

# ★ ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 64, No. 4 – April 2016

## GENERAL MEETING

THE PRESIDIO . OBSERVATION POST . BUILDING 211

211 Lincoln Boulevard, San Francisco

7:00 pm Doors Open . 7:30 pm Announcements . 8:00 pm Speaker

**!!! APRIL GENERAL MEETING !!!**  
**!!! DIFFERENT LOCATION FOR APRIL GENERAL MEETING ONLY !!!**  
**GENERAL MEETING WILL BE AT PRESIDIO OFFICERS' CLUB**  
**SEE NEXT PAGE FOR DIRECTIONS**

April 19, 2016

### DR. MARK MARLEY THE NEW ERA OF EXOPLANET DISCOVERY



Although science fiction has long dreamed of their existence, it has only been 20 years since the announcement of the first confirmed extrasolar planets. We now know of thousands of worlds beyond our own solar system. Almost all of these planets were discovered by indirect means, mostly by searches for the subtle effects of these distant planets on their own suns. While astronomers have developed astounding methods for teasing out details about many of these planets, the vast majority will forever remain as little more than curves and dips on data plots. However as we enter the third decade of exoplanet science a new method of discovery is coming to the forefront: direct imaging. This method aims to block the light of stars so that the planets that orbit them can be directly detected. Directly imaged planets are not only somehow more satisfying, they also offer many more opportunities for in depth study since their light is naturally separated from that of their star. In my talk I will explain how direct imaging is already helping us to understand the origin and evolution of giant planets around young stars and I will discuss the promise this method holds in the search for life on Earth-like planets in the future.

*Dr. Mark Marley is a Research Scientist at NASA's Ames Research Center in Mountain View. His research background includes studies on both solar system and extrasolar giant planets. He has served on multiple NASA teams helping to define the future of extrasolar planet discovery and characterization and is a member of the Gemini Planet Imager Exoplanet Survey team, which recently announced the discovery of its first directly imaged planet. Dr. Marley has been awarded the NASA Medal for Exceptional Scientific Achievement and has published 150 scientific papers. As a Consulting Professor he teaches courses on solar system and extrasolar planets at Stanford University.*

**!!!! NOTE RE MEETING LOCATION – FOR APRIL ONLY !!!!**  
**PLEASE NOTE: OUR APRIL 19 MEETING WILL BE HELD AT THE PRESIDIO OFFICER'S CLUB,**  
**LOCATED AT THE OPPOSITE END OF THE PRESIDIO PARADE GREEN FROM OUR**  
**OBSERVATION POST REGULAR MEETING LOCATION**  
**(SEE MAP ON NEXT PAGE)**

**!!!! NOTE RE MEETING LOCATION – FOR APRIL ONLY !!!!**

**PLEASE NOTE: THE (APRIL 19) MEETING WILL BE HELD  
AT THE PRESIDIO OFFICER'S CLUB,  
LOCATED AT THE  
OPPOSITE END OF THE PRESIDIO PARADE GREEN  
FROM OUR REGULAR OBSERVATION POST MEETING  
LOCATION**

**On the map below, the OBSERVATION POST is encircled on the left.  
The PRESIDIO OFFICERS' CLUB is encircled on the right**



# **SFAA PRESIDENT'S NOTES**

## **The Complete Astronomical Experience**

In November of 2015 the SFAA was contacted by the Marin County Free Library (MCFL) requesting our participation in their annual One Book One Marin program. Now celebrating the 10<sup>th</sup> Anniversary, the MCFL selects one book of note that a program of events, such as book discussion groups at all branch libraries, lectures, demonstrations, culminating with the author being interviewed at Dominican University by Michael Krasny of KQED. The MCFL had contacted the SFAA three years ago when the book discussed was "Packing for Mars" by March Roach and a number of Marin based SFAA members brought their telescopes to five different branch libraries for a brief talk and public viewing of celestial objects. In 2016 we are in the process of doing a similar participation and have engaged the public in Bolinas and South Novato. Weather conditions cancelled several more events one has been re-scheduled and we will be at Point Reyes on 7 April and Marin City on 5 April. This will be a first time at Marin City and the people of Point Reyes have been "clamoring" for our participation once again.

I have had the honor of working with the MCFL, coordinating these events with members and setting up my Celestron for public viewing. Thus far, in particular I wish to thank long time member and former President Ken Frank and member P.J. Cabrera (who comes all the way from San Francisco!) for their invaluable participation. Events' like these are much more than setting up one's telescope and letting the public have a look. Public participation ranges from 30 to 50 people of all ages and they are full of questions about our solar system and beyond. SFAA members engage in answering these questions as well as explain the object the public are viewing through their telescope. The feeling one gets in these situations is a simultaneous combination of honor, responsibility and thrill to have a dozen people surrounding you listening to and learning from your explanation of astronomical phenomena.

Personally I find this interaction fulfilling and achieving a higher purpose in helping the public understand some aspects of our universe, and I know this is true for all participating SFAA members as well. It is a satisfying experience to sit at one's telescope (at a Member's Only night on Tam for example) and find objects of specific interest, study them and perhaps gather data over time. But the complete experience is sharing this knowledge with the public who are so interested and eager to learn. For many people the only time they will ever look through a telescope and be amazed at the beauty and extent of the universe (or that even such objects exist way beyond the scope of their eyesight) will be because an SFAA member has stepped forward to provide the opportunity. SFAA members who have a telescope have an opportunity to complete their astronomical experience by stepping forward to engage in these scheduled outreach events.

**Michael Patrick**

President

San Francisco Amateur Astronomers



**SFAA INVITED TO PARTICIPATE IN  
ONE BOOK ONE MARIN  
FEBRUARY 4 – APRIL 5, 2016**



(MCFL) chooses a book to branches. “The goal of community through of literature and culture. community interesting three-month period, events are free and open



Each year the Marin County Free Library be read and discussed during the same time period at all One Book One Marin is to build a stronger, enriched library utilization, community dialogue, and the exploration A variety of community partners collaborate to bring the programming and events related to the book throughout a February – April, each year. Anyone can participate. All to the public.”\*

In early 2016 the book chosen to be discussed is “The Martian”, by Bay Area author Andy Weir. Events will culminate at Dominican University in San Rafael with Michael Krasny of KQED interviewing Mr. Weir followed by a book signing.

***A CALL FOR SFAA MEMBER TELESCOPES***

The MCFL has invited the SFAA to be a focal point of events in One Book One Marin by setting up telescopes at five branch libraries for the public to observe selected objects and have them explained. In addition, the SFAA has requested publicity to suggest the attending public bring their own binoculars to the observing event so as to participate with their instrument as well as SFAA telescopes.

In 2013 the SFAA participated in a similar event when the One Book was “Packing for Mars” by Mary Roach. Public participation at each library location was around 50 enthusiastic people of all ages. Our efforts were well received by the public and the enthusiasm was mutual.

The dates and locations for our observing events are as follows:

Set up: 5:30; Talk 6:40; Viewing 7:00-8:15  
Tuesday, March 8                      Fairfax Library  
Thursday, March 10                    Point Reyes Library

Set up: 6:30; Talk 7:40; Viewing 8:00-8:45  
**Tuesday, April 5                      Marin City Library**

Participating SFAA members will have VIP seating at the interview of Andy Weir by Michael Krasny at Dominican University.

SFAA members interested in having fun sharing their telescope and knowledge of the universe with the public at these events should contact:

Michael Patrick  
Email: [mdpatric@pacbell.net](mailto:mdpatric@pacbell.net)

\*Marin County Free Library website, One Book One Marin page



## SFAA 2016 LECTURE SERIES UPCOMING LECTURES

May 17 **DR. MARK SHOWALTER**

Senior Research Scientist, SETI Institute

### PLUTO ON THE HORIZON: OUR FIRST ENCOUNTER WITH THE DOUBLE PLANET



The more we learn about Pluto, the more interesting it becomes. In the last decade, four tiny moons have been discovered orbiting the central "binary planet," which consists of Pluto and its large moon Charon. Pluto itself has a thin atmosphere and shows signs of seasonal changes. Tantalizing evidence suggests that Charon may have volcanoes. However, even in our most powerful telescopes, Pluto and its moons are just dots in the sky. All of that changed on July 14, 2015, when NASA's New Horizons spacecraft flew past Pluto and provided our first close-up look at these distant worlds. In this lecture, Dr.

