The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

June/July 2018 — 652nd General Meeting Notice (July 14). NO GENERAL MEETING IN JUNE.

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 FRANCK MARCHIS (left) spoke at our May meeting about the SETI Institute's search for exoplanets, and in particular the growing collection of methods and efforts aimed at direct imaging of exoplanets and spectroscopic analysis of their atmospheres. See p. 4 of this issue for Ken Lum's review of the talk.

UPCOMING DATES

NO GENERAL MEETING in June.

Jun 5: SMCAS Board Meeting at Avanti Pizza in Belmont.

Jul 14: Pot luck StarBQue, Annual Meeting for election of officers and Star Party at Crestview Park. See page 8.

Jul 17: No board meeting in July.

Aug 21: SMCAS Board Meeting, CSM ISC room.

More events and further details on page 5.

President's Corner

Normally we elect officers and Board members at our June meeting. However, this June we are not holding a meeting due to lack of space (CSM is shut down). So, we will hold our annual election on July 14 at our mid-summer StarBQue at Crestview Park. At the StarBQue, SMCAS will provide the grilled meats and utensils, and we ask attendees to bring pot-luck items (appetizers, salads, veggies, desserts) to round out the dining options. We hope to see you there starting at 6:00pm.

SMCAS has been periodically experiencing service issues with our Yahoo Group email. As a result, the SMCAS Board has decided to migrate our email listserver service to a new provider, Groups.IO, which is dedicated solely to group email service. We are hoping to do this migration this summer. Members will receive an email invitation to join our new service there. Once we migrate our members to the new service, we will shut down the Yahoo group. Only SMCAS members will be allowed on the new service, so if you are not current with your membership dues this is a good time to renew!

Many of our members have wondered what dark sky observing sites there are on the Peninsula. Member Alan Galitz discovered that the Midpeninsula Regional Open Space District offers astronomers an after-hours astronomy permit for astronomical observing at the Monte Bello Open Space Preserve, which is near Skyline Drive on Page Mill Road. Alan, along with a few other SMCAS members obtained permits for couple nights in May and tested it out. Reports were favorable on the viewing; they experienced dark skies by Peninsula standards. If you plan to try it out, be aware the viewing site is in the unpaved parking lot, so dust can be an issue. You may want to bring a tarp to put on the ground to control the dust. Also, Page Mill Road up to Monte Bello OSP can be a challenging road at night, with lots of curves. But the viewing may make it worthwhile! Check the weather before you go. And be sure to obtain a permit, which gives you after hours access to the locked parking lot. Permits can be obtained at www.openspace.org/visit-a-preserve/permits/astronomy-permit.

Saturday May 5 was a busy day for SMCAS, with two major star party events! On that day, we hosted an afternoon and evening solar viewing and star party in support of the KIPAC Open House. The open house, open to the public at the SLAC/KIPAC campus in Menlo Park, attracted over 600 attendees! Our star party location was different from previous years, now next to the food service area, so we attracted a steady stream of visitors. A special shout out and thanks to our many volunteers who made this so successful: Darel Chapman, Edwin Ching, Rachel Freed, Ariana Freed-Wilhelm, Alan Galitz, Bill Lockman, Ken Lum, MaryAnn McKay, Mike Ryan, Galina Sokolova, Marion Weiler, and Wolf Witt. We have been hosting star parties at SLAC and KIPAC open house events for several years now, and if you haven't participated in one of these yet, plan on participating in the future! These are fun events, and our support of SLAC/KIPAC is reciprocated when they support our events.

Also on May 5, SMCAS was invited to host a star party for about 30 Girl Scouts at a camporee held by the San Francisco Council at the Camp Butano Creek Girl Scout camping facility on the coast near Pescadero. Ed Pieret successfully handled this event, which was well received by the Girl Scouts. He put on afternoon demos and a talk, but coastal fog prevented any real evening stargazing. Thanks Ed!

Marion Weiler
President, San Mateo County Astronomical Society

May Meeting Review

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

By Ken Lum

Imagine being able to directly image and spectroscopically analyze extrasolar planets several tens to even thousands of light years away. Doing this would provide the most definitive proof of the existence of an exoplanet. It could even enable a search for the chemical signatures of life. This capability is now coming within reach of astronomers as new tools are developed to push telescopes beyond their previously defined limits of resolution and sensitivity. To explain how these kinds of very difficult observations are starting to be made, Dr. Franck Marchis of the SETI Institute (cover photo) was invited to summarize some of the projects he and his organization are involved in to do this.

