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Ion Trap Quantum Networks[1]

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Trapped atomic ions are among the most promising candidates for a future quantum information processor, with each ion storing a single quantum bit (qubit) of information. Trapped ion qubits enjoy an unrivaled level of quantum coherence, and small numbers of ions can be entangled through a suitable interaction with optical fields. The next generation experiments will transport and distribute trapped ion qubits to generate truly large-scale entangled quantum states. Several approaches for networking trapped ion qubits will be discussed, along with state-of-the-art experimental progress. This includes the use of phonons between ions in a Coulomb crystal, the physical shuttling of ions throughout complex and microfabricated ion trap structures, the coupling of remotely-located ions through a photonic coupling, and perhaps even the use of a cold (neutral) atomic gas.

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