Who are you?
The ATLAS Experiment

The BaBar Experiment
Why should I care about electricity and magnetism?
Magnetic Resonance Imaging (MRI)

PET Scans (Positron Emission Tomography)
While this data is for students and their majors, clearly an education in physics is a critical ingredient in success on the MCAT!

(similar data exists on the LSAT)

<table>
<thead>
<tr>
<th>Major</th>
<th>Physical Sciences</th>
<th>Biological Sciences</th>
<th>Verbal reasoning</th>
<th>Number of applicants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical Engineering</td>
<td>10.9</td>
<td>10.7</td>
<td>9.6</td>
<td>1,005</td>
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<tr>
<td>Physics</td>
<td>11.1</td>
<td>10.3</td>
<td>9.6</td>
<td>207</td>
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<tr>
<td>Electrical Engineering</td>
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<td>10.5</td>
<td>9.4</td>
<td>195</td>
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<tr>
<td>Economics</td>
<td>10.4</td>
<td>10.5</td>
<td>9.7</td>
<td>566</td>
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<td>Neuroscience</td>
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<td>10.6</td>
<td>9.5</td>
<td>1,066</td>
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<tr>
<td>Mathematics</td>
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<td>10.1</td>
<td>9.6</td>
<td>374</td>
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<tr>
<td>English</td>
<td>9.4</td>
<td>9.9</td>
<td>10.3</td>
<td>434</td>
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<tr>
<td>Biochemistry</td>
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<td>10.3</td>
<td>9.1</td>
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<td>Chemistry</td>
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<td>9.9</td>
<td>9.0</td>
<td>2,091</td>
</tr>
<tr>
<td>Microbiology (or Bacteriology)</td>
<td>9.0</td>
<td>9.9</td>
<td>8.7</td>
<td>775</td>
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<tr>
<td>Psychology</td>
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<td>9.4</td>
<td>9.1</td>
<td>2,421</td>
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<tr>
<td>Biology</td>
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<td>9.5</td>
<td>8.7</td>
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<td>Premedical</td>
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<td>9.0</td>
<td>8.4</td>
<td>663</td>
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<td>All Majors</td>
<td>9.2</td>
<td>9.8</td>
<td>9.0</td>
<td>41,487</td>
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</table>
While this data is for students and their majors, the reason a physics major is valuable is because physics teaches you about problem solving in challenging environments, requiring innovative thinking.

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

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What are the goals (learning outcomes) of this course?
Upon successful completion of this course, students will be able to:

1. Explain the nature of electrical charge, force, potential, and fields and describe the behavior of electrical phenomena; explain the basic components of electrical circuitry, including conductors, batteries, resistors, and capacitors; explain the nature of magnetism and describe the behavior of magnetic phenomena; explain the nature of light and its connection to electricity and magnetism; explain the basic working of optical systems; explain how the study of electricity, magnetism, and light set the stage for a revolution in our understanding of the universe;

2. Apply their understanding of electricity, magnetism, light, and optics to areas other than physics, such as medicine, biology, chemistry, electronics, and everyday life.

3. Demonstrate the basic understanding of electricity, magnetism, light, and optics required to advance in the study of physics or topics which require a basic understanding of these phenomena.
What is the structure of this course?
STRUCTURE

● Lectures
  ● Tue/Th; attendance is required (see syllabus for exceptions)
  ● Expect “chalk talk”, multimedia, demonstrations, and discussions

● Homework
  ● about 1 per week - 10% of the grade
  ● strict homework policy (see course website)
  ● quality of homework policy applies to answers on quizzes and tests

● Quizzes
  ● about 1 per week, in-class - 15% of the grade
  ● two lowest quiz grades are automatically dropped

● Exams
  ● 3 incremental in-class exams (see syllabus) worth 45% of the grade
  ● Final exam (cumulative) - 30% of the grade
RESOURCES

● Me
  ● Office hours: 2-4 on Monday and Wednesday
  ● Additional discussions must be arranged in writing (e-mail)

● Teaching Assistant
  ● We will setup 1 help session per week

● The Web
  ● Course website: http://www.physics.smu.edu/sekula/phy1308

● Communication
  ● I will make announcements over e-mail (please check at least once per week)
  ● I'll push announcements out by Twitter and identi.ca and Facebook, as well as any useful factoids in the news about topics we are discussing.
    - find anything interesting or have a question? Tag it with #phy1308.
THE BIG PICTURE

- I encourage you to work together outside of class
  - cheating and plagiarism will NOT BE TOLERATED
  - Work handed in must be the unique product of your own effort, even if you collaborate with others

- Science has much in common with the humanities
  - there is a good story, and this class will aim to teach part of it
  - to seek a deeper understanding of the world around us and the larger cosmos, we will dig rigorously into many subjects

- Physics is exciting
  - physics is the study of energy, matter, space, and time
  - it is a quest, paid for with the blood of experimental labor and expressed in the language of mathematics, for the ultimate knowledge of the origin, composition, and fate of the universe.
REVIEW OF CORE PRINCIPLES
Core Physics Principles 1

- Matter can execute motion
  - that motion can be described using place (coordinates: $x$, $y$, $z$, etc.) and time ($t$), changes in place with respect to time (speed, $v = \Delta x/\Delta t$), and acceleration (changes in speed with respect to time)

- Forces alter the motion of matter
  - Newton's Laws
    - In the absence of forces, objects at rest tend to remain at rest, objects in motion tend to remain in motion ("inertia", or the tendency of matter to resist change)
    - Force alters motion, as encapsulated by $F=ma$ (or its more general form, $F = \Delta p/\Delta t$)

- Total Energy and momentum are always conserved
CORE PHYSICS PRINCIPLES 2

● Matter is made from atoms
  ● all matter is composed of fundamental building blocks called “atoms”

● Atoms are composed of electrons, protons, and neutrons
  ● electrons “orbit” a nucleus of protons and neutrons

● The macroscopic properties of matter are a result of the behavior of atoms
ALGEBRA

• You should already be able to . . .
  
  ● express statements in symbolic form
    - example: “Write an equation that expresses the position of an object as proportional to time.”
  
  ● solve simple equations
    - 1st order equations: $2x - 1 = 3$
    - 2nd order (quadratic) equations: $3x^2 - 4x - 1 = 5$
GEOMETRY/ TRIGONOMETRY

- You should already be able to . . .
  - know what a point, line, and plane are
  - know how to relate angles when lines bisect each other
  - explain the relationship between angles in a triangle
  - compute sines, cosines, and tangents
VECTORS

- You should already be able to . . .
  - know how to define a coordinate system
  - know that a “vector” is a way of expressing a direction in space using numbers along coordinate axes
  - know how to write a vector in either “unit vector” notation or in (x, y, z) notation
  - know how to add and multiply vectors
CALCULUS

- You should already be able to . . .
  - explain what a derivative is, and be able to calculate one.
  - explain what an integral is, and be able to calculate one.
RESOURCES

- Don’t be afraid of math
  - if you haven’t done this in a while, there are many ways to review
  - recommended by previous PHY1308 students:
    - Schaum’s reference guides on calculus, trig, etc.
    - “Calculus for Dummies” or similar book - bad title, good solid and quick review
    - Tutoring at ALEC