Sonoma Skies

Newsletter of the Sonoma County Astronomical Society
A nonprofit scientific and educational organization

March 2011 | ***www.sonomaskies.org*** | **Volume XXXIV No. 3**

Fermi Gamma-ray Space Telescope (GRST) – A Progress Report

Professor Lynn Cominsky [1] presented an update on the Fermi GRST mission to the Sonoma County Astronomical Society on February 9, 2011. Her talk was billed as "Exploring the Extreme Universe of the Fermi Gamma-ray Space Telescope." Cominsky began the talk by asking what turned the cartoon character Bruce Banner into The Hulk. As it turns out, the transforming radiation was gamma rays. Of course, this is fantasy and could not occur in reality.

Unlike visible light with paltry photon energy on the order of 1 to 2 electron-volts (eV) [2], gamma rays feature an intense radiation of at least 100 million eV (MeV) per photon. The challenge for scientists is to figure out a way to study gamma rays, especially since they can't penetrate Earth's atmosphere, even after traveling across the vast expanse of space. The other difficulty is that even if gamma rays could reach Earth's surface, they couldn't be focused or imaged. They pass right through most matter used as mirrors or lenses. Consequently, special detectors are needed to detect gamma rays and two candidates for the job were used on Fermi: Scintillating detectors and Silicon strips.

After outlining the challenges of gamma-ray detection, Cominsky explained why the extreme Universe should be studied. Unlike the view of the Milky Way obtained in the visible light spectrum, observing our galaxy with "gamma-ray eyes" reveals a lot of dynamic churn. Fermi's predecessors, the Energetic Gamma Ray Experiment Telescope or EGRET and the Burst and Transient Source Experiment or BATSE [3], completed the first all-sky survey of gamma-ray emissions across our galaxy from 1991 to 2000. They showed that the Milky Way is blazingly bright, bathed in gamma-rays. It was noted that cosmic ray collisions with gas release gamma-ray radiation, pulsars and blazars [4] emit gamma rays, occasional explosions lead to gamma-ray bursts, and many unknown sources of gamma-rays exist. More

continued page 2

26th Annual Striking Sparks Awards Celebration

SCAS March 9 Meeting, 7:30 PM
at Proctor Terrace School

Join us at the March meeting to celebrate one of the best things our club does—awarding brand new telescopes to the winners of our Striking Sparks contest.

We have selected the winners for 2011. They are: Austin Henderson from Sequoia Elementary; Hana Jafari from Sequoia Elementary; Connor Nielsen from St. Rose Catholic School; Olivia Pimentel from Douglas L. Whited Elementary; Conrad Smith from Valley Vista Elementary; and Zander Voge from Mark West Charter School.

We will be awarding the contest winners new easy-to-use 6-inch reflecting Dobsonian-mount telescopes. The applicants have attended SCAS meetings or the Robert Ferguson Observatory programs, have written essays about their interest in astronomy, and each was nominated by a teacher.

This is the 26th year of the Striking Sparks program. Over 200 telescopes have been awarded to Sonoma County students.

We want to thank Orion Telescopes and Binoculars for providing a discount purchase of the telescopes, Scope City for providing extra 10mm eyepieces, and telescope sponsors Bruce MacEvoy, Janet Randall and the Hejtmanek family annual fund. We are also grateful to an anonymous donor who sponsored three telescopes with extra eyepieces. Dickson and BJ Yeager are providing star charts and lens cleaning equipment.

Join us for the awards celebration with our new Young Astronomers!

—Larry McCune, Striking Sparks Coordinator

LINKS TO WHAT'S INSIDE

President's Message

Hello To You All,

The SCAS distinguishes itself from any other astronomy club in this country by awarding excellent reflecting telescopes to select students.

We have done this for 25 years and in that period have awarded no less than 234 telescopes. We can never know for sure if our efforts will succeed in Striking a Spark of burning curiosity about our universe in any of our recipients, but we earnestly hope it does. So, we continue to go about this endeavor with strong altruistic motivations, planting these seeds that offer views of all that surrounds our little blue dot of a planet in space.

This month will mark our 26th year of Striking Sparks in Sonoma County and we will award six exceptional students these instruments of discovery.

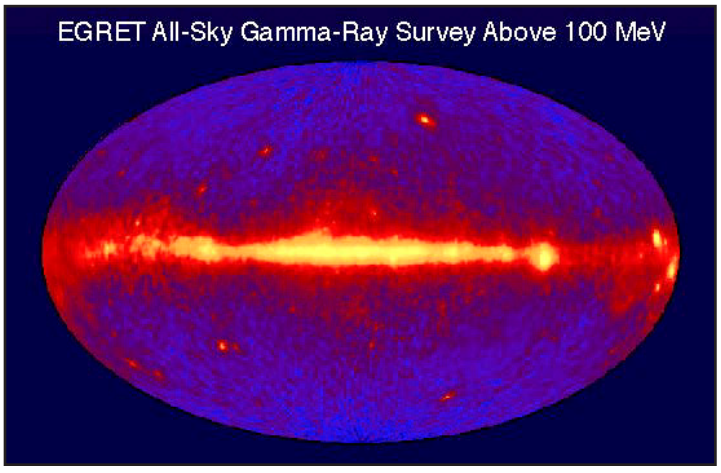
Whether they sincerely grasp this opportunity is entirely up to them. But, for those that express an interest in learning more, the SCAS stands committed to assisting those young people in any manner that they wish.

Plan to come to the Striking Sparks celebration Wednesday, March 9th, to express your support for these six young people and stand ready to help them should they ask.

—Len Nelson, SCAS - President

FERMI *(from page 1)*

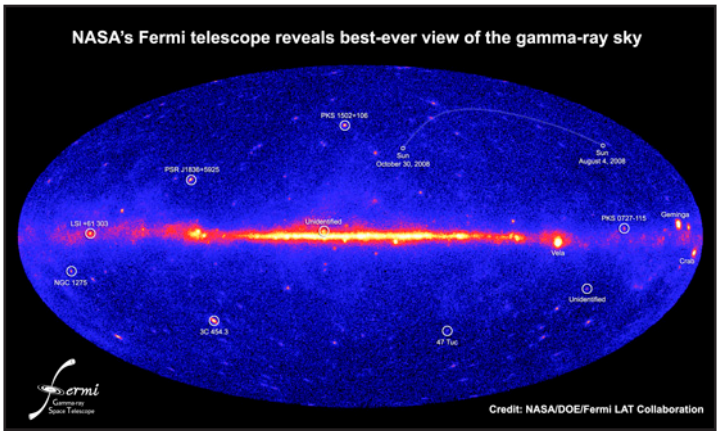
than half of the gamma-ray sources seen by EGRET were unidentified. More space-based probes were needed, and this set the stage for Fermi.



