

PRIMEFOCUS

Tri-Valley Stargazers



May 2017



Meeting Info

What:

The James Webb Space Telescope - A Glimpse of Things To Come

Who:

Dr. Lance Simms

When:

May 19, 2017
Doors open at 7:00 p.m.
Meeting at 7:30 p.m.
Lecture at 8:00 p.m.

Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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May Meeting

The James Webb Space Telescope - A Glimpse of Things To Come

Dr. Lance Simms

In 2018, an Ariane 5 rocket will blast off from Earth and begin a long, 1 million mile journey to the second Sun-Earth Lagrange Point. Its cargo will be arguably one of the most expensive and precious instruments NASA has ever made: the James Webb Space Telescope (JWST). As the successor to the Hubble Space Telescope, JWST will peer deeper into the universe than ever before. It will unlock secrets that we haven't even begun to imagine. In this short talk, I will give an overview of the astounding engineering challenges behind JWST and describe some of the scientific questions it will try to answer. I will also try to convey that all of my previous statements depend on mission success, which is by no means guaranteed.

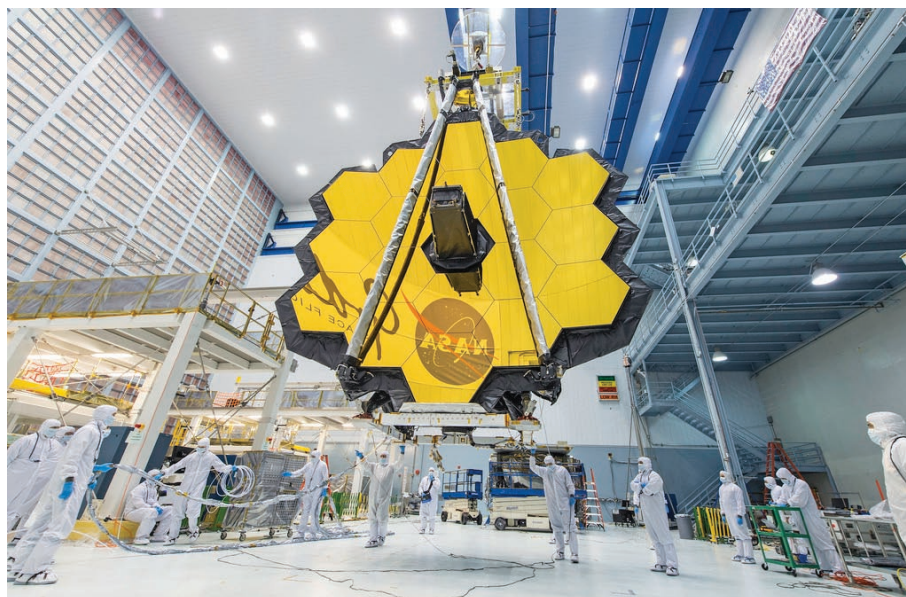


Image Caption: The James Webb telescope in full bloom. Image Credit: NASA. See: https://farm3.staticflickr.com/2893/33433274343_7f20f00427_b.jpg

Lance Simms is a physicist/engineer at Lawrence Livermore National Laboratory. He received a B.S. in Physics from University of California: Santa Barbara in 2003 and a Ph.D. in Applied Physics from Stanford in 2009. His Ph.D. work focused on the application of Hybrid CMOS imagers in astronomy. Nowadays, he loves working with whatever detectors he can get his hands on (infrared, visible, X-ray, you name it), and he currently characterizes and programs imagers for optical payloads on small satellites.

News & Notes

2017 TVS Meeting Dates

The following lists the TVS meeting dates for 2017. 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
May 19	May 22	
Jun. 16	Jun. 19	May 26
Jul. 21	Jul. 24	Jun. 30
August: No General Meeting or Board Meeting		
Sep. 15	Sep. 18	Aug. 25
Oct. 20	Oct. 23	Sep. 29
Nov. 17	Nov. 20	Oct. 27
Dec. 15	Dec. 18	Nov. 24

Money Matters

As of the last Treasurer's Report on 4/24/17, our club's checking account balance is \$14,859.75.

