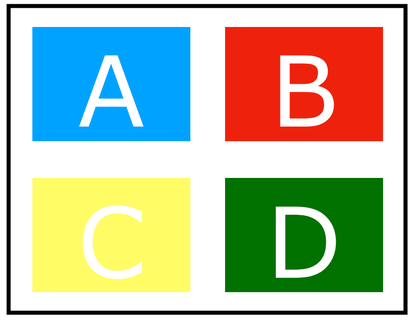

# Chapter 1: Think like me

Grab an ABCD page from me if you don't have one




(Hint: it looks like this)

Reading Assignment to be completed in Canvas
due on Monday, August 27th

HW1 posted to website under:
http://www.physics.utah.edu/~wik/courses/astr1060fall2018/homework.html
due on Wednesday, September 5th

# Updated Info

## Syllabus

### ASTR/PHYS 1060 Fall 2018: The Universe

- Instructor: Daniel Wik
- Office: INSCC 320
- Contact info (phone/email): http://www.physics.utah.edu/~wik
- Office Hours:
  - Tues 1:30-3pm (tentative)
  - Fri 12-1pm (tentative)
  - by pre-arranged appointment (preferred) or can just stop by (esp. for quick questions)
- Teaching Assistants (office hours held in JFB 325):
- Randall Rojas-Bolivar
  - Tues 5-6pm
  - Wed 3-4pm
- Zane Gerber
  - Mon 12-1pm
  - Thurs 11:45am-12:45pm
- Classroom: JFB 101 (in the saucer section of the northern physics building)
- Class Time: 10:45-11:35am on Mon/Wed/Fri
- Course Website: http://www.physics.utah.edu/~wik/courses/astr1060fall2018
- Textbook: Understanding Our Universe, 2nd edition, by Palen, Kay, Smith, and Blumenthal

# Forgot to mention I think, well, just in case:

## Observatory & Planetarium Visits (extra credit opportunities)

### Observing

- Every Wednesday night there are free public observing nights at the South Physics Observatory. I encourage you to go to these during the semester to see some of the things we've talked about in class yourself. Extra-credit will be given if you submit a short (2-3 paragraph) report including what kind of telescope you looked through and what objects you looked at. Check the the following website for times and weather information (there are no star parties if its cloudy!):http://web.utah.edu/astro/

### Planetarium

- The Clark planetarium is a great place to help you understand the motions of the skies above us. I encourage you to go some time early on in the class. A good, cheap chance to visit will be on Oct. 11th and 13th at 6:45 pm for the "Gateway to the Stars Program." Admission is just $2. Another similar opportunity is the "Night Vision" program. It is shown Saturdays at 6:45 pm and also costs $2. Extra-credit will be available for writing a small report describing the show.

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# Silence cell phones, don't use 'em, and use laptops for note taking only

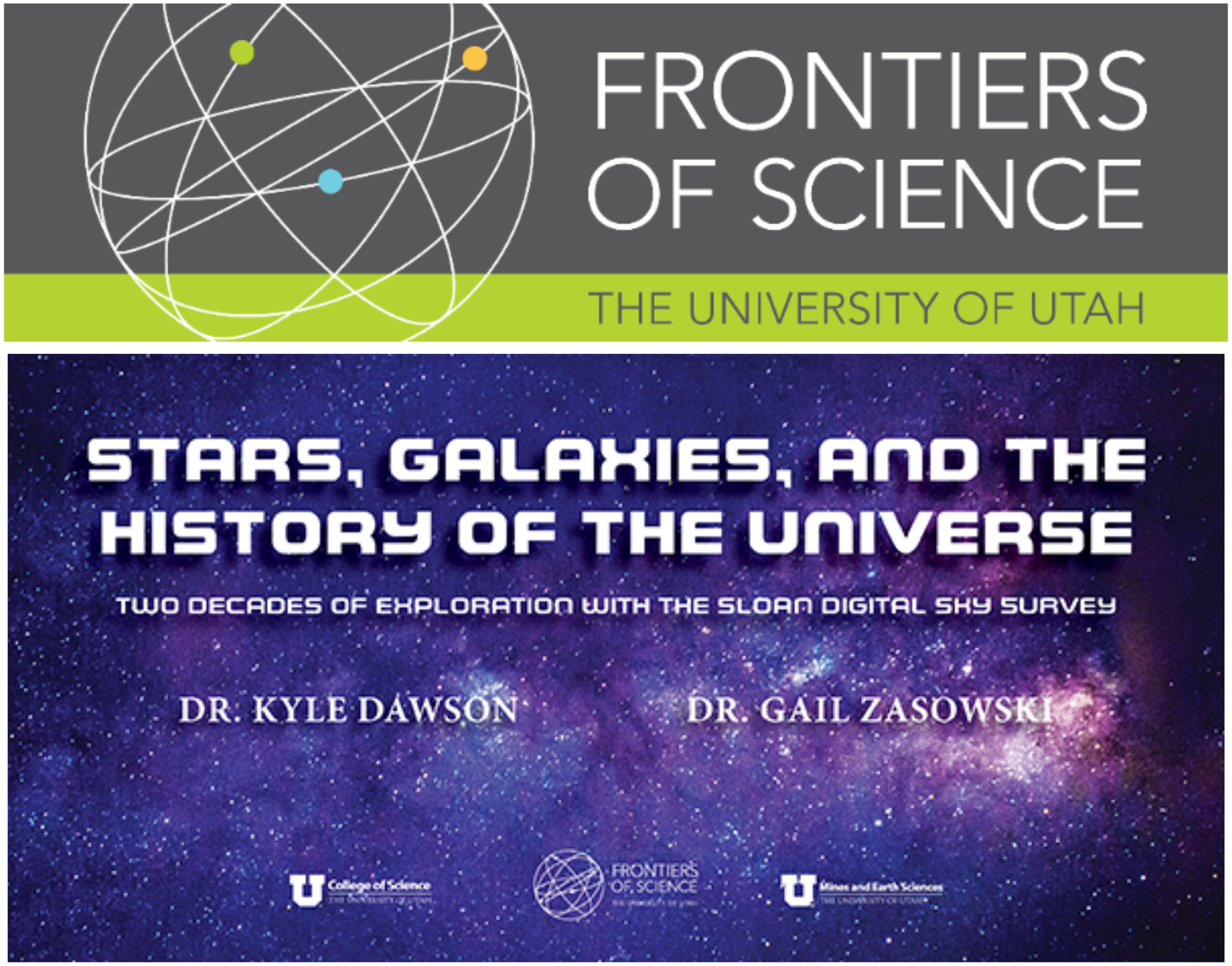
Doing other things on devices distracts those around you

Taking HAND-WRITTEN notes improves retention
(whether or not you ever look at them again)

# Most Popular Requested Topics

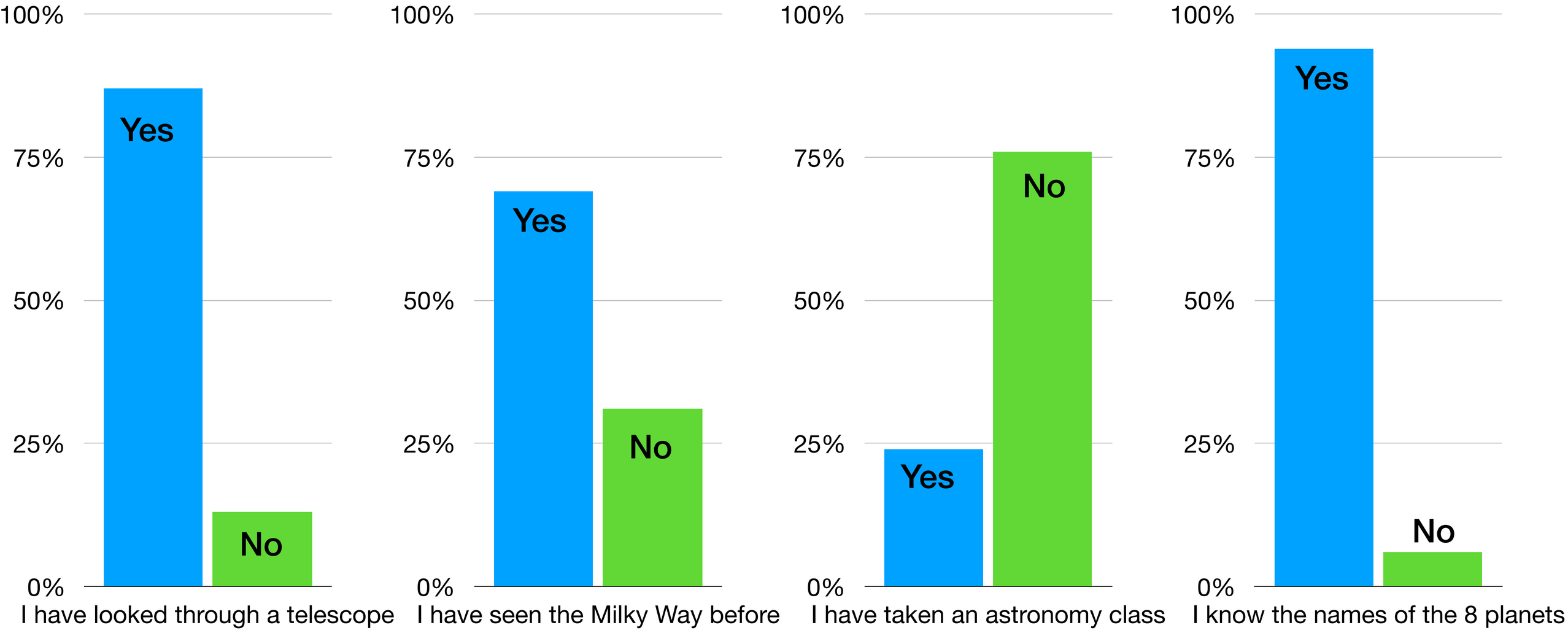
| | |
|---|---|
| Nothing / Blank | 56 |
| Black Holes | 30 |
| Anything / Everything | 25 |
| Aliens / ET life | 11 |
| Dark Matter | 9 |
| Dark Energy | 6 |
| SpaceX / Human exploration | 6 |

