The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

May 2018 — 651st General Meeting Notice

EVENT HORIZON

Founded in 1960, the San Mateo County Astronomical Society is a 501(c)(3)non-profit organization for amateur astronomers and interested members of the public. Visitors may attend Society meetings and lectures on the first Friday of each month, September to June, and star parties two Saturdays a month. All events are free for visitors and guests. Family memberships are offered at a nominal annual cost. Detailed info is found at www.smcasastro.com, where those who want can join via Paypal.
Membership includes access to this monthly Event Horizon newsletter, discounted costs and subscriptions to calendars and magazines, monthly star parties of the Society and the College of San Mateo, use of loaner telescopes, field trips, social occasions and general meetings presenting guest speakers and programs. For additional information, please email us at SMCAS@live.com, or call us at (650) 678-2762.

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DR ADRIAN LIU (left) spoke at our April meeting about 21 cm cosmology, an emerging technique for studying the early universe by observing radio waves from hydrogen atoms that existed prior to the first stars and galaxies. Our own Ken Lum (right) reviews the talk starting on p. 4 of this issue.

DATES TO SAVE

May 4: General meeting, pizza, and presentation at the CSM Planetarium. Details on page 3.

May 15: SMCAS Board Meeting, CSM ISC room.

Jun 1: NO GENERAL MEETING in June. Election of officers and board will be held at a combined summer StarBQue and Annual Meeting, tentatively on July 14. We encourage your involvement as a volunteer in keeping our Society running smoothly.

More events and further details on page 6.

President's Corner

A really good film I saw recently may be of interest to many of our members. It is a Russian produced film entitled *Salyut 7*, and billed as the Russian version of *Apollo 13*. Based on real events, the IMDb web site describes the film as follows:

> The year is 1985. The unmanned Soviet space station Salyut 7, which is in low Earth orbit, suddenly stops responding to commands from the Control Center. If the space station—the pride of Soviet space engineering—falls from the sky, not only will it damage the image of the country, it will also be a disaster bringing untold casualties. To investigate the failure and prevent the catastrophe, people must be sent to the station. Yet no one in history has ever attempted to dock an uncontrolled vehicle in space. To this day, this mission is considered to be the most technically challenging in the history of space exploration.

Unsaid in this review, if not brought back into service and brought home, the Soviet military decides it must be destroyed in space, polluting orbital space with a huge debris field in order to protect it from being picked up by the US space shuttle into its cargo bay and brought back to American soil where its secrets would come into American hands. The film space sequences are incredibly beautiful and well done—whether shots looking down on earth, or life in a weightless environment. The story line is good, and really gets gripping at the end. This is a film well worth your time if you are interested in beautiful photography of earth from space, life in space, the space program in 1985 and our rivalry with Russia as seen from their perspective, or just a good adventure story. It is available on Amazon Prime for free, and likely on other popular streaming services.

More film details at: https://www.imdb.com/title/tt6537238.

For those of you who use Amazon, a reminder to please sign up for the Amazon Smile program, then every time you purchase from Amazon while logged into the Amazon under Smile, SMCAS gets a small donation (0.05% of purchase price). The prices are the same as non-Smile buyers, so it costs you nothing! These many small donations from current SMCAS Smile members adds up for SMCAS. The more members using it the better! More info on the SMILE program and how to register it can be found at:

https://smile.amazon.com/gp/chpf/about

Marion Weiler
President, San Mateo County Astronomical Society

SMCAS General Meeting and Presentation on Friday May 4, 2018

Dr Franck Marchis

Senior Scientist, Expolanet Research Group Director
SETI

Another Pale Blue Dot:
The SETI Institute's Search for Exoplanets

Friday, May 4, 2018, College of San Mateo, Building 36
SMCAS General meeting at 7:00 p.m. ISC Room, room 110
Presentation at 8:00 p.m. in the CSM Planetarium
Free and open to the public, free parking (lots 5 and 6 recommended)

In only two decades, we've gone from the mere speculation about planets beyond our solar system (exoplanets) to being able to observe them through a variety of methods. Dr. Franck Marchis, Planetary Astronomer and chair of the exoplanet group at the SETI Institute will discuss new and sophisticated projects which aim to image directly those exoplanets. Future instruments could soon deliver an image of a cousin of Earth, or another Pale Blue Dot, a planet similar to our own.

