Vol.73 No.1* Jan-Feb, 2016

SVAS OBSERVER

Sacramento Valley Astronomical Society

Founded in 1945

Happy New Year!

HGO

by Stuart Schulz

Inside This Issue

SVAS Event Calendar

Jan 9, Saturday

New Moon.

Jan 9, Saturday

Blue Canyon, weather permitting.

Jan 15, General Meeting Friday at 8:00pm

Sacramento City College, Mohr Hall Room 3
3835 Freeport Boulevard, Sacramento, CA.

Feb 6, Saturday

Blue canyon, weather permitting.

Feb 7, Sunday

New Moon.

Feb 19, General Meeting, Friday at 8:00pm

Sacramento City College, Mohr Hall Room 3
3835 Freeport Boulevard, Sacramento, CA.

SVAS Guest Speaker

Don Machholz

Messier Marathon

East SVAS West

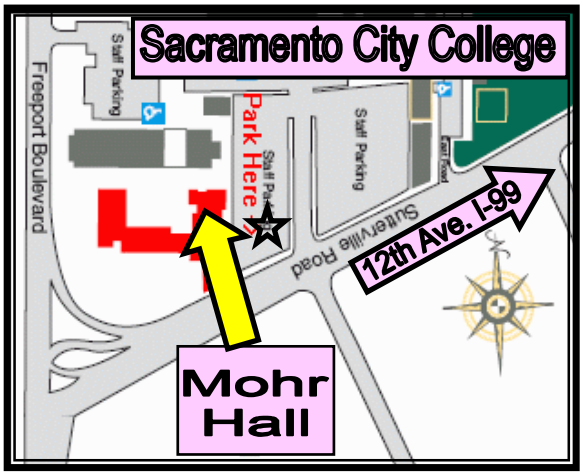
Jan 15th

Star Party Schedule for 2016

Star Parties

Jan 9
Feb 6
Mar 5
April 9
May 7
June 4
July 2
July 29,30,31, Star-B-Q
Sept 3
Oct 1
Oct 29
Dec 3

Blue Canyon



Community Star Parties

Contact Wayne Lord

Congrats SpaceX!

"If one can figure out how to effectively reuse rockets just like airplanes, the cost of access to space will be reduced by as much as a factor of a hundred. A fully reusable vehicle has never been done before. That really is the fundamental breakthrough needed to revolutionize access to space."

--Elon Musk

Dec 21st 2015

ORBCOMM-2 Mission

Mission Overview With this mission, SpaceX's Falcon 9 rocket delivered 11 satellites to low-Earth orbit for ORBCOMM, a leading global provider of Machine-to-Machine (M2M) communication and Internet of Things (IoT) solutions.

The ORBCOMM launch was targeted for an evening launch from Space Launch Complex 40 at Cape Canaveral Air Force Station, Fla. The 11 satellites were deployed approximately 20 minutes after liftoff, completing a 17-satellite, low Earth orbit constellation for ORBCOMM.

This mission also marked SpaceX's return-to-flight as well as its first attempt to land a first stage on land. The landing of the first stage was a secondary test objective.

Credits: SpaceX

"I would like to die on Mars; just not on impact."

SpaceX pulled off a history making first vertical return landing of a first stage rocket, during an orbital launch. This will dramatically reduce the cost of delivering payloads to space.

There are a few very unique additions to this rockets first stage, that make a return landing possible. There are cold-gas thrusters on the top that actuate to flip the rocket over to an upright landing position, so the main thrusters can take over to slow the descent. There are grid guidance fins attached to the top of the first stage, which extend during descent, and are fully directional to steer and guide the rocket back to the landing pad. Just before landing, the carbon fiber landing gear extend to support the rocket after touchdown. Very innovative!

Elon Musk, CEO of SpaceX, has a dream to establish a self-sustaining permanent base on Mars. This rocket return landing is a giant step in that direction.

Elon is also the CEO of Telsa Motors, where they are making history with electric cars as well. Electric cars have far less moving parts, more interior room, the motors do most of the breaking and send that energy back to the batteries, and instant torque providing amazing performance. He feels electric cars will replace fossil fuel engines, and they are our future ticket for clean air and inexpensive fuel. Is he planning driving Tesla's on Mars, where there is no fossil fuel or oxygen? Observer Editor

UFO?

No...a Navy Trident Missile Test

by Bill Hagbery

Nov 7, 2015

The light "left a huge blue mark in the sky and than disappeared" over the San Francisco Bay. Credit: Adam Corey

Flying over Disneyland

Bill Hagbery's cell phone photo

Saturday evening, while at the Stockton star party area off of Hwy 4, Nick and I and several others observed this missile test.

At first it appeared to be a bright spot light with two cones of overlapping light... one wide and another narrow. At first I thought it might be a helicopter approaching from the south with a spotlight shining to the side. I didn't get out my cell phone camera in time to catch the early part, but did snap a couple photos shortly afterwards. We had our telescopes set up and were able to observe much of the flight through them, until it was almost behind a tree near the horizon.

We thought it was a missile from Vandenberg AFB with six or eight "booster" rockets. Six or eight times there appeared to be booster rockets burning out and falling away. Someone must have captured that on video but it may have only been visible thru a telescope.

It was an exciting way to start the evening!

The Navy reported testing a Trident missile launched from the US Kentucky, an Ohio class submarine. It was part of ongoing readiness testing for our defense systems. It was viewed from California, Arizona, and Nevada.

