

Wide Field-of-View Quadratic Metalenses for Stereo Imaging

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Recently, interest in metalenses has been growing. Metalens consists of an ultrathin dielectric surface patterned with nanoscale structures, and thanks to their high performance, compactness, and slim profile, they hold the potential to replace conventional refractive optical devices. [1, 2] Conventional wide-angle imaging relies on bulky fisheye optics or multi-camera arrays and suffers from heaviness and complexity [3]

Therefore, we present an near-infrared (NIR) metalens imaging system that achieves a full 180° field-of-view (FoV).

Here, we introduce a planar stereo metalens architecture on a single flat substrate that combines a quadratic-phase metalens design. Our 5.36 mm-diameter metalens focuses 940 nm light over a full 180° FoV to ensure stereo correspondences. The quadratic phase profile decouples angle-dependent phase requirements and maintains diffraction-limited performance across the entire FoV.

We demonstrate real-time, wide-angle 3D imaging with high fidelity, compactness, and manufacturability via a single lithography step. This work overcomes fundamental limitations of planar wide-angle optics and paves the way for ultracompact, high-performance metalens cameras in biomedical, industrial, robotics and autonomous-vehicle applications.

References

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