Introduction to Quantum Error Correction and Fault-Tolerance

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Abstract.

Quantum superpositions are very delicate. Just looking at one will make it collapse into something that acts classically, and the environment is always trying to look (a process known as decoherence). Building a functioning quantum computer will almost certainly require some sort of fault-tolerant protocol so that individual errors and local decoherence do not poison the whole computation. I will describe the basic theory of quantum error correction and discuss how to make computations fault-tolerant. If the error rate is below some threshold value, arbitrarily long fault-tolerant quantum computations are possible.