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The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Coming Events

Monthly Meeting
No meeting this month
Baker Wetlands Discovery Center

Public Observing
No public observing this month
Baker Wetlands Discovery Center

Club Officers
President
Rick Heschmeyer email

AICOR
William Winkler email

NSN Coordinator
Howard Edin email

Faculty Advisor
Dr. Jennifer Delgado email.

Newsletter Editor
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Inside This Issue

Report From the Officers

By Rick Heschmeyer

At our April club meeting, AAL president Rick Heschmeyer shared some KU astronomy program history, focusing on Dr. N. Wyman Storer, who taught at KU from 1935 until 1970. In the mid-1940's Dr. Storer had a radio program called "Skygazing" on KFKU radio, KU's original AM radio station. The recordings of two of those programs were shared with club members. They were titled "The Constellations of the North" and "The Seasons". Originally recorded on 16" transcription discs, Rick was able to find a radio station outside Cincinnati to convert the original recordings into digital format. They provided an interesting glimpse back 75 years at the KU astronomy department and the teacher who led it. While it was too cloudy immediately after the meeting, the few that hung around were treated to clearing skies and looks through the 14" in the dome.

On the Saturday before our April club meeting, April 23rd, Baker Wetlands Discovery Center hosted their Family Fun Day and AAL was there. Weather made it impossible to conduct our planned Solar Observing, but despite the high winds and clouds, Bill Wachspress opened the dome to show off the 14-inch Meade Ritchey-Chretien telescope inside, and Rick Heschmeyer had a table inside displaying part of his meteorite collection.

The April "Telescope Night at KU" was a success. A short talk "61 Years of Human Spaceflight" preceded telescope observations of the Moon. The May event will take place on May 12th. Once the flyer is received, I will email and post on the club's Facebook page.

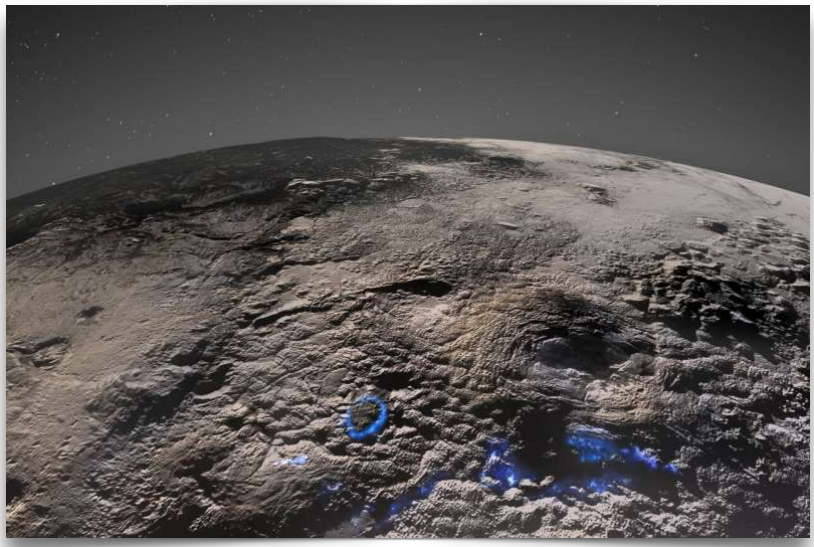
There is no planned AAL club meeting for May, but we are in the final planning stages for a joint Star Party event between AAL members and the KU Astronomy Department at Baker Wetlands Discovery Center on the weekend of May 21-22. As details are finalized, an invitation will go out to club members.

The Post-Lawrence City Band Concert Observing Sessions in South Park have been set for this summer. The dates for observing are June 1, June 15, June 29, and July 13. Observing will begin as soon as the concerts finish, usually around 9 PM, weather permitting of course.

Enjoy the warmer temperatures and plan on joining us at one of our events this summer.

Giant ice volcanoes identified on Pluto

Physorg, March 29, 2022



Perspective view of Pluto's icy volcanic region. The surface and atmospheric hazes of Pluto are shown here in greyscale, with an artistic interpretation of how past volcanic processes may have operated superimposed in blue.

Strange lumpy terrain on Pluto unlike anything previously observed in the solar system indicates that giant ice volcanoes were active relatively recently on the dwarf planet, scientists said on Tuesday.

The observation, which was made by analyzing images taken by NASA's New Horizons spacecraft, suggests that Pluto's interior was hotter much later than previously thought, according to a new study in the *Nature Communications* journal.

Rather than shooting lava into the air, ice volcanoes ooze a "thicker, slushy icy-water mix or even possibly a solid flow like glaciers", said Kelsi Singer, study author and planetary scientist at Colorado's Southwest Research Institute.

