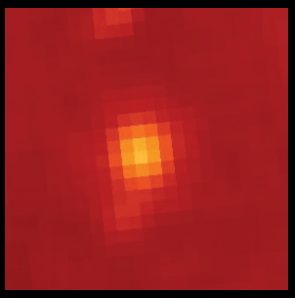
PRIMEFOCUS

Tri-Valley Stargazers

February 2012



Meeting Info

What:
Chit-chat

Who:
You

When:
February 17, 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

February Meeting

General Discussion

Unfortunately, we do not have a speaker for this month's meeting. Even so, we plan to hold an informal meeting where the membership can exchange ideas about all things astronomical.

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 Coordinator, 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.

Observer's Handbooks and Calendars Still Available

Five RASC Observer's Guides and two Calendars are still available for purchase. The 2012 edition of the Observer's Guide is bundled with the Earth Centered Universe Planetarium Software. This free software will function through March 31, 2013 and will not perform predictions for events later than December 31, 2013. Prices are $25 for the Handbook and $17 for the Calendar. Get them while they last!!!

Dues are Due

If you haven't yet paid your annual TVS dues, please do so ASAP since membership runs from January through December. Our membership rates remain unchanged from last year, as do the subscription rates for *Astronomy* and *Sky & Telescope*. The membership application is on page 8 of this (or any recent) TVS newsletter.

News & Notes

2012 TVS Meeting Dates

Below are 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
Feb. 17	Feb. 20	
Mar. 16	Mar. 19	Feb. 24
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 January 22, 2012 the TVS account balances are:

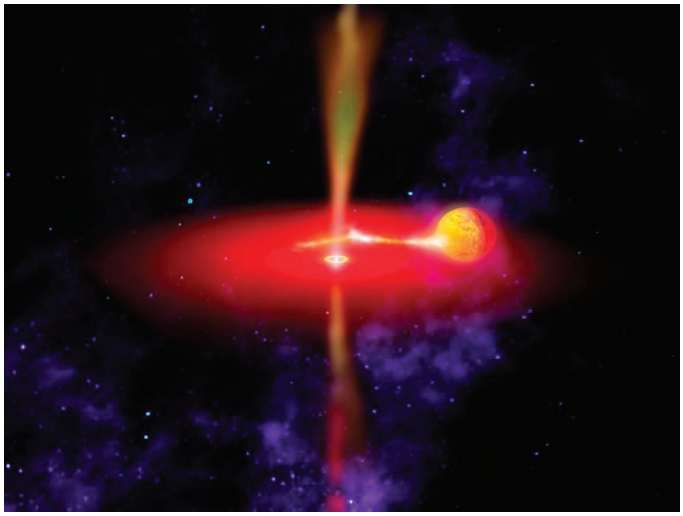
Checking	$12,523.01
CD #1	cashed in as part of consolidating CD's
CD #2	cashed in as part of consolidating CD's

Journal Club by Ken Sperber

Milky Way Black Hole Actively Feeding

In the present epoch of the universe super-massive black holes (SMBH's) are rather quiescent, showing little activity since most of the gas in the galaxies has been consumed in the process of star formation over the last 13.7 billion years. Exceptions to this behavior include M87, whose pronounced jets belie the activity of its SMBH. In extreme cases 10^{46} erg s^{-1} (~13 orders of magnitude more energy than is released by the Sun every second) can be released for a period of months when a star is shredded apart after it ventures too close to a SMBH. Other, more tame, SMBH's do exhibit variability, including the SMBH at the center of the Milky Way, Sagittarius A (Sgr A*). Observations indicate that Sgr A* has flares of 10^{34}-10^{35} erg s^{-1} that last a few hours, and occur on an almost daily basis. These flares emit at both infrared and X-Ray energies, and are a factor of 3-100x times the quiescent emission of Sgr A*.

Zubovas et al. (2011) have tested the hypothesis that the flares are due to the disruption of asteroids that pass too close to Sgr A*. The time that it takes the flare to brighten or dim provides an indication of the size of the flare region. This distance is obtained by multiplying the speed for light by the time it take for the flares' brightness to change, indicating that the flare region is approximately 10 astronomical units (AU) in diameter (10x the distance between the Earth and the Sun).



