PRIMEFOCUS

Tri-Valley Stargazers

November 2015

November Meeting

The Invention of Spectroscopy, the Era of Big Refractors, and the Ascendency of Reflecting Telescopes in the 19th Century

Dr. Kenneth Lum

At the beginning of the 19th Century, the spectroscope was invented by Joseph Fraunhofer in Germany, which introduced a way to ascertain the chemical compositions of astronomical objects through remote sensing. Additionally, larger telescopes were being built. This happened with both refractors and reflectors, leading to a competition to see which of these two kinds of telescopes would ultimately become dominant in astronomy. Initially, refractors where the preferred technology, especially after the failure of the Great Melbourne reflector in 1846. As a consequence, numerous large refractor telescopes were built in the latter part of the century. But when new technologies allowing reflector telescope mirrors to be made from glass rather than metal, large reflecting telescopes became more practical and outpaced refractors in their performance. This was especially the case in the U.S., where reflector telescope innovation accelerated hand in hand with the development of the science of astrophysics.

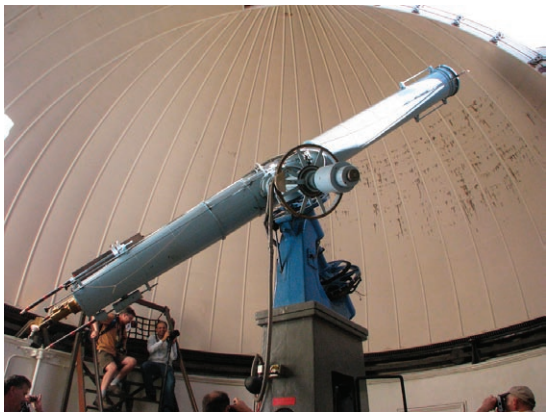

Image Caption: 15" Clark refractor of the Washburn Observatory of the University of Wisconsin, Madison. Completed in 1881. Credit: Dr. Kenneth Lum

Dr. Kenneth Lum is retired from the practice of Emergency Medicine. Since high school he has also been an enthusiastic amateur astronomer, having built two telescopes at the Adler Planetarium in Chicago and a large Newtonian reflector when he re-entered amateur astronomy in 1986. He pursued his interest in astronomical photography during the 1990s and continues to study the history of astronomy and astronomical instrumentation. Dr. Lum is currently interested in ways to enhance the performance of small telescopes with the use of a photomultiplier eyepiece and astronomical video cameras. Since 1994, he has been traveling with the Antique Telescope Society, which annually visits different historical astronomical observatories in the US and Europe.

Meeting Info

What:
Spectroscopy, Refractors, and Reflectors in the 19th Century

Who:
Dr. Kenneth Lum

When:
November 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

Inside

News & Notes

2015 and 2016 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**
Nov. 20	Nov. 23	
Dec. 18	Dec. 21	Nov. 27
Jan. 15	Jan. 18	Dec. 25
Feb. 19	Feb. 22	Jan. 29
Mar. 18	Mar. 21	Feb. 26
Apr. 15	Apr. 18	Mar. 25
May 20	May 23	Apr. 29
Jun. 17	Jun. 20	May 27
Jul. 15	Jul. 18	Jun. 24
Aug. 19	Aug. 22	Jul. 29
Sep. 16	Sep. 19	Aug. 26
Oct. 21	Oct. 24	Sep. 30
Nov. 18	Nov. 21	Oct. 28
Dec. 16	Dec. 19	Nov. 25

Money Matters

As of October 19, 2015 the TVS checking account balance is $10,879.76.

TVS Elections to be Held

Our annual election of club officers will be held during our November meeting. The candidates are Chuck Grant for president, Rich Combs for vice-president, Jill Evanko for secretary, and Roland Albers for treasurer. Additional nominations are welcome.

The Jack Marling Award: New Recipients

The Jack Marling Award is the award given by the Tri-Valley Stargazers to a member for their outstanding contributions to the club over long periods of time. The award includes honorary free life-time membership in the club. The award is not given on a regular basis, but can be given at any time when the board of directors becomes aware of a sufficiently meritorious candidate[1].