Source: NASA's EGRET survey of the Milky Way

Enter Fermi

A new mission was needed to map gamma-ray sources and identify the unknown sources of gamma-rays. The Fermi Gamma-ray Space Telescope ("Fermi") became the first space-based collaboration between astrophysicists looking to study the gamma-ray sky in detail and particle physicists who sought to build detectors capable of capturing gamma rays above Earth's atmosphere. The partnership is international in nature and includes scientists and researchers from France, Germany, Italy, Japan, and Sweden. This mission came together with a successful launch on June 11, 2008.



Fermi's View of the Milky Way Galaxy – with "gamma-ray eyes"

Fermi uses a Large Area Telescope (LAT) and a Gamma-ray Burst Monitor (GBM) to detect energetic photons and then filters them for only those of cosmic origin. The LAT is an imaging high-energy gamma-ray telescope covering the energy range from about 20 MeV to more than 300 GeV. Such gamma-rays are emitted only in the most extreme conditions, by particles moving very nearly at the speed of light. LAT is comprised of a 4 x 4 array of towers, each employing a pair-conversion technique or more specifically, the sensing of an electron and positron (anti-matter) pair production [5]. The LAT's field of view covers about 20 percent of the sky at any time, and it scans continuously, covering the whole sky every three hours. Integrated with LAT is a calorimeter that determines the incoming energy of the gamma-ray radiation [6]. There are roughly 100,000 cosmic ray events (filtered out) for every one gamma-ray event and on average, one gamma-ray event per second occurs from a strong source.

Complementing this detection range of high-energy photons are two other detection methods employed in Fermi's GBM instrument. The first method includes a set of twelve sodium iodide (NaI) scintillators to detect low energy photons (from 10keV – 1 MeV) and the second is a pair of cylindrical bismuth germanate (BGO) scintillators to capture higher-energy photons (from 150 keV – 30MeV). The overlap is intentional to ensure every gamma-ray burst in the entire sky is captured and processed. After a triggering event, the GBM processor calculates the preliminary position and spectral information of the gamma-ray burst for telemetry to the ground and possible autonomous re-pointing of Fermi. The GBM is expected to detect about 200 gamma-ray bursts per year.

Fermi with its two operating instruments uses a 40Mbps downlink, supporting 800,000 channels of data coming from the detectors. The total power consumed to track this wide range of energetic gamma-rays is 1500 watts, about the amount of power used by a hair dryer. Solar panels capture sunlight to provide the needed power to run Fermi's two main instruments.

Fermi Makes New Discoveries after Two Years of Operation

Fermi has made a number of scientific discoveries and

continued page 8

The Herschel 500

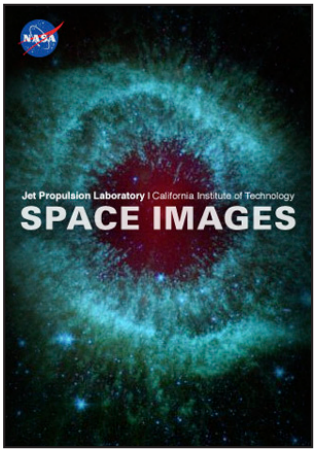
SCAS member Bruce MacEvoy recently completed the project of "restoring" the entire list of double stars discovered by William Herschel, based on Herschel's original catalogs. Bruce has compiled a "Herschel 500" list of double stars, comparable to the Herschel 400 list of deep sky objects.

His principal motive was to resurrect Herschel's priority in the discoveries and celebrate his remarkable persistence and achievements as a visual astronomer. He is known today primarily for his deep sky discoveries.

The lists and details of the project are available here: *http://www.handprint.com/ASTRO/herschel.html*.

Space Images from NASA's Jet Propulsion Laboratory

The first-ever NASA-JPL iPhone/iPod Touch app, Space Images, reached 500,000 downloads in January 2011 just as JPL prepared to release an updated version of the free app. Space Images features breathtaking views of Earth, the solar system, and the rest of the universe. Soon after its release in January 2010, Space Images was selected as an iTunes "Staff Favorite" and quickly became a top app in the Education category.



Space Images has since received praise from users for its extensive and stunning collection of images taken by NASA-JPL spacecraft and for its educational value. The new version, Space Images 2.0, optimized for the recently released iPad and iPhone 4, will bring even more stellar photos to viewers' fingertips, plus videos, Facebook and Twitter connectivity, and a new format that makes it easier to browse through photos at a higher resolution. It will be available in the iTunes Store by spring. If an Android device is more your style, Space Images 2.0 for those will be released soon after.

Be sure to visit *http://bit.ly/e2yy4y* to download Space Images free from the iTunes App Store.

I was able to quickly download the App onto my four-year old iPod Touch and some brilliant images came to life from the 'Latest' screen. Other areas to scroll include 'Top Rated' images and 'Categories,' where you can search through groupings of images of the Sun, the planets, asteroids & comets, the Universe, and spacecraft & telescopes, to name a few.

—Submitted by R.K. Koslowsky

Jane's "What's Up" Podcast

Jane Houston Jones produces a monthly "What's Up" podcast that features objects we can observe each month. Find Jane's podcasts here: *http://solarsystem.nasa.gov/news/whatsup.cfm*

SCAS cartoonist Herb Larsen can be contacted at hlarsenii@yahoo.com

Social Amenities

Many thanks to Eric and Mary Ann Swanson for providing refreshments at the February SCAS meeting.

Welcome, New Members

The SCAS wishes to welcome new members Phil Balmer and Tim Smith, and to welcome back long-time member Steve Follett.

Events

Robert Ferguson Observatory

Public Observing Night

Saturday, March 26
Solar Viewing: Noon - 4:00 PM
Night Viewing begins 8:00 PM

The Observatory features three telescopes: A 14-inch SCT with CCD camera in the East wing, an 8-inch refractor under the dome and a 24-inch Dobsonian in the West wing. SCAS members may set up telescopes in the observatory parking lot to assist with public viewing. Auto access closes at dusk; late arrivals must carry equipment from the horse stable parking area.

Fees: No admission fee for the solar viewing, but donations are appreciated. The Park charges $8 per vehicle for entry. A $3 donation is requested from adults 18 and over for admission to the observatory during night viewing sessions.

