Notes: Introduction to Observing Variable Stars
- Russ Valentine

- Most information is from the AAVSO Visual Observing Manual. AAVSO stands for The American Association of Variable Star Observers. The manual is at http://www.aavso.org/aavso/. A few words on eypieces by Carl Feehrer, AAVSO Member/Observer (http://www.aavso.org/publications/manual/eyepieces.shtml)
- Reasons to observe variables
  - Get more familiar with the night sky (compare finding a start to a nebula).
  - Record useful data for professional astronomers.
  - As a personal challenge to see if you can record accurate data and predict the stars magnitude based off your observations.
  - See for you self variables stars and that they do exists and not rely on what someone else had told you, or what you've read.
- Prepare
  - Get a list of stars you want to observe as well as their star charts
    - If first starting there is a list of easy to observe stars. (http://www.aavso.org/observing/aids/easystars.shtml)
    - After more experience can observe harder ones based on observing conditions and equipment.
      - People are still able to observe variables even in light polluted areas. (Many observations from your backyard is better than a just few from a dark site).
      - Great need for variable observations during morning or evening twilight.
    - Equipment
      - Binoculars – Very good, large field of view easy to find variable star and can contain many compare stars in same field. (7x50 or 10x50 are useful)
      - Telescope – Most popular are 6" + telescopes, but any should work fine
        - Eye pieces – Low and high power are usually needed, low to find field and higher power when viewing dimmer stars or crowded fields.
          - True field of view = apparent field of few/ magnification
          - Exit pupil = focal length / focal ratio; EP should be 2mm < EP < 7mm for visual as that's the size of a pupil in eye. Otherwise light is wasted.
          - Should find out what your field of view with scope + eyepieces, so you can know what charts you might need later. Can use drifting method (1 degree/4min.).
        - Mount – Any nice stable mount should be good. For high power a drive might be useful.

- Un-aided eye – There are bright variables that could be observed with the un-aided eye (Give examples).
- Watch – For certain variables time is very important, the best would be some clock that is synced to a atomic clock, if it isn't as time sensitive your clock should atleast be accurate within a few minutes.
- Paper – to write down your observations.
- Atlas – A start atlas or star charts are needed to find the stars and are used to find the magnitude of neighboring stars. If you are wanting to turn in your observations to the AAVSO, then want you to use their star charts so that the star magnitudes are consistant.
  - AAVSO stars charges, come in different sizes

Table 1.1 - Chart Scales

	arc/mm	area	Good for:
a	5 min	15 degs	binocs/finder
ab	2.5 min	7.5 degs	binocs/finder
b	1 min	3 degs.	sm. Telescope
c	40 sec	2 deg	3 - 4" tel.
d	20 sec	1 deg.	≥ 4" tel.
e	10 sec	30 min	lg. telescope
f	5 sec	15 min	lg. telescope
g	2.5 sec	7.5 min	lg. telescope

  - They also to make it easier they have charts that are flipped if the scope has even or odd (using diagonal) reflections.
  - The variable star is labled by having a broken cross with a circle in the middle. (Show examples)
  - Also suggest making carboard cutouts of your actually field of view that you can place on the chart to make it more easier to recognize.
- Make observation
  - Find the general area (Can use an 'a' or 'b' chart to help you find it).
  - Find a star near your variable use your finder to center the scope on that star
  - You can then star hop until you have the variable in the field. You should be able to use an appropriate star chart to compare your telescope field to an chart of appropriate area.
  - You can also use setting circles or GOTO.
  - Locate some good comparison stars. You should look at your chart to see the comparison stars in that area. This should be close but a little +/- in brightness from what the variable star is to get a observation (Show paper demonstration).
  - Estimate the brightness based on comparison stars.
  - Record your observation
    - **name** and **designation** of the variable

- date and **time** of your observation
                - **magnitude** estimate for the variable
                - **magnitudes of the comparison stars** used for the estimate
                - **identification of chart used**
                - **notes** on any conditions which might effect seeing (i.e. clouds, haze, moonlight, high wind, etc.)
        o If you want you can turn your observation into the AAVSO.
        o Extra notes:
                - Best to observe close to the limited magnitude for your conditions and equipment.
                - Remember the star might not be seen if it dimmed below your magnitude for the condition, make sure you have the right star.
                - Should use close to center of field instead of edge to judge the brightness of variable as well as comparitors. (Edges probably not as bright with your eye piece of the edge and can mess up measurments.)
                - If you don't see the variable you can still record that it is less than your limit on visible magnitude (After you find what that is).
                - Special techniques are used for red stars because of the eye not responding to red as well. Red stars also should be avoided as comparison stars.
- About Variable Stars
        o How often to observe certain variables
        o **Type of Star Observing Frequency**
                - Cepheids every clear night
                - RR Lyrae stars every 10 minutes
                - RV Tauri stars once per week
                - Mira variables once per week
                - Semiregular once per week
                - Cataclysmic Variables every clear night
                - Symbiotic stars* once per week
                - R CrB stars*-at Max once per week
                - R CrB stars-at Min every clear night
                - Eclipsing Binaries every 10 minutes during eclipse
                - Rotating stars every 10 minutes
                - Irregular variables once per week
                - Suspected variables every clear night
- Submitting Observations to the AAVSO
        o read their manual, where most of the info comes from.
        o You do not need to be a AAVSO member to send in observations.
        o Get observing code, you can use their web application to enter in observations.