

SESSION 3.2

Observing the Jupiter System

Unit Goals

The Solar System is centered around the Sun, the only star in the Solar System.

A wide variety of objects orbit the Sun in the Solar System.

Scientists categorize Solar System objects according to their characteristics; however, not all objects can be easily categorized.

Objects in the Solar System are in regular and predictable motion.

The Solar System is mostly empty space, and is very large compared to the objects located within it.

Overview

We cannot observe our Solar System as someone located outside of it might. However, we *can* observe the system of Jupiter and its moons, which can serve as a useful analogy for understanding our own Solar System. In 1610, Galileo's discovery and careful observations of four of Jupiter's moons were instrumental in disproving the geocentric model, which held that the Earth was at the center of everything, including the Solar System. In this session, students carefully observe Jupiter's moons just as Galileo did. The class discusses their observations and arrives at the conclusion that Jupiter is at the center of a system of orbiting moons. Students' reenactment of this discovery highlights the important role of the telescope in the development of astronomy, starting at the very onset of the telescope's use as a scientific instrument. It also clarifies the distinction between the terms *planet* and *moon*. During this session, the key concepts that will be added to the classroom concept wall are:

- *Telescopes allow astronomers to observe distant objects in space that might otherwise not be seen.*
- *Scientific explanations are based on evidence gathered from observations and investigations.*
- *Planets orbit stars.*
- *Moons orbit planets.*
- *The Solar System is centered around the Sun—the only star in the Solar System.*

Observing the Jupiter System	Estimated Time
Introducing Galileo and the Telescope	5 minutes
What Galileo Saw: Observing Jupiter	15 minutes
Reviewing and Discussing the Data	15 minutes
Evidence for the Heliocentric Solar System	10 minutes
Total	45 minutes

What You Need

For the class:

- overhead projector or computer with large-screen monitor or LCD projector
- prepared key concept sheets from the copymaster packet or CD-ROM file
- transparency of the Telescopic View of Jupiter With Galileo's Observation Notes from the transparency packet or CD-ROM file
- transparency of the Observing Jupiter Over 9 Nights from the transparency packet or CD-ROM file

TEACHER CONSIDERATIONS

Key Vocabulary

Scientific Inquiry Vocabulary

Category
Characteristic
Evidence
Model
Observation
Prediction
Scale
Scale model
Scientific explanation

Space Science Vocabulary

Asteroid
Astronomical Unit (AU)
Comet
Diameter
Heliosphere
Kuiper Belt Object (KBO)
Moon
Orbit
Planet
Sphere
Star
System

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- 4 transparencies of the Tracking Objects Near Jupiter from the transparency packet or CD-ROM file
- transparency pens in the following colors: black, blue, orange, and red
- transparencies of the three pages of the Pre-unit 3 Questionnaire from the transparency packet or CD-ROM file

For each student:

- 1 copy of the Tracking Objects Near Jupiter student sheet from the copymaster packet or CD-ROM file
- 1 pencil

Getting Ready

1. **Arrange for the appropriate projector format to display images to the class.** Decide whether you will be using the overheads or the CD-ROM. Set up an overhead projector or a computer with a large-screen monitor or LCD projector.
2. **Prepare the key concept sheets.** Make a copy of each key concept and have them ready to post onto the classroom concept wall during the session.
3. **Decide how you will divide the class into teams for the Observing Jupiter activity.** You will need at least four teams—one for each of the moons to be observed.
4. **Make copies of the Tracking Objects Near Jupiter student sheet.** Each student should receive a copy, and you will need to make three transparencies (for a total of four) for the class discussion.

TEACHER CONSIDERATIONS

TEACHING NOTES

The key concepts can be posted in many different ways. If you don't want to use sentence sheets, here are some alternatives:

- Write the key concepts out on sentence strips.
- Write the key concepts out before class on a posted piece of butcher paper. Cover each concept with a strip of butcher paper and reveal each one as it is brought up in the class discussion.

If you plan to use the CD-ROM for this session, be prepared to switch between the CD-ROM and overhead transparencies. If you'd prefer not to have to switch constantly between the two, use the transparencies for the lesson and show the [Jupiter's Moons Animation](#) in [Galileo's Study](#) (within the [Observing Jupiter](#) activity) only if your students need it.

