

The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

December 2018 — 656th 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.



THE SEARCH FOR PLANET NINE was the topic of our November meeting, with speaker Michael Medford (right) of the Lawrence Berkeley National Laboratory. The as yet hypothetical planet has been proposed to account for apparently unlikely coincidences in the orbits of distant solar system bodies. See page 4 for much more.

Table of Contents

President's Corner.....	2
December Meeting.....	3
Past Meeting Review.....	4
SMCAS Event Schedule.....	6
NASA Night Sky Network...	7
Rise and Set Chart.....	8
Calendar.....	9
Directions to Meetings and Star Parties.....	10
Membership Form.....	11

UPCOMING DATES

Dec 7: General Meeting, Pizza, and Presentation at the CSM Planetarium. Details on page 6.

Jan 12: Holiday party at the Crystal Springs Methodist Church in San Mateo.

Jan 15: SMCAS Board meeting, to be held in a Board member's home. Contact a Board member for the location.

More events and further details on page 6.

President's Corner

The end of 2018 is near! 2018 has been a year of abundance and joy. May 2019 bring all of us a sense of renewal and feeling of optimism.

Looking back, my first year as president of SMCAS has been quite enjoyable. The Board has been wonderful to work with and they are all committed to making SMCAS the best it can be for all members. Our membership ranks have also increased.

Fast forward to 2019 when we will see a deeper commitment to public outreach and more club member activities. To start 2019, we will have our holiday party on January 12th. Party details are elsewhere in the newsletter. Instead of a member presentation, we will have a Secret Santa gift exchange. For those members and/or non-member attendees who wish to participate, please bring a wrapped gift costing less than \$25. Numbers will be drawn from a hat to determine gift selection. Subsequent draws can either steal a previously selected gift or select a new gift to unwrap. Gifts can be astro-related, weird, funny, etc. I trust the members will keep it interesting.

The club recently participated in two astro-related events—the SLAC open house and the CSM Family Science and Astronomy Day. Both events were a success. Many thanks to our project leaders Bill Lockman and Ed Pieret for organizing and managing the events. Both are leading a Board subcommittee on how to have SMCAS deliver better events and broaden our public reach. Their efforts will really pay off in 2019.

From an observing perspective, 2018 has been challenging. Between the clouds, smoke, and wind, very few Crestview Star Parties had optimal seeing. However, there seemed to be larger public crowds at the star parties and an increase in the number of telescopes at each event. Several new astrophotographers even showed up on a few nights.

2019 may turn out to be a turning point in the traditional technology used in public observing. I have started to see new telescope designs where eyepieces are replaced by highly sensitive imaging sensors. These sensors then project the image to your iPhone. It will be interesting to see if our expensive optical eyepieces will become worthless paper weights in the near future. The next generation of observers may never look through a glass eyepiece or need a truck to carry around a huge telescope. Change is constant. Maybe this is what is needed to bring in the next generation into the hobby.

I would like to wish the SMCAS Board, members and your families Happy Holidays and Happy New Year!

Clear Skies!

