UNIVERSITY OF TEXAS AT DALLAS - DEPARTMENT OF PHYSICS

PHYSICS COLLOQUIUM

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Monday, April 16, 2007; 4:00-5:00 PM
Kusch Auditorium, FN 2.102

Quantum Transport in Graphene Nanoribbons

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Recently it has become possible to fabricate atomically thin sheets of graphite, which are referred to as graphene. Graphene is a strictly 2D crystal and can be viewed as an unrolled single walled carbon nanotube. Its unique band structure results in remarkable electronic transport properties that are fundamentally different from conventional 2D systems realized in semiconducting heterostructures. The most intriguing example is the unusual quantization of the Quantum Hall effect. Furthermore, graphene is likely to become an important material system in the fields of nanotechnology and spintronics. For example, its mean free path and both its phase and spin coherence length are expected to be very long.

Nanostructured graphene reveals a number of exciting properties. For example, I will show that the finite size of narrow graphene ribbons (~20 nm) leads to the formation of a band-gap. Furthermore, the phase-coherence length in nanostructured graphene is of the order 1 µm. Such a long phase coherence length allows for the direct observation of quantum interference phenomena in ring shaped ribbons. I will continue my talk with experiments in which we locally modulate the carrier density in graphene ribbons by means of a top gate. These studies allow us to explore the rich physics of graphene based pn-junctions. I will conclude with experiments addressing the spin coherence length in graphene. Here the spin injection has been achieved by means of ferromagnetic Co/Cu/Co multilayer electrodes.