GO! Introducing Galileo and the Telescope

1. **The spyglass was invented to look at distant objects.** Tell students that in 1608, makers of eyeglasses in the Netherlands were putting together devices called a spyglass, which consisted of a tube with a lens (a piece of glass with curved sides) at each end. The spyglass could be used to look at distant objects, making them appear larger and closer.

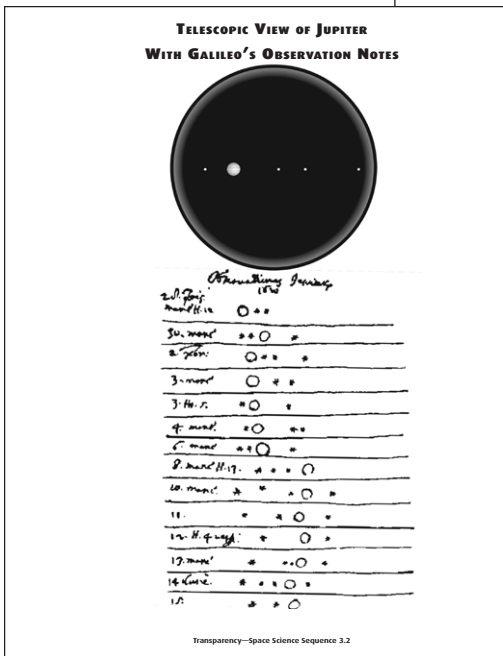
2. **Introduce Galileo and the invention of the telescope.** By 1609, news of the spyglass had reached Galileo Galilei, a scientist in Italy. Galileo was interested in using the spyglass to study objects in the sky. He began creating his own spyglasses, improving upon the design and calling them telescopes.

3. **Have students briefly share their experiences with telescopes.** Ask, “Have any of you looked through a telescope?” Follow up student responses with questions such as, “What did you look at?” “What was it like?” and “Did you look at things in the sky or on the Earth?”

4. **Show the class the Telescopic View of Jupiter with Galileo’s Observation Notes overhead transparency.** If you are using the CD-ROM, open the **Observing Jupiter activity** and click on **Galileo’s Notes**. Tell students that when Galileo observed Jupiter with his telescope, he was the first person to see that a planet is spherical. He also noticed four “specks” of light close to Jupiter. When he first saw them, he wrote in his notebook about how the “stars” near Jupiter were in a neat little line.

5. **Don’t reveal to your students yet that these “stars” are actually Jupiter’s moons!** At some point, your students will probably realize that the four spots near Jupiter are actually its orbiting moons. If they bring this up at any time during the session, confirm that they are indeed the moons of Jupiter, and that Galileo eventually came to the same conclusion. From then on, refer to the spots as moons. However, if no one points this out, continue to refer to the spots as “specks” or “stars” and wait to reveal that they are Jupiter’s moons until later in this session (during Reviewing and Discussing the Data).

6. **Explain that Galileo observed and recorded the movements of these spots carefully.** Tell students that Galileo watched these “star-like” objects and noted that as Jupiter moved across the sky, the “star-like” objects moved with it. He also observed that they appeared in different places around Jupiter each night. Explain that this was very unusual, since other stars never changed position in relation to one another.



TEACHER CONSIDERATIONS

TEACHING NOTES

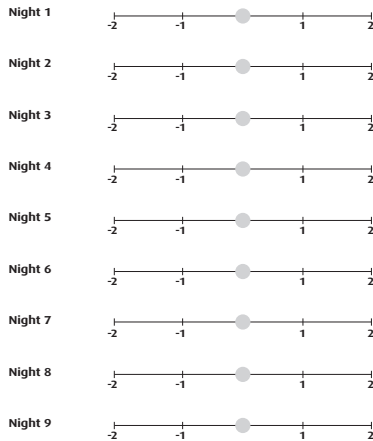
Although Galileo is sometimes credited as the inventor of the telescope, he was not its inventor. However, it is not entirely clear who actually did invent it. Hans Lippershey, a Dutch spectacle maker, applied for the first patent in 1608, but two others—Jacob Metier and Zacharias Janssen, who were also Dutch spectacle makers—applied a short time later. They all claimed to have invented it first and accused the others of stealing the idea. The idea had actually been written about hundreds of years earlier, but the technology of making glass and lenses was not far enough advanced at that time for any device to be made. Galileo does, however, deserve credit as the first person to make major discoveries using a telescope to study the night sky. These include the discovery of the moons of Jupiter, the surface features on the Moon, sunspots, the phases of Venus, and stars in the Milky Way.

