# Announcements

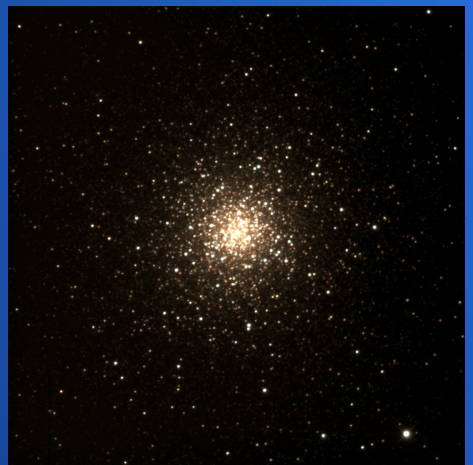
- Please do not use AI to complete your labs
  - If you need help, ask me - I am literally paid to help you anyway I can short of giving you the answer
    - You can ask me in class, via email, or come to my office hours
- Tuesday the 28th and Wednesday the 29th are for make up labs
  - All other labs need to be in by Monday the 27th
  - If you are going to makeup a lab, it must be one you were absent for, and you must let me know in advance
    - If nobody lets me know, *I will not be here*

# Open Clusters

# Types of Star Clusters

**Globular Clusters**:

- Old
- Dense
- 10,000s to 100,000s of stars
- Located in the Galactic Halo
- No gas or dust (all used up)



**Open Clusters** (What we are doing today):

- Young
- Loose
- 100s to 1000s of stars
- Located in the Galactic Disk
- Some gas and dust too

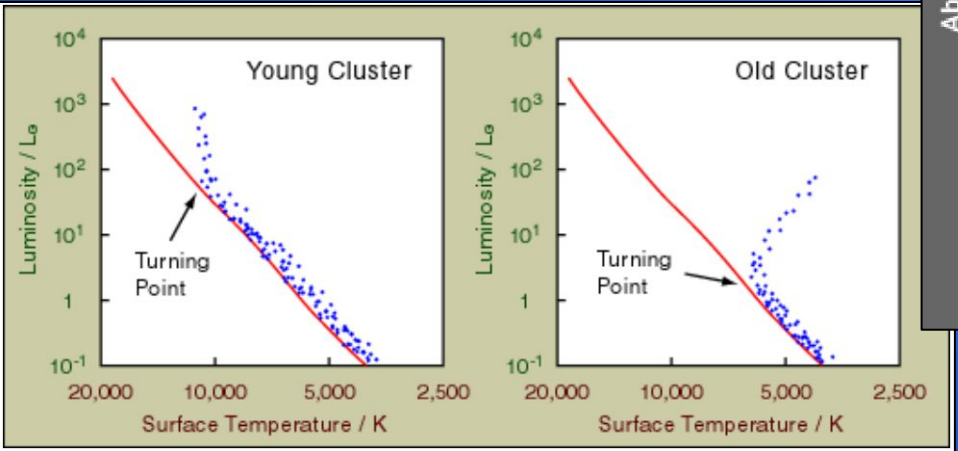
But a lot of the stuff we are doing today with Open Clusters can also be applied to Globular Clusters

