Adopted Levels, Gammas

History			
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	P. K. Joshi, B. Singh, S. Singh, A. K. Jain	NDS 138, 1 (2016)	15-Oct-2016

Q(β^-)=−5120 *17*; S(n)=10630 *30*; S(p)=2771 *18*; Q(α)=1010 *18* 2012Wa38
S(2n)=19570 *19*, S(2p)=8877 *16* (2012Wa38).

While band structures here are adopted from 2011Zh47, differences between the studies by 2011Zh47 and 2009Dh01 carried out using identical reactions and similar γ-ray counting systems are pointed out as follows:

1. The yrast band reported by 2011Zh47 consisting of Eγs 966.3 − 800.7 − 874.8 −942.6 − 663.0 − 781.3 − 916.8 is reported in 2009Dh01 as Eγs 967 − 876 − 801 − 663- 781- 943 − 1036. In addition, Eγ 1036 keV at the top of the band is not observed by 2011Zh47.
2. The sequence of Eγs 237.8 − 139.0 − 212.0 − 268.6 − 228.0 in 2011Zh47, is observed as 238 − 212 − 138 − 268 − 228 by 2009Dh01.
3. The band number 9 of 2011Zh47 consisting of Eγs 244.3 − 274.4 − 320.2 − 369.5 − 432.4 − 497.0 which was found not connected to any other level of ^{139}Pm, was observed to be connected to band number 1 in 2009Dh01.
4. Band 4 of 2011Zh47 of Eγs 104.2 − 329.6 − 316.7 − 473.0 − 533.0 − 657.7 is reported by 2009Dh01 as 104.0 − 329 − 316 − 473 − 454 − 1009 − 533.
5. Band 5 of 2011Zh47 consisting of Eγs: 224.4 − 262.1 − 454.3 − 394.5 − 602.1 − 313.3 has been reported by 2009Dh01 as 262 − 224 − 394 − 313.

^{139}Pm Levels

Bands: adopted from 2011Zh47.
Levels 188.7, 654.7, 1405.8, 2352.4 have been assigned the configuration π3/2[541], α=−1/2 in 1987Xu01.
Levels 778.9, 1375.9,1405.8,2190.9 have been assigned configuration π3/2[541], α=+1/2 in 1987Xu01.

Cross Reference (XREF) Flags

A	^{139}Pm IT decay (180 ms)	D	^{116}Cd(^{27}Al,4nγ) E=110-142 MeV
B	^{139}Sm ε decay (2.57 min)	E	^{116}Cd(^{27}Al,4nγ):ciae
C	^{139}Sm ε decay (10.7 s)	F	^{116}Cd(^{27}Al,4nγ):iuac

E(level)	J$^\pi$[†]	T$_{1/2}$[‡]	XREF	Comments
0.0	(5/2)$^+$	4.15 min *5*	ABCDEF	%ε+%β^+=100 J$^\pi$: allowed ε decay to 3/2$^+$. 5/2$^+$ from systematics of Z=61, N<86 nuclei. T$_{1/2}$: from 1977De06 (γ's). Other: 4.0 min *2* (1968Bl14).
188.7[#] *3*	(11/2)$^-$	180 ms *20*	A CDEF	%IT=100; %ε+%β^+<0.05 J$^\pi$: E3 γ to (5/2)$^+$. T$_{1/2}$: from 10.7-s ε decay. Upper limit for %ε+%β^+ deduced from systematics of log *ft* values in 1998Si17: for ΔJ=0, Δπ=no, centroid log *ft*=6.1 with a width of 0.9 for 352 cases of odd-A nuclei. Minimum log *ft*=4.1 for such transitions gives %ε+%β^+<0.7.
227.96 *12*	(5/2$^+$,7/2$^+$)		B	J$^\pi$: ≥5/2 from lack of direct ε feeding from (1/2$^+$). Probably 5/2,7/2 since the level is fed by γ's from other low-spin levels. π=+ from syst of N=78 nuclei.
273.73 *9*	(3/2)$^+$		B	J$^\pi$: E2(+M1) γ to (5/2)$^+$. log *ft*=6.4 via 1/2$^+$.
306.69 *9*	(1/2,3/2)$^+$		B	J$^\pi$: E2 γ to (5/2)$^+$. log *ft*=5.6 via 1/2$^+$.
462.66 *11*	(1/2,3/2)$^+$		B	J$^\pi$: M1(+E2) γ to (3/2)$^+$. log *ft*=6.8 via 1/2$^+$.
589.48 *14*			B	
596.31 *12*	(1/2,3/2)$^+$		B	J$^\pi$: M1,E2 γ to (5/2)$^+$. log *ft*=6.1 via 1/2$^+$.
654.6[#] *4*	(15/2$^-$)		DEF	
655.30 *17*			B	
721.36 *18*	(1/2,3/2)$^+$		B	J$^\pi$: M1(+E2) γ to (3/2)$^+$. log *ft*=6.5 via 1/2$^+$.

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Adopted Levels, Gammas (continued)

^{139}Pm Levels (continued)

E(level)	J^{π} †	XREF	Comments
782.03 *9*	$(1/2,3/2)^+$	B	J^{π}: M1,E2 γ's to $(3/2)^+$ and $(5/2)^+$. log *ft*=5.8 via $1/2^+$.
785.7[@] *4*	$(13/2^-)$	DEF	E(level): level reported at 778.9 keV in 1987Xu01 and 2009Dh01 with reversed ordering of the 590-597 γ cascade.
855.7 *4*		B	
862.19 *18*		B	
885.59 *23*		B	
925.85 *18*		B	
929.59 *17*		B	
1015.75 *15*		B	
1111.4 *3*		B	
1126.87 *22*		B	
1183.76 *17*		B	
1207.4 *3*		B	
1284.5[&] *5*	$(15/2^-)$	E	
1366.3 *3*		B	
1376.1[@] *4*	$(17/2^-)$	DEF	
1406.1[#] *4*	$(19/2^-)$	DEF	
1441.87 *16*		B	
1461.59 *25*		B	
1463.1 *3*		B	
1502.1 *3*		B	
1526.65 *23*		B	
1595.8 *4*		B	
1666.4 *3*		B	
1714.0[e] *4*	$(15/2^+)$	DEF	
1719.9 *4*		B	
1896.1 *11*		F	
1902.9[&] *4*	$(19/2^-)$	E	
1951.9[e] *4*	$(17/2^+)$	DEF	
1981.8 *3*		B	
2043.7 *3*		B	
2074.6 *4*		B	
2090.7[e] *4*	$(19/2^+)$	E	Reported as 2163 keV level $(19/2^+)$ in 1987Xu01.
2107.7[c] *4*	$(19/2^+)$	DEF	
2190.8[@] *4*	$(21/2^-)$	DEF	
2210.01 *19*		B	
2302.6[e] *4*	$(21/2^+)$	DEF	
2352.5[#] *4*	$(23/2^-)$	DEF	
2518.3[d] *5*	$(21/2^+)$	EF	
2571.3[e] *4*	$(23/2^+)$	DEF	
2614.7 *6*		E	
2691.3[c] *4*	$(23/2^+)$	DEF	
2768.4[&] *5*	$(23/2^-)$	EF	
2799.3[e] *5*	$(25/2^+)$	DEF	
2964.8[d] *4*	$(25/2^+)$	DEF	
3024.5 *5*		DE	
3158.0[a] *4*	$(25/2^-)$	DEF	
3200.2[@] *4*	$(25/2^-)$	E	
3236.1 *3*		B	
3262.4[a] *4*	$(27/2^-)$	DEF	
3281.4[c] *4*	$(27/2^+)$	DEF	
3307.6 *11*		F	
3390.6 *6*		EF	

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Adopted Levels, Gammas (continued)

^{139}Pm Levels (continued)

