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Scanning tunneling microscopy and spectroscopy of graphene on graphite[1]

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Graphene, a single atomic layer of crystalline carbon, exhibits fascinating electronic properties owing to low energy quasiparticles that resemble relativistic Dirac fermions. Recent experiments on graphene deposited on insulating substrates revealed that substrate induced potential fluctuations obscure the Dirac fermion nature of the carriers. Using low temperature scanning tunneling microscopy (STM) and spectroscopy (STS) we demonstrated that substrate induced potential fluctuations are substantially reduced when graphene is deposited on graphite and that in these samples the intrinsic structural and electronic properties of graphene become accessible. We observed the honeycomb structure and the V shaped density of states that vanishes at the Dirac point, characteristic of Dirac fermions. In finite magnetic field we observed the appearance of a single sequence of Landau levels, with square root dependence on level index and field, further attesting to the Dirac fermion nature of the charge carriers. The experiments give access to the fundamental parameters of the electronic spectrum in graphene including the Fermi velocity, electron-phonon coupling constant and electron-electron interactions. In addition they revealed the appearance of a small gap at the Dirac point and an anomaly at the Fermi energy. Work in collaboration with E.Y. Andrei and A. Luican.

[1] G. Li and E.Y. Andrei, Nature Phys. 3, 623 (2007).
[2] G. Li, A. Luican, and E.Y. Andrei, http://arxiv.org/abs/0803.4016

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