



Vol. 65, No. 11 – November 2017

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***** NOTE: There is no lecture scheduled for November *****

SFAA wishes everyone a happy Thanksgiving.
We'll see you at the lecture in December.

***** SFAA 2018 Board Election at December Meeting *****

SFAA will have several openings on the Board and possibly two for Officers. The SFAA needs a full complement of Board and Officers to be able to keep events going and expanding into new areas.

If you have ever thought about wanting to pitch in and help the SFAA grow into something even more interesting, educational and community oriented, please contact Michael Patrick at president@sfaa-astronomy.org or any of the Officers or Board members you may know. Our email addresses are listed on our website.

01.

SFAA PRESIDENT'S NOTE | OF LAVA TUBES IN THE MOON

Much of my observing time is spent on Mt. Tam on Members Only and/or Public nights. These observing nights are thoughtfully designed months in advance by Secretary Anthony Barreiro to coincide with the Saturday most proximate to the New Moon. Proximity to the New Moon means essentially no Moon or very little so as to be able to observe deep space objects in our galaxy and beyond. For example, in my quest to observe globular clusters I need as dark a sky as we can get on Mt. Tam, so a substantially illuminated Moon is, at the least, something of a nuisance and a non-starter for deep space observing.

A week later on Public nights not long after Sunset, quite often I show a sliver of the Moon along the terminator line and am always impressed by the detail of craters and mountains creating shadow and contrast. In the semi-darkness I will advertise to wandering members of the public, "Would you like to have a look at the Moon?" After leaning over to the eyepiece, many inevitably let out "Ooh's, aah's and look up from the eyepiece and exclaim "I've never seen the Moon so close up! It's awesome!" and then they have another look to verify what they've just seen.

So, for me, sometimes the Moon is a nuisance and other times it is 'awesome'. It depends on what my observing goals are at the time. All along I have felt I should spend more time observing the Moon and get to know its surface and the names of the major craters. After all, the Moon is our closest celestial object and we can observe it in better detail than any other. A recent NASA APOD (Astronomical Picture of the Day) has pushed me over the motivational edge to spend time observing the Moon, particularly the Last Quarter and, what looks to be a challenging sector at that. All this from the comfort of my backyard deck!



The APOD of 25 October 2017 is titled "Marius Hills and a Hole in the Moon". The image shows a picture of a section of the Moon taken in the 1960's by NASA's Lunar Orbiter 2 and shows the Marius crater and Marius Hills region. At the lower left of the image is an inset photo taken by JAXA's

SELENE spacecraft showing a hole in the Moon that subsequent measurements by NASA's Lunar Reconnaissance Orbiter indicated the hole extending down nearly 100 meters. Follow-up investigations of SELENE ground penetrating radar data indicated existence of hollow areas under the surface of the Moon that extend considerable distances. These hollow spaces are probably remainders of ancient lava flows that produced lava tubes.

What is so highly intriguing here is that these hollow lava tubes could provide living space that protect humans from solar and other cosmic radiation as well as the continuous bombardment of small but high speed asteroids and other space debris. It has been estimated that the size of some of these lava tubes are big enough to house entire Earth cities. In any event, this discovery hopefully will give new impetus on going back to the Moon in the not too distant future and establishing comparatively safe habitation structures for a permanent human presence. Humans haven't been to the Moon since the 1970's and these lava tubes provide an excellent reason to finally go back – and stay there.

It seems to me that establishing a permanent presence on (in?) the Moon would be the best next step for human space exploration. Many lessons could be learned and applied later in more ambitious exploration endeavors such as Mars and beyond. The Moon is relatively close and supply and/or rescue is more feasible within a few days rather than months or longer. This is an opportunity to make the Moon within our reach and grasp.

Dark, clear and stable skies,

Michael Patrick
President, SFAA

Post Note: The Marius crater is located at about 12° N Latitude and 310° Longitude, just NW of crater Kepler in the Oceanus Procellarum.

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, Douglas Smith, Paul Salazar	

***** Call For Design Submissions *****

Calling all Designers! The SFAA Board is excited to announce that we are looking to create SFAA Hoodies; the exact item that all well-dressed night sky watchers need!