E(level)	J^{π}[†]	XREF	Comments
3417.0[#] *4*	(27/2$^-$)	DEF	
3417.0+x		F	
3459.9 *6*		E	
3488.4 *5*		E	
3526.5 *11*		F	
3531.8 *6*		E	
3559.1[d] *4*	(29/2$^+$)	DEF	
3592.0[a] *4*	(29/2$^-$)	DEF	
3611.3 *7*		E	
3679.5 *5*		F	
3749.5[&] *5*	(27/2$^-$)	E	
3863.7 *5*		F	
3908.7[a] *4*	(31/2$^-$)	DEF	
3987.0 *11*		F	
4056.4[c] *5*	(31/2$^+$)	EF	Reported as 4155.3 keV (31/2$^+$) in 1987Xu01.
4083.3 *6*		EF	
4086.0+x		F	
4089.6 *5*		F	
4224.4 *7*		E	
4279.6 *6*		E	
4336.5 *4*		F	
4381.7[a] *4*	(33/2$^-$)	DEF	
4383.3[#] *4*	(31/2$^-$)	DEF	
4409.5 *4*		F	
4418.4[d] *5*	(33/2$^+$)	DEF	
4467.5 *5*		F	
4487.1 *5*		F	
4503.6 *5*		E	
4542.3 *6*		E	
4878.3+x		F	
4914.6[a] *5*	(35/2$^-$)	EF	Reported as 4833.3 keV (35/2$^-$) in 1987Xu01.
4923.2 *7*		EF	
4932.2[c] *6*	(35/2$^+$)	EF	Reported as 5259.3 in 2009Dh01.
5039.7 *5*		F	
5092.3 *8*		E	
5105.9 *5*		F	
5183.2[b] *5*	(35/2$^-$)	E	Reported as 5258.8 keV (35/2$^-$) in 1987Xu01.
5184.0[#] *4*	(35/2$^-$)	E	
5236.1 *6*		E	
5248.8 *6*		EF	
5249.1 *7*		E	
5306.2 *5*		F	
5336.9 *7*		E	
5407.5[b] *5*	(37/2$^-$)	E	
5442.0+x		F	
5505.5[d] *6*	(37/2$^+$)	DEF	
5516.7 *5*		F	
5572.3[a] *7*	(37/2$^-$)	E	
5635.8 *7*		E	
5669.6[b] *6*	(39/2$^-$)	E	
5728.2 *5*		F	
5992.8 *12*		E	
5996.8[c] *8*	(39/2$^+$)	E	Reported as 5874.8 (39/2$^+$) in 2009Dh01.

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Adopted Levels, Gammas (continued)

^{139}Pm Levels (continued)

E(level)	J^{π}[†]	XREF	Comments
6058.8[#] *4*	(39/2$^-$)	DEF	The 874.8 − 800.7 cascade, decaying out of this level was reported in reverse order in 1987Xu01.
6123.9[b] *7*	(41/2$^-$)	E	
6220.3 *7*		E	
6340.9+x		F	
6518.4[b] *8*	(43/2$^-$)	E	
6704.9 *8*		EF	
6719.3 *8*		E	Reported as 6722.9 (43/2$^-$) in 2009Dh01.
7001.4[#] *4*	(43/2$^-$)	E	Reported as 6722.4 (43/2$^-$) in 1987Xu01.
7094.4 *6*		E	
7120.5[b] *9*	(45/2$^-$)	E	
7433.8[b] *10*	(47/2$^-$)	E	
7664.4[#] *4*	(47/2$^-$)	E	Reported as 7503 keV (47/2$^-$) in 1987Xu01 and 2009Dh01.
8445.7[#] *5*	(51/2$^-$)	DEF	
9177.5 *6*		EF	
9362.5[#] *8*	(55/2$^-$)	E	Reported as 9480 keV (55/2$^-$) in 1987Xu01 and 2009Dh01.
9481.5 *6*		F	
9901.0 *8*		E	
10592		D	1112 keV Eγ, was observed in 1987Xu01 but authors were uncertain.
y[f]	J	E	
244.3+y[f] *5*	J+1	E	
518.7+y[f] *6*	J+2	E	
838.9+y[f] *7*	J+3	E	
1208.4+y[f] *8*	J+4	E	
1640.8+y[f] *8*	J+5	E	
2137.8+y[f] *9*	J+6	E	

[†] For low-spin (J<11/2) states, assignments are from multipolarities deduced from ce data in 2.57-min ε decay, combined with log *ft* values. For high-spin (J≥11/2) data, the assignments are based on angular correlation (DCO) and angular distribution data (ADO ratios) from mainly (^{27}Al,4nγ) (2011Zh47), combined with band associations.

[‡] From γ(t) in (^{27}Al,4nγ), except as noted.

[#] Band(A): Yrast, ΔJ=2 band based on 11/2$^-$. Two sharp band crossings are observed at $\hbar\omega$=0.39 and 0.45 MeV, first corresponding to alignment of $h_{11/2}$ neutron pair and the second due to alignment of $h_{11/2}$ proton pair.

[@] Band(B): ΔJ=2 band based on 13/2$^-$.

[&] Band(C): ΔJ=2 band based on 15/2$^-$.

[a] Band(D): ΔJ=1 band based on 25/2$^-$. Possible magnetic-dipole rotational band with tentative configuration $(\pi h_{11/2})\otimes(\nu h_{11/2})^{-2}$ (2011Zh47).

[b] Band(E): ΔJ=1 band based on 35/2$^-$. Possible magnetic-dipole rotational band with tentative configuration $(\pi h_{11/2})\otimes(\nu h_{11/2})^{-4}$ (2011Zh47).

[c] Band(F): ΔJ=2 band based on 19/2$^+$.

[d] Band(G): ΔJ=2 band based on 21/2$^+$.

[e] Band(H): ΔJ=1 band based on 15/2$^{(+)}$.

[f] Band(I): γ sequence.

Adopted Levels, Gammas (continued)

γ(^{139}Pm)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[†]	δ	α[#]	$I_{(\gamma+ce)}$	Comments
188.7	$(11/2)^-$	188.7[‡] *3*	100[‡]	0.0	$(5/2)^+$	E3[‡]		1.494 *24*		α(K)=0.668 *10*; α(L)=0.638 *11*; α(M)=0.1503 *25*; α(N)=0.0329 *6*; α(O)=0.00420 *7* α(P)=3.37×10^{-5} *5* B(E3)(W.u.)=0.27 *4*
227.96	$(5/2^+,7/2^+)$	228.0 *2*	100	0.0	$(5/2)^+$	[M1,E2]		0.143 *13*		α(K)=0.115 *17*; α(L)=0.022 *4*; α(M)=0.0048 *9*; α(N)=0.00106 *19*; α(O)=0.000151 *19* α(P)=6.8×10^{-6} *17*
273.73	$(3/2)^+$	273.7 *2*	100	0.0	$(5/2)^+$	E2(+M1)	≥0.94	0.078 *6*		α(K)=0.063 *7*; α(L)=0.0123 *5*; α(M)=0.00270 *13*; α(N)=0.00060 *3*; α(O)=8.48×10^{-5} *19* α(P)=3.6×10^{-6} *6*
306.69	$(1/2,3/2)^+$	33.0 *1*		273.73	$(3/2)^+$	(M1)		6.00 *10*	8.9 *12*	ce(L)/(γ+ce)=0.675 *7*; ce(M)/(γ+ce)=0.144 *3*; ce(N)/(γ+ce)=0.0325 *7*; ce(O)/(γ+ce)=0.00489 *11*; ce(P)/(γ+ce)=0.000306 *7* α(L)=4.73 *8*; α(M)=1.010 *4*; α(O)=0.0342 *6*; α(P)=0.00214 *4*
		306.7 *2*	100 *7*	0.0	$(5/2)^+$	E2		0.0507		α(K)=0.0399 *6*; α(L)=0.00843 *12*; α(M)=0.00186 *3*; α(N)=0.000412 *6*; α(O)=5.74×10^{-5} *9* α(P)=2.18×10^{-6} *3*
462.66	$(1/2,3/2)^+$	188.9 *1*	100 *6*	273.73	$(3/2)^+$	M1(+E2)	≤1.0	0.256 *5*		α(K)=0.209 *12*; α(L)=0.036 *6*; α(M)=0.0079 *14*; α(N)=0.0018 *3*; α(O)=0.00026 *4* α(P)=1.28×10^{-5} *14*
		234.6 *3*	41 *14*	227.96	$(5/2^+,7/2^+)$					
589.48		315.7 *2*	73 *12*	273.73	$(3/2)^+$					
		361.5 *3*	27 *8*	227.96	$(5/2^+,7/2^+)$					
		589.5 *2*	100 *12*	0.0	$(5/2)^+$					
596.31	$(1/2,3/2)^+$	322.6 *3*	11.4 *23*	273.73	$(3/2)^+$					
		368.4 *3*	3.6 *14*	227.96	$(5/2^+,7/2^+)$					
		596.3 *2*	100 *9*	0.0	$(5/2)^+$	M1,E2		0.010 *3*		α(K)=0.0087 *23*; α(L)=0.00124 *23*; α(M)=0.00027 *5*; α(N)=6.0×10^{-5} *11*; α(O)=8.9×10^{-6} *18* α(P)=5.3×10^{-7} *16*
654.6	$(15/2^-)$	465.9 *1*	100	188.7	$(11/2)^-$	Q				
655.30		381.4 *4*	3.0 *10*	273.73	$(3/2)^+$					
		427.5 *4*	5.0 *20*	227.96	$(5/2^+,7/2^+)$					
		655.3 *2*	100 *15*	0.0	$(5/2)^+$					
721.36	$(1/2,3/2)^+$	447.5 *2*	100	273.73	$(3/2)^+$	M1(+E2)	≤0.84	0.0243 *21*		α(K)=0.0206 *19*; α(L)=0.00290 *15*; α(M)=0.00062 *3*; α(N)=0.000140 *7*; α(O)=2.09×10^{-5} *12* α(P)=1.29×10^{-6} *14*
782.03	$(1/2,3/2)^+$	319.2 *3*	9.0 *27*	462.66	$(1/2,3/2)^+$					
		475.3 *2*	36 *4*	306.69	$(1/2,3/2)^+$					
		508.5 *3*	68 *16*	273.73	$(3/2)^+$	M1,E2		0.015 *4*		α(K)=0.013 *4*; α(L)=0.0019 *3*; α(M)=0.00041 *6*;

