T3 Workshop on Statistical Nuclear Physics in Astrophysics and Applications
August 14-17 2023, Ohio University, Athens, OH, USA

ABSTRACT

Semi-microscopic approach to nucleon-nucleus inelastic scattering

Aaina Thapa

Lawrence Livermore National Laboratory

Developing a predictive capability for inelastic scattering will find applications in multiple areas. Charged-particle inelastic scattering is an experimental probe for excitation spectrum of the target nucleus. It can also be used as a surrogate for (n, γ) reactions to predict capture cross sections for unstable nuclei relevant to s-process. Experimental data for neutron-nucleus inelastic scattering is scarce and thus one needs a robust theoretical framework to complement it. Our work uses microscopic nuclear structure calculations to obtain nucleon-nucleus scattering potentials to calculate cross sections for these processes. We implement the Jeukenne, Lejeune, Mahaux (JLM) semi-microscopic folding approach, where the medium effects on nuclear interaction are parameterized in nuclear matter to obtain nucleon-nucleon interaction in a medium at positive energies. We solve the nuclear ground state using Hartree-Fock-Bogoliubov many-body method, and by approximating interaction between nucleons within a nucleus as Gogny-D1M potential. The vibrational excited states of the target nucleus are calculated using quasi-particle random phase approximation method. We will present our results for elastic and inelastic scattering cross sections for 90,92,94Zr nuclei.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52- 07NA27344, with partial support from LDRD project 20-ERD-030.