

NATIVE
SKY
WATCHERS

**TWO-EYED SEEING:
HAWAIIAN
INDIGENOUS
ASTRONOMY &
NASA MOON TO
MARS**

Photo by: Kalepa Baybayan



LIVE
(virtual)
SHOW

Friday, March 12, 2021

Credit: Hokulele, Photo by: Kalepa Baybayan



Two-Eyed Seeing

Etuaptmunk or Two-Eyed Seeing "is learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing and from the other eye with the strengths of Western knowledges and ways of knowing and to use both these eyes for the benefit of all." (Bartlett, Marshall and Marshall, 2021)

Land Acknowledgment

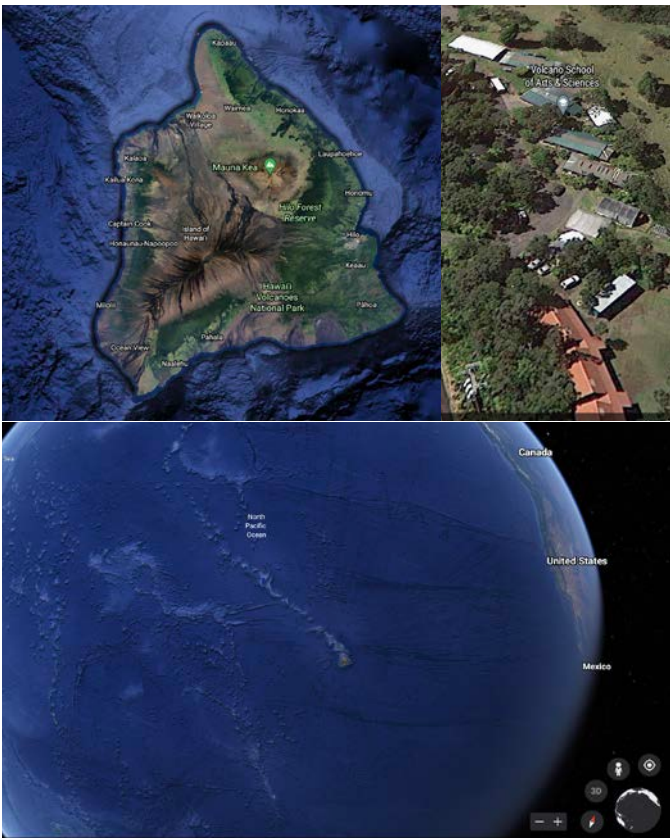
Land Acknowledgment - Hawaiian Islands and Hawai'i...

He lani i luna, he honua i lalo.

"The sky above, the earth below"; speaks to the synergistic relationship between the earth, sea, sky, and people. We acknowledge the synergy and relationships that exist between all things and foster a healthy community."

- Kālepa Baybayan

"Wherever I go, I travel with my sky and earth, and that is because my cultural roots to my place assures me of who and what I am." -Larry Kimura



Credit: Google Earth Web, <https://earth.google.com/web/>

The *Native Skywatchers* program would like to acknowledge that the land under our feet is the original homelands of the Dakota people and later the Ojibwe. *Mni Sota Makoce*, "Land where the waters reflect the skies" is the Dakota name for Minnesota. 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'.

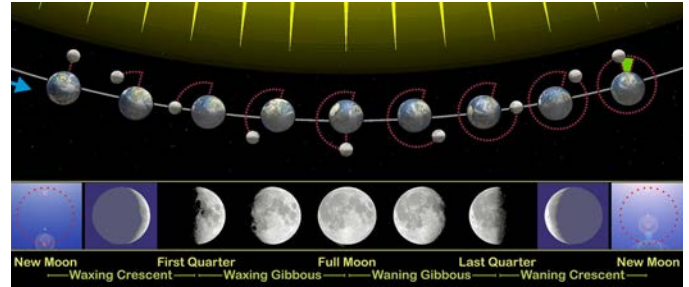


Diagram created by Orion 8, 2018 (not to scale)

Pō Mahina - Moon Nights

"PōMahina, Moon Nights", is our lunar calendar for counting the nights. Hawaiian counted the moons by breaking them up into three sections called Anahulu. The first ten moon nights were Ho'onui, meaning 'increasing in size'. The second ten moon nights were Poepoe, meaning 'roundness or fullness'. The third and last ten nights were Hō'emi, meaning 'diminishing'!

