Overview:

In this activity students think about the size and properties of the sun along with other stars then go on a star tour in Google Sky.

Objectives:

The student will:

- The student will:
- make a viewfinder to use as a tool for understanding size in relation to distance;
- observe that objects look smaller when they are far away; and
- recognize stars are like the sun, but so far away they look like points of light.

Targeted Alaska Grade Level Expectations:

Science

[3] SD4.1 The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by recognizing that objects appear smaller the farther away they are.

[4] SD4.1 The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by recognizing that stars are like the sun but are so far away that they look like points of light.

Vocabulary:

star – a large, spherical celestial body consisting of a mass of gas that is hot enough to sustain nuclear fusion and thus produce radiant energy. Stars begin their life cycle as clouds of gas and dust called nebulae and develop, through gravitation and accretion, into increasingly hot and dense protostars. Any of the celestial bodies visible to the naked eye at night as fixed, usually twinkling points of light, including binary and multiple star systems.

sun – a medium-sized, main-sequence star located in a spiral arm of the Milky Way galaxy, orbited by all of the planets and other bodies in our solar system and supplying the heat and light that sustain life on Earth. Its diameter is approximately 1.4 million km (868,000 mi), and its mass, about 330,000 times that of Earth, comprises more than 99 percent of the matter in the solar system. It has a temperature of some 16 million degrees C (27 million degrees F) at its core.

solar system - the sun together with nine planets, their moons, and all other bodies that orbit it, including asteroids, comets, meteoroids, and Kuiper belt objects. The Milky Way contains 12 stars known to have planets in orbit around them, though none is known to have as extensive or diverse a group of orbiting bodies as the sun's system.

relative – having meaning or significance only in relation to something; not absolute

A Closer Look:

The solar system consists of much more than just the sun and planets. It contains billions of other objects and extends far beyond the outermost planets. Several hundred thousand asteroids revolve around the sun in orbits mainly between Mars and Jupiter. Countless smaller meteoroids, including debris and fragments from the collision of larger bodies, are also present, some of which approach Earth's orbit closely enough to be known as near-Earth objects. In addition, as many as a billion objects, most the size of a speck of dust, cross through our atmosphere as meteors or micrometeoroids each day, though the vast majority are invisible to observers on the ground. Astronomers have recorded more than 800 comets passing through the inner part of the solar system. Billions more lie in the area surrounding the solar system, in the disk of debris known as the Kuiper belt and in the swarm of comets known as the Oort cloud. All of these objects orbit the sun at high speeds. Some orbits, like those of the planets near the sun, are almost circular. Other orbits, like those of comets that make their way in among the planets, are stretched out into long ellipses. As in most scientific fields, new discoveries are constantly changing our understanding and definitions. The objects in the Kuiper belt, for example, were

discovered in the 1990's. When the new planetarium at the American Museum of Natural History opened in 2000, many visitors were shocked to find that Pluto, long known as the ninth, outermost planet, had been demoted to a Kuiper belt object, causing considerable controversy.

Materials:

- Cardstock (1 piece per student)
- Scissors
- Rulers
- Lamp with a visible bulb (lamp shade removed)
- Sand (one grain)
- Meter stick or tape measure
- Overhead projector
- Computers with Google Earth downloaded (students can work individually or in pairs)
- VISUAL AID: "Relative Star Sizes"
- STUDENT WORKSHEET: "Star Scavenger Hunt in Google Sky"

Activity Preparation:

1. Gather rulers, scissors and cardstock for distribution.
2. Students will need to walk around freely during this lesson, so prepare the classroom accordingly, or move to a more spacious area, like the gym, for Activity Procedure steps 2-4. Turn on the lamp with a visible bulb, so that it has time to heat up before the activity (for steps 2-4).
3. Become familiar with Google Sky before asking students to do the worksheet.

