^{251}Cf α decay 2003Ah07,1968Ch03,1970BrZN

History

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

Parent: ^{251}Cf: E=0.0; J$^{\pi}$=1/2^{+}; $T_{1/2}$=898 y *44*; Q(α)=6177.0 *9*; %α decay=100

^{251}Cf-$T_{1/2}$: From Adopted Levels in ^{251}Cf.

^{251}Cf-Q(α): From 2012Wa38. Eα (to 404.90 level)=5679.3 *16* yields Qα=6176.2 *16*.

2003Ah07: Produced ^{251}Cf from α decay of ^{255}Fm. Measured level $T_{1/2}$, γ, α, α-γ coincidence, and electron spectra with high resolution spectrometers such as the passivated, implanted, planar silicon Detector (PIPS) (FWHM=10.5 and 9.2 keV). The latter being also measured by the PIN diode.

1970BrZN: Studied alpha spectrum decay of ^{251}Cf with a Au-Si surface barrier detector (FWHM=15 keV) and ZnS-photomultiplier tube. Measured γ′s with 5 cm^3 Ge(Li) detector and electrons with Si(Li) detector. Measured α-particles energies, γ energies, intensities, α-γ coincidence, and conversion electrons.

1968Ch03: α decay of ^{251}Cf along with α-γ coincidence measurements were done using Si(Au), Ge(Li) and NaI(Tl) detectors Measured Eα, Iα, Eγ, Iγ, α-γ coincidences. Deduced J^{π}, $T_{1/2}$ and identified rotational bands.

Other measurements: 1966Rg01.

^{247}Cm Levels

E(level)[†]	J$^{\pi}$	$T_{1/2}$	Comments
0.0[‡]	9/2^{-}	1.56×10^{7} y *5*	$T_{1/2}$: From Adopted Levels.
61.67[‡] *4*	11/2^{-}		
134.66[‡] *6*	13/2^{-}		
219.02[‡] *7*	15/2^{-}		
227.379[#] *19*	5/2^{+}	26.3 μs *3*	$T_{1/2}$: From 2003Ah03. Others: 25 μs *3* (1968Ch03).
265.86[#] *4*	(7/2^{+})		
285.41[@] *5*	(7/2^{+})		
318.31[#] *5*	9/2^{+}		
345.89[@] *6*	(9/2^{+})		
404.90[&] *3*	1/2^{+}	100.6 ns *6*	$T_{1/2}$: From 2003Ah03.
432.98[&] *23*	(3/2^{+})		
448.8[&] *13*	(5/2^{+})		
516.68[&] *11*	(7/2^{+})		
518.59[a] *7*	(3/2^{+})		
581.67[a] *8*	(5/2^{+})		

[†] From least-squares fit to Eγ′s.
[‡] Band(A): 9/2[734].
[#] Band(B): 5/2[622].
[@] Band(C): 7/2[624].
[&] Band(D): 1/2[620].
[a] Band(E): 1/2[631].

α radiations

Eα[†]	E(level)	Iα[‡@]	HF[#]	Comments
5505 *2*	581.67	0.27 *5*	33 *7*	Iα: 0.060 *17* from I(γ+ce) imbalances.
5567 *2*	518.59	≤1.9	≥10	Eα: From Eα(404.9 level)=5679.3 *16* and the level energy difference from least-squares fit to Eγ′s (recoil energy is taken into account). Eα=5568 *2*, measured by 2003Ah07, is assumed by the evaluator to be a doublet, feeding the 516.7- and 518.6-keV levels. Iα: 1.9 *1* was measured by 2003Ah07 for the doublet.

Continued on next page (footnotes at end of table)

^{251}Cf α decay 2003Ah07,1968Ch03,1970BrZN (continued)

α radiations (continued)

