

HONR 229Q The Light Fantastic—What is Light, How Do We Use It, Its Mysteries and Potential

CORE Physical Science (PS) Course

Tuesday/Thursday, 2:00-3:15 p.m. Hornbake 0103

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Office Hours: TuTh 9:20 - 10:50 am, and by appointment. I am generally available to talk with students when I am in my office.

SYNOPSIS

This course covers a variety of topics. The history of the development of our understanding of light will be reviewed, especially with regard to the influence of modern thinking about quantum mechanics and photons. There will be a discussion of several interesting natural optical phenomena, optical devices, and a broad treatment of much of the interesting developments in modern optics that have led to the establishment of the new field that has come to be called *Photonics*. Photonics involves the use of light quanta to do what has traditionally been done with electrons. It includes optical communication systems, electro-optic devices, holography, optical memory systems, compact disc players, laser displays, laser isotope separation, smart weapons, and optical sensors. There will be minimal simple mathematics in the course.

Some of the natural phenomena to be discussed include:

Rainbows, Halos and Glories
The Green Flash
Corona
Mirages
Ice Crystal Effects
Twinkling Stars

Physiological Optics

The Eye and Human Vision
Animal Vision
Vision Defects
Eye Safety

Optical phenomena and devices to be discussed include:

Simple Lenses and their Aberrations

Telescopes and Microscopes
Interference and Diffraction
Prisms and Gratings
Caustic Curves

Other Issues Related to our Understanding of Light

How The Quantum Theory Changes Our View of Light - Waves And Particles
Relativity
What are Photons and how do they behave
Philosophical issues relating to Quantum Mechanics and Photons.
The Velocity of Light and How It Has Been Measured

Photonics

Lasers - How They Work and What they can Do
Holography - Three Dimensional Photography
Electrooptic Devices - Modulators, Deflectors and Switches
Optical Communication Systems
Optical Fibers
Optical Sensors
Compact Disk Players
Optical Memory Systems

Suggested reading list for the course

Color and Light in Nature, David K. Lynch and William Livingston, Cambridge
1995
Light and Colour in the open air, M. Minnaert, Dover, 1954
Seeing the Light, David S. Falk, Wiley, 1986
Rainbows, Halos, and Glories, R. Greenler, Cambridge University Press, 1980
Light, M.I. Sobel, The University of Chicago Press, 1987
Understanding Fiber Optics, Jeff Hecht, 4th Edition, Prentice-Hall, 2002

Course grading will be based on several take-home essay and literature research projects. There will be a final examination. It will count for 25% of the final grade. The final examination, unless this is a take home examination, will be in class on Thursday December 18, from 10:30am – 12:30pm. I am also considering awarding credit for a short (10 min.) seminar given by each student on a subject of their own choice chosen from the course material. Class participation will also count towards the final grade – this includes attendance and participation in discussions. Details will be discussed with the class.

Students in the class are required to honor the University of Maryland Code of Academic Integrity. Details of this code are available at the University's web site.

