

4-6 Planetarium Lesson: Our Place in Space

Theme:

The movements of objects in the sky can be observed and described. The length of a day and a year are due to Earth's regular and predictable motions.

Goals:

- Students will understand that science, including astronomy, requires curiosity and inquiry.
- Students will better understand the movements of the earth and the planets of our solar system.
- Students will recognize key features in an Alaskan night sky.
- Students will be excited about space science.

Objectives:

Students will learn:

- Observation is a part of the process of science, including astronomy.
- The apparent movements of objects in the sky are observable and related to Earth's movements.
- Stars appear to rotate around the North Star.
- The tilt of the earth on its axis affects the seasons and day length
- Like the earth, other planets orbit the sun.

Alaska Science Performance Standards/Grade Level Expectations:

SA1.1 (4-6): The student develops an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating

The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by:

SD3.1 [4]: recognizing changes to length of daylight over time and its relationship to seasons.

The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by:

SD4.1 [4]: recognizing that stars are like the sun but are so far away that they look like points of light.

SD4.2 [4]: recognizing that objects have properties, locations, and movements that can be observed and described.

SD4.1 [5]: distinguishing between stars, planets, moons, comets, and meteors.

SD4.2 [5]: recognizing that the Earth is in regular and predictable motion and this motion explains the length of a day and year.

Alaska Content Standards-Cultural Standards:

B1: Students are able to acquire insights from other cultures without diminishing the integrity of their own.

E4: Students determine how ideas and concept from one knowledge system relate to those derived from other knowledge systems.

Outline:

Outside the Dome:

- Introduce yourself. Say you are from Fairbanks & work at the University (UAF).
- Explain that a planetarium is a place where you can see stars and things in the sky no matter what time of day it is or what the weather is like. Some are buildings that you go to (like libraries or museums) but this one is portable.
- Tell what it will be like inside and go over the rules.
- Explain how to get inside quickly.

Inside the Dome:

Getting Acquainted

- Familiarize the class with the dome setting, view, your plans, & how to communicate.

Light and Dark Skies

- Daytime view of sky from Alaska
- Astronomy definition
- The Sun is a star
- Using compass directions, horizon, zenith and degrees to explain locations.
- Path of the sun in the sky varies with the season and with location
- Sun appears to rise and set as earth rotates on its axis
- View stars and Milky Way galaxy

The North Star, Star Movement, & Constellations [Introduce Concept of Rotation]

- Stars on Alaska's flag? Big Dipper & north star
 - Explain location using directions new vocabulary
- Trace the big dipper. Discuss how it is an asterism that is part of a constellation, Ursa Major. Trace Ursa Major.
- Use the big dipper to locate the north star, Polaris.
 - Discuss significance of Polaris
 - Discuss cultural variation/ circumpolar similarities
 - Polaris/Big Dipper Story
- Advance time and watch the stars appear to spin while Polaris stays fixed.
 - Like the sun rising and setting, this spinning in the sky relates to the earth's rotation on its axis every 24 hours.
 - Pleiades Story

Orbit of Earth and Planets [Introduce Concept of Orbit]

- Besides rotating, Earth is also in orbit. 365 days to orbit the sun.
- Other planets orbiting the sun as well: Define Solar System
 - Outer solar system (Gas Planets...some are frozen gas)
 - Inner solar system (Terrestrial Planets)

Our Home (Earth, Solar System, & Galaxy) [Rotation & Orbit Recap]

- Recap; emphasize the terms rotate & orbit utilizing view of earth from space
 - Ask the students to describe earth's movement as they watch it from space (Rotation vs. Orbit)
 - Ask the students to find Alaska when it rotates into view while identifying continents...etc..
- Time Filler:
 - Play Aurora movie and discuss
 - Milky Way from Space

Starry Night Script:

OUR PLACE IN SPACE (4-6)

Put the Computer into [RED SCREEN MODE](#) to help you & students see better in the planetarium.

Put the [UAF Logo](#) on the screen before you get into the show.
[Click HERE](#) to remove the logo.

Introduction

Introduce yourself and explain what a planetarium is.

Light and Dark Skies

Start with a (light) **daytime view** of the sky. If it is the wrong time of year to use the current view/time, change to a summer day.

Explain that today you are going to talk about **astronomy**.

Discuss the definition: from Greek words that mean "star law," astronomy is a science that studies things in the universe, outside the earth's atmosphere. Ask for suggestions of what astronomers look for or things you might see in the planetarium (stars, planets, etc).