Outreach Star Party: Help Needed

May 26: Muslim Community Center in Pleasanton

Club Star Parties: 2017 Spring/Summer/Autumn

The following club star parties have been approved by the TVS Board:

May 20: H2O Open House (see below for more details)

June 17: Tesla Winery star party - (Saturn Opposition)

July 15: H2O Open House

July 22: Tesla Winery star party

August 25 – 27: Yosemite/Glacier Point weekend

September 23: Tesla Winery star party

October 21: Tesla Winery star party (Orionids Meteors).

The May 20 H2O Open House will be open to all club members and the public. We will meet at the corner of Mines and Tesla and leave for H2O at 6:30 PM. No late arrivals are possible without your own key. 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.

Calendar of Events

Present - August 31, 10:00am-5:00pm, Wednesday-Sunday

What: California's First Philanthropist: The Legacy of James Lick

Who: Exhibition
Where: Pioneer Hall at the Presidio, 101 Montgomery, Suite 150, Presidio of San Francisco, 94129
Cost: Free

James Lick used his wealth to establish charitable organizations to address the basic needs of the many who were less fortunate. He willed his entire fortune to benefit the people of California. In addition to endowing existing service organizations, including homes for the elderly, schools for orphans, and The Society for the Prevention of Cruelty to Animals, Lick allocated \$700,000 to build "a telescope superior to and more powerful than any telescope yet made" on Mount Hamilton. Other beneficiaries included the California Academy of Sciences, The Mechanics Library, landmarks in Golden Gate Park, as well as The California School for Mechanical Arts, the first to enroll young women interested in studying industrial design and manufacturing. This exhibition considers the legacy of James Lick, and features images by Isaiah West Taber, who documented many of the projects Lick funded, including The Lick Observatory and The Academy of Sciences.

For more information see: <http://www.californiapioneers.org/museum/today-in-the-museum/>

May 24, 7:00pm

What: The Sky Event of the Decade: The August 21 'All-American' Eclipse of the Sun
Who: Prof. Andrew Fraknoi, Foothill College
Where: Smithwick Theatre, 12345 El Monte Road, Los Altos Hills, CA 94022
Cost: Free, \$3 parking (Credit Cards or \$1 dollar bills)

NOTE: Everyone attending this lecture will receive a free pair of certified eclipse-viewing glasses courtesy of Google.

On August 21, 2017, there will be a rare eclipse of the Sun visible throughout the U.S. and all of North America. People in a narrow path from Oregon to South Carolina will see a spectacular total eclipse, with the Moon briefly covering the Sun, and day turning into night. Everyone else (an estimated 500 million people, including all of us in the Bay Area) will see a nice partial eclipse, where the Moon covers a good part of the Sun. The talk will describe how eclipses work, why they are one of nature's most spectacular sights, what scientists learn during eclipses, exactly when and where the eclipse of 2017 will be best visible, and how to observe the eclipse safely.

After the talk, Fraknoi will be signing his new children's book about eclipses *When the Sun Goes Dark* (2017, NSTA Kids) in Appreciation Hall across the courtyard.

Andrew Fraknoi is the chair of the astronomy department at Foothill College and the co-author of *Solar Science: Exploring Sunspots, Seasons, Eclipses, and More*, a book for educators.

Header Image: Comet 96P/Machholz 1 imaged on April 4, 2007 by STEREO-A. Image credit: NASA.

Calendar of Events (continued)

For more information see: www.foothill.edu/news/newsfmt.php?sr=2&rec_id=5005 or phone 650-949-7888.

May 27, 8:30pm

What: Popular Myths of Astronomy
Who: Prof. Thomas Targett, Sonoma State University
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

Much of what we think we know about space comes from film and television, but Hollywood's job is more often to entertain than to educate. In this presentation, we will sort fact from fiction, taking a tour through the worlds of Star Trek, Star Wars, and much more.

For more information see: <http://www.friendsofmontam.org/astromy/schedule>

June 2, 6:00pm - 10:00pm

What: \$5 First Fridays
Who: Chabot Exhibit
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Chabot Admission\$5, Free for Members

At \$5 First Fridays you can join a Night Hike through the redwoods or enjoy various laser and planetarium shows. Admission also includes hands-on activities and live demonstrations throughout the center, as well as any special events that are going on that evening. It's fun for the whole family!

