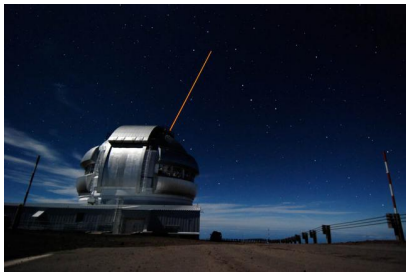
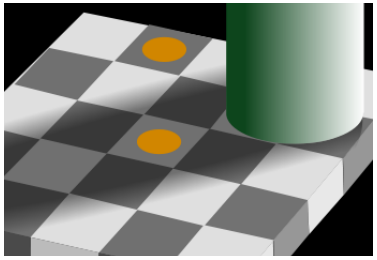
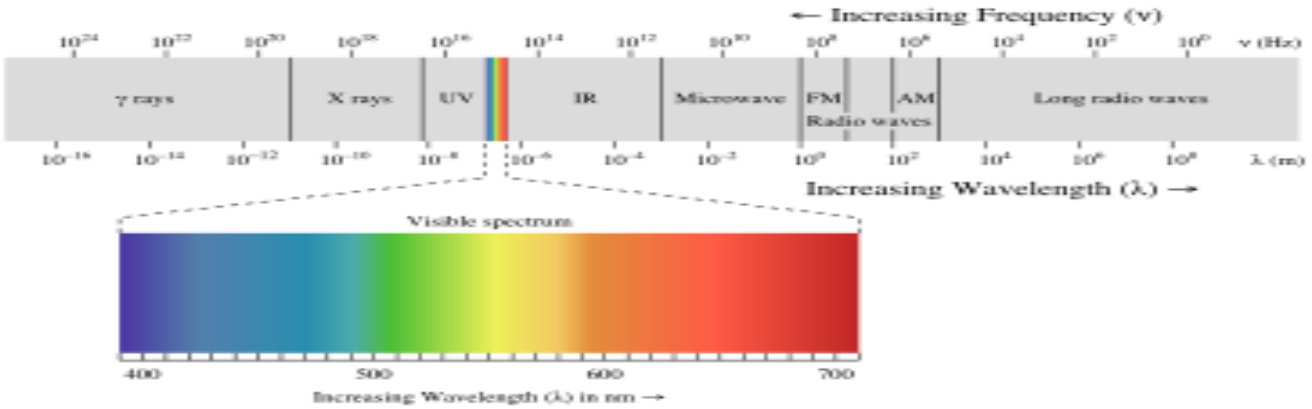
Physics 1230: Light and Color



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http://www.colorado.edu/physics/phys1230/

lecture 1

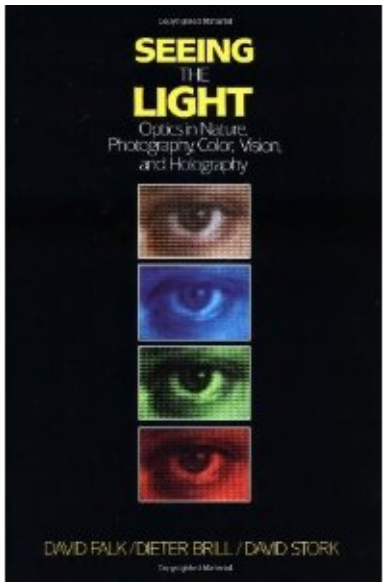
Today

- course logistics
- pedagogical comments
- course overview
- introduction: what is light?

"Last Time"

recall "Lecture 0":

- prerequisites: algebra, physical science
- do you have your text "Seeing the Light", D. Falk, D. Brill, D. Stork (SL)?



- do you have the iClicker and know how to use it?
  - must be registered (once)
  - must be set to frequency BA

Announcements

- homework 1 is posted on Desire2Learn (D2L)
  - due Tue, Jan 21 in homework box in Help Room
  - solutions will be posted on D2L
- reading for this week is:
  - Ch 1, SL: "What is Light?"
  - course syllabus details
- remember to bring your clicker to every class
  - register it (once)
  - set it to frequency BA

Administrative details

All course information can be found on the class website, that must be checked regularly (daily)

http://www.colorado.edu/physics/phys1230

Class rules

- no use of laptops, cell phones, no texting, no newspapers
- you are responsible for all the material assigned in the book even if it is not covered in class
- Lots of physics discussion (with nearby "study group" of students) during clicker questions is expected before voting

  it facilitates your learning and gives me valuable feedback on your understanding

Collective work vs. independent work

What is authorized:

- working with others to make sense of questions
- collectively sorting out the answer (explaining reasoning)
- writing up your own solution in your own words

The CU Honor Code

"On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work."

