An Introduction to Physics 204A

Problem Set #1 (due next time)

Lecture Outline

1. A Preview of Physics
2. A Preview of Phys 204A
3. The Scientific Method
4. Coordinate Systems

What is the universe made out of?

Universe
What is the universe made of?

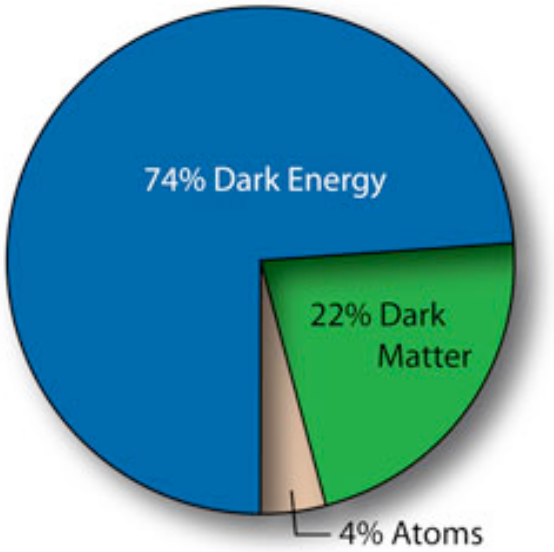
Matter (4%)
Nearly all the stuff in our corner of the universe

Dark Matter (22%)
Causes stars on the outer edge of galaxies to rotate faster

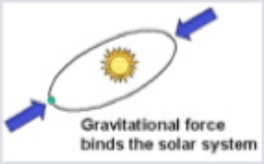
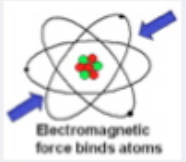
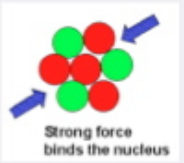
Dark Energy (74%)
Causes the universe to expand at an ever increasing rate

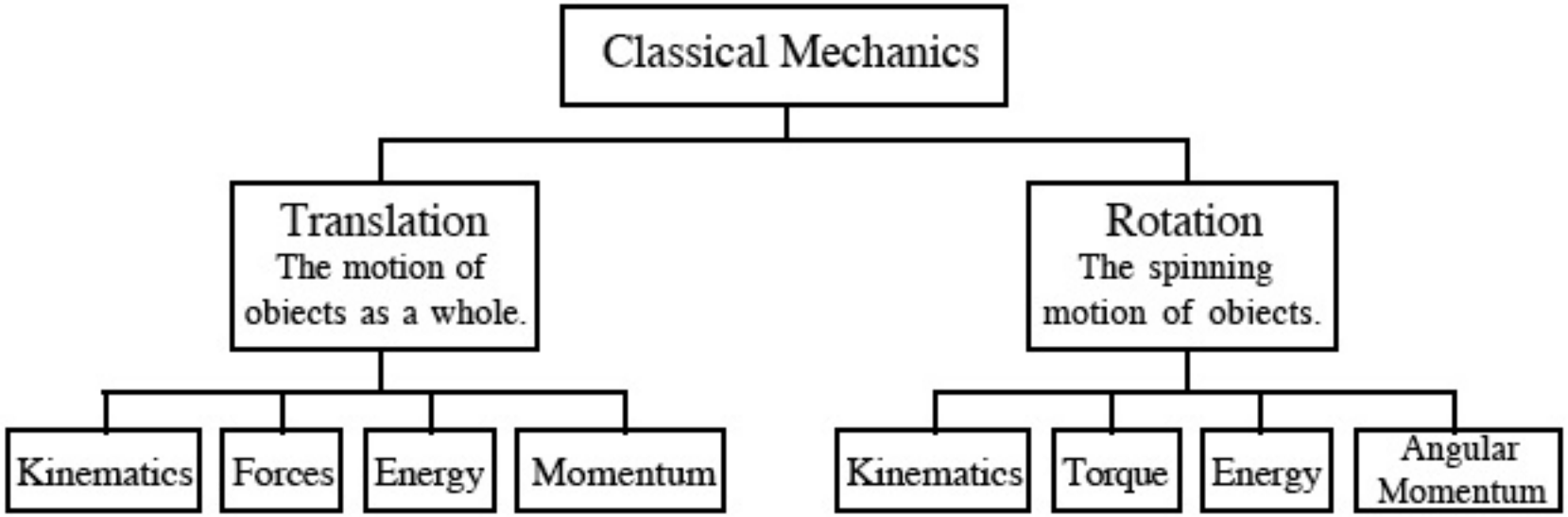
Quarks
neutrons and protons are made of quarks

Leptons
the electron is one type of lepton



How do the parts interact?

Interaction	Strength	Example	
Gravitational	1	Solar System	
Electromagnetic	10^{36}	Hydrogen Atom	
Weak Nuclear	10^{25}	Beta Decay	
Strong Nuclear	10^{38}	Nuclear Stability	


Classical Mechanics
Translation
The motion of objects as a whole.
Rotation
The spinning motion of objects.
Kinematics
Forces
Energy
Momentum
Kinematics
Torque
Energy
Angular Momentum

Newton's Laws of Motion explain the concept of force.

