^{254}Es α decay (39.3 h)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Y. Akovali	NDS 94,131 (2001)	1-Aug-2001

Parent: ^{254}Es: E=80 *3*; $J^{\pi}=2^{+}$; $T_{1/2}$=39.3 h *2*; Q(α)=6615.7 *15*; %α decay=0.32 *1*

The 39.3-H ^{254}Es α decay scheme presented here is basically that constructed by 1973Ah04. The 79.9 and 96.3 gammas were placed by 1973Ah04 to deexcite the 211.8-keV and 131.9-keV levels. In accord with the ^{249}Bk(n,γ) work, the order of these two sequential γ rays is reversed here, connecting through the 115.44-keV level.

Data from the 39.3-H ^{254}Es and the decay scheme are being reanalyzed by the authors of 1973Ah04, and their final results, together with their interpretations will Be submitted for publication (priv. comm. from I. Ahmad). Until their work is completed, data and level scheme given here should Be considered tentative.

^{250}Bk Levels

E(level)[†]	J^{π}[†]	$T_{1/2}$	Comments
0.0[‡]	2^{-}		
34.47[‡]	(3^{-})		
35.59[#]	(4^{+})		
78.33[#]	(5^{+})		
80.26[‡]	(4^{-})		
103.83[@]	(1^{-})		
115.45[&]	(3^{+})		
125.01[@]	(2^{-})		
130.49[#]	(6^{+})		
137.32[‡]	(5^{-})		
175.13	(1^{+})	42 ns *2*	K=0,(p 7/2[633],n 7/2[613]) configuration was assigned by 1973Ah04. See Adopted Levels for a comment.
211.82[a]	2^{+}		
236.74[a]	(3^{+})		
270.46[a] *2*	(4^{+})		
298 *2*			
316[a] *3*	(5^{+})		J^{π}: $J^{\pi}=5^{+}$ of K=2,(p 7/2[633],n 3/2[622]) band was assigned by 1973Ah04. From (n,γ) data, $J^{\pi}=5^{+}$ of K=5,(p 7/2[633],n 3/2[622]) was assigned to a 316.46-keV level.

[†] ADOPTED values.
[‡] Band(A): K=2,(p 3/2[521],n 1/2[620]) band.
[#] Band(B): K=4,(p 7/2[633],n 1/2[620]) band.
[@] Band(C): K=1,(p 3/2[521],n 1/2[620]) band.
[&] Band(D): K=3,(p 7/2[633],n 1/2[620]) band.
[a] Band(E): K=2,(p 7/2[633],n 3/2[622]) band.

α radiations

Eα[†]	E(level)	Iα[‡@]	HF[#]	Comments
6280 *3*	316	0.16 *3*	6.5×10^{2} *15*	this α could Be doublet, feeding two 5^{+} state At 316 *3* and 316.46 keV. See ^{250}Bk Adopted Levels.
6297 *2*	298	0.48 *6*	270 *40*	
6325 *2*	270.46	2.2 *2*	79 *10*	
6357 *2*	236.74	8.3 *5*	30 *3*	
6382 *2*	211.82	75.0 *10*	4.4 *4*	

Continued on next page (footnotes at end of table)

^{254}Es α decay (39.3 h) (continued)

α radiations (continued)

Eα[†]	E(level)	Iα[‡@]	HF[#]	Comments
6415 *2*	175.13	1.8 *2*	270 *40*	
6455 *3*	137.32	0.12 *4*	6.2×10^3 *30*	
6463 *2*	130.49	0.62 *7*	1.28×10^3 *20*	
6469[&] *4*	125.01	≈0.08	≈10550	see the comment on 6591α.
6513 *2*	78.33	1.4 *14*	1.0×10^3	
6557 *2*	35.59	5.8 *4*	370 *30*	Iα: from comparison of the 6557α peak with the 6382α peak In (α)(L x ray) coincidence spectrum, 1973Ah04 suggested that about half of the 5.8 intensity feeds the 34.5-keV level.
6591[&] *4*	0.0	4.0 *5*	7.9×10^2 *11*	if the proposed configurations of K=2,(p 7/2[633],n 3/2[622]) and K=2,(p 3/2[521],n 1/2[620]) for the 39.3-H ^{254}Es and ^{250}Bk g.s., respectively, are correct, an α transition between them May Be due to some admixture of other configurations In parent or/and daughter states. The α peak observed At 6591 keV could possibly belong mostly to ^{253}Es decay.

