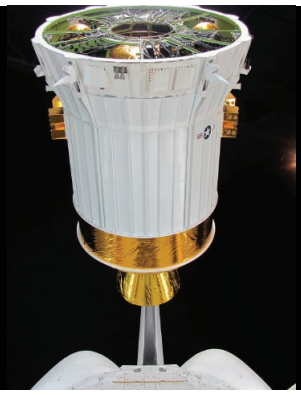
PRIMEFOCUS

Tri-Valley Stargazers

July 2014



Meeting Info

What:
Telescope Innovations in 17th and 18th Century England

Who:
Dr. Ken Lum

When:
July 18, 2014
Doors open at 7:00 p.m.
Lecture at 7:30 p.m.

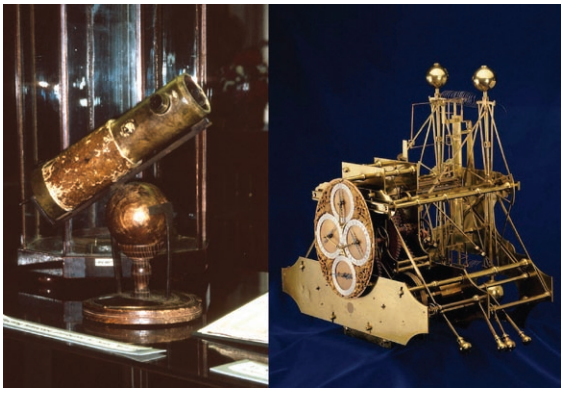
Where:
Unitarian Universalist Church in Livermore
1893 N. Vasco Road

Inside

July Meeting

Telescope Innovations in 17th and 18th Century England

Dr. Ken Lum



Caption: Left: Isaac Newton's original reflector from 1668-1671. Right: H1, John Harrison's first marine chronometer for finding longitude at sea; 1735. Credit: Ken Lum

Following the invention and initial improvement of the telescope in the Netherlands in early 17th Century, most of the innovation in telescope technology passed into England in the late 17th Century with important contributions mainly by the Germans. Most notable of these were the invention of the reflecting telescope by Isaac Newton in 1668 and the achromatic lens beginning around the 1730s by Chester Moore Hall and John Dolland in England, and Samuel Klingenstierna in Sweden. These innovations improved the most pressing defects of telescopes at the time, which were chromatic aberration and spherical aberration. They allowed telescopes to be built with shorter and more manageable lengths while giving better images. Improvements in metal working technology, driven by the Industrial Revolution in England, and glass making technology in Germany, allowed larger and more mechanically precise telescopes to be made by the 18th and early 19th Centuries. Dr. Lum will give a travelogue of some of the places where these innovations took place, including visits to other important places in the history of astronomy in England, as experienced during a 1996 Antique Telescope Society tour. Among the places he visited was the house in Bath, England where William Herschel and his sister, Caroline lived and discovered Uranus, in 1781, and the Royal Greenwich Observatory where efforts were made to determine longitude at sea.

Dr. Kenneth Lum is recently 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 reentered amateur astronomy in 1986. He pursued an 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 almost annually visiting different historical astronomical observatories.

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**
Jul. 18	Jul. 21	
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 June 23, 2014 the TVS checking account balance is: $12,659.64

2014 Barcroft High-Altitude Star Party

The East Bay Astronomical Society and the Tri-Valley Stargazers have reserved Sunday, Sept. 21 - Friday, Sept. 26 for a star party at Barcroft High-Altitude Research Center. Barcroft is located in the White Mountains at about 12,450ft above sea level. In order to acclimatize to the high altitude it is recommended that one should spend at least one night at about 8000ft, such as a motel in Mammoth Lakes, or at Grandview Campground in the White Mountains. Oxygen is NO LONGER PROVIDED at Barcroft Station, though the EAS is planning on donating an oxygen concentrator to Barcroft. For more information see: http://www.eastbayastro.org/index/Barcroft.htm

One More TVS Open House for 2014

The remaining TVS Open House for 2014 will be on Saturday, August 16. Interested parties, especially those who are not keyholders to H2O, 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.

