^{201}At ε decay 2010De04

History Type	Author	Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 187,355 (2023)	20-Sep-2022

Parent: ^{201}At: E=0; $J^{\pi}=9/2^-$; $T_{1/2}=87.6$ s *13*; Q(ε)=5732 *10*; %ε+%$β^+$ decay=29 *7*

^{201}At-Q(ε): From 2021Wa16.

2010De04: 1.4 GeV proton beam induced spallation on a 49 mg/cm^2 UC_2-C target at ISOLDE-CERN facility. Francium was surface ionized, accelerated to 30 keV and mass separated by the ISOLDE General Purpose Separator (GPS). Using tape systems, measured Eγ, Iγ, γγ, ce, γ(ce) coin; Detectors: two HPGe detectors located at 90° and 180° around Si(Li) detector placed in a MINI-ORANGE spectrometer. ^{201}At source is produced from α decay of ^{205}Fr.

Other: 1970DaZM.

^{201}Po Levels

E(level)†	J^{π}‡	$T_{1/2}$‡	Comments
0.0	$3/2^-$	15.50 min *22*	
5.61 *13*	$5/2^-$		
423.4 *3*	$13/2^+$	8.96 min *12*	%IT≈42.6; %α=2.4 *5*; %ε+%$β^+$≈55 %IT, %α and %ε+%$β^+$ are from Adopted Levels.
621.66 *17*	$(7/2)^-$		
623.3? *5*	$(5/2^-)$		E(level): No γ-rays reported in 2010De04 to depopulate this level, presumably due to small branchings to low-lying states. Evidence for the existence of this level is from γγ coin data.
722.44 *19*	$7/2^-$		
758.30? *20*	$(7/2)^-$		
766.3? *3*	$(9/2)^-$		
1006.7? *4*	$(11/2)^+$		
1015.2 *4*	$(11/2)^+$		
1059.5 *4*	$(7/2)^-$		
1124.8? *5*	(7/2,9/2,11/2)		
1242.9? *5*	(7/2,9/2,11/2)		
1552.2 *4*	$(9/2)^+$		
1574.3 *4*	$(9/2,11/2)^+$		
2044.0 *5*	$(9/2)^+$		
2202.9 *5*	$(9/2,11/2)^+$		

† From a least-squares fit to Eγ′s, unless otherwise stated.
‡ From Adopted Levels.

ε,$β^+$ radiations

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
(3529 *10*)	2202.9	0.17 *6*	1.0 *3*	6.62 *18*	1.2 *4*	av Eβ=1130.9 *45*; εK=0.6904 *12*; εL=0.12822 *23*; εM+=0.04250 *8*
(3688 *10*)	2044.0	0.47 *15*	2.4 *8*	6.29 *17*	2.9 *9*	av Eβ=1201.4 *45*; εK=0.6719 *12*; εL=0.12454 *24*; εM+=0.04126 *8*
(4158 *10*)	1574.3	0.09 *6*	0.27 *19*	7.3 *4*	0.36 *25*	av Eβ=1411.0 *45*; εK=0.6118 *14*; εL=0.1129 *3*; εM+=0.03736 *9*
(4180 *10*)	1552.2	0.9 *3*	2.8 *9*	6.34 *18*	3.7 *12*	av Eβ=1420.9 *45*; εK=0.6088 *14*; εL=0.1123 *3*; εM+=0.03717 *9*
(4489 *10*)	1242.9?	0.12 *3*	0.28 *8*	7.40 *16*	0.40 *11*	av Eβ=1559.8 *45*; εK=0.5666 *14*; εL=0.1042 *3*; εM+=0.03449 *9*
(4607 *10*)	1124.8?	0.11 *3*	0.23 *6*	7.51 *16*	0.34 *9*	av Eβ=1612.9 *46*; εK=0.5503 *14*; εL=0.1011 *3*; εM+=0.03346 *9*
(4717 *10*)	1015.2	1.3 *3*	2.6 *7*	6.48 *16*	3.9 *10*	av Eβ=1662.4 *46*; εK=0.5351 *14*; εL=0.0983 *3*;

