OPTICAL SPECTROSCOPY AND PHOTOPHYSICS OF SINGLE WALL CARBON NANOTUBES

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We explore the fundamental nature and dynamics of excited electronic states in single wall carbon nanotubes (SWNT). Psec luminescence and photobleaching dynamics of SWNTs in micellar solution show that non-radiative Auger recombination is extremely fast. When the tubes are wrapped with DNA, they show circular dichorism. At low pH, nanotube surface endoperoxides protonate and introduce holes that quench the luminescence. At higher concentration these holes also bleach the band gap optical absorption. Near infrared two photon luminescence excitation spectra quantitatively reveal the importance of excitons. In order to characterize excited states in both metallic and semiconducting SWNTs at the single-tube level, we detect white-light Rayleigh scattering from individual tubes suspended over an open slit in a substrate. Finally, we discuss how short pieces of metallic SWNTs may be related to the Diffuse Interstellar Bands.