HIGH-RESOLUTION SPECTROSCOPY AND ANALYSIS OF THE 3 μm REGION OF C_2H_4 IN NATURAL ISOTOPIC ABUNDANCE.

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Ethylene is a natural gaseous compound present in the atmosphere of the Earth but also observed in the atmospheres of outer solar system bodies such as Neptune and Titan[1] [2]. Optical remote sensing of this species in these environments requires knowledge of spectroscopic parameters characterizing its spectrum. Such an information is compiled in databases,[3,4] their improvement being a long-lasting, constant effort.

We present here a detailed analysis and modeling of the strongly absorbing ν_9 and ν_{11} fundamental bands of C_2H_4 observed in the 3 μm region. Due to the complexity of the observed spectrum, we have built a reasonably complex polyad scheme that includes some fundamental and combination bands previously analyzed using the tensorial formalism developed in Dijon for asymmetric-top molecules[5]. A four-polyad system has been used to analyze a region where mainly five rovibrational modes: ν_9, ν_{11}, $\nu_2 + \nu_{12}$, $\nu_2 + \nu_{10}$, and $2\nu_{10} + \nu_{12}$ of the ethylene emerge. A first frequency analysis has been performed, providing 3328 assignments and 87 adjusted parameters with a root mean square of 5.9×10^{-3} cm^{-1} and a standard deviation of 2.0×10^{-3} cm^{-1}. The line intensities were then fitted with a root mean square deviation of 1.9%, using parameters determined from the analysis of the line positions. The band intensities were also determined and compared with previous work. A new line list of calculated lines in the 2900-3300 cm^{-1} region will be proposed to

[1] G.S. Orton et al, *Icarus*, **70**, 1-12, (1987)
[2] A. Coustenis et al, *Icarus*, **124**, 54-76, (1989)
[3] I.E. Gordon et al, *J. Quant. Spectrosc. Radiat. Transf.*, **277**, 107949, (2022)
[4] T. Delahaye *et al.*, *J. Mol. Spectrosc*, **380**, 111510, (2021)
[5] J.P. Champion et al, *Academic Press Inc.*, 339-422, (1992)

be added to the ECasDa, HITRAN[6], and GEISA databases[7].

[6] I.E. Gordon et al, *J. Quant. Spectrosc. Radiat. Transf.*, **277**, 107949, (2022)
[7] T. Delahaye et al, *J. Mol. Spectrosc*, **380**, 111510, (2021)