PRIMEFOCUS

Tri-Valley Stargazers

November 2012

Meeting Info

What:
Astronomy at 40,000 Feet,
SOFIA Early Science Results

Who:
Robert Brauer

When:
November 16, 2012
Doors open at 7:00 pm
Featured Speaker at 7:30 pm
Show and Tell, afterward

Where:
Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

Inside

News & Notes	2
Journal Club	2
Calendar of Events	4
What's Up	6
NASA Space Place	7
Membership/Renewal Application	8

November Meeting

Astronomy at 40,000 Feet, SOFIA Early Science Results

Robert Brauer

After achieving the First Light Flight in 2010, the Stratospheric Observatory For Infrared Astronomy (SOFIA) obtained science data during its first full year of science operation in 2011. This year was called the Early Science phase. Robert Brauer from the SOFIA Science Project at NASA Ames Research Center will share science results from 2011 as well as show some fun videos.

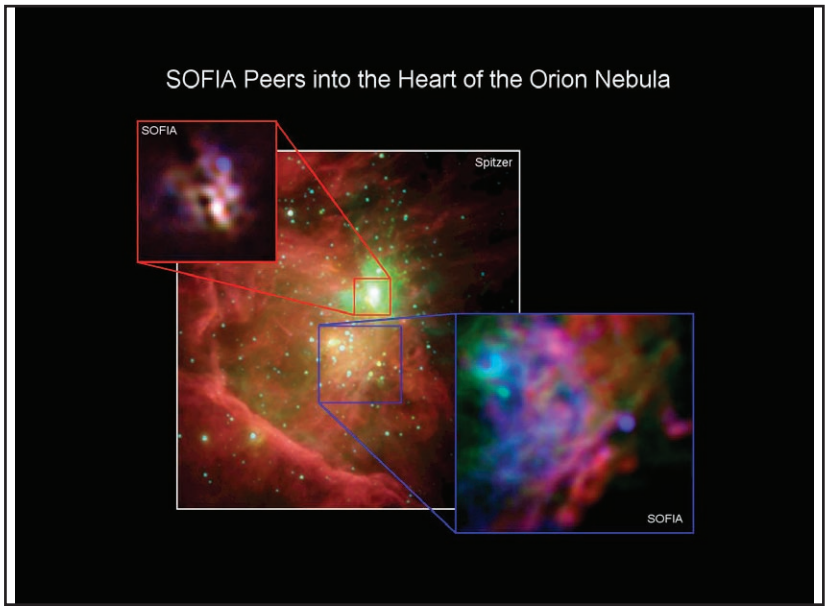


Image Caption: This graphical representation from the SOFIA Science Center compares two infrared images of the heart of the Orion nebula captured by the FORCAST camera on the SOFIA airborne observatory's telescope with a wider image of the same area from the Spitzer space telescope. (SOFIA image: James De Buizer / NASA / DLR / USRA / DSI / FORCAST; Spitzer image: NASA/JPL)

Robert Brauer is the Product Assurance Manager for Universities Space Research Association (USRA), the prime contractor for SOFIA. Robert is responsible for planning, directing, and implementing all Safety, Reliability, Maintainability, and Quality Assurance activities for USRA.

Show & Tell

There is no formal topic for Show and Tell this month. Contact Todd Billeci and/or Gert Gottschalk if you are interested in giving a short presentation.

News & Notes

2012/2013 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**
Nov. 16	Nov. 19	
Dec. 21	Dec. 24	Dec. 07
Jan. 18, 2013	Jan. 21	Jan. 04
Feb. 15	Feb. 18	Feb. 01
Mar. 15	Mar. 18	Mar. 01
Apr. 19	Apr. 22	Apr. 05
May 17	May 20	May 03
Jun. 21	Jun. 24	Jun. 07
Jul. 19	Jul. 22	Jul. 05
Aug. 16	Aug. 19	Aug. 02
Sep. 20	Sep. 23	Sep. 06
Oct. 18	Oct. 21	Oct. 04
Nov. 15	Nov. 18	Nov. 01
Dec. 20	Dec. 23	Dec. 06

