^{226}Fr β^- decay

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Y. A. Akovali	NDS 77,433 (1996)	1-Feb-1996

Parent: ^{226}Fr: E=0.0; J$^\pi$=1$^-$; $T_{1/2}$=49 s *1*; Q(β^-)=3671 *91*; %β^- decay=100.0

1993MeZW deduced Q(β^-)=3.7±0.1 MeV from β-γ coincidence data. See also 1987VeZV. Other measurement: E(β^-)max=4050 *590* from singles β^- spectrum (1975We23).

^{226}Ra Levels

E(level)	J$^\pi$	E(level)	J$^\pi$	E(level)	J$^\pi$	E(level)	J$^\pi$
0.0	0$^+$	1122.4 *3*	(2$^+$)	1767.1 *10*	0,1,2	1982.7 *10*	0$^+$,1
67.67 *1*	2$^+$	1156.2 *1*	2$^+$	1778.4 *10*	0,1,2	2006.7 *15*	0,1,2
211.54 *2*	4$^+$	1238.9 *5*	(2)	1786.1 *10*	1$^-$,2$^+$	2015.2 *15*	0,1,2
253.73 *1*	1$^-$	1390.0 *1*	2$^+$	1865.0 *10*	1,2$^+$	2056.8 *5*	1,2$^+$
321.54 *6*	3$^-$	1422.5 *10*	0,1,2	1882.3 *7*	0,1,2	2086.1 *10*	1,2$^+$
446.3 *2*	5$^-$	1437.8 *7*	1$^-$,2	1888.4 *15*	0,1,2	2182.3 *15*	0,1,2
824.6 *1*	0$^+$	1587.3 *5*	1,2$^+$	1897.4 *10*	1$^-$,2$^+$	2189.4 *10*	2$^+$
873.7 *1*	2$^+$	1621.3 *5*	1$^-$,2$^+$	1907.8 *10*	1,2$^+$	2269.7 *10*	1,2$^+$
1048.8 *1*	1$^-$	1723.4 *3*	2$^+$	1945.6 *10*	1,2$^+$		
1070.5 *2*	(2$^-$)	1738.5 *10*	1,2$^+$	1951.0 *10*	1$^-$,2$^+$		
1077.2 *2*	1$^-$,2	1756.2 *10*	1,2$^+$	1970.8 *5*	1$^-$,2$^+$		

