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Diode-laser measurements of CO_2-broadening coefficients in the ν_4 fundamental band of methane at room temperature

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Methane is a minor component of our atmosphere, as well as of Jupiter, Saturn, Uranus, Neptune and Mars. CH_4 has been detected on Mars by many studies[1−2]. But the origin of methane is still uncertain, it can be internal processes like volcanic or biological processes, or external like cometary impacts.

Self-broadening of CH_4[3] and CH_4 perturbed by N_2, O_2 and Ar[4−5] have already been measured. But they are only valid for Earth conditions. For atmospheric observations of methane in the Martian atmosphere, we need parameters like broadening coefficients due to carbon dioxide, the main constituent of the Martian atmosphere.

Using a tunable diode-laser spectrometer, we have measured CO_2-broadening coefficients of about 40 absorption lines of the P-, Q- and R- branches in the ν_4 fundamental band of methane, with J values ranging between 1 and 9. Each line was recorded at room temperature (296 K) and for 4 different pressures, ranging from 8 to 50 mbar.

The experimental determination of CO_2-broadening coefficient was performed by fitting to the experimental profile of each line recorded at each pressure, a theoretical profile based either on the Voigt or the Rautian-Sobel'Man models. The last one takes into account the Dicke effect, a narrowing due to the molecular confinement.

Preliminary results will be presented and discussed. Impact on atmospheric investigations on Mars will be addressed.

[1] V. Formisano, S. Atreya, T. Encrenaz, N. Ignatiev, and M. Giuranna, Science 306, 1758-1761, 2004
[2] M.J. Mumma, G.L. Villanueva, R.E. Novak, T. Hewagama, B.P. Bonev, M.A. DiSanti, A.M. Mandell, and M.D. Smith, Science 323, 1041-1045, 2009
[3] M. Lepère, J. Mol. Spectrosc. 238, 193-199, 2006
[4] B. Martin, and M. Lepère, J. Mol. Spectrosc. 259, 46-55, 2010
[5] A.S. Pine, J. Quant. Spectrosc. Radiat. Transfer. 57, 157-176, 1997