DETROIT THE NEW Science CENTER

DASSAULT SYSTEMES PLANETARIUM

THE LITTLE STAR THAT COULD

Teacher's Resource Kit

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The Little Star That Could

Teacher's Resource Kit

Thank you for scheduling a field trip to the New Detroit Science Center and its newest facility, the Dassault Systèmes Planetarium. The Planetarium is a 50-foot wide tilted theater with 116 seats, room for 6 wheelchairs, and assisted listening devices for the hearing-impaired. Using advanced projection equipment, the Planetarium can create virtually any environment. You can be seated in the interior of a spacecraft, witness the birth of a star, stargaze at the night sky over Southeastern Michigan, or travel faster than light among the stars of the Milky Way galaxy.

About the Show

In this lively participatory program, characters come alive as the different colored stars of the nighttime sky and the planets of the Solar System are explored. During the show, the audience is introduced to Little Star a small yellow star in search for planets of his own to protect and warm. Along the way, he meets other stars, learns what makes each star special, and discovers that stars combine to form star clusters and galaxies. Eventually, he finds his planets and the students are introduced to each of his planets and learn some basic information about our Solar System

This show appropriate for

Grade Level(s): **1-3**
Program Length: **40minutes**

Michigan Content Standards and Benchmarks

More information can be found at the Michigan Department of Education website at:
http://cdp.mde.state.mi.us/MCF/ContentStandards/default.html

The Detroit Science Center and the Dassault Systèmes Planetarium are dedicated to assisting all educators in building and utilizing curricula based on the above-mention standards and benchmarks. Each of our school shows keep you and your students in mind. For ***The Little Star That Could****, the Standards & Benchmarks addressed include:*

Elementary School

Constructing New Scientific Knowledge I-1,5
Matter & Energy IV. 1-1,3,4; 2-1;3-1,2,4; 4-3,4
Solar System, Galaxy & Universe V. 4-1,2

Little Star

We welcome any suggestions, comments, or tips on the activities and resources in this kit, so we can improve these resources for you and your students in the Midwest and Ontario communities! Thanks again for choosing the New Detroit Science Center and the Dassault Systèmes Planetarium! Contact us @

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http://www.sciencedetroit.org/theaters/#Digidome

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Program Objectives:

Upon completion of this program, students will be able to:

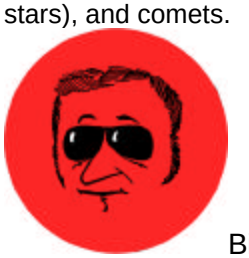
1) Explain that stars are just like the Sun, but are located very far away, so they appear small.
2) Explain why stars have different colors;
3) Explain which star color is hottest, and which star color is coolest;
4) Identify the names and order of planets in our solar system;
5) Understand that only certain types of stars are just the right size and temperature to support life on any of their planets;

Pre-visit Activities The Little Star That Could - Focus on Stars!

Questions for you and your students to ponder before your visit

Q: What can I see in the Sky?

A: In the daytime, you can see the Sun, the Moon (sometimes), clouds, birds, airplanes, and rainbows. On a clear night away from city lights you can see stars, the Milky Way, the Moon (sometimes), planets, meteors (called shooting stars), and comets.



Big Daddy

Q: What are stars, & how far are they?

A: Stars are suns, many times farther away from Earth than our star the Sun – also known as Sol. The Sun is at the center of the Solar System, with its light and heat warming the planets. The Sun's gravity keeps the planets orbiting around on a consistent basis. The Sun is approximately 93 million miles away, and a beam of light would take 8 and a third minutes to travel to the Earth.

The next nearest star, Proxima Centauri, is 24.3 trillion miles, or a beam of light would take four years, two months, and two weeks to reach Proxima. Many of the stars you can see in the night sky range from six light years to over one thousand six hundred light years away from you.

Q: Where are the stars during the daytime?

A. The Sun, our star, is so close to the Earth that it shines much brighter than all of the other stars. This hides the stars, until the Sun sets in the west. Then we can see the other stars in the sky, if it is clear. When it is cloudy, the clouds block everything in the sky from our view.

Q: Why do we see different stars and star pictures during the year?

