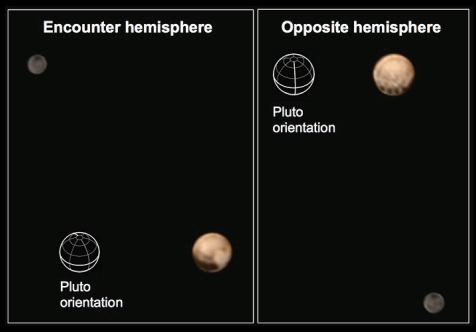
PRIMEFOCUS

Tri-Valley Stargazers



July 2015

Meeting Info

What:
Summer Barbecue

Who:
TVS Members and Friends

When:
July 17, 2015
Set-up at 6:30 p.m.
Dinner at 7:00 p.m.

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

Inside

July Meeting

Summer Barbecue

Our July meeting will be our annual Summer BBQ. Plan on working up an appetite by helping to set-up and get the charcoal going at about 6:30pm. We will start eating around 7:00pm.

Jill/TVS will provide hamburgers and hotdogs (actually chicken sausages), with a variety of toppings including blue cheese, mushrooms, bacon, etc. There will also be vegetarian black bean burgers, and she will provide caprese salad sticks (mozzarella ball, basil, kalamata olive and cherry tomato on a skewer).

Members are asked to bring a side dish, salad, or dessert to share. Please bring enough to feed about 5-8 people. Use the first letter of your last name to determine which type of dish to bring:

•A-F Dessert

•G-L Macaroni or Potato Salad

•M-R Green or Fruit Salad

•S-Z Appetizers

News & Notes

2015 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**
Jul. 17	Jul. 20	
Aug. 21	Aug. 24	Jul. 31
Sep. 18	Sep. 21	Aug. 28
Oct. 16	Oct. 19	Sep. 25
Nov. 20	Nov. 23	Oct. 30
Dec. 18	Dec. 21	Nov. 27

Money Matters

As of June 22, 2015 the TVS checking account balance is $11,811.48.

TVS Solar scope and mount have arrived!

Our Lunt LS60THa solar telescope and its Celestron CG-4 mount have arrived. Initial tests by Roland indicate that the scope works beautifully, showing plenty of detail on the solar surface and several clearly visible prominences around the edge. The mount is a good size for the scope, sturdy but without dwarfing the scope. Tracking the Sun while observing is very easy with the slow motion knobs. The RA axis is a bit tight in spots and the dovetail mars the scope's rail, but these are minor issues. We will be using it at club functions and outreach events, and it will make its debut at this month's summer barbecue meeting.

H2O: The old picnic table is available

The club's old wooden picnic table is still at H2O and free for anyone who is willing to disassemble it and haul it away. Note that the old picnic table's wood is very weathered, twisted, warped, etc., and it will not be useful for most applications. Please contact Chuck Grant if interested.

TVS Yosemite Star Party: July 17-18

Bob McKoon will be coordinating this year's TVS star party at Glacier Point, Yosemite National Park. We were lucky in drawing the nearly-new Moon weekend of July 17-18. TVS members who bring telescopes for public observing will receive free camping at the Bridalveil campgrounds. The Moon, with ~6% of the disk visible, will set by 10pm. On these dates sunset occurs at about 8:25pm with sunrise at about 6:00am. Contact Bob for more information (rmckoon"at"yahoo.com).

Star Party, Volunteers Needed: Tuesday, July 28

The Girl Scouts Camporee astronomy night at the Alameda County Fairgrounds in Pleasanton is from 8:00 to 10:00pm. There will be approximately 400 participants, so we need lots of TVS volunteers. Contact Eric Dueltgen, the TVS Star Party Coordinator if you can be of assistance (coordinator"at"trivalleystargazers.org).

TVS H2O Open House: August 8

The next TVS Open House at H2O is Saturday, August 8. Interested club members, especially those who have paid a key deposit but have not yet completed an orientation visit, are encouraged to attend. We will meet at the corner of Mines Rd. and Tesla Rd., and depart to H2O at 6:30pm in a caravan led by Chuck Grant. Admission is $3/car; please bring the exact amount. The site is primitive, with 2 pit toilets, and no running water. Bring warm clothes, and food and water for the evening. Use a flashlight with a red filter so that people's dark adaptation is not ruined by white light. Check the TVS website for the latest information.

