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Imaging Current in Si-doped InAs/GaSb Quantum Wells ERIC M. SPANTON, KATJA C. NOWACK, Stanford Institute for Materials and Energy Sciences, LINGJIE DU, Rice University, GERARD SULLIVAN, Teledyne Scientific, RUI-RUI DU, Rice University, KATHRYN A. MOLER, Stanford Institute for Materials and Energy Sciences — Quantum spin hall (QSH) insulators are characterized by current-carrying edges in which single-particle elastic backscattering is forbidden, resulting in a theoretical conductance of e2/h per edge. Various theoretical mechanisms have been proposed to explain why, in devices with edges longer than several microns, the measured resistance is greater than expected. We used a scanning superconducting quantum interference device to image 2D current flow in inverted InAs/GaSb composite quantum wells with edges of tens of microns. We compared wells with Si doping at the InAs/GaSb interface (which acts to suppress residual bulk conductivity) to wells without doping. In the Si-doped samples, we observed that the majority of current flowed along the edge of the device when it was tuned into the bulk gap using a front gate. The current at the edges is consistent with an edge resistance that remained unchanged over a wide range of temperature and gate voltage, even in the presence of bulk conduction. These results set strong limits on candidate mechanisms for edge scattering.

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