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Shear-driven anomalous diffusion

Thursday 10 July 2025 10:00 (30 minutes)

Shear-driven diffusion represents a form of turbulent diffusion of a diffusing impurity in a stream with a velocity gradient. This issue has attracted much attention and has been studied for years. However, the linear shear flow in two-dimensional anomalous motion is not well studied. We study such anomalous process by introducing a memory kernel in the corresponding Fokker–Planck equation, which occurs due to the the long-tailed waiting time of the particle while performing a two-dimensional Brownian motion in a linear shear flow. Thus, the corresponding motion becomes non-Markovian. By analysis of the probability density function and the moments, we showed that the system exhibits characteristic crossover anomalous dynamics. Additionally, we introduce a stochastic resetting of the particle performing a shear-driven anomalous motion to the initial position, and we showed that the system reaches a non-equilibrium stationary state in the long time limit.

[1] T. Sandev, A. Iomin, J. Kurths, and L. Kocarev, *Phys. Fluids* **37**, 067101 (2025).

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