Three simple steps:

1. Think up a great design idea
2. Draw it
3. Submit it to president@sfaa-astronomy.org

Got more than 1 idea? Fantastic! Repeat steps 1 – 3.

Your design might be the winner. What are you waiting for? The sky's the limit!

02.

SFAA BOARD OF DIRECTORS ELECTION FOR 2018 | ANTHONY BARREIRO

SFAA elects our Directors and Officers every December for the upcoming calendar year. The Officers and Directors constitute the Board of Directors, which is SFAA's governing body. The Board maintains our membership roster, manages the club's funds, organizes and publicizes our activities, coordinates member volunteers, and communicates on the club's behalf with the larger community. Fortunately the club has a stable cash flow and adequate reserves. Members' dues fund all of our activities, so (unlike many non-profit organizations) Board members don't have to do any fundraising.

The board meets once a month. Our first meeting of the year is a day retreat to plan for the year ahead. The remaining meetings are on weekday evenings, usually two online meetings and an in-person meeting each quarter.

Any current member of SFAA is eligible to run for the Board. Some of our current board members will not be able to serve another term, so we need new people to run to fill the available seats. We're looking for fresh ideas and perspectives to enhance the events and communications SFAA offers to members and the broader public. If you have been participating in club activities and you have time and energy to commit to helping direct the club's affairs, please consider running for the Board.

The responsibilities of the SFAA Officers and Directors are described in more detail in the Bylaws page on the SFAA website at: <http://www.sfaa-astronomy.org/sfaa-bylaws/>

If you are willing to run for the Board, if you have questions, or if you would like to nominate another member, please contact Anthony Barreiro at secretary@sfaa-astronomy.org



Editor's Note: Introducing a *New Above The Fog* Feature



After attending several SFAA Star Parties, I have seen that our Members have some AMAZING telescopes. This new feature puts the spotlight on our Members and their telescopes. Thank you, George, for kicking off this exciting new feature!

Please share the story of your telescope with other Members—you know they will be interested! Here are a couple of suggestions that might be helpful in putting your submission together:

- History of telescope, i.e. Did you make it?, Who did you get it from?, How long have you had it?
- Size and type of telescope, including magnification
- Noteworthy or favorite objects to view, including the first object you saw through your scope
- Members' own astrophotos are welcome, too
- Include photos of your scopes and a photo of yourself with your scope

Submit your articles and photos to newslettereditor@sfaa-astronomy.org

03. ASTRONOMY EVENTS



SAN FRANCISCO AMATEUR ASTRONOMERS EVENTS NOVEMBER 11, 2017 – DECEMBER 19, 2017

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

Saturday, November 11, 7:30 pm – 10:30 pm
City Star Party, Presidio Main Parade Ground

Saturday, November 18, 5:00 pm – 2:00 am
Mt. Tam Members Night

**** NOTE ** There is NO LECTURE in
NOVEMBER due to the Thanksgiving Holiday**

Saturday, December 9, 5:30 pm – 10:00 pm
City Star Party, Pint Lobos

Saturday, December 16, 4:30 pm – 2:00 am
Mt. Tam Members Night

Tuesday, December 19, 7:30 pm – 9:15 pm
Meeting and Lecture, Presidio Officers Club

Check back for 2018 events in the next edition of
Above The Fog or at the SFAA website

* * * * *
**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>

* * * Mark Your Calendars * * *

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

**** UPDATE: Tuesday, November 14 Meeting has been POSTPONED until 2018. ****

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.

04.

SFAA NEEDS YOU: VOLUNTEER OPPORTUNITIES | ANTHONY BARREIRO

Volunteers Needed for SFAA Star Parties

Throughout the year SFAA provides two or three star parties a month. Every month of the year we do a City Star Party at various locations in San Francisco and a members night on Mount Tamalpais. From April through October, in collaboration with Mt. Tam State Park, the Friends of Mt. Tam, and Wonderfest, SFAA provides telescope observing as part of the monthly public astronomy program. That's a total of 31 star parties a year! We need a couple of experienced SFAA members to serve as contact people for each of these events. If you've been to at least a few star parties, you're familiar with the procedures, and you're able to commit to attending a specific star party, we need your help.

