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Quantum Hall effect in dual gated $BiSbTeSe_2$ topological insulator SU KONG CHONG, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah 84112 USA, KYU BUM HAN, AKIRA NAGAOKA, Department of Materials Science and Engineering, University of Utah, Salt Lake City, Utah 84112 USA, JARED HARMER, RYUICHI TSUCHIKAWA, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah 84112 USA, TAYLOR D. SPARKS, Department of Materials Science and Engineering, University of Utah, Salt Lake City, Utah 84112 USA, VIKRAM V. DESHPANDE, Department of Physics and Astronomy, University of Utah, Salt Lake City, Utah 84112 USA
— The discovery of topological insulators (TIs) has expanded the family of Dirac materials and enables the probing of exotic matter such as Majorana fermions and magnetic monopoles. Different from conventional 2D electron gas, 3D TIs exhibit a gapped insulating bulk and gapless topological surface states as a result of the strong spin-orbit coupling. $BiSbTeSe_2$ is also known to be a 3D TI with a large intrinsic bulk gap of about 0.3 eV and a single Dirac cone surface state. The highly bulk insulating $BiSbTeSe_2$ permits surface dominated conduction, which is an ideal system for the study of quantum Hall effect (QHE). Due to the spin-momentum locking, the Dirac fermions at the topological surface states have a degeneracy of one. In the QH regime, the Hall conductance is quantized to $(n + 1/2)e^2/h$, where n is an integer and the factor of half is related to Berry curvature. In this work, we study the QHE 3D TI using a dual gated $BiSbTeSe_2$ device. By tuning the chemical potentials on top and bottom surfaces, integer QHE with Landau filling factors, ν =0, $\pm$1, and $\pm$2 are observed.

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