HIGH ACCURACY MEASUREMENTS OF NEAR-INFRARED CO₂ AND O₂ TRANSITIONS TO SUPPORT ATMOSPHERIC REMOTE SENSING

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Recent remote sensing missions such as NASA’s Orbiting Carbon Observatory (OCO-2) have aimed to measure carbon dioxide mixing ratios with a precision of 1 ppm (0.25%) in order to elucidate carbon sources and sinks. This daunting mission objective will require some of the most accurate spectroscopic reference data ever assembled. To address this need we have utilized frequency-stabilized cavity ring-down spectroscopy (FS-CRDS), an ultraprecise refinement of traditional cw-cavity ring-down spectroscopy, to measure CO₂ and O₂ transitions in the near-infrared. We will discuss new line lists as well as observations of subtle line shape effects such as Dicke narrowing, speed-dependence, and line mixing. The effects of line list and line shape on O₂ A-band atmospheric retrievals were assessed using simulated atmospheric transmission spectra. Furthermore, we will discuss a series of enhancements we have made to our spectrometer including high-bandwidth Pound-Drever-Hall locking and the use of a self-referenced optical frequency comb as an absolute frequency reference.