NUCLEAR SEMINAR SERIES

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4:00 pm - Rm 184 NSH

Self-consistent multiparticle-multihole configuration mixing description of atomic nuclei

The self-consistent multiparticle-multihole configuration mixing method is an adaptation to nuclei of an approach known as “Multi-Configuration Hartree-Fock” or “Multi-Configuration Self-Consistent Field” which has been used for decades in the fields of atomic physics and quantum chemistry.

This method considers the nuclear wave function as a general superposition of Slater determinants. Both the expansion coefficients of the many-body state and the single-particle natural orbitals are determined simultaneously via a variational principle which ensures full self-consistency between correlations and underlying mean-field picture.

A few years ago, we have applied for the first time the full formalism of this approach to the description of some light and mid-mass nuclei using an effective phenomenological interaction (the Gogny force) [1,2]. In the first part of my talk I will go over these applications and emphasize the impact of using consistent natural orbitals on the description of ground- and excited-state properties, such as energies, radii and transition probabilities.

While these first results were encouraging, the use of the Gogny force is a priori not fully adapted to the present many-body approach. Therefore, and in order to go towards an ‘ab-initio’ description of nuclei, we have recently started to implement interactions derived from chiral effective field theory. I will show preliminary calculations of light nuclei.

[1] C. Robin, N. Pillet, D. Peña Arteaga and J.F. Berger, PRC 93, 024302 (2016).
[2] C. Robin, N. Pillet, M. Dupuis, J. Le Bloas, D. Peña Arteaga and J.F. Berger, PRC 95 044315 (2017).

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