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Quantum walks under magnetic field

Quantum walks can be seen as the quantum counterpart of the classical random walk on lattice. They lead to a dynamic which is very different from the tight binding hamiltonian framework and its schrodinger equation. Other features from both systems can be compared and I mainly focus on the effect of a transverse magnetic field to the lattice. In the hamiltonian case, when we plot the energy of the system with respect to the magnetic flux, we obtain a fractal like pattern known as the "Hofstadter butterfly". This figure is the phase diagram of a topological insulator i.e systems where their physical properties are guided by number (invariant) insensitive to perturbation.
A quantum walk counterpart of these butterflies can be plotted but another topological invariant needs to be defined.
Eventually, I have reproduced in a recent paper an Arahanov-Bohm cage like effect for quantum walks, an unusual phenomenon of extreme localisation of the electron wavefunction when the magnetic flux is tuned to a precise value.

Field

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