Star party contact persons check the weather forecast during the days before a star party, keep in touch with the other contact person, and make a decision whether or not to cancel the event because of rain, or because of high fire danger on Mt. Tam. On the day of the star party, contact people arrive early, welcome and orient members, and hold a brief huddle for all the telescope operators to review procedures and answer questions. On Mount Tamalpais contact people make sure that every vehicle belongs to an SFAA member and has a parking pass. For the Mt. Tam public astronomy program, SFAA contact people coordinate with the Friends of Mount Tam volunteers who manage the visitor parking area. Contact people always have plenty of time to set up and use their own equipment and to enjoy the star party. At the end of the night on Mt. Tam, the contact persons need to make sure members know to lock the gate behind them on the way out.

A small number of SFAA members have been serving as contact people for all our star parties. It would be great to have a larger pool of volunteers, so that we could all take turns. If you sign up you will receive one email a month asking people to volunteer for upcoming star parties.

If you're willing to help out, or if you have questions, please contact Anthony Barreiro at secretary@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!

05.

FOCUS ON SFAA MEMBERS: 2017 ECLIPSE STORIES & IMAGES | LIZ TRIGGS

Many SFAA members travelled to the various eclipse sites in August and created wonderful memories with their families and friends. With so many great stories and pictures to share, we invited members to share their eclipse experiences prior to the October lecture.

The room was packed, both for our outstanding speaker and for SFAA members' wonderful eclipse stories. Everyone really enjoyed the members session and when we asked, they all said they'd like to do more of these.

Thank you to the members who participated: Andy Rudovsky, Mitchell Schoenbrun, Harith Alshuwaykh, and to Allison Broennimann who sent in a great video recap of the SFAA Eclipse expedition to Jackson Hole. And a very special thanks to P.J. Cabrera who managed all of the technical details, acted as M.C. for the session and even stood in to introduce Andy's video since Andy was out of town.



Photo credits: Liz Triggs

Harith Alshuwaykh kicked off the session discussing these beautiful eclipse images.



* * * * *

**WANT TO HAVE
MORE SESSIONS FEATURING
SFAA MEMBERS?**

* * * * *

Did you enjoy this special session where SFAA members shared stories and images? We can do more of these.

Please submit your ideas for future sessions to: Michael Patrick at president@sfaa-astronomy.org

Photo credits: Liz Triggs

Mitchell Schoenbrun discusses his trip to Oregon. The photo below shows his "hat cam" view in the inset image.



Photo credits: Liz Triggs

Right: Master of Ceremonies P.J. Cabrera introduces the Rudovsky family eclipse chasers short video. Take a look at those t-shirts they had made for the big event!

Below: P.J. Cabrera shows part of Andy Rudovsky's video, which captured all of the eclipse action.



06.

THE 2017 YOSEMITE TRIP | DOUGLAS SMITH

The 2017 San Francisco Amateur Astronomers annual Yosemite trip was a success. The group hosted Star Parties the weekend of July 28-29 through the National Park Service Special Programs (<https://www.nps.gov/yose/planyourvisit/programs.htm>). Our group of about 20 SFAA members met Friday where Ken Frank presented on the Eclipse to the visitors at Glacier Point at dusk. Many remained to view through our scopes.

As in other years, the Bridal Veil Campground was delayed opening, so the group was given a campsite in the valley. Word got out late as David Frey found out about the closure on Thursday before the weekend! The majority of the group stayed at the Ranger's station within walking distance of Glacier Point. The Rangers were very hospitable and tried to be accommodating. We had a great potluck Saturday before the Star Party at the Point.

Stargazing viewing both nights was very nice – clear and good temperatures. The public was appreciative of our views of stellar objects.

If you haven't been on a SFAA Yosemite trip – plan to join us next year! Enjoy the gallery of photos from the trip...

