DETROIT THE NEW Science CENTER

DASSAULT SYSTEMES

PLANETARIUM

SPRING SKIES

Teacher's Resource Kit

TABLE OF CONTENTS

SPRING SKIES

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 115 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.

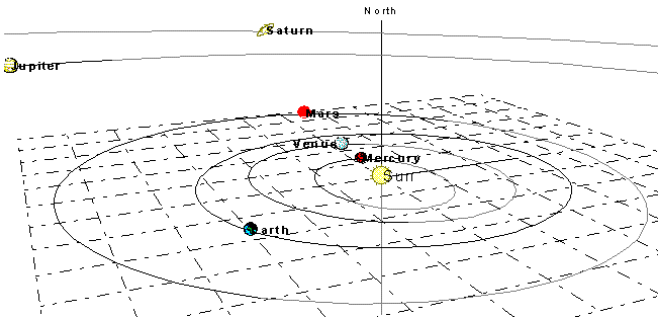
About the Show

Students will explore objects visible in the spring night skies with the assistance of the Planetarium presenter. We will look at the constellations of Leo the Lion, Coma Berenices, Virgo, Bootes the Guardian, Corona Borealis, and Hercules the Hero. The program will also feature the Moon, meteor showers, and the planets visible in the evening skies.

The presentation will concentrate on the current night skies over Southeastern Michigan, with tips on using stars in one constellation to find other constellations and planets that will be visible with the naked eye.

This show appropriate for

Grade Level(s): 3 - 12
Program Length: 45 minutes



Solar System Status – April 20, 2002

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* ***Spring Skies****, the Standards & Benchmarks addressed include:*

Elementary School

Matter & Energy IV. 1-1
Solar System, Galaxy and Universe V. 4-1,2

Middle School

Matter & Energy IV. 2-5
Waves & Vibrations IV. 4-4
Solar System, Galaxy & Universe V. 4-2,3

High School

Matter & Energy IV. 2-5
Waves & Vibrations IV. 4-4
Solar System, Galaxy & Universe V. 4-2,3

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 Southeastern Michigan community! Thanks again for choosing the 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) Identify the constellations visible during any night of the year;
2) Identify the constellations visible during the spring months;
3) Explain the difference between a star and a planet, and how to discover the nature of each;
4) Explain the nature of the moon's phases;
5) Explain perceived and actual movement of the Sun, Moon and stars across the sky;
6) Understand the limits of our knowledge of the universe.

Pre-visit Activities

Spring Skies-Focus on Astronomy Questions

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, rainbows, and sundogs. 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.

Q: Why does the Moon change shape and appear sometimes during the day or sometimes at night?

A: From any location on the Earth, the Moon appears to be a circular disk, which, at any specific time, is lighted to some degree by direct sunlight. Like the Earth, the Moon is a sphere, which always is lit by the Sun, with sunlight falling on one half of its surface. As the Moon orbits the Earth, the side that faces the Earth is lit by the Sun at different angles during its 29 and one half-day cycle. This gives the Moon the appearance of growing larger, then smaller as we see from the Earth. Although this cycle is a continuous process, there are eight distinct, traditionally recognized phases. The phases designate both the degree to which the Moon is illuminated and the geometric appearance of the illuminated part. These phases of the Moon, in the sequence of their occurrence are: a) New Moon (not visible); b) waxing crescent; c) 1st quarter moon; d) waxing gibbous); e) Full Moon; f) waning gibbous; g) 3rd quarter; and h) waning crescent The cycle stars over with the next New Moon.

Q. What are the planets?

A. Once thought to be gods, the planets (from the Ancient Greek word for wanderer) are worlds made of either solid matter (terrestrial or Earth-like) or Gas Giants (cloud planets consisting of hydrogen, helium and other gases). The terrestrial planets are Mercury, Venus, Earth and Mars; while the Gas Giants include Jupiter, Saturn, Uranus and Neptune. Pluto, while solid, is still unexplored and unknown.

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 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. 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 enters the Earth's air and rubs against the air particles. This friction produces a lot of heat. The meteoroid is now a meteor, what many call a shooting star. As the meteor moves 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. Rocks from space such as our example meteorite are valued by many cultures around our home planet.

