

PrimeFocus



WHEN:

February 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:

News and Notes	2
Calendar of Events	2
TVS Donation to San Ramon HS Astro Club	4
TVS Astrophotos	5
What's Up	6
NASA Night Sky Notes	7
Membership/Renewal Application	8

Comets: What Are They, Why Do We Care, and How Do We Visit Them?

Dr. Mark Moretto, University of Colorado at Boulder

Comets are well-preserved leftovers from the formation of the solar system and they represent windows into the physical conditions and chemical composition of the regions where they formed. To investigate the inner most regions of the coma, an unbound atmosphere of gas and dust, and the comet's nucleus usually requires dedicated space missions. Comets are notoriously unpredictable and thus spacecraft missions to visit them are faced with numerous hazards and uncertainties. This talk will cover a brief introduction to comets and their scientific and cultural importance, then discuss several recent comet missions. Finally, I will discuss my thesis work on the dynamics and navigation of spacecraft orbiting active comets.



Caption: TVS member Kai Yung imaged Comet C/2002 E3 (ZTF) from Livermore at about 1am on January 31, 2023. He used a Canon 500mm f/4 lens and a ZWO ASI1600mm Pro at -10°C on a ZWO AM5 mount. He used ZWO LRGB filters (L: 30sec x 150, RGB: 30sec x 75). See p.5 of this newsletter for more comet images by club members.

Mark Moretto has been studying comets in high school, when he began working with Mike A'Hearn and Lori Feaga at the University of Maryland. During this program he studied outbursts of Comet Tempel 1 that were observed by the Deep Impact spacecraft. Mark continued this work through his undergrad at the University of Maryland. Mark earned his Ph.D. in Aerospace Engineering Sciences in July 2022 from the University of Colorado Boulder. During his Ph.D., Mark studied the dynamics of spacecraft and natural grains orbiting active comets with the goal of enabling bolder missions to comets and better understanding their behavior. Mark has also earned a B.S. in Aerospace Engineering, and a B.S. in Astronomy from the University of Maryland in 2017 and a M.S. in Aerospace Engineering Sciences from CU Boulder in 2019. Currently, he is a postdoc at CU Boulder. Mark has earned awards for his work, including the 2013 National Young Astronomer Award, one of Aviation Week's 20 Twenties in 2019, and one of Astronomy Magazine's 25 Rising Stars in Astronomy in 2022.

News and Notes

2023 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Feb. 17	Feb. 20	
Mar. 17	Mar. 20	Mar. 3
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 01/23/23, our club's account balance is \$73,574.63. This includes \$43,134.94 in the H2O Rebuild fund.

Time to Renew Club Membership for 2023

Now is a great time to become part of TVS. Membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member.

Those renewing their club membership are encouraged to do so by using the online application before the end of December. Normally our memberships are only good for the calendar year, but anyone joining after October 1st will be given a membership for the remainder of 2022 and all of 2023.

The regular club membership remains a bargain at \$30. Student membership (full-time High School or College student) is only \$10! To become a key holder to H2O, you must be 18 or older. There is a one-time \$20 Key deposit and a \$10 annual access fee.

You can join TVS or renew your membership online at: <http://www.trivalleystargazers.org/membership.shtml> After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the 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.

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.

February 23: Arroyo Seco Elementary School, 5280 Irene Way, Livermore. Family Science Night. Set up at 5:00pm, Observing 6:00-8:00pm

February 28: Vintage Hills Elementary School, 1125 concord St., Pleasanton. Set up at 4:30pm, Observing 5:30-7:30pm

Calendar of Events

February 15, 7:00pm-8:00pm

What: Satellite Constellations: An Existential Threat for Astronomy?

Who: Emma Loudon (Yale University), Federico Di Vruno (SKA Spectrum Manager), and Matthew Goodman (Enclosure)

Sponsor: SETI Institute

Online: REGISTRATION REQUIRED

<https://www.eventbrite.com/e/seti-talks-satellite-constellations-an-existential-threat-for-astronomy-tickets-531219671337>

A growing number of swarms of satellites are outshining the stars, and scientists fear no one will do anything to stop it. Activities in near-Earth space are becoming increasingly privatized, with the number of satellites in low-Earth orbit predicted to grow dramatically from about 2,000 to over 100,000 in the next decade due to the launch of planned satellite constellations.

