^{124}La ε decay 1992Id01,1997As05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. Katakura, Z. D. Wu	NDS 109, 1655 (2008)	1-Apr-2008

Parent: ^{124}La: E=0.0+x; J^π=(8$^-$); $T_{1/2}$=29.21 s *17*; Q(ε)=8.83×10^3 *6*; %ε+%$β^+$ decay=100.0

Parent: ^{124}La: E=0.0+y; $T_{1/2}$=21 s *4*; Q(ε)=8.83×10^3 *6*; %ε+%$β^+$ decay=100.0

^{124}La(0.0+y)-Low-spin isomer.

The decay scheme is that proposed by 1992Id01. The decay scheme is from combined decay of high-spin ($T_{1/2}$=29 s *1*) and low-spin ($T_{1/2}$<1 s) states in ^{124}La. β branchings and log *ft* values from high-spin state given in 1992Id01 are only approximate values and the sum represents 88% of total decay. These values are not given here.

1992Id01: ^{92}Mo(^{35}Cl,2pn), ^{92}Mo(^{40}Ca,5p3n); E(^{35}Cl)=5.4-6.5 MeV/nucleon, on-line ms, semi γ, ce, γγ-coin.

1997As05: ^{92}Mo(^{36}Ar,3pn); E=195 MeV, enriched ^{92}Mo, HPGe detectors, measured Eγ, γγ-coin,γγ directional correlation.

1992Mo13: Mo(^{35}Cl,2pxn); measured: βγ(t).

^{124}Ba Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0	0$^+$	11.0 min *5*	
229.68 *19*	2$^+$	0.297 ns *26*	$T_{1/2}$: from βγ(t) (1992Mo13).
651.17 *25*	4$^+$		
872.6 *3*	2$^+$		
898.0? *10*	0$^+$		
1071.1 *11*	0$^+$		A_2(841γ) (230γ)(θ)=0.33 *7* A_4(841γ) (230γ)(θ)=0.85 *12* (1997As05).
1162.2 *5*	(3$^+$)		
1227.7 *3*	6$^+$		
1323.8 *3*	4$^+$		
1353.3 *10*	(2$^+$)		
1356.7 *11*	0$^+$		A_2(1127γ) (230γ)(θ)=0.32 *15*, A_4(1127γ) (230γ)(θ)=1.23 *28* (1997As05).
1672.1 *4*	(5$^+$)		
1739.1? *6*	(4$^+$)		
1857.2 *4*	(6)$^+$		
1912.5 *4*	5$^-$		
1922.4 *4*	8$^+$		
2033.6 *4*	(4$^-$)		
2261.2 *4*	(7)$^-$		
2266.4 *4*	5$^-$		
2359.0 *4*	(6)$^-$		
2459.3? *5*	$^-$		
2477.2 *11*	(8$^+$)		
2646.8 *6*	(7$^-$)		
2704.2 *5*	(8)$^-$		
2720.5 *6*	(9$^-$)		
3095.1 *5*	(7$^-$)		

† From a least-squares fit to Eγ's.

‡ From Adopted Levels, unless otherwise indicated.

γ(^{124}Ba)

E_γ†	I_γ†#	E_i(level)	J_i^π	E_f	J_f^π	Mult.&	α@	Comments
192.9[a] *2*	5.7 *6*	2459.3?	$^-$	2266.4	5$^-$	M1	0.1577	α(K)=0.1352 *20*; α(L)=0.0179 *3*; α(M)=0.00369 *6*; α(N+..)=0.000928 *14* α(N)=0.000797 *12*; α(O)=0.0001220 *18*; α(P)=8.88×10^{-6} *13*

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^{124}La ε decay 1992Id01,1997As05 (continued)

