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Terahertz Multiheterodyne Dual-comb Spectroscopy Based on Quantum Cascade Lasers

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We demonstrate the most compact terahertz multiheterodyne dual-comb spectroscopy using two quantum cascade lasers (QCLs) emitting around 4.2 THz without a need of additional fast detectors and moving parts in the system. With only ~270 nW terahertz power coupled into a terahertz QCL detector comb (no optics for alignment), the down-converted dual-comb spectra are successfully obtained in real-time at different carrier frequencies. To prove the spectroscopic ability, we further demonstrate that the compact dual-comb system can be used to calibrate the relative humidity in the air and to measure the transmission of samples. Due to the small optical coupling aperture (150 μ m), it is also potential to use the dual-comb technique for terahertz imaging.

SHORT BIO:

Hua Li received the Ph.D. degree in microelectronics and solid state electronics from the Shanghai Institute of Microsystem and Information Technology (SIMIT), Chinese Academy of Sciences (CAS), Shanghai, China, in 2009. From 2009 to 2012, he was with the Walter Schottky Institute, Technical University of Munich, Germany, as an Alexander von Humboldt research fellow. In Germany, his work was focused on injectorless quantum cascade lasers emitting in the mid-infrared wavelength range. From 2012 to 2013, he was with the Institute of Industrial Science, The University of Tokyo, Japan, where he was involved with the electrical domain investigation of terahertz quantum cascade lasers as a JSPS postdoctoral research fellow. From 2013 to 2015, he was with the Laboratoire Matériaux et Phénomènes Quantiques, University Paris Diderot (Paris 7), France, where he was involved with mode locking of terahertz quantum cascade lasers as a postdoctoral associate. Since 2015, he has been appointed as a “Hundred-Talent” professor at SIMIT, CAS. His research interests include quantum cascade lasers based frequency combs, fast terahertz detection, laser mode-locking, and applications of inter-subband semiconductor devices. He has authored or coauthored more than 50 peer-reviewed publications.