PrimeFocus

April 2024

WHEN:

April 19, 2024
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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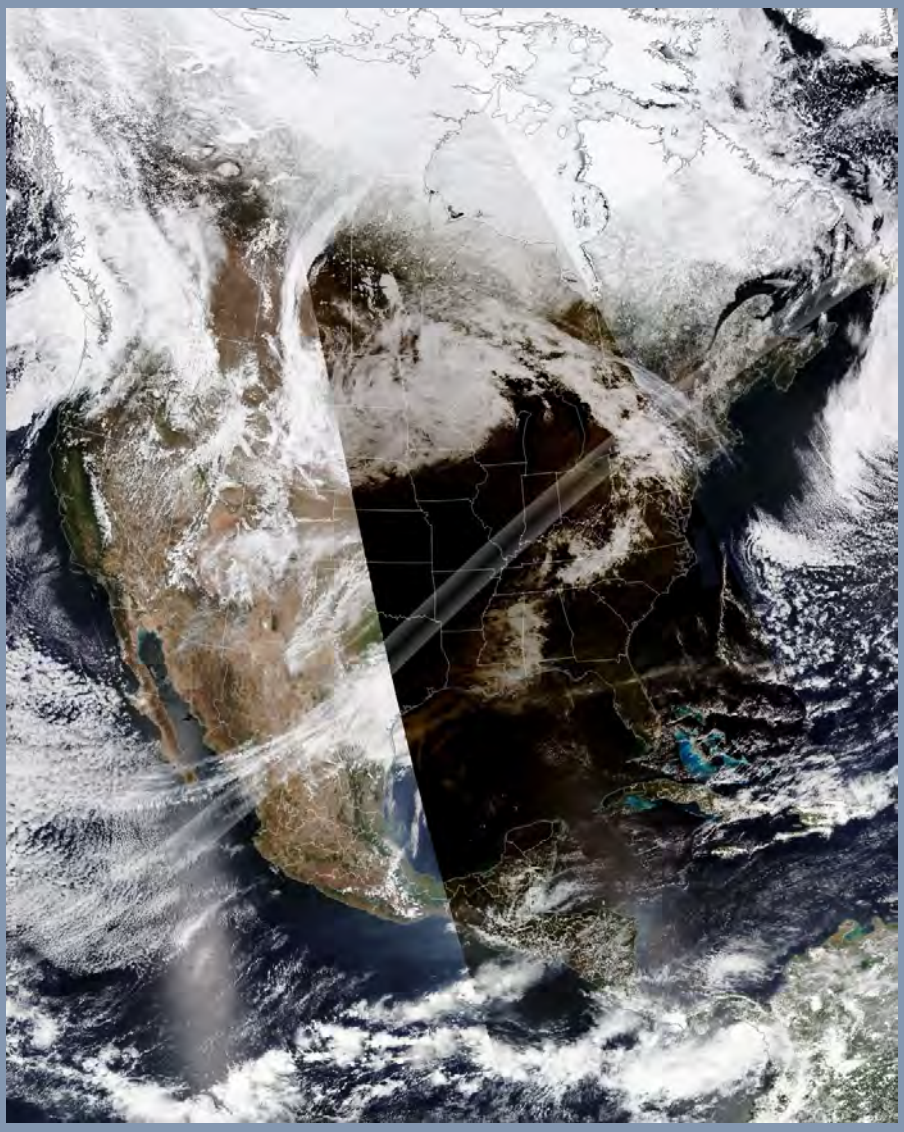
THE GREAT NORTH AMERICAN SOLAR ECLPISE

This month we experienced an amazingly beautiful solar eclipse on April 8th that spanned across the continental United States and parts of Mexico and Canada. Traveling approximately 1,800 miles per hour or greater as the shadow of the eclipse moved eastward, the path of totality quickly passed along 12 states from Texas to Maine. The entire continental US was able to experience at least a partial solar eclipse including here in the Bay Area. While some places along the path experienced clouds others were completely clear of any obstructions. Many TVS club members had the opportunity to travel to places along path of totality and what follows in the Astrophotography Section are some of their experiences and photographs along the way.



NASA Earth Observatory images by Michala Garrison and Wanmei Liang, using data from DSCOVR EPIC and VIIRS data from NASA EOSDIS LANCE, GIBS/Worldview, and the Joint Polar Satellite System (JPSS).

NEWS AND NOTES

2024 Meeting Dates

Club Meeting	Board Meeting	PrimeFocus Deadline
Apr. 19	Apr. 22	Apr. 5
May 17	May 20	May 4
Jun. 21	Jun. 21	Jun. 8

Money Matters

As of the last Treasurer's Report on 2/19/24, our club's account balance is $60,725.89. This includes $26,146.47 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Aveesh Agrawal, Edgardo Traverso, Kai Mildenberger, Vidya Adoni,Arun Manoharan, Maya Manoharan, Rishaan Manoharan, Auggie Manoharan, and Sambasiva Gadipati. Please say hello and chat with him during our meetings.

