Colóquios do DFM

Prof. Dr. Gunter M. Schütz

Forschungszentrum Jülich, Germany

Phase transition in single-file diffusion with open boundaries

Single-file diffusion is a widespread phenomenon occuring in e.g. as molecular diffusion in zeolites, colloidal diffusion in narrow channels, or in electrophoresis. As a model we use an one-dimensional simple symmetric exclusion process with two different particle species. At the boundaries we assume different reservoir densities which drive the system into a non-equilibrium steady state. For investigating the dynamics we derive a system of coupled non-linear diffusion equations for the coarse-grained particle densities. Exact analytical expressions are obtained for the self-diffusion coefficients, which turn out to be length-dependent, and for the stationary solution. In the steady state we find a discontinuous boundary-induced phase transition as the total exterior density gradient between the system boundaries is varied. This is the first instant where a quasi one-dimensional system with short-range interaction is shown to exhibit a non-equilibrium phase transition without any bulk driving force. Also a pumping effect is observed that drives one particle species against their external gradient. This could be relevant for explaining the behaviour of symporters, a specific type of biological ion channel.

Dia: 17/08/2007 - 14 horas

Anfiteatro das Exatas