The SAN MATEO COUNTY ASTRONOMICAL SOCIETY

May • June 2020 Issue REVISED 666th General Meeting Notice: May General Meeting CANCELED

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 membership information is found at ***http://www.smcasastro.com/membership.html*** *where those who want can join via PayPal. Membership also includes access to our 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* ***(650) 678-2762****.*

Membership forms are available near the end of this newsletter beginning on page 21.

San Mateo County Astronomical Society member and aspiring astrophysicist, Isabella "Isy" Cooke, is peering through her Galileo-scope at the July 19 and July 20, 2019 Glacier Point Star Party at Yosemite National Park. Isy assembled the telescope herself. *Photo by Lisa Cooke.*

Volunteers are needed for August's Glacier Point Star Party. See more page 6 for details.

Table of Contents

Upcoming Events:

May, 2020: 666th SMCAS General Meeting - CANCELED

June, 2020: 667th SMCAS General Meeting - CANCELED

Saturday, June 13, 2020, sunset at 8:31 pm: Crestview Star Party, Page 13
(Pandemic/weather-permitting)

Saturday, June 27, 2020, sunset at 8:34 pm: Crestview Star Party, Page 13
(Pandemic/weather-permitting)

Saturday, July 11 or July 18, 2020, 6pm: Crestview Star-B-Que – Installation of Officers (Pandemic/weather-permitting) Page 5

Friday, Aug 28 - Saturday, Aug. 29, 2020: Yosemite Glacier Point Star Party Camping Event, Page 6
(Pandemic/weather-permitting)

Crestview Star Party 2020 schedule: http://www.smcasastro.com/crestview-park.html

---

Save July 11 or July 18 for 60th Anniversary Star-B-Que

Our annual Board of Directors Installation Star-B-Que is tentatively set to take place on Saturday, July 11 or Saturday, July 18, starting at 6pm. It will feature our traditional installation ceremony and our usual delicious potluck dinner.

Regrettably, though the scheduling of this event is firm, the holding of it is tentative. We're hopeful, but not sure it will happen due to the coronavirus pandemic. As an outdoor event, we are able to practice social distancing. But we normally draw between 25 and 30 people, so if the limiting group protocol is still 10, we may not be able to gather. Or we may need some workaround such as separating ourselves into two, or even three, groups.

Also, on April 17, San Mateo County mandated the wearing of masks, even outside in group or gathering situations. Hopefully that requirement, and maybe the attendance limit, may be relaxed by the time July arrives. Obviously, if the pandemic expands or becomes more acute, we may need to cancel this event as well. We'll try and give the membership alerts and updates as circumstances change.

The event is extra special this year. That's because 2020 represents 60 years since the founding of our Society in 1960. The founding meeting was on July 3 of that year and the Star-B-Que would be our first plenary event following the 60th anniversary. We expect to present and display a commemorative certificate honoring the occasion, which is generously being prepared for us by member, and graphic designer, Lisa Cooke.

For the potluck, our Society normally provides the meat entree, usually hamburgers and hot dogs. Members are invited to contribute other entrees like chicken, appetizers, side dishes like starches, pastas and salads, condiments, drinks and desserts. Oh, and bring yourself hats and layered clothing. It can get chilly and breezy around sunset.

If the skies are predicted to be clear, we also ask you to bring your telescopes. Jupiter and Saturn should be in the sky either evening. As an outdoor event, it's obviously contingent on the weather. Cloudiness could prevent the Star Party, but not necessarily the potluck banquet. If overcast is likely following sunset, we have the option of shifting the event a week later, to Saturday, July 18. If that's likely to happen, there will be one or more email announcements to members, probably around July 5 or July 6.

So, let's hope for the best and for now, assume the event will take place. Plan to come gather and to have a great time!

Seeking Volunteers to Staff Summer Star Party at Glacier Point:

By Bill Lockman

The SMCAS Board is in the process of organizing this year's weekend stargazing trip to Glacier Point in Yosemite National Park on **Friday, August 28** and **Saturday, August 29**. On these two nights, our moon will be in waxing Gibbous phase, similar to the conditions at last year's Glacier Point Star Party. We are seeking volunteers to supply and staff telescopes and also one or two volunteers to give a short presentation prior to the beginning of stargazing on each of the two dates listed above.

We are not yet sure what impact the unprecedented coronavirus pandemic will have on this trip, so for planning purposes, we are assuming that the event will go ahead as scheduled. We will keep you apprised of the situation on our group website, smcasastro.com.

If you would like to participate, please read the Invite Letter and Participation and Guidelines PDF from David Balogh, Yosemite's coordinator of the Summer Star Parties at Glacier Point 2020. Also, please email Edward Pease (eddeL4329@aol.com), with a copy to the Board at smcasbd@groups.io and provide the following information:

1) who and how many of you are planning to participate,
2) your contact information (phone and email), and that of a friend or relative to contact in case of an emergency,
3) what accommodations you would need, and
4) what astronomical equipment you are planning to bring.

