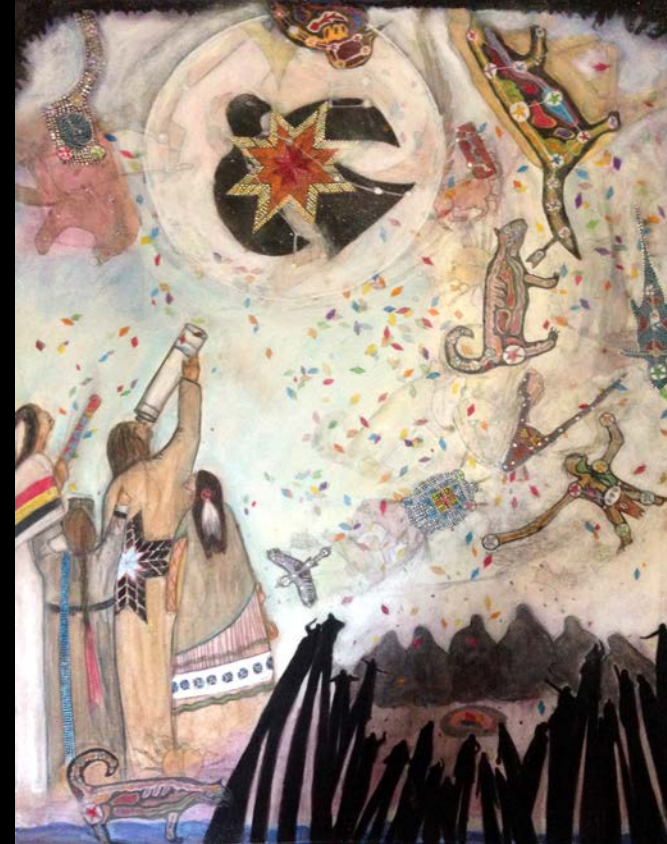


# *"Celestial Calendar-Paintings and Culture-Based Digital Storytelling Cross-Cultural, Interdisciplinary, STEM/STEAM Resources for Authentic Astronomy Education Engagement"*



Annette S. Lee, ©2012



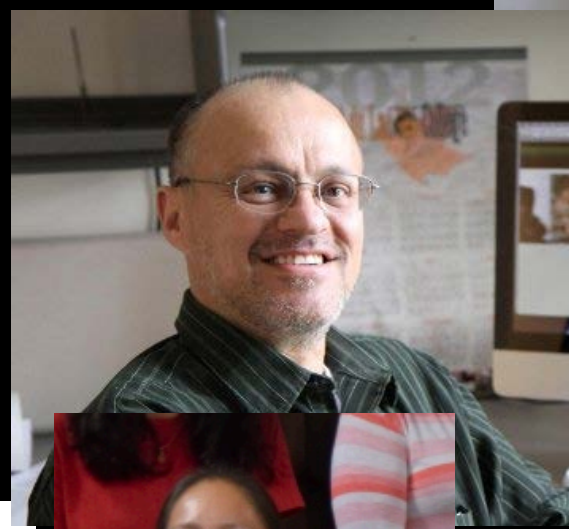
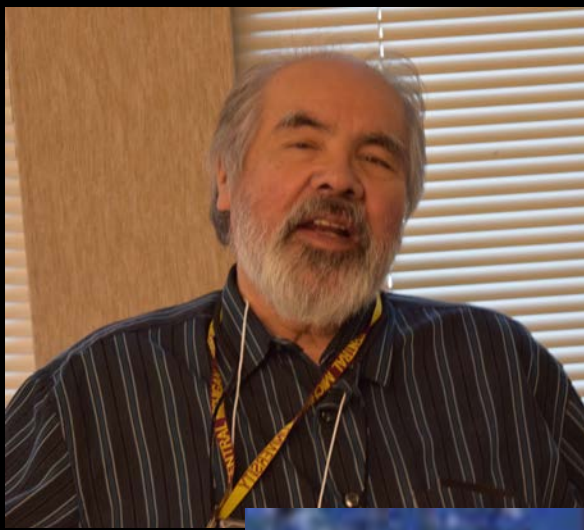
Annette S. Lee, ©2015

# The *Native Skywatchers* Initiative

Founded in 2007 by A. Lee

Revitalizing native – Ojibwe & D(L)akota - Sky & Earth Knowledge







# Mni Sota Makoce ~ Minnesota





# INTERDISCIPLINARY STEM RESOURCES

Created by A. Lee & the *Native Skywatchers* team

SCIENCE + CULTURE + ART

# OJIBWE GIIZHIG ANUNG MASINAAIGAN

Ojibwe Sky Star Map

## ZIIGWAN ~ Spring

Mishi Bizhiw, Curly Tail, Great Panther

Madoodiswan, Sweat Lodge

Ikwe'anung, Women's Star, Venus

Waabun'anung, Morning Star

Ningobi'anung, Evening Star

## NIIBIN ~ Summer

Ajiijaak/Bineshi Okanin, Crane/Skeleton Bird

Noondeshin Bemaadizid, Exhausted Bather

Nanaboujou, Nanaboujou

Glizis, Sun

Dibik-giizis, Night Sun, Moon

Ishpeming, Sky Above, Universe

## BIBOON ~ Winter

Biboonkeonini, Wintermaker

Maingan Mikan, Wolf Trail, Ecliptic

Jiibaykona, Spirit Path, Milky Way

Jiibay Ziibi, River of Souls, Milky Way

Gwiingwa, Shooting star, Meteor

Anung Nibwakawin, Star Wisdom

## DAGWAAGIN ~ Fall

Mooz, Moose

Bugonagiizhig, Hole in the Sky, Pleiades

Madoo'asinik, Sweating Stones, Pleiades

Waawaate, Aurora Borealis, Northern Lights

Jiibayag niimi'idiway, Spirits Dancing, Aurora Borealis

Gaagige Giizhig, Forever Sky, Universe

Biboon

Maang, Loon

Giwed'inanung, North Star, Polaris

Ojiig, Fischer

## GIWEDINANG ~ North

Original drawing by Dennis S. Lee & William P. Wilson, © 2012, Ojibwe Language Consultants: William Wilson

