

The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

November 2018 — 655th 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.



SOLAR VIEWING through Ken Lum's white light and H-alpha filtered telescopes at the SLAC Kids Night on October 13. As in other recent years, numerous SMCAS members participated in the event. SMCAS Board Member Bill Lockman has a complete report starting on page 6.

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UPCOMING DATES

Nov 2: General Meeting, Pizza, and Presentation at the CSM Planetarium. Details on page 3.

Nov 13: SMCAS Board Meeting, CSM ISC room (rescheduled from Nov 20).

Dec 7: General Meeting, Pizza, and Presentation.

More events and further details on page 8.

President's Corner

Hello everyone,

I would like to thank the club members who volunteered at the SLAC Kids Night. In addition to astronomy related demos, attendees were provided with telescope viewing. The seeing was actually pretty good. Viewers were able to observe the Andromeda Galaxy (M31), Saturn, Mars, the Great Hercules Globular Cluster (M13) and of course, the Moon. We were able to capture some photos of the Moon for attendees by holding their phones to the eyepieces. A special thank you to Bill Lockman for project managing the event for the club.

As November approaches, we can look forward to earlier sunsets and the Leonids meteor shower on the mornings of the 17th and 18th. November is always a transition month in the Bay Area regarding the weather. I am hoping we get quality seeing so the burgeoning astrophotography participants can image at the upcoming Crestview star parties.

I would like to mention another event in November that is of particular interest. The annual Nightfall Star Party in Borrego Springs is one of my favorite events of the year. It is held at the Palm Canyon RV resort/motel from November 1st to 4th. With pools, hot tubs, a swap meet, free presentations and the surrounding Anza-Borrego Desert State Park, this is the best star party around! They even have a food/beverage cart that travels between scopes at night to bring you your order. On the other end of the spectrum is the Golden State Star Party at Frosty Acres Ranch near Adin, CA from June 29th to July 3rd, 2019. I mention this event since the club will consider a coordinated effort for members considering attending. It will require you to bring your own shelter such as an RV or tent. On-site facilities include extremely well maintained porta-potties, free hot showers, and excellent meals. The conditions during the day can be challenging with high winds and heat. At night, you are rewarded with cool temps and the most amazing skies you have ever seen. I remember my first experience there turning my dob to the Whirlpool Galaxy and actually seeing the spiral structure. The club board will discuss some options for this year's event for members considering attending. Stay tuned for details. Clear Skies!

Frank Seminaro

President, San Mateo County Astronomical Society



From the SLAC open house, the Moon photographed using an iPhone held up to an 8mm Ethos eyepiece on a 115mm refractor.

Michael Medford

Astrophysics Graduate Student
UC Berkeley, Lawrence Berkeley National Lab

The Hunt for Planet Nine

Friday, November 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)

Scientists have proposed that there is a giant planet lurking beyond Pluto, a Neptune-size world orbiting the sun about 20 times the distance of Neptune's orbit, but so massive that it may have tipped the entire solar system a few degrees sideways. A race is on to discover this as yet unseen Planet Nine using classical astronomy and new computational techniques. In this presentation, Michael Medford will discuss why scientists believe that Planet Nine exists, how the search is being conducted, and what has been learned so far in the quest to answer the question of whether Planet Nine exists or not.



This is a distant view from Planet Nine back towards the Sun. The object is thought to be gaseous, similar to Uranus and Neptune. Hypothetical lightning lights up the night side. Credit: Caltech/R. Hunt (IPAC).



Michael is currently a fourth year graduate student pursuing a PhD in Astrophysics at the University of California Berkeley. After spending several years pursuing a career as a [physics teacher and actor](#) he came back to graduate school to develop a deeper understanding of the intricate workings of the Universe. The joy he feels in developing that understanding is only made stronger by sharing that enthusiasm as a science communicator. His research centers around exploring the very edges of our knowledge of what the universe contains. He is trying to find black holes in the Milky Way and actively hunting for [the mysterious Planet Nine](#). Details of this work and previous lines of research can be [read about here](#). He leverages large-scale computational techniques to transform seemingly insolvable problems into useful science. He works out of the [Computational Cosmology Center](#) at the [Lawrence Berkeley National Laboratory](#) with [Peter Nugent](#), and in the [UC Berkeley Astronomy Department](#) with [Jessica Lu](#).

