Evolution of spins due to fluctuating fields

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Abstract

Coupling of spins to magnetic fields is a common technique used to trap ultra-cold gases. Fluctuations of the field can lead to uncontrolled transitions between spin states and ultimately to losses in the population of trapped atoms. Here we study the evolution of spins in the presence of external fields with fluctuating components described as stochastic processes. We solve the stochastic Bloch equations (which are similar to the stochastic Langevin equation for Brownian motion). This approach offers a complementary picture to the quantum Master Equation approach.

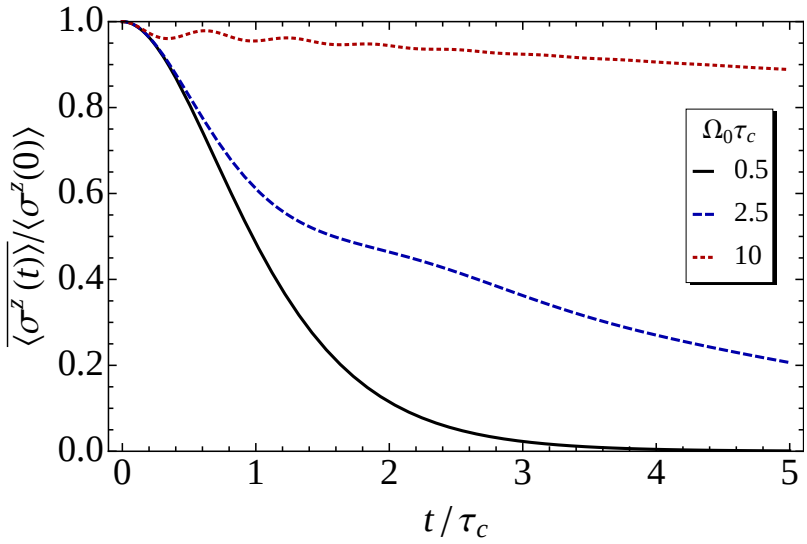

Figure 1: The expectation value of z spin component, $\overline{\langle\sigma^z(t)\rangle}$, subject to Gaussian colored noise versus time for non-vanishing constant magnetic field, Ω_0, in z direction. The strength of fluctuations, ω_0, and the correlation time of the noise, τ_c, where chosen to satisfy $\omega_0\tau_c = 1$.