Title: STIRAP-inspired robust gates for a superconducting dual-rail qubit

Abstract:
Stimulated Raman adiabatic passage (STIRAP) is a powerful technique for robust state transfer capabilities in quantum systems. This method, however, encounters challenges for its implementation as a gate in qubit-subspace due to its sensitivity to initial states. By incorporating single-photon detuning into the protocol, the sensitivity to the initial state can effectively be mitigated, enabling STIRAP to operate as a gate. In this study, we experimentally demonstrate the implementation of robust rotations in a dual-rail qubit formed by two strongly coupled *fixed-frequency* transmon qubits. We achieve state preparation fidelity in excess of 0.98 using such rotations. Our analysis reveals these gates exhibit significant resilience to errors. Furthermore, our numerical calculations confirm that these gates can achieve fidelity levels in excess of 0.999.