High precision measurements of $\Delta^{17}O$ in CO_2 using VCOF CRDS

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Precise IRMS measurements of small oxygen-17 anomalies in CO2 are particularly challenging because of isobaric interference between 16O13C16O and 16O12C17O isotopologues. In recent years, several methods have been proposed to solve this problem [e.g., Barkan and Luz, 2012; Passey et al., 2014; Barkan et al., 2015], all of which require quantitative chemical conversion to molecular oxygen. In practice, these chemical preparation steps come at a significant cost in time and resources, and they might explain some of the discrepancies observed between different IRMS techniques [e.g., Passey et al., 2014 vs Barkan et al., 2015].

Laser absorption techniques offer a promising alternative for direct measurements of Δ17O, because the three isotoplogues of interest have distinctive infra-red absorption spectra.

High-precision CRDS measurements of isotopologue ratios, however, require excellent spectral selectivity and stability. Using optical feedback frequency stabilization in combination with a conventional CRDS setup (Burkart et al., 2013), we obtain a laser line width in the sub-kHz regime with a frequency drift of less than 20 Hz/s, which allows us to measure Δ17O in 20 mbar of pure CO2 with a precision of 10 ppm in less than 30 minutes.

We will describe the instrument's current capabilities and performance, and discuss possible strategies to further improve system stability and single-spectrum precision.