EPSC Abstracts
Vol. 8, EPSC2013-470, 2013
European Planetary Science Congress 2013

J-MAG: Magnetometer science on the JUICE mission

M. K. Dougherty (1) and the J-MAG Team.
(1) Imperial College London, UK, m.dougherty@imperial.ac.uk

Abstract

The magnetometer instrument is one of the core instruments on the JUICE model payload and is critical for resolving prime science objectives of the mission. The importance of a magnetometer instrument on JUICE can be described under two separate themes:

1. The magnetic field drives the plasma processes occurring within the Jupiter system. Understanding such observations allows for a better understanding of dynamical plasma processes, of the generation of aurora and of the various current systems which arise within this rapidly rotating magnetosphere; the interactions of the magnetosphere of Ganymede within the Jovian magnetosphere within which it is embedded; to name but a few.
2. However the cutting edge magnetometer science which is unique to JUICE lies in being able to gain an understanding of the interior structure of the icy moons of Jupiter, specifically those of Ganymede, Callisto and Europa. Of particular interest are knowledge of the depth at which the liquid oceans reside beneath their icy surfaces, the strength of any internal magnetic fields such as at Ganymede and the strength of any induced magnetic fields arising within these oceans.

The rapidly rotating Jovian magnetosphere provides one with an extensive laboratory in order to study fundamental astrophysical processes. The principal interaction between a planet and its plasma environment is mediated via the planetary magnetic field, and hence investigations of magnetic field data are crucial in understanding the dynamics and physical processes which arise. However the value of magnetic field measurements are not restricted to providing an overall picture of the fundamental physical processes occurring; in fact they are crucial in gaining an understanding of the internal structure of planetary bodies as well as allowing discoveries, such as the presence of a dynamic and exotic atmosphere at Saturnôs small moon Enceladus.

The primary science objectives of JUICE which will be constrained by magnetic field observations include:

- At Ganymede:
  - Characterisation of the extent of the ocean and its relation to the deeper interior
  - Characterisation of the ice shell
  - Characterisation of the local environment and its interactions with the Jovian magnetosphere
  - Description of the deep interior and B field generation
- At Europa, further constrain the depth of the liquid ocean and its conductivity
- At Callisto, characterise the outer shells, including the ocean
- Compare differentiated (Ganymede and Europa) and undifferentiated bodies (Callisto)
- Explore the Jovian magnetosphere
  - Characterise the magnetosphere as a fast rotator
  - Characterise the magnetosphere as a giant accelerator
  - Understand the moons as sources and sinks of magnetospheric plasma.