As low-Earth orbit fills with [constellations of telecommunications satellites](#), Astronomers are trying to figure out how to do their jobs. The satellites' glinting solar

continued on p.3

Calendar of Events (con't)

panels and radio bleeps all but obscure many cosmic objects, bringing more radio interferences to cutting-edge antenna arrays dedicated to understanding our universe.

For more information, see: <https://www.seti.org/talks>

February 18, 23, 24, March 3, 4, 10, 11
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/>

February 23, 6:00pm

What: Exoplanet Watch: Inviting Citizen Scientists to Observe Transiting Exoplanets

Who: Dr. Rob Zellum (Nasa Jet Propulsion Laboratory)

Sponsor: NASA Night Sky Network

Online: <https://youtube.com/live/cISbIBDHxU>

On January 10, 2023, **Exoplanet Watch** was announced as NASA's newest citizen science project studying exoplanets, or planets that orbit stars beyond our solar system. The project is growing daily, and we're encouraging astronomers who have telescopes with a tracking mount and a camera to participate in the project by making your own observations of exoplanet transits. We'll show you how, when, and where to look! We'll also show you how to use our free EXOTIC (Exoplanet Timing Interpretation Code) software to make your own light curves. If you have more data than time to process it, you can contribute your own observations of transiting exoplanets so that other citizen scientists can make their own light curves.

Exoplanet Watch participants have studied 275 different exoplanets so far, and created more than 1,500 light curves. With your help, we can expand the reach of the project. We have participants in 24 time zones already, but the more participants we have, the better. Your work will help make the timing for upcoming James Webb Space Telescope exoplanet observations more precise, freeing up valuable space telescope time for other scientists. If your observations or your light curves are used in a scientific paper, you will get credit as a co-author on the paper. We'll walk you through our website and how to participate in the project.

continued on p.4

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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.

TVS Donation to San Ramon CA High School Astro Club



Last year, TVS donated a 10-inch Odyssey telescope to the San Ramon California High School Astronomy Club. Here, their members are seen enjoying their donated scope. As some of the students are TVS members, maybe we will see them at H2O in the future.

Calendar of Events (con't)

For more information, see: nightsky.jpl.nasa.gov/news-display.cfm?News_ID=707

February 28, 7:15pm-9:00pm

What: All About the HR Diagram
Who: Jeff Adkins, (Mt. Diablo Astronomical Society)
Where: Lindsay Wildlife Experience Community Room, 1931 First Avenue, Walnut Creek, CA 94597
Cost: Lecture: Free, Parking \$3

Details not available.

For more information, see: nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=120536

March 3, 6:00pm-10:00pm

What: First Friday: The Science of Color
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline

Bld. Oakland, CA 94619

Cost: \$15 Adults, \$10 kids/seniors, \$5 members

What is color? How do humans and animals define color? Explore an array of hands-on color demonstrations and activities fun for the whole family. Learn how we bend light to see the spectrum and hear experts talk about various aspects of color and how it relates to space science.

For more information, see:

<https://chabotspace.org/events/events-listing/>

March 6, 7:30pm

What: Searching for Planet B
Who: Dan Tell (Morrison Planetarium)
Where: Golden Gate Park, 55 Music Concourse Drive, San Francisco
Cost: Members and Seniors \$12, Guests \$15

continued on p.6

TVS Astrophotography: Comet C/2022 E3 (ZTF)



Caption: Comet C/2022 E3 (ZTF) as imaged by TVS members Swaroop Shere (top), Gopal K (lower left), and Ron Kane (lower right). Swaroop imaged the comet on January 18 using a AstroPhysics 130mm GT telescope (820mm focal length) and QHY-268M camera. For each RGB filter, thirty 60 sec exposures were obtained. Gopal K imaged the comet using a 4-inch refractor (480mm focal length) with a Nikon D5600, obtaining sixty 2 min exposures. Ron Kane imaged the comet using a Celestron 9.25" telescope with an ASI183MC camera, obtaining seventy-one 30 sec exposures. Ron's image, stacked on the stars, shows the large proper motion of the comet across the sky. The comet moved ~9 arc minutes over the course of the ~40-minute imaging session.

