Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Coherent phonon spectroscopy of the shearing mode in bilayer and few-layer graphene DAVIDE BOSCHETTO, Department of Physics, Columbia University and Laboratoire d'Optique Appliquée, ENSTA/Ecole Polytechnique, Palaiseau, LENADRO MALARD, CHUN HUNG LUI, KIN FAI MAK, HUGEN YAN, Department of Physics, Columbia University, ZHIQIANG LI, TONY F. HEINZ, Department of Physics and Electrical Engineering, Columbia University
— The interlayer shearing vibration in graphite, a low-energy optical phonon, is known to consist of adjacent atomic planes moving laterally in opposite directions with respect to one another. We have applied coherent phonon spectroscopy, based on a sensitive femtosecond pump-probe measurement, to investigate the corresponding mode in few-layer graphene samples down to bilayer thickness. Here we report on the evolution of the frequency and lifetime of this mode with thickness. To model the expected behavior, we have analyzed a model of identical nearest-neighbour couplings. We find that this model predicts most of the observed reduction in frequency with decreasing layer thickness. We consider to the remaining deviations between the model and our experimental data in terms of a slight increase in the interlayer spacing, leading to a reduced restoring force, with decreasing graphene layer thickness. This decrease in lattice spacing with thickness is expected for layered materials governed by van der Waals forces. We also show experimentally that the shearing mode frequency is robust against external perturbations, such as different substrates and the presence of adlayers.

Davide Boschetto
Dept of Physics, Columbia University, New York, New York, 10027 USA

Date submitted: 26 Nov 2010 Electronic form version 1.4