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Two-states Ornstein-Uhlenbeck particle in a trapping potential

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In recent years, much attention has been paid to the observation of non-Gaussian probability density functions for diffusing systems in a variety of experiments and theoretical models, as such property could entail new physical insight. In this work, we solved analytically the Langevin equation of motion in the overdamped regime of a particle moving both in absence and in presence of a harmonic potential, assuming the diffusion coefficient to be a Telegraph Process, i.e. the diffusion coefficient changes stochastically between two states. We computed analytically the first four momenta of the distribution of the particle position observing a non-Gaussian behaviour for short times. We found that the duration of the non-Gaussian behaviour decreases with the strength of the confinement and increases with the increasing of the microscopic time scale of the subordinating process. The relations we determined can become a very useful tool in experiments to determine the value of the unknown microscopic time scale starting from the value of kurtosis.

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