^{246}Bk $\varepsilon+\beta^+$ decay 1976Ah03

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 198,449 (2024)	31-Jul-2022

Parent: ^{246}Bk: E=0.0+x; J$^\pi$=2$^{(-)}$; T$_{1/2}$=1.80 d *2*; Q(ε)=1350 *60*; %ε+%β^+ decay=100

^{246}Bk-Q(ε): From 2021Wa16.

1976Ah03: ^{246}Bk was produced from the irradiation of ^{243}Am with 34 MeV α particles at the Argonne 152 cm cyclotron. The chemically mass separated ^{246}Bk was then processed into a thin source. The electron capture decay of ^{246}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 ^{246}Bk, Eγ, Iγ, E(ce), Ice, ceγ-coin, Deduced levels, multipolarity, J^π and log*ft*. See earlier report: 1966Ah02.

Other: 1966Or01.

Using program RadiationReport, the evaluator has calculated from the decay scheme, x-ray intensities as follows: Kα_2 x ray=19.7 *24*, Kα_1 x ray=30.9 *38*, Kβ_{12} x ray=15.6 *19*. These values are compared with experimental results (1976Ah03) of Kα_2 x ray=19.0 *13*, Kα_1 x ray=29.0 *2*, and (Kβ_1 x ray=11.0 *8* + Kβ_2 x ray=4.0 *3*)= 15.0 *8*. This agreement confirms the quality of the data and the consistency of the decay scheme.

^{246}Cm Levels

E(level)‡	J$^\pi$†	T$_{1/2}$†
0.0	0$^+$	4706 y *40*
42.85 *10*	2$^+$	123.2 ps *23*
142.06 *12*	4$^+$	
841.55 *12*	2$^-$	
876.36 *12*	3$^-$	
1078.83 *9*	1$^-$	
1104.85 *14*	2$^-$	
1124.28 *9*	2$^+$	
1128.09 *12*	3$^-$	
1165.49 *11*	3$^+$	

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

ε,β^+ radiations

E(decay)	E(level)	Iε†‡	Log *ft*	Comments
(1.9×10^2 *6*)	1165.49	0.55 *11*	7.4 *6*	εK=0.3 *3*; εL=0.49 *18*; εM+=0.21 *12*
(2.2×10^2 *6*)	1128.09	0.27 *5*	8.0 *5*	εK=0.4 *3*; εL=0.40 *18*; εM+=0.17 *10*
(2.3×10^2 *6*)	1124.28	10.8 *9*	6.4 *5*	εK=0.4 *3*; εL=0.39 *17*; εM+=0.16 *9*
(2.5×10^2 *6*)	1104.85	2.97 *29*	7.1 *4*	εK=0.49 *20*; εL=0.36 *13*; εM+=0.15 *7*
(2.7×10^2 *6*)	1078.83	5.6 *5*	6.9 *4*	εK=0.53 *14*; εL=0.33 *9*; εM+=0.13 *5*
(4.7×10^2 *6*)	876.36	21.5 *22*	7.03 *16*	εK=0.673 *22*; εL=0.237 *16*; εM+=0.090 *7*
(5.1×10^2 *6*)	841.55	50 *6*	6.74 *15*	εK=0.682 *18*; εL=0.231 *13*; εM+=0.087 *6*
(1.21×10^3 *6*)	142.06	≤0.56	≥10.2^{1u}	εK=0.704 *5*; εL=0.215 *4*; εM+=0.0804 *16*
(1.31×10^3 *6*)	42.85	≈7.5	≈8.5	εK=0.7484 *17*; εL=0.1850 *12*; εM+=0.0666 *6*
(1.35×10^3 *6*)	0.0	≤3	≥9.7^{1u}	εK=0.714 *4*; εL=0.209 *3*; εM+=0.0774 *12* Iε: −6 % *9* deduced by the evaluator from I(K x ray), Q(ε), ε branchings, theoretical K/ε ratios of the proposed level scheme and the experimental K-shell fluorescence yield ω=0.976 (1976Ah03). Negative feeding −9 % *10* was also deduced by 1976Ah03. A limit of Iε≤3 is given by the evaluator.

