

Metalenses by Nanophotonics

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Abstract:

Metalenses consist of nanostructures that locally control the optical phase. They offer many degrees of freedom for manipulating a wavefront, which gives a number of advantages over bulk lenses, such as the straightforward elimination of spherical aberrations and an ultrathin dimension. Using higher refractive index materials such as silicon affords more degrees of freedom in terms of design and fabrication and provides the basis for high-performance metalenses, even in the visible. Nevertheless, the imaging performance of single-element metalenses is still limited by coma and chromatic aberrations. This limitation is exacerbated by high numerical apertures and large areas. We review the challenges and trade-offs between numerical aperture, field of view, coma, chromatic aberration, and size. We also demonstrate a new phase engineering approach to address these issues and demonstrate a novel type of metalens with high resolution and a high field of view.