Final exam for AST555: Observational Astronomy

Dragonfly imaging of NGC 4565 ("the Needle")

A > Technical aspects

Go to the following page:
https://www.dropbox.com/sh/w5khgzefkmu5a2z/AAA_UZfbhMww_1u4mLtip5eYa?dl=0
and download the files.

a) Examine the count levels in the central regions of some bright stars. At what count level does the detector saturate?

b) Use the calibration files ("flat" and "dark") to correct the science ("light") frames. Describe each step and what it does to the frames.

c) Derive the zeropoint (flux calibration) of each of the two frames, using multiple stars in the image. You can assume that the filters are similar to the SDSS filters. Use the SDSS database. Use unsaturated stars.

d) Extra credit: use stars of different colors to determine whether the Dragonfly filters are offset from the SDSS filters, and in which direction. Hint: one filter is nearly identical, one is offset.

e) (you can answer this even if you did not answer c): The filters that are used in Dragonfly are identical to the SDSS filters. How can it be that you found an offset in c ?

Download the following files:
http://www.astro.yale.edu/dokkum/outgoing/coadd_SloanG.fits.gz
http://www.astro.yale.edu/dokkum/outgoing/coadd_SloanR.fits.gz

f) Do a qualitative comparison between these frames and the frames you analyzed above. Explain the differences in the field of view, pixel size, number of visible objects in the images, etc.

g) Determine the zeropoints of the coadded images. You can use the same stars as before, and either compare to SDSS or just scale from your previous result.

h) Measure the background noise in the individual images and in the coadded images. Use what you know about Poisson statistics to calculate how many frames went into the coadds. Hint: don't forget to take the zeropoint difference into account.

i) The number of frames is also listed in the headers of the images. Explain any differences between your answer in h and the number in the header.

B > Analysis

Determine whether NGC 4565 has an "edge", that is, whether its major axis surface brightness profile shows a sharp faint-ward turn at some radius. Discuss your result.
Hint: do the analysis in log(counts), not linear counts: the profile will, to first order, be an exponential function of the form counts ~ exp(-r) and the question is whether there is a "break" or "truncation" in that function.

C > Notes

Working together: it is fine to help each other with technical / software aspects; in fact, I encourage discussions about this as it can be difficult to do on your own (installing IRAF etc). However, make sure your actual analysis is your own work, even if you take turns working on the same computer.

Software: everything can be done with IRAF or equivalent python / IDL tasks.

Grading: The main goal here is to encourage you to interact with actual imaging data. If you really can't do something because of limitations in the software that you use, describe what steps you would take if you were able to, and perhaps do something else that uses the image and demonstrates that you can interact with it. The graduate students will be graded differently from the undergraduates. E.g., in B, I expect the graduate students to compare to scientific literature.