

# PRIMEFOCUS

Tri-Valley Stargazers



September 2013



## Meeting Info

### What:

SLS (Space Launch System): Our Next Ride

### Who:

Faride Khalaf

### When:

September 20, 2013  
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

### SLS (Space Launch System): Our Next Ride

For some time, NASA has been looking beyond single-entity space transportation programs. Our future in space has never been more secure or as exciting. Over the last half century NASA was the sole organization to design our entire space program and to go ankle deep in the ocean that is our corner of the universe. With the knowledge and experience gained through

risk and expenditure, the time has come to pay huge dividend to the investors. We are now for the first time in history successfully launching privately designed and built large scale space vehicles. There are many corporations contending to provide commercial space transportation for NASA as well as for those private citizens with means and will to rise above the Earth's atmosphere for that rare glimpse at our home planet. NASA's Space Launch System (SLS) is the new protocol for the American Space Program. By sharing several decades' worth of essential and invaluable scientific data along with expertise and oversight, NASA is laying the foundation for a thriving aerospace industry and providing a great boost to our morale and economy. The SLS is an elaborate approach to lifting crew and cargo into the sky in a way that is safe, economical, and with greater options and flexibility. In this presentation you'll gain some insight into the future of space travel and understand why our traditional means of exploration are now history.

Faride Khalaf began his aviation career as a skydiver in 1982. He received his FAA Airframe and Powerplant license from the College of Alameda in 1985, and became an Inspection Authorization (Officer) in 2001. He was an Aircraft Mechanic Instructor at the late Sierra Academy in Oakland for several years beginning in 1986. He was a General Mechanic at United Airlines for a decade. During two of those years he was a Mechanic Instructor teaching structural repairs, and for two years was a Fuel Systems Specialist. He's been a Private Pilot for 25 years, and is the sole owner of a 1947 Cessna 120.

Editors Note: Recall that in July 2012, Faride gave an excellent presentation to TVS on the "Saturn V: The First 700 seconds." Faride will also be giving a series of talks at Chabot Space and Science Center as part of their "Saturday Night Space Talks."



## News & Notes

### 2013 TVS Meeting Dates

The following lists the TVS meeting dates for 2013. 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. 20	Sep. 23	
Oct. 18	Oct. 21	Sep. 27
Nov. 15	Nov. 18	Oct. 25
Dec. 20	Dec. 23	Nov. 29

### Money Matters

Treasurer David Feindel indicates that as of July 13, 2013 the TVS account balances are:

Checking    \$12,296.97

### TVS Needs YOU!!!

TVS needs your help. Please consider taking on the role of Vice-President or Program Director. Anyone interested in either (or both) of these positions is encouraged to contact any of the club officers via e-mail or at the monthly meeting.

### Group Observing at Lick Observatory

There is an opportunity for group observing at Lick Observatory on September 21. The group rate is \$1000 for 30 people. Groups will observe a variety of astronomical objects through both the historic 36" Lick Refractor using its eyepiece and the 40" Nickel Reflector equipped with a CCD direct imaging camera; the camera has a 6.3x6.3-arcminute field of view and B, V, R, and I filters. Groups will be able to request the objects they would like to observe and will have access to that night's digital images from the Nickel Telescope. Participants may also bring their own telescopes to this prime viewing site. Communicate through the TVS yahoo users group to express your interest.

