NIGHT SKY
LESSON PLAN

WOLF RIDGE℠
ENVIRONMENTAL LEARNING CENTER

NIGHT SKY

CLASS DESCRIPTION: An Earth Science and Cultural History Class

Reexamine our relationship with the natural world by engaging with phenomena of the night sky. To do this, students will explore phenomena of the night sky, notice patterns, and hear stories. With these experiences, students will understand their own relationship with the night sky.

Total time: 1 hours and 45 minutes
Audience: 6-20 students, 4th grade through adult
Activity level: easy
Travel: none
Total uphill travel: none

GUIDING QUESTION

What can we learn through the night sky?

CONCEPTS

- The night sky is filled with a variety of phenomena (stars, planets, northern lights, etc).
- People continue to study the night sky to seek patterns and meaning.
- Cultures throughout the world have attached stories to phenomena in the night sky.
- Our lives are connected to phenomena in the night sky.

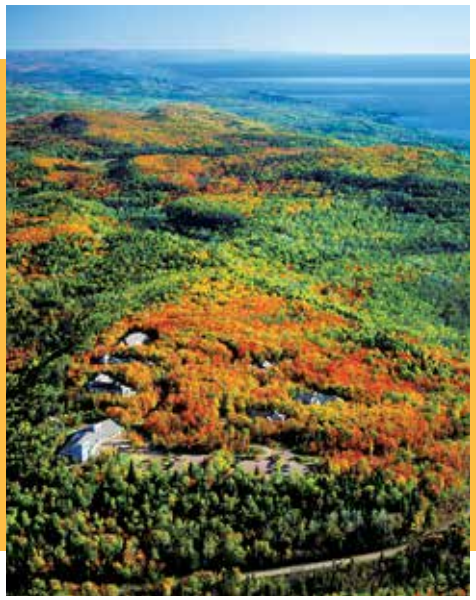
Guiding Framework: NGSS Crosscutting Concepts: Patterns, Systems and Systems Models | Cultural Competency

OUTCOMES

Upon completion of the Night Sky class, students will be able to:

- Locate and identify phenomena of the night sky by using various models.
- Communicate meaning behind the patterns (including constellations) of the night sky.
- Explore cultural values and practices through stories of the night sky.
- Create a connection with the night sky.

Guiding Framework: NGSS Science and Engineering Practices: Developing and Using Models, Obtaining, Evaluating, and Communicating information



WOLF RIDGE℠
ENVIRONMENTAL LEARNING CENTER

Our mission is to develop a citizenry that has the knowledge, skills, motivation and commitment to act together for a quality environment.

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NIGHT SKY

Revised October 2025

Equipment

bin

- full lesson plan
- Wolf Ridge Notes
- 8 yard rope for model activity
- 20 cards for model activity
- 20 pencils, scrap paper
- *Talking Sky* book
- 2 circumpolar story sheets
- 4 seasonal story sheets
- Wolf Ridge Night Sky Technology Guide
- telescope battery pack

extras

- astronomy briefcase (kit rm)
- planetarium (SC rm 1)
- telescopes (telescope deck)
- clipboards (kit rm)

Appendices

- Glossary
- References
- Resources
- Additional Information
  - Featured Constellations
  - Ojibwe Moon Names
- Model activity master key
- 2 circumpolar story sheets
- 4 seasonal story sheets
- Spiral Learning Sheet

Set-up (30 min.)

- Classroom/class prep description
- Safety Management

Introduction (5 min.)

Classroom (45 min)

I. What is in the night sky? (20 min.)

II. What connections can be made in the night sky? (15 min.)

III. What stories are in the night sky? (10 min.)

[Transition] (5 min)

Experience (45 min)

I. What is in the night sky? (10 min.)

II. What connections can be made in the night sky? (20 min.)

A. Circumpolar Constellations

B. Seasonal Constellations

III. What stories are in the night sky? (15 min.)

Conclusion (5 min)

Clean-up (15 min.)

LBC MINDSET PLACE PETAL
The Ojibwe Night Sky is so intricately connected to this place! Getting to know this place through the Night Sky informs the Vision and Big Ideas of place-based solutions.

Set-up (30 min)

Classroom portion - To prepare for the classroom portion set up the scheduled classroom with chairs for the adults. Prepare the board with three circles full of dots. Take out all the needed materials for the solar system model activity.

Experience portion - To prepare for the experience portion make sure your chosen technology is operating properly. It is expected that the liaison connects with their lead teacher to understand the school's expectations surrounding night sky technology. See the Wolf Ridge Night Sky Technology Guide for more detailed set up or troubleshooting details. In addition to technology set up, be sure to locate the story cards in the Night Sky kit.

Safety Management

Adhere to and be familiar with all general safety practices designated by Wolf Ridge. Be aware of any student's special needs (medical, etc.) and adjust the activities as needed to maintain safety. Post an adult with a flashlight at the inside exit to the planetarium to facilitate kids who need to leave due to a health problem.

- First aid kit is located in the kit room.

I. Introduction (5 min.)

This class has two complementary sections that will be facilitated by either naturalists or chaperones. If there is one learning group, then the naturalist will facilitate the beginning classroom section, and then facilitate the experience section. This experience section will either be outside on the astronomy deck (good weather), or inside in the planetarium (unideal night sky watching weather).

If there are two learning groups, then the naturalist will introduce the flow of the evening before taking off with learning group one to facilitate the experience section. Learning group two will stay in the classroom with the chaperones. At the halfway mark, the naturalist will return to the classroom to retrieve learning group two and drop off learning group one.

While kids are coming in, make sure adults have an understanding of the flow of the classroom and experience portion of the class. Make sure you have clear expectations of what technology might be used.

Open the full group with a question that relates to the concepts of this class. Favorite story? When I say "night sky" what word comes to mind? Have you noticed any patterns in nature this week? After this opening proceed to whichever portion you are teaching first. This lesson plan will flow from the Classroom to the Experience portion.

Classroom Portion

I. What is in the night sky? (20 min)

Classroom: Model Activity

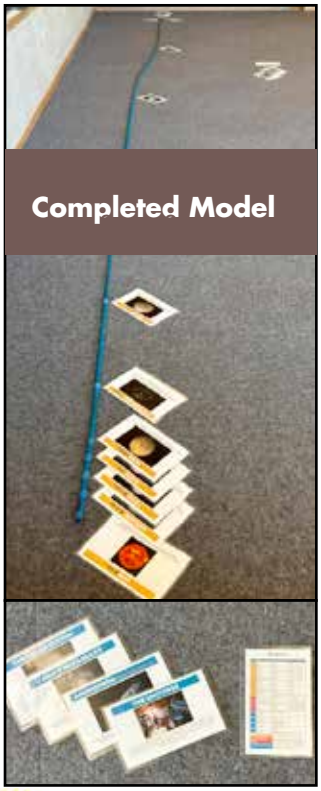
Materials include the 24 feet blue rope and the corresponding 20 model cards. The blue rope is marked with blue velcro at the set spots for the each planet. This is a to-scale model of the orbiting bodies of the Solar System including other phenomena. This model activity is meant to demonstrate the vastness of the night sky and beyond! This activity starts on a smaller scale with the planets in our Solar System. The goal is then to expand from the Solar System to the galaxy and beyond to the universe using the remainder of the model cards. How is it all related?

As the naturalist leading this activity you can go as deep into the universe as you want. Choose if you want to focus on the **YELLOW** (planet cards 1-11), **RED** (solar system cards 12-15), **and/or** **BLUE** (universe expansion cards 16-19). See model chart in appendices for more information.

YELLOW (planet cards 1-11) Assign a student to be the Sun and another student to Pluto. They will stand at opposite ends of the rope. Ask students to point to where they think earth might be, or the other planets. They might be surprised! Place the 9 other cards along the blue rope at the marked velcro rings. The order will be **Sun, Mercury, Venus, Earth, Mars, Asteroid Belt, Jupiter, Saturn, Uranus, Neptune, Pluto.** Every planet is marked with its distance measured in au (astronomical units) which is the distance from the Sun to Earth.

RED (solar system cards 12-15) Now that students have a concept for how big our Solar System is, expand this wonder. Demonstrate the scale of other phenomena in our Solar System. Have students stand beyond the rope for **Kuiper Belt, Heliosphere,** and **Voyager 1/2. Oort Cloud** represents the end of our Solar System (the scale is now hard to visualize).

BLUE (universe expansion cards 16-19) But wait, there's more! We've only seen the reaches of our **Solar System.** Let's zoom out from the Solar System and expand to the galaxies and beyond to the universe. Pull out the **Milky Way Galaxy** card, followed by **Andromeda** (an example of another galaxy). For the final zoom out card pull out the **Universe** card. The night sky is full of amazing and wonderful phenomena whether seen by our eyes or not. From the planets in our solar system, to Galaxies far far away, there are still many mysteries to be fascinated by and tell stories about.