Dr. Franck Marchis is a Senior Scientist and Exoplanet Research Thrust Chair at the SETI Institute. Franck earned his PhD in Astrophysics at the Université Paul Sabatier, France, in 2000. He is a planetary astronomer with 17 years of experience in academic, international and non-profit scientific institutions and has conducted multiple research projects in a wide range of areas. He is best known for his discovery and characterization of multiple asteroids, his study of Io volcanism and imaging of exoplanets, planets around other stars. Today, Marchis dedicates most of his energy to instruments capable of imaging and characterizing Earth-like exoplanets by being involved in education, public outreach, technology, and scientific investigations related to those ambitious projects both in the United States and in Europe. Marchis is also involved in startups related to astronomy so he is a co-founder of Unistellar and its Chief Scientific Officer as well as scientific advisor of VR2Planets and NellyBenHayoun Studios.

In April 2007, the asteroid numbered 1989SO8 was named "(6639) Marchis" in honor of his work in the field of multiple asteroids. He has also been a consultant and interviewee for several science documentaries for the Science channel, BBC, ARTE and news media in English, French and Spanish.

April Meeting Review

Watching Our Universe Grow Up: Radio Snapshots through Cosmic Time

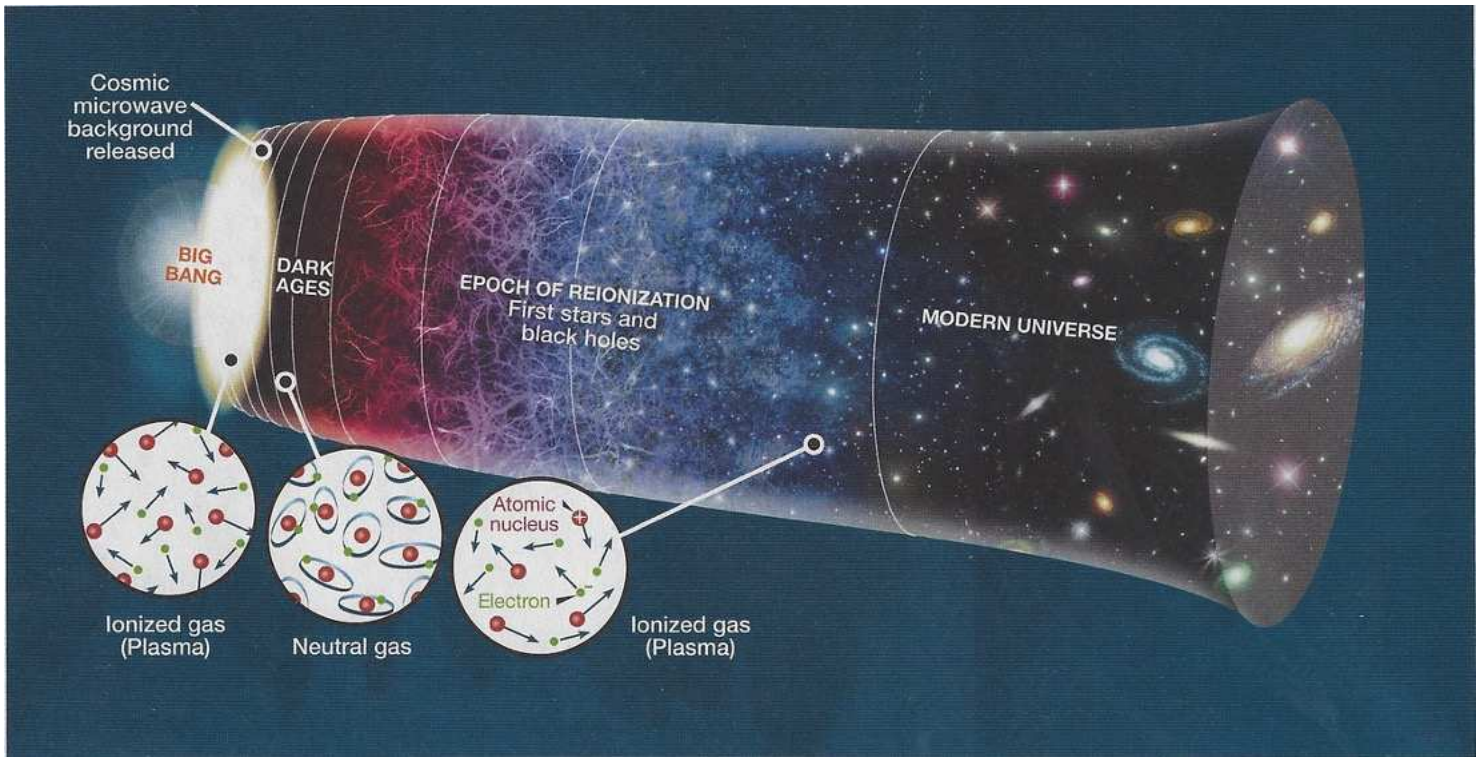
By Ken Lum

Last month, Dr. Adrian Liu of UC Berkeley (and soon to be at McGill University) came to describe a project to use the 21 cm radiation of neutral hydrogen to probe the fate of this gas in the early Universe. By doing so, astronomers hope to better understand how early stars and galaxies formed in the first epochs of the Universe's history.

