^{106}Cd(^{35}Cl,3pγ) 1994Pa27

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

1994Pa27: E=150 MeV ^{35}Cl beam was produced from the tandem Van de Graaff accelerator of the Nuclear Structure facility at the Darebury Laboratory, incident on a 500 μg/cm^2 self-supporting ^{106}Cd target. Reaction products were separated by the Daresbury recoil separator. γ rays were detected with the Eurogam spectrometer consisting of 45 large-volume Compton-suppressed HPGe detectors. Measured Eγ, Iγ, $\gamma\gamma$-con, γ(DCO). Deduced levels, J, π, configurations, band structures, γ-ray multipolarities. Comparisons with shell-model calculations.

^{138}Sm Levels

E(level)[†]	J$^\pi$[‡]
0[c]	0$^+$
346.9[c] 3	2$^+$
891.8[c] 5	4$^+$
1577.7[c] 6	6$^+$
2353.4[c] 6	8$^+$
2509.4[#] 6	(7$^-$)
2654.4[h] 6	(7$^-$)
2905.7[a] 7	10$^+$
3029.6[#] 6	(9$^-$)
3108.1[g] 7	10$^+$
3262.4[a] 7	12$^+$
3301.1[h] 6	(9$^-$)
3641.2[#] 7	(11$^-$)
3821.1[g] 7	12$^+$
3919.4[a] 7	14$^+$
3921.8[h] 7	(11$^-$)
4072.5[e] 7	13$^+$
4342.4[#] 7	(13$^-$)
4489.4[f] 7	14$^+$
4616.4[g] 8	14$^+$
4735.6[h] 8	(13$^-$)
4782.5[b] 8	16$^+$
4805.7[d] 7	15$^+$
4834.4[a] 8	16$^+$
4926.4[e] 8	15$^+$
5075.7[@] 7	(15$^-$)
5201.1[#] 8	(15$^-$)
5257.9[f] 8	(16$^+$)
5329.8[b] 8	18$^+$
5441.5[g] 8	16$^+$
5705.8[@] 8	(17$^-$)
5722.9?[h] 8	(15$^-$)
5768.4[d] 8	(17$^+$)
5860.6[e] 8	(17$^+$)
5938.4[a] 8	18$^+$
6016.0[b] 8	20$^+$
6167.9[f] 13	(18$^+$)

Continued on next page (footnotes at end of table)

^{106}Cd(^{35}Cl,3pγ) 1994Pa27 (continued)

^{138}Sm Levels (continued)

E(level)[†]	Jπ[‡]	Comments
6261.0[#] 8	(17⁻)	
6343.5[g] 9	18⁺	
6490.2[@] 8	(19⁻)	
6887.3[b] 9	22⁺	
6915.2[d] 9	(19⁺)	
6987.9[&] 9	(20⁺)	
7209.5[a] 9	(20⁺)	
7378.5[g] 9	(20⁺)	
7443.8[@] 9	(21⁻)	
7906.7[&] 9	(22⁺)	
7977.1[b] 9	(24⁺)	
8565.1[@] 9	(23⁻)	
8862.8[&] 10	(24⁺)	
9263.1[b] 14	(26⁺)	
9852.1[@] 14	(25⁻)	
9881.1[&] 10	(26⁺)	
10965.5[&] 11	(28⁺)	
12111.1[&] 11	(30⁺)	
13310.0?[&] 15	(32⁺)	
x[i]	(13⁻)	Additional information 1.
x+139.7[i] 3	(14⁻)	
x+317.9[i] 5	(15⁻)	
x+545.4[i] 5	(16⁻)	
x+845.0[i] 6	(17⁻)	
x+1178.6[i] 6	(18⁻)	
x+1598.9[i] 7	(19⁻)	
x+2043.3[i] 7	(20⁻)	
x+2553.1[i] 8	(21⁻)	
x+3109.2[i] 10	(22⁻)	
x+3675.2[i] 13	(23⁻)	
x+4212.2[i] 15	(24⁻)	
x+4848.2[i] 16	(25⁻)	
x+6067?[i]	(27⁻)	

