^{245}Bk ε decay 1976Ah03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 189,1 (2023)	14-Feb-2023

Parent: ^{245}Bk: E=0.0; J^{π}=(3/2$^-$); $T_{1/2}$=4.96 d *3*; Q(ε)=809.3 *15*; %ε decay=99.88 *1*

^{245}Bk-Q(ε): From 2021Wa16.

1976Ah03: ^{245}Bk was produced from the irradiation of ^{243}Am with 34 MeV α particles at the Argonne 152 cm cyclotron. The chemically mass separated ^{245}Bk was then processed into a thin source. The electron capture decay of ^{245}Bk was investigated by measuring the gamma-rays and conversion-electron spectra with Ge(Li) and Si(Li) detectors, respectively. Measured $T_{1/2}$ of ^{245}Bk, Eγ, Iγ, E(ce), Ice, ceγ-coin. Deduced levels, multipolarity, J^{π} and log*ft*.

1975Ya03: ^{245}Bk was produced from the ^{241}Am(α,x) reaction at the Argonne 60-in cyclotron. The conversion electron spectra from the chemically separated ^{245}Bk were measured with a cooled Si(Li) detector. The γ rays were detected with a NaI(Tl) detector. Measured $T_{1/2}$ of 356-keV level by γ-ce delayed coin.

1956Ch77: ^{245}Bk was produced from the ^{243}Am(α,2n) and ^{244}Cm(α,p2n) reactions at the Crocker Laboratory. The gammas were measured with a thallium-activated sodium iodide crystal detector and x-rays were detected using a xenon-filled proportional counter. The electron spectrum in coincidence with K x-rays was observed with an anthracene scintillation crystal. Deduced decay scheme.

1956Ma32: ^{245}Bk was produced from the ^{244}Cm(d,n) and ^{243}Am(α,2n) reactions at the Argonne 60-in. cyclotron. Conversion electrons were measured with electron spectrometer, and the gammas were detected with a NaI detector. Measured ratios of conversion electron to K x-rays. Intensities of the x-rays were measured with the NaI detector.

1979Ah01: The electron spectrum was measured with a cooled Si(Li) spectrometer and the photon spectrum measured with Ge(Li) diodes. From the measured intensities of K-Auger electrons and K x-rays, K-shell fluorescence yield for Cm was deduced: ω(K)=97.1% *6*.

Using program RADLST, the evaluator has calculated from the decay scheme, x-ray intensities as follows: Kα_2 x ray=35.1 *22*, Kα_1 x ray=55 *4*, Kβ x ray=27.9 *18*. These values are compared with experimental results (1976Ah03) of Kα_2 x ray=35.0 *24*, Kα_1 x ray=54.0 *34*, and (Kβ_1' x ray=20.5 *15* + K$\beta_2'\xi$ ray=7.3 *5*)= 27.8 *16*. This agreement confirms the quality of the data and the consistency of the decay scheme.

^{245}Cm Levels

E(level)‡	J^{π}†	$T_{1/2}$†	Comments
0.0	7/2$^+$	8423 y *74*	
54.819 *20*	9/2$^+$	≤0.10 ns	
252.833 *23*	5/2$^+$		
295.701 *17*	7/2$^+$		
355.95 *10*	1/2$^+$	0.29 μs *2*	$T_{1/2}$: From γ-ce delayed coincidence method (1975Ya03).
361.4 *4*	3/2$^+$		
418.7 *4*	5/2$^+$		
633.63 *11*	(3/2)$^-$		
661.52 *8*	(5/2)$^-$		
740.97 *12*	(1/2$^+$)		
769.2 *4*	(3/2)$^+$		

† From Adopted Levels.
‡ From least-squares fit to Eγ data by the evaluator.

^{245}Bk ε decay 1976Ah03 (continued)

ε radiations

E(decay)	E(level)	Iε[†‡]	Log *ft*	Comments
(40.1 *16*)	769.2	0.184 *20*	6.42 *8*	εL=0.38 *3*; εM+=0.62 *3*
(68.3 *15*)	740.97	1.04 *10*	6.37 *5*	εL=0.589 *5*; εM+=0.411 *5*
(147.8 *15*)	661.52	0.62 *6*	7.46 *5*	εK=0.076 *10*; εL=0.633 *6*; εM+=0.291 *4*
(175.7 *15*)	633.63	2.61 *26*	7.09 *5*	εK=0.247 *9*; εL=0.523 *6*; εM+=0.230 *3*
(390.6 *16*)	418.7			
(447.9 *16*)	361.4			
(453.4 *15*)	355.95	5.7 *14*	8.00 *11*	εK=0.6659 *6*; εL=0.2420 *4*; εM+=0.09208 *17* Iε: Sum of ε intensities to 355.95, 361.4, 418.7 levels.
(556.5 *15*)	252.833	90 *9*	7.02 *5*	εK=0.6930 *3*; εL=0.2233 *2*; εM+=0.08365 *10*

† Deduced by the evaluator from intensity balance at each level.

