Adopted Levels, Gammas

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

Q(β^-)=−1311 *3*; S(n)=6794.3 *22*; S(p)=7116 *12*; Q(α)=4770.0 *15* 2021Wa16
S(2n)=12051.0 *11*, S(2p)=12655.6 *18* (2021Wa16).

For deformation parameters deduced from Coulomb excitation, see 1973Be44 and 1977Mi11. For deformation parameter deduced from the ratio of (p,t) spectroscopic factors for g.s. and the first 0^+ state, see 1979Ab10.

The fission probability and the fission-fragment angular distributions were measured by 1988Bl03. The fine structure observed between 5.6 and 5.8 MeV was interpreted by 1988Bl03 as indicative of two opposite parity rotational bands in the third well of the nuclear potential. Some structure near 6.1 and 6.4 MeV excitation was also observed, and was tentatively interpreted as one (K=2) and two (K=4) phonon vibrations in the third well.

1986De36 studied ^{230}Th via the ^{232}Th(^{206}Pb,^{208}Pbγ) reaction at 6.4 MeV/nucleon. They reported observing γ-ray transitions depopulating states in the ground-state band up to spin 12^+, but reported no γ-ray energies or intensities.

^{230}Th Levels

Cross Reference (XREF) Flags

A	^{234}U α decay	F	^{232}Th(p,t)
B	^{230}Ac β^- decay	G	^{232}Th(α,α'2nγ)
C	^{230}Pa ε decay	H	^{232}Th(^{136}Xe,Xγ)
D	^{230}Th(d,d′)	I	Coulomb excitation
E	^{230}Th(d,pnγ)		

E(level)†	J$^\pi$‡	T$_{1/2}$	XREF	Comments
0.0#	0^+	75584 y *55*	ABCDEFGHI	%α=100; %^{24}Ne=5.8×10^{-11} *13*; %SF≤4×10^{-12} %^{24}Ne from T$_{1/2}$(^{24}Ne)=1.3×10^{17} y *3* (1996Bu05). %SF from T$_{1/2}$(SF)>2×10^{18} y (1985TrZY). Value recommended in 2000Ho27. Relative probability of cluster and α emission was measured by 1986Tr10; clusters were identified as neon ions from their residual ionic paths, and assigned to ^{24}Ne from comparison of experimental path distribution with calculations and from its decay energies. T$_{1/2}$: From 2013Ch53. Other measured values: 7.57×10^4 y *1* (2000Ch56), 7.54×10^4 y *3* (1980Me10, specific activity), 8.23×10^4 y *25* (1930Cu02, from ^{222}Rn growth), 7.3×10^4 y *4* (1931So01, from ^{226}Ra growth), 8.0×10^4 y *3* (1949Hy03, specific activity), 7.61×10^4 y *14* (1962At01, calorimetry). See 1980Me10 and 1990Ho28 for earlier measurements and for recalculated half-lives. Other value: >1.5×10^{17} y (1952Se67). T$_{1/2}$(SF)≥1.5×10^{17} y (1952Se67) yields %SF≤5×10^{-11}. Isotope shift relative to ^{232}Th was measured by 1989Ka29 by LASER spectroscopy: IS=15360 *30* MHz [IS=ν(^{230}Th)-ν(^{232}Th)].
53.230# *11*	2^+	0.354 ns *9*	ABCDEFGHI	B(E2)↑=8.06 *11* (1973Be44) J$^\pi$: 53.20γ to 0^+ is E2. T$_{1/2}$: From (α)(ce)(t) in ^{234}U decay (1965Ne03). Other values: T$_{1/2}$=0.37 ns *2* from γce(t) in ^{230}Pa decay (1960Be25), T$_{1/2}$=0.352 ns *5* calculated by the evaluator from B(E2) of 8.06 *11*.
174.119# *17*	4^+	0.166 ns *5*	ABCDEFGHI	J$^\pi$: 120.90γ E2 to 2^+; assignment to g.s. band. T$_{1/2}$: from (α)(ce)(t) in ^{234}U decay (1965Ne03).
356.54# *12*	6^+		DEFGHI	
508.143@ *12*	1^-		ABCDEF I	J$^\pi$: 508.2γ E1 to 0^+.
571.758@ *14*	3^-		BCDEF I	B(E3)↑=0.64 *6*

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Adopted Levels, Gammas (continued)

^{230}Th Levels (continued)

E(level)[†]	J^{π}[‡]	$T_{1/2}$	XREF	Comments
				J^{π}: 518.5γ E1 and 397.7γ E1 to 2^+ and 4^+ levels; L(p,t)=3.
593.89[#] *17*	8^+		DEFGHI	
634.920[&] *18*	0^+		ABCD F I	J^{π}: 634.9-keV E0 transition to 0^+; L(p,t)=0.
677.530[&] *16*	2^+	15 ps *2*	ABC EF I	B(E2)↑=0.046 *6* $T_{1/2}$: calculated by the evaluator from B(E2). See Coulomb excitation. J^{π}: 624.3γ E0+M1+E2 to 2^+.
686.76[@] *14*	(5^-)		DEF I	J^{π}: 114.9γ to 3^-, 330.1γ to 6^+; band assignment.
769.6 *6*	(4^+)		I	J^{π}: 413γ to 6^+, 716γ to 2^+.
775.5[&] *3*	(4^+)		EF	J^{π}: 420γ to 6^+; band assignment.
781.374[a] *13*	2^+	3.3 ps *5*	BCD F I	B(E2)↑=0.123 *13* J^{π}: 781.35γ E2 to 0^+, L(p,t)=2. $T_{1/2}$: calculated by the evaluator from B(E2). See Coulomb excitation.
825.660[a] *20*	3^+		BC EF I	J^{π}: 772.4γ E2 to 2^+; γ ray to 4^+, and γ ray from 2^-; ratio of reduced transition rates agrees with theory (Alaga rule): B(E2,772.4γ)/B(E2,651.6γ)=0.39 *17* observed, 0.40 theory.
852.21[@] *17*	(7^-)		DEF HI	J^{π}: 165.5γ to (5^-), 496γ to 6^+; band assignment.
879.36[#] *24*	(10^+)		E GHI	
883.6[a] *5*	4^+		DEF I	J^{π}: L(p,t)=4.
923.00[&] *19*	(6^+)		EF	J^{π}: 567γ to 6^+, 749γ to 4^+; band assignment.
951.900[b] *13*	1^-		BCD F I	J^{π}: 951.95γ E1 to 0^+.
955.08[a] *22*	(5^+)		E	J^{π}: 599γ to 6^+, 781γ to 4^+; band assignment.
971.732[b] *16*	2^-		BC F I	J^{π}: 463.6γ M1+E2 to 1^-, 399.95γ M1+E2 to 3^-.
1009.603[c] *13*	2^+	≥0.8 ps	BC f I	B(E2)↑≤0.097 XREF: f(1011.6). $T_{1/2}$: Calculated by evaluators from B(E2). See Coulomb excitation. J^{π}: 1009.6γ E2 to 0^+.
1012.53[b] *3*	3^-		BCD f I	B(E3)↑≤0.57 XREF: f(1011.6). J^{π}: 959.2γ E1 to 2^+; 838.4 E1 to 4^+.
1022 *2*			F	
1039.51[a] *21*	(6^+)		EF I	
1052.198[c] *25*	(3^+)		C EF I	
1065.36[@] *21*	(9^-)		EF HI	
1079.214[d] *15*	$(2)^-$		BC F I	J^{π}: 1026γ E1 to 2^+; 253.6γ to 3^+ state; no γ ray to 4^+; ratio of reduced transition rates is in fair agreement with theory (Alaga rule): B(E2,571γ)/B(E2,508γ)=2.7 *14* observed, 4.0 theory.
1089 *2*			F	
1107.3[c] *4*	(4^+)		EF I	
1108.9[b] *7*	(5^-)		D I	XREF: D(1110). J^{π}: γ-ray transitions to 4^+, 3^- states of the K=0^+ g.s. and K=0^- octupole-vibrational bands, but no γ rays to 0^+, 2^+ and 1^- states of these bands.
1117.4[&] *3*	(8^+)		E	
1125.6 *5*	(1^-),(0^+)		F	
1127.780[d] *14*	3^-		CD I	J^{π}: 1074.68γ E1 to 2^+; 954γ to 4^+ state.
1134.3[a] *3*	(7^+)		E	
1144 *2*			F	
1148.0 *9*			F	
1176.0[c] *3*	(5^+)		E I	
1184.8 *9*			F	
1196.8[d] *10*	(4^-)		I	J^{π}: 1022.7γ to 4^+ state, but no γ rays to the 0^+, 2^+ states of the g.s.

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Adopted Levels, Gammas (continued)

^{230}Th Levels (continued)

E(level)[†]	Jπ[‡]	XREF	Comments
			band.
1206.7[#] *5*	(12$^+$)	E GHI	
1241.2 *9*		F	
1243.1[a] *3*	(8$^+$)	E	
1251.3 *7*	(8$^+$)	I	
1255.4[c] *3*	(6$^+$)	EF	
1259.2 *6*	(3$^-$)	F	Jπ: L(p,t)=(3).
1283.6 *6*	(5$^-$)	F	Jπ: L(p,t)=(5).
1297.14 *7*	0$^+$	B F	Jπ: L(p,t)=0.
1322.1[@] *4*	(11$^-$)	E HI	
1322.3 *5*	(3$^-$)	F	
1337.2 *5*	4$^+$	F	
1349.1[c] *4*	(7$^+$)	E	
1358.5[a] *3*	(9$^+$)	E	
1359.5 *7*	(2$^+$)	F	
1375.28 *6*	(1,2$^+$)	B F	Jπ: γ ray to 0$^+$ level.
1400.89 *4*	(2$^+$)	B F	Jπ: γ rays to 0$^+$ and 4$^+$ levels.
1401.5 *5*	2$^+$	F	XREF: F(1401.5).
1420.4 *5*	(3$^+$)	F	
1440.4 *8*	(3$^+$)	F	
1447.9 *5*	0$^+$	F	Jπ: L(p,t)=0.
1448.5[c] *4*	(8$^+$)	E	
1485.63 *8*	(4$^+$)	B F	
1496.0 *10*		F	
1507.4 *5*	4$^+$	F	
1520.0[a] *6*	(10$^+$)	I	
1524.8 *5*	2$^+$	F	
1566.2 *6*	(1$^-$)	F	
1571.9[#] *6*	(14$^+$)	HI	
1573.51 *20*	1$^{(-)}$,2$^+$	B D F	Jπ: 1573.5γ to 0$^+$; populated in (d,d′). Unnatural parity assigned in (p,t).
1584.7 *6*	(4$^-$,5$^+$)	F	
1589.8 *3*	0$^+$	B D F	Jπ: L=0 in ^{232}Th(p,t) reaction.
1594.7 *8*	(1$^-$)	F	Jπ: L(p,t)=(1).
1601.2 *11*	(3$^-$)	F	
1612.1 *10*	(4$^-$,5$^+$)	F	
1616.1[@] *5*	(13$^-$)	HI	
1618.7 *9*	(4$^-$,5$^+$)	F	
1628 *2*		D	
1630.1 *7*	2$^+$	F	
1638.45 *9*	(0$^+$)	B F	Jπ: γ rays to 2$^+$ states; log *ft*=7.1 from (1$^+$) ^{230}Ac β^- decay; L(p,t)=0. *J*π=2$^+$, K=0 was suggested by 1972Ma15 from energy difference of the 1638.5- and 1589.8-keV levels.
1653.2 *11*	(6$^+$)	F	
1663 *3*		D	
1668.2 *7*	(4$^+$)	F	
1679.1 *7*	(2$^+$)	F	
1683.3 *7*	(4$^-$)	F	
1694.9 *7*	(4$^+$)	F	
1695.71 *9*	1$^{(-)}$,2$^+$	B D	Jπ: 1695.7γ to 0$^+$. Populated in (d,d′).
1708.8 *8*	2$^+$	F	
1718 *3*		D	
1723.5 *7*	(4$^+$)	F	
1744.87 *8*	(0$^+$)	B F	
1750.7 *8*	(3$^-$)	F	

