Colloquium

Exploring the Nuclear Frontier with Radioactive Beams and Active-Target Detectors

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Room 118 Nieuwland Science Hall

Refreshments @ 3:30 in 202 NSH

One of the goals of nuclear physics is to understand the properties of nuclei and their diverse array of emergent phenomena, from the nucleus' fundamental constituents and interactions. We can greatly extend our understanding of nuclei by studying those that have proton and neutron numbers very different from the stable nuclei that occur in our natural world. In these exotic nuclei we expect to see new types of nuclear phenomena and changes in structure that often challenge our current nuclear models and understanding. Radioactive beams are needed to study nuclei that are far from stability, but producing these beams is a challenge. Beams of unstable nuclei can only be produced at modest intensities and new ways of taking full advantage of these low-intensity radioactive beams are needed. One way we can address this issue is with the use of active-target detectors, such as the Active-Target Time-Projection-Chamber (AT-TPC). These detectors have the advantage of increasing the luminosity of nuclear reactions while maintaining good energy resolution. The AT-TPC and similar detectors allow us to take full advantage of the radioactive-ion beams at present and future nuclear physics facilities to explore the frontier of rare isotopes where much spectroscopic information is unknown. I will discuss how active-target detector technology will be used with the radioactive beams that will be available at Argonne National Laboratory, the National Superconducting Cyclotron Laboratory, the future Facility for Rare Isotope Beams. I will also present future perspectives for using the in-flight radioactive beams available at Notre Dame to study alpha-cluster states in light nuclei and measure reaction parameters of interest for element production in astrophysical environments.