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Adopted Levels, Gammas (continued)

γ(^{139}Pm) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. †	Comments
							α(N)=9.2×10^{-5} *14*; α(O)=1.36×10^{-5} *24* α(P)=7.9×10^{-7} *24*
782.03	(1/2,3/2)$^+$	554.2 *3*	10.5 *21*	227.96	(5/2$^+$,7/2$^+$)		
		782.0 *1*	100 *16*	0.0	(5/2)$^+$	M1,E2	
785.7	(13/2$^-$)	597.0 *3*	100	188.7	(11/2)$^-$	D	
855.7		582.0 *3*	100	273.73	(3/2)$^+$		
862.19		588.4 *4*	3.8 *19*	273.73	(3/2)$^+$		
		862.2 *2*	100 *12*	0.0	(5/2)$^+$		
885.59		578.9 *4*	30 *10*	306.69	(1/2,3/2)$^+$		
		611.7 *3*	40 *15*	273.73	(3/2)$^+$		
		886.0 *5*	100 *20*	0.0	(5/2)$^+$		
925.85		329.5 *4*	28 *11*	596.31	(1/2,3/2)$^+$		
		463.1 *3*	89 *22*	462.66	(1/2,3/2)$^+$		
		619.2 *3*	100 *22*	306.69	(1/2,3/2)$^+$		
		652.2 *3*	72 *22*	273.73	(3/2)$^+$		
929.59		333.4 *4*	15 *5*	596.31	(1/2,3/2)$^+$		
		467.0 *3*	19 *5*	462.66	(1/2,3/2)$^+$		
		622.9 *4*	6.3 *25*	306.69	(1/2,3/2)$^+$		
		655.8 *2*	100 *15*	273.73	(3/2)$^+$		
1015.75		419.7 *3*	15 *4*	596.31	(1/2,3/2)$^+$		
		709.0 *4*	8 *3*	306.69	(1/2,3/2)$^+$		
		741.9 *3*	100 *14*	273.73	(3/2)$^+$		
		1015.7 *2*	62 *10*	0.0	(5/2)$^+$		
1111.4		648.8 *3*	100 *27*	462.66	(1/2,3/2)$^+$		
		837.6 *4*	27 *7*	273.73	(3/2)$^+$		
1126.87		853.1 *3*	21 *5*	273.73	(3/2)$^+$		
		1126.9 *3*	100 *27*	0.0	(5/2)$^+$		
1183.76		587.3 *4*	6.1 *20*	596.31	(1/2,3/2)$^+$		
		720.7 *4*	10 *4*	462.66	(1/2,3/2)$^+$		
		877.2 *3*	20 *4*	306.69	(1/2,3/2)$^+$		
		910.1 *2*	100 *14*	273.73	(3/2)$^+$		
1207.4		744.8 *3*	100 *17*	462.66	(1/2,3/2)$^+$		
		933.6 *4*	67 *17*	273.73	(3/2)$^+$		
1284.5	(15/2$^-$)	498.9 *5*	100	785.7	(13/2$^-$)		
1366.3		770.0 *3*	100 *20*	596.31	(1/2,3/2)$^+$		
		1138.2 *4*	80 *40*	227.96	(5/2$^+$,7/2$^+$)		
1376.1	(17/2$^-$)	590.4 *3*	23.7 *20*	785.7	(13/2$^-$)	Q	
		721.5 *1*	100 *6*	654.6	(15/2$^-$)	D	
1406.1	(19/2$^-$)	751.4 *1*	100	654.6	(15/2$^-$)	Q	
1441.87		720.4 *4*	14 *5*	721.36	(1/2,3/2)$^+$		
		1135.2 *2*	100 *18*	306.69	(1/2,3/2)$^+$		
		1168.1 *3*	86 *14*	273.73	(3/2)$^+$		
		1441.9 *3*	64 *18*	0.0	(5/2)$^+$		

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Adopted Levels, Gammas (continued)

γ(^{139}Pm) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. †	Comments
1461.59		679.3 *4*	38 *15*	782.03	$(1/2,3/2)^+$		
		1188.0 *3*	100 *23*	273.73	$(3/2)^+$		
1463.1		741.4 *4*	38 *13*	721.36	$(1/2,3/2)^+$		
		1156.7 *4*	100 *38*	306.69	$(1/2,3/2)^+$		
1502.1		1228.3 *4*	50 *17*	273.73	$(3/2)^+$		
		1274.1 *3*	100 *34*	227.96	$(5/2^+,7/2^+)$		
1526.65		930.1 *3*	100 *16*	596.31	$(1/2,3/2)^+$		
		1220.2 *3*	28 *8*	306.69	$(1/2,3/2)^+$		
1595.8		1322.1 *3*	100	273.73	$(3/2)^+$		
1666.4		1359.7 *3*	39 *11*	306.69	$(1/2,3/2)^+$		
		1392.6 *4*	100 *22*	273.73	$(3/2)^+$		
1714.0	$(15/2^+)$	1059.4 *3*	100	654.6	$(15/2^-)$	D	
1719.9		1446.2 *4*	100	273.73	$(3/2)^+$		
1896.1		490.0	100	1406.1	$(19/2^-)$		
1902.9	$(19/2^-)$	526.8 *3*	100 *7*	1376.1	$(17/2^-)$	D	
		618.4 *5*	43 *7*	1284.5	$(15/2^-)$	Q	
		1248.1 *5*	26.2 *24*	654.6	$(15/2^-)$		
1951.9	$(17/2^+)$	237.8 *5*	11.4 *19*	1714.0	$(15/2^+)$	(D)	
		1297.3 *1*	100 *3*	654.6	$(15/2^-)$	D	
1981.8		1392.2 *5*	3.1 *11*	589.48			
		1675.2 *3*	100 *17*	306.69	$(1/2,3/2)^+$		
2043.7		1322.3 *4*	27 *9*	721.36	$(1/2,3/2)^+$		
		1770.0 *3*	100 *27*	273.73	$(3/2)^+$		
2074.6		1768.0 *4*	100 *34*	306.69	$(1/2,3/2)^+$		
		1800.7 *5*	23 *6*	273.73	$(3/2)^+$		
2090.7	$(19/2^+)$	139.0 *3*	100 *12*	1951.9	$(17/2^+)$		
		714.6 *5*	20.7 *24*	1376.1	$(17/2^-)$		
2107.7	$(19/2^+)$	701.6 *1*	100 *4*	1406.1	$(19/2^-)$	D	
		731.5 *5*	10.1 *15*	1376.1	$(17/2^-)$		
2190.8	$(21/2^-)$	784.6 *1*	95 *12*	1406.1	$(19/2^-)$	D	
		814.8 *1*	100 *14*	1376.1	$(17/2^-)$	Q	
2210.01		1903.2 *3*	28 *7*	306.69	$(1/2,3/2)^+$		
		1936.6 *5*	21 *7*	273.73	$(3/2)^+$		
		1982.0 *5*	12 *5*	227.96	$(5/2^+,7/2^+)$		
		2210.0 *3*	100 *14*	0.0	$(5/2)^+$		
2302.6	$(21/2^+)$	212.0 *1*	100 *7*	2090.7	$(19/2^+)$	(D)	γ transition observed only in 2011Zh47.
		896.0 *3*	52 *4*	1406.1	$(19/2^-)$	D	
2352.5	$(23/2^-)$	946.5 *1*	100	1406.1	$(19/2^-)$	Q	
2518.3	$(21/2^+)$	1112.2 *3*	100	1406.1	$(19/2^-)$	(D)	
2571.3	$(23/2^+)$	268.6 *1*	100	2302.6	$(21/2^+)$	D	
2614.7		1208.6 *5*	100	1406.1	$(19/2^-)$		
2691.3	$(23/2^+)$	338.5 *5*	22.2 *15*	2352.5	$(23/2^-)$	D	
		583.7 *1*	100 *5*	2107.7	$(19/2^+)$	Q	