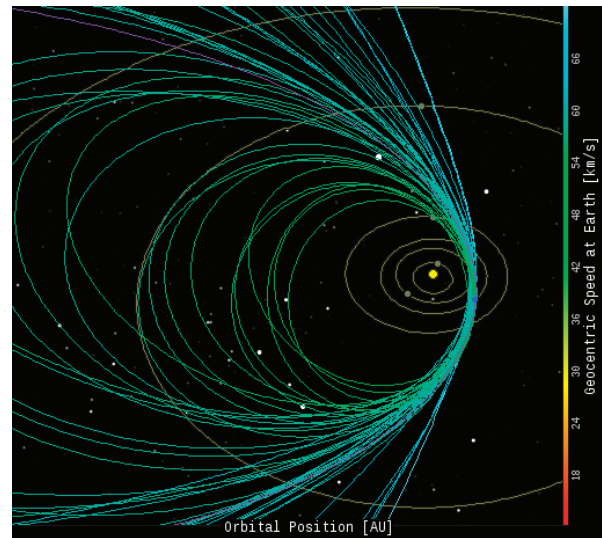
## Journal Club By Ken Sperber

### Perseids and Rogue Meteors

Last month was the annual Perseid Meteor Shower. These meteors are debris from Comet Swift-Tuttle, whose 133-year highly eccentric orbit extends beyond that of Pluto. The first recorded observation of Comet Swift-Tuttle was in 36AD. The last time that Comet Swift-Tuttle made a close approach to the Sun (reached perihelion) was December 1992. As the comet warms up, when it crosses into the inner solar system, it sheds ice and dust, giving rise to the familiar coma and tail. This debris spreads out along the comet's orbital path,

providing fodder for the annual meteor shower. Since the Comet Swift-Tuttle's orbit intersects Earth's orbit, the debris left behind from its close encounter with the Sun slams into Earth's atmosphere at about 130,000 miles per hour.

Due to velocity with which the gas and dust is expelled from the comet, gravitational effects, and the Poynting-Robertson Effect, the orbit of the debris can be changed from that of the parent comet. In the case of the Poynting-Robertson Effect, the pressure of light from the Sun creates a drag on the small particles that causes their orbital period to shorten. Below is a plot of Perseid Fireball orbits on or about August 11, 2013. The purple line is the orbit of Comet Swift-Tuttle, and the green and blue lines are the estimated orbits of the fireballs, with the color of the line corresponding to the meteors' velocity (see scale at right). Note how the orbits intersect Earth (the blue dot to the lower-right of the Sun). The orbits were estimated from triangulation of meteors observed by the NASA All-sky Fireball Network that is operated by the NASA Meteoroid Environment Office. Note the dispersion of the particle orbits due to the afore-mentioned mechanisms.



Caption/Credit: Plot of Perseid fireball orbits made by Bill Cooke, head of the NASA Meteoroid Environment Office.

In an attempt to get to dark skies for the 2013 Perseid meteor shower (and visit yet another National Park), Karen and I made our way to Arches National Park, near Moab, Utah. On the night of August 11-12, the sky was mostly cloudy, with only the occasional view of a meteor. The night of August 12-13 was much better, with some thin scattered cloud. Plopping our cameras down on tripods, we took 30 second exposures about once each minute (with the other 30 seconds each minute being spent on in-camera noise reduction). Over the course of the night I managed to image about 6 meteors. For about an hour at a time, I kept my camera pointed in one direction, with the anticipation of stacking the images to get

**Header Image:** Perseid meteor photographed from the International Space Station on August 13, 2011 by Astronaut Ron Garan. Image Credit: NASA

## Calendar of Events

star trails. Below is a stack of 56 images, obtained between 9:17-10:20pm MDT. One clearly sees the star trails circling the vicinity of Polaris, the North Star. At the lower-left is a bright meteor running vertically. From its direction of travel, it did not originate from the direction of the constellation Perseus, and hence it is classified as a rogue meteor that is not affiliated with a known shower. Other (straight) diagonal trails are due to airplanes. At the bottom center, off in the distance, is Delicate Arch.



Caption: Star Trails and rogue meteor imaged on August 12, 2013 at Arches National Park. Credit: Ken Sperber, Nikon D80, 18mm, f/3.5, ISO-2000, stack of 56 30-second exposures.

For more information see: <http://en.wikipedia.org/wiki/Perseids>, <http://earthsky.org/astronomy-essentials/everything-you-need-to-know-perseid-meteor-shower>, <http://www.spaceweather.com/archive.php?day=11&month=08&year=2013&view=view>, <http://www.nasa.gov/offices/meo/home/index.html>

### September 9, 7:30pm

**What:** The Chelyabinsk Meteor: A Cosmic Wake-up Call?  
**Who:** David Morrison, Senior Scientist, NASA Lunar Science Institute  
**Where:** California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA  
**Cost:** General \$12, Seniors \$10, Academy members \$8. Reserve a space online or call 1-877-227-1831.