Eα[†]	E(level)	Iα[‡@]	HF[#]	Comments
5569 *2*	516.68	≤1.9	≥11	Eα: From Eα(404.9 level)=5679.3 *16* and the level energy difference from least-squares fit to Eγ′s (recoil energy is taken into account). Eα=5568 *2*, measured by 2003Ah07, is assumed by the evaluator to be a doublet, feeding the 516.7- and 518.6-keV levels. Iα: 1.9 *1* was measured by 2003Ah07 for the doublet.
5635 *2*	448.8	4.9 *2*	10.7 *8*	
5651 *2*	432.98	3.3 *2*	19.5 *17*	
5679.3 *16*	404.90	35.4 *5*	2.62 *16*	Iα: 44.2 *24* from I(γ+ce) imbalances. Eα: Recommended by 1991Ry01 from Eα=5680.3 *10* measured by 1971Bb10, 5667 *10* by 1968Ch03, and 5667 *3* by 1970BrZN. Adjustments were applied by 1991Ry01 because of changes in calibration energies. Eα=5679 *2* from 2003Ah07.
5738 *2*	345.89	0.8 *1*	248 *34*	
5766 *2*	318.31	3.6 *2*	78 *7*	
5798 *2*	285.41	2.5 *2*	170 *17*	
5817 *2*	265.86	4.0 *2*	136 *11*	
5854 *2*	227.379	27.6 *5*	31.7 *19*	
(5859)	219.02			From the γ′s de-exciting the 219-keV level, existence of an alpha branch to the 219.0-keV level with Iα=1.2% *7* and Eα=5862 *2* may be deduced from intensity balance. For Iα≈1.2%, HF≈800.
5946 *2*	134.66	0.60 *6*	4.52×10^3 *52*	
6017 *2*	61.67	12.5 *3*	519 *32*	Iα: 9.7 *16* from I(γ+ce) imbalances.
6078 *2*	0.0	2.6 *1*	5.15×10^3 *36*	Iα: 6 *5* from I(γ+ce) imbalances.

† Measurements by 2003Ah07, except where noted otherwise.

‡ Measurements of 2003Ah07 are adopted.

$r_0(^{247}Cm)$=1.4924 *88*, unweighted average of $r_0(^{246}Cm)$=1.4836 *5* and $r_0(^{248}Cm)$=1.5012 *6* (1998Ak04), is used in calculations of HF.

@ Absolute intensity per 100 decays.

γ(^{247}Cm)

^{251}Cm x-rays: (2003Ah07)

E(x-ray)	I(x-ray)	Transitions
104.57 *2*	12.6 *7*	$K\alpha_2$ x-ray
109.26 *2*	19.8 *10*	$K\alpha_1$ x-ray
122.31 *2*	7.7 *5* I($K\beta_3$ x-ray+$K\beta_1$ x-ray)	$K\beta_3$ x-ray
123.40 *2*		$K\beta_1$ x-ray
127.01 *4*	2.6 *2* I($K\beta_2$ x-ray+$K\beta_4$ x-ray +KO_{23} x-ray)	$K\beta_2$ x-ray+$K\beta_4$ x-ray
128.00 *5*		KO_{23} x-ray

Others: 1966Rg01, 1968Ch03, 1970BrZN

E_γ [†]	I_γ [‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [@]	δ	α [a]	Comments
(16[#] *3*)		448.8	(5/2$^+$)	432.98	(3/2$^+$)				
(28[#] *2*)		432.98	(3/2$^+$)	404.90	1/2$^+$				
38.48 *5*	0.038 *6*	265.86	(7/2$^+$)	227.379	5/2$^+$	(M1+E2)	0.21[@] *5*	183[&] *32*	α(L)=1.4×10^2 *3*; α(M)=35 *8* α(N)=9.8 *21*; α(O)=2.4 *5*; α(P)=0.44 *8*; α(Q)=0.0202 *4*
(44[#] *2*)		448.8	(5/2$^+$)	404.90	1/2$^+$				
52.45 *5*	0.048 *5*	318.31	9/2$^+$	265.86	(7/2$^+$)	(M1+E2)	0.27[@] *6*	70[&] *8*	α(L)=51 *8*; α(M)=13.3 *23* α(N)=3.7 *7*; α(O)=0.92 *15*; α(P)=0.169 *24*; α(Q)=0.00792 *21*
58.03 *5*	0.024 *5*	285.41	(7/2$^+$)	227.379	5/2$^+$	(M1+E2)	0.53[@] *11*	80[&] *22*	α(L)=59 *11*; α(M)=16 *4* α(N)=4.4 *9*; α(O)=1.08 *21*; α(P)=0.19 *4*; α(Q)=0.0052 *4*
60.5 *1*	0.010 *3*	345.89	(9/2$^+$)	285.41	(7/2$^+$)	(M1+E2)	0.48[@] *16*	62[&] *21*	α(L)=46 *13*; α(M)=12 *4* α(N)=3.4 *11*; α(O)=0.83 *25*; α(P)=0.15 *4*; α(Q)=0.0047 *5*
61.67 *5*	0.40 *3*	61.67	11/2$^-$	0.0	9/2$^-$	M1+E2	0.25[@] *2*	37.5 *16*	α(L)=27.8 *11*; α(M)=7.1 *4* α(N)=1.96 *9*; α(O)=0.491 *21*; α(P)=0.092 *4*; α(Q)=0.00493 *8* α(L1+L2):α(L3):α(M+N)=23.5 *31*:3.3 *8*:11.0 *17* (2003Ah07). α(K):α(L1+L2):α(L3):α(M):α(N)=0.24 *5*:1.0 *1*:0.5 *1*:0.7 *1*:0.37 *5* (1970BrZN).
(68[#] *2*)		516.68	(7/2$^+$)	448.8	(5/2$^+$)				