Ice volcanoes were already thought to be on several chilly moons in the solar system, but Pluto's "look so different from anything else we ever have seen", Singer told AFP.

"The features on Pluto are the only vast field of very large icy volcanoes and they have a unique texture of undulating terrain."

Singer said it was difficult to pinpoint exactly when the ice volcanoes were formed "but we believe they could be as young as a few hundred million years or even younger".

Unlike much of Pluto, the region does not have impact craters, which means "you cannot rule out that it is still in the process of forming even today", she added.

'Extremely significant'

Lynnae Quick, a planetary scientist at NASA's Goddard Space Flight Center specialized in ice volcanoes, said the findings were "extremely significant".

"They suggest that a small body like Pluto, which should have lost much of its internal heat long ago, was able to hold onto enough energy to facilitate widespread geological activity rather late in its history," she told AFP.

"These findings will cause us to re-evaluate the possibilities for the maintenance of liquid water on small, icy worlds that are far from the Sun."

David Rothery, professor of planetary geosciences at The Open University, said "we don't know what could provide the heat necessary to have caused these icy volcanoes to erupt".

The study said that one of the structures, the Wright Mons, is about five kilometers (three miles) high and 150 kilometers (90 miles) wide, and has around the same volume as one of Earth's biggest volcanoes —the Mauna Loa in Hawaii.

Rothery told AFP he had been to Mauna Loa and "experienced how vast it is".

"This makes me realize how big Wright Mons is relative to Pluto, which is a much smaller world than our own."

The analyzed images were taken when the New Horizons—an unmanned nuclear-powered spacecraft about the size of a baby grand piano—became the first spaceship to pass by Pluto in 2015.

It gave the greatest insight yet into Pluto, which was long considered the farthest planet from the Sun before it was reclassified as a dwarf planet in 2006.

"I love the idea that we have so much left to learn about the solar system," Singer said.

"Every time we go somewhere new, we find new things that we didn't predict—like giant, recently-formed ice volcanoes on Pluto." ☀

RECORD BROKEN: HUBBLE SPOTS FARTHEST STAR EVER SEEN

HUBBLESITE, MARCH 30, 2022

A LUCKY COSMIC ALIGNMENT HAS REVEALED A SINGLE SOURCE OF LIGHT IN THE FIRST BILLION YEARS AFTER THE BIG BANG, SETTING UP A MAJOR CONFIRMATION FOR THE JAMES WEBB SPACE TELESCOPE IN ITS ROOKIE YEAR.

NASA's Hubble Space Telescope has established an extraordinary new benchmark: detecting the light of a star that existed within the first billion years after the universe's birth in the big bang—the farthest individual star ever seen to date.

The find is a huge leap further back in time from the previous single-star record holder; detected by Hubble in 2018. That star existed when the universe was about 4 billion years old, or 30 percent of its current age, at a time that astronomers refer to as "redshift 1.5." Scientists use the word "redshift" because as the universe expands, light from distant objects is stretched or "shifted" to longer, redder wavelengths as it travels toward us.

The newly detected star is so far away that its light has taken 12.9 billion years to reach Earth, appearing to us as it did when the universe was only 7 percent of its current age, at redshift 6.2. The smallest objects previously seen at such a great distance are clusters of stars, embedded inside early galaxies.

"We almost didn't believe it at first, it was so much farther than the previous most-distant, highest redshift star," said astronomer Brian Welch of the Johns Hopkins University in Baltimore, lead author of the describing the discovery, which is published in the March 30 journal Nature. The discovery was made from data collected during Hubble's

(Reionization Lensing Cluster Survey) program, led by co-author Dan Coe at the Space Telescope Science Institute (STScI), also in Baltimore.

"Normally at these distances, entire galaxies look like small smudges, with the light from millions of stars blending together," said Welch. "The galaxy hosting this star has been magnified and distorted by gravitational lensing into a long crescent that we named the Sunrise Arc."

After studying the galaxy in detail, Welch determined that one feature is an extremely magnified star that he called Earendel, which means "morning star" in Old English. The discovery holds promise for opening up an uncharted era of very early star formation.

"Earendel existed so long ago that it may not have had all the same raw materials as the stars around us today," Welch explained. "Studying Earendel will be a window into an era of the universe that we are unfamiliar with, but that led to everything we do know. It's like we've been reading a really interesting book, but we started with the second chapter, and now we will have a chance to see how it all got started," Welch said.

When Stars Align

The research team estimates that Earendel is at least 50 times the mass of our Sun and millions of times as bright, rivaling the most massive stars known. But even such a brilliant, very high-mass star would be impossible to see at such a great distance without the aid of natural magnification by a huge galaxy cluster, WHL0137-08, sitting between us and Earendel. The mass of the galaxy cluster warps the fabric of space, creating a powerful natural magnifying glass that distorts and greatly amplifies the light from distant objects behind it.

