

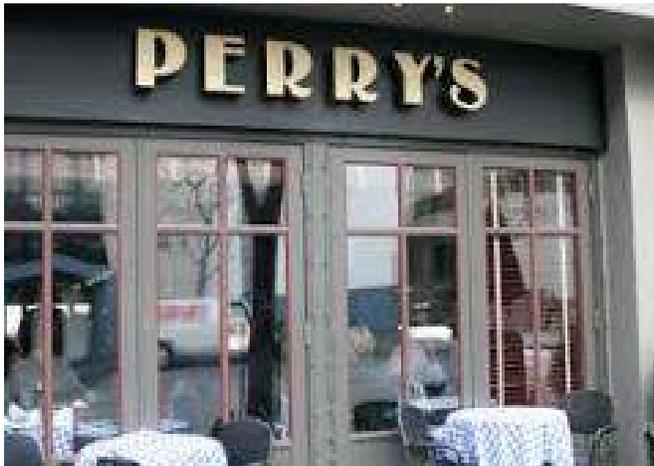
# ABOVE THE FOG

• BULLETIN OF THE SAN FRANCISCO AMATEUR ASTRONOMERS •

Vol. 61, No. 1 - January 2013

**Saturday, January 19, 2012**  
**SAN FRANCISCO AMATEUR ASTRONOMERS**  
**ANNUAL AWARDS DINNER**

**PERRY'S EMBARCADERO**  
**155 Steuart Street, San Francisco**  
**6:30 p.m. Drinks on the Terrace**  
**7:00 p.m. Dinner**



Join us as we enjoy the views from the Embarcadero under the lights of the Bay Bridge.

We have a private room, a wonderful four-course dinner menu – with drinks included – all for a ticket price of \$40 for adults and \$28 for children.

See the 4-Course Banquet Menu below or **Download It Here.** **Select your meal at dinner -- no need to pre-**

select.

SPACE IS LIMITED.

PLEASE BOOK EARLY VIA  
THE PAYPAL LINK AT

<http://www.sfaa-astronomy.org/sfaaannual-awards-dinner-sat-january-19th-2013/>





## UPCOMING LECTURES

**FEBRUARY 20, 2013**

### **ANGIE AND DOUG TRAEGER - HOW TO MEET BAT PEOPLE**

Practical Observational Astronomy is one of several science and nature oriented classes offered at the San Francisco State University's Sierra Nevada field campus every summer. Doug and Angie Traeger, SFAA members, attended and participated in the astronomy course in the summers of 2011 and 2012. They would like to share their experiences. They'll cover the ins and outs on a week-long course that includes lectures in the day and guided observing at night.

*Doug and Angie have been active amateur astronomers for 13 years, and they each have their own dobsonian telescopes. They travel to observe together.*

### **ROBERT DOUGLAS - TITIRO ETU**

Early Polynesian navigators from the Cook Islands and Tahiti sometimes used titiro etu (star peekers). These were made using coconut shells. In a sense, a titiro etu substituted for not having a more modern sextant. Each titiro etu was designed for a known island associated with a particular star. The instrument allowed navigators to determine when they were on the latitude of the destination island.

*Ever since grade school, Bob had been interested in astronomy and space travel. When he was 13, his father bought him a 2.4-inch f/15 Unitron refracting telescope. At the University of Washington, Bob received a BS, MS and PhD degrees in mathematics. He came to San Francisco State University as an Assistant Professor of Mathematics in 1969, and was in the Mathematics Department for about the first 15 years. He then switched into the newly-created Computer Science Department for another 15 years. Bob has taken eight trips to Australia for observing the southern skies, including two total solar eclipses there.*

### **PAUL SALAZAR - SOLAR AND LUNAR ECLIPSES, PAST, PRESENT AND FUTURE.**

In this talk, Paul will provide an overview of one of the most riveting astronomical phenomenon, eclipses. They happen with regularity, but sometimes you need to travel to see one, and other times they come to you. We'll recap a few recent eclipses, and talk about the next few years worth of good eclipses, as well as discuss some of the more interesting aspects of solar eclipses.

*Paul Salazar is an amateur astronomer and blogger, speaking on astronomy at various venues including Mt. Tam and Yosemite, and on KFOG and KALW radio. He lives in San Francisco, and is a business executive at a startup in Silicon Valley called Skytree.*

**MARCH 20, 2013**

### **DR. RALPH KAEHLER**

#### **SCIENTIFIC VISUALIZATION IN NUMERICAL ASTROPHYSICS AND COSMOLOGY**

Three-dimensional movies of the birth of the first stars in the Universe are just some of the stunning visuals at the Schwob Computing and Information Center, a resource at KIPAC's Computational Physics Department. The visualizations are based on large-scale computer simulations that model complex astrophysical and cosmological processes, ranging from the formation of the first galaxies to the motion of dark matter on cosmic scales. In his presentation, Ralf will describe the role of scientific visualization in cosmological research, explain how he develops and employs state-of-the-art computer graphics techniques to produce the visualizations, and show us many examples of images and animations resulting from the work done at KIPAC. Dr Ralf Kaehler is a computational scientist at KIPAC, the Kavli Institute for Particle Astrophysics and Cosmology. He manages KIPAC's visualization laboratory, designs and implements computer graphics software and produces astrophysical images and movies that have been presented worldwide on numerous covers of magazines, in planetarium shows and TV documentaries.

