ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 65, No. 5 – May 2017

IN THIS ISSUE

Thanks to everyone for your outstanding contributions to this edition. Keep them coming!

01. SFAA PRESIDENT'S NOTE | THE JOYS OF AMATEUR ASTRONOMY

This month we have the opportunity to observe galaxies in Leo, Virgo and Coma Berenices, a truly dramatic window outside of our galaxy into deep space. Deep space, that is, in relation to the power of amateur telescopes – galaxies 40, 50, 60 million light years distant. The wonder, awe and fun to be found in amateur astronomy are observing such objects. This experience is enhanced by reading up on theories on galaxy formation, cosmology and on the latest discoveries by the big telescopes and spacecraft and attending lectures such as the ones SFAA sponsors at the Presidio. We now can have a greater understanding of what we are looking at than in years past through modest research.

M. Messier was a pretty good observer, but he was looking for comets and in the course of his efforts, he discovered many objects. But, he didn't have knowledge of what he was looking at. Even one hundred years ago we still were not sure of what we were looking at even though our ability to see further and further into the universe had advanced significantly. In the past twenty to thirty years, astronomy/astrophysics has advanced in a seemingly logarithmic fashion and that pace seems to be accelerating.

The big telescopes on Earth and in space can obviously go magnitudes beyond what most amateur instruments can gather, but the vicarious experience of being able to see that in the here and now is an experience way beyond looking at photographs, no matter how spectacular. Such observing keeps us in contact with the wonders of our universe and makes it real, not just an intellectual exercise.

Dark, clear and stable skies,

Michael Patrick
President, SFAA

SFAA Board Officers and Directors:

President	Michael Patrick	president@sfaa-astronomy.org
Vice President	Liz Triggs	vice-president@sfaa-astronomy.org
Treasurer	Michael Patrick	treasurer@sfaa-astronomy.org
Secretary	Anthony Barreiro	secretary@sfaa-astronomy.org
Directors:	PJ Cabrera, Anil Chopra, Brian Kruse, Matthew Jones, Jessica Miller, Scott Miller, Mina Reyes, Douglas Smith, Paul Salazar	

*** * * MARK YOUR CALENDARS * * ***

Quarterly in-person SFAA Board Meetings – all SFAA members are welcome to attend:

Tuesday May 9, 7:00 pm – 8:45 pm
SF Public Library: Ortega Branch Meeting Room / 3223 Ortega Street, San Francisco

Tuesday August 8, 7:00 pm – 8:45 pm
SF Public Library: Presidio Branch Meeting Room / 3150 Sacramento Street, San Francisco

Tuesday November 14, 7:00 pm – 8:45 pm
SF Public Library: Presidio Branch Meeting Room / 3150 Sacramento Street, San Francisco

Come join us to learn what's going on with upcoming club events such as: public outreach, star viewing trips, scientific lectures, telescope making, members-only dark sky viewing nights, opportunities to participate in Astronomy, and much more.

02. ASTRONOMY EVENTS

SAN FRANCISCO AMATEUR ASTRONOMERS EVENTS
MAY 9, 2017 – JUNE 30, 2017

Details at: http://www.sfaa-astronomy.org

Tuesday May 9, 7:00 pm – 8:45 pm
San Francisco Public Library: Ortega Branch Meeting Room / 3223 Ortega Street, San Francisco
Quarterly in-person SFAA Board Meeting – All SFAA Members are welcome to attend

Saturday May 13, 10:00 am – 1:30 pm
Mt. Tam West Peak Hike

Saturday May 13, 8:00 pm – 11:00 pm
City Star Party, Presidio Main Parade Ground

Tuesday May 16, 7:30 pm – 9:15 pm
Presidio Officers Club
Meeting and Lecture

Saturday May 20, 7:00 pm – 2:00 am
Mt. Tam Members Night

Saturday May 27, 7:30 pm – 11:00 pm
Mt. Tam Public Astronomy Night

Saturday June 3, 10:00 am – 2:00 pm
** Volunteer Opportunity **
Astronomy Festival @ Bay Area Discovery Museum

Thursday June 15, 8:00 pm – 11:00 pm
City Star Party, Presidio Main Parade Ground

Tuesday June 20, 7:30 pm – 9:15 pm
Presidio Officers Club
Meeting and Lecture

Saturday June 24, 7:30 pm – 2:00 am
Mt. Tam Members Night

Thursday June 29, 4:00 pm – 11:00 pm
** Volunteer Opportunity ** CAS Asteroid Day Nightlife (evening) @ California Academy of Sciences

Friday June 30, all day
** Volunteer Opportunity ** CAS Asteroid Day (daytime programs) @ California Academy of Sciences

* * * * * * * * *

GET REAL, LIVE HELP WITH YOUR TELESCOPE!

* * * * * * * * *

Are you a new telescope owner? Or perhaps you could use some help with alignment, collimation or other adjustments? Collimating a reflector, like playing guitar or dancing the tango, can, with great effort, be learned from reading, but it is much easier and more enjoyable to learn hands-on from somebody who already knows how to do it.

Bring your telescope to a Star Party – we'll be happy to help!

BAY AREA ASTRONOMY EVENTS

Each month, long-time SFAA member Kenneth Lum assembles and sends out a list of Bay Area Astronomy events. As each month unfolds, check the following link for information regarding additional events:

http://tech.groups.yahoo.com/group/bayastro/?v=1&t=directory&ch=web&pub=groups&sec=dir&slk=94

03. SFAA NEEDS YOU: VOLUNTEER OPPORTUNITIES | ANTHONY BARREIRO

Upcoming Volunteer Outreach Opportunities

In addition to our lectures and star parties, SFAA often partners with schools, museums, and other community organizations to offer astronomy-related outreach activities. We depend on our members to provide people of all ages a first-hand experience of the wonders of the universe. Outreach activities are often centered around telescope observing, but there are many ways to teach people about astronomy, and there are always roles for members at all levels of expertise, including beginners, whether or not you bring a telescope. Here are some upcoming outreach opportunities. Please help out as you're able.

The California Academy of Sciences is looking for help with the following activities. In addition to volunteers willing to help out, SFAA also needs a coordinator for each event. A coordinator needs to make a firm commitment to attending the event and will need to do some advance planning and coordination with Academy staff and other SFAA volunteers. If you're interested in helping with one or more of these events, either as a coordinator or as a volunteer, please send an email to Anthony Barreiro, secretary@sfaa-astronomy.org

- **Thursday, June 29** (NightLife) and/or **Friday, June 30** - **ASTEROID DAY** (daytime programming)

The Bay Area Discovery Museum is planning an **Astronomy Festival**, **Saturday, June 3**, 10 am-2 pm. Michael Patrick is coordinating SFAA's participation in this festival. We're in the early planning stages, so ideas and suggestions are welcome. Solar telescopes are always a big hit at daytime astronomy events. If you're interested in helping out with this event, please send an email to president@sfaa-astronomy.org

Snack Volunteers Needed

SFAA also needs members to volunteer to bring **light refreshments** to our monthly **meetings and lectures** at the Presidio Officers Club, on the **Third Tuesday of Each Month**. Refreshments help to create a welcoming, sociable atmosphere for members and guests. If a few members each bring something, there's less burden on any one member, and we'll have a good variety of snacks and beverages. You may donate snack items or simply provide receipts to be reimbursed for your expenses, and your fellow members will be grateful to you! If you can bring refreshments, please send an email to Linda Mahan, speakerchair@sfaa-astronomy.org
Let Linda know which month or months you can help with, and what you would like to bring.

