

Fluctuations and large deviations in non-equilibrium systems

B. Derrida

Laboratoire de Physique Théorique

École Normale Supérieure

24, rue Lhomond

F-75231 Paris, Cedex 05, France

Abstract

After introducing large deviation functions and recalling some of their properties (their link to the free energy, the Gallavotti–Cohen symmetry) I will discuss some models, the exclusion processes, for which the non-equilibrium steady state can be calculated exactly.

These simple models, for which the steady state is maintained by contact with two or more reservoirs, show that non-equilibrium systems have a number of properties which contrast with equilibrium systems: phase transitions in one dimension, non local free energy functional, violation of the Einstein relation between the compressibility and the density fluctuations, non-Gaussian density fluctuations.

For these simple models, one can also calculate the distribution of current flowing from one reservoir to the other. Surprisingly, the distribution is the same as for quantum mesoscopic conductors.