TVS Membership Advantage

All TVS members are eligible for a 10% discount at Orion's Cupertino store by mentioning that they are members of TVS (Orion has been provided a list of TVS members; but NO contact information). New members should bring a copy of their "Welcome to TVS" email as proof of membership.

TVS has Telescopes for Sale

TVS has two vintage telescopes looking for homes for only $10 each (or best offer). They are a Towa 80mm refractor with a manual equatorial mount with slow-motion controls and a Cave Optical 6" Newtonian OTA. I'll be setting them up at our next meeting for anyone interested.

Magazine Giveaway

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!

Calendar of Events

July 14, 7:30pm

What: Black Holes, Magnetars and Millisecond Pulsars: The Wickedly Cool Stellar Undead

Who: Scott Ransom, Astronomer at the National Radio Astronomy Observatory and Research Professor at UVA

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.

The most massive stars burn the fastest and brightest and die spectacularly, exploding as supernovae and leaving behind some of the most fantastic objects in the Universe: neutron stars and black holes. These are fascinating objects themselves, but ever since Bell and Hewish discovered the first pulsar over 40 years ago, we've realized that we can use the neutron stars especially as powerful tools for basic physics and astrophysics as well. We currently know of more than 2000 neutron stars in our Galaxy, almost all of them as pulsars or magnetars. But recently, instrumentation improvements have been rapidly expanding the numbers of the so-called millisecond pulsars (MSPs). These systems, which spin hundreds of times per second, act as Nature's atomic clocks. Specialized "timing" observations of the MSPs are providing a wealth of science, including new tests of general relativity, fantastic probes of the interstellar medium, constraints on the physics of ultra-dense matter, new windows into the evolution of stellar systems both simple and complex, and the promise of a direct detection of massive ripples in space-time, gravitational waves.

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

July 15, Noon-1:00pm

What: Water Vapor at Europa's South Pole – Observa-

Header Image: Space Shuttle Full Fuselage Trainer and Boeing Inertial Upper-Stage (IUS) at the Museum of Flight, Seattle. The IUS was used to launch payloads, such as Galileo, form the Shuttle Payload Bay. Credit: Ken Sperber

Calendar of Events (continued)

tions by the Hubble Space Telescope
Who: Lorenz Roth, Southwest Research Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

With its subsurface water ocean and relatively young icy surface Europa is among the top candidates in the search for habitable environments in our solar system. Existence of water vapor plumes on Europa has long been speculated and could possibly provide accessibility of subsurface liquid reservoirs. Images of auroral emissions obtained in December 2012 by the Hubble Space Telescope (HST) revealed coincident signals from hydrogen and oxygen pointing to the existence of transient water vapor near the moon's south pole. The aurora is excited by impinging charged particles from Jupiter's huge magnetosphere, which interacts with Europa's atmosphere and interior water ocean.

Dr. Roth will provide an overview of the complex interaction between Europa and Jupiter's magnetosphere, the generation of the plume aurora signals and our HST detection method, and the important implications of the plume discovery for the future exploration of Europa and its hidden water ocean.

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

July 19, Aug. 16, 8:00pm-10:00pm

What: Telescopes Out of the Box
Who: Workshops
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Guests $50 per session, Members $45 per session. Reservations: (510) 336-7373

Remember how excited you were when you got that new telescope? You were going to make all kinds of new discoveries in the sky, but now it's just collecting dust. With the clear summer skies, it's time to dust off those 'scopes and explore our Universe! Work with our expert astronomers on assembling and properly handling your telescope, and get tips for identifying objects in the night sky. Gain skills that will last a lifetime and impress your friends and family. Learn the basics in one class or sign up for all three and deepen your knowledge!

