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Autoresonant readout of a high Q resonator coupled to a superconducting quantum bit¹ KATER MURCH, STEVEN WEBER, R. VIJAY, UC Berkeley, QNL, ERAN GINOSSAR, Physics Department, University of Surrey, STEVEN M. GIRVIN, Physics Department, Yale University, I. SIDDIQI, UC Berkeley, QNL — The frequency of a nonlinear oscillator changes with oscillation amplitude. When a high-Q, nonlinear oscillator is excited with a frequency chirped drive, the system can respond at either low or high oscillation amplitude depending on whether the drive excitation is below or above a critical value, respectively – a phenomenon known as autoresonance. We exploit this nonlinear phenomenon to read out the state of a superconducting transmon qubit coupled to a high-Q nonlinear resonator. Because the excitation is non-equilibium, the resonator can be read out faster than its energy decay time. The fidelity for mapping the qubit state onto the oscillator can be as high as 80% and is limited by the T_1 lifetime of the qubit, and readily achievable pulse parameters.

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