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CALL FOR VOLUNTEERS

SFAA is looking for volunteers to help at Star Parties – both on Mt. Tam and for City Star Parties. Please send an email to Michael Patrick at president@sfaa-astronomy.org if you’re interested.

01.

DECEMBER 20TH LECTURE | LEO BLITZ, UC BERKELEY DEPARTMENT OF ASTRONOMY

THE PRESIDIO . OBSERVATION POST . BUILDING 211

211 Lincoln Boulevard, San Francisco

7:00 pm Doors Open | 7:30 pm Light Refreshments | 7:45 pm Announcements | 8:00 pm Speaker

SFAA'S GENERAL MEETINGS OCCUR ON THE 3RD TUESDAY OF EACH MONTH (EXCEPT JANUARY)

“ARE ANCIENT GALAXIES REALLY RED AND DEAD?”



LEO BLITZ, PH.D., UC Berkeley, Professor Emeritus of Astronomy

Galaxies are broadly divided into two classes: spiral and elliptical. Unlike the spirals, the ellipticals, often referred to as early-type galaxies, are largely composed of old stars that give them a reddish color. They typically have little interstellar material with which to form new stars; these galaxies are often referred to as “red and dead.” We will see, however, that a substantial fraction of these galaxies contain surprising amounts of neutral hydrogen and these do form stars, albeit at a reduced rate compared to their spiral cousins. Early-type galaxies

outside of clusters can be seen to be accreting gas from their surroundings, which is the source of at least some of the gas fueling star-formation taking place within them. In addition, the galaxies are seen to contain super-massive black holes in their centers. The black holes appear to be responsible for ejecting much of the gas that falls into the nuclei of these galaxies, reenergizing the intergalactic medium.

Leo Blitz's research interests focus mainly on how galaxies form and evolve into the objects we see today, and how the interstellar gas within galaxies is collected to form stars. Items of current active interest include trying to understand the nature of dark matter on galactic scales, particularly in dwarf galaxies and in the outer parts of the Milky Way. He is also working on how the diffuse interstellar medium generates star-forming giant molecular clouds in different environments to unravel the basic physics of star formation on galactic scales. His team operates an array of fifteen millimeter-wave radio telescopes as part of the CARMA Array, near Bishop, California. They are building the Allen Telescope Array, a new type of radio interferometer of 350 dishes using commercial satellite dish technology to synthesize an aperture of 10,000 square meters for use at centimeter wavelengths.

02.

***** FREE PUBLIC ASTRONOMY EVENT BY AGU *****

AMERICAN GEOPHYSICAL UNION (AGU): DECEMBER 11 -- FREE PUBLIC LECTURE: "HOW DO WE CHOOSE A LANDING SITE ON MARS?"

The American Geophysical Union (AGU) invites the general public to a free lecture about how planetary scientists select landing sites on Mars.

**Sunday December 11, 12:00 to 1:00 pm,
Moscone Center South, Room 104,
747 Howard St, San Francisco, CA 94103**



Dr. Michael Meyer, Dr. Bethany Ehlmann, and Alex Longo will deliver the Public Lecture at the 2016 Fall Meeting titled How Do We Choose a Landing Site on Mars? on Sunday December 11th from 12:00pm-1:00pm. Read more in this Eos article (<https://eos.org/agu-news/how-on-earth-to-decide-where-on-mars-to-land>) or check out the AGU calendar event page (<https://fallmeeting.agu.org/2016/public-events/>).

Today we know Mars to be a vast beautiful planet that in many ways is like the American Southwest. It has sweeping vistas and huge mountains with long and wide valleys. In its past Mars had an enormous ocean with a significant atmosphere and it is only by studying this planet on the surface that we will be able to unlock its past and understand how we will live and work on the Red planet in the future. Finding the right landing sites for our robotic and human missions requires an extensive knowledge about the planet. Our panel of experts will discuss "how on Earth" we find the right places to go to on Mars.



Dr. Michael Meyer
Lead Scientist for the Mars Exploration Program
Senior Scientist, Science Mission Directorate, NASA
Headquarters

Dr. Meyer is responsible for the science content of current and future Mars missions, and Program Scientist for the Mars Science Laboratory – Curiosity rover mission. He was the Senior Scientist for Astrobiology and Program Scientist for the 2001 Mars Odyssey, Mars Microprobe mission, and for two Shuttle /Mir experiments. The Astrobiology Program, started in 1997 with him as the Discipline Scientist, is dedicated to the study of the life in the universe. He has managed NASA's Exobiology Program from 1994 to 1997. Dr. Meyer was also the Planetary Protection Officer for NASA, responsible

for mission compliance to NASA's policy concerning forward and back contamination during planetary exploration. Dr. Meyer earned a Ph.D. and M.S. in Oceanography, Texas A&M University, and B.S. in Biology, Rensselaer Polytechnic Institute.



Dr. Bethany Ehlmann
Assistant Professor of Planetary Sciences, Caltech
Research Scientist at the Jet Propulsion Laboratory

Dr. Ehlmann's research focuses on the composition of planetary surfaces, tracing evidence of water-related processes throughout the solar system, remote sensing techniques and instruments, and unraveling Mars' environmental evolution. She was a student science collaborator on the Mars Exploration Rovers (Spirit and Opportunity), is co-investigator on the CRISM imaging spectrometer on the Mars Reconnaissance Orbiter, is Participating Scientist on the Mars Science Laboratory Curiosity rover, and is part of the science team of the upcoming Mars 2020 rover.



