DETROIT THE NEW Science CENTER

DASSAULT SYSTEMES

PLANETARIUM

Teacher's Resource Kit

TABLE OF CONTENTS

WSKY-Radio Station To The Stars
Teacher's Resource Kit

Introduction to the Dassault Systèmes Planetarium

Thank you for scheduling a field trip to the New Detroit Science Center and the Dassault Systèmes Planetarium. The Planetarium is a 50-foot wide theater, featuring 116 seats with room for 6 wheelchairs and assisted listening devices for the hearing-impaired. The Planetarium can transform into the interior of a spacecraft, transporting you to witness the birth of a star, or explore the heavens above as you take a personal tour of the night sky over Southeastern Michigan.

Information about the Show

Join cosmic DJs Moondog Matt Midnight and Stella Sunspot as they present a totally spaced out show that explores the Universe. Visitors will experience talk radio of the future as Dr. Cosmos answers questions on everything from shooting stars to black holes. Throw in a crazy traffic report, wacky weather forecast, with a couple of chart topping tunes and you'll catch yourself cruising the cosmos.

This show appropriate for

Grade Level(s):	3-12
Program Length:	40 minutes

Michigan Curriculum Benchmarks

WSKY-Radio Station of The Stars fulfills the following benchmarks:

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

Program Objectives:

Upon completing this program, students will be able to:

1. Describe how many cultures were curious about the night sky;
2. Describe what a constellation is, and name one mentioned in the show.
3. Explain the life cycles of stars from their birth to their death;
4. Identify the planets of the Solar System;
5. Describe what places in space humans have visited.

The New 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.

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! Thanks again for choosing the New Detroit Science Center and the Dassault Systèmes Planetarium!

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Pre-visit Activities: WSKY Q & A

Questions to discuss before your visit.

Q: How many of the planets of the Solar System can I see without a telescope?

A: In all, 5 of the nine planets in our solar system can be seen in your backyard with the aid of a telescope or binoculars. Mercury, the closest planet to the Sun, is the hardest to see. Mercury never wanders very far from the brilliant light of the Sun. Venus, 2nd closest planet, is the brightest planet by far. Venus does move a little farther away from the sun, but can only be seen before sunrise or after sunset. Mars, Jupiter, and Saturn can be easily found, if they are not near the sun as seen from the earth. Check out web sites such as skyandtelescope.com or heavens-above.com for assistance in finding the visible planets in your night sky

Q: Where did the planets' names come from?

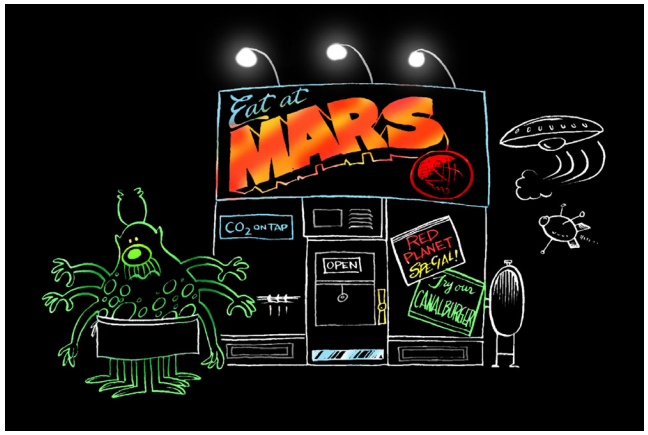
A: Thousands of year ago, humans did not know what to think of the wandering lights that appeared among the stars. Superstition led our ancestors in places like Babylonia (ancient Iraq) to think the wandering lights were gods, and knowing where they appeared in the sky would help predict the future. This is how the practice of astrology began.

