Speed Bumps in Graphene

Joseph A. Stroscio
NIST Fellow
Center for Nanoscale Science and Technology
National Institute of Standards and Technology, Gaithersburg, MD 20899
Email: joseph.stroscio@nist.gov

Graphene, a two-dimensional honeycomb lattice of sp^2-bonded carbon atoms, has received considerable attention due to its unique physical properties. Graphene is a semimetal whose charge carriers exhibit a linear dispersion near the Fermi level. As a result of this band structure, graphene's charge carriers can be described as massless Dirac fermions which exhibit exciting quantum properties. These same electronic properties also make graphene appealing for possible applications in future carbon-based electronics. Understanding the role that defects play in the transport properties of graphene is essential for potential carbon-based electronics. In our studies at NIST scanning tunneling microscopy and spectroscopy are used to characterize the growth of epitaxial graphene on SiC(0001) [1] and to measure scattering from defects [2]. Energy-resolved maps of the differential conductance reveal standing-wave modulations of the local density of states on two different length scales reflecting both intravalley and intervalley scattering [2]. While backscattering is normally suppressed due to the chiral symmetry of Dirac quasiparticles in graphene, the presence of atomic defects is shown to mix quasiparticle wavefunctions of different symmetries.

[1] Imaging the interface of epitaxial graphene with silicon carbide via scanning tunneling microscopy, G. M. Rutter, N.P. Guisinger, J. N. Crain, E. A. A. Jarvis, M. D. Stiles, T. Li, P. N. First, and J. A. Stroscio, Phys. Rev. B **76**, 235416 (2007).
[2] Scattering and Interference in Epitaxial Graphene, G. M. Rutter, J. N. Crain, N.P. Guisinger T. Li, P. N. First, and J. A. Stroscio, Science **317**, 219 (2007).