Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Gate-tunable nanoplasmonic effects in single- and bi-layer graphene ZHE FEI, GREGORY ANDREEV, University of California, San Diego, WENZHONG BAO, University of California, Riverside, ALEKSANDR RODIN, ALEXANDER MCLEOD, University of California, San Diego, LINGFENG ZHANG, Boston University, ZENG ZHAO, University of California, Riverside, GERARDO DOMINGUEZ, MARK THIEMENS, MICHAEL FOGLER, University of California, San Diego, ANTONIO CASTRO-NETO, National University of Singapore, CHUNNING LAU, University of California, Riverside, FRITZ KEILMANN, Max Plank Institute of Quantum Optics, DIMITRI BASOV, University of California, San Diego — We employed near-field infrared (IR) nanoscopy and nanoimaging to study mid-IR nanoplasmonic effects of both single-layer graphene (SLG) and bilayer graphene (BLG) on SiO2/Si substrate. In our previous study, we found that SLG enhanced and blueshifted the surface phonon resonance of SiO2 due to plasmon-phonon coupling [Z. Fei et al. Nano. Lett. 2011]. Here we report that both these effects are also observed in BLG. Using back-gate we were able to systematically change the carrier density in both SLG and BLG while monitoring the evolution of the hybrid plasmon-phonon resonance. New data are in accord with our point-dipole modeling results. IR imaging with nanoscale resolution revealed fringe patterns extending along the edges of both SLG and BLG. We ascribe these patterns to the interference of plasmon waves launched by the near-field probe with those reflected from the edges. Detailed analysis allowed us to observe gate-induced changes in the plasmon dispersion of both SLG and BLG, which are consistent with the notion of massless Dirac fermions in SLG and massive carriers in BLG.

Zhe Fei
University of California, San Diego

Date submitted: 07 Nov 2011 Electronic form version 1.4