^{206}Pb(α,4nγ),^{206}Pb(^{3}He,3nγ) 1986Ra24

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	F. G. Kondev	NDS 201,346 (2025)	21-Jan-2025

Beam: E=53 MeV (α,4nγ); E=27 MeV (^{3}He,3nγ); Target: ^{206}Pb (90.4%), ^{207}Pb (6.7%) and ^{208}Pb (2.9%); Detectors: large co-axial Ge(Li) and small planar Ge(Li), Si(Li). Measured: excitation function, γ(θ), γγ(t) coin, γ(t), γ(θ), Ice, Eγ, Iγ.

^{206}Po Levels

E(level)[†]	J$^{\pi}$[‡]	$T_{1/2}$	Comments
0.0	0^{+}	8.8 d *1*	$T_{1/2}$: From Adopted Levels.
700.4 *4*	2^{+}		
1162.0 *4*	2^{+}		
1177.4 *6*	4^{+}		
1433.8 *6*	4^{+}		
1546.1 *7*	4^{+}		
1564.2 *8*	4^{+}		
1572.9 *7*	6^{+}		Configuration=$\pi(h^{+2}_{9/2})$.
1585.4 *8*	8^{+}	210 ns *10*	$T_{1/2}$: From 1986Ra24, deduced from 395γ(t), 477γ(t) and 700γ(t) after taking into account the contribution from the 9^{-} ($T_{1/2}$=1.0 μs *1*) isomer Others: 160 ns *40* (1970Ya03). g−factor=+0.919 *13* (1973Br14) using the stroboscopic technique. The value was corrected for Knight shift and diamagnetic effect; g-factor=0.916 *13*, weighted average of 0.905 *18* (deduced using the stroboscopic technique) and 0.926 *18* (deduced using the time-difference PAC technique) (1973Na18). Both values were corrected for Knight shift and diamagnetic effect. Configuration=$\pi(h^{+2}_{9/2})$.
2100.2 *7*	6^{+}		
2199.8 *9*	8^{+}		Configuration=$\pi(f^{+1}_{7/2},h^{+1}_{9/2})$.
2261.6 *9*	9^{-}	1.0 μs *1*	$T_{1/2}$: Unweighted average of 0.95 μs *10* (62γ(t)) and 1.1 μs *2* (614γ(t)) in 1986Ra24. Configuration=$\nu(f^{-1}_{5/2},i^{-1}_{13/2})$.
2302.0 *8*	5^{-}		J$^{\pi}$: Note that J^{π}=5^{+} in the Adopted Levels.
2418.2 *9*	10^{+}		
2422.2 *9*	9^{+}		
2590.2[#] *9*	10^{+}		
2656.0 *9*	11^{-}		Configuration=$\pi(h^{+1}_{9/2},i^{+1}_{13/2})$.
2780.1 *9*	11^{+}		
3067.5 *9*	11^{-}		
3462.3 *10*	13^{-}		
3484.9 *11*	12^{-}		J$^{\pi}$: 13^{-} in Adopted Levels.
3548.2 *11*	14^{-}		
3557.6 *11*	12^{-}		
3694.5[#] *12*	15^{-}		
3950.9 *12*	13^{-}		J$^{\pi}$: 14^{-} in Adopted Levels.
4075.1[#] *13*	16^{-}		
4105.2[#] *12*	15^{-}		
4144.0[#] *12*	15^{-}		
4613.8[#] *13*	16^{-}		J$^{\pi}$: 15^{+} in Adopted Levels.
4692.0[#] *12*	15		
4758.0[#] *13*	16		
5149.0[#] *13*	16		

† From a least-squares fit to Eγ.
‡ From 1986Ra24, based on the deduced transition multipolarities using α(K)exp, α(L)exp and γ(θ).
# This level was excluded from the Adopted Levels.

^{206}Pb(α,4nγ),^{206}Pb(^{3}He,3nγ) 1986Ra24 (continued)

γ(^{206}Po)

