^{251}Fm ε decay 1978Ah02

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. Morse	NDS 189,111 (2023)	23-Sep-2022

Parent: ^{251}Fm: E=0; J$^{\pi}$=(9/2^{-}); T$_{1/2}$=5.30 h *8*; Q(ε)=1447 *15*; %ε+%β^{+} decay=98.20 *13*
^{251}Fm-Q(ε): From 2021Wa16.
1978Ah02: ^{251}Fm produced by ^{249}Cf(α,2n); measured γ (Ge(Li)), ce (Si(Li)), $\gamma\gamma$.

^{251}Es Levels

E(level)[@]	J$^{\pi}$[&]	Comments
0[†]	3/2^{-}	configuration=π3/2^{-}[521]
8.30[‡] *24*	(7/2)$^{+}$	configuration=π7/2^{+}[633]
31.70[†] *20*	5/2^{-}	
55.80[‡] *24*	(9/2)$^{+}$	
76.1[†] *3*	7/2^{-}	
114.04[‡] *25*	(11/2^{+})	
182.5[‡] *3*	(13/2^{+})	
263.0[‡] *4*	(15/2^{+})	
461.40 *22*	7/2^{-}	configuration=π7/2^{-}[514]
777.90 *24*	(9/2)$^{+}$	configuration=π9/2^{+}[624]
889.06[#] *24*	(11/2)$^{+}$	configuration={π7/2^{+}[633]⊗2^{+}}11/2^{+}
957.48[#] *24*	(13/2)$^{+}$	
1238.90 *24*	(11/2)$^{+}$	configuration={ν9/2^{-}[734]⊗ν1/2^{+}[620]⊗π3/2^{-}[521]}11/2^{+}
1264.90 *24*	(11/2)$^{+}$	Interpreted as a three-quasiparticle state, but a configuration could not be definitively assigned. The most likely configuration is stated to be {ν9/2^{-}[734]⊗ν5/2^{+}[622]⊗π3/2^{-}[521]}11/2^{+}.
1301.3 *3*	(7/2^{+},9/2,11/2)	
1307.0 *3*	(7/2^{+},9/2,11/2^{+})	
1356.9 *3*	(7/2^{+},9/2,11/2^{+})	

† Band(A): π3/2^{-}[521].
‡ Band(B): π7/2^{+}[633].
# Band(C): {π7/2^{+}[633]⊗2^{+}}11/2^{+} γ-vibrational band.
@ No γ decay has been observed to the ground state of ^{251}Es. The level energies calculated here rely on the 5/2^{-} member of the π3/2^{-}[521] band having an energy of 31.7 *2* keV. This value was calculated in 1978Ah02 from the observed difference of 44.4 *2* keV in the energies of the γ rays depopulating the 461.4-keV level to the 7/2^{-} and 5/2^{-} members of this band. All other level energies are established relative to this level using a least-squares fit to the γ-ray energies.
& From Adopted Levels.

