

PRIME FOCUS

Tri-Valley Stargazers

September 2006



Meeting Info:

What

Scope Maintenance

Who

TVS Members

When

September 15, 2006
Conversation at 7:00 p.m.
Lecture at 7:30 p.m.

Where

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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September Meeting

Scope Maintenance

TVS Members

It's been a while since we've done a scope maintenance night. We thought it might be a good idea to run it again, for those who may have purchased a scope during this summer observing season and are still trying to figure out how it works. Or if you're thinking of purchasing a scope and aren't quite sure what to look for.

Telescope ownership requires some effort on the owner's part to keep the scope running and in good overall shape. A well maintained telescope can last a lifetime and bring the owner many years of faint fuzzy hunting.

Does your scope need to be collimated, but you're not really sure how that is done? Does your GoTo scope need a little help in figuring out where it is, but you're not sure what stars to use to orient the scope? And what do those funny lines and numbers encircling the mount mean—you know, the parts that say "RA" and "Dec" ? Just how *are* you supposed to use those?

This will be the night for everyone to bring their scopes and learn how to best optimize what they have. We'll have a few of our loaner scopes out as test models as well. TVS has a lot of experienced scope makers and tinkerers who will be able to help you get the most out of your scope.



The TVS Yosemite Star Party. Clear dark skies could be found at 7,214'. Photo: Dave Feindel

News & Notes

2006 TVS Meeting Dates

Below are the TVS meeting dates for the next few months. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting. The *Prime Focus* deadline applies to that month's issue (e.g., the November 5th deadline is for the November issue).

Lecture Meeting	Board Meeting	Prime Focus Deadline
Sept. 15	Sept. 18	Sept. 3
Oct. 20	Oct. 23	Oct. 8
Nov. 17	Nov. 20	Nov. 5
Dec. 15	Dec. 18	Dec. 3

Money Matters

Treasurer **David Feindel** reports the TVS account balances (as of August 21, 2006):

Checking	\$3,233.94	
CD #1	\$3,556.37	matures 11/17/06
CD #2	\$2,496.46	matures 8/27/06

November Elections

The TVS elections will be here before you know it, so we thought we'd get a jump on recruiting volunteers to take on some of the officer and board positions in the club.

Any member can run for any office or to be on the board. All you need to do is to notify any existing officer or board member and they will add your name to the ballot. You don't have to have experience, just a desire to help the club. Candidates for officer or board member positions will be voted for at the November meeting.

We are in need of more Board Members. The Board meets monthly in Livermore on the Monday after the general meeting to discuss club related business and to make decisions regarding the future of the club. Meetings usually last a couple of hours.

We are especially in need of someone to take on the unfilled tasks of Secretary and Program Director. The Secretary's duty is primarily to attend the board meetings and take the minutes, type them up and distribute them at the next board meeting. Occasionally, the Secretary would need to respond to some club related correspondence.

The Program Director is in charge of finding speakers for the monthly meetings. The Bay Area has a wealth of potential speakers from such places as the Lawrence Livermore and Berkeley Labs, NASA Ames, and UC Berkeley, to name just a few. What's needed is someone to contact the various places and wrangle a speaker. We need 10 speakers a year (the other two months of the year are our potluck dinners). This position is very important, and

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Calendar of Events

September 11, 7:30 p.m.

What: *Exploration of a New World*

Who: Dr. Charles Wood (Wheeling Jesuit University & Titan Radar Mapper Team)

Where: Kanbar Hall, Jewish Community Center, S.F.

Cost: \$4.00 at the door or by mail

Titan is the largest piece of unexplored real estate in the solar system. It is bigger than the planet Mercury and has a dense atmosphere. The Cassini radar instrument is discovering volcanoes, river channels and dunes - features that make Titan the most Earth-like object in the solar system.

All programs begin at 7:30 pm in Kanbar Hall at the Jewish Community Center of San Francisco, 3200 California Street. Parking is available across the street in the UCSF Laurel Heights campus parking lot for \$1.25 per night. Parking in the JCC garage is \$1.25 per half-hour. The #1 California, #3 Jackson, #4 Sutter, and #43 Masonic MUNI lines stop directly in front of the building. The #38 Geary and #24 Divisadero buses stop only a few blocks away.

September 15 and 16, 7:00 p.m.

