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Spotlight on "Diffractive Waveplate Arrays"

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Spotlight summary:

Diffractive waveplates arrays open new avenues to light beam manipulation

Manipulation of light beams traditionally has been performed by using lenses, prisms, waveplates, and other discrete components. With such bulky elements, we have a rather limited ability to implement complex optical systems, where light beams can be switched, steered, (de)focused, and reconfigured arbitrarily. Much higher flexibility is gained by utilizing photonic metasurfaces that can be engineered at the nanoscale. Among these, diffractive waveplates can be potentially designed to realize all types of optical beam transformation. With respect to conventional devices, such as Fresnel lenses or phase plates, the optical functionality of diffractive waveplates is related to the molecular orientation pattern of their structure (and not to structure discontinuities), offering the possibility to realize much more complex geometries.

In this work, S.V. Serak and coworkers gather the most recent advances in the development of new-generation diffractive waveplate arrays. Advanced functionalities, like high-resolution beam shapers and vector vortex waveplates, are demonstrated by designing highly complex architectures made of several overlapped waveplate arrays. High tunability of these devices is achieved by using

low-voltage electrical signals to control the orientation of a liquid crystal layer of only a few microns in thickness, thus achieving extremely compact beam steering devices, tunable lenses, and controllable polarization filters. Furthermore, large-area diffractive waveplate arrays are realized on arbitrary (even flexible) substrates by fast and low-cost fabrication processes.

It seems that diffractive waveplate arrays have the right stuff to revolutionize electro-optical devices in many fields of application, such as displays, smart windows, optical communications, beam shaping, and optical communications. A new avenue is open…

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