^{136}Xe(α,2nγ) 1987Pr06

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 146, 1 (2017)	30-Sep-2017

1987Pr06: E=20, 22, 24, 27 MeV α beams were produced from the Rossendorf cyclotron. Target was gaseous ^{136}Xe (99% enriched). γ rays were detected with Ge(Li) detectors. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\gamma(\theta)$, γ(pol), γ(t), Doppler-shift attenuation. Deduced levels, J, π, $T_{1/2}$, configurations, γ-ray multipolarities and mixing ratios. Comparisons with shell-model calculations. 1987Pr06 supersedes 1986En06, 1984En02.

Others: 1973Ke07, 1976Ik04.

All data are from 1987Pr06, unless otherwise noted.

^{138}Ba Levels

E(level)[†]	J$^{\pi}$[@]	$T_{1/2}$[‡]	Comments
0.0	0$^+$		
1435.8 *3*	2$^+$		
1898.6 *4*	4$^+$	2.3[#] ns *1*	
2090.5 *4*	6$^+$	0.8 μs *2*	g=0.98 *2* (1976Ik04) $T_{1/2}$: from γ(t) in 1973Ke07. Other: >35 μs (1987Pr06, γ(t)).
2203.0 *5*	6$^+$		
2217.8 *5*	2$^+$		
2307.5 *4*	4$^+$	≤0.07[#] ns	
2415.3 *4*	5$^+$	≤0.07[#] ns	
2445.5 *4*	3$^+$		
2582.9 *5*	1$^+$		
2640.2 *5*	2$^+$		
2779.2 *4*	4$^+$		
2851.4 *4*	4$^+$		
2880.6 *5*	3$^-$		
2931.3 *5*	2$^+$		
3049.8 *5*	2$^+$		
3154.5 *5*	4$^+$		
3163.3 *5*	(2)$^+$		
3183.7 *5*	8$^+$	20 ps *+20−14*	$T_{1/2}$: other: ≤70 ps (1973Ke07).
3257.1 *4*	3		
3309.3 *6*	(5,6,7)		
3359.5 *5*	7$^+$	25 ps *10*	
3609.9 *6*			
3622.3 *5*	10$^+$	0.51[#] ns *7*	$T_{1/2}$: other: ≤70 ps (1973Ke07).
3632.9 *6*	9$^-$	31 ps *18*	$T_{1/2}$: other: ≤70 ps (1973Ke07).
3678.0 *6*	8$^-$	≤0.07[#] ns	
3910.8 *5*	10$^+$	≤14 ps	$T_{1/2}$: other: ≤70 ps (1973Ke07).
4114.9 *7*			
4157.8 *6*			
4584.4 *6*			
4689.4 *6*	12$^+$	≤14 ps	$T_{1/2}$: other: ≤70 ps (1973Ke07).
4864.2 *6*			

[†] From a least-squares fit to γ-ray energies.
[‡] From 1987Pr06 using DSAM, unless otherwise noted.
[#] From γ(t) in 1987Pr06.
[@] From Adopted Levels.

^{136}Xe(α,2nγ) 1987Pr06 (continued)

γ(^{138}Ba)

γ-ray polarization from 1987Pr06: values of POL1 are deduced from γ(θ) and values of POL2 are from γ(pol); opposite signs of POL1 and POL2 indicate parity change.