Night Sky Classes—Spring Series

Classes begin at 7 PM. Series of six sessions held Jan. 25, Feb. 1, Mar. 1, Mar. 8, Mar. 29, and Apr. 5. Each class includes a lecture on the constellations of the season, their history and mythology, and how to find stars and deep sky objects within them. Includes observing. **Fees:** $75 for the series. (Single session fee is $23). 10% discount for VMOA members. Classes are held at the Observatory. For information or to register: (707) 833-6979, *nightsky@rfo.org*

Rent the Ferguson Observatory!

Groups of up to 50 can be accommodated. Astronomer docents provide sky interpretation and operate telescopes, and you can stay up as late as you want! Make your reservation at least two weeks prior to your event. Best times for optimal sky gazing are around a week away from a Full Moon.

For information or to make a reservation, visit *http://www.rfo.org* or email George Loyer: *gloyer(at)rfo.org*.

Golden State Star Party 2011

Wednesday, June 29 through Sunday, July 3

The Golden State Star Party is a 4 night dark-sky event held each summer at Frosty Acres Ranch in North-Eastern California, near Mount Lassen, alongside rural Adin, California. GSSP has dark skies from horizon to horizon, and room for hundreds of astronomers.

Early registration ends on March 30th. Early Registration Fee: $60; after March 30: $70. On Site Registration: $75. Kids under 18 are free. *http://www.goldenstatestarparty.org/home*

SRJC Planetarium

"Target Earth" through March 27

We may not realsize it but Earth is a spaceship orbiting around our star at some 67,000 mph and we are not alone! Asteroids and comets are among the many other objects vying for space in our solar system. These objectshave hit the Earth before and will do so again. Join us as we look at this sobering realization of how vulnerable we are.

Show times: 7:00pm Fridays & Saturdays, 3:00pm Sundays

"First Friday Night Sky"—Mar. 4

7:00 and 8:30 PM: Offered on the first Friday of January through May of 2011. Content varies, with emphasis on the stars, constellation, planets, and other interesting facts in or about the sky that night. No planetarium shows Feb. 5 and 6.

Admission is free; donations to support SRJC's Planetarium are appreciated. Seating will be on a first-come, first-served basis; so arrive early enough to pick up your free parking permit, return it to your vehicle, and arrive back in the planetarium by the scheduled start time. Info: 527-4372, *http://www.santarosa.edu/planetarium/*

Morrison Planetarium Dean Lecture Series

Apr. 4, 7:30 PM: "The New Universe and The Human Future"—Prof. Joel R. Primack and Nancy Ellen Abrams, Esq.University of California, Santa Cruz

In the centuries since Newton, scientifically minded people have thought of Earth as a lonely rock orbiting an average star in a universe where no place is special. Modern cosmology, however, is now giving us a completely new picture of the universe based on dark matter, dark energy, and the drama of cosmic evolution. In this talk, Abrams and Primack will explain the new picture with stunning astronomical videos and relate it to life here on Earth, suggesting ways of understanding the global issues of our time in their cosmic context.

Lectures sell out early, so reserve now. Call 800-794-7576 for reservations. Adults $12, Seniors $10, Members $6. *http://www.calacademy.org/events/index.php*

ALCON 2011

Bryce Canyon National Park Utah
June 29 - July 2, 2011

Registration is now open for ALCon, the Astronomical League Convention at Bryce Canyon. Details and registration information at: *http://alcon.astroleague.org/*

Events

Community Outreach
Event Horizons

Batting .500

If this column's heading were referring to a baseball batting average, it would be pretty good. However, this is the success rate of the February school star parties. We were 2-for-4.

Evergreen Elementary in Rohnert Park had 8 SCAS volunteers and about 200 appreciative students and family members on Friday, February 4th.

The following Tuesday had Lynn Anderson acting as one of the judges at the Sonoma County Office of Education's county-wide science fair.

While there were no astronomy projects among over 150 entries, the physics entries judged by Lynn and his team of fellow judges were interesting and ran the gamut from mediocre to well thought out and well executed. One Jr. High student built a wind tunnel to test the air resistance of various shaped Styrofoam cars, and another dropped a weight down a tube from measured heights onto different types of packing material to test which of the materials would best protect an egg at the bottom of the column.

On Thursday, February 10th, Len Nelson entertained and educated students at Petaluma's Meadow Elementary School. That night he, Dickson Yeager, Eric Swanson, Ted Judah, and Young Astronomer Ray Pan provided telescope viewing to about 75 students and families.

The next two Thursday nights were rained out at Windsor Creek and Sequoia Elementary. Sequoia has rescheduled for Wednesday, April 27th.

Lynn will be giving a classroom presentation on Monday, February 28th at Oak Grove Elementary School in western Santa Rosa. The following night has a star party scheduled if the weather gods allow.

The following Tuesday has us scheduled to be at Petaluma's Sonoma Mountain Elementary. On Saturday, *March 12th*, Lynn and (?) will be at Mark West Elementary School for the district science day.

Early April has us scheduled to be at Binkley Elementary School in Rincon Valley on *April Fool's Day*, and out to Gerneville Middle School on Thursday, *April 7th*. There is a possibility that Oak Grove will be re-scheduled sometime around these dates.

Again, if you would like to join the list of volunteers for any of these events, email Lynn Anderson at *astroman(at)sonic.net* You don't need to have a telescope. Sometimes having a volunteer to help with crowd control, keep track of who has what object in the eyepiece and direct the public to something they haven't yet seen, or to give start tours with a green laser (which you can borrow) or just to answer questions is a great help to the success of a star party.

—Lynn Anderson, SCAS Director of Community Activities

Sonoma State University Series "What Physicists Do"

Mondays at 4:00 PM

Darwin Hall Room 103 (Coffee at 3:30 PM)

Mar. 7: "Exoplanets/Carbon Fiber Deformable Mirrors for Telescopes"—Dr. Mark Ammons, Lawrence Livermore National Laboratory

Mar. 14: "The Galaxy Next Door"—Dr. Puragra Guhathakurta, University of California Santa Cruz

Mar. 21: "Ultrafast Short Wavelength Coherent Radiation"—Dr. Philip Bucksbaum, Stanford University, SLAC

Mar. 28: "Astronomical Fluid Dynamics/Physics Education"—Dr. Adrienne Traxler, University of California Santa Cruz

Information: *http://phys-astro.sonoma.edu/wpd/*

SSU Observatory Public Viewing

March 25 – 9:00 – 11:00 PM: "The Beehive Cluster"

Observatory located inside the stadium area at the SE corner of campus (E. Cotati Ave. and Petaluma Hill Rd., two miles east of US 101). Follow signs to campus. Parking Lot F is most convenient. Call 707/664-2267 if it appears weather may force cancellation.
http://www.phys-astro.sonoma.edu/observatory/pvn.html

Taylor Observatory

Located in Kelseyville off Highway 29

Mar. 12: Public Event, 8-11 PM. "Earth"
The evening event includes a lecture, a planetarium show and telescope viewing.