The greenish color of the comet coma is due to emission from diatomic Carbon and Cyanogen, excited by ultraviolet light from the Sun. Typically, a comet exhibits two tails; a broad dust tail in which small dust particles are pushed away from the nucleus by solar radiation pressure, and a narrower ion tail that follows the ionized solar wind. In the top image by Swaroop, the dust and ion tail extend to the lower-left. A 3rd tail, the anti-tail, seen extending to the upper-right, points toward the Sun. It is composed of larger dust particles that are less affected by solar radiation pressure and they form a disk in the comets orbit. Only when the Earth crosses the orbital plane of the comet does the anti-tail become visible. For more information, see: wikipedia.org/wiki/Anti-tail and www.spaceweather.com/archive.php?view=1&day=22&month=01&year=2023

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

February

13 Mon Last-Quarter Moon (8:01am)

- 13 Mon Algol at minimum brightness for two hours centered on 8:02pm
- 14 Tue The Moon leads Antares by $\sim 4.5^\circ$ (Morning)

19 Sun New Moon (11:06pm)

- 21 Tue The Moon is $\sim 6^\circ$ below Venus with Jupiter to the upper left of the pair (Dusk)
- 22 Wed The Moon is $\sim 1^\circ$ left of Jupiter in the west (Dusk)
- 26 Sun Venus and Jupiter, low in the west, are $\sim 3^\circ$ apart (Dusk)
- 26 Sun The Moon sits between the Pleiades and the Hyades (Evening)

27 Mon First-Quarter Moon (12:06am)

- 27 Mon The Moon is $\sim 1^\circ$ from Mars in the SW (Dusk)
- 28 Tue Venus and Jupiter are $\sim 1^\circ$ apart in the WSW (Dusk)

March

- 1 Wed Venus and Jupiter are 0.5° apart in the west (Dusk; see March S&T, p.46)
- 2 Thu The Moon is $\sim 1.5^\circ$ from Pollux in the SE (Evening)
- 5 Sun The Moon is $\sim 4^\circ$ left of Regulus (Evening)
- 5 Sun Algol at minimum brightness for two hours centered on 9:47pm

7 Tue Full Moon (4:40am)

- 9 Thu The Moon and Spica rise together in the ESE, separated by $\sim 5^\circ$ (Dusk; by dawn, their separation is $\sim 2^\circ$)
- 12 Sun Daylight Savings Time begins (2am)
- 14 Tue The Moon trails Antares in the SE by $\sim 4^\circ$ (Morning)

14 Tue Last-Quarter Moon (7:08pm)

21 Tue New Moon (10:23am)

- 22 Wed The 1-day old Moon is $\sim 1.5^\circ$ to the upper left of Jupiter. Venus blazes above (Dusk)
- 23 Thu The Moon is $\sim 5^\circ$ below Venus in the west (Dusk)
- 24 Fri The Moon is $\sim 6^\circ$ above Venus in the west (Dusk)
- 25 Sat The Moon $\sim 1.5^\circ$ left of the Pleiades, high in the west (Dusk)
- 27 Mon Mercury and Jupiter are near the western horizon, separated by $\sim 1.5^\circ$. 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 $\sim 3.5^\circ$ below Pollux (Dusk)

Calendar of Events (con't)

Do alien worlds hold the answers to humanity's future? Can we use the discoveries from astronomy and modern space science to escape the climate crisis here on Earth? Synthesizing the last 15 years of research lectures and science visualization at the California Academy of Sciences explore what we know about potentially habitable planets, but also how modern space-based observations of our Earth can guide us to humanity's future.

For more information, see: [Benjamin Dean Astronomy Lecture](#)

NASA Night Sky Notes



Spot the King of Planets: Observe Jupiter

By David Prosper

Jupiter is our solar system's undisputed king of the planets! Jupiter is bright and easy to spot, helped by its massive size and banded, reflective cloud tops. Jupiter even possesses moons the size of planets: Ganymede, its largest, is bigger than the planet Mercury. What's more, you can easily observe Jupiter and its moons with a modest instrument, just like Galileo did over 400 years ago.

