^{229}Pa ε decay 1987Ah05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 109, 2657 (2008)	1-Jun-2008

Parent: ^{229}Pa: E=0.0; J^π=(5/2$^+$); $T_{1/2}$=1.50 d *5*; Q(ε)=311 *3*; %ε decay=99.52 *5*
Additional information 1.

^{229}Th Levels

E(level)‡	J^π†	$T_{1/2}$
0.0	5/2$^+$	7340 y *160*
0.0076# *5*	(3/2$^+$)	
29.2 *1*	(5/2$^+$)	
42.44 *5*	7/2$^+$	
71.8260# *5*	(7/2$^+$)	
146.4 *1*	(5/2$^-$)	
148.2 *1*	(7/2$^-$)	

† Adopted values.
‡ From γ-ray energies reported in 1987Ah05, unless otherwise specified.
# From Adopted Levels, Gammas.

ε radiations

E(decay)	E(level)	Iε‡	Log *ft*	Comments
(163 *3*)	148.2	0.20 *1*	7.45 *4*	εK=0.339 *17*; εL=0.467 *12*; εM+=0.194 *6*
(165 *3*)	146.4	0.20 *1*	7.47 *4*	εK=0.348 *16*; εL=0.460 *11*; εM+=0.191 *6*
(239# *3*)	71.8260			
(269 *3*)	42.44	6.4 *8*	6.65 *6*	εK=0.607 *4*; εL=0.2842 *24*; εM+=0.1087 *11*
(282 *3*)	29.2	0.9 *7*	7.6 *4*	εK=0.621 *3*; εL=0.2748 *21*; εM+=0.1045 *9*
(311 *3*)	0.0076			
(311 *3*)	0.0	93† *1*	5.66 *2*	εK=0.6451 *22*; εL=0.2579 *16*; εM+=0.0970 *7*

† Includes possible ε feeding to 0.0076-keV level.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{229}Th)

Iγ normalization: Deduced by evaluators from a relative K x ray intensity of 206 *3* (1987Ah05), a theoretical ratio of ε(K)/ε=0.63 (1977Ba48), and a K-fluorescence yield of 0.969 *4* (1996Sc06). The resulting total number of atomic vacancies produced by the electron-capture process, and the normalization factor (Iγ normalization) become 339 *10* and 0.293 *10*, respectively.
γγ: 1961Ru06, 1987Ah05.

K x-rays(Th): (1987Ah05)

E	I(relative)	
89.95 5	60.0 10	Kα_2 x ray
93.35 5	100	Kα_1 x ray
104.85 5	11.7 3	Kβ_3 x ray
105.64 5	22.7 6	Kβ_1 x ray
108.64 5	9.0 3	Kβ_2 x ray
109.50 8	3.0 1	KO$_{23}$ x ray

E_γ[‡]	I_γ[#a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	δ	α[†]	Comments
(13.244[@] *2*)	0.005 *2*	42.44	$7/2^+$	29.2	$(5/2^+)$	[M1]		358	α(M)=266 *4*; α(N+..)=91.6 *13* α(N)=71.2 *10*; α(O)=16.86 *24*; α(P)=3.27 *5*; α(Q)=0.313 *5*
(29.1851[@] *4*)	0.020 *10*	29.2	$(5/2^+)$	0.0076	$(3/2^+)$	M1[+E2][&]	0.145	225	α(L)=168.0 *24*; α(M)=42.6 *6*; α(N+..)=14.49 *21* α(N)=11.36 *16*; α(O)=2.62 *4*; α(P)=0.478 *7*; α(Q)=0.0296 *5* I_γ: calculated from I(ce(N); 29γ)/I(ce(M); 42γ)=0.15 *5*/3.3 *5* (1989AhZZ), Mc(42γ)=27 *8*, Iγ(42γ)=0.15 *1*, and α(N)(29γ)=9.0.
(29.190[@])	0.007 *1*	29.2	$(5/2^+)$	0.0	$5/2^+$	M1		139.8	α(L)=105.6 *15*; α(M)=25.5 *4*; α(N+..)=8.76 *13* α(N)=6.80 *10*; α(O)=1.612 *23*; α(P)=0.313 *5*; α(Q)=0.0299 *5*
(29.3911[@] *4*)		71.8260	$(7/2^+)$	42.44	$7/2^+$	[M1]		137.0	α(L)=103.5 *15*; α(M)=25.0 *4*; α(N+..)=8.58 *12* α(N)=6.67 *10*; α(O)=1.579 *23*; α(P)=0.306 *5*; α(Q)=0.0293 *4*
42.44 *5*	0.15 *1*	42.44	$7/2^+$	0.0	$5/2^+$	M1+E2	0.4 *1*	1.3×10^2 *4*	α(L)=1.0×10^2 *3*; α(M)=26 *8*; α(N+..)=9 *3* α(N)=7.0 *22*; α(O)=1.6 *5*; α(P)=0.27 *8*; α(Q)=0.0090 *5* δ: From ^{233}U α decay. Mult.: from ce measurements of 1958Hi78: L1/L2/L3/M1/M2/M3/N2+N3=15/25/30/3/10/9/13. See also ^{233}U α decay.
(42.4425[@])	0.0004 *1*	42.44	$7/2^+$	0.0076	$(3/2^+)$	[E2]		683	α(L)=500 *7*; α(M)=136.7 *20*; α(N+..)=46.0 *7* α(N)=36.5 *6*; α(O)=8.12 *12*; α(P)=1.337 *19*; α(Q)=0.00336 *5*
(42.6333[@] *2*)		71.8260	$(7/2^+)$	29.2	$(5/2^+)$	(M1)		45.8	α(L)=34.6 *5*; α(M)=8.33 *12*; α(N+..)=2.86 *4* α(N)=2.22 *4*; α(O)=0.526 *8*; α(P)=0.1021 *15*; α(Q)=0.00974 *14*
(71.812[@@] *8*)		71.8260	$(7/2^+)$	0.0076	$(3/2^+)$	E2[&]		53.9	α(L)=39.4 *6*; α(M)=10.81 *16*; α(N+..)=3.65 *6* α(N)=2.90 *4*; α(O)=0.644 *9*; α(P)=0.1066 *15*; α(Q)=0.000350 *5*
(71.8159[@] *20*)		71.8260	$(7/2^+)$	0.0	$5/2^+$	[M1+E2]	0.25	12.50	α(L)=9.37 *14*; α(M)=2.33 *4*; α(N+..)=0.797 *12* α(N)=0.623 *9*; α(O)=0.1452 *21*; α(P)=0.0271 *4*; α(Q)=0.00200 *3*

