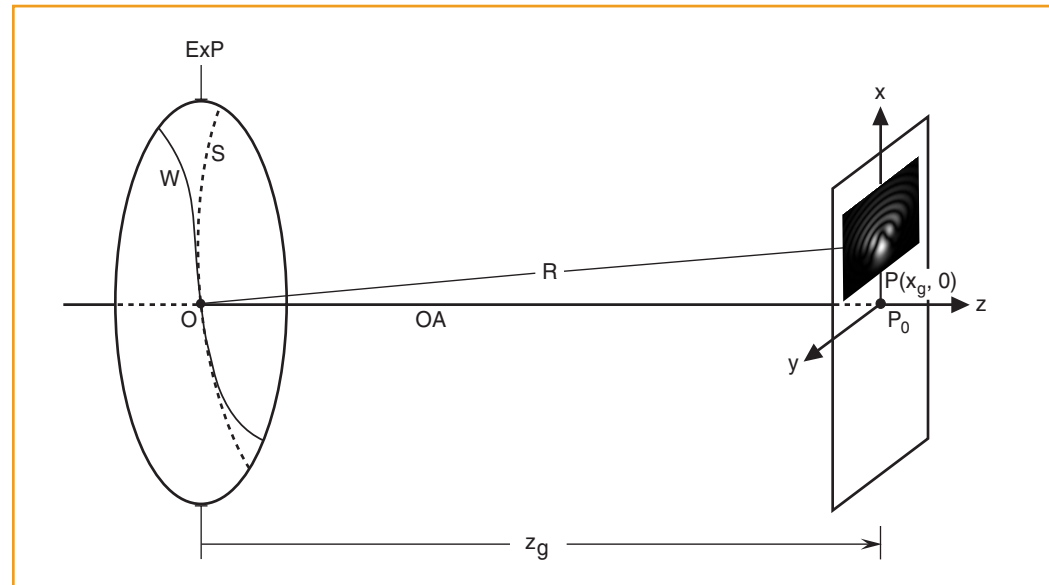


# Optical Imaging and Aberrations



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**Lectures**

**Text Book:**

V. N. Mahajan, *Optical Imaging and Aberrations, Part II: Wave Diffraction Optics* (2001, SPIE Press).

V. N. Mahajan, *Optical Imaging and Aberrations, Part I: Ray Geometrical Optics* (1998, SPIE Press).

**Reference Book:**

M. Born and E. Wolf, *Principles of Optics*, 7th edition (Oxford, New York, 1999), Chapter IX, "The Diffraction Theory of Aberrations," pp. 517-553.

**Course Grade:**

Home Work      40%

Mid Term Test   30%

Final Test        30%

## Teaching Assistant

**Sheng Yuan** at "Sheng Yuan" <syuan@optics.arizona.edu>

- He will grade the home work and answer questions
- Home work is due the following week
- Send your home work to Sheng Yuan
- Feel free to ask me questions by email at

virendra.n.mahajan@aero.org

- **Lectures are prerecorded**

Available from "Cindy Robertson" <cindyr@optics.arizona.edu>

# LECTURES

## **General Theory:**

Lecture 1: R-S Theory of Diffraction, PSF, and Strehl Ratio

Lecture 2: Optical Transfer Function (OTF)

## **Imaging With Circular Pupils:**

Lecture 3: Aberration-Free Imaging and Aberrations

Lecture 4: Strehl Ratio and Aberration Balancing

Lecture 5: Geometrical PSFs and Aberration Balancing

Lecture 6: Aberrated PSFs

Lecture 7: Symmetry Properties, LOS, and Comparison of Geometrical and  
Diffraction PSFs

Lecture 8. Aberrated Diffraction and Geometrical OTFs

Lecture 9. Polychromatic PSF and OTF, Image of a Disc, Pinhole Camera,  
and Two-Point Resolution

- Lecture 9 is on 24 Oct
- **Mid term test on 24 Oct in place of home work.....Take Home**
- Send your test to Sheng and me on 31 Oct
- Distance students send their tests to Cindy Robertson

## **Imaging With Annular Pupils:**

Lecture 10. Aberration-Free PSF and OTF

Lecture 11. Aberrated System

Lecture 12: Symmetry Properties of Aberrated PSFs and Line of Sight

## **Imaging With Gaussian Pupils:**

Lecture 13: Truncated Gaussian Pupil

Lecture 14: Weakly-Truncated Gaussian Pupil

## **Random Aberrations**

Lecture 15: Random Image Motion and Imaging Through Turbulence

Lecture 16: Imaging Through Kolmogorove Turbulence

Lecture 17 Phase Aberrations and Adaptive Optics

**Final Exam.....Take Home on 19 Dec**

Return your test to Sheng and me on 24 Dec

**Lecture 18: Incoherent vs Coherent Imaging (Bonus Lecture)**

- Coherent Imaging
- Two-Point Resolution

- Line-Spread Function (LSF)
- Edge-Spread Function (ESF)
- Image of a Disc
- Image of a General Extended Object
- Use of a Lens for Obtaining Fourier Transforms