Université Paris-Saclay IJCLab (Laboratoire de Physique des 2 Infinis Irène Joliot-Curie) Bât. 100, F-91405 Orsay

Séminaire de Physique Nucléaire Théorique

Insights into the reactions and structure of light nuclei from Effective Field Theory.

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In this talk I will show how an Effective Field Theory for weakly-bound few-body systems ("Halo EFT") aids the modeling and understanding of light nuclei in the p-shell. After introducing Halo EFT I will discuss two examples of its use. First, I will describe our recent analysis of the reaction ${}^{3}\text{He}(\alpha, \gamma)$ [1]. In this case we take ${}^{3}\text{He}$ and ${}^{4}\text{He}$ as the effective degrees of freedom and work to next-to-leading order in the EFT. We use a Bayesian analysis to perform the extrapolation of higher-energy data to solar energies and find a markedly smaller uncertainty to previous evaluations, as well as significant constraints on ${}^{3}\text{He-}{}^{4}\text{He}$ scattering parameters. Second, I will demonstrate that a three-body (α -neutronproton) model of 6 Li exhibits a correlation between the deuteron- α scattering length and the ⁶Li binding energy [2]. Such correlations appear generically in three-body systems with weak binding (cf. the Phillips line in the A=3 system) and can be understood as a consequence of the requirement that the EFT be renormalized. The emergence of such a correlation in the presence of p-wave nucleon- α interactions is particularly striking, as is the fact that it is rather insensitive to the actual values of the p-wave phase shifts. I will close by discussing the implications of this finding for model and EFT treatments of ⁶He and ⁶Li.

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