[†] From a least-squares fit to γ-ray energies.
[‡] From 1994Pa27 based on deduced γ multipolarities from DCO ratios, band energy and intensity pattern.
[#] Band(A): Band 1. (π,α)=(-,1). Configuration=((π $h_{11/2}$)(π $g_{7/2}$)). β_2=0.21, β_4=−0.02, γ=−20°.
[@] Band(B): Band 2. (π,α)=(-,1). Configuration=((π $h_{11/2}$)(π $g_{7/2}$)(ν $h_{11/2}$)^2) β_2=0.17, β_4=−0.02, γ=−30°.
[&] Band(C): Band 3. (π,α)=(+,0). Configuration=((π $h_{11/2}$)^2(ν $i_{13/2}$)^2) β_2=0.32, β_4=0.02, γ=0°. Prolate shape with enhanced quadrupole deformation.
[a] Band(D): Band 4. (π,α)=(+,0). Configuration=(π $h_{11/2}$)^2 β_2=0.21, β_4=−0.02, γ=−20°.
[b] Band(E): Band 5. (π,α)=(+,0). Configuration=((π $h_{11/2}$)^2(ν $h_{11/2}$)^2) β_2=0.18, β_4=−0.03, γ=−26°.
[c] Band(F): Band 6. g.s. band. (π,α)=(+,0). β_2=0.20, β_4=−0.02, γ=−25°.
[d] Band(G): Band 7. π=+. 4-quasiparticle configuration. Possible configurations are (π,h11/2), (π,g7/2), (ν,h11/2), (ν,g7/2).
[e] Band(H): Band 8. π=+. 4-quasiparticle configuration. Possible configurations are (π,h11/2), (π,g7/2), (ν,h11/2), (ν,g7/2).

Continued on next page (footnotes at end of table)

^{106}Cd(^{35}Cl,3pγ) 1994Pa27 (continued)

^{138}Sm Levels (continued)

[f] Band(I): Band 9. π=+. 4-quasiparticle configuration. Possible configurations are (π,h11/2), (π,g7/2), (ν,h11/2), (ν,g7/2).
[g] Band(J): Band 10. (π,α)=(+,0). For lower band configuration= $(\nu\ h_{11/2})^2$, β_2=0.18, β_4=−0.03, γ=−30°. For upper band configuration= $(\nu\ h_{11/2})^4$, β_2=0.17, β_4=−0.02, γ=−75°.
[h] Band(K): Band 11. (π,α)=(-,1). Configuration=$((\nu\ h_{11/2})(\nu\ g_{7/2}))$ β_2=0.19, β_4=−0.03, γ=−30°.
[i] Band(L): Band 12. (π,α)=(-,1). Configuration=$((\pi\ h_{11/2})(\pi\ g_{7/2})(\nu\ h_{11/2})^2)$ β_2=0.21, β_4=−0.02, γ=−91°. Collectively rotating oblate band.

γ(^{138}Sm)

