Tri-Valley Stargazers

March 2023

PrimeFocus

WHEN:

March 17, 2023
Doors open at 7:00pm
Meeting at 7:30pm
Lecture at 8:00pm

WHERE:

Unitarian Church
1893 North Vasco Rd.
Livermore, CA 94551

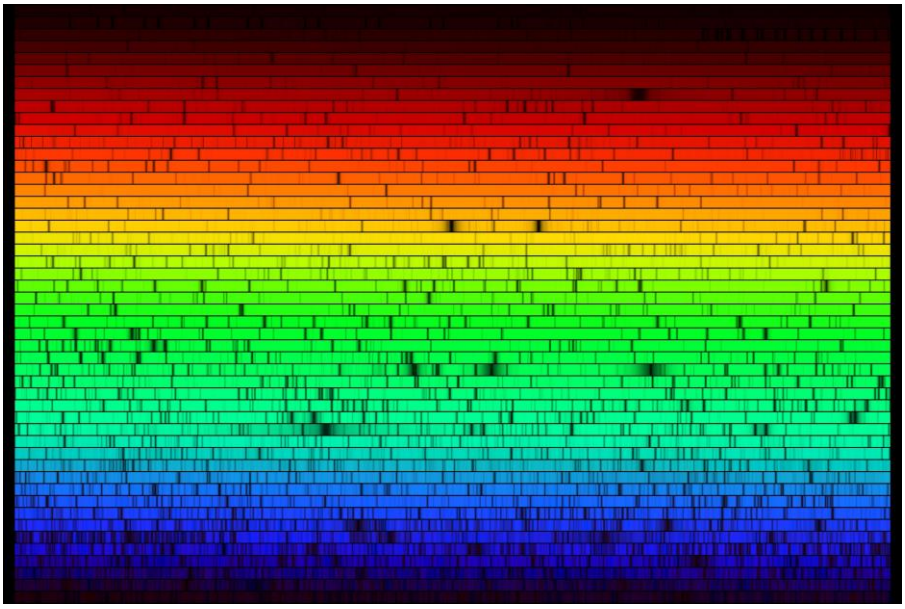
and via Zoom

TVS QR Code

INSIDE THIS ISSUE:

Unlocking the Sun: Spectroscopy in the 1800's
Prof. Lauren Woolsey, Grand Rapids Community College

Have you ever wondered how we figured out what the Sun is made of? The story of how we determined the chemical makeup of our own star combines chemistry, physics, and astronomy in a tale of mystery, far-flung expeditions, and unexpected discoveries. After a brief overview of what spectroscopy is and a discussion of some of the key pieces of physics that laid the foundations for these revelations, Dr. Lauren Woolsey will take us through the secrets of the Sun during this turning point in science history.



Caption: A high-resolution version of the spectrum of our Sun. This image was created from a digital atlas observed with the Fourier Transform Spectrometer at the McMath-Pierce Solar Facility at the National Solar Observatory on Kitt Peak, near Tucson, Arizona. The images shown here were created to mimic an echelle spectrum, with wavelength increasing from left to right along each strip, and from bottom to top. Each of the 50 slices covers 60 angstroms, for a complete spectrum across the visual range from 4000 to 7000 angstroms. Source: N.A.Sharp, NOAO/NSO/Kitt Peak FTS/AURA/NSF. See: NASA Solar Spectrum

Dr. Woolsey went to the University of Maryland College Park for her undergraduate studies. On her way to getting bachelor's degrees in both astronomy and physics, Lauren served as a teaching assistant for two semesters, worked as an intern at Goddard Space Flight Center, and wrote an honors thesis on tilting Uranus using nonlinear resonances. After a summer research experience for undergraduates (REU) in solar physics, she decided to attend graduate school to study our star, the Sun.