See www.chabotspace.org/first-fridays.htm for more information and to pre-purchase tickets, or call (510) 336-7373.

June 5, 7:30pm

What: Coloring the Universe
Who: Dr. Travis Rector, University of Alaska Anchorage
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members \$12, Seniors \$12, General \$15. Reserve a space online or call 1-877-227-1831.

Everyone loves pictures of space. But have you ever wondered if that's what they really look like? Or if the colors are real? For over twenty years astronomer Dr. Travis A. Rector has been making color astronomical images with some of the world's largest telescopes. Dr. Rector will give a behind-the-scenes look at what professional astronomers do, and what they don't do, when making these beautiful images. He'll also share with people images and stories from his new book, called "Coloring the Universe."

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

June 21-25

What: Golden State Star Party
Who: Chabot Exhibit
Where: Aiden, CA
Cost: \$70 or \$25/night. No refunds, but registration can be transferred to other parties without restriction.

If you've never been out to a sky beyond your backyard or local astronomy sites, you're in for an amazing treat. Have you seen a dark sky, or only remember them from childhood? For you, that first view at GSSP will be truly incredible.

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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.

Club Star Party: Tesla Vintners, April 29



Image Caption: TVS members setting up at the April 29 Tesla Vintner's Club Star Party. See the story below. Image Credit: K. Ross Gaunt

Calendar of Events (continued)

Do you need a telescope to attend? No! But if you have one, bring it (nothing is too small). If not, binoculars, or just your eyes will do. There will be plenty of telescopes to look through.

Do you think you're too much of a beginner? It's a friendly and helpful group – you'll fit right in and make new friends under an amazing sky. Whether you're an observer or imager, you'll have lots of company, get plenty of help, and see lots of new equipment and sights.

Campers and RV's are welcome (no hookups). There is limited hotel accommodations in nearby towns.

For more information see: <http://goldenstatestarparty.org/index.php/golden-state-star-party/newcomers-and-novices-welcome/>

Tesla Star Party By Roland Albers

About a dozen club members attended the party. The weather was excellent: clear, calm, and not too cold. We all set-up in the gravelled parking area, shielding us from the neighboring lights from Wente's facilities, but impacting the view to the west with a few trees. While setting up and waiting for the sky to darken, we were able to enjoy observing the 3-day-old moon. As twilight deepened, we started on our chief goal for

the evening, an abbreviated version of a Messier Marathon as inspired by Don Machholz's talk at our last meeting.

Everyone took up the challenge in their own way. Chuck used his large Dobsonian and manually found the objects with the aid of printed finder charts. Most of the rest used go-to telescopes in hopes of finding more objects during the limited time we had the use of the winery grounds.

Chuck made the first marathon observation, finding M42 low in the west. Soon after, I was able to find both M42 and M45 in binoculars, both quite washed out by the western twilight. Then we began on the star clusters of the winter Milky Way, such as M35 through M38. The most popular cluster of the evening turned out to be M47, a large and bright open cluster in Puppis.

We then proceeded to a portion of the Marathon dominated by galaxies, particularly the large numbers in Leo, Ursa Major and Virgo. For me, it was fascinating to view so many galaxies in relatively quick succession and truly become aware of the great variety in sizes, shapes, surface brightness and core brightness. My favorite galaxy of the evening was M82, bright and distinct in my C8, even within the light pollution surrounding southern Livermore.

I proceeded at a leisurely pace, taking notes and talking frequently with others throughout the evening. I was able to observe a total of 30 objects before we wrapped up at midnight. I think Tom Dossa made the most observation of the group, finding over 60 Messier objects!

Outreach Star Party: Tracy Girl Scouts, May 6



Image Caption: At the Girl Scout event, held in Tracy on May 6, there were 20 girls who participated. Rich gave an interesting program about astronomy. There were 3 other club members with telescopes. I set up my 9" Celestron and waited for Polaris to show up, but an altostratus cover prevented any observations that night. Caption and image Credit: K. Ross Gaunt

Club member Dan Helmer appreciated the interaction with fellow TVS members, stating "Being a novice, to me it's not so much about what I see, but what I learn. Every time I go out for an observation session, there's always some challenge I encounter (usually operator error with setup/calibration of my C11). The thing I love about the TVS members is their willingness to share their knowledge and time with rookies like me - Roland let me borrow his compass when my phone was acting up so I could point my telescope north. Dennis helped me troubleshoot a problem by showing me how Stellarium works, and Ross showed me some additional functionality I never knew my scope had."

