COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

# Mathematical and Physical Aspects of Topologically Protected States

## May 1 - 3, 2017

**Department of Applied Physics and Applied Mathematics and Department of Mathematics**
**Columbia University**

## Organizers

| | |
|---|---|
| **Shi Jin** | University of Wisconsin-Madison |
| **Jianfeng Lu** | Duke University |
| **Michael I. Weinstein** | Columbia University |

## Confirmed Speakers

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|---|---|
| **Boris Altshuler** | Columbia University |
| **Andrea Alù** | University of Texas at Austin |
| **Jean V. Bellissard** | Georgia Institute of Technology |
| **Charles Fefferman** | Princeton University |
| **Jürg Fröhlich** | ETH Zurich |
| **Gian Michele Graf** | ETH Zurich |
| **Shi Jin** | University of Wisconsin-Madison |
| **Alexander B. Khanikaev** | City University of New York |
| **Michal Lipson** | Columbia University |
| **Terry Loring** | University of New Mexico |
| **Mitchell Luskin** | University of Minnesota |
| **Emil Prodan** | Yeshiva University |
| **Mikael C. Rechtsman** | Pennsylvania State University |
| **Marin Soljačić** | MIT |
| **David Vanderbilt** | Rutgers University |

A limited amount of funding for travel and lodging is available for young researchers from Ki-Net nodes**.**
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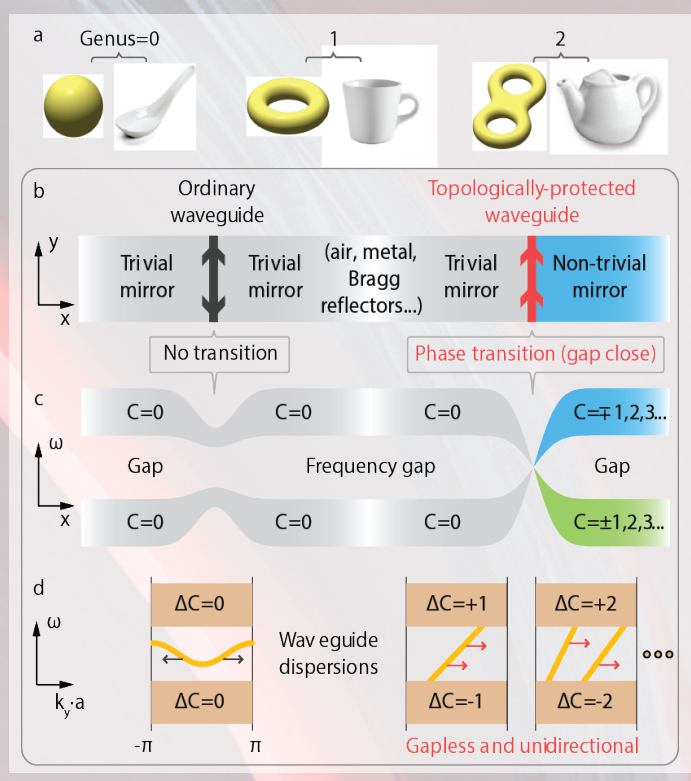


From "Topological photonics" by Ling Lu, John Joannopolous, and Marin Soljačić *Nature Photonics* **8,** 821–829 (2014)

## Scientific Background

The field of Topological Insulators (TI) has its origins in phenomena in condensed matter physics such as the Quantum Hall Effect, followed by theoretical and experimental work on 2D crystalline materials, e.g. graphene, and more recently three-dimensional TIs. A hallmark of TIs is the existence of uni-directionally propagating states, localized within 1D line defects or 2D facets created from the bulk TI. Such states and their propagation properties are robust against spatially localized (even large) perturbations.

With the recognition that many phenomena are related to the general properties of waves propagating in media with certain dispersion properties (e.g. periodic media with band structures having novel features such as symmetry-induced "Dirac points"), theoretical and applied physicists, and engineers have explored realizations of TI-like phenomena in, for example, photonics and acoustics.

The mathematical and theoretical approaches taken to study TIs range from the analysis of PDEs and tight-binding models, to index theory, to non-commutative geometry, and computational aspects of these subjects.

## Goals

This workshop will focus on recent developments in this area at the interface of mathematics and fundamental and applied physics. The workshop is aimed at a broad group of researchers, with a view toward promoting interactions between the communities of mathematicians, physicists, and engineers. The organizers aim for the introductory part of each talk to be tutorial (at the first year graduate level) before focusing on more recent developments.

Background image by Simon Stutzer