# Welcome to Physics 110!


- You have found your way to Phys 110: Astronomy!
- If you are in Lab Group A, we are meeting for lab this week!
- Things to do before next class:
  - Access the course page at `http://www.willamette.edu/~jjrembold/classes/wu110/main/`
  - Read over the syllabus
  - Get yourself a copy of the digital book
  - Remember your phone or computer for polling questions on Wednesday
- WebWorK Assignment 1 is posted and due Wednesday
  - Instructions and web address for logging in on the class website

# My Vitals


- Name: Jed Rembold
- Office: Collins 311 (it's shared)
- Office Hours: M,W,Th 2-4pm *and open door* (≈always)
- Goudy Hours: M–Th 1-2pm near the windows in Goudy Commons
- Email: jjrembold@willamette.edu
- Phone: 503-370-6860

# Grading


Attendance is mandatory for both lecture and labs!

| Attendance | Lab | Homework | 3 Midterms | Final |
|---|---|---|---|---|
| 5% | 20% | 25% | 30% | 20% |

# Attendance


- Class attendance is graded through participation in class polls
- Generally 1-3 polls per day
- Answering at all gets you full points for the day
- Answering correctly gets you bits of extra credit
- `http://rembold-class.ddns.net`
- Will start on Wednesday

# Homework


- Homework will predominantly be online through WebWorK
- Small assignments will be given after each class, to be due before the start of the next class
- You can do the assignments late, but will be only receive 75% credit
- Don't be confused by WebWorK's terms
  - Reduced Scoring Period: is the time when it is technically due (the next class period)
  - Due date: is the point at which you can no longer receive any credit for the assignment

# Tests


- 3 Midterms
  - Test 1: Sep 28 - Chapters 1-6
  - Test 2: Oct 26 - Chapters 7-14
  - Test 3: Nov 16 - Chapters 15-24
- Final
  - Dec 12: 8:00-11:00am
  - Will be comprehensive
- You will want access to at least a basic scientific calculator for test days, as you can't use your phone calculator for tests!

# Labs


- Labs will be Monday from 7-10pm
- You *must* be at lab in order to receive credit
- Groups A and B will alternate weeks for lab
  - The schedule is posted on the webpage if you ever lose track!
- I will post each week's lab manual on the website. You are responsible for printing it off and bringing it with you to lab.
- Labs will be a mix of observation activities (when weather allows), planetarium software demonstrations, and other activities
- Let me know as soon as possible if you are going to need to miss a lab
  - May be able to have you work through it at the other group's date
  - May be able to make it up at a later week in the semester

# Campuswire


- Invitations to Campuswire should be going out today
- Classroom forum to better communication and asking of questions
- Asking questions there allows others to benefit from seeing my (or other students!) responses
- I will also use it for general communication and some occassional polling, so check it out!

