

# PrimeFocus



**WHEN:**

January 20, 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**



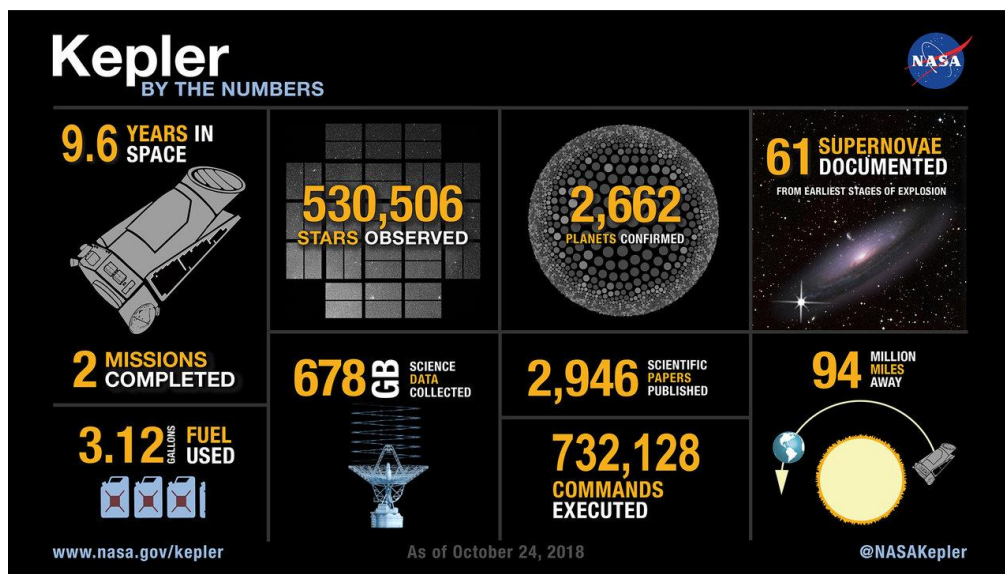
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**Planet Formation from a Dynamical Perspective**  
**Dr. Juliette Becker, 51 Pegasi b Postdoctoral Fellow at Caltech**

Recent observational advances have allowed the discovery of thousands of exoplanets and an initial characterization of their orbital and physical parameters. As this population has grown, it is increasingly apparent that existing models of planet formation are incomplete. The Kepler/K2/TESS data have presented counterexamples to prevailing theories, including theories of hot Jupiter formation.

In this talk, I will present my and others' work towards integrating these theories of planet formation with new astronomical discoveries. Resolving these conflicts requires not only a deep understanding of the current dynamical states of benchmark systems, but also an exploration of their histories through theoretical analysis expanding on the observational data. I will explain how theoretical models can give these needed constraints and determine the most probable formation pathways of these systems. As the number of known exoplanets approaches 5000 and individual systems are being more deeply characterized, we are entering a new era of exoplanet science where it will be possible to construct a coherent theory of planet formation; as I conclude my talk, I will outline the roadmap to this understanding.



Caption: During 9.6 years in orbit, Kepler led to the discovery of more than 2,600 planets by observing more than half a million stars. Credit: <https://exoplanets.nasa.gov/keplerscience/#Science%20Results>

Dr. Becker is currently a 51 Pegasi b Postdoctoral Fellow at Caltech. Her research focus is exoplanet and solar system dynamics with a goal of constructing a unified theory of planet formation. She completed her Ph.D. in 2019 at the University of Michigan, and will be starting as an assistant professor at the University of Wisconsin – Madison in Fall 2023.

# News and Notes

## 2023 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Jan. 20	Jan. 23	
Feb. 17	Feb. 20	Feb. 3
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 12/19/22, our club's account balance is \$71,478.94. This includes \$43,130.04 in the H2O Rebuild fund.

## TVS Welcomes New Members

TVS welcomes new members Vendant Birla, Ten Chanyontpatanakul, and David Rice. Please say hello and chat with them during our meetings.