Q. How do you tell which is a planet and which is a star?

A. You can tell a planet from a star by watching the object and its location among the stars every clear night. Stars do not appear to change position with respect to each other, while a planet will move among the stationary stars over the passing of time. The further a planet is from the Sun, the slower it will move in the sky.

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 discovered other stars with planets, but this system of the Sun and nine planets is known as the Solar System.

Q. What is outside the Solar System?

A. The Solar System is part of a collection of stars that are in a galaxy that we call the Milky Way. The stars that we can see all belong to a small part of our galaxy, and our ancestors organized the stars into pictures that we call constellations.

Q: What are stars, and how far are they from Earth?

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, or 149,637,000 kilometers, from Earth. The next nearest star – Proxima Centauri, is 24.3 trillion miles, or 41.1 trillion kilometers, from Earth. It would take a beam of light 4 years, 2 months, and two weeks to reach Proxima. Many of the stars you can see in the night sky range from six to over one thousand six hundred light years away from you.

Q: Why do we see some stars anytime during the year, but other stars are only seen during one or two seasons?

A: From our location on the Earth, the sky appears to be an invisible sphere or ball, with the stars attached to this sphere. The sphere appears to spin once every day, with the stars moving from the left to the right. Anyone watching the stars at night over several hours will see this slow drifting, with stars appearing to rise out of the East, and appearing to set in the West. Only the stars in the Northern sky move differently, circling around a star named Polaris. Located in a spot in the sky that Earth's North Pole is pointing towards, Polaris the North Star appears to be the anchor around which all other Northern stars spin.

Earth orbits the Sun once a year, traveling each of the 365 days it takes to complete each orbit. 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 seen close to the Sun in daytime during each summer. Only the stars near the North Star are visible during anytime during the year.

Q. Who gave the stars their names?

A. All of the stars that have names (over 300) were names between 500 and over 2000 year ago. Most of the star names in use today came from Arabic names. The names we use today remind us of the debt we owe to the Islamic astronomers and culture.

Q. What are constellations-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, Andromeda); royalty (Queen Cassiopeia); animals (Ursa Major and Minor, Leo, Scorpius) among others. Go out on a clear night, and make up your own constellations and stories for each.

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. It's a collection of over 200 billion stars organized in a pinwheel shape, which astronomers call a spiral galaxy. We call our galaxy the Milky Way because of its appearance. Out in the countryside, the many stars that are too far away for us to see as individual stars appear to combine into a glowing light similar to a river of milk running across our night time sky.

Q. What is outside the Milky Way?

A. The Milky Way is one of 30 galaxies that are together in space. Some are spiral, like the Great Andromeda Galaxy, while others are odd shaped, and are called irregular galaxies. Astronomers call this the Local Group. The Local Group is part of a cluster of many galaxies called the Virgo Cluster, for its location in the direction of the constellation of Virgo

Q. How many stars are in the Universe?

A. Astronomers estimate that there are so many stars in the Universe that we really cannot count them.

Q. How big is the Universe?

A. The universe is so vast that starlight from the most distant stars, traveling over 186,282 miles every second, would take over 13 billion years to reach us on the Earth.

M104-Sombrero Galaxy –Virgo
Courtesy NOAO/AURA/NSF

Post Visit Activities
How to Use a Star Map!

Just as people make and use maps to find their way around your town, city, state or country, astronomers use maps to find their way across the starry skies. Simple maps are available for no charge over the Internet. Teaching yourself and your students how to find objects in the night sky by using the enclosed star map is a skill that can last a lifetime.

You can get a map for the skies over southeastern Michigan by going to… .

Heavens Above www.heavens-above.com.

Start by registering as a user for free, and the web site will help you choose the right location. Once there, look down to the Astronomy section, and select Whole Sky Chart. Once there, be sure to check the bottom of the page and select a current date and time during the evening hours. Be sure to select the black and white version, so it will be easy to read. Now all you need is your trusty star map and a flashlight with fresh batteries and a clear sky.

Start by folding your sky map in half, with the map on the outside of the fold. Make sure the fold is across the east and the west. Hold the map with North at the bottom of the page. The stars and constellations on the page will match up with your view of the night sky. Start by looking for the best known of all the star pictures – the Big Dipper. Look for four bright stars that make up the cup or bowl, and the three stars attached to the back of the bowl forming the curved handle.

