Metasurface Optics for Ultra-Compact Augmented Reality Visors

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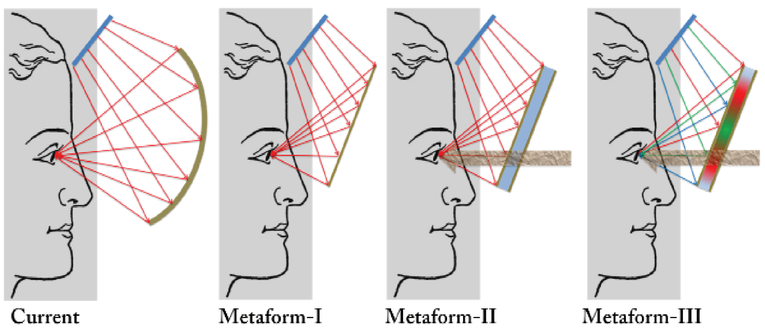
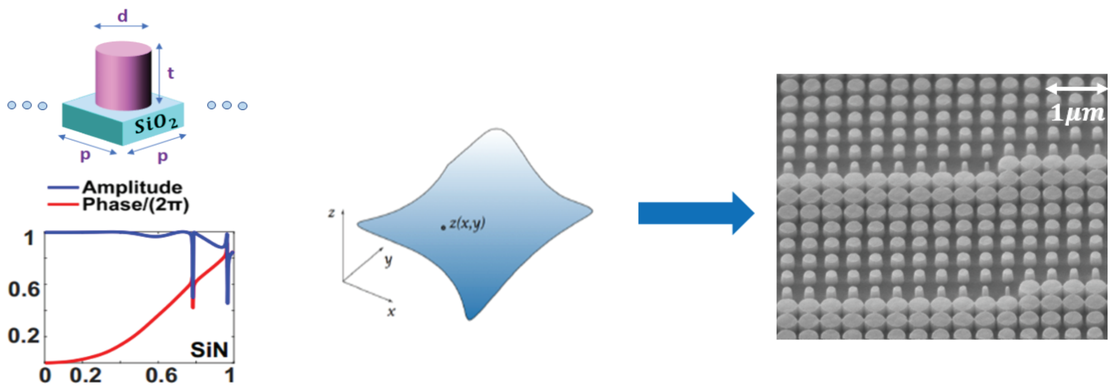
Abstract

The next generation of metasurface near-eye visors which will circumvent real-world distortions and provide a large field of view, as needed for an immersive AR experience is designed.

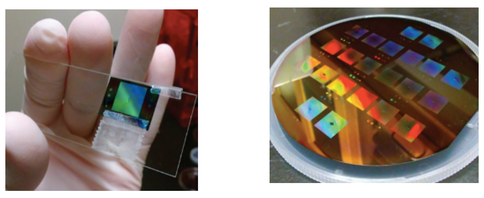


Background



Bayati, Elyas, Appl. Opt. (2019)

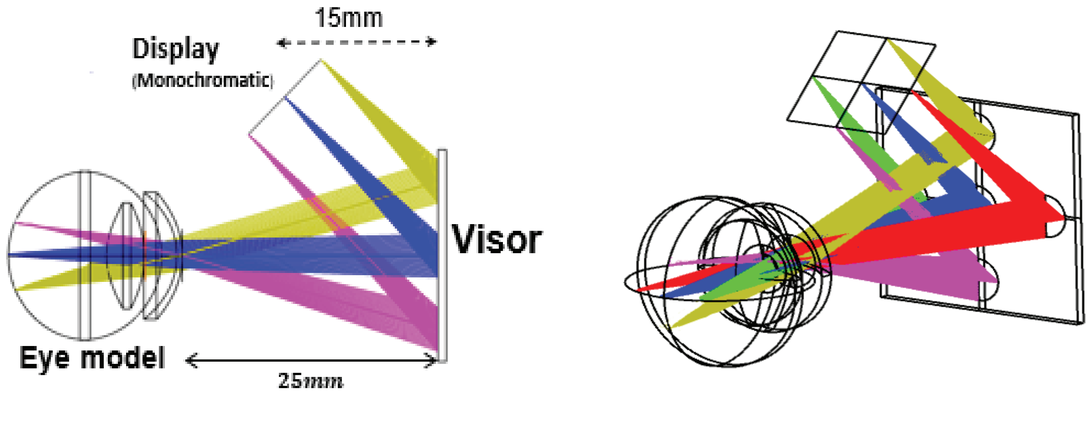
• Metasurfaces are quasiperiodic arrays of subwavelength optical antennas, which can arbitrarily modify the phase, amplitude, or polarization of an incident optical wave-front
• We can shape and convert any optical freefrom shape to a surface of these nanoscatteres



Colburn,Shane, Optica. (2018)

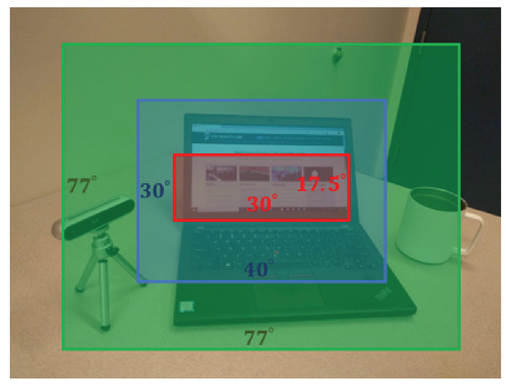
• Large area metasurfaces in large scale can be fabricated