Continued on next page (footnotes at end of table)

^{201}At ε decay 2010De04 (continued)

ε,β+ radiations (continued)

E(decay)	E(level)	Iβ+ ‡	Iε‡	Log *ft*	I(ε+β+)†‡	Comments
						εM+=0.03251 *9*
(4725 *10*)	1006.7?	1.6 *4*	3.3 *9*	6.38 *16*	4.9 *13*	av Eβ=1666.2 *46*; εK=0.5340 *14*; εL=0.0981 *3*; εM+=0.03244 *9*
(4966 *10*)	766.3?	2.0 *5*	3.2 *9*	6.43 *16*	5.2 *14*	av Eβ=1775.0 *46*; εK=0.5011 *14*; εL=0.0919 *3*; εM+=0.03038 *9*
(4974 *10*)	758.30?	0.76 *23*	1.2 *4*	6.85 *17*	2.0 *6*	av Eβ=1778.6 *46*; εK=0.5000 *14*; εL=0.0917 *3*; εM+=0.03032 *9*
(5010 *10*)	722.44	1.4 *3*	2.2 *6*	6.60 *16*	3.6 *9*	av Eβ=1794.8 *46*; εK=0.4951 *14*; εL=0.0908 *3*; εM+=0.03002 *9*
(5110 *10*)	621.66	1.0 *3*	1.6 *4*	6.77 *16*	2.6 *7*	av Eβ=1840.6 *46*; εK=0.4816 *14*; εL=0.0882 *3*; εM+=0.02917 *9*

† From the decay scheme and the intensity balances. There is a negative intensity balance at the 1059.5-keV level.
‡ Absolute intensity per 100 decays.

^{201}At ε decay 2010De04 (continued)

γ(^{201}Po)

Iγ normalization: ΣI(γ+ce)(to g.s.)=100% and by assuming that there is no direct feeding to the g.s. (J^π=3/2$^-$), 5.61-keV level (J^π=5/2$^-$), 423.4-keV level (J^π=13/2$^+$) and the 623.3-keV level (J^π=(5/2)$^-$).

E_γ †	I_γ †a	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	δ@	α&	$I_{(\gamma+ce)}$ a	Comments
(5.61 *13*)		5.61	5/2$^-$	0.0	3/2$^-$				264 *9*	$I_{(\gamma+ce)}$: From the decay scheme and the intensity balance.
358.5 *4*	4.0 *4*	1124.8?	(7/2,9/2,11/2)	766.3?	(9/2)$^-$					%Iγ=0.34 *9*
x392.2b										E_γ: Weak γ ray reported in 2010De04 to depopulate J^π=(11/2$^+$) level, but the placement is unlikely given the expected Mult=[E3].
417.8 *2*	27.6 *11*	423.4	13/2$^+$	5.61	5/2$^-$	M4		4.84 *7*	161 *6*	%Iγ=2.4 *6* α(K)=2.74 *4*; α(L)=1.542 *22*; α(M)=0.424 *6* α(N)=0.1116 *16*; α(O)=0.02250 *32*; α(P)=0.00253 *4* E_γ,Mult.: From adopted gammas. I_γ: From I(γ+ce) and α. $I_{(\gamma+ce)}$: From the decay scheme and the intensity balance.
436.2 *2*	11.5 *10*	1059.5	(7/2)$^-$	623.3?	(5/2$^-$)	M1+E2	0.93 *23*	0.119 *19*		%Iγ=0.98 *25* α(K)exp=0.094 *14* α(K)=0.094 *16*; α(L)=0.0193 *19*; α(M)=0.0046 *4* α(N)=0.00119 *11*; α(O)=0.000246 *24*; α(P)=3.0×10^{-5} *4*
476.6 *4*	4.7 *5*	1242.9?	(7/2,9/2,11/2)	766.3?	(9/2)$^-$					%Iγ=0.40 *11*
491.8 *2*	33 *5*	2044.0	(9/2)$^+$	1552.2	(9/2)$^+$	E2		0.0334 *5*		%Iγ=2.8 *8* α(K)exp=0.023 *7* α(K)=0.02292 *32*; α(L)=0.00788 *11*; α(M)=0.001982 *28* α(N)=0.000509 *7*; α(O)=0.0001015 *14*; α(P)=1.111×10^{-5} *16*
492.7 *2*	39 *6*	1552.2	(9/2)$^+$	1059.5	(7/2)$^-$	E1		0.01058 *15*		%Iγ=3.3 *10* α(K)exp=0.010 *4* α(K)=0.00871 *12*; α(L)=0.001433 *20*; α(M)=0.000335 *5* α(N)=8.57×10^{-5} *12*; α(O)=1.768×10^{-5} *25*; α(P)=2.196×10^{-6} *31*
537.0 *2*	37 *3*	1552.2	(9/2)$^+$	1015.2	(11/2)$^+$	M1+E2	3.58 *17*	0.0328 *7*		%Iγ=3.2 *8* α(K)exp=0.024 *3* α(K)=0.0240 *6*; α(L)=0.00665 *11*;

