²²⁶Ra(α ,2n γ) 1998We01,1993Ac02,1986Sc18

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

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

1993Ac02: $E\alpha=28$ MeV; measured $E\gamma$, $I\gamma$ in coin with ce(L2)(129.1 γ).

1986Sc18: $E\alpha$ =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($\alpha, \alpha' 2n\gamma$), 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) [‡]	\mathbf{J}^{π}	E(level) [‡]	J^{π}	E(level) [‡]	J^{π}	E(level) [‡]	J^{π}
0.0 [#]	0^{+}	831.80 [@] 15	0^{+}	1174.57 ^{&} 10	5+	1599.5 ^{†#} 6	14+
57.78 [#] 3	2+	874.47 [@] 8	2+	1189.8 ^a 4	11-	1627.9 ^{&} 4	9+
186.91 [#] 4	4+	911.9 [#] 4	10^{+}	1239.4 [#] 5	12^{+}	1733.2 [@] 4	12^{+}
328.02 ^{<i>a</i>} 8	1-	920.9 ^a 3	9-	1270.12 ^{&} 23	6+	1762.7 <mark>&</mark> 5	10^{+}
378.32 [#] 12	6+	968.44 [@] 8	4+	1280.5 [@] 3	8+	1838.4 ^{†a} 5	15-
396.04 ^a 8	3-	968.983 ^{&} 20	2^{+}	1379.6 ^{&} 3	7+	1988.1 ^{†#} 7	16+
519.20 ^a 8	5-	1022.57 ^{&} 4	3+	1490.3 [@] 3	10^{+}	2209.8 ^{†a} 6	17^{-}
622.6 [#] 3	8+	1091.10 ^{&} 5	4+	1497.2 ^{<i>a</i>} 4	13-	2407.9 ^{†#} 7	18^{+}
695.58 ^a 23	7-	1105.45 [@] 17	6+	1497.4 ^{&} 4	8+		

[†] From 1993Ac02.

[‡] From least squares fit to $E\gamma$, unless otherwise noted.

[#] Band(A): $K^{\pi} = 0^+$, g.s. band.

^(a) Band(B): $K^{\pi}=0^+$, β vibrational band.

[&] Band(C): $K^{\pi}=2^+$, γ vibrational band. ^{*a*} Band(D): $K^{\pi}=0^-$, octupole band.

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

E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	E_f	\mathbf{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 <i>4</i>	396.04	3-
		546.45 2	328.02	1-
		687.8 2	186.91	4+
		816.5 1	57.78	2^{+}

