SUB-DOPPLER RESOLUTION SPECTROSCOPY OF THE FUNDAMENTAL BAND OF HCl WITH AN OPTICAL FREQUENCY COMB

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We have demonstrated wavelength modulation spectroscopy of HCl using a difference-frequency-generation (DFG) source and an enhanced-cavity absorption cell. The frequency axis of the spectrum is calibrated by a fiber-based optical frequency comb which is locked to a Rb clock linked with TAI. The pump and signal sources of DFG are a 1.06-μm Nd:YAG laser and a 1.55-μm ECLD, and the idler wave is generated in a waveguide-type PPLN. The hyperfine structure caused by the Cl nucleus with the spin 3/2 is resolved for the $R(0)$, $R(1)$, and $R(2)$ transitions in the fundamental vibration band. The hyperfine components of $\Delta F = +1, 0, -1$, and the cross-over resonances are observed with a typical line width of about 220 kHz, and the transition frequencies are measured with an uncertainty of less than 10 kHz. The pressure- and power-dependences of the transition frequency and the spectral intensity of the cross-over resonances are also investigated.