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Exploiting Kerr Cross Non-linearity in Circuit Quantum Electrodynamics for Non-demolition Measurements SHWETANK KUMAR, DAVID DIVINCENZO, IBM Research — High quality factor microwave resonators are versatile devices which find many applications in circuits for scalable quantum computing architectures. We will present a novel circuit for dispersive readout of energy stored in one mode of a nonlinear superconducting ring resonator by detecting frequency shift of a second mode coupled to the first via Kerr nonlinearity. Symmetry is used to enhance the circuit responsivity by minimizing the nonlinear terms that do not contribute to the detector response. Assessment of the signal to noise ratio indicates that the scheme will function at the single photon level, allowing quantum non-demolition measurement of the photon number state of one resonator mode. Experimental data from a simplified version of the device demonstrating the principle of operation will be presented. Extensions of this work to implement on-chip superconducting beam splitters with applications towards linear optics qubit schemes will be discussed.

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