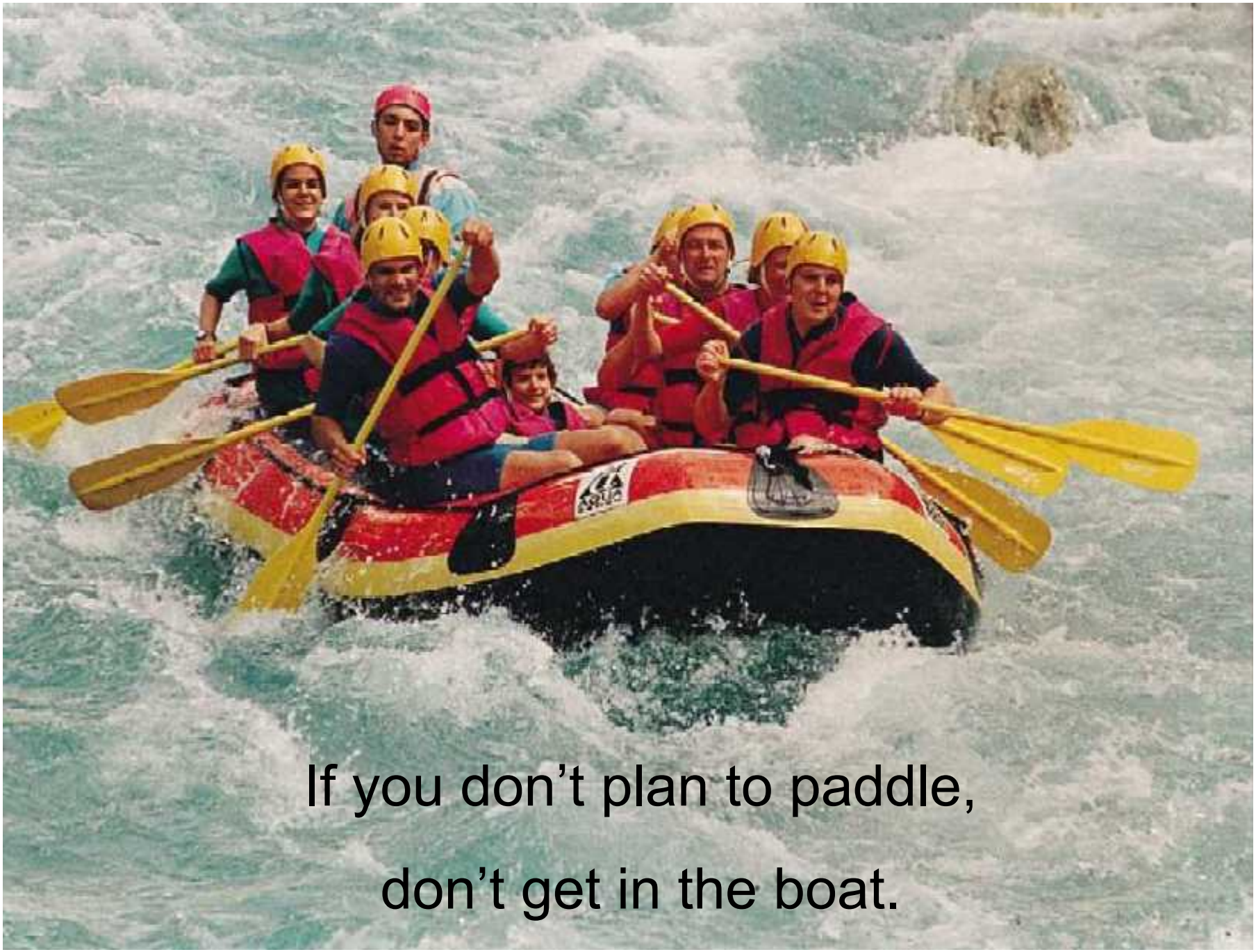
What is NOT authorized:

- telling students answers
- representing someone else's work as your own

Pedagogical comments

Physics is difficult, but succeeding in this class is not;
follow these suggestion and you ***will*** do well:

- Learning only comes as a result of *your* effort
- Stay on top of it; that's easier than playing catch-up
- Attend class regularly, participate, ask questions
- Read text and review notes *before* class; it will save you time
- Do homework early (not last minute)
- Working in study groups is OK, but be "careful"
  (make sure you can do it on your own)
- Think hard about concepts and solve many problems
  ...no pain, no gain
- Come see one of us right away if you are having difficulties


If you don’t plan to paddle,
don’t get in the boat.

