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Fluxonium qubits: Single and two-qubit gates

Superconducting qubits have enabled recent progress in experiments with large quantum computing circuits. In these, transmon qubits have been the broadly used qubit of choice. To further improve the performance of such circuits, the introduction of the fluxonium qubit can bring added benefits of longer coherence times and larger anharmonicity. In this talk, I will discuss how we can overcome single-qubit errors in fluxonium qubit due to the breakdown of the rotating wave approximation. Next, I'll discuss two-qubit gates with fluxonium qubits. The two fluxonium qubits interact directly and through a transmon-based coupler circuit. The coupling strengths between the qubits and the coupler are designed to minimize residual crosstalk while allowing for fast gate operations. In our experiment we observe fast two qubit gates (< 50ns) and high two-qubit gate fidelities (~99%). We demonstrate experimentally that different pulse schemes can speed up the duration of the gate