β^- radiations

E(decay)	E(level)	Iβ^- †‡	Log *ft*	Comments
(1.40×10^3 *9*)	2269.7	0.26 *4*	7.0 *2*	av Eβ=462 *32*
(1.48×10^3 *9*)	2189.4	0.22 *5*	7.2 *2*	av Eβ=494 *32*
(1.49×10^3 *9*)	2182.3	0.11 *3*	7.5 *2*	av Eβ=497 *32*
(1.58×10^3 *9*)	2086.1	0.23 *5*	7.3 *2*	av Eβ=535 *32*
(1.61×10^3 *9*)	2056.8	0.36 *5*	7.1 *2*	av Eβ=547 *33*
(1.66×10^3 *9*)	2015.2	0.14 *3*	7.5 *2*	av Eβ=564 *33*
(1.66×10^3 *9*)	2006.7	0.23 *9*	7.3 *2*	av Eβ=567 *33*
(1.69×10^3 *9*)	1982.7	0.28 *4*	7.3 *2*	av Eβ=577 *33*
(1.70×10^3 *9*)	1970.8	1.6 *2*	6.5 *1*	av Eβ=581 *33*
(1.72×10^3 *9*)	1951.0	0.66 *10*	6.9 *2*	av Eβ=589 *33*
(1.73×10^3 *9*)	1945.6	0.48 *8*	7.1 *2*	av Eβ=592 *33*
(1.76×10^3 *9*)	1907.8	0.28 *4*	7.3 *1*	av Eβ=607 *33*
(1.77×10^3 *9*)	1897.4	0.26 *5*	7.4 *2*	av Eβ=611 *33*
(1.78×10^3 *9*)	1888.4	0.11 *3*	7.8 *2*	av Eβ=615 *33*
(1.79×10^3 *9*)	1882.3	0.15 *3*	7.6 *2*	av Eβ=617 *33*
(1.81×10^3 *9*)	1865.0	0.64 *9*	7.0 *1*	av Eβ=624 *33*
(1.88×10^3 *9*)	1786.1	0.65 *12*	7.1 *2*	av Eβ=656 *33*
(1.89×10^3 *9*)	1778.4	0.51 *9*	7.2 *2*	av Eβ=659 *33*
(1.90×10^3 *9*)	1767.1	0.46 *8*	7.2 *2*	av Eβ=664 *33*
(1.91×10^3 *9*)	1756.2	1.3 *3*	6.8 *2*	av Eβ=669 *33*
(1.93×10^3 *9*)	1738.5	0.86 *12*	7.0 *1*	av Eβ=676 *33*
(1.95×10^3 *9*)	1723.4	1.01 *15*	6.9 *1*	av Eβ=682 *33*
(2.05×10^3 *9*)	1621.3	0.51 *8*	7.3 *1*	av Eβ=724 *33*
(2.08×10^3 *9*)	1587.3	0.21 *5*	7.7 *2*	av Eβ=738 *33*
(2.23×10^3 *9*)	1437.8	0.10 *5*	8.2 *3*	av Eβ=799 *34*
(2.25×10^3 *9*)	1422.5	0.15 *3*	8.0 *2*	av Eβ=806 *34*
(2.28×10^3 *9*)	1390.0	3.9 *5*	6.6 *1*	av Eβ=819 *34* E(decay): 1975We23 obtained E(β^-)=2170 *890* from (1322γ)(β^-) data.
(2.43×10^3 *9*)	1238.9	0.20 *4*	8.0 *2*	av Eβ=882 *34*

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^{226}Fr β^- decay (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^-[†‡]	Log *ft*	Comments
(2.51×10^3 *9*)	1156.2	2.2 *3*	7.0 *1*	av Eβ=917 *34*
(2.55×10^3 *9*)	1122.4	0.07 *4*	8.6 *3*	av Eβ=931 *34*
(2.59×10^3 *9*)	1077.2	2.0 *3*	7.1 *1*	av Eβ=950 *34*
(2.60×10^3 *9*)	1070.5	1.4 *2*	7.3 *1*	av Eβ=952 *34*
(2.62×10^3 *9*)	1048.8	2.5 *4*	7.0 *1*	av Eβ=962 *60*
(2.80×10^3 *9*)	873.7	0.62 *10*	7.8 *1*	av Eβ=1035 *34*
(2.85×10^3 *9*)	824.6	0.15 *9*	8.4 *3*	av Eβ=1056 *34*
(3.35×10^3[#] *9*)	321.54	1.0 *10*	>7.6	av Eβ=1268 *34*
(3.42×10^3 *9*)	253.73	34 *5*	6.4 *1*	av Eβ=1297 *34* E(decay): 1975We23 measured E(β^-)=3580 *390* by (186γ)(β^-) and E(β^-)=3510 *330* by (254γ)(β^-) coincidences.
(3.60×10^3 *9*)	67.67	12 *5*	6.9 *2*	av Eβ=1376 *43*
(3.67×10^3 *9*)	0.0	27 *10*	6.6 *2*	av Eβ=1405 *34*

† From intensity balance at each level, except for the β- to g.s. The intensity of the β^- to g.s. was calculated by assuming that the Alaga rule holds for β^- transitions to the 0^+, 2^+ levels of the g.s. band.
‡ Absolute intensity per 100 decays.
# Existence of this branch is questionable.

γ(^{226}Ra)

Iγ normalization: Obtained by requiring Σ Ti(γ's to g.s.)=100%−Iβ(to g.s.)= 73% 10, assuming that Iβ(to g.s.)=27% 10 is correct.
$\gamma\gamma$: 1980KuZL.
$\beta\gamma$: 1975We23, 1987VeZV.
The decay scheme is presented as constructed by 1981Ku02.

