

PRIMEFOCUS

Tri-Valley Stargazers

March 2002



Meeting Info:

What

CCD Imaging

Who

Ron Bissinger

When

March 22, 2002

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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Note
the date!



The Horsehead Nebula

The Horsehead nebula is located in Orion, below Orion's left belt star Alnitak. This image was taken from Pleasanton through a 12" SCT at f/3.3 with an ST7. RGB composite of 3 shots each color at 10:10:15 minutes. *Photo: Ron Bissinger*

March Meeting

ELECTRONIC ASTROIMAGING FOR AMATEURS What Can It Do and How Can I Get Started?

Ron Bissinger

Up until the last couple of years electronic imaging has been a fairly costly and cumbersome proposition for amateur astronomers, requiring the investment of thousands of dollars and considerable time in order to obtain reasonably pleasing images. There also was limited opportunity for amateurs to use their equipment and talent to contribute data for real science.

That has all changed. Consumer digital cameras and digicams purchased for conventional terrestrial photography are now being used with modest 3 to 4-inch scopes and larger Dobs to obtain good lunar, planetary and solar images, such as those of the recent lunar occultations of Saturn. CCD cameras designed for the amateur astronomer have become more plentiful and cheaper, particularly as good used equipment has come on the market. And a number of organizations and groups have embraced the contributions that CCD imagers can make to science.

The goal of this presentation is to encourage everyone to delve into electronic imaging and show how it can be done with modest equipment and resources. The discussion will go beyond the CCD "pretty pictures" now ubiquitous in all the magazines and will examine consumer digital devices and their capabilities. CCD cameras aimed at amateur astronomers will be discussed along with their technical specifications matched to imaging targets, optical configurations and mounts. Typical equipment setups for doing CCD imaging will be presented for a variety of budgets. An overview will also be given on digital imaging processing and several software packages will be compared. And finally, several

News & Notes

opportunities for undertaking scientific studies will be presented along with some examples of the science that can be done with modest imaging equipment.

I made my first 6" reflecting telescope when I was 14 and took my first film image on Kodachrome, one of M42, while laying on the frozen ground guiding the scope for 40 minutes one January night in upstate NY in 1965. My interest in astronomy idled while I obtained a BS in chemical engineering from Clarkson University and an MS in chemical engineering from UC Berkeley, followed by an MBA from the University of Denver. I worked initially in the oil industry and then moved into high technology where I have recently been CFO of several software companies. My interest in astronomy was rekindled about 6 years ago when I attended an ASP convention in Santa Clara. I live in Pleasanton with my wife and 10 year old daughter.

Dues Are Past Due!

Our official dues collection date was in January, but it's not too late to get your dues in for year 2002. If you wish to get a discounted subscription to *Astronomy* (\$29) and/or *Sky & Telescope* (\$29.95) magazine, you will need to get your subscription in by this month as the discount subscription offer ends this month. You can find the renewal/application form on the last page of this newsletter.

2002 TVS Meeting Dates

For the next two years, our monthly lecture meetings will be on the **third** Friday of the month, with the Board meeting on the Monday following the lecture meeting. Here are the dates for 2002:

| Lecture Meeting | Board Meeting | Prime Focus Deadline |
|-----------------|---------------|----------------------|
| Mar. 22 | Mar. 25 | Apr. 7 |
| Apr. 19 | Apr. 22 | Apr. 27 |
| May 17 | May 20 | May 25 |
| June 21 | June 24 | June 29 |
| July 19 | July 22 | July 27 |
| Aug. 16 | Aug. 19 | Aug. 24 |
| Sep. 20 | Sep. 23 | Sep. 28 |
| Oct. 18 | Oct. 21 | Oct. 26 |
| Nov. 15 | Nov. 18 | Nov. 23 |
| Dec. 20 | Dec. 16 | Dec. 28 |

School Star Parties

Recently, TVS participated in the Pleasanton School District's Science Fair. We managed to show a few hundred kids and their parents such celestial gems as Saturn, Jupiter and the Moon. Many thanks to **Chuck Grant, Maggie Halberg, David Feindel** and his daughter **Caroline, Rich Campbell, Bob McKoon, and Hugh Bartlett** for bringing their scopes and sharing the view with the crowds.

Every year TVS puts on star parties for schools or groups like the Scouts, bringing our scopes out to show kids the neat things that can be found in the night sky. If you'd like to have us come to your kid's school or group, contact **Rich Green** at richgreen@pacbell.net or 925-449-2190.