χ^{228} Th) continued) Fr(level) $\frac{1}{7}$ $\frac{1}{$		²²⁶ Ra(α ,2n γ) 1998We01,1993Ac02,1986Sc18 (continued)							
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	γ ⁽²²⁸ Th) (continued)								
874.47 2° 874.5 2 0.0 0° 911.9 10° 289.4 622.6 8° 920.9 2° 28.5 $\frac{1}{7}$ 24.6 $\frac{3}{7}$ 695.58 7° 968.44 4° 449.23 396.04 3° 590.13 378.32 6° 968.93 2° 78.19 2 186.91 4° 90.07 577.82 1° 968.98 2° 78.19 2 186.91 4° 90.07 577.82 1° 910.07 57.78 2° 968.98 0.0 0° 103.25 9 577.82 1° 910.10 4° 71.31 378.32 6° 109.14 103.25 9 57.78 2° 102.57 3° 856.62 106.91 4° 103.25 9 57.78 2° 1105.45 6° 409.92 695.58 7° 166.91 4° 1270.12 6° 891.82 100 ¹ 2 186.91 4° 12° 120.1 1280.4 10° 20.10 378.32 6° <th>E_i(level)</th> <th>\mathbf{J}_i^{π}</th> <th>E_{γ}^{\dagger}</th> <th>I_{γ}^{\dagger}</th> <th>E_f</th> <th>\mathbf{J}_f^{π}</th> <th>Mult.</th> <th>Comments</th>	E _i (level)	\mathbf{J}_i^{π}	E_{γ}^{\dagger}	I_{γ}^{\dagger}	E_f	\mathbf{J}_f^{π}	Mult.	Comments	
911.9 10 ² 289.4 24.6 15 622.6 8 ⁺ 920.9 9 ⁻ 225.1 $\frac{1}{2}$ 3 100 ² 7 622.6 8 ⁺ [E1] 968.44 4 ⁺ 442.23 3 519.20 5 ⁻ 572.3 1 396.04 3 ⁻ 571.3 1 378.32 6 ⁺ 968.983 2 ⁺ 782.1 1 186.91 4 ⁺ 910.7 1 57.78 2 ⁺ 968.983 2 ⁺ 782.1 1 186.91 4 ⁺ 911.20 2 57.78 2 ⁺ 968.982 0.0 0 ⁻ 1022.57 3 ⁺ 835.65 2 186.91 4 ⁺ 916.1 3 778.22 6 ⁺ 1031.25 9 57.78 2 ⁺ 104.1 4 ⁺ 715.1 3 378.32 6 ⁺ 105.45 6 ⁺ 409.9 2 695.88 7 ⁻ 586.4 2 57.78 2 ⁺ 105.45 6 ⁺ 409.9 2 695.88 7 ⁻ 586.4 2 51.78 2 ⁺ 105.45 6 ⁺ 409.9 2 695.88 7 ⁻ 586.4 2 51.78 2 ⁺ 105.45 6 ⁺ 386.6 1 4 ⁺ 105.25 9 57.78 2 ⁺ 106.1 3 100 ² 7 911.9 10 ⁺ 1174.57 5 ⁺ 796.2 1 48 10 378.32 6 ⁺ 918.1 3 100 ² 7 911.9 10 ⁺ 1189.8 11 ⁻ 268.9 ¹ 3 0 ⁻ 586.4 2 51.920 5 ⁻ 918.1 3 100 ² 7 911.9 10 ⁺ 1189.8 11 ⁻ 268.9 ¹ 3 0 ⁻ 586.4 2 519.20 5 ⁻ 586.4 2 519.20 5 ⁻ 586.4 2 100.8 378.32 6 ⁺ 1270.12 6 ⁺ 891.8 2 100 8 378.32 6 ⁺ 1270.12 6 ⁺ 891.8 2 100 8 378.32 6 ⁺ 1270.12 6 ⁺ 891.8 2 100 8 378.32 6 ⁺ 1270.13 3 100 ² 7 911.9 10 ⁺ 1270.14 103.3 100 13 378.32 6 ⁺ 1270.15 3 50.19 622.6 8 ⁺ 1270.17 43 100 15 622.6 8 ⁺ 1270.17 4 ⁺ 300.13 100 13 378.32 6 ⁺ 1270.14 4 ⁺ 300.13 100 13 378.32 6 ⁺ 1270.14 4 ⁺ 300.13 100 13 378.32 6 ⁺ 1270.14 4 ⁺ 874.7 3 100 15 622.6 8 ⁺ 1170.13 100 ² 100.3 100.3 178.32 6 ⁺ 1170.13 100 ² 100.42 8 ⁺ 1170.14 500.5 2 100 10 ⁴ 1170.17 522.6 8 ⁺ 1170.17 500.5 2 100 118 92.0 9 ⁺ 1170.17 1189.8 11 ⁻ 1170.17 1189.8 