^{243}Cm α decay

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	E. Browne, J. K. Tuli	NDS 122, 293 (2014)	30-Jun-2013

Parent: ^{243}Cm: E=0.0; J^{π}=5/2^{+}; $T_{1/2}$=28.9 y *4*; Q(α)=6168.8 *10*; %α decay=99.71 *3*
^{243}Cm-Q(α): From 2012Wa38.
^{243}Cm-$T_{1/2}$: Recommended in 2012Ch30, weighted average (using the Limited Statistical Weight method) of 29.0 y *8* (1958Ch38) and 29.20 y *12* (1986Ti03). Other value: 29.1 y *1* (1989Ho24).
See also the evaluation from the Decay Data Evaluation Project (ddep) (2012Ch30).
$\alpha\gamma$: 1953As14, 1963Le17, 1966Ba07, 1977VaZW.
$\alpha\gamma(\theta)$: 1963Fl01.
(L x ray)(γ)(θ): 1975Za11.
(K x ray)(L x ray)(θ): 1974Ma27.

^{239}Pu Levels

E(level)‡	J^{π}†	$T_{1/2}$	Comments
0.0	1/2^{+}		
7.8607 *20*	3/2^{+}		
57.2750 *20*	5/2^{+}		
75.7055 *23*	7/2^{+}		
163.755 *23*	9/2^{+}		
192.8 *10*	11/2^{+}		
285.4594 *17*	5/2^{+}	≈1.2 ns	$T_{1/2}$: from 1956St23.
330.124 *3*	7/2^{+}		
387.419 *20*	9/2^{+}		
391.5847 *22*	7/2^{-}		
427? *3*			
434 *3*	(9/2^{-})		
451? *5*			
462 *3*	(11/2^{+})		
469.8 *4*	(1/2^{-})		E(level): from Adopted Levels.
481? *3*			
487 *3*	(11/2^{-})		
492.1 *3*	3/2^{-}		
499? *3*			
505.56 *20*	(5/2^{-})		
538 *3*			
543? *3*			
556.2 *5*	(7/2^{-})		E(level): from Adopted Levels; from Eα E(level)=552 *3*.
746 *3*			
756 *3*			
763 *3*			
813 *3*			
850 *15*			

† From Adopted Levels.
‡ Deduced by evaluator from a least-squares fit to γ-ray energies.

^{243}Cm α decay (continued)

α radiations

Eα[†]	E(level)	Iα[‡&]	HF[#]	Comments
5607[a]				
5713[a] *5*		≤0.04		From 1963Dz07 (s).
5226 *15*	850	0.00039	138	Eα: from 1963Le17 (αγ semi).
5267 *3*	813	0.0015	61.0	
5316 *3*	763	0.001	185	
5323 *3*	756	0.003	68.1	
5332 *3*	746	0.003	78.4	
5523 *3*	556.2	0.002	1550	
5532[a] *3*	543?	0.006	614	
5537 *3*	538	0.002	1970	
5568 *3*	505.56	0.007	861	
5575[a] *3*	499?	0.007	937	
5582 *3*	492.1	≈0.009	≈797	
5587 *3*	487	≈0.02	≈383	
5593[a] *3*	481?	0.01	828	
5609 *3*	469.8	≤0.01	≥957	Iα: I(5609α + 5607α)=0.01 was measured by 1966Ba07.
5612 *3*	462	≈0.03	≈353	
5622[a]	451?	0.06	203	
5639 *3*	434	0.14	108	
5646[a]	427?	0.03	553	
5682 *3*	391.5847	0.2	130	Iα=0.41% *4*, deduced by evaluator from γ-ray transition intensity balance.
5686	387.419	1.6	17.1	Iα≈2.5% *1*, deduced by evaluator from γ-ray transition intensity balance.
5742.1[@] *9*	330.124	11.5[@] *5*	4.89	Iα=9.5% *21*, deduced by evaluator from γ-ray transition intensity balance.
5785.2[@] *9*	285.4594	73.2[@] *23*	1.33	Iα=72% *3*, deduced by evaluator from γ-ray transition intensity balance.
5876 *3*	192.8	0.7	430	
5907 *3*	163.755	0.1	4260	Iα=0.11% *2*, deduced by evaluator from γ-ray transition intensity balance.
5991.8[@] *15*	75.7055	5.7[@] *2*	211	Iα≈7%, deduced by evaluator from γ-ray transition intensity balance.
6010	57.2750	1.1	1350	
6058[@] *1*	7.8607	4.7[@] *3*	559	Iα≈6%, deduced by evaluator from γ-ray transition intensity balance.
6066.2[@] *17*	0.0	1.5[@] *2*	1920	

[†] From 1966Ba07 (s), unless otherwise specified. 1966Ba07 reported uncertainties of 1 keV near their alpha calibration lines of 5167.7 (^{240}Pu), 5498.8 (^{238}Pu), 5806.1 (^{244}Cm), and 2-3 keV elsewhere. Others: 1953As14, 1957As70, 1957As83, 1962Iv01, 1963Le17, 1963Dz07, 1970By01, 1971Bb10, 1976BaZZ, 1977VaZW.

