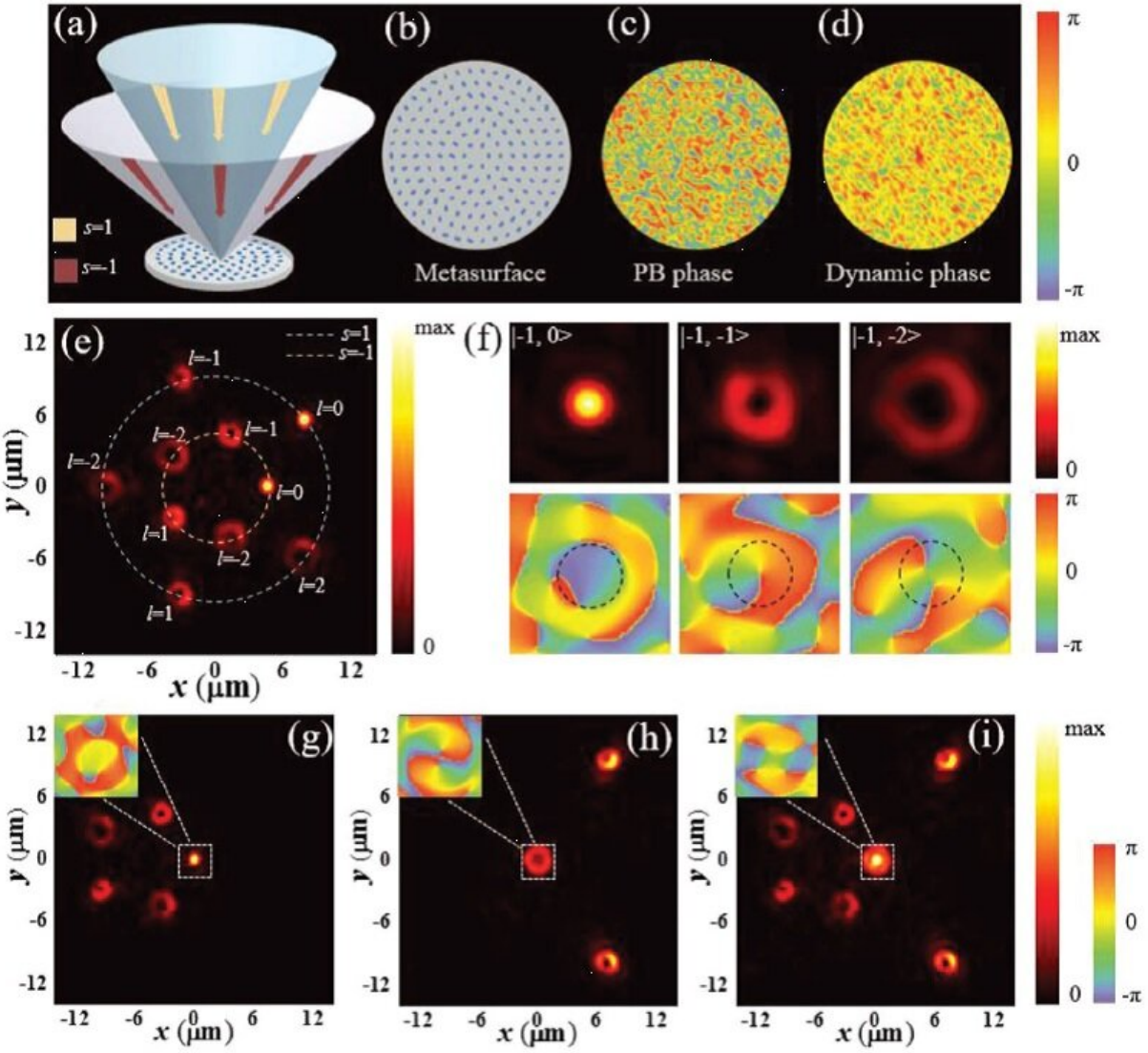
Method of angular momentum multiplexing and demultiplexing for high-capacity optical communications

March 18 2020, by Zhang Nannan



Performance of the designed AM multiplexer. Credit: XIOPM

Optical multiplexing and demultiplexing utilizing the intrinsic physical properties of light has played a crucial role in high-capacity data storage and high-speed communications.

However, the generation and detection of angular momentum (AM) carrying beams are based on bulk optical elements such as spatial light modulator, spiral phase plates, cylindrical mode converters, and freeform refractive elements. Hence, these methods suffer from bulky size that cannot be easily integrated with other miniature systems.

To realize AM multiplexing and demultiplexing, the methods based on metallic metasurface are proposed, which suffers from huge Ohmic losses. How to suppress the losses and improve the compactness of system are still a challenge?

A research team led by Prof. Dr. Zhang Wenfu from Xi'an Institute of Optics and Precision Mechanics (XIOPM) of the Chinese Academy of Sciences (CAS) proposed a method for AM multiplexing and demultiplexing based on a dielectric metasurface. Employing the off-axis technique and spin photonic Hall effect, the orbital angular momentum (OAM) and spin angular momentum (SAM) multiplexing and demultiplexing can be achieved. The result was published in *Advanced Optical Materials*.

The OAM multiplexing and demultiplexing is via the off-axis technique and the SAM multiplexing and demultiplexing is based on the based on photonic spin Hall Effect in the anisotropic medium, which are integrated on a single-layer metasurface.

Moreover, the function of focusing for the output light has been integrated on the demultiplexer directly, which effectively improves the compactness of the system.

The proposed metadevice for AM multiplexing and demultiplexing shows a great potential for high-efficiency and high-capacity optical communication and can be integrated with other miniature system.

More information: Siqi Li et al. Efficient Optical Angular Momentum Manipulation for Compact Multiplexing and Demultiplexing Using a Dielectric Metasurface, *Advanced Optical Materials* (2020). DOI: 10.1002/adom.201901666

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