This is one lecture you won't want to miss! ( sent to me by an enthusiast who heard this lecture!)

# IMPORTANT DATES & SIGNIFICANT UPCOMING SFAA VIEWING EVENTS

## SFAA GENERAL MEETINGS & LECTURES

*Randall Museum, 199 Museum Way (Near 14<sup>th</sup> Street and Roosevelt)*  
*Third Wednesday of each month: 7:00 p.m. Doors open. 7:30 p.m. Announcements. 8:00 p.m.*  
*Speaker*

**SFAA BOARD MEETINGS IMMEDIATELY PRECEDE GENERAL MEETINGS  
AND BEGIN AT 6:00 P.M.**

February 20, March 20, April 17, May  
15, June 19, July 17, August 21,  
September 18, October 15,  
November 20, December 18

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## 2010 MT TAM SPECIAL USE PERMIT STAR PARTIES MEMBERS ONLY (GATEKEEPERS NEEDED)

Special Use Permit observing nights on Mount Tamalpais are private, open *only* to SFAA members.  
Please arrive by sunset.

SFAA/Mt. Tam permit required for each car.  
We must vacate the mountain by 2:00 a.m. except on specially approved nights  
(such as Messier Marathon).

Always on a Saturday  
January 12, February 9, March 9, April 6, May 4, June 8, July 6, August 3, August 31,  
October 5, November 2, November 30

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## MT TAM PUBLIC STAR PARTIES (April through October)

Public nights on Mount Tamalpais start with a lecture in the Mountain Theatre  
followed by public viewing in the Rock Springs parking lot.  
SFAA members may view privately after crowd departs from approx. 11 pm-2 am.  
For more information: <http://www.sfaa-astronomy.org/starparties/>

2013 Dates: April 13, May 11, June 15, July 13, Aug 10, Sept 7 and Oct 12

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NOVEMBER 2012 - THE EVENING SKY

November Sky Map: <http://skymaps.com/skymaps/tesmn1301.pdf>

November Sky Calendar: <http://skymaps.com/articles/n1301.html>

**BAY AREA ASTRONOMY EVENTS**

Kenneth Lum

<http://tech.groups.yahoo.com/group/bayastro/?v=1&t=directory&ch=web&pub=groups&sec=dir&slk=94>

**BAY AREA REGULARLY SCHEDULED EVENTS**

<p><b>EVERY FRIDAY NIGHT 7:00 PM – 10:00 PM excluding major holidays</b></p> <p><b>The Telescope Makers' Workshop</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER 10000 Skyline Boulevard Oakland, CA 94619-2450</b></p>	<p><b>THE TELESCOPE MAKERS' WORKSHOP</b> is held every Friday night from 7pm - 10pm, excluding major holidays (e.g. Christmas Day and New Year's Day) that fall on Fridays. The Workshop is always closed on Memorial Day Weekend. Attendance every Friday night is not mandatory, and members work at their own pace. The Workshop meets at Chabot Space &amp; Science Center, 10000 Skyline Blvd., Oakland. Contact us for more specific details:</p> <p>Contact: E-mail Richard Ozer (<a href="mailto:rozer@pacbell.net">rozer@pacbell.net</a>) or (510) 406-1914</p>
<p><b>EVERY FRIDAY &amp; SATURDAY EVENING, weather permitting 7:30 PM – 10:30 PM</b></p> <p><b>CHABOT SPACE AND SCIENCE CENTER 10000 Skyline Boulevard Oakland, CA 94619-2450 (510) 336-7300</b></p>	<p><b>EXPLORE THE NIGHT SKIES AT THE CHABOT OBSERVATORIES</b> For more information: <a href="http://www.chabot.space.org/">http://www.chabot.space.org/</a></p> <p><b>Free Telescope Viewing</b> Regular hours are every Friday &amp; Saturday evening, weather permitting: 7:30pm -10:30pm Come for spectacular night sky viewing the best kept secret in the Bay Area and see the magnificence of our telescopes in action!</p> <p><b>Daytime Telescope Viewing</b> On Saturday and Sunday afternoons come view the sun, moon, or Venus through Chabot's telescopes. Free with General Admission. (weather permitting)</p> <p>12pm - 5pm: Observatories Open</p>
<p><b>January 12 Sunset – 5:11 PM (TWICE MONTHLY)</b></p> <p><b>Inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.</b></p> <p><b>SAN MATEO COUNTY ASTRONOMICAL SOCIETY STAR PARTY</b></p>	<p><b>STAR PARTIES AT CRESTVIEW PARK, SAN CARLOS</b></p> <p>Come out and bring the kids for a mind expanding look at the universe</p> <p>The City of San Carlos Parks and Recreation Department and the San Mateo County Astronomical Society has open Star Parties twice a month. These events are held in Crestview Park, San Carlos California. Note that inclement weather (clouds, excessive wind and showers) will cause the event to be canceled without notice.</p> <p>For more information call Bob Black, <b>(650)592-2166</b>, or send an email to <a href="mailto:SMCAS@live.com">SMCAS@live.com</a> or call Ed Pieret at <b>(650)862-9602</b>.</p> <p><b>Reasons to Attend</b> If you have kids interested in space or planets bring them here for a real life view of planets, nebula, star clusters and galaxies. If you are thinking of buying a telescope or want help using a telescope you own, come here to talk with experienced users. If you think you might have an interest in astronomy come and talk to experienced amateur astronomers.</p> <p><b>Cautions</b> Dress warmly and wear a hat. Visitors should park on the street and walk into the park so your headlights don't affect the observer's dark adaptation. Only park in the parking lot if you are arriving before dark and plan to stay until the end of the event. You shouldn't need lights but if you feel you do, only bring a small flashlight with the lens covered using red</p>