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	δ[‡]	Comments
107.7 *3*	3 *1*	2415.3	5$^+$	2307.5	4$^+$			I_γ: others: 2 *1* (Eα=22 MeV), 2 *1* (Eα=24 MeV), 4 *1* (Eα=27 MeV).
112.6 *3*	26 *1*	2203.0	6$^+$	2090.5	6$^+$	D+Q	−0.25 *2*	I_γ: others: 29 *1* (Eα=22 MeV), 34 *1* (Eα=24 MeV), 37 *1* (Eα=27 MeV). A_2=+0.26 *1*, A_4=−0.01 *2* (1987Pr06); A_2=+0.23 *8*, A_4=−0.19 *9* (1973Ke07).
191.9 *3*	152 *3*	2090.5	6$^+$	1898.6	4$^+$			I_γ: others: 173 *3* (Eα=22 MeV), 217 *4* (Eα=24 MeV), 223 *4* (Eα=27 MeV).
212.3 *3*	7 *1*	2415.3	5$^+$	2203.0	6$^+$	(D)		I_γ: others: 6 *1* (Eα=22 MeV), 5 *1* (Eα=24 MeV), 4 *1* (Eα=27 MeV). A_2=−0.14 *3*, A_4=−0.01 *5* (1987Pr06).
227.7 *3*	1 *1*	2445.5	3$^+$	2217.8	2$^+$			I_γ: others: 1 *1* (Eα=22 MeV), 1 *1* (Eα=24 MeV), 1 *1* (Eα=27 MeV).
247.0 *3*	1 *1*	4157.8		3910.8	10$^+$	D,Q		I_γ: others: 2 *1* (Eα=22 MeV), 2 *1* (Eα=24 MeV), 2 *1* (Eα=27 MeV). A_2=−0.16 *13*, A_4=−0.72 *24* (1987Pr06).
288.5 *3*	3 *1*	3910.8	10$^+$	3622.3	10$^+$	D+Q	−0.38 *10*	I_γ: others: 6 *1* (Eα=22 MeV), 13 *1* (Eα=24 MeV), 20 *1* (Eα=27 MeV). A_2=+0.24 *5*, A_4=−0.21 *7* (1987Pr06); A_2=−0.4 *4* (1973Ke07).
318.5 *3*	4 *1*	3678.0	8$^-$	3359.5	7$^+$	E1		I_γ: others: 5 *1* (Eα=22 MeV), 7 *1* (Eα=24 MeV), 9 *1* (Eα=27 MeV). A_2=−0.37 *6*, A_4=+0.10 *8* (1987Pr06). POL1=−0.40 9 (Eα=22 MeV), POL2=+0.57 *37*.
324.8 *3*	17 *1*	2415.3	5$^+$	2090.5	6$^+$	D+Q	−0.08 *3*	I_γ: others: 15 *1* (Eα=22 MeV), 13 *1* (Eα=24 MeV), 15 *1* (Eα=27 MeV). A_2=−0.04 *3*, A_4=+0.04 *4* (1987Pr06). δ: or −7.5 *15*.
363.9 *3*	3 *1*	2779.2	4$^+$	2415.3	5$^+$			I_γ: others: 3 *1* (Eα=22 MeV), 3 *1* (Eα=24 MeV), 8 *1* (Eα=27 MeV).
408.9 *3*	17 *1*	2307.5	4$^+$	1898.6	4$^+$	D+Q	−0.23 *7*	I_γ: others: 13 *1* (Eα=22 MeV), 10 *1* (Eα=24 MeV), 11 *1* (Eα=27 MeV). A_2=+0.20 *4*, A_4=+0.04 *4* (1987Pr06).
438.6 *3*	22 *1*	3622.3	10$^+$	3183.7	8$^+$	E2		I_γ: others: 39 *2* (Eα=22 MeV), 81 *3* (Eα=24 MeV), 109 *4* (Eα=27 MeV). A_2=+0.22 *1*, A_4=−0.05 *2* (1987Pr06); A_2=+0.43 *7*, A_4=+0.62 *8* (1973Ke07). Note that A_4 from 1973Ke07 indicates ΔJ=1, inconsistent with Mult=E2, ΔJ=2. POL1=+0.34 2, POL2=+0.44 *10*.
449.2 *3*	15 *1*	3632.9	9$^-$	3183.7	8$^+$	E1		I_γ: others: 24 *1* (Eα=22 MeV), 44 *2* (Eα=24 MeV), 50 *3* (Eα=27 MeV). A_2=−0.34 *3*, A_4=−0.00 *3* (1987Pr06). POL1=−0.44 3, POL2=+0.30 *10*.
462.8 *3*	444 *13*	1898.6	4$^+$	1435.8	2$^+$			I_γ: others: 472 *14* (Eα=22 MeV), 547 *16* (Eα=24 MeV), 546 *16* (Eα=27 MeV). POL1=+0.02 2, POL2=+0.03 *2*.
482.0 *3*	1 *1*	4114.9		3632.9	9$^-$	D,Q		I_γ: others: 2 *1* (Eα=22 MeV), 6 *1* (Eα=24 MeV), 7 *2* (Eα=27 MeV). A_2=−0.08 *12*, A_4=+0.19 *17* (1987Pr06).
[x]506.5 *3*	23 *2*							I_γ: others: 40 *2* (Eα=22 MeV), 11 *1* (Eα=24 MeV), 33 *4* (Eα=27 MeV).

