

NC STATE UNIVERSITY

Astronomy

Shoot for the Stars



Introduction

Welcome to Astronomy: Shoot for the Stars.

This publication was designed to meet the needs of our residential 4-H camps in North Carolina and was developed with an emphasis on youth discovering knowledge through experimentation. In particular the lessons in this publication allow for both daytime and nighttime activities.

This publication is a collaboration of the Science House located in the College of Physical and Mathematical Sciences and 4-H located in the College of Agriculture and Life Sciences. Funding for this publication was provided by a grant from the National Science Foundation. The publication was piloted during the summer of 2008 and changes made in accordance with evaluations.

Table of Contents



Space...

Keeps Going 4

Time...

Keeps Running..... 7

Sun...

Keeps Shining 10

Moon...

Keeps Turning..... 13

Constellations...

Keep Telling Stories 16

Space Travel...

Keep Dreaming 18

Day and Night...

Keep Switching 20

Seasons...

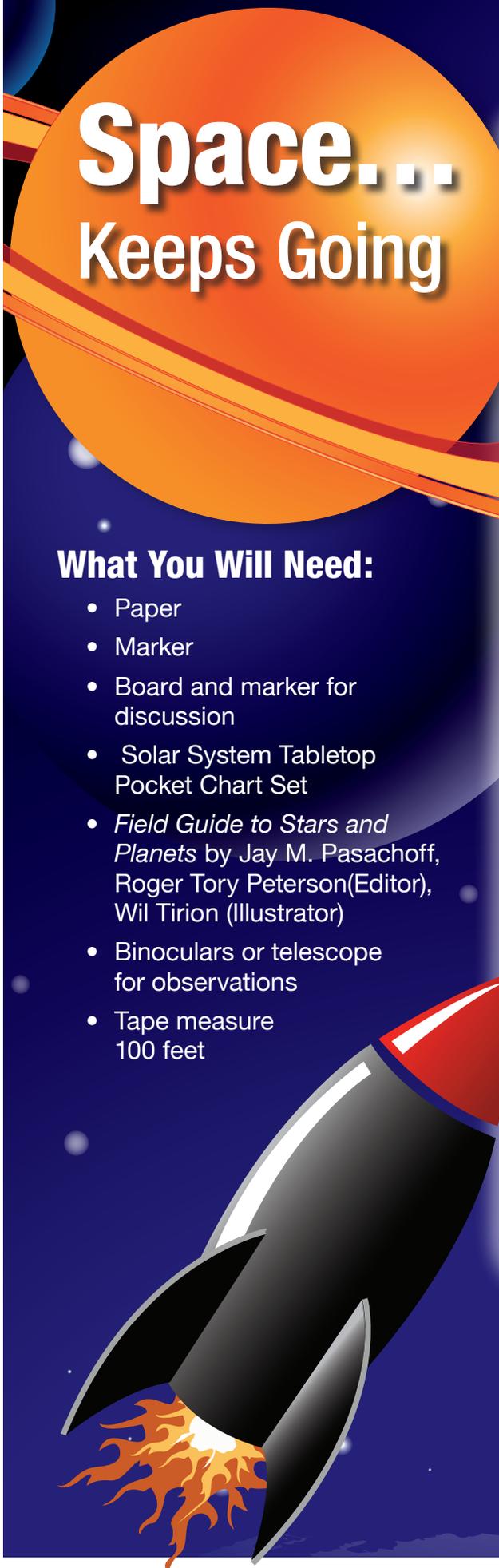
Keep Changing 22

Star Art...

Intro to Myths of Different Cultures 24

Flash Cards...

..... 26



Space... Keeps Going

What You Will Need:

- Paper
- Marker
- Board and marker for discussion
- Solar System Tabletop Pocket Chart Set
- *Field Guide to Stars and Planets* by Jay M. Pasachoff, Roger Tory Peterson(Editor), Wil Tirion (Illustrator)
- Binoculars or telescope for observations
- Tape measure 100 feet

Information You Need to Know:

“Space...the final frontier.” Most campers have formed their understanding of outer space based on popular movies. But during this session campers will explore the reality of our solar system. The planets are fellow wanderers of the Earth in the solar system. (As a matter of fact, the word *planet* comes from a Greek word meaning wanderer.) Many people, including scientists, have watched planets in the night sky. The planets can be seen at night not because they produce their own light like the sun or stars, but because they can reflect light. Some of the planets, such as Mercury, Venus, Mars, Jupiter, and Saturn, can even be seen without the aid of a telescope. Other planets—Neptune, Uranus, and Pluto—were discovered using the telescope and careful observations.