Observer Editor

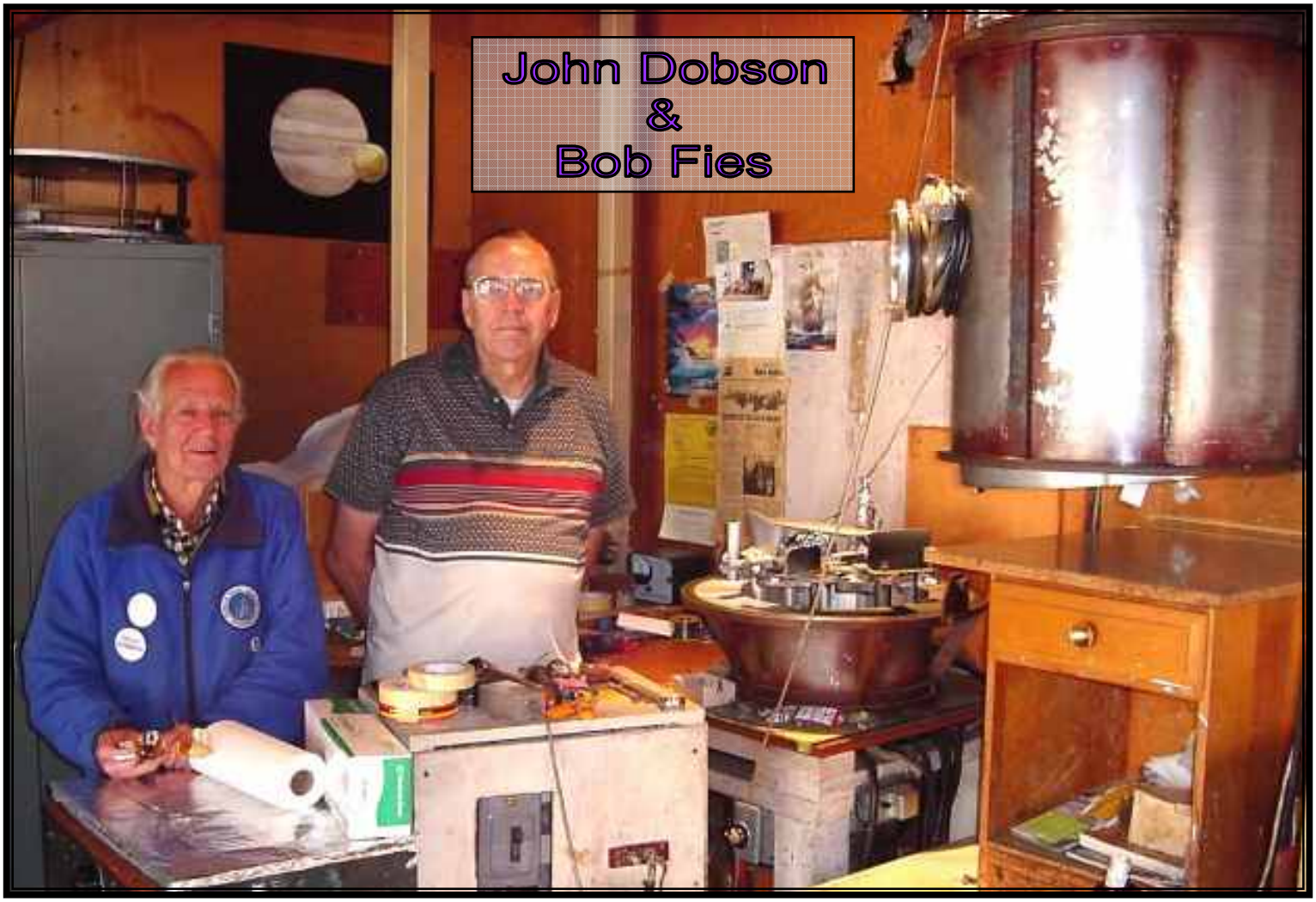
Visiting Bob Fies

Mirror Workshop

by Lonnie Robinson

Paul Redmon and I visited Bob Fies last November, in San Carlos, CA. (Just south of San Francisco), and we had a very enjoyable afternoon watching him aluminize Paul's recently completed 12.5" mirror. It's a fairly short drive from Sacramento, and we hoped he could finish the mirror while we waited, to save costly and risky shipping. We arrived a bit late, about 2:00pm, and Bob was waiting for us. After introductions, he went right to work cleaning the glass for coating.

Bob is a longtime active member (since the early 1990s) of the San Mateo County Astronomical Society (SMCAS) and a fellow editor for his own ALCOAT newsletter. John Dobson ask Bob if he could figure out how to coat mirrors, he said yes, and over the years has coated many mirrors for John and the San Francisco Sidewalk Astronomers. He also coats mirrors for the Chabot Space and Science Center Telescope Workshop, for local astronomy clubs, and some commercial projects. His services came highly recommended, and we were excited to add Paul's mirror to the long standing tradition.



In the photo below are Bob's two telescopes. The 8" was built to document a telescope making website, and the 12.5 Dobsonian rocker base was made by John Dobson. Bob ground, polished, and figured both mirrors.

Cleaning the mirror for coating is critical, and there were several steps to make sure it was spotless. Lucky, we didn't need to remove a previous coating, which is a whole other process. With a new mirror, it's first cleaned with mineral spirits to remove pitch residue and oily finger prints. Then a pure methanol cleaning (common name is wood alcohol) to remove the mineral spirits and leave no residue. Finally, a soaking in diluted 10 percent swimming pool acid which has been warmed. This keeps the mirror from frosting over after the final cleaning with methanol.

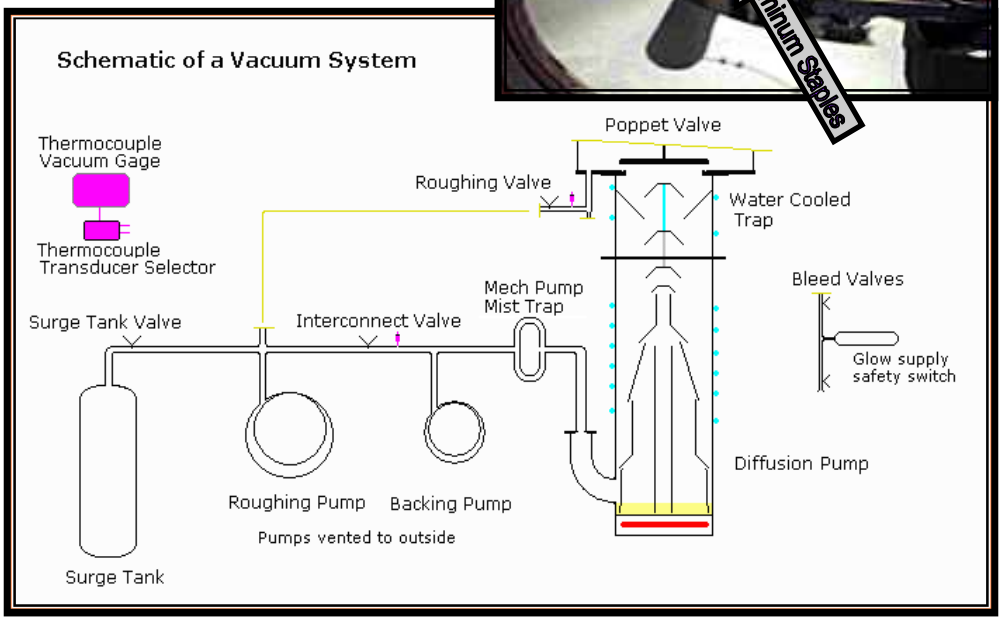
When Bob was satisfied all of the glass surfaces were spotless, he mounted the mirror upside down in the upper part of the vacuum chamber. We were ask not to talk to him during the mounting, to prevent any breath moisture from settling on the mirror. There is a hoist installed overhead on rails, making lifting and moving the mirrors, and the heavy upper chamber assembly, an easy task. The chamber can accommodate up to 20" mirrors.

