Abstract Submitted
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Observation of topological surface state quantum Hall effect in an intrinsic three-dimensional topological insulator[1] YANG XU, IRENEUSZ MIOTKOWSKI, YONG CHEN, Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907, YONG P.CHEN'S GROUP IN PURDUE TEAM, CHIH-KANG SHIH'S GROUP IN UT-AUSTIN COLLABORATION, M. ZAHID HASAN'S GROUP IN PRINCETON COLLABORATION — A three-dimensional (3D) topological insulator (TI) is a novel quantum matter with a gapped insulating bulk yet a conducting surface hosting topologically-protected gapless surface states of Dirac fermions. One of the most distinct electronic transport signatures predicted for such topological surface states (TSS) is a half-integer quantum Hall effect (QHE) in a magnetic field. We have observed well-developed QHE arising from TSS in an intrinsic TI of $BiSbTeSe_2$[1]. Our samples can exhibit surface dominated conduction even close to room temperature, while the bulk conduction is negligible. At low temperatures and high perpendicular magnetic fields, the Hall conductance shows well quantized integer plateaux in exfoliated flake devices on SiO_2/Si substrates, where the top and bottom surface each contributing a half integer e^2/h Hall conductance, accompanied by vanishing longitudinal resistance. We have also studied dual-gated devices where both the top and bottom surfaces can be independently gated. Such intrinsic 3D TI materials exhibiting no measurable bulk conduction and well-developed surface state QHE pave the way for further applications of topological quantum electronics.

[1]Yang Xu et al, Nature Physics, doi: 10.1038/nphys3140 (2014).

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