Mark Showalter, a co-investigator on the New Horizons mission, will describe how he discovered two of the moons of Pluto and will discuss the results from the many first time images of Pluto from the New Horizons Mission.

His early work with Voyager data led to the discoveries of Jupiter's faint, outer "gossamer" rings and Saturn's tiny ring-moon, Pan. Starting in 2003, his observations with the Hubble Space Telescope led to the discoveries of "Mab" and "Cupid," small moons of Uranus now named after characters from Shakespeare's plays. In 2011, he began a Hubble observing program focused on Pluto, which led to the discoveries of two tiny moons. Their names, "Kerberos" and "Styx", were selected through an international naming campaign. Most recently, he discovered the 14th known moon of Neptune, whose permanent name has yet to be selected.

*Dr. Mark Showalter is a Senior Research Astronomer at the SETI Institute who studies the dynamics of rings and small moons in the Solar System. He is the Principal Investigator of NASA's Planetary Data Systems, and works closely with the New Horizons Space Mission to Pluto. Dr. Showalter works on some of NASA's highest-profile missions to the outer planets, including Cassini, now orbiting Saturn, and New Horizons, which flew past Jupiter en route to its 2015 encounter with Pluto. Known for his persistence in planetary image analysis, Mark's work on the earlier Voyager mission led to his discovery of Jupiter's faint, outer "gossamer" rings and Saturn's tiny ring-moon, Pan.*

### June 2 **MICHAEL PACKER** CRACKING GLOBULAR CLUSTERS



The 160 spherical oceans of stars we call globular clusters (GCs) need aperture, good seeing and dark skies to resolve detail. But once observed to their core GC's can reveal an exquisitely rich sea of red giant and fuel spent stars that do not take us back to the big bang but rather show us time in its extreme. Michael's talk will cover the general properties of Globular Clusters and which ones to observe or image for detail. The talk will also show GC formation with some N-particle animation and the role these ancient clusters play in the new field of galactic archaeology.

Join San Francisco Amateur Astronomers on Mt. Tamalpais this summer to observe the many Globular Clusters made even more interesting after our speaker's presentation. Go to [sfaa-astronomy.org](http://sfaa-astronomy.org) for our complete observing schedule.

*Michael Packer is an amateur astronomer of 25 years and lighting engineer designing optics for indoor and outdoor luminaires. He has a Masters of Physics from San Francisco State University and researched efficient lighting at Lawrence Berkeley National Laboratory.*



## **Arduino and Astronomy - A year of tinkering at the Astronomical Society of the Pacific**

**Saturday, April 16, 2016, 10:00am - 3:00pm**

**ASTRONOMICAL SOCIETY OF THE PACIFIC  
390 Ashton Avenue, San Francisco**

The Astronomical Society of the Pacific is convening a focus group of tech-savvy astronomers interested in helping develop astronomy applications utilizing the Intel Edison and Curie microcontrollers. During a total of six sessions, participants will design prototype "make projects" focused on astronomy and space science content. For example, we may design and test Arduino controlled automated rockets, robotic tracking systems for telescopes, and automated systems for collecting spectroscopic data. The primary goal is to create a portfolio of engaging "Intel Inside" projects for amateur astronomers and astronomy enthusiasts that take advantage of the capabilities of the Intel Edison Development Board and Intel Curie Module.

Experience with programming and microcontrollers is preferred, however any background in actively using technology is acceptable. The sessions do not include basic training on Arduino or other microcontroller programming.

Participants will receive a \$125 stipend for each session they attend. They will also receive a SparkFun Starter Pack for Intel Edison (a \$120 value), Intel Curie module, and other materials to create usable (and wearable!) projects. Lunch is provided at each session.

When: First Session takes place on **Saturday, April 16, 2016, 10:00am - 3:00pm** (we will schedule two subsequent sessions during the April 16 session)

To apply to join this focus group, go to: <https://www.surveymonkey.com/r/ZZW29MQ>

# Helping you enjoy your state park

Mt Tam Enthusiasts:

It's April, and time to start our new season of public talks and observing sessions on Mt Tam. We have an exciting series planned, and you can preview it on our website: [friendsofmontam.org/astronomy](http://friendsofmontam.org/astronomy).

**What is Dark Matter?** -this basic question will be posed and discussed by **Dr. Holger Müller**, Professor of Physics at U.C. Berkeley, in his talk "**Shining Light on the Dark Side with Lasers and Atoms.**" at the **SAT APRIL 9 Mt Tam Astronomy Program at 8:00pm in the Mountain Theater.**

Multiple lines of astronomical evidence demonstrate the existence of dark matter and dark energy — mysterious stuff whose gravity holds galaxies together and drives the accelerated expansion of the universe, respectively. Physicists have long assumed that this "dark sector" would at least partially consist of new, relatively massive particles, but have not been able to turn up uncontested evidence for them. A dark sector made of very light particles, however, could have escaped detection in any experiment conducted so far, yet is compatible with all astronomical and cosmological evidence. Precision measurements in physics are suitable to searching for such ultralight dark-sector candidates.

Dr. Holger Müller successfully applied for his first patent when he was 14. Later, he did his undergraduate thesis with Jürgen Mlynek at the University of Konstanz, Germany. He graduated from Humboldt-University, Berlin, with Achim Peters as advisor. Dr. Müller received a fellowship of the Alexander von Humboldt Foundation and joined the group of Steven Chu in Stanford as a postdoc. In July 2008, he joined the physics faculty at U.C. Berkeley. In his research, Dr. Müller uses methods from atomic, molecular, and optical physics. His work is centered on advancing the experimental technology to push the sensitivity of experiments to new levels, and to perform precision measurements of fundamental quantities.

**The Mt Tam Astronomy Programs** are sponsored by the **Mt Tamalpais State Park**, organized by the **Friends of Mt Tam** and **Wonderfest the Bay Area Beacon of Science** and are followed by star parties in the Rock Springs parking lot by the **San Francisco Amateur Astronomers.**

The evenings are FREE and open to the general public. Families and youth groups are encouraged to attend. Please:

- Park at Rock Spring parking lot and CARPOOL if possible
- Dress appropriately, it can be cold April evenings on the mountain
- Bring a flashlight to help navigate your way from the theater to the telescopes and cars
- Help us inform others about these programs
- IF the weather is questionable the day of the event, call our hotline: 415-455-5370 after 4:00pm. Any changes will be posted. Note that cloudy weather and/or high winds may prevent observing through the telescopes, but generally don't stop the lectures.

**We still need some volunteers for this program.** If you plan to attend and are willing to help, contact our Volunteer Coordinator, **Sarah Sinkie** at **415-316-6058**, [ssinkie@bradleyrealestate.com](mailto:ssinkie@bradleyrealestate.com). All volunteers hear the program and have time to join the observing.

We are working toward updating our audio/visual equipment, and if anyone with expertise in projectors and sound systems is willing to give advice it would be appreciated. Contact **Larry Lanes** **415-328-1845**, [lawrencelanes@gmail.com](mailto:lawrencelanes@gmail.com) **Any contributions toward new equipment would also be gratefully accepted.** Send to Astronomy Programs, c/o FMT, P.O. Box 7064, Corte Madera, CA 94976-7064. (Tax deductible!)

Check us out at Meet Up, Facebook or on our website: [friendsofmontam.org](http://friendsofmontam.org)

Hope to see you on the Mountain!!!

