^{226}Ra(α,2nγ) 1998We01,1993Ac02,1986Sc18

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Khalifeh Abusaleem	NDS 116, 163 (2014)	31-Dec-2012

1998We01: Eα=28 MeV. Measured Eγ, Iγ, $\gamma\gamma$, ce-γ. Deduced: level energy, J^π, and band structure. Three Compton-suppressed Ge detectors and iron-free orange spectrometer.

1993Ac02: Eα=28 MeV; measured Eγ, Iγ in coin with ce(L2)(129.1γ).

1986Sc18: Eα=33, 42, 55 MeV; measured ce, (ce)(ce), (ce)γ.

The level scheme is that proposed by 1986Sc18 and 1993Ac02, confirming levels known from ^{228}Ac β^- decay, ^{228}Pa ε decay and ^{230}Th(α,α'2nγ), and adding the levels with J>14. The 1^- and -3 levels of the $K^\pi=0^-$ band are not seen in this experiment.

^{228}Th Levels

E(level)‡	Jπ	E(level)‡	Jπ	E(level)‡	Jπ	E(level)‡	Jπ
0.0#	0^+	831.80@ 15	0^+	1174.57& 10	5^+	1599.5†# 6	14^+
57.78# 3	2^+	874.47@ 8	2^+	1189.8a 4	11^-	1627.9& 4	9^+
186.91# 4	4^+	911.9# 4	10^+	1239.4# 5	12^+	1733.2@ 4	12^+
328.02a 8	1^-	920.9a 3	9^-	1270.12& 23	6^+	1762.7& 5	10^+
378.32# 12	6^+	968.44@ 8	4^+	1280.5@ 3	8^+	1838.4†a 5	15^-
396.04a 8	3^-	968.983& 20	2^+	1379.6& 3	7^+	1988.1†# 7	16^+
519.20a 8	5^-	1022.57& 4	3^+	1490.3@ 3	10^+	2209.8†a 6	17^-
622.6# 3	8^+	1091.10& 5	4^+	1497.2a 4	13^-	2407.9†# 7	18^+
695.58a 23	7^-	1105.45@ 17	6^+	1497.4& 4	8^+		

† From 1993Ac02.
‡ From least squares fit to Eγ, unless otherwise noted.
# Band(A): $K^\pi=0^+$, g.s. band.
@ Band(B): $K^\pi=0^+$, β vibrational band.
& Band(C): $K^\pi=2^+$, γ vibrational band.
a Band(D): $K^\pi=0^-$, octupole band.

γ(^{228}Th)

E_i(level)	J_i^π	E_γ†	E_f	J_f^π
57.78	2^+	57.8	0.0	0^+
186.91	4^+	129.1	57.78	2^+
328.02	1^-	270.2	57.78	2^+
		328.0	0.0	0^+
378.32	6^+	191.3	186.91	4^+
396.04	3^-	209.2	186.91	4^+
		338.3	57.78	2^+
519.20	5^-	141.0	378.32	6^+
		332.4	186.91	4^+
622.6	8^+	244.4	378.32	6^+
695.58	7^-	317.4	378.32	6^+
831.80	0^+	503.7 2	328.02	1^-
		774.1 2	57.78	2^+
874.47	2^+	478.45 4	396.04	3^-
		546.45 2	328.02	1^-
		687.8 2	186.91	4^+
		816.5 1	57.78	2^+

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^{226}Ra(α,2nγ) 1998We01,1993Ac02,1986Sc18 (continued)

$\gamma(^{228}Th)$ (continued)

