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Séminaire de Physique Nucléaire Théorique

Ab initio description of monopole resonances in light- and medium-mass nuclei : Towards a fundamental theory of nuclear spectroscopy

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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. The Random Phase Approximation (RPA) within the frame of phenomenological Energy Density Functionals (EDF) has become the standard tool to address giant resonances and extensive studies, have been performed throughout the years. A proper study of collective excitations within the ab initio framework is, however, missing. Additionally, the ab initio many-body methods developed over the past two decades encounter limitations when it comes to dealing with excited-state properties.

In this perspective, I will present the first systematic ab initio predictions of (giant) monopole resonances. Ab initio Quasiparticle-RPA (QRPA) and Projected Generator Coordinate Method (PGCM) calculations of monopole resonances are compared in light- and mid-mass closed- and open- shell nuclei. Monopole resonances represent the starting point for exploring higher multipolarities, the goal in the medium term being to establish PGCM and QRPA as complementary tools in the development of a fundamental theory of nuclear excitations.

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