γ(^{124}Ba) (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[@]	Comments
								The placement is different from those in (HI,xnγ) and ^{64}Ni(^{64}Ni,4nγ).
								α(K)exp=0.115 *15*.
229.7 *2*	100	229.68	2$^+$	0.0	0$^+$	E2	0.1080	B(E2)(W.u.)=73 *7* α(K)=0.0854 *13*; α(L)=0.0179 *3*; α(M)=0.00380 *6*; α(N+..)=0.000919 *14* α(N)=0.000801 *12*; α(O)=0.0001129 *17*; α(P)=4.64×10^{-6} *7* α(K)exp=0.086 *5*. Mult.: from adopted gammas.
261[a]	≈1.5	2720.5	(9$^-$)	2459.3?	$^-$			E$_\gamma$: γ-ray observed only in coin. Not observed in (HI,xnγ) and ^{64}Ni(^{64}Ni,4nγ).
325.4 *4*	≈2	2359.0	(6)$^-$	2033.6	(4$^-$)			E$_\gamma$: γ-ray observed only in coin.
345.2 *4*	1.4 *3*	2704.2	(8)$^-$	2359.0	(6)$^-$	E2	0.0291	α(K)=0.0240 *4*; α(L)=0.00409 *6*; α(M)=0.000860 *13*; α(N+..)=0.000210 *3* α(N)=0.000183 *3*; α(O)=2.65×10^{-5} *4*; α(P)=1.385×10^{-6} *20* α(K)exp=0.032 *13*. Mult.: From α(K)exp and relevant levels.
348.5 *4*	0.8 *3*	2261.2	(7)$^-$	1912.5	5$^-$	E2	0.0283	α(K)=0.0233 *4*; α(L)=0.00396 *6*; α(M)=0.000832 *13*; α(N+..)=0.000204 *3* α(N)=0.000177 *3*; α(O)=2.57×10^{-5} *4*; α(P)=1.348×10^{-6} *20* α(K)exp=0.029 *9*. Mult.: From adopted gammas.
385.6 *4*	1.2 *3*	2646.8	(7$^-$)	2261.2	(7)$^-$	D		α(K)exp=0.0055 *12*. Mult.: From adopted gammas. 1992Id01 assigned E1, but the assignment contradicts the spin assignment of ^{64}Ni(^{64}Ni,4nγ).
421.5 *2*	91 *3*	651.17	4$^+$	229.68	2$^+$	E2	0.01600	α(K)=0.01333 *19*; α(L)=0.00212 *3*; α(M)=0.000442 *7*; α(N+..)=0.0001089 *16* α(N)=9.42×10^{-5} *14*; α(O)=1.384×10^{-5} *20*; α(P)=7.89×10^{-7} *11* α(K)exp=0.013 *1*. Mult.: from adopted gammas.
443.0 *4*	1.9 *3*	2704.2	(8)$^-$	2261.2	(7)$^-$	M1	0.0178	α(K)=0.01533 *22*; α(L)=0.00198 *3*; α(M)=0.000407 *6*; α(N+..)=0.0001024 *15* α(N)=8.79×10^{-5} *13*; α(O)=1.349×10^{-5} *20*; α(P)=9.95×10^{-7} *15* α(K)exp=0.020 *4*.
446.7 *3*	3.1 *3*	2359.0	(6)$^-$	1912.5	5$^-$	M1	0.01745	α(K)=0.01501 *22*; α(L)=0.00194 *3*; α(M)=0.000399 *6*; α(N+..)=0.0001002 *15* α(N)=8.60×10^{-5} *13*; α(O)=1.321×10^{-5} *19*; α(P)=9.74×10^{-7} *14* α(K)exp=0.017 *3*.
451.2 *2*	3.6 *4*	1323.8	4$^+$	872.6	2$^+$	E2	0.01314	α(K)=0.01099 *16*; α(L)=0.001707 *24*; α(M)=0.000356 *5*; α(N+..)=8.78×10^{-5} *13* α(N)=7.60×10^{-5} *11*; α(O)=1.120×10^{-5} *16*; α(P)=6.55×10^{-7} *10* α(K)exp=0.016 *4*. Ice(K) deduced after subtraction of Ice(L) of the 421.5-keV transition. Mult.: From adopted gammas.
455[a]	≈2.5	2720.5	(9$^-$)	2266.4	5$^-$			E$_\gamma$: γ-ray observed only in coin.
533.3 *3*	4.5 *5*	1857.2	(6)$^+$	1323.8	4$^+$	E2	0.00827	α(K)=0.00697 *10*; α(L)=0.001031 *15*;