E_i(level)	J_i^π	E_γ †	I_γ †	E_f	J_f^π	Mult.	Comments
874.47	2^+	874.5 *2*		0.0	0^+		
911.9	10^+	289.4		622.6	8^+		
920.9	9^-	225.1‡ *3*	24.6‡ *15*	695.58	7^-	[E2]	
		298.3‡ *3*	100‡ *7*	622.6	8^+	[E1]	
968.44	4^+	449.23 *3*		519.20	5^-		
		572.3 *1*		396.04	3^-		
		590.1 *3*		378.32	6^+		
		781.9 *2*		186.91	4^+		
		910.7 *1*		57.78	2^+		
968.983	2^+	782.1 *1*		186.91	4^+		
		911.20 *2*		57.78	2^+		
		968.98 *2*		0.0	0^+		
1022.57	3^+	835.65 *2*		186.91	4^+		
		964.80 *2*		57.78	2^+		
1091.10	4^+	713.1 *3*		378.32	6^+		
		904.19 *3*		186.91	4^+		
		1033.25 *9*		57.78	2^+		
1105.45	6^+	409.9 *2*		695.58	7^-		
		586.4 *2*		519.20	5^-		
		918.1 *3*		186.91	4^+		
1174.57	5^+	796.2 *1*	48 *10*	378.32	6^+		
		987.7 *1*	100 *12*	186.91	4^+		
1189.8	11^-	268.9‡ *3*	67‡ *5*	920.9	9^-	[E2]	
		278.0‡ *3*	100‡ *7*	911.9	10^+	[E1]	
1239.4	12^+	327.5		911.9	10^+		
1270.12	6^+	891.8 *2*	100 *8*	378.32	6^+		
		1083.2		186.91	4^+		I_γ: weak γ ray.
1280.5	8^+	359.6 *2*	30 *10*	920.9	9^-		
		585.0 *2*	100 *30*	695.58	7^-		
		902.3		378.32	6^+		I_γ: γ-ray peak is masked.
1379.6	7^+	756.9 *3*	50 *19*	622.6	8^+		
		1001.3 *3*	100 *13*	378.32	6^+		
1490.3	10^+	300.6 *3*	33 *13*	1189.8	11^-		
		569.5 *2*	100 *13*	920.9	9^-		
		867.1 *5*	14 *4*	622.6	8^+		
1497.2	13^-	257.7‡ *3*	52‡ *8*	1239.4	12^+	[E1]	
		307.3‡ *3*	100‡	1189.8	11^-	[E2]	
1497.4	8^+	874.7 *3*	100 *15*	622.6	8^+		
		1119.1		378.32	6^+		I_γ: weak γ.
1599.5	14^+	360.1 *3*		1239.4	12^+		
1627.9	9^+	715.9 *3*	38 *8*	911.9	10^+		
		1005.4 *3*	100 *15*	622.6	8^+		
1733.2	12^+	236.0 *3*	25 *8*	1497.2	13^-		
		543.3 *2*	100 *17*	1189.8	11^-		
		821.6 *4*	15 *11*	911.9	10^+		
1762.7	10^+	850.8 *3*	100 *50*	911.9	10^+		
		1140.2		622.6	8^+		I_γ: weak γ ray.
1838.4	15^-	341.2 *3*		1497.2	13^-		
1988.1	16^+	388.6 *3*		1599.5	14^+		
2209.8	17^-	371.4 *3*		1838.4	15^-		
2407.9	18^+	419.8 *3*		1988.1	16^+		

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$\gamma(^{228}Th)$ (continued)

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‡ From 1993Ac02.

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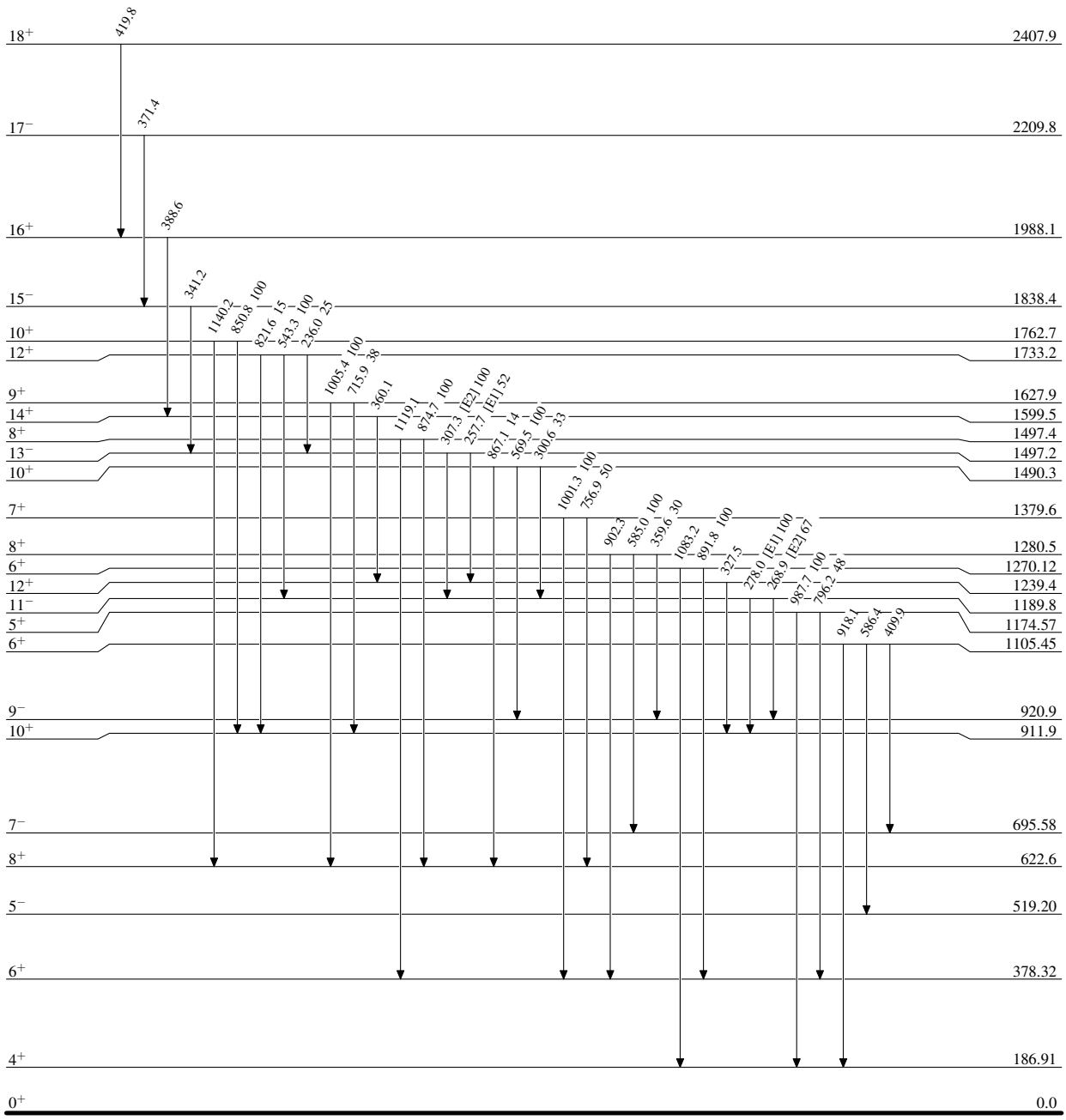
Level Scheme