† Measured by 1973Ah04. Earlier measurement: 1967Fi03.
‡ α intensity per 100 α decays, measured by 1973Ah04.
# Calculated using $r_0(^{250}Bk)=1.502$ *3*.
@ For absolute intensity per 100 decays, multiply by 0.0032 *1*.
& Existence of this branch is questionable.

γ(^{250}Bk)

X Rays Measured By 1973Ah04:

Energy	Intensity (per 100 α Decays)	
107.2 2	1.8 2	Kα$_2$ x ray
112.2 2	2.8 3	Kα$_1$ x ray
126.2 2	1.2 2	Kβ$_1'$ x ray
131.0 4	0.4 1	Kβ$_2'$ x ray

αγ, (α)(ce), Ag(t), γγ, γce Data Were Taken By 1973Ah04:
(6382α)(L x ray,79.90,96.30,K x ray,177.3,211.8 γ's), Prompt Coincidence;
Ice/I(6382α)=2.0 3 Deduced From I[(6382α)(L x ray)].
I(K x ray)=0.42% 5 (from 177.3, 211.8 γ's)
(6382α)(50.07,71.30,90.7,K x ray,104.0,126.0,175.7 γ's), Delayed COIN.:
$T_{1/2}$(175.13 Level)=42 Ns 2
I(K x ray)=0.06% 1 (from 175.7γ)
(6382α)(ce); α(L)exp(211.8γ)=0.016 4, α(L)exp(175.7γ)=2.8 8.

Eγ[†]	Ei(level)	J_i^π	Ef	J_f^π	I(γ+ce)[ab]	Comments
(1.12[‡])	35.59	(4$^+$)	34.47	(3$^-$)		1991Ba63 calculated total conversion coefficient to Be α(1.1γ)=986. See 1991Ba63 for N, O, P, Q subshell-conversion coefficients.
(34.47[‡])	34.47	(3$^-$)	0.0	2$^-$		
(35.59[‡])	35.59	(4$^+$)	0.0	2$^-$		
(36.4)	211.82	2$^+$	175.13	(1$^+$)	17 *5*	this transition was not observed; existence was deduced from (6382α)(γ)

Continued on next page (footnotes at end of table)

^{254}Es α decay (39.3 h) (continued)

γ(^{250}Bk) (continued)

