A.2.5. Kinematically Complete Differential Ionization Cross Sections for 2keV Electron Impact Ionization of C^{2+}--*S. Hagmann, H.Kollmus,* J.Ullrich,* R.Moshammer,* and R. Mann***

The fundamental process of electron impact ionization of atoms, after 80 years of study, still plays a central role in our understanding of dynamics and structure of atoms and molecules. In this field (e,2e) kinematically complete experiments have become the most sensitive tool for a more basic understanding of the process. Fundamentally, there is a lot of interest in applying the same tools to the spectroscopy of ions but, standard crossed beam techniques provide luminosity which is insufficient by orders of magnitude. We thus have begun to investigate differential electron impact ionization cross sections via inverse kinematics in ion-atom collisions. In an experiment which aimed at proving this technique we used a reaction microscope [1] to investigate kinematically complete differential ionization cross sections for 2keV e^{-} + C^{2+} in inverse kinematics via ion-atom collisions 3.6AMeV C^{2+} + He at the UNILAC at GSI, Germany. At the expense of reduced angular resolution for the scattered electrons, the slow and fast electrons were both detected on the 2D position sensitive, multi-hit capable channelplate detector of the reaction microscope [1]. An electron from a He atom in the cold supersonic gas jet is regarded as quasifree and ionizes the C^{2+} projectile. The electron ionized from the projectile finds itself slightly above the continuum threshold of the outgoing C^{3+} projectile. Via inverse kinematics this electron is seen in the laboratory system at $\theta_e \approx 0$ and with $v_e \approx v_{proj}$ in the ECC cusp. Accordingly the inelastically scattered ionizing electron is seen with small laboratory energy at large forward angles. Our preliminary results cover the entire range of momentum transfers contributing to the differential cross section and exhibit the following characteristics of the cross section: a) in the range of very small momentum transfer, i.e. quasi-photoionization, we observe clearly the bimodal structure in the angular distribution of the “photo”-electrons. This is the first complete angular distribution for photoionization of ions. b) In the range of large momentum transfer the angular distribution is dominated by binary collisions on the Bethe-ridge.

We are currently checking whether, in spite of the finite resolution, deviations from the 1^{st} Born approximation can be seen in the angular distribution of the electrons for collisions with small momentum transfer or — in the range of large momentum transfer — momentum profiles may be seen for an electron originally bound to the C^{2+} electron.

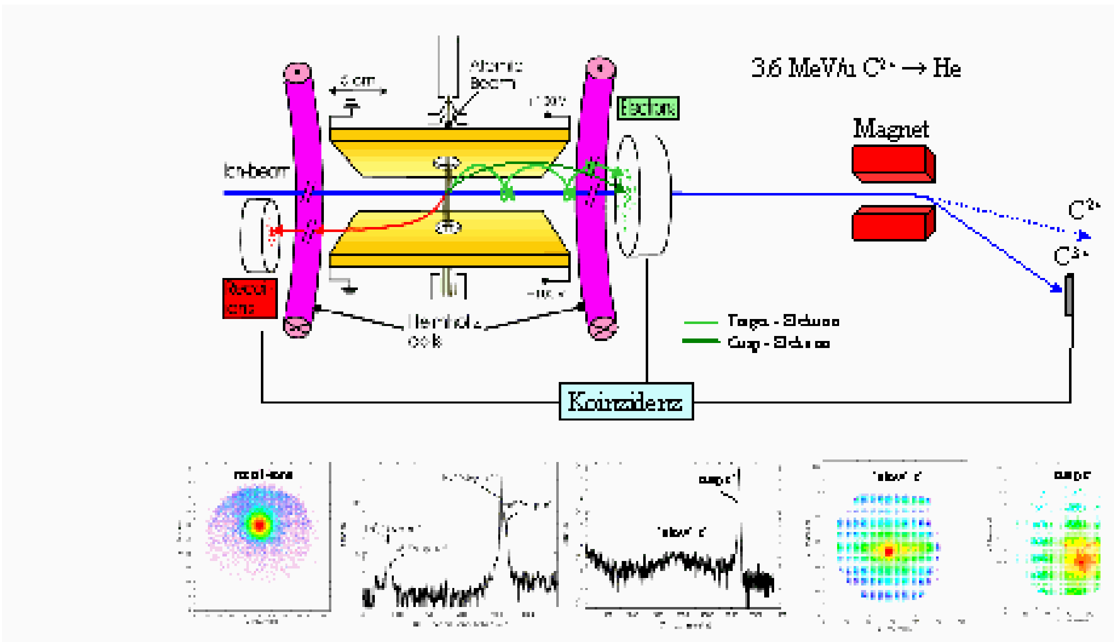

Figure 1. Experimental setup of the Reaction Microscope.

Reference

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1. J. Ullrich *et al*., J. Phys. B 30, 2917 (1997).