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Observations of whistler mode waves in the Jovian system and their consequences for the onboard processing within the RPWI instrument for JUICE

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Abstract

Evidence for a magnetosphere at Ganymede has been found in 1996 using measurements of plasma waves onboard the Galileo spacecraft (fig. 1). This discovery demonstrates the importance of measurements of waves in plasmas around Jovian moons [1].

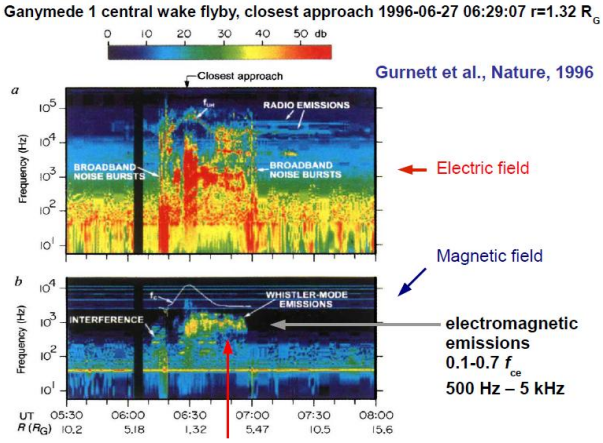

Figure 1. First observation of the magnetosphere of Ganymede by the PWS instrument onboard the Galileo spacecraft (from [1])

Galileo also observed whistler-mode waves in the magnetosphere of Ganymede similar to important classes of waves in the Earth magnetosphere: chorus and hiss [2].

Data from the Galileo spacecraft have therefore shown the importance of measurements of waves in plasmas around Jovian moons, especially in the light of recent advances in analysis of whistler-mode waves in the Earth magnetosphere and their importance for acceleration of radiation belt electrons to relativistic energies. Multicomponent measurements of the fluctuating magnetic and electric fields are needed for localization and characterization of source regions of these waves.

Radio & Plasma Waves Investigation (RPWI) experiment will be implemented on the JUICE (JUpiter ICy moon Explorer) spacecraft. RPWI is a highly integrated instrument package that provides a comprehensive set of plasma and fields measurements. Proposed measurement modes for the low frequency receiver subsystem of RPWI include onboard processing which will be suitable for analysis of whistler-mode waves:

(1) Polarization and propagation analysis based on phase relations to identify wave modes and propagation directions

(2) Poynting vector to determine source regions

(3) Detailed frequency-time structure, polarization, wave vector directions to identify linear or nonlinear source mechanisms

References

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[2] Kurth, W. S.; Gurnett, D. A.; Roux, A.; Bolton, S. J.: Ganymede: A new radio source, Geophysical Research Letters 24, p. 2167, 1997.