## 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.

January 18: Livermore Elementary School, 2451 Portola Ave, Livermore. Family Science Night. Set up at 5:00pm, Observing 6:00-8:00pm

January 26: Croce Elementary School, 5650 Scenic Ave., Livermore. Family Science Night. Set up at 5:00pm, Observing 6:00-8:00pm

# Calendar of Events

## January 18, 7:00pm-8:00pm

What: SETI TALKS - Meet COSMIC: An Alien Hunter Instrument at the VLA

Who: Dr. Chenoa Tremblay (SETI Institute), Dr. Mark Ruzindana (UC Berkeley), and Molly Bentley (Big Picture Science)

Sponsor: SETI Institute

Online: REGISTRATION REQUIRED

<https://www.eventbrite.com/e/seti-talks-meet-cosmic-an-alien-hunter-instrument-at-the-vla-tickets-505705327247>

COSMIC SETI (the Commensal Open-Source Multimode Interferometer Cluster Search for Extraterrestrial Intelligence) is about to survey of 40 million stars for technosignatures using the National Science Foundation's Karl G. Jansky Very Large

## Calendar of Events (con't)

Array (VLA). The VLA is the world's largest radio telescope array operating at microwave frequencies.

COSMIC SETI is a collaboration between the SETI Institute and the National Radio Astronomy Observatory (NRAO), which operates the VLA, to bring a state-of-the-art search for extraterrestrial intelligence to the VLA for the first time. COSMIC SETI will enable SETI Institute scientists to analyze the data for evidence of technosignatures, signs of technology not caused by natural phenomena.

Once up and running, COSMIC SETI will be the most comprehensive SETI observing program ever conducted in the Northern Hemisphere.

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

**January, 21, 27, 28, February 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://chabot.space.org/events/events-listing/>

**January 24, 7:15pm-9:00pm**

What: The Search for Evidence of Life on Enceladus

Who: Dr. Alfonso Davila, (NASA Ames Research Center)

Where: Lindsay Wildlife Experience Community Room, 1931 First Avenue, Walnut Creek, CA 94597

Cost: Lecture: Free, Parking \$3

Dr. Davila will discuss the tremendous astrobiological potential on Saturn's moon Enceladus. He will explain the strategies to search for evidence of life in ocean materials ejected from a plume of gas discovered by the Cassini spacecraft, particularly in the context of the proposed Enceladus Orbilander mission.

For more information, see: [www.meetup.com/A-A-N-C/events/290837078](http://www.meetup.com/A-A-N-C/events/290837078)

**February 6, 7:30pm**

What: Unveiling a Dark Universe: From Tiny Galaxies to Cosmic Maps

Who: Dr. Risa Wechsler (Stanford University)

Where: Golden Gate Park, 55 Music Concourse Drive,

continued on p.4

### **Officers**

#### **President**

Ron Kane  
[president@trivalleystargazers.org](mailto:president@trivalleystargazers.org)

#### **Vice-President**

Eric Dueltgen  
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#### **Treasurer**

John Forrest  
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#### **Secretary**

David Lackey  
[secretary@trivalleystargazers.org](mailto:secretary@trivalleystargazers.org)

#### **Past President**

Roland Albers  
[past\\_president@trivalleystargazers.org](mailto:past_president@trivalleystargazers.org)

### **Volunteer Positions**

#### **Astronomical League Rep.**

**OPEN**  
[alrep@trivalleystargazers.org](mailto:alrep@trivalleystargazers.org)

#### **Club Star Party Coordinator**

Eric Dueltgen  
[coordinator@trivalleystargazers.org](mailto:coordinator@trivalleystargazers.org)

#### **Del Valle Coordinator**

David Wright  
[delvalle@trivalleystargazers.org](mailto:delvalle@trivalleystargazers.org)

#### **Historian**

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#### **Librarian**

Ron Kane  
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#### **Loaner Scope Manager**

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#### **Newsletter Editor**

Ken Sperber  
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### **Night Sky Network Rep.**

Ross Gaunt  
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### **Observatory Director/Rebuild Chairman**

Chuck Grant  
[observatory@trivalleystargazers.org](mailto:observatory@trivalleystargazers.org)

### **Observing Program Coordinator**

Ron Kane  
[awards@trivalleystargazers.org](mailto:awards@trivalleystargazers.org)

### **Outreach Coordinator**

Eric Dueltgen  
[outreach@trivalleystargazers.org](mailto:outreach@trivalleystargazers.org)

### **Potluck Coordinator**

**OPEN**  
[potluck@trivalleystargazers.org](mailto:potluck@trivalleystargazers.org)

### **Program Coordinator**

Dan Helmer  
[programs@trivalleystargazers.org](mailto:programs@trivalleystargazers.org)