The Thrill of Discovery! Seeing Gravitational Waves AND Light From a Neutron Star Collision

By Ken Lum

Dr. Mandeep Gill of the Stanford Linear Accelerator Center Kavli Institute for Particle Astrophysics and Cosmology (SLAC/KIPAC), who has coordinated many outreach efforts with SMCAS in the past, came last month to speak about the amazing results that continue to come from the Laser Interferometer Gravitational Wave Observatory (LIGO). These unusual observatories consist of two large Michaelson interferometers each with two 4 km vacuum light tunnels oriented at right angles to each other (Fig.1). These observatories use laser light to compare the length of each tunnel to each other at a given facility with extreme precision down to an accuracy of $1/10,000$ the diameter of a proton (or 0.87×10^{-19} m with the diameter of the proton being 0.87×10^{-15} m). Any change in the length of one interferometer arm relative to the other due to gravitational waves could be detected. One observatory is located in Livingston, LA and the other is in Hanford, WA giving a separation of 3,002 km between the observatories. A third gravitational wave observatory called VIRGO has also more recently started operations in Italy.

The purpose of these observatories is to detect gravitational waves from colliding black holes and neutron stars in binary star systems. Albert Einstein, using his General Theory of Relativity, predicted that accelerating masses should radiate energy in the form of gravitational waves which cause periodic wobbles in the fabric of space-time resulting in variations of distances between two points in space. Such accelerating masses are typically found in the form of binary star systems orbiting each other, some of which evolve to become binary black holes or binary neutron stars.

The radiation of gravitational wave energy from such systems ultimately leads the components to spiral into each other and collide causing gravitational waves of increasing frequency to radiate out at the speed of light. When Einstein



Figure 1. The right angle oriented laser tunnels of the Hanford LIGO interferometer.

made his initial calculations in 1916, he found the variations in the wobbles of space-time to be so small that he doubted they would ever be detected. But by the 1950s some physicists began to think they could be detected. The first attempt was made in the 1960s by Joseph Weber who built a gravitational wave detector from a large aluminum bar. But his detections were ultimately deemed artifactual.

But then, in 1974, Russell Hulse and Joseph Taylor, Jr. discovered the first binary pulsar and found they were slowly spiraling in towards each other with a gradual decay of orbital period that matched the loss of energy in gravitational radiation as predicted by general relativity providing the first indirect evidence of gravitational waves.

By the 1970s, some physicists began experimenting with the idea of using Michaelson interferometers to detect gravitational waves directly. In particular, Rainer Weiss, Kip Thorne, and Barry Barish, who were to receive the 2017 Nobel Prize for this work, pushed the idea far enough to actually have the LIGO interferometer detectors built. After almost a quarter of a century of technological refinement, the LIGO

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Thrill of Discovery, continued from p. 4

interferometers were sensitive enough to finally make a direct detection of gravitational waves from a merger of binary black holes in September, 2015.

While 3 more black hole binary mergers were subsequently detected, a different kind of detection catalogued as GW170817 was made in August, 2017 (Fig. 2). This had characteristics that seemed more in line with the merger of binary neutron stars. Since the Italian VIRGO was also now operational and making this detection as well, the use of the three interferometer observatories together allowed a triangulated localization of the source in the sky. Once this was done, other observatories observing in gamma rays, X-rays, UV, visible, infrared and radio parts of the spectrum began looking for the exact source of the gravitational waves. The Fermi Gamma Ray Space Telescope (managed out of SLAC) was the first to make an independent detection 1.7 seconds after the gravitational wave detection. Then, the 1 m Henrietta Swope telescope at Las Campanas Observatory in Chile was the first to find the optical counterpart of the gravitational wave event in the galaxy NGC 4993, in the constellation of Hydra at a distance of 130 million light years in the form of a pinpoint of light brightening to 17th magnitude (Fig. 3).

