PURDUE INNOVATES | Office of Technology Commercialization

Time-Varying Metasurfaces Technology for Novel Applications

Time-varying optical metasurfaces enable a new class of magnetic-free optical isolators and tunable planar devices for optical communications and laser cooling applications.

The inception of optical metasurfaces has enabled the development of planar optical devices such as planar lenses. Optical metasurfaces have been used to implement numerous planar devices including light bending and planar lenses. All these metasurfaces are based on phase discontinuity, which is spatially varying along the metasurface, and this variant phase allows for several functionalities that were only previously available via bulky curved structures. However, the strength of metasurfaces with time-variant phase modality remains unexplored, creating a need for more improvements in the field.

Researchers at Purdue University have developed a time-varying, optical metasurface technology to obtain a new class of planar optical devices, which includes tunable versions of planar devices obtained by space variant metasurfaces. The impact of time-varying metasurfaces exceeds tunable devices and new physical effects are obtained. Time-varying metasurfaces exhibit a more universal form of Snell's relation not limited by Lorentz reciprocity, enabling the building of magnetic-free optical isolators. In addition, these metasurfaces allow for wavelength modulation, which can be utilized to build frequency or phase modulators, or they can be used to control energy eigenstates of single photons in quantum experiments

Advantages:

-Time-variant phase modality

-Enables magnetic-free optical isolators

-Wavelength modulation

Potential Applications:

Technology ID

2016-KILD-67239

Category

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Computing/Photonic & Optical Computing Technologies

Authors

Alexander Kildishev

Vladimir Shalaev

Amr Mohammad E Shaltout

Further information

Will Buchanan

wdbuchanan@prf.org

View online

-Tunable planar lenses

-Optical communications

-Laser cooling

TRL: 3

Intellectual Property:

Provisional-Patent, 2015-07-13, United States | Utility Patent, 2016-07-13, United States | CON-Gov. Funding, 2021-07-28, United States

Keywords: Optical metasurfaces, planar optical devices, time-varying metasurfaces, phase discontinuity, magnetic-free optical isolators, wavelength modulation, frequency modulators, phase modulators, quantum experiments, tunable planar lenses