

# ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 64, No. 1 – January 2016

**FRIDAY, JANUARY 22, 2015 - 5:00 pm – 9:00 pm**  
**SFAA ANNUAL AWARDS AND MEMBERSHIP DINNER**  
**MARIPOSA HUNTER'S POINT YACHT CLUB**  
**405 Terry A. Francois Boulevard**  
**San Francisco**

Directions: <http://www.yelp.com/map/mariposa-hunters-point-yacht-club-san-francisco>



Dear Members, our Annual January get-together will be Friday, January 22nd, 2016 from 5:00 to 9:00 at the Mariposa, Hunter's Point Yacht Club. There are many things to celebrate in this fun atmosphere, with tacos served by El Tonayense, salads & more, along with a full cash bar. All members are invited and SFAA will be paying for food. Non-members are welcome at a cost of \$25. Telescopes will be set up on the patio, which provides beautiful views of the bay.

We will be celebrating a year when we have made a successful transition to the Presidio, have continued the success of the sharing and viewing we have on Mt Tam, expanded and strengthened our City Star Parties and volunteered at many schools. Our Yosemite trip was very successful and the opportunity to tour Lick Observatory will not be soon forgotten. We will also be welcoming new members to our board and commending those whose work and commitment, our club could not function without.

We look forward to enjoying the evening with all those who enjoy the night sky with the San Francisco Amateur Astronomers. There is plenty of parking, as well as easy access from the KT line and the 22 bus.

Please RSVP at [aachopmra@gmail.co](mailto:aachopmra@gmail.co)

Anil Chopra



# 2016 SAN FRANCISCO AMATEUR ASTRONOMERS GENERAL ELECTION

The following members have been elected to serve as San Francisco Amateur Astronomers' Officers and Directors for calendar year 2016.

President

**MICHAEL PATRICK**

Vice President

**MATT JONES**

Treasurer

**KATIE GALLINGER**

Secretary

**ANTHONY BARREIRO**

Directors

**PJ CABRERA . ANIL CHOPRA**  
**BRIAN KRUSE . SCOTT MILLER**  
**AGNES PYRCHLA . DOUGLAS SMITH**  
**LIZ TRIGGS**

Alternate Director

**PAUL SALAZAR**

The Officers and Directors are responsible for planning and coordinating club activities -- including our meetings, star parties, school programs, telescope loan program, telescope making workshop, liaison with media and other community organizations, and other outreach and public education activities -- as well as the behind-the-scenes work involved in running a 501(c)3 nonprofit educational organization. More information about the duties of officers and directors can be found at <http://www.sfaa-astronomy.org/sfaa-bylaws/>.

If you have any questions, feedback, requests, or suggestions -- or if you want to help out with club activities -- please contact the officers and board via <http://www.sfaa-astronomy.org/contact-us/>. We look forward to hearing from you.



## **SFAA 2016 LECTURE SERIES UPCOMING LECTURES**

**February 16 BRIAN H. DAY**  
**NASA SOLAR SYSTEM EXPLORATION RESEARCH VIRTUAL INSTITUTE LEAD FOR  
CITIZEN SCIENCE, PLANETARY MAPPING, AND OUTREACH FILMS**

### **A HARD RAIN'S A-GONNA FALL**



Throughout the entire history of life on Earth, we have been at the mercy of the deadly impacts by rocks from space. Just ask the dinosaurs! On multiple occasions, devastating impacts from Near Earth Objects (NEOs) have probably wiped out life on Earth, requiring life here to start over again. However, these events are not relegated to Earth's distant past. Each year, Earth experiences multiple near misses by asteroids and, as in the case of the Chelyabinsk event of 2013, sometimes takes a direct hit. But now, for the first time in the entire history of life on Earth, we have the capability of doing something about it. In this talk, we will examine the threats posed to us by NEOs, explore strategies and technologies to mitigate these threats, and look at ways

in which the amateur astronomy community can help save the world.

*Brian Day works at NASA's Solar System Exploration Research Virtual Institute where he serves in lead positions for lunar and planetary mapping and modeling, citizen science, and outreach. He is a member of the site selection and analysis teams for the Resource Prospector and Lunar Mission One missions to the Moon, and is supporting analysis of potential human landing sites on Mars. Brian was the Education and Public Outreach Lead for NASA's LCROSS and LADEE lunar missions. He has participated in a number of Mars analog field studies in some of Earth's harshest environments, and in 2007, flew on NASA's Aurigid MAC mission to record fragments of comet Kiess entering Earth's upper atmosphere.*

**March 15 DR. AMY FURNISS**  
**THE VIOLENT UNIVERSE OBSERVED WITH THE FERMI TELESCOPE**



The Fermi Gamma-ray Space Telescope was launched into space in June 2008. The main instrument is the Large Area Telescope (LAT). Dr. Amy Furniss will present the Fermi-LAT instrument and highlight its most interesting results after seven years of operation. Gamma-ray observations open a new window into the universe, allowing us the study of exotic and violent processes. These photons are also an important tool in the search for the dark matter that pervades the universe. One expected signal is gamma rays from annihilations of massive dark matter particles, and the LAT has made by far the most sensitive searches for this process. The high-energy sky seen by the Fermi-LAT is quite

dynamic, including explosions of

massive stars and their remnants and supermassive black holes in the centers of distant galaxies. The Fermi-LAT also enabled the identification of many cosmic particle accelerators, including supernova remnants and active galactic nuclei, which are far more powerful than the largest particle accelerator on Earth, the Large Hadron Collider in Europe.

