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Topological Photonic Systems

The discovery of topological light states unveiled a myriad of physical platforms wherein the wave propagation is impervious to perturbations of the propagation path and immune to back-reflections [1, 2].

In this talk, I will present an overview of our work on topological photonic systems [1-7]. In particular, I will highlight that there is a wide class of three-dimensional photonic systems – in some cases formed only by time-reversal invariant materials – wherein the transport of light is protected against back-scattering [4]. Specifically, an optical system invariant under the action of the composition of the parity, time-reversal, and duality operators (*PTD*) may enable bidirectional waveguiding immune to arbitrary deformations of the propagation path (see Fig. 1). Furthermore, I will discuss the consequences of the intriguing properties of topologically protected unidirectional edge states in the context of fluctuational electrodynamics. It will be shown that topological edge states may induce a circulation (with no net sinks or sources) of thermal (or zero-point) energy in closed orbits, such that the angular momentum of the electromagnetic field is nonzero [5]. Furthermore, the topological edge states may also induce a spontaneous lateral recoil force when an excited atom is placed in the vicinity of a topological material [6-7].

References

[1] M. G. Silveirinha, "Chern Invariants for Continuous Media", Phys. Rev. B, 92, 125153, 2015.

[2] M. G. Silveirinha, "Bulk-edge correspondence for topological photonic continua", Phys. Rev. B, 94, 205105, 2016.

[3] M. G. Silveirinha, "Z2 Topological Index for Continuous Photonic Materials", Phys. Rev. B, 93, 075110, 2016.

[4] M. G. Silveirinha, "PTD Symmetry Protected Scattering Anomaly in Optics", Phys. Rev. B, 95, 035153, 2017.

[5] M. G. Silveirinha, "Topological Angular Momentum and Radiative Heat Transport in Closed Orbits", Phys. Rev. B, 95, 115103, 2017.

[6] M. G. Silveirinha, S. A. H. Gangaraj, G. W. Hanson, M. Antezza, "Fluctuation-induced forces on an atom near a photonic topological material", arXiv:1711.04941

[7] S. A. H. Gangaraj, G. W. Hanson, M. Antezza, M. G. Silveirinha, "Spontaneous lateral atomic recoil force close to a photonic topological material", arXiv:1711.04939

Figures

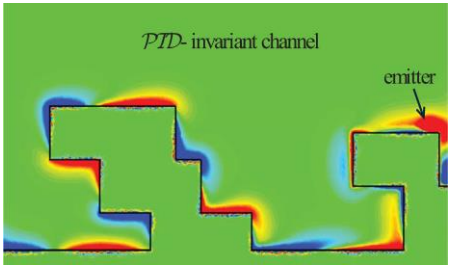

Figure 1: Waveguiding in a bi-directional PTD-invariant channel that supports edge waves protected against back-scattering.