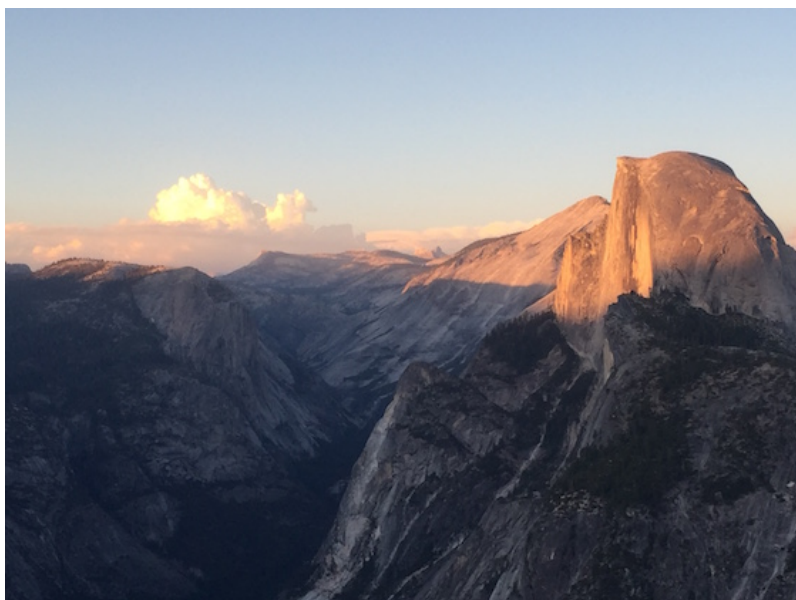


Photo credits: Dave Frey

Above left: Sunrise at Glacier Point overlooking Half Dome, right across the street from the Ranger Station where some camped.

Above right: Sunset at Glacier Point overlooking Half Dome, just before our Friday night viewing

Left: The crowd shot here includes Matthew Jones, Douglas Smith, Dan Seneres, Cory Schumacher, Peter Schumacher, Larissa Schumacher, Barbara Schumacher

Photo credits: Dave Frey

Top left: SFAA Group after the potluck, just before heading to our Saturday presentation. Back row: Peter Shumacher, Matt Frey, John Belew, Ken Frank, Douglas Smith, Cory Schumacher, Larissa Schumacher, Front row (left to right): Barbara Schumacher, David Frey, Adam Ramsey (NPS Ranger), Matt Jones

Top right: Public visitors viewing John Belew's amazing telescope (John is in the black hoody).

Lower left: Dave Frey, Matt Frey

Lower right: SFAA at Glacier Point, overlooking Half Dome and Nevada falls—look at all that water—what a welcome sight! Crowd shot here includes: David Frey, Matt Frey, John Belew, Barbara Schumacher, Cory Schumacher, Ken Frank, Peter Schumacher, Larissa Schumacher, Douglas Smith, Matt Jones, Dan Seneres,



Photo credits: Dave Frey

Top left: The Schumacher family (Barbara, Larissa, Cory, minus Peter) with Matt Jones

Center right: "I'm the king of the world!" – Matt Frey

Lower left: Saturn astrophoto by David Frey through John Belew's Explore Scientific. ES127 scope with an ES82 4.7mm eyepiece



07. LICK OBSERVATORY TOUR 2017 | JESSICA MILLER

The amazing thing about Lick Observatory and Mt Hamilton is every time you get to the top of the 365 turns, the experience is different. The people in the group, the weather, the objects in the night sky, the view, the tour guides, it's always changing. This year's SFAA night tour of the Lick Observatory was amazing. Unfortunately the air particulate count was in the high zone so the dome and mirror couldn't be opened on the Shane Refractor. The entire group was able to do the always-thrilling walk around the outside catwalk of the dome.

After a brief pause for a spectacular sunset, the group got a brief history lecture. The soap opera of the life of James Lick and the Lick Observatory is one of the highlights of the tour, so I (and a few other members) was sad to have such a brief presentation. That disappointment was soon forgotten as we were treated to an extended viewing time through The Great Lick Telescope.

It's been a little over 129 years since The Great Lick Telescope saw it's first light. Amazingly, it still is breathtaking to look through it and see a double star or a globular cluster. There are have been modern mechanics and electronics added over the years (a tracker is very nice). It's still the same glass that was ground all those years ago. And when the drive up the mountain seems a bit long and frustrating, it's humbling to remember that the 36-inch lens also had to make the same trip up the mountain; albeit using real horsepower and no air conditioning.

Thank you to all members and guests who made the trip this year. I hope everyone had a wonderful time. If you missed this year's SFAA tour, hope you can join us next year.