Completed Model

II. What connections can be made in the night sky?

Classroom: Constellation Drawing (15 min)

Now that we have a better understanding of what's actually in the night sky, lets see what connections can be made. There are millions of phenomena and wonders in the sky. Humans have made connections with the night sky for thousands of years. Demonstrate this idea by drawing out constellations with your class!

Using your prepared chalkboard. Ask students what these dots may represent - call back to the solar system model and the variety of phenomena in the night sky like planets, stars, galaxies, etc. Ask three students to come up to the board and connect the dots to create the constellation that shows the pictures they see in the stars. Now that imagined constellations have been identified, call up three new students to name the constellations.

What do these patterns mean to you? As a group, create a story about these three constellations. Try having every student contribute a sentence as you go around the circle.

The pictures you see are as unique as the people who connect them. You may see something completely different than your neighbor, even though you are looking at the same

WILD PEDAGOGIES: EXPANDING IMAGINATION
Let this moment be a time to celebrate intentional imagination that highlights the wonder of recognizing meaning. Expand your imaginative reach!

stars. People seek meaning and patterns in the night sky. Demonstrate this by erasing one of your constellations and having a student come draw a new connection with the same dots.

Humans have been recognizing meaning around stars since time immemorial. Patterns and pictures imagined in the stars are called constellations. Constellations are important to different cultures all around the world. They represent characters, important animals, seasonal practices, and even values specific to a culture. Stories and myths about these constellations have been passed down through the generations. Notice how easy is was as a class to quickly see a pattern and tell a story! Tonight, we are going to get to hear stories from a couple of different cultures, including the Ojibwe, Greeks and Romans.

III. What stories are in the night sky? (10 min)

Classroom: Story Sharing

Why do people create stories from the night sky? They demonstrate personal values, meaningful experiences, and even fun entertainment! It's time for you to create your own story and get creative. Now that you have practice identifying patterns, naming them, and telling a story as a class, students will write their own story.

Hand out paper, clipboard, and pencils or students to form their own constellations and stories. Allow time to slow down and become storytellers. Provide time to share these stories with one another as a small or large group. What are the personal values and meaningful experiences behind this story? Why did you choose that story to tell? What inspired this story?

Humans make connections with patterns in the sky based on prior experiences, traditions, beliefs, values, inside jokes, etc. The stories students share may pass on some of these elements. There are millions of stories inspired by personal connections in the sky.

[Transition] (10 min)

What other stories are out there? After leading your learning group through the complementary classroom portion, you will transition to the planetarium/astronomy experience which repeats the same spiral. If there are two learning groups, this would be the time to retrieve the classroom kids and take them on the experience of a lifetime. If one learning group, briefly step out to begin blowing up the planetarium while students are creating their own stories.

Experience Portion

I. What is in the night sky? (10 min)

Experience: Explore sky

This section will occur either on the astronomy deck or inside the planetarium, depending on weather and visibility. The flow and content are the same regardless of where you are or how the technology performs. It is expected that the liaison connect with their lead teacher to understand the school's expectations surrounding night sky technology.

Look up at the sky, what do you see? What is out there? Share out your observations. You may include stars, planets, galaxies, constellations, black holes, supernovas, nebulas and the unknown. The planetarium has the ability to highlight phenomena, and as a naturalist you can highlight the existence of phenomena, even if unseen, on the astronomy deck.

Here are some listed phenomena of the night sky. Depending on if students started with the classroom portion, recall information from the solar system model, or use this opportunity to prepare them to go deeper with the classroom portion later. Notice this list does not include

constellations which are in the following section. You do not need to know everything. Take this class as an opportunity to learn something new every time you teach it.

Moon - Our moon is so big that some astronomers think we should be called a double planet. With a telescope, craters, mountain ranges, and lava fields are easy to see. The moon is 240,000 miles from earth; 30 earths would fit between the two. The moon, scientist now believe, condensed from the debris of a collision between the very early earth and a Mars-sized object that stripped off a good part of earth's outer crust and mantle.

Stars - The stars, which are distant suns, are massive balls of mostly hydrogen gas. Under intense gravitation pressure, they are undergoing nuclear fusion emitting huge amounts of heat, light and other radiation. Their gravity holds solar systems of planets together. There are 100 billion suns in the Milky Way galaxy. We can only see 2000 or so with our naked eyes on a clear night.

Sun - Our sun is the nearest star. Do not point the telescope at the sun or look directly at its brilliance.
Polaris - Also known as the North Star. It is roughly 447.6 light-years from Earth. Technically Polaris is a triple star system in which these three stars have unique orbits around each other.
Sirius - Sirius is the brightest star. It is roughly 8.6 light-years away. Compared to our sun, Sirius is double the size and 25 times more luminous.

Planets - The word means wanderers in Greek. Planetary fun facts included in the classroom model activity.

Milky Way - The band of stars we see showing the thickness of our galaxy. Our galaxy is shaped like a frisbee and our solar system is 2/3 the way out toward the rim. The rim looks packed with stars because we are looking through the thickness of the frisbee. Many young people have never seen the Milky Way because of light pollution.

Other galaxies - Andromeda is the only visible galaxy with our naked eyes. Andromeda is our sister galaxy. At 2.2 million light years it is the farthest object we can see without binoculars or a telescope. It is another galaxy, very similar to ours in size and shape, containing 150 billion stars. There are another 100 billion that can be seen with telescopes.

Asteroids - Large chunks of space rocks (Ceres is almost 1000 km across) that float around in space, mostly in a belt between Mars and Jupiter.

Meteors - Mistakenly called shooting stars, meteors are bits of rock left over from the formation of the solar system that enter earth's atmosphere and due to their high speed and friction, burn up leaving a glowing trail for a fraction of a second in the sky. Usually only the size of a pea or smaller, they never reach the surface. Meteors the size of a house and larger can land intact making craters and leaving bits of themselves called meteorites. As the earth passes through an especially dirty part of space, meteor maybe swept into our atmosphere in large numbers (called a meteor shower).

Comets - Beyond the orbit of Pluto, way beyond, but still part of the solar system, is a cloud of rocks and ice called the Oort Cloud. There are estimated to be more than a billion dirty snowball objects out there waiting to get knocked out of orbit and fall into the inner solar system drawn by the Sun's gravity. Once in sight we recognize them as comets. The tail, which always streams away from the Sun, can be millions of miles long and is made up of gases "boiling" away from the comet as it heats up.

Northern lights - Electromagnetic storms on the Sun blast charged particles (ions) toward Earth in a cycle that appears to peak every 10 years. This solar wind of ions takes a few days to reach earth and when they enter the atmosphere they are funneled by the magnetic

WILD PEDAGOGIES: LOCATING THE WILD

Wolf Ridge is a beautiful place that allows the wild sky to be seen without intense light pollution. Encourage students, no mater where they come from, to connect to the wonder of the wild sky. These phenomena are present whether seen or unseen. The stories they tell hold value and meaning, clear sky or clouded mystery – the night sky is a locatable wild for every student.

field to the north and south magnetic poles. These ions travel downward until at about 50 miles up they encounter gases of oxygen and nitrogen. The high energy ions charge up the gases until they glow like the gas in a fluorescent light tube.

Spacecraft - It is likely that you will see a satellite pass overhead during your astronomy class. Large solar panels powering many spacecraft reflect light easily. Currently 18,000 pieces of space junk are continuously being tracked by radar. The International Space Station has a schedule for viewers to observe its flybys.

The night sky is full of a variety of phenomena! Take a moment with the kids to be amazed at the beautiful display before our eyes, seen and unseen. Use the planetarium to zoom in on some phenomena. Lay on your backs on the astronomy deck and list out the phenomena around you. How are these observations related? How do they relate to other phenomena in the night sky? What connections can you make? What do you still wonder about?

Though the wonders of the night sky may seem separate, they are related to each other. What may appear to be a star, could be a galaxy far in the distance. That galaxy is a system composed of millions of stars and potentially planets held together by gravitational pull. When stars explode, supernovas are formed and have the potential to create black holes. Without technology, we would have a difficult time studying these phenomena because they are so far away. Technology allows us to better understand how these phenomena are related.

II. What connections can be made in the night sky?

Experience: Explore the sky **(20 min.)**

Now that students have a better understanding of the variety of phenomena in the night sky, it is time to make connections. Now is the time for constellations! They might have come up already, but try to reserve this time to connecting the dots and seeing the constellations. Spend the earlier time really digging into what is in the night sky before you connect the dots.

Constellations are groups of stars visualized together to form pictures in the night sky. Take time to connect the dots and call out any recognized constellations. This lesson plan focuses on a few. Feel free to continue to increase your knowledge of constellations as you grow in your understanding of the night sky. Different cultures throughout history have connected their own pictures and passed these tradition along. The listed constellations below correlate Ojibwe and Greek constellations. The patterns are not the same, though many overlap in similar ways.

