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Advances in Solenoidal-Spectrometer Techniques for Reaction Studies

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The solenoidal-spectrometer technique for direct-reaction studies has advanced significantly since it was first demonstrated with the HELIOS spectrometer at Argonne's ATLAS facility and has become an essential tool for nuclear structure, reaction mechanism, and nuclear astrophysics studies. There are now three dedicated solenoidal spectrometers: the ISOLDE Solenoidal Spectrometer at HIE-ISODLE, HELIOS, and SOLARIS at FRIB, each with unique attributes. Both HELIOS and SOLARIS operate in a vacuum, silicon-array mode, and with the Active Target Time Projection Chamber. Recent results that highlight the advantages of these approaches will be briefly shown. The main focus will be on the use of the (d,pγ) reaction in inverse kinematics as a method to obtain (n,γ)-reaction cross sections. This was recently demonstrated via a study of the ^{85g}Kr(d,pγ) reaction with HELIOS and the Apollo scintillator array. The neutron capture cross section on the radioisotope ⁸⁵Kr (T_{1/2} = 10.7 yr), an *s*-process branching point nucleus, carries a significant uncertainty due to the challenges of direct studies. The technique has significant potential for future indirect (*n*,γ)-reaction studies. This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under Contract Number DE-AC02-06CH11357. This research used resources of ANL's ATLAS facility, which is a DOE Office of Science User Facility.

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