	<p>cellophane or red balloon.  Please respect the telescopes and ask permission from the owner if you wish to touch.  Parents, please watch your children.  The park is residential, and adjacent to homes and backyards, please keep noise to a minimum.  Schedule Time  Astronomers arrive to set up at around sunset. Observing starts at about one hour after sunset and continues for two to three hours.</p>
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## BAY AREA EVENTS – NOVEMBER 2012

<p><b>Thursday</b>  <b>January 10, 2013</b>  <b>4:15 PM</b></p> <p><b>Lockheed Martin Colloquia</b>  <b>3251 Hanover St</b>  <b>ATC Auditorium in Building 202</b>  <b>Palo Alto, CA 94304</b></p> <p><b>Cost: Free</b></p>	<p><b>SPACE COLONY EARTH'S STARSHIP ARK</b>  Dr. Vince Teofilo, formerly Lockheed Martin</p>
<p><b>Tuesday, January 15</b>  <b>4:15 PM</b></p> <p><b>STANFORD UNIVERSITY</b>  <b>HEWLETT TEACHING CENTER</b>  <b>Rm 201</b>  <b>Palo Alto, CA 94305</b></p>	<p>DR. YURI SATO, ROWLAND INSTITUTE, HARVARD UNIVERSITY</p> <p>DEVICE ENGINEERING WITH QUANTUM AND/OR ARTIFICIAL MATERIALS</p> <p>Dr. Sato University will give the Applied Physics/Physics colloquium .</p>
<p><b>Tuesday, January 15</b>  <b>7:00 PM</b></p> <p><b>SETI INSTITUTE</b>  <b>COLLOQUIUM SERIES</b>  <b>189 Bernardo Ave</b>  <b>Mountain View, CA 94043</b></p>	<p><b>ED LU OF B612</b>  <b>THE SENTINEL B612 TELESCOPE - FINDING ASTEROIDS BEFORE THEY FIND US</b></p> <p>We know how to deflect asteroids, but our technology is useless if we do not scan the skies to look for asteroids to know well in advance if one is on a collision course with Earth. The Sentinel Space Telescope, the first privately supported deep space mission, is designed to do just that and to enable humanity to protect our planet from future asteroid impacts. Sentinel is an infrared space telescope to be placed into solar orbit in 2017 from where it will find and track asteroids that threaten Earth. It will discover more asteroids each month than the total discovered by all other telescopes combined up until the present. In addition to becoming one of the humanity's great scientific instruments, Sentinel will be unique in that its main purpose is actually to protect the Earth.</p> <p><a href="https://plus.google.com/events/cp0no21djf0qfgdv2t9t18at4jq">https://plus.google.com/events/cp0no21djf0qfgdv2t9t18at4jq</a></p>
<p><b>Thursday, January 17</b>  <b>4:15 PM</b></p> <p><b>LOCKHEED MARTIN COLLOQUIA</b>  <b>3251 Hanover St</b>  <b>Building 202, ATC Auditorium</b>  <b>Palo Alto, CA 94304</b></p> <p><b>Cost: Free</b></p>	<p><b>DR. JOANNE HEWETT, SLAC</b>  <b>RECENT RESULTS FROM LHC</b></p>
<p><b>Friday, January 18</b>  <b>7:00 PM - 9:00 PM</b>  <b>Weather Permitting</b></p> <p><b>San Jose Astronomical Association</b>  <b>Houge Park</b>  <b>Twilight Drive</b>  <b>San Jose, CA 95124</b></p> <p><b>Cost: Free</b></p>	<p><b>HOUGE PARK STAR PARTY</b>  Meet with members of San Jose Astronomical Society for a Star Party, weather permitting.</p>