γ(^{247}Cm) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J_i^π	E_f	J_f^π	Mult. [@]	δ	α [a]	Comments
73.00 *8*	0.040 *5*	134.66	13/2⁻	61.67	11/2⁻	[M1+E2]	0.7[@] *+5−4*	39[&] *16*	α(L)=28 *13*; α(M)=8 *4* α(N)=2.1 *10*; α(O)=0.52 *24*; α(P)=0.09 *4*; α(Q)=0.0023 *7*
(83.7[#] *2*)		516.68	(7/2⁺)	432.98	(3/2⁺)				
84.35 *8*	0.040 *5*	219.02	15/2⁻	134.66	13/2⁻	[M1+E2]		26 *15*	α(L)=19 *11*; α(M)=5 *4* α(N)=1.5 *9*; α(O)=0.36 *22*; α(P)=0.06 *4*; α(Q)=0.0012 *9*
113.7 *1*	0.024 *5*	518.59	(3/2⁺)	404.90	1/2⁺	[M1+E2]		8 *3*	α(L)=5.5 *20*; α(M)=1.5 *7* α(N)=0.41 *18*; α(O)=0.10 *4*; α(P)=0.018 *6*; α(Q)=0.0005 *4*
134.65 *8*	0.014 *3*	134.66	13/2⁻	0.0	9/2⁻	[E2]		4.94	α(K)=0.1531 *22*; α(L)=3.46 *5*; α(M)=0.976 *14* α(N)=0.272 *4*; α(O)=0.0659 *10*; α(P)=0.01104 *16*; α(Q)=6.08×10^{-5} *9*
157.35 *8*	0.020 *4*	219.02	15/2⁻	61.67	11/2⁻	[E2]		2.56	α(K)=0.1741 *25*; α(L)=1.723 *25*; α(M)=0.485 *7* α(N)=0.1350 *20*; α(O)=0.0328 *5*; α(P)=0.00552 *8*; α(Q)=3.65×10^{-5} *6*
165.70 *5*	0.12 *1*	227.379	5/2⁺	61.67	11/2⁻	E3		30.4	α(K)=0.235 *4*; α(L)=21.3 *3*; α(M)=6.47 *10* α(N)=1.83 *3*; α(O)=0.445 *7*; α(P)=0.0750 *11*; α(Q)=0.000469 *7* Ice(L1+L2):Ice(L3)=15 *3*:6.7 *26* (2003Ah07).
177.52 *2*	17.3 *9*	404.90	1/2⁺	227.379	5/2⁺	E2		1.567 *22*	α(K)=0.1643 *23*; α(L)=1.015 *15*; α(M)=0.285 *4* α(N)=0.0794 *12*; α(O)=0.0193 *3*; α(P)=0.00327 *5*; α(Q)=2.52×10^{-5} *4* Ice(K):Ice(L1+L2):Ice(L3):Ice(M+N)=0.19 *3*:0.71 *8*:0.31 *3*:0.41 *5* (2003Ah07). Ice(K):Ice(L1+L2):Ice(L3):Ice(M):Ice(N)= 4.1 *6*:18 *1*:9 *1*:12 *1*:6.4 *10* (1970BrZN). α(K)exp=0.25, α(exp)=1.27 (1968Ch03).
227.38 *2*	6.8 *3*	227.379	5/2⁺	0.0	9/2⁻	M2+E3	0.52 *+9−8*	10.3 *4*	α(K)=6.0 *5*; α(L)=3.15 *9*; α(M)=0.87 *3* α(N)=0.242 *9*; α(O)=0.0609 *20*; α(P)=0.0113 *3*; α(Q)=0.00056 *4* α(K):α(L1+L2):α(L3):α(M+N)=6.0 *5*:2.7 *3*:0.41 *5* :1.53 *17* (2003Ah07). α(K):α(L1+L2):α(L3):α(M):α(N)=7 *2*:3.7 *6*:0.6 *2*:2.1 *4* :0.85 *15* (1970BrZN).
256.65 *8*	0.13 *1*	318.31	9/2⁺	61.67	11/2⁻	[E1]		0.0611 *9*	α(K)=0.0477 *7*; α(L)=0.01007 *15*; α(M)=0.00246 *4* α(N)=0.000670 *10*; α(O)=0.0001672 *24*; α(P)=3.10×10^{-5} *5*; α(Q)=1.675×10^{-6} *24*
265.86 *8*	0.43 *3*	265.86	(7/2⁺)	0.0	9/2⁻	[E1]		0.0565 *8*	α(K)=0.0442 *7*; α(L)=0.00927 *13*; α(M)=0.00226 *4* α(N)=0.000617 *9*; α(O)=0.0001540 *22*; α(P)=2.86×10^{-5} *4*; α(Q)=1.559×10^{-6} *22* Since an E1 transition from 5/2[622] to 9/2[734] state would be K forbidden, there might be some M2 admixture in 265.86 γ. α(M2)=7.10.
284.2 *1*	0.12 *1*	345.89	(9/2⁺)	61.67	11/2⁻	[E1]		0.0489 *7*	α(K)=0.0383 *6*; α(L)=0.00794 *12*; α(M)=0.00194 *3*

