LAB 9. STELLAR SAFARI

Introduction

You will select color band filters to study astronomical targets in specific wavelength ranges, and choose a color palette to render the resulting images. You will use the colors to understand the objects in the images. This is an online lab developed by the Vera C. Rubin Observatory.

Supplies

Computers to access the Rubin Observatory website

Procedure

Getting started

Ideally, I'd like you to work in pairs for this activity. If there are an odd number of students, one group may have three people. Or, one independent student can go solo.

1. Open a web browser, and type "rubinobservatory.org/education" in the address field. This brings you to a page with several activities.
2. Click on the one titled "Stellar Safari." This brings up a new tab.
3. Click on the "Start Investigation" button.

   This brings up the first page of the activity, or perhaps a log-in page. Log in if necessary, and then start in earnest. The progress bar at the top of the page shows how far you have gotten in the activity, with thumbtacks to indicate "checkpoints" along the way. This divides the activity into three parts. The arrow buttons at the bottom of the page take you forward or backward to the next or previous page.

Running the activity

First part: The H-R Diagram

This part reviews the H-R diagram for categorizing stars on the basis of their luminosity and surface temperature. A "classic" H-R diagram plots absolute luminosity against spectral class. Both of these properties are derived from calculations. A related plot that can be made from directly measured properties shows apparent magnitude vs. color index. This is justified when the stars are the same distance from Earth, as are stars in the same cluster.

4. Read the first page, then scroll ahead, doing the indicated activities and answering the questions. The most important insight for you to pick up from this activity is how the color index of a star is obtained, how it relates to a star's surface temperature, and why it relates to a star's surface temperature.
5. Fundamentally, the properties of a main sequence star are determined by the star's mass. You should know how mass correlates to luminosity, surface area, fusion rate, surface temperature, and main sequence lifetime.

Second part: Comparing Star Clusters

Here you fit an "isochrone," a theoretical H-R diagram based on a stellar evolution model, to the observed color-magnitude diagram of an actual star cluster. To match an isochrone to the color-magnitude diagram, adjust two parameters: one for the age of the stars in the cluster (all stars in the cluster are assumed to be the same age), and one for the distance to the cluster.

6. Your first isochrone fit is for Question 19. Adjust the cluster's age and distance by clicking and dragging on the sliders. To read the value of a parameter, hover over its slider knob.

Third part: Learning about clusters from their isochrones

Here you compare clusters and individual stars based on insights obtained from the clusters' isochrones and from the stars' places in the isochrones.

7. There are just a few activities in this section. Answer the fitting questions, and then the analysis questions.

Finishing Up

First: **Don't leave without checking in with your instructor!**

8. When you get to the end, click the "REVIEW YOUR ANSWERS" button.
9. At the bottom of the window, click the "DOWNLOAD ANSWERS" button. It will create an Excel spreadsheet with your answers. Open WyoCourses and upload the spreadsheet to the lab assignment. The spreadsheet is evidence that you completed the activity, but it's not very easy to read.
10. With the review window open, consult your instructor to **discuss your findings** and your answers.
11. Leave **after** your instructor checks you off.