
LAB 9. COLORING THE UNIVERSE

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 “Coloring the Universe.” 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: Types of Light

This part reviews the principal wavelength bands of the electromagnetic spectrum, and explains how color images are made. Grayscale photographs are recorded with different color filters, and the grayscale photographs, rendered in visible colors, are combined to make an image meaningful to our vision.

4. Read the first page, then scroll ahead, doing the indicated activities and answering the questions. When you see a “tool” with a drop-down menu, try different menu selections. Then read the accompanying instructions to move through the steps of the lesson. If you have time, also see what happens if you do something contrary to the instructions, to see if the instructions have a worthwhile basis.

Second part: Eyes vs. Telescopes

Here you learn about the camera filters used by the Rubin Telescope. The filters are designated **u**, **g**, **r**, **i**, **z**, and **y** based on the wavelength bands that they transmit, from shortest to longest wavelengths.

5. Read the text, look at the graphics, do the activities, and answer the questions.

Third part: Estimating Star Temperatures

Here you look at images of star fields recorded through different color filters. From the differences in brightness of the stars in the different wavelength ranges, you can deduce which stars are hotter and which are cooler. Combining the colorized images and balancing the colors allows you to see the temperature differences immediately.

6. First, practice colorizing and color balancing the image of a star field to make the temperature differences most apparent.
7. Then, apply this technique to filtered images of a spiral galaxy.
8. Finally, compare images of different galaxies in a single field of view.

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.