Intensities: Relative photon branching from each level

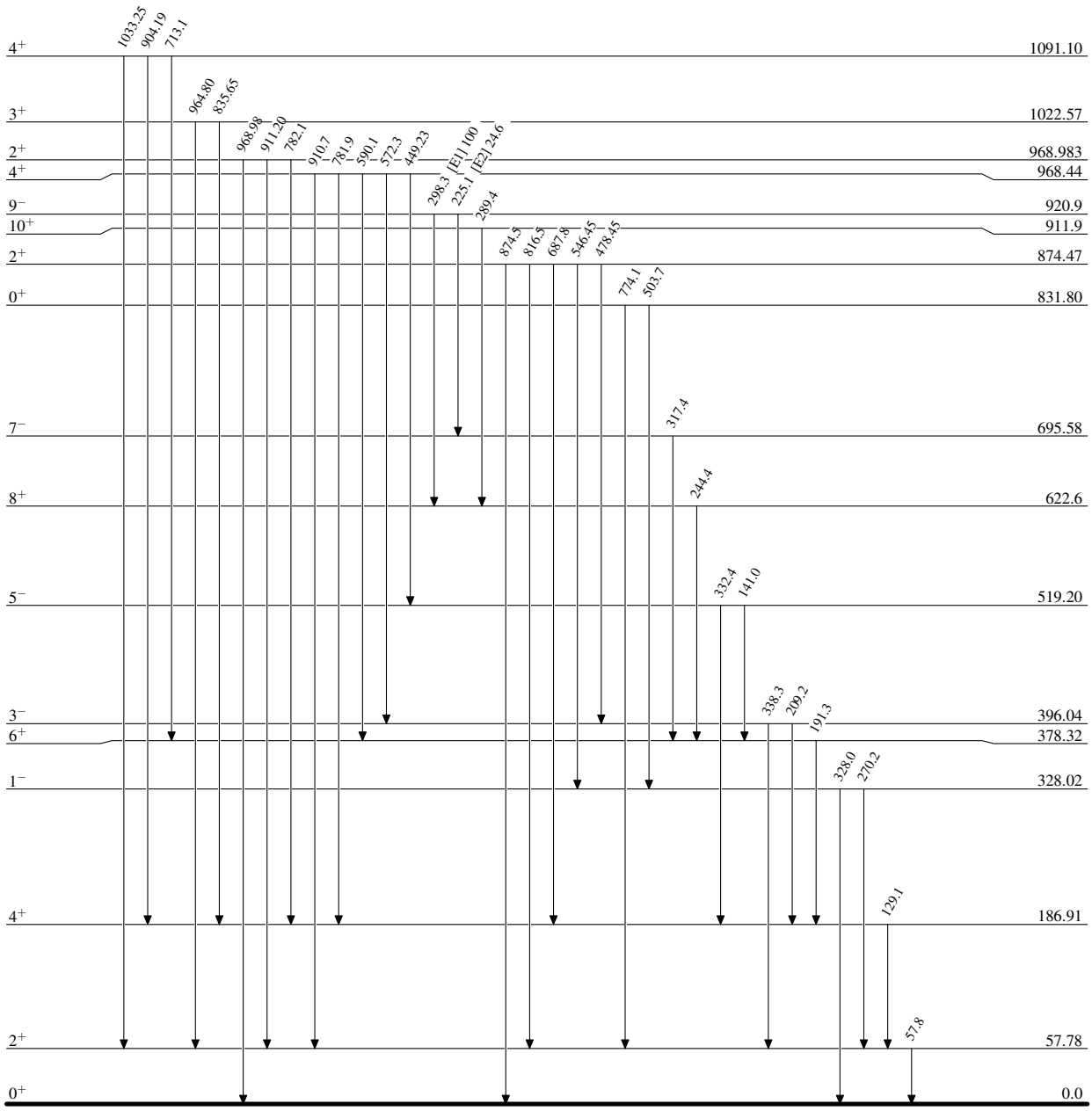


$^{228}_{90}Th_{138}$

^{226}Ra(α,2nγ) 1998We01,1993Ac02,1986Sc18

Level Scheme (continued)

