

PRIMEFOCUS

Tri-Valley Stargazers

October 2013



Meeting Info

What:

The Fascinating Universe of Variable Stars

Who:

Gordon Myers

When:

October 18, 2013
Doors open at 7:00 p.m.
Lecture at 7:30 p.m.

Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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October Meeting

The Fascinating Universe of Variable Stars

Gordon Myers

Historians debate whether the first confirmed variable star was Mira (a.k.a. Omicron Ceti, with observations recorded in 1596), or Algol (a.k.a. the Demon star, with observations recorded in 1667 - but which may have been known in antiquity). Since then, thousands of variable stars have been identified. Over the past century, astrophysicists have started to understand why these "stars" rapidly change brightness. Yesterday's "variable stars" are today realized to be a menagerie of strange celestial objects – including stars in birth throes, eclipsing binaries, stars in death agonies, and the bizarre world of cataclysmic variables. These objects give us insight into star formation and evolution, distances in the universe, exoplanet detection, and the high-energy physics of nova, supernova and cataclysmic variables. The presentation will briefly describe various objects we measure as variable stars. It will describe the role the AAVSO has played since 1911 collecting data from amateurs around the globe and coordinating research with professionals. Current activities helping astrophysicists collect and analyze data, supporting space borne telescope observations, and enhancing collaboration between amateurs and professionals will be described. Finally, opportunities for individual amateurs to become involved will be presented.

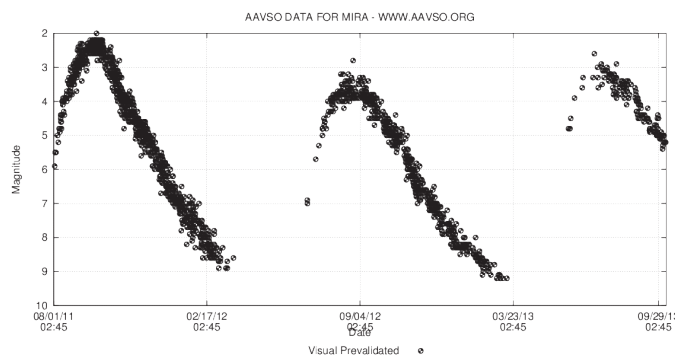


Image Caption: Light curve of Mira for the 800 days preceding the end of September 2013.
Image Credit: AAVSO: <http://www.aavso.org/lcg>

Gordon Myers is the current Board President of the Astronomical Society of the Pacific (ASP) and an active variable star observer working with the American Association of Variable Star Observers (AAVSO). He graduated from Caltech and worked for IBM on the Apollo and Space Shuttle Programs. After retiring from IBM he became an "Earth and Space Explainer" at the American Museum of Natural History in New York city helping visitors better understand and enjoy their visits to the Rose Center for Earth and Space. He completed a series of astrophysics courses at Columbia University and has been observing variable stars using remote telescopes operated over the Internet since 2004.

News & Notes

2013/2014 TVS Meeting Dates

The following lists the TVS meeting dates for 2013. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	Board Meeting	Prime Focus Deadline
Oct. 18	Oct. 21	
Nov. 15	Nov. 18	Oct. 25
Dec. 20	Dec. 23	Nov. 29
Jan. 17	Jan. 20	Dec. 27
Feb. 21	Feb. 24	Jan. 31
Mar. 21	Mar. 24	Feb. 28
Apr. 18	Apr. 21	Mar. 28
May 16	May 19	Apr. 25
Jun. 20	Jun. 23	May 30
Jul. 18	Jul. 21	Jun. 27
Aug. 15	Aug. 18	Jul. 25
Sep. 19	Sep. 22	Aug. 29
Oct. 17	Oct. 20	Sep. 26
Nov. 21	Nov. 24	Oct. 31
Dec. 19	Dec. 22	Nov. 28

Money Matters

Treasurer David Feindel indicates that as of September 23, 2013 the TVS account balances is:

Checking \$12,354.97

TVS Needs YOU!!!

