EPSC Abstracts,
Vol. 4, EPSC2009-234, 2009
European Planetary Science Congress,

HIRIMS : a High Spectral Resolution Near-Infrared Mapping Spectrometer for EJSM/JGO

Pierre Drossart, Jean-Michel Réess, Bruno Bézard, Thierry Fouchet, Emmanuel Lellouch, Raphaël Moreno (1), François Poulet, Yves Langevin (2), Giuseppe Piccioni, Gianrico Filacchione (3), Dmitri Titov (4), Oleg Korablev, Nicolai Ignatiev,Anna Fedorova, Alexander Rodin (5), Gordon L. Bjoraker (6), Joachim Saur (7) , Ingo Mueller-Wodarg (8), Katia Matcheva (9), P.G.J. Irwin (10), Tom Stallard and Steve Miller (11)

(1)LESIA, Observatoire de Paris France, (2) IAS (Institut d'Astrophysique Spatiale, Orsay France), (3) INAF-IASF (Istituto di Astrofisica Spaziale e Fisica Cosmica) & INAF-IFSI (Istituto di Fisica dello Spazio Interplanetario), Rome, Italy, (4) Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany, (5) In IKI and Phys-Tech Inst., (6) Goddard Space Flight Center, (7) University of Cologne, (8) Imperical College London, (9) University of Florid, (10) University of Oxford, (11) University College London (Pierre.Drossart@obspm.fr, Fax: +33 1 450 771 70)

Abstract

The atmosphere of Jupiter has reached today a stage of knowledge where new investigations will need a substantially higher level of performance to make breakthroughs in the science return. An instrument will be proposed to EJSM to study other dynamics structure and composition of the atmosphere of Jupiter with high resolution infrared imaging spectroscopy in order to give access to different levels of the atmosphere and constrain the coupling between them, in accordance with the general objectives of EJSM Jupiter science.

The science objectives are threefold:

- Deep atmospheric sounding for CO, H_2O, water cloud structure, and more generally disequilibrium and condensable species in the deep atmosphere [1]
- Constrain the nature of the external supply of oxygen (through CO stratospheric measurement) [2]
- Upper atmospheric structure through H_2 quadrupole, H_3^+ and CH_4 lines with dynamics and spatial variations related to dynamical phenomena to be traced [3].

Part of the theoretical study will consist in identifying the expected signature from gravity wave propagation in the upper atmosphere, and the possible coupling of gravity waves with internal (seismic) waves through dynamical forcing at the tropopause. If demonstrated, this coupling would allow HIRIMS to fill most of the objectives devoted to a seismology instrument as described in EJSM core payload, by detecting indirectly the signature of acoustic modes. Another part of the study will consist in optimizing the spectral ranges devoted to the molecular species, in order to optimize spectral resolution, spectral range and sensitivity to reach the science objectives.

The HIRIMS concept is based on a push broom or scanning imaging, using a matrix array detector with the complete spectral mapping recorded without any single point failure moving part within the instrument.

In order to achieve spectral resolution as high as 50,000 with a compact instrument, an imaging heterodyne Fourier transform spectrometer can be used. This instrument is based on a static Michelson interferometer in which the "air corner" mirrors are replaced by gratings. Each 2D detector image provides a spatial information and a spectral information. For each pixel along the slit, an interferogram is recorded. The Fourier transform of those interferograms provides spectra. The second spatial direction is obtained by rotation of the planet, by relative movement of the spacecraft or by using a scanning device inside the instrument. In terms of heritage, the philosophy of the proposal will benefit from the success of VIRTIS experiment on Rosetta and Venus-Express, and from Bepi Colombo instrumentation development, even if the technical approach will be different.

References

[1] Drossart et al. (1990), *Icarus*, 83, 248-253.

[2] Bézard et al. (2002) , *Icarus*, 159, 112-131

[3]Raynaud et al., (2004), *Icarus*, 171, 133-152