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Effects of randomness on a spin quantum data bus SANGCHUL OH, XUEDONG HU, Department of Physics, University at Buffalo, The State University of New York — A spin $1/2$ Heisenberg chain with an odd number of spins could be used as a quantum data bus between spin qubits. Here we study how random exchange couplings and external magnetic fields affect the information transfer capability of such a spin bus. We find that for small external magnetic fields, the energy gap between the two lowest levels is robust against randomness in exchange couplings, while effective qubit couplings are more susceptible to such randomness. On the other hand, randomness in the external magnetic field could cause a change in the bus ground state. We also explore how randomness in a spin bus affects the fidelity of various bus gates.

Sangchul Oh
Dept of Physics, University at Buffalo, The State University of New York

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