Structure of A $\sim$ 130 nuclei in La-Ce region

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In recent years, the light rare earth nuclei, with 50≤N(Z)≤82, have attracted a considerable experimental interest, because of the rich variety in their shapes and structures, arising out of different angular momentum coupling schemes for the generation of high spin states. The systematic study of different band structures, viz., chiral bands, magnetic rotation bands, highly deformed bands etc., for the near spherical nuclei of this mass region, has revealed that in these nuclei, multi-particle excitation and alignments play an important role even at very high excitation energy. Experimental data on the odd-odd and odd-A nuclei of this mass region have displayed a varied amount of signature splitting in the yrast sequence and in many cases, signature inversion of quasiparticle Routhians and thus the anomalous signature splitting have been observed. These can be attributed to the presence of triaxiality in these nuclei as predicted by cranked shell model calculation [1]. The observation of two nearly degenerate ΔI = 1 bands, known as the chiral bands, in the odd-odd nuclei of this mass region, have established the presence of a different orientation geometry of the deformed nuclear field and the coupled odd particles. As evidenced from the experimental signatures and understood from theoretical calculations, in such cases, the angular momentum of the triaxially deformed core is perpendicular to the individual angular momenta of both the odd particles. At excitation energy $\sim$ 10 MeV, bands with stable triaxial minima, arising due to excitation of neutron quasiparticles beyond the $N = 82$ shell gap, has been predicted from cranked Nilsson-Strutinsky calculations and subsequently observed in several Nd isotopes. Very recently, rotational like sequences of strongly enhanced magnetic dipole (M1) transitions, known as Magnetic Rotation (MR) bands [2], observed in spherical or near-spherical nuclei of this mass region have drawn a significant interest. For these bands, the perpendicular component of the dipole moment ($\mu_\perp$) and, therefore, the B(M1) values decrease in a characteristic manner with the increase in angular momentum I. The understanding of the mechanism of angular momentum coupling involved, in such cases, have been realized by the use of Tilted Axis Cranking codes [3]. The MR bands are also well described by using the semi-classical description, proposed by R. M. Clark and A. O. Macchiavelli [4].

In the present talk, a systematics will be presented for the high spin structure of A $\sim$ 130 nuclei in La-Ce region including some of the nuclei, viz., ^{136,137}La, ^{137,138,139}Ce [5], studied with Indian National Gamma Array (INGA). The magnetic rotation bands in A $\sim$ 130 region will be discussed, following the semi-empirical prescription of R. M. Clark and A. O. Macchiavelli, and a comparison will be made with similar data from other mass regions.

References

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