§5. Resonant Excitation/Ionization Processes in Electron-Ion Collisions

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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.

Resonant process is very interesting and important feature in electron-ion collisions. This can be observed not only in the excitation but also in the ionization processes[1)]. We have developed an electro-static charge state analyzer for the precise measurements of ionization cross sections of positive ions by electron impact. Figure 1 is a photography of the analyzer, consisting of an electro-static deflector and Faraday cups for the measurement of the currents of the primary ions and the product ions. Because our ion source can produce very high current ion beam in the order of 1 mA, product ion current can be measured using an electro-meter, which enables us to measure the absolute cross sections with high accuracy.

Preliminary measurements of the single ionization cross sections for Ar^+ are in progress.

1) For example, G. H. Dunn, in "Electron Impact Ionization", Edited by T. D. Mărk and G. H. Dunn, (Springer Verlag, Wien New York, 1985).

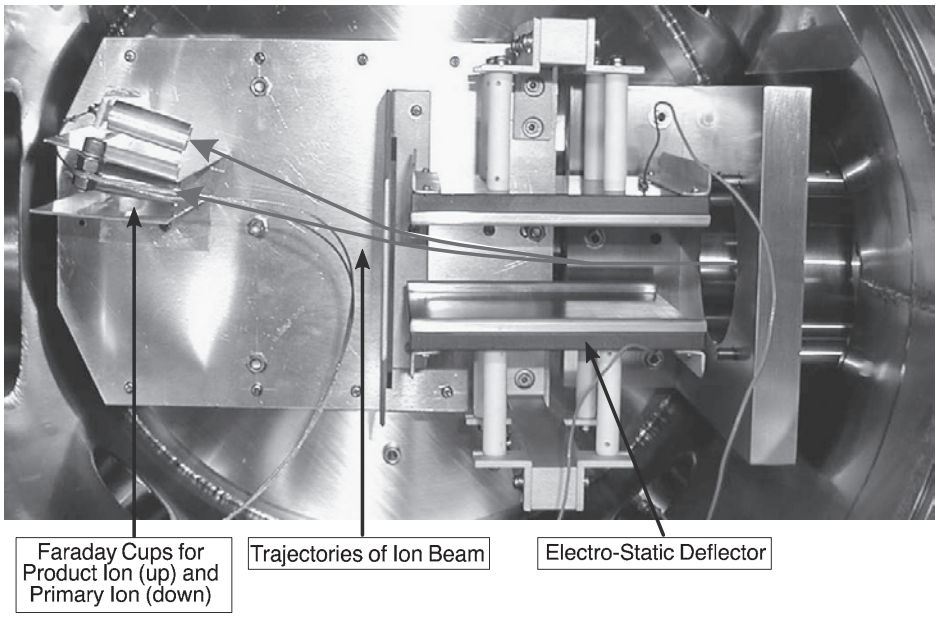

Fig. 1: Photography of an electro-static charge state analyzer. Lines with arrows represent the trajectories of the primary ions (down) and the product ions (up).