

Lab 6. Basics of Photometry

Equipment

- Good photocopies of Figure 3 and 4
- Dividers (or protractors if dividers are unavailable)

Mini Lecture prior to Lab

- Make sure the students have covered some of the basics on light and the properties of stars in their lectures. Otherwise you might have to go over definitions of absolute and apparent magnitude, luminosity, and flux (which they should have done in the pre-lab), and review Wien's Law and Stephan-Boltzmann's Law, and correlations between the Luminosities, Temperatures, and Radii. Make sure students know WHY they are measuring the radii of stellar images and more importantly, HOW this provides them with the information on the Luminosities, Temperatures, and Radii of stars.
- Go over black body spectra and demonstrate (using drawings like Plot 4) how the difference between two magnitudes (obtained with different filters), gives information on the color of the star AND its temperature.
- Mention the use of filters in astronomy, how we use them and what information they provide. A neat intuitive demo is to use 3-D glasses (with one red and one blue lens) and have the students look at color pictures. Test the pictures before class and choose some that show the biggest contrasts (red and blue M&M's also work fine – and you'll get brownie points from the students).

General Procedure

- Some students may spend a disproportionate amount of time on Part I – which only includes calibrating standard stars. Please mention that they have to complete parts I to III in class.
- It is possible to gather the data of table II relatively quickly – one student broke the record of doing it in 10 minutes. Budgeting half an hour for this is reasonable.
- Please make sure that each student measures the SAME star in BOTH pictures. This minimizes misclassifications and systematic errors.
- Please encourage the students to plot the HRD in class and ask them to show you the HRD before leaving class. You'll see immediately if something went wrong. Part IV can be done at home.
- Also, please make sure the students label the HRD and write rough numbers on the axis.

Notes & Suggestions

- Please make sure that the students make the connection between measuring radii and plugging numbers into tables, and the overall goal of the lab.
- The second photometry lab uses the data the students obtained from this lab. Both labs are complementary and provide the students with an in-depth laboratory experience and understanding.

General Concepts & What students might get out of this Lab

- How to get information of the colors and magnitudes of stars from black & white pictures
- An intuitive understanding of what magnitudes are and how we measure them using first principles
- How to determine the Luminosities, Temperatures, and Radii of Stars through an analysis of their magnitudes and some correlations.
- The significance and usage of the Hertzsprung-Russel-Diagram

Scientific Methodologies

- How to calibrate data and why this is important.
- How doing experiments using first principles (and using old-fashioned methods) can provide them with a deeper understanding of the concepts.