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Indication of Long Lived States in Decay Associated Spectra of Single-Walled Carbon Nanotubes[1] VASUDEV LAL, ROSEANNE SENSION, DUNCAN STEEL, University of Michigan, Ann Arbor — The direct bandgap nature of Single-Walled Carbon Nanotubes(SWCNTs) along with the quantized energy level structure due to reduced dimensionality makes them useful elements in chip-based photonic devices for sensing and communications. However, their fundamental linear and nonlinear optical properties remain poorly understood. Using various nonlinear optical spectroscopy techniques with micelle encapsulated SWCNTs, we have measured carrier dynamics at both the picosecond, and tens of nanosecond timescale. We measure a fast 20ps timescale decay that agrees well with the lifetime of the lowest excited state measured before for such samples but surprisingly we also obtain an optical double-resonance signal on the slow timescale (10nsec). Such slow timescale signals due to artifacts such as thermal effects have been ruled out. Decay associated spectra shows striking differences between the spectral lineshapes arising from the fast and slow components of the nonlinear optical signal which might indicate the creation of a long-lived state by the pump pulse that changes the subsequent probe spectra. This indicates the possibility of the presence of either a trap state or possibly a more complex energy level structure for the SWCNT involving the presence of a metastable state.

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