Adopted Levels, Gammas

History							
Туре	Author	Citation	Literature Cutoff Date				
Full Evaluation	C. D. Nesaraja	NDS 125, 395 (2015)	31-Mar-2014				

 $Q(\beta^{-}) = -613 \ 16$; $S(n) = 6550 \ 60$; $S(p) = 4417 \ 5$; $Q(\alpha) = 5890 \ 5 \qquad 2012 \text{Wa38}$

Identification:

1965Mi08: ²⁴⁷Bk produced by irradiating ²⁴⁶Cm sample with He ions from the Argonne 150-cm cyclotron. It was then followed by chemical purification and mass spectrometric measurements. Half-life was measured.

1956Ch77: ^{244,245,246}Cm bombardment by 28-MeV He ions. Bk was chemically separated from the decay of ²⁴⁷Cf.

Theoretical and Systematical studies:

2013Ni13,2012Ni16: α decay T_{1/2} for transitions from ground-state to favored rotational bands using multichannel cluster model (MCCM).

2012Sa05: Partial $T_{1/2}$, α branching ratio to individual residual states using Coulomb and proximity potential model for deformed nuclei (CPPMDN).

2011Zh36: Systematic analysis of α decay to members of favored bands using the Geiger-Nutall law. Calculated the partial half-lives.

2010Ni02: Systematics and calculations of $T_{1/2}$ and relative intensities of α decay within the generalized density-dependent cluster model.

2004Pa40: Calculated deformation parameters and the proton one-quasiparticle states of heaviest nuclei using the macroscopic-microscopic approach.

2003Re14: Calculated binding energy and $Q\alpha$ and ground-state deformations 2002Du16: Calculated partial half-lives for α and cluster decays.

1997Mo25: Calculated ground-state binding energy, proton and neutron pairing gaps, neutron and proton separation energies, Q values and partial half-lives for α and β decays.

1995Mo29, 1980Ho32: Calculated ground-state masses and nuclear ground-state deformations.

1993Bu09: Calculated partial α decay half-life, α branching, and nuclear radius using the cluster model predictions.

1985Lo17: Calculation of spontaneous fission half-life of ground-state.

1981Mo24: Calculated ground-state electric multipole moments Q2, Q4 and masses.

1980Ho32: Calculated fission-barrier heights, deformation and energy at saddle-point were.

²⁴⁷Bk Levels

Cross Reference (XREF) Flags

- **A** 247 Cf ε decay
- **B** 251 Es α decay
- C $^{246}Cm(\alpha,t)$ E=28, 29 MeV
- **D** 249 Bk(p,t) E=15 MeV

E(level)	J^{π}	T _{1/2}	XREF	Comments
0.0 [‡]	3/2-	1380 y 250	ABC	$%\alpha$ ≤100 A calculated half-life of ≈10000 y for spontaneous fission (1985Lo17) yields %SF≈12. T _{1/2} : From 1965Mi08. J ^π : Favored α decay from g.s level in ²⁵¹ Es.
29.88 [‡] 11	$(5/2^{-})$		ABC	J^{π} : Band member; γ to $3/2^{-}$ g.s. level.
40.81 [#] 11	7/2+		AB D	J^{π} : L=0 in ²⁴⁹ Bk(p,t) reaction $[J^{\pi}(^{249}Bk)=7/2^+]$.
71.60 [‡] <i>13</i>	$(7/2^{-})$		ABC	J^{π} : Band member in (α, t) data.
82.81 [#] 23	$(9/2)^+$		AB D	J ^{π} : L=2 in ²⁴⁹ Bk(p,t) reaction [J ^{π} (²⁴⁹ Bk)=7/2 ⁺]; log <i>t</i> =6.05 for ε feeding from

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

²⁴⁷Bk Levels (continued)

E(level)	$J^{\pi \dagger}$	XREF	Comments			
			$(7/2^+)^{247}$ Cf.			
125.5 [‡] 4	$(9/2^{-})$	AC	J^{π} : From band member in (α ,t) data.			
137 [#] 5	$(11/2^+)$	D	J^{π} : From band member in (p,t) data.			
196 [#] 3	$(13/2^+)$	CD	J^{π} : From band member in (α ,t) and (p,t) data.			
265 [#] 2	$(15/2^+)$	D	J^{π} : From band member in (p,t) data.			
334.92 [@] 12	$(5/2)^+$	Α	J ^{π} : M1 294.1 γ to 7/2 ⁺ level; 334.9 γ to (3/2 ⁻) level, 305.2 γ to (5/2 ⁻) level.			
378.1? [@] 6	$(7/2^+)$	Α	J^{π} : 337.3 γ to 7/2 ⁺ level 334.9-keV.			
447.80 ^{&} 9	$(5/2^{-})$	Α	J^{π} : (E1)407.0 γ to 7/2 ⁺ level; M1+E2 447.8 γ to (3/2 ⁻) level.			
487 ^{<i>a</i>} 3	$(1/2^+)$	С	J^{π} : From band member in (α ,t) data.			
489.4 ^{&} 3	$(7/2^{-})$	Α	J^{π} : 363.9 γ to (9/2 ⁻) level, 459.5 γ to (5/2 ⁻) from 447.8-keV level.			
518 ^a 5	$(3/2^+)$	С	J^{π} : From band member in (α, t) data.			
541 ^{&} 3	$(9/2^{-})$	С	J^{π} : From band member in (α ,t) data.			
587 [@] 4	$(13/2^+)$	С	J^{π} : From band member in (α,t) data.			
704 ^b 4	$(1/2^{-})$	С	J^{π} : From band member in (α,t) data.			
743 ⁶ 3	$(5/2^{-})$	С	J^{π} : From band member in (α ,t) data.			
815 ^b 4	$(7/2^{-})$	С	J^{π} : From band member in (α ,t) data.			
			J^{π} : (α, t) data.			
828 ⁶ 5	$(9/2^{-})$	С	J^{π} : From band member in (α ,t) data.			
904 [°] 3	$(9/2^{-})$	С	J^{π} : From band member in (α ,t) data.			
983 <i>3</i>		С	J^{π} : From band member in (α ,t) data.			
1149 4		С	J^{π} : From band member in (α ,t) data.			
1166 ^d 4	$(13/2^+)$	С	J^{π} : From band member in (α ,t) data.			

