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Integration of Polarization States and Color Multiplexing through a Singular Metasurface

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Abstract : Photonics research continues to push the boundaries of optical science, and the development of metasurface technology has emerged as a transformative force in this domain. The work presents the intricacies of a unified metasurface design tailored for efficient polarization and color control in optical systems. The proposed unified metasurface serves as a singular, nanoengineered optical element capable of simultaneous polarization modulation and color encoding. Leveraging principles from metamaterials and nanophotonics, this design allows for unprecedented control over the behavior of light at the subwavelength scale. The metasurface's spatially varying architecture enables seamless manipulation of both polarization states and color wavelengths, paving the way for a paradigm shift in optical system design. The advantages of this unified metasurface are diverse and impactful. By consolidating functions that traditionally require multiple optical components, the design streamlines optical systems, reducing complexity and enhancing overall efficiency. This approach is particularly promising for applications where compactness, weight considerations, and multifunctionality are crucial. Furthermore, the proposed unified metasurface design not only enhances multifunctionality but also addresses key challenges in optical system design, offering a versatile solution for applications demanding compactness and lightweight structures. The metasurface's capability to simultaneously manipulate polarization and color opens new possibilities in diverse technological fields. The research contributes to the evolution of optical science by showcasing the transformative potential of metasurface technology, emphasizing its role in reshaping the landscape of optical system architectures. This work represents a significant step forward in the ongoing pursuit of pushing the boundaries of photonics, providing a foundation for future innovations in compact and efficient optical devices.

Keywords : metasurface, nanophotonics, optical system design, polarization control
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