My present understanding is that camping for the Star Party participants will be at Bridalveil Campground, just a few miles from the Glacier Point Star Party area. Edward Pease (eddeL4329@aol.com or 408-998-4329) and his wife and backup, Mary Ann McKay (maedchris@aol.com or 650-445-5206), have volunteered to be SMCAS event coordinators, camp coordinators and camp hosts for the trip. Contact Ed or Mary Ann if you have questions about the camping arrangements.

So far, about 10 to 15 members have pledged their attendance. Roughly the same number have expressed interest, and there are free accommodations for up to 30 participants. More can attend if they are willing to pay their way into the Park and for use of the campground.

If you do decide to volunteer for the stargazing activities, you will experience unparalleled views of the night sky from 7,214-foot Glacier Point, as well as the satisfaction and enjoyment of providing astronomy outreach to the public!

Norm Abt, Lisa, Isy, and Michael Cooke from 2019 Glacier Point trip. The telescope is a 5-inch Celestron SCT.

President's Corner

Hi All,

Well, since the end of the drought, chaotic nighttime weather has largely blocked most star parties for over a year. And now, the COVID-19 outbreak has halted almost everything else. It's become a challenge for organizations like ours to provide value to members and community. We can't know what the future holds, but we still need to plan, and hope for the best.

We currently have no face-to-face events planned through June. But, we are hoping to resume activities by at least the latter half of 2020. We'll use the intervening time to keep in touch through the Event Horizon, to open May nominations and conduct June elections for the 2020-2021 officers and board.

I invite all members to make nominations, whether in person or via email, opening May 1. If you wish to stand for election or know a member who would, please phone me at (650) 678-2762 or email me at jmrastro@yahoo.com.

The board will hold its meetings on its customary third Tuesday of each month, by ZOOM teleconference until further notice. Other business will be by email. Elections will occur at our June 5 meeting, if held or likely by email or teleconference, if not. Installation of new officers will take place at a Crestview Park Star-B-Que and potluck on Saturday, either July 11 or July 18 at 6pm, depending upon weather forecasts and the status of the pandemic. If so, we'll follow it with a star party.

Other events hopefully begin in August. The principal one is our invitation by Yosemite National Park to host two public star parties at Glacier Point, on the evenings of Friday, August 28 and Saturday, August 29. Up to 30 of us (members and guests) are offered free Park access and camping at Bridalveil Campground. Of course, I appeal to any interested member to grab a telescope and come help us with the hundreds of park guests who always attend.

Edward Pease and wife Mary Ann McKay, a former board member, have generously volunteered to be our organizers and camp hosts. If you would like to be a part of this grand, outreach weekend, please contact them, and they will fill you in on all you need to know. Ed's email is eddeL4329@aol.com, and Mary Ann's is maedchris@aol.com. You can phone Ed at (408) 998-4329. Mary Ann is reachable at (650) 445-5206.

I want to give a special thank you to Lisa Cooke, a graphic designer, who along with her talented husband Michael, and her precocious and charming daughter, Isy, are among our most active and dynamic members. Lisa is redesigning the signature logo of our organization, as well as drafting new outreach table signage and handout literature. She's also designing a celebratory certificate to recognize the 60th anniversary of our Society's founding, to fall on July 3, 2020.

Finally, I wish to announce the arrival of Michelle Morales Torres, a new member who has generously volunteered to be our new Event Horizon editor. Michelle is admirably suited to the role, with a history of producing the 'Epistle' newsletter for St. Paul's Episcopal Church in Burlingame. She also authors "Looking Up" a sky-observing column in the weekend edition of the San Mateo Daily Journal. And, she holds a college degree in Communications. She's very enthusiastic and will, I'm sure, do a superb job with the Event Horizon.

She follows a tradition of excellent prior editors with whom we've been blessed. Outgoing editor, Bill Lockman, a member of the board, has done outstanding work. Regrettably, he could only devote a year to the task, but he stepped up when we really needed someone to do so. Before Bill was Ted Jones, still an active member, who also turned in an awesome job of reporting, writing and production nearly every month for, I believe, three years. I salute both Bill and Ted (Bill and Ted's Excellent Adventure?) and, on behalf of the Society, thank them profoundly for their service and commitment. To all of you and those dear to you, I'm sure I speak for all officers and board members in wishing you good health, happiness and good fortune during this difficult time, and far into the future. We look forward to when we can see, share astronomy and break bread with you all again. All the best.

