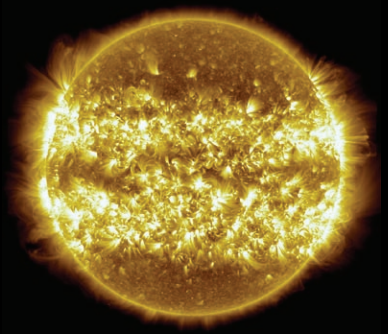
PRIMEFOCUS

Tri-Valley Stargazers

May 2013



May Meeting

Watching the magnificent Sun with NASA's Solar Dynamics Observatory

Dr. Regina Soufli

Launched in 2010, the Solar Dynamics Observatory (SDO) is NASA's most advanced solar mission to date. It studies the sun's interior, its atmosphere, called the corona, and the impacts on Earth's upper atmosphere and nearby space environment. One of the most crucial components aboard the SDO imaging telescopes are the multi-layer-coated mirrors, developed and calibrated to reflect light with extremely high precision, on the order of a fraction of one nanometer (1 nanometer = 1 billionth of a meter). The SDO multilayer mirrors act as reflective lenses and are responsible for capturing the images and movies of the sun produced by SDO at seven extreme ultraviolet (EUV) wavelengths. By imaging the sun at specific EUV emission lines from the solar plasma, the SDO telescopes record solar activity in exquisite spatial, spectral and temporal resolution for the purpose of studying and elucidating the sun's extremely complex and dynamic magnetic field, its plasma and related phenomena. SDO has already contributed to several discoveries, including sympathetic solar flares and super-high-speed solar waves. It also has enabled modeling efforts to predict solar activity, including extreme events (such as flares and coronal mass ejections), which when directed toward Earth, can disrupt satellite communications and electricity grids and may pose threats to aviation and astronaut safety. SDO also has brought scientists closer to solving the most intriguing enigma in modern solar physics: the coronal heating mechanism.

Regina Soufli received her Diploma in Electrical Engineering from the National Technical University of Athens in Greece and her Ph.D. in Electrical Engineering from the University of California, Berkeley. She was staff scientist at the Harvard-Smithsonian Center for Astrophysics working on NASA's Chandra X-ray Observatory. At Lawrence Livermore National Lab she has been principal investigator on programs related to extreme ultraviolet (EUV) and x-ray optics for semiconductor lithography, solar physics and astrophysics, synchrotron and free-electron lasers, and high-energy physics. She has recently been developing x-ray optics for the Linac Coherent Light Source, the world's first x-ray free electron laser, and EUV multilayer optics for NASA's Solar Dynamics Observatory and NASA / NOAA's space weather satellites. Her interests are in EUV/X-ray interactions with matter, surface and materials science, corrosion science, multilayer thin films, roughness and scattering. She is author of about 100 publications and a book chapter, and has received two "R&D 100" awards.

Header Image: This is a composite of 25 images of the Sun taken by the Solar Dynamics Observatory. The images, spanning the period April 16, 2012 to April 15, 2013, were taken at a wavelength of 171 Angstroms, and reveal where the Sun was most active during this period. 171 Angstroms corresponds to the extreme ultraviolet, and shows solar material at a temperature of about 600,000 Kelvin. Credit: NASA's Goddard Space Flight Center/SDO/S. Wiessinger; also see: http://sdo.gsfc.nasa.gov/gallery/potw.php?v=item&id=142

Meeting Info

What:
Watching the magnificent Sun with NASA's Solar Dynamics Observatory

Who:
Dr. Regina Soufli

When:
May 17, 2013
Doors open at 7:00 p.m.
Featured Speaker at 7:45 p.m.

Where:
Unitarian Universalist Church in Livermore
1893 N. Vasco Road

Inside

News & Notes

2013 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**
May 17	May 20	
Jun. 21	Jun. 24	May 24
Jul. 19	Jul. 22	Jun. 28
Aug. 16	Aug. 19	Jul. 26
Sep. 20	Sep. 23	Aug. 30
Oct. 18	Oct. 21	Sep. 27
Nov. 15	Nov. 18	Oct. 25
Dec. 20	Dec. 23	Nov. 29

Money Matters

Treasurer David Feindel indicates that as of April 22, 2013 the TVS account balance is:

Checking $12,762.92

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 email or at the monthly meeting.