Photo credits: Jessica Miller

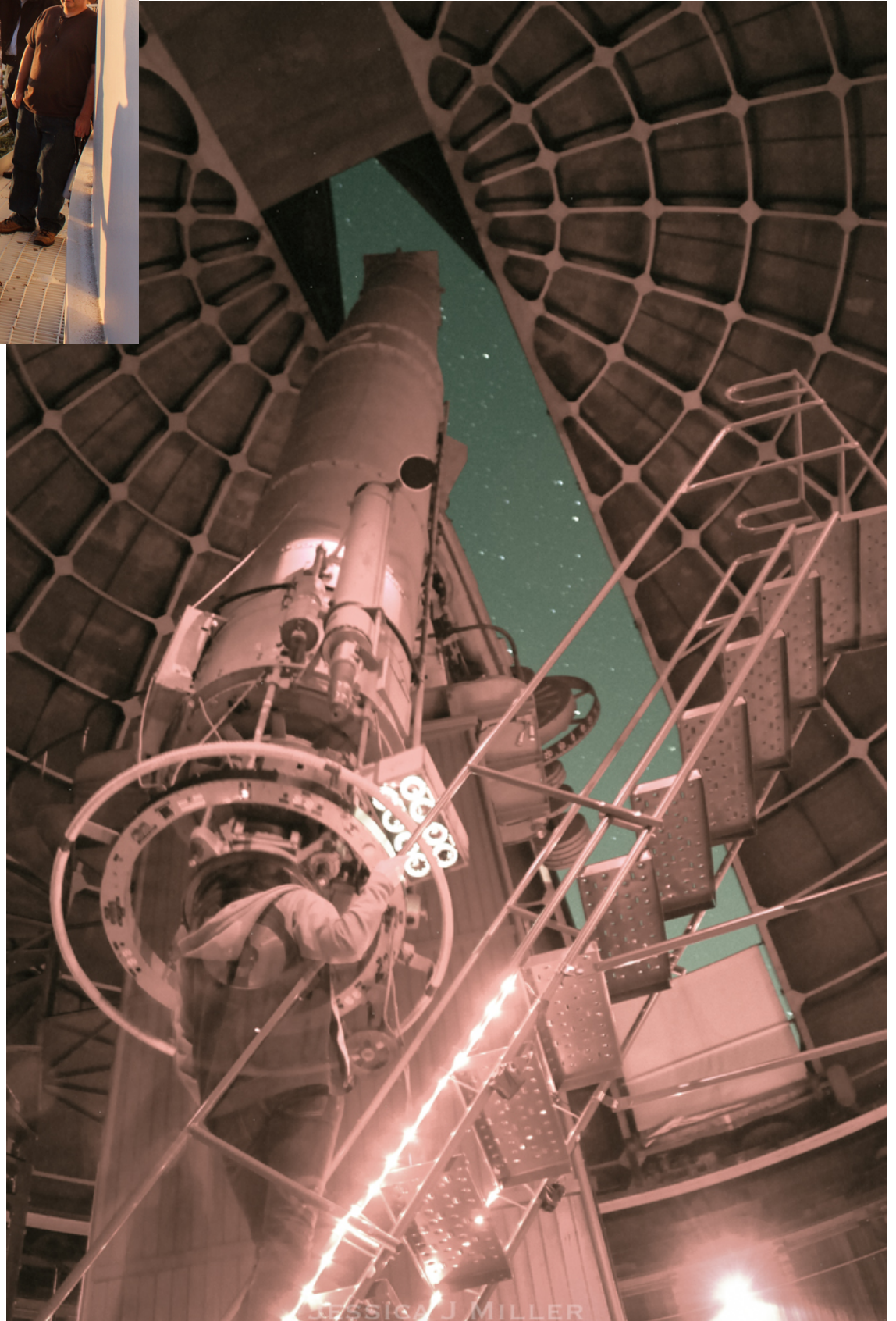
Above: The SFAA crowd outside the main entrance, before the tour



Photo credits: Jessica Miller

Left: P.J. and Kate Cabrera lead the group outside on the catwalk of one of the domes for a breathtaking 360-degree view

Below: The main attraction—The Great Lick Refractor, built in 1888 with a 36 inch lens—a major achievement in its day and still thrilling astronomers!



08.