TVS needs your help. Please consider taking on the role of Vice-President or Program Director. Anyone interested in either (or both) of these positions is encouraged to contact any of the club officers via e-mail or at the monthly meeting.

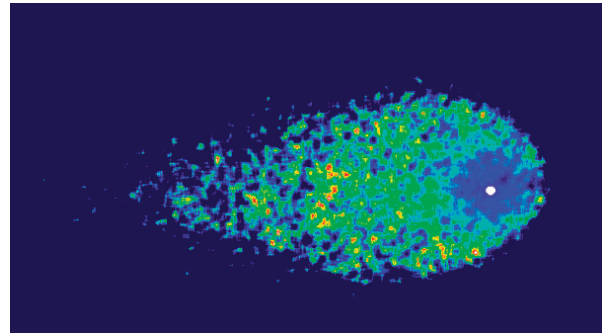
Journal Club By Ken Sperber

Comet C/2012 S1 ISON: Boom or Bust

Barely one year ago, September 21, 2012, Comet ISON was discovered by V. Nevski and A. Novichonol. They used the 16-inch reflector of the International Scientific Optical Network that is located in Russia. As indicated on Wikipedia, an investigation of archived data indicated that prediscovey images of Comet ISON were made by the Mt. Lemmon Survey, and Pan-STARRS. These additional data were useful data points for calculating the orbit of the comet. It has been determined that the comet is in a hyperbolic orbit (eccentricity greater than 1), indicating that the comet is a first

time visitor to the Sun's vicinity, likely from the Oort Cloud. Unless it is "suitably" gravitationally perturbed to reduce the eccentricity to less than one, it won't pass this way again. Comet ISON has already made its closest approach to Mars, about 6.7 million miles on October 1. On November 28 it will pass within 1.15 million miles of the Sun and then it will pass within 40 million miles of Earth on December 26.

There has been much debate about how bright Comet ISON might become, and whether or not it will survive its' close passage by the Sun. When it was discovered, it was near the orbit of Jupiter. Given its brightness, there was immediate speculation that it could be "The Comet of the Century." As reported in February 2013, nearly 2000 brightness observations showed that the comet was rapidly brightening, and if that rate of brightening continued the estimate was that ISON would be brighter than the full Moon just after perihelion. However, first time interlopers are notoriously fickle, and ISON did not continue to brighten as anticipated. At closest approach to the Sun, the surface temperature of Comet ISON could reach 2700C (4890F), hot enough to melt metal and rock. Furthermore, it will pass within the Roche limit of the Sun, meaning that gravitational shear could rip the comet apart if its tensile strength is too weak.



Caption: Comet ISON as imaged by the HST. The white dot is the location of the comet nucleus, which is surrounded by a dust coma. The color change suggests that there is relatively more water close to the nucleus. Credit: NASA/ESA.

Numerous scientific journal articles have addressed the issue of whether or not Comet ISON will survive its' close passage of the Sun. As noted above there are two processes that can destroy the comet (1) sublimation under intense solar heating, and (2) gravitational disruption. Size matters! Kreutz family comets are sungrazers, and analysis of their behavior indicates that sublimation will destroy comets <0.2km in size. Comets in the range 0.2-1km should survive sublimation, but will likely fragment with no piece big enough to produce a visible comet. Larger comets should survive sublimation, and if fragmentation does occur there should be a large enough chunk to remain visible. ISON is estimated to be 0.4-2km in size. Knight and Walsh (2013, ApJ 776:L5) use numerical

Header Image: HST image of Comet ISON taken April 10, 2013.
Image Credit: NASA/ESA

Journal Club (continued)

simulations to estimate the conditions under which ISON could disintegrate. Tidal disintegration depends upon which way the comet is rotating. Densities $<0.1\text{g}/\text{cm}^3$ are required to disrupt retrograde or non-rotating bodies. For prograde rotating bodies disruption could occur for densities $<0.7\text{g}/\text{cm}^3$. They indicate that if ISON is a typical comet (1km, $0.5\text{g}/\text{cm}^3$, with a random rotation axis, it is likely to survive its' close passage of the Sun.

