

Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

**Empirical Study of the π electron Plasmon Energy Dependence
on the Bundling/De-bundling Effect in Single Wall Carbon Nanotubes**

KIRAN LINGAM, RAMAKRISHNA PODILA, PENGYU CHEN, Clemson University, CODRUTA LOEBICK, NAN LI, LISA PREFFERLE, Yale University, APPARAO RAO, Clemson University — Many researchers have done detailed studies on optical, thermal and electronic properties of SWNTs. But, very few studies have been done on sub-nanometer SWNTs. Here we studied collective electron excitations in this quasi 1D system. At high excitation energies, broad absorption peak is observed which is attributed to the π plasmon (5-7 eV). We used UV-Vis NIR spectroscopy to determine the energy of the π plasmons in sub nanometer diameter SWNTs (0.4 nm to 0.9 nm). SWNTs form bundles due to van der Waal forces and this bundling influences their electronic structure. It is known that SWNTs wrapped with a surfactant can be isolated with long centrifugation. The hydrodynamic sizes of the dispersed SWNTs at different centrifugation times were determined by using the Dynamic Light Scattering technique. Systematic studies have been done on the dependence of the π plasmon energy on the nanotube bundle diameter. The energy of the π plasmon was found to vary with the bundle diameter and the energy to be given by the relation $E = (-0.022 \text{ eV}) \cdot \ln(d/1 \text{ nm}) + 5.34 \text{ eV}$. We have done similar studies on HiPCo and Carbolex SWNTs and the empirical relation obtained is consistent with the results above.

Kiran Lingam

Date submitted: 28 Nov 2010

Electronic form version 1.4