Thanks to the rare alignment with the magnifying galaxy cluster, the star Earendel appears directly on, or extremely close to, a ripple in the fabric of space. This ripple, which is defined in optics as a "caustic," provides maximum magnification and brightening. The effect is analogous to the rippled surface of a swimming pool creating patterns of bright light on the bottom of the pool on a sunny day. The ripples on the surface act as lenses and focus sunlight to maximum brightness on the pool's floor.

This caustic causes the star Earendel to pop out from the general glow of its home galaxy. Its brightness is magnified a thousandfold or more. At this point, astronomers are not able to determine if Earendel is a binary star, though most massive stars have at least one smaller companion star.

Confirmation with Webb

Astronomers expect that Earendel will remain highly magnified for years to come. It will be observed by NASA's James Webb Space Telescope. Webb's high sensitivity to infrared light is needed to learn more about Earendel, because its light is stretched (redshifted) to longer infrared wavelengths due to the universe's expansion.

"With Webb we expect to confirm Earendel is indeed a star, as well as measure its brightness and temperature," Coe said. These details will narrow down its type and stage in the stellar lifecycle. "We also expect to find the Sunrise Arc galaxy is lacking in heavy elements that form in subsequent generations of stars. This would suggest Earendel is a rare, massive metal-poor star," Coe said.

Earendel's composition will be of great interest for astronomers, because it formed before the universe was filled with the heavy elements produced by successive generations of massive stars. If follow-up studies find that Earendel is only made up of primordial hydrogen and helium, it would be the first evidence for the legendary Population III stars, which are hypothesized to be the very first stars born after the big bang. While the probability is small, Welch admits it is enticing all the same.

"With Webb, we may see stars even farther than Earendel, which would be incredibly exciting," Welch said. "We'll go as far back as we can. I would love to see Webb break Earendel's distance record." ☀

Springtime Catspotting: Lynx and Leo Minor

By David Prosper

Nasanightskynetwork, April 2022

Many constellations are bright, big, and fairly easy to spot. Others can be surprisingly small and faint, but with practice even these challenging star patterns become easier to discern. A couple of fun fainter constellations can be found in between the brighter stars of Ursa Major, Leo, and Gemini: **Lynx** and **Leo Minor**, two wild cats hunting among the menagerie of animal-themed northern star patterns!

Lynx, named for the species of wild cat, is seen as a faint zigzag pattern found between Ursa Major, Gemini, and Auriga. Grab a telescope and try to spot the remote starry orb of globular cluster NGC 2419. As it is so distant compared to other globular clusters - 300,000 light years from both our solar system and the center of the Milky Way - it was thought that this cluster may be the remnants of a dwarf galaxy consumed by our own. Additional studies have muddied the waters concerning its possible origins, revealing two distinct populations of stars residing in NGC 2419, which is unusual for normally-homogenous globular clusters and marks it as a fascinating object for further research.

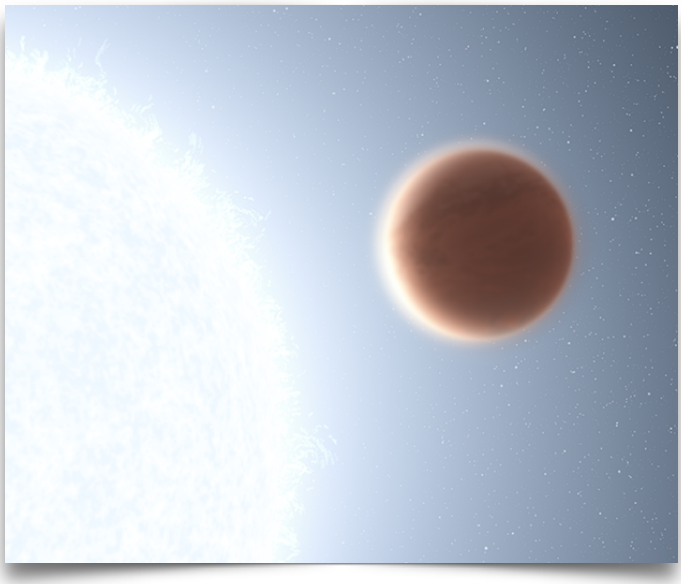
Leo Minor is a faint and diminutive set of stars. Its “triangle” is most noticeable, tucked in between Leo and Ursa Major. Leo Minor is the cub of Leo the Lion, similar to Ursa Minor being the cub to the Great Bear of Ursa Major. While home to some interesting galaxies that can be observed from large amateur scopes under dark skies, perhaps the most intriguing object found within Leo Minor’s borders is Hanny’s Voorwerp. This unusual deep-space object is thought to be a possible “light echo” of a quasar in neighboring galaxy IC 2497 that has recently “switched off.” It was found by Hanny van Arkel, a Dutch schoolteacher, via her participation in the Galaxy Zoo citizen science project. Since then a few more intriguing objects similar to Hanny’s discovery have been found, called “Voorwerpjes.”