Continued on next page (footnotes at end of table)

^{229}Pa ε decay 1987Ah05 (continued)

γ(^{229}Th) (continued)

E_γ[‡]	I_γ[#a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.	α[†]	Comments
(74.542[@] *5*)	0.049 *5*	146.4	(5/2$^-$)	71.8260	(7/2$^+$)	[E1]	0.255	α(L)=0.193 *3*; α(M)=0.0470 *7*; α(N+..)=0.01561 *22* α(N)=0.01233 *18*; α(O)=0.00277 *4*; α(P)=0.000478 *7*; α(Q)=2.49×10^{-5} *4* I_γ: from Iγ(74.57γ)/Iγ(146.4γ)=0.15 *1*, as measured in ^{233}U α decay, and Iγ(146.4γ)=0.33 *2*.
(76.350[@] *4*)	0.036 *4*	148.2	(7/2$^-$)	71.8260	(7/2$^+$)	[E1]	0.240	α(L)=0.181 *3*; α(M)=0.0441 *7*; α(N+..)=0.01465 *21* α(N)=0.01157 *17*; α(O)=0.00260 *4*; α(P)=0.000450 *7*; α(Q)=2.36×10^{-5} *4* I_γ: from Iγ(76.39γ)/Iγ(119.0γ)=0.083 *9*, as measured in ^{233}U α decay, and Iγ(119.0γ)=0.44 *2*.
117.2 *1*	0.16 *1*	146.4	(5/2$^-$)	29.2	(5/2$^+$)	E1	0.336	α(K)=0.259 *4*; α(L)=0.0585 *9*; α(M)=0.01418 *21*; α(N+..)=0.00475 *7* α(N)=0.00373 *6*; α(O)=0.000852 *12*; α(P)=0.0001518 *22*; α(Q)=9.20×10^{-6} *13*
119.0 *1*	0.44 *2*	148.2	(7/2$^-$)	29.2	(5/2$^+$)	(E1)	0.324	α(K)=0.250 *4*; α(L)=0.0562 *8*; α(M)=0.01362 *20*; α(N+..)=0.00456 *7* α(N)=0.00359 *5*; α(O)=0.000819 *12*; α(P)=0.0001461 *21*; α(Q)=8.90×10^{-6} *13*
146.4 *1*	0.33 *2*	146.4	(5/2$^-$)	0.0	5/2$^+$	(E1)[&]	0.198	α(K)=0.1547 *22*; α(L)=0.0329 *5*; α(M)=0.00794 *12*; α(N+..)=0.00267 *4* α(N)=0.00209 *3*; α(O)=0.000480 *7*; α(P)=8.68×10^{-5} *13*; α(Q)=5.61×10^{-6} *8*
148.2 *1*	0.062 *6*	148.2	(7/2$^-$)	0.0	5/2$^+$	[E1]	0.193	α(K)=0.1504 *22*; α(L)=0.0319 *5*; α(M)=0.00770 *11*; α(N+..)=0.00259 *4* α(N)=0.00203 *3*; α(O)=0.000466 *7*; α(P)=8.42×10^{-5} *12*; α(Q)=5.46×10^{-6} *8*

† Additional information 2.
‡ From 1987Ah05. Other measurements: 1958Hi78, 1961Ru06.
# Photon intensity relative to I(Kα$_1$ x ray)=100 (1987Ah05).
@ Transition was not seen in ^{229}Pa ε decay; Eγ and Iγ are from ^{233}U α decay.
& From ^{233}U α decay.
a For absolute intensity per 100 decays, multiply by 0.293 *10*.

^{229}Pa ε decay 1987Ah05

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays