^{249}Bk α decay 2013Ah03

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

Parent: ^{249}Bk: E=0.0; $J^\pi=7/2^+$; $T_{1/2}$=327.2 d *3*; Q(α)=5521.0 *14*; %α decay=1.37×10^{-3} *10*

^{249}Bk-$T_{1/2}$: Measured by 2014Ch47 from growth of daughter activity ^{249}Cf and γ-ray intensities from subsequent decay of ^{249}Cf. The most recent adopted $T_{1/2}$ for ^{249}Bk prior to 2014Ch47 is 330 d *4* (2011Ab07).

^{249}Bk-J^π: From ^{249}Bk Adopted Levels in the ENSDF database.

^{249}Bk-Q(α): From 2021Wa16.

^{249}Bk-%α decay: From 1969Mi08. Based on the argument of 2013Ah03 who preferred %α=0.00137 *10* over 0.00145 *8*, both of which are from two separate methods in 1969Mi08. The former value does not depend on detector solid angle and the initial analysis of the number of ^{249}Bk atoms. The most recent adopted %α for ^{249}Bk for ^{249}Bk prior to 2014Ch47 is 1.45×10^{-3} *8 4* (2011Ab07).

2013Ah03: 10−μg of purified ^{249}Bk was obtained from ORNL in which, 1−μg ^{249}Bk source was used for measuring the γ-ray singles and 0.3−μg of ^{249}Bk for the $\gamma\alpha$-coin measurement. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma\alpha$-coin. Low energy photon spectrometer (LEPS) was used to measure γ rays and a Passivated Implanted Planar Silicon detector (PIPS) to detect the α particles. A Ge detector was also used for the $\gamma\gamma$-coin measurement. The Eα and Iα were measured at ANL with the Argonne double-focusing magnetic α spectrometer. Deduced levels, J, π, α hindrance factors using radius parameter= 9.323 fm.

1994Po30: α spectra were measured with a Si(Au) detector with 35 keV energy resolution for the 5486 keV α-line in ^{241}Am. Measured M and L x-rays.

1993Po20: ^{249}Bk produced at the high flux reactor and subsequently purified and extracted. The γ-rays were measured with a Ge(Li) detector with FWHM= 2.0 keV and 3.0 keV for the 122 keV ^{57}Co and 661.6 keV ^{137}Cs lines, respectively. Measured Eγ and Iγ.

1975Ba27, 1971Bb10, 1969Ba57: α decay from ^{249}Bk was studied using a double focus magnetic α spectrograph. The energies were determined for the intense α groups. The energy of the main α group in both 1971Bb10 and 1969Ba57 were different due to the correction made to the energy standard ^{242}Cm α_0 group. 1975Ba27 determined Eα and Iα for ten α groups and identified three rotational bands with the configurations: 5/2$^-$[523], 5/2$^+$[624], and 7/2$^+$[633].

1966Ah02: ^{249}Bk produced from neutron irradiation of Cm at LBNL. The α decay particles from the isolated and purified ^{249}Bk were analyzed with a double-focusing magnetic spectrograph. The γ singles were measured with Ge(Li) detectors. Weak alpha groups were observed in coincidence with γ-rays. Eα values in 1966Ah02 have been revised by 2013Ah03 by 1.0 keV using new energies of ^{238}Pu and ^{240}Pu as an internal calibration.

1956Ch77: ^{249}Bk produced from neutron irradiation of Pu. Measured $\gamma\alpha$-coin, from decay of ^{245}Bk . Deduced Eγ, Iγ, Eα and Iα, I(K x-ray) and I(L x-ray).