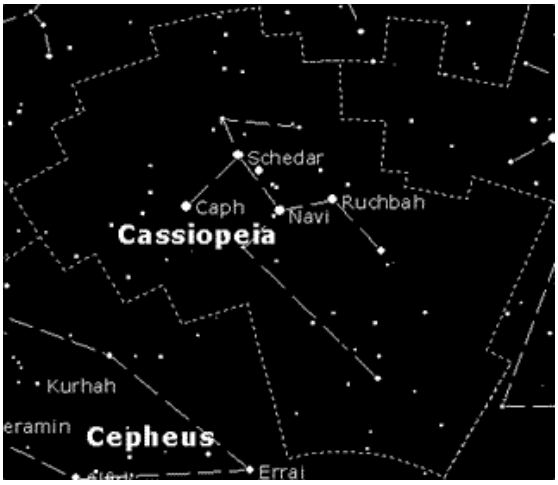
Please note that the Big Dipper is not a constellation. It is a popular star grouping, but it belongs to the constellation of Ursa Major, the Great Bear.

After you find the Big Dipper's bowl or cup, look for the two stars at the end of the bowl. Known as the Pointer Stars, draw a line through these stars away from the bottom of the cup. See below.

The Pointer Stars lead you to Polaris, which also is known as the North Star. Using stars to find other stars is called ***star hopping*** by astronomers.

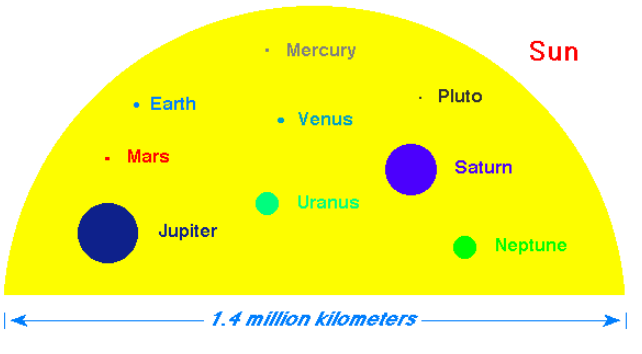
The North Star is part of another constellation, Ursa Minor, the Lesser Bear. Better known as the Little Dipper, it starts with Polaris as the tip of the handle, and finishes with two stars at the end of the cup named Kochab (pronounce as ko-chab) and Pherkad (pronounce fer-cad.)

Continue the line from the Pointer stars of the Big Dipper, past Polaris, on to what looks like a lazy M or W in the sky. This is the Queen Cassiopeia, another northern constellation.



Cassiopeia is very close to the Little Dipper; and along with the Big Dipper all three are known as circumpolar constellations. Circumpolar means that these constellations circles around the North Star Polaris. This rotation also means that the Big Bear, Little Bear, and Cassiopeia never leave the skies over the northern half of earth. They are visible to northern hemisphere skywatchers in winter, spring, summer and autumn.

For each of the other directions, you will turn the map so that direction is at the bottom of the page. Remember to refold the map, east to west for looking to the north or south, while folding across north and south to observe the eastern or western skies.