A. Earth orbits the Sun once a year, constantly moving during the 365 and one-quarter days it takes to go around the Sun. As we circle the Sun, our view of the stars also changes a little bit every day. So stars seen in night in the winter are not seen during the summer

Q: Why do stars have different colors?

A: Stars have different colors because they have different temperatures. The different temperatures tell astronomers a lot about each of those stars in the night sky.

Mr. Blue-White Star

Q. What are shooting stars, & where do they go when they disappear?

A. Shooting stars are actually among the smallest particles orbiting the sun, and most are no larger than grains of sand. Scientists call these tiny dust and rock objects meteoroids while they are in orbit around the Sun. Many of these meteoroids are castoffs from comets melting as they travel close to the Sun.

Pearl, the White Star

As these meteoroids travel, they are sometimes pulled towards a planet by the force of the planet's gravity. When a meteoroid gets very close to the Earth, the meteoroid is pulled towards us by the Earth's gravity. They move fast, up to 128,000 miles per hour! They enter the Earth's air and rub against the air. This friction produces a lot of heat, up to 5000 degrees F! Have your students rub their hands together to produce heat from friction.. The meteoroid is now a meteor, or a shooting star. As the meteor falls and heats up, it begins to glow and

is sometimes visible from the surface of the earth. In many instances, the meteor melts on its way down towards the surface. The larger the meteor is, the brighter it appears in our nighttime sky. The intense heat melts almost all the meteors before they get close to the ground, and that is why a shooting star disappears from our view after a brief time. But if a meteor is heavier that one kilogram (about 2.2 pounds), there is a good chance that it will survive all the way to the ground. The meteor is now called a meteorite.

Sapphire, a blue star

Q. What is in the Solar System?

A. The Solar System refers to our system of one star (the Sun), nine planets, over 100 moons, over 5,000 asteroids, millions of comets, and uncounted bits of dust and rock (meteoroids). Astronomers have found other stars with planets, but our system of one star and nine planets is known as the Solar System.

Goldie, a gold star

The Solar System

Q. Where do the stars move?

A. The Earth spins towards the east, so the Sun appears to rise in the east and set in the west. In fact, nearly everything that we can see also rises in the east and sets in the west. Only the stars near the North Star, Polaris, travel in a circle. These northern stars never rise or set.

Q. What are constellations and who made them?

A. Constellations are imaginary pictures made up of stars visible from the Earth. All peoples on Earth devised these star pictures, which were invented to honor heroes (Hercules, Perseus, Andromeda); royalty (King Cepheus, Queen Cassiopeia; animals (Ursa Major and Minor, Leo, Scorpius, Canis Major) among others. Go out on a clear night, and make up your own constellations and stories for each.

The Old Timer

Q. Do the stars we see in the sky belong to the Milky Way galaxy?

A. Every star we see in the night sky belongs to the Milky Way, a collection of over 200 billion stars. While every star we see is a member of the Milky Way, there are many, many stars that we cannot see that also belong to the Milky Way galaxy.

The Milky Way from Earth by David Malin

Little Star Classroom Activity One – Compare the Sizes of Stars

From our view on the Earth, the stars we see in the night sky seem to be the same size, while at the same time we recognize the fact that some stars are brighter than others. In this activity, your students will compare some well-known bright stars in the sky for their size. This will be give your students a chance to compare stars up close, and to try to use reason to explain why some stars are brighter than others. The activity will conclude with you demonstrating the concept of near and far stars. The stars are not all the same distance from the earth. With a flashlight and your students at their desks, your students will experience the difference between near and far stars in our night sky.

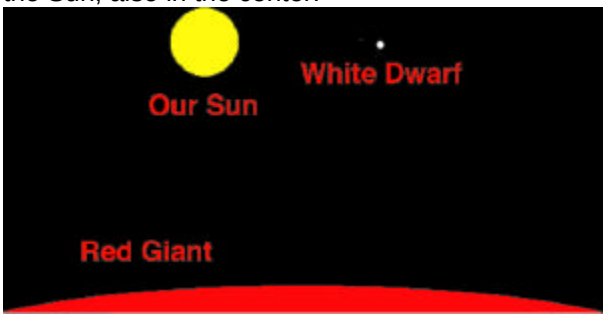
Most people do not realize that stars, just like humans, come in many different sizes. Study the following list to see just how large the difference can be. For the sake of this activity, assume that one solar diameter is 12 inches or 1 foot in size.