**Astronomy Nights on Mt. Tamalpais** -Free and open to all (no signup)

**2016 MT TAM ASTRONOMY PROGRAMS -- our 28th year on the mountain**

Presented by Mt Tamalpais State Park, Friends of Mt Tam, Wonderfest, San Francisco Amateur Astronomers

<p><b>April 9</b> <b>8:00pm</b></p>	<p><b>Dr. Holger Müller</b>, <i>Professor of Physics, UC Berkeley</i>  <b>*** Shining Light on the Dark Side with Lasers and Atoms ***</b>                  Multiple lines of astronomical evidence demonstrate the existence of dark matter and dark energy — mysterious stuff whose gravity holds galaxies together and drives the accelerated expansion of the universe. Precision measurements in physics are suitable for searching for ultralight dark-sector candidates.</p>
<p><b>May 14</b> <b>8:30pm</b></p>	<p><b>Dr. Chris McKay</b>, Planetary Scientist, NASA Ames Research Center  <b>*** Searching for life in Ocean Worlds of the Outer Solar System ***</b>                  NASA’s new program, “Ocean Worlds,” focuses on the many oceans in the moons of the outer Solar System. Enceladus, Europa, and Titan are of particular interest. Where do we look, and how do we search for evidence of life?</p>
<p><b>June 11</b> <b>8:30pm</b></p>	<p><b>Dr. Norbert Werner</b>, Astrophysicist, Kavli Institute, Stanford  <b>*** The Beating Hearts of Galaxies ***</b>                  Did you know that black holes can blow bubbles? Join us on a fascinating journey through the Universe where you will learn about the intimate connection between the intergalactic gas, the birth and death of stars and galaxies, and the growth of supermassive black holes in the centers of galaxy clusters.</p>
<p><b>July 9</b> <b>8:30pm</b></p>	<p><b>Dr. Nathalie Cabrol</b>, Director, Carl Sagan Center, SETI Institute  <b>*** Habitability and Life Beyond Earth ***</b>                  Dr. Cabrol will discuss the current scientific revolution in astrobiology, with the latest updates from current missions, the existing plans for new ones, and where we stand on our quest to understanding habitability and finding life beyond Earth.</p>
<p><b>July 23</b> <b>8:30pm</b></p>	<p><b>MOVIE NIGHT</b> Screening of the 1984 classic science fiction film  <b>***2010: The Year We Make Contact***</b>                  The thrilling sequel to Stanley Kubrick’s 1968 sci-fi masterpiece, <i>2001: A Space Odyssey</i>, based on Arthur C. Clarke’s Novel <i>2010: Odyssey Two</i>. Directed by Peter Hyams, starring Roy Scheider as an American astronaut sent on a joint U.S.-Soviet space mission to Jupiter in an effort to find out what happened to the missing crew of the original Jupiter mission. Co-starring Helen Mirren and John Lithgow. Post-screening discussion moderator will be Tucker Hiatt of Wonderfest.</p>
<p><b>Aug 6</b> <b>8:30pm</b></p>	<p><b>Dr. Xiaosheng Huang</b>, Assistant Professor of Physics, University of SF  <b>*** Measuring Cosmological Distances with Supernovae ***</b>                  To measure distances to far-away galaxies, astronomers make use of what are called “standard candles,” objects whose true brightness can be calibrated accurately. Professor Huang will discuss Type Ia supernovae, the most powerful of all standard candles, including how to make them an even more useful tool for understanding the evolution of the cosmos.</p>
<p><b>Sept 10</b> <b>8:00pm</b></p>	<p><b>Yvonne Cagle, MD</b>, Colonel, U.S.A.F. (ret), Space &amp; Life Sciences Directorate, Johnson Space Center  <b>*** A Pocket Full of Stars ***</b>                  Five decades of space exploration have nourished our curiosity, our culture, AND our economy. Dr. Yvonne Cagle, a former member of NASA’s astronaut corps, discusses remarkable space “spinoffs” that benefit nearly all Earthlings and describes her own journey to “catch a falling star,” explaining how NASA’s sharing of “a pocket full of stars” has so enriched the planet.</p>
<p><b>Oct 8</b> <b>7:30pm</b></p>	<p><b>Dr. Andrew Siemion</b>, Director, Berkeley SETI Research Center, UCB  <b>*** The Search for Extraterrestrial Technologies and the Breakthrough Listen Initiative ***</b>                  Dr. Siemion will discuss the scientific rationale behind the search for extraterrestrial intelligence and some of the recent discoveries in astrophysics that are informing and spurring the search. He will also review the Breakthrough Listen Project, including current observational status, early results, and plans for the future.</p>





# Camping at Mt. Tam after Star Parties



Anthony Barreiro



SFAA board members Scott Miller and Anthony Barreiro have been in touch with Roberto Walton, the supervising ranger for Mount Tamalpais State Park, to develop a plan for SFAA members to camp at Mt. Tam after our star parties, rather than needing to drive all the way down the mountain late at night in the dark. We now have three options:

- SFAA members will now be permitted to sleep in our vehicles at Rock Springs until 7:00 am after our star parties, year round. Tent camping is **not** allowed at Rock Springs. There are porta-potties at Rock Springs, but no running water and no trash containers. Please bring plenty of water, and take all your trash with you when you depart.
- SFAA members can go to Pantoll or Bootjack campground during the day before a star party, set up a tent, and pay for a space -- just like any other visitor.
- SFAA members can set up a tent in the overflow lot at Pantoll and pay for the space -- again, just like any park visitor. You need to be out of the overflow lot by 9:00 am.

If you use Pantoll or Bootjack campgrounds, please remember that other campers are sleeping, and be very quiet when you arrive at the campground.

SFAA will continue to coordinate with the State Park and the Friends of Mount Tamalpais to provide a safe and enjoyable experience for our members, and for visitors to our public astronomy programs. If you have any suggestions for improvements, please contact Scott Miller at [hscottmil@gmail.com](mailto:hscottmil@gmail.com) or Anthony Barreiro at [anthonybarreiro@yahoo.com](mailto:anthonybarreiro@yahoo.com).

## VOLUNTEER OPPORTUNITIES AT THE CALIFORNIA ACADEMY OF SCIENCES

By Anthony Barreiro



**Astronauts, Rock stars,  
Astrophysicists and  
scientists need you **NOW**  
to organize **Asteroid  
Day on  
June 30th!****

<http://www.idealist.org/view/internship/cmmpPFBTChSP/>

Bing Quock, the Assistant Director of the Morrison Planetarium, has invited SFAA members to provide programming during these upcoming events at the California Academy of Sciences. Volunteers get free admission to the Academy. These events give us the chance to promote astronomy and the SFAA to a large number of interested people.

- March 10: **“Rocks” NightLife** (6-10pm)--this edition of the Academy’s weekly “museum after dark” program for adults features a theme of rocks, which could easily extend to meteorites, asteroids, and other small solar system bodies, which is the subject of the new Planetarium show, “Incoming!,” opening the following day. Broadly, any displays about astronomy (including telescope viewing on the Academy’s living roof) are popular during NightLife, but some connection to the evening’s “rock” theme is preferred to tie in with “Incoming!”
- April 14: **“Yuri’s Day” NightLife** (6-10pm)--this annual celebration of Yuri Gagarin’s pioneering spaceflight is a NightLife favorite, featuring astronomy displays, space-themed beverages, and live music.
- May 14: **Astronomy Day** (10am-4pm)--an annual observance since 1973, Astronomy Day is a day for amateur and professional astronomers to engage the public in anything and everything astronomical, from safe solar viewing (weather-permitting) and representation from local amateur groups, observatories, and educational programs to astronomy-themed maker projects (mirror-grinding, sundials, astro-gizmos), demos (astronomy apps, stargazing & satellite-watching websites), and space-crafts for kids. This day especially is wide-open to ideas! In past years SFAA members have offered solar telescope viewing, astrophotography displays (the Academy could provide a large plasma-screen monitor), small telescope demos and how-to’s, and information about club activities and other local skywatching opportunities.
- June 30: **Asteroid Day** and **Asteroid NightLife**--this will be the second annual Asteroid Day, organized by the B612 Foundation and held on the anniversary of the 1908 Tunguska Event. Asteroid Day promotes asteroid awareness and hopes to engage and educate the public with displays and presentations about the smaller and sometimes most-overlooked members of our solar system. Falling on a Thursday, Asteroid Day activities will be held both during the museum’s daytime public hours (10am-5pm) and during NightLife (6-10pm).

If you’re interested in helping with Astronomy Day, please contact Anthony Barreiro at [anthonybarreiro@yahoo.com](mailto:anthonybarreiro@yahoo.com). If you’re interested in helping with any of the Nightlife programs, please contact PJ Cabrera at [pj.cabrera@gmail.com](mailto:pj.cabrera@gmail.com).

