



Close up: "Ojibwe Gijzig Anung Masinaaigan"; A. Lee, W. Wilson / Gawboy, 2012

Two-Eyed Seeing: Ojibwe Astronomy & NASA Moon to Mars



Dagwaagin-Fall

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Partnering schools: Alternative School-Cloquet; North Star Duluth Edison Charter School; Nett Lake Elementary School; MN



Land Acknowledgment

The *Native Skywatchers* program would like to acknowledge that the land under our feet is the original homelands of the Dakota people, *Mni Sota Makoce*, "Land where the waters reflect the ...skies"... "or clouds". Later Anishinaabe began settling in Northern Minnesota, (the Great Migration). We acknowledge both the Dakota and Anishinaabe's painful history of genocide and forced removal from this territory, and we honor and respect the many diverse Indigenous peoples still connected to this land on which we gather.

Moon Phases

As viewed from space, half of the Moon is always lit up by the Sun, just like Earth. As viewed from your backyard, the amount of the half-lit Moon that we can see changes, depending on the relative position of Sun-Earth-Moon. We call this 'the phases of the Moon'.

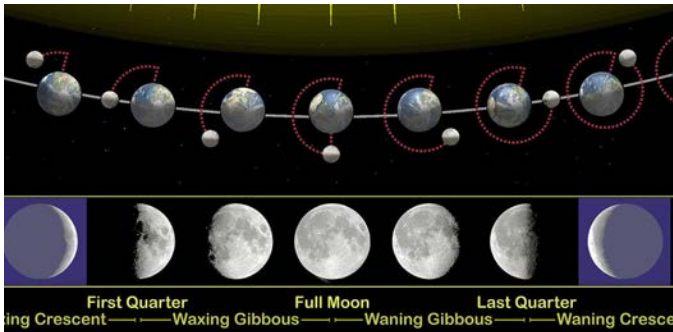


Diagram created by Orion 8, 2018 (not to scale)

Oct - Giizis

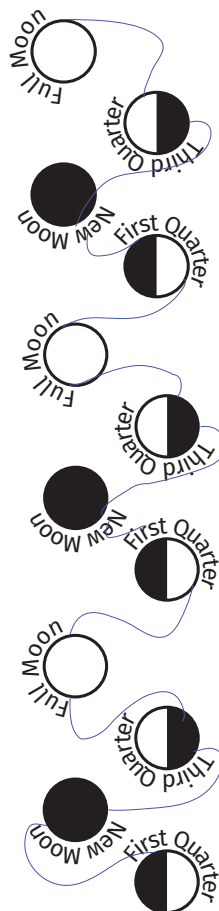
- Oct. 1 Full Moon
- Oct. 9 Third Quarter
- Oct. 16 New Moon
- Oct. 23 First Quarter
- Oct. 31 Full Moon

Nov - Giizis

- Nov. 8 Third Quarter
- Nov. 14 New Moon
- Nov. 21 First Quarter
- Nov. 30 Full Moon

Dec - Giizis

- Dec. 7 Third Quarter
- Dec. 14 New Moon
- Dec. 21 First Quarter
- Dec. 29 Full Moon



Dibiki Giizisoog

Indigenous Moons

Traditionally, Indigenous people keenly observed celestial objects, especially the Moon, and kept track of the passing of time. Each full Moon marked the passing of one month. Women kept track of their sacred "Moon Time". Seasonal activities that were culturally significant each month became the name of each month. Some years had thirteen moons. Like a drum beat or a heartbeat, the rhythm of the sky was unfolding in the seasons and in the phases of the Moon.

To acknowledge the cycles of the Moon was to become part of something bigger, the cosmic cycle. In this way, knowing the Moon was more than timekeeping; it was and still is about building a relationship with sky.



Photo by Melissa Peterson, Fall 2020

Ojibwe Dibiki Giizisoog (Moons)

October - *Binaakwii-giizis* - Falling Leaves Moon

November - *Gashkadino-giizis* - Freezing Moon

December - *Manidoo-giizisoons* - Little Spirit Moon

Halloween Blue Moon - Oct. 31

Is a Blue Moon Really Blue?

