Shape Transition From Prolate to Oblate In Exotic Cs And La Isotopes Near Proton drip Line

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Introduction

Various interesting features like shape transition, shape co-existence, octupole deformation etc have been predicted in the mass region A≃120. Shape transition and shape co-existence are well established in ths mass region . The macroscopic-microscopic mass model of Moller and Nix [1] predicts a large prolate deformation in the mass region A∼ 120 near the proton drip line. This prolate deformation is induced by the collective behaviour which increases with the number of active nucleons outside the shell closures Z=50. The calculated prolate deformations for most of the neutron deficient Cs and La nuclei are $\beta_2 \simeq$ 0.15-0.20 and $\beta_2 \simeq$ 0.30-0.35 [1] [3] respectively. Experimental verification of these results regarding deformation, shape transition etc. is very important. In this respect an experiment have been performed to populate high spin states of the neutron deficient Cs and La isotopes like^{119}Cs, ^{121}La, using ^{32}S bombarding on ^{92}Mo target. The TRS calculations have been done for ^{119}Cs isotope and a shape transition from prolate to oblate has been observed. Similar calculation is being done for the La isotopes. In this article all these theoretical and experimental results will be presented.

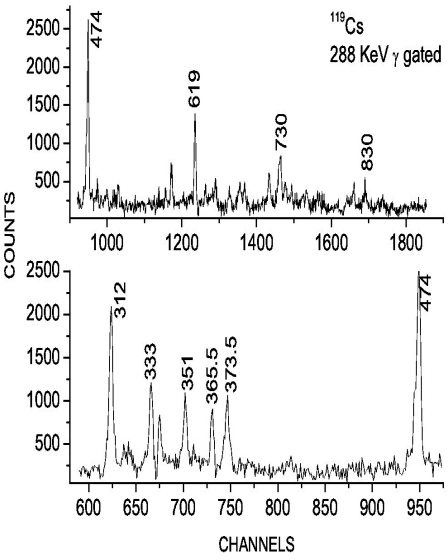

FIG. 1: 288 KeV γ-gated spectra of ^{119}Cs

Experiment

The experiment was carried out at the Inter University Accelerator Centre (IUAC), New Delhi, utilizing beam of 150 MeV ^{32}S beam (from 15UD Pelletron accelerator). The beam was bombarded on self supporting ^{92}Mo target with thickness of 7.3 mg/cm^2.The compound nucleus ^{124}Ce was produced in a state of high excitation and high angular momentum. This compound nucleus evaporates pro-

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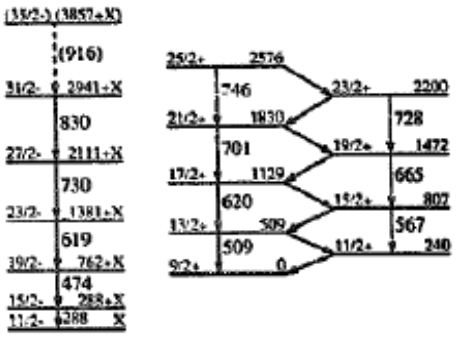

FIG. 2: Level scheme of ^{119}Cs

tons, neutrons, α, lighter nuclei to de excite itself. As a result a number of exotic nuclei such as ^{121}La, ^{120}Ba, ^{118}Xe,^{119}Cs, ^{116}Xe etc.. have been populated, in excited state and get de excited by emitting γ rays. Two fold γ-γ coincident events were collected using the Indian National Gamma Array (INGA). INGA is designed to hold 24 Compton suppressed clover detectors. Among 24 detectors , only 12 were in proper working mode during the experiment. Those were at angles 148°, 128°, 90,°, 46°, 57°, 32° with respect to the beam direction. The list mode data were sorted into different 4096 x 4096 matrices after gain matching of all the spectra. For analysis of data INGASORT software [2] was used.

$$^{32}\mathrm{S} + {}^{92}\mathrm{Mo} \longrightarrow {}^{124}\mathrm{Ce}^*$$

Result

From the experimental data both $\Pi g_{9/2}$ and $\Pi h_{11/2}$ bands have been observed. Fig [1] shows 288 KeV γ-gated spectra of ^{119}Cs which mainly shows the $\Pi h_{11/2}$ band. As ^{119}Cs is occupying shape driving extruder $\Pi g_{9/2}$ orbital so it should have large deformation.

The TRS calculations for ^{119}Cs have been done for hω=0.01 to 0.91 and is shown in fig [3]. The TRS calculation clearly shows the existence of oblate deformation in higher energy states. The details analysis in this respect is going on and will be presented.

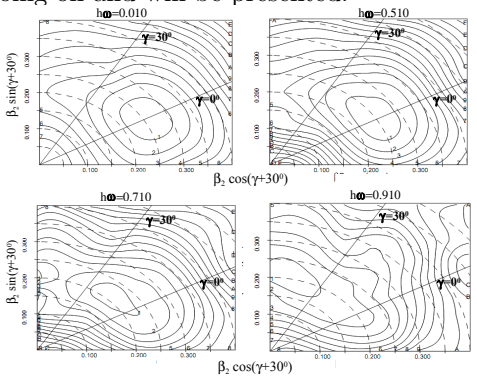

FIG. 3: TRS calculation for ^{119}Cs with $\Pi(h_{11/2})$ configuration

References

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[2] R.K. Bhowmik, INGASORT manual, private communication, 2003
[3] B. Caderwall et al. Z.Phys A 338 (1991)