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Quantum Hall effect from 2D surface states of the 3D topological insulator HgTe

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Three dimensional (3D) topological insulators (TI) exhibit two dimensional (2D) topologically protected conducting surface states created by strong spin-orbit coupling. Those states show a dispersion relation of massless Dirac fermions and exhibit spin-momentum locking.
We present our results on high field (31T) magneto-transport experiments of the 3D topological insulator HgTe. In-plane tensile (tetragonal) strain exerted on the MBE grown 70nm thin film HgTe samples from the zinc doped CdTe substrate opens a small gap (~20 meV) and therefore lifts the band degeneracy in the center of the Brillouin zone. We study samples grown on two different crystallographic directions of the substrate material and compare the effect of varying crystallographic direction on the transport result.
We observe evidence for quantized Hall (QH) resistance in both samples developing at cryogenic temperatures. We confirm the 2D character of the probed states through tilted magnetic field measurements. The observed effect is also confirmed to derive from Dirac fermions of the two TI surfaces as shown through a non-zero Berry's phase by an extrapolation of the filling factors of the QH plateaus to the large magnetic field limit.
DC magneto-transport experiments are compared to zero field temperature dependent THz time domain spectroscopy data.
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