Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Effects of collective excitations on the G-band and RBM modes in the Raman spectra of metallic unfilled and filled carbon nanotubes SAURABH GAYEN, Drexel University, SURJYO BEHERA, SHYAMALENDU BOSE, Drexel University — The Raman spectra of a single-wall carbon nanotube (SWNT) consist of three types of modes; (i) the high frequency G-mode arising out of tangential oscillations of carbon atoms, (ii) D-mode due to the defects in the nanotube and (iii) the low frequency radial breathing mode (RBM) resulting out of radial oscillations of the carbon atoms. In this paper we theoretically investigate the effects of collective oscillations of electrons (plasmons) on the G and RBM modes in the Raman spectra of a filled and unfilled metallic SWNT. Inclusion of plasmon and the filling (rattler) atom produces four peaks in the Raman spectra in general. The positions and relative strengths of the Raman peaks [1] depend upon phonon frequencies of the nanotube and that of the filling atoms, the plasmon frequency, the strength of the electron-phonon interaction, strength of the interactions between the nanotube phonons and rattler phonon and radius of the nanotube [2]. Usually the intensity of the G-mode is higher than that of RBM. For heavier filling atoms the frequency of the rattler phonon is lower in value, which may broaden the peak to such an extent that it may disappear in the background spectrum altogether. 1.S.M. Bose et al., Physica B **351**, 129 (2004) 2. S.M. Bose, S.Gayen and S. Behera, Phys. Rev. B **72**, 153402 (2005).

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Date submitted: 30 Nov 2005 Electronic form version 1.4