Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	N. Nica	NDS 117, 1 (2014)	1-Oct-2013

Q(β^-)=7690 *22*; S(n)=4102 *22*; S(p)=9734 *28*; Q(α)=−1860 *30* 2012Wa38
Q(β^-n)=1234 *21* (2012Wa38).

^{148}La Levels

The bands observed in ^{148}La are interpreted as aligned coupling of $[\pi h_{11/2}\nu h_{9/2}]_{low\ spin}$ to the deformed core rotor. (^{252}Cf SF decay dataset, 2009Lu11).

Cross Reference (XREF) Flags

- A ^{148}Ba β^- decay
- B ^{149}Ba β^-n decay (0.344 s)
- C ^{252}Cf SF decay

E(level)†	Jπ‡	$T_{1/2}$	XREF	Comments
0.0	(2$^-$)	1.26 s *8*	A C	%β^-=100; %β^-n=0.15 *3* Recommended delayed neutron emission probability (1993Ru01). Others: 0.24% 2 (1993Ru01), 0.13% 1 (1983Re10), 0.143% 15 (1986ReZR), 0.11% 1 (1986Wa17), 0.13% 2 (1984Ma39),<0.1% (1982Ga24). $T_{1/2}$: weighted average of 1.55 s *3* (1982Ga24), 1.42 s *7* (1983Re10), 1.40 s *2* (1986Wa17), 1.428 s *12* (1993Ru01), 1.38 s *2* (1986ReZR) and 1.05 s *1* (1983Gi04). Others: 1.7 s *5* (1973SeYW), 1.29 s *8* (1969WiZX). Jπ: 56.1γ from (1$^+$) is E1, strong β^- to (3$^-$) level in ^{148}Ce.
47.21 *3*	(1$^-$,2$^-$)		A	Jπ: 47.2γ to (2$^-$) is M1, No γ from (1$^+$).
56.034 *25*	(1$^+$)	67 ns *4*	A C	$T_{1/2}$: from 1984Ch02 (β^- decay). Other: 58 ns *3* (1974ClZX, SF decay). J=1$^+$ from log *ft*=4.8 via 0$^+$ parent (1984Ch02); parentheses on adopted Jπ indicate uncertainty in β^- branching estimates.
61.44 *3*	(−)		A	Jπ: 61.48γ to (2$^-$) is M1,E2.
109.89 *3*	(1$^+$)		A	J=1$^+$ from log *ft*=5.0 via 0$^+$ parent (1984Ch02); parentheses on adopted Jπ indicate uncertainty in β^- branching estimates.
133.668 *24*	(−)		A	Jπ: γ to (2)$^-$ is E2,M1.
140.92# *22*	(2$^+$)		C	Jπ: M1 γ to (1$^+$), 56 (0$^+$,1$^+$ excluded by authors presumably based on the rotational character of this nucleus).
154.49 *4*			A	
159.42 *6*			A	
168.71 *4*			A	
201.26 *5*			A	
217.86 *4*			A	
230.46 *5*			A	
261.08 *5*			A	
282.2@ *4*	(3$^+$)		C	
287.08 *5*			A	
338.80 *10*			A	
350.6# *4*	(4$^+$)		C	
363.85 *7*			A	
369.23 *4*			A	
401.15 *7*			A	
441.7@ *4*	(5$^+$)		C	
471.89 *5*			A	
500.22 *5*			A	

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{148}La Levels (continued)

E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF	E(level)†	Jπ‡	XREF
538.08 *11*		A	830.67 *11*		A	1495.9# *6*	(10+)	C
554.13 *11*		A	1060.1# *5*	(8+)	C	1612.4@ *7*	(11+)	C
663.0# *4*	(6+)	C	1101.8@ *6*	(9+)	C	1980.0# *7*	(12+)	C
708.2@ *5*	(7+)	C	1229.04 *10*		A	2226.0@ *7*	(13+)	C
717.22 *9*		A	1252.47 *7*		A			

† From a least-squares fit to Eγ data, with normalized χ^2=6.65>critical χ^2=1.57. This fact is due to Eγ′s from ^{148}Ba β^- decay dataset, reported with higher than realistic precision.
‡ For levels assigned In either band, assumed by 2009Lu11 (SF decay) based on the rotational character of this nucleus.
# Band(A): Band based on (2+), α=0. Upbend at ħω≈0.2 MeV.
@ Band(a): Band based on (3+), α=1.

