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Imaging edge currents in HgTe quantum wells in the quantum spin Hall (QSH) regime KATJA C. NOWACK, ERIC M. SPANTON, MARIA R. CALVO, MATTHIAS BAENNINGER, MARKUS KOENIG, ELI FOX, ANDREW J. BESTWICK, JOHN R. KIRTLEY, Stanford Institute for Materials and Energy Sciences, BEENA KALISKY, Bar-Ilan University, MATHIAS MUEHLBAUER, CHRSITIAN AMES, PHILIP LEUBNER, CHRISTOPH BRUENE, HARTMUT BUHMANN, LAURENS W. MOLENKAMP, Wuerzburg University, DAVID GOLDHABER-GORDON, KATHRYN A. MOLER, Stanford Institute for Materials and Energy Sciences — Conducting edge modes at the sample boundaries are a key feature of the QSH state, which was predicted and experimentally demonstrated in HgTe quantum wells. The existence of the edge modes has been inferred from conductance measurements on sufficiently small devices. Here we use a scanning SQUID to image current in devices made from HgTe quantum wells. First, I will show images of current in large Hallbars directly confirming the existence of the edge modes. Next, I will discuss progress on detecting persistent currents (PCs) flowing along the edges of anti-dots in HgTe quantum wells. The magnitude of the PC, which is periodic in flux, will depend on backscattering in the edge. Our scanning SQUID can probe currents of less than a nA, and allows us to characterize many anti-dots, one anti-dot at a time, on the same sample. The dependence of the PC on length and temperature, as well as variations between nominally identical anti-dots may provide insight into the scattering mechanisms that limit the ballistic nature of the QSH edge modes.

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