[‡] From 1966Ba07, unless otherwise specified. Others: 1976BaZZ, 1963Dz07, 1963Le17.

[#] Using r_0(^{239}Pu)=1.4996, average of r_0(^{238}Pu)=1.5013 *10* and r_0(^{240}Pu)=1.4979 *7* (1998Ak04).

[@] From 1979Ry03 and 1991Ry01.

[&] For absolute intensity per 100 decays, multiply by 0.9971 *3*.

[a] Existence of this branch is questionable.

γ(^{239}Pu)

Iγ normalization: from 1972Ah02.

x-rays(Pu):

Eγ (1972Ah02)	Iγ(%α) (1972Ah02)			Calculated (RADLST)	
99.536	13.5 *5*	$K\alpha_2$	x ray	12.5 *5*	
103.750	20.8 *8*	$K\alpha_1$	x ray	19.8 *8*	
117.1	7.6 *3*	$K\beta_1'$	x ray	9.8 *4*	(Kβ x ray)
120.6	2.6 *1*	$K\beta_2'$	x ray		

The agreement between measured and calculated K x ray supports the experimental γ-ray intensities and assigned multipolarities.

E_γ[#]	I_γ[@c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ[b]	α[†‡]	$I_{(\gamma+ce)}$[c]	Comments
(4.2 *CA*)		391.5847	7/2$^-$	387.419	9/2$^+$	[E1]				
(7.860[&] *3*)	≈0.015	7.8607	3/2$^+$	0.0	1/2$^+$	M1+E2	0.055 *3*	5.7×10^3 *4*	≈85	ce(M)/(γ+ce)=0.74 *4*; ce(N+)/(γ+ce)=0.261 *20* ce(N)/(γ+ce)=0.203 *17*; ce(O)/(γ+ce)=0.049 *5*; ce(P)/(γ+ce)=0.0083 *7*; ce(Q)/(γ+ce)=0.000286 *19* $I_{(\gamma+ce)}$: deduced by evaluator from γ-ray and α-particle transition intensity balance at 7.86-keV level. I(γ+ce)(7.86γ)=I(γ+ce)(49γ) + I(γ+ce)(67γ) + I(γ+ce)(277γ) + Iα(6058α)≈85%. I_γ: deduced by evaluator from I(γ+ce)(7.86γ)≈85% and α=5700 *400*.
(18.43 *CA*)		75.7055	7/2$^+$	57.2750	5/2$^+$	(M1+E2)				ce lines were obscured by Auger lines in ^{239}Am decay; an upper limit of 3% for its transition intensity was given by 1972Po04.
44.663 *5*	0.13 *2*	330.124	7/2$^+$	285.4594	5/2$^+$	M1+E2	0.20 *3*	86 *8*		α(L)=64 *6*; α(M)=16.2 *17*; α(N+..)=5.7 *6* α(N)=4.4 *5*; α(O)=1.08 *11*; α(P)=0.193 *17*; α(Q)=0.00902 *15* I_γ: deduced from Iγ(44.66γ)/Iγ(254.4γ)=0.13 *1*/0.11 *6*, as observed in ^{239}Np β^- decay (1982Ah04), and Iγ(254.4γ)=0.11 *1*.
(49.412[&] *4*)	≈0.2	57.2750	5/2$^+$	7.8607	3/2$^+$	M1+E2	0.50 *3*	126 *8*		α(L)=92 *6*; α(M)=24.8 *17*; α(N+..)=8.7 *6* α(N)=6.8 *5*; α(O)=1.62 *11*; α(P)=0.269 *17*; α(Q)=0.00592 *13* I_γ: From decay scheme and transition intensity balance.
57.273[d] *4*	≈0.05[d]	57.2750	5/2$^+$	0.0	1/2$^+$	E2		222		α(L)=161.1 *23*; α(M)=45.0 *7*; α(N+..)=15.73 *22*