*Dr. Amy Furniss moved into a post-doctoral position at Stanford University for 2 years after completion of her PhD in Physics at UC Santa Cruz in 2013, She is now an Assistant Professor at Cal State University East Bay in Hayward California and continues to collaborate closely with connections at both UC Santa Cruz and Stanford.*

**April 19 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.*

**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.*





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



Each year the Marin County Free Library (MCFL) chooses a book to be read and discussed during the same time period at all branches. “The goal of One Book One Marin is to build a stronger, enriched community through library utilization, community dialogue, and the exploration of literature and culture. A variety of community partners collaborate to bring the community interesting programming and events related to the book throughout a three-month period, February – April, each year. Anyone can participate. All events are free and open 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:

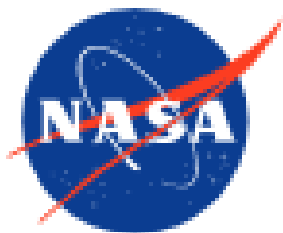
Set up: 5:30; Talk 6:30; Viewing 6:45-8:00	
Thursday, February 4	Bolinas Fire Station
Tuesday February 9	South Novato Library
Set up: 5:30; Talk 6:40; Viewing 7:00-8:15	
Tuesday, March 8	Fairfax Library
Thursday, March 10	Point Reyes Library
Set up: 6:30; Talk 7:40; Viewing 8:00-8:45	
Tuesday, April 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



NASA – JPL What's Up - January 2016

## **WHAT'S UP FOR JANUARY? A METEOR SHOWER, A BINOCULAR COMET, AND THE WINTER CIRCLE OF STARS!**

**Jane Houston Jones**

### **WHAT'S UP FOR JANUARY? A METEOR SHOWER, A BINOCULAR COMET, AND THE WINTER CIRCLE OF STARS!**

Hello and welcome. I'm Jane Houston Jones from NASA's Jet Propulsion Laboratory in Pasadena, California.

In case you missed last month's Geminid and Ursid meteor showers, January 4th's Quadrantids will either sizzle or fizzle for observers in the U.S. The shower may favor the U.S., or it could favor Europe, depending on which prediction turns out to be correct. The shower's radiant, in the obsolete constellation Quadrans Muralis, is in a star-poor but familiar area in the northeast sky. It makes a triangle with Ursa Major and Ursa Minor – the big and little dippers. U.S. Observers should begin looking at 08:00 Universal Time – that's midnight Pacific or 3 a.m. Eastern - and European observers should look 8 hours earlier at 00 UT. The peak should last about two hours, with rates of 120 meteors per hour predicted in areas with a dark sky.

In the middle of the month, midnight through pre-dawn will be prime time for viewing comet Catalina. It's also near Ursa Major this month. It should be visible in binoculars if you have a dark sky, but a telescope would be ideal. Between the 14th and the 17th, the comet will pass by two stunning galaxies: M51, the Whirlpool galaxy and M101, a fainter spiral galaxy.

Winter is also the best time to view the constellation Orion in the southeastern sky. Even from the city, you'll see that its stars have different colors. No telescope needed. Just look up a few hours after sunset. Orion's shoulder star Betelgeuse is a red giant while its opposite knee is blue. And below the familiar belt stars is the Orion Nebula, a star-forming region, easily visible with binoculars.

The colorful stars of Orion are part of the Winter Circle of Stars. Let's start with Orion's blue star Rigel, and work clockwise to create the circle. At 6 o'clock, notice the brilliant white of Sirius, the brightest star in our northern hemisphere skies. Next up is faint yellow Procyon at 8 o'clock, and the colorful Gemini Twins Pollux and Castor at 10 o'clock. Brighter Pollux is faint orange and Castor is white. Yellow Capella appears at 12 o'clock. Finally at 2 o'clock stunning orange Aldebaran is near the Pleiades, in the constellation Taurus the bull. In the middle of our circle lies red Betelgeuse.

A star's color reveals the star's temperature and age. In a flame, the hottest part is blue, and the cooler parts are yellow and red. Stars work the same! The hotter a star, the more blue light it produces. The cooler the star, the more red light it produces. Medium-hot stars like our sun are yellow.

You can learn about all of NASA's studies of the stars and much more at [www.NASA.gov](http://www.NASA.gov)