The direct imaging of extrasolar planets poses challenges that cannot be overcome by conventional telescopic and photographic technology. The enormous brightness difference between an extrasolar planet and its parent star causes the light of a parent star to swamp out the image of its exoplanet. Typically, stars are around a billion to 10 billion times brighter than their planets.

In addition, the generally very small angular separation between a parent star and its exoplanet(s) also makes separating the image of the planet from the image of the star extremely difficult. Exoplanets located at greater distances from their stars that are bright in the visible to infrared will be the easiest to image. But resolutions going down to 0.01 to 1 arcseconds are needed to successfully image exoplanets.

These challenges get worse with smaller and fainter Earth-like extrasolar planets. In order to achieve such unprecedented image separations, the light of bright parent stars have to be blocked by coronagraphs built into the optical paths of the observing telescopes. In addition, atmospheric distortion of images needs to be stabilized to achieve the highest possible resolutions. This has involved the incorporation of adaptive optics or required space based telescopes or even both.

The coronagraph was originally invented by the French astronomer, Bernard Lyot, in the 1930s to create artificial solar eclipses at the telescope with an occulting disk so that the fainter solar corona could be observed without needing an actual solar eclipse to block out the Sun. For imagers of exoplanets, the coronagraph creates artificial eclipses of stars so that nearby extrasolar planets are not overwhelmed by the glare of the star.

Adaptive optics, an outgrowth of military technology, was declassified in the 1990s and has seen wide application, particularly, in ground-based visible and near-infrared astronomy. This imaging technology improves resolution by comparing a telescopically observed real star image using a device called a wave front sensor with a mathematically idealized model of a star image in a computer (or control system) in real time. The telescope then uses a deformable mirror in the optical path to modify the observed real star image to match the mathematically idealized star image model. Should the astronomical object be too faint to have its distortions be measured by the wave front sensor, then a laser is used to project an artificial guide star in the upper atmosphere to provide a brighter substitute point source for the wave front sensor to measure atmospheric distortions [1]. The Gemini Planet Imager being used with the 8 meter Gemini South telescope in Chile is an example of an imager using both a coronagraph and adaptive optics (Fig. 1, 2).

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Finally, perhaps the best way to eliminate atmospheric distortion is to eliminate the atmosphere altogether. And this is done by placing a telescope in space. The Hubble Space Telescope (HST) has been used in this manner to image extrasolar planets (Fig. 3).

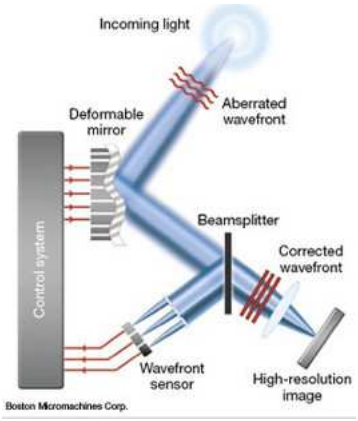

Figure 1. An adaptive optics system that diverts light from a distorted image via a beam splitter to the control system (computer) which controls a deformable mirror to correct the reflected image to match an idealized perfect star image model before reflecting the corrected image to the detector to the right.

The first exoplanet to be directly imaged was 2M1207b, a companion of a brown dwarf, 2M1207, in Centaurus. It was discovered in 2004 using the European Southern Observatory's Very Large Telescope. Since then, some 19 exoplanets have been directly imaged [2]. All detections so far seem to be of Jupiter sized or greater planets with the possible exception of Fomalhaut b, now named Dagon, a star system of about 25 light years distance whose physical nature is under some debate. Fomalhaut b is the smallest directly imaged planet thus far with a mass of that of Jupiter or smaller. It was found by a team led by Dr. Paul Kalas of UC Berkeley in 2008 using the Hubble Space Telescope [2] (Fig. 3). With further progress, it is hoped that smaller, Earth-like planets can be directly imaged.