E_γ[†]	I_γ[#b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	α[c]	$I_{(\gamma+ce)}$[ab]	Comments
									coincidences observed. transition intensity is deduced from intensity balance At the 211.8-keV level.
(42.74[‡])		78.33	(5$^+$)	35.59	(4$^+$)			≈1.4	
(45.79[‡])		80.26	(4$^-$)	34.47	(3$^-$)	(M1+E2)			
50.07 *5*	2.8 *3*	175.13	(1$^+$)	125.01	(2$^-$)	(E1)	0.882		α(L)=0.659; α(M)=0.1665; α(N+..)=0.0587 B(E1)(W.u.)=3.8×10^{-6} *6*
(52.16[‡])		130.49	(6$^+$)	78.33	(5$^+$)	(M1+E2)	2.6×10^2 *20*		
(57.06[‡])		137.32	(5$^-$)	80.26	(4$^-$)	(M1)	42.8		
(58.64[‡])		270.46	(4$^+$)	211.82	2$^+$	(E2)			
71.30 *5*	13.0 *13*	175.13	(1$^+$)	103.83	(1$^-$)	(E1)	0.352		α(L)=0.263; α(M)=0.0656; α(N+..)=0.02347 B(E1)(W.u.)=6.1×10^{-6} *9*
79.90 *8*	1.10 *13*	115.45	(3$^+$)	35.59	(4$^+$)	(M1)	16.05		α(K)= 0.0745; α(L)=0.0167; α(M)=0.00408
(80.26[‡])		80.26	(4$^-$)	0.0	2$^-$	(E2)			
90.7 *4*	0.20 *6*	125.01	(2$^-$)	34.47	(3$^-$)	(M1)	11.13		α(L)=8.26; α(M)=2.028; α(N+..)=0.778
(94.91[‡])		130.49	(6$^+$)	35.59	(4$^+$)	(E2)	26.7		
96.3 *1*	1.70 *18*	211.82	2$^+$	115.45	(3$^+$)	(M1)	9.28		α(L)=6.92; α(M)=1.699; α(N+..)=0.653
(102.84[‡])		137.32	(5$^-$)	34.47	(3$^-$)	(E2)	18.4		
104.0 *2*	3.1 *3*	103.83	(1$^-$)	0.0	2$^-$	(M1)	7.47		α(L)=5.55; α(M)=1.363; α(N+..)=0.524
(121.29[‡])		236.74	(3$^+$)	115.45	(3$^+$)	(M1)			
126.0 *8*	0.15 *6*	125.01	(2$^-$)	0.0	2$^-$	(M1)	4.38		α(L)=3.20; α(M)=0.783; α(N+..)=0.301
175.7 *3*	0.85 *18*	175.13	(1$^+$)	0.0	2$^-$		2.76		α(K)=1.72; α(L)=0.78; α(M)=0.21; α(N+..)=0.084 Mult.: α(L)exp(175.7γ)=2.8 *8*, obtained from (6382γ)(ce) delayed coincidence data (contribution from Ce(177.3γ) was subtracted), and α(K)exp(175.7γ)=1.8, obtained by 1973Ah04 from (6382α)(K x ray,175.7γ) delayed coincidence data, do not yield consistent mixing ratio: α(L)exp suggests E1+M2, δ=0.67 *14*, and α(K)exp=1.8 yields δ=0.3. By considering the fact that K/L(exp)=0.64 does not agree with 175.7γ being E1+M2 (K/L=4.29 for E1, 2.16 for M2), it is likely that L-electron intensity was overestimated. α: E1+M2 (E1 part is K-forbidden) is assumed: α(E1)=0.1479, α(M2)=31.8; α(M2/E1=0.09)=2.76.

Continued on next page (footnotes at end of table)

^{254}Es α decay (39.3 h) (continued)

γ(^{250}Bk) (continued)

E_γ[†]	I_γ[#b]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[@]	α[c]	Comments
								Additional information 1.
177.3 *1*	17.0 *17*	211.82	2^+	34.47	(3^-)	(E1)[&]	0.145	α(K)= 0.111; α(L)=0.0257; α(M)=0.00630; α(N+..)=0.00232
(202.27[‡])		236.74	(3^+)	34.47	(3^-)			
211.8 *1*	29 *3*	211.82	2^+	0.0	2^-	E1[&]	0.0967	α(K)=0.0745; α(L)=0.01665; α(M)=0.00408; α(N+..)=0.00151
(235.98[‡])		270.46	(4^+)	34.47	(3^-)			

[†] Measured by 1973Ah04.
[‡] From Adopted Gammas. This transition was not seen In 39.3-H ^{254}Es α decay.
[#] Photon intensity per 100 α decays, measured by 1973Ah04. Absolute intensities were determined from α-count rate of mass-separated 39.3-H ^{254}Es which was In equilibrium with ^{254}Fm, and γ spectrum taken with known efficiency.
[@] From (α)(K x ray), (α)(ce) data of 1973Ah04, and from intensity balance.
[&] Determined by 1973Ah04 from (6382α)(K x ray) prompt-coincidence intensity. From (α)(ce) coincidence, α(L)exp(211γ)=0.016 *4* was obtained, In agreement with (α)(K x ray) results.
[a] From intensity balance and from 276-d ^{254}Es decay scheme.
[b] For absolute intensity per 100 decays, multiply by 0.0032 *1*.
[c] 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.

