MP 12: Hydrodynamics

Time: Thursday 15:00–15:40 Location: HL 001

MP 12.1 Thu 15:00 HL 001

Bad metal data versus a theory of non-linear diffusion — •Matthias Kaminski[1], Navid Abbasi[2], and Omid Tavakol[3] — [1]University of Alabama, Tuscaloosa, USA — [2]Lanzhou University, Lanzhou, China — [3]University of Toronto, Toronto, Canada

In a system with one conserved charge the charge diffusion is modified by non-linear self-interactions within an effective field theory (EFT) of diffusive fluctuations. We include the slowest ultraviolet (UV) mode, constructing a UV-regulated EFT of non-linear diffusion. Predictions from this theory are in agreement with experimental data in a bad metal system.

MP 12.2 Thu 15:20 HL 001

Hydrodynamics of charged two-dimensional Dirac systems: the role of collective modes — •Kitinan Pongsangangan[1], Tim Ludwig[2], Henk T.C. Stoof[2], and Lars Fritz[2] — [1]Institute of Theoretical Physics, Technische Universität Dresden, 01062 Dresden, Germany — [2]Institute for Theoretical Physics and Center for Extreme Matter and Emergent Phenomena, Utrecht University, Princetonplein 5, 3584 CC Utrecht, The Netherlands

We study the hydrodynamic properties of ultraclean interacting two-dimensional Dirac electrons with Keldysh quantum field theory. We demonstrate that long-range Coulomb interactions play two independent roles: (i) they provide the inelastic and momentum-conserving scattering mechanism that leads to fast local equilibration; (ii) they facilitate the emergence of collective excitations, for instance plasmons, that contribute to transport properties on equal footing with electrons. Our approach is based on an effective field theory of the collective field coupled to electrons. Within a conserving approxima- tion for the coupled system we derive a set of coupled quantum-kinetic equations. This builds the foundation of the derivation of the Boltzmann equations for the interacting system of electrons and plasmons. We demonstrate that plasmons show up in thermo-electric transport properties as well as in quantities that enter the energy-momentum tensor, such as the viscosity.