E$_\gamma$[†]	I$_\gamma$[‡a]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.[#]	α[b]	Comments
67.672[@] *2*	4.3 *4*	67.67	2^+	0.0	0^+	E2	61.9	α(L)=45.2; α(M)=12.2; α(N+..)=4.40
(67.81[&] *20*)		321.54	3^-	253.73	1^-			
110.00 *5*	2.1 *2*	321.54	3^-	211.54	4^+	[E1]	0.388	α(K)=0.301; α(L)=0.0658; α(M)=0.0158; α(N+..)=0.0054
(124.8[&] *2*)	0.004 *2*	446.3	5^-	321.54	3^-	[E2]	3.81	I$_\gamma$: from the branching measured in (HI,xnγ).
143.872[@] *4*	3.4 *3*	211.54	4^+	67.67	2^+	E2	2.11	α(K)=0.280; α(L)=1.34; α(M)=0.363; α(N+..)=0.132
186.053[@] *4*	100 *5*	253.73	1^-	67.67	2^+	E1	0.108	α(K)=0.086; α(L)=0.0169; α(M)=0.00402; α(N+..)=0.00139
234.7 *1*	0.12 *4*	446.3	5^-	211.54	4^+	[E1]	0.0623	
253.729[@] *10*	137 *9*	253.73	1^-	0.0	0^+	E1	0.0520	α(K)=0.0417; α(L)=0.00779; α(M)=0.00186; α(N+..)=0.00064
254.1 *2*	15 *5*	321.54	3^-	67.67	2^+	[E1]	0.0519	α(K)=0.0416; α(L)=0.00777; α(M)=0.00185; α(N+..)=0.00064 Transition was observed in $\gamma\gamma$ coincidence; intensity was deduced from $\gamma\gamma$ data.
444.50 *5*	0.79 *4*	1882.3	0,1,2	1437.8	1^-,2	[D,E2]	0.14 *12*	α(E1)=0.0151, α(E2)=0.0523, α(M1)=0.257.
516.30 *5*	1.4 *1*	1390.0	2^+	873.7	2^+	[D,E2]	0.092 *81*	α(E1)=0.0112, α(E2)=0.0362, α(M1)=0.173.

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^{226}Fr β^- decay (continued)

$\gamma(^{226}Ra)$ (continued)