Alex Longo
Student, Cardinal Gibbons High School, Raleigh, North
Carolina

Alex has been fascinated by planetary science, especially Mars, from an early age. He is on the All-A Honors Roll in his high school and created and wrote the syllabus for the Space Explorers Club at Cardinal Gibbons. He has advocated a particular landing site on Mars for both Mars 2020 and at the recent Human Landing site workshops. He was the youngest person to speak at the NASA landing site selection conference and published an online document, "The Importance of Mars 2020 and Gusev

Crater." He has received a number of honors and awards, been interviewed by the press on a number of occasions, and has given a number of invited talks to other students about his experiences in participating in NASA science activities.

03.

UPCOMING SFAA LECTURES AND EVENTS 2017

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

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

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

***** NOTE: NO SFAA LECTURE IN JANUARY 2017 *****

Just a reminder that there is not a lecture in January. Watch for details about the annual SFAA Membership Dinner, which is held each January. We'll see you there!

SAVE THE DATE: January 21, 2017 for the Annual SFAA Membership Party.

There will be no Lecture in January because we will have our annual SFAA Membership and Awards Party (Stay tuned for more details), where, for over 50 years the SFAA has enjoyed dinner and drinks in a lively atmosphere with all those who enjoy the night sky. Members are encouraged to participate and nominate people for such awards as:

- Service Award
- Observer of the Year, and
- Herman Fast Award (This is the most important award we give, named for one of SFAA's most dedicated and accomplished members, and one of the Founders.)

FEBRUARY 21ST | BRIAN KRUSE, ASTRONOMICAL SOCIETY OF THE PACIFIC (ASP) & BOARD MEMBER, SAN FRANCISCO AMATEUR ASTRONOMERS



"MARS AND THE HUMAN IMAGINATION"

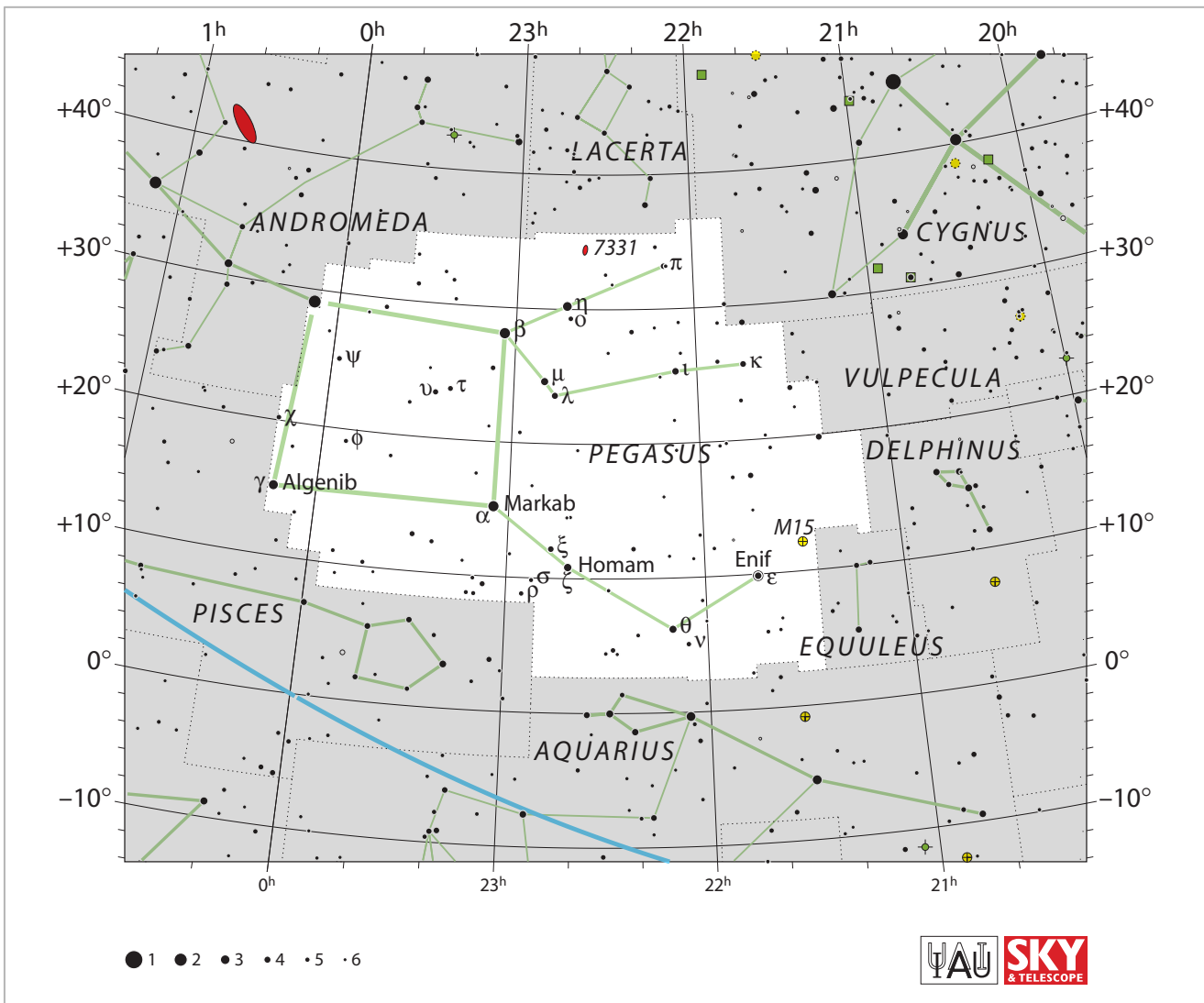
Mars has long been an object of intense interest in ancient and modern myths. Its ruddy glow inspiring visions of conflict and war, and its surface markings creating a whole genre of popular (mis)representations of Mars as the abode of life in a variety of forms. In this presentation, discover how popular culture has represented, and misrepresented Mars while sparking a special interest most all have in what is actually taking place on the planet most similar to earth in our solar system. NASA missions have returned a plethora of images and information about what Mars is really like. Find out the latest about what is known about the red planet, and what still remains for investigation and discovery on future missions.