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^{124}La ε decay 1992Id01,1997As05 (continued)

γ(^{124}Ba) (continued)

E_γ [†]	I_γ [†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [&]	α [@]	Comments
								α(M)=0.000214 *3*; α(N+..)=5.31×10^{-5} *8* α(N)=4.58×10^{-5} *7*; α(O)=6.82×10^{-6} *10*; α(P)=4.21×10^{-7} *6* α(K)exp=0.0090 *8*.
576.6 *2*	60 *2*	1227.7	6$^+$	651.17	4$^+$	E2	0.00672	Mult.: From adopted gammas. α(K)=0.00568 *8*; α(L)=0.000824 *12*; α(M)=0.0001710 *24*; α(N+..)=4.24×10^{-5} *6* α(N)=3.66×10^{-5} *6*; α(O)=5.46×10^{-6} *8*; α(P)=3.45×10^{-7} *5*
620	≈2	2477.2	(8$^+$)	1857.2	(6)$^+$			Mult.: from adopted gammas. E_γ: γ-ray observed only in coin.
629.5 *4*	3.1 *5*	1857.2	(6)$^+$	1227.7	6$^+$	M1	0.00747	α(K)=0.00644 *9*; α(L)=0.000822 *12*; α(M)=0.0001688 *24*; α(N+..)=4.25×10^{-5} *6* α(N)=3.64×10^{-5} *6*; α(O)=5.60×10^{-6} *8*; α(P)=4.16×10^{-7} *6* α(K)exp=0.0080 *15*.
643.1 *4*	3.8 *3*	872.6	2$^+$	229.68	2$^+$	M1,E2	0.0061 *11*	α(K)=0.0052 *9*; α(L)=0.00069 *9*; α(M)=0.000143 *17*; α(N+..)=3.6×10^{-5} *5* α(N)=3.1×10^{-5} *4*; α(O)=4.7×10^{-6} *7*; α(P)=3.3×10^{-7} *7* α(K)exp=0.0068 *10*.
668[a] *5*	≈1.5	898.0?	0$^+$	229.68	2$^+$			I_γ(668)/I_γ(643)<0.006 deduced by 1997As05 showed this gamma-ray should not exist.
672.6 *2*	7.6 *8*	1323.8	4$^+$	651.17	4$^+$	M1,E2	0.0055 *10*	α(K)=0.0047 *9*; α(L)=0.00062 *8*; α(M)=0.000128 *16*; α(N+..)=3.2×10^{-5} *5* α(N)=2.7×10^{-5} *4*; α(O)=4.2×10^{-6} *6*; α(P)=2.9×10^{-7} *6* α(K)exp=0.0063 *5*.
685.0 *4*	1.7 *4*	1912.5	5$^-$	1227.7	6$^+$	(E1)	1.62×10^{-3}	α(K)=0.001403 *20*; α(L)=0.0001745 *25*; α(M)=3.57×10^{-5} *5*; α(N+..)=8.94×10^{-6} *13* α(N)=7.68×10^{-6} *11*; α(O)=1.173×10^{-6} *17*; α(P)=8.49×10^{-8} *12* α(K)exp≤0.0030.
694.7 *3*	18.0 *7*	1922.4	8$^+$	1227.7	6$^+$	E2	0.00419	α(K)=0.00356 *5*; α(L)=0.000496 *7*; α(M)=0.0001026 *15*; α(N+..)=2.55×10^{-5} *4* α(N)=2.20×10^{-5} *3*; α(O)=3.31×10^{-6} *5*; α(P)=2.19×10^{-7} *3* α(K)exp=0.0042 *5*.
798.0 *5*	3.6 *6*	2720.5	(9$^-$)	1922.4	8$^+$	(E1)	1.18×10^{-3}	Mult.: From adopted gammas. α(K)=0.001024 *15*; α(L)=0.0001266 *18*; α(M)=2.59×10^{-5} *4*; α(N+..)=6.49×10^{-6} *10* α(N)=5.58×10^{-6} *8*; α(O)=8.53×10^{-7} *12*; α(P)=6.22×10^{-8} *9* α(K)exp≤0.002.
834.0 *4*	5.1 *5*	3095.1	(7$^-$)	2261.2	(7)$^-$	M1	0.00381	α(K)=0.00329 *5*; α(L)=0.000416 *6*; α(M)=8.54×10^{-5} *12*; α(N+..)=2.15×10^{-5} *3* α(N)=1.84×10^{-5} *3*; α(O)=2.83×10^{-6} *4*; α(P)=2.11×10^{-7} *3* α(K)exp=0.0045 *5*.
841.4[‡]		1071.1	0$^+$	229.68	2$^+$			
872.5 *5*	3.0 *6*	872.6	2$^+$	0.0	0$^+$	E2	0.00245	α(K)=0.00210 *3*; α(L)=0.000280 *4*;

