Quantum Corrections to the Conductivity of Disordered Fermi Systems Interacting by Gauge Fields

Peter WÖLFLE
Institute for Condensed Matter Theory
Karlsruhe Institute of Technology
D-76128 Karlsruhe
GERMANY

We calculate the Altshuler-Aronov-type quantum corrections to the conductivity of fermions in two-dimensional disordered systems, subject to a transverse gauge field. One example for such a system is the fractional quantum Hall effect near half-filling, where the system of composite fermions interacts strongly with a Chern-Simons gauge field. Wheras the exchange contribution is found to be localizing [1], the Hartree contribution may be delocalizing [2]. A recent finding that the Hartree contribution is dominant, and therefore may lead to a metallic state [3] is shown to be incorrect. We find that both, decoherence effects and vertex corrections, play an important role. Surprisingly, it appears that the gauge field is regularized by the presence of disorder, such that a controlled strong coupling analysis is possible.

[1] A. D. Mirlin and P. Wölfle, Phys. Rev. B 55, 5141 (1997)
[2] T. Ludwig, I.V. Gornyi, A.D. Mirlin, and P. Wölfle, Phys. Rev. **B 77**, 235414 (2008)
[3] V. M. Galitski, Phys. Rev. B **72**, 214201 (2005).