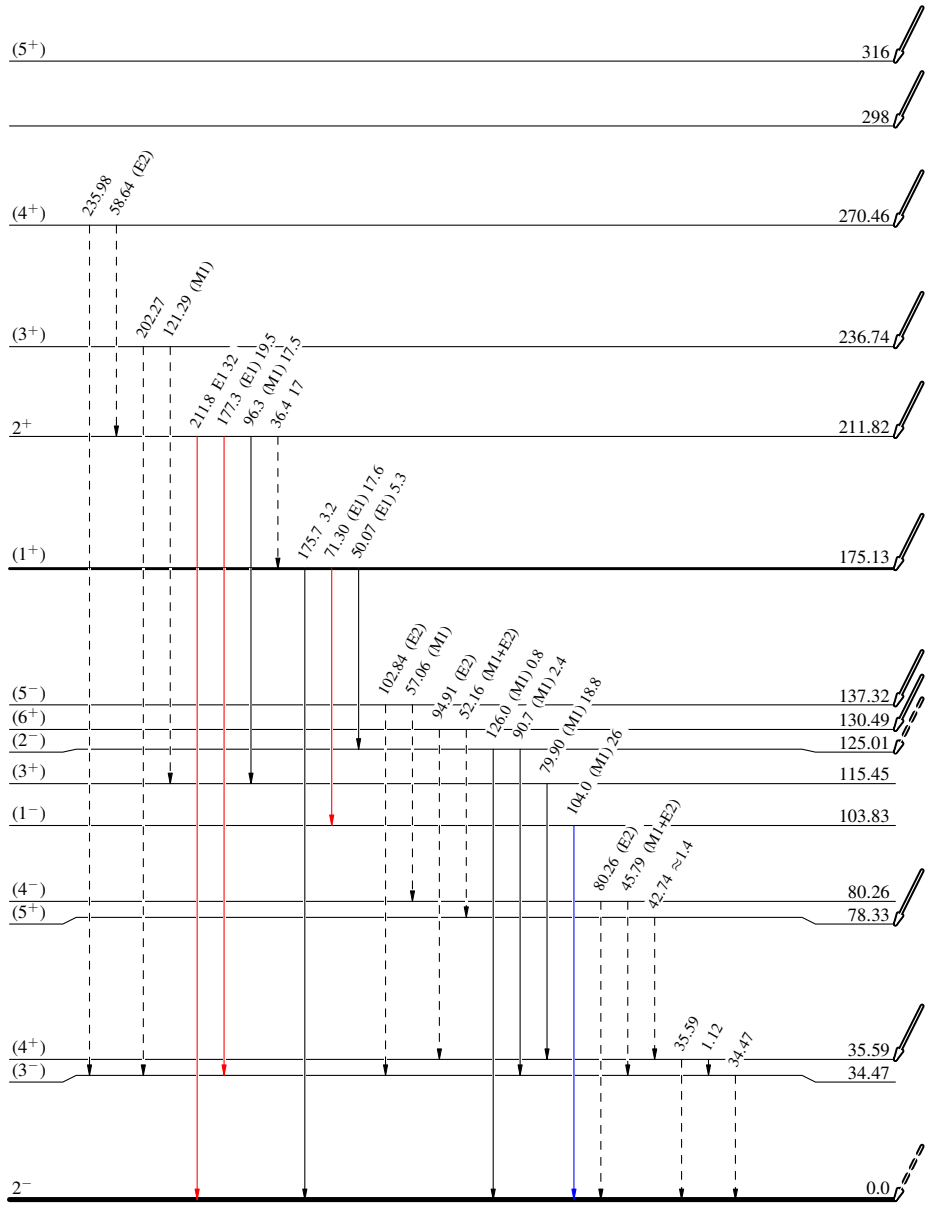
^{254}Es α decay (39.3 h)

Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 decays through this branch

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- γ Decay (Uncertain)

