Int. Workshop "Shapes and Dynamics of Atomic Nuclei: Contemporary Aspects"
ed. Nikolay Minkov, Heron Press, Sofia 2023

Onset of pear shapes and its microscopic realization

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Abstract

Pear-shaped nuclear deformation has attracted much attention from both experimental and theoretical points of view. The octupole shapes and related collective phenomena are studied using the framework of nuclear density functional theory. By mapping the mean-field potential energy surface of a universal energy density functional with quadrupole and octupole shape degrees of freedom onto the corresponding one of the boson system, the interacting-boson Hamiltonian describing low-energy positive and negative-parity energy spectra and transition strengths is determined. This presentation will focus on recent calculations using this mapping procedure exploring the octupole collectivity in large sets of proton-rich and neutron-rich nuclei with mass $A = 70-250$, including actinides and lanthanides, and, in particular, some challenging cases of neutron-rich Kr, Sr, Zr, and Mo near $N = 60$, and $N \approx Z$ Ge, Se, and Kr, where triaxiality and coexistence of quadrupole shapes play a crucial role along with the octupole degree of freedom.