

# Diffraction Analysis of Apodized Pupil Mapping Systems

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Joint with  
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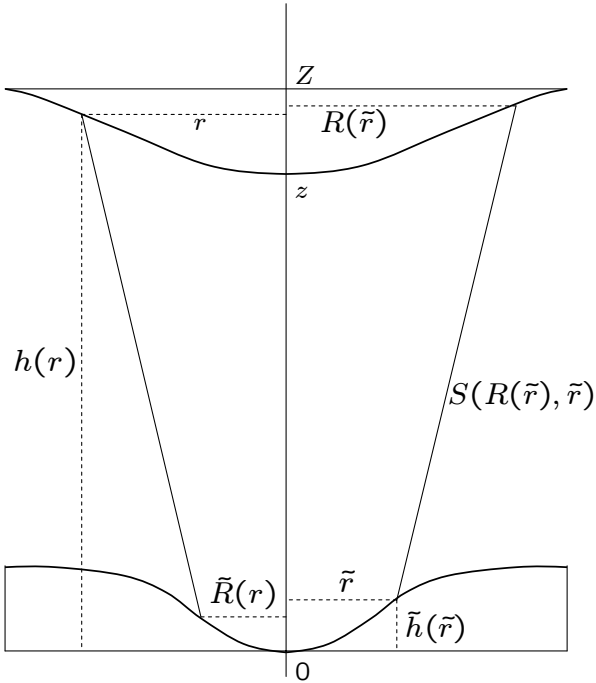
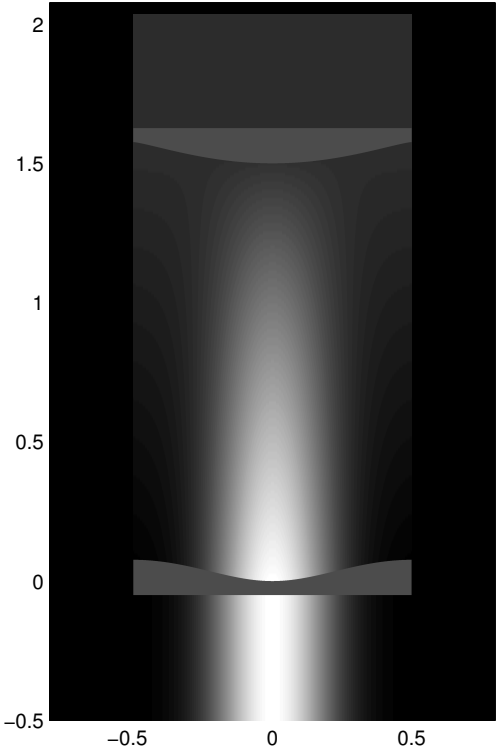
April 26, 2006

# Summary

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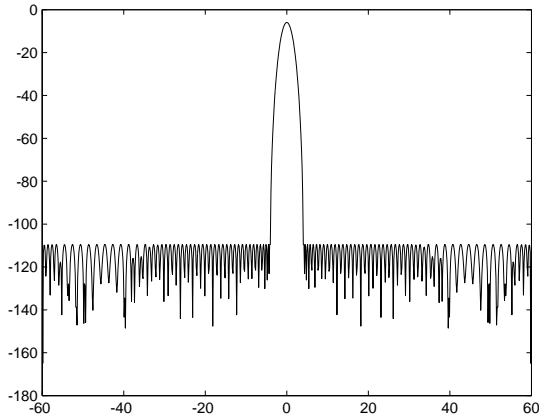
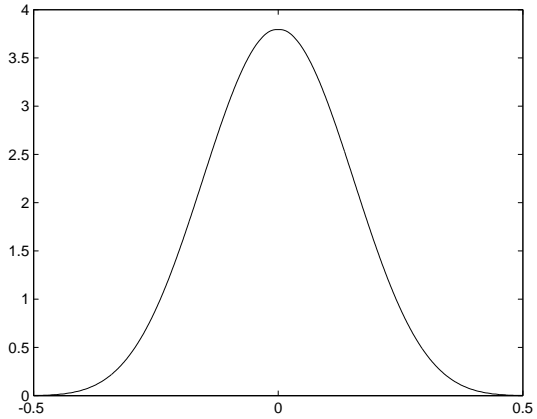
- Pure pupil mapping (aka PIAA) is similar to apodization.
- Advantages:
  - Ideally 100% throughput (vs. about 10% for apodization).
  - Very small inner working angle (vs. about  $4\lambda/D$  for apodization).
- Disadvantages:
  - Doesn't achieve  $10^{-10}$  contrast.
  - Not an imaging system.
  - Hard to manufacture?
- Apodized Pupil Mapping (aka hybrid PIAA) resolves first disadvantage.
- Star occulter with reversed system resolves second disadvantage.
- Sensitivity to Zernike perturbations are shown.

