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Imaging and manipulating mesoscopic magnetic structures in a Cr-doped topological insulator (Bi,Sb)$_2$Te$_3$ YIHUA WANG, JOHN KIRTLEY, Stanford University, XIAO FENG, KE HE, YAYU WANG, QI-KUN XUE, Tsinghua University, KATHRYN MOLER, Stanford University — The surface of a three-dimensional topological insulator hosts spin-polarized metallic states which are protected by time-reversal symmetry. Breaking time-reversal symmetry without an external magnetic field may lead to an exotic surface quantum Hall state that supports chiral edge currents at the domain boundaries. Using scanning superconducting quantum interference device microscopy, we have imaged the magnetic structure of a 5 nm-thick topological insulator BiSbTe doped with Cr. We found micron-scale domains of magnetization that vanished at 15K and ferromagnetic dipoles that persisted to higher temperatures. Applying local magnetic field through a microscopic current loop, we generated switchable magnetic structures shaped like dots, stripes and patches. The ability to create, to image and to manipulate mesoscopic magnetic domain boundaries in topological insulators is an important step towards generating exotic edge states and building spin-based electronic devices.

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