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Quantum noise of an electromagnetically controlled two level system CHING-KIT CHAN, L.J. SHAM, Department of Physics, University of California San Diego — A coherent control of a spin is limited by both the decoherence due to coupling with the environment and noise coming from the quantized control. A quantum noise study is particularly important in fault tolerant quantum computation where a very high fidelity is demanded. Here, we present a time evolution study of a two level system interacting with a laser pulse and the electromagnetic vacuum based on the multimode Jaynes- Cummings model. We develop a diagrammatic formalism in which one can easily identify the coherent Rabi oscillation of the TLS and its relaxation from corresponding diagrams. In the small time limit ($t \ll T_1$), where the noise level is small but still an issue to fault tolerant quantum computing, this method gives a quantitative evaluation of the quantum noise of the TLS under an optical control with an arbitrary pulse shape. Furthermore, this approach can be naturally extended from the Markovian to the non-Markovian regime, resulting in dynamics different from that obtained in the optical Bloch analysis. All these calculations are done without any stochastic assumption.

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