Geophysical Research Abstracts
Vol. 21, EGU2019-5309, 2019
EGU General Assembly 2019

The effect of magnetic field on dust impact signals detected by RPWS

Libor Nouzak (1), Jiri Pavlu (1), Jakub Vaverka (1), Sean Hsu (2), Shengyi Ye (3), Jana Safrankova (1), Zdenek Nemecek (1), Zoltan Sternovsky (2,4)

(1) Charles University, Faculty of Mathematics and Physics, Department of Surface and Plasma Science, Prague, Czech Republic (nouzak@aurora.troja.mff.cuni.cz), (2) University of Colorado, Laboratory for Atmospheric and Space Physics, Boulder (CO), USA, (3) University of Iowa, Physics and Astronomy Department, Iowa City (IA), USA, (4) University of Colorado, Aerospace Eng. Sci. Department, Boulder (CO), USA

The antennas of the RPWS (Radio and Plasma Wave Science) instrument onboard the Cassini spacecraft detected dust impacts during the Grand Finale orbits between the D ring and the atmosphere of Saturn. However, the frequency of the detected signals was two orders of magnitude lower than in ring grazing orbits. Because the spacecraft was close to the Saturn with magnetic fields up to 12 μT, the mechanisms for a signal generation could be affected.

We present results from laboratory investigations of dust impacts onto a scaled down model (approximately 1:20) of the Cassini spacecraft with antennas structures similar to RPWS in an external magnetic field. The detection modes of the antennas can be configured either in dipole or monopole. Both antennas and the spacecraft body can be biased up to $\pm$50 V with respect to the vacuum chamber. Small tungsten foils were attached to the antenna impact location to increase the impact charge production. The HGA (High Gain Antenna) of the spacecraft model was pointed into the dust beam and bombarded with submicron-sized iron grains in the velocity range of 20–40 km/s (using the 3 MV dust accelerator operated at the University of Colorado) to simulate the generation of the impact signals during the Grand Finale ring plane crossings. Two different orientations and three different intensities (zero, 0.35 mT and 1.45 mT) of magnetic field were applied to investigate the effects of magnetic fields.

The experimental results support the suggestion that the amplitude of dust impact signals can be affected by the magnetic field. The pre-spike part of the signals (due to electrons escaping first under zero or low positive bias potential) decreases with the magnetic field increase. The reduction of the signals depends on the magnetic field and interacting surface orientation. The electron part of dust impact signals decreases with increasing intensity of the magnetic field, but the ion part remains unaffected.