

ASTR 3520
Astronomical Observations and Instrumentation II: Spectroscopy
Fall 2007

Homework / Lab 1:
Due: 18 September 2007 (Tuesday in lab)

Purpose:

In this lab, you will be asked to reduce a set of raw CCD images. The purpose is to exercise basic IRAF data reduction skills.

CCD Image Basic Data Reduction:

In this homework you will start to become familiar with the IRAF software package. There is an IRAF tutorial available on the web which will lead you through the reduction steps. You will perform the tasks described in the tutorial

<http://www.ifa.hawaii.edu/~joshw/IRAFtutorial/index.html>

Your assignment is to reduce the imaging data (00000075.fits to 00000079.fits) in

<http://origins.colorado.edu/~bally/ASTR3520/public/IMAGES/>

The data files consist of 3 bias frames, 3 dark frames, 3 flat frames, and 4 astronomical images of M57 using various color filters. The files you need all start with the prefix "00000" and have extensions such as BIAS, DARK, FLAT. You will need to figure out which image is what using the IRAF task `imhead *.fits long+`. Be careful. Some frames were binned 2x2 while others were not binned.

In the end you will turn in three things:

- Your final reduced image.
- A "script" of the commands you ran in IRAF to produce the final image.
- A file containing the results of the image analysis (see below).

Image Reductions:

We have four images for you to reduce, all are of the Ring Nebula (M57), but are in four different filters. Your reduction process should include dark subtraction and flat fielding of all the individual frames (as described in the tutorial mentioned above). You will not stack the images

because they are different filters, however you should align the images using '*imalign*', so that you can easily display the four filters in four different buffers in *ximtool* and blink between them to see the differences in the images based on the filter.

Generate the script by pasting the commands from the IRAF window into a text file (using the text editor of your choice, such as *nedit* or *emacs*). Please do not paste every command you run into the script. We are not interested in how many times you ran '*cd*', '*ls*', or '*display*'. Only paste in the commands which operate on the images, such as '*imarith*' or '*imcombine*'. Also, you may wish to use the '#' comment symbol to make notes of what you are doing in the script if it is not perfectly obvious.

Image Analysis:

Use the USNO catalog to visually identify the star field in your image. (Remember that the image may not be oriented, or have the same parity, as the USNO finder chart). The USNO charts may be found at:

`'http://www.nofs.navy.mil/data/FchPix/cfra.html'`

Using the positions and magnitudes of several stars in the USNO star-list, and their corresponding pixel coordinates measured with '*imexamine*', determine the following quantities:

- Orientation of the image (to 1 degree precision).
- The pixel scale on the sky (in arcseconds per pixel).
- Knowing that the pixel size is 6.8 micrometers, calculate the effective focal length of the imaging system.
- Estimate the magnitude of the faintest star that is reliably detected on the image.
- Estimate the magnitude that corresponds to 1 count (ADU) on the image (the photometric 0-point).

Turn in your material by e-mailing you files to Adam Ginsburg.

Name the files *yourname.fits*, *yourname.cl* and *yourname.txt*. The *.cl* file is the script and the *.txt* file are the answers to the questions. For example, I'd copy *bally.fits*, *bally.cl*, and *bally.txt* to the mail.