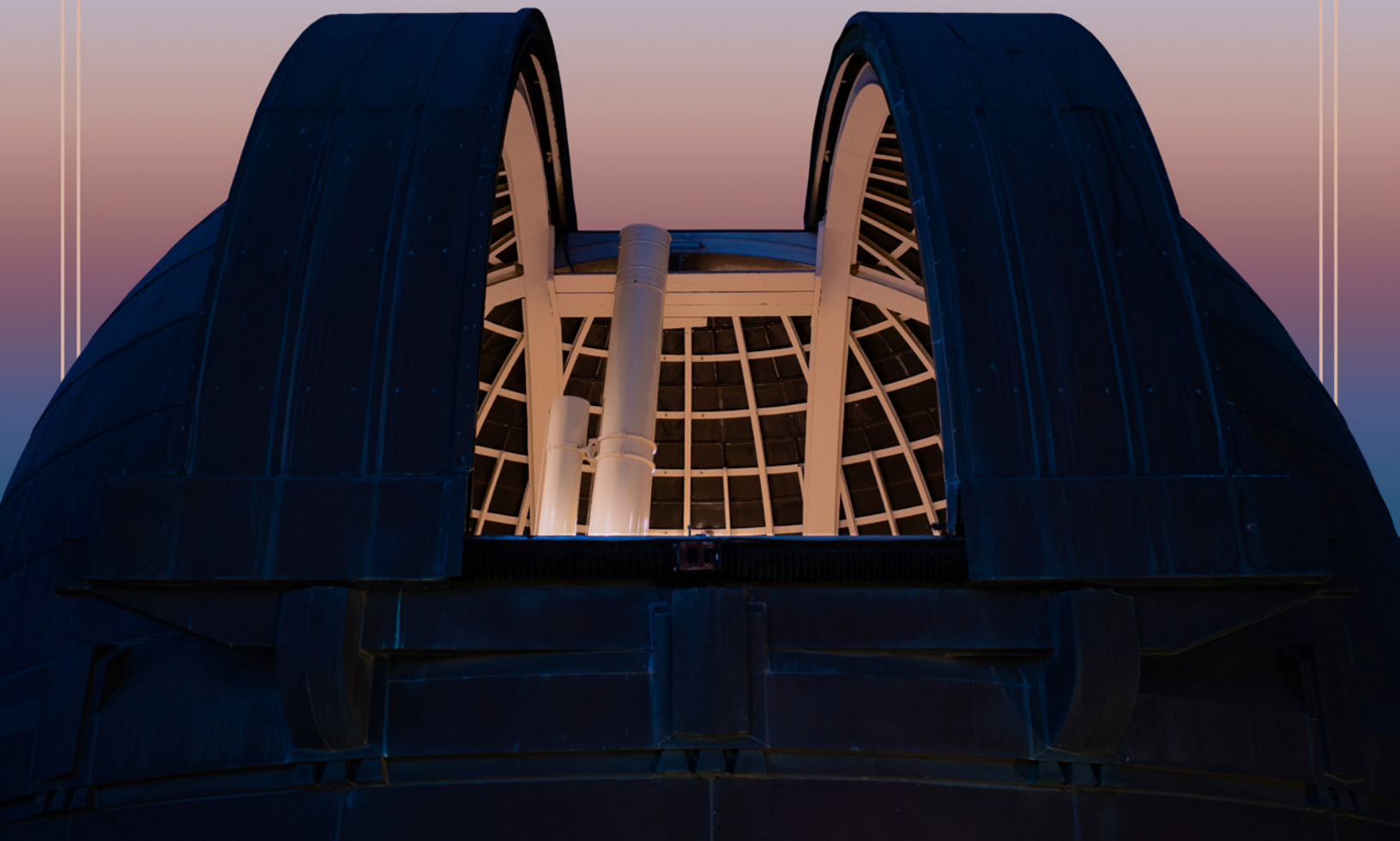
# GRIFFITH OBSERVATORY ONLINE SCHOOL PROGRAM

## MODULE 1: EVERYONE IS AN OBSERVER

STUDENT GUIDE



# Preparing for Your Virtual Visit

We are excited that your class will be participating in Module 1: Everyone Is an Observer of Griffith Observatory's Online School Program. Together we shall join the tradition of observing. Here are some things you'll need to know before your virtual visit.

- You and your class will experience the entire live program in Zoom. Your teacher will send you the steps to follow to join the Zoom webinar session.
- Before joining the webinar, please set your Zoom name to contain your real first and last name.
- When you are admitted into the Zoom webinar, you will enter muted with your video off.
- You and your class will meet a Museum Guide and a Telescope Demonstrator from Griffith Observatory. They will lead you through the live experience.
- During the program, you will be asked to participate in polls. After a question is asked, a poll will pop up on your screen. Select an answer, and remember to click "Submit!"
- You may use Zoom's chat function to communicate with Griffith Observatory staff if you are experiencing technical difficulties.
- You may submit to the Q&A box any questions about science you might have for Griffith Observatory staff. We shall hold a question-and-answer session at the end of the program and shall try to answer as many of your questions as we can.
- Remember to stay on your best behavior. We encourage you to answer the polls and ask any space or science-related questions you might have, especially those relevant to our discussion. Be polite. Any spamming behavior or inappropriate, rude, or harassing language sent to staff in the chat or Q&A is not tolerated and may result in being dropped from the Zoom session.
- We hope you have a wonderful time!

# Pre-program Materials

To get the most out of Module 1: Everyone Is an Observer, explore the following materials before your visit.

## Module 1 Glossary

The glossary lists and defines important words used in Module 1: Everyone Is an Observer.

## Listen to the Module 1 Glossary

If listening helps you remember, this audio file will help you remember the words and definitions in the Module 1 Glossary.

## Crossword Puzzle

Are you a Module 1 Glossary Master? We challenge you to a crossword puzzle.

## Draw the Moon

This exercise invites you to observe and record your observations of the Moon's phases over time. By the end, you'll be a Moon-phase expert.

## Observer's Questionnaire

What's in your night sky tonight? This night-time questionnaire will send you outside on a quest to find out. Share and compare your observations with those of your classmates.

