^{135}La ε decay (19.5 h) 1971Ba18,1983Dz04

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Alexander A. Rodionov And Yuri L. Khazov	NDS 109, 517 (2008)	22-Jan-2008

Parent: ^{135}La: E=0.0; J^π=5/2$^+$; $T_{1/2}$=19.5 h *2*; Q(ε)=1200 *10*; %ε+%β^+ decay=100.0

The decay scheme is mainly as given by 1971Ba18.

2006Fe06: Measured Eγ, Iγ, γγ using YRAST ball with nine Compton- suppressed 'Clover' Ge detectors. Comparisons with interacting boson- fermion and shell-model calculations.

Others: 1971Be72 (also 1971Be77), 1965Mo05, 1965Gr06, 1958Mi88, 1953Wa30, 1948Ch03, 1943We02.

Total decay energy of 1198 keV *11* calculated (by RADLIST code) from level scheme agrees with the expected value of 1200 keV *10*.

^{135}Ba Levels

E(level)	J^π†	$T_{1/2}$	Comments
0.0	3/2$^+$		
220.955 *14*	1/2$^+$		
268.218 *20*	11/2$^-$	28.7 h *2*	
480.525 *14*	5/2$^+$	≤10 ps	$T_{1/2}$: from γγ(t) (1971Be72).
587.817 *15*	3/2$^+$		
855.000 *14*	3/2$^+$		
874.524 *18*	7/2$^+$		
909.63? *11*	1/2$^+$		
979.963 *18*	3/2$^+$,5/2$^+$		
1007.99? *10*			

† From 'Adopted Levels'.

ε,β^+ radiations

ε/β^+=1.42×10^4 *5* from I(K x ray) (1983Dz04) and I($\gamma^\pm$) (1971Ba18).

E(decay)	E(level)	Iβ^+ †	Iε†	Log *ft*	Comments
(192 *10*)	1007.99?		0.00038 *11*	9.35 *14*	εK= 0.800 *4*; εL= 0.155 *3*; εM+= 0.0451 *10*
(220 *10*)	979.963		0.0065 *11*	8.25 *9*	εK= 0.809 *3*; εL= 0.1482 *21*; εM+= 0.0430 *7*
(290 *10*)	909.63?		<0.00023	>10.0	εK= 0.8218 *14*; εL= 0.1385 *11*; εM+= 0.0397 *4*
(325 *10*)	874.524		0.17 *3*	7.22 *9*	εK= 0.8258 *11*; εL= 0.1355 *8*; εM+= 0.0387 *3*
(345 *10*)	855.000		0.058 *10*	7.75 *8*	εK= 0.8277 *10*; εL= 0.1341 *7*; εM+= 0.03825 *23*
(612 *10*)	587.817		0.146 *23*	7.88 *7*	εK= 0.8402; εL= 0.12463 *20*; εM+= 0.03513 *7*
(719 *10*)	480.525		1.52 *24*	7.01 *7*	εK= 0.8425; εL= 0.12293 *14*; εM+= 0.03457 *5*
(1200 *10*)	0.0	0.007	98.1 *3*	5.66 *1*	av Eβ=90 *5*; εK= 0.8474; εL= 0.1192; εM+= 0.03334 I(ε+β^+): from I(K x ray) and I($\gamma^\pm$) intensities and intensity balance in level scheme. Iβ^+: ε/β^+=1.42×10^4. β^+ feeding to g.s. is observed by 1971Ba18 through $\gamma^\pm$.

† Absolute intensity per 100 decays.

γ(^{135}Ba)

Iγ normalization: based on I(ε+β^+)=98.1% 3 to g.s..
α(exp)=Ice/Iγ normalized to α(K)(220.94)=0.0951 (M1+E2, δ=0.38 *8*). Ice: average of values of 1965Mo05 and 1983Dz04, normalized to ce(K)(220.9γ)=100. Thus Ice′s should be multiplied by 0.0951 to convert these to γ-ray intensity scale.
I(Kα_2 x ray)=1412 *7*, I(Kα_1 x ray)=2754 *8*, I(Kβ_1 x ray)=734.3 *22*, I(Kβ_2 x ray)=205.8 *22* (1983Dz04); I(K x ray)=5010 *150* (1971Ba18); I($\gamma^{\pm}$)=0.93 *3* (1971Ba18) on the same scale as γ-ray intensities.

