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Quantum non-demolition measurement of microwave photons in superconducting circuits using engineered quadratic interactions CHUNQING DENG, University of Waterloo, JAY GAMBETTA, ADRIAN LUPASCU — We present a quantum electrical circuit with Josephson junctions formed by two anharmonic oscillators coupled with an interaction of the form $g\gamma_1^2\gamma_2^2$ where γ_1 and γ_2 are position-like coordinates. This type of coupling allows the quantum non-demolition measurement of the energy of one oscillator by monitoring the frequency of the second oscillator. We find that the optimized coupling strength g scales as $\sqrt{\omega_1\omega_2}/\sqrt{n_1 n_2}$, with $\omega_{1,2}$ the frequency, and $n_{1,2}$ the maximum photon storage capacity of each resonator. With an optimized coupling, it is possible to achieve high fidelity detection of up to 10 photons over a time of the order of microseconds. We discuss the possibility of observing quantum jumps in the number of photons and related applications. We also present our experimental work on the implementation of this detection scheme. C. Deng, J. M. Gambetta, and A. Lupascu, arXiv:1008.3363 (2010).

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