

# Sonoma Skies

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

November 2011

[www.sonomaskies.org](http://www.sonomaskies.org)

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## 2012 Striking Sparks Sponsors Wanted

There is an opportunity for you or your organization to sponsor a telescope and participate in this worthwhile program. The cost to sponsor a “Striking Sparks” telescope is \$250. Contact Larry McCune, Striking Sparks Coordinator, at: [llmcune\(at\)comcast.net](mailto:llmcune(at)comcast.net)

This will be the 27th year of the program, and so far over 240 telescopes have been awarded to Sonoma County students. Our program’s goal is to focus science and astronomy interest in Sonoma County students.

For the 2011-2012 school year, we will be awarding the contest winners telescopes at the Wednesday, March 14, 2012 SCAS meeting at Proctor Terrace Elementary School.

Students who have been nominated by their teachers or by SCAS members, write essays about their interest in astronomy, and attend SCAS meetings or the Robert Ferguson Observatory between now and February 8, 2012, are eligible to enter the contest. All contest entries must be postmarked no later than Saturday, February 18, 2012. For more information on the program, see [www.sonomaskies.org](http://www.sonomaskies.org).

—Larry McCune, SCAS Striking Sparks Coordinator

## Questionnaire

SCAS members, we need your help! Please watch for a questionnaire we will be sending you by email, and please respond to us.

We really want to hear back from you some ideas for moving your club forward into the next few years! SCAS is YOUR club, and we want YOU to be involved, let us know what you think!

## Building a Personal Observatory

with Bruce MacEvoy  
SCAS November 9 Meeting, 7:30 PM  
at Proctor Terrace School

Who among us hasn’t dreamed of having a permanent observatory for our nocturnal enjoyment...of the star gazing kind, of course! No need to drive out to a dark sky spot, spend too much time setting equipment up, polar aligning, etc. And then the great Sonoma Nebula creeps in! Yikes! Wouldn’t it be nice to go out back, discovering a clear, still dark sky with steady stars beckoning and “seize the day, er...night”?

How better than to have your own observatory at your disposal, simply requiring rolling back a roof or dome to get started?

Some of our members have done just that, and this month SCAS member Bruce MacEvoy will share with us the joys and trials of his observatory-building experience.

Bruce graduated from UC Irvine and then got his doctorate in psychology at Cornell in 1986. He moved to California and found a variety of successes in academia and business, finally retiring from Yahoo in 2000. He moved to Sonoma county the following year and discovered the skies were dark enough to build his own observatory.

Be sure to come join us as Bruce talks about the process of establishing his observatory, and either live vicariously through his experience or perhaps get inspired to think about building your own!

—John Whitehouse, SCAS VP



## LINKS TO WHAT’S INSIDE

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## President's Message

Hello SCAS Members,

The time for change approaches. At the November 9 meeting we must decide and nominate who will take the helm as President beginning January 2012.

For two years, I have done my level best to carry that weight but, as noted in the October issue, have determined that it is time to step aside for new blood and inspiration to surge through our club. As of yet, no one, to my knowledge, has expressed a surging desire to take on the task, but that will surely change as we come to decision time.

In the meantime, at the October SCAS board meeting, it was decided that a polling of our members was long overdue, in order to determine what direction(s) *you* would like to see the SCAS steer toward. Please pour out your thoughts when responding to this inquiry. Your board would like to deliver to our members that which they are interested in and new ideas are needed occasionally to bring that about.

So, think hard and long and decide what talents and or suggestions you might be able to bring to the SCAS.

We need some lively discussion at the November meeting. Please do come prepared.

Clear Skies,

—Len Nelson, SCAS President

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## “FABRIC OF THE COSMOS” ON PBS

Beginning Nov. 2, there is a new four-part series from Dr. Brian Greene of Columbia University based on his recent book, *The Fabric of the Cosmos*. <http://www.pbs.org/wgbh/nova/physics/fabric-of-the-cosmos.html>

## MORE ON COMETS AND HABITABILITY IN THE NEXT ISSUE:

Nudged by the gravitational force of a passing star, a small world of rock and ice finds itself moving in a new orbit. Hundreds of thousands of years go by. The Sun is no longer just a bright star in the opaque sky, but a glowing ember of light. Pluto and the Kuiper belt are passed. Neptune and then Jupiter are similarly ignored. The warmth of the solar wind starts to turn the traveler's ices directly into gases. Sublimation awakens the body after its slumber of 4.5 billion years. The comet shivers under the warmth of the Sun and unfurls its flag of debris into space. Surrounded by a growing coma of dust and gas it follows its charted course past the asteroid belt toward Earth and Sun. The comet's maiden voyage is a sight to behold when viewed from any of the inner planets.

To learn more, please look for the article, Comets and Habitability, based on last month's guest speaker talk, in the December issue of *Sonoma Skies*.

## TRANSIT OF VENUS DOCUMENTARY

The link below is for a video preview of an upcoming documentary about the June 2012 transit of Venus. The transit will be partly viewable from CA with the sun setting on Tuesday, June 5 while the transit is in progress. Observations will require a clear western view. <http://vimeo.com/lightcurvefilms/thelasttransitofvenus>

Here is a link devoted to the transit, including how to view it safely: <http://www.transitofvenus.org/>

## CRAB NEBULA'S POWERFUL BEAMS SHOCK ASTRONOMERS

When astronomers detected intense radiation pumping out of the Crab Nebula, one of the most studied objects in space, at higher energies than anyone thought possible, they were nothing short of stunned.

