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Nuclear Astrophysics Experiments using Active Target Detectors at CENS

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Observations of astrophysical phenomena, such as the luminosity of X-ray bursts and the abundance pattern of stars, can be explained by nuclear reactions occurring in the stars. It is well known that the nuclear reaction rates of nuclei involved in nucleosynthesis have a direct impact on stellar evolution, such as energy generation, the nucleosynthesis path, and nal abundance pattern of the elements. However, due to large uncertainties in theoretical models and a lack of measurements with rare isotope beams for proton- and alpha-induced reactions, our knowledge of astronomical observables is still far behind.
One recent sensitivity study showed the light curve of X-ray bursts is extremely sensitive to (,p) reactions on proton-rich radioactive nuclei, including the 14O(,p)17F reaction. In order to constrain the astrophysical reaction rate, the cross section measurement along the large range of Ecm has been proposed using the TexAT active target time projection chamber. With this measurement, we expect to reduce the statistical uncertainty of the cross sections down by 5 to 13%, resulting in the signi cant enhancement of the astrophysical uncertainty. Furthermore, we are developing a new detector system to provide a high detection e ciency as well as a high energy and position resolution of particles, namely AToM-X, at CENS.
Details of the experiment and new detector system will be presented. We will also discuss plans to utilize this system for experiments of nuclear reactions using radioactive ion beams.

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