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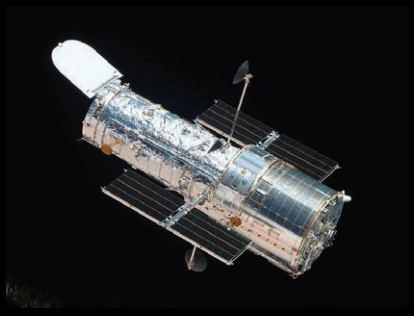
Tri-Valley Stargazers



March 2012

Meeting Info

What:
CXBN: Mapping the Mysterious Cosmic X-Ray Background with a NanoSatellite

Who:
Dr. Lance Simms

When:
March 16, 2012
Doors open at 7:00 p.m.
Lecture at 7:30 p.m.

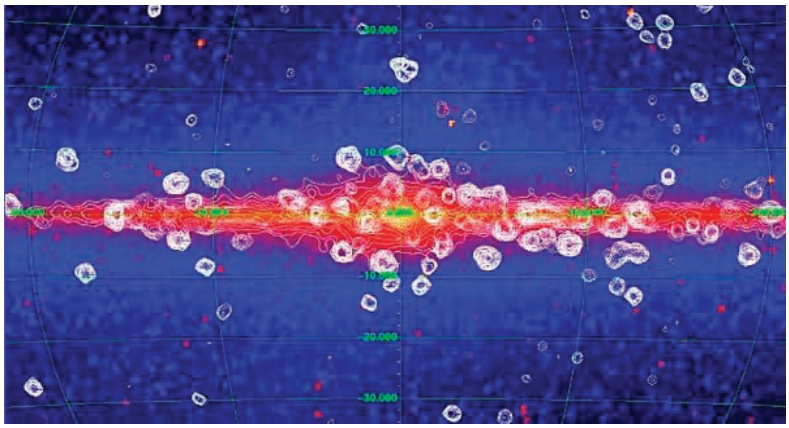
Where:
Unitarian Universalist Church in Livermore
1893 N. Vasco Road

Inside

March Meeting

CXBN: Mapping the Mysterious Cosmic X-Ray Background with a NanoSatellite

Discovered in the 1960s, the Cosmic X-Ray Background (CXB) is a mysterious signal believed to pervade the entire universe. Akin to the Cosmic Microwave Background (CMB), it consists of radiation that comes at us from all directions from the furthest reaches of space. But while the CMB is a cold relic of the early universe, the CXB hints at some of the most intense and energetic objects we know of: Supermassive Black Holes (SMBHs). It is believed that the CXB is generated by the SMBHs at the centers of Active Galactic Nuclei (AGNs) throughout the universe.



Caption: X-Ray data (contours) from the Rossi X-Ray Timing Explorer are superimposed on infrared data from the Cosmic Background Explorer mission. Image Credit: NASA/GSFC/RXTE/COBE/M. Mevnivtsev et al.

Many large and expensive satellites have studied the CXB as a secondary mission, but there is considerable disagreement between measurements. The Cosmic X-Ray Background Nanosat (CXBN) is a small, low-cost mission that will launch in August 2012 to study the CXB with state-of-the-art technology. In this talk, I will first give an introduction to the CXB and the theory behind it, followed by an overview of the CXBN mission and what we expect to discover with it.

Lance Simms is a postdoctoral researcher at Lawrence Livermore National Laboratory. He received his BS from University of California: Santa Barbara in 2003 and his PhD in Applied Physics from Stanford University in 2009. He is what you might call a "detector head", jumping at the chance to work on any kind of astronomical detectors available to him, whether it's a novel pixelated x-ray detector or an off-the-shelf CCD used on an 8" telescope. He currently lives in Livermore and thoroughly enjoys getting out to Del Valle or Yosemite for a night of observing.

