

Controlled generation and imaging application of Poincaré sphere beams via all-dielectric metasurface

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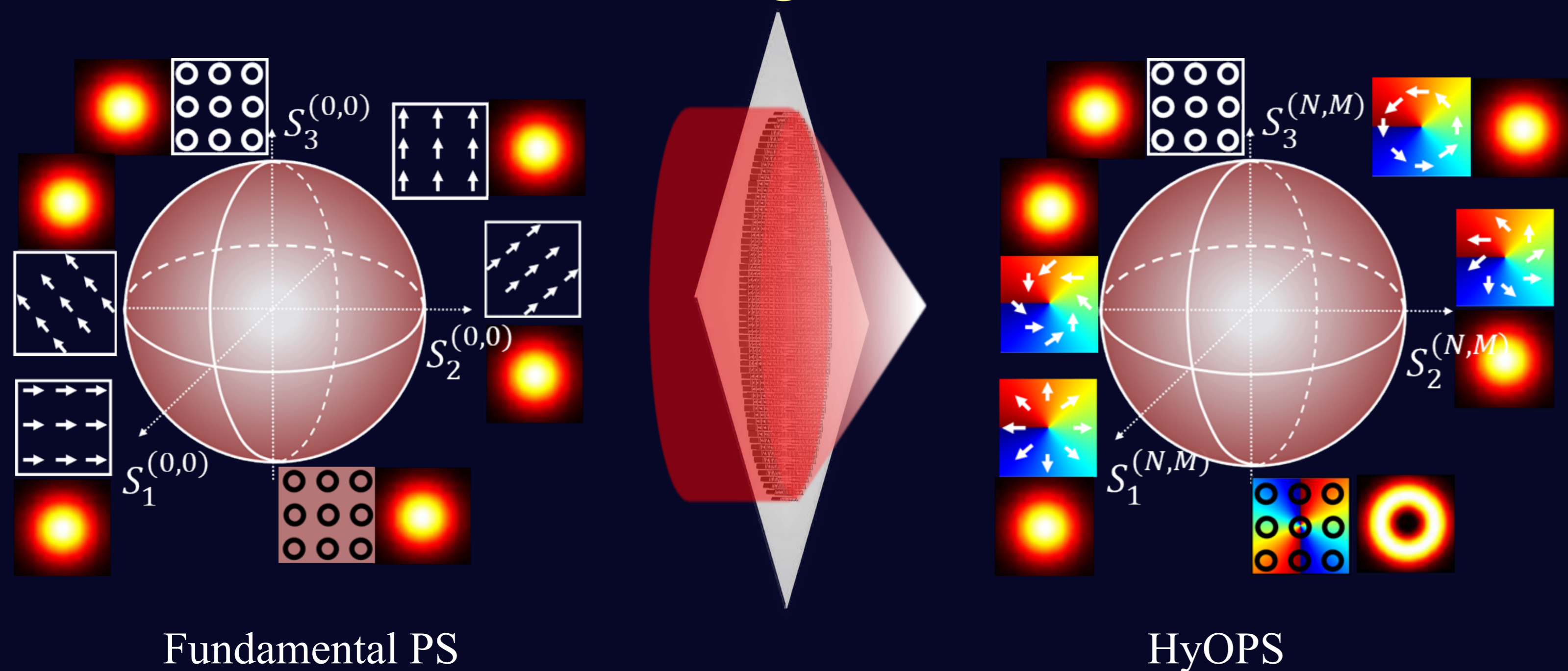
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Abstract Here, we present a unified design method of the all-dielectric metasurfaces so that arbitrary vector vortex beams on a HOPS or HyOPS can be controlled generated and highly focused with a numerical aperture (NA). Then, we demonstrate some metasurface samples which can generate and tightly focus the 0-1-order and 0-2-order HyOPS beams with a NA of 0.89. Finally, a high-magnification (58X) and subwavelength-resolution (0.7λ) microscope is demonstrated by utilizing the 0-1-order HyOPS beams sample as an objective lens. Benefiting from the tunability of the topological charge carried by the focal field, the imaging mode of the microscope can be tune from bright field mode to edge-enhancement mode.