out of 157
potential responses

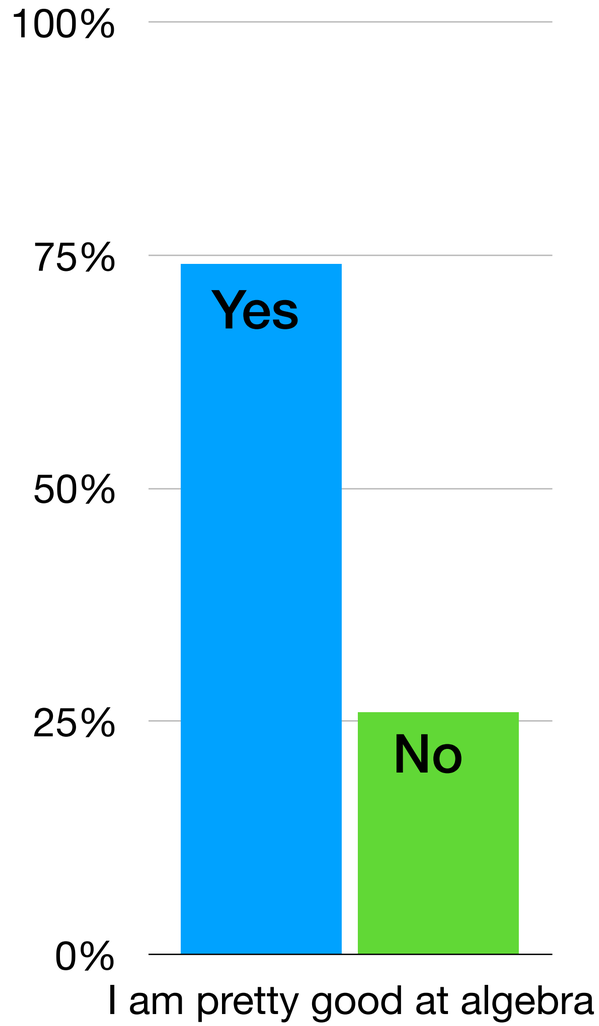



**TUESDAY | AUGUST 28 | 6:00 p.m.**
**Aline W. Skaggs Bldg. (ASB) Room 220**

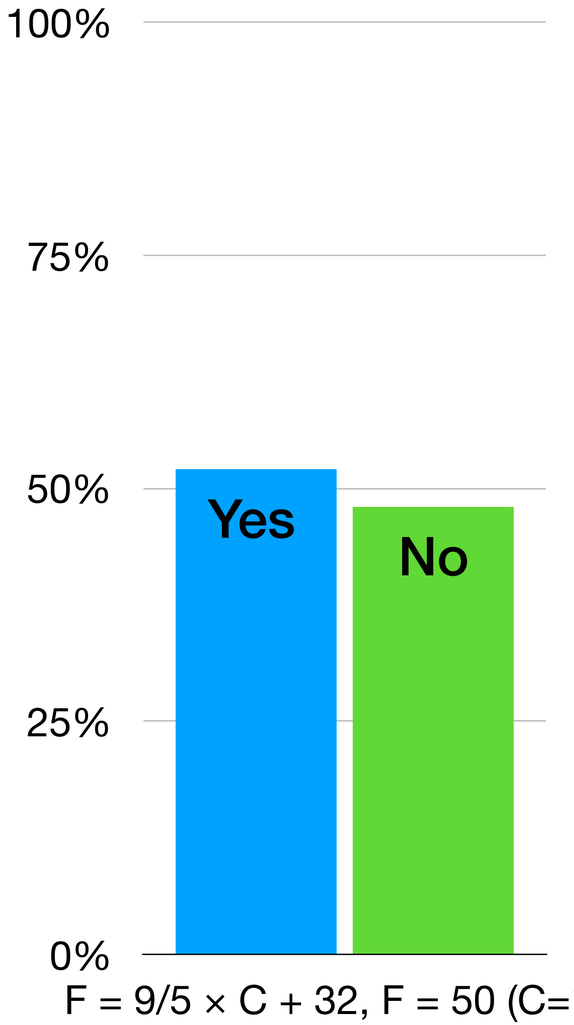
# Survey Responses



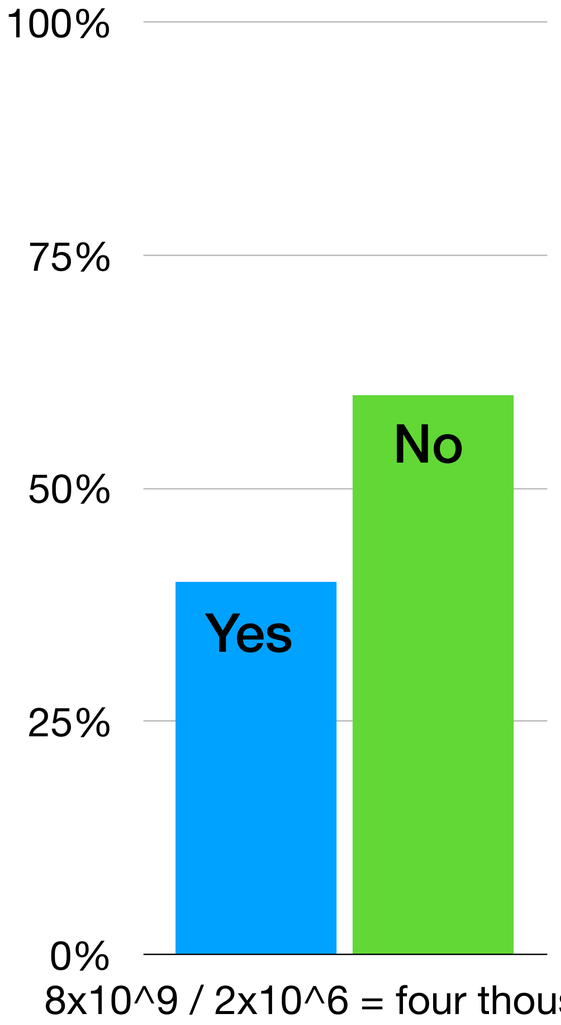
# Survey Responses




I am pretty good at algebra

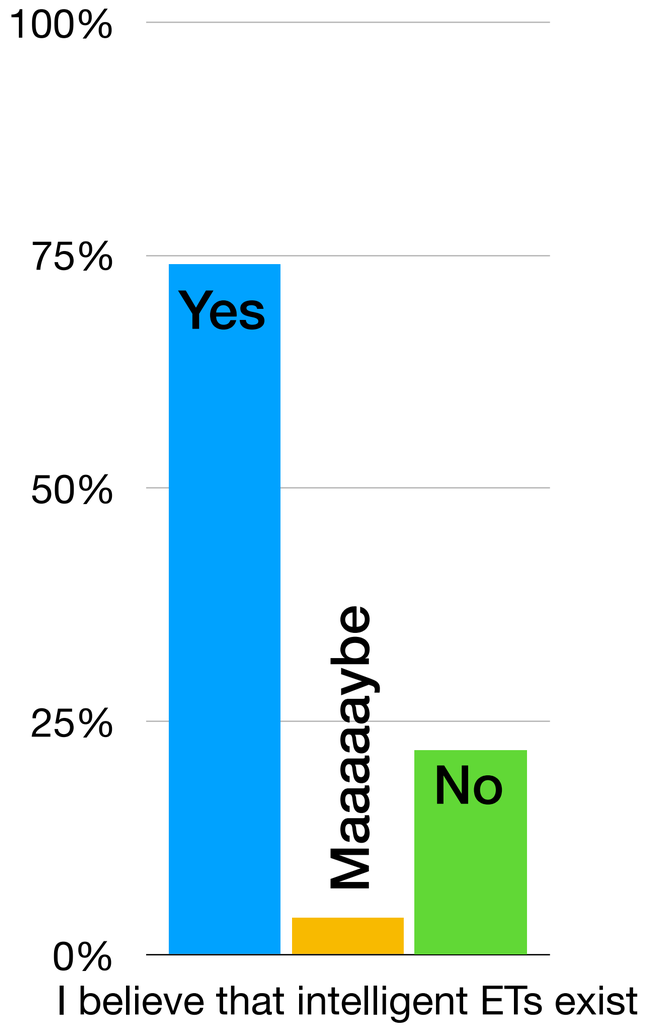



F = 9/5 × C + 32, F = 50 (C=10)