Anahulu Ho'onui...means increasing

Hilo-First Crescent Moon, Mar 14

Hoaka

Kū-kahi

Kū-lua

Kū-kolu

Kū-pau

'Ole-kū-kahi -1st Quarter, March 21

'Ole-kū-lua

'Ole-kū-kolu

'Ole-pau or 'Ole-kū-pau

Anahulu Poepoe...means fullness

Huna

Mohalu

Hua

Akua -Full Moon, March 28

Hōkū

Mahea-lani

Kulu

La'au-kū-kahi

La'au-kū-lua

La'au-pau or La'au-kū-pau

Anahulu Hō'emi...means diminishing

'Ole-kū-kahi -3rd/Last Quarter, Apr 4

'Ole-kū-lua

'Ole-pau

Kaloa-kū-kahi

Kaloa-kū-lua

Kaloa-pau

Kane

Lono

Mauli

Muku - New Moon, April 11

(Baybayan 2021; Johnson, Mahelona, Ruggles 2015)



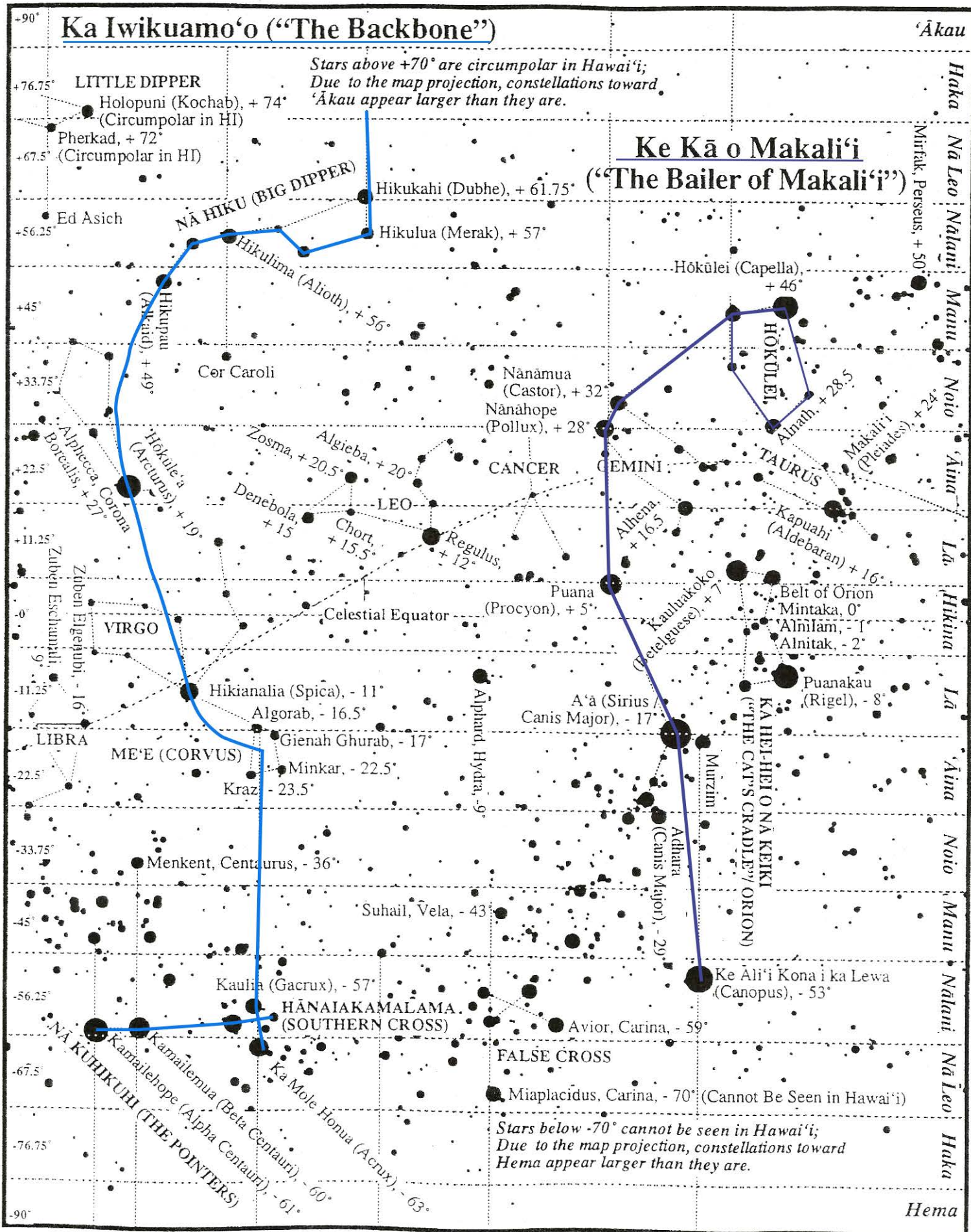
Hilo -First Crescent Moon, Photo by Birrell Walsh



