

Astronomy & Culture


Nancy Alima Ali
Center for Science Education
Space Sciences Lab
University of California, Berkeley
nancy.ali@ssl.berkeley.edu

E Hō Mai

E hō mai (i) ka 'ike mai luna mai ē
'O nā mea huna no'eau o nā mele ē
E hō mai, e hō mai, e hō mai ē (a)

Give forth knowledge from above
Every little bit of wisdom contained in song
Give forth, give forth, oh give forth

-Edith Kanakaole

 <http://apps.ksbe.edu/kscholars/oli/ehomai>



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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US Dept of State Geographer

30°03'28.27" N 108°58'03.94" W elev 4825 ft

Maui's Fishhook



Image Credit: Bishop Museum; *Explorers of Polynesia* Planetarium Show

Ka Makau Nui O Maui = Scorpius

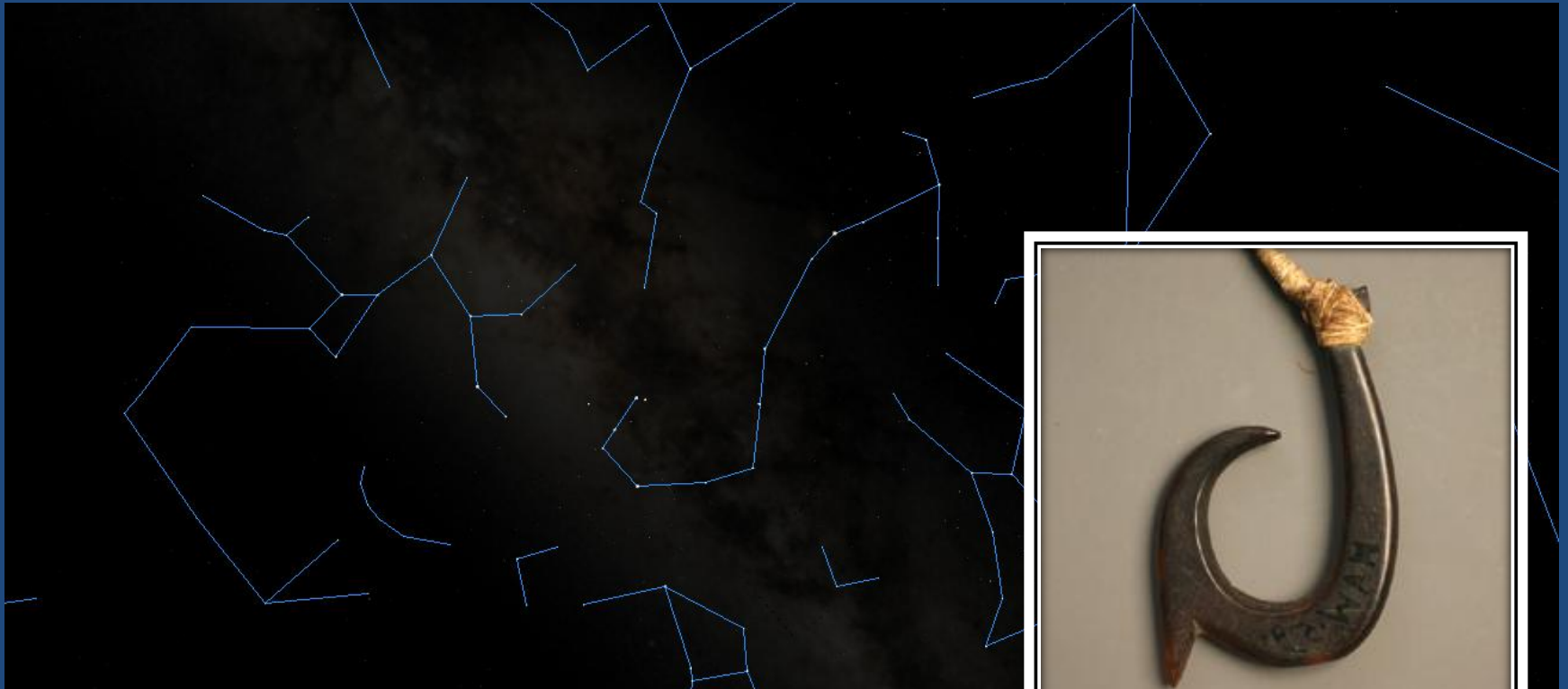


Image Credit: Starry Night Pro

Image Credit:
Bishop Museum Ethnology Collection

Celestial Navigation



Image Credit: Eli Witt, Polynesian Voyaging Society

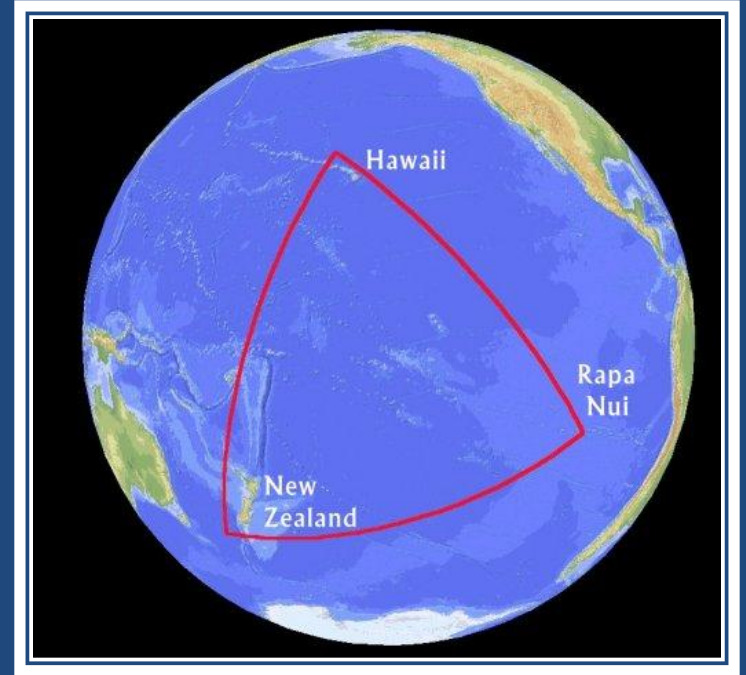


Image Credit: Wikipedia

Hawaiian Star Compass

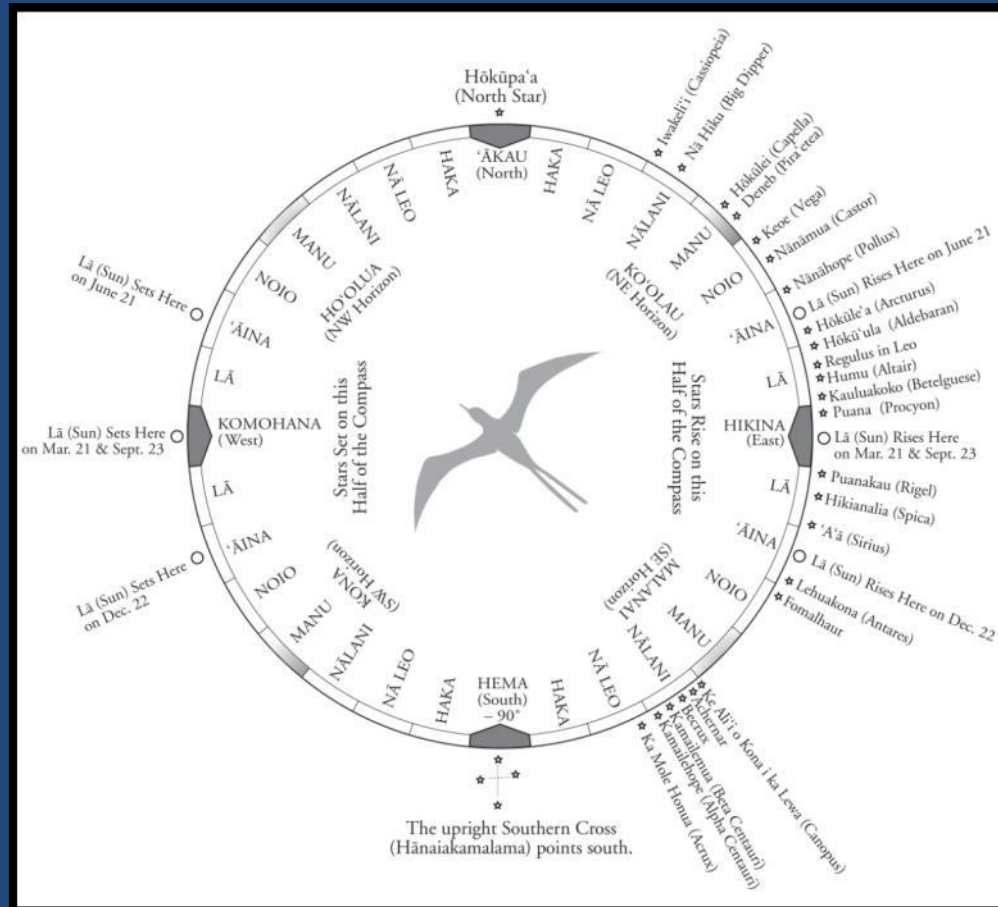


Image Credit: Nainoa Thompson, Polynesian Voyaging Society



<http://earthsky.org/human-world/kaiulani-murphys-star-compass-helps-navigate-oceans>