## Solar System Match-up

Can you match each solar system object with its description?

# Glossary

## MODULE 1: EVERYONE IS AN OBSERVER

**astronomy** – the study of space and everything in it, including, but not limited to, stars, planets, galaxies, nebulae, black holes, supernovae, asteroids, comets, and the search for life beyond Earth.

**atom** – a basic unit of matter. An atom has a nucleus containing protons and neutrons and a cloud of electrons surrounding the nucleus.

**calculate** – to determine something with arithmetic.

**comet** – a small, icy object from the outer part of the solar system. Comets form tails as they approach the Sun and begin to warm up. The heat vaporizes the icy materials in comets to form tails of gas and dust that point away from the Sun. Comets contain some of the essential chemistry for life, including carbon and water.

**ecliptic** – The apparent path of the Sun and all the planets of the solar system through the sky is known as the "ecliptic" because lunar and solar eclipses can occur only when the moon crosses it.

**galaxy** – a massive collection of stars, gas, dust, and other celestial objects bound together into a single system by gravity. A galaxy may contain from ten million stars to one trillion stars. The Earth and Sun are in the Milky Way Galaxy.

ANDROMEDA GALAXY (M31)

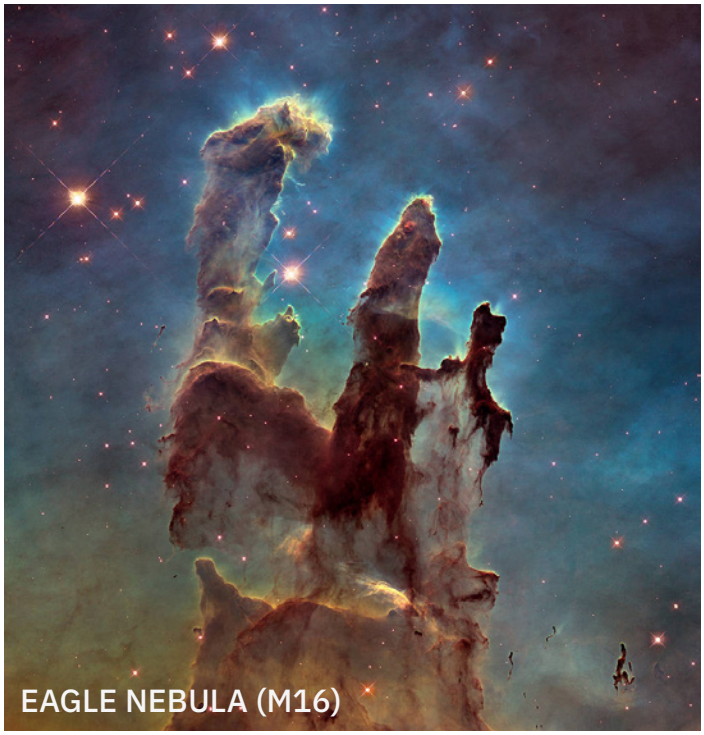
**galaxy cluster** – a large collection of galaxies bound together by gravity. A cluster may contain hundreds to thousands of galaxies.

***Hubble Space Telescope*** – a large telescope that orbits Earth. It takes pictures and makes observations, and astronomers study those pictures and observations to learn about distant objects.

**light waves** – Light travels as a wave. There are types of light we cannot see. They have much shorter or much longer wavelengths than visible light. The types of light include radio waves, microwaves, infrared, visible light (which we can see), ultraviolet, X-rays, and gamma rays.

**lunar phases** – the different shapes the Moon appears to have over a month. The apparent shape of the Moon depends on the angle at which we see it hit by sunlight.

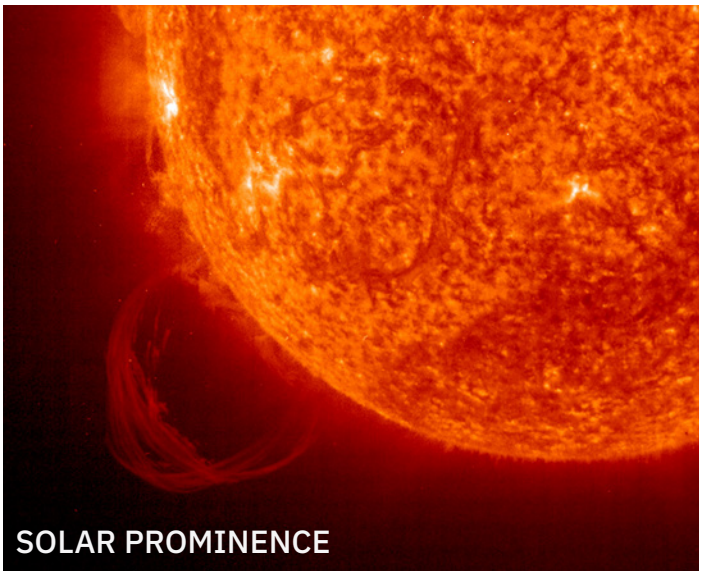
**nebulae** – plural form of *nebula.* Known as "star nurseries," nebulae are made of large clouds of interstellar gas and dust that look similar to clouds when viewed from far away. Over time, stars and planets can form within some nebulae.


EAGLE NEBULA (M16)

**observatory** – a place for observing and studying astronomical objects and events.

**orbit** – a path followed by an object under the influence of gravitational force from another body. The Earth orbits the Sun. The Moon and the International Space Station orbit the Earth.

**planet** – A planet is an object that (a) orbits the Sun, (b) is massive enough to be spherical in shape, and (c) has cleared away its neighboring region of other objects. There are eight planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.