$^{139}_{61}Pm_{78}$-7

Adopted Levels, Gammas (continued)

γ(^{139}Pm) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. †	Comments
2768.4	(23/2$^-$)	865.4 *3*	100	1902.9	(19/2$^-$)	Q	
2799.3	(25/2$^+$)	228.0 *3*	100 *6*	2571.3	(23/2$^+$)	D	
		497.1 *2*	57 *10*	2302.6	(21/2$^+$)		γ transition observed only in 1987Xu01.
2964.8	(25/2$^+$)	393.3 *3*	54 *8*	2571.3	(23/2$^+$)	D	
		446.4 *5*	22 *3*	2518.3	(21/2$^+$)	(Q)	
		612.3 *1*	100 *6*	2352.5	(23/2$^-$)	D	
		661.8 *5*	<8.4	2302.6	(21/2$^+$)		
3024.5		225.1		2799.3	(25/2$^+$)		γ transition observed only in 1987Xu01.
		453.2 *3*		2571.3	(23/2$^+$)		
3158.0	(25/2$^-$)	805.7 *3*	25 *4*	2352.5	(23/2$^-$)	D	γ transition observed only in 2011Zh47.
		967.1 *1*	100 *5*	2190.8	(21/2$^-$)	Q	
3200.2	(25/2$^-$)	847.8 *5*	<48	2352.5	(23/2$^-$)		
		1009.4 *3*	100 *5*	2190.8	(21/2$^-$)	Q	
3236.1		2929.0 *10*	24 *12*	306.69	(1/2,3/2)$^+$		
		2962.4 *3*	100 *24*	273.73	(3/2)$^+$		
3262.4	(27/2$^-$)	62.1 *5*		3200.2	(25/2$^-$)		γ transition observed only in 2011Zh47.
		104.2 *3*	22 *3*	3158.0	(25/2$^-$)	D	
		909.9 *1*	100 *5*	2352.5	(23/2$^-$)	Q	
3281.4	(27/2$^+$)	590.1 *1*	100	2691.3	(23/2$^+$)	Q	
3307.6		955.1	100	2352.5	(23/2$^-$)		
3390.6		591.3 *3*	100	2799.3	(25/2$^+$)		
3417.0	(27/2$^-$)	1064.5 *1*	100	2352.5	(23/2$^-$)	Q	
3459.9		1107.4 *5*	100	2352.5	(23/2$^-$)		
3488.4		523.5 *5*	100	2964.8	(25/2$^+$)		
3531.8		732.5 *3*	100	2799.3	(25/2$^+$)		
3559.1	(29/2$^+$)	277.9 *5*	<6.2	3281.4	(27/2$^+$)		
		594.3 *1*	100 *7*	2964.8	(25/2$^+$)	Q	
3592.0	(29/2$^-$)	329.6 *1*	100	3262.4	(27/2$^-$)	D	
3611.3		586.8 *5*	100	3024.5			
3679.5		1327.0 *3*	100	2352.5	(23/2$^-$)		
3749.5	(27/2$^-$)	981.0 *3*	100	2768.4	(23/2$^-$)	Q	
3863.7		601.3 *3*	100	3262.4	(27/2$^-$)		
3908.7	(31/2$^-$)	316.7 *1*	100 *6*	3592.0	(29/2$^-$)	D	
		646.2 *5*	10.3 *23*	3262.4	(27/2$^-$)	Q	
3987.0		570.0	100	3417.0	(27/2$^-$)		
4056.4	(31/2$^+$)	497.4 *5*	50 *5*	3559.1	(29/2$^+$)	D	
		567.9 *5*	20 *4*	3488.4			
		775.0 *3*	100 *7*	3281.4	(27/2$^+$)	Q	
4083.3		551.4 *5*	31 *3*	3531.8			
		692.7 *3*	100 *11*	3390.6			
4086.0+x		669.0 *1*	100	3417.0+x		(Q)	
4089.6		672.6 *3*	100	3417.0	(27/2$^-$)		
4224.4		943.0 *5*	100	3281.4	(27/2$^+$)		

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Adopted Levels, Gammas (continued)

γ(^{139}Pm) (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.†
4279.6		687.5 *5*	100	3592.0	(29/2$^-$)	
4336.5		744.5 *1*	100	3592.0	(29/2$^-$)	
4381.7	(33/2$^-$)	473.0 *1*	100 *4*	3908.7	(31/2$^-$)	D
		790	<12	3592.0	(29/2$^-$)	
4383.3	(31/2$^-$)	633.7 *3*	30.1 *24*	3749.5	(27/2$^-$)	Q
		966.3 *1*	100 *5*	3417.0	(27/2$^-$)	Q
4409.5		850.4 *2*	100 *24*	3559.1	(29/2$^+$)	
		883.0	<59	3526.5		
4418.4	(33/2$^+$)	859.3 *3*	100	3559.1	(29/2$^+$)	Q
4467.5		1050.5 *3*	100	3417.0	(27/2$^-$)	
4487.1		928.0 *3*	100	3559.1	(29/2$^+$)	
4503.6		911.6 *5*		3592.0	(29/2$^-$)	
		1086.7 *5*	100	3417.0	(27/2$^-$)	
4542.3		1125.3 *5*	100	3417.0	(27/2$^-$)	
4878.3+x		792.3 *2*	100	4086.0+x		
4914.6	(35/2$^-$)	533.0 *3*	100 *11*	4381.7	(33/2$^-$)	D
		1005.6 *5*	25 *2*	3908.7	(31/2$^-$)	
4923.2		1014.5 *3*	100	3908.7	(31/2$^-$)	D
4932.2	(35/2$^+$)	875.8 *3*	100	4056.4	(31/2$^+$)	Q
5039.7		658.0 *3*	100	4381.7	(33/2$^-$)	
5092.3		1009.0 *5*	100	4083.3		
5105.9		696.4 *1*	100	4409.5		
5183.2	(35/2$^-$)	800 *1*	>69	4383.3	(31/2$^-$)	
		801.6 *3*	100 *11*	4381.7	(33/2$^-$)	D
		903.5 *5*	15 *2*	4279.6		
		1274.3 *5*	31.5 *19*	3908.7	(31/2$^-$)	Q
5184.0	(35/2$^-$)	800.7 *1*	100	4383.3	(31/2$^-$)	Q
5236.1		854.5 *5*	100 *7*	4381.7	(33/2$^-$)	
		1327.4 *5*	60 *33*	3908.7	(31/2$^-$)	
5248.8		745.2 *5*	100	4503.6		
5249.1		830.7 *5*	100	4418.4	(33/2$^+$)	
5306.2		922.9 *3*	100	4383.3	(31/2$^-$)	
5336.9		955.2 *5*	100	4381.7	(33/2$^-$)	
5407.5	(37/2$^-$)	224.4 *3*	100 *12*	5183.2	(35/2$^-$)	D
		492.9 *5*	12 *7*	4914.6	(35/2$^-$)	
5442.0+x		563.7 *2*	100	4878.3+x		
5505.5	(37/2$^+$)	1087.1 *3*	100	4418.4	(33/2$^+$)	Q
5516.7		1608.0 *3*	100	3908.7	(31/2$^-$)	
5572.3	(37/2$^-$)	657.7 *5*	100	4914.6	(35/2$^-$)	(D)
5635.8		1254.1 *5*	100	4381.7	(33/2$^-$)	
5669.6	(39/2$^-$)	262.1 *3*	100	5407.5	(37/2$^-$)	D
5728.2		622.3 *2*	100	5105.9		
5992.8		744 *1*	100	5248.8		

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Adopted Levels, Gammas (continued)

