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Effect of nonlinear nonlinear coupling to a pure dephasing model
LI GE, NAN ZHAO, Beijing Computational Science Research Center, Beijing 100084, China — We investigate the influence of the nonlinear coupling to the coherence of a pure dephasing model. The total system consists of a qubit and a Bosonic bath, which are coupled by an interaction $H_I = g_1\sigma_z \otimes x + g_2\sigma_z \otimes x^2$ with $x = \frac{1}{\sqrt{2}}(a + a^\dagger)$. It's shown that no matter how small g_2 is, the long time behavior of the coherence is significantly changed by the nonlinear coupling for free induction decay (FID), while the effect of g_1 can be neglected as long as g_1 is much smaller than the enegy splitting of the qubit. In the case that many-pulse dynamical decoupling control is exerted on the qubit, g_2 also modulates the oscillation of the coherence. Our results indicate that the nonlinear coupling must be taken into account for long time dynamics.

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