<p><b>Saturday, January 19</b> 7:00 PM - 10:00 PM</p> <p><b>COLLEGE OF SAN MATEO</b> Building 36 1700 W Hillsdale Rd San Mateo, CA 94402</p> <p><b>Cost: Free</b></p>	<p><b>JAZZ UNDER THE STARS</b></p> <p>Visit our roof top observatory and see the moon and Saturn thru our telescopes, while listening to KCSM Jazz 91 FM. Dress warmly.</p> <p>No food or drinks in the observatory. Children are welcome and need to be attended at all times.</p> <p>Parking is free in lot 5, Marie Curie</p>
<p><b>Wednesday, February 6</b> 7:00 PM</p> <p><b>SMITHWICK THEATER</b> FOOTHILL COLLEGE El Monte Road &amp; Freeway 280 Los Altos Hills CA 94022</p>	<p><b>Silicon Valley Astronomy Lectures</b> <b>DR. SANDRA FABER, UNIVERSITY OF CALIFORNIA, SANTA CRUZ (AND LICK OBSERVATORY)</b></p> <p>Free, illustrated, non-technical talk <b>HOW GALAXIES WERE COOKED FROM THE PRIMORDIAL SOUP</b></p> <p>One of the great mysteries of the night sky is why it's mostly dark, only punctuated by pinpoints of light in the form of stars and galaxies. The lumpiness of today's universe is a fundamental characteristic that took billions of years to grow. Dr. Faber will review the prevailing "Cold Dark Matter" theory for galaxy formation and compare its predictions to present-day observations. It's a remarkable saga involving invisible dark energy and matter, the properties of the Universe an instant after it was born, cosmic expansion faster than light, and the creation of structure from quantum fluctuations. What's more, she will show that we probably understand this cosmic history better than we understand the origin of our own DNA!</p> <p>Sandra Faber is Interim Director of the University of California Observatories and University Professor at UC Santa Cruz. She was one of three astronomers who diagnosed the flaw in the mirror of the Hubble Space Telescope and played a major role in its repair. She established the scientific case for the giant Keck Telescopes, now operating in Hawaii and has helped develop instruments for them to probe the early universe. Her primary research interests include the formation and distribution of galaxies and "cosmology" -- the study of the properties of the entire universe. Dr. Faber was one of the creators of the "Cold Dark Matter" theory for how the cosmos developed its present-day structure. Among her awards are the Russell Prize of the American Astronomical Society and the Bruce Medal of the Astronomical Society of the Pacific, each given for a lifetime of distinguished contributions to astronomy. In 2013, she will be receiving the National Medal of Science from President Obama.</p> <p>Foothill College is just off the El Monte Road exit from Freeway 280 in Los Altos. For directions and parking information, see: <a href="http://www.foothill.edu/news/transportation.php">http://www.foothill.edu/news/transportation.php</a> For a campus map, see: <a href="http://www.foothill.edu/news/maps.php">http://www.foothill.edu/news/maps.php</a></p> <p>The lecture is co-sponsored by: * NASA Ames Research Center * The Foothill College Astronomy Program * The SETI Institute * The Astronomical Society of the Pacific.</p> <p>Parking on campus costs \$3. Call the series hot-line at 650-949-7888 for more information and driving directions.</p>

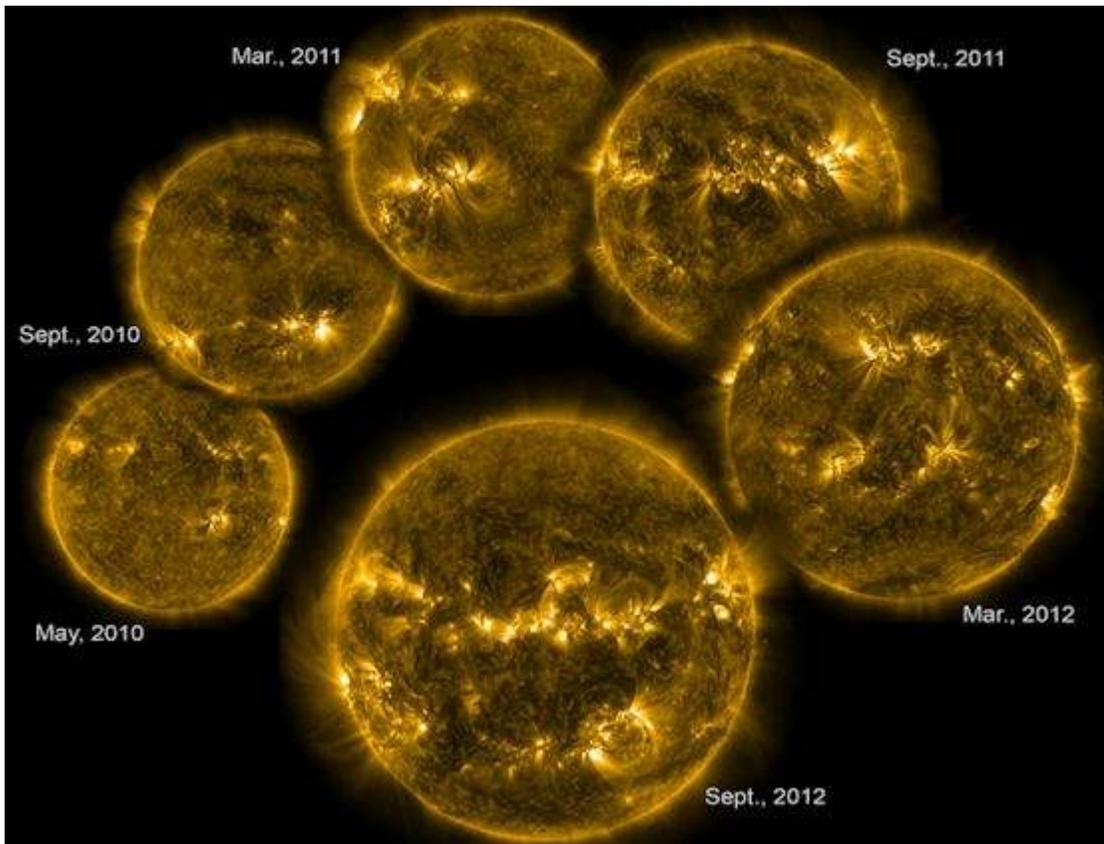
## NASA SCIENCE CAST

The Science@NASA team is pleased to announce a new product: the ScienceCast. Every week, we produce a short video highlighting a topic in NASA science news. A complete list of ScienceCast episodes may be found on Science@NASA's Youtube channel: <http://www.youtube.com/user/ScienceAtNASA> . Enjoy!