Ongoing Opportunities to Participate in our SFAA Club

SFAA is also looking for volunteers to help in these areas:

- **Star Parties** – both on Mt. Tam and for City Star Parties
- **Marketing** – we can use help posting SFAA event updates to SFGate, SF FunCheap, Eventful, Bay Area Science, etc.
- **Above The Fog** – submit an occasional article, astrophoto and/or serve as a member of the editorial team.

Please send an email to Michael Patrick at president@sfaa-astronomy.org if you're interested.

On behalf of the board of directors and your fellow SFAA members, thank you for your willingness to help out!

SFAA NEEDS YOU: VOLUNTEER OPPORTUNITIES (continued)

SFAA at Makers Faire May 19 – 21, 2017

It is not too late to join SFAA at Makers Faire! The event is May 19-21 at the San Mateo Event Center (http://makerfaire.com). SFAA is looking for help to staff our booth on telescope making. No prior experience necessary. **We provide admission to the event.** We'd like to get more volunteers involved so everyone participating can also explore the Faire!

If you would like to volunteer, please contact Douglas Smith for more information at dsmith@201design.com

Makers Faire is an event created by Make magazine to "celebrate arts, crafts, engineering, science projects and the Do-It-Yourself mindset". Very appropriate for SFAA to share how to build your own telescope!

Makers Faire takes place Saturday May 20th to Sunday May 21st. There is also a special school classroom day on Friday May 19. SFAA will be showing the design and construction of Dobsonian telescopes with live glass grinding demonstrations. We'll have some home-built telescopes on exhibit to show how they're balanced and designed around the optics. Additionally we'll be showing some 3D printed parts connecting electronics to accommodate remote views through the telescope.

One Tam: West Peak Hike – Saturday, May 13th 10am-1:30pm

Join filmmaker Gary Yost and Marin Municipal Water District ranger Matt Cerkel on Mt. Tam for a special talk about the true peak of our beloved mountain. Gary and Matt will lead you on a hike from the Mountain Theater overflow parking lot up the Mountaintop Trail to the long-abandoned Mill Valley Air Force Station, once used for targeting short-range nuclear missiles at incoming Russian bombers during the Cold War. Gary will discuss what he learned about the area while making his award-winning short documentary film, “The Invisible Peak,” and he’ll update everyone on the quest to restore the West Peak of the mountain. Matt will bring his deep knowledge of the flora, fauna, and biological ecosystem of this very unique and fragile portion of Mt. Tam. We’ll also discover spectacular vistas and secret corners of the mountain, and learn about some of the plants and animals that live on Mt. Tam.

Meeting Location: The Mountain Theater overflow parking lot (also known as the quarry parking lot) is located just past the Mountain Theater entrance. If you are unfamiliar with the location, the Google Map marks the location of the Mountain Theater (marked as the "Cushing Memorial Amphitheater" on the map), and you will see just north of it, the parking lot marked as "Quarry Parking Lot". To get there, drive up Pan Toll Road, make a right on Ridgecrest Blvd, pass the Mountain Theatre Fire Road and Rock Spring Trail (the entrance to the Mountain Theatre), and look for a dirt paving lot on your right where we are meeting.

Hike parameters: five to seven miles and up to 2000 feet elevation. **All hikes are free and open to the public.**

For additional details, please visit the Friends of Mt. Tam site at http://www.friendsofmttam.org

04. SFAA IN THE COMMUNITY: EVENT SUMMARIES

Yuri's Night and Astronomy Day @ California Academy of Sciences | Jessica Miller

The SFAA has been lucky enough to be invited to participate in two astronomy-related events at the California Academy of Sciences in Golden Gate Park. We had a telescope on the roof for Yuri's NightLife. Introducing adults to Jupiter and four of its moons through one of the club's loaner scopes was a great experience. Second only to the expression of joy on a kid's face when they see the moon through a telescope for the first time. But the real highlight of the night was the phenomenal transit of the ISS. Somehow, both the SFAA and the East Bay Astronomical society members convinced a roof full of adults to wave at the passing astronauts!

Astronomy Day was the second event in April that SFAA participated in. We had both a table inside (complete with galaxy print table cloths) and a telescope on the roof. As it was a daytime event, we were pointed at the Golden Gate Bridge and the finger-nail moon once it was high enough in the daytime sky. Thank you to **Anh P.A. Ho** and **Liz Wong** for volunteering their time to help represent the SFAA!

Public Star Party @ Mt. Tam | Michael Patrick

These photos show the SFAA in action on Saturday 29 April 2017, in the Rock Springs parking lot. These photos are early on in the evening, just after sunset with telescopes pointed toward the crescent waxing Moon. Most people are heading to the Mountain Theater for the lecture.

The SFAA had about 15 telescopes set up in total by the end of the evening and a crowd of around 200 members of the public forming lines at each scope to view objects such as M 81 & M 82, M 104, M 13, the Beehive Cluster, Jupiter and more.

One could hear the "Ooooh's" and "Aaaah's" from the public throughout the evening

SFAA IN THE COMMUNITY: EVENT SUMMARIES (continued)

Girl Scouts' Golden Gate Bridging Event @ Crissy Field | P. J. Cabrera

On Saturday 29 April 2017, **P.J. Cabrera, Kate Cabrera**, and **Liz Triggs** represented the San Francisco Amateur Astronomers at the Girl Scouts' Golden Gate Bridging Event at Crissy Field in San Francisco. We volunteered to show the Girl Scouts the sun in 3 different ways:

- the Girl Scouts saw the sun through a homemade telescope built by Scott Miller, a member of the SFAA. Scott also lent us a solar filter.
- the Astronomy Society of the Pacific (ASP) (in the booth next to us) allowed us to use their SunSpotter to share & explain its operation.
- the ASP gave us some of their surplus eclipse glasses to share & explain to the Girl Scouts these are safety glasses to use to look directly at the sun, especially for events such as at the upcoming eclipse. The ASP also gave us informative index cards about the August 21st Solar Eclipse.

We had lots of fun & were thrilled to have a lot more interaction with the Girl Scouts than last year.

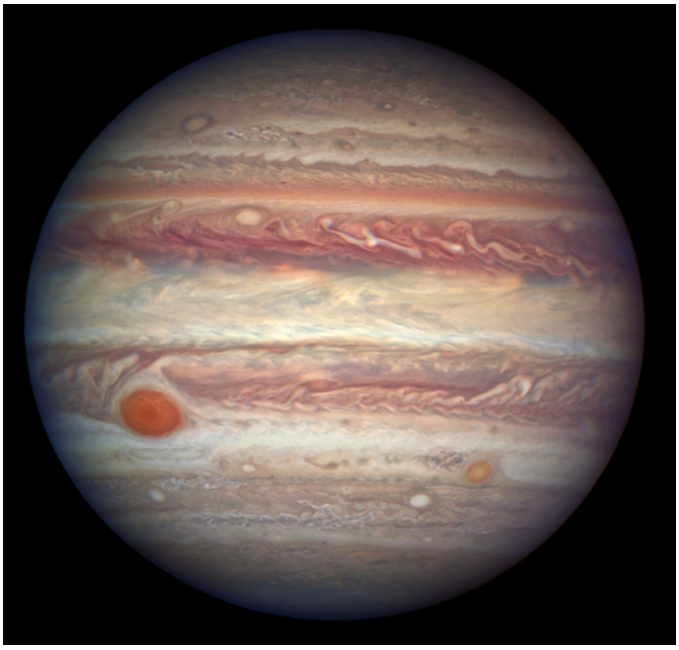
SF City Star Party @ Pier 17, adjacent to the Exploratorium | Liz Triggs

On Sunday 30 April 2017, **Kathleen McCowin, Scott Miller, George Teiber, P.J. Cabrera, Kate Cabrera**, and **Liz Triggs** represented the San Francisco Amateur Astronomers at the city star party in San Francisco. We set up 4 telescopes and enjoyed outstanding views of our moon, Arcturus and Jupiter. All delighted in seeing the striations of Jupiter plus the clear bright images of four of Jupiter's moons. Over the course of the evening, we had over 400 people stop by to enjoy the views.

