

The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

March 2018 — 649th 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.



KELLY STIFTER, the speaker at our February meeting, shows off her SMCAS patch in the clean room at SLAC where she works on the detector for LUX ZEPELIN, a next generation dark matter direct detection experiment. See page 4 for a review of the February talk and more about LUX ZEPELIN.

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DATES TO SAVE

- Mar 2:** General meeting, pizza, and presentation at the CSM Planetarium. Details on page 3.
 - Mar 20:** SMCAS Board Meeting, CSM ISC room.
 - Mar 24:** Spring Equinox Social at Crystal Springs Methodist Church, San Mateo.
 - Apr 6:** General meeting, pizza, and presentation.
- More events and further details on page 6.

President's Corner

Enrico Fermi once famously asked the question in regards to Extraterrestrial Intelligence visiting earth: "Where are they?" If life is common in the universe, and intelligent life a least part of that, why haven't they come to visit us? Many hypotheses try to explain this, but the mystery remains.

When it comes to volunteers at SMCAS, we often ponder a similar question. We have lots of members, but where are the volunteers? Our society and mission depends on volunteers, for everything from the Executive team and Board of Directors, to helping out at meetings, participating in star parties and more. Engaging volunteers in a Society can be a challenge. Most of our active volunteers got involved due to their love of astronomy and desire to share that with the public. Many other volunteers got involved because someone asked them to take on a role.

It may be illuminating to see the breadth of volunteer activity and roles that keep our Society going, and this is not a complete list:

- Executive team: President, VP, Treasurer, Secretary
- Board members at large: 5 members
- Meeting set up
- Meeting Greeters
- Liaison to the City of San Carlos Parks & Rec for Crestview Park
- Star party Coordination
- Membership chair
- Webmaster, social media
- Event Horizon Editor
- Speaker chair
- Publicity
- Special events (e.g., SLAC Kids Night) Coordination

We are coming up on our annual nomination and election of officers cycle starting with open nomination at the May meeting and election at our June meeting. We have 9 slots on the Board. We also have a need for individuals to take on some of the support roles noted above.

So please, you can be the one to solve Fermi's Paradox by showing you are here, or by stepping forward when asked to support our wonderful Society!

Marion Weiler

President, San Mateo County Astronomical Society

SMCAS General Meeting and Presentation on Friday March 2, 2018

Dr Chris McKay

Senior Scientist

NASA Ames Space Sciences and Astrobiology

Enceladus: A Moon of Saturn with a Life of its Own?

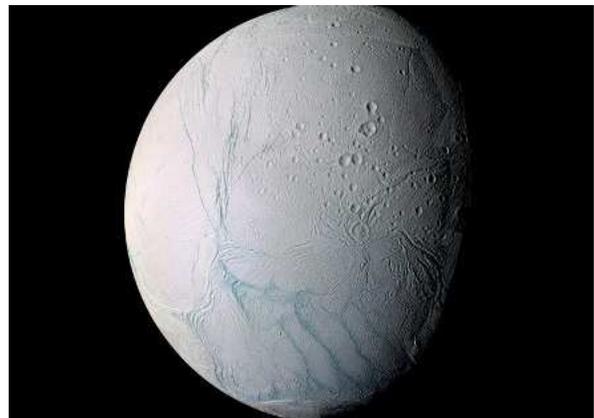
Friday, March 2, 2018, College of San Mateo, Building 36

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)

Mars has long been the primary target for the search for a second genesis of life beyond Earth. Now interest in the search for life has expanded to the subsurface oceans of the outer Solar System: particularly on Enceladus. Analysis of the plume of Enceladus by the Cassini Spacecraft indicates a habitable organic-rich ocean. Samples from the plume may be comparatively easy to obtain on future flythrough and sample return missions. Let's go!



Dr McKay received his PhD in Astrogeophysics from the University of Colorado in 1982. His research interests focus on the evolution of the solar system and the origin of life. He is also actively involved in planning for future Mars missions including human exploration. He has been involved with polar and desert research, traveling to the Antarctic Dry Valleys, the Atacama Desert, the Arctic, and the Namib Desert to conduct research in these Mars-like environments.

