^{249}Es $\varepsilon+\beta^+$ decay **1976Ah07**

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. D. Nesaraja	NDS 195,718 (2024)	12-Oct-2023

Parent: ^{249}Es: E=0; J^π=7/2$^+$; $T_{1/2}$=102.2 min *6*; Q(ε)=1450 *syst*; %ε+%β^+ decay=99.43 *8*

^{249}Es-$T_{1/2}$: From Adopted Levels. Note that 1976Ah07 measured $t_{1/2}$= 102.3 min *6* for ^{249}Es from decay of the 379.5γ that was measured with a Ge(Li) detector.

^{249}Es-Q(ε): 1450 *30* (2021Wa16).

1976Ah07: ^{249}Es was produced by bombarding 18 MeV deuterons on ^{249}Cf target at the Argonne 60 inch cyclotron. The irradiated target was mass separated. Low-energy gammas from the decay of ^{249}Es were measured with a planar Ge(Li) with FWHM=600 eV at Eγ=100 keV, high-energy gammas were measured with a coaxial Ge(Li) detector, and conversion electrons were measured with a Si(Li) detector with FWHM=1.0 keV at E(electron)=100 keV and FWHM=1.6 keV at E(electron)=600 keV. Measured Eγ, Iγ, conversion electron spectra, E(ce), I(ce), α, $T_{1/2}$(^{249}Es), branching ratio. Deduced level scheme and multipolarity.

1970Ah01: ^{249}Es was produced from ^{249}Bk(α,4n) reaction with E(^{4}He)= 45 MeV from the Argonne cyclotron. The target was purified prior to irradiation to remove ^{249}Cf that formed from the decay of ^{249}Bk. Chemical separation was done after the irradiation to remove fission products. Gamma rays were measured with Ge(Li) and NaI(Tl) detectors. Measured $\gamma\gamma$ coincidence and Cf(Xrays).

^{249}Cf Levels

E(level)[†]	J^π[‡]	$T_{1/2}$[#]	Comments
0[@]	9/2$^-$	351 y *2*	
62.49[@] *4*	11/2$^-$		
136.22[@] *35*	13/2$^-$		
144.96[&] *5*	5/2$^+$	45 μs *5*	
187.94[&] *6*	7/2$^+$		
243.07[&] *6*	9/2$^+$		
379.52[a] *5*	7/2$^+$		
437.56[a] *5*	9/2$^+$		
442.98[b] *6*	7/2$^+$		
500.67?[b] *31*	(9/2$^+$)		
813.20[c] *8*	(5/2)$^-$		
852.19[c] *7*	(7/2)$^-$		
902.52[c] *17*	(9/2$^-$)		
1007.97 *6*	(9/2$^+$)		Configuration=9/2[615] (1976Ah07).
1199.8 *4*	(7/2$^-$,9/2)		
1218.50 *10*	(7/2)$^-$		E(level): K^π=7/2$^-$. Three-quasiparticle state. Configuration=((π 7/2[633])(π 3/2[521])(ν 3/2[622])) (1976Ah07).
1238.05 *17*	(5/2$^-$,7/2,9/2$^+$)		
1267.7 *4*	(9/2$^-$)		
1304.30 *30*			

[†] From least-squares fit to Eγ data by the evaluator.
[‡] From Adopted Levels. Band assignments are from 1976Ah07.
[#] From Adopted Levels.
[@] Band(A): 9/2$^-$[734] Band.
[&] Band(B): 5/2$^+$[622] Band.

Continued on next page (footnotes at end of table)

^{249}Es $\varepsilon+\beta^+$ decay 1976Ah07 (continued)

^{249}Cf Levels (continued)

[a] Band(C): 7/2$^+$[624] Band.
[b] Band(D): 7/2$^+$[613] Band.
[c] Band(E): K^π=5/2$^-$ Gamma vibrational band built on 9/2[734].