E_γ [†]	I_γ [‡a]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	α [b]	Comments
552.2 *1*	2.9 *2*	873.7	2^+	321.54	3^-	[E1]	0.00975	α(K)=0.00795; α(L)=0.00136
565.4 *1*	1.1 *1*	1390.0	2^+	824.6	0^+	[E2]	0.0294	
570.9 *1*	4.0 *3*	824.6	0^+	253.73	1^-	[E1]	0.00912	α(K)=0.00744; α(L)=0.00127
620.0 *1*	3.2 *3*	873.7	2^+	253.73	1^-	[E1]	0.00776	α(K)=0.00633; α(L)=0.00107
646.2 *3*	0.42 *8*	1723.4	2^+	1077.2	1^-,2	[D,E2]	0.051 *44*	α(E1)=0.00716, α(E2)=0.0219, α(M1)=0.0951.
755.8 *2*	1.0 *1*	1077.2	1^-,2	321.54	3^-	[D,E2]	0.034 *29*	α(E1)=0.00533, α(E2)=0.0158, α(M1)=0.0630.
795.1 *1*	2.3 *2*	1048.8	1^-	253.73	1^-	[M1]	0.0552	α(K)=0.0445; α(L)=0.00801
816.9 *2*	1.1 *1*	1070.5	(2^-)	253.73	1^-	[M1]	0.0514	α(K)=0.0415; α(L)=0.00746
823.5 *3*	0.82 *8*	1077.2	1^-,2	253.73	1^-	[D,E2]	0.027 *23*	α(E1)=0.00455, α(E2)=0.0133. α(M1)=0.0503.
834.7 *1*	2.8 *2*	1156.2	2^+	321.54	3^-			
848.3 *5*	0.55 *8*	1970.8	$1^-,2^+$	1122.4	(2^+)			
902.6 *3*	0.80 *6*	1156.2	2^+	253.73	1^-			
910.9 *2*	1.0 *2*	1122.4	(2^+)	211.54	4^+			
917.3 *5*	0.41 *8*	1238.9	(2)	321.54	3^-			
944.6 *3*	5.0 *5*	1156.2	2^+	211.54	4^+			
980.6 *5*	7.3 *7*	1048.8	1^-	67.67	2^+			
991.4 *8*	0.43 *6*	1865.0	$1,2^+$	873.7	2^+			
1002.2 *5*	7.5 *7*	1070.5	(2^-)	67.67	2^+			
1009.0 *5*	10.5 *10*	1077.2	1^-,2	67.67	2^+			
[x]1041.9 *5*	1.1 *2*							
1048.1 *5*	5.8 *6*	1048.8	1^-	0.0	0^+			
1083.6 *8*	0.53 *10*	1907.8	$1,2^+$	824.6	0^+			
1087.9 *5*	2.1 *2*	1156.2	2^+	67.67	2^+			
1109.7 *10*	0.36 *8*	1982.7	0^+,1	873.7	2^+			
1117.0 *10*	0.80 *20*	1437.8	1^-,2	321.54	3^-			
1155.8 *5*	3.0 *3*	1156.2	2^+	0.0	0^+			
1168.8 *10*	0.95 *14*	1422.5	0,1,2	253.73	1^-			
1171.7 *10*	0.82 *12*	1238.9	(2)	67.67	2^+			
1183.5 *8*	0.69 *7*	1437.8	1^-,2	253.73	1^-			
1231.9 *5*	0.93 *9*	2056.8	$1,2^+$	824.6	0^+			
1299.6 *5*	1.5 *2*	1621.3	$1^-,2^+$	321.54	3^-			
1322.5 *5*	13.4 *12*	1390.0	2^+	67.67	2^+			
1333.6 *5*	1.1 *2*	1587.3	$1,2^+$	253.73	1^-			
1365.0 *10*	0.50 *20*	2189.4	2^+	824.6	0^+			
1368.3 *10*	0.80 *20*	1621.3	$1^-,2^+$	253.73	1^-			
1390.7 *10*	7.7 *7*	1390.0	2^+	0.0	0^+			
[x]1413.3 *15*	0.42 *8*							
1465.2 *15*	1.4 *3*	1786.1	$1^-,2^+$	321.54	3^-			
1471.1 *10*	3.2 *5*	1723.4	2^+	253.73	1^-			
1486.2 *15*	0.55 *8*	1738.5	$1,2^+$	253.73	1^-			
1503.2 *10*	1.8 *2*	1756.2	$1,2^+$	253.73	1^-			
1513.4 *10*	2.8 *3*	1767.1	0,1,2	253.73	1^-			
1524.7 *10*	3.1 *4*	1778.4	0,1,2	253.73	1^-			
1532.4 *10*	2.2 *4*	1786.1	$1^-,2^+$	253.73	1^-			
1554.4 *15*	0.37 *8*	1621.3	$1^-,2^+$	67.67	2^+			
1576.0 *10*	0.69 *20*	1897.4	$1^-,2^+$	321.54	3^-			
1587.0 *15*	0.17 *4*	1587.3	$1,2^+$	0.0	0^+			
1610.7 *10*	1.9 *2*	1865.0	$1,2^+$	253.73	1^-			
1620.9 *15*	0.44 *6*	1621.3	$1^-,2^+$	0.0	0^+			
1628.2 *15*	0.41 *6*	1951.0	$1^-,2^+$	321.54	3^-			
1634.7 *15*	0.66 *10*	1888.4	0,1,2	253.73	1^-			
1648.9 *15*	0.66 *9*	1970.8	$1^-,2^+$	321.54	3^-			
1655.0 *10*	1.7 *2*	1723.4	2^+	67.67	2^+			
1670.4 *10*	1.6 *2*	1738.5	$1,2^+$	67.67	2^+			
[x]1680.4 *15*	0.44 *9*							
1685.2 *15*	0.39 *8*	1897.4	$1^-,2^+$	211.54	4^+			