Quote of the night came from a little boy named Alex—when asked how many craters he could see on the moon, he enthusiastically said "all of them!"

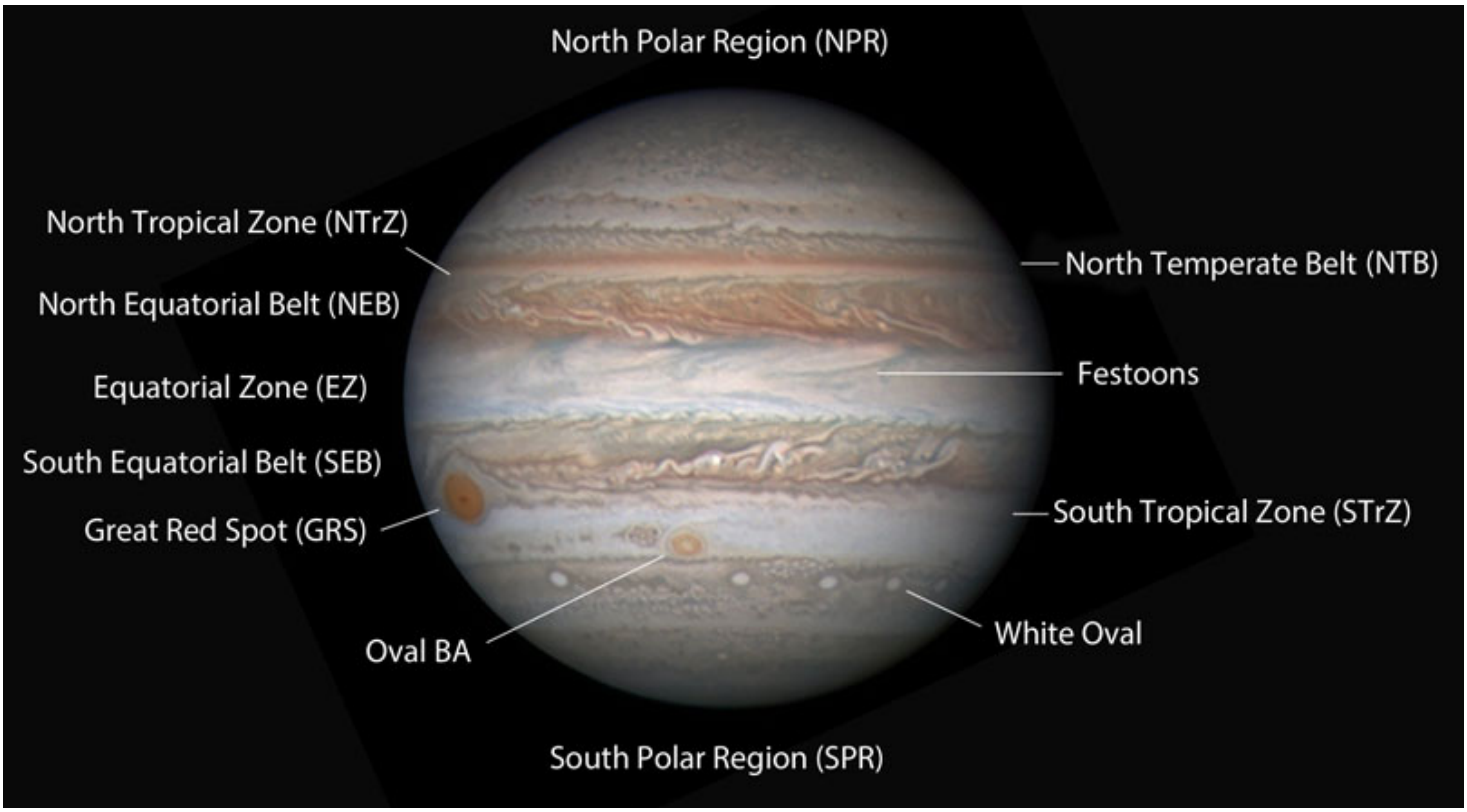
Looking forward to seeing you at the next SFAA event!

05. THE URBAN ASTRONOMER BLOG: NOW IS THE TIME TO VIEW JUPITER | PAUL SALAZAR



Jupiter is the brilliant 'star' that is currently dominating the evening sky, outshining all other celestial objects except the Moon. The largest planet in the Solar System, Jupiter is on the Top 10 viewing list for every backyard astronomer because it is easy to find and offers such richness when viewed with magnification, and of course it is dazzling whether viewed from the darkness of a country setting or the bright lights of an urban setting. And having just passed opposition in early April, Jupiter is well positioned for viewing shortly after sunset and is above the horizon nearly the entire night; being just past opposition also means that Jupiter presents the greatest surface area for viewing. A casual glance toward the south-east in the evening is all you need to find Jupiter.

The image below from *Sky & Telescope* shows the intricate details visible on the surface of the planet. Any telescope of good quality will reveal the major bands on Jupiter's Northern and Southern Hemispheres, and a CCD will capture the Great Red Spot and some of the patterns in the clouds. The four largest moons of Jupiter add a dynamic and ever-changing view to the planet, with regular transits and eclipses adding live drama to an evening focused on just one celestial object.



Sky & Telescope has an excellent article that highlights many of the things you can see on Jupiter - it's worth a short read (http://www.skyandtelescope.com/observing/jupiter-lights-the-night-at-opposition/). It also includes links to detailed timings of the transit of the Great Red Spot and the Jovian moon transits and eclipses.

NASA recently pointed the Hubble Space Telescope at Jupiter as part of its ongoing planetary exploration looking at not only the planet but its moons, each of which has an interesting geological history and aids in understanding the formation of the Solar System. This short video on HubbleSite provides further details on their work (http://hubblesite.org/video/945/news_release/2017-15).

Jupiter is presently in the constellation Virgo just above the bright star Spica and slowly moving retrograde toward Porrima in the coming two months. Given the relative orbital speeds of the Earth and Jupiter, we see Jupiter in a different sign of the Zodiac each opposition; approximately every 12 months Jupiter has moved to the next sign. That means in a year Jupiter will be found in the constellation Libra, and a year later in Scorpius.

Images courtesy NASA and Sky & Telescope.

