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Direct Measurement of the D-Mode and G-Mode Optical Phonon Lifetimes in Single Wall Carbon Nanotubes HUGEN YAN, DAOHUA SONG, TONY HEINZ, Columbia University — Time-resolved Raman spectroscopy has been applied to determine the population lifetime of both zone-center and zone-edge optical phonons. Non-equilibrium populations of these phonons were produced by the rapid relaxation of charge carriers following photoexcitation of the nanotube sample with a femtosecond laser pulse. The temporal evolution of these phonon populations was recorded using the strength of antiStokes Raman scattering in G-mode (for the zone-center phonons) and D-mode (for the zone-edge phonons) as a function of the time delay of the fs probe pulse. A longer lifetime was found for the D-mode than for the G-mode phonons, a result consistent with recent ab-initio calculations of the anharmonic decay of these phonons [1]. We also report on the transient mode populations for the zone-center and zone-edge phonons that result from carrier cooling. [1] N. Bonini, M. Lazzeri, N. Marzari, and F. Mauri, Phys. Rev. Lett. **99**, 176802 (2007).

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