ULTRASENSITIVE, HIGH ACCURACY MEASUREMENTS OF TRACE GAS SPECIES

DAVID A. LONG, ADAM J. FLEISHER, Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, USA; DAVID F. PLUSQUELLIC, Physical Measurement Laboratory, National Institute of Standards and Technology, Boulder, CO, USA; JOSEPH HODGES, Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD, USA.

Our laboratory seeks to apply novel cavity-enhanced spectroscopic techniques to present problems in atmospheric and physical chemistry. Primarily we use cavity ring-down spectroscopy in which the passive decay of optical power within a Fabry-Pérot resonator is utilized to extract an absorption signal. With this technique we have demonstrated quantum (shot) noise limited sensitivities in both the near-infrared and mid-infrared spectral regions. Both commercial and home-built optical frequency combs are employed either to serve as absolute frequency references for molecular spectra or in a multiheterodyne approach for multiplexed sensing. I will discuss this novel instrumentation as well as measurements we have made of atmospherically relevant species such as CO$_2$, H$_2$O, O$_2$, CH$_4$, and CO with implications for in situ and remote (i.e. satellite-based) sensing. I will conclude by discussing future directions and plans for challenging measurements in the mid-infrared.