^{237}Am ε decay 1975Ah05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 107, 2323 (2006)	15-Mar-2006

Parent: ^{237}Am: E=0.0; J$^{\pi}$=5/2$^{(-)}$; $T_{1/2}$=73.6 min *8*; Q(ε)=1480 *SY*; %ε+%β^+ decay=99.975 *3*

Other measurement: 1972PoZS.

^{237}Am source was prepared by the ^{237}Np(α,4n), E(α)=42−MeV and ^{237}Np(^{3}He,3n), E(^{3}He)= 32-MeV reactions; Detector: Ge(Li), NaI(Tl); Measured: Eγ, γγ coin, Iγ, ce.

^{237}Pu Levels

E(level)[†]	J$^{\pi}$[‡]	Comments
0.0[#]	7/2$^-$	J$^{\pi}$: From Adopted Levels.
47.71[#] *4*	9/2$^-$	J$^{\pi}$: 47.7γ M1+E2 to 7/2$^-$ state.
145.553[@] *11*	1/2$^+$	J$^{\pi}$: 145.6γ E3 to 7/2$^-$ state.
155.465[@] *14*	3/2$^+$	J$^{\pi}$: 9.9γ M1+E2 to 1/2$^+$ state.
201.188[@] *13*	5/2$^+$	J$^{\pi}$: 45.7γ M1+E2 to 3/2$^+$ state.
224.26[@] *5*	7/2$^+$	
280.226[&] *15*	5/2$^+$	J$^{\pi}$: 280.2γ E1 to 7/2$^-$ state.
320.975[&] *16*	7/2$^+$	J$^{\pi}$: 40.7γ M1+E2 to 5/2$^+$ state and 321.0γ E1 to 7/2$^-$ state.
370.41[a] *4*	3/2$^+$	
404.20[a] *5*	5/2$^+$	
407.82[b] *6*	5/2$^+$	
438.41[b] *7*	7/2$^+$	J$^{\pi}$: 390.7γ E1 to 9/2$^-$ state, 438.4γ E1 to 7/2$^-$ state.
453.29[a] *14*	7/2$^+$	
473.52[c] *7*	7/2$^+$	J$^{\pi}$: 425.8γ E1 to 9/2$^-$ state, 473.5γ E1 to 7/2$^-$ state.
655.30[d] *20*	(5/2)$^-$	J$^{\pi}$: 655.3γ M1 to 7/2$^-$ state.
696.20[d] *22*	7/2$^-$	J$^{\pi}$: 648.5γ M1 to 9/2$^-$ state, 696.2γ M1 to 7/2$^-$ state.
908.90[e] *12*	7/2$^+$	J$^{\pi}$: 435.2γ M1 to 7/2$^+$ state, 504.8γ M1 to 5/2$^+$ state.
1000.6 *3*	(7/2)	

† From a least-squares fit to the γ-ray energies.
‡ From rotational band structure and γ-ray multipolarity.
\# 7/2[743] band.
@ 1/2[631] band.
& 5/2[622] band.
a 3/2[631] band.
b 5/2[633] band.
c 7/2[624] state.
d 5/2[752] band.
e 7/2[613] state.

ε,β^+ radiations

E(decay)	E(level)	Iε[†‡]	Log *ft*	I(ε+β^+)[‡]	Comments
(479 *SY*)	1000.6	0.43 *7*	7.13 *7*	0.43 *7*	εK=0.68770 *8*; εL=0.22732 *6*; εM+=0.08498 *3*
(571 *SY*)	908.90	4.08 *19*	6.338 *21*	4.08 *19*	εK=0.7075; εL=0.21364 *3*; εM+=0.07890 *1*
(783 *SY*)	696.20	≥0.53	≤7.5	≥0.53	εK=0.7324; εL=0.1963; εM+=0.071279 *8*
(824 *SY*)	655.30	≤1.5	≥7.1	≤1.5	εK=0.7355; εL=0.1942; εM+=0.07034

Continued on next page (footnotes at end of table)

