



Towards High Speed Imaging with Pulsed Terahertz Quantum Cascade Lasers

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The terahertz (THz) quantum cascade laser (QCL) is a compact high-power source of narrowband radiation and is an attractive device for a large variety of sensing and imaging applications. Terahertz QCL's have been demonstrated with peak output power exceeding 1 W and operating temperatures as high as 200 K in pulsed mode. Laser feedback interferometry (LFI) is a coherent sensing technique that has been successfully demonstrated previously in the THz for high-resolution imaging, materials analysis, and measuring QCL emission spectrum. However, LFI has been predominantly demonstrated with the THz QCL operating in cw mode, enforcing reliance on cryogenic cooling, which is bulky, expensive, and impractical for real-world deployment. To overcome this limitation, we have recently demonstrated a novel LFI scheme based on a THz QCL operating in pulsed mode which enables a marked reduction in the heat generated within the laser, thereby permitting higher operating temperatures. In this way, the required cooling power is significantly reduced allowing for a cryogen-free cooling solution. A practical benefit of LFI in pulsed operation is that this sensing mode is inherently less sensitive to environmental noise, including mechanical vibrations.

SHORT BIO:

Aleksandar D. Rakić leads the Photonics and Microwave Engineering group at The University of Queensland focusing on the development of technologies for sensing and imaging across the electromagnetic spectrum including microwave, terahertz wave and optical systems. Rakić's group pioneered the development of several world's first laser-feedback interferometric sensors including systems based on monolithic vertical-cavity surface-emitting laser arrays (VCSELs), blue-green lasers, terahertz quantum cascade lasers and mid-infrared interband cascade lasers. His current focus is on the development of sensing and imaging systems exploiting the THz spectrum for applications from security and defence to in vivo biomedical imaging. He is currently Professor of Photonics within the School of IT and Electrical Engineering, The University of Queensland and the Associate Dean (External Engagement) in Faculty of Engineering Architecture and Information Technology.