The Measurement and Simulation of Terahertz Difference Frequency Generation in Quantum Cascade Lasers

FENG XIE, Department of Physics, Texas A&M University, MIKHAIL BELKIN, FEDERICO CAPASSO, Department of Engineering and Applied Science, Harvard University, JEROME FAIST, Institute for Quantum Electronics, ETH Zurich — Recently the research on Terahertz (THz) source and imaging has attracted significant attention. To achieve the room-temperature operated semiconductor light source in the THz range became one of the main challenges. Quantum Cascade lasers (QCL) are the primary contenders. However, the goal of achieving room-temperature operation in THz QCLs still remains elusive. Combining optical nonlinearities with a mid-infrared QCL or a near-infrared diode laser is an alternative approach. A device integrating two QCL active cores lasing at different mid-infrared wavelengths and giant second order susceptibility for difference frequency generation (DFG) together could be a promising THz light source. In this talk, the measurement of a THz difference frequency generation QCL is presented. The laser works at two mid-infrared wavelengths, around 9um and 10um. The wavelength of the DFG signal is around 60 um. The result of simulations for the DFG spectra is also presented.

1This work was supported by NSF Grants:ECS-0547019, EEC-0540832, and OISE 0530220, and AFOSR grant FA9550-05-1-0435.