

Service de Physique Nucléaire
SÉMINAIRE

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CEA Saclay, Orme des Merisiers Bat 703, p 135

Pushing the Boundaries of Ab-Initio Nuclear Structure

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In recent years, there has been tremendous progress in the field of ab-initio nuclear structure and reaction physics. Key to these advances has been the use of effective field theory (EFT) and renormalization group (RG) methods. Chiral EFT provides a consistent framework for two-, three-, and higher many-nucleon forces and observables, and the RG makes it possible to systematically change the resolution scale at which these operators probe the atomic nucleus.

These techniques have allowed practitioners to soften nuclear interactions and dramatically improve the convergence behavior of ab-initio many-body calculations, all while maintaining a stringent link to Quantum Chromodynamics, the fundamental theory underlying the strong interaction. Together with the rapidly increasing computing power available for scientific applications, these advances have pushed the boundaries of nuclei that are accessible by ab initio methods from light nuclei with $A=12-16$ all the way to the tin isotopes.

After giving a pedagogical introduction into the key elements of chiral EFT and the free-space Similarity RG (SRG), I will focus on one particular ab-initio method, the In-Medium SRG, and present recent results from successful applications to ground-state calculations for closed- and open-shell nuclei [1-3]. With a simple modification, the existing IM-SRG technology can also be adapted to derive valence-shell interactions for the nuclear many-body Shell Model [4-5], granting us immediate access to excitation spectra and deformed nuclei. A benchmark application to the oxygen isotopic chain shows that IM-SRG-derived SM interactions are competitive with current phenomenological forces [5].

- [1] K. Tsukiyama, S. Bogner, A. Schwenk, Phys. Rev. Lett. 106, 222502 (2011).
- [2] H. Hergert et al., Phys. Rev. C 87, 034307 (2013).
- [3] H. Hergert et al., Phys. Rev. Lett. 110, 242501 (2013).
- [4] K. Tsukiyama, S. Bogner, A. Schwenk, Phys. Rev. C. 85, 061304 (2012).
- [5] S. Bogner, H. Hergert, J. Holt, A. Schwenk, arXiv:1402.1407 [nucl-th].

This seminar is organized within the framework of the ESNT workshop: Radioactive Ion Beam Experiments and Three-Nucleon Forces 31 March-11 April (<http://esnt.cea.fr>).

Le cafe sera servi 10 minutes avant
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http://irfu.cea.fr/Phocea/Vie_des_labos/Seminaires/index.php