Scilight

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Crystal topological waveguides allow for the visualization of nanophotonic light flow

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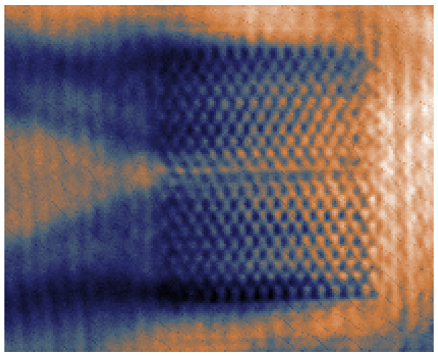
Understanding photon behavior in topological waveguides is an important step toward telecommunication applications.



Because of their potential telecommunication applications, it is essential to be able to characterize photonic behavior within topological waveguides. As a step toward this goal, Dubrovkin et al. used a scattering near-field imaging technique to map light flow in topological waveguides within the telecommunication frequency range.

“Topological waveguides are an emerging technology that can be used to implement optical interconnects with unprecedented levels of robustness,” said author Alexander Dubrovkin.

The group created valley photonic crystal (VPC) waveguides by combining two VPCs with opposite orientations of triangular air holes. The structure is hosted in a suspended semiconductor slab, which enables near-field imaging on the flat side of the device. To optimize the waveguides, they studied the effects of different lattice constants at the same excitation wavelength.

Using scattering-type scanning near-field optical microscopy, they tested the waveguide structure and directly observed the launching, guiding and out-coupling of light waves. They found the photons are strongly confined along the interface between the two VPCs.

“Our work demonstrates *in situ* nanoscale characterization of the light flow through such devices at the telecommunication frequency,” Dubrovkin said.

He noted their demonstrated approach can contribute to the design and optimization of robust on-chip topological waveguides and provides a method to image nanophotonic waveguiding in these structures. Because the optical resolution in this method is independent of wavelength, it can easily be transferred to shorter wavelengths within the visible spectrum.

Source: “Near-field mapping of the edge mode of a topological valley slab waveguide at λ=1.55 μm,” by Alexander M. Dubrovkin, Udvas Chattopadhyay, Bo Qiang, Oleksandr Buchnev, Qi Jie Wang, Yidong Chong, and Nikolay I. Zheludev, *Applied Physics Letters* (2020). The article can be accessed at https://doi.org/10.1063/5.0004390.