MODULAR STEM

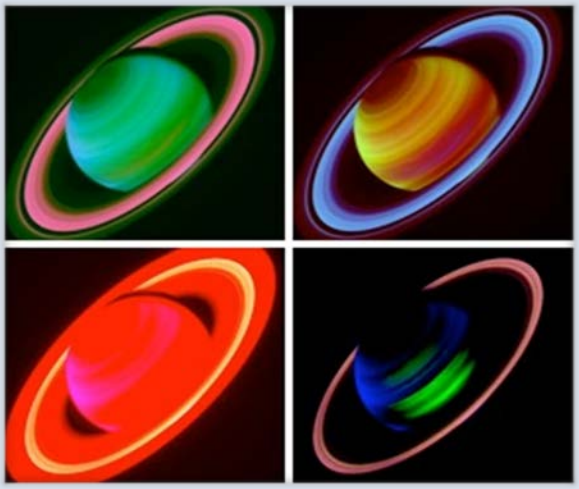
# Color the Universe

## INTRODUCTION

The universe is overflowing with color. Large clouds of warm dust glow in pinks, purples, greens, and reds. Most of these colors go unseen by human eyes since they are far too dim for our tiny eyes to perceive.

Through this project, though, we will learn how astronomers use electronic CCD cameras to detect light that our eyes never could. We will use real images from the Hubble Space Telescope to construct our own color images of a celestial object.

You will see that there is a great deal of artistry that goes into making beautiful scientific images. As you work on this project, reflect on how various forms of art (music, movies, and fine arts) rely on science, mathematics, engineering, and technology.



Saturn in many colors

## Project Description

**The Hubble Space Telescope is one of the best telescopes available to professional astronomers because it is located in space, above the blurring effects of Earth's atmosphere. Many astronomers wait years for their chance to collect images from this powerful telescope. In this project, you will use real astronomical images captured by the Hubble Space Telescope to create your own amazing color picture of a celestial object.**

**The final project will include:**

- **The final version of your color astrophotos, which you can produce using the resources found on this page (http://bit.ly/PChkcr)**
- **A written description of your object and what is visible in the image**
- **Written answers to the four essential questions below**

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## ESSENTIAL QUESTIONS

To successfully complete this project, you will need to be able to answer the following questions:

**EQ 1: What is light, and what is color?**

- Explore these videos for an overview of the full spectrum of light. (http://1.usa.gov/ejZjUT)
- Experiment with some of these optical illusions based on color. (http://bit.ly/reUjKW)
- Run to see how any color can be made from red, green, and blue. (http://bit.ly/f6Qags)

**EQ 2: What types of objects produce light of different colors?**

- Watch how this metal nail changes color as it gets hotter. (http://bit.ly/S3zd24)
- Explore the Astronomy Picture of the Day for colorful objects in space. (http://apod.nasa.gov)
- Read through these pages to learn about the meaning of color in images. (http://bit.ly/C6xlT)

**EQ 3: How do astronomers capture images of objects in space?**

- Learn what types of cameras are used to capture astrophotos. (http://to.pbs.org/V79bcy)
- Read about the computer chips inside these digital cameras. (http://bit.ly/R4B3Qh)
- Explore how pixels in a CCD are like buckets collecting rain water. (http://bit.ly/x8cjso)

**EQ 3: How are astronomical images manipulated to reveal colors?**

- Watch this video for a quick overview of how color astrophotos are made. (http://bit.ly/Qs1Ftb)
- Explore Step 1 of this project in which you manipulate real astrophotos. (http://bit.ly/R9IeVS)
- Create a color astrophoto by following these step-by-step directions. (http://bit.ly/Tc3miB)

## GOING FURTHER

You may choose to explore some of these resources to gain a deeper understanding of the topic.

- Watch this video to learn more about the Hubble Space Telescope. (http://bit.ly/V7rQF9)
- Explore more of the amazing images from the Hubble Space Telescope. (http://bit.ly/2EJzk)
- Contribute to the work of professional astronomers using this site. (http://bit.ly/121Uqo)
- Use this powerful, free software to find interesting objects in the night sky. (http://bit.ly/gQqMg)