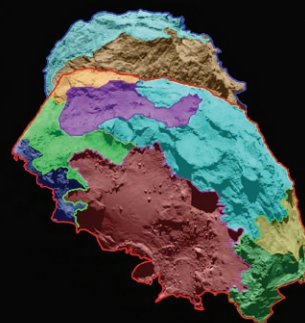


# PRIMEFOCUS

Tri-Valley Stargazers



September 2014



## Meeting Info

### What:

Show and Tell

### Who:

You

### When:

September 19, 2014  
Doors open 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

### Show and Tell

Presently, we have no scheduled speaker for September. Please monitor the TVS website for details in case a speaker is found at the last minute. As an alternative we will have Show and Tell session. Some brief presentations regarding Astronomical league Observing/Imaging Programs have been solicited.

TVS desperately needs a Program Director to help maintain a regular schedule of speakers to ensure the viability of the club.

### Observing the Summer's Finest Globular Clusters at H2O

#### Roland Albers

During last month's Open House at H2O, my son and I spent some time observing and comparing three of the summer's best globular clusters: M4, M13, and M22. Using a Celestron C8 SCT with a TeleVue 24mm Panoptic eyepiece (83X magnification), the renowned M13 was certainly the brightest and M4 the most easily resolved into individual stars, but the globular we found the most spectacular



Caption: M22 imaged by Roland Albers

was M22. M22 was almost as large and bright as M13 but thanks to the dark skies of H2O and the clear and calm air the night of the Open House, it seemed to resolve into many more individual, pinpoint stars. Sitting amid a rich field of Milky Way stars in Sagittarius, M22 is one of the most beautiful sights through the eyepiece I've found and now a permanent member of my "must-see" list of summer objects.

Inspired by our H2O observations, I took the above photo of M22 a week later from my backyard in Pleasanton. It was taken with a 1370mm AT6RC 6-inch astrograph and an unmodified Canon T3i DSLR and is the result of combining 14 3-minute sub-exposures along with 5 dark frames and 9 flat frames. I calibrated and stacked the frames with DeepSky Stacker and also used DSS for initial stretching and color correction. I then used Photoshop for additional stretching, black-point adjustment, sharpening, and conversion to jpeg.

## News & Notes

### 2014 TVS Meeting Dates

The following lists the TVS meeting dates for 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
Sep. 19	Sep. 22	
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 August 17, 2014 the TVS checking account balance is: \$12,760.89.

### Painting Party at H2O: September 20

We will be having a painting party at the Hidden Hill Observatory on Saturday September 20th, the day after our regular meeting. We will be repainting the observatory building. If you want to help out, we will meet at Mines Road at 1:00 and caravan from there. We will supply the paint, but you should bring tools like scrapers, paint brushes, rollers, stepping stools, plenty of water for cleanup, etc. There will be a new Moon that night, so bring some dinner and plan to stay late. If you have a solar scope, you should bring that too. See you then!

### October is Eclipse Month: GET READY!

On Wednesday, October 8th there will be a total lunar eclipse visible from the Bay area. The partial phases begin and end at 2:15am and 5:34am, respectively. The total eclipse lasts about 30 minutes, extending from 3:25am to 3:55am. Uranus will be 1 degree from the Moon during totality! See p.50 of the October 2014 issue of S&T for more information.

On Thursday, October 23 there will be a partial solar eclipse visible from the Bay area. The Sun's disk will be approximately 39% obscured. The eclipse begins at 1:54pm, with maximum eclipse at 3:17pm, ending at 4:33pm.

See [eclipse.gsfc.nasa.gov/OH/OH2014.html](http://eclipse.gsfc.nasa.gov/OH/OH2014.html) for more details about these two eclipses. See [skypub.com/observing/celestial-objects-to-watch/eclipses](http://skypub.com/observing/celestial-objects-to-watch/eclipses) for tips on observing and imaging eclipses.

## Book Review by Gert Gottschalk

**“Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time” by Dava Sobel**

The story of this book is the life long struggle of John Harrison to overcome adversity and intrigue of a multitude of en-

emies. In parallel it is the story of the greatest technological breakthrough in maritime navigation, the determination of the correct longitude of a ship at sea. The story begins in October 22nd 1707 when four out of five English warships under the command of Clowdisley Shovell misjudged their position and ran into rocky cliffs near the Scilly Isles. Almost 2000 sailors lost their lives.