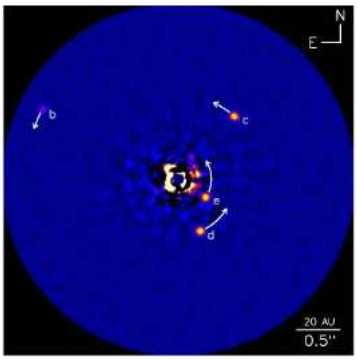

Figure 2. Images of exoplanets orbiting the star HR 8799 using the Gemini Planet Imager. The star is blocked by a coronagraph to prevent the planetary images from being overwhelmed by starlight. Adaptive optics sharpens the images of the exoplanets.

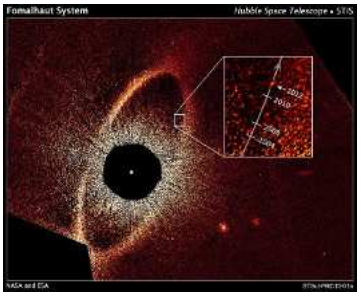

Figure 3. Hubble Space Telescope images of the planet, Fomalhaut b, orbiting the star Fomalhaut.

Spectroscopy has been successfully done with the imaged planets of HR 8799 (Fig. 2). They show the presence of water, methane, carbon monoxide, and acetylene. To expand this line of inquiry to other star systems will require construction of a new class of 30 meter telescopes such as the 30 meter telescope proposed for Mauna Kea, HI, the 39 meter European Extremely Large Telescope slated for Chile, and the Giant Magellan Telescope also destined for Chile. Eventually, the James Webb Space Telescope (JWST), now scheduled for launch in 2020, will also be a candidate instrument for doing this work.

Other direct imaging projects include Project Blue (www.projectblue.org) where a low cost small space telescope is proposed just for the purpose of imaging the Earth-like planets recently discovered in the nearby Alpha Centauri system. By focusing a low cost space telescope mission on a narrow goal, its proponents hope to avoid the delays and cost overruns of a more general purpose mission such as the HST and JWST.

Perhaps most ambitious of all are plans to actually image surface features on exoplanets. A number of far-out proposals are now being debated. Two are the ExoPlanet Surface Imaging [3] using observed unresolved reflected light variations over the course of an exoplanet's orbital and axial rotation to reconstruct exoplanet surface features

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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.

Sat, Jun 9	8:30 pm	**Crestview Park Star Party**
Tue, Jun 5	7:00 pm	**SMCAS Board Meeting at Avanti Pizza, 2040 Ralston Ave, Belmont**
Sat, Jun 16	8:30 pm	**Crestview Park Star Party**
Sat, Jul 7	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. Followed by the Star Party in the next entry on this list.**
Sat, Jul 14	8:30 pm	**Crestview Park Star Party**
Tue, Jul 17		No board meeting in July
Sat, Aug 4	8:15 pm	**Crestview Park Star Party**
Sat, Aug 11	8:00 pm	**Crestview Park Star Party**
Tue, Aug 21	7:00 pm	**SMCAS Board Meeting**
Sat, Sep 1	7:30 pm	**Crestview Park Star Party**
Sat, Sep 8	7:30 pm	**Crestview Park Star Party**
Sat, Sep 29	7:00 pm	**Crestview Park Star Party**

General meetings and board meetings are held in the ISC Room (room 110) in building 36 at the College of San Mateo, unless otherwise noted. For directions to the building or to the star party site at Crestview Park in San Carlos, see page 10. 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.

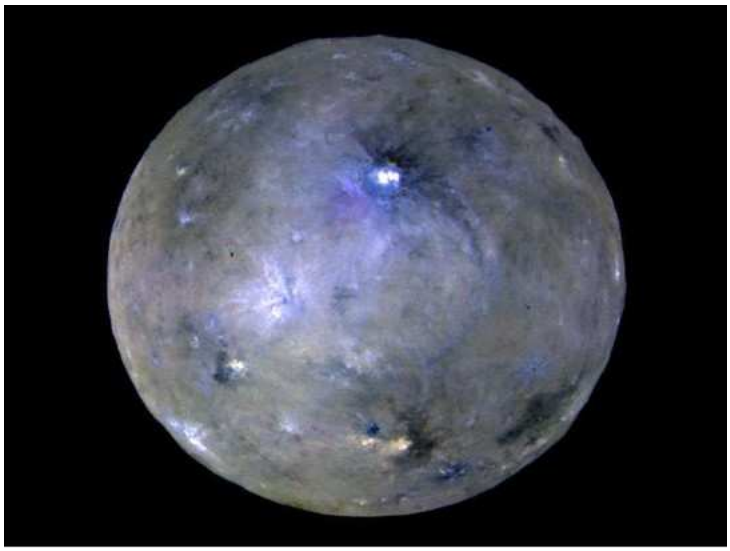
What Is the Asteroid Belt?

