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Topologically Protected Quantum State Transfer NORMAN YAO, CHRIS LAUMANN, Harvard University, LIANG JIANG, ALEXEY GORSHKOV, California Institute of Technology, HENDRIK WEIMER, Harvard University, IGNACIO CIRAC, Max-Planck-Institut fur Quantenoptik, MIKHAIL LUKIN, Harvard University — Quantum state transfer between distant qubits forms an essential ingredient of any scalable quantum information processor. We propose and analyze a novel approach for quantum state transfer between remote spin qubits mediated by the edge mode of a chiral spin liquid. In previous approaches, the fidelity of quantum state transfer depends sensitively on disorder-induced eigenstate localization. To overcome this sensitivity to disorder, we investigate the topologically non-trivial phase of an exactly solvable 2D spin Hamiltonian, ultimately demonstrating the possibility of achieving robust, topologically protected quantum state transfer through the associated edge mode. Realistic imperfections, decoherence effects and generalizations are discussed.

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