TVS Tesla Winery Star Parties (8pm-Midnight): September 19, & October 17

TVS will hold numerous star parties at Tesla Vintners in Livermore! Tesla Vintners is located on Tesla Road near Mines Road, and it has reasonably dark skies overhead and to the south, considering its urban location. The winery is private property, and we are the guests of Steve Powell, the owner. *These star parties are only open to current club members and their guests.*

The winery has two entrances. The main entrance is likely to be closed, so plan on using the unmarked delivery entrance, the one closer to Mines Road. The winery has a large parking area in the middle of the grounds plus a large open field in the back. We are welcome to use both, but lights from the Wente winery to the east can be a problem in the back. The winery also has a bathroom which we will be able to use. The star party will run through midnight.

Normal star party etiquette applies, so no bright lights, no dogs, no loud music, and definitely no smoking or fires.

Calendar of Events

July 11, 8:00pm

What: Screening of the 1997 Classic Science Fiction Film "Contact"
Who: Dr. Carolyn Porco, Science Advisor on the film
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area

Header Image: New color images from NASA's New Horizons spacecraft, taken July 1, 2015, show two very different faces of the mysterious dwarf planet, including one with a series of intriguing spots along the equator that are evenly spaced. Image Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute, See www.nasa.gov/feature/new-horizons-color-images-reveal-two-distinct-faces-of-pluto-series-of-spots-that-fascinate

Calendar of Events (continued)

Cost: Free

Post discussion led by Dr. Carolyn Porco, Science Advisor on the film. Jodie Foster portrays the film's protagonist, Dr. Eleanor "Ellie" Arroway, a SETI scientist who finds strong evidence of extraterrestrial life and is chosen to make first contact. The film was released on July 11, 1997, grossed $171 million worldwide and won the Hugo Award and received multiple Saturn awards and nominations.

For more information see: http://www.friendsofmttam.org/astronomy/schedule

July 14, 12:00pm

What: Kepler 138b - A Mars Size Planet in a Tug of War
Who: Jason Rowe, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

No details available.

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

July 21, 12:00pm

What: Pluto, the Kuiper Belt and the Early History of the Solar System
Who: Renu Malhotra, University of Arizona
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Our understanding of the formation of the solar system has undergone a revolution in recent years, owing to new theoretical insights into the origin of Pluto and the discovery of the Kuiper belt and its complex dynamical structure. The emerging picture is one of dramatic orbital migration of the planets in the early history of the solar system, driven by interaction with the primordial Kuiper belt, which produced the final solar system architecture that we live in today. The evidence is all over the solar system, as close as the Moon and as far away as Pluto and the remnant Kuiper belt. Dr. Malhotra will review this new view of our solar system's history, describe the astronomical evidence, and critically assess current theoretical models.

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

July 24: 8:30-10:30pm

What: Summer in Space Movie Series
Who: You at the Outdoor Amphitheater
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $10 (does not include general admission)

Grab some popcorn and join us in our outdoor amphitheater as we celebrate classic science fiction films from the 1950's and 1960's. Inspired by comic books, these family-friendly films sparked the world's interest in interstellar travel, aliens and otherworldly terrains.

July 24: "Flash Gordon Conquers the Universe"

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

July 25, 8:30pm

What: Weighing Galaxies
Who: Dr. Phil Marshall, Kavli Institute
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

We live in a galaxy of about one hundred billion stars, the Milky Way. As the sky over Mount Tam darkens, and the stars in the disk of our galactic home come into view, see how we are mapping out where the Dark Matter is, both in our lo-

continued on page 4

cal group of galaxies and further out in the depths of space. Galaxies are much heavier than they look – what could that mean for our understanding of how stars form, and what Dark Matter is?

