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Hydrodynamics of Dirac Systems

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Hydrodynamics describes the movement of continuous fluids. Hydrodynamic descriptions elegantly combine the underlying conservation laws with specific material properties and the concept of local thermodynamic equilibrium. Recent advances in the microstructuring of ultra-pure materials have triggered the research field of hydrodynamic electronics, where the electrons of a solid obey the laws of hydrodynamics. This leads to non-local, super-ballistic or turbulent electric and thermal transport.
In this talk, I will discuss the hydrodynamic behavior of Dirac fluids, relevant to graphene, certain organic charge-transfer salts, or the surface states of topological insulators. I discuss issues like thermalisation and information scrambling, bounds on transport coefficients and ways to avoid them, the role of velocity slip in electron hydrodynamics, and the solution of hydrodynamic problems that is based on the duality between quantum field theory and gravity theory.