February Meeting Review

Direct Detection of Dark Matter

By Ken Lum

Beginning in the 1930s, most astronomers have come to the conclusion that the Universe is made up mostly of stuff that we cannot actually detect. In fact, it would seem that only around 4% of the physical Universe is made up of ordinary atoms, also known as baryonic matter or Standard Model (SM) matter. Another 24% of the Universe appears to be made up of, as yet, undetectable matter, now called Dark Matter (DM). Dark Matter reveals itself entirely through its gravitational effects causing galaxies and galaxy clusters to rotate faster than what would be predicted just on the basis of the visible standard model matter (SM) content [2]. Otherwise, Dark Matter has never been detected in any other way. Finally, the remaining 72% of the Universe seems to be made up of a mysterious unknown form of energy, known as Dark Energy, which is causing the Universe to accelerate its expansion rate.

The search for Dark Matter is being pursued in various experiments, both on the ground and in space. Ms. Kelly Stifter, a Ph.D. candidate in the Physics Department and SLAC National Accelerator Laboratory, Stanford University, came for our February meeting to explain about one ground based experiment that she is working on known as the LUX ZEPLIN (LZ) experiment. The LZ experiment is a combination of two prior dark matter detection experiments previously known as the Large Underground Xenon (LUX) and Zoned Proportional Scintillation in Liquid Noble Gases (ZEPLIN) experiments. It is located in the Sanford Underground Research Facility (SURF) in South Dakota in a decommissioned gold mine in an effort to reduce signal noise from cosmic rays. The facility is named after T. Denny Sanford who donated \$70 million to its construction.

Various hypotheses have been put forward as to the nature of Dark Matter. These include such



Our February speaker Kelly Stifter, unmasked (cf. cover photo), with SMCAS President Marion Weiler.

difficult-to-detect macroscopic entities as small black holes and interstellar planets, and exotic subatomic particles such as axions and WIMPs (Weakly Interacting Massive Particles). The current hypothesis receiving the most research attention is that Dark Matter is made of WIMPs with energy equivalent masses of around 10^4 gigaelectronvolts (GeV).

Particle physicists typically detect subatomic particles via their interactions with each other. In this scheme, DM particles can collide (rarely) with each other or with Standard Model (SM) matter leading to detectable emissions of energy or other particles. Experiments to detect dark matter can be classified into indirect detection vs. direct detection. The LZ experiment is the only direct detection experiment being built. It assumes that if DM particles are all over space, then they should also be detectable here on Earth.

Other more indirect detection experiments include attempts to make DM particles by colliding SM particles together and looking for evidence of

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Dark Matter, continued from p. 4

missing momentum after the collisions that could be due to dark matter particles. This work is being done at the Large Hadron Collider (LHC) in Switzerland. A space-based experiment known as the Alpha Magnetic Spectrometer (AMS) is a particle detector situated on board the International Space Station in an effort to detect excess antimatter particles such as positrons (a kind of electron-like particle but with a positive electric charge) originating from the annihilation of DM particles in space. Thus far, excess positrons have been detected that is consistent with the existence of DM, but other explanations have not been ruled out.

The LZ experiment that Ms. Stifter is working on proposes to detect DM particles directly by having a container of about 10 metric tons of liquid xenon surrounded by 494 photomultiplier light detection tubes, which are deployed above and below the liquid xenon. The collision of prospective DM particles with xenon nuclei should cause recoiling that should lead to a prompt flash of scintillation light followed by a burst of electrons. The electrons would be pushed to the top of the tank

by an electric field where the photomultiplier tubes would detect a second flash of light called electroluminescence (Fig. 1). Present efforts are aimed at increasing the sensitivity of the detector to particles in the 10^4 GeV mass range and to eliminate noisy signals from spurious cosmic rays and underground radioactivity. The experiment is estimated to run for 3 years.

Other than the experiments mentioned, other experiments have narrowed the mass and interaction range that DM particles could have [1]. And so if DM is a type of or family of subatomic particles, it is starting to run out of places to hide. This has created a sense of excitement as well as a deepening sense of pessimism about whether DM would ever be detected or whether physicists' theories are barking up the right or wrong trees. So stay tuned for more to come!