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^{226}Fr β^- decay (continued)

γ(^{226}Ra) (continued)

E_γ[†]	I_γ[‡a]	E_i(level)	J_i^π	E_f	J_f^π
1692.6 *10*	2.6 *3*	1945.6	1,2$^+$	253.73	1$^-$
1697.3 *10*	1.4 *2*	1951.0	1$^-$,2$^+$	253.73	1$^-$
1716.8 *10*	3.2 *3*	1970.8	1$^-$,2$^+$	253.73	1$^-$
1722.1 *15*	0.83 *12*	1723.4	2$^+$	0.0	0$^+$
1728.4 *10*	1.0 *1*	1982.7	0$^+$,1	253.73	1$^-$
1738.3 *10*	3.1 *3*	1738.5	1,2$^+$	0.0	0$^+$
1753.0 *15*	1.4 *5*	2006.7	0,1,2	253.73	1$^-$
1755.4 *10*	6.3 *9*	1756.2	1,2$^+$	0.0	0$^+$
1761.5 *15*	0.83 *12*	2015.2	0,1,2	253.73	1$^-$
1785.2 *15*	0.38 *8*	1786.1	1$^-$,2$^+$	0.0	0$^+$
1797.2 *15*	0.49 *7*	1865.0	1,2$^+$	67.67	2$^+$
1839.6 *10*	0.84 *8*	1907.8	1,2$^+$	67.67	2$^+$
1865.5 *10*	1.1 *1*	1865.0	1,2$^+$	0.0	0$^+$
1883.9 *10*	1.7 *2*	1951.0	1$^-$,2$^+$	67.67	2$^+$
1897.8 *15*	0.50 *10*	1897.4	1$^-$,2$^+$	0.0	0$^+$
1903.4 *10*	4.1 *4*	1970.8	1$^-$,2$^+$	67.67	2$^+$
1907.4 *15*	0.37 *7*	1907.8	1,2$^+$	0.0	0$^+$
1914.8 *15*	0.38 *6*	1982.7	0$^+$,1	67.67	2$^+$
[x]1925.6 *10*	1.6 *2*				
1928.6 *15*	0.65 *13*	2182.3	0,1,2	253.73	1$^-$
[x]1939.3 *15*	0.78 *11*				
1944.0 *15*	0.37 *10*	1945.6	1,2$^+$	0.0	0$^+$
1951.1 *15*	0.53 *10*	1951.0	1$^-$,2$^+$	0.0	0$^+$
1971.1 *10*	1.3 *2*	1970.8	1$^-$,2$^+$	0.0	0$^+$
1990.3 *10*	0.89 *9*	2056.8	1,2$^+$	67.67	2$^+$
[x]2002.3 *10*	0.41 *5*				
2014.4 *15*	0.51 *10*	2269.7	1,2$^+$	253.73	1$^-$
2017.6 *10*	1.2 *2*	2086.1	1,2$^+$	67.67	2$^+$
2056.9 *15*	0.40 *6*	2056.8	1,2$^+$	0.0	0$^+$
[x]2067.2 *15*	0.17 *4*				
[x]2077.3 *15*	0.29 *4*				
2087.8 *15*	0.21 *5*	2086.1	1,2$^+$	0.0	0$^+$
[x]2095.7 *15*	0.37 *6*				
2120.9 *10*	0.67 *9*	2189.4	2$^+$	67.67	2$^+$
[x]2132.7 *15*	0.29 *4*				
[x]2143.4 *10*	0.48 *5*				
2190.9 *15*	0.21 *3*	2189.4	2$^+$	0.0	0$^+$
2202.2 *10*	0.85 *9*	2269.7	1,2$^+$	67.67	2$^+$
[x]2223.0 *10*	0.22 *3*				
2272.0 *20*	0.23 *7*	2269.7	1,2$^+$	0.0	0$^+$

† From 1981Ku02, 1980KuZL. Other measurement: 1975We23.

‡ Listed by 1980KuZL.

From ce work in ^{230}Th α decay and ^{226}Ac ε decay.

@ Measured by 1977Ku25 in ^{230}Th α decay.

