

# **Planets Curriculum**

## **3<sup>rd</sup> through 5<sup>th</sup> grades, 45 minutes**

### **Notice**

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### **Objectives**

Students will learn:

- A basic definition of the word "planet;"
- How to recognize planets in the night sky;
- How planets and stars differ from each other; and
- What prograde and retrograde planetary motion are.

### **Materials required**

- Flashlight and extra batteries
- Laser and light pointers
- Planet props (see <http://www.noao.edu/education/peppercorn/pcmain.html> for suggestions)
- Pictures of planets
- Earth on a stick (globe with handles at north and south poles to represent axis)
- Sun, Earth, Venus, Jupiter labels on strings
- Digitarium™ system set for the current date and time, with atmospheric effects and landscape turned on

## I. Introduction (10 to 15 minutes)

A) Inform students that you'll be learning about the planets today, and that the planetarium is a tool for doing so. You'll discuss some topics outside the dome, then go inside to learn more. Inside students will observe tonight's sky, point out what they think are planets in the night sky, test their predictions, and observe the motion of planets in the night sky.

B) Assess students' knowledge of the planets. Which is the biggest? The smallest? Closest to the sun? Farthest from the sun? etc. When were the planets discovered? *[Those visible to the naked eye have been known for as long as there have been humans. Uranus was discovered in 1781, Neptune in 1846.]* Is Earth the only planet with a moon? *[No, only Mercury and Venus have none.]* What keeps the planets in their orbits around the sun? *[Gravity.]* You may want to use props to help students visualize the size of the planets.

C) What is a planet anyway? The Facts on File Dictionary of Astronomy defines a planet as, 'A body that orbits the Sun or another star and shines only by the light that it reflects.' Discuss with students what this means, for example, what the words 'orbit' and 'reflect' mean, etc.

**Note:** The above is a very simple and broad definition. If students are interested, discuss the August, 2006 International Astronomical Union definition of a planet (an object that is in orbit around the sun, is large enough for its own gravity to pull it into a nearly spherical shape, and has cleared the neighborhood around its orbit). Why did this definition change Pluto's status to a dwarf planet?

D) Segue into a discussion of how planets and stars differ, highlighting the following differences:

- Stars create their own light; planets simply reflect light.
- Planets orbit stars; stars remain in virtually constant positions.  
*[Discuss proper motion/precession with older, interested students.]*
- Planets are closer to us than are most stars.

E) Prepare students for entering the planetarium--method of entry, rules for behavior, etc.

## II. Recognizing planets in the sky (15 to 20 minutes)

A) *[When all are in and seated, speed up time to let the sun set, then turn off atmospheric effects and landscape.]* Before you start looking for planets in the real night sky, it will be helpful to know which direction is which. If you're

observing the sky of the northern hemisphere, there's one star in particular that will help you find your directions: Polaris, the north star. Allow a student to point out the Big Dipper with a light pointer, then show how to use the 'pointer stars' to find Polaris. Review the other directions and display the cardinal points.

B) One difference between stars and planets is that stars create light while planets merely reflect it. How might that look in the night sky? While students might think reflecting light would make planets dimmer than most stars, that's not the case with most of the planets [*all but Uranus and Neptune, which require a telescope to be seen*]. Remind them that most stars are much farther away from Earth than are the planets, and lead them to the fact that planets are often brighter in our night sky than stars.

C) Ask students to predict what they think are planets in the sky. Have three or four students use a LIGHT pointer to point to their predictions; each student can assign a name to his/her potential planet, or you can just name the planet after the student— .e., 'planet Joey.' [*Note: You may want to display and define the ecliptic to make success more probable.*]

D) Ask students how we'll figure out whether or not the candidates are planets. Remind students that a planet orbits a star: if we advance or regress in time, the potential planets should have different backgrounds than they do with the current setting. Make sure everyone remembers which 'planets' are being observed by pointing them out once more.

E) Move forward in time day by day until two or three months have passed [*or run several seconds of the annual motion script*]. Did the candidates move against the background of stars? If so, then they were in fact planets.

F) Assuming that at least one candidate was truly a planet, discuss which one it was, then turn on planet labels to highlight the other visible planets. Use the zoom function to take a closer look at each of the planets that are currently visible. [*NOTE: Stellarium, the software run by Digitalium™ systems, includes all solar system bodies under the heading planet. Labeling planets labels the sun, Earth's moon, Pluto, etc., as well as the eight official planets.*]

G) **OPTIONAL:** Use the images in the “Planet Tour” folder in the “Planets” directory on the Lesson Media DVD to discuss the planets in order.

### **III. Retrograde and Prograde Motion of Planets (10 minutes)**

A) Ask students in which direction the planets moved in the night sky.

Make sure planet labels are on, then move forward in time week by week so that students can observe planetary motion. Ask students in which direction the sun rises and in which it sets. Point out that planets usually do the opposite, though not always. When the planets are moving from west to east, it is called prograde motion. Retrograde motion, or the movement of a planet from east to west, occurs when Earth overtakes one of the outer planets in its orbit, or when one of the inner planets overtakes Earth in its orbit.

Position Mercury low in the west, then turn on planet trails and jump forward in time week by week until Mercury's trail makes a loop in the sky [*or run the annual motion script with planet trails and labels turned on*]. Emphasize that Mercury is simply rotating on its axis and orbiting the sun, just like Earth does, but that from our perspective, Mercury makes those loops in the sky.

B) Turn off planet trails but leave labels on. Jump forward in time day by day so that students can observe the motion of the stars as compared to that of the planets. Be sure to emphasize that Earth's rotation and revolution give us this changing view— the stars are not orbiting Earth.

C) **OPTIONAL:** Change your point of view to “Solar System Observer” using the Digitarium™ system's text menu; this will allow you to look down on the solar system [*you may need to change longitude and other settings to enable this view*]. Zoom in far enough to see the sun and the four innermost planets, then speed up time to show their orbits.

D) **OPTIONAL:** Show the slide of Ptolemy's arrangement of the earth, sun, and planets, and discuss how he explained retrograde motion.

E) Prepare students for exiting and regroup outside the dome.

#### **IV. Conclusion (5 to 10 minutes)**

A) **OPTIONAL:** If time allows, use four volunteers to model the reason we see retrograde motion. The volunteers will be the sun, Earth, Venus, and Jupiter. All planets should orbit the sun approximately as quickly as in the real sky (i.e., Jupiter taking the longest, Venus the shortest), and Earth should observe when s/he is passed by a planet or passes another planet.

B) When all are seated outside the planetarium, review how to find planets in the night sky. How can observing the sky for many nights in a row help you identify what are planets and what are stars? What else did they learn?