$\gamma(^{139}Pm)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult. †	Comments
5996.8	(39/2$^+$)	1064.6 *5*	100	4932.2	(35/2$^+$)	(Q)	
6058.8	(39/2$^-$)	874.8 *1*	100	5184.0	(35/2$^-$)	Q	
6123.9	(41/2$^-$)	454.3 *3*	100	5669.6	(39/2$^-$)	D	
6220.3		971.5 *5*	92 *25*	5248.8			
		1036 *1*	100 *25*	5184.0	(35/2$^-$)		
6340.9+x		898.9 *3*	100	5442.0+x			
6518.4	(43/2$^-$)	394.5 *3*	100	6123.9	(41/2$^-$)	D	
6704.9		1199.4 *5*	100	5505.5	(37/2$^+$)		
6719.3		1213.8 *5*	100	5505.5	(37/2$^+$)		
7001.4	(43/2$^-$)	781 *1*	37 *3*	6220.3			
		942.6 *1*	100 *7*	6058.8	(39/2$^-$)	Q	
7094.4		1035.5 *5*	100	6058.8	(39/2$^-$)		
7120.5	(45/2$^-$)	602.1 *5*	100	6518.4	(43/2$^-$)	(D)	
7433.8	(47/2$^-$)	313.3 *5*	100	7120.5	(45/2$^-$)	(D)	
7664.4	(47/2$^-$)	569.8 *5*	<11.2	7094.4			
		663.0 *1*	100 *6*	7001.4	(43/2$^-$)	Q	
8445.7	(51/2$^-$)	781.3 *3*	100	7664.4	(47/2$^-$)	Q	γ from 2011Zh47. In 1987Xu01, this level was shown to depopulate by a 942γ.
9177.5		731.8 *3*	100	8445.7	(51/2$^-$)		
9362.5	(55/2$^-$)	916.8 *5*	100	8445.7	(51/2$^-$)	(Q)	
9481.5		1035.8 *2*	100	8445.7	(51/2$^-$)		
9901.0		723.5 *5*	100	9177.5			
244.3+y	J+1	244.3 *5*	100	y	J		
518.7+y	J+2	274.4 *3*	100	244.3+y	J+1	D	
838.9+y	J+3	320.2 *3*	100	518.7+y	J+2	D	
1208.4+y	J+4	369.5 *3*	100	838.9+y	J+3	D	
1640.8+y	J+5	432.4 *3*	100	1208.4+y	J+4	D	
2137.8+y	J+6	497.0 *3*	100	1640.8+y	J+5	(D)	

† For low-spin (J<11/2) levels, values are from 2.57-min ε decay. For high-spin (J≥11/2), values are from (^{27}Al,4nγ):CIAE, which is considered by the evaluators as more reliable as the authors, in response to evaluators′ queries, have considered, in detail, differences between their previous publication 2010Zh12 and 2009Dh01, culminating in 2011Zh47 publications with data details sent as private communication to the evaluators.

‡ From 10.7-s ε decay.

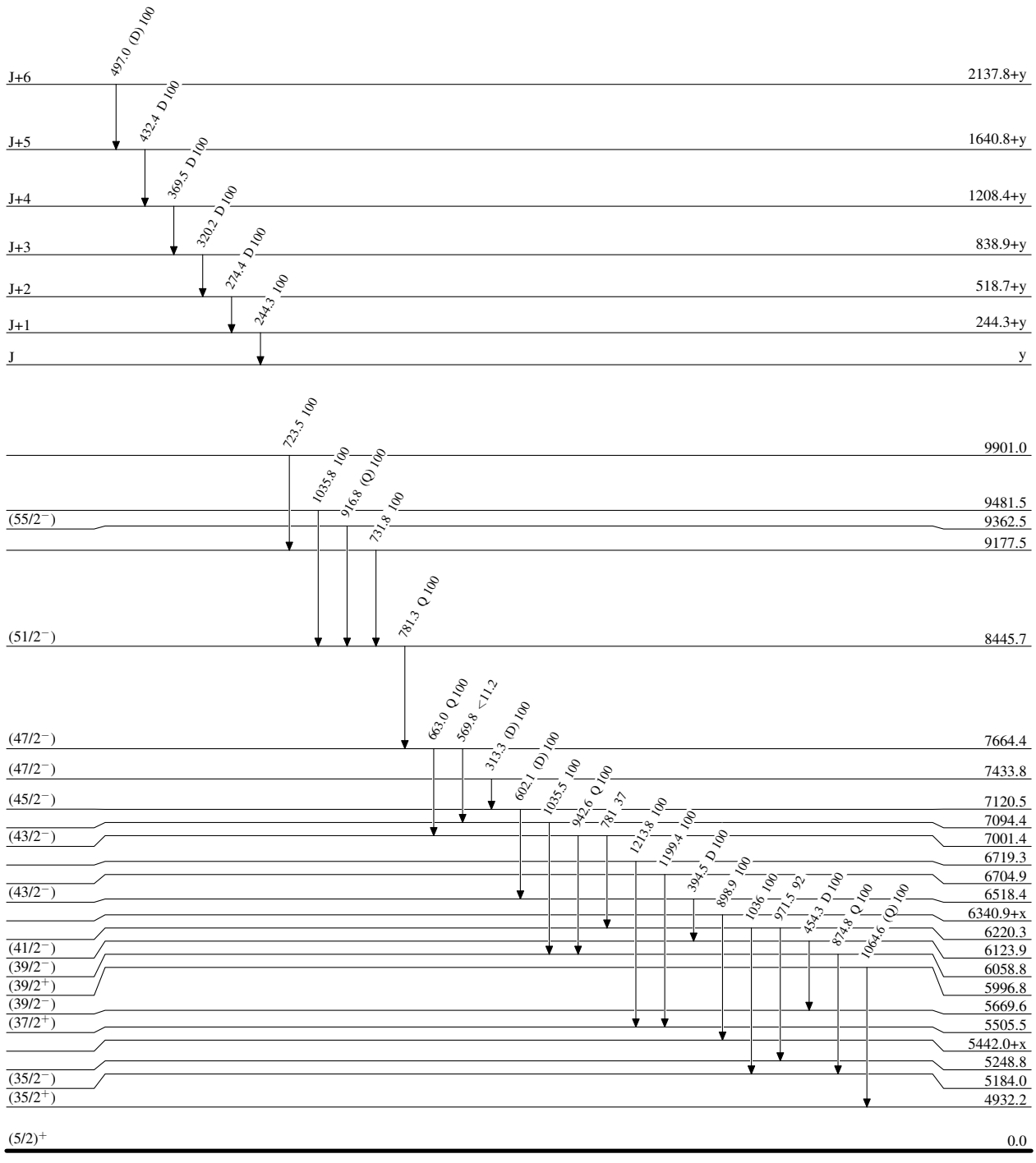
Theoretical values from BrIcc code. If δ(M2/E1) not given, value overlaps those for M1 and E2.