The award is named after TVS founding member, noted planetary nebula observer, and founder of Lumicon, Jack Marling. Lumicon was an internationally famous astronomical products company based in Livermore. Lumicon developed new technology such as film hypering, narrow band interference filters and digital setting circles as well as manufacturing a wide range of proven-technology products aimed towards amateurs and made available through mail-order. Jack donated significant amounts of equipment to TVS including the 17.5 inch telescope which sits in Hidden Hill Observatory, which is now called "The Jack Marling Telescope". Jack, of course, has been given life-time membership status.

Other past recipients are:

Don Machholtz, Rich and Barbara Green, Rich Combs, and Debbie Dyke.

Don Machholtz, famous comet hunter, TVS member and long time author of the monthly "Comet Comments" newsletter column was given this award when he retired from writing his column because the information had become more easily accessible over the internet. Prior to this he was the only reliable source of accurate, timely and practical comet observing information available to amateurs. Although not a local resident, he maintained his ties to TVS and has visited as an invited speaker.

At different points in TVS history, the contributions of a few individual members were particularly significant. Each of them has performed nearly every function of the club at one time or another. These included the elected positions of President, Vice President, Secretary, Treasurer and Board Member as well as the appointed/volunteer positions of newsletter editor, program director, star party participant and organizer, educational outreach volunteer, refreshments organizer and supplier, speaker, teacher, host (opened their homes to TVS board meetings), represented the club in other organizations, etc. It is not an exaggeration to say that each one of them, by performing many of these functions, carried much of the club on their shoulders, sometimes for many years.

Rich and Barbara Green, Rich Combs, and Debbie Dyke are each such heroes and have received this award for their many contributions over many years.

For anyone who is familiar with the history of the club, two other people are noticeably absent from this list. Now is the time to correct this omission. Alane Alchorn and Alan Gorski are also heroes that gave many years of service, tirelessly leading and participating in nearly every function of the club.

Alane has served many duties in the club including several officer roles including President, hosting star parties at her ranch, arranging our general meeting location, and many of the other non-elected roles, but she may be remembered most for her many years of producing our newsletter, Prime Focus. Each new newsletter editor brings a new format and editorial style, and Alane's Prime Focus was always excellent.

Header Image: The Rosette Nebula and the embedded open cluster NGC2244 as imaged by Andy Coutant using a Canon EOS 600/T3i Rebel with a full spectrum modification and an Orion Skyglow imaging filter on a Celestron EdgeHD 11 with the Hyperstar system.

Alan Gorski has served in all officer positions, newsletter editor, and many of the other non-elected roles. Alan was an active observer and astrophotographer at H2O and other locations, and he has had pictures published in Sky & Telescope. Some of his more unusual compositions included photographing aurora and meteor showers at H2O, all back in the days of film. Alan was always enthusiastic about sharing his knowledge and activities, and he gave many presentations at TVS meetings. His most significant contribution to the long term survival of TVS may have been spearheading the effort to turn the club into the official not-for-profit corporation that it is today.

For their selfless efforts we are proud to name Alan and Alane as recipients of the Jack Marling Award for outstanding service to the Tri-Valley Stargazers. Thank you for doing everything.

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[1] "We really feel the significance of ones contributions right as they announce they are moving out of the area or otherwise cutting back on their participation, and we wonder how the club can possibly go on without them. Sadly, that is usually the first time in a long time that we remember that we give awards and that one is overdue." -- Chuck Grant speaking for the TVS board of directors

Calendar of Events

November 17, 12:00pm

What: Connected Exploration
Who: Eric Stackpole, OpenROV
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details not available.

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

November 21, 11:00am

What: Genesis on the Benchtop: How Do We Study the Origin of Life in the Lab?
Who: Itay Budin, LBNL
Where: UC Berkeley, Genetics and Plant Biology Building, Room 100 (northwest corner of campus)
Cost: Free, limited hourly pay parking on/nearby campus. The venue is within walking distance of BART and bus lines.