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^{136}Xe(α,2nγ) 1987Pr06 (continued)

γ(^{138}Ba) (continued)

E_γ	I_γ †	E_i(level)	J^π_i	E_f	J^π_f	Mult.‡	δ‡	Comments
516.6 *3*	42 *2*	2415.3	5+	1898.6	4+	M1+E2	−0.11 *4*	I_γ: others: 41 *2* (Eα=22 MeV), 33 *1* (Eα=24 MeV), 28 *5* (Eα=27 MeV). A_2=−0.41 *5*, A_4=−0.12 *8* (1987Pr06). POL1=−0.31 8, POL2=−0.24 *21*.
546.9 *3*	6 *1*	2445.5	3+	1898.6	4+			I_γ: others: 4 *1* (Eα=22 MeV), 4 *1* (Eα=24 MeV), 7 *1* (Eα=27 MeV).
727.1 *3*	24 *1*	3910.8	10+	3183.7	8+	E2		I_γ: others: 51 *2* (Eα=22 MeV), 68 *3* (Eα=24 MeV), 114 *5* (Eα=27 MeV). Mult.: Q from γ(θ) and M2 ruled out by RUL. A_2=+0.24 *11*, A_4=−0.07 *14* (1987Pr06). POL1=+0.37 23, POL2=+0.45 *62*.
778.6 *3*	1 *1*	4689.4	12+	3910.8	10+	E2		I_γ: others: 10 *1* (Eα=22 MeV), 38 *2* (Eα=24 MeV), 74 *3* (Eα=27 MeV). Mult.: Q from γ(θ) and M2 ruled out by RUL. A_2=+0.34 *9*, A_4=−0.13 *11* (1987Pr06); A_2=+0.3 *2* (1973Ke07).
871.7 *3*	33 *2*	2307.5	4+	1435.8	2+			I_γ: others: 29 *2* (Eα=22 MeV), 19 *1* (Eα=24 MeV), 18 *12* (Eα=27 MeV).
944.2 *3*	16 *1*	3359.5	7+	2415.3	5+	E2		I_γ: others: 18 *2* (Eα=22 MeV), 18 *1* (Eα=24 MeV), 18 *2* (Eα=27 MeV). Mult.: Q from γ(θ) and M2 ruled out by RUL. A_2=+0.30 *12*, A_4=−0.06 *14* (1987Pr06).
952.7 *3*	4 *1*	2851.4	4+	1898.6	4+			I_γ: others: 2 *1*.
962.1 *3*	6 *2*	4584.4		3622.3	10+			I_γ: others: 4 *1* (Eα=22 MeV), 7 *1* (Eα=24 MeV), 8 *2* (Eα=27 MeV).
980.7 *3*	32 *2*	3183.7	8+	2203.0	6+	E2		I_γ: others: 53 *2* (Eα=22 MeV), 92 *4* (Eα=24 MeV), 104 *5* (Eα=27 MeV). Mult.: Q from γ(θ) and M2 ruled out by RUL. A_2=+0.28 *4*, A_4=−0.20 *7* (1987Pr06); A_2=+0.3 *2* (1973Ke07).
1009.7 *3*	25 *1*	2445.5	3+	1435.8	2+	D+Q	−2.90 *15*	I_γ: others: 20 *2* (Eα=22 MeV), 12 *1* (Eα=24 MeV), 10 *3* (Eα=27 MeV). A_2=−0.21 *13*, A_4=+0.04 *19* (1987Pr06). δ: or −0.14 *3*.
x1040.3 *3*	25 *1*							I_γ: others: 20 *2* (Eα=22 MeV), 20 *2* (Eα=24 MeV), 50 *5* (Eα=27 MeV).
1064.0 *3*	2 *1*	3154.5	4+	2090.5	6+			I_γ: others: 2 *1* (Eα=22 MeV), 1 *1* (Eα=24 MeV).
1093.3 *3*	101 *4*	3183.7	8+	2090.5	6+	E2		I_γ: others: 153 *6* (Eα=22 MeV), 281 *11* (Eα=24 MeV), 315 *1* (Eα=27 MeV). A_2=+0.26 *2*, A_4=−0.16 *3* (1987Pr06); A_2=+0.15 *10*, A_4=−0.02 *2* (1973Ke07). POL1=+0.36 5, POL2=+0.41 *13*.
1106.3 *3*	15 *1*	3309.5	(5,6,7)	2203.0	6+	D,Q		I_γ: others: 15 *1* (Eα=22 MeV), 16 *1* (Eα=24 MeV), 10 *3* (Eα=27 MeV). A_2=−0.15 *14*, A_4=+0.08 *21* (1987Pr06).
1147.1 *3*	8 *1*	2582.9	1+	1435.8	2+			I_γ: other: 8 *1* (Eα=22 MeV).
x1156.7 *3*	5 *1*							I_γ: others: 12 *5* (Eα=22 MeV), 8 *4* (Eα=24 MeV).
x1198.0 *3*	6 *2*							I_γ: others: 8 *3* (Eα=22 MeV), 20 *4* (Eα=24 MeV), 22 *6* (Eα=27 MeV).
1204.4 *3*	5 *3*	2640.2	2+	1435.8	2+			
1241.8 *3*	8 *2*	4864.2		3622.3	10+			I_γ: others: 10 *2* (Eα=22 MeV), 23 *5* (Eα=24 MeV), 21 *7* (Eα=27 MeV).
1264.7 *3*	17 *3*	3163.3	(2)+	1898.6	4+			I_γ: others: 21 *2* (Eα=22 MeV), 12 *2* (Eα=24 MeV).
1343.4 *3*	30 *3*	2779.2	4+	1435.8	2+			I_γ: others: 27 *4* (Eα=22 MeV), 18 *2* (Eα=24 MeV), 12 *4* (Eα=27 MeV).