Following its Big Bang origin, the Universe consisted entirely of a plasma of free protons and electrons. Before an age of around 400,000 years, it was so hot that these particles could not combine to form atoms. After 400,000 years the Universe cooled as it expanded to a temperature of about 3000ºK whereupon the free protons and electrons combined into neutral single hydrogen atoms then comprising nearly all of the material composition of the Universe. This is known as the ***Epoch of Recombination***. It is known also as the time of the origin of the ***Cosmic Background Radiation*** when photons of light could travel through space without being blocked by free electrons causing the Universe to become transparent to light.

Immediately after the Epoch of Recombination, there was a period of perhaps 500 million years when there was mostly free neutral hydrogen gas in the Universe without yet any visibly radiating stars. This era is known as the ***Dark Ages*** [2]. With time, this neutral hydrogen coalesced through gravitational attraction to form the first stars. These first stars were very hot and massive

Continued on p. 5



History of the Universe. *The period after the Big Bang, when charged particles trapped photons, gave way to the Epoch of Recombination, when particles combined into atoms and released the photons we now know as the cosmic microwave background. Soon after that, in the Epoch of Reionization, higher-energy emissions from the first stars began once again stripping electrons off hydrogen atoms. Credit: figure and caption are from [1], (c) 2018* Sky & Telescope. *All rights reserved. Used with permission.*

Watching Our Universe, continued from p. 4

and went supernova after relatively short lifetimes. These very hot objects emitted large amounts of high energy radiation causing some of the neutral hydrogen gas to reionize into free electrons and protons in the neighborhoods of these stars. This is known as the ***Epoch of Reionization*** situated at around 500 million years after the Big Bang. Unfortunately, although these first stars were intrinsically very bright, they are too far away to be seen by any telescopes here on Earth making the Epoch of Reionization presently unobservable.

Also, because there were no stars or galaxies during the Dark Ages, there is currently no way to probe this era in the early Universe either. But the Universe was full of neutral hydrogen gas during this time and this gas does emit in the 21 cm wavelength of radio microwave light thus potentially providing a means to observe the Universe during the Dark Ages epoch up to the Epoch of Reionization.

In 1944, Hendrik van de Hulst predicted that neutral single hydrogen atoms should emit radio microwave radiation at a wavelength of 21 cm. This radiation was detected in 1951, and it has become a probe that is used to map the distribution of neutral hydrogen, particularly in the Milky Way Galaxy.

But observing the Universe much farther away during the Dark Ages and up to the Epoch of Reionization is a far greater challenge as the 21 cm light from these eras is very faint and highly redshifted to lower energy longer wavelengths making it hard to detect. Also, the Dark Ages and Epoch of Reionization signal is overwhelmed by nearby sources from terrestrial transmitters and hydrogen gas in the Milky Way. In order to observe such a faint signal, various ground-based radio telescope interferometers are being constructed, often in very remote locations to minimize the effects of terrestrial microwave sources.

These radio telescopes include:

- The Murchison Wide Field Array (MWA) in remote western Australia (en.wikipedia.org/wiki/Murchison_Widefield_Array)
- EDGES (Experiment to Detect the Global EoR Signature) of the MIT Haystack Observatory located at the MWA facility in western Australia (www.haystack.mit.edu/ast/arrays/Edges). They claim to have detected a signal from the first stars in the Universe. The website has a nice video explantation.
- The Donald C. Backer Precision Array for Probing the Epoch of Reionization (PAPER) and Hydrogen Epoch of Reionization Array (HERA) in South Africa (en.wikipedia.org/wiki/Precision_Array_for_Probing_the_Epoch_of_Reionization)
- The Low-Frequency Array (LOFAR) in the Netherlands and Northern Europe (en.wikipedia.org/wiki/LOFAR)

These instruments are now being configured to observe this very faint 21 cm light. Also, because this signal is highly redshifted due to their sources being at cosmological distances, it will be possible to use the redshift measurements to determine distances and develop a 3-D map of neutral hydrogen gas in the eras of the Dark Ages and Epoch of Reionization. Such maps should provide information about the conditions under which the first stars and galaxies formed.

References

1. Geach, J. 2018. The first galaxies, *Sky & Telescope* 135(4):14–21.

2. Wikipedia. Chronology of the universe. Retrieved April 30, 2018 from en.wikipedia.org/wiki/Chronology_of_the_universe#Dark_Ages.