These events are held even in cloudy or rainy weather, although telescope viewing will not be possible. There is a suggested donation of $3 per person. No reservation required. Info: 707/262-4121 or *http://www.taylorobservatory.org*

Events

SETI Institute Colloquium

3/2: Sand Seas in the Solar System—Lori Fenton, Carl Sagan Center and SETI Institute

There are four worlds in our Solar System that have substantial atmospheres and observable surfaces: Venus, Earth, Mars, and Titan. The effects of an atmosphere interacting with a surface are clear: each of these planetary bodies has sand seas covering some fraction of its surface. Hidden within the morphology of these dunes lies a record of climate change that scientists are only beginning to understand.

3/8 (Tues. evening): Small planets are common: evidence from the Eta-Earth Survey and the Kepler mission—Andrew Howard, Astronomy Department, UC Berkeley

Most planets are thought to form through the 'core accretion' process. This process can be probed by comparing the occurrence rates of extrasolar planets of different masses and orbital distances. Until recently, the evidence was limited to massive, Jovian planets. This talk will focus on recent results that probe much smaller planets: 1) the Eta-Earth Survey, a radial velocity planet search that provides a census of nearby extrasolar planets with masses of 3-1000 Earth-masses; and 2) the Kepler mission, which detects transiting planets with sizes down to one Earth radius. We are learning that close-in, 'super-Earth'-size planets are ubiquitous and that the models of planet formation and migration need substantial revision to account for them.

3/15 (Tues. 3-5pm): Planetary Science Decadal Survey Rollout Town Hall Meeting—Scott Hubbard (Stanford and SETI) and Dale Cruikshank (NASA Ames)

The Decadal Survey report is advisory to NASA and the NSF.The core of the report consists of a prioritized list of recommended flight missions and research directions, as well as recommendations for research facilities and data archiving. The report is a result of two-year effort of several committees working with the Steering Committee, and extensive community input through more than 100 white papers addressing every component of Solar System studies.

Two of the members of the Survey's Steering Committee, Dale Cruikshank (NASA Ames) and Scott Hubbard (Stanford University), will make a presentation and respond to questions.

3/16: Earth science collaborative for ecological forecasting—Ramakrishna Nemani, NASA Ames Earth Science Division

There is increasing pressure on the science community not only to understand how recent and projected changes in climate are likely to impact our global environment and the natural resources on which we depend, but also to design solutions to mitigate or cope with the likely impacts. Responding to this multi-dimensional challenge requires new tools and research frameworks that assist scientists in collaborating to rapidly investigate complex, interdisciplinary science questions of critical societal importance. Dr. Nemani will describe one such collaborative research framework called NASA Earth Exchange (NEX). NEX combines state-of-the-art supercomputing, Earth system modeling, remote sensing data from NASA and other agencies, and a scientific social networking platform to deliver a complete work environment in which users can explore and analyze large Earth science data sets, run modeling codes, collaborate on new or existing projects, and share results within and/or among communities.

3/23: Extratropical cyclones, frontal waves, and Mars dust Modeling forecasting—Jeffrey Hollingsworth, Chief of Planetary System Branch, NASA Ames Research Center

Dr. Hollingsworth will describe how the NASA Ames Mars GCM has been utilized to investigate dust lifting associated with cyclogenesis and frontal waves. The model has been applied at high resolution in simulations related to Mars' dust cycle. A single weather event has been examined to detemine how large scale dust storms interact with the CO2 polar caps. Dr. Hollingsworth will discuss the implications of large-scale extratropical weather systems on the martian dust cycle.

3/30: Exchanging Information with the Stars: Wide-Area Communication Writ Large—David Messerschmitt, Department of EE and CS, UC Berkeley and SETI Institute

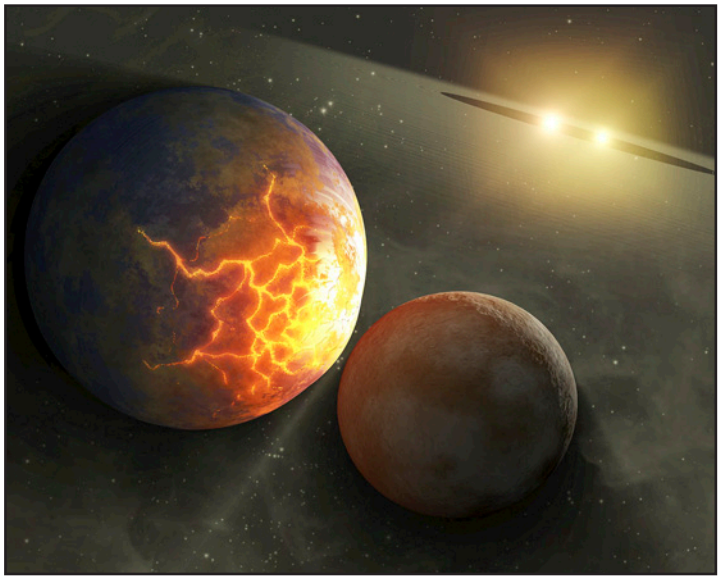
The search for extraterrestrial intelligence has sought radio beacons devoid of information content. It seems likely, however, that a civilization transmitting a radio signal intended for our detection will also be motivated to embed information within the signal, especially in view of the large speed-of-light latencies. Successful exchange of information by radio with intelligent civilizations in distant solar systems requires an understanding of the end-to-end communication system design, including resources available to transmitter and receiver and properties of radio propagation in the interstellar medium.

Although interstellar space is nearly an ideal vacuum, it contains sufficient low- density plasma to profoundly affect radio transmission over interstellar distances. The primary impairments are attenuation, thermal noise, plasma dispersion, scattering, and interference in the vicinity of the receiver. The most difficult technical challenge is initial discovery of a signal, and the primary obstacles are the infeasibility of coordination between transmitter and receiver and related "needle in a haystack" issues. Impairments are actually helpful as an implicit form of coordination through constraining design choices as well as constraining the size of the "haystack".

In this talk, Dr. Messerschmitt will address end-to- end communication system design emphasizing noise, dispersion, and interference, deferring scattering to future work. He will show that an effective means of countering interference without compromising noise immunity is spread spectrum signaling, and proceed to characterize the effect of plasma dispersion upon these broadband signals. The conclusion is that while design considerations provide guidance as to carrier frequencies and bandwidth and time duration of signals, there is also a demonstrated tradeoff between transmit power and the computational burden placed on the receiver.