Next up is "The Impending Demise of Comet C/2012 S1 ISON" by I Ferrin of the University of Antioquia, Columbia. The author has developed a technique called "Secular Light Curves." Essentially, the author has removed the changing Earth-Comet distance that causes unwanted variations in the apparent brightness of the comet. Rather the "reduced magnitude" brightness includes only brightness changes that are due to the comet-Sun distance. The reduced magnitude is then plotted vs. the log of the distance from the Sun, and additionally as a function of time before and after perihelion. For Comet Halley, after it first became visible it brightened rapidly, but then slowed down in its rate of brightening (known as a "slope discontinuity event") as it came within ~ 1.7 Astronomical Units (Earth-Sun distance) of the Sun. After perihelion it remained brighter than for an equal distance compared to that on its way toward the Sun.

From the brightness observations the author has processed, Comet ISON experienced its' slope discontinuity event at 5.1 AU, much further out than Halley's Comet, as of January 2013. Since that time the reduced magnitude has barely increased, with the latest observations showing a decrease in brightness! The author then compared Comet ISON's light curve to that of other observed comets. Two comets showed similar reduced magnitude light curves, Comet C/2002 O4 Honig and Comet C/1996 Q1 Tabur. Both disintegrated. The author

concludes that "there is a 100% probability that Comet ISON is turning off or disintegrating."

Time will tell!

For more information see: <http://iopscience.iop.org/2041-8205/776/1/L5/article>, <http://astronomia.udea.edu.co/cometspage/>, <http://www.universetoday.com/104818/comet-ison-a-viewing-guide-from-now-to-perihelion/>, and http://en.wikipedia.org/wiki/C/2012_S1

Calendar of Events

October 13, 20, 27, 8:30pm

What: The Kepler Story: An Immersive Theatre Experience
Who: Norbert Weisser
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Academy members \$12, General Public \$15.
Reserve a space online or call 1-877-227-1831.

We are excited to announce our first ever prime-time Sunday evening performance series taking place in the Morrison Planetarium - the world's largest all digital dome. As a one-man performance with dramatic supporting music and full dome visuals, the Morrison Planetarium in collaboration with Motion Institute presents The Kepler Story - an innovative, immersive performance piece about the life and story of 17th-century astronomer and mystic Johannes Kepler. The story of his life, including his discovery of the three laws of planetary motion which removed Earth once and for all from its position at the center of the Universe, took an even more dramatic turn when his mother was arrested for witchcraft

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tvs@trivalleystargazers.org

Eyes on the Skies

Eyes on the Skies is a robotic solar telescope run by Mike Rushford (rushford@eyes-on-the-skies.org). You may access it by visiting www.eyes-on-the-skies.org.

TVS E-Group

So how do you join the TVS e-group, you ask? Just send an e-mail message to the TVS e-mail address (trivalleystargazers@gmail.com) asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

Calendar of Events (continued)

and Kepler was forced to defend her. On the way to her trial, reading Galileo's father's book on harmony, Kepler experienced one of his greatest epiphanies about the harmony of the universe.

See http://www.calacademy.org/events/special_programs/keplerstory/?utm_source=bronto&utm_medium=email&utm_term=+More+Details+%26+Tickets+&utm_content=New+Science+Lectures+%26+Festivals&utm_campaign=Lectures_eBlast_092313 for lecture and reservation information.

October 14, 7:30pm

What: The Search for Habitability and Life Beyond Earth: From micro-ETs to Exoplanets
Who: Nathalie A. Cabrol, SETI Institute
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: General \$12, Seniors \$10, Academy members \$8. Reserve a space online or call 1-877-227-1831.