## APRIL METEOR SHOWERS - Lyrids



Active from April 16th to April 25th

Peak night -Apr 22-23

The Lyrids are a medium strength shower that usually produces good rates for three nights centered on the maximum. These meteors also usually lack persistent trains but can produce fireballs. These meteors are best seen from the northern hemisphere where the radiant is high in the sky at dawn. Activity from this shower can be seen from the southern hemisphere, but at a lower rate.

**Radiant:** 18:04 +34° - **ZHR:** 18 - **Velocity:** 30 miles/sec (medium - 48.4km/sec) - **Parent Object:** C/1861 GI (Thatcher)



**2016 Expo Date: May 26-30**

## The RTMC Astronomy Expo

Beginning to advanced amateur astronomers attend the **RTMC Astronomy Expo** from Thursday to Monday to

- observe from the dark sky of YMCA Camp Oakes,
- see new developments in amateur telescope making,
- check out commercial telescopes and equipment brought by vendors for observers,
- listen to presentations covering observing, telescopes, and getting started in astronomy,
- check out the swap meet on both Saturday & Sunday, and
- socialize and observe with friends

**May 26-30, 2016 . Camp Oakes . Big Bear City, California**





Main Telescope Field at the RTMC Astronomy Expo

Originally called the Telescope Makers Conference, the Riverside Telescope Makers Conference (RTMC) was founded in 1969 by Clifford W. Holmes as a way for amateur telescope makers to share their craft. In 1975, the RTMC moved to its current home at Camp Oakes, a YMCA camp near Big Bear City. Located 50 miles northeast of Riverside in the San Bernardino mountains, the site offers space for camping, several dormitories and 18 three-sided shelters, a meeting/dining hall, and the Charles Walker Observatory. The camp is located at an elevation of 7,600 feet. Click on the following link to view a [labeled aerial photograph of Camp Oakes](#).

Since its inception, the RTMC has expanded to encompass all aspects of amateur astronomy from beginning to advanced topics and from telescope making to "armchair" astronomy. Recently, the RTMC has included events for the whole family with swimming, rock wall climbing, hikes, activities for spouses and activities for the young kids. In 2000, the official name of the conference was changed to the "RTMC Astronomy Expo."

During the RTMC the camp has more people than a typical recreational campground of its size, but the primary reason for attending is precisely because it offers a chance to rub shoulders with a large number of people who know telescopes and like to talk about them. What we offer is a chance to see and look through a large variety of telescopes (with relatively dark skies and high altitude), attend talks by professional and amateur astronomers on different aspects of telescope construction and use, see some astronomical equipment and software in use, and buy astronomical equipment and software (often at reduced prices). The vendors contribute door prizes for Saturday and Sunday evenings. We don't know exactly what prizes we'll have in advance, but in the past there have been telescopes of 8 to 12 inches in aperture.

Vendors ranging from major telescope manufacturers to people selling T-shirts have booths at the telescope field and along the paths leading to it.

#### **Date**

**The 48th annual RTMC Astronomy Expo will take place from Thursday, May 26 through Monday, May 30, 2016.**

#### **Location**

YMCA Camp Oakes, five miles southeast of Big Bear City on State Route 38 at Lake Williams Road between mileposts 44 and 45. This location is about 50 miles northeast of Riverside in the San Bernardino mountains.

Longitude 116° 45' 15" West

Latitude 34° 13' 50" North

Altitude 7250 feet (2210 meters)

[Click here for maps and directions.](#)

#### **Moonrise and Moonset (PDT)**

Thurs, May 26: Moonset 9:53 AM, Moonrise 11:50 PM

Fri, May 27: Moonset 10:51 AM

Sat, May 28: Moonrise 12:32 AM, Moonset 11:52 AM

Sun, May 29: Moonrise 1:12 AM, Moonset 12:54 PM

Mon, May 30: Moonrise 1:51 AM, Moonset 1:59 PM

## 2016 - Fun With Our Sun!

At this year's Expo, we continue our tradition of celebrating amateur astronomy in its many facets, from beginner to advanced researchers and imagers. If you like to camp under the stars, hear great science lectures, see our vendors with the latest in astro-goodies and look through amazing telescopes, then come and join us!

Our theme this year is "Fun With Our Sun", celebrating the observation and science of our nearest star. We will have speakers on solar science and solar telescopes to view the sun in various wavelengths. Our Beginners' Corner activities will involve the family in safe solar observation and, of course, we have our Beginners' Star Party at night.

Our skies this year are putting on a real planetary show, with Mars close to a very favorable opposition. Jupiter will be in the western sky and Saturn will show off its wide-open rings, rising just after 8:00 pm. The Moon rises later, so we'll also enjoy deep-sky viewing.

At night, we've expanded the star party activities to include both the upper and lower telescope fields. If you have a telescope of any size, bring it! If you are having problems with your telescope, bring it anyway; our "Telescope Urgent Care" booth will have knowledgeable amateurs who may be able to help.

The RTMC Astronomy Expo offers talks and activities at the Beginners' Corner, Merit Awards for telescope making, an Astro-Imaging Exhibition, an Imaging Workshop and activities for families with kids. Also this year, we are letting all kids, ages 0 to 17, enter the Expo for free. Fun things include the swimming pool, the zip line (extra fee), canoeing on the lake, the rock climbing wall, archery, and other activities. Don't forget the Swap Meet on Saturday and Sunday and see what everyone's selling.

### Keynote Speaker



This year our keynote speaker is Tamitha Mulligan Skov, a solar astronomer and "space weather forecaster." She hosts the online TV show, "Spaceweather.tv," telling us what is happening on our star and how it will affect us on Earth. Dr. Skov is an engaging speaker and active solar scientist, so her presentation is a must-see.

### AstroPhotography

David Ault is coming in from Texas to share his expertise in astro imaging with the RTMC attendees.

### Workshop

A senior electrical engineer at IBM, Dave is more known among the viewers of The Astro Imaging Channel as somebody at home with imaging equipment and software and, more importantly, Dave is somebody who can help other people understand it all. He has been an amateur astronomer for more than twenty-five years, with the last five particularly in imaging. He plans to talk about how to maximize your data, showing the fundamentals of image processing concepts. He will work through the steps of turning acquired data into a linear image, and then turning that linear data into a masterpiece. He is especially knowledgeable about PixInsight, and will show off a number of processes and scripts in the Pixinsight Tool Box. Even if you do not use PixInsight as your main tool, you will pick up a lot of useful ideas. And if you are a Pixinsight fan, you need to be there.

Dave has developed a number of advanced techniques, and has shared his expertise in small workshops and on his website <http://trappedphotons.com/>. Whether you are fairly advanced, or just dabbling, you will find value in this workshop. Also, you will get to spend the day with other amateur imagers, swapping stories, and sharing hints.

This is a premium workshop, available to no more than the first 50 to register. The workshop will be from 10:00 to 4:00 Sunday, with breaks for lunch. Through the years, these RTMC AE Premium Astrophoto Workshops have been over-booked by early April, so be sure to sign up early!

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## MESSAGE FROM MARTIN L. CAREY, PRESIDENT, RTMC ASTRONOMY EXPO --

I am sending this invitation to astronomy clubs in our region, hoping that you can join us this Memorial Day weekend for our 2016 RTMC Expo. As the new president of RTMC, I am working with our board to rebuild our event, knowing that astronomy

club members are vital in helping make RTMC great again. We would love to have your members be part of the RTMC tradition.

On Sunday afternoon at the 2015 Expo, we invited our guests to meet in the auditorium with RTMC Board members and make suggestions. Our meeting focused on improving attendance and general appeal. Suggestions are grouped into major categories.

**1. Bring back the star party to the Telescope field.**

Answer: Yes we will! We will bring back the nightlife to RTMC and are gathering leaders and telescopes.

**2. Astronomy clubs demonstrating Telescope Making.**

Answer: This has been a challenge. Our volunteers were contacting clubs and building scopes at RTMC in 2016. We will continue to look for clubs to take charge, and although ATM volunteers are harder to find, but we greatly value our telescope makers out there, and want to help show your work.

