Chiral 1D transport in magnetic topological insulators: precise quantization and manipulation

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Chiral (one-way) one-dimensional (1D) conduction is important for metrology, and could be interesting technologically. Such conduction occurs at the edge of a two-dimensional (2D) electron system in high magnetic field, giving rise to dissipationless longitudinal transport and Hall conductance well-quantized in multiples of the von Klitzing constant: the quantum Hall effect. The recent prediction and discovery of the quantum anomalous Hall (QAH) effect in thin films of the three-dimensional ferromagnetic topological insulator CryBixSb1-x-y)2Te3 has opened new possibilities for chiral edge state-based devices in zero external magnetic field. Like the ν=1 quantum Hall system, the QAH system is predicted to have a single chiral edge mode encircling the boundary of the film, with a chirality determined by the TI’s out-of-plane magnetization. Backscattering of the chiral edge mode should be suppressed. We will report on the observation of well-quantized Hall resistivities along with very low longitudinal resistivities. We will also demonstrate 1D conduction not only at film edges but also along magnetic domain walls within the plane.