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Diffusion and quantum spreading on complex graphs

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Data about complex systems often are schematized as graphs or networks; the study of the dynamics across the links and nodes in networks, which can describe e.g. information or energy flows, has become a popular and important topic in many scientific disciplines. We have studied classical Markovian diffusion and quantum spreading on several types of networks. We demonstrate that (i) quantum spreading can transverse a network exponentially faster than its classical counterpart; (ii) slowdown by static disorder is more pronounced for quantum spreading than for classical diffusion; (iii) diffusion properties are largely affected by the underlying topological structure of the network, while properties of quantum spreading are mostly determined by spectral structures.