References

1. Moustakas, L. In the dark about dark matter. *Sky & Telescope*, August 2017.
2. Yeager, A. Vera Rubin's universe. *Sky & Telescope*, August 2017.

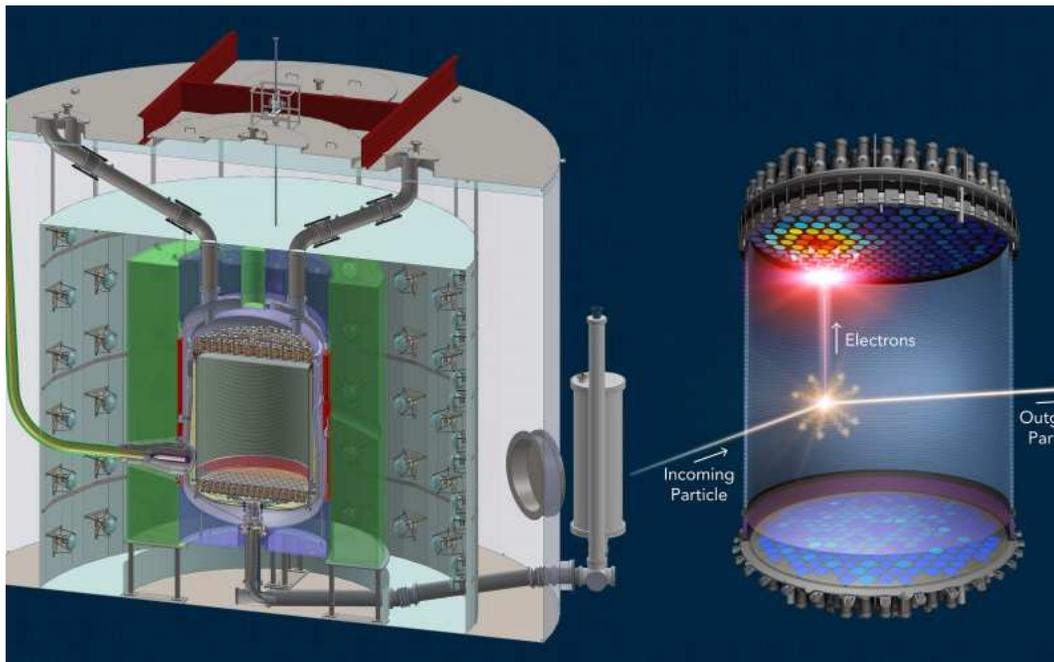


Figure 1. Diagram of the LZ Experiment showing how a possible DM particle could hit a xenon nucleus in the tank causing it to scintillate with light and release a shower of electrons that would be detected by the photomultiplier tubes distributed around the detector. (Courtesy: Sanford Underground Research Facility)

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, Mar 2	7:00 pm	General Meeting, Pizza Social and Presentation
Sat, Mar 10	6:15 pm	Crestview Park Star Party
Sat, Mar 17	7:15 pm	Crestview Park Star Party
Tue, Mar 20	7:00 pm	SMCAS Board Meeting
Sat, Mar 24	6:00 pm	Spring Equinox Social, Crystal Springs Methodist Church, San Mateo
Fri, Apr 6	7:00 pm	General Meeting, Pizza Social and Presentation
Sat, Apr 14	7:45 pm	Crestview Park Star Party
Tue, Apr 17	7:00 pm	SMCAS Board Meeting
Sat, Apr 21	7:45 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. 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 Equinox Social 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.

What Is the Ionosphere?

By Linda Hermans-Killiam

High above Earth is a very active part of our upper atmosphere called the ionosphere. The ionosphere gets its name from ions—tiny charged particles that blow around in this layer of the atmosphere.

How did all those ions get there? They were made by energy from the Sun!

Everything in the universe that takes up space is made up of matter, and matter is made of tiny particles called atoms. At the ionosphere, atoms from the Earth's atmosphere meet up with energy from the Sun. This energy, called radiation, strips away parts of the atom. What's left is a positively or negatively charged atom, called an ion.