More on clickers

- *Extra points from clicker questions*
- On 1st question, hold down on/off button until power light starts flashing. Then enter BA and vote; light should flash green and power light should be solid blue
- Can only set frequency after the 1st question on the class has started; then set for the rest of class
- If you turn off your clicker, repeat above procedure
- You can vote as often as you like during the allowed time, with only last vote counted
- Only use your own clicker
- Put your name and contact information on your clicker (in case it is lost)
- Answering for someone else using their clicker is a violation of the CU honor

clicker question

set frequency to BA

1st clicker question

Do you have your clicker here today?

a. Yes, I have my own

b. No, but I have my own at home

c. No, I don't have one

clicker question

Light and Color background

What is your background for Light and Color?

a. I have not had physics in high school or college

b. I have had physics in high school but not college

c. I have taken more than one physics course

d. I am a science major

clicker question

Math background

What is your math background?

a. Taken up to some level of calculus

b. Taken up to some level of trigonometry

c. Taken up to some level of algebra

d. Forgotten even my algebra

clicker question

set frequency to CB

Reasons for taking this class

Why are you taking this course?

a. Because of requirements by the university

b. Because it was recommended to me

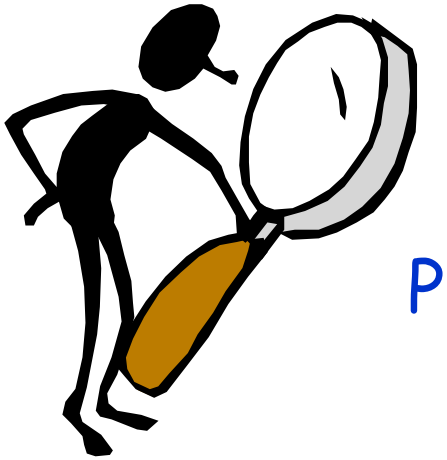
c. Because it looked easy

d. Because it looked interesting

e. Wait, this is not Cooking 101?

Purpose of this class

- Understand enough about light to be able to talk about it
- Develop a model for how light behaves and how we see things
- Develop confidence in our ability to understand the world through observation, reasoning, and a little math…



Presented in terms of stuff around you:

Color, painting, vision, cameras, rainbows, glasses …

Course overview

- What is light? (Newton, Faraday, Maxwell, Einstein, Planck)
  - electromagnetic waves *(oscillating E and B fields)*
  - photons *(particles of light)*
  - properties *(frequency, wavelength, polarization, interference)*
  - ray optics *(shadows, reflections, refractions)*
- Applications
  - lenses and mirrors
  - photography
  - the eye
  - optical instruments (*telescopes, microscopes)*
  - lasers
- Perception
  - colors
  - contrast
  - properties

Scientific notation and metric system

Powers of 10 give a shorthand notation for very large numbers:

- $10^0 = 1$
- $10^1 = 10$
- $10^2 = 100$
- $10^3 = 1000$
- …
- 10^n = 1000…000 (n zeros)

or very small numbers:

- $10^{-1} = 0.1$
- $10^{-2} = 0.01$
- $10^{-3} = 0.001$
- …

Scientists don't use feet or miles to indicate distances.