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**
Mar. 16	Mar. 19	
Apr. 20	Apr. 23	Mar. 30
May 18	May 21	Apr. 27
Jun. 15	Jun. 18	May. 25
Jul. 20	Jul. 23	Jun. 29
Aug. 17	Aug. 20	Jul. 27
Sep. 21	Sep. 24	Aug. 31
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 February 17, 2012 the TVS account balances are:

Checking	$13,578.81
CD #1	cashed in as part of consolidating of CD's
CD #2	cashed in as part of consolidating of CD's

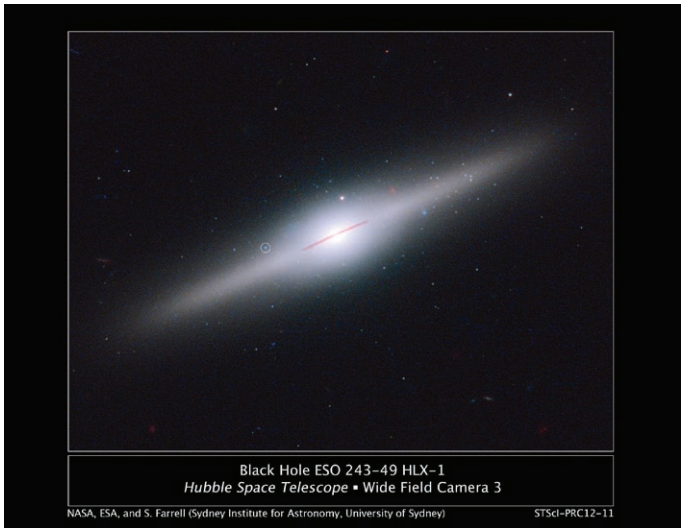
TVS Program Director Position Needs To Be Filled

TVS needs to fill the Program Director position, a critical club position, as Jim Alves has stepped down. The Program Director is responsible for booking monthly speakers for the club meetings. Jim has attempted to book as many speakers as possible for 2012 and develop leads for future speakers. He will also be available to assist in transitioning someone into the role of Program Director, including providing contact information, examples of communications, etc. If you would like to take on this important club position, please contact Jim and/or any TVS officer or board member.

Journal Club by Ken Sperber

Identification and Environment of an Intermediate Mass Black Hole

Black Holes are expected to come in a variety of sizes: (1) stellar-mass black holes formed in supernova explosions, (2) intermediate mass black holes (100-1 million times the mass of the Sun), and (3) supermassive Black Holes (million to a billion times the mass of the Sun). Cygnus X-1 is an example of a stellar-mass black hole. It is part of a binary star system, and as such basic orbital dynamics calculations indicate that Cygnus X-1 has a mass between 5-10x that of the Sun. Thus, it must be a black hole since it is too massive to be a white dwarf or a neutron star. Material from its companion star forms an accretion disk that radiates copious amounts of X-Rays that were first observed by the Uhuru X-Ray satellite in the mid-1970's. Supermassive black holes are believed to lurk at the center of virtually every galaxy. The Milky Way is home to a supermassive black hole that weighs about 4 million solar masses, a relative lightweight compared to the 6 billion solar mass black hole that lies at the center of M87, or the 21 billion solar mass black hole in NGC4889, the heaviest yet identified.



Caption: The intermediate mass black hole, HLX-1, in ESO 243-49 lies to the upper-left of the galactic core (circled). Image Credit: NASA, ESA, and S. Farrell (University of Sydney).

It is not known how supermassive black holes become so large, but the hypothesis is that they develop from the accretion of intermediate mass black holes. However, until now, no intermediate mass black holes had been found. Intermediate mass black hole, HLX-1, in galaxy ESO 243-49 is the first object of its class to be identified (Farrell et al. 2009, Nature, 460, p. 73). Farrell et al. (2012) used the Hubble Space Telescope and the *Swift* X-Ray Observatory to study the environment around HLX-1. The observed X-Ray brightness of HLX-1 is about 400x that expected for a 20 stellar-mass black hole, and it varies in brightness by a factor of 50, having had 3 outbursts since 2009.

By observing distribution of energy from near-infrared to visible, ultraviolet and X-Ray wavelengths, Farrell et al. (2012) have come up with two models of the environment around HLX-1. Compared to the irradiated disk that is required to explain the X-Ray emission, there is an observed excess of

Header Image: The Hubble Space Telescope as seen from the Space Shuttle Atlantis. Image Credit: NASA

Journal Club (continued)

near-infrared, visible, and ultraviolet energy. This "red" excess can be explained by the presence of a stellar population with a total mass of about 5 million solar masses. However, the observations were insufficient to determine if this stellar population consisted of stars that are 13-200 million years old, or stars that are 13 billion years old! As the authors state: "The upper limit of 40 parsecs derived for the cluster diameter is consistent with either a globular cluster or young massive star cluster..." Even so, there is suggestive evidence that the preferred model is that with the young star population, because of the large amount of reprocessing (absorption of high energy photos and reemission at lower energy) by the disk approaches unrealistically large values for the model with older stars. Additional observations are needed to determine which model is correct.

