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Charge Transport in 3D topological insulators in the presence of surface potential fluctuation XINGYUE PENG, YIMING YANG, RAJIV SINGH, SERGEY SAVRASOV, DONG YU, Univ of California - Davis — Field effect measurements on the surface of a 3D topological insulator (TI) have often shown a high minimum conductivity as the Fermi level is shifted to Dirac point. Not only does this minimum conductivity vary from 5 to 50 e^2/h strongly dependent on sample details but the gate dependent conductivity also exhibits anomalous non-monotonic behavior which is not yet understood. Understanding the nature of this minimum conductivity is crucial for the design and fabrication of novel spintronic devices based on 3D TIs. We propose a theoretic model to explain this anomalous behavior, considering the existence of surface potential fluctuations as indicated by scanning tunneling spectroscopy (STS) and scanning photocurrent microscopy (SPCM) measurements on the surface of a 3D TI. Our model agrees well with preexisting experiments and our own transport measurements in field effect transistors (FETs) incorporating Sb-doped single Bi_2Se_3 nanoribbons.

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