Phase Transitions in Driven Diffusion and Brownian Motor Systems

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In connection with directed transport on the molecular level, two research areas have attracted great attention in the past: Brownian motors and driven diffusion systems under a static bias. Brownian motors are operated by a periodic process in time, where, in contrast to classical engines, fluctuations caused by thermal noise and thermally assisted overcoming of energy barriers are important. Driven diffusion under a static bias has received particular interest in connection with transport through open tube-like compartments and for general studies of non-equilibrium steady states (NESS). I shall first address the problem of variables controlling NESS in the presence of particle interactions beyond hard-core repulsions and present a theoretical approach based on time-dependent density functional theory to predict boundary-induced bulk phases in generic situations, where minimum and maximum current principles can no longer be applied. Then I will show that boundary-induced phase transitions also appear in collective Brownian motors and argue that their occurrence is generic.