SFAA LECTURE SCHEDULE 2017

*** * * NOTE: THERE IS NO LECTURE IN NOVEMBER * * ***

DECEMBER 19TH LECTURE | BARRY WELSH, UC BERKELEY SPACE SCIENCES LABORATORY

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)

"EXOCOMETETS: NOW YOU SEE THEM, NOW YOU DON'T"



**BARRY WELSH, PH. D.
UC BERKELEY, SPACE SCIENCES LABORATORY**

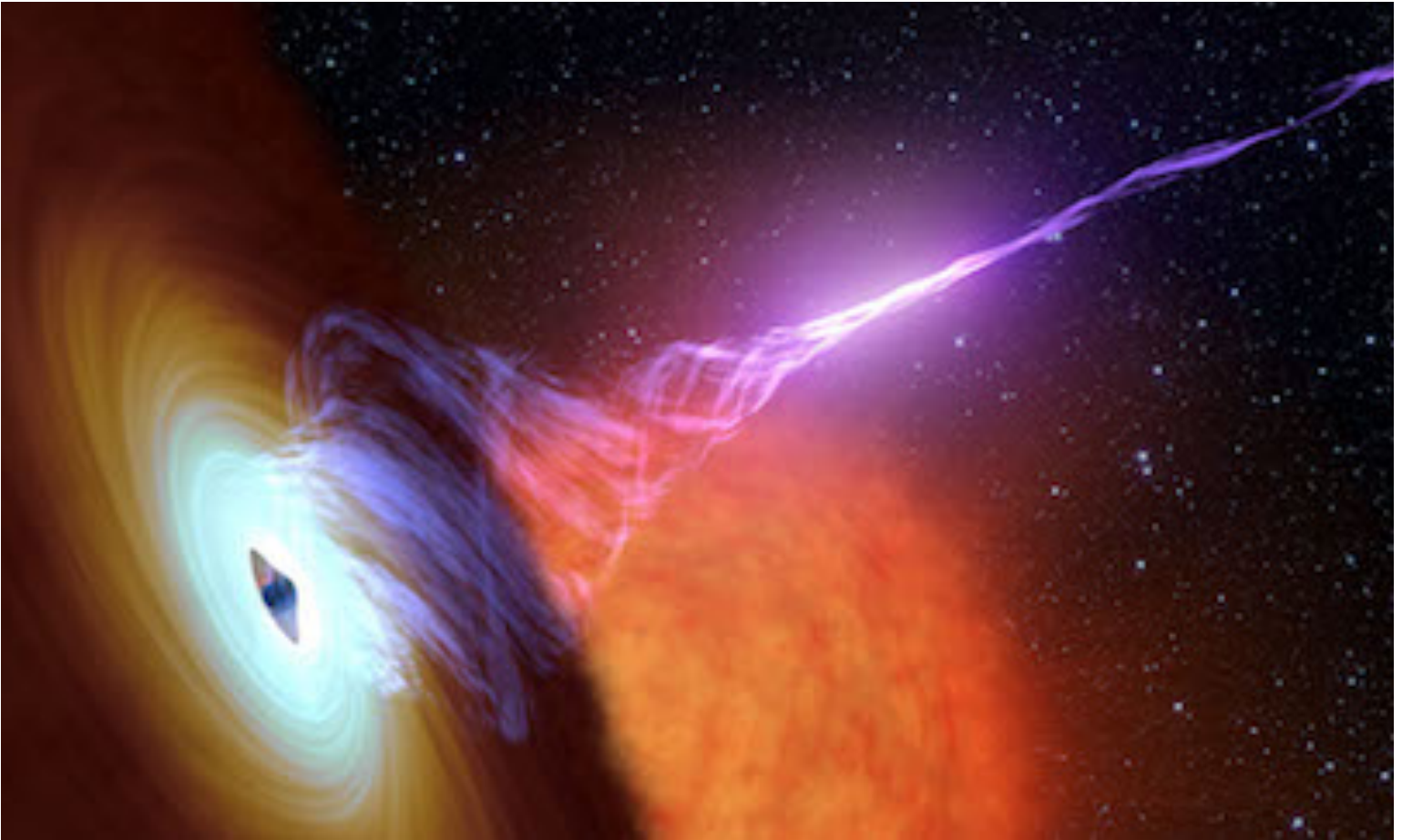
Minor bodies such as Kuiper Belt Objects, comets and asteroids constitute the rocky, icy debris left over from the planet building phase of our solar system. The existence of reservoirs of small rocky bodies (i.e. asteroids/planetesimals) in orbit around young stellar systems is now well established. The initial proto-planetary disks that contain the reservoir of dust and gas required to form exoplanets are short lived ($\ll 1$ Myr). The circumstellar debris disk observed around young stars of ages 10-50 Myr are continually replenished by collision and evaporation amongst planetesimals. The gravitational field can potentially enable large numbers of kilometer-sized icy bodies into trajectories directed toward the young central star.