Most of the time, the answer is no. A blue moon refers to when there is a second full moon in the same calendar month. The phrase usually has nothing to do with the actual color of the Moon.



Blue Moon, by Codybird, Dec. 2009

But there is another definition of a blue Moon (the Moon appearing with a bluish tinge) that can happen in certain rare conditions. If volcanic eruptions or fires release particles in the atmosphere just the right size (>900 nm), then some red light is scattered out of the white moon light leaving more blue light.



Visible Blue Moon, by Crefollet, Dec. 2012

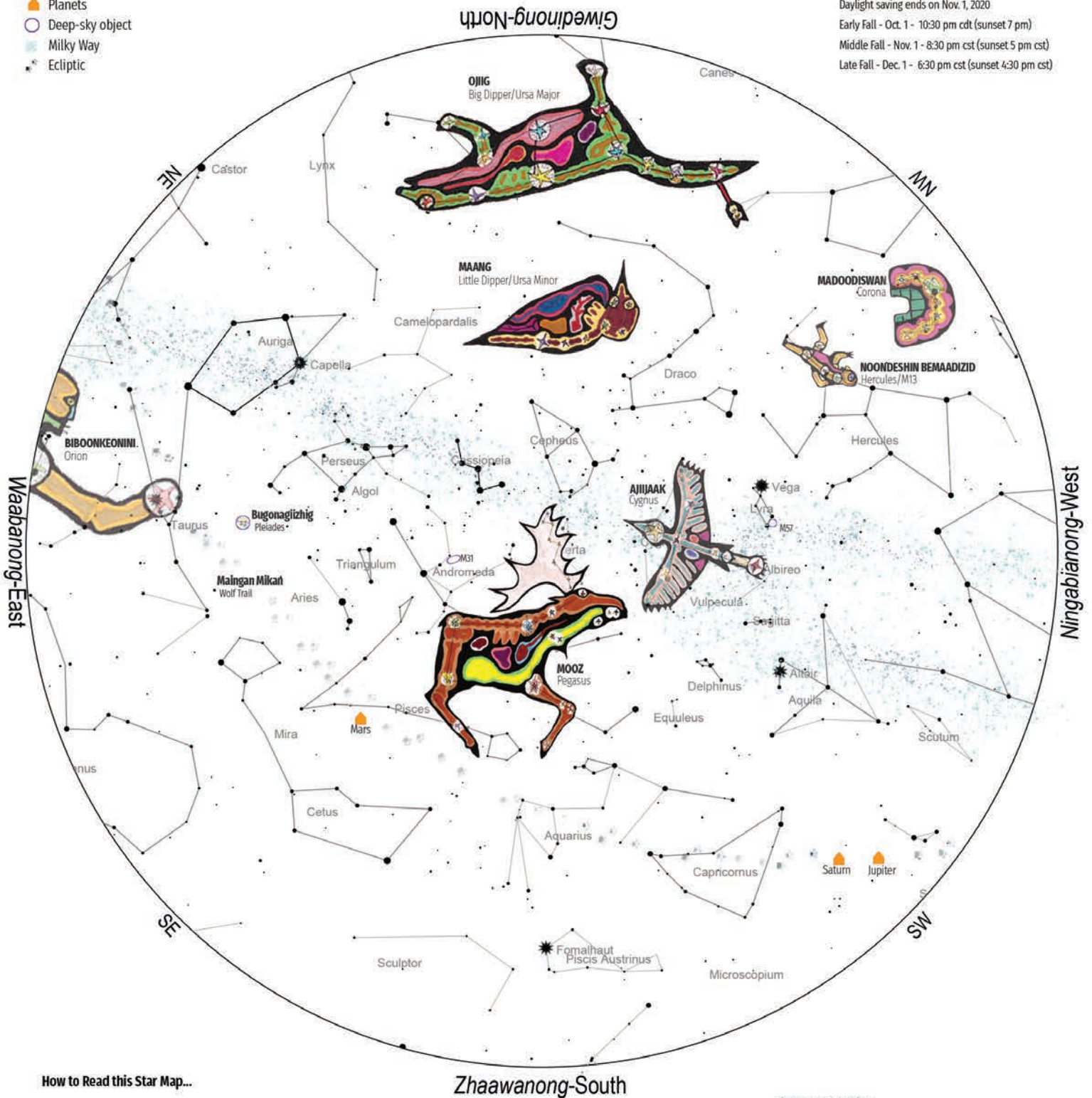
DAGWAAGIN - FALL NIGHT SKY

Legend

- ★ Bright stars
- 🟠 Planets
- Deep-sky object
- ☁ Milky Way
- ♁ Ecliptic

Best Time to Use this map

- Sunset times in fall are getting earlier and earlier.
- Daylight saving ends on Nov. 1, 2020
- Early Fall - Oct. 1 - 10:30 pm cdt (sunset 7 pm)
- Middle Fall - Nov. 1 - 8:30 pm cst (sunset 5 pm cst)
- Late Fall - Dec. 1 - 6:30 pm cst (sunset 4:30 pm cst)



How to Read this Star Map...

This map is a snapshot of the entire night sky as seen in the Fall from mid-latitudes in North America. Imagine the page is a flat version of the sky above you, a dome shape. Standing outside, face north, then turn the map so that 'north' is on the bottom of the page. Look up and you will see all the objects on the map are in the night sky. Have fun!

Tips for Observing...

Enjoy! Dress warm. Get to the darkest sky possible. Allow ~10 minutes for eyes to adjust to the darkness. Amazingly more stars will 'appear' as your eyes become 'dark adapted'. Use a red light if possible.

Dagwaagin - Fall Constellations

Mooz in the Sky

During the Fall night skies, the Mooz constellation is shining down on us full strength, highest and brightest in the sky at this time. On a clear fall night look south and nearly overhead for four bright stars that make a square (Pegasus). The square forms the body of the Mooz. Fainter stars below the square form the legs. Stars on the upper-right of the square make up the Mooz's head. Above the head a zigzag of fainter stars (Lacerta) mark the Mooz's antlers. After you have located the Ojibwe Mooz constellation, try to find the Mooz's bell (flap of skin under the chin) and the heart stars.