Mike Ryan
(650) 678-2762
jmrastro@yahoo.com

The eVscope for the Older Astronomer

By Ed Pieret

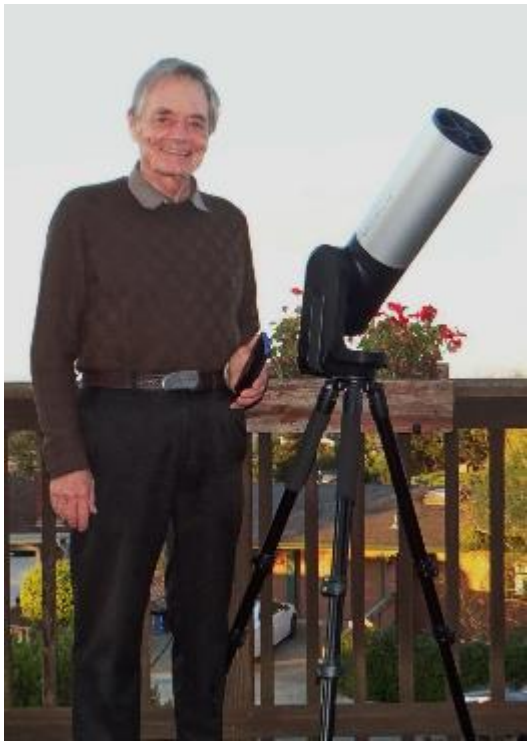
I have watched several very good amateur observational astronomers quit viewing as age made it more difficult. This is a shame and a loss to our community. When I joined the Kickstarter campaign for the eVscope in 2017, I thought it might be a great option to enable me to continue observing as I got older. I was focused on the fact that it was much lighter than my Celestron 8, would be easier to set up and hoped it would perform nearly as well. As I pointed out in a previous article, I was blown away by the instrument's capabilities. I have seen object after object that I had only seen in photographs.

I believe the eVscope could significantly extend the time astronomers remain active. For the older astronomer the eVscope provides many advantages when compared to conventional optical telescope. Some are:

- The eVscope is easy transport because the telescope and tripod weigh under 20 pounds.
- Setup is easy and fast. The only attachment is the telescope to the tripod.
- Good night vision is not required. The image in the eyepiece is always bright enough to see, even if the object is faint.
- The only control on the telescope is the power switch. Everything else is done through a smart phone app. There are no controllers with small or faintly lit text.
- There is no heavy power supply to lug around since power comes from an integrated rechargeable battery.
- There are no eyepieces, finders, GPS units or other accessories to carry and attach. Everything is integrated in the telescope and the smart phone app.
- Changing magnification only requires a pinch/spread gesture on the smartphone screen. There are no eyepieces to change.
- There are no external wires to get tangled or to become a tripping hazard.
- Alignment is totally automatic, there are no alignment stars to find or auxiliary alignment device to install and adjust.
- You can clearly see the object you are observing with the smartphone app so there is no requirement to repeatedly look through the eyepiece. In fact, the telescope can be run competently while sitting in a nearby chair.

And it runs circles around any of your older optical telescopes! If you doubt this is true, go to http://www.astronomered.com/my-evscope.html and view the objects there. These images are the same images visible through the eyepiece (except for the data around the edges identifying the object).

Right now, I keep it attached to its tripod and take it out to my deck on every clear night. The other night I viewed seven Messier objects and a couple NGC galaxies in well under an hour including setup, alignment and slewing time. When the current crisis is over, I intend to bring my eVscope to both Crestview Star Parties and Jazz Under the Stars. If you would like to see it, be sure to come to one of these events.



Ed Pieret with his eVscope.

Neutrinos: The Ghosts of the Standard Model of Particle Physics

(Note there are many **hyperlinks** in this article for those who want to read more)

by

Ken Lum

Neutrinos are a family of mysterious weakly interacting subatomic particles that are responsible for carrying off much of the energy of radioactive decay. Because this type of particle is so weakly interactive with matter, a majority of neutrinos can travel from their source, on average, through 100 light years of water before they actually collide with any water molecules!

Fig. 1 Dr. Micah Buuck (middle) from his talk on March 6. On the left is Professor Darryl Stanford and on the right is Marion Weiler.

To explain how physicists have been investigating this elusive particle, **Dr. Micah Buuck (Fig. 1)** of SLAC National Laboratory came March 6 to explain his participation in working to find evidence for an, as yet, unobserved form of radioactive decay known as **neutrinoless double beta decay**.

I. The Nature of Radioactivity

The story of the neutrino began with the discovery of radioactivity in 1896 by the French physicist, **Henri Becquerel,** when he placed some uranium salts on top of some photographic film stored in a light-tight box. To his surprise, the developed film was found to have darkened despite never having been exposed to any external light.

