**Sci-Port: LOUISIANA'S Science Center**

# Sky Time

**Grades:** 4th, 5th, 8th-12th.

**Duration:** 50

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## Program Description

Demonstrate why the tilt of the Earth's axis results in the Sun being higher in the sky in the summer and lower in the sky in winter, and why this results in Earth's seasons. Learn that the constellations of stars rise and set like the Sun due to Earth's rotation. You will also learn that North Pole of Earth's rotation axis points toward the distant star Polaris (the North Star) and be able to demonstrate how this affects the tilt of Earth's rotation axis toward or away from the Sun at different times of year. Demonstrate why we see different constellations in the night sky at different times of night and different times of the year.

## Louisiana GLEs:

### Grade 4: Science as Inquiry

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions (SI-E-A2)
4. Predict and anticipate possible outcomes (SI-E-A2)
6. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
7. Use the five senses to describe observations (SI-E-A3)
9. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
10. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate (SI-E-A5) (SI-E-B4)
11. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
17. Recognize that a variety of tools can be used to examine objects at different degrees of magnification (e.g., hand lens, microscope) (SI-E-B3)
22. Explain and give examples of how scientific discoveries have affected society (SI-E-B6)
68. Identify the relationship between Earth's tilt and revolution and the seasons (ESS-E-B4)

**English Language Arts**
*Speaking and Listening*
*Standard 4*
34. Adjust pacing to suit purpose, audience, and setting when speaking
35. Interpret, follow, and give multi-step directions
37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
38. Adjust speaking content according to the needs of the audience

## Grade 5: Earth in the Solar System

40. Describe the significance of Polaris as the North Star (ESS-M-C1)
44. Explain rotation and revolution by using models or illustrations (ESS-M-C4)

**English Language Arts**
*Speaking and Listening*
*Standard 4*
32 Adjust diction and enunciation to suit the purpose for speaking
33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

## Grade 8: Earth in the Solar System

42. Interpret a scale model of the solar system (ESS-M-C5)
45. Explain how seasonal changes are caused by the tilt of Earth as it rotates on its axis and revolves around the Sun (ESS-M-C7)
46. Illustrate and explain how the angle at which sunlight strikes Earth produces changes in the seasons and length of daylight (ESS-M-C7)
47. Compare the relative distances from Earth to the Sun on the first day of summer and the first day of winter (ESS-M-C7)

## Grades 9-12: Science as Inquiry

7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations) (SI-H-A4)
13. Identify scientific evidence that has caused modifications in previously accepted theories (SI-H-B2)
29. Demonstrate the elliptical shape of Earth's orbit and describe how the point of orbital focus changes during the year (ESS-H-D6)

## Key Terms:

**Arc:** The apparent path of a celestial body as it rises above and falls below the horizon.
**Axis:** The real or imaginary line on which a thing turns (as the axis of the earth, from North Pole to South Pole, around which the earth turns)
**Celestial Sphere:** An imaginary sphere of infinite extent with the earth at its center on which the stars, planets, and other heavenly bodies appear to be located.

**Constellation:** A group of stars seen as forming a figure or design in the sky, especially one of 88 officially recognized groups, many of which are based on mythological traditions from ancient Greek and Middle Eastern civilizations. A group of stars seen as forming a figure or design in the sky, especially one of 88 officially recognized groups, many of which are based on mythological traditions from ancient Greek and Middle Eastern civilizations. These irregularly defined areas completely fill the celestial sphere and divide it into nonoverlapping sections used in describing the location of celestial objects.

**Ecliptic:** The great circle on the celestial sphere that represents the Sun's apparent path among the background stars in one year. The northernmost point this path reaches on the celestial sphere is the Tropic of Cancer, its southernmost point is the Tropic of Capricorn, and it crosses the celestial equator at the points of vernal and autumnal equinox. The plane of the ecliptic is the imaginary plane that intersects the celestial sphere along the ecliptic, and the north and south ecliptic poles are the points where a perpendicular line through the middle of this plane intersect the sphere. The plane of the ecliptic corresponds to the plane in which the Earth orbits the Sun. If the Earth's axis were not tilted, the ecliptic would be identical to the celestial equator and the ecliptic poles identical to the celestial poles. In this case, the Sun's path would not move northward or southward from the equator during the year. As it is, the plane of the celestial equator is tilted 23.45° to the plane of the ecliptic, corresponding to the tilt of the Earth's axis with respect to its orbital plane, giving the Sun its apparent northward and southward movement among the background stars. See illustration at celestial sphere.

**Equinoctial Point:** Either of the two celestial points at which the celestial equator intersects the ecliptic

**Equinox:** Either of the two times during a year when the sun crosses the celestial equator and when the length of day and night are approximately equal; the vernal equinox or the autumnal equinox.

**Kinesthesia:** The sense that detects bodily position, weight, or movement of the muscles, tendons, and joints.

**Polaris:** A bright star at the end of the handle of the Little Dipper in the constellation Ursa Minor. Polaris is 1° from the north celestial pole, and it remains in the same location in the sky all year, making it a useful navigation tool. Polaris is actually a double star with a faint companion star and has an apparent magnitude of 2.04. Also called North Star. Scientific name: Alpha Ursae Minoris.

