Topological photonics with ZnO

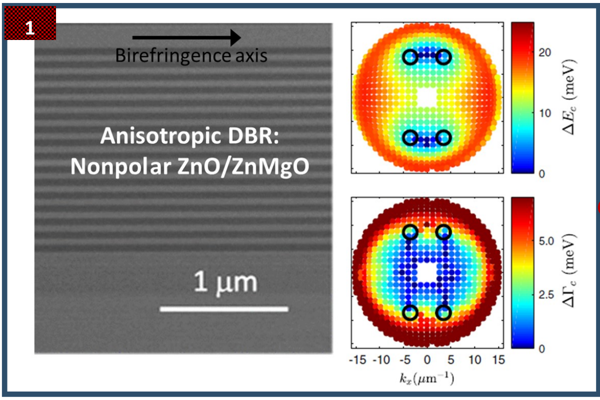

***Fig 1**: Cross-section SEM image of an anisotropic optical microcavity based on nonpolar ZnO/ ZnMgO DBR (left) displaying Voigt Exceptional points. Energy difference (top right) and FWHM difference (bottom right) between the two eigenmodes of the cavity as a function of in-plane momentum. The four exceptional points are indicated by*

Making planar optical microcavities "Exceptional"

Voigt points represent propagation directions in anisotropic crystals along which optical modes degenerate, leading to a single circularly polarized eigenmode.

By employing an appropriately-designed dielectric, anisotropic optical microcavity based on nonpolar ZnO/ZnMgO Bragg reflectors, we have been able to implement a non-Hermitian system and mimic thereby the behavior of Voigt points in natural crystals.

To prove the exceptional nature of these particular locations in momentum space, we have monitored the complex-square-root topology of the mode eigenenergies (real and imaginary parts) around the Voigt points. As illustrated in the figure above, when approaching the exceptional points the eigenergies of the two eigenmodes coalesce, and so do the eigenvectors (not shown). Polarization state analysis shows that these artificially - engineered Voigt points behave as vortex cores for the linear polarization and sustain chiral modes.

Breakthroughs

We have designed and fabricated a planar optical microcavity displaying exceptional points in momentum space.

Perspectives

Our findings apply to any planar microcavity with broken cylindrical symmetry and, thus, pave the way for exploiting exceptional points in optoelectronic devices such as VCSELs and resonant cavity light emitting diodes.

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