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Circulation of energetic ions within Ganymede's magnetosphere: a Monte-Carlo simulation approach

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The study of Ganymede, the only known moon in the Solar System to possess an intrinsic magnetic field embedded within a planetary magnetosphere, is of significant importance in view of future missions to the Jovian system. Indeed, the dynamics of the entry and circulation inside Ganymede's magnetosphere of the Jovian energetic ions, as well as the morphology of their precipitation on the moon's surface determine the variability of the sputtered-water release and exosphere generation. The so-called planetary space weather conditions around Ganymede can also have a long-term impact on the weathering history of its icy surface.

In this talk, I will discuss some key characteristics of the circulation of the Jovian magnetospheric ions within the environment of Ganymede as derived from the application of a single-particle Monte Carlo model driven by the electromagnetic fields from a global MHD model. In particular, the Jovian energetic ion circulation and precipitation to Ganymede' s surface was estimated for different relative configurations between the moon's magnetic field and Jupiter's plasma sheet, characterized by conditions similar to those encountered during the NASA Galileo G2, G8, and G28 flybys of Ganymede (i.e., when the moon was above, inside, and below the center of Jupiter' s plasma sheet). The resulting differences between the various surface precipitation patterns and the implications in the water sputtering rate will be discussed. The results of this preliminary analysis are relevant to ESA' s JUICE mission and in particular to the planning of future observation strategies for studying Ganymede' s environment.