Geophysical Research Abstracts,
Vol. 11, EGU2009-1682, 2009
EGU General Assembly 2009

Hot space plasmas mass-spectrometry for planetary studies

O. Vaisberg
Space Research Institute, Space plasma, Moscow, Russian Federation (olegv@iki.rssi.ru)

The main goals of in-situ mass-spectrometry of the plasma in the solar system are: determination of mass-composition and separate measurements of velocity distributions of ions. Mass-composition of key information for the sources, transport and sinks of space plasma and frequently can be used for investigation of mass composition of solar system bodies. Measurements of velocity distributions of different ions in space plasma are used for investigation of physical processes in space plasma including the heating and dissipation mechanisms, as well as sources, transport and sinks of plasma constituents.

Mass-separating plasma measurements require analysis of energy (velocity) distributions, thus making energy-mass-spectrometers for hot space plasma quite different from mass-spectrometers for cold plasma (ionospheric plasmas, for example). At the same time, energy-mass-spectrometers have lower mass resolution (M/M from 4 to 60) compared to conventional mass-spectrometers. High velocity of ions does not allow, as a rule, the use of magnets as components of energy-mass-spectrometers.

Most frequently used technique for hot space plasma mass-analysis is combination of energy per charge analysis in electric field and time-of flight measurements. Product is velocity distribution and M/Q ratio. In many cases plasma consists of singly charged ions, and mass if ion can be identified. More reliable identification of mass may require consideration of additional evidence or comparison with models. To perform unique determination of mass, velocity and charge one requires to combine three analyzing techniques, usually the energy per charge, time of flight, and total energy.

We discuss most successful experiments techniques in the field. Since 1960th progress in experimental technique led to development of sophisticated instruments for space plasma and planetary studies. Plasma diagnostics became recognized method in planetary studies. Several successful applications of plasma diagnostics in planetary missions are presented.