# Astronomy


Crux
Musca
β
Proxima
Centaurus
α
Circinus
© Y. Beletsky (LCO), ESO, Pale Red Dot

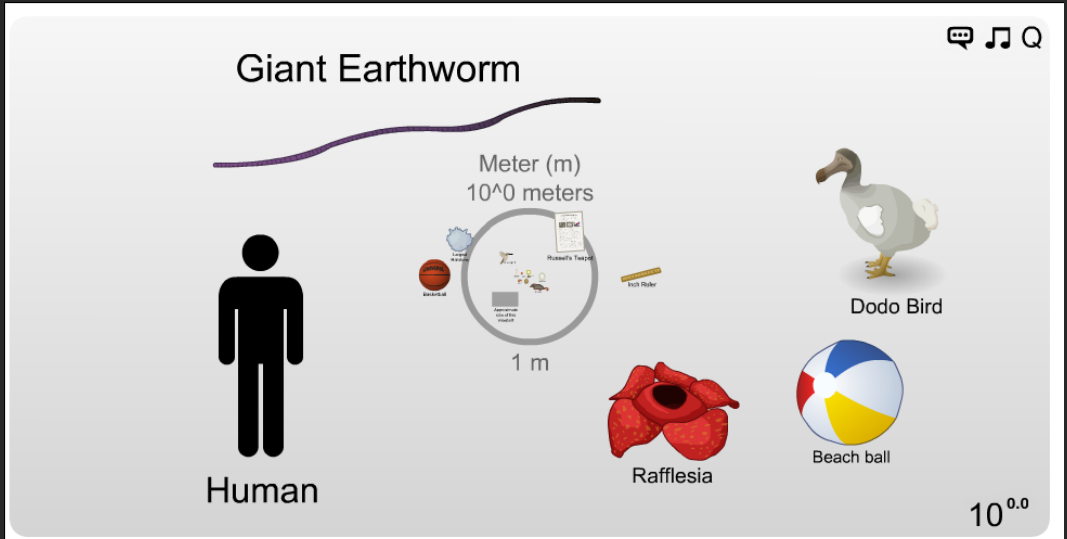
# Some Basics


- Distances
  - Meters instead of feet
  - Kilometers instead of miles
  - Astronomical Units (AU)
    - Average distance from Earth to Sun
    - $\approx$ 150 million km
  - Light-year
    - Distance light travels in a year
    - $\approx$ 10 trillion km
    - A light-year is a distance not a time!
- Times
  - Still use seconds, days, years, etc

# Recall Your SI Notation!

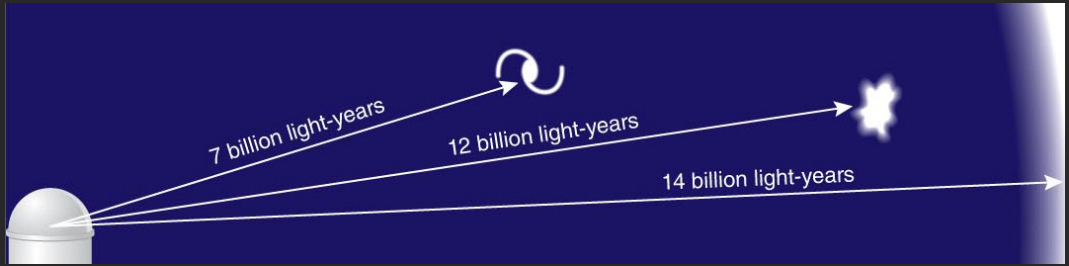
| $10^n$ | Prefix | Symbol | Scale | |
|---|---|---|---|---|
| $10^{-2}$ | centi | c | Hundredth | 0.01 |
| $10^0$ | | | One | 1 |
| $10^3$ | kilo | k | Thousand | 1000 |
| $10^6$ | mega | M | Million | 1000000 |
| $10^9$ | giga | G | Billion | 1000000000 |
| $10^{12}$ | tera | T | Trillion | 1000000000000 |
| $\vdots$ | $\vdots$ | $\vdots$ | $\vdots$ | $\vdots$ |

# What does this look like?

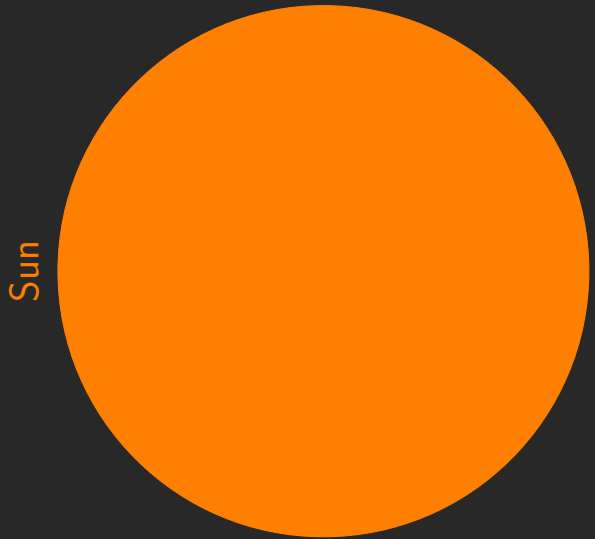


# The Implications of Light Speed

- Light travels at a constant, fast speed ($3 \times 10^8\,\mathrm{m/s}$)
- Astronomic distances so large though that light takes measurable time to reach us
- Looking at distant objects is really looking back in time



# Solar System Sizes



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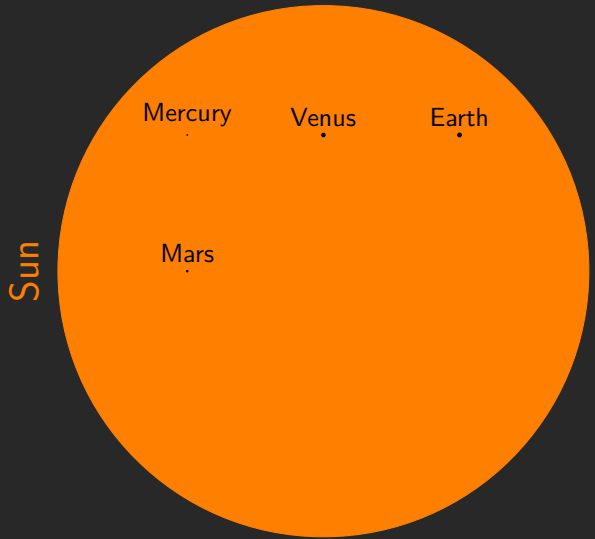