11 ⁻ 1173.2 12 ⁺ 36.03 3 100 5 ⁰ 911.9 10 ⁺ 1176.27 1 ⁻ 118.93 3 100 5 ⁰ 911.9 10 ⁺ 1176.17 1189.8 11 ⁻ 1170.17 1189.8 11 ⁻ 1170.17 1189.8 11 ⁻ 1171.19 10 ⁺ 1172.7 10 ⁺ 80.83 3 100 5 ⁰ 911.9 10 ⁺ 1172.7 10 ⁺ 80.83 3 100 5 ⁰ 911.9 10 ⁺ 1172.7 10 ⁺ 80.83 3 100 5 ⁰ 911.9 10 ⁺ 1172.7 10 ⁺ 80.83 3 100 5 ⁰ 911.9 10 ⁺ 1172.7 1 ⁺ 30.83 3 100 5 ⁰ 911.9 10 ⁺ 1172.7 1 ⁺ 30.83 3	874.47	2+	874.5 2		0.0	0^{+}			
9209 9 ⁻⁷ 225.1 ³ 3 24.6 ⁷ 15 695.8 7 ⁻⁷ [E2] 988.44 4 ⁴ 492.3 3 10 ⁵ 7 6512.6 8 ⁺ [E1] 988.44 4 ⁴ 492.3 3 10 ⁵ 7 6512.0 8 ⁺ 7 971.1 378.32 6 ⁺ 771.1 1 86.91 4 ⁺ 910.7 1 57.8 2 ⁺ 968.98 2 ⁻⁶ 77.8 2 ⁺ 968.98 2 ⁻⁶ 0.0 0 ⁺ 911.2 2 57.78 2 ⁺ 968.98 2 ⁻⁶ 0.0 0 ⁺ 911.2 2 57.78 2 ⁺ 968.98 2 ⁻⁷ 78.1 1 186.91 4 ⁺ 968.98 2 ⁻⁷ 0.0 0 ⁺ 911.1 3 ⁻⁷ 77.8 2 ⁺ 968.98 2 ⁻⁷ 0.0 0 ⁺ 911.1 3 ⁻⁷ 77.8 2 ⁺ 968.98 2 ⁻⁷ 0.0 0 ⁺ 911.2 3 ⁻⁷ 77.8 2 ⁺ 904.19 3 ⁻⁷ 77.8 2 ⁺ 904.19 3 ⁻⁷ 77.8 2 ⁺ 904.19 3 ⁻⁷ 78.32 6 ⁺ 904.19 3 ⁻⁷ 78.32 6 ⁺ 905.19 4 ⁺ 103.32 5 ⁻⁷ 91.19 1 ⁰ 4 ⁻ 1105.4 ⁵ 6 ⁺ 409.9 2 ⁻⁶ 695.8 7 ⁻ 918.1 3 ⁻¹ 186.91 4 ⁺ 1105.4 ⁵ 6 ⁺ 409.9 2 ⁻⁶ 695.8 7 ⁻ 918.1 3 ⁻¹ 186.91 4 ⁺ 1105.4 ⁵ 6 ⁺ 409.9 2 ⁻⁶ 695.8 7 ⁻ 918.1 3 ⁻¹ 186.91 4 ⁺ 1105.4 ⁵ 6 ⁺ 109.7 7 ⁻¹ 100 12 ⁻⁷ 186.91 4 ⁺ 1189.8 11 ⁻ 228.9 4 ³ 3 100 [‡] 7 ⁻ 911.9 10 ⁺ [E1] 1239.4 12 ⁺ 327.5 ⁻⁷ 910.9 1 ⁻ 1189.3 1 ⁻¹ 28.9 4 ³ 3 100 [‡] 7 ⁻ 911.9 10 ⁺ 1189.8 11 ⁻ 28.8 4 ³ 3 100 [‡] 7 ⁻ 911.9 10 ⁺ 1189.8 11 ⁻ 28.8 4 ³ 3 100 [‡] 7 ⁻ 911.9 10 ⁺ 1189.8 11 ⁻ 128.9 4 ³ 3 100 [‡] 7 ⁻ 911.9 10 ⁺ 1189.8 11 ⁻ 108.3 ⁻ 902.3 37.8 2 ⁴ 4 ⁻ 108.3 10 ⁻ 30.6 3 33.13 1189.8 11 ⁻ 1001.3 3 100 13 37.8 32 6 ⁺ 1189.8 11 ⁻ 1101.3 3 100 13 37.8 32 6 ⁺ 1189.1 16 ⁻ 1001.3 3 100 [‡] 7 ⁻ 78.3 2 ² 8 ⁺ 119.1 10 ⁻ 1005.4 ³ 100 173 622.6 8 ⁺ 119.2 1 ⁻ 110.2 3 ⁻ 31.8 8 ⁻ 11 ⁻ 110.4 ⁻ 110.5 37.8 2 ⁻ 110.5 3 ⁻ 11.8 9 ⁻ 110 ⁻ 118.9 8 ⁻ 11 ⁻ 110 ⁻ 110.5 3 ⁻ 38.8 1 ⁻ 110	911.9	10^{+}	289.4	4	622.6	8+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	920.9	9-	225.1 [‡] 3	24.6 [‡] 15	695.58	7-	[E2]		
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91.20 2 57.78 2 ⁺ 968.98 2 0.0 0 ⁺ 964.80 2 57.78 2 ⁺ 1091.10 4 ⁺ 713.13 378.32 6 ⁺ 904.19 3 186.91 4 ⁺ 1033.25 9 57.78 2 ⁺ 105.45 6 ⁺ 409.9 2 695.58 7 918.13 186.91 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 60 [‡] 7 91.9 10 ⁺ 1239.4 12 ⁺ 327.5 911.9 10 ⁺ 1003.2 186.91 4 ⁺ 1033.2 186.91 4 ⁺ 1189.8 11 ⁻ 268.9 [‡] 3 60 [‡] 7 91.9 10 ⁺ 1239.4 12 ⁺ 