2024 Club Star Party Schedule

Save the dates for the 2024 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.

April 27: Tesla Vintner's Star Party, 5143 Tesla Rd., Livermore. Set-up at 7:30pm, Observing 8:15-Midnight.

H2O Open House star parties are open to only club members and their guests. 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.

May 25: H20 Open House, at 6pm the caravan to H2O PROMPTLY leaves the corner of Mines and Tesla Rds., Livermore. Observing until 11:30pm.

May 10: School star party at Warwick Elementary, 3375 Warwick Drive, Fremont. Set up 7:30pm, observing from 8:00pm to 9:300pm, The fair goes from 10 to 5.

CALENDAR OF EVENTS

April 19, 20, 26, 27, May 3, 4, 10, 11, 7:30-10:30 PM

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/

April 17, 7:00 PM

What	The Allure of the Multiverse: Beyond the Limits of Direct Observation
Who	SETI Institute
Where	You Tube
Cost	Free

Given that the extent of the observable universe has yet to be mapped out, some might wonder why some physicists have introduced the concept of a multiverse into their models. This talk will examine why some eminent physicists, such as the late Nobel laureate Steven Weinberg, have been attracted to the idea of the multiverse, and others, such as Princeton cosmologist Paul Steinhardt, have raised significant concerns. We'll also show that the cultural (think Marvel movies) and scientific ideas of multiverses differ significantly.

Paul Halpern is Professor of Physics at Saint Joseph's University and the author of eighteen popular science books. The recipient of a Guggenheim Fellowship, a Fulbright Scholarship, and an Athenaeum Literary Award, he has appeared on numerous radio and television shows including "Future Quest," "Science Friday," "The Simpsons 20th Anniversary Special," and C-SPAN's "BookTV." His most recent book is "The Allure of the Multiverse: Extra Dimensions, Other

Worlds, and Parallel Universes," just published by Basic Books.

The lecture is co-sponsored by:

The Foothill College Science, Tech, Engineering & Math Division
The SETI Institute
The Astronomical Society of the Pacific.

For more information, see:
https://www.seti.org/event/allure-multiverse-beyond-limits-direct-observation

May 13, 7:30 PM

What	Unravelling the Mysteries of Black Holes and Neutron Stars
Who	California Academy of Scineces
Where	Morrison Planetarium
Cost	Public: $15 Members and seniors: $12

Featuring Dr. Alexandra Tetaranko, University of Lethbridge. The most powerful cosmic engines in our universe are fueled by compact objects such as black holes and neutron stars. These cosmic engines consume large amounts of material and expel matter in the form of jets traveling at near the speed of light. Recent groundbreaking discoveries of gravitational waves from systems harboring compact objects and the direct imaging of the black hole shadows with the Event Horizon Telescope, represent major steps forward in our understanding of such systems. However, there exists a huge population of compact objects in our own galaxy which provides much more ideal laboratories, offering a real-time view of the behavior of these compact objects and their dynamic environments. In this talk, Dr. Tetarenko will discuss new experiments leveraging the capabilities of today's state-of-the-art telescopes to observe repetitive, (somewhat) predictable, energetic surges of radiation that allow us to track the path of material from inflow to outflow in these galactic systems.

For more information, see:
https://www.calacademy.org/events/benjamin-dean-astronomy-lectures/unraveling-the-mysteries-of-black-holes-and-neutron-stars

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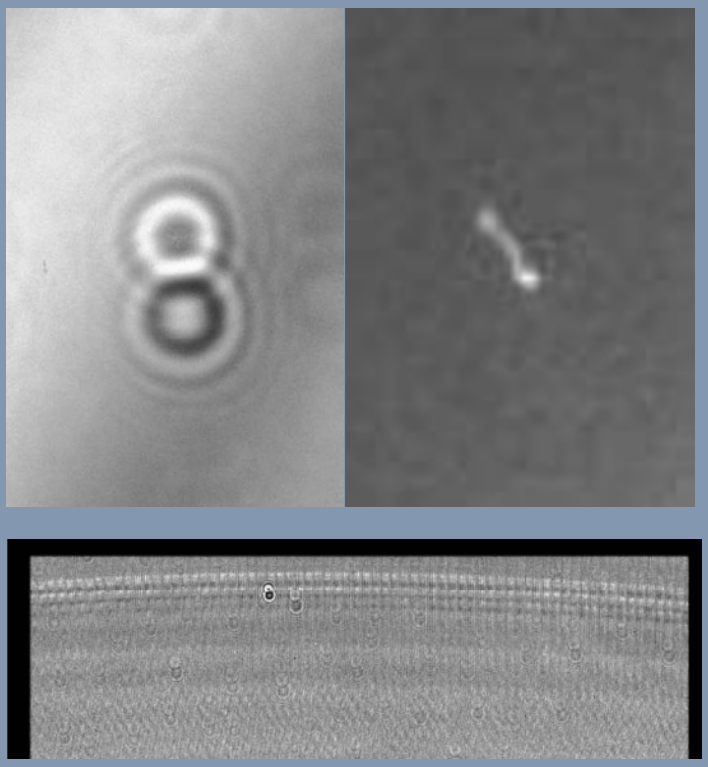
TVS E-Group
To Join the TVS E-Group just send an email to TVS at info@trivalleystargazers.org asking to join the group. Make sure you specify the email address you want to use to read and post to the group.

