



Generation of Ganymede's exosphere

Christina Plainaki (1), Anna Milillo (1), Stefano Massetti (1), Alessandro Mura (1), Xianzhe Jia (2), Stefano Orsini (1), Elisabetta De Angelis (1), Valeria Mangano (1), and Rosanna Rispoli (1)

(1) INAF-IAPS, Rome, Italy (christina.plainaki@iaps.inaf.it), (2) Dept. of Atmospheric, Oceanic, and Space Sciences, University of Michigan, USA (xzjia@umich.edu)

The interactions between Jupiter's magnetospheric plasma and Ganymede's icy surface are responsible for the generation of the moon's neutral environment. Such interactions are strongly constrained by the moon's intrinsic magnetic field determining the pattern of the ion precipitation to the icy surface. In this paper, the water and oxygen exospheres of Jupiter's moon Ganymede are simulated through the application of a 3D Monte Carlo modeling technique that takes into consideration the combined effect on the exosphere generation of the main surface release processes (i.e. sputtering, sublimation and radiolysis) and the precipitation of the magnetospheric ions to the moon's surface. We find that plasma precipitation occurs in a region related to the open-closed magnetic field lines (OCFB) boundary and its extent depends on the assumption used to mimic the plasma mirroring in Jupiter's magnetosphere. In the full mirroring assumption, the primary surface sputtering mechanism at the whole polar cap of Ganymede can alone explain the observed higher albedo of this region; in the non-mirroring assumption the polar cap brightness above the OCFB ring can be explained with the action of secondary sputtering due to ionized exospheric particles re-impacting the surface. At small altitudes above the moon's subsolar point the main contribution to the neutral environment comes from sublimated water; the spatial distribution of the directly sputtered-water molecules exhibits a close correspondence with the plasma precipitation region and extends at high altitudes, being, therefore, well differentiated from the sublimated water. The oxygen exosphere comprises two different populations: a thermal one (extending to some 100s of km above the surface) and a more energetic one consisting of more energetic oxygen molecules sputtered directly from the surface after water-dissociation by ions has taken place.