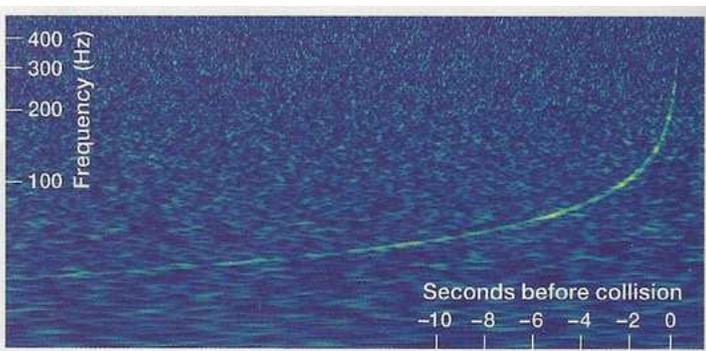


Figure 2. LIGO detection tracing of gravitational waves from the GW170817 neutron star merger showing rapidly increasing frequency of the signal as the stars orbited with increasing speed around each other just before colliding.

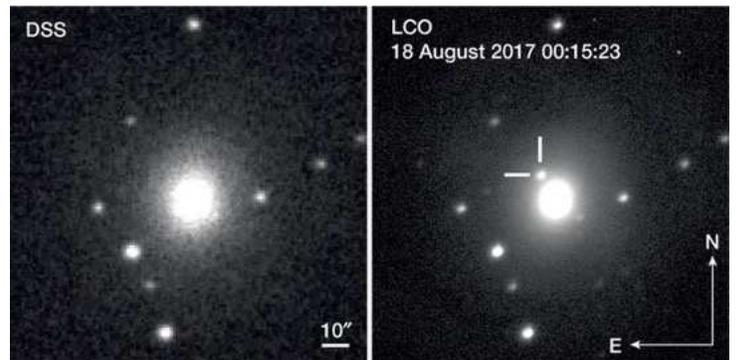


Figure 3. Comparison showing the optical detection of the neutron star merger and its concomitant explosion. (DSS-before detection photo from the Digital Sky Survey, LCO-After detection photo from the Las Campanas Observatory).

Not only is this the first detection of merging neutron stars, but it is the first detection of a gravitational wave source in multiple wavelengths in the electromagnetic spectrum using many different observatory instruments. It is therefore, called a “multi-messenger detection”.

Even more interesting is that merging neutron stars are now also considered a significant source of heavy elements independent of the heavy element production in supernovae. When neutron stars merge, the combined stellar remnant explodes scattering neutron debris. Some of the debris also contains protons as well and some of the neutrons decay into protons. The neutrons and protons then combine in the debris fields to form many of the heaviest elements going from Niobium up the Periodic Table to Uranium. These new insights make Dr. Gill's “*The Thrill of Discovery*” really palpable. So our world is not just made from supernova remnants but could also be made of material from the explosions of merging neutron stars as well!

Reference

Schilling, Govert. When neutron stars collide. *Sky & Telescope*, 135(2):32–39 (February 2018).

Kids Night at SLAC, October 13, 2018

By Bill Lockman, SMCAS Board Member

A primary component of the SMCAS charter is astronomy outreach. This involves spreading knowledge and appreciation of the universe around us, and inspiring areas of investigation for tomorrow's future astronomers. SMCAS's involvement in Kids Night at the SLAC National Accelerator Laboratory (hereafter referred to as SLAC) offered the perfect opportunity to provide astronomy outreach to a segment of the general population with a high intrinsic interest in, and understanding of, basic science.

Over 700 people from the SLAC community attended Kids Night. Seventy-five volunteers staffed the Kids Night activities, including fifteen individuals recruited by SMCAS.

The activities organized by SMCAS included viewing solar prominences and sunspots using H-alpha- and white-light-filtered telescopes (cover photo, page 1). After dark, we also viewed Mars and Saturn and photographed the moon through our stargazing telescopes. These activities provided views of the heavens at levels of detail far greater than those obtained by the unaided eye, and often elicited jaw-dropping expressions of interest from young children, teenagers and parents alike. Altogether, we provided nine telescope rigs for daylight and nighttime viewing. In another SMCAS activity, we displayed two models of the solar system. In the first model, a soccer ball represented the sun. At this scale, Jupiter was about 130 yards from the sun and the planets were tiny spheres with diameters on the order of millimeters. This model demonstrated how vast (and empty) the solar system actually is. In the second model, the sun was represented by a one-meter-diameter image. This model provided a more detailed view of the sun and planets. Kids and parents were amazed at how small our "pale



Figure 1. Mary Ann McKay and Ed Ching assisting in constructing a planisphere.

blue dot" Earth actually is compared to the sun and the gas giants.

