Abstract Submitted
for the FWS19 Meeting of
The American Physical Society

Development and Parameterization of a Bidirectional Comb Laser[1] KELLY FRADET, RICKY ARNOLD, BACHANA LOMSADZE, Santa Clara University — A frequency comb is a laser source whose spectrum is made up of discrete, equally spaced frequency lines, similar in shape to the teeth on a comb. Frequency combs are typically created using mode-locked lasers. Since the development of frequency comb technology, a method known as dual-comb spectroscopy (DCS) has attracted attention as a revolutionary approach to optical detection. DCS contains two frequency combs and its working principle is similar to Fourier transform Infrared spectroscopy (FTIR). But DCS doesnt require moving mechanical parts and hence enables the measurement of high-resolution absorption spectra rapidly. In DCS, one frequency comb interrogates the sample and the linear response is sampled in time with another comb that has a slightly different repetition rate. The resulting interferogram is captured by a single photodetector. Because of these qualities DCS is used both in the laboratory and outside for field applications such as atmospheric monitoring. However, DCS setups are expensive as they require two separate mode locked lasers. To overcome this limitation, we built two mode-locked lasers (with different repetition rates) from a single resonator. We successfully produced a dual-comb signal and set up an experiment using a Fabry-Perot interferometer to monitor and remove phase fluctuations. This improvement to DCS makes the technique even more powerful for practical applications outside the laboratory.

[1]This material is based upon work supported by the National Science Foundation under Grant No. [1904704]

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Date submitted: 01 Nov 2019 Electronic form version 1.4