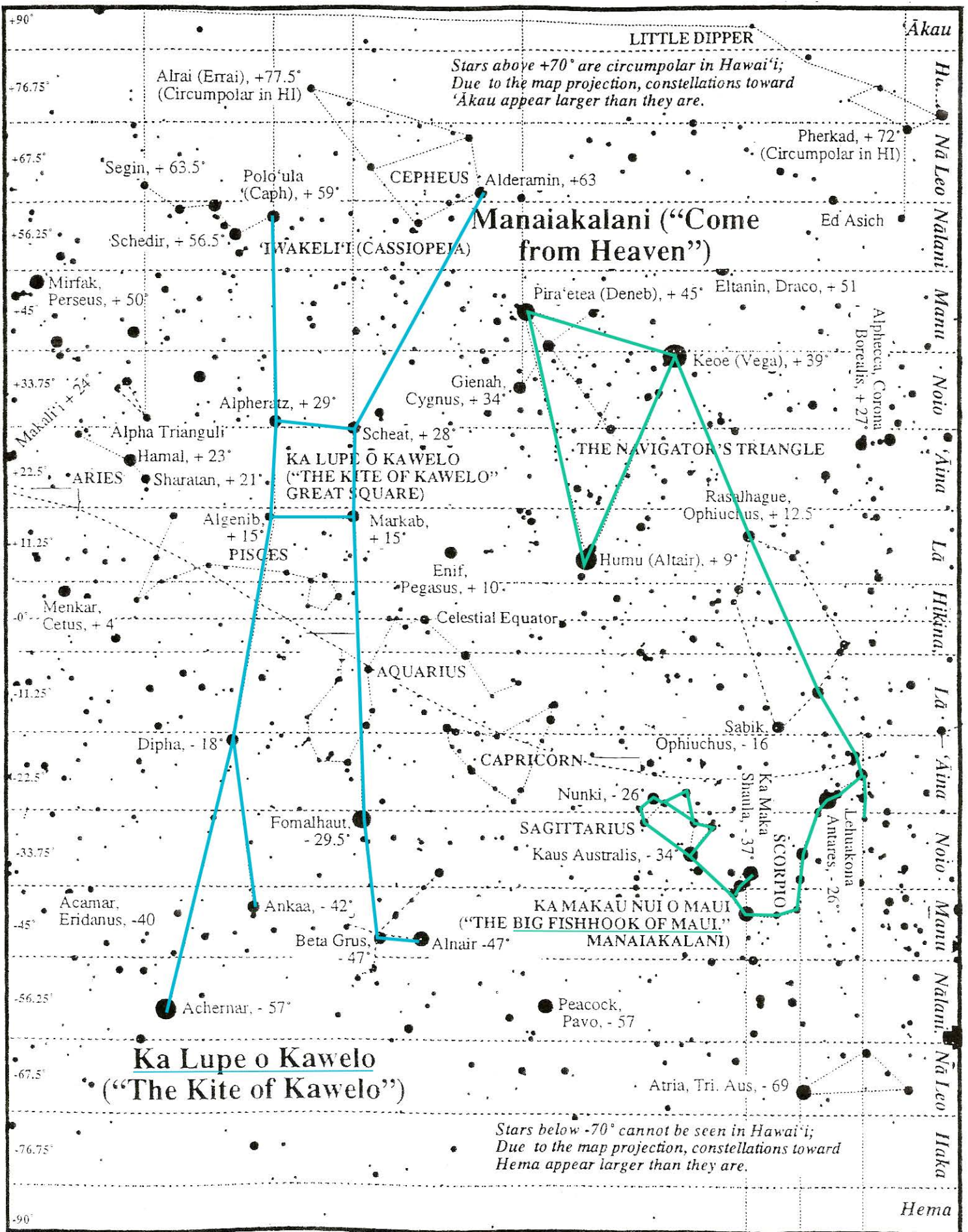
Kulu, Waning Gibbous, Photo by Anthony Thelion



