NUCLEAR SEMINAR SERIES

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4:00 pm - Rm 184 NSH

Nuclear Astrophysics Measurements using the MUSIC active target system

Direct measurements of nuclear reactions relevant for nuclear astrophysics are experimentally challenging because of their small cross sections and the intensity limitation of radioactive beams. At Argonne National Laboratory we have developed a novel technique to measure total cross sections of astrophysically important reactions using a Multi-Sampling Ionization Chamber (MUSIC). The MUSIC detector is a highly efficient active target system with a segmented anode that allows the investigation of a large energy range of the excitation function. Recently, the MUSIC detector has been successfully used for measurements of (α,p) and (α,n) reactions that play a crucial role in several astrophysical scenarios. For instance, some (α,p) reactions have been found to be important for the understanding of X-ray bursts and the production of ^{44}Ti in core-collapse supernovae. Furthermore, some (α,n) reactions have been found to be relevant for the weak r-process in neutrino-driven winds after a core-collapse supernova. In this talk, I will present recent results on the direct measurement of (α,p) and (α,n) reaction rates using the MUSIC detector and the potential of application of Machine Learning techniques for data analysis.

Since helium is the second most abundant element in the universe, there are numerous reaction rates involving α-particles that play a crucial role in nuclear astrophysics. For instance, some (α,p) reactions have been found to be fundamental for the understanding of X-ray bursts and the produc- tion of ^{44}Ti in core-collapse supernovae. Furthermore, some (α,n) reactions have been found to be relevant for the nucleosynthesis of light nuclei in the rapid neutron-capture process (r-process) in neutrino-driven winds.

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