For more information see: http://arxiv.org/abs/1110.6510 http://www.universetoday.com/93605/young-star-cluster-in-disintegrated-galaxy-reveals-first-ever-intermediate-mass-black-hole/ http://www.cfa.harvard.edu/news/2012/pr201203.html http://en.wikipedia.org/wiki/Supermassive_black_hole

Calendar of Events

March 14, Noon-1:00pm

What: A Post-Equinox View of Saturn's Rings
Who: Larry Esposito, LASP, University of Colorado, Boulder
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Saturn's Equinox 2009: Oblique lighting exposed vertical structure and embedded objects. The rings were the coldest ever. Dr. Esposito will show how images inspired new occultation and spectral analysis that show abundant structure in the perturbed regions. The rings are more variable and complex than we had expected prior to this seasonal viewing geometry.

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

March 17, 11:00am

What: The Sun: A Star in Our Own Backyard
Who: Dr. Hazel Bain, UC Berkeley
Where: UC Berkeley, Genetics and Plant Biology, Room 100
Cost: Free

The stars in the night sky have always been a source of intrigue and wonder. With our very own star at the center of our solar system, the Sun offers us a unique opportunity to study the inner workings of these giant balls of plasma. Starting at the core, I will discuss the processes occurring at the different layers of the Sun: From sunspots observed in the photosphere, which vary characteristically with the solar cycle, to explosive flares and coronal mass ejections, which release huge amounts of energy into the corona. Finally I will talk about the effect these eruptive events have on the Earth's atmosphere, and how the particles accelerated at the Sun produce the displays of lights known as the Aurora Borealis and the Aurora Australis.

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

continued page 4

Calendar of Events (continued)

March 17, 11:00am-5:00pm

What: Celebrate Women's History Month
Who: Narrated by Astronaut Mae Jemison
Where: Chabot Space & Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Free with General Admission

Visit the "Out of this World" lab where recorded biographical interviews of Women pioneers from the early days of the space program will be shown throughout the day. "Rocket Girls and Astronettes" is narrated by astronaut Mae Jemison. Participate in online scavenger hunts about the participants featured in the videos. Play the Chabot produced Expedition to Mars board game, which features famous female Astronauts.

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

March 21, Noon - 1:00pm

What: A New Feed for the Allen Telescope Array and the Science That it Will Enable
Who: Jack Welch, UC Berkeley
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The current feeds of the antennas in the Allen Telescope Array are somewhat unusual and provide wide bandwidth and good sensitivity. We have recently developed an upgrade to the feed which has even more bandwidth and, equally important, substantially better sensitivity. The new sensitivity is about as good as can be achieved. We describe the steps to the upgrade and then lay out new science that is enabled by it, including SETI and the structure of both the nearby and distant universe.

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

March 23, 6:00pm-7:30pm

What: Future Fridays
Who: Brian David Johnson, FutureCaster, Intel, SciFi Author, The Tomorrow Project Anthology
Where: Chabot Space & Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $20 Members / $23 Guests

($29 at the door, no discounts & subject to availability)

Are you an active participant in your future? What kind of future do you want to live in? What kind of futures should we avoid? How is Intel using Science Fiction to design better technologies? Intel's Futurist Brian David Johnson will explore these questions and his futurecasting work.

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

March 28, Noon - 1:00pm

What: Smart Coatings on Spacecraft Surfaces - New Tools for the Spacecraft Designer's Tool Belt
Who: Steve McDaniel, Reactive Surfaces, Inc.
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

As we enter the era of manned space flight and habitation beyond low Earth orbit, much longer duration human occupation and much less frequent resupply will be the norm, stretching the capacities and capabilities of life support systems. The myriad internal surfaces aboard ISS and the various crew compartments on drawing boards today are viewed as a liability due to contamination and fouling. Yet, if such surfaces operate synergistically with life support systems, these same surfaces become an asset with practically no increased load weight penalty. Virtually all of these surfaces are coated. Bio-based, non-toxic additives to such coatings, many of which are already being marketed for 1XG applications, will create the functionalized surfaces needed.