## **SOLAR VARIABILITY AND TERRESTRIAL CLIMATE**

**Jan. 8, 2013:** *In the galactic scheme of things, the Sun is a remarkably constant star. While some stars exhibit dramatic pulsations, wildly yo-yoing in size and brightness, and sometimes even exploding, the luminosity of our own sun varies a measly 0.1% over the course of the 11-year solar cycle.*

There is, however, a dawning realization among researchers that even these apparently tiny variations can have a significant effect on terrestrial climate. A new report issued by the National Research Council (NRC), "The Effects of Solar Variability on Earth's Climate," lays out some of the surprisingly complex ways that solar activity can make itself felt on our planet.

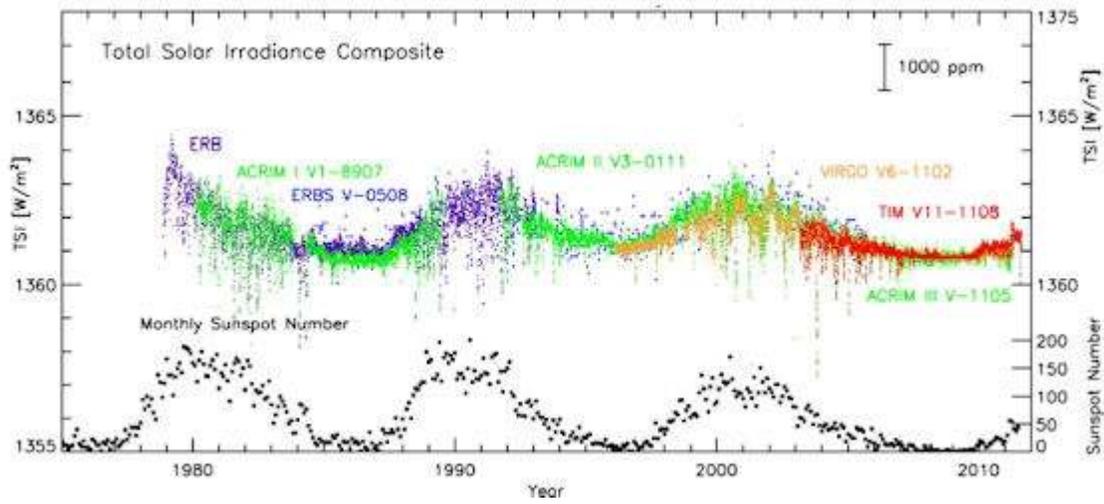


**These six extreme UV images of the sun, taken by NASA's Solar Dynamics Observatory, track the rising level of solar activity as the sun ascends toward the peak of the latest 11-year sunspot cycle. [More](#)**

Understanding the sun-climate connection requires a breadth of expertise in fields such as plasma physics, solar activity, atmospheric chemistry and fluid dynamics, energetic particle physics, and even terrestrial history. No single researcher has the full range of knowledge required to solve the problem. To make progress, the NRC had to assemble dozens of experts from many fields at a single workshop. The report summarizes their combined efforts to frame the problem in a truly multi-disciplinary context.

One of the participants, Greg Kopp of the Laboratory for Atmospheric and Space Physics at the University of Colorado, pointed out that while the variations in luminosity over the 11-year solar cycle amount to only a tenth of a percent of the sun's total output, such a small fraction is still important. "Even typical short term variations of 0.1% in incident irradiance exceed all other energy sources (such as natural radioactivity in Earth's core) combined," he says.

Of particular importance is the sun's extreme ultraviolet (EUV) radiation, which peaks during the years around solar maximum. Within the relatively narrow band of EUV wavelengths, the sun's output varies not by a minuscule 0.1%, but by whopping factors of 10 or more. This can strongly affect the chemistry and thermal structure of the upper atmosphere.

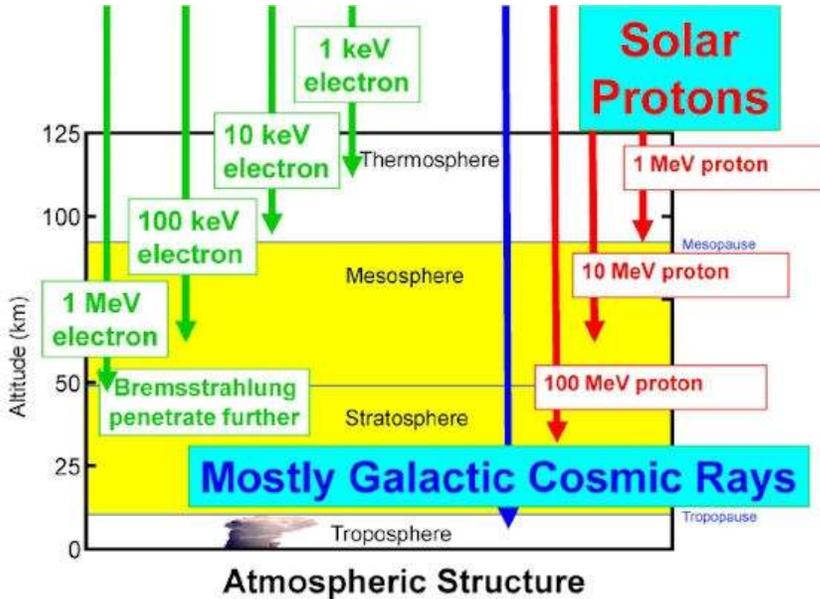


Space-borne measurements of the total solar irradiance (TSI) show ~0.1 percent variations with solar activity on 11-year and shorter timescales. These data have been corrected for calibration offsets between the various instruments used to measure TSI. SOURCE: Courtesy of Greg Kopp, University of Colorado.