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

July 22, Noon-1:00pm

What: The Diversity of Habitable Zones and the Planets
Who: Stephen Kane, San Francisco State University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The field of exoplanets has rapidly expanded from the exclusivity of exoplanet detection to include exoplanet characterization. A key step towards this characterization is the determination of which planets occupy the Habitable Zone (HZ) of their host stars. As the Kepler data continues to be processed, the orbital period sensitivity is increasing and there are now numerous exoplanets known to occupy the HZ of their host stars. In this talk Dr. Kane will describe the properties of the HZ, the dependence on the spectral type properties, and the current state of exoplanet detections in the HZ. Along the way Dr. Kane will attempt to dispel some common misconceptions regarding the Habitable Zone. Dr. Kane will relate HZ results to the calculation of eta_Earth and eta_Venus. Finally, Dr. Kane will present several case studies of HZ Kepler planets, including circumbinary planets for which the HZ is a time-dependent function.

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

July 29, Noon-1:00pm

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What: Khayyam: A Tunable Spatial Heterodyne Spectrometer for Broadband Observation of Diffuse Emission Line Targets
Who: Sona Hosseini
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Sona Hosseini will report on progress toward development of a tunable spatial heterodyne spectrometer (TSHS) at the fixed focus of the Coudé Auxiliary Telescope (CAT) in the Shane Telescope at Lick Observatory (Khayyam). Spatial Heterodyne Spectrometer (SHS) instruments are a class of interferometric sensor capable of providing a combination of large étendue, high resolving power (R=λ/dλ~ 105) and wide field of view (FOV~0.5 degree) at Optical and NUV wavelengths in a compact format.

The TSHS implementation addresses the bandpass limitation of the basic SHS through controlled rotation of pilot mirrors in the interferometer. The use of a single grating as both a dispersing and beam-splitting element in the all reflective SHS greatly relaxes the precision required in the alignment of the other optical elements relative to a more typical scanning Fourier Transform Spectrometer and allows the TSHS implementation to be accomplished with low cost commercial rotation stages. The new design builds on a previous design originally tested in 2007, and will address several issues identified with the input beam, output imaging, and grating efficiency. Here she will discuss the design considerations going into this new system and the initial results of the installation and testing of the TSHS and the future plans.

Following completion of the ground based TSHS version (Khayyam), the longer term goals of the TSHS project are to provide in flight testing on a sounding rocket platform that Sona's research group is developing and then ultimately a translation to satellite applications.

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

August 2, 8:30pm

What: How We Found the Higgs Boson
Who: Dr. Beate Heinemann , Lawrence Berkeley Lab
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

How does the Large Hadron Collider near Geneva in Switzerland work and how did its use lead to the discovery in 2012 of the Higgs boson. What is hoped to be learned in the future at this collider.

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

August 4, 7:30pm

What: Beyond Hubble: The James Webb Space Telescope & The Search for Life in the Universe
Who: Dr. Jason Kalirai, Project Scientist, Space Telescope Science Institute
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.

For over twenty-three years the Hubble Space Telescope has been a centerpiece of modern astronomy. Today, it is regarded as one of the most important scientific instruments that humans have every built. Using Hubble's amazing images, I will show why the New York Times described Hubble as having "taught us to see the properties of a universe humans have been able, for most of their history, to probe only with their thoughts." With the hugely successful but last Hubble servicing mission in May 2009 now behind us, attention is now turning to Hubble's successor, the James Webb Space Telescope (JWST). JWST will be the size of a tennis court, be launched 1 million miles into space, and be 100x more powerful than Hubble and all previous telescopes. I will describe the design and technology behind this audacious "Hubble 2.0", and outline a prescription to use it and other telescopes to answer the fundamental question, "are we alone?".

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

August 5, Noon-1:00pm

What: Our Galactic Center
Who: Reinhard Genzel, MPI for Extraterrestrial Physics, Garching and UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Evidence has been accumulating for several decades that many galaxies harbor central mass concentrations that may be in the form of black holes with masses between a few million to a few billion time the mass of the Sun.

Dr. Genzel will discuss measurements over the last two decades, employing adaptive optics imaging and spectroscopy on large ground-based telescopes that prove the existence of such a massive black hole in the Center of our Milky Way, beyond any reasonable doubt. These data also provide key insights into its properties and environment. Most recently, a tidally disrupting cloud of gas has been discovered on an almost radial orbit that reached its peri-distance of ~2000 Schwarzschild radii in 2014, promising to be a valuable tool

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Calendar of Events (continued)

for exploring the innermost accretion zone. Future interferometric studies of the Galactic Center Black hole promise to be able to test gravity in its strong field limit.