What would happen if a large sized asteroid or space object collided with the Earth? On February 15, 2013, a rocky projectile entered the Earth's atmosphere traveling at more than 11 miles per second. It was about 65 feet in diameter, or half the diameter of the famous Tunguska impact of 1908, which flattened a thousand square miles of Siberian forest. Its terminal explosion, at an altitude of 14 mi, released energy of about half a megaton, equivalent to a couple dozen Hiroshima-sized atom bombs. About two minutes later, the shock wave reached the ground in Chelyabinsk, Russia, breaking windows and injuring about 1500 people from flying glass. The Chelyabinsk impactor was smaller than most asteroids that have been detected by the telescopes of the NASA Spaceguard Survey, which focuses on finding asteroids of about 100m or larger. Since it approached the Earth from very near the direction of the Sun, it could not have been seen by any ground-based optical telescope of any size. It therefore struck without warning. Has this event served as a kind of cosmic wake-up call for planetary defense? NASA scientist David Morrison will speak to us about how we survey space to try to determine when Earth will be impacted by a large space object, and what the potential implications could be for life on Earth.

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

#### **Officers**

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tvs@trivalleystargazers.org

#### **Eyes on the Skies**

Eyes on the Skies is a robotic solar telescope run by Mike Rushford (rushford@eyes-on-the-skies.org). You may access it by visiting [www.eyes-on-the-skies.org](http://www.eyes-on-the-skies.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 ([trivalleystargazers@gmail.com](mailto:trivalleystargazers@gmail.com)) 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)

### September 10, Noon-1:00pm

**What:** To The Asteroids - and Beyond!  
**Who:** John Lewis, Professor Emeritus U. Arizona LPL  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

Tsiolkovskii and Goddard dreamed of the day when we would have access to the resources of the asteroids. Today, with an enormous and rapidly growing body of data on meteorites, the Near-Earth Asteroids (NEAs) and their more distant counterparts, we can envision the propulsion systems, transportation system architectures, ores, processing schemes and markets for products made from materials sourced in nearby space. Most of these products are of greatest value and significance in space; some, such as platinum-group metals and energy, would be worth returning to Earth. The resources of the NEAs also provide the propellants and structural materials for a broad expansion of human presence in space. This talk will survey the what, where, how and why of space resource utilization-- and raise the timely question of when.

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 17, Noon-1:00pm

**What:** Marine Microbial Mats and Our Early Biosphere  
**Who:** David Des Marais, NASA Ames Research Center  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

Photosynthetic microbial mats are complete microbial ecosystems that can construct laminated "miniature reefs" called stromatolites. Their fossilized equivalents are among the oldest most abundant evidence of early life. Dr. Des Marais and his colleagues have studied cyanobacterial mats in an arid coastal environment at the Exportadora de Sal, S.A. (ESSA) salt works, Guerrero Negro, Baja California Sur, Mexico. He will show how the mats' oxygenated zone reflects a dynamic balance between vigorous photosynthetic O<sub>2</sub> production and O<sub>2</sub> consumption by diverse sulfide-oxidizing and heterotrophic bacteria.

Anoxygenic phototrophs and sulfate-reducing bacteria are quantitatively important consumers of dissolved organic matter. He will show how several previously unknown rRNS gene sequences of bacteria and eukarya were identified, indicating that these mats can extend our understanding of the diversity and early evolution of benthic microbial communities. He continues to catalog the diversity of lipid biosignatures, whose fossil equivalents can record the diversity of ancient microbial ecosystems.

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 21, 11:00am

**What:** Water, Water, Everywhere – from the Earth, the Moon, Mars, and Beyond  
**Who:** Dr. Gregory Delory, UC Berkeley  
**Where:** UC Berkeley, Genetics and Plant Biology Bldg., Room 100  
**Cost:** Free, limited hourly pay parking on/nearby campus. The venue is within walking distance of BART and bus lines.

