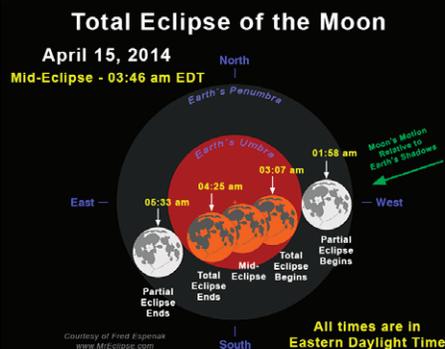


PRIMEFOCUS

Tri-Valley Stargazers



May 2014



Meeting Info

What:

Masks of the Cosmos

Who:

Prof. Wil van Breugel

When:

May 16, 2014

Doors open at 7:00 p.m.

Lecture at 7:30 p.m.

Where:

Unitarian Universalist Church in Livermore
 1893 N. Vasco Road

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May Meeting

Masks of the Cosmos

Prof. Wil van Breugel

Humans have always wondered about the origin of 'the Cosmos' and their own place in it. Different cultures world wide have believed that they discovered its true nature, but this may have been just another idea, or (anthropological) 'mask', that they projected on the cosmos. With the many new scientific discoveries of the past century, do we now know everything, or have we created yet another mask?



Caption: Native American Guide at Meteor Crater, Arizona.
 Credit: K. Sperber

What are the limitations and strengths of cultural and physical cosmologies? I will discuss how we think we know things, look at some examples of cosmologies in ancient and modern times, and conclude with the cultural 'impacts' of meteors.

Prof. Wil van Breugel, formerly of Lawrence Livermore National Laboratory, is an Adjunct Professor Emeritus at UC Merced. Prof. van Breugel received his Ph.D. in 1980 from Leiden University, The Netherlands. His research interests have included Active Galactic Nuclei, including the effects of supermassive black holes on galaxy formation, distant, massive galaxies, and the formation and evolution of the largest structures in the universe-clusters of galaxies. Since leaving LLNL he has become interested in bridging the sciences and humanities.

TVS Open House, May 23: Possible Meteor Shower/Storm!

(No Promises)

The Friday, May 23rd TVS Open House coincides with the potential new meteor shower that is expected to result from debris from Comet 209P/LINEAR (see p.30 of the May issue of S&T). This comet is making an extremely close pass by Earth on May 26 and it is possible that a meteor storm could result as Earth passes through debris from a previous passage. Interested non-keyholders should meet at the corner of Mines Rd. and Tesla Rd., for departure to H2O at 6:30pm in a caravan led by Chuck Grant. Access is \$3/car. See p. 2 of the newsletter for more details about the facilities at H2O.

News & Notes

2014 TVS Meeting Dates

The following lists the TVS meeting dates for 2014. 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 |
|-----------------|---------------|----------------------|
| May 16 | May 19 | |
| Jun. 20 | Jun. 23 | May 30 |
| Jul. 18 | Jul. 21 | Jun. 27 |
| Aug. 15 | Aug. 18 | Jul. 25 |
| Sep. 19 | Sep. 22 | Aug. 29 |
| Oct. 17 | Oct. 20 | Sep. 26 |
| Nov. 21 | Nov. 24 | Oct. 31 |
| Dec. 19 | Dec. 22 | Nov. 28 |

Money Matters

Treasurer Roland Albers indicates that as of April 21, 2014 the TVS checking account balance is:

Checking \$12,945.97

TVS Open Houses for 2014

The TVS Open House's for 2014 will be on Friday, May 23 and Saturday, August 16. Interested parties, especially those who are not keyholders to H2O, will meet at the corner of Mines Rd. and Tesla Rd., and depart to H2O at 6:30pm in a caravan led by Chuck Grant. Admission is \$3/car; please bring the exact amount. The site is primitive, with 2 pit toilets, and no running water. Bring warm clothes, and food and water for the evening. If you plan to observe the meteor shower, a reclining lawn chair will be helpful. Use a flashlight with a red filter so that people's dark adaptation is not ruined by white light.

TVS Yosemite Star Party

Bob McKoon will be coordinating this year's TVS star party at Glacier Point, Yosemite National Park. We were lucky in drawing the new Moon weekend of June 27-28. TVS members who bring telescopes for public observing will receive free camping at the Bridalveil campgrounds. On these dates sunset occurs at about 8:35pm with sunrise at about 5:50am. Contact Bob for more information (rmckoon"at"yahoo.com).

Golden State Star Party

The Golden State Star Party will be held from Wednesday, June 25 through Sunday, June 29th. See <http://www.goldenstatestarparty.org/> to register for this annual event, and to find out details of the available amenities at the site.

Magazine Giveaway

TVS has back issues of *S&T* and *Astronomy* magazines freely available. If you are interested in being a recipient of these valuable resources of astronomical history, please make your

interest known at a forthcoming club meeting. First come, first serve!

Calendar of Events

May 13, Noon-1:00pm

What: Carbon Dioxide Snowfalls, Polar Caps, and the Climate of Mars

Who: Daniel Huber, SETI Institute

Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA

Cost: Free

Like the Earth, Mars experiences seasonal cycles due to its ~25-degree axial tilt. Unlike the Earth, polar winter on Mars brings temperatures cold enough to freeze out the atmosphere, in the form of carbon dioxide surface frosts and snowfalls. The ice caps of Mars grow and shrink in response to seasonal changes in the polar heat balance. Since 2006, we have been monitoring the martian polar regions with multi-spectral thermal infrared measurements acquired by the Mars Climate Sounder (MCS). From these data, we retrieve vertical profiles of temperature and aerosol opacity, as well as surface properties such as ice granularity and dust content. This dataset provides an unprecedented view of the rich and complex ice caps and polar atmosphere. In this talk, I will highlight the dynamic polar processes at the heart of the martian CO2 cycle, as revealed by MCS. We will see evidence for striking inter-annual repeatability, diverse thermal and precipitation regimes, and intense localized snowstorms. In light of these new observations, we will explore the implications for the present and past climate of Mars.