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Adopted Levels, Gammas (continued)

^{230}Th Levels (continued)

E(level)†	Jπ‡	XREF	Comments
1762.3 *8*	(4$^+$)	F	
1769.6 *8*	(4$^+$)	F	
1770.73 *10*	(1,2$^+$)	B	Jπ: 1770.5γ to 0$^+$.
1775.22 *7*	(1,2$^+$)	B F	Jπ: 1775.3γ to 0$^+$.
1789.4 *5*	1$^{(-)}$,2$^+$	B D	Jπ: 1789.4γ to 0$^+$ level. Populated in (d,d′).
1793.1 *6*	(5$^-$)	F	
1802.5 *6*	0$^+$	F	
1810.73 *6*	(1,2$^+$)	B	Jπ: 1810.7γ to 0$^+$ level.
1812.0 *8*	4$^+$	F	
1824.9 *7*	(6$^+$)	F	
1839.61 *20*	1$^{(-)}$,2$^+$	B D F	Jπ: 1839.6γ to 0$^+$ level. Populated in (d,d′).
1849.55 *8*	(2$^+$)	B	Jπ: γ rays to 4$^+$, 2$^+$, and 2$^-$ levels; log *ft*=6.9 from (1$^+$) ^{230}Ac β- decay.
1851.4 *7*	(3$^-$)	F	
1858.2 *5*	(3$^-$)	B D F	
1868.9 *7*		F	This level is fit as a double in ^{232}Th(p,t), with spin components (0$^+$) and (6$^+$).
1887.0 *9*	(2$^+$)	F	
1902.70 *9*	(1,2$^+$)	B	Jπ: 1902.7γ to 0$^+$ level.
1910.0 *9*	(6$^+$)	F	
1914.7 *9*	(1$^-$)	F	
1926.0 *7*	4$^+$	F	
1931.1 *8*	(1$^-$)	F	
1939.8 *11*	(1)	F	
1947.0 *6*	4$^+$	F	
1947.2@ *6*	(15$^-$)	HI	
1949.87 *7*	(1,2$^+$)	B	Jπ: 1949.8γ to 0$^+$ level.
1956.4 *6*	2$^+$	F	
1967.01 *10*	(1,2$^+$)	B F	Jπ: 1966.7γ to 0$^+$ level, but not 2$^+$ in (p,t).
1969.6# *7*	(16$^+$)	HI	
1973.50 *7*	(1$^+$,2$^+$)	B F	Jπ: 1973.5γ to 0$^+$ level, and possible 1147.9γ to 3$^+$ state, but 2$^+$ in (p,t).
1985.4 *8*	(5$^-$)	F	
2000.86 *7*	(1,2$^+$)	B	Jπ: 2000.9γ to 0$^+$ level.
2001.6 *8*	(3$^-$)	F	
2010.13 *9*	(1,2$^+$)	B F	Jπ: 2010.1γ to 0$^+$ level. Assigned 2$^+$ in (p,t).
2017.3 *7*	(3$^-$)	F	
2024.67 *12*	(1$^+$,2$^+$)	B F	Jπ: γ rays to 0$^+$ and 3$^+$ levels. Assigned 2$^+$ in (p,t).
2032.8 *7*	4$^+$	F	
2039.1 *7*	4$^+$	F	
2048.7 *7*	(4$^+$)	F	
2060.9 *12*	(3$^-$)	F	
2073.2 *8*	(8$^+$)	F	
2074.9 *8*	(4$^+$)	F	
2078.25? *9*		B	
2085.9 *8*	(4$^+$)	F	
2093.9 *7*	0$^+$	F	
2102.0 *7*	4$^+$	F	
2118.4 *6*	4$^+$	F	
2122.77 *9*	(1,2$^+$)	B	Jπ: 2122.8γ to 0$^+$ level.
2130.7 *7*	2$^+$	F	
2133.16? *10*		B	
2137.9 *7*	2$^+$	F	
2150.5 *6*	0$^+$	F	
2151.82 *10*	(1,2$^+$)	B	Jπ: 2152.0γ to 0$^+$ level.
2168.8 *7*	(4$^+$)	F	
2175.1 *6*	0$^+$	F	
2181.7 *7*	(4$^+$)	F	

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Adopted Levels, Gammas (continued)

^{230}Th Levels (continued)

E(level)†	J$^{\pi}$‡	XREF	Comments
2187.1 *6*	2^+	F	
2194.8 *8*	(6^+)	F	
2205.4 *10*	2^+	F	
2207.8 *8*	(4^+)	F	
2216.0 *7*	(4^+)	F	
2226.0 *6*	2^+	F	
2241.0 *7*	2^+	F	
2249.9 *7*	(6^+)	F	
2255.3 *7*	4^+	F	
2268.9 *6*	0^+	F	
2276.0 *8*	(4^+)	F	
2282.99 *16*	$1,2^+$	B F	J$^{\pi}$: 2282.5γ to 0^+ level.
2295.9 *8*	4^+	F	
2298.6 *3*	$(1,2^+)$	B	J$^{\pi}$: 2298.6γ to 0^+ level.
2305.4 *7*	2^+	F	
2310.6@ *7*	(17^-)	HI	
2311.2 *8*	(4^+)	F	
2314.28? *14*	$(1,2^+)$	B	J$^{\pi}$: 2314.0γ to 0^+ level.
2317.7 *7*	4^+	F	
2329.6 *7*	2^+	F	
2337.1 *8*	(5^-)	F	
2354.8 *10*	(6^+)	F	
2368.91 *17*	(0^+)	B F	
2383.8 *8*	(4^+)	F	
2388.4 *10*		F	
2395.2 *7*	0^+	F	
2396.4# *9*	(18^+)	HI	
2402.0 *8*	(6^+)	F	
2411.6 *7*	2^+	F	
2422.7 *7*		F	This level is fit as a doublet in ^{232}Th(p,t), with the two spins being (0^+) and (4^+).
2426.4 *9*	(0^+)	F	
2436.6 *9*	2^+	F	
2442.5 *8*	2^+	F	
2449.2 *2*	(3^-)	F	
2461.0 *7*	2^+	F	
2467.2 *7*	2^+	F	
2474.3 *8*	2^+	F	
2478.5 *8*	4^+	F	
2481.3 *12*	(6^+)	F	
2493.8 *7*	0^+	F	
2501.1 *7*	4^+	F	
2508.3 *7*		F	
2519.3 *7*	(6^+)	F	
2528.1 *7*	0^+	F	
2536.9 *7*	4^+	F	
2549.8 *11*	0^+	F	
2556.2 *8*	(4^+)	F	
2562.9 *9*	(4^+)	F	
2573.2 *7*	(6^+)	F	
2589.1 *7*	2^+	F	
2596.4 *8*	(0^+)	F	
2601.3 *7*	(4^+)	F	
2616.0 *7*	2^+	F	
2625.9 *7*	2^+	F	
2640.0 *8*	4^+	F	

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Adopted Levels, Gammas (continued)

^{230}Th Levels (continued)

E(level)[†]	Jπ[‡]	XREF	E(level)[†]	Jπ[‡]	XREF	E(level)[†]	Jπ[‡]	XREF
2660.9 *7*	4^{+}	F	2855.9 *7*	2^{+}	F	3083.8 *7*	2^{+}	F
2666.4 *7*	(2^{+})	F	2862.9 *7*	2^{+}	F	3100.9 *7*	2^{+}	F
2671.6 *7*	4^{+}	F	2870.6 *10*	(3^{-})	F	3113.9 *12*	(≤ 4)	F
2679.2 *8*	2^{+}	F	2879.7 *7*	2^{+}	F	3124.7 *8*	(4^{+})	F
2694.9 *7*	2^{+}	F	2886.1 *10*	(1^{-})	F	3125.4[@] *10*	(21^{-})	HI
2703.8[@] *9*	(19^{-})	HI	2896.1 *7*	2^{+}	F	3135.9 *10*	(≤ 4)	F
2706.5 *7*	2^{+}	F	2906.4 *8*	(3^{-})	F	3147.4 *8*	(≤ 4)	F
2712.9 *5*	(6^{+})	F	2913.6 *15*	(4^{+})	F	3162.0 *7*	2^{+}	F
2726.6 *7*	2^{+}	F	2923.7 *9*	2^{+}	F	3173.6 *8*	2^{+}	F
2740.6 *7*	2^{+}	F	2930.6 *7*	2^{+}	F	3186.1 *7*	(6^{+})	F
2746.2 *7*	4^{+}	F	2940.6 *7*	2^{+}	F	3198.4 *7*	2^{+}	F
2754.2 *10*	(6^{+})	F	2950.5 *8*	(6^{+})	F	3212.2 *7*	2^{+}	F
2764.9 *7*	2^{+}	F	2987.9 *10*	(6^{+})	F	3223.1 *7*	2^{+}	F
2777.3 *7*	2^{+}	F	2999.0 *7*	2^{+}	F	3234.0 *7*		F
2791.5 *7*	4^{+}	F	3009.9 *8*	2^{+}	F	3248.6 *7*	2^{+}	F
2799.7 *8*	2^{+}	F	3020.6 *8*	2^{+}	F	3258.8 *8*		F
2808.1 *7*	0^{+}	F	3030.3 *9*	2^{+}	F	3269.9 *12*	(2^{+})	F
2824.4 *10*	4^{+}	F	3043.0 *7*	2^{+}	F	3324.1[#] *11*	(22^{+})	HI
2834.0 *10*	2^{+}	F	3052.4 *9*	(3^{+})	F	3572.3?[@] *11*	(23^{-})	H
2841.3 *7*	(2^{+})	F	3064.3 *15*	(2^{+})	F	3819.1?[#] *15*	(24^{+})	HI
2848.7[#] *10*	(20^{+})	HI	3072.6 *8*	(6^{+})	F			

[†] Deduced by evaluator from a least squares fit to adopted γ-ray energies, unless otherwise specified.

[‡] Spin/parity assignments are based on rotational and band structures, on γ-ray multipolarities, on log *ft* values from ^{230}Ac β^{-} decay and ^{230}Pa ε decay, and on hindrance factors from ^{234}U alpha decay. For levels populated only in ^{234}Th(p,t), spin/parity assignments are based on angular distribution of scattered tritons. Some additional specific arguments are given for individual levels.