# Pupil Mapping via Ray Optics

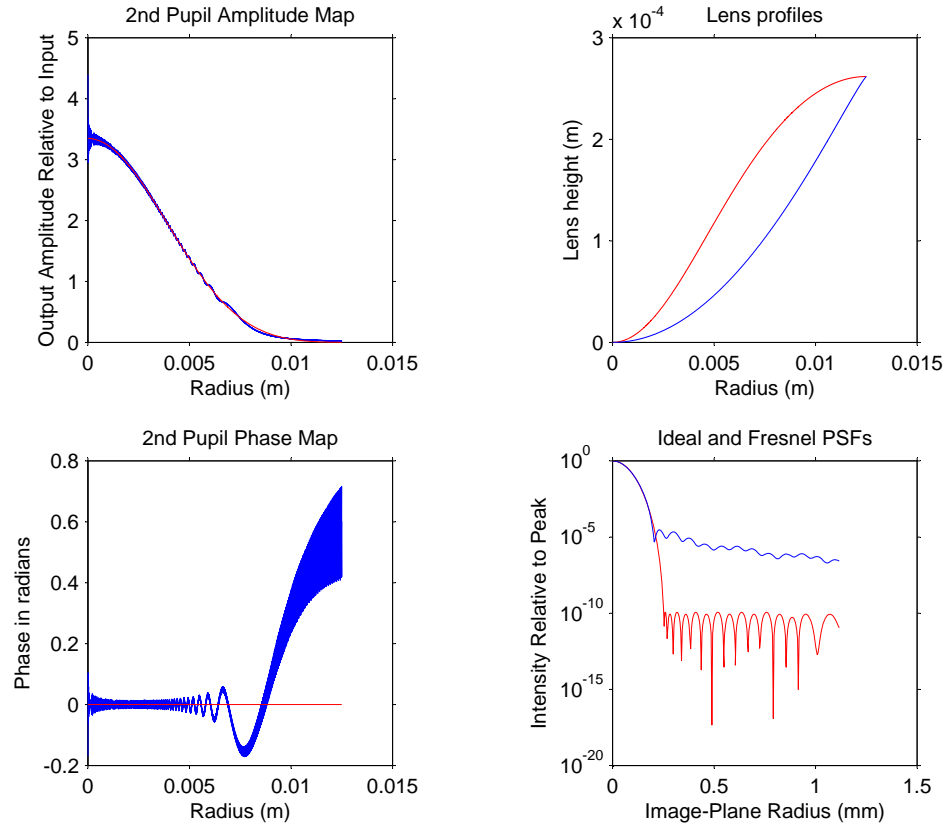


# High-Contrast Amplitude Profiles

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