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^{124}La ε decay 1992Id01,1997As05 (continued)

γ(^{124}Ba) (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[@]	$I_{(\gamma+ce)}$	Comments
									α(M)=5.77×10^{-5} *9*; α(N+..)=1.442×10^{-5} *21* α(N)=1.241×10^{-5} *18*; α(O)=1.88×10^{-6} *3*; α(P)=1.296×10^{-7} *19* α(K)exp=0.0023 *4*.
898[a]		898.0?	0$^+$	0.0	0$^+$	E0		0.0094 *13*	$I_{(\gamma+ce)}$: calculated by Ice(E0)=Ice(K)(E0)×1.13 to include the contribution from L1 and higher shells.
932.5 *4*	5.5 *5*	1162.2	(3$^+$)	229.68	2$^+$				E_γ: γ-ray observed only in coin.
942.4 *4*	1.8 *4*	2266.4	5$^-$	1323.8	4$^+$	E1	8.53×10^{-4}		α(K)=0.000739 *11*; α(L)=9.08×10^{-5} *13*; α(M)=1.85×10^{-5} *3*; α(N+..)=4.65×10^{-6} *7* α(N)=4.00×10^{-6} *6*; α(O)=6.12×10^{-7} *9*; α(P)=4.50×10^{-8} *7* α(K)exp=0.0008 *4*.
1020.9 *3*	4.9 *6*	1672.1	(5$^+$)	651.17	4$^+$	M1,E2	0.0021 *4*		α(K)=0.0018 *3*; α(L)=0.00023 *4*; α(M)=4.6×10^{-5} *7*; α(N+..)=1.17×10^{-5} *17* α(N)=1.00×10^{-5} *15*; α(O)=1.53×10^{-6} *23*; α(P)=1.12×10^{-7} *20* α(K)exp=0.0015 *3*.
1033.5 *3*	18.2 *5*	2261.2	(7)$^-$	1227.7	6$^+$	E1	7.16×10^{-4}		α(K)=0.000620 *9*; α(L)=7.60×10^{-5} *11*; α(M)=1.553×10^{-5} *22*; α(N+..)=3.90×10^{-6} *6* α(N)=3.35×10^{-6} *5*; α(O)=5.13×10^{-7} *8*; α(P)=3.78×10^{-8} *6* α(K)exp=0.00046 *9*.
1039.0 *5*	3.5 *10*	2266.4	5$^-$	1227.7	6$^+$	E1	7.09×10^{-4}		α(K)=0.000614 *9*; α(L)=7.53×10^{-5} *11*; α(M)=1.537×10^{-5} *22*; α(N+..)=3.86×10^{-6} *6* α(N)=3.31×10^{-6} *5*; α(O)=5.08×10^{-7} *8*; α(P)=3.74×10^{-8} *6* α(K)exp=0.00054 *27*.
1088.0[a] *5*	1.8 *4*	1739.1?	(4$^+$)	651.17	4$^+$	M1,E2	0.0018 *3*		α(K)=0.00154 *24*; α(L)=0.00020 *3*; α(M)=4.0×10^{-5} *6*; α(N+..)=1.01×10^{-5} *15* α(N)=8.7×10^{-6} *12*; α(O)=1.33×10^{-6} *20*; α(P)=9.7×10^{-8} *17* α(K)exp=0.0019 *4*. Other placement with 3351 keV level to 2263 keV level (1995As05).

