**CO2-BROADENING COEFFICIENTS IN THE 3 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. Methane has been detected on Mars by many studies [1,2] and is the main driver for the future ESA mission ExoMars. The origin of methane on Mars is still uncertain: it can be produced through internal processes like volcanic or biological processes, or external ones like cometary impacts. The NOMAD instrument [3] on-board ExoMars mission, has been especially designed to observe CH4 in the 3 fundamental band. However, to retrieve CH4 abundances, accurate spectroscopic line parameters are needed.

The previous studies of methane collisional broadening coefficients in the  fundamental band were devoted to the CH4-CH4, CH4-He, CH4-N2, CH4-O2, CH4-H2, CH4-Ar and CH4-Xe mixtures [4-7]. These works are especially useful for Earth atmosphere. The main component of the Martian atmosphere is carbon dioxide. The CO2-broadening coefficients are thus needed to determine precisely the quantity of methane present in this atmosphere. Very recently, we also determined the CO2-broadening coefficients in the 4 vibrational band [8].

In the present study, we have measured CO2-broadening coefficients of absorption lines in the  fundamental band of methane. Each line was recorded at room temperature (296 K) and for 4 different pressures, comprised between 20 and 60 mbar. The line profiles have been individually fitted, at each pressure, with two lineshapes: the Voigt profile and the Rautian and Sobel'man model which includes the Dicke narrowing. From these fits, we have obtained the collisional half-widths at each pressure and then determined accurately the CO2-broadening coefficients.

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References

[1] V. Formisano, S. Atreya, T. Encrenaz, N. Ignatiev, 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, M.D. Smith, Science **323**, 1041-1045 (2009)

[3]A.C. Vandaele, F. Daerden, R. Drummond, E. Neefs, J.-J. López-Moreno, J. Rodriguez Gomez, M. R. Patel, G. Bellucci and the NOMAD team, 4th international workshop on the Mars atmosphere: Modelling and observations, Paris, 8-11 (2011)

[4] A.S. Pine, J. Chem. Phys. **97**, 773-785 (1992)

[5] A.S. Pine, J. Quant. Spectrosc. Radiat. Transfer. **57**, 157-176 (1997)

[6] A.S. Pine, T. Gabard, J. Mol. Spectrosc. **217**, 105-114 (2003)

[7] D. Mondelain, S. Payan, W. Deng, C. Camy-Peyret, D. Hurtmans, A.W. Mantz, J. Mol. Spectrosc. **244**, 130-137 (2007)
[8] L. Fissiaux, Q. Delière, G. Blanquet, S. Robert, A.-C. Vandaele, M. Lepère, J. Mol. Spectrosc. **297**, 35-40 (2014)