Plasma domains at Mars. Their boundaries and solar wind and IMF control of them

E. Dubinin (1), M. Fraenz (1), J. Woch (1), E. Roussos (1), S. Barabash (2), R. Lundin (2), J. D. Winningham (3), R. Frahm (3), M. Acuna (4)

(1) Max-Planck-Institute for Solar System Research, Katlenburg-Lindau, Germany, (2) Swedish Institute of Space Physics, Kiruna, Sweden, (3) Southwest Research Institute, San-Antonio, USA, (4) NASA Goddard Space Center, Washington, USA

A total of about 400 orbits during the first year of the ASPERA-3 operation onboard Mars Express spacecraft was analyzed to obtain a statistical pattern of the main plasma domains in the Martian space environment. The environment is controlled by the direct interaction between the solar wind and planetary atmosphere/ionosphere which results in the formation of the magnetospheric cavity. Ionospheric plasma was traced by the characteristic "spectral lines" of photoelectrons that enable to detect an ionospheric component even far from the planet. Plasmas of the solar wind and planetary origin were distinguished by the ion mass spectrometry. Several different regions, namely, boundary layer/mantle, plasma sheet, region with ionospheric photoelectrons, ray-like structures near the wake boundary were identified. Upstream parameters like solar wind ram pressure and the direction of the interplanetary electric field were inferred as proxy from the Mars Global Surveyor magnetic field data in the reference point of the magnetic pile-up region in the northern dayside hemisphere. It is shown that morphology and dynamics of the main plasma domains and their boundaries are governed by these factors as well as by local crustal magnetization.