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V–14 Gamma-Gamma Directional Correlation in ^{147}Pm*

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The level at 490 keV in ^{147}Pm has been assigned spins $3/2^+$, $5/2^+$ and $7/2^+$.[1] More recently the spin assignments $5/2^+$ and $7/2^+$ have been favoured.[2] There is also a considerable uncertainty in the measured mixing ratio of some of the gamma rays. With the availability of recent intensity data[2-4] taken with Ge(Li) detectors, it is possible to measure the mixing ratio of some of the γ-rays and decide about the spin of the 490 keV level.

In the present work, we have measured the gamma-gamma directional correlation of seven cascades in the decay of ^{147}Nd. This has been done by using pairs of $3'' \times 3''$ and $2'' \times 2''$ NaI(Tl) crystals along with fast-slow coincidence circuits. Corrections for the interfering cascades were made by using recent intensity data taken with Ge(Li) detectors.[3] We have attempted the angular correlation of 275–410 keV cascade for the first time. This cascade yields the mixing ratio of 410 keV gamma ray which has not been determined accurately so far.

Our angular correlation data for 398–91 keV cascade taken in conjunction with the mixing ratio of 398 keV gamma ray[5] requires spin assignments of $5/2^+$ to the 490 keV level. This yields the mixing of 198 keV transition to be M1 + (82 ± 4)% E2 which is in agreement with the internal conversion data.[3] Table I shows the summary of the results obtained in our measurements.

References

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Table I. Summary of gamma-gamma directional correlation analysis in ^{147}Pm.

Cascade (keV) with spin sequence	Correlation coefficient	Gamma ray energy	Multipole admixture
596–91 ($5/2^+ \rightarrow 5/2^+ \rightarrow 7/2^+$)	$A_2 = 0.022 \pm 0.019$, $A_4 = -0.012 \pm 0.033$	596	M1 + (19^{+6}_{-4})% E2
275–410 ($5/2^+ \rightarrow 3/2^+ \rightarrow 7/2^+$)	$A_2 = 0.021 \pm 0.007$, $A_4 = 0.0013 \pm 0.0050$	410	E2 + 3.8% M3
275–319 ($5/2^+ \rightarrow 3/2^+ \rightarrow 3/2^+$)	$A_2 = 0.022 \pm 0.009$, $A_4 = -0.009 \pm 0.016$	319	M1 + 0.5% E2
197–398 ($5/2^+ \rightarrow 5/2^+ \rightarrow 5/2^+$)	$A_2 = 0.062 \pm 0.012$, $A_4 = 0.070 \pm 0.021$	197	M1 + (82 ± 4)% E2
319–91 ($3/2^+ \rightarrow 5/2^+ \rightarrow 7/2^+$)	$A_2 = 0.107 \pm 0.008$, $A_4 = 0.005 \pm 0.015$	319	M1 + $(1.5^{+1.9}_{-1.5})$% E2
398–91 ($5/2^+ \rightarrow 5/2^+ \rightarrow 7/2^+$)	$A_2 = -0.062 \pm 0.018$, $A_4 = -0.008 \pm 0.00$	398	M1 + (5 ± 1.5)% E2
440–91 ($5/2^+ \rightarrow 5/2^+ \rightarrow 7/2^+$)	$A_2 = 0.053 \pm 0.013$, $A_4 = 0$	440	M1 + (25^{+4}_{-3})% E2

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