$^{247}_{96}$Cm$_{151}$-4

γ(^{247}Cm) (continued)

$E_γ$ [†]	$I_γ$ [‡b]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult. [@]	α [a]	Comments
								α(N)=0.000528 *8*; α(O)=0.0001320 *19*; α(P)=2.46×10^{-5} *4*; α(Q)=1.362×10^{-6} *19*
285.41 *8*	1.13 *9*	285.41	(7/2$^+$)	0.0	9/2$^-$	[E1]	0.0484	α(K)=0.0380 *6*; α(L)=0.00787 *11*; α(M)=0.00192 *3* α(N)=0.000523 *8*; α(O)=0.0001308 *19*; α(P)=2.44×10^{-5} *4*; α(Q)=1.350×10^{-6} *19*
289.3 *1*	0.070 *7*	516.68	(7/2$^+$)	227.379	5/2$^+$	[M1+E2]	0.9 *7*	α(K)=0.7 *6*; α(L)=0.19 *6*; α(M)=0.049 *13* α(N)=0.014 *4*; α(O)=0.0034 *9*; α(P)=0.00064 *21*; α(Q)=3.E−5 *3*
291.20 *8*	0.30 *3*	518.59	(3/2$^+$)	227.379	5/2$^+$	[M1+E2]	0.9 *7*	α(K)=0.7 *6*; α(L)=0.19 *6*; α(M)=0.048 *13* α(N)=0.013 *4*; α(O)=0.0033 *9*; α(P)=0.00063 *21*; α(Q)=3.E−5 *3*
315.8 *1*	0.024 *3*	581.67	(5/2$^+$)	265.86	(7/2$^+$)	[M1+E2]	0.7 *6*	α(K)=0.5 *5*; α(L)=0.15 *6*; α(M)=0.037 *12* α(N)=0.010 *3*; α(O)=0.0026 *8*; α(P)=0.00049 *18*; α(Q)=2.6×10^{-5} *21*
318.3 *1*	0.050 *5*	318.31	9/2$^+$	0.0	9/2$^-$	[E1]	0.0384	α(K)=0.0302 *5*; α(L)=0.00614 *9*; α(M)=0.001495 *21* α(N)=0.000408 *6*; α(O)=0.0001021 *15*; α(P)=1.91×10^{-5} *3*; α(Q)=1.086×10^{-6} *16*
345.9 *1*	0.043 *4*	345.89	(9/2$^+$)	0.0	9/2$^-$	[E1]	0.0322 *5*	α(K)=0.0254 *4*; α(L)=0.00510 *8*; α(M)=0.001240 *18* α(N)=0.000338 *5*; α(O)=8.48×10^{-5} *12*; α(P)=1.593×10^{-5} *23*; α(Q)=9.22×10^{-7} *13*
354.3 *1*	0.013 *2*	581.67	(5/2$^+$)	227.379	5/2$^+$	[M1+E2]	0.5 *4*	α(K)=0.4 *4*; α(L)=0.10 *5*; α(M)=0.026 *10* α(N)=0.0072 *25*; α(O)=0.0018 *7*; α(P)=0.00034 *14*; α(Q)=1.9×10^{-5} *16*

† From 2003Ah07. Other measurements: 1968Ch03, 1970BrZN.