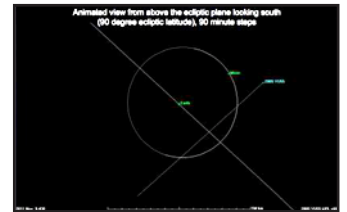
The inexplicably powerful gamma-rays came from the very heart of the Crab Nebula, where an extreme object called a pulsar resides.

“It was totally not expected — it was absolutely jaw-dropping,” Andrew McCann, a Ph.D. candidate at McGill University in Montreal, Canada, and a co-author of the new study, told SPACE.com. “This is one of the hottest targets in the sky, so people have been looking at the Crab Nebula for a long time. Now there's a twist in the tale. High-energy rays coming from the nebula are well-known, but coming from the pulsar is something nobody expected.”

Read more at [Space.com](http://Space.com)

## Asteroid to Approach Earth on November 8

Near-Earth asteroid 2005 YU55 will pass within 0.85 lunar distances from Earth on November 8, 2011. The upcoming close approach by this relatively large 400 meter-sized, C-type asteroid presents an excellent opportunity for synergistic ground-based observations including optical, near infrared and radar data. The animated illustration shows the Earth and moon flyby geometry for November 8th and 9th when the object will reach a visual brightness of 11th magnitude and should be easily visible to observers in the northern and southern hemispheres.



Click on image for animation

For information on how to do photometry on this object, see: <http://www.nightskyobserver.com/asteroids-and-neos/photometry-needed-for-the-november-asteroid-flyby/>

Although classified as a potentially hazardous object, 2005 YU55 poses no threat of an Earth collision over at least the next 100 years. However, this will be the closest approach to date by an object this large that we know about in advance, and an event of this type will not happen again until 2028 when asteroid (153814) 2001 WN5 will pass to within 0.6 lunar distances.



# Events

## ROBERT FERGUSON OBSERVATORY

### Public Observing Night

Saturday, November 19

Solar Viewing: 11 AM - 3 PM

Night Viewing begins 6 PM

(Please arrive before 9 PM)

Thursday, November 25

Solar Viewing: 11 AM - 3 PM

The Observatory features four telescopes: A 14-inch SCT with CCD camera in the East wing, an 8-inch refractor under the dome, a radio telescope for observing Sun activity, and a 24-inch reflector 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 solar viewing; donations are appreciated. Observatory night viewing fee: \$3 for adults 18 and over; children admitted free. The Park charges \$8 per vehicle for entry at all times. Info: [www.rfo.org](http://www.rfo.org)

*\*Note: Unless you are a current RFO volunteer, you are expected to pay Park and RFO fees. SCAS and RFO are separate organizations and we pay fees and dues accordingly. Members who arrive before dark to set up a telescope with the intent of serving the public are considered temp-volunteers and need not pay the RFO fee.*

### Night Sky Classes—Fall Series

#### Upcoming Sessions

Nov. 22, Nov. 29

**Classes begin at 7:00 PM.** Series of six sessions. 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\(at\)rfo.org](mailto:nightsky(at)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 [www.rfo.org](http://www.rfo.org) or email George Loyer: [gloyer\(at\)rfo.org](mailto:gloyer(at)rfo.org).

## SRJC PLANETARIUM

### “Nebulae, Clusters, the Winter Sky” through November 20

During winter months the Sun is below the horizon more than 12 hours in Sonoma County. On these longer cool clear nights we have ample opportunity to observe our beautiful winter nighttime sky. We'll tour our traditional winter sky and more definitively discover winter's beautiful deep space nebulae and clusters. We'll travel through interstellar space to see star forming regions, young and old stellar clusters, and other distant objects in our winter sky.

Show times: 7:00pm Fridays & Saturdays, 3:00pm Sundays. Admission is \$5 General & \$3 Students and Seniors (60+). Cash only, please.

**“First Friday Night Sky”—Nov. 4 at 7:00 and 8:30 PM:**

Admission Free. Focus is on the stars, constellations, planets and other interesting facts about the current night sky.

*No planetarium shows Nov. 5 or 6.*

Seating is 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/>



## SONOMA STATE UNIVERSITY SERIES

### “WHAT PHYSICISTS DO”

Mondays at 4:00 PM

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

**Nov 7: “Carbon Reduction with Appropriate Technology”**—Dr. Pete Schwartz, California Polytechnic State University, San Luis Obispo

Information: <http://phys-astro.sonoma.edu/wpd/>

## SSU OBSERVATORY PUBLIC VIEWING

**Nov. 5, 8:00 PM: “Bay Area Science Festival Star Party”**

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>

## “WHAT’S UP” PODCAST

Using a combination of NASA images, beautifully clear graphics and her own narration, Jane does an outstanding job of explaining what you can expect to see in the night sky each month. Find Jane's podcasts here: <http://solarsystem.nasa.gov/news/whatsup.cfm>

# Events

## Community Outreach Event Horizons

### School Star Parties up and Running

October has been kind to the star party viewers throughout Sonoma County. Although the planned star party at Petaluma's Grant Elementary on Tuesday, the 18th was fogged out—in spite of the anti-fog dance preformed by Len Nelson—Eric Swanson, Alan Karbousky, and 3 of our Young Astronomers were on hand and ready to show the gathering audience anything besides the telescope.

Two days later, there was success! Len, Eric and Ted Judah were again joined by the three Young Astronomers; Blane Eldred, Ky Heon and Conrad Smith. They shared their telescopes with about 86 students and family members with views of Jupiter and an assortment of M-objects. There was also an ISS pass around 7:40.

