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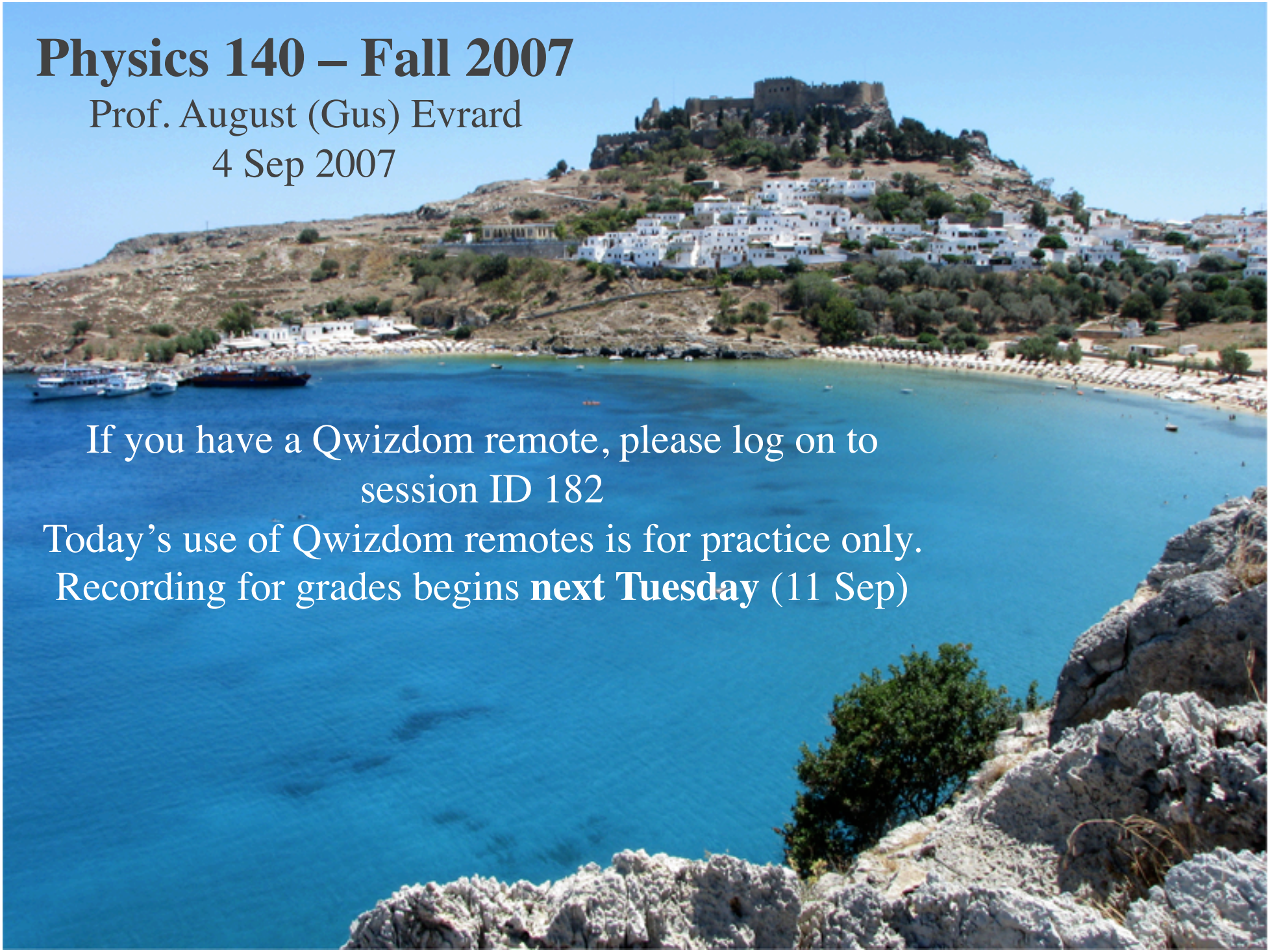


Physics 140 – Fall 2007

Prof. August (Gus) Evrard

4 Sep 2007

If you have a Qwizdom remote, please log on to session ID 182

Today's use of Qwizdom remotes is for practice only.

