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Composite fermions for fractionally filled Chern bands[1]

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We consider fractionally filled bands with a non-zero Chern index that exhibit the Fractional Quantum Hall Effect in zero external field[3] a possibility supported by numerical work.[4] Analytic treatments are complicated by a non-constant Berry flux and the absence of Composite Fermions (CF), which would not only single out preferred fractions, but also allow us compute numerous response functions at nonzero frequencies, wavelengths and temperature using either Chern-Simons field theory or our Hamiltonian formalism.[5] We describe a way to introduce CF's by embedding the Chern band in an auxiliary problem involving Landau levels. The embedded band can be designed to approximate a prescribed Chern density in k space which determines the commutation relations of the charge densities and hence preserve all dynamical and algebraic aspects of the original problem. We find some states for which the filling fraction and dimensionless Hall conductance are not equal. The approach extends to two-dimensional time-reversal invariant topological insulators and to composite bosons.

[2]In collaboration with G. Murthy, University of Kentucky
[3]R. Roy and S. Sondhi, *Physics* **4**, 46 (2011) and papers reviewed therein.
[4]Ibid.
[5]G. Murthy and R. Shankar, Rev. Mod. Phys., **75**, 1101, (2003)