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Photonic and electronic interactions of ions

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Merged-beam techniques are used to study electron-ion recombination as well as photoionization and photofragmentation of ions. Time reversal symmetry relates photoionization to electron-ion recombination and measurements addressing both processes can provide new detailed insight into the role of specific reaction pathways in both channels. Beams of mass and charge state analyzed accelerated ions provide well defined, clean targets for studying electron-ion and photon-ion interactions. Complete collection at high selectivity and efficient detection of product ions is ensured by the directionality of the incident energetic ion beam and, thus, absolute cross sections can be determined with good accuracy. Employing monochromatized photons and cold electron beams together with well prepared ion beams facilitates the measurement of high-resolution resonance spectra and delivers detailed spectroscopic information about singly and multiply excited states of the ions. Plasma rate coefficients derived from such measurements are required to model astrophysical and laboratory plasmas and their emission and absorption characteristics. Besides atomic ions, also fullerene ions and endohedral fullerenes with encapsulated atomic ions are addressed in photon-ion merged-beams experiments. A particularly interesting subject of such studies is the response of endohedral fullerenes to photoabsorption by the atom encaged inside a carbon sphere. Plasmon resonances, redistribution of oscillator strengths and containment resonances are exciting topics for studies of these exotic nano-scale objects.