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Triaxiliaty, Gamma Softness, IBM and Deformed Nuclei

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The question whether deformed nuclei are triaxial has been raised from the early days of the study of nuclear collective motion. Davydov and Fillipov proposed their triaxial rigid rotor model in 1958, five years after Bohr and Mottelson proposed the nuclear collective model in 1953. But the idea of triaxiality in nuclei did not gain much acceptance. Nuclear collective motion continued to be investigated with the assumption of axial symmetry till recent times. Recent investigations indicate that some nuclei in the transitional region are better described by the assumption of triaxiality.

Also early in the history of nuclear collective motion, Wilets and Jean (1956) proposed the gamma soft vibrator model. In this model, the potential energy surface has a minimum for $\beta \neq 0$ but is independent of the triaxiality parameter Υ. Thus, the nucleus is unstable with respect to Υ deformation and the value of Υ fluctuates widely. Though based on diametrically opposite physical pictures, both the models have been used to describe collective spectra in the transitional region with some success.

Understanding the inter relationship between these two contradictory models has been the topic of many investigations. The connection became clear with the introduction of the Interacting Boson Model (IBM) by Arima and Iachello in 1974. In particular, the 0 (6) limit of IBM is related to triaxiality. It has been shown that in the limit of infinite boson number the 0 (6) limit of IBM is equivalent to the gamma soft model of Wilets and Jean.

In our work we have studied some of the aspects of the interrelationship between various models of triaxiality. We find that near $\Upsilon = \pi/6$ to the first approximation, the energy levels of a rigid triaxial rotor are gamma flat, thus mimicking a gamma soft behavior.

Cubic terms were introduced in the IBM Hamiltonian by Casten to produce rigid triaxiality. Whether such terms can be generated from the Casimir invariants of the subgroups of U (6) was investigated. All possible cubic terms were constructed from the Casimir invariants of the subgroups of U (6). Their classical limits were taken and it was found that, except for one none could produce rigid triaxiality.

Biography:

Dr. Ramesh Kumar Gupta is the Principal of 70 Years old reputed pre-independence and Historic college known as Vaish College, Rohtak since 20.07.2011. He has done M.Sc (physics), M.Phil (Physics), Ph.d (Specialization Nuclear Physics). He has served as Associate Professor in physics at Vaish College for 23 Years . He was also the Registrar of Maharaja Aggarsain University Buddi (H.P) for nearly one 'year. He was also Deputy Academic Registrar/ Associate Professor in physics at Delhi Institute of advanced studies at Sector 25, Rohini New Delhi for nearly 2 Years. He has presented various research papers in national/international Conferences.' He is the member of various committee of M.D.U Rohtak. He has written various books on physics & personality development.