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Progress in the spectroscopic modelling of Titan's infrared spectra

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Abstract

The Composite Infrared Spectrometer (CIRS) on-board Cassini has obtained spectra in the far and mid-infrared with a spectral resolution of 0.5 cm^{-1}. Mismatch between observed spectra and model spectra obtained from the available line lists has led us to study the bending bands of HC_3N and C_4H_2, the longest carbon chains observed on Titan. Our experimental study for HC_3N (Jolly et al. 2007) has shown that band intensities had to be revised and that including hot bands with lower level as high as 1300 cm^{-1} was necessary to model our experimental spectra at 0.5 cm^{-1} resolution. A new extended line list could be obtained by fitting high resolution data with the help of a global analysis. This line list was made available to the astronomers of the CIRS team and is included in the new version of the GEISA data base. Thanks to the precision of the new spectroscopic data, ^{13}C isotopologues of HC_3N have been detected and quantified for the first time in the atmosphere of Titan (Jennings et al. 2008, ApJL). Search for the ^{15}N isotopologues of HC_3N will also be presented.
The proportion of hot bands is even more important for C_4H_2 than for HC_3N and a new extended line list was absolutely necessary to improve the CIRS spectral analysis. We will present a new line list and show comparison between synthetic spectra and experimental spectra of C_4H_2 obtained between 193 and 296 K at 0.1 and 0.5 cm^{-1} resolution. The new line lists of both bending modes ν_8 and ν_9 have already been used by Teanby et al. (2009) to compare model spectra and CIRS observations of C_4H_2 at 220 and 630 cm^{-1}. They have shown that the abundance determination of C_4H_2 in both far and mid infrared are in good agreement thanks to this new spectroscopic study. The first spectroscopic analysis of the ^{13}C isotopologues of C_4H_2 will also be presented and the possibility to detect such isotopologues will be discussed.
Progress in the hunt of new molecules, as for example C_6H_2, will also be discussed.

References

[1] Jolly, A. et al. (2007) *Journal of Molecular Spectroscopy, 242, 46–54*
[2] Jennings, A. et al. (2008) *ApJ Letters*, 681, L109.

[3] Teanby, N. et al. (2009) *Icarus*, in press