SFAA PRESIDENT'S NOTE | TO NEW MEMBERS' WANTING TO LEARN ASTRONOMY

According to the survey conducted this summer past, most new members of the SFAA regard themselves as a beginning learner in astronomy and joined the organization to address that curiosity. In addition, the survey indicated, most new members also own a pair of binoculars. This is a great combination - intellectual curiosity in astronomy and a pair of binoculars – that can easily lead to direct experience of the wonders of our universe and the beginning of a base of knowledge on which to build and expand.

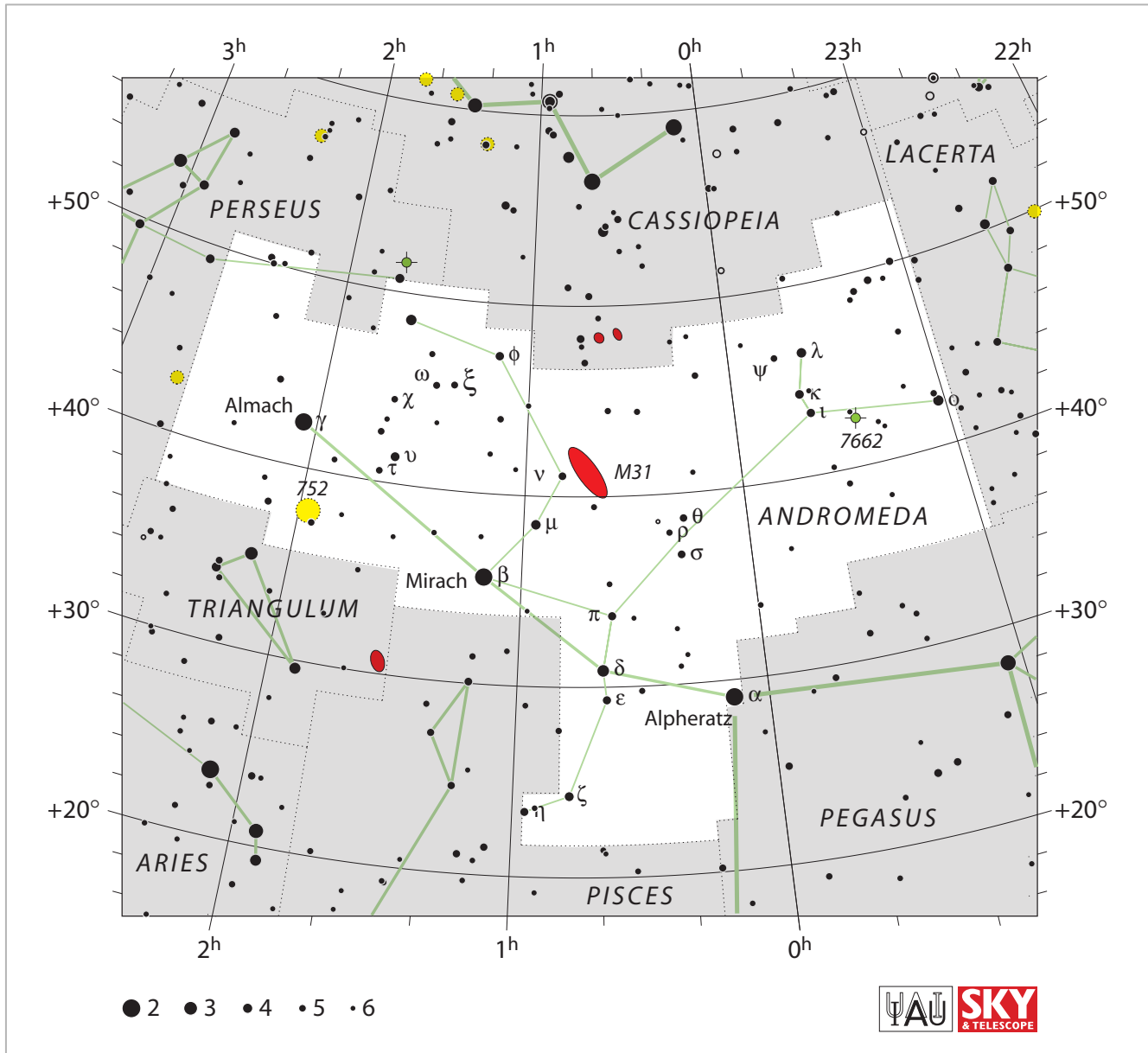
Viewing Hubble photographs of the universe is something to behold, but one is several steps away from experiencing the object directly. I invite new members, on a clear night with little to no Moon shining, to grab their binoculars, search for M 31 and directly experience a galaxy 2.5 million light years (mly) distant. By so doing you will have accomplished a number of steps to understand the night sky and astronomy.

