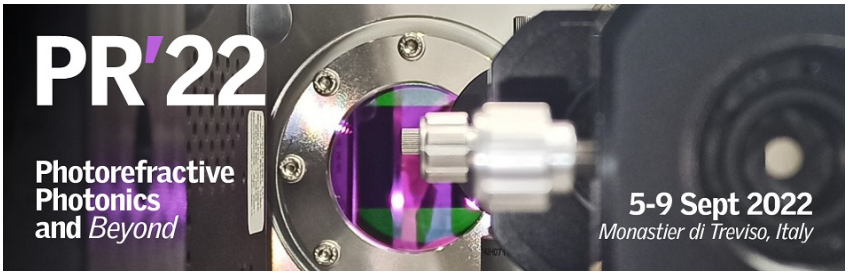

Contribution ID: **42** Type: **Regular Talk**

Amplitude, phase, and polarization control of light wave with double phase meta-surface

Tuesday, 6 September 2022 17:55 (25 minutes)

We propose a method for simultaneous control of three elements of light wave; amplitude, phase, and polarization by dielectric meta-surfaces based on the principle of double phase holography. Meta-surfaces consisting of one type of meta-atom can independently control only two of the three elements. In double phase holography, the intensity is modulated by the interference of light waves of two different phases. By applying this principle, a meta-surface consisting of two types of meta-atoms can control three elements simultaneously. We have demonstrated this principle by numerical calculations using the finite element method and the rigorous coupled wave equation. The meta-atom is assumed to be a Si rectangle on a SiO_2 substrate. The incident light wavelength was set to 1.06 μm. The length and orientation of the three sides of the rectangle are the design parameters. The phase of the scattered light is controlled by the difference between the resonance frequency of the meta-atom and the frequency of the incident light wave. The orientation of the rectangular body determines the polarization of the scattered light. It is shown that this can generate arbitrary amplitudes below a certain value, phases in the range of 0~2\pi, and all polarizations on the Poincaré sphere.

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Session Classification: Materials micro- and nano-engineering

Track Classification: Micro- and nano-engineering