THE VERA RUBIN OBSERVATORY: SURVEYING INTO THE PAST
BY SAANIKA KULKARNI

Last week, I got to talk to Theo Schutt (they/them), a fourth-year graduate student at Stanford University about the Vera C. Rubin Observatory. Theo shared some fascinating insights into the future of astronomy and our quest to understand the universe, and I'm so excited to share their perspective with you all!

Stanford's SLAC National Accelerator Lab is involved with the construction of Rubin's 3.2 gigapixel camera, the highest resolution in the world. Theo specifically worked on characterizing sensor anomalies for the CCD sensors that make up the camera. In the Rubin camera, the way these sensors are built can cause a specific issue called the tree ring effect. This effect is caused by the way the silicon used in the camera is grown, which creates a slight variation in its sensitivity across the surface. Think of it like ripples on a pond–the sensitivity goes up and down in a circular pattern. In more scientific terms, the way the silicon crystals (called boules) are grown in the CCD sensors causes a harmful electric field to generate perpendicular to the flow of photoelectrons. This can mess with the accuracy of the images, but before the work of Theo's group, we weren't sure by how much.



These are three types of non uniformities caused by the CCD sensors; on the left, diffraction rings are shown, which are caused by small dust particles on the sensors. In the middle, cosmic rays are shown; these are present in every astronomical image, but will be masked during data reduction. On the right, you can see a reflection, which comes from inside the cryostat of the camera. These will also be masked. Image credit: Rubin Observatory

A larger part of Theo's time at SLAC has been dedicated to building a sort of "projector" for the Rubin camera. This projector, in Theo's words, "projects uniform light onto the sensors," producing flatfield images. By doing this, the LSST team can effectively evaluate all of the nonuniformities of the sensors.

Once complete, the LSST camera will be a marvel of engineering, designed to capture vast swaths of the night sky in exquisite detail. To achieve this, it needs to operate in extreme conditions. The camera's heart, the CCD sensor array, is chilled to a frigid -140°C to minimize electrical noise and ensure optimal performance. This icy environment is maintained by a special chamber called a cryostat, essentially a giant thermos bottle for the camera's delicate innards. The camera itself is a massive instrument, roughly the size of a small SUV. To ensure precise alignment with the telescope's optics, it will be meticulously positioned at the prime focus point, where the incoming light converges. This critical placement will allow the camera to capture the widest possible field of view, maximizing the amount of sky it can survey in a single observation. The entire assembly will be housed within a specialized enclosure for protection from the harsh environment on the telescope's peak.
ion from the harsh environment on the telescope's peak.

Our conversation progressed from the camera to the telescope as a whole, and I quickly realized that the Rubin Observatory is not your average telescope! It all starts with the observatory's design. The telescope itself needs to be stout in order to handle the weight of the massive camera and move swiftly across the sky. Unlike traditional telescopes that focus on a single point, the Rubin Observatory needs to scan vast stretches of the cosmos in rapid succession, with the time between each image being 5 seconds. This requires a robust mount, capable of precisely maneuvering the hefty camera assembly without sacrificing image quality. Additionally, to minimize the weight of the mirrors, the primary and tertiary mirrors are actually the same piece of glass! They are just polished differently according to where the focus needs to be.

