Special Issue on Quantum Error Correction and Fault Tolerance

Quantum technologies are maturing by the day and making exciting advances across computing, communications, networking, sensing, and beyond. The critical path to scaling these technologies for a practical advantage over classical systems involves the implementation of fault tolerant procedures. The most established fault tolerance framework uses quantum error correcting codes and decoders. The theory of quantum error correction has recently produced codes with optimal parameters that could potentially reduce the resource overhead of fault tolerance. However, several challenges remain to be addressed before these theoretical advances lead to scalable, fault tolerant, practical quantum systems. Besides computing, error correction techniques are necessary for other applications as well. The goal of this special issue is to invite previously unpublished work in the broad areas of quantum error correction and fault tolerance with connections to classical and quantum information theory. The topics include but are not limited to:

- Construction of quantum error correcting codes
- Fault tolerant logical operations
- Quantum low-density parity-check codes, algebraic codes, subsystem codes etc.
- Classical decoders for quantum codes
- Quantum algorithms for decoding classical codes
- Coding schemes for quantum repeaters in quantum networks
- Fundamental limits, e.g., resource overhead, parameter bounds, tradeoffs
- Error correction for robust quantum sensing
- Classical information/coding problems from quantum challenges
- Tailored error correction for quantum algorithms and hardware
- Entropic bounds for fault tolerant quantum systems

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