The uranium salts that were exposing the film were emitting some kind of "radiation." What the salts were emitting was found by **Marie and Pierre Curie** and others when they placed a magnet in the path of the radiation **(Fig. 2).**

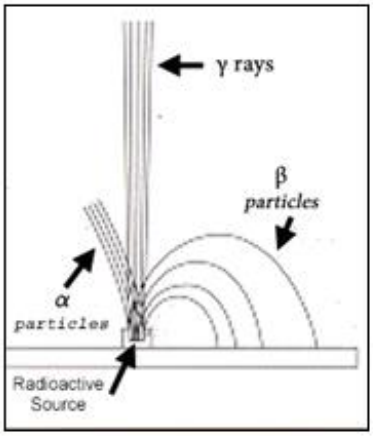


Figure 2
Behavior of radiation products of radioactive decay in a magnetic field.

The magnetic field of the magnet segregated the radiation into three components which were called alpha**(α),** beta**(β),** and gamma**(γ) (Fig. 2).**

Further examination of the **alpha radiation** showed it to be made of positively(+) charged helium nuclei produced when **Uranium-238** (atomic number 238 with 92 protons and 146 neutrons in the nucleus) decayed into **Thorium-234** (atomic number 234 with 90 protons and 144 neutrons in the nucleus) and an **alpha particle** (helium nucleus-atomic number 4 with 2 protons and 2 neutrons) **(Fig. 3).**

$$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He^{+}$$

↑
alpha particle
(Helium nucleus

Figure 3
Uranium decays into thorium, and an alpha particle in alpha decay.

Neutrinos (cont'd)

Beta radiation decay consists of the emission of negatively charged electrons(e^-), given off by the decay of neutrons (n) in the atomic nucleus into protons (p^+) and electrons **(Fig. 4).**

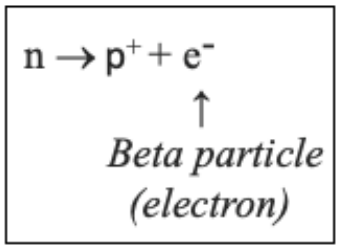


Figure 4
Emission of a beta particle in beta decay.

Because alpha and beta particles have opposite charges, their paths were found to be deviated by magnetic fields in opposite directions **(Fig. 2).**

Gamma rays are emitted by radioactive nuclei that have been excited to higher energy levels as a result of alpha or beta decay. Shortly following their decay, these excited nuclei spontaneously lose their excess energy as gamma radiation to reach their ground energy states. Because gamma radiation is electrically neutral in the form of high-energy photons, it is not deviated by a magnetic field, and it travels in a straight line from the nucleus to a detector. **(Fig. 2).**

Other radioactive elements also emit radiation in these ways and all these emissions are mediated by the nuclear weak force, acting through exchanges of what are called W and Z bosons, much as the electromagnetic force acts through exchanges of photons.

II. The Discovery of Neutrinos

A big mystery occurred when the energies of alpha particles were compared to those of beta particles. The energies of these particles could be measured from the strength of the magnetic fields required to alter their pathways. In **alpha decay**, the energy of alpha particles accounted for all the mass lost by the parent nucleus. As mass and energy are equivalent from Einstein's famous equation, $E=mc^2$, this result was a verification of the **law of conservation of energy** when applied to alpha decay. As a result, α particles travel along mostly the same pathway in a magnetic field of given strength and each possesses mostly the same sharply defined energy value. **(Fig. 2).**

Beta decay, however, presented a very different scenario. The energies of individual beta particles varied by a considerable amount. As a result, individual beta particles took different pathways as they exited the parent nuclei and went through the magnetic field such that each beta particle had its own unique energy content **(Fig. 2).** This meant that not all the energy of the emitted electron particles could account for the energy (and equivalent matter) lost by the parent nuclei.

This disturbing result suggested that **energy conservation, a cornerstone of thermodynamics, might not apply to beta radiation decay**! The German physicist, **Wolfgang Pauli**, could not accept this and came up with a solution to this conundrum in 1930 by suggesting there might be an invisible subatomic particle that was emitted along with beta particles that carried off the excess energy of beta decay. However, he did not publish his idea for fear that his reputation might take a hit should he be proven wrong. Nonetheless, he encouraged others to work out the details and publish their results as he still felt the idea had merit.

Most notably, the Italian physicist, **Enrico Fermi**, came up with a solution for the postulated undetected particle in 1933, and he named it the **"neutrino"** (ν) for "the little neutral one". Fermi's Theory was called the **"**Four-Point Beta-decay Theory" for the four particles that participate in the reaction **(Fig. 5).**

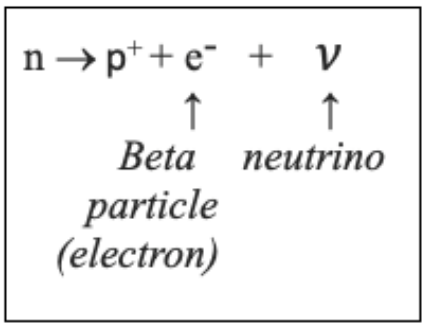


Figure 5
Fermi's Four-Point Beta-decay Theory

Neutrinos (cont'd)

The neutrino was deemed very hard to detect and weakly interactive with matter because it had very little or no mass and no electric charge. From the mathematics of this theory and other ideas providing estimated physical properties of this particle, the race was on to directly detect the neutrino.