Meanwhile, at Rincon Valley Middle School, Lynn Anderson was joined by John Whitehouse, Frank Siroky, Loren Cooper, and Dickson Yeager, with Alan Karbousky on green lazer, to provide viewing for around 175 eager students and family members. Young Astronomers Austin Henderson and Olivia Pimentel brought their Sparks telescopes to share their love for the night sky. As in Petaluma, the ISS pass and Jupiter, as well as the brighter M-objects kept the viewers enthralled. The teacher, Penny Sirota, gives her students an astronomy scavenger hunt list to be checked off as the students view the different types of objects, such as globular clusters, planets and galaxies.

On Tuesday, October 25th, Lynn led about 75 Fifth-Graders at Rincon Valley's Whited Elementary School in the Pocket Solar System activity and gave a PowerPoint slide show featuring the planets and examples of the types of objects to be viewed at the star party on the next night.

The star party at Whited was a great success. Two of last year's Sparks winners, Olivia Pimentel and Conner Nielsen, were joined by Lynn, Eric Swanson, Walt Bodley, Dickson Yeager, Len Nelson, and Frank Siroky to provide viewing for about 170 of the students and their families. With 8 telescopes, many objects beside Jupiter were able to be shown to those who came out on the crisp, clear autumn evening. The organizing teacher, Jody Venard, provided hot apple cider to help ward off the night's chill. For those who stayed to the end of the star party, Eric was able to target Uranus (a first for this viewer.)

**Upcoming:** *November 2nd*, under a first quarter moon, will again find the SCAS volunteers in Rincon Valley, this time at Austin Creek Elementary. Hopefully, the clear night weather will continue.



SCAS member Len Nelson and YA Blane Eldred setting up for a Star party at Grant Elementary. Photo by Eric Swanson.

Thanks to the bright moon nights and the week of Thanksgiving, no more star parties are on the calendar until Wednesday, *Nov. 30th* at Petaluma's Old Adobe Elementary School.

Petaluma's Valley Vista Elementary is scheduled for the week of *December 12th-16th*. More details on this star party in next month's Event horizons.

If you have an interest in participating in public astronomy and are not already on the volunteer list, contact Lynn at [astroman\(at\)sonic.net](mailto:astroman(at)sonic.net) to receive email announcements about upcoming volunteer opportunities. If you know of a teacher who might be interested in an evening star party, solar viewing or a classroom presentation, do share Lynn's contact information with them.

—Lynn Anderson, SCAS Director of Community Activities

## MT. TAMALPAIS ASTRONOMY

**Nov. 5, 5:30PM: "The Milky Way as a Dark Matter Laboratory"**—Dr. Michael Kuhlen, Theoretical Astrophysics Center

Over the next decade, a combination of astronomical observations and particle physics experiments hold great promise to finally shed light on the nature of dark matter, the dominant contributor to the matter content of the universe.

This is a special post-season program, part of Bay Area Science Festival, in collaboration with Wonderfest. Includes a "nekkid-eye Nightscape" tour following the program

Free and open to the public. Families and students encouraged to come. Presentations held in the Mountain Theatre. Viewing afterwards in Rock Springs Parking Area, provided by San Francisco Amateur Astronomers. Dress warmly and car pool if possible. Bring a flashlight! Info: 415/455-5370; <http://www.mttam.net/>

## MORRISON PLANETARIUM DEAN LECTURE SERIES

**Nov. 7, 7:30 PM: "Sun, Maize, and the Maya Calendar: Maya Astronomy and Enduring Traditions in Mesoamerica"**—Dr. Isabel Hawkins, Astronomer, Exploratorium / Doña Maria Ávila Vera, Yucatec Maya Elder

Mesoamerica's great pyramids excite our imagination with images of a fascinating civilization in the distant past, but they also provide a tangible link to the richness and enduring power of Maya culture as expressed by the Maya people today. The infamous year 2012 gains astronomical and cultural significance in a calendar system that connects the Maya, corn, and the zenith passage of the Sun. The presenters will share experiences from recent research trips to Guatemala and Mexico, where they gathered content through the Maya people's own voice regarding the Calendar system and their cultural practices.

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

# Events

## SETI INSTITUTE COLLOQUIUM

**Nov. 2, 12:00pm: “ET Math: How Different Could It Be?”**—John Stillwell, Professor of Mathematics, University of San Francisco

We like to think that intelligent aliens would have the same basic ideas about numbers and geometry as us, but, even if they do, they might express those ideas very differently. To illustrate what different forms a concept can take, I will show how differently the law  $ab=ba$  has been interpreted at different times in human mathematical culture. This seemingly basic law has several different origins -- in geometry, number theory, and set theory -- some of which seem alien even to experienced mathematicians.

**Nov. 9, 7:00pm: “Past Climate In Antarctica: Looking Back to Our Future”**—Stephen Pekar, City University of New York

Carbon dioxide levels are predicted to rise during this century to levels not seen in 25 to 50 million years. Back during this time, the Earth changed from a generally ice-free ‘greenhouse world’ to a more much colder and heavily glaciated ‘icehouse world’. Dr. Pekar will provide an overview of Antarctic climate changes when CO<sub>2</sub> levels were similar to what is predicted for this century and also provide some of early results from IODP Wilkes Land Expedition.

Dr. Pekar is traveling to the SETI Institute with the assistance of the Integrated Ocean Drilling Program Ocean Leadership Distinguished Lecturer Series.