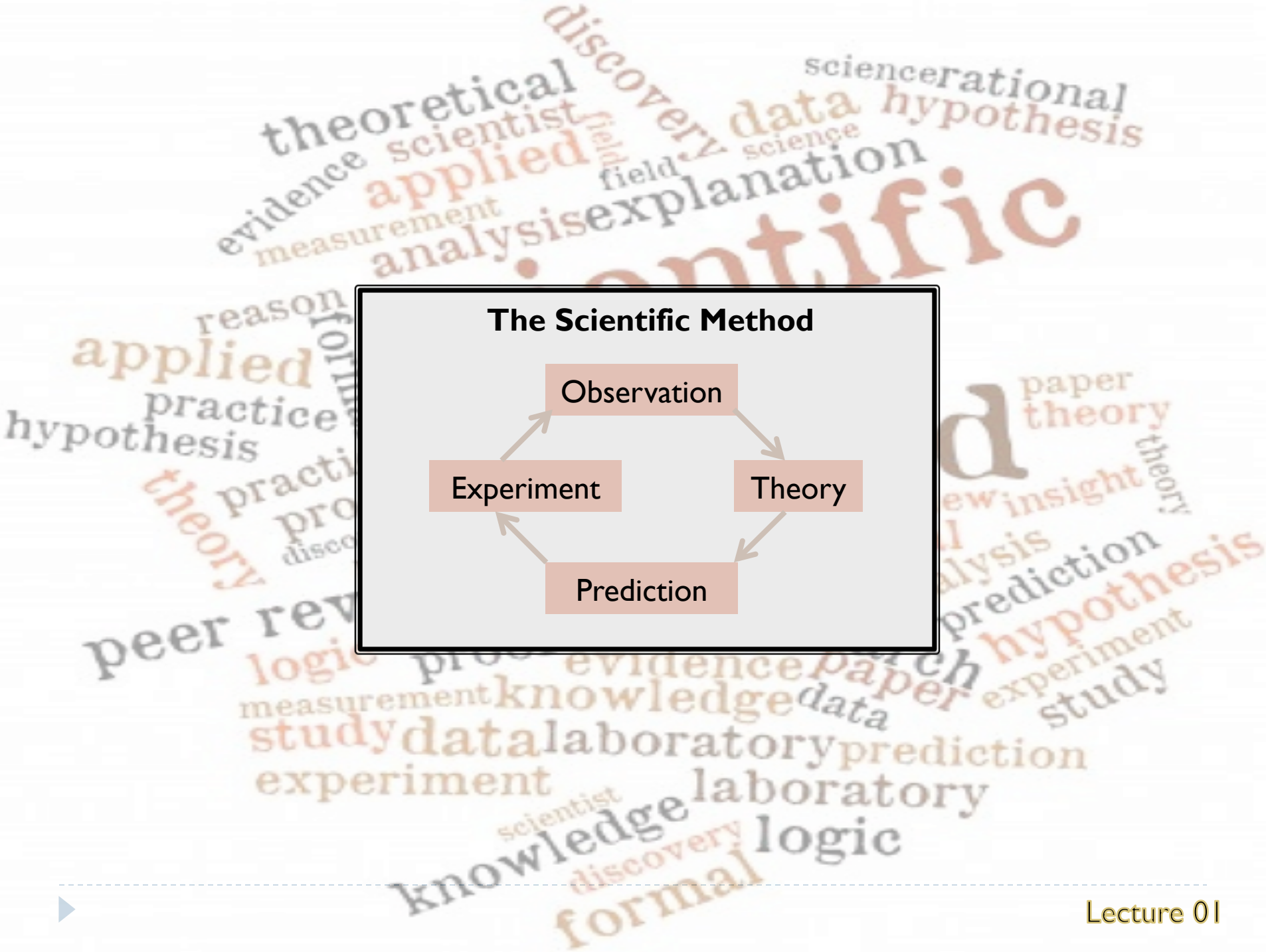
1. Newton's First Law - The Law of Inertia
2. Newton's Second Law - $\sum F=ma$
3. Newton's Third Law - The Law of Action/Reaction

Conservation Laws

4. Conservation of Energy
5. Conservation of Linear Momentum
6. Conservation of Angular Momentum

One of the Four Interactions

7. The Law of Universal Gravitation


The Scientific Method
Observation
Theory
Prediction
Experiment

Metric Prefix Pop Quiz!

prefix	name	power
		10^{-6}
	milli	
c	centi	10^{-2}
		10^{3}
M		
		10^{9}

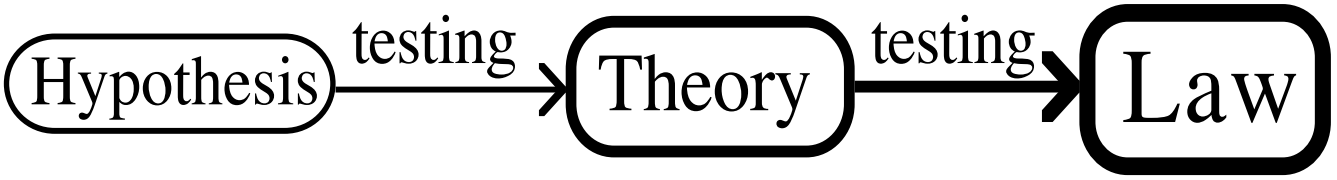
Example 1: Convert 32mpg to dollars per mile.

