

# ION-ATOM COLLISIONS<sup>1</sup>

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Ion-atom collision processes constitute reaction channels of fundamental importance in plasma environments, such as in fusion devices and astrophysical plasmas. From its beginning the merged-beams technique has provided needed access to ion-atom collisions at eV/u interaction energies. Because of the difficulty in the merged-beams technique, earlier experiments were generally limited to collision systems with relatively large cross sections using low-charge-state beams. With the development of the electron-cyclotron-resonance (ECR) ion source intense beams of multicharged ions became available and an opportunity arose to study a new family of collisions. Neutral beam generation using photodetachment has allowed intense, well-characterized neutral beams compatible with ultrahigh vacuum conditions. A merged-beams apparatus was developed at Oak Ridge National Laboratory and used in conjunction with an ECR ion source permitting measurements of electron capture from collision energies of 20 meV/u to 5000 keV/u for a variety of multicharged ions on atomic H or D. While special beam trapping techniques (i.e., octopole ion beam guide in combination with advanced multicharged-ion sources have recently extended more conventional beam-gas techniques, the merged-beams technique is unique in its ability to measure absolute cross sections for fundamental ion-atom collision systems.

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