Hawaiian Star Compass



Image Credit: Indigenous Education Institute

Hawaiian Star Compass

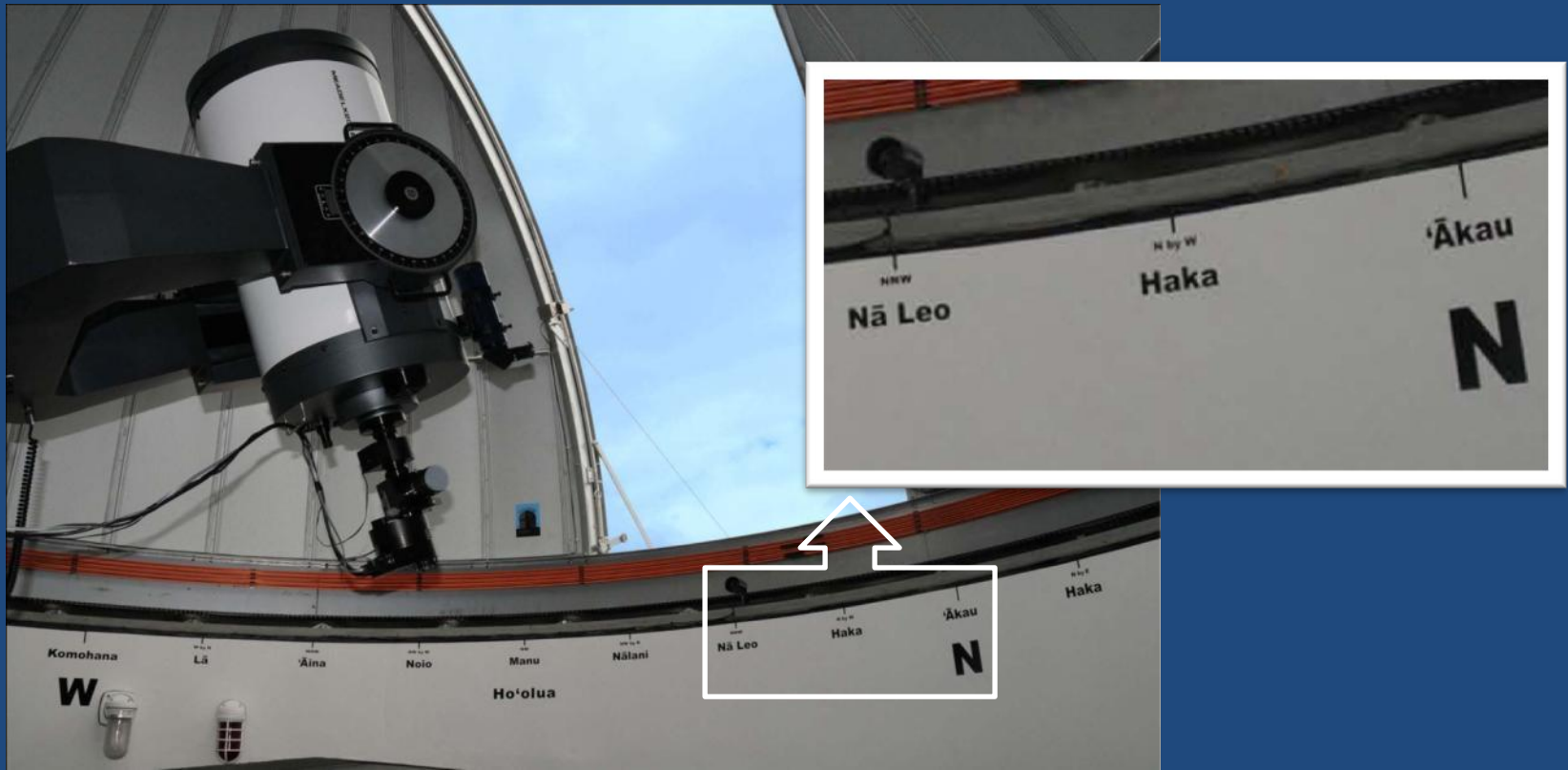


Image Credit: Joseph Ciotti, Windward Community College

Science Within Culture

- Science does not occur in a vacuum – it has developed and exists within culture
- “Western Science” – what we call science today has its origins in Western cultures
- This culture of science has been adopted by scientists worldwide
- Indigenous people have been practicing science for thousands of years.
- A broader and older definition of science “to know”

Adapted from Cosmic Serpent: Collaboration with Integrity by Dr. Nancy C. Maryboy, Dr. David Begay, and Dr. Laura Peticolas; with input from Dr. Isabel Hawkins, Alonso Mendez and Dr. Bryan Mendez .

Nature of Science

- Cyclical process of observation, measurement, prediction, and verification of knowledge
- Interplay between theory and experiment
- Importance of cycles and interrelationships
- Based on centuries of accumulation of knowledge
- Knowledge is both deep and precise

Knowledge Holders

- Western Science:
 - Discipline based, specific areas of expertise
 - Requires years of training
 - Scientific community provides validation for knowledge, not for character of individual
- Indigenous Science:
 - Can be discipline based
 - Requires years of training
 - Whole community provides validation of the character of knowledge holder

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Transmission of Knowledge

- Western Science:
 - Importance of written transmission of knowledge
 - Knowledge is shared through written journals and conferences
 - The public has a right to learn results of publically-funded science investigations
- Indigenous Science:
 - Importance of oral transmission of knowledge
 - Knowledge shared through elders and ceremony
 - Knowledge is only imparted to those who are deemed qualified
 - Protected native knowledge is not shared unless properly authorized by the tribe

