^{232}Th(d,p2nγ) 1993AcZZ

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh, Jagdish K. Tuli, and Edgardo Browne	NDS 185, 560 (2022)	31-Aug-2022

1993AcZZ (thesis): ^{231}Th was produced in ^{232}Th(d,p2n ce) and ^{232}Th(d,p2nγ),E=23,28 MeV reactions at Bonn cyclotron facility. The γ-rays were measured by four Compton-suppressed Ge detectors in coincidence with conversion electrons detected in an orange spectrometer. Measured Eγ, Iγ, I(ce), (ce)(ce)-coin, γ(ce)-coin. Deduced energy levels, J^{π}. Author also mentioned ^{230}Th(d,p ce),E=14,16,18,20 MeV, but no data from this reaction were given in the thesis.

^{231}Th Levels

E(level)[†]	J$^{\pi}$[‡]	E(level)[†]	J$^{\pi}$[‡]	E(level)[†]	J$^{\pi}$[‡]	E(level)[†]	J$^{\pi}$[‡]
0.0[#]	5/2$^+$	162.3[@] 7	11/2$^+$	240.9[&] 5	5/2$^+$	330.4[@] 8	15/2$^+$
41.8[@] 5	7/2$^+$	221.4[&] 5	3/2$^+$	275.3[&] 5	7/2$^+$	432.9[#] 6	17/2$^+$
96.3[#] 5	9/2$^+$	240.8[#] 6	13/2$^+$	324.5[&] 5	9/2$^+$	544.7[@] 8	19/2$^+$

[†] From Eγ data, assuming ΔEγ=0.5 keV when not stated.
[‡] As proposed in 1993AcZZ.
[#] Band(A): ν5/2[633],α=+1/2. Note that the 13/2$^+$ and 17/2$^+$ band members decay by different γ rays as compared to those assigned, tentatively, by 2002AbZV in ^{232}Th(^{209}Bi,^{210}Biγ).
[@] Band(a): ν5/2[633],α=−1/2. Note that the 11/2$^+$, 15/2$^+$ and 19/2$^+$ band members decay by different γ rays as compared to those assigned, tentatively, by 2002AbZV in ^{232}Th(^{209}Bi,^{210}Biγ).
[&] Band(B): ν3/2[631].

γ(^{231}Th)

The ce data and the multipolarities deduced from ce data were not given in 1993AcZZ.
Intensities from (ce)γ-coin data with different gates on conversion lines from 1993AcZZ are listed under comments.

Unassigned gamma rays in ^{232}Th(d,p2nγ),E=23,28 MeV (1993AcZZ)

Eγ(keV)	γ(ce)-coin intensities			
	Iγ(a)	Iγ(b)	Iγ(c)	Iγ(d)
117.4 4	10.6 35	24 11	-	-
122.3 3	-	36.4 52	-	-
124.5 5	25.7 36	61.1 56	104 18	-
126.0 4	-	-	82 17	-
140.6 3	-	-	101 16	-
141.7 3	30.5 43	-	-	6.0 11
143.5 4	20.5 40	62.0 87	148 20	-
148.2 3	-	-	112 16	4.7 10
150.7 5	-	63.9 87	81 15	-
158.7 3	20.8 34	108 12	119 14	-
160.1 4	-	80 12	-	16.8 33
162.8 4	18.5 34	49.2 84	49 12	-
178.5 4	12.8 27	35.9 66	63 12	4.9 9
180.6 4	-	41.3 76	-	-
185.7 2	93.5 42	300 10	195 15	31.5 14
188.1 3	18.2 29	-	-	-
195.6 4	10.5 26	-	-	-
198.5 3	10.2 25	28.1 55	4.2 9	4.2 9
206.5 4	16.8 31	48.2 64	7.1 9	7.1 9
211.9 3	-	33.4 61	-	-
215.8 4	21.2 43	-	-	-
216.8 5	-	22.1 62	-	-
219.2 4	12.9 30	-	-	-