Map created by Dennis S. Lee, William P. Wilson, and C. Gawboy, © 2012

Additional references: C. Gawboy, W. Wilson, M. Price, T. Kinn

created by: A. Lee, W. Wilson, C. Gawboy, ©2012



## WETU ~ SPRING

Oçeti/Peta, Fireplace/Fire  
Anpo Wiçanłıpi Sunkaku, Arcturus  
Wiçanłıpi Oyate, Star Nation  
Anpo Wiçanłıpi/Anpetu D/Luta,  
Morning Star, Venus  
Wiçanłıpi Omani, Planet

## Makoçe Wiçanłıpi Wowapi DULAKOTA STAR MAP

## BDOKETU/BLOKETU ~ SUMMER

Ahdeška/Agleška, Salamander  
Wi, Anpetu Wi (Day Sun), Sun  
Hanwi (Night Sun), Moon  
Wiçanłıpi Hinłıpayaya,  
Meteor/Falling Star  
Wanałı Tawaçipi,  
Aurora Borealis

## WANIYETU ~ WINTER

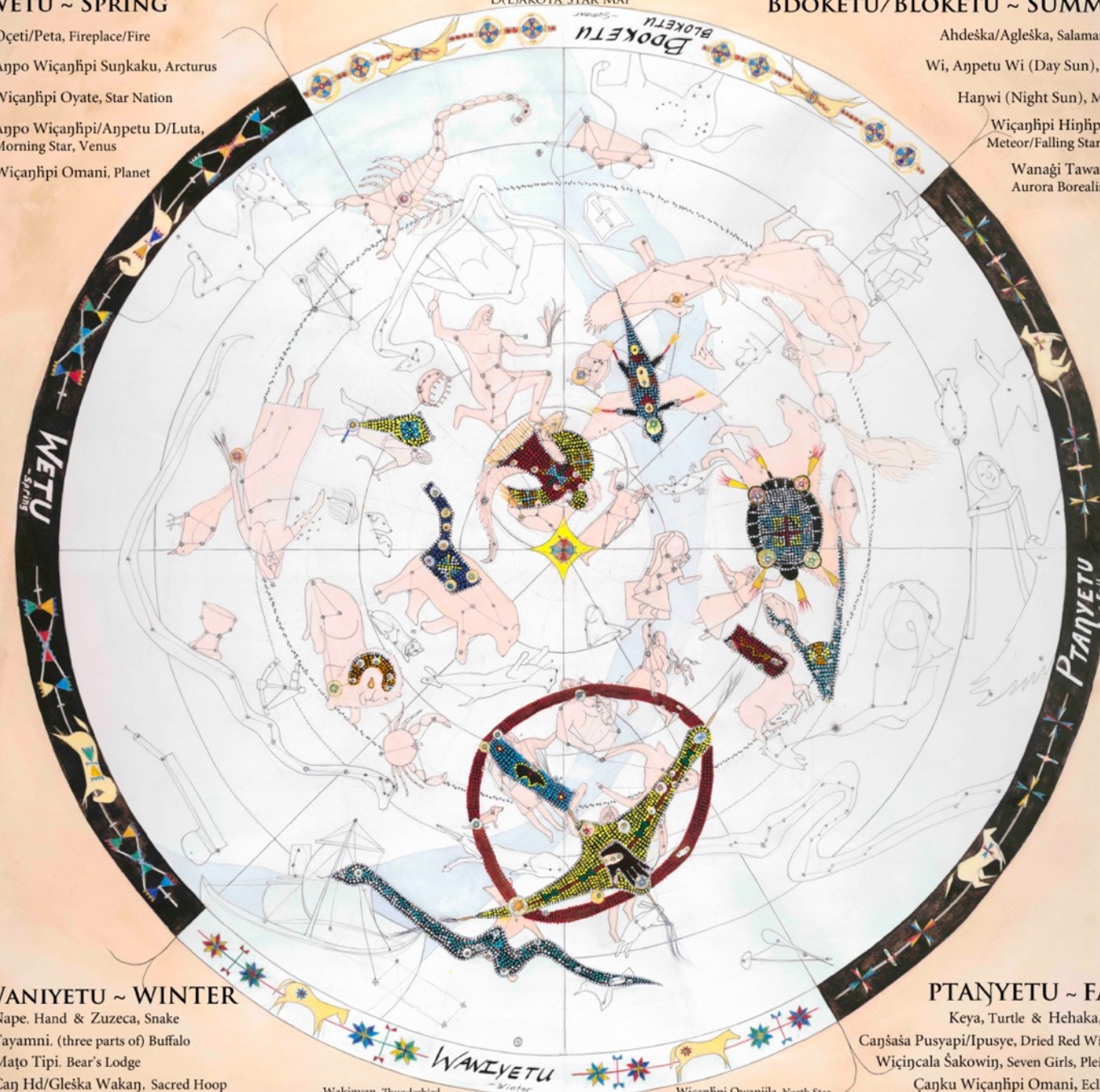
Nape, Hand & Zuzeca, Snake  
Tayamni. (three parts of) Buffalo  
Mało Tipi. Bear's Lodge  
Çan Hd/Gleška Wakan, Sacred Hoop  
Wanałı Taçanłku (Road of the spirits), Milky Way

