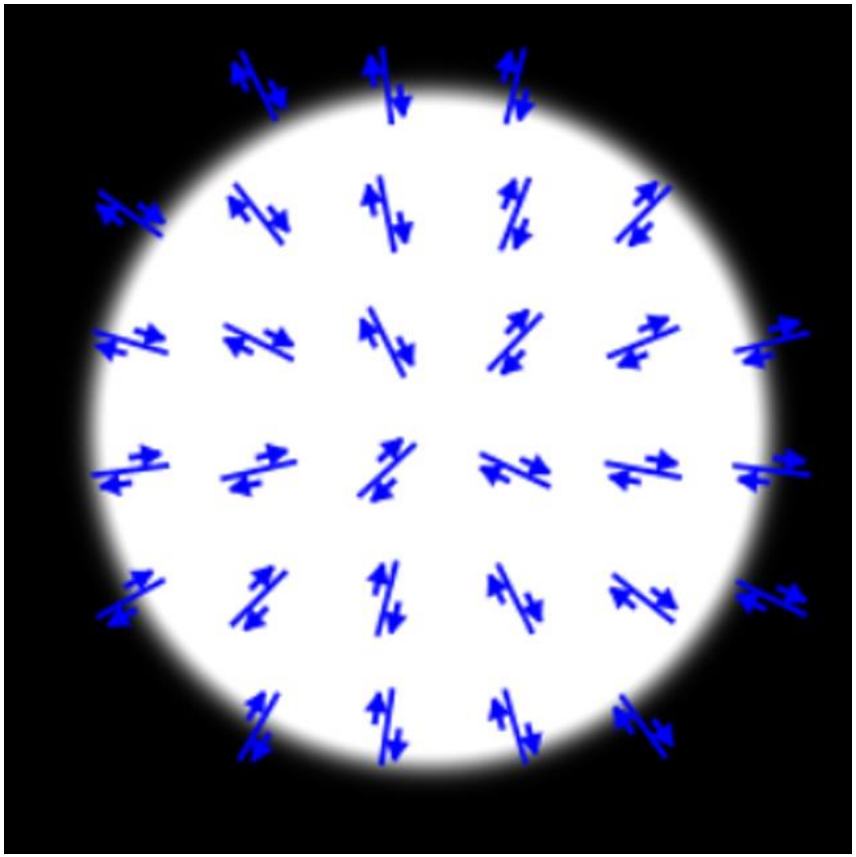
Imaging of Sub-Wavelength Gratings by Using Vector Beam Illumination

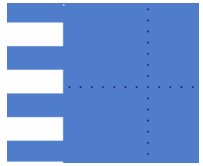
Abstract



It has been shown that the polarization of light play an important role in the interaction with micro- and nanostructures. For example, different types of vector beams have been employed in microscopy. In this example, a high-NA microscope for imaging of sub-wavelength grating is build up, and the influences from illumination with linear, radial, and azimuthal polarizations is investigated.

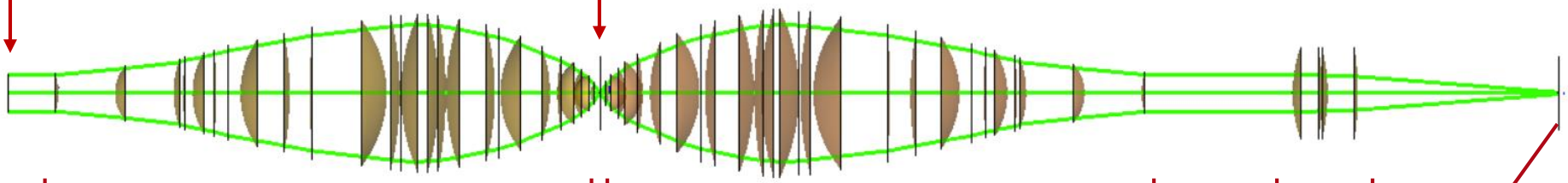
Modeling Task

plane wave
- wavelength 532 nm
- type of polarization
  a) linear polarization
  b) radial polarization
  c) azimuthal polarization



rectangular grating (fused silica)
- period: 450 nm
- duty cycle 50%
- depth 610 nm