Colloquiums run from Noon to 1 PM on Wednesdays (unless oterwise noted. Location: SETI Headquarters at 189 N. Bernardo Ave., Mountain View *(map)*. Free. Lectures are available on YouTube at: *http://www.youtube.com/setiinstitute*

Young Astronomers



Planetary collisions such as shown in this artist's rendering could be quite common in binary star systems where the stars are very close.

Thank Goodness the Sun is Single

By Trudy E. Bell

It's a good thing the Sun is single. According to new research, Sun-like stars in close double-star systems "can be okay for a few billion years—but then they go bad," says Jeremy Drake of the Harvard-Smithsonian Astrophysical Observatory in Cambridge, Mass.

How bad? According to data from NASA's Spitzer Space Telescope, close binary stars can destroy their planets along with any life. Drake and four colleagues reported the results in the September 10, 2010, issue of The Astrophysical Journal Letters.

Our Sun, about 864,000 miles across, rotates on its axis once in 24.5 days. "Three billion years ago, roughly when bacteria evolved on Earth, the Sun rotated in only 5 days," explains Drake. Its rotation rate has been gradually slowing because the solar wind gets tangled up in the solar magnetic field, and acts as a brake.

But some sun-like stars occur in close pairs only a few million miles apart. That's only about five times the diameter of each star—so close the stars are gravitationally distorted. They are actually elongated toward each other. They also interact tidally, keeping just one face toward the other, as the Moon does toward Earth.

Such a close binary is "a built-in time bomb," Drake declares. The continuous loss of mass from the two stars via solar wind carries away some of the double-star system's angular momentum, causing the two stars to spiral inward toward each other, orbiting faster and faster as the distance shrinks. When each star's rotation period on its axis is the same as its orbital period around the other, the pair effectively rotates as a single body in just 3 or 4 days.

Then, watch out! Such fast spinning intensifies the magnetic dynamo inside each star. The stars "generate bigger, stronger 'star spots' 5 to 10 percent the size of the star—so big they can be detected from Earth," Drake says. "The stars also interact magnetically very violently, shooting out monster flares."

Worst of all, the decreasing distance between the two stars "changes the gravitational resonances of the planetary system," Drake continued, destabilizing the orbits of any planets circling the pair. Planets may so strongly perturbed they are sent into collision paths. As they repeatedly slam into each other, they shatter into red-hot asteroid-sized bodies, killing any life. In as short as a century, the repeated collisions pulverize the planets into a ring of warm dust.

The infrared glow from this pulverized debris is what Spitzer has seen in some self-destructing star systems. Drake and his colleagues now want to examine a much bigger sample of binaries to see just how bad double star systems really are.

They're already sure of one thing: "We're glad the Sun is single!"

Read more about these findings at the NASA Spitzer site at *www.spitzer.caltech.edu/news/1182-ssc2010-07-Pulverized-Planet-Dust-May-Lie-Around-Double-Stars*. For kids, the Spitzer Concentration game shows a big collection of memorable (if you're good at the game) images from the Spitzer Space Telescope. Visit *spaceplace.nasa.gov/en/kids/spitzer/concentration/*.

—Article provided by JPL/NASA

Hello Young Astronomers

March is here and at 2:00 AM on the morning of Sunday the 13th, Daylight Savings time begins, after which you must wait one hour longer to see the evening's night sky. So most schools try to schedule their astronomy events before that happens.

One school star party in Petaluma could really use your assistance. That would be for Sonoma Mountain Elementary in east Petaluma. Their event day is Tuesday, March 8th, with an alternate date of the 10th should the 8th not offer decent sky conditions.

Do plan to come if you can and by all means bring your Striking Sparks telescope to share. This will be our last view of Jupiter in the west before it slips into the Sun's glare and is gone from our view for a couple of months, when it will reappear in the early morning's sky. The crescent Moon will offer good views both evenings. Then, prepare to get your last views of the winter constellations before they too are lost as the day light hours quickly lengthen.

—Len Nelson, SCAS President

FERMI *(from page 2)*

reconfirmed those made by its predecessors. In the gamma-ray sky there are gamma-ray pulsars, bright blazars, radio galaxy sources, globular cluster sources, and an unexpected source; gamma-rays emanating from a high-mass x-ray binary star system [7]. Of course, there are still many unidentified sources, but the work continues.

Most gamma-ray bursts appear to come from hypernovae [8], emitting burst energies about a billion-trillion times as powerful as the Sun. These bursts are seen almost once a day and each produces more energy than the Sun does in its projected lifetime. This means that at least one new black hole is created somewhere in the Universe each day. Popular culture depicts the power of a hypernova, as evidenced in the 2009 Star Trek movie where an enormous supernova, threatening the entire galaxy, and destroying planets is depicted on a hypernova scale.

Bursting Out All Over

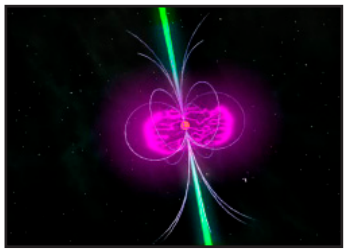
Strong gamma-ray bursts have been detected by both the LAT and GBM instruments. More than 520 GBM bursts and over 20 LAT bursts (at much higher energies) have been detected during the first two years of Fermi's operation. Once detected, the Internet is used to immediately notify ground-based astronomers, both professional and amateur, who use their visible light telescopes to determine the age of the gamma-ray source. One of the most extreme gamma-ray bursts detected was GRB080916C, found to be about 12.2 billion years old [9]. Its burst lasted for 23 minutes, almost 700 times as long as the two-second average for such high-energy bursts. Follow-up ground observations were made within 32 hours after the blast occurred.

Strange Things in the Sky

An unexpected discovery was made and announced in Seattle in January 2011 [10]. Fermi's GBM instrument detected thunderstorm activity hurling anti-matter into space; positrons resulting from the pair production event described above when gamma-ray energy is converted into mass. Electric fields near the top of the storm create an upward-moving avalanche of electrons. When their path is deflected by molecules in the air, these electrons emit gamma rays. Some gamma rays pass near the nuclei of nitrogen and oxygen atoms in the upper atmosphere. When this happens, the gamma ray transforms into an electron and its antiparticle, a positron. These higher-energy electrons and positrons escape into space by spiraling along Earth's magnetic field. Such Terrestrial Gamma-ray Flashes (TGFs) and their electron/positron beam soon reach altitudes where Fermi is orbiting. When a high-atmosphere-created positron that hadn't already been annihilated, collided with an electron on Fermi, the two particles transformed into gamma rays and the GBM detected a signal characteristic of positron annihilation. Fermi has recorded a number of these TGFs and it's estimated that there could be as many as 500 TGFs per day.