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^{124}La ε decay 1992Id01,1997As05 (continued)

γ(^{124}Ba) (continued)

E_γ[†]	I_γ[†#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[&]	α[@]	Comments
1094.0 *5*	1.5 *5*	1323.8	4^+	229.68	2^+	Q	1.49×10^{-3}	α(K)=0.001285 *18*; α(L)=0.0001666 *24*; α(M)=3.42×10^{-5} *5*; α(N+..)=8.57×10^{-6} *12* α(N)=7.37×10^{-6} *11*; α(O)=1.123×10^{-6} *16*; α(P)=7.98×10^{-8} *12* α(K)exp=0.0026 *6*. Mult.: From adopted gammas. 1992Id01 assigned M1, but M1 assignment contradicts the mult.=Q assignment in ^{64}Ni(^{64}Ni,4nγ).
1127[‡]		1356.7	0^+	229.68	2^+			
1131.0 *3*	7.7 *4*	2359.0	$(6)^-$	1227.7	6^+	E1	6.13×10^{-4}	α(K)=0.000525 *8*; α(L)=6.42×10^{-5} *9*; α(M)=1.311×10^{-5} *19*; α(N+..)=1.032×10^{-5} *16* α(N)=2.83×10^{-6} *4*; α(O)=4.33×10^{-7} *6*; α(P)=3.20×10^{-8} *5*; α(IPF)=7.02×10^{-6} *12* α(K)exp=0.0005 *2*.
1173 *1*	>3.5	3095.1	(7^-)	1922.4	8^+	(E1)	5.86×10^{-4}	α(K)=0.000492 *7*; α(L)=6.00×10^{-5} *9*; α(M)=1.226×10^{-5} *18*; α(N+..)=2.18×10^{-5} *5* α(N)=2.64×10^{-6} *4*; α(O)=4.05×10^{-7} *6*; α(P)=3.00×10^{-8} *5*; α(IPF)=1.87×10^{-5} *5* α(K)exp≤0.0008.
1261.4 *3*	9.4 *5*	1912.5	5^-	651.17	4^+	E1	5.59×10^{-4}	α(K)=0.000432 *6*; α(L)=5.26×10^{-5} *8*; α(M)=1.074×10^{-5} *15*; α(N+..)=6.32×10^{-5} *9* α(N)=2.32×10^{-6} *4*; α(O)=3.56×10^{-7} *5*; α(P)=2.64×10^{-8} *4*; α(IPF)=6.05×10^{-5} *9* α(K)exp=0.0005 *1*.
1353.3[‡]		1353.3	(2^+)	0.0	0^+			
1382.5 *4*	2.5 *5*	2033.6	(4^-)	651.17	4^+			
1493[a] *1*	3 *1*	2720.5	(9^-)	1227.7	6^+			Not observed in (HI,xnγ) and ^{64}Ni(^{64}Ni,4nγ).
1615 *1*	2.9 *6*	2266.4	5^-	651.17	4^+			
1867 *1*	5 *1*	3095.1	(7^-)	1227.7	6^+			

[†] From 1992Id01.
[‡] From 1997As05.
[#] Relative to I(230γ)=100.
[@] α(K)exp are from Ice(K)/Iγ normalized to α(K)(E2)=0.00569 for 577γ (6^+ to 4^+).
[&] From α(K)exp in 1992Id01, unless otherwise noted.
[a] Placement of transition in the level scheme is uncertain.

