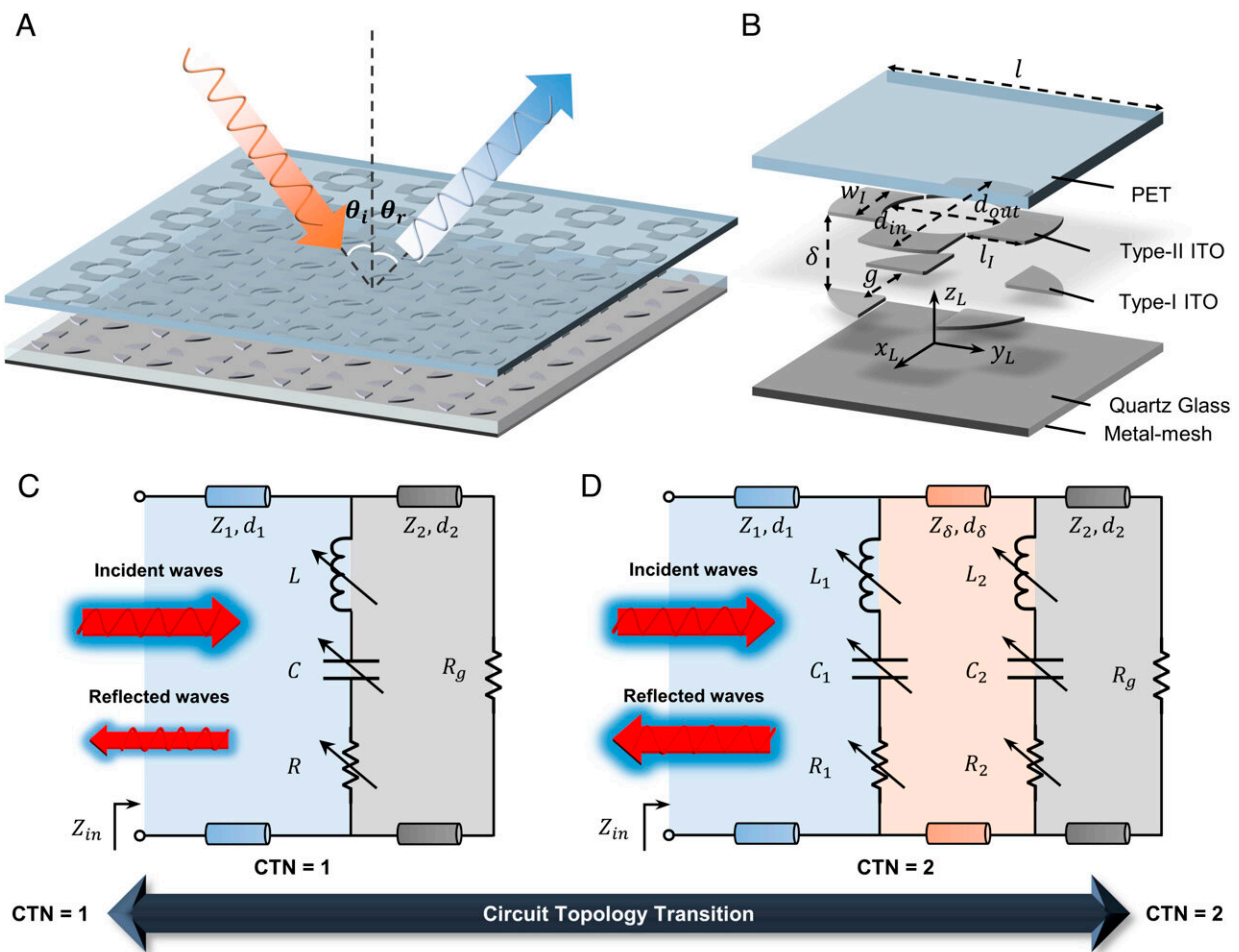


Metamaterial chimera nearly undetectable across visible light, microwave, and infrared spectra

February 8 2024, by Bob Yirka



The geometry and circuit topology transition of the Chimera metasurface. (A) The schematic view of Chimera metasurface. (B) The geometries of meta-atom. (C) the gapless case with strong absorption and (D) the hybrid-layer case with tunable interlayer coupling and continuously adaptive reflection. The CTN is the

abbreviation of the circuit topology number. Credit: *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2309096120

A multi-institutional team of optoelectronic and materials engineers in China has developed a type of metamaterial that is nearly invisible across visible light, microwave and infrared spectra. In their paper, [published](#) in *Proceedings of the National Academy of Sciences*, the group describes their inspiration for the material, how it was made and its performance when tested.

The researchers noted that most metamaterials developed to provide some degree of invisibility have been designed for just one purpose—making it difficult for people to see a hidden object with the [naked eye](#) or [night vision goggles](#). They set out instead to create a single metamaterial that could provide multiple types of invisibility. To that end, they looked to nature for inspiration.

The research team noted that the chameleon is adept at hiding in visible light. By blending into the background, it becomes difficult to see. They also noted that glass frogs are hard to spot due to their transparency. And bearded dragons have evolved to hide from predators with thermal sensing abilities.

Prior research has shown that metamaterials can provide invisibility via surfaces that have grooves or bumps designed to reflect electromagnetic waves in desired ways. For this new study, the researchers manipulated their material to reflect [visible light](#), [microwave](#) and infrared spectra in ways that mimic the chameleon, glass frog and bearded dragon. They call the result a metamaterial chimera, referring to the mythical amalgamation of the three animals they tried to mimic.

They used a five-step process to layer their material, each with its own invisibility characteristics and attributes. One layer, for example, reflected microwaves, another had circuitry that confers the illusion of transparency and yet another hid heat emissions using a mechanism to change the color of the metamaterial for cooling purposes.

Testing showed the material worked reasonably well and likely could prove useful for a wide variety of applications, from wildlife studies to [military applications](#).

More information: Zhao-Hua Xu et al, Chimera metasurface for multiterrain invisibility, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2309096120](https://doi.org/10.1073/pnas.2309096120)

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