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## Concepts for Fault-Tolerant Quantum Computing with Trapped Ions

*Thursday, 28 September 2023 09:00 (30 minutes)*

Quantum computers hold the promise to efficiently solve some computationally hard, classically intractable problems. Unfortunately, unavoidable noise limits the capabilities of current noisy intermediate-scale quantum (NISQ) devices. In my talk, I will first introduce basic concepts of topological quantum error correcting codes and quantum fault-tolerance, which is imperative to prevent errors from spreading uncontrollably through the quantum register. I will in particular discuss most modern fault-tolerant protocols that led to the first realisation of a universal set of logical quantum gates with trapped ions. Furthermore, I will highlight promising alternative approaches towards error-corrected quantum processors, based e.g. on code-switching, quantum machine-learning (so-called quantum auto-encoders) or new autonomous measurement-free, yet fully-fault-tolerant error correction protocols. Finally, I will outline promising pathways to scale up current trapped-ion architectures towards scalable, error-corrected trapped-ion quantum computers.

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