PRIMEFOCUS

Tri-Valley Stargazers

February 2013

Meeting Info

What:
The Birth of Star Clusters

Who:
Prof. Steve Stahler
UC Berkeley

When:
February 15, 2013
Doors open at 7:00 p.m.
Show & Tell at 7:30 p.m.

Featured Speaker at 8:00 p.m.

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

Inside

February Meeting

The Birth of Star Clusters

Prof. Steve Stahler

Stars are forming all around us, all the time. While a few are clumped into well-known groups, like the Pleiades and Hyades, the vast majority seem to be randomly scattered throughout space. Astronomers have discovered, however, that all stars are in fact born into compact groups. Most survive only a few million years, but some last much longer. Prof. Stahler will discuss a unifying theory for all stellar groups that promises to explain these observations.

Steven Stahler is an astrophysicist at the University of California, Berkeley. Raised in Maryland, he attended graduate school at Berkeley in physics. He was a professor at MIT before returning to the Bay Area in 1992. His research centers on the problem of star formation, which he has attacked from many different perspectives. He is the author, along with Francesco Palla, of The Formation of Stars (Wiley, 2004), the first comprehensive text in this field. Steve especially enjoys the esthetic aspect of his research, which he tries to convey in his public talks and articles. Not coincidentally, he is also an accomplished artist. For more information, and a sampling of recent sketches, see http://www.astro.berkeley.edu/~stahler.

Urgent: TVS Needs a New Program Director and Vice-President

Due to increased responsibilities at work, Todd Billeci will no longer be able to serve a TVS Vice-President and as the Program Director. Let's thank Todd for his service to the club.

The Program Director position is extremely important for the viability of the club. The main duty of the Program Director is to solicit speakers for the monthly meetings. With the summer barbecue and the Holiday Potluck, the club aims to have 10 speakers per year. With LLNL, UC Berkeley, LBNL, AMES, and UC Santa Cruz in our region, many candidates for presentations are in our vicinity.

The main duty of the Vice-President is to fill in for the President, when the President is unavailable. This could include opening the church for our monthly meeting, and hosting of said meeting.

Anyone interested in either (or both) of these positions is encouraged to contact any of the club officers via email or at the monthly meeting. All are encouraged to take an active role in TVS, including influencing the changing vision of the club.

News & Notes

2013 TVS Meeting Dates

The following lists the TVS meeting dates for 2013. 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**
Feb. 15	Feb. 18	
Mar. 15	Mar. 18	Feb. 22
Apr. 19	Apr. 22	Mar. 29
May 17	May 20	Apr. 26
Jun. 21	Jun. 24	May 24
Jul. 19	Jul. 22	Jun. 28
Aug. 16	Aug. 19	Jul. 26
Sep. 20	Sep. 23	Aug. 30
Oct. 18	Oct. 21	Sep. 27
Nov. 15	Nov. 18	Oct. 25
Dec. 20	Dec. 23	Nov. 29

Money Matters

Treasurer David Feindel indicates that as of November 16, 2012 the TVS account balance is:

Checking $11,857.26

Journal Club by Ken Sperber

By the Light of the Silvery Moon?

Nature works in mysterious ways. Though I never gave it any thought, if you'd have asked me if this column would contain information on dung beetles, I'd have thought you were crazy! But first, ...

We and the creatures of this planet have adapted to the rhythm of the Earth in the cosmos. The prime example is the circadian rhythm, as our sleep cycle has synchronized with the 24-hour rotation period of the Earth. As part of their circadian rhythm, box jellyfish tend to descend to deeper (and therefore darker) water during daylight hours. A more curious example is the appearance of multitudes of box jellyfish in the waters off of Hawaii beginning about 7 days after a Full Moon through ~5 days thereafter. The observations indicate that when certain high tides occur at night (when the jellies are closer to the surface) the jellies are washed over the reefs that surround the islands, and they get trapped in the shallower waters nears the beaches. At these times it is wise to stay out of the water, lest you increase your chances of being stung. Their sting, though not usually deadly, is reportedly more painful than that of the Portuguese Man-of-War. When planning your next trip to Hawaii, consult the Box Jelly Calendar posted by the Waikiki Aquarium: http://www.waquarium.org/boxjelly-calendar.html

Now to dung beetles and their link to the cosmos. In the US alone, the dung beetle is estimated to save the cattle industry $380 million per year, since they help clear the surface of livestock excrement. The beetles recycle nutrients to the deep soil and remove a key breeding source for flies and other pests. The dung is a food source for the beetles and their developing larvae.