$^{239}_{94}$Pu$_{145}$-3

γ(^{239}Pu) (continued)

E_γ[#]	I_γ[@c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ[b]	α[†‡]	Comments
									α(N)=12.36 *18*; α(O)=2.91 *4*; α(P)=0.457 *7*; α(Q)=0.001109 *16* I_γ: γ ray placed twice in level scheme. Iγ=0.14 *1* was measured for the doublet. Iγ from transition intensity balance at 57-keV level. I(γ+ce)(228γ) + I(γ+ce)(272γ) + I(γ+ce)(334γ) + Iα(6010) − I(γ+ce)(49γ)≈0.06%.
57.30[d]	≈0.09[d]	387.419	9/2$^+$	330.124	7/2$^+$	[M1+(E2)]		28.6 *5*	α(L)=21.5 *4*; α(M)=5.4 *8*; α(N+..)=1.428 *21* α(N)=7 *6*; α(O)=1.6 *13*; α(P)=0.26 *20*; α(Q)=0.0028 *17* I_γ: from Iγ(doublet)=0.14% *1* and Iγ(57γ, 57-keV level)≈0.05%. E_γ: from E(level) difference. E=57.273 *4* measured for the doublet. α: for M1. Transition intensity balance at 387-keV level and theoretical α(E2)=221 suggest a negligibly small E2 admixture.
(61.460[&] *2*)	0.015 *2*	391.5847	7/2$^-$	330.124	7/2$^+$	E1		0.473	α(L)=0.354 *5*; α(M)=0.0881 *13*; α(N+..)=0.0300 *5* α(N)=0.0236 *4*; α(O)=0.00553 *8*; α(P)=0.000871 *13*; α(Q)=2.87×10^{-5} *4* I_γ: deduced from Iγ(61.46γ)/Iγ(334.31γ)=129 *2*/207 *3*, which was recommended by 1986LoZT, and from ^{239}Np β^- decay.
(67.841[&] *7*)	0.20 *5*	75.7055	7/2$^+$	7.8607	3/2$^+$	E2		98.5	α(L)=71.5 *10*; α(M)=20.0 *3*; α(N+..)=6.99 *10* α(N)=5.50 *8*; α(O)=1.293 *19*; α(P)=0.204 *3*; α(Q)=0.000543 *8* I_γ: From decay scheme and transition intensity balance.
(88.06[&] *3*)	0.0016	163.755	9/2$^+$	75.7055	7/2$^+$	M1+E2	0.50	12.26	α(L)=9.07 *13*; α(M)=2.36 *4*; α(N+..)=0.830 *12* α(N)=0.645 *9*; α(O)=0.1563 *22*; α(P)=0.0274 *4*; α(Q)=0.001050 *15* I_γ: from Iγ(88.06)/Iγ(106.47)=0.12 *5*, from ^{239}Np β^- decay.
(101.96[&] *2*)	0.008 *CA*	387.419	9/2$^+$	285.4594	5/2$^+$	E2		14.42	α(L)=10.46 *15*; α(M)=2.93 *5*; α(N+..)=1.026 *15* α(N)=0.805 *12*; α(O)=0.190 *3*; α(P)=0.0302 *5*; α(Q)=0.0001088 *16* I_γ: from Iγ(101.96γ)/Iγ(311.7γ)≈8/17, as deduced by 1972Po04 in ^{239}Am ε decay.
(106.125[&] *2*)	0.31 *3*	391.5847	7/2$^-$	285.4594	5/2$^+$	E1(+M2)	−0.007 *7*	0.26 *3*	Additional information 1. α: experimental anomalous conversion coefficient (1959Ew90). Other: 1957Ew30. I_γ: deduced from Iγ(106.12γ)/Iγ(334.31γ)=27.2 *4*/2.07 *3*, as measured in ^{239}Np β^- decay.
(106.47[&] *4*)	0.0136	163.755	9/2$^+$	57.2750	5/2$^+$	E2		11.80	α(L)=8.56 *12*; α(M)=2.40 *4*; α(N+..)=0.839 *12* α(N)=0.659 *10*; α(O)=0.1553 *22*; α(P)=0.0248 *4*; α(Q)=9.29×10^{-5} *13* I_γ: from intensity balance at 163.76 level.

