Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 200,2 (2025)	22-Aug-2022

Q(β^-)=4189 *25*; S(n)=5690 *27*; S(p)=8225 *25*; Q(α)=−2391 *27* 2021Wa16
S(2n)=13150 *40*, S(2p)=19090 *30* (2021Wa16).
Additional information 1.
Additional information 2.

^{154}Pm Levels

Cross Reference (XREF) Flags

A ^{154}Nd β^- decay
B ^{9}Be(^{238}U,Fγ)

E(level)[†‡]	J$^\pi$[#@]	T$_{1/2}$	XREF	Comments
0[&]	(4$^+$)	2.68 min *7*	B	%β^-=100 E(level): Although it is generally assumed that this level is the ground state, this has not been determined experimentally. J$^\pi$: (3,4), from log*ft* values of β^- branches to ^{154}Sm levels of known J^π. (4$^+$) based on 2012So10 analysis of two-quasiparticle (2qp) bandhead energies based on the mapping of the physically admissible configuration space with inputs from observed 1qp energies in the core odd-mass isotope and isotone, and the experimental 2qp level energies in the neighboring odd-odd nuclei. Proposed configuration: (π 5/2[532])+(ν 3/2[521]) (2012So10). Other discussions of possible configurations are given by 1971Da28, 1972Ta13, 1973Pr05, and 1974Ya07. T$_{1/2}$: Weighted average of 2.9 m *2* (1974Ya07), 2.5 m *2* (1973Pr05), 2.65 m *10* (1972Ta13), 2.8 m *2* (1971Da28), and 2.5 m *5* (1958Wi42), all from ^{154}Pm β^- decay. %β^-: Assumed to be 100%.
0+x	(1$^-$)	1.73 min *10*	A	%β^-=100 Additional information 3. E(level): This level is generally assumed to be an excited level. The only experimental values of the energy are from the difference in Q(β^-) deduced from endpoints of β^- branches from the 1.73- and 2.68-m levels. 1972Ta13 give E(x)=210 *70*, from Q(β^-)=4400 *180* and 4190 *170*; and 1971Da28 give E(x)=0 *280* keV from Q(β^-)=3900 *200* and 3900 *300*. From a systematic study of the separation energies of Gallagher-Moszkowski pairs, and assuming their configuration assignments are correct, 2012So10 estimate that this level is 30 *10* keV above the 2.68-m level. J$^\pi$: (0,1) from log*ft* values of β^- branches to ^{154}Sm levels of known J^π. Note that log*ft* ≈ 5.5 to 2$^+$ at 2069 keV excludes J=0. (1$^-$) based on 2012So10 analysis (see J^π comment at g.s.). Proposed configuration: (π 5/2[413])+(ν 3/2[521]) (2012So10). For other discussions of possible configurations, see the comment for the g.s. J^π value. T$_{1/2}$: Weighted average of 1.7 m *2* (1974Ya07), 1.6 m *2* (1973Pr05), 1.8 m *2* (1972Ta13), and 1.8 m *2* (1971Da28), all from ^{154}Pm β^- decay. %β^-: Assumed to be 100%, since IT decay has not been observed.
50.688+x *14*	(2$^-$)		A	J$^\pi$: Characterized by 2012So10 as the 2$^-$ member of the K^π=1$^-$ band based on the (π 5/2[413])+(ν 3/2[521]) configuration and sustained by not being populated by β^- decay from the 0$^+$ parent. Also, E2 γ to (1$^-$) determines π=−.
68.006+x *16*	(2$^-$)		A	J$^\pi$: M1 γ to (1$^-$), (2$^-$) from not being populated from 0$^+$ β^- parent. Proposed configuration (π 5/2[532])+(ν 5/2[642]) in 2012So10.
79.382+x *23*	(1$^-$)		A	J$^\pi$: (0$^-$,1$^-$,2$^-$) from E1 γ from (1$^+$), (1$^-$,2$^-$,3$^-$) from M1 γ to (2$^-$) and (0,1) based

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{154}Pm Levels (continued)

