Localization in the quantum Hall effect: towards a magnetic landscape

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Abstract

The quantum Hall effect is a phenomenon of quantization of the transverse resistivity of a 2D electron gas in a magnetic field. Because of its universality and extreme precision, this discovery by K. von Klitzing in 1980 has motivated a tremendous number of studies. The quantification of the Hall resistivity as one varies the intensity of the magnetic fiels es usually explained by a picture coming from the quasi-classical limit. Indeed when the electric potential e.g. caused by defaults varies slowly at the magnetic scale, the eigenstates are localized along equipotential lines. Therefore they cannot conduct the current, except at the edges and ocasionnally at the center of the Landau levels.
In this poster wa show investigations to characterize the localization properties of eiginstates in a quantum Hall system. They are based on adapting the localization landscape of M. Filoche and S. Mayboroda to a magnetic case. We present the challenges that arise from adding a magnetic field for the definition of the landscape, as well as a candidate definition. This candidate is simulated in different ways depending on the boundary conditions. Also, we illustrate the non trivial simulations of magnetic Schrödinger eigenfunctions.
This groundwork will allow to study localization properties of eigenstates via brute force computations, and to evaluated predictions via a magnetic landscape function.

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