^{245}Am Levels

E(level)†	J^π‡	$T_{1/2}$	Comments
0.0#	5/2$^+$	2.05 h *1*	$T_{1/2}$: From Adopted Level.
19.3# *25*	7/2$^+$		
28.27@ *13*	(5/2$^-$)		E(level): From Adopted Level.
47.8# *25*	(9/2$^+$)		
71.1@ *25*	(7/2$^-$)		
88.4# *25*	(11/2$^+$)		
124.0@ *25*	(9/2$^-$)		
134.2# *25*	(13/2$^+$)		
154.5& *25*	(3/2$^-$)		
187.0& *25*	(5/2$^-$)		
231.7& *25*	(7/2$^-$)		

Continued on next page (footnotes at end of table)

^{249}Bk α decay 2013Ah03 (continued)

^{245}Am Levels (continued)

E(level)[†]	Jπ[‡]
292.7[&] *25*	(9/2⁻)
328.3[a] *25*	7/2⁺
397.4[a] *25*	9/2⁺
475.6[a] *25*	11/2⁺

[†] Level energies are calculated from Qα(^{249}Bk)=5521.0 *14*, (2021Wa16) and measured Eα′s.
[‡] From Adopted Levels.
[#] Band(A): π5/2[642] band.
[@] Band(B): π5/2[523] band.
[&] Band(C): π3/2[521] band.
[a] Band(D): π7/2[633] band.

α radiations

Eα[†]	E(level)	Iα[†#]	HF[‡]	Comments
4965 *4*	475.6	≈0.01	≈59	
5042 *2*	397.4	0.12 *1*	16.7 *19*	
5110 *2*	328.3	2.70 *5*	2.13 *17*	
5145 *2*	292.7	0.018 *5*	5.5×10^{2} *16*	
5205 *2*	231.7	0.048 *7*	504 *83*	
5249 *2*	187.0	0.09 *1*	516 *70*	
5281 *2*	154.5	0.09 *1*	8.2×10^{2} *11*	
5301 *2*	134.2	0.046 *7*	2.15×10^{3} *37*	
5311 *2*	124.0	0.03 *1*	3.8×10^{3} *13*	
5346 *2*	88.4	2.60 *5*	73 *6*	
5363 *2*	71.1	0.077 *8*	3.14×10^{3} *41*	
5386 *2*	47.8	17.9 *2*	18.7 *15*	
(5405)	28.27			Eα: Not observed as it was masked by the strong E(α)=5414 keV.
5414 *2*	19.3	69.7 *3*	7.1 *6*	Iα: Large intensity to the 7/2 member of the ground-state band is due to the strong Coriolis mixing between the 5/2⁺[624] and 7/2⁺[633] orbitals (2015Ah03,1966Ah02).
5433 *2*	0.0	6.57 *10*	98 *8*	

[†] From 2013Ah03.
[‡] The nuclear radius parameter r_0(^{245}Am)=1.48943 *52* is deduced from interpolation (or unweighted average) of radius parameters of the adjacent even-even nuclides.
[#] For absolute intensity per 100 decays, multiply by 1.37×10^{-5} *10*.

γ(^{245}Am)

Measured x-ray intensities (2013Ah03)

Energy	Intensity	x-ray	
102.04 *4*	0.35 *3*	Am $K_{\alpha2}$	
106.48 *4*	0.53 *4*	Am $K_{\alpha1}$	
119.26 *4*		Am $K_{\beta3}$	
119.26+120.31	0.22 *2*	Am $K_{\beta3}$+Am	K_{b1}
120.31 *4*		Am $K_{\beta1}$	
123.8 *3*	0.08 *1*	Am $K_{\beta2}$	

