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Dispersive magnetometry with a noiseless SQUID parametric amplifier M. HATRIDGE, UC Berkeley/LBNL, R. VIJAY, D.H. SLICHTER, QNL, UC Berkeley, JOHN CLARKE, UC Berkeley/LBNL, I. SIDDIQI, QNL, UC Berkeley — We have realized a dispersive magnetometer circuit consisting of an unshunted dc SQUID in parallel with an on-chip capacitor. An input flux signal is encoded as a phase modulation of a microwave pump tone applied to this nonlinear resonator. This phase modulation creates a voltage signal in which all the information is contained in a single quadrature. For sufficiently strong microwave drive power, the nonlinearity of the resonator results in phase sensitive parametric amplification of the voltage signal with potentially zero added noise. We obtain an effective flux noise of 0.14 $\mu\Phi_0\mathrm{Hz}^{-\frac{1}{2}}$ with 400 kHz bandwidth, corresponding to 32 dB of parametric gain at 5.56 GHz and an added noise of no greater than 0.14 photons. By reducing the parametric gain to 15 dB, we can increase the bandwidth to 20 MHz with an effective flux noise of 0.29 $\mu\Phi_0\mathrm{Hz}^{-\frac{1}{2}}$. In these measurements, the SQUID never enters the voltage state. Thus, this technique is well suited to applications requiring low backaction, such as quantum state measurement. We acknowledge support from the AFOSR(RV, IS), the Hertz Foundation (DHS), and the DOE (MH, JC).

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