E(level)[†‡]	Jπ[#@]	XREF	Comments
			on log *ft*≈5.7 from 0^+ parent.
94.0[a] *2*	(5^+)	B	
105.690+x *34*	(2^-)	A	Jπ: (1^-,2^-,3^-) from M1(+E2) γ to (2^-), (2^-,3^-) from not being populated from 0^+ parent in β^- decay, (2^-) from being populated from (1^+) level.
151.702+x *14*	(1^+)	A	Jπ: (1^+,2^+) from E1 γ's to (1^-) and (2^-) respectively. (1^+) from log*ft*=5.2 from 0^+ parent in β^- decay. 2012So10 suggest that this is $J^\pi=1^+$ with the configuration (π 5/2[532])-(ν 3/2[521]).
154.93+x *6*		A	
173.81+x *5*	(2^-)	A	Jπ: (0^-,1^-,2^-) from E1 γ from (0^+,1^+); (2^-) more likely from not being populated by β^- decay from the 0^+ parent.
180.689+x *16*	(1^+)	A	Jπ: (1^+,2^+) from E1 γ to (2^-) and (1^-). (1^+) based on log *ft*≈5.6 from 0^+ parent. Proposed configuration J^πK = 1^+0 (π 5/2[413])(ν 5/2[642]) in 2012So10.
185.492+x *27*	(0^+,1^+)	A	Jπ: (0^+,1^+,2^+) from M1(+E2) γ to (1^+) and (0,1) based on log *ft*≈6.9 from 0^+ parent.
194.192+x *34*	(0^+,1^+)	A	Jπ: (0^+,1^+,2^+) from (E1) γ to (1^-) and (0,1) based on log *ft*≈6.8 from 0^+ parent.
203.0[&] *3*	(6^+)	B	
244.615+x *32*	(0^+,1^+)	A	Jπ: (0^+,1^+,2^+) from M1 γ to (1^+) and (0,1) based on log *ft*≈6.6 from 0^+ parent.
268.78+x *26*		A	
329.0[a] *3*	(7^+)	B	
470.0[&] *3*	(8^+)	B	
505.49+x? *23*		A	
597.39+x *30*		A	
627.9[a] *4*	(9^+)	B	
633.85+x *9*	(0,1)	A	Jπ: (0,1) based on log *ft*≈6.9 from 0^+ parent.
652.36+x *27*		A	
682.31+x *8*	(0,1)	A	Jπ: (0,1) based on log *ft*≈6.9 from 0^+ parent.
699.99+x? *30*		A	
801.8[&] *4*	(10^+)	B	
831.55+x *8*	(1^+)	A	Jπ: (0,1) based on log *ft*≈5.6 from 0^+ parent. (1^+) from proposed configuration (π 5/2[413])(ν 3/2[651]) in 2012So10.
850.227+x *29*	(1^+)	A	Jπ: From log*ft*≈4.8 from 0^+ parent in β^- decay; 2012So10 assign configuration of ((π 5/2[532])(ν 3/2[532])) (with rather strong ΔK=0 band mixing).
906.96+x *5*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.3 from 0^+ parent.
990.8[a] *4*	(11^+)	B	
1049.64+x *8*	(1^+)	A	Jπ: (0,1) based on log *ft*≈5.2 from 0^+ parent. (1^+) from proposed configuration (π 5/2[413])(ν 3/2[402]) in 2012So10.
1060.54+x *8*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.3 from 0^+ parent.
1198.8[&] *7*	(12^+)	B	
1204.50+x *11*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.4 from 0^+ parent.
1389.21+x *10*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.3 from 0^+ parent.
1415.8[a] *7*	(13^+)	B	
1662.8[&] *8*	(14^+)	B	
1662.70+x *20*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.6 from 0^+ parent.
1689.99+x *31*	(0,1)	A	Jπ: (0,1) based on log *ft*≈5.6 from 0^+ parent.
1898.8[a] *8*	(15^+)	B	

† Additional information 4.

‡ From the ^{154}Nd β^- decay dataset (except the pseudolevels are not adopted since they may represent several actual levels), and from ^{9}Be(^{238}U,Fγ) dataset, which have no common levels. In each dataset the E(level) values were deduced from a least-squares fit to the respective γ energies.

\# For the ^{9}Be(^{238}U,Fγ) levels tentatively assigned by 2018Bh07 from the proposed band structure, with all J^π values reassigned by evaluator based on (4^+) for g.s. For the ^{154}Nd β^- decay levels the arguments are given in comments.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{154}Pm Levels (continued)

[@] For several levels, the configurations of 2012So10 (superseding 1990So08) are given; for other discussions of the configurations, see 1971Da28, 1972Ta13, 1973Pr05, and 1974Ya07.

[&] Band(A): Signature α=0 band.

[a] Band(a): Signature α=1 band.