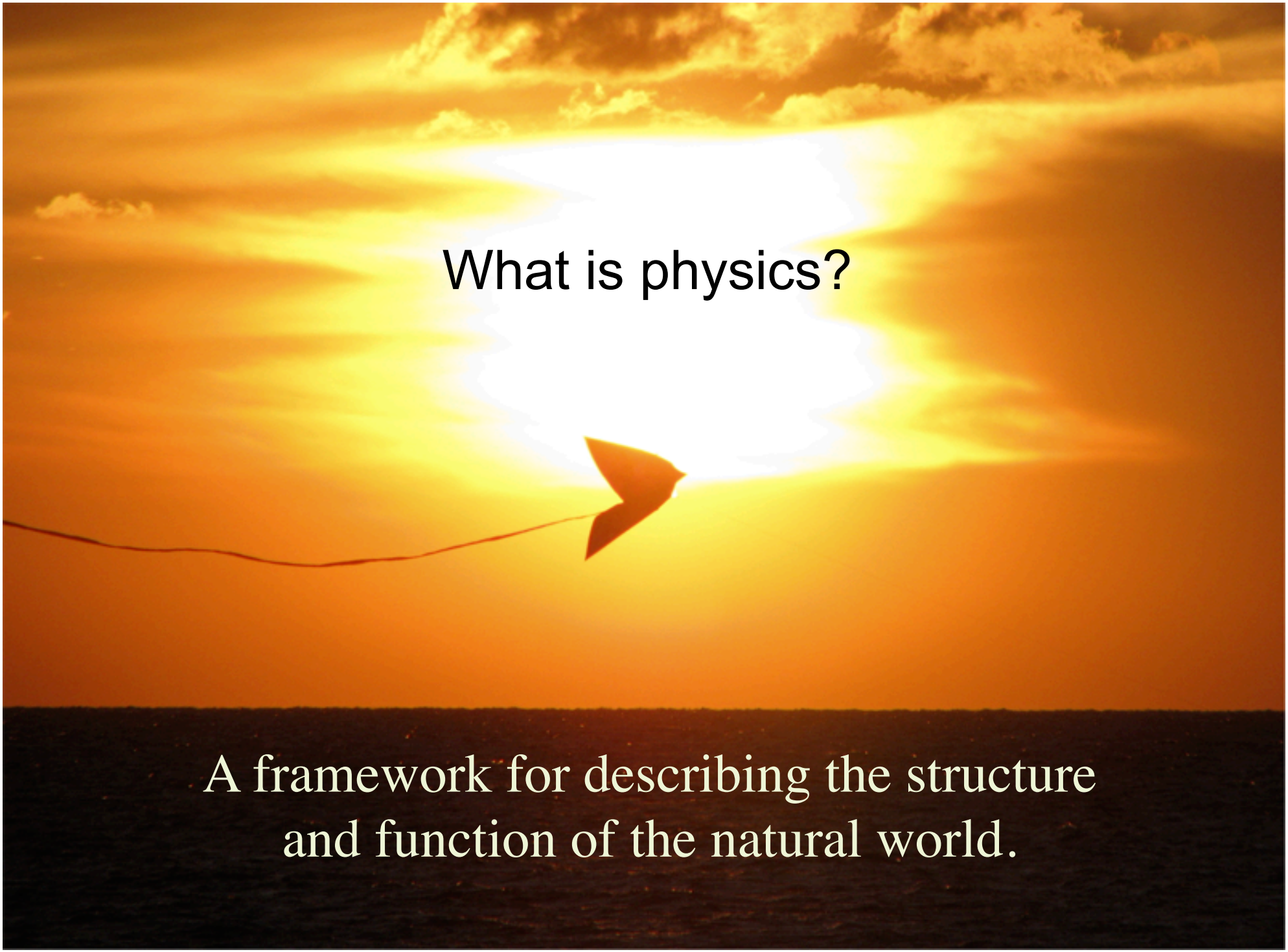
Recording for grades begins **next Tuesday** (11 Sep)

