

PRIMEFOCUS

Tri-Valley Stargazers

August 2010



Meeting Info

What: SiPIN Hybrid CMOS Arrays in Astronomy

Who: Dr. Lance Simms

When:

August 20, 2010

Doors open at 7:00 p.m.

Lecture at 7:30 p.m.

Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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August Meeting

SiPIN Hybrid CMOS Arrays in Astronomy

Dr. Lance Simms

CMOS detectors offer some advantages over CCDs in astronomy including random access to pixels, high speed readout, radiation hardness, and low power requirement. Hybrid SiPIN CMOS arrays seek to combine these advantages with the high quantum efficiency and fill factor of a CCD.

I will present results from testing HyViSi SiPIN arrays at the Kitt Peak 2.1m telescope and show how they perform in full-field imaging, near-infrared response, high speed photometry, and telescope guiding, as well as where they deviate from the ideal. I will also try to give some outlook as to where astronomy is headed when it comes to detectors.

I grew up in the northern suburbs of Chicago and received my BS in physics at University of California at Santa Barbara. After spending the year following my graduation at work on silicon strip sensors for the CMS tracker, I decided that astronomy was the way to go. I received my masters and PhD in applied physics from Stanford University with an emphasis in astronomical imagers. After graduation I moved to Chile to work on the ALMA radio telescope, and now I am a post-doc at LLNL. I would love to stay in the field of detector research and development, but my real dream is to explore the inner solar system as a NASA astronaut.

What's wrong with this picture?

1) It's a Saturday night on a New Moon weekend, and I'm the only one enjoying the stars at H2O. It would be great to have the company of other club observers and astrophotographers at H2O to share the dark skies.

2) This is 1 of 2 photos that I have in this issue of the newsletter. I'd love for other club members to submit their photos and/or stories to share with the club. Please see page 3 for my contact information if you wish to contribute to a future newsletter.

Photo: Ken Sperber, August 7, 2010.



News & Notes

2010 TVS Meeting Dates

The following lists the TVS meeting dates for 2010. The lecture meetings are on the third Friday of the month, with the Board meetings on the Monday following the lecture meeting.

Lecture Meeting	Board Meeting	Prime Focus Deadline
Aug. 20	Aug. 23	
Sept. 17	Sept. 20	Aug. 28
Oct. 15	Oct. 18	Sep. 24
Nov. 19	Nov. 22	Oct. 29
Dec. 17	Dec. 20	Nov. 26

Money Matters

Treasurer David Feindel indicates that as of the May 17, 2010 the TVS account balances are:

Checking	\$5,130.32	
CD #1	\$3,761.41	rolled over 5/17/2010
CD #2	\$2,654.36	rolled over 2/27/2010

TVS Volunteers Needed

We still need a volunteer to take on the duties of the club Secretary. We also could use more members on the Board of Directors. If you wish to help with any of these positions, please contact any officer or board member.

Don't miss Hugh Bartlett's S&T Article

TVS' own Hugh Bartlett has a wonderful article in the September issue of S&T in which he discusses "Binocular Showpieces for Light-Polluted Skies." This article presents showpiece objects for late summer, including gorgeous colored single stars, variable stars, double and multiple stars, asterisms, and even a globular cluster! Can you guess which globular cluster is highlighted? Look for a future installment by Hugh that will likely be published in the December issue of S&T.

Journal Club by Ken Sperber

boom, Boom, BOOM! (Part I)

No, this month's column is not about a John Lee Hooker song, rather it is about different types of supernovae. I came across an article reporting the first identification of a pair-instability supernova (Gal-Yam et al. 2009), and in reading this article I began to question my own understanding of different types of supernova (I'm not an astrophysicist). This led me on a 2-week binge of reading articles and watching a series of DVD presentations by Alex Filippenko (UC Berkeley) to improve my understanding of how supernovae develop.

There are still many questions that come to mind, some that are of pure ignorance, and others that are reflective of the state of the science.

Supernovae come in two flavors, those without hydrogen in their spectra (Type I) and those with hydrogen in their spectra (Type II). As it turns out, this categorization does not reflect different explosion mechanisms. You've probably heard of Type Ia supernovae, as these are the "standard candles" for measuring cosmic distance that led two competing teams to conclude that the expansion of the universe is accelerating. This month I'll talk about Type Ia supernovae, and then next month I'll talk about the death of more massive stars.

