γ

Legend

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

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

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



$^{152}_{64}Gd_{88}$

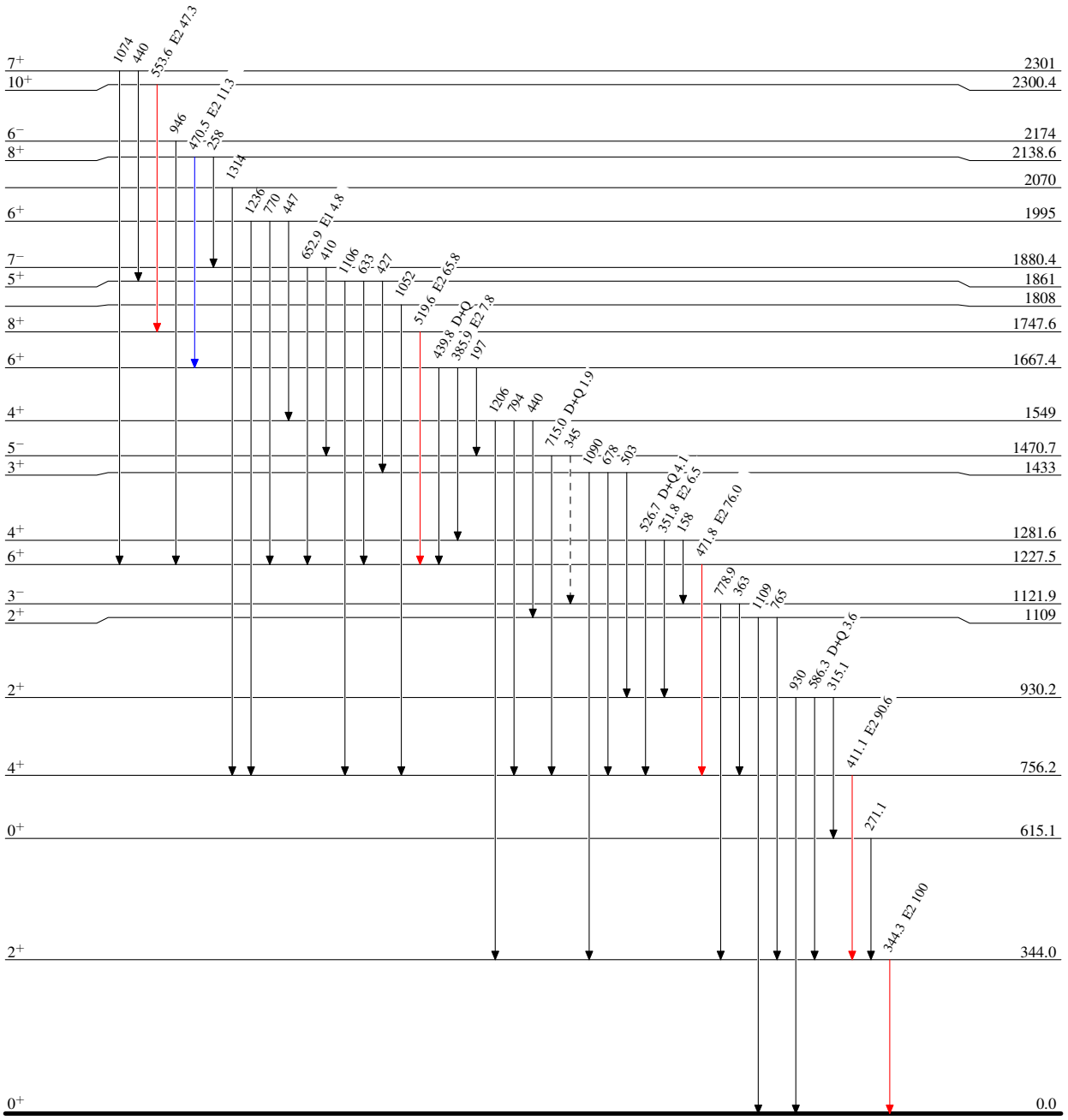
^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13

Level Scheme (continued)

