PRIMEFOCUS

Tri-Valley Stargazers

December 2013

Meeting Info

What:
Holiday Potluck Dinner

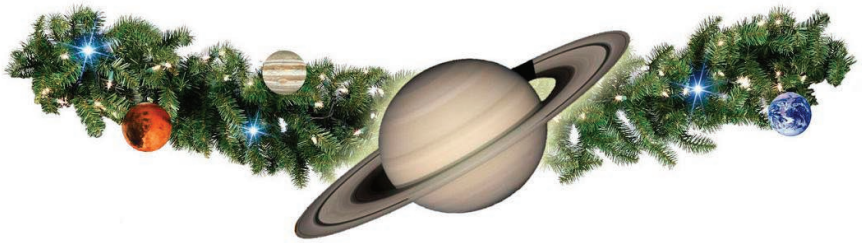
Who:
You, Family, and Friends

When:
December 20, 2013
Doors open at 6:30 p.m.
Dinner at 7:00 p.m.

Where:
Unitarian Universalist Church in Livermore
1893 N. Vasco Road

Inside

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. Members are asked to bring a dish to share, and of course bring family and friends to share in the festivities. Based on the first letter of your last name members are asked to bring a dish to share: A-F: Vegetable or Fruit Dish; G-L: Dessert; M-R: Main Dish; S-Z: Rice or Potato Dish.

Dues Are Due

TVS' membership year runs from January to December, so now is the time to renew your membership. Our membership rates remain unchanged from last year, as do the subscription rates for Astronomy and Sky & Telescope. We no longer offer the "Regular" membership level since we do not send out printed copies of the newsletter. Rather, at the "Basic" membership level we contact you via e-mail to let you know that a .pdf of the newsletter is available. The renewal form can be found on the back of this newsletter or on our website under the Membership link. Please make our Treasurer's New Year especially wonderful by sending in your renewal today.

Royal Astronomical Society of Canada (RASC) Handbooks and Calendars Available for Purchase

The club now has RASC Handbooks and Calendars available for purchase. The 2014 edition of the handbook is bundled with the *Earth Centered Universe* Planetarium Software (http://www.nova-astro.com/handbook/2014.html). This free software will function through March 31, 2015 and will not perform predictions for events later than December 31, 2015. Prices are the same as last year: $25 for the Handbook and $17 for the Calendar. See Roland Albers for purchases, or contact him via e-mail (rhalbers3"at"gmail.com) to arrange to pick up Handbooks and/or Calendars if you can't attend the meeting. For more information on the handbook and calendar, see http://www.rasc.ca/observers-handbook and http://www.rasc.ca//observers-calendar

News & Notes

2013/2014 TVS Meeting Dates

The following lists the TVS meeting dates for 2013/2014. 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. 20	Dec. 23	
Jan. 17	Jan. 20	Dec. 27
Feb. 21	Feb. 24	Jan. 31
Mar. 21	Mar. 24	Feb. 28
Apr. 18	Apr. 21	Mar. 28
May 16	May 19	Apr. 25
Jun. 20	Jun. 23	May 30
Jul. 18	Jul. 21	Jun. 27
Aug. 15	Aug. 18	Jul. 25
Sep. 19	Sep. 22	Aug. 29
Oct. 17	Oct. 20	Sep. 26
Nov. 21	Nov. 24	Oct. 31
Dec. 19	Dec. 22	Nov. 28

Money Matters

Treasurer Roland Albers indicates that as of November 29, 2013 the TVS checking account balance is:

Checking $11,959.97

Let's thank David Feindel for many years of dedicated service as the TVS Treasurer.

Magazine Giveaway: Black Friday

TVS has back issues of *S&T* and *Astronomy* magazines freely available. If you are interested in being a recipient of these valuable resources of astronomical history, please make your interest known at a forthcoming club meeting. First come, first serve!

H2O Maintenance: Paint Needed

The H2O Observatory needs a new coat of paint. Please contact the Observatory Director, Chuck Grant, if you can donate two gallons of a neutral exterior paint to ensure the observatory structure remains weather-resistant.

Comet ISON Update By Ken Sperber

Comet ISON has come and gone. Even though it didn't survive to put on a post-perihelion show of note, she did "not go gentle into that good night. Rage, rage, against the...light" she did (thanks Dylan Thomas).

