

Observations of the Giant Planets with Herschel

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Abstract

We describe the first results of the observations of the Giant Planets with Herschel.

Overview

In the framework of the “Herschel Solar System Observations (HssO)” Key Program (Hartogh et al. 2009), observations of the Giant Planets have been obtained with the three instruments of Herschel (PACS, SPIRE, HIFI). The general goals of these observations are to (i) investigate the origin of water in the outer planets through determination of its vertical (and, at Jupiter & Saturn, spatial) distribution in these objects, using notably HIFI observations (Fig. 1) (ii) (re-)measure the abundance of some key molecules (e.g. HD, CH₄, CO) and search for new species in full range PACS & SPIRE spectra covering the 55-650 μm (15-180 cm^{-1}) range.

We will present results of this program. Highlights include (i) new determinations of the D/H ratio and of the CH₄ stratospheric abundance in Uranus and Neptune (Fig. 2) (ii) determination of the vertical profile of CO on Neptune and further evidence for its dual origin (iii) detection of the Enceladus H₂O torus in absorption against Saturn (Fig. 1) and the indication that Enceladus’ activity is at the origin of Saturn stratospheric water (iv) spatial/vertical distribution of water in Jupiter and further evidence that H₂O in Jupiter originates from the Shoemaker-Levy 9 impacts.

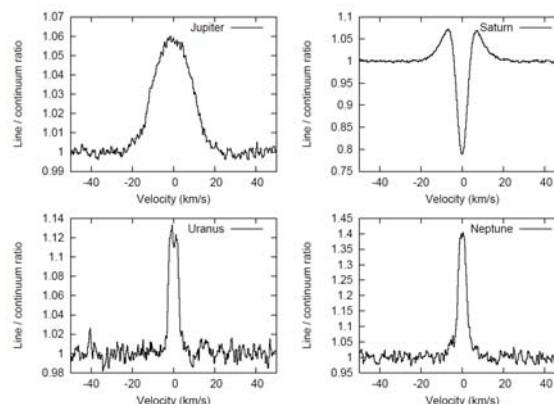


Figure 1: The H₂O 556.935 GHz line observed in all four Giant Planets by HIFI, showing emission due to stratospheric H₂O. In Saturn’s case, absorption due to water in the Enceladus torus is also seen (Hartogh et al. 2011, submitted).

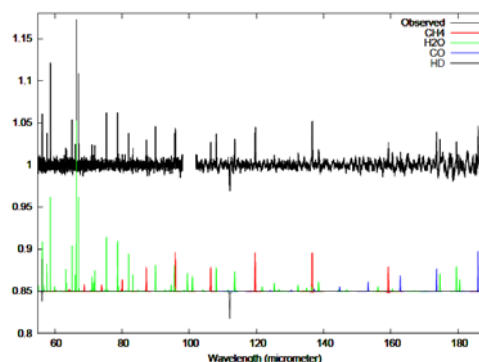


Figure 2: Neptune PACS spectrum (line/continuum) showing spectral signatures of CH₄, H₂O, CO and HD (From Lellouch et al. 2010).

References

[1] Lellouch, E., Hartogh, P., Feuchtgruber, H. et al. First results of Herschel-PACS observations of Neptune. *A & A* 518, L152 (2010).

[2] Hartogh, P., Lellouch, E., Moreno, R. et al. Direct detection of the Enceladus H₂O torus with Herschel. *A & A*, submitted (2011)