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A cryogenic quantum gas scanning magnetic microscope JACK DISCIACCA, MATTHEW NAIDES, RICHARD TURNER, RUBY LAI, BENJAMIN LEV, Stanford University — Improved measurements of strongly correlated and topologically non-trivial systems open the path to a better fundamental understanding of these materials as well as the possibility for predictive design of new materials. We are working to demonstrate atom chip trapping of quantum gases to enable single-shot, large area imaging of electronic transport through these materials via detection of magnetic flux at the 10^{-7} flux quantum level and below. Using the exquisite sensitivity of ultracold atoms in the form of either an atomic clock or Bose-Einstein condensate, the cryogenic atom chip technology we have recently demonstrated [1] will provide a magnetic flux detection capability that surpasses other techniques while allowing sample temperatures spanning <10 K to room temperature. We will report on experimental progress toward developing this novel quantum gas scanning magnetic microscope and describe our recent proposal to image topologically protected transport through a non-ideal topological insulator in a relatively model-independent fashion.

[1] M. A. Naides, R. W. Turner, R. A. Lai, J. M. DiSciacca, and B. L. Lev, Trapping ultracold gases near cryogenic materials with rapid reconfigurability, Appl. Phys. Lett. 103, 251112 (2013).

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