One teacher said, “I emphasized the importance of keeping records in their science notebooks. We had a big laugh over the fact that Galileo probably had a science teacher who taught him to write everything down. It was a very engaging lesson for all of us.”

SESSION 3.2 Observing the Jupiter System

TRACKING OBJECTS NEAR JUPITER

In 1610, Galileo Galilei observed Jupiter with a telescope. He was curious about objects that appeared to him to be small bright stars.



Student Sheet and Transparency—Space Science Sequence 3.2

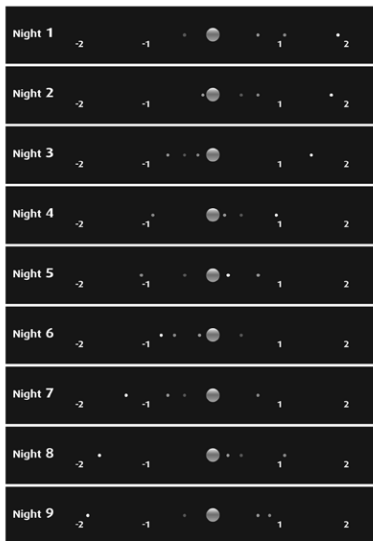
7. Explain to students that Galileo’s telescope allowed him to observe a distant object like Jupiter. Tell students that without a telescope, Galileo would not have been able to observe Jupiter in much detail. Today, they will observe Jupiter just as Galileo did and learn what he discovered from his careful observations. Post on the concept wall, under Key Space Science Concepts:

Telescopes allow astronomers to observe distant objects in space that might otherwise not be seen.

What Galileo Saw: Observing Jupiter

1. Pass out the Tracking Objects Near Jupiter student sheets and pencils. Each student should receive an observation sheet and pencil. Tell students that, on this sheet, they will record their observations of Jupiter as though they had been observing it over nine consecutive “nights.”

OBSERVING JUPITER OVER 9 NIGHTS



Transparency—Space Science Sequence 3.2

2. Begin by showing the class Night 1 only. Put the Observing Jupiter Over 9 Nights transparency (with the moons already colored) on the overhead projector. Show only Night 1, covering all other nights with a piece of paper. If you are using the CD-ROM, open the Observing Jupiter activity and click on Look Through the Telescope to reveal Night 1.

3. Explain why the spots around Jupiter have been colored in. Explain to the class that what they are seeing represents a view of Jupiter through a telescope with a little more information than what Galileo had. The four “star-like” objects have been given different colors so they can be more easily distinguished from one another. Night 1 indicates that this is the first night of Galileo’s observations.

TEACHER CONSIDERATIONS

CD-ROM NOTES

CD-ROM Instructions: Galileo's Study

Three activities can be found in Galileo's Study, which is within the Observing Jupiter activity on the CD-ROM:

- 1. An animation of Galileo's observations of Jupiter's moons.** (You may choose to use this in place of the overhead transparency for the Observing Jupiter activity.) Click on the telescope to access Galileo's observations. Use the BACK and NEXT arrows to navigate through each of the nine nights. Click on MAIN MENU to return to the study.
- 2. An animated orrery of Jupiter and its moons.** Click on the Jupiter system model sitting on the table to access this interactive. The animation shows synchronized views of the movements of Jupiter's moons from two perspectives—the top and the side. (Elapsed time is counted in Earth days.) Click PLAY to begin the animation. This is an excellent way to demonstrate orbital movement to your students if they are having difficulty visualizing the orbits of Jupiter's moons from different perspectives. Click on MAIN MENU to return to the study.
- 3. A copy of Galileo's observation notes.** Click on the book on Galileo's table to access his actual, handwritten observations of the moons of Jupiter. To enlarge the interactive to full screen, press CONTROL F (Windows) or APPLE F (Macs). Press ESC to exit the full-screen display. Click on MAIN MENU to return to the study.

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Optional: For younger students, you might want to turn the classroom lights on and off between observation nights to represent a passing day.