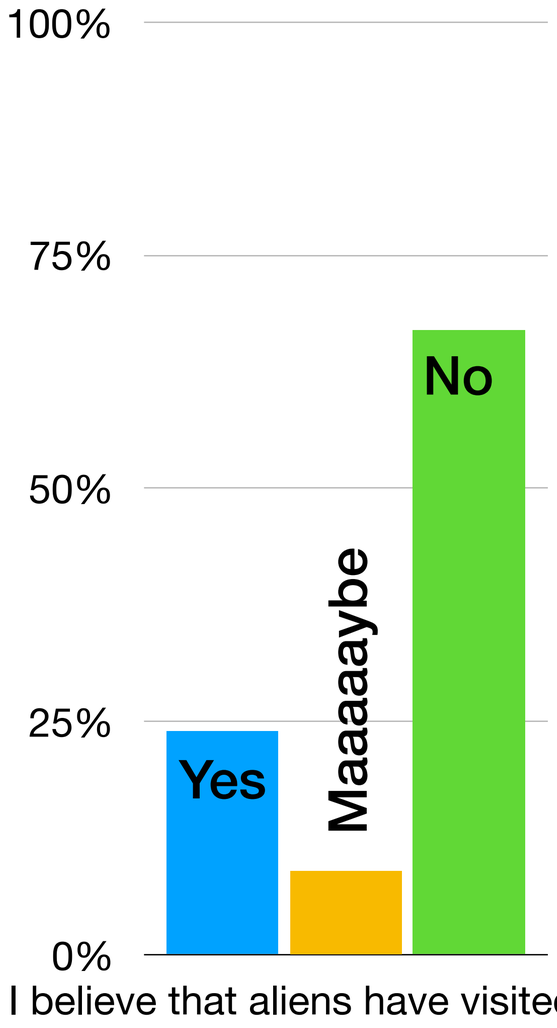



8x10^9 / 2x10^6 = four thousand

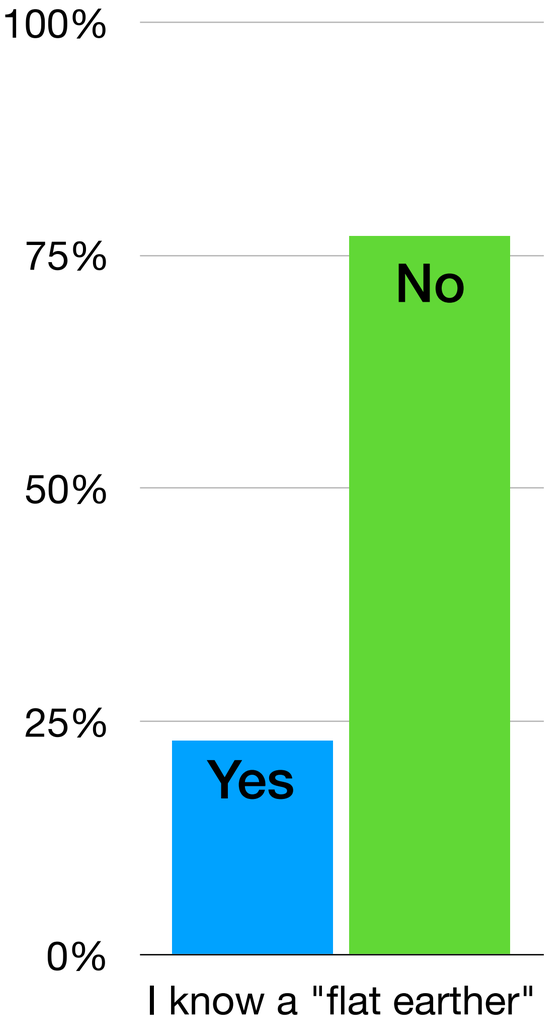
# Survey Responses




I believe that intelligent ETs exist




I believe that aliens have visited Earth




I know a "flat earther"


A) The Milky Way
C) Bright Stars
B) Clouds of Magellan
D) Comet
© GUILLAUME BLANCHARD 2011

# Scale Models

scale model of Manhattan island by Joe Macken

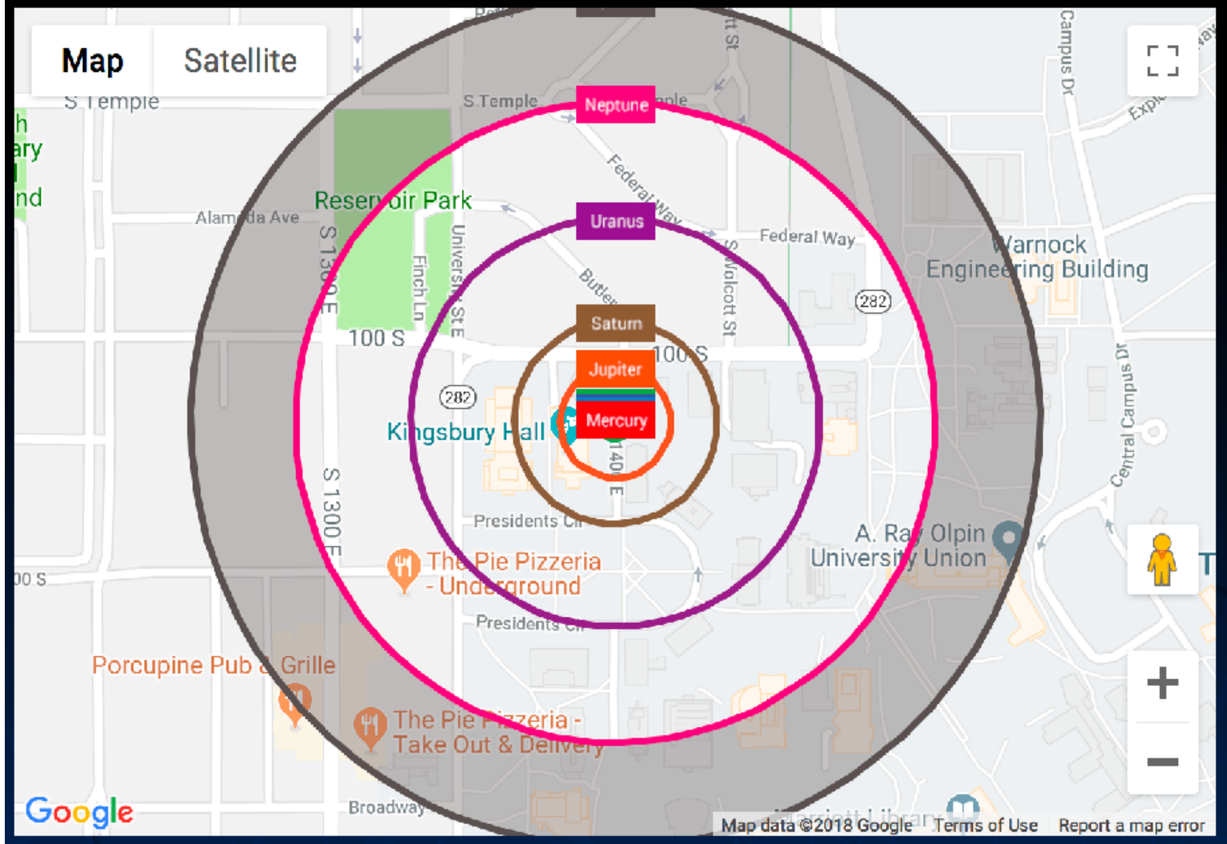
If the Sun were the size of a softball (~4” in diameter), how big would the Earth be?

A) Golf ball (1.7”)
B) Coffee bean (0.4”)
C) Sesame seed (0.1”)
D) Mustard seed (0.03”)

If the Sun were the size of a softball (~4” in diameter), how far away would the Earth be?

