MAR12-2011-005833

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Dynamic screening and the effective fine structure constant of graphene[1]

PETER ABBAMONTE, University of Illinois

Electrons in graphene behave, in the low energy sector, like massless Dirac fermions. The degree to which Coulomb correlations influence these fermions is still subject to debate. In this talk I will describe inelastic x-ray scattering experiments on crystals of graphite, to which we have applied newly developed reconstruction algorithms to image the dynamical screening of charge in (effectively) a freestanding graphene sheet. We found that the polarizability of the Dirac fermions in graphene is amplified by excitonic effects in the particle-hole spectrum, which enhances screening of interactions among low energy quasiparticles. I will argue that interactions should be characterized by an effective, screened fine-structure constant, $\alpha_g^*(\mathbf{k},\omega)$, which our measurements suggest converges to the value $\alpha_g^* = 0.14 \pm 0.092$ in the small wave vector limit. This value is smaller than the bare $\alpha_g = 2.2$, and suggests that the strength of interactions in graphene is similar to that in band semiconductors like Si or GaAs. I will discuss the implications of this result for other Dirac systems, such as nodal quasiparticles in cuprates and topological insulator surface states.

[1]Supported by DOE grant DE-FG02-07ER46453