^{230}Ac β^- decay 1980Gi04

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	C. Morse	NDS 197,259 (2024).	26-Sep-2023

Parent: ^{230}Ac: E=0.0; J$^\pi$=(1$^+$); $T_{1/2}$=122 s *3*; Q(β^-)=2976 *16*; %β^- decay=100

^{230}Ac-Q(β^-): From 2021Wa16.

The decay scheme is presented as proposed by 1980Gi04. Levels below 1297 keV and their decays were taken from a previously known partial decay scheme (1977El03). Levels above 1297 keV are from γ-ray energy fits in 1980Gi04. A tentative level at 1625 keV proposed by 1980Gi04, deexcited by 1625.1γ, is not shown here.

^{230}Th Levels

E(level)‡	J$^\pi$†	$T_{1/2}$	E(level)‡	J$^\pi$†
0.0	0$^+$	7.538×10^4 y *30*	1770.76 *11*	(1,2$^+$)
53.25 *4*	2$^+$		1775.24 *7*	(1,2$^+$)
174.12 *7*	4$^+$		1789.4 *5*	1$^{(-)}$,2$^+$
508.18 *5*	1$^-$		1810.76 *6*	(1,2$^+$)
571.80 *8*	3$^-$		1839.61 *20*	1$^{(-)}$,2$^+$
634.95 *10*	0$^+$		1849.65 *10*	(2$^+$)
677.64 *7*	2$^+$		1858.3 *5*	(3$^-$)
781.39 *7*	2$^+$		1902.70 *9*	(1,2$^+$)
825.79 *8*	3$^+$		1949.89 *7*	(1,2$^+$)
951.99 *5*	1$^-$		1967.03 *10*	(1,2$^+$)
971.74 *9*	2$^-$		1973.58 *9*	(1$^+$,2$^+$)
1009.74 *6*	2$^+$		2000.93 *8*	(1,2$^+$)
1012.05 *14*	3$^-$		2010.15 *9*	(1,2$^+$)
1079.46 *8*	(2)$^-$		2024.73 *13*	(1$^+$,2$^+$)
1297.17 *8*	0$^+$		2078.53? *11*	
1375.32 *6*	(1,2$^+$)		2122.79 *9*	(1,2$^+$)
1400.92 *5*	(2$^+$)		2133.22? *11*	
1485.66 *9*	(4$^+$)		2151.84 *10*	(1,2$^+$)
1573.51 *20*	1$^{(-)}$,2$^+$		2282.99 *17*	1,2$^+$
1589.9 *3*	0$^+$		2298.6 *3*	(1,2$^+$)
1638.57 *10*	(0$^+$)		2314.34? *15*	(1,2$^+$)
1695.71 *9*	1$^{(-)}$,2$^+$		2368.95? *17*	(0$^+$)
1744.93? *9*	(0$^+$)			

† From Adopted Levels.

‡ From a least-squares fit to E_γ.

β^- radiations

E(decay)	E(level)	Iβ^-†‡	Log *ft*	Comments
(607# *16*)	2368.95?	0.18 *6*	6.38 *15*	av Eβ=182.6 *55*
(662# *16*)	2314.34?	0.20 *5*	6.46 *12*	av Eβ=201.3 *56*
(677 *16*)	2298.6	0.09 *3*	6.84 *15*	av Eβ=206.8 *56*
(693 *16*)	2282.99	0.36 *7*	6.27 *10*	av Eβ=212.2 *56*
(824 *16*)	2151.84	0.71 *14*	6.23 *10*	av Eβ=258.6 *58*
(843# *16*)	2133.22?	0.39 *8*	6.53 *10*	av Eβ=265.3 *58*
(853 *16*)	2122.79	0.97 *17*	6.15 *9*	av Eβ=269.1 *58*
(898# *16*)	2078.53?	0.36 *8*	6.66 *10*	av Eβ=285.2 *59*
(951 *16*)	2024.73	0.39 *8*	6.71 *10*	av Eβ=304.9 *59*
(966 *16*)	2010.15	0.51 *12*	6.62 *11*	av Eβ=310.3 *59*
(975 *16*)	2000.93	0.46 *10*	6.68 *10*	av Eβ=313.7 *60*

Continued on next page (footnotes at end of table)

^{230}Ac β^- decay 1980Gi04 (continued)

β^- radiations (continued)

E(decay)	E(level)	Iβ^- † ‡	Log *ft*	Comments
(1002 *16*)	1973.58	0.87 *15*	6.44 *8*	av Eβ=323.8 *60*
(1009 *16*)	1967.03	0.65 *15*	6.58 *11*	av Eβ=326.2 *60*
(1026 *16*)	1949.89	1.8 *4*	6.16 *10*	av Eβ=332.6 *60*
(1073 *16*)	1902.70	0.92 *20*	6.52 *10*	av Eβ=350.3 *61*
(1118 *16*)	1858.3	0.050 *21*	7.85 *19*	av Eβ=367.0 *61*
(1126 *16*)	1849.65	0.40 *7*	6.96 *8*	av Eβ=370.3 *61*
(1136 *16*)	1839.61	0.09 *3*	7.62 *15*	av Eβ=374.1 *61*
(1165 *16*)	1810.76	1.6 *3*	6.41 *9*	av Eβ=385.1 *61*
(1187 *16*)	1789.4	0.025 *10*	8.24 *18*	av Eβ=393.2 *62*
(1201 *16*)	1775.24	2.2 *4*	6.32 *9*	av Eβ=398.6 *62*
(1205 *16*)	1770.76	0.75 *17*	6.79 *11*	av Eβ=400.3 *62*
(1231# *16*)	1744.93?	0.58 *17*	6.93 *13*	av Eβ=410.2 *62*
(1280 *16*)	1695.71	0.44 *8*	7.11 *9*	av Eβ=429.2 *62*
(1337 *16*)	1638.57	0.41 *8*	7.21 *9*	av Eβ=451.3 *63*
(1386 *16*)	1589.9	0.07 *3*	8.04 *19*	av Eβ=470.3 *63*
(1403 *16*)	1573.51	0.19 *5*	7.62 *12*	av Eβ=476.7 *63*
(1490 *16*)	1485.66	0.31 *8*	7.50 *12*	av Eβ=511.2 *64*
(1575 *16*)	1400.92	3.5 *5*	6.54 *7*	av Eβ=544.7 *64*
(1601 *16*)	1375.32	2.5 *4*	6.71 *8*	av Eβ=554.9 *64*
(1679 *16*)	1297.17	4.1 *9*	6.57 *10*	av Eβ=586.0 *64*
(1897# *16*)	1079.46	≈0		av Eβ=673.8 *65*
(1964 *16*)	1012.05	0.30 *6*	8.98[1u] *9*	av Eβ=670.2 *62*
(1966 *16*)	1009.74	0.18 *18*	8.2 *5*	av Eβ=702.0 *66*
(2004# *16*)	971.74	≈0		av Eβ=717.5 *66*
(2024 *16*)	951.99	1.11 *24*	7.44 *10*	av Eβ=725.6 *66*
(2195 *16*)	781.39	0.76 *18*	7.74 *11*	av Eβ=795.4 *66*
(2298 *16*)	677.64	0.16 *11*	8.5 *3*	av Eβ=838.1 *66*
(2341 *16*)	634.95	0.54 *15*	7.99 *13*	av Eβ=855.7 *66*
(2404 *16*)	571.80	0.54 *17*	9.22[1u] *14*	av Eβ=843.8 *64*
(2468 *16*)	508.18	10.2 *14*	6.81 *7*	av Eβ=908.2 *67*
(2923 *16*)	53.25	20 *16*	6.8 *4*	av Eβ=1097.6 *67*
(2976 *16*)	0.0	40 *16*	6.53 *18*	av Eβ=1119.9 *67*

