Stevens Institute of Technology

Nanotechnology Graduate Program

Quantum Cascade Semiconductor Infrared Lasers: From Trace Gas Sensing to Non-linear Optics

Wednesday, January 23rd, 2008
Babbio 110, 11:00 am [NOTE ROOM, TIME CHANGE]

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The Quantum cascade (QC) laser is an entirely new type of semiconductor laser developed by Capasso and his group at the AT&T Bell Laboratories in 1994. The laser wavelength depends on the band-gap engineering of a device not on the intrinsic band gap of the semiconductors used to fabricate it. Since QC lasers have much higher power than the lead salt lasers previously used for mid-infrared laser spectroscopy a range of new molecular spectroscopic experiments to be carried out.

In this talk I intend to give two examples of the use of the intra-pulse QC laser spectrometer which Nigel Langford and I have developed. The first is its application to airborne measurements of the trace gases nitrous oxide and methane, and the second is to rapid-passage effects in non-linear optics. The rapid frequency down chirp of pulsed, or pulse modulated, quantum cascade lasers lends itself to studies of rapid passage effects in low pressure gases, an extension of NMR techniques to the infrared region. We will show experimental examples of these effects in optically thin and thick, long pathlength, low pressure, spectra of nitrous oxide and acetylene at 7.84 microns. These unusual effects will be analysed by making use of numerical solutions of the Maxwell-Bloch equations.

Light refreshments will be served prior to seminar

For additional information please contact Prof. Rainer Martini, rmartini@stevens.edu

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