Improved Superconducting Qubit Readout by Qubit-Induced Nonlinearities in the Straddling Regime

MAXIME BOISSONNEAULT, Universite de Sherbrooke, J.M. GAMBITTA, 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 nonlinearities and the straddling regime for qubit readout.