ε,β^+ radiations

E(decay)	E(level)	Iβ^+ [‡]	Iε[‡]	Log *ft*	I($\varepsilon+\beta^+$)[†‡]	Comments
(146 *syst*)	1304.30		0.038 *4*	6.9 *3*	0.038 *4*	εK=0.02 *17*; εL=0.66 *10*; εM+=0.32 *7*
(182 *syst*)	1267.7		0.037 *7*	7.2 *3*	0.037 *7*	εK=0.22 *17*; εL=0.54 *11*; εM+=0.24 *7*
(212 *syst*)	1238.05		0.054 *7*	7.25 *24*	0.054 *7*	εK=0.35 *14*; εL=0.45 *9*; εM+=0.20 *5*
(232 *syst*)	1218.50		1.56 *10*	5.92 *21*	1.56 *10*	εK=0.41 *11*; εL=0.41 *7*; εM+=0.18 *4*
(250 *syst*)	1199.8		≈0.026	≈7.8	≈0.026	εK=0.46 *8*; εL=0.38 *6*; εM+=0.16 *3*
(442 *syst*)	1007.97		1.70 *10*	6.70 *9*	1.70 *10*	εK=0.643 *14*; εL=0.257 *10*; εM+=0.100 *5*
(548 *syst*)	902.52		0.18 *6*	7.91 *16*	0.18 *6*	εK=0.676 *8*; εL=0.234 *6*; εM+=0.0895 *24*
(598 *syst*)	852.19		2.15 *12*	6.93 *6*	2.15 *12*	εK=0.687 *6*; εL=0.227 *4*; εM+=0.0862 *19*
(637 *syst*)	813.20		10.0 *6*	6.33 *6*	10.0 *6*	εK=0.693 *5*; εL=0.223 *4*; εM+=0.0841 *16*
(1007 *syst*)	442.98		3.47 *29*	7.25 *5*	3.47 *29*	εK=0.7273 *17*; εL=0.1992 *12*; εM+=0.0735 *6*
(1012 *syst*)	437.56		8.3 *10*	6.87 *6*	8.3 *10*	εK=0.7276 *17*; εL=0.1990 *12*; εM+=0.0734 *5*
(1071 *syst*)	379.52		39.2 *28*	6.25 *5*	39.2 *28*	εK=0.7304 *15*; εL=0.1970 *10*; εM+=0.0726 *5*
(1207 *syst*)	243.07		0.6 *7*	8.2 *5*	0.6 *7*	εK=0.7359 *11*; εL=0.1932 *8*; εM+=0.0709 *4*
(1305 *syst*)	144.96		3.6 *25*	7.5 *3*	3.6 *25*	εK=0.7391 *9*; εL=0.1910 *7*; εM+=0.0699 *3*
(1388 *syst*)	62.49		1.1 *7*	8.9[1u] *3*	1.1 *7*	εK=0.7038 *19*; εL=0.2152 *13*; εM+=0.0810 *6*
(1450 *syst*)	0	0.0025 *12*	26 *9*	6.72 *16*	26 *9*	av Eβ=222 *14*; εK=0.7428 *7*; εL=0.1884 *5*; εM+=0.06871 *23* Iε: Calculated by evaluator from measured I(K x ray) − [I(K x ray (from ce(K))) + I(K x ray (from ε to excited levels))]. The observed K x ray intensities were converted into K shell vacancies with K-shell fluorescence ω= 0.973 *4* (1979Ah01). With I(K x ray)=81.8 *50* (1976Ah07) from the adopted decay scheme; I(K x ray (from ce(K)))=3.88 *23*; I(K x ray (from ε to excited levels))=51.1 *79*; ω= 0.973 *4* (1979Ah01); I((ε to g.s.))=26 *9* is deduced.

[†] Deduced by evaluator from intensity balance at each level.
[‡] Absolute intensity per 100 decays.

$\gamma(^{249}Cf)$

Iγ normalization: From (100-Iε to g.s.)/(ΣI(γ+ce)to g.s.).

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  The Cf x-ray intensities (1970Ah01):
 E(x ray)      I(x ray)     Cf x ray
109.6          0.67 7       Kα2
114.8          0.98 1       Kα1
129.3 +133.4   0.55 6       Kβ+Kβ2
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  The Cf x-ray intensities (1976Ah07):
 E(x ray)      I(x ray)     Cf x ray
109.83 5       24.4 15       Kα2
115.04 5       38.0 23       Kα1
128.61 5       4.8 3         Kβ3
129.84 5       9.5 6         Kβ1
133.59 5       3.9 3         Kβ2+Kβ4
134.73 5       1.23 9        KO2,3
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E_γ	I_γ @	E_i(level)	J^π_i	E_f	J^π_f	Mult.†	δ†	α#	$I_{(\gamma+ce)}$ @	Comments
43.00 *5*	0.033 *7*	187.94	7/2$^+$	144.96	5/2$^+$	M1+E2	0.27 *+8−10*	1.8×10^2 *5*		α(L)=1.30×10^2 *34*; α(M)=34 *10* α(N)=9.6 *27*; α(O)=2.4 *7*; α(P)=0.43 *10*; α(Q)=0.0147 *4* Mult.,δ: From α(N+)exp=9.6 *27*.
55.14 *5*	0.032 *7*	243.07	9/2$^+$	187.94	7/2$^+$	M1+E2	0.14 *12*	55 *14*		α(L)=41 *10*; α(M)=10.2 *30* α(N)=2.8 *8*; α(O)=0.73 *21*; α(P)=0.138 *31*; α(Q)=0.00724 *25* Mult.,δ: From α(L12)exp=32 *10*,α(M)exp=11.5 *33*.
58.01 *5*	0.044 *7*	437.56	9/2$^+$	379.52	7/2$^+$	M1+E2	0.52 *9*	95 *15*		α(L)=69 *10*; α(M)=18.8 *31* α(N)=5.3 *9*; α(O)=1.32 *21*; α(P)=0.224 *32*; α(Q)=0.00534 *28* Mult.,δ: From α(L1)exp=23.2 *59*, α(L2)exp=32.2 *77*, α(L3)exp=16.7 *33*, α(M1+M2)exp=15.0 *40*, α(M3+M4+M5)exp=6.0 *15*.
62.47 *5*	0.127 *10*	62.49	11/2$^-$	0	9/2$^-$	M1+E2	0.291 *+29−31*	46.9 *26*		α(L)=34.6 *19*; α(M)=9.0 *5* α(N)=2.50 *15*; α(O)=0.64 *4*; α(P)=0.115 *6*; α(Q)=0.00479 *9* Mult.,δ: From α(L1)exp=20.9 *39*, α(L3)exp=4.8 *9*.
(63.1)		500.67?	(9/2$^+$)	437.56	9/2$^+$	[M1,E2]		1.1×10^2 *8*	0.050 *15*	ce(L)/(γ+ce)=0.7 *4*; ce(M)/(γ+ce)=0.20 *18*

