

154. Title: Rapid and sensitive trace gas detection with continuous wave Optical Parametric Oscillator-based Wavelength Modulation Spectroscopy

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Abstract: A fiber-amplified Distributed Bragg Reflector diode laser is used to pump a continuous wave, singly resonant Optical Parametric Oscillator (OPO). The output radiation covers the 3-4 μm with ability of rapid (100 THz/s) and broad mode-hop-free tuning (5 cm^{-1}). Wavelength Modulation Spectroscopy is combined with the OPO to take optimal advantage of the spectral scan speed. The sensitivity of the system was determined as 0.8 ppbv (parts-per-billion by volume) for ethane (C_2H_6) for the absorption peak at 2996.9 cm^{-1} recorded in 1.3 seconds, corresponding to a noise equivalent absorption sensitivity (NEAS) of $1.2 \times 10^{-9} \text{ cm}^{-1}/\text{Hz}^{1/2}$. A comparison between results using the 1(st), 2(nd) and 4(th) harmonic derivative signal from wavelength modulation was performed. The broad continuous tunability was demonstrated by covering 35 cm^{-1} while recording absorption features of ethane, methane and water.