Geophysical Research Abstracts
Vol. 16, EGU2014-15159, 2014
EGU General Assembly 2014

From the subsurface ocean of Enceladus to interplanetary space - the journey of Saturnian stream particles

Hsiang-Wen Hsu (1), Frank Postberg (2), Sascha Kempf (1), Mihaly Horanyi (1), and Ralf Srama (2)
(1) LASP, University of Colorado Boulder, CO, USA, (2) IRS, Universität Stuttgart, Stuttgart, Germany

Discovered already 10 years ago at the beginning of the Cassini mission at Saturn, silica (SiO_2) nanoparticles, so-called stream particles, stand out from the water-dominated world of the Saturnian system. They serve as a unique remote-sensing tool to probe the conditions at their formation sites as well as their interactions with the surroundings. This presentation will give an overview about the life journey of silica nanoparticles at the Saturnian system and the associated implications derived mainly based on the Cassini Cosmic Dust Analyser measurements.

The first part of the journey starts from their source moon Enceladus. Here the formation criteria of silica nano-colloids provide detailed constraints on the subsurface ocean of Enceladus, indicating high interior temperature and current hydrothermal activities. The second part describes the processes about how nanosilica particles enter the E ring as ice grain inclusions and later become detached because of the plasma sputtering erosion. Once exposed to open space they get charged which eventually leads to their ejection from the magnetosphere into interplanetary space. During this the final stage we focus on how charged nanodust interacts with the solar wind magnetic field and how to derive solar wind information with a single spacecraft located inside the magnetosphere. It is found that a small fraction of the ejected nanoparticles is in fact sent back into the magnetosphere of Saturn because of the complex dynamical interactions with solar wind. The detection time and the dynamical properties of these “returned” particles thus enable us to probe the solar wind magnetic field structure from inside the magnetosphere.