E_γ[‡]	I_γ[†b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[c]	Comments
107.32 *9*	0.068 *3*	587.817	3/2+	480.525	5/2+	E2(+M1)	>1.5	1.39 *11*	α(K)=0.93 *5*; α(L)=0.36 *5*; α(M)=0.079 *11*; α(N+..)=0.019 *3* α(N)=0.0164 *23*; α(O)=0.0022 *3*; α(P)=4.56×10^{-5} *7* Additional information 5.
124.89[@] *7*	0.010 *3*	979.963	3/2+,5/2+	855.000	3/2+	M1,E2		0.70 *18*	α(K)=0.53 *8*; α(L)=0.14 *8*; α(M)=0.029 *17*; α(N+..)=0.007 *4* α(N)=0.006 *4*; α(O)=0.0009 *5*; α(P)=2.95×10^{-5} *5* Additional information 12. α(K)exp=0.5 *2*.
220.94 *2*	3.56 *4*	220.955	1/2+	0.0	3/2+	M1+E2	0.38 *8*	0.1110 *17*	α(K)=0.0941 *14*; α(L)=0.0134 *5*; α(M)=0.00279 *10*; α(N+..)=0.000694 *23* α(N)=0.000598 *21*; α(O)=9.0×10^{-5} *3*; α(P)=6.03×10^{-6} *10* Additional information 2. δ: from K/L=7.0 *2*. α(L)exp=0.0136 *6*.
x236.68[@] *10*	0.004 *2*								I_γ: ≤0.001 (1971Ba18).
x242.12[@] *11*	0.004 *2*								
259.58 *4*	0.29 *2*	480.525	5/2+	220.955	1/2+	(E2)		0.0721	α(K)=0.0579 *9*; α(L)=0.01129 *16*; α(M)=0.00239 *4*; α(N+..)=0.000580 *9* α(N)=0.000505 *7*; α(O)=7.19×10^{-5} *10*; α(P)=3.21×10^{-6} *5* Additional information 3. Mult.: M1,E2 from α(K)exp=0.055 *14*. M1 ruled out from adopted J^π.
267.17 *9*	0.020 *3*	855.000	3/2+	587.817	3/2+				
268.218 *20*	[a]	268.218	11/2−	0.0	3/2+	M4		5.31	α(K)=3.79 *6*; α(L)=1.182 *17*; α(M)=0.267 *4*; α(N+..)=0.0658 *10* α(N)=0.0572 *8*; α(O)=0.00820 *12*; α(P)=0.000405 *6* E_γ,Mult.: from ^{135}Ba IT decay.
287[&d]		874.524	7/2+	587.817	3/2+				probably a very weak γ ray In the work of 2006Fe06.
322[&]		909.63?	1/2+	587.817	3/2+				
366.84 *2*	2.10 *2*	587.817	3/2+	220.955	1/2+	M1(+E2)	<0.5	0.0283 *6*	α(K)=0.0243 *6*; α(L)=0.00323 *5*; α(M)=0.000665 *10*; α(N+..)=0.0001669 *24* α(N)=0.0001434 *21*; α(O)=2.19×10^{-5} *3*; α(P)=1.57×10^{-6} *5* Additional information 6. α(K)exp=0.026 *2*, K/L+M+=5.4 *8*.
374.46 *2*	1.21 *4*	855.000	3/2+	480.525	5/2+	M1+E2	−0.43 *3*	0.0266	α(K)=0.0227 *4*; α(L)=0.00306 *5*; α(M)=0.000631 *9*;

γ(^{135}Ba) (continued)