Photo by J. Tibbetts, Oct. 2020

Mooz on the Land

Moose hunting happens on the land in fall when the herd is at their fattest and strongest. Bull moose are in rut and are out looking/listening for a mate. Traditionally, when a moose is taken, tobacco is offered. In addition to using every part of the animal from the meat to the bones, to the nose and toes, the moose's beard or 'bell' is hung from a tree. This shows respect for the animal's spirit and mirrors the Mooz constellation, land and sky. "The reason they hang it is because all the stars are hanging" (W. Wilson).

Lake Hegman Pictographs

Some of the Ojibwe constellations can be seen in the pictographs at the Boundary Waters Canoe Area in northern Minnesota and Ontario, Canada. For example, high up on the cliffs at North Lake Hegman, the Mooz constellation is painted on the rock face, complete with a heart line of stars indicated. To the left of Mooz is the Ojibwe Wintermaker constellation and followed by *Gaadidnaway* - Curly Tail or *Mishi Bizhiw* - Mountain Lion constellation. Carl Gawboy was the first person to understand that some of the rock paintings in the Boundary Waters Canoe Area are actually Ojibwe constellations.



Page 6 Photo by MN DNR



Photo by A. Lee, Lake Hegman, MN, 2013

Mikinaak - Snapping Turtle - Earth Sky

The word '*mikinaak*' is translated 'snapping turtle', but it means 'Making a Roadway' or rather 'Making a Spirit Roadway'. Snapping turtles call lakes, rivers, and wetlands their home but they lay their eggs on land buried in a nest. *Mikinaak* is associated with the *Jiisakaan*, Shaking Tent ceremony "That's the messenger... When you pray that's the road you follow." (W. Wilson).



Photo by A. Lee, Fall 2020



Original Painting by W. Wilson, 2014, used with permission

Planets to See this Fall

About an hour after sunset - **Mars** (east), **Jupiter** & **Saturn** (south/southwest)

About an hour before sunrise - **Venus** (east), **Mars** (west)
This time is called 'the end of night' or helical rising and is recognized by Indigenous people world-wide as a sacred time.