## WAZIYATA ~ NORTH

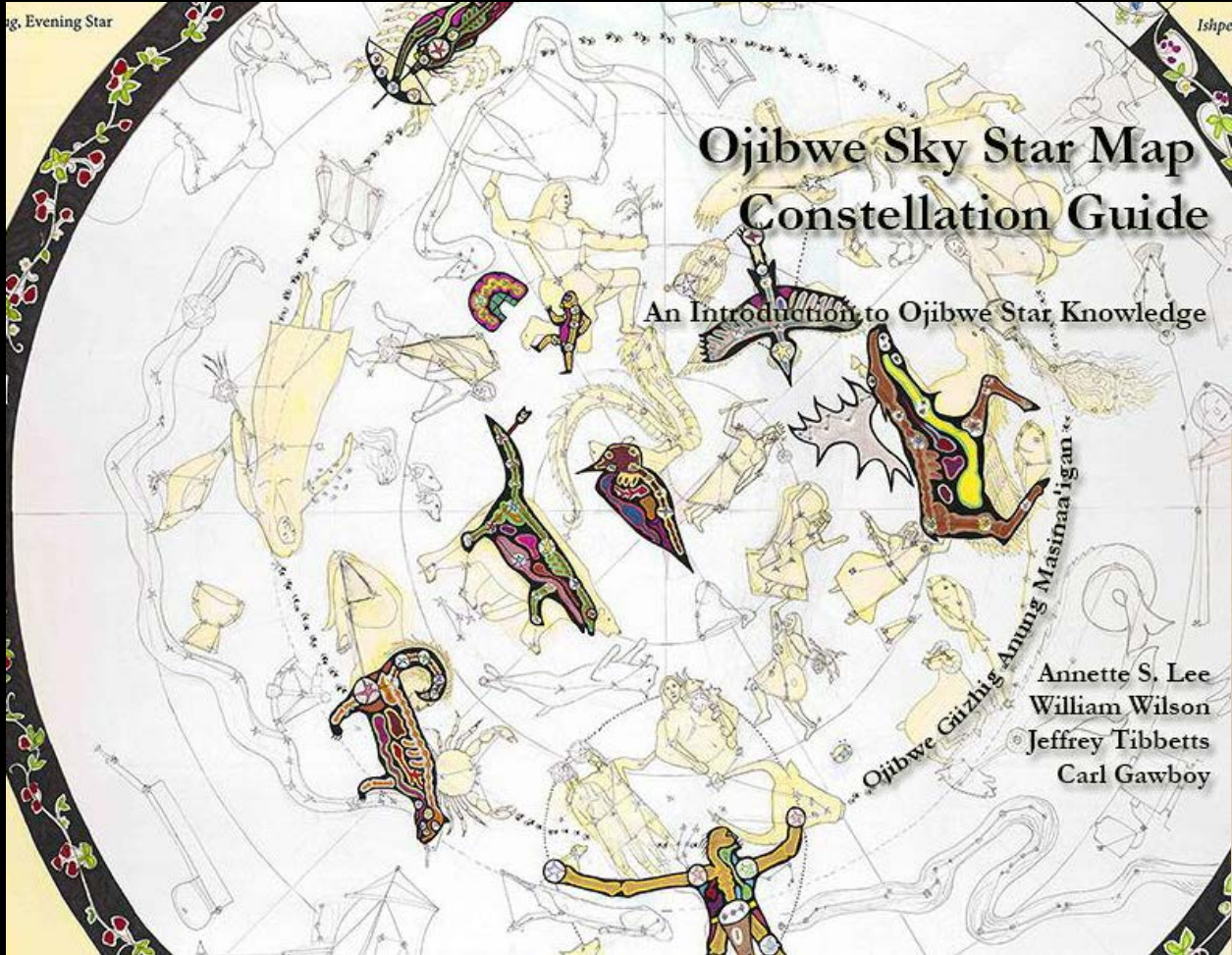
To/Tun Win, Blue/Birth Woman, Big Dipper

## PTANYETU ~ FALL

Keya, Turtle & Hehaka, Elk  
Çanłsaša Pusyapi/Ipusy, Dried Red Willow  
Wiçanłala Šakowin, Seven Girls, Pleiades  
Çanłku Wiçanłıpi Omani, Ecliptic  
Wamakohnaka/Makasitomni, Universe









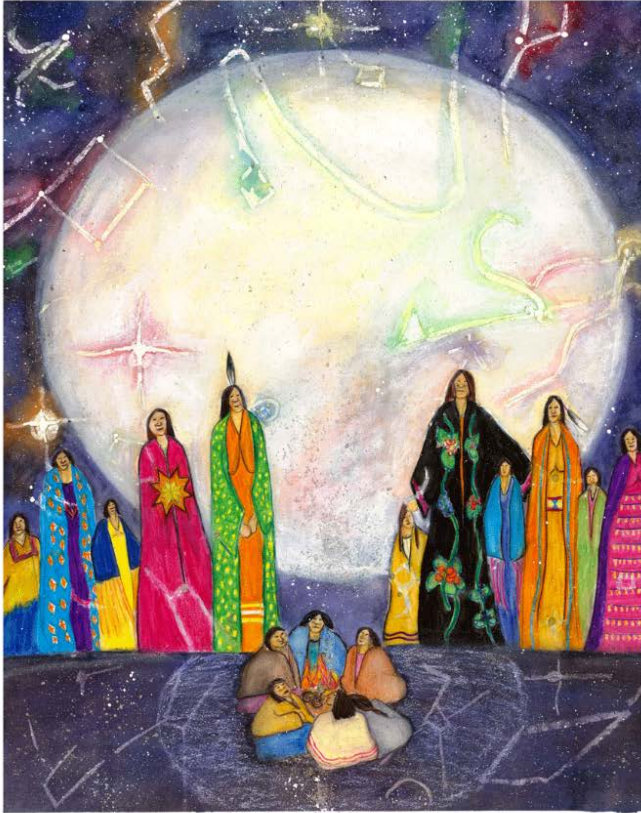
## Native Skywatchers 2015 - Two day Workshops.

Mon & Tues, June 8 & 9, 2015 at Fond du Lac Tribal & Comm. College  
Thur & Fri, June 11 & 12, 2015 at MN Dept. of Education - St. Paul

**Native Skywatchers Educator & Community Workshop:  
Ojibwe & D(L)akota Star Knowledge**

Registration is now open!

Building Community around Native Star Knowledge



*Group 2012* *Annette S. Lee*

**Native Skywatchers - Ojibwe & D(L)akota Star Knowledge**  
Educator & Community Workshop - Everyone Welcome.

Fond du Lac Tribal & Community College, Mon & Tues, June 8 & 9, 2015  
MN Dept. of Education - St. Paul, Thurs & Fri, June 11 & 12, 2015

Register at: [http://web.atehouse.edu/plantark/native\\_skywatchers.html](http://web.atehouse.edu/plantark/native_skywatchers.html) Sponsored by NASA-MN Space Grant, St. Cloud State University, Fond du Lac Tribal & Community College



# Minnesota Academic Standards

## Science K-12 2009 version

3. Interactions Among Science, Technology Engineering, Mathematics, and Society	2. Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.	3.1.3.2.1	Understand that everybody can use evidence to learn about the natural world, identify patterns in nature, and develop tools.  <i>For example:</i> Ojibwe and Dakota knowledge and use of patterns in the stars to predict and plan.
		3.1.3.2.2	Recognize that the practice of science and/or engineering involves many different kinds of work and engages men and women of all ages and backgrounds.

