DOPPLER-LIMITED SPECTROSCOPY WITH A DECADE-SPANNING TERAHERTZ FREQUENCY COMB

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We report the generation and detection of a decade-spanning TeraHertz (THz) frequency comb (0.15-2.4 THz) using two Ti:Sapphire femtosecond laser oscillators and ASynchronous OPtical Sampling THz Time-Domain Spectroscopy (ASOPS-THz-TDS). The measured linewidth of the comb at 1.5 THz is 3 kHz over a 60 second acquisition. With time-domain detection of the comb, we measure three transitions of water vapor at 10 mTorr between 1-2 THz with an average Doppler-limited fractional uncertainty of 5.9×10^{-8}. Significant improvements in bandwidth, resolution, and sensitivity are possible with existing technologies and will enable future studies of jet-cooled hydrogen-bonded clusters.