Maingan Mikan - Wolf's Trail



Photo credit USFWS

Anyone who looks at the sky long enough will notice patterns. Planets we can see will move from east to west, passing through south, along the same path through the sky. In Ojibwe this special 'path of the planets' is called the '*Maingan Mikan*, Wolf's Trail' (the ecliptic).

So why a wolf's trail and not a deer trail or rabbit trail? The answer lies in the keen observation of the pattern of animal behavior unique to the wolf that mirrors the motion of the planets (retrograde motion). Most of the time the wolf will travel with the pack, but every once in while the lone wolf will rebel and travel off in a different direction before looping back. This rebellious movement of the planets is wolf-like.

NASA Moon to Mars

Would you consider going to the Moon someday? ...or to Mars?

NASA has a plan, the Artemis Program, to send humans back to the Moon by 2024 and then keep going so that by 2030 humans will land on the Red Planet Mars. Right now there is a lot of research happening to prepare. Did you know that the astronauts' toilets were just updated to accommodate women astronauts better and capture more waste? Until recently it was mostly men going to space and cleaning up escaped waste is messy, everything floats!

Another messy problem NASA is trying to solve is Lunar Dust. Small sticky particles are everywhere on the Moon. It can cause everything from equipment failure to damaging spacesuits. A plan for mitigating Lunar dust is a must for the future of space exploration.

Even more important than the dust problem is the problem of human health in space. High energy radiation can cause serious damage to our DNA and even cancer. Microgravity causes the heart to get smaller, more fluid in the head, and muscles get seriously weak. Travel to the Moon might be a 3-day trip, but to Mars would be a 7-9 month trip (one way). Lots to learn here....



Moon to Mars, Photo credit NASA.gov

Our Educators recommend:

Educator Melissa Peterson, 5th grade teacher & K-5 Science Coordinator recommends the NASA-Moon to Mars activity called " Build a Heat Shield"! Students work together and build a heat shield that will protect the content (candy) of a crew module from a simulated atmospheric re-entry.

Educator Lindsey Markwardt, 5-12 grades Indian Education Liason recommends the NASA-Moon Pod essay contest. Imagine a one-week expedition to the Moon's South Pole.. What should you bring? Who gets to be on your team? What skills and tech should they have? Give NASA your best plan!

Educator Genie Turner, 5th & 6th grade teacher at nett Lake Elementary, recommends the NASA "On Target" activity. Kids modify a paper cup so it can zip down a line and drop a marble onto a target. This models NASA's LCROSS spacecraft to search for water on the Moon.

NASA STEM on Station



Northern Lights Over Canada, sighted from the International Space Station The station's main solar arrays are seen in the left foreground. Expedition 53 crew, Sept. 15, 2017. Photo credit NASA.gov

Circling the Earth once every 93 minutes about 250 miles above the ground in low Earth orbit (LEO) is a space station as long as ten buses launched nearly 22 years ago and inhabited continuously since November of 2000. The International Space Station (ISS) has been visited by 240 astronauts (including space tourists) from 19 different nations. In this microgravity space environment a multitude of scientific research is carried out in astronomy, astrobiology, meteorology, physics, etc. It is the perfect testing ground for our future missions to the Moon and Mars. Remarkably, the ISS is a multinational collaboration between: NASA (U.S.), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada).

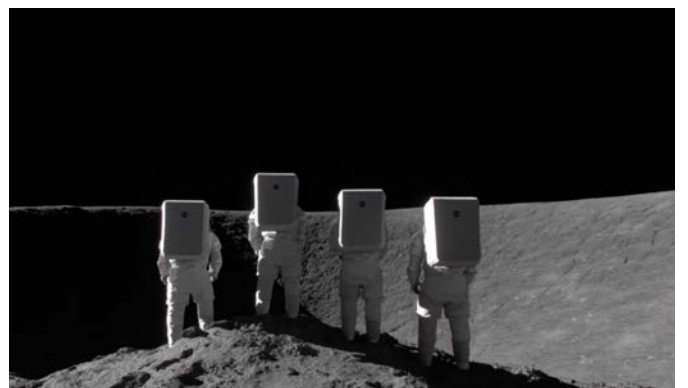
Space Station Interesting Facts:

- Across the atmosphere of the Earth, lightning flashes about 50 times per second. That's 4.3 million times a day and roughly 1.5 billion times a year. (NASA Earth Observatory)

- Astronauts have to work out for two hours a day while on board to help keep their muscles in shape while in space.