After sealing the chamber, it was time to pump all the air out. Bob's own words describes the pump down process best: "The atoms (O2 and N2) of gas travel at about the speed of sound between collisions with other atoms. At sea level pressure this travel distance is very short. The vacuum in the tank, when used for high vacuum coating, must be good enough that most of the very reactive aluminum atoms reach the mirror before colliding with oxygen molecules. An adequate vacuum is about 1/10,000 of a millimeter of mercury as in a mercury column barometer. There are two mechanical vacuum pumps that remove most of the air. The large pump "roughs out" the tank while the second pump backs the oil diffusion pump, and after three or four minutes they leave a pressure of about 1/3 millimeter. Then both mechanical pumps are valved to back the oil diffusion pump, and the large poppet valve between the diffusion pump and the tank is opened slowly and carefully so as to avoid a stall in the diffusion pump. After about 20 minutes the tank reaches the necessary vacuum.

The oil diffusion pump uses a special oil to boost the vacuum. This oil gets very hot and moves through the chimney as a jet that pushes the remaining air toward the me-

chanical pumps. A water cooled “cold trap” is used to keep the hot vapor from streaming back into the coating tank. The hot diffusion pump oil must be kept under vacuum all the time, and therefore the need for two pumps, one for backing and one for roughing.” There is a balloon full of helium attached to the chambers top, to help keep the diffusion pump oil away from the mirror. It got smaller as the chamber air was pumped out and the helium drawn in.

As we watched the pressure gauges indicating when the proper vacuum was being achieved, Bob explained how the aluminum is deposited on the glass surface. There are four tungsten heating coils mounted in the chamber bottom, and connected to an external 3 volts at 100 amps power. Pure aluminum **U** shaped “staples” were clinched on each tungsten coil. There are two steps in melting the aluminum, after the mirror rotator is started. First, one of the coils has a cover over it, and when the heated aluminum evaporates it fills the chamber without hitting the mirror. This aluminum absorbs any left over oxygen molecules, producing a much better vacuum. Then by applying voltage to melt the rest of the uncovered aluminum, it effectively coats the mirror in this more complete vacuum. Bob watched carefully not to over melt the aluminum, quitting just as it formed small drops. If it overheats and melts the aluminum completely off the coils, the tungsten itself will start to evaporate towards the mirror.



The coating thickness is controlled by the distance the mirror is from the elements, the amount of aluminum on the coils, and how long the voltage is applied. The aluminum atoms travel in a straight lines, but radiate out in a spherical pattern from the evaporation coils. The further away from the evaporation coils, the thinner the surface distribution. The coating happened very quickly and we watched for the exact moment, but somehow missed it. The last procedure was the application of a quartz overcoat, a very thin glass layer that makes the aluminum surface much tougher to resist scratching and corrosion.

The viewing window coated over too, and one of the tests for a quality coating was to apply scotch tape and remove it, to see if any coating came off the viewing glass. When the chamber was again filled with air, the top lifted off with the mirror attached, we were happy to see the coating process was a success.

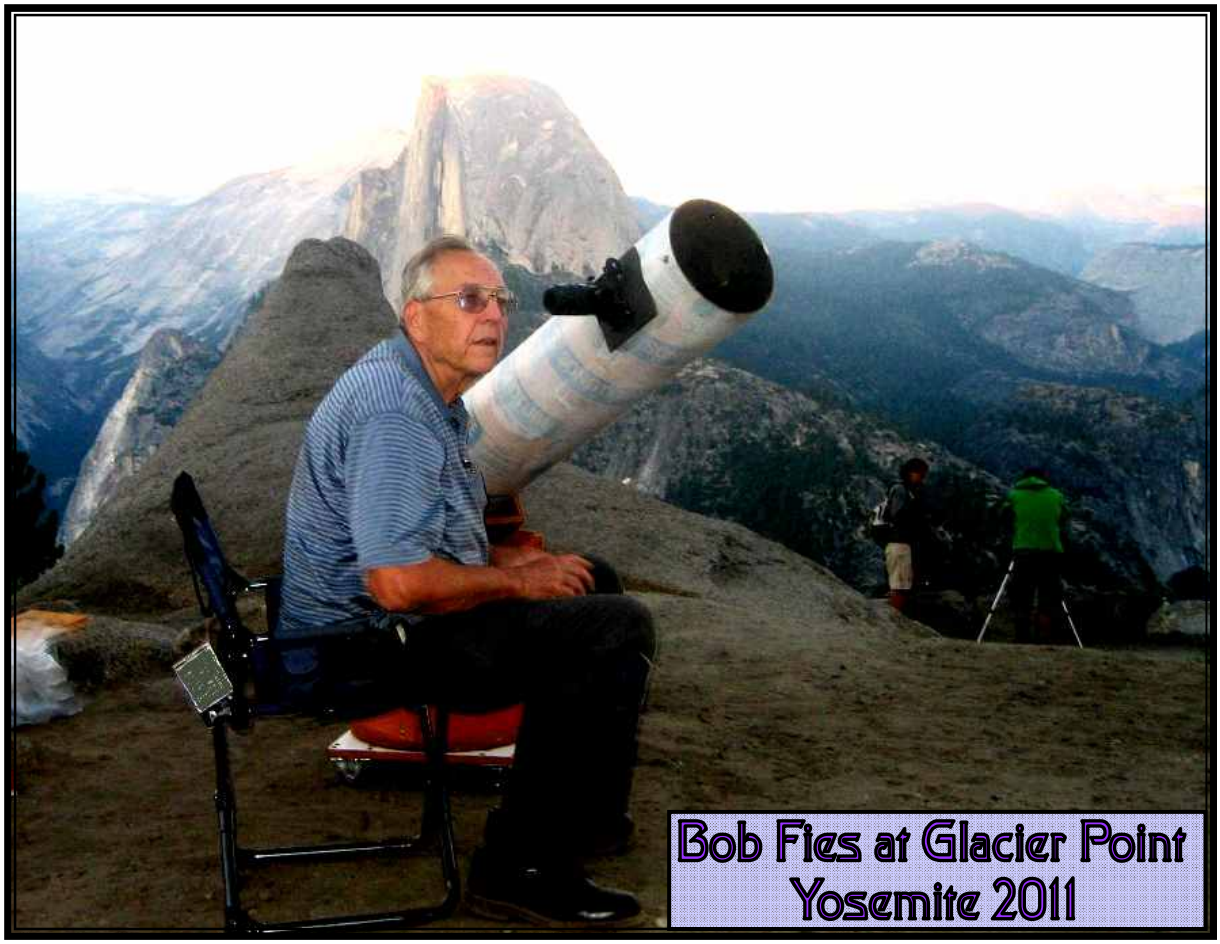
Bob checked the mirror surface carefully, and held it up to the light to make sure the coating thickness was adequate. Satisfied everything went well, he turned the mirror over on some Kimwipe tissue paper and stamped his name and date on the back. Then he helped us carefully pack the mirror back in it's box for the trip home.

