Anomalous fluctuation relations

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We study Fluctuation Relations (FRs) for Gaussian stochastic systems that are anomalous, in the sense that the diffusive properties strongly deviate from the ones of Brownian motion. For this purpose we use a Langevin approach: We first briefly review the concept of transient work FRs for simple Langevin dynamics generating normal diffusion [1]. We then consider two different types of additive, power law correlated Gaussian noise [2,3]: (1) internal noise with a fluctuation-dissipation relation of the second type (FDR2), and (2) external noise without FDR2. For internal noise we find that FDR2 leads to conventional (normal) forms of transient work FRs. For external noise we obtain various forms of violations of normal FRs, which we call anomalous FRs. We show that our theory is important for understanding experimental results on fluctuations in biological cell migration. Similar results are observed more generally in small glassy systems [1].

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