Under the impressions of accidents like this the British government established a ‘Board of Longitude’ that was to offer a prize money of 20000pounds to an invention or method to determine longitude at sea to better than 30nautical miles. (The prize money would be 2.5million Pounds in 2014)

Much to the dismay of the members of the board a lot of unfeasible ideas poured in like anchoring ships across the ocean which as a time signal would fire canons at 12noon. No suggestion was given how the ships were to be anchored and how they were supposed to keep time!

The board had a strong bias for scientific approach and astronomers of the day were eager to pick up the challenge and come up with methods of determining time by astronomical methods. There are astronomical events that are perfectly suitable to derive time, like eclipses of the Sun and the Moon, the positions of the Galilean Moons of Jupiter, and the orbital position of the Moon in front of the stars. Now eclipses are too rare to provide constant time keeping so this method was quickly discounted. Observing Jupiter's Moons from a moving deck of a ship at night was no trivial task either. And what to do when Jupiter was not up? So the method of measuring the angle between the Moon and stars became the favorite of the Board.

At this point John Harrison a carpenter and self educated clock maker from rural England enters the competition. He started as a carpenter and moved on to repair clocks in churches as a side job. There he learned the shortfalls of clocks as timekeepers of the day. Church clocks were easily off by 15minutes per day and had to be constantly reset to the village sun dial for even the lowest accuracy.

From the time in 1713 when Harrison built his first clock to the completion of the prize winning clock now called H4 in 1761 Harrison had to invent the entire technology in the field of mechanical precision time keeping.

Dava Sobel's book takes us through the trials and misfortunes that Harrison suffered through and much attention is given to the personal adversities facing Harrison. At many times his adversaries were member of the Board of Longitudes propagating their own method of lunar angular distances. At one

Header Image: Comet 67P/Churyumov-Gerasimenko morphology based on observations from Rosetta. Image Credit: ESA/Rosetta/MPS for OSIRIS Team/MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

## Book Review (continued)

event Nevil Maskelyne at the time the Astronomer Royal and himself a contender for the prize was designated the referee to certify that Harrison's watch actually performed as claimed. Of course he didn't.

The book takes us through many roadblocks that Harrison encountered and it sad to see how technological and scientific advancement was derailed by members of the scientific community themselves. Only at the very end of his life Harrison get's his recognition when his case was brought before King George III who authorized the payment of a reward to Harrison, though it is noteworthy that the actual prize money was never given to anybody.

Chronometers following Harrison's design proved to be the solution to the longitude problem and a copy of Harrison's competition watch was carried by Captain James Cook on his second and third voyage. Cook praised the accuracy of the chronometer and the maps he produced of the southern Pacific would have been possible without it.

Though we learn a lot about Harrison's life and struggle in the book the author fails to satisfy the technically inclined reader. There are only few photos of Harrison's clocks in the color pages of the book. We would have liked to see more excursions into the technical realm. Where Harrison made inventions and where he single handedly improved chronometer technology decades ahead of everybody else only brief side remarks are found.

Still overall the book s a fine story to read on the perseverance of Harrison against all odds. The paperback version of the book can be bought on Amazon for \$9.34 the Kindle version \$7.99. PBS made a NOVA documentary on the story that can be seen on Youtube :

<https://www.youtube.com/watch?v=e1k0g2OTCa8>

## Calendar of Events

### September 16, Noon-1:00pm

What: Mars: Periglacial morphology and ice stability  
Who: Jennifer Heldmann, NASA Ames  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

At the Mars Phoenix landing site and in much of the martian northern plains, there is ice-cemented ground beneath a layer of dry permafrost. Unlike most permafrost on Earth, though, this ice is not liquid at anytime of year. However, in past epochs at higher obliquity the surface conditions during summer may have resulted in warmer conditions and possible melting. At the Mars Phoenix landing site and in much of the martian northern plains, there is ice-cemented ground beneath a layer of dry permafrost. Unlike most permafrost on Earth, though, this ice is not liquid at anytime of year. However, in past epochs at higher obliquity the surface conditions during summer may have resulted in warmer conditions and possible melting.

