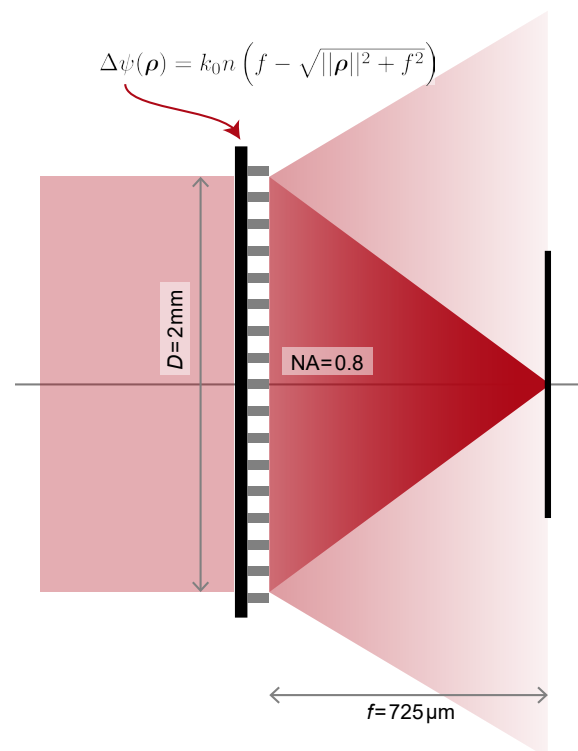


Metalens and Metasurface Holograms

Metalenses and metasurfaces have risen to scientific fame by virtue of their unique properties for manipulation of electromagnetic fields, and nowadays their fabrication has become feasible. But their design difficulty goes far beyond that of traditional lenses, because the properties of the nanoscale building blocks must be included.

Benefits in VirtualLab Fusion

- **Unified platform** with solvers for nanoscale building blocks and for large-size composite lens/surface as a whole
- **Import of functional design from Zemax® OpticStudio®**, or direct definition via formula
- **In-built rigorous Fourier modal method (FMM)**, a.k.a. rigorous coupled wave analysis (RCWA), with fully vectorial information
- **Convenient graphical user interface** for nano-building-block structure setup, e.g., nanofin and nanopillar as typical choices
- **Look-up table concept** connecting the rigorous building block analysis result to the large-size metalens/-surface modeling



Metalens

- The functionality of a metalens can be specified via polynomial coefficients, e. g., import from Zemax® OpticStudio®.
- The simulation can be done on different levels: either based on idealized model(s), or directly with nano-building-block property incorporated.
- Flexible inclusion of metalenses within an optical system together with other components.

Meta-Hologram

- Traditional phase-only holograms realize phase profiles via etching different depths in a transparent substrate, which is typically only valid for paraxial cases.
- Such phase profiles can be realized also by metasurfaces with spatially varying nanoscale building blocks.
- With meta-building blocks, high-NA holograms can be designed in a straightforward manner.

Nanofin Building Blocks

- Nanofin structures work on the form birefringence principle. The phase manipulation is realized by the rotation of the individual nanofins.
- The nanofin structure parameters must be carefully optimized to realize desired functionality as half-wave plates.
- Due to the birefringence property, metalenses with nanofins as building blocks are polarization sensitive.

Nanopillar Building Blocks

- Rotationally symmetric nanopillars made of high-refractive-index materials are another common type of meta-building blocks.
- The phase control with nanopillars is realized via adjustment of the pillar diameter.
- Due to the rotational symmetry of the nanopillar structure, metalenses constructed with them are polarization insensitive.

