FREQUENCY STABLE AND LOW PHASE NOISE THZ GENERATION FOR PRECISION SPECTROSCOPY

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The terahertz (THz) region offers new possibilities for accurate characterization of light molecules[1] as well as the low lying vibrational modes of heavier ones[2]. High resolution molecular spectroscopy requires sub-KHz and very stable sources to typically resolve sub-Doppler features. Unfortunately, current high resolution THz spectrometers remain rather complex and/or cover limited spectral ranges necessitating fastidious experimental adjustments[3,4]. We recently developed an efficient system that generates a low phase noise, continuously tunable THz signal. It achieves Hz linewidth and mHz/s stability by locking two commercial distributed feedback (DFB) lasers, using optical feedback technique, onto a common highly stable V-shaped optical cavity. The photomixing of the lasers is achieved using a commercial photomixer that emits a collimated THz radiation. A Mach-Zehnder modulator provides fine frequency tuning by adding or subtracting a Radio-Frequency (RF) frequency to one of the DFB lasers. To illustrate the performances and the agility of the instrument we will present phase noise measurements results and spectroscopic applications on absorption lines of methanol and water vapours up to 1.4 THz including a recording of hyperfine structure of water line at 556.9 GHz, obtained by saturation spectroscopy.

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