A) One step (3’)
B) Across the table (10’)
C) Across the room (30’)
D) President’s Circle (300’)

# Map a Model Solar System




## Location

100 1400 East, Salt Lake City, UT, U

INCHES

Sun

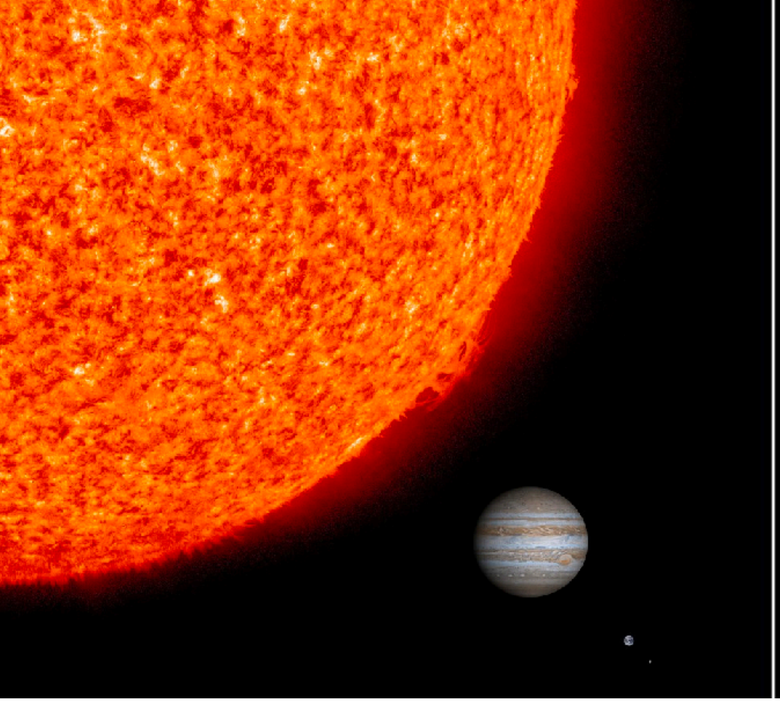
4

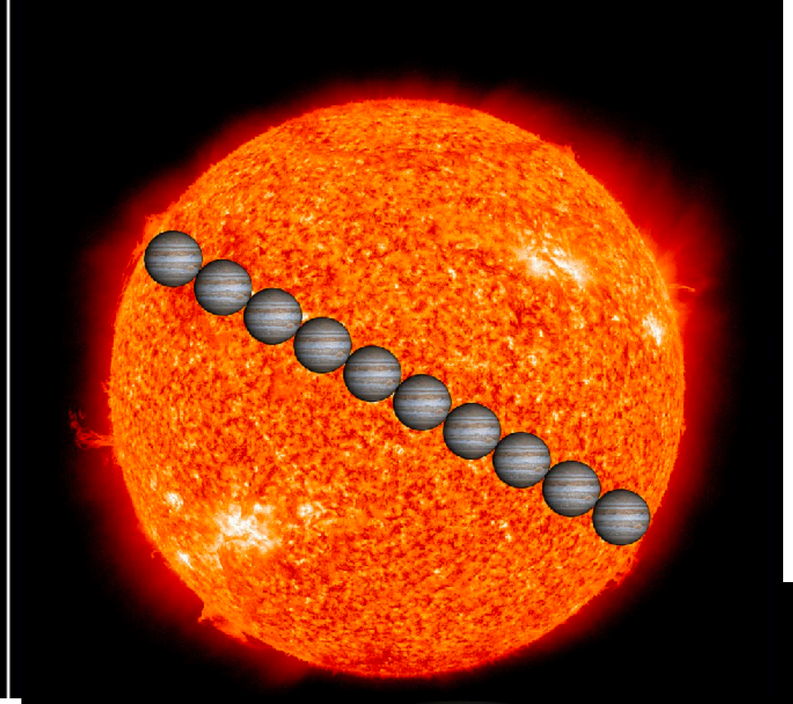
Earth

Go

| Mercury | Venus | Earth | Mars | Jupiter | Saturn | Uranus | Neptune | Kuiper Belt |
|---|---|---|---|---|---|---|---|---|
| Diameter (in) **0.014** | Diameter (in) **0.035** | Diameter (in) **0.037** | Diameter (in) **0.02** | Diameter (in) **0.411** | Diameter (in) **0.346** | Diameter (in) **0.147** | Diameter (in) **0.142** | Diameter (in) **0.007** |
| Average Orbital Radius (mi) **0.003** | Average Orbital Radius (mi) **0.005** | Average Orbital Radius (mi) **0.007** | Average Orbital Radius (mi) **0.01** | Average Orbital Radius (mi) **0.035** | Average Orbital Radius (mi) **0.065** | Average Orbital Radius (mi) **0.13** | Average Orbital Radius (mi) **0.204** | Average Orbital Radius (mi) **0.271** |

