Condensed Matter Seminar

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"The Kerr-cat qubit: stabilization, readout and operations"

Monday, April 26, 2021

4:00pm – 5:00pm

Virtual Meeting:

Zoom Link: https://virginiatech.zoom.us/j/89809849634?pwd=OTY3ZHBmOUJzYmdNNTJldHpsNlNZZz09

Passcode: 727986

Schrödinger cat states, superpositions of coherent states in an oscillator, encode a noise-biased qubit that is naturally protected against phase-flip errors. To be practical for quantum information processing, these highly excited states must be stabilized to maintain the protection in a way that is simultaneously compatible with fast gates and readout of the encoded information. We experimentally demonstrate a method for the generation and stabilization of Schrödinger cat states--the Kerr-cat qubit--that is based on the interplay between Kerr nonlinearity and single-mode squeezing in a superconducting microwave resonator. The realized Kerr-cat qubit exhibits over an order of magnitude increase in the transverse relaxation time over the single-photon Fock-state encoding, and all single-qubit gates were performed sixty times faster than the shortest coherence time. Unlike traditional two-level systems, the Kerr-cat qubit also admits a CNOT gate that preserves its noise-bias. All together, the Kerr-cat qubit is a potentially powerful tool for quantum information processing and even promises significant overhead reduction for quantum error correction in surface-code-style architectures.