## **SAN FRANCISCO AMATEUR ASTRONOMERS EXPEDITION**

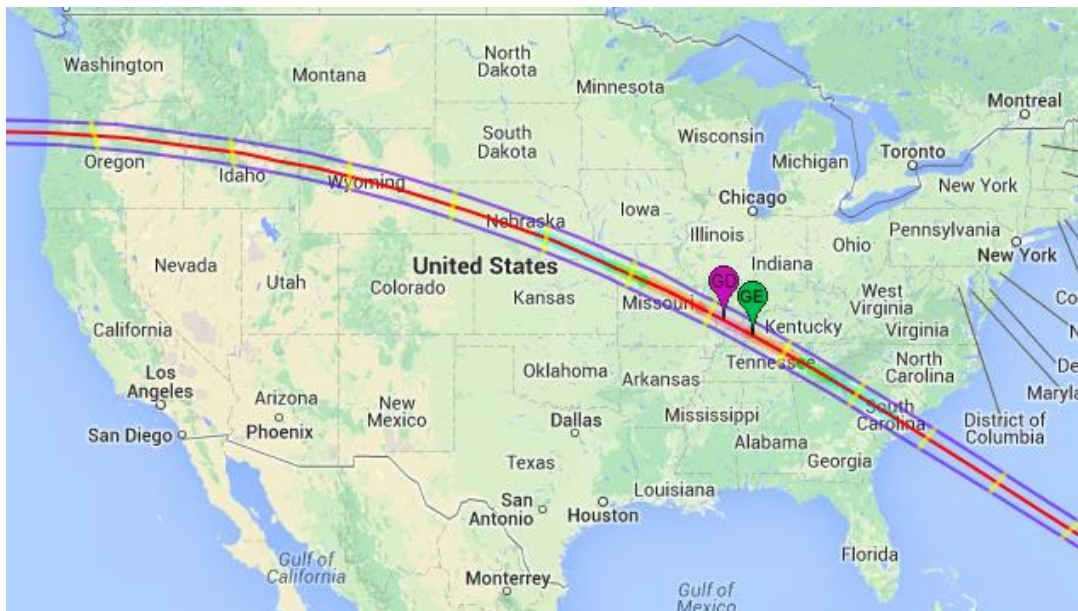
**August 21, 2017**

**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&sec=dir&slk=94>

## BAY AREA REGULARLY SCHEDULED EVENTS

**EVERY FRIDAY NIGHT  
7:00 PM – 10:00 PM  
excluding major holidays**

**The Telescope Makers'  
Workshop**

**CHABOT SPACE AND  
SCIENCE CENTER  
10000 Skyline Boulevard  
Oakland, CA 94619-2450**

**THE TELESCOPE MAKERS' WORKSHOP** 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 & Science Center, 10000 Skyline Blvd., Oakland.

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!

For more information call or email Richard Ozer at [rozer@pacbell.net](mailto:rozer@pacbell.net) or phone (510) 406-1914.

**EVERY FRIDAY &  
SATURDAY EVENING,  
weather permitting  
7:30 PM – 10:30 PM**

**CHABOT SPACE AND  
SCIENCE CENTER  
10000 Skyline Boulevard  
Oakland CA 94619-2450  
(510) 336-7300**

### **EXPLORE THE NIGHT SKIES AT THE CHABOT OBSERVATORIES**

For more information: <http://www.chabot.space.org/>

#### **Free Telescope Viewing**

Regular hours are every Friday & 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!

**Daytime Telescope Viewing** On Saturday and Sunday afternoons come view the sun, moon, or Venus through Chabot's telescopes. Free with General Admission. (weather permitting)