### **Publicity and Fundraising**

**OPEN**  
[publicity@trivalleystargazers.org](mailto:publicity@trivalleystargazers.org)

### **Refreshment Coordinator**

**OPEN**

### **Webmaster**

Hilary Jones  
[webmaster@trivalleystargazers.org](mailto:webmaster@trivalleystargazers.org)

### **Web & E-mail**

[www.trivalleystargazers.org](http://www.trivalleystargazers.org)  
[info@trivalleystargazers.org](mailto:info@trivalleystargazers.org)

### **TVS E-Group**

To join the TVS e-group just send an email message to TVS at: [info@trivalleystargazers.org](mailto: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)

San Francisco

Cost: Members and Seniors \$12, Guests \$15

The Universe is dominated by a mysterious, unseen substance known as dark matter, which makes up more than eighty percent of the cosmos. In recent decades, much has been learned about dark matter, including its density and spatial distribution, but its fundamental nature — for example, what kind of particle it is, how massive it is, and how it interacts — remains largely unknown. This lecture will explain how tiny galaxies, measurements of distorted spacetime, and the largest maps of the cosmos are giving us insights into the nature of dark matter, and will describe the enormous discovery potential provided by the next decade of cosmic surveys.

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

**February 8, 7:00pm**

What: Our Boldest Effort to Answer our Oldest Question: The Breakthrough Listen Search for Intelligent Life Beyond Earth

Who: Dr. Andrew Siemion (UC Berkeley SETI Research Center)

Where: Foothill College, Smithwick Theater, 12345 El Monte Road, Los Altos Hills, CA 94022

Cost: Lecture: Free, Parking \$3

No details available.

We ask that attendees be vaccinated and boosted against COVID-19 and wear a mask while indoors at the event. Extra masks will be provided.

For more information, see: <https://foothill.edu/astronomy/>

## TVS President's Message

This message is to express my thanks for member participation in operating the club for the past year. I took over the role of president following Roland Albers in Dec 2019 and we immediately entered COVID restrictions preventing in-person social meetings. Fortunately, Zoom meetings work well for us and we actually grew in membership. So, thank you to the earlier members for staying with us and for those who chose to join and remain a part of us! Zoom will continue as we go forward so that we can take advantage of remote presenters, keep remote members with us, and have participation by those who can't readily make the Friday night meeting in person.

I want to express my thanks to the Board members and volunteers who help throughout the year. These people are providing the resources you get and use as a member. So, Thank You to:

Eric Duelgton - Vice President and Outreach Coordinator. He performs the VP duties and is present at member and Board meetings as well as organizing all of our public and school outreach star parties. As a volunteer to these events, I find it especially satisfying when someone looks thru my telescope and goes "Wow!"

John Forrest - Treasurer. We have a bank account, are a 501(c)(3) organization and need to juggle expenses for our meetings, supplies, and other income/outgo activities. He's got the role pretty-well greased and we're in good hands. Thank you, John for keeping us going!

Ross Gaunt - Outgoing Secretary. Ross has been our secretary for the past two years and is stepping aside to focus on his stage production activities with the local high schools. We'll miss Ross because we'll have to pick up the tasks of renewing memberships, adding new members, keeping our membership info and updating member lists with the Astronomical League. He also records the minutes of the Board meetings.

Ross will continue to support the Quick Dome and the 14-inch telescope, which is our only permanently mounted instrument at H2O. He will also continue as our NASA Night Sky Network contact. Ross - Thank you for the past two years!

Dan Helmer - Programs (Committee) - Dan has been phenomenal at getting speakers for our member meetings. Zoom has expanded his reach and we've even had our most distant member Dwight Lanpher - Maine present to the club. Other contacts have included NASA, SETI, Lick Observatory, and National Lab researchers, and I suspect he's had fun making the contacts and getting speakers to participate. Dan - thank you for doing what you do to keep us interested!

Ken Sperber - Newsletter editor. Ken has been our editor and production manager for some time. His work results in our monthly issue of Prime Focus that details club activity and science of interest. My thanks to Ken for this work, it's a tough job, time consuming, and with deadlines. Ken has established a pretty high bar for quality work.