What: *Music of the Spheres*

Who: Various musicians and speakers

Where: Lick Observatory, Mt. Hamilton

Cost: Varies

Friday, September 15 and Saturday, September 16 are the last two evenings for this summer's Music of the Spheres concerts at Lick Observatory. Tickets are still available. Visit www.ucolick.org/public/music.html for more information. Doors open at 7:00 pm, concerts start at 7:30 pm

Come up and enjoy a concert, pick up a wine glass or coffee mug, attend a science lecture, view through the 36" refractor, go outside to enjoy the view and look through the telescopes brought up by our volunteers. If you do purchase tickets, consider coming up early and enjoy your dinner on the mountain top! Also even though it might be 90 degrees or warmer in the valley, you just never know what the temperature will be on the mountain top — bring a sweater, jacket, or sweatshirt just in case! And a full tank of gas! (There is no public gas station on Mt Hamilton.)

The concerts are as follows:

Newsletter header image: M13 (NGC6205) and NGC6207

M13 is one of the brighter globular clusters seen from the Northern Hemisphere. In this image, you can also see the galaxy NGC6207 in the lower left of the picture. M13 is located in Hercules, about 25,000 ly away, and contains around 200,000 stars.

Image was taken September 3, 2006, with a Takahashi FS-102 at f/6, LRGB (2x10 minutes).

Photo: Ken Sperber

September 15 (Friday)

Great Guitars: Daniel Roest (www.danielguitar.com) and Muriel Anderson (www.murielanderson.com/index.html). Classical guitarist Daniel Roest opens for prolific songwriter and vocalist Muriel Anderson. A highly skilled instrumentalist, Muriel is the first woman to win the National Fingerpicking Guitar Championship. She performs folk, classical, bluegrass, and international music on nylon, steel-string, and harp-guitars. With sense of humor and a contagious joy of music, she charms audiences worldwide. Her recordings have also “circled the globe” entertaining Space Shuttle astronauts.

Black Holes: Hearts of Darkness

Speaker: Alex Filippenko (http://astro.berkeley.edu/faculty_pgs/filippenko.html)

Doors open: 7:00 pm, Concert starts: 7:30 pm

September 16 (Saturday)

Great Guitars: Daniel Roest (www.danielguitar.com) and Peppino D’Agostino (www.peppinodagostino.com/press_bio_us.htm). Classical guitarist Daniel Roest opens for Peppino D’Agostino, a world-class solo fingerstyle guitarist and composer. A charismatic entertainer, Peppino plays steel string guitar with dazzling virtuosity. His repertoire includes contemporary acoustic, classical, open tuning, and percussive music with influences as diverse as Paco de Lucia’s flamenco and the Beatles’ pop sensibility. Peppino has produced eleven CDs and has collaborated and performed with various rock and jazz icons.

New Worlds, Yellowstone, and Life in the Universe

Speaker: Geoff Marcy (<http://astro.berkeley.edu/~gmarcy>)

September 22, 8:00 to 11:00 p.m.

What: *Lunar Lounge Express*

Who: Kevin Beadles Band

Where: Chabot Space & Science Center, Oakland

Cost: \$15 adults, \$10 student

Party under the stars and enjoy an evening of live music, a *SonicVision* planetarium show, telescope viewing, hands-on exhibits, giveaways and outta-this-world fun! Enjoy food from our Celestial Café, along with refreshments from the cash bar.

The musical guest is the Kevin Beadles Band, a rootsy American rock providing a rock ‘n’ roll soundtrack for unreleased Western movies. The sound is big, open and lyrical.

Tickets available at the Chabot Box Office, 510-336-7373.

September 23, 8:00 p.m.

What: *Latest Results From the Huygens’ Mission to Titan*

Who: Dr. Chris McKay (NASA-Ames)

Where: Mt. Tamalpais Mt. Theater (www.mttam.com)

Cost: Free

Last year the Huygens Probe landed successfully on Titan, the largest moon of Saturn. What we saw was not what we expected. Hear the latest results from the analysis of the data from the Probe.

