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Quantum walks with ultracold atoms in optical lattices STUART VAN DER LEE, DAVID FEDER, University of Calgary — The behavior of several ultracold atoms (bosons or fermions) undergoing a quantum walk in a one-dimensional optical lattice is investigated numerically. Both discrete and continuous time quantum walks are implemented, the latter within the context of a tight-binding model. Because the quantum statistics place constraints on the overlap between different many-particle states, the Hamiltonian generates a one-particle quantum walk on a graph with vertices of higher degree. The results will be used to make predictions for experiments with ultracold atoms in optical lattices, as well as to explore fundamental issues related to quantum information, such as graph covering and the role of entanglement.

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