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Intracavity Optogalvanic Spectroscopy (ICOGS)[1] ERHAN ILKMEN, OZGUR DOGRU, DANIEL MURNICK, Rutgers University, Newark, NJ 07102 — Optogalvanic spectroscopy is a powerful technique for isotopic ratio analysis of CO_2. Isotopic lasers in resonance with specific molecular transitions in a RF glow discharge provide high specificity. Periodically modulated laser beam changes the population densities of the specific excited molecules that changes the impedance of the discharge, which then can be detected as voltage change across the electrodes. The optogalvanic signal is linear in path length and laser intensity providing a way to achieve high sensitivity. Earlier external cell studies have shown the limit of detection of $^{14}C/^{12}C$ ratio to be of the order of $\sim 10^{-9}$. It is now shown that placing the analyte cell directly into a $^{14}CO_2$ laser cavity greatly enhances the sensitivity - by about 10^6 which enables detection of trace amounts of $^{14}CO_2$ molecules with high signal to noise ratios. This huge improvement in sensitivity from the earlier studies is believed to be due to high internal laser power ($\sim$50W) and increase in interaction length of the laser photons with the excited molecules. The effective interaction length is of the order of the single mode laser coherence length. Unlike in intracavity laser absorption spectroscopy, the ICOGS signal does not change the laser output.

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