Money Matters

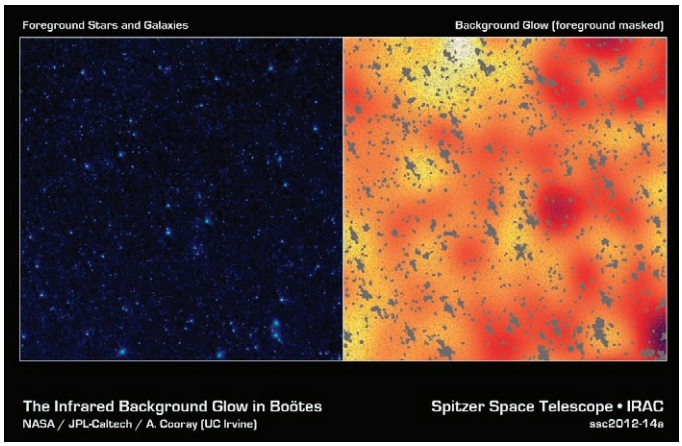
Treasurer David Feindel indicates that as of July 8, 2012 the TVS checking account balance is $12,302.78

Journal Club by Ken Sperber

Heat Rash

In 1933, Fritz Zwicky, an astronomer who worked for the California Institute of Technology (think Palomar Observatory), postulated the existence of dark matter as being necessary to hold galaxies and galaxy clusters together. He came to this conclusion based on observations of the Coma Cluster, finding that the total gravitational mass of the cluster far exceeded the mass expected from the stellar luminosity (brightness) alone. Additionally, the Milky Way (and other spiral galaxies) require the presence of dark matter in order to explain the high velocity of stars that rotate about the outskirts of the galaxy. If dark matter were not present, these stars would have flown off into the cosmos long ago, as they would not have been gravitationally bound to the galaxy.

In the present view of the make-up of the universe, dark matter constitutes about 84% of the total matter in the universe. As the name implies, dark matter can't be seen (it doesn't interact via the electromagnetic force), but its effect is manifested by its gravitational influence. The clumping of dark matter forms the "backbone" structure on which normal matter is concentrated, and along which galaxies and clusters of galaxies are found. When galaxies collide, the dark matter halo gets larger, and the stars and gas are believed to



Caption: The image on the left shows a portion of our sky, called the Boötes field, in infrared light, while the image on the right shows a mysterious, background infrared glow captured by NASA's Spitzer Space Telescope in the same region of sky. Using Spitzer, researchers were able to detect this background glow, which spreads across the whole sky, by masking out light from galaxies and other known sources of light (the masks are the gray, blotchy marks). Image credit: NASA/JPL-Caltech/UC Irvine

fall to the center of the dark matter halo.

As it turns out, this may not be entirely true. Cooray et al. (2012, NATURE, 490, 514-516) looked at the Bootes Constellation for 250 hours with the Spitzer Space Telescope. They were studying the infrared (IR) background, which heretofore has been largely unexplained. The two leading hypotheses for the IR background are that (1) it is caused by the first stars and galaxies, and (2) it is the result of star streams that have been shed from colliding galaxies. As seen in the figure above, after masking out light from galaxies and other known light sources, the authors isolated the IR background over a region of the sky covering the equivalent of 50 full moons. They were able to characterize the size distribution of the blotches, and they concluded that the glow is too bright to have come from the first stars and galaxies. Rather, the authors suggest that tidal streams of stars stripped off during galaxy collisions can account for the IR background. The Hubble Legacy image of Arp 188 on p.3 is an excellent example of tidal star streams resulting from a galactic collision. The authors estimate if only 1 in 1000 stripped stars does not fall to the center of the dark matter halo, then the IR background is accounted for by interacting galaxies.

For more information see: http://www.universetoday.com/98166/dark-matter-halos-may-contain-stars/, http://www.jpl.nasa.gov/news/news.php?release=2012-334-&rn=news.xml&rst=3562, http://www.nature.com/nature/journal/v490/n7421/full/nature11474.html?WT.ec_id=NATURE-20121025, and http://en.wikipedia.org/wiki/Fritz_Zwicky

Header Image: SOFIA, the Stratospheric Observatory for Infrared Astronomy, is housed in a Boeing 747SP. The primary mirror has a diameter of 2.7 meters, and is senstive to IR light in the range of 0.3-1600 microns. Photo Credit: NASA/Carla Thomas.

Explanation: In this stunning mage of Arp 188 is from the Hubble Legacy Archive, as processed by Bill Snyder. Arp 188 is 420 million light-years distant toward the constellation Draco. Its tidal tail is about 280 thousand light-years long and features massive, bright blue star clusters. One story goes that a more compact intruder galaxy crossed in front of Arp 188 - from right to left in this view - and was slung around behind the Tadpole by their gravitational attraction. During the close encounter, tidal forces drew out the spiral galaxy's stars, gas, and dust forming the spectacular tail. The intruder galaxy itself, estimated to lie about 300 thousand light-years behind the Tadpole, can be seen through foreground spiral arms at the upper right. Arp 188 will likely lose its tail as it grows older, the tail's star clusters forming smaller satellites of the large spiral galaxy. This was the Astronomy Picture of the day on November 8, 2012.