Yosemite Star Party

This year's Yosemite Star Party will be held on Friday and Saturday, August 16 and August 17, at Glacier Point. Tri-Valley members who bring telescopes for public observing will receive free camping at the Bridalveil campgrounds. On these evenings, sunset occurs at about 8pm. On August 16, moonrise is at 4:18pm and moonset is at 2:35am. On August 17, moonrise is at 5:13pm and moonset is at 3:42am.

Those interested in participating should contact Bob McKoon (rmckoon"at"yahoo.com).

Calendar of Events

May 11, 8:30pm

What: Deep Space Industries
Who: Dr. Jim Luebke, Deep Space Industries
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

Deep Space Industries is a new company dedicated to exploring, characterizing, retrieving, and processing Near-Earth asteroids for fuel, building materials, and planetary defense.

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

May 14, Noon-1:00pm

What: Life Before Genetics: Autogenesis, Information, and the Outer Solar System
Who: Terrence W. Deacon, Anthropology Department, UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The investigation of the origins of life has been hindered by what we think we know about current living organisms. This includes three assumptions about necessary conditions: 1) that it emerged entirely on Earth, 2) that it is dependent on the availability of liquid water, and 3) that it is coextensive with the emergence of molecules able to replicate themselves.

In addition, the three most widely explored alternative general models for a molecular process that could serve as a precursor to life also reflect reductionistically-envisioned fragments of current living systems: e.g., container-first, metabolism-first, or information-first scenarios. Finally, we are hindered by a technical concept of information that is fundamentally incomplete in precise ways that are critical to characterizing living processes.

These all reflect reductionistic "top-down" approaches to the extent that they begin with a reverse-engineering view of what constitutes a living Earth-organism and explore possible re-compositional scenarios. This is a Frankensteinian enterprise that also begins with assumptions that are highly Earth-life specific and therefore unlikely to lead to a general exo-biology.

The approach Dr. Deacon will outline instead begins from an unstated conundrum about the origins of life. The initial transition to a life-like process necessarily exemplified two almost inconceivably incompatible properties: 1) it must have involved exceedingly simple molecular interactions, and 2) it must have embodied a thermodynamic organization with the unprecedented capacity to locally compensate for spontaneous thermodynamic degradation as well as to stabilize one or more intrinsically self-destroying self-organizing processes.

This talk will explore the origins of life problem by attempting to identify the necessary and sufficient molecular relationships able to embody these two properties. From this perspective, Dr. Deacon will develop a model system - autogenesis - that redefines biological information and opens the search for life's origin to cosmic and planetary contexts seldom considered.

Calendar of Events (continued)

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

May 15, 7:00pm-8:30pm

What: Being a Mars Rover: What It's Like on the Surface of Mars
Who: Dr. Lori Fenton, SETI Institute
Where: Smithwick Theater, Foothill College, El Monte Road and Freeway 280, Los Altos Hills, CA
Cost: Free, Parking lots 1, 7 and 8 provide stair and no-stair access to the theatre. Visitors must purchase a parking permit for $3 from dispensers in student parking lots.

On Aug. 6, 2012, many people around the world gathered around TVs and computers to await news of NASA's latest mission to Mars. The complex, yet flawless landing of the rover Curiosity led to worldwide acclaim. What has NASA's youngest robot been up to since then, and what has it discovered? Where on Mars did it land and why was that site chosen above all others? Dr. Fenton will give an overview of the rover's capabilities, accomplishments, and plans on Mars and describe what it's really like on the surface of the red planet.

For more information see: http://www.foothill.edu/news/newsfmt.php?sr=2&rec_id=3013 or call (650) 949-7888.

May 18, 11:00am

What: Connecting Infinitesimal to Infinity: The Search for Dark Matter
Who: Dr. Nader Mirabolfathi, UC Berkeley
Where: UC Berkeley, Genetics and Plant Biology Building, Room 100 (northwest corner of campus)
Cost: Free, limited hourly pay parking on/nearby campus. The venue is within walking distance of BART and bus lines.

At the very small scales the Standard Model of Elementary Particles explains the building blocks of the nature and their interactions. Although the model is very successful (e.g., prediction of Higgs Bosons recently discovered at CERN), it is incomplete! A new physics beyond the Standard Model is indeed required to explain some internal problems of this model.

