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Exact Joint Density-Current Probability Function for the Asymmetric Exclusion Process MARTIN DEPKEN, Instituut Lorentz, University of Leiden, ROBIN STINCHCOMBE, Department of Physics, University of Oxford — We examine the asymmetric simple exclusion process with open boundaries, a paradigm of driven diffusive systems with nonequilibrium phase transitions. We derive the exact form of the joint probability function for the bulk density and current, both for finite systems, and in the thermodynamic limit. The resulting distribution is non-Gaussian, and while the fluctuations in the current are continuous at the continuous phase transitions, the density fluctuations are discontinuous. The derivations are done by using the standard operator algebraic techniques, and by introducing a modified version of the original operator algebra. As in equilibrium systems, the probability-normalization constant for the steady-state probabilities is shown to completely characterize the fluctuations, albeit in a manner very different from that of a standard equilibrium partition function.

Martin Depken
Instituut Lorentz, University of Leiden

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