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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

November 13, 12:00pm

What: Climate Change Impacts in the Arctic Ocean
Who: Kevin Arrigo, Stanford University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Sea ice in the Arctic Ocean is in rapid decline. This reduction in ice extent and thickness has resulted in a longer open water season and higher marine productivity. Until recently, phytoplankton blooms on continental shelves were thought to be restricted to waters free of sea ice. However, during the summer of 2011 in the Chukchi Sea, a large phytoplankton bloom was observed for the first time beneath fully consolidated pack ice and extended from the ice edge to >100 km into the pack. This has been made possible by a thinning sea ice cover with more numerous melt ponds over the past decade that has enhanced light penetration through the sea ice into the upper water column.

These and other observations suggest that phytoplankton blooms are currently widespread on nutrient-rich Arctic continental shelves and that past estimates of annual primary production in waters where under-ice blooms develop are ~10-fold too low. These massive phytoplankton blooms represent a marked shift in our understanding of Arctic marine ecosystems and their early timing can potentially disrupt life cycle strategies of both resident and migratory Arctic species.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

November 20, Noon-1:00pm

What: On the long-term orbital evolution of the natural satellites
Who: Benoit Noyelles
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The natural satellites of the giant planets of our Solar System are nearly all locked into resonances. There are spin-orbit resonances, resulting in synchronous rotations as for our Moon, but also orbital resonances between them. This configuration cannot be the result of a random process but is the consequence of slow dissipation acting over the ages, driving the system into a dynamical equilibrium.

Quantifying this dissipation yields clues on the internal structure of these bodies and their parent planets. A good way to quantify this process is to elaborate accurate orbital ephemerides of these bodies, in which this dissipation is considered. For that, we must dispose of the last 100 years of astrometric observations.

In this talk, Dr. Noyelles will explain how the orbital dissipation in Jupiter was quantified, present a surprising result for the Saturnian satellites that could explain the formation of the Cassini Division, and discuss some dynamical aspects of the satellites of Uranus.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

November 27, Noon-1:00pm

What: The Algorithmic Origins of Life
Who: Sara Walker, BEYOND Center, ASU
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The origin of life is arguably one of the greatest unanswered questions in science. A primary challenge is that without a proper definition for life – a notoriously challenging problem in its own right – the problem of how life began is not well posed. Here we propose that the transition from non-life to life may correspond to a fundamental shift in causal structure, where information gains direct, and context-dependent, causal efficacy over matter, a transition that may be mapped to a nontrivial distinction in how living systems process information.

Dr. Walker will discuss potential measures of such a transition, which may be amenable to laboratory study, and how the proposed mechanism corresponds to the onset of the unique mode of (algorithmic) information processing characteristic of living systems.

For more information see: http://www.seti.org/csc/lectures, e-mail info@seti.org, or phone 650-961-6633.

December 3, 7:30pm

What: Near-Earth Objects: Finding Them Before They Find Us
Who: Dr. Donald Yeomans, NASA JPL
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Adults $12, Seniors $10, Academy members $6. Reserve a Space Online or call 415-379-8000

Of all the natural disasters that could befall us, only an Earth impact by a large comet or asteroid has the potential to end civilization in a single blow. Yet these near-Earth objects also offer tantalizing clues to our solar system's origins, and someday could even serve as stepping-stones for space exploration. Donald Yeomans introduces the public to the science of near-Earth objects—its history, applications, and ongoing quest to find near-Earth objects before they find us.

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

Calendar of Events (continued)

December 4, 7:00pm

What: NASA's Curiosity Rover: Four Months on Mars
Who: Ashwin Vasavada, Deputy Scientist of the MSL Mission, Jet Propulsion Lab
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, or phone 650-961-6633.

December 11, 9:30am - 2:00pm

What: Senior Day
Who: You
Where: Chabot Space & Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Tickets: $28 per person (Groups of 12 or more)/$30 Individual, Registration Closes December 7th; To register contact us at (510) 336-7373 or Group sales@ChabotSpace.org

Join us for an exclusive day tailored just for Senior Citizens. This all-inclusive package includes lunch, the planetarium show Tales of the Maya Skies, a tour of the observatory, along with self-guided exhibit exploration and activities highlighting Maya Culture. Special Rates for Groups of 12 or more.

For more information see: http://www.chabotspace.org/events.htm

December 11, 7:00pm

What: Ten Days To The End of the World?
Who: David Morrison, Ed Krupp and Andy Fraknoi
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, or phone 650-961-6633.

