

HELIOS: a new approach to studying transfer reactions in inverse kinematics

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The new helical-orbit spectrometer, HELIOS [1,2], at Argonne National Laboratory (ANL) provides a way of studying transfer reactions in inverse kinematics that circumvents the problems traditionally associated with this reaction mode: low resolution brought on by the rapidly changing laboratory energy with angle, and a kinematic compression at forward c.m. angles. This is achieved by transporting outgoing ions in the strong, homogeneous magnetic field of a solenoid, where the ions execute helical orbits before returning to the magnetic axis. The field disperses ions according to their energy, angle of emission, and charge-to-mass ratio giving rise to the particle's cyclotron period which provides particle identification. Along the axis, surrounding it, is an array of position-sensitive Si detectors used to measure energy, position, and time of flight. This detector array can be coupled with recoil detection to provide a full kinematic description of the reaction. To date, the device has been used to study reactions with light radioactive beams of ^{12}B [3] and ^{15}C [4], through to medium and heavy stable beams of ^{86}Kr and $^{130,136}\text{Xe}$, respectively. The potential of such a device for exploitation with radioactive beam programmes, for example CARIBU at ANL [5], and around the world, is demonstrated.

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