^{237}Am ε decay 1975Ah05 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Iε[†‡]	Log *ft*	I($\varepsilon+\beta^+$)[‡]	Comments
					Iε(to 655.3 level)+Iε(to696.2 level)=2.03 *17* per 100 ε decays.
(1006 *SY*)	473.52	6.5 *4*	6.70 *3*	6.5 *4*	εK=0.7458; εL=0.1870; εM+=0.06723
(1026 *SY*)	453.29	1.0 *3*	7.53 *13*	1.0 *3*	εK=0.7466; εL=0.1864; εM+=0.06697
(1041 *SY*)	438.41	9.6 *6*	6.57 *3*	9.6 *6*	εK=0.7473; εL=0.1860; εM+=0.06678
(1072 *SY*)	407.82	5.0 *6*	6.88 *6*	5.0 *6*	εK=0.7485; εL=0.1851; εM+=0.06641
(1075 *SY*)	404.20	5.1 *6*	6.87 *6*	5.1 *6*	εK=0.7486; εL=0.1850; εM+=0.06636
(1109 *SY*)	370.41	1.9 *3*	7.33 *7*	1.9 *3*	εK=0.7499; εL=0.1841; εM+=0.06598
(1159 *SY*)	320.975	5.6 *5*	6.90 *4*	5.6 *5*	εK=0.7516; εL=0.1829; εM+=0.06547
(1199 *SY*)	280.226	49.7 *24*	5.986 *22*	49.7 *24*	εK=0.7529; εL=0.1821; εM+=0.06509
(1255[#] *SY*)	224.26	0.3 *9*	8.2 *13*	0.3 *9*	εK=0.7545; εL=0.1809; εM+=0.06460
(1278[#] *SY*)	201.188	0.6 *7*	8.0 *5*	0.6 *7*	εK=0.7551; εL=0.1805; εM+=0.06441
(1324 *SY*)	155.465	10 *6*	6.8 *3*	10 *6*	εK=0.7562; εL=0.1797; εM+=0.06407
(1334[#] *SY*)	145.553	<2.35	>8.2^{1u}	<2.35	εK=0.7225; εL=0.2030; εM+=0.07444 Intensity balance at the 145.544-keV level gives Iε=−3±6 per 100 ε decays. If log f^1t is required to be greater than 8.5, then Iε<2.4%.
(1480 *SY*)	0.0	<5	>7.2	<5	εK=0.7594; εL=0.1773; εM+=0.06305

† Deduced from γ transition intensities. The ε branch to g.s. was deduced in 1975Ah05 as (0.6 ±5)% from comparison of the measured K x-ray intensity with those expected ones due to K conversions of γ's and the K captures to excited levels.

‡ For absolute intensity per 100 decays, multiply by 0.99975 *3*.

Existence of this branch is questionable.

γ(^{237}Pu)

Iγ normalization: Normalization factor to convert relative photon intensities to intensities per 100 ε decays was obtained by requiring all transitions (γ, ce and ε) feeding the g.s. to sum to 100% (1975Ah05).
$\gamma\gamma$: 1975Ah05

X rays(Pu):

E(x ray) 1975Ah05	I(%) 1975Ah05	I(x-ray) calculated	
99.5 1	27.9 14	27.2 18	Kα_2 x ray
103.8 1	43.5 23	44 3	Kα_1 x ray
117.1 1	15.7 10	15.1 14	Kβ_1' x ray
120.7 1	5.1 4	5.5 5	Kβ_2' x ray

E$_\gamma$[†]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[‡]	δ[#]	α[b]	I$_{(\gamma+ce)}$[@a]	Comments
9.903 *16*	155.465	3/2$^+$	145.553	1/2$^+$	M1+E2	0.071 *+19−26*	3.2×10^3 *10*	22 *5*	α(M)=2.3×10^3 *9* Ice: N1/N2/N3=1.6 *3*/1.4 *3*/1.1 *4*. Iγ=0.0057 *12* from Ice(N1) and α(N1)=279 *3*.
40.748[c] *6*	320.975	7/2$^+$	280.226	5/2$^+$	M1+E2	0.194 *30*	123 *14*	3.4 *4*	α(L)= 92 *10*; α(M)= 23.3 *26* Ice: L1/L2/L3=1.5 *2*/0.6 *2*/0.41 *6*. The ce contributions from each γ of the doublet could not be deduced. The second possible 40.748γ between the 696.2- and 655.3-keV levels is assumed by the evaluator to be much weaker. The intensity balance at the 655.3-keV level suggests that Ti(40.748γ deexciting 696.2 level)<1.50 *15*; the sum of the (N-forbidden) ε branches to the 696.2- and 655.3-keV levels is 2.03% 17 (independent of any 40.748γ between them). The measured ce intensities are assigned here to the 40.748γ deexciting the 320.97-keV level. It may be considered as an upper limit. Iγ=0.028 *5* from Ice(L3) and α(L3)=14.4 *5*. I(γ+ce)=1.33Ice(L)+Iγ. 1983Bh10 calculated penetration parameters for the 40.748-keV photon from measured L-subshell conversion ratios. Possible effects on these ratios from conversion lines of the second 40.78γ deexciting the 696.2-keV level were not considered.
40.748[ce] *6*	696.20	7/2$^-$	655.30	(5/2)$^-$					Since no coincidence data were taken between conversion electrons and γ's, this placement which is based on expectation of an intraband transition, and from energy