† β intensities to all excited levels, have been deduced by the evaluator from intensity balance at each level. See comment on photon normalization for method of estimating Iβ to g.s.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

^{230}Ac β^- decay 1980Gi04 (continued)

$\gamma(^{230}Th)$

Iγ normalization: Normalization factor of 0.083 *21* to convert relative intensities to absolute Iγ's per 100 β^- decays, obtained by the evaluator, by requiring the sum of all transitions (γ rays and β particles) that populate the g.s. to be 100%. Since β intensities were not measured, the β branch to the g.s. was estimated based on the β branch to the 2^+ level and (ft to 0^+)/(ft to 2^+)=0.5 (Theory, Alaga Rule). No contribution to the uncertainties from this procedure, nor from the unplaced γ rays in the decay scheme have been included in the normalization factor. The sum of unplaced γ-ray intensities is ≈3.2%.

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[a]	$I_{(\gamma+ce)}$[b]	Comments
53.2 *1*	2.4 *6*	53.25	2^+	0.0	0^+	E2	228 *4*		α(L)=166.8 *28*; α(M)=45.7 *8*; α(N)=12.22 *20*; α(O)=2.72 *5*; α(P)=0.448 *7*; α(Q)=0.001240 *20*
120.8 *1*	4.0 *4*	174.12	4^+	53.25	2^+	E2	4.96 *7*		α(K)=0.257 *4*; α(L)=3.44 *5*; α(M)=0.944 *14*; α(N)=0.253 *4*; α(O)=0.0564 *8*; α(P)=0.00940 *14* α(Q)=5.22×10^{-5} *7*
(146.7)		781.39	2^+	634.95	0^+				E_γ: from Coulomb excitation. This γ was not observed in ^{230}Ac β^- decay. The ratio of Iγ(146.7γ)/Iγ(728.0γ)=0.245 *12*, measured in Coulomb excitation yields Iγ(146.7γ)=1.4 *6*. See "Coulomb excitation" for a comment for its reduced transition rate, if its relative intensity from the level were correct. See also ^{230}Pa ε decay.
(170.2[@])		951.99	1^-	781.39	2^+				
(183.6[@])	0.011 *4*	1009.74	2^+	825.79	3^+				I_γ: Deduced by evaluators from ^{230}Pa ε decay.
(228.0[@])	0.27 *10*	1009.74	2^+	781.39	2^+	E0+E2+M1	1.1 *7*	1.4 *6*	α(K)=0.8 *7*; α(L)=0.242 *31*; α(M)=0.061 *4*; α(N)=0.0164 *11*; α(O)=0.00380 *35* α(P)=0.00069 *11*; α(Q)=4.2×10^{-5} *34* Total Ice=1.4 *6* from Ice(228.0γ)/Iγ(956.5γ)=77 *23*/290 *60*, as observed in ^{230}Pa ε decay.
(253.6[@] *3*)	0.030[&] *12*	1079.46	$(2)^-$	825.79	3^+	[E1]	0.0543 *8*		α(K)=0.0433 *6*; α(L)=0.00833 *12*; α(M)=0.002001 *29*; α(N)=0.000529 *8* α(O)=0.0001227 *18*; α(P)=2.275×10^{-5} *32*; α(Q)=1.686×10^{-6} *24*
(274.25[@])	0.040[&] *14*	951.99	1^-	677.64	2^+	[E1]	0.0455 *6*		α(K)=0.0363 *5*; α(L)=0.00691 *10*; α(M)=0.001658 *23*; α(N)=0.000439 *6* α(O)=0.0001018 *14*; α(P)=1.894×10^{-5} *27*; α(Q)=1.428×10^{-6} *20*
(294.2[@])	0.016[&] *8*	971.74	2^-	677.64	2^+	[E1]	0.0388 *5*		α(K)=0.0311 *4*; α(L)=0.00586 *8*; α(M)=0.001404 *20*; α(N)=0.000371 *5*; α(O)=8.63×10^{-5} *12* α(P)=1.609×10^{-5} *23*; α(Q)=1.231×10^{-6} *17*
(298.0[@] *3*)	0.06[&] *3*	1079.46	$(2)^-$	781.39	2^+	[E1]	0.0377 *5*		α(K)=0.0302 *4*; α(L)=0.00568 *8*; α(M)=0.001362 *19*; α(N)=0.000360 *5*; α(O)=8.38×10^{-5} *12* α(P)=1.563×10^{-5} *22*; α(Q)=1.199×10^{-6} *17*