The program is FREE and open to the general public. Families, students and youth groups are encouraged to attend. The Madrone Picnic area is reserved from 6:30 p.m. and the talk will be followed by telescope viewing in the Rock Spring Parking Area until around 11:30 p.m. Dress

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<p>Officers</p> <p>President: Chuck Grant cg@fx4m.com 925-422-7278</p> <p>Vice-President: Rich Campbell r_photon@yahoo.com</p> <p>Treasurer: David Feindel feindel1@comcast.net</p> <p>Secretary: Debbie Dyke (acting secretary)</p> <p>Board of Directors Alane Alchorn, Jim Alves, Debbie Dyke, Gert Gottschalk, Stan Isakson, Mike Rushford, John Swenson.</p>	<p>Volunteer Positions</p> <p>Librarian: Jim Alves jim_alves_engr@yahoo.com 209-833-9623</p> <p>Newsletter Editor: Debbie Dyke astrodeb@comcast.net 925-461-3003</p> <p>Program Director: unfilled</p> <p>Loaner Scope Manager: John Swenson johnswenson1@comcast.net</p> <p>Webmaster: Chuck Grant</p> <p>Observatory Director/ Key Master: Chuck Grant</p> <p>School Star Party Chair: Rich Campbell r_photon@yahoo.com</p>	<p>Public Star Party Chair: Rich Campbell</p> <p>Historian: Debbie Dyke</p> <p>Mentor: Mike Rushford rushford@eyes-on-the-skies.org</p> <p>Addresses <i>Mailing:</i> Tri-Valley Stargazers P.O. Box 2476 Livermore, CA 94551</p> <p><i>Lecture Meeting:</i> Unitarian Universalist Church 1893 N. Vasco Road, Livermore</p> <p><i>Board & Discussion Meetings:</i> Round Table Pizza 1024 E. Stanley Blvd., Livermore</p>	<p>Web & E-mail www.trivalleystargazers.org tvs@trivalleystargazers.org</p> <p>Eyes on the Skies Eyes on the Skies is a robotic solar telescope run by Mike Rushford (rushford@eyes-on-the-skies.org). You may access it by visiting www.eyes-on-the-skies.org.</p> <p>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 (tvs@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.</p>
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News & Notes *continued*

warmly and bring a flashlight. Carpool if possible.

Sponsored by your State Park, assisted by the Mount Tamalpais Interpretive Association and telescopes courtesy of the San Francisco Amateur Astronomers.

If the weather is iffy the day of the program, call the hotline 415-455-5370. The message changes around 3:00 p.m., but only if there is a cancellation. If the programs will go as scheduled the tape will not be updated. You can also check with SFAA at 415-289-NOFOG.

September 24, 4:00 p.m.

What: *Are We Still Dinosaurs? The Asteroid Test*

Who: Rusty Schweickart

Where: Chabot Space & Science Center, Oakland

Cost: \$15 adults, \$10 student

Rusty Schweickart, Apollo 9 Astronaut and Chairman of the Association of Space Explorers Committee on Near Earth Objects will present a talk about the risk to Earth from Near Earth Objects and the things we can do to protect the Earth from the next big cosmic collision.

October 4, 7:00 - 8:30 p.m.

What: *Dark Energy & the Runaway Universe*
Astronomy

Who: Alex Filippenko (UC Berkeley)

Where: Foothill College, Los Altos

Cost: Free (parking is \$2)

Astronomer Alex Filippenko of the University of California, Berkeley, will present *Dark Energy & the Runaway Universe*, a non-technical, illustrated talk Wednesday, Oct. 4, at 7 p.m. in the Smithwick Theater for Foothill College in Los Altos Hills. No background in science is required for this talk. Arrive early to locate parking and the theater. Visitors must purchase a parking permit for \$2 (eight quarters).

In 1998, observations of very distant exploding stars provided intriguing evidence that the expansion of the entire Universe is speeding up with time, rather than slowing down due to gravity as expected. Today, new and completely independent observations strongly support this amazing conclusion. Over the largest scales of space, our Universe seems to be dominated by a repulsive “dark energy” stretching the very fabric of space itself.

Dr. Filippenko, who is a leader in the group that has made some of these remarkable observations, will give us a progress report on our “runaway universe.” He is Professor of Astronomy at U.C. Berkeley, has written about 500 papers in astronomical publications, and has been voted the “Best Professor” on campus five times. He has been featured in three astronomy video courses published by The Teaching Company, and won the 2004 Carl Sagan Prize for Science Popularization. Co-sponsored

by Foothill College Astronomy Program, NASA Ames Research Center, SETI Institute and Astronomical Society of the Pacific.

For more information, phone 650-949-7888.

October 9, 7:30 p.m.

What: *Seeing the Sky with Gamma-ray Eyes*

Who: Dr. Steve Ritz, (NASA Goddard Space Flight Center and University of Maryland)

Where: Kanbar Hall, Jewish Community Center, S.F.

