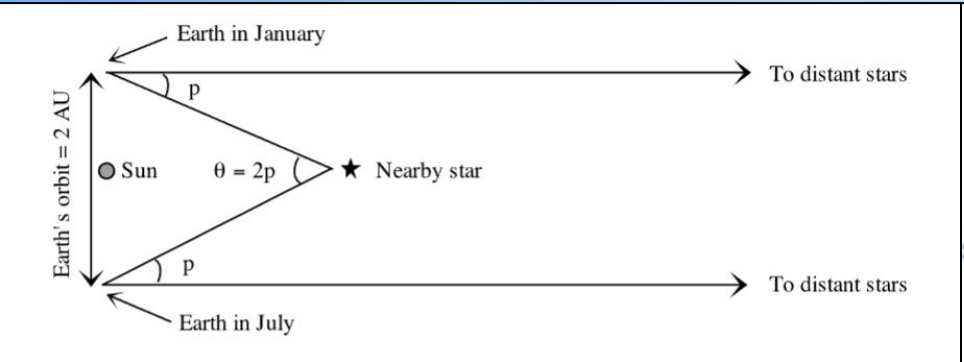
# Announcements

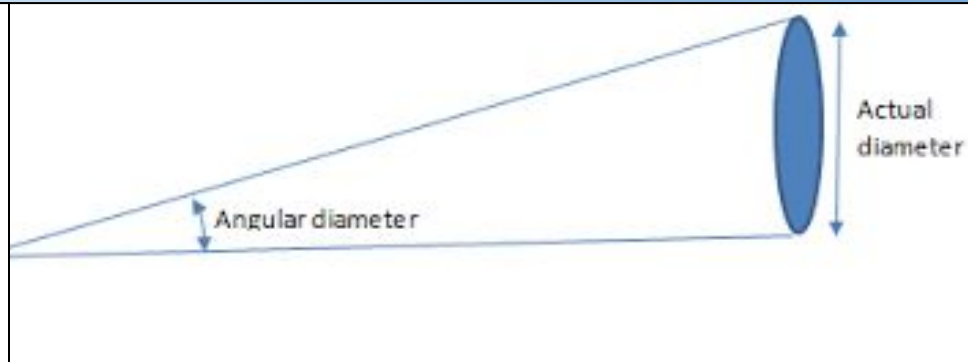
- Next week is spring break
  - No class
- After that we have one more night lab
- Mid-Semester Reminder
  - Please do not use AI to complete your labs
    - I can tell
      - I have had to make one report so far (both my classes combined) (better than last semester)
        - But there are more I have suspicions about
- Next class is the last time to turn in any lab from the first half of the semester
  - Any lab from today or earlier will not be accepted after that

# Magnitudes and Stellar Brightness

# Review From Previous Labs (Parsecs)

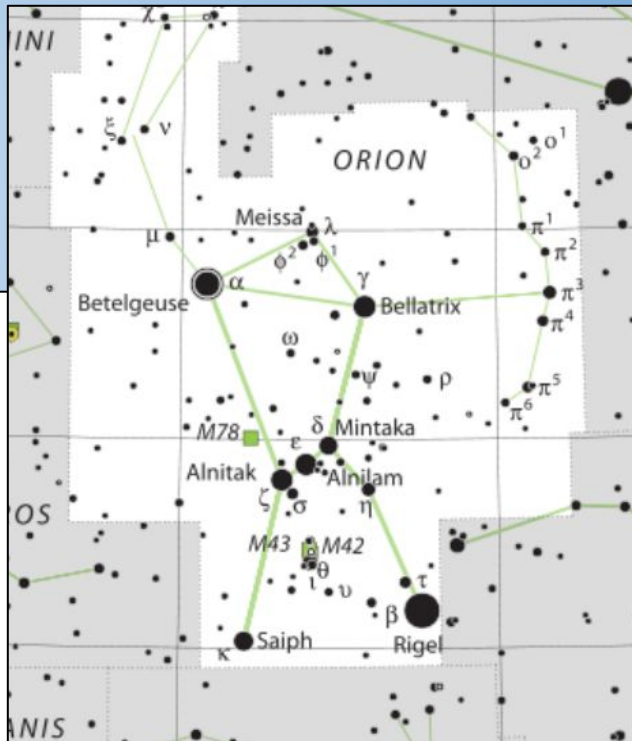
- A unit of distance, not time
  - Equal to 3.26156 ly
  - Comes from the apparent movement (parallax) of the object
    - 1 pc is the distance to an object with a parallax angle of 1 arcsecond