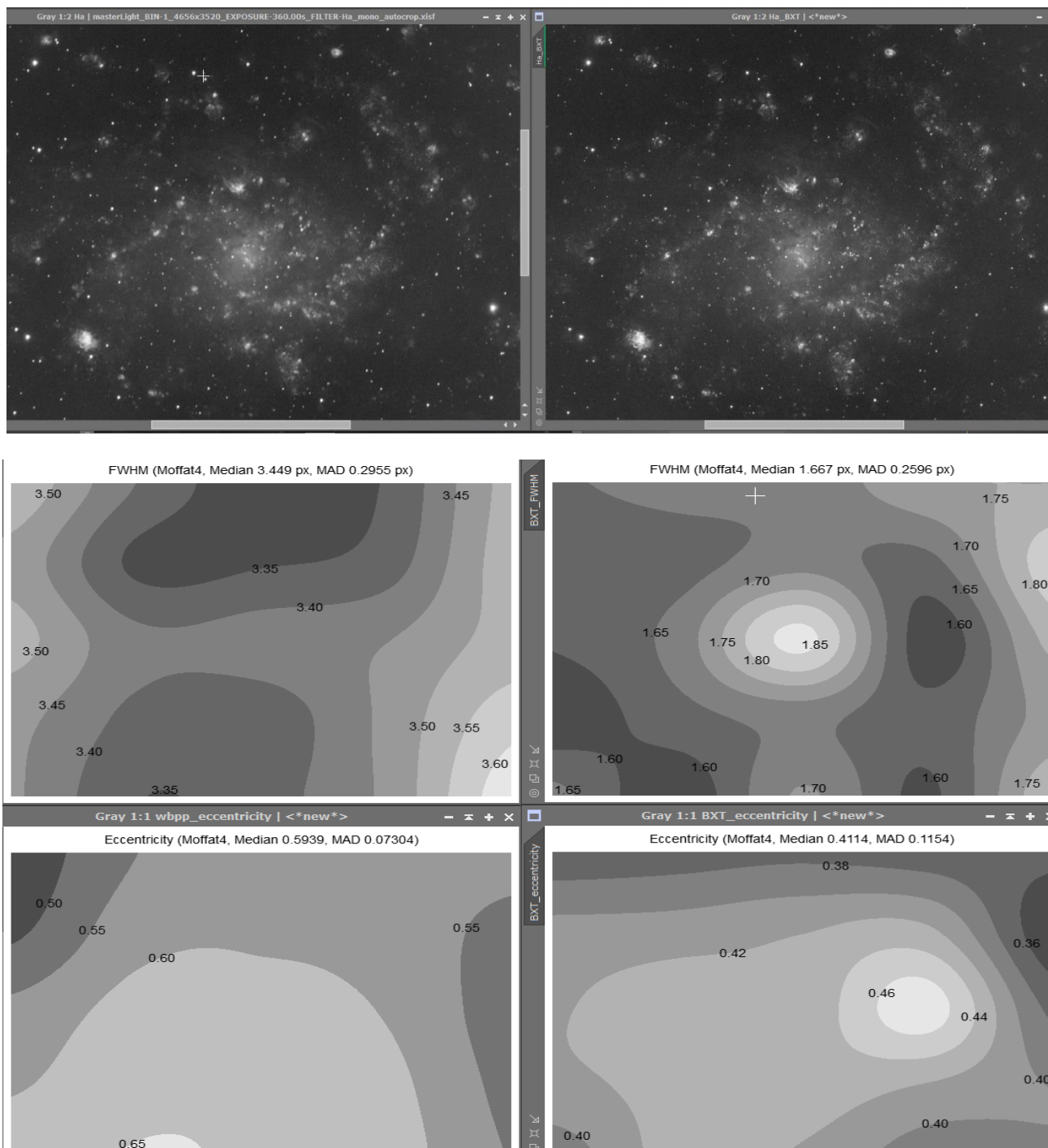
Ken moved from Dublin to Flagstaff, AZ this year. Fortunately, he is still willing to be editor, but this will change as he gets more commitments in his new viewing area. Ken would appreciate someone as a protégé to become the next editor.

The people mentioned are those who need to be thanked each month for the star parties, club meetings, operations, and presentations. These are things we see mostly. We have many others though who work in less visible positions.