Stars that are born with less than 0.45 solar masses become helium white dwarfs. At their cores, the temperature is not hot enough for the helium to fuse into carbon and oxygen. Even if these stars were in binary systems, it is unlikely that they would be able to accrete enough mass to go supernova, and they would just cool off over billions of years.

Stars born with 0.45-8 solar masses have cores hot enough to fuse their helium and they wind up as carbon-oxygen white dwarfs. The Sun will become a white dwarf of about 0.6 solar masses after passing through the planetary nebula phase in about 5 billion years. Most white dwarfs have masses below 1.1 solar masses since the more massive progenitor stars have stronger winds and thus shed a larger fraction of their initial mass. Stars that are born with 8-10 solar masses can become oxygen-magnesium-neon white dwarfs, or they may explode as supernovae.

For a Type Ia supernova to occur, the white dwarf must be in a binary star system so that it can gain mass either by siphoning off material from its companion (usually a red giant) or through collision and coalescence with its companion (most likely another white dwarf). Once the white dwarf accumulates ~1.4 solar masses, it reaches the Chandrasekar limit. At this critical mass, electron degeneracy can no longer support the star against the force of gravity, and the ensuing runaway fusion reaction destroys the star. Electron degeneracy, in which electrons are packed together as closely as possible while still orbiting nuclei, is a quantum mechanical effect based on the Pauli Exclusion principle. Type Ia supernovae reach maximum brightness over about a 3-week period, and then decline in brightness over many months. The main

This image of Supernova 1006c is a composite of X-ray, visible, and radio wavelengths. Evidence suggests that SN1006c was a Type Ia supernova and it is estimated to have been the brightest supernova ever recorded on Earth. It is located about 7000 light years away in the constellation of Lupus. For more information see: <http://chandra.harvard.edu/photo/2008/sn1006c/>

Image Credit: X-ray: NASA/CXC/Rutgers/G.Cassam-Chenai, J.Hughes et al.; Radio: NRAO/AUI/NSF/GBT/VLA/Dyer, Maddalena & Cornwell; Optical: Middlebury College/F.Winkler, NOAO/AURA/NSF/CTIO Schmidt & DSS

Journal Club continued

source of the Type Ia supernova light comes from gamma-rays emitted by the radioactive decay of Nickel⁵⁶ to Cobalt⁵⁶ to Iron⁵⁶.

In next month's column I'll describe core-collapse supernovae.

For more information see: Burrows (1987, *Physics Today*, September issue, 28-37); Crowther et al. (2010, *Mon. Not. R. Astron. Soc.*, arXiv:1007.3284v1, submitted); Filippenko, A. (2007, *Understanding the Universe: An Introduction to Astronomy*, 2nd Edition, The Teaching Company, <http://www.teach12.com>); Gal-Yam et al. (2009, *Nature*, 462: 624-627, doi:10.1038/nature08579); Kawabata et al. (2010, *Nature*, 465, 326-328, doi:10.1038/nature09055); Perets et al. (2010, *Nature*, 465, 322-325, doi:10.1038/nature09056); http://imagine.gsfc.nasa.gov/docs/science/known_12/supernovae.html; and yes, Wikipedia.

Calendar of Events

August 18, 12:00 - 1:00 pm

What: From Earth to the Stars: Psychological Issues during Space Missions

Who: Nick Kanas, Professor of Psychiatry, UCSF

Where: SETI in Mountain View

Cost: Free

Recent studies on-orbit have provided information on important psychological and interpersonal issues that affect crewmembers and mission control personnel who are involved with near-Earth space missions. However, the extreme distances, communication delays, and increased crewmember

autonomy that will characterize missions to Mars and beyond will introduce additional psychosocial stressors never before experienced. Professor Kanas will discuss these stressors and their impact on people traveling to the outer solar system and nearby stars, including those resulting from new technologies, such as traveling at a significant fraction of the speed of light, putting crewmembers in suspended animation, or creating giant self-contained generation ships of colonists who will not return to Earth. Professor Kanas is the author of two books: *Space Psychology and Psychiatry* and *Star Maps: History, Artistry, and Cartography*.

