
Dynamical symmetry breaking and phase transitions in driven diffusive systems

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Abstract

We study the probability distribution of a current flowing through a 1D diffusive system, connected to a pair of reservoirs at its two ends. Sufficient conditions for the occurrence of a host of possible phase transitions both in and out of equilibrium are derived. These transitions manifest themselves as singularities in large deviation functions, resulting in enhanced current fluctuations. Microscopic models which implement each of the scenarios are presented, with possible experimental realizations. Depending on the model, the singularity is associated either with a particle-hole symmetry breaking, which leads to a continuous transition, or in the absence of the symmetry with a first-order phase transition. An exact Landau theory which captures the different singular behaviors is derived.

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