Science & Literacy Activity

GRADES 3-5

OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to astronomy. Students will read content-rich texts, view the *Dark Universe* space show, and use what they have learned to complete a CCSS-aligned writing task, creating an illustrated text about how technology helps us see stars or other objects in the universe that are too far away to see with our eyes.

Common Core State Standards:
W.3-5.2, W.3-5.8, W.3-5.9
RI.3-5.1, RI.3-5.2, RI.3-5.7, RI.3-5.10

New York State Science Core Curriculum:
PS 1.1b

Next Generation Science Standards:
PE 4-PS4-2
DCI ESS1.A: The Universe and its Stars
The Sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.
DCI PS4.B: Electromagnetic Radiation
An object can be seen when light reflected from its surface enters the eyes.

Materials in this packet include:

- Teacher instructions for:
  - o Pre-visit student reading
  - o Visit to *Dark Universe* and student worksheet
  - o Post-visit writing task
- Text for student reading: "Looking Into the Universe"
- Student Worksheet for *Dark Universe* visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

SUPPORTS FOR DIVERSE LEARNERS: An Overview

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It represents information in multiple ways and offers multiple ways for your students to engage with content as they read about, discuss, view, and write about scientific concepts. Different parts of the experience (e.g. reading texts) may challenge individual students. However, the arc of learning is designed to offer varied opportunities to learn. We suggest that all learners experience each activity, even if challenging. We have provided ways to adapt each step of the activities for students with different skill-levels. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

1. BEFORE YOUR VISIT

This part of the activity engages students in reading a non-fiction text about how the distance of stars and other objects in the universe determines how they appear to us and how we can use technology, like telescopes, to help us see them more clearly. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read "Looking into the Universe." Have them write notes in the large right-hand margin. For example, they could underline key passages, paraphrase important information, or write down questions that they have.

Discussion Quesions:

Ask:

- The Sun and the tiny points of light that we see in the night sky are all stars; why does the Sun look so much larger and brighter than the stars in the night sky? *(A: The Sun is much closer to us than other stars, that makes the Sun look larger and brighter than the stars we see in the night sky.)*
- Whether we are looking with our eyes or with instruments like telescopes, what do the Moon, stars, comets, and other objects in the sky have in common so we can see them? *(A: They all give off light; we see them because our eyes or the instruments collect the light that they give off.)*
- Why did using a large telescope help Edwin Hubble see a galaxy that was not visible with the naked eye? *(A: Telescopes can collect more light than our eyes can. That is why we can use them to see things that we would not otherwise be able to see because they are farther away.)*

They can work in pairs, small groups, or as a class. During discussion, remind students to use evidence from the text to explain their thinking.

SUPPORTS FOR DIVERSE LEARNERS: Student Reading
- "Chunking" the reading can help keep them from becoming overwhelmed by the length of the text. Present them with only a few sentences or a single paragraph to read and discuss before moving on to the next "chunk."
- Provide "wait-time" for students after you ask a question. This will allow time for students to search for textual evidence or to more clearly formulate their thinking before they speak.

After the reading, show students the following supplementary material.
- To help them visualize star distances: Build the Big Dipper — amnh.org/ology/features/stufftodo_astro/dipper.php
- To help them understand how telescopes help us see objects that would otherwise be too dim to see with the naked eye: Gathering Light — amnh.org/explore/curriculum-collections/discovering-the-universe/gathering-light

2. DURING YOUR VISIT

This part of the activity engages students in exploring the *Dark Universe* space show.

Museum Visit & Student Worksheet
It is important to review the worksheets with the students prior to their visit so that they know what information to look for when they are viewing the space show. Let students know that they will be using the Student Worksheets to gather information about four kinds of technology used to see the universe. Explain to students that they will be viewing the space show in the Hayden Planetarium, and that when the show ends, the group will gather in a quiet location to discuss what they saw and share ideas. Back in the classroom they will refer to these notes when completing the writing assignment.

SUPPORTS FOR DIVERSE LEARNERS: Museum Visit
- Review the Student Worksheet with students, clarifying what information they should collect during the visit.
- Have students work in pairs, with each student completing their own Student Worksheet.

3. BACK IN THE CLASSROOM

This part of the activity engages students in an informational writing task that draws on the pre-visit reading and on observations made at the Museum.

Writing Task:
Distribute the Student Writing Guidelines handout, which includes the following prompt for the writing task:

> Explain why using technology like telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.
>
> Be sure to:
> - name three kinds of technology used to see the universe
> - describe what we were able to learn from each
> - include an labeled illustration for each
>
> Support your discussion with evidence from the reading and *Dark Universe*.

Go over the handout with students. Tell them that they will use it while writing, and afterwards, to evaluate and revise their essays.

Before they begin to write, have students use the prompt and guidelines to frame a discussion around the information that they gathered from viewing *Dark Universe* and compare their findings. They can work in pairs, small groups, or as a class. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading and discussion questions, and their notes from the space show that can be used in their response to the prompt. Instruct each student to take notes on useful information that their peers gathered as they compare findings. Students should write their essays individually.

