Exploring the structure of Xe isotopes in A~130 region: Single particle and Collective excitations

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The existence of variety of nuclear shapes and their coexistences are the results of the complicated interplay between the single-particle and the collective motions of the nucleus. The structures of nuclei around the doubly magic shell closure ^{132}Sn (N = 82 and Z = 50) are of contemporary interest to obtain the information on both single particle and collective modes of excitations. Isotopes with a few proton particles and neutron holes with respect to the shell closure give us the unique opportunity to investigate the low lying single particle level structures, which in turn helps us to understand the effective nucleon-nucleon shell model residual interactions. The Xe (Z=54) nuclei in A~130 transitional region are important links between the spherical and deformed shapes. Coupling of valance nucleons in high-j orbitals in the high-spin regime forms a variety of band structures. In odd-A Xe nuclei, the valence neutron in high-j orbital is responsible in generating different band structures. ^{125}Xe is known to have band structures based on prolate deformation [1], whereas ^{127,129}Xe are reported to have significant triaxiality [2, 3]. But data on the next Xe isotopes are very limited [4, 5]. In this mass region, the even mass Xe isotopes are potential candidates for investigation of E(5) symmetry breaking since the experimental $R_{4/2}$ ratios are very close to the theoretical predicted values [6,7].

In the present work, excited levels of ^{130,131}Xe were populated via the reaction ^{130}Te (α, xn) ^{130,131}Xe, at a beam energy of 38 MeV, delivered from the K-130 cyclotron at Variable Energy Cyclotron centre (VECC), Kolkata. The Indian National Gamma Array (INGA) setup at VECC, consisting of seven Compton suppressed Clover detectors, were used for the detection of γ rays. Digital data acquisition system consisting of PIXIE-16 digitizer modules was used to acquire the time stamped LIST mode data [8].

In the present work, 67 new transitions have been placed in the level scheme of ^{131}Xe. The Yrast negative parity band in ^{131}Xe is seen above the band crossing frequency and the possible signature partner of this band is also observed. Presence of several band structures is also established from the present work. The new results are explained in terms of large scale shell model (using NUSHELLX) and TRS calculations. New transitions are identified at lower spin region in ^{130}Xe which carries the information about E(5) symmetry breaking. Details of this work will be presented at the conference.

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