Lynx and Leo Minor are relatively “new” constellations, as they were both created by the legendarily sharp-eyed European astronomer Johannes Hevelius in the late 1600s. A few other constellations originated by Hevelius are still in official use: Canes Venatici,

Lacerta, Scutum, Sextans, and Vulpecula. What if your eyes aren't quite as sharp as Johannes Hevelius – or if your weather and light pollution make searching for fainter stars more difficult than enjoyable? See if you can spot the next Voorwerp by participating in one of the many citizen science programs offered by NASA at science.nasa.gov/citizenscience! And of course, you can find the latest updates and observations of even more dim and distant objects at nasa.gov.

Map of the sky around Lynx and Leo Minor. Notice the prevalence of animal-themed constellations in this area, making it a sort of celestial menagerie. If you are having difficulty locating the fainter stars of Leo Minor and Lynx, don't fret; they are indeed a challenge. Hevelius even named the constellation as reference to the quality of eyesight one needs in order to discern these faint stars, since supposedly one would need eyes as sharp as a Lynx to see it! Darker skies will indeed make your search easier; light pollution, even a relatively bright Moon, will overwhelm the faint stars for both of these celestial wildcats. While you will be able to see NGC 2419 with a backyard telescope, Hanny's Voorwerp is far too faint, but its location is still marked. A few fainter constellation labels and diagrams in this region have been omitted for clarity. Image created with assistance from Stellarium ☀

HUBBLE PROBES EXTREME WEATHER ON ULTRA-HOT JUPITERS



HUBBLESITE, APRIL 6, 2022

SIZZLING WORLDS VAPORIZE MOST OF THE DUST IN THEIR ATMOSPHERES

"When you're hot, you're hot!" crooned country singer Jerry Reed in a top 1971 pop music song. Hubble astronomers might change the lyrics to: "when you're hot, you're super-hot!"

This comes from studying planets that are so precariously close to their parent star they are being roasted at seething temperatures above 3,000 degrees Fahrenheit. It's raining vaporized rock on one planet, and another planet's atmosphere is being "sunburned" by intense ultraviolet radiation from its star. This makes the upper atmosphere hotter rather than cooler.

This Hubble research provides dramatic new insights into the vast range of atmospheric conditions on other worlds, and helps astronomers build better theories for making themselves "exoplanet weather forecasters." Before thousands of planets around other stars were discovered, astronomers were limited to doing comparative planetology only to the handful of worlds in our solar system.

As oddball as the super-hot Jupiters are, this kind of research helps pave the way to better understanding the atmospheres of cooler exoplanets, especially potentially inhabitable terrestrial planets. The super-

hot Jupiters are uninhabitable, of course, and any visitors would need to wear sunscreen SPF 10,000.

In studying a unique class of ultra-hot exoplanets, NASA Hubble Space Telescope astronomers may be in the mood for dancing to the Calypso party song "Hot, Hot, Hot." That's because these bloated Jupiter-sized worlds are so precariously close to their parent star they are being roasted at seething temperatures above 3,000 degrees Fahrenheit. That's hot enough to vaporize most metals, including titanium. They have the hottest planetary atmospheres ever seen.

In two new papers, teams of Hubble astronomers are reporting on bizarre weather conditions on these sizzling worlds. It's raining vaporized rock on one planet, and another one has its upper atmosphere getting hotter rather than cooler because it is being "sunburned" by intense ultraviolet (UV) radiation from its star.

This research goes beyond simply finding weird and quirky planet atmospheres. Studying extreme weather gives astronomers better insights into the diversity, complexity, and exotic chemistry taking place in far-flung worlds across our galaxy.

"We still don't have a good understanding of weather in different planetary environments," said David Sing of the Johns Hopkins University in Baltimore, Maryland, co-author on the two studies being reported. "When you look at Earth, all our weather predictions are still finely tuned to what we can measure. But when you go to a distant exoplanet, you have limited predictive powers because you haven't built a general theory about how everything in an atmosphere goes together and responds to extreme conditions. Even though you know the basic chemistry and physics, you don't know how it's going to manifest in complex ways."