γ(^{148}La)

E_i(level)	J_i^π	E_γ‡	I_γ‡#	E_f	J_f^π	Mult.@	α†	Comments
47.21	(1−,2−)	47.22 *4*	100	0.0	(2−)	(M1)	9.47	α(K)=8.07 *12*; α(L)=1.109 *16*; α(M)=0.231 *4*; α(N+..)=0.0595 *9* α(N)=0.0507 *8*; α(O)=0.00822 *12*; α(P)=0.000633 *9*
56.034	(1+)	56.08 *4*	100	0.0	(2−)	E1	1.140	α(K)=0.959 *14*; α(L)=0.1436 *21*; α(M)=0.0297 *5*; α(N+..)=0.00740 *11* α(N)=0.00637 *9*; α(O)=0.000971 *14*; α(P)=5.41×10−5 *8* B(E1)(W.u.)=9.6×10−6 *6*
61.44	(−)	61.48 *4*	100	0.0	(2−)	M1,E2	8 *4*	α(K)=4.1 *4*; α(L)=3 *3*; α(M)=0.7 *6*; α(N+..)=0.17 *14* α(N)=0.15 *13*; α(O)=0.021 *17*; α(P)=0.00026 *4*
109.89	(1+)	48.44 *4*	58 *1*	61.44	(−)	E1	1.682	α(K)=1.408 *20*; α(L)=0.218 *3*; α(M)=0.0451 *7*; α(N+..)=0.01118 *16* α(N)=0.00965 *14*; α(O)=0.001458 *21*; α(P)=7.79×10−5 *11*
		53.81 *4*	100 *2*	56.034	(1+)	M1,E2	13 *7*	α(K)=5.66 *16*; α(L)=6 *5*; α(M)=1.3 *12*; α(N+..)=0.3 *3* α(N)=0.27 *24*; α(O)=0.04 *4*; α(P)=0.00037 *6*
		109.87 *5*	23 *2*	0.0	(2−)			
133.668	(−)	72.20 *5*	50 *5*	61.44	(−)			
		86.44 *4*	52 *2*	47.21	(1−,2−)	M1,E2	2.5 *9*	α(K)=1.63 *24*; α(L)=0.7 *5*; α(M)=0.15 *11*; α(N+..)=0.04 *3* α(N)=0.032 *24*; α(O)=0.005 *4*; α(P)=0.000104 *6*
		133.53& *4*	100 *2*	0.0	(2−)	E2,M1	0.60 *12*	α(K)=0.45 *5*; α(L)=0.11 *6*; α(M)=0.025 *13*; α(N+..)=0.006 *4* α(N)=0.005 *3*; α(O)=0.0008 *4*; α(P)=3.01×10−5 *17*
140.92	(2+)	84.7 *3*	100	56.034	(1+)	M1	1.74 *3*	α(K)=1.49 *3*; α(L)=0.202 *4*; α(M)=0.0420 *8*; α(N+..)=0.01083 *19* α(N)=0.00922 *16*; α(O)=0.00150 *3*; α(P)=0.0001158 *21* Mult.: from α(exp)=1.51 *49* (2009Lu11).
		141.1 *3*	20.2	0.0	(2−)	[E1]	0.0907	α(K)=0.0776 *12*; α(L)=0.01040 *16*; α(M)=0.00215 *4*; α(N+..)=0.000545 *9*