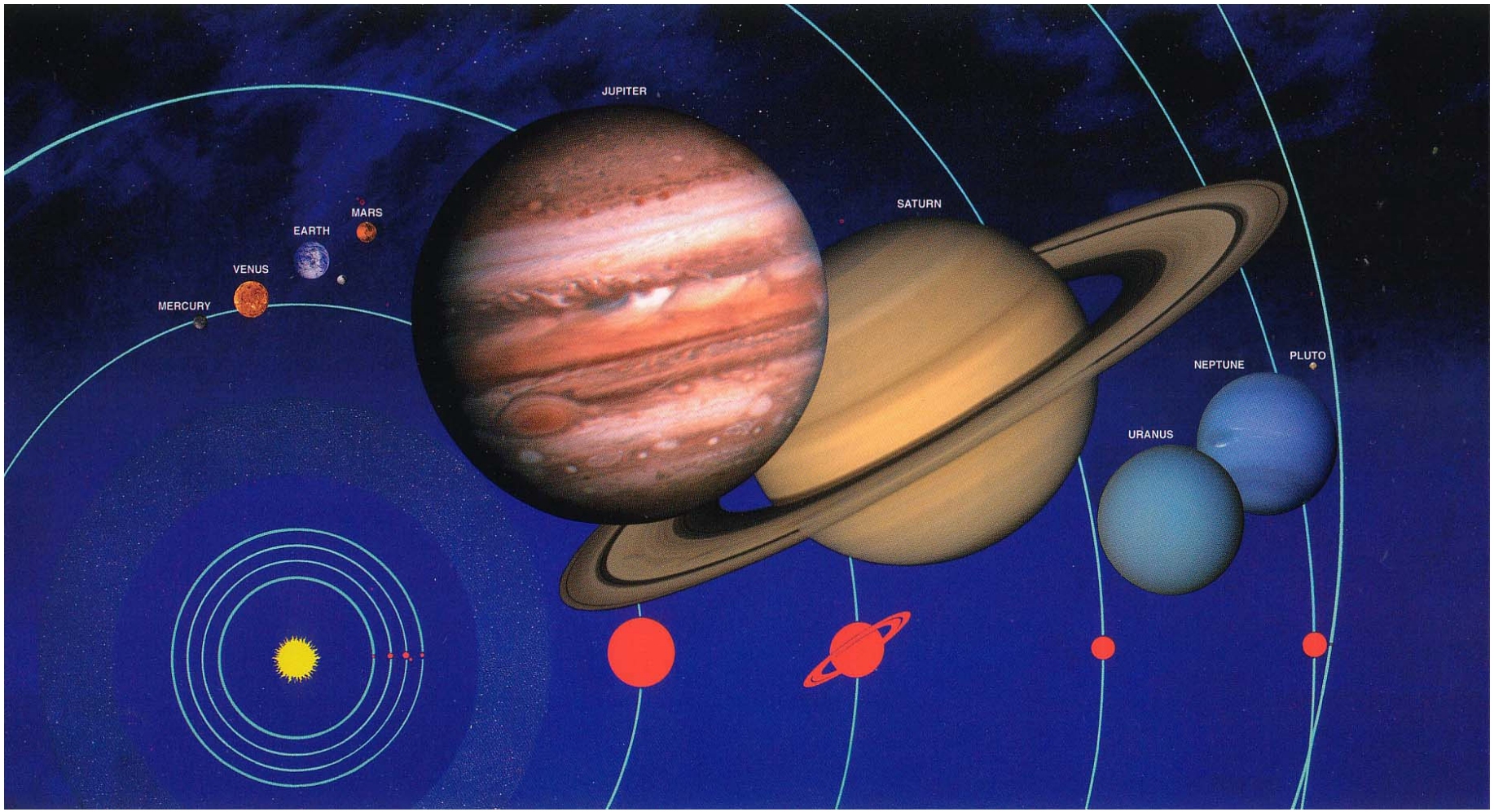
Q: Who invented the dot-to-dot star pictures we call constellations?