Upcoming SMCAS Meetings and Events

We have many fun and interesting activities planned in the coming months. See the web site (www.smcasastro.com) or contact Marion Weiler (mgwe@pacbell.net) for more information or to volunteer at any of these events. Please contact Ed Pieret (epieret@comcast.net) if you are available to help out with Star Parties at Crestview Park and other locations.

Fri, May 4	7:00 pm	**General Meeting, Pizza Social and Presentation**
Sat, May 5	TBD	**Girl Scout Star Party at Butano Girl Scout Camp**
Sat, May 5	5:00 pm	**KIPAC Open House Star Party**
Sat, May 5	8:00 pm	**Crestview Park Star Party**
Sat, May 12	8:00 pm	**Crestview Park Star Party**
Tue, May 15	7:00 pm	**SMCAS Board Meeting**
Fri, Jun 1	7:00 pm	**NO GENERAL MEETING in June (CSM will be closed)**
Sat, Jun 9	8:30 pm	**Crestview Park Star Party**
Sat, Jun 16	8:30 pm	**Crestview Park Star Party**
Sat, Jul 14	6:00 pm	**Pot Luck StarBQue Social and Annual Meeting at Crestview Park, with election of officers and board members (time and place are tentative as of this issue's publication date)**

General meetings and board meetings are held in the ISC Room (room 110) in building 36 at the College of San Mateo. For directions to the building or to the star party site at Crestview Park in San Carlos, see page 11. All SMCAS members are welcome at board meetings.

The times given for the star parties are approximately at sunset. Arrive then to set up a telescope or if you want to learn about telescopes. If you would like to merely see the wonders of the night sky through our telescopes, observing starts about an hour later and usually continues for about two hours.

CalStar Star Party at Lake San Antonio, April 12–16

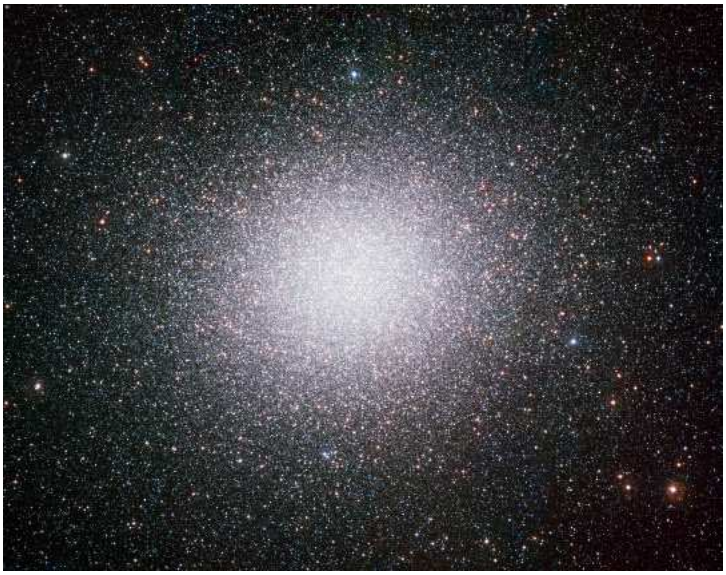
By John Fiske and Ted Jones

Mostly curious about checking out the Lake San Antonio area for future star-gazing, we attended the CalStar Star Party scheduled for April 12–16, sponsored by SJAA and the Left Coast Observers (sponsors of the Golden State Star Party). We drove almost 200 miles south on US 101 to this Monterey County Park roughly 20 miles northwest of Paso Robles in the interior Coast Range. The current South Shore Overflow parking lot had been used for the CalStar star party before.

Arriving on Thursday afternoon we found the site in a broad gently southward sloping plane carpeted by tiny yellow composite flowers, a few oak trees, an almost horizon-horizon viewscape, and about 20 other amateur astronomers settling in. Camping conditions there were “primitive”. There were a few scattered picnic tables, portapotties, and water from spigots (which had a white color, so we didn't trust the water). Also, there was lots of Sun glare during the days, so we recommend bringing “shade” in addition to water. Afternoon temperatures were in the 80s, but nighttime temperatures dipped into the mid-30s.

Viewing conditions the first two evenings were very good, with somewhat darker skies than those at Fremont Peak State Park. We were able to see 12th-magnitude galaxies through John's 14-inch dob (one of the smaller telescopes there). In spite of a small light dome from Paso Robles, we could see Omega Centauri just above the southern horizon…not a great view, but to see Omega Centauri at all was one of our trip highlights.

Looking north. Center: John's 14-inch dob (black).



Omega Centauri, the biggest glob of all. From CalStar's latitude (35.9º N) this sort of resolution cannot be expected, but it was still great to see the cluster in our scopes. Image credit: European Southern Observatory.

