

Distributed Quantum Information Processing

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Quantum information is an emerging science, the results of which influence many disciplines, ranging from cold atoms, condensed matter physics, to technology. It predicts spectacular applications like efficient prime factorization of integers and secure cryptography. For an efficient performance of such tasks, it is important to understand the flow of information distributed over macroscopic or mesoscopic systems, as well as that between separated systems. I will present necessary basic notions and tools of quantum information theory in general, and entanglement theory in particular. The connections between entanglement and quantum phase transitions will be discussed. I will also discuss possibilities of performing fault tolerant quantum computation using trapped ions.