Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

High-fidelity resonator-induced phase gate with single-mode squeezing SHRUTI PURI, Dpartement de Physique, Universit de Sherbrooke , ALEXANDRE BLAIS, Dpartement de Physique, Universit de Sherbrooke and Canadian Institute for Advanced Research — Despite recent breakthroughs in the demonstration of small-scale quantum error correction, reaching the fidelity required for fault tolerance with entangling gates still remains a challenge. We propose a protocol to increase the fidelity of a two-qubit resonator induced phase gate by using a off-resonant narrowband squeezing drive. For this gate, two superconducting transmon qubits are dispersively coupled to a microwave resonator. By off-resonantly driving the resonator, a controlled-Z gate can be implemented between the qubits [1]. However, photons leaving the resonator reveal the qubit which-path information leading to decoherence. We show that driving the resonator with a field squeezed at an optimal angle and strength erases the qubit which-path information and consequently increases the gate fidelity. We find that, under realistic conditions and modest squeezing power, it is possible to implement a high-fidelity two-qubit controlled-Z gate with short gate times. [1] A. W. Cross and J. M. Gambetta Phys Rev A 91, 032325 (2015).

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Date submitted: 05 Nov 2015 Electronic form version 1.4