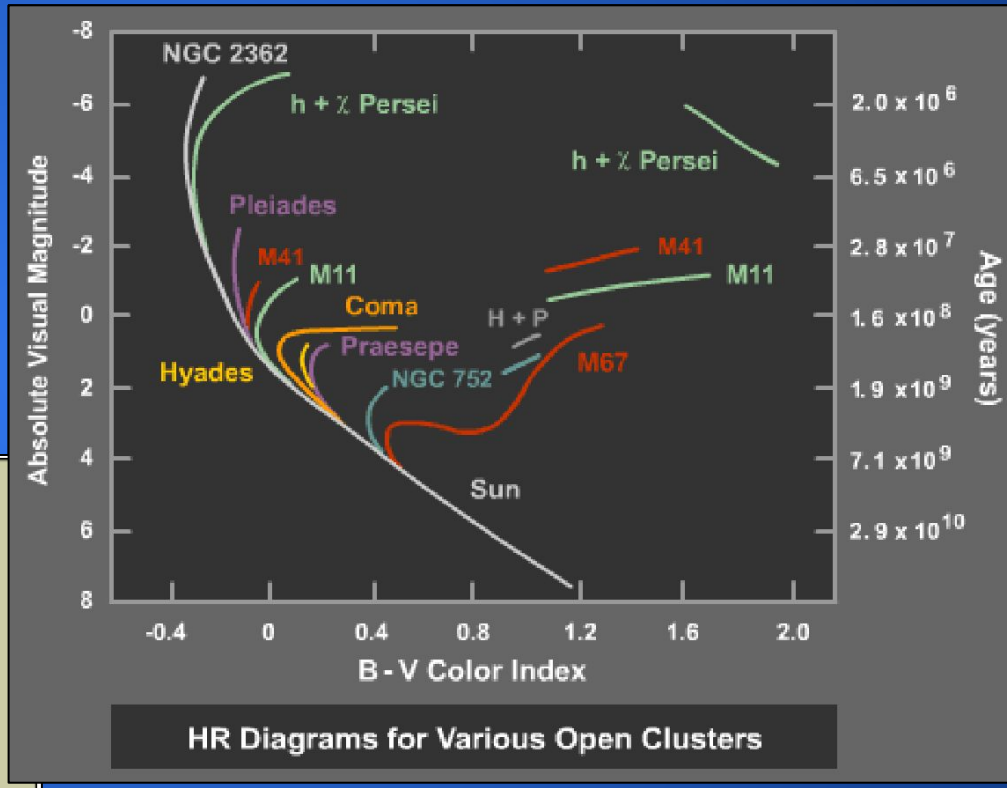
# Star Clusters

- All stars in a cluster formed at the ***same time*** from the same cloud of dust and gas
  - Stars in a cluster are all the ***same age***
- More massive stars die faster than less massive stars
  - Blue stars are hotter and more massive
    - Last a few million years
  - Red stars are cooler and less massive
    - Last potentially trillions of years
  - The Sun is in between at around 10 billion years
  - Biggest to smallest: O, B, A, F, G, K, M
    - **O**ne **B**oring **A**fternoon **F**rank **G**rew **K**iller **M**arijuana

# Star Clusters Cont.

- When a star cluster forms, we see a lot of little stars, and only a few really big stars
- The big stars then die faster, leading to:

