PRIMEFOCUS

Tri-Valley Stargazers

December 2015

Meeting Info

What:
Holiday Potluck Dinner

Who:
You, family, and friends

When:
December 18, 2015
Doors open at 6:30 p.m.
Dinner at 7:00 p.m.

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

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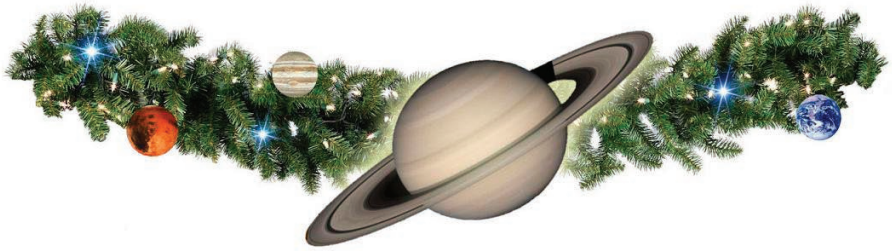
December Meeting



Holiday Potluck Dinner

This month is our Holiday dinner. We'll be opening the doors at 6:30 to set up the tables and chairs, and then the feast will begin at 7pm. TVS will provide the drinks and paper/plasticware. Jill Evanko will be preparing the main course for this month's holiday celebration. This will consist of Chinese ribs and tri-tip roast. Those planning on attending are asked to contact Jill (secretary"at"trivalleystargazers.org) to indicate what type of side dish (green salad, potato, pasta, or rice) or dessert they will bring to the festivities. This will help ensure that a wide variety of treats will to be shared, and provide a head count on the number of attendees expected so that we can plan appropriately. We look forward to sharing the holiday together.

2016 Dues Are Due

TVS membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member. The term of membership is one calendar year - January through December. Note: As an option, Patron Membership, which grants use of the club's 17.5" reflector at H2O, has once again become available at the annual rate of $100.00.

You can join TVS or renew your membership online at:

http://www.trivalleystargazers.org/membership.shtml After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the 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.

News & Notes

2015 and 2016 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**
Dec. 18	Dec. 21	
Jan. 15	Jan. 18	Dec. 25
Feb. 19	Feb. 22	Jan. 29
Mar. 18	Mar. 21	Feb. 26
Apr. 15	Apr. 18	Mar. 25
May 20	May 23	Apr. 29
Jun. 17	Jun. 20	May 27
Jul. 15	Jul. 18	Jun. 24
Aug. 19	Aug. 22	Jul. 29
Sep. 16	Sep. 19	Aug. 26
Oct. 21	Oct. 24	Sep. 30
Nov. 18	Nov. 21	Oct. 28
Dec. 16	Dec. 19	Nov. 25

Money Matters

As of November 23, 2015 the TVS checking account balance is $11,182.76. This includes $150.00 from the sales of two of the club's old telescopes and $97.00 from the sales of some of the club's other old equipment during both last month's meeting and the SJAA Fall Swap Meet.

TVS Elections: The People Have Spoken

Chuck, Rich, Roland, and Jill were all re-elected to serve another year in their same posts. We thank them for their continued service to the club!

Star Party Request: January 8

Eric Dueltgen, the club star party coordinator, has received a request for a star party at Rancho Las Positas Elementary School in Livermore on Friday, January 8 (weather permitting, of course). They are having an astronomy night that evening, and would like us to set up some scopes. We plan to setup at about 5:00, close to sunset. The event is scheduled from 6:00 to 7:30 pm. Please let me know if you can help (coordinator"at"trivalleystargazers.org).

