

Supplementary Material

Cascaded liquid crystal holography for optical encryption

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Note 1. Property of the photoalignment agent SD1

SD1 exhibits a remarkable sensitivity towards the polarization of incident light. Following the absorption of ultraviolet photons, the dye molecules undergo isomerization and ultimately align themselves perpendicular to the local polarization due to their dichroic absorptions. This unique behavior allows for the recording of only the final photo-reorientation, rendering SD1 molecules highly rewritable and significantly advancing the efficiency of the photopatterning process.

Note 2. Characterizations

All experiments were performed under the room temperature (27°C) and ambient conditions (humidity of 38%). The micrograph was taken by a crossed polarizing optical microscope (DM2700P, Leica). A commercial camera (EOS 850D, Canon, Japan) was used to capture all the holographic images. A supercontinuum laser (SuperK EVO, NKT Photonics, Denmark) combined with a multichannel acoustic-optic tunable filter (SuperK SELECT, NKT Photonics, Denmark) were adopted to emit monochromatic lasers (at the wavelengths of 470 nm, 540 nm, and 580 nm). The laser of 633 nm (TEM-F-633, Changchun New Industries Optoelectronics Technology Co., Ltd., China) was also utilized to perform the cascaded LC-holography.

Supplementary Figures

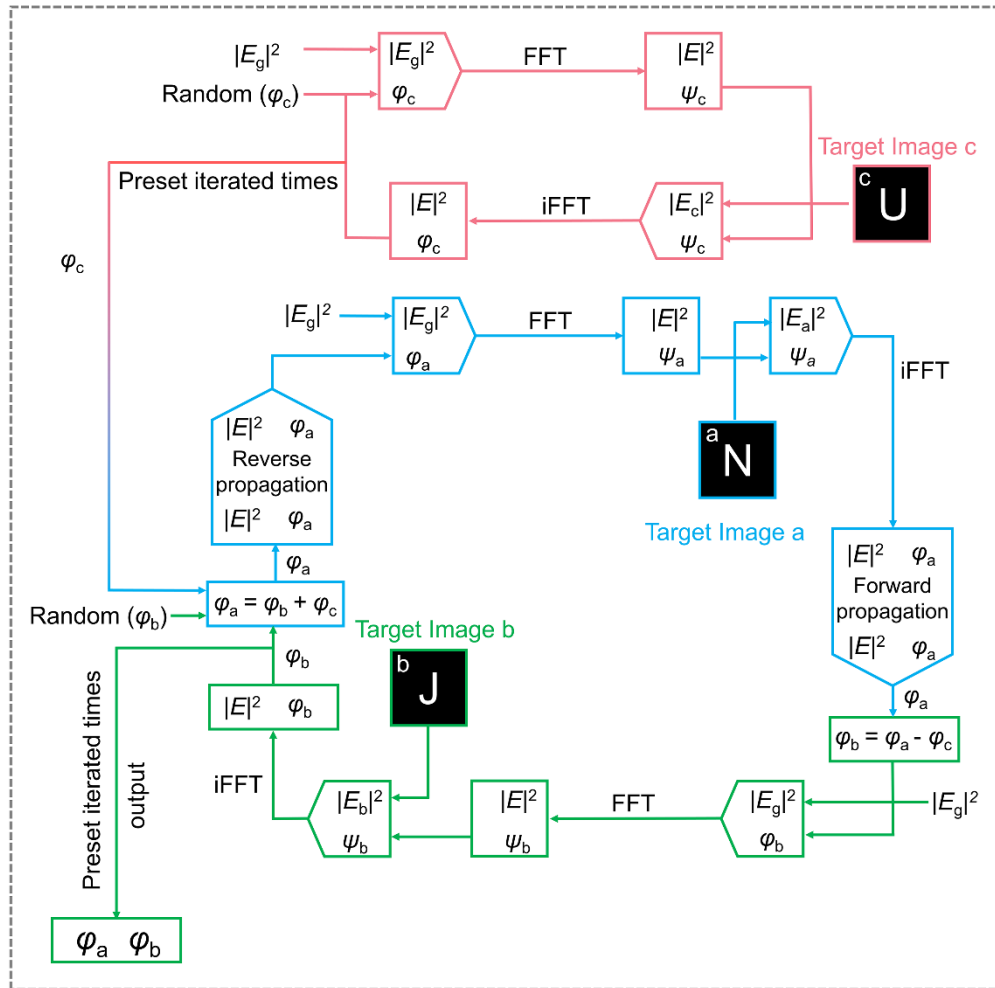


Fig. S1. Flowchart of the holographic iterative algorithm for pre-calibrating the effect of glass substrates. Fast Fourier transform and inverse fast Fourier transform are denoted as FFT and iFFT. The red, blue, and green parts of the flow chart represent the parts involved in the generation of phase profiles of φ_a , φ_b , and φ_c . $|E_g|^2$ corresponds to the amplitude of a standard Gaussian beam. The propagation of light between two liquid crystal layers is added to our algorithm.

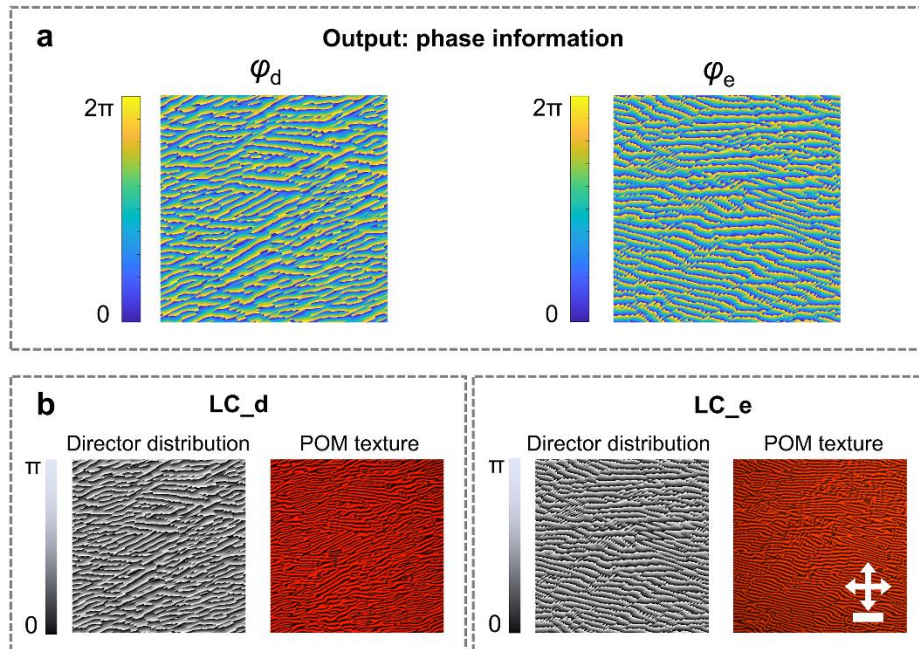


Fig. S2. Two LC elements (LC_d and LC_e) for secret sharing. (a) Output phase information for LC elements (LC_d and LC_e). (b) The designed phase profile of LC director distributions. Insets show crossed polarized microscopic textures of LC_d and LC_e. The orthogonal polarizer and analyzer are represented by crossed white arrows. Scale bar: 200 μm .