DETROIT THE NEW Science CENTER

DASSAULT SYSTEMES PLANETARIUM

VIEWS OF THE UNIVERSE

Teacher's Resource Kit

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Views of the Universe

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.

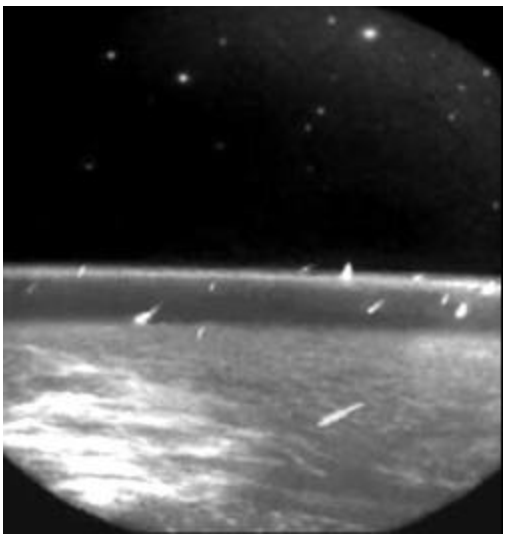
About the Show

Views of the Universe will take you on a virtual journey, visiting planets of our Solar System, probing into large clouds of gas and dust in space called nebulae (nebula in singular), exploring the life and death of stars, plummet into a black hole (singularity), and more. This show is a great introduction to the science of astronomy and the hobby of stargazing for any age.

The presentation will conclude with a guided tour of the current night skies over Southeastern Michigan, including what planets, stars, and other celestial objects will be visible from your backyard.

This show is appropriate for

Grade Level(s): **4 - 12**
Program Length: **45 minutes**



Leonid Meteor Shower – from Earth orbit

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-mentioned standards and benchmarks. Each of our school shows keep you and your students in mind. For* **Views of the Universe**, *the Standards & Benchmarks addressed include:*

Elementary School

Constructing New Scientific Knowledge I, 1-5
Reflecting on Scientific Knowledge II 1-1
Solar System, Galaxy and Universe V. 4-1,2

Middle School

Constructing New Scientific Knowledge I, 1
Reflecting on Scientific Knowledge II 1-1&3
Solar System, Galaxy & Universe V. 4-1,2,3,5,6

High School

Constructing New Scientific Knowledge I, 1,2,3
Reflecting on Scientific Knowledge II 1-2,3
Solar System, Galaxy & Universe V. 4-1,2,3,5,6

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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Program Objectives:
Upon completion, students will be able to:
1) Identify the different types of objects visible in the night sky; such as stars, planets, and constellations;
2) Explain the differences between planets and stars;
3) Understand the spatial relationships between the objects in our Solar System and other objects in the Universe,
4)Understand the limits of our knowledge of our and other solar systems.

Pre-visit Activities Views of the Universe - 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 other atmospheric effects. On a clear night away from city lights, you can see stars, the Milky Way, the Moon (sometimes), planets, meteors (commonly called shooting stars), and comets.

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

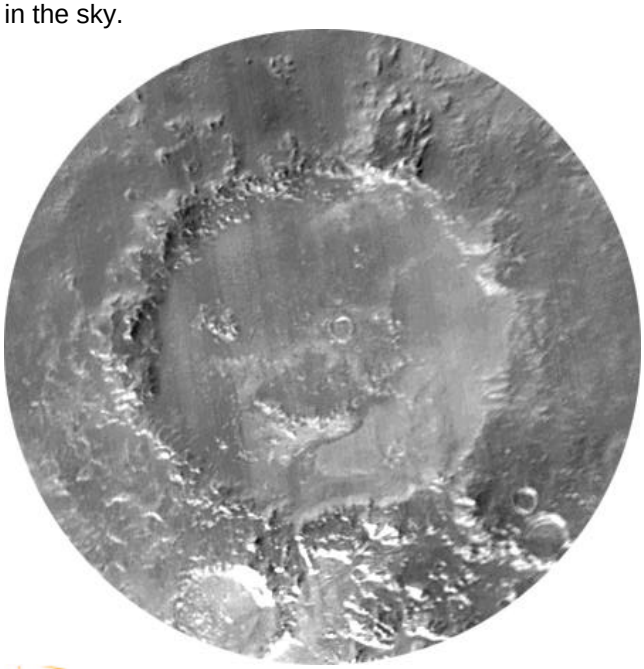
A: From any location on the Earth, the Moon appears to be a circular disk, which, at any specific time, is lighted to some degree by direct sunlight. Like the Earth, the Moon is a sphere, which always is lit by the Sun, with sunlight falling on one half of its surface. As the Moon orbits the Earth, the 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. How do you tell which is a planet and which is a stars?