[#] Band(A): $K^{\pi}=0^{+}$ g.s. rotational band. Assignments for levels with $J^{\pi}\geq 6^{+}$ are from inband γ rays observed in Coulomb excitation.

[@] Band(B): $K^{\pi}=0^{-}$ octupole-vibrational band. Assignments for levels with $J^{\pi}\geq 5^{-}$ are from γ rays to lower members of the K=0^{-} octupole-vibrational band and to the g.s. rotational band.

[&] Band(C): $K^{\pi}=0^{+}$ β-vibrational band.

[a] Band(D): $K^{\pi}=2^{+}$ γ-vibrational band. Assignments for levels with $J^{\pi}\geq 6^{+}$ are from γ ray decays to the g.s. rotational band, and from fit to the K=2 γ- vibrational band.

[b] Band(E): $K^{\pi}=1^{-}$ octupole-vibrational band. Distorted by Coriolis interaction.

[c] Band(F): $K^{\pi}=2^{+}$ band. Assignments for levels with $J^{\pi}\geq 3^{+}$ are from γ decays to the g.s. band observed in Coulomb excitation.

[d] Band(G): $K^{\pi}=2^{-}$ octupole-vibrational band.

Adopted Levels, Gammas (continued)

$\gamma(^{230}Th)$

Additional information 1.

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[e]	$I_{(\gamma+ce)}$	Comments
53.230	2^+	53.20 *2*	100	0.0	0^+	E2	227.9 *32*		α(L)=166.8 *24*; α(M)=45.7 *6*; α(N)=12.22 *17*; α(O)=2.72 *4*; α(P)=0.448 *6*; α(Q)=0.001240 *17* B(E2)(W.u.)=196 *6* E_γ: From ^{234}U alpha decay.
174.119	4^+	120.90 *2*	100	53.230	2^+	E2	4.94 *7*		α(K)=0.257 *4*; α(L)=3.42 *5*; α(M)=0.940 *13*; α(N)=0.2520 *35*; α(O)=0.0562 *8* α(P)=0.00936 *13*; α(Q)=5.21×10^{-5} *7* B(E2)(W.u.)=265 *9* E_γ: From ^{234}U alpha decay.
356.54	6^+	182.5 *2*	100	174.119	4^+				E_γ: From ^{232}Th(^{136}Xe,Xγ).
508.143	1^-	454.92 *2*	100 *5*	53.230	2^+	E1	0.01528 *21*		α(K)=0.01237 *17*; α(L)=0.002202 *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*
		508.15 *2*	61 *3*	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*
571.758	3^-	63.5 *2*		508.143	1^-				E_γ: From ^{230}Th(d,pnγ).
		397.62 *2*	87 *4*	174.119	4^+	E1	0.02019 *28*		α(K)=0.01630 *23*; α(L)=0.00295 *4*; α(M)=0.000704 *10*; α(N)=0.0001866 *26* α(O)=4.36×10^{-5} *6*; α(P)=8.20×10^{-6} *11*; α(Q)=6.65×10^{-7} *9*
		518.54 *2*	100 *5*	53.230	2^+	E1	0.01174 *16*		α(K)=0.00953 *13*; α(L)=0.001671 *23*; α(M)=0.000398 *6*; α(N)=0.0001054 *15* α(O)=2.468×10^{-5} *35*; α(P)=4.68×10^{-6} *7*; α(Q)=3.97×10^{-7} *6*
593.89	8^+	237.4 *2*	100	356.54	6^+				E_γ: From ^{232}Th(^{136}Xe,Xγ).
634.920	0^+	581.65 *10*	100 *5*	53.230	2^+	E2	0.0302 *4*		α(K)=0.02029 *28*; α(L)=0.00735 *10*; α(M)=0.001884 *26*; α(N)=0.000503 *7* α(O)=0.0001158 *16*; α(P)=2.094×10^{-5} *29*; α(Q)=1.089×10^{-6} *15*
		634.9 *2*		0.0	0^+	E0		120 *25*	
677.530	2^+	503.55[g] *10*	86[g#] *13*	174.119	4^+	E2	0.0420 *6*		α(K)=0.0266 *4*; α(L)=0.01141 *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} *20* B(E2)(W.u.)=4.2 *+8−7*
		624.33 *7*	88 *5*	53.230	2^+	E0+M1+E2	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*
		677.53 *6*	100 *9*	0.0	0^+	E2	0.02170 *30*		α(K)=0.01533 *21*; α(L)=0.00475 *7*; α(M)=0.001204 *17*;

$^{230}_{90}Th_{140}$-7

Adopted Levels, Gammas (continued)

γ(^{230}Th) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	α[e]	Comments
								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* B(E2)(W.u.)=1.10 *+19−16*
686.76	(5$^-$)	114.9[&]	19[&] *6*	571.758	3$^-$			
		330.2[&] *2*	55[&] *4*	356.54	6$^+$			E_γ: From (d,pnγ).
		512.7[&] *2*	100[&] *6*	174.119	4$^+$			E_γ: From (d,pnγ).
769.6	(4$^+$)	413.0[&]	≤45[&]	356.54	6$^+$			
		595.5[&]	82[&] *55*	174.119	4$^+$			
		716.4[&]	100[&] *37*	53.230	2$^+$			
775.5	(4$^+$)	419.7[a] *5*	16[a] *4*	356.54	6$^+$			
		601.1[a] *3*	100[a] *10*	174.119	4$^+$			
781.374	2$^+$	607.41 *8*	2.72 *6*	174.119	4$^+$	[E2]	0.0274 *4*	α(K)=0.01873 *26*; α(L)=0.00647 *9*; α(M)=0.001654 *23*; α(N)=0.000442 *6* α(O)=0.0001018 *14*; α(P)=1.846×10^{-5} *26*; α(Q)=9.98×10^{-7} *14* B(E2)(W.u.)=0.37 *+19−16*
		728.13 *2*	100 *5*	53.230	2$^+$	E2	0.01868 *26*	α(K)=0.01345 *19*; α(L)=0.00391 *5*; α(M)=0.000985 *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* B(E2)(W.u.)=5.5 *+10−8*
		781.39 *2*	75 *4*	0.0	0$^+$	E2	0.01618 *23*	α(K)=0.01184 *17*; α(L)=0.00325 *5*; α(M)=0.000815 *11*; α(N)=0.0002174 *30* α(O)=5.04×10^{-5} *7*; α(P)=9.32×10^{-6} *13*; α(Q)=6.08×10^{-7} *9* B(E2)(W.u.)=2.9 *+6−4*
825.660	3$^+$	651.61 *6*	27 *4*	174.119	4$^+$	M1+E2	0.06 *4*	α(K)=0.050 *33*; α(L)=0.010 *5*; α(M)=0.0025 *12*; α(N)=6.7×10^{-4} *31*; α(O)=1.6×10^{-4} *7* α(P)=3.0×10^{-5} *15*; α(Q)=2.6×10^{-6} *17*
		772.41 *6*	100 *7*	53.230	2$^+$	M1+E2	0.041 *25*	α(K)=0.033 *20*; α(L)=0.0066 *32*; α(M)=0.0016 *7*; α(N)=4.2×10^{-4} *20*; α(O)=1.0×10^{-4} *5* α(P)=1.9×10^{-5} *10*; α(Q)=1.7×10^{-6} *11*
852.21	(7$^-$)	165.5 *2*	6 *5*	686.76	(5$^-$)			Eγ from ^{230}Th(d,pnγ); Iγ from Coulomb Excitation.
		258.2 *2*	30 *3*	593.89	8$^+$			Eγ from ^{230}Th(d,pnγ); Iγ from Coulomb Excitation.
		495.8 *2*	100 *5*	356.54	6$^+$			Eγ from ^{230}Th(d,pnγ); Iγ from Coulomb Excitation.
879.36	(10$^+$)	285.6 *2*	100	593.89	8$^+$			E_γ: From (d,pnγ).
883.6	4$^+$	205.9[&h]	6.0[&] *30*	677.530	2$^+$			
		527.0[&]	6.3[&] *15*	356.54	6$^+$			
		709.5[&]	100[&] *5*	174.119	4$^+$			
		830.4[&]	36.2[&] *30*	53.230	2$^+$			
923.00	(6$^+$)	566.5 *2*	34 *4*	356.54	6$^+$			E_γ,I_γ: From ^{230}Th(d,pnγ).
		748.8 *3*	100 *7*	174.119	4$^+$			E_γ,I_γ: From ^{230}Th(d,pnγ).

$^{230}_{90}Th_{140}$-8

$\gamma(^{230}Th)$ (continued)

E_i(level)	J_i^π	E_γ[†]	I_γ[†]	E_f	J_f^π	Mult.[‡]	δ[d]	α[e]	$I_{(\gamma+ce)}$	Comments
951.900	1^-	170.53 *5*	≤0.02[@]	781.374	2^+	E1		0.1377 *19*		α(K)=0.1083 *15*; α(L)=0.02226 *31*; α(M)=0.00537 *8*; α(N)=0.001417 *20*; α(O)=0.000326 *5* α(P)=5.94×10^{-5} *8*; α(Q)=4.00×10^{-6} *6*
		274.38 *2*	0.25 *2*	677.530	2^+	E1		0.0454 *6*		α(K)=0.0363 *5*; α(L)=0.00690 *10*; α(M)=0.001656 *23*; α(N)=0.000438 *6* α(O)=0.0001017 *14*; α(P)=1.891×10^{-5} *26*; α(Q)=1.426×10^{-6} *20*
		316.99 *2*	0.57 *4*	634.920	0^+					
		380.12 *2*	1.12 *6*	571.758	3^-	E2		0.0854 *12*		α(K)=0.0457 *6*; α(L)=0.0293 *4*; α(M)=0.00776 *11*; α(N)=0.002077 *29*; α(O)=0.000472 *7* α(P)=8.26×10^{-5} *12*; α(Q)=2.67×10^{-6} *4*
		443.74 *2*	19.6 *10*	508.143	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)=0.00056 *12* α(P)=0.000107 *26*; α(Q)=9.4×10^{-6} *33* δ: Other: 0.55 *2* in ^{230}Pa ε decay.
		898.66 *2*	19.6 *12*	53.230	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)=8.41×10^{-6} *12* α(P)=1.617×10^{-6} *23*; α(Q)=1.471×10^{-7} *21*
		951.95 *6*	100 *5*	0.0	0^+	E1		0.00377 *5*		α(K)=0.00310 *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*
955.08	(5^+)	598.6[a] *3*	48[a] *4*	356.54	6^+					
		780.9[a] *3*	100[a] *5*	174.119	4^+					
971.732	2^-	294.23 *2*	0.67 *3*	677.530	2^+	E1		0.0388 *5*		α(K)=0.0311 *4*; α(L)=0.00585 *8*; α(M)=0.001403 *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*
		399.95 *2*	7.8 *5*	571.758	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*
		463.59 *6*	10.3 *7*	508.143	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*
		918.50 *2*	100 *5*	53.230	2^+	E1		0.00402 *6*		α(K)=0.00330 *5*; α(L)=0.000548 *8*; α(M)=0.0001294 *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*
1009.603	2^+	183.90 *11*	0.20[@] *7*	825.660	3^+	M1+E2		2.1 *12*		α(K)=1.4 *12*; α(L)=0.513 *15*; α(M)=0.132 *12*; α(N)=0.0353 *33*; α(O)=0.0081 *5* α(P)=0.001462 *23*; α(Q)=8.E−5 *6*
		228.23 *5*	0.41 *7*	781.374	2^+	E0+E2+M1		1.1 *7*	27 *8*	α(K)=0.8 *7*; α(L)=0.241 *31*; α(M)=0.061 *4*;