Long-time SFAA Member, Paul Salazar is "The Urban Astronomer". In case you haven't met Paul, here is an excerpt from his blog profile: In 2005 I began writing a column for the San Francisco Waldorf School newsletter called "The Urban Astronomer." I started this blog in 2007 as a place to archive my articles and to offer additional insights on the night sky - even if you live in a big city. In 2008 I became an occasional guest on the KFOG Morning Show, and more recently on KALW and KGO. Archived shows are posted on the blog. Check out the blog at: http://urbanastronomer.blogspot.de

* * * SFAA T-SHIRTS NOW AVAILABLE! * * *

Many of you have asked when those handsome blue SFAA T-Shirts will be available for sale. We have a limited number available, so reserve yours now!

Prices:
$10 for SFAA Members (membership must be current)
$25 for non-Members

Shirts will be available for purchase and/or pick-up at the next lecture at the Presidio Officers' Club. If you need to renew your membership or want to join as a new member, please submit the Membership Application, included as the final page of this newsletter, or from our web site, at: http://www.sfaa-astronomy.org/membership/

06. CITIZEN SCIENCE OPPORTUNITIES: VERIFICATION OF NEW COMET AND ASTEROID DISCOVERIES | P.J. CABRERA

Citizen Science Overview

With the increasing popularity of the Internet over the last two decades, it has become easier to communicate and distribute information to people spread all around the globe. Scientists have seized on the proliferation of the Internet to coordinate collaborative activities with members of the general public interested in science. These projects seek not only to publish their information on the Internet, but also to enlist the public's help in the observation, cataloguing and categorizing of astronomical phenomena.

Citizen science projects are an exciting way in which amateur astronomers can contribute their time and effort to the advancement of science. They also provide a way to learn more about the science by being involved more directly in the process. Many of these projects do not require heavy or expensive equipment, and some only require access to a computer connected to the Internet.

Over the next several ***Above The Fog*** issues, I will give overviews of different citizen science projects looking for help from the public.

Citizen Science Project - Verification of New Comet and Asteroid Discoveries

Among the most enduring ideas conjured by the word 'astronomer', is the image of the scientist, looking through their instrument, discovering something new. And although the image is archaic by now - most astronomers and astrophysicists look at data on a computer and rarely if ever look through a telescope with their own eyes - even in this age, our solar system is still teeming with new asteroids, comets, Kuiper belt objects, and new stars are born and others are destroyed in fiery explosions in our own galaxy and in galaxies far away. This month I will discuss comet and asteroid discovery. Next month I will discuss nova and supernova discovery.

Eyes everywhere

Every clear night, dozens of automated robotic telescopes around the world survey the sky. These robotic surveys take photos of the sky and discover new asteroids and comets every week. In a way, the sheer number of these surveys should kill any hope of an amateur discovering something new. It's a numbers game - they have the budget to operate all night and bigger telescopes at prime locations. But unless their new discoveries can be verified by others, they are not recognized as official. That is where a dedicated amateur can help and be recognized for their input.

The Minor Planet Center

Over a century ago, the International Astronomers Union created the Minor Planet Center (MPC) as a clearinghouse for information regarding newly discovered asteroids, comets and other solar system bodies. As the MPC receives word of new discoveries, it publishes bulletins to inform astronomers and the public in general. It also keeps a list of new objects that need verification. This list used to be updated and published on a weekly basis, but with the Internet, a web page is updated constantly, and email lists exist where new objects of interest are discussed.

When an object is first discovered, there is not enough data to compute a precise orbit. The position and motion of the object is uncertain, and follow up is needed fast, or the object could become "lost". This is especially true of near Earth objects, as these move very fast across the sky. And once they move into twilight, they may be too far and too faint before they move again in the night sky. Larger objects, such as comets and Kuiper belt objects, on the other hand, move slowly and are relatively easier to verify.

Verification can sometimes help characterize the type of object discovered, and not just its orbit. In the last decade, a few new objects were reported to be asteroidal, but after other people observed the object, they realized they were looking at a new comet. It doesn't happen often, but it's in the realm of possibility for every new discovery.

Verification

To help verify a new discovery, you first need to determine if your telescope and observing location can resolve the object you're trying to see. The MPC new objects list can be sorted by apparent magnitude. Pick an object brighter than your limiting magnitude. Next, you need to determine where and when to look. Astronomy software such as The Sky, Celestia, and Stellarium, among others, can connect to the MPC database and download the preliminary orbits for the new objects. Once you have this data, you can create an observing plan.

Armed with your observing plan and telescope at your observing location, you can either scan the object's part of the sky visually or photographically. While the photographic method is often less time consuming, there is a great beauty to scanning the sky for several minutes and enjoying the view, while keeping an eye for anything that moves. Depending on the object's distance from Earth, you should detect a celestial object has moved after 10 to 20 minutes of scanning.

The photographic method may be less time consuming and more accurate, but the camera's field of view is usually much more narrow. With the uncertainty in the preliminary orbits of new objects, the object may be just outside the camera's field of view. So rather than taking a single photo and calling it a day, you need to take more photos in a mosaic pattern, to cover the expected area and capture the object.

Once the object is detected, you need to report its coordinates in the sky to the MPC. This helps refine the orbit, making the object motion more predictable, with no uncertainty. Software such as The Sky Professional Edition can superimpose your photos over its star charts, and this can be used to measure precise positions for the object. With the visual method, you can use an eyepiece with markings etched in the glass to measure the angular distance between the object and surrounding stars. You can then draw a marking in a star chart using the same stars as reference, and obtain the coordinates.

* * * NEEDED: TELESCOPE LOANER SPACE * * *

Because the SFAA's dedicated, long-time loaner telescope coordinator and Board member Anil Chopra will be moving from the Bay Area in June, the SFAA urgently needs a find a secure and accessible space in San Francisco to store loaner telescopes. Anil currently stores scopes in his garage, and the minimum space requirement is a 10-foot by 10-foot area. The SFAA's operating budget cannot accommodate a large monthly rental cost, so a donated space from an SFAA member would be preferred. Contact Michael Patrick at president@sfaa-astronomy.org

07. CITIZEN SCIENCE: ECLIPSE MEGAMOVIE PROJECT | BRIAN KRUSE

We're excited to announce an opportunity to contribute to a first-of-its-kind citizen science project: the Eclipse Megamovie!

Representing a collaboration between Google, UC Berkeley, the Astronomical Society of the Pacific and others, the project will use photographs of the upcoming August 21st total solar eclipse to build a movie of the entire eclipse from coast to coast. We need skilled photographers to help create the movie as well as support solar science research. For more on the goals of the project, see UC Berkeley's official press release:

http://news.berkeley.edu/2017/02/21/megamovie-project-to-crowdsource-images-of-august-solar-eclipse/

Our aim is to recruit over 1,000 amateur photographers and astronomers who will be on the path of totality on August 21, 2017. Team members receive training and submit a practice image before the eclipse. Once you qualify, you will receive a pin to designate your status as an official photographer for the project. Your name will also be included in the credits of the final Eclipse Megamovie. If you want to participate, visit our website at: https://eclipsemega.movie and SIGN IN to apply!