γ(^{230}Th) (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ	α[a]	Comments
(316.8[@])	0.066[&] 17	951.99	1−	634.95	0+	[E1]		0.0329 5	α(K)=0.0264 4; α(L)=0.00493 7; α(M)=0.001180 17; α(N)=0.000312 4; α(O)=7.27×10^{-5} 10 α(P)=1.359×10^{-5} 19; α(Q)=1.055×10^{-6} 15
(332.0[@])	0.18[&] 7	1009.74	2+	677.64	2+	[E2(+M1)]		0.38 26	α(K)=0.29 23; α(L)=0.072 24; α(M)=0.018 5; α(N)=0.0048 14; α(O)=0.00111 34 α(P)=2.1×10^{-4} 7; α(Q)=1.5×10^{-5} 12 Iγ(332.0γ)/Iγ(375.2γ)=1.6 10 measured here is consistent with the ratio of 1.43, expected from Alaga rule, if the 332.0γ is an E2 transition. An admixture of M1 which is K-forbidden is not ruled out.
363.9 3	0.5 2	1849.65	(2+)	1485.66	(4+)			0.28 25	
(375.2[@])	0.11[&] 5	1009.74	2+	634.95	0+	(E2)		0.0885 12	α(K)=0.0469 7; α(L)=0.0307 4; α(M)=0.00813 11; α(N)=0.002177 30; α(O)=0.000494 7 α(P)=8.64×10^{-5} 12; α(Q)=2.74×10^{-6} 4
(380.15[@])	0.12[&] 3	951.99	1−	571.80	3−	E2		0.0854 12	α(K)=0.0457 6; α(L)=0.0293 4; α(M)=0.00776 11; α(N)=0.002076 29; α(O)=0.000472 7 α(P)=8.25×10^{-5} 12; α(Q)=2.67×10^{-6} 4
388.3 1	1.2 1	2133.22?		1744.93?	(0+)			0.23 21	
397.7 1	5.0 5	571.80	3−	174.12	4+	E1		0.02019 28	α(K)=0.01629 23; α(L)=0.00295 4; α(M)=0.000704 10; α(N)=0.0001865 26 α(O)=4.35×10^{-5} 6; α(P)=8.20×10^{-6} 11; α(Q)=6.65×10^{-7} 9
(399.95[@])	0.27[&] 3	971.74	2−	571.80	3−	M1+E2	1.4 6	0.18 8	α(K)=0.13 7; α(L)=0.036 9; α(M)=0.0089 20; α(N)=0.0024 5; α(O)=0.00056 13 α(P)=1.03×10^{-4} 27; α(Q)=7.E−6 4
(401.3[@] 5)	0.034[&] 8	1079.46	(2)−	677.64	2+	[E1]		0.01981 28	α(K)=0.01599 23; α(L)=0.00289 4; α(M)=0.000690 10; α(N)=0.0001828 26 α(O)=4.27×10^{-5} 6; α(P)=8.04×10^{-6} 11; α(Q)=6.53×10^{-7} 9 The 401-keV γ ray from the J^π=2−, K=2 state to the 2+, 0 state is a K-forbidden E1 transition.
423.2 1	1.1 2	1375.32	(1,2+)	951.99	1−			0.18 17	
(440.8[@])	0.58[&] 24	1012.05	3−	571.80	3−	M1		0.295 4	α(K)=0.2364 33; α(L)=0.0441 6; α(M)=0.01059 15; α(N)=0.00282 4; α(O)=0.000668 9 α(P)=0.0001297 18; α(Q)=1.231×10^{-5} 17
443.9 1	2.2 4	951.99	1−	508.18	1−	M1+E2	0.6 6	0.23 8	α(K)=0.18 6; α(L)=0.036 9; α(M)=0.0088 19; α(N)=0.0024 5; α(O)=0.00055 12 α(P)=0.000106 26; α(Q)=9.4×10^{-6} 33
448.9 1	1.5 3	1400.92	(2+)	951.99	1−	[E1]		0.01570 22	α(K)=0.01271 18; α(L)=0.002266 32; α(M)=0.000540 8; α(N)=0.0001431 20 α(O)=3.35×10^{-5} 5; α(P)=6.33×10^{-6} 9; α(Q)=5.24×10^{-7} 7

γ(^{230}Th) (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	δ	α[a]	Comments
454.9 *1*	100	508.18	1⁻	53.25	2⁺	E1		0.01528 *21*	α(K)=0.01237 *17*; α(L)=0.002203 *31*; α(M)=0.000525 *7*; α(N)=0.0001391 *19* α(O)=3.25×10⁻⁵ *5*; α(P)=6.15×10⁻⁶ *9*; α(Q)=5.10×10⁻⁷ *7*
(463.60[@])	0.35[&] *5*	971.74	2⁻	508.18	1⁻	M1+E2	−0.28 *3*	0.242 *5*	α(K)=0.194 *4*; α(L)=0.0368 *6*; α(M)=0.00884 *15*; α(N)=0.00236 *4*; α(O)=0.000557 *9* α(P)=0.0001079 *18*; α(Q)=1.008×10⁻⁵ *20*
503.5[c] *2*	1.7 *4*	677.64	2⁺	174.12	4⁺	[E2]		0.0420 *6*	α(K)=0.0266 *4*; α(L)=0.01142 *16*; α(M)=0.00296 *4*; α(N)=0.000792 *11*; α(O)=0.0001813 *25* α(P)=3.24×10⁻⁵ *5*; α(Q)=1.463×10⁻⁶ *21* I_γ: from Iγ(503.5γ)/Iγ(677.6γ)=0.79 *17*, measured in ^{230}Th Coulomb excitation. Iγ=2.1 *4* was measured for the doublet.
503.5[c] *2*	0.37 *12*	1012.05	3⁻	508.18	1⁻				I_γ: from Iγ(503.5γ)/Iγ(959.1γ)=0.16 *5*, as measured in ^{230}Pa ε decay.
503.5[cd] *2*		2314.34?	(1,2⁺)	1810.76	(1,2⁺)				
(508[@] *1*)	0.30[&] *15*	1079.46	(2)⁻	571.80	3⁻	[M1,E2]		0.12 *8*	α(K)=0.09 *7*; α(L)=0.021 *9*; α(M)=0.0050 *22*; α(N)=0.0013 *6*; α(O)=3.2×10⁻⁴ *14* α(P)=6.0×10⁻⁵ *28*; α(Q)=4.9×10⁻⁶ *35* The 508-keV γ ray from the J^π=2⁻ state of K=2 band to the J^π=3⁻ state of K=1 band is assumed to be either M1 or E2, or M1+E2. See ^{230}Pa ε decay for a comment.
508.2 *1*	62.8 *20*	508.18	1⁻	0.0	0⁺	E1		0.01222 *17*	α(K)=0.00992 *14*; α(L)=0.001743 *24*; α(M)=0.000415 *6*; α(N)=0.0001099 *15* α(O)=2.57×10⁻⁵ *4*; α(P)=4.88×10⁻⁶ *7*; α(Q)=4.13×10⁻⁷ *6*
518.5 *1*	5.1 *5*	571.80	3⁻	53.25	2⁺	E1		0.01174 *16*	α(K)=0.00953 *13*; α(L)=0.001672 *23*; α(M)=0.000398 *6*; α(N)=0.0001054 *15* α(O)=2.469×10⁻⁵ *35*; α(P)=4.69×10⁻⁶ *7*; α(Q)=3.97×10⁻⁷ *6*
571.1 *2*	1.3 *3*	1079.46	(2)⁻	508.18	1⁻	M1+E2	0.11 *2*	0.1457 *21*	α(K)=0.1169 *17*; α(L)=0.02173 *31*; α(M)=0.00521 *7*; α(N)=0.001389 *20*; α(O)=0.000329 *5* α(P)=6.38×10⁻⁵ *9*; α(Q)=6.05×10⁻⁶ *9*
581.7 *1*	6.5 *5*	634.95	0⁺	53.25	2⁺	E2		0.0302 *4*	α(K)=0.02029 *28*; α(L)=0.00734 *10*; α(M)=0.001884 *26*; α(N)=0.000503 *7* α(O)=0.0001158 *16*; α(P)=2.093×10⁻⁵ *29*; α(Q)=1.089×10⁻⁶ *15*
ˣ600.7 *2*	1.0 *3*								
(607.5[@])	0.12[&] *7*	781.39	2⁺	174.12	4⁺	[E2]		0.0274 *4*	α(K)=0.01872 *26*; α(L)=0.00647 *9*; α(M)=0.001653 *23*; α(N)=0.000442 *6* α(O)=0.0001017 *14*; α(P)=1.846×10⁻⁵ *26*; α(Q)=9.97×10⁻⁷ *14*

$^{230}_{90}$Th$_{140}$-5

^{230}Ac β^- decay 1980Gi04 (continued)

γ(^{230}Th) (continued)

