Contribution ID: **168** Type: **Poster**

Lifetime measurement of nearly degenerate band in ^{126}I: Search for chiral geometry

The nuclear mass $\sim$ 130 is the most promising region in search of chiral symmetry. The two nearly degenerate (ΔI = 1) bands, based on the particle configuration $\pi h_{11/2} \otimes \nu h_{11/2}$, are the initial evidence of chiral behavior in nuclei, as found in ^{126}I [1]. The electromagnetic selection rules of inter-band and intra-band provide a tenacious proof of chiral bands. In the present work, we have experimentally determined the lifetimes and transition probabilities of proposed chiral states in ^{126}I using the technique of Doppler shift attenuation method.
The high spin states of ^{126}I were populated *via* the reaction ^{124}Sn(^{7}Li, 5n)^{126}I at 50 MeV beam energy using 15 Compton suppressed HPGe clover detectors installed in the Indian National Gamma Array at Inter University Accelerator Centre, New Delhi, India. The target was an enriched (99.4\%) ^{124}Sn foil of thickness 2.7 mg/cm^2. Three asymmetric matrices - corresponding to 32° *vs.* all detectors for the forward Doppler shift, 148° *vs.* all for the backward Doppler shift and 90° *vs.* all for the full unshifted γ-peak to examine contamination - were created from the triple-coincidence data. We analyzed the data by fitting globally and simultaneously all the concerned γ-peaks for the angles 32° and 148° using the Lineshape program.
We deduced the reduced transition probabilities (B(E2)) from lifetime values found in picoseconds. For the proposed chiral band [1], some of our tentative results at spins 17^+, 18^+ and 19^+ were 0.11, 0.04 and 0.05 (all in e^2b^2), respectively. There seemed a little staggering in B(E2) values. We performed the two-quasi-particle-plus rotor model calculation and found a good agreement with the experimental B(E2) values. However, the theoretical values were approximately equal without any staggering.

[1] Bhushan *et al.*, Phys. Rev. C 88, 054306 (2013).

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Session Classification: POSTER SESSION