4. **Explain the number line.** Point out that the numbers to the right and left of Jupiter are like the numbers on a number line with Jupiter in the position of zero. Students should use these numbers to describe the positions of the colored spots. To assess your students' understanding of this, ask them the following questions:
 - “What number is the white spot closest to?” [2.]
 - “Which two colored spots are close to the number 1?” [The orange and blue spots.]
 - “Which spot is on the side with the negative numbers?” [The red spot.]
 - “What is located in the place where zero would be on the number line?” [Jupiter.]
5. **Divide the class into teams and assign a colored spot for each team to observe.** Ask each team to imagine that they are a group of astronomers working together to carefully observe their assigned spot. Have them fill in the color of their assigned spot as indicated on their Tracking Objects Near Jupiter student sheet.
6. **Students record their observations for Night 1.** Have students find the positions of their assigned spots for Night 1. Ask them to make an X with their pencils on the Night 1 line to show the position of their spot as they see it in relation to Jupiter and the numbers on the number line. Encourage students within each team to help one another. Before going on to Night 2, walk around the classroom and check to see that everyone understands how to correctly record the position of their assigned spot.
7. **Ask, “Where is your spot on Night 2?”** Cover up Night 1 on the transparency with another piece of paper and move the first piece of paper down to reveal Night 2. (If you are using the CD-ROM, click on the NEXT arrow to move on to Night 2.) Have students record the position of their spots for Night 2, making sure that they mark their observations on the Night 2 line of the student sheet.
8. **Continue moving along from night to night.** Continue revealing each successive nightly view of Jupiter. As you show each night's view, have students record the new position of their spot *on the next lower line*. (Check to make sure that no one is marking all of their observations on the same line.) By Night 4, most students should be proficient at observing and recording their spots, and you can probably pick up the pace.

TEACHER CONSIDERATIONS

TEACHING NOTES

Classroom Management Considerations

- **Have each team of students observe just one of the moons.** This makes it easier for teammates to check one another's observations and to discuss their predictions together.
- **Make sure each moon has a team assigned to observe it.** Designate at least four teams so that observations can be made for each of the moons.
- **The white and orange moons may be difficult to distinguish from one another.** You might want to assign the white and orange moons—Callisto and Europa, respectively—to teams seated near the front of the classroom, since students farther back may have difficulty distinguishing between these two lighter colors.
- **Some students may be able to make observations for more than one moon at a time.** Consider suggesting this as an extra challenge to selected or advanced students, but tell them to give priority to their assigned moon when making their observations.
- **An advanced option for the Observing Jupiter activity.** This is a good option for assigning moon observations if you have older students who work well independently and have good recording skills. Divide the class into groups of four. Ask each member of a group to observe and record a different colored spot. As students progress through each night of observation, they can see how their recorded data differ from those of their team members.

SESSION 3.2 Observing the Jupiter System

9. **Have students predict where they think their spots will be next.** Starting around Night 4 or 5, ask your students to predict where they think their spots will be on the next night. Some students may be doing this already.
10. **Have students compare data with their teammates.** Students should discuss any differences in their observations with teammates as they continue through the activity.
11. **After Night 9, have students connect the Xs on their observation sheets.** Each student should draw a line from the X they made on Night 1 to the X they made on Night 2, continuing down through Night 9. (Each of the four moons will generate a different zigzag pattern as students connect their Xs.)
12. **Record observation results for each spot on transparencies.** Ask four students who observed different colored spots to trace their zigzag patterns onto four separate transparencies of the Tracking Objects Near Jupiter student sheet. Give each student a transparency marker that matches the color of his or her spot. Use a black pen for the white moon (Callisto).

