EPSC Abstracts,
Vol. 4, EPSC2009-403, 2009
European Planetary Science Congress,

High spectral and spatial resolution observation of upper atmospheres by IR heterodyne spectroscopy

D. Stupar, P. Kroetz, G. Sonnabend, M. Sornig and R. Schieder

I. Physikalisches Institut, University of Cologne, Cologne, Germany, (stupar@ph1.uni-koeln.de / Fax: +49-221-4705162)

Abstract

IR heterodyne spectroscopy offers the capability of very high spectral resolving power (greater than 10^7) combined with relatively high sensitivity. In addition the spatial resolution is inherently higher when compared to heterodyne observations at mm and sub-mm wavelength. This high spectral and spatial resolution enables unique high sensitivity studies of the physical and chemical processes in planetary atmospheres through measurement of fully resolved lineshapes of transitions of molecular species. The Cologne Tunable Heterodyne Infrared Spectrometer (THIS) offers for the first time the possibility to study the whole mid-IR (7-14m) by heterodyne techniques (Fig. 1) [1]. THIS has been used regularly to study dynamics and temperatures on Mars and Venus [2, 3].

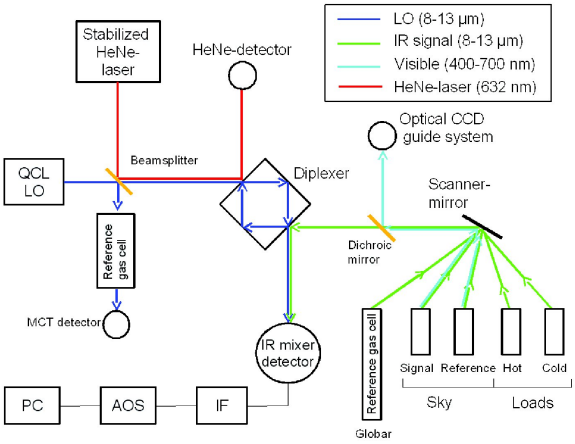

Figure 1: Schematic view of the heterodyne receiver THIS. The IR signal from the telescope or the calibration loads (green) is combined to the radiation from a suitable LO (red) and detected on a MCT mixer. Hereby a difference frequency signal is generated which is used for spectral analysis.

OUTLOOK

The information about the distribution of **Methane in the atmosphere of Mars** is still sparse and no information was gatherd on the vertical ditribution due to insufficient spectral resolution of the recorded spectra. Mid-IR heterodyne spectroscopy opens another window for methane observations at 7.8 μm (Fig. 2).

Acetylene (C_2H_2) in the outer planet atmosphere is one of the most populous products of methane photochemistry. Therefore (C_2H_2) can be used as a probe to study planetary aurorae and stratospheric chemistry and structure.

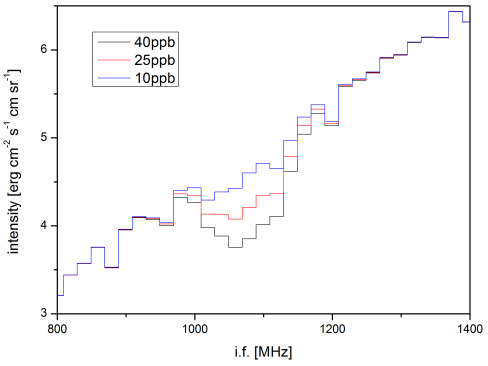

Figure 2: Simulated Methane spectrum for different volume mixing ratios using a full radiative transfer model. The simulated noise represents one hour of integration time according to the instrument's sensitivity.

Bibliography

References

[1] G. Sonnabend et. al. (2008) *JQSRT*, 109, 1016–1029.

[2] G. Sonnabend et. al. (2005) *AA*, 435, 1181–1184.

EPSC Abstracts,
Vol. 4, EPSC2009-403, 2009
European Planetary Science Congress,

[3] G. Sonnabend et. al. (2006) *GRL*, 33, 18201.