$\gamma(^{154}Pm)$

E_i(level)	J^π_i	E_γ[†‡]	I_γ	E_f	J^π_f	Mult.[@]	α[&]	$I_{(\gamma+ce)}$	Comments
50.688+x	(2^-)	50.691 *22*	100	0+x	(1^-)	E2	30.4 *4*		α(K)=4.44 *6*; α(L)=20.17 *29*; α(M)=4.66 *7* α(N)=1.011 *14*; α(O)=0.1253 *18*; α(P)=0.0002406 *34*
68.006+x	(2^-)	17.3		50.688+x	(2^-)			≈98	$I_{(\gamma+ce)}$: Deduced from $\gamma\gamma$ coincidence intensities in ^{154}Nd β^- decay (1993GrZZ).
		68.000 *22*	100	0+x	(1^-)	M1	4.71 *7*		α(K)=3.99 *6*; α(L)=0.564 *8*; α(M)=0.1205 *17* α(N)=0.0271 *4*; α(O)=0.00409 *6*; α(P)=0.000257 *4*
79.382+x	(1^-)	28.7 *3*	12	50.688+x	(2^-)	M1	9.07 *31*		α(L)=7.15 *25*; α(M)=1.53 *5* α(N)=0.344 *12*; α(O)=0.0517 *18*; α(P)=0.00324 *11* α: Deduced value (1993GrZZ). See the comment in the ^{154}Nd β^- decay data set.
		79.38 *15*	100	0+x	(1^-)	M1,E2	4.1 *11*		α(K)=2.38 *18*; α(L)=1.4 *10*; α(M)=0.31 *24* α(N)=0.07 *5*; α(O)=0.009 *6*; α(P)=1.3×10^{-4} *4*
94.0	(5^+)	94.0 *2*	100	0	(4^+)				
105.690+x	(2^-)	37.63 *6*	100	68.006+x	(2^-)	M1(+E2)	$6.\times10^1$ *5*		α(L)=4; α(M)=10 *10* α(N)=2.2 *21*; α(O)=0.28 *25*; α(P)=9 α: Deduced from $\gamma\gamma$ coincidence intensities in ^{154}Nd β^- decay. See the comment in that data set.
		105.7 *3*	12	0+x	(1^-)				
151.702+x	(1^+)	45.99 *4*	11.7	105.690+x	(2^-)				
		72.319 *22*	10.4	79.382+x	(1^-)	E1	0.643 *9*		α(K)=0.539 *8*; α(L)=0.0819 *11*; α(M)=0.01743 *24* α(N)=0.00384 *5*; α(O)=0.000539 *8*; α(P)=2.529×10^{-5} *35*
		83.697 *20*	53	68.006+x	(2^-)	E1	0.434 *6*		α(K)=0.365 *5*; α(L)=0.0542 *8*; α(M)=0.01152 *16* α(N)=0.00255 *4*; α(O)=0.000360 *5*; α(P)=1.748×10^{-5} *25*
		101.019 *20*	45	50.688+x	(2^-)				
		151.703 *20*	100	0+x	(1^-)				
154.93+x		87.7[#] *3*	0.7	68.006+x	(2^-)				
		104.20 *9*	100	50.688+x	(2^-)				
173.81+x	(2^-)	95.0[#] *3*	4.6	79.382+x	(1^-)				
		122.95 *10*	100	50.688+x	(2^-)	M1,E2	0.97 *11*		α(K)=0.69 *4*; α(L)=0.22 *11*; α(M)=0.049 *27* α(N)=0.011 *6*; α(O)=0.0014 *7*; α(P)=3.8×10^{-5} *9*
180.689+x	(1^+)	130.002 *20*	73	50.688+x	(2^-)	E1	0.1307 *18*		α(K)=0.1109 *16*; α(L)=0.01566 *22*; α(M)=0.00333 *5* α(N)=0.000739 *10*; α(O)=0.0001068 *15*; α(P)=5.65×10^{-6} *8*
		180.693 *22*	100	0+x	(1^-)	E1	0.0535 *7*		α(K)=0.0455 *6*; α(L)=0.00628 *9*; α(M)=0.001333 *19* α(N)=0.000297 *4*; α(O)=4.35×10^{-5} *6*; α(P)=2.413×10^{-6} *34*
185.492+x	$(0^+,1^+)$	30.8 *3*	1.5	154.93+x					
		33.8 *2*	15	151.702+x	(1^+)	M1(+E2)	1.0×10^2 *9*		α(L)=8; α(M)=17 *16*

