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Effective field theory for halo nuclei[1]

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The region towards the proton and neutron drip lines in the isotopic chart, where nuclei become less bound, has attracted strong interest from the nuclear physics community. In some of those nuclei, known as halo nuclei, a clusterized picture emerges: the distances between one or a few nucleons and core, or among clusters, are much larger than the range of strong interaction. In the past two decades, the effective field theory (EFT) methodology, which treats clusters as fundamental degrees of freedom (DOF) and capitalizes on the separation of scales, has been intensively studied and applied to describe halo nuclei. This EFT is closely related to the EFT that describes hadronic molecules" and cold atomic gases. The methodology is systematical and model-independent. In this talk, I will discuss some of the recent developments in this field, and focus on the progress our group has made in studying nuclear reactions using EFT, including elastic and inelastic scatterings and radiative capture reactions. I will highlight how the marriage between EFT and the statistical analysis tool, Bayesian inference, produces robust uncertainty estimations for extrapolated reaction cross sections and previously unrealized constraints on scattering observables. In the end, I will discuss the complementarity between EFT and numerically intensive ab initio structure calculations that use nucleons as fundamental DOF, and how EFT can help ab initio methods calculate scattering and reactions.

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