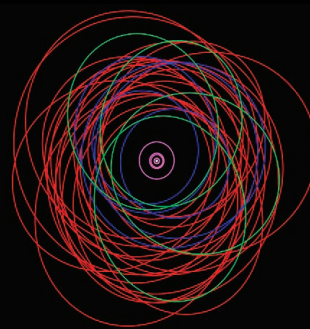


PRIMEFOCUS

Tri-Valley Stargazers



March 2015



Meeting Info

What:

Citizen Science to the Rescue!

Who:

Todd Rigg-Carriero, M.S.,
City College of San Francisco

When:

March 20, 2015
Doors open at 7:00 p.m.
Meeting at 7:30 p.m.
Lecture at 8:00 p.m.

Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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March Meeting

Citizen Science to the Rescue!

Todd Rigg-Carriero, M.S.

In today's highly technological world, having our students graduate with a degree in some aspect of science is crucial. However, opposing this is our country's preoccupation with standardization. The 'one size fits all' education model we currently have isn't about creating innovative thinkers; it is pandering to a common denominator. Instead, we should be personalizing our education system by striving to create a meaningful learning experience for students based on depth of inquiry, collaboration through trust and creativity, and development into capable, adaptable citizens of the world. We should use real tools, real materials, and real problems to encourage students' love of learning, curiosity about the world, ability to engage, tenacity to think big, and persistence to do amazing things. One small contribution to that goal are Citizen Science projects which use real data exploring real problems that anyone can use including and especially grade-schoolers.

Todd Rigg Carriero is an astronomy instructor at City College of San Francisco. He received his M.S. in Astronomy and Astrophysics from the University of Michigan in 2002 and has been educating students of all ages ever since. Apart from introducing the value of critical thinking to hoards of young adults, he can frequently be found giving astronomy night and science education policy presentations to K-12 schools around the Bay Area. Engaging kids in summer camp activities is also a special treat. He is credited with taking the discovery images of two of Saturn's moons: S/2000 S3 "Siarnaq", S/2000 S4 "Tarvos" (see the header image, provided by Dr. S. Sheppard, for a top-down view of the orbits of Saturn's moons). Todd currently resides in Livermore with his wife, second grader, a huge kitten, and three fish.

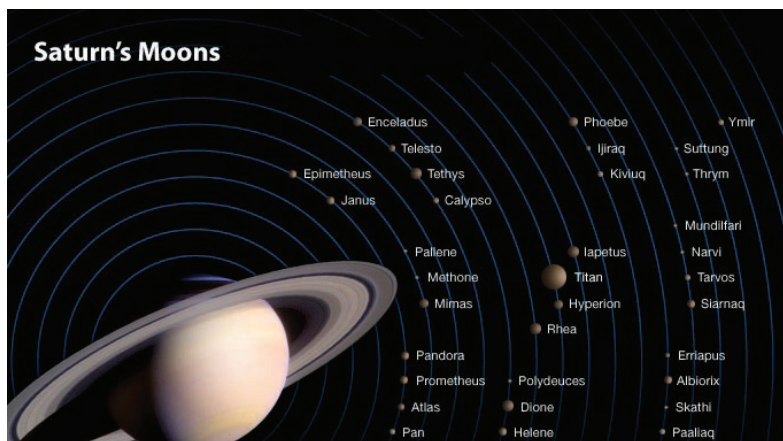


Image Caption: Siarnaq and Tarvos are two of Saturn's 53 named moons. Siarnaq is about 19 miles in diameter, taking 895 days to orbit Saturn. Tarvos is about 8 miles in diameter, taking 926 days to orbit Saturn. Credit: NASA JPL-Caltech, see: <http://saturn.jpl.nasa.gov/science/moons/>

News & Notes

2015 TVS Meeting Dates

The following lists the TVS meeting dates for 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
Mar. 20	Mar. 23	
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 reports that as of February 23, 2015 the TVS checking account balance is: \$13,537.88.

TVS to Purchase a Solar Telescope

The TVS board approved the purchase of a solar telescope for the club. We will be purchasing a Lunt LS60THa, a 60mm solar telescope with an integrated pressure-tuned Hydrogen-alpha filter. The club will primarily use the Lunt telescope for outreach programs, but it will also be available as a loaner telescope to members in good standing. The telescope is currently on back-order, so an arrival date is not yet available. Donations towards the purchase of this club asset would be very welcome.