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 days and weeks. The further the planet is from the Sun, the slower it will move in the sky.



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. 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?

A. Stars are suns that are so far away that they look like tiny points of the light in the night sky. In reality, some stars are so huge that they would be 700 times larger than our Sun.

Q. Why do stars move?

A. All of the objects we see in the sky move in a number of directions. The rising and setting of the Sun and the stars in the night sky are caused by the Earth's spinning, or rotation, once a day. From our view on Earth, the whole sky moves.

Q. Who gave the stars their names?

A. All of the stars that have names (about 300 of them) were named between 500 and over 2000 years ago. Most of the star names in use today came from Arabic names. The IAU (International Astronomical Union) name stars by their coordinates or location in the sky. NTTS 045251+3016 is one example.

Q. What are constellations and who made them?

A. Constellations are imaginary connect the dot pictures made up of stars visible from Earth. All cultures invented star pictures, which were named to honor heroes (Hercules, Andromeda); royalty (Queen Cassiopeia); animals (Ursa Major and Minor, Leo, Scorpius, Canis Major) and others. Go out on a clear night, and make up your own constellations and stories.

Q. Do the stars we see in the sky belong to the Milky Way galaxy? Why do we call it the Milky Way?

A. Every star you can see in the sky is part of the Milky Way galaxy, a collection of over 200 billion stars. It is in a pinwheel shape, which astronomers call a spiral galaxy. We call our galaxy the Milky Way because of how it looks from Earth with just our eyes. The many stars that are too small and far away to be seen with our eyes as individual stars; appear to gather their light to form of a river of milk running across the evening country sky. City lights prevent us from seeing it in our cities.

Q. What is outside the Milky Way?

A. The Milky Way is one of over 30 local 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 collection the Local Group. Many more galaxies are outside this neighborhood of local galaxies.

Q. How many stars are in the Universe?

A. There are too many stars to count!

Q. How old is the Universe?

A. Astronomers think the Universe is over 13 billion years old, give or take a billion or two. The Solar System is approximately four and one half billion years old by most estimates.

Q. How big is the Universe?

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

Triangulum Galaxy M33 courtesy Tony & Daphne Hallas @ http://www.astrophoto.com

Post - Visit Activities
How to Use a Star Map!

Just as people make and use maps to find their way around a 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 a 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.

On the main web page register as a user for free, and the web site will help you choose the right location. Once this is done, you will be directed to your home page. Now look down to the fourth section, listed as Astronomy. Click on Whole sky chart. Once there, be sure to look at 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, a flashlight with fresh batteries and a clear sky.

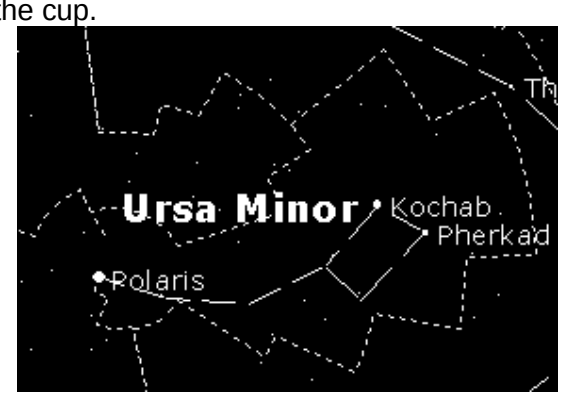
Start by folding your sky map in half, with the map on the outside of the fold. Make sure the fold is from East to West. Hold the map with North at the bottom of the page. The stars and constellations on the page will match up with your view of the night sky. Start by looking for the best known of all the star pictures – the Big Dipper. Look for four bright stars that make up the cup, 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, Latin for Great Bear.

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

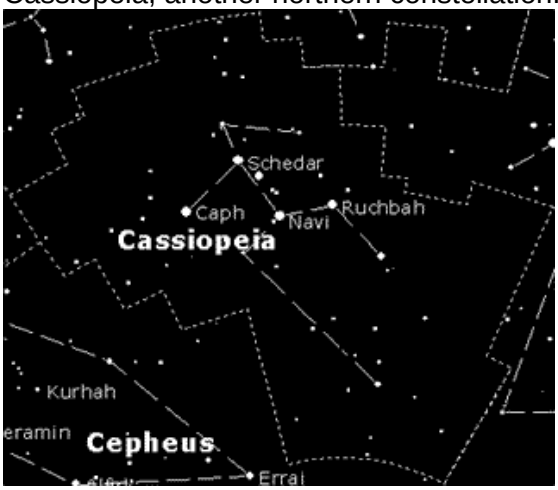
The Pointer Stars lead you to Polaris, which also is known as the North Star. Using one set of stars to find other stars is called ***star hopping*** by astronomers.