**Nov. 16, 12:00pm: “Smart Coatings on Spacecraft Surfaces - New Tools for the Spacecraft Designer’s Tool Belt”**—Steve McDaniel, Reactive Surfaces, Inc

As we enter the era of manned space flight and habitation beyond low Earth orbit, much longer duration human occupation and much less frequent resupply will be the norm, stretching the capacities and capabilities of life support systems. The myriad internal surfaces aboard ISS and the various crew compartments on drawing boards today are viewed as a liability due to contamination and fouling. Yet, if such surfaces operate synergistically with life support systems, these same surfaces become an asset with practically no increased load weight penalty. Virtually all of these surfaces are coated. Bio-based, non-toxic additives to such coatings, many of which are already being marketed for 1XG applications, will create the functionalized surfaces needed.

**Nov. 30, 12:00pm: “Inefficient Collisions, Hit-and-Runs, and Splats”**—Erik Asphaug, Earth and Planetary Sciences Department, University of California, Santa Cruz

**Colloquiums** run from Noon to 1 PM on Wednesdays and at 7:00 PM one evening per month. Location: SETI Headquarters at 189 N. Bernardo Ave., Mountain View ([map](#)). Free. Lectures are available on YouTube at: <http://www.youtube.com/setiinstitute>

## ASTRONOMER ANDREW FRAKNOI AT FAMILY SCIENCE DISCOVERY DAY AT AT&T PARK

Sunday Nov. 6, 12:30PM

**“Whatever Happened to Pluto: Why It Got Kicked out of the Planet Club, and Why It Had It Coming!”**— Andrew Fraknoi, Chair of the Astronomy Department at Foothill College and the former Executive Director of the Astronomical Society of the Pacific

The demotion of Pluto shocked the public and led to angry letters and even protests in some cities. But the story of how Pluto became a dwarf started back in the year 1800 when a Sicilian astronomer made a dramatic cosmic discovery. Popular lecturer and frequent radio guest Andrew Fraknoi will fill everyone in on the behind-the-scenes history of Pluto and what really led to its being kicked out of the planet club. He will also describe the newer dwarf planets Eris, Makemake, and Haumea, whose discovery contributed to Pluto’s downfall.

The entire day is free and open to the public. There will be many dozens of booths, activities, and exhibits on science throughout AT&T Park. (The Physics Chanteuse will also perform).

For more information about the Bay Area Science Festival, see: <http://www.bayareascience.org/festival/>

## TAYLOR OBSERVATORY

Located in Kelseyville off Highway 29

**Nov. 19, 8-11 PM: Public Event, “Search for the Edge of the Solar System”**—Janis Traub

Learn about NASA’s Interstellar Boundary Explorer’s (IBEX) search for the edge of the solar system. Evening event includes lecture, 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.

**“Mystery of the Christmas Star” Planetarium Shows:** November 24, 2011- January 7, 2012 (Fri. & Sat. only 7pm, 7:45pm & 8:30pm) Show prices: \$6/Adult \$3/Children under 12yrs; not recommended for children under 5yrs; \*Reservations recommended.

Info: 707/262-4121 or <http://www.taylorobservatory.org>

## BAY ASTRO YAHOO GROUP

Kenneth Lum created this Yahoo group to list astronomical events of all types around the entire Bay Area. Once you join, you can set it up to receive digests rather than daily messages. Any member can post events.

<http://tech.groups.yahoo.com/group/bayastro/>

# Young Astronomers

## Jupiter Shadow Transits

The star party at Grant Elementary school on October 17th gave us a surprisingly clear view of Jupiter considering that it is yet low to the eastern horizon in the early evening. I knew that a shadow transit was occurring (of Europa) but I did not think that I'd be able to see it in my rather small 80mm TeleVue refractor but....yes, there it was! Just to be sure that my imagination was not adding the pinpoint-size shadow to the view, I asked YA Blaine Eldred and Conrad Smith to come over and to confirm the sighting and they too saw it.

If any of you have never seen a shadow transit, by all means please contact me so that we can arrange for you to have the experience too. Jupiter will be in our night sky for a few months and, with it getting dark so early now, you will have ample opportunities to catch it in the early evening.

Let me know if there is anything else that you'd really like to see and we'll see what we can do to make it happen.

Clear Skies,

—Len Nelson, SCAS President

## The Gray Cubicle You Want to Work In

By Dr. Tony Phillips

It's another day at the office.

You're sitting in a gray cubicle, tap-tap-taping away on your keyboard, when suddenly your neighbor lets out a whoop of delight.



Over the top of the carpeted divider you see a star exploding on the computer screen. An unauthorized video game? No, this explosion is real. A massive star just went supernova in the Whirlpool Galaxy, and the first images from Hubble are popping up on your office-mate's screen.

It's another day at the office...at NASA.

Just down the hall, another office-mate is analyzing global temperature trends. On the floor below, a team of engineers gathers to decode signals from a spaceship that entered "safe mode" when it was hit by a solar flare. And three floors above, a financial analyst snaps her pencil-tip as she tries to figure out how to afford just one more sensor for a new robotic spacecraft.

These are just a few of the things going on every day at NASA headquarters in Washington DC and more than a dozen other NASA centers scattered around the country. The variety of NASA research and, moreover, the variety of NASA people required to carry it out often comes as a surprise. Consider the following:

NASA's Science Mission Directorate (SMD) supports research in four main areas: Earth Science, Heliophysics, Astrophysics, and Planetary Science. Read that list one more time. It includes everything in the cosmos from the ground beneath our feet

to the Sun in the sky to the most distant galaxies at the edge of the Universe.