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

April 2, 7:30pm

What: Hot on the Trail of Temperate Planets Orbiting Cool Red Dwarfs
Who: Dr. John A. Johnson, Assistant Professor of Astronomy, California Institute of Technology
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 800-794-7576

Just three years ago the prospect of finding temperate, rocky worlds around other stars was still the subject of science fiction: none had been found and reasonable estimates put us years or decades away from such a momentous discovery. All of that has changed very recently on the heels of the extraordinarily successful NASA Kepler mission. By searching for the tiny diminutions of starlight indicative of an eclipsing planet, Kepler has produced thousands of new planet candidates orbiting distant stars. Careful statistical analyses have shown that the majority of these candidates are bona fide planets, and the number of planets increases sharply toward Earth-sized bodies. Even more remarkably, many of these planets are orbiting right "next door," around tiny red dwarf stars, several of them residing in the Goldilock's zone where temperatures are amenable to the existence of liquid water. Dr. Johnson will describe our multi-telescope campaign to validate and characterize these micro planetary systems, and present some early, exciting results that point the way to

Calendar of Events (continued)

the detection of the first Earth-sized planet in the habitable zone of a star.

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

April 4, Noon - 1:00pm

What: Characterization of dark materials on Iapetus, Phoebe and Hyperion
Who: Cristina Dalle Ore, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details of the presentation are not available.

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

April 11, Noon - 1:00pm

What: Advances in Fast Burning Fuels and High Performance Hybrid Rocket Propulsion
Who: Brian Cantwell, Stanford University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details of the presentation are not available.

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

April 18, Noon - 1:00pm

What: The Search for New Particles at the CERN Large Hadron Collider
Who: Michael Peskin, Stanford Linear Accelerator Center
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details of the presentation are not available.

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)

All times Pacific Standard Time, unless indicated otherwise.

March

1-8	Thu-	Mars at opposition on the 3rd, and closest to Earth on the 5th (all night)
8	Thu	Full Moon (1:39am)
10	Sat	The Moon forms a triangle with Spica and Saturn (after 10-11pm for best viewing)
10-24	Sat-	Zodiacal light visible in the west beginning about 80 minutes after sunset
11	Sun	Daylight Savings Time begins (2am)
12-13	Mon-	Venus and Jupiter within about 3 degrees of each other (see p.48 of S&T March 2012)
14	Wed	Last-Quarter Moon (6:25pm PDT)
19	Mon	Spring begins (10:14pm PDT)
22	Thu	New Moon (7:37am PDT)
25-27	Sun-	Crescent Moon near Jupiter (25th), Venus and The Pleiades (26th), and Aldebaran (27th)
30	Thu	First-Quarter Moon (12:41pm PDT)

April

2-3	Mon-	Venus passes through the southern portion of The Pleiades (Evening)
3	Tue	Mercury stationary, Mars 9 degrees north of the Moon
6	Fri	Full Moon (12:19pm PDT)
13	Fri	Last-Quarter Moon (3:50am PDT)
15	Sun	Saturn at opposition
17	Tue	Algol at minimum brightness for ~2 hours centered on 7:44pm PDT

The Hidden Power of Sea Salt, Revealed

Last year, when NASA launched the Aquarius/SAC-D satellite carrying the first sensor for measuring sea salt from space, scientists expected the measurements to have unparalleled sensitivity. Yet the fine details it's revealing about ocean saltiness are surprising even the Aquarius team.

"We have just four months of data, but we're already seeing very rich detail in surface salinity patterns," says principal investigator Gary Lagerloef of Earth & Space Research in Seattle. "We're finding that Aquarius can monitor even small scale changes such as specific river outflow and its influence on the ocean."

Using one of the most sensitive microwave radiometers ever built, Aquarius can sense as little as 0.2 parts salt to 1,000 parts water. That's about like a dash of salt in a gallon jug of water.

"You wouldn't even taste it," says Lagerloef. "Yet Aquarius can detect that amount from 408 miles above the Earth. And it's working even better than expected."