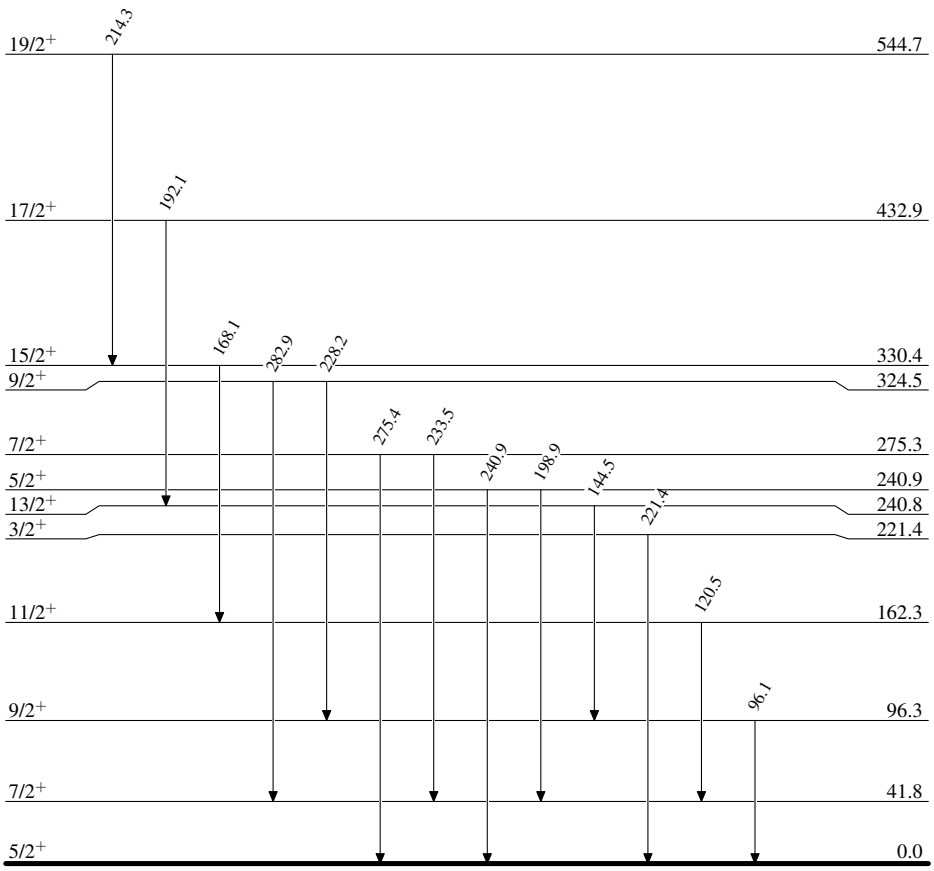
225.9 *3*	36.1 *37*	43.6 *64*	-	-
235.2 *4*	14.3 *39*	-	-	-
239.1 *4*	-	30.1 *64*	-	-
240.7 *4*	-	-	-	4.2 *9*
249.2 *4*	-	-	-	4.0 *9*
250.6 *4*	-	21.2 *54*	-	-
257.3 *3*	20.0 *35*	37.5 *58*	-	-
290.3 *4*	-	-	-	3.5 *7*
295.4 *4*	10.3 *23*	-	-	-
304.1 *3*	22.2 *27*	19.7 *51*	-	-
314.1 *4*	-	-	30 *8*	-
332.6 *4*	8.3 *10*	-	-	-
348.1 *3*	-	-	47 *7*	-

Iγ(a): gate on ce(L_2, 120.5γ, 11/2+→7/2^+); E(d)=27 MeV.
Iγ(b): gate on ce(L_3, 120.5γ, 11/2+→7/2^+); E(d)=27 MeV.
Iγ(c): gate on ce(L_2, 96.1γ, 9/2+→5/2^+); E(d)=27 MeV.
Iγ(d): gate on ce(M, 96.1γ, 9/2+→5/2^+); E(d)=27 MeV.