$^{154}_{61}Pm_{93}$-4

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ [†‡]	I_γ	E_f	J^π_f	Mult. [@]	α [&]	$I_{(\gamma+ce)}$	Comments
									α(N)=4 *4*; α(O)=0.5 *4*; α(P)=0.0012 *8* α: Deduced (1993GrZZ) from $\gamma\gamma$ coincidence intensities.
185.492+x	(0^+,1^+)	79.75 *25*	11	105.690+x	(2^-)				
		106.4 *3*	2.9	79.382+x	(1^-)				
		117.480 *25*	100	68.006+x	(2^-)	E1	0.1723 *24*		α(K)=0.1460 *20*; α(L)=0.02081 *29*; α(M)=0.00442 *6* α(N)=0.000981 *14*; α(O)=0.0001412 *20*; α(P)=7.33×10^{-6} *10*
		134.85 *12*	3.3	50.688+x	(2^-)				
		185.0 *3*	3.5	0+x	(1^-)				
194.192+x	(0^+,1^+)	13.5		180.689+x	(1^+)			≈33	$I_{(\gamma+ce)}$: Deduced (1993GrZZ) from $\gamma\gamma$ coincidence intensities.
		114.81 *3*	100	79.382+x	(1^-)	(E1)	0.1835 *26*		α(K)=0.1554 *22*; α(L)=0.02219 *31*; α(M)=0.00472 *7* α(N)=0.001047 *15*; α(O)=0.0001504 *21*; α(P)=7.78×10^{-6} *11*
		126.15 *8*	16	68.006+x	(2^-)				
		194.3 *3*	5	0+x	(1^-)				
203.0	(6^+)	109.0 *2*	100 *14*	94.0	(5^+)				
		203.0 *5*	93 *14*	0	(4^+)				
244.615+x	(0^+,1^+)	63.94 *5*	11.3	180.689+x	(1^+)	M1	5.62 *8*		α(K)=4.77 *7*; α(L)=0.675 *10*; α(M)=0.1442 *20* α(N)=0.0325 *5*; α(O)=0.00489 *7*; α(P)=0.000308 *4*
		70.78 *4*	8.3	173.81+x	(2^-)	E1	0.681 *10*		α(K)=0.571 *8*; α(L)=0.0870 *12*; α(M)=0.01853 *26* α(N)=0.00408 *6*; α(O)=0.000572 *8*; α(P)=2.67×10^{-5} *4*
		89.69 *8*	6.4	154.93+x					Mult.: E1 for 89.69γ is incompatible with M1 for 63.94γ and E1 for 70.78γ (with all multipolarities from 1993GrZZ in β^- decay), reason for which no multipolarity is adopted for 89.69γ.
		165.21 *5*	100	79.382+x	(1^-)				
		176.5[a] *3*	8.3[a]	68.006+x	(2^-)				
		193.7 *3*	8.3	50.688+x	(2^-)				
		244.70 *15*	6.9	0+x	(1^-)				
268.78+x		218.5 *4*	100	50.688+x	(2^-)				
329.0	(7^+)	126.0 *2*	46 *9*	203.0	(6^+)				
		235.0 *5*	100 *11*	94.0	(5^+)				
470.0	(8^+)	141.0 *2*	86 *17*	329.0	(7^+)				
		267.0 *5*	100 *11*	203.0	(6^+)				
505.49+x?		425.2[b] *5*	83	79.382+x	(1^-)				
		454.8[b] *5*	100	50.688+x	(2^-)				
597.39+x		416.7 *3*	100	180.689+x	(1^+)				
627.9	(9^+)	158.0 *2*	21 *6*	470.0	(8^+)				
		299.0 *5*	100 *9*	329.0	(7^+)				
633.85+x	(0,1)	453.4 *3*	23	180.689+x	(1^+)				
		482.1 *3*	17	151.702+x	(1^+)				
		554.6 *3*	100	79.382+x	(1^-)				

$^{154}_{61}Pm_{93}$-5

Adopted Levels, Gammas (continued)

