DUAL-COMB SPECTROSCOPY OF C₂H₂, CH₄ AND H₂O OVER 1.0 - 1.7 μm

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A dual-comb spectrometer (DCS) has great advantages over the conventional FTIR in respect with the resolution and the measurement time. We reduce the relative linewidth of two optical frequency combs in our DCS to less than 1 Hz and extended the observable spectral bandwidth to be compatible with the FTIR. The figure shows the recorded spectrum of entire vibrational bands of ¹²C₂H₂ at 1.03 μm and 1.53 μm, CH₄ at 1.67 μm and H₂O at 1.46 μm. It takes 140 ms to record a time domain interferogram, from which the spectrum across over 1.0-1.7 μm is obtained by Fourier transformation. The interferogram is averaged more than 400,000 times successively to improve the signal to noise ratio. The horizontal axis is scaled by the absolute frequency and the transition frequencies are determined by fitting the absorption lines with the Voigt functions. The discrepancy from the previous sub-Doppler resolution measurements is typically a few MHz.