SOLAR PROMINENCE

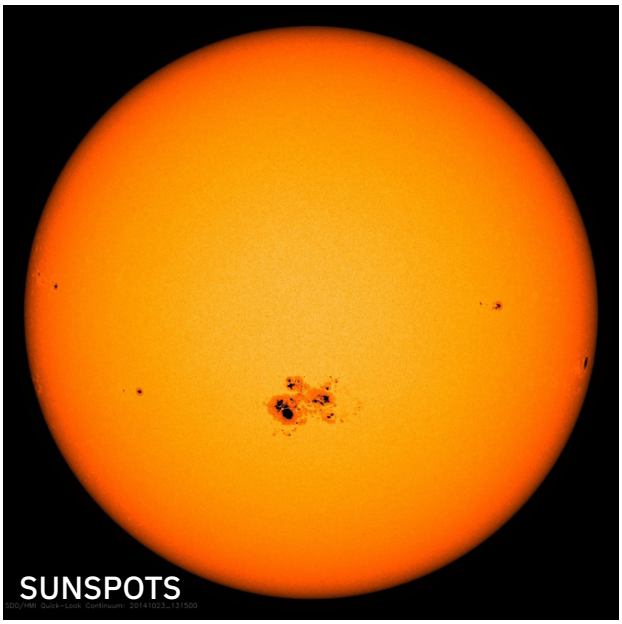
**solar filter** – a special filter applied to a telescope to dim the Sun's light and allow the viewer to look safely at the Sun.

**solar prominences** – large structures of glowing hydrogen gas that extend thousands of miles out from the Sun. They are usually loop-like in shape.

**solar system** – a system of planets, moons, asteroids, comets, and other small objects that orbit a star. The Sun is the star in our solar system.

**spacecraft** – a vehicle or machine that can carry people, instruments, or cargo beyond Earth's atmosphere into space and back home again or to some other destination.

**star** – a celestial body of gas that generates light and other energy and is held together by its own gravity. The Sun is a star, and while stars look like tiny pinpoints of light to us, many are larger than the Sun. They look tiny because they are so far away.


SUNSPOTS

**sunspot** – an area of strong magnetic activity in the outer layer of the Sun. Sunspots appear as spots darker than the surrounding area.

**telescope** – an instrument that uses lenses and/or mirrors to gather and focus light for observation. In astronomy, telescopes allow the viewer to study distant objects in detail by making them appear larger, brighter, and sharper than what is seen with the unaided eye. There are two primary types of optical telescopes: Reflecting telescopes, which use mirrors, and refracting telescopes, which use lenses.


TELESCOPES AT GRIFFITH OBSERVATORY

**tradition** – cultural ideas, beliefs, activities, behaviors, and objects that have existed or have been repeated for a long time.

**universe** – all of space and time and all of its contents, including the solar system and all stars and galaxies.

**visible spectrum** – the band of colors which the eye can see. They include red, orange, yellow, green, blue, indigo, and violet.

**world record** – a title that indicates a person, place, or object that is the very best at something. Griffith Observatory's 12-inch Zeiss Refracting Telescope holds a world record: More people have looked through it than any other telescope on Earth.

# What can you see in the sky?



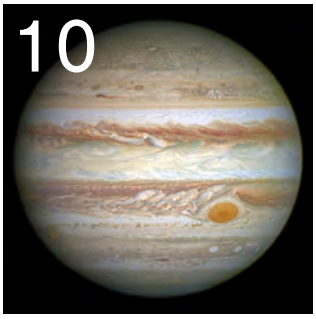


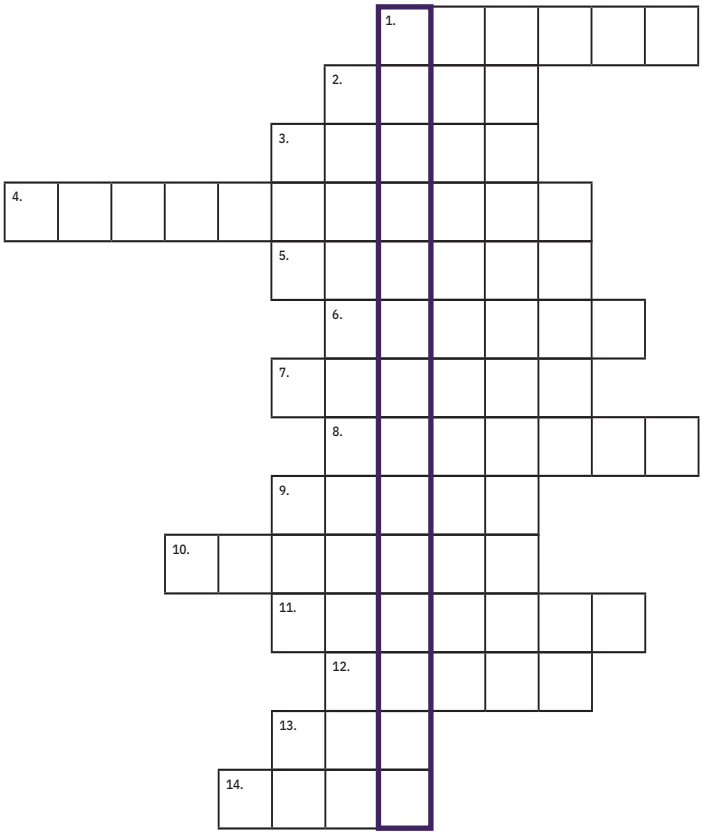








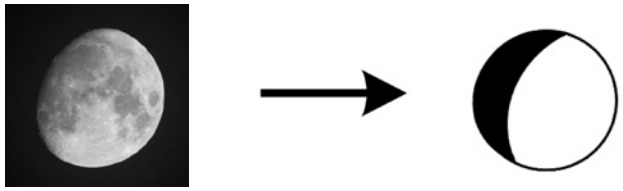




Solve the crossword to discover the hidden word.

There are 88 _____ in the sky.


# Draw the Moon

Every four days, try to find the Moon. Sometimes you will find it in the night sky and sometimes in the daytime sky. Color in the circle to match what you see by shading in the darkened part. Enter the date and time you observe the Moon and what phase it has. If you can't find it at all, just write "No Moon."

**EXAMPLE:** 

**DATE** _____ **DATE** _____

**TIME** _____ **TIME** _____

**PHASE** _____ **PHASE** _____

**DATE** _____ **DATE** _____

**TIME** _____ **TIME** _____

**PHASE** _____ **PHASE** _____

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PHASE _____

## DISCUSSION QUESTION

How long does it take the Moon to return to the same shape? _____

To find out more about Moon phases, visit [obs.la/moonphases](obs.la/moonphases)

# Observer's Questionnaire

Every time you look up at the Moon, the planets, and the stars, you are observing them, and that makes you an astronomer. Here at Griffith Observatory, we want to help you to understand what you're seeing up there.