"Rules of Thumb" for Significant Figures:

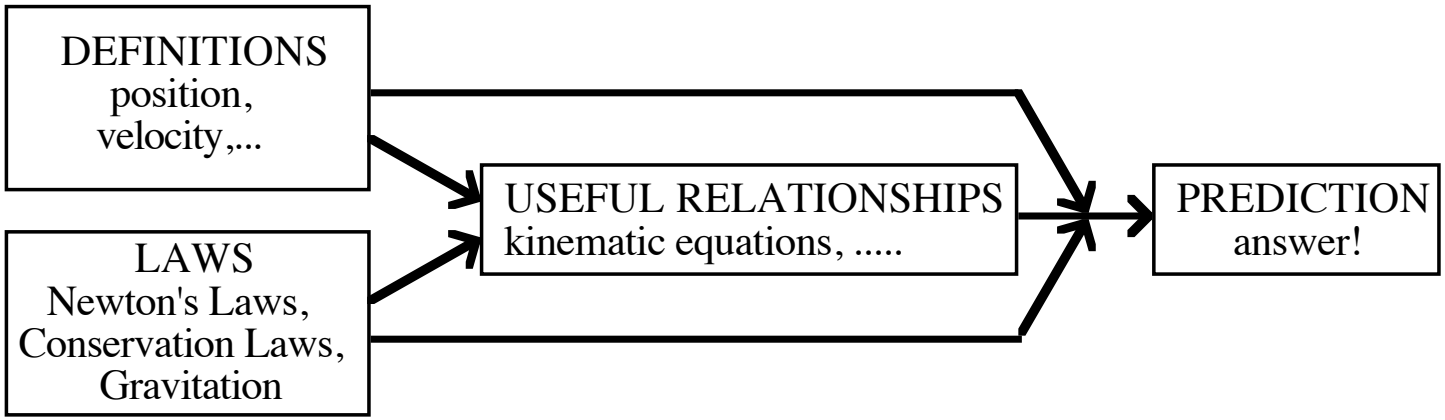
1) Multiplication/Division - the answer has the same number of significant figures as the quantity with the fewest significant figures.

2) Addition/Subtraction - the answer has the same number of decimal places as the term with the fewest decimal places.

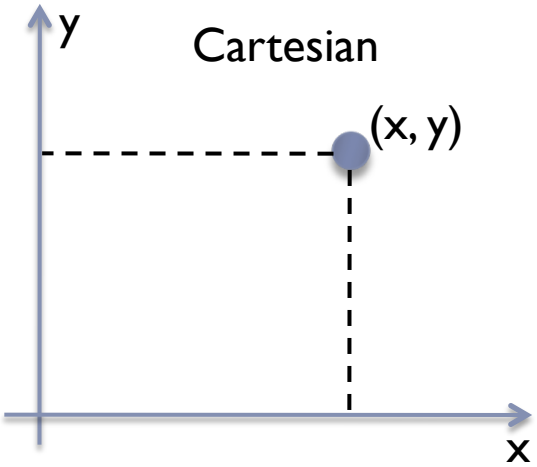
How a hypothesis becomes a law….



Making Predictions with Theories

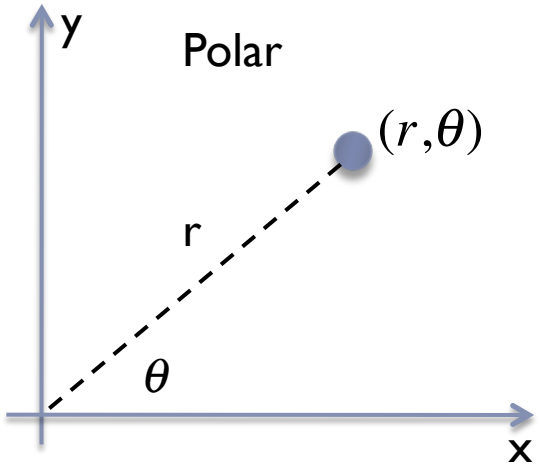


Coordinate Systems



$$x = r\cos\theta$$

$$y = r\sin\theta$$



$$r = \sqrt{x^2 + y^2}$$

$$\theta = \arctan\frac{y}{x}$$

Example 2: Find the x and y coordinates of a point at r =10cm and an angle of 37°.

COMMENT ON PROBLEM SOLVING:
The most effective way to solve physics problems is to begin with a sketch of the situation. Then list the known information and the quantities you for which you are searching. Again, I will always take the time to do this and I expect the same from you.

Lecture 01 - Summary

Physics seeks to understand what the universe is made of and how the parts interact.

Scientific Method

1. Metric Prefixes
2. Converting Units
3. Significant Figures

Standard Coordinate Systems in 2D

Focus on laws and reasoning not formulas.