

Nuclear Structure Studies with the Active-Target Time-Projection-Chamber: Moving Towards Exotic Beams

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The use of radioactive beams allows for the study of many unstable nuclei and continues to yield important information on the evolution of nuclear structure as well as uncover unique nuclear phenomena such as clustering and halos. One of the main challenges of using radioactive beams is dealing with their low-intensities, especially for beams of nuclei far from stability. A new detector, the Active-Target Time-Projection-Chamber (AT-TPC), is being developed at the National Superconducting Cyclotron Laboratory (NSCL) that will allow us to overcome some of these low-intensity limitations. The AT-TPC does this by using its tracking gas simultaneously as a target, which maximizes luminosity without sacrificing good energy resolution. This opens up a new window for experiments with lower beam rates. I will discuss the use of the AT-TPC's Prototype in several experiments using secondary beams from Twinsol at the University of Notre Dame to study alpha-cluster states, fusion, and the decay of the Hoyle state. In addition, I will show results for a test experiment using the Prototype AT-TPC to study isobaric analog states of Sn isotopes at Argonne National Laboratory (ANL). Possibilities for future experiments with more exotic Twinsol beams as well as experiments with fission fragments at ANL and neutron-rich nuclei with the ReA3 accelerator and the AT-TPC at NSCL will be presented.