Lauren's research at Harvard University focused on the magnetic fields of the solar corona and how they affect the outflows from the Sun called the solar wind. While working on her Ph.D. dissertation, she was a teaching fellow for three semesters, focusing on teaching astronomy to non-science majors. She earned an A.M. (2013) and a Ph.D. (2016) in Astronomy and Astrophysics from Harvard and has been working at Grand Rapids Community College since the Fall 2016. She earned tenure in Winter 2020 and teaches primarily general education astronomy courses and algebra-based physics courses, focusing on teaching students critical thinking and problem-solving skills.

News and Notes

2023 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Mar. 17	Mar. 20	
Apr. 21	Apr. 24	Apr. 7
May 19	May 22	May 5
Jun. 16	Jun. 19	Jun. 2
Jul. 21	Jul. 24	Jul. 7
Aug. 18	Aug. 21	Aug. 4
Sep. 15	Sep. 18	Sep. 1
Oct. 20	Oct. 23	Oct. 6
Nov. 17	Nov. 20	Nov. 3
Dec. 15	Dec. 18	Dec. 1

Money Matters

As of the last Treasurer's Report on 02/20/23, our club's account balance is $71,736.73. This includes $43,137.47 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Michael Brotsis, Saril Kaiprath, Munish Kapoor, and Sahil Metha. Please say hello and chat with them during our meetings.

In Memoriam - Hilary Jones, longtime TVS member, technical contributor, and most recent Webmaster

Hilary David Jones, age 82, of Danville, CA passed away at home on February 5, 2023 after fighting pancreatic cancer. He was born on April 22, 1940 in Middletown, New York to Hugh Everett Jones and Dorothy Beatrice Phelps. He is survived by his wife of 58 years, Susan R. (Hildebrand) Jones, his daughter Wendy L. (Jones) Rafn, his son Christopher R. Jones, and his granddaughter, Rosetta R. Jones.

Hilary studied physics and received a B.A. from Occidental College in 1962 and a Ph.D. from Cornell University in 1968. He worked for Sandia National Laboratory – Livermore from 1969 until his retirement in 2002. His personal time was spent enjoying computer science, astronomy, music, photography, hiking, and nature.

Hilary created software for fun as well as for his profession. In 1976, he built his first home computer, a KIM-1, on which Hilary coded all software programs himself. He programmed a text adventure, "The Christmas Game", for his kids who had to buy the right presents, decorate the hall, and feed Santa cookies, which was treasured. In 1977, he wrote an article for the November issue of Byte Magazine describing a computer he designed and built from scratch. It had only 4 instructions and 64 bytes of memory, but was fully functional. In 1986, he wrote the first version of a MacIntosh program called MacAtoms. It was used at Sandia and other places for several years. During his last years at Sandia, he worked on the Hierarchical High Performance Storage System (HPSS) project.

In May 1995, Hilary received an award from Sandia for Exceptional Performance for his work on the project and in 1997 the team won a R&D 100 award for their work.

Hilary combined his love of astronomy and computers doing astrophotography. In 2005, he was the grand prize winner of the Meade Messier Challenge and was featured in Sky and Telescope magazine. He was a member of the Tri-Valley Stargazers of Livermore, CA and he also enjoyed astronomy at a home observatory, which he built himself.

Hilary practiced piano at home, which was enjoyed by his family. He also sang bass with the Valley Concert Chorale for many years. He particularly enjoyed participating in the group's community project, Music in the Schools.

Hilary loved to make plays on words and amused his family with his sense of humor. Family camping trips, long road trips, and his work building a cabin near Donner Pass enriched our lives. He was much loved and will live on in our memories. A private celebration of his life will be held by the family.

--Susan Jones

2023 Club Star Party Schedule

Save the dates for the 2023 Club Star Parties.

Del Valle star parties are also public outreach events. They are jointly hosted with the EBRPD and held at the Arroyo Staging Area. The public is invited for the first 1.5-2 hours, while club members can stay the remainder of the night.

Tesla Vintners star parties are open to only club members and their guests. These star parties end at midnight, but participants can leave earlier, should they wish.