A. Circumpolar Constellations

Some constellations are always visible from the northern hemisphere. Their position changes through the night and the year, but they are visible all throughout. If in the planetarium demonstrate this by having students focus on the North Star as you fast forward time. It stays generally in the same spot. Besides Ursa Major and Minor, other northern hemisphere circumpolar constellations include: Cassiopeia, Cepheus, Camelopardalis, and Draco.

Ojiig the Fisher - The Big Dipper and Ursa Major/Big Bear - Although the Big Dipper is generally considered a constellation all by itself, it is actually an asterism in the Ursa Major or Big Bear constellation. Asterisms are recognizable shapes in larger constellations. While the stars in constellations look like they are right next to each other, the reality is that they are light years away from each other. The Big Dipper is the one exception! Five of the seven stars are believed to have formed in the same nebula.

Maang the Loon - Little Dipper and Ursa Minor - Loon occupies the premier position of all the constellations, circling the northern sky throughout the year. Loon pivots by its tail on Giwed'anung, the Ojibwe name for Polaris or the North Star. Follow the edge of the "cup" of the big dipper straight up until you find Polaris, the North Star. This is the tip of the long tail of the Little Bear, or the handle of the Little Dipper.

B. Seasonal Constellations

Some constellations only appear in certain seasons. Below is a list of a major constellation correlated with its season of prominence.

Winter: Biiboonkeonini Winter Maker - Orion - The Wintermaker is one of the greatest constellations in the night sky towering above the southern sky throughout the winter. The Ojibwe welcomed the Wintermaker and celebrated his arrival with a snowshoe dance. It is easily recognized by three of the brightest stars in our night sky lined up in a row to make Orion's Belt. From these three stars, it is not hard to find the two stars Betelgeuse and Bellatrix. Betelgeuse (pronounced Beetle Juice) is often a kid favorite, because translated from Arabic, it actually means "armpit". Betelgeuse is a red giant and actually appears slightly red both in the planetarium and in our night sky.

Spring: Mishi Bizhiw Curly Tail/Great Puma - Leo and Hydra - Curly Tail is often talked about in stories as a lynx or a puma. This spirit cat is connected to water and flooding. Spring in the north woods is a time of ice melt and seasonal flooding. The water can be a dangerous thing in the spring, and this is seen in Mishi Bizhiw's mischievous nature. Leo (Lion) and Hydra (water snake). Hydra is known as the worlds largest constellation.

Summer: Nanaboujou - Scorpio - Nanaboujou is a prominent figure in Ojibwe culture (you will find many variations on the spelling of this name). He is often connected to their creation story and is known as a bit of a trickster. This constellation portrays the bow of Nanaboujou which is always in pursuit of Curly Tail. Scorpio's brightest star is the scorpion's heart named Antares.

Fall: Mooz Moose - Pegasus - Just as the Mooz constellation rises in the Autumn night sky, so begins the season of Moose hunting for the Ojibwe. The square asterism makes this consteltion stand out in the night sky. Pegasus contains the deep sky globular cluster M15.

What do these patterns in the night sky tell us? Patterns in the night sky can tell us about seasonal changes, navigational knowledge, and are the origin of our 365- day calendar year. Constellations in the night sky are patterns of stars that create images and likely have a story to tell. Tonight in the classroom section, you did/will see patterns and tell your own stories. Humans have created stories that relate to constellations to relay cultural traditions or experiences.









III. What stories are in the night sky? (15 min)

Experience

Ask if they are familiar with any stories of constellations. From the story cards, choose a few stories to share. It is recommended to choose a circumpolar and a seasonal story to share with the class. The story cards include:

Circumpolar Stories

- Ojiig (Fisher)
- Draco

Seasonal Stories

- Fall Mooz (Moose)
- The Wintermaker
- Spring Curly Tail
- Summer Nanaboujou

Understand Native Minnesota

The story cards contain stories from Carl Gawboy and Ron Morton's book *Talking Sky.* When reading these stories, read from the story cards to respect the storyteller. Oral storytelling is a highly valued and respected skill within the Ojibwe culture because they relate their history and traditions through stories. Storytelling is a skill that is practiced and respected within Ojibwe culture. This is unlike the game of telephone where information may be lost along the way (a game that better represents Western value of oral storytelling).

It is helpful to understand the context of *Talking Sky* before you read off the story cards. These excerpts from *Talking Sky* all begin with a conversation between Ron Morton (former professor of geology at UMD) and Carl Gawboy (Ojibwe author/artist and former professor of American Indian studies at St. Scholastica). The first person pronouns (I, me, my) in the book are always referring to Ron. When Ron refers to Carl he calls him by name or uses he/him pronouns. Any italicized words on the card are when Carl goes into story mode.

This class is also a great opportunity to practice your own storytelling skills. Draco is listed as one of the circumpolar stories to share. The story card contains one naturalist's retelling (pulled from a variety of stories and myths). Have fun with it and tell it your own way! You also don't have to share the Draco myth. Find a constellation story you would enjoy sharing, whether circumpolar or seasonal.

Debrief the stories after sharing with the class. What are the personal values or meaningful experiences from this story? What can we learn from it? What can we learn about the culture?

Throughout time, and currently, stories are a way to share oral history. Cultures have unique traditions, beliefs, religions and values that influence their stories and shape the passing of knowledge from generation to generation. All stories have meaning, and some stories have deep cultural significance that may relate to either religious beliefs or creation stories. Not all stories are ours to share, but the existence of these stories reveals the wonder and depth behind being people in this universe.

What other stories are there? How can you seek out more stories and become a storyteller yourself?

IV. Conclusion (5 min)

Whether on the astronomy deck, in the planetarium, or at the close of the classroom portion, take some time to close your class with intention. If time allows, ask students what connections they made tonight? What stories stuck with them? How can they continue to learn through the night sky when at home?

Clean Up (15 min.)

See Wolf Ridge Night Sky Technology Guide on appropriate clean up for your chosen technology. Return all model activity materials to the Night Sky kit. Return story cards to the kit. Stack any chairs and erase chalk board. If any technology equipment is running low on batteries or is misbehaving, inform the kit manager promptly.

Appendices

Glossary

au (astronomical units) - The distance from the Earth to the Sun. Used as a unit of measurement for many planetary objects.

Curly Tail/Great Panther/Great Puma/Lynx - This Spring Ojibwe constellation goes by many names. It is known in the night sky by its distinct curly tail (head of Leo the Lion). Panther is the more general term for a large cat with a solid color (including jaguars and leopards). Carl's book *Talking Sky* refers to this constellation as the Great Panther, but since the books publication he refers to it as the Great Puma which is the regional name for mountain lions/cougars. There are also many Ojibwe stories relating this figure with a Lynx (these stories often include the Great Puma's tail being cut off).

Heliosphere - The Heliosphere is like a shield protecting the Solar System from interstellar radiation. It is created due to the Sun sending out constant solar material called solar wind.

Kuiper Belt - A donut-shaped region full of comets, asteroids, and other icy bodies. Pluto is in the Kuiper Belt.

Oort Cloud - Theorized to be the outer bound of the Solar System. Made up of icy bodies and other remnants of scattered objects.

Nanaboujou (Nenabozho) - A summer Ojibwe constellation. Nanaboujou is a prominent hero is many Ojibwe stories and is known as a trickster.

Shingebis - A hell-diver or grebe/a fish-eating duck. Connected to an Ojibwe story with Wintermaker.

References

- *Talking Sky* by Carl Gawboy and Ron Morton
- *Ojibwe Sky Star Map Constellation Guide: An Introduction to Ojibwe Star Knowledge* by Annette S. Lee, William Wilson, Jeffrey Tibbetts, and Carl Gawboy

Sources

- planetarium dome system - Digitalis Education Solutions, Inc., 817 Pacific Ave, Bremerton, WA 98337: http://digitaliseducation.com/digitarium.html
- laser pointers - Amazon.com

FEATURED CONSTELLATIONS

This chart is a collection of resources regarding constellations. One main resource in the book *Ojibwe Sky Star Map Constellation Guide: An Introduction to Ojibwe Star Knowledge* by Annette S. Lee, William Wilson, Jeffrey Tibbetts, and Carl Gawboy. Other Greek seasonal constellations are included as well.

