MAR17-2016-020033

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

Topological Valley Transport at Bilayer Graphene Domain Walls

LONG JU, Cornell University

Electron valley, a degree of freedom that is analogous to spin, can lead to novel topological phases in bilayer graphene. A tunable bandgap can be induced in bilayer graphene by an external electric field, and such gapped bilayer graphene is predicted to be a topological insulating phase protected by no-valley mixing symmetry, featuring quantum valley Hall effects and chiral edge states. Observation of such chiral edge states, however, is challenging because inter-valley scattering is induced by atomic-scale defects at real bilayer graphene edges. Recent theoretical work has shown that domain walls between AB- and BA-stacked bilayer graphene can support protected chiral edge states of quantum valley Hall insulators. In this talk, I will discuss about our experimental effort on such stacking domain walls. We employed infrared near field nanoscopy to locate the domain walls in bilayer graphene and measure their electrical resistance in a dual-gated device configuration. Unlike single-domain bilayer graphene, which shows gapped insulating behaviour under a vertical electrical field, bilayer graphene domain walls feature one-dimensional valley-polarized conducting channels with a ballistic length of about 400 nanometres at 4 kelvin. Such topologically protected one-dimensional chiral states at bilayer graphene domain walls open up opportunities for exploring unique topological phases and valley physics in graphene.