Physics 140 is a calculus-based introductory course intended for

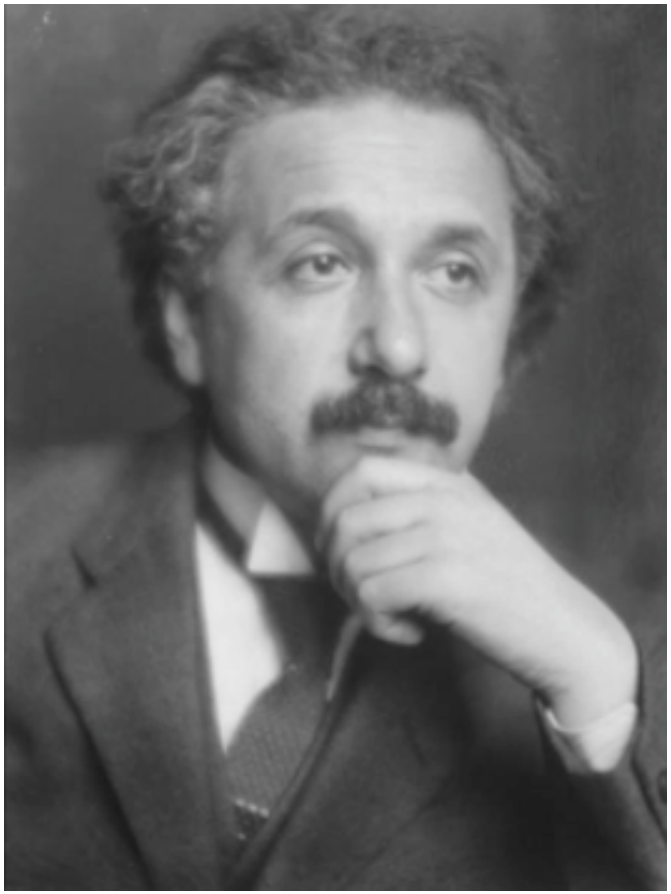
- potential majors in the natural sciences
- engineering students
- students skilled in trigonometry, algebra & calculus

Physics 140 is generally not intended for

- pre-professional students (see physics 125)
- students looking only to satisfy Nat Sci distribution
- students with no background in calculus


What is physics?
A framework for describing the structure and function of the natural world.

All of science is nothing more than a refinement of everyday thinking.



Source: Life (1921)

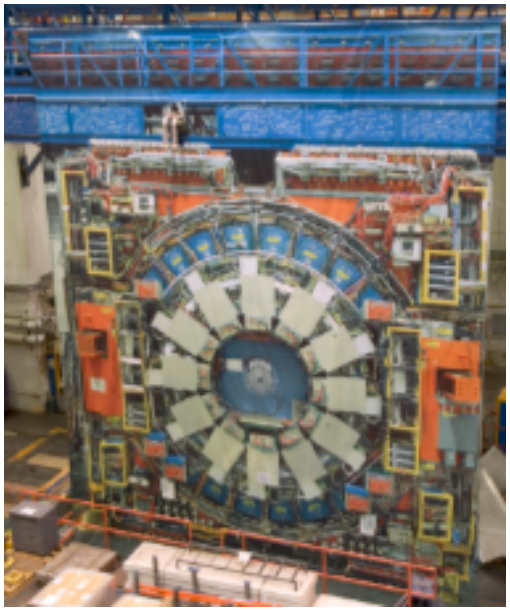
What we call physics comprises that group of natural sciences which base their concepts on measurements, and whose concepts and propositions lend themselves to mathematical formulations.

The New Quotable Einstein, A. Calaprice, ed., Princeton Univ. Press, 2005, pp. 235,6

