Achromatic metalens array for full-colour light field imaging

With the support by the National Natural Science Foundation of China, the research team directed by Prof. Wang ShuMing (王漱明) at the National Laboratory of Solid State Microstructures, School of Physics, College of Engineering and Applied Sciences, Nanjing University, have recently reported the full-colour light field imaging based on achromatic metalens array, which was published in *Nature Nanotechnology* (https://doi.org/10.1038/s41565-018-0347-0).

The superior imaging and sensing capability of insects keep mosquitoes and flies from being captured by human beings with bare hands. One of the key factors is that the compound eyes of insects provide multi-spatial-channels optical information for light field imaging and sensing. A light field camera captures both the intensity and the direction of incoming light. This enables a user to refocus pictures and reconstruct depth of field information afterwards. Microlens arrays have been used for the acquisition purpose, but obtaining broadband achromatic images with no spherical aberration remains challenging.

Recently they have successfully fabricated and demonstrated the optical broadband achromatic meta-lens in visible regime [*Nature Communications* 2017, 8: 187; *Nature Nanotechnology*, 2018, 13: 227] with the diameter at the similar size as lenses of the compound eyes of insects. Here they describe a metalens array made of GaN nanoantennas that can be used to capture light field information and demonstrate a full-colour light field camera devoid of chromatic aberration. The metalens array contains an array of 60x60 metalenses of which diameters are 22 μm. The camera has a diffraction-limited resolution of 1.95 μm under white light illumination. The depth of every object in the scene can be reconstructed slice by slice from a series of rendered images with different depths of focus.

Full-colour, achromatic light field cameras could be considered as an important milestone of the research of metasurface and meta-lens, and open an avenue for the future applications of optical meta-devices in micro robotic vision, non-men vehicle sensing, virtual and augmented reality (VR and AR), drone, miniature personal security system, etc.

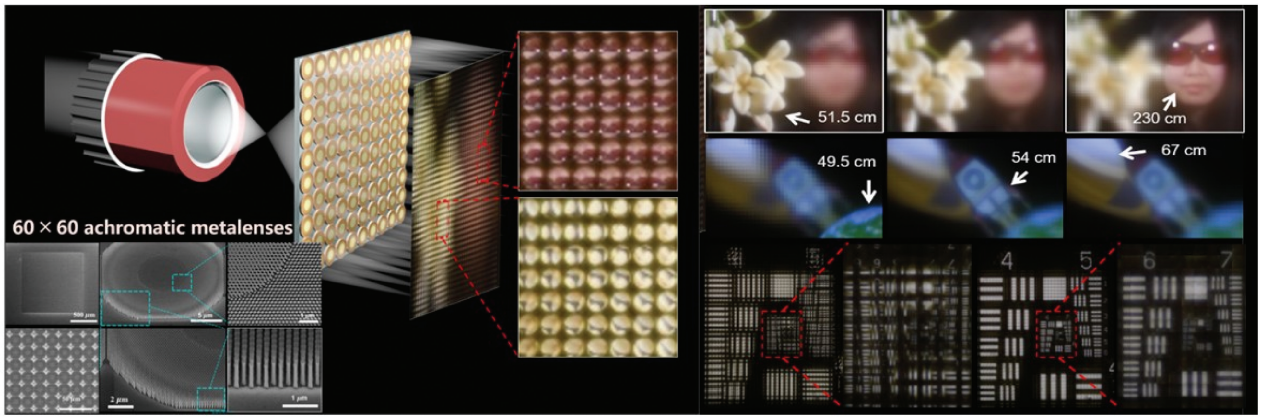

Figure Schematic diagram of the light field imaging with a metalens array with 60x60 achromatic metalenses (left); the light field imaging at different depths, and the imaging of 1951 USAF resolution test chart (right).