Frank Seminaro

President, San Mateo County Astronomical Society

SMCAS General Meeting and Presentation on Friday December 7, 2018

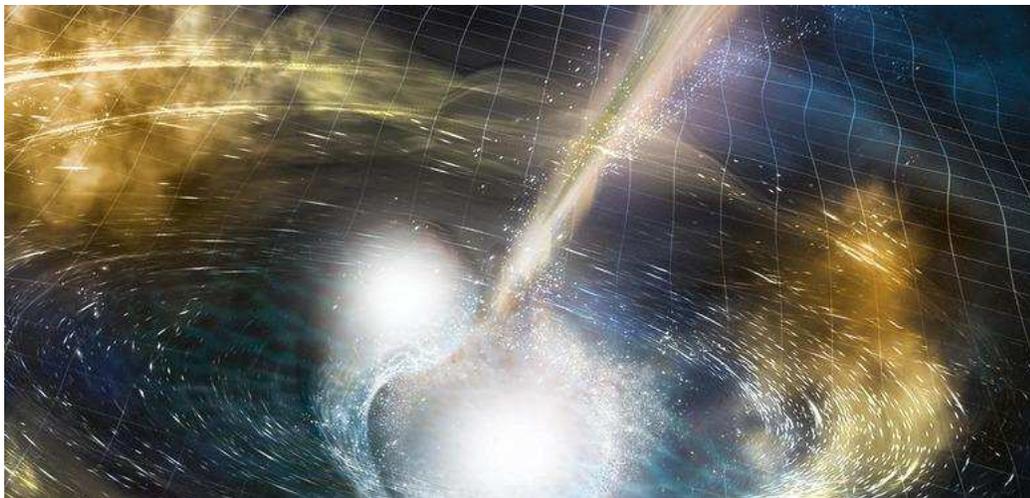
Dr Brian Lantz

Senior Research Scientist
LIGO, Stanford

Seeking Gravitational Waves: The Tao of LIGO

Friday, December 7, 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)

Gravitational waves (ripples in space and time) were first predicted by Einstein, who thought they were too weak to detect (and didn't believe in black holes). However, the Laser Interferometer Gravitational-Wave Observatory (LIGO) made the stunning first detection of Gravitational Waves from colliding black holes in 2015. So, what is LIGO, what is the science



behind it and the challenges in making it, how does it work, how will it evolve and what new discoveries may we encounter with the next generation of gravitational wave detectors?

In this talk, Dr

Lantz will address these questions from the viewpoint of someone intimately involved in the design and construction of key elements of LIGO.

Brian is the Lead scientist for Seismic Isolation System in the the Advanced Laser Interferometer Gravitational Wave Observatory (LIGO), and leader of the working group to develop seismic isolation and suspension systems for the next generation of gravitational-wave detectors. He received his PhD in Physics from the Massachusetts Institute of Technology in 1998.



The Hunt for Planet Nine

By Ken Lum

Our November meeting had Michael Medford, 4th year graduate student at the Lawrence Berkeley National Laboratory, come and describe the efforts he and his team are making to investigate a proposed but as yet undiscovered 9th planet in the outer Solar System.

After the 1930 discovery of Pluto (which is no longer the 9th planet as it was reclassified a dwarf planet by the International Astronomical Union), there was speculation that there existed many more small bodies orbiting the Sun beyond the orbit of Neptune at 30 Astronomical Units (AU; an AU is the distance between the Sun and the Earth) from the Sun. Then, in 1992, a small object named 15760 Albion was discovered by Drs. David Hewitt and Jane Luu at a distance of around 43 AU. Since then, over a thousand such objects have been discovered in the outer Solar System with many more estimated to exist. These objects of around 60 miles diameter or more consist mostly of frozen ices of methane, ammonia, and water, and occupy a region between 30 to 50 AU out that is now called the Kuiper Belt with the objects being called Kuiper Belt Objects (KBOs). Some have highly eccentric elliptical orbits that reach out as far as 100 AU. These are the small remnant leftovers from the formation of the Solar System.

In 2014, Chadwick Trujillo of Northern Arizona University and Scott Sheppard of the Carnegie Institution for Science found that about a dozen KBOs had their orbital perihelia locations (their closest approaches to the Sun) cluster together in a confined area of the Solar System's planetary orbital or ecliptic plane (Fig. 1). They also all move from south to north when passing through their perihelia. Such a remarkable confining of so many objects to having a near common location and direction for their perihelia near the ecliptic plane seemed unlikely to be due to a mere chance holdover from the Solar System's formation. They speculated that some massive planet at an even