Walking among the cubicles in NASA's science offices, you are likely to meet people working on climate change, extraterrestrial life, Earth-threatening asteroids, black holes or a hundred other things guaranteed to give a curious-minded person goose bumps. Truly, no other government agency has a bigger job description.



Some of the employees of NASA's Science Mission Directorate may work in gray cubicles, but their jobs are anything but dull. They get to study Earth, the Sun, the Solar System, and the Universe!

And it's not just scientists doing the work. NASA needs engineers to design its observatories and build its spacecraft, mathematicians to analyze orbits and decipher signals, and financial wizards to manage the accounts and figure out how to pay for everything NASA dreamers want to do. Even writers and artists have a place in the NASA scheme of things. Someone has to explain it all to the general public.

Clearly, some cubicles are more interesting than others. For more information about the Science Mission Directorate, visit [science.nasa.gov](http://science.nasa.gov). And for another way to reach the Space Place, go to <http://science.nasa.gov/kids>.

—Article provided by JPL/NASA

## Bay Area Science Festival

Festival continues through November 13. Check out the activities at <http://www.bayareascience.org/festival/>.

## Unmanned spacecraft? Says who?

What's it like to work right in the middle of an exciting NASA science mission? The Space Place decided to find out by asking NASA scientists and engineers to describe some of their most exciting moments on the job. The result is Mission Chronicles, a blog for parents and teachers—although kids are welcome to read it too. The latest post comes from a mission ACE, more formally called a mission controller. He or she is the one who maintains the human link between spacecraft and Earth as the robotic explorer carries out its mission of discovery in deep space.

Check out the ACE's story at <http://spaceplace.nasa.gov/mission-chronicles>.

## Studying A Super-Earth *(from page 3)*

effect compels the spectrum to blue shift as the planet pulls the star towards our observational position and red shifts the planet as it pulls the star in the other direction away from our observational position during its complete, short orbit. These subtle shifts are caused by the gravitational effects of the planet, which is so close to its star.

This discovery forced astronomers to accept that giant planets could exist in short-period orbits. Once astronomers realized that it was worth looking for giant planets with the currently available technology, much more telescope time was devoted to radial velocity planet searches, and hence many more exoplanets have been discovered since then. This radial velocity or Doppler “wobble” technique informs the presence of a planet and its associated spectrum defines the planet’s mass, its orbital period, the orbital distance, and eccentricity.

Another technique is the transit method of exoplanet detection used, for example, by the Kepler Mission. There is a brightness variation, a sort of “wink” of the star, which provides another means for detecting and studying Earth-sized extrasolar planets. It is also known as the photometric transit method, and it relies upon a planet orbiting across the disc of its parent star in our line of sight [2]. The transit method records a drop in brightness when a planet moves across the disc of its star. Since stars are far away, one cannot directly see a planetary transit. Rather, astronomers measure the decrease and increase in the stars brightness with respect to time. The result is called the star’s “light curve.” Since our Sun is much closer, we can see a planet transit across it. Venus transited the Sun in 2004 (the first one since 1882) and Mercury transited the Sun in 2006.

The main limitation of the photometric transit method is the small likelihood that an exoplanet’s orbit will be correctly aligned to pass between our observational position here on Earth and its star. The probability that this occurs is less than one percent. To overcome this, astronomers either observe stars that are known to be “edge-on,” or observe several stars at once. The first approach is being performed by a group called the TEP (Transits of Extrasolar Planets) Network, and the second is part of NASA’s ongoing Kepler Mission [3]. Regardless of the observational strategy, changes in relative light intensity during a transit defines the size of the exoplanet.

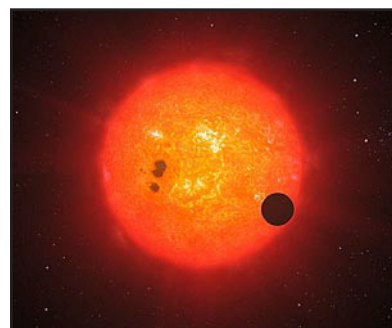
### From 1 to more than 500 Exoplanets in 16 Years

Today, more than 500 exoplanets have been discovered using these three methods. Planets are being found with masses between one and ten Earth masses, simply because detection methods have become more refined during the past ten years. These exoplanets are categorized as super-Earths.

Super-Earths are interesting because our Solar System doesn’t have them. Our Sun shines on either small rocky planets or large gas giants, which are greater than 17 Earth masses.

Both ground-based surveys and space-based detection are finding super-Earths. HARPS in Chile and Keck’s HiRes instrument in Hawaii have used the Doppler “wobble” to characterize 25 super-Earths, while the transit method has found nine super-Earths, including GJ 1214b [4]. In this case, the exoplanet was studied as it passed in front of its parent star and some of the starlight passed through the planet’s atmosphere, allowing its characterization.

Space-based detection has succeeded using the Convection Rotation and planetary Transits (COROT), a mission launched in 2006 by the French Space Agency (CNES) with the ESA and others. The mission’s two objectives are to search for exoplanets with short orbital periods, particularly those of large terrestrial size, and to perform asteroseismology by measuring solar-like oscillations in stars. One super-Earth exoplanet has been found to date, COROT 7b, the smallest terrestrial exoplanet ever detected outside the Solar System. It was detected in 2009, is less than twice the size of Earth, and orbits a Sun-like star. Its temperature is so high that it is possibly covered in lava or water vapor. Meanwhile the Kepler mission, launched by NASA in 2009, has found many super-Earths using the transit detection method. It has been designed to find an Earth-sized planet with a one-year orbital period.



