EPSC Abstracts
Vol. 6, EPSC-DPS2011-881-1, 2011
EPSC-DPS Joint Meeting 2011

The vertical profile of CO in the atmosphere of Neptune from JCMT and IRAM observations

T. Cavalié (1,2), **M. Dobrijevic** (1,2), F. Billebaud (1,2), E. Lellouch (3), B. Hesman (4), Fouchet, T. (3), Hartogh, P. (5), Encrenaz, T. (3)
(1) Université de Bordeaux, Laboratoire d'Astrophysique de Bordeaux, France (cavalie@obs.u-bordeaux1.fr), (2) CNRS/INSU, UMR5804, Floirac, France, (3) Observatoire de Paris-Meudon, France, (4) University of Maryland/NASA GSFC, Greenbelt, USA, (5) Max Planck Institute für Sonnensystemforschung, Germany.

Abstract

Infrared observations carried out with ISO and Spitzer have led to the detection of H_2O and CO_2 in the upper atmospheres of the giant planets and Titan [1, 2, 3]. Observing these condensible species above the tropopause implies the presence of an external source of oxygen (rings and/or satellites, interplanetary dust particles and large comet impacts). However, this is not the case for CO, because this molecule does not condense at the tropopause of any giant planet. Thus, an additional source is likely to provide CO to the upper atmosphere in a significant way by means of upwards convective mixing originating from the deep hot atmosphere. This internal source has been observed in Jupiter and Neptune [4, 5].

In Jupiter, the external source responsible for the presence of CO is is a distribution of cometary impacts [4]. In Saturn, our recent observations of the CO(3-2) and CO(6-5) lines at the JCMT also shows the presence of an external source, possibly of cometary origin too [5, 6]. In Neptune, the same process is likely to occur [7, 8, 9], but the magnitude of the external source is not well-constrained.

In this paper, we will present a new observation of CO in the atmosphere of Neptune, obtained with the James Clerck Maxwell Telescope (JCMT) in the CO(6-5) line at 691.473 GHz. We will present a joint analysis of this line and the CO(2-1) and CO(3-2) lines (published previously in [5, 6]) with the photochemical model we have developed in [10]. We will derive new constraints on the CO vertical profile in the upper atmosphere of Neptune and thus on the origin of this species.

Acknowledgements

T. Cavalié wishes to acknowledge for funding from the Centre National d'Études Spatiales (CNES).

References

[1] Feuchtgruber, H., Lellouch, E., de Graauw, T. et al, 1997. External supply of oxygen to the atmospheres of giant planets. Nature 389, 159-162.

[2] Coustenis, A., Salama, A., Lellouch, E. et al, 1998. Evidence for water vapor in Titan's atmosphere from ISO/SWS data. A&A 336,L85-L89.

[3] Burgdorf, M., Orton, G., van Cleve, J. et al, 2006. Detection of new hydrocarbons in Uranus' atmosphere by infrared spectroscopy. Icarus 184, 634-637.

[4] Bézard, B., Lellouch, E., Strobel, D. et al, 2002. Carbon monoxide on Jupiter: evidence for both internal and external sources. Icarus 159, 95-111.

[5] Cavalié, T., Billebaud, F., Dobrijevic, M., et al, 2009. First observation of CO at 345 GHz in the atmosphere of Saturn with the JCMT: new constraints on its origin. Icarus 203, 531-540.

[6] Cavalié, T., Hartogh, P., Billebaud, F., et al, 2010. A cometary origin for CO in the stratosphere of Saturn? A&A 510, A88.

[7] Lellouch, E., Moreno, R., Paubert, G., 2005. A dual origin for Neptune's carbon monoxide? a&A 430, L37-L40.

[8] Hesman, B.E., Davis, G.R., Matthews, H.E., et al, 2007. The abundance profile of CO in Neptune's atmosphere. Icarus 186, 342-353.

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

[10] Dobrijevic, M., Cavalié, T, Hébrard, É. et al, 2010. Key reactions in the photochemistry of hydrocarbons in Neptune's stratosphere. Planet. Space Sci. 58, 1555-1566.