The Telescope Loaner Program

As part of our efforts to clean out the club's storage closet, we have streamlined our collection of telescopes for the loaner program. Members can rent any of the following telescopes for $15/month:

•Orion XT8i 8-inch f/5.9 Dobsonian reflector with push-to controller

•Coulter Odyssey 10-inch f/4.5 Dobsonian reflector (we have two of these)

•Celestron C8 8-inch SCT with motor-driven fork mount, wedge and tripod

•Meade LX200 10-inch SCT with go-to fork mount and tripod

•Unitron 75mm f/16 refractor with a manual GEM and tripod

•Edmunds Astroscan wide-field Newtonian reflector

The Orion XT8i requires a $100 refundable deposit. The other telescopes require a $50 refundable deposit. See http://www.trivalleystargazers.org/loanerscope.shtml for more information about our collection. If interested in renting any of these see John Swenson, our loaner scope manager, during any club meeting.

Calendar of Events

December 15, 12:00pm

What: High Temperature Volcanism on Earth: Physical Volcanology, Mineralogy, and Geochemistry of Archean Komatiites
Who: Michael Lesher, Laurentian University, Sudbury
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Komatiites are magnesium-rich magmas characterized by very high temperature (up to 1640°C vs. ~1200°C for modern basalts), very low viscosity (0.1-1 Pa·s), and a very large interval (460-160°C) between liquidus and solidus. As a consequence, they formed highly mobile flows capable of flowing long distances over gentle slopes that - if channelized - thermally and thermomechanically eroded wallrocks and substrates. This led to the formation of some of the world's richest nickel-copper-platinum group element deposits. The most magnesian examples formed only the Archean, marking a fundamentally different thermal structure in the Earth's mantle prior to 2.5 Ga

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

December 19, 11:00am

What: How to be Really Good at Not Finding Dark Matter
Who: Prof. Bob Jacobsen, UCB
Where: UC Berkeley, Genetics and Plant Biology Building,

Header Image: Hubble Space Telescope image of the Cone Nebula. The Cone Nebula is part of the Christmas Tree Nebula, which collectively are denoted as NGC2264. Credit: NASA, Holland Ford (JHU), the ACS Science Team and ESA.

Calendar of Events (continued)

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.

Astronomers have found evidence for something that exerts a gravitational pull on stars, galaxies and even large parts of the Universe, but that doesn't otherwise seem to do anything interesting. Knowing little more about it, they call it Dark Matter. Physicists want to detect and study something strange like that, so we build detectors. Very, very sensitive and quiet detectors that have to be buried deep within the Earth to get them away from any sorts of false signals. One of these detectors, LUX, is located in Cal's old gold mine. It has looked for several years without finding any signs of Dark Matter, which is really, really interesting.

Come hear about some fun things:

How do people find such weird things?

Why look on Earth for something found in the sky?

What's good about _not_ finding Dark Matter?

How do you know your detector isn't just broken?

Gold mine? What gold mine?

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

December 19, 8:00-10:00pm

What: Winter Solstice
Who: Octopus Literary Salon
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $15 (does not include general admission; book online)

Come revel in the stories of the nights sky as we celebrate the Winter Solstice with the Octopus Literary Salon. Illuminating storytellers, poets and musicians will recount the myths and legends from around the world that mark the season, followed by a Planetarium show that will explain the astronomical science behind the winter cosmos. Enjoy live music, delight in our imaginative holiday installation of LED lights and space toys and stay warm with hot apple cider. Beer, wine, and tamales will be for sale.

Help us spread the light of generosity in our community by bringing a toy to donate and receive a $1 off admissions all day long

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

January 5, 12:00pm

What: Finding Amazing Structures Hidden in Big, Complex, Dense, Raw Data
Who: Marvin Weinstein , Quantum Insights
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Mr. Marvin Weinstein consults on the application of Dynamic Quantum Clustering (DQC) to exploring and analyzing big, complex datasets. The goal is to reveal and understand unexpected hidden information without modeling the data or engaging in complex statistical analyses.

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

January 9, 8:00-10:00pm

What: The Physics of Time Travel
Who: Dr. Ken Warton, San Jose State
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $15 (does not include general admission; book online)

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Calendar of Events (continued)

Is time travel science fiction or a plausible reality? Written about for centuries and theorized by the most celebrated scientists, the quantum mechanics of time travel are still a hot topic in modern physics. Using popular movies as a framework, Professor Wharton will outline several distinct categories of consistent time travel stories, and discuss possible connections with actual physics.