First, study the constellation charts listed below and find them at night. Pegasus is obvious as it is also called The Great Square of Pegasus – it really is a huge square (and more) in the night sky this time of year. Spend some time studying the pattern of stars that form Pegasus so it becomes familiar – do this again the next night if possible so you can easily find it.



Next, look at the eastern most corner star – named Alpheratz on the constellation chart. This is actually a star in the constellation Andromeda but it is easier to find Pegasus at first and then hone in on Alpheratz.

Now, from Alpheratz, moving to your left or north, count two bright stars that line in a slightly curved row to the star named Mirach in the chart. From Mirach slowly pan your binoculars roughly to your right until you find M 31, the Andromeda galaxy. You will have found M 31 through the amateur observers' technique of "star hopping" or following a recognizable pattern of stars to find the desired object.



M 31 when viewed through your binoculars will not exactly look like a Hubble photo, but it will appear as an elongated, fuzzy object. You are now directly looking at a galaxy that is about 250 thousand light years (kly) in diameter and is 2.5 mly distant. The light of that galaxy, at which you are looking, left it 2.5 million years ago – you are essentially looking back in time.

After viewing M 31 you might do a little research on the Andromeda galaxy and the M designation. M stands for Messier, Charles Messier (1730-1817) who was an 18th / 19th century comet hunter. While looking for comets he also saw around 110 other objects in the sky that he catalogued and to this day we observe these objects as Messier or M objects. Such objects also have an NGC, or New General Catalogue designation which is much more extensive.

Well, now you have identified two constellations, learned the essential art of “star hopping”, found and viewed a not-so distant galaxy and learned how to use a star or constellation chart. Not bad for an evening’s work. In addition to laying a foundation to begin observing the night sky, there are a number of areas you can now research: M 31, the Andromeda galaxy and Charles Messier and how the NGC catalogue came into use.

While the SFAA works to provide a mix of events aiming at all knowledge levels, there are some things that require little effort that beginning learners’ can do for themselves. These are experiences you can share with your friends and attendees at SFAA lectures particularly during the Meet & Greet portion of our monthly meetings.

Dark, clear and stable skies,

**Michael Patrick
President, SFAA**

SFAA Board Officers and Directors:

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



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

Many of you have asked when those handsome blue SFAA T-Shirts will be available for sale. It’s just in time for the holidays, and we have a limited number available, so reserve yours now!

Prices:

\$10 for SFAA Members (membership must be current)

\$25 for non-Members

Shirts will be available for purchase and/or pick-up at the December 20th lecture at the Presidio. If you need to renew your membership or want to join as a new member, please submit the Membership Application, included as the final page of this newsletter, or from our web site, at: <http://www.sfaa-astronomy.org/membership/>

05.

SFAA BOARD OF DIRECTORS ELECTION | ANTHONY BARREIRO

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

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

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

The responsibilities of the SFAA Officers and Directors are described in more detail in a proposed revision to the Bylaws: <http://www.sfaa-astronomy.org/proposed-updates-to-sfaa-bylaws/>

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

AN AMATEUR'S REFLECTION ON AN OPPORTUNITY TO MEET THE UNKNOWN | ANIL CHOPRA

I came to San Francisco, from Chicago, 6 years ago and was very fortunate to have met Ken Frank, who was then an SFAA Board member and introduced me to this wonderful club. Since joining SFAA, I have had the great pleasure of making wonderful friends, exploring Mt. Tam in ways I would have never suspected, and following in Ken's shoes, helping folks join our club and expand their access to the night sky (to name a few).

Every human before 1900 lived with the great dark sky as his or her companion. Only the last 5 generations of humans have lost consistent touch with the depth of night sky, since the electrification of the city. Contemplation of the night sky might have been what sparked the evolutionary change, some 160 thousand years ago, which made us human... It is such an important aspect of what we are, to remember infinity is just outside our window... and it is our club that enables young people a perception of what is beyond our little island in this vast ocean of space... it is our club that can help remind us of the world beyond the well-lit dome of our present moment, filled with electronic visions of work and distraction. It is our club that enables one to bring a blanket and spread it out in the middle of Rock Springs Parking lot and find enough stillness and quiet... to hear shooting stars.

We all are very busy, but we also make time for what we find important. Being a Board member for this club, serving not only the members of SFAA, but also the community at large, is an opportunity to expand your understanding of the night sky, of how such organizations work and an exercise for your creativity. Finding time to spend up at Mt Tam, to tune-up that scope, and help support and grow this club's work, is time reinvigorating your ability to grapple with the great unknown... it is what keeps us growing... and it allows so many others access to this wonderful, natural, vast playground called space. Join the board of SF Amateur Astronomers and take this opportunity to use your talents (or learn how to use your talents) in helping all of us, Meet the Unknown.

06.

THE URBAN ASTRONOMER BLOG: GEMINID METEOR SHOWER 2016 | PAUL SALAZAR

Every year there are many meteor showers that arrive on schedule, resulting from the fact that Earth travels through well-established regions of dust and particles on its annual trek around the Sun. The Geminids are one of the year's best, reliably peaking as the Earth passes through the remnants of asteroid 3200 Phaethon on December 13th and 14th each year.



One of the most important factors in viewing a meteor shower is to find a dark sky and this year, unfortunately, this will be very difficult due to the fact that the full Moon coincides with the peak of the Geminids. So although many meteors will streak into the upper atmosphere and burn up, most won't be visible because their light will be drowned out by the glowing moonlight in our atmosphere.

