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Nonlinear response and fluctuations of a driven particle in simple model fluids

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We present some results on the dynamics of a driven tracer particle beyond the linear regime, in two different model fluids. We first focus on a lattice gas model – where the tracer interacts via hard-core repulsion with a crowding particle bath – which allows for analytical computations. In this model, two surprising phenomena can occur: negative differential mobility, namely a nonmonotonic force-velocity relation, and enhanced diffusivity induced by the crowding interactions. Then, we consider the dynamics of a driven interial particle in a steady laminar flow. Here we can observe the phenomenon of absolute negative mobility, where the tracer velocity is opposite to the applied external force. In this framework, we also study the dynamics of an active particle with finite persistence time and discuss a generalized fluctuation-dissipation relation, involving the correlation with non-equilibrium extra-terms.

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