The origin of life is a topic that has driven scientific research from many disciplines, ranging from astronomy to organic chemistry. Molecular biology has revealed that all life on earth shares a common ancestor, yet we know little about how those first cells arose. In this talk I will focus on laboratory efforts to understand how pools of molecules can organize and transition into biological systems capable of Darwinian evolution. A long-term goal of this research is to build simple, self-replicating cells in the lab. While this synthetic approach cannot tell us how life on Earth began, it can shed light on the conditions needed for biology to arise – and the likelihood that it has arisen elsewhere.

For more information see: http://scienceatcal.berkeley.edu/the-sciencecal-lecture-series/

November 27, 11:00am-4:00pm

What: Black Hole Friday
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Free with general admission. call (510) 336-7373

Check out Chabot's second Black Hole Friday where we explore one of the most mind-bending phenomenon in the Universe. Immersed in a field of stars accompanied by the vi-

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Calendar of Events (continued)

sual and auditory re-creation of a black hole and the abstract equations that describe it, this is a sensory-rich experience. Engage in a variety of black hole related demonstrations throughout the Center and don't forget to stop by Destination Universe to step into our Black Hole.

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

December 1, 12:00pm

What: Power Laws, Predictable Evolution, and the Limits of Life
Who: Chris Kempes, Santa Fe Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

A central question in understanding the possibilities for life in the universe is what fundamental constraints and tradeoffs organize evolution. In this talk Dr. Kempes will discuss how power-laws in biology highlight common underlying constraints––often basic physical laws––across the diversity of life on our planet. He will then describe how work that we have done shows how these relationships can be derived and used to predict or interpret a range of phenomena including major evolutionary tradeoffs and ecological response. Specifically, Dr. Kempes will focus on energetic limitations in microbial life which allow us to predict the smallest possible bacteria and several other evolutionary transitions. Notably, he predicts that the smallest bacteria are limited by fundamental maintenance metabolism along with general space requirements. Dr. Kempes will also describe how similar work in vascular plants can be used to predict ecological structure from resource constraints and how this provides a range of tools for constraining and potentially detecting vegetation in a range of exoplanetary environments.

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

DSLR Astrophotography

Over the past 5 years the sensitivity of DSLR imaging chips has increased, while their inherent noise has decreased. As such, DSLR's are increasingly being used for astrophotography. DSLR imaging chips typically have a weak response to hydrogen-alpha light since the imaging chips have an infrared (IR) blocking filter to maintain proper Red-Green-Blue color balance. As such, your standard "unmodified" off-the-shelf DSLR is best suited for imaging open clusters, globular clusters, meteors, and the Moon and Sun. Indeed, many beautiful astrophotos taken with unmodified DSLR's by club members (e.g., Roland Albers, Steve Goldenberg, Gert Gottschalck) have graced these pages. Unmodified cameras can also be used for imaging emission nebulae, but compared to modified cameras long exposure times are needed, and achieving high contrast images is a challenge.

What is a "modified" camera? These are DSLR's whose IR blocking filter has been removed from the imaging chip and replaced with a filter that passes hydrogen-alpha light and cuts off the IR at longer wavelengths. Two examples of astrophotos with modified DSLR's are shown on p.5. Alan Gorski used a modified Canon 50D and a telephoto lens to image of the region around Deneb, which shows the prevalence of hydrogen-alpha emission along the central axis of the Milky Way. Andy Coutant produced the high contrast image of the eastern Veil Nebula using a C-11 and the HyperStar system using a full spectrum modified Canon T3i and an Orion Skyglow imaging filter. A full spectrum modified camera is one in which there is no IR cutoff, so some sort of filter is required to cut off the IR longward of the hydrogen-alpha line.

So, where does one get a modified DSLR? There are two approaches, one is to buy a pre-modified DSLR, such as those available from Hutech (www.hutech.com/). One benefit of this approach is that the Hutech modified cameras come with 1-year warranties. Hutech has cameras with APS-C and full frame (35mm) sensors. Another option is to send your camera out to have the sensor modified. Hap Griffen (www.hapg.org/dslrmods.html) and Gary Honis (http://dslrmodifications.com/) are two noted experts who perform this service. One downside of this latter approach is that your camera warranty is voided. Also, Mr.'s Griffen and Honis only modify select models of Canon cameras, with Hap Griffen also modifying the full frame Canon 6D.

