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Development of a solenoid spectrometer for nuclear astrophysical studies of fusion reactions near stellar energies

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Abstract

A solenoid spectrometer for nuclear astrophysics (SSNAP) has been developed to study heavy-ion fusion reactions of astrophysical importance near stellar energies. Charged particles follow helical trajectories within the strong magnetic field of a superconducting solenoid. The $^{12}\text{C}(^{12}\text{C},\text{p})^{23}\text{Na}$ reaction was studied as the first measurement using the solenoid spectrometer at the University of Notre Dame within the energy range of $E_{\text{c.m.}}=4.0$ to 6.0 MeV. This experiment demonstrated that the solenoid spectrometer is able to provide outstanding capability for detection of light charged particles produced by nuclear fusion reactions having a relatively wide energy range.

Keywords: nucleosynthesis, solenoid spectrometer, magnetic field,

$^{12}\text{C}(^{12}\text{C},\text{p})^{23}\text{Na}$, PSSD, SSNAP

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