Upcoming Star Parties: Volunteers Needed

March 21, St. Isadore's Catholic School in San Ramon: Club Star Party Coordinator Eric Dueltgen requires your assistance in participating in the Saturday, March 21 star party at the St. Isadore's Catholic School in San Ramon. A large number of scopes will be needed for the big group of students.

April 23, Mendenhall Middle School in Livermore: Rich Combs is capping off his Project ASTRO Partnership with Katie Smiley at Mendenhall Middle School with a star party on Thursday, April 23. Katie teaches four eighth-grade classes with 25-30 students in each class. Rich anticipates a good crowd, including family members. Currently we plan to be on the grass of El Padro Park, just north of Mendenhall School. Sunset is at 7:43. The tentative time is from 7:45 to 9:15pm. Venus, Jupiter and a crescent Moon will all put in an appearance. Any and all Tri-Valley Stargazers are invited, with or without a scope. Unaided eye and binocular objects would be a nice addition to the usual scope treats. Details will appear in the April TVS newsletter.

If you can be of assistance in sharing the excitement of astronomy with interested minds, please contact Eric to volunteer your assistance (coordinator"at"trivalleystargazer.s.org).

TVS Yosemite Star Party

Bob McKoon will be coordinating this year's TVS star party at Glacier Point, Yosemite National Park. We were lucky in drawing the nearly-new Moon weekend of July 17-18. TVS members who bring telescopes for public observing will receive free camping at the Bridalveil campgrounds. The Moon, with ~6% of the disk visible, will set by 10pm. On these dates sunset occurs at about 8:25pm with sunrise at about 6:00am. Contact Bob for more information (rmckoon"at"yahoo.com).

TVS H2O Open House Star Parties

The dates for this year's Open House Star Parties at H2O are Saturday, May 9 and Saturday, August 8. As usual we will be meeting at the corner of Mines Road and Tesla Road and car-avanning to the observing site. More details will be included in the April and July newsletters.

Journal Club By Ken Sperber

Gravitational Lensing of Supernova Refsdal

Einstein's General Theory of Relativity posits that the warping of space-time by massive objects can result in a gravitational lens that can magnify the light of more distant objects, thus making visible what would otherwise be too dim to be seen. Depending on the distance between the gravitational lens and the more distant object, and how closely they are aligned along our line-of-sight, the resulting lensed image of the distant object can take on different appearances, such as multiple distorted images of the object, including the possibility of concentric rings surrounding the gravitational lens, termed an Einstein Ring, or in rare cases as 4 images in the shape of a cross, known as an Einstein Cross.

Typically, the lensed object is a Quasar, the extremely bright core of a galaxy in which the supermassive black hole is voraciously feeding. For the first time, this past November, multiple images of a supernova that is 9.3 billion light years distant have been observed thanks to gravitational lensing of an elliptical galaxy in the cluster MACS J1149.6+2223, which is 5 billion light years from Earth. As seen in the Hubble Space Telescope image on p.3, Supernova Refsdal is seen as an Einstein cross. What's more interesting is that the light paths of each of the 4 images of the supernova are of different lengths such that each image shows the supernova explosion at different times relative to the actual explosion, the time difference being days to weeks between the images.

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Header Image: The orbits of Saturn's moons. Saturn and its rings are at the very center of the image. Image Credit: Dr. Scott Sheppard. See: <http://home.dtm.ciw.edu/users/sheppard/satellites/satsatdata.html>

