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Interpretation of dust impact signals detected by Cassini at Saturn

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The Cassini spacecraft spent more than 13 years in the dusty environment of Saturn. During this long period of investigations of the Saturn magnetosphere, the RPWS (Radio Plasma Wave Science) instrument recorded more than half a million spiky signatures. However, not all of them can be interpreted as dust impact signals because plasma structures like solitary waves can result in similar pulses.

We select the registered spike waveforms recorded by both dipole and monopole configurations of electric field antennas operated in 10 kHz or 80 kHz sampling rates at the distance of 0.2 Rs around the rings mid-plane. These waveforms were corrected using Cassini WBR (Wide Band Receiver) transfer function to obtain the correct shape of the signal. The signal polarity, amplitude, and timescales of different parts of the waveforms were quantitatively inspected according to the spacecraft potential, the density of the ambient plasma, the intensity of the Saturn's magnetic field, and its orientation with respect to the spacecraft. The magnetic field orientation was also used for distinguishing between signals resulting from dust impacts and signals produced by solitary waves misinterpreted as dust impact signals.

The preliminary results of our study indicate similarities with previous laboratory studies of dust impact waveforms on the reduced model of Cassini bombarded with submicron-sized iron grains in external magnetic fields at the LASP facility of the University of Colorado. The polarity of the signals changes in accordance with a polarity of the spacecraft potential and pre-spike signals are also observed. The core of the paper is devoted to the relation between characteristics of dust impact signals and local plasma parameters and magnetic field intensity at the radial distance from 2 Rs to 60 Rs from Saturn surface.