Intensities: Relative photon branching from each level



$^{228}_{90}Th_{138}$

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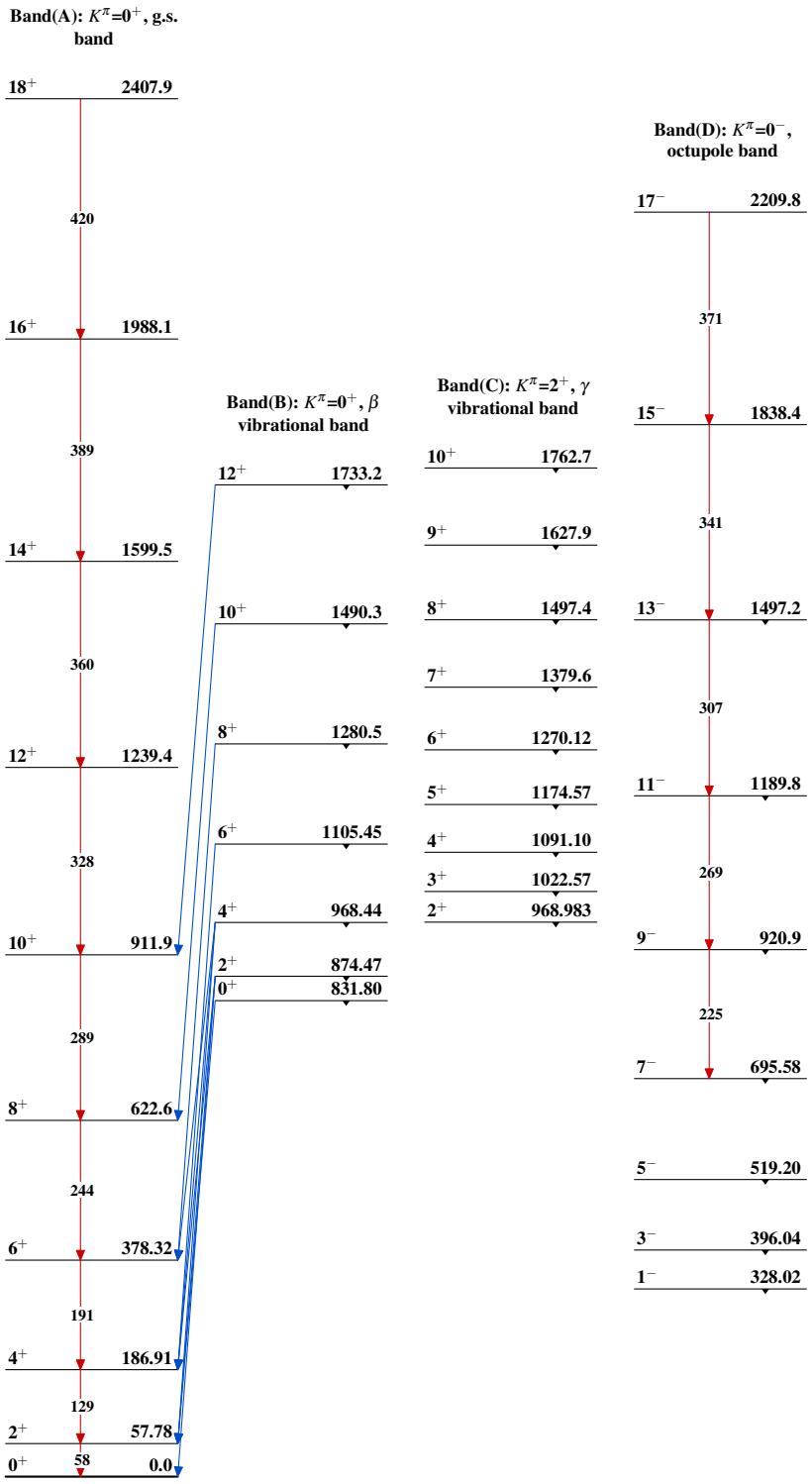

$^{228}_{90}Th_{138}$