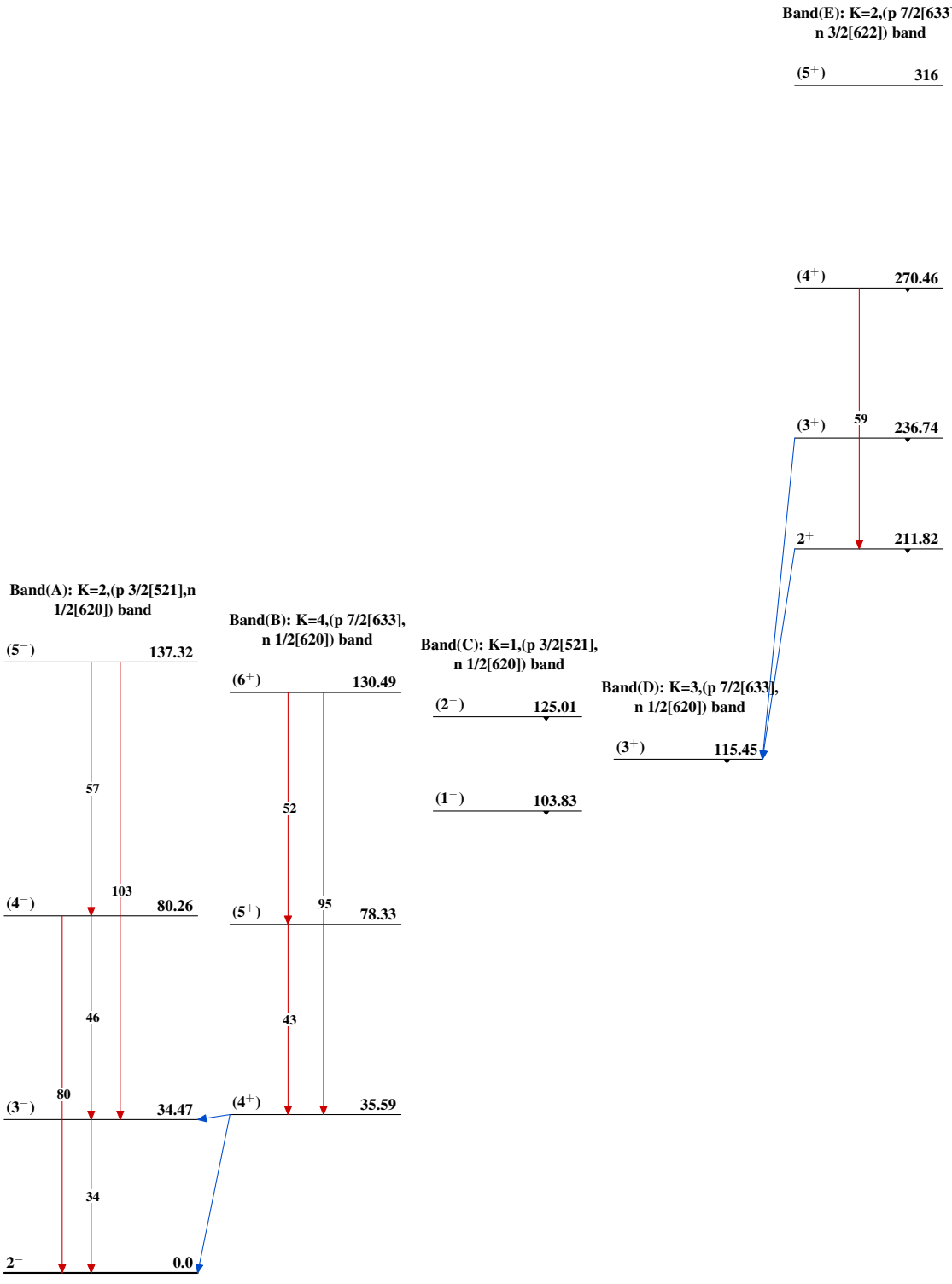
2^+ 80 39.3 h *2*
Q_α=6615.7 *15* %α=0.33
$^{254}_{99}Es_{155}$



	Eα	Iα	HF
	6280	0.00051	650
	6297	0.00154	270
	6325	0.0070	79
	6357	0.0266	30
	6382	0.240	4.4
	6415	0.0058	270
	6455	0.00038	6200
	6463	0.00198	1280
	6469	≈0.00026	≈10550
	6513	0.004	1000
	6557	0.0186	370
	6591	0.0128	790

$^{250}_{97}Bk_{153}$

^{254}Es α decay (39.3 h)



$^{250}_{97}Bk_{153}$