I feel that I was very fortunate to have the opportunity to image ISON, made realistic by the nearby availability of H2O, the club observing site. In mid-November I came to the realization that time was short for morning imaging/observing of ISON, as the Moon was working toward becoming full. As my goal was to do imaging in a period during which the Moon was set, I ventured out to H2O on the evening of Thursday, November 14. Not having imaged for nearly 2 years, I wanted ample time to set up my equipment, and work the problems that would surely arise. Not surprisingly, it took me longer than usual to set up, and when I first attached the ST-2000XM to the telescope I had trouble focussing since I forgot that I didn't require the use of an extension tube when using the f/6 focal reducer.

November was a rich time for comet observing/imaging, as there were 4 comets within telescopic view: ISON, Lovejoy R1, LINEAR X1, and Enke 2P. All of these comets were predawn objects in the eastern sky. The first to rise was Lovejoy R1, which I imaged with my DSLR at prime focus of my 4-inch refractor. As the DSLR doesn't have a live view mode, focussing was problematic. The photos were less than satisfactory. I then switched to my SBIG ST-2000XM CCD camera. Following the techniques used by other astrophotographers, I decided to use 1 minute exposures. But then the biggest problem of the night arose. I had replaced the camera desiccant the day before, so I didn't anticipate any frosting problems. Given that it was a cold night I set the camera to run at -30 degrees C, but I soon noticed the test images degrading, showing a Xmas tree-like pattern that obscured the stars. With fingers crossed for good luck, I turned the temperature control off to let the CCD get above freezing. I then backed it down to -10 degrees C. With no frosting evident, I decided to cut my losses and proceed with imaging. The frost issue put me behind schedule for my goal of imaging 4 comets in one night!

Aimed at Comet Lovejoy R1, I obtained 16 luminance, and 5 each of RGB between 3:41am - 4:21am. At this time Lovejoy had a bright coma, and a faint tail. The satisfactory images gave some hope that I was ready for ISON. For later image calibration, I then took a set of flat frames so as to "remove" the numerous "dust donuts" scattered on my CCD chip, and account for vignetting and uneven illumination of the optical path.

With Comet ISON having arisen sufficiently above the horizon, I took a set of 18 luminance images and 5 each of RGB between 5:03am-5:43am. I then quickly slewed to Comet LINEAR X1, which was barely above the horizon, and squeezed off a set of 9 luminance images. By this time morning twilight was making its presence abundantly felt. LINEAR was seen as a barely extended coma with just a hint of tail. The progression of twilight caused the background values of the images to jump from values of 3500 to 12,000 (Max: 65,536) over the 9-minute imaging run (YUK!). So ended my attempt at imaging 4 comets in one night.

Header Image: Hubble Space Telescope image of COmet ISON taken on April 30, 2013. Credit: NASA

Comet ISON Update (continued)

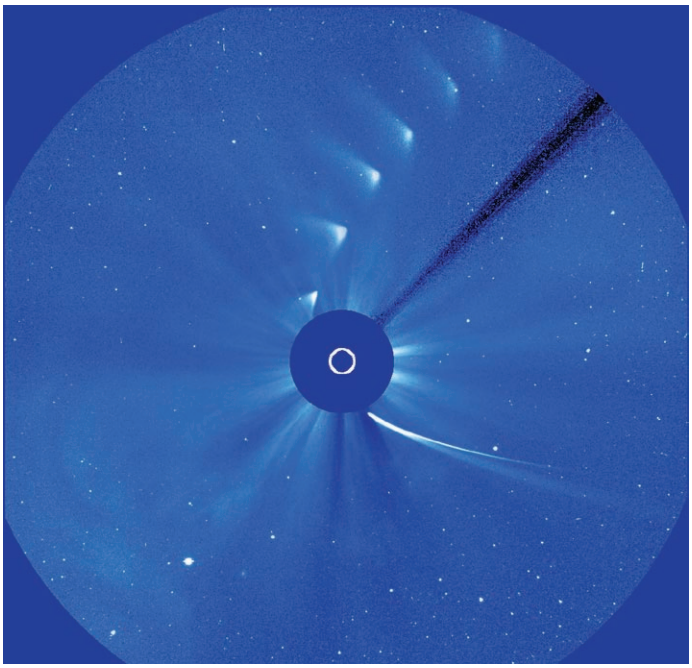
Caption: Comet ISON imaged on November 15, 2013 using a Takahashi FS-102 at f/6 and an SBIG ST-2000XM. The image consists of 18 one-minute luminance frames, and a synthetic luminance frame constructed from the sum of the average of 5 one-minute red, green, and blue frames. Credit: Ken Sperber