Money Matters

At the February Board meeting, Treasurer **Mike Anderson** reported the current balances (as of February 18, 2002) of our various accounts:

| | | |
|----------|------------|------------------|
| Checking | \$2,809.51 | |
| CD #1 | \$3,853.54 | matures 05/17/02 |
| CD #3 | \$2,378.16 | matures 05/27/02 |
| CD #4 | \$2,024.06 | matures 04/16/02 |

The Payments for *Astronomy* and *Sky & Telescope* magazines were mailed. The last batch of subscriptions will be mailed after the March Board meeting.

Observing Book/Calendar still available

Treasurer **Mike Anderson** still has a few copies of the *2002 RASC Observer's Handbook* and the *RASC Observer's Calendar 2002* left for sale. The *Handbook* can be purchased for \$15, the calendar for \$10. You can pick up one of the remaining copies at the March meeting.

Loaner Scope Winter Special Continues

TVS has a variety of telescopes available for members to rent. Our winter special allows you to rent any scope for a month and receive another rental month for free. See our Loaner Scope manager **John Swenson** for more info (jswenson1@attbi.com) or come to the March meeting to check out a scope. All you need to rent a scope is to supply a \$50 refundable deposit check and a \$15 rental payment (\$5 for students).

Newsletter header image: M1, the Crab Nebula, located in the constellation Taurus. This image was taken from Pleasanton through a 12" SCT at f/10 with an ST7. RGB composite of 3 shots each color at 10:10:15 minutes. *Photo: Ron Bissinger*

Calendar of Events

March 6, 7:00 p.m.

Who: Dr. Debra Fischer (U.C. Berkeley)

What: *Planets Beyond: The Search for Other Solar Systems*

Where: Smithwick Theater, Foothill College

Cost: Free (but parking is \$2.00)

Dr. Fischer (part of the team of astronomers who have found most of the planets around other stars) was instrumental in the discovery of the first system of planets known outside our own – around the star Upsilon Andromedae. She will discuss what the latest discoveries are telling us about planetary systems (with more than one planet around a star) out there and the possibility that there are not just Jupiters around other stars, but Earths.

To get to Foothill College, located in the Los Altos Hills, take the El Monte Road exit off of Freeway 280. Call the series hotline at 650-949-7888 for more information.

Co-sponsored by: NASA Ames Research Center, Foothill College Astronomy Program, SETI Institute, Astronomical Society of the Pacific

NOTE: The lecture is free, but there is a parking fee of \$2 for all cars at Foothill College. There are often lines for parking permit tickets in the lots just around 7 pm, so attendees are urged to come a bit early to have enough time to park.

March 19, 7:00 p.m.

Who: Dr. Michael Bica (SIRF Science Center)

What: *Lifting the Cosmic Veil through Infrared Astronomy*

Where: Morrison Planetarium, San Francisco

Cost: \$3.00

The cosmos reveals fascinating new insights when studied with light at wavelengths longer than the human eye can

see. The first infrared satellite surveyed the cosmos in 1983. What scientific results have been obtained since then and what do astronomers hope to learn in the next 15 years?

April 6, 3:00 p.m.

Who: Chris McKay (NASA/Ames Research Center)

Pascal Lee (SETI Institute; NASA/Ames Research Center)

Rachel Whitaker (Dept. of Plant Biology, UC Berkeley)

What: *Extreme Environments: From the Ends of the Earth to the Depths of Space.*

Where: Morrison Auditorium, San Francisco

Cost: \$3.00 by mail, \$5.00 at the door

Has life evolved in the extreme environments of other worlds, as it has in hostile environments on earth? And how can humans survive on other planets? This talk is presented by the The Planetary Society Bay Area Volunteer Network and the Morrison Planetarium of the California Academy of Sciences. For more info, call 415-750-7128 or visit www.calacademy.org.

April 9, 7:00 p.m.

Who: Dr. Mike Shull (University of Colorado)

What: *Next Generation Ultraviolet/Optical Telescopes in Space*

Where: Morrison Planetarium, San Francisco

Cost: \$3.00

Earth's atmosphere not only blurs images from space, but also blocks many wavelengths of light, limiting our view of the universe. On the heels of the Hubble come new ideas for space telescopes that will extend our view into the ultraviolet.

continued next page

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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.

Calendar of Events *continued*

The Distinguished Lecture Series Chabot Space & Science Center

Below is a listing of the upcoming speakers for Chabot's lecture series. The talks start at 7:30 p.m. in the Tien Megadome Theater, with a reception and refreshments following the talks. Admission is \$5. For reservations and information call 510-336-7373. Tickets may also be purchased through Ticketweb.com or at the door.

