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# THE HALF-FILLED LANDAU LEVEL: THE CASE FOR DIRAC COMPOSITE FERMIONS

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Abstract:

In a two-dimensional electron gas under a strong magnetic field, correlations generate emergent excitations fundamentally distinct from electrons. Halperin, Lee and Read predicted that composite fermions bound states of an electron with two magnetic flux quanta can experience zero net magnetic field and form a Fermi sea. I will present evidence from infinite-cylinder DMRG which further verifies the existence of this exotic Fermi sea, but finds a twist: the phase is particle-hole symmetric. Following a recent conjecture of D Son, we find our results are only consistent if composite fermions are actually massless Dirac particles, similar to the surface of a topological insulator. Exploiting this analogy we observe the suppression of $2 k_F$ backscattering characteristic of Dirac particles. Thus the remarkable phenomenology of Dirac fermions is relevant also to two-dimensional electron gasses in the quantum Hall regime.

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