physics is …

discovering the building blocks of nature

Source: DOE - Fermi National Laboratory

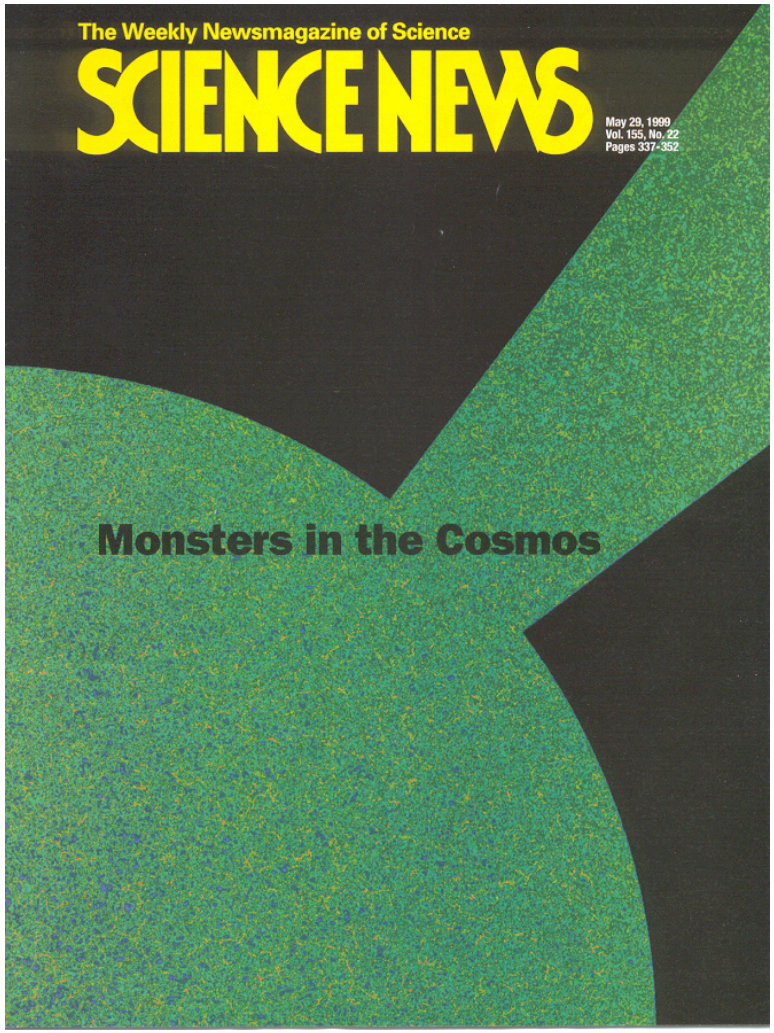


Source: DOE - Fermi National Laboratory

physics is …

revealing the structure of the entire universe

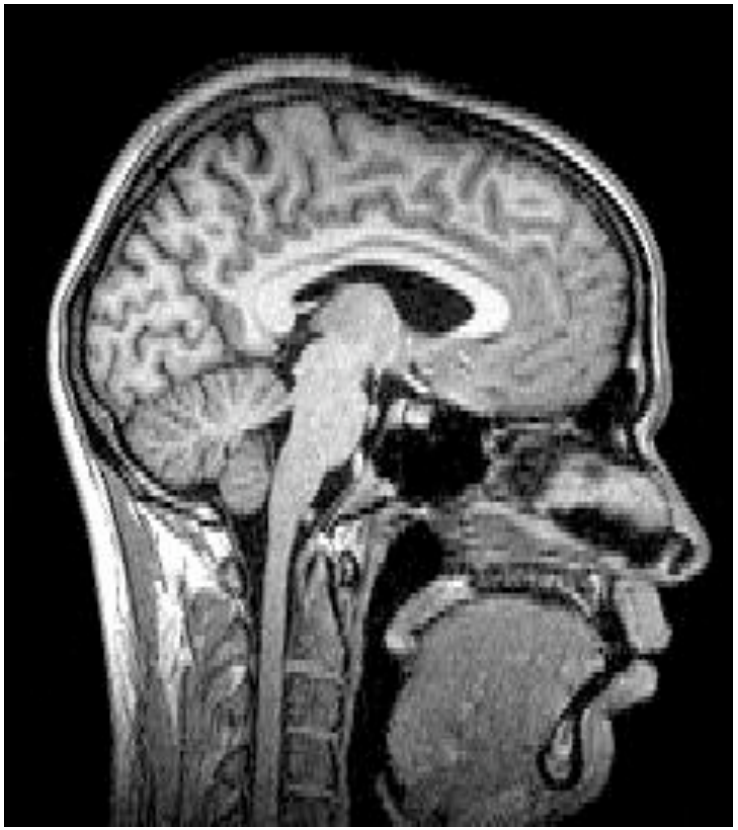
Source: NASA - STRS-61



Source: Science News (1999)