12pm - 5pm: Observatories Open



<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>
---	---

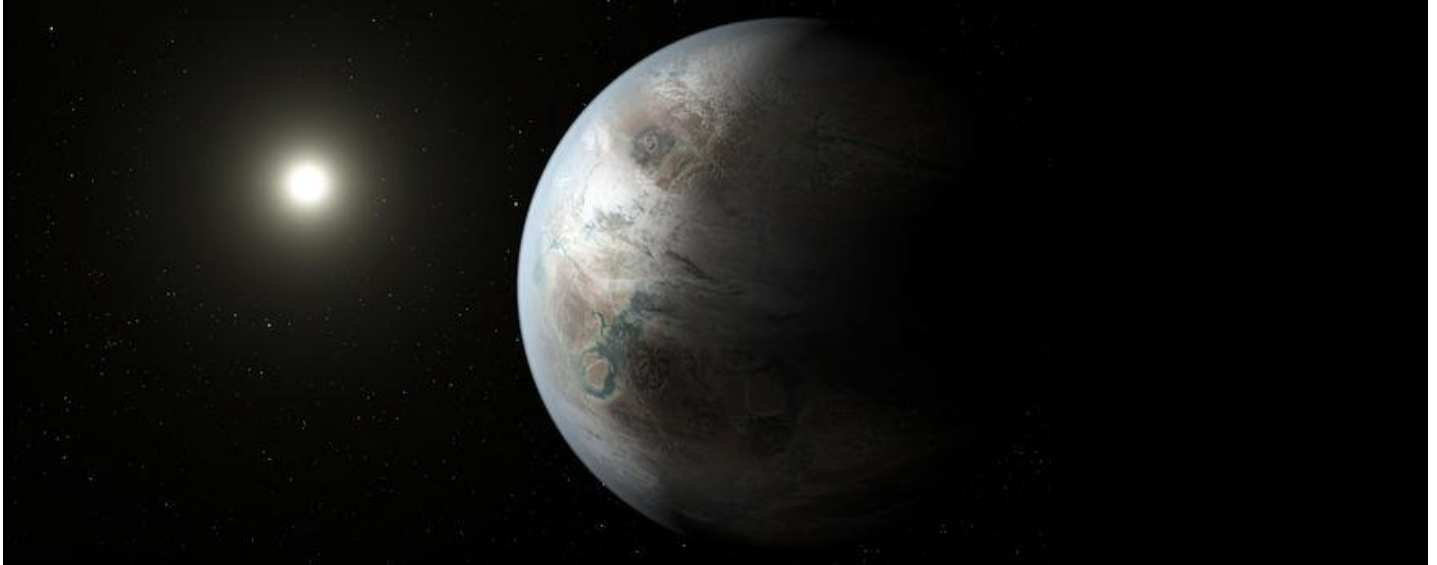
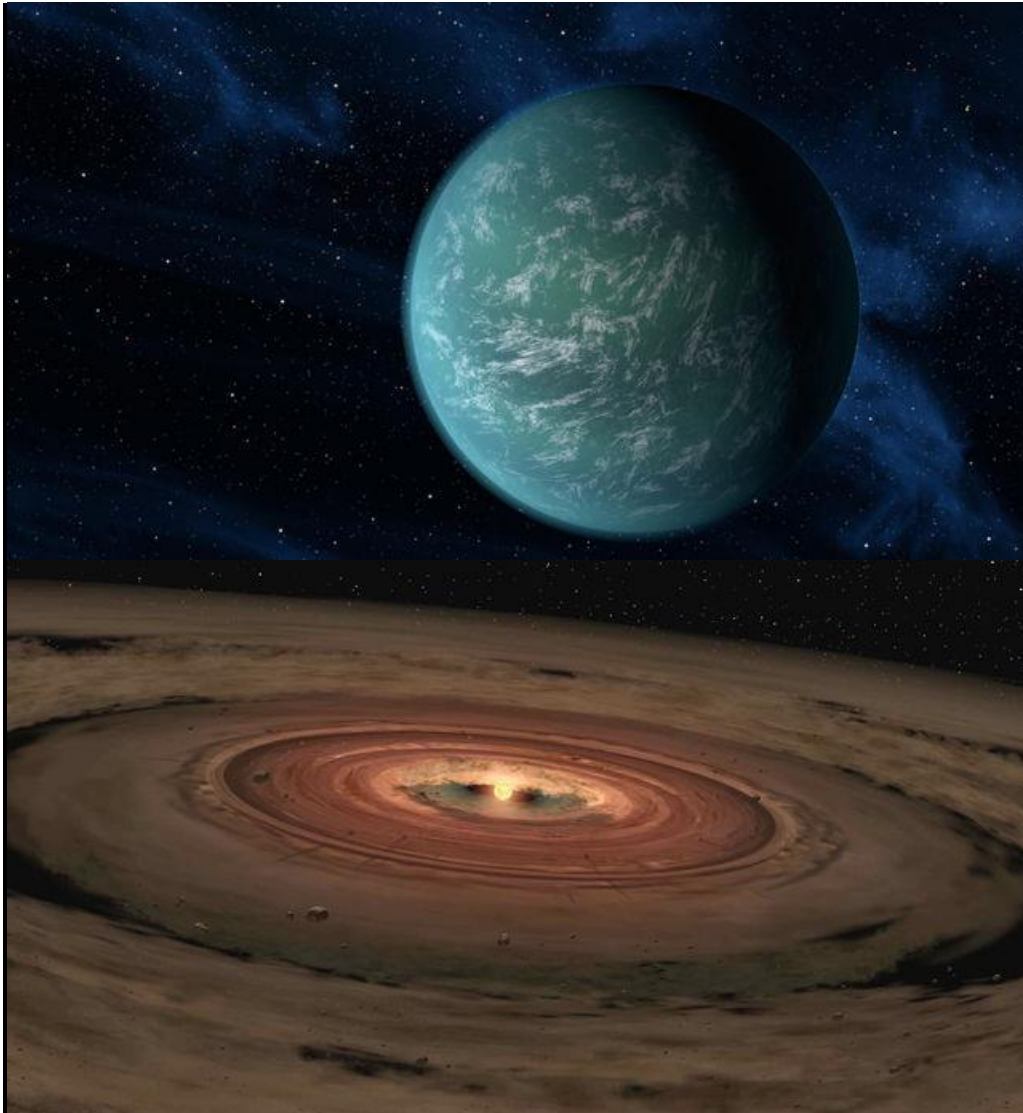
## **BAY AREA EVENTS – JANUARY 2016**

<p><b>MONDAY, 1/4</b> <b>12:00 AM – 3:00 AM</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER</b> <b>10000 Skyline Boulevard</b> <b>Oakland CA 94619-2450</b> <b>(510) 336-7300</b></p> <p><b>Cost: \$5</b></p>	<p><b>QUADRANTIDS METEOR SHOWER</b></p> <p>Hang out on the hill with us as we watch the Quadrantids Meteor Shower make it's annual trip through our atmosphere and light up the night sky. Our scientists will be ready to help you catch the brightest meteors in this prolific shower!</p> <p>*Visibility may be obscured by the waning gibbous (nearly full) moon</p> <p>Website: <a href="http://www.chabotspace.org/events.htm">http://www.chabotspace.org/events.htm</a></p>
<p><b>THURSDAY, 1/07</b> <b>11:00 AM - 12:00 PM</b></p> <p><b>KAVLI INSTITUTE ASTROPHYSICS COLLOQUIUM</b> <b>Location TBA</b> <b>Stanford, CA 94305</b></p> <p><b>Cost: Free</b></p>	<p><b>BRIAN METZGER, COLUMBIA UNIVERSITY</b> <b>SIGNATURES OF NEUTRON STAR MERGERS IN THE ERA OF ADVANCED LIGO</b></p> <p>Coalescing stellar mass compact objects (binary neutron stars and black holes) are promising sources for the direct detection of gravitational waves by Advanced LIGO in the next few years, if not this fall. Maximizing the scientific return from such a discovery will require identifying a coincident electromagnetic counterpart. One possible counterpart is a short gamma ray burst, powered by the accretion of a centrifugally supported torus onto the central black hole. Neutron star mergers are also accompanied by a thermal optical/IR transient, powered by the radioactive decay of neutron-rich elements synthesized in the merger ejecta (a 'kilonova'). In addition to providing a beacon to the gravitational wave chirp, kilonovae provide a direct probe of an astrophysical site for rapid neutron capture (r-process) nucleosynthesis. I will describe recent work showing how free neutrons in the outermost layers of the ejecta could power a bright 'precursor' to the main kilonova emission, greatly enhancing the prospects for its detection.</p> <p>Website: <a href="http://kipac.stanford.edu/collab/seminars/ac/astrophysics-colloquium-winter-2016/20160107">http://kipac.stanford.edu/collab/seminars/ac/astrophysics-colloquium-winter-2016/20160107</a></p>