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

E_i(level)	J^π_i	E_γ[†‡]	I_γ	E_f	J^π_f
633.85+x	(0,1)	566.2[#] 5	20	68.006+x	(2^-)
652.36+x		383.5 5	50	268.78+x	
		471.7 3	100	180.689+x	(1^+)
682.31+x	(0,1)	176.5[a] 3	8.6[a]	505.49+x?	
		414.0 4	15	268.78+x	
		501.8 3	31	180.689+x	(1^+)
		508.7 4	43	173.81+x	(2^-)
		527.3 4	31	154.93+x	
		602.8 3	100	79.382+x	(1^-)
		613.6[#] 4	12	68.006+x	(2^-)
699.99+x?		505.8[b] 3	100	194.192+x	$(0^+,1^+)$
801.8	(10^+)	174.0 2	42 16	627.9	(9^+)
		331.0 5	100 13	470.0	(8^+)
831.55+x	(1^+)	197.9 3	≤2.6	633.85+x	(0,1)
		587.0 4	4.3	244.615+x	$(0^+,1^+)$
		637.4 3	19	194.192+x	$(0^+,1^+)$
		645.9[#] 5	5.2	185.492+x	$(0^+,1^+)$
		650.3 3	18	180.689+x	(1^+)
		763.66 15	10	68.006+x	(2^-)
		780.79 15	100	50.688+x	(2^-)
		831.59 15	84	0+x	(1^-)
850.227+x	(1^+)	167.89 8	2.7	682.31+x	(0,1)
		216.40 10	3.1	633.85+x	(0,1)
		605.51 10	13	244.615+x	$(0^+,1^+)$
		669.7 4	1.6	180.689+x	(1^+)
		676.6 4	0.6	173.81+x	(2^-)
		695.2[#] 5	0.6	154.93+x	
		698.73 20	5.6	151.702+x	(1^+)
		744.45 25	11	105.690+x	(2^-)
		770.90 20	3.7	79.382+x	(1^-)
		782.7 3	1.3	68.006+x	(2^-)
		799.55 4	100	50.688+x	(2^-)
		850.20 5	49	0+x	(1^-)
906.96+x	(0,1)	662.2 4	3.0	244.615+x	$(0^+,1^+)$
		721.46 5	100	185.492+x	$(0^+,1^+)$
		726.27 10	54	180.689+x	(1^+)
		755.34 12	49	151.702+x	(1^+)
		827.51 15	6.4	79.382+x	(1^-)
906.96+x	(0,1)	839.0 3	35	68.006+x	(2^-)
990.8	(11^+)	189.0 2	27 10	801.8	(10^+)
		363.0 5	100 14	627.9	(9^+)
1049.64+x	(1^+)	804.96 25	25	244.615+x	$(0^+,1^+)$
		855.4 3	7.0	194.192+x	$(0^+,1^+)$
		864.16 15	100	185.492+x	$(0^+,1^+)$
		868.95 20	31	180.689+x	(1^+)
		944.08 20	34	105.690+x	(2^-)
		970.0[#] 3	12	79.382+x	(1^-)
		981.4 3	21	68.006+x	(2^-)
		999.06 20	32	50.688+x	(2^-)
		1049.7[#] 4	7.7	0+x	(1^-)
1060.54+x	(0,1)	815.9 3	5.7	244.615+x	$(0^+,1^+)$
		866.4 3	25	194.192+x	$(0^+,1^+)$
		875.02 15	43	185.492+x	$(0^+,1^+)$
		908.78 12	100	151.702+x	(1^+)
		981.4 3	10	79.382+x	(1^-)
		992.6 3	14	68.006+x	(2^-)
		1060.6 3	6.4	0+x	(1^-)
1198.8	(12^+)	397.0 5	100	801.8	(10^+)
1204.50+x	(0,1)	960.0 3	50	244.615+x	$(0^+,1^+)$
		1010.2 3	5.4	194.192+x	$(0^+,1^+)$
		1018.85 25	100	185.492+x	$(0^+,1^+)$
		1024.1 3	27	180.689+x	(1^+)
		1052.79 20	68	151.702+x	(1^+)
		1136.5 4	25	68.006+x	(2^-)
		1153.7[#] 3	22	50.688+x	(2^-)
1389.21+x	(0,1)	1194.7 3	4.1	194.192+x	$(0^+,1^+)$
		1283.51 15	100	105.690+x	(2^-)
		1310.4[#] 4	13	79.382+x	(1^-)
		1321.17 20	96	68.006+x	(2^-)
		1389.22[#] 20	31	0+x	(1^-)
1415.8	(13^+)	425.0 5	100	990.8	(11^+)
1662.8	(14^+)	464.0 5	100	1198.8	(12^+)
1662.70+x	(0,1)	1417.6[#] 3	320	244.615+x	$(0^+,1^+)$
		1482.3 3	100	180.689+x	(1^+)
		1583.8[a#] 5	100[a]	79.382+x	(1^-)
1689.99+x	(0,1)	1509.6 4	100	180.689+x	(1^+)

$^{154}_{61}Pm_{93}$-6

γ(^{154}Pm) (continued)

E_i(level)	J^π_i	E_γ[†‡]	I_γ	E_f	J^π_f
1689.99+x	(0,1)	1583.8[a#] *5*	24[a]	105.690+x	(2$^-$)
1898.8	(15$^+$)	483.0 *5*	100	1415.8	(13$^+$)

[†] Unplaced γ's are not included here, see ^{154}Nd β^- decay and ^{9}Be(^{238}U,Fγ) datasets.

[‡] From ^{154}Nd β^- decay (1993GrZZ) and ^{9}Be(^{238}U,Fγ) datasets. No γ is common to both datasets.

[#] Existence and placement of γ is questionable.

[@] Based on data of 1993GrZZ in ^{154}Nd β^- decay dataset, from α_K(exp), from IKx/Iγ ratio or from α(exp) based on intensity balances from $\gamma\gamma$ coincidence spectra.

[&] Additional information 5.