So, what's a hungry dung beetle to do when he finds a source of food. Some species are "rollers." They will roll the dung into ball, and much like a log rolling competition, the beetle will perch on top of the dung ball and scurry along rolling the ball, up to 10 times their weight, to a safe underground haven. They must retreat with their find quickly, as other beetles lie in wait to try to steal their quarry. The quickest route to their lair is a straight line. So, how do beetles orient themselves when it is night? Previous research has found that dung beetles orient themselves by moonlight at night, polarized light during twilight, and of course the Sun during daytime.

But how does a dung beetle find its way on a moonless night? While humans, birds, and seals are known to use starlight to orient themselves, this trait has never been demonstrated in insects. As such, Dacke et al. (2013, Current Biology, 23, 1-3) hypothesized that the beetles orient themselves by starlight on moonless nights. To test their hypothesis, the authors performed 3 sets of experiments: two out in the open and one in a planetarium. All 3 experiments used circular arenas into which the dung beetles were released at the center.

In Experiment 1 the authors measured the distance the dung balls were rolled until they were radially 1.2 meters away from the release point at the center of the arena. Under a moonless sky the average distance covered was ~2.1 meters, but when the beetles were prevented from seeing the night sky they took a more erratic course, needing to cover 4.8 meters of ground until they were 1.2 meters distant from the release point.

Experiments 2 and 3 timed how long it took the dung rolling beetles to reach the edge of the arena after being released in the center. Experiment 2 took place outside, while experiment 3 took place in a planetarium using the same arena and methodology. For reference, outside under a moonlit sky it took the beetles ~21 seconds to reach the arena boundary. Outside and in the planetarium consistent results were obtained: (a) Under a moonless starry sky with the Milky Way visible it took the beetles ~42 seconds to reach the arena boundary, and (b) Outside under overcast conditions or with the beetles' eyes covered, and in a completely dark planetarium (no sky projection) it took the beetles ~122 seconds to reach the arena boundary, a statistically significant longer time compared to (a).

Header Image: The Double Cluster (NGC884/869) from H2O by Ken Sperber on November 27, 2005. Ken used a Takahashi FS-102 at f/6 and an SBIG ST-2000XM. LRGB exposures were 3x10 minutes.

Journal Club (continued)

The benefit of the planetarium is that other idealized experiments could be performed. It took the beetles more than 80 seconds to reach the arena edge when only 18 of the brightest stars were projected on the dome. This is also statistically longer than for the starry sky with the Milky Way present (~42 seconds). When only the diffuse light of Milky Way was projected (no other foreground stars) it took ~53 seconds for the beetles to reach the arena edge. This time was not statistically different relative to the 42 seconds for the starry sky with the Milky Way.

The authors' testing indicates that dung beetles orient themselves by the diffuse light of the Milky Way. They anecdotally support this result by citing previous observational work that showed that dung beetles are "unable to roll along straight tracks on moonless nights" when the Milky Way is not visible.

For more information see: http://www.sciencedirect.com/science/article/pii/S0960982212015072 http://www.bbc.co.uk/news/science-environment-21150721 and http://en.wikipedia.org/wiki/Dung_beetle

Calendar of Events

February 12, Noon-1:00pm

What: Surface exploration of small solar system bodies: challenges and prospects
Who: Marco Pavone, Stanford University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

In recent years, space agencies worldwide have shown an increasing interest in the exploration of small solar system bodies. Of special importance is direct access to their surfaces, as it allows precise characterization of soil properties and surface physics, and, in turn, holds the potential to lead to a much improved understanding about the origins and evolution of the solar system.

Surface exploration of small bodies, however, presents daunting technological challenges. In this talk, Dr. Pavone will discuss past attempts together with recent advancements in the field of microgravity planetary rovers, including wheeled rovers, legged rovers, tethered robots, and hoppers. When tasked with operation in microgravity, these rovers must be able to function in unprecedented conditions, where traction is almost non-existent, environmental characteristics are extreme, and sharp regolith, boulders, and loose dust are dominant features of the landscape. In the final part of his talk, Dr. Pavone will focus on a reference mission to Phobos, whose aim would be to address both high-priority science objectives identified for Mars' moons and strategic knowledge gaps for future human exploration in the Martian system.

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

February 16, 11:00am - 4:00pm

What: Invention Experience
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Included with General Admission. Tickets available online or by calling (510) 336-7373.