Paul Redmon's 12.5 inch Hourglass Dob at Graeagle, CA.

Paul bought his mirror blank from Forrest Lockhart, at the Cameron Park Rotary Community Observatory. Forrest started grinding this mirror many years ago but decided not to finish it. We have star tested it without a coating, but we will make sure to include Forrest for the aluminized first light viewing.

Paul and I want to thank Bob for a really fun afternoon, and highly recommend his high quality and economical coating service. He will take all the necessary steps to ensure your mirror project gets the very best coating possible.

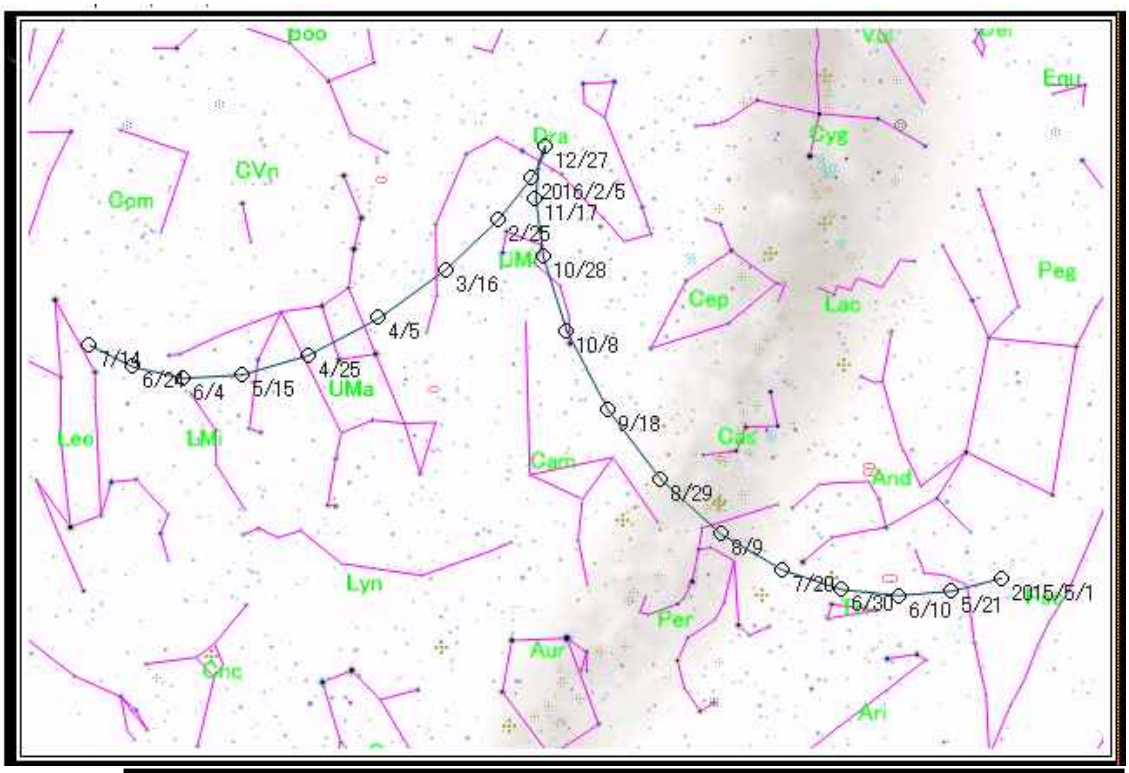
Contact Bob at: **Aluminum Coating, for Optics and Telescope Mirrors.** http://www.alcoat.net/

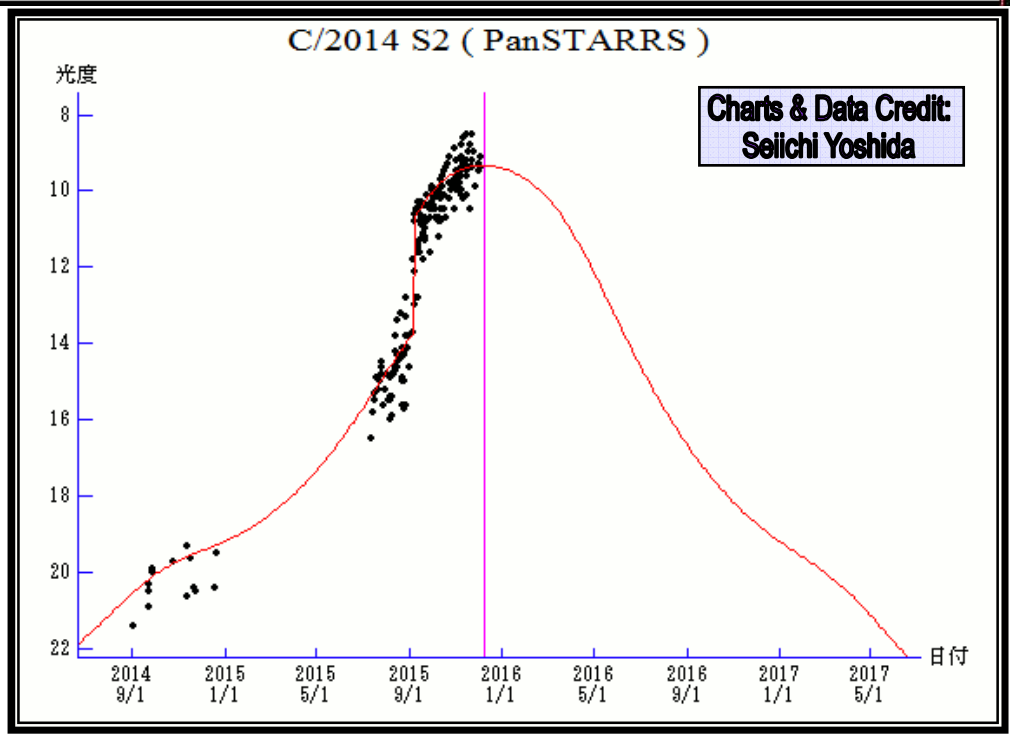


Bob Fies at Glacier Point Yosemite 2011

Comet Corner

Comet PanSTARRS C/2014 S2





Comet PanSTARRS S2 is beating brightness expectations, and may top 7th magnitude at it's brightest on Jan 1st. It reached perihelion on December 9th, and will cross from Draco towards Ursa Major, and into Ursa Minor in January.

