MAR16-2015-001897

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

The half-filled Landau level and topological insulator surfaces

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The metallic state of the half-filled Landau level - described originally in pioneering work by Halperin , Lee, and Read as a liquid of composite fermions - was proposed recently by Son to be described by a particle-hole symmetric effective field theory distinct from that in the prior literature. This talk will develop a simple picture of the particle-hole symmetric composite fermion through a modification of older pictures as electrically neutral "dipolar" particles. This picture, and the proposed particle-hole symmetric theory, will be further substantiated through a recently developed deep connection between the half-filled Landau level and correlated surface states of certain three dimensional topological insulators. The phenomenology of composite fermi liquids (with or without particle-hole symmetry) will be revisited. It will be shown that their heat/electrical transport dramatically violates the conventional Wiedemann-Franz law but satisfies a modified one. References: 1. Chong Wang and T. Senthil, Half-filled Landau Level, Topological Insulator Surfaces, and Three Dimensional Quantum Spin Liquids, cond-mat arXiv:1507.08290 (2015).