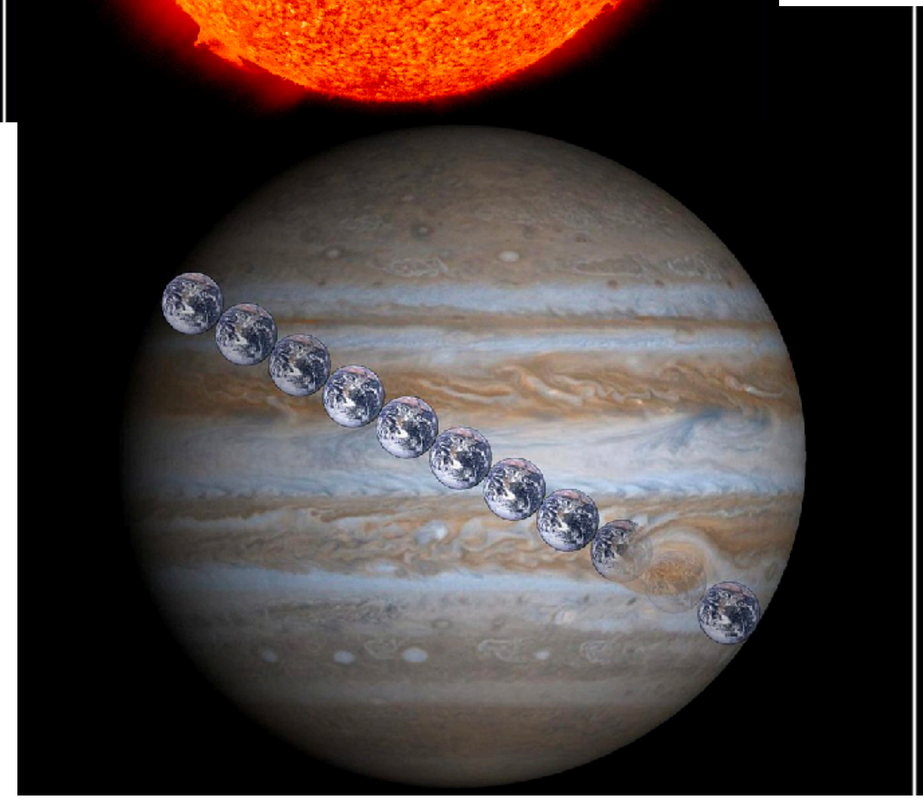
Credits

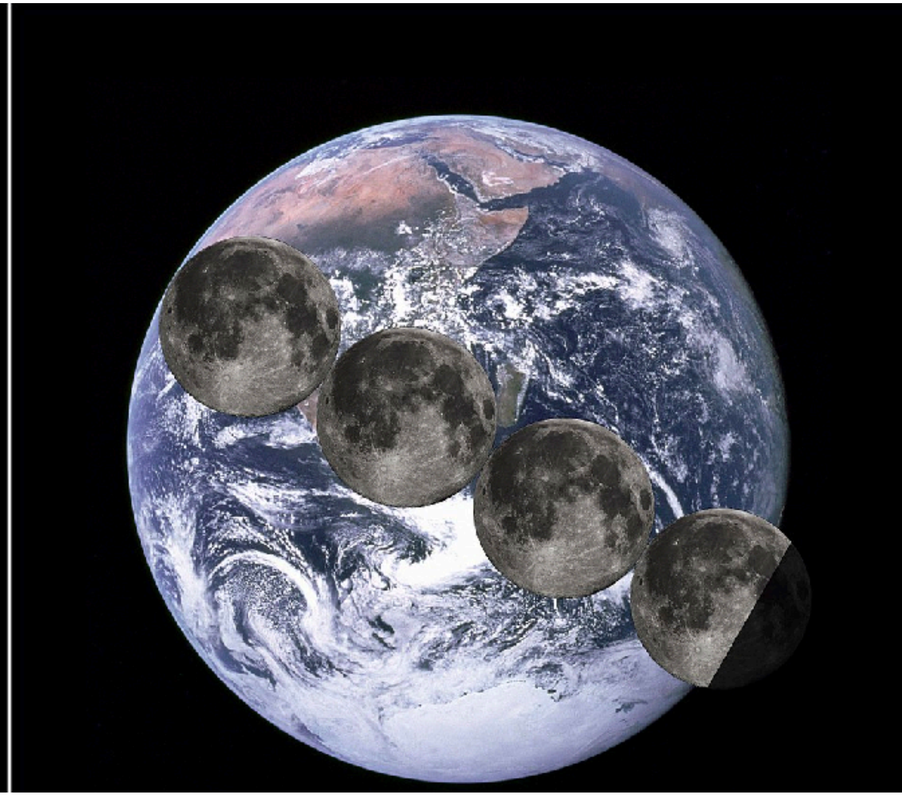




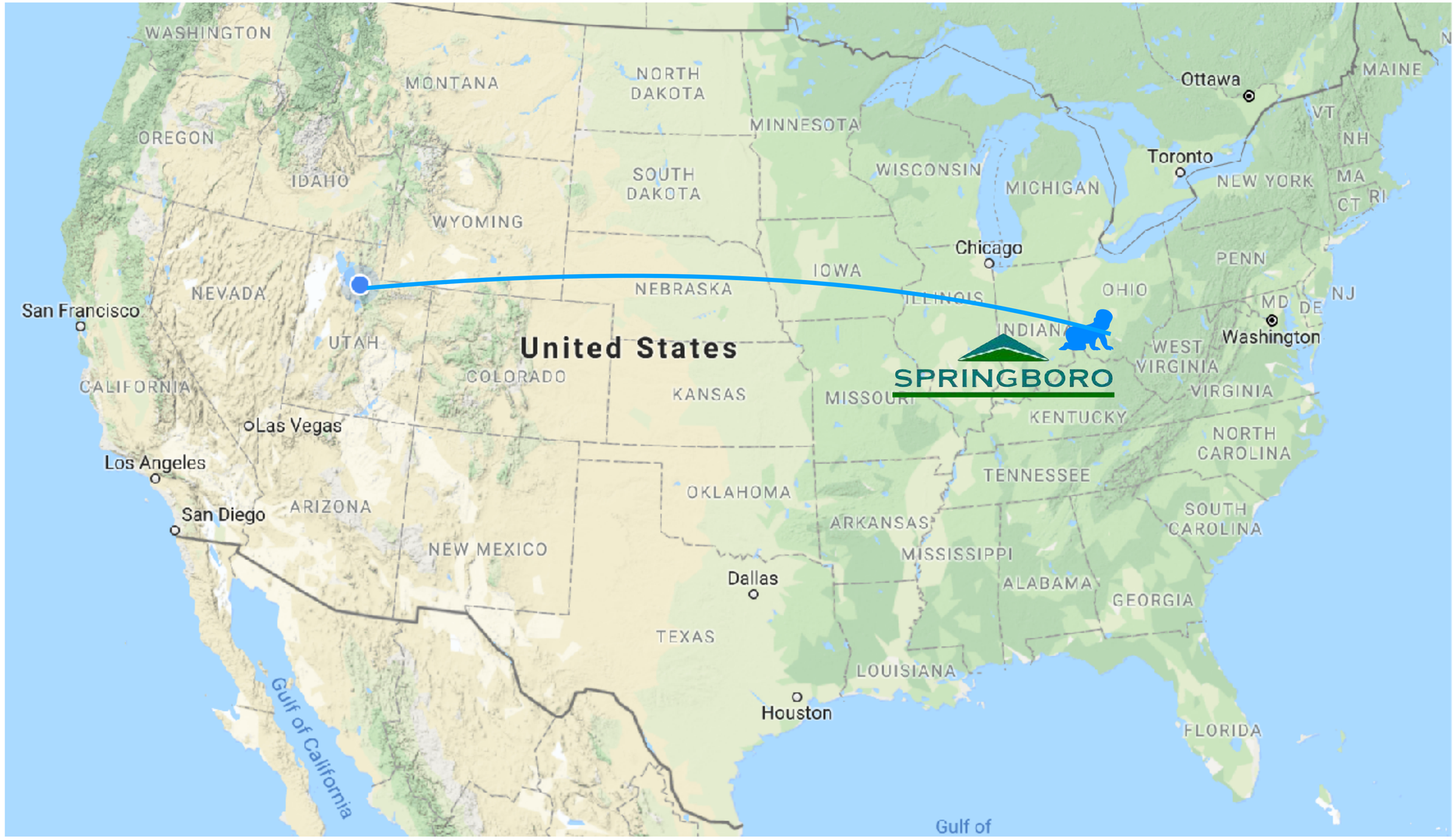
Relative sizes of the Sun, Jupiter, Earth, and the Moon

Jupiter is ~5x farther from the Sun than is the Earth



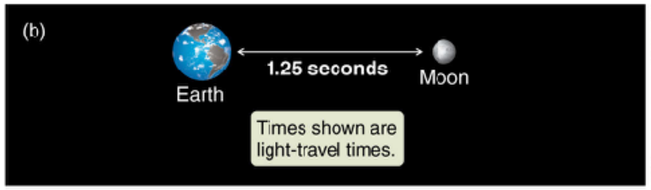


# How far away is the nearest star, if the Sun is a softball?

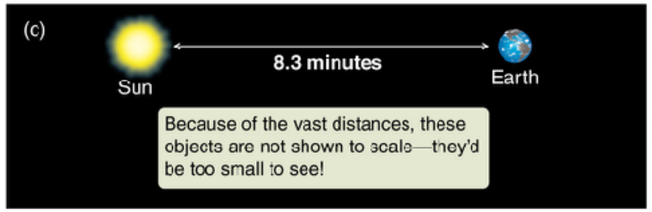


# Scale by light-speed

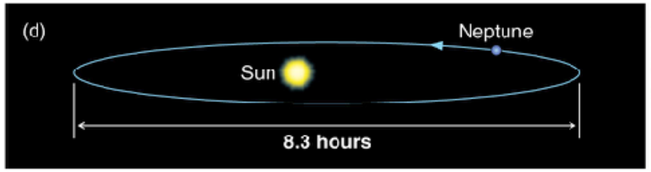

Moving outward through the universe at the speed of light, going around Earth is like a snap of your fingers.



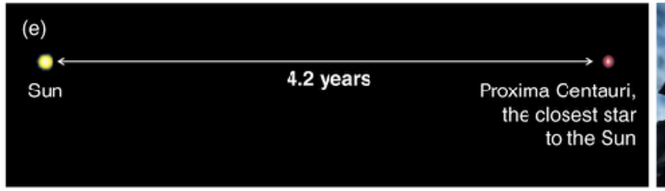

The Moon is a little more than a second away.



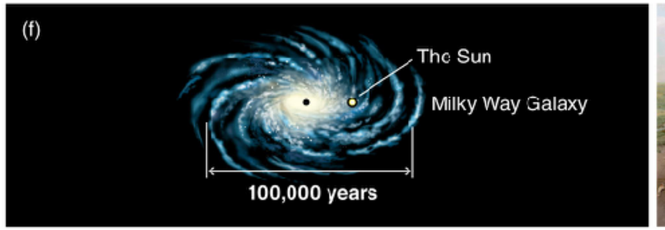

The Sun's distance is like a quick meal.



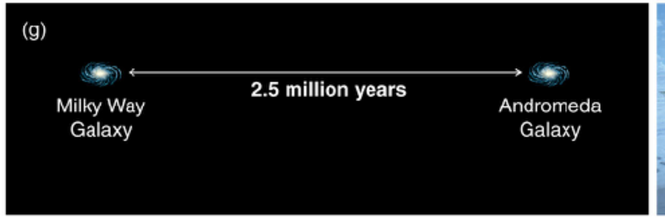

The diameter of Neptune orbit is a night's sleep.



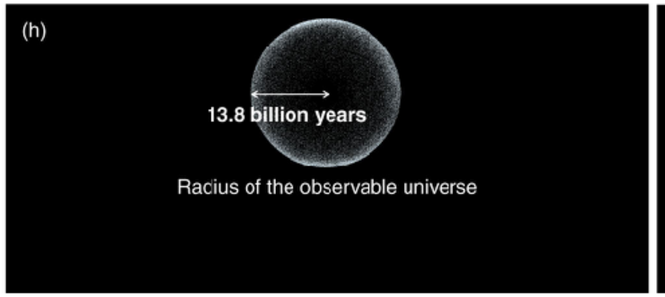

Leaving the Solar System, the distance to the nearest star is like the time you spend in high school.




The diameter of the galaxy is like the age of our species.