March 21

Who: Dr. Gibor Basri (Professor of Astronomy, University of California, Berkeley)

What: *What is a Planet?*

In light of new discoveries and the Pluto controversy, Dr. Basri will discuss the increasing debate over the meaning of the word "planet" and possibilities of a broadly accepted consensus.

April 18

Who: Dr. George Smoot (Physics Division, Lawrence Berkeley National Lab)

What: *Harmonics of the Universe: the Latest Findings of the BOOMERANG & MAXIMA Experiments*

May 16

Who: Ken Crowell

What: *The Universe at Midnight*

Dr. Crowell will discuss his most recent book, *The Universe at Midnight*. He describes recent revelations in cosmology, including the surprising discovery that the universe's expansion is accelerating.

Astronomical insights

by David Feindel

I reached a milestone in my astronomy career—I've now spent more on accessories than telescopes. Think about it. Although "what telescope do you have?" may be everyone's first question, it's the accessories that determine its usefulness. In my case, an adequate tripod, a barlow, additional EPs, a better finder scope, and a good sky atlas seemed to rank just behind oxygen as necessities of life. A DC power supply is what put me over the hump. Eight AA batteries just don't have enough voltage or cold-weather capacity to power my telescope for long (electronic scope owners take notice: problems in slewing, tracking, or "goto-ing" may well stem from low voltage). Running it off a solid power supply has produced a noticeable improvement in slewing speed and increased consistency in pointing, at the cost of confining my scope to within 50 feet of an electrical outlet (not a big limitation with typical California back yards!).

To practice for this month's Messier Marathon, I went out the other night to find the Auriga objects (M36, 37, and 38—all open clusters). I read Sue French's article on them in *S&T* (2/01), O'Meara's entries in *The Messier Objects*, and pored over the page in my *Sky Atlas*. Although the moon was up, I hoped it being low on the eastern horizon would limit its impact on viewing. Out to the backyard observatory, choosing a spot where Polaris is visible but no street lights or porch lights. Setup and align the ETX. GOTO Aldebaran to verify alignment. It's in the FOV at 48x. Good. Study Jupiter and Saturn for awhile, while the scope cools down. Now to find M37, the brightest (and supposedly easiest) of the three objects. Cheating, I select it with AutoStar, and "GOTO". Nothing. At least nothing that resembles the pictures or guides, even when reversed west-for-east for my scope and finder. Slews to M36 and M38 produce the identical result. Re-check alignment. Yes, a slew to Capella puts it in the FOV, although barely. Go back to M37, and try averted vision and tripod jiggling. Still nothing. Go back to Capella; it missed by a half degree left in azimuth, and maybe a quarter degree low in alt. Go back to M37, and manually correct. There! Not terribly bright, but obvious that it is M37. Now to find it star-hopping. Start at Alnath (β Tau), and make 3 hops of mag 7 stars, each almost exactly 2.5 degrees NW, and there is M37. Two tries, and less elapsed time than AutoStar. Did the same for M36 and M38, and then M35, an open cluster in Gemini, for fun. Believe now that I can find these four in the marathon without computer aid. Only 106 more to go!

One other issue crept in; what is listed in O'Meara as a mag 5.6 object (M37) doesn't stand out at all. Has anyone studied what the impact is of Tri-Valley suburban lighting and/or the moon's presence do to limiting magnitudes? Does this lighting make the same difference in visible magnitude whether viewing naked eye, binoculars, or telescopes? How much of a difference does going to H2O make?

Web surfing this month turned up several useful sites. First, if you haven't joined the sci.astro.amateur news group, by all means do so. Typically, 100+ posts/day (my guess), and some of it is mindless, but there's often good discussions on telescopes and accessories, astro events, sightings, and tips. One link I followed was to www.cpac.org.uk, the web site for the Castle Point Astronomy Club. Their members have written a Java applet called *The Planets*, which provides current positions of the Galilean and Saturn moons, and other useful planetary info. Included is a red-on-black mode for those with laptops. Another interesting site is stdatu.stsci.edu/cgi-bin/dss_form, which gets you an image of any section of sky you specify, based on data provided by early digital sky-mapping missions. Also take a look at www.excelsis.com—it has a ratings page on astronomy equipment, with ratings provided by users.