Background



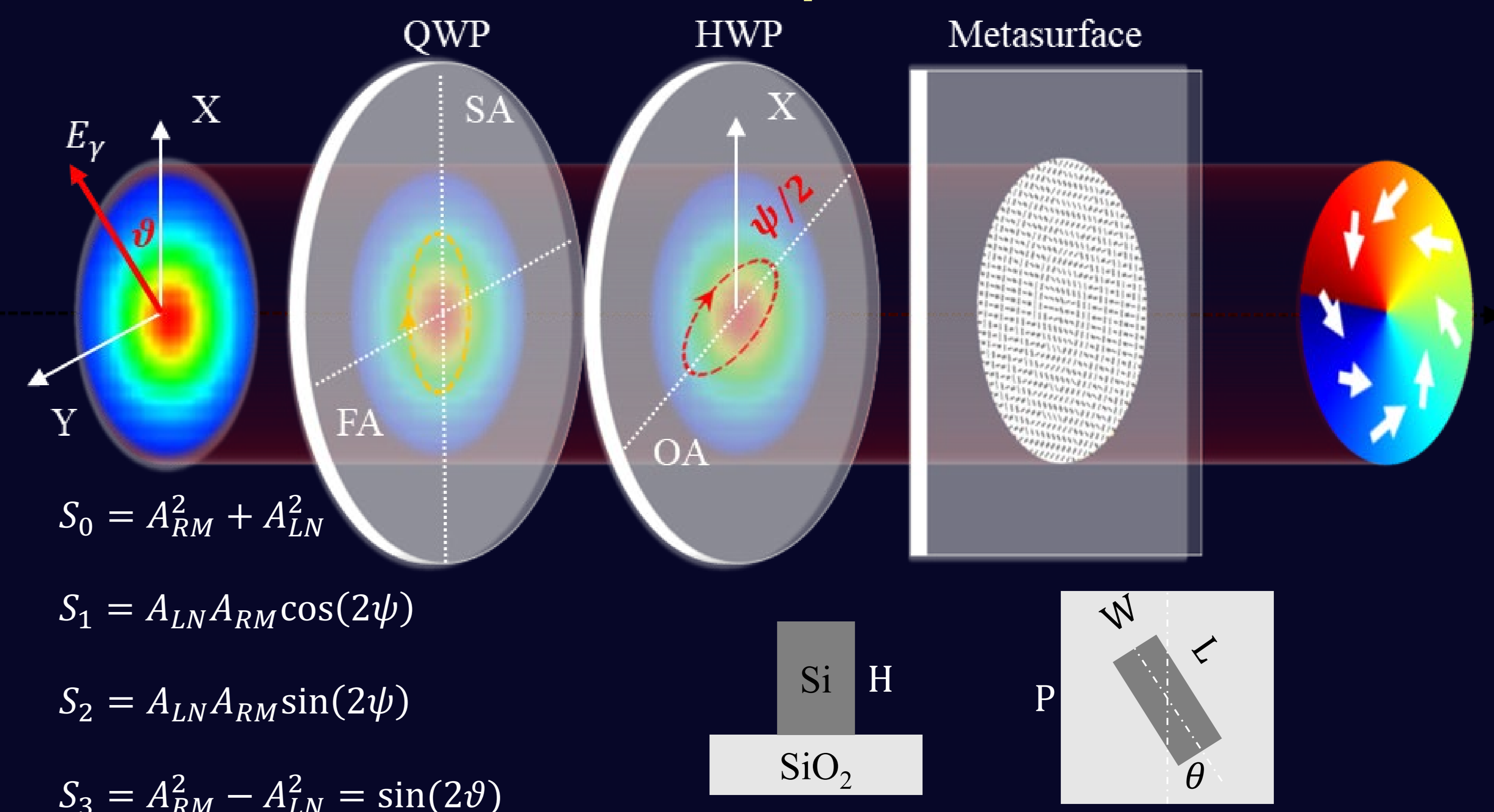
Fundamental PS

HyOPS

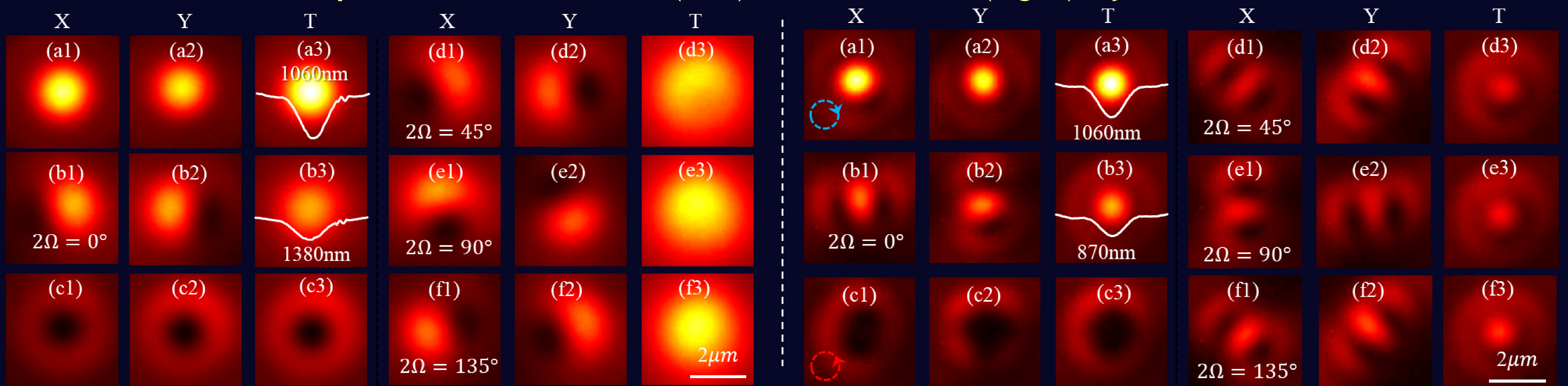
Applications

- Optical imaging
- Optical communication
- Optical metrology
- Optical manipulation

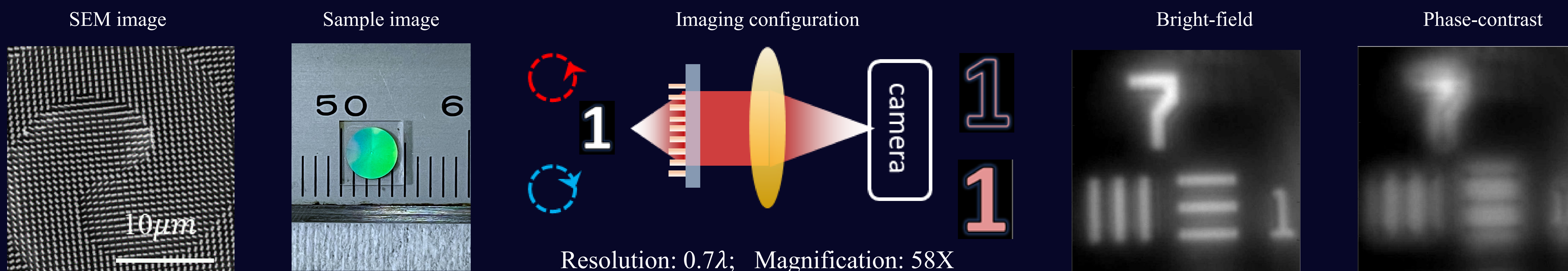
Principle



Manipulation of 0-1 order (left) and 0-2 order (right) HyOPS beams



Dual-mode microscope experiment



Conclusion

1. Developed a general design frame of designing a metasurface for generating focused/non-focused arbitrary vector vortex beams on HyOPS and HOPS.
2. NIR metasurface samples were fabricated and characterized for generating and tightly focusing arbitrary HyOPS beams.
3. Demonstrated the 1st compact dual-mode microscope with a magnification of 58X and a resolution of 0.7λ in 1550nm around the world.

Acknowledgement

EPSRC's funding support and PhD studentship from the Chinese Scholarship Council are acknowledged.