^{249}Es $\varepsilon+\beta^+$ decay 1976Ah07 (continued)

$\gamma(^{249}Cf)$ (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[#]	$I_{(\gamma+ce)}$[@]	Comments
										ce(N)/(γ+ce)=0.06 *6*; ce(O)/(γ+ce)=0.014 *14*; ce(P)/(γ+ce)=0.0023 *22*; ce(Q)/(γ+ce)=2.7×10^{-5} *25* α(L)=8.E1 6; α(M)=23 *17* α(N)=6 *5*; α(O)=1.6 *12*; α(P)=0.26 *18*; α(Q)=0.0031 *19*
63.45 *5*	0.058 *7*	442.98	7/2$^+$	379.52	7/2$^+$	M1		32.0 *5*		α(L)=23.99 *34*; α(M)=5.91 *8* α(N)=1.637 *23*; α(O)=0.425 *6*; α(P)=0.0822 *12*; α(Q)=0.00486 *7* Mult.: From α(L1)exp=22.8 *49*.
(73.7)		136.22	13/2$^-$	62.49	11/2$^-$	[M1,E2]		6.×10^1 *4*	<0.1	ce(L)/(γ+ce)=0.71 *34*; ce(M)/(γ+ce)=0.20 *16* ce(N)/(γ+ce)=0.06 *5*; ce(O)/(γ+ce)=0.014 *12*; ce(P)/(γ+ce)=0.0023 *20*; ce(Q)/(γ+ce)=3.3×10^{-5} *30* α(L)=41 *26*; α(M)=11 *8* α(N)=3.2 *22*; α(O)=0.8 *5*; α(P)=0.13 *8*; α(Q)=0.0019 *13*
(136.2)		136.22	13/2$^-$	0	9/2$^-$	[E2]		5.53 *8*	<0.1	ce(K)/(γ+ce)=0.01806 *33*; ce(L)/(γ+ce)=0.597 *6*; ce(M)/(γ+ce)=0.1700 *28* ce(N)/(γ+ce)=0.0478 *9*; ce(O)/(γ+ce)=0.01186 *22*; ce(P)/(γ+ce)=0.001914 *35*; ce(Q)/(γ+ce)=9.40×10^{-6} *17* α(K)=0.1179 *17*; α(L)=3.90 *5*; α(M)=1.110 *16* α(N)=0.312 *4*; α(O)=0.0774 *11*; α(P)=0.01250 *17*; α(Q)=6.14×10^{-5} *9*
136.37 *8*	0.065 *15*	379.52	7/2$^+$	243.07	9/2$^+$	[M1]		15.50 *22*		α(K)=12.01 *17*; α(L)=2.61 *4*; α(M)=0.641 *9* α(N)=0.1777 *25*; α(O)=0.0461 *7*; α(P)=0.00891 *13*; α(Q)=0.000525 *7*
144.99 *6*	0.18 *2*	144.96	5/2$^+$	0	9/2$^-$	M2+E3[‡]	0.42 +*11*−*12*	64.9 *11*		α(K)=30.7 *25*; α(L)=24.5 *21*; α(M)=7.1 *7* α(N)=2.01 *21*; α(O)=0.51 *5*; α(P)=0.091 *7*; α(Q)=0.00350 *22* Mult.,δ: From α(L1)exp=13.0 *26*, α(L2)exp=6.1 *12*, α(L3)exp=4.7 *9* α(M1+M2)exp=5.5 *11*, α(M3+M4+M5)exp=1.59 *32*, α(N)exp=2.89 *57*.
191.6 *1*	0.40 *3*	379.52	7/2$^+$	187.94	7/2$^+$	M1+E2	0.53 +*18*−*19*	5.0 *5*		α(K)=3.7 *5*; α(L)=0.962 *19*; α(M)=0.2436 *34* α(N)=0.0677 *10*; α(O)=0.01740 *25*; α(P)=0.00325 *8*; α(Q)=0.000159 *21* Mult.,δ: From α(L1+L2)exp=0.82 *14*, α(L3)exp=0.054 *20*, α(M)exp=0.222 *50*.
234.6 *1*	0.26 *3*	379.52	7/2$^+$	144.96	5/2$^+$	M1+E2	4.7 *15*	0.75 *13*		α(K)=0.23 *12*; α(L)=0.378 *10*; α(M)=0.1057 *21* α(N)=0.0297 *6*; α(O)=0.00740 *16*; α(P)=0.00124 *4*;

$^{249}_{98}Cf_{151}$-4

γ(^{249}Cf) (continued)