In a paper in the April 6 journal Nature, astronomers describe Hubble observations of WASP-178b, located about 1,300 light-years away. On the daytime side the atmosphere is cloudless, and is enriched in silicon monoxide gas. Because one side of the planet permanently faces its star, the torrid atmosphere whips around to the nighttime side at super-hurricane speeds exceeding 2,000 miles per hour. On the dark side, the silicon monoxide may cool enough to condense into rock that rains out of clouds, but even at dawn and dusk, the planet is hot enough to vaporize rock. "We knew we had seen something really interesting with this silicon monoxide feature," said Josh Lothringer of the Utah Valley University in Orem, Utah.

In a paper published in the Jan. 24 issue of Astrophysical Journal Letters, Guangwei Fu of the University of Maryland, College Park, reported on a super-hot Jupiter, KELT-20b, located about 400 light-years away. On this planet a blast of ultraviolet light from its parent star is creating a thermal layer in the atmosphere, much like Earth's stratosphere. "Until now we never knew how the host star affected a planet's atmosphere directly. There have been lots of theories, but now we have the first observational data," Fu said.

By comparison, on Earth, ozone in the atmosphere absorbs UV light and raises temperatures in a layer between seven to 31 miles above Earth's surface. On KELT-20b the UV radiation from the star is heating metals in the atmosphere which makes for a very strong thermal inversion layer.

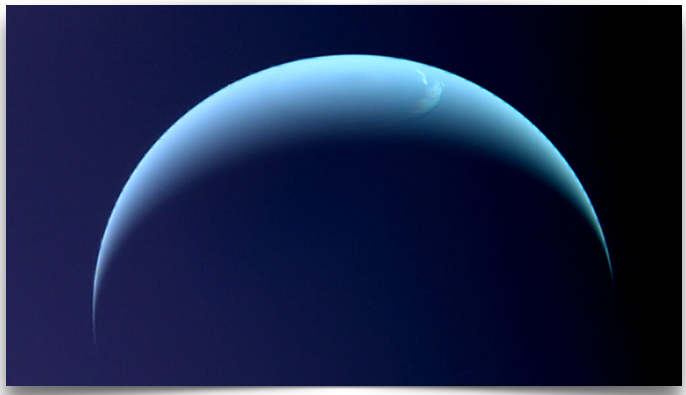
Evidence came from Hubble's detection of water in near-infrared observations, and from NASA's Spitzer Space Telescope's detection of carbon monoxide. They radiate through the hot, transparent upper atmosphere that is produced by the inversion layer. This signature is unique from what astronomers see in the atmospheres of hot-Jupiters orbiting cooler stars, like the Sun. "The emission spectrum for KELT-20b is quite different from other hot-Jupiters," said Fu. "This is compelling evidence that planets don't live in isolation but are affected by their host star."

Though super-hot Jupiters are uninhabitable, this kind of research helps pave the way to better understanding the atmospheres of potentially inhabitable terrestrial planets. "If we can't figure out what's happening on super-hot Jupiters where we have reliable solid observational data, we're not going to have a chance to figure out what's happening in weaker spectra from observing terrestrial exoplanets," said Lothringer. "This is a test of our techniques that allows us to build a general understanding of physical properties such as cloud formation and atmospheric structure."

The Hubble Space Telescope is a project of international cooperation between NASA and ESA (European Space Agency). NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Maryland, conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy in Washington, D.C. ☀

New thermal maps of Neptune reveal surprising temperature swings

Atmospheric temperatures show a global drop, then a weird spike at the south pole



Voyager 2 captured this portrait of Neptune when the NASA probe flew by the ice giant in 1989. A new analysis of Earth-based data shows intriguing and unexplained temperature swings in Neptune's atmosphere.

By Liz Kruesi
SCIENCENEWS, APRIL 11, 2022

Neptune's atmospheric temperature is on an unexpected roller-coaster ride, and it could take decades for scientists to piece together what's happening at the distant planet.

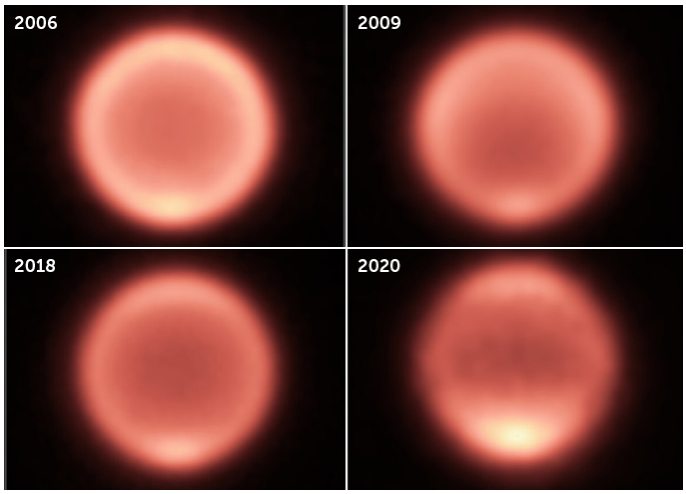
The ice giant's global temperature dropped about 8 degrees Celsius between 2003 and 2012 at the start of Neptune's summer, researchers report April 11 in *Planetary Sciences Journal*. Then from 2018 to 2020, thermal images show that the planet's south pole brightened dramatically, indicating a spike of 11 degrees C (*SN: 10/2/07*).

