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Shapes for a precise description of nuclear spectroscopy

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Despite the atomic nuclei are quantum many-body systems made of interacting protons and neutrons, their spectra can be in many cases described by simple geometrical models. The best framework to explain microscopically such a collective behavior is the self-consistent mean-field approach based on energy density functionals like Skyrme, Gogny or Relativistic Mean Field. These methods have been developed significantly in the last two decades. In particular, the inclusion of different intrinsic shapes and beyond mean effects, such as symmetry restorations and shape mixing, has improved remarkably the comparison with the experimental data. In this contribution I will discuss the theoretical tools needed to compute nuclear structure properties such as masses, radii, excitation energies and/or transition probabilities. Additionally, I will show some selected examples that illustrate the ability of the energy density functional methods to describe phenomena like shape evolution, shape coexistence and shape mixing in nuclei from a microscopic point of view.

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