E_γ	I_γ[@]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[†]	α[#]	Comments
								α(Q)=1.6×10^{-5} *5* Mult.,δ: From α(K)exp=0.200 *86*, α(L1+L2)exp=0.314 *72*, α(L3)exp=0.054 *20*.
255.0 *2*	0.11 *3*	442.98	7/2$^+$	187.94	7/2$^+$	M1	2.69 *4*	α(K)=2.097 *30*; α(L)=0.441 *6*; α(M)=0.1084 *15* α(N)=0.0300 *4*; α(O)=0.00779 *11*; α(P)=0.001505 *21*; α(Q)=8.82×10^{-5} *12* Mult.: From α(L1+L2)exp=0.56 *20*.
298.0 *1*	0.56 *4*	442.98	7/2$^+$	144.96	5/2$^+$	M1	1.741 *24*	α(K)=1.360 *19*; α(L)=0.286 *4*; α(M)=0.0701 *10* α(N)=0.01941 *27*; α(O)=0.00504 *7*; α(P)=0.000973 *14*; α(Q)=5.69×10^{-5} *8* Mult.: From α(K)exp=1.29 *23*, α(L1+L2)exp=0.291 *56* α(M)exp=0.082 *16*, α(N)exp=0.036 *12*.
370.1 *2*	0.14 *4*	813.20	(5/2)$^-$	442.98	7/2$^+$	[E1]	0.0296 *4*	α(K)=0.02326 *33*; α(L)=0.00476 *7*; α(M)=0.001161 *16* α(N)=0.000320 *4*; α(O)=8.16×10^{-5} *11*; α(P)=1.499×10^{-5} *21*; α(Q)=7.19×10^{-7} *10*
375.1 *1*	3.3 *3*	437.56	9/2$^+$	62.49	11/2$^-$	E1	0.0288 *4*	α(K)=0.02265 *32*; α(L)=0.00462 *6*; α(M)=0.001128 *16* α(N)=0.000310 *4*; α(O)=7.93×10^{-5} *11*; α(P)=1.457×10^{-5} *20*; α(Q)=7.01×10^{-7} *10* Mult.: From α(K)exp=0.0257 *49*,α(L1+L2)exp=0.0056 *18*.
379.5 *1*	40.6 *25*	379.52	7/2$^+$	0	9/2$^-$	E1	0.0281 *4*	α(K)=0.02213 *31*; α(L)=0.00451 *6*; α(M)=0.001100 *15* α(N)=0.000303 *4*; α(O)=7.73×10^{-5} *11*; α(P)=1.422×10^{-5} *20*; α(Q)=6.86×10^{-7} *10* Mult.: From α(K)exp=0.026 *4*, α(L1+L2)exp=0.005 *1*, α(K)exp=0.00048 *14*, α(M)exp=0.0015 *3*.
433.7 *3*	0.062 *10*	813.20	(5/2)$^-$	379.52	7/2$^+$	[E1]	0.02156 *30*	α(K)=0.01704 *24*; α(L)=0.00340 *5*; α(M)=0.000827 *12* α(N)=0.0002277 *32*; α(O)=5.83×10^{-5} *8*; α(P)=1.078×10^{-5} *15*; α(Q)=5.34×10^{-7} *8*
437.6 *1*	0.75 *5*	437.56	9/2$^+$	0	9/2$^-$	E1	0.02119 *30*	α(K)=0.01675 *23*; α(L)=0.00333 *5*; α(M)=0.000812 *11* α(N)=0.0002235 *31*; α(O)=5.72×10^{-5} *8*; α(P)=1.059×10^{-5} *15*; α(Q)=5.25×10^{-7} *7* Mult.: From α(K)exp=0.0245 *54*.
443.1 *3*	0.031 *9*	442.98	7/2$^+$	0	9/2$^-$	[E1]	0.02068 *29*	α(K)=0.01635 *23*; α(L)=0.00325 *5*; α(M)=0.000791 *11* α(N)=0.0002177 *31*; α(O)=5.57×10^{-5} *8*; α(P)=1.032×10^{-5} *15*; α(Q)=5.13×10^{-7} *7*
507.3 *3*	0.04 *1*	1007.97	(9/2$^+$)	500.67?	(9/2$^+$)	[M1,E2]	0.23 *17*	α(K)=0.18 *14*; α(L)=0.044 *22*; α(M)=0.011 *5* α(N)=0.0030 *14*; α(O)=8.E−4 *4*; α(P)=1.5×10^{-4} *8*; α(Q)=7.E−6 *6*
565.0 *2*	0.210 *17*	1007.97	(9/2$^+$)	442.98	7/2$^+$	M1	0.302 *4*	α(K)=0.2362 *33*; α(L)=0.0490 *7*; α(M)=0.01200 *17* α(N)=0.00332 *5*; α(O)=0.000862 *12*; α(P)=0.0001664 *23*; α(Q)=9.73×10^{-6} *14* Mult.: From α(K)exp=0.233 *46*, α(L1+L2)exp=0.049 *16*.
570.3 *3*	0.054 *14*	1007.97	(9/2$^+$)	437.56	9/2$^+$	M1	0.294 *4*	α(K)=0.2303 *32*; α(L)=0.0477 *7*; α(M)=0.01170 *16* α(N)=0.00324 *5*; α(O)=0.000840 *12*; α(P)=0.0001622 *23*; α(Q)=9.48×10^{-6} *13* Mult.: From α(K)exp=0.189 *79*.
609.2 *4*	≈0.03	852.19	(7/2)$^-$	243.07	9/2$^+$	[E1]	0.01132 *16*	α(K)=0.00904 *13*; α(L)=0.001719 *24*; α(M)=0.000416 *6*