Caption: This artist's concept illustrates what the flaring black hole called GX 339-4 might look like. Infrared observations from NASA's Wide-field Infrared Survey Explorer (WISE) reveal the best information yet on the chaotic and extreme environments of this black hole's jets. GX 339-4 likely formed from a star that exploded. It is surrounded by an accretion disk (red) of material being pulled onto the black hole from a neighboring star (yellow orb). Some of this material is shot away in the form of jets (yellow flows above and below the disk). The region close in to the black hole glows brightly in infrared light. Image Credit: NASA

The authors present detailed calculations that estimate an asteroid of 10km in diameter is required to give rise to the typical energy of the observed flares. This assumes complete tidal disruption of the asteroid occurs within 1 AU of Sgr A* for an asteroid that has a density of 1 g cm^{-3} (the same as the density of water) and that has the structure of a rubble pile. As an example, think of Comet Shoemaker-Levy 9 being pulled apart because it passed too close to Jupiter. The situation in the vicinity of the SMBH is much more extreme, with the disrupted asteroid chunks (~1km in size) vaporizing due to friction with the gas accretion disk that surrounds the SMBH (see the figure above for an artist's concept of the accretion disk).

The next big question to answer is: Are there enough asteroids of sufficient size in the vicinity of Sgr A* to account for the number of observed flares? Based on observations of the number and size distribution of asteroids in our solar system and the amount of dust in debris disks around nearby stars, the authors estimate that there are approximately 20 million asteroids per star that are big enough to give rise

Header Image: WISE images showing strong bursts and dimming of infrared light in the black hole GX 339-4. The data cover a period of approximately 1 day, speeded up. Infrared light has a wavelength about 15 times longer than the eye can see. Image Credit: NASA and JAXA.

Journal Club (continued)

to the observed flares. With approximately 4 million stars close enough to interact with Sgr A*, there are 80 trillion candidate asteroids that could produce Sgr A* flares. When stars pass close enough to Sgr A* or pass close enough to each other, some of the asteroids are stripped off, generating an hypothesized "Super-Oort Cloud" that surrounds Sgr A*. Calculations indicate that gravitational perturbations by passing stars will occasionally cause asteroids in the "Super-Oort Cloud" to change their orbits and get close enough to Sgr A* to be sheared apart and vaporize with the frequency and amplitude of the observed flares.

See http://arxiv.org/abs/1110.6872v1 to obtain the full journal article. To see observed infrared flaring of Black Hole GX 339-4 see the animation of WISE images produced by JAXA (http://www.astro.isas.jaxa.jp/~pgandhi/wise_gx339/wise_blackhole_anim.html).

Calendar of Events

February 15, Noon - 1:00pm

What: Mysteries of the Oscillations of Gas Accreting Onto Black Holes, Neutron Stars, and White Dwarfs
Who: Bob Wagoner, Stanford University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View
Cost: Free

Dr. Wagoner will survey the QPOs (quasi-periodic oscillations) seen in the luminosity fluctuation power spectra of compact objects accreting from a binary companion star. There is little understanding of the different frequency relationships in these systems. Dr. Wagoner will focus on the theory and observations of black holes, and compare the predictions of their spin via diskoseismolgy with those from two other methods.

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

February 17, Noon - 1:00pm

What: Inflation and the Landscape of String Theory
Who: Alexander Westphal, Deutsches Elektron-Synchrotron
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View
Cost: Free

One of the major advances of string theory in recent years was an understanding that vacuum solutions with potentially viable four-dimensional cosmology come in a plethora of an incredibly large and rich 'landscape' of string theory vacua. The number of possible vacua and, in turn, types of Universes, may exceed 10 to the power 1000.

This progress was enabled by finding ways to give mass to ('stabilize') the moduli. The moduli are the typically 100 to 1000 massless scalar fields which are associated with deformations of extra dimensions required by string theory. Moduli stabilization also gave rise to the first well-controlled string theory constructions of cosmological inflation, a very early burst of exponential expansion of the universe needed to produce its large scale and spatial flatness. Inflation seeds density perturbations, which are the source of all visible structure in our universe, as well as gravitational wave fluctuations. If the gravitational wave fluctuations are seen (e.g., by the PLANCK satellite), this would tell us that inflation took place at an energy scale only 100 times below Planck scale of

continued page 4

quantum gravity and maybe string theory itself. We may then hope for leftover imprints from the fundamental theory in high-scale inflation.