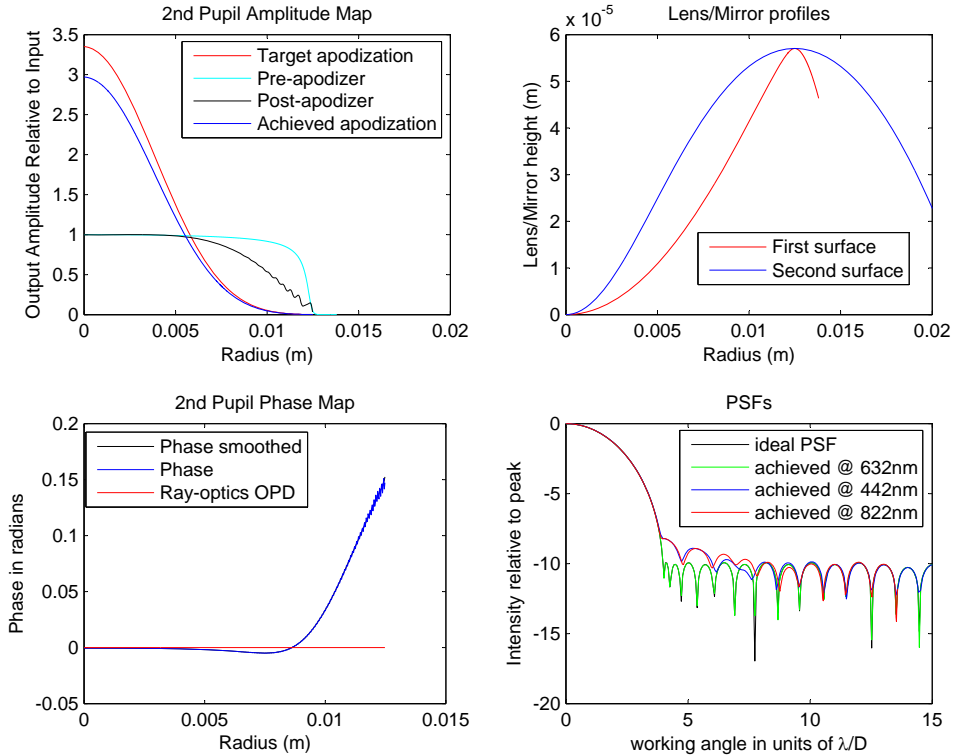


# Diffraction Analysis: Pupil Mapping



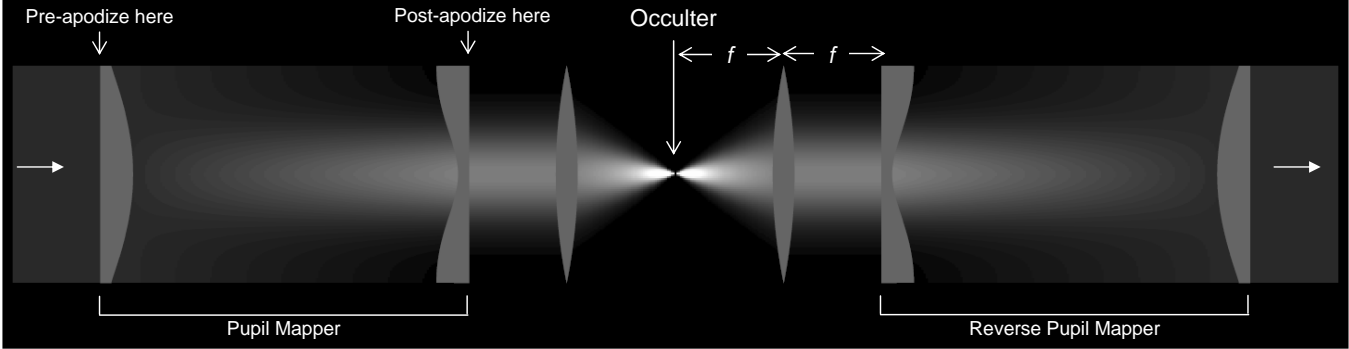
Yikes!! Contrast lost.