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

$\gamma(^{148}La)$ (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡#]	E_f	J_f^π	Mult.[@]	α[†]	Comments
								α(N)=0.000467 *8*; α(O)=7.38×10^{-5} *12*; α(P)=4.96×10^{-6} *8*
154.49		44.43 *6*	7 *1*	109.89	(1$^+$)			
		98.5 *2*	100 *21*	56.034	(1$^+$)			
		107.32 *5*	15 *2*	47.21	(1$^-$,2$^-$)			
159.42		49.65 *8*	19 *4*	109.89	(1$^+$)			
		98.1 *2*	100 *23*	61.44	($^-$)			
168.71		112.73 *5*	33 *2*	56.034	(1$^+$)			
		168.68 *5*	100 *7*	0.0	(2$^-$)			
201.26		46.30 *6*	3 *2*	154.49				
		145.48 *5*	100 *3*	56.034	(1$^+$)			
217.86		58.52 *6*	18 *2*	159.42				
		84.02[&] *5*	100 *8*	133.668	($^-$)			
		156.42 *6*	82 *5*	61.44	($^-$)			
		218.30[&] *10*	20 *5*	0.0	(2$^-$)			
230.46		96.58[&] *6*	66 *7*	133.668	($^-$)			
		120.95 *20*	100 *20*	109.89	(1$^+$)			
		174.55 *5*	97 *10*	56.034	(1$^+$)			
261.08		92.40 *5*	100 *4*	168.71				
		127.38 *6*	62 *8*	133.668	($^-$)			
282.2	(3$^+$)	141.3 *3*	100	140.92	(2$^+$)	M1(+E2)	0.50 *9*	α(K)=0.38 *4*; α(L)=0.09 *5*; α(M)=0.020 *10*; α(N+..)=0.0049 *24* α(N)=0.0042 *21*; α(O)=0.0006 *3*; α(P)=2.56×10^{-5} *16* Mult.: from α(exp)=0.54 *18* (2009Lu11).
287.08		153.39 *8*	50 *8*	133.668	($^-$)			
		177.06 *6*	100 *8*	109.89	(1$^+$)			
338.80		205.13 *9*	100	133.668	($^-$)			
350.6	(4$^+$)	68.4 *3*	18.9	282.2	(3$^+$)	[M1(+E2)]	5.6 *24*	α(K)=3.1 *4*; α(L)=1.9 *16*; α(M)=0.4 *4*; α(N+..)=0.10 *9* α(N)=0.09 *8*; α(O)=0.013 *10*; α(P)=0.000197 *19*
		209.7 *3*	100	140.92	(2$^+$)	[E2]	0.1517	α(K)=0.1173 *18*; α(L)=0.0271 *4*; α(M)=0.00584 *9*; α(N+..)=0.001449 *22* α(N)=0.001254 *19*; α(O)=0.000188 *3*; α(P)=7.37×10^{-6} *11*
363.85		230.37 *17*	21 *18*	133.668	($^-$)			
		307.79 *6*	100 *6*	56.034	(1$^+$)			
369.23		214.96 *5*	100 *4*	154.49				
		235.62 *6*	45 *2*	133.668	($^-$)			
		259.37 *5*	69 *4*	109.89	(1$^+$)			
		312.76 *6*	40 *6*	56.034	(1$^+$)			
401.15		246.66 *6*	100 *10*	154.49				
		345.1 *2*	20 *5*	56.034	(1$^+$)			
441.7	(5$^+$)	91.1 *3*	53.6	350.6	(4$^+$)	[M1(+E2)]	2.1 *7*	α(K)=1.40 *20*; α(L)=0.5 *4*; α(M)=0.12 *9*; α(N+..)=0.029 *21* α(N)=0.025 *18*; α(O)=0.0037 *25*; α(P)=8.9×10^{-5} *5*
		159.5 *3*	100	282.2	(3$^+$)	[E2]	0.386	α(K)=0.283 *5*; α(L)=0.0814 *13*; α(M)=0.0177 *3*; α(N+..)=0.00436 *7* α(N)=0.00378 *6*; α(O)=0.000555 *9*; α(P)=1.68×10^{-5} *3*
471.89		270.25[&] *12*	41 *4*	201.26				
		317.63 *20*	18 *3*	154.49				
		410.65 *7*	42 *2*	61.44	($^-$)			