H2O Open House star parties are open to the public. The open house ends at midnight, and all participants are encouraged to stay the duration. The drive to H2O takes about 1 hour, and the caravan leaves promptly from the corner of Mines and Tesla Rds. No gas stations are available on the route, so be prepared. Admission is $3/car-bring exact change. H2O is a primitive site with two porta-potties. Bring water, food, and warm clothing, as needed. Red flashlights are to be used so observers can preserve their night vision.

March 22: Outreach party at the Muslim Community Center, 5724 W. Las Positas Blvd., Pleasanton. Set up at 6:00pm, Observing 7:15-9:30pm

March 23: Marylin Ave Elementary School, 800 Marylin Ave., Livermore. Set up at 6:00pm, Observing 7:15-8:00pm

March 27: Live Oak Elementary School, 5151 Sherwood Way, San Ramon. Set up at 7:00pm, Observing 7:45-9:00pm

March 28: Vintage Hill Elementary School, 1125 Concord St., Pleasanton. Set up at 6:00pm, Observing 7:15-8:30pm

continued on p.3

News and Notes (con't)

April 15: Tri-Valley Innovations Fair, Alameda County Fairgrounds, Pleasanton. Solar Observing set up at 9:00am, Observing 10:00am-5:00pm

Calendar of Events

March 18, 24, 25, 31, April 1, 7, 8, 14, 15
7:30pm-10:30pm

What: Free Telescope Viewing
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Free

Join Chabot astronomers on the Observatory Deck for a free telescope viewing! Weather permitting, this is a chance to explore stars, planets and more through Chabot's historic telescopes. Chabot's three large historic telescopes offer a unique way to experience the awe and wonder of the Universe. Three observatory domes house the Center's 8-inch (Leah, 1883) and 20-inch (Rachel, 1916) refracting telescopes, along with a 36-inch reflecting telescope (Nellie, 2003).

Are the skies clear for viewing tonight? Viewing can be impacted by rain, clouds, humidity and other weather conditions. Conditions can be unique to Chabot because of its unique location in Joaquin Miller Park. Before your visit, check out the Weather Station to see the current conditions at Chabot.

For more information, see: https://chabotspace.org/events/events-listing/

March 22, Noon-1:00pm

What: The Origin of Water on Earth: Alien Meteors, Icy Comets, or Solar Wind?
Who: Ashley King (Natural History Museum, London), Luke Daly (University of Glasgow)
Sponsor: SETI Institute
Online: REGISTRATION REQUIRED: Water on Earth

Water is necessary for life on Earth, but its origin is still unknown. There are multiple hypotheses about its origin. The most common theory is Earth's water is alien, crashing down in meteors long ago when Earth was very young. Over the eons, icy asteroids and comets delivered oceans to Earth, depositing the water directly to its surface. Another scenario suggests that most of Earth's water was already inside the planet and rose to the surface over time. Water's origin may be more complex, brought to us by the solar wind, for instance. For more information, see: www.seti.org/talks

March 30, 5:00pm-6:00pm

What: Earth-Based Analogs In Support of Space Missions
Who: Dr. Mark Shepanek (NASA)
Sponsor: Smithsonian Air & Space Museum
Online: REGISTRATION REQUIRED: Earth-Based Analogs

Space exploration has provided tremendous benefits for humanity in the fields of science, technology, and engineering. With limited access to the exciting and challenging environment of space, ground-based analogs provide opportunities to address many of the key challenges of space

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TVS E-Group
To join the TVS e-group just send an email message to TVS at: info@trivalleystargazers.org asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

Calendar of Events (con't)

missions while providing substantial immediate benefits on Earth today. Join Marc Shepanek from NASA's Office of the Chief Health and Medical Officer to hear about testing sites on Earth — like the Australian National Antarctic Research Expeditions — that support work done on the International Space Station and beyond.

For more information, see: Earth-Based Analogs

April 3, 7:30pm

What: The Caves of Mars: Preparing for a Mission to a Lava Tube
Who: Dr. Jennifer Blank (Blue Marble Space Institute of Science)
Where: Golden Gate Park, 55 Music Concourse Drive, San Francisco
Cost: Members and Seniors $12, Guests $15

Biologic and Resource Analog Investigations in Low Light Environments (BRAILLE) is a multi-year, NASA-funded Mars analog project centered around fieldwork in volcanic caves at Lava Beds National Monument in Northern California. We are motivated to search for evidence of life on Mars beneath its surface—and one way to gain access there is through a volcanic cave!