Board Members At Large - Roland, Gert, Chuck, Hilary, and Dan. These are our reliable members who know club operations and have corporate history. Roland is our Past-

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# TVS Astrophotography: PixInsight BlurXterminator Plug-in



Caption: Kai Yung reports: BlurXTerminator (BlurXT) is for those doing AP using PixInsight and wanting to get better results without going through crazy processes. BlurXT is from Russell Crowman, the creator who previously published StarXTerminator and NoiseXTerminator. OMG! This is a total game changer. I am split between how excited yet sad I am about this development. It's close to push button simple to get localized deconvolution with jaw dropping results. But with these new neural net based tools, our final rendering will all look like NASA's award winning shots. Where's the blood and tears required to get differentiated and standout images. You be the judge... <https://youtu.be/rWEuW4MTrQ>

In the above comparison, in the left column H-alpha images of M33 were processed as usual in PixInsight, while those in the right column were then processed with the BlurXT plug-in. The BlurXT image is clearly superior to that processed using the standard workflow. This is borne out by the reduced Full Width Half Maximum (FWHM) and reduced Eccentricity achieved with BlurXT over the image field. IMHO, the FWHM and Eccentricity contour plots convincingly demonstrate how effective it is on fixing optical train imperfections (tilted optics), tracking error, and bad seeing by locally deconvoluting the data. For more information on BlurXT, see: [www.rc-astro.com/index.php](http://www.rc-astro.com/index.php)

# What's Up

By Ken Sperber (adapted from S&T)

All times are Pacific Standard Time

## January

- 18 Wed The Moon and Antares rise together, separated by  $\sim 1.5^\circ$  (Dawn)
- 21 Sat New Moon (12:53pm)**
- 22 Sun Venus and Saturn are separated by  $0.5^\circ$  in the WSW (Dusk)
- 22 Sun Algol at minimum brightness for two hours centered on 9:27pm
- 25 Wed The Moon is  $\sim 3^\circ$  below Jupiter (Evening)
- 28 Sat First-Quarter Moon (7:19am)**
- 28 Sat The Moon is between Mars and Jupiter, with Venus and Saturn closer to the horizon in the WSW (Dusk)
- 30 Mon High in the SW, the Moon is within  $0.5^\circ$  of Mars (Evening)

## February

- 3 Fri The Moon, Castor, and Pollux form a line in the east (Evening)
- 5 Sun Full Moon (10:29am)**
- 6 Mon The Moon trails Regulus by  $\sim 4.5^\circ$  (Evening)
- 10 Fri The Moon is  $\sim 2.5^\circ$  from Spica (Evening)
- 10 Fri Algol at minimum brightness for two hours centered on 11:12pm
- 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)**

President and moved to Prescott, AZ in the last year, but he can still participate. Gert, Chuck, and Dan all have additional roles on committees, including Astrophotography, H2O Observatory Director, and Programs (previously described). Hilary also participates as both Board member and Webmaster. Thank you again to these members who have experience at keeping things on track.

And we have a number of others involved in committees supporting our club. A number of them have been mentioned already but I wish to say thanks to Dennis Beckley - Astronomical League Representative and David Wright - Del Valle Coordinator.

Dennis has been our AL Rep for a long time but recently informed me that he's stepping down and a new Rep is needed. Dennis was our focal point for doing the AL Observing Programs and would take our work, review it, and forward it to the AL Observing program leaders. On final acceptance Dennis would get to make the presentation of the certificates and pins to the observer at our club meetings. My thanks to Dennis for having been our Rep and I ask for a volunteer to take his place and to hopefully transition over the next month or so for continuity. Anyone?

David works with the EBPRD / Del Valle managers for our access to the Del Valle observing site. This year there was an intensive effort to renew our 5-year special use permit. I think we came distressingly close to losing access and it's important to continue to follow procedures to maintain management

confidence in our use. David, thank you for keeping our access secure.

Brian Blau - Publicity and Fundraising. Brian led our fundraising program following the loss of our telescope building at H2O in the August 2020 fire. We benefited from his work in major ways both in funding and hardware donations. We're hopefully going to have a great observatory facility as a result of his efforts. Thanks may be overdue but my thanks to Brian! Unfortunately, Brian also moved to Prescott and he is not available to us.

There are yet other positions to fill. Here are positions for which we'd really appreciate some help -

- Astronomical League Rep
- Refreshment Coordinator for the monthly meeting
- Potluck Coordinator
- Publicity and Fundraising
- Webmaster assistance
- Loaner Telescope assistance

Please let a Board member or me know of your interest. The work is less if we spread it over a larger number of people and while these are important for the club operation, we all help one another in ensuring things get done.

