LeRoy Apker Award Talk: Parallel State Transfer and Efficient Quantum Routing on Quantum Networks

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We study the routing of quantum information in parallel on multi-dimensional networks of tunable qubits and oscillators. These theoretical models are inspired by recent experiments in superconducting circuits using Josephson junctions and resonators. We show that perfect parallel state transfer is possible for certain networks of harmonic oscillator modes. We further extend our model to analyze the distribution of entanglement between every pair of nodes in the network, and find that the routing efficiency of hypercube networks is both optimal and robust in the presence of dissipation and finite bandwidth.

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