SEARCH FOR FISSION-LIKE PROCESSES IN THE 200-MeV p+^{28}Si REACTION

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Studies of the 200-MeV p+^{28}Si reaction at backward angles show evidence of significant amounts of relatively energetic ions of Z > 9. In order to examine the possibility that these yields may be the result of a two-body breakup (fission-like) process, a coincidence experiment was performed.

A 100 \mu g/cm^2 isotopically-separated target of \(^{28}\text{Si}\) was bombarded with 200-MeV protons from the Indiana University Cyclotron Facility. The fragments were detected with a pair of gas-ionization-\(\Delta E\) and semiconductor-\(E\) detector telescopes operating at gas pressures of 6 and 9 torr of isobutane. Windows on the gas ionization detectors were 70 \mu g/cm^2 polypropylene. Fragments with atomic numbers up to Z=12 with energies as low as \(~0.2\text{ MeV/nucleon}\) could be detected with this system. One detector telescope served as a defining detector (\(\Delta \theta = \pm 2\) degrees) and was kept fixed at forward laboratory angles (11, 30, and 55 deg.) while the second detector (\(\Delta \theta = \pm 4\) degrees) was rotated through correlation angles, \(\Delta \theta\), from approximately 40 to 180 degrees in the laboratory system. Both singles and coincidence data were recorded on line.

In Fig. 1 is shown an example of data taken at 11° by the defining detector. In this \(\Delta E\) versus \(E\) contour taken at a gas pressure of \(~9\) torr, Z values of up to Z=12 are clearly defined. Because of their low energy loss in the gas-ionization detector, Z=1 and Z=2 are not clearly defined in these spectra. In Fig. 2, taken at 170° and 9 torr, fragments with charges up to Z=9 are clearly observed, indicating that some heavy fragments are being emitted in the backward direction. However, the coincidence spectra indicate few heavy fragment-heavy fragment coincidences. Instead the heavy fragments are found to be primarily in coincidence with H or He. Further work and analysis are in progress in order to understand the yields and sources of these energetic fragments emitted at backwards angles.