‡ Measured by 2003Ah07, except as noted otherwise. Absolute intensities were determined by 2003Ah07 by measuring the alpha rate of a thin ^{251}Cf source with a Si detector of known geometry and measuring the gamma spectrum with a Ge spectrometer of known absolute efficiency which was determined with a calibrated source. Earlier measurements: 1968Ch03, 1970BrZN. See also ^{247}Am $β^-$ decay.

\# Transition was not observed. Existence is from the level scheme.

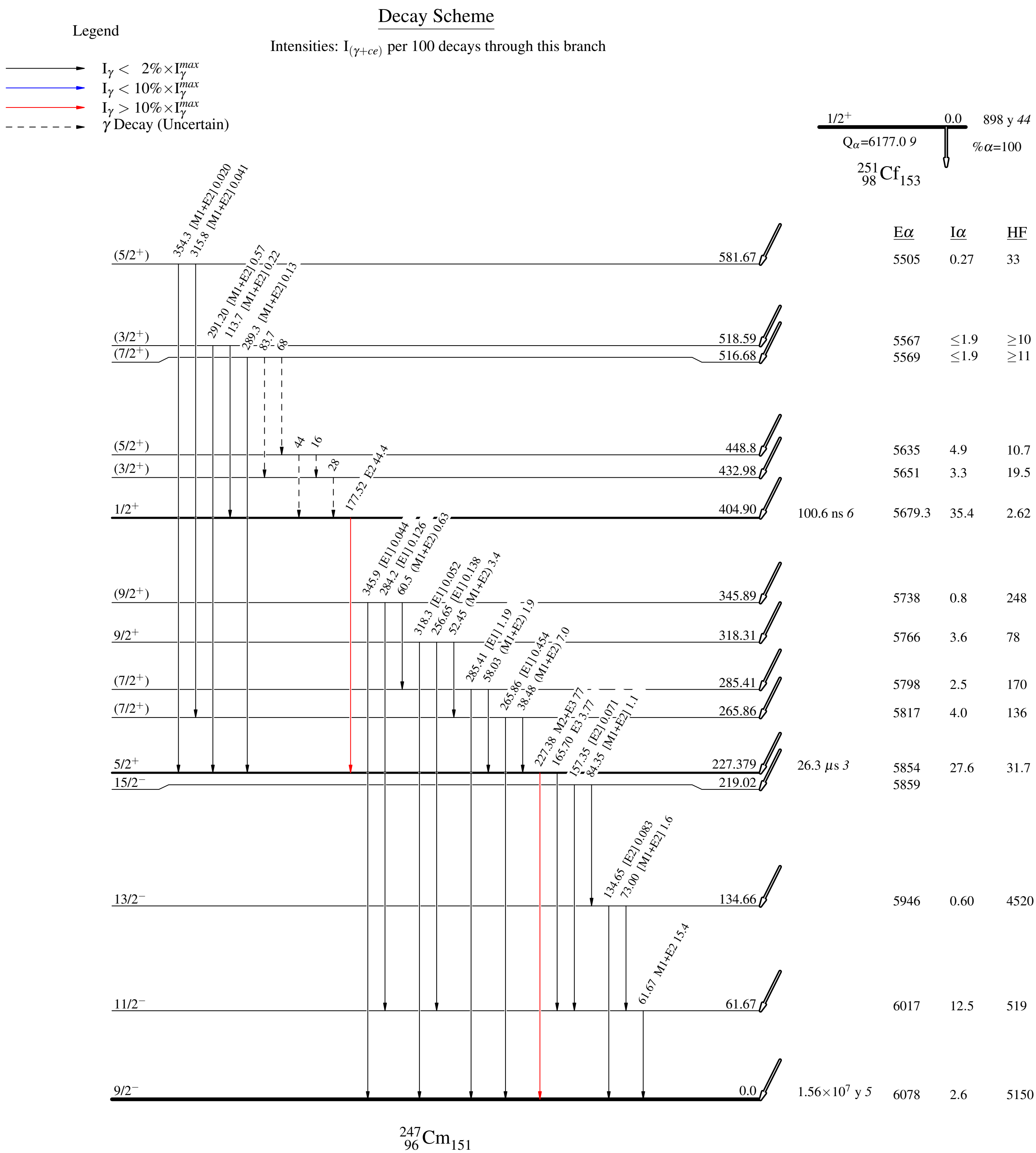
@ Determined by evaluator from α(exp) (2003Ah07).

