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Reducing the overhead of quantum error correction

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Abstract: Fault-tolerant protocols and quantum error correction (QEC) are essential to building reliable quantum computers from imperfect components that are vulnerable to errors. Optimizing the resource and time overheads needed to implement QEC is one of the most pressing challenges that will facilitate a transition from NISQ to the fault tolerance era. In this talk, I will discuss two intriguing ideas that can significantly reduce these overheads. The first idea, erasure qubits, relies on an efficient conversion of the dominant noise into erasure errors at known locations, greatly enhancing the performance of QEC protocols. The second idea, single-shot QEC, guarantees that even in the presence of measurement errors one can perform reliable QEC without repeating measurements, incurring only constant time overhead.