Physics 228: Optics & Modern Physics

- Lectures (Thurs + Mon) -> recitation (with quiz) -> homework -> exam prep

Office hours start next week

Web site: http://www.physics.rutgers.edu/ugrad/228

Grades = exams + homework + quizzes

(+ subjective judgment of instructors)

Questions not addressed on web site?

Lectures, demonstrations: Prof. Rabe

Mastering Physics, exams, grades: Prof. Coleman

Quizzes: your recitation instructor

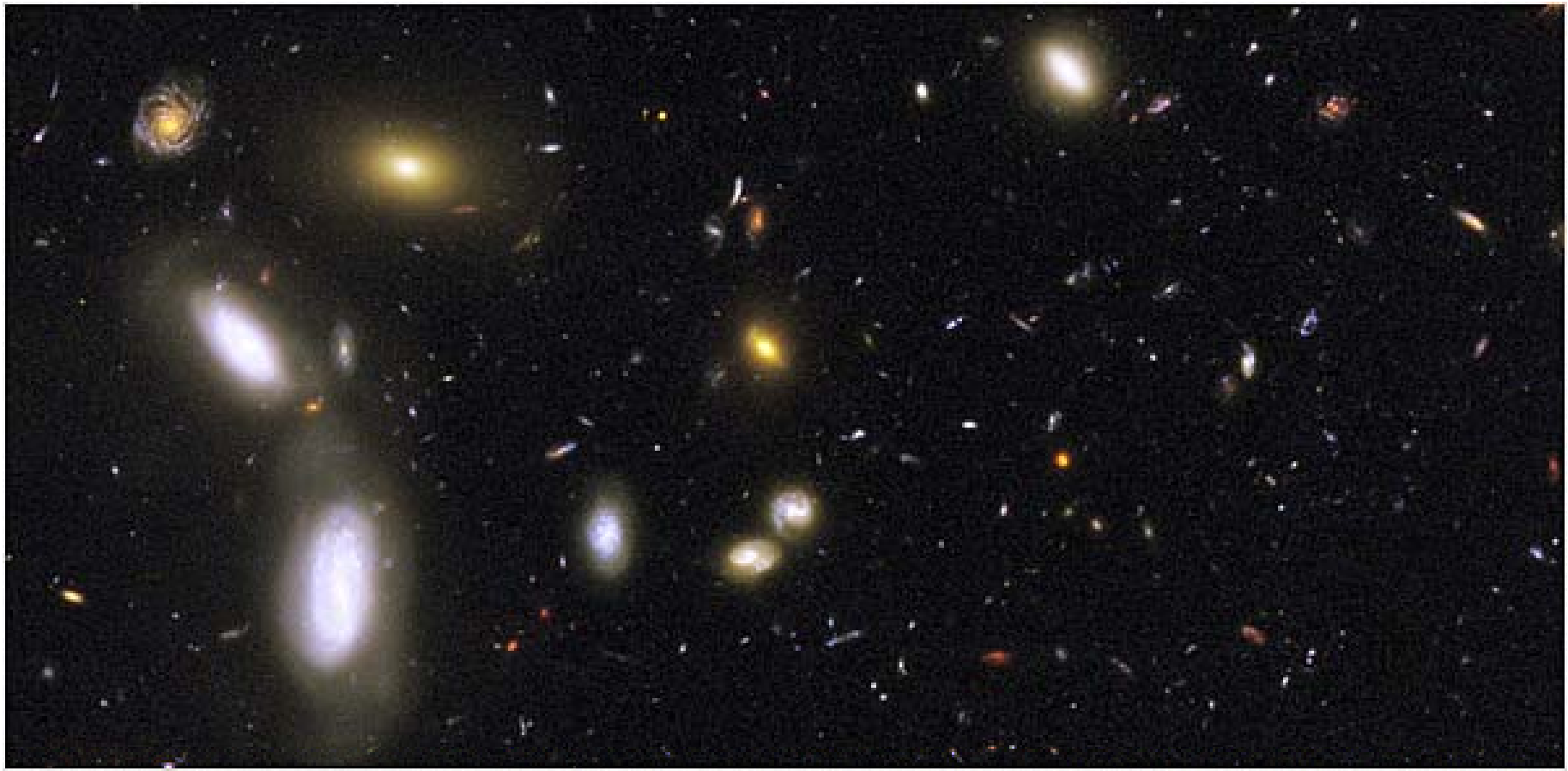
Physics 228: Optics & Modern Physics

- Optics
- Special relativity
- Quantum mechanics
- Atomic physics
- Molecules and solids
- Nuclear physics
- Elementary particle physics

Chapters 33-44 of the textboook (end of Vol 2, Vol 3)

Puzzle:
Since glass is transparent, why isn’t a glass beaker invisible?

