10 μm Ethylene: Spectroscopy, Intensities and a Planetary Modeler's Atlas

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FTS and TDL spectra of ethylene in the 10 μm region have been observed, measured, calibrated, assigned and intensities measured working toward the goal of a planetary modeler's atlas. A spectrum taken in double pass configuration at the 1-m McMath FTS instrument at Kitt Peak National Observatory has been measured and calibrated against CO_2 laser bands with a calibration standard deviation of 0.0002 cm^{-1}. Using the results of a previous analysis (Cauuet et al., 1990) we have assigned the FTS spectrum and have measured over 500 intensites of ethylene lines in the 900-1000 cm^{-1} region. Using measurements of 15 isolated transitions in this region made independently at the University of Tennessee and Goddard Space Flight Center using TDL spectrometers, the FTS intensities have been calibrated and transformed to 296 K. A benefit of this calibration approach is the improvement of the accuracy of intensity determination as well as compensation for the pressure and temperature determinations of an FTS spectrum taken for line position determination. Using a calculated spectrum, including mixing coefficients for ν_4, ν_7, ν_{10}, and ν_{12} interactions and calculated relative intensities (A. Fayt, 1996), we have used the calibrated FTS intensities as the independent variable in a non-linear regression to determine the vibrational band intensities of ν_7, ν_{10}, and ν_{12} (ν_4 is not determined by the data). These vibrational band intensities (scaled dipole moment derivatives) make it possible for us to generate an ethylene atlas at temperatures of our choice, which will be useful to the planetary atmosphere modeling community.

References:

Cauuet et al. (1990), *J. Molec. Spectrosc.* **139**, 191-214.
A. Fayt (1996), private communication.

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