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

$\gamma(^{230}Th)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[d]	α[e]	Comments
									α(N)=0.0164 *11*; α(O)=0.00378 *35* α(P)=0.00069 *11*; α(Q)=4.2×10^{-5} *34*
1009.603	2^+	332.07 *5*	2.96 *7*	677.530	2^+	[E2]		0.1247 *17*	α(K)=0.0596 *8*; α(L)=0.0479 *7*; α(M)=0.01279 *18*; α(N)=0.00343 *5*; α(O)=0.000776 *11* α(P)=0.0001345 *19*; α(Q)=3.61×10^{-6} *5* Although an admixture of M1 multipolarity is possible, the 332.0-keV γ ray is assumed to be E2, since a $J^\pi=2^+$,K=2 to 2^+,0 M1 transition is K forbidden and since the relative photon intensities of 332.0γ and 374.7γ agree with the Alaga rule (see ^{230}Ac β^- decay) when 332.0γ is taken as E2.
		374.67[f] *2*	<3	634.920	0^+	(E2)		0.0888 *12*	α(K)=0.0470 *7*; α(L)=0.0309 *4*; α(M)=0.00818 *11*; α(N)=0.002188 *31*; α(O)=0.000497 *7* α(P)=8.69×10^{-5} *12*; α(Q)=2.75×10^{-6} *4*
		835.59 *8*	3.7 *4*	174.119	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)=5.35×10^{-7} *7*
		956.38 *2*	100 *8*	53.230	2^+	M1+E2	6.1 *4*	0.01157 *19*	α(K)=0.00883 *15*; α(L)=0.002063 *32*; α(M)=0.000509 *8*; α(N)=0.0001357 *21* α(O)=3.17×10^{-5} *5*; α(P)=5.94×10^{-6} *9*; α(Q)=4.43×10^{-7} *7* δ: From ^{230}Pa ε Decay.
		1009.59 *2*	68 *4*	0.0	0^+	E2		0.00980 *14*	α(K)=0.00750 *10*; α(L)=0.001734 *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*
1012.53	3^-	440.78 *10*	20 *4*	571.758	3^-	M1+E2		0.18 *12*	α(K)=0.14 *10*; α(L)=0.031 *13*; α(M)=0.0076 *30*; α(N)=0.0020 *8*; α(O)=4.7×10^{-4} *19* α(P)=9.E−5 *4*; α(Q)=7.E−6 *5*
		503.6[g] *10*	≤3[g#]	508.143	1^-				E_γ: 503.55 keV *10* measured in ^{230}Pa $\varepsilon+\beta^+$ decay is inconsistent with final state energy. The evaluator has increased the uncertainty to 1 keV.
		838.45 *5*	7.0 *25*	174.119	4^+	E1		0.00473 *7*	α(K)=0.00388 *5*; α(L)=0.000649 *9*; α(M)=0.0001534 *21*; α(N)=4.07×10^{-5} *6*; α(O)=9.57×10^{-6} *13* α(P)=1.837×10^{-6} *26*; α(Q)=1.659×10^{-7} *23*
		959.28 *4*	100 *13*	53.230	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)=1.435×10^{-6} *20*; α(Q)=1.315×10^{-7} *18*
1039.51	(6^+)	683.0[a] *2*	100[a] *6*	356.54	6^+				
		865.2[a] *5*	34[a] *5*	174.119	4^+				
1052.198	(3^+)	374.67[fh] *2*		677.530	2^+				
		878.02 *10*	57 *7*	174.119	4^+				I_γ: Iγ=129 *48* from Coulomb Excitation may have a contribution from other γ-ray transition.

From ENSDF

$^{230}_{90}Th_{140}$-10

$\gamma(^{230}$Th) (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f	Mult.[‡]	δ[d]	α[e]	Comments
1052.198	(3^+)	999.4 *10*	100 *7*	53.230	2^+				
1065.36	(9^-)	213.2 *2*	50 *10*	852.21	(7^-)				Eγ from ^{230}Th(d,pnγ), Iγ from Coulomb Excitation.
		471.4 *2*	100 *10*	593.89	8^+				Eγ from ^{230}Th(d,pnγ), Iγ from Coulomb Excitation.
1079.214	$(2)^-$	253.55 *2*	1.4 *1*	825.660	3^+	E1		0.0544 *8*	α(K)=0.0433 *6*; α(L)=0.00834 *12*; α(M)=0.002002 *28*; α(N)=0.000530 *7* α(O)=0.0001228 *17*; α(P)=2.276×10^{-5} *32*; α(Q)=1.687×10^{-6} *24*
		297.86 *2*	6.0 *4*	781.374	2^+	E1		0.0378 *5*	α(K)=0.0303 *4*; α(L)=0.00569 *8*; α(M)=0.001363 *19*; α(N)=0.000361 *5*; α(O)=8.39×10^{-5} *12* α(P)=1.564×10^{-5} *22*; α(Q)=1.200×10^{-6} *17*
		401.62 *10*	1.2 *2*	677.530	2^+	E1		0.01977 *28*	α(K)=0.01596 *22*; α(L)=0.00289 *4*; α(M)=0.000689 *10*; α(N)=0.0001825 *26* α(O)=4.26×10^{-5} *6*; α(P)=8.03×10^{-6} *11*; α(Q)=6.52×10^{-7} *9*
		507.48[b]	15[b] *8*	571.758	3^-				
		571.08 *2*	76 *4*	508.143	1^-	M1+E2	0.11 *2*	0.1457 *21*	α(K)=0.1169 *17*; α(L)=0.02174 *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*
		1025.96 *2*	100 *5*	53.230	2^+	E1		0.00330 *5*	α(K)=0.00272 *4*; α(L)=0.000448 *6*; α(M)=0.0001056 *15*; α(N)=2.80×10^{-5} *4*; α(O)=6.60×10^{-6} *9* α(P)=1.272×10^{-6} *18*; α(Q)=1.173×10^{-7} *16*
1107.3	(4^+)	750.3 *5*	11 *3*	356.54	6^+				I_γ: From ^{230}Th(d,pnγ), scaled by the ratio of the 934 and 1055 intensities in Coulomb excitation.
		934.0[&]	59[&] *27*	174.119	4^+				
		1055.0[&]	100[&] *25*	53.230	2^+				
1108.9	(5^-)	537.0		571.758	3^-				E_γ: From Coulomb Excitation.
		935.0		174.119	4^+				E_γ: From Coulomb Excitation.
1117.4	(8^+)	524.1[a] *5*	20[a] *5*	593.89	8^+				α(K)exp=2.9 *12*.
		760.7[a] *3*	100[a] *10*	356.54	6^+				
1127.780	3^-	175.84 *5*	0.7[@] *2*	951.900	1^-				I_γ: From ^{230}Pa ε Decay.
		302.16 *4*	1.6 *2*	825.660	3^+	E1		0.0366 *5*	α(K)=0.0293 *4*; α(L)=0.00550 *8*; α(M)=0.001318 *18*; α(N)=0.000349 *5*; α(O)=8.11×10^{-5} *11* α(P)=1.514×10^{-5} *21*; α(Q)=1.164×10^{-6} *16*
		346.39 *3*	1.69 *15*	781.374	2^+	E1		0.0271 *4*	α(K)=0.02181 *31*; α(L)=0.00402 *6*; α(M)=0.000961 *13*; α(N)=0.000254 *4*; α(O)=5.93×10^{-5} *8* α(P)=1.111×10^{-5} *16*; α(Q)=8.78×10^{-7} *12*
		450.22[h] *2*	≈1.5	677.530	2^+				The 450-keV γ from $J^\pi=3^-$ of K=2 band to the $J^\pi=2^+$ state of the K=0 band is a K-forbidden [E1] transition.
		556.06 *2*	26.9 *15*	571.758	3^-	M1+E2		0.10 *6*	α(K)=0.07 *5*; α(L)=0.016 *8*; α(M)=0.0039 *17*; α(N)=0.0010 *5*; α(O)=2.4×10^{-4} *11* α(P)=4.7×10^{-5} *23*; α(Q)=3.9×10^{-6} *27*

$^{230}_{90}$Th$_{140}$-11

$\gamma(^{230}Th)$ (continued)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f	Mult.[‡]	α[e]	Comments
								M1 part of the 556.0γ from the 3^- state of the K=2 band to the 3^- state of the K=0 octupole band is K-forbidden.
1127.780	3^-	619.66 2	24 2	508.143	1^-	E2	0.0263 4	α(K)=0.01805 25; α(L)=0.00611 9; α(M)=0.001559 22; α(N)=0.000417 6; α(O)=9.60×10^{-5} 13 α(P)=1.744×10^{-5} 24; α(Q)=9.59×10^{-7} 13
		953.66	23 5	174.119	4^+			
		1074.52 2	100 5	53.230	2^+	E1	0.00305 4	α(K)=0.002506 35; α(L)=0.000412 6; α(M)=9.71×10^{-5} 14; α(N)=2.58×10^{-5} 4; α(O)=6.08×10^{-6} 9 α(P)=1.171×10^{-6} 16; α(Q)=1.084×10^{-7} 15
1134.3	(7^+)	540.3[a] 3	34[a] 4	593.89	8^+			
		777.8[a] 3	100[a] 7	356.54	6^+			
1176.0	(5^+)	819.5[a] 3	65[a] 6	356.54	6^+			
		1001.9[a] 4	100[a] 7	174.119	4^+			
1196.8	(4^-)	1022.7	100	174.119	4^+			E_{γ}: From Coulomb Excitation.
1206.7	(12^+)	327.9 5	100	879.36	(10^+)			
1243.1	(8^+)	365.3[ah]	≤20[a]	879.36	(10^+)			
		649.4[a] 3	100[a] 10	593.89	8^+			
		886.1[a] 4	35[a] 7	356.54	6^+			
1251.3	(8^+)	657.3[&]	100[&] 38	593.89	8^+			
		894.8[&]	62[&] 44	356.54	6^+			
1255.4	(6^+)	661.4[ah]	≤12[a]	593.89	8^+			
		898.9[a] 3	100[a] 8	356.54	6^+			
		1081.4[ah]	≤30[a]	174.119	4^+			
1297.14	0^+	789.0[b] 1	15.2[b] 8	508.143	1^-			
		1243.9[b] 1	100[b] 3	53.230	2^+			
1322.1	(11^-)	256.6[c] 5		1065.36	(9^-)			
		442.2[c] 5		879.36	(10^+)			
1349.1	(7^+)	755.6[a] 5	86[a] 11	593.89	8^+			
		992.2[a] 5	100[a] 12	356.54	6^+			
1358.5	(9^+)	479.7[a] 6	39[a] 8	879.36	(10^+)			
		764.5[a] 3	100[a] 12	593.89	8^+			
1375.28	$(1,2^+)$	423.2[b] 1	7.4[b] 14	951.900	1^-			
		867.1[b] 3	38.5[b] 21	508.143	1^-			
		1322.1[b] 1	58[b] 4	53.230	2^+			
		1375.4[b] 1	100[b] 4	0.0	0^+			
1400.89	(2^+)	448.9[b] 1	7.9[b] 16	951.900	1^-			