SMCAS also staffed three other activities. The first activity involved constructing planispheres, an analog device to assist in recognizing stars and constellations. The kids constructed over 50 planispheres. The volunteers staffing this activity were fully engaged with the kids (Fig. 1) during the entire two-hour-long activity.

The second activity illustrated how refracting and reflecting telescopes work. Every telescope consists of a light-collecting element forming an inverted image of a far-away object, and an eyepiece element magnifying this image. The bigger the light-gathering element, the brighter the image appears. Actual refracting- and reflecting telescopes demonstrated the use of lenses and mirrors as light gathering elements, respectively. The volunteers staffing this activity (Fig. 2) also used ray diagrams to explain how telescopes formed and magnified images of distant objects.

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SLAC Kids Night, continued from p. 6

The third SMCAS activity, "cooking up a comet", gave insight into the "dirty snowball" model in which comets are composed of material from the early solar system in the form of frozen water, gases, simple organic compounds, and dust. Using dry ice and simple household materials, this comet-making activity (Fig. 3) was a big hit with kids and adults alike.

In summary, Kids Night at SLAC was a well-planned and successfully operated event, thanks to Rachel Isip, the SLAC events coordinator, her staff, and to our volunteers: Karen Boyer, Tina Cartaro, Ed Ching, Rachel Freed, Alan Galitz,

Vikas Kapur, Ken Lum, Tom McDonough, Mary Ann McKay, Ed Pieret, Mike Ryan, Frank Seminaro, Achim Weidemann and Wolf Witt. I would also like to thank Marion Weiler for his help and encouragement as I planned and recruited volunteers for our astronomy activities, and Ed Pieret, for supplying much of the outreach material. Hopefully, after participating in these activities, many kids will continue to explore the cosmos as amateur astronomers, and possibly be inspired to pursue a career in astronomy or observational cosmology.



Figure 2. Telescope optics activity staffed by Achim Weidemann and Karen Boyer.



Figure 3. Comet chef Ed Pieret making a dirty snowball facsimile of a comet.

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, Nov 2	7:00 pm	General Meeting, Pizza Social and Presentation
Sat, Nov 3	6:00 pm	Crestview Park Star Party
Sat, Nov 10	5:00 pm	Crestview Park Star Party
Tue, Nov 13	7:00 pm	SMCAS Board Meeting (rescheduled from Nov 20)
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
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 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 13. 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.

Porthole to Andromeda, contributed by SMCAS member Ted Hauter. The image was captured at Sequoia National Park using rather modest equipment, including a 2.5-inch scope, AVX mount, and a Canon SL2 DSLR camera from Costco. The three prominent galaxies are the Andromeda Galaxy (M31) and its satellite galaxies M32 (starlike but fuzzy, just above M31) and M110 (below).



November's Dance of the Planets

By Jane Houston Jones and David Prosper

November's crisp autumn skies bring great views of our planetary neighbors. The Moon pairs up with Saturn and Mars in the evenings, and mornings feature eye-catching arrangements with dazzling Venus. Stargazers wanting a challenge can observe a notable opposition by asteroid 3 Juno on the 17th and watch for a few bright Leonid meteors.

Red Mars gleams high in the southern sky after sunset. Saturn sits westward in the constellation Sagittarius. A young crescent Moon passes near Saturn on the 10th and 11th. On the 15th a first quarter Moon skims by Mars, coming within 1 degree of the planet. The red planet receives a new visitor on November 26th, when NASA's InSight mission lands and begins its investigation of the planet's interior. News briefings and commentary will be streamed live at:

bit.ly/landsafe.

Two bright planets hang low over the western horizon after sunset as November begins: Jupiter and Mercury. They may be hard to see, but

binoculars and an unobstructed western horizon will help determined observers spot them right after sunset. Both disappear into the Sun's glare by mid-month.



Early risers are treated to brilliant Venus sparkling in the eastern sky before dawn, easily outshining everything except the Sun and Moon. On November 6th, find a location with clear view of the eastern horizon to spot Venus next to a thin crescent Moon, making a triangle with the bright star Spica. The following mornings watch Venus move up towards Spica, coming within two degrees of the star by the second full week of November. Venus will be up three hours before sunrise by month's end---a huge change in just weeks! Telescopic observers are treated to a large, 61" wide, yet razor-thin crescent at November's beginning, shrinking to 41" across by the end of the month as its crescent waxes.