- Basic equipment necessary for participating in the Eclipse Megamovie Project:
- Camera: DSLR (digital single lens reflex)
- Telephoto or zoom lens: minimum focal length of 300mm
- A stable and level tripod
- Ability to identify the GPS coordinates and time to the nearest second

<> <> <> <> <> <> <> <> <> <> <> <> <> <> <> <>

* * SFAA ECLIPSE SAFETY GLASSES NOW AVAILABLE -- $1.00 EACH * *

A solar eclipse occurs when the Moon blocks any part of the Sun. On Monday, August 21, 2017, a solar eclipse will be visible (weather permitting) across all of North America. The whole continent will experience a partial eclipse lasting 2 to 3 hours. Halfway through the event, anyone within a roughly 70-mile-wide path from Oregon to South Carolina will experience a brief total eclipse, when the Moon completely blocks the Sun's bright face for up to 2 minutes 40 seconds, turning day into night and making visible the otherwise hidden solar corona — the Sun's outer atmosphere — one of nature's most awesome sights. Bright stars and planets will become visible as well.

Looking directly at the Sun is unsafe except during the brief total phase of a solar eclipse ("totality"), when the Moon entirely blocks the Sun's bright face, which will happen only within the narrow path of totality.

The only safe way to look directly at the uneclipsed or partially eclipsed Sun is through special-purpose solar filters, such as "eclipse glasses" (example at left) or hand-held solar viewers.

Get your safety glasses at the next meeting. SFAA is selling them for $1.00 each.

08. PRIMORDIAL NEBULA OF OUR SOLAR SYSTEM | TOM KELLOGG

I have been reading *Sky and Telescope* for 45 years and am always learning with each issue. While reading a May 2017 article (pages 14-21 “Rosetta’s Trove of Discoveries”) by Joel Parker I got confused so I sent the following question and got an amazingly clear answer which Joel gave us permission to publish in our *Above The Fog* newsletter (Joel grew up in San Leandro).

My email to Joel Parker:

Joel, thank you for the excellent article on a totally amazing space mission, Rosetta. Rosetta is one of the most impressive success stories of our time. As you described Clues to comet 67P's Origin I got an image in my mind of our primordial solar nebula around 5 billion years ago, a while before our solar system formed. It was a nebula, let's say like Orion Nebula, with material that had been ejected from nova and super nova some billions of years prior. There are variations of concentrations of particles and molecules that I assume are changing and moving in the millions of years during which our solar system forms. I don't quite see how Deuterium/Hydrogen (D:H) variations in water between the inner solar system and outer solar system can be characterized since there ought to be a random distribution within the time frame of the formation of our solar system.

Second question on life of 67P. It lost 0.2% of its mass in just 2 years. At that rate it would lose 100% in around 1,000 years. That makes me think that this object must be rather young.

Thanks again for taking me along on a fascinating journey in orbit around a comet during its closest approach to the sun.

Response from Joel Parker:

Dear Tom,

Thank you for your questions about my “Rosetta” article in *Sky & Telescope*. I'm glad you enjoyed the article and the mission.

Regarding your question about the D:H variations, you are correct that the ratio was probably fairly constant within the part of the molecular cloud that formed our solar system. However, during the early stages of solar system formation there are variations in the chemistry that goes on in different parts of the solar nebula driven by varying environmental conditions, such as heating due to distance from the Sun, but also self-shielding of parts of disk. These environmental variations could affect the amount of "reprocessing" of original D:H ratios in different locations in the disk. It is the old "nature vs. nurture" question applied to solar system formation. There was an article a few years ago about this that is mentioned here: https://carnegiescience.edu/news/earth’s-water-older-sun

The same researchers, in a more recent paper, study how organic materials in primitive solar system bodies generally have higher and more variable D:H ratios compared to water. They think this difference may be due to additional processes that organics have for "fractionation" (e.g., separating molecules by composition or mass) compared to water and the higher volatility of sources of carbon compared to oxygen.

Your point about mixing during this period is an ongoing question: how much radial mixing occurred through the disk? In fact, variations in the chemicals that eventually got bound up into planets, asteroids, and comets are used as guides for how much mixing could have happened.

Regarding your second question: Yes, if the erosion continues at this rate, 67P will eventually disappear! Though the timescale may not be 1,000 years. That mass loss that was measured by Rosetta was during the peak period of the comet's activity during this orbit, and it probably did not lose much mass during the other 4.5 years of its orbit. So another way to look at it is if this mass loss rate continued, 67P would disappear in about 500 orbits, or over 3,000 years. But what most likely will happen is, before it has a chance to erode away, it sill simply run out of gas (literally). After enough passes by the Sun, most of the ices will have evaporated, and it will become an "extinct" comet, and in many ways will be hard to discriminate from an asteroid. Another possibility is that 67P will have some kind of catastrophic disruption, either due to a close pass to Jupiter or to the Sun. Statistics of comets and modeling of cometary orbits in the solar system indicate that the "active" (or "physical") lifetime of these Jupiter family comets ranges from 3,000-30,000 years (typically about 12,000 years), but the median "dynamical" lifetime (how long it lasts in that type of orbit) is about 270,000 years.

Your suggestion that 67P may be rather young based on its erosion rate would assume that it has been in this orbit (and eroding at this rate) for a long time and how large it was to begin with. What is likely the case is that it was in cold storage (and therefore, dormant) in the outer solar system for a very long time until its orbit got perturbed by a planet (probably initially Neptune), that eventually brought it into the inner solar system close enough to the Sun that it then became active as a comet.

I appreciate your questions, and thanks for reading the article and wondering about it all.

Kind regards,

Joel

Joel Parker is a research astronomer, space mission manager, and Director at the Southwest Research Institute. He studied astronomy and physics at the University of California at Berkeley and the University of Colorado at Boulder, receiving his Ph.D. in 1992. He has worked at NASA in Houston and Maryland, and among other projects has been a scientist for telescopes that have flown on the space shuttle, and has used the Hubble Space Telescope and other observatories in space and around the world for his research of comets, asteroids, and massive stars. He is honored to be a science team member and project manager on space missions to the Moon, comets, and the outer solar system, and is the Deputy PI on the Alice UV spectrograph on the Rosetta mission. Joel also has been an actor, director, and crew member on stage, film, and TV for more than 35 years, a musician for more than 40 years, and for over 10 years has been a host and producer of the radio science show "How on Earth". He loves to combine his research and performance experience to promote science and education and public outreach. Joel lives in Boulder, Colorado.

09. AURORA BOREALIS IN SWEDEN | AGNES PYRCHLA

I had the pleasure of seeing the aurora borealis in Abisko National Park, Sweden in February 2017. It's about 100 miles north of the Arctic Circle, and it's known to be one of the best spots to view the Northern Lights because of a valley that leads to relatively cloudless skies.

Seeing this phenomenon is otherworldly but also subtle -- once you see how it moves, it makes sense that this is a solar wind that is passing through. The Sami people of Northern Sweden used to think that the aurora were their ancestors and children were not allowed to point at the sky for fear of being snatched away -- today, the aurora borealis are a reminder of the sun's immense power.

For these shots I used a Nikon D3200, with an f2.8 prime lens by Samyang

10.