For today
Light = electromagnetic radiation
Light and matter
Law of reflection
Law of refraction
Total internal reflection



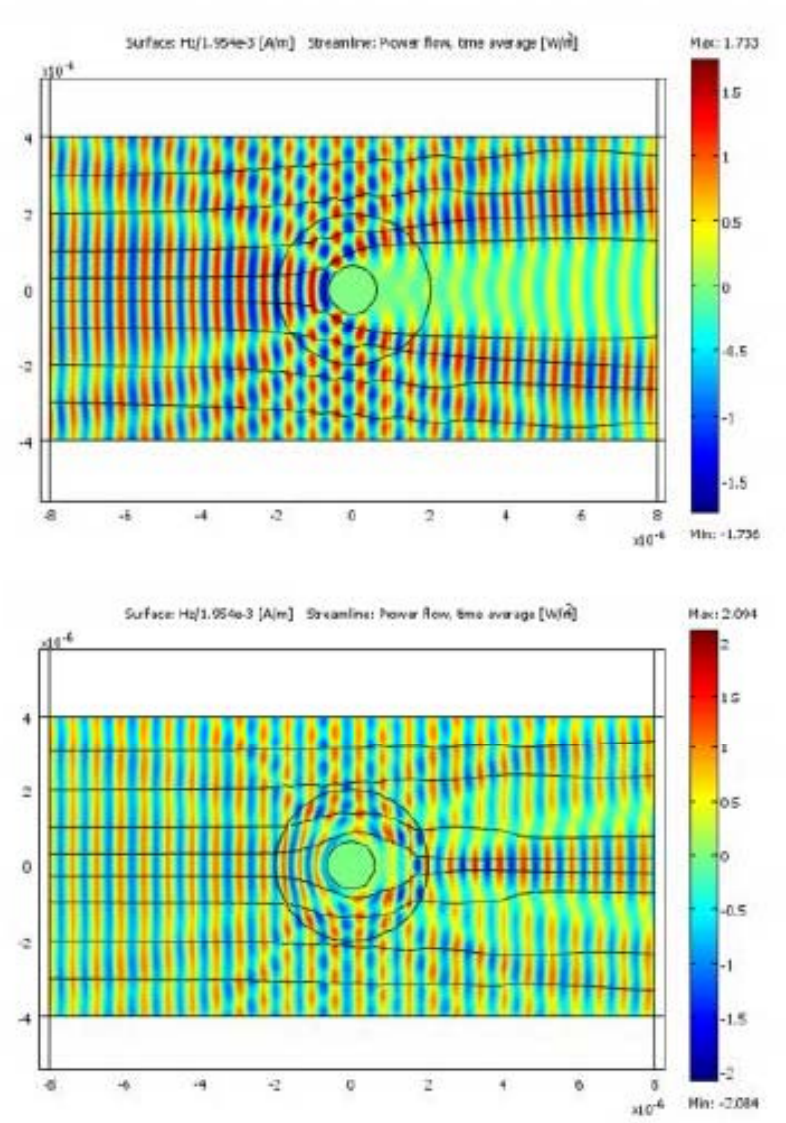
“With Updated Hubble Telescope, Reaching Farther Back in Time”
The New York Times, January 11, 2010

12 billion light years away

Light can be manipulated to make us “see” objects that are not real

Engineers create 'optical cloaking' design for invisibility

http://www.physorg.com/news94744716.html



These two images (Cloak off, top. Cloak on, bottom) were taken from corresponding videos depicting scientific simulations performed at Purdue to show how objects might be "cloaked" to render them invisible. The new findings demonstrate how to cloak objects for any single wavelength, not for the entire frequency range of the visible spectrum. But the research represent a step toward creating an optical cloaking device that might work one day for all wavelengths of visible light. The videos show how light interacts with an uncloaked and cloaked object. When uncloaked, as depicted in the first image, light waves strike the object and bounce backward. As depicted in the second image, a cloaking device designed using nanotechnology guides light around anything placed inside this cloak

The New York Times

February 18, 1999

Researchers Slow Speed of Light To the Pace of a Sunday Driver

By MALCOLM W. BROWNE

When light travels through empty space, it zips along at a speed of 186,171 miles a second -- the highest speed anything can attain, even in principle. A moonbeam takes only a little over one second to reach Earth.

But a Danish physicist and her team of collaborators have found a way to slow light down to about 38 miles an hour, a speed easily exceeded by a strong bicyclist.

The physics team, headed by Dr. Lene Vestergaard Hau, who works at the Rowland Institute for Science in Cambridge, Mass., and at Harvard University, expects soon to slow the pace of light still further, to a glacial 120 feet an hour -- about the speed of a tortoise.

"We're getting the speed of light so low we can almost send a beam into the system, go for a cup of coffee and return in time to see the light come out," Dr. Hau said in an interview.