By Linda Hermans-Killiam

There are millions of pieces of rocky material left over from the formation of our solar system. These rocky chunks are called asteroids, and they can be found orbiting our Sun. Most asteroids are found between the orbits of Mars and Jupiter. They orbit the Sun in a doughnut-shaped region of space called the asteroid belt.

Asteroids come in many different sizes—from tiny rocks to giant boulders. Some can even be hundreds of miles across! Asteroids are mostly rocky, but some also have metals inside, such as iron and nickel. Almost all asteroids have irregular shapes. However, very large asteroids can have a rounder shape.

The asteroid belt is about as wide as the distance between Earth and the Sun. It's a big space, so the objects in the asteroid belt aren't very close together. That means there is plenty of room for spacecraft to safely pass through the belt. In fact, NASA has already sent several spacecraft through the asteroid belt!



This image captured by the Dawn spacecraft is an enhanced color view of Ceres, the largest object in the asteroid belt. Credit: NASA/JPLCaltech/UCLA/MPS/DLR/IDA.

The total mass of objects in the asteroid belt is only about 4 percent the mass of our Moon. Half of this mass is from the four largest objects in the belt. These objects are named Ceres, Vesta, Pallas and Hygiea.

The dwarf planet Ceres is the largest object in the asteroid belt. However, Ceres is still pretty small. It is only about 587 miles across—only a quarter the diameter of Earth's moon. In 2015, NASA's Dawn mission mapped the surface of Ceres. From Dawn, we learned that the outermost layer of Ceres—called the crust—is made up of a mixture of rock and ice.

The Dawn spacecraft also visited the asteroid Vesta. Vesta is the second largest object in the asteroid belt. It is 329 miles across, and it is the brightest asteroid in the sky. Vesta is covered with light and dark patches, and lava once flowed on its surface.

The asteroid belt is filled with objects from the dawn of our solar system. Asteroids represent the building blocks of planets and moons, and studying them helps us learn about the early solar system.

For more information about asteroids, visit: https://spaceplace.nasa.gov/asteroid

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!

June Rise and Set Chart

SMCAS 2018 (PDT)	**Jun 9 Rise**	**Jun 9 Set**	**Jun 16 Rise**	**Jun 16 Set**	**Jun 23 Rise**	**Jun 23 Set**
Sun	5:47 AM	8:29 PM	5:47 AM	8:32 PM	5:48 AM	8:34 PM
Moon	3:10 AM	4:01 PM	9:00 AM	11:29 PM	4:33 PM	3:03 AM
Mercury	6:01 AM	8:56 PM	6:36 AM	9:34 PM	7:11 AM	9:57 PM
Venus	8:27 AM	11:06 PM	8:40 AM	11:07 PM	8:54 AM	11:04 PM
Mars	11:47 PM	9:32 AM	11:25 PM	9:09 AM	11:01 PM	8:43 AM
Jupiter	5:31 PM	4:04 AM	5:01 PM	3:35 AM	4:31 PM	3:06 AM
Jupiter's moons	c g i e J		g ei J c		g e i J c	
10 PM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io					
Saturn	9:36 PM	7:18 AM	9:07 PM	6:48 AM	8:37 PM	6:18 AM
Uranus	3:17 AM	4:32 PM	2:50 AM	4:05 PM	2:23 AM	3:39 PM
Neptune	1:26 AM	12:52 PM	12:59 AM	12:24 PM	12:31 AM	11:57 AM
Pluto	10:32 PM	8:19 AM	10:04 PM	7:51 AM	9:36 PM	7:23 AM

– The solstice is on June 21 at 3:07 AM.

– Star parties are at Crestview on the 9th and 16th.

– Jazz Under the Stars is at CSM on the 23rd.

– courtesy of Ron Cardinale

Exoplanets, continued from p. 4

and the Solar Gravity Lens Mission to turn the Sun into a giant gravitational lens to do high resolution imaging of exoplanets [4,5].

