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Merged Beam Measurements of Mutual Neutralization at Subthermal Collision Energies[1]

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We have measured the total cross sections and kinetic energy distributions for the mutual neutralization of a large ensemble of atomic anions and cations with a merged beam apparatus. An unprecedented resolution in the kinetic energy spectra allows us to identify the states of both reactants and products down to their fine structure. Knowing the angular distribution of the products in the laboratory and center-of-mass frame, allows for total, partial, and differential cross sections to be retrieved. Multi-channel Landau-Zener calculations have been performed with an asymptotic method for the evaluation of ionic-covalent coupling matrix elements. The systematic analysis of branching ratios has shed new light on the electron transfer mechanism. These single pass measurements prepare similar studies involving molecular ions, to be performed with the double electrostatic ion storage ring DESIREE operating at cryogenic temperature.

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