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Second order dispersive regime of circuit QED with a transmon qubit MAXIME BOISSONNEAULT, Universite de Sherbrooke, J. M. GAMBETTA, IQC and University of Waterloo, ALEXANDRE BLAIS, Universite de Sherbrooke — In many recent circuit QED experiments [1,2], a transmon-type [3] qubit is fabricated inside a high-Q transmission line resonator. Compared to the Cooper-pair box (CPB), the transmon has both a stronger coupling to the resonator and a significantly longer dephasing time [4]. By going to the dispersive regime, where the qubit-resonator detuning is much larger than the coupling strength, the qubit can be controlled and measured through the resonator. In previous work [5], we have shown that one must include non-linear corrections to the dispersive approximation in strong measurements of a CPB qubit. These corrections cause a saturation of the signal-to-noise ratio and photon-dependant qubit decay and dephasing rates. In this talk, we will show how these non-linear corrections come into play with the transmon, and how they could be used to improve the measurement. [1] Houck et al, Nature, 2007, 449, 328 [2] Majer et al, Nature, 2007, 449, 443 [3] Koch et al, PRA, 2007, 76, 042319, [4] Schreier et al, PRB 77, 180502 (2008), [5] Boissonneault et al, PRA, 2008, 77, 060305(R).

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