DUAL-COMB SPECTROSCOPY OF C_2H_2, CH_4 AND H_2O OVER 1.0 - 1.7 μm

KANA IWAKUNI, *Department of Physics, Faculty of Science and Technology, Keio University, Yokohama, Japan*; SHO OKUBO, HAJIME INABA, KAZUMOTO HOSAKA, ATSUSHI ONAE, *National Metrology Institute of Japan (NMIJ), Ntional Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan*; HIROYUKI SASADA, *Department of Physics, Faculty of Science and Technology, Keio University, Yokohama, Japan*; FENG-LEI HONG, *National Metrology Institute of Japan (NMIJ), Ntional Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan*.

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 $^{12}C_2H_2$ at 1.03 μm and 1.53 μm, CH_4 at 1.67 μm and H_2O 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.