Reviewing and Discussing the Data

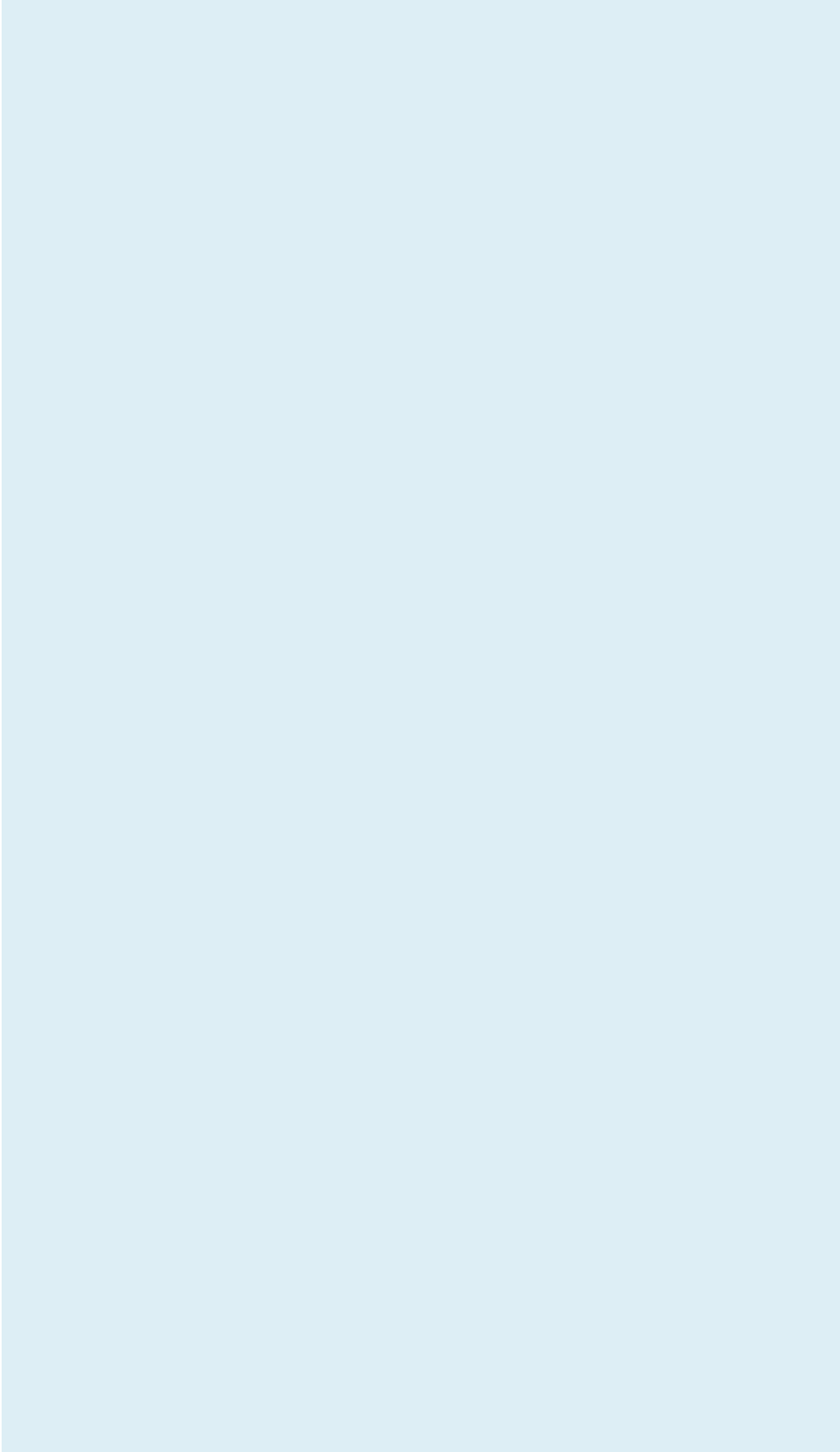
1. **If necessary, reveal now that the four “spots” are actually Jupiter’s moons.** Ask students, “Are these spots really stars?” “What makes you think that?” Accept responses and, if necessary, explain that the motion of the spots is not like the motion of stars. They have been tracking the movements of the four largest moons of Jupiter, called the Galilean Moons in honor of their discoverer, Galileo.

- The white moon is Callisto (ka-LIS-toe).
- The blue moon is Ganymede (GAN-ee-meed).
- The orange moon is Europa (yur-OH-pa).
- The red moon is Io (EYE-oh).

A closer look at the motions of these objects will show why they are classified as moons.

2. **Teams discuss their moon’s changes in position.** Ask each team to discuss how their moon moved over nine nights of observation. Ask them to try to explain why their moon changed positions. What might explain their observations?

