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Flat and conformal optics with dielectric metasurfaces

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Flat optical devices based on lithographically patterned sub-wavelength dielectric nano-structures provide precise control over optical wavefronts, and thus promise to revolutionize the field of free-space optics. Here, I have discussed our work on high contrast transmit-arrays and reflectarrays composed of silicon nano-posts located on top of low index substrates like silica glass or transparent polymers. Complete control of both phase and polarization is achieved at the level of single nano-post, which enables control of the optical wavefront with sub-wavelength spatial resolution. Using this nano-post platform, we demonstrate lenses, wave-plates, polarizers, arbitrary beam splitters and holograms. Devices that provide multiple functionalities, like simultaneous polarization beam splitting and focusing are implemented. By embedding the metasurfaces in flexible substrates, conformal optical devices that decouple the geometrical shape and optical function are shown. Multiple flat optical elements are integrated in optical systems such as planar retro-reflectors and Fourier lens systems with applications in ultra-compact imaging systems. Applications in microscopy and the prospects for tunable devices are discussed.

Biography

Amir Arbabi is currently a Senior Researcher at Caltech. From January 2017, he will be an Assistant Professor at the University of Massachusetts, Amherst. He received PhD degree in Electrical Engineering from University of Illinois at Urbana-Champaign. He has authored and coauthored over 70 papers in peer reviewed journals and conferences. His current research interests include photonic integrated circuits and on-chip integration of free space optical elements and systems.

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