DSLR's are susceptible to substantial thermal noise, especially during summer months, since the imaging sensor is not cooled, but rather it operates at ambient temperature. As such, taking dark frames is important, especially if you will be stacking many images. DSLR's can automatically remove a dark frame after each exposure via the cameras noise reduction system. Removal of a single dark frame after each exposure is advantageous since over the course of the night the ambient temperature will change, and with it the level of thermal noise. However, there are 2 disadvantages to this approach; there is read noise in each dark frame that could otherwise be removed by stacking multiple dark frames, and secondly, valuable imaging time is taken up by the camera generating a dark frame after each exposure. The alternative is to turn off the cameras long exposure and high ISO noise reduction, and expose dark frames with the same duration and ISO as your individual exposures. You can probably take a dozen or more dark frames while you pack up the rest of your astro-equipment at the end of the night. You should also take a dozen or so bias exposures using the fastest shutter speed

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Image Caption: Alan Gorski took this image of the sweeping emission nebulae surrounding Deneb, including the North American Nebula (NGC7000). It is a 10-minute exposure at ISO 800 using a modified Canon 50D APS-C format DSLR from Hutech, a 70-200mm f/2.8 lens stopped down to f/4, a focal length of 100mm, and an Astronomik CLS filter. The exposure was hand-guided using a TeleVue NP127, a 5x barlow, and a 5mm reticle eyepiece on a Losmandy G-11 mount.

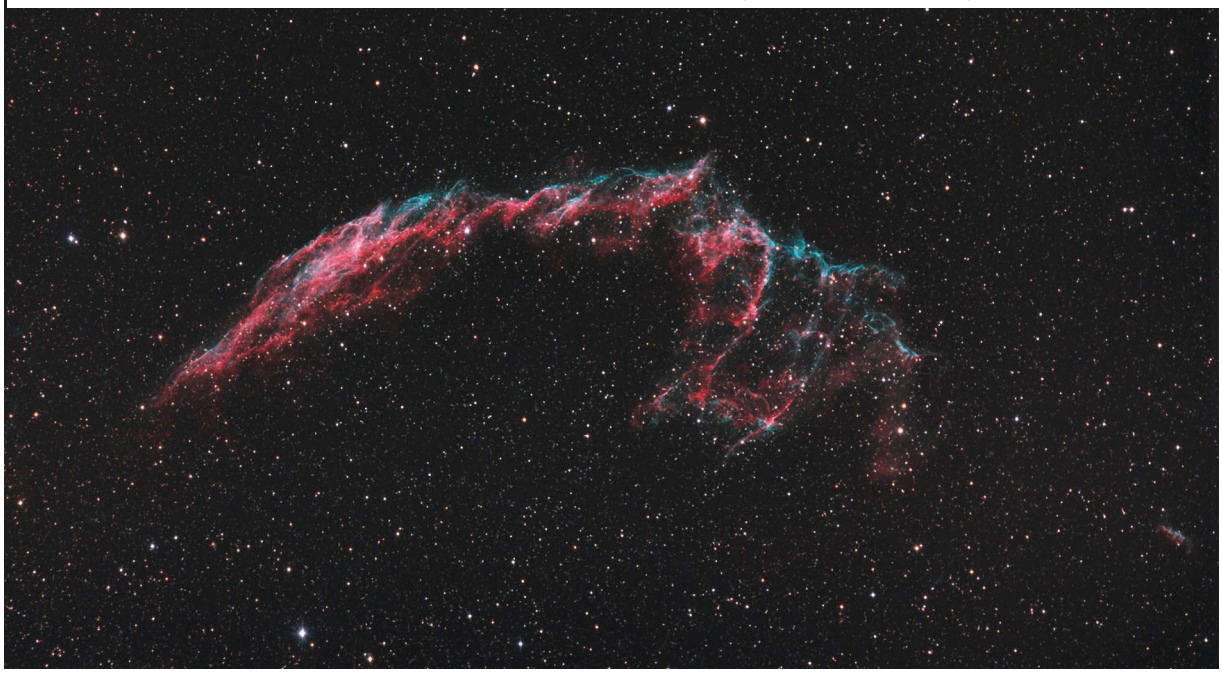


Image Caption: Andy Coutant took this image of the eastern portion of the Veil Nebula (NGC6992.6695) from Glacier Point at Yosemite National Park. He used a Canon EOS 600/T3i Rebel with a full spectrum modification and an Orion Skyglow imaging filter on a Celestron EdgeHD 11 with the Hyperstar system. The 54 minute exposure (47 seventy second subframes) was taken at ISO 800 within Orion Starshoot Pro used for guiding..

