Accessing topological boundary phenomena using photonic waveguide arrays

O. Zilberberg[1], Y. Lahini[2], M. Rechtsman[3]
[1] *Institute for Theoretical Physics, ETH Zurich, 8093 Zurich, Switzerland*
[2] *Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University*
[3] *Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802, USA*
E-mail: odedz@phys.ethz.ch

The introduction of topological concepts into photonics has opened up many exciting avenues of research [1]. Much of this activity has been focused on the experimental observation of topologically-protected edge states in systems ranging from photonic crystals and metamaterials in the microwave domain, to arrays of coupled waveguides, and integrated silicon ring resonators in the visible domain. In all of these works, spatially-periodic dielectric structures act as lattices for light which, in combination with an engineered synthetic gauge field, lead to topological photonic energy bands.

In my talk, I will review how one can directly image and probe the topological signatures appearing at the boundary of such samples. Specifically, I will present how the boundary modes of 1D [2, 3, 4] and 2D [5] topological pumps can be images using coupled photonic waveguide arrays, see Fig. 1.

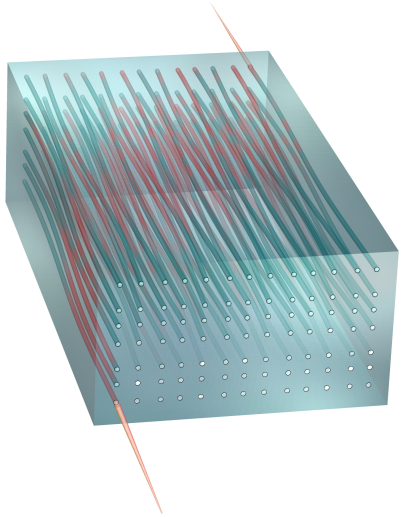

FIG. 1: An illustration of a 2D array of evanescently-coupled waveguides used in the experiment [5] with z-dependent waveguide spacings and 7×13 dimensions. Light is injected into the input facet of the device, it pumps across it during its propagation (due to the topological nature of the 2D pump), and is collected on the other side using a CCD camera.

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