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

γ(^{148}La) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡#]	E_f	J_f^π	Mult.[@]	α[†]	Comments
471.89		415.78 *6*	100 *2*	56.034	(1$^+$)			
500.22		212.95 *7*	29 *3*	287.08				
		390.3 *2*	18 *10*	109.89	(1$^+$)			
		444.28 *5*	100 *3*	56.034	(1$^+$)			
538.08		369.3 *2*	23 *9*	168.71				
		404.46 *14*	100 *9*	133.668	(−)			
		476.6 *2*	95 *36*	61.44	(−)			
554.13		185.0 *2*	46 *27*	369.23				
		323.63 *12*	100 *8*	230.46				
663.0	(6$^+$)	221.3 *3*	13.9	441.7	(5$^+$)	[M1(+E2)]	0.123 *5*	α(K)=0.1002 *21*; α(L)=0.018 *5*; α(M)=0.0038 *10*; α(N+..)=0.00095 *23* α(N)=0.00082 *20*; α(O)=0.00013 *3*; α(P)=7.1×10^{-6} *9*
		312.4 *3*	100	350.6	(4$^+$)	[E2]	0.0413	α(K)=0.0335 *5*; α(L)=0.00615 *9*; α(M)=0.001309 *19*; α(N+..)=0.000329 *5* α(N)=0.000283 *4*; α(O)=4.35×10^{-5} *7*; α(P)=2.25×10^{-6} *4*
708.2	(7$^+$)	266.5 *3*	100	441.7	(5$^+$)	[E2]	0.0686	α(K)=0.0548 *8*; α(L)=0.01091 *16*; α(M)=0.00233 *4*; α(N+..)=0.000583 *9* α(N)=0.000503 *8*; α(O)=7.65×10^{-5} *12*; α(P)=3.59×10^{-6} *6*
717.22		583.6 *2*	10 *3*	133.668	(−)			
		607.33 *11*	100 *8*	109.89	(1$^+$)			
		661.1 *2*	14 *5*	56.034	(1$^+$)			
830.67		569.6 *2*	68 *32*	261.08				
		600.2 *2*	100 *36*	230.46				
		720.8 *2*	95 *36*	109.89	(1$^+$)			
		774.6 *2*	27 *14*	56.034	(1$^+$)			
1060.1	(8$^+$)	351.9[a] *3*	<4	708.2	(7$^+$)	[M1(+E2)]	0.032 *4*	α(K)=0.027 *4*; α(L)=0.00400 *10*; α(M)=0.00084 *3*; α(N+..)=0.000214 *5* α(N)=0.000183 *5*; α(O)=2.91×10^{-5} *5*; α(P)=2.0×10^{-6} *4*
		397.1 *3*	100	663.0	(6$^+$)	[E2]	0.0199	α(K)=0.01643 *24*; α(L)=0.00273 *4*; α(M)=0.000576 *9*; α(N+..)=0.0001456 *21* α(N)=0.0001250 *18*; α(O)=1.95×10^{-5} *3*; α(P)=1.139×10^{-6} *17*
1101.8	(9$^+$)	393.6 *3*	100	708.2	(7$^+$)	[E2]	0.0204	α(K)=0.01685 *24*; α(L)=0.00281 *4*; α(M)=0.000593 *9*; α(N+..)=0.0001499 *22* α(N)=0.0001287 *19*; α(O)=2.00×10^{-5} *3*; α(P)=1.167×10^{-6} *17*
1229.04		757.15 *13*	74 *32*	471.89				
		1011.2 *2*	100 *42*	217.86				
		1173.0 *2*	63 *42*	56.034	(1$^+$)			
1252.47		535.2 *2*	18 *10*	717.22				
		1118.82 *7*	100 *5*	133.668	(−)			
		1196.3 *2*	41 *13*	56.034	(1$^+$)			
1495.9	(10$^+$)	435.8 *3*	100	1060.1	(8$^+$)	[E2]	0.01516	α(K)=0.01261 *18*; α(L)=0.00202 *3*; α(M)=0.000426 *6*; α(N+..)=0.0001081 *16* α(N)=9.27×10^{-5} *14*; α(O)=1.452×10^{-5} *21*; α(P)=8.83×10^{-7} *13*
1612.4	(11$^+$)	510.6 *3*	100	1101.8	(9$^+$)	[E2]	0.00974 *14*	α=0.00974 *14*; α(K)=0.00816 *12*;