Star Parties

Although summer is still a few months away, now is the time to start planning your vacation time around the upcoming star party dates. As of yet, we do not have any dates for **Camp Shelly** (located at Lake Tahoe) or our summer **Sycamore Grove** star party series. As those dates are set, we'll let you know. Check the club's web site for updates and more information.

March 9 and March 16 H2O Messier Marathon

To start the season off, TVS has decided to conduct two Messier Marathons at H2O. For those who would like to attend and don't have a key to the site, there will be a caravan leaving the corner of Mines and Tesla in Livermore at 5:00 p.m. It's about an hour drive from the rendezvous point and there is a \$3 per car entry fee to the site. Note that this is *not* an open house event. This is a hard core marathon night with the last person left standing when the sun comes up as the winner; a take-no-prisoners, no-holds-bar, all-out, knock-down Messier Marathon®.

Unless it's cloudy.

If you have any questions regarding the event, contact Vice President **Gary Steinhour** at steinhour1@juno.com.

March 16 thru October 12 Mt. Diablo Star Party

The Mt. Diablo Astronomical Society's public star parties on top of Mt. Diablo. Check their web site for more info: <http://members.aol.com/mdas101b/private/index.htm>. Listed are the dates and the topics they will be discussing for each star party.

| | |
|-------------|--|
| March 16 | "Why are days getting longer?" |
| April 13 | Build a scale model of the solar system. |
| May 18 | "Why do planets align with the Zodiac?" |
| June 8 | "What causes eclipses?" |
| July 13 | "Why does the moon have phases?" |
| August 10 | "What causes meteor showers?" |
| September 7 | "Why are the days getting longer?" |
| October 12 | "Why is there a North Star?" |

May 24-26 RTMC

The Riverside Telescope Makers' Conference (RTMC) Astronomy Expo. This perennial favorite takes place at a YMCA camp east of Big Bear Lake in the San Bernardino mountains of Southern California. It truly is an experience. This year's theme is Women in Astronomy and the keynote speakers are Ed and Robin Krupp. For more info, visit their web site at www.rtmc-inc.org or call 909-948-2205.

June 1, August 3, September 28

H2O Open House

For those who have never been to the club's dark-sky site and would like to know what it's like, here is your opportunity. A caravan will depart Livermore from the corner of

Mines and Tesla at a time to be determined later. There is a \$3 per car entry fee to the site. Bring your own telescope or, if the telescope repair gods will allow, just look through the club's 17.5-inch scope. There is no running water, or power outlets. There are two outhouses. Plan your evening accordingly. If you have any questions, contact President **Chuck Grant** at 925-422-7278 or cg@fx4m.com.

July 10-14 Shingletown Star Party

For the past eight years The Astronomy Connection (TAC) has been organizing star parties at Mount Lassen Volcanic National Park in north eastern California. The event grew in popularity to the point where they have nearly outgrown available space at the park's group campsite and observing areas.

This year, thanks in large part to work by amateur astronomers in the Sacramento area, they will try a new location. TAC is happy to announce the Shingletown Star Party. This is a public event hosted by Shasta County at the Shingletown Airport just outside Shingletown on Hwy 44, 35 miles east of Redding and 17 miles west of Lassen Park. The airport is being closed in order to allow amateur astronomers to stay on site and leave their equipment set up over over the nights of July 10, 11, 12, 13 and 14.

A preliminary web site is on-line where those interested in attending may sign up. More info regarding the star party and surrounding area's activities and sights will be posted on the web page shortly. Attendees can sign up at: <http://www201.pair.com/resource/resource-intl/ssp.html>.

July 12-13 Yosemite

TVS will host a public star party at Glacier Point in Yosemite. For those who choose to participate in this trip, you'll be provided with free park entrance and camping in exchange for allowing the public to look through your telescope. After the crowds leave, you can continue observing by yourself for the rest of the night. However, when you're done observing for the night, you have to pack up your gear and head back down to the campsite at Bridalveil Creek campground. More info to come. If you can't wait and want to reserve a spot now, contact trip coordinator **Dave Rodrigues** at 510-483-9191.

August 9-11 (tentative) White Mountain Trip

These dates are *very* tentative, as the folks at the Barcroft Research Station have yet to be contacted in regards to setting up a date for our trip. The August 9-11 date is our first choice for venturing up the mountain. We'll let you know the final dates when we get word from our trip coordinator **Dave Rodrigues**.

What's Up *by Debbie Dyke*

All times Pacific Standard unless otherwise noted.