TEACHER CONSIDERATIONS



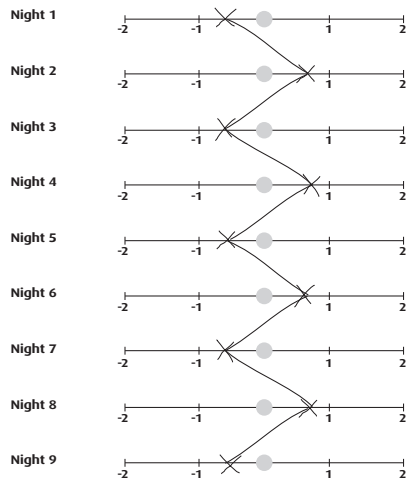
SESSION 3.2 Observing the Jupiter System

Name: Maria F.

Your spot's color: RED

Tracking Objects Near Jupiter

In 1610, Galileo Galilei observed Jupiter with a telescope. He was curious about objects that appeared to him to be small bright stars.



3. The class discusses Io's movements. After a few minutes, regain the attention of the class. Display the transparency of the Tracking Objects Near Jupiter student sheet for Io (with its zigzag path marked in red). Ask the team(s) who tracked Io to explain the moon's movements. Ask, "Does Io hop from side to side around Jupiter each night?" [No. Io doesn't really hop around Jupiter each night. It just orbits the planet so quickly that it appears on the other side of Jupiter each night.]

4. Display the zigzag paths of the other moons one at a time. For each moon, place the student-prepared transparency tracing the moon's nightly position on the overhead. Ask the team(s) who tracked that moon if they can explain the moon's change in position each night. Ask, "What is causing the moon to change position each night?" [The moon is orbiting Jupiter.]

5. Solidify student understanding about orbital movement. Many students may have difficulty deducing their moon's orbital movement from their side-view observations. Invite them to explain how an orbiting object might appear to make the side-to-side motion that they have observed. Possible explanations include:

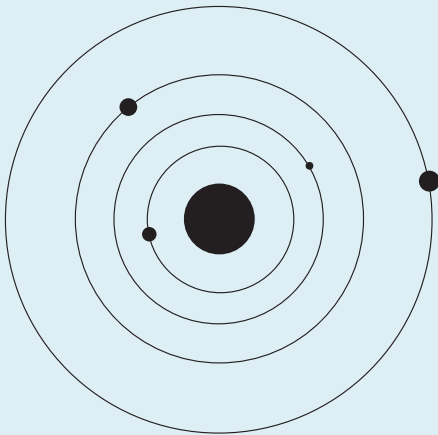
- The moons are moving around Jupiter like cars on a flat racetrack, and we are viewing the race from the sidelines. If we were to view the race from the elevated box seats, we would see the cars moving around and around the racetrack.
- We are viewing Jupiter and its moons "from the side." If we were looking "from the top," we would see the circular path each moon makes as it moves around Jupiter.

6. Demonstrate orbital movement using two students. Remove the transparencies from the overhead projector and have a student stand in the middle of the projected light so his or her shadow falls on the screen. Have another student orbit, or walk around, the first student. The shadow of the orbiting student will move from side to side on the screen even though the student is actually moving in a circle. Ask, "If someone wanted to see the orbiting student going in a circle around the first student, from what location would they have to watch?" [They would have to observe the orbiting student from the ceiling.]

TEACHER CONSIDERATIONS

TEACHING NOTES

Orbital Periods of the Moons. While it's possible for students to use their observation data to calculate the approximate number of nights it takes each moon to orbit Jupiter, their results may vary depending on their observing and recording skills and the method they use to count nights. It's much more important that students understand the orbital movements of the moons themselves, rather than how many nights it takes each moon to orbit Jupiter. Astronomers have determined the following orbital periods for each moon: Io (2 days), Europa (4 days), Ganymede (7 days), and Callisto (17 days).



**Orbiting Moons
Top View**



**Orbiting Moons
Side View**

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Teachers found this animation particularly useful for solidifying student understanding of orbital movement. It's worth showing if you have access to a computer and some additional class time!

