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Concatenated Stabilizer Dynamical Decoupling GERARDO PAZ SILVA, DANIEL LIDAR, University of Southern California — We show how to integrate concatenated dynamical decoupling (CDD) techniques with quantum error correction (QEC) codes: the two main strategies to protect quantum information from the decoherence induced by unwanted interaction with the environment. It has been shown that CDD can be used as a lower level protection layer against decoherence and improves the effective error rate of a physical gate, provided one assumes certain locality conditions (local bath assumption) [Ng, Lidar, Preskill, arXiv:0911.3202]. The typical CDD protocol uses pulses from a group of non-commuting operators to decouple to arbitrary order, in the sense of Magnus expansion, the state one wants to protect from the environment. Here, in the same spirit as [Lidar, Phys. Rev. Lett. 100, 160506 (2008)], we show how to decouple a state encoded in some stabilizer QEC code to arbitrary order by applying pulses from the stabilizer group of the QEC code. We demonstrate the technique for concatenated and non-concatenated QEC codes and show that, in contrast to the CDD case, (i) one can omit the local bath assumption, and (ii) has the freedom of simultaneously introducing evolution for the protected state.

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