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Initialization and Readout of Spin Chains for Quantum Information Transport GURNEET KAUR, PAOLA CAPPELLARO, Massachusetts Institute of Technology, MIT — Linear chains of spins acting as quantum wires are a promising approach to achieve scalable quantum information processors. Nuclear spins in apatite crystals closely emulate a one-dimensional spin chain, thus providing an ideal test-bed for the experimental study of quantum information transport by means of Nuclear Magnetic Resonance techniques. The natural dipolar interaction among the spins can be manipulated via the available collective NMR control to simulate the Hamiltonian capable of driving quantum transport. We present control protocols for initialization and readout of ^{19}F spin chains in Fluorapatite, even in the absence of single-spin addressability. We experimentally prepare and read out desired initial states for transport tasks, such as the simulation of single-spin excitation transport and a two-spin encoded state for quantum information transfer. Our control schemes enable experimental characterization of quantum transport in spin chains and will allow further studies of protocols for perfect fidelity transfer.

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