Astronomers have also discovered many other objects orbiting the sun such as asteroids. Several of these other astronomical bodies orbiting the sun are actually larger than Pluto. In 2006 the IAU, International Astronomical Union, established a clear definition for planets within our solar system. The IAU stated that a planet must orbit the sun, be shaped into a sphere by its own gravity, and use its gravity to remove the large pieces of debris from its orbit. Pluto does orbit the sun and is a sphere with its own gravity. But it has not cleared its orbit of large pieces of debris and since Pluto has failed the third requirement, it has been demoted to dwarf planet status. So now the planets within the solar system are divided into two groups, the terrestrial planets and the giant planets. The terrestrial planets are Mercury, Venus, Earth, and Mars. They are similar in size and composition to the Earth, whereas the giant planets (Jupiter, Saturn, Uranus, and Neptune) are much larger than the Earth, have a gaseous nature, and may have a small solid core.

The focus of this lesson will be on the solar system and understanding relative distances. At night, campers may use the star chart to locate the planets with the naked eye, binoculars, or telescope. The planets do not twinkle because they do not create their own light. Remember that the planets are each found within a different constellation of the zodiac. For example, Saturn is found in the constellation Leo. Not all of the planets are visible during summer, so consult a current star map for position. One is available at Google Earth and will be explained in the **What You Can Do with Campers** section.

Things You Will Be Able to Do:

- Define a planet
- Name the planets in our solar system
- Explore the characteristics of several planets
- Explore the relative distances for the planets
- Observe the planets at night (if conditions allow)

What You Can Do With Campers:

Identify the planets—Ask the campers to list the planets in our solar system. Brainstorm and compile descriptions of the planets. As a group, create a definition of the term *planet* based on those descriptions listed. Share what the term *planet* means. Explain that scientists went through this process in 2006, and share with the campers the IAU's definition. Explain why Pluto was demoted to a dwarf planet.

Race to Place the Planets—Ask the campers to choose a planet as their role. Students may make a nametag to identify them through the rest of the discussion. (Ask the group to arrange themselves in the correct order based on the questions. Examples of questions to ask:

- List the planets in order from largest in diameter to smallest.
Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, and Mercury
- List the planets in order from closest to the sun to farthest away.
Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune
- List the planets in order from largest in mass to smallest.
Jupiter, Saturn, Neptune, Uranus, Earth, Venus, Mars, and Mercury
- Which planets have rings?
Jupiter, Saturn, Uranus, and Neptune
- Which planets have moons?
Jupiter, Saturn, Uranus, Neptune, Earth, and Mars
- Which planet has the longest day? How long is it?
Mercury 4,222.6hr
- Which planet has the shortest day? How long is it?
Jupiter 9.9hr

You can use the metric planetary fact chart to answer questions and create new questions. (If needed, have the campers break into two sets of planets that will race to get in the correct order. Make it a game and keep score if you wish.)

An alternative to this activity is to use the Solar System Tabletop Pocket Chart Set. The set contains pictures of the planets and planet fact cards, which can be turned over and played like Concentration. (The cards can be matched up by the symbols in the corner of the cards.)

Metric Planetary Fact								
	MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE
Mass (1024kg)	0.330	4.87	5.97	0.642	1899	568	86.8	102
Diameter (km)	4879	12104	12756	6792	142,984	120,536	51,118	49,528
Gravity (m/s ²)	3.7	8.9	9.8	3.7	23.1	9.0	8.7	11.0
Length of Day (hours)	4222.6	2802.0	24.0	24.7	9.9	10.7	17.2	16.1
Distance from Sun (106 km)	57.9	108.2	149.6	227.9	778.6	1433.5	2872.5	4495.1
Orbital Period (days)	88.0	224.7	365.2	687.0	4331	10,747	30,589	59,800
Number of Moons	0	0	1	2	63	60	27	13
Ring System	No	No	No	No	Yes	Yes	Yes	Yes

Adapted from <http://nssdc.gsfc.nasa.gov/planetary/factsheet/index.html>

Night Activities:

Observe the planets—Use a current star chart and compass to identify the planets visible during the summer. Locate which constellation(s) the planet(s) are located within during this time of the year. Observe the differences between the stars and the planets. Consult Google Earth. Choose your present location on the Earth and then choose Sky view. This will allow you to see the current sky. Choose constellations and planets that you would like to view.