This lunchtime talk is part of the SETI Institute Colloquium Series. Location is 515 N. Whisman Road, Mountain View, CA 94043. For more info, visit their web site <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

August 25, 12:00 - 1:00 pm

What: Beyond Kepler: Direct Imaging of Earth-like Planets

Who: Ruslan Belikov, Space Science Division, NASA Ames

Where: SETI in Mountain View

Cost: Free

Is there another Earth out there? People have been asking this question for over two thousand years, and we finally stand on the verge of answering it. The Kepler mission (which was featured in several of the past SETI talks) will likely find the first ever Earth-sized planet around the habitable zone of another star. This talk is about the next step after Kepler, which might be a mission to directly image Earth-like planets and analyze their spectra for biomarkers such as oxygen, water, and atmosphere. The talk will cover the technology of direct planet imaging, focusing on the work done at NASA

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Eyes on the Skies

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

TVS E-Group

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

Calendar of Events continued

Ames, as well as the science we might get out of it and some repercussions.

This lunchtime talk is part of the SETI Institute Colloquium Series. Location is 515 N. Whisman Road, Mountain View, CA 94043. For more info, visit their web site <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.

August 27-28, 7:00pm-10:00 am

What: Slumber with the Stars
Who: Ages 5 and up
Where: Chabot Space & Science Center
Cost: Advanced Reservations Required: \$75 members/\$85 guests

Spend a night under the stars or with some really cool exhibits. Join us for Slumber with the Stars, Chabot's newest family night out. An overnight in our Center that includes games, exhibit exploration, hike in the Redwoods, a live planetarium show and viewing through our renowned, large telescopes. An experience your family will remember for a lifetime.

A minimum of 1 adult for every 5 kids is required.

The Chabot Space and Science Center is located at 10000 Skyline Blvd, Oakland. For more info, visit their web site <http://chabotspace.org/visit/calendar/default.aspx?date=7/23/2010#calendar> or call (510) 336-7373.

September 1, 12:00 - 1:00 pm

What: Free Electron Laser Communication with Exoplanets and Other Space Applications
Who: Bill Colson, Distinguished Professor, Physics Department, Naval Postgraduate School, Monterey CA
Where: SETI in Mountain View
Cost: Free

The U.S. Navy is developing a Free Electron Laser with MW-level average output power, as reported in a recent National Academy Report. Several scientific space applications appear to be interesting and feasible, including power beaming to satellites, space stations, or space vehicles. New proposals also include scientific investigation of the moon and nearby planets using an FEL stationed on earth, but capable of illuminating small areas of these objects with light spectrally brighter than the sun, permitting direct observations at tunable, selectable wavelengths. It also appears possible to use such an FEL to send detectable signals out to 50 light-years or more, conceivably providing communications capability across such distances. Invoking the concept of reciprocity, it could be we should be looking for such signals from intelligent civilizations on exoplanets. A plan for such exploration is suggested.

September 7, 12:30 pm

What: The Little Book of String Theory

Who: Steven Gubser, Professor of Physics at Princeton University

Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA 94118

Cost: Free with Museum admission. Seating is limited. Reserve a Space Online or call 800-794-7576

Theoretical physicist "Gubser does a masterly job of introducing string theory in simple terms and without using math. His goal is not to convert people to the cause but to help them better understand the ideas. Cars on a freeway, the vibration of piano strings, and buoys in the ocean are among the examples from everyday life used to explain difficult concepts."

September 8, 12:00 - 1:00 pm

What: NASA's Flexible Path Architecture Study for Human Missions

Who: David Korsmeyer, NASA Ames Research Center

Where: SETI in Mountain View

Cost: Free

NASA supported the "Review of U.S. Human Spaceflight Plans" (HSF) Committee during the Summer of 2009 by performing a study and analysis of a novel Flexible Path concept. The Flexible Path architecture for human spaceflight calls for incrementally more aggressive human missions out into the inner solar system. Exploration of the Moon, Lagrange points, Near Earth Objects, leading to the exploration of the Martian moons. All of these missions would have broad technical and scientific merit as precursors to the future exploration of the Mars surface. Dr. Korsmeyer lead the Flexible Path Architecture Study for NASA in support of the HSF Committee.

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September 11, 8:30pm

What: The Globe at Night: How and Why to Preserve the Night Sky

Who: Kenneth Frank, Astronomical Society of the Pacific-Dark Sky Network

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

Cost: Free

Saving our Dark Skies is a Global Problem. Find out how light pollution is measured and what you can do to understand and help preserve this natural resource locally.