We have identified many such "lava tubes" in images from Mars orbiters, and by visiting similar environments on Earth with the right technology, we hope to quantify the microbial life living there (and find out what it eats), to characterize mineral features that could be signatures of life, and to gain experience using robots to detect life and to map below-ground regions.

These efforts will help NASA prepare for a future life-detection mission to a Martian lava tube! Our project has evolved to include new autonomous and AI technologies that show much promise for developing future missions to Mars—or the Moon! This presentation will provide an overview of BRAILLE, showcasing its most significant accomplishments and taking audiences inside these remarkable caves.

For more information, see: Benjamin Dean Astronomy Lecture

April 7, 6:00pm-10:00pm

What: First Friday: Climate Series: Drying Out: Understanding California's Drought
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: $15 Adults, $10 kids/seniors, $5 members

One of the most obvious effects of climate change in California is our prolific drought. Why is California so prone to these dry spells? What are the long-term effects on our ecosystem? How are different communities in the Bay Area affected? Learn from experts how droughts begin, how they affect the plants and animals of our state and what we can do to help slow down drought conditions. Join Ann-Marie Benz from the California Native Plant Society, for a talk about creating a drought-resistant garden by planting California native plants and be sure to stop by their table for hands-on activities demonstrating how drought resistant plants have adapted to survive harsh conditions. See how science and innovation are helping us to understand and combat our drought locally and around the world.

For more information, see:
https://chabotspace.org/events/events-listing/

April 11, 5:00pm-6:00pm

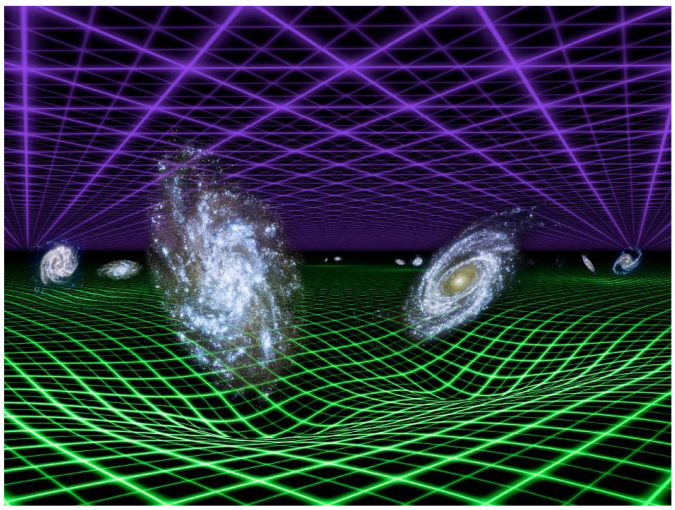
What: Life Support: What the International Space Station Teaches Us About Our Changing Earth
Who: Dr. Julie Robinson (NASA)
Sponsor: Smithsonian Air & Space Museum
Online: REGISTRATION REQUIRED: ISS Changing Earth

When humans explore space, we have to reproduce all the same systems that Earth provides to sustain life—water, air, surface, and biota — in order to survive in the unforgiving environment of space. In several decades of continuous presence on the International Space Station, we have learned surprising things about the engineering of systems that support human life. At the same time, we have collected extraordinary data about the Earth system passing below us. Spaceflight gives us the opportunity to understand climate change and mitigate its effects to improve the resilience of communities on our home planet. Join Julie Robinson, NASA's deputy director for earth science, as we explore what living in space teaches us about life on Earth.