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

All times are Pacific Standard Time.

November

17-18 Tue Leonid Meteor Shower; best after midnight

18 Wed First-Quarter Moon (10:27pm)

24 Tue Algol at minimum brightness for 2 hours centered on 9:15pm

25 Wed Full Moon in the Hyades star cluster (2:44pm)

28 Sat Spica less than 5 degrees from Venus

December

2 Wed Last-Quarter Moon (11:40pm)

5 Sat Venus anchors a chain that runs past Spica to "connect" Mars, the Moon, Beta Virginis, Jupiter, and Regulus (morning)

7 Mon Occultation: Crescent Moon covers Venus (~7:53am), Venus reappears (~9:39am; (see p. 46, December S&T)

11 Fri New Moon (2:29am)

13-14 Sun- Geminid Meteor Shower visible Sunday and Monday nights; best after midnight (see p. 44, December S&T)

17 Thu Algol at minimum brightness for 2 hours centered on 7:48pm

18 Fri First-Quarter Moon (7:14am)

your camera can muster. When image processing, the bias frames are used to scale images to account for the different temperatures at which the exposures were taken, and by averaging lots of dark frames and bias frames the read noise of your calibration masters is reduce. Flat field exposures should also be taken, especially for full frame cameras, since vignetting is likely to be an issue.

Light pollution is an ever-growing problem, especially here in the Bay area. Light pollution has two effects; first it reduces your signal-to-noise ratio, and second it can impart gradients across your image, especially if you are doing widefield astrophotography. Thus, for both unmodified and modified cameras light pollution filters can, in some cases, be beneficial. Light pollution filters that attach to the end of a camera lens can be problematic for a focal lengths of ~70mm or less. This arises since these filters are interference filters, and the spectral response of the filter changes for light that enters the filter from "large" angles of incidence. This results in images that have a color gradient that appears as a bullseye. An alternative is to use a light pollution filter that clips in behind the lens, such as the IDAS-P2 FF from Hutech (APS-C size), and the Astronomik CLS (APS-C and Canon 6D full frame). In this case, the light has passed through all of the lens elements, and upon exiting the back of the lens the light is perpendicular to the filter and you get a uniform spectral response across the field of view. Alan Gorski has had success at focal lengths as short as 8mm using clip-in filters.

A downside to a modified camera is that the color balance is not correct for daylight photography. One can use custom camera settings to address this issue, but settings need to be changed for different exposure settings and lenses. A solution to this problem is to use a filter that has an IR cutoff consistent with an unmodified camera. In terms of screw on filters that you attach to the end of your camera lens, the X-NiteCC1 filter (www.maxmax.com/aXNiteTreeFilterComparison.htm) is an option. Clip-in filters, such as the Astronomik OWB-CCD Type III (www.astronomik.com/en/clip-filter-fur-canon-vollformat.html) or the VLC-FF from Hutech are an alternative. With clip-in filters for APS-C sensors you can compose your image through the viewfinder or in live view mode. For the Canon 6D full frame camera, the filter clips in directly over the imaging sensor with the reflex mirror remaining flipped up, so you cannot compose your image by looking through the viewfinder. Rather you can only compose your image using the live view mode.

Obviously, there are many issues to consider when using your DSLR for astrophotography, and considering whether to have it modified. An excellent article can be found at: www.astropix.com/HTML/I_ASTROP/DSLR_HA.HTM

I thank Roland Albers, Andy Coutant, Steve Goldenberg, and Alan Gorski for sharing their astroimaging wisdom, which was very helpful in my preparation of this article. All errors in interpretation and preparation are my own-Ken Sperber.

