Magnetotransport in Graphene Nanostructures: Disorder and Interaction Physics for Dirac fermions

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Introduction

During our runs at SCM2 in 2012, we studied the magnetotransport, quantum Hall effect (QHE) and Coulomb drag in graphene and boron nitride (BN) based hybrid nanostructures.

Experimental

During our recent magnet time we measured our BN/graphene/BN/graphene stacking at 300 mK and magnetic field up to 18 T. The observed mobility of graphene on boron nitride is as high as 75 000 cm^2/V-s. We observed the many body quantum Hall states at filling factor ν=1. In another representive device, we observed quantum Hall effects in both graphene layers. In future we will study the magneto-transport of Dirac fermions in two layers with tunable interactions in strong magnetic fields, such as Coulomb drag between two quantum Hall states in graphene.

Results

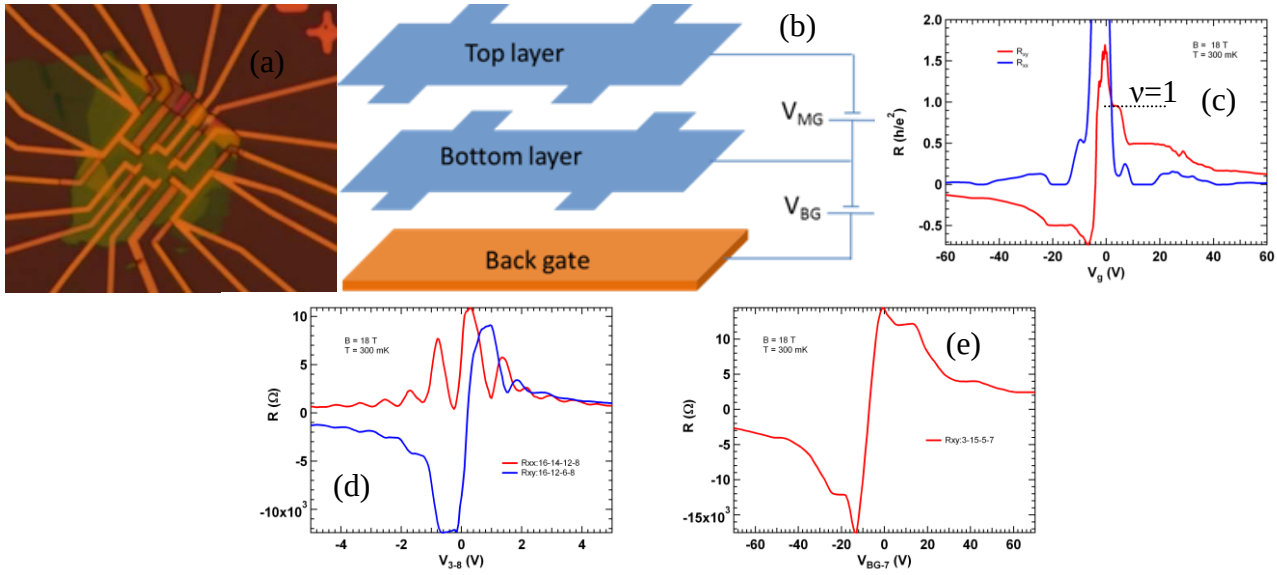

Fig. 1 (a) Optical image of the graphene stacking device. The width of the Hall bar is 1.5 μm. (b) Schematic of back gating and mutual gating of graphene double layer. (c) Quantum Hall effect of bottom layer graphene as function of back gate voltage, the many-body QH state at ν=1 (indicated by dashed line) is observed. (d) Quantum Hall effect of top layer graphene as a function of mutual gating voltage and (e) that of the bottom layer graphene as a function of the back gating voltage in another representive graphene stacking device.

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