

PHYS 323 Modern Optics

Course Description: A study of geometrical and physical optics.

Prerequisite: Physics II (PHYS 222) and its associated Calculus III (MATH 291).

Instructor: Michael J. Ruiz, Ph.D. in theoretical physics from the University of Maryland.

Email: ruiz@unca.edu

UNC Asheville (UNCA)

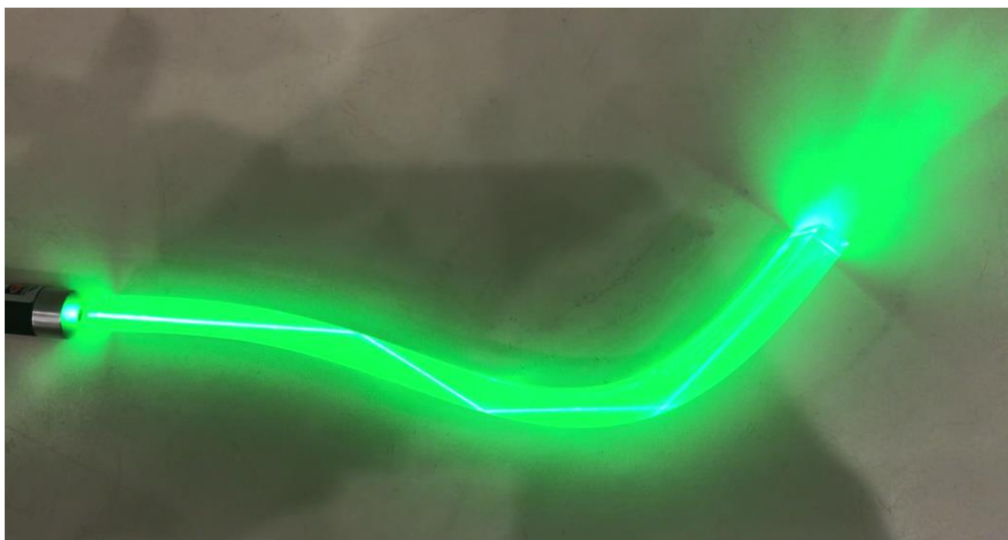
August 2020



| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|--|-----------|-------------------------------------|-------------------------------|
| 3 | 4 | 5 | 6 | 7 |
| 10 | 11 A. Principle of Least Time | 12 | 13 B. Snell's Law, Mirages | 14 Last Day to Drop/Add |
| 17 | 18 C. Rainbows | 19 | 20 D. Mirrors | 21 |
| 24 | 25 E. Lenses & Lens Maker Formula | 26 | 27 F. Thick Lenses | 28 |
| 31 | | | | |

Text: [Optics](#) by Michael J. Ruiz

Lectures: [YouTube](#)



Academic Integrity: Honor Code taking Exams with Closed Book. However, you are encouraged to work on homework together as long as you write up the solution in your own words and style.

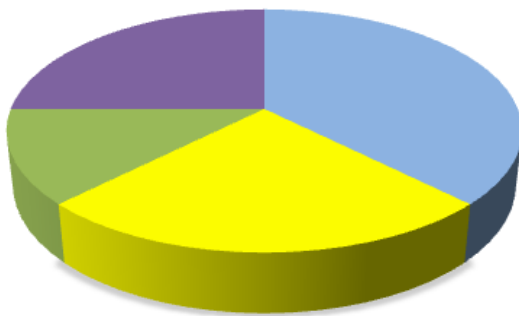
October 2020

| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|---|-----------|--|--|
| | | | 1 O. Polarization Birefringence | 2 |
| 5 | 6 P. Rayleigh Scattering | 7 | 8 Q. Waves in 1D, 2D, 3D | 9 Last Day to Withdraw is 10/09/2020* |
| 12 | 13 Exam E2 (H-N) 3:00 pm | 14 | 15 R. Fourier Optics | 16 |
| 19 | 20 S. Fraunhofer Diffraction | 21 | 22 T. Fresnel Diffraction | 23 |
| 26 | 27 U. Wave Guides Fiber Optics | 28 | 29 V. Fabry-Pérot | 30 |



*Always double check withdrawal dates with the Registrar's Website.

Grading



■ Exams ■ Final ■ Best Exam PCT ■ Homework




100 Exam 1
 100 Exam 2
 100 Exam 3
 200 Final
 100 Best Exam Percentage
200 Homework (Due on Tuesdays)
 800 **Total** (No ± Grades, See Right)

Borderline Cases: If your grade is near the borderline (10 points away), I will consider helping you if you have turned in 90% of the homework. In addition, I may look for a strong performance on the Final Exam, depending on the grade sought after.