From ENSDF

$^{237}_{94}$Pu$_{143}$-3

$\gamma(^{237}$Pu) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[#]	α[b]	$I_{(\gamma+ce)}$[@a]	Comments
										fit may be considered questionable (the authors of 1975Ah05 did not show this second placement in their decay scheme).
45.724 *8*		201.188	5/2$^+$	155.465	3/2$^+$	M1+E2	0.47 *13*	170 *60*	1.49 *19*	α(L)= 125 *40*; α(M)= 33 *11* Iγ=0.0085 *22* from α(L1)=34.3 *26* and Ice(L1). Ice: L1/L2/L3=0.29 *7*/0.43 *7*/0.4 *1*.
47.71 *4*		47.71	9/2$^-$	0.0	7/2$^-$	M1+E2	0.24 *8*	79 *15*	4.2 *6*	α(L)=59 *14*; α(M)=15 *4* Iγ=0.053 *17* from Ice(L)=3.1 *6* and α(L)=59 *14*. Ice: (L1+L2)/L3/M=2.5 *5*/0.60 *15*/0.8 *2*.
55.638 *11*		201.188	5/2$^+$	145.553	1/2$^+$	(E2)		261	5.5 *5*	α(L)=188.7; α(M)=52.6; α(N+..)=19.99 Iγ=0.021 *3* from Ice(L2) and α(L2)=102.7. Ice: L2/L3/M/N=2.2 *3*/1.4 *2*/≈1.2/≈0.5.
68.8 *1*		224.26	7/2$^+$	155.465	3/2$^+$	(E2)		94.2	3.0 *6*	α(L)= 68.0; α(M)= 19.00; α(N+..)= 7.22 Iγ=0.032 *6* from Ice(L2) and α(L2)=38.04. Ice: L2/L3/M/N=1.2 *2*/≈1.0/≈0.6/≈0.2.
79.05 *2*		280.226	5/2$^+$	201.188	5/2$^+$	(M1)		12.0	2.6 *3*	α(L)= 9.01; α(M)= 2.193; α(N+..)= 0.822 Iγ=0.20 *3* from Ice(L12) and α(L1)+α(L2)=8.96, Iγ=0.28 *7* from Ice(M) and α(M)=2.193. Ice: L12/M=1.8 *2*/0.61 *15*; L1/L12=1.6 *3*/1.8 *2*.
123.8 *3*	≈0.04	404.20	5/2$^+$	280.226	5/2$^+$	[M1]		15.5		α(K)=12.2; α(L)=2.46; α(M)=0.599; α(N+..)=0.225
124.72 *3*	0.28 *5*	280.226	5/2$^+$	155.465	3/2$^+$	(M1)		15.1		α(K)= 11.92; α(L)= 2.404; α(M)= 0.586; α(N+..)= 0.2199 Ice(L1)=0.76 *13*.
127.5 *2*	0.11 *2*	407.82	5/2$^+$	280.226	5/2$^+$	[M1]		14.2		α(K)=11.2; α(L)=2.26; α(M)=0.550; α(N+..)=0.206
145.552 *12*	0.48 *4*	145.553	1/2$^+$	0.0	7/2$^-$	E3		51.6		α(K)= 0.209; α(L)= 36.2; α(M)= 10.9; α(N+..)= 4.31 Ice: (L1+L2)/L3/M/N=11.9 *8*/5.0 *4*/6.1 *6*/2.2 *2*; and L2/L3=10.6 *5*/4.8 *6*. E=145.536 *9* in ^{241}Cm α decay; 145.544 *10* is adopted.
158.3 *3*	0.07 *2*	438.41	7/2$^+$	280.226	5/2$^+$	[M1]		7.66		α(K)=6.04; α(L)=1.21; α(M)=0.296; α(N+..)=0.111
179.94 *2*	0.24 *5*	404.20	5/2$^+$	224.26	7/2$^+$	(M1(+E2))	0.7 *7*	4.0 *14*		α(K)=2.9 *14*; α(L)=0.84 *1*; α(M)=0.213 *8*; α(N+..)=0.080 *4* Ice(K)=0.69 *7*.
183.7 *2*	0.19 *5*	407.82	5/2$^+$	224.26	7/2$^+$	M1(+E2)	0.7 *7*	3.8 *13*		α(K)=2.7 *13*; α(L)=0.78 *2*; α(M)=0.199 *6*; α(N+..)=0.075 *3* Ice: K/L=0.5 *1*/0.12 *3*.
193.4 *3*	0.09 *3*	473.52	7/2$^+$	280.226	5/2$^+$	[M1]		4.35		α(K)=3.43; α(L)=0.689; α(M)=0.167; α(N+..)=0.0625
203.03 *5*	0.42 *5*	404.20	5/2$^+$	201.188	5/2$^+$	M1(+E2)	0.4 *4*	3.4 *4*		α(K)= 2.6 *4*; α(L)= 0.59 *1*; α(M)= 0.145 *1*; α(N+..)= 0.0541 *3* Ice: K/L=1.20 *15*/0.21 *3*.
206.7 *1*	0.33 *4*	407.82	5/2$^+$	201.188	5/2$^+$	M1(+E2)	0.3 *3*	3.4 *2*		α(K)= 2.6 *2*; α(L)= 0.56 *1*; α(M)= 0.138 *1*; α(N+..)=0.0514 *3* Ice: K/L=0.85 *12*/0.16 *3*.