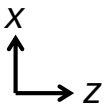
sample



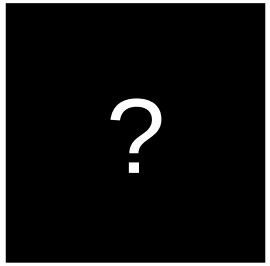
condenser lens
(NA = 0.76)

objective lens
(NA = 0.76)

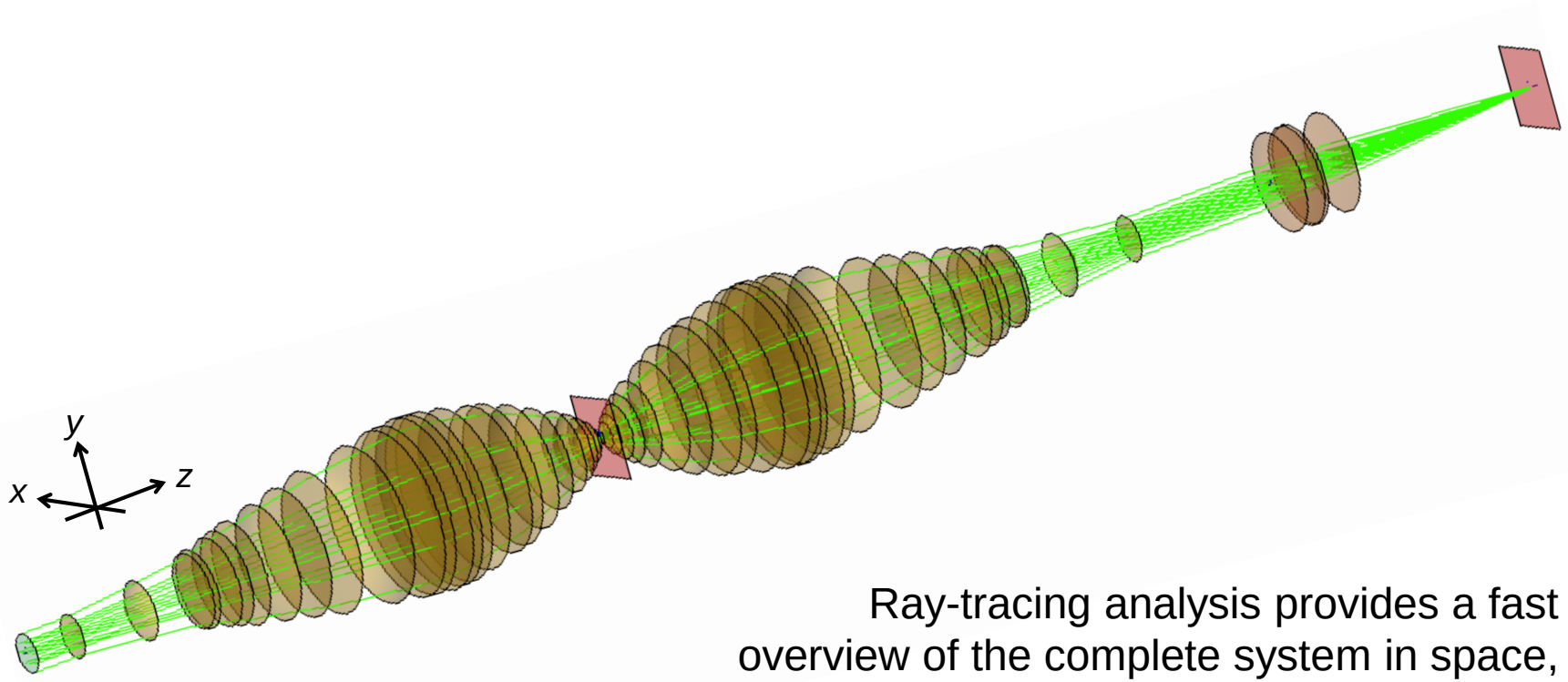
tube lens
(NA = 0.15)



How to calculate the image of the sub-wavelength grating, under illumination with differently polarized light?

