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Dielectric Metasurface For Achromatic Imaging Applications

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DESCRIPTION

Metasurface can use artificial microstructures to manipulate electromagnetic waves more accurately and flexibly. All-dielectric metalens have a wide range of materials and low cost so it has a wide application prospect.We propose a all-dielectric achromatic metalens that can operate over a broadband of wavelengths in the visible region. It controls the wavefront of light through the Pancharatnam-Berry phase and propagation phase to eliminate the chromatic aberration. Meanwhile, we also use Gerchberg-Saxton algorithm and its improved algorithm to iterate over multiple design wavelengths and obtain holographic phases suitable for broadband. Thus, both the metalenses and holographic metasurfaces can achieve achromatic broadband in the visible light range, which provides a new method for the development of meta-optical imaging devices.

Metasurfaces are artificial ultra-thin microstructures to easily control electromagnetic waves including their amplitude, phase, and polarization.

Compared with traditional optical elements, the advantages of metasurfaces are not only the subwavelength thickness in size, but also the higher accuracy and flexibility from the visible domain, infrared domain to the microwave domain. Metasurfaces have excellent potentials in many light modulation applications, such as polarization control, metalens , vortex-beam generators , nonlinear optics , color printing and holography . The regulation of electromagnetic waves depended on the electromagnetic resonance effect of the typical metasurfaces, which usually required the noble metals in the structures so that they cause large intrinsic Ohmic loss when applied to the full light wave domain. Hence, all-dielectric metasurfaces are proposed to overcome the loss shortcoming, and they achieve high and uniform transmittance to realize the practical application functions. More recently, achromatic metalenses as the typical subject of metasurfaces could achieve diffraction limited achromatic focusing by modulating optimized amplitude, phase, and polarization for high-resolution holograpic imaging. There are many wavefront modulation methods to achieve these significant achromatic metasurfaces, such as transmission phase, geometric phase, resonance phase, or joint control of geometric phase and transmission phase etc. However, there is a great challenge to design an achromatic metalens that is able to eliminate the chromatic effect over a broad band of wavelengths in the visible region to achieve high performance full-color achromatic imaging applications.

The basic principle of achromatic and the phase modulation method that combines the Pancharatnam-Berry (PB) phase with the propagation phase. We use the phase superposition principle of structural units to construct a metalens that can achromatize in the visible light band, which is composed of a square all-dielectric periodic arrangement of micro-nano units. We compared the focusing results of a metalens using only PB phase modulation with a metalens using both PB phase and propagation phase modulation to verify the effectiveness of using two phase modulations. We also investigate different phase recovery algorithms(PRA) with multi-wavelength iterations to achieve achromatic imaging in continuous optical bands. This work will help to broaden the applicable frequency band of holographic phase plates. To start with, we concentrate because of its mathematical and rotational boundaries on the spread and period of occurrence light. As per the standard of stage cross-over, the PB stage is joined with the engendering stage to acquire fixed stage control and leftover stage control, individually

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CONFLICT OF INTEREST

The author declares there is no conflict of interest in publishing this article.

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