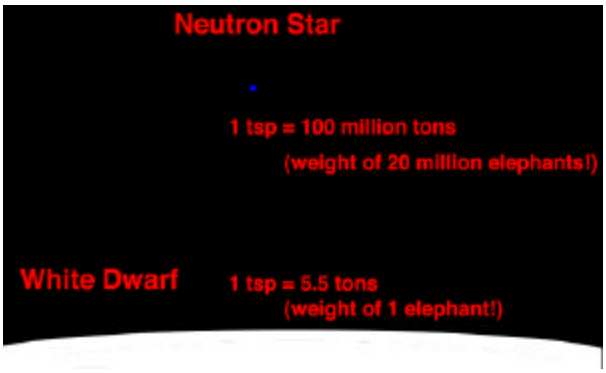
Star	Real Size	Model Size
Sun or Sol	**1 Solar Diameter**	**1 foot**
Rigel	**50 Solar Diameters**	**50 feet**
Betelgeuse	**550 Solar Diameters**	**550 feet**
Aldebaran	**36 Solar Diameters**	**36 feet**
Castor A	**2 Solar Diameters**	**2 feet**
Jupiter – Largest Planet	**0.1 Solar Diameters**	**1.2 inches**
White Dwarf	**0.01 Solar Diameters**	**0.12 inches**
Neutron Star	**0.00001 Solar Diameters**	**0.00012 inches**

Star size is measured by comparing it to our star, the Sun. The Sun has a size of 1 solar diameter. A star twice that big would have a size of 2 solar diameters. Because of the size of some stars, make your model flat instead of 3 dimensions. Paper is the best material to use.

Assemble a team of students to build each of the star models from the sun to the white dwarf, but exclude the neutron star and Betelgeuse, since these two are too small and too large respectively, to build easily. Please be available to assist any of your team if they have a question. For the largest stars, use butcher's paper, and use masking tape and apply it to the back of the paper to make a large enough piece for your model. A string cut to the length of the diameter of each star will help each of your teams build their star model. Using watercolors to paint the permit your students to give the proper color to their star.
For the largest star Betelgeuse, you will find it so large that you cannot make a model. You can describe how large it would be by comparing it to something familiar, such as a room or gym that is very large in your school. Use the length of the large room and divide it into the width of Betelgeuse. Your students will have an idea how many of the particular room you would need to equal the size of Betelgeuse.

To display your star models, request a location during the science fair next to a wall. Hang Rigel on the wall first, and then glue the other stars onto it. One idea is to place them all in the center, like the rings of a target. On a table in front of the other stars, have a second model of the Sun with another Jupiter on top of the Sun, also in the center.





Little Star Classroom Activities – Constellations

1. Class or group discussion about what a constellation is
2. Showing drawings of a few constellations
3. Having each child complete a dot-to-dot paper of two constellations
4.

Materials: For each student:

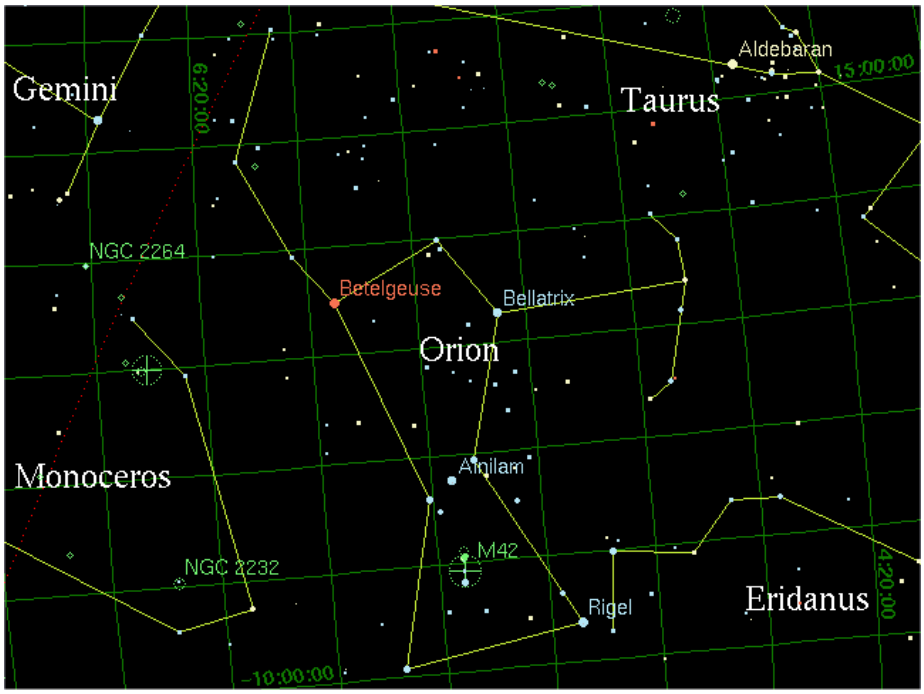
1. Worksheets (one copy of each included in this packet)
2. Dot-to-dot worksheet
3. Make Your Own Constellation worksheet
4. Pencil, crayon or marker

For lesson:

1. Pictures of constellations (a few included in this packet; can also use a book or sky map that shows them)

Procedure:

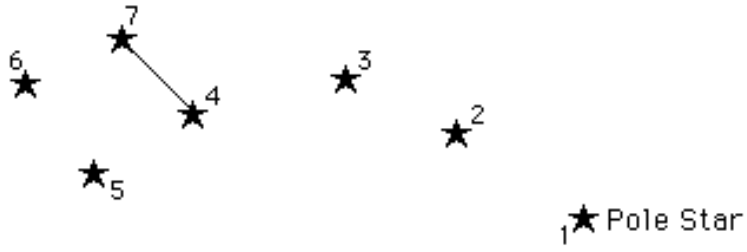
1. Explain that constellations are groups of stars that can be seen in the night sky. People draw imaginary lines between the stars to make pictures of animals, people or things. Each picture is a constellation. Some of the more famous constellations are The Big Dipper and Orion, the Hunter (or name the constellations you have pictures of). Show the children pictures or drawings of constellations.
2. You can continue by saying that there are many constellations in the sky, but you can't see all of them at once. Which constellations you will see depend on the time of year, time of night and where you are on the Earth.
3. The students can complete the dot-to-dot worksheet of The Little Dipper and Draco the Dragon, two constellations that can be found in our sky.
4. The students can complete the Make Your Own Constellation worksheet.



Name_____

Can you connect the stars in number order?

Make the Little Dipper.