For more information, see: ISS Changing Earth

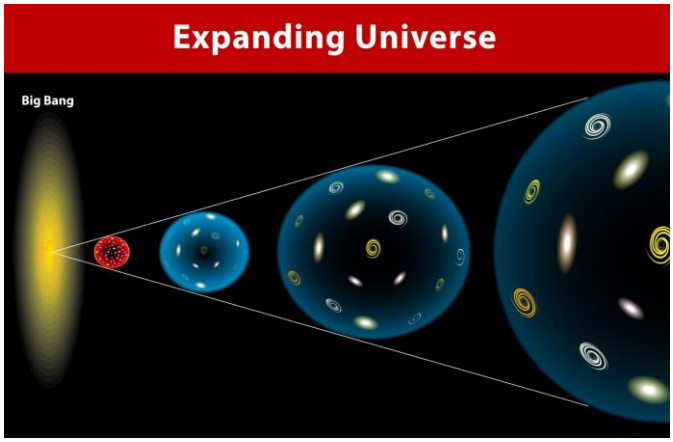
Black Holes: The Source of Dark Energy?

The reclusive nature of dark energy has been a fundamental question in modern astrophysics. It is the majority of the universe, making up 68% of everything as compared to a measly 5% for visible matter. Since the first evidence of dark energy, astrophysicists have always thought that dark energy was a separate entity present in the universe that just didn't fit into our model. Now, new research led by Dr. Duncan Farrah at the University of Hawai'i, Manoa, and published in the Astrophysical Journal Letters suggests that nothing in our universe model has to change to accommodate dark energy. Instead, something predicted in Einstein's Theory of General Relativity could solve dark energy: black holes.



A depiction of Einstein's theory of General Relativity, which stated that mass and energy bend the "fabric" of spacetime. (NASA/JPL-Caltech)

Wait…Where Was Einstein Going With General Relativity? General Relativity was certainly one of Einstein's most celebrated theories, and it had a set of equations to describe it. Enter the Field Equations! Published in 1915, this was one of the most important, if not the most, set of equations to describe spacetime. For space purposes, I won't describe all the strenuous details about them, but you definitely need to know this: they were intended to describe the geometry of spacetime when warped by mass and energy while establishing spacetime as a unified dimension. Einstein thought that the universe was "static" and not changing radically, so in his field equations, he added a so-called "cosmological constant," an expansive force, to combat the attractive force of gravity. However, something was fundamentally off about this equation. Any imbalances in mass distribution (further causing a gravitational imbalance) would cause the cosmological force to expand or contract the universe. This idea suggested that the universe wasn't stable and that it would need to be observed in order to determine whether it was stable or not. So…observing the stability of the universe was definitely beyond Einstein's time; So who did it?



The Expanding Universe You might've already guessed the answer to the previous question based on the name of this section, but I'll tell you anyway: Edwin Hubble. Indeed, it was Edwin Hubble who proved that the universe was in fact, unstable and that galaxies were actually moving *away* from us, and he could tell this by observing the light from distant galaxies. This light was slightly reddened and since redshift occurred when things were moving away from a source, Hubble concluded that the universe was expanding, but at a *constant* rate. It wasn't until 1998 that Dr. Adam Reiss (then at the University of California, Berkeley) and his colleagues published a paper in the Astronomical Journal, which detailed the nature of the expanding universe as an accelerating one, and the reason behind it: dark energy.

Dark Energy and Black Holes So we know that dark energy causes the expansion of the universe, but what causes dark matter? Farrah's team at the University of Hawai'i came up with a mind-boggling theory: If we can measure the rate of the growth of a black hole's mass and find it proportional or even equivalent to the rate of the expansion of the universe, we can find out the total energy that a black hole contributes to the universe. And that's exactly what the team did. What's more interesting is that they concluded that the total energy black holes contribute is about 68%. You might find this statistic familiar because it's actually the total amount of dark energy in the universe. That's pretty convenient! What's more, is that the team postulates that dark energy is created when a black hole breaks matter down, BUT, I'll save that for a future article. With all of this new and upcoming information about dark energy, it's best to take some time to process it! What's certain is that this isn't a for-sure conclusion about dark energy. In order to conclude properly, we would need to have physical evidence that this is the case and that black holes are the reason for the expansion of the universe, and that's up to a telescope collaboration like EHT (Event Horizon Telescope)!