More on Hawaiian Moons at:
<https://imiloahawaii.org/imiloathome>



Credit: Polynesian Voyaging Society, <http://www.hokulea.com/moananuiakea/>



Credit: Polynesian Voyaging Society, <http://www.hokulea.com/moanuanuakea/>

A Hua He Inoa-Give Forth a Name

'Ikemakalua-

Two-Eyed Seeing

- 'Ike: know, see, feel, recognize, experience, understand, perception, vision

- Maka: Eyes - Lua: Two

"I was amazing at how much attention this naming of astronomical discoveries got. So I really started to think about how this could impact our language movement; teaching a new generation this skill and the practice of creating Hawaiian names."

- Larry Kimura



Credit: "A Hua He Inoa", 'Imiloa Astronomy Center



Credit: "A Hua He Inoa", 'Imiloa Astronomy Center

"To be able to name the objects, students first studied the asteroid themselves...We made sure they had access to experts in both 'ōlelo Hawaii and astronomy...A Hua He Inoa' is a critical step towards integrating indigenous perspectives and place-based scientific research."

- Ka'iu Kimura



The intent is to continually create new spaces for our language to thrive.

Ka'iu Kimura
Executive Director, 'Imiloa Astronomy Center

Credit: "A Hua He Inoa", 'Imiloa Astronomy Center

"Hawaiian language was and still is a 'treasure house embedded with the whole way of seeing the world. It adds to the whole richness of being on earth and approaching different concepts in different ways." - Larry Kimura

In Hawaiian language, words have power; a name was a person's most precious possession, a force unto itself. "A name became a living entity...identified a person and could influence health, happiness and even life span." - Mary Kawena Pukui (Ref - Wizinowich 2020)



indigenous perspectives and place-based scientific research.

Credit: "A Hua He Inoa", 'Imiloa Astronomy Center, <https://imiloahawaii.org/a-hua-he-inoa>

'Imiloa Astronomy Center

Ref: 'Imiloa Astronomy Center, <https://imiloahawaii.org>



Credit: 'Imiloa Astronomy Center, <https://imiloahawaii.org/aboutimiloa>

'IMILOA MEANS "TO SEEK FAR" AND IS THE HAWAIIAN WORD FOR BOTH "EXPLORE" AND "EXPLORER".

AT 'IMILOA, WE EXPLORE OUR PLACE IN THE GENEALOGY OF THE UNIVERSE AND CONTINUALLY SEEK, LEARN, AND ADAPT TO AN EVER-EVOLVING ENVIRONMENT THAT INSPIRES DISCOVERY AND INNOVATION.