Naomi Rowe-Gurney, a planetary scientist at NASA Goddard Space Flight Center in Greenbelt, Md., and colleagues looked at 17 years of mid-infrared data from ground-based telescopes and the no-longer-functioning Spitzer Space Telescope (*SN: 7/18/18*; *SN: 1/28/20*). The researchers used infrared light to pierce Neptune's top cloud layer and peer at its stratosphere, where the planet's atmospheric chemistry comes into view.

Each Neptune year lasts 165 Earth years, so the time period analyzed — from 2003 to 2020 — is essentially equivalent to five weeks on Earth. The wildest temperature shift occurred from 2018 to 2020, when the atmospheric temperature at Neptune's south pole rose from –121° C to –110° C.

Temperature swings

These mid-infrared images from the Very Large Telescope in Cerro Paranal, Chile, and the Subaru Telescope atop Mauna Kea in Hawaii, show thermal snapshots of Neptune from 2006 to 2020. The map dims after 2006 (top left), showing a global cooling. But between 2018 and 2020, Neptune's south pole lit up, indicating it warmed by 11 degrees Celsius by 2020 (bottom right).



"We weren't expecting any seasonal changes to happen in this short time period, because we're not even seeing a full season," says Rowe-Gurney. "It's all very strange and interesting."

The researchers don't yet know what's causing the temperature changes. The sun's ultraviolet rays break up methane molecules in the stratosphere, so that chemistry or even the sun's activity cycle could be a trigger. Nailing down specifics requires more observations. "We need to keep observing over the next 20 years to see a full season and see if something else changes," says Rowe-Gurney. ☀

Why Venus rotates, slowly, despite sun's powerful grip

Planet's atmosphere explains the gravity of the situation

By Jules Bernstein

Sciencedaily, April 20, 2022

If not for the soupy, fast-moving atmosphere on Venus, Earth's sister planet would likely not rotate. Instead, Venus would be locked in place, always facing the sun the way the same side of the moon always faces Earth.

The gravity of a large object in space can keep a smaller object from spinning, a phenomenon called tidal locking. Because it prevents this locking, a UC Riverside scientist argues the atmosphere needs to be a more prominent factor in studies of Venus as well as other planets.

These arguments, as well as descriptions of Venus as a partially tidally locked planet, were published today in a *Nature Astronomy* article.

"We think of the atmosphere as a thin, almost separate layer on top of a planet that has minimal interaction with the solid planet," said Stephen Kane, UCR astrophysicist and lead paper author. "Venus' powerful atmosphere teaches us that it's a much more integrated part of the planet that affects absolutely everything, even how fast the planet rotates."

Venus takes 243 Earth days to rotate one time, but its atmosphere circulates the planet every four days. Extremely fast winds cause the atmosphere to drag along the surface of the planet as it circulates, slowing its rotation while also loosening the grip of the sun's gravity.

Slow rotation in turn has dramatic consequences for the sweltering Venusian climate, with average temperatures of up to 900 degrees Fahrenheit -- hot enough to melt lead.

"It's incredibly alien, a wildly different experience than being on Earth," Kane said. "Standing on the surface of Venus would be like standing at the bottom of a very hot ocean. You couldn't breathe on it."

One reason for the heat is that nearly all of the sun's energy absorbed by the planet is soaked up by Venus' atmosphere, never reaching the surface. This means that a rover with solar panels like the one NASA sent to Mars wouldn't work.

The Venusian atmosphere also blocks the sun's energy from leaving the planet, preventing cooling or liquid water on its surface, a state known as a runaway greenhouse effect.

It is unclear whether being partially tidally locked contributes to this runaway greenhouse state, a condition which ultimately renders a planet uninhabitable by life as we know it.

Not only is it important to gain clarity on this question to understand Venus, it is important for studying the exoplanets likely to be targeted for future NASA missions.

Most of the planets likely to be observed with the recently launched James Webb Space Telescope are very close to their stars, even closer than Venus is to the sun. Therefore, they're also likely to be tidally locked.

Since humans may never be able to visit exoplanets in person, making sure computer models account for the effects of tidal locking is critical. "Venus is our opportunity to get these models correct, so we can properly understand the surface environments of planets around other stars," Kane said.