On the other hand at the very large scales our observations of dynamics of galaxies, clusters of galaxies or the Universe as a whole do not match our expectations based on the luminous matter content of the Universe. A new form of matter that doesn't emit or interact with light, i.e., dark matter is required to explain our observations.

I will speak about a new class of elementary particles, a.k.a Weakly Interacting Massive Particles (WIMPs), to resolve inconsistencies in our understanding of the nature at both extreme large and small scales and how they are connected together. I will also explore the experimental efforts to detect these particles in terrestrial laboratories.

For more information see: http://scienceatcal.berkeley.edu/lectures

May 18, 7:00pm-9:00pm

What: An Evening with Astronauts
Who: Astronauts Ed Lu and Rusty Schweickart
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $20 members, $23 guests, $29 at the door (subject to availability). Tickets available by calling (510)

continued on page 4

336-7373.

Explore the world of asteroid hunters with Astronauts Ed Lu and Rusty Schweickart, co-founders of the B612 Foundation - a private foundation dedicated to protecting the Earth from asteroids. Lu and Schweickart will share the latest information on new technologies that help protect our Earth and plans to build, launch, and operate the first privately funded deep telescope. Hear how their time served as astronauts helped inspire them to protect our planet. Panel discussion followed by Q&A.

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

May 20, 7:30pm

What: Brilliant Blunders
Who: Dr. Mario Livio, Space Telescope Science Institute
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Adults $12, Seniors $10, Academy members $8. Reserve a space online or call 1-877-227-1831.

Dr. Mario Livio is a senior astrophysicist at the Hubble Space Telescope Science Institute and a bestselling author. He wrote "The Golden Ratio," a highly acclaimed book about mathematics and art for which he received the International Pythagoras Prize and the Peano Prize. His latest literary adventure, "Brilliant Blunders," draws on the lives of five renowned scientists. He shows how even these geniuses made major mistakes and how their errors were an essential part of the process of achieving scientific breakthroughs. We all make mistakes, and that includes five of the greatest scientists in history—Charles Darwin, William Thomson (Lord Kelvin), Linus Pauling, Fred Hoyle, and Albert Einstein. Fred Hoyle, for example, was an eminent astrophysicist who ridiculed an emerging theory about the origin of the universe that he dismissively called "The Big Bang." And the name stuck! Join us to learn more about the Brilliant Blunders that advanced the science of its time. Livio is also the author of such books as "The Equation That Couldn't Be Solved," "Is God a Mathematician?" and "The Accelerating Universe." Book Signing to follow.

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

May 21, Noon-1:00pm

What: Convection in Ice Mantles: Effects of Texture and Anisotropy
Who: Max Rudolph, University of Colorado, Boulder
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The icy mantles of satellites in the outer solar system may transport heat by solid-state convection, which is important because it provides a mechanism for cycling material between ocean and surface, controls the rate of heat transport, and may produce surface geological features. The style of convection and rate of heat transport depend strongly on ice rheology, which is complex. I will discuss the effect of crystallographic preferred orientation (CPO) on ice rheology and how this phenomenon affects convection. Next, I will present the results from numerical models of ice convection in which we incorporate CPO development and the resulting viscous anisotropy. CPO develops as a result of strain and can potentially be detected using spacecraft radar observations. Hence, if we can detect CPO, we can study not only the present state but also the strain-history of an icy satellite. Our numerical models lead to specific predictions of where CPO is likely to develop and what CPO fabrics are likely to develop in association with specific geologic settings.

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

May 28, Noon-1:00pm

What: Do Cyanobacteria Use Iron for Photosynthesis?
Who: Niki Parenteau, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Dr. Parenteau will speak about her research into the origins of photosynthesis and how this might relate to ancient banded iron formations formed during the great oxidation event. Banded Iron Formations (BIFs) are widespread Precambrian sedimentary deposits that accumulated in deep ocean basins with inputs of reduced iron and silica from deep ocean hydrothermal vents.

There is a large scientific debate as to whether abiotic or biotic mechanisms were responsible for the oxidation of mineral assemblages in BIFs. Biotic oxidation could have occurred as a result of the photosynthetic production of oxygen by cyanobacteria, or could have been directly formed by anoxygenic phototrophs or chemolithotrophs.