Credit: 'Imiloa Astronomy Center, <https://imiloahawaii.org/15th-birthday>

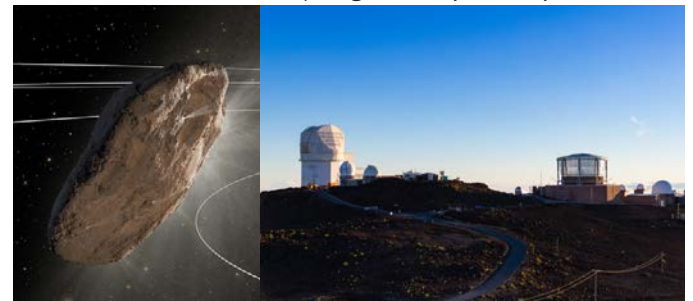
'Oumuamua - First Scout

Ou - to reach out for; Mua - First

Using observations from NASA's Hubble Space Telescope and ground-based observatories, an international team of scientists have confirmed 'Oumuamua (oh-MOO-ah-MOO-ah), the first known interstellar object to travel through our solar system, got an unexpected boost in speed and shift in trajectory as it passed through the inner solar system last year.

"Our high-precision measurements of 'Oumuamua's position revealed that there was something affecting its motion other than the gravitational forces of the Sun and planets," said Marco Micheli of ESA's (European Space Agency) Space Situational Awareness Near-Earth Object Coordination Centre in Frascati, Italy, and lead author of a paper describing the team's findings.

"The more we study 'Oumuamua, the more exciting it gets," Meech said. "I'm amazed at how much we have learned from a short, intense observing campaign. I can hardly wait for the next interstellar object!" Kamo'oalewa - Object is a piece of a larger object that broke off... that will now orbit on its own in our Solar System - <https://www.nasa.gov/press-release/our-solar-system-s-first-known-interstellar-object-gets-unexpected-speed-boost>



Credit: <https://www.nasa.gov>

Credit: By dronepicr - Haleakala Observatory

Voyaging & Exploration

Mālama Honua (5:43) -Polynesian Voyaging Society.....Hokulea.com

Some quotes from the video, **Nainoa Thompson**:

“Are you going to be responsible... Are you going to take action?”

“The greater risk is not to take action.”

“Stay on course, move inspiration into action... help move the movement of kindness around the Earth.”



Credit: "Mālama Honua", Polynesian Voyaging Society



Credit: Hōkūle‘a, Photo by Danee Hazama

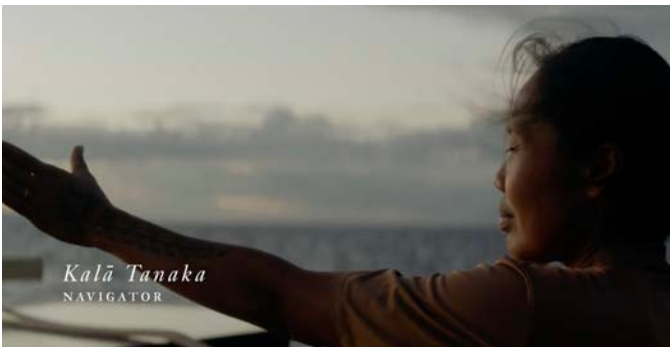
Hawai‘i Rooted-Navigating the Star (2:36), Wayfinding

Some quotes from the video, **Kalā Tanaka**:

“When we voyage, I never feel alone. I feel loved. I feel like I am part of something great. I feel like my kupuna, my ancestors, are there with me and they’re helping me get to my destination.”

“As long as you can see a star, as long as you know what star that is....and the connection that star shares with you and your direction... you’ll always know where to go.”

“The canoe is spiritual. It connects us to these islands and also to our ancestors....As Hawaiians, as voyagers we have a deep connection to our environment. And when you sever that connection, we lose part of who we are. And I don’t want to do that.”



