Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Novel Electron-Phonon Relaxation Pathway in Graphite Revealed by Time-Resolved Raman Scattering and Angle-Resolved Photoemission Spectroscopy JHIH-AN YANG, STEPHEN PARHAM, DANIEL DESSAU, DMITRY REZNIK, Univ of Colorado - Boulder — Ultrafast dynamics of photo-excited electron-hole pairs has attracted a lot of attention in the last decade due to its importance for a number of technologies such as solar cells. We report dynamics of electron-hole excitations as well as G phonons in graphite after an excitation by an intense laser pulse investigated by the combination of ultrafast pump-probe Raman scattering and angle-resolved photoemission spectroscopy. We found that the increase of the G phonon population occurs about 65 fs later than the prediction of the accepted two-temperature model. This time-delay is also evidenced by the absence of the so-called self-pumping for G phonons. The unusual pump fluence dependence also contradicts the two-temperature model. These experimental observations imply a new relaxation pathway which we call Anharmonic Phonon Model (APM): Instead of hot carriers transferring energy to G-phonons directly, the energy is first transferred to optical phonons near the zone boundary K-points, which then decay into G-phonons via phonon-phonon scattering. The simulation results based on the APM will also be presented.

Jhih-An Yang
Univ of Colorado - Boulder

Date submitted: 07 Nov 2016 Electronic form version 1.4