And so should we ever find spectroscopic signatures of life on exoplanets with these techniques, consider that we could even reconstruct what they smell like? Good idea or no? Or maybe a recipe for grey goo? Maybe reconstruct the extraterrestrial alien altogether from the spectra and have it escape and multiply and EAT US! That would be a movie about indirect alien invasions by proxy. Maybe the movie will make "billions and billions!" Maybe good they are very, very far away after all!

References

1. Hall, S. 2016. Untwinkling the stars, *Sky and Telescope* 131(5):30–36 (May issue).

2. Wikipedia. List of directly imaged exoplanets. Retrieved June 3, 2018.

3. Berdyugina, S. V. and Kuhn, J. R. 2017. Surface imaging of Proxima b and other exoplanets: Topography, biosignatures, and artificial mega-structures. Preprint retrived June 3, 2018.

4. Wang, B. 2018. Direct megapixel imaging and spectroscopy of an exoplanet with a solar gravity lens mission. Retrieved June 3, 2018.

5. Turyshev G. and Shao M. 2017. Using the Sun as a cosmic telescope. *Scientific American* "Observations" blog. Retrieved June 3, 2018.

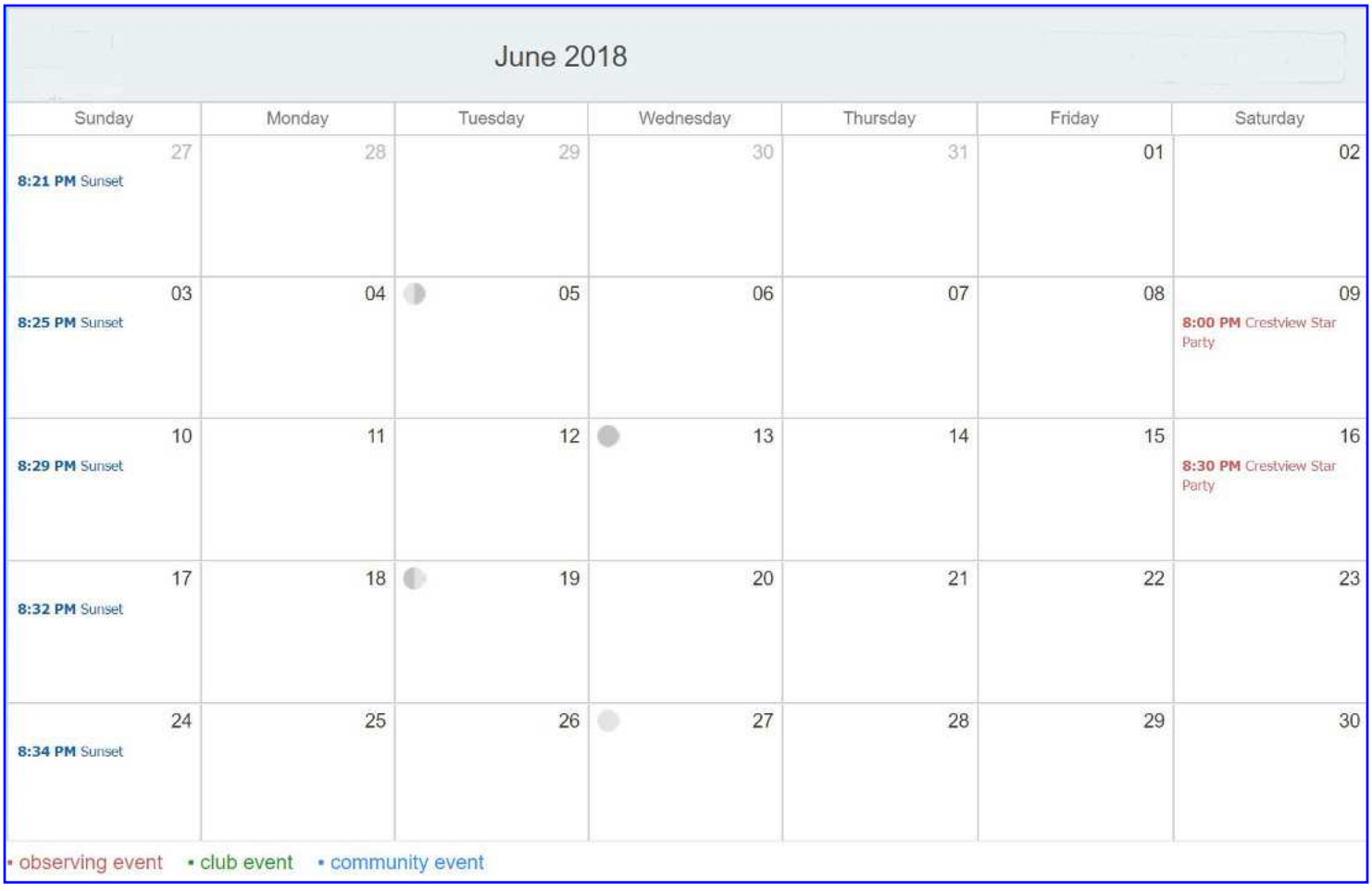
SMCAS StarBQue and Star Party at Crestview Park, 6:00 PM, July 14