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

January 12, 12:00pm

What: Life in the Universe — the Breakthrough Initiatives
Who: S. Pete Worden , Breakthrough Initiatives and Executive Director, Life in the Universe Division
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

On July 20, 2015, the 46th anniversary of the Apollo 11 moon landing, the Breakthrough Prize Foundation announced in London, UK a new initiative to study life in the universe. The announcement was made by Silicon Valley billionaire Yuri Milner and physicist Steven Hawking. The Breakthrough Initiatives currently consist of two primary elements, Breakthrough Listen which is a $100M renewed search for intelligent extraterrestrial signals, and Breakthrough Message, a global competition with a $1M prize to create, but not send a message representing humanity. S. Pete Worden, the former Center Director of the NASA Ames Research Center, is the Chairman of the Breakthrough Prize Foundation. He will talk about these initiatives in the broader context of our search for life in the universe.

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

Journal Club by Ken Sperber

Red Dwarfs: Ultra-cool and Ultra-active

As you probably know, the Kepler mission to observe transiting planets has been hugely successful. Based on observing ~150,000 stars in Cygnus, statistics suggest that 40 billion Earth-like planets orbit the habitable zone of Sun-like and Red Dwarf stars in the Milky Way! Given that Red Dwarf stars are more common than Sun-like stars, many astronomers suggest that planet searches around these stars would be the most fruitful. A key reason is that Red Dwarf stars are cooler than the Sun, and as such their habitable zone, where liquid water is possible, lies close-in. Thus, the orbital period of a planet in the habitable zone of a Red Dwarf star is shorter than 1 year, making detection easier than for planets in the habitable zone of a Sun-like, or larger, star.

In terms of the development of life, Red Dwarf stars remain on the main sequence far longer than Sun-like stars, and thus they provide a longer time for life to develop and flourish. However, an important question remains: Is the energy output of a Red Dwarf stable enough across the electromagnetic energy spectrum to provide an environment suitable for the development of life? In the case of the Sun we know there is an 11-year solar cycle over which the intensity of sunspots, UV light, and solar flares vary. Fortunately, the magnetic field of the Earth is strong enough to ameliorate the effects of most solar flares, with the strongest flares capable of affecting power grids and satellites in orbit.

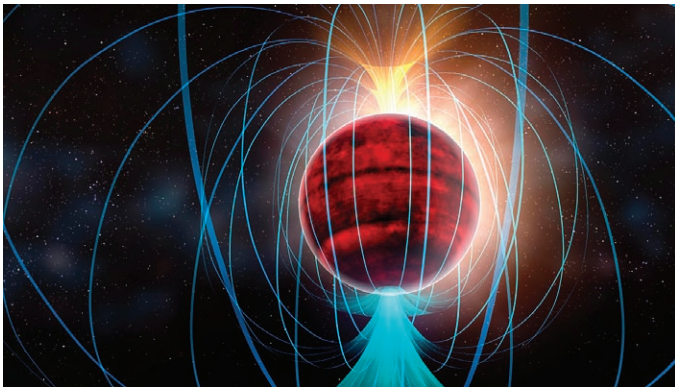

Image Caption: Artist's impression of red dwarf star TVLM 513-46546. ALMA observations suggest that it has an amazingly powerful magnetic field (shown by the blue lines), potentially associated with a flurry of solar-flare-like eruptions. Credit: NRAO/AUI/NSF; Dana Berry / SkyWorks