ε,β^{+} radiations

E(decay)	E(level)	Iβ^{+} [‡]	Iε[‡]	Log *ft*	I(ε+β^{+})[†‡]	Comments
(90 *15*)	1356.9		0.0182 *11*	7.18 *22*	0.0182 *11*	εL=0.62 *4*; εM+=0.38 *4*
(140 *15*)	1307.0		0.069 *3*	7.07 *13*	0.069 *3*	εK=0.00 *5*; εL=0.670 *22*; εM+=0.330 *22*
(146 *15*)	1301.3		0.043 *3*	7.32 *14*	0.043 *3*	εK=0.01 *7*; εL=0.67 *4*; εM+=0.32 *3*
(182 *15*)	1264.90		0.93 *5*	6.30 *13*	0.93 *5*	εK=0.19 *9*; εL=0.56 *6*; εM+=0.25 *3*
(208 *15*)	1238.90		2.43 *9*	6.08 *12*	2.43 *9*	εK=0.31 *7*; εL=0.48 *5*; εM+=0.210 *23*
(558 *15*)	889.06		0.45 *15*	8.05 *15*	0.45 *15*	εK=0.672 *4*; εL=0.2369 *25*; εM+=0.0910 *12*
(669 *15*)	777.90		0.43 *3*	8.27 *4*	0.43 *3*	εK=0.6925 *23*; εL=0.2229 *16*; εM+=0.0846 *8*
(986 *15*)	461.40		2.84 *11*	7.834 *24*	2.84 *11*	εK=0.7218 *9*; εL=0.2028 *7*; εM+=0.0754 *3*
(1391 *15*)	55.80		12.7 *16*	7.51 *6*	12.7 *16*	εK=0.7377 *4*; εL=0.1918 *3*; εM+=0.07047 *13*
(1439 *15*)	8.30	0.0064 *11*	80.6 *16*	6.744 *15*	80.6 *16*	av Eβ=216.9 *71*; εK=0.7389 *4*; εL=0.1910 *3*;

Continued on next page (footnotes at end of table)

^{251}Fm ε decay 1978Ah02 (continued)

ϵ,β^+ radiations (continued)

E(decay)	E(level)	Comments
		εM+=0.07009 *12* Iβ^+: Lacking any other information, the evaluator calculated the β feeding to this state assuming that it does not decay to the ground state due to the very low energy and presumed M2 nature of the decay.

† Calculated from γ-ray intensity balance.
‡ Absolute intensity per 100 decays.

γ(^{251}Es)

E_γ	I_γ[&]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ[‡]	α[@]	Comments
47.48 *6*	0.12 *1*	55.80	(9/2)$^+$	8.30	(7/2)$^+$	M1+E2	0.243 *+25−27*	125 *9*	ce(M)=2.65 *19*; ce(N)=1.02 *8*; α(M)exp=22 *2*; α(N)exp=8.5 *10* α(L)=92 *7*; α(M)=24.1 *18*; α(N)=6.7 *5*; α(O)=1.73 *13*; α(P)=0.311 *20*; α(Q)=0.01213 *20*
