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Encoding a Qubit into a Cavity Mode in Circuit-QED using Phase Estimation BARBARA TERHAL, DANIEL WEIGAND, RWTH - Aachen — Gottesman, Kitaev and Preskill have formulated a way of encoding a qubit into an oscillator such that the qubit is protected against small shifts (translations) in phase space. The idea underlying this encoding is that error processes of low rate can be expanded into small shift errors. The qubit space is defined as an eigenspace of two mutually commuting displacement operators which act as large shifts/translations in phase space. We propose and analyze the approximate creation of these qubit states by coupling the oscillator to a sequence of ancilla qubits realizing the protocol of approximate phase estimation for a displacement operator. We analyze the performance of repeated and adaptive phase estimation as the experimentally most viable schemes given a realistic upper limit on the number of photons in the oscillator. We propose a physical implementation of the protocol using the dispersive coupling between an ancilla transmon qubit and a cavity mode in circuit-QED. We estimate that in a current experimental set-up one can prepare a good code state from a squeezed vacuum state using 8 rounds of adaptive phase estimation lasting in total about 4 microsec., with at least 80

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