

# PRIMEFOCUS

Tri-Valley Stargazers



September 2012



## Meeting Info

### What:

Part 1: Show & Tell

Part 2: Lecture: How to  
Illuminate a Dark Galaxy with  
the Help of a Black Hole

### Who:

Dr. Sebastiano Cantalupo

### When:

September 21, 2012

Doors open at 7:00 pm

Show & Tell at 7:30 pm

Featured Speaker at 8:00 pm

### Where:

Unitarian Universalist  
Church in Livermore  
1893 N. Vasco Road

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## September Meeting

### How to Illuminate a Dark Galaxy with the Help of a Black Hole Sebastiano Cantalupo, Ph.D.

How do galaxies around us form their stars? In our current picture of galaxy formation these bright islands filled with stars should have begun their life from tiny density fluctuations of the rarefied primordial gas that fills the Universe. As this gas collapses due to gravity, it becomes denser, allowing the formation of stars. However, until the first stars form the galaxies do not emit any light in the visible range. Therefore this epoch of their life is very difficult to study. These "dark" phases of galaxy formation are still the most mysterious part of a galaxy's life. How long do they last? Are there galaxies that were never able to form stars? So far, searches with radio telescopes for "dark" galaxies in the local Universe around our own Milky Way have not been successful. Due to the faintness of the gas radio emission, this technique does not allow us to search the distant, early Universe where the probability to find such objects may be higher. In this lecture, I will discuss very recent searches for "dark" galaxies with a new method that allows us to detect these elusive objects at extremely large distances from us, corresponding to the first billion years in the history of the Universe. The idea is very simple: if these galaxies do not emit light, we will "shine" a bright light on them. The brightest sources of light in the Universe are produced by galaxies with supermassive black holes, called "quasars". Similar to a fluorescent material, when the gas in the "dark" galaxies is illuminated by a quasar it becomes visible at a very particular frequency or color. I will show how searching for this specific light around a quasar has produced the first sample of "dark" galaxies ever detected.

Sebastiano Cantalupo is currently a Postdoctoral Researcher at the University of California, Santa Cruz. He obtained his PhD in Astrophysics at the Federal Institute of Technology (ETH), Zurich, Switzerland in 2008 and his master's degree at the University of Padua, Italy in 2003. After his PhD studies, Sebastiano moved to the Institute of Astronomy, Cambridge, UK for a three-year appointment as a Postdoctoral Research Associate before arriving at UC Santa Cruz in 2011. Already during his PhD, Sebastiano enjoyed both the theoretical/numerical and observational approach to research in Astronomy. He likes to develop numerical codes to study complex phenomena like the transport of radiation within cosmological simulations (and to produce nice simulation pictures and movies) as well as conducting observation with the largest telescope facilities such as the Very Large Telescope in Chile and the W.M.Keck telescope in Hawaii.

### Show & Tell: Observing Reports

In the wake of the recent, highly successful H2O Open House (12 carloads of observers!) we would like to present member observing reports at the next meeting. Please prepare a short recollection of your experience of the event: what you did, telescopes viewed through, and objects observed.

## News & Notes

### 2012 TVS Meeting Dates

The following lists the TVS meeting dates for 2012. 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
Sep. 21	Sep. 24	
Oct. 19	Oct. 22	Sep. 28
Nov. 16	Nov. 19	Oct. 26
Dec. 21	Dec. 24	Nov. 30

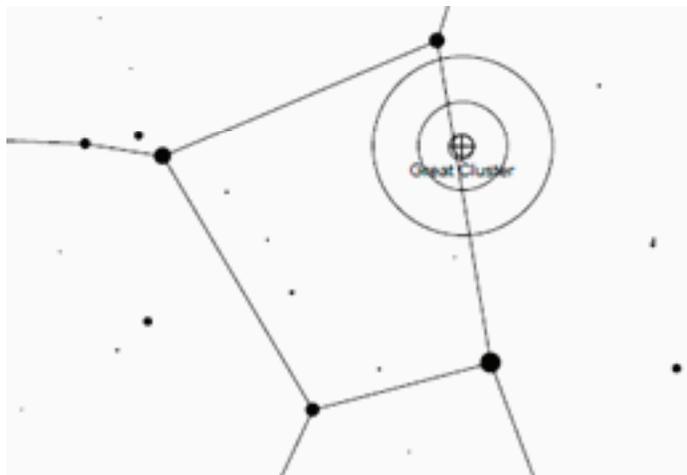
### Money Matters

Treasurer David Feindel indicates that as of July 8, 2012 the TVS checking account balance is \$12,302.78