$E_γ$[†]	$I_γ$[@]	E_i(level)	$J^π_i$	E_f	$J^π_f$	Mult.[a]	Iγ[&]	Comments
12.5 *1*		1585.4	8+	1572.9	6+	[E2]		$E_γ$: From adopted gammas, based on γ-rays energy difference in ^{198}Pt(^{13}C,5nγ) in 1990Ba31.
61.8 *5*	26 *4*	2261.6	9−	2199.8	8+	E1	4.3 *2*	Mult.: From γ-ray intensity balance in the out-of-beam data.
85.9 *5*	8 *1*	3548.2	14−	3462.3	13−	M1		Mult.: From γ-ray intensity balance in the out-of-beam data.
146.3 *5*	2.4 *3*	3694.5	15−	3548.2	14−	M1		Mult.: A_2=−0.27 *3*, A_4=−0.11 *3*; γ-ray intensity balance in the out-of-beam data.
168.0 *5*	2.2 *2*	2590.2	10+	2422.2	9+	(M1)		Mult.: A_2=−0.26 *3*, A_4=−0.05 *3*; absence of measurable lifetime.
189.9 *5*	2.0 *2*	2780.1	11+	2590.2	10+	(M1)		Mult.: A_2=−0.33 *3*, A_4=−0.03 *3*; absence of measurable lifetime.
237.8 *5*	17 *2*	2656.0	11−	2418.2	10+	E1	2.7 *3*	Mult.: A_2=−0.23 *1*, A_4=0.01 *2*; A_2=−0.25 *8*, A_4=0.08 *13* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.05 (^{206}Pb(α,4nγ)); γ-ray intensity balance in the out-of-beam data.
256.4[‡] *5*		1433.8	4+	1177.4	4+	E2	2.6 *3*	Mult.: A_2=0.27 *2*, A_4=0.02 *3* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.10 *3* (^{206}Pb(^{3}He,3nγ)).
362.0 *5*	1.8 *2*	2780.1	11+	2418.2	10+	M1(+E2)		Mult.: A_2=−0.59 *5*, A_4=0.09 *7* α(K)exp=0.48 (^{206}Pb(α,4nγ)).
380.6[#] *5*	3.9 *5*	4075.1	16−	3694.5	15−	M1(+E2)		Mult.: A_2=−0.40 *3*, A_4=0.10 *4*; α(K)exp=0.221 (^{206}Pb(α,4nγ)).
384.1[‡] *5*		1546.1	4+	1162.0	2+	E2	1.0 *5*	Mult.: A_2=0.21 *8*, A_4=0.05 *10* (^{206}Pb(^{3}He,3nγ));
386.8[‡] *5*		1564.2	4+	1177.4	4+	M1(+E2)	3.4 *5*	Mult.: A_2=0.15 *4*, A_4=0.11 *6* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.20 *4* (^{206}Pb(^{3}He,3nγ)).
394.8 *5*	33 *4*	3462.3	13−	3067.5	11−	(E2)	4 *2*	Mult.: α(K)exp=0.033 (^{206}Pb(α,4nγ)) and 0.039 *3* (^{206}Pb(^{3}He,3nγ)). Note, that the 394.8 + 395.5 doublet has an average α(K)exp that agrees with E2.
395.5 *5*	94 *5*	1572.9	6+	1177.4	4+	E2	40 *2*	Mult.: A_2=0.17 *1*, A_4=−0.03 *2*; A_2=0.21 *1*, A_4=0.01 *20* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.033 (^{206}Pb(α,4nγ)) and 0.39 *3* (^{206}Pb(^{3}He,3nγ)). Note that the 394.8 + 395.5 doublet has an average α(K)exp that agrees with E2.
457.0[#] *5*	5.3 *8*	5149.0	16	4692.0	15	M1		Mult.: A_2=−0.28 *2*, A_4=0.08 *2*; α(K)exp=0.154 (^{206}Pb(α,4nγ)).
461.6[‡] *5*		1162.0	2+	700.4	2+	M1	0.8 *2*	Mult.: A_2=0.24 *2*, A_4=−0.12 *2* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.13 *1* (^{206}Pb(^{3}He,3nγ)).
466.0 *5*	2.5 *4*	3950.9	13−	3484.9	12−	M1(+E2)		Mult.: A_2=−0.43 *4*, A_4=0.11 *5*; α(K)exp=0.15 (^{206}Pb(α,4nγ)).
469.8[#] *5*	1.6 *4*	4613.8	16−	4144.0	15−	M1		Mult.: A_2=−0.19 *5*, A_4=0.15 *7*; α(K)exp=0.14 (^{206}Pb(α,4nγ)).
477.1 *5*	98 *2*	1177.4	4+	700.4	2+	E2	73 *3*	Mult.: A_2=0.10 *2*, A_4=0.00 *2*; A_2=0.18 *2*, A_4=0.02 *2* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.027 (^{206}Pb(α,4nγ)) and 0.13 *1* (^{206}Pb(^{3}He,3nγ)).
527.4[‡] *5*		2100.2	6+	1572.9	6+	M1	1.4 *3*	Mult.: α(K)exp=0.09 *1* (^{206}Pb(^{3}He,3nγ)).
557.0[#] *5*	2.8 *5*	4105.2	15−	3548.2	14−	M1(+E2)		Mult.: A_2=−0.07 *3*, A_4=0.18 *4*; α(K)exp=0.085 (^{206}Pb(α,4nγ)).
595.8[#] *5*	6.2 *8*	4144.0	15−	3548.2	14−	M1(+E2)		Mult.: A_2=−0.52 *2*, A_4=0.05 *2*; α(K)exp=0.094 (^{206}Pb(α,4nγ)).
614.4 *5*	37 *2*	2199.8	8+	1585.4	8+	M1(+E2)	9.2 *5*	Mult.: A_2=0.08 *1*, A_4=0.02 *2*; A_2=0.19 *2*, A_4=0.02 *3*

