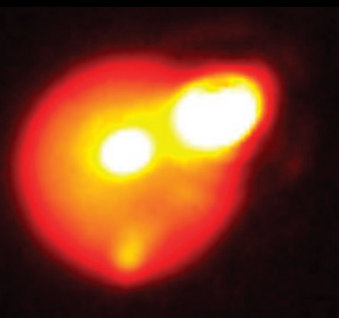


PRIMEFOCUS

Tri-Valley Stargazers



December 2014



Meeting Info

What:

Holiday Potluck Dinner

Who:

You, Family, and Friends

When:

December 19, 2014
Doors open at 6:30 p.m.
Dinner at 7:00 p.m.

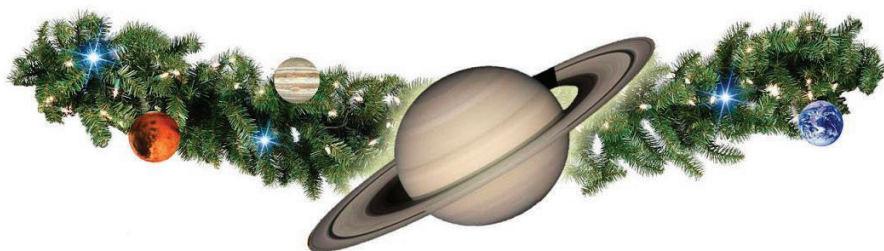
Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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NASA's Space Place	7
Membership/Renewal Application	8

December Meeting



Holiday Potluck Dinner

This month is our Holiday dinner. We'll be opening the doors at 6:30 to set up the tables and chairs, and then the feast will begin at 7pm. TVS will provide the drinks and paper/plasticware. Jill Evanko will be preparing the main course for this month's holiday celebration. This will consist of Chinese ribs and tri-tip roast. Those planning on attending are asked to contact Jill (secretary@trivalleystargazers.org) to indicate what type of side dish (green salad, potato, pasta, or rice) or dessert they will bring to the festivities. This will help ensure that a wide variety of treats will be shared, and provide a head count on the number of attendees expected so that we can plan appropriately. We look forward to sharing the holiday together.

2015 Dues Are Due

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. The term of membership is one calendar year - January through December.

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.

News & Notes

2014 and 2015 TVS Meeting Dates

The following lists the TVS meeting dates for 2014 and 2015. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	Board Meeting	Prime Focus Deadline
Dec. 19	Dec. 22	
Jan. 16	Jan. 19	Dec. 30
Feb. 20	Feb. 23	Jan. 30
Mar. 20	Mar. 23	Feb. 27
Apr. 17	Apr. 20	Mar. 27
May 15	May 18	Apr. 24
Jun. 19	Jun. 22	May 29
Jul. 17	Jul. 20	Jun. 26
Aug. 21	Aug. 24	Jul. 31
Sep. 18	Sep. 21	Aug. 28
Oct. 16	Oct. 19	Sep. 25
Nov. 20	Nov. 23	Oct. 30
Dec. 18	Dec. 21	Nov. 27

Money Matters

Treasurer Roland Albers indicates that as of November 24, 2014 the TVS checking account balance is: \$12,589.19.

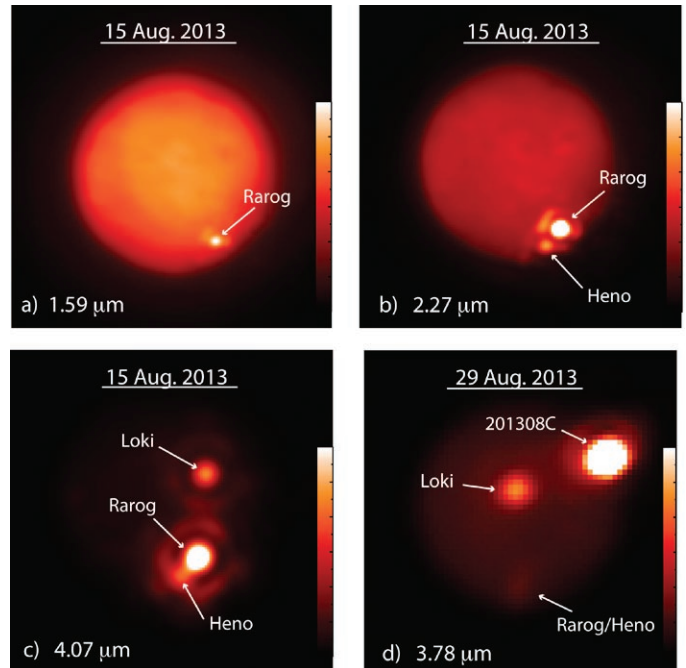
TVS Election: Welcome the Club Officers

The incumbents from 2014 ran unopposed, with Chuck Grant being re-elected as president, Jill Evanko as Secretary, and Roland Albers as Treasurer. With longtime club member Rich Combs coming on board as Vice-President, TVS now has a full slate of elected officers. Rich has also agreed to take on the Volunteer Position of Program Director. Additionally, Hilary Jones has taken on the role of Club Historian.