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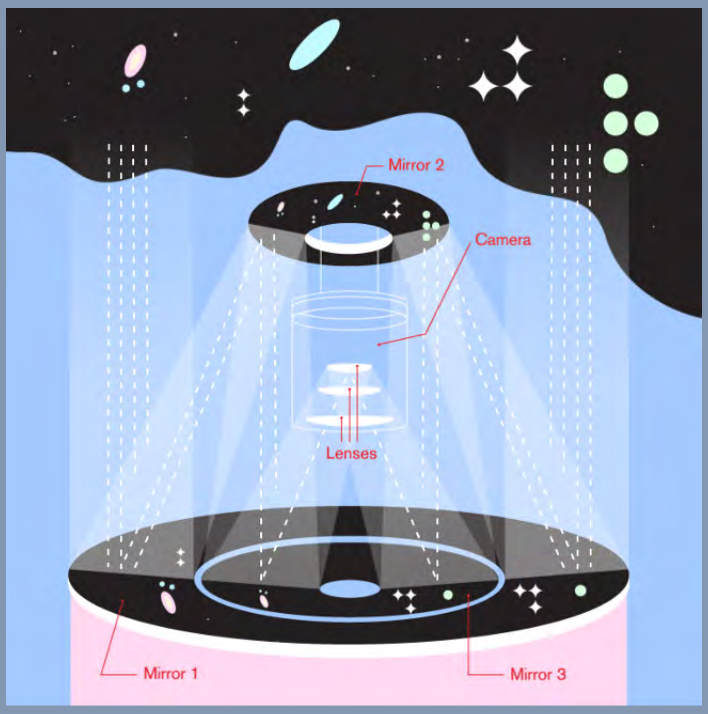
The Vera Rubin Observatory continued;



LSST's mirror design. The secondary mirror (labeled mirror 2) is actually a "donut" shaped mirror, which allows it to disperse light to the tertiary mirror instead of concentrating it like a traditional mirror. One trade-off of this design is the light lost bouncing off of mirror 1 and the light that is lost in the holes of the mirrors. Image credit: Symmetry Magazine

With such a powerful camera at its heart, the Vera C. Rubin Observatory is poised to revolutionize our understanding of the universe. This achievement wouldn't be possible without the pioneering work of Dr. Anthony Tyson, Chief Scientist of the Rubin project and a Distinguished Professor of Physics at UC Davis. Dr. Tyson's vision of using CCD cameras for wide-field surveys in the 1980s paved the way for the development of highly sensitive CCD sensors, making the incredible resolution of the Rubin camera possible. This innovation, coupled with the engineering expertise of institutions like SLAC, has resulted in a truly groundbreaking instrument.

With such a groundbreaking instrument, the success of the Rubin project relies heavily on the combined expertise of researchers from various institutions. This collaborative spirit resonates deeply with Theo Schutt. Before Stanford, Theo researched X-ray astrophysics as an undergraduate at Columbia University. However, when it came to graduate studies, Stanford's renowned Rubin Observatory project wasn't the sole attraction. Theo specifically sought out Dr. Aaron Roodman's group, impressed by Stanford's exceptional commitment to inclusivity and collaboration. As Theo explained, "For me, it's really important to be able to work in a positive and respectful environment; as exciting as the science can be, being part of such a supportive community is probably my favorite part of my research." The Rubin Observatory isn't just about scientists making discoveries on their own. They view working together as essential to their mission. This includes collaboration among professional researchers, but also extending that collaboration to the public. The observatory is actively developing ways for the general public to participate in their research. This is often called "citizen science" and allows people with no prior astronomy experience to contribute to real scientific discoveries. To make citizen science possible, the Rubin Observatory plans to make all its data releases publicly available. This means anyone with an internet connection will be able to explore the data the observatory collects, potentially contributing to new findings.

The Vera C. Rubin Observatory, with its record-breaking camera and innovative design, promises to be a game-changer for astronomy. This powerful telescope will capture vast swaths of the night sky in exquisite detail, allowing scientists to tackle some of the universe's most enduring mysteries. One key objective is mapping dark matter, the invisible substance thought to comprise most of the universe's mass. By studying the gravitational influence of dark matter on visible objects, the LSST could revolutionize our understanding of its properties and distribution. Additionally, the observatory's rapid scanning capabilities will enable the discovery and tracking of near-Earth asteroids, some of which could pose a threat to our planet. The data collected by Rubin will be a treasure trove for astronomers for decades to come, potentially leading to groundbreaking discoveries that reshape our understanding of the cosmos.

TVS ASTROPHOTOGRAPHY

Partial Solar Eclipse, by Aveesh Agrawal
This picture of the partial solar eclipse was taken in Pleasanton, California with a EOS Canon Rebel T7 camera through a Rainbow Symphony 70mm solar lens. It captures the peak of the eclipse viewed in California at 11:13am. Aveesh will be sharing a story of experiencing the solar eclipse in the upcoming May PrimeFocus

Total Solar Eclipse 2024, by Swaroop Shere

Bailey's Beads at C3 2024, by Swaroop Shere

Total Solar Eclipse Corona 2024, by Swaroop Shere

I planned for a trip to Mazatlan with my wife and kid almost a year ago to watch the eclipse. It would be the first time for my daughter who turned 4 recently. We were wary of the weather forecast that had forecasted high clouds as we landed in Mazatlan. On D-day, we got together with a few local families to watch the eclipse. There were thin high clouds and we were hoping we would be able to see and capture through those. Thankfully, the cloud condition did not worsen by the eclipse T -0 and we were all treated to a beautiful spectacle. Watching my kids reaction to the eclipse was probably the most precious thing we brought back with us. She would accompany me during my practice runs with eclipse orchestrator prior to the

