Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Third-order Coherent Optical Spectroscopy of Individual Carbon Nanotubes TATYANA SHEPS, PHILIP G. COLLINS, Department of Physics and Astronomy, Univ. of California Irvine, Irvine, CA 92697-4576, ERIC POTMA, Department of Chemistry, Univ. of California Irvine, Irvine, CA 92697-4576 — Single walled carbon nanotubes (SWCNTs) are low dimensional conductors with unique electronic and electro-optic properties. To probe these properties, we investigate the third-order, coherent anti-stokes (CAS) response of individual SWCNTs using a dual color, four-wave-mixing technique. Despite being nanoscale objects much smaller than the wavelength of light, the CAS response allows single SWCNTs to be optically imaged with good spatial resolution and high signal-to-noise [1]. The absence of any Raman signature shows that the CAS response is dominated by electronic, rather than vibrational, dynamics, which suggests a method for straightforward optical discrimination between metallic and semiconducting SWCNTs. Furthermore, electrically-connected SWCNTs in a field effect transistor geometry enable additional investigation of the dependence of the CAS signal on charge carrier densities. We observe changes in the CAS signal that depend on contact resistances and on physiochemical effects that change the effective SWCNT Fermi level.
[1] H. Kim et al, Nano Lett. 9 2991-2995 (2009).

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Date submitted: 14 Dec 2009 Electronic form version 1.4