Journal Club By Ken Sperber

Io: Multiple Volcanic Outbursts

Io is the most geologically active body in the solar system. You probably remember the discovery image of volcanic activity on Io from the Voyager 1 flyby in 1979 that showed the profile of an erupting plume. The nearly constant resurfacing of Io through volcanic activity is maintained by tidal interactions with Jupiter. These tidal interactions arise due to Io's eccentric orbit that is maintained by resonant orbital interactions with Europa and Ganymede. The gravitational pull of Jupiter on Io varies due to Io's eccentric (non-circular) orbit, and this gives rise to tides on Io that are estimated to be 100 meters in height. This causes friction throughout Io, which in some locations heats the crust to 1000-2000K, with about 400 volcanoes currently active!



Caption: Images of Io obtained at different infrared wavelengths (in microns, μm , or millionths of a meter) with the W. M. Keck Observatory's 10-meter Keck II telescope on Aug. 15, 2013 (a-c) and the Gemini North telescope on Aug. 29, 2013 (d). The bar on the right of each image indicates the intensity of the infrared emission. Note that emissions from the large volcanic outbursts on Aug. 15 at Rarog and Heno Patera have substantially faded by Aug. 29. A second bright spot is visible to the north of the Rarog and Heno eruptions in c and to the west of the outburst in d. This hot spot was identified as Loki Patera, a lava lake that appeared to be particularly active at the same time. Image by Imke de Pater and Katherine de Kleer, UC Berkeley.

As seen in the figure above, an unprecedented series of large outbursts occurred on Io in August 2013. Fortunately, Prof. Imke de Pater of UC Berkeley and her team were in the midst of an Io observing campaign using the Keck II and Gemini North telescopes. Images obtained in the infrared were used to follow the temporal evolution of these outbursts. The August 15 Heno Patera outburst had an effective temperature of 720K over an area of 300 km^2 , and the Rarog Patera outburst had an effective temperature of 1040K over an area of 120 km^2 . Volcanic flow models indicate that these were fountain type eruptions, with the former eruption being no older than a few hours, while the latter eruption was no older than 4-5 minutes! The eruption of 201308C, observed on August 29, was one of the strongest eruptions ever observed on Io. It was estimated to have released 15-25 TeraWatts of energy, being 2-5x as energetic as the Heno and Rarog outbursts.

According to Prof. de Pater "The team hopes that monitoring

Header Image: The Aug. 29, 2013, outburst on Io was among the largest ever observed on the most volcanically active body in the solar system. Infrared image taken by Gemini North telescope, courtesy of Katherine de Kleer, UC Berkeley.

Journal Club (continued)

Io's surface annually will reveal the style of volcanic eruptions on the moon, constrain the composition of the magma, and accurately map the spatial distribution of the heat flow and potential variations over time. This information is essential to get a better understanding of the physical processes involved in the heating and cooling processes on Io."

For more information see: <http://newscenter.berkeley.edu/2014/08/04/a-hellacious-two-weeks-on-jupiters-moon-io/> <http://www.universetoday.com/113677/new-image-captures-one-of-the-brightest-volcanoes-ever-seen-in-the-solar-system/> and [http://en.wikipedia.org/wiki/Io_\(moon\)](http://en.wikipedia.org/wiki/Io_(moon))

Calendar of Events

December 6, January 3, 8:00-10:00pm

What: Lost in Space
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: \$30; does not include admission to the Center
Reservations: (510) 336-7373

Just like our public missions for families, but this one is strictly for adult flyers. Bring your friends and join an intrepid team to land on the red planet, construct a probe to send to one of the moons of Mars and save your crew from calamity. Grab your flight suit, strap on a helmet and experience the thrill and excitement of a NASA simulated space mission to Mars! Wine, beer and light snacks will be provided.

See <http://www.chabotspace.org/events.htm> for more information, or call (510) 336-7373.

December 8, 7:30pm

What: Exploring Alien Worlds

Who: Nick Cowan, Assistant Professor of Astronomy, Amherst College
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members \$8, Seniors \$10, General \$12. Reserve a space online or call 1-877-227-1831.

