TEMPERATURE DEPENDENCE OF N_2- AND O_2-COLLISIONAL PARAMETERS OF TRANSITIONS IN THE ν_4 BAND OF METHANE

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Line shape parameters provide important information to understand and determine intermolecular potentials. They are also crucial data to compute radiative transfer models, for which the accuracy of the spectroscopic parameters are directly realated to the precision of retrieved information from remote sensed spectra[1]. Many works (see Ref[2] and references therein) have shown that the Voigt model, widely used in the atmospheric community, does not reproduce accurately experimental line profile. Beyond-Voigt effects, such as the speed-dependence, need to be considered. Because the temperature varies with altitude in planetary atmospheres, the temperature dependence of the line shape parameters needs to be quantified.

In this work, line shape parameters at various temperatures were measured using a high-resolution quantum cascade laser spectrometer for ν_4 band methane lines diluted in nitrogen and oxygen. The measurements were performed from low (150K)[3] to high temperatures (600K)[4] thanks to specific absorption cells that have a good temperature stability and no gradient of temperature along the absorption path. For each temperature, the line shape parameters were determined using a multi-spectrum technique considering the Voigt, Nelkin-Ghatak, Speed-Dependence Voigt and Speed-Dependence Nelkin-Ghatak profiles. The temperature dependence were deduced from the empirical power law and the physics based double power law (Gamache-Vispoel model[5]). The results are compared to literature when possible.

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