$^{239}_{94}$Pu$_{145}$-4

^{243}Cm α decay (continued)

$\gamma(^{239}Pu)$ (continued)

E_γ[#]	I_γ[@c]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[b]	δ[b]	α[†‡]	$I_{(\gamma+ce)}$[c]	Comments
(117.1 *CA*)		192.8	11/2$^+$	75.7055	7/2$^+$					
(166.39[&] *6*)	0.012 *3*	330.124	7/2$^+$	163.755	9/2$^+$	M1		6.22		α(K)=4.91 *7*; α(L)=0.984 *14*; α(M)=0.239 *4*; α(N+..)=0.0846 *12* α(N)=0.0651 *10*; α(O)=0.01621 *23*; α(P)=0.00308 *5*; α(Q)=0.000202 *3* I_γ: deduced from Iγ(166.39γ)/Iγ(254.4γ)=0.111 *23*, using I(ce(L1))(166.39γ)/I(ce(K))(254.4γ)=7 *1*/105 *15* from ^{239}Am ε decay (1959Ew90), and the following theoretical conversion coefficients: α(L1)(166.39γ; M1)=0.932, and α(K)(254.4γ; M1+E2)=1.457.
209.753 *2*	3.30 *10*	285.4594	5/2$^+$	75.7055	7/2$^+$	M1+E2	0.37 *8*	2.93 *13*		α(K)=2.27 *12*; α(L)=0.499 *9*; α(M)=0.1231 *18*; α(N+..)=0.0435 *7* α(N)=0.0335 *5*; α(O)=0.00830 *13*; α(P)=0.00156 *3*; α(Q)=9.3$\times10^{-5}$ *5* δ: from α(K)exp=2.42 *14*; α(L12)exp=0.488 *15* (1991Sh06). Other value: δ=−0.004 *+1−24* from $\gamma(\theta)$ (1972Kr07,1990Si12).
228.183 *2*	10.6 *3*	285.4594	5/2$^+$	57.2750	5/2$^+$	M1+E2	0.28 *7*	2.41 *9*		α(K)=1.88 *8*; α(L)=0.395 *7*; α(M)=0.0967 *15*; α(N+..)=0.0342 *6* α(N)=0.0263 *4*; α(O)=0.00653 *11*; α(P)=0.001233 *23*; α(Q)=7.7$\times10^{-5}$ *3* δ: from α(K)exp=2.01 *7*; α(M)exp=0.0968 *59* (1991Sh06). Other value: δ=+0.001 *+9−1* from $\gamma(\theta)$ (1972Kr07,1990Si12).
254.40 *3*	0.11 *1*	330.124	7/2$^+$	75.7055	7/2$^+$	M1+E2	−0.159 *6*	1.85		α(K)=1.457 *21*; α(L)=0.294 *5*; α(M)=0.0716 *10*; α(N+..)=0.0253 *4* α(N)=0.0195 *3*; α(O)=0.00485 *7*; α(P)=0.000920 *13*; α(Q)=5.93$\times10^{-5}$ *9*
272.87 *9*	0.08 *1*	330.124	7/2$^+$	57.2750	5/2$^+$	M1+E2	+0.165 *9*	1.518		α(K)=1.198 *18*; α(L)=0.241 *4*; α(M)=0.0588 *9*; α(N+..)=0.0208 *3* α(N)=0.01599 *23*; α(O)=0.00397 *6*; α(P)=0.000754 *11*; α(Q)=4.86$\times10^{-5}$ *7*
277.599 *2*	14.0 *4*	285.4594	5/2$^+$	7.8607	3/2$^+$	M1+E2	0.23 *10*	1.42 *7*		α(K)=1.12 *6*; α(L)=0.228 *6*; α(M)=0.0555 *13*; α(N+..)=0.0196 *5* α(N)=0.0151 *4*; α(O)=0.00375 *9*; α(P)=0.000711 *19*; α(Q)=4.53$\times10^{-5}$ *22* δ: from α(K)exp=1.19 *5*; α(L12)exp=0.238 *10*, α(M)exp=0.0579 *29* (1991Sh06). Other value: δ=+0.165 *2*, from $\gamma(\theta)$ (1972Kr07,1990Si12).
285.460 *2*	0.73 *2*	285.4594	5/2$^+$	0.0	1/2$^+$	E2		0.247		α(K)=0.0843 *12*; α(L)=0.1190 *17*; α(M)=0.0326 *5*; α(N+..)=0.01145 *16* α(N)=0.00896 *13*; α(O)=0.00213 *3*; α(P)=0.000356 *5*; α(Q)=4.99$\times10^{-6}$ *7*

^{243}Cm α decay (continued)

$\gamma(^{239}$Pu) (continued)