# Apodized Pupil Mapping

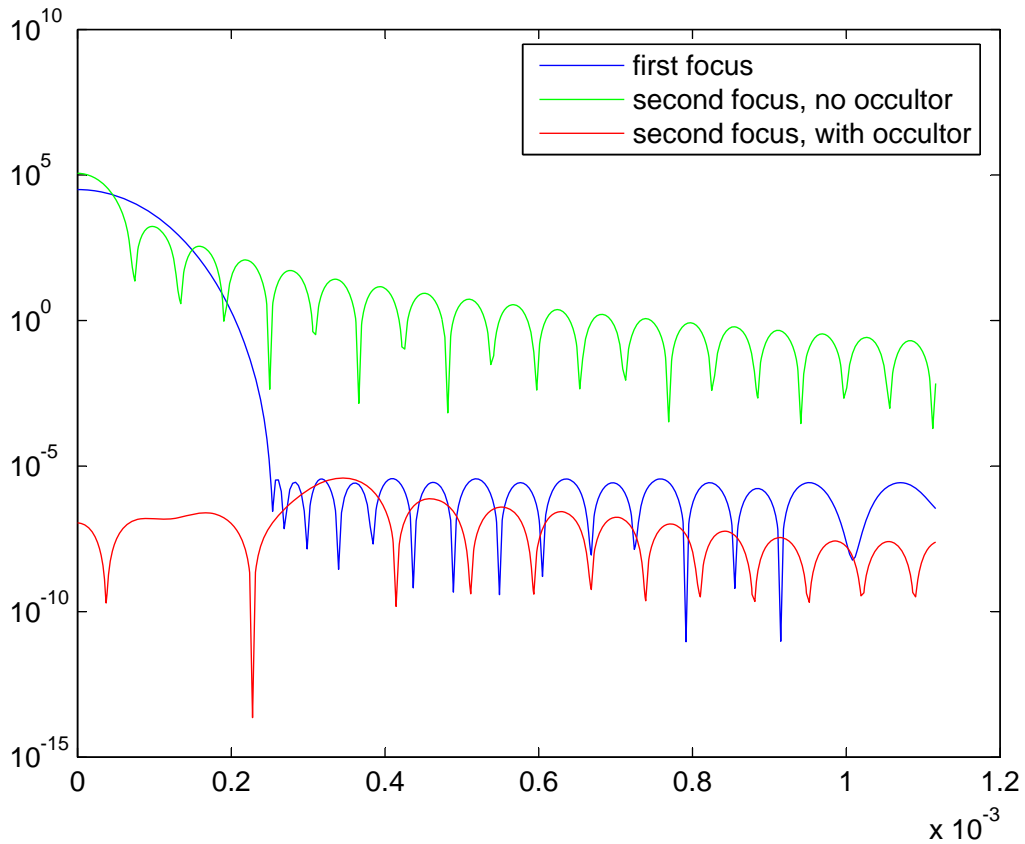


Contrast regained. Slightly chromatic.