Ojibwe		Related Greek Constellation
GIIWEDIN - North		
Loon	Maang	Ursa Minor (Little Dipper)
Fisher	Ojiig	Ursa Major (Big Dipper)
North Star	Giiwedin Anang	Polaris
		Draco (dragon)
NIIBIN - Summer		
Crane/Skeleton Bird	Ajijaak/Bineshi Okanin	Cygnus (swan)
Exhausted Bather/Person	Noondeshin Bemaadizid	Hercules
Nenabozho	Nenabozho	Scorpio (scorpion)
		Bootes (herdsman)
		Lyra (lyre)
		Sagittarius (centaur)
DAGWAAGIN - Fall		
Moose	Mooz	Pegasus (winged horse), Lacerta
Hole in the Sky	Bagone'giizhig	Pleiades (7 Sisters)
Sweating Stones	Madoodoowasiniig	Pleiades (7 Sisters)
		Capricorn (Seagoat)
		Perseus (warrior)
BIBOON - Winter		
Wintermaker	Biboonikeonini	Orion, Canis Minor, Taurus (bull)
		Gemini (twins)
		Auriga (Charioteer)
		Canis Major (dog)
ZIIGWAN - Spring		
Curly Tail, Great Puma	Gaadidnaway, Mishibizhii	Leo (lion), Hydra
Sweat Lodge	Madoodiswan	Corona
		Virgo (goddess)
		Cassiopeia (queen)
		Cepheus (king)

OJIBWE MOON NAMES

This chart is a collection of resources regarding Ojibwe moons. One main resource is the Fond du Lac chart from 1998 included in the book *Ojibwe Sky Star Map Constellation Guide: An Introduction to Ojibwe Star Knowledge* by Annette S. Lee, William Wilson, Jeffrey Tibbetts, and Carl Gawboy. Ojibwe.net has a "Cosmology and Geography" project that chronicles Moons and Days for Western and Eastern dialects of the Ojibwe language. This chart is a combination of information from these resources.

Month	Fond du Lac 1998 Ojibwe Sky Star Map Constellation Guide (Annette S. Lee, et al)	Western Dialect Ojibwe.net	Eastern Dialect Ojibwe.net
January	**Gichimanidoo-giizis** Great Spirit Moon	**Aabita-bibooni-giizis** Half Winter Moon	**Shki-bboon-giisoons** Little New-winter Moon
February	**Namebini-giizis** Sucker Fish Moon	**Migiziwi-giizis** Eagle Moon **Webinige-giizis** Throwing Away Moon	**Mkwa-giizis** Bear Moon
March	**Onaabani-giizis** Hard Crust on the Snow Moon	**Aandego-giizis** Crow Moon	**Ziizbaakdoke-giizis** Sugaring Moon
Thirteenth Month		**Bookwaagame-giizis** Broken Snowshoe Moon	
April	**Iskigamizige-giizis** Maple Sap Boiling Moon	**Maango-giizis** Loon Moon	**Nmebin-giizis** Sucker Moon
May	**Zaagibagaa-giizis** Budding Moon	**Waabigwani-giizis** Flower Moon	
June	**Ode'imini-giizis** Strawberry Moon		**Baashkaabigonii-giizis** Blooming Moon **Gtige-giizis** Planting Moon
July	**Aabita-niibino-giizis** Mid-Summer Moon	**Baapaashkizige-giizis** Bursting Moon	**Miin-giizis** Blueberry Moon
August	**Manoominike-giizis** Ricing Moon		**Mckominike Giizis** Raspberry Picking Moon **Datgaagmin-giizis** Blackberry Moon
September	**Waatebagaa-giizis** Leaves Changing Color Moon		**Mdaamin-giizis** Corn Moon
October	**Binaakwii-giizis** Falling Leaves Moon	**Waatebagaa-giizis** Leaves Turning Colors Moon	**Bnaakwii-giizis** Harvest Moon
November	**Gashkadino-giizis** Freezing Moon		**Baashkaakodin-Giizis** Freezing Moon
December	**Manidoo-giizisoons** Little Spirit Moon	**Bibooni-giizis** Winter moon	**Gchi-bboon-giizis** Big Winter Moon

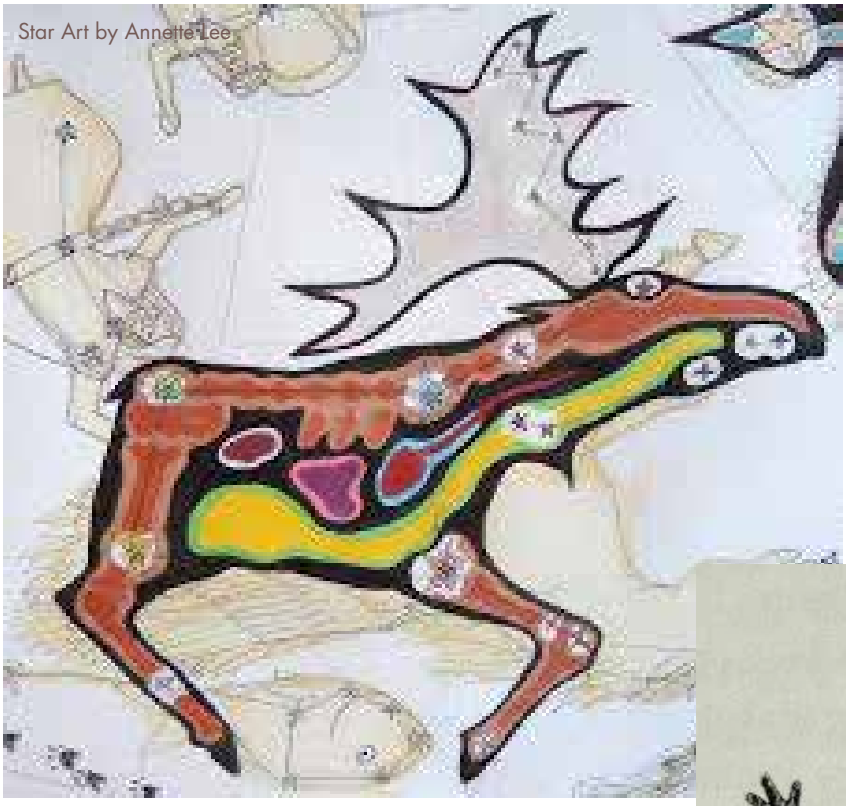
Model Key

#	Phenomena	au (astronomical unit)	1 yd = 5 au
1	Sun	0 au	0 yds
2	Mercury	.4 au	3 in or .08 yds
3	Venus	.7 au	5 in or .14 yds
4	Earth	**1 au**	7 in or .19 yds
5	Mars	1.5 au	9 in or .25 yds
6	Asteroid Belt	2.8 au	18 in or .5 yds
7	Jupiter	5.2 au	1 yd
8	Saturn	9.6 au	2 yds
9	Uranus	19.2 au	4 yds
10	Neptune	30 au	6 yds
11	Pluto	Average 39.5 au	8 yds = 1 rope
12	Kuiper Belt	30-50 au	6 - 10 yds
13	Heliosphere	120 au	24 yds = 3 ropes
14	Voyager 1& 2	168 au & 140 au	28 yds & 34 yds
15	Oort Cloud	5,000 - 100,000 au	1000-20,000 yds 125- 2,500 ropes
16	Solar System	0 - 100,000 au	
17	Milky Way Galaxy	1 billion stars 4,000 systems	
18	Andromeda Galaxy	2.5 light years 160 billion au	
19	Universe	200 bil - 2 Tril galaxies	

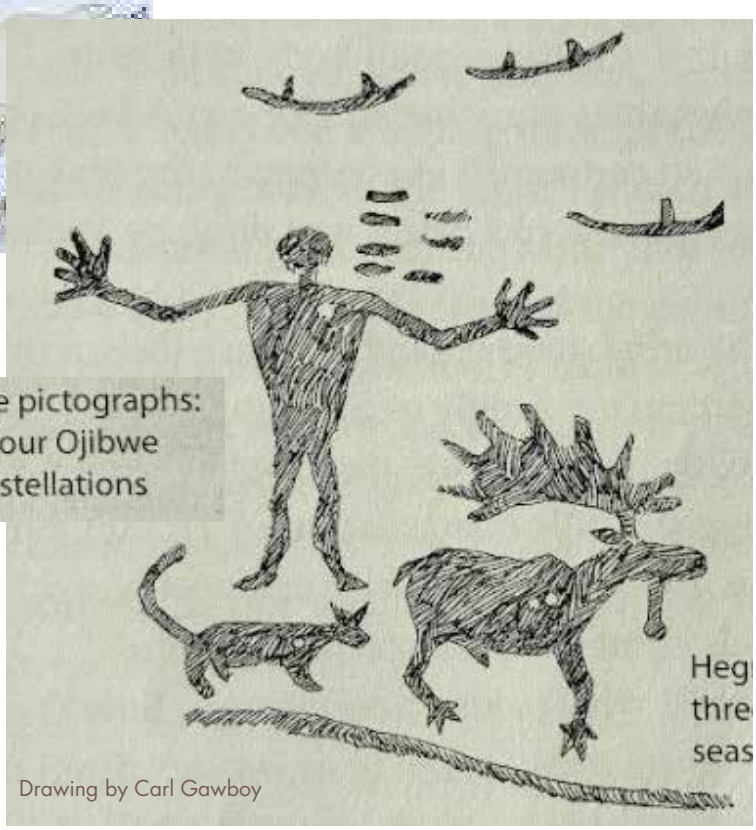
Our planets #1-11	Use the blue rope. Go from Sun to Pluto.
Our Solar System #12-15	Extend past the blue rope. Have students stand "to scale" in the room (if possible).
The Universe #16-19	The scale doesn't work anymore! Imagine the extent of the Universe. Zoom out!