γ(^{237}Pu) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ[#]	α[b]	Comments
214.9 *2*	0.24 *5*	370.41	3/2+	155.465	3/2+	(M1)		3.23	α(K)= 2.55; α(L)= 0.512; α(M)= 0.1243; α(N+..)= 0.0464 Ice(K)=0.61 *15*.
224.86 *4*	0.24 *5*	370.41	3/2+	145.553	1/2+	(M1)		2.85	α(K)= 2.25; α(L)= 0.450; α(M)= 0.1094; α(N+..)= 0.0408 Ice(K)=0.56 *12*.
229.1 *3*	0.15 *5*	453.29	7/2+	224.26	7/2+	[M1]		2.70	α(K)=2.13; α(L)=0.427; α(M)=0.104; α(N)=0.0387
248.7 *2*	0.59 *6*	404.20	5/2+	155.465	3/2+	(M1(+E2))	0.6 *6*	1.7 *5*	α(K)= 1.3 *4*; α(L)= 0.31 *4*; α(M)= 0.076 *7*; α(N+..)= 0.028 *3* Ice(L)=0.18 *3*.
252.2[d] *2*	0.27[d] *7*	407.82	5/2+	155.465	3/2+	M1(+E2)	0.6 *6*	1.6 *5*	α(K)=1.2 *4*; α(L)=0.23 *10*; α(M)=0.073 *6*; α(N+..)=0.027 *2* Iγ=0.42 *5* was measured for this γ placed twice. Iγ(252γ deexciting 407 level)= 0.42 *5* − Iγ(252γ deexciting 453 level). δ: contributions of ce′s from 252γ deexciting 453 level have been subtracted in calculations of mixing ratio. Ice: K/L=0.6 *1*/0.12 *3* for the doublet.
252.2[d] *2*	0.15[d] *5*	453.29	7/2+	201.188	5/2+	[M1]		2.07	α(K)=1.63; α(L)=0.326; α(M)=0.079; α(N+..)=0.0296 I_γ: calculated by the evaluator from Alaga rule and Iγ(229γ).
273.3 *1*	0.76 *5*	320.975	7/2+	47.71	9/2−	[E1]		0.0511	α(K)=0.0403; α(L)=0.00815; α(M)=0.00197; α(N+..)=0.00072
280.23 *2*	47.3 *20*	280.226	5/2+	0.0	7/2−	E1		0.0484	α(K)= 0.0382; α(L)=0.00769; α(M)=0.00186; α(N+..)=0.00068 Ice: K/L12/L3=1.92 *15*/0.32 *3*/0.06 *2*.
321.0 *1*	1.4 *1*	320.975	7/2+	0.0	7/2−	E1		0.0360	α(K)= 0.0286; α(L)=0.00562; α(M)=0.00136; α(N+..)=0.00049 Ice(K)<0.07.
390.7 *1*	0.55 *4*	438.41	7/2+	47.71	9/2−	E1		0.0238	α(K)=0.0190; α(L)=0.00363; α(M)=0.00088; α(N+..)=0.00032 Ice(K)<0.02.
407.8 *1*	0.63 *5*	407.82	5/2+	0.0	7/2−	(E1)		0.0218	α(K)=0.0174; α(L)=0.00331; α(M)=0.00080; α(N+..)=0.00029 Ice(K)≈0.02.
425.8 *1*	1.94 *12*	473.52	7/2+	47.71	9/2−	E1		0.0200	α(K)=0.0160; α(L)=0.00302; α(M)=0.00073; α(N+..)=0.00026 Ice(K)=0.04 *1*.
435.2 *3*	0.25 *4*	908.90	7/2+	473.52	7/2+	M1		0.462	α(K)= 0.365; α(L)= 0.0723; α(M)=0.0176; α(N+..)=0.00654 Ice(K)=0.10 *2*.
438.4 *1*	8.3 *4*	438.41	7/2+	0.0	7/2−	E1		0.0188	α(K)=0.0151; α(L)=0.00283; α(M)=0.00068; α(N+..)=0.00025 Ice(K)=0.13 *3*.
453.2 *3*	0.10 *2*	453.29	7/2+	0.0	7/2−	[E1]		0.0176	α(K)=0.0141; α(L)=0.00264; α(M)=0.00064; α(N+..)=0.00023
455.8 *3*	0.09 *2*	908.90	7/2+	453.29	7/2+	M1		0.407	α(K)= 0.322; α(L)= 0.0638; α(M)=0.0155; α(N+..)=0.00577 Ice(K)≈0.03.
473.5 *1*	4.3 *3*	473.52	7/2+	0.0	7/2−	E1		0.0161	α(K)=0.0129; α(L)=0.00241; α(M)=0.00058; α(N+..)=0.00021 Ice(K)=0.07 *2*.
501.2 *3*	0.28 *4*	908.90	7/2+	407.82	5/2+	M1		0.315	α(K)= 0.249; α(L)= 0.0493 Ice(K)=0.06 *2*.
504.8 *3*	0.19 *4*	908.90	7/2+	404.20	5/2+	M1		0.309	α(K)= 0.245; α(L)= 0.0483 Ice(K)=0.05 *2*.
648.5 *3*	0.26 *4*	696.20	7/2−	47.71	9/2−	M1		0.158	α(K)=0.125; α(L)=0.0246 Ice(K)≈0.03.
655.3 *2*	1.30 *13*	655.30	(5/2)−	0.0	7/2−	M1		0.153	α(K)=0.122; α(L)=0.0239 Ice(K)=0.13 *2*.

