Geophysical Research Abstracts, Vol. 7, 06351, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06351

First results from ASPERA-3 ion mass analyzer (IMA) on CO_2^+ escape.

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According to the latest results from Mars Express the amount of carbonates on the Martian surface are too low in order to explain the one hundred times denser CO_2 atmosphere of Mars in the past. This controversy prompted us to investigate the escape of CO_2 associated with the solar wind interaction. Ionized $C0_2$ present in the Martian ionosphere can through electrodynamic processes gain energies exceeding the escape energy and be lost into space.

The ASPERA-3 instrument (Analyzer of Space Plasmas and Energetic Atoms) onboard Mars Express includes the IMA sensor (Ion Mass Analyzer) providing ion composition measurement in the energy range of $\sim$ 10 eV – 36 keV. Since the instrument design was optimized for the plasma dynamics studies, the mass resolution is not enough to directly resolve CO_2^+ and O_2^+, the main molecular ion composing the Mars ionosphere according to the theoretical models. Therefore, a special multi-species fitting technique, using the laboratory and in-flight calibrations, was developed to resolve the CO_2^+ peak from the neighboring much more intense O_2^+ peak. This technique was applied to the observations covering the period from April 4, 2004 to October 10, 2004. The events of heavy ion escape were identified inside the solar wind void including the Martian eclipse and the mass spectra were analyzed using the technique. We report the results of statistical studies of these events which permitted to determine CO_2^+ / O_2^+ ratio in the escaping plasma.