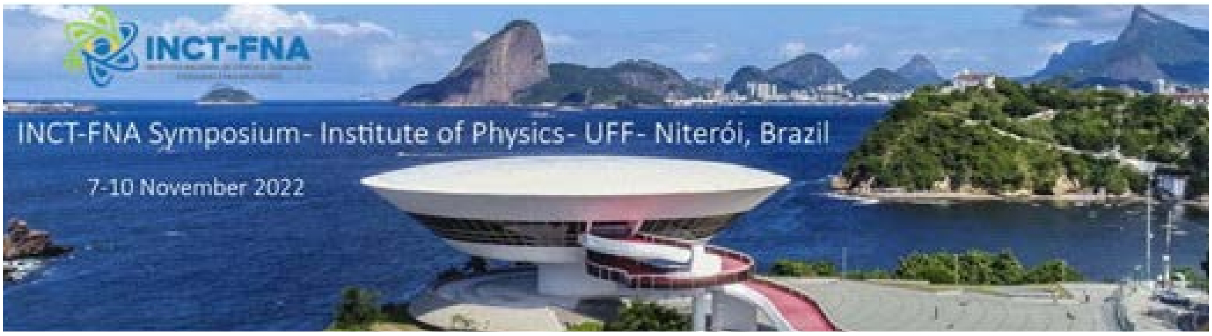

Progress and challenges of effective field theories in nuclear systems

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Effective field theory (EFT), in phylosophical terms, hinges on the idea that nature, across all its energy/distance scales, is extremely complex and diverse to be described by a single theory of everything, if the latter exists. It is a pragmatic attitude towards science, narrowing the energy/distance range one is working with, and identifying the relevant, active degrees of freedom at hand. EFT ideas have been used implicitly throughout the history of physics, but only in the last few decades they have been explicitly recognized and systematized as a tool to describe complicated phenomena in terms of a simpler, though schematic, framework. Remarkable examples belong to the realm of quantum field theory, with the standard model of particle physics now understood as the leading term of a more underlying theory, and chiral effective field theory as the representation of quantum chromodynamics at the hadronic scale.

EFTs permeated and are now common parlance in nuclear physics. Chiral interactions are being extensively used in ab-initio structure calculations of light and medium-mass nuclei with prominent success. Nevertheless, loosely-bound nuclei still pose technical challenges to ab-initio methods. Halo EFT provides a better starting point to grasp the dominant phenomena with the most relevant degrees of freedom. Universality naturally emerges out of the formalism, providing explanations to non-trivial correlations such as the Phillips and Tjon lines. Halo EFT has been applied to capture reactions at the low energy domain not yet accessible by current experiments, but of great importance to nuclear astrophysics. In this talk, I will present recent achievements and open issues of halo EFT applied to weakly-bound nuclear systems.

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