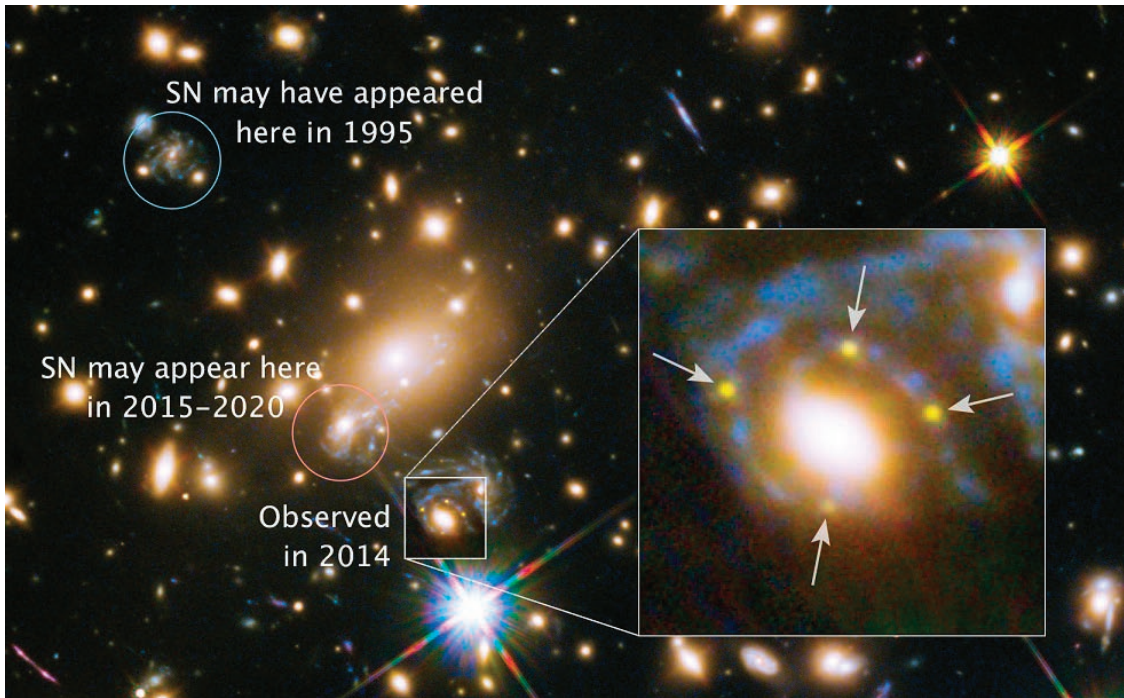


Image Caption: The inset elliptical galaxy is acting as a gravitational lens, magnifying the light of a more distant supernova. The alignment of the supernova relative to elliptical galaxy is such that 4 images of the supernova are visible as an Einstein cross. The mass of the galaxy cluster is lensing the supernova host galaxy producing multiple images of the host galaxy within the field of view. Credit: NASA, ESA, and S. Rodney (JHU) and the FrontierSN team; T. Treu (UCLA), P. Kelly (UC Berkeley), and the GLASS team; J. Lotz (STScI) and the Frontier Fields team; M. Postman (STScI) and the CLASH team; and Z. Levay (STScI)

If that isn't bizarre enough, the mass of the galaxy cluster is also acting as a gravitational lens, producing multiple images of the supernova host galaxy. Modelling of the light paths for each of the host galaxy images suggests that the supernova would have been visible in 1995 in one of the lensed images. More fun is the prediction that Supernova Refsdal will become visible within 5 years in one of the other lensed images! What a neat result to celebrate the 100th anniversary of the publication of the General Theory of Relativity.

For more information see: <http://hubblesite.org/newscenter/archive/releases/2015/08/full/>

Calendar of Events

March 17, 12:00pm

What: Starspots and the Dynamic Evolution of Hot-Jupiter Exoplanet Systems

Who: Jeremy Tregloan-Reed, NASA Ames

Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA

Cost: Free

When a hot-Jupiter transits its host star and crosses an ac-

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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)

tive region there is a possibility that it will occult a starspot. When this happens a starspot anomaly is usually seen in the resulting transit light curve. Generally viewed as a nuisance, the most common approach is to remove the affected data points before performing an analysis to determine the light-curve properties. However, when a starspot anomaly is found in transit photometry it can allow a wealth of information to be discovered. Apart from determining the physical properties of the starspot (such as position, size and temperature) if a starspot anomaly is found in two sets of transit photometry and is due to the same starspot it is then possible to determine the stellar rotation period at the given latitude of the starspot. It is also possible to measure the sky-projected stellar obliquity of the system which can then begin to shed some light on the primary mechanism of the dynamical evolution of the system.

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

March 24, 12:00pm

What: The Dynamics of the Yellowstone Hydrothermal System
Who: Shaul Horowitz, USGS
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The Yellowstone Plateau Volcanic Field is characterized by extensive seismicity, episodes of uplift and subsidence, and a hydrothermal system that comprises more than 10,000 thermal features. Some of the recent advances include more refined geophysical images of the magmatic system, characterization of fluid sources and water-rock interactions, quantitative estimates of heat and magmatic volatile fluxes, discovering and quantifying the role of thermophile microorganisms in the geochemical cycle, defining possible links between hydrothermal activity, deformation, and seismicity; quantifying the dynamics of geyser eruptions, and the discovery of extensive hydrothermal activity in Yellowstone Lake.