physics is …

helping to heal the sick



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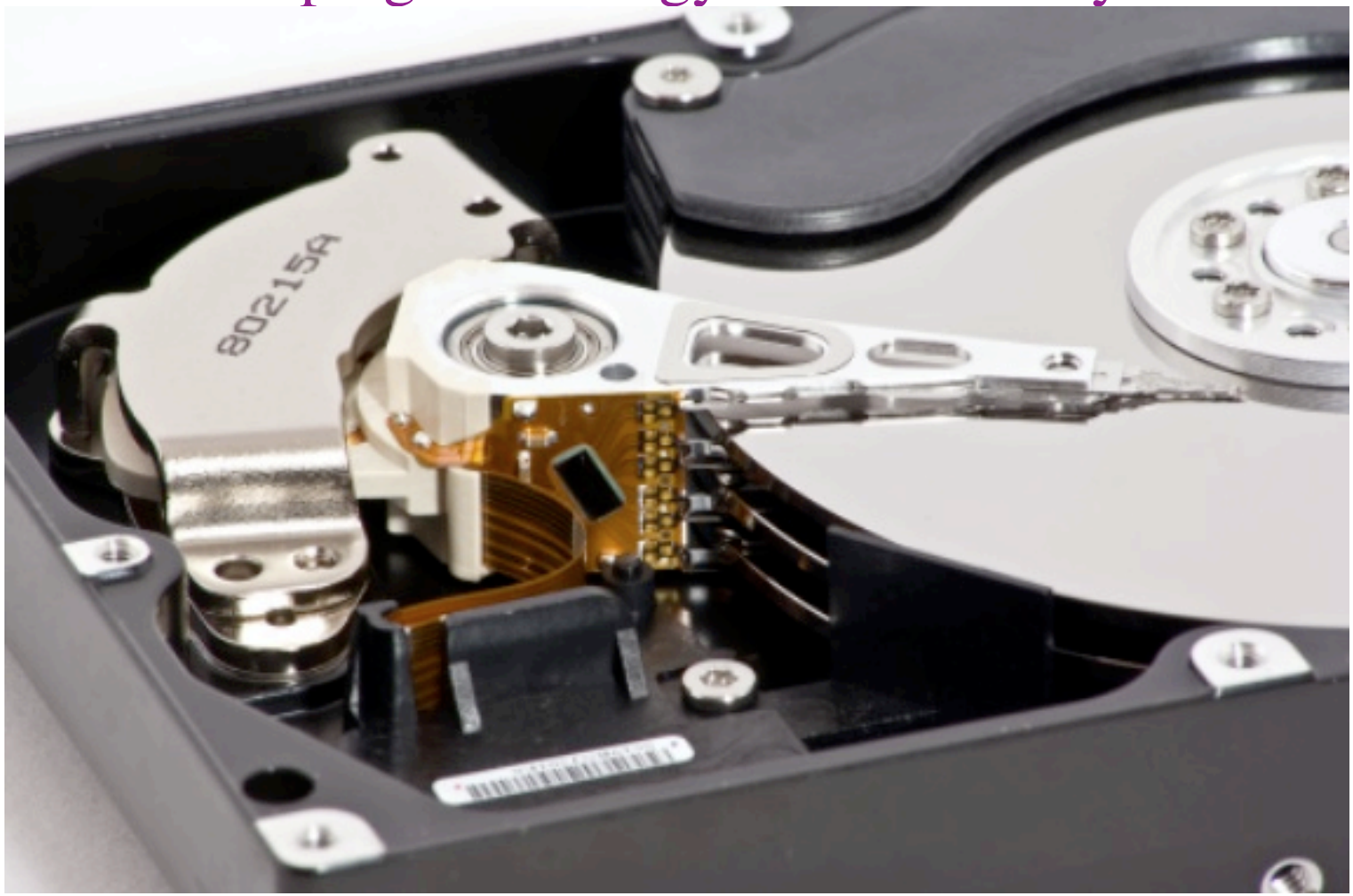
physics is …