The North Star is part of another constellation, Ursa Minor, the Lesser Bear. Better known as the Little Dipper, it starts with Polaris at 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 as fer cad) at the end of the cup.



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 Queen Cassiopeia, another northern constellation.



Cassiopeia is very close to the Little Dipper; and, along with the Big Dipper, all three are called circumpolar constellations. Circumpolar means that these constellations circle 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 you face is at the bottom of the page. Remember to refold the map, East to West for looking at either the North or South, while folding across from North and South to observe the eastern or western skies.

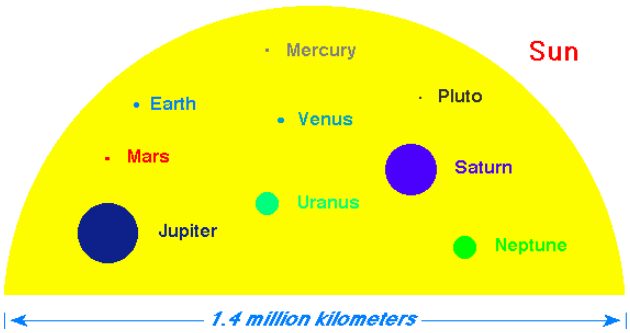


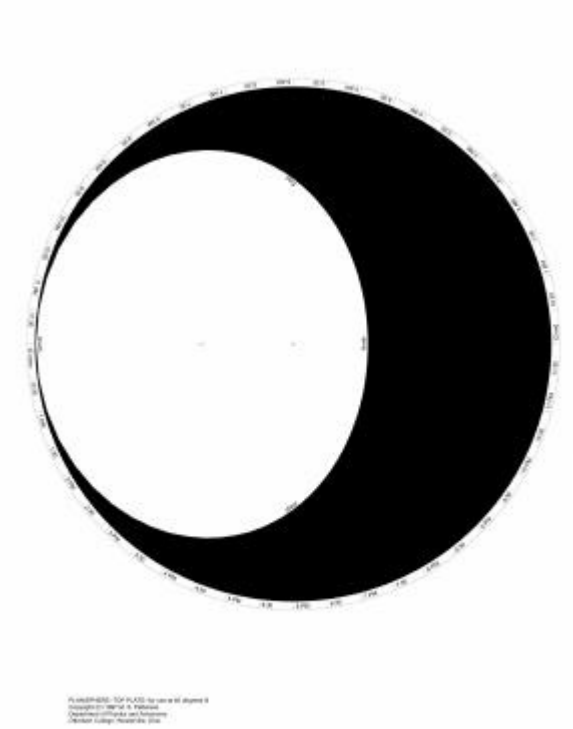
Illustration of a bright Meteor Shower

M31-The Great Andromeda Galaxy by Tony and Daphne Hallas See more @ http://www.astrophoto.com

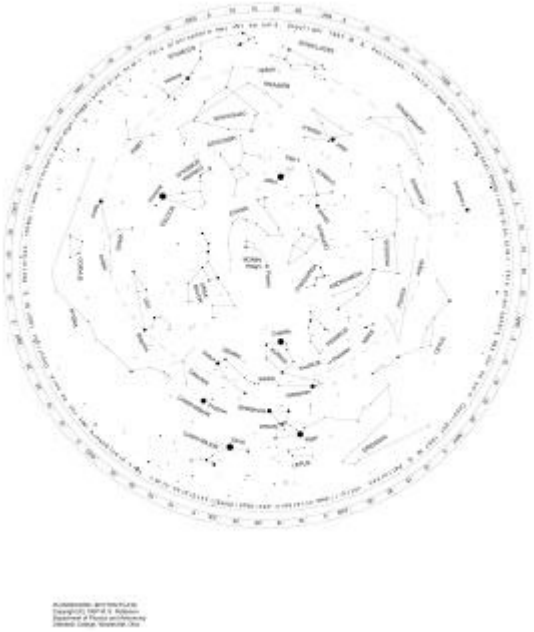
Build a Planisphere

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.