& Deduced by evaluator from intensity balance.

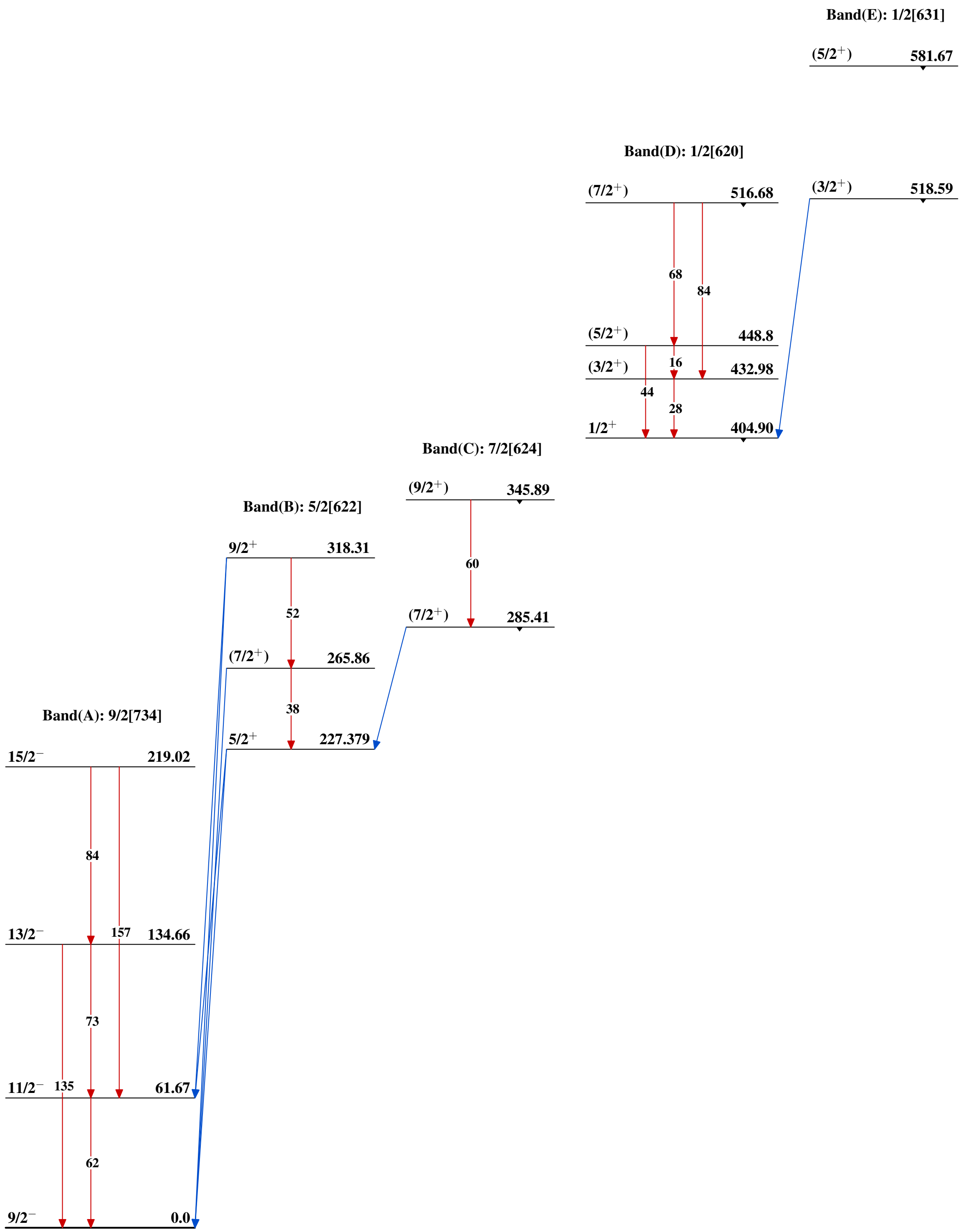
a Additional information 1.

b Absolute intensity per 100 decays.

^{251}Cf α decay 2003Ah07,1968Ch03,1970BrZN



^{251}Cf α decay 2003Ah07,1968Ch03,1970BrZN



$^{247}_{96}Cm_{151}$