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Quantum Limited Amplification and Detection with a Non-Linear Cavity Detector CATHERINE LAFLAMME, AASHISH CLERK, Department of Physics, McGill University — A variety of recent experiments demonstrate the power of using driven microwave resonators for quantum measurement and amplification. Here, we consider theoretically the use of a driven cavity with a Kerr-type non-linearity to amplify a dispersively coupled signal. We consider the regime where there is no multi-stability in the cavity dynamics; this is similar to recent experiments.[1,2] The amplifier quantum-limit in this case involves the physics of backaction, unlike the more studied 'scattering' mode of operation. We calculate the added noise of this nonlinear cavity amplifier, and show that it exhibits universal scaling in the vicinity of the bifurcation point. We also show that for low frequencies the nonlinear cavity amplifier reaches the fundamental quantum limit on its noise temperature, but has large backaction - imprecision noise correlations. This implies that the non-linear cavity cannot be simply used for QND qubit measurement, but could have interesting applications to non-resonant force sensing. Our results have applications to quantum information processing, electromechanics and optomechanics.

[1]M. Hatridge *et al.*, arXiv:1003.2466v1
[2]F.R. Ong *et al.*, arXiv:1010.6248v1

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