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Study of internal and atmospheric structure of Jupiter through seismic measurement

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Abstract

Seismic investigation has been successful to recover not only the internal structure of the Earth, but is also applicable to fluid bodies, like the Sun and stars. In the case of the Sun, the so-called helioseismology not only revealed the deep internal structure and rotation through the measurement of the frequencies of acoustic eigenmodes, but also allowed the study of MHD behavior beneath the surface by the measurement of wave time travel, a technique similar to seismic tomography. Here we propose to apply this technique to giant planets, and in particular to Jupiter.

Recent ground based observations with the SYMPA network have put in evidence the presence of periodic structures compatible with the expected acoustic modes of the planet. We will present the principle of the measurement and the result already obtained. However, such measurements remain limited due to the terrestrial atmosphere and the daily interruption of the observations. The EJSM mission offers a unique opportunity to investigate in detail the internal structure of Jupiter, through detection of global acoustic modes and the upper troposphere, through the characterization of travelling waves in that region.

The DSI-ECHOES instrument is a Doppler Spectro Imager proposed for the Jupiter Ganymede Orbiter spacecraft. It is based on the principal of Fourier transform spectroscopy and allows the measurement of velocity field at the surface of Jupiter with sensitivity sufficient for the detection of global modes and gravity waves.