That was accomplished in 1956 by **Clyde Cowan** and **Frederick Reines** initially using the nuclear reactor in Hanford, Washington and then later at the Savanah River Plant in South Carolina as their neutrino sources. The reaction they were hoping to observe was actually a collision of an antineutrino with a proton to yield a neutron and a **positron (e^+)** (the positively charged antimatter version of the electron) – a reaction known as I**nverse Beta Decay**. **(Fig. 6).**

$$\bar{\nu} + p^+ \rightarrow n + e^+$$

antineutrino positron

Figure 6
Inverse beta decay

The detector consisted of two tanks of water with antineutrinos coming from the reactors colliding with the protons in the hydrogen atoms of the water molecules. The positrons from the reaction would annihilate with regular matter electrons giving off prompt gamma rays detectable with a scintillator.

Another layer of detection was provided by dissolving cadmium chloride in the water. The cadmium nuclei would absorb the free neutrons from the Inverse Beta decay reaction and also give off gamma rays a little later in time. Thus, each detection was defined by two gamma ray signals spaced a few microseconds apart. This detection was subsequently confirmed by others using different detection methods.

III. Types of Neutrinos, their Mass and the Solar Neutrino Problem

Neutrinos were subsequently discovered to be of **three types** called **"flavors",** the **electron neutrino (ν_e),** the **muon neutrino (ν_μ),** and the **tau neutrino (ν_τ)** each associated with its own particular "**lepton",** (e.g. the **electron**, the **muon**, and the **tau lepton** respectively)**.** This discovery helped to solve the problem of why the observed flux of neutrinos from the Sun was seen to be far less than predicted by the theory of hydrogen fusion reactions taking place in its core This became known as the solar neutrino problem.

The Italian physicist, **Bruno Pontecorvo**, proposed in 1957 that neutrino flavors could change from one to another (known as **Neutrino Oscillation**) while in transit from the Sun if they had a small amount of mass. The early detectors could only find electron neutrinos. Once the other types of neutrinos could be seen with later detectors, starting in the early 2000s, the Solar Neutrino Problem was solved. The earlier detectors just could not see the muon and tau neutrinos arising from oscillating electron neutrinos.

Today, the mass of neutrinos is still a bit uncertain, but a recent estimate suggests it is at least six million times lighter than an electron. And the estimated sum of all the mass of neutrinos in the universe is insufficient to explain the as yet unresolved dark matter problem.

IV. Antineutrinos and Double Beta Decay

Dr. Buuck's talk ended with a description about an as yet unobserved variant of a rare mechanism of radioactivity known as **Double Beta Decay (also often written as $\beta^-\beta^-$)**.

Double Beta Decay is a fourth form of radioactive decay that is much rarer than the three described above. It was first proposed by the German-born physicist, **Maria Goeppert-Mayer** in

Neutrinos (cont'd)

1935. In this form of decay, two neutrons (n) in a radioactive nucleus would decay simultaneously into two protons (p^+), two electrons (beta particles, e^-) and two neutrinos (ν) **(Fig. 7).**

$$2n \text{ (in a nucleus)} \rightarrow 2p^+ + 2e^- + 2\nu$$

Figure 7
Double Beta Decay

The resulting nucleus would lose 2 neutrons and gain 2 protons thereby transmuting into a new element. This form of radioactivity has been actually observed to occur in 14 radioactive isotopes and is also called **ordinary double beta decay.**

The Italian physicist, **Ettore Majorana,** expanded on Goeppert-Mayer's idea in 1937 when he proposed that **neutrinos could be their own antiparticle** due to the fact that they were both elementary particles (and had no internal electrically charged components such as quarks) and were electrically neutral.

Today, fermion particles (e.g. quarks, leptons, and baryons) that can potentially be their own antiparticle are called Marjorana fermions**.** These are distinct from Dirac fermions (named after the English physicist, **Paul Dirac,** who predicted the existence of antimatter in 1930). In Dirac fermions the matter and antimatter counterparts are distinctly different. Matter particles are made up of distinct matter quarks.

By contrast, antimatter particles are made up of distinct antimatter quarks. And matter elementary particles such as electrons and antimatter elementary particles such as positrons are not the same particle. In the Standard Model* of particle physics, only the neutrino can be considered a Majorana fermion. All other particles are Dirac fermions.