That being said, if the weather is clear and you have warm clothing, it will be a fine night to just sit out in your garden or a park or on a mountainside and look anyhow. The Geminids reach their peak much earlier than most meteor showers, so a pleasant hour of viewing in the evening should reveal a few of the brighter meteors. Just temper your expectations and you will have a nice night. You won't see hundreds of meteors per hour, but then again, there will be plenty of stars and if you have binoculars, you can turn it into an evening of reacquainting yourself with the brighter stars and nebulae of the winter sky as Orion climbs high into the eastern sky after sunset and Pegasus dominates the sky overhead.

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

07.

2017 SFAA STAR PARTY SCHEDULE | ANTHONY BARREIRO

The dates for next year's City Star Parties, Mt. Tamalpais member nights, and Mt. Tam public astronomy programs are listed below. Please make note of them and plan to attend as many star parties as you're able, both for your own learning and enjoyment and to support the club's mission of promoting astronomy to the larger community.

City Star Parties are held monthly at various locations in San Francisco. For the past few years we've been rotating among the Presidio Main Parade Ground, the Embarcadero at Pier 17 (near the Exploratorium), and our traditional location of Land's End / Point Lobos, and we'll continue to use these sites in 2017. The observing conditions at City Star Parties can be challenging – high humidity, a good chance of clouds or fog, and, especially on the Embarcadero, severe light pollution. But these events also give us our greatest opportunity to do outreach to the general public who might simply be walking by. Watching the reaction of a child or adult who is seeing the Moon, Jupiter, Saturn, or a bright double star or open cluster through a telescope for the first time is a very rewarding experience! Our hosts at the Presidio and our partners at the Exploratorium are very welcoming, supportive, and appreciative of our star parties. At Land's End we're on our own, doing old-school sidewalk astronomy.

SFAA holds a member night at the Rock Springs Parking Area on Mt. Tam every month, on the Saturday nearest the new Moon, to allow the best possible deep sky observing. When San Francisco and the lower elevations of Marin are covered by fog, Rock Springs is often above the fog (thus the title of our newsletter). If the fog is thick enough to absorb significant light pollution, the sky at Rock Springs can be crystal clear and dark enough for the Milky Way to be easily visible to the unaided eye. Only current SFAA members and their guests are eligible to attend member nights, and every vehicle needs to have a current California State Parks parking pass. Guests need to arrive with the SFAA member who invited them, in the member's vehicle. Parking passes are available by request when you join or renew your membership, or by sending an email with your postal mailing address to treasurer@sfaa-astronomy.org.

From April through October of each year, SFAA collaborates with Mt. Tamalpais State Park, the Friends of Mt. Tam, and Wonderfest to offer a free monthly public astronomy program. Wonderfest and Friends of Mt. Tam invite a professional astronomer to give a lecture in the Mountain Theater, followed by a public star party at Rock Springs. SFAA members provide the telescopes for the star parties. Mt. Tam public astronomy programs usually attract hundreds of people, and the visitors are very appreciative of the opportunity to observe through the telescopes. Visitors have to leave around 11 pm, but SFAA members with parking passes can stay as late as we like. More details about the Mt. Tam public astronomy programs, including the speakers and their topics, are posted at <http://www.friendsofmonttam.org/astronomy/schedule>.

Thorough advice about star party etiquette is available at http://www.sfaa-astronomy.org/wp-content/uploads/2013/11/SFAA_Guidelines_GeneralStarPartyEtiquette.pdf. A few important points:

A star party is a great opportunity to set up your telescope, get practice using it, and share the view with others. If you're thinking about getting a telescope (or another telescope), star parties will let you check out various designs and get advice from more experienced observers.

But you don't need to bring a telescope to attend a star party, or even to do outreach. If you can help a first-time visitor get oriented to the night sky, learn a couple of constellations, and find the North Star, you will have done some very valuable outreach. And if you need that kind of beginning information yourself, a star party is the perfect place to get started.

If you can offer a ride to a star party, or if you need a ride, please post a message to our facebook group: <https://www.facebook.com/groups/152754481404310/>. SFAA encourages members to carpool, but we do not coordinate rides – it's up to individual members to make their own arrangements.

Please check the SFAA website, <http://www.sfaa-astronomy.org/>, the day of the star party. Star parties are cancelled if rain is likely or if there is high fire danger on Mt. Tamalpais.

Plan to arrive at least half an hour before sunset. This will give you time to get oriented to the observing location, meet other members, and set up your equipment in the light of day. If you arrive after dark, especially on Mt. Tam, you will annoy everyone with your headlights – not a great way to start your evening! Please bring a dim red or amber flashlight. If you bring a laser pointer, please be very careful not to blind anybody or ruin any photographs, and never point a laser anywhere near an airplane. Dress warmly and bring more layers than you think you're going to need. Bring water, a warm beverage, and food, and remember to take all your trash with you. Smoking is not permitted on Mt. Tam.

Our star parties only happen because members make the effort to come out. If you've been to a few star parties and you are willing to occasionally serve as a contact person for an upcoming event, please send an email to secretary@sfaa-astronomy.org to be added to our monthly star party email list. The duties of a contact person are very modest: keep track of the weather forecast, keep in touch with the other contact person(s), make a decision to cancel if needed, and be committed to attend the star party.