Metaform I Visor



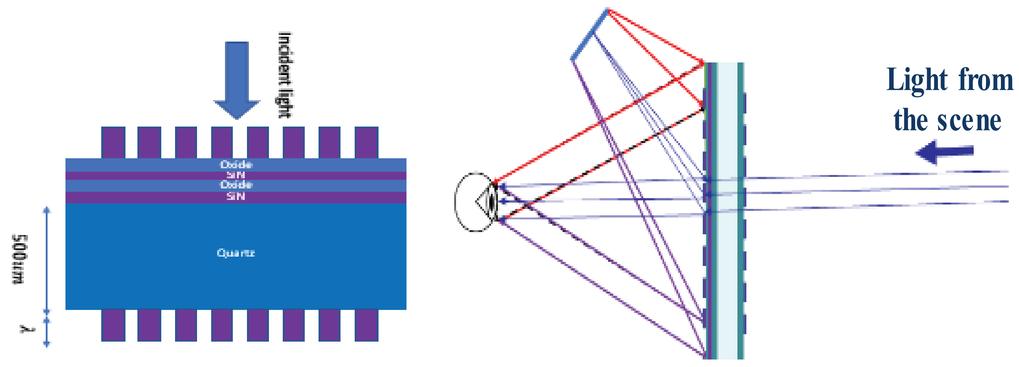
• A phase mask for single visor is designed to guide light from the display to the eye.
• The use of metasurfaces, allow very large bending angle, allowing large field of view (more than 77 degrees) when placed only 2.5 cm away from the eye

Hololens I
Magic Leap One
Metaware Visor

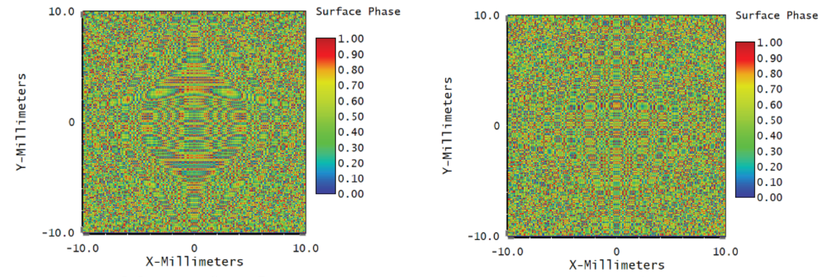


• Better Field of View compare to current existing AR

Metaform II Visor



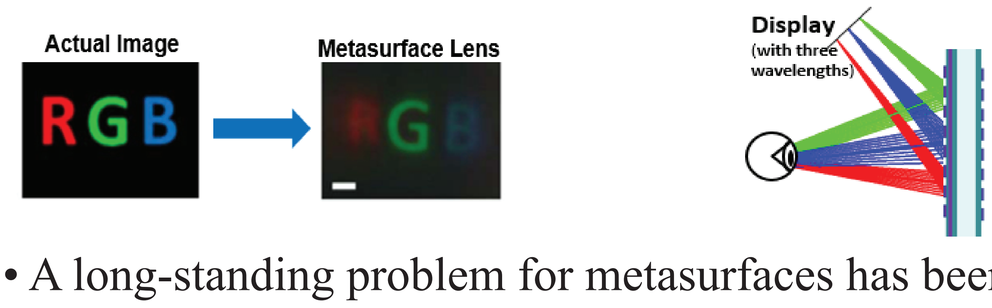
• A composite metasurface is developed to improve the see-through quality
• Use of another metasurface to correct any distortion of the real-world caused by the first metasurface



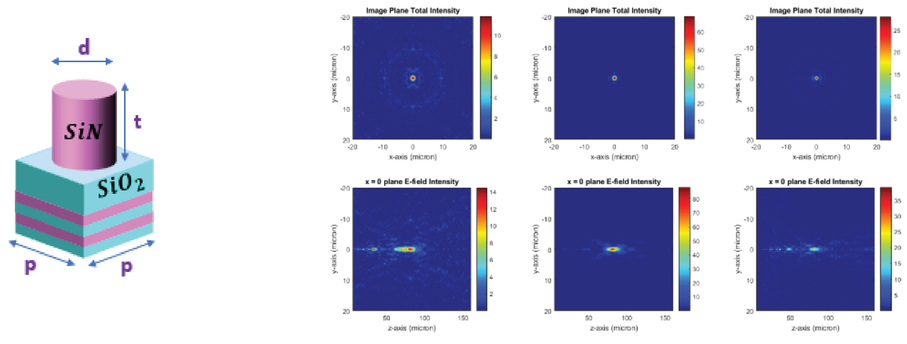
Metasurface I *Metasurface II*

• Optimized phases for composite metasurface visor
• RMS wavefront error for metasurface visor (0.63λ) can be much smaller than current freeorm visors (1.17λ)

Metaform III Visor (Future work)



• A long-standing problem for metasurfaces has been their strong chromatic aberrations (rainbow effect)
• Chromatic aberration can be solved using computational imaging and performing dispersion engineering



Acknowledgements

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