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

Pacific Standard Time

November

11	Sun	Venus 5 degrees and Spica 1 degree north of Moon
12	Mon	Saturn 4 degrees north of Moon
13	Tue	New Moon (2:08pm)
14	Wed	Moon at perigee
15	Thu	Venus 4 degrees north of Spica
16	Fri	Mars 4 degrees and Pluto 0.1 degrees south of Moon
17-18	Sat	Leonid Meteor Shower (best am-predawn)
20	Tue	First Quarter Moon (6:31am)
23	Fri	Uranus 5 degrees south of the Moon
27-12	Tue-	Best Mercury apparition of the year, 6-10 degrees lower-left of Venus (1 hour before dawn)
27	Tue	Venus 0.6 degrees south of Saturn
28	Wed	Full Moon, Jupiter located 0.6 degrees to the north (6:46am)

December

2-3	Sun-	Jupiter at opposition, visible all night (see p.52 December S&T)
6	Thu	Last Quarter Moon (7:31am)
8-9	Sat-	Vesta at opposition, visible all night (see p.50 December S&T)
9-11	Sun-	Crescent Moon near Spica (9th), Saturn (10th), Venus and Mercury (11th)
13	Thu	New Moon (12:42am)
13-14	Thu-	Geminid Meteor Shower (see p.52 December S&T)
17-18	Mon-	Ceres at opposition (visible all night; see p.50 December S&T)
19	Wed	First Quarter Moon, Uranus 5 degrees south of Moon (9:19am)

A Cosmic Tease: Trials of the Herschel Space Telescope Science Teams

By Dr. Marc J. Kuchner

Vast fields of marble-sized chunks of ice and rock spun slowly in the darkness this week, and I sat in the back of a grey conference room with white plastic tables spread with papers and laptops. I was sitting in on a meeting of an international team of astronomers gathered to analyze data from the Herschel Infrared Observatory. This telescope, sometimes just called Herschel, orbits the Sun about a million miles from the Earth.

The meeting began with dinner at Karl's house. Karl charred chorizo on the backyard grill while the airplanes dribbled into Dulles airport. Our colleagues arrived, jetlagged and yawning, from Germany, Sweden, and Spain, and we sat on Karl's couches catching up on the latest gossip. The unemployment level in Spain is about twenty percent, so research funding there is hard to come by these days. That's not nice to hear. But it cheered us up to be with old friends.

The meeting commenced the next morning, as the vast fields of ice and rock continued to spin—shards glinting in the starlight. Or maybe they didn't. Maybe they didn't exist at all.

You see, this team is looking at a series of images of stars taken by a device called a bolometer that is blind to ordinary starlight. Instead, the bolometer inside Herschel senses infrared light, a kind of light that we would probably refer to as heat if we could feel it. But the idea of pointing the bolometer at the stars was not to collect ordinary starlight. It was to measure heat coming from the vicinity of these stars, like an infrared security camera, in case there was something else to be found lurking nearby.

And lo and behold, for a handful of stars, the bolometer measurements were off the charts! Maybe something was orbiting these stars. From the details of the bolometer readings—which channels lit up and so on—you would guess that this stuff took the form of majestic fields or rings of icy and rocky particles. It would be a new kind of disk, a discovery worth writing home to Madrid about.

There are several teams of astronomers analyzing data from the Herschel Space Telescope. They call themselves by oddly inappropriate sounding acronyms: GASPS, DUNES, DEBRIS. For the time being, the scientists on these teams are the only ones with access to the Herschel data. But in January, all the data these teams are working on will suddenly be released to the public. So they are all under pressure to finish their work by then. The team whose meeting I was sitting in on would like to publish a paper about the new disks by then.

Figure Caption: Samuel Pierpoint Langley, who developed the bolometer in 1878. His instrument detects a broad range of infrared wavelengths, sensitive to differences in temperature of one hundred-thousandth of a degree Celsius (0.00001 C). In 1961, Frank Low developed the germanium bolometer, which is hundreds of times more sensitive than previous detectors and capable of detecting far-infrared radiation.

But it's not so simple. The stars that this team had measured were relatively nearby as stars go, less than a few hundred light years. But the universe is big, and full of galaxies of all kinds—a sea of galaxies starting from maybe a hundred thousand light years away, and stretching on and on. Maybe one of those background galaxies was lined up with each of the stars that had lit up the bolometer—fooling us into thinking they were seeing disks around these stars.

The team argued and paced, and then broke for lunch. We marched to the cafeteria through the rain. Meanwhile, vast fields of marble-sized chunks of ice and rock spun slowly in the darkness. Or maybe they didn't.

What else did Herschel recently uncover? Find out at http://spaceplace.nasa.gov/comet-ocean.

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/.

Tri-Valley Stargazers
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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.