E_γ[†]	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
139.7 *3*	<1	x+139.7	(14$^-$)	x	(13$^-$)	(M1+E2)	
178.2 *3*	1	x+317.9	(15$^-$)	x+139.7	(14$^-$)	(M1+E2)	
227.4 *3*	4	x+545.4	(16$^-$)	x+317.9	(15$^-$)	M1+E2	R(DCO)=0.6 *1* at 134°, 0.5 *1* at 158° (1994Pa27).
299.7 *3*	3	x+845.0	(17$^-$)	x+545.4	(16$^-$)	M1+E2	R(DCO)=0.7 *1* at 134°, 0.6 *1* at 158° (1994Pa27).
333.6 *3*	3	x+1178.6	(18$^-$)	x+845.0	(17$^-$)	M1+E2	R(DCO)=0.7 *1* at 134°, 0.5 *1* at 158° (1994Pa27).
346.9 *3*	100	346.9	2$^+$	0	0$^+$	E2	R(DCO)=0.9 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
356.6 *3*	41	3262.4	12$^+$	2905.7	10$^+$	E2	R(DCO)=1.1 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
406 *1*	<1	x+545.4	(16$^-$)	x+139.7	(14$^-$)	(E2)	
417 *1*	<1	4489.4	14$^+$	4072.5	13$^+$	M1+E2	
420.2 *3*	2	x+1598.9	(19$^-$)	x+1178.6	(18$^-$)	(M1+E2)	
444.4 *3*	1	x+2043.3	(20$^-$)	x+1598.9	(19$^-$)	(M1+E2)	
495.4 *3*	4	5329.8	18$^+$	4834.4	16$^+$	E2	R(DCO)=1.0 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
509.9 *3*	<1	x+2553.1	(21$^-$)	x+2043.3	(20$^-$)	(M1+E2)	
520.5 *3*	5	3029.6	(9$^-$)	2509.4	(7$^-$)	E2	R(DCO)=1.4 *2* at 134°, 0.9 *1* at 158° (1994Pa27).
527 *1*	<1	x+845.0	(17$^-$)	x+317.9	(15$^-$)	(E2)	
544.9 *3*	98	891.8	4$^+$	346.9	2$^+$	E2	R(DCO)=1.0 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
547.4 *3*	6	5329.8	18$^+$	4782.5	16$^+$	(E2)	
552.3 *3*	43	2905.7	10$^+$	2353.4	8$^+$	E2	R(DCO)=1.1 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
556 *1*	<1	x+3109.2	(22$^-$)	x+2553.1	(21$^-$)	(M1+E2)	
611.6 *3*	9	3641.2	(11$^-$)	3029.6	(9$^-$)	E2	R(DCO)=1.3 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
620.7 *3*	5	3921.8	(11$^-$)	3301.1	(9$^-$)	E2	R(DCO)=0.9 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
630.1 *3*	4	5705.8	(17$^-$)	5075.7	(15$^-$)	E2	R(DCO)=1.2 *1* at 134°, 1.5 *2* at 158° (1994Pa27).
633 *1*	<1	x+1178.6	(18$^-$)	x+545.4	(16$^-$)	(E2)	
646.9 *3*	1	3301.1	(9$^-$)	2654.4	(7$^-$)	E2	R(DCO)=0.9 *2* at 134°, 1.5 *2* at 158° (1994Pa27).
657.0 *3*	39	3919.4	14$^+$	3262.4	12$^+$	E2	R(DCO)=1.2 *1* at 134°, 1.3 *1* at 158° (1994Pa27).
668.3 *3*	4	4489.4	14$^+$	3821.1	12$^+$	E2	R(DCO)=1.3 *2* at 134°, 1.4 *2* at 158° (1994Pa27).
676.0 *3*	4	3029.6	(9$^-$)	2353.4	8$^+$	(E1)	R(DCO)=0.7 *1* at 134°, 0.7 *1* at 158° (1994Pa27).
685.9 *3*	95	1577.7	6$^+$	891.8	4$^+$	E2	R(DCO)=1.1 *1* at 134°, 1.1 *1* at 158° for a composite peak of 685.9+686.2 (1994Pa27).
686.2 *3*	8	6016.0	20$^+$	5329.8	18$^+$	E2	R(DCO)=1.1 *1* at 134°, 1.1 *1* at 158° for a composite peak of 685.9+686.2 (1994Pa27).
701.2 *3*	9	4342.4	(13$^-$)	3641.2	(11$^-$)	E2	R(DCO)=1.3 *1* at 134°, 1.4 *2* at 158° (1994Pa27).
713.0 *3*	12	3821.1	12$^+$	3108.1	10$^+$	E2	R(DCO)=1.1 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
733.2 *3*	1	4805.7	15$^+$	4072.5	13$^+$	E2	R(DCO)=1.3 *1* at 134°, 0.9 *1* at 158° for a composite peak of 733.2+733.3 (1994Pa27).
733.3 *3*	7	5075.7	(15$^-$)	4342.4	(13$^-$)	E2	R(DCO)=1.3 *1* at 134°, 0.9 *1* at 158° for a composite peak of 733.2+733.3 (1994Pa27).
754 *1*	<1	x+1598.9	(19$^-$)	x+845.0	(17$^-$)	(E2)	
754.7 *3*	18	3108.1	10$^+$	2353.4	8$^+$	E2	R(DCO)=1.2 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
768.5 *3*	3	5257.9	(16$^+$)	4489.4	14$^+$	(E2)	
775.2 *3*	91	2353.4	8$^+$	1577.7	6$^+$	E2	R(DCO)=1.0 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
784.4 *3*	4	6490.2	(19$^-$)	5705.8	(17$^-$)	E2	R(DCO)=1.6 *3* at 134° (1994Pa27).
795.3 *3*	12	4616.4	14$^+$	3821.1	12$^+$	E2	R(DCO)=1.0 *1* at 134°, 1.0 *1* at 158° (1994Pa27).
810.1 *3*	8	4072.5	13$^+$	3262.4	12$^+$	M1+E2	R(DCO)=0.4 *1* at 134°, <0.3 at 158° (1994Pa27).
813.8 *3*	4	4735.6	(13$^-$)	3921.8	(11$^-$)	(E2)	

Continued on next page (footnotes at end of table)

^{106}Cd(^{35}Cl,3pγ) 1994Pa27 (continued)

γ(^{138}Sm) (continued)

