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Analysis of Rabi Oscillations of a Josephson Phase Qubit[1] S. K. DUTTA, H. XU, FREDERICK W. STRAUCH, PHILIP R. JOHNSON, R. C. RAMOS, HANHEE PAIK, T. A. PALOMAKI, R. M. LEWIS, J. R. ANDERSON, ALEX J. DRAGT, C. J. LOBB, F. C. WELLSTOOD, Department of Physics, University of Maryland — We have experimentally studied asymmetric Nb/AlOx/Nb dc SQUID qubits at 25 mK. The two lowest metastable levels localized within a single well of the complex two-dimensional potential of the device can serve as qubit states, if they are not unduly perturbed by resonant coupling to higher states of the full potential. Rabi oscillations between the qubit states can be driven with a microwave bias current. State readout is performed by measuring the tunneling rate from all energy levels with non-zero occupation probability to the finite voltage state. To interpret the results of our Rabi oscillation measurements, we have used a multi-level density matrix simulation to extract the populations of the individual quantum states from this total rate. We can then calculate the visibility of the oscillations and determine the effects of the higher levels and multi-photon transitions.

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