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Quantum Information Transport in Nuclear Spin Chains. PAOLA CAPPELLARO, ITAMP-Harvard University and Smithsonian Astrophysical Observatory, Cambridge, MA 02138, USA, DAVID CORY, Massachusetts Institute of Technology, Department of Nuclear Science and Engineering, Cambridge, MA 02139, USA — In many solid-state proposals for quantum computers, the transport of information over relatively short distances inside the quantum processor itself is an essential task, and one for which relying on photons, and therefore on a frequent exchanging of information between solid-state and light qubits, could be too costly. Quantum wires based on spins could be a viable alternative leading to much theoretical work on quantum information transfer in linear spin chains. Experimental studies on nuclear spin systems in solid-state by NMR (the most natural implementation of such models) has been up to now prevented by the unavailability of the desired (Heisenberg) Hamiltonian, since the naturally occurring interaction assumes the dipolar form. We present here a similarity transformation between the Heisenberg Hamiltonian and an interaction which is achievable with the collective control provided by rf pulses in NMR. Not only this second Hamiltonian allows us to simulate the information transport in a spin chain, but it also provides a means to observe its signature experimentally. With this scheme it will be possible to study experimentally, in solid-state NMR systems, the transport of polarization beyond exactly solvable models.

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