Recording what you observe is an important part of science. Here are some questions that might help you to do that.

1. What is the date and time you started your observation?

Date _____/_____/_____ Time _____:_____ a.m. / p.m (Circle one)

2. When you look up tonight, how many stars can you see? Count them and record that number below. If you can see more than 50 stars, just write "50+."

Record the number of stars you can see tonight. _____

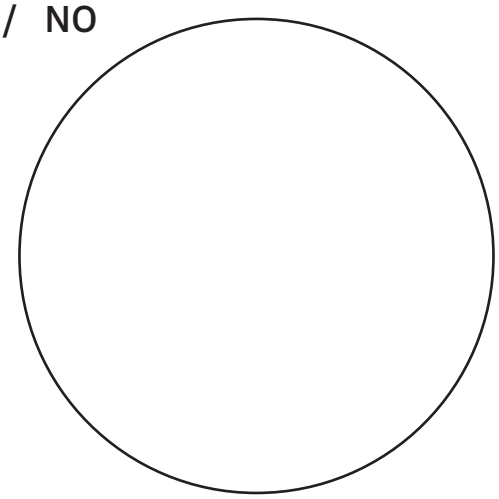
3. Are you sure those are all stars? What else can you see in the night sky (not including things made by people, such as airplanes, jets, helicopters, or blimps)?

What else besides stars can I see in the night sky?

_____

4. Can you see the Moon tonight? (Circle one) YES / NO

If yes, draw a picture of the moon, as you observe it, here.



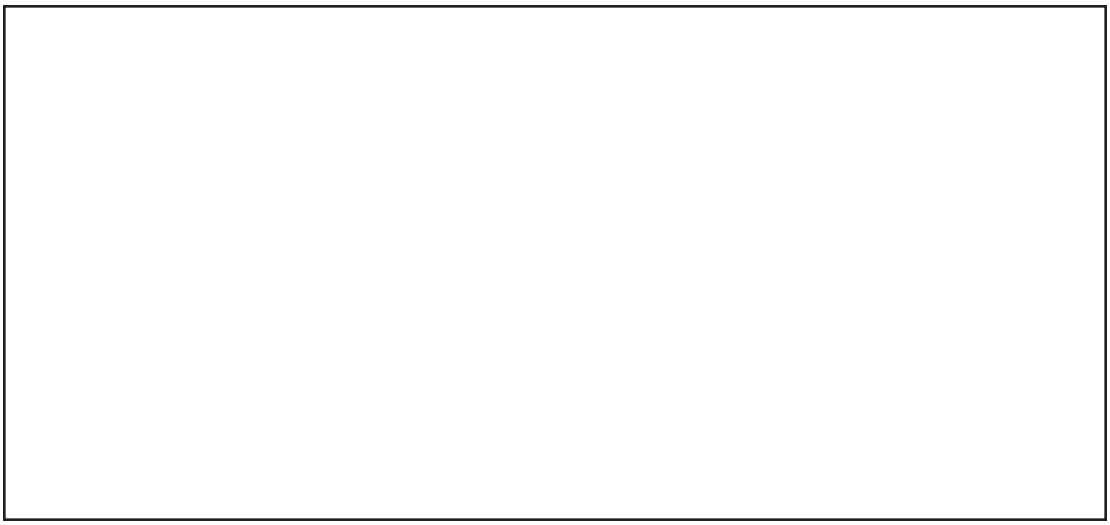
6. Can you tell what phase the Moon is in tonight? If so, record it here.

_____

7. Do you recognize any constellations (stars that form a familiar pattern)?

Circle one: YES / NO

If YES, draw it below.
If NO, mark down some stars just as you see them and connect the stars with lines.



8. What is the name of the constellation you drew? If you had to make up this constellation, what did you name it?

_____

9. Did you see a meteor (also known as a shooting star) tonight?

Circle one: YES / NO

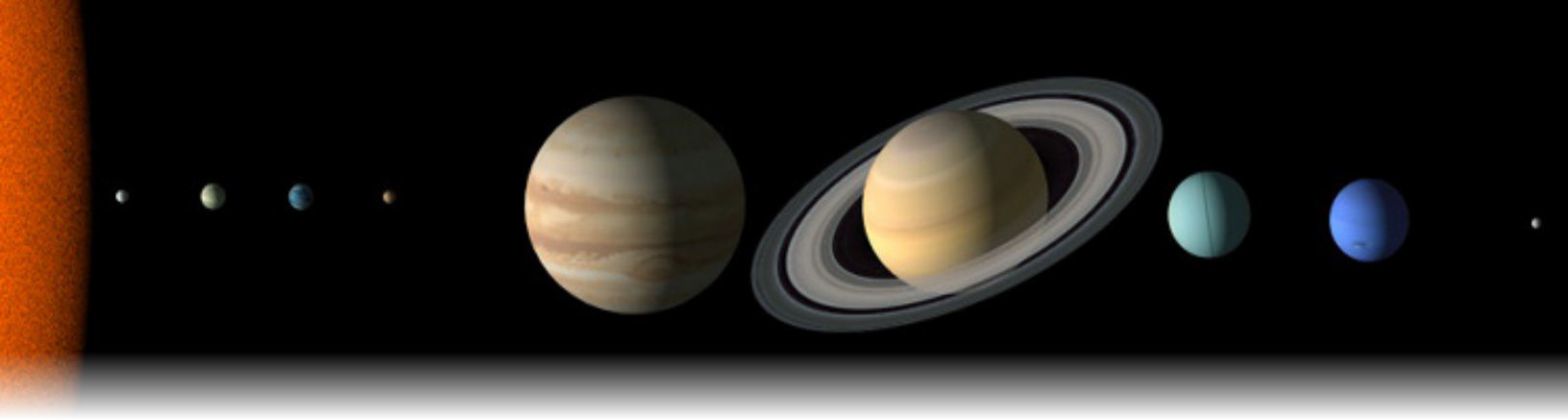
10. If you have any other comments or observations, record them here.