This artist's impression shows the super-Earth exoplanet GJ 1214b passing in front of its faint red parent star. Image credit: ESO/L. Calçada.

### Super-Earth Detection Status

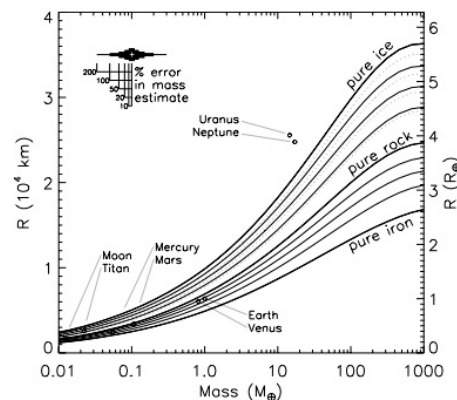
As of June 2011, 28 super-Earths have been found, those exoplanets with a mass less than ten Earth masses. It appears that 10 to 50 percent of solar-type stars (a wide range for now) are the most likely stellar hosts for low-mass Earths. Data collected also suggests that super-Earths tend to lie in multi-planet systems. Kepler’s transit method has identified 356 “candidate” exoplanets with radii less than two Earth radii. Follow-up observations are needed and Kepler is building up a healthy backlog of work to complete.

### Super-Earth Atmospheres

Researchers like Kempton want to understand the composition, structure (including the temperature profile as a function of altitude), and presence of clouds in exoplanet atmospheres. Questions abound: Do super-Earths retain a hydrogen atmosphere? Are super-Earths habitable?

In terms of habitability, planetary composition holding the atmosphere in place is important. Planets can range from pure rock to pure iron, such as Earth and Venus or they can be pure ice such as Uranus and Neptune, both of which have hydrogen atmospheres.

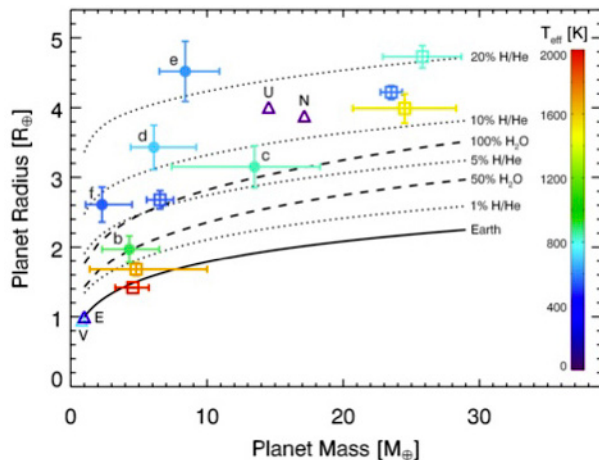
In the figure at right, Fortney et al (2007) provide a curve relating planetary mass to radius for bodies in the Solar System [5]. The topmost thick black curve is for pure “warm” waterice. The middle thick curve is for pure rock ( $Mg_2SiO_4$ ). The bottommost thick curve is for pure iron (Fe).



*continued Page 9*

## Studying A Super-Earth (from page 8)

Mass-radius relationship of small transiting exoplanets, with Solar System planets shown for comparison are included in the figure below, courtesy of Lissauer et al (2011) [6]. Planets Kepler-11b thru -11f are represented by filled circles with 1-sigma ( $\sigma$ ) error bars, with letters written above. Other transiting extrasolar planets in this size range are shown as open squares, representing, in order of ascending radius, Kepler-10b, COROT-7b, GJ 1214b, Kepler-4b, GJ 436b, and HAT-P-11b. The triangles (labeled V, E, U and N) correspond to Venus, Earth, Uranus, and Neptune, respectively. The colors of the points show planetary temperatures (measured for planets in our Solar System and computed mean planet-wide equilibrium temperatures for Bond albedo = 0.2 for the extrasolar planets), with values shown in the color bar at the right. Using previously implemented planetary structure and evolution models, mass-radius curves are plotted for 8 Gyr-old planets, assuming  $T_{\text{eff}} = 700$  K. The solid black curve corresponds to models of planets with Earth-like rock-iron composition. The higher dashed curve corresponds to 100 percent H<sub>2</sub>O. All other curves use a water or hydrogen-helium envelope atop the rock-iron core. The lower dashed curve is 50 percent H<sub>2</sub>O by mass, while the dotted curves are hydrogen-helium envelopes that make up 2%, 6%, 10%, and 20% of the total mass. There is significant degeneracy in composition from only a mass and radius measurement. Planet Kepler-11d, -11e, and -11f appear to require a hydrogen-helium envelope, much like Uranus and Neptune, while Kepler-11b and -11c may have H<sub>2</sub>O and/or hydrogen-helium envelopes.



As shown above, GJ 1214b (the blue open square plotted along the dashed 100 percent H<sub>2</sub>O curve) is just barely in the pure ice region. Its density is 1.9 g/cm<sup>3</sup> (compared with Earth at 5.5 g/cm<sup>3</sup>). It has an orbital period of just 1.58 days and although it orbits close to its host star, that star is a cool one. The equilibrium temperature is about 500 degrees Kelvin.

