Nuclear matter in the FRIB & multi-messenger astronomy era

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Born in the aftermath of core-collapse supernovae, neutron stars contain matter under extreme conditions of density and temperature. In recent years, neutron star observations have yielded novel insights into the nature of strongly interacting, neutron-rich matter in the high-density regime where current theoretical models are challenged. At the same time, chiral effective field theory (EFT) has developed into a powerful framework to study nuclear matter properties with quantified uncertainties in the moderate-density regime for modeling neutron stars. Furthermore, a few months ago, the new Facility for Rare Isotope Beams (FRIB) at Michigan State University opened its doors to scientific users, enabling experiments with nuclei in the very neutron-rich regime. In short, the next decade is expected to witness a strong interplay between neutron star observation, experiment, and theory, with stringent tests of nuclear predictions and great potential for discoveries.

In this INPP Seminar, I will discuss recent developments in EFT-based nuclear matter calculations and their implications for the structure of neutron stars. I will show how EFT, combined with new many-body ideas, enables the statistically robust uncertainty quantification of nuclear matter properties. Furthermore, I will motivate joint projects involving Bayesian machine learning and high-performance computing at the INPP.

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4:00 pm

Lindley Hall room 321