A. Every culture on our home world spent time observing the brilliant night sky, full of thousands of stars. Since there were no electric lights, radios, TVs, movies, computers, video games, or other electric or electronic devices; many people spent time looking into the night sky, and they began to play connect-the-dots to invent pictures of people, animals, or things important to them. In 1930 the International Astronomical Union established the names and borders for 88 constellations, covering the sky as seen from the earth from the North to the South Pole. Many were named in Latin, the language of science during the last century.

Q: Have humans traveled to another planet?

A. No one from our planet has traveled to another planet in our Solar System. The farthest anyone has traveled is to our closest neighbor, the Moon. Starting in 1969 through 1972, 27 American astronauts in have traveled to the Moon, with 12 astronauts landing on the surface. Plans announced by NASA have planned new manned missions to the Moon, and then on the Red Planet – Mars

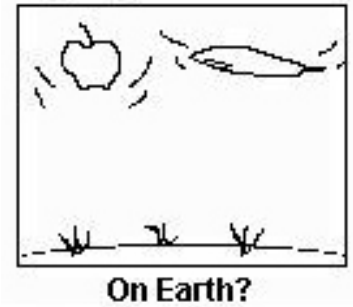


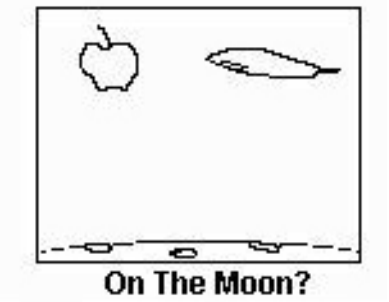


Planets of The Solar System - Size is to Scale, distance apart is not to scale

Classroom Activity- Questions & Answers about Gravity

Name_____School_____





Question 1: Which object will hit the ground first: an apple or a feather? _____

Question 1a: Why? _____

Question 2: What weighs more: a pound of feathers or bricks?

_____

Question 3: Imagine that the Earth is made from lots of tiny rocks. Which way will they fall?

_____

Question 3a: When will they stop falling?

_____

Question 4: Where else in space might this occur?

_____

_____

Question 5: Why is the Earth round?

_____

Question 6: This drawing shows an enlarged person holding a rock. If he threw the rock slightly to his right, what path would the rock take? Show what happens to the rock by drawing a line showing the complete path of the rock, from the person's hand to where it finally stops.

Question 6a: Why will the rock fall that way?

_____

Question 7: What path would the rock take if the person threw it a little harder? _____

Question 7a: With enough force, would it be possible for the rock never to hit the Earth? _____

Draw the path of a rock that never hits Earth.

Classroom Activity- Escape Velocity – Escape from a Gravity Well

Grade Level: Grades 4th and up

Goal: Students will build a device to demonstrate how much velocity is needed to leave a gravity well. Gravity Wells vary in size, based on the amount of matter at the center of the well. This device will assist students in explaining how matter is pulled into gravity wells such as planets, larger ones around stars, and monstrous gravity wells that we call black holes.

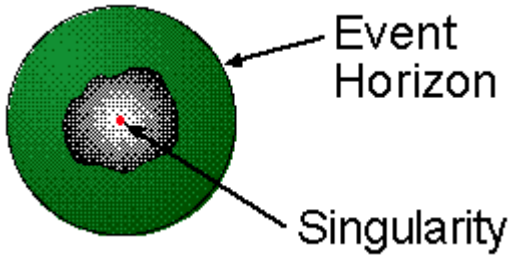
Objective: To understand that the size and strength of a particular gravity well is proportional to the amount of mass an object in space, such as a planet, star or black hole.

Background

Normal objects in space, such as planets or stars, distort or change the area of space around them. Astronauts such as your students have to be aware of this effect, or risk falling down the gravity well. The largest gravity wells are made by black holes, formed from the collapse of a giant star under its own gravity. All of its mass is squeezed into a single point, known as a singularity. At this point, both space and time stop. It's very hard for us to imagine a place where mass has no volume and time does not pass, but that's what it is like at the center of a black hole.