$^{230}_{90}Th_{140}$-12

Adopted Levels, Gammas (continued)

$\gamma(^{230}Th)$ (continued)

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f
1400.89	(2^+)	892.7[b] *1*	43.9[b] *21*	508.143	1^-
		1226.7[b] *1*	61[b] *4*	174.119	4^+
		1347.7[b] *1*	100[b] *3*	53.230	2^+
		1401.0[b] *1*	20.9[b] *21*	0.0	0^+
1448.5	(8^+)	569.0[ah]	≤25[a]	879.36	(10^+)
		854.6[a] *4*	100[a] *14*	593.89	8^+
		1092.1[ah]	≤25[a]	356.54	6^+
1485.63	(4^+)	913.7[b] *2*	50[b] *13*	571.758	3^-
		977.6[b] *2*	29[b] *13*	508.143	1^-
		1432.4[b] *1*	100[b] *9*	53.230	2^+
1520.0	(10^+)	313.0[&h]	44[&] *15*	1206.7	(12^+)
		640.7[&]	33[&] *19*	879.36	(10^+)
		926.3[&]	100[&] *41*	593.89	8^+
1571.9	(14^+)	365.3[c] *5*	100	1206.7	(12^+)
1573.51	$1^{(-)},2^+$	1573.5[b] *2*	100[b]	0.0	0^+
1589.8	0^+	1536.6[b] *3*	100[b]	53.230	2^+
1616.1	(13^-)	293.4[c] *5*		1322.1	(11^-)
		409.8[c] *5*		1206.7	(12^+)
1638.45	(0^+)	628.8[b] *1*	100[b] *11*	1009.603	2^+
		1585.4[b] *2*	72[b] *7*	53.230	2^+
1695.71	$1^{(-)},2^+$	1187.5[b] *3*	45[b] *11*	508.143	1^-
		1642.5[b] *2*	38[b] *7*	53.230	2^+
		1695.7[b] *1*	100[b] *11*	0.0	0^+
1744.87	(0^+)	735.1[b] *2*	16[b] *4*	1009.603	2^+
		1691.7[b] *1*	100[b] *6*	53.230	2^+
1770.73	$(1,2^+)$	1717.5[b] *1*	100[b] *6*	53.230	2^+
		1770.5[b] *10*	15[b] *4*	0.0	0^+
1775.22	$(1,2^+)$	1267.1[b] *2*	37[b] *4*	508.143	1^-
		1721.9[b] *1*	59[b] *3*	53.230	2^+
		1775.3[b] *1*	100[b] *4*	0.0	0^+
1789.4	$1^{(-)},2^+$	1789.4[b] *5*	100[b]	0.0	0^+
1810.73	$(1,2^+)$	1302.6[b] *1*	62[b] *3*	508.143	1^-

E_i(level)	J^π_i	E_γ[†]	I_γ[†]	E_f	J^π_f
1810.73	$(1,2^+)$	1757.5[b] *1*	100[b] *3*	53.230	2^+
		1810.7[b] *1*	19.8[b] *19*	0.0	0^+
1839.61	$1^{(-)},2^+$	1839.6[b] *2*	100[b]	0.0	0^+
1849.55	(2^+)	363.9[b] *3*	23[b] *9*	1485.63	(4^+)
		839.9[b] *1*	100[b] *9*	1009.603	2^+
		878.0[b] *2*	45[b] *5*	971.732	2^-
		1675.4[b] *3*	45[b] *10*	174.119	4^+
1858.2	(3^-)	1805.0[b] *5*	100[b]	53.230	2^+
1902.70	$(1,2^+)$	1394.5[b] *2*	22[b] *6*	508.143	1^-
		1902.7[b] *1*	100[b] *4*	0.0	0^+
1947.2	(15^-)	331.0[c] *5*		1616.1	(13^-)
		375.5[c] *5*		1571.9	(14^+)
1949.87	$(1,2^+)$	1896.7[b] *1*	42[b] *2*	53.230	2^+
		1949.8[b] *1*	100[b] *2*	0.0	0^+
1967.01	$(1,2^+)$	1913.8[b] *1*	100[b] *5*	53.230	2^+
		1966.7[b] *3*	15[b] *3*	0.0	0^+
1969.6	(16^+)	397.7[c] *5*		1571.9	(14^+)
1973.50	$(1^+,2^+)$	1147.9[bh] *1*	92[b] *6*	825.660	3^+
		1920.2[b] *1*	100[b] *4*	53.230	2^+
		1973.5[b] *5*	10[b] *4*	0.0	0^+
2000.86	$(1,2^+)$	991.2[bh] *1*	27[b] *7*	1009.603	2^+
		2000.9[b] *1*	100[b] *10*	0.0	0^+
2010.13	$(1,2^+)$	1956.9[b] *1*	100[b] *6*	53.230	2^+
		2010.1[b] *2*	17[b] *4*	0.0	0^+
2024.67	$(1^+,2^+)$	1053.1[b] *2*	100[b] *23*	971.732	2^-
		1198.9[b] *2*	100[b] *23*	825.660	3^+
		1971.3[b] *5*	28[b] *12*	53.230	2^+
		2024.6[b] *3*	33[b] *12*	0.0	0^+
2078.25?		999.1[b] *1*	100[b] *19*	1079.214	$(2)^-$
		1068.1[b] *3*	30[b] *12*	1009.603	2^+
		1252.5 *3*	30 *8*	825.660	3^+
2122.77	$(1,2^+)$	1043.2[b] *3*	14[b] *5*	1079.214	$(2)^-$

$^{230}_{90}Th_{140}$-13

$\gamma(^{230}Th)$ (continued)

E_i(level)	J^{π}_i	E_{γ}[†]	I_{γ}[†]	E_f	J^{π}_f
2122.77	$(1,2^{+})$	2069.5[b] *2*	51[b] *5*	53.230	2^{+}
		2122.8[b] *1*	100[b] *5*	0.0	0^{+}
2133.16?		388.3[b] *1*	67[b] *6*	1744.87	(0^{+})
		1455.5[b] *2*	100[b] *28*	677.530	2^{+}
		1625.1[bh] *3*	≤78[b]	508.143	1^{-}
2151.82	$(1,2^{+})$	750.7[b] *3*	28[b] *5*	1400.89	(2^{+})
		2098.6[b] *1*	100[b] *5*	53.230	2^{+}
		2152.0 *10*	6.3 *16*	0.0	0^{+}
2282.99	$1,2^{+}$	1311.5[b] *2*	100[b] *23*	971.732	2^{-}
		2229.5[b] *5*	61[b] *12*	53.230	2^{+}
		2282.5[b] *3*	78[b] *6*	0.0	0^{+}
2298.6	$(1,2^{+})$	2245.4[b] *10*	57[b] *29*	53.230	2^{+}
		2298.6[b] *3*	100[b] *15*	0.0	0^{+}
2310.6	(17^{-})	341[c] *1*		1969.6	(16^{+})
2310.6	(17^{-})	363.4[c] *5*		1947.2	(15^{-})
2314.28?	$(1,2^{+})$	503.5[b] *2*	[b]	1810.73	$(1,2^{+})$
		1636.8[b] *2*	100[b] *22*	677.530	2^{+}
		2314.0[b] *10*	26[b] *6*	0.0	0^{+}
2368.91	(0^{+})	968.0[b] *2*	100[b] *42*	1400.89	(2^{+})
		1797.2[b] *3*	83[b] *17*	571.758	3^{-}
2396.4	(18^{+})	426.8[c] *5*		1969.6	(16^{+})
2703.8	(19^{-})	393.2[c] *5*		2310.6	(17^{-})
2848.7	(20^{+})	452.3[c] *5*		2396.4	(18^{+})
3125.4	(21^{-})	421.6[ch] *5*		2703.8	(19^{-})
3324.1	(22^{+})	475.4[c] *5*		2848.7	(20^{+})
3572.3?	(23^{-})	446.9[ch] *5*		3125.4	(21^{-})
3819.1?	(24^{+})	495[ch] *1*		3324.1	(22^{+})

† From ^{230}Pa ε decay, unless otherwise specified.
‡ From ce measurements in ^{230}Pa ε decay. Multipolarities in square brackets are from level scheme; they are included for transition-rate calculations when needed.
# Doublet. Individual intensities were determined from coincidence data in ^{230}Pa ε decay.
@ Weak γ ray; seen only in $\gamma\gamma$- coincidence spectra in ^{230}Pa ε decay.
& From Coulomb Excitation.
a From $^{230}Th(d,pn\gamma)$.
b From ^{230}Ac β^{-} decay.
c From $^{232}Th(^{136}Xe,X\gamma)$.
d From ^{230}Ac β^{-} decay.
e Additional information 2.
f Multiply placed.
g Multiply placed with intensity suitably divided.
h Placement of transition in the level scheme is uncertain.