The last decade has seen a revolution in astrobiology – the study of the origin, evolution, distribution, and future of life in the universe. Results returned by planetary missions in the Solar System such as Messenger, Venus Express, the Mars Exploration Rovers, Mars Reconnaissance Orbiter, Mars Express, MSL and the Curiosity rover, Cassini, and Kepler, as well as multi-disciplinary research in terrestrial extreme environments have resulted in a new, inclusive, vision of astrobiology. What we learn from one planet helps us understand others, including our own, and guides the design and planning of future astrobiology-focused missions. In her presentation, Dr. Cabrol will discuss this revolution in astrobiology, with the latest updates from these various missions, and where we stand on our quest to understanding habitability and find life beyond Earth.

See <http://www.calacademy.org/events/lectures/> for lecture and reservation information.

October 15, 7:00pm

What: Asteroid Radar Astronomy, Spacecraft Missions, and the Impact Hazard
Who: Michael Busch, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The near-Earth asteroids (NEAs) are a population of objects on orbits that pass near that of the Earth. Many NEAs are attractive targets for spacecraft missions, and NEAs are also important because some of them will eventually hit Earth. Both future NEA missions and the impact hazard motivate understanding the sizes, shapes, surface properties, and trajectories of as many objects as possible.

The techniques of radar astronomy provide a way to characterize a representative sample of the NEA population. I will review these techniques and describe some recent radar results, focusing on spacecraft targets and objects with future close encounters with Earth.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

October 16, 7:00pm, Doors open: 7:00pm

What: Confessions of an Alien Hunter
Who: Seth Shostak (SETI Institute) Ryan Wyatt (Director of the Morrison Planetarium)
Where: Rickshaw Stop, 155 Fell St. at Van Ness
Cost: \$8 <http://www.ticketfly.com/purchase/event/314559> (promo code "NERDALIEN" or sf.nerdnite.com one week before the event

Seth Shostak knew he would spend his life hunting for signs of life in the Universe from the time he was just 10 years old. He is now Senior Astronomer at the SETI (Search for Extraterrestrial Intelligence) Institute whose mission is to explore, understand and explain the origin, nature and prevalence of life in the Universe. Shostak has published hundreds of scientific articles, written several popular books and even has his own radio show. Ryan Wyatt, Director of Morrison Planetarium at the California Academy of Sciences will join Shostak on stage to hear the latest confessions of one of this world's leading alien hunters!

See http://www.calacademy.org/events/special_programs/keplerstory/?utm_source=bronto&utm_medium=email&utm_term=+More+Details+%26+Tickets+&utm_content=New+Science+Lectures+%26+Festivals&utm_campaign=Lectures_eBlast_092313 for lecture and reservation information.

October 19, 7:30pm-8:15pm

What: Saturn V Countdown
Who: Faride Khalaf
Where: Chabot Space and Science Center, Space Cafe, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Included with general admission

Take a closer look at this magnificent flying machine that took man farther and faster than ever before. The story of the complex and powerful Saturn V moon rocket is anything but short and sweet. Nearly half a million dedicated people toiled for the better part of a decade to get the most powerful machine ever built to rise from the wetlands of Florida and send the spacecraft and its crew to the moon. Join the discussion as we examine some of the subtleties of their creation, and reveal the genius in their logic and rationale. Learn what it took to build stages, test, transport, assemble and launch this marvel of engineering.

Calendar of Events (continued)

See <http://www.chabotspace.org/events.htm> for more information.

October 22, Noon-1:00pm

What: Dynamics of Ice, Water and Salts in the Martian Subsurface
Who: Bryan Travis, Los Alamos National Laboratory
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Recent discoveries on Mars suggest ice may be or recently was present at latitudes where it is not expected and at unexplained abundance. As ice may be unstable under present Martian climatic conditions, a mechanism may be needed to explain the presence of ice in the near surface at these latitudes. Water release history, chemical composition, and heat fluxes are variable over the surface of Mars, and there could be more than one mechanism responsible for near-surface ice. The purpose of this numerical modeling study is to show that thermochemical circulation of brines in the subsurface of Mars is a possible mechanism that can deposit ice and brine, close to, or even at, the surface of Mars.