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

γ(^{148}La) (continued)

E_i(level)	J_i^π	E_γ[‡]	I_γ[‡#]	E_f	J_f^π	Mult.[@]	α[†]	Comments
								α(L)=0.001246 *18*; α(M)=0.000262 *4*; α(N+..)=6.66×10^{-5} *10* α(N)=5.70×10^{-5} *8*; α(O)=9.00×10^{-6} *13*; α(P)=5.80×10^{-7} *9*
1980.0	(12$^+$)	484.1 *3*	100	1495.9	(10$^+$)	[E2]	0.01127	α(K)=0.00943 *14*; α(L)=0.001462 *21*; α(M)=0.000307 *5*; α(N+..)=7.81×10^{-5} *11* α(N)=6.69×10^{-5} *10*; α(O)=1.054×10^{-5} *15*; α(P)=6.67×10^{-7} *10*
2226.0	(13$^+$)	613.6 *3*	100	1612.4	(11$^+$)	[E2]	0.00600 *9*	α=0.00600 *9*; α(K)=0.00507 *8*; α(L)=0.000737 *11*; α(M)=0.0001540 *22*; α(N+..)=3.93×10^{-5} *6* α(N)=3.36×10^{-5} *5*; α(O)=5.35×10^{-6} *8*; α(P)=3.65×10^{-7} *6*

† Additional information 1.
‡ From ^{148}Ba β^- decay or ^{252}Cf SF decay (for the only common 56γ, Eγ is from ^{148}Ba β^- decay).
# Relative photon branching from each level.
@ Based on α(K)exp measurements from γ′s from ^{148}Ba β^- decay; based on α(exp) measurements for γ′s from ^{252}Cf SF decay.
& Differs by 3σ or more from the value calculated from the energy difference of initial and final levels.
a Placement of transition in the level scheme is uncertain.