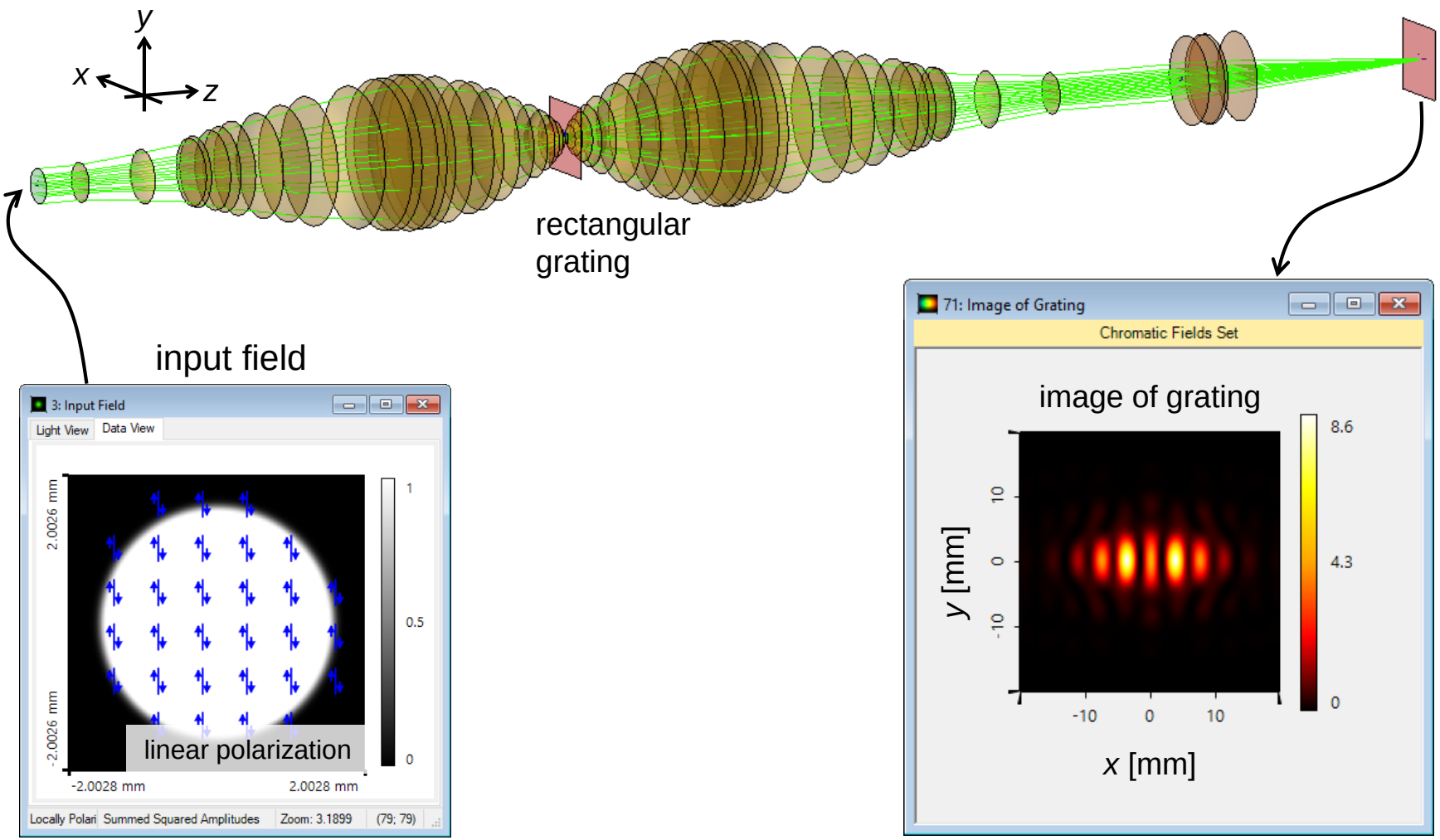


Ray-Tracing System Analysis

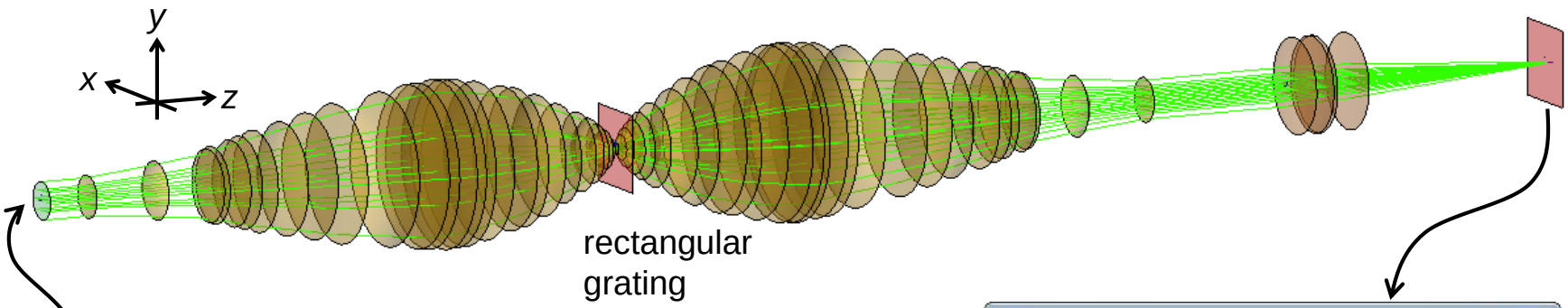


Ray-tracing analysis provides a fast overview of the complete system in space, including multiple diffraction orders.