"We aren't doing a good job of considering this right now. We're mostly using Earth-type models to interpret the properties of exoplanets. Venus is waving both arms around saying, 'look over here!'"

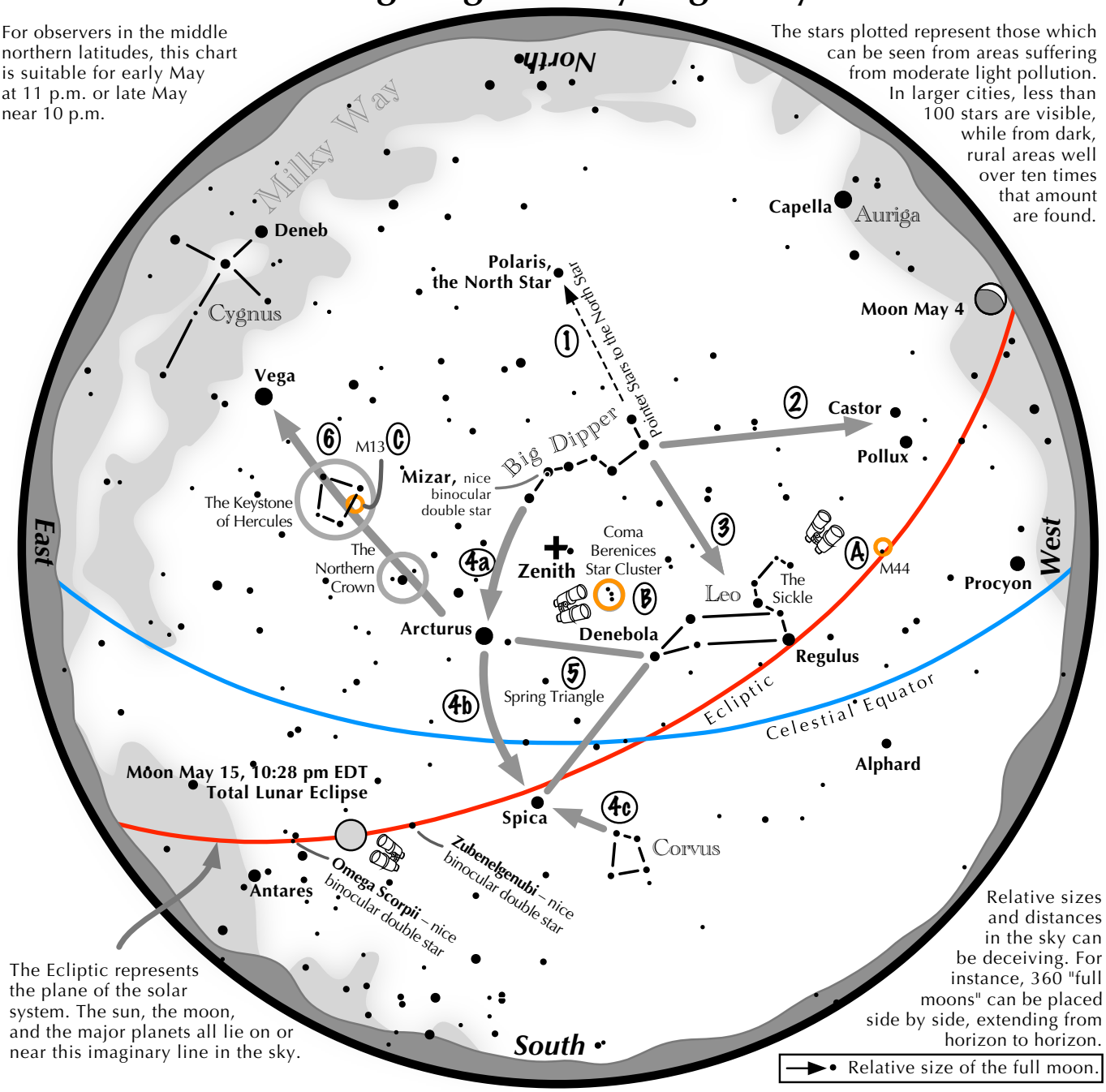
Gaining clarity about the factors that contributed to a runaway greenhouse state on Venus, Earth's closest planetary neighbor, can also help improve models of what could one day happen to Earth's climate.

"Ultimately, my motivation in studying Venus is to better understand the Earth," Kane said. ☀

Navigating the May Night Sky

For observers in the middle northern latitudes, this chart is suitable for early May at 11 p.m. or late May near 10 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

Relative size of the full moon.