# Review From Previous Labs (Stellar Nomenclature)

- Proper name is a Greek letter and the name of the constellation
  - Usually, the brightest gets α, second brightest gets β, etc…
    - But there are exceptions

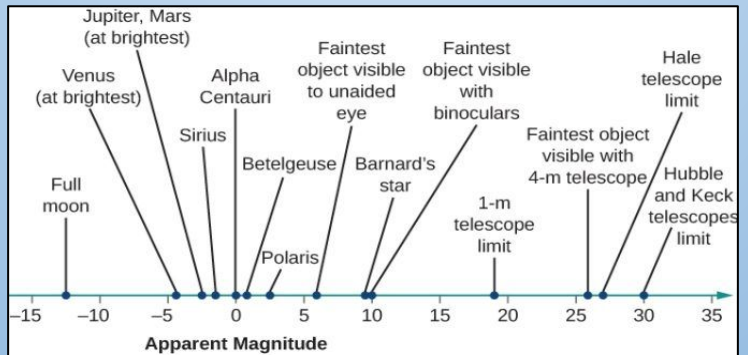



**The Lower-case Greek Alphabet**

| | | | | | |
|---|---|---|---|---|---|
| α | alpha | ι | iota | ρ | rho |
| β | beta | κ | kappa | σ | sigma |
| γ | gamma | λ | lambda | τ | tau |
| δ | delta | μ | mu | υ | upsilon |
| ε | epsilon | ν | nu | ϕ | phi |
| ζ | zeta | ξ | xi | χ | chi |
| η | eta | ο | omicron | ψ | psi |
| θ | theta | π | pi | ω | omega |

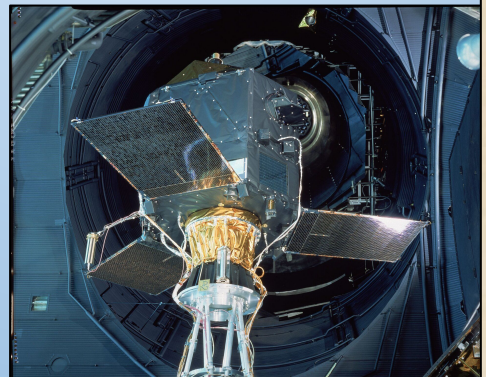
# Review From Previous Labs (Apparent Magnitude)

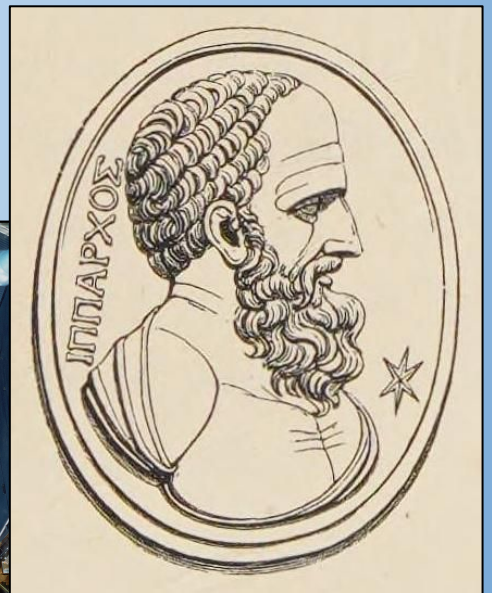
- Previously I mentioned magnitude - how bright a star is
- More specifically we discussed “Apparent Magnitude”
  - This is how bright things appear to be - further objects look less bright than they actually are
- Important details:
  - Inverse Scale
    - Smaller = Bigger
  - Logarithmic Scale
    - A difference of 1 magnitude is a difference of 2.512 times in terms of brightness



