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Nuclear structure effects involving pear-shape deformation

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Abstract

In this talk two recently studied aspects of the pear-shape [axial qudrupole-octupole (QO)] deformation in atomic nuclei will be reviewed namely, the structure of alternating-parity bands in even-even nuclei and the interplay of QO shape-dynamics with the single-particle (s.p.) motion in odd-mass nuclei. The study in the first aspect is inspired by recent confirmations of stable octupole shape in several nuclei (^{224}Ra [1] and ^{144,146}Ba [2]) and involves an application of a collective QO model approach [3, 4] to less studied alternating-parity spectra in the nuclei $^{130-136}$Nd. The model descriptions suggest the presence of a soft QO mode in $^{130-134}$Nd and possible stabilization of the octupole shape in ^{136}Nd. In the second aspect, we apply the QO model [4] extended with s.p. motion to determine the electric-transition [5] and magnetic-dipole-moment [6] characteristics of the 7.8 eV isomer in ^{229}Th, which is of a great current interest for the establishment of a new, “nuclear clock”, frequency standard. The obtained result emphasizes the essential role of the QO deformation mode and its extremely fine interplay with the odd neutron degree of freedom for the appearance of such an unusual nuclear excitation at the border of the atomic energy scale. Both research aspects reveal the widespread manifestation of nuclear complex-shape dynamics showing the need for a consistent theoretical treatment of the variety of related phenomena.

References

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