The high elevation Dry Valleys of Antarctica provide the best analog on Earth of martian ground ice, such as University Valley. This setting provides a natural gradient in physical permafrost properties, water vapor transport, and ice stability. We will also discuss geomorphic ramifications of this ground ice distribution as polygon size is shown to increase down the length of the valley and is correlated with increasing ice depth. Since polygons are long-lived landforms and observed characteristics indicate no major fluctuations in the ice-table depth during their development, the University Valley polygons have likely developed for at least 104 years to achieve their present mature-stage morphology, and the ice-table depth has been stable for a similar length of time. we will review a landing site selection study encompassing this information gleaned from the Antarctic terrestrial analog studies plus Mars spacecraft data analysis to identify candidate land-

continued on page 4

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**Refreshment Coordinator:**  
Laurie Grefsheim

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info@trivalleystargazers.org

#### TVS E-Group

So how do you join the TVS e-group, you ask? Just send an e-mail message to the TVS e-mail address (info@trivalleystargazers.org) asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

## Calendar of Events (continued)

ing sites for a future mission to search for life on Mars.

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

### September 26, 6:00pm

What: Night Hike  
Who: Chabot Staff/You  
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619  
Cost: \$12; does not include admission to the Center  
Reservations: (510) 336-7373

Enjoy an easy 1-2 mile end-of-summer hike through the beautiful redwoods and watch the sun set over the bay! After the hike, stay and explore other amazing objects in the night sky through our telescopes (weather permitting) or tour the Telescope Makers Workshop. Hike will take place rain or shine.

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

### September 23, Noon-1:00pm

What: Are you living in a simulation?  
Who: Silas Beane, University of Washington  
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA  
Cost: Free

Philosophers have long considered the possibility that we live in an artificial or simulated reality. Dr. Beane will give a short overview of some of the simulation arguments/scenarios that he personally finds most compelling.

Dr. Beane will then attempt to frame the simulation argument in the context of science. In particular, he will discuss recent work which suggests various observational tests of the hypothesis that we are currently living in a simulated universe. These include studies of the cosmic microwave background, high-energy cosmic rays, and high-precision terrestrial experiments.

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

### September 27, 7:30pm

What: NuSTAR's Sharper View of the Universe  
Who: Dr. Lynn Cominsky, Sonoma SU  
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area  
Cost: Free

Launched in June 2012, NuSTAR is bringing the high-energy Universe into focus. Exploding stars, hidden black holes and other exotic objects are all being studied in an entirely new

light.

For more information see: <http://www.friendsofmetam.org/astronomy/schedule>

### September 30, Noon-1:00pm

What: Inflationary Cosmology with BICEPs  
Who: Chao-Lin Kuo, Stanford University  
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA  
Cost: Free

How did the universe begin? This is one of the deepest mysteries in science. I will describe the BICEP program, a series of South Pole-based experiments aiming to answer this question by studying the polarization of cosmic microwave background radiation. This whole enterprise is an amazing combination of big ideas (inflation, general relativity, and quantum gravity) and cutting edge technology (superconductors, quantum electronics, microwave engineering, and advanced materials). In March 2014, the second experiment of the series BICEP2 has announced a detection of degree-scale B-mode polarization that is consistent with having an inflationary origin. I will describe what this measurement means and how we are going to follow up on it.

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

### October 6, 7:30pm

What: A Planet for Goldilocks  
Who: Natalie Batalha, NASA Ames  
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.

Not too hot, not too cold reads the prescription for a world that's just right for life as we know it. Finding evidence of life beyond Earth is one of the primary goals of astronomy focused science agencies in the United States and abroad. The goal looms closer as a result of recent discoveries made by NASA's Kepler Mission. Launched in March 2009, Kepler is exploring the diversity of planets and planetary systems orbiting other stars in the galaxy. Finding inhabited environments is a path of exploration that stretches decades into the future and begins by determining if Goldilocks planets abound. Dr. Batalha will describe the latest discoveries of NASA's Kepler Mission and the possibilities for finding inhabited environments in the not-so-distant future.

