

The Plasma Cloud of Enceladus

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Abstract

The Cassini orbiter spacecraft flew behind the Enceladus plume, as observed from the Earth, on 26 January, 2010. At that time, Cassini was about 577.000 km behind Enceladus, and the radio line of sight passed through the plume about 52 km from the South pole. The occultation was observed by two Deep Space Net tracking stations near Canberra, Australia, one(DSS 43) instrumented for S-band (13.04 cm) and X-band (3.56 cm), and the other (DSS 34) with X-band and Ka-band (0.94 cm). Having two different coherent frequencies at two stations enabled us to obtain two independent measurements. The measurements were made well away from solar conjunction (Earth-Cassini-Sun angle 122 deg.), where the effects of solar wind plasma were small, and the excellent stability of the Cassini USO (Ultra Stable Oscillator) of 10^{-13} could be fully exploited. The very preliminary results reveal the presence of a plasma cloud around Enceladus, extending to a distance of about 7000 km., and having an 16 columnar electron content of about 0.2 hexem (10^{-2} m $^{-2}$). From this measurement, the radial distribution of electron density can be determined assuming a geometrical configuration, i.e. cylindrical symmetry. This work was performed at the Jet Propulsion Laboratory, California Institute of Technology; San Jose State University; and The University of Michigan under NASA contracts.