Calendar of Events continued

September 13, 7:30 pm

What: Kepler: Are There Any Good Worlds Out There?
Who: Jon Jenkins, SETI Institute, Co-Investigator, Kepler Discovery Mission
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA 94118
Cost: Adults \$12, Seniors \$10, Academy members \$6. Seating is limited.

The Kepler Mission began on May 12, 2009, initiating NASA's first search for Earth-like planets. Kepler released light curves for the first 43 days of observations for over 150,000 target stars and announced the identification of over 700 planetary candidates, 3000 eclipsing binaries, and five multiple transiting planet candidate systems. Jenkins will discuss the equipment, mission and how the Science Pipeline will be modified to reveal small Earth-like planets in habitable zones of their stars.

September 15, 12:00 - 1:00 pm

What: From the Earth to Mars: Lessons for Mars Science

and Exploration from the Houghton-Mars Project, Devon Island, High Arctic

Who: Pascal Lee, SETI Institute, Mars Institute, & NASA Ames Research Center
Where: SETI in Mountain View
Cost: Free

The Houghton impact crater site on Devon Island, High Arctic, is one of the most Mars-like places on Earth. Since 1997, the Houghton-Mars Project (HMP) has been conducting science and exploration research at the site, and established the HMP Research Station, now the largest privately operated polar research station in the world. Geology and astrobiology investigations have led to the formulation of the "Mars, Always Cold, Sometimes Wet" Model. Dr. Lee will describe how Houghton is being used to conduct exploration investigations which are helping pave the way towards the first human mission to Mars.

This lunchtime talk is part of the SETI Institute Colloquium Series. Location is 515 N. Whisman Road, Mountain View, CA 94043. For more info, visit their web site <http://www.seti.org/csc/lectures>, e-mail info@seti.org, or phone 650-961-6633.



Karen Harris took this lovely photo of a Perseid meteor in the predawn sky over the South Tufa of Mono Lake on August 13, 2010. The 30-second photo was taken with a Sony A550 using a focal length of 18mm at f/3.5 and ISO-800.

What's Up by Ken Sperber (adapted from Sky and Telescope)

All times Pacific Daylight unless otherwise noted.

August

- 16 Mon First-Quarter Moon (11:14am)
- 19-20 Thur- Neptune is at opposition (visible all night; see www.SkyandTelescope.com/neptune for a chart)
- 24 Tue Full Moon (10:05am)
- 26-27 Thur- The Moon is within 6 (12) degrees of Jupiter on the 26th (27th) (Late evening)
- 31 Tue The Pleiades (M45) are about 6 degrees to the left of the waning gibbous Moon (4am-ish)
- 31 Tue Spica is 1 degree away from Venus (dusk)

September

- 1 Wed Last-Quarter Moon (10:22am)
- 1-5 Wed- Venus, Spica, and Mars are within 5 degrees of each other, visible in the west (Dusk)
- 6-21 Mon- Zodiacal Light visible in the eastern predawn sky (1-2 hours before sunrise)
- 8 Wed New Moon (3:30am)
- 14 Tue First-Quarter Moon (10:50pm)
- 17-19 Fri- Jupiter and Uranus are within 1 degree of each other (all night)
- 22 Wed Jupiter and Uranus are 6 degrees below the Moon (all night)
- 22 Wed Autumn Begins (8:09pm)
- 23 Thu Full Moon (2:17am)
- 27 Tue Regulus and Mercury are within 1 degree of each other in the lower west (Dusk)
- 30 Thu Last-Quarter Moon (8:52pm)



Ken Sperber took this image of a Perseid meteor in the predawn sky over the South Tufa of Mono Lake on August 13, 2010. Note the reflection of the meteor in the lake. The 25-second photo was taken with a Sony DSC-W300 using a focal length of 8mm at f/2.8 and ISO-400.



The Sun Can Still Remind Us Who's Boss

by Dr. Tony Phillips

Grab your cell phone and take a good long look. It's indispensable, right? It tells time, surfs the web, keeps track of your appointments and, by the way, also makes phone calls. Modern people can hardly live without one.

One good solar flare could knock it all out.

"In the 21st century, we're increasingly dependent on technology," points out Tom Bogdan, director of NOAA's Space Weather Prediction Center in Boulder, Colorado. "This makes solar activity an important part of our daily lives."

