^{231}Pa(p,2nγ), ^{230}Th(α,4nγ) 1993Ac02,1987Ze07,1983Ha31

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

1983Ha31: ^{230}U produced via ^{230}Th(α,4n) at 40 MeV. Performed γ-ray and electron spectroscopy, observed ground-state rotational band.

1987Ze07: ^{230}U produced through ^{231}Pa(p,2n) reaction at 14 MeV. Performed γ-ray and electron spectroscopy, observed ground-state and octupole-vibration band. Also performed ^{230}Pa β-decay measurement to identify low-lying states in octupole band.

1993Ac02: ^{230}U produced through ^{230}Th(α,4n) reaction at 42 MeV. Performed γ-ray and conversion-electron spectroscopy, observed ground and octupole-vibration band.

^{230}U Levels

E(level)‡	Jπ†	Comments
0.0#	0^+	
51.5# *4*	2^+	
169.2# *4*	4^+	
347.1# *6*	6^+	
366.3 *3*	1^-	
435.2@ *5*	3^-	
558.2@ *5*	5^-	
578.2# *6*	8^+	
733.9@ *6*	7^-	
856.3# *6*	10^+	
958.6@ *6*	9^-	B(E1)(J to J-1)/B(E2)(J to J-2)≥1 (1993Ac02).
1175.8# *6*	12^+	
1228.9@ *6*	11^-	B(E1)(J to J-1)/B(E2)(J to J-2)=1.3 *3* (1993Ac02).
1531.7# *6*	14^+	
1539.4@ *6*	13^-	B(E1)(J to J-1)/B(E2)(J to J-2)=2.2 *4* (1993Ac02).
1886.1@ *6*	15^-	
1920.6# *9*	16^+	
2266.1?@ *9*	17^-	
2337.2?# *9*	18^+	

† As assigned in 1993Ac02.
‡ Deduced by evaluator from a least-squares fit to γ-ray energies.
# Band(A): $K^\pi=0^+$ g.s. rotational band.
@ Band(B): $K^\pi=0^-$ octupole-vibrational band.

γ(^{230}U)

E_γ#	E_i(level)	J_i^π	E_f	J_f^π	Mult.‡	α&	Comments
117.74 *13*	169.2	4^+	51.5	2^+	E2	6.45 *10*	α(K)=0.1890 *28*; α(L)=4.56 *7*; α(M)=1.264 *19*; α(N)=0.343 *5*; α(O)=0.0789 *12* α(P)=0.01296 *19*; α(Q)=6.16×10^{-5} *9* E_γ: Weighted average of 117.7 keV *2* (1993Ac02), 117.7 keV *3* (1987Ze07), and 117.8 keV *2* (1983Ha31).
177.5 *13*	347.1	6^+	169.2	4^+	E2	1.18 *4*	α(K)=0.1844 *32*; α(L)=0.724 *26*; α(M)=0.200 *7*; α(N)=0.0542 *19*; α(O)=0.0125 *4*

Continued on next page (footnotes at end of table)

^{231}Pa(p,2nγ), ^{230}Th(α,4nγ) 1993Ac02,1987Ze07,1983Ha31 (continued)

γ(^{230}U) (continued)