Glowing Solar System—Using the positions marked during the people solar system for the planets, place glow-in-the-dark painted planets at each location and enjoy a walk through space. During the walk through the solar system, the campers can hypothesize what planet will be visited next and why. They can also imagine what they would find on the other planets in the solar system.

What if...

These are some questions that you may want to let the campers explore or research.

Why was Pluto initially named a planet?

Scientists thought that there was a ninth planet and were looking for it. In 1930, a team of scientists found an object in the place where the planet was thought to be.

How do you think the definition of a planet will change in the future?

In preparation to be future scientists, the campers should brainstorm how the definition of a planet will change. Campers might consider how the planets will be observed differently. Will exploration of the planets change their classification? Will analysis of the planet composition change the definition?

How do the planets move in the sky?

The planets appear in the same general position during a night view. The motion of the planets can be observed over time to progress in general from west to east across the sky, but at times they appear to stop, move east to west, stop, and continue back west to east. (This apparent stop-backup-stop is once again seen over time, not in a single viewing.) This apparent motion occurs because the motion of the Earth and other planets around the sun and the planets positions relative to each other.

What You Can Do With Campers: (cont.)

Build a people solar system—Explore the relative position of the planets by creating a people solar system. To help the campers understand the position of the planets relative to each other, ask the campers to hypothesize how the planets will be placed, and have the campers try to place themselves in the positions that they think are correct. Ask the campers to share why they think they are in the right positions. Campers will need a large area to create the people solar system (approximately 100 feet). Provide each group of planets with their nametags and a ruler or measuring tape and their relative distance from the sun.

To find the relative distance from the sun, divide the distance of the planet by the distance of Mercury to the sun. The relative distances for the planets are as follows: Mercury-1, Venus-1.8, Earth-2.5, Mars-3.8, Jupiter-13, Saturn-24, Uranus-48, Neptune-76, and Pluto-100.

One person takes the position of the sun, and all distances are measured from the sun. Mercury is placed 1 foot from the sun. Venus is placed 1.8 feet from the sun. The Earth is placed 2.5 feet from the sun, and the other planets follow this pattern till the dwarf planet Pluto is in place 100 feet from the sun. Once the positions are marked, the nametags can be placed so that other campers can see the solar system that this group created. Also, if large groups are making several solar systems, consider having each group mark positions and compare them to see who marked correctly. If you want to do the activity in a building, adapt by using inches for the relative distance instead of feet. The whole solar system will fit in a 9 foot area.

The people solar system was adapted from the "Toilet Paper Solar System" from the Astronomical Society of the Pacific.

WORKS CONSULTED

Chippindale, Suzanne. "Toilet Paper Solar System" Astronomical Society of the Pacific. 27 Apr. 2008 <<http://161.58.115.79/education/family/materials/toiletpaper.pdf>>.

"planet." Encyclopædia Britannica. 2008. Encyclopædia Britannica Online. 27 Apr. 2008 <<http://nclive.lib.ncsu.edu:2221/eb/article-256233>>.

Williams, Dr. David R. "Planetary Fact Sheet-Metric." National Space Science Data Center. 29 November 2007. NASA. 27 Apr 2008 <<http://nssdc.gsfc.nasa.gov/planetary/factsheet/index.html>>

"The Retrograde Motion of Planets." ScienceU. 2007. Geometry Technologies. 2 Apr. 2009 <<http://www.scienceu.com/observatory/articles/retro/retro.html>>.

Credits

Prepared by:

Pam Lovin, Educational Consultant

Scott Ragan, Professional Development Coordinator,
The Science House

Dr. Ed Maxa, Associate Professor and Extension Specialist,
Department of 4-H Youth Development and
Family & Consumer Sciences

Graphic Layout:

Imp Designs, Raleigh, North Carolina



**College of Physical and
Mathematical Science**

COLLEGE OF
AGRICULTURE & LIFE SCIENCES
ACADEMICS • RESEARCH • EXTENSION

Distributed in furtherance of the acts of Congress of May 8 and June 30, 1914. North Carolina State University and North Carolina A&T State University commit themselves to positive action to secure equal opportunity regardless of race, color, creed, national origin, religion, sex, age, veteran's status, or disability. In addition, the two Universities welcome all persons without regard to sexual orientation. North Carolina State University, North Carolina A&T State University, U.S. Department of Agriculture, and local governments cooperating.

E08-50326
4H-472