How We Know Mars has Liquid Water on its Surface

By Dr. Ethan Siegel

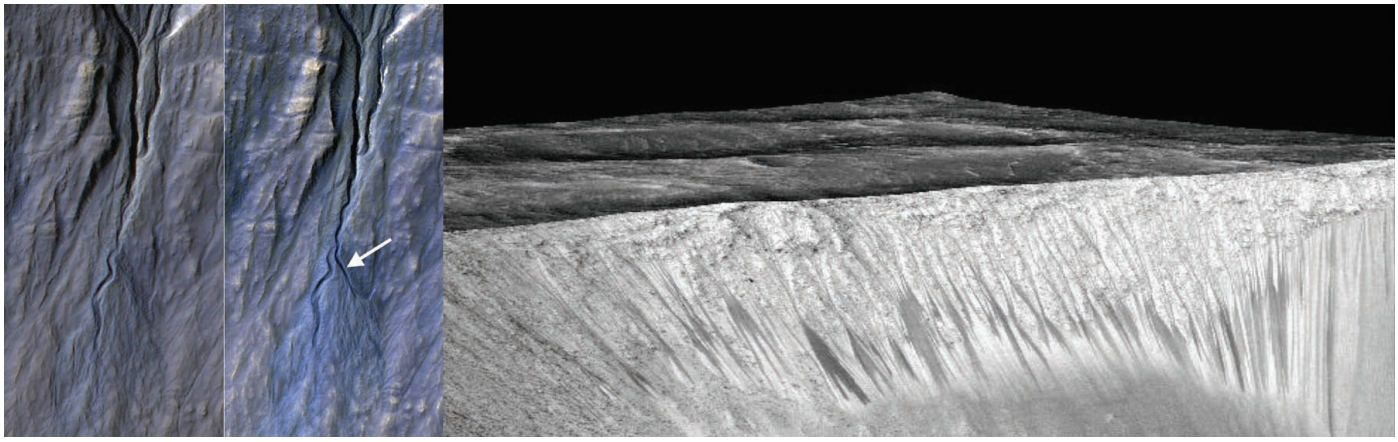
Of all the planets in the solar system other than our own, Mars is the one place with the most Earth-like past. Geological features on the surface such as dried up riverbeds, sedimentary patterns, mineral spherules nicknamed "blueberries," and evidence of liquid-based erosion all tell the same story: that of a wet, watery past. But although we've found plenty of evidence for molecular water on Mars in the solid (ice) and gaseous (vapor) states, including in icecaps, clouds and subsurface ices exposed (and sublimated) by digging, that in no way meant there'd be water in its liquid phase today.

Sure, water flowed on the surface of Mars during the first billion years of the solar system, perhaps producing an ocean a mile deep, though the ocean presence is still much debated. Given that life on Earth took hold well within that time, it's conceivable that Mars was once a rich, living planet as well. But unlike Earth, Mars is small: small enough that its interior cooled and lost its protective magnetic field, enabling the sun's solar wind to strip its atmosphere away. Without a significant atmosphere, the liquid phase of water became a virtual impossibility, and Mars became the arid world we know it to be today.

But certain ions—potassium, calcium, sodium, magnesium, chloride and fluoride, among others—get left behind when the liquid water disappears, leaving a "salt" residue of mineral salts (that may include table salt, sodium chloride) on the surface. While pure liquid water may not persist at standard Martian pressures and temperatures, extremely salty, briny water can indeed stay in a liquid state for extended periods under the conditions on the Red Planet. It's more of a "sandy crust" like you'd experience on the shore when the tide goes out than the flowing waters we're used to in rivers on Earth, but it means that under the right temperature conditions, liquid water does exist on Mars today, at least in small amounts.

The measured presence and concentration of these salts, found in the dark streaks that come and go on steep crater walls, combined with our knowledge of how water behaves under certain physical and chemical conditions and the observations of changing features on the Martian surface supports the idea that this is the action of liquid water. Short of taking a sample and analyzing it in situ on Mars, this is the best current evidence we have for liquid water on our red neighbor. Next up? Finding out if there are any single-celled organisms hardy enough to survive and thrive under those conditions, possibly even native to Mars itself!

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!



Images credit: NASA/JPL-Caltech/Univ. of Arizona, of a newly-formed gully on the Martian surface (L) and of the series of gullies where the salt deposits were found (R).

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 ($100). 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.