Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Theoretical study of carrier transport and screening in topological insulator $\mathbf{Bi_2Se_3}$[1] SHAFFIQUE ADAM, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD, E.H. HWANG, Condensed Matter Theory Center, University of Maryland, College Park, MD, M.D. STILES, CNST, NIST, Gaithersburg, S. DAS SARMA, CMTC, UMD, College Park — This theoretical work is motivated by two recent experiments on Bi_2Se_3 examining the charge inhomogeneity [1-2] close to the topologically protected crossing point of surface bands in these bulk topological insulators. Reminiscent of graphene close to charge neutrality [3-4], the energy landscape becomes highly inhomogeneous, forming a sea of electron and hole puddles, which determine the properties at low carrier density. Here, we show that the induced carrier density fluctuations are of order 1 % of the impurity density, providing a small-parameter with which we can perform a controlled perturbation theory. Analytic results are obtained for the minimum conductivity and puddle auto-correlation length. We also find that the band asymmetry between electron and holes states is a necessary ingredient to understand the aforementioned experiments. **References:** [1] H. Beidenkopf *et al*, "*Spatial fluctuations of helical Dirac fermions on the surface of topological insulators*," Nat. Phys. *online publ.*, (2011) [2] D. Kim *et al.*, "*Minimum conductivity and charge inhomogeneity in* Bi_2Se_3," arXiv:1105.1410. [3] S. Adam *et al.*, "*A self-consistent theory for graphene transport*," PNAS **104**, 18392 (2007). [4] S. Das Sarma *et al.*, *"Electronic transport in 2D graphene*," *Rev. Mod. Phys.* **83**, 407 (2011).

Shaffique Adam
Center for Nanoscale Science and Technology, NIST

[1] This work is supported in part by LPS-NSA-CMTC.

Date submitted: 14 Nov 2011 Electronic form version 1.4