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The role of the interaction between Jovian plasma and icy surface in the generation of Ganymede's exosphere (invited)

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The interaction of Jupiter's magnetospheric plasma with Ganymede intrinsic magnetic field and with its icy surface is mainly responsible for the generation of a neutral environment around Ganymede.

In the current work, we simulate the major exospheric components, water and oxygen, of Jupiter's moon Ganymede applying a 3-D Monte Carlo modeling technique. The model takes into consideration the effect of water sublimation in the warmer regions and the combined effects of the precipitation of Jupiter's magnetospheric ions determined by the moon's intrinsic field, and the surface release processes of sputtering and radiolysis. The intrinsic magnetic field imposes the existence of non-homogeneously distributed ion-precipitation zones on Ganymede's surface implying also a spatially inhomogeneous neutral release.

Our results are summarized as follows: a) the maximum contribution to the exosphere comes from sublimated water and is located at small altitudes above the moon's subsolar point; b) there is a close correspondence of the near-surface spatial distribution of the directly sputtered-water molecules with the open-closed magnetic field lines boundary, that also agrees well with the Galileo magnetic field and plasma flow measurements; c) the molecular oxygen exosphere comprises two different regions: the first one is an homogeneous, relatively dense, close to the surface thermal-oxygen region (extending to some 100s of km above the surface) and the second one is a less homogeneous region of more energetic oxygen molecules resulting from direct sputtering to the surface; the later has a spatial distribution that depends both on the plasma surface impact and the moon's surface temperature distribution (that determines the actual efficiency of radiolysis); d) a slight asymmetry in the modelled oxygen exosphere appears between Jupiter and anti-Jupiter direction, that seems to be consistent with the HST observations of Ganymede's auroral emissions.