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Double Differential Cross Section Measurements for Electron Impact Ionization of Atmospheric Gases

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Synopsis We present comprehensive experimental measurements of double differential cross sections (DDCS) for atmospheric gases, Ar, N_2, CO_2 and CH_4. DDCSs were obtained by measuring the energy and angular distributions of one of the two outgoing electrons which are indistinguishable by use traditional electron spectrometer with an electron analyzer.

Collision techniques has provided a description the structure of matter at the atomic or molecular level and explained natural laws. Applications of the results from collision physics are of most importance to atmospheric science, and meteorological phenomena. Recently, an intensive effort of experimental and theoretical work has been devoted to the study of ionization differential cross-sections of atoms and molecules by electron impact [1-4]. Doubly differential cross sections (DDCS) of single ionization, as a function of ejected energy, and the angle of the ejected electron, contain valuable information about both the collision dynamics and the internal structure of atomic or molecular systems.

The single ionizing collision between a projectile electron and a target ends up two of outgoing electrons called scattered and ejected electrons which are indistinguishable as feature of the ionization events. In the DDCS measurements, scattered or ejected electrons are detected by an electron energy analyzer rotating around the collision centre in a plane. Outgoing electrons from collision event have been focused at the entrance of the analyzer. The analyzer can be rotated around the target beam axis in the desired angle.

Ionization behavior of atmospheric gases are important especially ionosphere or plasma environment. We measured double differential cross-sections of Ar, N_2, CO_2 and CH_4 targets at intermediate electron impact energy (Figure 1). For all atom and molecules, we observed ionization peaks for lower ejected electron energies at $E_0 > 200$ eV as expected. We will present all data for other incident and ejected electron energies at conference.

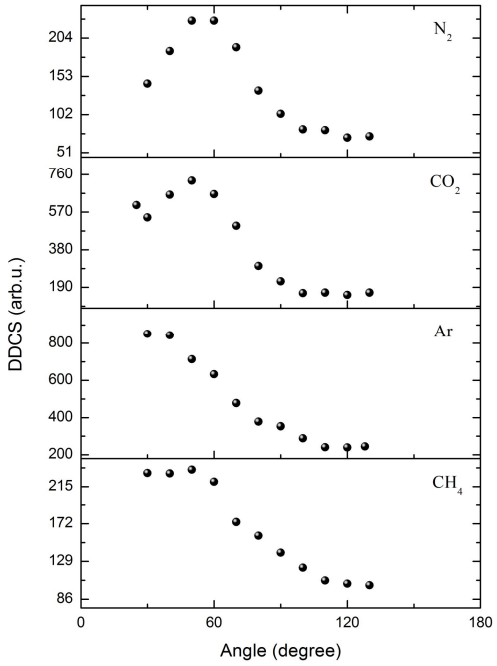

Figure 1. The DDCS measurements for 50 eV ejected electron energy of Ar, N_2, CO_2 and CH_4 at 250 eV incident electron energy

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References

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