

MOLECULAR LINE INTENSITIES OF CARBON DIOXIDE IN THE 1.6 μm REGION DETERMINED BY CAVITY RINGDOWN SPECTROSCOPY

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Here we present some recent advances in frequency stabilized cavity ring-down spectroscopy (FS-CRDS) measurements of molecular line intensities of carbon dioxide in the (30012) \leftarrow (00001), the (30013) \leftarrow (00001), and the (30014) \leftarrow (00001) bands near 1.6 μm .

These measurements were performed near 296K using a frequency stabilized cavity ringdown spectrometer [1]. Additional independent measurements were performed on a frequency agile rapid scanning (FARS) CRDS [2].

We have compared the line intensities obtained from Hartmann Tran Profile (HTP) fits of the measured spectra to several spectroscopic databases, including UCL (ie, HITRAN2016) [3]. The overall agreement between these results and the ab initio calculations of Zak et al is excellent [3], although some individual transitions show deviations of up to 1%. The intensities for the (30012) \leftarrow (00001) show average agreement at the 0.1% level. Preliminary measurements on the (30013) \leftarrow (00001), and the (30014) \leftarrow (00001) bands in this region also show good agreement with the ab initio of Zak et al for the (30013) \leftarrow (00001), but considerably poorer agreement for the (30014) \leftarrow (00001) band. No significant J-dependence is observed for any of the three bands.

This work demonstrates significant improvement in experimental determination of important CO₂ line intensities in the 1.6 μm region. It also demonstrates that it may be feasible for ab initio theory to provide sufficiently accurate results for global determinations of line intensities in the near future.

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[3] E. J. Zak, J. Tennyson, O. L. Polyansky, L. Lodi, N. F. Zobov, S. A. Tashkun, and V. I. Perevalov, *J. Quant. Spectrosc. Radiat. Transfer* 189, 267-280 (2017).