Contribution ID: **94** Type: **Contributed Oral**

Improving the Theoretical Description of β-Decay Half-Lives for Nuclear r-Process

Tuesday, 20 August 2024 15:05 (15 minutes)

The rapid neutron capture process (r-process) is responsible for creating more than half of the nuclei heavier than iron. Through a series of neutron captures, r-process facilitates the creation of neutron-rich nuclei up to the neutron drip line. A theoretical input for the description of this process requires knowledge of nuclear masses, neutron capture mechanisms, α-decays, induced fission rates and yields, β-decay rates, as well as β-delayed neutron capture rates, from the vicinity of the stability valley to the neutron drip line. Due to huge extrapolations involved, however, any theoretical model faces significant challenges when making predictions toward the neutron drip line.

The nuclear energy density functional theory (NEDFT) is an effective model for evaluating required theoretical inputs. With a goal to describe all nuclear data essential for r-process within the NEDFT, in this work, we focus on β-decay rates. The β-decay rates are evaluated within the relativistic NEDFT framework. First, the axially-deformed covariant Hartree-Bogoliubov theory based on point-coupling interactions is employed to determine the nuclear ground state, and the excitations are described within the linear response quasiparticle random-phase approximation (pnQRPA). Calculations are performed throughout the nuclear landscape for $8 \leq Z \leq 120$ and employed in r-process simulations to obtain nuclear abundance patterns. Uncertainties of the model are calculated using the emulators based on the reduced basis methods (RBMs). The preliminary results of our simulations will be presented.

Funding Agency

DOE-DE-NA0004074 (NNSA)

Email Address

ravlic@frib.msu.edu

Presenter if not the submitter of this abstract

Primary author: RAVLIC, Ante (Facility for Rare Isotope Beams, Michigan State University)

Co-authors: Prof. GODBEY, Kyle (MSU/FRIB); Dr GIULIANI, Pablo (MSU/FRIB); Dr LALIT, Sudhanva (MSU/FRIB); NAZAREWICZ, Witold (Michigan State University, Facility for Rare Isotope Beams)

Presenter: RAVLIC, Ante (Facility for Rare Isotope Beams, Michigan State University)

Session Classification: Nuclear Astrophysics

Track Classification: Nuclear Astrophysics