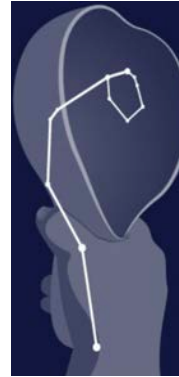
Credit: "Hawaii Rooted-Navigating the Stars", <https://www.gohawaii.com/hawaii-rooted>

Nā ‘Ohana Hōkū ‘Ehā, 4 Star Families

AN INTRODUCTION TO A HAWAIIAN WAYFINDER’S NIGHT SKY

Nā ‘Ohana Hōkū ‘Ehā, The Four Star Families, is a practical device for reading the tropical night sky developed by modern Hawaiian wayfinders. It divides ka lanipa‘a, the celestial sphere, into four divisions that run north to south, with each segment organized around a grouping of bright stars and identifiable constellations.

Ref: **‘Imiloa Astronomy Center**, <https://imiloahawaii.org/the-four-star-families>



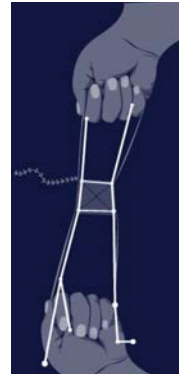
The winter-spring Star Family is called **Kekāomakali‘i, The Bailer of Makali‘i**. To find the Bailer, search for Kaheiheionākeiki, Orion the Hunter, and the three stars of his belt. These three stars rise a little South of due East. Kekāomakali‘i resembles the shape of a Canoe Bailer, with the scoop of the bailer carrying Orion and other stars overhead and “pouring” them out towards the west. To identify the scoop, look to the northeast and the constellation Auriga, The Charioteer, and locate the golden-yellow hued brightest star in the constellation, Hōkūlei, Capella.



The spring-summer Star Family is **Kaiwikuamo‘o, the Backbone. Locate Nāhiku** (The Seven), the Big Dipper in the northeast. Draw a mental line between the two stars, Hikukahi and Hikulua, at the beginning of the “cup shape” of the Big Dipper northwards to a faint star, Hōkūpa‘a (Fixed Star), Polaris, our North Star. Return to the Big Dipper and follow a line south from the handle of the Big Dipper to the Red Giant and zenith star for Hawai‘i, Hōkūle‘a, Arcturus, the fourth brightest star in the night sky.



The summer-fall Star Family is **Mānaiakalani, The Fishhook of Maui**. A triangle of stars in the northeast represents a coil of fishing line that belongs to the demigod, Maui. It extends southward and is tied to the top of a fish hook-shaped constellation. It fishes along the bottom of the sea for a magical Giant Trevally, Pimoe, Sagittarius. The three stars in the northeast form the Summer Triangle: Pira‘etea, Deneb in the constellation Cygnus the Swan; Keoe, Vega in the constellation Lyra the Harp; and Humu, Altair in the constellation Aquilae the Eagle.



The last Star Family, **Kalupeakawelo, the Kite of Kawelo** is a fall-winter that completes the final section of stars on the celestial sphere and the Hawaiian wayfinder’s full picture of the entire night sky. Kalupeakawelo, The Kite of Kawelo, is made up of the Great Square of Pegasus, a square-shaped kite that rises from the eastern horizon and flies overhead towards the western horizon. The four stars of the Great Square are named for Hawaiian chiefs; Keawe of Hawai‘i Island, Pi‘ilani of Maui, Kākuhihewa of O‘ahu, and Manokalanipo of Kaua‘i.

More on Hawaiian Star Families at: <https://imiloahawaii.org/the-four-star-families>

Oceanic Wayfinding



Photo credit: Danee Hazama

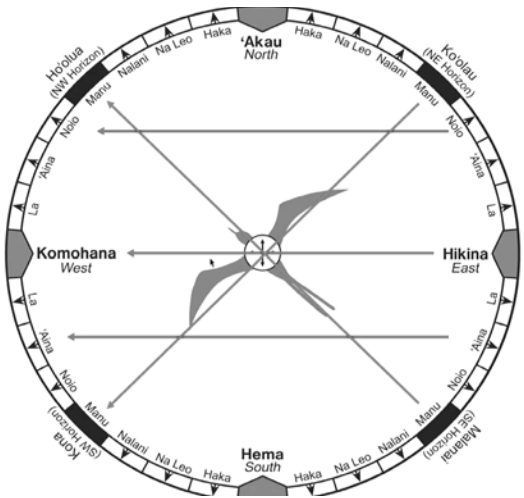


Photo credit: Natasha Nazario

Hawaiian Star Compass

Movements for the Seven Houses:

- Lā (sun)
- ‘Aina (land)
- Noio (tern)
- Manu (bird)
- Nāleo (voices)
- Nālani (heavens)
- Haka (emptiness)



Credit: Polynesian Voyaging Society

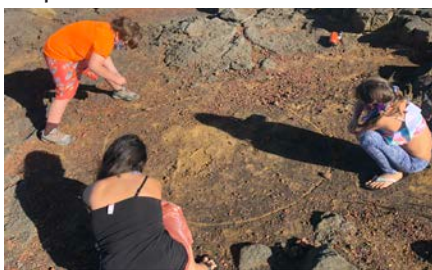
We acknowledge the Four Directions:

- Hikina - East
- Hema - South
- Komohana - West
- ‘Akau - North

Kula ‘Amakihi Wayfinding Project

Ka Lae (South Point) Hawaiian Star Compass, oriented to the 4 cardinal points, 7 houses in each quadrant.

Kunihi - ‘oli (chant) to the land, asking for permission to enter...



Credit: Barbara Sarbin



Credit: Natasha Nazario

Volcano School -Kula 'Amakihi Class

Lead educators: Ms. Lisa, Ms. Barbara, and Ms. Jacqueline designed and delivered several "Two-Eyed Seeing/'Ikemakalua: Hawaiian Astronomy & NASA Moon to Mars" projects for their students at the



Credit: <https://www.volcanoschool.net/>

Volcano School of Arts & Sciences-A Hawaiian-Focused Public Charter School in Volcano, Hawaii. Some highlights are:

- **Kula 'Amakihi Wayfinding Project.** Students made a place-based Hawaiian compass.

- **Mauna 'Ulu Moonscape & Holei Sea Arch.** Placed-based exploring, observation, and discovery.

- **"Who are You in the Crew?"** Comparisons between a Hōkūle'a crew and an Artemis crew.



Photo credit: Danee Hazama



Artist rendering, Orion spacecraft docked to Mars Transfer Vehicle, Photo credit: NASA.gov

Who Are You in the Crew?

Kiana Safety and Weather Communication... "I like to check the weather and make sure it's safe to be outside...I would predict the weather and watch the currents and the tides."

Benjamin Safety Officer... "I would want to be the safety officer because at my old school I was a safety officer and I was awarded by the Maui police department."

Eloise Science Educator... "I would be the role of the Science Educator because I like to do science. I love to learn science but most of all I would love to be the crew's Science Educator!"

Kai The Quartermaster... "I want this role because the name sounds like I'm the lord of time and space, and it seems to me to be one of the more simpler Role and Duty. I think I'll be a good fit for the role of Quartermaster because I like statistics and knowing how much of what I need for this amount of time...Sometimes I personally think that would be arduous about the role of Quartermaster is trying to evenly distribute the weight. "

Mauna 'Ulu Moonscape



Credit: Natasha Nazario

Holei Sea Arch



Credit: David Dunton



Credit: David Dunton

NASA Moon to Mars



Photo credit: NASA.gov, <https://www.nasa.gov/artemisprogram>

Our Educators recommend:

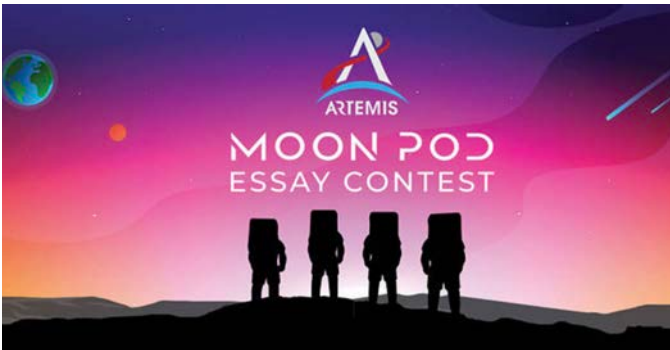


Photo credit: NASA.gov, https://www.nasa.gov/solve/Moon_Pod_Essay_Contest/

Ms. Lisa, Ms. Barbara, and Ms. Jacqueline recommend this NASA Artemis Activity: **IMAGINE LEADING A ONE-WEEK EXPEDITION ON THE MOON AND WRITE AN ESSAY THAT TELLS NASA ALL ABOUT IT.**