Jan 1st - Max brightness +7?
Jan 22 - 20 degrees form comet Catalina.
Feb 29 - 19 degrees from Polaris.

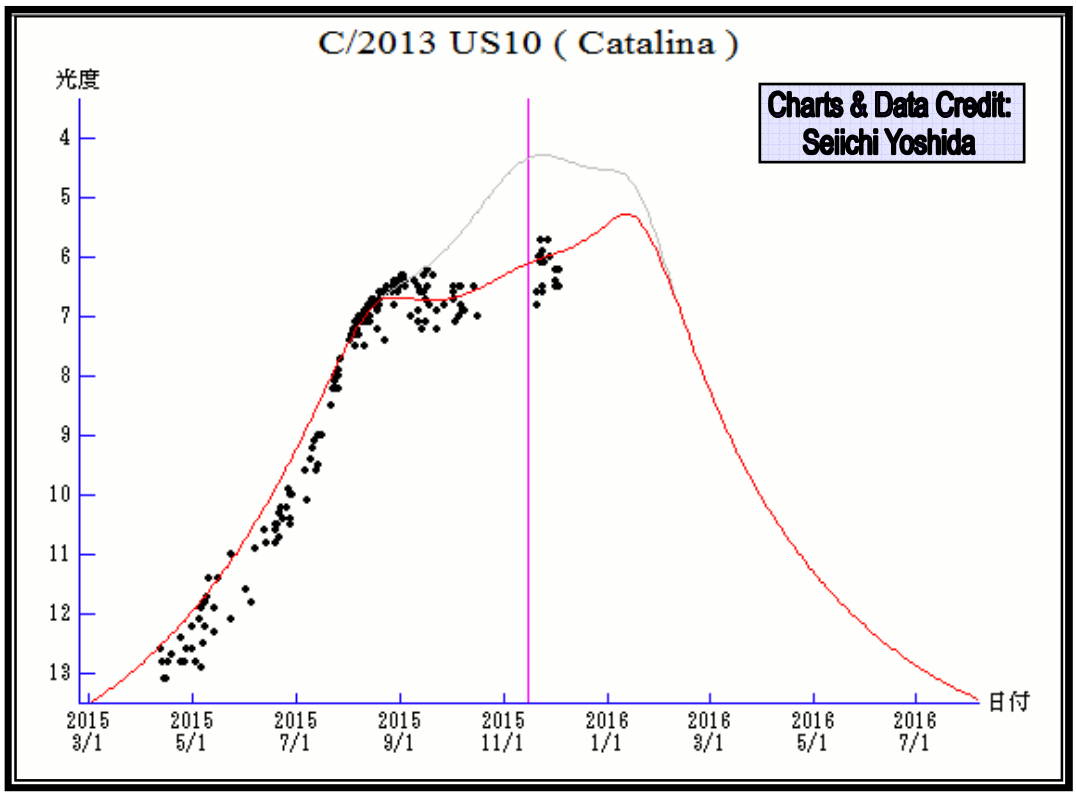
Comet Catalina C/2013 US10

Photo Credit: Ian Sharp

Comet Catalina will be closest to Earth on January 12th, and could be naked eye visual at mag 5-6.

Jan 1- .5 deg from Arcturus
Jan 9 - Canes Venatici
Jan 14 - Near dippers handle end star Alkaid.
Jan 17 - Just northeast of Mizar.
Jan 21 - Moves into Draco on it's way out.

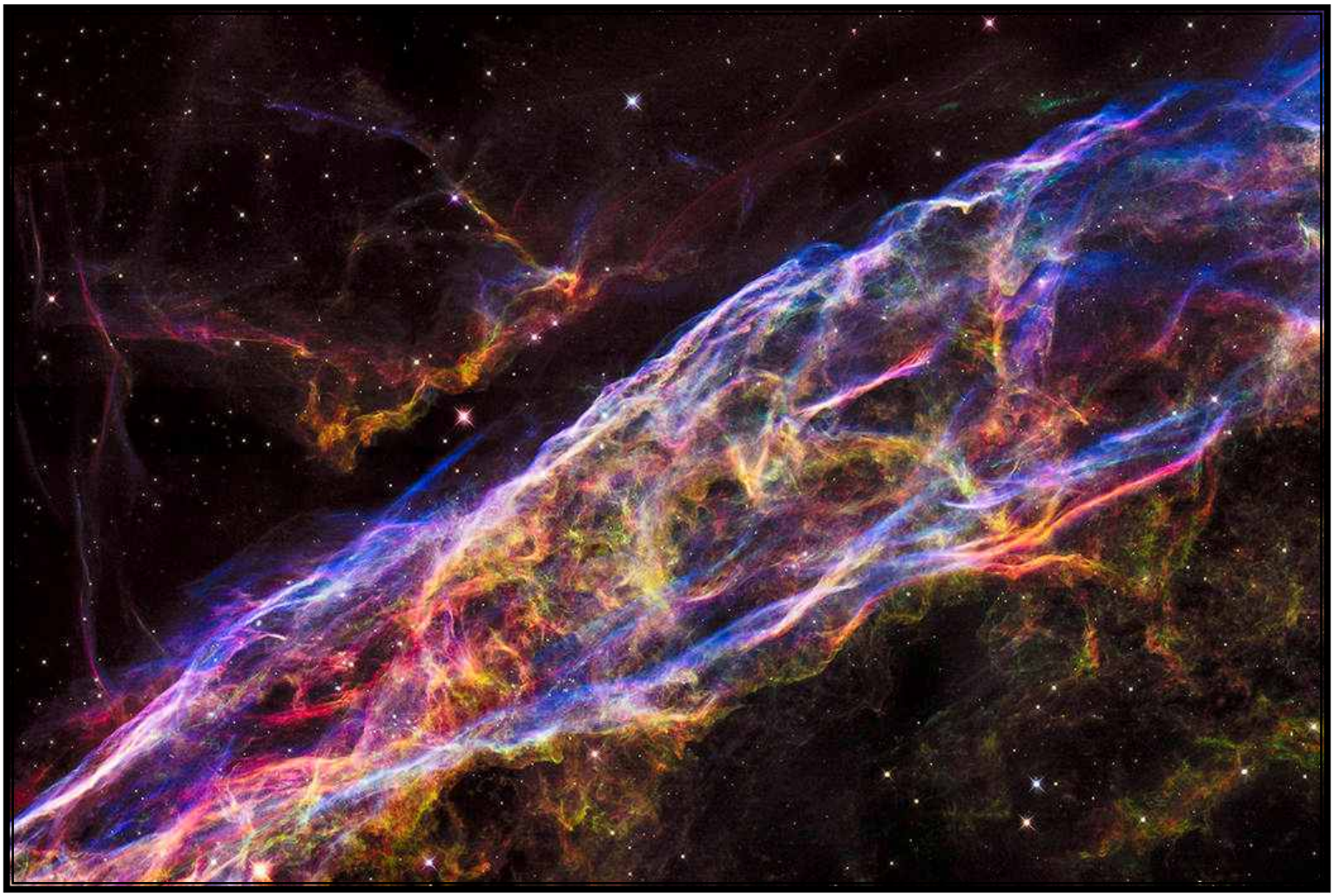
It will move about 2deg per day, you should see motion in less than 30 min. On it's way from the sun, Catalina will remain visual for several months, while crossing just below Polaris. It will fade quickly after mid January. Photos are showing two tails.