Thousands of planets orbiting other stars have been discovered since the 1990's. The existence of extrasolar planets confirms that planets are commonplace, but closer inspection of these planetary systems reveals that they are completely different from our Solar System. Cowan will discuss how we can observe the atmospheres of exoplanets with current and future telescopes, despite the fact that our targets are pale dots next to bright stars. Current observations of exoplanets are sufficient to infer clouds, winds, and greenhouse gases on these alien worlds. Evaluating the large-scale planetary climate for dozens (and soon hundreds) of worlds will eventually revolutionize our understanding of all planets, including Earth. Over the course of the presentation, we will explore what makes Earth habitable and will estimate the likelihood that similar climates exist on nearby exoplanets.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

December 9, Noon-1:00pm

What: Rosetta: Wild Bounce at Comet Churyumov-Gerasimenko
Who: Claudia J. Alexander, Jet Propulsion Laboratory
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Rosetta is the third cornerstone mission of the European Space Agency's (ESA) Horizon 2000 Programme. It's goals are to examine some of the original material of the solar system

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Officers

President:
Chuck Grant
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925-422-7278

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Webmaster:
Hilary Jones
webmaster@trivalleystargazers.org

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AANC Representative:
unfilled

**Astronomical League
Representative:**
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alrep@trivalleystargazers.org

Historian:
Hilary Jones
historian@trivalleystargazers.org

Refreshment Coordinator:
Laurie Grefsheim

Web & E-mail

www.trivalleystargazers.org
info@trivalleystargazers.org

TVS E-Group

So how do you join the TVS e-group, you ask? Just send an e-mail message to the TVS e-mail address (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 (continued)

with a comprehensive evaluation of the mineralogic, isotopic, and organic constituents of a comet; understand how the body works as a machine to absorb and re-radiate energy from the sun; and understand more about the origins of the solar system.

In this talk, I'll explain the science background of some of the mysteries of comets including pros and cons about why we think comets might have brought Earth's water, concepts regarding missing nitrogen in the outer solar system, and material the comet is made of (CAIs & IDPs). The talk will include early images of the comet's activity. I'll set the stage for the landing and walk through the 60 hours of time spent on the comet's surface. Finally I'll present an overview of initial findings.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

December 12, January 30, 10:00am

What: \$5 Fridays
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: \$5; Reservations: (510) 336-7373

Look out for our discounted days! \$5 Fridays are back this fall! On select days, enjoy the entire Center, including planetarium shows, for the price of a lunch value meal.

See <http://www.chabotspace.org/events.htm> for more information, or call (510) 336-7373.

December 16, 7:00pm

What: The Rosetta Lander (PHILAE) Mission: Landing on Comet 67P/Churyumov-Gerasimenko
Who: Jens Biele, DLR
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The Rosetta Lander, Philae, landed on 67P/Churyumov Gerasimenko on 12 November 2014. Before this could happen, a landing site had to be selected within just 2 months, based on data from the Rosetta Orbiter instruments and analyses on flight dynamics and illumination profiles. Philae was programmed to perform a First Scientific Sequence, immediately following touch down, and then enter its long term science mode.

The paper will report on the actual landing and the very first results. The landing was successful, though the operational sequences had to be modified ad hoc: Philae did not anchor upon first touchdown at 15:34:06 UTC but rebounded at least once, finally settling - fully operating all the while - at a place not ideal for long-term science. A wealth of science data has

been received.

Rosetta is an ESA mission with contributions from its member states and NASA. Rosetta's Philae lander is provided by a consortium led by DLR, MPS, CNES and ASI.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

December 18, Noon-1:00pm

What: Exploring the Inner Edge of the Habitable Zone in the Early Solar System
Who: Michael Way, Goddard Institute for Space Studies
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

3-D models can help explore the possible roles of rotation, atmosphere and ocean dynamical transports, cloud feedbacks and sea ice-albedo feedbacks in determining the habitability of a range of planetary environments. Using recent modifications to the Goddard Institute for Space Studies (GISS) IPCC AR5 General Circulation Model (GCM) we have explored the Inner Edge of the habitable zone (HZ) of our Solar System. We find that while Venus is currently outside the HZ, it may have been close to or within it early in Solar System history when the solar luminosity was lower and an ocean may have been present. The GISS GCM maintains habitable equilibrium surface temperatures for a solar constant 40% stronger than present day Earth (comparable to the Faint Young Sun at Venus' orbit) even if Venus rotated as rapidly as Earth early in its history. Stratospheric water vapor concentration is an order of magnitude smaller than the classical water loss limit for this simulation. We have also explored the parameter space in models with slower rotation rates. Our results are based on an atmosphere coupled to a 100m mixed layer ocean with no ocean heat transport. We are currently running the same experiments with with a fully coupled dynamic ocean. Negative cloud feedbacks due to increasing high, thick clouds in the tropics as the planet warms appear to be the stabilizing mechanism, along with maintenance of subsaturated water vapor by the general circulation.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

