Realization of Topological Anderson Insulators

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The discovery of topological insulators relying on spin-orbit coupling in condensed matter systems has created much interest in various fields, including in photonics. In two-dimensional electronic systems, topological insulators are insulating materials in the bulk, but conduct electric current on their edges such that the current is completely immune to scattering. However, demonstrating such effects in optics poses a major challenge because photons are bosons, which fundamentally do not exhibit fermionic spin-orbit interactions. The here presented idea, which constituted the first realization of a photonic topological insulator at optical frequencies relies on the Floquet principle. A honeycomb waveguide lattice – also called photonic graphene - is periodically driven in time such that a topological band gap is opened up at the Dirac points in the band structure [1]. Short after this first experiment another group reported imaging of topological edge states in silicon photonics [2]. These works have generated much follow up, among them – as one of the most intriguing one in the area of "topological photonics" – our first experimental observation of topological Anderson insulators (predicted in [3]), where a system becomes topological only when disorder is introduced [4]. The purpose of this talk is to review these developments and discuss new conceptual ideas.

REFERENCES

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