



FWF SFB INFRARED OPTICAL NANOSTRUCTURES

IR-ON SEMINAR

Carbon-based optoelectronics

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

Carbon-based materials exhibit extraordinary physical properties and have therefore attracted much attention from both universities and the electronics industry. In this seminar talk I will review my research activities at IBM on the optical and optoelectronic properties of carbon nanotubes and graphene. Specifically, I will present photoconductivity studies of graphene [1], I will discuss the origin of its photoconductive behavior [2], and present an ultrafast (>40 GHz) metal-graphene-metal photodetector [3]. We used this graphene-based photodetector to demonstrate the faithful detection of data streams at rates of 10 gigabits per second [4]. In our carbon nanotube work, we fabricated split-gate, single nanotube diodes. We then utilized the radiative electron-hole recombination of the carriers generated at the p-n junction to produce the first nanotube true light-emitting diode [5]. The efficiency of this diode was orders of magnitude higher than what had been achieved previously using ambipolar nanotube transistors, had much lower power consumption and a significantly narrower linewidth. This light emitting diode opens up the possibility of developing nanotube single-photon sources and other nanodevices.

Host: K. Unterrainer

- [1] F. Xia, T. Mueller, R. Golizadeh-Mojarad, M. Freitag, Y. Lin, J. Tsang, V. Perebeinos, and Ph. Avouris, *Nano Lett.* 9, 1039 (2009).
- [2] T. Mueller, F. Xia, M. Freitag, J. Tsang, and Ph. Avouris, *Phys. Rev. B* 79, 245430 (2009).
- [3] F. Xia, T. Mueller, Y. Lin, A. Valdes-Garcia, and Ph. Avouris, *Nature Nanotech.*, DOI: 10.1038/NNANO.2009.292 (2009).
- [4] T. Mueller, F. Xia, and Ph. Avouris, submitted (2009).
- [5] T. Mueller, M. Kinoshita, M. Steiner, V. Perebeinos, A. A. Bol, D. B. Farmer, and Ph. Avouris, *Nature Nanotech.*, DOI: 10.1038/NNANO.2009.319 (2009).