March

- 2 Sat For the next two weeks, look for the Zodiacal Light in the west after the end of evening twilight.
- 4 Mon 1774 First recorded observation of the Orion Nebula by Wilhelm “Billy” Herschel.
- 5 Tues **Last Quarter Moon** 5:24 p.m.
Early morning **double shadow transit** on Jupiter. Io’s shadow first appears on Jupiter at 12:52 a.m., followed by Callisto’s shadow at 2:15 a.m. Jupiter will set before the transits are complete.
1979 Voyager 1 flies past Jupiter and captures first detailed images of it and its moons.
- 10 Sun 1977 Rings of Uranus discovered.
- 13 Wed **New Moon** 6:02 p.m.
Double shadow transit on Jupiter. 9:15-9:30 p.m.
1781 Wilhelm Herschel discovers Uranus using a 6-inch scope he built himself.
- 14 Thur 1879 Albert Einstein born.
- 17 Sun ♣ **St. Patrick’s Day.** ♣
Tri-Valley Stargazers discussion meeting. 2:00 p.m. at the Round Table Pizza on 1024 E. Stanley Blvd., Livermore. Join your fellow members to discuss astro stuff over pizza.
Mars 4° N of the Moon 8:00 p.m.
- 18 Mon 1965 First walk in space by Cosmonaut Alexei Leonov from the Voskhod 2.
- 19 Tues Around 9:00 p.m. look to the west for a nice little grouping of the Moon, Saturn (3° N of the Moon) and the Pleiades (about 8° S of the Moon).
- 20 Wed Spring has sprung – **Vernal Equinox** 11:16 a.m.
Double shadow transit on Jupiter. Ganymede’s shadow transits from 10:10 p.m. to 1:30 a.m.
Io’s shadow follows at 11:10 p.m. to 1:25 a.m.
- 21 Thur **First Quarter Moon** 6:28 p.m.
Jupiter 3.5° N of the moon 10:30 p.m. M35 is less than 1° S from the Moon.
- 22 Fri **Tri-Valley Stargazers general meeting.** 7:30 p.m. at the Unitarian Universalist Church, 1893 N. Vasco Road, Livermore.
- 23 Sat 1993 Eugene and Carolyn Shoemaker and David Levy take a picture of something fuzzy that ends up being known as Shoemaker-Levy 9.
- 25 Mon **Tri-Valley Stargazers Board meeting.** 7:00 p.m. at the Round Table Pizza in Livermore.
- 28 Thur **Full Moon** 10:25 a.m.
- 29 Fri 1974 Mariner 10 makes first flyby of Mercury and sends pictures home.
- 31 Sun Easter.

April

- 4 Thur **Last Quarter Moon** 7:29 p.m.
- 7 Sun **Daylight Savings Time begins.** At 2:00 a.m. wake up and set your clocks one hour forward.
- 11 Thur 1879 Bernhard Schmidt, the creator of the Schmidt telescope, born.
- 12 Fri 1961 Yuri Gagarin becomes the first man in orbit (orbit lasted 1h 48m).
1981 Columbia becomes the first space shuttle launched into space. The mission lasted 2 days, 6 hours.
- 14 Sun 1970 Apollo 13 disaster strikes, but Tom Hanks saves the crew from almost certain death.

Astro Events

Jupiter Transits

Below is a listing of transits 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 at that time, or that it is up but it's still daylight.

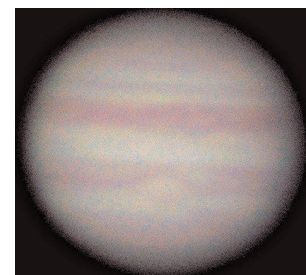
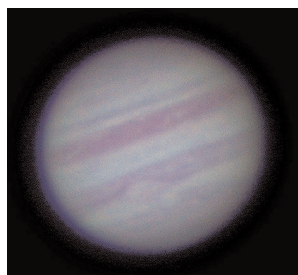
March