The raw images of Comet ISON were very exciting, as numerous streamers were visible in the tail. The challenge was that the comet had moved across about 8% of the field of view during the imaging session. I would have to do a "one-star" alignment on a bright comet core that was nearly saturated. Fortunately, the software was up to the task, and I'm very happy with the above result. I have a color version in which the coma and tail have a blue-green color, consistent with

Comet ISON Update (continued)

the presence of cyanogen and diatomic Carbon. WIth my telescope focal length and CCD chip, ISON spans about 1 degree of sky in my image. Based on the orbital elements, ISON was 134.61 million km from Earth when I took the images. With a bit of basic trigonometry, I calculate that the comet extends ~2.35 million km in my image.

With the unexpected detailed structure in the tail of Comet ISON well-imaged, I wondered how the structure would change in subsequent days. On Saturday, November 16, Karen and I headed back to H2O for another round of imaging. However, this time I came away empty handed. The set-up went well enough, but we could see fog creeping over the hills to the west. The fog began to recede at about 1am, as we grabbed a bit of sleep. Upon waking we found the equipment drenched in dew. It was a mad scramble to dry off the equipment, and put it away in a warmed car. We did however, take out my 70mm TeleVue Pronto, which provided a nice view of the fuzzy-headed ISON.



Caption: Comet ISON as imaged by SOHO between November 28-30, 2013. Credit: NASA

As we know, Comet ISON began to disintegrate just as it approached perihelion. This was noted as a sudden dimming of the comet's brightness. The above composite image from SOHO shows it's further demise as the debris receded from the Sun. Whether the disintegration was due to the heating and damaging effects of solar radiation, and/or gravitational disruption should become more clear as the observations are further evaluated. I'll keep you updated on the latest research on ISON as it is published over the coming months.

In the meantime, get out and see Comet Lovejoy R1, which is currently about 4th magnitude!

Calendar of Events

December 14-15, 11:00am-5:00pm

What: Moonbots Have Landed
Who: Included with General Admission
Where: Chabot Space and Science Center, Space Cafe, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Free member admission. RSVP required. Space is limited and by reservation only, so call (510) 336-7392.

See the show then compete in the challenge! Enjoy our newest planetarium show, Back to the Moon For Good, and cheer on teams as they battle for the $30million Google Lunar XPRIZE purse. Then become a member of the team as you design, build and test your very own moonbot using robotics kits. Guided by our expert robotics team, experience the nail-biting moments from the show as your design must successfully land on the Moon. Will you be the next citizen scientist to take us to the Moon for good? See http://www.chabotspace.org/events.htm for more information.

December 17, Noon-1:00pm

What: Life's Struggle to Survive
Who: John Baez, UC Riverside
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

When pondering the number of extraterrestrial civilizations, it is worth noting that even after it got started, the success of life on Earth was not a foregone conclusion. We recount some thrilling episodes from the history of our planet, some well-documented but others merely theorized: our collision with the planet Theia, the oxygen catastrophe, the snowball Earth events, the Permian-Triassic mass extinction event, the asteroid that hit Chicxulub, and more, including the global warming episode we are causing now. All of these hold lessons for what may happen on other planets.

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

December 21, 7:00pm-8:00pm

What: SLS, Our Next Ride
Who: Faride Khalaf
Where: Chabot Space and Science Center, Space Cafe, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Free member admission. RSVP required. Space is limited and by reservation only, so call (510) 336-7392.

The future of space travel is percolating. For the first time in history, we are successfully launching privately designed and built large-scale space vehicles. There are many corporations and individuals contending to provide commercial

space transportation for NASA to fly above the Earth's atmosphere. NASA's Space Launch System (SLS) is the new protocol for the American Space Program. In this presentation you'll gain some insight into the future of space travel and understand how our traditional means of exploration are now history.

See http://www.chabotspace.org/events.htm for more information.

January 7, Noon-1:00pm

What: Deciphering year-to-year wiggles on the Keeling Curve
Who: Weile Wang, NASA Ames Research Center
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The concentration of carbon dioxide in the atmosphere was 315 parts per million by volume (ppm) when Charles Keeling started his measurement at the Mauna Loa Observatory, Hawaii, in 1958. It surpassed 400 ppm on May 9, 2013 for the first time in the 55-year continuous record of measurements. The so-called 'Keeling curve' that shows the rapidly increasing atmospheric carbon dioxide concentration since 1958 is one of the most famous and important scientific findings of our time – yet a full and detailed understanding of the curve and its variations is still to be achieved. For instance, the year-to-year variability that appears as the 'wiggles' on the Keeling curve have long been linked to variations of the natural climate-carbon system. But questions remain about what (ocean versus land), where (tropics versus mid-high latitudes) and how (e.g., temperature versus precipitation) different drivers affect the observed variability. This presentation reviews the scientific literature on these questions and presents a simple yet robust analysis that points toward the most likely answer.

