MONDAY - 4/15/2019

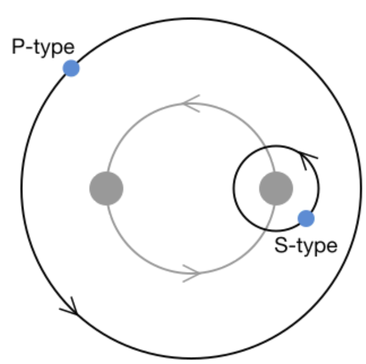
- Today, we will begin our project of the quarter
- It will be a scientific paper format but we will also submit code and have graphs
- This Friday, the observing/data project proposal is due
    - Provide references of literature
- May 20, first draft will be due! (bring a few copies so we can have peer review)
- May 29, second draft due! (outline, sections, references will all be done; working through the details of the analysis)
- June 7, final draft will be due!
- April 29-May 6, May 8-11 (Arcsat viewing period)
    - Make a note in your proposal how you expect to get your data
    - ARCSAT
        - 0.5-meter Astrophysical Research Consortium Small Aperture Telescope

      https://www.apo.nmsu.edu/Telescopes/ARCSAT/index.html
- ADS is a good tool
- Hint for reading scientific papers: write a summary of the paper so it's easy to search through them later
- When you put references down, make sure you know the overall idea of the paper before just taking a sentence from it
- Look at the abstract, conclusions and the PLOTS!
- https://www.annualreviews.org/journal/astro summaries of particular research topics

Potential Project:
Finding potentially habitable planets around a binary star system
How will we do this?

1. First find a binary star system
2. Find the ones that have planets
3. Then find ones with planets within the habitable zone

5 ways to find a planet:
https://exoplanets.nasa.gov/5-ways-to-find-a-planet/
Kepler Archive
P-type orbits (when a planet orbits both stars)
S-type orbits (when a planet orbits one star in the binary system)



K-type star (at least one of the stars in the binary system has to be)
S-type orbit
Habitable zone/terrestrial planet (take into account the size of the planet, size of the star, AU, etc.)

Deducing that the habitable zone for these types of stars are similar??
How will the other sun affect the habitable zone of the other star and the types of planet that orbit it?

Nice little paper to reference:
http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?db_key=AST&bibcode=2008ASPC..398..201Q&letter=.&classic=YES&defaultprint=YES&whole_paper=YES&page=201&epage=201&send=Send+PDF&filetype=.pdf
Terrestrial Planet Formation in Binary Star Systems
Elisa V. Quintana

WEDNESDAY- 4/17/2019

Found some other nice little references for our project!
https://www.annualreviews.org/doi/abs/10.1146/annurev-astro-082214-122238
- How to Characterize Habitable Worlds and Signs of Life
- Lisa Kaltenegger

https://www.annualreviews.org/doi/abs/10.1146/annurev.astro.41.071601.170049
- Evolution of a Habitable Planet
- James F. Kasting1 and David Catling2

FRIDAY - 4/19/2019

Things that make looking for planets hard:
- Multiple planets around a star
- Angle inclination
- Binary star systems

Most of our systems look quite simple but in reality, it can be quite difficult

What else can we observe:
- Planetary nebula (extremely short lived in astronomy)
    - Tells us a lot about the star that has died
    - Very complex shapes which come from binary or triple systems that are involved as the stars are forming or planets that got BOOM(ed) as well

Color Magnitude Diagrams (CMD)
- Helps us understand the evolution of a star

What do we actually observe (From Emission to Observation)

- Questions to guide us:
    - What is it that we actually measure from celestial object?
    - What information about a star must we have before we can estimate its luminosity?
    - If observing at optical wavelengths, what wavelength range would we be considering?
    - Etc.
    - Think about resolution
    - Number of photons we register in any given image
    - Approximate brightness ratio between 1st and 2nd magnitude star
    - Define the magnitude difference between 2 stars
    - What would the brightness of a star depend on?
    - How would flux from very hot star differ from flux from very cool star?

Should start thinking about what you expect to see so you understand what's happening around you

The Story of a Traveling Photon

1. Photon (aka object) takes a stroll (interstellar junk)
    a. Travels through clouds, dust, gas, etc.
    b. OR gets absorbed and dies
    c. OR goes through gravitational lensing and dies
2. Approaches Earth and goes through the atmosphere
    a. OR gets scattered and DIES
3. Looks through telescope (optical)
4. Crashes into CCD
5. CCD creates electrons
6. Created into files
7. Mixed with correction files
8. Fits.file??

Happy equations located on slides in today's lecture

Resolution tells us about--makes things not look like one blob, helps us distinguish between different objects
R = wavelength/aperture

Techniques: imaging (just like an actual photo), photometry, spectroscopy (looking at cool looking graphs that separate the light and putting it into wavelengths)

Electromagnetic spectrum: Gamma rays, x rays, UV, visible, infrared, microwaves, radio

Filters
- Tells us how long it takes to see that object, transmission

Differential Vs. Absolute Photometry
- Both include comparison to another star
- Differential: comparison to a star of unknown luminosity
- Absolute: comparison to a star of known luminosity

Why wouldn't we always do absolute?
*1 deg = 60 arc mins

How do we measure the flux of a star (ROUND) from a CCD (square or rectangular pixels)
Some choices:
- Toss all partial pixels - just don't count that flux
- Use those pixels - even though they will have more sky than full "object" pixels
- Use a weighting scheme

Intervening materials
- Weather (clouds)
- Dust
- Sky brightness
- Cranes
- Airmass (atmosphere)