Absolute negative mobility in tracer dynamics

David Mukamel
Department of Physics of Complex Systems, The Weizmann Institute, Rehovot, Israel

Instances of negative mobility, where a system responds to a perturbation in a way opposite to naive expectation, have been observed and studied theoretically and experimentally in numerous nonequilibrium systems. Here we show that absolute negative mobility (ANM), whereby current is produced in a direction opposite to the drive, can occur around equilibrium states. This is demonstrated in a simple one-dimensional lattice model of bath particles with a driven tracer. We derive analytical predictions in the linear response regime and elucidate the mechanism leading to ANM by studying the high-density limit. We also study numerically a model of hard Brownian disks in a narrow planar channel, for which the lattice model can be viewed as a toy model. We find that the model exhibits negative differential mobility (NDM), but no ANM. Effective attraction between tracers mediated by the bath particles will be discussed.†.