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Duo gating on a 3D topological insulator - independent tuning of both topological surface states CHUAN LI, BOB DE RONDE, MARIEKE SNELDER , MARTIN STEHNO, Twente Tech Univ, YINGKAI HUANG, MARK GOLDEN, University of Amsterdam, ALEXANDER BRINKMAN, Twente Tech Univ, ICE TEAM, IOP COLLABORATION — ABSTRACT: Topological insulators are associated with a trove of exciting physics, such as the ability to host robust anyons, Majorana Bound States, which can be used for quantum computation. For future Majorana devices[1] it is desirable to have the Fermi energy tuned as close as possible to the Dirac point of the topological surface state. Based on previous work on gating BSTS[2] [3], we report the experimental progress towards gate-tuning of the top and bottom topological surface states of $BiSbTeSe_2$ crystal flakes. When the Fermi level is moved across the Dirac point conduction is shown to change from electron dominated transport to hole dominated transport independently for either surface. In the high magnetic field, one can tune the system precisely between the different landau levels of both surfaces, thus a full gating map of the possible landau levels combination is established. In addition, we provide a simple capacitance model to explain the general hysteresis behaviors in topological insulator systems.

[1]L. Fu, C.L. Kane,Phys. Rev. Lett **100**, 096407 (2008).
[2]Y. Xu et al.Nat. Phys.**10**, 956-963 (2014).
[3]R. Yoshimi et al., Nat. Comm. **6**, 6627 (2015).

Chuan Li
Twente Tech Univ

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