Jupiter is our solar system's largest planet; you could fit 11 Earths along Jupiter's diameter, and in case you were looking to fill up Jupiter with some Earth-size marbles, you would need over 1300 Earths to fill it up! However, despite its awesome size, Jupiter's true rule over the outer solar system comes from its enormous mass. If you took all of the planets in our solar system and put them together, they would still only be half as massive as Jupiter all by itself. Jupiter's mighty mass has shaped the orbits of countless comets and asteroids. Its gravity can fling these tiny objects towards our inner solar system and also draw them into itself, as famously observed in 1994 when Comet Shoemaker-Levy 9, drawn towards Jupiter in previous orbits, smashed into the gas giant's atmosphere. Its multiple fragments slammed into Jupiter's cloud tops with such violence that the fireballs and dark impact spots were not only seen by NASA's orbiting Galileo probe, but also observers back on Earth!



Caption: Look for Jupiter along with Venus and a very thin crescent Moon, the evening of February 22, 2023. This trio consists of the brightest objects in the sky – until the Sun rises! Binoculars may help you spot Jupiter's moons as small bright star-like objects on either side of the planet. Keep watching Jupiter and Venus as the two planets will continue to get closer together each night until they form a close conjunction the night of March 1. Image created with assistance from Stellarium.

Jupiter is easy to observe at night with our unaided eyes, as well-documented by the ancient astronomers who carefully recorded its slow movements from night to night. It can be one of the brightest objects in our nighttime skies, bested only by the Moon, Venus, and occasionally Mars, when the red planet is at opposition. That's impressive for a planet that, at its closest to Earth, is still over 365 million miles (587 million km)

away. It's even more impressive that the giant world remains very bright to Earthbound observers at its furthest distance: 600 million miles (968 million km)! While the King of Planets has a coterie of around 75 known moons, only the four large moons that Galileo originally observed in 1610 – Io, Europa, Ganymede, and Callisto – can be easily observed by Earth-based observers with very modest equipment. These are called, appropriately enough, the *Galilean moons*. Most telescopes will show the moons as faint star-like objects neatly lined up close to bright Jupiter. Most binoculars will show at least one or two moons orbiting the planet. Small telescopes will show all four of the Galilean moons if they are all visible, but sometimes they can pass behind or in front of Jupiter, or even each other. Telescopes will also show details like Jupiter's cloud bands and, if powerful enough, large storms like its famous Great Red Spot, and the shadows of the Galilean moons passing between the Sun and Jupiter. Sketching the positions of Jupiter's moons during the course of an evening - and night to night – can be a rewarding project! You can download an activity guide from the Astronomical Society of the Pacific at bit.ly/drawjupitermoons



Caption: This stunning image of Jupiter's cloud tops was taken by NASA's Juno mission and processed by Kevin M. Gill. You too can create amazing images like this, all with publicly available data from Juno. Go to missionjuno.swri.edu/junocam to begin your image procession journey – and get creative! Full Image Credit: NASA/JPL-Caltech/SwRI/MSSS; Processing: Kevin M. Gill, license: CC BY 2.0 <https://creativecommons.org/licenses/by/2.0/> Source: <https://apod.nasa.gov/apod/ap201123.html>

NASA's Juno mission currently orbits Jupiter, one of just nine spacecraft to have visited this awesome world. Juno entered Jupiter's orbit in 2016 to begin its initial mission to study this giant world's mysterious interior. The years have proven Juno's mission a success, with data from the probe revolutionizing our understanding of this gassy world's guts. Juno's mission has since been extended to include the study of its large moons, and since 2021 the plucky probe, increasingly battered by Jupiter's powerful radiation belts, has made close flybys of the icy moons Ganymede and Europa, along with volcanic Io. In 2024 NASA will launch the Europa Clipper mission to study this world and its potential to host life inside its deep subsurface oceans in much more detail. Find the latest discoveries from Juno and NASA's missions at nasa.gov.

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.



Tri-Valley Stargazers
P.O. Box 2476
Livermore, CA 94551
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.