NEW CHALLENGES FOR SIMULATIONS FROM THE CASSINI MISSION

CESAR BERTUCCI 1, R. Modolo 2, K. Szegő 3, S. Simon 4

1. Instituto de Astronomía y Física del Espacio, Buenos Aires, Argentina
2. LATMOS, Velizy, France
3. RFKI KMKI, Budapest, Hungary
4. University of Cologne, Cologne, Germany

Abstract: Saturn's magnetosphere is an extremely rich laboratory for the study of plasma processes using simulations. The presence of internal sources of plasma (moons, rings) within a multi-species rotating magnetospheric flow lead to linear and non-linear processes as a result of the collisionless electromagnetic coupling. From the global structure of the Kronian magnetosphere [Hansen, et al., 2005] to the microphysics of the plasma interaction between the rings and the magnetospheric plasma [Cowee et al., 2007], simulations have contributed to explain this complex planetary plasma system at different temporal and spatial scales. In particular, Titan's plasma environment is one of the most challenging scenarios as its Nitrogen, Methane, and Hydrogen-rich atmosphere interacts with a multi-species, transonic Kronian magnetospheric flow. Several magnetohydrodynamic [e.g., Ma et al., 2006], multi-fluid [Snowden, et al., 2008] and hybrid [e.g., Modolo et al., 2007] global simulations have successfully reproduced Cassini's observations under different upstream conditions inside the Kronian magnetosphere. However, and until now, these simulations cannot provide a good description of the microscopic processes responsible of the transfer of the momentum from the external flow into the atmosphere, especially when the external plasma wind changes from the Kronian magnetospheric flow to the magnetosheath's shocked solar wind as occurred during Cassini's T32 flyby, when Saturn's magnetopause receded inside the moon's orbit [Bertucci, et al., 2008; Ma, et al., 2009; Simon, et al., 2009]. In this talk we will review the simulation work done so far and mention the outstanding questions towards which new efforts could be oriented.

Cesar Bertucci, Buenos Aires, Argentina, e-mail: cbertucci@iafe.uba.ar