7. **If you are using the CD-ROM, click on Jupiter's Moons Animation (in Galileo's Study) within the Observing Jupiter activity to demonstrate orbital movement to your students.** Ask students to observe the movement of Jupiter's moons from both the top and side views.
8. **Note whether moons return to their starting points.** Ask, "Did any of the moons return to their starting points during the nine nights of observation?" [Io returns to its starting point every other night; Europa takes about four nights; Ganymede returns after seven nights.] The only moon that does not return to its starting point over nine nights is Callisto, which needs approximately 17 nights to make it all the way around Jupiter.
9. **Place the stack of all four moon transparencies on the overhead.** Have students compare the overlaid zigzag patterns of the four moons. Ask, "Which moons get around Jupiter the most quickly?" [Io (red) is the fastest, then Europa (orange), then Ganymede (blue), and then Callisto (white).] Make sure students realize that Callisto traveled a little more than halfway around its orbit in nine nights; we would have to observe Callisto for about eight *more* nights to see it move back to where it started.
10. **Distances of the moons from Jupiter.** Ask students if they can tell which moons are closer to Jupiter and which are farther away. [Io is the closest, then Europa, then Ganymede, and then Callisto.] Ask students if there is any relationship between how far away the moon is from Jupiter and how long it takes the moon to orbit Jupiter. Students should notice that the closer the moon is to Jupiter, the faster it completes its orbit around the planet.

TEACHER CONSIDERATIONS

PROVIDING MORE EXPERIENCE

Ask, “If Callisto is farthest from Jupiter, why does it appear to be closer to Jupiter than to Europa on Night 5?” [Certain orbital positions of Europa and Callisto, if viewed from the side, can make it appear that Callisto is closer to Jupiter than to Europa. If Europa has reached the “rightmost” or “leftmost” part of its orbit, AND Callisto happens to be close to crossing in front of or behind Jupiter in its orbit, then it would appear that Callisto is closer to Jupiter than to Europa from a sideview perspective.] It may help to use three students and the overhead to model this for the class. Have one student stand in the middle of the overhead’s projected light so that his or her shadow falls on the screen. Ask the second student to walk in a small orbit around the first student. While the second student is orbiting the first student, have the third student walk in a much larger orbit around the first student. Point out when the third student’s shadow appears to be closer to the first student’s shadow than the second student’s shadow.

TEACHING NOTES

Students may wonder whether the moons closer to Jupiter really do orbit faster or whether they simply have less distance to cover because their orbits are smaller. Let students know that they will be exploring this question later on in the unit. In Session 3.10, students will participate in a human orrery and learn that not only do planets closer to the Sun have a smaller orbit to travel, but that those planets actually do travel faster as well.

How Galileo Tracked Jupiter’s Moons. Could Galileo see color differences between the four moons? No. For this activity, we’ve arbitrarily color-coded the moons to make them easier to distinguish from one another, but Galileo would not have had this artificial enhancement to help him with his observations. So how did Galileo track the moons and draw his conclusions? Several things might have helped him. Callisto (the white spot) moves so slowly that it is often very nearly in the same position night after night—making it easy to distinguish this moon from the others. Io (the red spot) is also easily identified, since it moves so quickly in its orbit that a change in its position is detectable after only a few hours of observation. Remember also that Galileo was a seasoned scholar and scientist. Once he realized that the “specks of light” did not behave like stars, he logically concluded that they were most likely the moons of Jupiter. With this conclusion in mind, he could deduce the orbital patterns of each of the four moons.

Evidence for the Heliocentric Solar System

- 1. Tell students about the geocentric model.** Explain that at one point in time, many people believed that the Earth was located in the center of the Universe with everything else, including the Sun and other planets, revolving around it. Some of your students may have heard of the geocentric model, while others may not be aware of it. If you have additional time, continue discussion of the geocentric model as suggested on the right-hand page under Teacher Considerations.
- 2. Discuss how Galileo’s observations challenged the geocentric model.** Ask students if they can see how Galileo’s observations might have convinced others that the Earth was *not* in the center of the Universe. [Galileo’s discovery of moons orbiting Jupiter (and not Earth) suggested that not everything moved around the Earth.]
- 3. Galileo used the Jupiter system as a *model* to understand the Solar System.** Explain that Galileo used his observations of the Jupiter system to help him better understand another system—the Solar System. Using the Jupiter system as a model, Galileo reasoned (correctly) that the Solar System was organized similarly to Jupiter and its moons. Remind students of the key concept from Session 3.1:

Scientists use models to demonstrate ideas, explain observations, and make predictions.

