POTENTIAL ERRORS IN ELECTRON DENSITY MEASUREMENTS IN THE PRESENCE OF DUST.

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We report on electron density observations made simultaneously with Langmuir and impedance probe techniques on a common sounding rocket platform as it passed through dusty plasma. Discrepancies between the observations of the two instruments are the subject of this paper and raise concern with Langmuir probe techniques for dusty plasmas. The NASA Sudden Atom Layer (SAL) campaign was an experiment to investigate the presence of charged dust within and/or around a sporadic metal layers in Earth's mesosphere. The SAL rocket passed through a sporadic sodium layer at 94 km, accompanied by a sporadic E layer at 92.5 km. An onboard dust detector observed a 5 km thick positively charged dust layer starting at 90 km. This work presents the data from three other instruments: an electric field probe, a DC Langmuir probe, and a RF impedance probe. The impedance probe data is analyzed using Balmain's theory of a short antenna in a cold magnetoplasma to determine absolute electron density, and to which the DC fixed bias Langmuir probe data is normalized giving relative electron density. The payload skin potential is observed relative to a floating sphere, which was a part of the E-field probe. The three datasets indicate a case of payload surface charging when the rocket passed through the dust layer. We first discuss the rocket wake effect through a 3-dimensional direct simulation Monte Carlo method. A circuit model is then used to hypothesize possible vehicle charging scenarios attributed to the presence of the dust layer. We conclude that triboelectric charging from the neutral dust present in the layer may have played a role in the charging of the payload.

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: barjatya6974

Date Received: September 12, 2005

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2. H - Waves in Plasma
3. (a) S-H1
4. C - Contributed Paper
5. No special instructions