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^{136}Xe(α,2nγ) 1987Pr06 (continued)

γ(^{138}Ba) (continued)

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[‡]	Comments
1358.6 *3*	5 *2*	3257.1	3	1898.6	4^+		I_γ: other: 5 *1* (Eα=22 MeV).
1406.9 *3*	15 *2*	3609.9		2203.0	6^+	D,Q	I_γ: others: 19 *2* (Eα=22 MeV), 23 *3* (Eα=24 MeV), 34 *5* (Eα=27 MeV). A_2=+0.43 *17*, A_4=+0.06 *22* (1987Pr06).
1415.7 *3*	24 *3*	2851.4	4^+	1435.8	2^+		I_γ: others: 17 *3* (Eα=22 MeV), 19 *3* (Eα=24 MeV), 11 *5* (Eα=27 MeV).
1435.8 *3*	1000 *44*	1435.8	2^+	0.0	0^+		I_γ: others: 1000 *44* (Eα=22 MeV), 1000 *44* (Eα=24 MeV), 1000 *46* (Eα=27 MeV). A_2=+0.03 *4*, A_4=+0.01 *5* (1987Pr06); A_2=+0.09 *12*, A_4=+0.09 *13* (1973Ke07).
1444.8 *3*	20 *3*	2880.6	3^-	1435.8	2^+		I_γ: other: 14 *3* (Eα=22 MeV).
1495.5 *3*	9 *3*	2931.3	2^+	1435.8	2^+		I_γ: other: 17 *12* (Eα=22 MeV).
1614.0 *3*	21 *2*	3049.8	2^+	1435.8	2^+		I_γ: other: 19 *3* (Eα=22 MeV).
1821.2 *3*	8 *3*	3257.1	3	1435.8	2^+		

[†] Quoted values are for bombarding energy at E(α)=20 MeV, θ=90°. Values for E(α)=22, 24 and 27 MeV in 1987Pr06 are given in comments. Values for all α bombarding energies are used in Adopted Gammas for getting adopted γ branching ratios if applicable.

