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Direct reaction experiments with exotic beams (Keynote Talk)

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Performing direct reaction experiments using rare isotope beams with very low intensities such as those presently or projected to be available at facilities around the globe is challenging. Techniques and methods to utilize these sparse beams in the most optimum way are essential to the progress of nuclear science. Among these techniques two approaches are well adapted to two different energy domains: knockout reactions on fast beams produced via projectile fragmentation, and using an active target detector to maximize the luminosity at energies close to the Coulomb barrier.

Although knockout reactions have been used extensively for over a decade, the details of the underlying reaction mechanism has only recently been explored experimentally. Results of exclusive experiments demonstrate the robustness of our understanding of such reactions, and validate their use as a spectroscopic tool. These reactions were recently used to measure one-nucleon removal cross section with a 5% precision on radioactive p-shell nuclei and interpret the results in relation to ab-initio calculations of spectroscopic factors.

At energies close to the Coulomb barrier, reactions in inverse kinematics are plagued by the difficulty to efficiently and precisely measure the characteristics of the emerging particles. The Active Target Time Projection Chamber (AT-TPC) used at the NSCL and elsewhere offers an elegant solution to this dilemma, and promises to advance our reach towards very exotic nuclei produced as radioactive beams. One particularly interesting avenue is the use of resonant scattering experiments to probe the spectroscopic and cluster properties of the projectile+target composite systems.

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