High spin structures in ^{109}In

D. Negi[1],* T. Trivedi[2], A. Dhal[1], S. Roy[3], V. Kumar[4], S. Kumar[4], M.K. Raja[5], S. Appanna Babu[6], G. Mohanto[1], J. Kaur[7], R. K. Sinha[8], D. Choudhury[9], D. Singh[1], R. Kumar[1], R. P. Singh[1], S. Muralithar[1], A. K. Bhati[7], S. C. Pancholi[1], and R. K. Bhowmik[1]

[1]*Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi - 110067, INDIA*
[2]*Department of Physics, University of Allahabad, Allahabad - 211002, INDIA*
[3]*S.N.Bose National Centre for Basic Sciences, Kolkata - 7000098, INDIA*
[4]*Department of Physics & Astrophysics, University of Delhi - 110007, INDIA*
[5]*Department of Nuclear Physics, Andhra University, Visakhapatnam's - 530003, INDIA*
[6]*Department of Physics, M.S. University of Baroda, Vadodara - 390002, INDIA*
[7]*Department of Physics, Punjab University, Chandigarh - 160014, INDIA*
[8]*Department of Physics, Banaras Hindu university, Varanasi - 221005, INDIA and*
[9]*Department of Physics, Indian Insititute of Technology, Roorkee - 247667, INDIA*

Introduction

Nuclei in the $A = 110$ mass region have been of considerable interest for the past few years especially due to the observation of several $\Delta I = 1$ magnetic dipole sequences [1, 2]. In most of the cases these rotational like bands have been interpreted due to the 'shears mechanism', which is described within the framework of tilted axis cranking model (TAC). In recent years, systematic studies have been carried out to identify the boundaries of the existence of the phenomenon in Ag and Cd isotopes [2, 3]. In the present work, nuclear structure at high spins in ^{109}In was investigated. A ΔI =1 band populated to high spins has been interpreted as magnetic rotational band.

Experimental Details

High spin states in ^{109}In were populated in the reaction ^{96}Zr(^{19}F, *6n*)^{109}In at a beam energy of 105 MeV. The emitted γ transitions were detected by the Indian National Gamma Array (INGA) at IUAC, which at the time of experiment consisted of 14 clover detectors. Target of thickness 1.0 mg/cm^2 with a 20.0 mg/cm^2 thick Pb as backing was used. The data were taken in triple coincidence mode with a total of three hundred million $\gamma - \gamma - \gamma$ events being recorded. The data were sorted using INGASORT program. After matching the gain to 0.5 keV/channel, different 4k $\times$ 4k matrices were made and the symmetrized matrix compatible with the radware format was used in the RADWARE program for coincidence analysis.

Results and Discussion

The level scheme deduced from the present work is shown in Fig. 1. It has been considerably modified in comparison to earlier works. Based on coincidence and intensity relationships along with the directional coorelation from oriented nuclear state (DCO), three $M1$ bands have been established. Band 1 has been identified as a case of magnetic rotational band. This is evident from Fig. 2, where a comparison of plots of the observed spins as a function of angular frequency for this band and the band 1 in ^{107}In is made. Band 1 in ^{107}In has been established as a magnetic rotational band with the configuration $\pi(g_{9/2})^{-1}\otimes\nu[h_{11/2}(g_{7/2},d_{5/2})]$ before the alignment of pair of neutrons in $(g_{7/2},d_{5/2})$ orbitals and the configuration $\pi(g_{9/2})^{-1}\otimes\nu[h_{11/2}(g_{7/2},d_{5/2})^3]$ after the alignment [4]. The similar nature of the plots, *viz.* the alignment gain and the crossing frequency, indicates the participation of same pair of neutrons in the alignment in band

*Electronic address: din_physics@yahoo.co.in

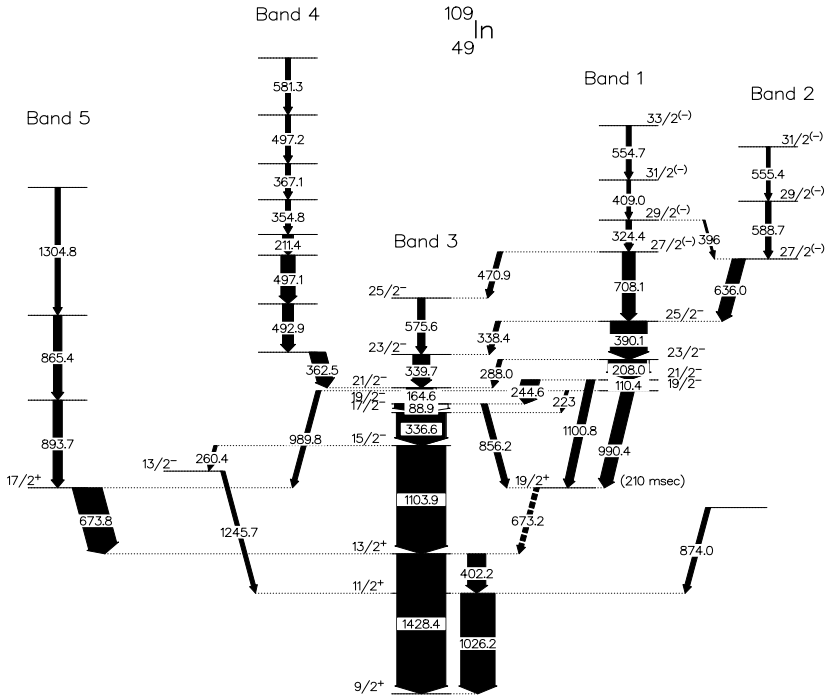

FIG. 1: Level scheme of ^{109}In deduced from the present work.

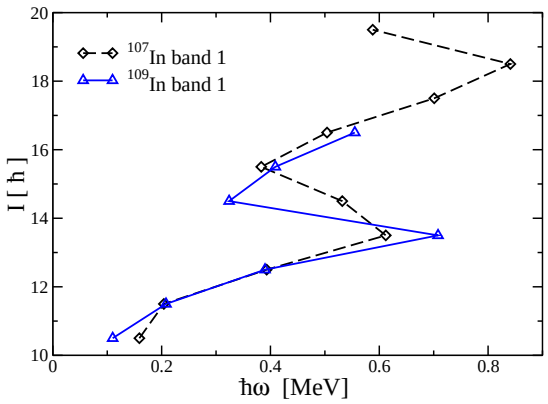

FIG. 2: Angular momentum as a function of rotational frequency for band 1 in ^{107}In and ^{109}In.

1 of ^{109}In as in ^{107}In . The semi-classical calculations [5] done for the states before the alignment in band 1 in both ^{107}In and ^{109}In show that the relative contribution of core towards the angular momentum generation is similar in both the nuclei.

Acknowledgments

We would like to thanks the pelletron staff at IUAC and INGA collaboration. D.N. would like to acknowledge CSIR for the financial grant.

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