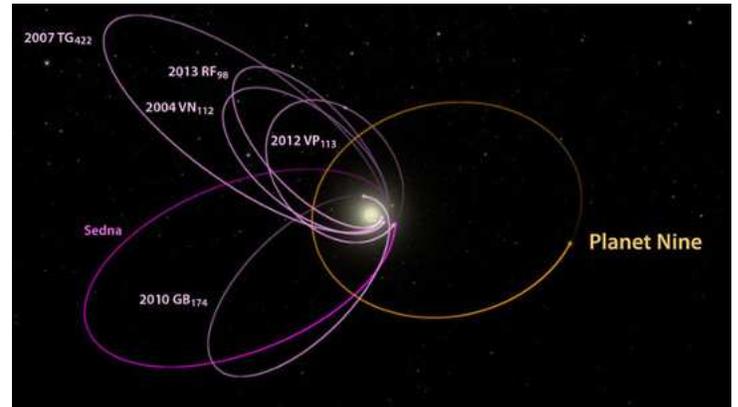


Figure 1. In purple, the orbits of several KBOs beyond the orbit of Neptune. Note the clustering in the positions of their perihelia (points of closest approach to the Sun) and the directions of the major axes of their orbits. In yellow, a hypothetical orbit of the proposed Planet Nine, whose gravitational influence could explain the coincidences in the KBO orbits. Credit: Caltech/Robert Hurt (IPAC).

greater distance was perhaps gravitationally tying these orbits together at their perihelia like a string wrapped around a set of rings. This would prevent the individual perihelia from precessing apart due to long term rotation of the individual KBO orbital planes around the Sun.

Then in 2016, Konstantin Batygin and Michael Brown of Caltech not only confirmed Trujillo and Sheppard's general conclusions via computer simulations, but refined their concept of a corralling planet to one with a highly eccentric orbit with a perihelion of around 300 AU and an average distance of 700 AU and maybe a mass of at least 10–20 Earth masses. With these initial theoretical specifications established, a search was on to find an actual such planet now called Planet 9.

While most teams are searching for Planet 9 by imaging ever more specific areas of sky with big telescopes, Mr. Medford, along with fellow UCB graduate student Danny Goldstein and faculty advisor Peter Nugent, use computer algorithms to

Continued on p. 5

Planet Nine, continued from p. 4

search archival images of relevant areas of sky obtained from the 1.2 meter Palomar Transient Factory (PTF) telescope in Southern California between 2009 and 2016. They are using a method called shift-and-add to digitally stack and potentially enhance images of extremely faint objects to look for evidence of Planet 9 (Fig. 2). Mr. Medford showed some samples of the kind of results that could be obtained in this manner.

Because Planet 9's orbit can only be known as an educated guess, the Berkeley team is having to stack successive images in literally millions of ways in the hope they get lucky and get at least one image with an enhanced view of a Planet 9 candidate. This requires enormous computing power presently obtained through use of the Cori computer, a Cray XC40 system that is considered to be currently among the ten most powerful supercomputers in the world. No doubt this method will have many uses in detecting other kinds of low visibility objects.

Alternatively, Ann-Marie Madigan and Jacob Fleisig of the University of Colorado, Boulder suggest that the combined gravity of many thousands of KBOs by themselves might be sufficient to gather the KBO perihelia together provided they are lined up properly and there is a sufficient mass of such objects to have an effect. This provides another potential explanation for the observations without the need to have a Planet 9. Finally, I read of an update of Oct. 3, 2018 from the Astronomical Union's Minor Planet Center that Chad Trujillo, Scott Sheppard, and David Tholen of the University of Hawaii have observed an object called 2015 TG387 nicknamed "The Goblin" which has properties similar to the Planet 9 of Batygin and Brown. But if this observation does not settle the issue, the upcoming Large Synoptic

