

LIFETIME MEASUREMENTS
OF NEGATIVE PARITY STATES IN ^{34}Cl

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The decay scheme (Fig. 1) of high-spin states in ^{34}Cl has been established from data taken in $^{27}\text{Al}(^{12}\text{C}, \alpha n)^{34}\text{Cl}$ and $^{31}\text{P}(\alpha, n)^{34}\text{Cl}$ reactions ¹. The lifetimes of the 4743 keV ($J^\pi=6^-$), 3632 keV ($J^\pi=5^-$) and 3600 keV ($J^\pi=4^-$) levels were measured by the recoil distance method in the $^{31}\text{P}(\alpha, n)^{34}\text{Cl}$ reaction at 13 MeV and 14.6 MeV, where a strong direct population of these levels has been observed. The obtained values for the lifetimes are reported in Table I. Transition strengths have been calculated (Table I) taking into account lifetimes, branching and multipole mixing ratios. The value ($\tau = 7 \pm 3$ ps) for the 4743 keV level allows the determination of the negative parity for this state. We note that this level has not been observed with the (α, d) reaction ^{2, 3}.

According to the weak-coupling model, the center of gravity of the negative parity multiplet ($f_{7/2}, d_{3/2}$) $J^\pi=2^-_5$ is 3.82 MeV. This value is in agreement with the $(2J+1)$ weighted mean energy of the first 2^- , 3^- , 4^- and 5^- levels, which is found at 3.46 MeV.

The E2 single-particle transition strength (0.38 W.u.) calculated between the 4^- and 2^- states is much lower than the experimental value (4.6 ± 1.0 W.u.). Furthermore the E2 transition strength between the 5315 keV and 4824 keV levels whose configurations are respectively $(f_{7/2})^2 J^\pi=7^+$ and $(f_{7/2}, p_{3/2}) J^\pi=5^+$ according to Ref. ^{2, 3} depends on the single-particle matrix element $\langle p_{3/2} \parallel E2 \parallel f_{7/2} \rangle$. Using effective charges of $e_p = 1.6e$ and $e_n = 0.7e$, the theoretical E2 strength is 9.4 W.u. which again is below the measured value of 30 ± 4 W.u. These differences suggest a collective enhancement for the E2 transitions in ^{34}Cl .

The 6^- level can result from the coupling of the 3^+ state at 146 keV, which has a $(d_{3/2})^2 J^\pi=3^+$ configuration, to a 3^- octopole vibration of the core (^{32}S). The E3 transition strength for the 6^- to the 3^+ transition in ^{34}Cl (22 ± 9 W.u.) is to be compared to the E3 strength of the transition deexciting the 3^- octopole vibration in ^{32}S (23 ± 5 W.u.). These two values are in good agreement.

REFERENCES

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TABLE I

E_i (keV)	E_f (keV)	Branching ratio (%)	$J_i^\pi - J_f^\pi$	τ (ps)	Transition strengths (W.u.)
5315	4824	66 ^{a)}	$7^+ - 5^+$	94 ± 12 ^{a)}	$E2 = 30 \pm 4$
	4743	34			$E1 = (6.1 \pm 0.8) 10^{-4}$
4743	3632	30 ^{a)}	$6^- - 5^-$	7 ± 3	$M1 = (9.8 \pm 4.2) 10^{-4}$
	3600	43	$6^- - 4^-$		$E2 = 3.9 \pm 1.7$
	146	27	$6^- - 3^+$		$E3 = 22 \pm 9$
3632	2376	67 ^{a)}	$5^- - 4^+$	280 ± 60	$E1 = (1.1 \pm 0.2) 10^{-6}$
	146	33	$5^- - 3^+$		$M2 = (9.4 \pm 2.0) 10^{-3}$
3600	2722	46 ^{b)}	$4^- - 2^-$	23 ± 5	$E2 = 4.6 \pm 1.0$
	2376	7	$4^- - 4^+$		$E1 = (1.5 \pm 0.3) 10^{-6}$
	146	47	$4^- - 3^+$		$E1 = (4.6 \pm 1.0) 10^{-7}$

a) Ref. 1 b) Ref. 4

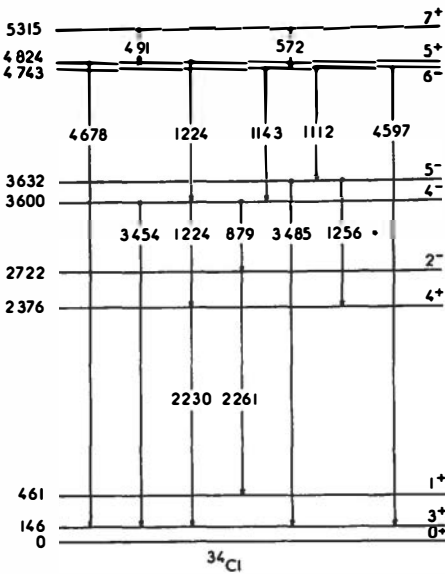


Fig. 1. Decay scheme of high-spin states in ³⁴Cl.