_____

_____

_____

**NICE WORK, ASTRONOMER.**



# Solar System Match-up

Draw a line from each item on the left to its description on the right.
Hint: If you don't know the answer, it's okay to look it up. That's how we learn!

| PLANETS...PLUS PLUTO | DESCRIPTIONS |
|---|---|
| Mercury | the coldest planet |
| Venus | it has very visible rings |
| Earth | the smallest planet |
| Mars | named for the Greek god of the sky |
| Jupiter | dwarf planet |
| Saturn | a planet with wandering robots |
| Uranus | the hottest planet |
| Neptune | has a lot of liquid water on its surface |
| Pluto | the largest planet |

| ALSO IN THE SOLAR SYSTEM | DESCRIPTIONS |
|---|---|
| Ceres | It starts at Pluto. |
| Europa | Many comets live here. |
| Kuiper Belt | the largest known asteroid |
| Titan | a moon of Jupiter covered in water ice |
| Oort Cloud | It has lakes of liquid methane. |

# Post-program Materials

We hope you enjoyed Module 1: Everyone Is an Observer of Griffith Observatory's Online School Program. To continue your lifelong journey as observers, here are some activities and resources.

## Module 1 Word Scramble

This worksheet reinforces the new terms you learned in Module 1: Everyone Is an Observer.

## 🔗 Shadows of the Sun: ChumashScience.com

This is an activity from the Chumash Science Through Time Project. The Chumash people are one of many native California tribes. This activity will have you measure the movement of a shadow through the day with the help of Indigenous Knowledge.

## Build Your Own Solar Pinhole Projector

This activity will show you how you may build your own solar pinhole projector to observe the Sun safely, never directly. With just two pieces of cardboard or paper and a pin, you will become a daytime observer.

## 🔗 Sky Report

Griffith Observatory's Sky Report provides up-to-date information about what to see in the skies over Los Angeles and surrounding areas.

## Coloring the Cosmos

We have included coloring book activities for a quiet moment.

## Stellarium Guide

This guide includes instructions to help you learn how to use Stellarium, free planetarium software that shows a realistic simulation of the sky in real time.

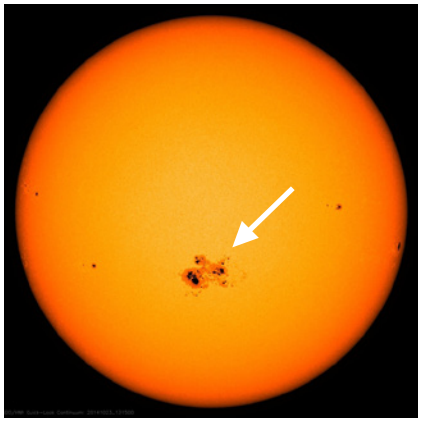
## Internet Resources

The internet may be helpful. This resource lists a variety of websites that will help you expand your astronomical knowledge and have fun doing it.

# Can you unscramble the following words?

EOCELTEPS

_ _ _ _ _ _ _ _ _



USNTSPO

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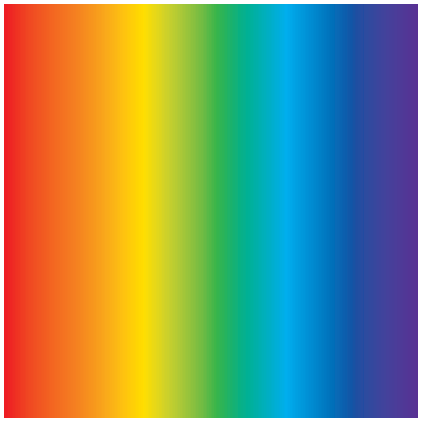
MTCEO

_ _ _ _ _

EROABOVSTRY

_ _ _ _ _ _ _ _ _ _



EURCTSPM

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SPFCREACAT

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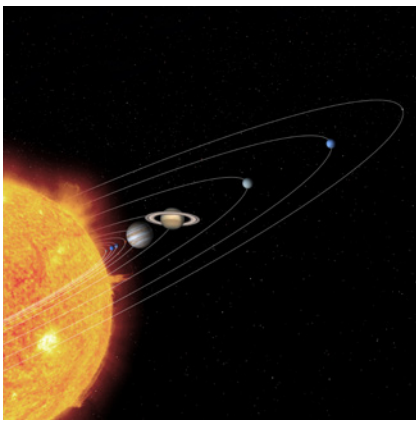