# History of the Magnitude scale

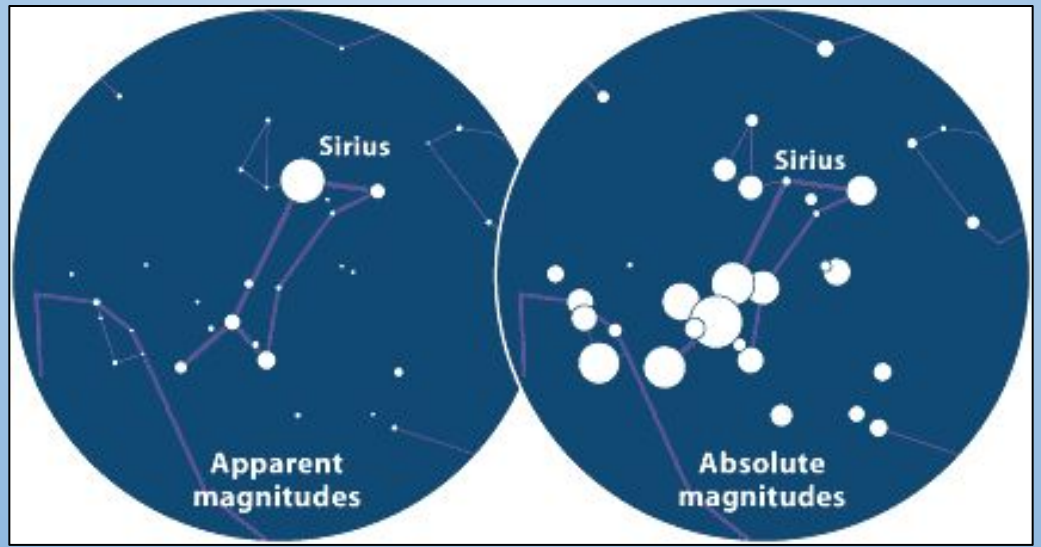
- Hipparchus (the ancient astronomer, not the telescope) divided the stars into 6 categories
  - The brightest were “1st magnitude” and the faintest were “6th magnitude” with the rest inbetween
    - This is why the scale is reversed with smaller numbers being brighter
- This has been expanded in the modern version
  - Now we have negative numbers and bigger (fainter) numbers
  - It also applies to things other than stars
    - Like the Moon, planets, and galaxies





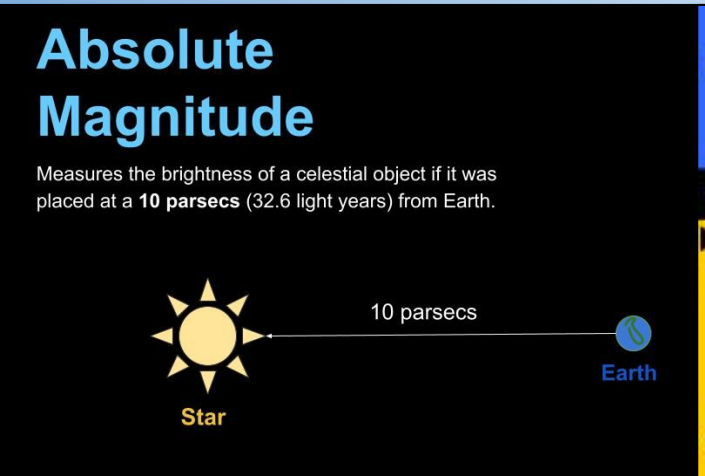
# Apparent Magnitude vs Absolute Magnitude