This official standards document contains the science  
standards revised in 2009 and put into rule  
effective May 24, 2010.



The figure below is a 180° panoramic view to the south showing the path of the stars a few hours after sunset

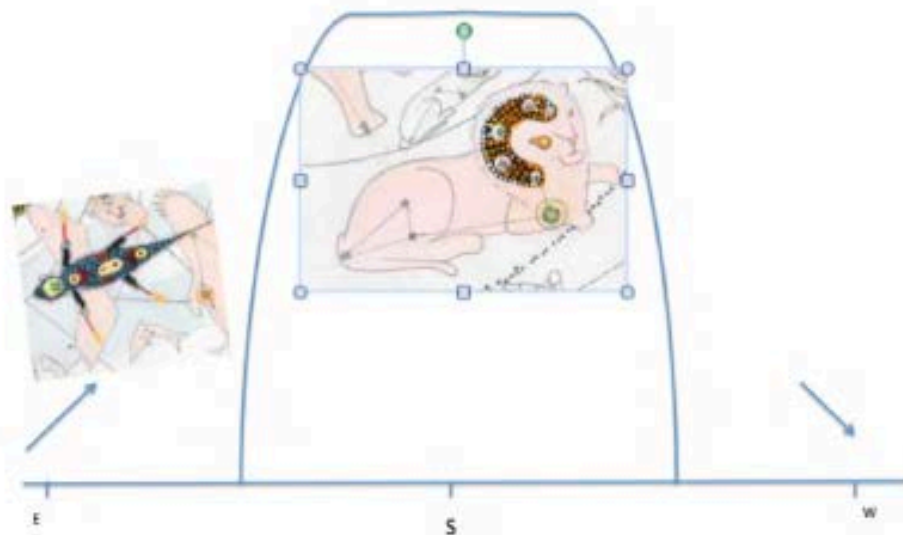


Figure 2 – Seasonal Stars, Facing due South a few hours after sunset.

- What season of stars would we see setting in the West at this time?
  - Winter
  - Spring
  - Summer
  - Fall
- Which of the following D(L)akota constellation/s would we see setting in the West at this time?
  - Hehaka* - Elk, (Pluces)
  - Zuzeca* - Snake, (lower Canis Major)
  - Wakigyan* - Thunderbird (~Draco)
  - To Wig* - Blue Spirit Woman (Big Dipper)
- What season of stars is not seen at this time?
- If we stayed up all night watching the stars, then just before the sunrise, what season of stars would we see rising in the East? (This is called 'helical rising'.)

Written by: Annette

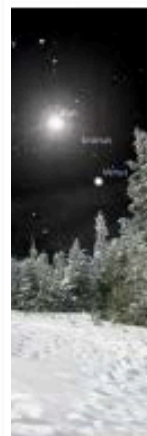
Native Skywatchers Curriculum

Written by: Annette S. Lee, 2012

- Match each constellation with the season that it is seen best and brightest in the night sky, i.e. in the south & overhead a few hours after sunset.
  - Fall
  - Winter
  - Spring
  - Summer
  - All-Season (North or Circumpolar)



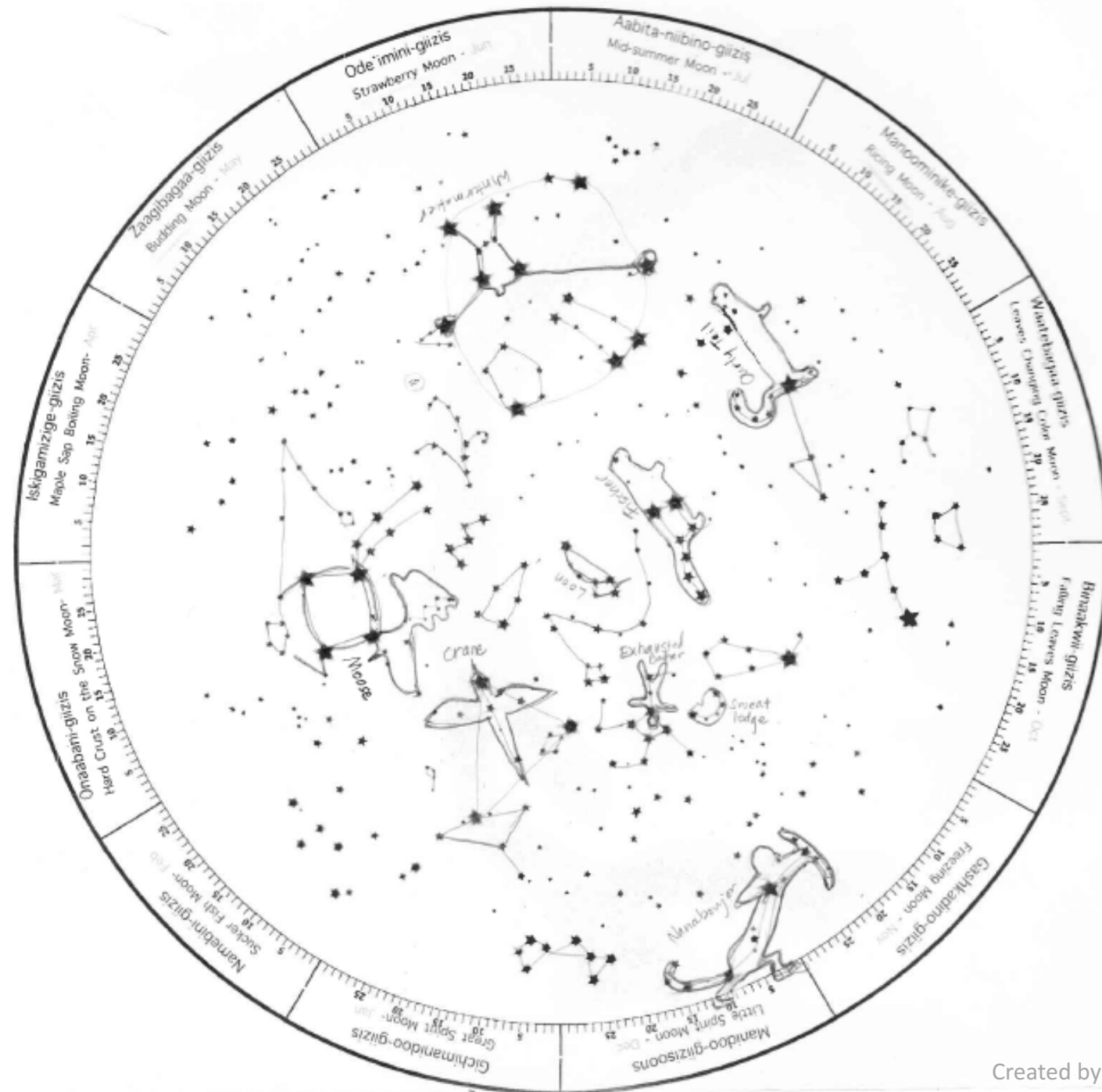
- What is one example of an Ojibwe constellation that is best seen in the Summer?
- If we are facing south, looking at stars a few hours after sunset in the Summer, then what season of stars are: Setting in the west? Rising in the east?
- At a particular time, on any given night, how many seasons of stars are visible in the night sky?
- What is the name of the Ojibwe constellation/celestial object best seen in the Fall that is a Doorway or Hole in the Sky?
- There is a Greek lion in the night sky called 'Leo'. What is the name of the Ojibwe lion constellation seen in the same area of the night sky?
- What is the Ojibwe name for the 'path of the Sun', called the 'ecliptic'?