E_γ [†]	I_γ [†]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	Comments
825.1 *3*	5	5441.5	16^+	4616.4	14^+	E2	R(DCO)=1.0 *2* at 134° (1994Pa27).
853.9 *3*	3	4926.4	15^+	4072.5	13^+	E2	R(DCO)<1.0 at 134° (1994Pa27).
858.7 *3*	3	5201.1	(15^-)	4342.4	(13^-)	(E2)	
863.1 *3*	7	4782.5	16^+	3919.4	14^+	E2	R(DCO)=1.1 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
865 *1*	<1	x+2043.3	(20^-)	x+1178.6	(18^-)	(E2)	
871.3 *3*	7	6887.3	22^+	6016.0	20^+	E2	R(DCO)=1.3 *1* at 134° (1994Pa27).
886.3 *3*	10	4805.7	15^+	3919.4	14^+	M1+E2	R(DCO)=0.5.(1) at 134°, <0.3 at 158° (1994Pa27).
902.0 *3*	5	6343.5	18^+	5441.5	16^+	E2	R(DCO)=1.2 *2* at 134° (1994Pa27).
910 *1*	<1	6167.9	(18^+)	5257.9	(16^+)	(E2)	
915.0 *3*	36	4834.4	16^+	3919.4	14^+	E2	R(DCO)=1.2 *1* at 134°, 1.1 *1* at 158° (1994Pa27).
918.8 *3*	5	7906.7	(22^+)	6987.9	(20^+)	E2	R(DCO)=1.5 *2* at 134°, 1.2 *2* at 158° (1994Pa27).
931.9 *3*	11	2509.4	(7^-)	1577.7	6^+	(E1)	R(DCO)=0.8 *1* at 134°, 0.7 *1* at 158° (1994Pa27).
934.2 *3*	3	5860.6	(17^+)	4926.4	15^+	(E2)	
947.4 *3*	6	3301.1	(9^-)	2353.4	8^+	E1	R(DCO)=0.8 *2* at 134°, 0.8 *2* at 158° (1994Pa27).
953.6 *3*	3	7443.8	(21^-)	6490.2	(19^-)	(E2)	
954 *1*	<1	x+2553.1	(21^-)	x+1598.9	(19^-)	(E2)	
956.1 *3*	4	8862.8	(24^+)	7906.7	(22^+)	E2	R(DCO)=0.9 *2* at 134° (1994Pa27).
962.7 *3*	3	5768.4	(17^+)	4805.7	15^+	(E2)	
987.3 *3*	5	5722.9?	(15^-)	4735.6	(13^-)	E2	R(DCO)=1.4 *2* at 134°, 1.3 *2* at 158° (1994Pa27).
1018.3 *3*	3	9881.1	(26^+)	8862.8	(24^+)	(E2)	
1035.0 *3*	2	7378.5	(20^+)	6343.5	18^+	(E2)	
1049.5 *3*	8	6987.9	(20^+)	5938.4	18^+	(E2)	R(DCO)=1.4 *3* at 134° (1994Pa27).
1059.9 *3*	1	6261.0	(17^-)	5201.1	(15^-)	(E2)	
1066 *1*	<1	x+3109.2	(22^-)	x+2043.3	(20^-)	(E2)	
1077.0 *3*	4	2654.4	(7^-)	1577.7	6^+	(E1)	
1084.4 *3*	2	10965.5	(28^+)	9881.1	(26^+)	(E2)	
1089.8 *3*	3	7977.1	(24^+)	6887.3	22^+	(E2)	
1103 *1*	<1	x+4212.2	(24^-)	x+3109.2	(22^-)	(E2)	
1104.0 *3*	17	5938.4	18^+	4834.4	16^+	E2	R(DCO)=1.1 *1* at 134°, 1.0 *2* at 158° (1994Pa27).
1121.3 *3*	2	8565.1	(23^-)	7443.8	(21^-)	(E2)	
1122 *1*	<1	x+3675.2	(23^-)	x+2553.1	(21^-)	(E2)	
1145.6 *3*	1	12111.1	(30^+)	10965.5	(28^+)	(E2)	
1146.8 *3*	1	6915.2	(19^+)	5768.4	(17^+)	(E2)	
1156.3 *3*	3	5075.7	(15^-)	3919.4	14^+	(E1)	R(DCO)=0.7 *2* at 134°, <0.7 at 158° (1994Pa27).
1173 *1*	<1	x+4848.2	(25^-)	x+3675.2	(23^-)	(E2)	
1199[#] *1*	<1	13310.0?	(32^+)	12111.1	(30^+)		
1219[#] *1*	<1	x+6067?	(27^-)	x+4848.2	(25^-)	(E2)	
1227.0 *3*	6	4489.4	14^+	3262.4	12^+	E2	R(DCO)=1.0 *2* at 134°, 1.3 *2* at 158° (1994Pa27).
1271.1 *3*	3	7209.5	(20^+)	5938.4	18^+	(E2)	
1286 *1*	<1	9263.1	(26^+)	7977.1	(24^+)	(E2)	
1287 *1*	<1	9852.1	(25^-)	8565.1	(23^-)	(E2)	

[†] From 1994Pa27. Intensities are relative to Iγ(346.9γ)=100, and ΔIγ<5%.