Activity Procedure:

1. Ask students to make viewfinders. In this lesson, the viewfinder will be used to look at an object from close up, and then from far away. To make the viewfinders, first distribute a piece of cardstock to each student. Ask students to draw a rectangle in the middle using a ruler. Two sides should measure about 8 centimeters and the other two sides should measure about 5 centimeters. Measure from the outer edge inward toward the center. Draw the rectangle. Make a hole in the center of the rectangle and then make diagonal cuts to the edges to make it easier to cut out the rectangle. Cut out the rectangle.
2. Have the students hold the viewfinders straight out at arm's length, close one eye, and look through it. Ask students to take turns looking at the lamp through their viewfinders from close-up and from far away (at least twenty feet, more if possible). When they are close up, they should not touch the lamp. Ask them to write down what they observe in their science journals. Once everyone has had a chance to look, ask students what they noticed. How did the bulb look close-up compared to farther away? (Students should observe that the bulb looked larger close-up than it did from farther away.) Ask students if they noticed the heat from the bulb. What was the temperature difference close-up compared to farther away? (It was warmer the closer they were to the bulb.)
3. Ask students to imagine the light is our sun. Give each student a grain of sand. Tell them the grain of sand represents Earth. Have students take a guess at how far Earth is from the sun using this relative scale. Ask students to stand where they think Earth would be located if the bulb were the sun. Ask for a volunteer to hold one end of the tape measure at the "sun." Walk out 26 feet. Point out that relative to the size of the light bulb, Earth would be about the size of a grain of sand located about 26 feet away. Ask students why we can feel the warmth of the sun at this distance even though we can't feel the warmth from the light bulb. Explain that nuclear fusion at its core produces energy that rises to the surface and radiates outward toward the planets. The sun's core is about 16 million degrees C (27 million degrees F) and its surface is about 6,200 degrees C (11,200 degrees F), a lot hotter than the lamp. Point out that the light and heat from our sun are so strong that we can't see the rest of the stars during the day. Explain our sun is a star and that other stars are like our sun, but very, very far away. Some are smaller and some are larger than our sun.

4. Explain how the distances and sizes of stars are hard for people to grasp, because the numbers are so large we cannot imagine them. Talking about relative size helps us imagine the scale. Show the VISUAL AID: "Star Sizes" using the overhead projector.

Critical Thinking Activity. *Information Processing Method*.
5. Project the VISUAL AID: "Relative Star Sizes." Ask students to break into small groups to discuss how they interpret the image and how it relates to the topic the class has been studying. Ask students to write a paragraph in their science journals reacting to the image. Ask them to include three questions they would like to know the answers to. When students are finished writing, ask for volunteers to read their paragraphs out loud. If no one volunteers, ask how the images are organized (from smallest to largest, progressively larger). Ask, "If stars are like our sun, why do they look like points of light?"

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6. Hand out the STUDENT WORKSHEET: "Star Scavenger Hunt in Google Sky." Open the Google Earth application. From the selection bar at the top of the window, select the planet icon. From the drop down menu, select Sky. Ask students to "travel" to the stars to find the answers to the questions on the worksheet.

Extension Ideas:

1. Explain and explore the life of a star. Use the real examples and images in the "Life of a Star" tour in Google Sky. This can be a teacher presentation, or students can work individually or in pairs at a computer station that has Google Earth downloaded.
   a. Open the Google Earth application. From the selection bar at the top of the window, select the planet icon.
   b. From the drop down menu, select Sky.
   c. In the menu on the left hand side, select the Education Center menu to open it.
   d. From this menu, select (double-click) the "Life of a Star" tour. The application will move to the starting location for the tour.
   e. Open the icon marked with the green crude hand-drawn star labeled "Introduction." A window will open with some introductory information.
   f. To move to the next image, click on the double arrows on the top right hand side of the window. The application will move to a location in the night sky where an image of part of a star's life cycle has been captured.
   g. When the screen stops moving, open the image by clicking in the green star again.
   h. To move to the next image, follow the same steps again.
2. Do some research on the Internet. Find what constellation Sirius belongs to. Use the viewfinder to zero-in on areas of the night sky. Try to find Sirius, the brightest star in the sky.
3. To get a sense of how small a human is in the universe, find Han Solo's spaceship in Google Earth "Sky": "Han Solo Escapes" in Sky3d.

Answers:

STUDENT WORKSHEET: "Star Scavenger Hunt in Google Sky"

1. Sirius
2. 36.7 light years
3. Proxima Centauri
4. Answers will vary depending on the day and season: May 18, 2011: 8.4 minutes.

