Fluctuating hydrodynamics in lattice systems: microscopic view and thermodynamics

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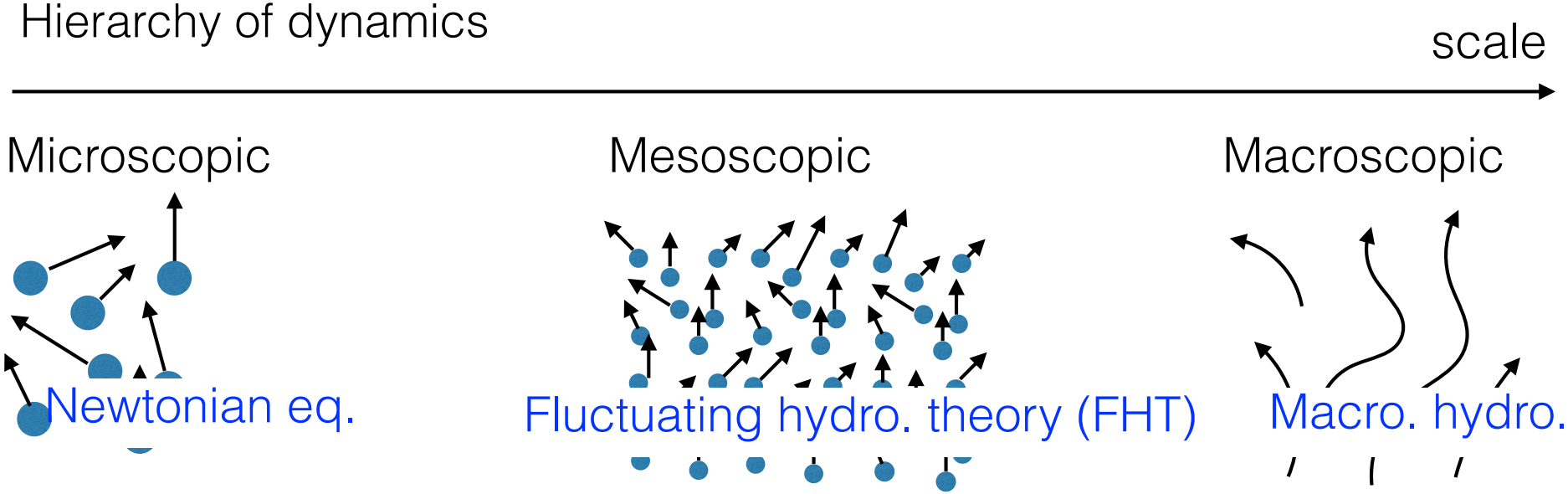
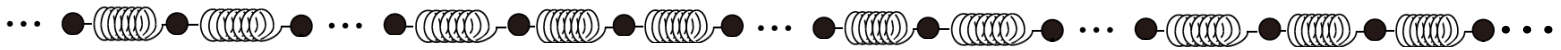
- Abstract

The fluctuating hydrodynamics theory (FHT) has been an important tool for analyzing the nonequilibrium phenomena of lattice systems. However, despite its practical success, its microscopic derivation is still lacking. In this talk, we discuss the microscopic derivation of the FHT, using the coarse-graining and projection procedure; the ensemble equivalence turns out to be critical. The Green-Kubo like formula for the bare transports are presented and the numerical simulation shows that the bare transport coefficients exist for a large coarse-graining length. We also discuss the thermodynamic structure.

- Hierarchy of dynamics



- How to derive the FHT in the Lattice systems ? $H = \sum_{n=1}^{N} \frac{p_n^2}{2} + \sum_{n=1}^{N-1} V(q_{n+1} - q_n)$



- FHT argument in lattice systems

  H. Spohn JSP, PRL (2014)

$$\partial c_{n,a}(t) = -\partial_n \left[\langle \hat{j}_{n,a} \rangle_{\mathrm{GGE}} + D_{a,b} \partial_n c_{n,b}(t) + B_{aa} \xi_{a,n}(t) \right]$$

  Assumption: finite bare transport coefficient

  Finite bare transport coefficient leads to diverging heat transport coeff.

- Several questions

  How do we derive the bare transport coefficients ?

  What is the thermodynamic structure ?