Imaging with Linearly Polarized Light

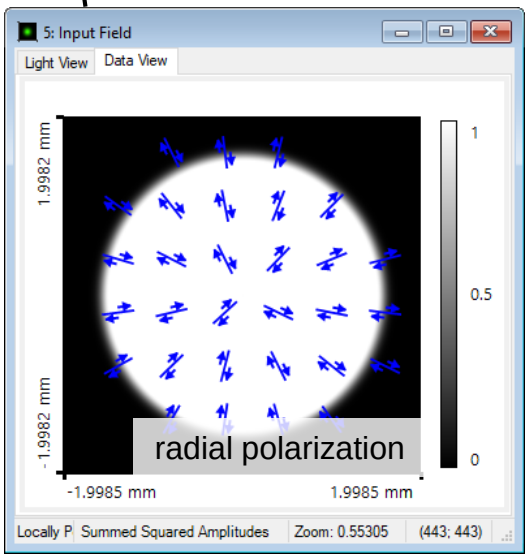


Imaging with Radially Polarized Light

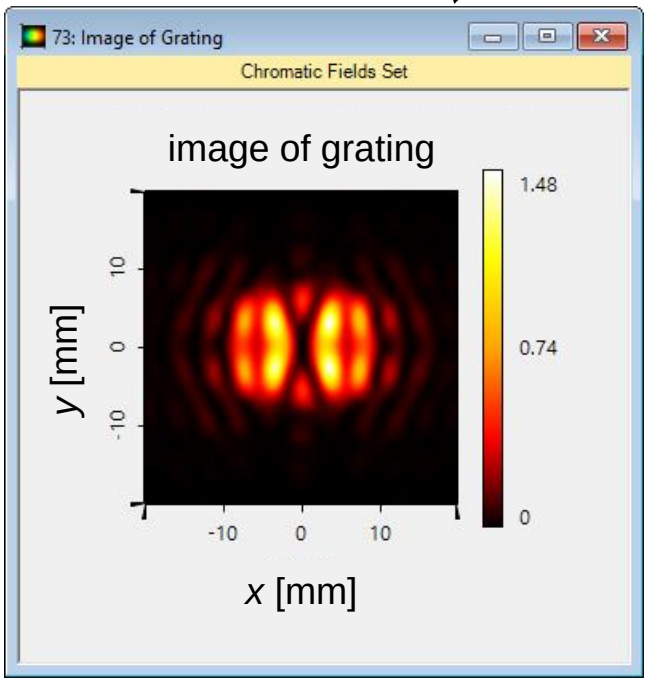


rectangular grating

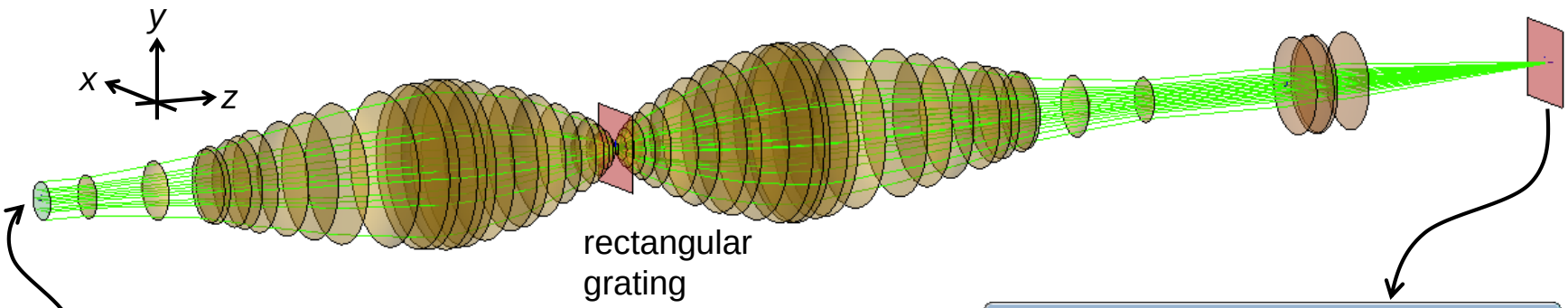
input field



Vector nature of light is taken into account, and interaction with grating is modeled by using Fourier modal method.