$^{139}_{61}Pm_{78}$-10

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

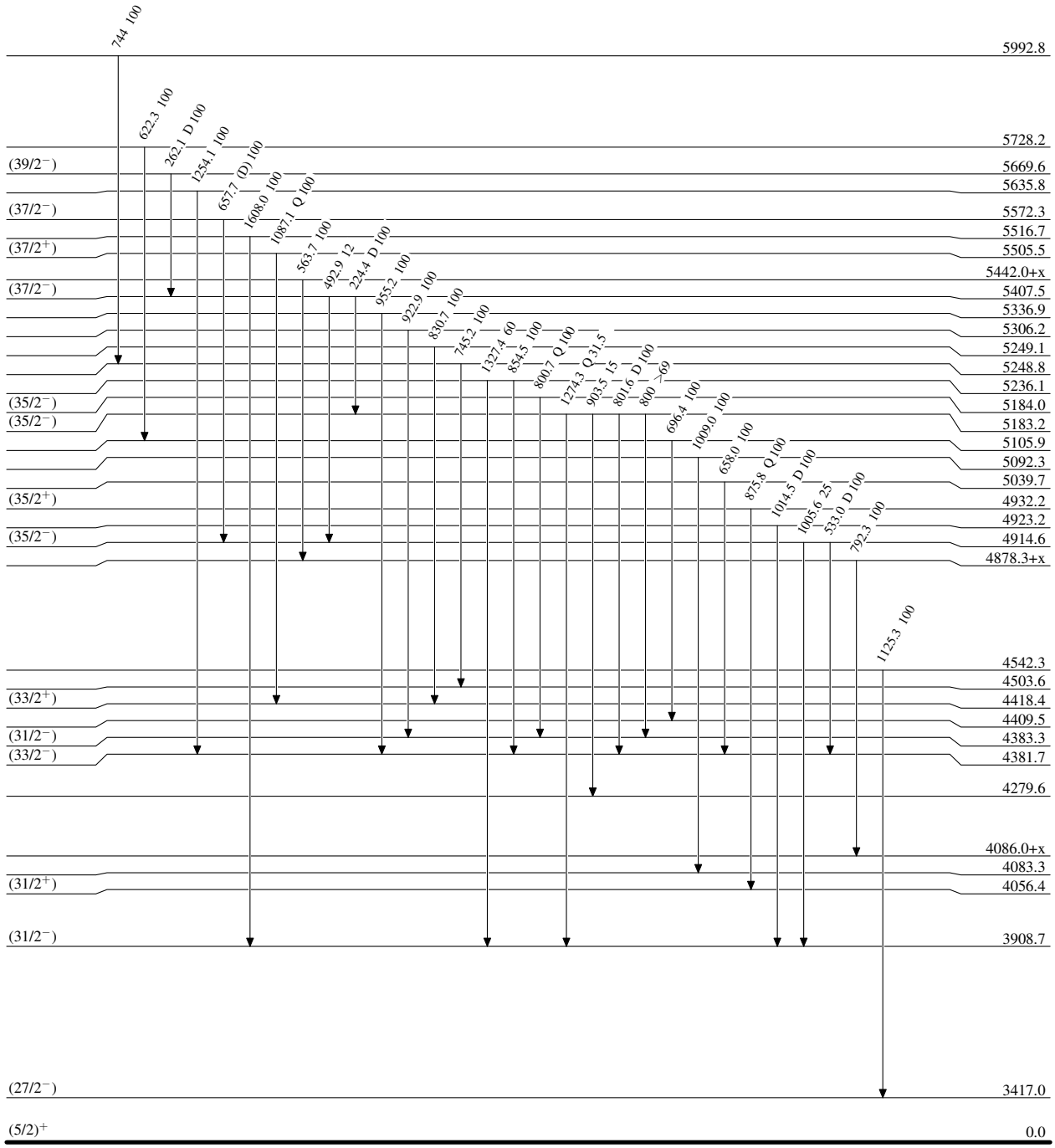


$^{139}_{61}Pm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

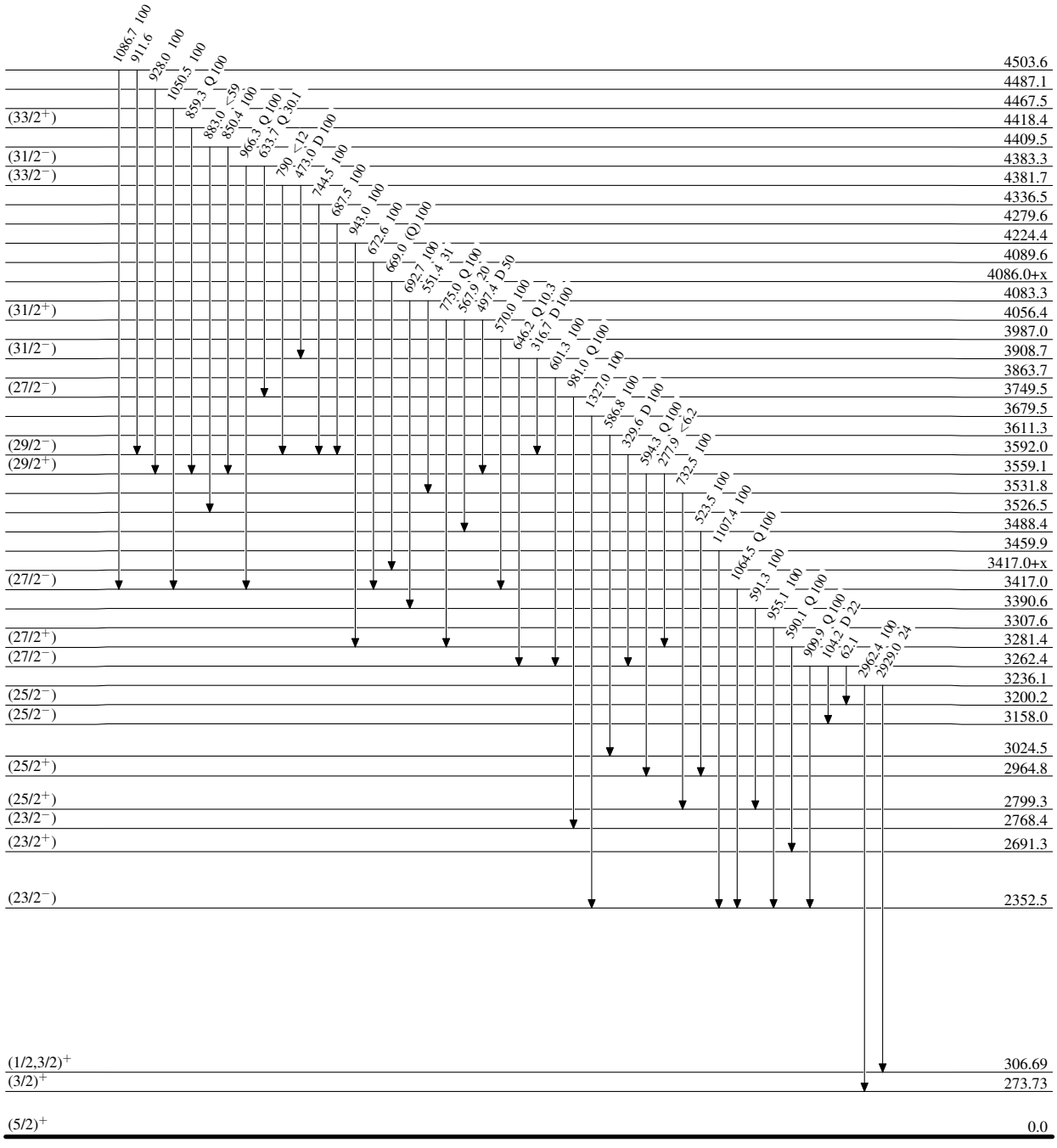


$^{139}_{61}Pm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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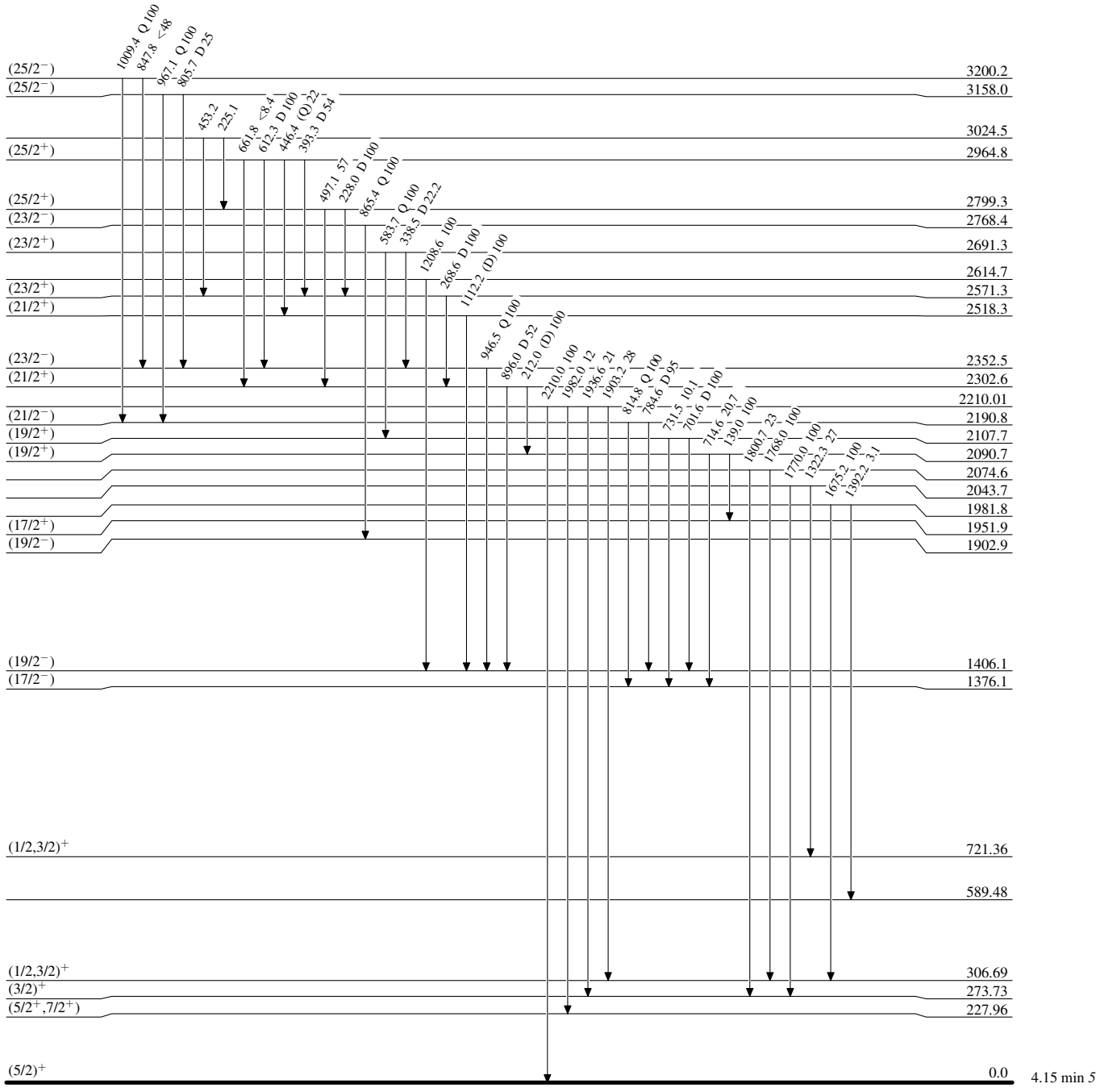
Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