## Observing Challenge by Todd Billeci

Introduction. To provide a shared experience for club members, observing challenges will be published periodically in Prime Focus. Club members are encouraged to try the observing challenges according to their experience level—Beginner, Intermediate or Advanced—and share results by posting observing reports to the TVS Yahoo group.

Beginner Challenge. The Hercules Propeller (M13). The great cluster in Hercules may be found by positioning a Telrad one-third the distance between Eta and Zeta Herculis. The cluster will be finder-visible as a bloated star.



A challenge when observing M13 is to detect the elusive "Hercules Propeller," a Y-shaped dark lane faintly visible within the globular cluster, just slightly off center. Dark-adapted eyes, averted vision, and magnification around 200X may be helpful.



M13: Historical drawing (1851)

Intermediate Challenge. Omega Nebula (M17). Starhop from Kaus Borealis to Polis. Moving the finder 5° northwest of Polis should center this bright object. A narrowband or OIII filter will significantly improve contrast. M17 is also known as the "swan" nebula; however, detection of the swan's features is challenging without large aperture. The elongated nebulosity with the letter "U" or "omega" asterism at one end is the swan's body. Given dark skies and averted vision, a faint trail of nebulosity may be observed curving back over the body, to give the swan's neck and head.



M17: Omega Nebula Historical Drawing (1875)

Header Image: What the heck is that?

## Observing Challenge (continued)

Advanced Challenge. NGC6520 / Barnard 86. This fine open cluster is located beside a dark nebula. Both objects should be visible in the same field of view. Starhop from Alnasl.



NGC6250

Todd welcomes your comments at [todd129@yahoo.com](mailto:todd129@yahoo.com)

Image Credits: M13: Bindon Stoney, Lord Rosse, 72-inch Newtonian, May 26th 1851, Birr Castle, Ireland. In 4th Earl of Rosse: Observation of Nebulae and Clusters at Birr Castle, Scientific Transactions of the Royal Dublin Society 2, 1880. M17: Léopold Trouvlot, Edward S. Holden, 26-inch refractor. 1875. Washington, USA Science Museum/Science and Technology Picture Library. NGC6520: Canada-France-Hawaii Telescope, Jean-Charles Cuillandre, Hawaiian Starlight, <http://www.cfht.hawaii.edu/HawaiianStarlight>

## Calendar of Events

### September 5, Noon-1:00pm

**What:** Coronal heating and acceleration and NASA's Solar Probe Plus mission  
**Who:** Stuart Bale, UC Berkeley  
**Where:** SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA  
**Cost:** Free

The thermodynamic temperature of the Sun's atmosphere rises from ~6000K at the visible surface to millions of degrees in its outer atmosphere, the corona. This hot coronal plasma then expands supersonically to become the solar wind; this wind acceleration process is ongoing to very high altitudes (~10 solar radii) There is no sufficient thermal energy source for this heating and expansion. However, remote sensing measurements of the coronal magnetic field suggest that the magnetic energy density is more than enough. Most of the proposed coronal heating/acceleration models involve the kinetic dissipation of plasma waves or turbulence, a process that is poorly understood. I will discuss some of these mechanisms and the associated puzzles.