Dr. Parenteau has been searching for modern descendants of such an ancestral "missing link" cyanobacterium in the phototrophic mats at Chocolate Pots, a hot spring in Yellowstone National Park. Dr. Parenteau will explain how her study of the biomats using C-14 carbon uptake experiments have tantalizingly showed that the cyanobacteria grow anoxygenically using reduced iron as an electron donor for photosynthesis in situ.

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

May 31 7:00pm-8:00pm

continued on page 5

What: Our Next Ride
Who: Fridays with Faride
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Included with General Admission, Tickets available online or call (510) 336-7373

NASA's Space Launch System (SLS) is the new protocol for the American Space Program. This is an elaborate approach to lifting crew and cargo into the sky in a way that is safe, economical, and with greater options and flexibility. In this presentation, you'll gain some insight into the future of space travel and understand why our traditional means of exploration are now history.

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

June 8, 8:30pm

What: Cosmos 360 with Geoff Marcy
Who: Dr. Geoff Marcy, UC Berkeley
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Members: $10 adults/$7 children; Non-members: $21 adults/$10 children; includes General Admission, tickets available online or call (510) 336-7373

We are pleased to have renowned astronomer Geoff Marcy of UC Berkeley join the journey! Debut of the latest show in the series and Q&A with Marcy and our host, truly an out of this world experience!

Geoff Marcy is one of the pioneers and leaders in the discovery and characterization of planets around other stars. His research has included detection of the first multiple-planet system, the first Saturn-mass planet and the first Neptune-mass planet. In recent years, Professor Marcy's research has focused on the search for Earth-size planets around other stars using Kepler, the NASA space-borne telescope. In March, 2012, he was appointed to the Alberts Chair in the Search for Extraterrestrial Intelligence and has won many awards for his work in the subject.

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

June 11, Noon-1:00pm

What: Measuring Atmospheric Boundary Layer Fluxes on Mars: Sonic Anemometer
Who: Don Banfield, Cornell University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The atmospheric boundary layer on Mars is where the influence between the surface and atmosphere (and vice versa) takes place on Mars. To better validate and improve mesoscale atmospheric models we suggest that direct observations of the interactions between the surface and atmosphere are needed. Such direct measurements of the forcings (and response) between surface and atmosphere allow much tighter constraints to be placed on the processes that control the behavior of the atmosphere in and well above the atmospheric boundary layer. To achieve these direct measurements, we propose using a sonic anemometer for Mars.

This instrument, based on the gold standard wind measurement techniques used terrestrially, has been in development under PIDDP (now PICASSO) funding for much of the last decade, and is now ready for use on upcoming Mars missions. Dr. Banfield will discuss the advantages such an instrument offers over other wind measurement techniques for Mars, as well as some details of the instrument itself.

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

June 15, 8:30pm

What: Dark Energy and the Runaway Universe
Who: Dr. Alex Filippenko, UC Berkeley
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

The expansion rate of the Universe is speeding up with time, rather than slowing down due to gravity as expected. The origin of the repulsive "dark energy" may be the biggest unsolved mystery in all of physics.

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

June 18, Noon-1:00pm

What: Conformal Gravity: New Light on Dark Matter and Dark Energy
Who: Robert Nesbet, IBM Almaden
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Dr. Nesbet will describe (in layman's terms) implications of a theory that differs from standard particle physics and cosmology only by imposing a universal symmetry principle. This theory has been found to explain dark energy and dark galactic halos without invoking dark matter. Subgalactic phenomenology (relevant to our solar system) is retained.

The model postulates that strict conformal symmetry (local Weyl scaling covariance), already satisfied by standard fermion and gauge boson theory, can be extended to all el-

continued on page 6

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

Pacific Daylight Time

May

9	Thu	New Moon (5:28pm)
11-12	Sat-	Thin crescent Moon in conjunction with Jupiter
17	Fri	First Quarter Moon (9:35pm)
21-22	Tue-	Waxing gibbous Moon close to Spica on the 21st, and Saturn on the 22nd
24-29	Fri-	Venus, Jupiter, and Mercury within a 5 degree circle. (After sunset); See skypub.com/may2013planets
24	Fri	Full Moon (9:25pm)
31	Fri	Last Quarter Moon (11:58am)

June

1-13	Sat	Mercury's highest evening apparition of 2013 (45 minutes after sunset); See p.51 of June S&T for how to observe Mercury during the day!
8	Sat	New Moon (8:56am)
9	Sun	Thin crescent Moon 6-8 degrees below Venus (shortly after sunset)
16	Sun	First Quarter Moon (10:24am)
18-19	Tue-	Mercury within 2 degrees of Venus (shortly after sunset)
23	Sun	Full Moon, largest of 2013 (4:32am)

Calendar of Events (continued)

ementary massless fields. This modifies Einstein-Hilbert general relativity and the Higgs scalar field model. No new physical fields are introduced.