# Occulter and Wavefront Reconstruction

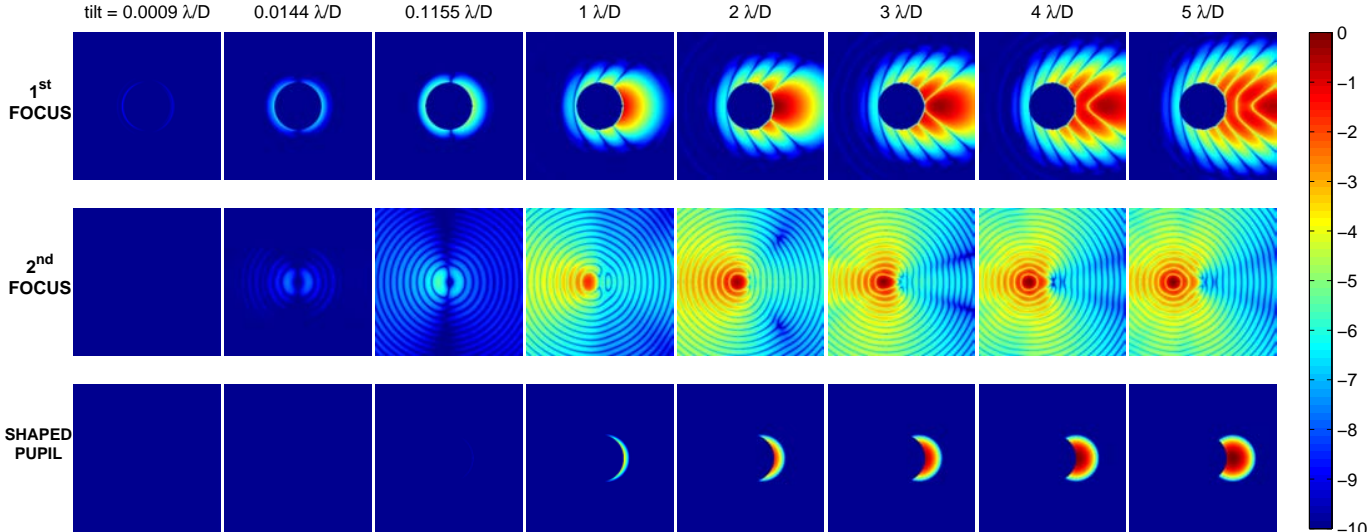


# On-Axis PSF at First and Second Focus

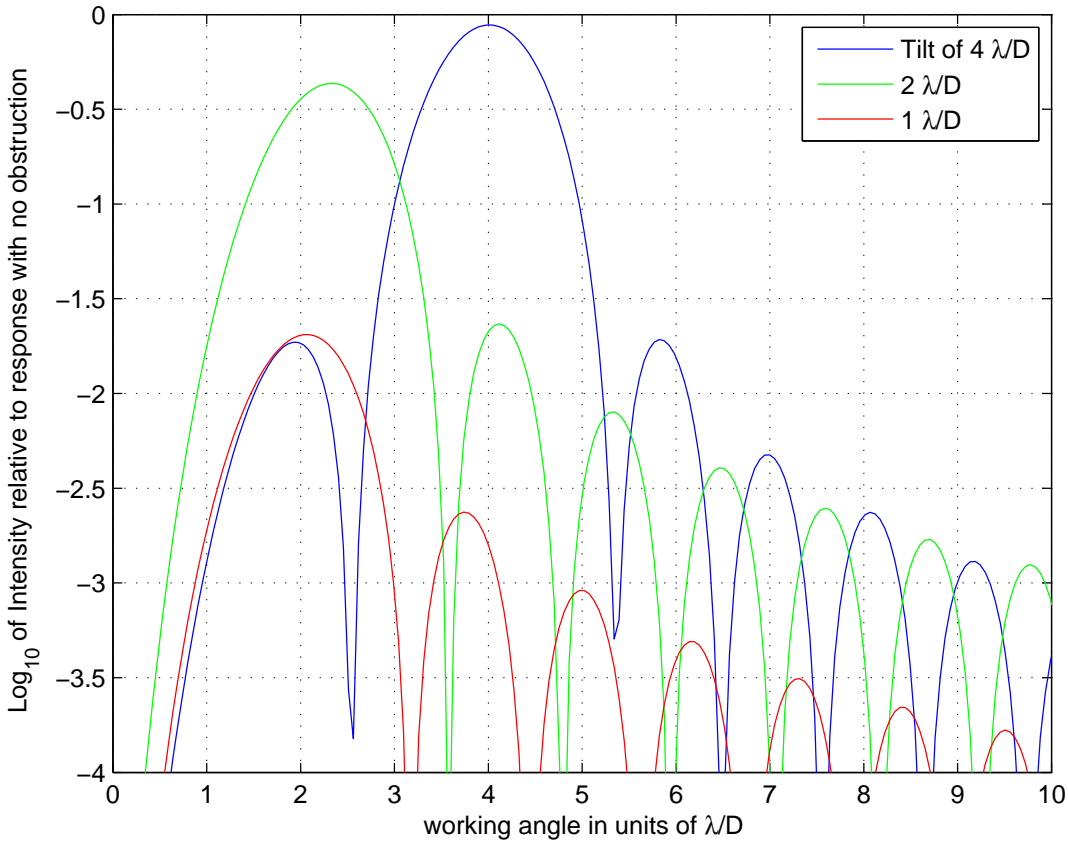