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

### October 7, Noon-1:00pm

continued on page 5

## Calendar of Events (continued)

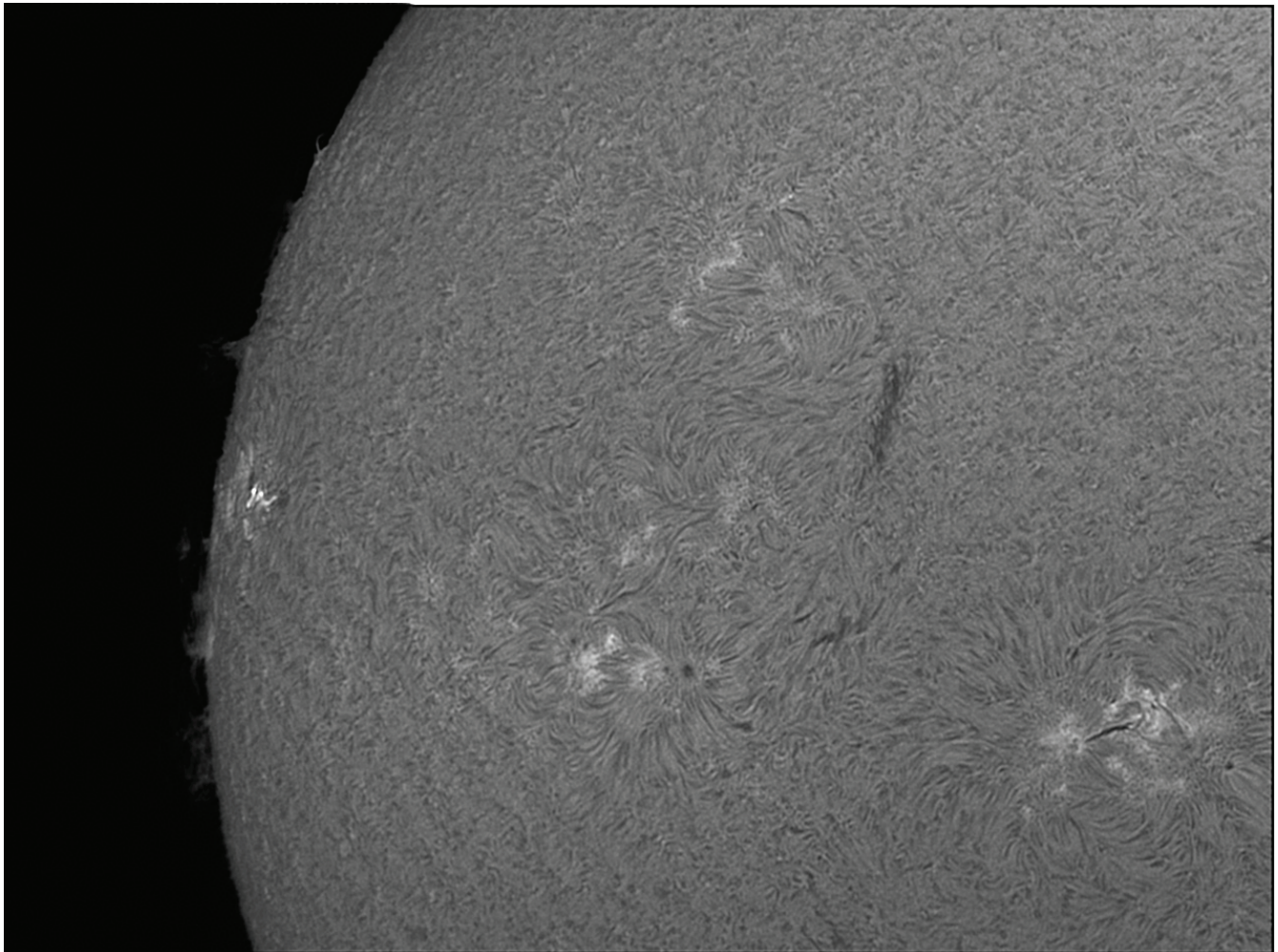
**What:** Recurring Slope Lineae: Confirmation of shallow subsurface flowing water on Mars  
**Who:** David Stillman, Southwest Research Institute  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA  
**Cost:** Free

Recurring Slope Lineae (RSL) are narrow (0.5 to 5 m) dark albedo features that incrementally lengthen down steep slopes and reoccur each year. RSL are well correlated with temperature, as they lengthen as temperature increases and fade as temperature decreases. RSL have been observed within a latitude band from 37°N to 52°S, but tend

to cluster in the southern mid-latitudes (SML) in and around Valles Marineris and Chryse Planitia.