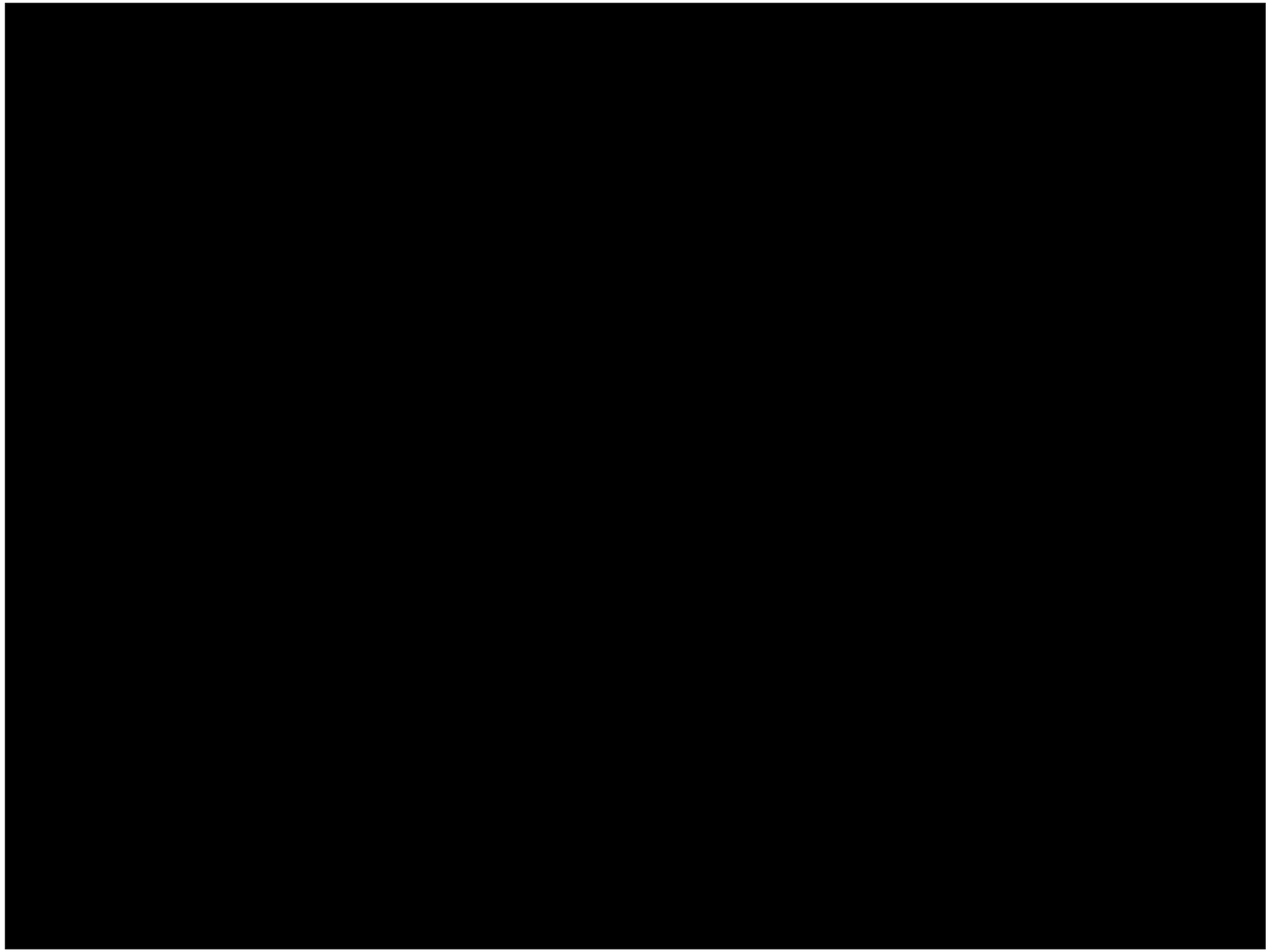

The distance between galaxies is like the time since our earliest human ancestors walked on Earth.



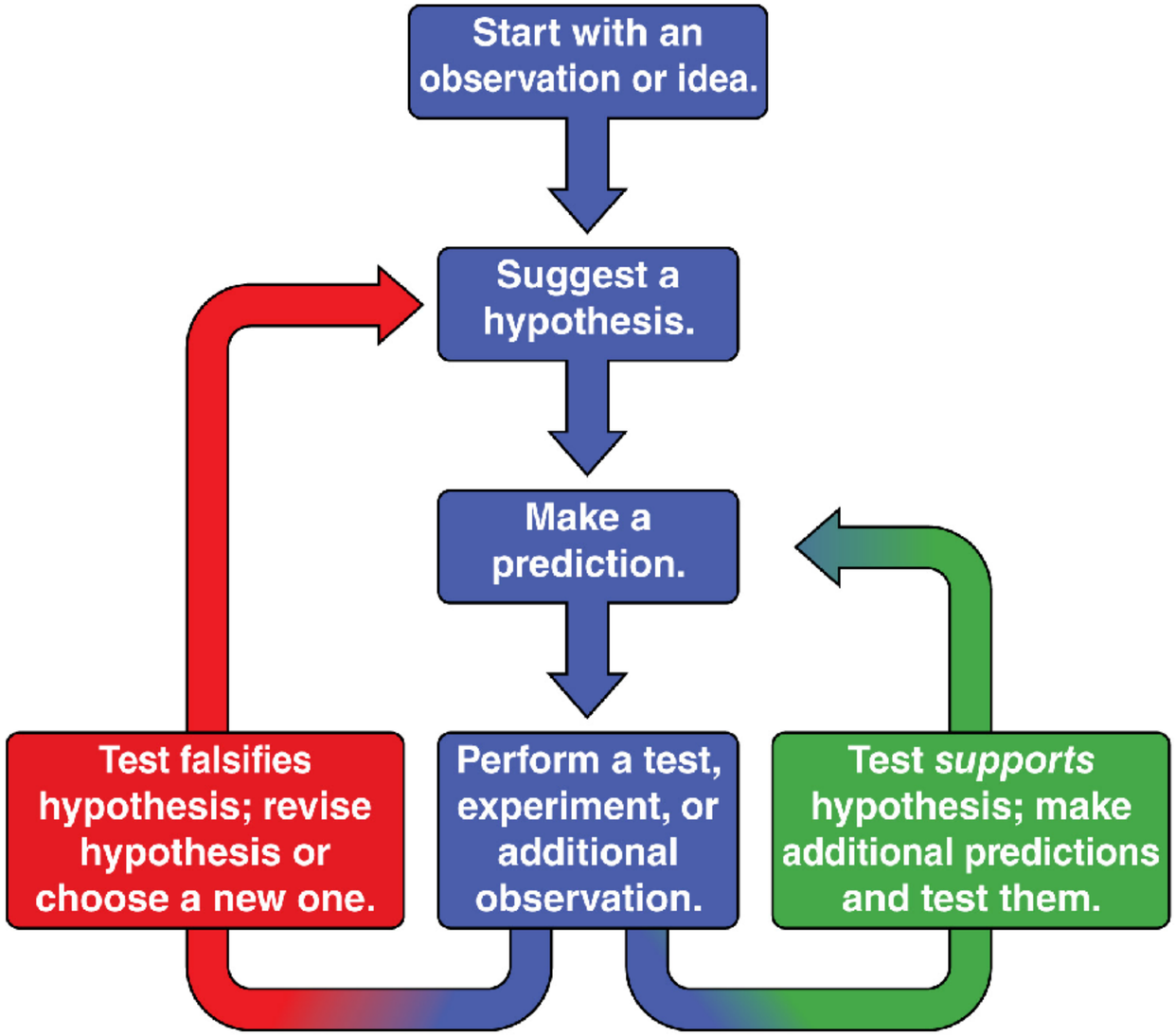

The size of the observable universe is like three times the age of Earth.

# Powers of Ten:

https://www.youtube.com/watch?v=0fKBhvDjuy0



# Scientific Method



# Scientific Notation

$10^6$ = 1,000,000 = one million

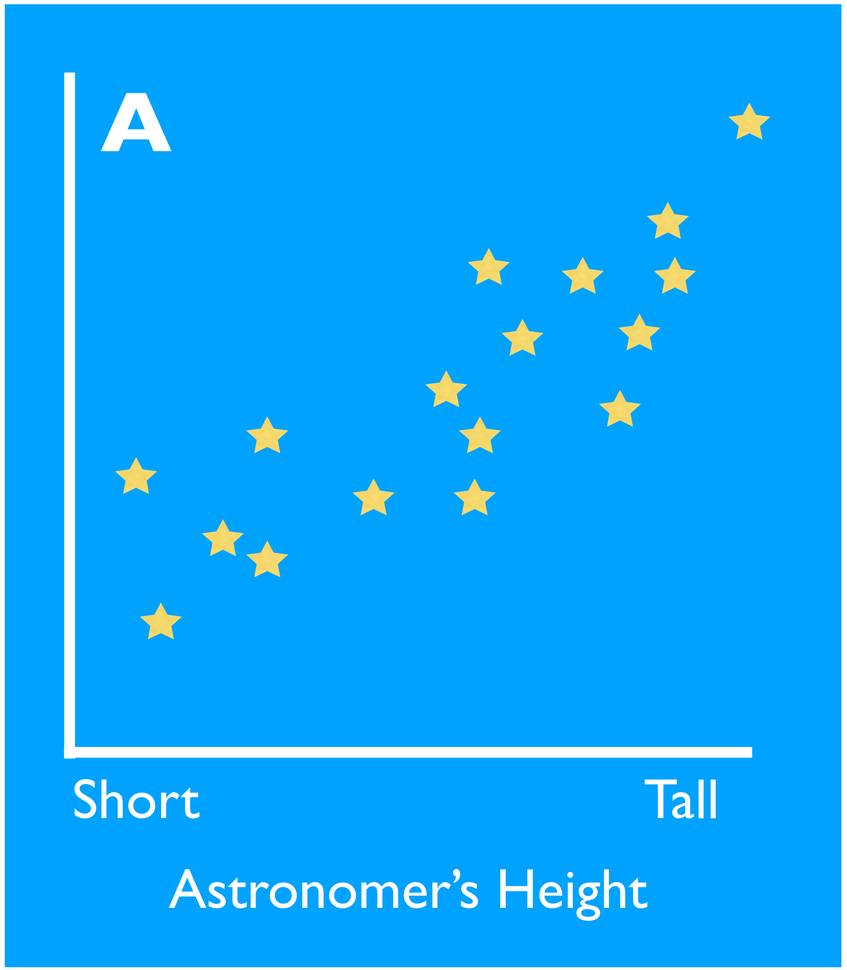
$5 \times 10^9$ = 5,000,000,000 = five billion

