A comprehensive intensity study of the $\nu_4$ torsional band of ethane

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The torsional spectrum of C$_2$H$_6$ has been investigated from 220 to 330 cm$^{-1}$ to measure the intensity of the fundamental and the first torsional hot band needed for atmospheric studies of Titan. Several spectra were measured at resolutions of 0.01 and 0.02 cm$^{-1}$ using the JPL Bruker IFS-125 coupled to a coolable multi-pass absorption cell originally developed at University of British Columbia.$^a$ Spectra were recorded at several temperatures from 293 K to 166 K, with the lower temperatures relevant to the stratosphere of Titan. Because this spectrum is very weak, a long absorption path of 52 m was used along with substantial sample pressures from 35 to 255 Torr. Intensities were analysed using a quantum mechanical model reported previously.$^b$ The torsional fundamental of C$_2$H$_6$ is observed in the CIRS spectra of Titan. Line parameters for the torsional bands are required for accurate characterization of spectral features of Titan’s far-infrared region. The current study should lead to a better understanding of the methane cycle in planetary atmospheres and permit the identification of the other molecular features in the CIRS data.$^c$

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