Finally, Thank You for being a member of TVS and making this a great resource for the old and the new astronomers in the community!

Ron Kane, 2021 -2023 President, Tri-Valley Stargazers

# NASA Night Sky Notes



## Binoculars: A Great First Telescope

By David Prosper

Mercury is the closest planet to the Sun. Mercury can be one of the brightest planets in the sky – but also easy to miss! Why is that? Since it orbits so close to the Sun, observing Mercury is trickier than the rest of the “bright planets” in our solar system: Venus, Mars, Jupiter, and Saturn. Mercury always appears near our Sun from our Earth-bound point of view, making it easy to miss in the glare of the Sun or behind small obstructions along the horizon. That’s why prime Mercury viewing happens either right before sunrise or right after sunset; when the Sun is blocked by the horizon, Mercury often appears similar to a “tiny Moon” in a telescope since, like fellow inner planet Venus, it shows distinct phases when viewed from Earth! Mercury’s small size means a telescope is needed to observe its phases since they can’t be discerned with your unaided eye. Safety warning: If you want to observe Mercury with your telescope during daytime or before sunrise, be extremely careful: you don’t want the Sun to accidentally enter your telescope’s field of view. As you may already well understand, this is extremely dangerous and can not only destroy your equipment, but permanently blind you as well! That risk is why NASA does not allow space telescopes like Hubble or the JWST to view Mercury or other objects close to the Sun, since even the tiniest error could destroy billions of dollars of irreplaceable equipment.



Caption: Mercury reaches maximum western elongation on the morning of January 30, which means that your best chance to spot it is right before sunrise that day! Look for Mercury towards the southeast and find the clearest horizon you can. Binoculars will help pick out Mercury’s elusive light from the pre-dawn glow of the Sun. Image created with assistance from Stellarium.

Despite being a small and seemingly barren world, Mercury is full of interesting features. It’s one of the four rocky (or terrestrial) planets in our solar system, along with Earth, Venus, and Mars. Mercury is the smallest planet in our solar system and also possesses the most eccentric, or non-circular, orbit of any planet as well: during a Mercurian year of 88 Earth days, the planet orbits between 29 million and 43 million miles

from our Sun – a 14-million-mile difference! Surprisingly, Mercury is **not** the hottest planet in our solar system, despite being closest to the Sun; that honor goes to Venus, courtesy its thick greenhouse shroud of carbon dioxide. Since Mercury lacks a substantial atmosphere and the insulating properties a layer of thick air brings to a planet, its temperature swings wildly between a daytime temperature of 800 degrees Fahrenheit (427 degrees Celsius) and -290 degrees Fahrenheit (-179 degrees Celsius) at night. Similar to our Moon, evidence of water ice is present at Mercury’s poles, possibly hiding in the frigid permanent shadows cast inside a few craters. Evidence for ice on Mercury was first detected by radar observations from Earth, and follow-up observations from NASA’s MESSENGER mission added additional strong evidence for its presence. Mercury sports a comet-like tail made primarily of sodium which has been photographed by skilled astrophotographers. The tail results from neutral atoms in its thin atmosphere being pushed away from Mercury by pressure from the nearby Sun’s radiation.



Caption: Mercury is hot, small, and heavily cratered, as seen in this image from NASA MESSENGER. Mercury is the most heavily cratered planet in our solar system, since it lacks either a substantial atmosphere or geologic activity to erode surface features like craters. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Source: [mercurys-subtle-colors](https://www.nasa.gov/mercurys-subtle-colors)

NASA’s Mariner 10 was Mercury’s first robotic explorer, flying by three times between 1974-1975. Decades later, NASA’s MESSENGER first visited Mercury in 2008, flying by three times before settling into an orbit in 2011. MESSENGER thoroughly studied and mapped the planet before smashing into Mercury at mission’s end in 2015. Since MESSENGER, Mercury was briefly visited by BepiColombo, a joint ESA/JAXA probe, which first flew by in 2021 and is expected to enter orbit in 2025 - after completing six flybys. Need more Mercury in your life? Check out NASA’s discoveries and science about Mercury at [solarsystem.nasa.gov/mercury/](https://solarsystem.nasa.gov/mercury/), and visit the rest of the universe at [nasa.gov](https://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](https://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](http://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.