# Optically measuring the eigenstates of an exciton-polariton topological insulator

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**Abstract**

The introduction of the concepts of topology into physics has made it possible to define a new way of classifying states of matter. Topological classes are based on topological invariants taking integer values such as the Chern number. Measuring these topological invariants has only been achieved in a few systems featuring two topological bands as their computation requires a complete knowledge of the system eigenstates.
We present experiments using polariton lattices to investigate new concepts in topological photonics. We developed a new method to fully reconstruct the eigenstates of such lattices over the entire Brillouin zone. We modulate the real space amplitude and phase of the light emerging from the lattice using a spatial light modulator. Different modulations lead to different interference conditions and thus intensity distributions in Fourier space. From this, eigenvectors are entirely reconstructed.
Exciton-polariton honeycomb lattices with TE-TM and Zeeman splitting are predicted to have non-zero Chern numbers and chiral edge states. We performed the eigenstates spectroscopy of this four-band system. The measured eigenstates show several signatures of non-trivial topology including sublattice localization inversion. Berry curvature is then computed for every band and non-zero Chern number are obtained. Bulk-edge correspondence is also explored for various interfaces.

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