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

March 27 (6:45pm), April 3 (6pm)

What: Night Hikes
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: \$14, does not include general admission; RSVP recommended, space limited, register online or call (510) 336-7373

Enjoy a hike through the beautiful redwoods! After the hike, stay and explore other amazing objects in the night sky

through our telescopes (weather permitting) or tour the Telescope Makers Workshop. Hike will take place rain or shine.

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

March 31, 12:00pm

What: Saturn's Rings: An Accessible Astrophysical Disk
Who: Matthew Tiscareno, Cornell University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Saturn's ring system is an astrophysical disk that is neither light-years away nor billions of years in the past. We can visit this disk at close range and observe a number of phenomena that also operate in disks of other kinds. As a result, we see small-scale processes that shape ring texture, connect those processes to the bodies and structures that cause them, and watch closely as the disk changes with time.

We will discuss recent Cassini observations that elucidate disk processes including 1) "self-gravity wakes" and "spiral density waves," both of which were originally proposed for galaxies but are observed with exquisite precision in Saturn's rings, 2) "propeller" features caused by 100-meter to km-sized moonlets embedded in the disk; these are the first objects ever to have their orbits tracked while embedded in a disk, rather than orbiting in free space, and hold the potential of deepening our understanding of planetary migration, and 3) irregular edge shapes in the gaps opened up by larger moons (10 km and more), which may hold clues to angular momentum transport.

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

April 4, 7:30pm - 10:30pm

What: Lost in Space
Who: East Bay Astronomical Society
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Age 21+ only, \$30 (does not include general admission)

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.

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Image Caption: Inspired by Roland's "What's Up?" presentation about the Open Clusters in Auriga at the February TVS Meeting, Forest Tanaka "got very excited about capturing one," and he did so that very night. Forest used an 8" Newtonian and Canon 5D Mark II at ISO 1600 on a Celestron AVX mount to take 64 30-second subframes for generating the above image.



Image Caption: At the February TVS meeting, Ken Sperber, Hilary Jones, and Roland Albers received Astronomical League awards for completing the Planetary Nebulae Observing Program, the Arp Galaxy Imaging Program, and the Double Star Observing Program, respectively. The awards, consisting of a certificate and a pin, were presented by Dennis Beckley, the TVS Astronomical League coordinator. Dennis reviewed the observing/imaging reports of Ken, Hilary, and Roland prior to submitting them to the relevant Astronomical League program coordinators for final approval. The awards will be noted online in the respective observing program webpages, and in an upcoming issue of "Reflector," the magazine of the Astronomical League. Dennis indicated that there are nearly 50 Astronomical League observing/imaging programs that cover a broad range of topics for beginning, intermediate, and advanced amateur astronomers. See: <https://www.astroleague.org/al/obsclubs/AlphabeticObservingClubs.html>

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

All times are Pacific Daylight Time.

March

- 8-23 Sun- Zodiacal light visible in the west (80 minutes after sunset)
- 13 Fri **Last-Quarter Moon (10:48am)**
- 20 Fri **New Moon (2:36am)**
- 20 Fri Spring begins in the Northern Hemisphere (3:45pm)
- 21 Sat Thin crescent Moon less than 3 degrees from Mars. Both are below Venus in the west (evening)
- 22 Sun The crescent Moon is about 4 degrees away from Venus (evening)
- 24 Tue The Moon crosses the Hyades Star Cluster
- 27 Fri **First-Quarter Moon (1:43am)**
- 29 Sun Algol is at minimum for roughly two hours centered on 1:58am

April

- 3 Fri Algol is at minimum for roughly two hours centered on 7:37pm
- 4 Sat **Full Moon (5:05am), lunar eclipse visible, Moon sets while leaving penumbra**
- 8 Wed Saturn about 3 degrees from waning gibbous Moon
- 10-12 Fri- Venus about 3 degrees away from The Pleiades (evening)
- 11 Sat **Last-Quarter Moon (8:44pm)**
- 18 Sat **New Moon (11:57am)**

Calendar of Events (continued)

April 6, 7:30pm

- What: Celebrating 25 Years of the Hubble Space Telescope
- Who: Paul Scowen, Arizona State University
- 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.