**3. Astronomy Club Conference to share knowledge.**

Answer: Excellent idea and we are exploring it. In 2015, we had clubs from East Bay, China Lake, Santa Barbara, Orange County, Los Angeles, Mt. Diablo, WAA, Riverside, Pomona Valley, Big Bear, and Camden City, Mo. RTMC will definitely do more in the future to serve astronomy clubs and showcase their accomplishments.

**4. Boy Scouts: Invite Boy Scouts and their families and offer astronomy badge classes, getting them involved in RTMC.**

Answer: We are working with Camp Oakes to bring in scout troops and we are building an astronomy badge course. We are also exploring astronomy programs for girl scouts.

**5. More Activities, including families:** More solar viewing would be good. Move show and tell to Sunday mornings and expand it. Encourage kids to enter our hobby. Have more software how to's, on devices that the kiddies already use.

Answer: Solar viewing is great, and our Theme this year is "Fun With Our Sun." Stand by for our show and tell feature on the schedule, coming soon. Kids and young people are very important to us, and we will be looking to encourage any

**6. Telescope Use Programs:** There are 1000's of unused telescopes in closets. Have a program to address those. How about a nightly "how to use your telescope"? People should know how to use their telescope by the time they leave RTMC.

Answer: We agree, so at Beginner's Star Party we will be available to assist any guests who want help with their scopes. Ask at the Info Booth, or any RTMC Expo Board member for assistance.

**7. Marketing: More and better use of social media. Bring in more vendors and interesting exhibits.**

Answer: Bringing in vendors is closely tied to attracting guests, and with a strained economy, we have to work harder to win them both back. We are redesigning our website and will bring it online soon. We are working with astronomy clubs to get out the word, and some of you are great at promoting RTMC. We love RTMC, and it is certainly worth our efforts. Best thing you can do is keep coming and show the vendors how much you appreciate them.

**8. Vendors:** Where are the big vendors? Can the vendors bring back the "2nds" again? We want good deals. Put an industry advisor liaison on Board, a non-voting member. Bring IDA back. Bring JPL in, especially if we have the Boy Scouts.

Answer: We are working to bring back the big vendors, and they are looking for greater guest numbers. Vendors will have to determine if bringing "seconds" is beneficial for them. At the Expo, ask the vendors for interesting offers and specials; there are always great deals to be found. Also, let them know what products you would like to see.

A big thanks to everyone who came! We can't do everything, but we are working hard to rebuild the RTMC Expo into a great event. Feel free to email me with suggestions or comments at [martincarey@sbcglobal.net](mailto:martincarey@sbcglobal.net).



## **SAN FRANCISCO AMATEUR ASTRONOMERS EXPEDITION**

**August 21, 2017**

**TOTAL SOLAR ECLIPSE  
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.

The club has arranged with a hotel in Teton Village, Wyoming, to enable advance bookings (2 years in advance!) with a special club rate of 10% discount. If you are a member of the SFAA and are interested in this, send an email to [2017eclipse@sfaa-astronomy.org](mailto:2017eclipse@sfaa-astronomy.org) and you'll be provided with additional details on the hotel and booking code. In the coming months the club will organize additional talks and events that will take place at the hotel on and before the date of totality. At this time, the most important thing is to book your hotel room so if you are at all considering this eclipse, get in touch and get your reservation in today. SFAA is not organizing air or ground transportation; that is left to each individual group or attendee.

If you have any other questions, send to [2017eclipse@sfaa-astronomy.org](mailto:2017eclipse@sfaa-astronomy.org).



# BAY AREA ASTRONOMY EVENTS

**Kenneth Lum**

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&sc=dir&slk=94>

## BAY AREA REGULARLY SCHEDULED EVENTS

<p><b>EVERY FRIDAY NIGHT 7:00 PM – 10:00 PM excluding major holidays</b></p> <p><b>The Telescope Makers’ Workshop</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER 10000 Skyline Boulevard Oakland, CA 94619-2450</b></p>	<p><b>THE TELESCOPE MAKERS’ WORKSHOP</b> is held every Friday night from 7pm - 10pm, excluding major holidays (e.g. Christmas Day and New Year's Day) that fall on Fridays. The Workshop is always closed on Memorial Day Weekend. Attendance every Friday night is not mandatory, and members work at their own pace. The Workshop meets at Chabot Space &amp; Science Center, 10000 Skyline Blvd., Oakland.</p> <p>Chabot's TMW is one of only a handful of regularly scheduled telescope making workshops in the U.S., and probably the world; it meets every Friday evening throughout the year, except Memorial Day weekend. It has been in operation since December of 1930, founded by Franklin B. Wright, and is currently run by Eastbay Astronomical Society member Rich Ozer, with help from other EAS members, Dave Barosso, Barry Leska, and others. The price of admission is FREE. All you have to do is show up, buy a mirror blank and a "tool" (typically around \$100 - \$200 depending on the size of the mirror) and start "pushin' glass!" We supply you with instruction, the various grits you'll need to first grind, and then polish and figure your mirror, and all the testing equipment needed. With a small bit of luck, you could wind up with a telescope that costs 1/3 or 1/4 the cost of a store-bought telescope, that is yet optically superior! It does take time - depending on how much time you put in on it, and other factors, it could take a few months or several months. But, it's a fun project, great for kids, and at the end you get a great telescope!</p> <p>For more information call or email Richard Ozer at <a href="mailto:rozer@pacbell.net">rozer@pacbell.net</a> or phone (510) 406-1914.</p>
<p><b>EVERY FRIDAY &amp; SATURDAY EVENING, weather permitting 7:30 PM – 10:30 PM</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER 10000 Skyline Boulevard Oakland CA 94619-2450 (510) 336-7300</b></p>	<p><b>EXPLORE THE NIGHT SKIES AT THE CHABOT OBSERVATORIES</b> For more information: <a href="http://www.chabotspace.org/">http://www.chabotspace.org/</a></p> <p><b>Free Telescope Viewing</b> Regular hours are every Friday &amp; Saturday evening, weather permitting: 7:30pm - 10:30pm Come for spectacular night sky viewing the best kept secret in the Bay Area and see the magnificence of our telescopes in action!</p> <p><b>Daytime Telescope Viewing</b> On Saturday and Sunday afternoons come view the sun, moon, or Venus through Chabot's telescopes. Free with General Admission. (weather permitting)</p> <p>12pm - 5pm: Observatories Open</p>



<p><b>Sunset – 5:11 PM (TWICE MONTHLY)</b></p> <p><b>Inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.</b></p> <p><b>SAN MATEO COUNTY ASTRONOMICAL SOCIETY STAR PARTY</b></p>	<p><b>STAR PARTIES AT CRESTVIEW PARK, SAN CARLOS</b></p> <p>Come out and bring the kids for a mind expanding look at the universe</p> <p>The City of San Carlos Parks and Recreation Department and the San Mateo County Astronomical Society have open Star Parties twice a month. These events are held in Crestview Park, San Carlos California. Note that inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.</p> <p>For more information call Bob Black, <b>(650)592-2166</b>, or send an email to <a href="mailto:SMCAS@live.com">SMCAS@live.com</a> or call Ed Pieret at <b>(650)862-9602</b>.</p> <p><b>Reasons to Attend</b></p> <p>If you have kids interested in space or planets bring them here for a real life view of planets, nebula, star clusters and galaxies.</p> <p>If you are thinking of buying a telescope or want help using a telescope you own, come here to talk with experienced users. If you think you might have an interest in astronomy come and talk to experienced amateur astronomers.</p> <p><b>Cautions</b></p> <p>Dress warmly and wear a hat.</p> <p>Visitors should park on the street and walk into the park so your headlights don't affect the observer's dark adaptation.</p> <p>Only park in the parking lot if you are arriving before dark and plan to stay until the end of the event.</p> <p>You shouldn't need lights but if you feel you do, only bring a small flashlight with the lens covered using red cellophane or red balloon.</p> <p>Please respect the telescopes and ask permission from the owner if you wish to touch.</p> <p>Parents, please watch your children.</p> <p>The park is residential, and adjacent to homes and backyards, please keep noise to a minimum.</p> <p><b>Schedule Time</b></p> <p>Astronomers arrive to set up at around sunset. Observing starts at about one hour after sunset and continues for two to three hours.</p>
<p><b>EVERY CLEAR SATURDAY MORNING OBSERVATORY 10:00 AM – 12:00 PM</b></p> <p><b>FOOTHILL COMMUNITY COLLEGE 12345 Moody Road Los Altos Hills</b></p> <p><b>Cost: Free</b></p>	<p>Solar observing with a Hydrogen alpha solar telescope every clear Saturday morning. This allows spectacular views of solar prominences and unusual surface features on the Sun not otherwise visible with regular white light telescopes. Admission is free.</p> <p>Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd. exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for \$ 3.00.</p>

