

The Recoil Mass Separator Project at Notre Dame

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Most stages of stellar evolution involve the radiative capture of protons and α particles, and many of the pertinent (p,γ) and (α,γ) reactions have been extensively studied by γ ray detection. However this method is limited at lower energies by the cosmic and the beam induced background.

One way to reduce this background is to detect the γ rays in coincidence with the reaction products, but this necessitates separating the recoils from the beam using a recoil mass separator (RMS) in inverse kinematics. This is an incredibly difficult task, since for typical reactions, the ratio of beam to reaction products will be on the order of 10^{17} . However, with proper design, an instrument capable of this level of separation can be built.

Such a facility to study (α,γ) reactions using beams with $A < 40$ is under development in the Nuclear Science Laboratory at Notre Dame. The instrument will have an angular acceptance of $\theta_{\max} = \pm 40$ mrad and an energy acceptance of $\Delta E/E = \pm 7.4\%$, which will allow it to be used to study reactions that could not otherwise be studied. The design of the system will be presented, including a discussion of a Wien filter designed specifically for this application. The current status of the project will be presented, along with a timeline for operations.