after sunset.

it orbits around the Earth  
one full circle around





# Planispheres







# Most Recent Work & Collaborations

Created by A. Lee & the *Native Skywatchers* team

SCIENCE + CULTURE + ART



# ININEW ACHAKOS MASINIKAN

Cree Star Map-Book

## SIKWAN ~ Spring

Mahtootisan, Sweat Lodge  
Tepahkoop Pinesisuk, Seven Birds  
Misewa, All that is ~ the Universe  
Tipiska Pisim, Night Sun - Moon  
Kotawew Pisim, Eclipse  
Pisim, Sun

## NIPIN ~ Summer

Nipin Pinisew, Summer Thunderbird  
Niska/Niska Meskinaw, Goose/Goose's Path  
Nipinesis Meskinaw, Summer Birds' Path  
Achak Sipit, Spirit River, Milky Way  
Achakosuk, Stars  
Askij, Earth

## PIPON ~ Winter

Mistapew, Giant & Wesakaycak, Teacher  
Mikanuk Meskinaw, Wolves Path, Milky Way  
Cheepiuk Wawatawin, Spirits Still, Northern Lights  
Cheepiuk Nemitowak, Spirits Dancing, Northern Lights  
Ahtimah Achakosuk, Dog (Wolf, Coyote, Fox & Pups) Stars  
Keewatin, Altar for Sweat Lodge, Polaris  
Seeseekwun, Rattle

## TAKWAKIN ~ Fall

Kokominakasis, Grandmother Spider  
Pakone Kisik, Hole in the Sky, Pleiades  
Achakos Ahikoop, Star Blanket, Pleiades  
Mahtootisan Assiniuk, Sweating Stones, Pleiades  
Pipon Pinisew, Winter Thunderbird  
Mista Muskwa, Bear & Ochek, Fisher  
Makinak, Turtle

## KIWETINOHK ~ North

Original Drawing by Annette S. Lee & William P. Wilson, 2016

Map Created by Wilfred Buck, Manitoba First Nations Education Resource Centre Inc. © 2016

Created by: A. Lee, W. Wilson, W. Buck, ©2016



# "GREEK" STAR MAP

Babylonian, Greek, and Egyptian Star Knowledge of the Mediterranean Sea

## SPRING Stars

Leo, Lion & Bootes, Herdsman  
Corona Borealis, Northern Crown  
Virgo, Maiden & Libra, Scales  
Coma Berenices, Queen's Hair  
Arcturus, (bright star in) Bootes  
Hydra, Water Snake  
Corvus, Crow  
Crater, Cup

## SUMMER Stars

Scorpius, Scorpion & Sagittarius, Centaur-Archer  
Cygnus, Swan & Lyra, Harp & Aquila, Eagle  
Summer Triangle, (sky landmark)  
SagA\* (center of Milky Way galaxy)  
SagA\* (supermassive black hole)  
Ophiuchus, Serpent-Bearer  
Delphinus, Dolphin  
Hercules, Hero

## WINTER Stars

Orion, Hero-Hunter & Taurus, Bull  
Canis Major, Big Dog & Canis Minor, Little Dog  
Gemini, Twins & Auriga, Charioteer  
Lepus, Hare & Cancer, Crab  
Winter Circle, (sky landmark)  
Sirius, (bright star in) Canis Major

## FALL Stars

Pegasus, Winged Horse  
Andromeda, Princess & Perseus, Hero  
Aries, Ram & Pisces, Fishes & Capricorn, Seagoat  
Cetus, Sea Monster & Aquarius, Water Carrier  
Pleiades, (open star cluster), Seven Sisters & Lacerta, Lizard  
Fomalhaut, (bright star in) Piscis Australis, Southern Fish  
Andromeda Galaxy, M31 (neighboring spiral galaxy)

Little Dipper ~ Ursa Minor, Little Bear  
NORTH ~ All Season  
Polaris - the North Star in Ursa Minor