TVS Astrophotography: The Orion Nebula by Aris Pope

Caption: Aris Pope obtained this magnificent image of the Orion and Running Man Nebulae, which was a recent Image of the Day on Astromart. Aris used a GSO 6-inch f/4 telescope, a Starizona Nexus 0.75x reducer/corrector, and a ZWO ASI294MC Pro camera with an Optolong L-eXtreme 2-inch filter. The integration time was 2h 40m (32 x 300sec). For more information, see: https://www.astrobin.com/8k45mq/B/

What's Up By Ken Sperber (adapted from S&T)

All times are Pacific Standard Time until March 12 at 2am, Pacific Daylight Time thereafter

March

14	**Tue**	**Last-Quarter Moon (7:08pm)**
21	**Tue**	**New Moon (10:23am)**
22	Wed	The 1-day old Moon is ~1.5° to the upper left of Jupiter. Venus blazes above (Dusk)
23	Thu	The Moon is ~5° below Venus in the west (Dusk)
24	Fri	The Moon is ~6° above Venus in the west (Dusk)
25	Sat	The Moon ~1.5° left of the Pleiades, high in the west (Dusk)
27	Mon	Mercury and Jupiter are near the western horizon, separated by ~1.5°. Above them are Venus, the Moon, and Mars (Dusk)
28	**Tue**	**First-Quarter Moon (7:32pm)**
28	Tue	Algol at minimum brightness for two hours centered on 9:22pm
29	Wed	The Moon is ~3.5° below Pollux (Dusk)

April

2	Sun	The Moon and Regulus, separated by ~4°, sink toward the western horizon (Morning)
5	**Wed**	**Full Moon (9:35pm)**
6	Thu	The Moon rises in the ESE, trailing Spica by ~5° (Evening)
9-	Sun-	The Moon rises in the SE, ~0.5° from Antares (All Night)
10-11	Mon-	Above the WNW horizon, Venus is ~2.5° left of the Pleiades (Evening)
13	**Thu**	**Last-Quarter Moon (2:11am)**
14	Fri	High in the west, Mars is ~0.25° left of Epsilon Geminorum (Evening)
16	Sun	In the ESE, the crescent Moon is ~5° below Saturn (Dawn)
19	**Wed**	**New Moon (9:13pm)**
22	Sat	In the WNW, Venus (The Pleiades) is ~6° (~7°) to the upper left (lower right) of the crescent Moon (Dusk)
22-	Sat-	The Lyrid Meteor shower peaks (All Night; see p.50 of the April 2023 S&T)
23	Sun	The Moon is ~5° to the upper left of Venus (Dusk)
25	Tue	High in the west, the Moon ~3° right of Mars (Evening)
27	**Thu**	**First-Quarter Moon (2:20pm)**
27	Thu	High in the SW, the Moon is ~4° above the M44, the Beehive Cluster (Evening)
29	Sat	High in the South, the Moon is ~5° to the upper left of Regulus (Evening)

NASA Night Sky Notes

Spot the Morning and Evening Star: Observe Venus

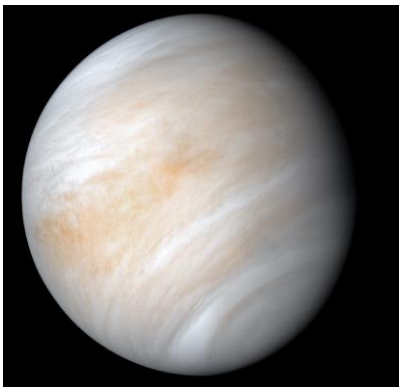
By David Prosper

Venus is usually the brightest planet in our skies, and is called "Earth's Twin" due to its similar size to Earth and its rocky composition. However, Venus is a nightmare version of our planet, featuring a thick, crushing atmosphere of acidic clouds, greenhouse gasses, howling winds, and intense surface heat.