<p><b>EVERY CLEAR FRIDAY EVENING</b>  <b>9:00 PM – 11:00 PM</b></p> <p><b>FOOTHILL COMMUNITY COLLEGE OBSERVATORY</b>  <b>12345 Moody Road</b>  <b>Los Altos Hills</b></p> <p><b>Cost: Free</b></p>	<p>Foothill Observatory is open for public viewing every clear Friday evening from 9:00 p.m. until 11:00 p.m. Visitors can view the wonders of the universe through the observatory's computer-controlled 16- inch Schmidt-Cassegrain telescope. Views of objects in our solar system may include craters and mountains on the moon, the moons and cloud-bands of Jupiter, the rings of Saturn, etc. Deep space objects including star clusters, nebulae, and distant galaxies also provide dramatic demonstrations of the vastness of the cosmos. The choice of targets for Any evening's viewing depends on the season and what objects are currently in the sky.</p> <p>The public viewing programs at Foothill are free of charge and are open to guests of all ages. Please note that the observatory is closed when the weather is cloudy. Also note that visitor parking permits are available from the machines in the parking lots for \$3.00.</p> <p>Come to Foothill Observatory and join us in the exploration of our Universe!</p> <p>Foothill Observatory is located on the campus of Foothill College in Los Altos Hills, CA. Take Highway 280 to the El Monte Rd exit. The observatory is next to parking lot 4. Parking at the college requires visitor parking permits that are available from the machines in the parking lots for \$3.00.</p>
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**BAY AREA EVENTS – APRIL 2016**

<p><b>FRIDAY, 4/1</b>  <b>8:00 PM</b></p> <p><b>SAN MATEO COUNTY ASTRONOMICAL SOCIETY</b>  <b>COLLEGE OF SAN MATEO</b>  <b>Building 36</b>  <b>1700 West Hillsdale Road</b>  <b>San Mateo CA 94402</b></p> <p><b>Cost: Free</b></p>	<p><b>R. JAY GABANY, ASTROPHOTOGRAPHER</b>  <b>RIVER OF STARS</b></p> <p>An ongoing collaboration between the speaker and an international team of professional astronomers has demonstrated the scientific potential of using modest aperture, commercially produced, semi-robotic telescopes situated under steady dark skies and affordable off-the-shelf astronomical cameras to reveal extremely dim, diffuse structures on the outskirts of distant galaxies that shed light on galactic evolution. This presentation will share techniques, experiences and highlights of the investigations thus far.</p> <p>Among his many accomplishments, GaBany's image of NGC 3521 was selected as the backdrop for the official crew portrait of Expedition 30 to the International Space Station. In 2012 and again in 2013, he was selected by the editors of Time magazine as one of "The 25 Most Influential People in Space."</p>
<p><b>MONDAY, 4/04</b>  <b>7:30 PM</b></p> <p><b>BENJAMIN DEAN ASTRONOMY LECTURE</b>  <b>CALIFORNIA ACADEMY OF SCIENCES</b>  <b>55 Music Concourse Dr.</b>  <b>San Francisco, CA 94118</b></p> <p><b>Cost: \$12 General</b></p>	<p><b>Franck Marchis, SETI Institute</b>  <b>Tiny Moons Around Asteroids</b></p> <p>After decades of speculation, the existence of multiple asteroids---asteroids with one or several companions around them---has been observationally confirmed. Today more than 200 companions of asteroids are known, and half of them were discovered by a large worldwide network of professional and amateur astronomers equipped with small and medium size telescopes. By detection of small dips in brightness due to mutual eclipse events, these surveys give us the opportunity to better understand these fascinating mini-planetary systems. Asteroid multiplicity is an astronomical prize for observers and theorists alike, since it helps constrain theories on the origin of our solar system. Dr. Marchis will briefly describe the powerful adaptive optics technology used today that make it possible to image several multiple asteroid systems. He will also present several NASA and ESA space mission concepts dedicated to explore these new worlds in-situ.</p>

<p><b>\$8 Members</b> <b>\$10 Seniors</b></p>	<p>Website: <a href="http://www.calacademy.org/events/benjamin-dean-astronomy-lectures/tiny-moons-around-asteroids">http://www.calacademy.org/events/benjamin-dean-astronomy-lectures/tiny-moons-around-asteroids</a></p>
<p><b>TUESDAY, 4/5</b> <b>12:00 NOON</b></p> <p><b>SETI INSTITUTE</b> <b>1065 LA AVENIDA</b> <b>MICROSOFT SVC</b> <b>BUILDING One Galileo</b> <b>Auditorium</b> <b>Mountain View, CA</b> <b>94043</b></p>	<p><b>SETI INSTITUTE COLLOQUIUM SERIES</b></p> <p><b>BOB RICHARDS, MOON EXPRESS</b> <b>MOON EXPRESS 2017 - A PRIVATE LUNAR MISSION ENABLING SCIENCE &amp; COMMERCE</b></p> <p>The health of our home planet and the survival of our species will only be secured through the use of space resources and the expansion of Earth's economic sphere to the Moon and beyond. Creating an off-Earth economy and multi-planet civilization will safeguard the long term prospects of humanity.</p> <p>Bob Richards is Co-Founder and CEO of Moon Express, Inc. (MoonEx), a privately funded lunar transportation and space resource development company, striving to become the first commercial company to land on the Moon, a challenge only accomplished by 3 superpowers in history. Located at Cape Canaveral, Moon Express has contracted for 3 launches to the Moon with Rocket Lab between 2017 and 2020, is partnered with NASA under its Lunar CATALYST program, and is one of only two teams in the Google Lunar X PRIZE competition with a verified launch contract.</p> <p>In this talk Bob Richards outlines Moon Express and it plans to develop lunar resources, and how this goal has set in motion technological, political, legal and regulatory precedents that will allow humanity to rationally and peacefully embrace and develop the Moon as the world's eighth continent.</p>
<p><b>WEDNESDAY, 4/6</b> <b>7:00 PM</b></p> <p><b>SMITHWICK</b> <b>THEATER</b> <b>FOOTHILL COLLEGE</b> <b>12345 El Monte Road</b> <b>Los Altos Hills, CA</b></p> <p><b>The lecture is free, but there is a charge of \$3 for parking on campus and exact change is appreciated.</b></p>	<p><b>SILICON VALLEY ASTRONOMY LECTURE SERIES</b> <b>DR. TOM ABEL, STANFORD UNIVERSITY</b> <b>FREE, ILLUSTRATED, NON-TECHNICAL TALK ON:</b> <b>“HOW THINGS IN THE UNIVERSE CAME ABOUT AND HOW THEY ENDED UP WITHIN US”</b></p> <p>Abel will take the audience on a journey through the early stages of the universe, using the latest computer animations of how the first stars formed and died, and how stars built up the first galaxies. His work has shown that the first luminous objects in the universe were very massive stars, shining one million times as brightly as our Sun. They died quickly and seeded the cosmos with the chemical elements necessary for life. Galaxies started to assemble just one hundred million years after the Big Bang, and they are still growing now. Computer simulations of these events provide remarkable insights into the early history of the cosmos.</p> <p>Abel is a computational astronomer who explores cosmic history using supercomputer calculations. A professor of physics at Stanford University and the SLAC National Accelerator Laboratory, he directs the Kavli Institute for Particle Astrophysics and Cosmology. Abel's long-term goal is "to build a galaxy, one star at a time," via computer modeling. Among his research interests are the processes and events of "the dark ages," the first few hundred million years after the Big Bang. His visualizations and simulations of dark-age events and have been featured on PBS, the Discovery Channel, and the cover of National Geographic.</p> <p>Foothill College is just off the El Monte Road exit from Freeway 280 in Los Altos. For directions and parking information, see: <a href="http://www.foothill.edu/news/transportation.php">http://www.foothill.edu/news/transportation.php</a> For a campus map, see: <a href="http://www.foothill.edu/news/maps.php">http://www.foothill.edu/news/maps.php</a></p> <p>The lecture is co-sponsored by: * The Astronomical Society of the Pacific</p>

