

Dust Impact Detection by the Cassini Langmuir Probe in Saturn's E ring

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Abstract

In this work, we present preliminary analysis of dust impact detections recorded by the Cassini Langmuir probe (LP) in Saturn's E ring. These signals appear as sharp spikes in the LP current-voltage (I-V) curves and show clear correlation with the E ring dust density. The statistical analysis will help to understand the nature of these detections as well as provide an alternative method to study the densest part of the E ring.

1. Introduction

Individual examination reveals the existence of sharp spikes in the Cassini Radio and Plasma Wave Science / Langmuir probe (RPWS/LP) I-V sweeps. They are characterized as a sudden increase or decrease in the probe current, with many of them appearing as one-point anomalies lasting less than a millisecond. Their occurrence generally correlates with the E ring dust density - the closer to the ring plane and Enceladus, the more frequent the appearance of spikes. Considering these characteristics, these signals are thought to be caused by dust impacts - most likely the collection of plasma produced from dust-probe impacts. Because of the low detection rate and the flexibility regarding to the spacecraft attitude, LP spikes provide an alternative way to explore the densest part of the E ring.

2. This Work

In this work we will present preliminary statistical analysis of the LP spike appearance as a function of the spacecraft location, the relative dust speed, the spacecraft and probe potentials, and other relevant parameters. Comparison with measurements carried out by the High Rate Detector, a subsystem of the Cassini Cosmic Dust Analyser, will provide constraints on the dust grain size responsible for these detections. We will also examine their spatial distribution to identify features that may associate with ring dynamical ef-

fects, such as the seasonal variation or the noon-to-midnight electric field.

3. Figure

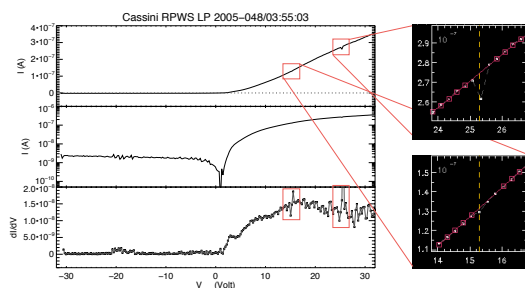


Figure 1: An example of the Cassini Langmuir probe dust impact detection. Two spikes occurred in one single I-V curve (i.e., recorded within 0.5 second). The spacecraft was in the ring plane at $4.1R_S$ (R_S is radius of Saturn) distance to Saturn. It is not clear if the higher amplitude of the spike registered at +25 V probe bias potential (Φ_{bias}) is caused by a larger/fast impactor or a higher collection efficiency at higher Φ_{bias} .