Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Twisting the physics in bilayer graphene JASON LUO, JAVIER SANCHEZ-YAMAGISHI, Massachusetts Institute of Technology, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute of Materials Science, Japan, PABLO JARILLO-HERRERO, Massachusetts Institute of Technology — Twisted bilayer graphene is the ultimate limit of a bilayer 2DEG, where two graphene layers are stacked with an interlayer distance of only 0.34nm. The interlayer tunnel coupling can be continuously tuned by twisting the two layers, leading to different physics in the small and large twist angle limits. At small twist angles, the two layers form a large superlattice unit cell and the hybridization of the layers leads to low-energy van Hove singularities in the electronic spectrum, resulting in a strong departure from the typical monolayer graphene transport properties. At large twist angles, the system behaves as two decoupled monolayer graphene sheets, and the occupation of quantum Hall edge modes on each layer can be independently controlled. This allows for the realization of a quantum spin Hall state in twisted bilayer graphene by doping to form an electron-hole bilayer at moderate magnetic fields. I will discuss our magnetotransport measurements of high-quality twisted bilayer graphene, and how, by independently controlling the total charge density and applied electric field, we can realize different novel electronic states in this system.

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Date submitted: 13 Nov 2014 Electronic form version 1.4