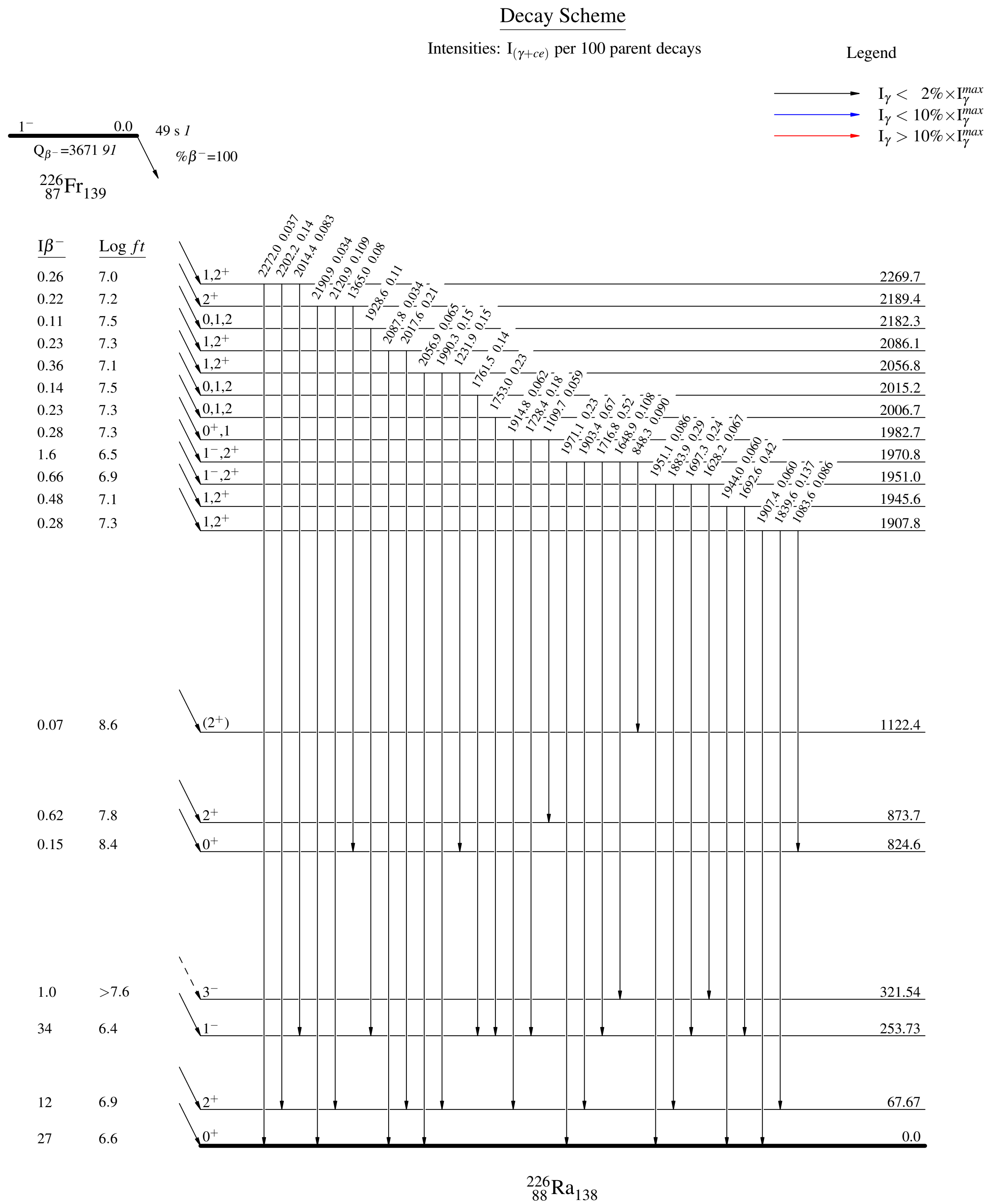
& Not observed in ^{226}Fr β^- decay; the energy is from the adopted gammas.

a For absolute intensity per 100 decays, multiply by 0.163 *25*.

b 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.

x γ ray not placed in level scheme.