RELATIVE STAR SIZES

VISUAL AID

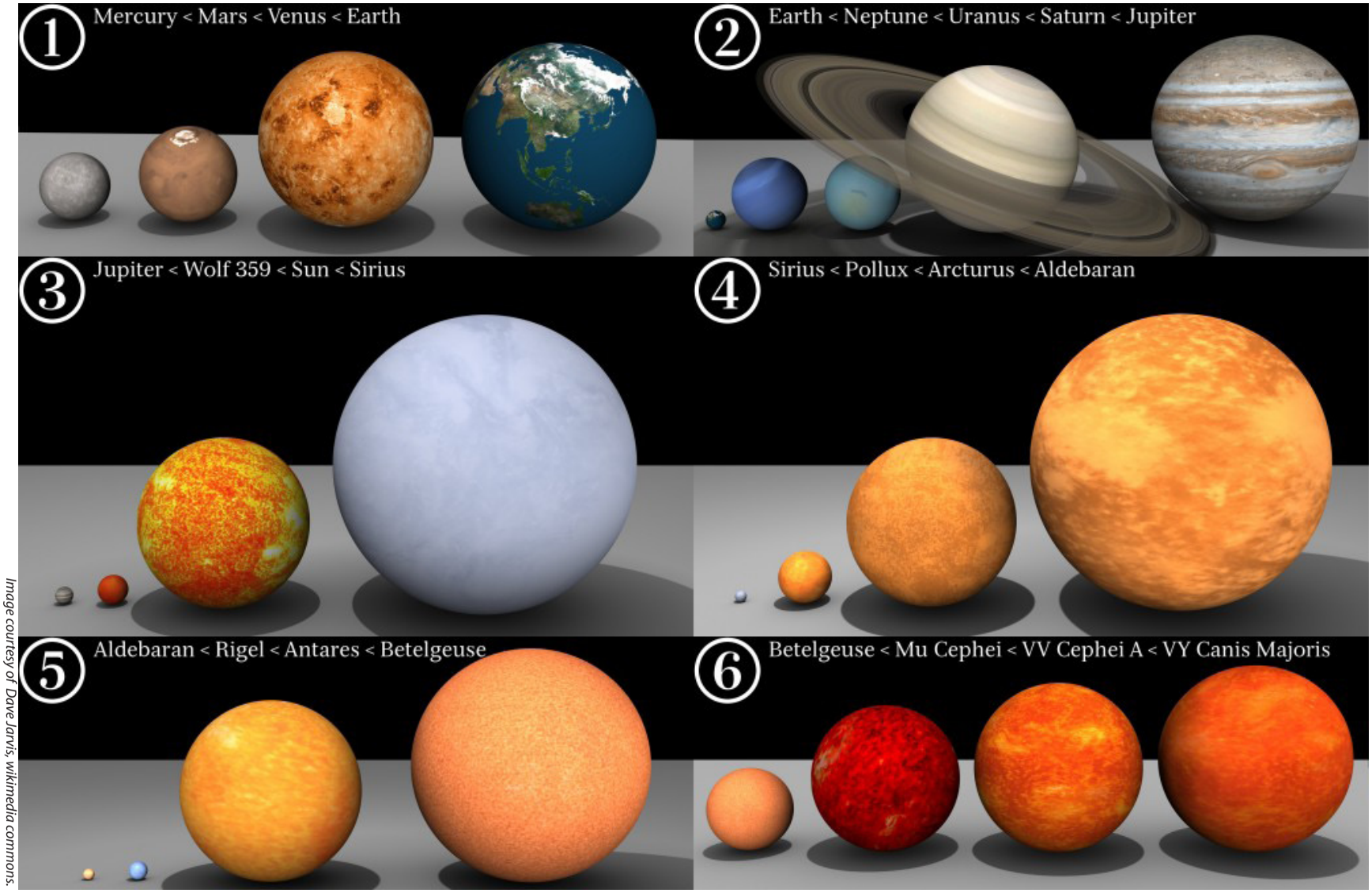

Image courtesy of Dave Jarvis, wikimedia commons.

NAME: _____ STUDENT WORKSHEET

STAR SCAVENGER HUNT IN GOOGLE SKY

Directions: Open the Google Earth application. From the selection bar at the top of the window, select the planet icon. From the drop down menu, select Sky. Make sure the "Education Center" menu is selected in the menu bar. Click open icons near the stars to access information about the stars. In the search finder, type the names of the following stars, one at a time to find answers to the questions below.

Stars: Arcturus, Sirius, Alpha Centauri, Sun

1. Which is the brightest star in the night sky?

   _____

2. How far away is Arcturus?

   _____

3. Which star is nearest to our sun?

   _____

4. How long does it take for light emitted from the Sun's surface to reach Earth?

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