Cost: \$4.00 at the door or by mail

Gamma rays reveal the most powerful processes in the Universe, including black holes, neutron stars, and other amazing objects, and they allow us to test some basic laws of physics in unique ways. The Gamma-ray Large Area Space Telescope (GLAST) will be launched next year. Together with other facilities, GLAST will open a wide new window on the high-energy sky. This talk will introduce the main scientific questions in this area, along with the opportunities for discovery.

All programs begin at 7:30 pm in Kanbar Hall at the Jewish Community Center of San Francisco, 3200 California Street. Parking is available across the street in the UCSF Laurel Heights campus parking lot for \$1.25 per night. Parking in the JCC garage is \$1.25 per half-hour. The #1 California, #3 Jackson, #4 Sutter, and #43 Masonic MUNI lines stop directly in front of the building. The #38 Geary and #24 Divisadero buses stop only a few blocks away.

Astro Events

Jupiter Transits

This is pretty much it for the Jupiter observing season. Below is a few listings of transit times for various Jupiter related objects. The abbreviations are fairly straight forward: G=Ganymede, C=Callisto, I=Io, E=Europa, GRS=Great Red Spot, and if you see a ‘s’ next to one of the moons, it means its shadow (e.g., Cs=Callisto’s shadow); na means Jupiter is below the horizon or it is daylight at that time.

September

Thurs 7	E	na	na	8:22p
	Is	na	na	8:50p
	Es	8:00p	9:00p	na
	GRS	na	na	8:50p
Sat 9	GRS	na	8:15p	na
Thurs 14	GRS	na	na	9:28p
	I	na	na	na
	E	8:32p	na	na
	Es	8:37p	9:30p	na

Astronomical insights

by David Feindel



The Astro Wizard does his magic. Photo: Dave Feindel

This year's TVS weekend at Yosemite was held over the Labor Day weekend. All of us who went (18!) were a bit hesitant about the moon's presence, with moonset times of 0:22 a.m., 1:17 a.m., and 2:28 a.m. respectively. After all, why drive 150 miles to a truly dark sky site when it won't be dark till after midnight? Well, there's the camaraderie with the club members. There's the Saturday night pot luck. There's Dave Rodrigues saying "hold out a quarter and say..." There's the view from Glacier Point, spectacular day or night. There's the opportunity to share your enthusiasm with 150-200 people, many of whom have never looked through a telescope before. There's the opportunity to mooch views through others' telescopes, comparing their performance to yours, and learning useful bits of information about setup, eyepiece selection, and observing. But most of all, there's the opportunity to be amazed at the universe. The beauty of watching the Pleiades rise in the eastern sky, just to the south of Half Dome, eerily there in the moonlight.

As always, I learned a few things during the trip. First, the sky is NOT the same at Yosemite as it is in Pleasanton. My paranoia rose exponentially as my scope failed to align three times. Duh, alignment stars are in a different place when you're 120 miles east

of where it thinks you are. Once I changed my location to Yosemite Valley, it aligned perfectly and slewed all night without a miss. We all knew that the moon would be bright, but how many of us thought to bring a neutral density filter to allow more comfortable viewing? I didn't. Lots of us were searing visitors' eyeballs with views of a 60%+ illuminated moon through 6" or 8" scopes. But Sunday night, I discovered that an OIII filter worked quite well attenuating the light, leaving the moon a nice cheesy green color (sorry, couldn't resist).

One of my objects shown to visitors was M92, well positioned in Hercules, just past the meridian. Dueling globulars, with Bill Drelling next to me pointing his LX-200 at M13. Looking up M92 in the SEDS database when I got back, I was close enough on its distance—25,000 ly distant (actually 26,700 ly), but missed the number of stars (my claim was 100,000+; actually estimated at 300,000), and not quite so close on its size (in astronomical terms, if you're within an order of magnitude, you're correct, right?) Make a note for next year to pick out some showcase objects beforehand, and memorize some standard facts! I also showed Uranus and Neptune, although my goal of seeing one of the Uranian moons fizzled because I never stayed awake past moonset. (The brightest moons, Titania and Oberon, are still mag ~13.8 objects, a stretch to see in an 8" scope unless it is really, really dark.)

All in all, another great Yosemite weekend.



The TVS Yosemite Star Party. This picture was taken about 11:32 p.m. on Saturday night, September 2nd. Dave Feindel's scope is the red light on the far right. To the left of him is Bill Drelling, and to the left of him is Hugh Bartlett. Photo: Dave Feindel

What's Up *by Debbie Dyke*

All times Pacific Daylight Saving Time unless otherwise noted.

