UNAMBIGUOUS ASSIGNMENT OF ETHYLENE TRANSITIONS IN THE 5900-6200 CM^{-1} RANGE

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Among other species, methane[1] and acetylene[2] were detected in the atmospheres of Hot Jupiter exoplanets. The James Webb Space Telescope is expected to detect other small hydrocarbons including ethylene (C_2H_4), in particular in the near-infrared spectral range[3]. High-temperature and high-resolution laboratory data are therefore needed both to unambiguously detect this species and to retrieve its atmospheric concentration and temperature profiles. Our aim is to produce high-temperature spectroscopic data of ethylene in the 1.6-1.7 μm spectral region using our SMAUG hypersonic wind tunnel, which has already been applied to methane[4,5]. Nevertheless, due to the very dense absorption spectrum of ethylene even at room temperature, a preliminary measurement campaign was carried out at very low temperatures under slit jet-cooled conditions to first provide accurate assignments of cold band transitions. A series of three spectra were recorded by cavity ringdown spectroscopy and tunable distributed feedback laser diodes at rotational temperatures of 6 K, 16 K and 54 K using either Ar/C_2H_4 or N_2/C_2H_4 gas mixtures. Unambiguous assignment of the observed rovibrational lines is performed using the TheoReTS *ab initio* line list[6] and the SPVIEW/XTDS software package[7]. These transitions have been attributed to seven interacting vibrational bands: $\nu_2+\nu_3+\nu_{11}$, $\nu_2+\nu_6+\nu_9$, $\nu_1+\nu_{11}$, $\nu_5+\nu_{11}$, $\nu_1+\nu_2+\nu_{12}$, $\nu_5+\nu_9$, and $\nu_9+2\nu_{12}$.

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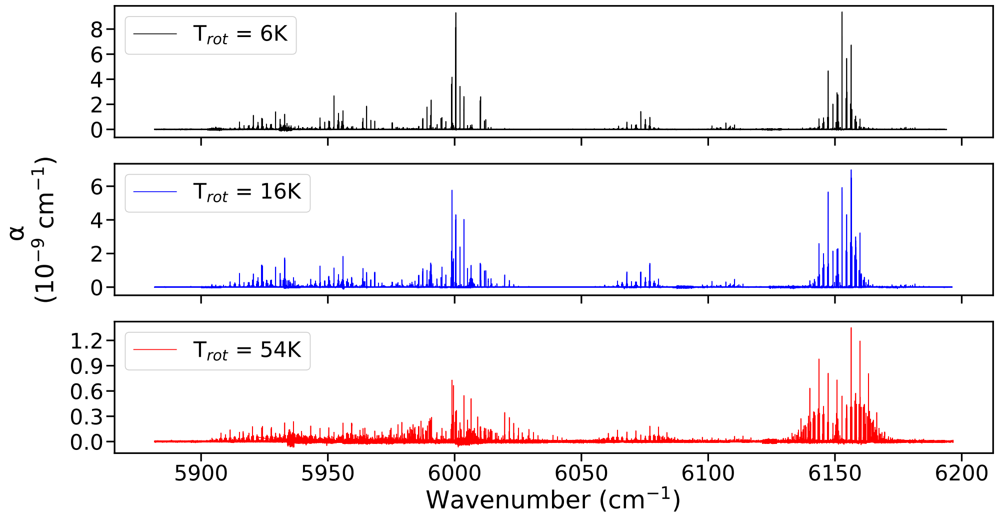

T_rot = 6K
T_rot = 16K
T_rot = 54K
α
(10⁻⁹ cm⁻¹)
Wavenumber (cm⁻¹)
5900
5950
6000
6050
6100
6150
6200