MOLECULAR TRANSITION FREQUENCES OF CO_2 NEAR 1.6 μ WITH KHZ-LEVEL UNCERTAINTIES

ZACHARY REED, *Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, USA*; BRIAN DROUIN, *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA*; DAVID A. LONG, JOSEPH T. HODGES, *Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, USA*.

We present measurements of molecular transition frequencies based on the comb-locked cavity ring-down spectroscopy technique [1], reporting vacuum transition frequencies of Doppler-broadened $^{12}C^{16}O_2$ in the 1.6 μm region for the (30012) $\leftarrow$ (00001) and (30013) $\leftarrow$ (00001) bands with an average combined standard uncertainty of 1 kHz. A global multi-state model was fit to these data and literature values to provide spectroscopic parameters and a best-case fit precision of 4 kHz. We identified and assigned an interaction between the (30012) and (33301) states which was manifest as an observed Fermi resonance in the (30012) $\leftarrow$ (00001) band. This interaction was accounted for in the global fit, significantly reducing uncertainties in the spectroscopic parameters of the (30012) state. We find excellent agreement with literature values, including better than 1 kHz RMS deviation with a recent saturation cavity ring-down study of the (30013) $\leftarrow$ (00001) band [2]. Agreement is excellent with CDSD 2019 [3] and HITRAN 2016 [4] for the (30013) $\leftarrow$ (00001) band, but much poorer for the (30012) $\leftarrow$ (00001) band.

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