NIGHT SKY

Seasonal Story Card - Fall



Star Art by Annette Lee



Hegman Lake pictographs: three of the four Ojibwe seasonal constellations

Drawing by Carl Gawboy

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Chapter One: Dagwaagin (Fall) and the Mooz (Moose) pg 11-13

***Talking Sky* by Carl Gawboy and Ron Morton**

These excerpts from *Talking Sky* all begin with a conversation between Ron Morton (former professor of geology at UMD) and Carl Gawboy (Ojibwe author/artist and former professor of American Indian studies at St. Scholastica). The first person pronouns (I, me, my) in the book are always referring to Ron. When Ron refers to Carl he calls him by name or uses he/him pronouns. Any italicized words on the card are when Carl goes into story mode.

Rotating the chart so that it showed the fall constellations, he placed it in front of me. Tapping it he said, "And there he is."

"Pegasus," I replied, "the big square in the sky."

"To the Greeks and most Americans, yes. But to the Ojibwe the great square was the body of a moose. And the constellation directly above it, Lacerta, was seen as the moose's great antlers.

"Even better," he continued, his voice becoming more excited, "these two stars here," and he tapped each in turn, "represent the bell or beard of the moose. As well, within the square of Pegasus, right here, there is a star that represents the moose's heart. These stars down here, below Pegasus, are his front legs. If you draw them in silhouette, the moose actually appears to be running."

"Like the Hegman Lake moose," I remarked.

"Good memory," he said, with a nod. "This grand star figure dominates the night sky from late September through most of November. Moose hunting season."

"Impressive," I said. "An antlered moose I see. To pick out the beard and heart stars is pretty observant. It would have been quite the sight in a night sky without any lights. But moose hunting in the fall?" I questioned. "That I don't get. Most of what I've heard and read has been about the Ojibwe hunting moose during the winter."

"Phooey!" Carl exploded. "Modern Indians on snowmobiles with high-powered rifles maybe, but not my ancestors. I mean Indians hunted moose year around if the chance presented itself. But mostly it was done in the fall. At that time of year moose had a lot of fat on them, and it was cool enough to render and preserve the meat. Fewer bugs as well,' he added, with a smile.

Taking a sip of coffee, he said, "In the spring it was too dangerous. Spring thaw, unpredictable high and turbulent water, plus the moose were scrawny and thin. Also there were a lot of young moose around, and they needed a mother so they could survive to become adult moose. Winter was too cold. And even on snowshoes trying to hunt down a skittish moose in deep snow would be a difficult undertaking. Summer was too hot and buggy. Fall was the perfect season for hunting moose. The old sources—Warren, Tanner, Densmore, my father—all talk about the fall moose hunt."

"Even so," I protested, "fall is rutting season. That's when moose are aggressive and dangerous. They bellow, tear up the earth, even charge people. They've put many a geologist up a tree, and for a big bull sometimes that's not enough. They then try to tear the tree down. There is this great story about a geologist run up a skinny little pine by a bull moose. The tree was so small the heels of his boots were a couple of feet above the moose's antlers. The moose would back off, lower its head, and charge the tree, running full tilt into it. The tree would bend forward from the force of the blow, then swing back. As it came back the geologist would lean down and hit the moose in the head with his hammer. This went on until a helicopter came along and chased the moose off. Stubborn and persistent was that moose. Why would you mess with them in the fall?"

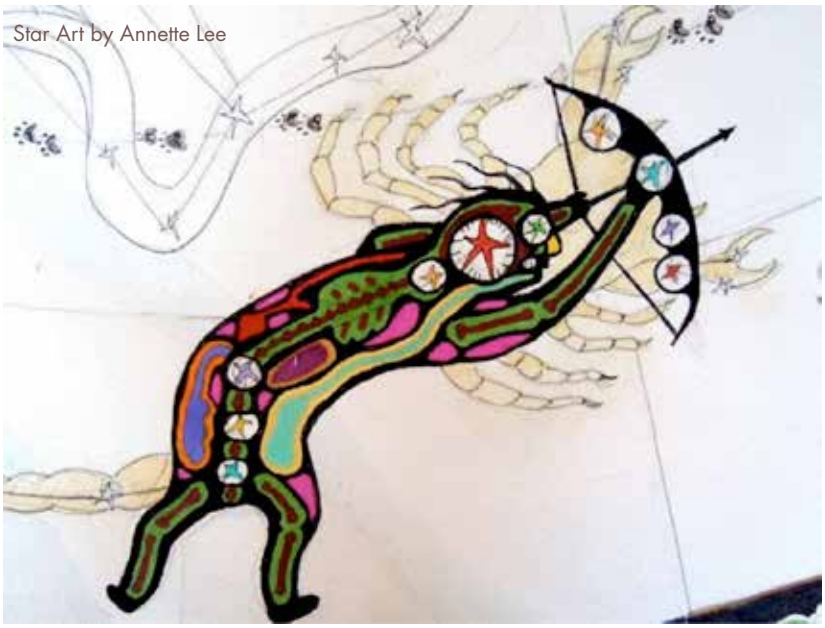
"You're making that up," he said, giving me a hard stare.

"No way. It's true," I insisted. "I heard it from the helicopter pilot who rescued the geologist. Point is, moose are really dangerous in the fall."

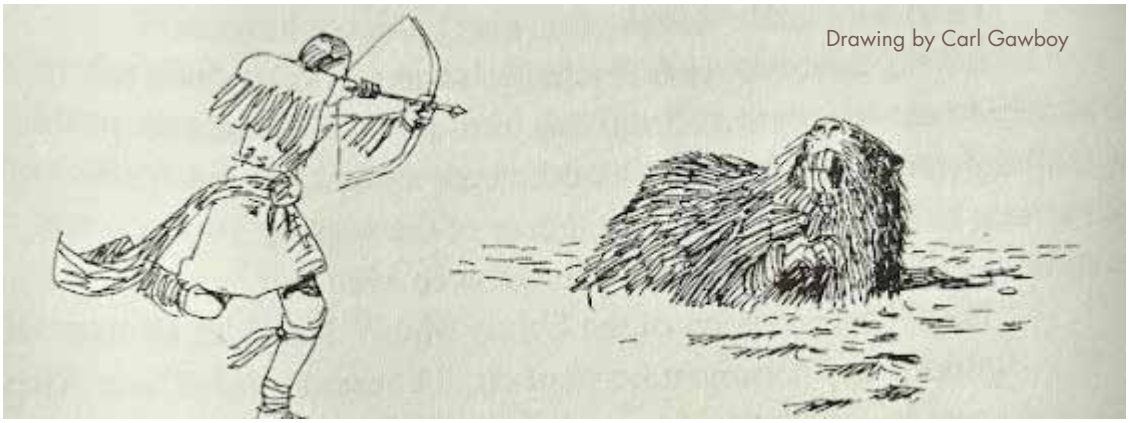
"And in the fall they are also foolish, careless, and easily lured into a trap," he told me. "That is one of the most important reasons they were hunted at that time of year. What you need to understand is that hunting moose was a most difficult proposition any time of year."

NIGHT SKY

Seasonal Story Card - Summer



Star Art by Annette Lee



Drawing by Carl Gawboy

Drawing by Carl Gawboy

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Chapter Four: Niibin (Summer) and Nanaboujou pg 51-53

***Talking Sky* by Carl Gawboy and Ron Morton**

These excerpts from *Talking Sky* all begin with a conversation between Ron Morton (former professor of geology at UMD) and Carl Gawboy (Ojibwe author/artist and former professor of American Indian studies at St. Scholastica). The first person pronouns (I, me, my) in the book are always referring to Ron. When Ron refers to Carl he calls him by name or uses he/him pronouns. Any italicized words on the card are when Carl goes into story mode.

"But back to Nanaboujou. Another of his attributes is that he looks out for humankind. On his journeys over the earth he destroys or conquers many ferocious animals and monsters of both land and sea-creatures whose continued existence would have placed in jeopardy the fate of humankind. One story that may go back to ancestral memories of the Ice Age is about Nanaboujou and the giant moose. Giant moose were real. The stag moose roamed the landscape as the glaciers melted. This creature was one of a group of animals that are referred to as Mega Fauna. The stag moose stood eight to ten feet high at the shoulder and had antlers that were eight to ten feet across. In the story Nanaboujou tracks the moose back to its home in the north and, after a fierce battle, slays it. The moose's blood runs into a nearby lake. There is so much blood it turns the water red. Thus the name Red Lake, referring to the one in Ontario."