Charts & Data Credit: Seiichi Yoshida

Veil Nebula Supernova Remnant

Hubble Zooms in on Shrapnel from an Exploded Star



NASA's Hubble Space Telescope has unveiled in stunning detail a small section of the expanding remains of a massive star that exploded about 8,000 years ago.

Called the Veil Nebula, the debris is one of the best-known supernova remnants, deriving its name from its delicate, draped filamentary structures. The entire nebula is 110 light-years across, covering six full moons on the sky as seen from Earth, and resides about 2,100 light-years away in the constellation Cygnus, the Swan.
This view is a mosaic of six Hubble pictures of a small area roughly two light-years across, covering only a tiny fraction of the nebula's vast structure.

This close-up look unveils wisps of gas, which are all that remain of what was once a star 20 times more massive than our sun. The fast-moving blast wave from the ancient explosion is plowing into a wall of cool, denser interstellar gas, emitting light. The nebula lies along the edge of a large bubble of low-density gas that was blown into space by the dying star prior to its self-detonation.

Image Credit: NASA/ESA/Hubble Heritage Team

Our Solar System Is Almost Normal, But Not Quite

by 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.

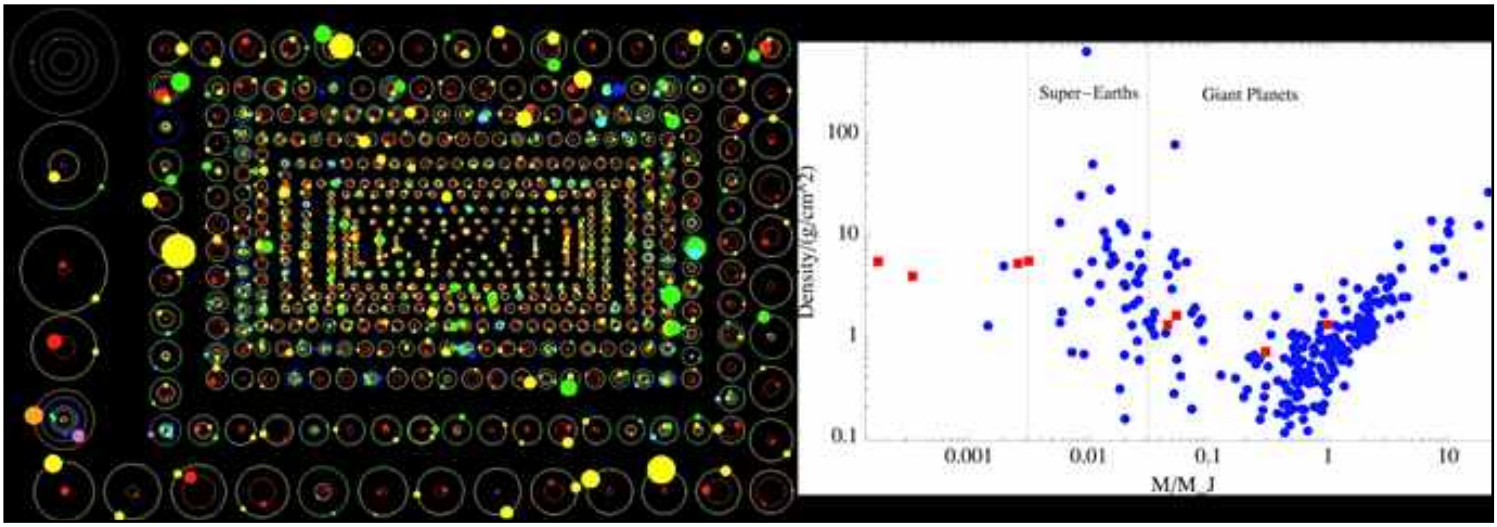
But there are a few big surprises, which is to say there are three major ways our solar system is an outlier among the planets we've observed:

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.

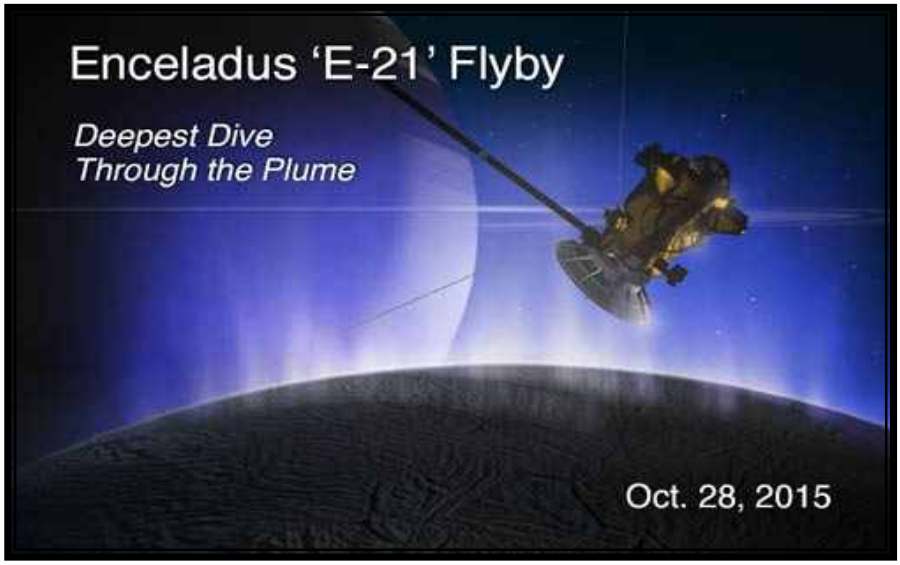
All eight of our solar system's planets' orbits are highly circular, with even the eccentric Mars and Mercury only having a few percent deviation from a perfect circle. But most exoplanets have significant eccentricities, which could indicate something unusual about us.

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!