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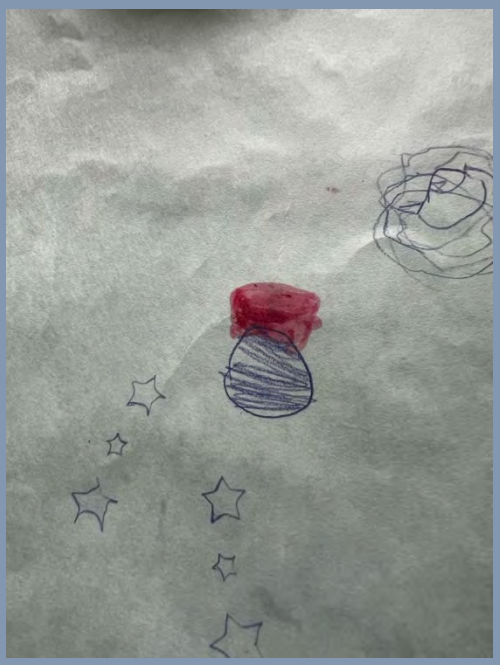
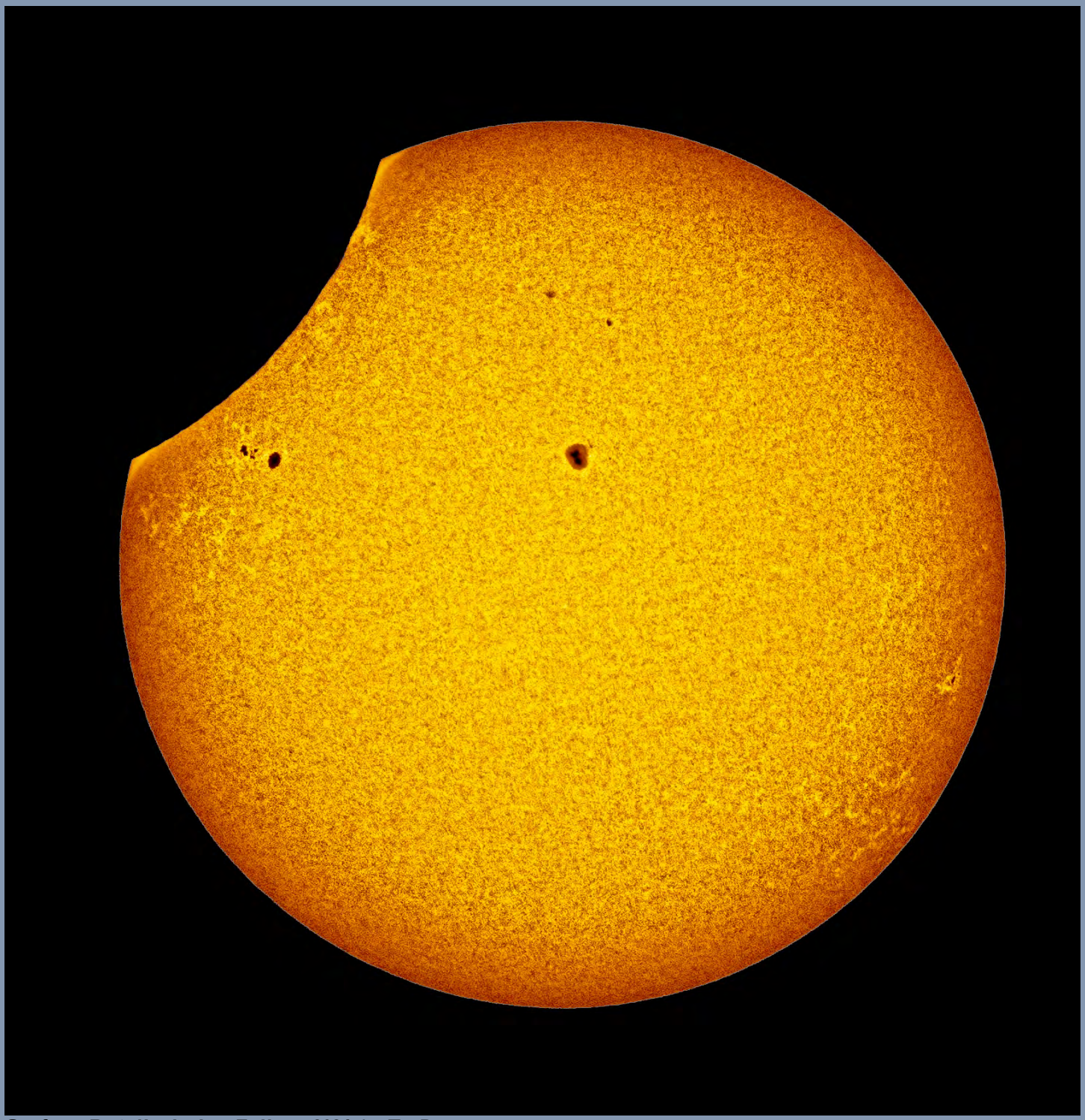


