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One-dimensional Topological Edge States of Bismuth Bilayers ILYA DROZDOV, ARIS ALEXANDRADINATA, SANGJUN JEON, STEVAN NADJ-PERGE, HUIWEN JI, ROBERT CAVA, B. ANDREI BERNEVIG, ALI YAZDANI, Princeton University — The hallmark of a time-reversal symmetry protected topologically insulating state of matter in two-dimensions (2D) is the existence of chiral edge modes propagating along the perimeter of the sample. Bilayers of bismuth (Bi), an elemental system theoretically predicted to be a Quantum Spin Hall (QSH) insulator[1], has been studied with Scanning Tunneling Microscopy (STM) and the electronic structure of its bulk and edge modes has been experimentally investigated. Spectroscopic mapping with STM reveals the presence of the state bound to the edges of the Bi-bilayer. By visualizing quantum interference of the edge state quasi-particles in confined geometries we characterize their dispersion and demonstrate that their properties are consistent with the absence of backscattering. Hybridization of the edge modes to the underlying substrate will be discussed. [1] Shuichi Murakami, Phys. Rev. Lett. 97, 236805 (2006). The work at Princeton and the Princeton Nanoscale Microscopy Laboratory was supported by ARO MURI program W911NF-12-1-0461, DARPA-SPWAR Meso program N6601-11-1-4110, NSF-DMR1104612, and NSF-MRSEC programs through the Princeton Center for Complex Materials (DMR-0819860)

Ilya Drozdov
Princeton University

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