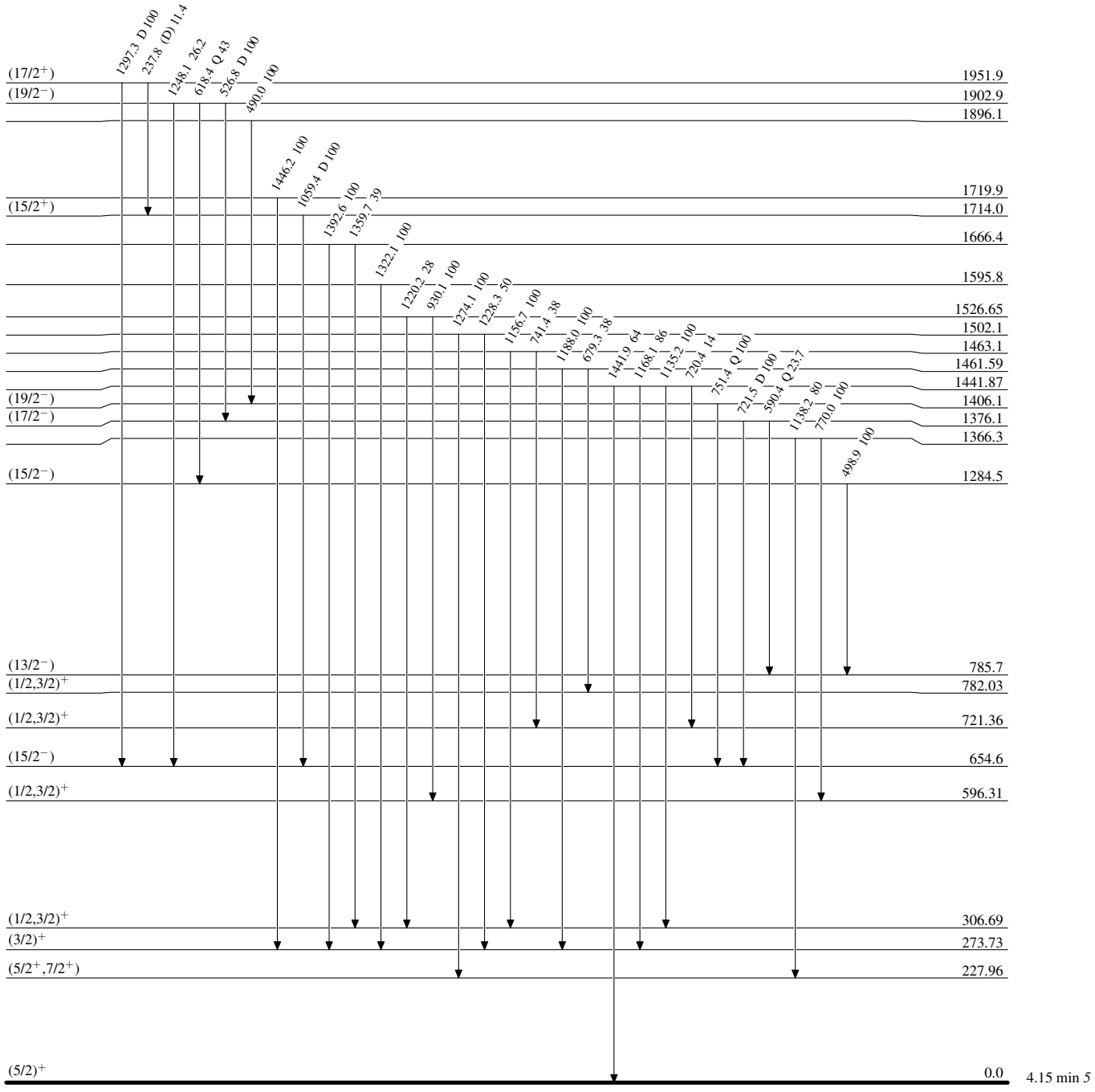


$^{139}_{61}Pm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

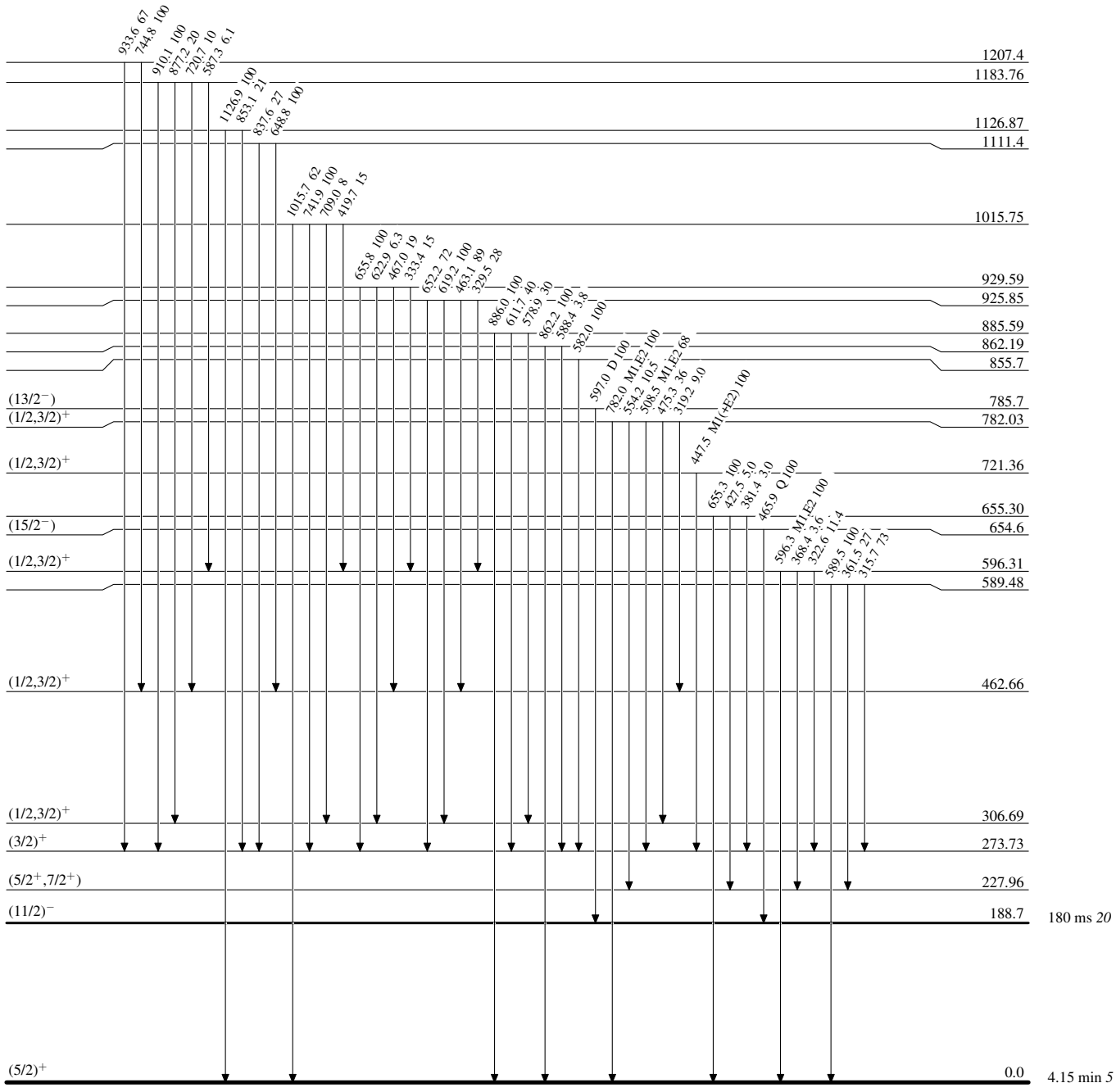


$^{139}_{61}Pm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level

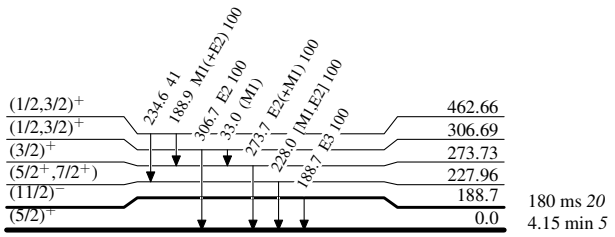