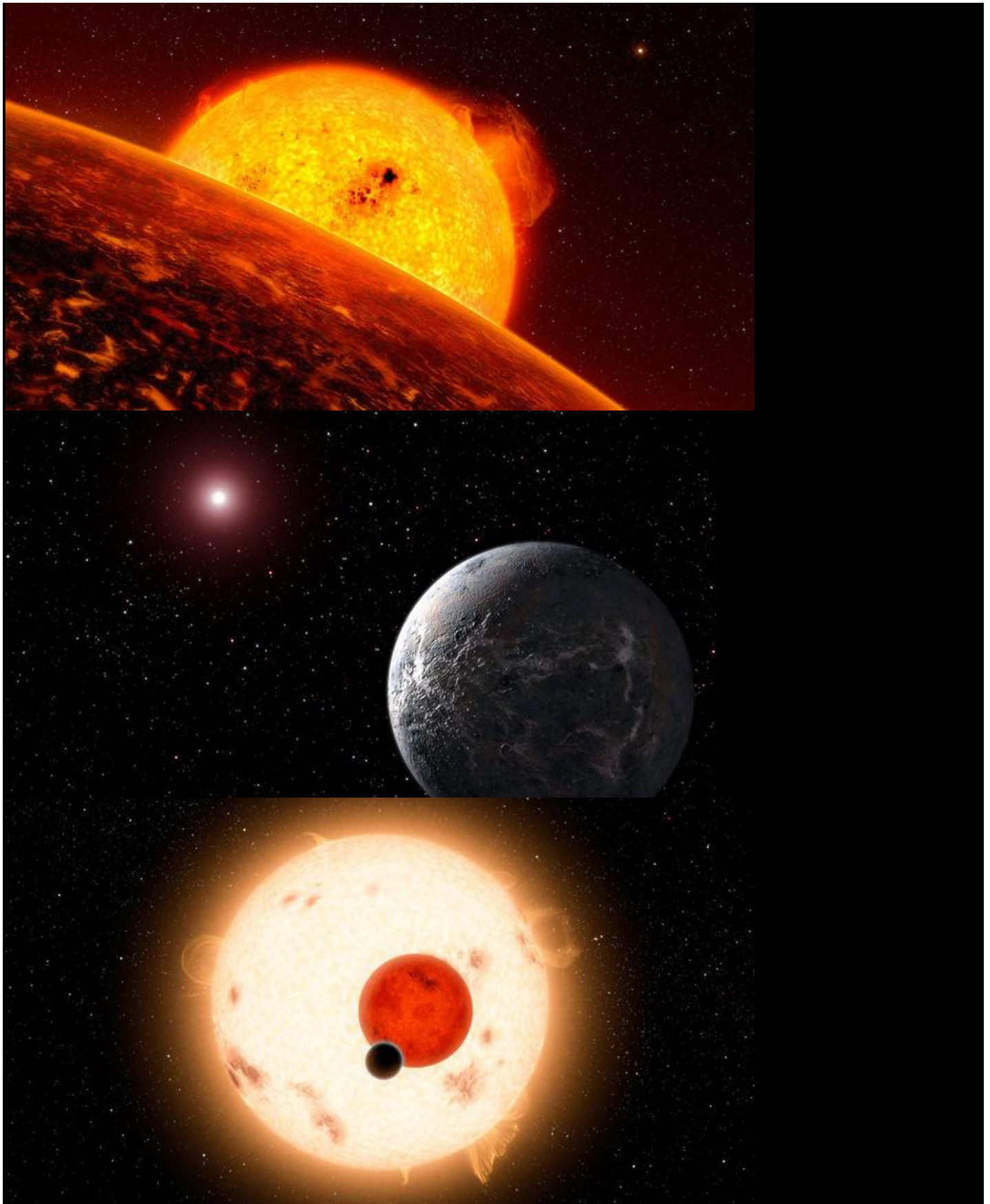
<p><b>FRIDAY, 01/08/16</b> <b>06:00 PM - 10:00 PM</b></p> <p><b>EVERGREEN VALLEY COLLEGE</b> <b>VISUAL PERFORMANCE ARTS (APA) THEATER</b> <b>3095 Yerba Buena Rd</b> <b>San Jose, CA 95135</b></p> <p><b>Parking &amp; campus map:</b> <b>Free parking after 6:00 PM</b> <b>in parking lot #6 for this event.</b></p>	<p><b>OUR FANTASTIC MOON</b></p> <p>The full moon is the second brightest object in the sky. This talk will be initiated with a historical overview of the role played by the moon in Indian, Mesopotamian, and Meso-american cultures. It will be proceed with a discussion of few curious facts about the geometry of its orbital motion and cyclic events. We complete with a survey of high resolution pictures and videos released by several lunar missions, especially the Lunar Reconnaissance Orbiter (LRO).</p> <p>Enjoy a free public stargazing after the talk at the Montgomery Hill Observatory of Evergreen Valley College from 7 pm to 10 pm.</p> <p>The facility has an 8-inch refractor telescope in a dome observatory, 14-inch SC telescope in a roll off roof observatory and several other telescopes set out for the public. View Andromeda Galaxy, Orion Nebula, Crab Nebula , Double cluster in Perseus, star cluster Hyades, Pleiades, "Owl" cluster, Beehive cluster, bright stars Rigel, Betelgeuse, Sirius, Aldebaran and many more objects</p>
<p><b>FRIDAY, 01/08</b> <b>7:30 PM</b></p> <p><b>PENINSULA ASTRONOMICAL SOCIETY</b> <b>FOOTHILL COLLEGE</b> <b>Room 5015</b> <b>Los Altos Hills, CA 94022</b></p>	<p><b>THE NGC/IC PROJECT</b></p> <p>Steve Gottlieb has been an active observer and catalogue junkie for over 25 years and member of SFAA since 1981. He's written a number of deep-sky observing articles for Sky &amp; Telescope, Astronomy, Deep Sky Magazine as well as the SFAA bulletin. Some of his observing challenges can be found at Adventures in Deep Space at: <a href="http://www.astronomy-mall.com/Adventures.In.Deep.Space/">http://www.astronomy-mall.com/Adventures.In.Deep.Space/</a>. His 600 favorite deep-sky objects are featured in the Orion "Deep Map 600" and the results of his catalogue sleuthing can be found in a number of popular digital setting circles which use his corrected databases.</p>
<p><b>SATURDAY, 1/09</b> <b>08:00 PM - 10:00 PM</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER</b> <b>10000 Skyline Blvd</b> <b>Oakland, CA 94619</b></p> <p><b>Cost \$15</b></p>	<p><b>DR. KEN WHARTON</b> <b>THE PHYSICS OF TIME TRAVEL (THIS ONE IS REALLY WORTH HEARING ABOUT!)</b></p> <p>Is time travel science fiction or a plausible reality? Written about for centuries and theorized by the most celebrated scientists, the quantum mechanics of time travel are still a hot topic in modern physics. Using popular movies as a framework, Professor Wharton will outline several distinct categories of consistent time travel stories, and discuss possible connections with actual physics.</p> <p>Website: <a href="https://14884.blackbaudhosting.com/14884/tickets?tab=2&amp;txobjid=7d7dd969-3926-4037-a895-4b7f781f503d">https://14884.blackbaudhosting.com/14884/tickets?tab=2&amp;txobjid=7d7dd969-3926-4037-a895-4b7f781f503d</a></p>
<p align="center"><b>Check the following link for information regarding additional events</b> <a href="http://tech.groups.yahoo.com/group/bayastro/?v=1&amp;t=directory&amp;ch=web&amp;pub=groups&amp;sec=dir&amp;slk=94">http://tech.groups.yahoo.com/group/bayastro/?v=1&amp;t=directory&amp;ch=web&amp;pub=groups&amp;sec=dir&amp;slk=94</a></p>	

