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Development of an Embedded Transmon Amplifier[1] JOHN MARK KREIKEBAUM, ANDREW EDDINS, DAVID TOYLI, ELI LEVENSON-FALK, Quantum Nanoelectronics Laboratory, Department of Physics, University of California, Berkeley, California 94720, USA., BENJAMIN LEVITAN, AASHISH CLERK, Department of Physics, McGill University, 3600 Rue University, Montreal, Quebec H3A 2T8, Canada., IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, Department of Physics, University of California, Berkeley, California 94720, USA. — Superconducting parametric amplifiers offer high quantum efficiencies and near quantum limited noise performance, but typically require the addition of circulators which are lossy, bulky, and magnetic, limiting efficiency and precluding scalable on-chip integration. In this talk, we present experimental results on a superconducting Josephson parametric amplifier (JPA) dispersively coupled to an on-chip transmon qubit. By embedding the qubit inside the amplifier directly, loss before the first stage of amplification is essentially eliminated. Study of the measurement induced dephasing and measurement rates as a function of device gain and amplification quadrature can be achieved by sweeping the power of the JPA pump tone and the relative phase between pump and readout tones. Of primary interest is whether the on-chip gain can be used to enhance measurement rates without producing excess backaction on the qubit. We investigate device performance in both the strong projective and weak continuous readout regimes and quantitatively compare results to theoretical predictions.

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