The quantromon: A qubit-resonator system with orthogonal qubit and readout modes

The measurement of a superconducting qubit is implemented by coupling it to a resonator. The common choice is transverse coupling, which, in the dispersive approximation, introduces an interaction term that enables the measurement. This cross-Kerr term provides a qubit-state dependent dispersive shift in the resonator frequency. In this talk, I will present a two-mode circuit, nicknamed quantromon, with two orthogonal modes implementing a qubit and a resonator with an intrinsic cross-Kerr coupling mechanism. I will present data characterizing some of the unique properties of this device like weak detuning dependence of the cross-Kerr shift and intrinsic Purcell protection [1]. Finally, I will present data demonstrating a single-shot readout fidelity of 98.3%, which is comparable to the state-of-the-art measurements without the use of a parametric amplifier and suggests a potential simplification of the measurement circuitry for scaling up quantum processors.

[1] Salunkhe et al., *Appl. Phys. Lett.* 126, 254001 (2025)