281.4 *1*	0.072 *5*	1238.90	(11/2)$^+$	957.48	(13/2)$^+$	M1		2.24	ce(K)=0.12 *1*; ce(L1)+ce(L2)=0.029 *3*; ce(M)=0.0084 *14*; α(K)exp=1.67 *18* α(L1)exp+α(L2)exp=0.40 *5*; α(M)exp=0.12 *2* α(K)=1.741 *25*; α(L)=0.371 *6*; α(M)=0.0914 *13*; α(N)=0.0254 *4*; α(O)=0.00666 *10* α(P)=0.001288 *18*; α(Q)=7.36×10^{-5} *11*
307.4 *1*	0.036 *3*	1264.90	(11/2)$^+$	957.48	(13/2)$^+$	(M1+E2)		1.01 *74*	ce(K)=0.043 *4*; ce(L1)+ce(L2)=0.011 *2*; ce(M)=0.0070 *14*; α(K)exp=1.19 *15* α(L1)exp+α(L2)exp=0.31 *6*; α(M)exp=0.19 *4* α(K)=0.72 *65*; α(L)=0.214 *77*; α(M)=0.055 *17*; α(N)=0.0153 *46*; α(O)=0.0040 *13* α(P)=7.3×10^{-4} *28*; α(Q)=3.2×10^{-5} *26*
349.9 *1*	0.84 *4*	1238.90	(11/2)$^+$	889.06	(11/2)$^+$	M1		1.223	ce(K)=0.84 *6*; ce(L1)+ce(L2)=0.210 *15*; ce(L3)<0.002; ce(M)=0.051 *5*; ce(N)=0.023 *3* α(K)exp=1.0 *1*; α(L1)exp+α(L2)exp=0.25 *2*; α(L3)exp<0.003; α(M)exp=0.061 *7*; α(N)exp=0.027 *4* α(K)=0.953 *14*; α(L)=0.202 *3*; α(M)=0.0498 *7*; α(N)=0.01384 *20*; α(O)=0.00363 *5* α(P)=0.000702 *10*; α(Q)=4.00×10^{-5} *6*
375.8 *1*	0.37 *2*	1264.90	(11/2)$^+$	889.06	(11/2)$^+$	M1		1.005	ce(K)=0.340 *24*; ce(L1)+ce(L2)=0.071 *7*; ce(M)=0.020 *2*; ce(N)=0.006 *1*; α(K)exp=0.92 *8* α(L1)exp+α(L2)exp=0.19 *2*; α(M)exp=0.054 *6*; α(N)exp=0.016 *3* α(K)=0.783 *11*; α(L)=0.1661 *24*; α(M)=0.0408 *6*; α(N)=0.01136 *16*; α(O)=0.00297 *5* α(P)=0.000575 *8*; α(Q)=3.28×10^{-5} *5*
385.3 *2*	0.031 *3*	461.40	7/2$^-$	76.1	7/2$^-$	(M1+E2)		0.54 *40*	ce(K)=0.021 *7*; ce(L1)+ce(L2)≈0.003; α(K)exp=0.68 *24*; α(L1)exp+α(L2)exp≈0.1 α(K)=0.39 *34*; α(L)=0.107 *48*; α(M)=0.027 *11*; α(N)=0.0076 *30*; α(O)=0.00197 *81* α(P)=3.7×10^{-4} *17*; α(Q)=1.7×10^{-5} *14*
405.6 *1*	1.01 *5*	461.40	7/2$^-$	55.80	(9/2)$^+$	E1+M2	0.179 *9*	0.091 *7*	ce(K)=0.060 *5*; ce(L1)+ce(L2)=0.020 *2*; ce(L3)<0.002; ce(M)≈0.005; α(K)exp=0.059 *6* α(L1)exp+α(L2)exp=0.020 *2*; α(L3)exp<0.002; α(M)exp≈0.005 α(K)=0.066 *5*; α(L)=0.0187 *15*; α(M)=0.0048 *4*; α(N)=0.00136 *11*; α(O)=0.00035 *3* α(P)=6.7×10^{-5} *6*; α(Q)=3.5×10^{-6} *3*