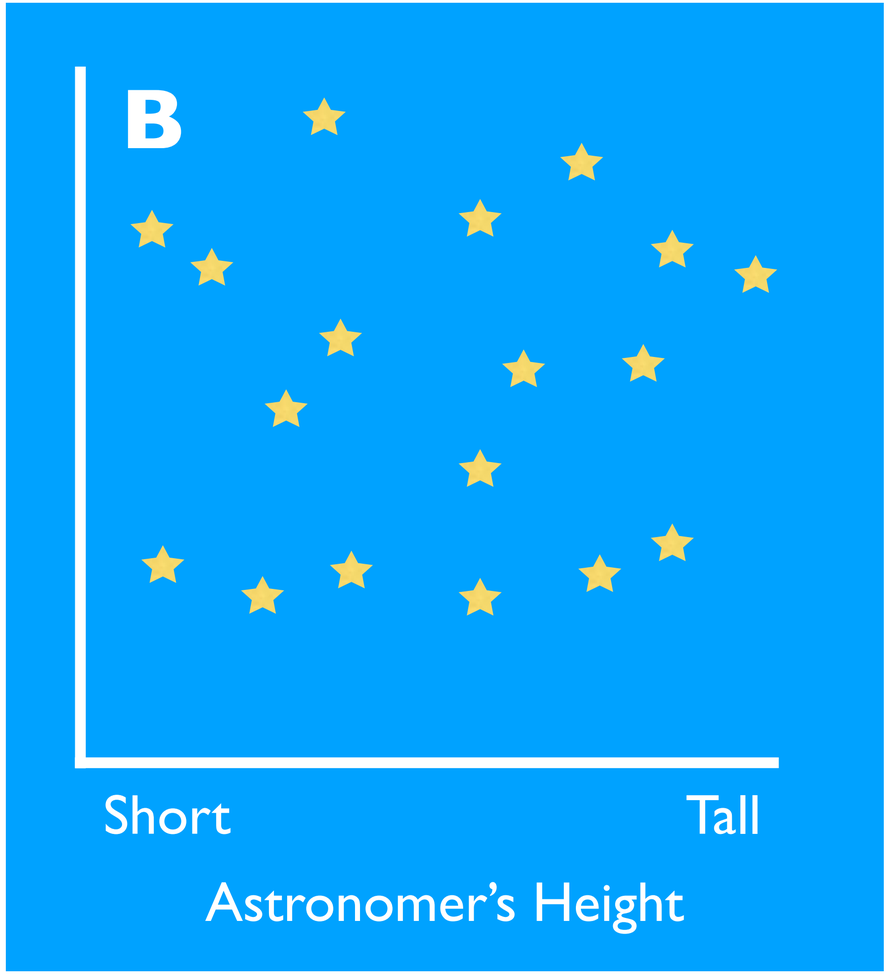
$2 \times 10^2 \times 3 \times 10^3 = 6 \times 10^5$ = 600,000 = six hundred thousand

Calculator / Computer shorthand: 2e-7 = $2 \times 10^{-7}$ = 0.0000002
(on exams and assignments, use the correct notation, not this shorthand)

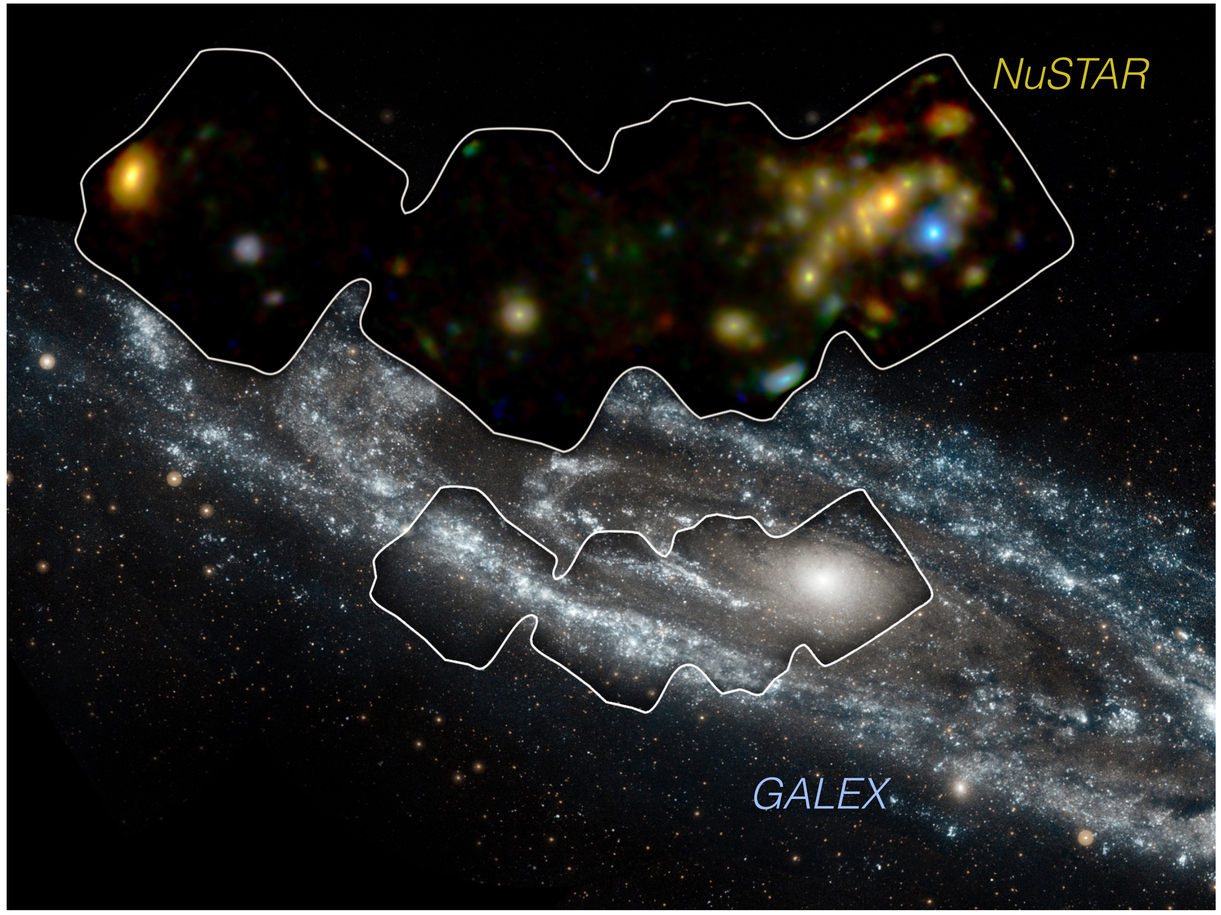
# Reading a Graph

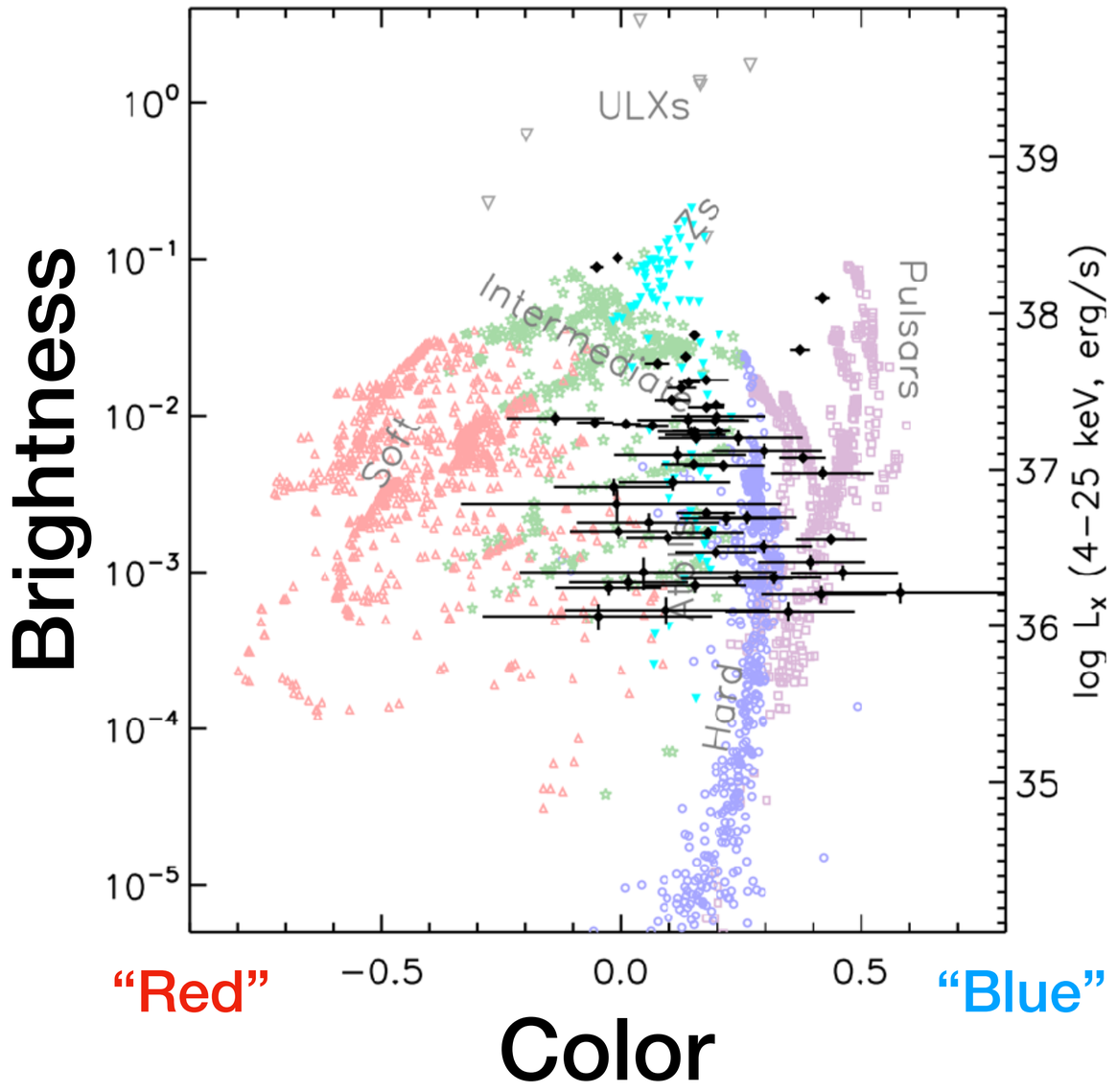
Which y-axis is IQ and which is weight?



