Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

The voltage-controlled superconducting flux qubit LUCA CHIROLLI, GUIDO BURKARD, University of Basel — We study a voltage-controlled version of the superconducting flux qubit [Chiorescu *et al.*, Science **299**, 1869 (2003)] and show that full control of qubit rotations on the entire Bloch sphere can be achieved. Circuit graph theory is used to study a setup where voltage sources are attached to the two superconducting islands formed between the three Josephson junctions in the flux qubit. Applying a voltage allows qubit rotations about the y axis, in addition to pure x and z rotations obtained in the absence of applied voltages. The orientation and magnitude of the rotation axis on the Bloch sphere can be tuned by the gate voltages, the external magnetic flux, and the ratio α between the Josephson energies via a flux-tunable junction. We compare the single-qubit control in the known regime $\alpha < 1$ with the unexplored range $\alpha > 1$ and estimate the decoherence due to voltage fluctuations.

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Date submitted: 09 Nov 2006 Electronic form version 1.4