# NASA JPL SCIENCE NEWS

Meanwhile, In A Galaxy Not So Far, Far Away...







The glittering city lights of Coruscant, the *Star Wars* core world, might have evolved on an older, near Earth-size planet like Kepler-452b. This real-life Earth cousin exists in a system 1.5 billion years older than Earth, giving any theoretical life plenty of time to develop an advanced technological civilization. Credits: NASA/Ames/JPL-Caltech



The fantasy creations of the "Star Wars" universe are strikingly similar to real planets in our own Milky Way galaxy. A super Earth in deep freeze? Think ice-planet "Hoth." And that distant world with double sunsets can't help but summon thoughts of sandy "Tatooine."

No indications of life have yet been detected on any of the nearly 2,000 scientifically confirmed exoplanets, so we don't know if any of them are inhabited by Wookiees or mynocks, or play host to exotic alien bar scenes (or even bacteria, for that matter). Still, a quick spin around the real exoplanet universe offers tantalizing similarities to several Star Wars counterparts.

### **A more ancient Earth?**

The most recently revealed exoplanet possessing Earth-like properties, Kepler-452b, might make a good stand-in for Coruscant -- the high-tech world seen in several Star Wars films whose surface is encased in a single, globe-spanning city. Kepler-452b belongs to a star system 1.5 billion years older than Earth's. That would give any technologically adept species more than a billion-year jump ahead of us. The denizens of Coruscant not only have an entirely engineered planetary surface, but an engineered climate as well. On Kepler-452b, conditions are growing markedly warmer as its star's energy output increases, a symptom of advanced age. If this planet (which is 1.6 times the size of Earth) were truly Earth-like, and if technological life forms were present, some climate engineering might be needed there as well.