E_γ[#]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	α[&]	Comments
							α(P)=0.00208 *7*; α(Q)=1.74×10^{-5} *4* E_γ: Weighted average of 177.5 keV *2* (1993Ac02), 177.6 keV *3* (1987Ze07), and 177.5 keV *2* (1983Ha31).
211.1[†] *3*	558.2	5$^-$	347.1	6$^+$			
231.10 *13*	578.2	8$^+$	347.1	6$^+$	E2	0.444 *6*	α(K)=0.1212 *17*; α(L)=0.2358 *33*; α(M)=0.0646 *9*; α(N)=0.01754 *25*; α(O)=0.00406 *6* α(P)=0.000683 *10*; α(Q)=8.60×10^{-6} *12* E_γ: Weighted average of 230.9 keV *2* (1998Ac02), 231.1 keV *3* (1987Ze07) and 231.3 keV *2* (1983Ha31).
266.0[†] *3*	435.2	3$^-$	169.2	4$^+$			
270.4[@a] *2*	1228.9	11$^-$	958.6	9$^-$			
278.12 *13*	856.3	10$^+$	578.2	8$^+$	[E2]	0.2387 *34*	α(K)=0.0864 *12*; α(L)=0.1115 *16*; α(M)=0.0303 *4*; α(N)=0.00823 *12*; α(O)=0.001910 *27* α(P)=0.000325 *5*; α(Q)=5.44×10^{-6} *8* E_γ: Weighted average of 278.0 keV *2* (1993Ac02), 278.2 keV *3* (1987Ze07), and 278.2 keV *2* (1983Ha31).
310.7[@a] *2*	1539.4	13$^-$	1228.9	11$^-$			
314.8[†] *3*	366.3	1$^-$	51.5	2$^+$			
319.40 *14*	1175.8	12$^+$	856.3	10$^+$	[E2]	0.1557 *22*	α(K)=0.0667 *9*; α(L)=0.0653 *9*; α(M)=0.01764 *25*; α(N)=0.00478 *7*; α(O)=0.001113 *16* α(P)=0.0001910 *27*; α(Q)=3.93×10^{-6} *6* E_γ: Weighted average of 319.5 keV *2* (1993Ac02) and 319.3 keV *2* (1983Ha31).
345.5[@a] *2*	2266.1?	17$^-$	1920.6	16$^+$			
354.4[@] *2*	1886.1	15$^-$	1531.7	14$^+$			
355.90 *14*	1531.7	14$^+$	1175.8	12$^+$	[E2]	0.1138 *16*	α(K)=0.0543 *8*; α(L)=0.0437 *6*; α(M)=0.01172 *16*; α(N)=0.00318 *4*; α(O)=0.000741 *10* α(P)=0.0001281 *18*; α(Q)=3.07×10^{-6} *4* E_γ: Weighted average of 355.9 keV *2* (1993Ac02) and 355.9 keV *2* (1983Ha31).
363.5[@] *2*	1539.4	13$^-$	1175.8	12$^+$			
366.3[†] *3*	366.3	1$^-$	0.0	0$^+$			
372.5[@] *2*	1228.9	11$^-$	856.3	10$^+$			
380.52 *18*	958.6	9$^-$	578.2	8$^+$			E_γ: Weighted average of 380.4 keV *2* (1993Ac02) and 380.8 keV *3* (1987Ze07).
383.6[†] *3*	435.2	3$^-$	51.5	2$^+$			
386.86 *17*	733.9	7$^-$	347.1	6$^+$			E_γ: Weighted average of 386.8 keV *2* (1993Ac02) and 387.0 keV *3* (1987Ze07).
388.9 *7*	1920.6	16$^+$	1531.7	14$^+$	[E2]	0.0891 *13*	α(K)=0.0460 *7*; α(L)=0.0317 *5*; α(M)=0.00847 *13*; α(N)=0.002296 *35*; α(O)=0.000537 *8* α(P)=9.34×10^{-5} *14*; α(Q)=2.52×10^{-6} *4* E_γ: Unweighted average of 388.3 keV *2* (1993Ac02) and 389.6 keV *3* (1983Ha31).
388.97 *17*	558.2	5$^-$	169.2	4$^+$			E_γ: Weighted average of 389.0 keV *2* (1993Ac02) and 388.9 keV *3* (1987Ze07).
416.6[@a] *2*	2337.2?	18$^+$	1920.6	16$^+$			

[†] From 1987Ze07.
[‡] Determined by 1983Ha31 from their L-subshell conversion electron measurements; values not reported by authors. Multipolarities in square brackets are from level scheme.
[#] γ-ray energy uncertainties are not reported by 1987Ze07. 1993Ac02 reports a uniform uncertainty of 0.2 keV in the reported

Continued on next page (footnotes at end of table)

^{231}Pa(p,2nγ), ^{230}Th(α,4nγ) 1993Ac02,1987Ze07,1983Ha31 (continued)

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

γ-ray energies, with spectra of quality similar to those reported in 1987Ze07. The evaluator has therefore assigned a slightly increased uncertainty of 0.3 keV to transition energies reported in 1987Ze07.

@ From 1993Ac02.

& Additional information 1.