‡ Absolute intensity per 100 decays.

$\gamma(^{245}Cm)$

Iγ normalization: The evaluator has normalized the decay scheme assuming no ε feeding neither to the ^{245}Cm ground state (J^π=7/2$^+$) nor to the 55-keV level (J^π=9/2$^+$), as expected from ^{245}Bk (J^π=3/2$^-$), and using the sum of the intensities of the 252- and 198-keV γ rays as the full strength of the ε decay (99.88 % 1).

Measured x-ray intensities (1976Ah03)

Energy	Intensity	x-ray
104.6 *1*	35.0 *24*	Cm Kα_2
109.3 *1*	54.0 *34*	Cm Kα_1
123.2 *2*	20.5 *15*	Cm Kβ_1′
127.1 *2*	7.3 *5*	Cm Kβ_2′

E$_\gamma$[†]	I$_\gamma$[†b]	E$_i$(level)	J^π_i	E$_f$	J^π_f	Mult.[‡]	δ	α[a]	Comments
(42.87[&] *2*)		295.701	7/2$^+$	252.833	5/2$^+$				
(54.77[&] *3*)		54.819	9/2$^+$	0.0	7/2$^+$				
103.1 *1*	0.4	355.95	1/2$^+$	252.833	5/2$^+$	E2		16.25 *24*	α(L)=11.74 *17*; α(M)=3.32 *5* α(N)=0.924 *14*; α(O)=0.2238 *33*; α(P)=0.0372 *5*; α(Q)=0.0001572 *23* %Iγ=0.39 L12:L3:M:NO=2.8 *2*:1.83 *13*:1.35 *13*:0.50 *6*. (1976Ah03); α(exp)= 16.6 (1975Ya03). I$_\gamma$: Deduced by the evaluator from total intensity provided in Fig. 10 (see note from pg.15) in 1976Ah03 and α(BrIcc).
198.0 *1*	0.17 *2*	252.833	5/2$^+$	54.819	9/2$^+$	E2		1.023 *14*	α(K)=0.1475 *21*; α(L)=0.634 *9*; α(M)=0.1778 *25* α(N)=0.0494 *7*; α(O)=0.01203 *17*; α(P)=0.002046 *29*; α(Q)=1.829×10^{-5} *26* %Iγ=0.167 *23* K:L12:L3=≤0.03:0.065 *6*:0.025 *3*;α(K)exp ≤0.18, α(L12)exp =0.38, α(L3)exp =0.15 (1976Ah03).
(240.90[&] *4*)		295.701	7/2$^+$	54.819	9/2$^+$	M1[#]		2.63 *4*	α(K)=2.064 *29*; α(L)=0.423 *6*; α(M)=0.1033 *14* α(N)=0.0284 *4*; α(O)=0.00722 *10*; α(P)=0.001421 *20*; α(Q)=0.0001015 *14*
252.85 *5*	31.3 *20*	252.833	5/2$^+$	0.0	7/2$^+$	M1+E2[#]	0.16[@] *+6−4*	2.25 *5*	α(K)=1.76 *4*; α(L)=0.366 *6*; α(M)=0.0895 *14* α(N)=0.0246 *4*; α(O)=0.00626 *10*; α(P)=0.001228 *20*; α(Q)=8.66×10^{-5} *21* %Iγ=30.7 *5*

$^{245}_{96}Cm_{149}$-3

γ(^{245}Cm) (continued)