E_γ[†]	I_γ[‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[#]	α[a]	$I_{(\gamma+ce)}$[b]	Comments
									α(P)=1.846×10^{-5} *26*; α(Q)=9.97×10^{-7} *14*
624.4 *1*	1.8 *2*	677.64	2$^+$	53.25	2$^+$	E0+E2+M1	0.07 *5*		α(K)=0.06 *4*; α(L)=0.012 *6*; α(M)=0.0028 *13*; α(N)=7.5×10^{-4} *35*; α(O)=1.8×10^{-4} *8* α(P)=3.4×10^{-5} *17*; α(Q)=2.9×10^{-6} *19* α: deduced in ^{230}Pa ε decay.
628.8 *1*	2.9 *3*	1638.57	(0$^+$)	1009.74	2$^+$				
(634.9[@])		634.95	0$^+$	0.0	0$^+$	E0		7.8 *20*	Total Ice=7.8 *20* from Ice(634.9γ)/Iγ(581.7γ)=29 *6*/24 *3*, as observed in ^{230}Pa ε decay.
^{x}635.6 *3*	1.0 *4*								
(651.8[@])	0.48[&] *20*	825.79	3$^+$	174.12	4$^+$	[E2]	0.02355 *33*		α(K)=0.01645 *23*; α(L)=0.00529 *7*; α(M)=0.001345 *19*; α(N)=0.000359 *5*; α(O)=8.29×10^{-5} *12* α(P)=1.513×10^{-5} *21*; α(Q)=8.67×10^{-7} *12*
^{x}671.4 *2*	2.2 *4*								
677.6 *1*	2.2 *2*	677.64	2$^+$	0.0	0$^+$	[E2]	0.02169 *30*		α(K)=0.01533 *21*; α(L)=0.00475 *7*; α(M)=0.001204 *17*; α(N)=0.000322 *5*; α(O)=7.43×10^{-5} *10* α(P)=1.359×10^{-5} *19*; α(Q)=8.03×10^{-7} *11*
728.0 *1*	5.7 *6*	781.39	2$^+$	53.25	2$^+$	E2	0.01869 *26*		α(K)=0.01345 *19*; α(L)=0.00391 *5*; α(M)=0.000986 *14*; α(N)=0.000263 *4*; α(O)=6.09×10^{-5} *9* α(P)=1.120×10^{-5} *16*; α(Q)=6.97×10^{-7} *10*
735.1 *2*	1.2 *3*	1744.93?	(0$^+$)	1009.74	2$^+$				
750.7 *3*	1.8 *3*	2151.84	(1,2$^+$)	1400.92	(2$^+$)				
772.6 *1*	2.9 *5*	825.79	3$^+$	53.25	2$^+$	E2	0.01656 *23*		α(K)=0.01209 *17*; α(L)=0.00335 *5*; α(M)=0.000839 *12*; α(N)=0.0002240 *31* α(O)=5.20×10^{-5} *7*; α(P)=9.59×10^{-6} *13*; α(Q)=6.21×10^{-7} *9*
781.5 *1*	4.6 *5*	781.39	2$^+$	0.0	0$^+$	E2	0.01618 *23*		α(K)=0.01184 *17*; α(L)=0.00325 *5*; α(M)=0.000814 *11*; α(N)=0.0002173 *30* α(O)=5.04×10^{-5} *7*; α(P)=9.31×10^{-6} *13*; α(Q)=6.08×10^{-7} *9*
789.0 *1*	6.5 *3*	1297.17	0$^+$	508.18	1$^-$				
^{x}798.0 *1*	1.4 *2*								
^{x}816.7 *1*	3.9 *2*								
(835.7[@])	0.27[&] *11*	1009.74	2$^+$	174.12	4$^+$	[E2]	0.01415 *20*		α(K)=0.01050 *15*; α(L)=0.00274 *4*; α(M)=0.000683 *10*; α(N)=0.0001823 *26* α(O)=4.24×10^{-5} *6*; α(P)=7.86×10^{-6} *11*; α(Q)=5.34×10^{-7} *7*
(838.7[@])	0.14[&] *7*	1012.05	3$^-$	174.12	4$^+$	[E1]	0.00473 *7*		α(K)=0.00387 *5*; α(L)=0.000648 *9*; α(M)=0.0001533 *21*; α(N)=4.07×10^{-5} *6*; α(O)=9.57×10^{-6} *13* α(P)=1.836×10^{-6} *26*; α(Q)=1.658×10^{-7} *23*
839.9 *1*	2.2 *2*	1849.65	(2$^+$)	1009.74	2$^+$				
867.1 *3*	5.7 *3*	1375.32	(1,2$^+$)	508.18	1$^-$				
878.0 *2*	1.0 *1*	1849.65	(2$^+$)	971.74	2$^-$				

^{230}Ac β^- decay 1980Gi04 (continued)

