Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Ultrafast hot electron process in graphite and at Ag/graphite interface SHIJING TAN, YANAN DAI, JINDONG REN, University of Pittsburgh, LIMING LIU, JIN ZHAO, University of Science and Technology of China, HRVOJE PETEK, University of Pittsburgh — We have investigated multiphoton photoemission from clean and Ag nanocluster decorated graphite surfaces. An unconventional multi-photon induced electronic heating involving up to eight quanta of light has been observed in clean graphite. Nonlinear photoexcitation between the π and π^* bands within the Dirac cones in graphite creates the primary anisotropic nonthermal hot electron populations. Ineffective screening enables further hot electron multiplication and energy redistribution through Auger recombination processes. Within 25 fs, the primary hot electron population instantaneously thermalizes through Coulomb scattering and leads to a Boltzmann population with effective electron temperatures exceeding 5000 K. Depositing Ag atoms onto graphite forms nanoclusters and introduces an interface state at 0.2 eV below E_F. The charge donated by Ag to the graphite near E_F enhances the screening of Coulomb potential, and thereby leads to a dramatic suppression of heating of electron gas in graphite. Furthermore, tuning of $h\nu$ around 2.1 eV, a resonant two-photon transition from the interface state to the σ-interlayer band in graphite is observed. This resonant transition opens a direct channel for the ultrafast interfacial electron transfer from Ag clusters to the graphite substrate.

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Date submitted: 11 Nov 2016 Electronic form version 1.4