For more information see: http://www.friendsofmttam.org/astronomy/schedule

July 28, 12:00pm

What: Imaging a Habitable Planet at Alpha Centauri with a Small Space Telescope
Who: Ruslan Belikov, NASA Ames Research Center
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

In 1990, at the request of Carl Sagan, Voyager 1 turned and took a picture of Earth from a distance of 6 billion kilometers. This produced the famous "pale blue dot" image of our planet. Several mission concepts are being studied to obtain similar images of Earth-like exoplanets (exo-Earths) around other stars. It is commonly thought that directly imaging a potentially habitable exoplanet requires telescopes with apertures of at least 1 meter, costing at least $1B, and launching no earlier than the 2020s. A notable exception to this is Alpha Centauri (A and B), which is unusually close for a Sun-like star. A ~30-45cm visible light space telescope equipped with a modern high performance coronagraph is sufficient to resolve the habitable zone at high contrast and directly image any potentially habitable planet that may exist in the system.

Dr. Belikov will describe the challenges involved with direct imaging of Alpha Centauri planetary systems with a small telescope and how new technologies currently being developed can solve them. He will also show examples of small coronagraphic mission concepts currently being developed to take advantage of this opportunity, and in particular a mission concept called "ACESat: Alpha Centauri Exoplanet Sattellite" submitted to NASA's small Explorer (SMEX) program in December of 2014..

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

August 1, September 5, 7:00pm

What: Lost in Space Adult Missions
Who: Challenger Learning Center
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $30, does not include general admission; RSVP recommended, space limited, register online or call (510) 336-7373

Just like our public missions for families, but this one is strictly for adult flyers. Bring your friends and join an intrepid team to land on the red planet, construct a probe to send to one of the moons of Mars and save your crew from calamity. Grab your flight suit, strap on a helmet and experience the thrill and excitement of a NASA simulated space mission to Mars! Beer (provided by Federation Brewery), wine and light snacks will be provided.

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

August 3, 7:30pm

What: The Intertwined Evolution of Galaxies and Super massive Black Holes in the Double-Dark Universe
Who: Rachel Somerville, Chair in Astrophysics Dept. of Physics & Astronomy at Rutgers
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.

Our current knowledge of the Universe extends mind-bendingly far in both space and time. The story that has emerged from the amazing technological accomplishments of modern astrophysics is bizarre and fascinating. We now believe that three quarters of the "stuff" in the Universe is "dark energy", a mysterious force that pushes spacetime apart and accelerates our expansion. Twenty-five percent of the cosmic pie is in the form of "dark matter", almost equally mysterious material that feels the force of gravity but no other forces, and has so far eluded direct detection in our laboratories on Earth. Roughly five percent is made up of "normal matter", i.e. atoms. But of this, only about 10 percent has actually been directly observed.

Additionally, astrophysicists have strong evidence that in the hearts of many, perhaps all, massive galaxies lurk supermassive black holes with masses millions to billions times the mass of our Sun. These black holes can grow by gobbling up stars and gas that fall into the center of their host galaxies. Some of this accreted mass is converted into energy, causing the black holes to release enormous amounts of radiation and produce giant jets of relativistic particles in some cases.

Somerville will explain the observational evidence that supermassive black holes exist, and that they power quasars, some of the most luminous objects in the Universe. She will talk about how galaxies form and evolve over cosmic time and how supermassive black holes shape the galaxy properties that we can observe…all in the context of the double dark universe.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

Calendar of Events (continued)

August 15, 11:00am

What: Black Holes/Neutron Stars
Who: Dr. Francois Foucary, 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.

No details available.

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

Travelogue By Ken Sperber

Medieval Astronomical Clock in Prague

Prague is one of the great European cities that Karen and I had the pleasure to visit while I was on business travel. It is just dripping with history, including a fantastic castle, a multitude of Gothic style churches, town squares where people sup late into the night, and the Charles Bridge-a pedestrian walkway across the Vltava River that offers scenic views in all directions. A more recent 20th Century creation, the Lennon Wall, as in John Lennon, sprang up in the 1980's as a means for people to air their grievances against the then ruling communists.

