THE HIGH RESOLUTION FAR-INFRARED SPECTRUM OF METHANE AT THE SOLEIL SYNCHROTRON

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As a tetrahedral molecule, methane has no permanent dipole moment. The spectrum of this molecule, however, displays faint absorption lines in the THz region, due to centrifugal distorsion effects. This is important for planetary applications since this region is used to measure methane concentration in some planetary atmospheres, in particular in the case of Titan[a]. Up to now, all measurements were relying on some old low resolution spectra[b]. Even if these results have been reexamined recently[c], it seemed highly desirable to obtain much more precise laboratory data.

The high-intensity synchrotron radiation, combined with a 150 m optical path in a White cell and a Bruker IFS 125 HR FTIR spectrometer at the AILES beamline of SOLEIL, enabled us to record this very weak spectrum at high resolution for the first time. Spectra were recorded at 9.91, 20, 50 and 100 mbar pressure with a resolution of 0.0011, 0.002, 0.005 and 0.01 cm^{-1}, respectively. The rotational clusters are fully resolved and the good signal-to-noise ratio should enable precise measurement of transition intensities, yielding an accurate determination of the dipole moment derivative. Such results should allow a better determination of CH_4 concentration in planetary objects.

[a] A. Coustenis, R. K. Achterberg, B. J. Conrath *et al.*, *Icarus* **189**, 35–62 (2007).
[b] M. Oldani, M. Andrist, A. Bauder and A. G. Robiette, *J. Mol. Spectrosc.*, **110**, 95–105 (1985).
[c] E. H. Wishnow, G. S. Orton, I. Ozier and H. P. Gush, *J. Quant. Spectrosc. Radiat. Transfer* **103**, 102–117 (2007).