Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Improved Superconducting Qubit Readout by Qubit-Induced Nonlinearities in the Straddling Regime MAXIME BOISSONNEAULT, Universite de Sherbrooke, J.M. GAMBETTA, IQC and University of Waterloo, J. BOURASSA, A. BLAIS, Universite de Sherbrooke — In dispersive readout schemes, qubit-induced nonlinearities have typically limited the measurement fidelities by reducing the signal-to-noise ratio (SNR) when the measurement power is increased [1]. However, it has been recently shown that these nonlinearities, together with the many-level system (MLS) nature of superconducting qubits, can be used to improve qubit readout in some regimes [2]. Moreover, for the transmon qubit [3], it has been shown that when the resonator's frequency sits between two of the MLS' transition frequencies – the so-called straddling regime – contributions of higher levels add constructively to improve the SNR [4]. In this talk, we explore the advantages of using both the qubit-induced nonlinearties and the straddling regime for qubit readout.

[1] Boissonneault et al, PRA 77, 060305(R) (2007)
[2] Reed et al, PRL 105, 173601 (2010), Bishop et al, PRL 105, 100505 (2010), Boissonneault et al, PRL 105, 100504 (2010)
[3] Koch et al, PRA 76, 042319 (2007)
[4] Srinivasan et al, V26.00006, 2010 March Meeting.

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Date submitted: 17 Nov 2010   Electronic form version 1.4