eclipse, and would shout out loud "Filters off, Filters off" right after EO made those announcements. It helped me remember to take the filters off during the actual eclipse :) The pictures came out pretty well despite the thin high cloud layer. I made the mistake of fiddling with the script 5 mins before totality to increase the global exposure compensation by 1/2 stop. It turned out to be a big mistake as it was not necessary for the thin clouds. The C2 diamond ring was completely washed out. The initial corona captures were also washed out. I immediately removed the global exposure compensation and prayed that EO would not crash. Thankfully it did not, and the rest of the pictures including totality, C3 Baileys beads and C3 diamond ring came out pretty well. I lost almost a minute of totality while I was fiddling with the settings instead of just watching it, something I vow to never repeat again. Eventually, I got about 2.5 minutes of watching the eclipse. Anyway, it was truly special to witness this eclipse family. My daughter drew pictures of the diamond ring and corona once we got back home, and I was amazed at how much a 4 year old would recollect.

Total Solar Eclipse with Venus & Jupiter 2024, by Tri Do

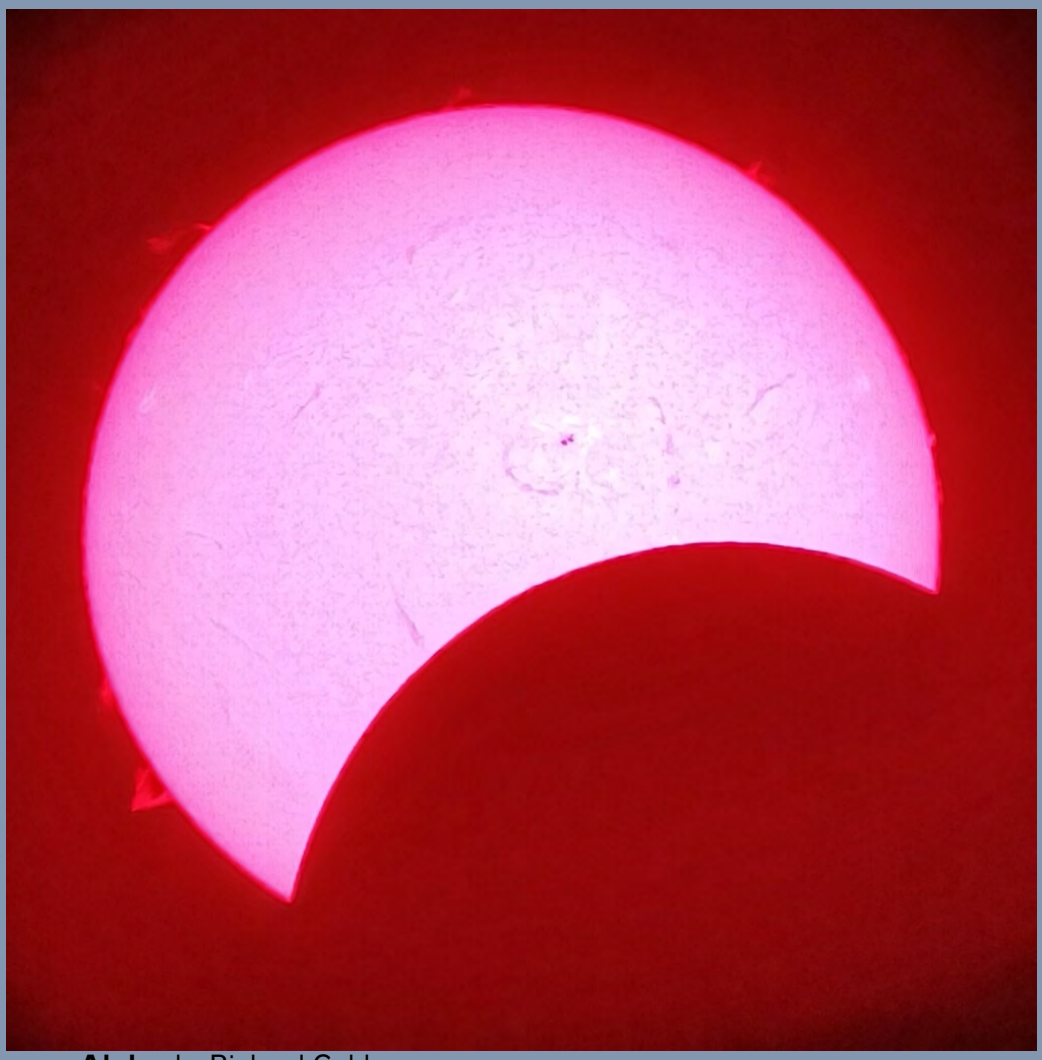
Close-up shots of the solar eclipse were taken from Princeton, Texas and captured with a Canon EOS 5D mk IV and EF 100-400mm lens at 400m with a 2x extender at f/9.5-f/11. The ZWO AM3 mount was set to track at solar rate and had been polar aligned the night before. Image capture was automated with Eclipse Orchestrator, although the camera needed rebooting twice during totality for unclear reasons. The clouds made focusing at the start of the eclipse and during the lower temperature near totality difficult. The wide angle shot was taken on a fixed tripod using a Canon EOS R with a Sigma 20mm f/11.