See 1990Po14 for Intensities of M and L x-ray emissions

E_γ [†]	I_γ [†@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	α[#]	Comments
28.0 *1*	≈0.10	28.27	(5/2$^-$)	0.0	5/2$^+$	(E1)		3.75 *6*	α(L)=2.78 *5*; α(M)=0.729 *12* α(N)=0.1950 *33*; α(O)=0.0443 *7*; α(P)=0.00588 *10*; α(Q)=0.0001379 *21*
280.36 *4*	0.10 *1*	328.3	7/2$^+$	47.8	(9/2$^+$)	(M1+E2)	0.7 *+7−6*	1.1 *4*	α(K)=0.9 *4*; α(L)=0.21 *4*; α(M)=0.054 *8* α(N)=0.0147 *20*; α(O)=0.0037 *5*; α(P)=0.00068 *13*; α(Q)=3.6×10^{-5} *15*
308.26 *4*	0.24 *2*	328.3	7/2$^+$	19.3	7/2$^+$	M1(+E2)	0.6 *9*	0.9 *4*	α(K)=0.7 *4*; α(L)=0.17 *4*; α(M)=0.041 *9* α(N)=0.0113 *24*; α(O)=0.0028 *6*; α(P)=5.3×10^{-4} *14*; α(Q)=3.0×10^{-5} *15* Mult.: M1 in 2013Ah03.
327.45 *4*	1.06 *6*	328.3	7/2$^+$	0.0	5/2$^+$	M1(+E2)	0.5 *7*	0.85 *33*	α(K)=0.66 *29*; α(L)=0.145 *34*; α(M)=0.036 *7* α(N)=0.0098 *20*; α(O)=0.0025 *5*; α(P)=0.00046 *11*; α(Q)=2.7×10^{-5} *11* I_γ: Weighted average of 1.05 *9* and 1.06 *7* determined by two separate methods (2013Ah03). Former value from measured absolute intensity (per 100 decays of ^{249}Bk)=0.00144 *8* and the latter value deduced from intensity balance at level 327-keV. Mult.: M1 in 2013Ah03.

† From 2015Ah03.
‡ From Adopted Gammas. Multipolarities from 2013Ah03, based on Iγ- and I(x-ray) data are given in comments.
# Additional information 1.
@ For absolute intensity per 100 decays, multiply by 1.37×10^{-5} *10*.