After discussing, ask if they can find 1 star in the sky in the current view.

The sun is a star!

Have all the students point to the sun and discuss how to explain it's location using the **compass directions**, and the vocabulary: **horizon and zenith**. Also explain how you could use **degrees** (0 degrees for the horizon, 90 for the zenith) to explain the height in the sky.

Why can't we see other stars during summer days? Stars are out there in space all the time. Like the sun, stars are balls of gas that emit light (don't reflect it). However, the sun is so close to us that it brightens our sky and blocks our view of the other stars.

So, lets change to a **dark sky** so we can see more than 1 star! [SPEED UP TIME \(1000x\)](#) and watch the sun set.

[STOP TIME](#) when the sun has just set.

Ask what the path of the sun looked like and why it is now dark. Use the compass directions and horizon/zenith vocab to describe the apparent movement. Talk about how the **earth rotates on its axis**, giving us night and day on earth (24 hours to rotate).

Discuss how our view of the path of the sun changes with the seasons...because **earth is tilted** (high in the sky for a longer period of time in the summer). Show a winter and summer path of the sun in Alaska to demonstrate. Also mention how from other places on the planet, it would look different (ex: sun rises in the east and sets in the west).

After watching the sun set, you may want to change to the current date. If desired, make it "artificially dark" by turning off the daylight ([TURN OFF DAYLIGHT](#)). Ask what they see in the sky. Talk about the stars, milky way, moon, etc.

The North Star, Star Movement & Constellations [Introduce Concepts of Rotation]

There is a star that is sort of 'special' in our sky, but before we find out why, we need to learn to

find it. We can use our horizon, zenith and compass directions to help explain where to look for things in the sky. Certain stars appear to be in patterns and we can also use these to find our way around. Can anyone tell me what star pattern is on **Alaska's flag**?

The Big Dipper is on the flag. Many students may already be pointing and exclaiming that they see the big dipper. Ask them to describe its location using the compass directions and new vocabulary of horizon and zenith.

[TRACE THE BIG DIPPER.](#)

The big dipper is part of a larger constellation. The big dipper is actually called an asterism. It is a part of the constellation Ursa Major.

[TRACE URSA MAJOR](#) to show the stick drawing of the constellation (the big bear).

(Also could turn on the sketch of the bear in the options menu.)

The big dipper can help us find that special star I mentioned. It's also on Alaska's flag. Does anyone know what it is called? It's called the north star. Does anyone know how to locate the north star?

Explain how the big dipper points to the north star, [POLARIS](#)

Tell the students that Polaris is another name for the north star. Polaris is Latin and a name that astronomers all over the world would recognize.

Mention that this star has **many other names**. Many northern cultures have a name for this star in their own language.

In circumpolar regions around the world, people have identified the Big Dipper with a type of deer; usually a caribou or reindeer. Inupiaq, Yup'ik, and Aleut people in Alaska have regarded the stars of the dipper as resembling one or more caribou. Koyukon Athabascans in interior Alaska have also regarded the Big Dipper as a deer, but instead of a caribou they notice a moose, which is also a member of the deer family.

Across the Bering Sea in Russia, a group of people called the Chukchi who have a long tradition of reindeer herding have a story about the well known reindeer in the sky. The Chukchi say the reindeer is tethered to a post or nail star (Alq'pe'near). If you observe the sky, the reindeer can be seen throughout the night pacing a great circle around the star to which it is tethered. [CARIBOU VIDEO](#) What star do you think they call the "nail star"?

Tell the students to **watch Polaris and watch Ursa Major.**

[TURN OFF SATELLITES](#) (very distracting!) and then [SPEED UP TIME \(1000x\)](#) so the stars appear to move. [STOP TIME](#) when the sun comes up. Why didn't it get bright. Because we turned off the daylight!

Discuss what they observed. Just like watching the sun move in the sky, we can also see evidence of the earth's spinning in a dark sky too. The stars appear to rotate in the sky. Polaris stays still! This is the North Star.

The earth spins like a top (that's why we have day and night). Right above us (directly above the North Pole) is Polaris. So, it looks like the other stars are spinning and Polaris is standing still. As we **rotate on our axis**, the stars appear to rotate around the sky. Ask again how long it takes for the Earth to rotate on its axis. (24 hours!)