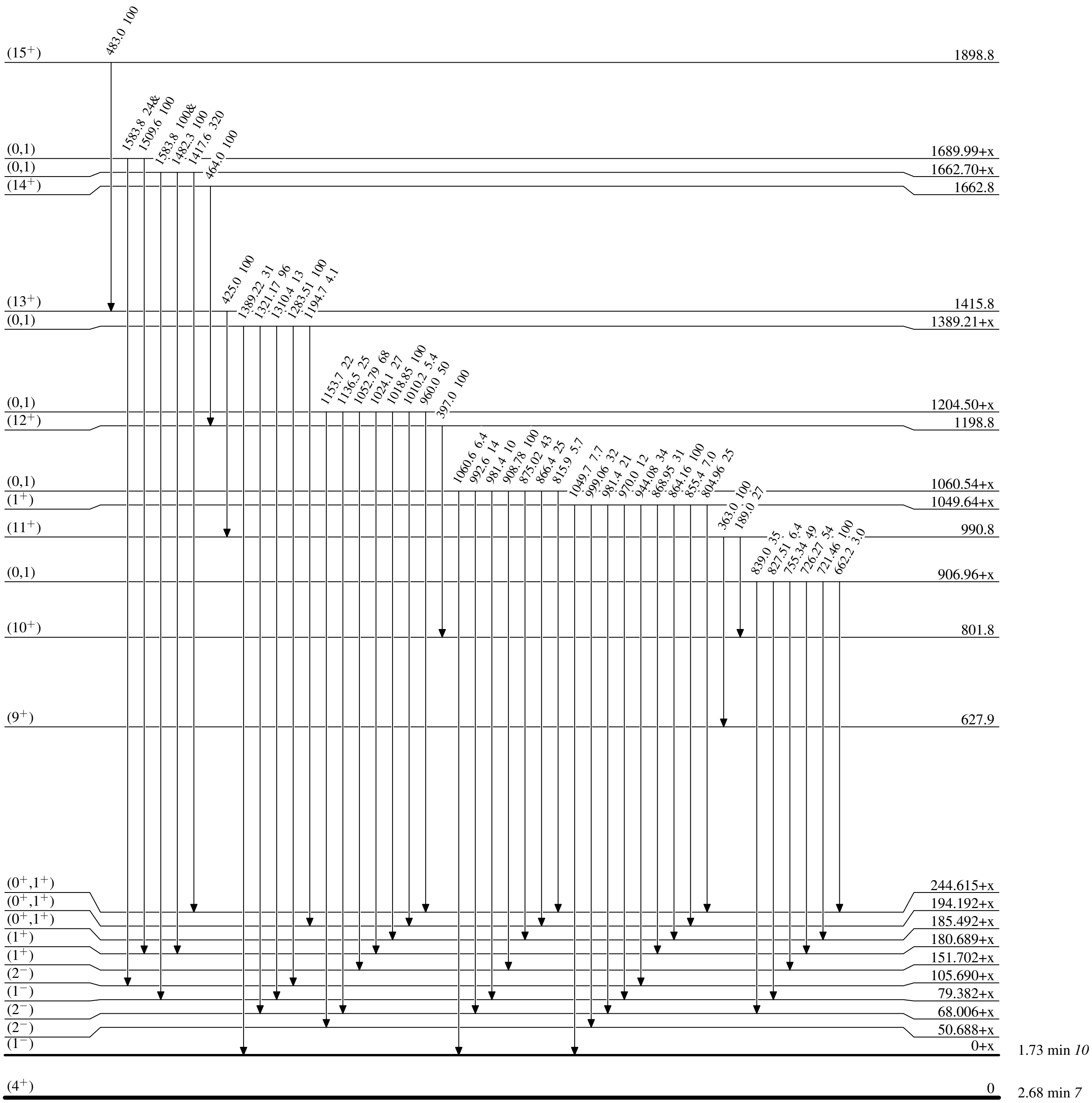
[a] Multiply placed with undivided intensity.

