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One Dimensional Exciton Diffusion on Semiconducting Nanotubes using Time Resolved Photoabsorption Spectroscopy R. M. RUSSO, D.E. LUZZI, E.J. MELE, University of Pennsylvania — We extend our recently reported analysis of the population relaxation of optically excited states on semiconducting carbon nanotubes to study the spectral shifts of their photoabsorption spectra. Highly excited tubes show a long time $1/\sqrt{t}$ decay of their photobleaching spectra which is well described by a one dimensional diffusion limited two body population relaxation. We find that the absorption spectra also show time-dependent spectral shifts with respect to the ground state absorption spectra. The spectral shifts are of order 10 nm and history dependent: two tubes prepared from different initial excitation densities but evolving to the same instantaneous excitation density show different lineshapes and spectral shifts. These features are analyzed by a model for the distribution of exciton separations produced in a diffusing population. The model provides an excellent parameter free description of the lineshape, and gives an estimate of the experimental exciton diffusion constant.

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