Kempton and her colleagues are working on atmospheric modeling to match the observational data from GJ 1214b [7]. This is an exciting project since GJ 1214b is currently the only known super-Earth that is accessible for space-based follow-up to determine the planet's atmospheric composition. GJ 1214b may represent a new class of planets – those falling in the intermediate range between gas or ice giants, and terrestrial planets. As more transiting super-Earths are discovered, and the mass-radius diagram begins to fill in for these smaller planets,

it will become clearer whether there is a sharp transition or a smooth continuum between the two types of planets. For now GJ 1214b remains an interesting and unique object that is ideally suited for the type of follow-up observations that will reveal more information about the nature of this planet, both its interior and its atmosphere.

The increasingly sophisticated observational techniques for transiting exoplanet spectroscopy as applied to study the atmospheres of planets orbiting M dwarfs, such as the stellar host of GJ 1214b, offers the promise of comparative studies of super-Earth type planets in the near-future. Ultimately, this approach will provide the best chance for the eventual first characterization of the atmosphere of a potentially habitable planet.

Kempton is on a quest to find the answer.

—Submitted by **R.K. Koslowsky, SCAS Member**  
<http://worldperspective.bravehost.com/astronomy.html>

### Notes:

[1] Dr. Eliza Kempton graduated from Middlebury College in 2003 with a B.A. in physics, and in 2009 she received her Ph.D. from Harvard University in astronomy. Kempton's research focuses on small extrasolar planets known as super-Earths. These planets are 1 to 10 times more massive than the Earth, and they are currently offering astronomers the first glimpse into “exo”-worlds that may be similar to our own. Kempton models the atmospheres of extrasolar super-Earths to determine aspects such as atmospheric structure and composition. Understanding the atmospheres of extrasolar planets is an important step on the road toward finding a truly Earth-like planet.

[2] When large astronomical bodies move across small ones, we call it an “occultation.” When small ones move in front of large ones we call it a “transit.” And when two astronomical bodies about the same size move in front of each other, we call it an “eclipse.”

[3] Please see the following about the Kepler mission: Part III in the Kepler Series is documented in the SCAS Sonoma Skies October 2010 newsletter, Volume XXXIII No. 9, p. 9; Part II in the Kepler Series may be found in the SCAS Sonoma Skies March 2010 newsletter, Volume XXXIII No. 2, pp. 1,9; Part I in the Kepler Series is captured in the SCAS Sonoma Skies July 2009 newsletter, Volume XXXII No. 7, pp. 1, 8.; follow the progress of Kepler at NASA: <http://kepler.nasa.gov/>.

[4] More on super-Earth GJ 1214b: [http://www.spacedaily.com/reports/First\\_Super\\_Earth\\_Atmosphere\\_Analyzed\\_999.html](http://www.spacedaily.com/reports/First_Super_Earth_Atmosphere_Analyzed_999.html)

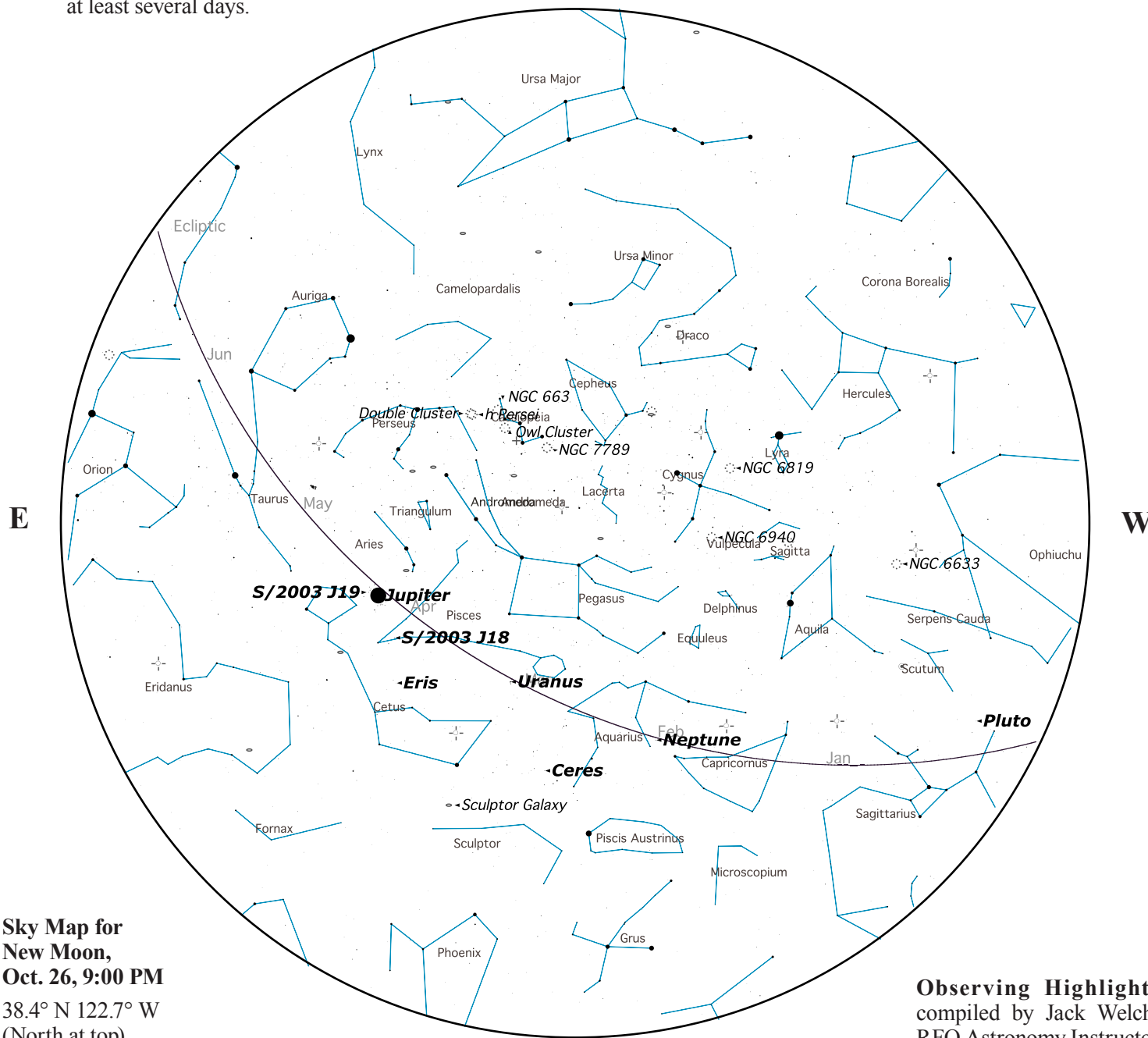
[5] Fortney et al (2007) paper: [http://iopscience.iop.org/0004-637X/659/2/1661/pdf/0004-637X\\_659\\_2\\_1661.pdf](http://iopscience.iop.org/0004-637X/659/2/1661/pdf/0004-637X_659_2_1661.pdf)

