Contribution ID: **65** Type: **not specified**

MANYBODY: Theory of nuclear quantum many-body systems

Friday, 15 December 2017 14:40 (20 minutes)

It is fascinating that the entire nuclear chart can be in principle described by the small set of parameters defining the quantum chromodynamics (QCD) and quantum electrodynamics Lagrangians. The direct applicability of Lattice-QCD, the only non-perturbative method that systematically implements QCD from first principles, is currently limited to very light nuclear systems.
We present a novel framework that combines nuclear effective field theories, and ab-initio nuclear many-body methods to understand how the wealth of data and peculiarities on nuclei and hypernuclei emerge from QCD. On the one hand, Lattice-QCD calculations at quark masses heavier than found in Nature enable to assess whether Standard Model parameters might have to be finely tuned for nuclei to be stable. On the other hand, Lattice-QCD inputs are essential when experimental data are scarce, as in the determination of the nucleon axial form factor, hyperon-neutron interactions and three-neutron potential. I will present how our framework is suitable to study with unprecedented accuracy, properties medium-mass nuclei, the onset of hyperons in neutron stars, and neutrino-nucleus interactions. High-performance computing, which has proven to be essential for most of the recent advances in nuclear theory, is a key ingredient of our effort. Our quantum Monte Carlo codes efficiently scale on up to more than 250,000 MPI processes and are ready to best capitalize on European leadership-class computing facilities.

Primary author: LOVATO, Alessandro (TIFP)

Co-author: Prof. PEDERIVA, Francesco (TIFP)

Presenter: LOVATO, Alessandro (TIFP)

Session Classification: Session 11