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Relationship to Nature

- Western Science:
 - Measurement based; importance of unbiased data
 - Observer is set apart from that which is being observed
 - Ultimately, all of nature could be decipherable to the rational human mind
- Indigenous Science:
 - Interrelationship based; importance of reciprocal relationship and stewardship
 - Observer is a part of that which is being observed
 - Nature will always possess unfathomable mysteries

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Spirituality

- Western Science:
 - Western scientists typically keep their scientific practice and spiritual beliefs separate
- Indigenous Science:
 - Spiritual aspects are embedded in everything; belief that the natural world contains a living spirit
 - Nature is honored constantly through daily spiritual practice

The Universe

- Western Science:
 - Universe is made up of physical objects that follow forces, creating a dynamic and ever-changing universe
 - The study of the universe is compartmentalized in dualistic forms and reduced to progressively smaller conceptual parts
- Indigenous Science:
 - Universe is made up of dynamic, ever-changing natural forces
 - Universe is viewed as a holistic, integrative system with a unifying life force

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“In the end I think that we are all indigenous to this world and we as humans have used the same thought processes to resolve the same grand question we all share and that is: What is our relationship to the space beyond this earth?”

– Alonso Mendez, Maya Archaeoastronomer



Image Credit: BizarroComic.Blogspot.com, 12/21/2009

The Ancient Maya



- Indigenous to what is now southern Mexico, Guatemala, Belize, El Salvador and Honduras
- Classic Maya civilization from 250 – 925 AD
- Built independent city-states
- Had well developed agriculture, long distance trade, architecture, etc.