Using high resolution spectrographs mounted on large aperture ground based telescopes, we have discovered 15 young stars that harbor swarms of exocomets. This lecture will describe attributes of comets in our solar system, and observing techniques to detect evaporating exocomets around young stars. The relevance of Kepler's discovery of "Tabby's Star" will also be discussed.

Brief Bio

Dr. Barry Welsh received his PhD from University College of London, and studied Far IR Astronomy. Researched UV Astronomy and Instrumentation at London and Oxford University. Researched physics and early mapping of the Interstellar Medium at the Space Sciences Laboratory, UC Berkeley. He was project manager on UV detector systems for NASA SOHO, FUSE, GALEX and HST-COS missions. He is now discovering exocomet systems and carrying out a search for optical laser pulses from exoplanet systems.

NUSTAR PROBES BLACK HOLE JET MYSTERY



This artist's concept shows a black hole with an accretion disk -- a flat structure of material orbiting the black hole -- and a jet of hot gas, called plasma.

Using NASA's NuSTAR space telescope and a fast camera called ULTRACAM on the William Herschel Observatory in La Palma, Spain, scientists have been able to measure the distance that particles in jets travel before they "turn on" and become bright sources of light. This distance is called the "acceleration zone."

NuSTAR is a Small Explorer mission led by Caltech and managed by JPL for NASA's Science Mission Directorate in Washington. NuSTAR was developed in partnership with the Danish Technical University and the Italian Space Agency (ASI). The spacecraft was built by Orbital Sciences Corp., Dulles, Virginia. NuSTAR's mission operations center is at UC Berkeley, and the official data archive is at NASA's High Energy Astrophysics Science Archive Research Center. ASI provides the mission's ground station and a mirror archive. Caltech manages JPL for NASA.

For more information, visit <http://www.nasa.gov/nustar> and <http://www.nustar.caltech.edu/>

Image Credit: NASA/JPL-Caltech

Black holes are famous for being ravenous eaters, but they do not eat everything that falls toward them. A small portion of material gets shot back out in powerful jets of hot gas, called plasma, that can wreak havoc on their surroundings. Along the way, this plasma somehow gets energized enough to strongly radiate light, forming two bright columns along the black hole's axis of rotation. Scientists have long debated where and how this happens in the jet.

Astronomers have new clues to this mystery. Using NASA's NuSTAR space telescope and a fast camera called ULTRACAM on the William Herschel Observatory in La Palma, Spain, scientists have been able to measure the distance that particles in jets travel before they "turn on" and become bright sources of light. This distance is called the "acceleration zone." The study is published in the journal Nature Astronomy.

Scientists looked at two systems in the Milky Way called "X-ray binaries," each consisting of a black hole feeding off of a normal star. They studied these systems at different points during periods of outburst -- which is when the accretion disk -- a flat structure of material orbiting the black hole -- brightens because of material falling in.

One system, called V404 Cygni, had reached nearly peak brightness when scientists observed it in June 2015. At that time, it experienced the brightest outburst from an X-ray binary seen in the 21st century. The other, called GX 339-4, was less than 1 percent of its maximum expected brightness when it was observed. The star and black hole of GX 339-4 are much closer together than in the V404 Cygni system.

Despite their differences, the systems showed similar time delays - about one-tenth of a second -- between when NuSTAR first detected X-ray light and ULTRACAM detected flares in visible light slightly later. That delay is less than the blink of an eye, but significant for the physics of black hole jets.

