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Controlling qubit drift by recycling error correction syndromes[1]

ROBIN BLUME-KOHOUT, Computing Science Research Institute, Sandia National Laboratories — Physical qubits are susceptible to systematic drift, above and beyond the stochastic Markovian noise that motivates quantum error correction. This parameter drift must be compensated – if it is ignored, error rates will rise to intolerable levels – but compensation requires knowing the parameters' current value, which appears to require halting experimental work to recalibrate (e.g. via quantum tomography). Fortunately, this is untrue. I show how to perform on-the-fly recalibration on the physical qubits in an error correcting code, using only information from the error correction syndromes. The algorithm for detecting and compensating drift is very simple – yet, remarkably, when used to compensate Brownian drift in the qubit Hamiltonian, it achieves a stabilized error rate very close to the theoretical lower bound. Against 1/f noise, it is less effective only because 1/f noise is (like white noise) dominated by high-frequency fluctuations that are uncompensatable.

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