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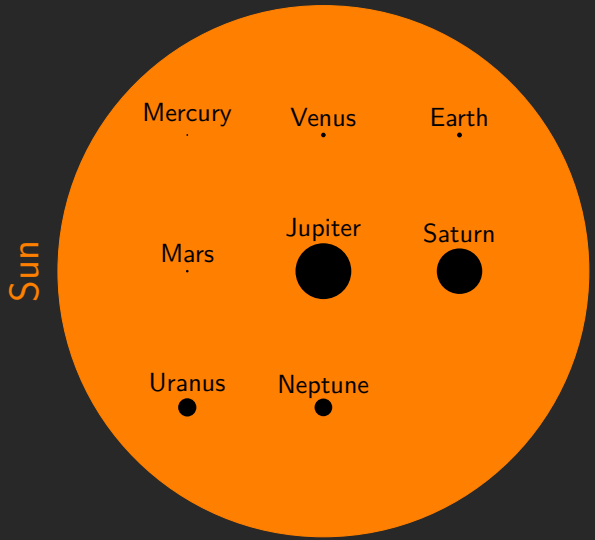

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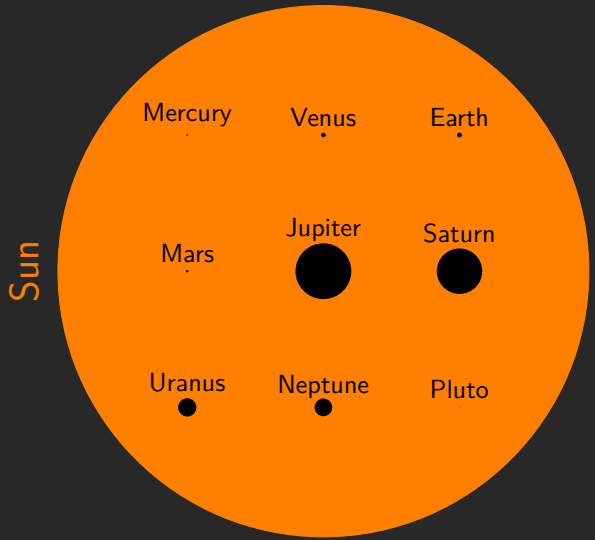

# Extrasolar Sizes

- Our own Solar System seems huge enough
- Space *really* kicks in once we leave our system
  - Nearest star (Alpha Centauri) is ≈8000x the distance to Pluto
  - This is a common star separation distance in the Milky Way
  - The Milky Way has has many stars as all the grains of dry sand on all Earth's beaches
  - With the Milky Way shrunk to the scale of a football field, the entire Solar System would be a microscopic dot on roughly the 20 yard line
  - The Milky Way is just one of ≈100 billion galaxies that we've seen in the observable universe

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**Moral of the Story**

Space is big. Like, unbelievably gigantic big. Stupidly big.

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- Check out "History of the Universe" by Halycon in the app store on your phone!

# Movement: Motion within Motion within...


Small to Big:

- Earth rotates on it's axis each 24 hours
- Earth rotates around the Sun in 365.25 days
- The Sun rotates around the center of the Milky Way in $\approx$230 million years
- We also have random and erratic bits of movements from local effects (nearby planets, stars, galaxies etc)
- All galaxies are moving away from each other due to the universe expanding
  - Raisin cake analogy

# Takeaways


**Distance**

Compared to us, the universe is nearly unimaginably large

**Time**

Our lives are an indistinguishable speck in the age of the universe

**Movement**

Literally everything is undergoing some sort motion. Both organized (orbits) and chaotic (pushes and pulls from neighbors).

# PSA: Calculator Advice

- Remember your order of operations!
  - Parenthesis, Exponents, Mult/Div, Add/Sub
  - Don't forget parenthesis when dividing by multiple things! (But don't go overboard with parenthesis either, or things get confusing!)
- Lots of large or tiny numbers in this class
  - $6 \times 10^8 =$ [6] [×] [10^] [8] [=] [6] [EE] [8]
  - Most calculators will return values in E notation