On Saturday evening (night 3) storm clouds came in from the northwest, eventually cutting short our observing. However, dodging the clouds we had the privilege of seeing many deep sky objects through a friend's 28-inch dob. Yes, 28 inches, with four times the light-gathering capability of John's 14-inch! Although seeing was imperfect, through a 200-power-plus eyepiece we had our best views yet of the Whirlpool Galaxy (M51), the globular cluster M3, the Sombrero Galaxy (M104), and the Eskimo Nebula (NGC 2392).

We recommend Lake San Antonio for star-gazing, but summer star parties are likely to be hot. At comparable distances (about 200 miles), some Sierra sites could provide better camping conditions, but may not provide similarly dark skies because of light pollution from Central Valley cities. The next CalStar Star Party at this location will be September 6–9.

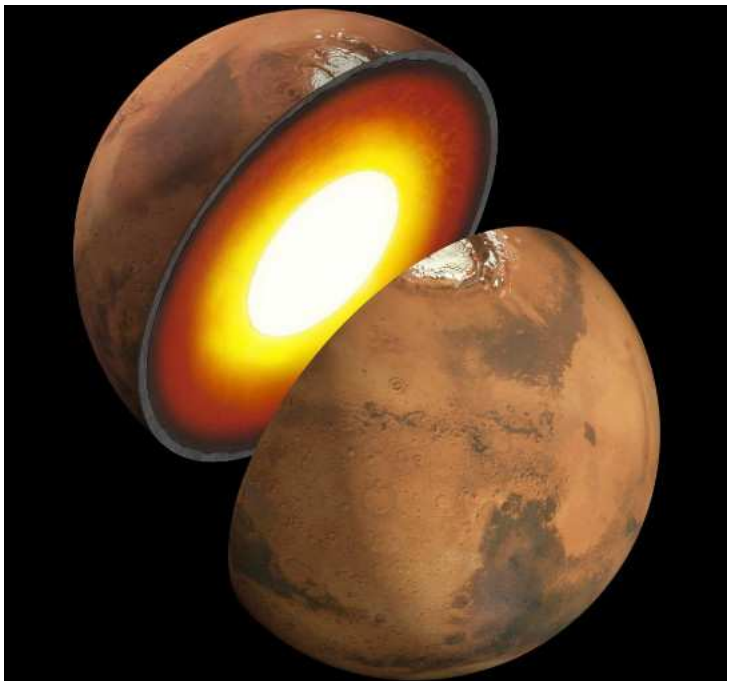
What's It Like inside Mars?

By Jessica Stoller-Conrad

Mars is Earth's neighbor in the solar system. NASA's robotic explorers have visited our neighbor quite a few times. By orbiting, landing and roving on the Red Planet, we've learned so much about Martian canyons, volcanoes, rocks and soil. However, we still don't know exactly what Mars is like on the inside. This information could give scientists some really important clues about how Mars and the rest of our solar system formed.

This spring, NASA is launching a new mission to study the inside of Mars. It's called Mars InSight. InSight—short for Interior Exploration using Seismic Investigations, Geodesy and Heat Transport—is a lander. When InSight lands on Mars later this year, it won't drive around on the surface of Mars like a rover does. Instead, InSight will land, place instruments on the ground nearby and begin collecting information.

Just like a doctor uses instruments to understand what's going on inside your body, InSight will use three science instruments to figure out what's going on inside Mars.



An artist's illustration showing a possible inner structure of Mars. Image credit: NASA/JPL-Caltech.

One of these instruments is called a seismometer. On Earth, scientists use seismometers to study the vibrations that happen during earthquakes. InSight's seismometer will measure the vibrations of earthquakes on Mars—known as marsquakes. We know that on Earth, different materials vibrate in different ways. By studying the vibrations from marsquakes, scientists hope to figure out what materials are found inside Mars.

InSight will also carry a heat probe that will take the temperature on Mars. The heat probe will dig almost 16 feet below Mars' surface. After it burrows into the ground, the heat probe will measure the heat coming from the interior of Mars. These measurements can also help us understand where Mars' heat comes from in the first place. This information will help scientists figure out how Mars formed and if it's made from the same stuff as Earth and the Moon.

Scientists know that the very center of Mars, called the core, is made of iron. But what else is in there? InSight has an instrument called the Rotation and Interior Structure Experiment, or RISE, that will hopefully help us to find out.

Although the InSight lander stays in one spot on Mars, Mars wobbles around as it orbits the Sun. RISE will keep track of InSight's location so that scientists will have a way to measure these wobbles. This information will help determine what materials are in Mars' core and whether the core is liquid or solid.

