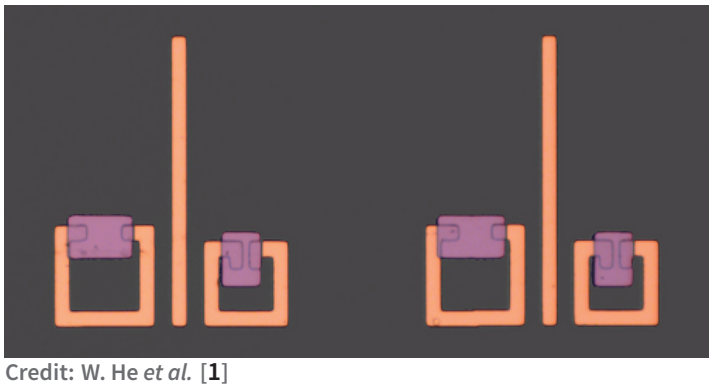
Flipping a Metasurface's Chirality

Illuminating a metasurface with a laser can enable the rapid modulation of the polarization of terahertz light transmitted through the metasurface.

By **Charles Day**

Photonic systems featuring an appropriate balance of gain and losses can host, under certain conditions, exceptional points (EPs)—singularities in the system's spectrum associated with exotic optical behavior. Different EPs have distinct traits, and switching between them controls a system's optical behavior. Now Tian Jiang of China's National University of Defense Technology and his collaborators have used EPs to flip a metasurface's transmission of terahertz radiation back and forth between right and left circular polarizations [**1**]. Thanks to the metasurface design, the switching was accomplished solely by adjusting the intensity of a laser probe.

The researchers fashioned their metasurface from a sheet of amorphous germanium on which they deposited an array of micrometer-scale structural elements made of gold. Each element consisted of a pair of square split-ring resonators of unequal size with a bar in between. When terahertz radiation struck the metasurface, it drove electronic oscillations in the resonators and bars, forming three coupled resonance modes.



Credit: W. He *et al.* [**1**]

Germanium's conductivity is sensitive to light. By adjusting the conductivity with a laser, the researchers changed the losses of the resonance modes and, in turn, the terahertz polarizations that were transmitted.

Jiang and his collaborators calculated the system's polarization eigenstates. Plotting them against the frequency of the terahertz radiation and the intensity of the laser probe revealed a pair of EPs, which corresponded to the transmission of right and left circular polarizations. The researchers confirmed the existence of the EPs and found they could switch between the EPs within a few picoseconds. Jiang foresees the new metasurface serving as a platform for exploring EP modulation and, more broadly, non-Hermitian physics, of which EPs are a much-investigated property (see **Viewpoint: Exceptional Sensing and Transport**).

Charles Day is a Senior Editor for ***Physics Magazine***.

REFERENCES

1. W. He *et al.*, "Loss-enabled chirality inversion in terahertz metasurfaces," **Phys. Rev. Lett. 134, 106901 (2025).**