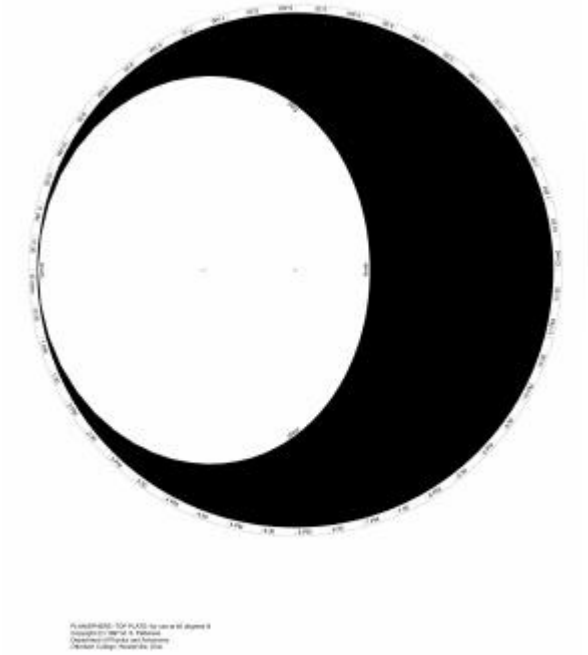
Meteor Shower – Looking at the Center

M51-Whirlpool Galaxy – Near Big Dipper

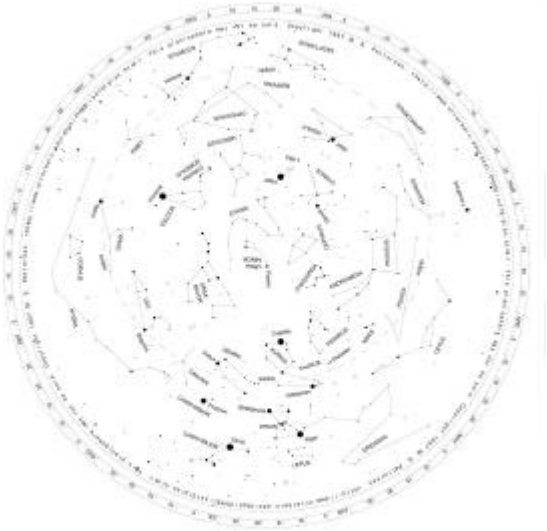
Build a Planisphere

A Planisphere is a star map that can be set to any time and date during the year. This kit has two sheets for the construction of a Planisphere. The sheet marked as the "top" is to be copied onto a clear plastic transparency. This permits the user to see through to the bottom sheet, which has the stars and constellations. The transparency also acts as a water resistant shield for the Planisphere. The bottom sheet is to be copied onto a heavier weight paper. After copying the top and bottom sections, cut around the outer circle for each sheet. Please keep the numbered edge on each sheet.

Place the transparency above the bottom sheet and press a pin through the top transparency at the black dot between the Z (Zenith) and the direction North.



Copy this image onto a transparency. This is the Top Page.



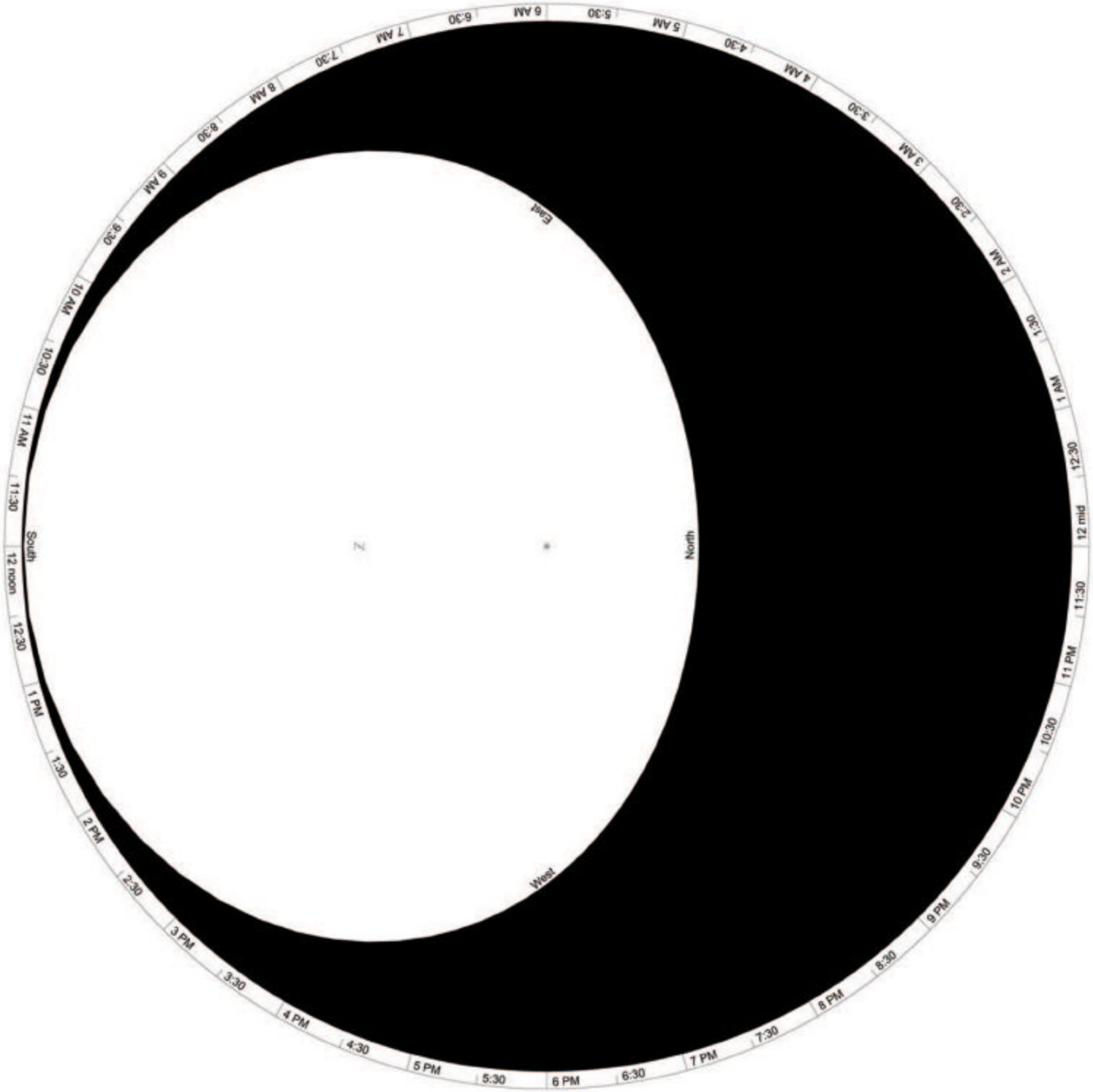
This is the Bottom Page. Copy this onto a heavier stock of paper for more strength