The coming decade will be a golden age for coronal and heliospheric physics. Several dedicated NASA space missions (STEREO, SDO, IRIS) and the NSF's Advanced Technology Solar Telescope will provide high spatial resolution magnetic field and plasma observations of the transition region and corona. The Solar Orbiter and Solar Probe Plus missions will dive deep into the heliosphere and make low altitude (to 9.5 solar radii) in situ measurements. I will describe the Solar Probe Plus mission and its measurements in some detail.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

#### **Officers**

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#### **Historian:**

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[tvs@trivalleystargazers.org](mailto:tvs@trivalleystargazers.org)

#### **Eyes on the Skies**

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

### September 10, 7:30pm

**What:** The Supernova of a Generation: SN 2011fe  
**Who:** Dr. Joshua Bloom, UC Berkeley  
**Where:** California Academy of Science, 55 Music Con-  
course Dr., Golden Gate Park, San Francisco, CA  
**Cost:** Adults \$12, Seniors \$10, Academy members \$6.  
Reserve a Space Online or call 415-379-8000

When some stars die they produce remarkably bright “super-  
nova” fireworks. Supernovae, the main source of the iron in  
our bodies, have had a profound impact on science for cen-  
turies. More recently, some types of explosions—called “Ia”  
supernovae—were used to make precise measurements of  
distance that revealed the mysterious acceleration of the uni-  
verse. Despite their importance, however, scientists still do  
not know what sort of star (or stars) lead to such supernovae  
nor do they understand in detail the mechanisms responsible  
for such explosions. Well-studied nearby supernovae, which  
could shed light on these deep mysteries, are uncommon.  
This past year, a rare Type Ia supernova dubbed SN2011fe  
was discovered in the Pinwheel Galaxy. Dr. Bloom, one of the  
researchers who facilitated the discovery and subsequent  
observations, will discuss some of the breakthrough results  
from SN 2011fe in the context of supernova science as well as  
some of the broader implications of the discovery.

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

### September 12, Noon-1:00pm

**What:** Ice on the Move: From Io to Pluto  
**Who:** John Spencer, Southwest Research Institute  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

It’s perhaps no surprise that the cold worlds of the outer solar  
system often display surfaces covered in ice, though the ice  
composition is sometimes unexpected, including sulfur diox-  
ide or nitrogen ice, for instance, in addition to water ice. The  
motion of these ices as they sublime and condense can have  
profound effects on these worlds and their atmospheres.  
The variable patchy atmosphere of Io, the extreme albedo  
contrasts seen on small scales on Callisto and on large scales  
on Iapetus, and seasonal changes in the atmospheres of Plu-  
to and Triton, are all controlled by the movement of surface  
ices.

For more information see: <http://www.seti.org/csc/lectures/>,  
e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### September 15, 11:00am

**What:** Black Holes  
**Who:** Dr. Jason Dexter  
**Where:** UC Berkeley, Genetics and Plant Biology Building,  
Room 100

**Cost:** Free

Abstract pending.

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

### September 19, Noon-1:00pm

**What:** Active geologic processes in the solar system:  
Mars, Io and Icy Satellites  
**Who:** Cynthia Phillips, SETI Institute  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

Abstract pending.

For more information see: <http://www.seti.org/csc/lectures/>,  
e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### September 22, 7:30pm

**What:** Sustainability Base  
**Who:** Kristina Wilmoth, NASA-Ames Research Center  
**Where:** Mt. Tamalpais State Park, Cushing Memorial Am-  
phitheater, more commonly known as the  
Mountain Theater, Rock Spring parking area  
**Cost:** Free

NASA is using lessons and innovations from space explora-  
tion to build the government’s greenest building on Earth.  
Sustainability Base will be an evolving exemplar for the  
future of buildings.

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

### September 26, 7:00pm

**What:** Human Missions to Near Earth Asteroids: An  
Update on NASA’s Current Status and Proposed  
Activities for Small Body Exploration  
**Who:** Paul Abell, Johnson Space Flight Center  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

Abstract pending.