Big Dipper~Ursa Major, Great Bear  
Cassiopeia, Queen

Cepheus, King  
Draco, Dragon







# ONE SKY - MANY ASTRONOMIES



ININEW-CREE, OJIBWE-ANISHINAABE, D(L)AKOTA-SIOUX STAR KNOWLEDGE

Created by: A. Lee, ©2016



# Digital Storytelling Videos-



*Biboonkeonini-Wintermaker*

# Digital Storytelling Videos-



*Ojiig* – The Fisher

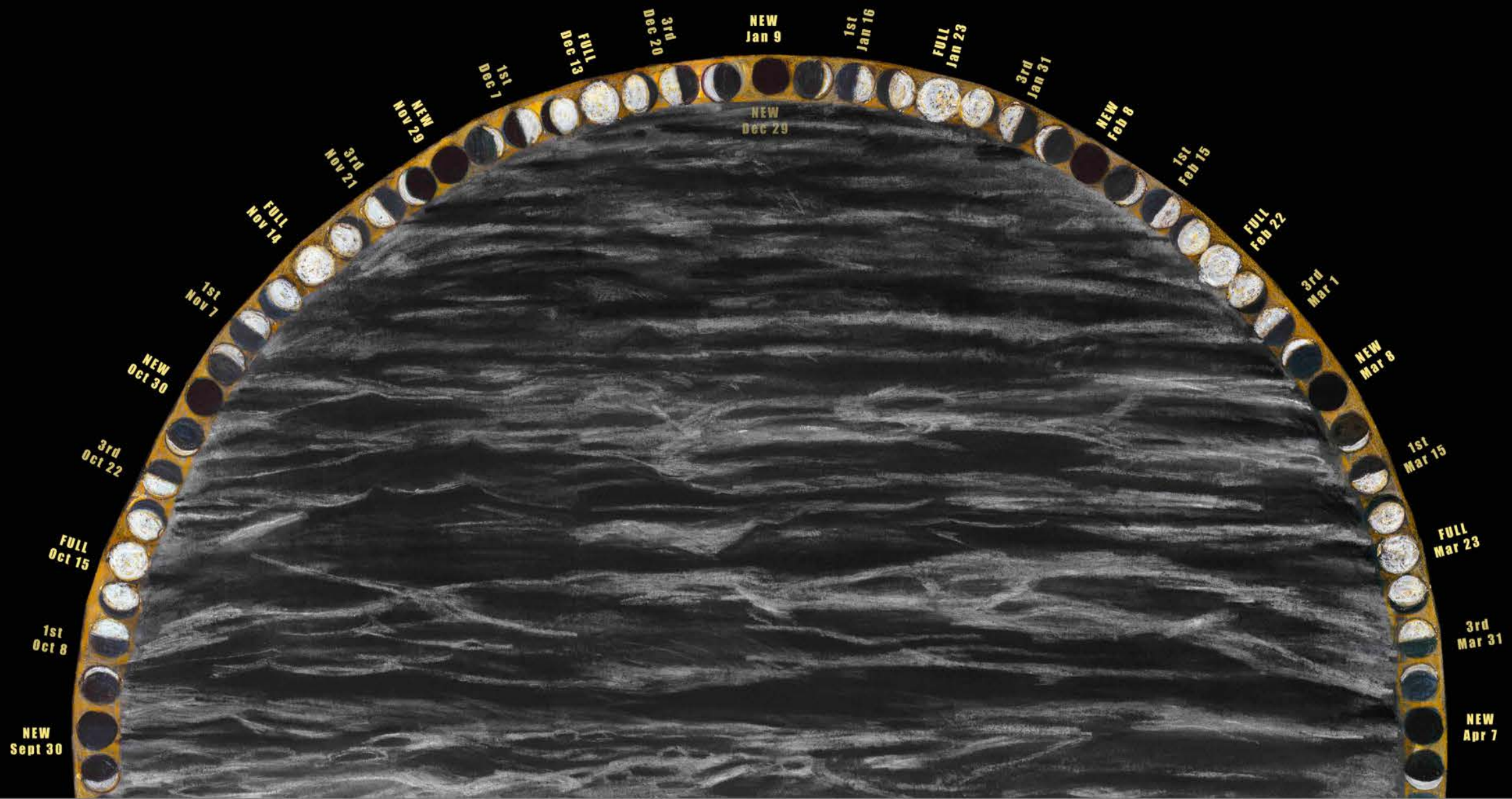


# Our Moon 2016





# Phases of the Moon 2016









Mar. 20, 2016  
 Jun 20, 2016  
 Sept. 22, 2016  
 Dec. 21, 2016

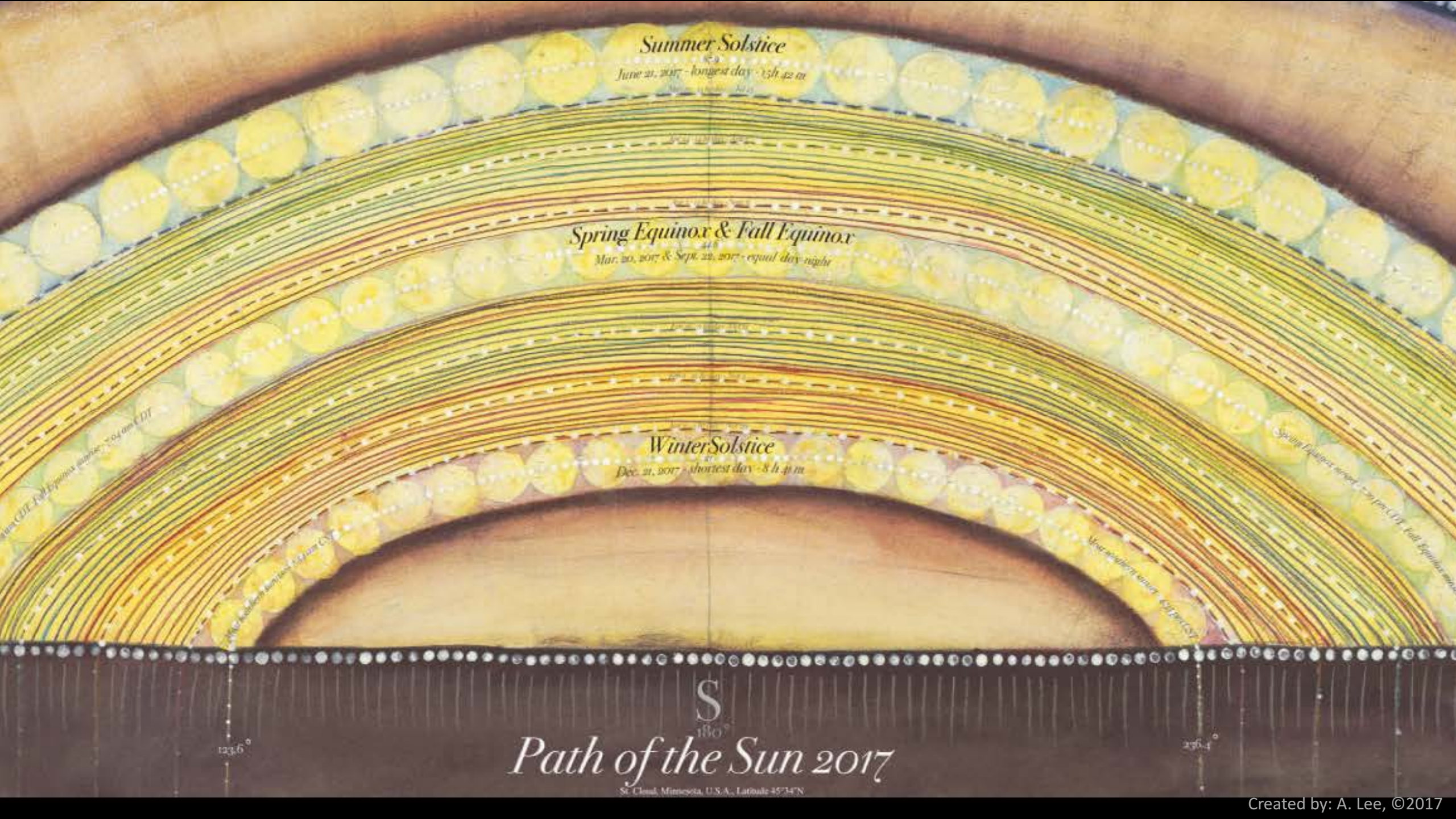
12 hrs - Mar 17, 7:22 am - 7:22 pm  
 15.5 hrs - Jun 20, 5:25 am - 9:07 pm  
 12 hrs - Sept 22, 7:06 am - 7:06 pm  
 8.5 hrs - Dec 21, 7:52 am - 4:33 pm