### **City in the sky**

Mining the atmospheres of giant gas planets is a staple of science fiction. NASA, too, has examined the question, and found that gases such as helium-3 and hydrogen could be extracted from the atmospheres of Uranus and Neptune. Gas giants of all stripes populate the real exoplanet universe; in "The Empire Strikes Back," a gas giant called Bespin is home to a "Cloud City" actively involved in atmospheric mining. The toadstool-shaped city provides apparent refuge for a fleeing Princess Leia and company -- at least until Darth Vader wreaks his usual havoc.

Many of the gas giants found so far by instruments such as NASA's Kepler Space Telescope are so-called "hot Jupiters" -- star-hugging behemoths far too thoroughly barbecued to be proper sites for floating cities. One recent discovery, however, shows that gas "exogiants" can orbit their stars at distances remarkably similar to those in our solar system. An international astronomical team discovered a [twin of our own Jupiter](#), orbiting its star at about the same distance as Jupiter is from the sun. The star, HIP 11915, is about the same age and composition as our sun, raising the possibility that its entire planetary system might be similar to ours. This not-so-hot Jupiter, about 186 light-years away from Earth, was detected using the 11.8-foot (3.6-meter) telescope at [La Silla Observatory in Chile](#).

Bespin's atmospheric layers include a band of breathable air, ideal for floating cities. In our galaxy, emerging technology allows us to read out the components of real exoplanet atmospheres -- including gas giants (though so far none show signs of habitable layers). And tasting the atmospheres of smaller, rocky, potentially habitable exoplanets soon could be within reach. Astronomers using [K2](#), the second planet-finding mission of the Kepler space telescope, recently detected three such planets orbiting a nearby dwarf star. The starlight shining through the atmospheres of these planets could reveal their composition in future observations.

### **Turn up the heat**

The planet Mustafar, scene of an epic duel between Obi-Wan Kenobi and Anakin Skywalker in "Revenge of the Sith," has a number of exoplanet counterparts. These molten, lava-covered worlds, such as Kepler-10b and Kepler-78b, are rocky planets in Earth's size range whose surfaces could well be perpetual infernos. Kepler-78b, roughly 20 percent larger than Earth, weighs in at twice Earth's mass; a comparable density means it could be composed of rock and iron. That might make it, like Mustafar, suitable for mining, although its extremely tight orbit around its sun-like star, along with scorching temperatures, provides an unlikely arena for industrial operations -- or for fencing with lightsabers.

Kepler-10b isn't much more pleasant. The first rocky world discovered using the Kepler telescope, it also hugs its sun, some 20 times closer than Mercury orbits ours. A balmy day on Kepler-10b means daytime highs of more than 2,500 Fahrenheit (1,371 Celsius), even hotter than lava flowing on Earth. The surface, free of any kind of atmosphere, might be boiling with iron and silicates.

At 3,600 degrees Fahrenheit (1,982 Celsius), however, CoRoT-7b has Kepler-10b beat. This well-grilled planet, discovered in 2010 with France's [CoRoT satellite](#), lies some 480 light-years away, and has a diameter 70 percent larger than Earth's, with nearly five times the mass. Possibly the boiled-down remnant of a Saturn-sized planet, its orbit is so tight that its star looms much larger in its sky than our sun appears to us, keeping its sun-facing surface molten.

### **Deep freeze**

The planet OGLE-2005-BLG-390, nicknamed "Hoth," is a cold super-Earth that might be a failed Jupiter. Unable to grow large enough, it had to settle for a mass five times that of Earth and a surface locked in the deepest of deep freezes, with a surface temperature estimated at minus 364 degrees Fahrenheit (minus 220 Celsius). That most likely means no "Hoth"-style tauntauns to ride, or even formidably fanged abominable snowmen (aka "wampas"). Astronomers used an extraordinary planet-finding

technique known as microlensing to find this world in 2005, one of the early demonstrations of this technique's ability to reveal exoplanets. In microlensing, backlight from a distant star is used to reveal planets around a star closer to us.

The planet lies toward the heart of the Milky Way, where a greater density of stars makes microlensing events more likely. The one-time event revealing the distant Hoth was captured by the Optical Gravitational Lensing Experiment, or OGLE, and confirmed by other instruments.

We won't have to travel 20,000 light years, however, to visit icy worlds. Saturn's smoggy moon, Titan, where the [Cassini spacecraft's](#) Huygens probe landed in 2005, is pocked with methane lakes and socked in permanently with thick, hydrocarbon haze. The freeze is so deep that water ice is no different from rock. Another Saturn moon, Enceladus, looks like a snowball but harbors a subsurface ocean much like Jupiter's moon Europa, another ice ball with a likely ocean underneath. That ocean would be warmed by tidal flexing as the little moon orbits Jupiter.