Journal Club By Ken Sperber

The Possible Fate of Comet 96P/Machholz 1

Last month TVS was privileged to have lifetime member Don Machholz speak about his contributions to the development of the Messier Marathon. He also spoke about his passion of searching for comets. Among his 11 discoveries, Comet 96P/Machholz 1, discovered on May 12, 1986, has several unique characteristics. According to Wikipedia, of numbered short-period comets it has the closest perihelion (0.124 AU, ~3x closer to the Sun than Mercury), with its orbit having both high inclination and high eccentricity. Furthermore, it is depleted in carbon and cyanogen. One hypothesis for the depletion is that given its short period,

5.28 years, the comet has made many passages by the Sun, which has likely baked off the volatiles. Other possibilities for the depletion are that the comet has an interstellar origin and was captured by the Sun, or that it formed in the extremely cold Oort Cloud where carbon was trapped in other molecules.

The close perihelion, the high eccentricity, and the short period of Comet 96P/Machholz 1 make it an object of interest to scientists who study solar system dynamics. Recently, Sekhar et al. (2017, MNRAS, <https://doi.org/10.1093/mnras/stx548>) performed a study of hundreds of solar system objects to assess the relative impacts of General Relativity (GR) vs. Lidov-Kozai (L-K) gravitational effects in perturbing their orbits. The simulations began from JPL-Horizons initial conditions, considered the Sun, the 8 planets (Mercury-Neptune), and extending out into the future for ~10,000 years. Two sets of parallel integrations were performed beginning from the same initial conditions, one only considered Newtonian (gravitational) influences, and the second set also included GR.

If an object passes close to the Sun and often enough, GR will cause the object's orbit to measurably precess. The observed precession of Mercury was a key confirmation of Einstein's GR Theory! L-K effects arise due to gravitational interactions in a three (or more)-body system. This effect can cause wild swings in eccentricity and orbital inclination, even causing an object to switch from a prograde orbit to a retrograde orbit. These swings can also affect the perihelion

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

All times are Pacific Daylight Time

May

18 Thu Last-Quarter Moon (5:33pm)

18 Thu Jupiter double shadow transit [Europa (Io) shadow ingress at 7:16pm (8:53pm); shadow egress 9:42pm (11:04pm)]

22 Mon Crescent Moon about 4 degrees below Venus (predawn)

25 Thu New Moon (12:44pm)

25 Thu Jupiter double shadow transit [Europa (Io) shadow ingress at 9:54pm (10:47pm); shadow egress May 26 at 00:19am (00:58am)]

29 Mon Crescent Moon about 3 degrees to the lower-left of M44, the Beehive Cluster (Evening)

June

1 Thu First-Quarter Moon (9:42am)

3 Sat Jupiter about 2 degrees from the Moon (evening)

9 Fri Full Moon (10:10am)

9 Fri Saturn about 3 degrees from the Moon

14 Wed Saturn at opposition

17 Sat Last-Quarter Moon (8:33am)

Journal Club (continued)

distance, and the orbital period, and thus the impact of GR. Meanwhile, precession due to GR will change the object's orbit and thus the gravitational L-K effects.

Sekhar et al. (2017) found three classes of objects when studying the relative impact of GR vs. LK. Firstly, while Halley-type comets and Sun-grazing Kreutz comets come close to the Sun, where the warping of space-time due to GR is large, their long orbital periods, ~100 to millions of years, means that L-K effects dominate over GR effects. This even holds true in cases where the objects are in high inclination orbits.

Secondly, the authors found that short period (<1 year) objects with eccentricities and inclinations similar to Mercury are dominated by GR effects.