$\gamma(^{249}Cf)$ (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[#]	Comments
									α(N)=0.0001146 *16*; α(O)=2.94×10^{-5} *4*; α(P)=5.52×10^{-6} *8*; α(Q)=2.91×10^{-7} *4*
625.3 *2*	0.130 *13*	813.20	(5/2)$^-$	187.94	7/2$^+$	[E1]		0.01080 *15*	α(K)=0.00862 *12*; α(L)=0.001634 *23*; α(M)=0.000396 *6* α(N)=0.0001089 *15*; α(O)=2.80×10^{-5} *4*; α(P)=5.25×10^{-6} *7*; α(Q)=2.78×10^{-7} *4*
628.5 *2*	0.210 *17*	1007.97	(9/2$^+$)	379.52	7/2$^+$	M1(+E2)	0.71 *+31−28*	0.163 *34*	α(K)=0.126 *27*; α(L)=0.028 *5*; α(M)=0.0069 *11* α(N)=0.00192 *30*; α(O)=0.00050 *8*; α(P)=9.5×10^{-5} *16*; α(Q)=5.2×10^{-6} *11* Mult.: From α(K)exp=0.126 *27*.
664.0 *5*	≈0.01	852.19	(7/2)$^-$	187.94	7/2$^+$	[E1]		0.00968 *14*	α(K)=0.00775 *11*; α(L)=0.001457 *21*; α(M)=0.000353 *5* α(N)=9.70×10^{-5} *14*; α(O)=2.496×10^{-5} *35*; α(P)=4.69×10^{-6} *7*; α(Q)=2.504×10^{-7} *35*
668.3 *2*	0.240 *19*	813.20	(5/2)$^-$	144.96	5/2$^+$	E1		0.00957 *13*	α(K)=0.00766 *11*; α(L)=0.001440 *20*; α(M)=0.000348 *5* α(N)=9.59×10^{-5} *13*; α(O)=2.466×10^{-5} *35*; α(P)=4.64×10^{-6} *6*; α(Q)=2.476×10^{-7} *35* Mult.: From α(K)exp≈0.038.
707.0 *5*	≈0.03	852.19	(7/2)$^-$	144.96	5/2$^+$	[E1]		0.00865 *12*	α(K)=0.00693 *10*; α(L)=0.001295 *18*; α(M)=0.000313 *4* α(N)=8.61×10^{-5} *12*; α(O)=2.217×10^{-5} *31*; α(P)=4.18×10^{-6} *6*; α(Q)=2.249×10^{-7} *32*
766.3[&] *3*	0.10[&] *1*	902.52	(9/2$^-$)	136.22	13/2$^-$	[E2]		0.0260 *4*	α(K)=0.01744 *24*; α(L)=0.00632 *9*; α(M)=0.001645 *23* α(N)=0.000458 *6*; α(O)=0.0001166 *16*; α(P)=2.119×10^{-5} *30*; α(Q)=7.71×10^{-7} *11*
766.3[&a] *3*	0.10[&] *1*	1007.97	(9/2$^+$)	243.07	9/2$^+$	[M1,E2]		0.08 *5*	α(K)=0.06 *4*; α(L)=0.014 *8*; α(M)=0.0034 *18* α(N)=1.0×10^{-3} *5*; α(O)=2.5×10^{-4} *13*; α(P)=4.7×10^{-5} *26*; α(Q)=2.5×10^{-6} *17* E_γ: Poor fit in the level. Level-energy difference=764.9 *1*.
789.7 *1*	1.15 *9*	852.19	(7/2)$^-$	62.49	11/2$^-$	E2		0.02448 *34*	α(K)=0.01658 *23*; α(L)=0.00583 *8*; α(M)=0.001515 *21* α(N)=0.000422 *6*; α(O)=0.0001074 *15*; α(P)=1.956×10^{-5} *27*; α(Q)=7.27×10^{-7} *10* Mult.: From α(K)exp=0.017 *4*.
813.2 *1*	9.2 *6*	813.20	(5/2)$^-$	0	9/2$^-$	E2		0.02309 *32*	α(K)=0.01578 *22*; α(L)=0.00540 *8*; α(M)=0.001398 *20* α(N)=0.000389 *5*; α(O)=9.92×10^{-5} *14*; α(P)=1.810×10^{-5} *25*; α(Q)=6.87×10^{-7} *10* Mult.: From α(K)exp=0.016 *3*, α(L1+L2)exp=0.0051 *9*, α(L3)exp=0.00055 *24*, α(M)exp=0.00155 *40*.
820.5 *5*	≈0.01	1007.97	(9/2$^+$)	187.94	7/2$^+$	[M1,E2]		0.07 *4*	α(K)=0.051 *35*; α(L)=0.012 *6*; α(M)=0.0029 *15* α(N)=8.E−4 *4*; α(O)=2.0×10^{-4} *11*; α(P)=3.9×10^{-5} *21*; α(Q)=2.1×10^{-6} *14*
840.0 *2*	0.097 *9*	902.52	(9/2$^-$)	62.49	11/2$^-$	[M1,E2]		0.06 *4*	α(K)=0.048 *33*; α(L)=0.011 *6*; α(M)=0.0027 *14*

γ(^{249}Cf) (continued)