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

January 14, Noon-1:00pm

What: Large Synoptic Survey Telescope: Entering the Era of Petascale Optical Astronomy
Who: Mario Juric, LSST Group
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The Large Synoptic Survey Telescope (LSST;http://lsst.org) is a planned, large-aperture, wide-field, ground-based telescope that will survey half the sky every few nights in six optical bands from 320 to 1050 nm. It will explore a wide range of astrophysical questions, ranging from discovering "killer" asteroids, to examining the nature of dark energy. The LSST will produce on average 15 terabytes of data per night, yielding an (uncompressed) data set of over 100 petabytes at the end of its 10-year mission. Dedicated HPC facilities will process the image data in near real time, with full-dataset reprocessings on annual scale. A sophisticated data management system will enable database queries from individual users, as well as computationally intensive scientific investigations that utilize the entire data set. In this talk, I will give an overview of what LSST will deliver once operational, review implications of LSST-sized data sets on astronomy in the 2020s, and discuss how we as a community will need to prepare for the upcoming age of petascale datasets.

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

February 3, 7:30pm

What: The State of the University
Who: Timothy Ferris, Science Writer
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.

Since the discovery of galaxies and of cosmic expansion nearly a century ago, scientists have made estimable progress in establishing the age, evolution, and composition of the universe. But in doing so they have found that almost all of the observable universe is made of unknown materials. "Dark energy," evidently a property of the vacuum, constitutes 68 percent of the matter/energy in the universe. "Dark matter," which interacts gravitationally with normal matter but is otherwise invisible, accounts for another 27 percent. Everything humans have previously observed-all the stars, planets, and nebulae-weighs in at less than 5 percent. And that's just the observable universe. There's lots more, perhaps an infinite amount, beyond. This talk surveys what is currently known about the universe, then presents a new way of looking at nature that goes beyond classical science to offer a glimpse of how the cosmos may be investigated in the near future.

See http://www.calacademy.org/events/lectures/ for lecture and reservation information.

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

All times Pacific Standard Time.

December

13-14	Fri	The Geminid meteor shower peak on this night. Best views predawn after moonset (see p.50 December S&T)
15	Sun	Aldebaran 2-4 degrees to lower-right of the Moon
17	Tue	Full Moon (1:28am)
18	Wed	Jupiter 5 degrees left of the nearly Full Moon
21	Sat	Winter Solstice, the shortest day of the year (9:11am)
25	Wed	Last-Quarter Moon (5:48am)
25-27	Wed-	The waning Moon passes Mars on Dec. 25-26, and Spica on Dec. 26-27
27-30	Fri-	Mars within 1 degree of the double star Gamma Virginis
28	Sat	Alpha Librae (Zubenelgenubi) 1-3 degrees to lower left of the Moon, with Saturn 5 degrees farther left