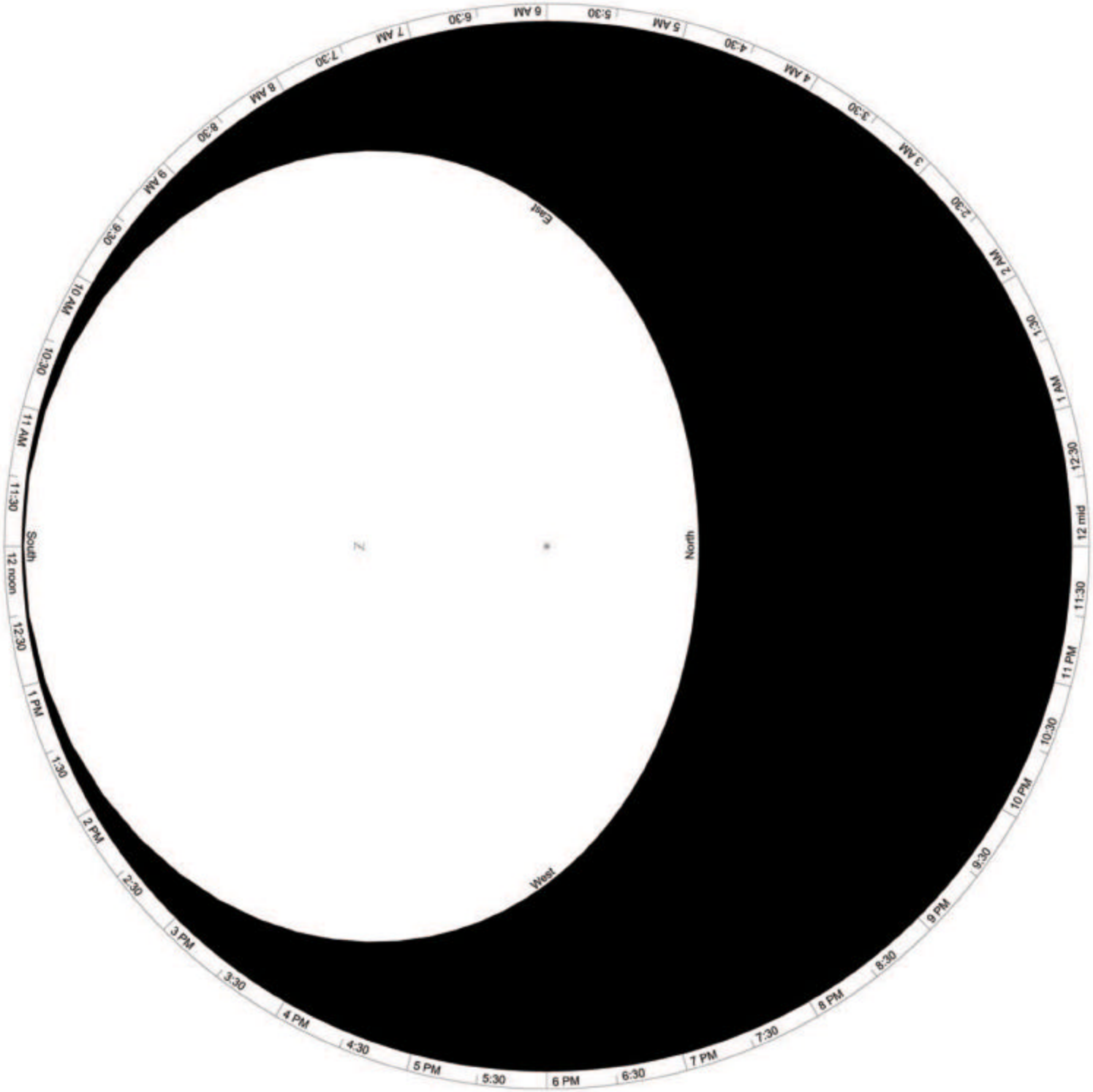
This is the Bottom Page. Copy this onto a heavier stock of paper for more strength

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 local astronomical Societies, including **Metro Detroit's Warren Astronomical Society** & **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) Headquarters-Pictures and movies of the universe!

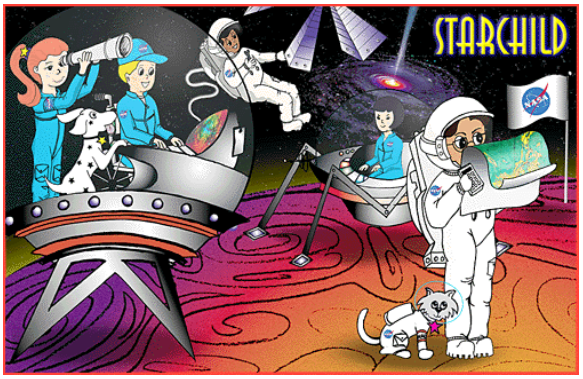
http://amazing-space.stsci.edu/ **-** ***Amazing Space*** a site with lots of Web-based activities designed for classroom use and for the general public.

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)** ***Planetary Photojournal*** will provide you with easy access to the images from various Solar System exploration programs.

http://www.heavens-above.com **Heavens Above** provides current sky maps and when you can see satellites such as the International Space Station!



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.skyandtelescope.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. It 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 (ESA)*** 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