Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Effects of the electron-plasmon interactions on the transport properties of a pristine graphene and a graphene coupled with Au nanoparticle arrays[1] WEI QIN, GUANGHUI CHEN, LAIMING WEI, CHANG-GAN ZENG, ZHENYU ZHANG, University of Science and Technology of China —

Graphene has been revealed as an appealing material for designing two-dimensional electronic devices due to its inherently weak electron-phonon scattering and correspondingly large carrier mobility. In the high temperature regime, the phonon-limited resistivity depends linearly on the temperature. Here, we first study the effects of interactions between the conduction electrons and the intrinsic plasmon modes of a pristine graphene monolayer on the transport properties of graphene. Within Boltzmann transport theory, we find a nonlinear temperature-dependent correction to the linear dependence of the resistivity as a result of the electron-plasmon scattering. Next, we generalize to systems consisting of a monolayer graphene proximity coupled with Au nanoparticle arrays. In the regions covered by the Au nanoparticles, the electron-electron interactions are further altered by the presence of the nanocavity plasmon modes between the nanoparticles and graphene. We find that the relaxation time of the hybrid system is much longer than that of pristine graphene, leading to enhanced dephasing length of the conduction electrons. These findings are discussed in connection with our experimental observations.

[1]Supported by NSF of China.

Wei Qin
University of Science and Technology of China

Date submitted: 09 Nov 2016 Electronic form version 1.4