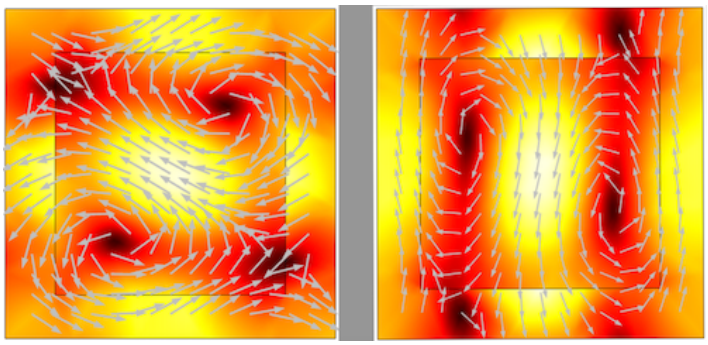
Birefringent Nanocubes Give Light a Circular Boost

An achiral metasurface selectively transmits two beams of opposite chirality.

By **Rachel Berkowitz**

If you shine a beam of unpolarized light at a noncubic crystal, two beams emerge from the other side. Materials like this are birefringent, meaning that their refractive index depends on the polarization and propagation direction of the light. Engineered surfaces can similarly trap and transmit light selectively, even creating a chiral beam from normally incident light. But can a birefringent surface result in two beams that affect one another's behavior? Bo Wang of the Institute of Physics of the Chinese Academy of Sciences and his colleagues now show that it can—and with an added twist [**1**]. The researchers developed a birefringent metasurface that, when hit with a beam of light, selectively transmits two beams of opposite chirality.

Wang and his team designed a transparent device consisting of a quartz substrate topped with a layer of lithium niobate that had been etched to create a lattice of nanocubes. They first showed that rotating the nanocubes' orientation by a small amount broke the surface's mirror symmetry. Calculations indicated that a beam of light interacting with this structure should result in two resonant modes whose wavelengths depend on the angle of rotation. Moreover, lithium niobate's intrinsic birefringence should induce coupling between the modes. Experiments verified the predicted transmission spectra of a 520-nm polarized beam, revealing two chiral resonances with opposite signs that result in significantly different extinction of left- and right-handed beams. Numerical simulations confirmed the chirality and coupling of these two modes. Wang says the design could be used to amplify chiroptical effects that are valuable in biosensing, quantum optics, and photochemistry.



Credit: B. Wang *et al.* [**1**]

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REFERENCES

1. B. Wang *et al.*, "Chiral resonant modes induced by intrinsic birefringence in lithium niobate metasurfaces," **Phys. Rev. Lett. 134, 113802 (2025).**