They use metric system (SI units):

meters (m)
1 meter = 39.4 inches

kilometers (km)
1 km = 1000 m = 0.625 mi

centimeters (cm)
1 cm = 10^{-2} m = 0.394 inches

millimeters (mm)
1 mm = 10^{-3} m

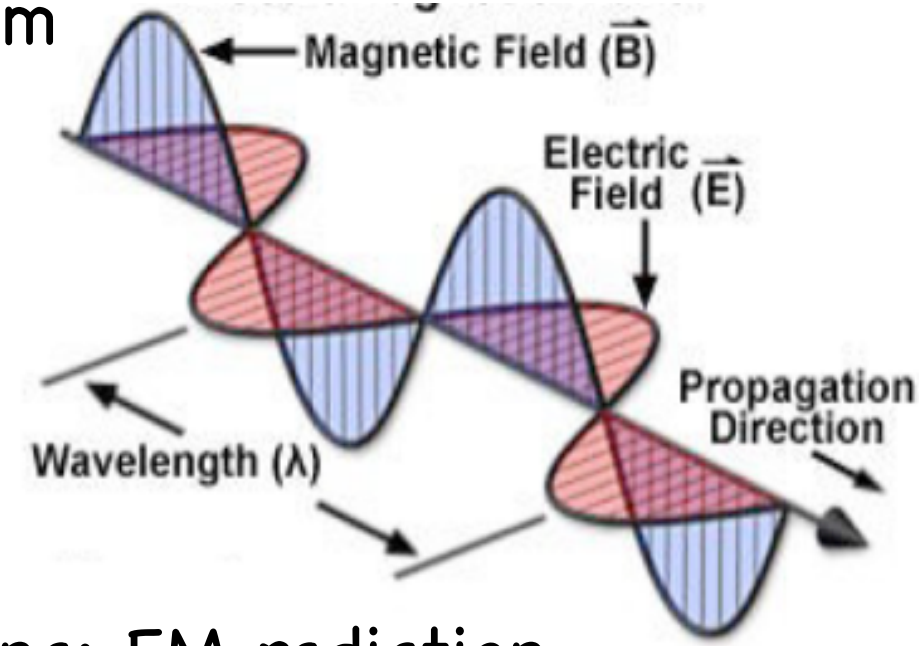
nanometers (nm)
1 nm = 10^{-9} m

Angstrom (A)
1 A = 10^{-10} m

What is light?

Electromagnetic (EM) wave or field:

- a wave of oscillating electric (E) and magnetic (B) fields, traveling with speed c = 300,000 km/sec, carrying energy and momentum

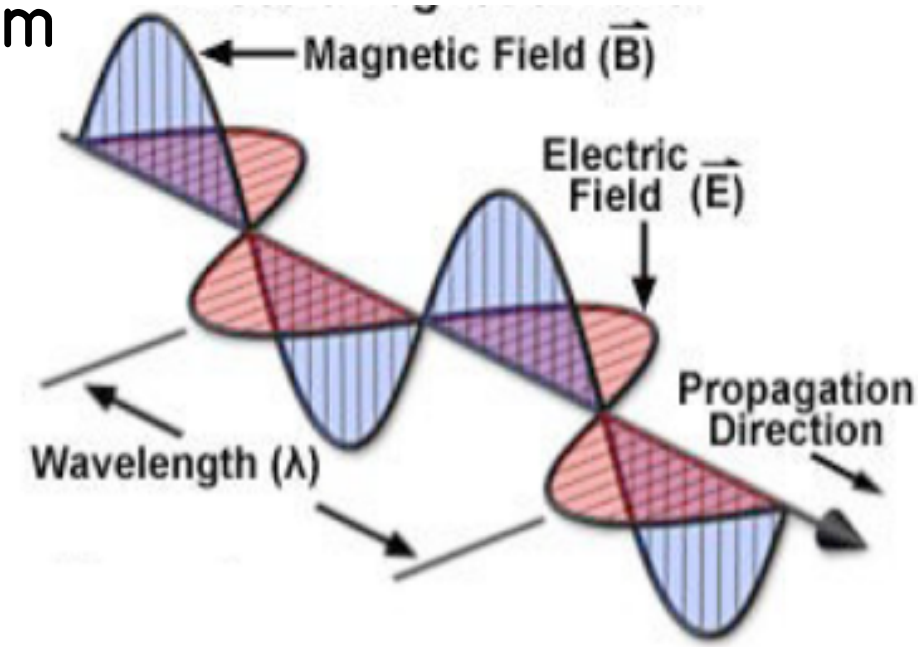


- part of more general phenomena: EM radiation

Next time

Electromagnetic (EM) wave or field:

- a wave of oscillating electric (E) and magnetic (B) fields, traveling with speed c = 300,000 km/sec, carrying energy and momentum



DETAILS on fundamental properties of light