[‡] From 1994Pa27 deduced based on measured DCO ratios. DCO ratios were obtained as R(DCO)=Iγ(134°,90°)/Iγ(90°,134°) at 134° or Iγ(158°,90°)/Iγ(90°,158°) at 158°, by gating on E2 transitions Expected values are ≥1.0 for stretched quadrupole and 0.6-0.7 for stretched dipole, and stretched Q transitions are assigned E2 and stretched D are assigned E1 (1994Pa27).

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

^{106}Cd(^{35}Cl,3pγ) 1994Pa27

Level Scheme

Intensities: Relative I_γ

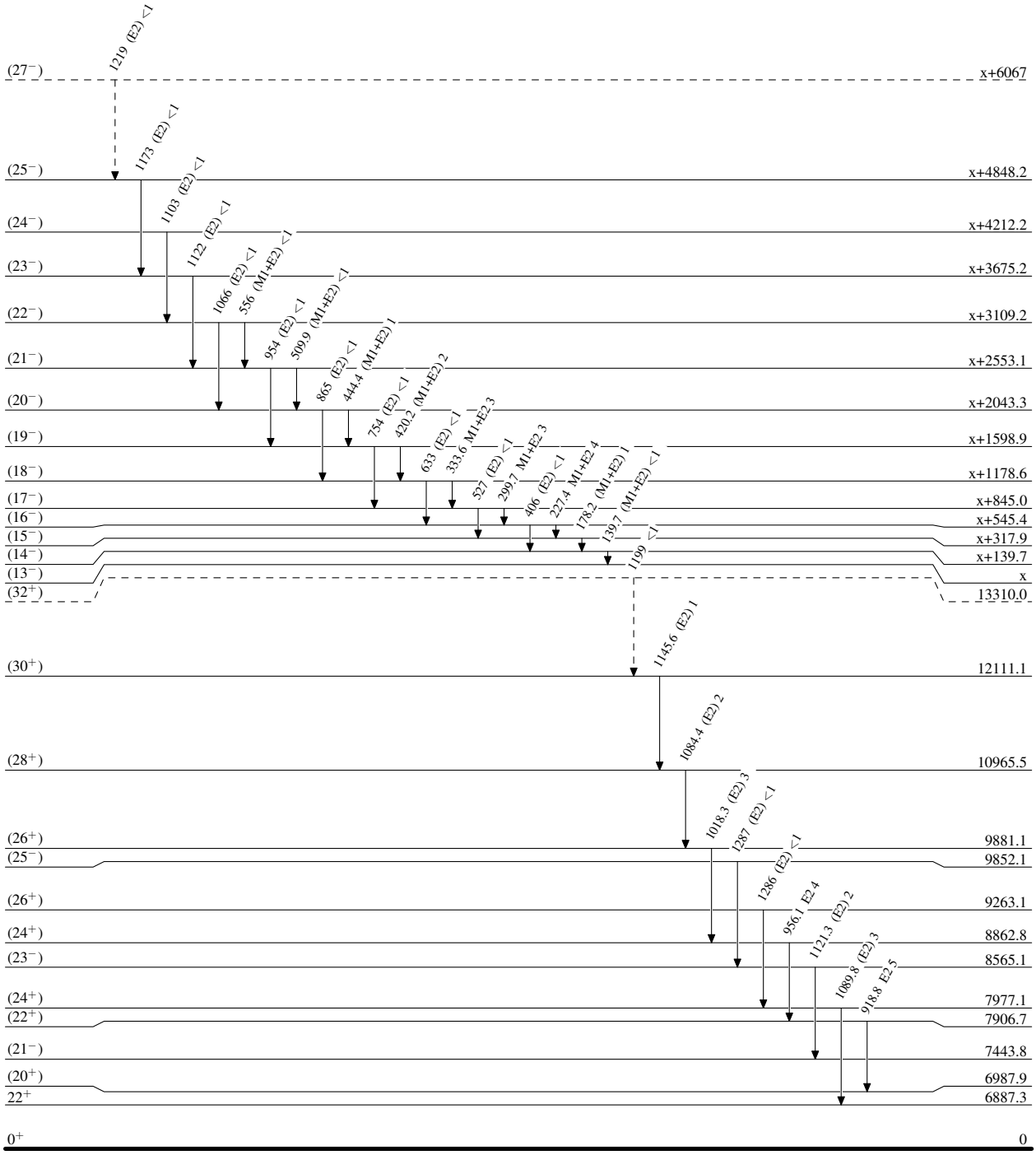
Legend

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

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

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

γ Decay (Uncertain)

