

Destruction of the Fractional Quantum Hall Effect by Disorder

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I suggest that Hall steps in the fractional quantum Hall effect are physically similar to those in the ordinary quantum Hall effect. This proposition leads to a simple scaling diagram containing a new type of fixed point, which I identify with the destruction of the fractional states by disorder.

It can be argued that the remaining "cosmic" issue in the theory of the fractional quantum Hall effect is how the effect is destroyed by disorder. If all but a very few of the hierarchial quantum Hall states now believed to exist were not destroyed by disorder, then the effect would be impossible to observe because the range of magnetic field strengths over which the Hall conductance is constant would be vanishingly small. In thinking about this problem, it is important to realize that the type of rigor one is accustomed to seeing in consideration of localization phenomena in the absence of magnetic fields may not be possible in this case. The presence of a magnetic field almost certainly makes this problem harder than two-dimensional localization with coulomb interactions, an as-yet unsolved problem. Given the complexity of the system, it is appropriate, in my opinion, to make qualitative theories, based on guesswork if necessary, which can serve as a conceptual guide for formulating experiments. The work