They did it again! NASA's newest Centennial Challenge, Night Rover and the I.S.I.S Project have joined forces with us to of-

Journal Club (continued)

fer an epic, hands-on day of exploration and creation that will have the Center jumping. In the spirit of the NASA Night Rover Challenge, Invention Experience invites students to invent, prototype, and present their own ideas. Prize drawings, giveaways, face to face with experts in the field and more.

See http://www.chabotspace.org/events.htm for more information.

February 19, 7:00pm

What: How to Catch a Moon of Pluto (and what to do with it when it's caught)
Who: Mark Showalter, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Our recent discoveries of two small moons orbiting Pluto raise interesting new questions about how the dwarf planet formed. We now know that a total of four outer moons circle around a central "double-planet" comprising Pluto and its large, nearby moon Charon. NASA's New Horizons spacecraft will arrive at Pluto in July 2015, and the new discoveries come just in time for the science planners to target close-up views of the tiny bodies during the flyby. However, the discoveries also come as a mixed blessing--small moons often raise clouds of dust, prompting concerns about a possible hazard to the spacecraft when it flies through the system at more than 10 km per second.

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

February 22, Noon-1:00pm

What: Adventures of a Vatican Astronomer
Who: Guy Consolmagno, Vatican Observatory
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

No scientist is a Spock-like android; a scientist's work is as intuitive, and just as full of human foibles, as a painting, a symphony, or a prayer. But most of us don't have the opportunity (or training) to reflect on the human dimensions of our work. Br. Guy Consolmagno does; he is both a Jesuit brother and a planetary scientist at the Vatican Observatory, splitting his time between the meteorite collection in Rome (which he curates) and the Vatican telescope in Arizona. Thanks to his Vatican connections, his work has sent him around the world several times to dozens of countries and every continent (including a meteorite hunting expedition to Antarctica). In this talk he will share some of those adventures, and reflect on the larger meaning of our common experience as scientists... not only what we do, but why we do it.

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

February 26, Noon-1:00pm

What: Star Formation through Radio Eyes: Probing Magnetic Fields with CARMA
Who: Chat Hull, UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

How do stars form? How can we use radio waves to probe the origins of stars within their cold, dusty natal clouds? And how do magnetic fields affect the star-formation process? Come and find out how I use CARMA, a millimeter-wave radio telescope in the Eastern Sierras, to find answers to these questions. I will begin by discussing the basics of radio astronomy, radio telescopes, and star formation. I will then talk about the research I've been doing on polarization and magnetic fields in forming stars, using the dual-polarization receiver system that I helped install and commission at CARMA.

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

March 5, Noon-1:00pm

What: The High Time Resolution Universe Survey and Searches for Extragalactic Pulses
Who: Sarah Spolaor, Jet Propulsion Laboratory
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Abstract unavailable.

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

March 11, 7:30pm

What: Where Will Curiosity Take Us? Following the Mars Science Laboratory Rover as it Explores the Red Planet
Who: Jennifer Blank, Bay Area Environmental Research Institute, NASA/Ames Research Center
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Adults $12, Seniors $10, Academy members $8. Reserve a Space Online or call 1-877-227-1831

NASA's most recent visitor to Mars, "Curiosity," touched down last August in Gale Crater. Curiosity is a rolling, robot geologist, carrying high resolution cameras and a suite of sophisticated analytical instruments which make up the Mars Science Laboratory. Blank is a member of the MSL Science Team, whose main goal is to discover clues in the rocks and soils on Mars that will indicate whether Mars once was capable of supporting life. Come hear Dr. Blank talk about Curiosity's

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first few months on Mars, the first discoveries, and the drive toward Mount Sharp, the rover's ultimate destination.

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

March 12, 7:00pm

What: A Different Universe
Who: Robert Laughlin, Stanford
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Abstract unavailable.

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

March 22 16, 6:00pm - 7:30pm

What: Future Fridays
Who: Prof. Alex Filippenko, UC Berkeley
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: $20 Members, $23 Guests, $29 at the Door, Space is Limited. Advanced registration is highly encouraged. Tickets available online or by calling (510) 336-7373

Alex Filippenko was a member of both teams whose leaders were awarded the 2011 Nobel Prize in Physics for discovering the accelerating Universe. Voted the "best professor" on the UC Berkeley campus a record nine times, and the 2006 National Professor of the Year, he is frequently featured in "The Universe" series on The History Channel.

