Study of Titan's Plasma Environment in the Supermagnetosonic Solar Wind After the Impact of a ICME

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Abstract:

Titan is Saturn's largest moon and transits its orbit just within the margins of the magnetosphere of its parent planet. Saturn's magnetopause position is controlled by the solar wind pressure but also by the planet's internal magnetospheric processes involving ionospheric currents and plasma from its moons and rings.

With more than 120 close flybys between 2004 and 2017, the Cassini spacecraft characterized Titan's plasma environment. Out of these, the so called T96 on December 1, 2013, stands out as the only flyby where Cassini found Titan outside of Saturn's magnetosphere, exposed to the supermagnetosonic and super-Alfvénic solar wind. This event followed the arrival of an ICME which increased the solar wind pressure and compressed Saturn's magnetosphere (Roussos et al., 2018). The formation of a collisionless bow shock and a Mars-like induced magnetosphere has been reported in previous works (Bertucci et al., 2015) but the complexity of the event left several issues unresolved.

In this work we analyze Cassini magnetic field and particle data to give a more complete description of Titan's plasma environment around T96, based on the ICME impacting the Kronian system and the response of Saturn's magnetosphere.

In particular, we identified the most probable candidate for the ICME event using space-weather models and observations by Mars Express. In addition, we carried out a more accurate estimation of the solar wind speed upstream from Titan, which allowed the characterization of supercritical substructures

within Titan's bow shock as well as a more realistic analysis on the presence of 'fossil' interplanetary magnetic fields within Titan's induced magnetosphere.

Acknowledgment: The authors would like to acknowledge ISSI for the opportunity it offered for very valuable discussions on this topic as part of the International Team 499 "Similarities and Differences in the Plasma at Comets and Mars".

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Session: The interaction of the sun with the planets, and space weather

Oral or Poster: ORAL