| Date | Object | Starts | Meridian | Ends |
|---------|--------|--------|----------|--------|
| Tue 5 | GRS | na | 6:35p | 8:45p |
| Wed 6 | I | 6:06p | 7:15p | 8:23p |
| | Is | 7:20p | 8:15p | 9:33p |
| | GRS | 10:30p | 12:30a | 2:35a |
| Thu 7 | GRS | 6:30p | 8:20p | 10:30p |
| Sat 9 | GRS | 12:05a | 2:00a | na |
| | GRS | 7:50p | 10:00p | 12:10a |
| Sun 10 | GRS | na | 5:50p | 8:00p |
| | E | 6:35p | 7:55p | 9:20p |
| | Es | 9:05p | 10:20p | 11:50p |
| Mon 11 | GRS | 9:40p | 11:40p | 1:40a |
| Tues 12 | GRS | na | 7:30p | 9:30p |
| Wed 13 | Gs | na | 7:35p | 9:30p |
| | I | 8:00p | 9:10p | 10:15p |
| | Is | 9:15p | 10:10p | 11:30p |
| | GRS | 11:20p | 1:20a | na |
| | GRS | 7:10p | 9:15p | 11:15p |
| Sat 16 | GRS | 12:50a | na | na |
| | GRS | 8:45p | 10:45p | 12:45a |
| Sun 17 | GRS | na | 6:30p | 8:45p |
| | E | 9:10p | 10:35p | 11:50p |
| | Es | 11:40p | 12:50a | na |
| Mon 18 | GRS | 10:20p | 12:20a | 2:20a |
| Tues 19 | GRS | 6:20p | 8:20p | 10:20p |
| Wed 20 | G | na | 6:25p | 8:15p |
| | I | 9:50p | 11:05p | 12:10a |
| | Gs | 10:10p | 11:35p | 1:30a |
| | Is | 11:10p | 12:10a | 1:25a |
| Thur 21 | GRS | 8:00p | 10:05p | 12:00a |
| | Cs | 8:20p | 10:00p | 11:40p |
| Fri 22 | Is | na | 6:40p | 7:50p |
| | GRS | na | na | 7:50p |
| Sat 23 | GRS | 9:40p | 11:40p | 1:40a |
| Sun 24 | GRS | na | 7:30p | 9:30p |
| | E | 11:45p | 1:10a | na |

| | | | | |
|---------|-----|--------|--------|--------|
| Tues 26 | GRS | 7:10p | 9:10p | 11:10p |
| Wed 27 | G | 9:05p | 10:45p | 12:15a |
| | I | 11:50p | 1:00a | na |
| Thur 28 | GRS | 8:50p | 10:50p | 12:50a |
| Fri 29 | GRS | na | 6:30p | 8:30p |
| | I | na | 7:30p | 8:30p |
| | Is | 7:35p | 8:35p | 9:50p |
| Sat 30 | GRS | 10:20p | 12:20a | 2:20a |
| Sun 31 | GRS | 8:30p | 10:30p | 12:30a |

April

| | | | | |
|---------|-----|--------|--------|--------|
| Tues 2 | GRS | 8:00p | 10:00p | 12:00a |
| Wed 3 | GRS | na | na | 7:50p |
| Thur 4 | Es | na | 7:20p | 9:00p |
| | GRS | 9:30p | 11:30p | 1:30a |
| Fri 5 | GRS | na | 7:30p | 9:30p |
| | I | 8:15p | 9:25p | 10:28p |
| | Is | 9:30 | 10:30p | 11:45p |
| Sat 6 | GRS | 11:15p | na | na |
| Sun 7 | GRS | 7:00p | 9:00p | 11:00p |
| Tues 9 | GRS | 8:40p | 10:40p | 12:40a |
| Wed 10 | GRS | na | 6:40p | 8:40p |
| Thur 11 | E | na | 7:40p | 9:00p |
| | Es | 8:50p | 10:00p | 11:40p |
| | GRS | 10:20p | 12:20a | na |
| Fri 12 | GRS | na | 8:15p | 10:15p |
| | I | 10:15p | 11:20p | 12:25a |
| | Is | 11:25p | 12:25a | na |



These two Jupiter images were taken by **Gert Gottschalk**, using his Canon G1 digital camera and Rachel - Chabot Space & Science Center's 20" refractor (which was stopped down to 16"). The left image was taken on February 2 and is an average of five exposures. The right image was taken on February 9 using a yellow filter to tame Rachel's chromatic aberration, and is an average of three exposures.

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Livermore, CA 94551

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 _____

Choose one: _____ I wish to download *Prime Focus* from the web (an e-mail notification will be sent to me when it's available for download). I understand that a paper version will *not* be mailed to me.
_____ I wish *Prime Focus* to be mailed to me.

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

Membership category: _____ \$5 Student _____ \$20 Individual _____ \$25 Family
_____ \$20 Hidden Hill Observatory (H2O) refundable key deposit (key property of TVS)
_____ \$29.95 *Sky & Telescope* magazine subscription (for one year)
_____ \$29.00 *Astronomy* magazine subscription (for one year)
\$ _____ 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.