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

August 12, Noon-1:00pm

What: Investigations of strange, linear features on Mars (AKA playing with dry ice blocks in the Utah desert)
Who: Serina Diniega, Jet Propulsion Laboratory
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Comparative geomorphology is a standard and highly useful approach in determining the origin of features seen on planetary surfaces. However, this approach sometimes can point interpretations into the wrong direction - the specific and sometimes highly unique conditions found on another planet cannot be neglected in the analysis! In particular, long, narrow grooves found on the slopes of martian sand dunes have been cited as evidence of liquid water via the hypothesis of melt-water initiated debris flows.

Dr. Diniega and her team proposed an alternative hypothesis: CO2 ice (AKA dry ice) blocks that form naturally on the dune surfaces each winter may fall onto and slide down the dune slope, carving out features such as those observed. To test this hypothesis, they experimented with dry ice blocks on terrestrial dunes and then compared the expected behavior of blocks on the Earth and Mars via a theoretical model. Their results demonstrated that CO2 blocks can move as natural "hovercrafts" on dune slopes on both Earth and Mars, and that such blocks on Mars can naturally create the unique features we see on Mars.

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

Trip Report by Ken Sperber

Seattle Museum of Flight

On July 4th, Karen and I took the opportunity to stop at the Museum of Flight, Seattle. It is located adjacent to Boeing Field, though it is a private museum that is not run by Boeing. The Museum of Flight is the largest museum of its kind on the west coast, and it requires at least 2 days to see all of the wonderful exhibits. For anyone interested in any aspect of flight, you will find exhibits worthy of your time. Exhibits date from the concept gliders of Da Vinci, through the balloon and Zeppelin age, replicas of the Wright Gliders and Flyers, WWI, WWII, through to contemporary military drones, and space age artifacts.

Above is a photo I took of the Space Shuttle Full Fuselage Trainer, in which all of the shuttle astronauts trained. It boasts a full flight deck (see photo below) mid-deck, and payload bay cameras, and it was also used for testing upgrades and emergency procedures. I took a half-hour tour of the flight and mid-deck that was hosted by a well-informed docent, which was well-worth the $30 additional cost.

The Shuttle Trainer and a host or other space artifacts are contained in the Charles Simonyi Gallery, including the Soyuz TMA-14 capsule in which he, as a private spaceflight participant, made his second visit to the International Space Station. Six months later this Russian capsule (see photo on p. 6) returned the Expedition 19 crew home. It is incredible to see how scarred the capsule is from the reentry, including some of the honeycomb heat shield that separated from the main body. A section of the capsule that contained an emergency parachute was removed to provide a well-lit view of the cramped quarters that the cosmonauts and astronauts has to endure.

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

All times Pacific Daylight Time.

July

12-24	Sat-	Mercury 6 to 8 degrees below Venus (Dawn)
12	Sat	Full Moon (4:25am)
13	Sun	Mars is 1.3 degrees north of fainter Spica
18	Fri	Last-Quarter Moon (7:08pm)
24	Thu	The crescent Moon is 5 degrees to the right of Venus with Mercury to their lower-left (Dawn)
25	Fri	The crescent Moon is directly below Venus and to the lower-right of Mercury (Dawn)
26	Sat	New Moon (3:24pm)
28	Mon	Delta-Aquarid Meteor Shower (after-midnight; best for southerly latitudes)

August

2	Sat	The Moon is about 5 degrees to the right of Mars (Dusk)
3	Sun	First-Quarter Moon (5:50pm) lies between Mars and Saturn (Dusk)
10	Sun	Full Moon (the largest of the year) (11:09am)
12-13	Tue-	Perseid Meteor shower peaks, but nearly Full Moon will hide all but the brightest meteors
17	Sun	Last-Quarter Moon (5:26am)
18	Mon	Venus and Jupiter are within 0.5 degrees of each other (Dawn)
23	Sat	The crescent Moon forms a triangle with Venus and Jupiter (Dawn)
23-26	Sat-	Mars passes 3.5 degrees south of Saturn (Dusk)
25	Mon	New Moon (7:13pm)
31	Sun	The Moon forms a tight triangle with Mars and Saturn (Dusk)