### **Sunset? Make it a double**

Luke Skywalker's home planet, Tatooine, is said to possess a harsh, desert environment, swept by sandstorms as it roasts under the glare of twin suns. Real exoplanets in the thrall of two or more suns are even harsher. Kepler-16b was the Kepler telescope's first discovery of a planet in a "circumbinary" orbit -- circling both stars, as opposed to just one, in a double-star system. This planet, however, is likely cold, about the size of Saturn, and gaseous, though partly composed of rock. It lies outside its two stars' "habitable zone," where liquid water could exist. And its stars are cooler than our sun, and probably render the planet lifeless. Of course, we could look on the bright side (so to speak). When the discovery was announced in 2011, Bill Borucki, the now-retired NASA principal investigator for Kepler at Ames Research Center, Moffett Field, California, said finding the new planet might actually broaden the prospects for life in our galaxy. About half of all stars belong to binary systems, so the fact that planets form around these, as well as around single stars, can only increase the odds.

A more recently announced exoplanet, Kepler-453b, is also a circumbinary and a gas giant, though its orbit within its star's habitable zone means any moons it might have could be hospitable to life. It was the tenth circumbinary planet discovered using the Kepler telescope.

### **Ocean world**

Kepler-22b, analog to the Star Wars planet Kamino (birthplace of the army of clone soldiers), is a super-Earth that could be covered in a super ocean. Watery, storm-drenched Kamino makes its appearance in "Attack of the Clones."

The jury is still out on Kepler-22b's true nature; at 2.4 times Earth's radius, it might even be gaseous. But if the ocean world idea turns out to be right, we can envision a physically plausible Kamino-like planet, with the help of scientists at the Massachusetts Institute of Technology in Cambridge. An ocean world tipped on its side -- a bit like our solar system's ice giant, Uranus -- turns out to be comfortably habitable based on recent computer modeling. Researchers found that an exoplanet in Earth's size range, at a comparable distance from its sun and covered in water, could have an average surface temperature of about 60 degrees Fahrenheit (15.5 degrees Celsius). Because of its radical tilt, its north and south poles would be alternately bathed in sunlight and darkness, for half a year each, as the planet circled its star.

Scientists previously thought such a planet would seesaw between boiling and freezing, rendering it uninhabitable. But the MIT scientists' three-dimensional model showed that the planet, even with a relatively shallow ocean of about 160 feet (50 meters), would absorb heat during its odd polar summer and release it in winter. That would keep the overall climate mild and spring-like year round.

The shallow depth, by the way, would be ideal for Kamino-style ocean platforms, allowing construction of covered cities at the ocean surface, where armies of clones could march and drill in peace.

### **Fly me to the exomoon**

Endor, the forested realm of the Ewoks, orbits a gas giant and was introduced in "Return of the Jedi." Detection of exomoons -- that is, moons circling distant planets -- is still in its infancy for scientists here on Earth. A possible exomoon was observed in 2014 via microlensing. It will remain forever unconfirmed, however, since each microlensing event can be seen only once. If the exomoon is real, it orbits a rogue planet, unattached to a star and wandering freely through space. The planet might have hung on to its moon after somehow being ejected during the early history of a forgotten planetary system. A team of Japanese, New Zealand, and American astronomers analyzed data gathered in 2011 with telescopes in New Zealand and Tasmania, and suggested the possible exomoon. They said a small star accompanied by a large planet also could have caused the same lensing effect.

More exomoons might soon be popping out from the depths of space. The Harvard-based Hunt for Exomoons with Kepler, or HEK, has begun to scour data from Kepler for signs of them. In early 2015, the researchers examined about 60 Kepler planets and determined that existing technology is sufficient to capture evidence of exomoons.

The hunt could have powerful implications in the search for life beyond Earth. If exomoons are shown to be potentially habitable, it would open another avenue for biology; habitable moons might even outnumber habitable planets. Could they have bustling ecosystems, with life forms even more exotic than Endor's living teddy bears, swinging between trees Tarzan-style? Stay tuned.

### **Breaking up is hard to do**

In "A New Hope," Princess Leia's home planet, Alderaan, is blown to smithereens by the Empire's Death Star as she watches in horror. Real exoplanets also can experience extreme destruction. A white dwarf star was caught in the act of devouring the last bits of a small planet in 2015, observed with the help of NASA's Chandra X-ray Observatory. White dwarfs are super-dense stellar remnants about the size of Earth, but with gravity more than 10,000 times that of our sun's surface. Tidal forces could rip a planet caught in its pull to shreds.

Observers thought at first they were seeing a black hole in the act of feeding inside a star cluster on the Milky Way's rim. X-ray observations, however, matched theoretical models of a planet being torn apart by a white dwarf.

A similar observation of a closer white dwarf was made by K2 in 2014. In this case, a tiny rocky object, probably an asteroid, was being vaporized into little more than a dusty ring as it whipped around the star every 4.5 hours.

NASA's Spitzer Space Telescope also picked up signs of debris from a likely asteroid collision in 2014. But rather than a sign of planetary destruction, the colliding asteroids could be part of a construction site. This young star -- about 1,200 light years away and only 35 million years old -- is surrounded by a ring of dust where such collisions are frequent. The smashed and broken bits fuse into larger and larger agglomerations, eventually forming full-sized planets.

Our own solar system might once have looked very similar, if anyone was watching.

NASA's Ames Research Center in Moffett Field, California, manages the Kepler and K2 missions for NASA's Science Mission Directorate. NASA's Jet Propulsion Laboratory in Pasadena, California, managed Kepler mission development. Ball Aerospace & Technologies Corp. operates the flight system with support from the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

JPL, a division of the California Institute of Technology in Pasadena, manages the Spitzer Space Telescope for NASA.

Written by Pat Brennan



## 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.