HIGH ACCURACY MEASUREMENTS OF NEAR-INFRARED CO_2 AND O_2 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 CO_2 and O_2 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 O_2 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.