Surface Details during Eclipse 2024, by Tri Do

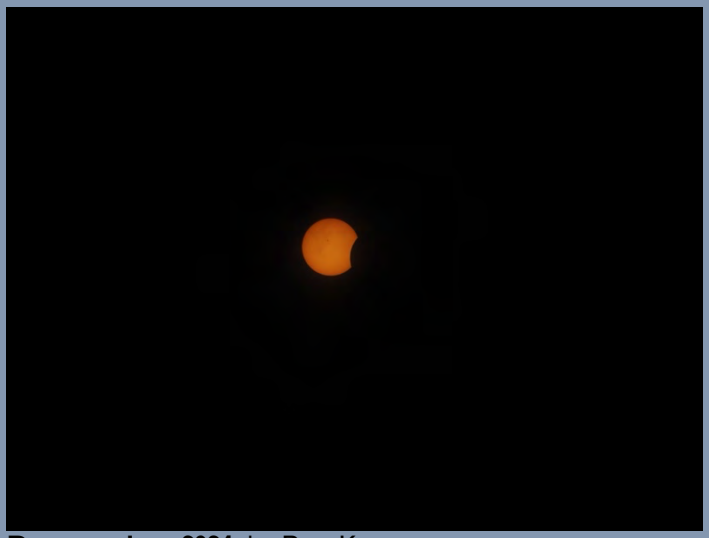
Surface Details during Eclipse 2024, by Tri Do

Total Solar Eclipse 2024, by Tri Do



Eclipse in Hydrogen Alpha, by Richard Gabby

I haven't seen many H-alpha eclipse images presented, but this unprocessed shot was taken near Pioneer CA with a hand held android cell phone camera looking through a Lunt LS60THa scope. I was really surprised at the amount of detail the cell phone was able to capture.



Progression 2024, by Ron Kane

My wife and I drove from Austin to Cottonwood Shores (50 miles) and found a small community park beside the local volunteer fire department. There were 15 or so fire fighters and spouses and the 2 of us. They had 1500 sets of glasses and only we showed up! It was great though, we saw the eclipse

and had bbq with them. Great time, traffic not so much fun yesterday or today but that seemed to be mostly construction... see if anything is useful here, I have raws I'm going to play with too.

