

TRACE GAS DETECTION WITH CW CAVITY RING-DOWN LASER ABSORPTION SPECTROSCOPY

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We are developing a technique to measure trace concentrations of gases in the near infrared region using continuous wave excitation of a cavity ring-down spectroscopy cell (CW-CRDS). Cavity Ring-down Spectroscopy is an absorption technique in which light is coupled into a high-finesse optical resonator. By monitoring the decay rate of the light inside the cavity, we can determine the sample's concentration. This technique will allow the use of modest power, single mode diode lasers that are easily transportable. The near-IR contains both vibrational overtone transitions and forbidden electronic transitions of many atmospherically important species. Our research has focused on investigating the properties of the cavity ring-down system in order to increase detection sensitivity of these atmospherically important species. Specifically, we are studying moisture detection at the parts per billion (ppb) to the parts per trillion (ppt) range. Recently, we have obtained a detection limit of better than $1 \times 10^{-11} \text{ cm}^{-1}$ per root Hz for $R = 0.999985$ reflectors which allows us to detect water at less than 100 ppb.