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Quantum analysis of a bandpass Purcell filter for accurate qubit readout EYOB A. SETE, University of California, Riverside, JOHN M. MARTINIS, University of California and Google Inc., Santa Barbara, ALEXANDER N. KOROTKOV, University of California, Riverside — In a circuit QED setup the readout fidelity of a superconducting qubit is partially limited by the qubit relaxation through the resonator into a transmission line, which is also known as the Purcell effect. One way to suppress this effect is to employ a filter, which impedes microwave propagation at the qubit frequency. We present a quantum analysis for the bandpass Purcell filter that was recently realized by E. Jeffrey et al. [PRL 112, 190504 (2014)]. Using experimental parameters, we show that the bandpass filter suppresses the qubit relaxation rate by two orders of magnitude while keeping the measurement rate the same. We also show that in the presence of a microwave drive the qubit relaxation rate further decreases with increasing drive strength.

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