Latitude +45°, central Minnesota, U.S.

"Path of the Sun 2016"





### Summer Solstice

June 21, 2017 - longest day - 15h 42 m

### Spring Equinox & Fall Equinox

Mar. 20, 2017 & Sept. 22, 2017 - equal day/night

### Winter Solstice

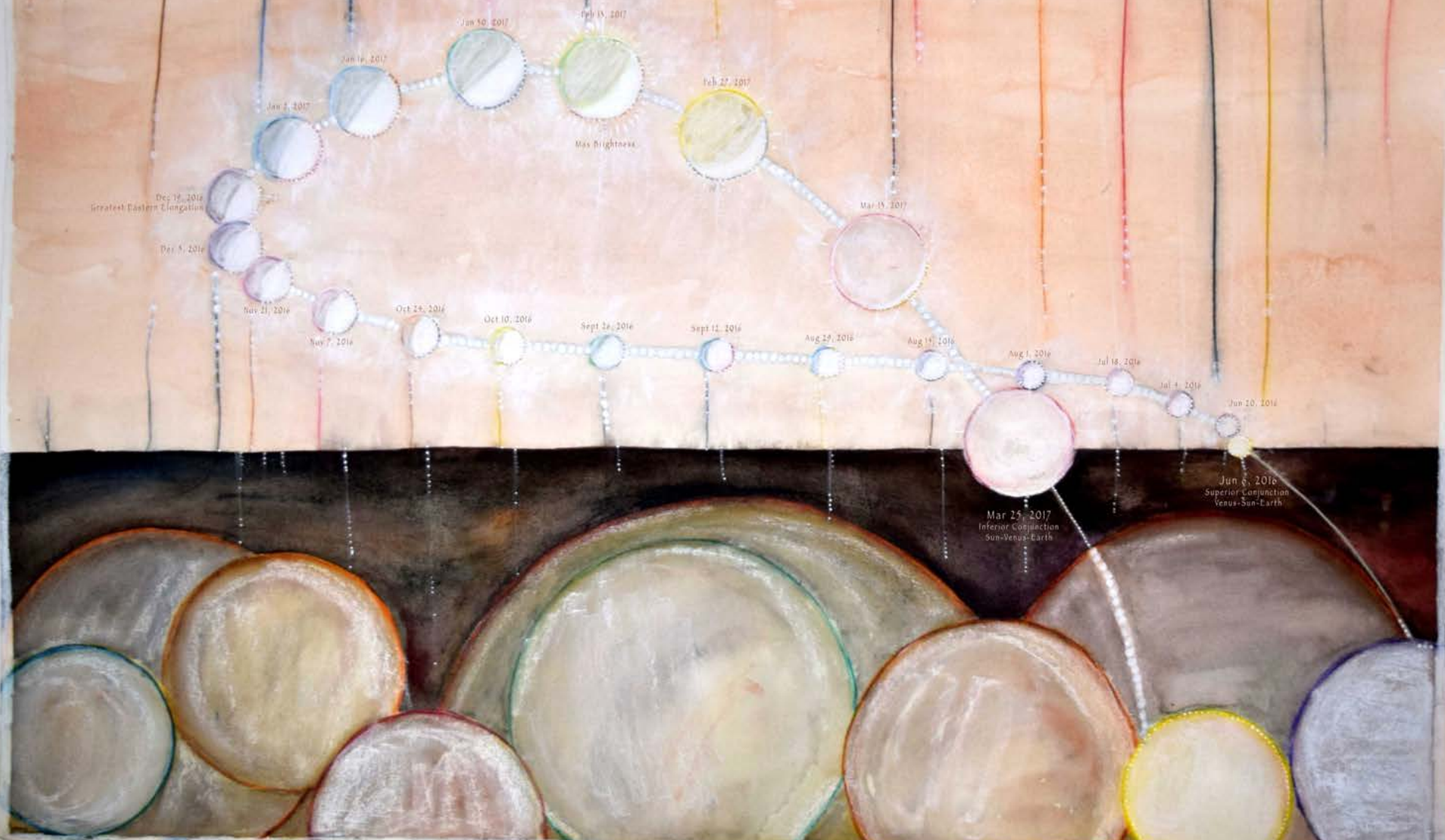
Dec. 21, 2017 - shortest day - 8 h 41 m

# S 180° Path of the Sun 2017

St. Cloud, Minnesota, U.S.A., Latitude 45°34'N



# Ikwe Anung, Anpetu Luta, Lamat, Venus, Evening Star



Created by: A. Lee, ©2017

Created by: A. Lee, ©2016



# NATIVE SKYWATCHERS - EARTH SKY CONNECTIONS

Twelve workshops-classes. Led by four native/mixed-race native artists. Eight community partners. Duluth Art Institute, Stearns History Museum, Mille Lacs Indian Museum, Fond du Lac Ojibwe School, Fond du Lac Tribe, Kennedy Elementary School, Onamia School, and Great River Regional Library.





