Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Impact Excitation by Hot Carriers in Carbon Nanotubes VASILI PEREBEINOS, PHAEDON AVOURIS, IBM - Watson — We find in Ref. 1 and 2, that the impact excitation processes in nanoscale devices are much more efficient than in conventional bulk semiconductors due to the enhanced Coulomb interaction in low dimensions. In semiconducting carbon nanotubes, we calculate the impact excitation rates to be 4-5 orders of magnitude larger than in bulk semiconductors [2]. The impact excitation rate is much higher in nanotubes than the impact ionization, which neglects electron-hole interaction of the produced electron-hole pair, while their difference is negligible in bulk materials. The angular momentum conservation law plays a crucial role in determining the threshold energy of the impact excitation. The spectra of the produced excitons depends strongly on the bias and not constrained by the dipole selection rule as in the photoluminescence. The triplet excitons have approximately equal probability to be produced, unlike 1/4 statistical fraction for the independently injected electrons and holes. [1] J. Chen, V. Perebeinos, M. Freitag, J. Tsang, Q. Fu, J. Liu, Ph. Avouris, Science 310, 1171, 2005. [2] V. Perebeinos and Ph. Avouris, Phys. Rev. B. 74, 121410(R), 2006.

Vasili Perebeinos
IBM - Watson

Date submitted: 20 Nov 2006 Electronic form version 1.4