Through the centuries an astronomical clock, the Prague Orlog, has marked the passage of time. This medieval clock, located in the Old Town Square, was installed in 1410. It is the third oldest astronomical clock in the world, and the only one working to this day. It is attributed to the clockmaker Mikulas of Kadan and Jan Sindel, a professor of mathematics and astronomy at Charles University. Mistakenly, until 1961 its construct was attributed to Jan of Ruze (Hanus).

Numerous repairs have been required, including in the 1550's, 1865, and in 1948 to repair damage incurred during WWII, with the most recent restoration occurring in 2005. Many embellishments were added over the centuries, including figures of the apostles that parade around at the top of the hour, a golden crowing rooster, and a dancing skeleton with an hourglass that reminds us our mortal time on this Earth is limited.

On the astronomical dial the Earth is located at the center, with the sky above and below the horizon color-coded blue and brown, respectively. The Latin words for east and west, and dawn and twilight are appropriately written. The hands of the clock bear the Sun and Moon, and there is a ring displaying the signs of the Zodiac. Three dials denote Old Czech Time, Central European Time, and Babylonian Time, with a star indicating sidereal time. The schematic diagram on p.6 details these features of the clock.

Image: Medieval Astronomical Clock in the Old Town Square of Prague, Czech Republic. Image Credit: Ken Sperber

As if this wasn't enough, Tycho Brahe is buried in the Church of Our Lady Before Tyn at the other end of the Old Town Square. In Prague, he was the imperial astronomer to the Holy Roman Emperor Rudolph II. Using parallax measurements he showed that comets and the supernova (stella novae-new stars) of 1752 were located above the atmosphere and more distant than the Moon, thus upsetting the doctrine of Aristotle that the celestial sphere is unchanging. Surely, he too laid eyes on the glorious astronomical clock that beckons visitors to this day.

For more information see: http://www.prague.cz/astronomical-clock/ and https://en.wikipedia.org/wiki/Prague_astronomical_clock, https://en.wikipedia.org/wiki/Tycho_Brahe

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

All times are Pacific Daylight Time.

July

12	Sun	Waning crescent Moon within 5 degrees of Aldebaran (dawn)
14	Tue	Venus comes within 2-3 degrees of Regulus (evening)
15	Wed	New Moon (6:24pm)
18	Sat	Venus within a few degrees of the crescent Moon and Regulus with Jupiter to the right (evening)
23	Thu	First-Quarter Moon (9:04pm)
25	Sat	Ceres at opposition (see July S&T, p. 50)
25	Sat	The Moon is a few degrees from Saturn
30	Thu	Delta Aquariid meteor shower (nearly Full Moon compromises the view)
31	Fri	Full Moon (3:43am)

August

1-31	Sat-	5 degrees left of Saturn are the telescopic double stars Beta Scorpii and Nu Scorpii (1 hour after sunset)
6	Thu	Last-Quarter Moon (7:03pm)
8	Sat	The Moon forms a triangle with the Pleiades and Aldebaran (morning)
8	Sat	Mars rises to the east-northeast as the sky brightens (dawn)
11	Tue	First dawn visibility of Sirius (20 minutes before dawn)
12-13	Wed	The Perseid Meteor showers peaks on August 13 at 1am PDT
14	Fri	New Moon (7:53am)
16	Sun	Mercury 6 degrees to the right of the thin crescent Moon, very low in the west (dusk)
22	Sat	First-Quarter Moon (12:31pm)
22	Sat	Saturn less than 4 degrees away from the First-Quarter Moon (evening)
29	Sat	Venus 10 degrees above the eastern horizon (dawn)
29	Sat	Full Moon (11:35am)

