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Minimum conductivity and charge inhomogeneity in Bi_2Se_3 in the topological regime[1] DOHUN KIM, SUNGJAE CHO, NICHOLAS BUTCH, PAUL SYERS, KEVIN KIRSHENBAUM, JOHNPIERRE PAGLIONE, MICHAEL FUHRER, University of Maryland — Using electrolytic and dielectric dual gating method, we report charge transport measurements of mechanically exfoliated Bi_2Se_3 in the topological insulator (TI) regime. We show that the surfaces of thin, low-doped Bi_2Se_3 crystals are strongly electrostatically coupled, and a gate electrode can be used to completely remove bulk charge carriers and bring both surfaces through the Dirac point nearly simultaneously with well-defined ambipolar electronic conduction of gapless surface states. In particular, we focus on linear carrier density dependent conductivity away from the Dirac point and a charge-inhomogeneous minimum conductivity region similar to that observed in graphene. An extension of the theory of charge disorder in graphene to Bi_2Se_3explains well the mobility at high carrier density and the doping level at zero gate voltage. We show that the observed minimum conductivity is governed by induced carrier density that is self-consistently determined by the screened, charged impurity potential, as experimentally observed in recent STM study on surfaces of TIs.

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Dohun Kim
University of Maryland

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