



FWF SFB INFRARED OPTICAL NANOSTRUCTURES

# IR-ON SEMINAR

## Terahertz quantum cascade lasers: physics and applications

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Seminarraum Institut für Photonik, Gußhausstrasse 27, 1040 Wien, Raum CBEG02

Efficient and miniaturized quantum cascade (QC) sources operating in the THz range have been successfully developed in the last few years and implemented in heterodyne or imaging systems for spectroscopy and security applications. Despite their cryogenic operation temperatures in the Terahertz, quantum cascade lasers have indeed attracted considerable attention thanks to the high output power, spectral purity, stability, compactness and reliability.

A review of  $\mu$ -photoluminescence and micro-Raman experiments on THz quantum-cascade lasers (QCLs) based on different active-regions and optical-waveguide configurations will be presented with particular emphasis on the nature of the electron and phonon distributions, the electron-lattice energy relaxation phenomena and the device quantum efficiency.

Recent results of the extremely high efficiency coupling of surface emitting micro-ring QCLs to the low-loss optical modes of hollow Terahertz waveguides will be reported.

Finally a brief overview on running experiments employing THz QCLs combined with state of art superconducting hot-spot air bridge bolometers and novel THz detectors will be given.

Host: K. Unterrainer