$^{139}_{61}Pm_{78}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



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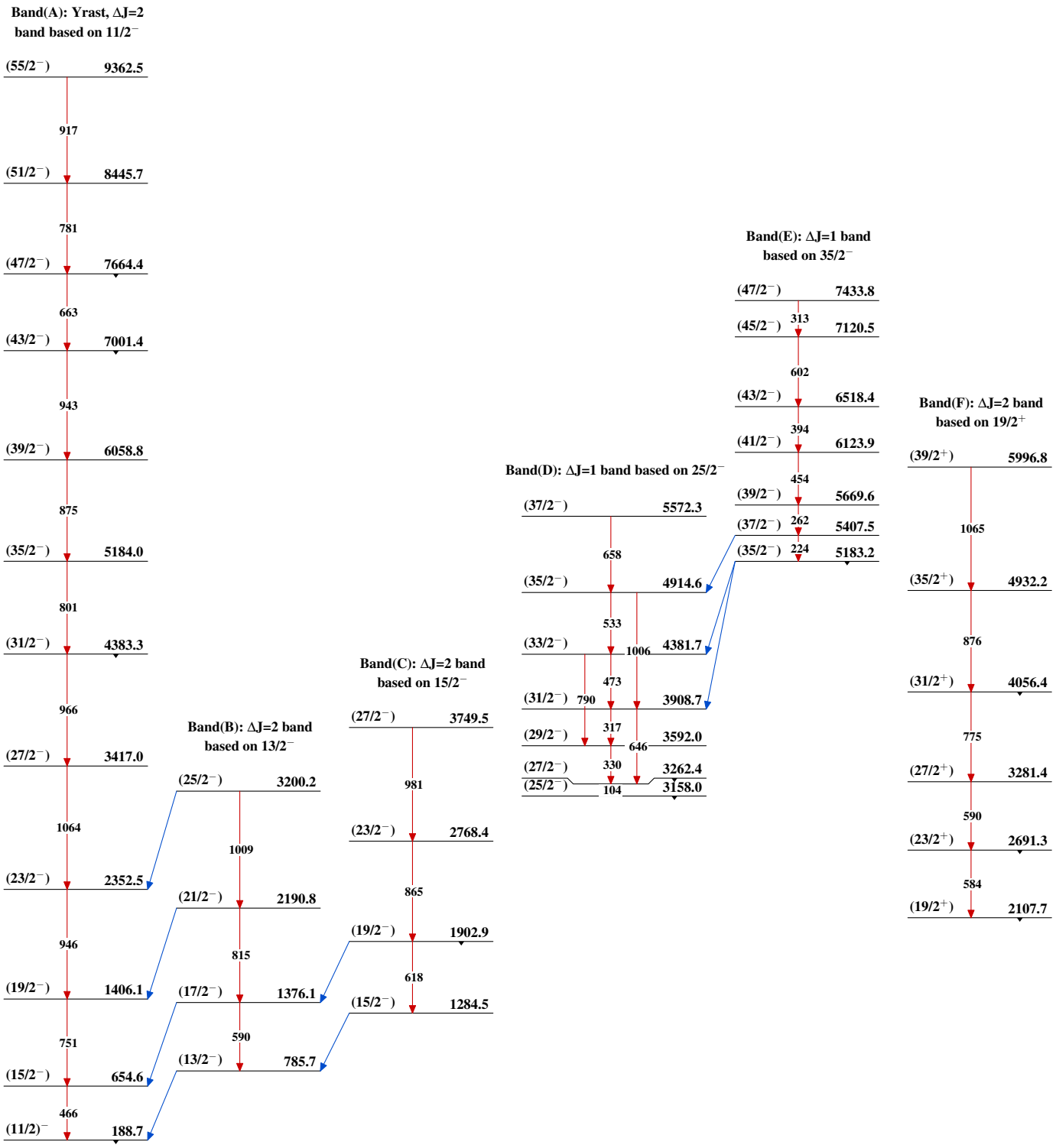
Adopted Levels, Gammas



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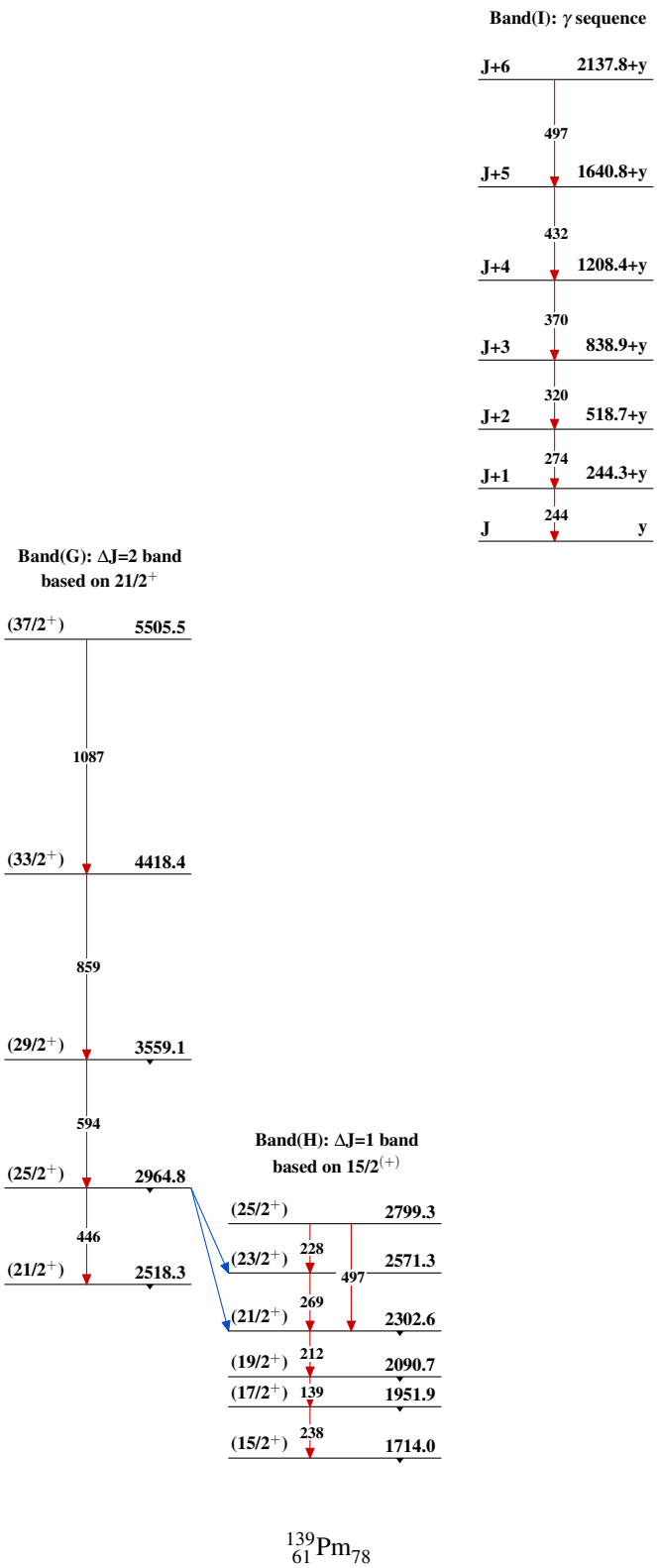
Adopted Levels, Gammas (continued)



$^{139}_{61}Pm_{78}$