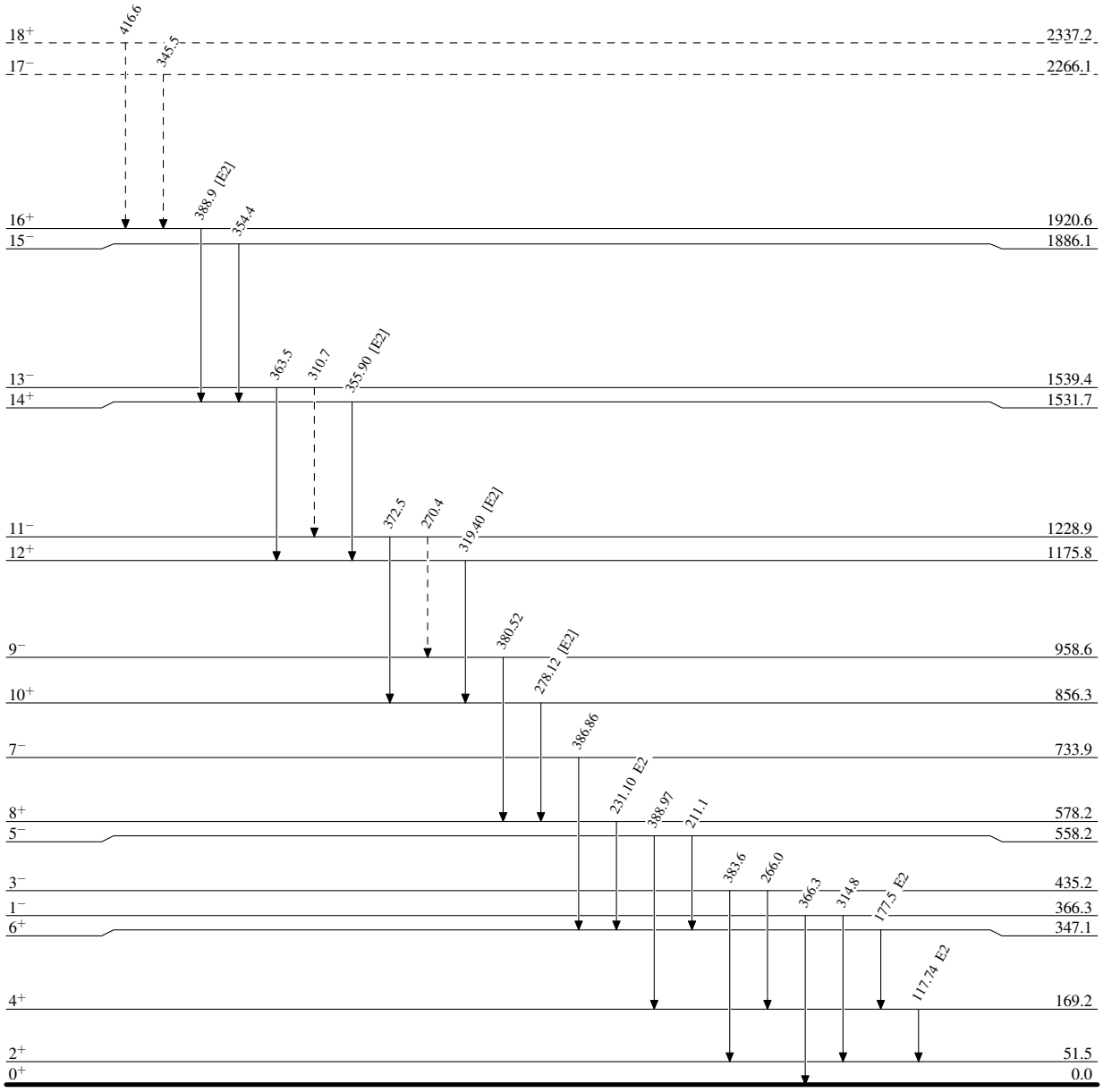
a Placement of transition in the level scheme is uncertain.

Legend

^{231}Pa(p,2nγ), ^{230}Th(α,4nγ) 1993Ac02,1987Ze07,1983Ha31

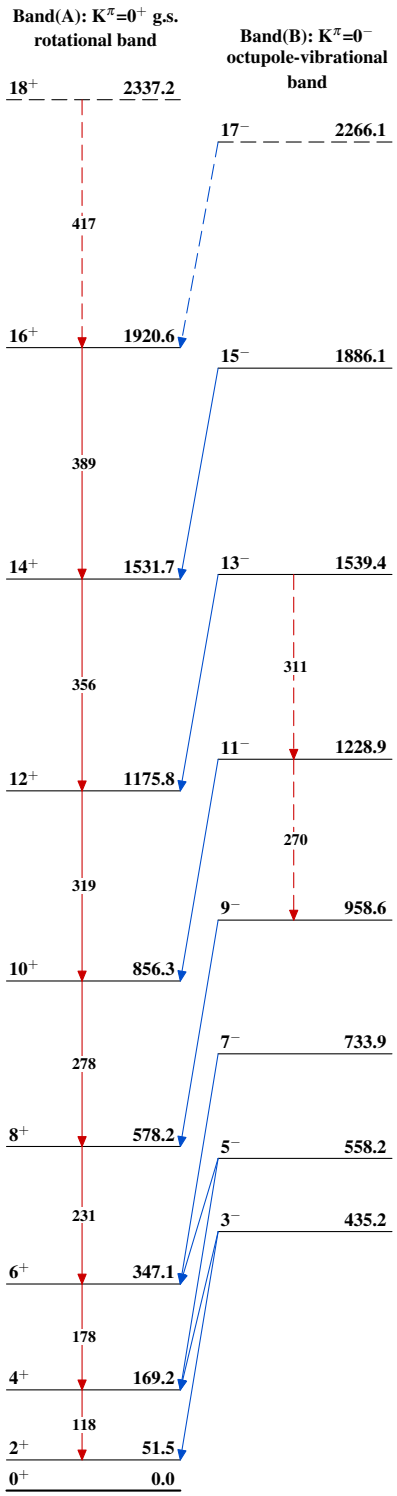
Level Scheme

γ Decay (Uncertain)



$^{230}_{92}U_{138}$

^{231}Pa(p,2nγ), ^{230}Th(α,4nγ) 1993Ac02,1987Ze07,1983Ha31



$^{230}_{92}U_{138}$