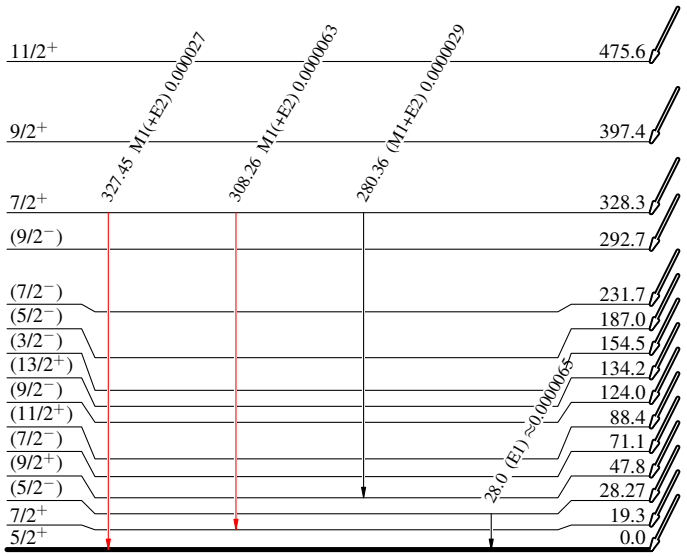
^{249}Bk α decay 2013Ah03

Decay Scheme

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

Legend

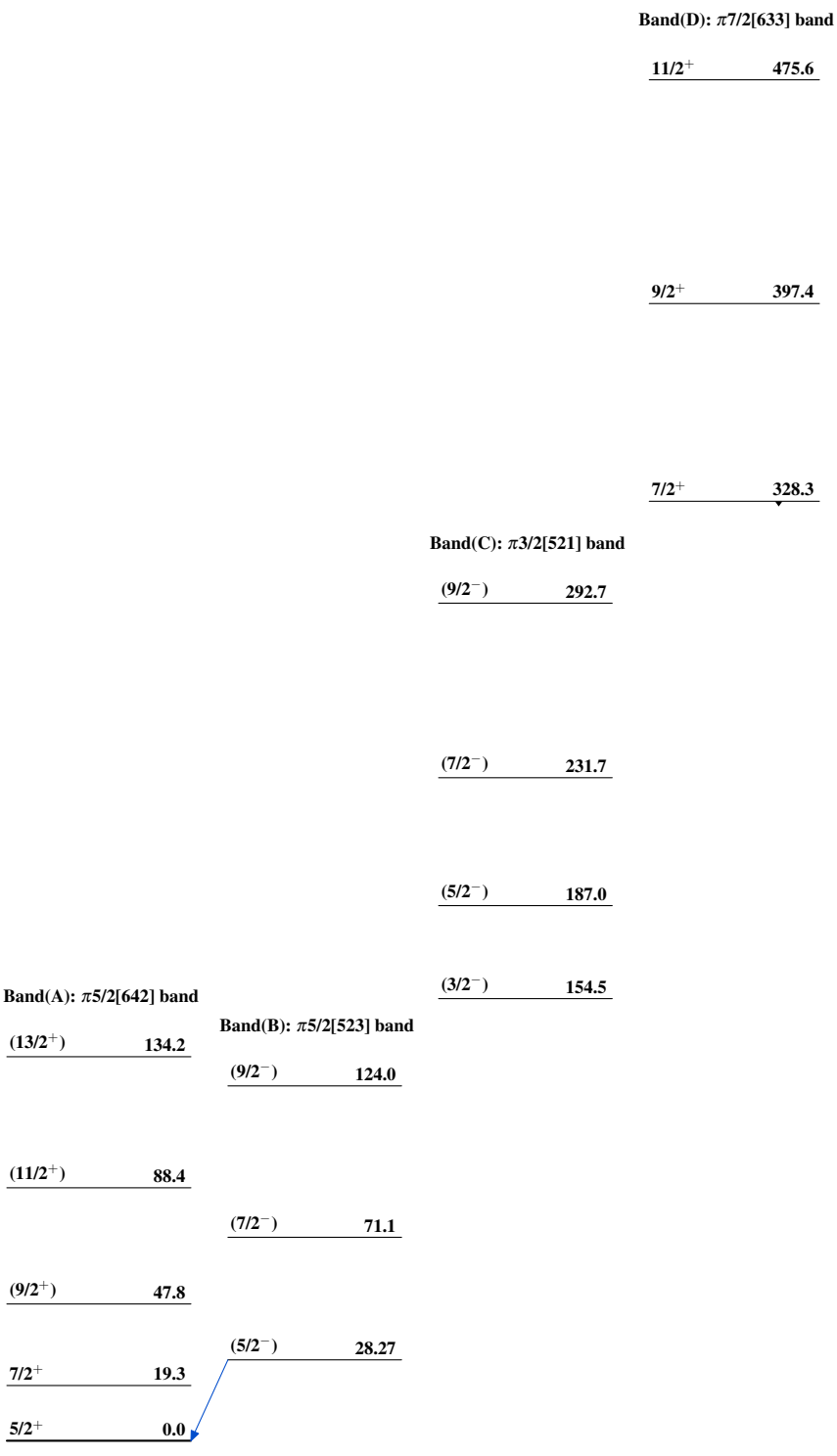
$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$



Eα	Iα	HF
4965	1.37×10^{-7}	≈59
5042	1.64×10^{-6}	16.7
5110	0.0000370	2.13
5145	2.5×10^{-7}	550
5205	6.6×10^{-7}	504
5249	1.23×10^{-6}	516
5281	1.23×10^{-6}	820
5301	6.3×10^{-7}	2150
5311	4.1×10^{-7}	3800
5346	0.0000356	73
5363	1.06×10^{-6}	3140
5386	0.000245	18.7
5405	0	
5414	0.00096	7.1
5433	0.000090	98

$^{245}_{95}Am_{150}$

^{249}Bk α decay 2013Ah03



$^{245}_{95}Am_{150}$