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Evidence for the robustness of geometric quantum computation SHI-LIANG ZHU, MCTP and FOCUS Center, Department of Physics, Michigan University, PAOLO ZANARDI, ISI Foundation, Torino, Italy — The fact that geometric phases can be used to realize universal quantum computation (QC) is in itself a significant contribution to the field of quantum information that attracted a lot of attention. However, regarding to its realistic application, the key prediction that geometric quantum gates may have built-in fault-tolerant features has still the status of a conjecture. One of the main difficulties in proving, or rejecting, the above robustness conjecture is that one does not have a suitable model which allows a direct and "fair" comparison between geometrical and dynamical operations. Here we describe a model which can be used to attack this problem. The model analyzed is, in a sense, a hybrid between purely geometric gate and standard dynamic one. We find that the maximum of fidelity in the model corresponds to those cases in which the dynamic phase is zero. The results might be the first convincing evidence of the robustness of geometric QC. Our predictions can be, in principle, experimentally tested in already existing QC prototypes.

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