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Large gain quantum-limited qubit state measurement using a two
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Dept. of Physics — A single nonlinear cavity dispersively coupled to a qubit func-
tions as a large gain detector near a bifurcation, but also has an unavoidable large
backaction that prevents QND measurement at weak couplings [1]. We show the-
oretically that a modified setup involving two cavities (one linear, one nonlinear)
and a dispersively coupled qubit allows for a far more optimal measurement. In
particular, operating near a point of bifurcation, one is able to both achieve a large
gain as well as a near quantum-limited backaction. We present analytic results for
the gain and noise of this detector and a heuristic understanding of the physics, thus
presenting a complete description of this new way of performing weak qubit state
measurements. The setup we describe can easily be realised in experiments with
superconducting circuits involving Josephson junctions [2,3].