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Dirac Composite Fermi Liquid in the Half-filled Landau level[1]
SCOTT GERAEDTS, Princeton University, MICHAEL ZALETEL, Station Q, Microsoft Research, ROGER MONG, University of Pittsburgh, MAX METLITSKI, Perimeter Institute, ASHVIN VISHWANATH, University of California Berkeley, OLEXEI MOTRUNICH, California Institute of Technology — Quantum Hall fluids at filling fraction one-half exhibit a compressible phase known as the 'composite Fermi liquid' (CFL) We use infinite-cylinder density matrix renormalization group to numerically determine that this phase is the ground state of a half-filled Landau level with Coulomb interactions. We find evidence for a Fermi surface of composite fermions, while also probing the non-Fermi liquid character of the phase. It has been recently realized that the traditional theory used to describe the CFL breaks particle-hole symmetry, while the lowest-Landau level projected Hamiltonian does not. We find that the composite Fermi liquid has particle-hole symmetry, inconsistent with the traditional theory but consistent with a recent theory proposed by Son [Phys. Rev. X 5, 031027]. Our results show the Dirac nature of the composite fermions. We also observe the suppression of certain kinds of backscattering processes of the composite fermions, similar to the suppression in topological insulator surface states.

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Scott Geraedts
Princeton University

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