As we approach the 25th Anniversary of the launch of the Hubble Space Telescope, we will use one of the most iconic images taken with the Observatory, that of the Eagle Nebula, or the Pillars of Creation, to outline a story about star and planet formation. The resolution of Hubble has allowed us to see things moving over the 20-25 years of its mission lifetime. In this presentation we will revisit many of the images taken of galactic nebulae with a view to understanding what they tell us about the process of forming a star and its attendant planetary system, and to understand the physics of these processes. In the particular case of looking at star formation around the most massive of stars, we will be looking back at our origins as we discuss evidence that shows it

was just this kind of environment in which our own Sun and our Solar System formed. Join us for an intimate look at the environment of a stellar nursery and an intriguing connection with the conditions under which our own planet may have formed, all while enjoying some of the best images the Hubble Space Telescope has taken over the past 25 years.

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

April 8, 7:00pm

- What: The DAWN Mission to Explore Dwarf Planet Ceres
- Who:
- Where: Smithwick Theatre, 12345 El Monte Road, Los Altos Hills, CA 94022
- Cost: Free, \$3 parking (\$1 dollar bills or coin required)

Abstract pending.

For more information see: http://www.foothill.edu/news/newsfmt.php?sr=2&rec_id=3359 or phone 650-949-7888.



The Heavyweight Champion of the Cosmos

By Dr. Ethan Siegel

As crazy as it once seemed, we once assumed that the Earth was the largest thing in all the universe. 2,500 years ago, the Greek philosopher Anaxagoras was ridiculed for suggesting that the Sun might be even larger than the Peloponnesus peninsula, about 16% of modern-day Greece. Today, we know that planets are dwarfed by stars, which themselves are bound together by the billions or even trillions into galaxies.



Image Caption: 10 billion light-years distant, El Gordo is the most massive galaxy cluster ever found. X-rays are shown in pink from Chandra; the overall matter density is shown in blue, from lensing derived from the Hubble space telescope. Image credit: NASA, ESA, J. Jee (UC Davis), J. Hughes (Rutgers U.), F. Menanteau (Rutgers U. and UIUC), C. Sifon (Leiden Observatory), R. Mandelbum (Carnegie Mellon U.), L. Barrientos (Universidad Catolica de Chile), and K. Ng (UC Davis).

But gravitationally bound structures extend far beyond galaxies, which themselves can bind together into massive clusters across the cosmos. While dark energy may be driving most galaxy clusters apart from one another, preventing our local group from falling into the Virgo Cluster, for example, on occasion, huge galaxy clusters can merge, forming the largest gravitationally bound structures in the universe.

Take the “El Gordo” galaxy cluster, catalogued as ACT-CL J0102-4915. It’s the largest known galaxy cluster in the distant universe. A galaxy like the Milky Way might contain a few hundred billion stars and up to just over a trillion (10^{12}) solar masses worth of matter, the El Gordo cluster has an estimated mass of 3×10^{15} solar masses, or 3,000 times as much as our own galaxy! The way we’ve figured this out is fascinating. By seeing how the shapes of background galaxies are distorted into more elliptical-than-average shapes along a particular set of axes, we can reconstruct how much mass is present in the cluster: a phenomenon known as weak gravitational lensing.

That reconstruction is shown in blue, but doesn’t match up with where the X-rays are, which are shown in pink! This is because, when galaxy clusters collide, the neutral gas inside heats up to emit X-rays, but the individual galaxies (mostly) and dark matter (completely) pass through one another, resulting in a displacement of the cluster’s mass from its center. This has been observed before in objects like the Bullet Cluster, but El Gordo is much younger and farther away. At 10 billion light-years distant, the light reaching us now was emitted more than 7 billion years ago, when the universe was less than half its present age.

It’s a good thing, too, because about 6 billion years ago, the universe began accelerating, meaning that El Gordo just might be the largest cosmic heavyweight of all. There’s still more universe left to explore, but for right now, this is the heavyweight champion of the distant universe!

Learn more about “El Gordo” here: <http://www.nasa.gov/press/2014/april/nasa-hubble-team-finds-monster-el-gordo-galaxy-cluster-bigger-than-thought/>

El Gordo is certainly huge, but what about really tiny galaxies? Kids can learn about satellite galaxies at NASA’s Space Place <http://spaceplace.nasa.gov/satellite-galaxies/>. Kids can learn about satellite galaxies at NASA’s Space Place <http://spaceplace.nasa.gov/satellite-galaxies/>.



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.