developing technology that enriches your life



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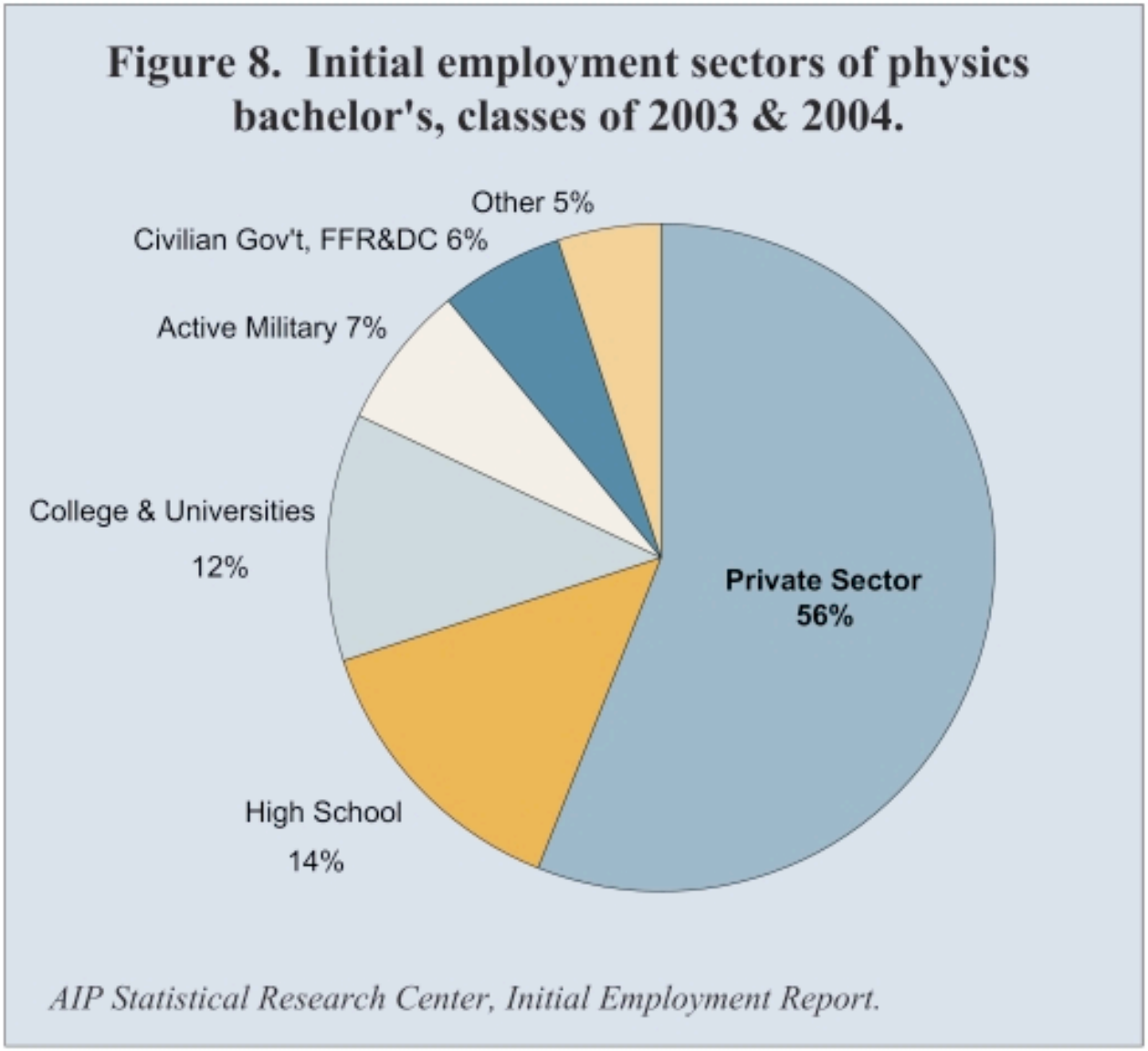
physics is …

