PRIMEFOCUS

Tri-Valley Stargazers

October 2011

TVS Tri-Valley Stargazers

Meeting Info

What:
A billion times beyond visible: Astronomy with the Fermi Gamma-ray Space Telescope

Who:
Dr. Justin Vandenbroucke

When:
October 21, 2011
Doors open at 7:00 p.m.
Lecture at 7:30 p.m.

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

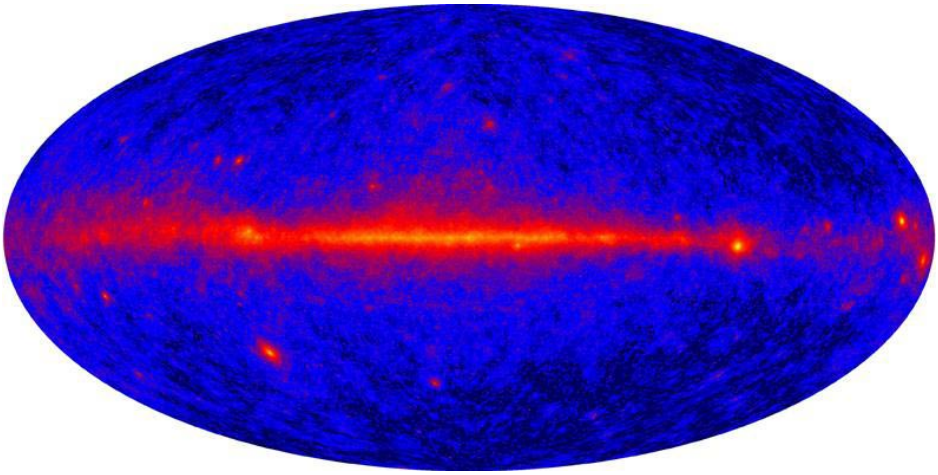
Inside

October Meeting

A billion times beyond visible: Astronomy with the Fermi Gamma-ray Space Telescope

Dr. Justin Vandenbroucke

The Fermi Gamma-ray Space Telescope is a particle physics detector in orbit around the Earth since 2008. Designed specifically to detect high-energy gamma rays, the detector functions as a telescope because it can measure the energy and direction of each gamma ray it detects. Fermi has a wide field of view and very good sensitivity, enough to make a map of the whole sky in gamma rays every three hours. These gamma rays are photons with energies a billion times more energetic than we can see with our eyes. Such energetic gamma rays are produced by extreme processes involving black holes, exploding stars, and the strange objects stars leave behind when they die. I'll explain how the telescope works and describe some of the most exciting discoveries we have made with it.



Caption: This all-sky view from Fermi reveals bright emission in the plane of the Milky Way (center), bright pulsars and super-massive black holes. Credit: NASA/DOE/ International LAT Team

Justin Vandenbroucke uses the techniques of particle physics to study the extremes of astrophysics. He received his B.A. from Stanford University (2002) and PhD from UC Berkeley (2009). For his PhD he worked on the IceCube neutrino telescope, including three trips to the South Pole to help build it. As a Kavli Fellow at the Kavli Institute for Particle Astrophysics and Cosmology (Stanford and SLAC National Accelerator Laboratory), he is now using gamma rays, instead of neutrinos, to study astrophysics and particle physics.

News & Notes

2011/2012 TVS Meeting Dates

The following lists the TVS meeting dates for 2011. 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**
Oct. 21	Oct. 24	
Nov. 18	Nov. 21	Oct. 28
Dec. 16	Dec. 19	Nov. 25
Jan. 20	Jan. 23	Dec. 30
Feb. 17	Feb. 20	Jan. 27
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 July 18, 2011 the TVS account balances are:

Checking	$5,420.09
CD #1	$3,764.24 rolled over 5/17/2011
CD #2	$2,657.00 rolled over 5/27/2011

TVS Positions: Filled and Needed

Jim Alves will vacate the Program Director position in January 2012, but for the next few months he will continue to book as many speakers as possible for the next year and develop leads for future speakers. He will also be available to assist in transitioning someone into that role, 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.

