Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Vertical transport in graphene/h-BN/graphene structures"

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Abstract: Van der Waals (vdW) structures - formed by stacking different layers of two-dimensional crystals and held together via interlayer vdW interactions - have emerged in recent years as a route to create systems with tailored properties. Among the many possibilities, graphene/boron nitride/graphene structures have received considerable attention, having been shown to operate as transistors and displaying negative differential conductance. In this work, we study in detail the effect of the rotational alignment between the hexagonal boron nitride (h-BN) spacer and the graphene layers in the vertical current of a graphene/h−BN/graphene device. We show that for small rotational angles, the transference of momentum by the h−BN crystal lattice to the tunneling electrons leads to multiple peaks in the I−V curve of the device, giving origin to multiple regions displaying negative differential conductance. We also study the effect of scattering by optical phonons in the vertical current and see how the spontaneous emission of optical phonons opens up new inelastic tunneling channels, leading to sharp features in the I-V curve at low temperature. Finally, we discuss the differences in the formal description of these mesoscopic devices between considering the graphene layers as part of the mesoscopic region or as part of the contacts.

References: Phys. Rev. B 93, 235403 (2016)

12:00pm
Wednesday, March 22, 2017
Duboc Room (4-331)

Host: Michael Pretko