327.5 911.9 10 ⁺ 1083.2 186.91 4 ⁺ 1083.2 186.91 4 ⁺ 1083.2 186.91 4 ⁺ 17270.12 6 ⁺ 891.8 2 100 8 378.32 6 ⁺ 1083.2 186.91 4 ⁺ 1083.2 186.91 4 ⁺ 1083.2 186.91 4 ⁺ 1083.2 6 ⁺ 1083.2 6 ⁺ 1083.2 6 ⁺ 1091.3 31.00 13 378.32 6 ⁺ 1092.3 378.32 6 ⁺ 1091.3 100 13 378.32 6 ⁺ 1091.3 100 15 622.6 8 ⁺ 1091.3 100 15 622.6 8 ⁺ 1091.3 100 15 622.6 8 ⁺ 1199.5 144 622.6 8 ⁺ 1191.1 378.32 6 ⁺ 1191.1 378.32 6 ⁺ 1192. 1297. ² 7 71.5 3 38 9 911.9 10 ⁺ 1239.4 12 ⁺ 1239.4 12 ⁺ 1230.4 10 15 622.6 8 ⁺ 1239.4 12 ⁺ 1379.6 1 ⁺ 300.6 3 33 1 <i>j</i> 1189.8 11 ⁻ 1621.9 9 ⁺ 71.5 9 3 88 9 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 38 9 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 38 9 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 38 8 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 88 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 88 911.9 10 ⁺ 1627.9 9 ⁺ 71.5 9 3 88 911.9 10 ⁺ 1628.1 16 ⁺ 388.6 3 100 50 911.9 10 ⁺ 1140.2 622.6 8 ⁺ 1239.8 11 ⁻ 1249.2 3 ⁺ 340.3 2 100 77 189.8 11 ⁻ 821.6 4 15 17 911.9 10 ⁺ 1140.2 622.6 8 ⁺ 129.8 11 ⁻ 129.8 11 ⁻	968.983	2^{+}	782.1 <i>I</i>		186.91	4^{+}			
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$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1022.57	31	835.65 2		186.91	4' 2+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1091 10	4+	904.80 2 713 1 3		378 32	$\frac{2}{6^{+}}$			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1071110	•	904.19 3		186.91	4 ⁺			
1105.45 6^{+} 409.9 2 695.87 7^{-} 918.1 3 186.91 4 ⁺ 1174.57 5^{+} 796.2 <i>I</i> 48 <i>I</i> 0 378.32 6 ⁺ 987.7 <i>I</i> 100 <i>I</i> 2 186.91 4 ⁺ 1189.8 11 ⁻ 268.9 [‡] 3 67 [‡] 5 920.9 9 ⁻ [E2] 278.0 [‡] 3 100 [‡] 7 911.9 10 ⁺ 1239.4 12 ⁺ 327.5 911.9 10 ⁺ 1239.4 12 ⁺ 327.5 911.9 10 ⁺ 1239.4 12 ⁺ 327.5 911.9 10 ⁺ 1083.2 186.91 4 ⁺ I _Y : weak γ ray. 1280.5 8 ⁺ 359.6 2 30 <i>I</i> 0 920.9 9 ⁻ 585.0 2 100 30 695.58 7 ⁻ 902.3 378.32 6 ⁺ I _Y : γ -ray peak is masked. 1379.6 7 ⁺ 756.9 3 50 <i>I</i> 9 622.6 8 ⁺ 1001.3 3 100 <i>I</i> 3 378.32 6 ⁺ 1490.3 10 ⁺ 300.6 3 33 <i>I</i> 3 1189.8 11 ⁻ 569.5 2 100 <i>I</i> 3 920.9 9 ⁻ 867.1 5 14 4 622.6 8 ⁺ 1497.4 8 ⁺ 874.7 3 100 <i>I</i> 5 622.6 8 ⁺ 1497.4 8 ⁺ 874.7 3 100 <i>I</i> 5 622.6 8 ⁺ 119.1 378.32 6 ⁺ I _Y : weak γ . 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ [E1] 377.3 [‡] 3 52 [‡] 8 1239.4 12 ⁺ [E1] 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ 119.1 378.32 6 ⁺ I _Y : weak γ . 