Cassini observations of the Saturn system

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The Cassini spacecraft

The Cassini spacecraft has been orbiting Saturn since 2004 and will continue to do so until 2017. On Cassini we are operating the Langmuir probe instrument, which was designed and built by IRF-Uppsala. The instrument can be described as a weather station for space plasmas.

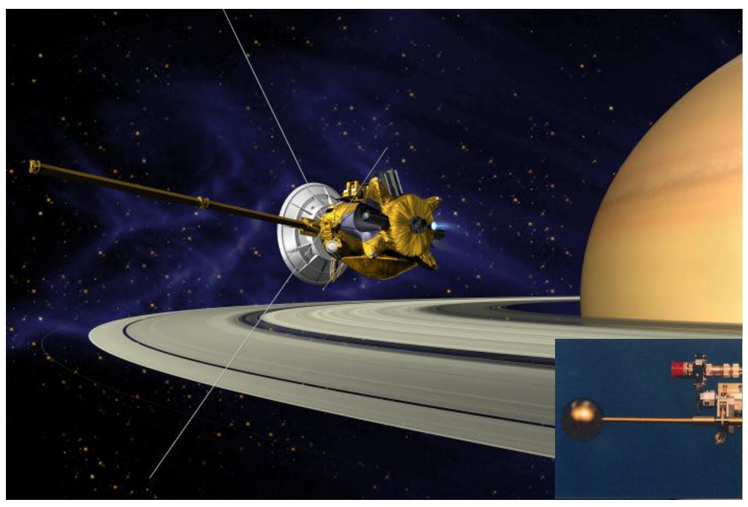

Figure 1: The Cassini spacecraft orbiting Saturn and the Langmuir probe instrument.

Saturn's magnetosphere

The interaction between the solar wind and Saturns magnetic field leads to the formation of an enormous magnetosphere. Within this magnetosphere orbits the moon Titan. Titan possesses a dense atmosphere, with a composition that is similar to the one believed to have existed on Earth, before life evolved. Using the Langmuir probe instrument we can study the properties of the giant magnetosphere as well as the properties of Titans upper atmosphere.

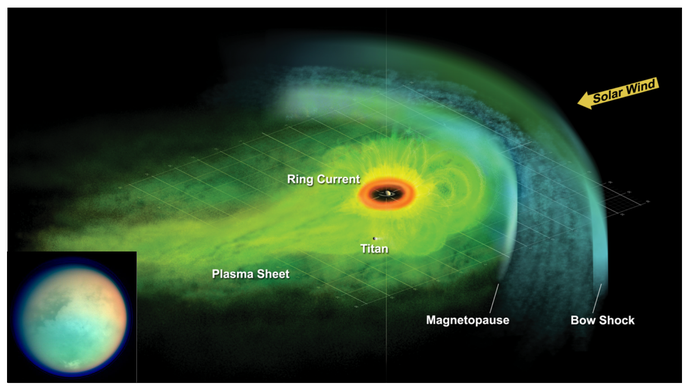

Figure 3: A cartoon illustrating the main features of Saturns enormous magnetosphere together with a photo of the moon Titan.

Electric currents in Titan's ionosphere

During three of the close flybys of Titan we detected electric currents flowing in the moon's dense ionosphere [1]. The ionosphere is the upper most region of the atmosphere and consists of ions and electrons. We study this to understand the momentum and energy transfer between Titan's ionosphere and Saturn's magnetosphere.