Numerical simulations indicate that brine convection can occur over a range of parameter values. Furthermore, the action of brine convection can be related to some of the surface features associated with subsurface water and ice during previous or even present epochs, such as polygonal ground and sorted stone circles. The numerical simulator developed for this study is versatile; besides Mars, it has been applied to other cold environments, such as asteroids and water moons, where fluid circulation may be or may have been a factor in the dynamics of such bodies.

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

October 29, Noon-1:00pm

What: Every Body is an Ark: How the microorganisms we carry will impact long term space travel
Who: Caitlin Contag, USC
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The human microbiome is essential to our health and deserves special consideration in the closed environments of space travel. The dynamics of host-microbe interactions will change if normal immune functions are altered during extended space travel. Opportunistic pathogens common in the human microbiome, including those in the genera *Candida*, *Aspergillus*, and *Staphylococcus*, could spread among crewmembers and put them at risk of serious disease. Not only will the microbiome be important to the maintenance of crew health, it will be critical in establishing a new healthy

human population from the small group of founders. This imposed bottleneck on human evolution and the associated microbial communities offers incredible opportunities to eliminate common pathogens that put human health at risk.

Conversely, isolating a subset of the human population could exclude some organisms that confer a significant health advantage. The characterization of the human microbiome is a relatively recent area of investigation, and the full functionality of the vast microbiota living in and on the human body is not yet well understood. Data suggest microbial involvement in diverse areas of human health and further studies will likely yield novel strategies to maximize the benefits of individuals' microbial communities in a particular environment. The ideal microbiome of space explorers should be developed alongside the spacecraft and dietary plans.

However, there are many ethical considerations associated with selecting participants for an interstellar program based on the composition of their microbiome, or significantly altering participants' microbiome. Similar to genomic sequencing, there are aspects of an individual's microbiota that could cause prejudice. Should the isolation of *Staphylococcus aureus* from a person's nares prevent his or her participation in a brave new world? Developing a more complete understanding of the benefits and harms conferred by the fungi, viruses, archaea, and bacteria that exist in and on our bodies will guide our determination of what non-human organisms can and should be included on the ark

For more information see: <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

November 2, 7:30pm-8:15pm

What: Saturn V Countdown
Who: Faride Khalaf
Where: Chabot Space and Science Center, Space Cafe, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Included with general admission

From imagination to realization, NASA's Apollo program is packed with bold vision, engineering elegance, and tales of courage and sheer human toil. We'll take a trip down memory lane and visit the Moon. With colorful images we will look back at the physics and challenges of landing astronauts on the lunar surface. How did we do it? In a play-by-play review, find out the necessary steps we took that put us on the Moon!

See <http://www.chabotspace.org/events.htm> for more information.

November 2, 7:30pm

What: Is Anybody Out There?
Who: Dr. Dan Werthimer, SETI Institute

Calendar of Events (continued)

Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area

Cost: Free

What is the possibility of life in the universe and how can we search for radio and optical signals from other civilizations.

For more information see: <http://www.mttam.net/astronomy/schedule.html>

November 4, 7:30pm

What: The Modern Origins Story: From the Big Bang to Habitable Planets

Who: Eliot Quataert, UC Berkeley

Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA

Cost: General \$12, Seniors \$10, Academy members \$8. Reserve a space online or call 1-877-227-1831.

The scientific understanding of our origins began in earnest with Copernicus, Galileo, Darwin, and others, and has since

evolved into a rich, detailed, and well-tested model. In addition to their intrinsic scientific importance, these ideas also have far reaching implications for other aspects of people's lives (e.g., philosophical, religious, and political). In this talk Quataert will provide an overview of the modern understanding of origins in astrophysics, from the big bang to the discovery of planets around other stars. The story begins in the infant universe, which we now know was remarkably smooth compared to what we see around us today, with only tiny differences in its properties from one part to another. By contrast, in the present universe there are enormous differences in the properties of matter from one part to another: some regions host planets, stars, and galaxies (and even humans!) while others do not. Quataert will describe how the universe evolved from its smooth beginnings to its current state, emphasizing how gravity reigns supreme and builds up the planets, stars, and galaxies required for biological evolution to proceed.

