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Ab-initio description of monopole resonance in light- and medium-mass nuclei

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Giant monopole resonances have a long-standing theoretical importance in nuclear structure. The interest resides notably in the so-called breathing mode that has been established as a standard observable to constrain the nuclear incompressibility [1]. The Random Phase Approximation (RPA) within the frame of phenomenological Energy Density Functionals (EDF) has become the standard tool to address (monopole) giant resonances and extensive studies, mostly in doubly-closed-shell systems, have been performed hroughout the years, including via the use of so-called sum rules [2]. A proper study of collective excitations in the ab-initio context is, however, missing.

In this perspective, the rst systematic ab-initio predictions of (giant) monopole resonances will be presented [3, 4, 5]. Ab-initio Quasiparticle-RPA (QRPA) [6] and Projected Generator Coordinate Method (PGCM) [7] calculations of monopole resonances are compared in light- and mid-mass closed- and open-shell nuclei, which allows in particular to investigate the role of super uidity from an ab-initio standpoint.

Sum rules are also employed within both many-body chemes to characterize the fragmentation of the monopole strength. The study further focuses on the dependence of the results on the starting nuclear Hamiltonian derived within the frame of chiral effective field theory.

Monopole resonance represents, thus, the first step towards the investigation of higher multipolarities. Eventually, the mid-term goal to establish PGCM as a new method to study resonances in the light- and medium-mass region of the nuclide chart will be discussed: interpretation and analysis of resonance data in lighter nuclei is a very demanding task on which ab-initio PGCM could shed new promising light.

References
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