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_ _ _ _ _ _ _ _ _ _ _

# How to Build Your Own Solar Pinhole Projector

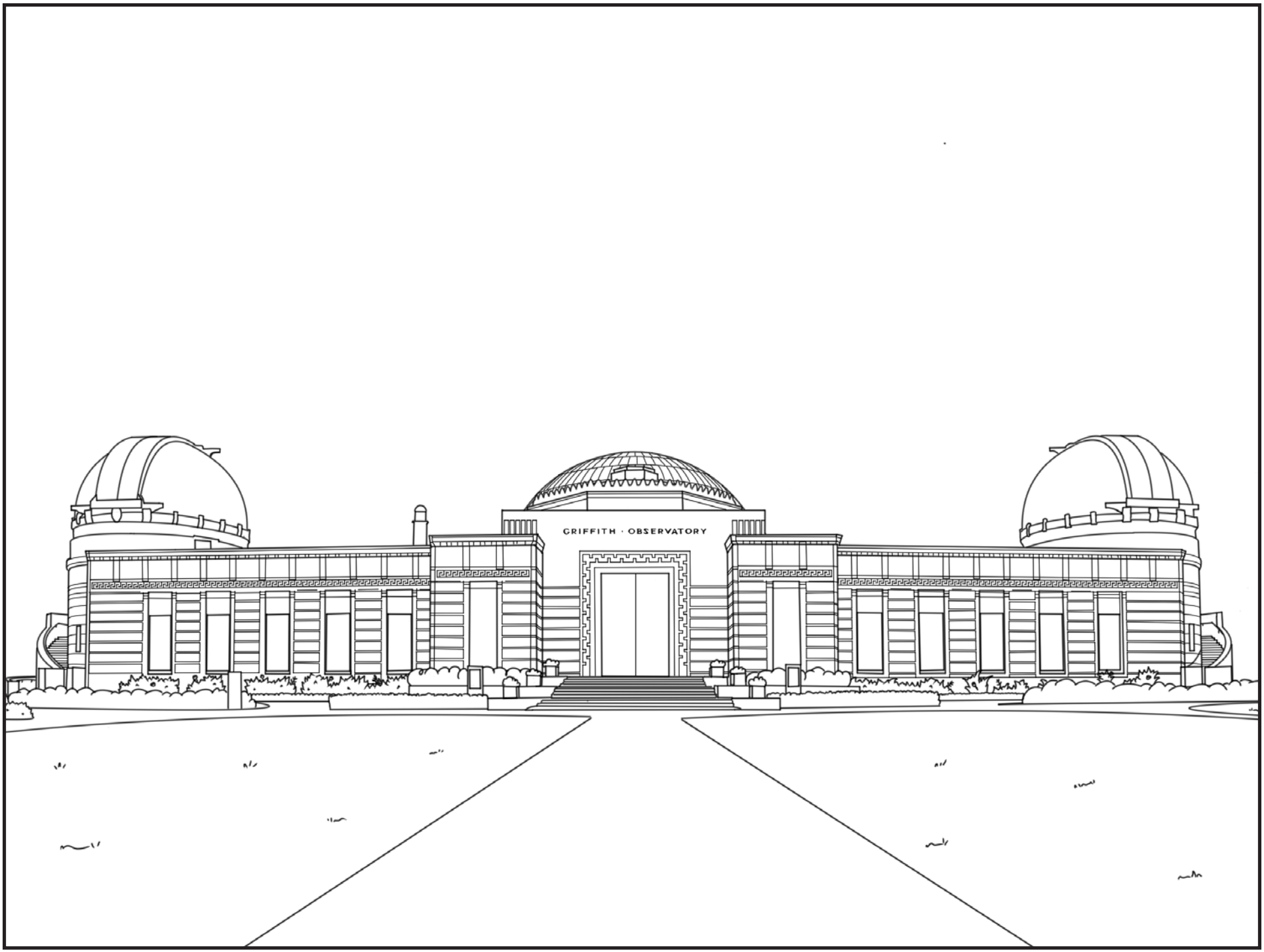
Before you begin, understand that you should ***NEVER, EVER LOOK DIRECTLY AT THE SUN***, not with sunglasses, not through a telescope, not through a tiny hole, never. There are solar glasses, solar telescopes, and solar filters that may be used to look at the Sun, but these are ***NOT*** the same as regular sunglasses, telescopes, and filters. Looking at the Sun with anything but genuinely safe devices may result in blindness. This project is safe because you are looking at an *image* of the Sun projected onto a piece of cardboard or paper. In a solar eclipse, this is a safe way to view the Sun.

## MATERIALS NEEDED:

- two pieces of cardboard, ideally one of them non-corrugated (without the ripples and ridges), or two pieces of plain white paper
- a pin, a sharp thumbtack, or a needle

## WHAT TO DO:

- Stand one piece of cardboard or paper on the ground by leaning it against a wall or pole. Make sure it is facing the Sun so that the entire surface is opposite the Sun and is illuminated in sunlight. This will act as the screen for your projector.
- Use a pin, thumbtack, or needle to puncture a small round hole in the other piece of non-corrugated cardboard or paper.
- Sometimes puncturing a hole will make little “flaps” that cast rough-edged shadows in the beam of sunlight. Use a finger or thumb to press down any rough edges of the hole you made. You want the hole to be as round as possible.
- Hold the piece of cardboard or paper with a hole in it between the Sun and the screen. Make sure the beam of sunlight going through the hole is shining onto the screen.
- See what happens when you move the piece of cardboard or paper with a hole in it closer and farther away from your screen.