This rocky inner world's orbit brings it closer to Earth than any of the other planets, and is the second closest to the Sun after Mercury. Like Mercury, Venus orbits between our planet and the Sun, so Earth-based observers can observe Venus in the morning before sunrise, or in the evening after sunset – but never high in the sky in the middle of the evening, unlike the outer planets. Since Venus is so striking in its twilight appearances, the planet features heavily in sky mythologies worldwide. Venus's bright morning and evening appearances are the origin for its dual nicknames: the Morning Star, and the Evening Star. Some ancient astronomers never made the connection, and assumed the Evening Star and Morning Star were two unrelated objects! Observers can even spot Venus during the daytime, if the sky is very clear and the planet is bright enough. Venus also has phases, similar to the Moon and Mercury. Galileo's observations of Venus's phases helped turn the astronomy world upside down in the early 1600s, and you can see them yourself using a telescope or even a surprisingly low-power pair of binoculars. **Warning**: Please be very careful when observing Venus with a telescope in the early morning or daytime. *Never allow the Sun to enter your instrument's field of view, as you could be permanently blinded!*

Caption: Venus and Jupiter continue to move closer together in the sky this month. Jupiter continues its descent towards the horizon while Venus continues to climb and will be visible in the evenings though mid-summer of 2023. It's a great year for Venus fans! Image created with assistance from Stellarium.

Venus's other moniker of "Earth's Twin" is a bit misleading. In terms of their surface temperatures and atmospheres, Venus and Earth are extremely different! The surface of Venus is warmer than that of Mercury, despite Mercury being many millions of miles closer to the Sun. While Mercury is still a scorching 800 degrees Fahrenheit (427 degrees Celsius), Venus is even hotter: 900 degrees Fahrenheit (482 degrees Celsius). The vast amount of carbon dioxide in the thick Venusian atmosphere acts as an insulating blanket that retains much of the Sun's heat, creating the runaway greenhouse effect that dominates its present-day climate. The Venusian surface is a crushing 90 Earth atmospheres on top of its absurd temperatures. These extreme conditions mean that the mission life of any past Venusian robotic landers were measured in **hours** at best – and usually minutes! However, conditions in Venus's upper atmosphere may be much more hospitable, with temperatures and pressures at 30 miles (50 km) above the surface that are much more Earth-like in temperature and pressure. Studies of the Venusian atmosphere, including seasonal appearances of dark streaks and faint signals of suggestive chemistry, intrigue researchers with the possibility that some sort of life may persist in its clouds. But far more evidence is needed to confirm such a claim, since non-biological factors like volcanism and other processes could also be the source for these signals.



Caption: The top layers of Venus's cloud pop in this contrast-enhanced image, reprocessed with modern techniques from Mariner 10 data. *Credit: NASA/JPL-Caltech Source: https://solarsystem.nasa.gov/resources/2524/newly-processed-views-of-venus-from-mariner-10/*

Venus's thick sulfuric acid clouds block direct visual observations of its surface from optical telescopes on Earth. Multiwavelength observations from space probes show evidence of active volcanoes and possibly some sort of plate tectonics, but follow-up missions will be needed to confirm the presence of active volcanism, plate tectonics, and any possible signs of life. In order to do so, NASA is sending two new missions to Venus by the end of this decade: the orbiter **VERITAS**, which will map the surface in high detail and study the chemistry of its rocks and volcanoes, and **DAVINCI+**, which will study its atmosphere and possible tectonic surface features via a "descent sphere" that will plunge into Venus's clouds. Follow their development and discover more about Venus at solarsystem.nasa.gov/venus, and of course, continue your exploration of the universe at nasa.gov.

This article is distributed by NASA's Night Sky Network (NSN). The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

Tri-Valley Stargazers
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www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member ($10). Must be a full-time high-school or college student.

_____ Regular member ($30).

Hidden Hill Observatory Access (optional): Must be 18 or older.

_____ One-time key deposit ($20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee ($10). You must also be a key holder to access the site.

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: $ _____

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone except as detailed in our Privacy Policy (http://www.trivalleystargazers.org/privacy.shtml).

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.