Ultranarrowband Chiral Absorbers Enabled by Brillouin Zone Folding

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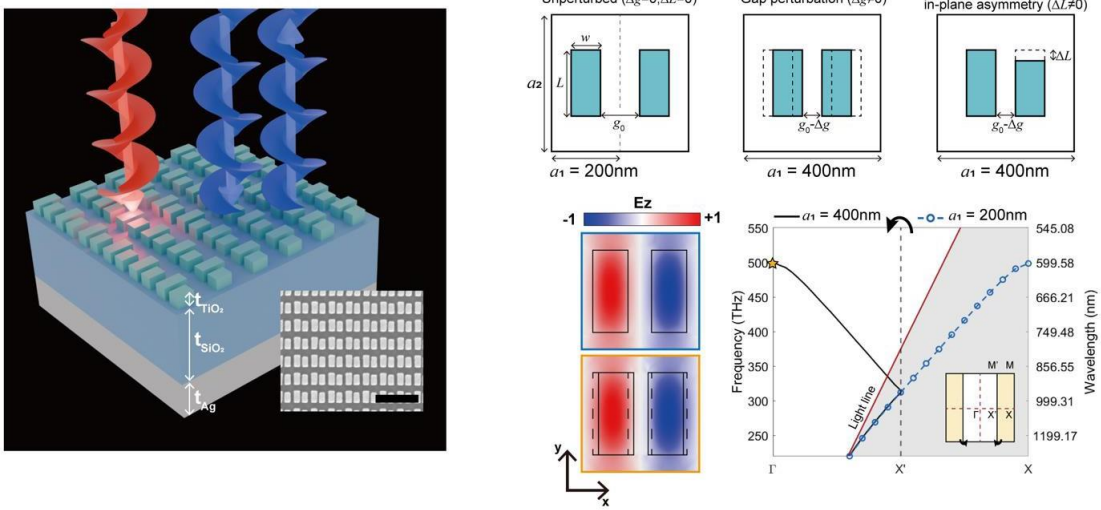
Chiral absorbers with strong selectivity and narrow spectral linewidths are highly attractive for controlling light-matter interactions. In this work, we demonstrate ultranarrowband chiral perfect absorbers operating in the visible range, based on planar TiO_2 metasurfaces utilizing Brillouin zone folding (BZF) and in-plane symmetry breaking. By engineering the unit cell to induce band folding and asymmetric resonances, we achieve high-Q guided-mode resonances with a differential absorptance (ΔA) of 0.75 and a linewidth of 1.4 nm at normal incidence. The absorber structure, composed of a TiO_2 dimer array on a SiO_2 spacer and Ag mirror, allows for highly selective enhancement of circularly polarized light absorption. Furthermore, we realize strong chiral photoluminescence by coating colloidal quantum dots onto the absorber surface, achieving a degree of circular polarization (DCP) of 0.72 with a narrow emission linewidth of 1.75 nm. This approach provides a simple and reliable platform for achieving visible-range chiral light control, with potential applications in chiral sensing, quantum photonics, and polarization-selective optoelectronics.



References

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