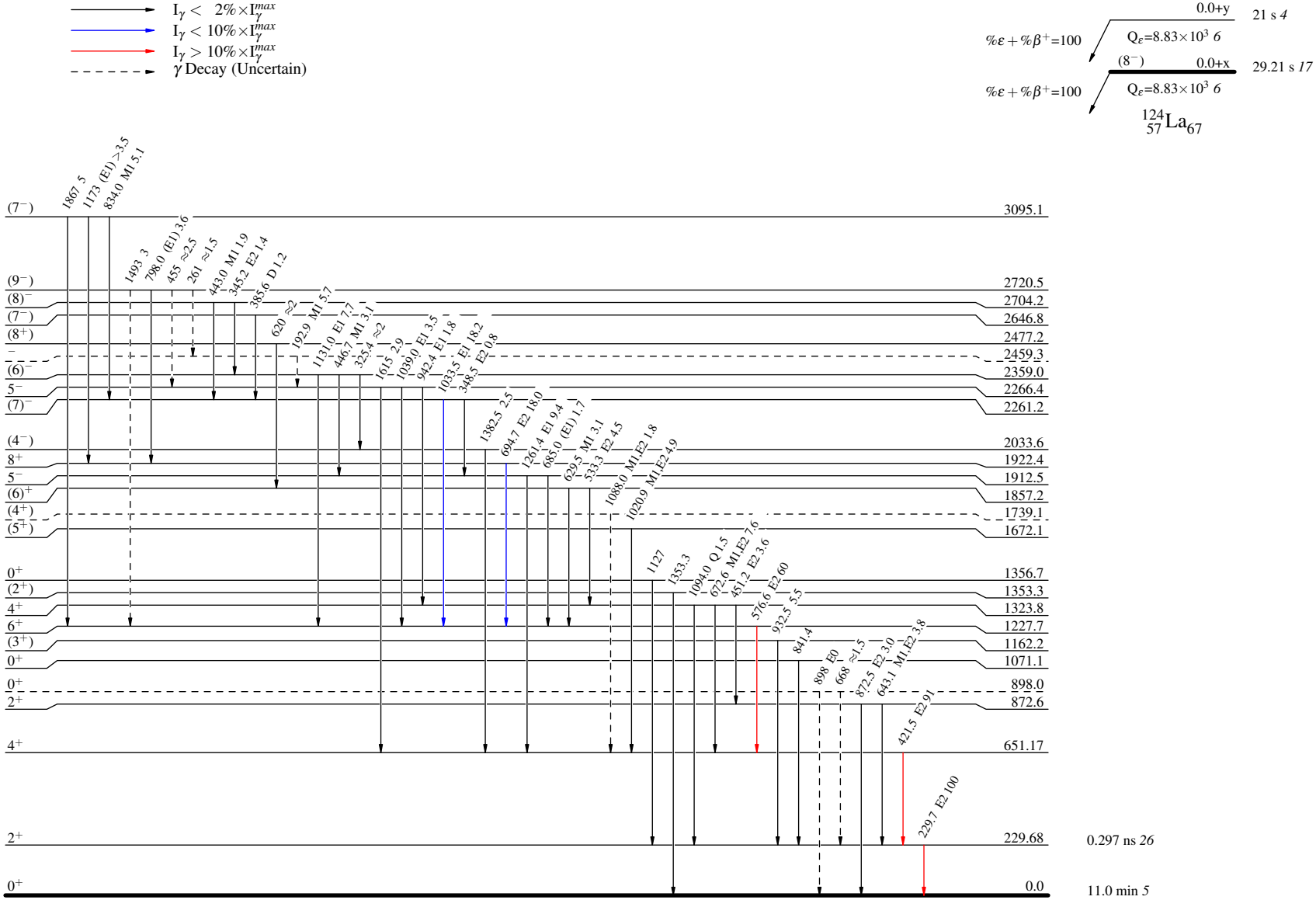
^{124}La ε decay 1992Id01,1997As05

Decay 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)



$^{124}_{56}Ba_{68}$

$^{124}_{56}Ba_{68}$-6