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A Single Electron Charge Qubit in the Strong Driving Limit[1]
J. STEHLIK, Y. DOVZHENKO, J. R. PETTA, Department of Physics, Princeton University, H. LU, A. C. GOSSARD, Materials Department, University of California at Santa Barbara — The dynamics of strongly driven two-level systems in the presence of dissipation have been thoroughly studied using theoretical models.[1] We use a model system, a GaAs double quantum dot (DQD) containing a single electron, to experimentally explore the strong-driving regime. We measured the transport through the DQD as a function of detuning and applied microwave power and compare with the Tien-Gordon model. In contrast with previous experiments, we directly access the occupation of the DQD using a quantum point contact charge sensor. In the high frequency regime ($\hbar\omega_{driving} \gg \Delta$, where Δ is the tunnel coupling) we observe up to 9-photon transitions and clear Bessel function behavior of the DQD occupation with applied microwave power. We also studied the intermediate frequency regime, observing 18-photon transitions. The data are modeled using the time-dependent Schrodinger equation.[2] By comparing the data with the simulations, we estimate $T_1 \sim 15$ ns and $T_2 \sim 3$ ns.
[1] A. J. Leggett *et al.*, Rev. Mod. Phys. **59**, 1 (1987).
[2] S. N. Shevchenko, S. Ashhab, F. Nori, Phys. Rep. **492**, 1 (2010).

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