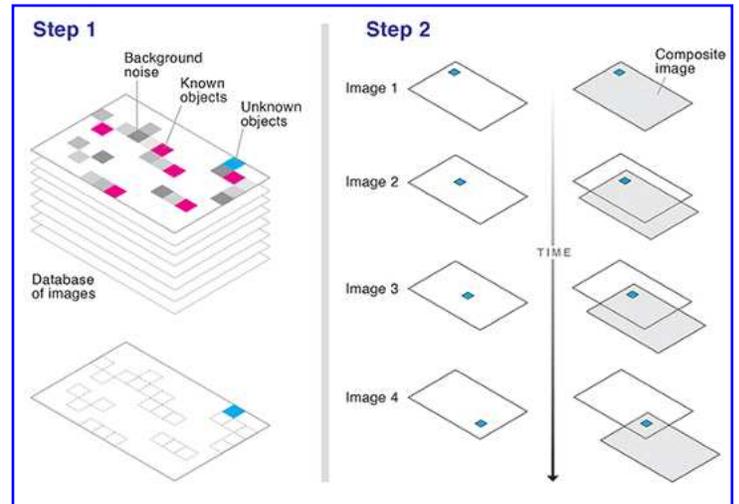


Figure 2. The Shift-and-Add method devised by a team from UC Berkeley to aid in the search for Planet Nine by combining multiple images of the same region of the sky taken at different times. The process has two steps. In the first step, noise and known objects are identified and removed from all the images. In the second step, the images are aligned (shifted) and combined (added) so that objects too faint to be seen on any single image—such as a distant planet—may become visible in the final composite image. Image credit: reference [4].

Survey Telescope (LSST) would be ideal for this search. So, stay tuned!

References

1. Beatty, J. Kelly. 2016. [Making the case for "Planet 9"](#). Retrieved 30 Nov 2018.
2. Beatty, J. Kelly. 2017. [New wrinkles in the search for "Planet X"](#). Retrieved 30 Nov 2018.
3. Barbuzano, J. 2018. [No Planet Nine? Small-body pile-up could explain odd orbits.](#) Retrieved 30 Nov 2018.
4. Gibbs, W.W., 2017. [Where is planet nine?](#) *IEEE Spectrum*, 54(8), pp.26-33. Web version retrieved 30 Nov 2018.

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, Dec 1	5:00 pm	Crestview Park Star Party
Fri, Dec 7	7:00 pm	General Meeting, Pizza Social and Presentation
Sat, Dec 8	5:00 pm	Crestview Park Star Party
Fri, Dec 14	4:00 am	Geminids Meteor Shower peaks — King of meteor showers (moon sets just before midnight)
Tue, Dec 18		No board meeting in December
Sat, Jan 5	5:00 pm	Crestview Park Star Party
Sat, Jan 12	5:00 pm	Crestview Park Star Party
Sat, Jan 12	6:00 pm	Holiday Party, Crystal Springs Methodist Church, San Mateo
Tue, Jan 15	7:00 pm	SMCAS Board Meeting (to be held in a board member's home; contact a board member for the location)
Sat, Jan 26	5:30 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.

Crystal Springs Methodist Church is located at 2145 Bunker Hill Drive, San Mateo. The Holiday Party will be in the Fireside Room.

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.

Observe Apollo 8's Lunar Milestones

By David Prosper

December marks the 50th anniversary of NASA's Apollo 8 mission, when humans first orbited the Moon in a triumph of human engineering. The mission may be most famous for "Earthrise," the iconic photograph of Earth suspended over the rugged lunar surface. "Earthrise" inspired the imaginations of people around the world and remains one of the most famous photos ever taken. This month also brings a great potential display of the Geminids and a close approach by Comet 46P/Wirtanen.

