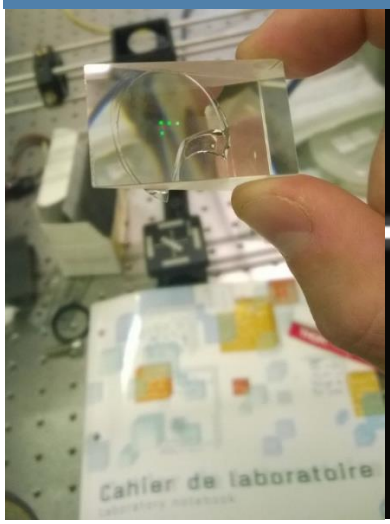
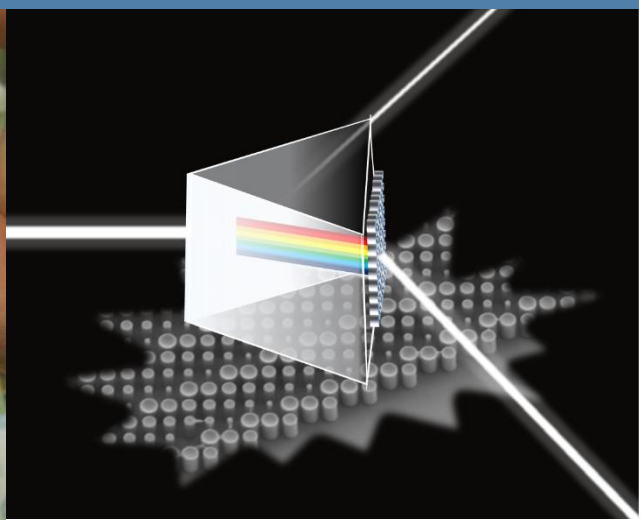
Hybrid-metasurfaces

NANO





Metasurfaces can successfully mitigate the dispersion of refractive optical components leading to new achromatic applications in the visible wavelength.

Metasurfaces reorganize dispersed rays and restore the color of light

Metasurfaces control various properties of light via scattering across a large number of subwavelength-spaced nanostructures. Wavelength-dependent diffraction and resonant scattering effects usually limit their working operation wavelengths. In refractive optics, chromatic dispersion is a significant problem and is generally treated by cascading multiple lenses into achromatic doublets, triplets, and so on. Recently, broadband achromatic metalenses in the visible have been proposed to circumvent chromatic aberration but their throughput efficiency is still limited.

Here, the dispersion of refractive components is corrected by leveraging the inherent dispersion of metasurfaces. Hybrid refractive-metasurface devices, with nondispersive refraction in the visible, are experimentally demonstrated. The dispersion of this hybrid component, characterized by using a Fourier plane imaging microscopy setup, is essentially achromatic over about 150 nm in the visible.

Breakthroughs

We show that the diffractive properties of simple phase gradient metasurfaces are sufficient to mitigate the dispersive behavior of a prism. Coupling it with phase gradient metasurfaces, we obtain identical refraction angle for all colors within a certain range of wavelength around the designed frequency. We extend this study to the design of a metasurface planar-convex lens

Perspectives

Addressing the problem of chromatic dispersion in multilayer/cascaded optical systems, these hybrid metasurface devices could challenge the performances of binary optics designs.

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