LINE INTENSITIES AND BROADENING COEFFICIENTS FROM HIGH RESOLUTION FAR INFRARED SPECTRA

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Molecular lines observed in high resolution far infrared spectra are associated with pure rotation transitions or belong to low-energy vibrational bands. Together with other parameters characterizing them, the intensities and broadening coefficients of these lines are required for example to analyze spectra of planetary atmospheres or to gain insight into the physics of the studied molecules or intermolecular interactions. Pure rotation line intensities can also be used to determine the particle density of chemically unstable species, allowing to obtain line intensities in another spectral range as was for example done for hypochlorous acid[a] and ozone.[b]

This lecture will deal with the measurement of the intensities and broadening coefficients of molecular lines observed in high resolution far infrared absorption spectra. It will skim over measurements carried out using THz spectroscopy and focus on Fourier transform spectroscopy. This latter technique is now commonly associated with synchrotron radiation, the high brightness and highly collimated nature of which being big advantages at low energies over conventional sources such as mercury lamps.[c] The lecture will present and discuss some recent and ongoing measurements carried out relying on Fourier transform far infrared spectra recorded using synchrotron radiation, highlighting some aspects specific to these retrievals.

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[a] J. Vander Auwera, J. Kleffmann, J.-M. Flaud, G. Pawelke, H. Bürger, D. Hurtmans, R. Pétrisse, J. Mol. Spectrosc. 204 (2000) 36–47.

[b] B.J. Drouin, T.J. Crawford, S. Yu, J. Quant. Spectrosc. Radiat. Transf. 203 (2017) 282–292.

[c] A.R.W. McKellar, J. Mol. Spectrosc. 262 (2010) 1–10.