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Title:A wideband, low-noise superconducting amplifier with high dynamic range
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Abstract:An ideal amplifier has very low noise, operates over a broad frequency range, and has large dynamic range. Unfortunately, it is difficult to obtain all of these characteristics simultaneously. For example, modern transistor amplifiers offer multi-octave bandwidths and excellent dynamic range, but their noise remains far above the limit set by the uncertainty principle of quantum mechanics. Parametric amplifiers can reach the quantum-mechanical limit, but generally are narrow band and have very limited dynamic range. Here we describe a parametric amplifier that overcomes these limitations through the use of a travelling-wave geometry and the nonlinear kinetic inductance of a superconducting transmission line. We measure gain extending over 2 GHz on either side of an 11.56 GHz pump tone and place an upper limit on the added noise of 3.4 photons at 9.4 GHz. The dynamic range is very large, and the concept can be applied from gigahertz frequencies to similar to 1 THz.
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