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Talk Invited Invited Talk

Renormalization Group studies of some Non-equilibrium Systems

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Results of position-space Renormalization Group (RG) studies on two different types of non-equilibrium states with steady-state phase transitions will be presented.

The first type corresponds to an Ising model in contact with two heat baths at different temperatures. Systems of this type had been studied earlier in various limits, in different contexts: Of particular interest has been the case with conserved dynamics (exchanges in different directions being driven by different heat baths) and when one of the heat baths is at an infinite temperature[1, 2]. The problem may be treated exactly when the exchange rate related to the infinite temperature bath is much faster than that for the finite temperature bath[1]. If these rates are equal, Monte Carlo studies indicate that the steady-state phase transition occurs when temperature of the finite temperature bath is at a much *higher* value[2] than the equilibrium phase transition temperature! Using the position-space RG, we determine the global phase transition behavior of this system for arbitrary temperatures of the heat baths and when the driving exchange rates have arbitrary speeds[3].

The second type of non-equilibrium system to be discussed is the "asymmetric exclusion process" (ASEP), which models one-dimensional classical transport systems in which particles can move only in one direction, and only into neighboring vacant sites. The system displays a number of steady-state phase transitions depending on the particle injection and absorption rates at the boundaries. The problem involving only one type of particle has been solved exactly[4], and a number of successful RG studies[7, 8] have been reported. We are analyzing a version of this system with two different types of particles moving in opposite directions[5, 6], using Monte Carlo, mean-field, and RG. An interesting feature of this model is the appearance of broken symmetry, when the transport properties associated with the two types of particles are the same.

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