Structure of ^{108}Ag at Low and Medium Spin

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Introduction

Study of band structures of nuclei from symmetry consideration plays an important role in understanding different phenomena in nuclear structure. In selected regions of the nuclear landscape, axial symmetry is broken and these nuclei, referred to as transitional nuclei, are described using the triaxial deformed mean-field. There are several empirical observations indicating that axial symmetry is broken in transitional regions. The structure of the gamma vibrational bands and their decay provide information about the nature of triaxial shapes. In addition, the chiral rotation is uniquely related to the triaxial nuclear shapes. Recently, RMF calculations [1] predict multiple chiral bands in some of the odd-odd isotopes of Ag, Rh and In owing to their triaxial shape. However, in our recent work, the lifetime measurements of the excited states of ^{112}In along with the Tilted Axis Cranking calculations suggest small axially symmetric deformation for this nucleus at lower excitation energy in contradiction to the predictions of RMF calculations [2]. As a part of this investigation to look for multiple chiral bands, the detailed spectroscopy of ^{108}Ag was carried out up to medium spin in the present work. The present measurement also aims to look at the low-lying states near the isomer with energy 111 keV and $T_{1/2} = 418$ years to understand and estimate the induced depletion of this long-lived isomer [3].

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Experimental Details and Results

Excited states of ^{108}Ag were produced in the in-beam experiment using ^{11}B + ^{100}Mo reaction at 39 MeV beam energy. The ^{11}B beam was provided by the Pelletron Linac facility at Mumbai. The target consisted of 10 mg/cm^2 self-supporting foil of ^{100}Mo.The emitted gamma rays from the excited states were detected using the Indian National Gamma Array (INGA) consisting of eighteen Compton suppressed clover detectors. Two and higher fold clover coincidence events were recorded in a fast digital data acquisition system based on Pixie-16 modules of XIA LLC [4]. The data sorting routine "Multi pARameter time-stamped based COincidence Search program (MARCOS)"developed at TIFR, sorts the time stamped data to generate $E_\gamma - E_\gamma$ matrix and $E_\gamma - E_\gamma - E_\gamma$ cube. The spins and parities of the levels were assigned by using the directional correlation of oriented nuclei (DCO) ratio analysis followed by the linear polarization

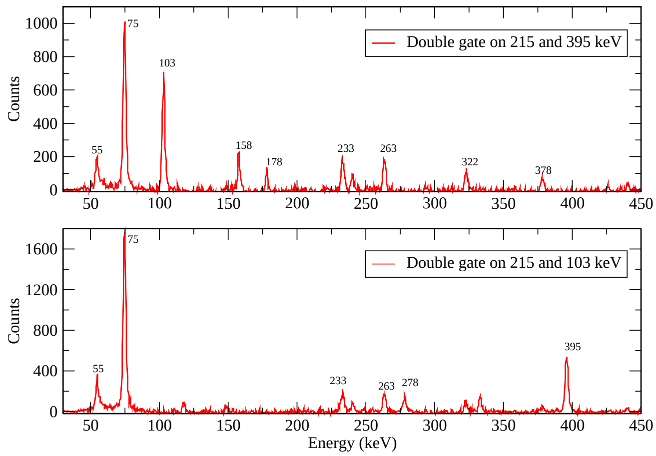

FIG. 1: Double gated spectra showing the transitions of the positive parity band and low-lying states of ^{108}Ag.

measurements of various transitions.

The previously known level scheme of ^{108}Ag was substaintially extended with addition of around forty new transitions [5]. This work includes modification of the previously known level scheme due to the available of 4×10^8 events in the $E_\gamma - E_\gamma - E_\gamma$ cube. Two double gated spectra obtained in coincidence with 215 - 395 keV and 215 - 103 keV transitions are shown in Fig. 1. These two spectra depict the 233 - 263 - 322 - 378 - 440 keV cascade present in the positive parity dipole band. Similar dipole band has been observed in ^{112}In with $\pi g_{9/2}^{-1} \otimes \nu(d_{5/2}/g_{7/2})(h_{11/2})^2$ quasiparticle configuration [2]. In addition, these two spectra also firmly establish the modification of the previous level scheme for the decay of 513 keV state by the 55 - 103 - 75 - 75 -215 keV transitions to the ground state due to the 178 keV transition seen in the 215 and 395 keV double gated spectrum. A dipole band up to $J^\pi = 18^+$ with its levels degenerate in energy with the respective spin states in the yrast negative parity band has been identified along with a number of connecting transitions. Projected shell model (PSM) calculations were performed for different quasiparticle configurations of this doubly odd nucleus. Detailed comparison of the measured energy levels of the bands and their B(M1)/B(E2) ratios with that of the model calculations will be presented.

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