ASTR337: Homework 6

Due Date/Time: Beginning of class (7 pm), Wednesday, October 30th 2019

Observing Narrative Log

From your Project Observing Night with your group partner, please *individually* write a 1-2 page narrative log describing what took place during the course of the night. Feel free to include figures to illustrate concepts. Be descriptive in describing the following:

- Key properties of the observatory
- Observing conditions (weather, seeing, temperature, moon phase, sunset/twilight times...)
- Properties of the telescope, mount, instrument
- Specific procedures you learned
- Notes of caution when operating the telescope/instrument
- Any additional relevant information

Provide as much detail as necessary for "future you" to return and conduct observations.

1. **CCD Data Reduction, building upon your work in Lab 5:**
   Please submit the following as a single zipped file via Moodle:
   1) Jupyter notebook,
   2) R-band master flat FITS file,
   3) <u>One</u> of your fully-calibrated FITS files of NGC 6853.
   4) B-band master flat and a calibrated B-band NGC 6853 image.

   a. By the end of Lab 5, you successfully created a V-band master flat field frame. Follow the same procedure in a new Jupyter Notebook (streamlined, now that you know how the reduction steps work) to create the R-band master flat field frame.

   b. Bias-subtract and dark-subtract all of the NGC 6853 science images, using the master calibrations you made in lab. Ensure that the dark exposure times match those of the NGC 6853 data.

   c. Write a function that performs flatfielding by dividing science images by the master flat, then use it to flatfield all of the bias-subtracted, dark-subtracted NGC 6853 images in V-band.

d. Apply your flatfielding function to reduce all of the bias-subtracted, dark-subtracted NGC 6853 images in R-band.

e. Compare a raw NGC 6853 image in V-band with its final reduced image counterpart in V-band. What has visibly changed due to the reduction process?

f. How do the background levels change between the raw NGC 6853 image and the reduced one? (Mouse around the "blank" parts of the images to see the count levels.)

g. Blink through the reduced NGC 6853 frames in DS9 to answer the following questions:
(1) Are the images perfectly aligned with each other, or are there offsets from image to image?
(2) If there are offsets, roughly how big are the offsets in pixels?
(3) Approximately how many arcseconds does that correspond to?
(4) Does the alignment change between the V and R images?

h. **Repeat the process in order to** create a B-band master flat, and reduce the B-band data for NGC 6853! We will use your final BVR images in the next lab.

Pre-Lab Reading and Questions for Week 7

Reading

Please read the following section in Chromey:

- 9.4 - *Image Combination*

Reading Questions

1. Why do we often "dither" (make small moves so that stars fall on different pixels) images taken with CCDs?
2. Describe in your own words the basic steps required to align two CCD images.
3. When and why might one want to resample CCD data?
4. Why do we use a median combination of registered images instead of merely adding them together or mean-combining them?
5. When and why might one want to "mask" pixels in an image by replacing them with "no data" values?