

EDUCATOR'S GUIDE

How Hubble Works

Preparation

Overview and Objectives

This lesson is geared toward an adult audience interested in learning more about objects in deep space.

When the Hubble Space Telescope was brought into space in 1990, people on Earth were able to see images they have never seen before due to the telescope's ability to interpret light in a way that humans cannot do on their own. This program discusses how the images we see of space objects are created by the data from Hubble.

This lesson includes a [slideshow](#) in which an instructor can lead participants through an exploration of Hubble images. The lesson culminates with participants coloring their own planetary nebula based on Hubble data.

Instructional Modalities

This activity was designed for both synchronous or asynchronous instruction.

For **synchronous instruction**, we recommend a platform that allows both for whole class discussion and for students to interact in small groups.

For **asynchronous adaptations**, we provide suggestions for teachers to provide additional support for the activities and for students to share their work with each other.

Materials

- [How Hubble Works Slideshow](#)

Additional Resources

<https://hubblesite.org/>

<https://www.jwst.nasa.gov/>

<https://www.nasa.gov/subject/6894/galaxies/>

Lesson

1. Introductory Activity

- Ask Participants:
 - **What are some objects that we can find in space?**
 - **Are those objects close to Earth or far away?**
 - **How can we get information about those objects?**
- Discuss the responses with the group.

2. Core Activity

- Share image of Hubble Space Telescope and the types of images the telescope has taken
 - **Why was it important to put a telescope in space if we have great and powerful telescopes here on Earth?**
- Placing a telescope above our atmosphere allows it to take clear images that are not distorted by our atmosphere. If you put your head under water and look up does the sky and clouds look the same? No, the water distorts what you're seeing because light reflects differently through the water. The same happens with our atmosphere.
- Share [video](#) (0:37 - 2:25) of how the images produced by the Hubble Space Telescope are created.
 - **What colors does the Hubble Space Telescope attribute to regions that emit large amounts of infrared radiation?**
 - **What colors does the Hubble Space Telescope attribute to regions that emit visible light?**
 - **What colors does the Hubble Space Telescope attribute to regions that emit large amounts of ultraviolet radiation?**
 - **What happens when Hubble combines these images of the different regions of a space object?**
- Have participants learn more about [Galaxy Zoo](#) by selecting "Learn More" and try out classifying galaxies by selecting "Getting Started" on the website's main page. If they have difficulty identifying different characteristics of the objects in each image, they can select "tutorial" or "need some help with this task" for clarification.

- **What is challenging about classifying galaxies?**
- **What could make this work easier?**
- **What did you notice as you attempted to classify different images?**

Asynchronous Adaptation

Have participants go through the [slideshow](#) on their own then access [Galaxy Zoo](#) to classify galaxies.

Extension Activities

To deepen student engagement with this content, you may choose to add the following activities :

Learn about the James Webb Telescope

With telescopes like the [James Webb](#) space telescope, we will be able to learn even more about objects in deep space. Learn more about the James Webb telescope with your family and talk to each other about what the telescope may be able to find!

Additional Resources/ References

The Meaning of Color in Hubble Images:

http://hubblesite.org/gallery/behind_the_pictures/meaning_of_color/

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