Intensities: Relative I_γ

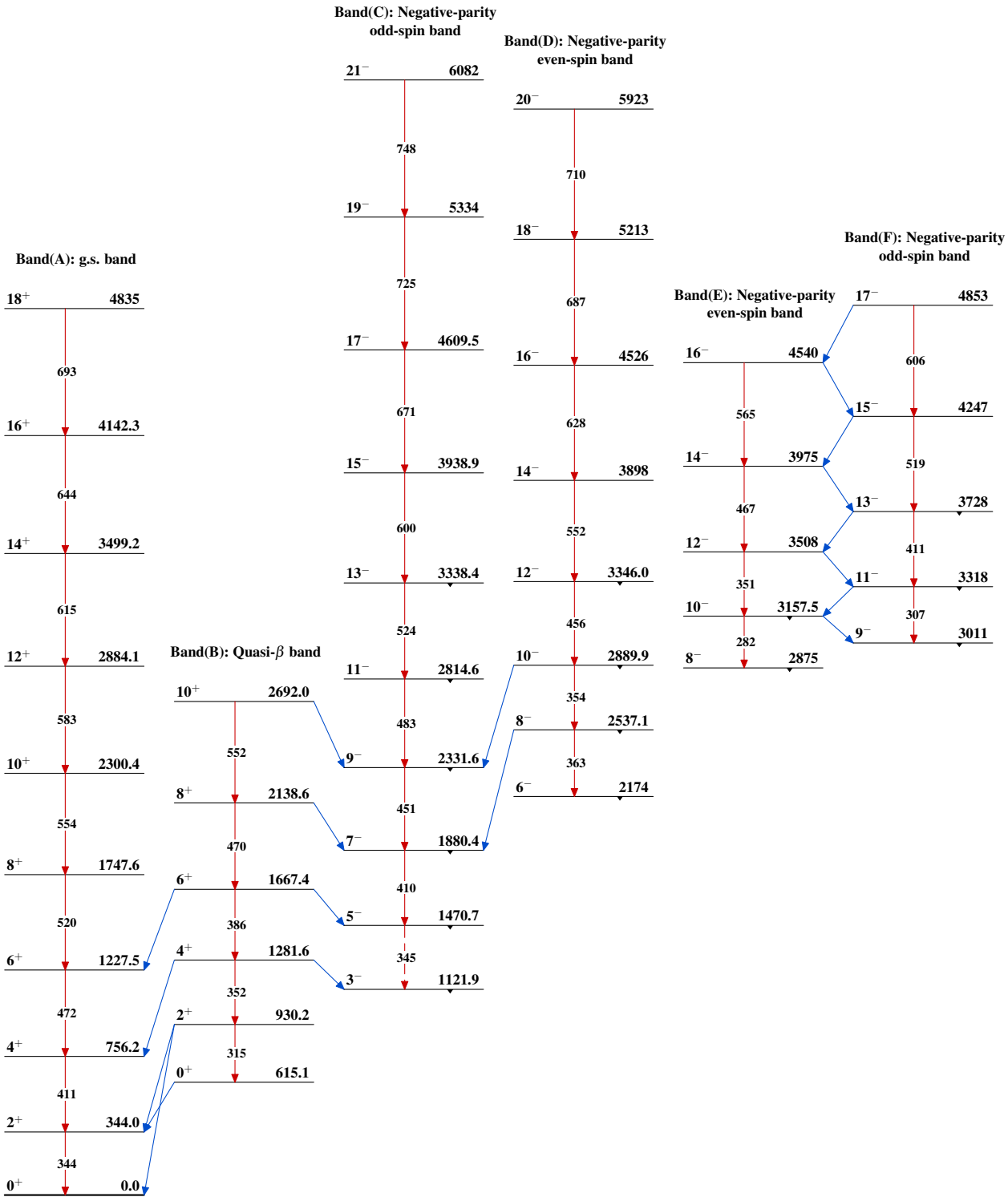
Legend

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



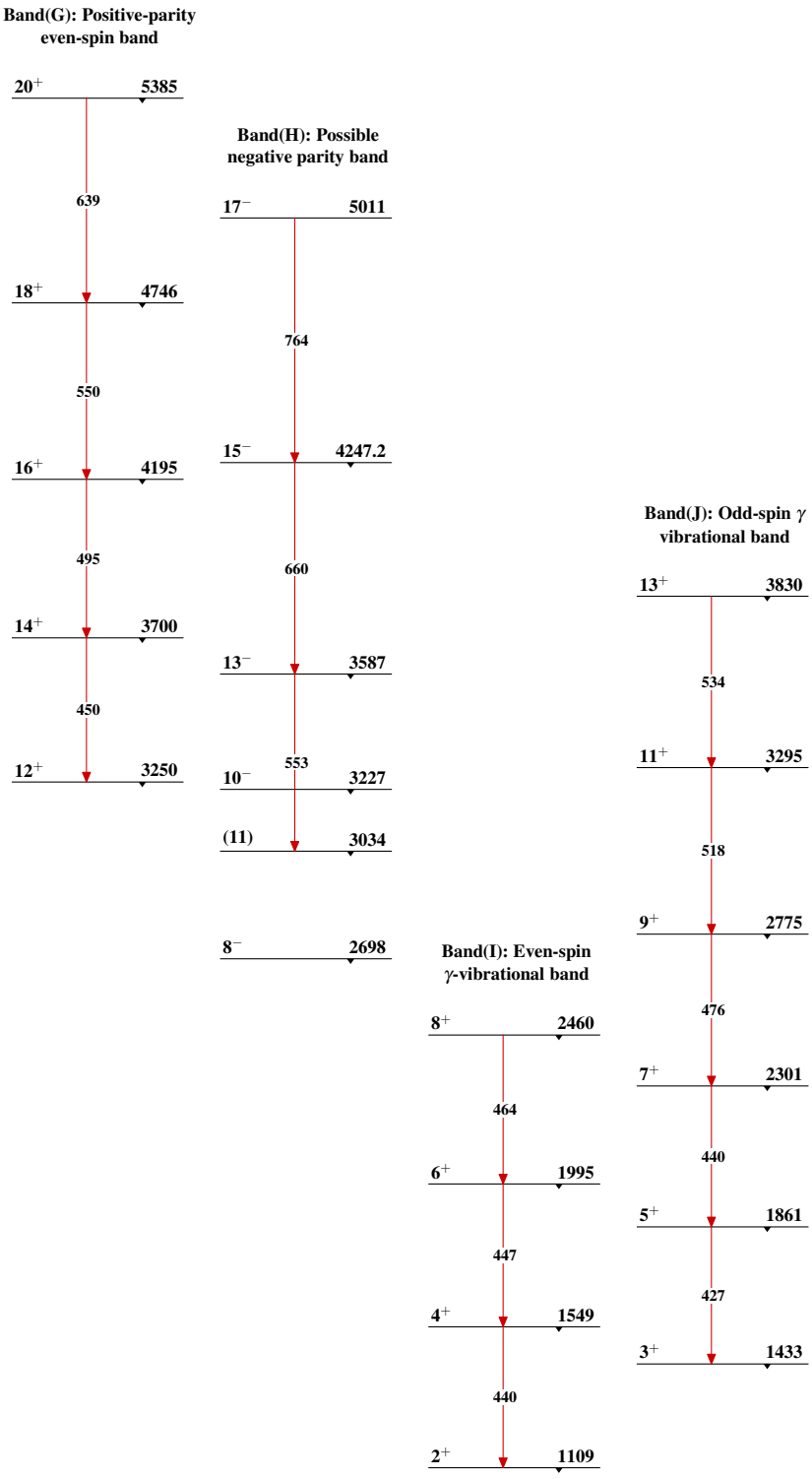
$^{152}_{64}Gd_{88}$

^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13



$^{152}_{64}Gd_{88}$

^{150}Sm(α,2nγ), ^{152}Sm(α,4nγ) 2006ShZY,1980Zo02,1980Gu13 (continued)



$^{152}_{64}Gd_{88}$