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## The SECAR Recoil Separator for Nuclear Astrophysics

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The explosive nuclear burning of hydrogen at high temperatures and densities on the surface of accreting white dwarfs and neutron stars gives rise to a number of observable nuclear explosions including Novae or X-ray bursts. Recent astronomical observations provide unprecedented information, for example, on atomic abundances in Nova ejecta and time structure of X-ray bursts. Interpretation of these data requires an understanding of the nuclear processes during the explosive events and, therefore, information on the reactions of unstable, proton-rich nuclei with hydrogen and helium.

We will present the conceptual design of the SEparator for CAPture Reactions (SECAR), a recoil separator designed to achieve the sensitivity needed to measure very low ( $p,\gamma$ ) and ( $\alpha,\gamma$ )  $rp$ -process reaction rates directly at astrophysical energies in inverse kinematics and for target masses up to  $A=65$ . This requires a large angle acceptance of  $\pm 25$  mrad to transmit the full reaction distribution of the recoils and a very high mass resolution  $m/dm > 750$  not available at existing recoil separators. SECAR will initially operate at the ReA3 rare isotope (RI) beam facility at NSCL, Michigan State University, and taking advantage of its unique capability to produce a wide range of radioactive beams. SECAR will achieve its full potential with the intense radioactive beams that can be produced at the Facility for Rare Isotope Beams (FRIB), a next generation facility currently under construction at Michigan State University.

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