Level Structures 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]. The twin degenerate dipole bands with similar energy staggering and electromagnetic strengths have been explained with aplanar tilted rotation of the triaxial core along with the valence neutrons and protons aligned along the two extreme axes of the core. Specific noncollective " aligned " states with the nuclear spin made up completely from angular momentum contributions of the particles and holes in open shells, are able to compete energetically with weakly deformed collective structures in vicinity of the Z=50 shell closure. The maximally aligned states have been observed in the ^{98,99}Ag and ^{98,102,103}Pd isotopes. In ^{102}Pd, four band structures have been observed up to termination and interpreted in terms of valence-space and core-excited configurations. The doubly odd nucleus ^{102}Ag can provide information on different modes of coupling mechanisms between the odd proton and the odd neutron outside the ^{100}Sn core. By the powerfull detector array the above mentioned features can be studied.

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 aquisition system based on Pixie-16 modules of XIA LLC [3]. 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 present level scheme of ^{102}Ag is built on the I = 5^+ ground state. The level scheme has been extended substantially with addition of about fifty new transitions to the earlier reported ones [4, 5]. The level scheme is established up to $\sim$ 10 MeV excitation energy. The gated coincidence spectrum is shown in Fig. 1. The present level scheme preserves major features of the previously observed bands by S.

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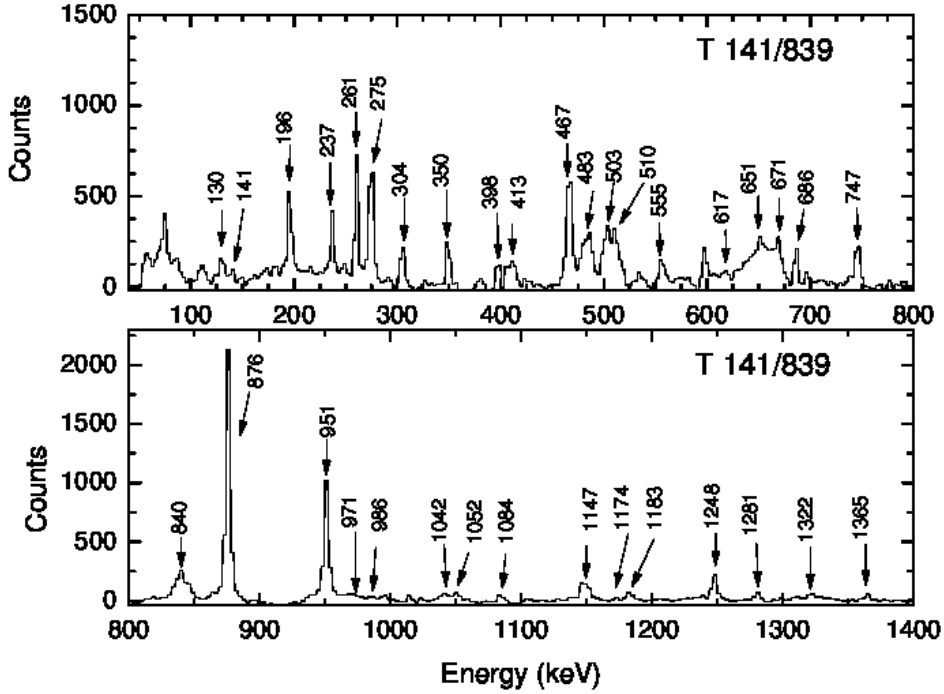

FIG. 1: γ-ray coincidence spectrum with double gate on the 141 keV and 839 keV transitions.

Rastikerdar [4] and V. Ravi Kumar et al.[5]. Previously reported level at 2378 keV having $\triangle \tau$ <4ns has not been observed in the present work. A new band consisting of 261-, 275-, 237-, and 267- keV transitions has been observed. The states of this band decay to yrast band by various gamma rays that have been observed in the present work. The data analysis is under progress and will be presented.

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