Without further ado, here is our schedule for 2017 star parties:

- Saturday 14 January, Land's End
- Saturday 28 January, Mt. Tam members
- Saturday 11 February, Presidio Parade Grounds
- Saturday 25 February, Mt. Tam members
- Saturday 11 March, Land's End
- Saturday 25 March, Mt. Tam members (Messier marathon)
- Saturday 22 April, Mt. Tam members
- Saturday 29 April, Mt. Tam public
- Sunday 30 April, Exploratorium, Pier 17
- Saturday 13 May, Presidio Parade Grounds
- Saturday 20 May, Mt. Tam members
- Saturday 27 May, Mt. Tam public
- Thursday 15 June, Presidio Parade Grounds
- Saturday 24 June, Mt. Tam members
- Saturday 1 July, Mt. Tam public
- Saturday 22 July, Mt. Tam members
- Saturday 29 July, Mt. Tam public
- Sunday 30 July, Exploratorium, Pier 17
- Saturday 12 August, Land's End
- Saturday 19 August, Mt. Tam members
- Saturday 26 August, Mt. Tam public
- Saturday 16 September, Mt. Tam members
- Saturday 23 September, Mt. Tam public
- Thursday 28 September, Presidio Parade Grounds
- Saturday 21 October, Mt. Tam members
- Saturday 28 October, Mt. Tam public
- Sunday 29 October, Exploratorium, Pier 17
- Saturday 11 November, Veterans Day, Presidio Parade Grounds
- Saturday 18 November, Mt. Tam members
- Saturday 9 December, Land's End
- Saturday 16 December, Mt. Tam members



BAY AREA ASTRONOMY EVENTS

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

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

08.

SFAA EXPEDITION 2017

TOTAL SOLAR ECLIPSE

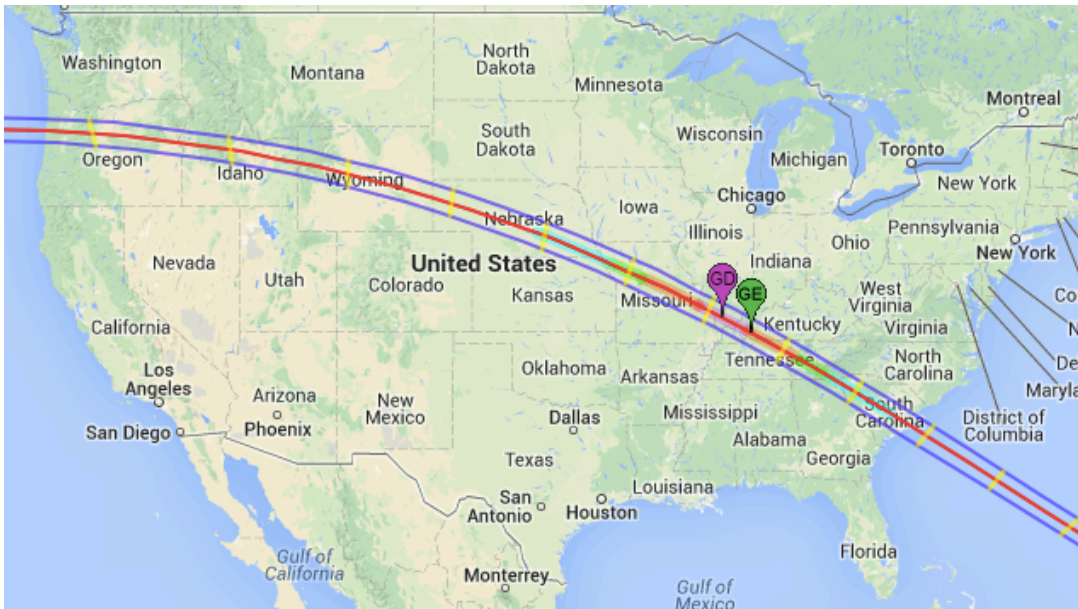
August 21, 2017

Jackson Hole, Wyoming (Teton Mountains)

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

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

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



IN MEMORIUM - SFAA FRIEND GEORGE CARVALHO



George Carvalho, Senior, was a man who instilled into his three sons, an understanding that the material of his life's work was worth the effort to find people who would continue to care about this material. In September, George and Shirley Carvalho generously donated two carloads of assorted and sundry astronomical equipment to the San Francisco Amateur Astronomers. George owned and operated a telescope and photography shop named Optica b/c in Oakland, California and worked there for 30 years until retiring in 1993.

On December 20th, during the Meet & Greet prior to our meeting and speaker, we will have an Astronomical Christmas. We will display and share the Carvalho family's donation to SFAA and its support of the joy of viewing the night sky.

Anil Chopra

George Carvalho, Sr.