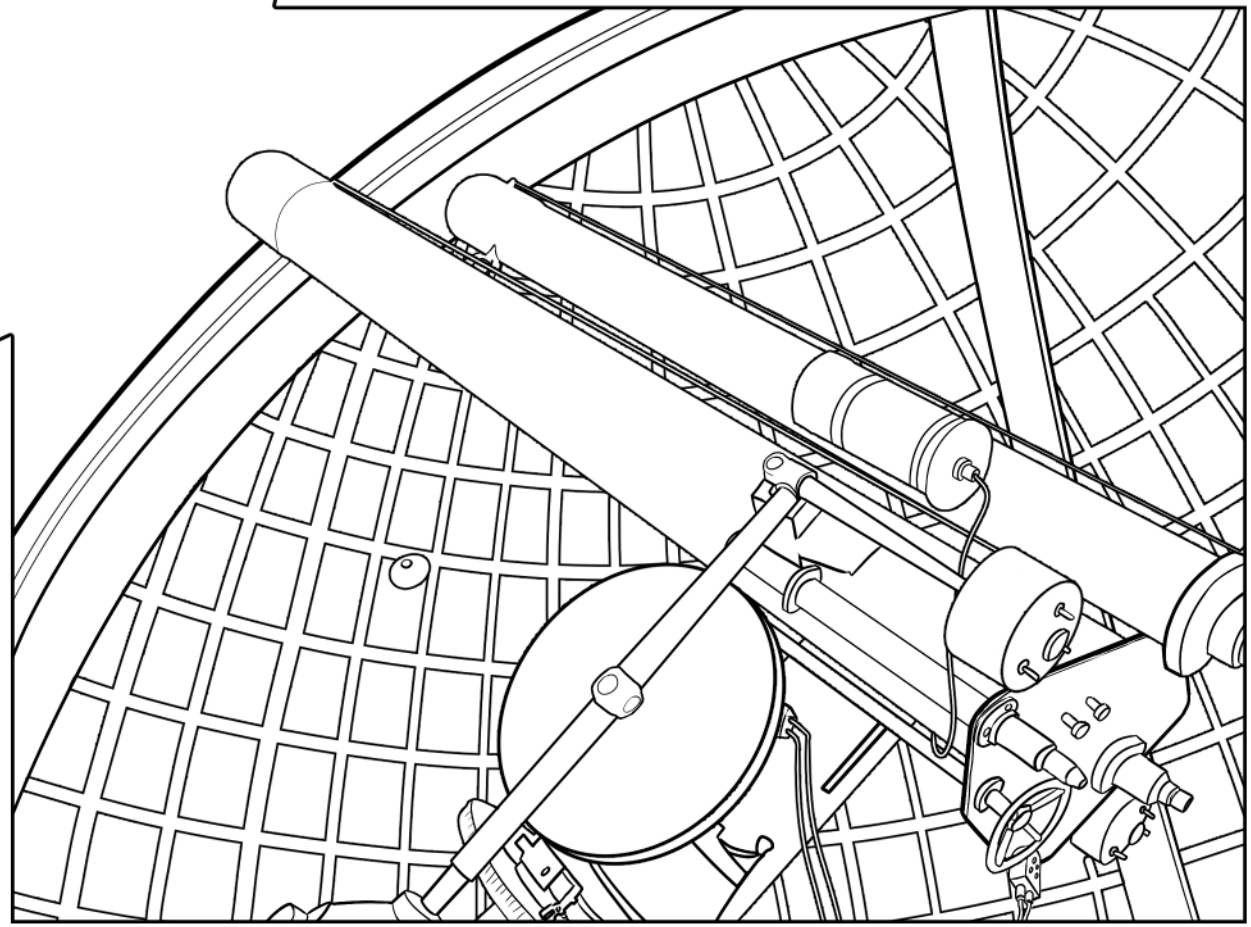



By Molly Ruhl

# The 12-inch Zeiss Refracting Telescope

More people have looked though Griffith Observatory's original 12-inch Zeiss refracting telescope than any other telescope in the world. Located in the roof-top dome on the building's east end, the Zeiss telescope commonly targets the Moon, planets, and brightest showpiece objects of our galaxy.

*What shall the Zeiss target tonight? You decide!*



By Jeff McKibben

# Stellarium Guide

Here are two free apps to help you tour the sky.

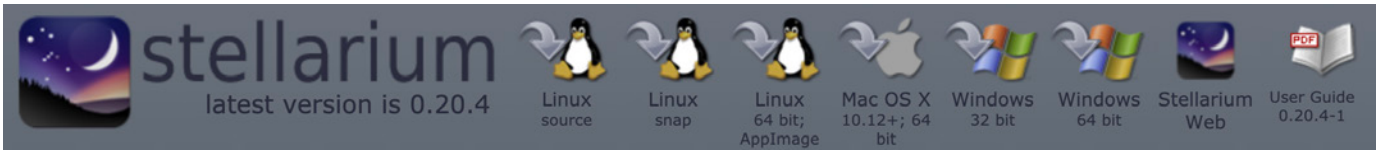
**Night Sky**

**Stellarium Mobile**

If you are interested in a more accurate sky and advanced controls, Stellarium is for you.

## Downloading and Installing Stellarium

With the help of an adult, visit **https://stellarium.org** to download Stellarium to your device. The top of the web page will look like the image below. Be sure to choose the correct version for your computer.




Once you download the file, find it in your “Downloads” folder. To install Stellarium, double-click on the installation file, and follow the installation instructions.

## Launching Stellarium

Once installed, double-click on the Stellarium icon to launch the program and begin your stellar exploration. When you start Stellarium, you may see something like the scene below.

You may change your view either by left-clicking and dragging your mouse or by using the arrow keys.

# Using Stellarium

Note the small bar at the bottom of the screen. It is possible that the simulated sky represents the sky from a city that is not the same as yours.


To change the location and time of your sky observation, move your cursor down to the lower left side of the screen to make a menu appear. The top four settings are especially useful for exploring the night sky.

**Location window [F6]**

**Date/time window [F5]**

**Sky and viewing options window [F4]**

**Search window [F3]**

Configuration window [F2]

Astronomical calculations window [F10]

Help window [F1]

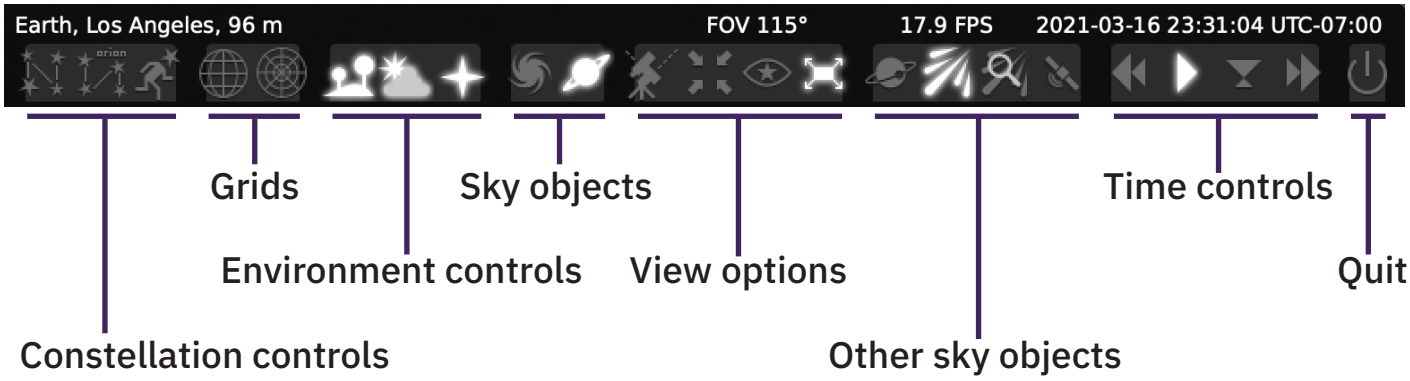
If you click on the **Location window**, you may see what the sky looks like from any place on Earth. You may even move yourself to another planet or moon!

Changing your location will not change the landscape, but you may do that by selecting the **Sky and viewing options window** and clicking on the **Landscape** tab to choose from a list of landscapes.