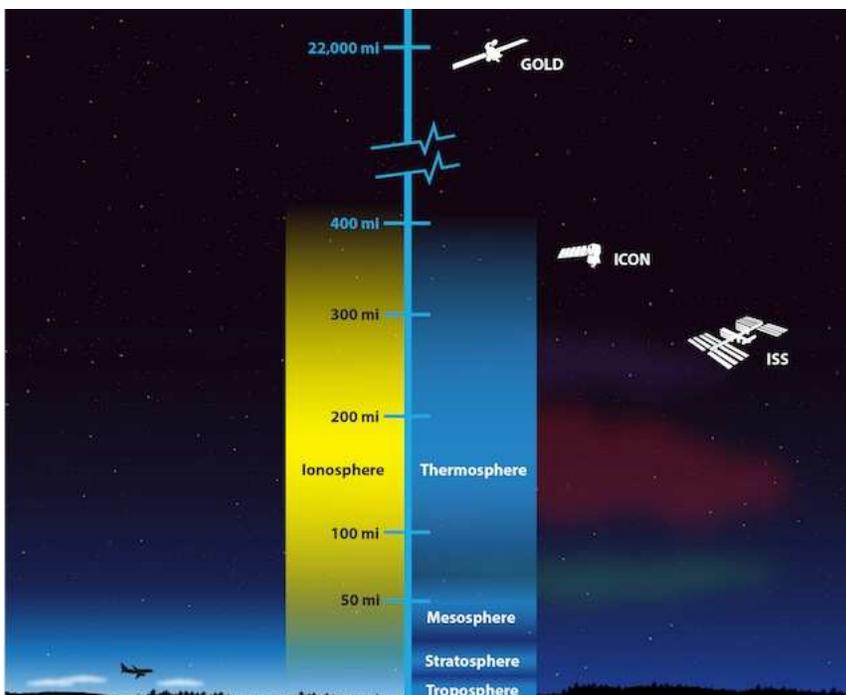
The ionosphere is filled with ions. These particles move about in a giant wind. However, conditions in the ionosphere change all the time. Earth's seasons and weather can cause changes in the ionosphere, as well as radiation and particles from the Sun—called space weather.

These changes in the ionosphere can cause problems for humans. For example, they can interfere with radio signals between Earth and satellites. This could make it difficult to use many of the tools we take for granted here on Earth, such as GPS. Radio signals also allow us to communicate with astronauts on board the International Space Station, which orbits Earth within the ionosphere. Learning more about this region of our atmosphere may help us improve forecasts about when these radio signals could be distorted and help keep humans safe.

In 2018, NASA has plans to launch two missions that will work together to study the ionosphere. NASA's GOLD (Global-scale Observations of the Limb and Disk) mission launched in January 2018.



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This illustration shows the layers of Earth's atmosphere. NASA's GOLD and ICON missions will work together to study the ionosphere, a region of charged particles in Earth's upper atmosphere. Changes in the ionosphere can interfere with the radio waves used to communicate with satellites and astronauts in the International Space Station (ISS). Credit: NASA's Goddard Space Flight Center/Duberstein (modified).

March Rise and Set Chart

SMCAS 2018		Mar 10 Rise	Mar 10 Set	Mar 17 Rise	Mar 17 Set
Sun	Equinox on 20th, 9:15 AM	6:25 AM	6:12 PM	7:15 AM	7:18 PM
Moon		2:02 AM	12:12 PM	7:39 AM	7:42 PM
Mercury	Low at sunset	7:06 AM	7:36 PM	7:51 AM	8:48 PM
Venus	Low at sunset	7:09 AM	7:21 PM	8:03 AM	8:36 PM
Mars	In the wee hours	1:52 AM	11:24 AM	2:43 AM	12:14 PM
Jupiter	Late at night	11:11 PM	9:28 AM	11:42 PM	10:00 AM
Jupiter's moons		J i g e c		c J g i e	
1 AM next day, E on left		J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io			
Saturn	In the wee hours	2:41 AM	12:20 PM	3:15 AM	12:54 PM
Uranus	In the evening	8:02 AM	9:06 PM	8:35 AM	9:40 PM
Neptune	In the sun's glare	6:18 AM	5:39 PM	6:51 AM	6:12 PM
Pluto	Before sunrise	3:34 AM	1:18 PM	4:07 AM	1:51 PM

- Star parties are at Crestview on the 10th (PST) and 17th (PDT).
- Daylight Saving Time starts on the 11th. Spring forward and Fall back or Fall forward and Spring back.

