Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Optical phonon and hot carrier lifetimes in single-walled carbon nanotubes by time-resolved anti-Stokes Raman scattering KWANGU KANG, DAVID CAHILL, TANER OZEL, MOONSUB SHIM, Frederick Seitz Materials Research Laboratory, and Department of Materials Science and Engineering, University of Illinois — The lifetimes of optical phonon and photoexcited carriers in both semiconducting and metallic single-walled carbon nanotubes are determined by time-resolved Raman scattering using a subpicosecond pump-probe method. Non-equilibrium populations of electronic and phonon excitations are observed by incoherent anti-Stokes Raman scattering from a broad continuum and the G mode, respectively. HiPco nanotubes with E_{22} transitions and arc-discharge nanotubes with E_{11} transitions dominate the spectra because of their resonance with the photon energy. To separate Raman scattering created by the probe beam from scattering created by the pump beam, we have developed a two- color pump-probe technique based on the broad bandwidth of the Ti:sapphire laser oscillator and narrow band-pass optical filters. For semiconducting tubes, the optical phonon lifetimes decrease from 1.2 ps to 0.9 ps with increasing laser fluence. The optical phonon lifetimes of metallic tubes, on the other hand, increase from 0.6 ps to 1.1 ps. The hot carrier lifetime is approximately 0.3 ps.

David Cahill
University of Illinois at Urbana-Champaign

Date submitted: 23 Nov 2007 Electronic form version 1.4