September

- 5 Tues Uranus at opposition. 4:00 a.m.
Pluto stationary. 4:00 a.m.
1977 Voyager 1 launched toward Jupiter and Saturn.
- 6 Wed Venus at perihelion.
- 7 Thurs **Full Moon.** 11:42 a.m. Largest full Moon of 2006.
Moon at perigee (221,448 miles). 8:00 p.m. Expect large tides.
- 8 Fri 1966 Star Trek debuts. It's ranked 52nd out of 54 shows.
- 9 Sat 1975 Viking 2 launched towards Mars.
- 11 Mon 1816 Carl Zeiss born.
- 12 Tues 1758 Messier sees the Crab Nebula, making it the first item in his list of fuzzy comet-like objects.
1959 Luna 2 becomes first spacecraft to impact the Moon.
- 14 Thurs **Last Quarter Moon.** 4:15 a.m.
1915 John Dobson born in China.
- 15 Fri **Tri-Valley Stargazers general meeting.** 7:30 p.m. at the Unitarian Universalist Church,
1893 N. Vasco Road, Livermore.
- 17 Sun **Tri-Valley Stargazers discussion meeting.** 2:00 p.m. at the Round Table Pizza on 1024
E. Stanley Blvd., Livermore. Discuss astro stuff with your fellow members.
- 18 Mon **Tri-Valley Stargazers Board meeting.** 7:00 p.m. at the Round Table Pizza in Livermore.
Saturn 2° South of the Moon. 8:00 p.m.
1819 Léon Foucault (Mr. Pendulum) born.
- 21 Thurs Zodiacal Light visible in the East before morning twilight for the next two weeks.
Moon at apogee (252,030 miles). 10:00 p.m.
- 22 Fri **New Moon.** 4:45 a.m.
Autumnal Equinox. 9:03 p.m.
Rosh Hashanah begins at sundown. Hebrew year 5767.
- 23 Sat 1791 Johann Franz Encke born.
1846 Gale and d'Arrest discover Neptune near the locations predicated by Adams and Le Verrier.
- 30 Sat **First Quarter Moon.** 4:04 a.m.
1880 Using an 11-inch Alvan Clark, Henry Draper takes the first photograph of the Orion Nebula.

October

- 1 Sun 1958 NASA established by an act of Congress.
Yom Kippur begins at sunset.
- 2 Mon 1608 J. Lippershey patents the telescope.
- 4 Wed Lunar occultation of 83 Aquarii, mag. 5.43. 9:24:14 p.m. 83 Aquarii reappears at 10:33:50 p.m.
1957 Sputnik 1 is launched by the Soviet Union, becoming the first artificial satellite to orbit the Earth.
- 6 Fri 1923 Edwin Hubble discovers a Cepheid Variable in the Andromeda Galaxy.
1995 Discovery of the first extrasolar planet (orbiting 51 Pegasi) announced.
- 7 Sat 1959 First photo of the "dark side" of the Moon taken by the Soviet Luna 3.
- 9 Mon Columbus Day.
The Moon passes in front of The Pleiades (M45). 9:00 p.m.
1604 A supernova appears between Jupiter and Saturn. Kepler notices it on the 17th and studies it.

Deadly Planets

by Patrick L. Barry and Dr. Tony Phillips

About 900 light years from here, there's a rocky planet not much bigger than Earth. It goes around its star once every hundred days, a trifle fast, but not too different from a standard Earth-year. At least two and possibly three other planets circle the same star, forming a complete solar system.

Interested? Don't be. Going there would be the last thing you ever do.

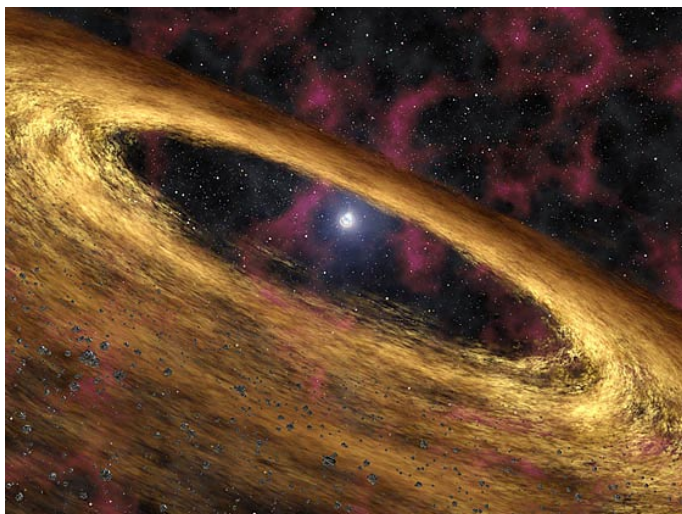
The star is a pulsar, PSR 1257+12, the seething-hot core of a supernova that exploded millions of years ago. Its planets are bathed not in gentle, life-giving sunshine but instead a blistering torrent of X-rays and high-energy particles.