December 1928 - June 2016

Published in The San Francisco Chronicle on July 3, 2016

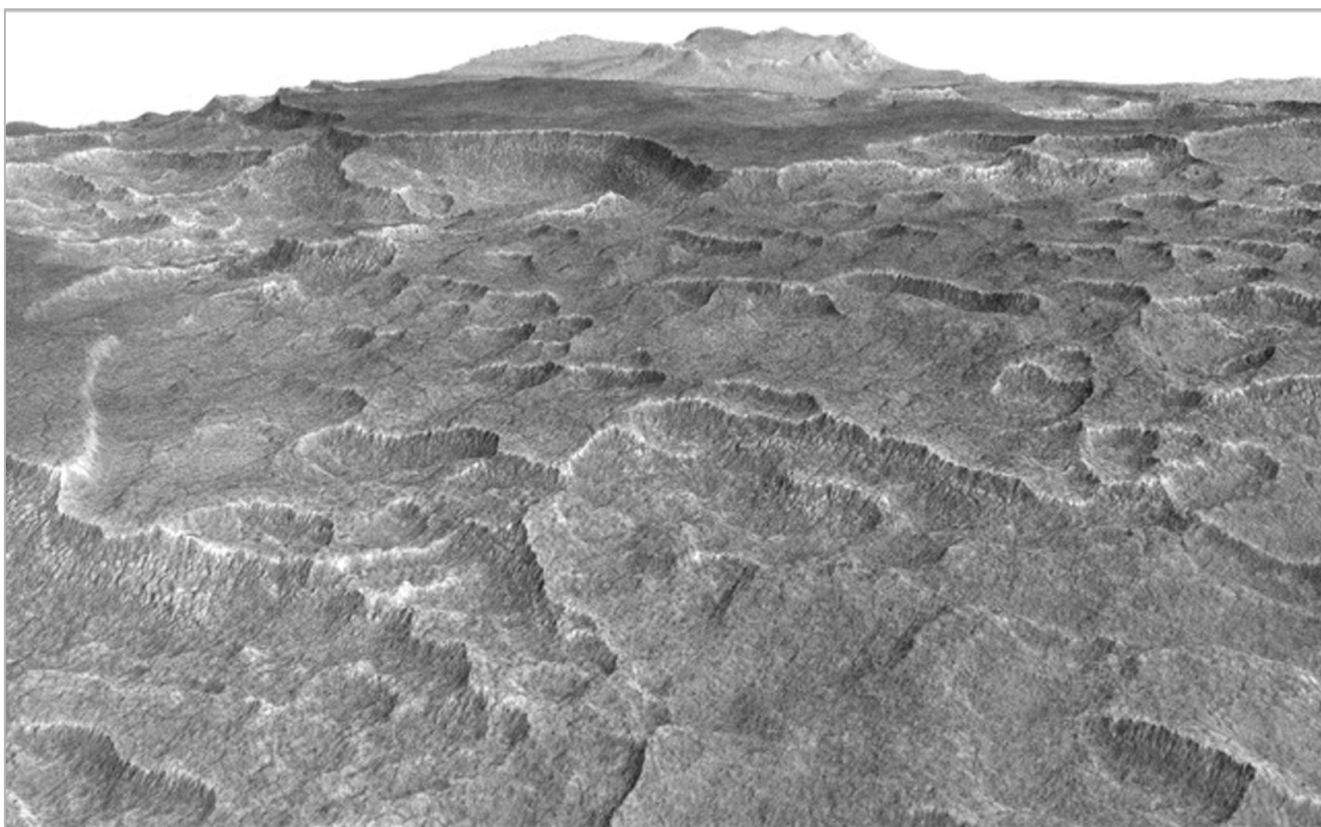
George Carvalho passed away in his sleep the same day Muhammed Ali left us. With his wife Shirley, who he was married to for over fifty years prior to her death last year, George raised three boys, a gaggle of ducks, and doted on five grandchildren from his home in Alameda. George was a sports fan, a collector, a tinkerer.

He was too young for WWII, but after attending Fremont High School in Oakland and playing football and running track at City College of San Francisco (CCSF), he served in the Navy Reserve for almost a decade shooting aerial photography of much of California. His love of photography became a lifelong passion. Something he studied at CCSF and later developed into a career by co-founding a small telescope, photography, and astronomy shop in Oakland – Optica b/c -- and also teaching both photography and astronomy at Merritt College in Oakland.

After retiring from Optica b/c he spent almost twenty years volunteering at the Oakland Museum's White Elephant sale – organizing and helping run the photography and astronomy sections. But he also spent a lot of focus doting on his five grandchildren. Asking them questions, making sand boxes and various contraptions, and trying to convert them to lifelong lovers of linguica.

An Alameda Resident for almost 60 years he is survived by his three sons George of Alameda, Kenneth and his wife Connie of Alameda, Chris of San Rafael, and grandfather to Matt, Josh, Charles, Julia & Joey Carvalho. Predeceased were his wife Shirley, his parents Jose and Julia Carvalho, and his brother William.

MARS ICE DEPOSIT HOLDS AS MUCH WATER AS LAKE SUPERIOR



This vertically exaggerated view shows scalloped depressions in Mars' Utopia Planitia region, one of the area's distinctive textures that prompted researchers to check for underground ice, using ground-penetrating radar aboard NASA's Mars Reconnaissance Orbiter. Image Credit: NASA/JPL-Caltech/Univ. of Arizona

More than 600 overhead passes with the spacecraft's Shallow Radar (SHARAD) instrument provided data for determining that about as much water as the volume of Lake Superior lies in a thick layer beneath a portion of Utopia Planitia.

These scalloped depressions on the surface are typically about 100 to 200 yards or meters wide. The foreground of this view covers ground about one mile (1.8 kilometers) across. The perspective view is based on a three-dimensional terrain model derived from a stereo pair of observations by the High Resolution Imaging Science Experiment (HiRISE) camera on the Mars Reconnaissance Orbiter. One was taken on Dec. 25, 2006, the other on Feb. 2, 2007.

The vertical dimension is exaggerated fivefold in proportion to the horizontal dimensions, to make texture more apparent in what is a rather flat plain.

Similar scalloped depressions are found in portions of the Canadian Arctic, where they are indicative of ground ice.

The University of Arizona, Tucson, operates HiRISE, which was built by Ball Aerospace & Technologies Corp., Boulder, Colo. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, California, manages the Mars Reconnaissance Orbiter Project for NASA's Science Mission Directorate, Washington.