[†] Spin and parity assignments from (α ,t) were based on L-values deduced from angular distributions and on relative peak intensities. Assignments from (p,t) were based on comparison of experimental spectroscopic factors with calculated ones.

[‡] Band(A): 3/2[521] band.

[#] Band(B): 7/2[633] band.

[@] Band(C): 5/2[642] band.

[&] Band(D): 5/2[523] band.

^{*a*} Band(E): 1/2[400] band. Assignments to this band were made by 1979Ah03 on the bases of spectroscopic factors for (α ,t) reaction and the systematics of orbitals.

^b Band(F): 1/2[521] band. Assignments to this band were made by 1979Ah03 from (α ,t) data.

^c Band(G): 7/2[514] band. Assignment was proposed by 1979Ah03 from (*a*,t) data and from systematics of orbitals.

^d Band(H): 9/2[624] band?. The assignment was suggested by 1979Ah03 from comparison of (α ,t) spectroscopic factor with that for 13/2⁺, 9/2[624] state in ²⁵¹Es (1978Ah02).

 $\gamma(^{247}\text{Bk})$

E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	I_{γ} ‡	E_f	\mathbf{J}_f^{π}	Mult. [#]	α &
29.88	$(5/2^{-})$	29.9 2	100	0.0	3/2-		
40.81	$7/2^{+}$	(10.9 [@])		29.88	$(5/2^{-})$		
		40.8 <i>3</i>		0.0	$3/2^{-}$		
82.81	$(9/2)^+$	42.0 2	100	40.81	$7/2^{+}$		
334.92	$(5/2)^+$	294.1 <i>1</i>	100 8	40.81	$7/2^{+}$	M1	1.651
		305.2 3	0.91 14	29.88	$(5/2^{-})$		
		334.9 2	2.9 3	0.0	3/2-		

Adopted Levels, Gammas (continued)

				γ ⁽²⁴⁷ Bk) (continued)			
E _i (level)	\mathbf{J}_i^π	E_{γ}^{\dagger}	I_{γ}^{\ddagger}	$\mathbf{E}_f \qquad \mathbf{J}_f^{\pi}$	Mult. [#]	δ	α &
378.1? 447.80	(7/2 ⁺) (5/2 ⁻)	337.3 5 376.2 <i>1</i> 407.0 <i>1</i> 417.9 ^{<i>a</i>} <i>1</i>	100 12.9 <i>13</i> 35 <i>4</i> 62 5	$\begin{array}{c cccc} 40.81 & 7/2^+ \\ 71.60 & (7/2^-) \\ 40.81 & 7/2^+ \\ 29.88 & (5/2^-) \end{array}$	(E1) M1+E2	0.68 24	0.0238 0.494 <i>10</i>
489.4	(7/2 ⁻)	447.8 <i>1</i> 363.9 <i>2</i> 417.9 ^{<i>a</i>} 459.5 <i>3</i>	100 7 100 <i>19</i> 100 <i>15</i>	$\begin{array}{ccc} 0.0 & 3/2^{-} \\ 125.5 & (9/2^{-}) \\ 71.60 & (7/2^{-}) \\ 29.88 & (5/2^{-}) \end{array}$	M1+E2	1.0 2	0.319 7

 † From $^{247}{\rm Cf}~\varepsilon$ decay.

* Relative photon intensities de-exciting each level, as measured in ²⁴⁷Cf ε decay. # From ce data taken in ²⁴⁷Cf ε decay. @ Transition is expected but unobserved.

& 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.

^a Multiply placed.

Adopted Levels, Gammas

Legend

γ Decay (Uncertain)

Level Scheme

Intensities: Relative photon branching from each level



 $^{247}_{97}\rm{Bk}_{150}$

Adopted Levels, Gammas

					Band(F): 1/2	[521] band
					(9/2 ⁻) (7/2 ⁻)	828 815
					(5/2-)	743
Band(C): 5/2[642] band					(1/2 ⁻)	704
(13/2 ⁺) 587	Band(D): 5	/2[523] band				
	(9/2-)	541	Band(E): 1/2[40	0] band		
			(3/2+)	518		
	(7/2-)	489.4	(1/2+)	487		
	(5/2-)	447.80				
(7/2 ⁺) <u>378.1</u> _						
(5/2)+ 334.92						



 $^{247}_{97}\mathrm{Bk}_{150}$

Adopted Levels, Gammas (continued)

Band(G): 7/2[5	14] band	Band(H): 9/2[624] band?			
(9/2-)	904	(13/2+)	1166		

 $^{247}_{97}\mathrm{Bk}_{150}$