Geophysical Research Abstracts
Vol. 19, EGU2017-5359, 2017
EGU General Assembly 2017

Laboratory investigation of dust impacts on antennas of the Cassini model spacecraft

Libor Nouzak (1), Jiri Pavlu (1), Zdenek Nemecek (1), Jana Safrankova (1), Aniya Khalili (2), Zoltan Sternovsky (3,4), David Malaspina (3), Eberhard Grun (3), Sean Hsu (3), Shengyi Ye (5), and Mihaly Horanyi (3)

(1) Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic, (2) Institute of Space Systems, University of Stuttgart, Stuttgart, Germany, (3) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA, (4) Aerospace Eng. Sci. Department, Univ. of Colorado, Boulder, CO, USA, (5) Physics and Astronomy Department, University of Iowa, Iowa City, IA, USA

We present data and findings from the laboratory investigation of dust impacts detected by antennas on spacecraft, with particular relevance to the RPWS (Radio Plasma Wave Science) instrument on Cassini. The aim of the laboratory simulation measurement is to clarify the physical processes of signal generation, and to investigate instrumental effects that affect the signals. A 20:1 reduced size model of the Cassini spacecraft has been constructed, including the three antennas of the RPWS instrument, which can be configured either in a dipole or a monopole mode. Small tungsten plates are attached to the antennae and the spacecraft body, and used as impact targets to provide high impact charge yields. The model spacecraft is bombarded with submicron-sized iron grains from the 5–25 km velocity range using the dust accelerator facility operated at the University of Colorado. The experimental results support the recent suggestion that most dust detection events recorded in the dipole mode are due to antenna hits, as opposed to impacts on the spacecraft body. On the other hand, impacts onto the High Gain Antenna generate signals on the monopole antenna only. Further analysis of the data shows that the recollection of the impact charge (by the spacecraft and/or the antenna), the induced charging, and thermionic emission of electrons are the main processes responsible for charge generation. The amplitudes and the polarities of the detected signals depend both on the impact location (antenna vs. spacecraft) and the polarity of the spacecraft potential.