Contribution ID : **662** Type : **not specified**

Nuclear and hadronic physics at intermediate energies from lattice QCD

The search for predictive capabilities in the study of hadronic reactions and nuclear structure from the Standard Model, which describes the strong and electroweak interactions in nature, is a defining challenge that bridges nuclear and particle physics. In this talk, I will present some of the progress made in that direction by calculations using Lattice QCD (LQCD), a systematically improvable numerical technique based on solving the fundamental theory of the strong interaction, quantum chromodynamics, in a finite volume.
Within this framework, nuclear systems up to atomic number A = 5, including systems with non-zero strangeness, have been studied over the past decade, with a range of unphysically-large values of the quark masses. These LQCD calculations have been used to provide phenomenologically-important results and to constrain nuclear effective field theories, allowing constraints on larger nuclei and on the quark-mass dependence of nuclear forces and bindings. Moreover, given the scarcity of experimental data on hyperon-nucleon and hyperon-nucleon scattering, LQCD calculations may, in the not-too-distant future, complement experimental information in these areas, providing critical information for the study of hypernuclei or contribute to the understanding of the equation of state of dense nuclear matter, for example.

Abstract

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Session Classification : Física Teórica

Track Classification : Física Teórica