Dr. Westphal will show how string theory has been recently found to push towards deviations from quantum field theory results for high-scale models of inflation which produce detectable gravitational wave fluctuations. He will describe how the next step is understanding the distribution of the energy scale of inflation across the 'landscape' of string theory vacua. This will decide if the peculiarities of high-scale inflation in string theory have any predictive power.

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

February 18, 11:00am-5pm

What: Black History Month Celebration: Race and the Space Race
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 African-American pioneers from the early days of the space program will be shown throughout the day. "Race and the Space Race" 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 African-American Astronauts. Visit Galaxy Explorers in action with activities celebrating the life and inventions of scientist George Washington Carver.

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

February 22, Noon - 1:00pm

What: Planetesimal Migration in the Early Days or Taking the Solar System by Störmer
Who: Kevin Grazier, BSG-75
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View
Cost: Free

Common wisdom holds that, in order for a terrestrial planet to have life, it's helpful to have a Jupiter-like planet in the system to shield against inbound comets. How well does Jupiter do that, really? Common wisdom held until recently that it would be impossible for an icy object like Ceres to exist within the inner Solar System. From where did the ice come? Common wisdom held until recently that the Centaur asteroids and Kuiper Belt objects were dynamically distinct. Are they?

Much of our understanding of the dynamical structure of the Solar System stems from long-term computational simulations of planet and planetesimal evolution--simulations that model orbital evolution over millions, even billions, of years. We first describe a multistep scheme that achieves the theoretical lower bounds for the propagation of error over long simulation intervals, and one that integrates close encounters very accurately. We then present a summary of our investigation into three different early Solar System scenarios: whether Jupiter protected Earth from impacts in the early Solar System, the icy nature of Ceres, and the interrelation between Centaur Asteroids and the Kuiper Scattered Disk.

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

February 24, Noon - 1:00pm

What: Space Buckyballs
Who: Jan Cami, The University of Western Ontario/SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View
Cost: Free

Fullerenes are a class of large and remarkably stable carbonaceous molecules in the shape of a hollow sphere or ellipsoid; the best known member of the class is the archetypical "buckminsterfullerene" C60 that resembles a soccer ball (and is therefore often called "buckyball"). Dr. Cami and colleagues have recently discovered the unmistakable spectral signatures of the fullerene species C60 and C70 in Spitzer observations of a young planetary nebula, and these are now the largest molecules known to exist in space. Since this discovery, fullerenes have been reported in a wide variety of astronomical objects at abundances of typically 0.1—1.5% of the cosmic carbon. They are formed in carbon-rich evolved stars, survive in the interstellar medium and are also detected in the disks surrounding young stars. Fullerenes have many interesting properties and could play a unique role in the physics and chemistry of the interstellar medium.

In this talk, Dr. Cami will give an overview of what we have learned so far from observational analyses, with a special focus on the surprising aspects that have challenged our understanding of some of the physics and chemistry involved – in particular about the formation and the state of fullerenes in space.

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

February 29, 7:00pm

What: The Trillion Dollar Space Enterprise --> Or How The Lynx Suborbital Vehicle Will Change The World
Who: Andrew Nelson, Chief Operating Officer, XCOR
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View

Calendar of Events (continued)

Cost: Free

Details of this talk are unavailable.

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

March 7, 7:00pm

What: How To Build A Time Machine
Who: Paul Davies, Beyond Center, Arizona State University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View
Cost: Free

Time travel makes great science fiction, but can it really be done? Travel into the future is already a reality, but visiting the past is a much tougher proposition, and may require fantastic resources such as a wormhole in space. Nevertheless, if going back in time is allowed, even in principle, then what about all those paradoxes that make time travel stories so intriguing?

Paul Davies is a physicist, cosmologist, and astrobiologist at Arizona State University, where he is Director of the Beyond Center for Fundamental Concepts in Science. He is the author of many books, including "How to Build a Time Machine" and, most recently, "The Eerie Silence: are we alone in the universe?"