Press the pin through the bottom paper at the dot near to Polaris, the North Star. You're done!

Once you have finished building your Planisphere, it is time to practice using it. The outer edges of the two sheets have markings for times of the day, and the dates of the year. The top has the times of the day in half-hour segments. The bottom has the dates and months.

To set the Planisphere, find a time you want to see on the top. Now locate the date on the bottom sheet and move the time to that date. The stars and constellations that appear in the window are the ones that are up in the sky for that time and date!
Now, let us see how good you are…try these times and dates. If you are using the Planisphere correctly, you will find a surprise in your answers!

December 25th at 12:00 AM, then June 25th at 12:00 PM. Also try June 25th at 12:00 AM, then December 25th at 12:00 PM
Notice that you see the same stars at nighttime and daytime, if you look 6 months apart!



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PLANISPHERE--BOTTOM PLATE

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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!

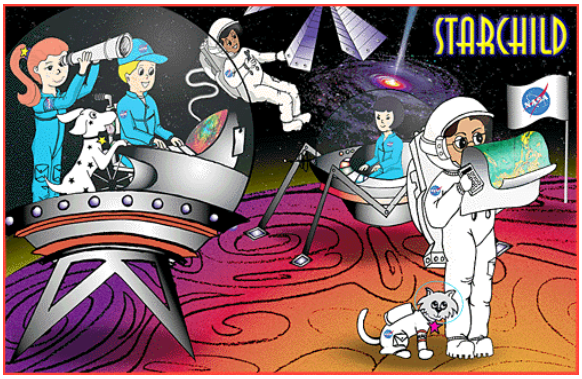
http://www.stsci.edu - ***Hubble Space Telescope*** (HST) HQ. Movies & pictures!

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://origins.stsci.edu **- *The Origins Program*** studies events starting at the birth of the universe in the Big Bang, the forming of galaxies, stars, & planets, & the start of life on Earth and possibly elsewhere.

http://www.stsci.edu/exined - Welcome to ***Education, Please*** stop and take a look at our latest electronic offerings of Macintosh, Windows, and DOS software available for downloading!

http://photojournal.jpl.nasa.gov @ NASA's Jet Propulsion Laboratory (JPL) - ***The Planetary Photojournal*** will provide you with easy access to the images from various Solar System exploration programs.



http://imagine.gsfc.nasa.gov/docs/homepage.html ***Go Imagine the Universe*** is a learning center for **high school students** 14 years and up.

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

http://www.skypub.com - Home 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 @ ***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, a free web site with current sky maps for your home, and information on how to observe satellites over your house, including the International Space Station.