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Quantum error correction below the surface code threshold

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Abstract

In this talk, I'll present an overview of our demonstration of quantum error correction below the surface code threshold (arXiv:2408.13687). Each time we increase the code to correct one extra error, the logical error rate is reduced by a factor of two. This culminates in a 101-qubit surface code with a logical error per syndrome extraction cycle of 0.143%. I'll touch on some promising developments (e.g. improved device performance, stability, leakage mitigation, real-time error correction) along with some of the challenges (e.g. an error floor around 10^{-10}) as we continue to scale.