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γ(^{251}Es) (continued)

E_γ	I_γ[&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[‡]	α[@]	Comments
429.7 *1*	0.084 *7*	461.40	7/2⁻	31.70	5/2⁻	(M1+E2)		0.40 *30*	ce(K)=0.039 *8*; ce(L1)+ce(L2)=0.0110 *15*; α(K)exp=0.46 *10*; α(L1)exp+α(L2)exp=0.13 *2* α(K)=0.29 *25*; α(L)=0.078 *38*; α(M)=0.0196 *86*; α(N)=0.0055 *24*; α(O)=0.00142 *64* α(P)=2.7×10^{-4} *13*; α(Q)=1.3×10^{-5} *10*
453.1 *1*	1.48 *8*	461.40	7/2⁻	8.30	(7/2)⁺	E1+M2	0.236 *+17−18*	0.100 *12*	ce(K)=0.100 *8*; ce(L1)+ce(L2)=0.028 *3*; ce(L3)<0.003; ce(M)=0.0090 *14*; ce(N)=0.004 *1* α(K)exp=0.068 *7*; α(L1)exp+α(L2)exp=0.019 *2*; α(L3)exp<0.002; α(M)exp=0.006 *1*; α(N)exp=0.0027 *7* α(K)=0.072 *8*; α(L)=0.0204 *25*; α(M)=0.0053 *7*; α(N)=0.00147 *18*; α(O)=0.00039 *5* α(P)=7.3×10^{-5} *9*; α(Q)=3.9×10^{-6} *5*
461.0 *1*	0.092 *6*	1238.90	(11/2)⁺	777.90	(9/2)⁺	(M1+E2)		0.33 *25*	ce(L1)+ce(L2)=0.008 *2*; α(L1)exp+α(L2)exp=0.087 *22* α(K)=0.24 *21*; α(L)=0.063 *32*; α(M)=0.0160 *73*; α(N)=0.0044 *21*; α(O)=0.00116 *54* α(P)=2.2×10^{-4} *11*; α(Q)=1.05×10^{-5} *82*
487.1 *2*	0.011 *2*	1264.90	(11/2)⁺	777.90	(9/2)⁺	(M1+E2)		0.28 *21*	α(K)=0.21 *18*; α(L)=0.054 *28*; α(M)=0.0136 *64*; α(N)=0.0038 *18*; α(O)=9.8×10^{-4} *47* α(P)=1.86×10^{-4} *96*; α(Q)=9.1×10^{-6} *70*
664.0 *3*	0.017 *3*	777.90	(9/2)⁺	114.04	(11/2⁺)	(M1+E2)		0.125 *88*	ce(K)≈0.0014; α(K)exp≈0.08 α(K)=0.095 *72*; α(L)=0.023 *13*; α(M)=0.0056 *30*; α(N)=0.00157 *82*; α(O)=4.1×10^{-4} *22* α(P)=7.8×10^{-5} *43*; α(Q)=4.0×10^{-6} *29*
694.5 *3*	0.015 *3*	957.48	(13/2)⁺	263.0	(15/2⁺)	(M1+E2)		0.111 *78*	ce(K)≈0.009; α(K)exp≈0.06 α(K)=0.084 *63*; α(L)=0.020 *11*; α(M)=0.0050 *26*; α(N)=0.00138 *73*; α(O)=3.6×10^{-4} *19* α(P)=6.9×10^{-5} *38*; α(Q)=3.5×10^{-6} *26* From the reported I_γ and I_{ce}, the K-conversion coefficient is α_K≈0.6. This is inconsisten with the reported value of α_K≈0.06.
706.3 *2*	0.025 *3*	889.06	(11/2)⁺	182.5	(13/2⁺)	(M1+E2)		0.106 *74*	ce(K)=0.0030 *9*; α(K)exp=0.12 *4* α(K)=0.081 *60*; α(L)=0.019 *11*; α(M)=0.0047 *25*; α(N)=0.00132 *69*; α(O)=3.4×10^{-4} *19* α(P)=6.6×10^{-5} *37*; α(Q)=3.4×10^{-6} *25*
722.1 *2*	0.082 *7*	777.90	(9/2)⁺	55.80	(9/2)⁺	M1+E2	0.50 *+28−35*	0.142 *25*	ce(K)=0.0092 *10*; α(K)exp=0.11 *2* α(K)=0.110 *21*; α(L)=0.024 *4*; α(M)=0.0059 *9*; α(N)=0.00163 *24*; α(O)=0.00043 *7* α(P)=8.2×10^{-5} *13*; α(Q)=4.6×10^{-6} *9*
769.6 *1*	0.40 *2*	777.90	(9/2)⁺	8.30	(7/2)⁺	M1		0.1429	ce(K)=0.046 *5*; α(K)exp=0.115 *14* α(K)=0.1117 *16*; α(L)=0.0234 *4*; α(M)=0.00573 *8*;

γ(^{251}Es) (continued)