"The giant beaver," I exclaimed. "Same deal. Part of the Mega Fauna. Giant beaver were eight feet long and four feet high, meaning a beaver pond had a totally different meaning way back then."

Carl nodded and said, "In the Ojibwe story the giant beaver has constructed an immense dam that blocks up the waters of Ojibwe Gitchi Gami not far from Boweting, which means Place of the Rapids.

It is now called Sault Ste. Marie. The giant beaver and Nanaboujou are archenemies and Nanaboujou is forever chasing the beaver around Lake Superior with only one object in mind: to bash its brains out.

The two have one fierce battle after another until the beaver, tired of fighting and realizing Nanaboujou will never give up, decides to leave the great lake. Unfortunately the only way out is to break through the immense dam it has built. Sensing Nanaboujou's approach, the beaver attacks the dam in a wild frenzy. Just as Nanaboujou creeps close enough to deliver a killing blow, the dam gives way. Water rages out of the breach, washing the beaver down the St. Marys River and into Georgian Bay."

"And it really happened!" I cried. "Glacial Lake Duluth, the precursor to Lake Superior, was blocked at Sault Ste. Marie by an immense ice dam. When the dam either broke or melted, water poured down what today is the St. Marys River in the form of catastrophic floods. And thus Lake Superior was born."

"I know," he said. "And to quote you, 'If you visit Georgian Bay, explore some of the many islands there and see if you can find the one which looks like a giant beaver.' "

Laughing, I said, "Another great story. One related to events that actually took place over 8,000 years ago."

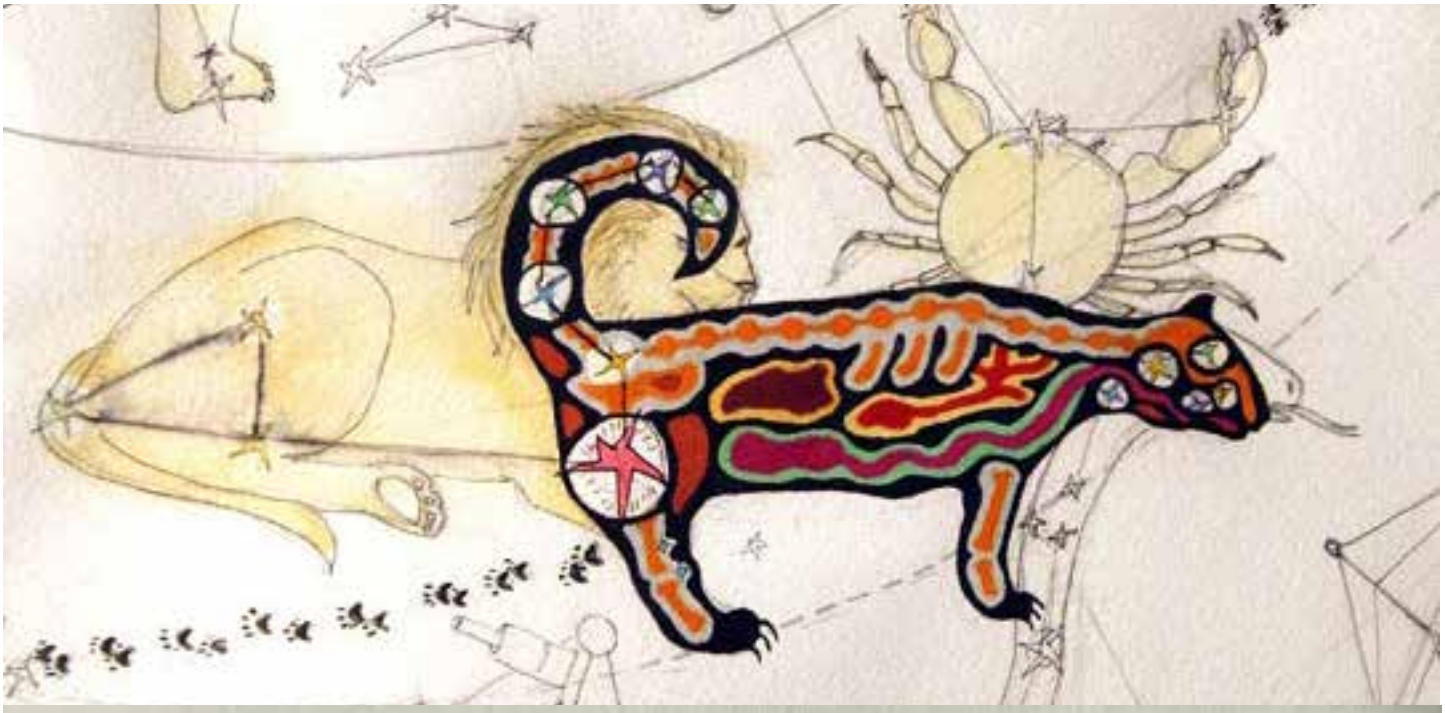
"Oral history—ancestral memories," he said, confidently.

"Oral history that didn't get wiped out by the great epidemics."

"Thank goodness for that," he said, with a deep sigh. "Nanaboujou is also seen as the one who gave the Ojibwe everything important that they have. He is also responsible for all Ojibwe ceremonies, large and small. For instance, Basil Johnston tells us that the Mide society itself was Nanaboujou's gift to the People. Once, when a deadly epidemic struck the Ojibwe, Gitchi Manito sent Nanaboujou with the gift of medicine. That is why Nanaboujou's name is invoked at every Mide ceremony."

NIGHT SKY

Seasonal Story Card - Spring



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Chapter Three: Ziigwan (Spring) and Mishi Bizhiw (Great Panther) pg 41-42

***Talking Sky* by Carl Gawboy and Ron Morton**

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"Your painting," I said. "Nanaboujou's magic arrow and the Great Puma, that has something to do with the great flood?"

"It does, and one of the nicest and shortest versions of it was told by my father. He told the story so many times I still remember it word for word."

"Oral history," I commented.

"In a way, very much so. And from my oral history the story goes like this:"

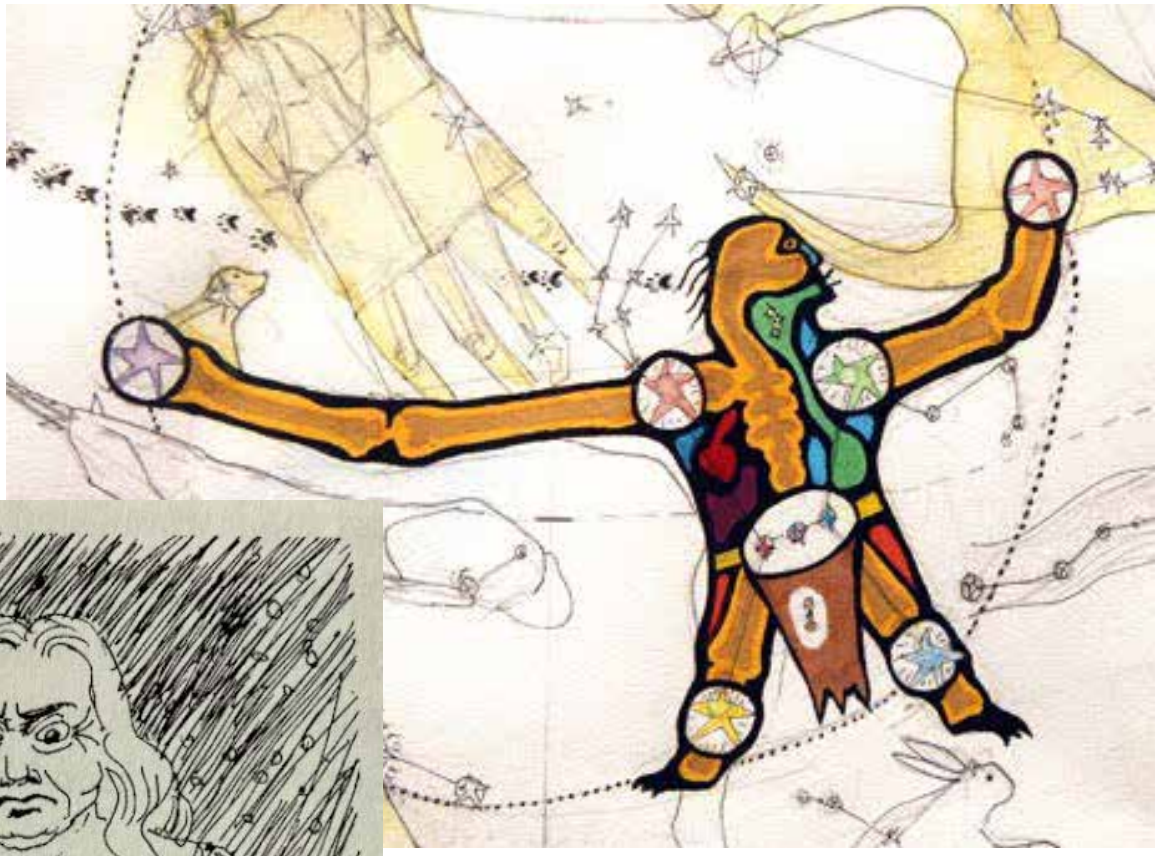
Nanaboujou and the evil Curly Tail had a battle after the world was created; a battle that pitted good versus evil. With a magic arrow Nanaboujou shot Curly Tail in the side. Crawling back to his underwater den, Curly Tail offered the riches of the world to anyone who would come and cure him. Nanaboujou, making promises to help Curly Tail, tricked the frog people into giving him a frog skin so he could swim down to Curly Tail's den. Going to the bedside of the evil one, Nanaboujou, instead of helping him, rammed the arrow tighter into Curly Tail's chest. But once again Nanabojou failed to kill the evil one. In his rage at Nanaboujou, Curly Tail called down the rains, and the floodwaters covered the earth. The whole world knows how Nanaboujou sent the muskrat to the bottom to get the handful of earth so that Nanaboujou could recreate the world above the sea.