See <http://www.calacademy.org/events/lectures/> for lecture and reservation information.



Caption: Image of NGC2024, the Flame Nebula. Steve Goldenberg took this image from H2O on October 5, 2013 using a Nikon 7000 DSLR coupled to his C-11. The exposure was 30 seconds at ISO 6400, with the telescope operating at f/6.3 and unguided.

What's Up by Ken Sperber (adapted from S&T and The Year in Space)

Pacific Daylight Time through November 2, PST thereafter.

October

- 1 Tue Crescent Moon forms a triangle with Mars and Regulus (Dawn, see p.48 October S&T)
- 3-16 Thu Zodiacal Light visible in the east beginning ~2 hours before dawn
- 4 Fri The star Delta Geminorum is just 6 arc minutes from Jupiter (predawn-dawn)
- 4 Fri New Moon (5:35pm)**
- 7-8 Mon- Venus conjunction with crescent Moon, with Saturn and Mercury to the lower-right of Venus (Dusk)
- 9 Wed The star Delta Scorpii 3/4 degrees above Saturn (dusk)
- 11 Fri First-Quarter Moon (4:02pm)**
- 15 Tue Mars 1 degree to the upper-left of Regulus in the east (Dawn)
- 16-17 Wed- Antares less than 2 degrees from Venus in the southwest (Dusk)
- 18 Fri Full Moon (4:38pm)**
- 25-26 Fri- The Moon and Jupiter are in close proximity (Dawn)
- 26 Sat Last-Quarter Moon (4:40pm)**
- 29 Tue Crescent Moon forms a triangle with Mars and Regulus (Dawn, see p.48 October S&T)

November

- 2-15 Sat- Zodiacal Light visible in the east (120-80 minutes before sunrise)
- 3 Sun New Moon (4:50am)**
- 6 Wed Venus 7 degrees to the lower-left of the crescent Moon (Dusk)
- 9 Sat First-Quarter Moon (9:57pm)**
- 11-28 Mon- Mercury above the east-southeast horizon (45 minutes before sunrise)
- 17 Sun Full Moon (7:16am)**
- 17-18 Sun- Comet ISON possibly visible to the unaided eye near Spica (Predawn, see p.50 November S&T)
- 22 Fri Comet ISON 5.5 degrees to the right of Mercury
- 25 Mon Last-Quarter Moon (11:28am)**
- 25-26 Mon- Saturn less than 1 degree from Mercury, Comet ISON possibly visible below them (1/2 hour before sunrise)
- 29 Fri Moon occults Spica in broad daylight

Tri-Valley Stargazers
P.O. Box 2476
Livermore, CA 94551



PRIMEFOCUS

Tri-Valley Stargazers Membership Application

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function.

Name _____ Phone _____ e-mail _____

Address _____

Do not release my: _____ address, _____ phone, or _____ e-mail information to other TVS members.

- Membership category:
- _____ \$5 Student.
 - _____ \$30 Basic. You will receive e-mail notification when the PDF version of Prime Focus is available for download off the TVS web site.
 - _____ \$10 Hidden Hill Observatory (H2O) yearly access fee. You need to be a key holder to access the site.
 - _____ \$20 H2O key holder fee. (A refundable key deposit—key property of TVS).
 - _____ \$40 Patron Membership. Must be a member for at least a year and a key holder.
 - _____ \$34 One year subscription to Astronomy magazine.
 - _____ \$60 Two year subscription to Astronomy magazine.
 - _____ \$32.95 One year subscription to Sky & Telescope magazine. Note: Subscription to S&T is for new subscribers only. Existing subscribers please renew directly through S&T.
 - \$ _____ Tax deductible contribution to Tri-Valley Stargazers.
 - \$ _____ TOTAL – Return to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551

Membership information: Term is one calendar year, January through December. Student members must be less than 18 years old or still in high school.