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Suppressing leakage by composition of pulses for single-qubit operations in a three-level system[1] JOYDIP GHOSH, MARK FRIESEN, SUSAN COPPERSMITH, University of Wisconsin-Madison — Many realizations of solid-state qubits are constructed from elements with more than two energy levels. The tunneling of quantum information to these additional energy levels, often called leakage errors, remains an impediment to devising high-fidelity quantum gate operations. Mitigating the leakage errors becomes more challenging if the couplings between the computational subspace and the leakage states are unknown, which is, in fact, the case for some semiconducting qubits. Here we propose an approach based on composition of pulses to suppress such leakage errors for a qubit encoded in a three-level system, and apply our theory specifically to the Charge Quadrupole (CQ) quantum dot qubit. The proposed scheme thus brings us one step closer to constructing a fault-tolerant quantum computer with solid-state elements.

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