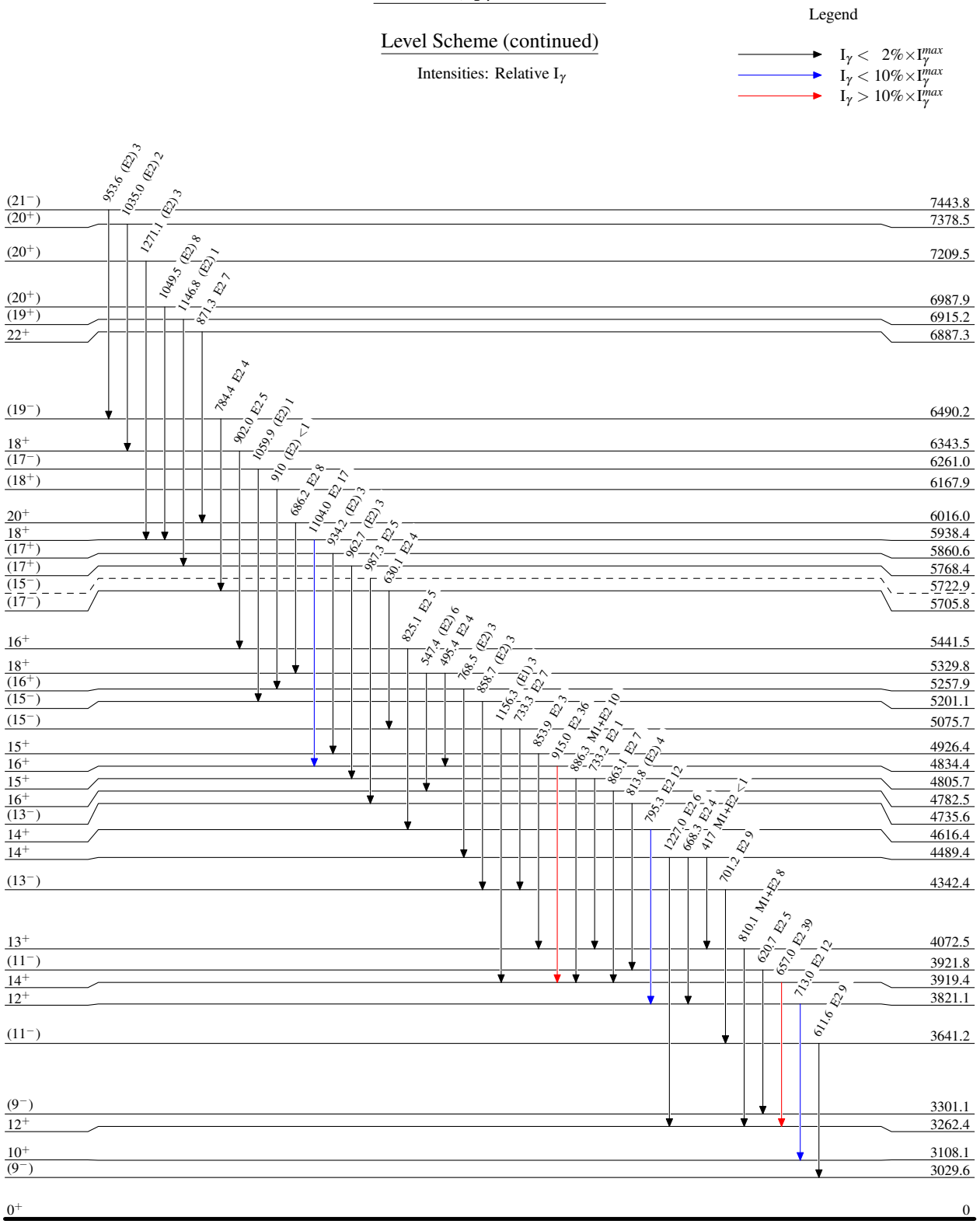


$^{138}_{62}Sm_{76}$

^{106}Cd(^{35}Cl,3pγ) 1994Pa27

Level Scheme (continued)