[6] Lissauer et al (2011) paper: <http://arxiv.org/pdf/1102.0291v1>

[7] Kempton (Miller-Ricci) & Fortney (2010) paper: <http://arxiv.org/abs/1001.0976>

# November 2011 Observing Highlights

- 11/6** Daylight Savings Time Ends, 02:00
- 11/7** Mercury in West through 11/23. A poor evening apparition. Mercury stays low to the horizon, setting early. Maximum altitude is only 5° 30 minutes after sunset on 11/15. Mercury is near much-brighter Venus during the first half of the month, providing an aid in spotting Mercury with binoculars. The bright red star Antares joins the Mercury-Venus pair on and around 11/10.
- 11/9** Moon near Jupiter, 18:00
- 11/10** Mars near Regulus, 02:00. Orange-red Mars is near the bright blue star Regulus in Leo. Use binoculars to enhance this colorful pair which can be appreciated for at least several days.
- 11/12** Algol minimum at 12:32am
- 11/14** Algol minimum at 9:21pm
- 11/17** Algol minimum at 7:10pm
- 11/17** Leonids Peak. The Leonid Meteor Shower is obscured by the last quarter moon this year. Still, best meteor displays (those bright enough to show up in the moonlight) should be during the morning hours of 11/18.
- 11/19** Moon near Mars, 02:00
- 11/24** New Moon, 22:00
- 11/26** Crescent Moon near Venus. A lovely 4.6% crescent moon accompanies Venus in the southwestern twilight.



**Sky Map for  
New Moon,  
Oct. 26, 9:00 PM**  
38.4° N 122.7° W  
(North at top)

**Observing Highlights**  
compiled by Jack Welch,  
RFO Astronomy Instructor

# November 2011

| Sunday        | Monday          | Tuesday                                       | Wednesday  | Thursday   | Friday  | Saturday  |
|---------------|-----------------|---|--|--|---|---|
|               |                 | <b>1</b>                                      |  <b>2</b> | <b>3</b>   | <b>4</b>  | <b>5</b>  |
|               |                 |   | <p><b>School Star Party</b><br/>Austin Creek Elementary</p>                                |  |   |   |
| <b>6</b>      | <b>7</b>        | <b>8</b>                                      | <b>9</b>   |  <b>10</b>   | <b>11</b>   | <b>12</b>   |
| DST ends 2 AM | Mercury in West | Asteroid flyby                                | <p><b>SCAS Meeting</b><br/>7:30 PM</p> <p>Moon near Jupiter<br/>Asteroid flyby</p>         | Mars near Regulus  |   |   |
| <b>13</b>     | <b>14</b>       | <b>15</b>                                     | <b>16</b>  | <b>17</b>  |  <b>18</b> | <b>19</b>   |
|               | Algol Minimum   |   |  | Leonids Peak<br>Algol Minimum  |   | <p><b>RFO Pubic Observing</b><br/>Solar: 11AM-3<br/>Night: 6PM &gt;</p> <p>Moon near Mars</p> |
| <b>20</b>     | <b>21</b>       | <b>22</b>                                     | <b>23</b>  |  <b>24</b> | <b>25</b>   | <b>26</b>   |
|               |                 | <p><b>RFO Night Sky Class</b><br/>7:00 PM</p> |  | Thanksgiving Day   | <p><b>RFO Pubic Observing</b><br/>Solar: 11AM-3</p>   | Crescent Moon near Venus  |
| <b>27</b>     | <b>28</b>       | <b>29</b>                                     | <b>30</b>  |  |   |   |
|               |                 | <p><b>RFO Night Sky Class</b><br/>7:00 PM</p> | <p><b>School Star Party</b><br/>Old Adobe Elementary</p>                                   |  |   |   |

*See Page 4 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@bryantlabs.net](mailto:kpayea@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@yahoo.com](mailto:scas-subscribe@yahoo.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@sonomaskies.org](mailto:publications@sonomaskies.org)

### SCAS Elected Board

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

### SCAS Appointed Positions

- Striking Sparks Program Coordinator:** Larry McCune  
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**Amateur Telescope Making:** Steve Follett 542-1561  
[follett@sonic.net](mailto:follett@sonic.net)  
**Librarian:** David Simons 537-6632 [davidsimons@planetatm.com](mailto:davidsimons@planetatm.com)

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