**Precession of the Equinoxes:** A slow westward shift of the equinoxes along the plane of the ecliptic, resulting from precession of the earth's axis of rotation, and causing the equinoxes to occur earlier each sidereal year. The precession of the equinoxes occurs at a rate of 50.27 seconds of arc a year; a complete precession requires 25,800 years.

**Precession:** The slow, conical motion of the earth's axis of rotation, caused by the gravitational attraction of the sun and moon, and, to a smaller extent, of the planets, on the equatorial bulge of the earth.

**Revolution:** The orbiting of one heavenly body around another.

**Rotation:** The action or process of rotating on or as if on an axis or center; specifically : the turning of a body part about its long axis as if on a pivot; rotation of the head to look over the shoulder.

**Solstice:** either of the two times of the year when the sun is at its greatest distance from the celestial equator.

**Winter Solstice:** In the Northern Hemisphere, the solstice that occurs on or about December 22.

**Zodiac:** An imaginary belt of the heavens, extending about 8° on each side of the ecliptic, within which are the apparent paths of the sun, moon, and principal planets. It contains twelve constellations and hence twelve divisions called signs of the zodiac. Each division, however, because of the precession of the equinoxes, now contains the constellation west of the one from which it took its name.

## Connections to Permanent Exhibits:

**Gravity Well:** Students can roll coins around an inverted cone. The coin's path, projected on a horizontal plane, simulates the orbits of the planets. (Coins collected from the exhibit are used to for a matching grant Sci-Port Discover y Center's new space expansion.)

**Dayna and Ronald Sawyer Space Dome Interactive Laser Planetarium:** Step inside and see the marvels of the universe. Have a chance to dock the Space Shuttle with the ISS or see the stars on the night your were born.

**Anderson Family Foucault Pendulum:** Watch the pendulum. It knocks down a mallet every 15 minutes. Name two other things a pendulum can do besides tell time.

**Sailing by the Stars:** Sit in the Earth chair and look at the sun on the stairway wall. What phase of the moon do you see? What causes the phases of the moon?

**Constellations; Winter**: What causes the stars to appear to move across the sky from east to west?
**Constellations; Spring:** Why is the Big Dipper called the "drinking gourd"?
**Constellations; Summer:** What animal represents the constellation Aquila? What is its biggest star?
**Constellations; Fall:** What is an asterism? Give an example.
**JP Morgan Chase Earth's Solar System**…The Earth's Backyard
**The Sun:** Read about the sun and ancient cultures.
**Interactive Sun:** Check out this computer program. What are three characteristics of the sun? Take the Sun Fact Quiz!!
**Abby and Joe Averett Solar Observatory:** What are two types of solar telescopes that we have in our rooftop solar observatory? Can you see any sunspots today?
**Mercury:** What spacecraft is on its way to Mercury right now? Name an interesting Mercurian fact.
**Venus:** Describe Venus' rotation (spin) as it relates to its revolution (orbit). What did the Magellan spacecraft do?
**Earth:** What phase of the moon can you see in the sky today? Why did the Apollo astronauts have to have a horizontal support for the American flag when they planted it on the moon? (Hint: See the photomontage outside the second floor space bathrooms.)
**Mars:** What is the largest mountain in the solar system? How many moons does Mars have?
**Jupiter:** Can you see Jupiter in the sky tonight? Name an interesting fact about a Jovian moon.
**Saturn:** What spacecraft arrived at Saturn in 2004? What did it do?
**Uranus:** How old are you on Uranus? Describe the atmosphere of Uranus.
**Neptune:** What makes Neptune blue? The Earth's axis tilts at 23.5 degrees. What is the Neptune's axial tilt.
**The Dwarf Planets**: Name 3 characteristics that define a classical planet? Name 3 dwarf planets and where are they found in our solar system?
**Sundial:** What is a gnomon? Look up at the skylight and find the shadow of the gnomon. What time is it?
**Comcast Deep Space Cluster…The Far Reaches of Our Universe**
**The Crab Nebula:** What does the Chandra X Ray Telescope tell us about the Crab Nebula? What does infrared radiation tell us? What elements make up the Crab Nebula and how do we know? What is in the center of the Crab Nebula?
**Our Cosmic Address:** Where is our sun in the Milky Way? What is a nebula?
**Exploring Space…Our Next Frontier**
**Gravity Assists:** Try to launch a ball and hit a target. How many targets did you hit?
**Stellar Wobble:** Roll the large ball, then the small ball. Which causes the more stellar wobble? What does stellar wobble tell us?

## Web Resources:

**Eric Weisstein's World of Astronomy**
http://scienceworld.wolfram.com/astronomy/

**NASA**
http://www.nasa.gov/

**NASA Jet Propulsion Laboratory**
http://www2.jpl.nasa.gov/basics/toc.html

**Space Science Institute**
http://www.spacescience.org/index.php

## Pre-Visit Activities

## Post-Visit Activities