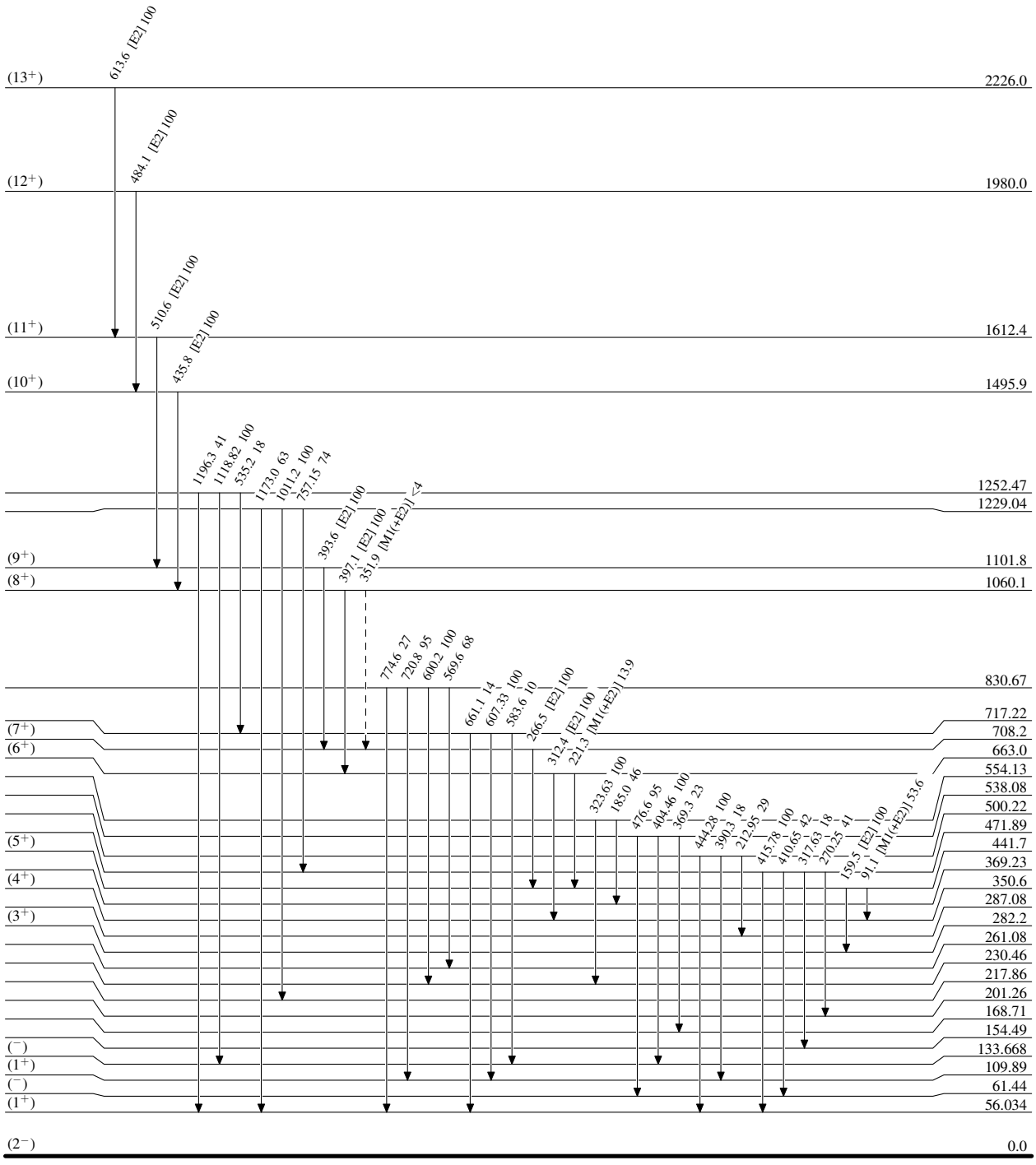
Adopted Levels, Gammas

Legend

Level Scheme

Intensities: Relative photon branching from each level

- - - - - - ► γ Decay (Uncertain)

