Experiments using Recoil Separators

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Radiative capture reactions are of paramount importance in virtually every astrophysical environment, many of them involving short-lived radionuclides away from stability.

Recoil separators were adapted in order to solve the problem of those hitherto infeasible measurements where the radionuclides of interest are too short-lived to make a target onto which light projectiles could impinge. With ISOL and fragmentation facilities producing accelerated radioactive ion beams of relatively high intensity, the inverse kinematics technique of recoil separators, using hydrogen and helium targets, was a solution that conferred many additional advantages to traditional measurements, such as different, controlled sources of systematic error, and most importantly, intrinsic and substantial background suppression. However, the method poses many additional challenges also.

The field of Recoil Separators using radioactive beams has become mature, with many of the challenges arising from the vastly varying experimental conditions for each reaction having now been probed in pioneering measurements. The state of the art is such that current and future recoil separators can draw upon a wide variety of techniques, data and example measurements to perform careful measurements of radiative capture reactions of astrophysical interest. Focusing on the catalogue of results and experiences from the DRAGON facility, I will discuss the performance characteristics, limitations and successes of recoil separators, highlighting reactions of importance in light of their connection to astronomical observables.