	<p>* The SETI Institute * NASA Ames Research Center * The Foothill College Astronomy Program.</p> <p>We get large crowds for these talks, so we ask people to try to arrive a little bit early to find parking.</p>
<p>THURSDAY, 4/7 7:00 PM</p> <p>LOCKHEED MARTIN 3251 HANOVER ST BUILDING 202 AUDITORIUM PALO ALTO, CA 94304</p>	<p><b>LOCKHEED</b>                                      <b>MARTIN</b>                                      <b>COLLOQUIA</b></p> <p><b>MR. GREG EDWARDS</b> <b>SUNSET GREEN FLASH</b></p>
<p><b>SATURDAY, 4/09</b> <b>12:00 PM - 04:00 PM</b></p> <p><b>THE SPACE STATION</b> <b>MUSEUM</b> <b>464 Ignacio Blvd</b> <b>Novato, CA 94949</b></p> <p><b>Cost: Free</b></p>	<p><b>'GLORY TO GAGARIN' AND THE HUMAN RACE IN SPACE</b></p> <p>In addition to our fabulous collection of Soviet space program artifacts (including a piece of Yuri's space flight suit), we'll have Yuri videos going, Russian music, Russian tea cookies and a LIVE SKYPE w/ APOLLO 15 CMP Astronaut AL WORDEN!!! He was there for the birth of the space age and the heated space race. We'll hear about his experience and impressions about early space flight and he'll take your questions.</p> <p>Website: <a href="http://www.thespacestationca.org/SpecialEvents.shtml">http://www.thespacestationca.org/SpecialEvents.shtml</a></p>
<p>Saturday, 4/09 7:30 PM</p> <p>SAN JOSE ASTRONOMICAL ASSOCIATION Houge Park Twilight Drive San Jose, CA 95124</p> <p><b>Cost: Free</b></p>	<p><b>DR. SUKANYA CHAKRABARTI, ROCHESTER INSTITUTE OF TECHNOLOGY</b> <b>THE MYSTERY OF DARK MATTER</b></p> <p>Dark matter is believed to pervade our universe, but there are few ways to find and understand this mysterious stuff that does not emit any light. I will review how the astronomical community first inferred the existence of dark matter and the current methods used to search for it. My own work in understanding dark matter is similar to the hunt for planets in the 1800s. I use a dynamical analysis to infer properties of dark-matter dominated dwarf galaxies from studying the gravitational tides they raise on galactic disks. We now have evidence that this method, that we call Galactoseismology (or analyzing Galaxy quakes), gives us a new way to hunt for the darkest galaxies and understand how dark matter is distributed in galaxies like our own.</p>

<p><b>SATURDAY, 4/09</b> <b>8:00 PM</b></p> <p><b>CUSHING MEMORIAL ('MOUNTAIN') AMPHITHEATER</b> <b>MT TAMALPAIS STATE PARK</b> <b>Pan Toll Road and Ridgecrest Blvd</b> <b>Mill Valley CA 94941</b></p> <p><b>Cost: Free</b></p>	<p><b>HOLGER MUELLE, UC BERKELEY</b> <b>SHINING LIGHT ON THE DARK SIDE WITH LASERS AND ATOMS</b> Multiple lines of astronomical evidence demonstrate the existence of dark matter and dark energy - mysterious stuff whose gravity holds galaxies together and drives the accelerated expansion of the universe. Precision measurements in physics are suitable for searching for ultralight dark-sector candidates.</p>
<p><b>Monday, 4/11</b> <b>7:30 PM</b></p> <p><b>LONG NOW FOUNDATION</b> <b>SF JAZZ CENTER</b> <b>201 Franklin St</b> <b>San Francisco, CA 94102</b></p> <p><b>Cost: TBA (free for members)</b></p>	<p><b>SOLVING DARK MATTER AND DARK ENERGY</b> <b>SPEAKER: PRIYAMVADA NATARAJAN</b></p> <p>Website: <a href="http://longnow.org/seminars/02016/apr/11/solving-dark-matter-and-dark-energy/">http://longnow.org/seminars/02016/apr/11/solving-dark-matter-and-dark-energy/</a></p>

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>

## ARTICLES OF INTEREST

[TEACHABLE MOMENTS](#) | MARCH 23, 2016

### MODELING GRAVITATIONAL WAVES

By [Lyle Tavernier](#)



The collision of two black holes 1.3 billion years ago (as shown in this animation) produced gravitational waves that were detected for the first time by researchers at the Laser Interferometer Gravitational-Wave Observatory (LIGO) on September 14, 2015.

Credit: Caltech

#### In the News

A century ago, Albert Einstein theorized that when objects move through space they create waves in spacetime around them. These gravitational waves move outward, like ripples from a stone moving across the surface of a pond. Little did he know that 1.3 billion years earlier, two massive black holes collided. The collision released massive amounts of energy in a fraction of a second (about 50 times as much as all of the energy in the visible universe) and sent gravitational waves in all directions. On September 14, 2015 those waves reached Earth and were [detected by researchers at the Laser Interferometer Gravitational-Wave Observatory \(LIGO\)](#).

#### Why is It Important?

Einstein published the Theory of General Relativity in 1915. In it, he predicted the existence of gravitational waves, which had never been directly detected until now. In 1974, physicists discovered that two neutron stars orbiting each other were getting closer in a way that matched Einstein's predictions. But it wasn't until 2015, when LIGO's instruments were upgraded and became more sensitive, that they were able to detect the presence of actual gravitational waves, confirming the last important piece of Einstein's theory.

It's also important because gravitational waves carry information about their inception and about the fundamental properties of gravity that can't be seen through observations of the electromagnetic spectrum. Thanks to LIGO's discovery, a new field of science has been born: gravitational wave astronomy.

#### How Did They Do It?

LIGO consists of facilities in Washington and Louisiana. Each observatory uses a laser beam that is split and sent down 2.5-mile (4-kilometer) long tubes. The laser beams precisely indicate the distance between mirrors placed at the ends of each tube. When a gravitational wave passes by, the mirrors move a tiny amount, which changes the distance between them. LIGO is so sensitive that it can detect a change smaller than 1/10,000 the width of a proton ( $10^{-19}$  meter). Having two observatories placed a great distance

apart allows researchers to approximate the direction the waves are coming from and confirm that the signal is coming from space rather than something nearby (such as a heavy truck or an earthquake).

### Teach It

Creating a model that demonstrates gravitational waves traveling through spacetime is as simple as making a gelatin universe!

### › See the activity!

Middle school students can develop a model that shows gravitational waves traveling through spacetime while working toward the following Next Generation Science Standard:

- **MS-PS4-2** - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

### Explore More

- [Gravitational waves news, videos and resources](#)
- [Laser Interferometer Gravitational-Wave Observatory \(LIGO\) Website](#)



### ABOUT THE AUTHOR

[Lyle Tavernier](#), Educational Technology Specialist, NASA/JPL Education Office

*Lyle Tavernier is an educational technology specialist at NASA's Jet Propulsion Laboratory. When he's not busy working in the areas of distance learning and instructional technology, you might find him running with his dog, cooking or planning his next trip.*

March 3, 2016

## Hubble Team Breaks Cosmic Distance Record

By pushing NASA's Hubble Space Telescope to its limits, an international team of astronomers has shattered the cosmic distance record by measuring the farthest galaxy ever seen in the universe. This surprisingly bright infant galaxy, named GN-z11, is seen as it was 13.4 billion years in the past, just 400 million years after the Big Bang. GN-z11 is located in the direction of the constellation of Ursa Major.