SUPPORTS FOR DIVERSE LEARNERS: Writing Task

- Re-read the "Before Your Visit" assignment with students. Ask what they saw in the show that helps them understand why using technology such as telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

Student Reading
Looking into the Universe

When you look up into the night sky, what can you see without a telescope? On most nights, you'll see the Moon and maybe a few planets. You might even glimpse a meteor's bright streak or a comet's glowing tail. These objects are very close.

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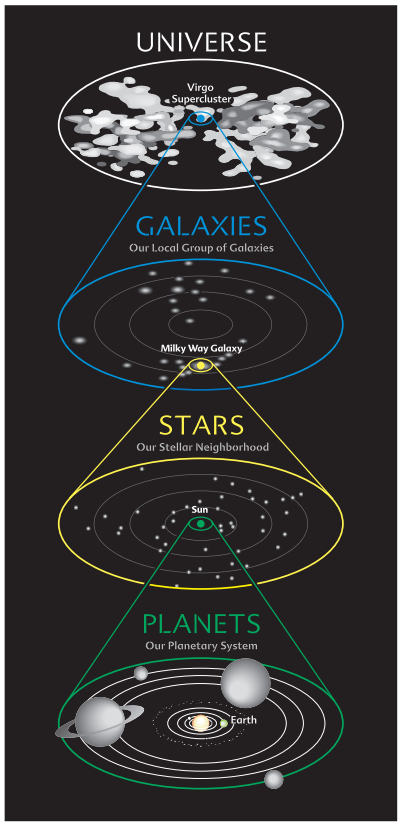

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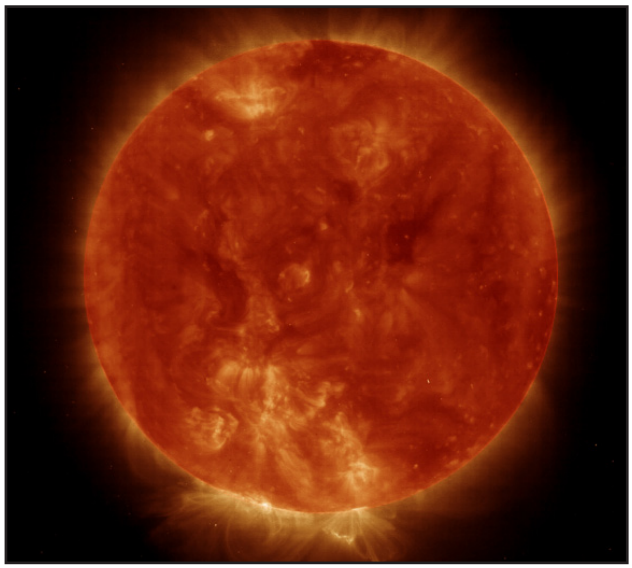
Earth is just one planet orbiting the Sun in our solar system. Our Sun is one of billions of stars in the Milky Way galaxy. Zoom out even further and you'd find that the Milky Way is one of millions of galaxies in the Virgo Supercluster. And as you probably guessed, millions of superclusters are spread out across the universe.

Beyond these objects, you can see thousands of stars. They might look like little dots of light, but they're really huge, burning balls of gas – just like our star, the Sun. Some are even bigger than our Sun. They just look tiny because they're so far away.



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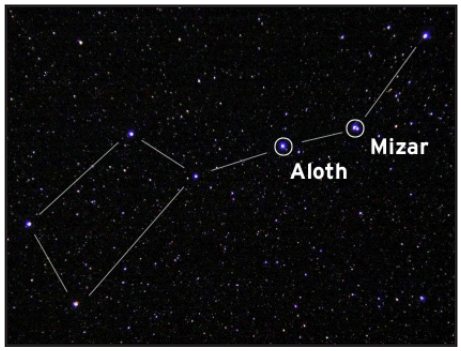
our star, the Sun

On a starry night, you can also make out constellations like the Big Dipper. Stars in a constellation may look close together, but they're really light-years apart — vast distances compared to our solar system. And, the stars in a constellation look like they're the same distance away, as if they're points on a distant "connect the dot" background. In fact, if you could travel through space to view the constellation from different angles, you'd see they're all different distances away. Some stars are billions of miles farther from Earth than others.



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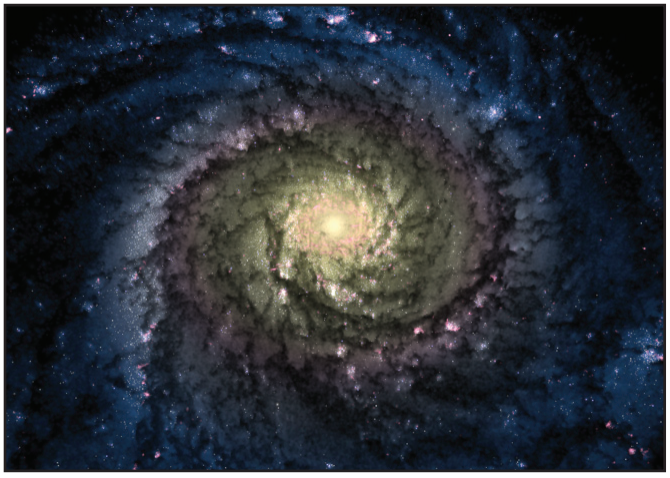
This is what the Big Dipper looks like from Earth. The stars of this constellation may all look the same distance away, but it's an illusion. The star Mizar is 88 light years from Earth, while Alioth is 631 light years away!