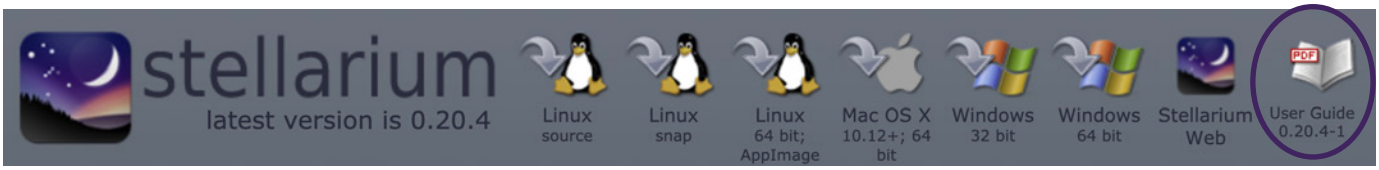
If you click on the **Date/time window**, you may change the date and time to anything you want. If you choose a time after the Sun sets, you will see the night sky. You may also view the sky thousands of years in the past or future!

Click on the **Search window** and search any sky object to inspect it. Get a closer look at what you have selected by zooming in.

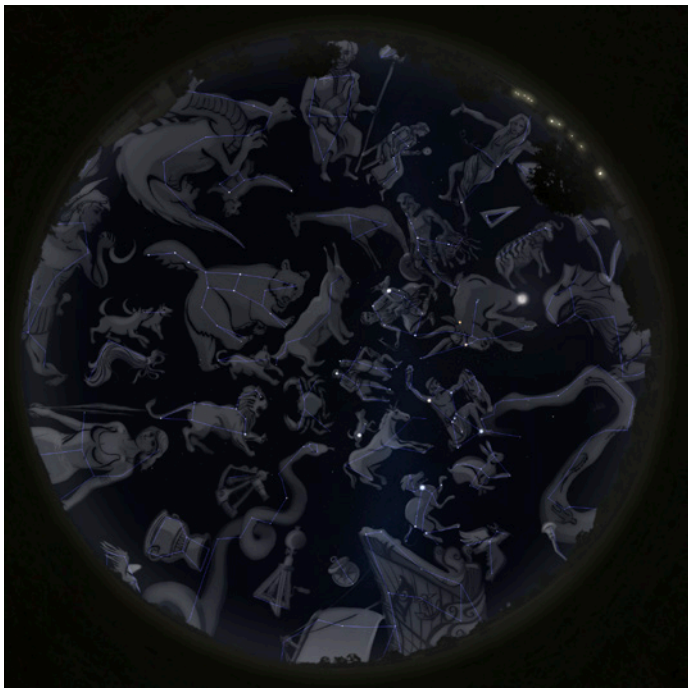
Move your cursor down to the lower side of the screen to access additional settings. These are useful for controlling the movement of the sky and selecting what you want to see in the sky.




For more thorough information including how to use Stellarium's more advanced functions, visit **https://stellarium.org** and download the official User Guide.




The wonder of space is yours to discover.



# Internet Resources

Not all websites are equally accurate. The world wide web, while convenient, can frequently provide incorrect and incomplete information. Below is a list of some of the best space science websites recommended by Griffith Observatory educators.

## GRIFFITH OBSERVATORY

The most-visited public observatory in the world.

**https://griffithobservatory.org**

## ASTRONOMY CLUBS

Find an astronomy club near you! Amateur (and some professional) astronomers are happy to share their telescopes, their enthusiasm, and their knowledge. A list of local clubs and more information may be found on our website:

**https://obs.la/astronomyresources**

## CITIZEN SCIENCE PROJECTS

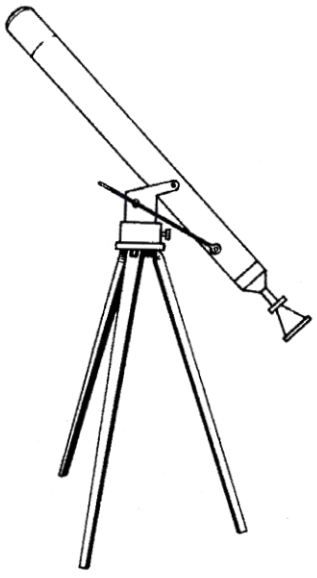
You may make a real contribution to astronomy by participating in these scientific projects.

Help scientists with their research into stars, Mars, Earth, galaxies, astronautics, the Sun, and black holes! Multiple projects are listed at this website:

**https://science.nasa.gov/citizen-science**

Another useful site that lists multiple Citizen Science projects:

**https://zooniverse.org**



## NASA WEBSITES FOR SPACE FANS

Check out games and projects for budding space scientists:

**https://spaceplace.nasa.gov/menu/play**

Explore space with NASA's remarkable app, "NASA's Eyes:"

**https://science.nasa.gov/eyes**

Visit websites dedicated to learning for grades 5 through 8:

**https://nasa.gov/learning-resources/for-students-grades-5-8**

Watch NASA's live and original programming for free:

**https://plus.nasa.gov**

GRIFFITH OBSERVATORY

# INTERNET RESOURCES CONTINUED...

## RESOURCES FOR TEACHERS

Free lesson plans and activities for K-12 from Jet Propulsion Laboratory:
https://jpl.nasa.gov/edu/

Find Next Gen STEM learning opportunities for students in multiple settings:
https://nasa.gov/learning-resources/for-educators

Search NASA's educational activities and resources by subject, type, and grade level:
https://science.nasa.gov/learn/catalog

## YOUTUBE CHANNELS

**Griffith Observatory**


**European Space Agency**


**PBS Space Time**

## MORE WEB LINKS

**California Science Center**: Astronomy education programs, workshops, lesson plans, and resources. https://californiasciencecenter.org

**The Lunar and Planetary Institute**: Astronomy education programs, workshops, and resources. https://lpi.usra.edu/education

**StarDate**: The public education and outreach arm of the McDonald Observatory, Texas.
https://stardate.org

**WorldWide Telescope**: This website turns your computer into a telescope and brings together data and imagery from telescopes around the world.
https://worldwidetelescope.org

**Astronomical Society of the Pacific**: Organization of professional and amateur astronomers with astronomy education conferences, education programs, and resources, including professional development opportunities for teachers. https://astrosociety.org

**Planetary Society**: Open membership organization that sponsors planetary events and programs. Its "Space for Kids" page lists many at-home activities.
https://planetary.org/kids

**Exploratorium**: A resource for at-home experimentation and projects.
https://exploratorium.edu/explore

GRIFFITH OBSERVATORY