Abstract Submitted
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Efficient estimation of quantum error correction thresholds in the presence of errors outside the Clifford group[1] MAURICIO GUTIERREZ, KENNETH BROWN, Georgia Institute of Technology — Classical simulations of noisy stabilizer circuits are often used to estimate the threshold of a quantum error-correcting code (QECC). It is common to model the noise as a depolarizing Pauli channel. However, it is not clear how sensitive a code's threshold is to the noise model, and whether or not a depolarizing channel is a good approximation for realistic errors. We have shown that, at the physical single-qubit level, efficient and more accurate approximations can be obtained[2]. We now examine the feasibility of employing these approximations to obtain better estimates of a QECC's threshold. We calculate the level-1 pseudo-threshold for the Steane [[7,1,3]] code for amplitude damping and dephasing along a non-Clifford axis. The expanded channels estimate the pseudo-threshold more accurately than the Pauli channels. However, at the logical level, the Pauli channels result in states that are closer to the states after the realistic errors, which is consistent with results by Geller and Zhou[3]. This suggests that employing Pauli channels can actually result in very accurate approximations of a QECC's performance.

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[2]M. Gutierrez *et al.*, Phys. Rev. A. **87**, 030302(R) (2013).
[3]M.R. Geller and Z. Zhou, Phys. Rev. A **88**, 012314 (2013).

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