As it turns out, Red Dwarf stars are capable of producing flares that are much stronger than the Sun's. Williams et al. (2015, ApJ, in press) observed the Red Dwarf star TVLM 513-46546 using the ALMA array. TVLM 513-46546 is classified as spectral type M9, with a mass of about 0.06 solar masses, and a rotation period of about 2 hours. Using ALMA, the authors found strong emission at 95 GHz. Of the possible mechanisms for producing such emission, the authors were able to exclude that this was associated with a debris disk. This is because the star lacks lithium absorption, which means the star is at least 100 million years old, much longer than the 10 million year dissipation time of a debris disk. They also excluded free-free emission, which is related to radio induced emission associated with X-Rays. They also rejected electron cyclotron maser emission, since this would require a magnetic field 10x stronger than the theoretical limit for fully convective stars, like Red Dwarfs. Thus, by process of elimination, the authors conclude that the 95GHz emission of TVLM 513-46546, which is 10,000x stronger than the Sun's, is due to synchrotron radiation. Synchrotron radiation arises due to electrons spiral-

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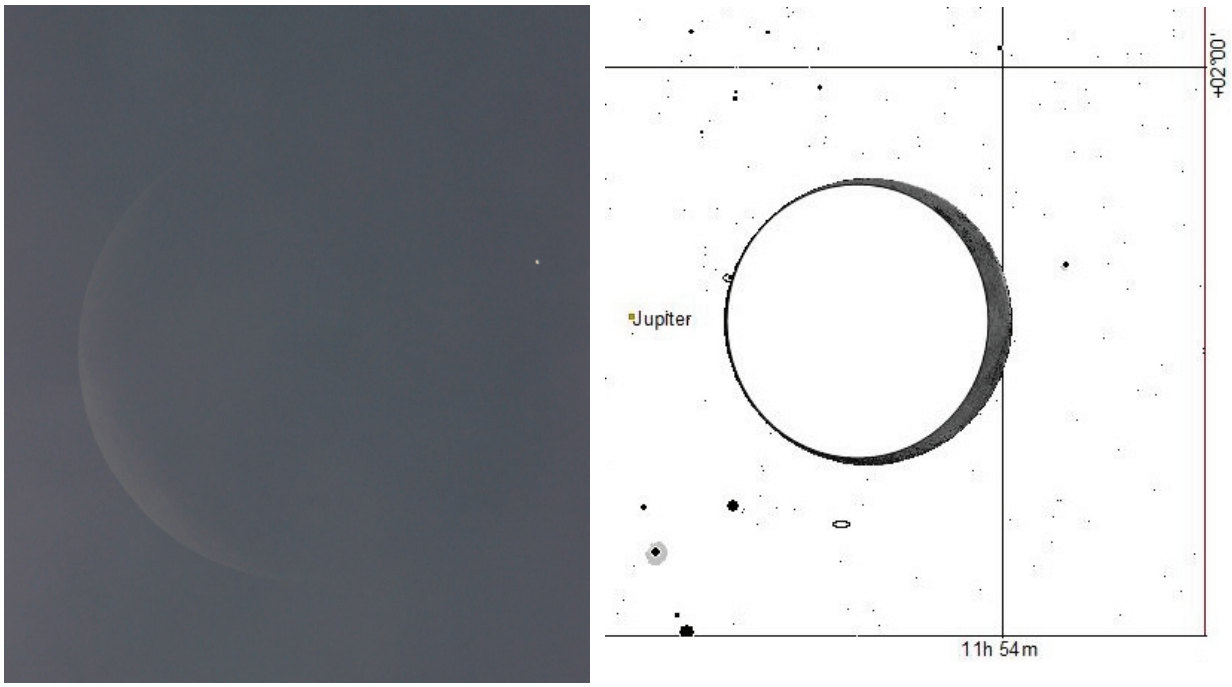


Image Caption: The December 7, 2015 occultation of Venus by the Moon. Left: Gert Gottschalk captured this image about 30 seconds after Venus egress during a hazy opening in the clouds. His picture was taken with his Takahashi FS-102 and a 1.4x Kenko teleconverter and a Canon EOS 600D / T3i. Right: The Jupiter-Moon occultation of September 2, 2016 occurs at about 2:00pm PDT, while Jupiter is transiting. Schematic produced using TheSky.

