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Systematic study of anomalous behaviour "flat" superdeformed bands

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The phenomenon of superdeformation was used many years ago to explain the fission isomers observed in the actinide nuclei. The curiosity for the superdeformation phenomena increased exponentially when a SD band in the 152Dy nucleus was observed. Many surprising properties of SD nuclei were observed experimentally, such as constant energy spacing between the transitions, lack of the transition linking the yrast SD band to the normal deformed (ND) states resulting in the 1-2 \hbar uncertainty in the spin assignments of the SD bands etc..The superdeformation spectroscopy has provided us with a great deal of information concerning the behaviour of MoI in the SD nuclei. The kinematic and dynamic moment of inertia (MoI) are two types of MoI explored in the SD nuclei. An appealing feature of the odd-A isotopes in Pb is the observation of dynamic MoI which remains nearly constant with the increasing rotational frequency (known as "flat" SD bands). Apart from these nuclei, flat SD bands were also observed in the 192Tl where dynamic MoI does not increase with frequency. We present the empirical evidence of super rigid character of the flat superdeformed bands in the Tl and Pb isotopes. For this purpose, we have used various rotational energy formulae. The free parameters of superdeformed bands in the Tl and Pb isotopes have been extracted and systematically studied to obtain the proposed empirical evidence. In particular, the intraband transition energies of the SD bands have been split into rotational and shape fluctuation energies. The role of the vibrational factor in the evolution of dynamic moment of inertia, softness parameter, alignment and effective pairing gap parameter of the flat SD bands has been studied. Using these models, two distinct natures have been identified for the SD bands in the Tl and Pb isotopes. Our study establishes the role of shape fluctuations, vibrational effect, deformation and pairing correlations for the unusual behaviour of the dynamic moment of inertia in the flat SD bands of the 190 mass region.

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