Geophysical Research Abstracts, Vol. 8, 02000, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02000

Analysis of the mass composition of the escaping plasma at Mars

E. Carlsson (1, 2), S. Barabash (1), A. Fedorov (3), E. Budnik (3), A. Grigoriev (1), Y. Futaana (1), H. Gunell (1), H. Nilsson (1), R. Lundin (1)

(1) Swedish Institute of Space Physics, Kiruna, Sweden (ella@irf.se / Phone:+46-980-79124), (2) Luleå University of Technology, Department of Physics, Luleå, Sweden, (3) Centre d'Etude Spatiale des Rayonnements, Toulouse, France

Results from Mars Express, Mars Exploration Rovers and Mars Global Surveyor indicate that Mars harbored large amounts of liquid water on the surface in the past. In order for the water-associated geomorphologic features to form, the pressure in the atmosphere must have been at least a hundred times higher to produce the necessary greenhouse effect required to hold liquid water stable. The present atmospheric pressure is only 6-9 mbar and moreover, the spectral imaging of Mars suggests that the amount of carbonates stored in the surface is too low in order to explain the denser atmosphere in the past. This controversy led us to investigate the escaping plasma by analyzing the data from the IMA sensor (Ion Mass Analyzer) of the ASPERA-3 instrument suite onboard Mars Express. The IMA sensor measures the differential flow of ion components in the energy range of 0.01-30 keV/q.

Since the instrument design was optimized for studies of plasma dynamics, the mass resolution is not adequate enough to directly resolve CO_2^+ from O_2^+, which is the main molecular ion composing the Mars ionosphere according to theoretical models. Therefore, a special multi-species fitting technique, using calibration and in-flight data, was developed to resolve the CO_2^+ peak from the neighboring and much more intense O_2^+ peak. This technique was applied to the observations covering the period from April 4, 2004 to October 2, 2005. The events of heavy ion escape were identified inside the induced magnetosphere boundary and the Martian eclipse. We report the results of statistical studies of these ion-beam events which permitted to determine CO_2^+/ O^+ and the O_2^+/ O^+ ratio of the escaping plasma at Mars.