



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

ESNT Seminar

Wednesday 11/12/2020, 14h-15h

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

**Johannes Kirscher**  
University of Manchester

### **Two-, three-, and four-body scales in universal few-boson systems**

In this talk, I will introduce work on the dynamics of few-body systems as it emerges from a separation of scales as expressed in the resonant interaction between two bosons.

The main part will concern the perturbative refinement of the two-boson interaction - which augments an initial, unitary description with a finite effective range - and its effects up to the six-boson system.

Hereby, the exposure of a significant dependence of the predicted ground-state energies of tetra-, penta-, and hexamers on details of the interaction, which is resolved at distances much smaller than the effective range, is presented.

With a demonstration on how to remove this sensitivity from all up to 6-boson systems numerically and semi-analytically with a single four-body contact parameter, I will conclude to subsequently relate these findings to the effects of the same, unitary two-body interaction in systems without a bosonic spectrum.

#### *References.*

- [1] B. Bazak, J. Kirscher, S. König, M. Pavón Valderrama, N. Barnea, and U. van Kolck, *Four-Body Scale in Universal Few-Boson Systems*, Phys. Rev. Lett. **122**, 143001 (2019).
- [2] M. Schaefer, L. Contessi, J. Kirscher, *Multi-fermion systems with contact theories*, in preparation.

*This seminar is organized within the framework of the ESNT project led in 2020 by L. Contessi with J. Kirscher. The talk will explain this project revolving pushing contact EFT towards its theoretical limit. In particular, the project aimed at investigating systems of many fermions close to unitarity with non-zero total angular momentum. This work constitutes a new study with many implications both in nuclear and cold atom physics.*