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

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

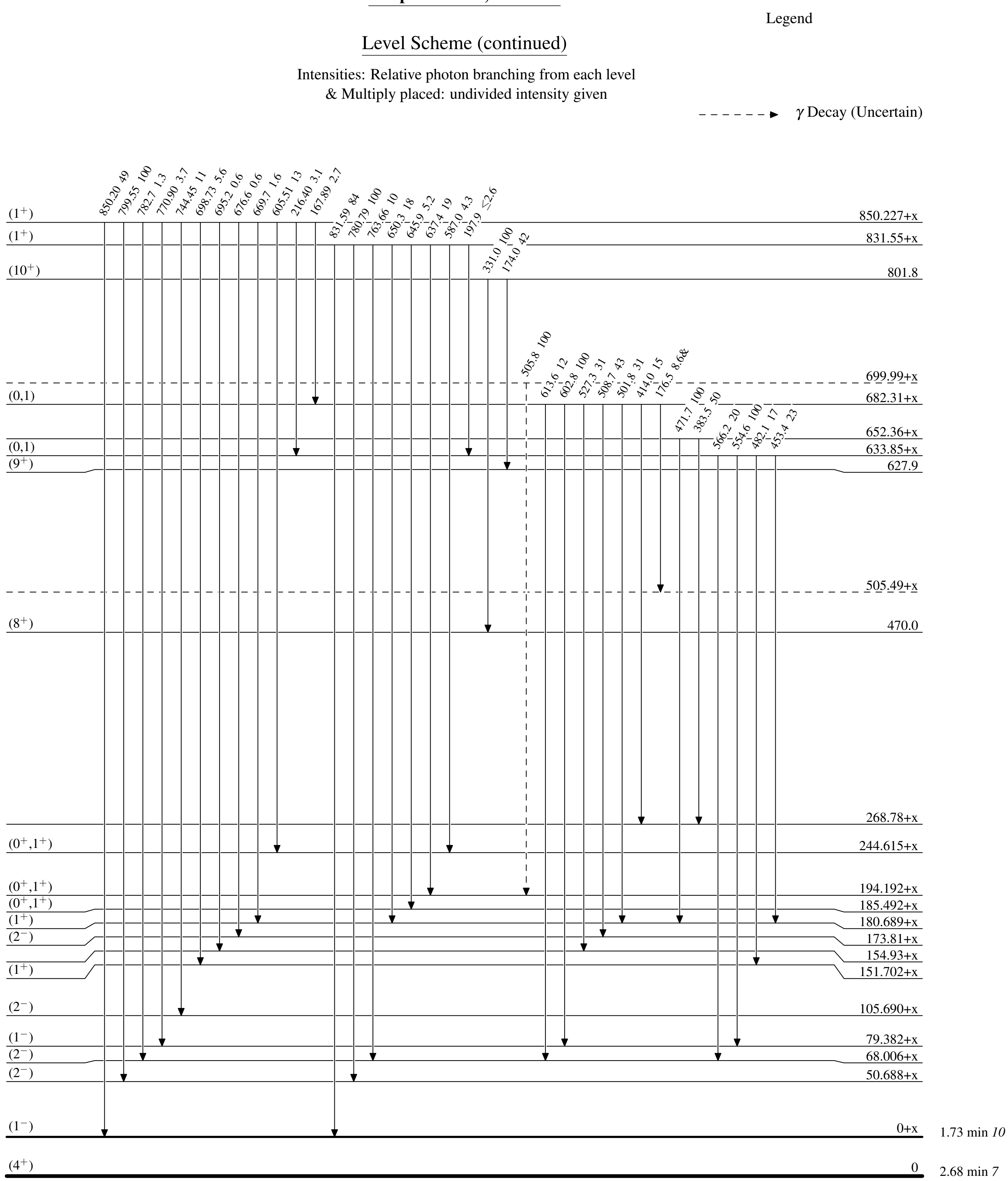


$^{154}_{61}Pm_{93}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



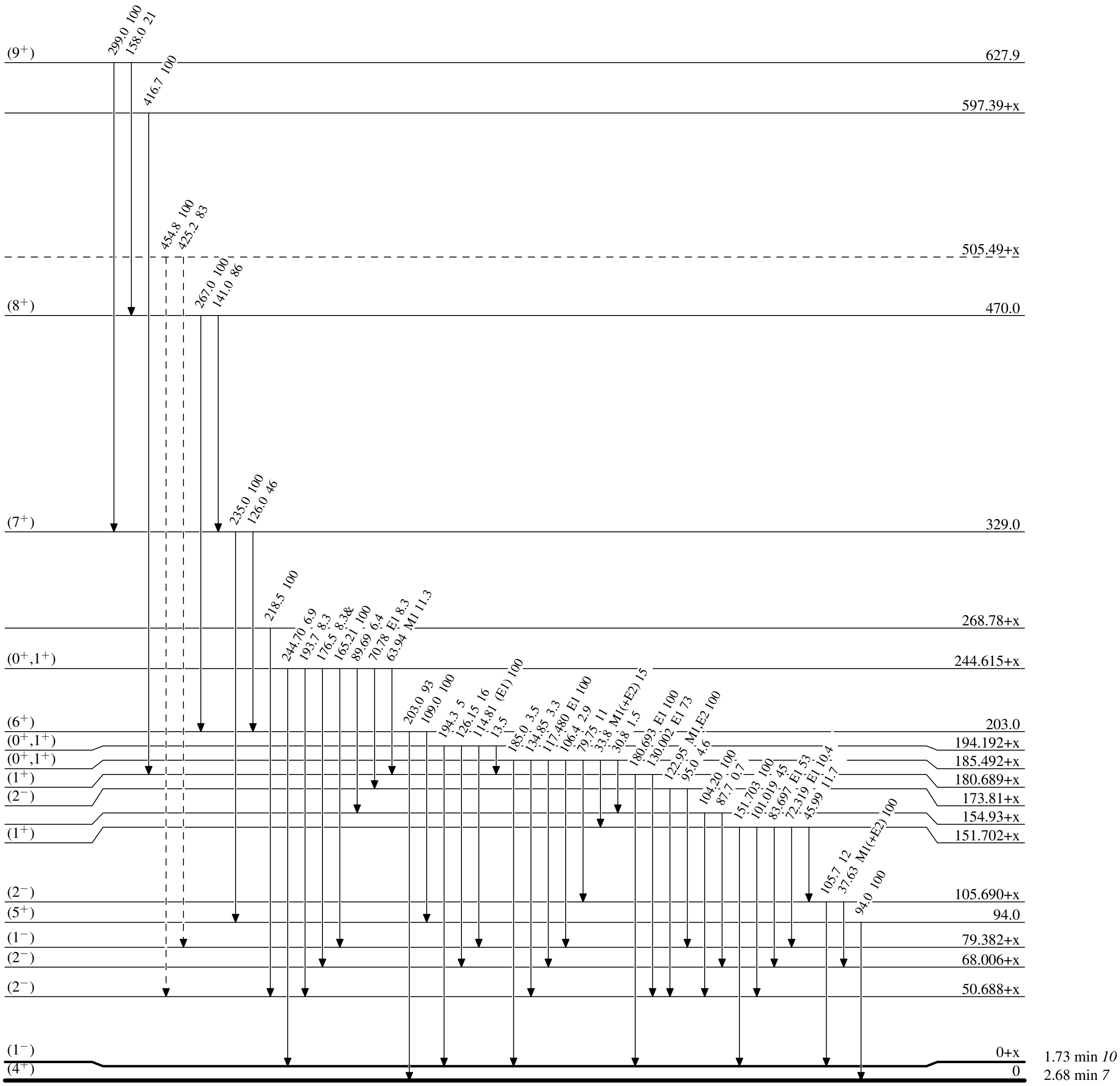
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given