E_γ[†]	I_γ[†b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[‡]	δ	α[a]	Comments
									K:L12:L3:M:NO=53.2 *37*:11.1 *8*:0.081 *8*:2.86 *21*:1.11 *8*; α(K)exp =1.70, α(L12)exp =0.35, α(L3)exp =0.0026, α(M)exp=0.091, α(NO)exp =0.035 (1976Ah03).
272.2 *3*	0.013 *3*	633.63	$(3/2)^-$	361.4	$3/2^+$	[E1]		0.0537 *8*	α(K)=0.0420 *6*; α(L)=0.00878 *12*; α(M)=0.002142 *30* α(N)=0.000584 *8*; α(O)=0.0001458 *21*; α(P)=2.71×10^{-5} *4*; α(Q)=1.486×10^{-6} *21* %Iγ=0.0127 *31*
(295.73[&] *2*)		295.701	$7/2^+$	0.0	$7/2^+$	M1+E2[#]	0.39[@] *+17−24*	1.32 *14*	α(K)=1.02 *12*; α(L)=0.223 *13*; α(M)=0.0550 *28* α(N)=0.0151 *8*; α(O)=0.00384 *20*; α(P)=0.00075 *5*; α(Q)=5.0×10^{-5} *6*
350.5 *1*	0.082 *7*	769.2	$(3/2)^+$	418.7	$5/2^+$	M1		0.929 *13*	α(K)=0.731 *10*; α(L)=0.1487 *21*; α(M)=0.0363 *5* α(N)=0.00996 *14*; α(O)=0.00254 *4*; α(P)=0.000499 *7*; α(Q)=3.56×10^{-5} *5* %Iγ=0.080 *9* K:L12=0.061 *6*:0.014 *2*; α(K)exp =0.74, α(L12)exp =0.17 (1976Ah03).
365.8 *1*	0.39 *3*	661.52	$(5/2)^-$	295.701	$7/2^+$	E1		0.0287 *4*	α(K)=0.02268 *32*; α(L)=0.00451 *6*; α(M)=0.001096 *15* α(N)=0.000299 *4*; α(O)=7.50×10^{-5} *11*; α(P)=1.412×10^{-5} *20*; α(Q)=8.27×10^{-7} *12* %Iγ=0.38 *4* Ice(K)=0.013 *4*; α(K)exp =0.033 (1976Ah03).
380.8 *1*	2.58 *18*	633.63	$(3/2)^-$	252.833	$5/2^+$	E1		0.0264 *4*	α(K)=0.02091 *29*; α(L)=0.00413 *6*; α(M)=0.001003 *14* α(N)=0.000274 *4*; α(O)=6.87×10^{-5} *10*; α(P)=1.296×10^{-5} *18*; α(Q)=7.65×10^{-7} *11* %Iγ=2.53 *24* L12:M=0.011 *1*:0.0043 *8*; α(L12)exp =0.0043, α(M)exp =0.0017(1976Ah03).
385.0 *1*	0.61 *4*	740.97	$(1/2^+)$	355.95	$1/2^+$	M1		0.718 *10*	α(K)=0.565 *8*; α(L)=0.1147 *16*; α(M)=0.0280 *4* α(N)=0.00769 *11*; α(O)=0.001958 *27*; α(P)=0.000385 *5*; α(Q)=2.74×10^{-5} *4* %Iγ=0.60 *6* K:L12:M:NO=0.340 *25*:0.075 *7*:0.023 *2*:0.010 *2*; α(K)exp =0.56, α(L12)exp =0.12, α(M)exp =0.038 α(NO)exp =0.016(1976Ah03).
407.8 *2*	0.03	769.2	$(3/2)^+$	361.4	$3/2^+$				%Iγ=0.029 *6* ce(K)(407.8γ+408.7γ)=0.017 *2* (1976Ah03).
408.7 *1*	0.23 *2*	661.52	$(5/2)^-$	252.833	$5/2^+$	[E1]		0.02287 *32*	α(K)=0.01816 *25*; α(L)=0.00355 *5*; α(M)=0.000861 *12* α(N)=0.0002349 *33*; α(O)=5.90×10^{-5} *8*; α(P)=1.116×10^{-5} *16*; α(Q)=6.69×10^{-7} *9* %Iγ=0.225 *25*
488.2 *2*	0.015 *3*	740.97	$(1/2^+)$	252.833	$5/2^+$	[E2]		0.0623 *9*	α(K)=0.0345 *5*; α(L)=0.02039 *29*; α(M)=0.00546 *8*

$\gamma(^{245}$Cm) (continued)

E_γ †	E_i(level)	Comments
		α(N)=0.001511 *21*; α(O)=0.000373 *5*; α(P)=6.73×10^{-5} *9*; α(Q)=2.012×10^{-6} *28* %Iγ=0.0147 *31*

† From 1976Ah03.
‡ From experimental conversion-electron data in 1976Ah03, except as noted. These values deduced here are given in the Adopted Gammas.
\# From Adopted Gammas.
@ From Adopted Gammas.
& γ-ray not observed in ^{245}Bk ε decay; Eγ from Adopted Gammas.
a Additional information 1.
b For absolute intensity per 100 decays, multiply by 0.98 *7*.

$^{245}_{96}$Cm$_{149}$-5

^{245}Bk ε decay 1976Ah03