280-GHz Radiation Source Driven by a 1064-nm Dual-Frequency Laser

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We investigate continuous-wave (CW) THz emission using a photoconductive antenna driven by a 1064-nm laser. Only few demonstrations were reported at 1064 nm [1,2], despite the availability and maturity of high-power lasers and components. Here, we combine a CW dual-frequency Vertical-external-cavity emitting laser [3] with a plasmonic-based photomixer [4], all operating at 1064 nm for CW THz generation. The photomixer is fabricated on an epitaxial semiconductor structure consisting of a 200-nm-thick undoped $In_{0.24}Ga_{0.76}As$ layer and a 200-nm-thick AlAs layer grown on a semi-insulating GaAs by molecular beam epitaxy. The photoconductor layer is integrated with a broadband logarithmic spiral antenna and plasmonic contact electrodes. The latter provide sub-picosecond transit time for photo-generated carriers thus enabling photomixing at THz frequencies without using a short-carrier-lifetime substrate.

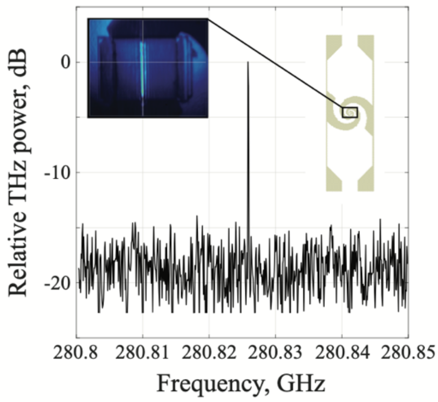

Fig. 1: Measured THz power spectrum around 280 GHz for a resolution bandwidth of 30 kHz. The top left inset shows the optical beam focused in- between plasmonic electrodes connected to the spiral antenna (top right inset).

The dual-frequency laser operation is based on the simultaneous operation of two transverse Laguerre-Gauss (LG) modes, offering a highly-stable and coherent spectrum for any beat frequency in the range 50–900 GHz [3]. These modes are combined by injecting a single-mode fiber. At the fiber output, cylindrical lenses are used to create an elliptical spot beam around the antenna gap (inset image from Fig.1). The THz signal is measured using a calibrated heterodyne head receiver. Figure 1 shows the measured THz power spectrum, clearly indicating a coherent radiation at 280 GHz for an incoming optical power of 30 mW.

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References:

[1]. R. Czarny et al., *Proc. SPIE*, vol. 5619, 2004.

[2]. S. Blin et al., *IEEE J. Sel. Top. Quantum Electron.* **23**(4), 1500511, 2017.

[3] D. Turan et al., *Optics Express* **28**, 3835-3845, 2020.