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May Rise and Set Chart

SMCAS 2018 (PDT)	May 5 Rise	May 5 Set	May 12 Rise	May 12 Set	May 19 Rise	May 19 Set
Sun	6:08 AM	8:03 PM	6:01 AM	8:09 PM	5:55 AM	8:15 PM
Moon	12:26 AM	10:32 AM	4:39 AM	5:16 PM	10:09 AM	Next Day
Mercury	5:13 AM	5:48 PM	5:09 AM	6:09 PM	5:10 AM	6:39 PM
Venus	7:41 AM	10:24 PM	7:46 AM	10:38 PM	7:53 AM	10:49 PM
Mars	1:18 AM	10:55 AM	1:03 AM	10:42 AM	12:46 AM	10:27 AM
Jupiter	8:08 PM	6:34 AM	7:36 PM	6:04 AM	7:05 PM	5:33 AM
Jupiter's moons	g ci J e		g c i J e		g i Je C	
10 PM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io					
Saturn	12:05 AM	9:43 AM	11:33 PM	9:15 AM	11:04 PM	8:46 AM
Uranus	5:29 AM	6:41 PM	5:03 AM	6:15 PM	4:36 AM	5:49 PM
Neptune	3:43 AM	3:07 PM	3:16 AM	2:40 PM	2:48 AM	2:13 PM
Pluto	12:55 AM	10:39 AM	12:28 AM	10:12 AM	11:56 PM	9:44 AM

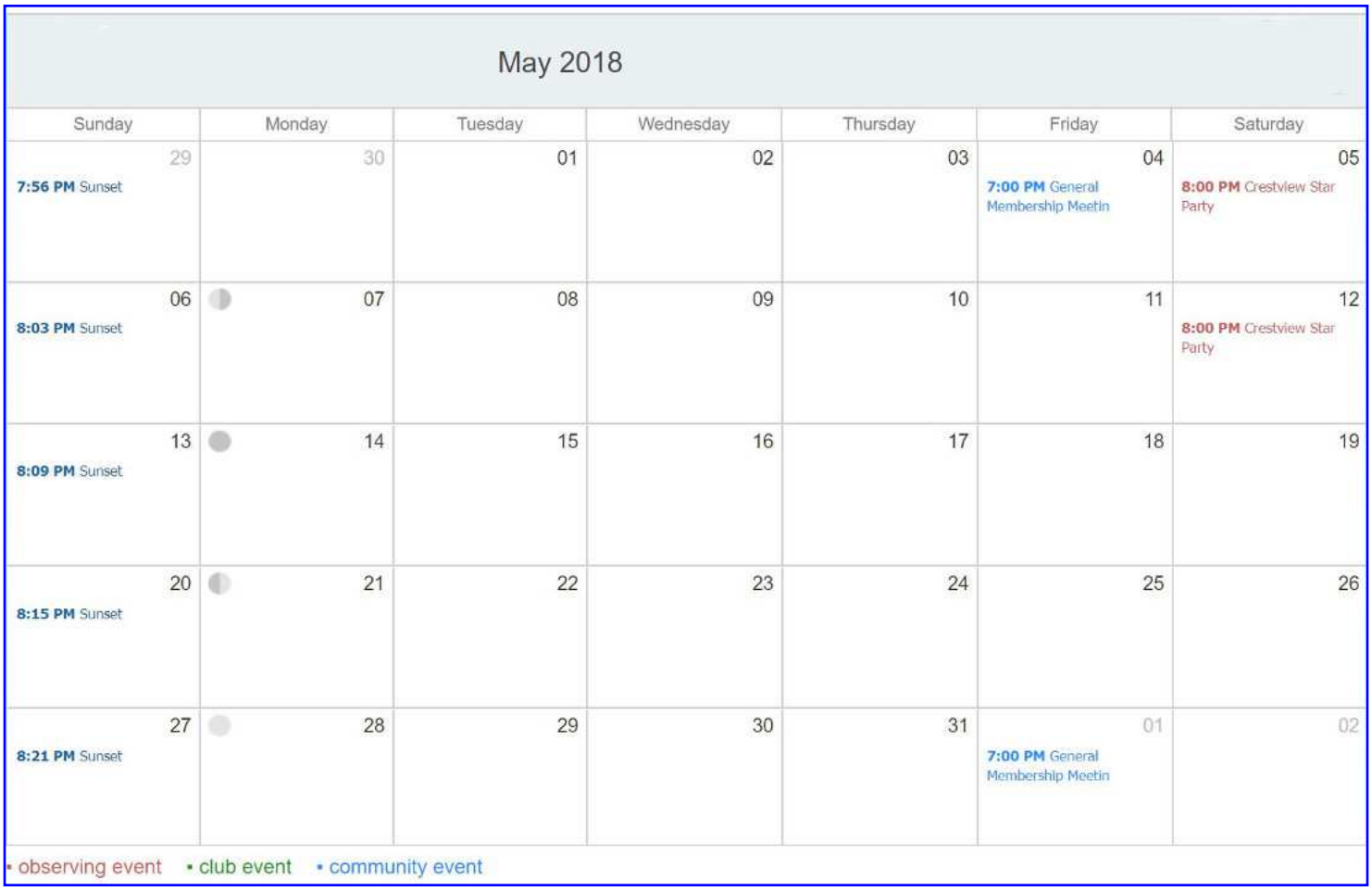
- Star parties are at Crestview on the 5th and 12th.
- Jazz Under the Stars is at CSM on the 19th.