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November Rise and Set Chart

SMCAS 2018 (PT)	Nov 3 Rise	Nov 3 Set	Nov 10 Rise	Nov 10 Set	Nov 17 Rise	Nov 17 Set
Sun	7:37 AM	6:08 PM	6:44 AM	5:01 PM	6:51 AM	4:56 PM
Moon	3:09 AM	4:20 PM	9:34 AM	7:39 PM	2:17 PM	1:01 AM
Mercury	9:39 AM	7:09 PM	8:45 AM	6:05 PM	8:27 AM	5:50 PM
Venus	6:42 AM	5:11 PM	4:59 AM	3:45 PM	4:26 AM	3:23 PM
Mars	2:48 PM	1:13 AM	1:30 PM	12:07 AM	1:13 PM	Next Day
Jupiter	9:04 AM	7:05 PM	7:44 AM	5:42 PM	7:24 AM	5:20 PM
Jupiter's moons	i j e g c		c i j e g		i j e g c	
7/6 PM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io					
Saturn	11:51 AM	9:26 PM	10:27 AM	8:01 PM	10:02 AM	7:37 PM
Uranus	5:32 PM	6:48 AM	4:04 PM	5:19 AM	3:35 PM	4:50 AM
Neptune	3:38 PM	3:01 AM	2:10 PM	1:33 AM	1:43 PM	1:05 AM
Pluto	12:49 PM	10:28 PM	11:22 AM	9:02 PM	10:55 AM	8:35 PM

- PDT for the 3rd, PST for the 10th and 17th. Standard Time starts on the 4th.
- Star parties are at Crestview on the 3rd and 10th.
- Jazz Under the Stars is at CSM on the 17th.