Intensities: Relative I_γ

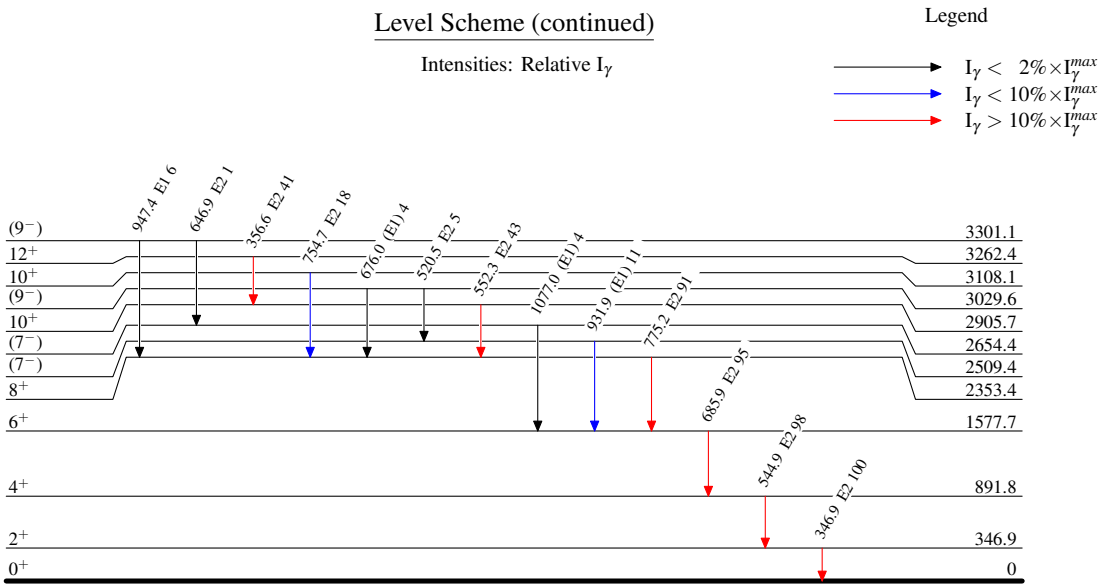


$^{138}_{62}Sm_{76}$

^{106}Cd(^{35}Cl,3pγ) 1994Pa27

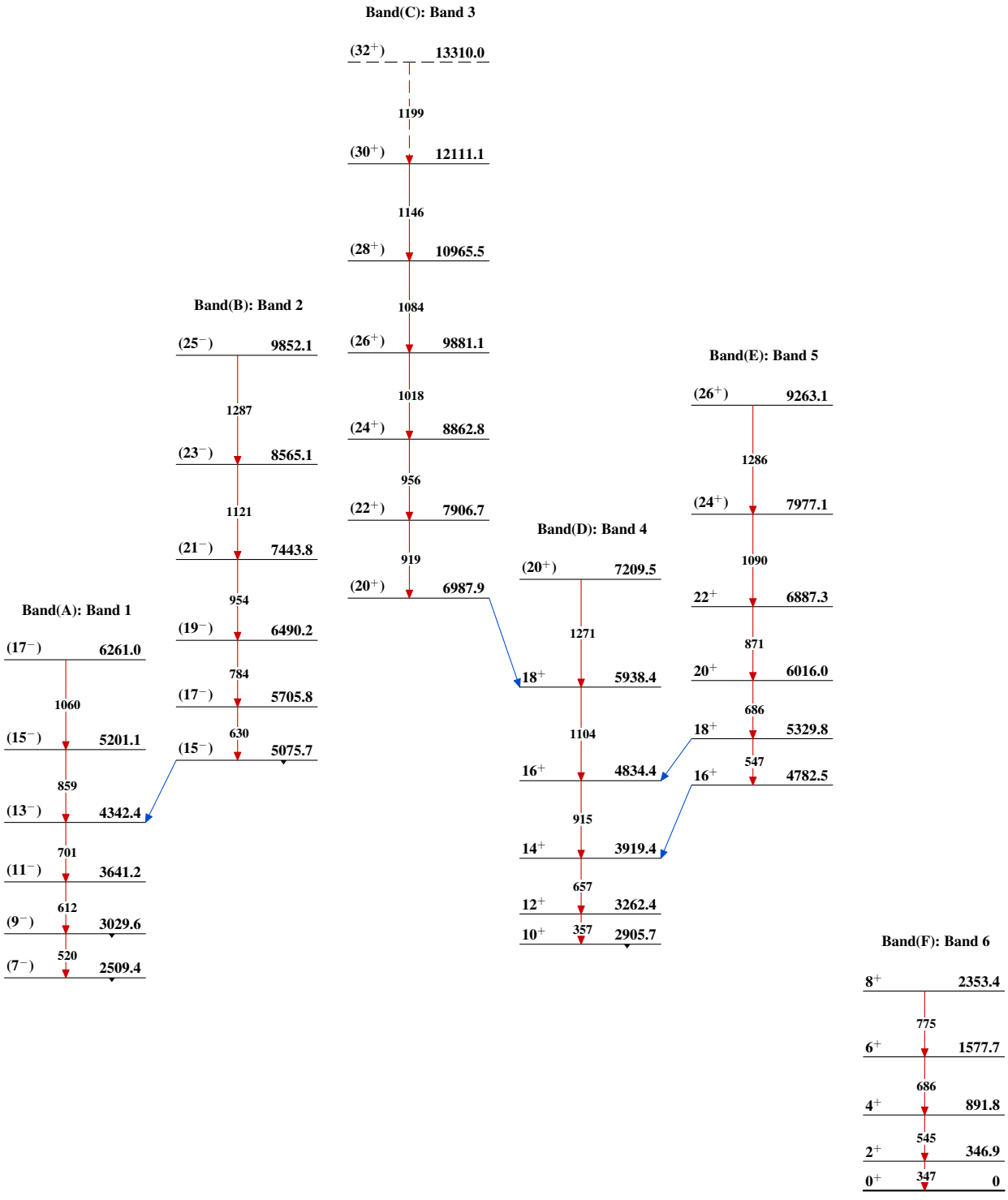
Level Scheme (continued)