*****NOTE: NEW SFAA MEETING LOCATION FOR 2017*****

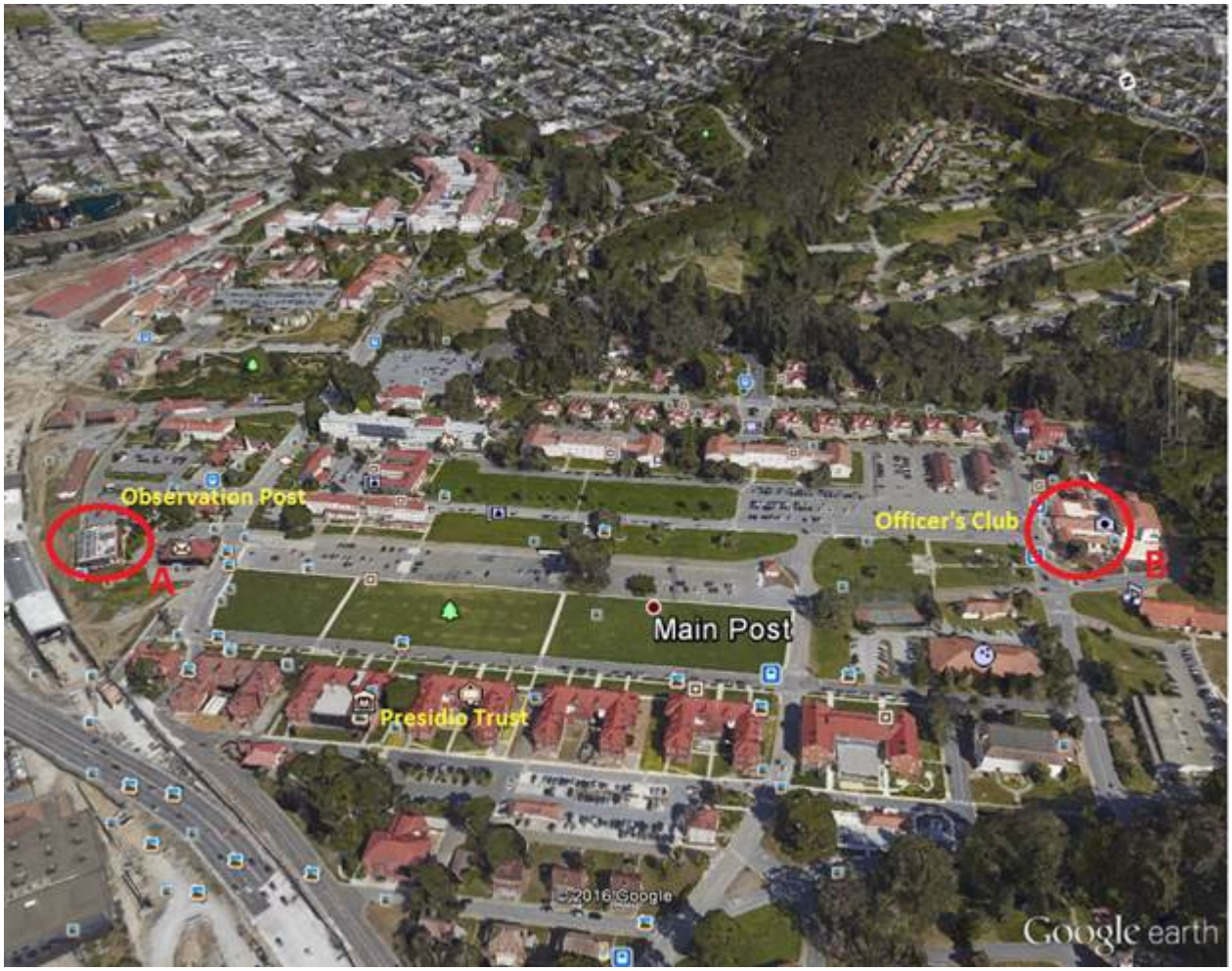
We are happy to announce that, starting in 2017, we will be meeting at:
The San Francisco Presidio Officers' Club
50 Moraga Avenue, San Francisco, CA 94129

The SFAA meetings will take place in Moraga Hall, which is just inside the main entrance.

(As you may or may not know, the building where we have been meeting is scheduled to be demolished)

The image below illustrates the location of the Presidio Officers' Club relative to our prior location at the Observation Post.

*** * * 7:00pm Doors open | 7:45pm Lecture starts * * ***



11.

MAY 16TH LECTURE | ANN MARIE CODY, PH.D., NASA AMES SETI INSTITUTE

THE PRESIDIO . PRESIDIO OFFICERS' CLUB, BUILDING 50 . MORAGA HALL
50 Moraga Avenue, San Francisco
7:00 pm Doors Open & Light Refreshments | 7:30 pm Club Announcements | 7:45 pm Speaker
SFAA'S GENERAL MEETINGS OCCUR ON THE **3RD TUESDAY** OF EACH MONTH (EXCEPT JANUARY)

"TWINKLE, TWINKLE, LITTLE STAR: HOW THE KEPLER SPACE TELESCOPE IS REVEALING THE BIRTHPLACES OF PLANETS"

ANN MARIE CODY, PH.D., NASA AMES SETI INSTITUTE

Thanks to numerous ground and space-based surveys, we are now aware of over 3300 planets orbiting other stars, with another nearly 2500 candidates from the Kepler Mission awaiting confirmation. The Universe is teeming with rocky and gaseous bodies. How did these planet systems form and evolve toward their present configurations? The answer to this question lies in the study of young planets and their formation environments. In this talk I will show how high- precision time series data from space telescopes is beginning to illuminate the conditions surrounding planet formation and the star-disk connection.

Progress is being made on two fronts. First, high cadence photometry of accreting young stars is revealing the structure of inner circumstellar disks on spatial scales inaccessible to direct imaging. In some cases, we are able to observe occultations by coherent dust clumps, which may be the precursors to planetesimals. Second, the onset of the K2 mission is enabling an unprecedented search for exoplanets at ages of a few to 100 million years.

Dr.Cody will present a selection of exquisite photometric time series from several recent campaigns, highlighting the case of K2-33b, a recently discovered transiting planet around a newborn star in the Upper Scorpius region.

Brief Bio

Ann Marie Cody, NASA Ames Research Center, works with the Kepler Space Telescope team on the K2 Mission, developing software to produce ultra-high precision measurements to search for exoplanets and the study of their origin.

12. UPCOMING SFAA LECTURES 2017

THE PRESIDIO . PRESIDIO OFFICERS' CLUB, BUILDING 50 . MORAGA HALL
50 Moraga Avenue, San Francisco
7:00 pm Doors Open & Light Refreshments | 7:30 pm Club Announcements | 7:45 pm Speaker
SFAA'S GENERAL MEETINGS OCCUR ON THE 3RD TUESDAY OF EACH MONTH (EXCEPT JANUARY)

JUNE 20TH | NATHAN WHITEHORN, UC BERKELEY, COSMOLOGY GROUP

"THE EARLIEST AND THE BRIGHTEST: THE DISTANT AND HIGH ENERGY UNIVERSE FROM THE SOUTH POLE"

The extreme universe is only dimly understood. What were the first luminous objects, and how does dark matter and dark radiation affect cosmic history? Learn how the 3rd generation South Pole
Telescope, and the IceCube Neutrino Observatory, located at the Amundsen-Scott South Pole Station provide insight into these questions.

Photo: Nathan Whitehorn is shown at the South Pole.