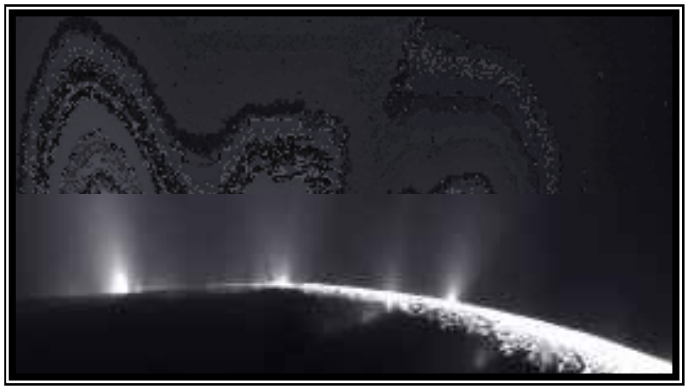


Images credit: NASA / Kepler Dan Fabricky (L), of a selection of the known Kepler exoplanets; Rebecca G. Martin and Mario Livio (2015) ApJ 810, 105 (R), of 287 confirmed exoplanets relative to our eight solar system planets.



Enceladus

This daring flyby will bring the spacecraft within 30 miles (48 kilometers) of the surface of Enceladus' south polar region. The flyby is Cassini's deepest-ever dive into the plume of icy spray that issues from fractures in the south polar region. The encounter will allow Cassini to obtain the most accurate measurements yet of the plume's composition, and new insights into the ocean world beneath the ice.



The Cassini mission is a cooperative project of NASA, ESA (the European Space Agency) and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging operations center is based at the Space Science Institute in Boulder, Colorado.

Although Dione (near) and Enceladus (far) are composed of nearly the same materials, Enceladus has a considerably higher reflectivity than Dione. As a result, it appears brighter against the dark night sky.

The surface of Enceladus (313 miles or 504 kilometers across) endures a constant rain of ice grains from its south polar jets. As a result, its surface is more like fresh, bright, snow than Dione's (698 miles or 1123 kilometers across) older, weathered surface. As clean, fresh surfaces are left exposed in space, they slowly gather dust and radiation damage and darken in a process known as "space weathering."

This view looks toward the leading hemisphere of Enceladus. North on Enceladus is up and rotated 1 degree to the right. The image was taken in visible light with the Cassini spacecraft narrow-angle camera on Sept. 8, 2015.

The view was acquired at a distance of approximately 52,000 miles (83,000 kilometers) from Dione. Image scale is 1,600 feet (500 meters) per pixel. The distance from Enceladus was 228,000 miles (364,000 kilometers) for an image scale of 1.4 miles (2.2 kilometers) per pixel.

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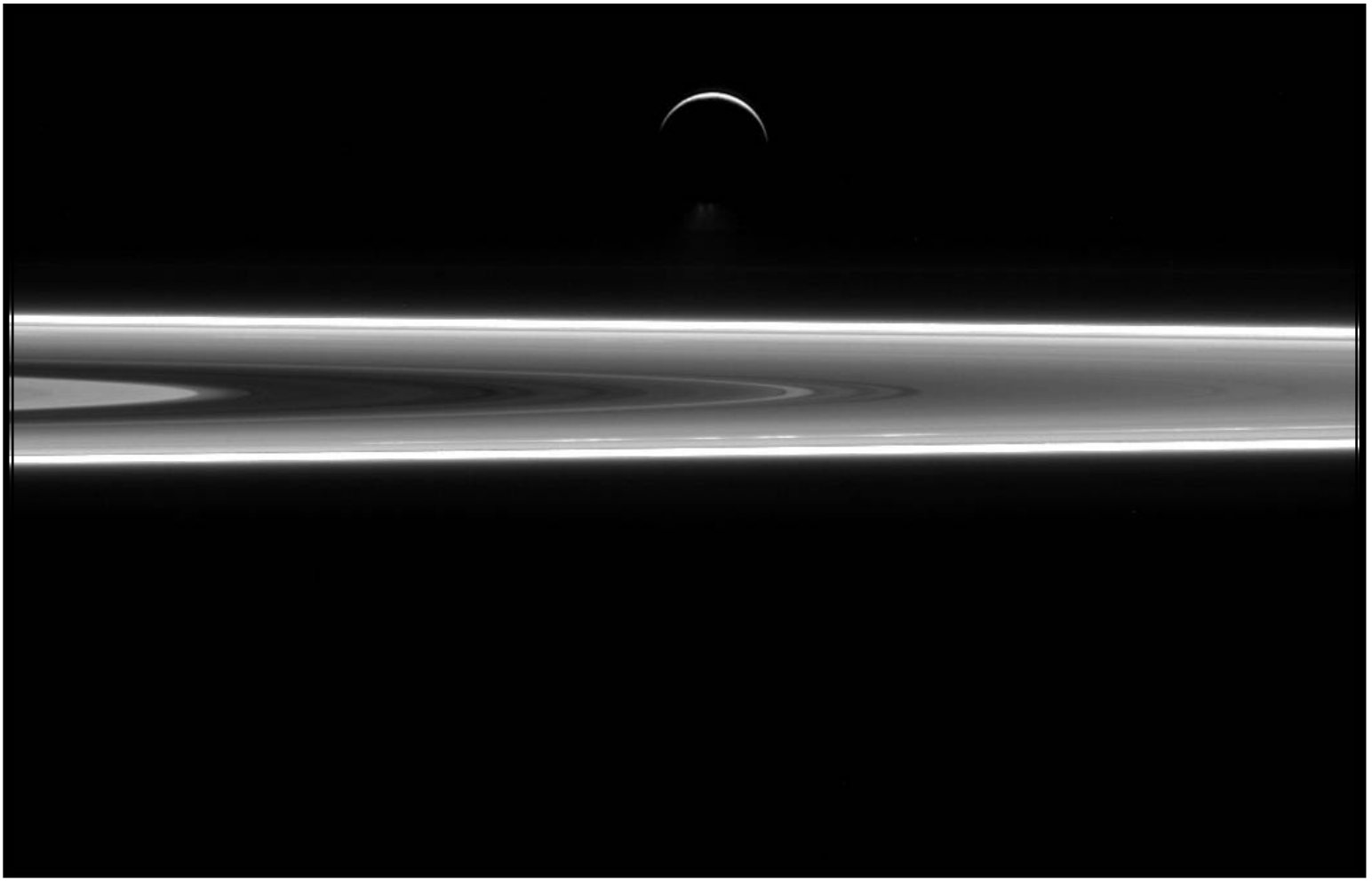
Credit: NASA/JPL-Caltech/Space Science Institute

Enceladus, the Water World



Although Enceladus and Saturn's rings are largely made up of water ice, they show very different characteristics. The small ring particles are too tiny to retain internal heat and have no way to get warm, so they are frozen and geologically dead. Enceladus, on the other hand, is subject to forces that heat its interior to this very day. This results in its famous south polar water jets, which are just visible above the moon's dark, southern limb, along with a sub-surface ocean.

