National Aeronautics and Space Administration

FY23 Innovative Spontaneous Concepts Research and Technology Development (ISC)

Visible Metasurfaces for Astronomical Cornographs

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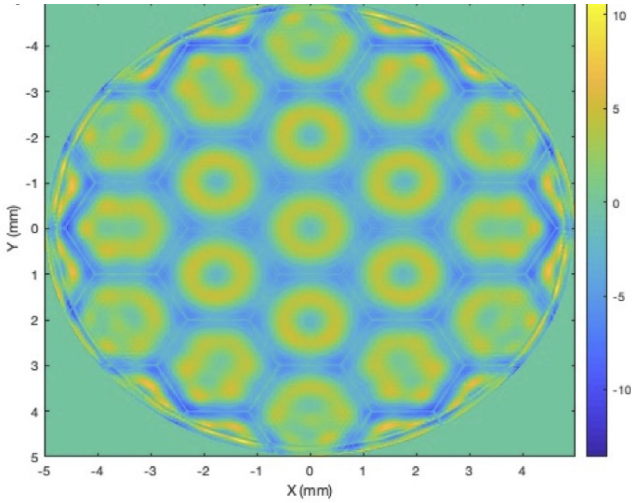
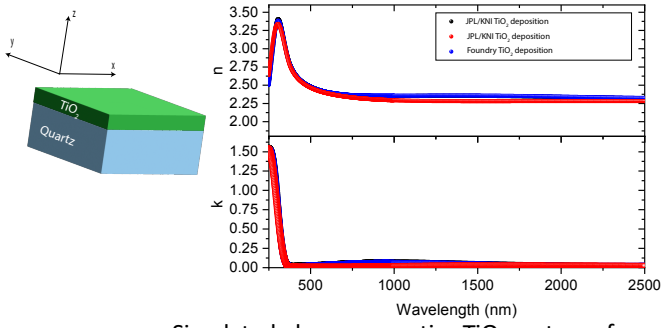
- High contrast imaging coronagraphs are a key technology to support the development of an unobstructed 6 meter space telescope.
- NASA's future segmented aperture coronagraphs require broadband starlight suppression of 10 orders of magnitude and closed-loop phase control to 10 pm accuracy
- Achromatic pupil-plane geometric phase masks enable coronagraphs to achieve the design performance of unobstructed monolith telescopes with arbitrary
- segmented apertures.
- Phase masks based on meta-surfaces have been considered a contender technology as they enable the required advances in wavefront sensing and control.
- To achieve this, high thruput meta-surfaces at visible wavelength with broadband operation is required.

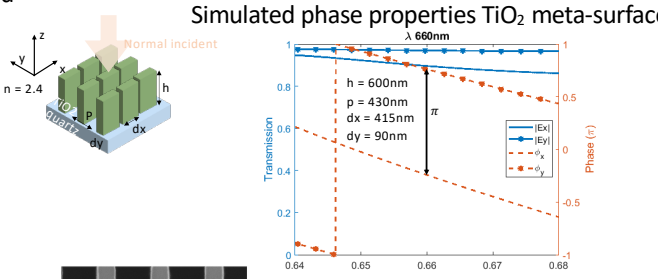


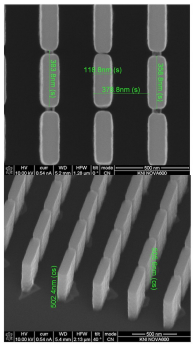
The design orientation of the pupil plane metasurface nano-posts which will impart an achromatic geometric phase to the wavefront upstream of a vector vortex coronagraph, optimized here for a segmented, unobstructed telescope aperture, as could be used for the high-priority Decadal recommended 6 m telescope

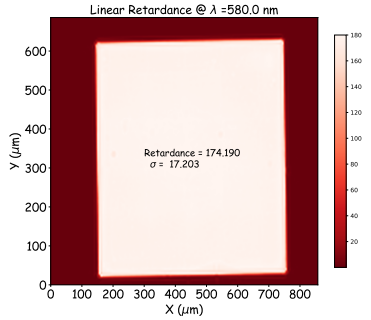
Deposited TiO2 film real and imaginary part of the refractive index for films deposited at JPL/KNI facility (Black and Blue) versus a TiO2 thin film deposited from a vendor (Red curve)



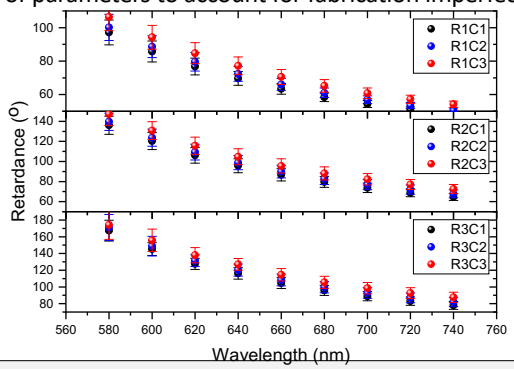
Simulated phase properties TiO_2 meta-surfaces







Measured retardance for different metasurfaces with different set of parameters to account for fabrication imperfections



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