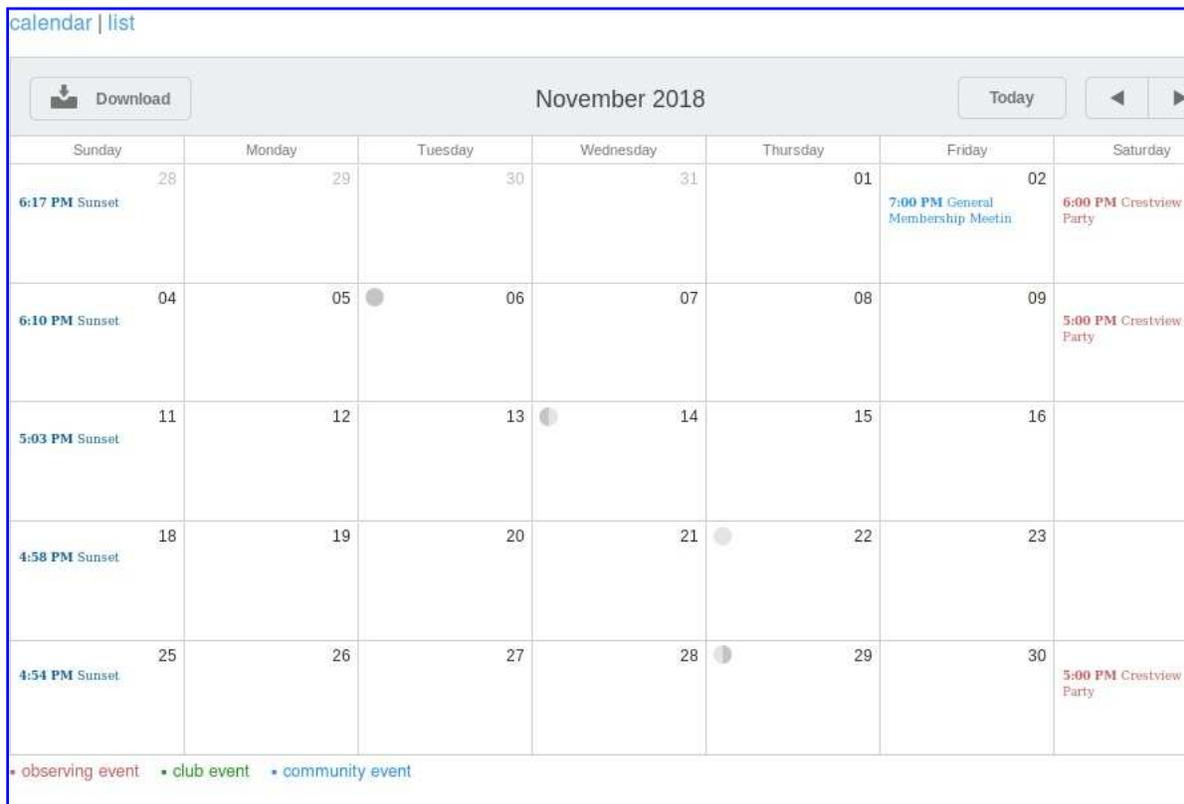
– *courtesy of Ron Cardinale*

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 courtesy of Ed Pieret

Dance of the Planets, continued from p. 9

Observers looking for a challenge can hunt asteroid 3 Juno, so named because it was the third asteroid discovered. Juno travels through the constellation Eridanus and rises in the east after sunset. On November 17th, Juno is at opposition and shines at magnitude 7.4, its brightest showing since 1983! Look for Juno near the 4.7 magnitude double star 32 Eridani in the nights leading up to opposition. It is bright enough to spot through binoculars, but still appears as a starlike point of light. If you aren't sure if you have identified Juno, try sketching or photographing its star field, then return to the same area over the next several days to spot its movement.

The Leonids are expected to peak on the night of the 17th through the morning of the 18th. This meteor shower has brought "meteor storms" as recently as 2002, but a storm is not expected this year. All but the brightest meteors will be drowned out by a waxing gibbous Moon. Stay warm and enjoy this month's dance of the planets!



This finder chart shows the path of the asteroid 3 Juno as it glides past 32 Eridani in November 2018. The asteroid's position is highlighted for selected dates, including its opposition on the 17th. Image created in Stellarium for NASA Night Sky Network.

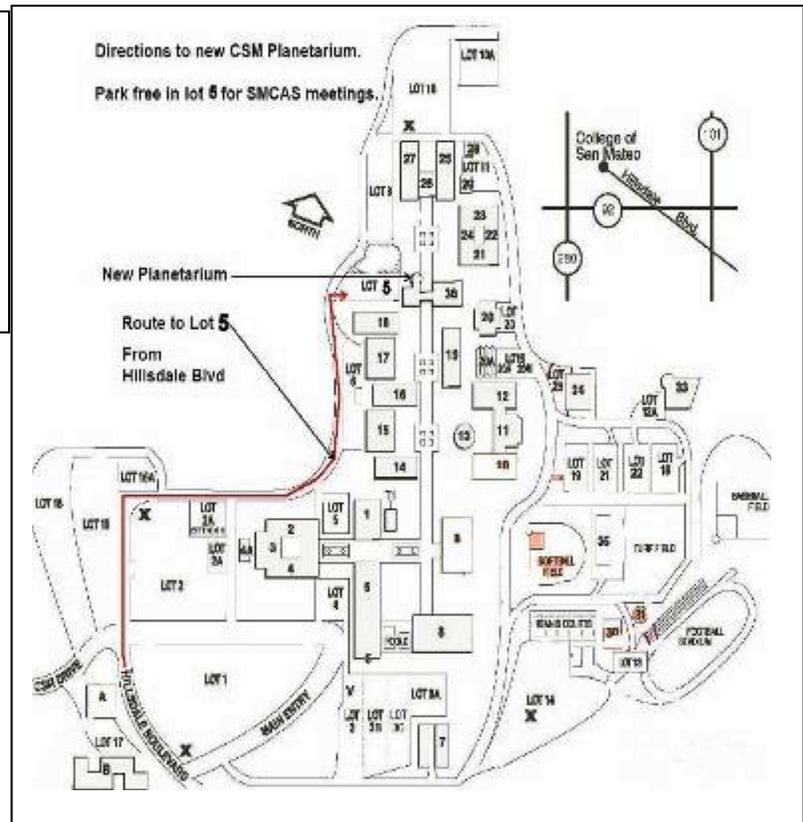
This article is distributed by NASA Night Sky Network. The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more! You can catch up on all of NASA's current and future missions at nasa.gov.

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>