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γ(^{201}Po) (continued)

E_γ [†]	I_γ [†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[@]	α[&]	$I_{(\gamma+ce)}$ [a]	Comments
										α(M)=0.001647 *27* α(N)=0.000423 *7*; α(O)=8.53×10^{-5} *14*; α(P)=9.74×10^{-6} *17*
559.1 *2*	17.8 *16*	1574.3	(9/2,11/2)$^+$	1015.2	(11/2)$^+$	M1+E2	1.78 *20*	0.0415 *33*		%Iγ=1.5 *4* α(K)exp=0.032 *5* α(K)=0.0320 *28*; α(L)=0.0072 *4*; α(M)=0.00176 *9* α(N)=0.000453 *22*; α(O)=9.3×10^{-5} *5*; α(P)=1.11×10^{-5} *7*
583.3 *2*	56 *5*	1006.7?	(11/2)$^+$	423.4	13/2$^+$	M1+E2	2.61 *17*	0.0304 *11*		%Iγ=4.8 *12* α(K)exp=0.023 *3* α(K)=0.0230 *9*; α(L)=0.00563 *14*; α(M)=0.001379 *32* α(N)=0.000354 *8*; α(O)=7.20×10^{-5} *17*; α(P)=8.44×10^{-6} *23*
591.8 *2*	100	1015.2	(11/2)$^+$	423.4	13/2$^+$	M1+E2	2.67 *18*	0.0291 *10*		%Iγ=8.5 *21* α(K)exp=0.022 *3* α(K)=0.0220 *9*; α(L)=0.00537 *13*; α(M)=0.001315 *31* α(N)=0.000338 *8*; α(O)=6.87×10^{-5} *17*; α(P)=8.06×10^{-6} *22*
616.1 *2*	18.6 *16*	621.66	(7/2)$^-$	5.61	5/2$^-$	M1+E2	1.72 *20*	0.0334 *27*		%Iγ=1.6 *4* α(K)exp=0.026 *4* α(K)=0.0260 *23*; α(L)=0.00561 *32*; α(M)=0.00136 *7* α(N)=0.000349 *19*; α(O)=7.1×10^{-5} *4*; α(P)=8.7×10^{-6} *6*
(617.7 *5*)		623.3?	(5/2$^-$)	5.61	5/2$^-$				6.45 *60*	α(K)=0.037 *23*; α(L)=0.0071 *31*; α(M)=0.0017 *7* α(N)=4.4×10^{-4} *18*; α(O)=9.E−5 *4*; α(P)=1.1×10^{-5} *5* E_γ: From level energy difference. $I_{(\gamma+ce)}$: Taken as half of I(γ+ce)(623.3−keV level)=12.9 *12*, determined from intensity balance.
621.6 *2*	10.5 *9*	621.66	(7/2)$^-$	0.0	3/2$^-$	(E2)		0.01950 *27*		%Iγ=0.90 *23* α(K)exp=0.019 *3* α(K)=0.01430 *20*; α(L)=0.00393 *6*; α(M)=0.000972 *14* α(N)=0.0002497 *35*; α(O)=5.03×10^{-5} *7*; α(P)=5.74×10^{-6} *8*
(623.3 *5*)		623.3?	(5/2$^-$)	0.0	3/2$^-$				6.45 *60*	α(K)=0.036 *22*; α(L)=0.0069 *30*; α(M)=0.0017 *7* α(N)=4.3×10^{-4} *18*; α(O)=9.E−5 *4*; α(P)=1.1×10^{-5}