Journal Club (continued)

ing around magnetic field lines. That this strong activity was found throughout the 4 hours of ALMA observing time suggests that such activity is not intermittent, but is rather constant. As noted in the Harvard-Smithsonian Center for Astrophysics press release: "A planet in the habitable zone of a star like this would be buffeted by storms much stronger than those generated by the Sun. 'If we lived around a star like this one, we wouldn't have any satellite communications. In fact, it might be extremely difficult for life to evolve at all in such a stormy environment,' says lead author Peter Williams of the Harvard-Smithsonian Center for Astrophysics (CfA). "That proximity would put the planet right in the bull's-eye for radiation that could strip its atmosphere or destroy any complex molecules on its surface." Further study of this, and other, Red Dwarf stars are needed to assess how ubiquitous this type of activity is for this class of stars, which will have broad implications for the scope of possible development of life around other worlds.

For more information see: https://www.cfa.harvard.edu/news/2015-26 and https://en.wikipedia.org/wiki/Kepler_(spacecraft)

Venus Occultation

On December 7, 2015, there was a daytime occultation of Venus by the Moon. The early morning sky initially looked clear, so anticipation of the event was high. However, as the time of first contact approached, 7:54am PST, clouds covered much of the Bay area. Luckily, TVS members Forrest Tanaka and Gert Gottschalk were poised (and patient) to take images through sucker holes in the clouds. On the club Yahoo users group, Forrest posted an image taken prior to the beginning of the occultation, and Gert captured the Venus egress at about 9:41am PST (left above). In addition to taking still images, Gert planned to use a USB camera to make a movie of the Venus ingress and egress, but weather conditions were so poor that the USB camera did not have the sensitivity to capture the event through the hazy cloud cover. The next occultation of Venus will be April 6, 2016. However, it will only be visible from Europe.

An occultation of Jupiter by the Moon will be observable from California on Friday, September 2, 2016. It occurs at about 2pm PDT with Jupiter transiting (see above right for a schematic). The Moon is actually only about 2-3% full, with Jupiter ingress on the darkside of the Moon. Caution will be warranted, as the Sun will only be slightly to the west.

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

All times are Pacific Standard Time.

December

11	Fri	New Moon (2:29am)
13-14	Sun-	Geminid Meteor Shower visible Sunday and Monday nights; best after midnight (see p. 44, December S&T)
17	Thu	Algol at minimum brightness for 2 hours centered on 7:48pm
18	Fri	First-Quarter Moon (7:14am)
21	Mon	Longest night of the year; winter begins at 8:48pm
23-	Wed	Mars 3 degrees to the upper-left of Spica, watch on subsequent nights as they diverge (morning)
25	Fri	Full Moon (3:11am)
30	Wed	Jupiter to the lower-left of the Moon in Leo (midnight)

January

1	Fri	Last-Quarter Moon (9:30pm)
3	Sun	The Moon forms a triangle with Mars and Spica (morning)
3-4	Sun	Quadrantid meteors shower peaks at about midnight on the 4th
6	Wed	Algol at minimum brightness for 2 hours centered on 7:31pm
7	Thu	Crescent Moon to the lower-left of Venus and Saturn, which are less than 2 degrees apart (dawn)
9	Sat	Venus and Saturn less than 0.5 degrees apart in the southeast (dawn)
9	Sat	New Moon (5:30pm)
16	Sat	First-Quarter Moon (3:26pm)
19	Tue	The Moon occults Aldebaran (see p.49, January S&T)
23	Sat	Full Moon (5:46pm)
25	Mon	Regulus about 3 degrees from the Moon
27	Wed	Jupiter about 4 degrees above the Moon
29	Fri	Algol at minimum brightness for 2 hours centered on 6:05pm
30	Sat	The Moon is about 4 degrees to the upper-left of Spica. Mars is about 1.5 degrees from Alpha Librae
31	Sun	Last-Quarter Moon (7:28pm)

Our Solar System Is Almost Normal, But Not Quite

By Dr. Ethan Siegel

It was just over 20 years ago that the very first exoplanet was found and confirmed to be orbiting a star not so different from our own sun. Fast forward to the present day, and the stellar wobble method, wherein the gravitational tug of a planet perturbs a star's motion, has been surpassed in success by the transit method, wherein a planet transits across the disk of its parent star, blocking a portion of its light in a periodic fashion. Thanks to these methods and NASA's Kepler spacecraft, we've identified many thousands of candidate planets, with nearly 2,000 of them having been confirmed, and their masses and densities measured.