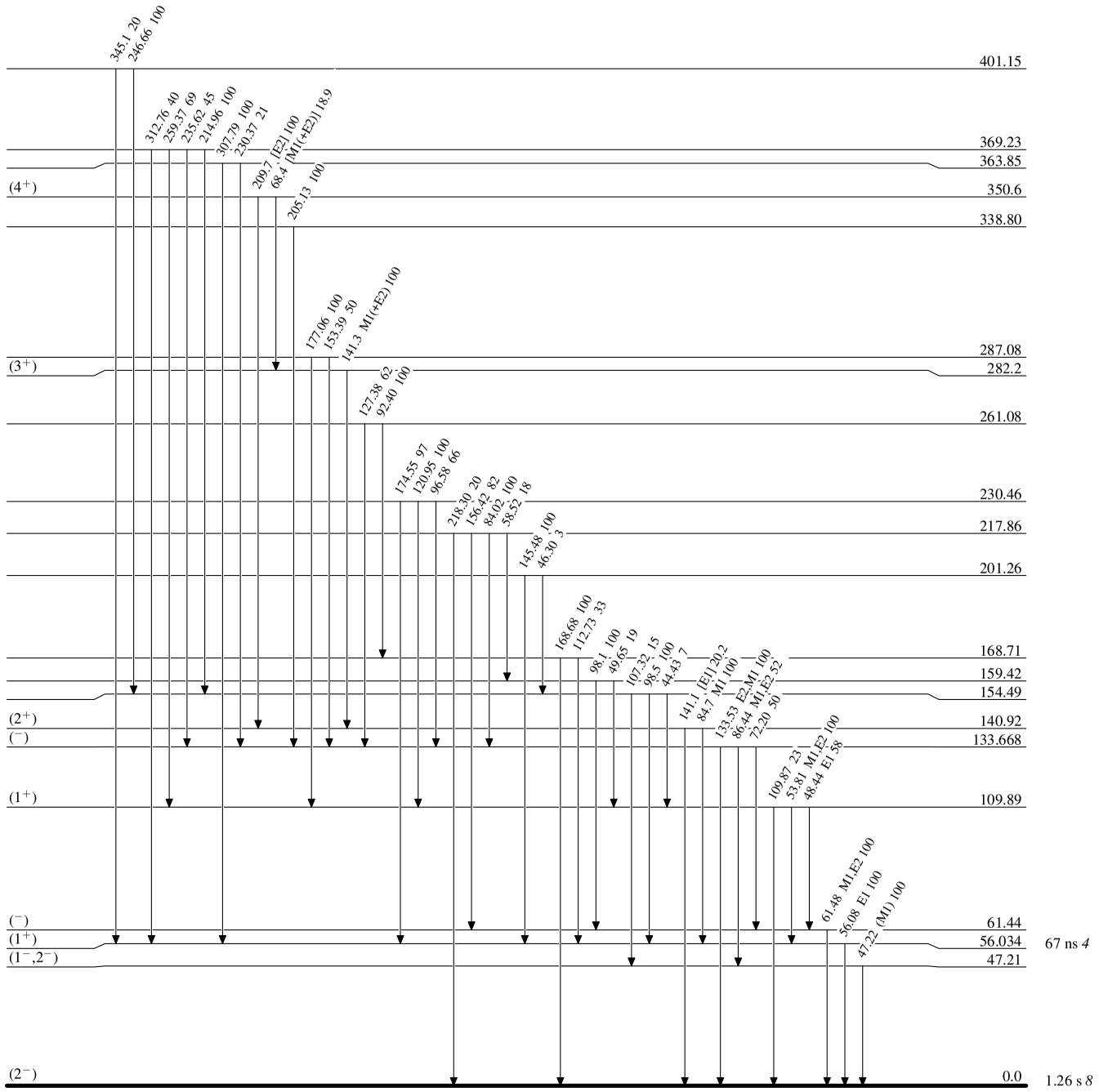


$^{148}_{57}La_{91}$

Adopted Levels, Gammas

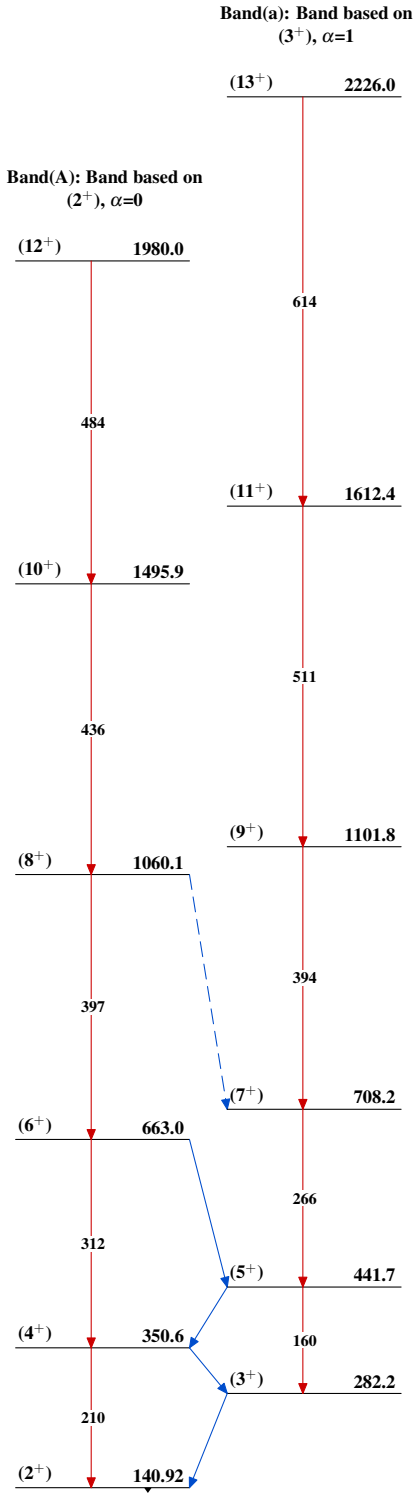
Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{148}_{57}La_{91}$

Adopted Levels, Gammas



$^{148}_{57}La_{91}$