γ(^{230}Th) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J^π_i	E_f	J^π_f	Mult. [#]	δ	α [a]	Comments
892.7 *1*	8.4 *4*	1400.92	(2$^+$)	508.18	1$^-$	[E1]		0.00423 *6*	α(K)=0.00347 *5*; α(L)=0.000577 *8*; α(M)=0.0001364 *19*; α(N)=3.62×10^{-5} *5*; α(O)=8.52×10^{-6} *12* α(P)=1.636×10^{-6} *23*; α(Q)=1.488×10^{-7} *21*
898.5 *1*	3.1 *3*	951.99	1$^-$	53.25	2$^+$	E1		0.00418 *6*	α(K)=0.00343 *5*; α(L)=0.000570 *8*; α(M)=0.0001347 *19*; α(N)=3.57×10^{-5} *5*; α(O)=8.42×10^{-6} *12* α(P)=1.617×10^{-6} *23*; α(Q)=1.472×10^{-7} *21*
913.7 *2*	1.2 *3*	1485.66	(4$^+$)	571.80	3$^-$				
918.6 *1*	3.5 *3*	971.74	2$^-$	53.25	2$^+$	E1		0.00402 *6*	α(K)=0.00330 *5*; α(L)=0.000547 *8*; α(M)=0.0001293 *18*; α(N)=3.43×10^{-5} *5*; α(O)=8.08×10^{-6} *11* α(P)=1.553×10^{-6} *22*; α(Q)=1.417×10^{-7} *20*
[x]939.2 *2*	1.0 *4*								
[x]946.3 *2*	1.0 *4*								
952.0 *1*	10.1 *3*	951.99	1$^-$	0.0	0$^+$	E1		0.00377 *5*	α(K)=0.00309 *4*; α(L)=0.000513 *7*; α(M)=0.0001211 *17*; α(N)=3.21×10^{-5} *4*; α(O)=7.57×10^{-6} *11* α(P)=1.455×10^{-6} *20*; α(Q)=1.332×10^{-7} *19*
956.5 *1*	5.3 *3*	1009.74	2$^+$	53.25	2$^+$	M1+E2	6.1 *4*	0.01157 *19*	α(K)=0.00883 *15*; α(L)=0.002062 *32*; α(M)=0.000509 *8*; α(N)=0.0001356 *21* α(O)=3.17×10^{-5} *5*; α(P)=5.94×10^{-6} *9*; α(Q)=4.43×10^{-7} *7*
959.1 *2*	2.3 *2*	1012.05	3$^-$	53.25	2$^+$	E1		0.00372 *5*	α(K)=0.00305 *4*; α(L)=0.000506 *7*; α(M)=0.0001194 *17*; α(N)=3.17×10^{-5} *4*; α(O)=7.46×10^{-6} *10* α(P)=1.436×10^{-6} *20*; α(Q)=1.315×10^{-7} *18*
[x]963.0 *2*	1.3 *5*								
968.0 *2*	1.2 *5*	2368.95?	(0$^+$)	1400.92	(2$^+$)				
[x]973.5 *2*	1.4 *5*								
977.6 *2*	0.7 *3*	1485.66	(4$^+$)	508.18	1$^-$	[E3]		0.0257 *4*	α(K)=0.01745 *24*; α(L)=0.00613 *9*; α(M)=0.001575 *22*; α(N)=0.000422 *6*; α(O)=9.78×10^{-5} *14* α(P)=1.796×10^{-5} *25*; α(Q)=1.077×10^{-6} *15*
[x]982.0 *5*	<0.3								
[x]987.0 *5*	<0.3								
991.2[d] *1*	1.2 *3*	2000.93	(1,2$^+$)	1009.74	2$^+$				
999.1 *1*	2.7 *5*	2078.53?		1079.46	(2)$^-$				
1009.7 *1*	3.0 *3*	1009.74	2$^+$	0.0	0$^+$	E2		0.00980 *14*	α(K)=0.00750 *10*; α(L)=0.001733 *24*; α(M)=0.000427 *6*; α(N)=0.0001139 *16* α(O)=2.66×10^{-5} *4*; α(P)=4.99×10^{-6} *7*; α(Q)=3.74×10^{-7} *5*
1026.3 *1*	2.0 *2*	1079.46	(2)$^-$	53.25	2$^+$	E1		0.00330 *5*	α(K)=0.00271 *4*; α(L)=0.000447 *6*; α(M)=0.0001055 *15*; α(N)=2.80×10^{-5} *4*; α(O)=6.60×10^{-6} *9* α(P)=1.271×10^{-6} *18*; α(Q)=1.172×10^{-7} *16*
1043.2 *3*	1.0 *3*	2122.79	(1,2$^+$)	1079.46	(2)$^-$				
[x]1045.3 *3*	0.6 *3*								
1053.1 *2*	1.8 *4*	2024.73	(1$^+$,2$^+$)	971.74	2$^-$				

γ(^{230}Th) (continued)

E$_\gamma$ [†]	I$_\gamma$ [‡b]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult. [#]	α [a]	Comments
[x]1065.5 *3*	0.5 *2*							
1068.7 *3*	0.8 *3*	2078.53?		1009.74	2$^+$			
[x]1093.8 *4*	1.8 *5*							
[x]1106.2 *3*	0.7 *2*							
1147.9[d] *1*	4.8 *3*	1973.58	(1$^+$,2$^+$)	825.79	3$^+$			
1187.5 *3*	1.3 *3*	1695.71	1$^{(-)}$,2$^+$	508.18	1$^-$			
1198.9 *2*	1.8 *4*	2024.73	(1$^+$,2$^+$)	825.79	3$^+$			
[x]1212.0 *2*	1.8 *4*							
1226.7 *1*	11.7 *6*	1400.92	(2$^+$)	174.12	4$^+$	[E2]	0.00680 *10*	α(K)=0.00531 *7*; α(L)=0.001117 *16*; α(M)=0.000272 *4*; α(N)=7.26×10^{-5} *10* α(O)=1.700×10^{-5} *24*; α(P)=3.22×10^{-6} *5*; α(Q)=2.60×10^{-7} *4*
1243.9 *1*	42.7 *10*	1297.17	0$^+$	53.25	2$^+$			
1252.5 *3*	0.8 *2*	2078.53?		825.79	3$^+$			
1267.1 *2*	5.0 *5*	1775.24	(1,2$^+$)	508.18	1$^-$			
[x]1268.2 *3*	2.5 *5*							
1302.6 *1*	6.6 *3*	1810.76	(1,2$^+$)	508.18	1$^-$			
[x]1306.2 *4*	1.4 *4*							
1311.5 *2*	1.8 *4*	2282.99	1,2$^+$	971.74	2$^-$			
1322.1 *1*	8.6 *5*	1375.32	(1,2$^+$)	53.25	2$^+$			
1347.7 *1*	19.1 *5*	1400.92	(2$^+$)	53.25	2$^+$	[M1,E2]	0.010 *5*	α(K)=0.008 *4*; α(L)=0.0016 *7*; α(M)=3.8×10^{-4} *16*; α(N)=1.0×10^{-4} *4*; α(O)=2.4×10^{-5} *10* α(P)=4.6×10^{-6} *20*; α(Q)=4.2×10^{-7} *20*
1375.4 *1*	14.8 *5*	1375.32	(1,2$^+$)	0.0	0$^+$			
1394.5 *2*	2.0 *5*	1902.70	(1,2$^+$)	508.18	1$^-$			
1401.0 *1*	4.0 *4*	1400.92	(2$^+$)	0.0	0$^+$	[E2]	0.00534 *7*	α(K)=0.00420 *6*; α(L)=0.000840 *12*; α(M)=0.0002034 *28*; α(N)=5.42×10^{-5} *8* α(O)=1.272×10^{-5} *18*; α(P)=2.424×10^{-6} *34*; α(Q)=2.038×10^{-7} *29*
1432.4 *1*	2.4 *2*	1485.66	(4$^+$)	53.25	2$^+$			
1455.5 *2*	1.8 *5*	2133.22?		677.64	2$^+$			
[x]1524.6 *3*	1.0 *4*							
1536.6 *3*	0.8 *3*	1589.9	0$^+$	53.25	2$^+$			
1573.5 *2*	2.3 *2*	1573.51	1$^{(-)}$,2$^+$	0.0	0$^+$			
1585.4 *2*	2.1 *2*	1638.57	(0$^+$)	53.25	2$^+$			
[x]1597.2 *2*	1.6 *3*							
1625.1 *3*	1.4 *3*	2133.22?		508.18	1$^-$			
1636.8 *2*	1.9 *4*	2314.34?	(1,2$^+$)	677.64	2$^+$			
1642.5 *2*	1.1 *2*	1695.71	1$^{(-)}$,2$^+$	53.25	2$^+$			
1675.4 *3*	1.0 *2*	1849.65	(2$^+$)	174.12	4$^+$			
1691.7 *1*	7.3 *4*	1744.93?	(0$^+$)	53.25	2$^+$			
1695.7 *1*	2.9 *3*	1695.71	1$^{(-)}$,2$^+$	0.0	0$^+$			
1717.5 *1*	7.8 *4*	1770.76	(1,2$^+$)	53.25	2$^+$			
1721.9 *1*	8.0 *4*	1775.24	(1,2$^+$)	53.25	2$^+$			