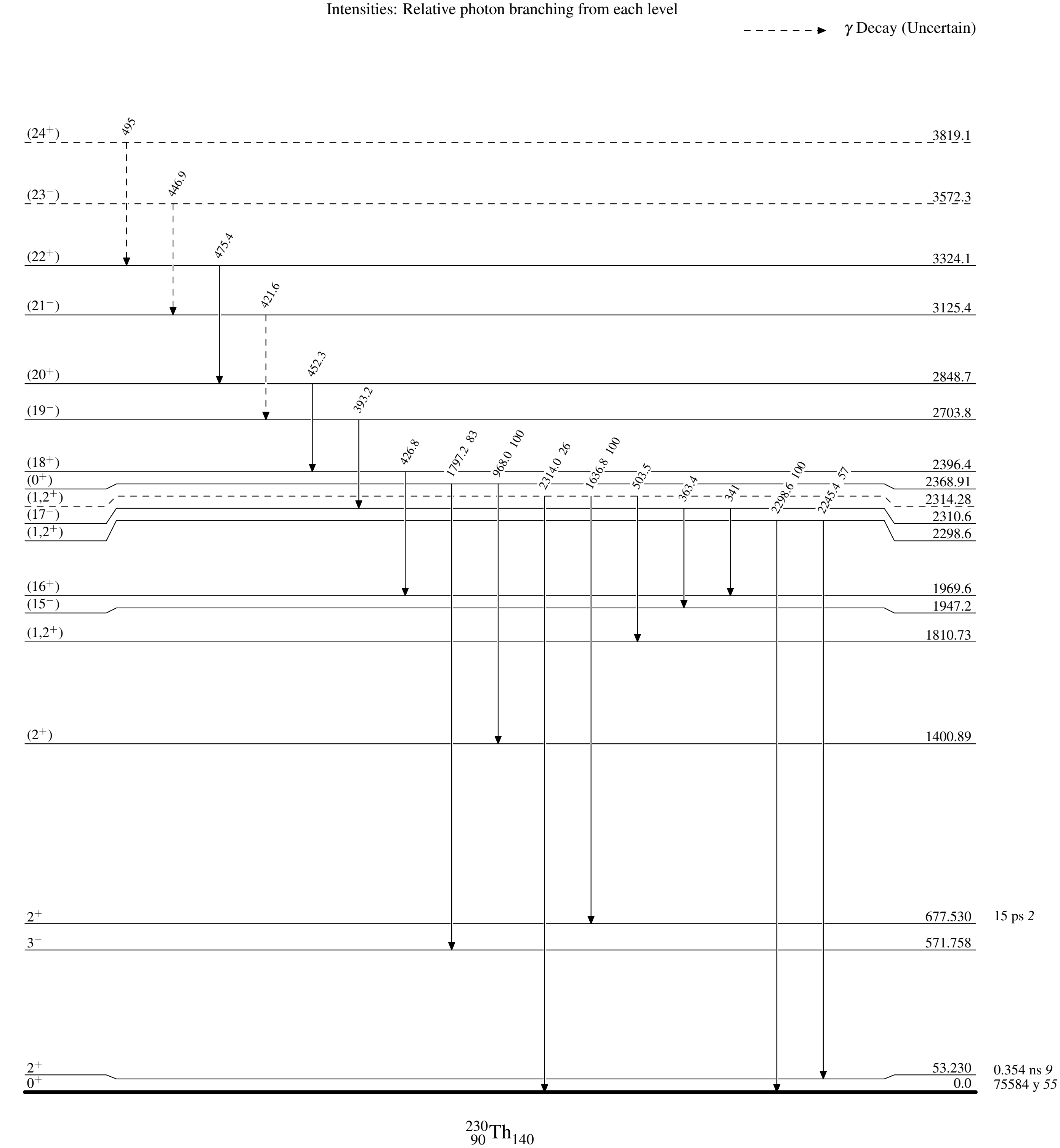
$^{230}_{90}Th_{140}$-14

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

Legend



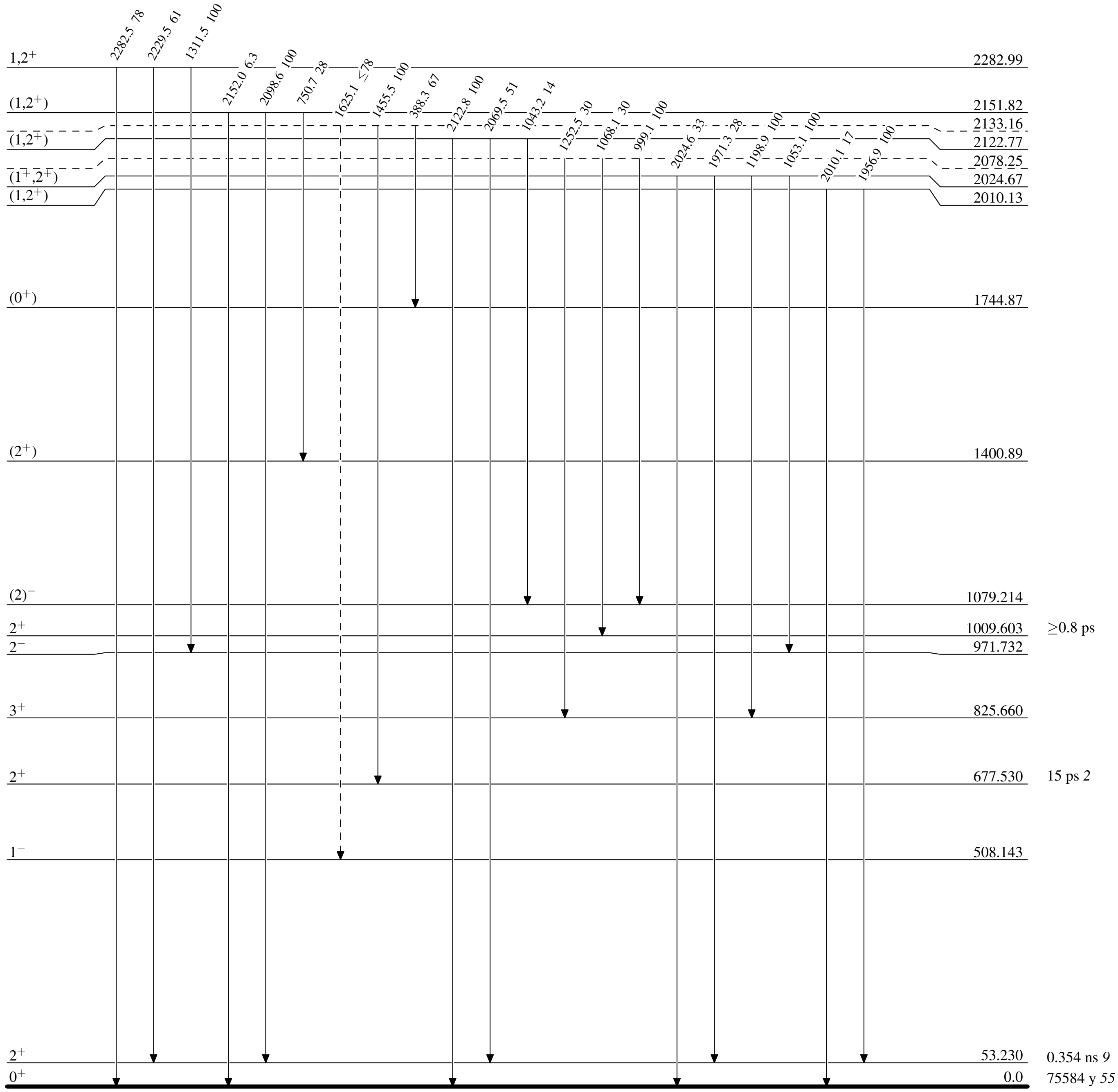
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)

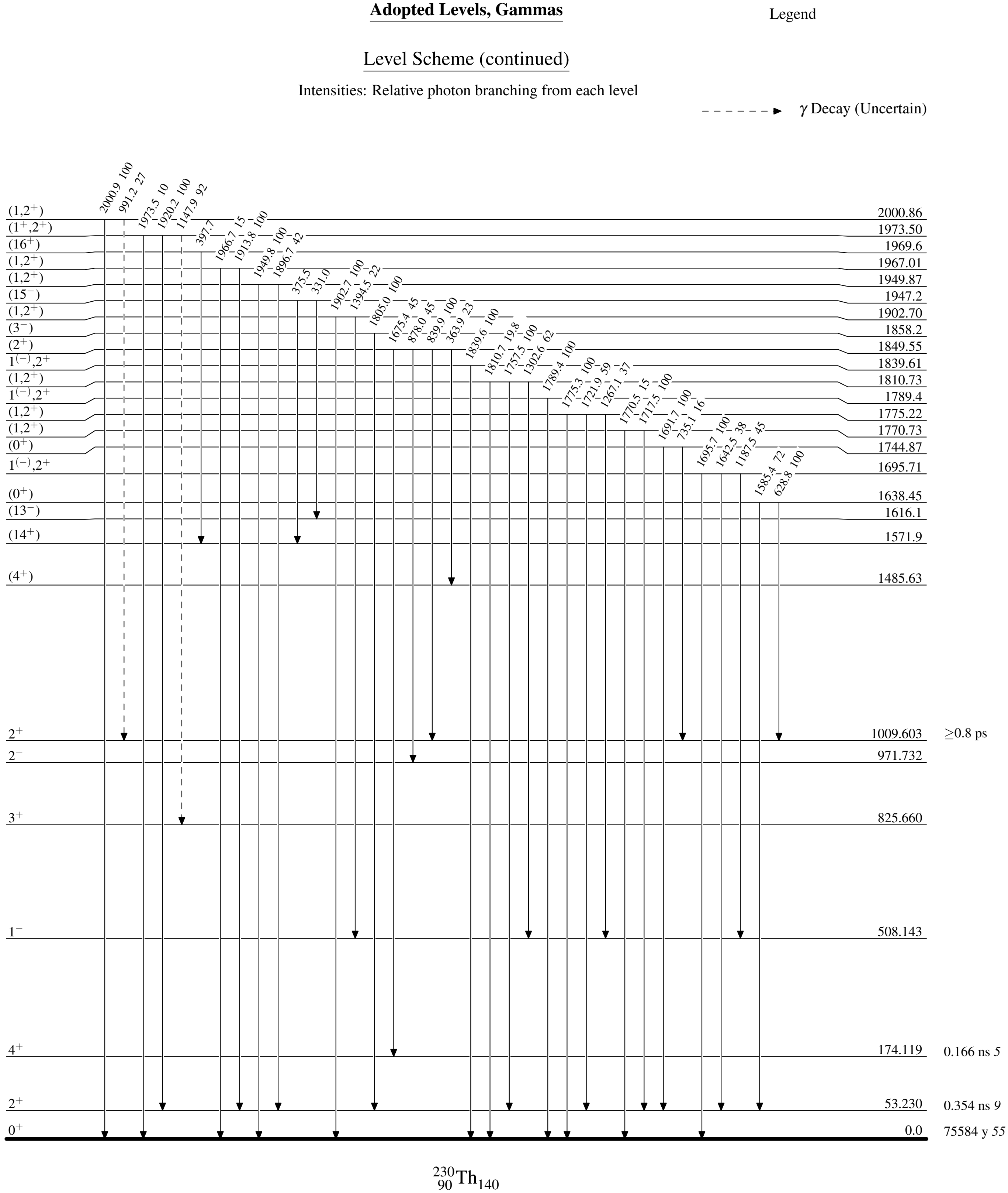


$^{230}_{90}Th_{140}$

Adopted Levels, Gammas

Level Scheme (continued)

