



Ion Acceleration by Multiple Reflections at Martian Bow Shock

M. Yamauchi (1), Y. Futaana (1), A. Fedorov (2), R.A. Frahm (3), E. Dubinin (4), R. Lundin (1), J.-A. Sauvaud (2), J.D. Winningham (3), S. Barabash (1), and H. Holmström (1)

(1) Swedish Institute of Space Physics, Kiruna, Sweden (M.Yamauchi@irf.se), (2) Institut de Recherche en Astrophysique et Planetologie, Toulouse, France, (3) Southwest Research Institute, San Antonio, USA, (4) Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany

The ion mass analyzer (IMA) on board Mars Express revealed bundled structures of ions in the energy domain within a distance of a proton gyroradius from the Martian bow shock. Seven prominent traversals during 2005 were examined when the energy-bunched structure was observed together with pick-up ions of exospheric origin, the latter of which is used to determine the local magnetic field orientation from its circular trajectory in velocity space. These seven traversals include different bow shock configurations: (a) quasi-perpendicular shock with its specular direction of the solar wind more perpendicular to the magnetic field (QT), (b) quasi-perpendicular shock with its specular reflection direction of the solar wind more along the magnetic field (FS), and (c) quasi-parallel (QL) shock. In all seven cases, the velocity components of the energy-bunched structure are consistent with multiple specular reflections of the solar wind at the bow shock up to at least two reflections. The accelerated solar wind ions after two specular reflections have large parallel components with respect to the magnetic field for the QL shock whereas the field-aligned speed is much smaller than the perpendicular speed for the QT shock. The reflected ions escape into the solar wind when and only when the reflection is in the field-aligned direction.