LINESHAPE ANALYSIS OF MILLIMETER TRANSITIONS OF OZONE: COMPARISON OF GALATRY AND SPEED DEPENDENT VOIGT PROFILES

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We present detailed line shape analysis of some ozone transitions observed in the millimeter range (between 300 and 320 GHz). Experiments were done, at various temperatures between 250 and 350 K with nitrogen and oxygen as buffer gases. Two different setups were used: a video spectrometer in Lille, and a frequency modulated spectrometer in Bologna.
In both laboratories, it was clearly observed that these lines exhibit significant departures from the usual Voigt profile. These departures are characteristic of a line narrowing phenomenon which is usually assigned to the correlation between molecular motions and collisions. For the analysis of experimental results, we consider speed dependent Voigt (SDVP) as well as Galatry profiles: although they are related to different physical processes (speed dependence of relaxation rates and molecular diffusion), they both perfectly fit observed line shapes.
However, it was clearly observed that the optical diffusion parameter involved in the Galatry profile evolves non linearly versus the buffer gas pressure. On the other hand, perfect linear behaviors were observed for SDVP parameters. Such results, previously observed on HCN infrared lines[a], demonstrate the Galatry profile must be disregarded and the SDVP retained. Theoretical calculations of the speed dependence of relaxation rates confirm this conclusion and allow to claim that molecular diffusion plays a minor role in the case of atmospheric ozone lines.

[a] J.-F. D'Eu, B. Lemoine and F. Rohart, *J. Mol.Spectrosc.* 212, 96 (2002).