Outside on the tarmac we took a walk through a Concorde, and the first Presidential Jet, the Air Force One that served Presidents Eisenhower, Kennedy, Johnson, and Nixon. Other highlights included the WWI gallery, which contained an amazing suite of Allied and Axis biplanes. These alone were worth the cost of admission ($19) to the museum. In the mammoth indoor main gallery, place-of-pride was given to an MD-21. What is an MD-21? It is a variant of the Mach 2+ SR-71 on which was mounted an unmanned reconnaissance vehicle that was launched to cross the border into the USSR after the Cold War escalated subsequent to the downing and capture of Francis Gary Powers, when his U-2 spy plane was downed by a USSR surface-to-air missile.

All this, and we missed going to the Bill and Moya Lear Gallery that contains the "Space: Exploring the New Frontier" exhibition. Thankfully, we purchased an annual pass, so we'll be sure to go back and enjoy all of the displays we missed, and revisit some of our favorites.

For more information see: http://www.museumofflight.org/

A Glorious Gravitational Lens

By Dr. Ethan Siegel

As we look at the universe on larger and larger scales, from stars to galaxies to groups to the largest galaxy clusters, we become able to perceive objects that are significantly farther away. But as we consider these larger classes of objects, they don't merely emit increased amounts of light, but they also contain increased amounts of mass. Under the best of circumstances, these gravitational clumps can open up a window to the distant universe well beyond what any astronomer could hope to see otherwise.

Image Caption: Abell 2218. Image credit: NASA, ESA, and Johan Richard (Caltech). Acknowledgement: Davide de Martin & James Long (ESA/Hubble).

The oldest style of telescope is the refractor, where light from an arbitrarily distant source is passed through a converging lens. The incoming light rays—initially spread over a large area—are brought together at a point on the opposite side of the lens, with light rays from significantly closer sources bent in characteristic ways as well. While the universe doesn't consist of large optical lenses, mass itself is capable of bending light in accord with Einstein's theory of General Relativity, and acts as a gravitational lens!

The first prediction that real-life galaxy clusters would behave as such lenses came from Fritz Zwicky in 1937. These foreground masses would lead to multiple images and distorted arcs of the same lensed background object, all of which would be magnified as well. It wasn't until 1979, however, that this process was confirmed with the observation of the Twin Quasar: QSO 0957+561. Gravitational lensing requires a serendipitous alignment of a massive foreground galaxy cluster with a background galaxy (or cluster) in the right location to be seen by an observer at our location, but the universe is kind enough to provide us with many such examples of this good fortune, including one accessible to astrophotographers with 11" scopes and larger: Abell 2218.

Located in the Constellation of Draco at position (J2000): R.A. 16h 35m 54s, Dec. +66° 13′ 00″ (about 2° North of the star 18 Draconis), Abell 2218 is an extremely massive cluster of about 10,000 galaxies located 2 billion light years away, but it's also located quite close to the zenith for northern hemisphere observers, making it a great target for deep-sky astrophotography. Multiple images and sweeping arcs abound between magnitudes 17 and 20, and include galaxies at a variety of redshifts ranging from z=0.7 all the way up to z=2.5, with farther ones at even fainter magnitudes unveiled by Hubble. For those looking for an astronomical challenge this summer, take a shot at Abell 2218, a cluster responsible for perhaps the most glorious gravitational lens visible from Earth!

Learn about current efforts to study gravitational lensing using NASA facilities: http://www.nasa.gov/press/2014/january/nasas-fermi-makes-first-gamma-ray-study-of-a-gravitational-lens/

Kids can learn about gravity at NASA's Space Place: http://spaceplace.nasa.gov/what-is-gravity/

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. See http://www.trivalleystargazers.org/membership.shtml for the online application and payment forms.