



## Numerical simulation of Ganymede's ionosphere

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Ganymede is one of the four Galilean moons that orbit around Jupiter and the key moon targeted by the JUperiter and ICy moons Explorer (JUICE) mission. Other than being the largest moon in the solar system, it is also the only one known to generate internally a magnetic field which is strong enough to overcome the background jovian field; thus, the moon carves out its own magnetosphere inside that of Jupiter. In addition, at Ganymede's orbit the jovian plasma is sub-Alfvénic and subsonic. The interaction of Ganymede's magnetosphere with its surroundings therefore differs from that of planetary magnetospheres resulting from the interaction with the super-Alfvénic and supersonic solar wind. All this makes Ganymede a peculiar celestial body to study.

One of the main goals of the JUICE mission is to characterize Ganymede's exosphere, ionosphere, and magnetosphere as well as its interaction with the jovian surrounding in great details. Ahead of the arrival of JUICE at Jupiter, models have been developed to predict Ganymede's environment. Observational constraints are primarily given from Galileo and from Earth-based telescopes. They remain limited, especially in terms of the ionospheric number density and temperature. To address the currently poorly constrained ionospheric environment, we have developed a test particle model of Ganymede's plasma environment. The model is driven by the densities of neutral species from the exospheric model of Leblanc et al. (Icarus, 2016) and the electromagnetic field taken from the hybrid model of Leclercq et al. (PSS, 2016). The simulation follows the motion of millions of test particles in the environment of the moon and allows to generate maps of ion densities, bulk velocities, and temperatures. We will present simulation outcomes for different ions, including  $H^+$ ,  $O^+$ , and  $O_2^+$ . We will also discuss how the results from the simulations are relevant to MHD and exospheric models and in interpreting plasma and particle data obtained by Galileo during its close flybys of Ganymede.