

Electromagnetic induction at Ganymede during the JUICE mission

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SUMMARY

The moons of Jupiter provide a window to understand the potential of habitability in our Solar System and beyond. The largest moon, Ganymede, is unique in possessing an intrinsic magnetic field in addition to a possible subsurface ocean. One of the main goals of the JUpiter ICy moons Explorer (JUICE) mission is to resolve the dynamo properties and confirm the ocean as well as gain a better insight into the moon's interior structure.

The most reliable method to understand the interior and confirm a subsurface ocean is through magnetic field measurements. Out of the five different fields observed at Ganymede, two of them, namely the internal dynamo and external magnetodisk fields originate at Jupiter. They create a time varying component due to the planet's fast rotation and the movement of the moon with respect to Jupiter. If Ganymede has a conducting ocean within its interior, we can model and predict its strength using this background field of Jupiter.

In this work, we use the JUICE trajectories in the flyby phase and compare them to the Galileo flybys to test their viability in order to potentially confirm the ocean. Subsequently, we move on to the orbital phase of JUICE to predict the induction signal assuming a perfect conductor response to Jupiter's background field and identify the different periodicities found in the signal. Observing the data at different frequencies will independently estimate the different properties such as the depth and conductivity of the ocean. Our results provide an understanding of expectations from the JUICE magnetometer observations on arrival at Ganymede.

Keywords: Jupiter, Ganymede, magnetic fields, icy moons, electromagnetic induction.