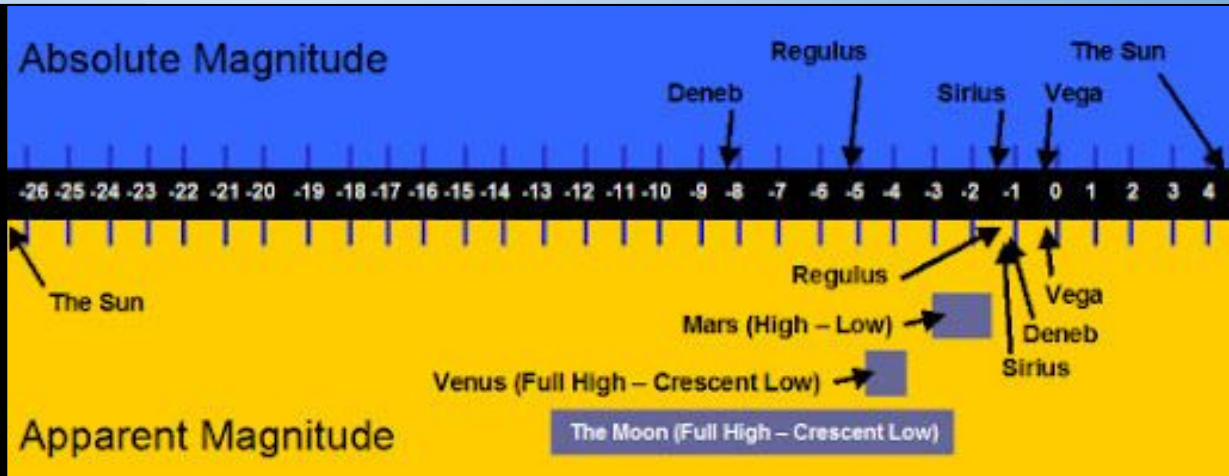
- Apparent magnitude depends on your distance to the object
- Absolute magnitude assumes the same distance for all objects
  - It is a way to describe how bright it actually is (relative to other stars)
  - It is how bright the star would be if it was exactly 10 parsecs away



# Absolute Magnitude

- Absolute Magnitude still has these important details:
  - Inverse Scale
    - Smaller = Bigger
  - Logarithmic Scale
    - A difference of 1 magnitude is a difference of about 2.512 times in terms of brightness



# Star Color and Temperature

- While spectral lines are impacted by composition (Spectroscopy Lab)…
- In something as hot as a star, the color you see depends on the temperature
  - Think metal changing color as it heats up
- In stars, red means a (relatively) cool temperature, and white/blue means a hot temperature
- We'll discuss more about what causes stars to have different temperatures in the upcoming HR Diagrams Lab
  - But for now, in simple terms, if we know the star's color
  - → We know its temperature, and if we know its temperature (and physical size)
  - → We know how intrinsically bright (absolute magnitude) it is

# Math Break

- If we know both the absolute magnitude and the apparent magnitude, we can calculate the distance to the star
- This equation is given in your lab script: $m - M = 5 \times \log_{10}(d) - 5$
  - It shows the mathematical relationship between both magnitudes and distance
    - m = apparent magnitude
    - M = absolute magnitude
    - d = distance (in parsecs)
  - In your lab, you need to find the distance based on the magnitudes
    - So I will work through this on the board with you to solve for d

# Today

- Constellation sketch (similar to Intro to the Night Sky Lab)
  - Include cardinal directions and at least 8 stars
    - Use dot size to indicate star brightness
  - Estimate the apparent magnitude
    - We know the brightest stars are Sirius (-1.5) and Vega (0.0)
    - And we know the faintest visible stars are about 3.5 to 4 (normally closer to 7, but we have a lot of light pollution)
    - Page 5 gives a good walkthrough on how to do this
- Do it again but with a telescope
  - This time the faintest stars will be roughly 7 magnitude
- Use the internet/stargazing app to find the actual magnitudes instead of the Audubon Guide (You can use the Audubon guide if want though)
- Question 4 - Use multiplication, not addition