Recent work by Cassini scientists suggests that Enceladus (313 miles or 504 kilometers across) has a global ocean of liquid water under its surface. This discovery increases scientists' interest in Enceladus and the quest to understand the role of water in the development of life in the solar system.

This view looks toward the unilluminated side of the rings from about 0.3 degrees below the ring plane. The image was taken in visible light with the Cassini spacecraft narrow-angle camera on July 29, 2015.

The view was acquired at a distance of approximately 630,000 miles (1.0 million kilometers) from Enceladus and at a Sun-Enceladus-spacecraft, or phase angle of 155 degrees. Image scale is 4 miles (6 kilometers) per pixel.

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Credit: NASA/JPL-Caltech/Space Science Institute

Seven Key Facts About Cassini's Completed Oct. 28 Flyby

This artist's rendering showing a cutaway view into the interior of Saturn's moon Enceladus. NASA's Cassini spacecraft discovered the moon has a global ocean and likely hydrothermal activity. A plume of ice particles, water vapor and organic molecules sprays from fractures in the moon's south polar region.

Credits: NASA/JPL-Caltech

NASA's Cassini spacecraft will sample the ocean of Saturn's moon Enceladus on Wednesday, Oct. 28, when it flies through the moon's plume of icy spray.

Cassini launched in 1997 and entered orbit around Saturn in 2004. Since then, it has been studying the huge planet, its rings and its magnetic field. Here are some things to know about the mission's upcoming close flyby of Enceladus:

Enceladus is an icy moon of Saturn. Early in its mission, Cassini discovered Enceladus has remarkable geologic activity, including a towering plume of ice, water vapor and organic molecules spraying from its south polar region. Cassini later determined the moon has a global ocean and likely hydrothermal activity, meaning it could have the ingredients needed to support simple life.

The flyby will be Cassini's deepest-ever dive through the Enceladus plume, which is thought to come from the ocean below. The spacecraft has flown closer to the surface of Enceladus before, but never this low directly through the active plume.

The flyby is not intended to detect life, but it will provide powerful new insights about how habitable the ocean environment is within Enceladus.

Cassini scientists are hopeful the flyby will provide insights about how much hydrothermal activity -- that is, chemistry involving rock and hot water -- is occurring within Enceladus. This activity could have important implications for the potential habitability of the ocean for simple forms of life. The critical measurement for these questions is the detection of molecular hydrogen by the spacecraft.

Scientists also expect to better understand the chemistry of the plume as a result of the flyby. The low altitude of the encounter is, in part, intended to afford Cassini greater sensitivity to heavier, more massive molecules, including organics, than the spacecraft has observed during previous, higher-altitude passes through the plume.

The flyby will help solve the mystery of whether the plume is composed of column-like, individual jets, or sinuous, icy curtain eruptions -- or a combination of both. The answer would make clearer how material is getting to the surface from the ocean below.

Researchers are not sure how much icy material the plumes are actually spraying into space. The amount of activity has major implications for how long Enceladus might have been active.

SVAS Main Events

July

SVAS Sponsors!

SVAS Officers

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Vice President — Lonnie Robinson

Secretary — Kevin Heider

Treasurer — Kevin Normington

Past President — Ross Gorman

SVAS Board of Directors

~ Even Year Term ~

Perry Preston Porter, Tom Braun

~ Odd Year Term ~

Bill Marquardt, Chuck Real, Charles Jones, David Macho

Committees

Membership / New Members	Walt Heiges / Kevin Normington
Star-B-Q & Resources	Walt Heiges
Yosemite Star Party	Tom Braun
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Speaker Seeker	Fera Zamani
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Community Star Parties	Wayne Lord
Observatory Director	Perry Preston Porter
Help for Beginners	Perry Preston Porter
HGO Maintenance Director	Stuart Schulz
Amateur Telescope Making	Lonnie Robinson / Bill Thomas
Scholarships	Chuck Real / Kevin Normington

Where We Meet

General Meetings the third Friday of each month beginning at 8:00pm.
Board Meetings begin at 6:30 on the same day. All members are welcome.
Star Parties on weekends nearest the new Moon.

Sacramento City College
Mohr Hall Room 3
3835 Freeport Boulevard
Sacramento, CA.
(12th St. Exit West off I-99)
WWW.SVAS.ORG

SVAS Observer - Newsletter

To Subscribe– First send in your membership application form below, with your dues, and upon approval by the Board of Directors the Observer newsletter (published bi-monthly beginning January) will be sent to your supplied email address in .pdf format. Second, request to join the SVAS Yahoo Group at http://groups-yahoo.com/group/svas-members. This group will keep you informed with the day to day current events and discussions.

Articles– Manuscripts and letters are welcome in MS Word, MS Publisher, or plain text format, and emailed to the SVAS Editor. Submission deadline is the 15th of the newsletter release month.

Advertising– Commercial, non-personal advertising, business card, and full page are available. Classified advertising is free to SVAS members.

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SVAS Membership Application

Date___/ ___ /___ **Membership** *(check one)* **New:** ___ **or Renew:**___

Annual Renewal Date June 1st (Expires July 1st)

(Four months minimum membership is requested, please include the following year if necessary)

General Member *(Family–Individual)*	*Prorate @ $3 per month*	**$36 per yr** _____
Observatory Member *(Please read Observatory Membership)*	*Prorate @ $7 per month*	**$84 per yr** _____
Student Member *(ID required)*	*Prorate @ $2 per month*	**$24 per yr** _____

Additional Tax Deductible Contribution $ _____

Total Enclosed Amount $ _____

Print Name_____

Address_____

City _____ **Zip**_____

Phone_____ *(E-mail required for newsletter mailing)*

E-mail_____

Signature_____

Observatory Membership

Observatory Membership offers the benefits of a regular membership plus the private use of the Henry Grieb Observatory (HGO) at Blue Canyon. **To apply, you must have been a general member for six months or longer, be certified and approved by the Observatory Director, and then approved by the SVAS Board of Directors.**

Please allow 30 Days Or More for Application Approval

By signing this application, I acknowledge I have accessed the SVAS website **SVAS.org**, read and understand the SVAS bylaws and the rules governing the USFS Special Use Permit. In doing so, I agree to abide by the respective "terms and conditions" of each as they relate to using the SVAS property and facilities. I further understand and acknowledge that failure to abide by these "terms and conditions" can result in revocation of use privileges and/or SVAS membership.

Detach, *SIGN*, & mail with payment.

To: SVAS Membership Application
PO Box 15274 –0274
Sacramento, California. 95851-0274