JULY 18TH | IMKE DE PATER, UC BERKELEY, PROF. ASTRONOMY, EARTH AND PLANETARY SCIENCE

"PEERING THROUGH JUPITER'S CLOUDS WITH KECK AND THE VLA"

Despite the fact that Jupiter has been observed for decades from the ground and in situ by spacecraft, we still do not know its bulk composition nor do we understand its global atmospheric dynamics well. The sensitivity upgrade to the Very Large Array (VLA), combined with novel data reduction techniques, has enabled us to produce detailed longitude-resolved maps of Jupiter's atmosphere at different wavelengths. Since at these wavelengths the main source of opacity is ammonia gas, our maps provide a 3D picture of ammonia gas in Jupiter's atmosphere, within and below the planet's visible cloud layers. These maps reveal upward and downward motions within the turbulent atmosphere, and bear a striking resemblance to visible- light images taken by amateur astronomers and Hubble.

At the 10-m Keck telescope we use 5-micron spectroscopy, which provides complementary information on cloud altitudes and composition. The results provide important context for NASA's Juno spacecraft that arrived at Jupiter on July 4th, 2016, after a five-year flight.

UPCOMING SFAA LECTURES 2017 (continued)

August 15th | YASHAR HEZAVEH, STANFORD UNIVERSITY
"UNVEILING THE DARK UNIVERSE: A TALE OF FISH TANKS, WINE GLASSES, AND THE SMALLEST DARK MATTER CLUMPS"

Learn how ALMA, the world's most sophisticated Radio Telescope, observes some of the most distant galaxies in our universe. The light rays, on their 12 billion light year journey to us, pass near other galaxies. Dark matter halos bend their trajectories, causing images to look like a funhouse mirror.

September 19th | NATALIE BATALHA, SPACE SCIENCES, NASA
"A PLANET FOR GOLDILOCKS: NASA'S SEARCH FOR LIFE BEYOND THE SOLAR SYSTEM"

Not too hot, not too cold, for a world just right for life. Launched in 2009, NASA's Kepler Space Mission is exploring planets orbiting other stars in the galaxy, to determine if Goldilocks planets abound. Dr Batalha will describe possibilities for finding inhabited environments in the future.

October 17th | TOM ABEL, KAVLI INSTITUTE. DIRECTOR OF KIPAC, STANFORD "HOW THE FIRST THINGS IN THE UNIVERSE CAME ABOUT, AND HOW THEY ENDED UP WITHIN US"

Join us for a fascinating journey through the early universe using the latest computer animations of early star formation, supernova explosions, and the build-up of the first galaxies. The first luminous objects were massive stars that seeded the cosmos with the chemistry needed for life.

November date is CANCELLED due to Thanksgiving Holiday

December 19th | TO BE ANNOUNCED

* * * Free Astronomy Books * * *

Dear members of the SFAA:

At the behest of the estate of George and Shirley Carvalho, we shared their library of Astronomy Books with the members of SFAA at the March and April SFAA meetings.

If anyone would like to send a note to the family of George and Shirley Carvalho, whose book donations we so amply enjoyed, please write to their sons, George Jr., Ken and Chris, at chris_p_carvalho@yahoo.com

We all know what a small note of gratitude can mean.

We all hope you are enjoying the books.

13. SFAA EXPEDITION 2017

TOTAL SOLAR ECLIPSE

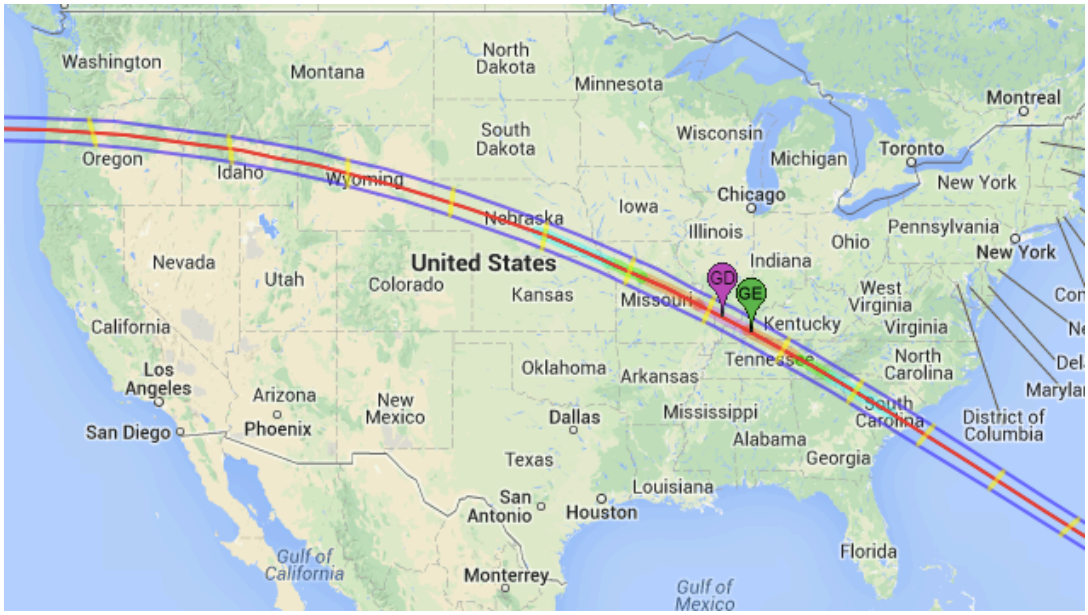
August 21, 2017

Jackson Hole, Wyoming (Teton Mountains)

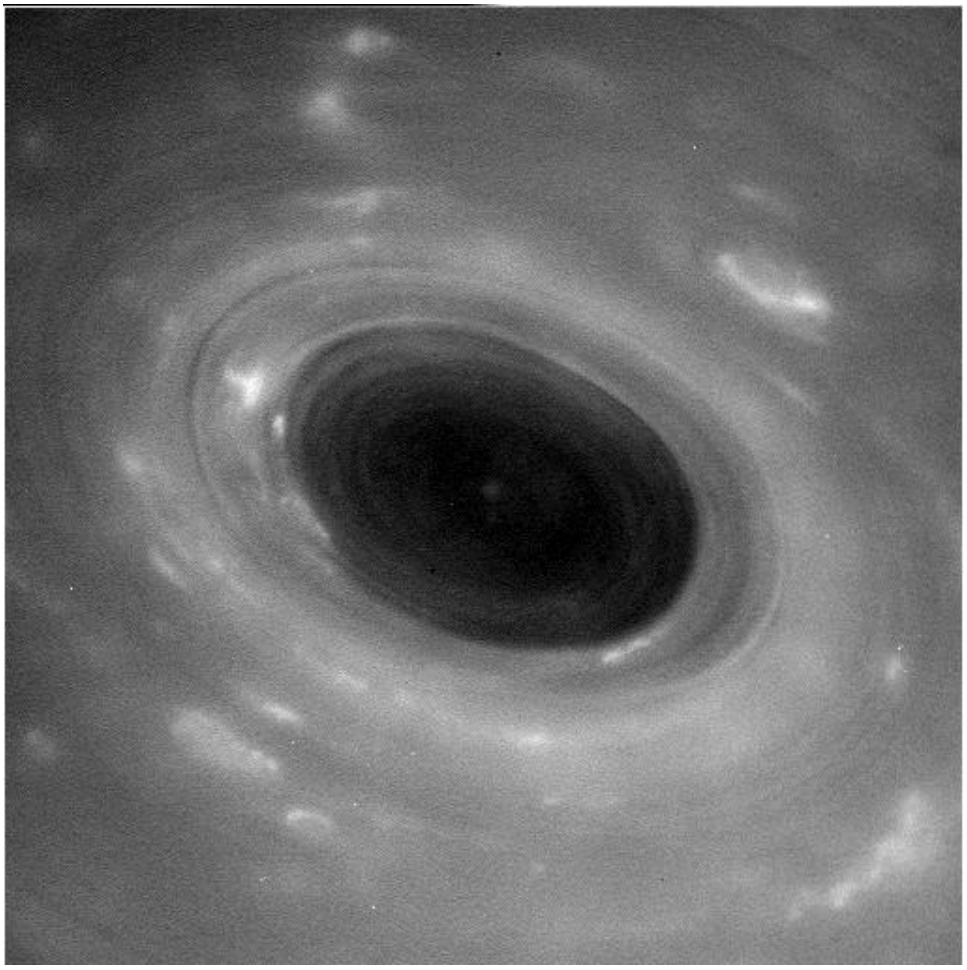
The San Francisco Amateur Astronomers is organizing an expedition to witness the August 21, 2017 Total Solar Eclipse. The eclipse will be visible across a broad swath of the USA, and club members will gather near Jackson Hole, Wyoming, to witness this spectacle high in the Teton Mountains. The trip is an opportunity for club members to gather in one place along the path of totality and journey together up the mountains for viewing of this spectacular astronomical phenomenon.