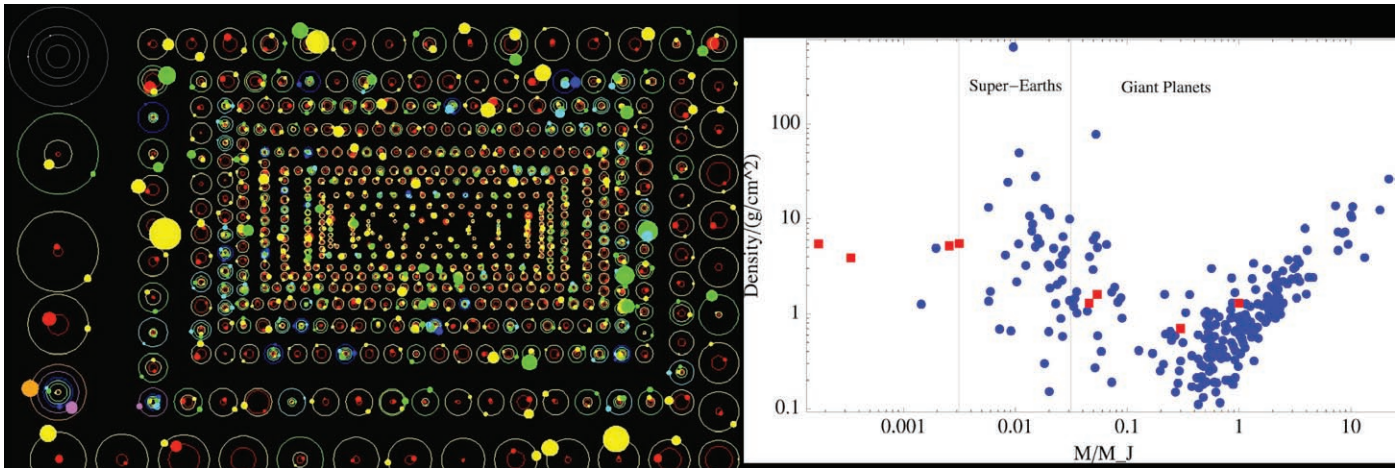
The gas giants found in our solar system actually turn out to be remarkably typical: Jupiter-mass planets are very common, with less-massive and more-massive giants both extremely common. Saturn—the least dense world in our solar system—is actually of a fairly typical density for a gas giant world. It turns out that there are many planets out there with Saturn's density or less. The rocky worlds are a little harder to quantify, because our methods and missions are much better at finding higher-mass planets than low-mass ones. Nevertheless, the lowest mass planets found are comparable to Earth and Venus, and range from just as dense to slightly less dense. We also find that we fall right into the middle of the "bell curve" for how old planetary systems are: we're definitely typical in that regard.

But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we've observed:

- All our solar system's planets are significantly farther out than the average distance for exoplanets around their stars. More than half of the planets we've discovered are closer to their star than Mercury is to ours, which might be a selection effect (closer planets are easier to find), but it might indicate a way our star is unusual: being devoid of very close-in planets.
- All eight of our solar system's planets' orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.
- And finally, one of the most common classes of exoplanet—a super-Earth or mini-Neptune, with 1.5-to-10 times the mass of Earth—is completely missing from our solar system.

Until we develop the technology to probe for lower-mass planets at even greater distances around other star systems, we won't truly know for certain how unusual we really are!

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!



Images credit: NASA / Kepler Dan Fabricky (L), of a selection of the known Kepler exoplanets; Rebecca G. Martin and Mario Livio (2015) ApJ 810, 105 (R), of 287 confirmed exoplanets relative to our eight solar system planets.

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.