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Double Occupancy Errors in Quantum Computing Operations: Corrections to Adiabaticity RYAN REQUIST, Stony Brook University, JOHN SCHLIEMANN, University of Basel, ALEXANDER ABANOV, Stony Brook University, DANIEL LOSS, University of Basel — We study the corrections to adiabatic dynamics of two coupled quantum dot spin-qubits, each dot singly occupied with an electron, in the context of a quantum computing operation. Tunneling causes double occupancy at the conclusion of an operation and constitutes a processing error. We model the gate operation with an effective two- level system, where non-adiabatic transitions correspond to double occupancy. The model is integrable and possesses three independent parameters. We confirm the accuracy of Dykhne's formula, a nonperturbative estimate of transitions, and discuss physically intuitive conditions for its validity. Our semiclassical results are in excellent agreement with numerical simulations of the exact time evolution. A similar approach applies to two-level systems in different contexts.

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