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Transport in inhomogeneous quantum critical fluids and in the Dirac fluid in graphene ANDREW LUCAS, JESSE CROSSNO, PHILIP KIM, SUBIR SACHDEV, Harvard University, KIN CHUNG FONG, Raytheon BBN — We present a hydrodynamic theory of transport in quantum critical fluids, disordered on long wavelengths due to fluctuations in the chemical potential. We argue that this approach is also well-suited to the Dirac fluid in graphene near the charge-neutrality point. Numerical simulations of this theory are compared to recent experiments on thermal and electric transport in clean samples of charge-neutral graphene. We obtain substantially improved quantitative agreement with data over existing hydrodynamic models. This provides evidence that the Dirac fluid behaves as a strongly interacting electronic fluid with transport governed by essentially classical collective phenomena. This work makes quantitative contact between AdS/CMT-inspired models of transport and an experimentally realized condensed matter system for the first time.

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