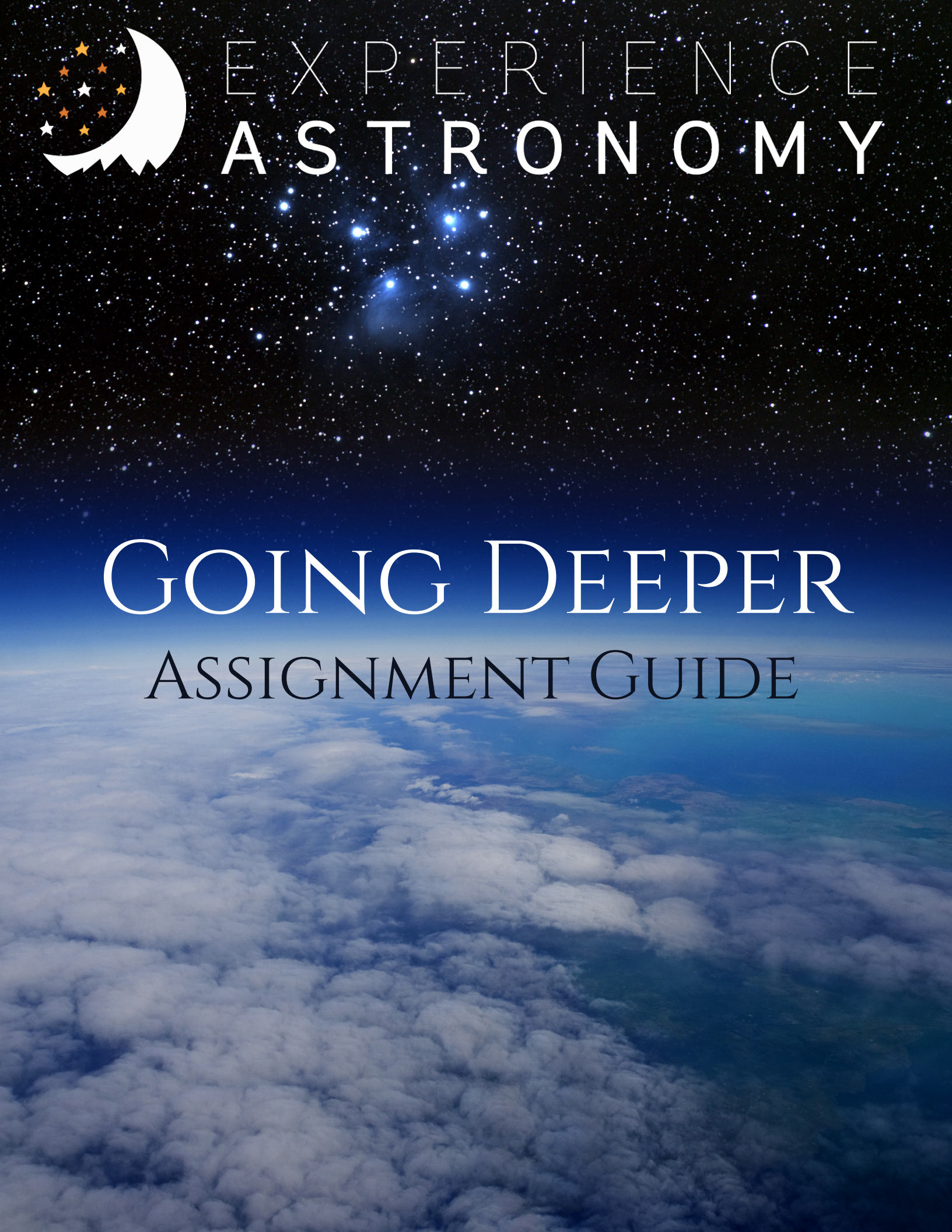

Going Deeper

Assignment Guide

Welcome to Experience Astronomy!

The Advanced Experience Astronomy course is an opportunity for you to learn more about the subject of astronomy with live online classes and special astronomy-related projects.

Every live class will be at least one hour long (though it may go longer depending on how many questions students have). Plenty of time will be given for Q&A during each class.

Every live class will cover a major theme in the subject of astronomy. Each live class will also discussion 4 potential projects you can complete having to do with that theme.

- **A Bible Project** (connecting astronomy to the Bible)
- **A Creative Project** (for hands-on creativity)
- **A History Project** (connecting astronomy to history and literature)
- **A Field Trip** (going somewhere to learn)

If you are looking for more hours for high school credit, we recommend doing two of the four projects between each live class. These projects combined with all the work for the course and the live videos should give you plenty of hours for high school credit.

There are no assignments following the last live event because it falls at the very end of the school year.

Class 1: The Sun

When we think of astronomy we often think only about nighttime viewing of the moon, stars, and planets. But since the dawn of creation, our closest star, the sun, has been the most important astronomical object.