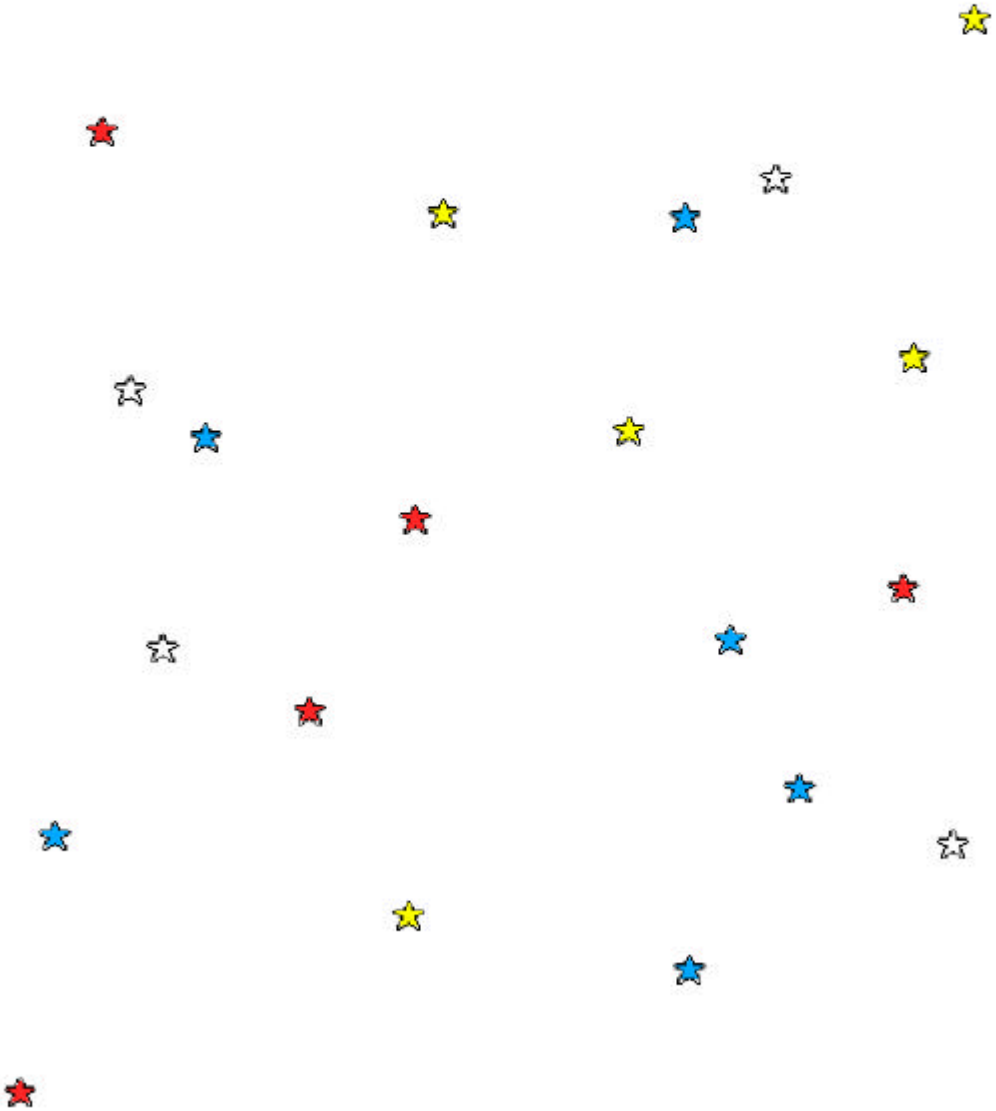


Make Draco, the Dragon.

Your Own Constellation worksheet

Name _____

You can make your own constellations.
Draw lines between some of these stars to make a picture.
What did you draw?
Can you give your constellation a name?
On the back, make up a story involving your constellation and share with your class



Teacher's Information Page on Star Colors
What do they mean to us?

Have you noticed that some stars look red, while most look whitish or bluish? If you haven't, go out one clear winter night and look at the constellation Orion. Betelgeuse is the bright **red** star at the top left corner, and Rigel is the bright **blue** star at the bottom right corner. You may want to use binoculars to see the colors more clearly.

The explanation for the colors of the stars is the same as why a stove burner turns red when you turn it on to the high position, or why the flame of a propane torch is **blue** in the center and red on the outside: the blue part of the flame is hotter than the **red** part. The stove burner turns **red** when you increase its temperature; if you could keep heating it, it would turn **blue**.

The temperature of the star determines its color. Blue stars are hotter than red stars.

In 1893, the German physicist Wilhelm Wien described the mathematical relationship between color and temperature. Color is associated with the wavelength of electromagnetic radiation, or light. Our eyes see the rainbow colors from blue to red. There are a lot more bands of light that our eyes can't see, like X-rays, ultraviolet, infrared, and radio waves. Wien discovered that the peak wavelength of radiation emitted by a body increases if the temperature decreases, and the peak wavelength decreases if the temperature increases. All bodies have a certain temperature associated with them. The temperature of the human body, about 97°F, emits light in the infrared. That's why policemen use infrared detectors to look for moving bodies in the dark. The stove burner looks like a dull black when it's not heated because it is emitting infrared light, which our eyes can't detect.

Astronomers take advantage of Wein's discovery to determine the temperature of stars. At their telescope they use an instrument called *photometer* to measure the colors of stars. A photometer consists of at least three filters, which allow only certain wavelengths of light to go through. Then they compare each neighboring wavelength band to determine which of the two is brighter and where the radiation peaks, and then they convert the color relationships to temperature.