January 6, Noon-1:00pm

What: Effects of Relative Humidity and Clouds on the Inner Edge of the Habitable Zone
Who: Ramses Ramirez, Cornell University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The habitable zone (HZ) is the region around a star in which liquid water could exist on a planetary surface. Although 1-D

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models have been traditionally employed in HZ studies, recent investigations using 3-D models incorporate more realistic physics and self-consistently calculate both the effects of clouds and relative humidity. However, both parameters remain poorly understood, especially as applied to planetary atmospheres near the inner edge of the HZ. Thus, 1-D models remain indispensable for recognizing major trends and patterns that can then be analyzed more fully with more sophisticated models. I will present an updated 1-D climate model, coupled with results from other 1-D and 3-D studies, to assess the sensitivity of our Solar System's inner edge to changes in surface relative humidity and clouds. This novel relative humidity parameterization self-consistently calculates surface relative humidity and assumes tropospheric relative humidity gradually increases with temperature. These results show that treating relative humidity more realistically moderately increases the width of the habitable zone. Lastly, I discuss certain caveats regarding the effects of clouds on the inner edge boundaries.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

January 20, 12:00pm

What: A New Model for the Origin of Life: Coupled Phases and Combinatorial Selection in Fluctuating Hydrothermal Pools
Who: Bruce Damer and Dave Deamer, UC Santa Cruz
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Hydrothermal fields on the prebiotic Earth are candidate environments for biogenesis. We propose a model in which molecular systems driven by cycles of hydration and dehydration in such sites undergo chemical evolution and selection in a dehydrated surface phase followed by encapsulation and combinatorial selection in a hydrated phase. This model is partly supported by recent science, and lies partly in the realm of speculation including a hypothesized pathway for the parallel evolution of the functional machinery of life. Complex models like this present challenges for science in the 21st century and we will describe a new technology to enable the simulation of such models.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.



Image Caption: The attendees at the September 2014 meeting of the Tri-Valley Stargazers. This was a "Show and Tell" affair during which Ken Sperber spoke about his experiences with Astronomical League Observing Programs, and his development of an Arp Galaxy Observing Guide. Hilary Jones presented a discussion of the different classifications of Arp Peculiar Galaxies. Roland Albers showed a new focussing aid, the Bahtinov mask, that was developed by Pavel Bahtinov in 2008. Gert Gottschalck presented his images of recent solar activity and he also discussed different brands of hydrogen-alpha telescopes and filters. Don Dossa shared his initial impressions of an Orion zoom eyepiece. Fortunately, no one dropped the eyepiece that Don graciously passed around for examination. Image Credit: K. Harris

What's Up by Ken Sperber (adapted from S&T and The Year in Space)

All times are Pacific Standard Time.

December

- 5 Fri Aldebaran and the Hyades near the almost full Moon
- 6 Sat **Full Moon (4:27am)**
- 11-12 Thu- Jupiter above the waning gibbous Moon
- 13-14 Sat Geminid Meteor shower (all night, best before midnight Moon rise)
- 14 Sun **Last-Quarter Moon (3:51am)**
- 15 Mon Algol at minimum brightness for 2 hours centered on 7:22pm
- 21 Sun Winter begins at 3:03pm
- 21 Sun **New Moon (5:36pm)**
- 22 Mon Thin crescent Moon to the right of Venus in the low west-southwest (Binoculars needed, Dusk)
- 28 Sun **First-Quarter Moon with Uranus nearby (10:31am)**

January

- 3-4 Sat- Quadrantid meteor shower should peak between these two mornings
- 4 Sun **Full Moon (8:53pm)**
- 5 Mon Algol is at minimum for roughly two hours centered on 9:07pm
- 7 Wed Jupiter within 5 degrees of waning gibbous Moon
- 8-12 Thu- Mercury and Venus within 1 degree of each other in the southwest (early evening)
- 13 Tue **Last-Quarter Moon (1:46am)**
- 16 Fri Saturn within 2 degrees of waning crescent Moon
- 20 Tue **New Moon (5:14am)**
- 21 Wed Thin crescent Moon forms a triangle with Mercury and Venus (Binoculars needed, Dusk)
- 23 Fri Rare triple shadow transit of Jupiter (10:27-10:52pm; see January S&T, p. 49)
- 26 Mon **First-Quarter Moon (8:48pm)**
- 27 Tue Algol is at minimum for roughly two hours centered on 7:42pm



Where the Heavenliest of Showers Come From

By Dr. Ethan Siegel

You might think that, so long as Earth can successfully dodge the paths of rogue asteroids and comets that hurtle our way, it's going to be smooth, unimpeded sailing in our annual orbit around the sun. But the meteor showers that illuminate the night sky periodically throughout the year not only put on spectacular shows for us, they're direct evidence that interplanetary space isn't so empty after all!