Below are four projects you or your family can do related to the sun.

Bible Project: Hezekiah's Shadow

King Hezekiah was one of the most celebrated kings in the history of Judah, but when he became sick, he believed it was the end of his life. He prayed to the Lord for mercy, and the prophet Isaiah arrived with a message of hope—and a miracle involving the sun.

Examine the miracle reported in Isaiah 38 and 2 Kings 20:1-11 and write a paper explaining what happened.

The paper should be at least 5 pages in length. It should (1) mention any major characters in the story and their significance in that period of Israel's history, (2) summarize what happens in the story, and (3) describe what might have happened astronomically speaking for the miracle to take place. Commentaries on the Book of Isaiah and 2 Kings will be very helpful.

Creative Project: Build a Sundial

Sundials, or "shadow clocks," have been used by people for at least 3500 years. We have records of the ancient Chinese, Babylonians, and Egyptians using various kind of shadow devices for telling time.

For this project, create your own horizontal sundial. You can make it out of any kind of material you wish, such as paper and styrofoam, or a more permanent one made from wood.

Get directions about how to build a sundial at experienceastronomy.com/sundial.

History Project: Building Stonehenge

In the field of archaeoastronomy (the study astronomy done by ancient peoples), the best known historical site in the world is probably Stonehenge. This impressive circle of enormous stones is filled with mysteries, but the builders clearly had the sun in mind when they arranged the boulders in the English countryside.

Build a model of Stonehenge. You can choose to build one from a purchased kit (probably the easiest way to go), or you can craft one on your own. On the platform in which you build it, draw lines showing how the various stones are aligned with significant points on the horizon where the sun rises and sets at different times of year.

Get more information about this at experienceastronomy.com/stonehenge.

Field Trip: Solar Observatory Interview

Plan a field trip to a solar observatory or schedule a phone interview with someone who works at a solar observatory (if you don't live near one). During your visit or phone call, talk to one of the astronomers or technicians who work there.

Write a 5-page paper in the form of a newspaper column with interview questions followed by the answers given. You may want to record your conversation so you can go back to write out some of the answers later. Craft questions that will help readers understand what a solar observatory is, how solar telescopes work, and why astronomers study the sun.

Class 2: Seasonal Skies

The visibility of different constellations changes from season to season. This is because of the Earth's position around the sun: one time of year, the night side of the Earth faces a certain direction out in space; another time of year, the night side of the Earth faces another direction.

Below are four projects you or your family can do related to the seasonal skies.

Bible Project: Paul in Athens

In Acts 17 we read the famous sermon preached by the apostle Paul to the city leaders in Athens. During this sermon, in verse 28, Paul quotes from a very popular Greek poem called *Phaenomena* by Aratus: "For we are indeed his offspring." This poem was all about different constellations.

Write 5-page paper about why Paul quoted this Greek poet. Consult different commentaries on the Book of Acts to learn about Paul's sermon. The paper should summarize (1) the major themes and message of Paul's sermon, (2) the major themes and parts of Aratus' poem, (3) what line from the poem Paul quotes and its original meaning, and (4) why Paul chose to use that quote for his sermon.

For some resources that might be helpful, go to experienceastronomy.com/aratus.

Creative Project: Build a Planisphere

A planisphere, sometimes called a star wheel, is a handy tool you can use when observing stars outside. It consists of a circular sky map (with calendar dates circling the rim) and an outer sleeve (with times of day and night circling the rim). Print the necessary pieces on card stock and cut to the right size.

To get the parts you need, go to experienceastronomy.com/planisphere.

History Project: The Gods Must Be Crazy

There are many mythological stories associated with constellations. The ones we are most familiar with in our culture come from the ancient Greeks.

Choose one character from Greek mythology that is associated with at least two different constellation stories. For instance, the Greek hero Orion is not only associated with his own constellation but with Scorpius and the Pleiades. Orpheus is associated with Lyra and Carina. There are many others from which to choose.

Research this mythological character and write a 4-page biography of his or her life as if they were a real person. Give as much detail as you can about their birth, family, notable traits, and at least two stories associated with stars in the sky. Make sure to tell readers how to find these constellations (when they are visible and where to look for them).

Field Trip: Visit a Planetarium

Find a local planetarium. These are often found at museums or universities. Attend one of their official programs and write a paper about the experience. Before or after the program, interview one of the personnel at the planetarium.

The paper should include (1) the name of the planetarium, (2) the name of the program attended, (3) the creator/writer of the program, (4) the date and time you attended, (5) a brief synopsis of the program, and (6) specific astronomy facts you learned during the program.