E_γ	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[†]	δ[†]	α[#]	Comments
									α(N)=7.E−4 *4*; α(O)=1.9×10^{-4} *10*; α(P)=3.7×10^{-5} *20*; α(Q)=2.0×10^{-6} *13*
852.2 *1*	0.88 *7*	852.19	(7/2)$^-$	0	9/2$^-$	E2		0.02105 *29*	α(K)=0.01459 *20*; α(L)=0.00478 *7*; α(M)=0.001234 *17* α(N)=0.000343 *5*; α(O)=8.75×10^{-5} *12*; α(P)=1.603×10^{-5} *22*; α(Q)=6.27×10^{-7} *9* Mult.: From α(K)exp=0.0151 *32*, α(L1+L2)exp=0.0070 *25*.
862.8 *3*	0.018 *6*	1007.97	(9/2$^+$)	144.96	5/2$^+$	[E2]		0.02054 *29*	α(K)=0.01428 *20*; α(L)=0.00463 *6*; α(M)=0.001194 *17* α(N)=0.000332 *5*; α(O)=8.47×10^{-5} *12*; α(P)=1.553×10^{-5} *22*; α(Q)=6.12×10^{-7} *9*
902.6 *3*	0.018 *6*	902.52	(9/2$^-$)	0	9/2$^-$	[M1,E2]		0.052 *33*	α(K)=0.040 *27*; α(L)=0.009 *5*; α(M)=0.0022 *11* α(N)=6.1×10^{-4} *32*; α(O)=1.6×10^{-4} *8*; α(P)=3.0×10^{-5} *16*; α(Q)=1.6×10^{-6} *11*
945.4 *1*	0.24 *2*	1007.97	(9/2$^+$)	62.49	11/2$^-$	(E1)		0.00521 *7*	α(K)=0.00420 *6*; α(L)=0.000762 *11*; α(M)=0.0001835 *26* α(N)=5.05×10^{-5} *7*; α(O)=1.303×10^{-5} *18*; α(P)=2.475×10^{-6} *35*; α(Q)=1.385×10^{-7} *19* Mult.: Deduced by authors (1976Ah07) from upper limit set for ce(K).
^{x}1000.5 *5*	0.020 *8*								
1007.9 *1*	0.73 *6*	1007.97	(9/2$^+$)	0	9/2$^-$	(E1)		0.00467 *7*	α(K)=0.00377 *5*; α(L)=0.000681 *10*; α(M)=0.0001637 *23* α(N)=4.51×10^{-5} *6*; α(O)=1.163×10^{-5} *16*; α(P)=2.213×10^{-6} *31*; α(Q)=1.247×10^{-7} *17* Mult.: Deduced by authors (1976Ah07) from upper limit set for ce(K).
^{x}1021.4 *5*	≈0.01								
1093.2 *3*	0.031 *6*	1238.05	(5/2$^-$,7/2,9/2$^+$)	144.96	5/2$^+$				
1137.3 *5*	≈0.01	1199.8	(7/2$^-$,9/2)	62.49	11/2$^-$				
1199.8 *5*	0.016 *6*	1199.8	(7/2$^-$,9/2)	0	9/2$^-$				
1205.1 *5*	0.030 *6*	1267.7	(9/2$^-$)	62.49	11/2$^-$	[M1,E2]		0.025 *14*	α(K)=0.019 *11*; α(L)=0.0042 *21*; α(M)=1.0×10^{-3} *5* α(N)=2.8×10^{-4} *14*; α(O)=7.E−5 *4*; α(P)=1.4×10^{-5} *7*; α(Q)=8.E−7 *5*; α(IPF)=7.E−6 *4*
1218.5 *1*	1.51 *10*	1218.50	(7/2)$^-$	0	9/2$^-$	M1+E2	0.62 *+29−28*	0.030 *5*	α(K)=0.024 *4*; α(L)=0.0050 *7*; α(M)=0.00122 *17* α(N)=0.00034 *5*; α(O)=8.7×10^{-5} *12*; α(P)=1.68×10^{-5} *24*; α(Q)=9.6×10^{-7} *16*; α(IPF)=1.10×10^{-5} *17* Mult.: From α(K)exp=0.0230 *43*, α(L1+L2)exp=0.0054 *16*.
1238.0 *2*	0.023 *3*	1238.05	(5/2$^-$,7/2,9/2$^+$)	0	9/2$^-$				
1267.8 *5*	0.006 *2*	1267.7	(9/2$^-$)	0	9/2$^-$	[M1,E2]		0.022 *12*	α(K)=0.017 *10*; α(L)=0.0037 *18*; α(M)=9.E−4 *4*

γ(^{249}Cf) (continued)

E_γ	I_γ[@]	E_i(level)	E_f	J^π_f	Comments
					α(N)=2.5×10^{-4} *12*; α(O)=6.4×10^{-5} *31*; α(P)=1.2×10^{-5} *6*; α(Q)=7.E−7 *4*; α(IPF)=1.8×10^{-5} *10*
1304.3 *3*	0.038 *4*	1304.30	0	9/2$^-$	

[†] From conversion coefficients deduced by the evaluator from Ice and Iγ data measured by 1976Ah07. The evaluator has normalized the experimental conversion coefficient values using the Normalized to Peak Gamma Method (NPG). Three well-known E2 gamma transistions were used in the normalization N(γ)=α(K)(BrICC)/α(K)(exp): 789.7, 813.2 and 852.2 transitions with 1.00(18), 1.04 (13), 0.99 (17), respectively giving a weighted average N=1.02 *13*. α(normalized)=N*(Ice/Iγ) are given in comments. All values are given in the Adopted Gammas as well.

[‡] From analysis of anomalous M2 conversion coefficients, see 1993Li52.

[#] Additional information 1.