Dr. Nesbet will show that conformal gravity and a conformal Higgs model fit empirical data on galactic rotational velocities, galactic halos, and Hubble expansion including dark energy. By implication, dark matter is not needed for an isolated galaxy. This model appears to be a promising tool for understanding both cosmology and elementary particle physics.

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

Caption: It's Saturn season! Gert Gottschalk took this image on April 29, 2013, one night after Saturn reached opposition (when Saturn was the closest to Earth for 2013). Gert used his 13" f/4 Newtonian with a TeleVue 2.5x barlow, a DMK41 imaging camera with a red filter. 300 of 900 images were combined in Registax. With good seeing conditions, Gert captured the Cassini Division, multiple cloud bands, and the long-lived hexagonal-shaped storm that resides over the North Pole!

Exploring the Water World

By Diane K. Fisher

In some ways, we know more about Mars, Venus and the Moon than we know about Earth. That's because 70% of our solar system's watery blue planet is hidden under its ocean. The ocean contains about 98% of all the water on Earth. In total volume, it makes up more than 99% of the space inhabited by living creatures on the planet.

As dominant a feature as it is, the ocean—at least below a few tens of meters deep—is an alien world most of us seldom contemplate. But perhaps we should.

The ocean stores heat like a "fly wheel" for climate. Its huge capacity as a heat and water reservoir moderates the climate of Earth. Within this Earth system, both the physical and biological processes of the ocean play a key role in the water cycle, the carbon cycle, and climate variability.

This great reservoir continuously exchanges heat, moisture, and carbon with the atmosphere, driving our weather patterns and influencing the slow, subtle changes in our climate.

The study of Earth and its ocean is a big part of NASA's mission. Before satellites, the information we had about the ocean was pretty much "hit or miss," with the only data collectors being ships, buoys, and instruments set adrift on the waves.

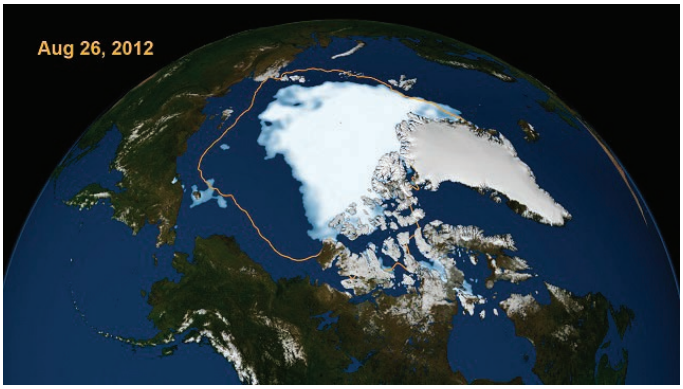
Now ocean-observing satellites measure surface topography, currents, waves, and winds. They monitor the health of phytoplankton, which live in the surface layer of the ocean and supply half the oxygen in the atmosphere. Satellites monitor the extent of Arctic sea ice so we can compare this important parameter with that of past years. Satellites also measure rainfall, the amount of sunlight reaching the sea, the temperature of the ocean's surface, and even its salinity!

Using remote sensing data and computer models, scientists can now investigate how the oceans affect the evolution of weather, hurricanes, and climate. In just a few months, one satellite can collect more information about the ocean than all the ships and buoys in the world have collected over the past 100 years!

NASA's Earth Science Division has launched many missions to planet Earth. These satellites and other studies all help us understand how the atmosphere, the ocean, the land and life—including humans—all interact together.

Find out more about NASA's ocean studies at http://science.nasa.gov/earth-science/oceanography. Kids will have fun exploring our planet at The Space Place, http://spaceplace.nasa.gov/earth.

This article was written by Diane K. Fisher and provided through the courtesy of the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



Caption: This image from September 2012 shows that the Arctic sea is the smallest recorded since record keeping began in 1979. This image is from NASA's Scientific Visualization Studio at Goddard Space Flight Center.

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.