Several researchers discussed how changes in the upper atmosphere can trickle down to Earth's surface. There are many "top-down" pathways for the sun's influence. For instance, Charles Jackman of the Goddard Space Flight Center described how nitrogen oxides (NOx) created by solar energetic particles and cosmic rays in the stratosphere could reduce ozone levels by a few percent. Because ozone absorbs UV radiation, less ozone means that more UV rays from the sun would reach Earth's surface.

Isaac Held of NOAA took this one step further. He described how loss of ozone in the stratosphere could alter the dynamics of the atmosphere below it. "The cooling of the polar stratosphere associated with loss of ozone increases the horizontal temperature gradient near the tropopause," he explains. "This alters the flux of angular momentum by mid-latitude eddies. [Angular momentum is important because] the angular momentum budget of the troposphere controls the surface westerlies." In other words, solar activity felt in the upper atmosphere can, through a complicated series of influences, push surface storm tracks off course.

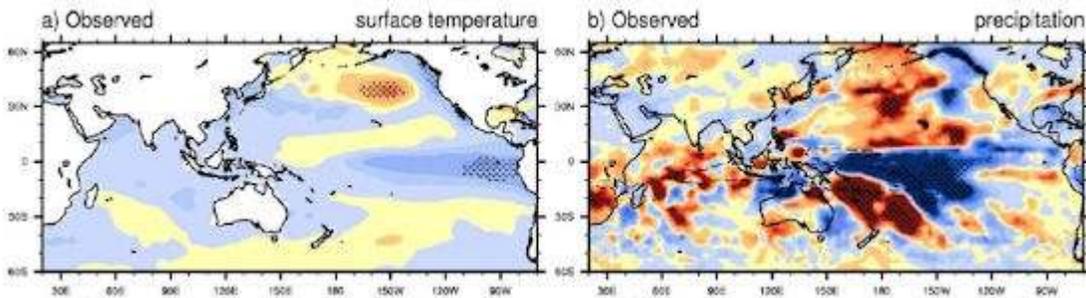
**How incoming galactic cosmic rays and solar protons penetrate the atmosphere.**  
 SOURCE: C. Jackman, NASA Goddard Space Flight Center, "The Impact of Energetic Particle Precipitation on the Atmosphere," presentation to the Workshop on the Effects of Solar Variability on Earth's Climate, September 9, 2011.



Many of the mechanisms proposed at the workshop had a Rube Goldberg-like quality. They relied on multi-step interactions between multiples layers of atmosphere and ocean, some relying on chemistry to get their work done, others leaning on thermodynamics or fluid physics. But just because something is complicated doesn't mean it's not real.

Indeed, Gerald Meehl of the National Center for Atmospheric Research (NCAR) presented persuasive evidence that solar variability is leaving an imprint on climate, especially in the Pacific. According to the report, when researchers look at sea surface temperature data during sunspot peak years, the tropical Pacific shows a pronounced La Nina-like pattern, with a cooling of almost 1° C in the equatorial eastern Pacific. In addition, "there are signs of enhanced precipitation in the Pacific ITCZ (Inter-Tropical Convergence Zone ) and SPCZ (South Pacific Convergence Zone) as well as above-normal sea-level pressure in the mid-latitude North and South Pacific," correlated with peaks in the sunspot cycle.

The solar cycle signals are so strong in the Pacific, that Meehl and colleagues have begun to wonder if something in the Pacific climate system is acting to amplify them. "One of the mysteries regarding Earth's climate system ... is how the relatively small fluctuations of the 11-year solar cycle can produce the magnitude of the observed climate signals in the tropical Pacific." Using supercomputer models of climate, they show that not only "top-down" but also "bottom-up" mechanisms involving atmosphere-ocean interactions are required to amplify solar forcing at the surface of the Pacific.



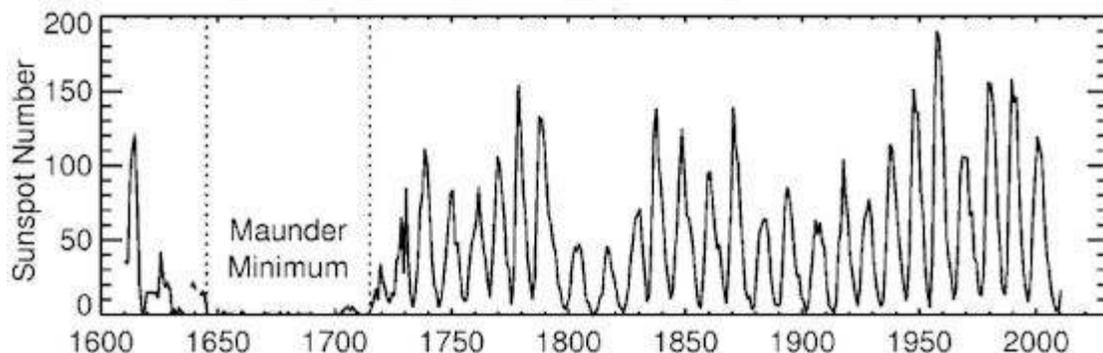
Composite averages for December-January-February for peak solar years. SOURCE: G.A. Meehl, J.M. Arblaster, K. Matthes, F. Sassi, and H. van Loon, Amplifying the Pacific climate system response to a small 11 year solar cycle forcing, Science 325:1114-1118, 2009; reprinted with permission from AAAS.