Class 3: Geocentricism

Before the days of telescopes, nearly everyone believed the Earth stood at the center of the universe. The sun, moon, planets, and stars all revolved around us in concentric "spheres" around the Earth. It wasn't until the innovative observations and calculations of Copernicus, Galileo, and Kepler that these long-accepted beliefs were seriously challenged.

Below are four projects that deal with this time period of astronomy.

Bible Project: Is the Bible Geocentric?

You've been taken back in time to 1632, and the famous astronomer Galileo has just published his book *Dialogue Concerning the Two Chief World Systems*. There are some who believe the book is heresy because it claims that the Earth spins on an axis and revolves around the sun (heliocentrism). They believe the Earth is motionless and that the sun and all the other objects in the sky move around us (geocentrism).

This was, first and foremost, a scientific question being debated. Heliocentrism was not widely accepted or tested yet, and geocentrism had been taught by scientists and philosophers for centuries. But some church leaders also used the Bible to bolster their belief in geocentrism.

Write a letter to these church leaders who believe geocentrism. Your letter should include commentary on the following passages:

- Joshua 10:12-13
- Psalm 19:5-6
- Psalm 93:1
- Psalm 96:10
- Psalm 104:5
- Ecclesiastes 1:5

You're goal isn't to convince the church leaders about answers to the scientific questions being debated, or to convince them how to handle Galileo's case. Rather, your goal is to give your understanding of what the Bible says about heliocentrism or geocentrism.

Creative Project: Planet Poster

You've been transported to a time in the future when travel to all the planets in our solar system is possible. You are working for a galactic travel agency, and you've been commissioned to design a poster advertising a trip to a planet (or dwarf planet) in the solar system.

Choose a planet for your poster and create an attractive design for the poster that will entice interested tourist to go there. Include appealing photos, fast facts about the planet, reasons to visit, information about where the tourists will be staying (such as on a moon orbiting the planet, a space station, or on the surface of the planet itself), etc. Once the poster is complete, write a 3-5-minute speech for a crowd of potential tourists and deliver the speech in front of your family.

History Project: The Heavenly Spheres

The idea of the heavens being composed of different revolving "spheres" is a common theme in ancient and medieval literature. From the time of the ancient Greeks, most ancient thinkers believed that Earth was at the center of the universe and the heavenly bodies revolved around it. But because certain objects—the sun, the moon, and the planets—do not move at the same pace as the background stars, each of these objects were said to occupy their own "sphere" above the Earth.

Research all three of these works of literature:

- "The Myth of Er," written by Plato in *The Republic*
- *The Dream of Scipio* by Marcus Cicero
- *Paradiso* by Dante Alighieri

Write a 5-page paper that discusses (1) the author of each work (briefly), (2) when and where each work was written (briefly), (3) what each work is generally about (briefly), and (4) how each work describes the heavenly spheres that move around the Earth.

Field Trip: Visit a Museum

Look for any local museums that have any exhibits associated with ancient or medieval astronomy (astronomy done before the 1600s). This could include:

- Exhibits about famous astronomers (Pythagoras, Hipparchus, Ptolemy, Al-Khwarizmi)
- Exhibits about ancient cultures known for their astronomical knowledge (the Chinese, the Babylonians, the Egyptians, the Greeks)
- Exhibits featuring astronomical objects (sundials, ancient calendars, astrological artifacts)

You may need to call around to different museums and ask to speak to the curators (they will know the most information about the exhibits in the museum).

Take a camera to the museum and take photos of any relevant objects. Take notes about what the objects are and why they are significant to astronomy. Print out or develop the photos and create a poster describing your trip to the museum. Include any information on the poster that it will help others know about your trip.

Class 4: Deep Space

When Job looked to the heavens and saw the wonders of the sky above, he said, "Behold, these are the fringes of His ways" (Job 26:14). Now, thanks to modern technology, we can look beyond the fringes of what Job saw—and we are still in awe of how little we know.

Below are four projects related to deep space.

Bible Project: Singing Stars

At the 2011 Desiring God National Conference, Louie Giglio, pastor of Passion City Church, gave a stirring message called "The Global God Who Gives the Great Commission." During this message Louie brings the message of Psalm 148 to life, showing how stars don't just shine—they also sing.

Praise him, sun and moon,
praise him, all you shining stars! (v.3)

Watch the sermon here: experienceastronomy.com/singing-stars.

When you are finished listening to the sermon, write a 5-page reflection paper about the significance of the message. How does richer knowledge about God's creative power in the universe impact our day-to-day lives?

Creative Project: Images from Hubble

The Hubble Space Telescope has been in low orbit around the Earth for more than a quarter of a century. Without the Earth's atmosphere above it to block its view of the universe, it can look deeper into space than any telescope on Earth.

Find 10 of the most stunning images you can find taken by the Hubble and compile them into a short book. Each image should have a lengthy caption describing what is in the image. The book should also contain a one-page introduction about what the Hubble Telescope is and a book cover featuring one or more of the images inside the book.

