Tuesday
May 9th
At 3:30pm

Nuclear Reaction Cross Section Measurements to Study the Abundance Pattern of Metal Poor Halo Stars

Abstract:

The rapid neutron capture process (r-process) may occur in supernovae or neutron star mergers, and is thought to be the source of roughly half of the stable nuclei heavier than iron. While the robustness of heavy element r-process abundance pattern has been demonstrated in a large number of halo-star observations, the lighter r-process elements show variations that indicate the existence of additional unanticipated nucleosynthesis processes, such as a possible weak r-process.

Recent sensitivity studies found individual neutron-capture reaction rates in the r-process model and α-induced reaction rates in the weak r-process model play an important role to determine the final abundance pattern. There are large uncertainties in the theoretical predictions of these reaction rates and a lack of measurements with radioactive ion beams. To address this problem, a number of experimental techniques have been developed recently to measure reaction cross sections with low-intensity radioactive beams. For example, the development of a large area, high-granularity silicon detector array, Super Oak Ridge Rutgers University Barrel Array (SuperORRUBA), has created opportunities to study neutron transfer reactions in inverse kinematics. Another significant accomplishment is the development of a neutron detector optimized for high efficiency up to 20 MeV neutron energy, the Heavy ion Accelerated Beam induced (Alpha,Neutron) Emission Ratio Observer (HABANERO) that enables the study of (_,n) reactions in inverse kinematics with reaccelerated radioactive ion beams at the ReA3 facility, NSCL.

These new technical developments, first results and their astrophysical context will be presented, and future prospects with the Facility for Rare Isotope Beams (FRIB) will be discussed.

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Refreshments will be served at 3:15pm