DIRECT FREQUENCY COMB CAVITY ENHANCED SPECTROSCOPY FOR TRACE GAS DETECTION USING MID-INFRARED INTERBAND CASCADE LASERS

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Optical frequency combs provide broadband coverage while still being able to take full advantage of cavity-enhanced methods. The mid-infrared is highly desirable for molecular spectroscopy, where many strong fundamental vibrational bands exist. Optical frequency comb development in this region has lagged behind that of the near-IR. Interband Cascade Lasers are monolithic devices which can provide mid-infrared frequency combs in the C-H stretching region (3 μm) with high power per comb tooth and large repetition rates ($\sim$9 GHz). Although they lack the octave-spanning coverage of fiber-based mode locked lasers, they can still provide sensitive multi-species detection. We have investigated different cavity enhanced schemes with these devices, including Vernier spectroscopy where we were able to resolve the individual comb teeth without the use of any diffraction optics. Here we discuss the development of these devices and their application towards cavity enhanced detection of trace molecules.