History Project: Space Probe Spotlight

Scientists have been sending robotic spacecraft into space since the 1950s. Research one of these famous spacecraft, writing a 5-page paper about (1) when it was created, (2) who created it, (3) what its mission was, and (4) what kinds of interesting information it collected on its mission.

Notable space probes include:

- Sputnik 1 (first probe in space)
- Mariner 2 (first probe to study another planet)
- Mariner 4 (first probe to snap a picture of another planet)
- Mariner 9 (first probe to circle another planet)
- Venera 7 (first probe to successfully land on another planet)
- Voyager 1 (furthest manmade object from the Earth)
- Voyager 2 (first spacecraft to study Uranus and Neptune up close)
- Pioneer 10 (first spacecraft to encounter Jupiter)
- Pioneer 11 (first spacecraft to encounter Saturn)
- Viking 1 (first spacecraft on Mars to complete its mission)
- Mars Pathfinder (first automated surface exploration of another planet)
- Cassini (first to orbit Saturn)
- Huygens (landed on Saturn's moon Titan; most distant landing from Earth of any human-made craft)
- Spirit and Opportunity (two Mars rovers)
- Curiosity (car-sized Mars rover)
- New Horizons (first to explore Pluto)

Field Trip: An Evening Under the Stars

The best way to enjoy the stars is to simply go out to a remote area and see the dark night sky firsthand. Take a trip to a remote area with little to no manmade light. You could simply find a remote area nearby or you could plan a trip using Google's Dark Site Finder map (darksitefinder.com). Spend at least 2½ hours under the stars after astronomical twilight (see timeanddate.com to find out when astronomical twilight ends in your areas). You may choose to spend the night outdoors.

Class 5: The Moon

God created two great lights in the sky: a greater one to rule the day and a lesser one to rule the night (Genesis 1:16). Since the dawn of time, the moon has been one of the most important heavenly lights, and has served as a one of the most spectacular objects for us to view from the Earth.

Below are four moon-related projects.

Bible Project: Seasons of the Moon

Psalm 104:19 tells us God gave us the moon to mark the seasons. Since ancient times, the phases of the moon were important markers of time, and in lunar and lunisolar calendars marked the months of the year.

Write a 5-page paper about the 12 months of the Hebrew calendar: Nisan, Iyar, Sivan, Tammuz, Av, Elul, Tishrei, Marcheshvan, Kislev, Tevet, Shevat, and Adar. Be sure to mention other names for each month (if any) and special holidays that fall during these months and why those holidays are significant to the Hebrew people.

Creative Project: Hebrew Calendar

Create a 3-year-long Hebrew calendar. Start with the upcoming civil Hebrew year, traditionally beginning with Rosh Hashanah, the first day of the month of Tishri. Each page should be a new month, reflecting the Hebrew month, not months of the Gregorian calendar.

- Mark on the calendar all New Moons and Full Moons (hint: New Moons should always be the first day of each month).
- Make sure to include an intercalary month if it is needed (online sources should let you know if one is needed).

- Mark on the calendar any major Biblical appointed times listed in Leviticus 23: Sabbath, Passover, the Feast of Unleavened Bread, First Fruits, Trumpets, Day of Atonement, and the Feast of Tabernacles.
- Mark when the first day of each Gregorian calendar month overlaps with your calendar.
- Create an attractive cover page for your calendar.

History Project: Moon Walker Biography

There have been 12 men to walk on the moon as part of NASA's Apollo program (Apollos 11, 12, 14, 15, 16, and 17). Several of these men have written books about their experiences as astronauts. Choose one of these books and write a 4-page book review of it.

- Edwin "Buzz" Aldrin: *Return to Earth* (1973), *Men From Earth* (1989), *Reaching for the Moon* (2005), *Magnificent Desolation* (2009).
- Alan L. Bean: *My Life As An Astronaut* (1989), *Apollo: An Eyewitness Account* (1998), *Mission Control, This is Apollo: The Story of the First Voyages to the Moon* (2009), *Painting Apollo: First Artist on Another World* (2009)
- Alan Shepard: *Moon Shot: The Inside Story of America's Apollo Moon Landings* (2011)
- Edgar D. Mitchell: *Earthrise: My Adventures as an Apollo 14 Astronaut* (2014)
- Eugene A. Cernan: *The Last Man on the Moon* (1999)

Field Trip: Visit an Observatory

Find a local observatory, perhaps at a nearby university, museum, or science center. Call ahead to see if you can look at the moon through one of their telescopes. During your trip, interview one of the astronomers or technicians at the observatory. Ask them to point out at least 3 interesting features on the moon, showing you those features. After you return home, look up information about those features online and write brief paper describing each feature, telling the story of your trip to the observatory.