Tight Focusing of Variously Polarized Beams by an Aplanatic Lens
Abstract

Knowing the vectorial electric field distribution near the focus of a high-NA objective lens is of great importance for applications e.g. microscopy, optical tweezer, laser machining, etc. The high-NA objective lens is often assumed as aplanatic lens. We demonstrate the focusing of variously polarized beams, e.g. linearly, circularly and radially polarized beams, by an aplanatic lens in VirtualLab Fusion. We investigate focal field with respect to different shapes of apertures, e.g. circular and annular.
Modeling Task

input field
- wavelength: 632.8 nm
- Gaussian profile
- polarization states
  1) linearly polarized
  2) circularly polarized
  3) radially polarized

aplanatic lens
- NA = 0.95

How does the shape of the aperture affect the focal spot for different polarized input fields?
Circular vs. Annular Aperture: Linearly Polarized Input

- Linearly polarized input in the y direction

Circular Aperture:
- FWHM 427 nm (x), 508 nm (y)

Annular Aperture:
- FWHM 319 nm (x), 441 nm (y)
Circular vs. Annular Aperture: Circularly Polarized Input

- input wave
- circular polarization right-hand directly

- circular aperture

- annular aperture

**Circularly Polarized Input**

FWHM 465 nm (x), 465 nm (y)  
FWHM 345 nm (x), 345 nm (y)
Circular vs. Annular Aperture: Radially Polarized Input

- Radially Polarized Input Wave

Circular Aperture:
- FWHM 393 nm (x), 393 nm (y)

Annular Aperture:
- FWHM 263 nm (x), 264 nm (y)
Peek into VirtualLab Fusion

convenient definition of different polarization states

idealized model for aplanatic lens

access to all vectorial field quantities for result analysis
VirtualLab Fusion Technologies

- prisms, plates, cubes, ...
- lenses & freeforms
- gratings
- apertures & boundaries
- lenses, Fresnel, meta lenses
- SLM & adaptive freeform arrays
- HOE, CGH, DOE
- nonlinear components
- free space
- waveguides & fibers
- scatterer
- diffractive beam splitters
- crystals & anisotropic components

Field Solver

# idealized component
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<td>- <a href="#">Investigation of Idealized Vectorial Focusing Situation Using Debye-Wolf Integral</a></td>
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