Fast Facts:

- › Water ice makes up half or more of an underground layer in a large region of Mars about halfway from the equator to the north pole.
- › The amount of water in this deposit is about as much as in Lake Superior. It was assessed using a radar aboard a NASA spacecraft orbiting Mars.
- › This research advances understanding about Mars' history and identifies a possible resource for future astronauts.

Frozen beneath a region of cracked and pitted plains on Mars lies about as much water as what's in Lake Superior, largest of the Great Lakes, researchers using NASA's Mars Reconnaissance Orbiter have determined.

Scientists examined part of Mars' Utopia Planitia region, in the mid-northern latitudes, with the orbiter's ground-penetrating Shallow Radar (SHARAD) instrument. Analyses of data from more than 600 overhead passes with the onboard radar instrument reveal a deposit more extensive in area than the state of New Mexico. The deposit ranges in thickness from about 260 feet (80 meters) to about 560 feet (170 meters), with a composition that's 50 to 85 percent water ice, mixed with dust or larger rocky particles.

At the latitude of this deposit -- about halfway from the equator to the pole -- water ice cannot persist on the surface of Mars today. It sublimates into water vapor in the planet's thin, dry atmosphere. The Utopia deposit is shielded from the atmosphere by a soil covering estimated to be about 3 to 33 feet (1 to 10 meters) thick.

"This deposit probably formed as snowfall accumulating into an ice sheet mixed with dust during a period in Mars history when the planet's axis was more tilted than it is today," said Cassie Stuurman of the Institute for Geophysics at the University of Texas, Austin. She is the lead author of a report in the journal *Geophysical Research Letters*.

Mars today, with an axial tilt of 25 degrees, accumulates large amounts of water ice at the poles. In cycles lasting about 120,000 years, the tilt varies to nearly twice that much, heating the poles and driving ice to middle latitudes. Climate modeling and previous findings of buried, mid-latitude ice indicate that frozen water accumulates away from the poles during high-tilt periods.

Martian Water as a Future Resource

The name Utopia Planitia translates loosely as the "plains of paradise." The newly surveyed ice deposit spans latitudes from 39 to 49 degrees within the plains. It represents less than one percent of all known water ice on Mars, but it more than doubles the volume of thick, buried ice sheets known in the northern plains. Ice deposits close to the surface are being considered as a resource for astronauts.

"This deposit is probably more accessible than most water ice on Mars, because it is at a relatively low latitude and it lies in a flat, smooth area where landing a spacecraft would be easier than at some of the other areas with buried ice," said Jack Holt of the University of Texas, a co-author of the Utopia paper who is a SHARAD co-investigator and has previously used radar to study Martian ice in buried glaciers and the polar caps.

The Utopian water is all frozen now. If there were a melted layer -- which would be significant for the possibility of life on Mars -- it would have been evident in the radar scans. However, some melting can't be ruled out during different climate conditions when the planet's axis was more tilted. "Where water ice has been around for a long time, we just don't know whether there could have been enough liquid water at some point for supporting microbial life," Holt said.

Utopia Planitia is a basin with a diameter of about 2,050 miles (3,300 kilometers), resulting from a major impact early in Mars' history and subsequently filled. NASA sent the Viking 2 Lander to a site near the center of Utopia in 1976. The portion examined by Stuurman and colleagues lies southwest of that long-silent lander.

Use of the Italian-built SHARAD instrument for examining part of Utopia Planitia was prompted by Gordon Osinski at Western University in Ontario, Canada, a co-author of the study. For many years, he and other

researchers have been intrigued by ground-surface patterns there such as polygonal cracking and rimless pits called scalloped depressions -- "like someone took an ice-cream scoop to the ground," said Stuurman, who started this project while a student at Western.

Clue from Canada

In the Canadian Arctic, similar landforms are indicative of ground ice, Osinski noted, "but there was an outstanding question as to whether any ice was still present at the Martian Utopia or whether it had been lost over the millions of years since the formation of these polygons and depressions."

The large volume of ice detected with SHARAD advances understanding about Mars' history and identifies a possible resource for future use.

"It's important to expand what we know about the distribution and quantity of Martian water," said Mars Reconnaissance Orbiter Deputy Project Scientist Leslie Tamppari, of NASA's Jet Propulsion Laboratory, Pasadena, California. "We know early Mars had enough liquid water on the surface for rivers and lakes. Where did it go? Much of it left the planet from the top of the atmosphere. Other missions have been examining that process. But there's also a large quantity that is now underground ice, and we want to keep learning more about that."

Joe Levy of the University of Texas, a co-author of the new study, said, "The ice deposits in Utopia Planitia aren't just an exploration resource, they're also one of the most accessible climate change records on Mars. We don't understand fully why ice has built up in some areas of the Martian surface and not in others. Sampling and using this ice with a future mission could help keep astronauts alive, while also helping them unlock the secrets of Martian ice ages."

SHARAD is one of six science instruments on the Mars Reconnaissance Orbiter, which began its prime science phase 10 years ago this month. The mission's longevity is enabling studies of features and active processes all around Mars, from subsurface to upper atmosphere. The Italian Space Agency provided the SHARAD instrument and Sapienza University of Rome leads its operations. The Planetary Science Institute, based in Tucson, Arizona, leads U.S. involvement in SHARAD. JPL, a division of Caltech in Pasadena, manages the orbiter mission for NASA's Science Mission Directorate in Washington. Lockheed Martin Space Systems of Denver built the spacecraft and supports its operations.

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