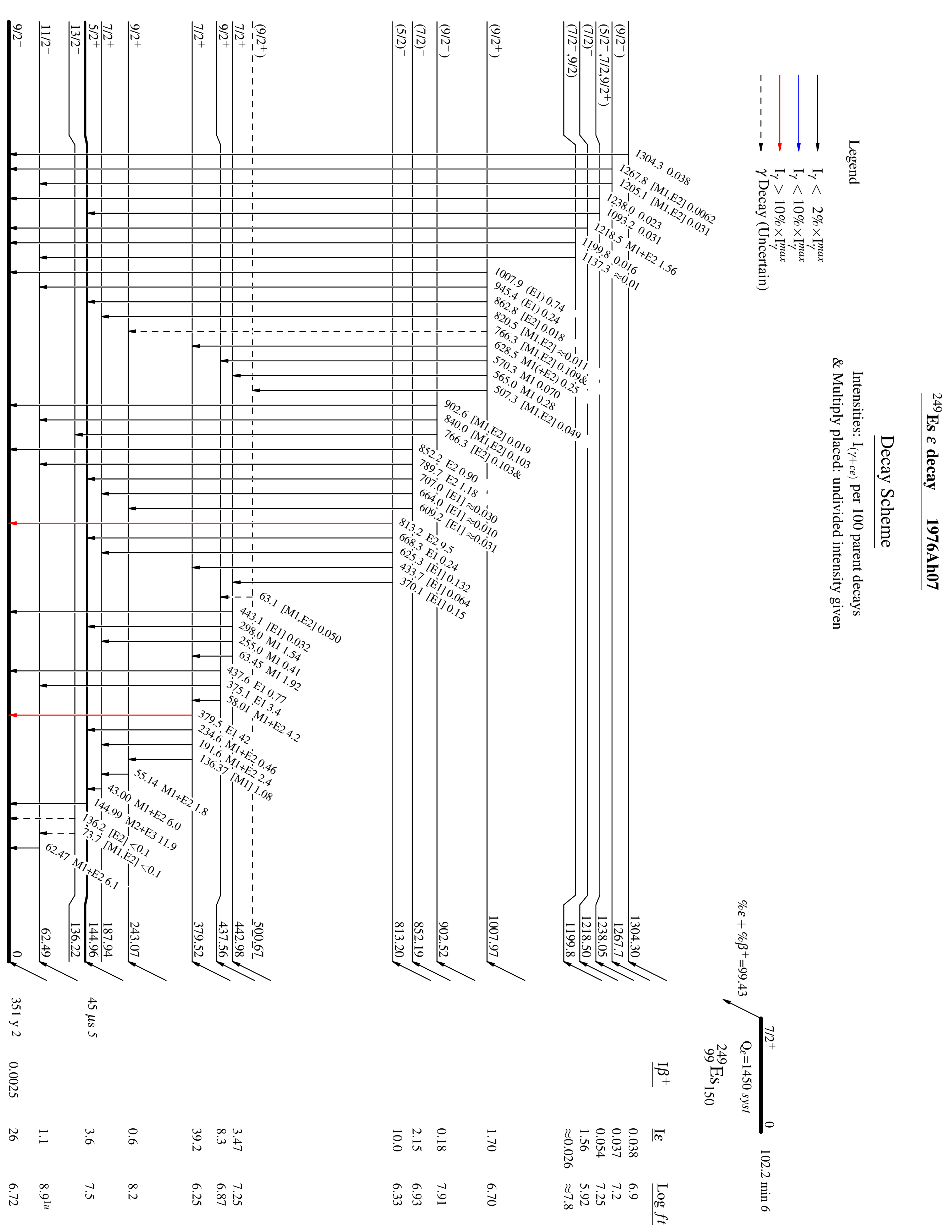
[@] Absolute intensity per 100 decays.

[&] Multiply placed with undivided intensity.