"As I recall, the ending of that myth is really special, about the formation of Lake Superior," I told him. "Where, after the land was whole again, Nanaboujou took his long measuring string and walked over all the lands measuring everything. He decided on the proper length of rivers, the height of hills and mountains, and the size and depth of lakes. When this was done he walked once more over the land looking for the perfect spot to make his greatest lake. When he found the place —not too far north, nor too far south, forest on one side, prairie on the other—he made it in the shape of a bow and arrow so the people who lived along its shores would always have good hunting.

"Very nice story."

NIGHT SKY

Seasonal Story Card - Winter



Drawing by Carl Gawboy

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Chapter Two: Biboon (Winter) and the Wintermaker pg 29-30

Talking Sky by Carl Gawboy and Ron Morton

These excerpts from *Talking Sky* all begin with a conversation between Ron Morton (former professor of geology at UMD) and Carl Gawboy (Ojibwe author/artist and former professor of American Indian studies at St. Scholastica). The first person pronouns (I, me, my) in the book are always referring to Ron. When Ron refers to Carl he calls him by name or uses he/him pronouns. Any italicized words on the card are when Carl goes into story mode.

"That story, the original of which comes from Maude Kegg, is a really important one," Carl said, rather emphatically. "There are also other stories," he continued, "about trying to get rid of the Wintermaker, but doing so through perseverance, determination, and trickery. One I particularly like concerns Shingebis, a hell-diver or grebe, a fish-eating duck. There are several versions of this story, but the one I originally learned goes something like this:"

Shingebis lived alone in a lodge by the shores of a lake. The weather had turned cold and ice had formed on the water. Shingebis collected logs to keep his fire going during the winter months. Shingebis was hearty and fearless. He would go out during the coldest of days and look for places where rushes grew up through the ice. Plucking these up with his bill he would dive down through the openings created in search of fish. In this way he found plenty of food and always went home dragging strings of fish behind him.

The Wintermaker, seeing this, was very upset that the duck had stayed in what was now his land after he had frozen all the plants and driven all the other birds off. He was also angry at the ducks perseverance and good luck in defiance of the coldest blasts of wind he could send. 'Why, ' the Wintermaker asked, 'does he not seem to mind the cold, and appears happy and contented as if it were summer. I will send weather he cannot possibly master. ' So the Wintermaker poured forth cold winds and great drifts of snow until it was impossible to live in the open air. Still Shingebis kept his warm fire going and managed to locate fish and bring them in the worst of weather.

Not understanding how this was possible, the Wintermaker decided to go and visit the duck. That very night he went to the door of Shingebis's lodge. Shingebis had cooked a meal of fish and was lying on a reed mat telling his stories and singing his songs.

The little fisherman knew that the Wintermaker was at his door for he could feel his icy breath. Even so he kept on telling stories and singing songs as though the Wintermaker was not present. At length the Wintermaker entered the lodge and took a seat opposite Shingebis. Still Shingebis refused to notice him. Instead he got up, as if no one was there, took his poker and stirred the fire so it burned brighter and hotter. All the while he continued to tell his stories and sing his songs. As it got hotter in the lodge tears started to flow down the Wintermaker's cheeks. These increased so fast that he said to himself, I can't stand it, I have to get out.' So he went and left Shingebis to his stories and songs.

Now truly upset with the duck, he decided to make the ice so thick that Shingebis could not get any more fish. Still, by persistence and great diligence, Shingebis managed to pull up the frozen roots and dive under the ice for fish. At last the Wintermaker had had enough. 'I cannot defeat him,' he said. 'He must be aided by some great Manidoo. I can neither freeze nor starve him. He is a very singular being and therefore I will leave this land to him.' And so the Wintermaker moved much further north, it warmed up, and the birds returned.

"Very nice," I said. "And if I understand it correctly, Shingebis persevered under the worst conditions and spring finally arrived, meaning the Ojibwe should do the same thing."

"That's the crux of the story," Carl replied. "The story has good advice about the proper attitude toward the winter season. Let the winter do what it will, but if you show calm and perseverance and keep to your ways..."

"Telling stories, singing songs, going about the three C's," I interrupted.

"You got it. If you do that, you will come through the winter months in pretty good shape. This is not saying one should be lax in preparing for winter, or that winter cannot be dangerous, only that you must face your challenges and do your duties."

NIGHT SKY

Circumpolar Story Card - Ojiig Fisher

Star Art by Annette Lee

Drawings by Carl Gawboy

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Chapter Five: Niibin (Summer) and Ojiig (Fisher) pg 56-59

Talking Sky by Carl Gawboy and Ron Morton

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And, as I made an attempt to connect the stars to make a whole fisher, Carl told the story of the brave little Fisher:

Fisher and his friends were out on a hunt. The hunt lasted weeks and weeks. The hunting was difficult because the snow and cold would not leave them alone. Fisher's friend, Bear, began to worry.

'Winter has lasted too long, ' he told Fisher. 'If spring does not come soon we will starve. The moose and caribou will have nothing to eat. The beaver will have no lily roots or fresh aspen bark. Something has happened in the sky world to stop the seasons from turning as they should.'

'Let us send Wolverine up to the sky world to find out what the matter is,' Fisher said.

They sent for Wolverine. He agreed to go, and ascended to the sky world by way of a great pine tree. He was gone for many days. Finally he returned.

'A great ogre beyond the edge of the sky has captured all the birds, ' Wolverine reported. He has imprisoned them in great birch bark makoks. That is why winter will never end.'

'Who is this ogre?' asked Fisher.

'He is bigger and more cruel than any being here in this world,' Wolverine said. 'Worse, he has his brothers with him to guard the birds.'

'We must kill him and free the birds,' said Fisher.

Having said this, he strapped on his quiver and his knife, picked up his bow, and set out. He came to the great pine tree and climbed it. From the top of the tree it was but a short step to the opening in the sky. Once through the opening, Fisher found himself in a wonderful world. It was warm, flowers were everywhere, and the air was alive with the buzzing of bees. Moving across the land, Fisher soon came to the ogre's encampment.

The two guardians, the ogre's brothers, turned to face him. Realizing quickness was his only chance, Fisher dashed between their legs. He ran as fast as he could to the huge baskets and stove them open. Out poured the birds: flickers, jays, robins, chickadees, ducks, geese, and swans. Up they spiraled in a great black cloud that darkened the entire sky. Then, in a tornado of wings, they plunged down through the hole in the sky and entered the world below. The great ogre shouted in rage. He and his brothers ran toward the brave little Fisher. Once again Fisher used his speed and quickness. He dashed between their legs and raced to the hole in the sky. Without hesitating, he threw himself through it. Far below he could see the earth. And before his eyes it was changing from white to brown to green. Down he fell, the ogre's arrows whizzing all around him.

Fisher was lucky. None of the arrows found its mark, and he landed on soft, mossy ground. He knew the ogres would not be far behind him, so he had to make his escape fast. He ran this way, he ran that way, he dodged terrible flights of arrows. But try as he might, he couldn't lose the ogre or his brothers. In fact they were getting closer.

In desperation he raced back to the great pine tree, thinking he could fool them by climbing into the sky world, then doubling back to earth. Quickly he climbed the tree, but he was not fast enough. The ogres saw him, and a great volley of arrows whizzed by, missing him by inches. At the top of the pine tree Fisher leapt to the north. Here one of the arrows found its mark and pinned him to the sky. Around and around he turned, and there he is to this very day.