E_γ	I_γ[&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[‡]	α[@]	Comments
									α(N)=0.001592 *23*; α(O)=0.000417 *6* α(P)=8.07×10^{-5} *12*; α(Q)=4.60×10^{-6} *7*
775.0 *1*	≈0.088[†]	889.06	$(11/2)^+$	114.04	$(11/2^+)$	(M1+E2)		0.084 *57*	α(K)=0.064 *46*; α(L)=0.0148 *82*; α(M)=0.0037 *20*; α(N)=1.02×10^{-3} *54*; α(O)=2.7×10^{-4} *15* α(P)=5.1×10^{-5} *29*; α(Q)=2.7×10^{-6} *19*
775.0 *1*	≈0.042[†]	957.48	$(13/2)^+$	182.5	$(13/2^+)$	(M1+E2)		0.084 *57*	α(K)=0.064 *46*; α(L)=0.0148 *82*; α(M)=0.0037 *20*; α(N)=1.02×10^{-3} *54*; α(O)=2.7×10^{-4} *15* α(P)=5.1×10^{-5} *29*; α(Q)=2.7×10^{-6} *19*
^{x}786.3 *5*	0.008 *2*								
^{x}796.6 *5*	0.012 *2*								
^{x}826.8 *5*	≈5×10^{-3}								
833.3 *1*	0.64 *4*	889.06	$(11/2)^+$	55.80	$(9/2)^+$	M1+E2	2.21 *+40−28*	0.039 *4*	ce(K)=0.020 *2*; ce(L1)+ce(L2)=0.0044 *5*; α(K)exp=0.031 *4*; α(L1)exp+α(L2)exp=0.0068 *9* α(K)=0.028 *4*; α(L)=0.0078 *6*; α(M)=0.00197 *14*; α(N)=0.00055 *4*; α(O)=0.000142 *10* α(P)=2.66×10^{-5} *20*; α(Q)=1.21×10^{-6} *13*
843.4 *1*	0.12 *1*	957.48	$(13/2)^+$	114.04	$(11/2^+)$	M1+E2	0.72 *+22−20*	0.081 *12*	ce(K)=0.0076 *9*; α(K)exp=0.063 *9* α(K)=0.063 *10*; α(L)=0.0138 *17*; α(M)=0.0034 *4*; α(N)=0.00095 *11*; α(O)=0.00025 *3* α(P)=4.8×10^{-5} *6*; α(Q)=2.6×10^{-6} *4*
^{x}858.5 *5*	≈5×10^{-3}								
880.8 *1*	2.23 *11*	889.06	$(11/2)^+$	8.30	$(7/2)^+$	E2		0.0209	ce(K)=0.031 *4*; ce(L1)+ce(L2)=0.0096 *10*; ce(M)=0.0033 *6*; α(K)exp=0.014 *2* α(L1)exp+α(L2)exp=0.0043 *5*; α(M)exp=0.0015 *3* α(K)=0.01447 *21*; α(L)=0.00476 *7*; α(M)=0.001231 *18*; α(N)=0.000344 *5*; α(O)=8.86×10^{-5} *13* α(P)=1.627×10^{-5} *23*; α(Q)=6.28×10^{-7} *9*
901.6 *1*	0.13 *1*	957.48	$(13/2)^+$	55.80	$(9/2)^+$	E2		0.0200	ce(K)≈0.2; α(K)exp≈0.01 α(K)=0.01392 *20*; α(L)=0.00449 *7*; α(M)=0.001158 *17*; α(N)=0.000323 *5*; α(O)=8.34×10^{-5} *12* α(P)=1.533×10^{-5} *22*; α(Q)=6.00×10^{-7} *9* From the reported I_γ and I_{ce}, the K-conversion coefficient is α_K≈1.5. This is inconsistent with the reported value of α_K≈0.01.
1056.2 *4*	0.006 *1*	1238.90	$(11/2)^+$	182.5	$(13/2^+)$	(M1+E2)		0.038 *23*	α(K)=0.029 *19*; α(L)=0.0065 *35*; α(M)=0.00160 *83*; α(N)=4.4×10^{-4} *23*; α(O)=1.16×10^{-4} *61* α(P)=2.2×10^{-5} *12*; α(Q)=1.20×10^{-6} *76*
1124.9 *2*	0.028 *3*	1238.90	$(11/2)^+$	114.04	$(11/2^+)$	(M1+E2)		0.032 *19*	α(K)=0.025 *16*; α(L)=0.0055 *29*; α(M)=0.00135 *69*; α(N)=3.8×10^{-4} *19*; α(O)=9.8×10^{-5} *51* α(P)=1.89×10^{-5} *99*; α(Q)=1.02×10^{-6} *63*