In this talk, Dr. Stillman will demonstrate how observations from the ~25 cm/pixel High Resolution Imaging Science Experiment (Hi-Rise) onboard Mars Reconnaissance Orbiter and surface temperature data acquired by three orbital instruments suggest that RSL are caused by subsurface liquid water flows

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



Caption: Gert Gottschalk took this image of the Sun on August 16, 2014 using his 60mm Lunt H-alpha telescope. The frames were recorded with a DMK41 camera, with 15% of 750 frames combined and processed in Registax and Photoshop CS2. This is one of 12 images that Gert combined into a movie. Each image is separated by 3 minutes. The movie can be found at: [http://www.trivalleystargazers.org/gert/sun\\_2014/Sun\\_20140816\\_ani2\\_015.gif](http://www.trivalleystargazers.org/gert/sun_2014/Sun_20140816_ani2_015.gif) Gert has a webpage devoted to his 2014 solar imaging campaign: [http://www.trivalleystargazers.org/gert/sun\\_2014/solar\\_campaign\\_2014.html](http://www.trivalleystargazers.org/gert/sun_2014/solar_campaign_2014.html)

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

All times Pacific Daylight Time.

### September

- 15 Mon Last-Quarter Moon (7:05pm)
- 17 Wed Algol at minimum brightness for 2 hours centered on 11:06pm
- 20 Sat Jupiter to the upper-left of the Moon (Dawn)
- 21-06 Sun- Zodiacal light visible in the east from dark locations (120 - 80 minutes before sunrise)
- 23 Tue New Moon (11:14pm)
- 23-30 Tue- Mars less than 4 degrees from Antares; closest on the 27th and 28th (Dusk)

### October

- 1 Wed First-Quarter Moon (12:33pm)
- 8 Wed Full Moon; Total Lunar Eclipse (2:15am - 5:34am including partial phase; see p.50 October S&T)
- 15 Wed Last-Quarter Moon (12:12pm)
- 17-18 Fri- Jupiter and the Moon make a nice pairing (Dawn)
- 20-22 Mon- Orionid meteor shower (Dawn)
- 20-04 Mon- Zodiacal light visible in the east from dark locations (120 - 80 minutes before sunrise)
- 23 Thu New Moon; Partial Solar Eclipse (1:54pm - 4:33pm; see p.52 October S&T)
- 25 Sat Saturn to the lower-right of the crescent Moon (Dusk)
- 30 Thu First-Quarter Moon (7:48pm)



## Droughts, Floods and the Earth's Gravity, by the GRACE of NASA

By Dr. Ethan Siegel

When you think about gravitation here on Earth, you very likely think about how constant it is, at  $9.8 \text{ m/s}^2$  ( $32 \text{ ft/s}^2$ ). Only, that's not quite right. Depending on how thick the Earth's crust is, whether you're slightly closer to or farther from the Earth's center, or what the density of the material beneath you is, you'll experience slight variations in Earth's gravity as large as 0.2%, something you'd need to account for if you were a pendulum-clock-maker.

