MAR08-2007-002575

Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

Intrinsic and Extrinsic Limits of Mobility in Graphene[1]

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Graphene is an exciting new condensed matter system, both for the opportunity to observe the physics associated with massless Dirac Fermions in the laboratory, and because of materials parameters which make it attractive for technological applications. However, in the few years since the experimental realization of graphene, progress toward cleaner (higher mobility) samples has largely stalled. I will discuss experiments performed on atomically-clean graphene on SiO_2[1] in ultra-high vacuum to determine the intrinsic and extrinsic limits of mobility in graphene[2,3], which point out both the promise of the material as well as the technological challenges that lie ahead in realizing better graphene samples. Intrinsic scattering by the acoustic phonons of graphene[3] limits the room-temperature mobility to 2 x 10^5 cm^2/Vs at a carrier density of 10^{12} cm^{-2}, higher than any known material. However, extrinsic scattering due to charges in the substrate[2] and substrate polar optical phonons[3] currently impose much more severe limits on the mobility, pointing out the importance of substrate choice for graphene devices[4].

[1] M. Ishigami, et al., *Nano Letters* **7**, 1643 (2007).
[2] J. H. Chen, et al., arXiv:0708.2408.
[3] J. H. Chen, et al., arXiv:0711.3646.
[4] J.-H. Chen, et al., *Advanced Materials* **1**9, 3623 (2007).

[1]Supported by U.S. ONR grant N000140610882 and U.S. NSF grants CCF-06-34321 and DMR-05-20471.