Imaging with Azimuthally Polarized Light



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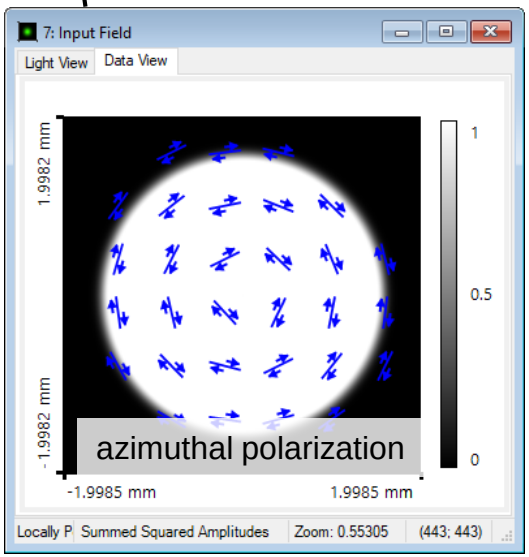

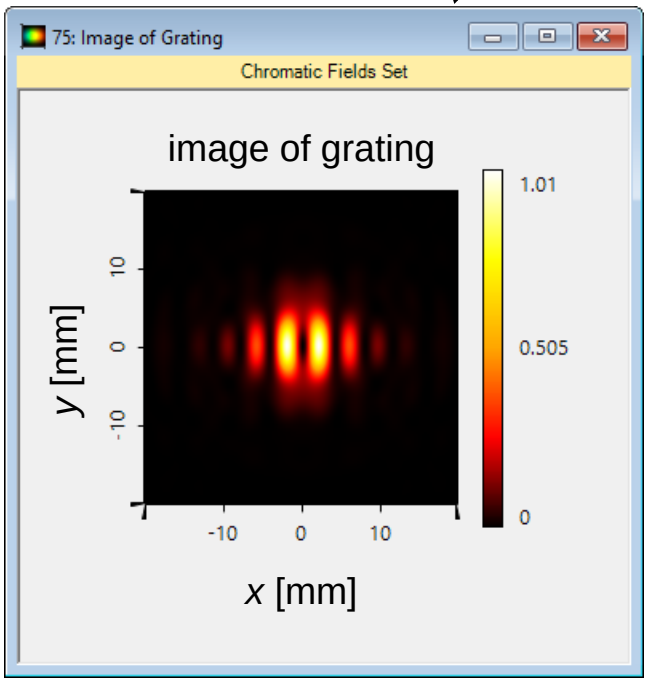

Document Information

title	Imaging of Sub-Wavelength Gratings by Using Vector Beam Illumination
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category	Application Use Case