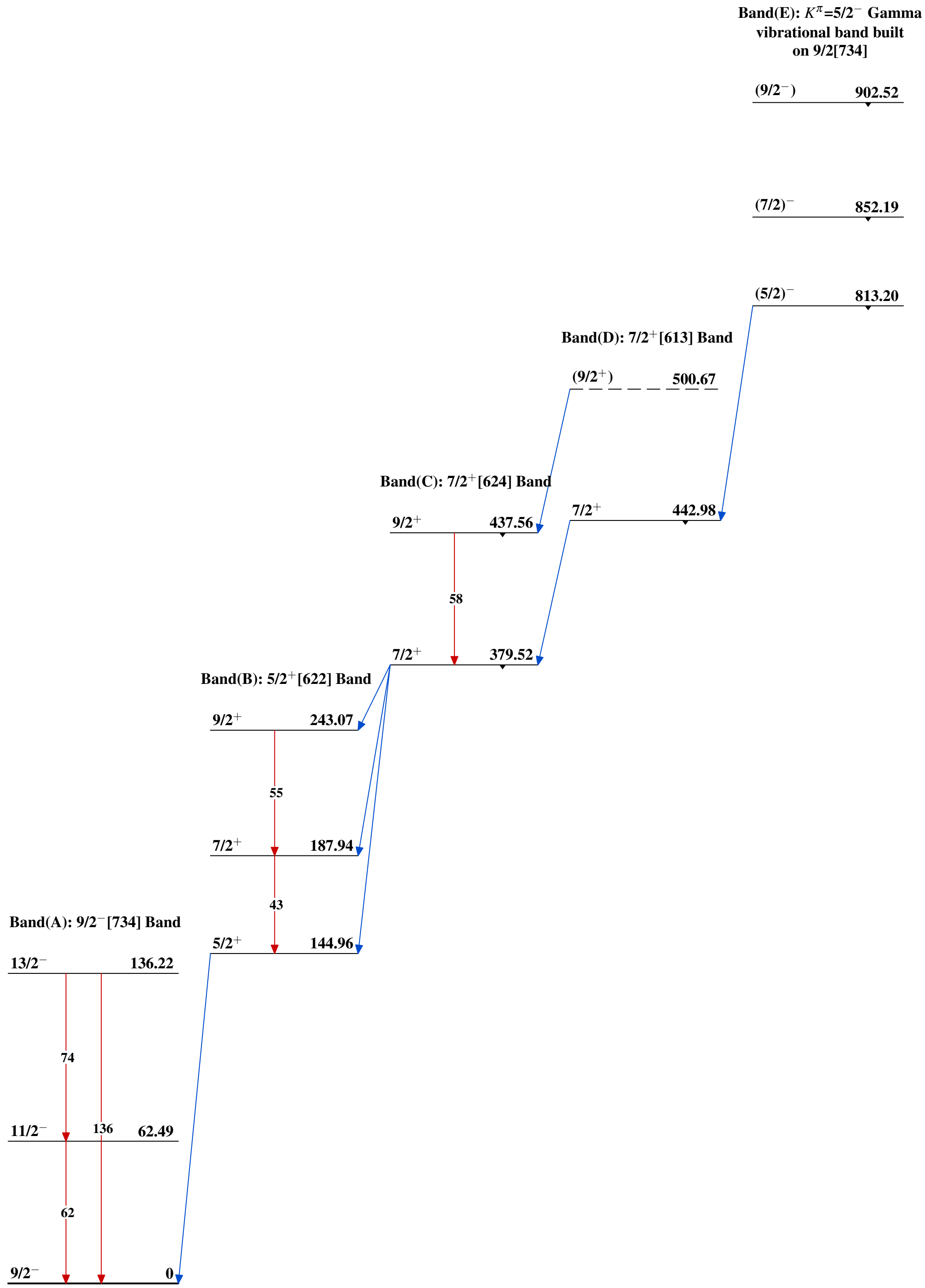
[a] Placement of transition in the level scheme is uncertain.

[x] γ ray not placed in level scheme.

$^{249}_{98}$Cf$_{151}$-8


249Es ε decay 1976Ah07
Decay Scheme
Intensities: I(γ+ce) per 100 parent decays
& Multiply placed: undivided intensity given
Legend
Iγ < 2%×Iγmax
Iγ < 10%×Iγmax
Iγ > 10%×Iγmax
γ Decay (Uncertain)
7/2+ 0 102.2 min 6
Qε=1450 syst
249 99 Es150
%ε+%β+=99.43
Iβ+ Iε Log ft
(9/2−) 1304.30 0.038 6.9
1267.7 0.037 7.2
(5/2−,7/2,9/2+) 1238.05 0.054 7.25
(7/2)− 1218.50 1.56 5.92
(7/2−,9/2) 1199.8 ≈0.026 ≈7.8
(9/2+) 1007.97 1.70 6.70
(9/2−) 902.52 0.18 7.91
(7/2)− 852.19 2.15 6.93
(5/2)− 813.20 10.0 6.33
(9/2+) 500.67
7/2+ 442.98 3.47 7.25
9/2+ 437.56 8.3 6.87
7/2+ 379.52 39.2 6.25
9/2+ 243.07 0.6 8.2
7/2+ 187.94
5/2+ 144.96 45 μs 5 3.6 7.5
13/2− 136.22
11/2− 62.49 1.1 8.9lu
9/2− 0 351 y 2 0.0025 26 6.72
1304.3 0.038
1267.8 [M1,E2] 0.0062
1205.1 [M1,E2] 0.031
1238.0 0.023
1093.2 0.031
1218.5 M1+E2 1.56
1199.8 0.016
1137.3 ≈0.01
1007.9 (E1) 0.74
945.4 (E1) 0.24
862.8 [E2] 0.018
820.5 [M1,E2] ≈0.011
766.3 [M1,E2] 0.109&
628.5 M1(+E2) 0.25
570.3 M1 0.070
565.0 M1 0.28
507.3 [M1,E2] 0.049
902.6 [M1,E2] 0.019
840.0 [M1,E2] 0.103
766.3 [E2] 0.103&
852.2 E2 0.90
789.7 E2 1.18
707.0 [E1] ≈0.030
664.0 [E1] ≈0.010
609.2 [E1] ≈0.031
813.2 E2 9.5
668.3 E1 0.24
625.3 [E1] 0.132
433.7 [E1] 0.064
370.1 [E1] 0.15
63.1 [M1,E2] 0.050
443.1 [E1] 0.032
298.0 M1 1.54
255.0 M1 0.41
63.45 M1 1.92
437.6 E1 0.77
375.1 E1 3.4
58.01 M1+E2 4.2
379.5 E1 42
234.6 M1+E2 0.46
191.6 M1+E2 2.4
136.37 [M1] 1.08
55.14 M1+E2 1.8
43.00 M1+E2 6.0
144.99 M2+E3 11.9
136.2 [E2] <0.1
73.7 [M1,E2] <0.1
62.47 M1+E2 6.1
249 98 Cf151

^{249}Es ε decay 1976Ah07



$^{249}_{98}Cf_{151}$