Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Random variable approach to dissipative spin dynamics and Landau-Zener transitions PETER P. ORTH, KARYN LE HUR, Department of Physics, Yale University, New Haven, CT 06520, USA, ADILET IMAMBEKOV, Department of Physics and Astronomy, Rice University, Houston, TX, 77251, USA — We present a random variable approach to solve for the dynamics of a dissipative two-state system. Based on an exact functional integral description, our method reformulates the problem as that of non-unitary time evolution of a quantum state vector under a Hamiltonian containing random noise fields. This non-perturbative formalism goes beyond the frequently used Non-Interacting Blip Approximation (NIBA) and is particularly well suited to treat an explicitly time-dependent Hamiltonian. As an example, we consider the renowned Landau-Zener problem in the presence of an Ohmic bath with a large bath cutoff frequency ω_c. We identify an intermediate time regime where the energy separation of the two spin states is much larger than their tunneling coupling Δ, but still smaller than ω_c such that bath mediated spin transitions still occur. Such a situation can for example be realized with a cold atomic quantum dot setup. We also derive an approximate analytical expression for the decay of the upper spin state population in this regime, which agrees well with our numerical results.

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Date submitted: 18 Nov 2009 Electronic form version 1.4