With the freeing of the birds the ogre's lost their power over the earth. So they left by way of the great pine tree, back through the hole in the sky to their world. They have never bothered the inhabitants of the earth again.

"Sad story," I commented. "Your people certainly had nothing on the old Greeks.

"Bah," he exclaimed. "It's not sad in the least bit. In fact it's a story of greatest bravery and courage and their rewards. Fisher didn't die. Each year he circles the heavens. In winter he crawls along the northern horizon, but in the spring, he gains power and ascends overhead. As he reaches the zenith the birds come and summer is restored to the land. Then slowly Fisher swings back to the west toward the horizon and it is time for the birds to leave. So it is Fisher, in gaining power, who heralds the coming of the birds, and when he loses power, he is the messenger that tells them it is time to go."

NIGHT SKY

Circumpolar Story Card - Draco

image credit Johannes Hevelius' Draco
from Uranographia (1690)

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Draco

A Naturalist's Retelling

In the night sky coiled round and round Polaris, the north star, lies the defeated Ladon the dragon (in Greek: Drakon, Draco). The constellation Draco is displayed under Hercules' foot and tells the legend of the epic battle between these two rivals.

Ladon was tasked with guarding a precious tree that produced beautiful golden apples. Some previous guards were known for picking the apples for themselves, so the owner of this tree, the goddess Hera, put Ladon in charge of watching the golden apples.

Now this dragon was known for having possibly a hundred heads that could all speak in different voices. Hera was sure he would prove to be an excellent guard for her tree. She valued this tree immensely due to it being a wedding present when Hera married her husband the god Zeus.

Now Hercules was on a mission of his own. Hercules was the son of Zeus, though his mother was human, making Hercules a demigod. He was trying to prove himself among the gods and atone for his crimes, so he embarked on 12 labors. Hera the goddess and owner of the golden apple tree, tried to make these labors difficult for Hercules, hoping that Hercules' story would end in defeat as a result of these labors.

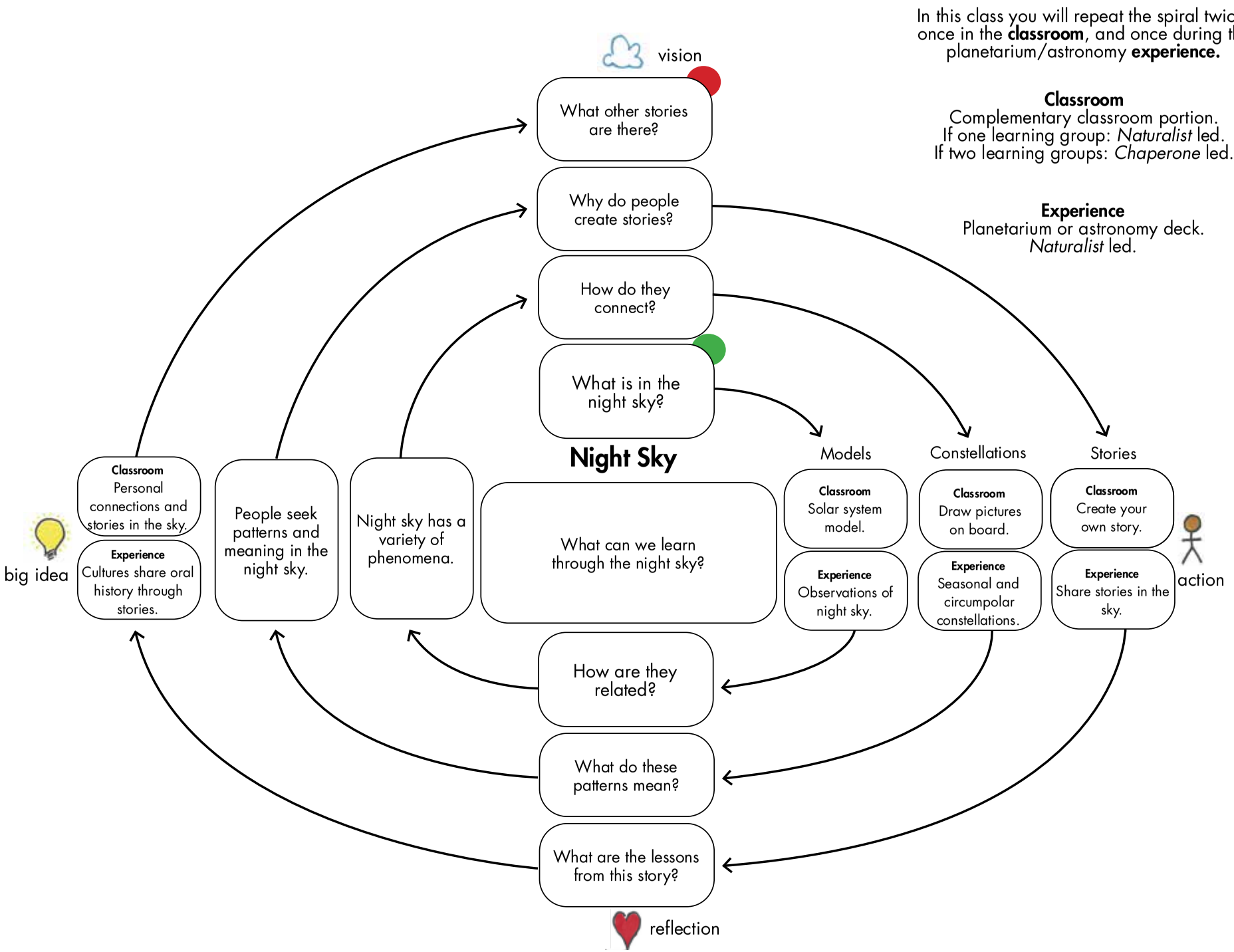
Hercules was sent on retrieval missions, monster slaying shenanigans, and capturing various beasts. His eleventh labor is where Hercules' story collides with the Ladon the dragon and those golden apples. For this eleventh labor Hercules was tasked with stealing one of these golden apples. Remember who owned this tree? That's right, Hera. Now she didn't quite get along with Hercules and this was a prime opportunity to muddle up his task.

Quick back story, rewind to Hercules' second labor. Hercules defeated the nine-headed water serpent, this story is told elsewhere. What matters now is that after defeating the nine-headed hydra, Hercules dipped his arrows in the Hydra's poisonous blood. Just one scratch from this arrow would leave the poison infiltrated in the bloodstream, meaning instant death. Now Hercules still carried these arrows as reminders of his victory and to always have an enhanced weapon on hand (or bow) for whenever needed.

Back on track. Ladon. Dragon. Eleventh labor. Angry Hera. Poisoned arrows. So Hercules sneaks up to the golden apple tree (as well as one can sneak up on a dragon with a hundred heads). His goal was to steal a golden apple and leave unscathed. He quickly realized there was no safe path past Ladon. He must defeat the dragon, then deal with retrieving an apple. The many voices distracted him and called out from different directions, confusing his aim. All Hercules needed to do was make one successful shot with his arrow, he knew the poison would do the rest. But this one shot would reveal his location, putting him at risk.

Hercules continued to weave around and through the dragon's long serpent like body, so Ladon ended up being twisted and wound up. This gave Hercules just enough time to place his arrow on the string and hope for a successful shot. Twang! The arrow met its mark. Hercules continued to dog and dash through Ladon as the poison quickly had its effect. Ladon fell and Hercules walked up Ladon's coiled body to pick the best golden apple from the tippy top of the tree.

Hera was now even further enraged at Hercules for besting her guard and successfully retrieving the golden apple. In her fury and grief she placed Ladon, coiled as he be, up in the sky as Draco. Today he lies tied up and twisted around the North star, still seeming to guard what lies at the center of his coiled defeat.


In this class you will repeat the spiral twice, once in the **classroom**, and once during the planetarium/astronomy **experience.**
Classroom
Complementary classroom portion.
If one learning group: *Naturalist* led.
If two learning groups: *Chaperone* led.
Experience
Planetarium or astronomy deck.
Naturalist led.
vision
What other stories are there?
Why do people create stories?
How do they connect?
What is in the night sky?
Night Sky
Models
Constellations
Stories
Classroom
Solar system model.
Classroom
Draw pictures on board.
Classroom
Create your own story.
Experience
Observations of night sky.
Experience
Seasonal and circumpolar constellations.
Experience
Share stories in the sky.
What can we learn through the night sky?
Night sky has a variety of phenomena.
People seek patterns and meaning in the night sky.
Classroom
Personal connections and stories in the sky.
Experience
Cultures share oral history through stories.
big idea
action
How are they related?
What do these patterns mean?
What are the lessons from this story?
reflection