Intensities: Relative photon branching from each level



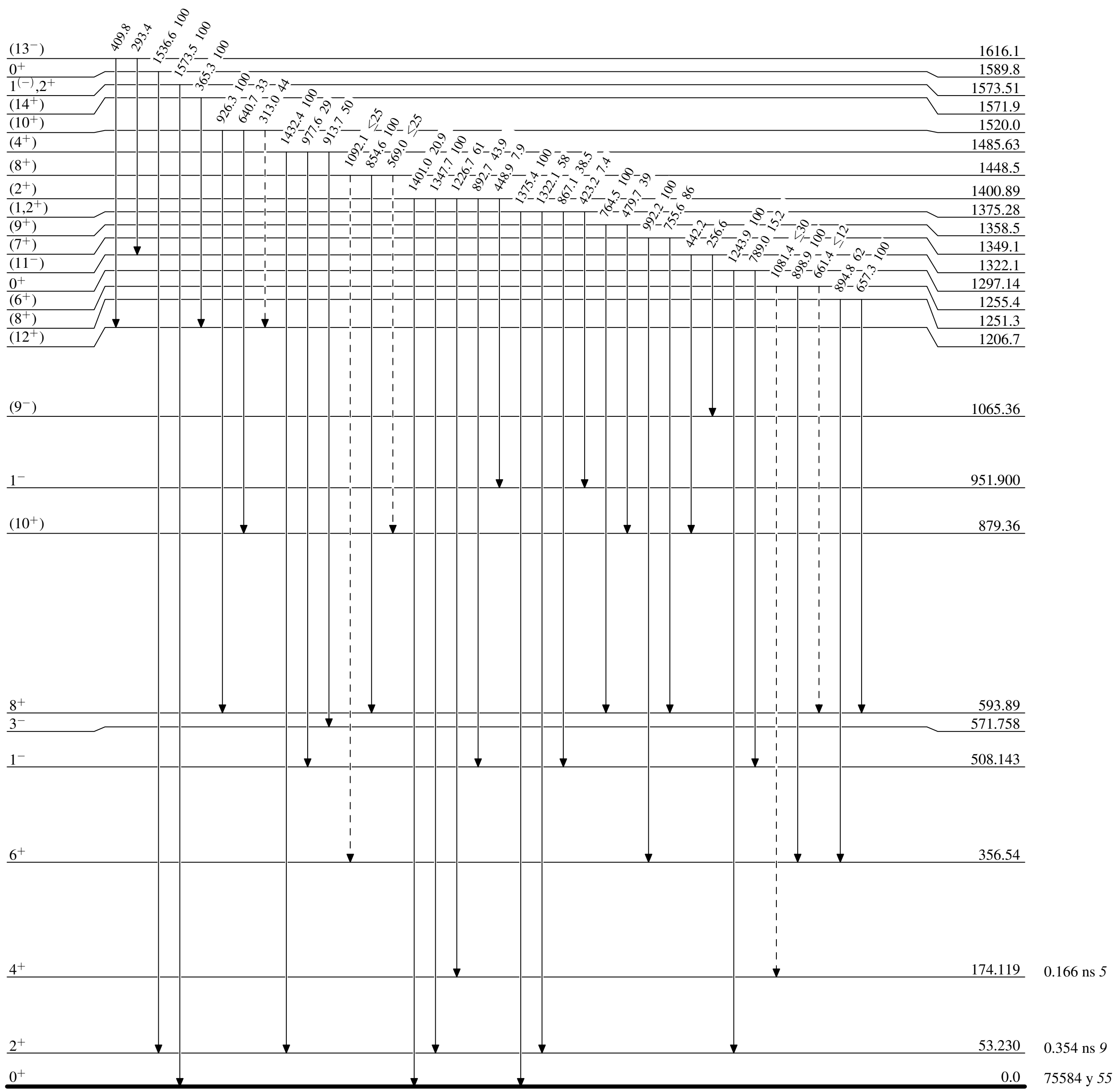
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



$^{230}_{90}Th_{140}$

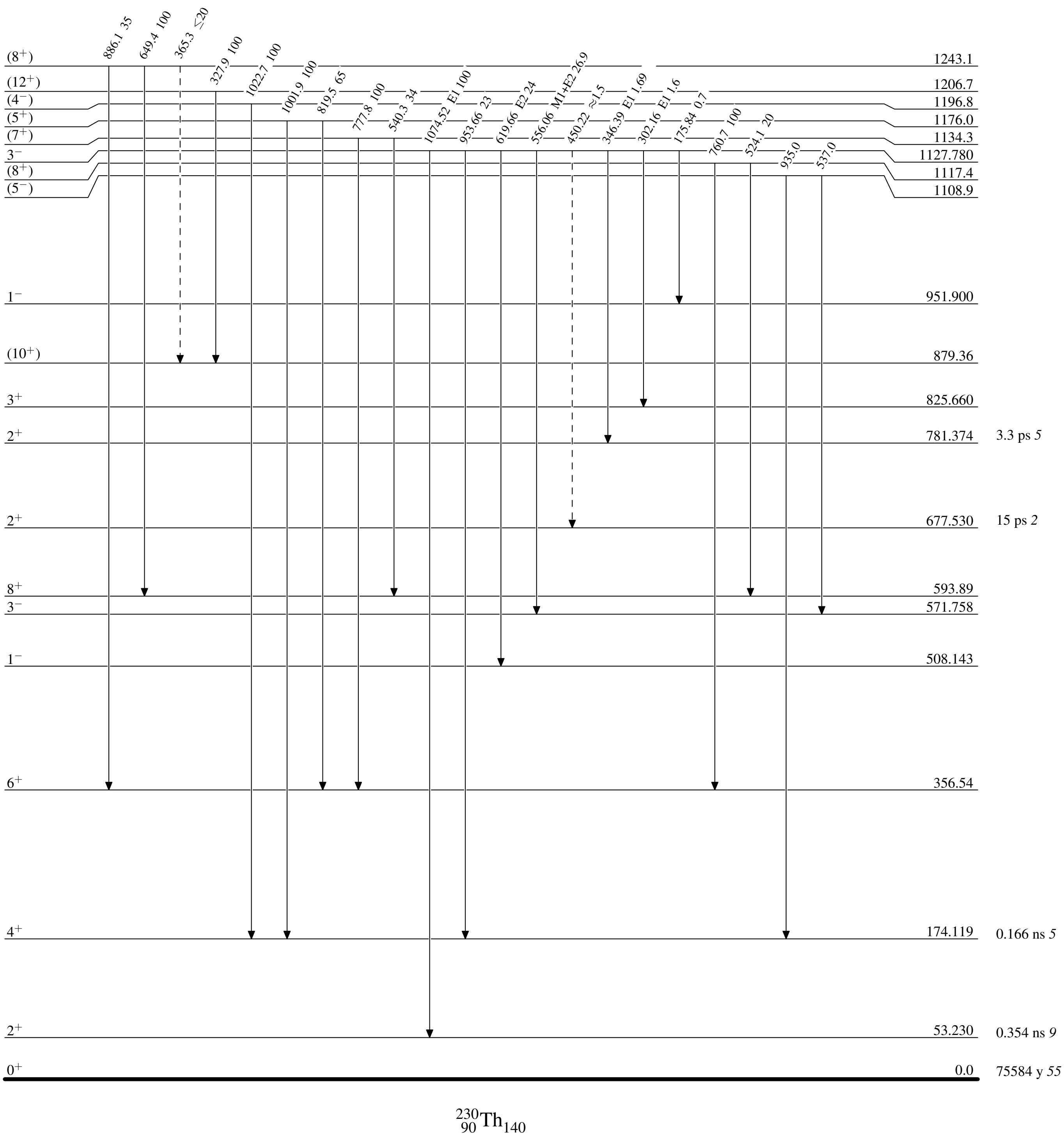
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level

γ Decay (Uncertain)



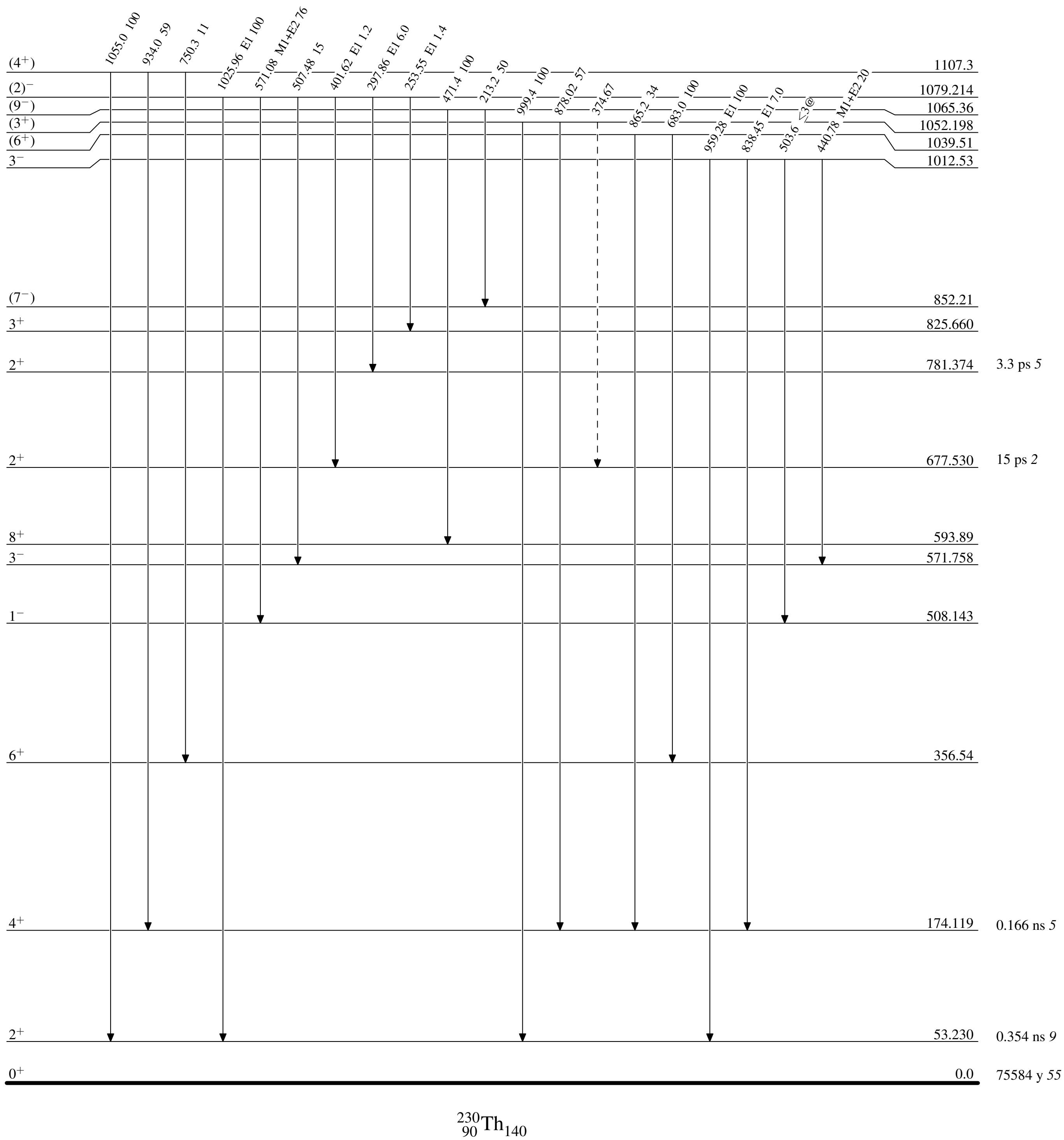
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

γ Decay (Uncertain)



