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Due to the recent discovery of topological insulators, it has been recognized that topology is indispensable in distinguishing phases of matter. Similarly, new optical material systems are being discovered with non-trivial topologies of their wave-functions in the momentum space, whose interfaces support novel states of light with ideal transport properties such as the robustness to large disorder or fabrication imperfections.

In this talk, I will show our experimental realizations and theoretical predictions of 2D and 3D photonic crystals with topologically protected edge and surface states. Specifically, I will discuss single and multimode one-way waveguides, the observation of Weyl points, and a nonsymmorphic 3D photonic crystal supporting a single Dirac cone surface state immune to random disorder. This research can be extended to phonons, plasmons and other bosons. These new degrees of freedom in bosonic band topologies promise wide exciting opportunities in both fundamental physics and technological outcomes.

Ling Lu is a professor in the Institute of Physics of Chinese Academy of Sciences in Beijing China.He obtained his bachelor in Physics in 2003 from Fudan University in Shanghai, China. He gothis Ph.D. in Electrical Engineering in 2010 at University of Southern California in Los Angeles. His thesis work, advised by Prof. John O’Brien, was on photonic crystal nanocavity lasers. He was a postdoc and later a research scientist in the Physics Department of Massachusetts Institute of Technology, where he worked with Prof. Marin Soljačić and John Joannopoulos and collaborated with Prof. Liang Fu. His current research focuses on topological photonics.

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: renminma@pku.edu.cn

北京大学物理学院凝聚态物理与材料物理所

Photograph by Xiaodong Hu