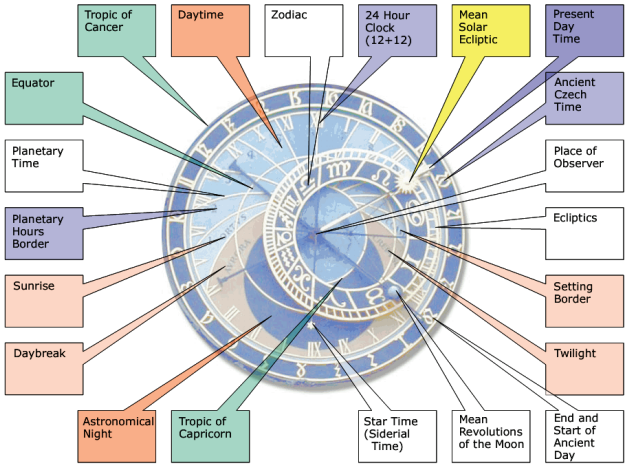


Image: Schematic of the astronomical dial of the Medieval Clock of Prague Schema Orloj. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Schema_Orloj_en.png#/media/File:Schema_Orloj_en.png

No Surprise! Earth's Strongest Gravity Lies Atop The Highest Mountains

By Dr. Ethan Siegel

Put more mass beneath your feet and feel the downward acceleration due to gravity increase. Newton's law of universal gravitation may have been superseded by Einstein's, but it still describes the gravitational force and acceleration here on Earth to remarkable precision. The acceleration you experience is directly proportional to the amount of mass you "see," but inversely proportional to the distance from you to that mass squared.

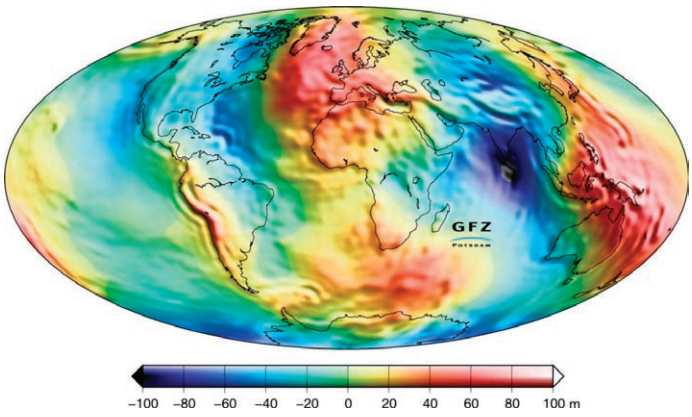


Image credit: NASA / GRACE mission / Christoph Reigber, et al. (2005): An Earth gravity field model complete to degree and order 150 from GRACE: EIGEN-GRACE02S, Journal of Geodynamics 39(1),1–10. Reds indicate greater gravitational anomalies; blues are smaller ones.

The denser the mass beneath your feet, the stronger the gravitational force, and when you are closer to such a mass, the force is even greater. At higher elevations or even higher altitudes, you'd expect your gravitational force to drop as you move farther from Earth's center. You'd probably also expect that downward acceleration to be greater if you stood atop a large mountain than if you flew tens of thousands of feet above a flat ocean, with nothing but ultra-light air and liquid water beneath you for all those miles. In fact this is true, but not just due to the mountain's extra mass!

Earth is built like a layer-cake, with the less dense atmosphere, ocean, and crust floating atop the denser mantle, which in turn floats atop the outer and inner cores of our planet. An iceberg's buoyancy is enough to lift only about one tenth of it above the sea, with the other nine tenths below the surface. Similarly, each and every mountain range has a corresponding "invisible mountain" that dips deep into the mantle. Beneath the ocean floor, Earth's crust might be only three to six miles thick, but it can exceed 40 miles in thickness around major mountain ranges like the Himalayas and the Andes. It's where one of Earth's tectonic plates subducts beneath another that we see the largest gravitational anomalies: another confirmation of the theory of continental drift.

A combination of instruments aboard NASA's Gravity Recovery and Climate Experiment (GRACE) satellites, including the SuperSTAR accelerometer, the K-band ranging system and the onboard GPS receiver, have enabled the construction of the most accurate map of Earth's gravitational field ever: to accelerations of nanometers per second squared. While the mountaintops may be farther from Earth's center than any other point, the extra mass of the mountains and their roots – minus the mass of the displaced mantle – accounts for the true gravitational accelerations we actually see. It's only by the grace of these satellites that we can measure this to such accuracy and confirm what was first conjectured in the 1800s: that the full layer-cake structure of Earth must be accounted for to explain the gravity we experience on our world!

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 ($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.