

# PHYSICS DEPARTMENT COLLOQUIUM

## *“Recent Developments in Quantum Cascade Lasers”*

BY

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Quantum Cascade (QC) lasers are a rapidly evolving mid-infrared, semiconductor laser technology based on intersubband transitions in multiple coupled quantum wells. The lasers' key strengths are their considerable wavelength tailorability, high power and high-speed operation, and fascinating design potential.

We will first give an overview of QC lasers followed by a discussion of several recent highlights. In particular, we will discuss QC lasers with active region cascades that are “multi-functional”; i.e. they are capable of multiple-wavelength or broadband emission, or also incorporate quantum wells with resonant intersubband optical nonlinearities. As an example for the latter, a QC laser with active regions specially designed to incorporate a giant optical nonlinearity emitted light at pump and second harmonic wavelengths of 9.1 and 4.55  $\mu\text{m}$ , respectively, with up to few milliwatts of second harmonic power and a nonlinear power conversion efficiency of up to 36  $\text{mW/W}^2$ .

We will conclude with a short review on the state of the art of QC laser performance and applications, such as trace gas sensing or communications. An outlook at the challenges and promises ahead in the QC laser area will close the talk.

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