- - - - - - ► γ Decay (Uncertain)

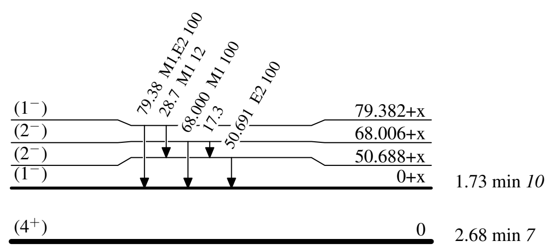


$^{154}_{61}Pm_{93}$

Adopted Levels, Gammas

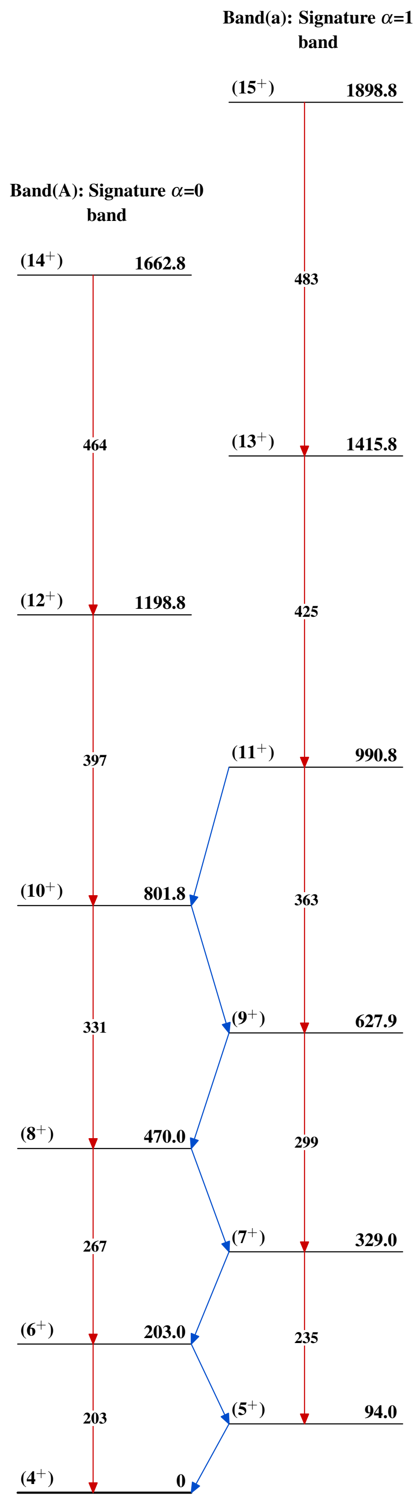
Level Scheme (continued)

Intensities: Relative photon branching from each level
& Multiply placed: undivided intensity given



$^{154}_{61}Pm_{93}$

Adopted Levels, Gammas



$^{154}_{61}Pm_{93}$