Water, essential for life as we know it, is an important indicator of the conditions present on other planets and moons throughout recent history and in the distant past. The presence and state of water and other similar volatile compounds throughout our own solar system provide insight into its formation, and the origin of the life-sustaining environments that it supports. The fact that water is found in otherwise extreme environments on other planets and moons may indicate the presence of active, dynamic processes at work that serve to replenish this otherwise fragile, volatile resource. Water is also a potential resource that future human space missions can utilize in order to engage in the sustainable exploration of our solar system. In this talk I will discuss the significance of recent discoveries of water in the most unlikely of places – our own Moon – and what this means for our understanding of how both the Moon and our solar system have evolved over time. Mars represents the converse case – whereas it was no great surprise to find water there, it is likely that a significant amount of it was lost over time. The importance and value of observations from recent space missions in addressing these questions will be discussed, as we seek to understand more about our own origins as well as our future destinations beyond Earth

Dr. Greg Delory is a Senior Space Fellow in a joint appointment at the Space Sciences Laboratory and Center for Integrative Planetary Sciences at UC Berkeley. His main activities are focused on the development of experimental techniques for the exploration of space and planetary environments. His research addresses a wide range of questions spanning planetary evolution and habitability to future human and robotic exploration of the solar system. Dr. Delory has participated as a Co-Investigator on numerous spaceflight missions throughout his career, including experiments on the Space Shuttle, suborbital sounding rockets, microgravity/parabolic flights, heliophysics explorer-class missions, Mars Scout, and lunar orbiter missions.

For more information see: <http://scienceatcal.berkeley.edu/lectures>

### September 24, Noon-1:00pm

**What:** The Colossus Project: Designing an Optical/IR

## Calendar of Events (continued)

Instrument to Detect Life Outside the Solar System

Who: Jeff Kuhn, IfA, University of Hawaii  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

This talk describes an effort to detect life, and even conduct a planetary census, in our cosmic neighborhood. I'll describe some results from the Colossus group, an interdisciplinary science and engineering team, working to show how telescopes much larger than the TMT or EELT could be built today by relaxing some of the astronomical requirements of current "world's largest telescope" projects.

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 28, 7:30pm-8:15pm

What: Stacking the Space Shuttle  
Who: Faride Khalaf  
Where: Chabot Space and Science Center, Space Cafe,  
10000 Skyline Blvd., Oakland, CA 94619  
Cost: Included with general admission

On our quest to land astronauts on Earth's moon we built the most massive and most powerful rockets to reach our goal. Assembling such vehicles require a specialized building where it all comes together. At NASA's Kennedy Space Center the Vehicle Assembly Building (VAB) was built for this purpose. To the aerospace industry, the term "stacking a rocket" is used to describe the indoor process of final assembly of all the stages, payload and components that make up a launch vehicle. In this presentation, we will see the various steps taken to stack a typical Space Shuttle prior to its launch.

See <http://www.chabot.space.org/events.htm> for more information.

### October 8, Noon-1:00pm

What: Black Holes, Quantum Mechanics and Firewalls  
Who: Joe Polchinsky, UC Santa Barbara  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

Details currently unavailable.

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 12, 7:30pm

What: Near Earth Asteroids: Friends or Foes?  
Who: Dr. Frank Marchis, SETI Institute  
Where: Mt. Tamalpais State Park, Cushing Memorial Am-

phitheater, more commonly known as the Mountain Theater, Rock Spring parking area

Cost: Free

The close flyby of the 30m asteroid 2012DA14 on February 15 and the Chebalkul Meteor which exploded over Russia the same day have increased awareness of the smaller objects in our solar system and their potential impact with Earth.

For more information see: <http://www.mttam.net/astronomy/schedule.html>

### October 15, 7:00pm

What: Asteroid Radar Astronomy, Spacecraft Missions,  
and the Impact Hazard  
Who: Michael Busch, SETI Institute  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

The near-Earth asteroids (NEAs) are a population of objects on orbits that pass near that of the Earth. Many NEAs are attractive targets for spacecraft missions, and NEAs are also important because some of them will eventually hit Earth. Both future NEA missions and the impact hazard motivate understanding the sizes, shapes, surface properties, and trajectories of as many objects as possible.

The techniques of radar astronomy provide a way to characterize a representative sample of the NEA population. I will review these techniques and describe some recent radar results, focusing on spacecraft targets and objects with future close encounters with Earth.

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

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

All times Pacific Daylight Time.

