

A METHOD FOR MEASURING BARE VISCOSITY IN FLUCTUATING HYDRODYNAMICS

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Abstract

Hydrodynamic equations provide a universal framework for describing collective dynamics in a wide variety of systems, including strongly correlated electron systems and active matter. However, in typical low-dimensional systems, particularly in two dimensions and below, thermal fluctuations lead to renormalized transport coefficients that depend on the system size and geometry. When such systems are described by fluctuating hydrodynamic equations that explicitly incorporate thermal fluctuations, the bare transport coefficients appearing as model parameters are expected to be independent of the system size and geometry. Despite various attempts, a systematic method for measuring these bare coefficients has not yet been established.

In this talk, I will present a method for determining the bare viscosity of a two-dimensional fluid. We introduce a wavenumber-dependent viscosity defined through the equilibrium correlation of time-averaged Fourier components of the fine-grained shear-stress field. Two-dimensional molecular dynamics simulations reveal a small-wavenumber divergence characteristic of the renormalized viscosity, while the large-wavenumber behavior allows us to determine the bare viscosity [1].

[1] Y. Kazuma, M. Itami, and S. Sasa, “Unifying renormalized and bare viscosity in two-dimensional molecular dynamics simulations,” *Phys. Rev. Res.* 8, 013234 (2026).