In recent years, researchers have considered the possibility that the sun plays a role in global warming. After all, the sun is the main source of heat for our planet. The NRC report suggests, however, that the influence of solar variability is more regional than global. The Pacific region is only one example.

Caspar Amman of NCAR noted in the report that "When Earth's radiative balance is altered, as in the case of a change in solar cycle forcing, not all locations are affected equally. The equatorial central Pacific is generally cooler, the runoff from rivers in Peru is reduced, and drier conditions affect the western USA."

Raymond Bradley of UMass, who has studied historical records of solar activity imprinted by radioisotopes in tree rings and ice cores, says that regional rainfall seems to be more affected than temperature. "If there is indeed a solar effect on climate, it is manifested by changes in general circulation rather than in a direct temperature signal." This fits in with the conclusion of the IPCC and previous NRC reports that solar variability is NOT the cause of global warming over the last 50 years.

Much has been made of the probable connection between the Maunder Minimum, a 70-year deficit of sunspots in the late 17<sup>th</sup>-early 18<sup>th</sup> century, and the coldest part of the Little Ice Age, during which Europe and North America were subjected to bitterly cold winters. The mechanism for that regional cooling could have been a drop in the sun's EUV output; this is, however, speculative.

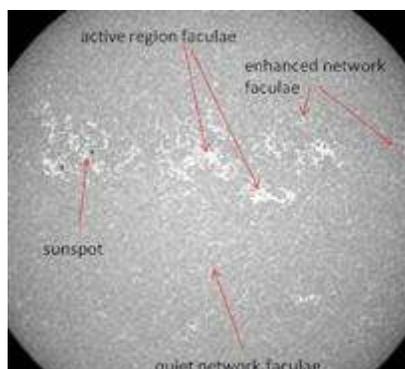


**The yearly averaged sunspot number for a period of 400 years (1610-2010).  
SOURCE: Courtesy of NASA Marshall Space Flight Center.**

Dan Lubin of the Scripps Institution of Oceanography pointed out the value of looking at sun-like stars elsewhere in the Milky Way to determine the frequency of similar grand minima. "Early estimates of grand minimum frequency in solar-type stars ranged from 10% to 30%, implying the sun's influence could be overpowering. More recent studies using data from Hipparcos (a European Space Agency astrometry satellite) and properly accounting for the metallicity of the stars, place the estimate in the range of less than 3%." This is not a large number, but it is significant.

Indeed, the sun could be on the threshold of a mini-Maunder event right now. Ongoing Solar Cycle 24 is the weakest in more than 50 years. Moreover, there is (controversial) evidence of a long-term weakening trend in the magnetic field strength of sunspots. Matt Penn and William Livingston of the National Solar Observatory predict that by the time Solar Cycle 25 arrives, magnetic fields on the sun will be so weak that few if any sunspots will be formed. Independent lines of research involving helioseismology and surface polar fields tend to support their conclusion. (Note: Penn and Livingston were not participants at the NRC workshop.)

"If the sun really is entering an unfamiliar phase of the solar cycle, then we must redouble our efforts to understand the sun-climate link," notes Lika Guhathakurta of NASA's Living with a Star Program, which helped fund the NRC study. "The report offers some good ideas for how to get started."



**This image of the Sun's upper photosphere shows bright and dark magnetic structures responsible for variations in TSI. SOURCE: Courtesy of P. Foukal, Heliophysics, Inc.**

In a concluding panel discussion, the researchers identified a number of possible next steps. Foremost among them was the deployment of a radiometric imager. Devices currently used to measure total solar irradiance (TSI) reduce the entire sun to a single number: the total luminosity summed over all latitudes, longitudes, and wavelengths. This integrated value becomes a solitary point in a time series tracking the sun's output.

In fact, as Peter Foukal of Heliophysics, Inc., pointed out, the situation is more complex. The sun is not a featureless ball of uniform luminosity. Instead, the solar disk is dotted by the dark cores of sunspots and splashed with bright magnetic froth known as faculae. Radiometric imaging would, essentially, map the surface of the sun and reveal the contributions of each to the sun's luminosity. Of particular interest are the faculae. While dark sunspots tend to vanish during solar minima, the bright faculae do not. This may be why paleoclimate records of sun-sensitive isotopes C-14 and Be-10 show a faint 11-year cycle at work even during the Maunder Minimum. A radiometric imager, deployed on some future space observatory, would allow researchers to develop the understanding they need to project the sun-climate link into a future of prolonged spotlessness.

Some attendees stressed the need to put sun-climate data in standard formats and make them widely available for multidisciplinary study. Because the mechanisms for the sun's influence on climate are complicated,

researchers from many fields will have to work together to successfully model them and compare competing results. Continued and improved collaboration between NASA, NOAA and the NSF are keys to this process.

Hal Maring, a climate scientist at NASA headquarters who has studied the report, notes that "lots of interesting possibilities were suggested by the panelists. However, few, if any, have been quantified to the point that we can definitively assess their impact on climate." Hardening the possibilities into concrete, physically-complete models is a key challenge for the researchers.

