Astronomy @ UChicago's SO-ED Fall 2018

October 13

Goals:

- Introduction to Galaxies!
- Feel more prepared to study DSOs at home
- Review some of the good resources
- See some basic math

Introduction to Galaxies

- Why are galaxies cool?
    - They look cool cuz they're easy to see (big) compared to individual stars or exoplanets
    - They are (by definition) where a ton of stuff goes on
- Hubble Classification (uses the tuning fork diagram) is based on shape:
    - Spiral: S
        - Barred spiral: SB
        - S(B)a-c: a has tighter and smoother arms, while c has looser arms (more star forming regions)
    - Lenticular (has the central nuclear bulge but no clear arms): S0
    - Elliptical: E
- Focus on starburst galaxies -- super high star formation galaxies.
    - Really dusty gas, lots of high mass stars that create clouds for new stars
    - Lots of examples are interacting galaxies (like Antennae). Look at elements in these galaxies -- can tell us what kinds of stars are there
- Questions to think about and look up:
    - First of all: Why are there so many topics this year???
        - Variables and Type Ia supernovae help determine distances
        - Pulsars, ULXs, and central bulges are the most easily observable
        - Stars and stellar formation/evolution help us learn more about our own origins
    - How do the spiral arms stay together?
        - Density wave theory (hypothesis) suggests arms are areas of high density that slow down stars, which travel through them -- also suggests gas clouds could collapse into stars in the arms
    - How did (different) galaxies form?
    - Why do some galaxies have different shapes? (elliptical, lenticular, spiral, ...)
    - How is the structure of the galaxies related to stellar formation?
    - How did astronomers determine these properties?
        - Distance is often determined using Cepheids (for closer things) and Type I supernovae for the roughly constant absolute magnitude
        - Think about which wavelengths are relevant for different observations

Miscellaneous:

- Nebulae
    - Molecular Hydrogen: H_2 like the normal gaseous form
    - H I region: Single Hydrogen atoms
    - H II region: Ionized Hydrogen (H^+)
    - Ionization can indicate presence of young nearby stars
- Interstellar Medium scatters light (mostly in higher frequencies)
    - Affects what we see and can require correction factors

DSOs:

- Questions to ask:
    - Why is this particular object important/interesting?
    - What does it tell us about similar objects?
    - How does it relate to the theory section/topics?
- Good resources:
    - Wikipedia
    - AAVSO for Variable Stars
    - Chandra (X-ray)
    - Spitzer Space Telescope (IR)
    - Research article abstracts (don't waste too much time trying to read the whole article)
    - Scioly.org
    - Random slides (that seem legit enough)
    - APOD!
- Information you should have:
    - Multiple images, ideally in different wavelengths (and labeled)
        - Memorizing for speed on tests is a good idea
        - Not always applicable, esp for very far or small objects -- get what you can
        - The wikipedia article
    - Discovery info
    - Location (pos. on celestial sphere, distance (if possible), galaxy, constellation, etc.)
    - Names in different catalogs
    - Facts that make the DSO stand out from other random objects
    - Facts that make the DSO representative of other objects

Math topics:

- Magnitude
- Distance modulus / K correction
- Parallax
- Redshift (brief) & Hubble's law
- Period-luminosity for Cepheids
    - (How was this reference established in the first place?)
- Tully-Fisher plot