If **Majorana neutrinos(which are their own antineutrinos)** are involved in some forms of double beta decay, then the neutrinos released from this reaction should annihilate each other leading to a **second type of double beta decay** known as **Neutrinoless Double Beta Decay** wherein only 2 protons and 2 beta particles (electrons) are released, but no detectable neutrinos **(Fig. 8).** This idea came from the American physicist, **Wendell Furry**, in 1939.

$$2n \text{ (in a nucleus)} \rightarrow 2p^+ + 2e^-$$

Figure 8
Neutrinoless Double Beta Decay
(Compare with Figure 7)

This latter type of double beta decay has never been observed, and it is this reaction that Dr. Buuck and other collaborators and teams are searching for.

Finding such a reaction would:

(1) confirm Majorana's original conjecture that the neutrino can be its own antiparticle.

(2) offer an explanation as to why the neutrino mass is so small, but non-zero and provide a better way of estimating the value of that mass.

(3) also make Majorana fermions a candidate for **Cold Dark Matter**

(4) contribute to an explanation as to why there is more matter in the Universe than antimatter.

(5) provide a better understanding of how supernovae can release so much energy so quickly and violently. Some estimate that as much as 98% or more of the energy released by a supernova is released as neutrinos. (Fig. 9)

-*In today"s Standard Model, the neutrinos present in the Four Point Beta Decay Theory (Fig. 5), in the initial state of Inverse Beta Decay)Fig. 6), and the final state of Double Beta Decay)Fig. 7) are actually electron antineutrinos.

Neutrinos (cont'd)

Fig. 9. Supernova 1987A. Still spewing out neutrinos (NASA)

All this makes finding evidence of this nuclear reaction fundamentally very important!

Dr. Buuck then went on to summarize some projects that are searching for this unusual, hypothesized, reaction including the one he is involved in with the **MAJORANA DEMONSTRATOR** at the **LUX-ZEPLIN** experiment in the **Sanford Underground Research Facility** in Lead, South South Dakota. This is an attempt to detect dark matter as described to our club in February, 2018 by **Ms. Kelly Stifter** of SLAC and written about in our March, 2018 Event Horizon newsletter.

References:
1) Solomey, Nicholas, The Elusive Neutrino: A Subatomic Detective Story, Scientific American, 1997

2) Wikipedia articles on the neutrinos and double beta decay.

Crestview Star Party

By Ed Pieret

Star parties are not what you normally think of when you hear the word party. There is no loud music, adult beverages, fattening food or raucous behavior. They are quiet events, held in the dark, to view and appreciate the wonders of the night sky.

SMCAS hosts a public star party at Crestview Park in San Carlos twice a month when the Moon is not present. At these events, members set up telescopes and share views and knowledge of the night sky. All ages are welcome. If you have kids interested in space or science, bring them here for a real time look at planets, nebula, star clusters and galaxies.

If you own a telescope, bring it to the star party. If you need assistance setting up or finding targets in the sky, there will be experienced astronomers there to help you.

Astronomers gather and setup around sunset and observing starts about one hour after sunset. Arrive at sunset if you want to learn about telescopes and equipment. If you are thinking of buying a telescope, this is a time to learn about design, manufacturers and features to look for.

In the event of inclement weather (rain, clouds, fog, or high winds) the star party will not be attended. Because each astronomer makes his or her own decision about attending and bringing a telescope, there is no official cancellation notice.

Email notices are sent out the day of the Crestview star party detailing sunset times and weather forecasts. If you would like to receive these and other announcements of local astronomy events, subscribe to SMCASnews@groups.io

For more information go to http://www.smcasastro.com/crestview-park.html.

Solar System Rise and Set Times:

By Ron Cardinale

Crestview Star Party – Pandemic/weather-permitting

SMCAS 2020 (PDT)	Apr 18 Rise	Apr 18 Set	Apr 25 Rise	Apr 25 Set
Sun	6:27 AM	7:48 PM	6:18 AM	7:54 PM
Moon	4:49 AM	3:55 PM	8:02 AM	10:37 PM
Mercury	5:58 AM	6:24 PM	6:01 AM	7:02 PM
Venus	8:25 AM	11:34 PM	8:14 AM	11:29 PM
Mars	3:20 AM	1:29 PM	3:07 AM	1:25 PM
Jupiter	2:19 AM	12:07 PM	1:54 AM	11:42 AM
Jupiter's moons	e i J g c		e i J g	
5 AM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io			
Saturn	2:38 AM	12:33 PM	2:11 AM	12:07 PM
Uranus	6:52 AM	8:19 PM	6:26 AM	7:53 PM
Neptune	4:58 AM	4:31 PM	4:31 AM	4:04 PM
Pluto	2:18 AM	11:59 AM	1:51 AM	11:32 AM

Solar System Rise and Set Times (cont'd)