γ(^{230}Th) (continued)

E_γ †	I_γ ‡b	E_i(level)	J_i^π	E_f	J_f^π	Mult.#	α a	Comments
x1728 *1*	<0.3							
x1732 *1*	<0.3							
1757.5 *1*	10.6 *3*	1810.76	(1,2$^+$)	53.25	2$^+$			
1770.5 *10*	1.2 *3*	1770.76	(1,2$^+$)	0.0	0$^+$			
1775.3 *1*	13.6 *5*	1775.24	(1,2$^+$)	0.0	0$^+$			
x1787.1 *5*	0.3 *1*							
1789.4 *5*	0.3 *1*	1789.4	1$^{(-)}$,2$^+$	0.0	0$^+$			
1797.2 *3*	1.0 *2*	2368.95?	(0$^+$)	571.80	3$^-$	[E3]	0.00707 *10*	α(K)=0.00537 *8*; α(L)=0.001204 *17*; α(M)=0.000296 *4*; α(N)=7.90×10^{-5} *11* α(O)=1.853×10^{-5} *26*; α(P)=3.52×10^{-6} *5*; α(Q)=2.85×10^{-7} *4*
x1800.4 *3*	0.8 *2*							
1805.0 *5*	0.6 *2*	1858.3	(3$^-$)	53.25	2$^+$			
1810.7 *1*	2.1 *2*	1810.76	(1,2$^+$)	0.0	0$^+$			
x1817.7 *3*	0.7 *2*							
1839.6 *2*	1.1 *2*	1839.61	1$^{(-)}$,2$^+$	0.0	0$^+$			
x1853.8 *5*	0.6 *2*							
x1869.0 *3*	2.0 *3*							
1896.7 *1*	6.4 *3*	1949.89	(1,2$^+$)	53.25	2$^+$			
1902.7 *1*	9.1 *3*	1902.70	(1,2$^+$)	0.0	0$^+$			
1913.8 *1*	6.8 *3*	1967.03	(1,2$^+$)	53.25	2$^+$			
1920.2 *1*	5.2 *2*	1973.58	(1$^+$,2$^+$)	53.25	2$^+$			
1949.8 *1*	15.3 *3*	1949.89	(1,2$^+$)	0.0	0$^+$			
1956.9 *1*	5.3 *3*	2010.15	(1,2$^+$)	53.25	2$^+$			
1966.7 *3*	1.0 *2*	1967.03	(1,2$^+$)	0.0	0$^+$			
1971.3 *5*	0.5 *2*	2024.73	(1$^+$,2$^+$)	53.25	2$^+$			
1973.5 *5*	0.5 *2*	1973.58	(1$^+$,2$^+$)	0.0	0$^+$			
2000.9 *1*	4.4 *4*	2000.93	(1,2$^+$)	0.0	0$^+$			
2010.1 *2*	0.9 *2*	2010.15	(1,2$^+$)	0.0	0$^+$			
2024.6 *3*	0.6 *2*	2024.73	(1$^+$,2$^+$)	0.0	0$^+$			
2069.5 *2*	3.6 *3*	2122.79	(1,2$^+$)	53.25	2$^+$			
x2084.9 *2*	3.1 *3*							
2098.6 *1*	6.4 *3*	2151.84	(1,2$^+$)	53.25	2$^+$			
2122.8 *1*	7.1 *3*	2122.79	(1,2$^+$)	0.0	0$^+$			
x2150 *1*	0.4 *1*							
2152 *1*	0.4 *1*	2151.84	(1,2$^+$)	0.0	0$^+$			
x2187.7 *3*	0.8 *2*							
x2203.0 *5*	0.6 *2*							
2229.5 *5*	1.1 *2*	2282.99	1,2$^+$	53.25	2$^+$			
x2233.0 *5*	0.6 *2*							
2245.4 *10*	0.4 *2*	2298.6	(1,2$^+$)	53.25	2$^+$			
x2263 *1*	0.2 *1*							
x2277.0 *5*	0.5 *2*							

$^{230}_{90}$Th$_{140}$-9

γ(^{230}Th) (continued)

E_γ [†]	I_γ [‡b]	E_i(level)	J_i^π	E_f	J_f^π
2282.5 *3*	1.4 *1*	2282.99	1,2$^+$	0.0	0$^+$
2298.6 *3*	0.7 *1*	2298.6	(1,2$^+$)	0.0	0$^+$
2314 *1*	0.5 *1*	2314.34?	(1,2$^+$)	0.0	0$^+$
[x]2330.5 *5*	0.7 *1*				
[x]2356.8 *5*	0.2 *1*				
[x]2517 *1*	0.1 *1*				

† From 1980Gi04. Other measurement: 1973Ch24.

‡ Relative photon intensities are from measurements in 1980Gi04.

\# From Adopted Levels. Multipolarities in square brackets are deduced from the level scheme.

@ From ^{230}Pa decay. This transition was not observed in ^{230}Ac decay.

& Deduced by the evaluator from the γ-ray branchings adopted from ^{230}Pa ε decay.

a Additional information 1.

b For absolute intensity per 100 decays, multiply by 0.083 *21*.

c Multiply placed.

d Placement of transition in the level scheme is uncertain.

