Welcome to Intro Physics II!

You have successfully found your way to Phys 222!

- Important things to keep in mind:
    - Homework is starting right away. Your first problem is due by midnight on Friday
        - Through WebWorK
        - Username is first portion of your email
        - Initial password is your student ID, and then change it!
    - Slides will be posted online before class each day
- To-Do's:
    - Check out the class webpage
    - Take a closer read through my syllabus to understand what you are getting into
    - Make sure you have some form of the book (or soon to have)
    - Remember your phone or computer for in-class polling on Friday
    - Get going on the first homework

Upcoming:

What is Intro Physics II?

The Pieces

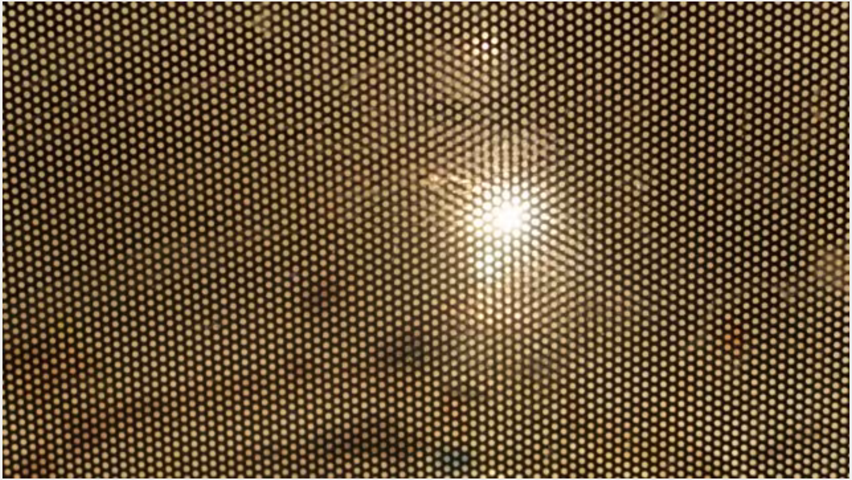
- Grab the people on either side of you to make small groups
- Find a blank piece of paper and draw a line down the center
  - On the left, list major topics that you learned last semester or in Phys 221
  - On the right, list topics that you think we'll be talking about this semester
- I'll give you about 5 minutes to create your lists and then we'll compile them on the board

My Rough List

- Momentum Principle
- Vector nature of forces
- Fundamental forces
- Iteration
- Energy principle
- Different types of energy, internal and external
- Angular Momentum Principle

- How charges behave
- Thinking with and calculating fields
- Working with electric potential
- What is the deal with magnetism?
- Basic circuits
- Maxwell's Equations
- What is and what causes radiation and light
- How do light waves interact with matter?

How do we explain them?

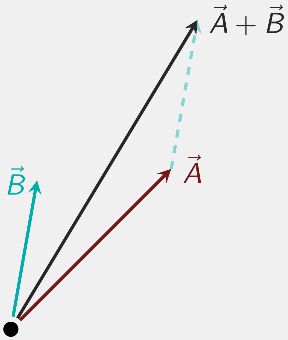


Upcoming:

Some Review

Vectors!

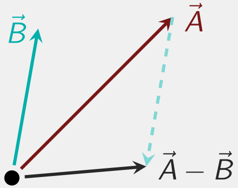
- Still dealing with forces, velocities, positions, etc this semester
  - Vectors still matter!
- Add them



$$\vec{\mathbf{A}}+\vec{\mathbf{B}}=\langle A_x+B_x, A_y+B_y, A_z+B_z\rangle$$

Vectors!

- Still dealing with forces, velocities, positions, etc this semester
  - Vectors still matter!
- Add them
- Subtract them



$$\vec{\mathbf{A}} - \vec{\mathbf{B}} = \langle A_x - B_x, A_y - B_y, A_z - B_z \rangle$$

Vectors!

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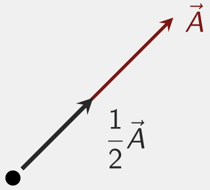
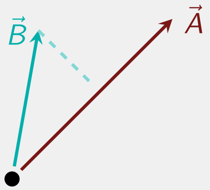
  - Vectors still matter!
- Add them
- Subtract them
- Scale them



$$c\vec{\mathbf{A}} = \langle c \cdot A_x, c \cdot A_y, c \cdot A_z \rangle$$

Vectors!

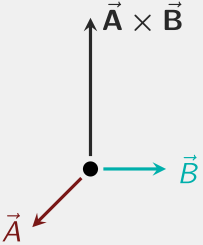
- Still dealing with forces, velocities, positions, etc this semester
    - Vectors still matter!
- Add them
- Subtract them
- Scale them
- Dot them



$$\vec{\mathbf{A}} \cdot \vec{\mathbf{B}} = A_x B_x + A_y B_y + A_z B_z$$

Vectors!