A (740-800) - apply knowledge in new areas
 B (660-739) - apply knowledge in familiar areas
 C (580-659) - apply knowledge in easy areas
 D (500-579) - misconceptions in principles
 F (0-499) - serious gaps in understanding

UNCA is committed to making courses accessible to persons with documented special learning needs. To apply, register with the Office of Academic Accessibility and then contact me ASAP.

November 2020

| Monday | Tuesday | Wednesday | Thursday | Friday |
|--------|---|---|--|---|
| 2 | 3 W. Lasers and Coherence | 4 | 5 X. Planck's Law and Radiometry | 6 |
| 9 | 10 Exam E3 (O-U) 3:00 pm | 11  | 12 Y. Bohr Atom And Spectroscopy | 13 |
| 16 | 17 Final Exam FN (A-Y) 3:00 pm | 18 FINALS WEEK | 19 FINALS WEEK | 20 FINALS WEEK |
| 23 | 24 Grades Assigned | 25 <i>Thanksgiving Begins</i> | 26  | 27  |
| 30 | | | | |

1. Time. Reserve at least 3 hours (organizing your notes, study, doing homework, etc.) for every hour of class. This amounts to at least 9 hours per week in addition to class time. If you are a full-time student and have a job, you should NOT work more than 15-20 hours per week.

2. Instructor. Drop by during office hours if you are confused.

3. Peers. Work with your classmates as long as your homework is in your own words and style.

Goals/Outcomes

1. Optics. You will acquire a solid foundation in geometrical and physical optics.

2. Math Physics. You will enhance your math for advanced work in physics and engineering.

3. The Literature. I will incorporate about 10 of my publications into the course. See last page.





4. The Derivation. You will understand many derivations, one of the hallmarks of physics.

5. The Numerical Result. You will do precise calculations, one of the hallmarks of engineering.

6. Interdisciplinarity. You will learn about interdisciplinary applications, hallmarks of the power of physics and a liberal arts school: camera optics, medical optics, optical instruments, etc.

7. Theoretical Physics. You will be trained to think as a theoretical physicist since your instructor is one. By studying under different Ph.D. professors, you get a well-rounded physics education.

December 2020

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---------|-----------|--|---|
| | 1 | 2 | 3 | 4 |
| 7 | 8 | 9 | 10  | 11 |
| 14 | 15 | 16 | 17 | 18 |
| 21  | 22 | 23 | 24 | 25  |
| 28 | 29 | 30 | 31  | |



Michael J. Ruiz, "Dioptres for a Myopic Eye from a Photo" *Physics Education* **54**, 065010 (November 2019) [pdf](#) and [Video Abstract](#)

Michael J. Ruiz, "Road Mirage Angle" *Physics Education* **54**, 065009 (November 2019). [pdf](#) and [Video Abstract](#)

Patrick Foo (Department of Psychology) and Michael J. Ruiz, "Inexpensive Endoscope Activities," *Physics Education* **54**, 055005 (September 2019). [pdf](#) and [Video Abstract](#)

Michael J. Ruiz, "Video of Scenery During a Total Eclipse: Luminance and Effects of Solar Limb Darkening," *Physics Education* **54**, 035001 (May 2019). [pdf](#) and [Video Abstract](#)

Gerson Morales (UNCA Engineering Student at Time of Research), James Perkins, Herb Pomfrey, and Michael J. Ruiz, "Accurate Pinhole Camera Apertures Using Insect Pins," *Physics Education* **54**, 025002 (March 2019). [pdf](#) and [Video Abstract](#)

Michael J. Ruiz, "Depth of Field and the Vanishing Fence," *Physics Education* **53**, 055015 (September 2018). [pdf](#) and [Video Abstract](#)

Halima Flynt (UNC Asheville Art Student) and Michael J. Ruiz, "Making a Room-Sized Camera Obscura," *Physics Education* **50**, 19 (January 2015). Chosen by the Editors as a Highlight of 2015. [pdf](#) and [Video Abstract](#)

M. J. Ruiz and T. L. Robinson (UNCA Music Student), "Illusions With Plane Mirrors," *The Physics Teacher* **25**, 206 (April, 1987). [Cover](#) Article. [pdf](#)

M. J. Ruiz, "Camera Optics," *The Physics Teacher* **20**, 372 (September 1982), an invited article and [cover](#) article. [pdf](#)