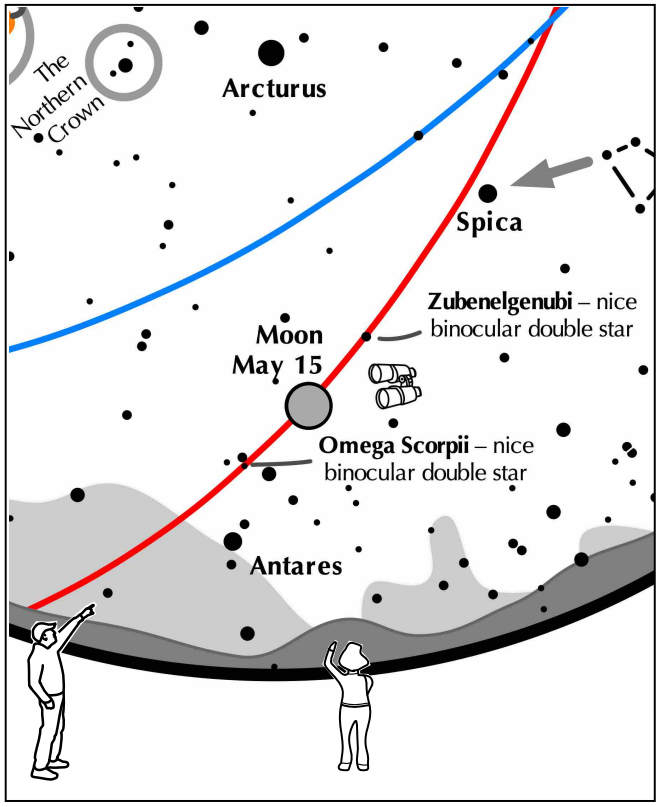
Navigating the May night sky: Simply start with what you know or with what you can easily find.

1. Extend a line northward from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.
2. Through the two diagonal stars of the Dipper's bowl, draw a line pointing to the twin stars of Castor and Pollux in Gemini.
3. Directly below the Dipper's bowl reclines the constellation Leo with its primary star, Regulus.
4. Follow the arc of the Dipper's handle. It first intersects Arcturus, then continues to Spica. Confirm Spica by noting that two moderately bright stars just to its southwest form a straight line with it.
5. Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.
6. Draw a line from Arcturus to Vega. One-third of the way sits "The Northern Crown." Two-thirds of the way hides the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.

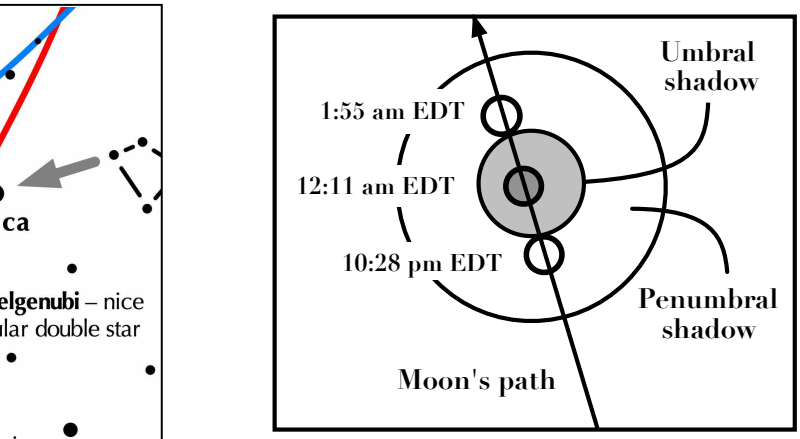
Binocular Highlights

A: M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux. **B:** Look near the zenith for the loose star cluster of Coma Berenices. **C:** M13, a round glow from a cluster of over 500,000 stars.

If you can observe only one celestial event in the evening this May, see this one.



View to the southeast on May 15 at 11 pm EDT, 8 pm PDT (near sunset)



The Moon slides through a total eclipse

In the evening hours of May 15, the brilliant full moon slides into Earth's shadow.

- Even though the partial umbral eclipse begins at 10:28 EDT, darkening may not be noticed for another 5 minutes.
- When totality is reached, the full moon's brilliance is gone, allowing the stars to appear. Can you spot the wide double star Zubenelgenubi to the moon's upper right? How about red Antares rising in the southeast?
- At mid eclipse, what color is the moon? How red is it?
- During the partial phases, can you notice that the shadow's edge is not straight, but curved?

About Astronomy Associates

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the last Sunday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. These meetings and the public observing sessions that follow are scheduled at the Baker Wetlands Discovery Center, south of Lawrence. All events and meetings are free and open to the public. Periodic star parties are scheduled as well.

Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Sundays when events are scheduled.

Copies of the Celestial Mechanic can also be found on the web at newsletter.
Annual Dues for the club are: $12 for regular members; $6 for students Membership forms can be accessed at the club website form.