Continued on next page (footnotes at end of table)

^{206}Pb(α,4nγ),^{206}Pb(^{3}He,3nγ) 1986Ra24 (continued)

γ(^{206}Po) (continued)

E_γ[†]	I_γ[@]	E_i(level)	J^π_i	E_f	J^π_f	Mult.[a]	$I\gamma$[&]	Comments
								(^{206}Pb(^{3}He,3nγ)); α(K)exp=0.057 (^{206}Pb(α,4nγ)) and 0.060 *4* (^{206}Pb(^{3}He,3nγ)).
676.2 *5*	5 *1*	2261.6	9$^-$	1585.4	8$^+$	(E1)	1.2 *3*	Mult.: A_2=−0.08 *1*, A_4=0.10 *2*;
700.3 *5*	100	700.4	2$^+$	0.0	0$^+$	E2	100	Mult.: A_2=0.11 *1*, A_4=0.00 *2*.
733.4[‡] *5*		1433.8	4$^+$	700.4	2$^+$	E2	6.7 *3*	Mult.: A_2=0.09 *1*, A_4=0.03 *1* (^{206}Pb(^{3}He,3nγ)). Note, that the A_2 value is inconsistent with the proposed multipolarity; α(K)exp=0.017 *2* (^{206}Pb(^{3}He,3nγ)).
805.9 *5*	38 *2*	3067.5	11$^-$	2261.6	9$^-$	E2	4 *1*	Mult.: A_2=0.31 *2*, A_4=0.08 *2* α(K)exp=0.010 (^{206}Pb(α,4nγ)). Note, that the 805.9 + 806.3 doublet has an average α(K)exp that agrees with E2.
806.3 *5*	6 *1*	3462.3	13$^-$	2656.0	11$^-$	(E2)		Mult.: α(K)exp=0.010 (^{206}Pb(α,4nγ)). Note that the 805.9 + 806.3 doublet has an average α(K)exp that agrees with E2.
828.9 *5*	4.9 *8*	3484.9	12$^-$	2656.0	11$^-$	M1(+E2)	0.2 *1*	Mult.: $A_2\approx$0; α(K)exp=0.027 (^{206}Pb(α,4nγ)).
832.8 *5*	23 *2*	2418.2	10$^+$	1585.4	8$^+$	E2	5.0 *5*	Mult.: A_2=0.31 *3*, A_4=−0.07 *4*; A_2=0.54 *12*, A_4=−0.05 *15* (^{206}Pb(^{3}He,3nγ)); α(K)exp=0.010 (^{206}Pb(α,4nγ)) and 0.011 *4* (^{206}Pb(^{3}He,3nγ)).
836.8 *5*	10 *1*	2422.2	9$^+$	1585.4	8$^+$	M1	5.0 *5*	Mult.: A_2=−0.33 *5*, A_4=0.50 *7*; α(K)exp=0.029 (^{206}Pb(α,4nγ)) and 0.023 *5* (^{206}Pb(^{3}He,3nγ)).
868.2[‡] *5*		2302.0	5$^-$	1433.8	4$^+$	E1	3.2 *3*	Mult.: A_2=−0.10 *5*, A_4=0.11 *8* (^{206}Pb(^{3}He,3nγ)); α(K)exp<0.005 (^{206}Pb(α,4nγ)).
901.6 *5*	1.5 *3*	3557.6	12$^-$	2656.0	11$^-$	M1	9.2 *5*	Mult.: A_2=−0.22 *5*, A_4=0.64 *7*; α(K)exp=0.04 (^{206}Pb(α,4nγ)).
922.7[‡] *5*		2100.2	6$^+$	1177.4	4$^+$	E2	3.3 *3*	Mult.: A_2=0.25 *6*, A_4=−0.12 *9* (^{206}Pb(^{3}He,3nγ));
1063.5[#] *5*	3.9 *5*	4758.0	16	3694.5	15$^-$	D		Mult.: A_2=−0.35 *5*, A_4=−0.07 *4*.
1143.8[#] *5*	4.2 *5*	4692.0	15	3548.2	14$^-$	D		Mult.: A_2=−0.31 *3*, A_4=0.08 *4*.
1162.1[‡] *5*		1162.0	2$^+$	0.0	0$^+$	E2	0.8 *2*	Mult.: A_2=0.20 *7*, A_4=−0.13 *10* (^{206}Pb(^{3}He,3nγ)).