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

March 12, 7:30pm

What: Times Change, Literally, For Human Culture and the Cosmos
Who: Dr. Adam Frank, Professor of Astrophysics at the University of Rochester
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

According to astrophysicist Adam Frank, specific human conceptions of time don't last forever and our "modern" version is already in the midst of a radical change. In his new book, About Time, Dr. Frank argues that new ideas in cosmology are pushing the revolution in time to its final stage. Just as a "clockwork universe" followed the invention of the clock 500 years ago, scientists are now moving beyond the Big Bang to talk about universes built from information pushing time into mind-boggling new territory. Imagine: An eternal "multi-verse" made of infinite, parallel universes with infinite versions of you, lots of little bangs but no big bang beginning, a string theory universe in 10 dimensions of ever-repeating cycles, or a universe where time doesn't exist at all. It's impossible to say which of these new ideas will become the foundation for a new time because the science is still in flux. We do know we're living at the twilight of the Big Bang. It's the end of time as we know it now and as we live it now. Book signing to follow.

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

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
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.

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

All times Pacific Standard Time, unless indicated otherwise.

February

14	Tue	Last-Quarter Moon (9:04am)
21	Tue	New Moon (2:35pm)
22	Wed	Mercury near 1-day-old crescent Moon, binoculars helpful (Dusk)
25-26	Sat-Sun	Moon and Venus in conjunction
28	Tue	Moon near the Pleiades, binoculars helpful
29	Wed	First-Quarter Moon (5:21pm)
29	Wed	Moon near the Hyades, binoculars helpful

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)

The Nerdiest Video Game Ever

By Dr. Tony Phillips

NASA has a job opening. Wanted: People of all ages to sort, stack, and catalogue terabytes of simulated data from a satellite that launches in 2015. Agile thumbs required.

Sorting terabytes of data? It's more fun than it sounds.

In fact it's a game: Satellite Insight. The Space Place Team at the Jet Propulsion Laboratory created the entertaining app for iPhones to get the word out about GOES-R, an advanced Earth science satellite built by NOAA and NASA.

Described by the Los Angeles Times as possibly "the nerdiest game ever," Satellite Insight may be downloaded for free from Apple's app store. Be careful, though, once you start playing it's hard to stop. Some reviewers have likened it to Tetris, one of the most popular video games of all time.

GOES, short for "Geostationary Operational Environmental Satellite," is the workhorse spacecraft for weather forecasters. NOAA operates two (at a time) in geosynchronous orbit, one above the west coast of N. America and one above the east coast. They monitor clouds, wind, rain, hurricanes, tornadoes and even solar flares. The GOES program has been in action since 1975.

GOES-R is the next-generation satellite with advanced technologies far beyond those of the older GOES satellites. It has sensors for lightning detection, wildfire mapping, storm tracking, search and rescue, solar imaging, and more. Many of the sensors are trailblazers. For example, the Advanced Baseline Imager has 60 times the capability of the current imager—16 channels instead of 5. It has twice the spatial resolution and five times the temporal refresh rate, including the 30-second imaging of weather systems over a region of 1000 km x 1000 km. Also, the Geostationary Lightning Mapper can count and pinpoint lightning bolts over the Americas 24/7. It's the first such detector to fly on a geosynchronous satellite, and it could lead to transformative advances in severe storm warning capability.

All in all, GOES-R represents a "huge technological leap from the current GOES." We know this because Satellite Insight tells us so. The app has an informative "Learn More" feature where players can find out about the satellite and the data they have been sorting.

Which brings us back to sorting data. It's a bit like eating Cheerios; just don't tell the kids it's nutritious, and they love it. Helping GOES-R gather and stash data from all those advanced sensors is just as satisfying, too—a dose of Earth science wrapped in thumb-flying fun.

More information about Satellite Insight may be found on the web at http://itunes.apple.com/us/app/satellite-insight/id463588902?mt=8. The game also available in web form (flying thumbs optional) at spaceplace.nasa.gov/satellite-insight.

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: New iPhone game is first NOAA app and only the second NASA game app. Just as with the real GOES-R, the challenge with Satellite Insight is to keep up with the massive influx of weather and other environmental data.

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.