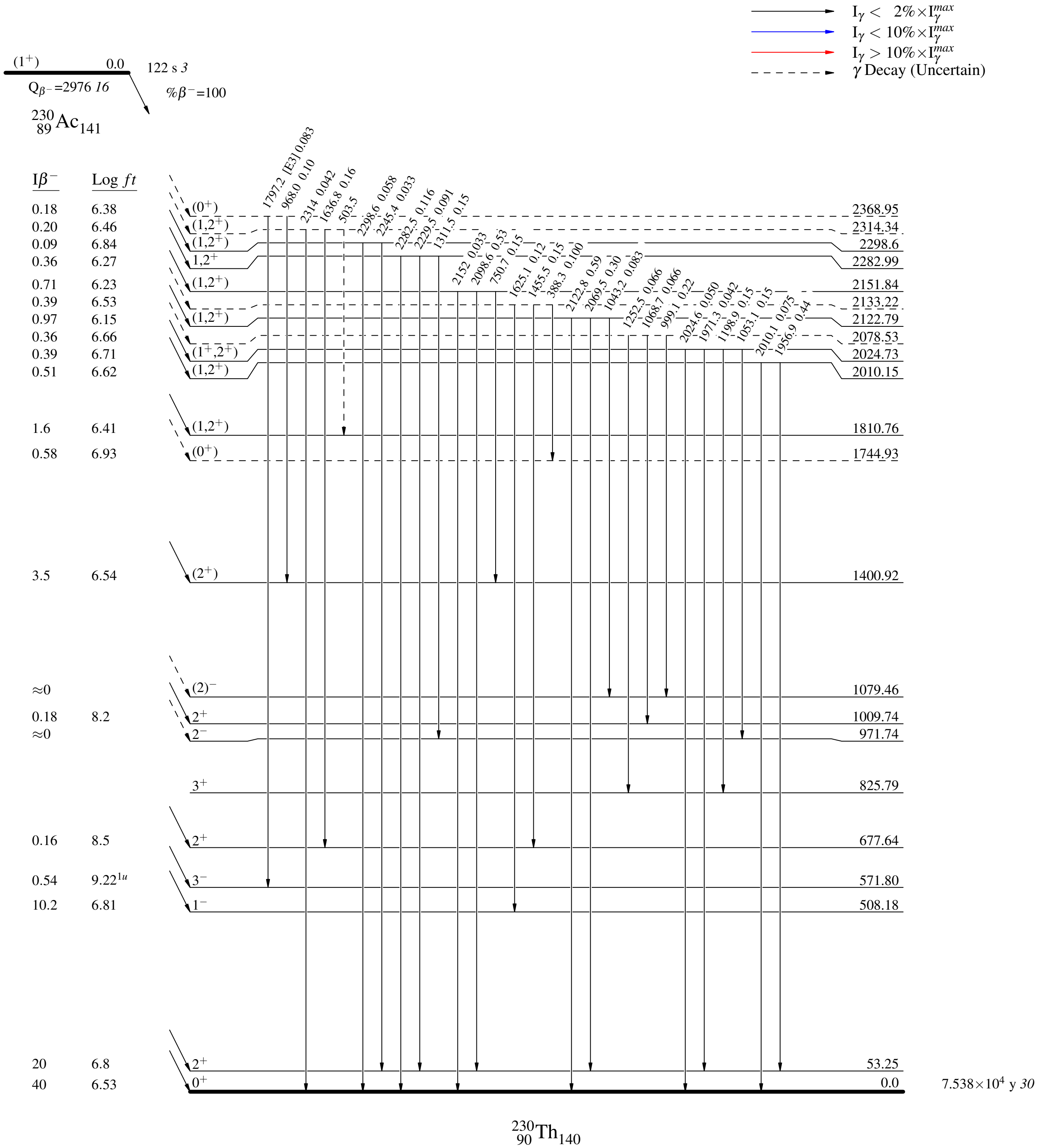
x γ ray not placed in level scheme.