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ [E1] 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ 119.1 378.32 6 ⁺ I _Y : weak γ . 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ 1100.5 4 3 100 <i>I</i> 5 622.6 8 ⁺ 173.2 12 ⁺ 236.0 3 25 8 1497.2 13 ⁻ 543.3 2 100 <i>I</i> 7 1189.8 11 ⁻ 821.6 4 15 <i>I</i> 1 911.9 10 ⁺ 1140.2 622.6 8 ⁺ 173.2 12 ⁺ 338.8 911.9 10 ⁺ 1140.2 622.6 8 ⁺ 173.8 11 ⁻ 821.6 4 15 <i>I</i> 1 911.9 10 ⁺ 1140.2 622.6 8 ⁺ 173.8 11 ⁻ 124 236.0 3 25 8 1497.2 13 ⁻ 137.5 543.3 2 100 <i>I</i> 7 1189.8 11 ⁻ 821.6 4 15 <i>I</i> 1 91.9 10 ⁺ 1140.2 622.6 8 ⁺ 173.8 11 ⁻ 124 236.0 3 25 8 1497.2 13 ⁻ 137.5 543.3 2 100 <i>I</i> 7 1189.8 11 ⁻ 149.8 11 ⁻ 149.8 11 ⁻ 140.2 622.6 8 ⁺ 17. 371.4 3 1838.4 15 ⁻ 37. 371.4 3 1838.4 15 ⁻ 37. 371.4 3 1838.4 15 ⁻ 37. 371.4 3 193.4 15 ⁻ 37. 371.4 3 193.4 15 ⁺ 37. 371.4 3 193.4 15 ⁻ 37. 47. 371.4 3 193.4			1033.25 9		57.78	2^{+}			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1105.45	6+	409.9 2		695.58	7-			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			586.4 2		519.20	5 ⁻			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1174 57	5+	918.1 3 706 2 1	18 10	180.91	4 · 6 ⁺			
1189.8 11^{-} 268.9 [‡] 3 $67^{\ddagger} 5$ 920.9 9 ⁻ [E2] 278.0 [‡] 3 $100^{\ddagger} 7$ 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 _y : 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 _y : γ -ray peak is masked. 1379.6 7^{+} 756.9 3 50.19 622.6 8^{+} 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 $52^{\ddagger} 8$ 1239.4 12^{+} [E1] 307.3 [‡] 3 100^{\ddagger} 1189.8 11^{-} [E2] 1497.4 8^{+} 874.7 3 100.15 622.6 8^{+} 119.1 $378.32 6^{+}$ I _y : weak γ . 1599.5 14^{+} 360.1 3 $1239.4 12^{+}$ [E1] 1627.9 9 ⁺ 715.9 3 38.8 911.9 10^{+} 1189.8 11^{-} [E2] 1733.2 12^{+} 256.0 3 25.8 1497.2 13^{-} 543.3 2 100.17 1189.8 11^{-} 821.6 4 15.11 911.9 10^{+} 1140.2 622.6 8^{+} 1733.4 15^{-} 341.2 3 100.5 622.6 8^{+} 1738.4 15^{-} 341.2 3 1497.2 13^{-} 821.6 4 15.11 911.9 10^{+} 1140.2 622.6 8^{+} I _y : weak γ ray. 1838.4 15^{-} 341.2 3 1497.2 13^{-} 1838.4 15^{-} 341.2 3 1497.2 13^{-} 1838.4 15^{-} 341.2 3 1497.2 13^{-} 1838.4 15^{-} 341.2 3 1497.2 13^{-} 184.1 16^{+} 388.6 3 1599.5 14^{+} 2209.8 17^{-} 371.4 3 183.84 15^{-}	11/4.57	5	987.7 1	100 12	186.91	4 ⁺			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1189.8	11-	268.9 [‡] 3	67 [‡] 5	920.9	9-	[E2]		
