



Columbia University Optics Seminar



“Grapheotonics: Photonics with CNTs and Graphene”



Prof. Stefan Strauf

Department of Physics and Engineering Physics
Stevens Institute of Technology

Date/Time: Monday, April 2nd, 11 – 12 noon

Location: Sindeband East 414, Schapiro building

Abstract: Carbon allotropes such as carbon nanotubes (CNTs) and graphene have recently gained tremendous interest as a nanomaterial for photonics and quantum photonics devices. In this talk I will review some of our recent work. The large exciton binding energies of about 400 meV in CNTs are attractive for practical devices however optical emission suffers from blinking and spectral diffusion. I demonstrate how these detrimental effects in individual CNTs can be largely eliminated, resulting in fifty-fold enhanced exciton emission and pronounced photon antibunching at elevated temperatures. Nanostructured graphene displays a semiconductor band gap but fabrication suffers from edge disorder where armchair and zigzag edges are mixed, reducing the gap energy. I show how Raman spectroscopy can be used to determine the fractional composition of armchair/zigzag edges and furthermore how edge chirality can be purified in graphene nanoribbons by triggering edge reconstruction all optical via selective phonon excitation. Towards efficient light-harvesting I present results for dye-functionalized graphene antidot superlattices revealing built lateral electrical fields as well as photocurrent measurements of large-scale CVD grown graphene for applications in novel IR detectors with strain-tunable band gaps.

Bio: Dr. Stefan Strauf joined Stevens Institute of Technology in 2006 as an Assistant Professor of Physics and Engineering Physics where he established an experimental nanophotonics lab. He received a PhD from Bremen University (Germany) in 2001 working on quantum optics with II-VI semiconductors. During his 4 postdoc years at UC Santa Barbara he demonstrated GaAs-based ultra-bright single photon sources and photonic crystal quantum dot nanolasers with world record performance. His current research focuses on novel graphene and CNT-based optoelectronic devices, such as quantum light sources, tunable IR detectors, and flexible solar cells as well as fundamental materials studies of nanostructured graphene. Dr. Strauf has published 55 papers including 18 letter journal papers. He received a Max-Kade foundation fellowship in 2003, the Harvey M. Davis Memorial Award for Research Excellence in 2008 and the NSF CAREER award in 2011. His web page can be found at www.stevens.edu/nanophotonics.