### September

- 8 Sun Venus close to the crescent Moon, with Spica and Saturn nearby (Dusk)
- 8-9 Sun- Mars passes through M44, the Beehive Cluster (Predawn, see p.52 September S&T)
- 9 Mon Saturn and Venus to the right of the Moon (Dusk; see p.49 September S&T)
- 12 Thu **First-Quarter Moon (10:08am)**
- 16-19 Mon- Saturn less than 4 degrees from Venus
- 19 Thu **Full Moon (4:13am)**
- 22 Sun Autumn begins (1:44pm)
- 24 Tue Spica 3/4 degree below Mercury, use binoculars or a telescope (15-30 minutes after sunset)
- 26 Thu **Last-Quarter Moon (8:55pm)**
- 28 Sat Jupiter to the upper-left of crescent Moon (Dawn, see p.48 September S&T)

### October

- 1 Tue Crescent Moon forms a triangle with Mars and Regulus (Dawn, see p.48 October S&T)
- 3-16 Thu Zodiacal Light visible in the east beginning ~2 hours before dawn
- 4 Fri The star Delta Geminorum is just 6 arc minutes from Jupiter (predawn-dawn)
- 4 Fri **New Moon (5:35pm)**
- 7-8 Mon- Venus conjunction with crescent Moon, with Saturn and Mercury to the lower-right of Venus (Dusk)
- 9 Wed The star Delta Scorpii 3/4 degrees above Saturn (dusk)
- 11 Fri **First-Quarter Moon (4:02pm)**
- 15 Tue Mars 1 degree to the upper-left of Regulus in the east (Dawn)
- 16-17 Wed- Antares less than 2 degrees from Venus in the southwest (Dusk)
- 18 Fri **Full Moon (4:38pm)**



## Size Does Matter, But So Does Dark Energy

By Dr. Ethan Siegel

Here in our own galactic backyard, the Milky Way contains some 200-400 billion stars, and that's not even the biggest galaxy in our own local group. Andromeda (M31) is even bigger and more massive than we are, made up of around a trillion stars! When you throw in the Triangulum Galaxy (M33), the Large and Small Magellanic Clouds, and the dozens of dwarf galaxies and hundreds of globular clusters gravitationally bound to us and our nearest neighbors, our local group sure does seem impressive.

Yet that's just chicken feed compared to the largest structures in the universe. Giant clusters and superclusters of galaxies, containing thousands of times the mass of our entire local group, can be found omnidirectionally with telescope surveys. Perhaps the two most famous examples are the nearby Virgo Cluster and the somewhat more distant Coma Supercluster, the latter containing more than 3,000 galaxies. There are millions of giant clusters like this in our observable universe, and the gravitational forces at play are absolutely tremendous: there are literally quadrillions of times the mass of our Sun in these systems.

The largest superclusters line up along filaments, forming a great cosmic web of structure with huge intergalactic voids in between the galaxy-rich regions. These galaxy filaments span anywhere from hundreds of millions of light-years all

the way up to more than a billion light years in length. The CfA2 Great Wall, the Sloan Great Wall, and most recently, the Huge-LQG (Large Quasar Group) are the largest known ones, with the Huge-LQG -- a group of at least 73 quasars -- apparently stretching nearly 4 billion light years in its longest direction: more than 5% of the observable universe! With more mass than a million Milky Way galaxies in there, this structure is a puzzle for cosmology.

You see, with the normal matter, dark matter, and dark energy in our universe, there's an upper limit to the size of gravitationally bound filaments that should form. The Huge-LQG, if real, is more than double the size of that largest predicted structure, and this could cast doubts on the core principle of cosmology: that on the largest scales, the universe is roughly uniform everywhere. But this might not pose a problem at all, thanks to an unlikely culprit: dark energy. Just as the local group is part of the Virgo Supercluster but recedes from it, and the Leo Cluster -- a large member of the Coma Supercluster -- is accelerating away from Coma, it's conceivable that the Huge-LQG isn't a single, bound structure at all, but will eventually be driven apart by dark energy. Either way, we're just a tiny drop in the vast cosmic ocean, on the outskirts of its rich, yet barely fathomable depths.

Learn about the many ways in which NASA strives to uncover the mysteries of the universe: <http://science.nasa.gov/astrophysics/>. Kids can make their own clusters of galaxies by checking out The Space Place's fun galactic mobile activity: <http://spaceplace.nasa.gov/galactic-mobile/>



Caption: Digital mosaic of infrared light (courtesy of Spitzer) and visible light (SDSS) of the Coma Cluster, the largest member of the Coma Supercluster. Image credit: NASA / JPL-Caltech / Goddard Space Flight Center / Sloan Digital Sky Survey.

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.