Pandemic/weather Crestview Star Party – -permitting

SMCAS 2020 (PDT)	May 16 Rise	May 16 Set	May 23 Rise	May 23 Set
Sun	5:57 AM	8:13 PM	5:52 AM	8:18 PM
Moon	3:20 AM	2:44 PM	6:40 AM	9:30 PM
Mercury	6:39 AM	9:26 PM	6:59 AM	9:59 PM
Venus	7:17 AM	10:25 PM	6:46 AM	9:44 PM
Mars	2:27 AM	1:14 PM	2:12 AM	1:10 PM
Jupiter	12:33 AM	10:22 AM	12:05 AM	9:54 AM
Jupiter's moons	c e i J g		i e J g c	
5 AM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io			
Saturn	12:49 AM	10:45 AM	12:21 AM	10:17 AM
Uranus	5:06 AM	6:36 PM	4:40 AM	6:11 PM
Neptune	3:09 AM	2:44 PM	2:42 AM	2:17 PM
Pluto	12:28 AM	10:08 AM	12:01 AM	9:40 AM

Pandemic/weather Crestview Star Party – -permitting

SMCAS 2020 (PDT)	**Jun 13 Rise**	**Jun 13 Set**	**Jun 27 Rise**	**Jun 27 Set**
Sun	5:47 AM	8:31 PM	5:50 AM	8:34 PM
Moon	1:49 AM	1:31 PM	12:36 PM	12:50 AM
Mercury	7:23 AM	9:55 PM	6:30 AM	8:35 PM
Venus	4:58 AM	7:10 PM	4:03 AM	5:59 PM
Mars	1:27 AM	12:55 PM	12:55 AM	12:42 PM
Jupiter	10:35 PM	8:25 AM	9:35 PM	7:23 AM
Jupiter's moons	e I J g		e i J g c	
11:30 PM, East on left	J=Jupiter, c=Callisto, e=Europa, g=Ganymede, i=Io			
Saturn	10:52 PM	8:51 AM	9:55 PM	7:52 AM
Uranus	3:20 AM	4:53 PM	2:27 AM	4:01 PM
Neptune	1:20 AM	12:56 PM	12:25 AM	12:01 PM
Pluto	10:33 PM	8:16 AM	9:37 PM	7:20 AM

Rise set times from *http://www.almanac.com/astronomy/rise/CA/San%20Carlos/*

Jupiter's moons' positions from *http://www.shallowsky.com/jupiter/*

Directions to SMCAS Public Star Parties (Weather Permitting)

Crestview Park - San Carlos

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 flashlights 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 (toward 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.

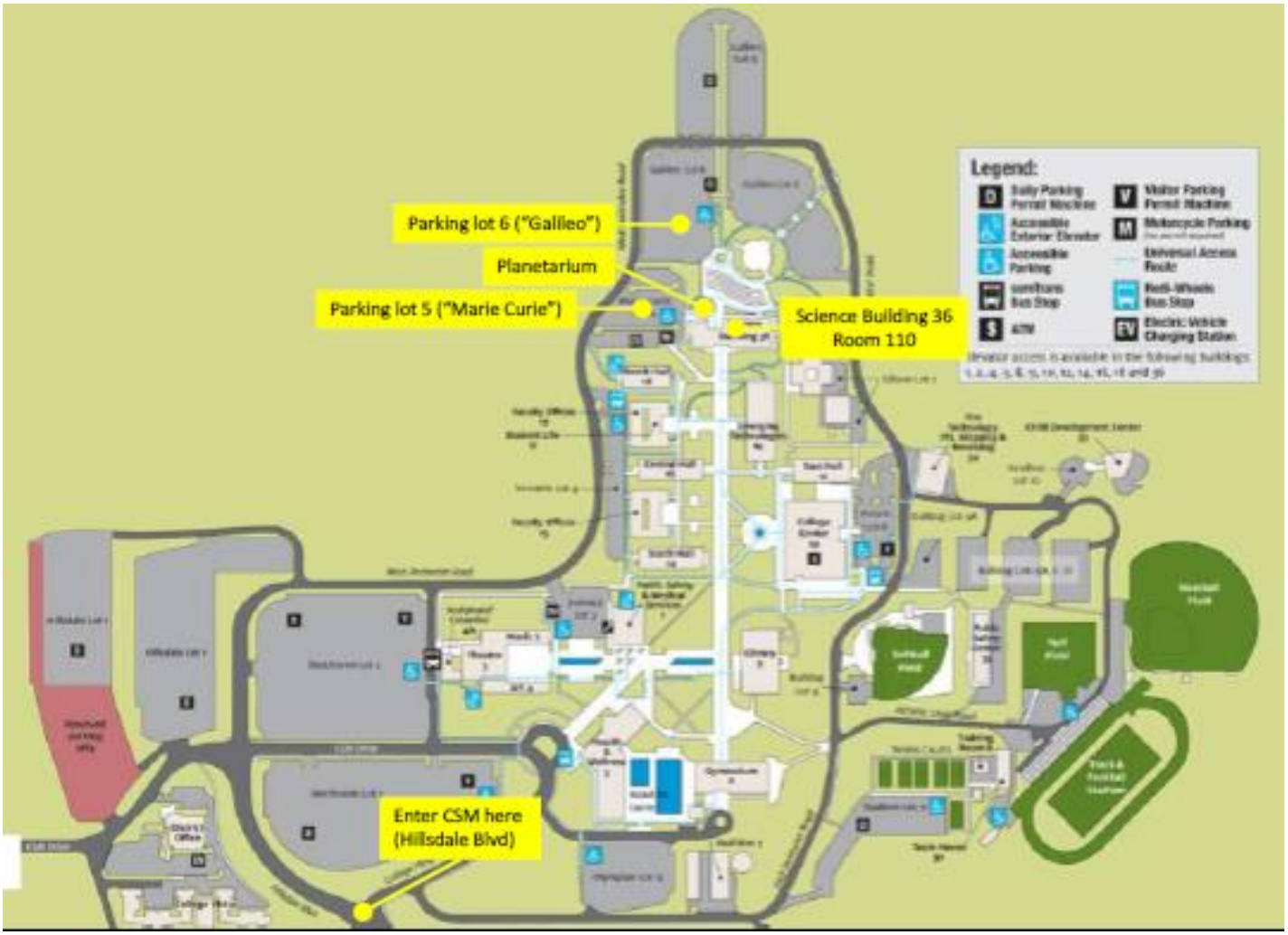
From Highway 280: take Edgewood Road exit. Go east (toward the Bay) about 0.8 miles. Turn left at Crestview Drive. Go 0.5-mile uphill to where Crestview meets Brittan. Again, drive the half-block, to the small blue sign on the right, and the entry road on the left.