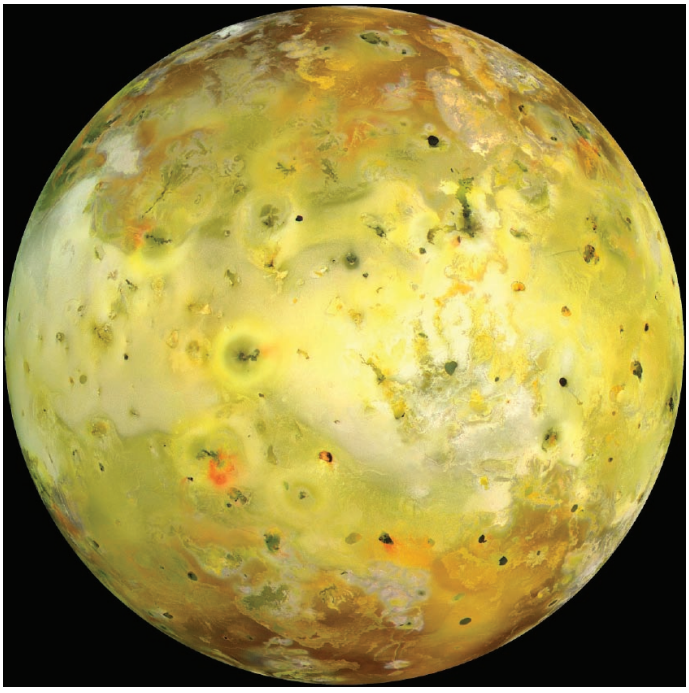
January

1	Wed	New Moon (3:14am) With a telescope or binoculars a skilled observer may be able to spot a nearly record thin young Moon AFTER sunset
2	Thu	Crescent Moon to the upper-left of Venus; binoculars or a telescope may reveal the Moon occulting the double star Beta Capricorn
5	Sun	Jupiter at opposition (visible all night)
7	Tue	First-Quarter Moon (7:39pm)
11	Sat	Venus at inferior conjunction, located 5 degrees north of the Sun
14	Tue	Jupiter to the left of the nearly Full Moon
15	Wed	Full Moon (8:52pm)
22-23	Wed-	The waning gibbous Moon to the lower right of Mars on the 22nd. On the 23rd the Moon is to the lower-left of Mars and close to Spica

The Most Volcanically Active Place is Out-of-This-World!

By Dr. Ethan Siegel

Volcanoes are some of the most powerful and destructive natural phenomena, yet they're a vital part of shaping the planetary landscape of worlds small and large. Here on Earth, the largest of the rocky bodies in our Solar System, there's a tremendous source of heat coming from our planet's interior, from a mix of gravitational contraction and heavy, radioactive elements decaying. Our planet consistently outputs a tremendous amount of energy from this process, nearly three times the global power production from all sources of fuel. Because the surface-area-to-mass ratio of our planet (like all large rocky worlds) is small, that energy has a hard time escaping, building-up and releasing sporadically in catastrophic events: volcanoes and earthquakes!



Caption: Io. Image credit: NASA / JPL-Caltech, via the Galileo spacecraft. Download photo here: http://photojournal.jpl.nasa.gov/catalog/PIA02308

Yet volcanoes occur on worlds that you might never expect, like the tiny moon Io, orbiting Jupiter. With just 1.5% the mass of Earth despite being more than one quarter of the Earth's diameter, Io seems like an unlikely candidate for volcanoes, as 4.5 billion years is more than enough time for it to have cooled and become stable. Yet Io is anything but stable, as an abundance of volcanic eruptions were predicted before we ever got a chance to view it up close. When the Voyager 1 spacecraft visited, it found no impact craters on Io, but instead hundreds of volcanic calderas, including actual eruptions with plumes 300 kilometers high! Subsequently, Voyager 2, Galileo, and a myriad of telescope observations found that these eruptions change rapidly on Io's surface.

Where does the energy for all this come from? From the combined tidal forces exerted by Jupiter and the outer Jovian moons. On Earth, the gravity from the Sun and Moon causes the ocean tides to raise-and-lower by one-to-two meters, on average, far too small to cause any heating. Io has no oceans, yet the tidal forces acting on it cause the world itself to stretch and bend by an astonishing 100 meters at a time! This causes not only cracking and fissures, but also heats up the interior of the planet, the same way that rapidly bending a piece of metal back-and-forth causes it to heat up internally. When a path to the surface opens up, that internal heat escapes through quiescent lava flows and catastrophic volcanic eruptions! The hottest spots on Io's surface reach 1,200 °C (2,000 °F); compared to the average surface temperature of 110 Kelvin (-163 °C / -261 °F), Io is home to the most extreme temperature differences from location-to-location outside of the Sun.

Just by orbiting where it does, Io gets distorted, heats up, and erupts, making it the most volcanically active world in the entire Solar System! Other moons around gas giants have spectacular eruptions, too (like Enceladus around Saturn), but no world has its surface shaped by volcanic activity quite like Jupiter's innermost moon, Io!

Learn more about Galileo's mission to Jupiter: http://solarsystem.nasa.gov/galileo/.

Kids can explore the many volcanoes of our solar system using the Space Place's Space Volcano Explorer: http://spaceplace.nasa.gov/volcanoes.

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.
_____ $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.
_____ $34 One year subscription to Astronomy magazine.
_____ $60 Two year subscription to Astronomy magazine.
_____ $32.95 One year subscription to Sky & Telescope magazine. Note: Subscription to S&T is for new subscribers only. Existing subscribers please renew directly through S&T.
$ _____ 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.