Strong Field Effects in Damped Rabi Oscillations of Two level System

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Damped Rabi Oscillations can be divided into elementary relaxation processes such as a simple decay and a damped oscillations. Since the coefficient of the solution involve physical relaxation rates corresponding to the processes, all the relaxation rates such as the dephasing rate are determined by simple calculations of the coefficients in these different relaxation processes [1, 2].

Theory: To study damped Rabi Oscillation starting with an initial condition (P_{00}+P_{11})=1, the multilevel system is divided into two parts to form a two-level system (m, n = 0, 1) and the rest of the system is regarded as the external system. Suppose that the number of levels in the external system is sufficiently large. In this case the probability density diffuses into the external system i.e. ρ_{kl} (k, l ≠ 0, 1) < < 1 during the typical decay time $\lceil_1 = \lceil_1^{-1}$. This means that the probability density has little chance to return from the external system to the two level system under this situation during the typical decay time [3].

For a case where the decoherence time is sufficiently long in relation to the Rabi oscillation time $\tau_R = \Omega_0^{-1}$ in an resonance situation ($\Delta \simeq 0$). Where we have studied damped Rabi-Oscillations at T=o. It has been shown that the following relations were obtained from combinations of the decay constant a,c, g and h as γ_+=g + h - 2a, γ_φ = a +2 c-3/2 (g+h), $\lceil_0$ = g and $\lceil_1$ = 2a - g, where γ_{10} in equation we have proposed a scheme for measuring the rates of internal relaxation and external decay from these relations. This scheme can be extended to a finite temperature.

Conclusion: Authors experimental value for relaxation time for damped Rabi Oscillation agrees with the calculated value. High power damped Rabi oscillations can in principal be use to relevant matrix elements needed for high fidelity microwave control superconducting phase qubits [4, 5].

References:

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