MAR14-2013-020416

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Quantum transport in graphene/hBN heterostructures

PABLO JARILLO-HERRERO, MIT

Graphene/hBN heterostructures constitute a new two-dimensional system where the electronic properties of the 2D system depend sensitively on the relative angle of rotation between the two constituent lattices. For large angles of rotation, the low energy electronic structure of graphene remains largely unperturbed, leading to ultra-high mobility pristine graphene samples, and where a novel realization of the quantum spin Hall effect will be discussed [1]. For very low angles of rotation, the electronic spectrum of graphene gets modified significantly, with the appearance of set of low energy superlattice Dirac points. Beyond this effect, we have observed an insulating state (at zero magnetic field) which can be described by the carriers acquiring a finite mass, which is correlated with the angle of rotation [2]. The large moire superlattice in such graphene/hBN system results also in the observation of the Hofstadter butterfly in nearly rotationally-aligned graphene/hBN devices [2].

[1] A. F. Young, J. D. Sanchez-Yamagishi, B. Hunt, S. H. Choi, K. Watanabe, T. Taniguchi, R. C. Ashoori, P. Jarillo-Herrero, Tunable symmetry breaking and helical edge transport in a graphene quantum spin Hall state, arXiv:1307.5104, Nature (in press)

[2] B. Hunt, J. D. Sanchez-Yamagishi, A. F. Young, M. Yankowitz, B. J. LeRoy, K. Watanabe, T. Taniguchi, P. Moon, M. Koshino, P. Jarillo-Herrero, R. C. Ashoori, Massive Dirac fermions and Hofstadter butterfly in a van der Waals heterostructure, Science 340, 1427 (2013)