Helical transport in coupled resonator waveguides

JungYun Han(jungyun5148@gmail.com)
PCS IBS, UST

Abstract

Topology connects the property of bulk with a quantized integer which is invariant under small deformation to the number of state in the edge of the system. Since bulk exhibits deformation resistivity, edge also can show robustness against small variations. Novel property along with topological property attracts people to involve in the work to realize disorder robust one-way transportation along the edge. So far, uni-directional one-dimensional edge transportation has been realized in two-dimensional resonator photonic platform by implying non-reciprocity. Here, we design a disorder-resistant one-dimensional coupled resonator optical waveguide (CROW) using synthetic pseudospin-momentum coupling. At critical energies, the optical field exhibits a pseudospin-momentum locking which is the basic ingredient for helical transport that suppresses disorder-induced backscattering. We show the resistance to disorder in two ways: First, we calculate the disordered eigenmodes' Anderson localization length ξ. We obtain an order of magnitude enhancement under typical device parameters. Second, we perform time-domain simulations of wavepacket propagation in the presence of disorder. We demonstrate that the pseudospin-momentum locking preserves the spatial shape without phase mixing. This work is promising in the sense of obtaining helical transport in smaller dimension with desired cost efficiency.

Keywords: *Helical transport, topology, waveguide, disorder, pseudospin*

References

[1] JY. Han, C. Gneiting, D. Leykam, arXiv:1902.06697

Biography

JY graduated from Yonsei University in 2015 and got a master's degree from Seoul National University in 2018. Now, JY is affiliated to center for theoretical physics of complex systems in institute for basic science as a PhD. student. JY is involving in the work on the topological property of quantum photonics, description of quantum systems interacting with the environment, and quantum information affected by gravity or relativistic observer.