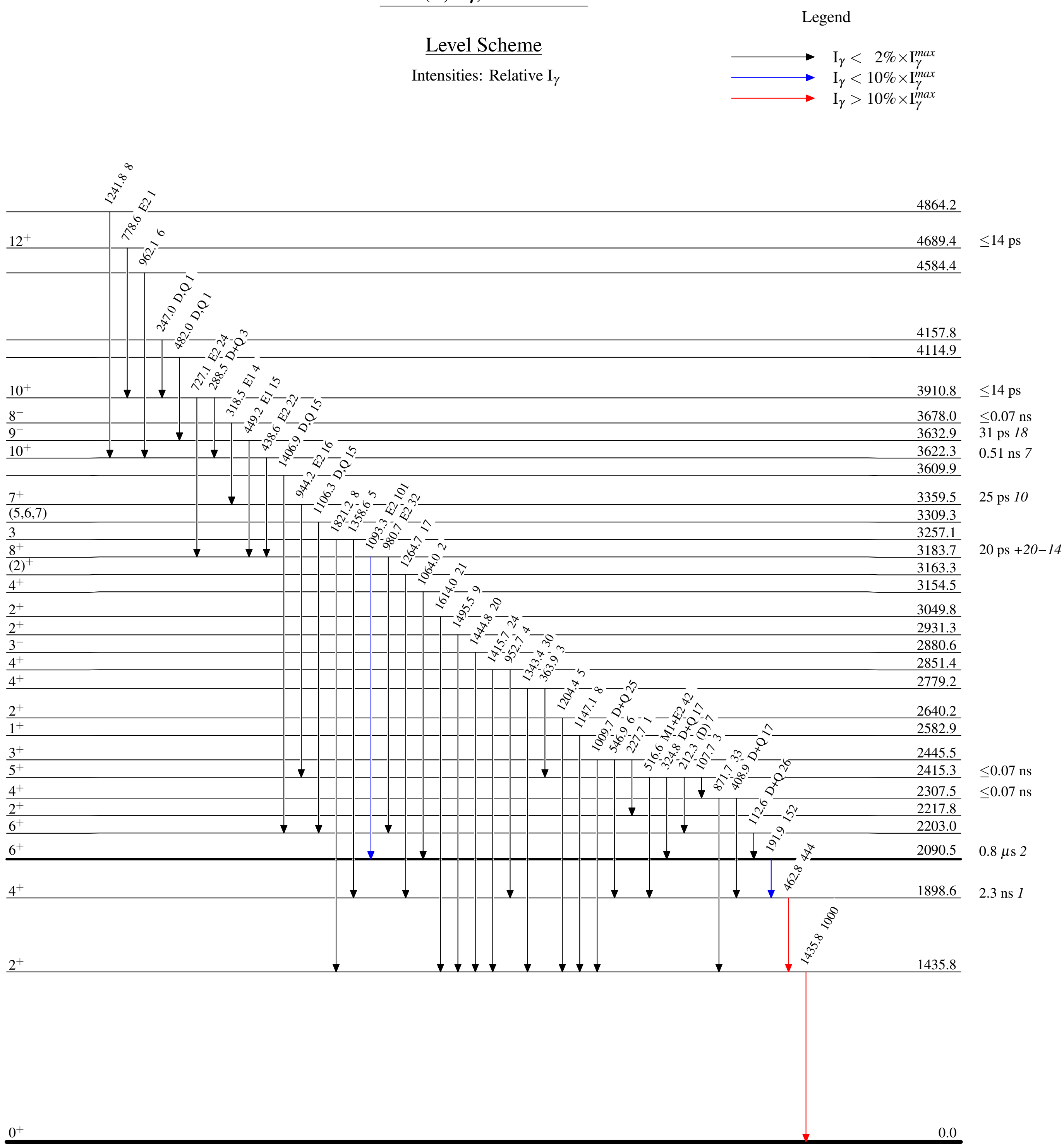
[‡] From 1987Pr06 based on measured $\gamma(\theta)$ and γ(pol), unless otherwise noted. Where there is no experimental evidence for the determination of polarity, the evaluator has replaced M1 or E1 with D, E2 with Q.

[x] γ ray not placed in level scheme.

^{136}Xe(α,2nγ) 1987Pr06

Level Scheme

Intensities: Relative I_γ



$^{138}_{56}Ba_{82}$