Nearing Totality in the Clouds 2024, by Ron Kane

Watching the Progress 2024, by Ron Kane

Total Solar Eclipse 2024, by Ron Kane

WHATS UP

Adapted from Sky & Telescope

All times are Pacific Standard Time

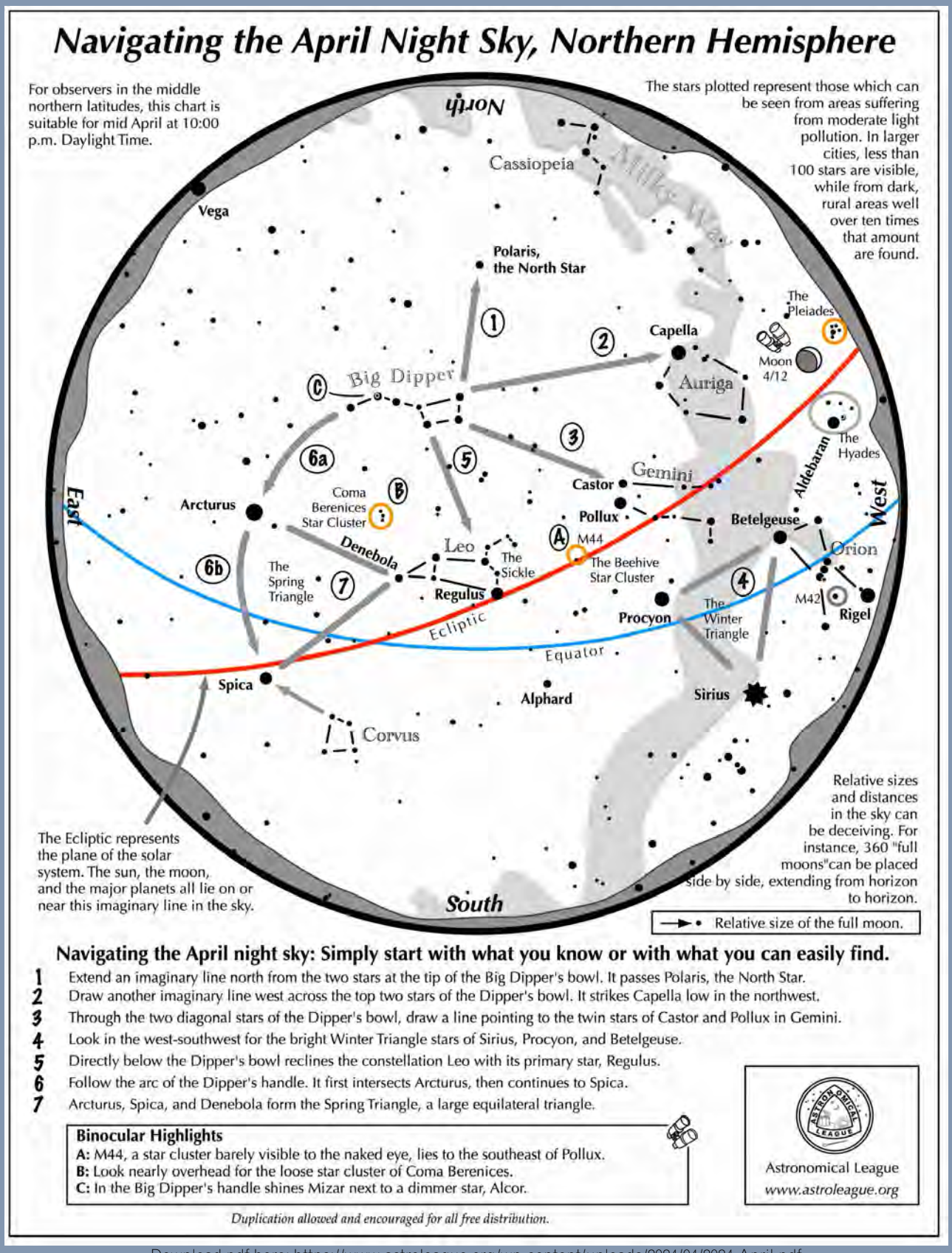
April 2024

18	Thu	Waxing gibbous moon trails Leo's lucida, Regulus, by around 6° in southern sky
21-22	Sun-Mon	The Lyrid meteor shower peaks
22	Mon	Moon 0.5° from Spica in Virgo
23	**Tue**	**Full Moon**
27	Sat	Facing south-southwest the wanning gibbous moon 5° lower left from the super-giant star and heart of the scorpion, Antares

May 2024

1	Wed	Moon at last quarter
3	Fri	Before sunrise see the moon , Mars, and Saturn strung out in a line about 20° long.
5	Sun	Before dawn a thin sliver of the moon will trail Mars by 4.5°
8	**Wed**	**New Moon**
12	Sun	Moon is about 2° left of Pollux in Gemini
15	Wed	Moon at first quarter

NAVIGATING THE NIGHT SKY FOR APRIL



Download pdf here: https://www.astroleague.org/wp-content/uploads/2024/04/2024-April.pdf

NASA NIGHT SKY NOTES

Participate in Eclipse Science
By Kat Troche

April is NASA's Citizen Science Month, and there is no shortage of projects available. Here are some citizen science projects that you can participate in on April 8th, on and off the path of totality right from your smartphone!

Eclipse Soundscapes, ARISA Lab / NASA

Eclipse Soundscapes

Eclipse Soundscapes will compare data from a 1932 study on how eclipses affect wildlife – in this case, crickets. There are a number of ways you can participate, both on and off the path. NOTE: you must be 13 and older to submit data. Participants 18+ can apply to receive the free Data Collector kit. Learn more at: eclipsesoundscapes.org/

GLOBE Eclipse

Folks that participated in the GLOBE Eclipse 2017 will be glad to see that their eclipse data portal is now open! With the GLOBE Observer smartphone app, you can measure air temperature and clouds during the eclipse, contributing data to the GLOBE program from anywhere you are. Learn more at: observer.globe.gov/

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Participate in Eclipse Scinece Continued;

HamSCI, The University of Scranton / NASA

HamSCI

HamSCI stands for Ham Radio Science Citizen Investigation. HamSCI has been actively engaged in scientific data collection for both the October 14, 2023, annular solar eclipse and the upcoming April 8, 2024, total eclipse. Two major activities that HamSCI will be involved in around the solar events will be the Solar Eclipse QSO Party (SEQP) and the Gladstone Signal Spotting Challenge (GSSC) which are part of the HamSCI Festivals of Eclipse Ionospheric Science. Learn more about these experiments and others at: hamsci.org/eclipse

SunSketcher, Western Kentucky University / NASA

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
P.O. Box 2476
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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.