Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Tunable Electron-Phonon Coupling in Isolated Metallic Carbon Nanotubes Observed by Raman Scattering YANG WU, JANINA MAULTZSCH, Columbia University, ERNST KNOESEL, Rowan University, BHUPESH CHANDRA, Columbia University, MINGYUAN HUANG, Columbia.University, MATT SFEIR, Columbia University, LOUIS BRUS, JAMES HONE, TONY HEINZ, Columbia University — Metallic single-walled carbon nanotubes can exhibit significant broadening of the high-energy (G) mode Raman features. In contrast to narrow Raman widths for semiconducting nanotubes, full widths in excess of 50/cm are commonly observed in metallic nanotubes. Different possible physical origins have been proposed in previous literatures. In this paper, we demonstrate the ability to modify the Raman linewidth by electrostatic gating. Using measurements of individual suspended nanotubes, we find that either a positive or negative shift in the Fermi energy by an applied electrostatic field can reduce the linewidth by more than a factor of two. The results can be understood in terms of blocking vertical electronic transitions (electron-hole pair generation) possible for the zone-center phonons in an unperturbed nanotube, but not in a nanotube with a sufficiently shifted Fermi level. A simple model is presented to explain the experimental results.

Yang Wu
Columbia University

Date submitted: 26 Nov 2006 Electronic form version 1.4