$^{237}_{94}$Pu$_{143}$-5

γ(^{237}Pu) (continued)

E_γ[†]	I_γ[†a]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[b]	Comments
696.2 *3*	0.20 *4*	696.20	7/2⁻	0.0	7/2⁻	M1	0.131	α(K)= 0.104; α(L)=0.0203 Ice(K)≈0.02.
720.4 *5*	0.24 *5*	1000.6	(7/2)	280.226	5/2⁺			
[x]743.5[&] *5*	0.27 *5*							
[x]792.0[&] *5*	0.16 *4*							
861.2 *3*	0.37 *4*	908.90	7/2⁺	47.71	9/2⁻			
908.8 *2*	2.60 *15*	908.90	7/2⁺	0.0	7/2⁻			
1000.6 *3*	0.19 *5*	1000.6	(7/2)	0.0	7/2⁻			

† From 1975Ah05, Photon intensity per 100 ε decays.

‡ From ce measurements in 1975Ah05. See also ^{241}Cm α decay. Ice′s given here were normalized in 1975Ah05 making use of α(K)exp (279.2γ of ^{203}Hg decay)=0.163 *2*.

Deduced by the evaluator from the ce intensities given in 1975Ah05. See also ^{241}Cm α decay.

@ Deduced from ce intensities of 1975Ah05.

& Assignment of these gammas to ^{237}Am decay is uncertain.

a For absolute intensity per 100 decays, multiply by 0.99975 *3*.

b 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.

c Multiply placed.

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.

^{237}Am ε decay 1975Ah05

Decay Scheme

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