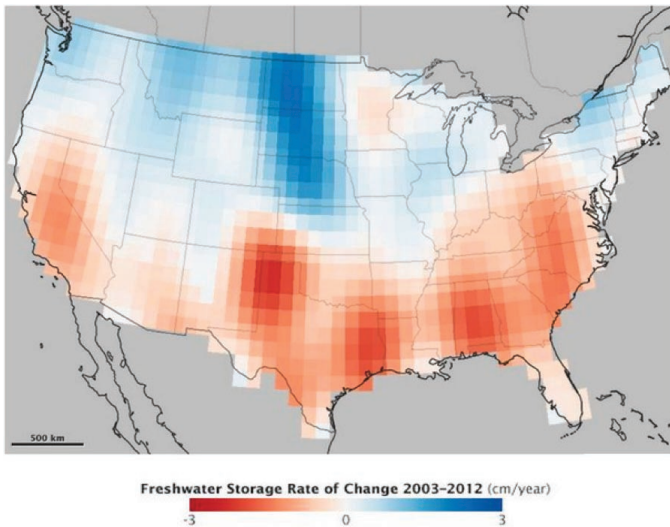


Image credit: NASA Earth Observatory image by Jesse Allen, using GRACE data provide courtesy of Jay Famigleitti, University of California Irvine and Matthew Rodell, NASA Goddard Space Flight Center. Caption by Holli Riebeck.

But surprisingly, the amount of water content stored on land in the Earth actually changes the gravity field of where you are by a significant, measurable amount. Over land, water is stored in lakes, rivers, aquifers, soil moisture, snow and glaciers. Even a change of just a few centimeters in the water table of an area can be clearly discerned by our best space-borne mission: NASA's twin Gravity Recovery and Climate Experiment (GRACE) satellites.

Since its 2002 launch, GRACE has seen the water-table-equivalent of the United States (and the rest of the world) change significantly over that time. Groundwater supplies are vital for agriculture and provide half of the world's drinking water. Yet GRACE has seen California's central valley and the southern high plains rapidly deplete their groundwater reserves, endangering a significant portion of the nation's food supply. Meanwhile, the upper Missouri River Basin—recently home to severe flooding—continues to see its water table rise.

NASA's GRACE satellites are the only pieces of equipment currently capable of making these global, precision measurements, providing our best knowledge for mitigating these terrestrial changes. Thanks to GRACE, we've been able to quantify the water loss of the Colorado River Basin (65 cubic kilometers), add months to the lead-time water managers have for flood prediction, and better predict the impacts of droughts worldwide. As NASA scientist Matthew Rodell says, "[W]ithout GRACE we would have no routine, global measurements of changes in groundwater availability. Other satellites can't do it, and ground-based monitoring is inadequate." Even though the GRACE satellites are nearing the end of their lives, the GRACE Follow-On satellites will be launched in 2017, providing us with this valuable data far into the future. Although the climate is surely changing, it's water availability, not sea level rise, that's the largest near-term danger, and the most important aspect we can work to understand!

Learn more about NASA's GRACE mission here: [http://www.nasa.gov/mission\\_pages/Grace/](http://www.nasa.gov/mission_pages/Grace/)

Kids can learn all about launching objects into Earth's orbit by shooting a (digital) cannonball on NASA's Space Place website. Check it out at: <http://spaceplace.nasa.gov/how-orbits-work/>



Tri-Valley Stargazers  
P. O. Box 2476  
Livermore, CA 94551  
[www.trivalleystargazers.org](http://www.trivalleystargazers.org)

## Tri-Valley Stargazers Membership Application

(or apply for membership online: [www.trivalleystargazers.org/membership.shtml](http://www.trivalleystargazers.org/membership.shtml))

### Contact information:

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Street Address: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Email Address: \_\_\_\_\_

Status (select one): \_\_\_\_\_ New member \_\_\_\_\_ Renewing or returning member

**Membership category** (select one): Membership term is for one calendar year, January through December.

\_\_\_\_\_ Student member (\$5). Must be a full-time high-school or college student.

\_\_\_\_\_ Regular member (\$30).

\_\_\_\_\_ Patron member (\$70). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

**Hidden Hill Observatory Access** (optional):

\_\_\_\_\_ One-time key deposit (\$20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

\_\_\_\_\_ Annual access fee (\$10). You must also be a key holder to access the site.

**Magazine Subscriptions** (optional): Discounted subscriptions are available only to new subscribers. All subsequent renewals are handled directly with the magazine publishers.

\_\_\_\_\_ One-year subscription to Sky & Telescope magazine (\$32.95).

\_\_\_\_\_ One-year subscription to Astronomy magazine (\$34).

**Donation** (optional):

\_\_\_\_\_ Tax-deductible contribution to Tri-Valley Stargazers

**Total enclosed:** \$ \_\_\_\_\_

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone other than other club members and the Astronomical League without your express permission.

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.