Planets Curriculum

3rd through 5th grades, 45 minutes

Notice

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Objectives

Students will learn:
- What a planet is;
- 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.bluebirdobs.org/observatorytools/pepercorn.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

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 be discussing some topics outside the planetarium, then going inside to learn more. Inside, students will observe tonight's sky as it will look at about ____ p.m./a.m. They will have the opportunity to point out what they think are planets in the night sky, test their ideas, 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. It took much longer for the other three to be noticed, as they require a telescope to be seen: Uranus was discovered in 1781, Neptune in 1846, and Pluto in 1930.****]*** Is Earth the only planet with a moon? ***[****No, the majority have moons; 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 'orbits' tells you about the planet, what 'reflects' means, etc.

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

1) Stars create their own light; planets simply reflect light.
2) Planets orbit stars; stars remain in virtually constant positions. ***[****Discuss proper motion and precession only with older, interested students.****]***
3) 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, darken the planetarium to let students better see the night sky.****]*** 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. Which star is that? Right, Polaris, also known as the north star. How will we find Polaris? ***[****Share the tip of finding the Big Dipper and using the 'pointer stars' to find Polaris. After finding Polaris, go over the other three* *directions in the night sky and bring up the cardinal points to help students remember which way is which.**]***

B) Outside the dome you covered the major differences between planets and stars. One difference was that stars create light while planets merely reflect it. How might that look in the night sky? How could you tell that something was reflecting light rather than making it? While students might think reflecting light would make planets dimmer than most stars, that's not the case with many of the planets ***[**all but Uranus, Neptune, and Pluto, 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. ***[**Mercury is not as bright as Mars, Venus, Jupiter, or Saturn, but it can be seen with the naked eye.**]***

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--i.e., 'planet Joey.' ***[**Note: the differences between stars and planets are not as obvious with the Digitarium Alpha projector as they are in the real night sky. You may want to display the ecliptic to make students' success more probable.**]***

D) Ask students how we'll figure out whether or not those things are planets. Lead them back to the idea that a planet orbits a star, so that means 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 week by week until two or three months have passed. Did the candidates move against the background of stars? If so, then they were in fact planets! If not, they were stars.

F) Assuming that at least one candidate was in fact a planet, discuss with students which one it is, then turn on the planet labels to highlight the other visible planets in the sky. Use the zoom function to take a closer look at each of the planets that are currently visible.

G) **OPTIONAL:** Use the images in the “Planet Tour” folder in the “Planets” directory on the lesson slides CD 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. ***[**You may hear from west to east, from east to west, or both.**]*** 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.

Make sure that Mercury is visible, then turn on planet trails and continue jumping forward in time week by week until Mercury's trail makes a loop in the sky. 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. If possible, briefly discuss how long a “year” lasts on Mercury ***[****be sure that students understand what you mean by a year—one trip around the sun—and how long one Earth year lasts****]***.

B) **OPTIONAL:** Show the slide of Ptolemy's arrangement of the earth, sun, and planets, and discuss how he explained retrograde motion. See the “ptolemaic_system” page for the diagram and an explanation of its parts.

C) Turn off planet trails but leave labels on. Speed up time 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. ***[****Note: It can take quite a while for the difference to become obvious. You may want to jump day by day rather than simply speeding up time.****]***

D) Prepare students for exiting the planetarium.

IV. Conclusion *(5 to 10 minutes)*

A) **OPTIONAL:** If time allows with older students, use four volunteers outside the dome to model the reason we see retrograde motion. One volunteer will be the sun, one Earth, one Venus, and one 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? How many of them believe they could find at least one planet in tonight's sky?