Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Phonon-Induced Gaps in Graphite and Graphene Observed by Angle-Resolved Photoemission YANG LIU, University of Illinois, Urbana-Champaign, LONGXIANG ZHANG, MATTHEW BRINKLEY, GUANG BIAN, TOM MILLER, TAI-CHANG CHIANG, UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN TEAM — Graphene systems, made of sheets of carbon atomic layers, have unusual electronic structures known as Dirac cones. While strong interest in the electronic structure of these graphitic materials has driven extensive ARPES studies, prior work has mostly focused on the quasiparticle band dispersion relations associated with the Dirac cones. Largely unexplored are spectral regions far away from the quasiparticle bands, where direct emission from the quasiparticles is forbidden, but indirect emission through coupling to phonons is allowed. Our ARPES measurements of graphite and graphene layers at low temperatures reveal heretofore unreported gaps at normal emission, one at around 67 meV and another much weaker one at around 150 meV. The major gap features persist to room temperature and beyond, and diminish for increasing emission angles. We show that these gaps arise from electronic coupling to out-of-plane and in-plane vibrational modes at the K point in the surface Brillouin zone, respectively, in accordance with conservation laws and selection rules governed by quantum mechanics. Our study suggests a new approach for characterizing phonons and electron-phonon coupling in solids.

Yang Liu
University of Illinois, Urbana-Champaign

Date submitted: 17 Nov 2010 Electronic form version 1.4