Chiral Structure in ^{120}I

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Introduction

The transitional region with A∼120 has gained a substantial preference in high spin spectroscopic studies due to the observance of various dynamical features such as backbending, shape coexistence, high spin phase transition, and signature splitting, octupole collectivity and chirality. These properties arise mainly because of the softness [1, 2] of the nuclei towards γ deformation resulting from the number of valence nucleons outside the closed shell [3]. Both the valence protons and neutrons are expected to have strong and specific shape driving force on the core when occupying the high-j orbitals that are close to Fermi surface. The proton Fermi surface lies just below the $h_{11/2}$ subshell, while the neutron Fermi surface lies in the $h_{11/2}$ midshell. The nuclei near Z=50 closure exhibit both single particle as well as collective excitations which result from the different deformations due to the involement of different quasiparticle orbitals. The present study reports an investigation of level scheme of odd-odd ^{120}I. Previously, this nucleus has been investigated by several groups [4–6]. By the powerfull detector array the above mentioned features can be studied.

Experimental details

Excited states in the ^{120}I nucleus (Z=53, N=67) were populated in the ^{112}Cd(^{11}B,3n)^{120}I fusion-evaporation reaction at E_{lab}= 50 MeV. The de-excitations were investigated through in-beam γ-ray spectroscopic techniques. The ^{11}B beam was provided by the Pelletron-LINAC facility at TIFR, Mumbai. The ^{112}Cd target of thickness ∼3 mg/cm^2 was prepared onto a ∼ 8 mg/cm^2 thick Pb backing. The recoiling nuclei in the excited states were stopped within the target and the de-exciting γ-rays were detected using the Indian National Gamma Array (INGA) consisting of 16 Compton suppressed clover detectors. Two and higher fold clover coincidence events were recorded in a fast digital data aquisition system based on Pixie-16 modules of XIA LLC [7]. The data sorting routine "Multi

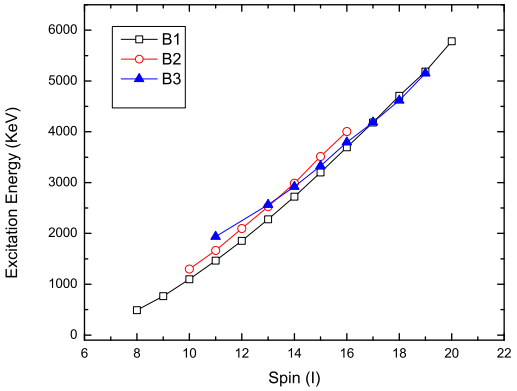

FIG. 1: The excitation energy vs spin plot for B1-B3 degenerate bands of ^{120}I.

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pARameter time stamped based COincidence Search program (MARCOS)", developed at TIFR, sorts the time stamped data to generate E_γ-E_γ matrices and E_γ-E_γ-E_γ cubes compatible with Radware format. The DCO ratios has been performed for the γ rays.

Discussion

The present level scheme of doubly-odd ^{120}I is built on the $I^\pi = 2^-$ ground state ($T_{1/2}$ = 81 min) [4–6]. The level scheme has been extended substantially with addition of about fifty new transitions and one new band to the earlier reported ones [4–6]. The level scheme is established up to $\sim$ 8 MeV excitation energy and level in B1-B10 band structures. The previous reported low-lying band structure is confirmed [6]. Present level scheme differ from the previous reported work [5] in the positive-parity band structures and at lower spin. In previous in-beam studies,[4, 8] the decay of band B1 is followed down to an isomeric state with $T_{1/2} = 53$ min. Band B1 is previously established up to the (16^-) state [4]. In recent work, it has been extended up to $I^\pi = 18^-$, tentatively up to (19^-). But in present work 276-, 334-, 366-,392-, 420-, 447-, 476-, 497 kev transitions are confirmed up to $I^\pi = 16^-$. Further this is extended with 488, 476, and 596 keV transitions at the top and confirmed up to (20^-). The crossover of 488-, 525-, 476-, and 525 kev transitions are observed. Previously observed 530- and 541 keV transitions are placed as cascade at $I^\pi = 17^-$. Previous β decay studies (see Ref. [9] and Refs. therein) show that this isomer decays directly into states in ^{120}Te and that the spin of the isomer is either 7 or 6, with 7 being more likely [5]. The triaxial projected shell model (TPSM) approach has been applied to reproduce the properties of chiral band structure in this nucleus. The results of data analysis in framework of TPSM will be presented in symposium.

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