You can take note of Apollo 8's mission milestones while observing the Moon this month. Watch the nearly full Moon rise just before sunset on December 21, exactly 50 years after Apollo 8 launched; it will be near the bright orange star Aldebaran in Taurus. The following evenings watch it pass over the top of Orion and on through Gemini; on those days five decades earlier, astronauts Frank Borman, Jim Lovell, and Bill Anders sped towards the Moon in their fully crewed command module. Notice how the Moon



Earthrise, 1968. Note the phase of Earth as seen from the Moon. Nearside lunar observers see Earth go through a complete set of phases. However, only orbiting astronauts witness Earthrises; for stationary lunar observers, Earth barely moves at all. Why is that? Credit: Bill Anders/NASA.



rises later each evening, and how its phase wanes from full on Dec 22 to gibbous through the rest of the week. Can you imagine what phase Earth would appear as if you were standing on the Moon, looking back? The three brave astronauts spent 20 sleepless hours in orbit around the Moon, starting on Dec 24, 1968. During those ten orbits they became the first humans to see with their own eyes both the far side of the Moon and an Earthrise! The crew telecast a holiday message on December 25 to a record number of Earthbound viewers as they orbited over the lifeless lunar terrain; "Good night, good luck, a merry Christmas and God bless all of you - all of you on the good Earth." 50 years later, spot the Moon on these holiday evenings as it travels through Cancer and Leo. Just two days later the astronauts splashed down into the Pacific Ocean after achieving all the mission's test objectives, paving the way for another giant leap in space exploration the following year.

The Geminids, an excellent annual meteor shower, peaks the evening of December 13 through the morning of the 14th. They get their chance to truly shine after a waxing crescent Moon sets around 10:30 pm on the 13th. Expert Geminid observers can spot around 100 meteors per hour under ideal conditions. You'll spot quite a few meteors by avoiding bad weather and light pollution if you can, and of course make sure to bundle up and take frequent warming breaks. The Geminids have an unusual origin compared to most meteor showers, which generally spring from icy comets. The tiny particles Earth passes through these evenings come from a strange "rock comet" named asteroid 3200 Phaethon. This dusty asteroid experiences faint outbursts of fine particles of rock instead of ice.

You can also look for comet 46P/Wirtanen while you're out meteor watching. Its closest approach

Continued on p. 9

December Rise and Set Chart

SMCAS 2018 (PST)	Dec 1 Rise	Dec 1 Set	Dec 8 Rise	Dec 8 Set	Dec 15 Rise	Dec 15 Set
Sun	7:05 AM	4:51 PM	7:11 AM	4:50 PM	7:17 AM	4:52 PM
Moon	1:07 AM	1:57 PM	8:19 AM	6:19 PM	12:47 PM	Next Day
Mercury	6:15 AM	4:22 PM	5:35 AM	3:51 PM	5:32 AM	3:39 PM
Venus	3:47 AM	2:50 PM	3:39 AM	2:38 PM	3:35 AM	2:27 PM
Mars	12:39 PM	11:50 PM	12:22 PM	11:45 PM	12:05 PM	11:40 PM
Jupiter	6:44 AM	4:36 PM	6:24 AM	4:14 PM	6:04 AM	3:52 PM
Jupiter's moons	e j c i g		e j i g c		c e j i g	
6:30 AM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io					
Saturn	9:13 AM	6:48 PM	8:48 AM	6:24 PM	8:24 AM	6:00 PM
Uranus	2:39 PM	3:53 AM	2:11 PM	3:25 AM	1:43 PM	2:57 AM
Neptune	12:48 PM	12:10 AM	12:20 PM	11:39 PM	11:53 AM	11:12 PM
Pluto	10:01 AM	7:41 PM	9:34 AM	7:15 PM	9:08 AM	6:48 PM

- Star parties are at Crestview on the 1st and the 8th. Jazz Under the Stars is at CSM on the 15th.