It's Not a Radio Pulsar?

Fermi discovered the first gamma-ray-only pulsar in CTA1, in October 2008. It's moving at 450 km/sec. Such a rotational speed for such a massive object is amazing, and yet, this high rotation rate was kicked off by the supernova explosion that created this pulsar. CTA1 is about 10,000 years old and it sends its light towards Earth at a rate of three times per second or, more precisely, once every 316.86 milliseconds. The amount of energy it emanates is about 1,000 times higher than that of our Sun.



Courtesy of NASA – artist conception of a "gamma-ray only pulsar"

This strange source is the first of a class that might be dubbed "gamma-ray only pulsars" – rotating neutron stars that appear to pulse only in high-energy radiations. Such pulsars [11] might not be detectable in radio or visible light if they emit those radiations into a narrow beam not seen from Earth. If true, our Galaxy might have more pulsars left for Fermi to discover – and it has – with 86 such pulsars found to date. Studying the gamma-ray properties of pulsars gives valuable clues to physics of the emission regions on neutron stars.

The Dark Matter Competition

Fermi continues to search for dark matter. In a friendly competition with CERN, to find the leading particle candidate to prove the existence of dark matter – the WIMP – Fermi is looking for gamma-ray energy lines in the range of 30GeV to 10TeV, although it can only see up to 300GeV. If nothing is detected and the theory is accurate, WIMP detection can only occur with gamma-rays above 300GeV [12]. WIMPS, or Weakly Interacting Massive Particles, are expected to be detected near the galactic center and Fermi sees that area of the galaxy very well.

Fermi continues its vigil of the galactic sky, day in and day out. It makes a complete scan of the heavens every three hours for gamma-rays. It's just a matter of time before more sources are found and their mode of operation is understood. If all unknown gamma-ray sources are not categorized by the Fermi mission, look for Fermi's progeny to get the job done in the decades of gamma-ray detection schemes to come.

—Submitted by R.K. Koslowsky

http://worldperspective.bravehost.com/astronomy.html

Notes:

[1] Dr. Lynn Cominsky has been studying high-energy astrophysics for over 25 years. After earning her BA in physics from Brandeis University in Massachusetts, she researched X-ray binary star sources. She went on to work with the Harvard Smithsonian Center for Astrophysics, doing graduate work at M.I.T., then post-doctoral work at UC Berkeley Space Sciences Laboratory. She has been associated with the Swift gamma ray telescope, GLAST (since renamed as Fermi), the XMM-Newton mission, Nustar, and other space-based high-energy orbiting labs observing extreme ultraviolet as well as X-ray and gamma-ray sources. Cominsky founded the Education and Public Outreach (E/PO) group at Sonoma State University, where she currently serves as the Chairperson of the Physics and Astronomy Department. She is also the self-described "servant" to all the animals at her Little H-Bar ranch in Sonoma County, California.

[2] 1 eV = 1.602176487×10−19 Joules (the conversion factor is numerically equal to the electron's elementary charge expressed in coulombs). For comparison, note that 1/40 eV is roughly the thermal energy in the room that our lecture was delivered. A single molecule in the air has an average kinetic energy 3/80 eV. 200 MeV is the total energy released in nuclear fission of

continued page 9

FERMI *(from page 8)*

one Uranium-235 atom, while 1 TeV (a trillion electronvolts, or 1.602×10−7 Joules) is about the kinetic energy of a flying mosquito.

[3] The principal scientific objectives of the EGRET instrument were to perform an all-sky survey of high-energy gamma-ray emission and make detailed studies of high-energy gamma-ray emitting sources. Major discoveries with EGRET include the identification of blazars [4], a type of active galaxy classified from optical and radio observations, as significant gamma-ray emitters. EGRET has detected dozens of blazars and found them to be quite variable in flux, with flares occurring on time scales of days or hours. EGRET has detected the high-energy tails of several gamma-ray bursts, including in one notable case GeV photons more than one hour after a burst at lower energies. EGRET observations of the LMC and SMC were used to confirm that cosmic rays are Galactic and not metagalactic or universal. EGRET data were used to confirm the well-known, enigmatic source Geminga as a radio-quiet pulsar, the first one detected in gamma-rays. With its efficient rejection of background, EGRET obtained the first sensitive map of the diffuse gamma-ray emission of the Milky Way, emission associated with cosmic-ray interactions with interstellar gas and photons, and made a reliable measurement of the isotropic, presumably extragalactic diffuse emission. *http://heasarc.gsfc.nasa.gov/docs/cgro/egret/*

Similarly, BATSE was a high-energy astrophysics experiment in orbit around Earth, riding on NASA's Compton Gamma-Ray Observatory (CGRO), as was EGRET. The primary objective of BATSE was to study the phenomenon of gamma-ray bursts, although the detectors also recorded data from pulsars, terrestrial gamma-ray flashes, soft gamma repeaters, black holes, and other exotic astrophysical objects. CGRO's nine-year mission ended in June 2000. *http://www.batse.msfc.nasa.gov/batse/*

[4] Blazars are a form of quasar. Quasars are the general case whereas blazars are simply quasars pointing at earth within a five-degree cone of view. Earth sees the end of a quasar emitting light directly at the planet – we observe down the jet. The special orientation of the jet explains the general peculiar characteristics of blazars: high observed luminosity, very rapid variation, high polarization (when compared with quasars, in general), and the apparent superluminal motions detected along the first few parsecs of the jets in most blazars.

[5] Two gamma-rays are produced for each annihilation of an electron and positron, a phenomena well-documented by particle physicists. This is an example of mass converted to energy, according to the relation E=mc2. The LAT, for example, invokes the reverse process to detect gamma-ray bursts. Incoming gamma-rays (photon energy) hit tungsten screens in the LAT and produce electron-positron pairs.

[6] Each 40 × 40 cm2 tower in LAT comprises a tracker, calorimeter and data acquisition module. The tracking detector consists of eighteen x-y layers of silicon strip detectors. This detector technology has a long and successful history of application in accelerator-based high-energy physics. It is well-matched to the requirements of high detection efficiency (>99%), excellent position resolution (<60 microns in this design), large signal-to-noise (>20:1), negligible cross-talk, and ease of trigger and readout. The calorimeter in each tower consists of eight layers of 12 CsI bars, read out by photodiodes, for a total thickness of 10 radiation lengths. Owing to the calorimeter's unique configuration, it can measure the three-dimensional profiles of gamma-ray showers, which, permits correction for energy leakage and enhances the capability to filter cosmic rays. The anticoincidence shield, which covers the array of towers, employs segmented tiles of scintillator, read out by wavelength-shifting fibers and miniature phototubes.

