Feedback controlled particle in non-Markovian systems

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Brownian motion of a particle is commonly described using Langevin dynamics. To model the stochastic fluctuation of the particle, an additional white-noise term is contained in the Langevin equation. In non-Markovian systems, e.g. viscoelastic fluids, such noise is not necessarily valid. In particular, when colloidal particles in non-Markovian baths are driven out of equilibrium, fluctuations remain not necessarily in equilibrium at colloidal time scales, as this is the case in viscous liquids. Here, we introduce a novel experimental setup that allows us to study these fluctuations under almost arbitrary non-equilibrium conditions. With a feedback-controlled optical tweezers, we are able to achieve a constant driving force on a colloidal particle within a viscoelastic system which allows us to directly obtain the non-equilibrium fluctuations of the bath.

References:

J. Berner, B. Müller, J.R. Gomez-Solano, et al. *Nat Commun* **9**, 999 (2018).