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.

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.

Crestview Star Party schedule is here: *http://www.smcasastro.com/crestview-park.html*

Directions to SMCAS Meetings at The College of San Mateo:



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 of Hillsdale Blvd. Continue straight onto West Perimeter Road and follow it until you reach Lot 5, "Marie Curie", or Lot 6, "Galileo." Science (ISC) Bldg. (36) and the Planetarium lie straight ahead. Enter Bldg. 36 either through the door facing the lot or walk around the dome to the courtyard entrance. We meet in ISC room 110 for pizza and soft drinks one hour prior to the talk in the Planetarium (Pictured below.)

San Mateo County Astronomical Society
Membership Application

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

rev 02272020

Become an SMCAS Member Today! Here's what you get:

- **Members Community**

Friendly advice and guidance from experienced recreational astronomers; access to SMCAS group emails, which provide general orientation information, announcements of astronomy events, file access and exchange.

- **SMCAS Events**

General meetings are held the first Friday of most months, at 7 pm in the Integrated Science Center (ISC) Room and Planetarium in the Science Center (Bldg. 36) at the College of San Mateo (CSM), 1700 W. Hillsdale Blvd., San Mateo. Meetings include lectures and presentations on space science, an activity session, and refreshments (usually pizza).

We also offer stargazing two Saturdays a month, weather permitting. Visitors and those without telescopes are welcome; members are glad to share! SMCAS also has sponsored dark-sky campouts at Fremont Peak State Park, field trips to SLAC, KIPAC and Lick Observatory, plus **member-only events, including Star-B-Ques and quarterly potlucks.**

- **Subscriptions** (free with your membership)

The Event Horizon, SMCAS' newsletter, with SMCAS and member information, viewing tips and articles.

The Reflector, published quarterly by the Astronomical League, a national alliance of astronomy groups like SMCAS.

- **Significant Discounts on Equipment and Publications**

Discounts on purchases at Bay Area astronomical equipment retailer Orion Telescope Center, on sky calendars and ephemerides, and on such periodicals as *Sky & Telescope* and *Astronomy*.

- **Access to Loaner Equipment**

Use of SMCAS loaner telescopes and other astronomy equipment.

- **Sharing your Appreciation of Astronomy and Space Science with the General Public.**

Your SMCAS membership helps bring astronomy to interested lay people, especially students and children

Annual Dues: (SMCAS is a tax-exempt non-profit 501(c)(3). Dues may be tax deductible; consult your tax advisor):

$30 Regular Family Membership; $15 Student Membership

Every membership includes all members of your immediate family, (including your kids).

To join you can:

Send application (see reverse side), with payment, to: SMCAS, P.O. Box 974, Station A, San Mateo CA 94403.

- Bring the completed application and payment to a meeting or event and give it to any SMCAS officer.
- Go online at http://www.smcasastro.com/, click on the Membership tab and pay via PayPal.
- **Bring your completed application to your first meeting or mail it** to
  SMCAS, P.O. Box 974, Station A, San Mateo CA 94403

Application Form on reverse side

San Mateo County Astronomical Society
Membership Application

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

rev 02272020

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: _____