[7] A December 2009 story highlighted the first unambiguous detection of high-energy gamma-rays from an enigmatic binary system known as Cygnus X-3. The system pairs a hot, massive star with a compact object—either a neutron star or a black hole—that blasts twin radio-emitting jets of matter into space at more than half the speed of light. *http://www.sciencedaily.com/releases/2009/11/091130112918.htm*

Then, in December 2010, a report documented the detection of GeV gamma-ray emission spatially coincident with the binary star system PSR B1259-63 with the Large Area Telescope (LAT). *http://www.astronomerstelegram.org/?read=3085*

[8] Hypernova is a term used to describe the supernovae of the most massive stars, the hypergiants, which have masses from 100 to over 300 times that of our Sun. Decaying 56Ni, a short-lived isotope of nickel, is believed to provide much of a hypernova's light. The radiation output of a nearby hypernova could cause serious harm to Earth, however no known hypergiant is located close enough to Earth to pose a threat. A group led by astrophysicist Brian Thomas has conjectured that a hypernova may have caused a mass extinction on Earth 440 million years ago, but there is no unambiguous evidence of it. Note that GRBs are not from our galaxy, they are very far away, outside our galaxy.

[9] GRB080916C is a gamma-ray burst, the most powerful ever recorded, that occurred on September 16, 2008 in the Carina constellation. The explosion had the power of over 9,000 supernovae, and the gas jets emitting the initial gamma rays moved at a minimum velocity of 99.9999 percent the speed of light, making this blast the most extreme recorded to date.

[10] *http://www.nasa.gov/mission_pages/GLAST/news/fermi-thunderstorms.html*

[11] Paper on gamma-ray-only pulsars co-authored by Lynn Cominsky: *http://www.stanford.edu/~imos/papers/2008Sci...322.1218A.pdf*

[12] Weakly interacting massive particles are hypothetical particles serving as one possible solution to the dark matter problem. These particles interact through the weak nuclear force and gravity, and possibly through other interactions no stronger than the weak force. Because they do not interact with electromagnetism they cannot be seen directly, and because they do not interact with the strong nuclear force they do not react strongly with atomic nuclei. This combination of properties gives WIMPs many of the properties of neutrinos, save for being far more massive and therefore slower. Fermi is searching for WIMP annihilation lines, similar to those seen from positrons and electrons, but at much higher energies.

[13] For more on "Cosmology and Gamma-ray Bursts," please see R.K. Koslowsky's *A World Perspective Newsletter*, February 2010, year 6, issue 2104.

March 2011 Observing Highlights

3/1 Crescent Moon near Venus, 5:30AM

3/1 Algol minimum at 2006

3/4 New Moon, 12:46 PM

3/6 Crescent Moon near Jupiter, 7 PM

3/12 Juno opposition, 2 !M

3/12 Mercury in West through 3/31. Good evening apparition, at least 4° altitude 45 minutes after sunset from 3/12 to 3/31. Maximum altitude of 8.8° (at 8:09 PM, 45m after sunset) on 3/22. Greatest elongation east at 6 PM on 3/22.

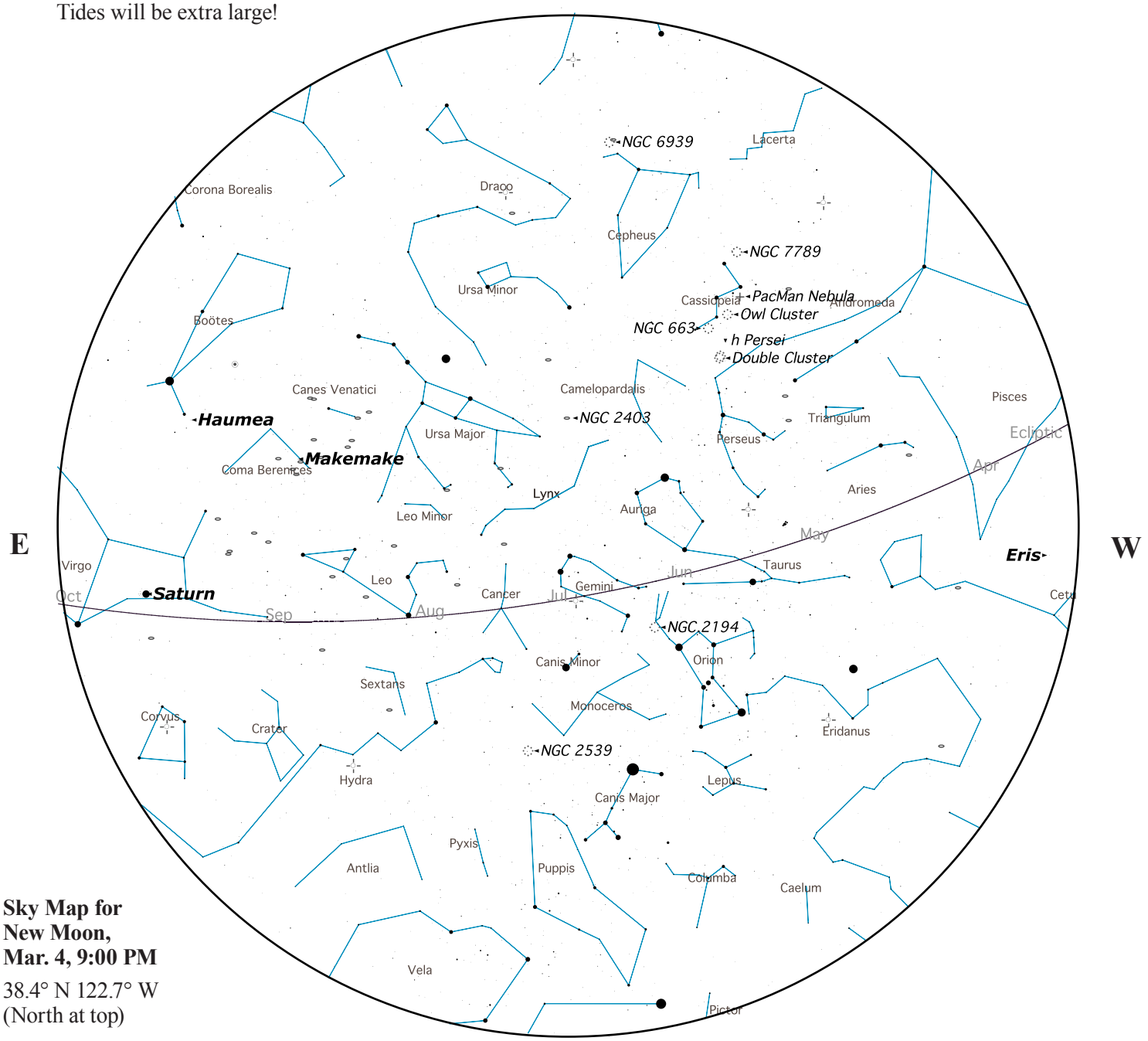
3/13 Daylight Savings Time Begins at 2 AM--Set clocks forward 1 hour.

