

§29. The Study of Excitation Processes of Atomic Ions by Electron Impact

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The understanding of the interaction between electron and ion is very important not only for the control and diagnostic of plasma but also for the atomic physics in many atomic processes in high temperature plasma. The study of ionization process in the electron-ion collision has been done for a long time, and the data was offered to the plasma control, the diagnostics of the plasma and so on. At present, however, there are a very few data for the excitation processes of electron-ion collisions because of its experimental difficulties mainly due to a low signal-to-noise ratio because of a low target ion density and very small cross sections. In this study, we have developed a high-density ion source and an original tandem type electrostatic energy analyzer for the e-ion collision experiments in order to overcome the experimental difficulties.

The purpose of this study is to observe electrons emitted from ions by electron impact. In this experiment, it is essential to have a good overlap between electron and ion beams at the collision region. An L-shape slit with a slit width of 0.1 mm was used in order to measure the current density profile of both beams at the collision region.

Figure 1 shows typical beam profiles measured by scanning the L-shape slit in the direction perpendicular to both electron and ion beams. The beam profile shown in fig.1(a) is obtained after the adjustment of both beams as to have maximum total currents, while fig.1(b) is measured by fixing the L-shape slit at the collision region as to have maximum current densities for both

beams at the collision region. The results clearly demonstrate that beam adjustments without observing the current density profile sometimes result in poor overlap between electron and ion beams.

Measurements of ejected electrons from positive ions by electron impact is in progress.

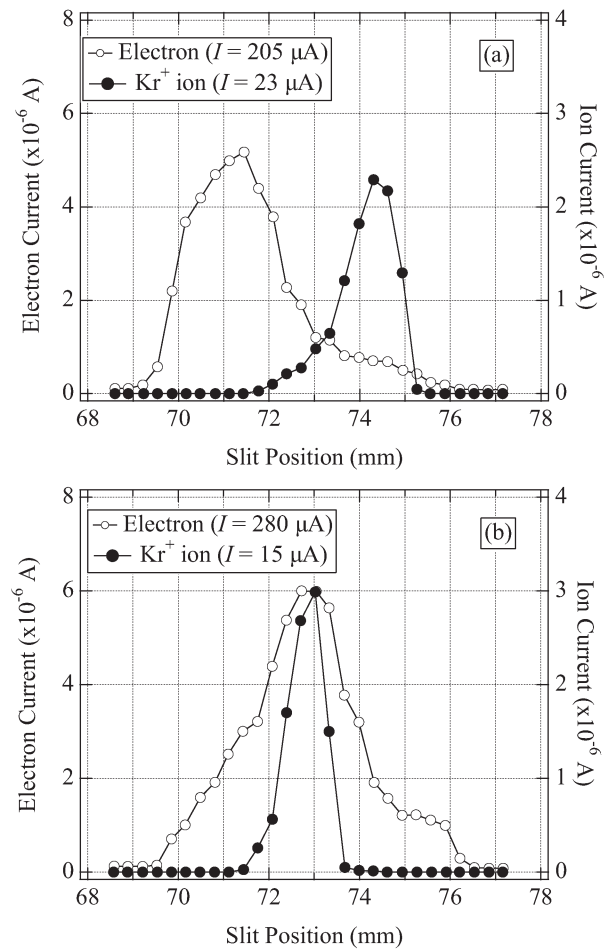


Fig. 1: Current density profiles of electron (open circles) and Kr⁺ ion (closed circles) beam measured by scanning an L-shape slit. (a) Both beams adjusted as to obtain the maximum total current. (b) Both beams adjusted as to obtain the maximum current density at the collision region.