Abstract Submitted
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Phase-matched Josephson traveling-wave parametric amplifier for superconducting qubit readout - experiment[1] CHRIS MACKLIN, QNL, University of California, Berkeley, K. O'BRIEN, NSF Nano-scale Science and Engineering Center (NSEC), University of California, Berkeley, M. E. SCHWARTZ, QNL, University of California, Berkeley, D. HOVER, V. BOLKHOVSKY, S. TOLPYGO, G. FITCH, T. WEIR, MIT Lincoln Laboratory, W.D. OLIVER, MIT Lincoln Laboratory and Research Laboratory of Electronics, Massachusetts Institute of Technology, X. ZHANG, NSF Nano-scale Science and Engineering Center (NSEC), University of California, Berkeley, I. SIDDIQI, QNL, University of California, Berkeley — We have developed a new generation of Josephson traveling wave parametric amplifiers (JTWPAs) utilizing the technique of resonant phase matching. Due to its transmission line geometry, the JTWPA is not limited by the gain-bandwidth tradeoffs inherent in resonator-based parametric amplifiers. We present experimental results on the amplifier performance of the JTWPA, demonstrating gain in excess of 20 dB over an instantaneous bandwidth of more than 2 GHz with a 1 dB compression power of -100 dBm. The system noise temperature with the JTWPA is less than a factor of 3 above the quantum limit as measured using a 3D transmon in the weak measurement regime to provide a precise power calibration at the relevant experimental reference plane. We also utilize quantum weak measurement to provide an independent measure of the quantum measurement efficiency, in good agreement with the noise power measurement. We demonstrate projective qubit readout with a raw measurement fidelity exceeding 98% in an 80 ns integration window, and extrapolate this performance to a multi-qubit system.

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