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Exploring topological phases with quantum walks[1] TAKUYA KITAGAWA, MARK RUDNER, EREZ BERG, EUGENE DEMLER, Harvard University
— The quantum walk was originally proposed as a quantum mechanical analogue of the classical random walk, and has since become a powerful tool in quantum information science. In this talk, we show that the dynamical protocols called discrete time quantum walks provide a versatile platform for studying topological phases, which are currently the subject of intense theoretical and experimental investigation. In particular, we demonstrate that recent experimental realizations of quantum walks simulate a non-trivial one dimensional topological phase. With simple modifications, the quantum walk can be engineered to realize all of the topological phases which have been classified in one and two dimensions. We further discuss the existence of robust edge modes at phase boundaries, which provide experimental signatures for the non-trivial topological character of the system. Reference: T.Kitagawa, M.Ruder, E.Berg, and E. Demler, Phys. Rev. A 82, 033429 (2010)

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