Large-scale shell-model challenges within the RIB era

L. Coraggio[1], A. Gargano[1], and N. Itaco[1,2]

[1] *Istituto Nazionale di Fisica Nucleare, Complesso Universitario di Monte S. Angelo, Via Cintia - I-80126 Napoli, Italy*
[2] *Dipartimento di Matematica e Fisica, Seconda Università di Napoli, viale Abramo Lincoln 5 - I-81100 Caserta, Italy*

Large-scale shell-model (LSSM) calculations have become a well-established approach so to obtain a microscopic theoretical description of the collective properties of atomic nuclei.

In present days, powerful computing devices are widely accessible and make more feasible to approach shell-model calculations with large model spaces for nuclei with many valence nucleons. This has given the opportunity to many nuclear-theory groups to study exotic features of the atomic nuclei within a microscopic approach, so supporting the experimental efforts to enlarge the knowledge of the chart of the nuclides in the rare-ion-beam era.

We present our approach to this challenging problem, starting from shell-model hamiltonians that are derived from realistic NN potentials by way of the many-body perturbation theory [1]. Results for the description of quadrupole collectivity in some isotopic chains will be presented [2,3], together with a novel procedure [4] that is helpful to reduce the computational complexity of large-scale shell-model calculations, by preserving as much as possible the role of the rejected degrees of freedom in an effective approach.

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