For more information see: <http://www.seti.org/csc/lectures/>,  
e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### October 3, Noon-1:00pm

**What:** Exploring the Dark Side of the Universe  
**Who:** Chris Fassnacht, UC Davis  
**Where:** SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
**Cost:** Free

In this talk Dr. Fassnacht will show how the powerful combina-

## Calendar of Events (continued)

tion of sensitive, high-resolution imaging with gravitational lensing can provide direct observational tests of galaxy formation scenarios under the cold dark matter paradigm as well as interesting constraints on cosmology. In particular, he will discuss the following two subjects. (1) Placing constraints on the Hubble Constant, curvature, and the dark energy equation of state parameter that are independent of and complementary to those obtained by other observational probes. Even with a single gravitational lens system it is possible to obtain precisions on these measurements that are comparable to those obtained by the other methods. (2) Placing observational constraints on the subhalo mass function by, for the first time, directly measuring masses of galaxy satellites outside of the Local Group. These measurements can be made even if the satellites are composed purely of dark matter. The imaging used for these projects comes from Keck adaptive optics (AO) and Hubble Space Telescope (HST) observations. In some cases the AO imaging is clearly sharper than that obtained with HST.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### October 10, 7:00pm

What: Europa's Great Lakes  
Who: Britney Schmidt, University of Texas at Austin  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

With an icy exterior covering a global ocean, Europa has long been a target of interest in the search for life beyond Earth. Europa exists in a dynamic environment, subject to intense irradiation and impact as well as immense tides from Jupiter. These processes deliver important thermal and chemical energy that could be critical to supporting a putative biosphere.

In the past few decades the debate about habitability of Europa has been focused strongly on the thickness of the ice shell. However, an arguably more critical question is: how does the ice shell recycle? New analysis of Europa's enigmatic "chaos terrains" indicates that chaos features form in the presence of a great deal of liquid water, and that large liquid water bodies exist within 3km of Europa's surface comparable in volume to the Great Lakes. The detection of shallow subsurface "lakes" implies that the ice shell is recycling rapidly and that Europa may be currently active.

In this presentation, we will explore environments on Europa and their analogs on Earth, from collapsing Antarctic ice shelves to subglacial volcanos in Iceland. Dr. Schmidt will present these new analyses, and describe how this new perspective informs the debate about Europa's habitability and future exploration.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

### October 17, Noon-1:00pm

What: Climate Change: What's Going On With the Sun?  
Who: Dan Lubin, SETI Institute  
Where: SETI Headquarters, 189 N. Bernardo Ave.,  
Mountain View, CA  
Cost: Free

Throughout the past century, while greenhouse gas (GHG) abundances have been steadily increasing and influencing Earth's climate, the Sun has remained relatively bright and quiescent. Solar cycles have been steadily active, with instantaneous sunspot numbers at solar maximum exceeding 100 in every cycle since 1893 (Cycle 13). The climate warming we have experienced since the beginning of the modern industrial era cannot be attributed to the Sun. However, the recent minimum between Cycles 23 and 24, and NASA predictions of a substantially lower sunspot number at the 2013 solar maximum, suggest that the Sun's recent bright and quiescent period may be ending. Both autocorrelation studies of recent solar cycles, and studies of solar analogs in nearby field stars, suggest a >40% chance of the Sun entering a new Maunder Minimum sometime in the Twenty First Century. During the historical Maunder Minimum (1645-1715), meteorological data from Europe and proxy records from global oceans indicate a substantially cooler climate, attributable to decreased solar irradiance. In our lifetime, we may therefore see a period of solar dimming in conjunction with increasing GHG abundances. A new Maunder Minimum would not entirely offset the projected GHG-induced warming (the GHG radiative forcing is at least three times larger than best estimates of the solar irradiance decrease). Instead, the complex interactions between radiative balance and atmospheric dynamics yield unusual regional patterns of pronounced warming versus cooling. This seminar will address the physical basis of climate change in the context of both GHG and solar variability, and will also extend the discussion to the influence of stellar variability upon habitable zones.

For more information see: <http://www.seti.org/csc/lectures>, e-mail [info@seti.org](mailto:info@seti.org), or phone 650-961-6633.

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

All times Pacific Daylight Time.