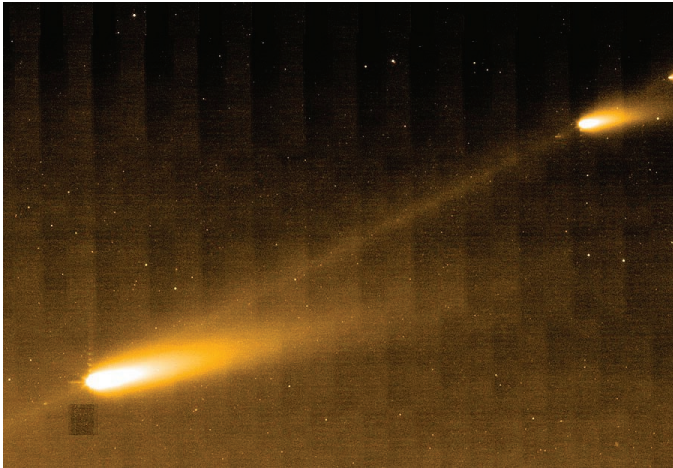


Image credit: NASA / JPL-Caltech / W. Reach (SSC/Caltech), of Comet 73P/Schwassman-Wachmann 3, via NASA's Spitzer Space Telescope, 2006.

When comets (or even asteroids) enter the inner solar system, they heat up, develop tails, and experience much larger tidal forces than they usually experience. Small pieces of the original object—often multiple kilometers in diameter—break off with each pass near the sun, continuing in an almost identical orbit, either slightly ahead-or-behind the object's main nucleus. While both the dust and ion tails are blown well off of the main orbit, the small pieces that break

off are stretched, over time, into a diffuse ellipse following the same orbit as the comet or asteroid it arose from. And each time the Earth crosses the path of that orbit, the potential for a meteor shower is there, even after the parent comet or asteroid is completely gone!

This relationship was first uncovered by the British astronomer John Couch Adams, who found that the Leonid dust trail must have an orbital period of 33.25 years, and that the contemporaneously discovered comet Tempel-Tuttle shared its orbit. The most famous meteor showers in the night sky all have parent bodies identified with them, including the Lyrids (comet Thatcher), the Perseids (comet Swift-Tuttle), and what promises to be the best meteor shower of 2014: the Geminids (asteroid 3200 Phaethon). With an orbit of only 1.4 years, the Geminids have increased in strength since they first appeared in the mid-1800s, from only 10-to-20 meteors per hour up to more than 100 per hour at their peak today! Your best bet to catch the most is the night of December 13th, when they ought to be at maximum, before the Moon rises at about midnight.

The cometary (or asteroidal) dust density is always greatest around the parent body itself, so whenever it enters the inner solar system and the Earth passes near to it, there's a chance for a meteor storm, where observers at dark sky sites might see thousands of meteors an hour! The Leonids are well known for this, having presented spectacular shows in 1833, 1866, 1966 and a longer-period storm in the years 1998-2002. No meteor storms are anticipated for the immediate future, but the heavenliest of showers will continue to delight sky-watchers for all the foreseeable years to come!

What's the best way to see a meteor shower? Check out this article to find out: <http://www.nasa.gov/jpl/asteroids/best-meteor-showers>.

Kids can learn all about meteor showers at NASA's Space Place: <http://spaceplace.nasa.gov/meteor-shower>.



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

Tri-Valley Stargazers Membership Application

(or apply for membership online: www.trivalleystargazers.org/membership.shtml)

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 (\$5). Must be a full-time high-school or college student.

_____ Regular member (\$30).

_____ Patron member (\$70). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

Hidden Hill Observatory Access (optional):

_____ 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.

Magazine Subscriptions (optional): Discounted subscriptions are available only to new subscribers. All subsequent renewals are handled directly with the magazine publishers.

_____ One-year subscription to Sky & Telescope magazine (\$32.95).

_____ One-year subscription to Astronomy magazine (\$34).

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 other than other club members and the Astronomical League without your express permission.

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