– courtesy of Ron Cardinale

Fundraising for the Group: SMCAS Participates in AmazonSmile and Receives a Percentage of Your Purchase

SMCAS is now enrolled in AmazonSmile, a program that enables certified 501(c)(3) non-profit organizations to receive donations from eligible purchases at Amazon.

To enroll in the program, go to smile.amazon.com. On your first visit to this site, you can select a charitable organization – San Mateo County Astronomical Society (SMCAS) – that will receive 0.5% of the purchase price of eligible items on Amazon. How will you know if an item is eligible? Items are clearly and literally marked on the product detail pages with "Eligible for AmazonSmile donation." For more information, go to smile.amazon.com/about.



May 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29 7:56 PM Sunset	30	01	02	03	04 7:00 PM General Membership Meetin	05 8:00 PM Crestview Star Party
06 8:03 PM Sunset	07	08	09	10	11	12 8:00 PM Crestview Star Party
13 8:09 PM Sunset	14	15	16	17	18	19
20 8:15 PM Sunset	21	22	23	24	25	26
27 8:21 PM Sunset	28	29	30	31	01 7:00 PM General Membership Meetin	02

• observing event • club event • community event

Calendar courtesy of Ed Pieret

Inside Mars, continued from p. 8

InSight will collect tons of information about what Mars is like under the surface. One day, these new details from InSight will help us understand more about how planets like Mars—and our home, Earth—came to be.

For more information about earthquakes and marsquakes, visit: spaceplace.nasa.gov/earthquakes.

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!

Reminder: Technical Advice and Loaner Scope Program

Among the benefits of SMCAS membership are technical advice, and for active members currently without a telescope, participation in our loaner telescope program.

If you seek further information about telescope selection, use or maintenance, feel free to contact members Mike Ryan (jmrastro@yahoo.com, or cell phone 650-678-2762) or Frank Seminaro (frank_seminaro@yahoo.com) for guidance.

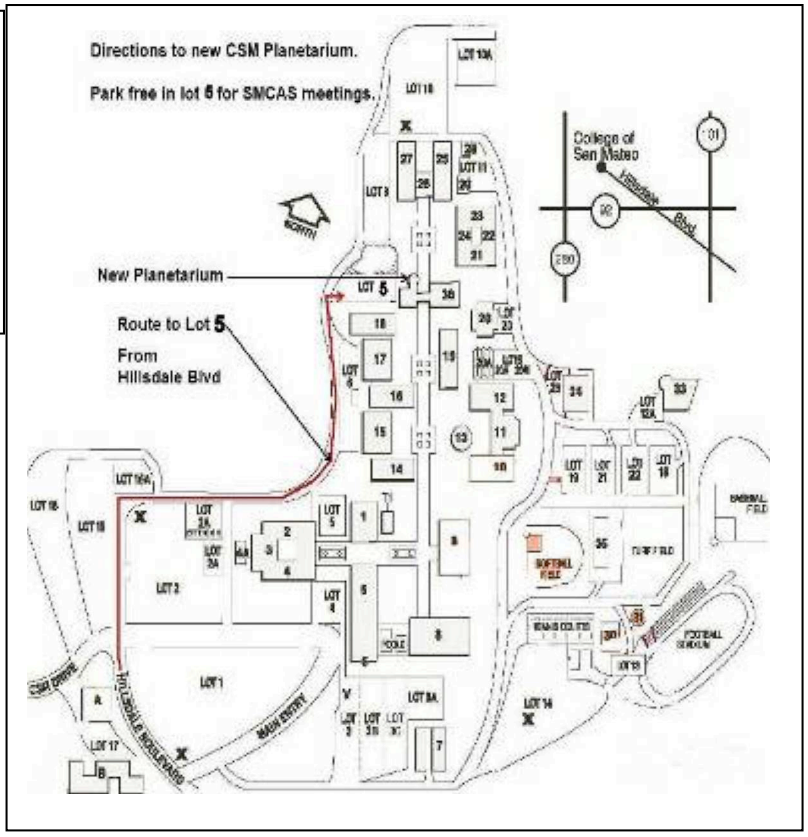
The contact for the telescope loaner program is Ed Pieret (EPIERET@comcast.net or 650-862 9602). For full details see Ed's article on p. 9 of the December 2017 *Event Horizon*.