Finally, many participants noted the difficulty in deciphering the sun-climate link from paleoclimate records such as tree rings and ice cores. Variations in Earth's magnetic field and atmospheric circulation can affect the deposition of radioisotopes far more than actual solar activity. A better long-term record of the sun's irradiance might be encoded in the rocks and sediments of the Moon or Mars. Studying other worlds might hold the key to our own.

The full report, "The Effects of Solar Variability on Earth's Climate," is available from the National Academies Press at [http://www.nap.edu/catalog.php?record\\_id=13519](http://www.nap.edu/catalog.php?record_id=13519).

Author: [Dr. Tony Phillips](#) | Production editor: [Dr. Tony Phillips](#) | Credit: [Science@NASA](mailto:Science@NASA)

## 2010 Club Officers & Contacts

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<i>City Star Party</i>		
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<i>1<sup>st</sup> Alternate</i>	Michael Farino	
<i>2<sup>nd</sup> Alternate</i>	Michael Patrick	
<i>Webmaster</i>	Matthew Jones	

## Club Telescopes

The SFAA owns eight very fine, easy to use, loaner telescopes well-suited for deep sky, planets, and star parties. All scopes are available to any SFAA member. The loaner custodians for the majority of our fleet are Pete & Sarah Goldie. Please contact them at [telescopes@sfaa-astronomy.org](mailto:telescopes@sfaa-astronomy.org) for details if you are interested in borrowing a scope or if you have items you can donate for the loaner program (eyepieces, star maps/books, red flashlights, collimator, etc.). Please contact the appropriate member indicated below if you are interested in borrowing one of the telescopes.

- 1) 6" f/10.3 Dobsonian/Ken Frank [ken@sfaa-astronomy.org](mailto:ken@sfaa-astronomy.org)
- 2) 8" f/7 Dobsonian/Pete Goldie
- 3) 8.5" f/6 Dobsonian/Pete Goldie
- 4) 10" f/8 Dobsonian/Pete Goldie
- 5) 114mm f/4 Newtonian StarBlast/Pete Goldie
- 6) 8" f/10 Celestron SCT/Annette Gabrielli/ [annette@sfaa-astronomy.org](mailto:annette@sfaa-astronomy.org)
- 7) 8" f/10 Meade SCT/Stefanie Ulrey/[treasurer@sfaa-astronomy.org](mailto:treasurer@sfaa-astronomy.org)
- 8) 9.5" f/5.6 Celestron Newtonian/Ken Frank/ [ken@sfaa-astronomy.org](mailto:ken@sfaa-astronomy.org)

## Club Astronomy Videos

The SFAA owns a series of astronomy videotapes featuring Alex Filippenko, a world-renowned professor of astronomy at UC Berkeley. The videotapes provide an introduction to astronomy and cover topics such as the Solar System, the lifecycles of stars, the nature of galaxies, and the birth of the Universe. The SFAA loans the tapes free to all members. If you are interested in viewing these tapes, you may check them out at any of the SFAA General Meetings. These tapes were kindly donated to the SFAA by Bert Katzung. For information on the course tapes themselves:

<http://www.teach12.com/ttc/assets/coursedescriptions/180.asp>

## Membership Dues

Membership is billed for each upcoming year on June 30. Members may receive no more than one bulletin after the expiration of membership.

## SFAA Website and Online Services

The SFAA web site at [sfaa-astronomy.org](http://sfaa-astronomy.org) is provided to our members and the general public for the sharing of club information and services. The web site contains links for club [star parties](#), [events](#), [newsletters](#), [lectures](#) and [meetings](#). If you wish to interact with other people who are interested in astronomy, the SFAA web site offers public and members only [bulletin board forums](#). If you wish to remain up-to-date on club activities, then we encourage you to subscribe to one or both of our public [mailing lists](#), which will allow you to receive our newsletter and/or club announcements via email. Other useful and interesting information and services are available on the site such as [observing location reviews](#), member [astronomy photos](#), and [members only telescope loans](#). Information about SFAA's membership, organization and by-laws are available at the club's online public document [archive](#). If you need to contact a representative of the SFAA, then please visit our [contacts](#) page to help in finding the right person to answer your questions.

***Above the Fog*** is the official bulletin of the San Francisco Amateur Astronomers. It is the forum in which club members may share their experiences, ideas, and observations. We encourage you to participate by submitting your articles, announcements, letters, photos and drawings. We would also like to hear from our new members. Tell us about yourself – what you have done in the past and what other clubs you have joined. **The deadline for the next issue is the 25th day of the month.** Send your articles to [Editor@sfaa-astronomy.org](mailto:Editor@sfaa-astronomy.org)

Has your membership expired? Your mailing label includes the month and year through which your membership is paid. If it is past, your membership has expired and this may be your last issue.



San Francisco Amateur Astronomers  
P.O. Box 15097  
San Francisco, CA 94115

MEMBERSHIP APPLICATION

Membership is billed for each upcoming year on June 30. Between January 1 and June 30, new members pay one half the amount listed below

Membership Categories (Check one):  
 \$10 Youth/Student     \$40 Institutional  
 \$25 Individual         \$75 Supporting  
 \$30 Family

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City \_\_\_\_\_  
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You can choose E-Mail (Recommended) or hard copy delivery for *Above the Fog* (Check one)

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