High spin structure in ^{130}Ba

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Introduction

Nuclei with mass A ~130 have been of great interest to experimental studies on high spin states. At high spin states, as the proton Fermi surface lies near the bottom of the $\pi_{h11/2}$ subshell and the neutron Fermi surface lies near the top of the ν $h_{11/2}$ subshell, the rotational alignment of a pair of protons from the lower $h_{11/2}$ midshell drives the nucleus to a near-prolate (γ~0°) shape while the rotational alignment of a pair of $h_{11/2}$ neutrons from the upper midshell drives the nucleus to an oblate shape near (γ~-60°) Thus, the different excitations of quasiparticles may drive the nucleus to form different shapes and shape coexistence have been observed in this mass region. A particularly interesting scenario occurs when the occupation of shape-driving orbitals at the Fermi surface removes axial symmetry and forces the nucleus to adopt a triaxial shape. This is particularly so for the nuclei in the *A*~130 region which exhibit a softness to γ. Evidence for characteristics such as shape coexistence and γ-softness has been gathered during the last two decades for many nuclei from Xe to Nd. Another interesting feature of this mass region is the existence of a regular *M*1 band which has been considered to be a promising candidate for magnetic rotation. The theoretical description of magnetic rotation is given in the framework of the tilted axis cranking (TAC) model developed by Frauendorf [1]. Experimentally it was first established in the neutron deficient Pb isotopes [2,3]. In several nuclei [4-8] of the *A* ~130 mass region *M*1 bands like those observed in the *A* <200 mass region are known. One signature of magnetic rotation is the decrease of the *B*(*M*1) values with increasing spin. Consequently, absolute reduced transition probabilities are crucial experimental observables for testing the structure of magnetic rotation as well as other nuclear excitations. The aim of the work is to study the high spin states and lifetime measurements using the DSAM technique.

Experimental Set-up

In the present work, the high spin states in ^{130}Ba have been studied through the ^{122}Sns(^{13}C, 5*n*)^{130}Ba heavy-ion fusion evaporation reaction with a beam energy of 65 MeV. The experiment was carried out at the 14-UD pelletron accelerator in IUAC, New Delhi India, which delivered the 65MeV MeV ^{13}C beam on a ~1.0 mg/cm2 thick enriched ^{122}Sn target foil rolled onto a ~6 mg/cm2 thick Au backing. The γ decay following the reaction was studied using an array consisting of 15 Compton suppressed clover detectors of INGA (Indian National Gamma Array). The data were collected when three or more clovers were fired.

Results and Discussion

Earlier, this nucleus has been populated using the reaction ^{120}Sns(^{13}C, 3*n*)^{130}Ba at 55 MeV [9] with few Ge(Li) detectors and for some bands the spin and parity is tentatively assigned and for one band no spin and parity has been assigned. Since clover detectors have been used in this experiment, polarization measurements will be useful to assign the spin/parity where it is unknown. In this work, all the earlier gamma rays have been found and a large number of new gamma rays have also been recognized in this nucleus. The background subtracted gated spectra for the negative parity band is shown in

Fig. 1. Some new transitions have been placed as shown in Fig. 2 with asterisk. The data analysis is in progress and the detailed results will be presented in the symposium.

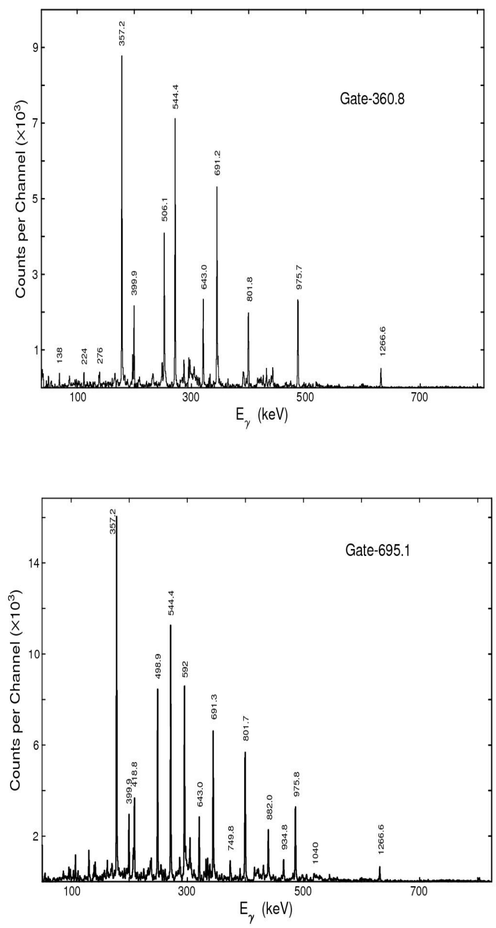

Fig. 1 **Background subtracted gated spectra in ^{130}Ba.**

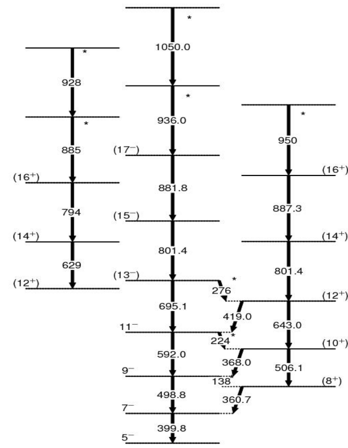

Fig. 2. Partial Level Scheme of ^{130}Ba.

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