E_γ[#]	I_γ[@c]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[b]	δ[b]	α[†‡]	Comments
311.7 *2*	0.017 *2*	387.419	9/2$^+$	75.7055	7/2$^+$	[M1+E2]	≤0.2	1.057 *23*	α(K)=0.835 *19*; α(L)=0.167 *3*; α(M)=0.0406 *7*; α(N+..)=0.01434 *24* α(N)=0.01104 *19*; α(O)=0.00275 *5*; α(P)=0.000522 *9*; α(Q)=3.38×10^{-5} *8* δ: assumed by evaluator.
315.880 *3*	0.018 *2*	391.5847	7/2$^-$	75.7055	7/2$^+$	E1(+M2)	+0.008 *8*	0.0372 *9*	α(K)=0.0294 *6*; α(L)=0.00583 *16*; α(M)=0.00141 *4*; α(N+..)=0.000493 *15* α(N)=0.000382 *12*; α(O)=9.3×10^{-5} *3*; α(P)=1.69×10^{-5} *6*; α(Q)=8.9×10^{-7} *3*
322.3 *2*	0.007 *1*	330.124	7/2$^+$	7.8607	3/2$^+$	[E2]		0.1699	α(K)=0.0679 *10*; α(L)=0.0745 *11*; α(M)=0.0203 *3*; α(N+..)=0.00713 *11* α(N)=0.00557 *8*; α(O)=0.001329 *19*; α(P)=0.000224 *4*; α(Q)=3.73×10^{-6} *6*
334.310 *3*	0.024 *2*	391.5847	7/2$^-$	57.2750	5/2$^+$	E1(+M2)	+0.006 *6*	0.0329 *6*	α(K)=0.0261 *5*; α(L)=0.00511 *10*; α(M)=0.001238 *24*; α(N+..)=0.000432 *9* α(N)=0.000334 *7*; α(O)=8.18×10^{-5} *16*; α(P)=1.48×10^{-5} *3*; α(Q)=7.91×10^{-7} *17*
(392.4[&] *5*)		556.2	(7/2$^-$)	163.755	9/2$^+$				
(430.0[&] *3*)		505.56	(5/2$^-$)	75.7055	7/2$^+$				
(434.7[&] *5*)		492.1	3/2$^-$	57.2750	5/2$^+$				
(447.6[&] *5*)		505.56	(5/2$^-$)	57.2750	5/2$^+$				
(461.9[&] *5*)		469.8	(1/2$^-$)	7.8607	3/2$^+$				
(469.8[&] *5*)		469.8	(1/2$^-$)	0.0	1/2$^+$				
(484.3[&] *5*)		492.1	3/2$^-$	7.8607	3/2$^+$				
(492.3[&] *5*)		492.1	3/2$^-$	0.0	1/2$^+$				
(497.8[&] *3*)		505.56	(5/2$^-$)	7.8607	3/2$^+$				
(499[&])		556.2	(7/2$^-$)	57.2750	5/2$^+$				
[x]≈640[ae]									Uncertain transition.
[x]≈680[a]									
[x]≈720[a]									
[x]≈740[a]									
[x]≈760[a]									

[†] Additional information 2.
[‡] Additional information 3.
[#] Measurements of 1959Ew90 (s ce), 1965Ma17 (cryst), 1972Po04 (s ce, semi), and 1979Bo30 (cryst), and 1982Ah04 (semi) observed in ^{239}Np and ^{239}Am decays, except as noted. Other measurements: 1953As14 (scin), 1955Sc08 (s ce), 1956Ne17 (pc, scin), 1964Ba31 ($\alpha\gamma$, semi).

$^{239}_{94}Pu_{145}$-6

γ(^{239}Pu) (continued)

[@] From 1972Ah02. Photon intensity per 100 α decays. Other measurements: 1956Ne17, 1964Ba31.
[&] Transition was not observed in ^{243}Cm α decay. Eγ is from the decay of ^{239}Np and ^{239}Am.
[a] From 1963Le17 ($\alpha\gamma$ and (α)(ce) coin).
[b] From ce data in ^{239}Am, ^{239}Np, and ^{243}Cm decays; and $\gamma(\theta)$ measurements by 1972Kr07, 1990Si12 from polarized ^{239}Np, unless otherwise specified.
[c] For absolute intensity per 100 decays, multiply by 0.9971 *3*.
[d] Multiply placed with intensity suitably divided.
[e] Placement of transition in the level scheme is uncertain.
[x] γ ray not placed in level scheme.

$^{239}_{94}$Pu$_{145}$-7

^{243}Cm α decay

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
@ Multiply placed: intensity suitably divided