- 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.

March 2018						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
25 5:58:46 PM Sunset	26	27	28	01	02 7:00 PM General Membership Meetin	03
04 6:05:43 PM Sunset	05	06	07	08	09	10 7:20 PM Crestview Star Party
11 6:12:23 PM Sunset	12	13	14	15	16	17 7:20 PM Crestview Star Party
18 7:18:50 PM Sunset	19	20	21	22	23	24
25 7:25:07 PM Sunset	26	27	28	29	30	31

Calendar courtesy of Ed Pieret

Ionosphere, continued from p. 7

GOLD will orbit 22,000 miles above Earth. From way up there, it will be able to create a map of the ionosphere over the Americas every half hour. It will measure the temperature and makeup of gases in the ionosphere. GOLD will also study bubbles of charged gas that are known to cause communication problems.

A second NASA mission, called ICON, short for Ionospheric Connection Explorer, will launch later in 2018. It will be placed in an orbit just 350 miles above Earth—through the ionosphere. This means it will have a close-up view of the upper atmosphere to pair with GOLD's wider view. ICON will study the forces that shape this part of the upper atmosphere.

Both missions will study how the ionosphere is affected by Earth and space weather. Together, they will give us better observations of this part of our atmosphere than we have ever had before.

To learn more about the ionosphere, check out NASA Space Place:

<https://spaceplace.nasa.gov/ionosphere>

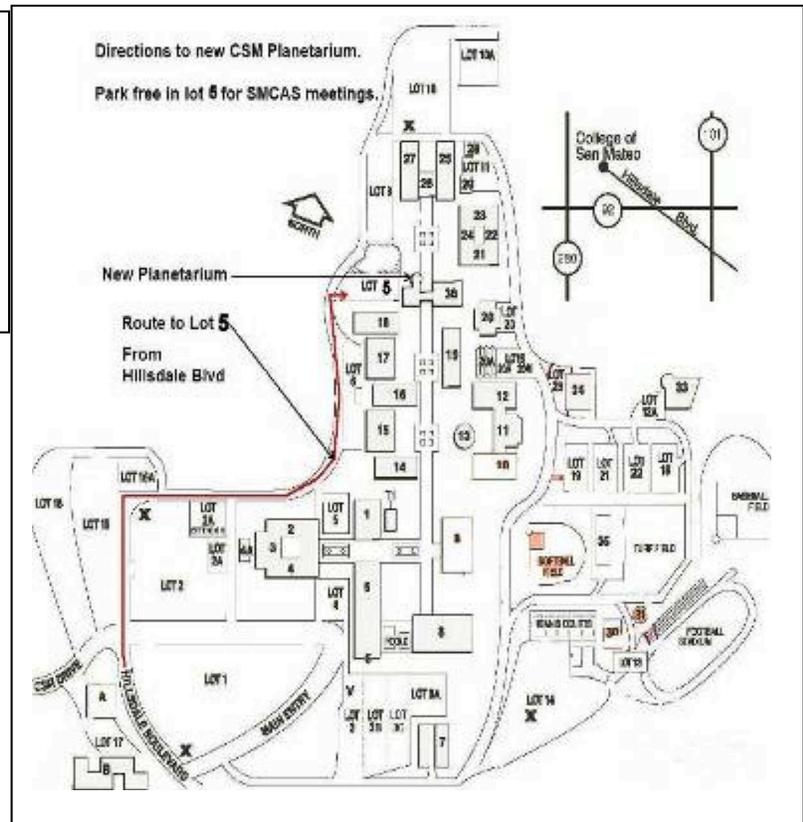
This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!

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: _____

<http://www.SMCASASTRO.com>