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γ(^{201}Po) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[&]	Comments
								5 E_γ: From level energy difference. $I_{(\gamma+ce)}$: Taken as half of I(γ+ce)(623.3−keV level)=12.9 *12*, determined from intensity balance.
628.6 *2*	14.1 *20*	2202.9	(9/2,11/2)$^+$	1574.3	(9/2,11/2)$^+$	E2	0.01903 *27*	%Iγ=1.21 *34* α(K)exp=0.014 *3* α(K)=0.01399 *20*; α(L)=0.00381 *5*; α(M)=0.000941 *13* α(N)=0.0002418 *34*; α(O)=4.88×10^{-5} *7*; α(P)=5.58×10^{-6} *8*
716.6 *4*	7.1 *6*	722.44	7/2$^-$	5.61	5/2$^-$	[M1,E2]	0.032 *18*	%Iγ=0.61 *16* α(K)=0.026 *15*; α(L)=0.0048 *21*; α(M)=0.0011 *5* α(N)=2.9×10^{-4} *12*; α(O)=6.1×10^{-5} *27*; α(P)=8.E−6 *4*
722.5 *2*	34 *3*	722.44	7/2$^-$	0.0	3/2$^-$	E2	0.01413 *20*	%Iγ=2.9 *7* α(K)exp=0.008 *1* α(K)=0.01068 *15*; α(L)=0.00261 *4*; α(M)=0.000639 *9* α(N)=0.0001642 *23*; α(O)=3.33×10^{-5} *5*; α(P)=3.90×10^{-6} *5*
758.3[‡] *2*	23.4 *20*	758.30?	(7/2)$^-$	0.0	3/2$^-$	E2	0.01278 *18*	%Iγ=2.0 *5* α(K)exp=0.007 *1* α(K)=0.00973 *14*; α(L)=0.002303 *32*; α(M)=0.000562 *8* α(N)=0.0001444 *20*; α(O)=2.94×10^{-5} *4*; α(P)=3.46×10^{-6} *5*
760.7[‡] *2*	69 *6*	766.3?	(9/2)$^-$	5.61	5/2$^-$	E2	0.01269 *18*	%Iγ=5.9 *15* α(K)exp=0.009 *1* α(K)=0.00968 *14*; α(L)=0.002285 *32*; α(M)=0.000558 *8* α(N)=0.0001432 *20*; α(O)=2.91×10^{-5} *4*; α(P)=3.43×10^{-6} *5*

† From 2010De04, unless otherwise stated.
‡ Placement in the decay scheme is not unambiguous.
# From multiple decay branches and the comparison of α(K)exp (2010De04) with theoretical values.
@ From α(K)exp and the briccmixing program.
& Additional information 1.
a For absolute intensity per 100 decays, multiply by 0.086 *21*.
b Placement of transition in the level scheme is uncertain.
x γ ray not placed in level scheme.

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^{201}At ε decay 2010De04

Decay Scheme

Intensities: I_γ per 100 parent decays