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Viscous electronics in graphene

Electron–electron (e–e) collisions can impact transport in a variety of surprising and sometimes counterintuitive ways. Despite long-time interest, experiments on the subject proved challenging because of the presence of momentum-relaxing scattering sources (e.g. phonons or impurities). Only recently, sufficiently clean electron systems in which transport dominated by momentum-conserving e–e collisions have become available, enabling the study of electron transport governed by interactions.

In this talk we will see that interacting electrons in graphene can behave as a very viscous fluid. It will be shown that the flow of electron fluid resembles that of classical liquids, such as oil, and is accurately described by the theory of hydrodynamics [1-4]. We will discuss how to measure the viscosity of electron fluids and talk about the applications of viscous electronics.

References

[1] Negative Local Resistance Caused by Viscous Electron Backflow in Graphene, D. A. Bandurin, et al., Science 351, 1055 (2016).

[2] Fluidity Onset in Graphene, D. A. Bandurin, A. Shytov, et al., Nat. Comm. 9, 4533 (2018)

[3] Superballistic Flow of Viscous Electron Fluid through Graphene Constrictions, R. Krishna Kumar, D.A Bandurin, et al., Nat. Phys. 13, 1182 (2017).

[4] Measuring Hall viscosity of Graphene's Electron Fluid, A.I. Berdyugin et al., Science 364, 6436, 162-165 (2019)