



CNMS DISCOVERY SEMINAR SERIES

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2:00 pm
Iran Thomas Auditorium, 8600

Exploring the Physics of Graphene with Local Probes

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Abstract:

The recent ability to isolate and study the single atomic sheet of carbon known as graphene has created a great deal of excitement in the scientific community, resulting in the Noble Prize in physics in 2010 and an exponentially increasing volume of publications numbering in the thousands. The excitement is equally driven by both the new physics of massless Dirac particles in a condensed matter system and the potential applications in technologies such as flexible displays and high speed transistors. Graphene is composed entirely of exposed surface atoms, which offers a unique opportunity to examine this new 2-dimensional electron system with local probe measurements. In this talk I will describe our studies using scanning tunneling spectroscopy to examine electron interactions and disorder in various graphenes produced by different methods with varying degrees of disorder. We apply local probe measurements in back-gated graphene devices, which we refer to as gate mapping scanning tunneling spectroscopy, where the local density of electron states is examined as the carrier density at the Fermi level is varied from holes to electrons through the neutrality point. Near the neutrality point electron interactions are visible as the screening length diverges. Experiments will be described from various systems of graphene on SiO₂ [1,2], graphene on boron nitride [3], epitaxial graphene on SiC [4], and finally suspended graphene membranes [5]. In suspended graphene membranes strain generated pseudomagnetic fields as seen to dominate the local probe measurements due to tip-graphene interactions [5].

- [1] Evolution of Microscopic Localization in Graphene in a Magnetic Field: From Scattering Resonances to Quantum Dots, S. Jung *et al.*, *Nature Physics* **7**, 245 (2011).
- [2] Microscopic Polarization in Bilayer Graphene, Gregory M. Rutter *et al.*, *Nature Physics* **7**, 649 (2011).
- [3] Renormalization of the Graphene Dispersion Velocity Determined from Scanning Tunneling Spectroscopy, Jungseok Chae *et al.*, *Phys. Rev. Lett.* (in press).
- [4] High Resolution Tunneling Spectroscopy of a Graphene Quartet, Y. Jae Song *et al.*, *Nature* **467**, 185 (2010).
- [5] Electro-Mechanical Properties of Graphene Drumheads, Nikolai N. Klimov *et al.*, *Science* **336**, 1557 (2012).

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