Directions to SMCAS Meetings at CSM, and to Star Parties

Star Parties are Free to Members and Visitors and are Held Regularly, Weather Permitting

Directions to the CSM Planetarium for Meetings

After exiting Hwy 92 at Hillsdale Blvd, climb the hill towards CSM, passing two traffic lights to the stop sign at the top. Continue straight, bear right then, after the 2nd stop sign, bear left over the rise. Enter the next parking lot on the right, called Lot 5, "Marie Curie'. Science Bldg 36 and the planetarium lie straight ahead. Enter Bldg. 36 thru the door facing the lot, or walk around the dome to the courtyard entrance.



Crestview Park

Come on out, and bring the kids, for a mind-blowing look at the Universe!

Bring your binoculars, telescopes, star guides, and lounge chairs for some informal star gazing at Crestview Park.

Dress warmly and wear a hat. Only visitors with telescopes should drive in. Others should park on the street and walk in, or arrive before dark so that car headlights don't affect the observers' dark adaptation. Bring small flash-lights only, covered with red cellophane or red balloon.

These measures avoid safety issues of maneuvering in the dark, as well as ruining the night vision of the viewers.

Please don't touch a telescope without permission. And, parents, please don't let children run around in the dark.

Directions to Crestview Park for Star Parties

From Hwy 101 or El Camino, take Brittan Avenue in San Carlos, west (to the hills). Follow Brittan 2.3 miles (from El Camino) to Crestview Drive. Turn right on Crestview. In half-a-block, you will see a small blue posted sign with an arrow, indicating the entry road into Crestview Park. It lies between houses with addresses #998 and #1000 Crestview Drive.

From Highway 280, take Edgewood Road exit. Go east (toward the Bay) about 0.8 miles. Turn left at Crestview Drive. Go 0.5 mile uphill to where Crestview meets Brittan. Again, drive the half-block, to the sign on the right, and the entry road on the left.

Note: If bringing a telescope and arriving after dark, please enter the Park with your headlamps and white interior lights off. If you aren't bringing a telescope, whether before or after dark, please park along Crestview Drive, and walk in.

2nd Note: Crestview Park is residential, adjacent to homes and backyards. Before inviting potentially noisy groups, please call Ed Pieret at (650) 595-3691 for advice and advisories. Call Ed also to check the weather and 'sky clock', and to see whether the star party is still scheduled.

San Mateo County Astronomical Society
Membership Application

rev 04022017

SMCAS@live.com; P.O. Box 974, Station A, San Mateo CA 94403; (650) 678-2762

Date: _____ Please check one: [ ] New Member or [ ] Renewal

[ ] $30 Regular Family Membership; [ ] $15 Student Membership

All members, please indicate areas of interest below. New members, please complete entire form. Renewing members, please provide your name and any information that has changed in the last year.

We will list your name, address, email address, and phone number(s) in our membership roster unless you have checked the box preceding that information. The membership roster is distributed to active members only.

Each member's name and mailing address must be provided to the Astronomical League (AL), SMCAS' parent organization. If you don't want AL to have your phone number and email address, indicate below.

[ ] Name(s) _____ [ ] Email Address _____

[ ] Address _____

[ ] City & Zip Code _____

[ ] Phone Number(s): _____ [ ] Do not provide my phone number(s) to the AL.

[ ] Don't provide my email address to the AL. (Checking this means you can ONLY get ***The Reflector*** by regular mail)

Please check one: send ***The Reflector*** [ ] by mail, or [ ] by email.

Areas of Interest

SMCAS encourages member involvement. We invite you to provide additional information about your interests, skills, occupation and prior experience. Please identify SMCAS projects and functions that you might like to help facilitate.

_____

Please indicate which of the following activities might be of interest to you:

_____Star Parties - Do you own a telescope you can bring: Yes ( ) No ( )

_____General Meetings - Finding (or being) a Speaker. Official greeter. Set up or take down ISC or refreshments.

_____ Family Science Day & Astronomy Festival (Usually at CSM the first Saturday in October).

_____Social Events - Equinoctial and Summer Solstice potlucks, Summer Star-B-Que, Holiday Potluck.

_____SMCAS Membership and Promotional Drives

_____Communications – 'Event Horizon' Newsletter, Website(s), Facebook page, group email, Publicity posting.

_____ Educational Programs – School, museum and library star parties, Bay Area Astro teacher assistants.

Other/Comments: _____

_____