Astronomers use another method to determine the temperature of the stars. Of course, different methods have to give the same result, so this is a way to check that the answers are correct. This second method uses the star's *spectrum*, which is the amount of light that the star gives off at every wavelength. Stars are mostly composed of hydrogen and helium, and traces of other chemical elements that absorb light. Different stars have different elements. The amount of light absorbed by the various elements, as seen in the spectrum, depends on the temperature of the star's outer layers. The coldest stars allow the formation of molecules, while the hottest stars strip the electrons off the atom to form ions.

The temperature of a star is determined by the mass it had when it formed and by its "growth" stage. In general, the more massive a star is, the hottest its surface. Stars have temperatures between about 2600 degrees Kelvin and 50,000 K. Our Sun has a surface temperature of 5780 K, which corresponds to a peak wavelength of 500 nm, a green-blue color (we see it yellow because of the Earth's atmosphere). Some stars, called white dwarfs, are the end of their lives and can reach temperatures of 100,000 K.

Astronomy & Space Exploration Web Sites

http://www.boonhill.net
Master Web Site for ***Michigan Astronomical Societies***, including the **Warren Astronomical Society** and the **Ford Amateur Astronomy Club**

http://www.nasa.gov
NASA HQ's Web Site. A great place to start your research!

http://www.jpl.nasa.gov/forum/indexpg.html
NASA's Jet Propulsion Laboratory (JPL) supplies a master list of web sites for astronomy and space exploration!

http://www.stsci.edu
Hubble Space Telescope
Web Site for the amazing orbiting telescope, with movies, pictures, and more!

http://amazing-space.stsci.edu/ -
Amazing Space a site with lots of Web-based activities designed for classroom use and for the general public.

http://www.spacekids.com/
spaceKids is SPACE.com web site for children o explore the Solar System, stars, the Milky Way galaxy, and the universe!

http://www.space.com/teachspace/index.html
TeachSpace delivers easy-to-teach space science lessons to upper-elementary and middle schoolteachers. We're launching with loads of teachable material, and we have much more in store

http://photojournal.jpl.nasa.gov
The Planetary Photojournal will provide you with easy access to the images from various Solar System exploration programs.

http://www.skyandtelescope.com
Web site for ***Sky and Telescope*** magazine, started in 1936. S&T is the oldest and longest running astronomy magazine in the US

http://www.astronomy.com
Astronomy Magazine, started in 1973, and is published by Kalmbach Publishing.

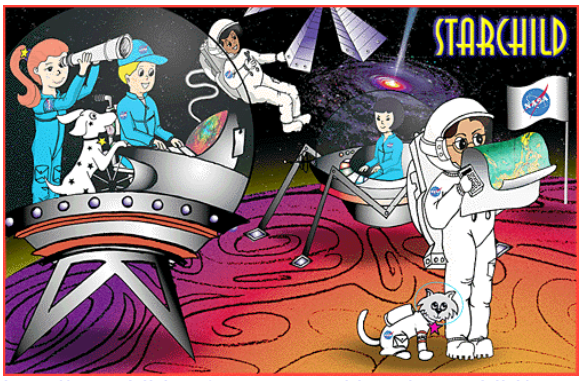
http://www.jpl.nasa.gov/cassini/Kids/
Cassini for Kids, a site just for kids where they can explore the beautiful ringed planet Saturn and learn about the spacecraft currently on their way there!

http://www.jpl.nasa.gov/galileo/education.html
Galileo K-12 Educator's Resources. The materials gathered in these pages are aimed at K-12 teachers and students for NASA's The Galileo mission to study Jupiter and its moons.

http://www.estec.esa.nl/outreach
The European Space Agency. The main education and outreach web site for ESA missions and activities.

http://www.astronomy.com/Content/static/parentsteachers/default.asp
Astronomy Magazine's web site for Parents and Teachers.

http://www.heavens-above.com
Heavens Above, an Astronomical web site with current sky maps, along with information on how to observe satellites from your backyard, including the International Space Station!



http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html
Starchild is a learning center for **Elementary age** astronomers.