

Three-dimensional multi-fluid MHD modeling of Enceladus' interaction with the magnetosphere of Saturn

M. Benna

NASA - Goddard Space Flight Center, Maryland, USA (mehdi.benna@gsfc.nasa.gov)

In this paper we present a three-dimensional MHD multi-fluid model of the interaction between Enceladus and the magnetosphere of Saturn. This model uses the numerical code CASIM3D initially developed to simulate cometary atmospheres.

The CASIM3D code uses a three-fluid approach where ions, neutrals, and electrons are considered as separate interacting fluids. The kinetic equations relative to these three fluids are solved using an adaptive Cartesian grid that is refined or relaxed as needed. The multi-fluid approach we chose leads to a more accurate representation of the atmosphere of Enceladus since the dynamics of ions, neutrals and electrons are computed separately and in a self-consistent way.

In the current simulation we investigate more precisely the structure of Enceladus' tenuous atmosphere in the light of the recent data gathered by the Cassini spacecraft during its flybys of this icy moon. These data are confronted with a model that takes into account a neutral plume emission from the southern polar terrain as a possible explanation of the density peaks detected by the Ion Neutral Mass spectrometer (INMS) and the Dust analyzer (CDA) instruments.