Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Real-time tuning of a double quantum dot using a Josephson parametric amplifier[1] J. STEHLIK, Y.-Y. LIU, Department of Physics, Princeton University, C. M. QUINTANA, Department of Physics, UC Santa Barbara, C. EICHLER, T. R. HARTKE, J. R. PETTA, Department of Physics, Princeton University — Josephson parametric amplifiers (JPAs)[2] have enabled advances in readout of quantum systems. Here we demonstrate JPA-assisted readout of a cavity-coupled double quantum dot (DQD).[3] Utilizing a JPA we improve the signal-to-noise ratio (SNR) by a factor of 2000 compared to the situation with the parametric amplifier turned off. At an interdot charge transition we achieve a SNR of 76 (19 dB) with an integration time $\tau = 400$ ns, which is limited by the linewidth of our cavity. By measuring the SNR as a function of τ we extract an equivalent charge sensitivity of 8×10^{-5} $e/\sqrt{\text{Hz}}$. We develop a dual-gate-voltage rastering scheme that allows us to acquire a DQD charge stability diagram in just 20 ms. Such rapid data acquisition rates enable device tuning in live "video-mode," where the results of parameter changes are immediately displayed. Live tuning allows the DQD confinement potential to be rapidly tuned, a capability that will become increasingly important as semiconductor spin qubits are scaled to a larger number of dots.

[1]Research is supported by the Packard Foundation, ARO Grant No. W911NF-15-1-0149, DARPA QuEST Grant No. HR0011-09-1-0007, and the NSF (Grants No. DMR-1409556 and DMR-1420541).
[2]B. Yurke, J. Opt. Soc. Am. B, **4** 1551 (1987).
[3]J. Stehlik *et al.*, Phys. Rev. Appl., **4** 014018 (2015).

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Date submitted: 02 Nov 2015 Electronic form version 1.4