Institut de recherche sur les lois fondamentales de l'univers
Département de Physique Nucléaire

ESNT Seminar

Friday 8th October 2021, 11-12h

Bat 703, DPhN salle de séminaires 135, CEA Saclay, Orme des Merisiers

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Multi-fermion systems with contact theories

Contact forces are one of the most intuitive ways to model interparticle interactions, but their minimalistic nature should not be mistaken for triviality: they can predict many emergent phenomena as bosonic drops binding, few-nucleons structure, and formation of hadronic molecules. Nonetheless, contact theories need to be carefully treated since, if not renormalized properly, they can lead to collapsing systems and divergent observables.
However, if treated adequately, these theories realize a mathematically consistent and complete representation of microscopic physics, as well as an elegant way to bridge the high energy degrees of freedom with low energy observables in an ab initio fashion. Moreover, the universal nature of this framework can be utilized to transpose the knowledge accumulated in one field to others that are harder to be approached experimentally.

The objectives of the talk are to describe how contact theories can be applied from nucleons to hadrons and atoms; to explain what are the advantages and disadvantages of these theories; and to underline the challenges that still remain to be solved in the future of contact effective field theories.

References.
♦ *Emergent four-body parameter in universal two-species bosonic systems,*
L. Contessi, J. Kirscher, M.P. Valderrama,
Phys. Lett. A ***408****, 127479 (2021). arXiv:2103.14711 doi : 10.1016/j.physleta.2021.127479*

♦ *Multi-fermion systems with contact theories,*
M. Schäfer, L. Contessi, J. Kirscher, J. Mares,
Phys. Lett. B ***816****, 136194 (2021). arXiv:2003.09862 doi: 10.1016/j.physletb.2021.136194*

♦ *Triple-X and beyond: hadronic molecules of three and more X(3872),*
L. Contessi, J. Kirscher, M. P. Valderrama,
Phys. Rev. D ***103****, 056001 (2021). arXiv:2008.12268 doi: 10.1103/PhysRevD.103.056001*

The works presented in this seminar were done within the ESNT project which started in Nov. 2019 about "Development and application of Effective Field Theories to nuclear systems".