^{230}Ac β^- decay 1980Gi04

Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

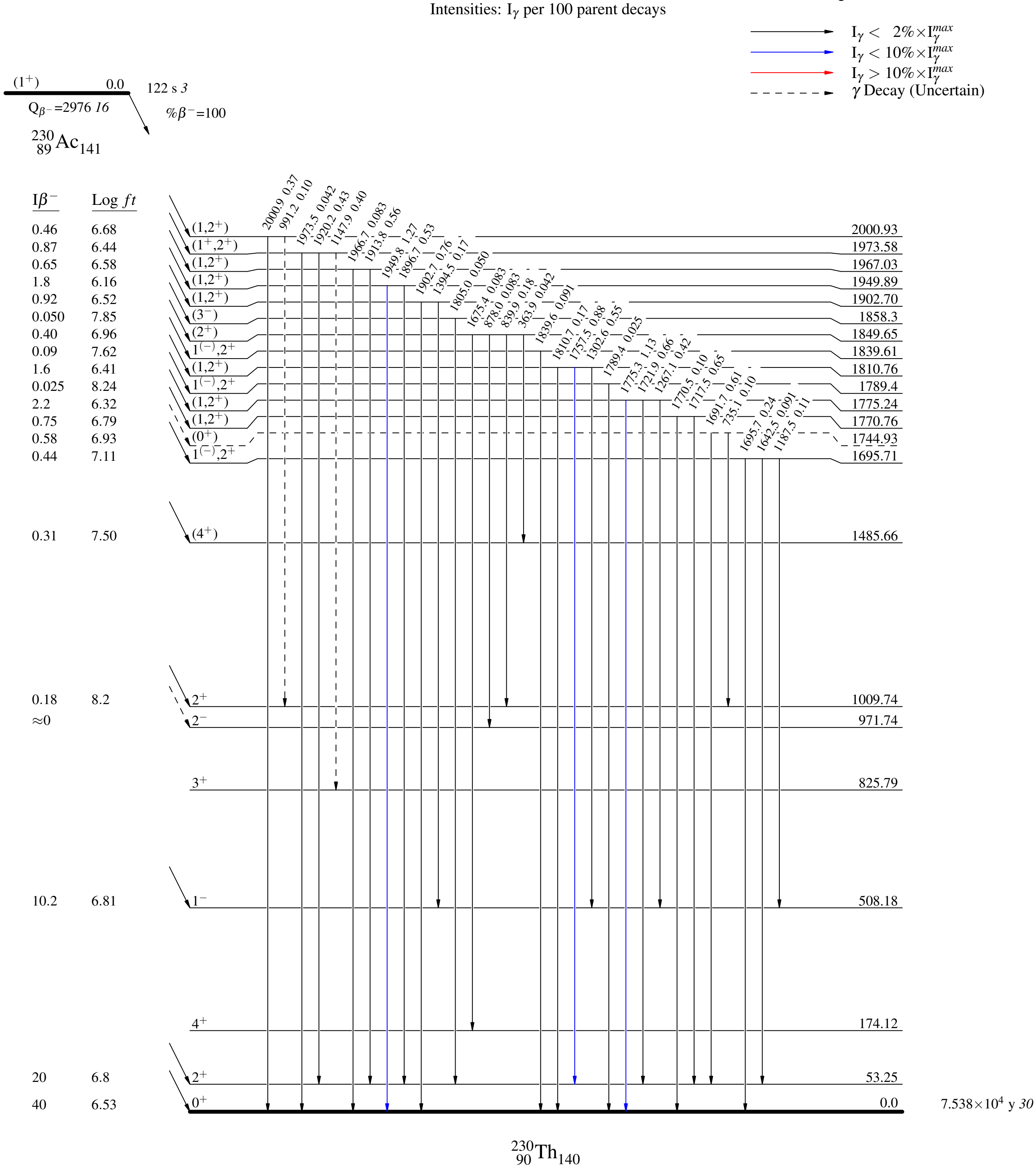


^{230}Ac β^- decay 1980Gi04

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays

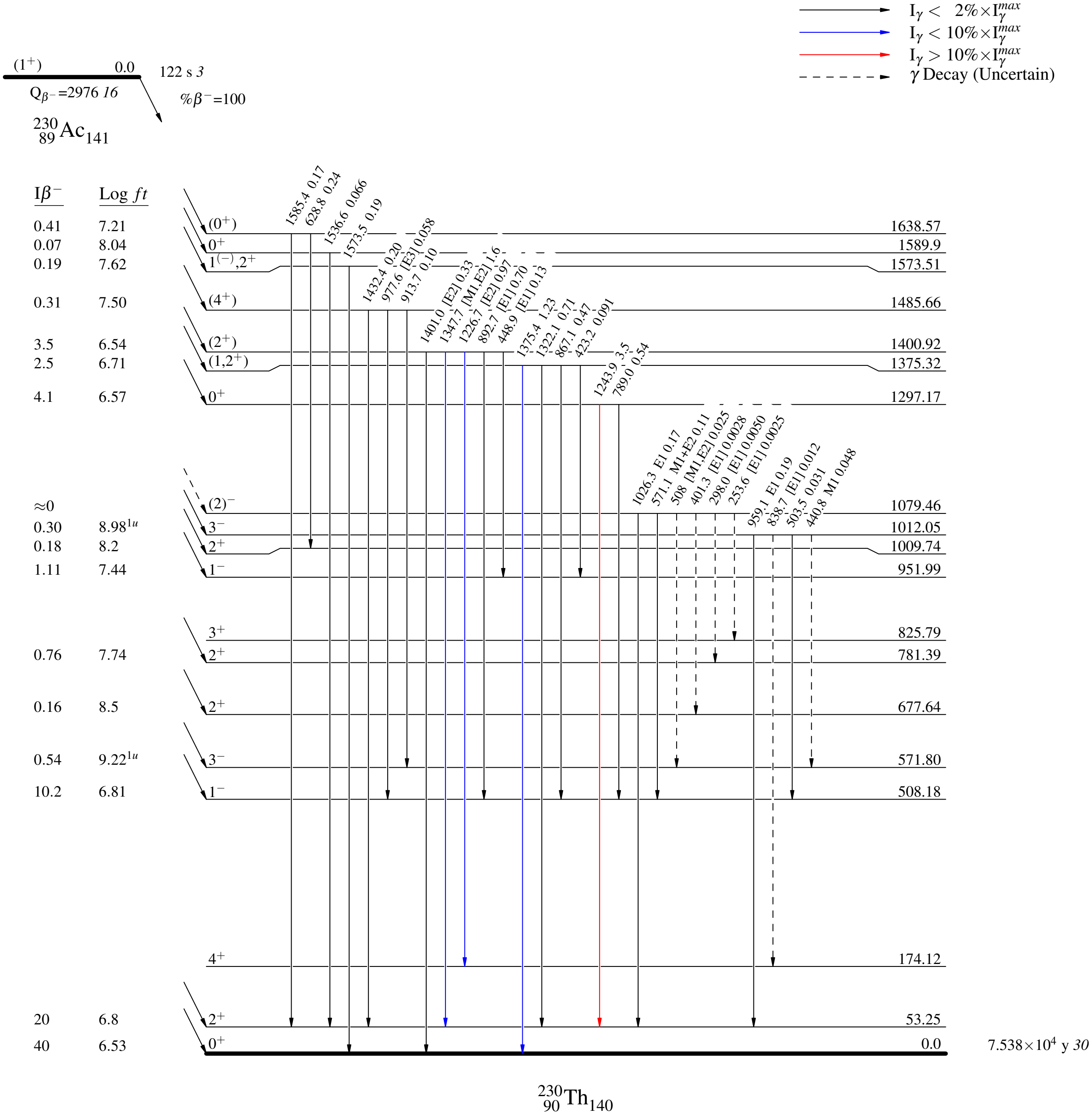
Legend



^{230}Ac β^- decay 1980Gi04

Decay Scheme (continued)

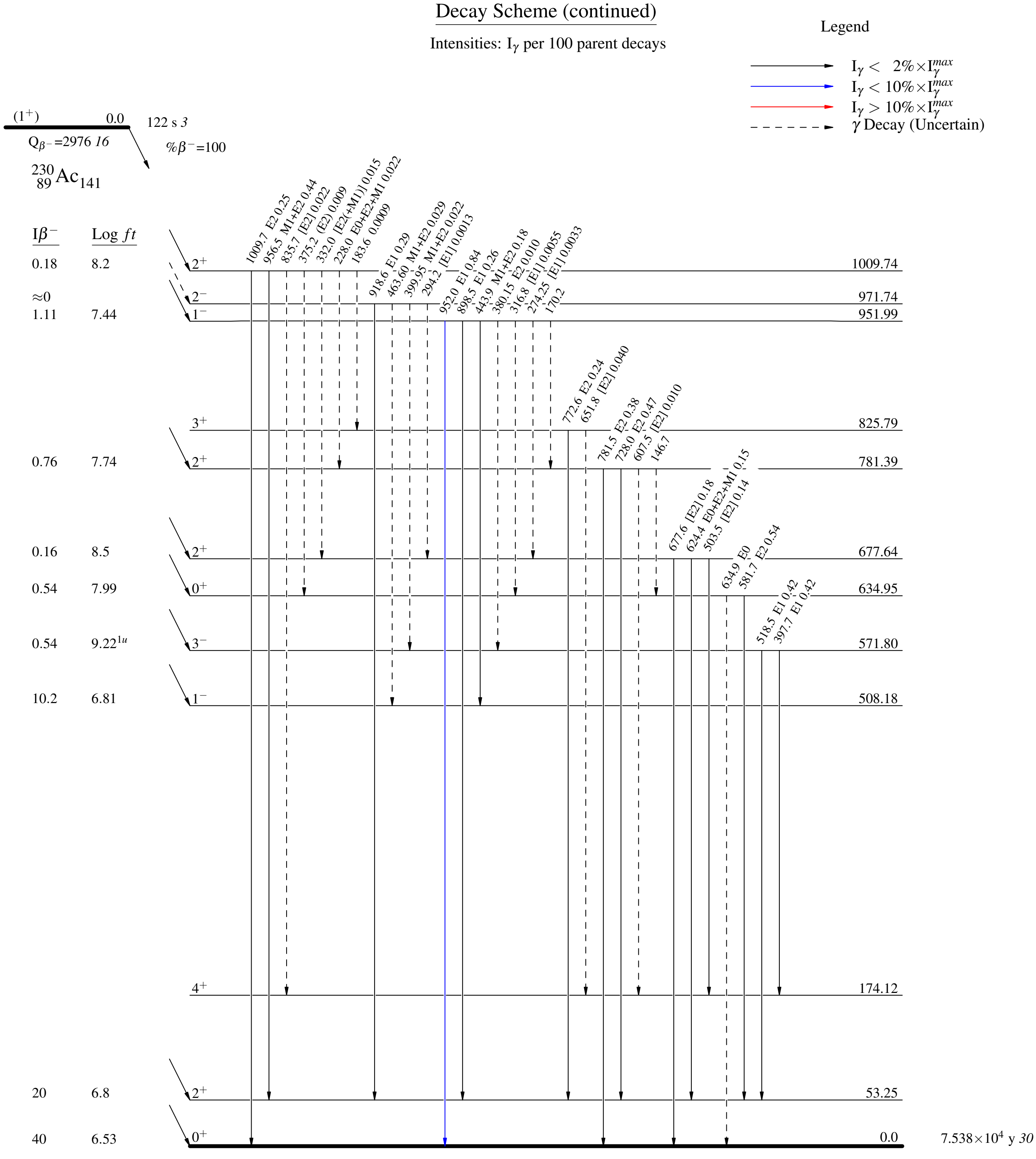
Intensities: I_γ per 100 parent decays



^{230}Ac β^- decay 1980Gi04

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays



^{230}Ac β^- decay 1980Gi04

Decay Scheme (continued)

Intensities: I_γ per 100 parent decays