Beyond-Mean-Field Description of Quadrupole-Hexadecapole Coupling In Atomic Nuclei

R. Rodríguez-Guzmán

Department of Physics, School of Sciencies and Humanities, Nazarbayev University, 53 Kabanbay Batyr Ave., Astana 010000, Kazakhstan

Recent progress [*Phys. Rev. C* **111** (2025) 024304] in the microscopic understanding of the subtle interplay between the quadrupole and hexadecapole degrees of freedom in atomic nuclei will be discussed, both at the mean-field level and from a (dynamical) beyond-mean-field perspective using the finite range and density dependent Gogny interaction. First, the emergence of (static) hexadecapole deformation effects will be considered within the Hartree-Fock-Bogoliubov (HFB) framework. Second, the stability of those mean-field hexadecapole deformation effects against zero-point quantum fluctuations and their coupling with the quadrupole degree of freedom will be considered within the two-dimensional Generator Coordinate Method (GCM). Results will be illustrated for a large set of even-even Ra, Th, U and Pu isotopes as well as for Yb, Hf, W and Os nuclei. Detailed consideration will be given to static and dynamic features, such as a transition from a regime in which the quadrupole and hexadecapole degrees of freedom are interwoven to a regime in which they are decoupled as well as an enhanced shape coexistence in the more neutron-rich sectors of the studied isotopic chains. It will be shown, that the dynamical quadrupole-hexadecapole configuration mixing brings a nontrivial additional correlation energy gain comparable to the quadrupole correlation energy itself. All these results point towards the non-trivial physics brought by the inclusion of higher order deformations in the dynamics of both ground and excited states.