E_γ [‡]	I_γ [†b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[#]	α[c]	Comments
									α(N+..)=0.0001581 *23* α(N)=0.0001359 *19*; α(O)=2.07×10^{-5} *3*; α(P)=1.461×10^{-6} *22* δ: from γγ(θ) (1971Be72). Additional information 8. α(K)exp=0.023 *2*, K/L+M+=5.0 *9*.
392.08[@] *9*	0.012 *3*	979.963	3/2$^+$,5/2$^+$	587.817	3/2$^+$				
394.04 *4*	0.28 *2*	874.524	7/2$^+$	480.525	5/2$^+$	[M1,E2]		0.0217 *23*	α(K)=0.0184 *23*; α(L)=0.00265 *5*; α(M)=0.000550 *8*; α(N+..)=0.0001368 *25* α(N)=0.0001179 *19*; α(O)=1.77×10^{-5} *6*; α(P)=1.15×10^{-6} *20*
420.12[@] *10*	0.017 *5*	1007.99?		587.817	3/2$^+$				
480.51 *2*	100	480.525	5/2$^+$	0.0	3/2$^+$	M1+E2	+1.6 *+5−4*	0.0120 *5*	α(K)=0.0102 *5*; α(L)=0.00146 *4*; α(M)=0.000304 *7*; α(N+..)=7.54×10^{-5} *18* α(N)=6.51×10^{-5} *15*; α(O)=9.7×10^{-6} *3*; α(P)=6.3×10^{-7} *4* Additional information 4. α(K)exp=0.0094 *5*, K/L+M+=5.5 *1*. δ: from K/L+M+ and γγ(θ) (1971Be72).
499.36[@] *6*	0.012 *4*	979.963	3/2$^+$,5/2$^+$	480.525	5/2$^+$				I_γ: ≤0.0009 (1971Ba18).
587.83 *2*	7.29 *5*	587.817	3/2$^+$	0.0	3/2$^+$	M1+E2	1.0 *4*	0.0076 *6*	α(K)=0.0065 *6*; α(L)=0.00088 *5*; α(M)=0.000181 *10*; α(N+..)=4.52×10^{-5} *25* α(N)=3.89×10^{-5} *21*; α(O)=5.9×10^{-6} *4*; α(P)=4.1×10^{-7} *4* Additional information 7. α(K)exp=0.0066 *4*, K/L+M+=5.4 *5*.
634.05 *2*	1.36 *4*	855.000	3/2$^+$	220.955	1/2$^+$	M1(+E2)	<1.3	0.0067 *7*	α(K)=0.0057 *6*; α(L)=0.00075 *6*; α(M)=0.000155 *11*; α(N+..)=3.9×10^{-5} *3* α(N)=3.34×10^{-5} *25*; α(O)=5.1×10^{-6} *5*; α(P)=3.7×10^{-7} *5* Additional information 9. α(K)exp=0.0059 *7*.
^{x}653.83[@] *8*	0.005 *2*								Additional information 1.
689[&]		909.63?	1/2$^+$	220.955	1/2$^+$				
758.94 *9*	0.046 *10*	979.963	3/2$^+$,5/2$^+$	220.955	1/2$^+$				
787.9 *5*	0.007 *2*	1007.99?		220.955	1/2$^+$				
855.00 *2*	1.24 *4*	855.000	3/2$^+$	0.0	3/2$^+$	M1(+E2)	<0.5	0.00349 *12*	α(K)=0.00301 *10*; α(L)=0.000382 *12*; α(M)=7.85×10^{-5} *23*; α(N+..)=1.97×10^{-5} *6* α(N)=1.69×10^{-5} *5*; α(O)=2.60×10^{-6} *8*; α(P)=1.93×10^{-7} *7* Additional information 10. α(K)exp=0.0042 *12*.

γ(^{135}Ba) (continued)

E_γ[‡]	I_γ[†b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[c]	Comments
874.51 *2*	10.8 *2*	874.524	7/2$^+$	0.0	3/2$^+$	E2	0.00244	α(K)=0.00209 *3*; α(L)=0.000279 *4*; α(M)=5.74×10^{-5} *8*; α(N+..)=1.434×10^{-5} *20* α(N)=1.234×10^{-5} *18*; α(O)=1.87×10^{-6} *3*; α(P)=1.289×10^{-7} *18* Additional information 11. α(K)exp=0.0018 *2*.
909.63[@] *11*	0.015 *4*	909.63?	1/2$^+$	0.0	3/2$^+$			I_γ: <0.001 (1971Ba18).
979.98 *2*	0.34 *2*	979.963	3/2$^+$,5/2$^+$	0.0	3/2$^+$			
1008.4 *5*	0.0011 *6*	1007.99?		0.0	3/2$^+$			
[x]1130.89[@] *11*	0.024 *6*							
[x]1173.89[@] *9*	0.050 *9*							

[†] Average of values of 1971Ba18 and 1983Dz04.
[‡] From 1971Ba18, except as noted; a calibration uncertainty of 15 eV is added in quadrature.
[#] From ce data.
[@] From 1983Dz04.
[&] From 2006Fe06.
[a] Isomeric transition. Iγ=0.00003 *2* was given by 1971Ba18. They assume the population of 268.2 level presumably arises from the decay of higher energy levels.
[b] For absolute intensity per 100 decays, multiply by 0.0152 *24*.
[c] Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.
[d] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{135}_{56}Ba_{79}$-4

^{135}La ε decay (19.5 h) 1971Ba18,1983Dz04