Condensed Matter Physics Seminar Series

Spread and erase -- How electron hydrodynamics can eliminate the Landauer-Sharvin resistance

Thomas Scaffidi

UC Irvine & University of Toronto

What is the ultimate limit of conductance of a metallic device of lateral size W? In the ballistic limit, the answer is the Landauer-Sharvin conductance, which is associated with an abrupt reduction of the number of conducting channels when going from the contacts to the device. However, the ballistic limit is not always the best-case scenario, since adding strong electron-electron scattering can take electrons to a viscous regime of transport for which "super-ballistic" flows were recently studied. In this talk, we will show that by a proper choice of geometry which resembles a "wormhole", it is possible to spread the Landauer-Sharvin resistance throughout the bulk of the system, allowing its complete elimination by electron hydrodynamics. This effect arises due to the interplay between geometry and strong electron-electron scattering, which allows for a net transfer of carriers from reflected to transmitted channels. Finally, we will discuss a recent experiment in a Corbino geometry which realizes one half of this "wormhole" geometry.

Thomas Scaffidi is a theoretical physicist working in the field of condensed matter. He received a bachelor's in Engineering from UCLouvain in 2009, a bachelor's and master's in Theoretical Physics from École Normale Supérieure (Paris) in 2012, and a PhD in Theoretical Physics from the University of Oxford in 2016. Prof. Scaffidi was a Gordon and Betty Moore Foundation Postdoctoral Fellow at UC Berkeley from 2016 to 2019, and an Assistant Professor at the University of Toronto from 2019 to 2022. Prof. Scaffidi was also a visiting scientist at the AWS Centre for Quantum Computing from 2020 to 2021.

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