

# **Terahertz Quantum Cascade Laser Sources For High Temperature Operation**

**Mikhail A. Belkin**

*The University of Texas at Austin, 10100 Burnet Rd. Bldg. 160, Austin, TX 78758. E-mail: mbelkin@ece.utexas.edu*

Terahertz quantum cascade lasers are currently the most advanced electrically-pumped semiconductor lasers in the spectral range 1-5 THz. However, their operation at room-temperature is still an unresolved challenge. I will discuss factors that currently limit the operation of these devices to cryogenic temperatures and describe the recent results of our work to improve the operating temperatures of terahertz quantum cascade lasers through innovative active region and waveguide designs, and through using nonlinear optical effects to produce coherent terahertz radiation without population inversion across the terahertz transition. In particular, I will describe terahertz quantum cascade lasers that achieved record operating temperatures in the frequency range from 2.3 to 3.8 THz and report on our progress in developing terahertz quantum cascade laser sources based on intra-cavity nonlinear frequency mixing.

This work is done in collaboration with the groups in Harvard University (Prof. F. Capasso), the University of Leeds (Prof. E. Linfield), Texas A&M University (Prof. A. Belyanin), the University of Paris-Sud (Prof. R. Colombelli), and ETH Zurich (Prof. J. Faist).