[TURN OFF URSA MAJOR.](#) [TURN OFF BIG DIPPER.](#) [TURN OFF POLARIS LABEL.](#)

When we think about pictures in the sky, most of us recall the Greek constellations, which have become the standard for Astronomers to use all over the world. In Science, constellations can be used as maps. Constellations divide the sky up into familiar boundaries, just as the United States is divided into familiar boundaries called states. Every major star in the sky is part of a constellation. Constellations give reference to other objects in the sky.

Even though most of us only know the common Greek/Roman constellations, people throughout the world have different names for constellations unique to their own culture.

Point out the **Pleiades** and ask the students if they know a name for this group of stars?

The Pleiades is a group of hot, bright stars that form the brightest star cluster visible in the sky. Another name for the star cluster is the **seven sisters**, or **Subaru**, after which the Japanese car company named themselves.

Coastal cultures across Alaska also have their own name for this group of stars. [Pleiades Movie](#)

Throughout the **Aleutian Islands** the Pleiades are known as a **bundle of codfish** (Atxidán Tamíngin). In southeast Alaska, the **Tlingít** know the Pleiades as an **old sculpin fish** (Weq). Alaska's well known creator and trickster, the Raven, gave the sculpin a special place in the sky after discovering that the fish was older than he.

In **northern Alaska**, the Pleiades are visualized as a scene from a **polar bear hunt**. Some Inupiat call the star cluster Pa-chuk-turin, which means the sharing or dividing. The largest star is viewed as the polar bear, and the others around it are the hunters who are dividing and sharing the meat from their successful hunt.

The Inupiat have also been known to use the Pleiades as a timepiece, or **sky clock**. In times of old, the Pleiades marked bedtime for the Kobuk River Eskimos when it reached a certain position in the sky. They called the stars Sakopsaktat, which means "the ones who close their eyes."

The Pleiades has also been used as a **timepiece** among the **Alutiiq of Kodiak Island** where the star cluster marks the beginning of the New Year when it is first seen above the horizon in early August.

Yup'ik Eskimos along the Bering Strait have known the Pleiades as a **litter of fox pups**, while those around **Norton Sound** and the **Lower Yukon River** have regarded the Pleiades as a single **red fox** (Kagguyat or Kavyagak).

The **Haida** in the far southeast part of Alaska call the stars of the Pleiades a **water bailer**, which is used to scoop water out of their canoes. The name for this is Hoot-oo.

The stars in the Pleiades are hard to miss despite the small space they occupy in the night sky (together, they kind of look like a short-handled little dipper). They shine so bright and vivid that cultures the world over have adopted them into their culture. Try to imagine some of the age old shapes and stories given to the Pleiades the next time you look up at the stars over Alaska.

Orbit of Earth and Planets

Besides spinning on its axis daily, the earth is also moving in another way. How long does it take for the earth to **orbit (go around) the sun**? (1 year, 365 days). Does every day of the year

seem the same? No, we have different seasons and get more or less sunlight during different times of the year. R

Go to a view of Earth. [EARTH ORBITING THE SUN](#)

Earth is of course not the only planet orbiting the sun. Everything that orbits our sun is part of our solar system. Who can think of **other planets in our solar system?**

Go to an outer view of the [OUTER SOLAR SYSTEM](#) to see the planets in orbit (*or use FavS/SolSys/OutSS*). Mention Pluto's status as a dwarf planet (not a planet). The others are the outer planets of our solar system, or the gas giants. Even though they are the biggest planets in our solar system (Jupiter is biggest, Saturn is 2nd), they are not very dense. In fact, if you had a bathtub big enough, Saturn would float!

[ZOOM](#) in to see the inner planets whizzing around. Then, go to a view of the [INNER SOLAR SYSTEM](#) (*or use FavS/SolSys/InnerSS*). These are the terrestrial (rocky) planets.

Our Home (Earth, Solar System, & Galaxy)

Let's head home. What is our home planet? [GO TO EARTH!](#) (*or go to the Fav Menu: Solar System/Earth and select "Our Home."*) View earth from space and allow it to rotate and ask them to describe the earth's movement (rotation).

[STOP TIME](#) if you want to explain what they are to watch for. [RUN TIME FORWARD](#) to start the earth rotating again. Have students identify continents, etc. Tell the students to say stop when they see Alaska.

Tell students to shield their eyes (it will get bright) and close by going back to [FAIRBANKS WITH RESET](#).