a launch vehicle for a successful career

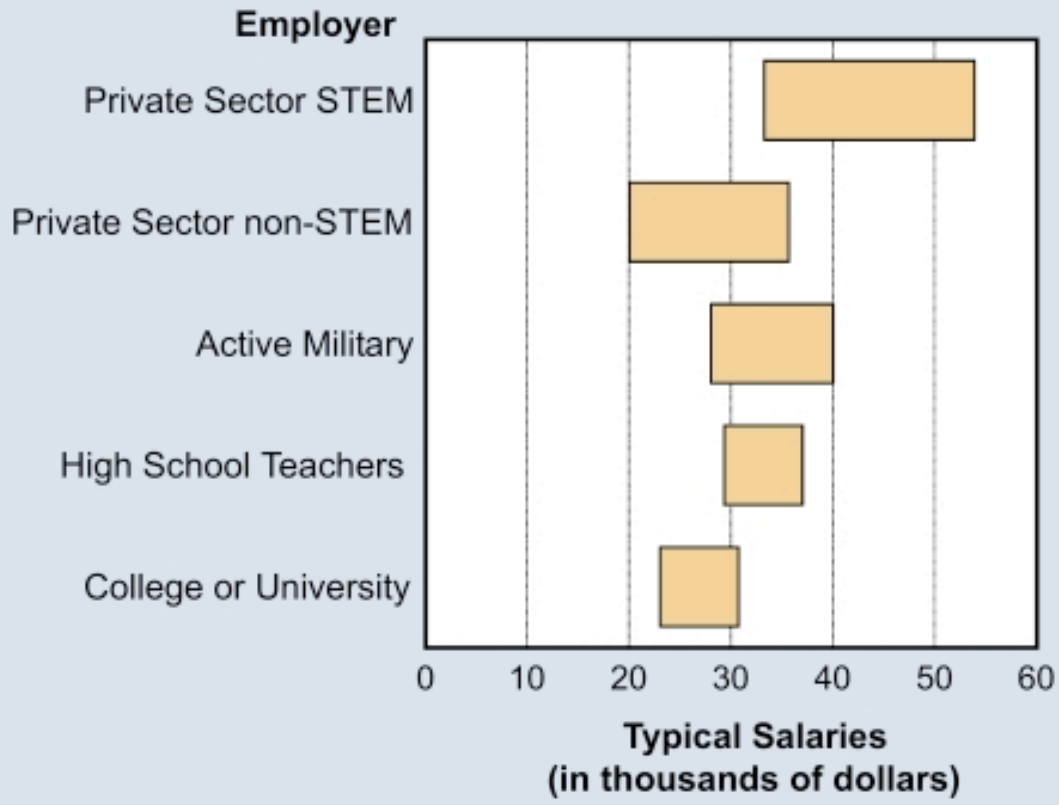


Source: http://www.aip.org/statistics/

physics is …

a launch vehicle for a successful career

Figure 10. Starting salaries for physics bachelor's , classes of 2003 & 2004.



Note: Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles.

STEM refers to positions in science, technology, engineering and math

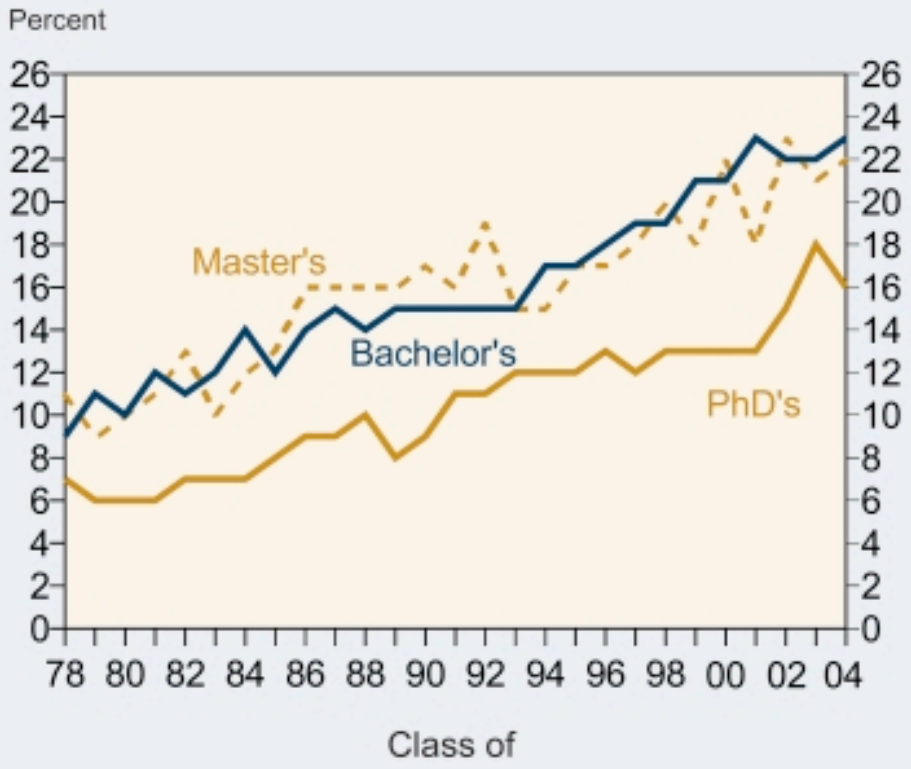
AIP Statistical Research Center, Initial Employment Report.

Source: http://www.aip.org/statistics/

physics is …

a launch vehicle for a successful career - for both women and men!

Figure 10. Percent of bachelor's degrees, masters degrees and doctorates in physics earned by women, 1978-2004.



Note: A form change occured in 1994 resulting in a more accurate representation of women among physics bachelors. Some of the increase in 1994 only, may be a result of that change.

AIP Statistical Research Center, Enrollments and Degrees Report.

Source: http://www.aip.org/statistics/

For you, this term, physics is …

MECHANICS

Mechanics is the study of macroscopic motion.

kinematics: descriptive =
location of an object & how it
is moving at some instant

dynamics: explanatory =
understand causes &
enable prediction of future motion

Newtonian Mechanics: limits of applicability

The `classical' description of motion that we will study breaks down in the following regimes-

- at small (atomic) distances (quantum mechanics)
- at high speeds (special relativity)
- under strong gravity (general relativity)
- where randomness rules (chaos/complex systems)

Structure of the course

- Course site: http://ctools.umich.edu

  Assignment #0: review the course site content!