γ(^{251}Es) (continued)

E_γ	I_γ[&]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	α[@]	Comments
1151.0 *2*	0.015 *2*	1264.90	$(11/2)^+$	114.04	$(11/2^+)$	(M1+E2)	0.030 *18*	α(K)=0.023 *15*; α(L)=0.0052 *27*; α(M)=0.00127 *65*; α(N)=3.5×10^{-4} *18*; α(O)=9.3×10^{-5} *47* α(P)=1.78×10^{-5} *93*; α(Q)=9.6×10^{-7} *59*
1183.0 *2*	0.074 *5*	1238.90	$(11/2)^+$	55.80	$(9/2)^+$	(M1+E2)	0.028 *17*	α(K)=0.022 *13*; α(L)=0.0048 *25*; α(M)=0.00119 *60*; α(N)=3.3×10^{-4} *17*; α(O)=8.6×10^{-5} *44* α(P)=1.65×10^{-5} *86*; α(Q)=9.0×10^{-7} *54*
1193.0 *2*	0.009 *1*	1307.0	$(7/2^+,9/2,11/2^+)$	114.04	$(11/2^+)$			
1209.1 *2*	0.035 *3*	1264.90	$(11/2)^+$	55.80	$(9/2)^+$	(M1+E2)	0.027 *16*	α(K)=0.021 *13*; α(L)=0.0045 *23*; α(M)=0.00112 *56*; α(N)=3.1×10^{-4} *16*; α(O)=8.1×10^{-5} *41* α(P)=1.56×10^{-5} *81*; α(Q)=8.5×10^{-7} *51*
1230.6 *2*	0.14 *1*	1238.90	$(11/2)^+$	8.30	$(7/2)^+$	E2	0.01111	α(K)=0.00823 *12*; α(L)=0.00214 *3*; α(M)=0.000539 *8*; α(N)=0.0001502 *21*; α(O)=3.89×10^{-5} *6* α(P)=7.29×10^{-6} *11*; α(Q)=3.34×10^{-7} *5*
1242.8 *4*	0.0052 *5*	1356.9	$(7/2^+,9/2,11/2^+)$	114.04	$(11/2^+)$			
1245.6 *4*	0.0062 *6*	1301.3	$(7/2^+,9/2,11/2)$	55.80	$(9/2)^+$			
1251.2 *2*	0.0190 *16*	1307.0	$(7/2^+,9/2,11/2^+)$	55.80	$(9/2)^+$			
1256.6 *2*	0.065 *5*	1264.90	$(11/2)^+$	8.30	$(7/2)^+$	E2	0.01069	α(K)=0.00794 *12*; α(L)=0.00204 *3*; α(M)=0.000514 *8*; α(N)=0.0001431 *20*; α(O)=3.71×10^{-5} *6* α(P)=6.96×10^{-6} *10*; α(Q)=3.21×10^{-7} *5*
[x]1279.0 *4*	0.0036 *4*							
1293.0 *3*	0.038 *3*	1301.3	$(7/2^+,9/2,11/2)$	8.30	$(7/2)^+$			
1298.8 *3*	0.042 *3*	1307.0	$(7/2^+,9/2,11/2^+)$	8.30	$(7/2)^+$			
1301.2 *3*	0.010 *1*	1356.9	$(7/2^+,9/2,11/2^+)$	55.80	$(9/2)^+$			
1348.6 *3*	0.0033 *3*	1356.9	$(7/2^+,9/2,11/2^+)$	8.30	$(7/2)^+$			

[†] Doublet with intensity divided based on γγ coincidence analysis. Combined intensity is 0.13 *1*.

[‡] Calculated with BrIccMixing version 2.3d, using measured conversion coefficients in 1978Ah02 as inputs. Uncertainties for the conversion coefficients, which were not reported in 1978Ah02, were calculated from the I_γ and I_{ce} values reported.