1239.4 12^+ 327.5 911.9 10^+ 1270.12 6^+ 891.8 2 100 8 378.32 6^+ 1083.2 100 30 695.58 $7^ 902.3$ 378.32 6^+ 1379.6 7^+ 756.9 3 $10^ 322.9$ 7^- 1490.3 10^+ 300.63 3378.32 6^+ I_7 : γ -ray peak is masked. 1490.3 10^+ 300.63 3373.31 1189.8 $1^ 569.52$ 100.13 920.9 $9^ 867.15$ 14.4 622.6 8^+ 1497.4 8^+ 874.73 100.15 622.6 8^+ 1_7 : weak γ . 1497.4 8^+ 874.73 100.15 622.6 8^+ 1_7 : weak γ . 1497.4 8^+ 874.73 100.15 622.6 8^+ 1_7 : weak γ . 1599.5 14^+ 360.13 1239.4 12^+ 1_7 : weak γ . 1657.9 9^+ 715.93 38.8 911.9 10^+			278.0 [‡] 3	100 [‡] 7	911.9	10^{+}	IE11		
1270.12 6 ⁺ 891.8 2 100 8 378.32 6 ⁺ 1083.2 186.91 4 ⁺ Iy: weak γ ray. 1280.5 8 ⁺ 359.6 2 30 10 920.9 9 ⁻ 902.3 378.32 6 ⁺ Iy: γ-ray peak is masked. 1379.6 7 ⁺ 756.9 3 50 19 622.6 8 ⁺ 1001.3 100 13 378.32 6 ⁺ Iy: γ-ray peak is masked. 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 [‡] 5 622.6 8 ⁺ 14 ⁺ 621.6 8 ⁺ 1497.2 13 ⁻ 257.7 [‡] 3 52 [‡] 8 1239.4 12 ⁺ [E2] 1497.4 8 ⁺ 874.7 3 100 15 622.6 8 ⁺ 1y: weak γ. 1529.5 14 ⁺ 360.1 3 1239.4 12 ⁺ 12 ⁺ 13 ⁻ <tr< td=""><td>1239.4</td><td>12^{+}</td><td>327.5</td><td></td><td>911.9</td><td>10^{+}</td><td></td><td></td></tr<>	1239.4	12^{+}	327.5		911.9	10^{+}			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1270.12	6+	891.8 2	100 8	378.32	6+			
1280.5 8' 359.6 2 30 10 920.9 9 585.0 2 100 30 695.58 7 902.3 378.32 6 ⁺ Iy: γ-ray peak is masked. 1379.6 7 ⁺ 756.9 3 50 19 622.6 8 ⁺ Iy: γ-ray peak is masked. 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 ⁺ 1239.4 12 ⁺ [E1] 307.3 [‡] 3 100 [‡] 1189.8 11 ⁻ [E2] 1497.2 13 ⁻ 257.7 [‡] 3 52 [‡] 8 1239.4 12 ⁺ [E1] 378.32 6 ⁺ Iy: weak γ. 1497.4 8 ⁺ 874.7 3 100 [‡] 5 622.6 8 ⁺ Iy: weak γ. 1599.5 14 ⁺ 360.1 3 1239.4 12 ⁺ 12 ⁺ 1627.9 9 ⁺ 715.9 3 38 8 911.9 10 ⁺ 1005.4 3 100 15 622.6 8 ⁺ Iy: weak γ. 1733.2 12 ⁺ 236.0 3 25 8 1497.2 13 ⁻ 1497.2 13 ⁻ 1497	1000 5	0+	1083.2	20.10	186.91	4 ⁺		I_{γ} : weak γ ray.	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1280.5	8'	339.6 Z	30 10	920.9	9 7-			