"One possibility is that the physics of the jet is not determined by the size of the disc, but instead by the speed, temperature and other properties of particles at the jet's base," said Poshak Gandhi, lead author of the study and astronomer at the University of Southampton, United Kingdom.

The best theory scientists have to explain these results is that the X-ray light originates from material very close to the black hole. Strong magnetic fields propel some of this material to high speeds along the jet. This results in particles colliding near light-speed, energizing the plasma until it begins to emit the stream of optical radiation caught by ULTRACAM.

Where in the jet does this occur? The measured delay between optical and X-ray light explains this. By multiplying this amount of time by the speed of the particles, which is nearly the speed of light, scientists determine the maximum distance traveled.

This expanse of about 19,000 miles (30,000 kilometers) represents the inner acceleration zone in the jet, where plasma feels the strongest acceleration and "turns on" by emitting light. That's just under three times the diameter of Earth, but tiny in cosmic terms, especially considering the black hole in V404 Cygni weighs as much as 3 million Earths put together.

"Astronomers hope to refine models for jet powering mechanisms using the results of this study," said Daniel Stern, study co-author and astronomer based at NASA's Jet Propulsion Laboratory, Pasadena, California.

Making these measurements wasn't easy. X-ray telescopes in space and optical telescopes on the ground have to look at the X-ray binaries at exactly the same time during outbursts for scientists to calculate the tiny delay between the telescopes' detections. Such coordination requires complex planning between the observatory teams. In fact, coordination between NuSTAR and ULTRACAM was only possible for about an hour during the 2015 outburst, but that was enough to calculate the groundbreaking results about the acceleration zone.

The results also appear to connect with scientists' understanding of supermassive black holes, much bigger than the ones in this study. In one supermassive system called BL Lacertae, weighing 200 million times the mass of our Sun, scientists have inferred time delays millions of times greater than what this study found. That means the size of the acceleration area of the jets is likely related to the mass of the black hole.

"We are excited because it looks as though we have found a characteristic yardstick related to the inner workings of jets, not only in stellar-mass black holes like V404 Cygni, but also in monster supermassive ones," Gandhi said.

The next steps are to confirm this measured delay in observations of other X-ray binaries, and to develop a theory that can tie together jets in black holes of all sizes.

"Global ground and space telescopes working together were key to this discovery. But this is only a peek, and much remains to be learned. The future is really bright for understanding the extreme physics of black holes," said Fiona Harrison, principal investigator of NuSTAR and professor of astronomy at Caltech in Pasadena.

NuSTAR is a Small Explorer mission led by Caltech and managed by JPL for NASA's Science Mission Directorate in Washington. NuSTAR was developed in partnership with the Danish Technical University and the Italian Space Agency (ASI). The spacecraft was built by Orbital Sciences Corp., Dulles, Virginia. NuSTAR's mission operations center is at UC Berkeley, and the official data archive is at NASA's High Energy Astrophysics Science Archive Research Center. ASI provides the mission's ground station and a mirror archive. Caltech manages JPL for NASA.

For more information on NuSTAR, visit:

<https://www.nasa.gov/nustar>
<http://www.nustar.caltech.edu/>

News Media Contact

Elizabeth Landau
Jet Propulsion Laboratory, Pasadena, Calif.
818-354-6425
Elizabeth.landau@jpl.nasa.gov

***** Fun Links For Your Night Sky Viewing *****

SPOT THE STATION: see the International Space Station! As the third brightest object in the sky the space station is easy to see if you know when to look up.

Sighting Opportunities

Sighting Opportunities. Find your next opportunity for spotting the station.

Subscribe to Spot The Station Alerts

Subscribe to email or text notifications and get alerts when the space station will be passing overhead in your area

IRIDIUM FLARES: Most Iridium satellites are still controlled, so their flares can be predicted. The Iridium communication satellites have a peculiar shape with three polished door-sized antennas, 120° apart and at 40° angles with the main bus. The forward antenna faces the direction the satellite is travelling. Occasionally, an antenna reflects sunlight directly down at Earth, creating a predictable and quickly moving illuminated spot on the surface below of about 10 km (6.2 mi) diameter. To an observer this looks like a bright flash, or flare in the sky, with a duration of a few seconds.

Iridium Flares Sighting Schedule, courtesy of Heavens Above



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.