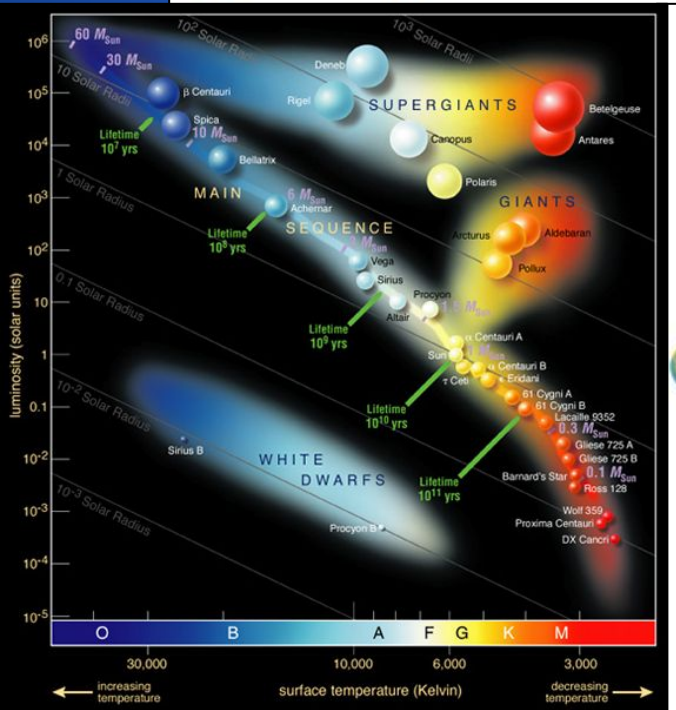


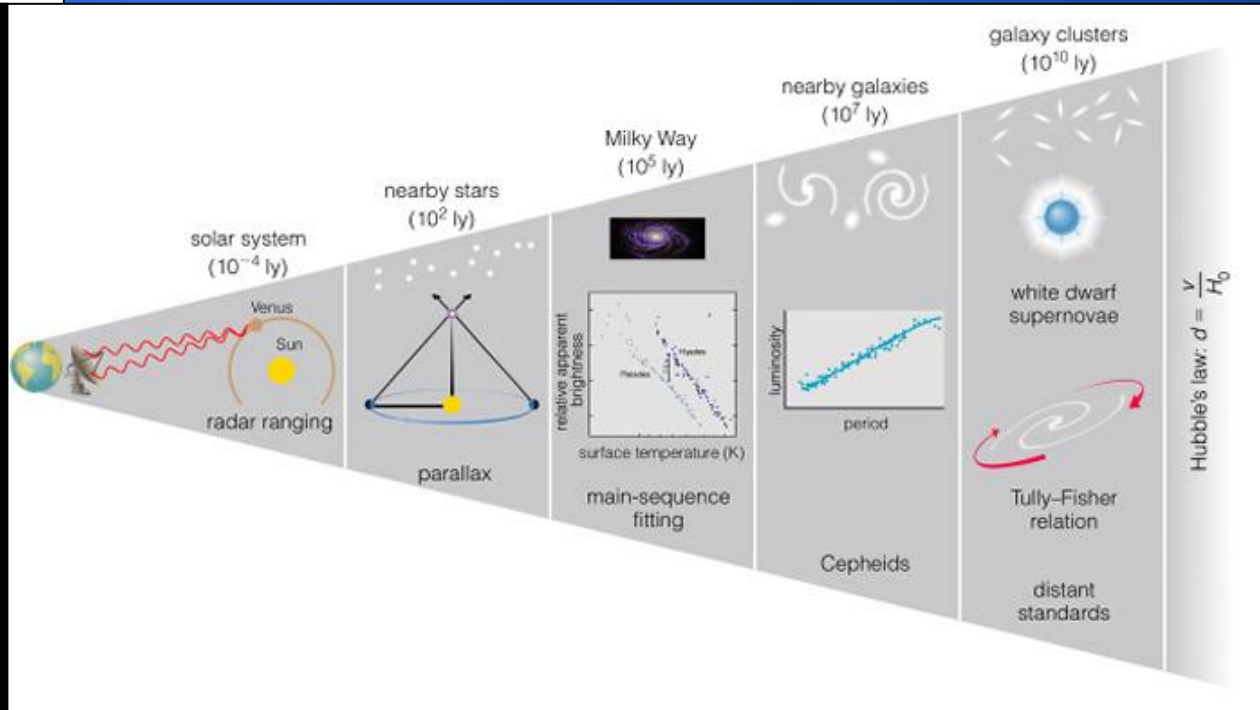




↑ Important: This is Figure 4 from your lab script

# Finding Distance With the Main Sequence (First, A Quick Review)

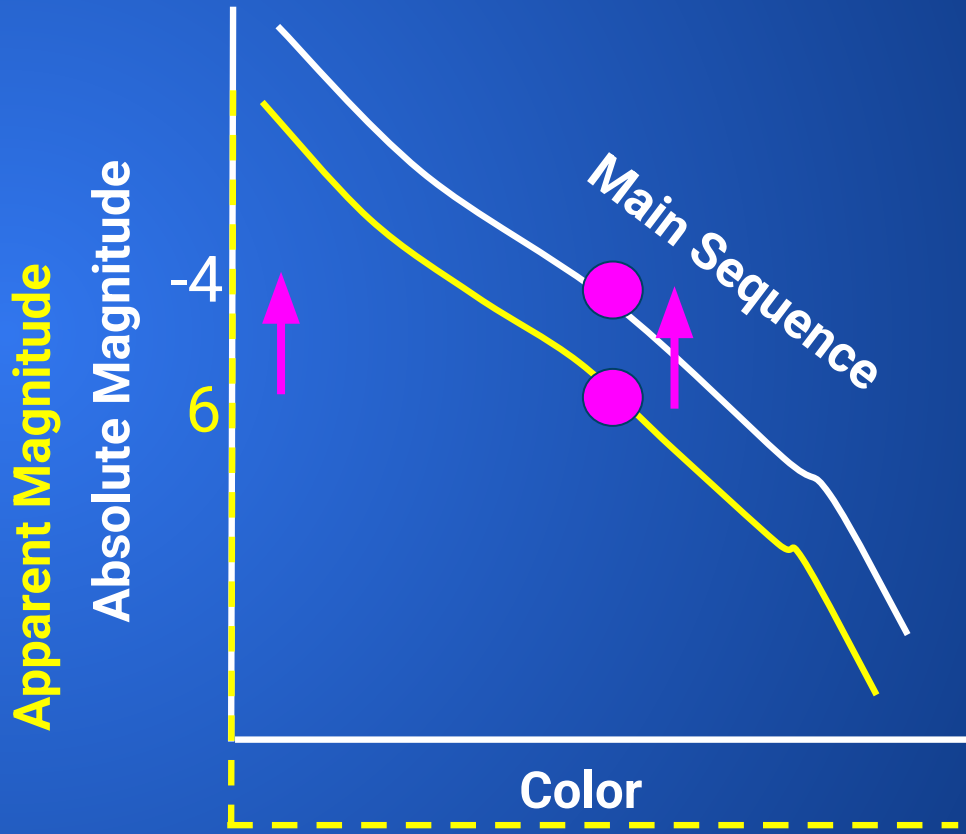
- $$d = 10^{\frac{m-M+5}{5}}$$ → "Distance Modulus" Note that your lab uses V and $M_V$ instead of m and M



# Finding Distance With the Main Sequence

- Overlay HR diagrams with apparent and absolute magnitude
  - Align the axes, then slide up and down so that the main sequences are aligned
- Plug the magnitudes into the distance modulus
  - M = -4, m = 6
  - d = 10^((6 + 4 + 5)/5)
  - d = 1000 pc



# Today:

- Grab a transparency, the data, and some dry-erase markers
- Graph the stars from Table 1 on Page 7 on the transparency
  - Note that Table 1 has two columns - so you will need a total of 14 stars
  - I recommend drawing a line (not necessarily straight) through them to make it easier to see the Main Sequence
- Place your transparency over the data
  - Line up the vertical axes, then move up or down so that the main sequences are on top of eachother
- Choose 3 points on the main sequence
  - For each point, subtract V-$M_v$ and write it on Table 2 (page 8)
    - Take the average of those 3 and use that to determine the distance (also put it on Table 2)
  - Then find the Turn-Off Point and record it on Table 2
    - Compare to figure 4 in your lab script to estimate the age (also put it on Table 2)
- I have the “actual” distances on the board
  - Record them on Table 2 and calculate the percent difference with your calculated distance