Salinity is critical because it changes the density of surface seawater, and density controls the ocean currents that move heat around our planet. A good example is the Gulf Stream, which carries heat to higher latitudes and moderates the climate.

"When variations in density divert ocean currents, weather patterns like temperature and rainfall are affected. In turn, precipitation and evaporation, and fresh water from river outflow and melt ice determine salinity. It's an intricately connected cycle."

The atmosphere is the ocean's partner. The freshwater exchange between the atmosphere and the ocean dominates the global water cycle. Seventy-eight percent of global rainfall occurs over the ocean, and 85 percent of global evaporation is from the ocean. An accurate picture of the ocean's salinity will help scientists better understand the profound ocean/atmosphere coupling that determines climate variability.

"Ocean salinity has been changing," says Lagerloef. "Decades of data from ships and buoys tell us so. Some ocean regions are seeing an increase in salinity, which means more fresh water is being lost through evaporation. Other areas are getting more rainfall and therefore lower salinity. We don't know why. We just know something fundamental is going on in the water cycle."

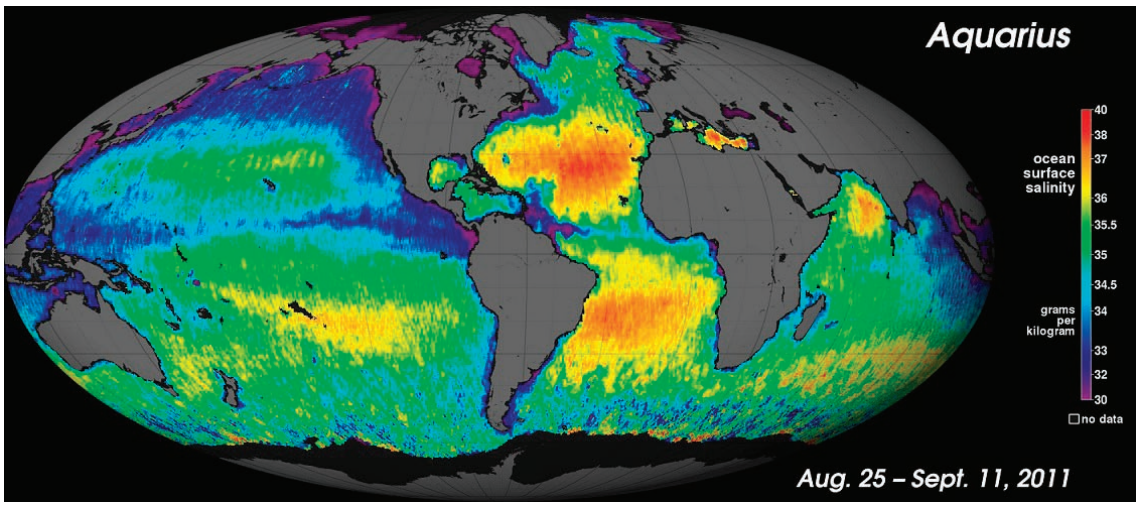
With Aquarius's comprehensive look at global salinity, scientists will have more clues to put it all together. Aquarius has collected as many sea surface salinity measurements in the first few months as the entire 125-year historical record from ships and buoys.

"By this time next year, we'll have met two of our goals: a new global map of annual average salinity and a better understanding of the seasonal cycles that determine climate."

Stay tuned for the salty results. Read more about the Aquarius mission at aquarius.nasa.gov.

Other NASA oceanography missions are Jason-1 (studying ocean surface topography), Jason-2 (follow-on to Jason-1), Jason-3 (follow-on to Jason-2, planned for launch in 2014), and Seawinds on the QuikSCAT satellite (measures wind speeds over the entire ocean). The GRACE mission (Gravity Recovery and Climate Experiment), among its other gravitational field studies, monitors fresh water supplies underground. All these missions, including Aquarius, are sponsors of a fun and educational ocean game for kids called "Go with the Flow" at spaceplace.nasa.gov/ocean-currents.

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



Caption: Aquarius produced this map of global ocean salinity. It is a composite of the first two and a half weeks of data. Yellow and red represent areas of higher salinity, with blues and purples indicating areas of lower salinity.

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.