Additionally, we still need people to fill the position of Vice-President, and to serve on the Board of Directors. Please consider offering some of your time to influence the future direction of TVS. If you wish to help with any of these positions, please contact any officer or board member. Just a reminder, at the November meeting TVS will hold elections. Please consider running for one of the officer positions.

Journal Club by Ken Sperber

What do Red Supergiants, Yellow Hypergiants, Luminous Blue Variables, and Wolf-Rayet Stars have in common? They are different phases in the evolution of stars whose initial masses are between 8-40 solar masses, and whose ultimate fate is explosion as a supernova. Such massive stars spend only a few million years as Yellow Hypergiants, and thus few have been observed, and as such little is known about their behavior. Recently, Lagadec et al. (2011, Astronomy and Astrophysics, in press) have identified IRAS 17163-3907 as a Yellow Hypergiant. Given its appearance, as seen on page 6, the authors have named this object "The Fried Egg Nebula." In 1987 it was classified as a Proto-Planetary Nebula based on 2.2 micron observations. Observations with the HST were unable to resolve this object at visible wavelengths. Lagadec et al. (2011) observed this object with three infrared filters at the Very Large Telescope at Paranal Observatory, and obtained optical spectra at the Mercator Telescope on La Palma.

The optical spectra identified three diffuse interstellar bands (DIB) in the line-of-sight between Earth and the Fried Egg Nebula. From the width of the DIB spectral lines, the amount of dust was estimated, finding that it results in the extinction of visible light by 6-9 magnitudes. Combining this information with the line-of-sight velocities of the three DIB's and a relationship to galactic distance, the authors estimate that the Fried Egg Nebula is 3.6-4.6 kpc distant (~13,000 light years). This is four times the previous distance estimate, indicating the this object is not a Proto-Planetary Nebula because it is intrinsically much brighter than previously estimated, being 500,000 times more luminous and ~20 times the mass of the Sun. The optical spectrum also revealed the presence of the 7450 Angstrom line of NI and the absence of Helium lines, indicating the central star to be a late B or early A-type star with a temperature of 7500-10,000K, consistent with it being a rare Yellow Hypergiant.

The evaluation of the infrared images indicates that two detached shells of material surround the Yellow Hypergiant star at distances of 2400 and 6000 Astronomical Units (1 AU is the average distance between the Sun and the Earth). Knowing the distances of the shells from the host star, and their expansion velocity (~40km/s) indicates that the time interval between ejection of the two shells was about 435 years. Radiative transfer modelling indicates that 4 solar masses of gas (99%) and dust (1%) make up the two shells of material. The mass loss is driven by strong stellar winds due "to a combination of pulsation and radiation pressure on the dust." Thus, these results have provided new insight on the transient activity of Yellow Hypergiants. For more details, see: http://www.eso.org/public/news/eso1136/

Header Image: The LAT (silver box at the top) was integrated on the spacecraft at General Dynamics Advanced Information Systems in December 2006. (NASA/General Dynamics Advanced Information Systems). For more information, see: http://www.nasa.gov/mission_pages/GLAST/spacecraft/index.html

Calendar of Events

October 19, Noon - 1pm

What: The oxygen isotopic composition of the Sun: implications for solar nebula chemistry
Who: Kevin McKeegan, UCLA
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
Cost: Free

We have measured the oxygen isotopic composition of the solar wind, captured and returned to Earth by NASA's Genesis mission. The data demonstrate that the Earth, Moon, Mars, and bulk meteorites are depleted in ^{16}O by ~7% relative to the bulk solar system in a non-mass-dependent manner. Gas phase photochemistry, occurring either in the solar nebula or in its progenitor molecular cloud, is most likely responsible for changing the isotopic composition of planetary materials in the inner solar system prior to planetesimal accretion. Understanding how, when, and where the rocky planets acquired an isotopic composition distinct from the average composition of the dust and gas from which the solar system formed is a major challenge for the science of planetary origins.