- 4. Galileo used his observations to support the heliocentric theory.** Galileo concluded that just as Jupiter’s moons orbit Jupiter, the Earth must also orbit something—the Sun. Tell students that the Jupiter system they observed today is like a miniature Solar System, with Jupiter playing the part of the Sun, and Jupiter’s moons playing the parts of the planets. Tell the class that Galileo used his observations of Jupiter’s moons as evidence for the heliocentric theory. Post on the concept wall, under Key Scientific Inquiry Concepts:

Scientific explanations are based on evidence gathered from observations and investigations.

TEACHER CONSIDERATIONS

PROVIDING MORE EXPERIENCE

Optional Discussion: Occultation and Transit

1. **Show students the Telescopic View of Jupiter With Galileo's Observation Notes transparency again.** Ask them to notice any similarities or differences between Galileo's notes and their own records.
2. **Tell the class that Jupiter has more than four moons.** Ask the class, "Why do you think Galileo observed the movements of only a few of Jupiter's moons?" "Where were Jupiter's other moons?" [Moons that happened to be in their orbits behind Jupiter could not be seen.]
3. **Define *occultation* and *transit*.** Explain to students that an *occultation* occurs when one object is hidden from view by another object in front of it. A *transit* occurs when an object passes in front of another object.
4. **Moons in occultation or transit with Jupiter would have been difficult to see.** Explain that Galileo would not have been able to see moons behind or in front of Jupiter. Jupiter's brightness would have made it difficult to detect a moon in front of it.

TEACHING NOTES

Additional Classroom Discussion: Examining "Evidence" for the Geocentric Model. Have students consider why so many people in Galileo's time believed that the Earth was in the center of the Universe with the Sun, other stars, and other planets all orbiting around it. Ask, "What evidence could make a person think that?" [It *looks* like everything is moving around the Earth. The Sun and stars seem to revolve in the sky around us. Students might add that even though the Earth is spinning, we can't feel the motion of the Earth. It feels like the Earth is stationary.]

Defining the term *system*. In the most general sense, a *system* is defined as "a group of independent but interrelated elements or objects comprising a unified whole." (The word derives from Greek and Latin, meaning *to combine or place together*.) This definition has been applied in our language in many different contexts. For example, our bodies have digestive and circulatory systems, while science and other disciplines use classification systems. A person can even devise a whole new system for doing a task! Because of the widespread use of this term, you may choose to discuss with your students what they think the term *system* means. If necessary, help them to come up with a useful definition. This will ensure that all students in the class have the same understanding of the term as they discuss the Jupiter system and the Solar System in this and future sessions.

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5. The Sun is a star. Remind students that the Sun is a star. Explain that Earth is just one of a number of planets that orbit around the Sun. Post on the concept wall, under Key Space Science Concepts:

Planets orbit stars.

6. Moons orbit planets. Tell students that just as planets orbit stars, moons orbit planets. Earth's moon orbits Earth, just as Jupiter's moons orbit Jupiter. Post on the concept wall, under Key Space Science Concepts:

Moons orbit planets.

7. The Sun is the only star in the Solar System. Ask the class, "How many stars do you think there are in the Solar System?" [Only one: the Sun.] Tell students that although the Solar System has many systems of planets and moons, they all orbit around the Sun. Post on the concept wall, under Key Space Science Concepts:

The Solar System is centered around the Sun—the only star in the Solar System.

8. Revisit Question #4 on the Pre-unit 3 Questionnaire with students. Show the transparency of the Pre-unit 3 Questionnaire. Go through each true-or-false question and ask students what answers they would choose after today's activity and discussion.

TEACHER CONSIDERATIONS

TEACHING NOTES

Galileo's discovery of the moons of Jupiter as evidence for the heliocentric model of the Solar System is a fascinating chapter in the history of science. For more information on this topic, see the Background Information for Teachers section on page 243.

Defining and classifying objects, such as planets or moons, according to their orbits (and what they orbit around) is a useful way to organize and learn about objects in the Solar System.

QUESTIONNAIRE CONNECTION

Use this opportunity to assess your students' understanding of this session's key concepts. Save the Pre-unit 3 Questionnaire transparency for use with other Questionnaire Connection opportunities in the unit.

Name: _____

Your spot's color: _____

TRACKING OBJECTS NEAR JUPITER

In 1610, Galileo Galilei observed Jupiter with a telescope. He was curious about objects that appeared to him to be small bright stars.