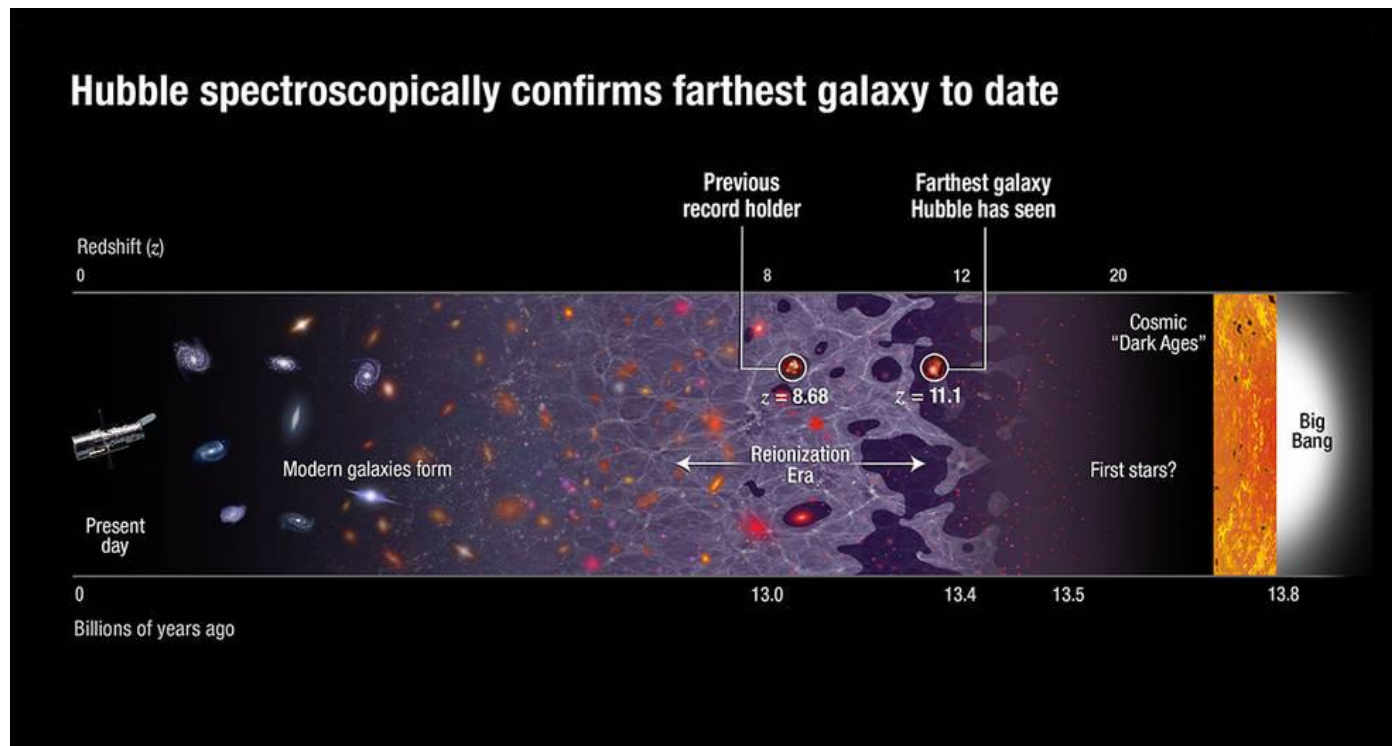
This animation shows the location of galaxy GN-z11, which is the farthest galaxy ever seen. The video begins by locating the Big Dipper, then showing the constellation Ursa Major. It then zooms into the GOODS North field of galaxies, and ends with a Hubble image of the young galaxy. GN-z11 is shown as it existed 13.4 billion years in the past, just 400 million years after the big bang, when the universe was only three percent of its present age.

**Credits: Video - NASA, ESA, and G. Bacon (STScI); science - NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale University), and G. Illingworth (University of California, Santa Cruz)**

"We've taken a major step back in time, beyond what we'd ever expected to be able to do with Hubble. We see GN-z11 at a time when the universe was only three percent of its current age," explained principal investigator Pascal Oesch of Yale University. The team includes scientists from Yale University, the Space Telescope Science Institute (STScI), and the University of California.

Astronomers are closing in on the first galaxies that formed in the universe. The new Hubble observations take astronomers into a realm that was once thought to be only reachable with NASA's upcoming James Webb Space Telescope.

This measurement provides strong evidence that some unusual and unexpectedly bright galaxies found earlier in Hubble images are really at extraordinary distances. Previously, the team had estimated GN-z11's distance by determining its color through imaging with Hubble and NASA's Spitzer Space Telescope. Now, for the first time for a galaxy at such an extreme distance, the team used Hubble's Wide Field Camera 3 to precisely measure the distance to GN-z11 spectroscopically by splitting the light into its component colors.



Hubble spectroscopically confirms farthest galaxy to date.

**Credits: NASA, ESA, B. Robertson (University of California, Santa Cruz), A. Feild (STScI)**

Astronomers measure large distances by determining the “redshift” of a galaxy. This phenomenon is a result of the expansion of the universe; every distant object in the universe appears to be receding from us because its light is stretched to longer, redder wavelengths as it travels through expanding space to reach our telescopes. The greater the redshift, the farther the galaxy.

“Our spectroscopic observations reveal the galaxy to be even farther away than we had originally thought, right at the distance limit of what Hubble can observe,” said Gabriel Brammer of STScI, second author of the study.

Before astronomers determined the distance for GN-z11, the most distant galaxy measured spectroscopically had a redshift of 8.68 (13.2 billion years in the past). Now, the team has confirmed GN-z11 to be at a redshift of 11.1, nearly 200 million years closer to the Big Bang. “This is an extraordinary accomplishment for Hubble. It managed to beat all the previous distance records held for years by much larger ground-based telescopes,” said investigator Pieter van Dokkum of Yale University. “This new record will likely stand until the launch of the James Webb Space Telescope.”

The combination of Hubble’s and Spitzer’s imaging reveals that GN-z11 is 25 times smaller than the Milky Way and has just one percent of our galaxy’s mass in stars. However, the newborn GN-z11 is growing fast, forming stars at a rate about 20 times greater than our galaxy does today. This makes an extremely remote galaxy bright enough for astronomers to find and perform detailed observations with both Hubble and Spitzer.

The results reveal surprising new clues about the nature of the very early universe. “It’s amazing that a galaxy so massive existed only 200 million to 300 million years after the very first stars started to form. It takes really fast growth, producing stars at a huge rate, to have formed a galaxy that is a billion solar masses so soon,” explained investigator Garth Illingworth of the University of California, Santa Cruz.

These findings provide a tantalizing preview of the observations that the James Webb Space Telescope will perform after it is launched into space in 2018. “Hubble and Spitzer are already reaching into Webb territory,” Oesch said.



“This new discovery shows that the Webb telescope will surely find many such young galaxies reaching back to when the first galaxies were forming,” added Illingworth.

This discovery also has important consequences for NASA’s planned [Wide-Field Infrared Survey Telescope](#) (WFIRST), which will have the ability to find thousands of such bright, very distant galaxies.

The team’s findings have been accepted for publication in an upcoming edition of the Astrophysical Journal.

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, Inc., in Washington.

For more information about previous times Hubble broke the distance record, visit:

- [http://www.nasa.gov/mission\\_pages/hubble/science/distance-record.html](http://www.nasa.gov/mission_pages/hubble/science/distance-record.html)
- [http://www.nasa.gov/mission\\_pages/hubble/science/sn-wilson.html](http://www.nasa.gov/mission_pages/hubble/science/sn-wilson.html)
- <https://www.nasa.gov/press/2014/july/hubble-shows-farthest-lensing-galaxy-yields-clues-to-early-universe/>

For images and more information about Hubble, visit:

- <http://www.nasa.gov/hubble>



**San Francisco Amateur Astronomers - 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.
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

Please mail to me a Mt. Tamalpais Parking Permit

**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**

New members will be entered onto the SFAA roster on the Night Sky Network (NSN) and will receive a verifying email from the NSN with username and password for the NSN. Renewing members will have their information updated but will not receive an email from the NSN. Both new and renewing members will receive a verifying email from the SFAA Treasurer upon completion of the membership process.