Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Inelastic X-ray Scattering Studies of Plasmons in Carbon Nanotubes M. H. UPTON, Brookhaven National Laboratory, D. CASA, T. GOG, Argonne National Laboratory, J. MISEWICH, J. P. HILL, Brookhaven National Laboratory, D LOWNDES, G. ERES, Oak Ridge National Laboratory — We report preliminary inelastic x-ray scattering measurements of the plasmon dispersions in oriented multi- and single- walled carbon nanotubes (M- and S- WCNT) and compare them to the plasmon dispersion in graphite. Two plasmon bands are observed dispersing along the nanotubes' axes: the π and $\pi + \sigma$ plasmon bands. The $\pi + \sigma$ plasmon band exhibits an apparent systematic variation in energy. Specifically, it has a lower energy in MWCNT than in graphite, and a still lower energy in SWCNT. The energy of the $\pi + \sigma$ plasmon band is determined by the plasma frequency of the material, which is proportional to the square root of the electron density. We postulate that the energy shift is a result of a surface effect – the electron wave function extends past the surface, lowering the average electron density in the bulk. The higher surface-to-volume ratio of the mostly SW sample would then lower the plasmon frequency with respect to the MWCNT sample and graphite. Thus, the systematic variation in plasmon frequency may be explained by a lowering of the net electron density by the surfaces in S- and M-WCNT. Work performed at BNL and the Advanced Photon Source was supported by the US DOE under contracts No. DE-AC02-98CH10886 and No. W-31-109-Eng-38 respectively.

Mary Upton
Brookhaven National Laboratory

Date submitted: 30 Nov 2005 Electronic form version 1.4