Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Auger Recombination of Excitons in Single-Walled Carbon Nanotubes FENG WANG, GORDANA DUKOVIC, MARK HYBERTSEN, LOUIS BRUS, TONY HEINZ, Columbia University — Single-walled carbon nanotubes (SWNTs) as prototypical 1- dimensional systems exhibit enhanced carrier-carrier interactions. As a consequence, one would expect semiconducting SWNTs containing multiple electron-hole pairs to display rapid Auger recombination. We have investigated this issue experimentally by examining the efficiency and temporal evolution of the fluorescence emission from SWNTs after excitation by a femtosecond laser pulse[1]. The behavior as a function of the pump excitation fluence, which controls the initial electron-hole density, reveals the presence of Auger recombination through a decrease in fluorescence efficiency and the emergence of a rapid decay channel when multiple electron-hole pairs are present in a SWNT.[2] Similar fluence-dependent effects have also recently been reported by Ma et al[3]. Quantitative analysis yields an Auger recombination rate of $\sim$1/psfor just 2 electron-hole pairs in a 400 nm long SWNT. This rapid Auger rate limits the sustainable electron-hole density that can be achieved within a single nanotube. We compare our experimental finding with a theoretical estimate of the Auger rate in SWNTs based on a point-contact interaction model. [1]F. Wang, et al., Phys. Rev. Lett. **92**, 177401 (2004). [2]F. Wang, et al., Phys. Rev. B, in press. [3]Y. Z. Ma, et al., J. Chem. Phys. **120**, 3368 (2004).

Feng Wang
Columbia University

Date submitted: 06 Dec 2004 Electronic form version 1.4