"It would be like trying to live next to Chernobyl," says Charles Beichman, a scientist at JPL and director of the Michelson Science Center at Caltech.

Our own sun emits small amounts of pulsar-like X-rays and high energy particles, but the amount of such radiation coming from a pulsar is "orders of magnitude more," he says. Even for a planet orbiting as far out as the Earth, this radiation could blow away the planet's atmosphere, and even vaporize sand right off the planet's surface.

Astronomer Alex Wolszczan discovered planets around PSR 1257+12 in the 1990s using Puerto Rico's giant Arecibo radio telescope. At first, no one believed worlds could form around pulsars—it was too bizarre. Supernovas were supposed to destroy planets, not create them. Where did these worlds come from?

NASA's Spitzer Space Telescope may have found the solution. Last year, a group of astronomers led by Deepto Chakrabarty of MIT pointed the infrared telescope toward



Artist's concept of a pulsar and surrounding disk of rubble called a "fallback" disk, out of which new planets could form.

pulsar 4U 0142+61. Data revealed a disk of gas and dust surrounding the central star, probably wreckage from the supernova. It was just the sort of disk that could coalesce to form planets!

As deadly as pulsar planets are, they might also be hauntingly beautiful. The vaporized matter rising from the planets' surfaces could be ionized by the incoming radiation, creating colorful auroras across the sky. And though the pulsar would only appear as a tiny dot in the sky (the pulsar itself is only 20-40 km across), it would be enshrouded in a hazy glow of light emitted by radiation particles as they curve in the pulsar's strong magnetic field.

Wasted beauty? Maybe. Beichman points out the positive: "It's an awful place to try and form planets, but if you can do it there, you can do it anywhere."

More news and images from Spitzer can be found at <http://www.spitzer.caltech.edu>. In addition, The Space Place Web site features a cartoon talk show episode starring Michelle Thaller, a scientist on Spitzer. Go to <http://spaceplace.nasa.gov/en/kids/live> for a great place to introduce kids to infrared and the joys of astronomy.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

News & Notes *continued*

unfortunately, the club has been without a Program Director for several years.

We also have a couple more volunteer positions to be filled. The Hospitality position requires bringing the refreshments to the meeting and making coffee and tea. The Host(ess) with the Most(ess) would also coordinate the planning for the summer and holiday potlucks. The amount of time spent taking care of the refreshment job each month is about an hour.

Another volunteer position is that of Publicity. The job would entail contacting local newspapers regarding club activities and meetings. The more advertisement the club can get, the more likely we can bring in new people to the meetings, who will hopefully join the club.

With school starting up again, TVS will continue with its commitment to putting on star parties for any teacher or school that requests our presence. Our star party coordinator, Rich Campbell, can't always be at every star party so it would be nice if we had one or two back-ups that would be able to do a little slide show, or do a Night Sky activity (or both!) for the group.

Please consider helping out in whatever way you can, and when November rolls around, don't be afraid of adding your name to the candidate list.

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



PRIMEFOCUS

Tri-Valley Stargazers Membership Application

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.

Name _____ Phone _____ e-mail _____

Address _____

Do not release my: _____ address, _____ phone, or _____ e-mail information to other TVS members.

- Membership category: _____ \$5 Student.
_____ \$30 Basic. You will receive e-mail notification when the PDF version of *Prime Focus* is available for download off the TVS web site.
_____ \$40 Regular. You will receive a paper version of *Prime Focus* in the mail.
_____ \$32.95 One year subscription to *Sky & Telescope* magazine.
_____ \$34 One year subscription to *Astronomy* magazine.
_____ \$60 Two year subscription to *Astronomy* magazine.
_____ \$10 Hidden Hill Observatory (H2O) yearly access fee. You need to be a key holder to access the site.
_____ \$20 H2O key holder fee. (A refundable key *deposit*—key property of TVS).
_____ \$40 Patron Membership. Must be a member for at least a year and a key holder.
\$ _____ Tax deductible contribution to Tri-Valley Stargazers.
\$ _____ TOTAL – Return to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551

Membership information: Term is one calendar year, January through December. Student members must be less than 18 years old or still in high school.