Abstract Submitted
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Observation of a nematic quantum Hall liquid on the surface of bismuth BENJAMIN E. FELDMAN, MALLIKA T. RANDERIA, ANDRAS GYENIS, Princeton University, FENGCHENG WU, University of Texas at Austin, HUIWEN JI, ROBERT J. CAVA, Princeton University, ALLAN H. MACDONALD, University of Texas at Austin, ALI YAZDANI, Princeton University — Nematic quantum fluids with wavefunctions that break the underlying crystalline symmetry can spontaneously form as a result of electronic correlations. We examine the quantum Hall states that arise in high magnetic fields from anisotropic hole pockets on the Bi(111) surface. Spectroscopy performed with a scanning tunneling microscope shows that a combination of local strain and exchange interactions lift the six-fold Landau level degeneracy to form three valley-polarized quantum Hall states. We image the resulting anisotropic wavefunctions and show that they have a different orientation for each broken-symmetry state. Our measurements provide a direct spatial signature of a local domains of a nematic quantum Hall liquid. Moreover, this is the first material system where the role of electronic interactions in the formation of nematic order can be quantified and directly correlated with a microscopic theory.

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