Continued on next page (footnotes at end of table)

^{246}Bk ε+β^+ decay 1976Ah03 (continued)

ε,β^+ radiations (continued)

† From level scheme intensity balance, unless otherwise noted. In order to generate an output from the LOGFT code, the evaluator had set the E(parent)=0.0.
‡ Absolute intensity per 100 decays.

$\gamma(^{246}Cm)$

Iγ normalization: From ΣI(γ+ce)(to 0.0+43 level)= 91% *4*. (I(γ+ce)(42.8γ) not included in this sum), since Iβ^-(g.s.) + Iβ(42-keV state)=9% *4* (1976Ah03). Uncertainty was not provided by authors (1976Ah03), but was assigned by the evaluator ε(g.s.)<8% from K x ray intensity (1976Ah03).

The evaluator calculated the number of K-shell holes due to internal conversions (0.49 *2*) and electron captures (69 *8*). The latter was deduced from ε branchings and theoretical K/ε ratios for Q+=1350 *60* keV. Experimental K-shell fluorescence yield correction of 0.971 *6* (1979Ah01) was used in the calculation to determine the total I(K x ray)= 68 % *8* which is in agreement with the measured value 63 % *4* by 1976Ah03.

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       Measured x-ray intensities (1976Ah03)
 Energy        Intensity     x-ray

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 104.6 1       19.0 13       Cm Kα2
 109.3 1       29.0 2        Cm Kα1
 123.2 2       11.0 8        Cm Kβ1'
 127.1 2       4.0 3         Cm Kβ2'
 Σ  I(K  x ray)=63 4    (1976Ah03)
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E_γ[†]	I_γ[†b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[a]	$I_{(\gamma+ce)}$[b]	Comments
34.8[#] *1*	0.0084[@] *7*	876.36	3^-	841.55	2^-	(M1,E2)	1.5×10^3 *14*	12.9 *16*	α(L)=1.1×10^3 *10*; α(M)=3.1×10^2 *28* α(N)=9.E1 8; α(O)=21 *19*; α(P)=3.5 *31*; α(Q)=0.021 *7* %Iγ=0.0086 *9* Mult.: M:N+O=2.6 *2*:0.76 *8*(1976Ah03). M1,E2 given by 1976Ah03. Note that BrIccMixing code gives a high reduced χ^2. $I_{(\gamma+ce)}$: From I(ce(M))=2.6 *2*, Ice(N+O)=0.76 *8*, (1976Ah03).
42.8[#]	≈0.085[@]	42.85	2^+	0.0	0^+	E2	1070 *15*	≈91	ce(L)/(γ+ce)=0.723 *8*; ce(M)/(γ+ce)=0.204 *4* ce(N)/(γ+ce)=0.0566 *11*; ce(O)/(γ+ce)=0.01368 *27*; ce(P)/(γ+ce)=0.00223 *4*; ce(Q)/(γ+ce)=5.49×10^{-6} *11* α(L)=774 *11*; α(M)=218.1 *31* α(N)=60.6 *8*; α(O)=14.65 *21*; α(P)=2.393 *34*; α(Q)=0.00587 *8* %Iγ≈0.087 $I_{(\gamma+ce)}$: From Ice(L1+L2)≈35, Ice(L3)≈30, Ice(M)=18.5 *14*, and Ice(N+O)=7.3 *6* (1976Ah03). Mult.: L1+L2:L3≈ 35:30 (1976Ah03) M:N+O= 18.5 *14*:7.3 6 (1976Ah03).
99.2[#] *1*	0.20[@] *1*	142.06	4^+	42.85	2^+	E2	19.43 *29*	4.0 *2*	ce(L)/(γ+ce)=0.687 *7*; ce(M)/(γ+ce)=0.1943 *35*

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γ(^{246}Cm) (continued)

