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【604】Domain wall qubits on magnetic racetracks

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We propose a scalable implementation of a quantum computer based on hardware-efficient mobile domain walls on magnetic racetracks. In our proposal, quantum information is encoded in the chirality of the spin structure of nanoscale domain walls. We estimate that these qubits are long-lived and could be operated at sweet spots reducing possible noise sources. Single-qubit gates are implemented by controlling the movement of the walls in magnetic nanowires, and two-qubit entangling gates take advantage of naturally emerging interactions between different walls. These gates are sufficient for universal quantum computing and are fully compatible with current state-of-the-art experiments on racetrack memories. Possible schemes for qubit readout and initialization are also discussed.

Theoretical Work

Theory

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