The Modern Maya



Image Credit: Andy Kreyche



Image Credit:
Bob Sacha



Image Credit: Jose Huchim Herrera



Image Credit: Igor Ruderman

- Misconception that Maya people only lived in the past
- More than 6 million Maya people living today
- Continue to speak language, practice traditions, engage in modern life

Leiden Plaque

- Earliest known complete Maya date is the Leiden Plaque
- Currently located at Rijksmuseum voor Volkenkunde in Leiden, The Netherlands
- Originally from Tikal, Guatemala
- Records accession of king on 8.14.3.1.12 or September 17, 320 AD

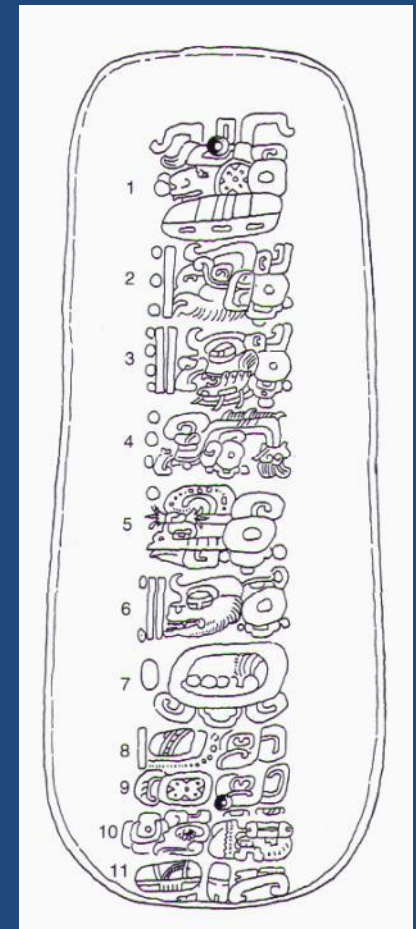
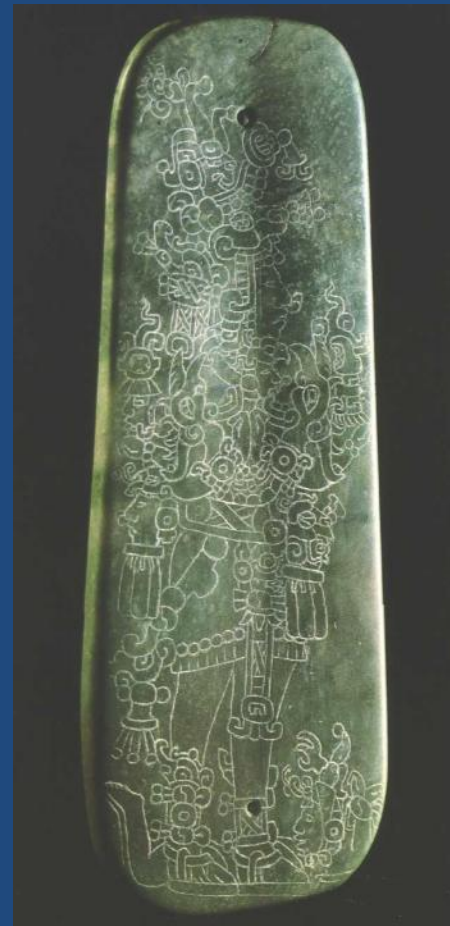


Image Credit (L): Rijksmuseum voor Volkenkunde

Image Credit (R): Anthony Aveni, *Skywatchers*

Maya Long Count Calendar

- The Long Count refers to how many days have past since creation date.
- Each number in long count date represents place value
- Example: Place value for 8.14.3.1.12 in Leiden Plaque

8	14	3	1	12
<ul style="list-style-type: none">• Baktuns• 144,000 days• 8 x 144,000	<ul style="list-style-type: none">• Katuns• 7,200 days• 14 x 7,200	<ul style="list-style-type: none">• Tuns• 360 days• 3 x 360	<ul style="list-style-type: none">• Uinals• 20 days• 1 x 20	<ul style="list-style-type: none">• Kins• 1 day• 12 x 1

1,253,912 days (3,435 years) have passed since mythological creation date

Maya Creation Story

- Current world era began when 3 stones were set down, centering the cosmos and separating sky and land
- August 13, 3114 BC



