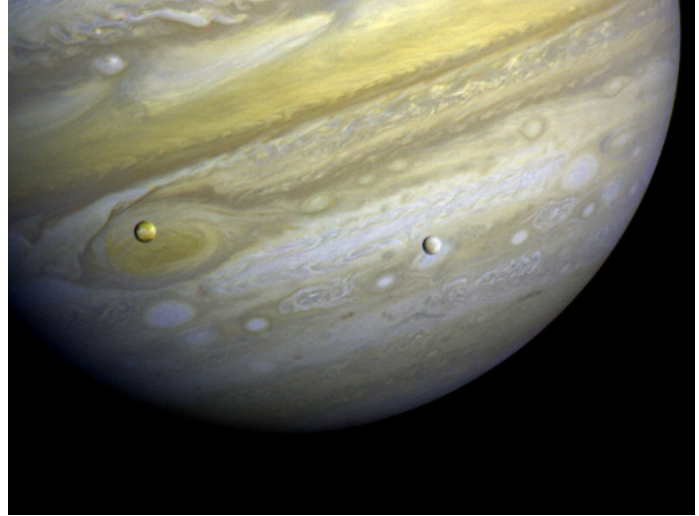


# The Phases of Jupiter's Moons

If you happened to live on the planet Jupiter and looked up into the beautiful night sky, what might its moons look like? Imagine seeing the full moon of Io rising as the crescent-shaped Ganymede begins to set. To a “Jupiterian,” the Galilean satellites would appear to go through the same phases as does our own Moon from Earth. For a classroom activity version of exploring moon phases, we recommend “Modeling Moon Phases and Eclipses” from the Great Explorations in Math and Science (GEMS) unit, *Earth, Moon, and Stars*. The simple moon phase model used in the planetarium show *Moons of the Solar System* to explain our Moon's monthly cycle of phases can also be applied to the more complex Jupiter system.



Adapt the procedures of that model as follows:

1. Have students work in teams of three. One student plays the role of “Jupiter” while the other two students each hold up two of Jupiter's four moons.
2. The room is darkened and one bright bulb is turned on, to be the “Sun.” Jupiter slowly turns and the phases of two of its four “moons” can then be observed.
3. The students holding the moons can then move around a little further in their orbits and stop so “Jupiter” can again turn on its axis and students can see how the phases have changed.
4. To add a guessing game element, have students take turns guessing what phases the other students are seeing. Competitively inclined students can have a point system to determine the “winner” of the guessing game.
5. For an even more complex challenge, divide the class into groups of 5 students: one student as Jupiter and the others being each of the four Galilean moons. Then do steps 2-4 again.

## More on Tracking of Jupiter's Moons

1. **Comparing Charts.** If you made four overhead transparencies of the data sheets, and had four students trace the data from the four different moons onto them (using different colored pens if possible) you can combine them as follows: Stack the completed transparencies so they are carefully lined up. Punch two holes at the top or side, so paper fasteners can be used to line them up quickly. Stack the four transparencies together, one at a time, on the overhead projector as the students watch. Ask questions about the combined graph such as:

***How will Jupiter's moons appear on night 3? 4? 5?***

***On what night does the white moon go from one side of Jupiter to the other? (6-7)***

***On what night will most of the moons be on the left side of Jupiter? (3, 7)***

***On what night will we see two moons on each side of Jupiter? (5, 6, 8, 9)***

***Occasionally, one of the outermost moons (Callisto or Ganymede) appears to be closer to Jupiter than the innermost moons (Io and Europa). On which night does this occur? (3, 5, 6)***

2. **Magazines.** The magazines *Astronomy* and *Sky and Telescope* have a monthly graph of Jupiter's moons that looks very much like the combined graph above. Show this graph to your students, and ask them further questions, such as:

***How many nights are represented on this graph? [One month, usually 30 or 31 nights.]***

***What does the column down the middle stand for? [Jupiter.]***

***How many moons are plotted on the graph? [Four.]***

***How will the moons appear on the 15th (or other interesting date) of the month?***

***How are the moons labeled on this graph? [In Sky & Telescope they are labeled by Roman numerals.] Which moon corresponds to which Roman numeral? When will moon III be behind Jupiter?***


















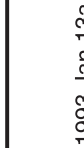
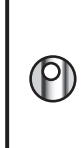

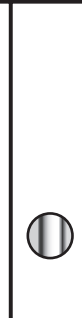


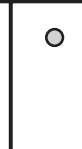





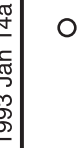

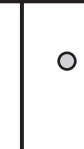








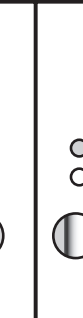

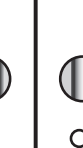





***Which moon orbits Jupiter the largest number of times? The smallest number of times?***

***Can you find a date when three of the moons will be found on the one side of Jupiter? On the other side?***

3. **Galileo.** Have your students read more about Galileo's life, and the trouble he got into because of his defense of Copernicus's theory. Plays by Bertolt Brecht and others have been written about Galileo's life. Your students might want to put on such a play, or make up one of their own.
4. **Arrange an outing** on a night when Jupiter will be visible in the night sky. Using binoculars or telescopes, students will be able to see Jupiter and some of its four largest moons. Contact your local amateur astronomy club to see if they might help your students have a "star party" when Jupiter is visible.
5. **Make a scale model** of the Jovian system. A detailed description of how to do this as a classroom activity is laid out in Activity 3 of the *Moons of Jupiter* unit of Great Explorations in Math and Science (GEMS). Using the method described there, students can, as homework, make scale models of the moons systems of other planets: Saturn, Uranus, Neptune, Mars, and Pluto.
6. **Make a flip book** "movie" of Callisto revolving around Jupiter! Make a copy of page 3 for each student. Have them follow the directions on the page.

## Ganymede and Callisto: The Movie

1. Make up a color code and color the moons in each box according to your code. 2. Cut out the boxes. 3. Tape them onto successive pages of a notepad or book. Be sure each box is positioned in the same orientation and relative location on each page: upper right unbound corner is best. 4. Flip the pages to "run the movie."

 1993 Jan 5a	 1993 Jan 11a	 1993 Jan 17a	 1993 Jan 23a
 1993 Jan 5b	 1993 Jan 11b	 1993 Jan 17b	 1993 Jan 23b
 1993 Jan 6a	 1993 Jan 12a	 1993 Jan 18a	 1993 Jan 24a
 1993 Jan 6b	 1993 Jan 12b	 1993 Jan 18b	 1993 Jan 24b
 1993 Jan 7a	 1993 Jan 13a	 1993 Jan 19a	 1993 Jan 25a
 1993 Jan 7b	 1993 Jan 13b	 1993 Jan 19b	 1993 Jan 25b
 1993 Jan 8a	 1993 Jan 14a	 1993 Jan 20a	 1993 Jan 26a
 1993 Jan 8b	 1993 Jan 14b	 1993 Jan 20b	 1993 Jan 26b
 1993 Jan 9a	 1993 Jan 15a	 1993 Jan 21a	 1993 Jan 27a
 1993 Jan 9b	 1993 Jan 15b	 1993 Jan 21b	 1993 Jan 27b
 1993 Jan 10a	 1993 Jan 16a	 1993 Jan 22a	 1993 Jan 28a
 1993 Jan 10b	 1993 Jan 16b	 1993 Jan 22b	 1993 Jan 28b