- *"I've been around the world 2,650 times or so, and I never once could see enough of it. During my first spacewalk, while I was outside in the dark, we were actually far enough south that we went through the earth's aurora. It is so fantastically beautiful and such a raw artistic human experience. To look at the northern lights is like magic. To be in them, to surf on them, that's beyond magic. It's surreal."* - Chris Hadfield

- If you know just when to look up, you can see the ISS zooming over your house (no telescope needed).



Artemis Plan, Photo credit NASA.gov

Indigenous Contributions to Science

History at the K-12 level has generally followed 'great man' narratives as a pedagogical tool to draw students into complex historical events through individuals who have directly impacted them. Histories of science have relied even more heavily on these tropes, as readily called to mind by Galileo Galilei, Isaac Newton and Albert Einstein. In virtually all cases for U.S. K-12 curricula, these approaches center the agency of European or European-diaspora men. In 2014, however, for the first time, the majority of America's public schools were non-white. In 2040 the U.S. will be a 'majority minority.' This project creates Indigenous astronomy content by Indigenous people for our communities and everyone. (Gerardo Aldana)

Indigenous Engineering

- Building a canoe entirely out of a birch bark treewith some help from the spruce and cedar tree
- Surviving in winter camp where the temperature is 40 below zero (F or C)! Moving camp, not always in the same spot because there is a layer of frozen ground (thick ice)



Ojibwe family in canoe on Lake Vermilion, ca. 1905 Photo credit - MN Historical Society

Food Sovereignty

- Ojibwe were/are future oriented, preserving for future needs, not just surviving pre-colonization times but thriving (Carl Gawboy)
- Every part of the animal was used.
- Gathering traditional foods, like all the berries, strawberries, blueberries, cranberries .. drying them in the summer
- Preserving of traditional foods: Example: in summer smoke all meat; in winter leave it hanging someplace where there's no wind
- Example: preserve the Mooz (cut into tiny shreds, dry it, mix with tallow and berries)
- Example: preserve fish so it would not rot (cut in half, hang & smoke)



Wild rice harvest on Mud Lake, MN, Sept. 2015, USACE photo by G. Stringham



Indigenous Housing

- Sustainability of a Wigwam, non-toxic, renewal materials, hole on top for light



Ojibwe people standing by a bull rush wigwam, c1910. Photo credit - MN Historical Society



Plant Medicine

- Sumac used for pipe stems, already a hole
- High bush cranberries bladder infection medicine... (Lindsey) or women's non-stop bleeding a root tea was used (William)
- Fall time to harvest....sage, tobacco, sweet grass, etc.
- Question: Is it ok to harvest flat cedar from a landscape bush? Depends on the situation, always better to use wild plants, but sometimes we have to make-do.



Cranberry gathering-photos by L. Markwardt (top), Birch Bark (middle) & Sumac (bottom), Photo credit A. Lee (above)



Close-up - Ojibwe Giizhig Anung Masinaagigan; A. Lee, W. Wilson, C. Gawboy, 2012

Miigwech!

Credit for this work:

Lee, Annette S., Carl Gawboy, William Wilson, Jim Knutson-Kolodzne, Lindsey Markwardt, Melissa Peterson, Jeffrey Tibbetts, and Genie Turner, "Two-Eyed Seeing: Ojibwe Astronomy & NASA Moon to Mars", October 2020, <https://nativeskywatchers.com/two-eyed-nasa-ojibwe.html>



Lee, Annette S., Carl Gawboy, Jim Rock, Jeff Tibbetts, William Wilson, and Charlene O'Rourke. "Native Skywatchers-Revitalization of Ojibwe & D (L) akota Star Knowledge-Collaborative Work with Educators", IAU General Assembly 22 (2015).

Lee, Annette S., William Wilson, Jeffrey Tibbetts, and Carl Gawboy. "Ojibwe Star Map Constellation Guidebook: An Introduction to Ojibwe Star Knowledge", Minneapolis, Minnesota: Native Skywatchers Press, 2014.

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