Mark your calendars for the SMCAS StarBQue which will be held starting at 6:00 PM, Saturday, July 14 at Crestview Park in San Carlos.

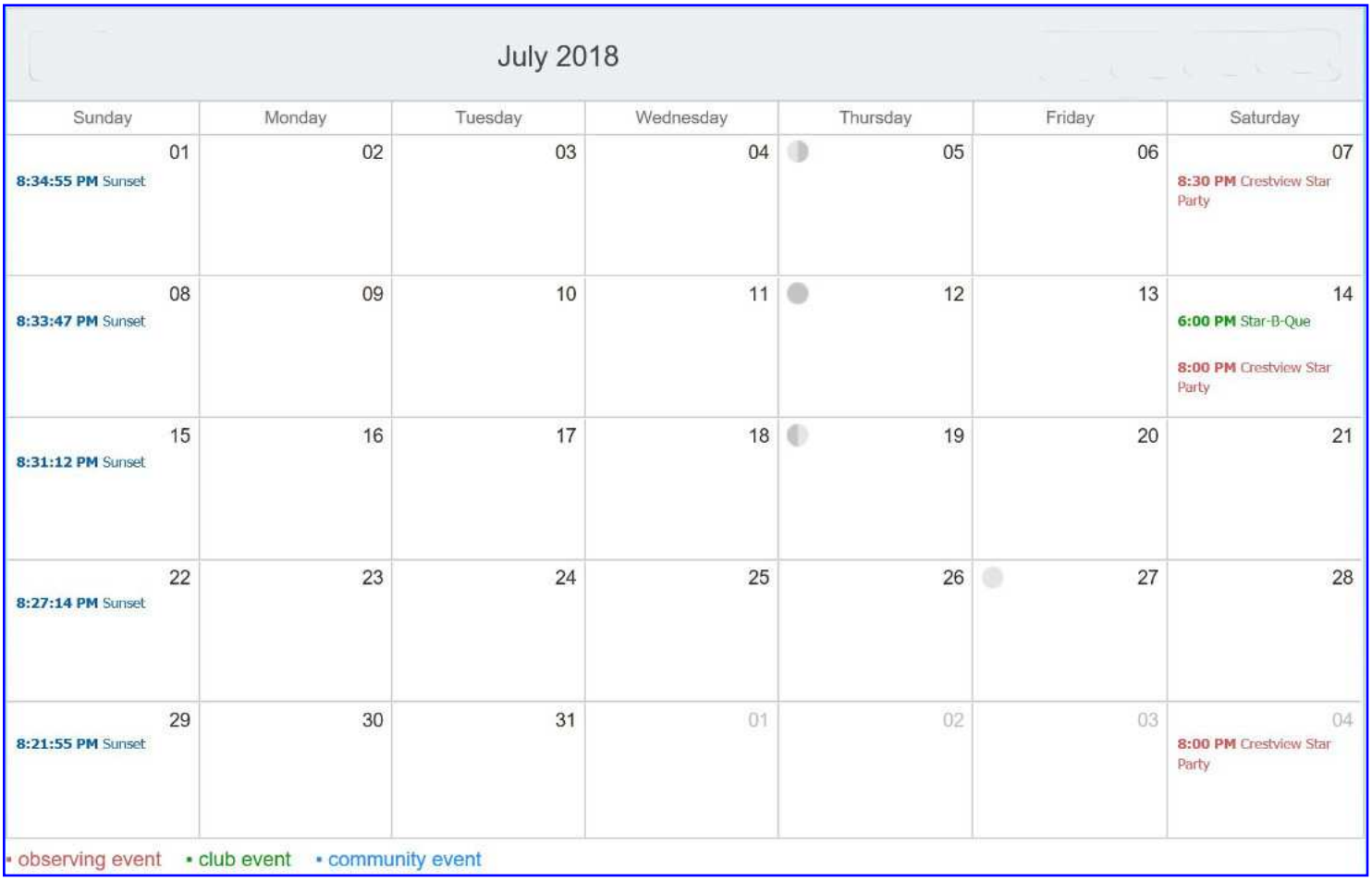
During the StarBQue there will be a short Annual Meeting to elect board members and SMCAS officers. After the StarBQue, we will hold our usually scheduled star party at the park. Sunset will be at 8:30 PM.