Q33.1

When light passes from vacuum (index of refraction $n = 1$) into water ($n = 1.333$),

A. the wavelength increases and the frequency is unchanged.

B. the wavelength decreases and the frequency is unchanged.

C. the wavelength is unchanged and the frequency increases.

D. the wavelength is unchanged and the frequency decreases.

E. both the wavelength and the frequency change.

Q33.3

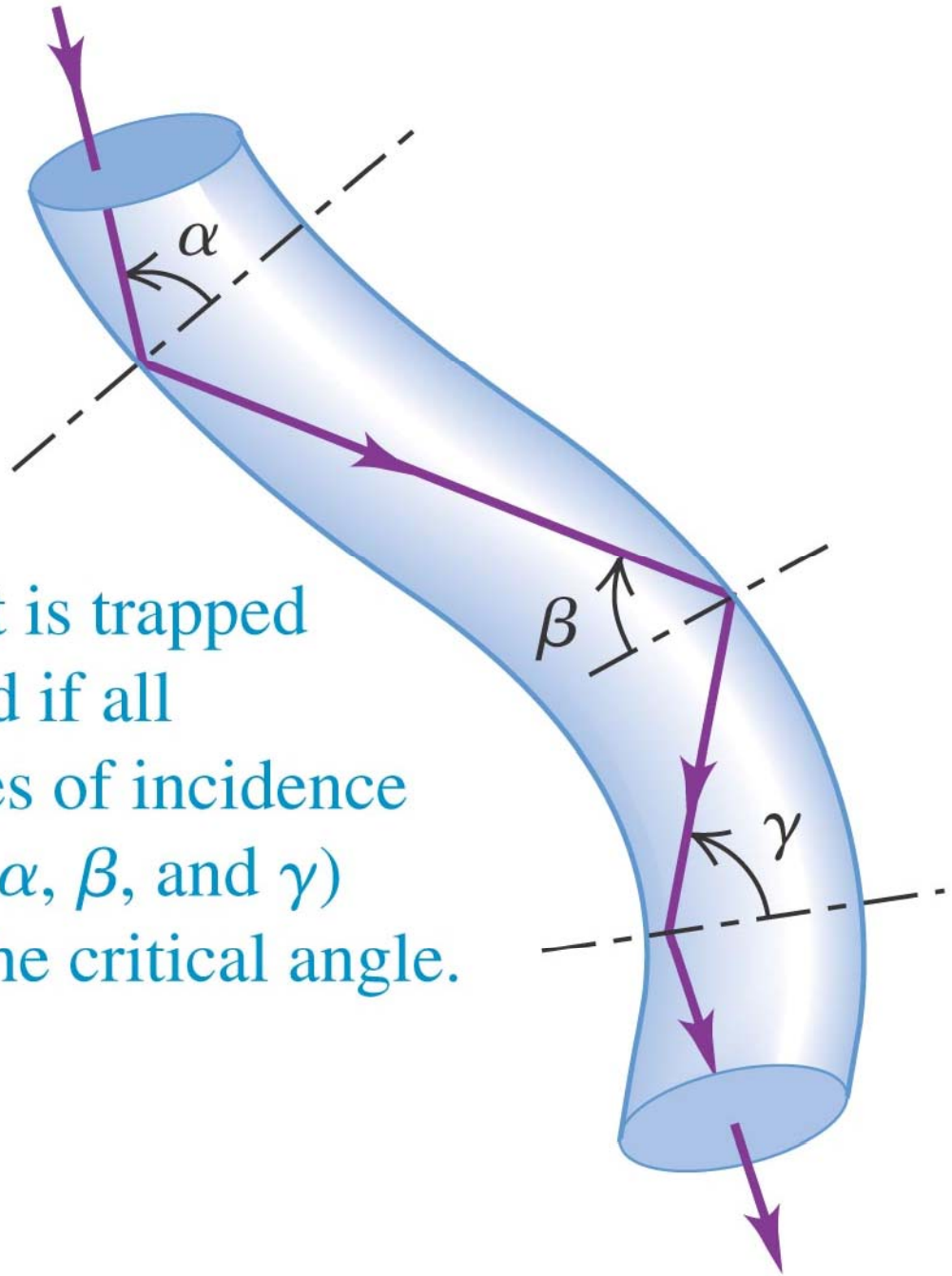
Light passes from a medium of index of refraction n_a into a second medium of index of refraction n_b. If $n_a < n_b$,

A. The light bends toward the normal and speeds up as it enters the second medium.

B. The light bends toward the normal and slows down as it enters the second medium.

C. The light bends away from the normal and speeds up as it enters the second medium.

D. The light bends away from the normal and the light slows down as it enters the second medium.



The light is trapped in the rod if all the angles of incidence (such as α, β, and γ) exceed the critical angle.