The third class of objects are influenced by both GR and L-K effects. These consist of objects whose perihelion is less than or equal to that of Mercury, and whose orbital periods are less than 8 years. Among the 244 objects in this class, Comet 96P/Machholz 1 was unique! It was the only object to exhibit an inclination flip, changing from a prograde to a retrograde orbit due to GR - L-K interactions. From a present-day eccentricity of 0.96 and an inclination of 58 degrees, Comet 96P/Machholz 1 exhibited swings in eccentricity between 0.68 and nearly 1, and inclination changes between 9-90 degrees,

with a period of about 4800 years. Then, at about 9000 years in the future, Comet 96P/Machholz 1 fell into the Sun. The effect of GR was to delay the infall time by about 5-30 years. At times when the perihelion distance decreased, the GR precession rates exceeded that of Mercury by up to a factor of ~60. This scenario was robust in a series of sensitivity simulations in which the semi-major axis was slightly perturbed in the initial conditions.

Do the author's simulations predict the fate of Comet 96P/Machholz 1? Possibly not. The authors are conservative, and state that their results indicate the time scales on which inclination flips and solar infall can occur. They cite other studies that come to different conclusions when using different numerical solvers, and considering the additional gravitational effects of the Pluto-Charon system, and the 10 largest asteroids.

Three-body problems--complicated!

For more information see: <https://www.sciencedaily.com/releases/2017/04/170426102226.htm> and <https://en.wikipedia.org/wiki/96P/Machholz>

NOAA's Joint Polar Satellite System to Monitor Earth as Never Before

By Ethan Siegel

Later this year, an ambitious new Earth-monitoring satellite will launch into a polar orbit around our planet. The new satellite—called JPSS-1—is a collaboration between NASA and NOAA. It is part of a mission called the Joint Polar Satellite System, or JPSS.



At a destination altitude of only 824 km, it will complete an orbit around Earth in just 101 minutes, collecting extraordinarily high-resolution imagery of our surface, oceans and atmosphere. It will obtain full-planet coverage every 12 hours using five separate, independent instruments. This approach enables near-continuous monitoring of a huge variety of weather and climate phenomena.

JPSS-1 will improve the prediction of severe weather events and will help advance early warning systems. It will also be indispensable for long-term climate monitoring, as it will track global rainfall, drought conditions and ocean properties.

The five independent instruments on board are the main assets of this mission:

- The Cross-track Infrared Sounder (CrIS) will detail the atmosphere's 3D structure, measuring water vapor and temperature in over 1,000 infrared spectral channels. It will enable accurate weather forecasting up to seven days in advance of any major weather events.
- The Advanced Technology Microwave Sounder (ATMS) adds 22 microwave channels to CrIS's measurements, improving temperature and moisture readings.
- Taking visible and infrared images of Earth's surface at 750 meter resolution, the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument will enable monitoring of weather patterns, fires, sea temperatures, light pollution, and ocean color observations at unprecedented resolutions.
- The Ozone Mapping and Profiler Suite (OMPS) will measure how ozone concentration varies with altitude and in time over every location on Earth's surface. This can help us understand how UV light penetrates the various layers of Earth's atmosphere.
- The Clouds and the Earth's Radiant System (CERES) instrument will quantify the effect of clouds on Earth's energy balance, measuring solar reflectance and Earth's radiance.

It will greatly reduce one of the largest sources of uncertainty in climate modeling.

The information from this satellite will be important for emergency responders, airline pilots, cargo ships, farmers and coastal residents, and many others. Long and short term weather monitoring will be greatly enhanced by JPSS-1 and the rest of the upcoming satellites in the JPSS system.



Image Caption: Ball and Raytheon technicians integrate the VIIRS Optical and Electrical Modules onto the JPSS-1 spacecraft in 2015. The spacecraft will be ready for launch later this year. Image Credit: Ball Aerospace & Technologies Corp.

Want to teach kids about polar and geostationary orbits? Go to the NASA Space Place: <https://spaceplace.nasa.gov/geo-orbits/>

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



Tri-Valley Stargazers
P. O. Box 2476
Livermore, CA 94551
www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

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

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

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

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

_____ Regular member (\$30).

_____ Patron member (\$100). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

Hidden Hill Observatory Access (optional):

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

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

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

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

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

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: \$ _____

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

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