[#] Based on the level scheme presented in 1978Ah02. Mixed multipoles have been assumed except in cases where the J^π values of the initial and final states or the measured conversion coefficients indicate only one multipole.

[@] Additional information 1.

[&] For absolute intensity per 100 decays, multiply by 0.9820 *13*.

[x] γ ray not placed in level scheme.

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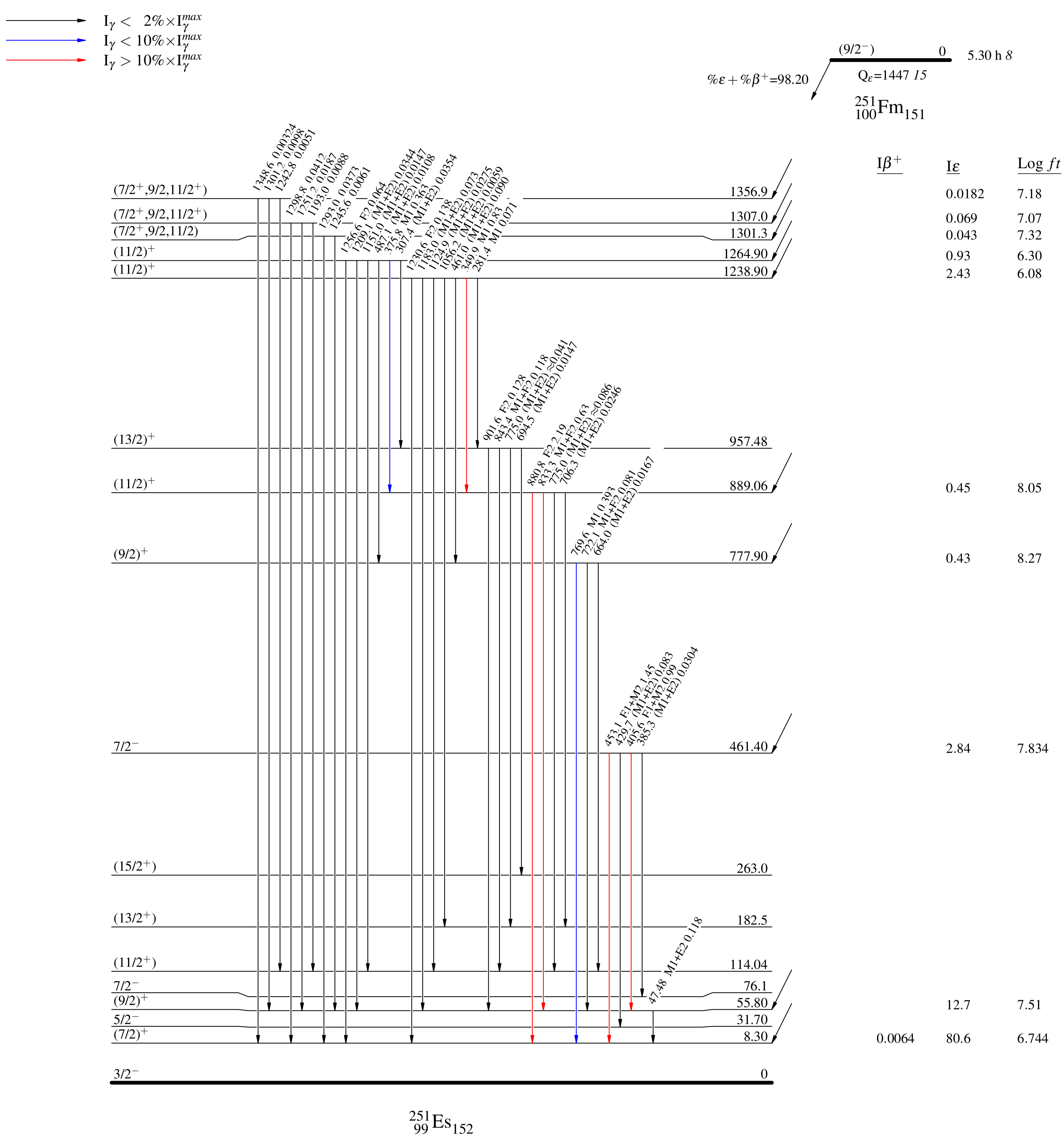
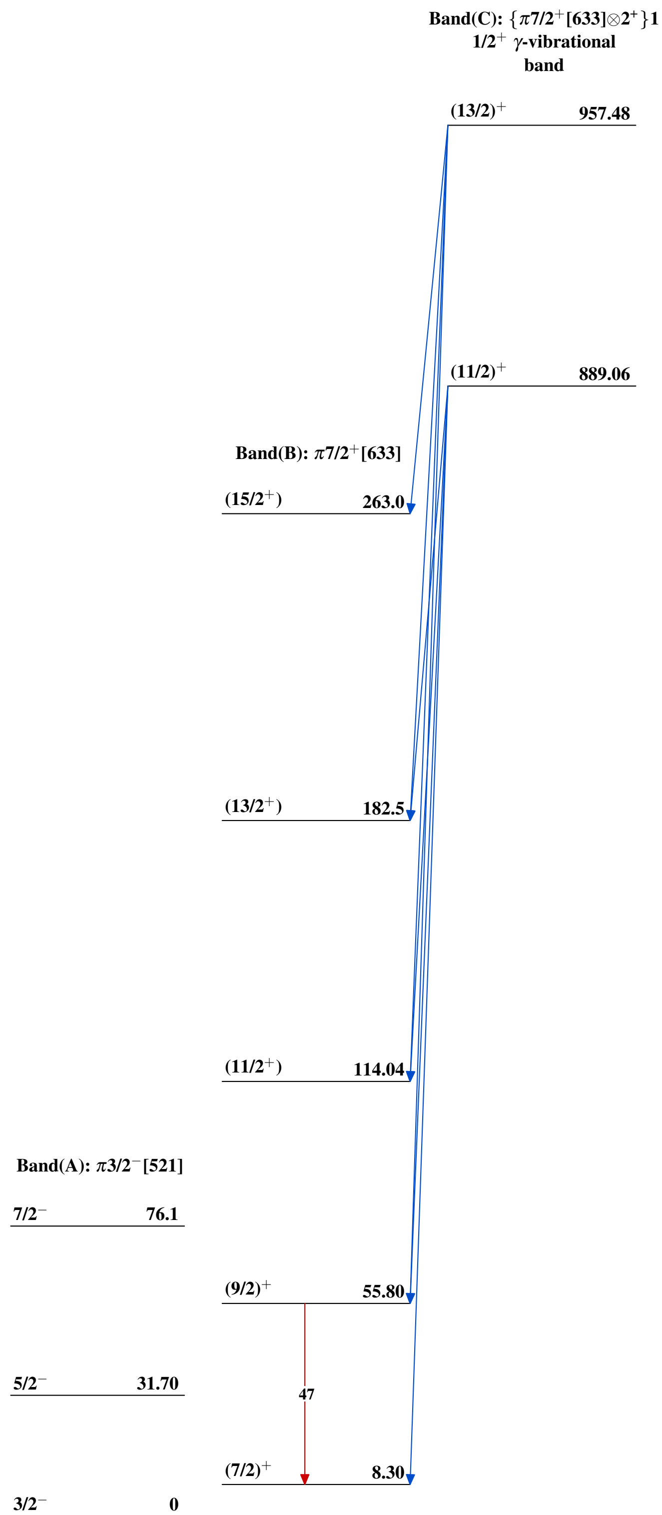
^{251}Fm ε decay 1978Ah02

Decay Scheme

Intensities: I_γ per 100 parent decays



^{251}Fm ε decay 1978Ah02



$^{251}_{99}Es_{152}$