Anatomy of a Black Hole

The point at the center of a black hole is called a *singularity*. Within a certain distance of the singularity, the gravitational pull is so strong that nothing--not even light--can escape. This boundary is called the *event horizon*. The event horizon is not a physical boundary, but the point-of-no-return for anything that crosses it. When people talk about the size of a black hole, they are referring to the size of the event horizon. The more mass the singularity has, the larger the event horizon. The structure of a black hole is something like this:



Many people think that nothing can escape the intense gravity of black holes. If that were true, the whole Universe would get sucked up. Only when something (including light) gets within a certain distance from the black hole, will it not be able to escape. But farther away, things do not get sucked in. Stars and planets at a safe distance will circle around the black hole, much like the motion of the planets around the Sun. The gravitational force on stars and planets orbiting a black hole is the same as when the black hole was a star because gravity depends on how much mass there is--the black hole has the same mass as the star, it's just compressed.

Black holes are truly black. Light rays that get too close bend into, and are trapped by the intense gravity of the black hole. Trapped light rays will never escape. Since black holes do not shine, they are difficult to detect.

Classroom Activity- Escape Velocity – Escape from a Gravity Well

Materials

1. A Large round garbage can
2. A square yard of swimsuit or other stretchable cloth
3. 2 – 3 Foot long Bungee cords
4. A bag of large (quarter-sized) marbles

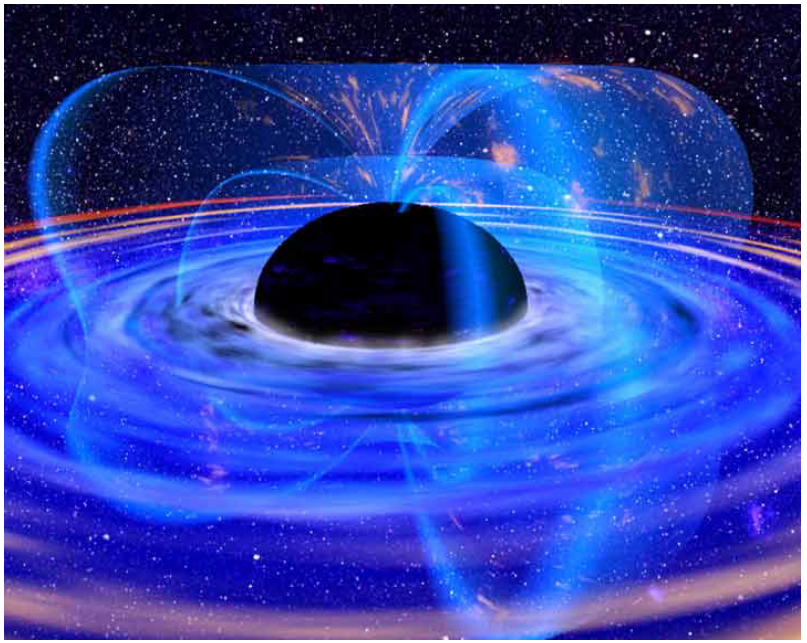
What to do:

First, start by putting a marble in the middle of the stretchable material, and tie the bungee cord in a knot around the marble. Then put a hole in the bottom of the can, and feed the bungee cord through the hole. Now put the cloth over the open end of the garbage can, and secure it to the garbage can with the other bungee cord. You should have a flat surface covering the garbage can, with a small dent in the middle of the cloth.

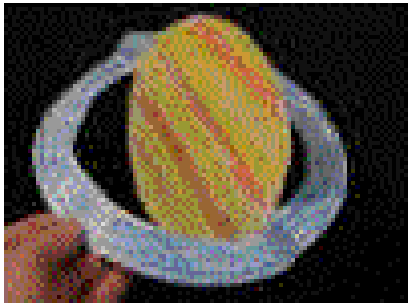
This will represent a gravity well created by the mass of a moon or planet. Now shoot some marbles around the gravity well. What happens to the marble after it orbits the planet's gravity well for 30 seconds or longer?

