Excited states in ^{100}Pd

M. Kaur[1], S. Sihotra[1],* V. Singh[1], N. Singh[1], J. Sethi[2], S. Saha[2], S. Roy[2], R. Palit[2], and D. Mehta[1]
[1]*Department of Physics, Panjab University, Chandigarh-160014 and*
[2]*Department of Nuclear and Atomic Physics, TIFR, Mumbai-400005*

Introduction

The level strutures of nuclei approaching the neutron and proton major shell closures at N=Z=50 are complex due to 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. 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. Exceptionally long vibrational band has been reported in ^{102}Pd [3], which exhibits sharp increasing trend of B(E2) values with spin and is indicative of angular momentum generation by increasing deformation. It has been explained as tidal wave travelling over the nuclear surface with constant angular velocity. Band structures with the values and trends of dynamic moment of inertia and transition rates as a function of angular momentum have been observed to be different from those in case of the axial deformed nuclei, wherein rotational bands are known to exhibit nearly constant electric quadrupole transition rates. This led to various new phenomenon, namely, smooth band termination (ST), magnetic rotation (MR) and antimagnetic rotation (AMR).

*Electronic address: ssihotra@pu.ac.in

Experimental details

Excited states in the ^{100}Pd nucleus were populated in the ^{75}As(^{31}P, 2p4n)^{100}Pd 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 [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_γ-E_γ matrices and E_γ-E_γ-E_γ cubes compatible with Radware format. For the INGA geometry, the expected value of the DCO ratio is typically $\geq$1.0 for the quadrupole transition and $\leq$0.6 for the dipole transition with gate on the stretched $E2$ transition. DCO ratio values $\sim$1 are, however, also expected for pure $\Delta I = 0$ dipole transitions. To determine the electric or magnetic nature of the γ rays, the measurements were performed using the clover detectors at 90° as Compton polarimeter. The Integrated Polarization Directional Correlation from Oriented nuclei (IPDCO) analysis was performed using two asymmetric polarization matrices corresponding to the parallel and perpendicular segments (with respect to the emission plane) of the clover detector cho-

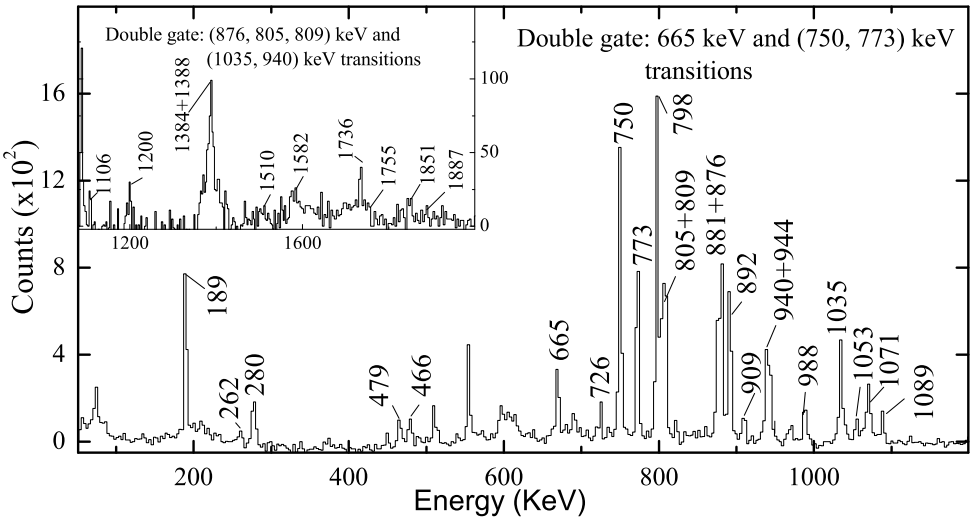

FIG. 1: Lower panel shows the double-gated coincidence spectrum for positive parity energy levels of yrast band and the inlet panel shows the transitions of excited negative parity bands for ^{100}Pd.

sen as a Compton polarimeter along one axis and the coincident γ rays in all the detectors along the other axis.

Discussion

The present level scheme of ^{100}Pd is built on the I = 0^+ ground state. The level scheme has been extended substantially with addition of many new transitions to the earlier reported ones [5, 6]. The level scheme is established up to $\sim$ 17 MeV excitation energy. Previously reported levels in positive parity band[5] are differ from the work reported by the Zhu et al., [6]. A new band consisting of 633-, 298-, 374-, 466, and 1167- 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. Also the band B2 is decaying to band B1 through new transitions. In the earlier work the band B1 has been reported as AMR band [6]. The DSAM lifetime measurements [7] are in process to confirm the AMR character. The transitions related to various bands have been shown in spectrum [Fig. 1]. The work related to AMR character will be presented.

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