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Perfect mixed state quantum transport in correlated spin networks ASHOK AJOY, PAOLA CAPPELLARO, Massachusetts Institute of Technology — Spin-based quantum networks form an attractive physical setting for quantum information processing and simulation. We consider the transport of quantum states in arbitrarily large and complex spin networks, with applications to distributed quantum computing. Specifically, we consider transport through spin networks in the mixed-state, since they are the least experimentally demanding to produce in high-temperature laboratory settings. We analyze conditions on the interaction and propagators that allow perfect state transfer in such networks. We show that when there is more than one possible transport path through the network, it is necessary to phase correlate the transport processes occurring along each path. We provide a modified isotropic XY-Hamiltonian that achieves this correlation, and use it to derive engineered couplings for perfect transport in complicated network topologies. Finally, we show that this Hamiltonian can perfectly transfer mixed states, even in arbitrary networks, as long as the spins between which the transport occurs are weakly coupled to the remaining spins.

Ashok Ajoy
Massachusetts Institute of Technology

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