			4 Ahaw
8 Kumk'u			hal K'ohba was manifested, the image
ox tun tzukah three stones were set			u tzapwa they planted
tun the stone, Jaguar Paddler			Stingray Paddler
utiy na-ho'-chan it happened at the First-Five-Sky			jaguar throne stone
u tz'apwa tun he planted the stone			Ek'-Na-Chak-?? Black-First-Red-??
utiy kab ??? it happened at Earth-Place			serpent throne stone
iwal utiy and then it happened the stone was set			Na Itzamhi
waterlily throne stone			utiy ch'a-chan it happened at Lying-down-Sky
Yax-Ox-Tun-nal First-Three-Stone-Place			were completed 13 bak'tuns
it was his action			Wak-Chan-Ahaw Raised-up-Sky-Lord

Image Credit: authenticmaya.com

Hearthstones of Creation



Image Credit: Madrid Codex



Image Credit: Akira Fujii, *Sky & Telescope*

Hearthstones of Creation



Image Credit: <http://www.flickr.com/photos/ilhuicamina/1185741043/>

Maya Cosmology

- After the 3 creation stones were set down, the universe was divided into:
 1. celestial realm
 2. earthly realm
 3. underworld realm
- 3 realms were united by a ceiba tree, the “world tree”



Image Credit: A. Mendez

Maya Household Altar



Image Credit: Nancy Alima Ali

Zenith Passage of the Sun

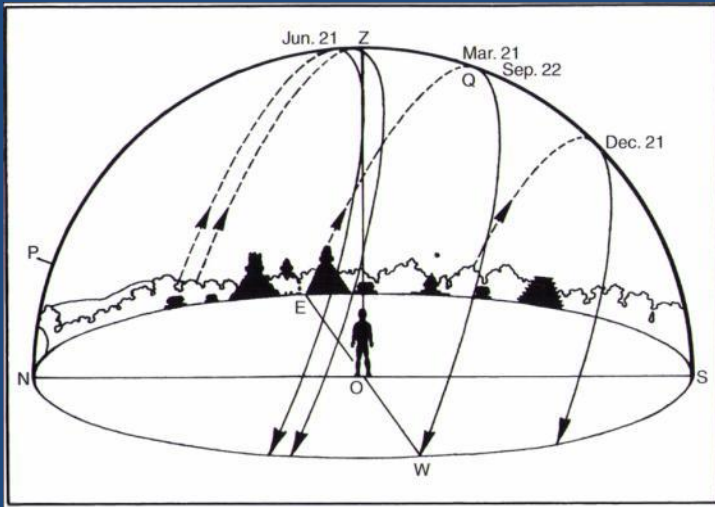


Image Credit: Anthony Aveni, *Skywatchers*



Image Credit: Nancy Alima Ali

- Solar zenith passage happens only once or twice a year, only in tropical latitudes
- Maya creation date was a solar zenith passage
- Zenith passage days continue to be celebrated today

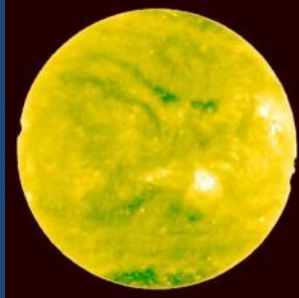


Image Credit: Justin Kerr

K1892

Sky on Creation Date



Image Credit: Alonso Mendez

- Zenith passage of the Sun
- Hearthstones of creation at nadir
- Sun and moon opposite each other

End of the Long Count

- Either December 21, 2012 AD or December 23, 2012 AD
- No evidence of doomsday prophecies
- Celebration of ending of a cycle
- Within contemporary Maya community, end of Long Count is an opportunity to reclaim knowledge



Image Credit: Bryan Mendez

Recommendations for Integrating Astronomy & Culture

- Value indigenous ways of knowing
- Respect community guidelines regarding knowledge
- Do not perpetuate stereotypes and misconceptions
- Reflect on your own knowledge and bias
- Cultivate positive intent
- Make a sustained and sincere effort to collaborate and form lasting relationships with indigenous colleagues
- Help to open forums for their knowledge to be shared with integrity

Thank You/Mahalo/Nip Olal

- Alonso Mendez, Archaeoastronomer
- Isabel Hawkins, Exploratorium
- Laura Peticolas, University of California Berkeley
- Bryan Mendez, University of California Berkeley
- Nancy Maryboy, Indigenous Education Institute
- David Begay, Indigenous Education Institute
- Paul Coleman, University of Hawaii