E_γ [†]	I_γ [†b]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [‡]	α [a]	Comments
								ce(N)/(γ+ce)=0.0541 *11*; ce(O)/(γ+ce)=0.01310 *27*; ce(P)/(γ+ce)=0.00217 *4*; ce(Q)/(γ+ce)=8.89×10^{-6} *18* α(L)=14.05 *21*; α(M)=3.97 *6* α(N)=1.105 *16*; α(O)=0.268 *4*; α(P)=0.0444 *7*; α(Q)=0.0001817 *26* %Iγ=0.204 *17* $I_{(\gamma+ce)}$: From Ice(L1+L2)=1.86 *14*, Ice(L3)=1.25 *9*, Ice(M)=0.89 *17* (1976Ah03). Mult.: L1+L2:L3:M= 1.86 *14*:1.25 *9*:0.89 *7* (1976Ah03).
734.3 *1*	3.1 *2*	876.36	3$^-$	142.06	4$^+$	E1	0.00752 *11*	α(K)=0.00606 *8*; α(L)=0.001100 *15*; α(M)=0.000265 *4* α(N)=7.22×10^{-5} *10*; α(O)=1.825×10^{-5} *26*; α(P)=3.52×10^{-6} *5*; α(Q)=2.327×10^{-7} *33* %Iγ=3.16 *30* Mult.: α(K)exp=0.0061,α(L1+L2)exp=0.0013, K:L1+L2= 0.019 *13*:0.004 *1* (1976Ah03); α(K)exp≤0.01 (1966Or01).
798.7 *1*	61 *4*	841.55	2$^-$	42.85	2$^+$	E1	0.00648 *9*	α(K)=0.00523 *7*; α(L)=0.000941 *13*; α(M)=0.0002260 *32* α(N)=6.17×10^{-5} *9*; α(O)=1.560×10^{-5} *22*; α(P)=3.01×10^{-6} *4*; α(Q)=2.017×10^{-7} *28* %Iγ=62 *6* Mult.: K:L1+L2:L3:α(K)exp:α(L1+L2)exp:α(L3)exp:K/L= 0.32 *2*:0.055 *4*:0.005 *1*:0.0052:0.0009:0.000081:≈5.2.
833.5 *1*	5.0 *3*	876.36	3$^-$	42.85	2$^+$	E1	0.00601 *8*	α(K)=0.00486 *7*; α(L)=0.000870 *12*; α(M)=0.0002088 *29* α(N)=5.70×10^{-5} *8*; α(O)=1.443×10^{-5} *20*; α(P)=2.79×10^{-6} *4*; α(Q)=1.876×10^{-7} *26* %Iγ=5.1 *5* Mult.: α(K)exp=0.0052 (1976Ah03); α(K)exp 0.004 *2* (1966Or01).
982.2 *2*	0.22 *2*	1124.28	2$^+$	142.06	4$^+$	[E2]	0.01428 *20*	α(K)=0.01042 *15*; α(L)=0.00287 *4*; α(M)=0.000727 *10* α(N)=0.0002001 *28*; α(O)=5.02×10^{-5} *7*; α(P)=9.51×10^{-6} *13*; α(Q)=5.00×10^{-7} *7* %Iγ=0.224 *26*
986.03 *4*	0.26 *3*	1128.09	3$^-$	142.06	4$^+$	(E1)	0.00449 *6*	%Iγ=0.27 *4* α(K)=0.00364 *5*; α(L)=0.000642 *9*; α(M)=0.0001539 *22* α(N)=4.20×10^{-5} *6*; α(O)=1.064×10^{-5} *15*; α(P)=2.065×10^{-6} *29*; α(Q)=1.417×10^{-7} *20* E_γ,Mult.: From Adopted Gammas. Mult.: α(K)exp≤0.008 (1966Or01).
1023.4 *2*	0.15 *2*	1165.49	3$^+$	142.06	4$^+$	[E2]	0.01321 *18*	α(K)=0.00971 *14*; α(L)=0.00260 *4*; α(M)=0.000657 *9* α(N)=0.0001808 *25*; α(O)=4.54×10^{-5} *6*; α(P)=8.62×10^{-6} *12*; α(Q)=4.63×10^{-7} *6* %Iγ=0.153 *23*
1036.0 *1*	1.75 *13*	1078.83	1$^-$	42.85	2$^+$	E1	0.00412 *6*	α(K)=0.00334 *5*; α(L)=0.000588 *8*; α(M)=0.0001409 *20* α(N)=3.84×10^{-5} *5*; α(O)=9.75×10^{-6} *14*; α(P)=1.893×10^{-6} *27*; α(Q)=1.306×10^{-7} *18* %Iγ=1.79 *18* Mult.: α(K)exp=0.0037 (1976Ah03); α(K)exp≤0.003 (1966Or01).
1062.0 *1*	2.9 *2*	1104.85	2$^-$	42.85	2$^+$	E1	0.00395 *6*	α(K)=0.00320 *4*; α(L)=0.000563 *8*; α(M)=0.0001348 *19* α(N)=3.68×10^{-5} *5*; α(O)=9.33×10^{-6} *13*; α(P)=1.813×10^{-6} *25*; α(Q)=1.254×10^{-7} *18* %Iγ=2.96 *29* Mult.: α(K)exp=0.0029 (1976Ah03); α(K)exp≤0.003 (1966Or01).
1078.8 *1*	3.7 *3*	1078.83	1$^-$	0.0	0$^+$	E1	0.00385 *5*	α(K)=0.00312 *4*; α(L)=0.000548 *8*; α(M)=0.0001311 *18*

