Supplemental Document

Optics Letters

Switchable imaging between edge-enhanced and bright-field based on a phase-change metasurface: supplement

HUI YANG,[1] ZHENWEI XIE,[1,2] HAIRONG HE,[1] QIANG ZHANG,[1] JIAOHAO LI,[1] YILIN ZHANG,[1] AND XIAOCONG YUAN[1,3]

[1]*Nanophotonics Research Center, Shenzhen Key Laboratory of Micro-Scale Optical Information Technology & Institute of Microscale Optoelectronics, Shenzhen University, Shenzhen 518060, China*
[2]*e-mail: ayst3_1415926@sina.com*
[3]*e-mail: xcyuan@szu.edu.cn*

Supplement DOI: https://doi.org/10.6084/m9.figshare.14892435

Parent Article DOI: https://doi.org/10.1364/OL.428870

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I. The comparison of the vortex and focusing vortex for edge-enhanced imaging

In contrast to the previous published works (that use a vortex phase for edge-enhanced imaging), we introduce a focusing vortex phase for edge-enhanced imaging. The corresponding phase profile is shown in Eq. (1) in the main text. The simulated intensity profiles of the GSST meta-device in the A-state with and without focusing phase are shown in Figs. S1(a) and S1(b), respectively. Corresponding edge-enhanced images of the object (a capital letter "A") are shown in Figs. S1(c) and S1(d), respectively. It can be observed that the edge-enhanced imaging with the focusing vortex exhibits better edge contrast.

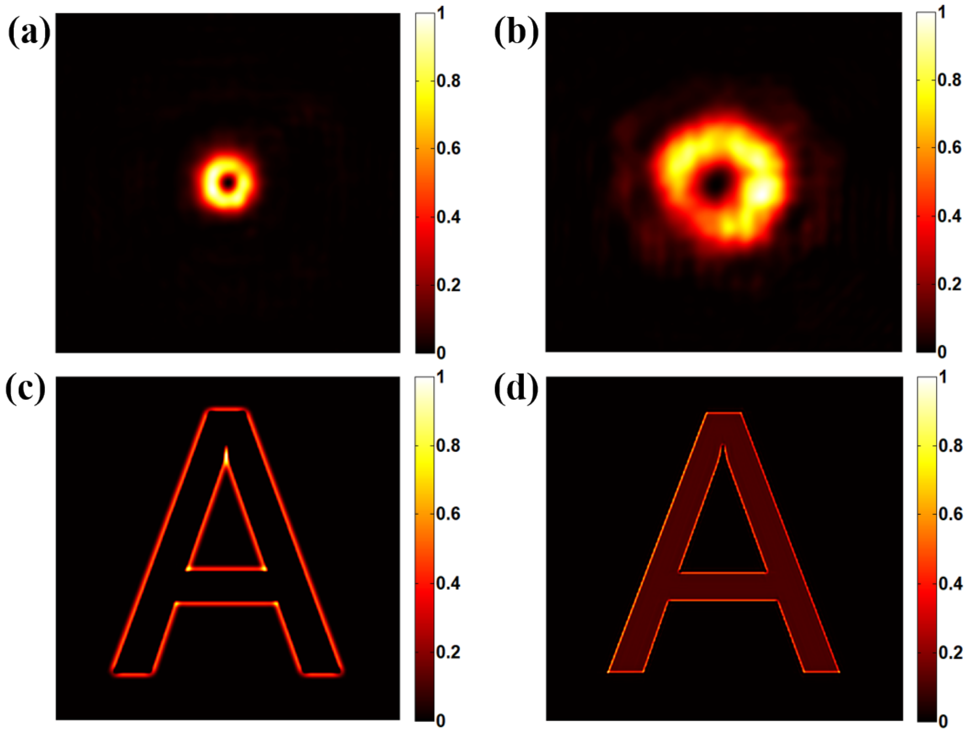

Fig. S1 Simulated intensity profile of the GSST meta-device in the A-state (a) with and (b) without focusing phase. (c) and (d) Corresponding edge-enhanced images of the object (a capital letter "A").

II. The spectrum transfer function of the proposed meta-device

As we know, the edge detection can be evaluate by the spectrum transfer function. The spectrum transfer function can be calculated as $H(k_x,k_y)=E_{out}(u,v)/E_{in}(u,v)$, where $u=x/(\lambda f)$ and $v=y/(\lambda f)$. For the proposed GSST meta-device in the A-state, the calculated spectrum transfer function is shown in Fig. S2. From Fig. S2, wen can conclude that the meta-device functions as a high-pass spatial filter in the Fourier space. Such a high-pass spatial filter results in edge-enhanced imaging when applied to the 4*f* imaging system.

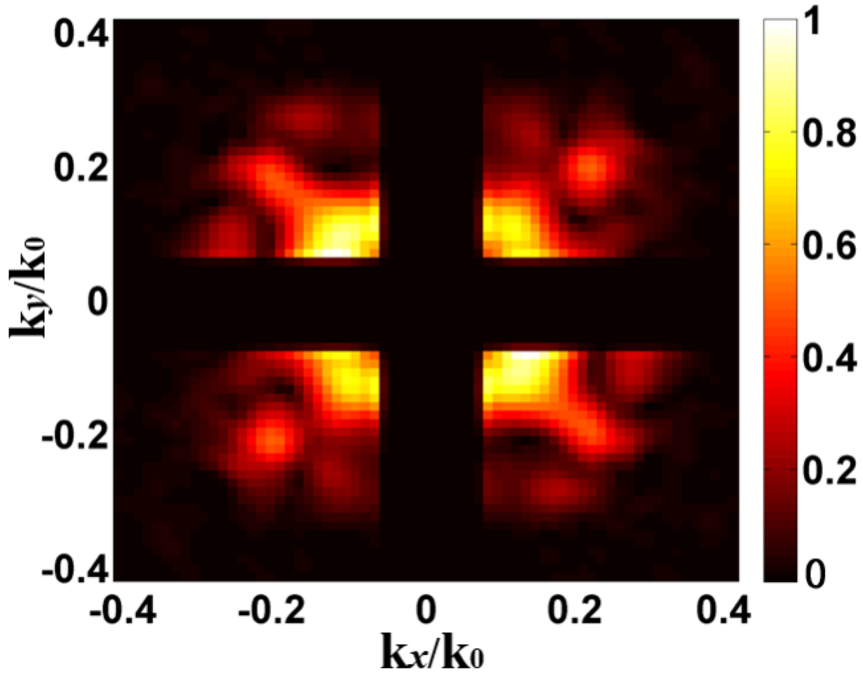

Fig. S2 Calculated spectrum transfer function of the proposed GSST meta-device in the A-state.