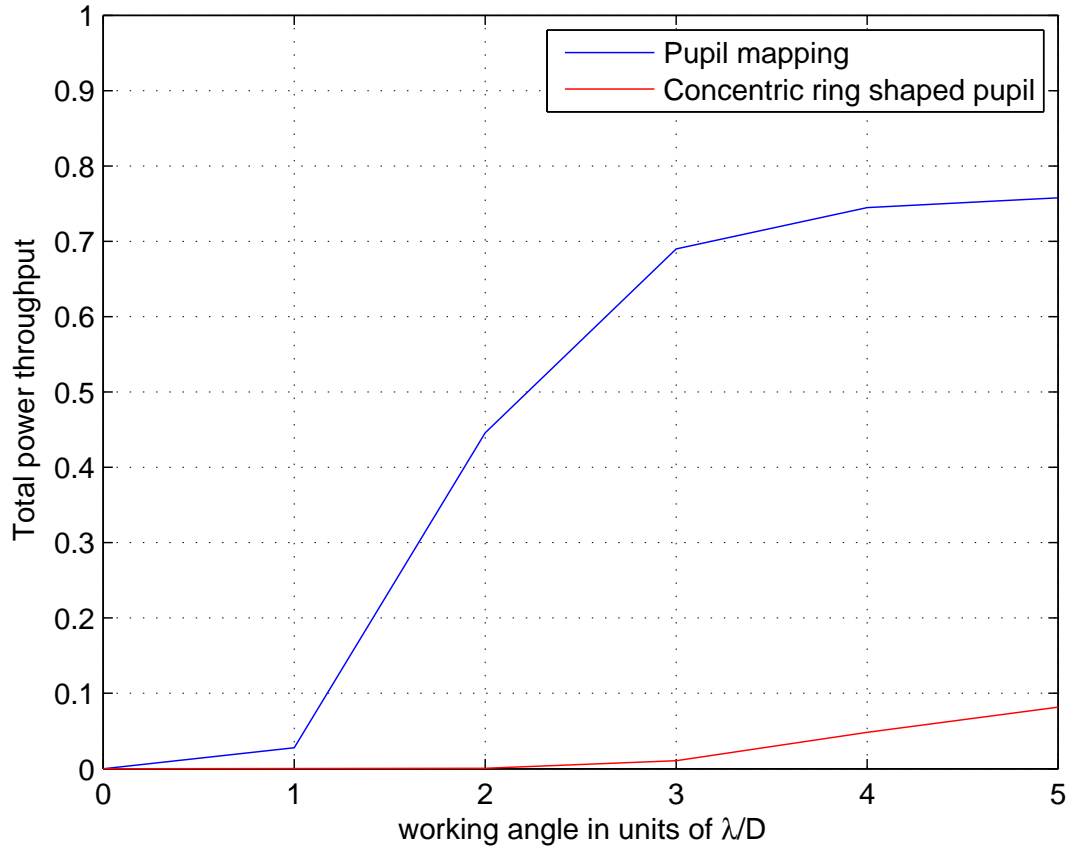
# Off-axis Planet Images



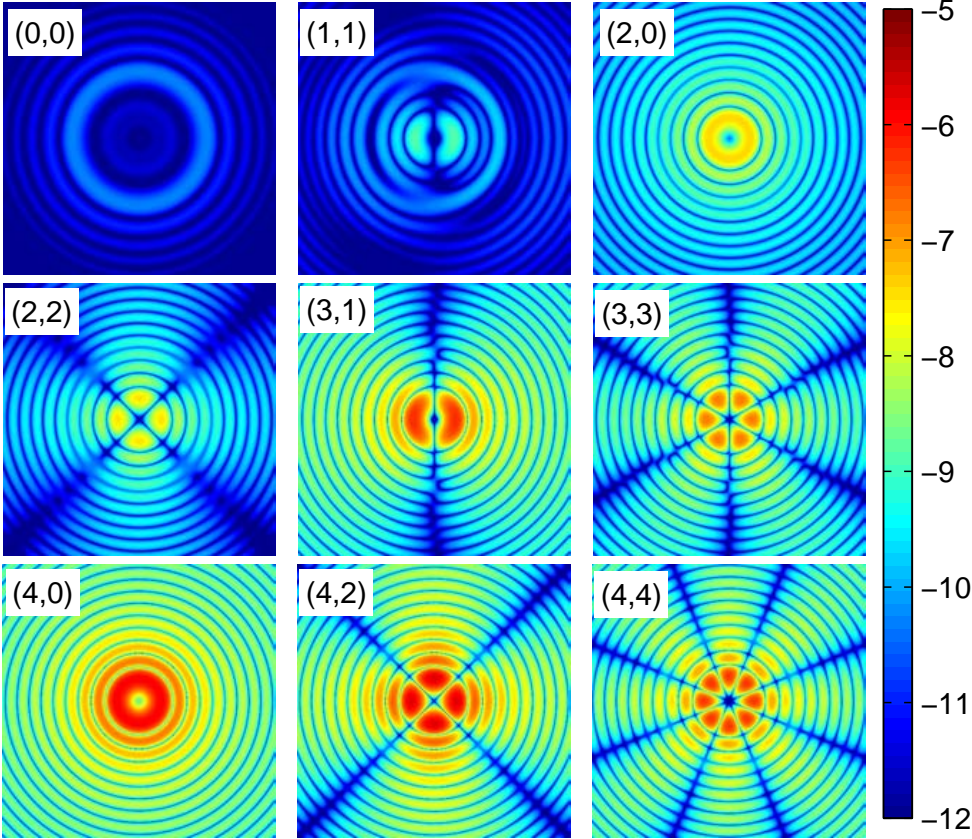
# Cross-Sectional Plots



# Off-Axis Source Attenuation