NATIVE SKYWATCHERS - EARTH SKY CONNECTIONS

# Art, Culture, and Science Workshop



## FOR EDUCATORS AND COMMUNITY

*Native Skywatchers - Earth Sky Connections* weaves together art, culture and science in a way that will inspire learners to create art in relation to the Earth, sky and cosmos. Participatory art workshops offered throughout Minnesota.

Two-day workshop at Elk River High School | Mon. June 12 & Tues. June 13, 2017 | 9 am to 3 pm | Fee \$80

One-day workshop at the Perpich Center for the Arts | Mon. August 7, 2017 | 9 am to 3 pm | Fee \$40

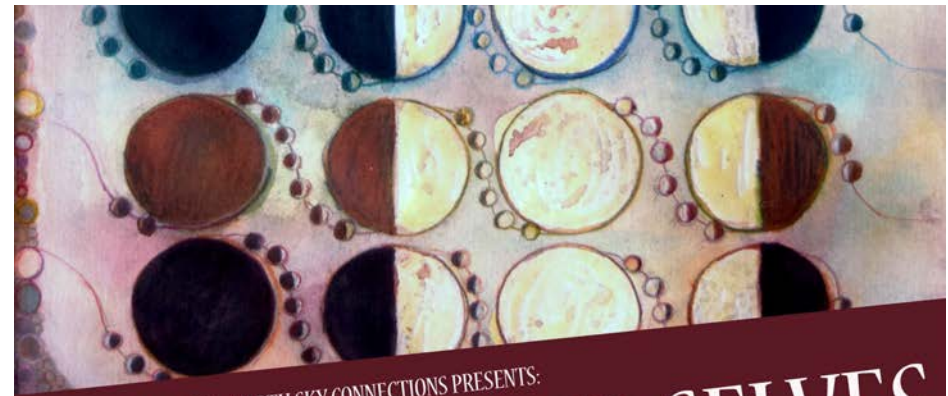


**For more information & registration:**  
[www.nativeskywatchers.org](http://www.nativeskywatchers.org) or 763-241-3400 ext. 2164



**ELK RIVER**  
HIGH SCHOOL

These activities are made possible by the voters of Minnesota through a Minnesota State Arts Board Arts Learning grant, thanks to a legislative appropriation from the arts and cultural heritage fund, FY 2017



NATIVE SKYWATCHERS - EARTH SKY CONNECTIONS PRESENTS:

# OUR MOON-OUR SELVES

LED BY: ANNETTE S. LEE & THE NATIVE SKYWATCHERS TEAM: W. Wilson, J. Tibbetts, A. Meyer, & M. Zelmer

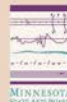
*This art-making workshop will focus on your own personal connection with the moon. Ideas in art, science, culture, and native culture that relate to the Moon will be shared. Listen to your heartbeat, and learn about the heartbeat of the Moon. Remember your connection. Create a Moon Calendar-Painting that will help you know the phases of the Moon on any given day or week and will also serve as a visual story of your relationship with the Moon. Tell your story about the Moon...*

To Register go to: [www.qigongconnection.com](http://www.qigongconnection.com)

For more information contact:

Mary Zelmer  
tel: 952-215-2027  
[mzelmer333@gmail.com](mailto:mzelmer333@gmail.com)  
[www.qigongconnection.com](http://www.qigongconnection.com)

Annette Lee  
tel: 320-308-2013  
[aslee17@gmail.com](mailto:aslee17@gmail.com)  
[www.nativeskywatchers.com](http://www.nativeskywatchers.com)



**Miigwech. Pidamaya. Thank you.**

Funded by the MN State Arts Board, Arts Learning Grant, 2016-17.  
Sponsored by the Qigong Connection.

These activities are made possible by the voters of Minnesota through a Minnesota State Arts Board Arts Learning grant, thanks to a legislative appropriation from the arts and cultural heritage fund, FY 2017.

**Sat. Jul. 22, 2017**

**1 - 4 pm**

**Carondelet Center**

1890 Randolph Ave.  
St. Paul, MN 55105  
Phone: 651-696-2750

<http://carondeletcenter.org>

**\$40**





# MAANG GROUP CAMP

## Leader Loon

Maang Group Camp is named after the Ojibwe loon constellation. Maang corresponds with Ursa Minor, the Little Dipper. This constellation contains Giiwedín Anang, the North Star. In Ojibwe tradition, the loon is a leader and messenger. As Maang rotates, the loon dips under the water to catch fish, then resurfaces.



Ojibwe Gízhig Anung Masinaa'ígen  
Ojibwe Sky Star Map  
by Annette S. Lee & William Wilson



## See more in the dark!

The night sky is one of this park's great resources. Travelers have enjoyed these night sky views for thousands of years. Native cultures saved stories of their past in the constellations. Early explorers relied on the stars to guide their way. People are still drawn "up north" by starry skies and northern lights.

Human-produced light pollution has become a problem across the globe. This spilled light interferes with nocturnal animals, human circadian rhythms and wastes energy. This park takes precautions to keep the sky dark. Energy efficient lights are strategically placed and shielded to reflect light downward. This allows for better stargazing and also helps wildlife like night-migrating birds.



Ken Hupila,  
Snotty Moose Studio





Created by: A. Lee, ©2017



# ***ISHPIMING MAANG***

(LOON IN THE SKY)

*by William Wilson*

**FIRST CUT**



*Pidamaya, Miigwech, Thanks for listening.*



by Annette S. Lee, 2012