CO_2- AND N_2- COLLISIONAL BROADENING COEFFICIENTS OF LINES IN THE ν_4 BAND OF METHANE

J. CLÉMENT, B. VISPOEL, O. BROWET, M. LEPÈRE, *Research Unit Lasers and Spectroscopies (LLS), Institute of Life and Environment (ILEE), University of Namur, 61, rue de Bruxelles,Namur, Belgium*; **M. MANGOLD, J. HAYDEN, P. ALLMENDINGER, A. HUGI**, *IRsweep AG, Laubisruetistrasse 44, Stäfa, Switzerland*

Remote sensing is a powerful tool to study planetary atmospheres. It uses the reflected or emitted radiation, captured by ground-based or space stations, to determine the physico-chemical characteristics of an atmosphere. It requires to compute the radiative transfer, which needs spectroscopic parameters. The constant improvements of the remote sensing instruments have pushed the need for high-resolution molecular spectroscopy. High accuracy spectroscopic data, such as collisional half-widths, need to be measured and studied in various spectral regions to keep up the pace with remote sensing community requirements.

This study uses the first mid-infrared dual comb spectrometer based on quantum cascade lasers[1] in the new step sweep mode which opens the door to high resolution[2]. Our very recent improvements of this instrument allows to obtain higher quality spectra in a lower amount of time. It helps to improve the analysis of absorption lines and the determination of collisional effects on line shapes.

In this work, we studied collisional half-widths of methane lines broadened by N_2 and CO_2 in the ν_4 vibrational band at room temperature. These parameters were deduced from the fits on the experimental line profiles using the Voigt and the Rautian-Sobel'man models. Our well-suited spectrometer and its recent improvements grant the observation of beyond-Voigt effects related to the molecular confinement. The experimental results were then compared, when possible, to the literature.

[1] doi:10.1364/CLEO_SI.2015.SW1G.3, G. Villares et al., "Dual-comb spectroscopy based on quantum-cascade-laser frequency combs", Nature Communications, 5(1):5192, (2014).

[2] doi:10.1016/j.jqsrt.2022.108239, M. Lepère et al., "A mid-infrared dual-comb spectrometer in step-sweep mode for high-resolution molecular spectroscopy", Journal of Quantitative Spectroscopy and Radiative Transfer, 287:108239, (2022).