- Still dealing with forces, velocities, positions, etc this semester
    - Vectors still matter!
- Add them
- Subtract them
- Scale them
- Dot them
- Cross them
- Boil them, mash them, stick 'em in a stew...



$$\left|\vec{\mathbf{A}} \times \vec{\mathbf{B}}\right| = \left|\vec{\mathbf{A}}\right|\left|\vec{\mathbf{B}}\right| \sin\theta$$

Fundamental Forces

- Gravity

$$\vec{\mathbf{F}} = -\frac{GM_1M_2}{|\vec{\mathbf{r}}|^2}\hat{\mathbf{r}}$$

- Electrostatic

$$\vec{\mathbf{F}} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{|\vec{\mathbf{r}}|^2}\hat{\mathbf{r}}$$

- Weak Force
- Strong Force

Fundamental Principles

- Momentum Principle

$$\Delta\vec{\mathbf{p}} = \vec{\mathbf{F}}_{net}\Delta t$$

- Energy Principle

$$\Delta E = W + Q$$

  - Single particles only have rest and kinetic energy
  - System can have potential, and other forms of internal energy
- Angular Momentum Principle

$$\Delta\vec{\mathbf{L}} = \vec{\tau}_{net}\Delta t$$

The Iterative Method

- Method to predict future motion given a force
- Process:
  - Determine the net force at that point in time

$$\vec{\mathbf{F}}_{net} = \quad ?$$

  - Use the net force and momentum principle to calculate a new momenta

$$\vec{\mathbf{p}}_{new} = \vec{\mathbf{p}}_{old} + \vec{\mathbf{F}}_{net}\Delta t$$

  - Use an estimate for the average velocity to update the position

$$\vec{\mathbf{r}}_{new} = \vec{\mathbf{r}}_{old} + \vec{\mathbf{v}}_{avg}\Delta t$$

  In general, use

$$\vec{\mathbf{v}}_{avg} = \frac{\vec{\mathbf{p}}_{new}}{m} \quad \text{or} \quad \vec{\mathbf{v}}_{avg} = \frac{\vec{\mathbf{v}}_{old} + \vec{\mathbf{v}}_{new}}{2} = \vec{\mathbf{v}}_{aavg}$$

Upcoming:

Syllabus Highlights

My Vitals

Name: Jed Rembold

Office: Collins 311 (it's shared)

Office Hours: MW 3–5pm *and open door*

Email: `jjrembold@willamette.edu`

Office Phone: (503)-370-6860

Grading

Attendance	Lab	Online HW	Video HW	3 Midterms	Final
4%	10%	15%	10%	36%	25%

Homework

- Online
  - Assigned Mon, Wed
  - Due Wed, Fri at midnight
  - Completed on WebWorK, *no penalty for incorrect answers*
- Video
  - Assigned Fri
  - Due Mon at midnight
  - $<$ 4 min video to show objective mastery
    - Objective provided
    - You choose/create problem
    - Can be a simple video!
  - I'll request permission to post my favorites to the webpage
  - One question on each test will pull from those videos

Tests

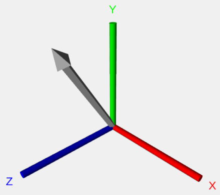
- 3 Midterms
  - First is February 21nd
  - Get a 3x5 inch index card, one side, handwritten
  - In class, so 1 hour in length
- Final
  - On Saturday, May 9th at 8am (lovely. . .)
  - Comprehensive
  - Can use previous index cards + 1

Labs

- You need to be at lab to receive lab credit
- Let both me and your lab instructor know if you need to miss:
  - Best to make it up at a different lab that day if possible
  - Worst case have one week after Spring Break when an old lab could be made up
- **You can not pass the class if you miss more than 4 labs**

Computation

- This course introduces computational skills that are often times neglected in other Intro courses
- The bulk of these will happen during lab
- Homeworks which rely on these skills will be scattered throughout the semester
- Don't neglect them! I can't really think of any scientific discipline in this day of age that can not benefit from applying computational methods in certain cases!
- The lab next week will be a Glowscript review to remind some of you of what you are doing and to get others of you up to speed on how this all works



Closing Example

Suppose we placed two charges of $4\,\mu\text{C}$ and $1\,\mu\text{C}$ two meters apart. Each charge is $1\,\text{g}$. If they were initially at rest when we released them, how far apart would they be $\frac{1}{10}$ of a second later?

Closing Example

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A. Force between them is:

$$F = \frac{1}{4\pi\epsilon_0}\frac{(4\times 10^{-6}\,\text{C})(1\times 10^{-6}\,\text{C})}{(2\,\text{m})^2} = 0.009\,\text{N}$$

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B. New momentum would be:

$$\vec{\mathbf{p}}_{new} = 0 + (0.009\,\mathrm{N})(0.1\,\mathrm{s}) = 0.0009\,\mathrm{kg\,m/s}$$

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C. Using that $\vec{\mathbf{v}}_{avg} \approx \frac{\vec{\mathbf{p}}_{new}}{m}$:

$$\vec{\mathbf{r}}_{new} = 2 + \left(\frac{0.0009}{0.001\,\text{kg}}\right)(0.1\,\text{s}) = 2.009\,\text{m}$$