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From energy density functionals to partial dynamical symmetries in nuclei

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Dynamical symmetries (DSs) provide useful benchmarks for interpreting the structure of nuclei. Notable examples are the U(5), SU(3) and SO(6) DSs of the interacting boson model (IBM), which encode the dynamics of spherical, axially-deformed and γ-unstable shapes, respectively. In the majority of nuclei, however, an exact DS rarely occurs. More often some states obey the patterns required by the symmetry, but others do not. This necessitates a certain degree of symmetry-breaking, a prominent case of which is partial dynamical symmetry (PDS) [1]. Its basic idea is to relax the stringent conditions imposed by an exact DS so that solvability and/or good quantum numbers are retained by only a subset of states. Detailed studies, in the IBM framework, have shown that PDSs account quite well for a wealth of spectroscopic data in various types of nuclei. In all these phenomenological studies, an Hamiltonian with a prescribed PDS is introduced, its parameters are determined from a fit to the spectra, and the PDS predictions (which are often parameter-free) are compared with the available empirical energies and transition rates. In the present contribution, we show that the PDS notion is robust and founded on microscopic grounds [2]. For that, we use self-consistent mean-field methods in combination with the IBM, to establish a linkage between universal energy density functionals (EDFs) and PDSs. An application to ^{168}Er shows that IBM Hamiltonians derived microscopically from known non-relativistic and relativistic EDFs in this region, conform with SU(3)-PDS.

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[2] K. Nomura, N. Gavrielov, and A. Leviatan, Phys. Rev. C **104**, 044317 (2021).

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