- Textbook: Young & Freedman (12th ed)
- Lecture: Tues,Thurs: 9am, 10am, 11am
- Reading for lecture (see syllabus on web page)
- Discussion sections: Mon (Th lec), Wed (Tu lec), starts **tomorrow**)

  group assignments at each meeting

- On-line homework via Mastering Physics (MaPhys)
- Grade reports via SAMS system

  http://cats.lsa.umich.edu/

- Exams: 3 midterms (1.5 hr) and one final (2 hr)

  Assignment #1: plan now for the exam dates

Hey, how about my grade?

You will receive an overall score S, derived from weighting the course elements (on a 0-100 scale) as follows:

S = 0.20 (homework) + 0.10 (discussion)
+ 0.15 (exam 1) + 0.15 (exam 2) + 0.15 (exam 3)
+ 0.20 (final) + 0.05 (lecture)

Letter grade determination:

Curved, based on your overall score S

A (85), B (75-85), C (60-75), D (45-60), E (<45)

What you should do for Physics 140 now

- read the contents of the **PHYSICS 140 F07** CTools site

  http://ctools.umich.edu
- sign up for a MaPhys account, begin first assignment
- read Chapter 1 of Y&F
- get ready to sign up for an SLC study group (see Physics Help link)

How can I do well in this course?

- be ***observant***

  think about physics - it's happening all around you!

- be ***organized***

  allocate time for reading/ homework/ study group

- be ***active***

  try several approaches to studying & problem solving,

  work with your peers (e.g., SLC-led study group)

- be ***patient***

  if at first you don't succeed…

Why come to lecture?

- find out topics of emphasis + tips not in the book. There is not enough time in lecture to cover in depth *all* of the topics that may appear in homework, discussion or on the exams. However, the most important subject matter will be covered in lecture.

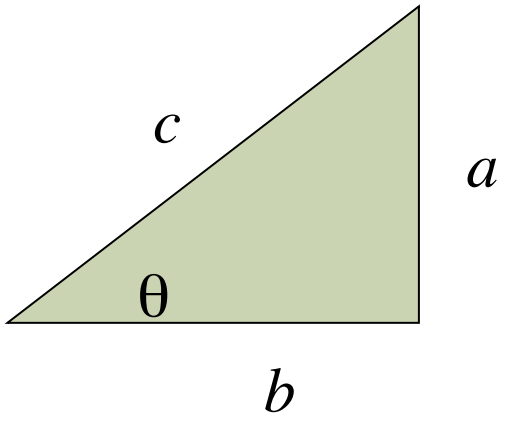
- see the demonstrations. Watch the principles of physics in action. The demos are usually cited by students as the most fun and informative part of the course.

- interact with your peers The ***peer instruction*** method will be used in lecture. Several times at each meeting, you will be asked to respond to a question. If there's a need, you'll discuss the problem with your neighbors (after some hints from me…) before respond a second time. This technique promotes the type of **active learning** that studies have shown leads to a deeper understanding of the material.

- oh, and, of course, there's the 5% credit to your final score…

Where are you from?

1. Ann Arbor
2. Michigan palm
3. Michigan UP
4. USA(outside MI), E of Mississippi river
5. USA(outside MI), W of Mississippi river
6. Outside USA



The above diagram shows a right triangle with side lengths and angle θ labeled. What does the ratio b/a represent?

1. sinθ
2. cosθ
3. tanθ
4. cotθ
5. arcsinθ

Scalars:

A scalar is a single value that **represents magnitude** (a quantity of something) and obeys ordinary arithmetic.
Often a unit is required (e.g., my car's top speed is 72 miles per hour) but not always (e.g., there are 3 eggs in my basket).
A scalar can be any real number (positive, negative or zero).

Vectors:

A vector is a set of values in coordinate space that **represent both magnitude and a direction** in that space. In most cases of interest, the magnitude requires a unit (e.g. the wind speed is 15 km/hr). Vector arithmetic includes:

- addition and subtraction (graphically or by components)
- two forms of multiplication
  - i) scalar (or `dot') product
  - ii) vector (or `cross') product

The magnitude of a vector is always a non-negative number.

http://phet.colorado.edu/simulations/vectormath/vectorMath.swf