Intensities: Relative I_γ



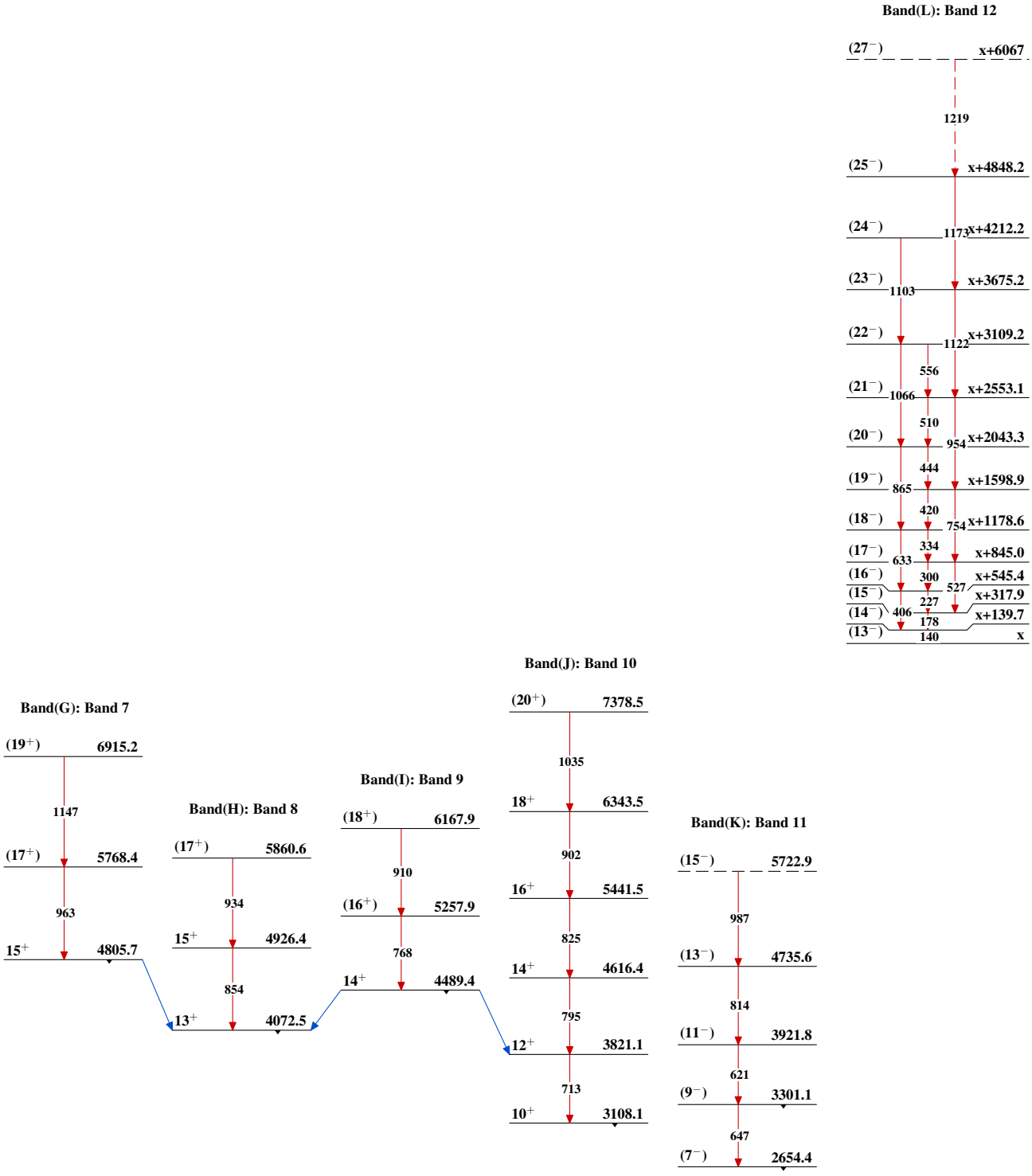
$^{138}_{62}Sm_{76}$

$^{106}Cd(^{35}Cl,3p\gamma)$ 1994Pa27



$^{138}_{62}Sm_{76}$

$^{106}Cd(^{35}Cl,3p\gamma)$ 1994Pa27 (continued)



$^{138}_{62}Sm_{76}$