### September

- 1 Sat Venus 9 degrees south of Pollux
- 8 Sat **Last Quarter Moon (6:15am); Jupiter ~1 degree north of Moon (see Sept. S&T, p. 48)**
- 9 Sun Ceres 0.6 degrees south of Moon
- 12 Wed Venus 4 degrees north of Moon
- 13 Thur Algol at minimum for 2 hours centered on 10:02pm
- 14 Fri Thin crescent Moon to lower-right of Regulus (1 hour before dawn)
- 14-28 Fri- Zodiacal light visible in the east 1-2 hours before sunrise
- 15 Sat **New Moon (7:11pm)**
- 18 Tue Moon well to Saturn's left (evening)
- 19 Wed Moon just left of Mars (evening)
- 22 Sat Autumn begins (7:49am)
- 22 Sat **First Quarter Moon (12:41pm)**
- 27 Thur Neptune 6 degrees south of the Moon
- 29 Sat **Full Moon (8:19pm)**
- 30 Sun Uranus 5 degrees south of the Moon; Mercury 1.8 degrees north of Spica

### October

- 1-5 Mon- Venus within 0.25 degrees of Regulus for North America (see October S&T, p. 48)
- 5 Fri Waning Gibbous Moon 3-4 degrees below Jupiter (~10pm onward)
- 8 Mon **Last Quarter Moon (12:33am)**
- 12 Fri Venus 6-7 degrees left of crescent Moon (Dawn)
- 13-27 Sat- Zodiacal light visible in the east (~2 hours before sunrise)
- 15 Mon **New Moon (5:02am)**
- 17-18 Wed- Crescent Moon near Mars and Antares, low in the west (Dusk)
- 18-22 Thur- Mars passes a few degrees above Antares, compare these similarly colored objects (45-90 minutes after sunset)
- 20-22 Sat- Orionid Meteor Shower (see October S&T, p. 50)



## A Brand New Age: Queue Observing at Mt. Paranal

By Dr. Marc J. Kuchner

First a caravan of white observatory cars arrives, winding up the narrow road to the 2600-m- (~8500-foot-) high summit. Then the shutters around the domes open, and rays from the setting sun alight on colossal mirrors and metal struts. It's the beginning of another busy night at Mt. Paranal, Chile, where I am learning about new, more efficient ways of managing a modern observatory.

I stepped into the observatory's control room to soak up some of the new, unfamiliar culture. Here, under florescent lights and drop ceilings are banks of computer screens, one bank to control each of the four big telescopes on the mountaintop and a few others too. At each bank sits two people, a telescope operator and an astronomer.

The layout of this workspace was not unfamiliar to me. But the way these Mt. Paranal astronomers work certainly was. When I was cutting my teeth at Mt. Palomar observatory in California, I would only go to the telescope to take my own data. In stark contrast, everyone observing at Mt. Paranal tonight is taking data for someone else.

The Mt. Paranal astronomers each spend 105 nights a year here on the mountain performing various duties, including taking data for other astronomers. The latter, they call "executing the queue." Headquarters in Germany decides what parts of the sky will have priority on any given night (the queue). Then the Mt. Paranal astronomers march up the

mountain and carry out this program, choosing calibrators, filling the log books, and adapting to changing conditions. They send the data back to headquarters, and from there it makes its way out to the wider astronomical community for study.

This new way of working allows the Mt. Paranal astronomers to specialize in just one or two telescope instruments each. Surely this plan is more efficient than the old-fashioned way, where each of us had to learn every instrument we used from scratch—sifting through manuals at 3:00 AM when the filter wheel got stuck or the cryogen ran out, watching precious observing time tick away. Here at Mt. Paranal, much of the work is done in a big room full of people, not off by yourself, reducing some dangers of the process. Also, queue observing cuts down on plane travel, an important step for cutting carbon emissions.

It's a brand new age, I thought as I watched the giant domes spin in the silent, cold Chilean night. And maybe with queue observing, some of the romance is gone. Still, my colleagues and I couldn't help saying as we stared out across the moonlit mountains: I can't believe how lucky we are to be here.

Dr. Marc J. Kuchner is an astrophysicist at the Exoplanets and Stellar Astrophysics Laboratory at NASA's Goddard Space Flight Center. NASA's Astrophysics Division works on big questions about the origin and evolution of the universe, galaxies, and planetary systems. Explore more at <http://www.science.nasa.gov/astrophysics/>. Kids can explore these topics at <http://spaceplace.nasa.gov/space>.



Image Caption: European Southern Observatory at Mt. Paranal, Chile.

Tri-Valley Stargazers  
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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.