Over the past year as we have promoted this event, hotel space in all of the Jackson Hole region has sold out. So at this point in time, we welcome SFAA members to join us for the weekend of August 19th and 20th at our location in Teton Village, and for totality on Monday August 21st. However, you will have to find hotel or camping accommodations elsewhere and drive in. If you wish to join us or just to get updates, send an email to 2017eclipse@sfaa-astronomy.org to receive periodic updates.

If you have any other questions, send to 2017eclipse@sfaa-astronomy.org.



NASA Spacecraft Dives Between Saturn and Its Rings



This unprocessed image shows features in Saturn's atmosphere from closer than ever before. The view was captured by NASA's Cassini spacecraft during its first Grand Finale dive past the planet on April 26, 2017.

Image credit: NASA/JPL-Caltech/Space Science Institute.

NASA's Cassini spacecraft is back in contact with Earth after its successful first-ever dive through the narrow gap between the planet Saturn and its rings on April 26, 2017. The spacecraft is in the process of beaming back science and engineering data collected during its passage, via NASA's Deep Space Network Goldstone Complex in California's Mojave Desert. The DSN acquired Cassini's signal at 11:56 p.m. PDT on April 26, 2017 (2:56 a.m. EDT on April 27) and data began flowing at 12:01 a.m. PDT (3:01 a.m. EDT) on April 27.

"In the grandest tradition of exploration, NASA's Cassini spacecraft has once again blazed a trail, showing us new wonders and demonstrating where our curiosity can take us if we dare," said Jim Green, director of the Planetary Science Division at NASA Headquarters in Washington.

As it dove through the gap, Cassini came within about 1,900 miles (3,000 kilometers) of Saturn's cloud tops (where the air pressure is 1 bar -- comparable to the atmospheric pressure of Earth at sea level) and within about 200 miles (300 kilometers) of the innermost visible edge of the rings.

While mission managers were confident Cassini would pass through the gap successfully, they took extra precautions with this first dive, as the region had never been explored.

"No spacecraft has ever been this close to Saturn before. We could only rely on predictions, based on our experience with Saturn's other rings, of what we thought this gap between the rings and Saturn

would be like," said Cassini Project Manager Earl Maize of NASA's Jet Propulsion Laboratory in Pasadena, California. "I am delighted to report that Cassini shot through the gap just as we planned and has come out the other side in excellent shape."

The gap between the rings and the top of Saturn's atmosphere is about 1,500 miles (2,000 kilometers) wide. The best models for the region suggested that if there were ring particles in the area where Cassini crossed the ring plane, they would be tiny, on the scale of smoke particles. The spacecraft zipped through this region at speeds of about 77,000 mph (124,000 kph) relative to the planet, so small particles hitting a sensitive area could potentially have disabled the spacecraft.

As a protective measure, the spacecraft used its large, dish-shaped high-gain antenna (13 feet or 4 meters across) as a shield, orienting it in the direction of oncoming ring particles. This meant that the spacecraft was out of contact with Earth during the ring-plane crossing, which took place at 2 a.m. PDT (5 a.m. EDT) on April 26. Cassini was programmed to collect science data while close to the planet and turn toward Earth to make contact about 20 hours after the crossing.

Cassini's next dive through the gap is scheduled for May 2.

Launched in 1997, Cassini arrived at Saturn in 2004. Following its last close flyby of the large moon Titan on April 21 PDT (April 22 EDT), Cassini began what mission planners are calling its "Grand Finale." During this final chapter, Cassini loops Saturn approximately once per week, making a total of 22 dives between the rings and the planet. Data from this first dive will help engineers understand if and how they will need to protect the spacecraft on its future ring-plane crossings. The spacecraft is on a trajectory that will eventually plunge into Saturn's atmosphere -- and end Cassini's mission -- on Sept. 15, 2017.

More information about Cassini's Grand Finale, including images and video, is available at:

https://saturn.jpl.nasa.gov/grandfinale

The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. JPL, a division of Caltech in Pasadena, California, manages the mission for NASA's Science Mission Directorate. JPL designed, developed and assembled the Cassini orbiter.

For more information about Cassini, visit:
http://www.nasa.gov/cassini

http://saturn.jpl.nasa.gov

News Media Contacts

Preston Dyches
Jet Propulsion Laboratory, Pasadena, Calif.
818-354-7013
preston.dyches@jpl.nasa.gov

Dwayne Brown/Laurie Cantillo
NASA Headquarters, Washington
202-358-1726 / 202-358-1077
Dwayne.c.brown@nasa.gov / Laura.l.cantillo@nasa.gov

San Francisco Amateur Astronomers
PO Box 15097
San Francisco, CA 94115

Application for New or Renewing Membership

1. Memberships, with dues payment, are for one year running from standard renewal dates of 1 July to 30 June and 1 January to 31 December. SFAA is a 501(c)(3) nonprofit organization. Membership dues are tax-deductible, as allowed by law.

2. Submitting appropriate dues in April, May, June, July, August, September, membership will run to 30 June of the next year.

3. Submitting appropriate dues in October, November, December, membership will run to 31 December of the next year; submitting appropriate dues in January, February or March, membership will run to 31 December of the same year.

4. Renewals are maintained at the original membership date unless the renewal is made later than the original cutoff date (e.g. September or March as described in 3). In such cases the membership date is shifted to the next renewal date 30 June or 31 December.

5. New or renewal memberships sent in via USPS mail will have membership start date based on postmark date.

This application is for:
□ **New**

□ **Renewing**

Name:_____

Address:_____

_____

Email:_____

Home Telephone (optional):_____

Cell Phone (optional):_____

Membership Type: □ Individual $25.00 □ Family $30.00 □ Student $10.00 □ Supporting $75.00
□ Institutional $40.00 **(All dues tax-deductible as allowed by law.)**

□ Please mail to me a Mt. Tamalpais Parking Permit (1 per membership)

To complete the membership process:
A. Print and fill out this form
B. Make check or money order payable to San Francisco Amateur Astronomers
C. Mail this form and payment to:

Treasurer, SFAA
PO Box 15097
San Francisco, CA 94115

Both new and renewing members will receive a verifying email from the SFAA upon completion of the membership process.