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Hall viscosity and electromagnetic response of electrons in graphene MOHAMMAD SHERAFATI, University of Missouri, ALESSANDRO PRINCIPI, Radboud University, GIOVANNI VIGNALE, University of Missouri — The Hall viscosity is a dissipationless component of the viscosity tensor of an electron liquid with broken time- reversal symmetry, such as a two-dimensional electron gas (2DEG) in the quantum Hall state. Similar to the Hall conductivity, the Hall viscosity is an anomalous transport coefficient; however, while the former is connected with the current response, the latter stems from the stress response to a geometric deformation. For a Galilean-invariant system such as 2DEG, the current density is indeed the generator of the geometric deformation: therefore a connection between the Hall connectivity and viscosity is expected and by now well established [1]. In the case of graphene, a non-Galilean-invariant system, the existence of such a connection is far from obvious, as the current operator is essentially different from the momentum operator. In this talk, I will first present our results of the geometric Hall viscosity of electrons in single-layer graphene [2]. Then, from the expansion of the nonlocal Hall conductivity for small wave vectors, I demonstrate that, in spite of the lack of Galilean invariance, an effective mass can be defined such that the relationship between the Hall conductivity and the viscosity retains the form it has in Galilean-invariant systems, not only for a large number of occupied Landau levels, but also, with very high accuracy, for the undoped system. [1] Hoyos and Son, PRL 108, 066805 (2012). [2] Sherafati, Principi, and Vignale, PRB 94, 125427 (2016).

Mohammad Sherafati
University of Missouri

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