Laser-induced topological edge states in a chain with four-band energy spectrum

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Abstract

Based on the theory of periodically driven quantum systems, a new pathway can be created to find topological phases by applying light on solid state systems. Here, we theoretically apply a linear laser beam to a one-dimensional lattice as a quantum wire. Using Floquet theory we study the quasi-energy of the system in a geometry with either finite or periodic boundary conditions. Topologically, the system has distinct phases depending on the laser intensity significantly. The results show that for different values of hopping dimerization and laser intensity the system hosts zero, one, two or three pairs of edge states. Furthermore, we evaluate appropriate topological invariants that for one, two, and three pairs of edge states take the values of 1, 2, and 3, respectively. Also, symmetry arguments show that there are time-reversal, particle-hole, chiral and parity symmetries. We also find that by breaking the parity symmetry, the edge states disappear resulting in this symmetry plays a key role.

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