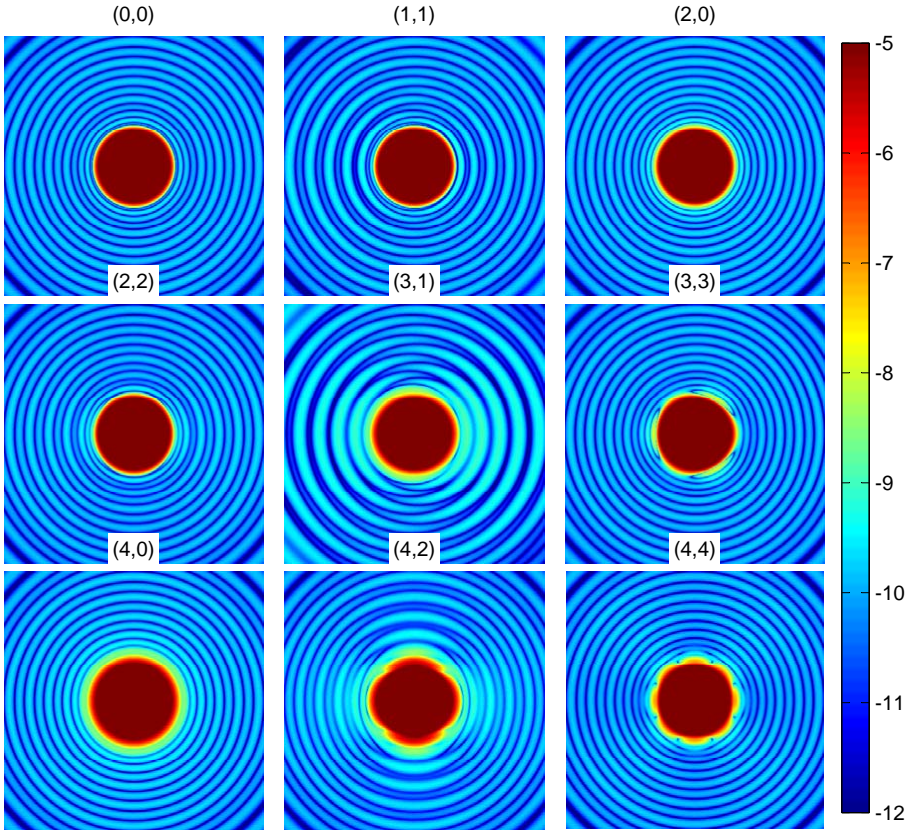


# Zernike Sensitivities: Apodized Pupil Mapping



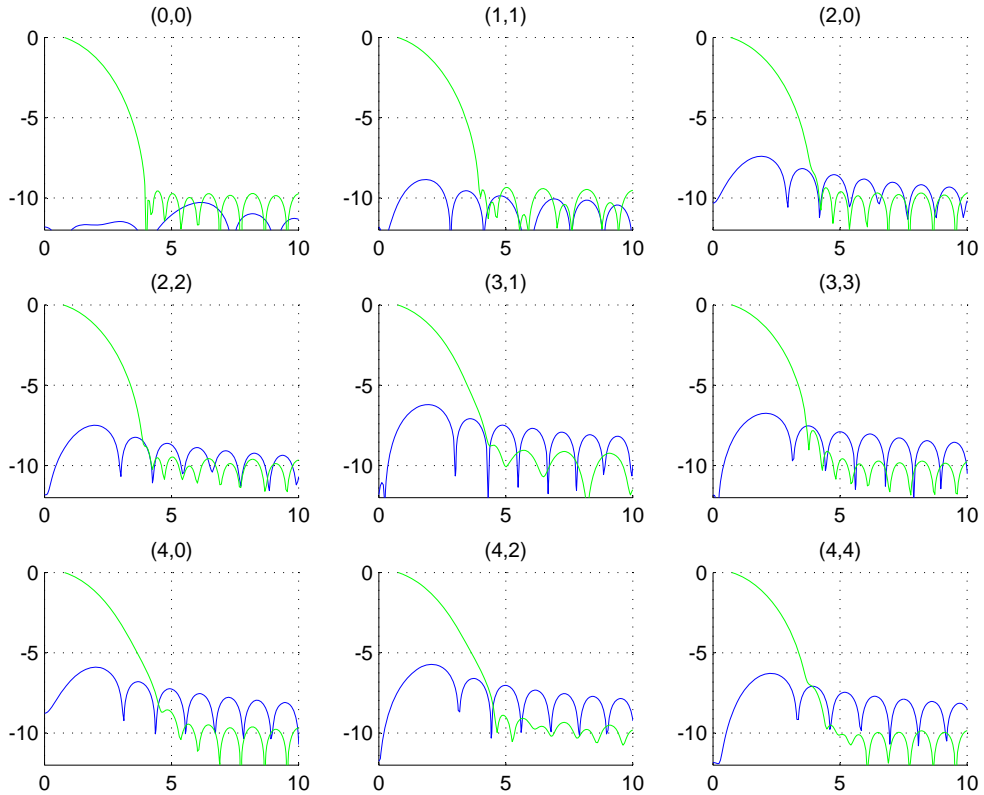
1/100th wave rms

# Zernike Sensitivities: Concentric Ring Mask



# Radial Profiles from Previous Two Slides

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# Contrast Degradation vs. RMS Error