The park has BBQ and picnic facilities which we have reserved. The club will provide hamburgers, BBQ chicken, sausages, and veggie burgers.

Attendees should bring their favorite fruit, vegetable, dessert, and/or non-alcoholic drinks for pot luck. This will be another wonderful opportunity to have nice food and socialize during a pleasant California evening, followed by nice summertime astronomical observing. It has been at least a couple of years since our last such event partly due to last year's solar eclipse. Hope to see everyone there!



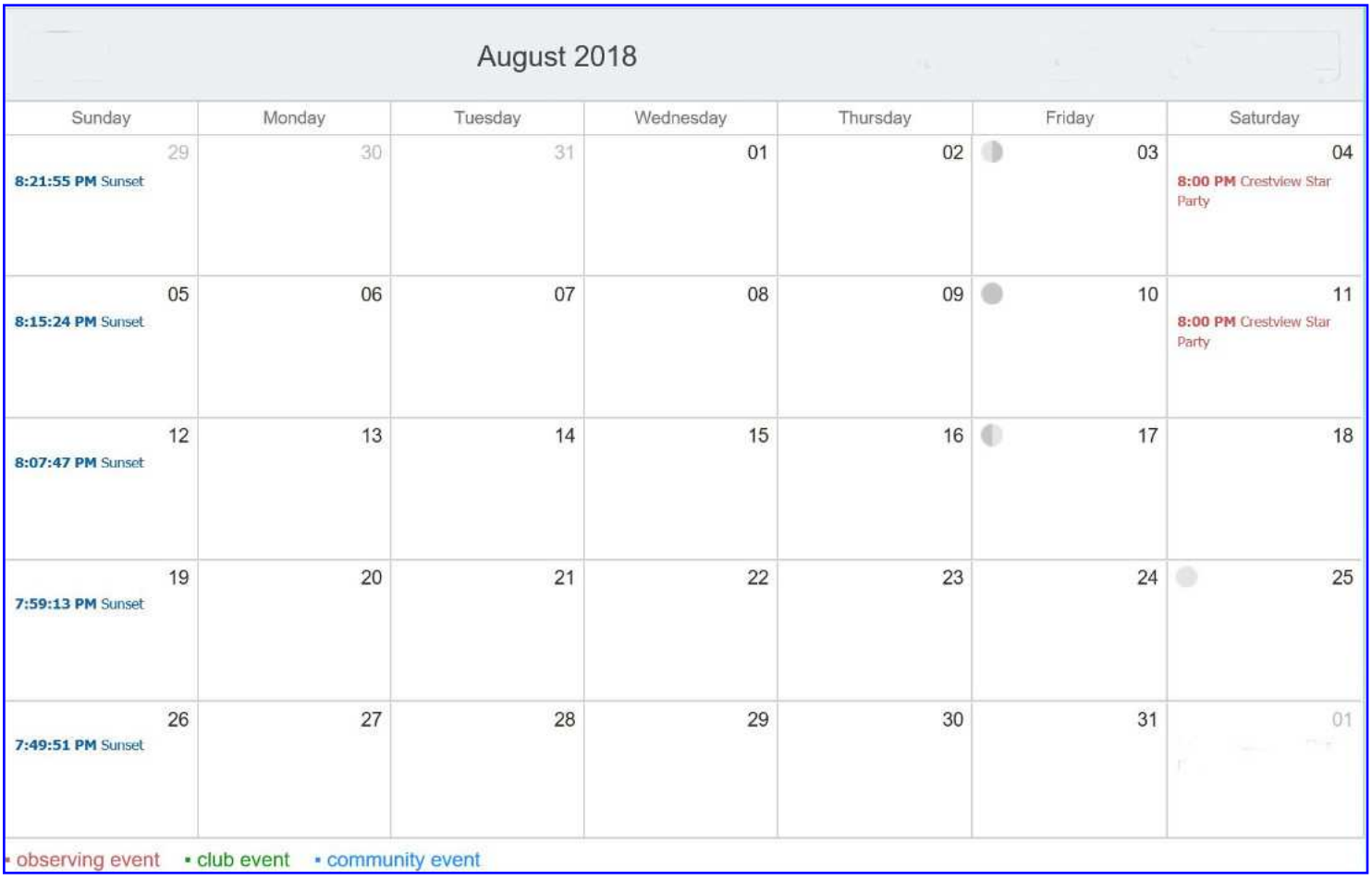
July and August calendars on p. 9



July 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
01 **8:34:55 PM** Sunset	02	03	04	05	06	07 **8:30 PM** Crestview Star Party
08 **8:33:47 PM** Sunset	09	10	11	12	13	14 **6:00 PM** Star-B-Que **8:00 PM** Crestview Star Party