Indeed, bad space weather can knock out power systems, telecommunications, financial and emergency services—basically, anything that needs electronics to work. That's why NOAA is building a new fleet of "space weather stations," the GOES-R satellites.

"GOES-R will bring our existing fleet of weather satellites into the 21st century," says Bogdan. "They're designed to monitor not only Earth weather, but space weather as well."

NOAA's existing fleet of Geostationary Operational Environmental Satellites (GOES) already includes some space weather capabilities: solar ultraviolet and X-ray telescopes, a magnetometer and energetic particle sensors. GOES-R will improve upon these instruments and add important new sensors to the mix.

One of Bogdan's favorites is a particle detector named "MPS-Low," which specializes in sensing low-energy (30 eV – 30

keV) particles from the sun.

Who cares about low-energy particles? It turns out they can be as troublesome as their high-energy counterparts. Protons and other atomic nuclei accelerated to the highest energies by solar flares can penetrate a satellite's exterior surface, causing all kinds of problems when they reach internal electronics. Low-energy particles, particularly electrons, can't penetrate so deeply. Instead, they do their damage on the outside.

As Bogdan explains, "Low-energy particles can build up on the surfaces of spacecraft, creating a mist of charge. As voltages increase, sparks and arcs can zap electronics—or emit radio pulses that can be misinterpreted by onboard computers as a command."

The Galaxy 15 communications satellite stopped working during a solar wind storm in April 2010, and many researchers believe low-energy particles are to blame. GOES-R will be able to monitor this population of particles and alert operators when it's time to shut down sensitive systems.

"This is something new GOES-R will do for us," says Bogdan.

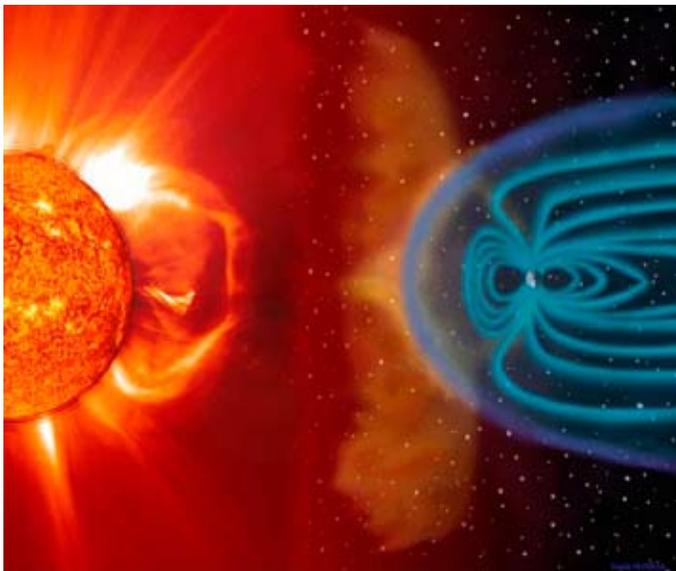
The GOES-R magnetometer is also a step ahead. It will sample our planet's magnetic field four times faster than its predecessors, sensing vibrations that previous GOES satellites might have missed. Among other things, this will help forecasters anticipate the buildup of geomagnetic storms.

And then there are the pictures. GOES-R will beam back striking images of the sun at X-ray and extreme UV wavelengths. These are parts of the electromagnetic spectrum where solar flares and other eruptions make themselves known with bright flashes of high-energy radiation. GOES-R will pinpoint the flashes and identify their sources, allowing forecasters to quickly assess whether or not Earth is in the "line of fire."

They might also be able to answer the question, Is my cell phone about to stop working?

The first GOES-R satellite is scheduled for launch in 2015. Check www.goes-r.gov for updates. Space weather comes down to Earth in the clear and fun explanation for young people on SciJinks, <http://scijinks.gov/space-weather-and-us>.

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



Artist's concept: In spite of Earth's protective magnetosphere, solar storms can wreak havoc with Earth satellites and other expensive electronics on the ground. Image Credit: NASA.

Tri-Valley Stargazers
P.O. Box 2476
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PRIMEFOCUS

Tri-Valley Stargazers Membership Application

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

Name _____ Phone _____ e-mail _____

Address _____

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

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

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