1379.6 7 ⁺ 756.9 50 19 622.6 8 ⁺ 197 197			902.3	100 50	378.32	6 ⁺		L_{α} : γ -ray peak is masked.	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1379.6	7+	756.9 3	50 19	622.6	8+		IV. Y INJ Pour IS Interious	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			1001.3 <i>3</i>	100 13	378.32	6+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1490.3	10^{+}	300.6 3	33 13	1189.8	11-			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			569.5 2	100 13	920.9	9- 0+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1407.2	12-	357.7^{\ddagger}	14 4	1220.4	0 12+	07.11		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1497.2	15	$257.7^{+}5$	52 ⁺ 8	1239.4	12			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1/07 /	8+	307.3 ± 3 874 7 3	100 15	622.6	11 g+	[E2]		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1477.4	0	1119.1	100 15	378.32	6 ⁺		I_{γ} : weak γ .	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1599.5	14+	360.1 3		1239.4	12+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1627.9	9+	715.9 <i>3</i>	38 8	911.9	10^{+}			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1500.0	10+	1005.4 3	100 15	622.6	8+			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1/33.2	121	236.0 3	25 8	1497.2	15			
1762.7 10^+ 850.8 100 $50^ 911.9$ 10^+ 1140.2 622.6 8^+ I_γ : weak γ ray. 1838.4 $15^ 341.2$ 1497.2 $13^ 1988.1$ 16^+ 388.6 1599.5 14^+ 2209.8 $17^ 371.4$ 1838.4 $15^ 2407.9$ 18^+ 410.8 3 1988.1 16^+			82164	15 11	911 9	10^{+}			
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1762.7	10^{+}	850.8 3	100 50	911.9	10^{+}			
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^+ $419.8.3$ $1988.1.16^+$			1140.2		622.6	8+		I_{γ} : weak γ ray.	
1988.1 16^+ $388.6.3$ 1599.5 14^+ 2209.8 $17^ 371.4.3$ 1838.4 $15^ 2407.9$ 18^+ $419.8.3$ 1088.1 16^+	1838.4	15-	341.2 3		1497.2	13-			
$2207.0 17 571.4 5 1050.4 15 2407 0 18^+ 410 8 3 1088 1 16^+ 16^+ 1088 1 16^+ 1088 1 16^+ 16^+ 1088 1088 1 16^+ 1088 108$	1988.1	16 ⁺	388.6 3		1599.5	14 ⁺			
2TU1.7 10 T17.0 J 1700.1 10	2407.9	$17 \\ 18^{+}$	419.8.3		1988.1	15^{15}			

²²⁶**Ra**(α ,2n γ) 1998We01,1993Ac02,1986Sc18 (continued)

 γ ⁽²²⁸Th) (continued)

[†] From 1998We01, unless otherwise noted. [‡] From 1993Ac02.

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

Level Scheme

Intensities: Relative photon branching from each level



 $^{228}_{90}{
m Th}_{138}$

4

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

Level Scheme (continued)

Intensities: Relative photon branching from each level



 $^{228}_{90}{
m Th}_{138}$





 $^{228}_{90}{
m Th}_{138}$