Low -lying states near $I^{\pi} = 5^{+}$ Ground State in ^{102}Ag

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Introduction

The level strutures of nuclei approaching the neutron and proton major shell closures at N=Z=50 are complex due the interplay between the single-particle and collective degrees of freedom. Various new deformation generating mechanisms have been identified in theoretical interpretation of the observed level structures. Investigations have revealed diversity in level structures resulting from coupling of the $g_{9/2}$, $d_{5/2}$, $g_{7/2}$, and $h_{11/2}$ valence nucleons and the core-excited configurations. The relevant intringuing triaxiality based phenomena such as magnetic rotation [1] and degenrate twin bands have been reported in this mass region [2].

Nuclear metastable states with half-lives longer than a few nanoseconds may be found in many nuclides in the nuclear landscape. With the increasing sensitivity of different measuring techniques, a number of new isomers are discovered with various spectrometers at new accelerator facilities. These isomers provide a tool to study the different nuclear structure models. In particular, nuclear isomers have the potential to provide material with high energy storage capacity with controlled release of its energy on demand [3–5]. Spectroscopic measurements of the excited states around these isomers are important for evaluation of the depletion pathways of the isomers and the associated rates. The motivation of the present work is to extend knowledge of the level scheme using higher statistics data obtained from the Indian National Gamma Array (INGA) and to ascertain the spin-parity assignments of the concerned low-lying energy levels near the isomeric state. By the powerfull detector array the above mentioned features can be studied.

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Experimental details

Excited states in the ^{102}Ag nucleus were populated in the ^{75}As(^{31}P, p3n)^{102}Ag fusion-evaporation reaction at E_{lab}= 125 MeV. The de-excitations were investigated through in-beam gamma-ray spectroscopic techniques. The ^{31}P beam was provided by the Pelletron-LINAC facility at TIFR, Mumbai. The ^{75}As target of thickness 2.8 mg/cm^2 was prepared by vacuum evaporation and rolled onto a 10 mg/cm^2 thick Pb backing. The recoiling nuclei in the excited states were stopped within the target and the de-exciting gamma-rays were detected using the Indian National Gamma Array (INGA) consisting of 21 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 [6]. The data sorting routine "Multi 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.These data were used to develop the level scheme.

Discussion

The low-lying states of ^{102}Ag near the $I^{\pi} = 5^{+}$ ground state have been investigated. The level scheme has been extended substantially with addition of several new transitions to the earlier reported ones near the ground states [7, 8]. The present level scheme preserves major features of the previously observed bands by

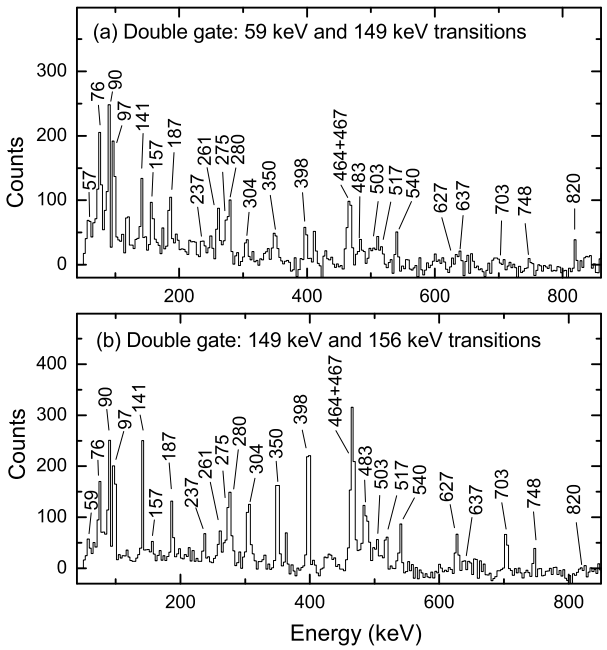

FIG. 1: γ-ray coincidence spectrum with double gate on (a) 59-keV and 149-keV, and (b) 149-keV and 156-keV transitions. The unmarked peaks are contaminations.

S. Rastikerdar [7] and V. Ravi Kumar et al.[8]. A new level $I^{\pi} = 3^{+}$ at 156 keV is observed in the present work. This level is decaying to the $I^{\pi} = 5^{+}$ ground state through 156 keV E2 transition, also it decay to $I^{\pi} = 4^{+}$ state by 59 keV transition. The new 59 keV transition is confirmed through the spectrum[Fig. 1]. Also many new transitions are observed at low spin and will be presented.

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