E_γ	E_i(level)	J_i^π	E_f	J_f^π	Comments
96.1	96.3	9/2^+	0.0	5/2^+	
120.5	162.3	11/2^+	41.8	7/2^+	
144.5 *3*	240.8	13/2^+	96.3	9/2^+	Iγ: 229 *21*, gate: ce(L_2, 96.1γ, 9/2+→5/2^+); 13.4 *13*, gate: ce(M, 96.1γ, 9/2+→5/2^+).
168.1 *3*	330.4	15/2^+	162.3	11/2^+	Iγ: 167 *6*, gate: ce(L_2, 120.5γ, 11/2+→7/2^+); 220 *14*, gate: ce(L_3, 120.5γ, 11/2+→7/2^+); 159 *14*, gate: ce(L_2, 96.1γ, 9/2+→5/2^+).
192.1 *2*	432.9	17/2^+	240.8	13/2^+	Iγ: 53.8 *59*, gate: ce(L_2, 120.5γ, 11/2+→7/2^+); 31.1 *57*, gate: ce(L_3, 120.5γ, 11/2+→7/2^+); 100 *12*, gate: ce(L_2, 96.1γ, 9/2+→5/2^+); 4.4 *9*, gate: ce(M, 96.1γ, 9/2+→5/2^+).
198.9	240.9	5/2^+	41.8	7/2^+	
214.3 *3*	544.7	19/2^+	330.4	15/2^+	Iγ: 53.8 *59*, gate: ce(L_2, 120.5γ, 11/2+→7/2^+); 51.8 *69*, gate: ce(L_3, 120.5γ, 11/2+→7/2^+); 69 *10*, gate: ce(L_2, 96.1γ, 9/2+→5/2^+); 2.8 *8*, gate: ce(M, 96.1γ, 9/2+→5/2^+).
221.4	221.4	3/2^+	0.0	5/2^+	
228.2 *3*	324.5	9/2^+	96.3	9/2^+	E_γ: from Table A4 in 1993AcZZ. Other: 228.8 in author's Fig. 17. Iγ: 112 *9*, gate: ce(L_2, 96.1γ, 9/2+→5/2^+).
233.5	275.3	7/2^+	41.8	7/2^+	
240.9	240.9	5/2^+	0.0	5/2^+	
275.4	275.3	7/2^+	0.0	5/2^+	
282.9	324.5	9/2^+	41.8	7/2^+	

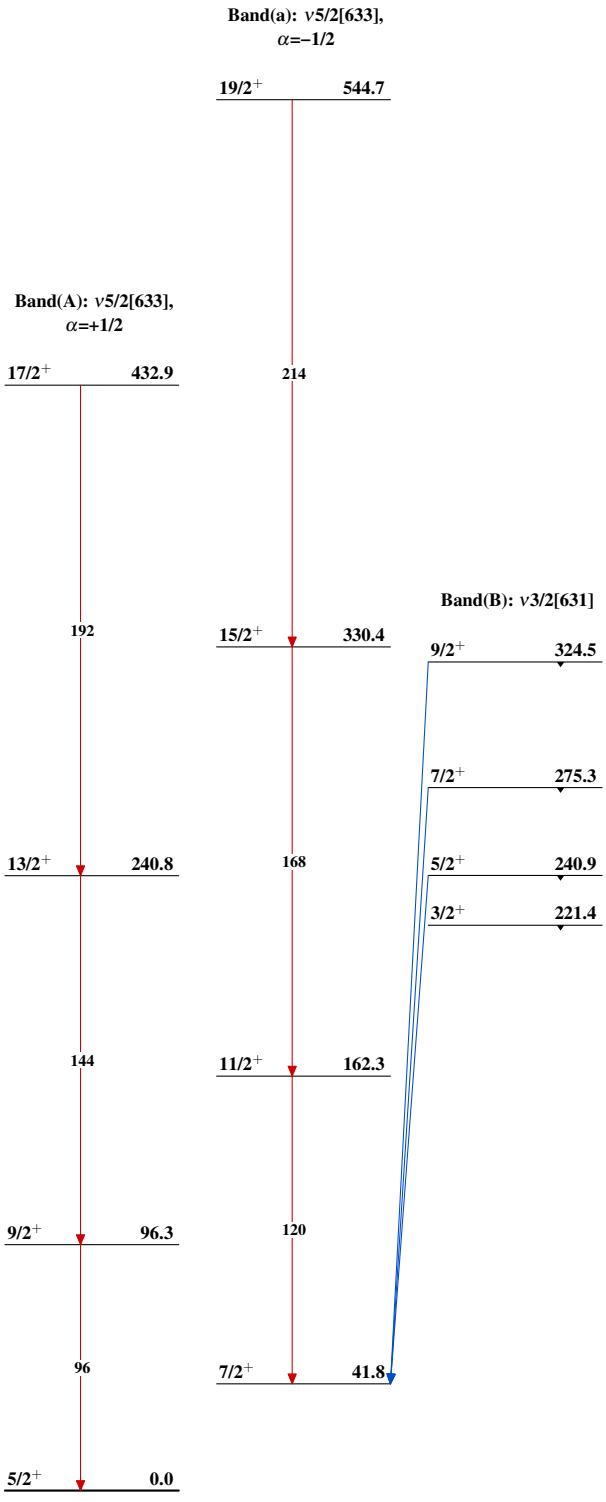
^{232}Th(d,p2nγ) 1993AcZZ

Level Scheme



$^{231}_{90}Th_{141}$

^{232}Th(d,p2nγ) 1993AcZZ



$^{231}_{90}Th_{141}$