# Real Life Example



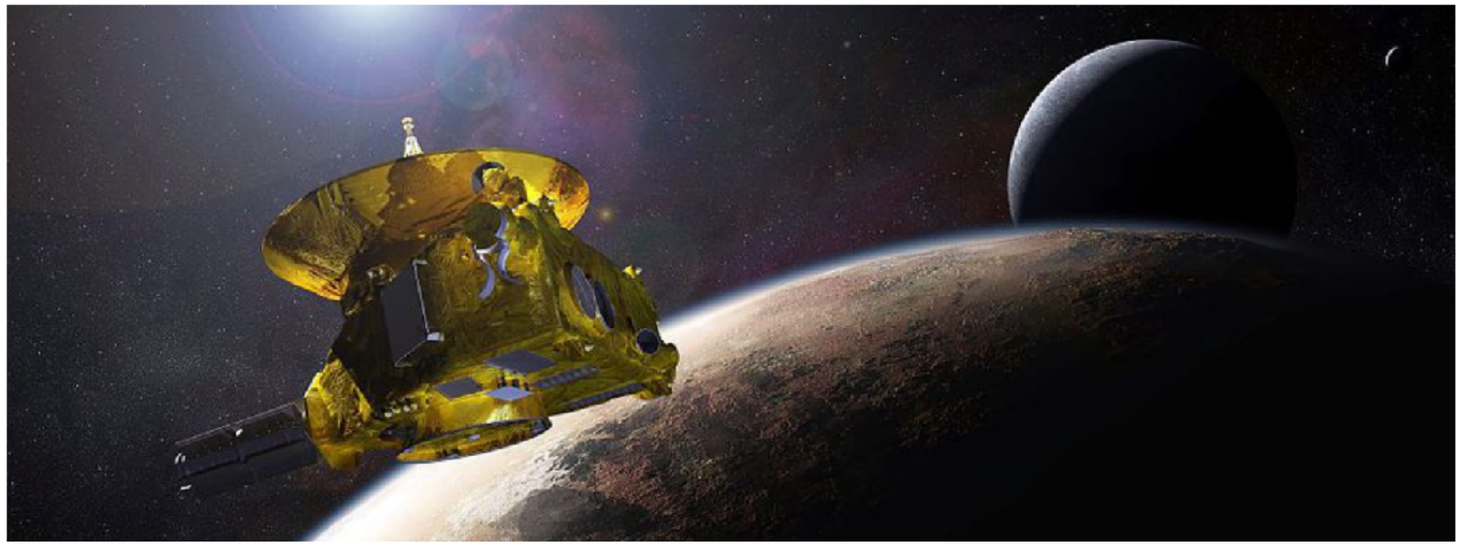



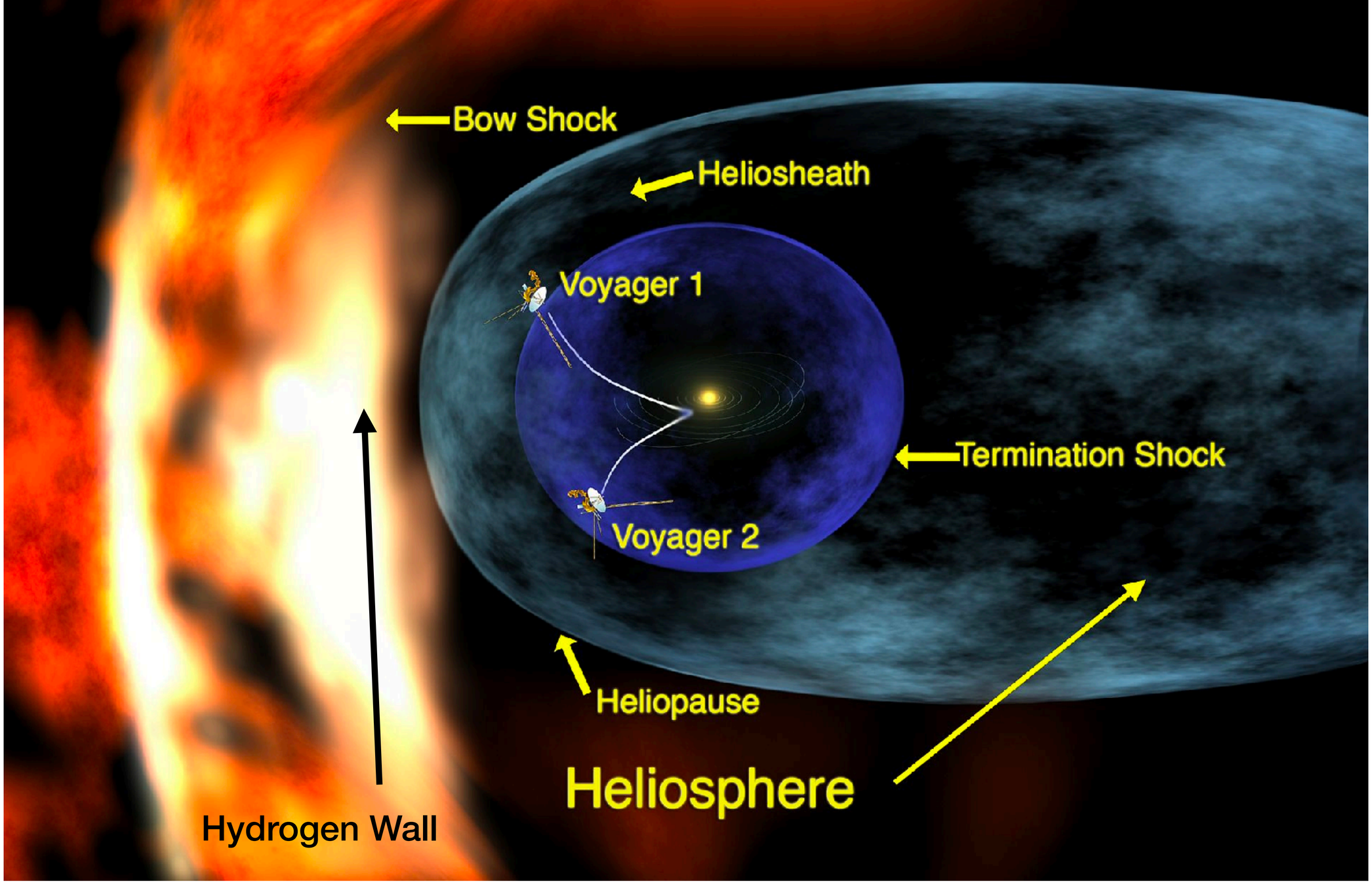
# New Horizons Detects Possible Hydrogen Wall at the Edge of the Solar System

The spacecraft spotted UV light scattered across the farthest reaches of the solar system.

By David Grossman Aug 13, 2018






Bow Shock
Heliosheath
Voyager 1
Termination Shock
Voyager 2
Heliopause
Heliosphere
Hydrogen Wall

# To conclude (or really, begin):

Because light travels at a finite speed, looking far away is looking into the past

There are ~100 billion stars in our Galaxy, the Milky Way

There are ~100 billion galaxies in the visible universe

Most stars host planets (although mostly uninhabitable by our standards)

We are made of stardust