3/19 Full Moon occurs about 1 hour before perigee. Tides will be extra large!

3/20 Vernal Equinox at 4:21 PM. The Vernal Equinox is the time when the Sun passes through the Celestial Equator along its upward path toward the Summer Solstice. "Equinox" means equal night. At the time of Equinox, the Sun is essentially above and below the horizon an equal amount of time for all locations on planet Earth. The Vernal Equinox marks the official beginning of our Spring season; in Sonoma County at 12:00 Noon you will find the Sun 51.5 degrees above our southern horizon.

3/21 Zodiacal Light in West through 4/3, 7:30 PM

3/31 Crescent Moon near Venus, 6 AM



Sky Map for New Moon, Mar. 4, 9:00 PM

38.4° N 122.7° W
(North at top)

March 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 **RFO Night Sky Class** 7:00 PM Crescent Moon near Venus, Algol Minimum	2	3	4 	5
6 Crescent Moon near Jupiter	7	8 **RFO Night Sky Class** 7:00 PM	9 **SCAS Meeting** 7:30 PM	10	11	12  Juno opposition; Mercury in West
13 Daylight Savings Time Begins	14	15	16	17	18	19  Large Tides
20 Vernal Equinox	21 Zodiacal Light in West thru 4/3	22	23	24	25	26  **RFO Pubic Observing** Solar: Noon-4 Night: 8 PM >
27	28	29 **RFO Night Sky Class** 7:00 PM	30	31 Crescent Moon near Venus		

See Pages 4-6 for more detailed information on events.

SCAS Membership Application/Renewal

Annual Membership dues are $25 due June 1.
(New members joining after Nov. 30 pay $12.50)

Please complete this form and give to the Membership Director or a Board member with your check, payable to "SCAS," at the next meeting, or mail your dues to: SCAS, P.O. Box 183, Santa Rosa, CA 95402-0183.

❑ **New** ❑ **Renewal** ❑ **Family** (no extra charge)

Name(s): _____

_____

Email: _____
(Required for *Sonoma Skies*)

Address: _____

City/State/Zip: _____

Telephone: _____

I am interested in serving in one or more of these areas:

❑ School Star Parties ❑ SCAS Board
❑ Newsletter ❑ Striking Sparks
❑ Mentoring Young Astronomers
❑ Yosemite Star Party ❑ Other_____

New Members please note interests and hobbies you would like us to know about:

_____

_____

_____

New Members please share your reason(s) for joining SCAS, and how you heard about the club:

_____

_____

_____

Your dues include our monthly newsletter *Sonoma Skies*, membership in the Astronomical League and its *Reflector* magazine, discounted subscriptions for *Sky and Telescope* and *Astronomy* magazines, great guest speakers at our monthly meetings, the annual Star-B-Que, and opportunities to meet new and interesting people who share your passion for the night sky and many aspects of astronomy and science.

Welcome to the SCAS!

Sonoma County Astronomical Society (SCAS)

Membership Information

Meetings: 7:30 PM on the second Wednesday of each month, in the Multipurpose Room of Proctor Terrace Elementary School, 1711 Bryden Lane at Fourth Street, Santa Rosa, unless otherwise announced in this publication. The public is invited.

Dues: $25, renewable June 1 of each year. New members joining between December 1 and May 31 pay partial-year dues of $12.50.

Star Parties: See the Events section for dates and times.

Rental Telescope: Members are eligible to borrow the club's 80mm refractor with tripod. Contact any Board member listed below.

Egroup URL: Connect with other members about going observing, observing reports and chat about astronomy and news items from AANC and *Sky & Telescope*. Hosted by Keith Payea at *kpayea(at)bryantlabs.net*. Any SCAS member is welcome to join. Visit *http://groups.yahoo.com/group/scas* and click the "Join" button, or send an email to *scas-subscribe(at)yahoogroups.com*

Discount Subscriptions: For ***Sky & Telescope***, new subscribers may send a check for $32.95 payable to "SCAS", with your complete mailing address, directly to: Larry McCune, 544 Thyme Place, San Rafael, CA 94903. Once you have received the discount rate, you may renew your subscription by sending your personal check with the renewal notice directly to Sky Publishing. Discount subscriptions to ***Astronomy*** Magazine occur annually in October. Check *Sonoma Skies* for details.

Library: SCAS Librarian David Simons hosts a library of astronomy books that may be checked out by members at SCAS meetings, to be returned at the next meeting. Videotaped lectures on astronomy may be rented for $3 per month.

Sonoma Skies is the monthly newsletter of the Sonoma County Astronomical Society (SCAS). Subscription is included as part of membership. Articles and member announcements are welcome and are published on a first come, first served basis, space permitting, and may be edited. **The deadline for submissions is 7 days prior to the end of each month.** Mail to: Editor, SCAS, P.O. Box 183, Santa Rosa, CA 95402, or email *publications(at)sonomaskies.org*

SCAS Elected Board

President: Len Nelson 763-8007 *lennelsn(at)comcast.net*
Vice-President & Program Director: John Whitehouse 539-5549 *jmw(at)sonic.net*
Treasurer: Larry McCune, (415)492-1426 *llmccune(at)comcast.net*
Secretary: Eric Swanson, 762-3118 *emswanson(at)comcast.net*
Membership Director: Mike Dranginis 523-4373 *mike880(at)comcast.net*
Director of Community Activities: Lynn Anderson 433-1154 *astroman(at)sonic.net*
Publications Director: Cecelia Yarnell 569-9663 *publications(at)sonomaskies.org*

SCAS Appointed Positions

Striking Sparks Program Coordinator: Larry McCune (415)492-1426 *llmccune(at)comcast.net*
Amateur Telescope Making: Steve Follett 542-1561 *sfollett(at)sonic.net*
Librarian: David Simons 537-6632 *davidsimons(at)planetatm.com*

Visit us on the web at:
www.sonomaskies.org