15 **8:31:12 PM** Sunset	16	17	18	19	20	21
22 **8:27:14 PM** Sunset	23	24	25	26	27	28
29 **8:21:55 PM** Sunset	30	31	01	02	03	04 **8:00 PM** Crestview Star Party

• observing event • club event • community event



August 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29 **8:21:55 PM** Sunset	30	31	01	02	03	04 **8:00 PM** Crestview Star Party
05 **8:15:24 PM** Sunset	06	07	08	09	10	11 **8:00 PM** Crestview Star Party
12 **8:07:47 PM** Sunset	13	14	15	16	17	18
19 **7:59:13 PM** Sunset	20	21	22	23	24	25
26 **7:49:51 PM** Sunset	27	28	29	30	31	01

• observing event • club event • community event

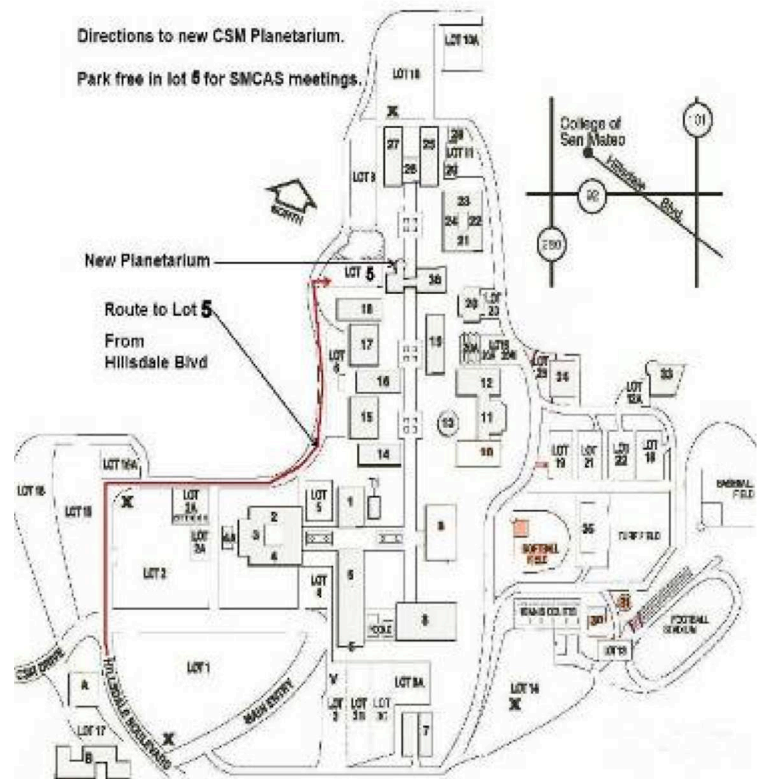
Calendars courtesy of Ed Pieret

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.



SAN MATEO ASTRONOMICAL SOCIETY 1960

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: _____

_____