Energy and Charge State Dependencies of Transfer Ionization and Single Capture

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Investigation of the charge state and energy dependencies of Transfer Ionization (TI) and Single Capture (SC) processes are being completed for Fluorine ions and are being extended to Silicon ions.
The collision systems reported here are $F^{(4-9)+}$ and $Si^{(12-14)+}$ ions interacting with Helium. The measurements are being made for beam energies between 0.5 to 2.5 MeV/u and using a supersonic He jet with two-stage collimation. A recoil ion momentum spectrometer is used to separate TI and SC by recording the longitudinal momentum transfer and time-of-flight of each recoil ion. A magnetic field is used to control the position of the recoil ions on the detector. The ratios of TI to SC are determined with high accuracy. Furthermore, total cross-sections for the bare and hydrogen like Fluorine ions are determined by using previously measured charge exchange cross-sections.[1] Charge exchange measurements are planned for the other charge states. SC and TI for higher Z-ions are also under investigation. This work is supported by the Chemical Sciences, Geosciences and Biosciences Division, Office of Basic Energy Research, Office of Science, U.S. Department of Energy.
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[1] T. R. Dillingham, J. R. Macdonald, and P. Richard, Phys. Rev. A **24**, 1237 (1981)