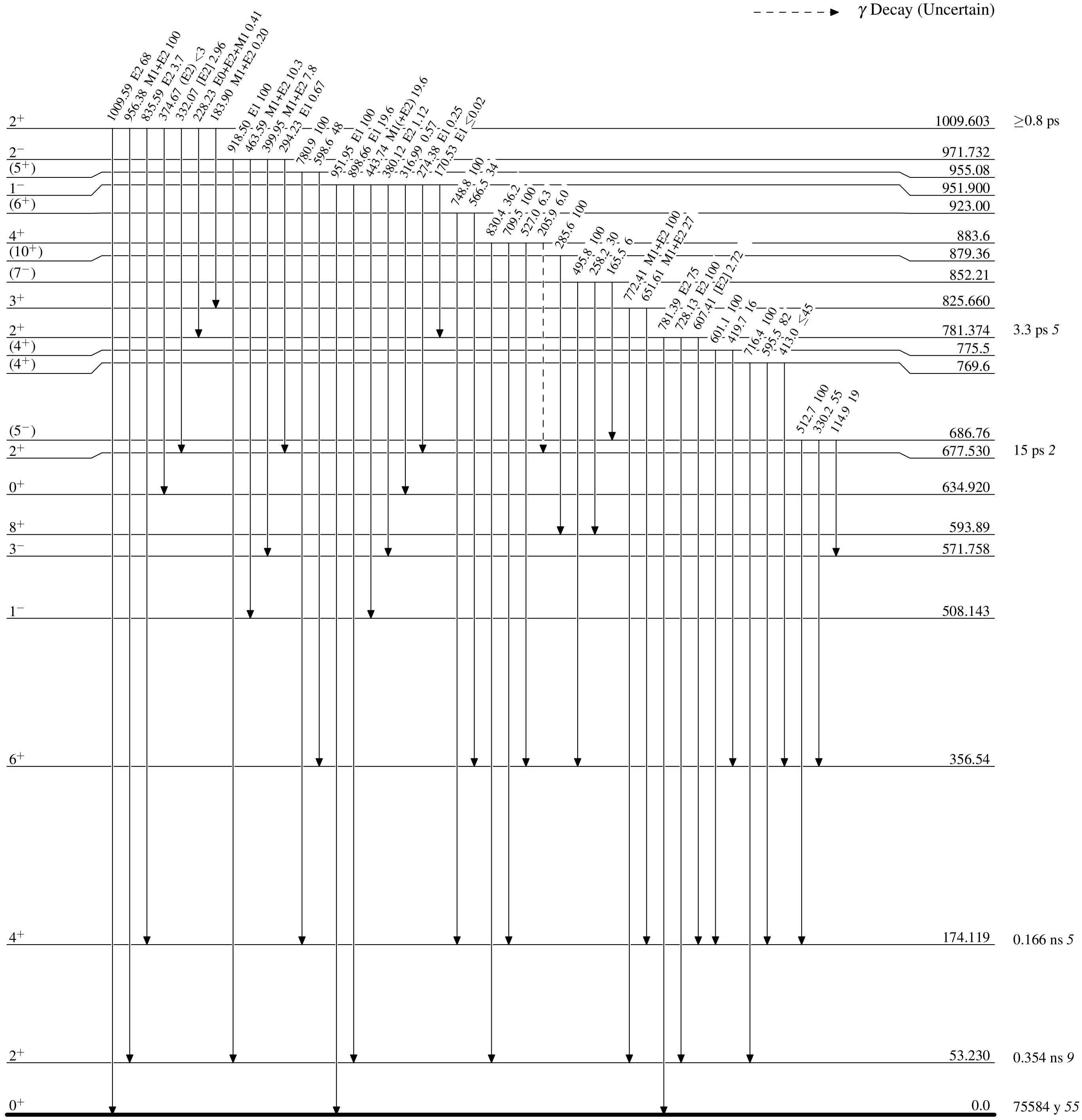
Adopted Levels, Gammas

Legend

Level Scheme (continued)

Intensities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided

γ Decay (Uncertain)

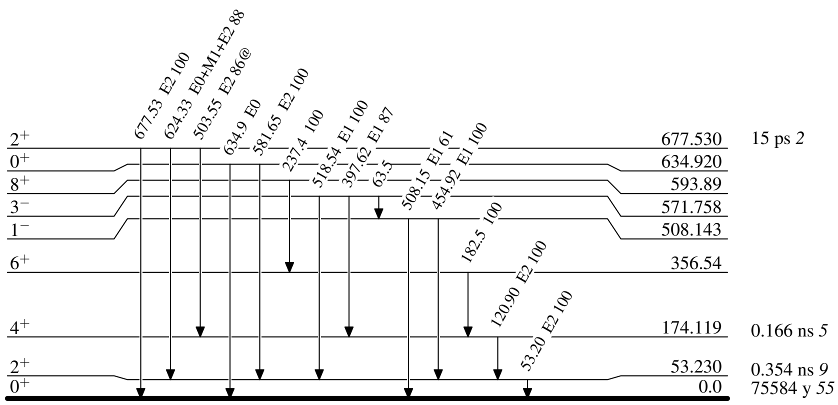


$^{230}_{90}Th_{140}$

Adopted Levels, Gammas

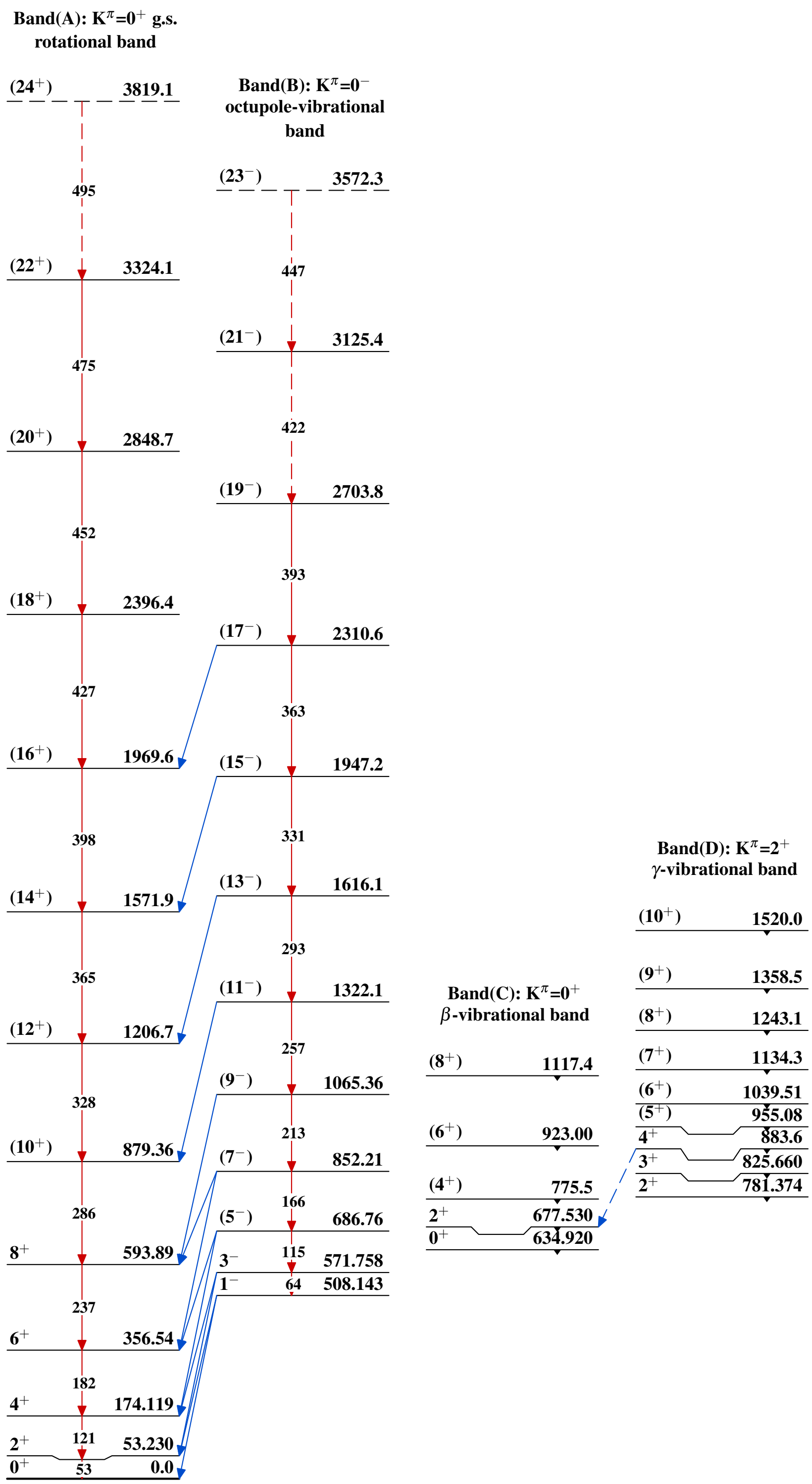
Level Scheme (continued)

Intentities: Relative photon branching from each level
@ Multiply placed: intensity suitably divided



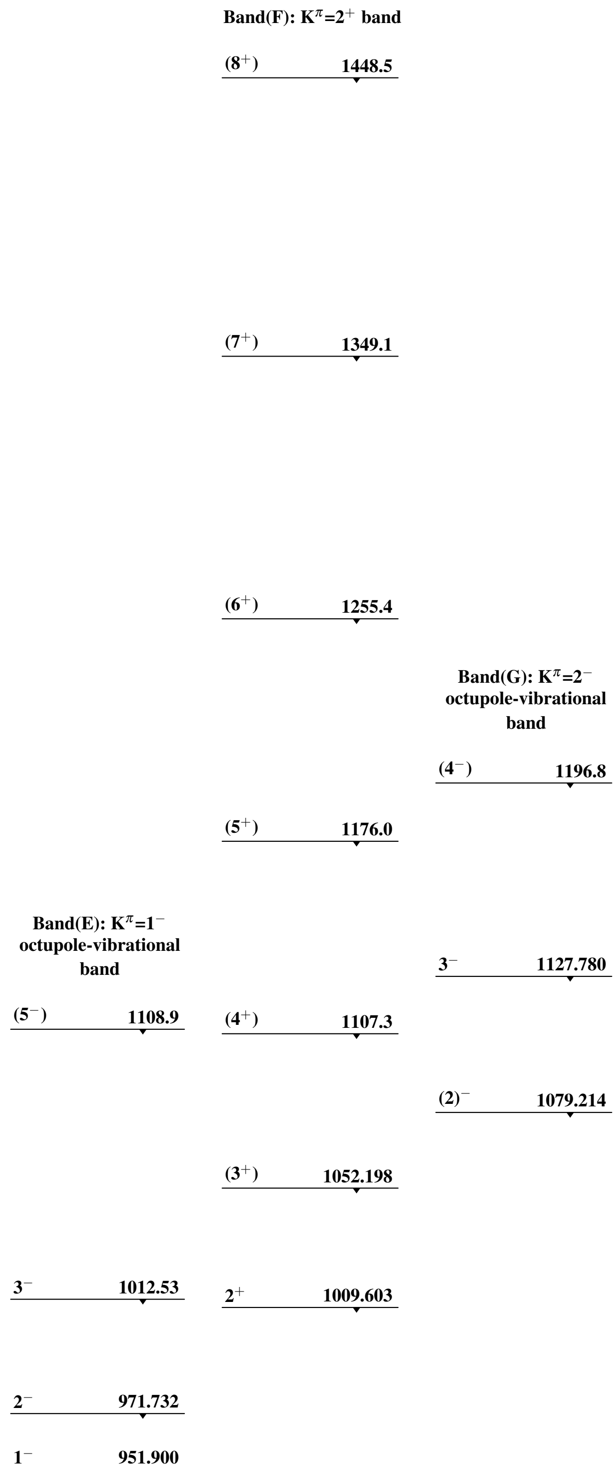
$^{230}_{90}Th_{140}$

Adopted Levels, Gammas



$^{230}_{90}Th_{140}$

Adopted Levels, Gammas (continued)



$^{230}_{90}Th_{140}$