EDUCATOR'S GUIDE

How Hubble Works

Preparation

Overview and Objectives
This lesson is geared toward families interested in discussing 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.

Family Discussion Questions

What are some things we can find in space?

What can we see in space when we look in the night sky?

How can we learn about the objects in space that are very far away?

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**
- **Video Reflection Activity Sheet** (p. 5)
- **Deep Space Dance Moves** (p. 6 - 7)

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?**
   - Watch the video on slide 9 which showcases dance moves that connect to objects found in deep space.
   - Share slides 10 through 14 to show different images taken by the Hubble Space Telescope. As participants see each deep space object, have them try out the dance move related to each object.

- Have participants create choreography to their favorite song using Deep Space Dance moves! Instruct participants to cut out the moves on the Deep Space Dance Moves worksheet or write the moves out on 12 small pieces of paper. Then have participants jumble the moves up and place them in order according to when each piece of paper is picked up.
- The 12 steps in jumbled order will be the choreography to a song of your choosing! Try jumbling the steps up again to make choreography for another song!
    - **What object in space would you like to learn more about?**

Asynchronous Adaptation

Have participants go through the slideshow on their own. Using their worksheet, participants can respond to questions about the video and plan out choreography for their own Deep Space dance. Have participants share videos of their dances with a peer.

Extension Activities

To deepen participant 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!

Help Scientists Identify Galaxies

Have participants visit Galaxy Zoo and help scientists classify galaxies according to their shape.

Additional Resources/ References

The Meaning of Color in Hubble Images:
http://hubblesite.org/gallery/behind_the_pictures/meaning_of_color/

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ACTIVITY 1: VIDEO REFLECTION

Directions:
Watch the video on how Hubble works and answer the questions below.

1. What colors does the Hubble Space Telescope attribute to regions that emit large amounts of infrared radiation?

2. What colors does the Hubble Space Telescope attribute to regions that emit visible light?

3. What colors does the Hubble Space Telescope attribute to regions that emit large amounts of ultraviolet radiation?

4. What happens when Hubble combines these images of the different regions of a space object?

ACTIVITY 2: DEEP SPACE DANCE MOVES

Directions:
Cut out the names of the deep space objects on this sheet and jumble them up. Place them in the choreography slots on the next activity sheet in the order that you pick each deep space object name up. Dance to your favorite song using this choreography!

Spiral Galaxy	Spiral Galaxy
Elliptical Galaxy	Elliptical Galaxy
Star Forming Nebula	Star Forming Nebula
Planetary Nebula	Planetary Nebula
Interacting Galaxy	Interacting Galaxy
Expanding Universe	Expanding Universe

ACTIVITY 2: DEEP SPACE DANCE PARTY

Directions:
Cut out the names of the deep space objects on the “Deep Space Dance Moves” activity sheet and jumble them up. Place them in the choreography slots on this sheet in the order that you pick each deep space object name up. Dance to your favorite song using this choreography!

1	7
2	8
3	9
4	10
5	11
6	12