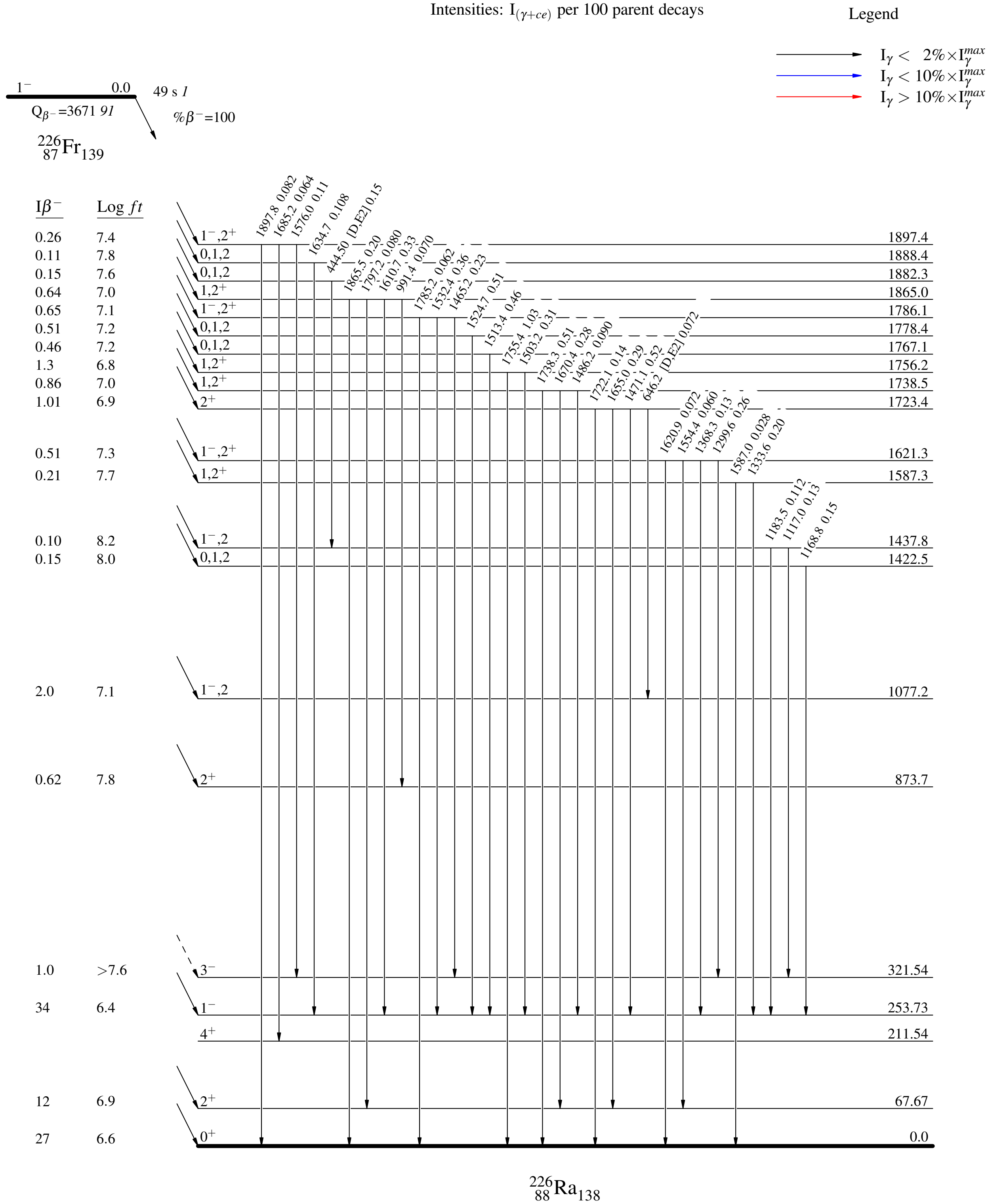
^{226}Fr β^- decay



^{226}Fr β^- decay

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays



^{226}Fr β^- decay

Decay Scheme (continued)

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays