

Cavity Enhanced Amplitude Modulated Laser Absorption Spectroscopy

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Over the past decade, laser absorption spectrometers have attracted plenty of research interest because of their potential to act as field-deployable gas/isotope analyzers. For this technique, a long interaction length between interrogating light and the gas sample is desirable to improve sensitivity. The most sensitive laser absorption spectrometer to date is noise-immune cavity-enhanced optical heterodyne molecular spectroscopy (NICE-OHMS). It combines absorption enhancement from a 100000 finesse cavity with laser frequency modulation to achieve a quantum shot-noise limited sensitivity. We have developed another absorption readout technique named cavity enhanced amplitude modulated laser absorption spectroscopy (CEAMLAS) using a lower finesse while still maintaining excellent absorption sensitivity. This improves usability in field deployed applications by avoiding the strict cleanliness requirements associated with high finesse cavities. We report the implementation of a CEAMLAS spectrometer, demonstrating that it can be readily used as a gas sensor or an isotope analyzer delivering real-time and continuous absorption data. We also discuss current noise limits and improvements made to achieve better sensitivity in a real life setup, as well as potential future developments for this technique.

