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Implementing gates in a fluxonium-like qubit with suppressed wavefunction overlap NATHAN EARNEST, YAO LU, DAVID MCKAY, University of Chicago, DAVID CZAPLEWSKI, LEONIDAS OCOLA, Argonne National Lab, DAVID SCHUSTER, University of Chicago — Superconducting Josephson junction qubits are a promising technology for quantum information processing, but are limited by finite lifetimes. The lifetime of the qubit, according to Fermi's golden rule, is dictated by the overall overlap of the $|0>$and $|1>$wavefunctions and so a long lived qubit may be constructed from states with well-isolated wavefunctions. A "double-well" fluxonium-like qubit[1] with well-separated degenerate ground states is obtained by increasing the qubit energy EJ and decreasing the charging energy EC. This qubit implementation is expected to have T2s similar to a tunable transmon qubit but, due to the isolated wavefunctions, has promise for long T1s that are insensitive to arbitrary forms of noise. This isolation, however, makes performing arbitrary quantum gates more difficult as wavefunction overlap also allows for arbitrary qubit operations. In this presentation, we will discuss methods for performing arbitrary quantum gates, the implications for decoherence due to flux noise, and discuss experimental progress.

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