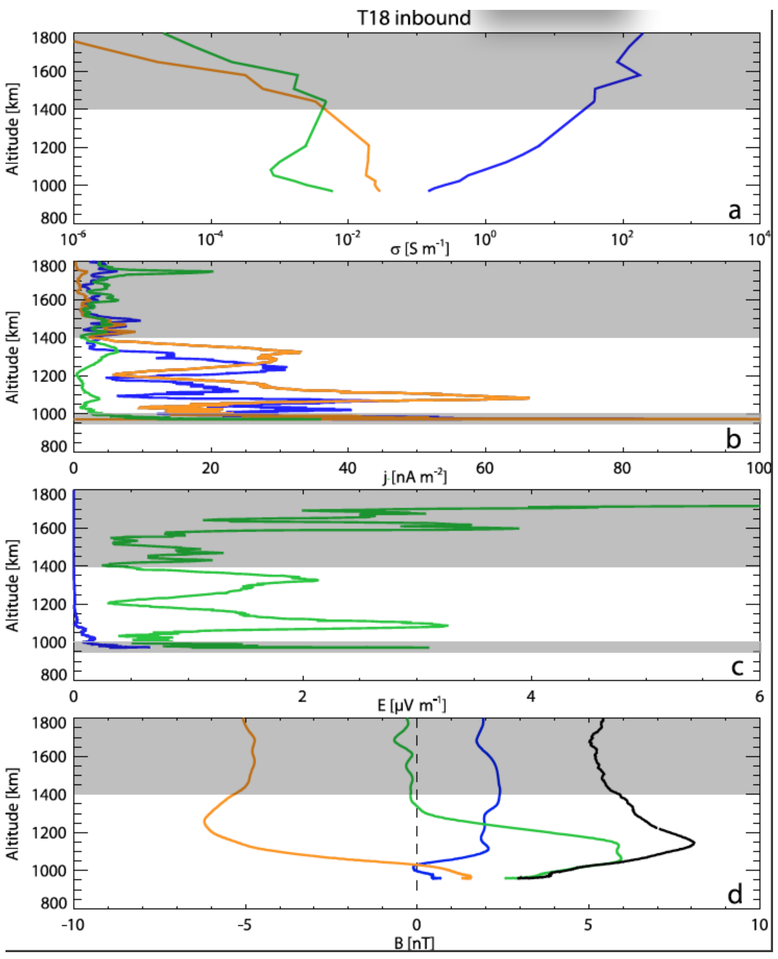

Figure 2: Measurement from one of the many close Cassini Titan flybys. The panels show altitude profiles of components of (a) the conductivity, (b) the electric current, (c) the electric field as well as (d) the magnetic field within the ionosphere of Titan.

Ions in Saturn's magnetosphere

Using the wealth of data gathered from the Langmuir probe we can map the ion parameters in the inner magnetosphere of Saturn. We study this since want to understand the dust-plasma interaction in the region surrounding Saturn's E-ring and how that affects the global Saturnian plasma system.

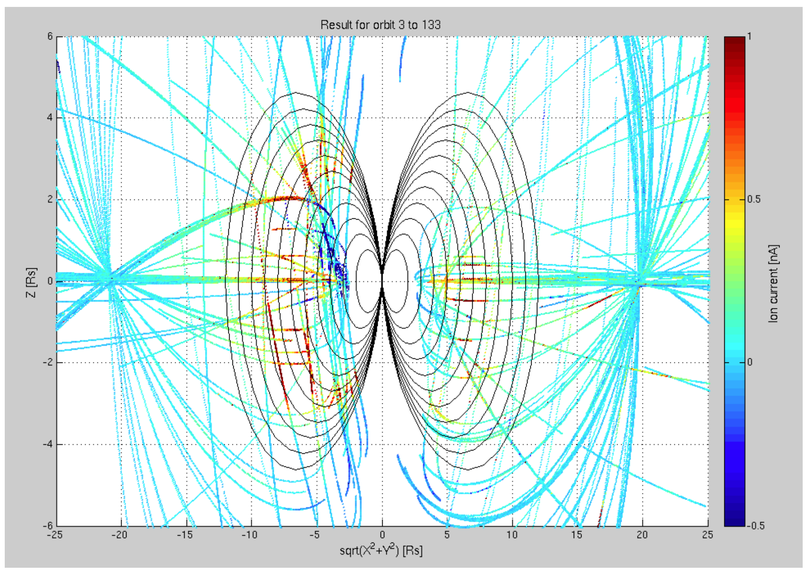

Figure 4: Langmuir probe measured ion current around Saturn, from which the ion density and velocity can be derived. The ion current increases with decreasing distance from the planet in the equatorial plane. The x-axis gives the radial distance from Saturn in Saturn radii, negative values correspond to the nightside of the planet and positive values correspond to the dayside. The large current measured between L-shell 6 and 10 (black curves) on the night side are not due to ions but to secondary electrons from the spacecraft. The area of a large negative ion current measured on the night side close to Saturn with positive z-values are not a true current but a trace due to eclipse cases.

PhD students

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References

[1] K. Ågren, D. J. Andrews, A. J. Buchert, S. C. Coates, S. W. H. Cowley, M. K. Dougherty, N. J. T. Edberg, P. Garnier, G. R. Lewis, R. Modolo, H. Opgenoorth, G. Provan, L. Rosenqvist, D. L. Talboys, J.-E. Wahlund, and A. Wellbrock. Detection of currents and associated electric fields in Titans ionosphere from Cassini data. *J. Geophys. Res. (in press)*, 2011.