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

October 26, Noon - 1pm

What: Living with a Star - dangerously
Who: Friedemann Freund, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
Cost: Free

The sun "talks" to the Earth. One channel, still poorly understood, involves the ionosphere. The ionosphere interacts magnetically with the solid Earth, reaching deep into the crust, generating forces that can trigger earthquakes. Before major earthquakes, the crust "talks" back to the ionosphere, causing perturbations.

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

November 2, Noon - 1:00pm

What: ET Math: How Different Could It Be?
Who: John Stillwell, University of San Francisco
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
Cost: Free

We like to think that intelligent aliens would have the same basic ideas about numbers and geometry as us, but, even if they do, they might express those ideas very differently. To illustrate what different forms a concept can take, I will show how differently the law ab=ba has been interpreted at different times in human mathematical culture. This seemingly basic law has several different origins -- in geometry, number theory, and set theory -- some of which seem alien even to experienced mathematicians.

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

November 5, 5:30pm

What: The Milky Way as a Dark Matter Laboratory
Who: Dr. Michael Kuhlen, Theoretical Astrophysics Center
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

continued page 4

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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 (continued)

Over the next decade, a combination of astronomical observations and particle physics experiments hold great promise to finally shed light on the nature of dark matter, the dominant contributor to the matter content of the universe.

This is a SPECIAL POST-SEASON PROGRAM that is part of the Bay Area Science Festival, in collaboration with Wonderfest, and includes a "nekkid-eye Nightscape" tour following the program.

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

November 7, 7:30pm

What: Sun, Maize, and the Maya Calendar: Maya Astronomy and Enduring Traditions in Mesoamerica
Who: Dr. Isabel Hawkins, Exploratorium Doña Maria Ávila Vera, Yucatec Maya Elder
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

Mesoamerica's great pyramids excite our imagination with images of a fascinating civilization in the distant past, but they also provide a tangible link to the richness and enduring power of Maya culture as expressed by the Maya people today. The infamous year 2012 gains astronomical and cultural significance in a calendar system that connects the Maya, corn, and the zenith passage of the Sun. The presenters will share experiences from recent research trips to Guatemala and Mexico, where they gathered content through the Maya people's own voice regarding the Calendar system and their cultural practices.

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

November 9, Noon - 1pm

What: Past Climate In Antarctica: Looking Back to Our Future
Who: Stephen Pekar, City University of New York
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
Cost: Free

Carbon dioxide levels are predicted to rise during this century to levels not seen in 25 to 50 million years. Back during this time, the Earth changed from a generally ice-free 'greenhouse world' to a more much colder and heavily glaciated 'icehouse world'. Dr. Pekar will provide an overview of Antarctic climate changes when CO2 levels were similar to what is predicted for this century and also provide some of early results from the IODP Wilkes Land Expedition.

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

November 13, Noon-4pm

What: San Jose Astronomical Association Swap Meet
Who:: All
Where: Twilight Drive, Houge Park, San Jose, CA
Cost: Free

Our annual astronomical Swap Meet, running from noon to about 4:00 pm. No admission fee. A 10% donation is requested on sales. For more information see: http://www.sjaa.net/directions.shtml

November 16, Noon - 1pm

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., Mountainview
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.

November 19, 11am

What: From Gas into Galaxies: Just Add Gravity!
Who: Dr. Genevieve Graves, UC Berkeley
Where: UC Berkeley, Genetics and Plant Biology Building, Room 100
Cost: Free

Details of this presentation are unavailable.

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

Caption: Konrad Thurmer took this image of M31, M32, and M110 on September 15, 2011 from a dark sky site near Coalinga, CA. He used his Orion ED80 (510mm focal length, f/6.3) with a Canon 35mm DSLR for 10x2min and 4x1min unguided exposures (ISO6400) on a CPC800 mount.

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

All times Pacific Daylight Time, unless otherwise noted.

