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Properties and Gate Control of the 0-Pi Qubit, Part 2: Gate Control AGUSTIN DI PAOLO, ARNE L. GRIMSMO, University of Sherbrooke, PETER GROSZKOWSKI, JENS KOCH, Northwestern University, ALEXANDRE BLAIS, University of Sherbrooke — Coherence times of superconducting qubits have been improved by more than five orders of magnitude over the last fifteen years. This astonishing rise has been possible thanks to the identification and partial suppression of noise sources, as well as to new qubit designs. Inspired by the idea of topological protection, namely to store quantum information in a nonlocal fashion, the 0-Pi qubit design aims at robust protection from several types of noise. However, this natural protection has the side effect of making single-qubit control difficult. Specifically, exponential suppression of local-operator matrix elements between the computational states renders conventional means of single-qubit gates impractical. In this talk, we show how to overcome this challenge by use of novel gate schemes for the 0-Pi qubit, and predict achievable gate fidelities.

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