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Josephson traveling-wave parametric amplifier for superconducting qubit readout[1] CHRIS MACKLIN, QNL, University of California, Berkeley, D.H. SLICHTER, NIST - Boulder, O. YAAKOBI, INRS-EMT, 1650 Boul. Lionel Boulet, Varennes, Quebec, J3X 1S2 Canada, L. FRIEDLAND, Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel, V. BOLKHOVSKY, D.A. BRAJE, G. FITCH, W.D. OLIVER, MIT Lincoln Laboratory, Lexington, MA, USA, I. SIDDIQI, QNL, University of California, Berkeley — Superconducting parametric amplifiers (paramps) have successfully demonstrated near quantum limited sensitivity, enabling single-shot qubit readout, feedback, and state tracking. However, these amplifiers are commonly limited to narrow bandwidth and modest dynamic range, and most require microwave circulators to separate input and output modes. These limitations stem from the use of a resonant non-linearity to achieve mixing between a signal and pump mode. Our traveling-wave parametric amplifier (TWPA) is based on a superconducting nonlinear Josephson junction transmission line, thereby inherently sidestepping the limitations associated with a cavity structure. We present theoretical predictions and experimental results, including improved gain and noise performance. We discuss transmon qubit readout in the circuit QED architecture using a TWPA. We also comment on promising architectures for chip-level integration and multiplexing.

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