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Landau-Zener gates, errors, and refocusing CHRISTIAN HICKE, Michigan State Univ., LEA F. SANTOS, Dartmouth College, MARK DYKMAN, Michigan State Univ. — We study single- and two-qubit Landau-Zener (LZ) gate operations and their robustness with respect to errors. In LZ operations, the qubit energies pass through the frequency of the external field (a single-qubit gate) or past each other (a two-qubit gate) ¹. Of central interest is stability against errors in the qubit energies. Such stability is particularly important for quantum computers with perpetually coupled qubits, where the energies of individual qubits depend on the state of neighboring qubits. We study refocusing based on a single-qubit LZ operation where an appropriate pulse of resonant radiation is applied concurrently with a pulse that controls the qubit energy. With such refocusing, arbitrary single-qubit LZ operations should become insensitive to small variations of the qubit energies. We show that a two-qubit LZ swap in computers with perpetually coupled qubits is much more robust when considered with respect to the basis of exact one-excitation states, which are not fully confined to individual qubits. We study the effect of errors in single-qubit energies on the LZ swap.

¹M.I. Dykman and P.M. Platzman, *Quant. Inf. Comp.* **1**, 102 (2001); V.G. Benza and G. Strini, *Fortschr. Phys.* **51**, 14 (2003); B. Golding and M.I. Dykman, *cond-mat/0309147*; A.V. Shitov, D.A. Ivanov, and M.V. Feigel'man, *Eur. Phys. B* **36**, 263 (2003); K. Saito and Y. Kayanuma, *Phys. Rev. B* **70**, 201304 (2004).

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