A QUANTUM CASCADE LASER DUAL-COMB SPECTROMETER IN STEP-SWEEP MODE FOR HIGH-RESOLUTION MOLECULAR SPECTROSCOPY

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To meet the challenges of high-resolution molecular spectroscopy, increasingly sophisticated spectroscopic techniques were developed. For a long time FTIR and laser-based spectroscopies were used for these studies. The recent development of dual-comb spectroscopy at high-resolution makes this technique a powerful tool for gas phase studies. We report on the use and characterization of the IRis-F1, a tabletop mid-infrared dual-comb spectrometer, in the newly developed step-sweep mode. The resolution of the wavenumber axis is increased by step-wise tuning (interleaving) and accurate measurement of the laser center wavelength and repetition frequency. Doppler limited measurements of N_2O and CH_4 reveal a wavenumber accuracy of 10^{-4} cm^{-1} on the complete covered range of 50 cm^{-1}. Measured half-widths of absorption lines show no systematic broadening, indicating a negligible instrument response function. Finally, measurements of nitrogen pressure broadening coefficients in the ν_4 band of methane show that the dual-comb spectrometer in step-sweep mode is well adapted for measurements of precision spectroscopic data, in particular line shape parameters.