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Channel Optimized Quantum Error Correction SORAYA TAGHAVI, USC, ROBERT KOSUT, DANIEL LIDAR — We develop a theory for finding quantum error correction (QEC) procedures which are optimized for given noise channels. Our theory accounts for uncertainties in the noise channel, against which our QEC procedures are robust. We demonstrate via numerical examples that our optimized QEC procedures always achieve a higher channel fidelity than the standard error correction method, which is agnostic about the specifics of the channel. This demonstrates the importance of channel characterization before QEC procedures are applied. Our main novel finding is that in the setting of a known noise channel the recovery ancillas are redundant for optimized quantum error correction. We show this using a general rank minimization heuristic and supporting numerical calculations. Therefore, one can further improve the fidelity by utilizing all the available ancillas in the encoding block.

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