MAR11-2010-002486

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Graphene under a tip[1]

EVA Y. ANDREI, Department of Physics and Astronomy, Rutgers University, Piscataway NJ

The strictly two dimensional structure of graphene results in 2D charge carriers that are readily accessible by surface probes such as scanning tunneling microscopy (STM) and spectroscopy (STS), and in electronic properties that can be controlled through doping, strain and external potentials. At the same time the 2D structure causes graphene to be extremely sensitive to environmental disturbances. I will describe STM, STS and magneto-transport experiments showing that when graphene is decoupled from substrate-induced potential fluctuations the intrinsic properties of the carriers become apparent. This is clearly seen in suspended graphene devices where, in the absence of substrate induced potential fluctuations, electron-electron interactions lead to a fractional quantum Hall effect and to an insulating phase at the Dirac point [1]. We find that even for non-suspended graphene it is possible to find non-invasive substrates on which one can directly observe the sequence of quantized Landau levels [2] and to track their evolution with field and doping down to the Dirac point where interaction effects kick in [3]. When the "substrate" is another graphene layer with relative orientation other than that of the standard Bernal stacking, it can profoundly affect the electronic density of states transforming it from the linear massless Dirac spectrum to one containing prominent Van Hove singularities which are controlled by the degree of twist between the layers [4].

[1] X. Du, I. Skachko, F. Duerr, A. Luican, EYAndrei, Nature **462**, 192 (2009)
[2] G. Li, A. Luican and E. Y. Andrei, Phys. Rev. Lett. 102, 176804 (2009).
[3] A. Luican, G. Li, and E. Y. Andrei, Phys Rev. B (R) (2011)
[4] G. Li, A. Luican and E. Y. Andrei, Nature Physics 6, 109 (2010)

[1]Work supported by DOE DE-FG02-99ER45742 , NSF-DMR-0906711 and Lucent.