With so many stars, so far away, it might seem like you're peering across the universe. But every star you see with your naked eye is in the Milky Way Galaxy, so you're seeing only a tiny fraction of the entire universe. When you look at a star, your eyes are capturing light that traveled all the way from the star to your eye. Astronomers learn about stars, galaxies, and other faraway phenomena by collecting light from them with specialized instruments that can collect much more light than the human eye.



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The Milky Way is a spiral galaxy.

To see farther into the universe, we use scientific instruments like telescopes. Telescopes allow us to view objects that are too far away, and too faint, to see with just our eyes. In 1923, the astronomer Edwin Hubble discovered that other galaxies existed. He used a large telescope to detect a galaxy beyond the Milky Way for the first time. Since then, scientists have found millions more.

Today, telescopes are larger and more powerful. We even put telescopes into space. Orbiting Earth high above the blurring effects of our atmosphere, they provide razor-sharp views of objects too faint or far away to ever have been seen before. We also have telescopes that can "see" different forms of light that are otherwise invisible to the human eye: gamma rays, X-rays, ultraviolet rays, infrared waves, microwaves, and radio waves.

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Named after astronomer Edwin Hubble, the Hubble Space Telescope was launched in 1990 and is the first major optical telescope to orbit Earth.

While we probably won't be traveling to other stars or galaxies anytime soon, new technology is letting us see farther than ever before. What might we discover next?

Student Worksheet

Instructions: Draw each one and write what it helped us discover or see about the universe.

Mount Wilson Observatory Telescope

What did it help us discover or see?

Bell Horn Radio Antenna

What did it help us discover or see?

Planck Satellite

What did it help us discover or see?

Galileo Probe

What did it help us discover or see?

ANSWER KEY

Student Worksheet

Instructions: Draw each one and write what it helped us discover or see about the universe.

Mount Wilson Observatory Telescope

What did it help us discover or see?
(Answer: saw the first galaxy other than the Milky way, Andromeda)

Bell Horn Radio Antenna

What did it help us discover or see?
(Answer: discovered energy coming evenly from all directions in the sky)

Planck Satellite

What did it help us discover or see?
(Answer: collected information about the early universe)

Galileo Probe

What did it help us discover or see?
(Answer: explored Jupiter's atmosphere)

Student Writing Guidelines

Writing Prompt:

Explain why using technology such as telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.

Be sure to:
• name three kinds of technology used to see the universe
• describe what we were able to learn from each
• include an labeled illustration for each

Support your discussion with evidence from the reading and *Dark Universe*.

Use this checklist to ensure that you have included all of the required elements in your essay.

- ☐ I included an introduction.
- ☐ I clearly explained why using technology such as telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.
- ☐ I included a labeled illustration of three kinds of technology used to see the universe and described what we were able to learn from each.
- ☐ All of the information I presented is relevant to technologies used to see the universe.
- ☐ I used information from "Looking into the Universe" to explain why using technology like telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.
- ☐ I used information from the *Dark Universe* space show to explain why using technology like telescopes helps us see stars or other objects in the universe that are too far away to see with our eyes.
- ☐ I included a conclusion at the end.
- ☐ I proofread my essay for grammar and spelling errors.

Assessment Rubric

	Scoring Elements	1 Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
RESEARCH	**Reading**	Attempts to include text using examples, quotes, or other references.	Presents some information from reading materials but may lack accuracy or relevance.	Accurately presents information from reading materials relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from reading materials to inform or explain.
	AMNH Exhibit	Attempts to include Museum exhibit content using examples, quotes, or other references.	Presents some information from Museum exhibit but may lack accuracy or relevance.	Accurately presents information from Museum exhibit relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from Museum exhibit to inform or explain.
WRITING	**Focus**	Attempts to address the prompt, but is off-task.	Addresses the prompt, but focus is uneven.	Addresses the prompt with an adequately detailed response; stays on task.	Addresses key aspects of prompt in a detailed response; stays on task.
	Development	Attempts to inform or explain but lacks details.	Informs or explains by presenting some details.	Informs or explains using appropriate details.	Informs or explains by providing detailed and relevant information.
	Conventions	Lacks cohesion and control of grammar, usage, and mechanics appropriate to grade level	Demonstrates an uneven command of standard English conventions appropriate to grade level.	Demonstrates a command of standard English conventions, with few errors as appropriate to grade level.	Maintains a well-developed command of standard English conventions, with few errors. Response includes language and tone appropriate to the purpose and specific requirements of the prompt.
SCIENCE	**Content Understanding**	Content is irrelevant, inappropriate, or inaccurate.	Shows uneven understanding of disciplinary content related to the prompt	Presents generally accurate disciplinary content related to the prompt.	Presents accurate and relevant disciplinary content to enhance understanding of the topic.