- 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.

calendar | list

Download

December 2018

Today

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
25 4:54 PM Sunset	26	27	28	29	30	01 5:00 PM Crestview Star Party
02 4:52 PM Sunset	03	04	05 ●	06	07 7:00 PM General Membership Meeting	08 5:00 PM Crestview Star Party
09 4:52 PM Sunset	10	11	12	13 ●	14	15
16 4:53 PM Sunset	17	18	19	20	21 ●	22
23 4:56 PM Sunset	24	25	26	27 ●	28	29
30 5:00 PM Sunset	31	01	02	03	04	05

● observing event ● club event ● community event

Calendar courtesy of Ed Pieret

Dance of the Planets, continued from p. 7

to Earth brings it within 7.1 million miles of us on December 16. That's 30 times the average Earth-Moon distance! While passing near enough to rank as the 10 closest cometary approach in modern times, there is no danger of this object striking our planet. Cometary brightness is hard to predict, and while there is a chance comet 46P/Wirtanen may flare up to naked eye visibility, it will likely remain visible only via binoculars or telescopes. You'll be able to see for yourself how much 46P/Wirtanen actually brightens. Some of the best nights to hunt for it will be December 15 and 16 as it passes between two prominent star clusters in Taurus: the Pleiades and the V-shaped Hyades. Happy hunting!

This article is distributed by NASA Night Sky Network. The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

You can catch up on all of NASA's current and future missions at nasa.gov.

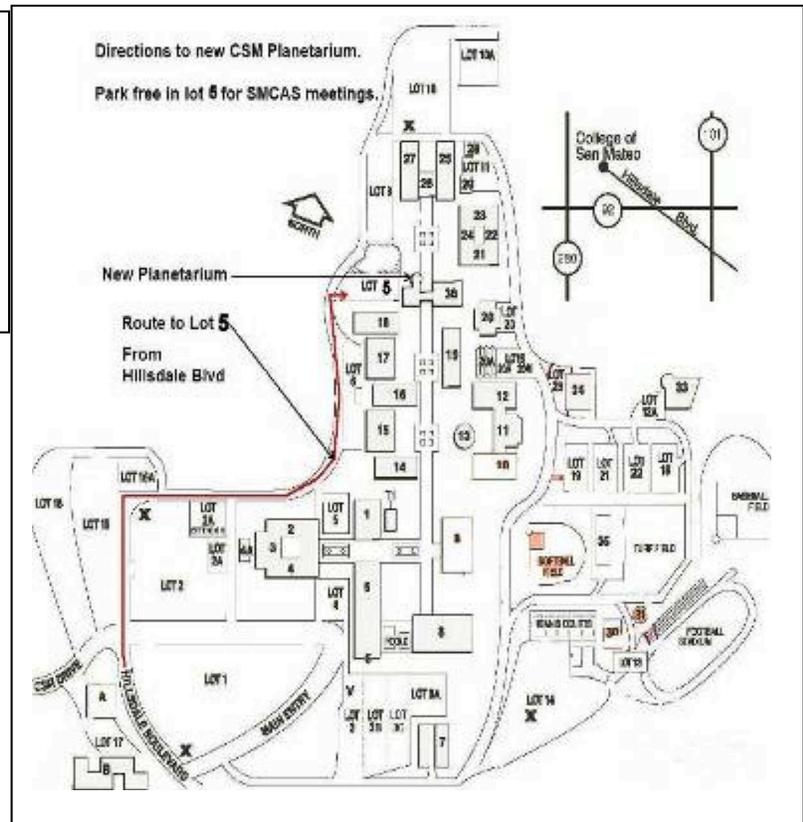
Holiday publications have arrived and will be available for distribution at the December 7 general meeting before the holidays. Thereafter, there are three options for getting your publication: (1) at the January 12 "holiday party", (2) send an e-mail to Ed Ching at chinged@gmail.com to arrange when to come it up from Woodside, off I280, or (3) before the December 7 meeting, make arrangements to coordinate transfer to and pick up from another Board Member (at their home in San Mateo County, or at a Crestview Star Party).

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.

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.

Directions to Crestview Park for Star Parties

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: _____

<http://www.SMCASASTRO.com>