Generation of scalar beams fully manipulated in amplitude and wavefront

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Abstract: Controlling light in amplitude and wavefront is prerequisite for various optical applications [1-3]. In this study, we aim to achieve complex scalar field modulation using a compact and flexible optical set-up employing single phase-only liquid crystal spatial light modulator (SLM). An approach of dual-pass modulation has been applied in which two cascaded phase holograms are encoded side-by-side on a single SLM. The two holograms displayed on SLM enable encoding of desired amplitude and phase in incoming light one-by-one. The first hologram is responsible for sculpting desired amplitude in light due to interference in the second hologram plane and finally the second hologram shapes the required wavefront in light. Commonly known scalar beams such as Laguerre-Gaussian and Bessel mode can be generated using the proposed experimental set-up.

Principle:

The principle of manipulating complex light fields fully in amplitude and phase with single SLM is illustrated in Figure 1. In Eq. (1), the *cos* term determines the amplitude distribution while phase is determined by the term $\frac{(\varphi_1 + 2\varphi_2)}{2}$. Hence, we can structure light in desired amplitude and phase independently at the same time by controlling of phase profiles displayed on SLM [4].

$$E(x,y) = \frac{1}{2} A_0 (\exp(i\varphi_1(x,y)) + 1) \exp(i\varphi_2(x,y)) \qquad (1)$$

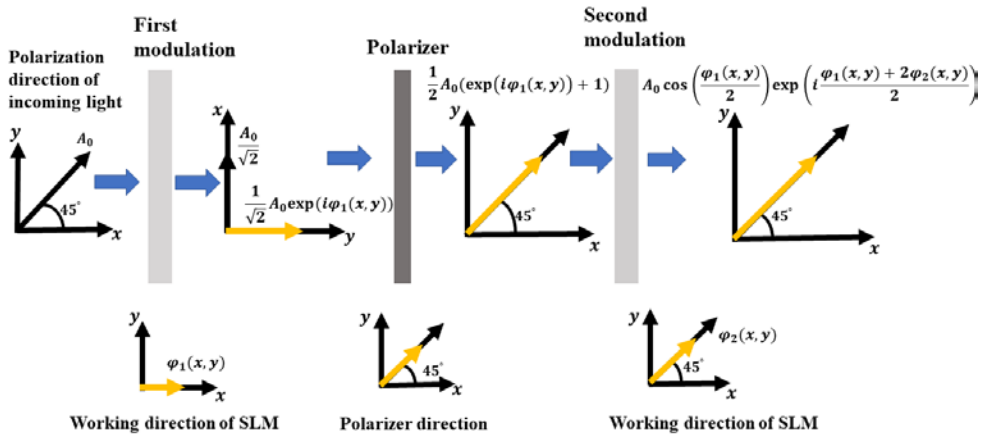

Fig. 2 Principle of manipulating light beam in both amplitude and phase employing dual modulation approach using single SLM

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