Now experiment with a stronger gravity well. Pull on the cord attached to the center of the cloth until you have a larger depression in the center of the material. This represents the gravity well around a star such as the Sun. Shoot some marbles in orbit around the star's gravity well. Compare the results with the planet's gravity well. What is the difference?

Now pull on the cord until you have a very deep depression. This represents the gravity well around a giant star or a small black hole. Again, shoot the other marbles around on the cloth. Try to get them to orbit around the depression. As they move closer to the well, what happens to the marbles?



Classroom Activity - Make A Paper Plate Saturn!



Grade Level: 3rd - 6th

Goal: Students will build a scale model of Saturn and its system of rings, and use the model to learn how the rings seem to vanish every 14 years.

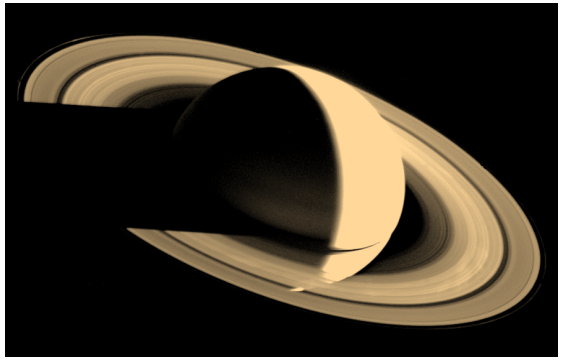
Objective: Every 14 years Saturn's rings seem to disappear! This was an embarrassment to Galileo as he observed the rings in his telescope. He made notes and drawings, and tried to share his observations with another scientist months later. However, the rings had disappeared! A year or so later, it was confirmed as they seemed to return.

Materials

- Paper plates
- Scissors
- Lots of crayons

What to do:

Fold a paper plate in half. Fold into quarters, and then unfold to the half. Starting about 1/2 inch from the edge, cut parallel to the perimeter stopping about 1/4 inch from the fold line making it into quarters. Unfold the plate and fold the outer ring until it stands out at right angles to the plates. Mark one end of the first fold line as north and the other end as south. The plate represents the disk of Saturn with the rings going around it. Pretend your head is the sun and hold Saturn out at arms length making it go around the sun. Saturn's axis is tilted 26 degrees from the plane of its orbit (compared to earth at 23 and 1/2 degrees...about the same). Keep the axis of Saturn pointed the same direction (imagine a distant star) and you will see the north side of the rings, then the edge of the rings, then the south side, the edge, and the north side again. It takes Saturn 29 years to orbit the sun. Therefore we see the rings on edge every 14 years (1995 recently). The rings are so thin they seem to disappear...just as a flat paper plate does when seen edge on!



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's (JPL) master list of web sites for space exploration!

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

http://www.astronomy.com/Content/static/parentsteachers/default.asp
Visit the ***Astronomy Magazine*** website for Parents and Teachers.

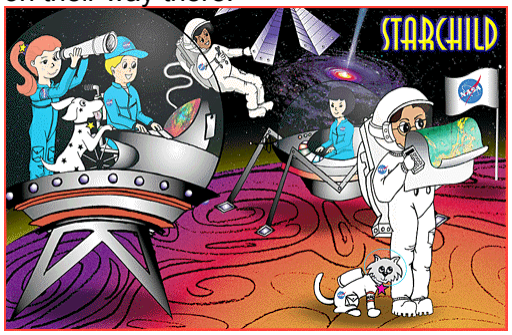
http://www.heavens-above.com/
Heavens Above, a web site with current sky maps, and info on how to observe satellites such as the International Space Station!

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