Engineers Manipulate Color on The Nanoscale, Making it Disappear

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Most of the time, a material's color stems from its chemical properties. Different atoms and molecules absorb different wavelengths of light; the remaining wavelengths are the "intrinsic colors" that we perceive when they are reflected back to our eyes.

So-called "structural color" works differently; it's a property of physics, not chemistry. Microscopic patterns on some surfaces reflect light in such a way that different wavelengths collide and interfere with one another. For example, a peacock's feathers are made of transparent protein fibers that have no intrinsic color themselves, yet we see shifting, iridescent blue, green, and purple hues because of the nanoscale structures on their surfaces.

Penn engineers have now developed a system of nanoscale semiconductor strips that uses structural color interactions to eliminate the strips' intrinsic color entirely.

The study, published in Nature Communications, was led by Deep Jariwala, assistant professor in the Department of Electrical and Systems Engineering, along with lab members Huiqin Zhang, a graduate student, and Bhaskar Abhiraman, an undergraduate.

The researcher's experimental system consists of nanoscale strips of a two-dimensional semiconductor, tungsten disulfide, arranged on a gold backing. These strips, only a few dozen atoms thick, are spaced out at sub-optical wavelength sizes, allowing them to give off the type of structural color seen in butterfly wings and peacock feathers.

"Other nanophotonics researchers have previously shown before that structural color and these intrinsic absorptions can interact; this is called 'strong coupling.' However, no one has seen this kind of disappearance before, especially in a material that is otherwise supposed to absorb nearly 100% of the light," Jariwala says.

Read the original article on University of Pennsylvania.