NASA is taking remote learning to the Moon! 2020 has been a year of working and living at a distance. Now consider what it might be like if you were living with a pod of astronauts 250,000 miles from Earth. Your challenge is to imagine leading a one-week expedition at the Moon's South Pole – with the whole world cheering you on. Tell us about the types of skills, attributes, and/or personality traits that you would want your Moon Pod crew to have and why. How many would be in your pod?



Photo credit: European Space Agency, Samantha, https://www.youtube.com/watch?v=C-65mBQ7s_Q

And of course you'll need high tech gear and gadgets! In your essay, also describe one machine, robot, or technology that you would leave on the lunar surface to help future astronauts explore the Moon.



Credit: Perseverance's Mastcam-Z's 1st panoramic image of Mars, <https://mars.nasa.gov/>

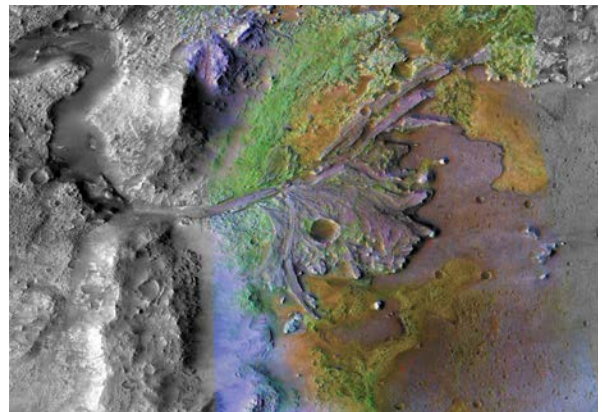
NASA STEM on Station



Credit: <https://www.nasa.gov/press-release/nasa-s-perseverance-drives-on-mars-terrain-for-first-time>

NASA's Perseverance Drives on Mars' Terrain for First Time

NASA's Mars 2020 Perseverance rover performed its first drive on Mars March 4, covering 21.3 feet (6.5 meters) across the Martian landscape. The drive served as a mobility test that marks just one of many milestones as team members check out and calibrate every system, subsystem, and instrument on Perseverance. Once the rover begins pursuing its science goals, regular commutes extending 656 feet (200 meters) or more are expected. "When it comes to wheeled vehicles on other planets, there are few first-time events that measure up in significance to that of the first drive," said Anais Zarifian, Mars 2020 Perseverance rover mobility test bed engineer at NASA's Jet Propulsion Laboratory in Southern California. "This was our first chance to 'kick the tires' and take Perseverance out for a spin. The rover's six-wheel drive responded superbly. We are now confident our drive system is good to go, capable of taking us wherever the science leads us over the next two years." -<https://www.nasa.gov/press-release/nasa-s-perseverance-drives-on-mars-terrain-for-first-time>



Credit: Jezero Crater, Perseverance landing site, 35 bilyr. old delta, <https://www.nasa.gov/perseverance/images>



Credit: Perseverance's Mastcam-Z's 1st panoramic image of Mars, <https://mars.nasa.gov/>

Mahalo!

Thank you.

Credit for this work:

Baybayan, Kālepa, Lisa Barnard, Barbara Sarbin, Jacqueline Ramirez, and Annette S. Lee., "Two-Eyed Seeing: Hawai'ian Indigenous Astronomy & NASA Moon to Mars", Mar. 2021, <https://nativeskywatchers.com/two-eyed-nasa-hawaiian.html>

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