[†] From 1986Ra24. $\Delta E\gamma$=0.5 keV was assigned by the evaluator.
[‡] Seen only in ^{206}Pb(^{3}He,3nγ).
[#] Different placement in the Adopted Levels, gammas.
[@] From ^{206}Pb(α,4nγ) experiment at 53 MeV in 1986Ra24.
[&] From ^{206}Pb(^{3}He,3nγ) experiment at 27 MeV in 1986Ra24.
[a] Deduced from α(K)exp and $\gamma(\theta)$ data (1986Ra24). The α(K)exp are normalized to α(K) (700.3γ)=0.0114 E2 (theory) value. The A_2 and A_4 values given in the comments section are from the ^{206}Pb(α,4nγ) data set, unless otherwise stated.

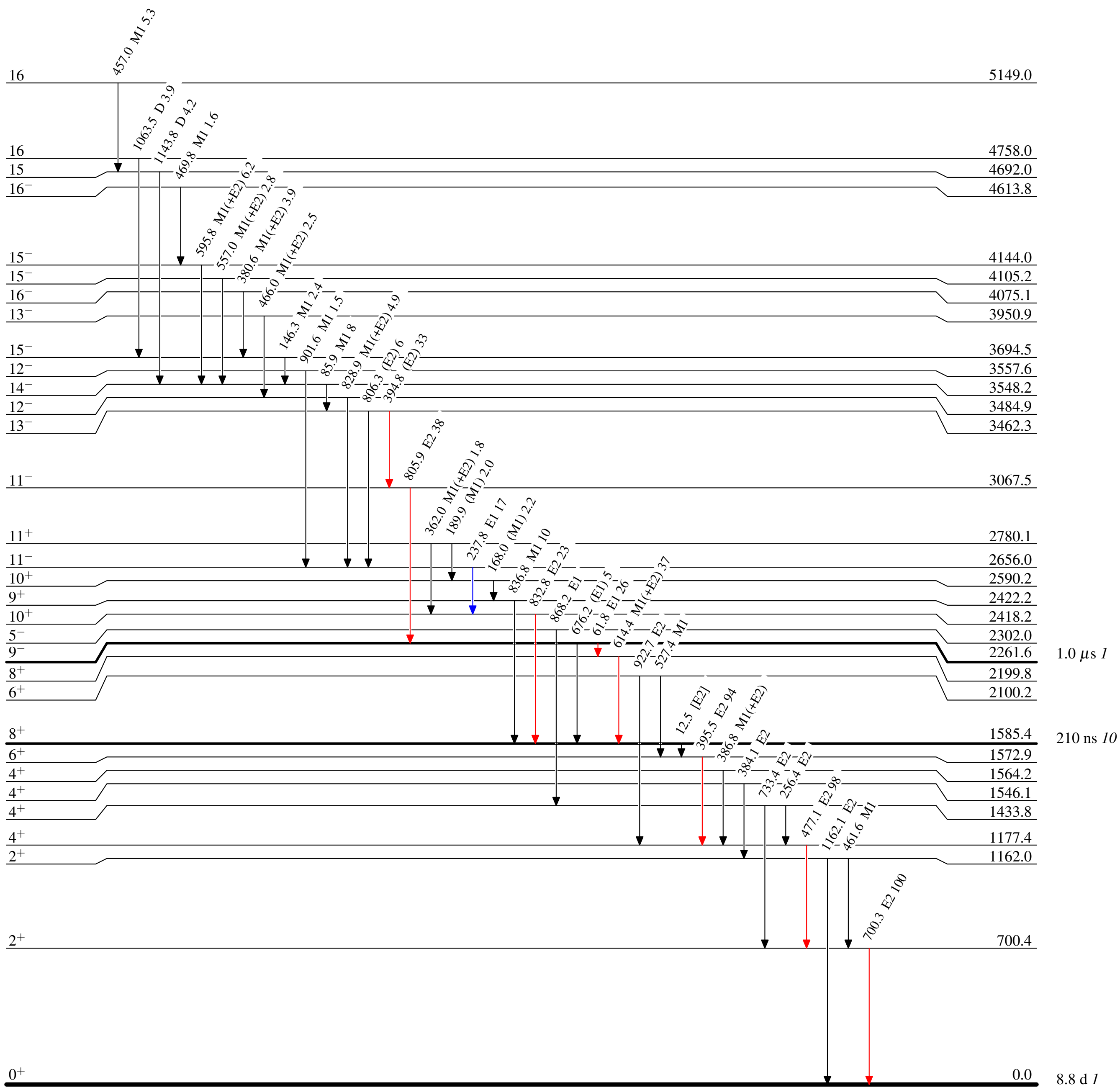
$^{206}Pb(\alpha,4n\gamma),^{206}Pb(^{3}He,3n\gamma)$ 1986Ra24

Level Scheme

Intensities: Relative I_γ

Legend

- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$



$^{206}_{84}Po_{122}$