October

19 Wed Last-Quarter Moon (8:30pm)

21-22 Fri- Orionid Meteor shower peaks in the early morning hours of the 22nd

25-8 Tue- Zodiacal light visible in the east (80-120 minutes before sunrise)

26 Wed New Moon (12:56pm)

27-16 Thu- Mercury visible 2 degrees below Venus in the southwest through November 16. On the 27th a thin crescent Moon may be visible to the lower-right of Mercury (Dusk)

28-29 Fri- Jupiter at opposition (see October S&T, p. 54. for more information)

November

2 Wed First-Quarter Moon (9:38am)

6 Sun Daylight Savings Time ends-turn your clocks back 1 hour at 2am

8 Tue Asteroid 2005 YU_{55} passes within 202,000 miles of Earth at 6:28PM PST (see November S&T, p. 53 for more information)

10 Thu Full Moon (12:16pm PST)

11 Fri Pleiades above the Moon, with the Hyades and Aldebaran below

18 Fri Leonid meteor shower peaks before dawn, but the Moon's glow will reduce the number of observable meteors

18 Fri Last-Quarter Moon (7:09am PST)

Caption: Astronomers have used ESO's Very Large Telescope to image a colossal star that belongs to one of the rarest classes of stars in the Universe, the yellow hypergiants. The new picture, taken with three IR filters centered at 8.59, 11.85, and 12.81 microns, respectively) is the best ever taken of a star in this class and shows for the first time a huge dusty double shell surrounding the central hypergiant. The star and its shells resemble an egg white around a yolky centre, leading the astronomers to nickname the object the Fried Egg Nebula. Image Credit: ESO/E. Lagadec

Dark Clues to the Universe

By Dr. Marc Rayman

Urban astronomers are always wishing for darker skies. But that complaint is due to light from Earth. What about the light coming from the night sky itself? When you think about it, why is the sky dark at all?

Of course, space appears dark at night because that is when our side of Earth faces away from the Sun. But what about all those other suns? Our own Milky Way galaxy contains over 200 billion stars, and the entire universe probably contains over 100 billion galaxies. You might suppose that that many stars would light up the night like daytime!

Until the 20th century, astronomers didn't think it was even possible to count all the stars in the universe. They thought the universe was infinite and unchanging.

Besides being very hard to imagine, the trouble with an infinite universe is that no matter where you look in the night sky, you should see a star. Stars should overlap each other in the sky like tree trunks in the middle of a very thick forest. But, if this were the case, the sky would be blazing with light. This problem greatly troubled astronomers and became known as "Olbers' Paradox" after the 19th century astronomer Heinrich Olbers who wrote about it, although he was not the first to raise this astronomical mystery.

To try to explain the paradox, some 19th century scientists thought that dust clouds between the stars must be absorbing a lot of the starlight so it wouldn't shine through to us. But later scientists realized that the dust itself would absorb so much energy from the starlight that eventually it would glow as hot and bright as the stars themselves.

Astronomers now realize that the universe is not infinite. A finite universe—that is, a universe of limited size—even one with trillions of stars, just wouldn't have enough stars to light up all of space.

Although the idea of a finite universe explains why Earth's sky is dark at night, other factors work to make it even darker.

The universe is expanding. As a result, the light that leaves a distant galaxy today will have much farther to travel to our eyes than the light that left it a million years ago or even one year ago. That means the amount of light energy reaching us from distant stars dwindles all the time. And the farther away the star, the less bright it will look to us.

Also, because space is expanding, the wavelengths of the light passing through it are expanding. Thus, the farther the light has traveled, the more red-shifted (and lower in energy) it becomes, perhaps red-shifting right out of the visible range. So, even darker skies prevail.

The universe, both finite in size and finite in age, is full of wonderful sights. See some bright, beautiful images of faraway galaxies against the blackness of space at the Space Place image galleries. Visit http://spaceplace.nasa.gov/search/?q=gallery.

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: This Hubble Space Telescope image of Galaxy NGC 4414 was used to help calculate the expansion rate of the universe. The galaxy is about 60 million light-years away. Credit: NASA and The Hubble Heritage Team (STScI/AURA)

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.