$\gamma(^{246}Cm)$ (continued)

E_γ [†]	I_γ [†b]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [‡]	α [a]	Comments
								α(N)=3.58×10^{-5} *5*; α(O)=9.07×10^{-6} *13*; α(P)=1.764×10^{-6} *25*; α(Q)=1.222×10^{-7} *17* %Iγ=3.8 *4* Mult.: α(K)exp=0.0041 (1976Ah03); α(K)exp≤0.003 (1966Or01).
1081.4 *1*	5.8 *4*	1124.28	2$^+$	42.85	2$^+$	E2	0.01190 *17*	α(K)=0.00884 *12*; α(L)=0.002286 *32*; α(M)=0.000575 *8* α(N)=0.0001581 *22*; α(O)=3.98×10^{-5} *6*; α(P)=7.57×10^{-6} *11*; α(Q)=4.17×10^{-7} *6* %Iγ=5.9 *6* Mult.: α(K)exp=0.0093 (1976Ah03); α(K)exp=0.008 *3* (1966Or01); K/L≈3.9 (1966Or01).
1122.64 [&] *6*	0.38 [&] *7*	1165.49	3$^+$	42.85	2$^+$	E2	0.01110 *16*	α(K)=0.00829 *12*; α(L)=0.002097 *29*; α(M)=0.000526 *7* α(N)=0.0001446 *20*; α(O)=3.64×10^{-5} *5*; α(P)=6.94×10^{-6} *10*; α(Q)=3.89×10^{-7} *5* α(IPF)=2.167×10^{-7} *31* %Iγ=0.39 *8* E_γ: From Adopted Gammas.
1124.3 [&] *1*	4.4 [&] *3*	1124.28	2$^+$	0.0	0$^+$	E2	0.01107 *15*	α(K)=0.00827 *12*; α(L)=0.002090 *29*; α(M)=0.000524 *7* α(N)=0.0001441 *20*; α(O)=3.63×10^{-5} *5*; α(P)=6.92×10^{-6} *10*; α(Q)=3.88×10^{-7} *5* α(IPF)=2.328×10^{-7} *34* %Iγ=4.5 *4* Mult.: α(K)exp=0.0085, K:L1+L2=0.041 *3*:0.0078 *12* (1976Ah03).

[†] From 1976Ah03, unless otherwise noted.
[‡] From Adopted Gammas. α and ce-ratios from 1976Ah03 are given in comments. Normalization of I(ce) to Iγ not stated (1976Ah03); normalized to α(K)(799γ,E1)=0.00524 (1966Or01).
[#] Observed in ce spectrum only (1976Ah03).
[@] Deduced by the evaluator from I(γ+ce) and α.
[&] The 1124.3γ appears to be a doublet from ^{246}Am (25 min) decay. From ^{246}Am (25 min) decay Iγ(1122.64)/Iγ(1023.44)=2.5 *3*, the evaluator deduced Iγ(1122.64)=0.38 *7* at E=1165−keV level and Iγ(1124.3)=4.4 *3* at E=1124−keV level.
[a] Additional information 1.
[b] For absolute intensity per 100 decays, multiply by 1.02 *7*.

From ENSDF

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^{246}Bk ε decay 1976Ah03

Decay Scheme

Intensities: I_γ per 100 parent decays