Mysterious dark matter and dark energy are aspects of our Universe that we cannot see, taste, or feel, but they are very important: dark matter keeps galaxies gravitationally bound, and dark energy is accelerating the expansion of the Universe. We wouldn't exist without dark matter, or if dark energy were much stronger than it is!

See http://www.chabotspace.org/events.htm for more information.

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

Pacific Standard Time until March 10, Pacific Daylight Time thereafter.

February

7-8	Thu-	Mars within 1 degree of Mercury in WSW (dusk)
9	Sat	New Moon (11:20pm)
10	Sun	With binoculars, the crescent Moon might be visible near Mars and Mercury (dusk)
11	Mon	Mercury to lower-left of the Moon (dusk)
12-20	Tue-	Mercury at least 10 degrees above the horizon (half-hour after sunset)
13	Wed	Uranus 4 degrees south of the Moon
17-18	Sun-	The Moon appears to the right (left) of Jupiter on the 17th (18th). They form a triangle with Aldebaran.
25	Mon	Full Moon (12:26pm)
27-12	Wed-	The zodiacal light is visible from dark locations in the west about 80 minutes after sunset.
28	Thu	Spica close to the Moon.

March

1-2	Fri-	Saturn rises at about 11pm to the left of the Moon
4	Mon	Last Quarter Moon (1:53pm)
7-10	Thu-	Comet PanSTARRS (C/2011 L4) visible in binoculars, and possibly with the unaided eye. Look low in the west shortly after sunset. See p.50 of the March issue of S&T
10	Sun	Daylight Saving Time Begins (turn clock ahead 1 hour at 2am); Neptune 6 degrees south of Moon
11	Mon	New Moon (12:51pm)
12-18	Tue	Comet PanSTARRS (C/2011 L4) expected to be brightest this week. On the 12th it will be to the left of a thin crescent Moon

The Art of Space Imagery

By Diane K. Fisher

When you see spectacular space images taken in infrared light by the Spitzer Space Telescope and other non-visible-light telescopes, you may wonder where those beautiful colors came from. After all, if the telescopes were recording infrared or ultraviolet light, we wouldn't see anything at all. So are the images "colorized" or "false colored"?

No, not really. The colors are translated. Just as a foreign language can be translated into our native language, an image made with light that falls outside the range of our seeing can be "translated" into colors we can see. Scientists process these images so they can not only see them, but they can also tease out all sorts of information the light can reveal. For example, wisely done color translation can reveal relative temperatures of stars, dust, and gas in the images, and show fine structural details of galaxies and nebulae.

Spitzer's Infrared Array Camera (IRAC), for example, is a four-channel camera, meaning that it has four different detector arrays, each measuring light at one particular wavelength. Each image from each detector array resembles a grayscale image, because the entire detector array is responding to only one wavelength of light. However, the relative brightness will vary across the array.

So, starting with one detector array, the first step is to determine what is the brightest thing and the darkest thing in the image. Software is used to pick out this dynamic range and to re-compute the value of each pixel. This process produces a grey-scale image. At the end of this process, for Spitzer, we will have four grayscale images, one for each for the four IRAC detectors.

Matter of different temperatures emit different wavelengths of light. A cool object emits longer wavelengths (lower energies) of light than a warmer object. So, for each scene, we will see four grayscale images, each of them different.

Normally, the three primary colors are assigned to these gray-scale images based on the order they appear in the spectrum, with blue assigned to the shortest wavelength, and red to the longest. In the case of Spitzer, with four wavelengths to represent, a secondary color is chosen, such as yellow. So images that combine all four of the IRAC's infrared detectors are remapped into red, yellow, green, and blue wavelengths in the visible part of the spectrum.

Download a new Spitzer poster of the center of the Milky Way. On the back is a more complete and colorfully-illustrated explanation of the "art of space imagery." Go to spaceplace.nasa.gov/posters/#milky-way.

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

Caption: This image of M101 combines images from four different telescopes, each detecting a different part of the spectrum. Red indicates infrared information from Spitzer's 24-micron detector, and shows the cool dust in the galaxy. Yellow shows the visible starlight from the Hubble telescope. Cyan is ultraviolet light from the Galaxy Evolution Explorer space telescope, which shows the hottest and youngest stars. And magenta is X-ray energy detected by the Chandra X-ray Observatory, indicating incredibly hot activity, like accretion around black holes.

Tri-Valley Stargazers
P.O. Box 2476
Livermore, CA 94551

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.