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Control of Transport Behavior in spin-1/2 Heisenberg Systems

LEA SANTOS, Yeshiva University — A complete understanding of transport behavior in many-body systems is one of the utmost challenges in fundamental studies of nonequilibrium statistical mechanics. In the classical domain, it is widely believed that chaotic systems should show diffusive transport, whereas integrability should be associated with ballistic transport. In the quantum domain, the conditions that determine specific transport behaviors are still under debate. Here, we analyze transport of local magnetization in finite spin-1/2 Heisenberg systems. By adjusting parameters in the Hamiltonian, these quantum systems may show both integrable and chaotic limits. We provide examples of chaotic systems leading to diffusive and also to ballistic transport. In addition, we develop schemes to control the transport behavior in these systems, showing that quantum control methods may be used to induce a transition from diffusive to ballistic transport.

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