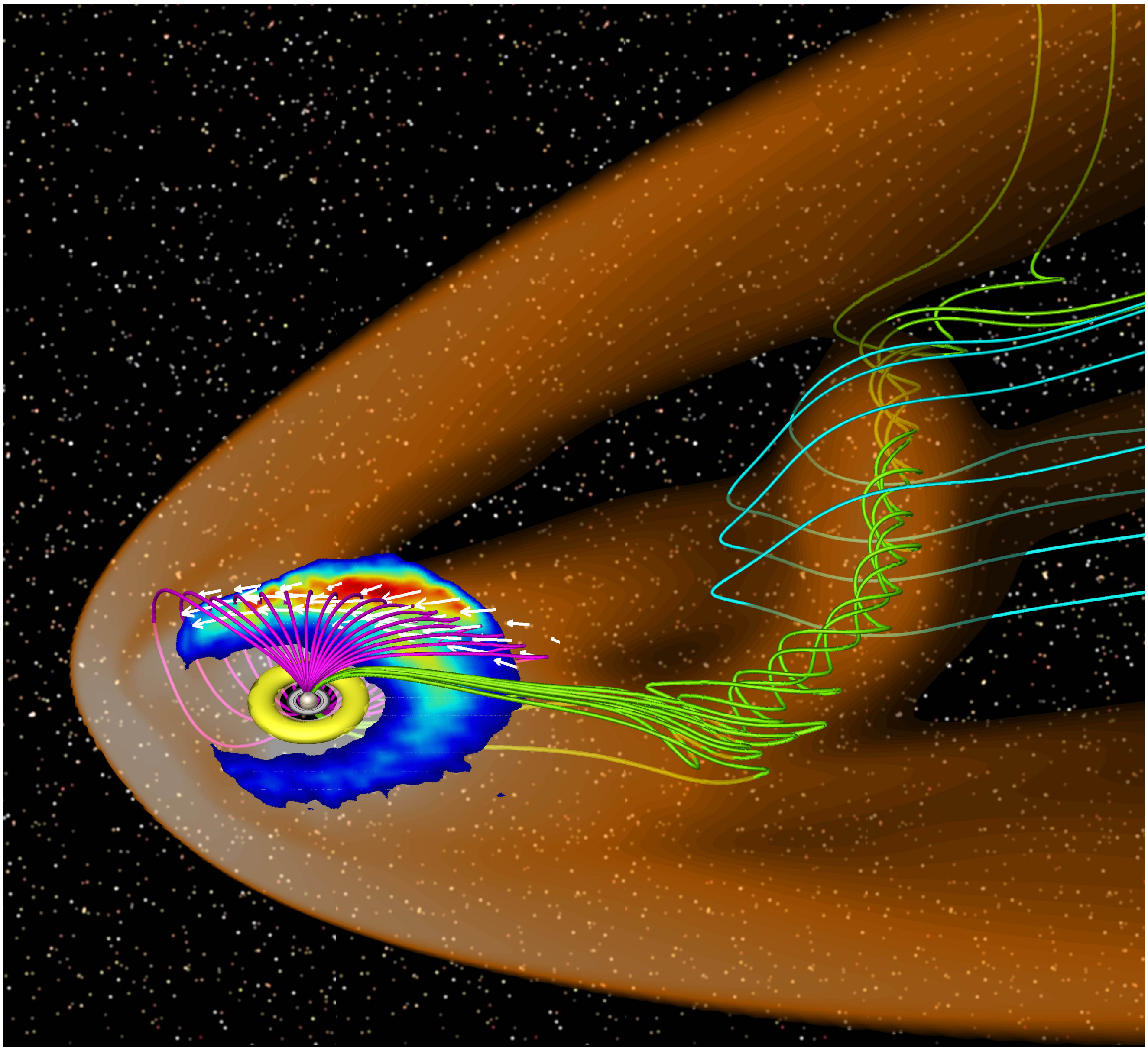
Global MHD Simulations of Saturn's Magnetosphere and Their Implications for Jupiter

*Xianzhe Jia[1]

1. University of Michigan Ann Arbor

At Saturn's orbital distance of ~ 9.5 AU, the low solar wind dynamic pressure and weak interplanetary magnetic field interact with the planet to create a magnetosphere that dwarfs Earth’ s magnetosphere. While the form of Saturn's magnetospheric cavity is still the result of solar wind stresses, many properties of the Kronian magnetosphere are determined largely by internal processes associated with the planet's rapid rotation and the stresses arising from internal plasma sources dominated by the icy moon, Enceladus. Coupling between the planetary ionosphere and the magnetosphere through electric currents plays a vital role in determining the global configuration and dynamics of Saturn's magnetosphere. To understand the large-scale behavior of the solar wind-magnetosphere-ionosphere interaction, we have applied the global MHD model, BATSRUS, to Saturn that self-consistently couples the solar wind, the magnetosphere, and the ionosphere and incorporates key mass-loading processes associated with Enceladus and its extended neutral cloud. Here we present results from our global simulations carried out to understand how the various internally and externally driven processes influence Saturn's magnetosphere, and discuss their implications for interpreting Cassin in-situ observations. We will also show results from an atmospheric vortex model we have developed that offers valuable insight into the physical processes that drive the ubiquitous periodic modulations of particles and fields properties observed by Cassini throughout the Saturnian magnetosphere. Implications of our Saturn simulations for another giant planet, Jupiter, will also be discussed.

Keywords: Saturn, Jupiter, Magnetosphere, Cassini



Plasmoid release in Saturn's magnetotail as simulated by *Jia et al.* [2012]