Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Electron Phonon Coupling Mechanism in Thermally Reduced Graphene MUGE ACIK, GEUNSIK LEE, CECILIA MATTEVI, MANISH CHHOWALLA, KYEONGJAE CHO, YVES J. CHABAL, THE UNIVERSITY OF TEXAS AT DALLAS COLLABORATION, RUTGERS UNIVERSITY COLLABORATION — Infrared absorption of atomic and molecular vibrations in solids can be affected by electronic contributions through non-adiabatic interactions, such as the Fano effect. Typically, the IR absorption lineshapes are modified or IR forbidden modes are detectable as a modulation of the electronic absorption. In contrast to such known phenomena, we report here the observation of a giant IR absorption band in reduced graphene oxide (GO), arising from the coupling of electronic states to the asymmetric stretch mode of a yet unreported structure [1], consisting of oxygen atoms aggregated at edges of defects. DFT calculations show that free electrons are induced by the displacement of the oxygen atoms, leading to a strong IR absorption that is in-phase with the phonon mode. This new phenomenon is only possible when all other oxygen-containing chemical species including hydroxyl, carboxyl, epoxide and ketonic functional groups are removed from the region adjacent to the edges, i.e. clean graphene patches are present. *The authors acknowledge funding from the NRI SWAN program and Texas Instruments. [1] Acik, M.; Lee, G.; Mattevi, C.; Chhowalla, M.; Cho, K.; Chabal, Y. J. *Nature Materials.* **9,** 840-845 (2010)

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Date submitted: 11 Nov 2010 Electronic form version 1.4