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

May 20, Noon-1:00pm

What: Microgravity, The Future of Innovation

Who: Ioana Cozmuta, NASA Ames Space Portal

Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA

Cost: Free

The International Space Station is a US taxpayers investment estimated at about \$70 billion spent over 30 years (with an overall price tag of \$100 billion by all member nations), thus it is natural to ask about the ISS's Return on Investment to justify its continuous operation and existence its scientific payoff. While this is not a trivial financial question, a more appropriate measure for the ISS would be the Return on Innovation phrased from the perspective of: "What is the cost of

Header Image: Diagram of the total lunar eclipse of April 15, 2014 by Fred Espenak, www.MrEclipse.com are licensed under a Creative Commons Attribution-NonCommercial-NoDerivs 3.0 Unported License. <http://www.mreclipse.com/LEdata/TLE2014Apr15/TLE2014Apr15.html>

NOT innovating and NOT exploring in microgravity?" The talk will also touch upon the need for a customized on-demand payload return from the ISS to augment the current payload downmass to Earth and increase the ISS commercialization potential.

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

May 21, 7:00pm

What: Monster Black Holes: What Lurks at the Centers of Galaxies
Who: Prof. Chung-Pei Ma, UC Berkeley
Where: Smithwick Theatre, 12345 El Monte Road, Los Altos Hills, CA 94022
Cost: Free, \$3 parking (coin required)

Black holes are among the most fascinating objects in the cosmos and have long entranced the public as well as astronomers. Today we understand that black holes can grow to monstrous size, swallowing the mass of millions or billions of suns. New telescopes and techniques in the past decade have expanded and improved our ability to weigh such "supermassive black holes." Dr. Ma will describe recent discoveries of record-breaking black holes, each with a mass of 10 billion times the mass of the Sun. New evidence shows that these objects could be the dormant remnants of powerful "quasars" that existed in the young universe

For more information see: http://www.foothill.edu/news/newsfmt.php?sr=2&rec_id=3359 or phone 650-949-7888.

May 27, Noon-1:00pm

What: A Search for Dyson Spheres using IRAS
Who: Richard Carrigan, Fermilab
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Unlike most radio SETI approaches, interstellar archaeology does not require intent to communicate on the part of the sender. Interstellar archaeology signatures include non-natural planetary atmospheric constituents, stellar doping, the Dyson sphere, a shroud around a star to harvest the visible light coming from the star. The shroud converts the visible light output to infrared. A Dyson sphere is an illustration of a so-called Kardashev Type II civilization, one that exploits the energy of a star. A Type III civilization would utilize the energy of a galaxy. One way to construct a Type III civilization would be to convert many of the stars in a galaxy to Dyson Spheres. A spreading Dyson sphere-based galactic civilization might give rise to voids of visible light with corresponding increased infrared emission hotspots. Elliptical galaxies, more uniform than spiral galaxies, are logical places to look for these "Dyson-Annis voids" of visible light. This presentation reviews a search for stellar Dyson spheres using data from the IRAS space telescope that operated in the eighties.

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

May 31, 8:30pm

What: When Worlds Collide
Who: Dr. Kevin Zahnle, NASA Ames Research Center
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

Collisions with Planet Earth will be discussed. Earth is constantly being struck by interplanetary debris, from fine dust to rocks or boulders big enough to outshine the Sun when they die, to asteroids or comets or even small stray planets.

For more information see: <http://www.friendsofmettam.org/astronomy/schedule>

continued on page 4

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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)

June 3, 7:00pm

What: MISSION TO PHOBOS AND DEIMOS: Exploring the Moons of Mars
Who: Pascal Lee, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details unavailable.

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

June 10, Noon-1:00pm

What: The Quantum Origin of The Universe
Who: Jim Hartle, UC Santa Barbara
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details unavailable.

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

June 13, 6:30pm-10:00pm

What: Full Moon Hike
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: \$12 for members and guests. Does NOT include admission to the Center.

Watch the full moon rising as we hike through the redwood and let its light guides our return on a moderate 4-5 mile hike. After the hike, stay and explore other amazing objects in the night sky through our telescopes (weather permitting) or tour the Telescope Makers Workshop. Hike will take place rain or shine.

See <http://www.chabotspace.org/events.htm> for more information, or call (510) 336-7373.

June 16, 7:30pm

What: Exploring Mars: A Decade of Discovery and Interpretation of the Red Planet
Who: Jeffrey Moore and Eldar Noe Dobra, NASA Ames
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: Advanced ticketing required. Academy members \$8, Seniors \$10, General \$12. Reserve a space online or call 1-877-227-1831.

Join two planetary geologists on a fully immersive tour of the Red Planet. Using the latest high-resolution data collected by spacecraft currently in orbit around Mars, Morrison Plane-

tarium's fulldome display will make you feel like you're flying over places where water once flowed and amazing processes still transform the martian surface. Your expert tour guides for the evening will give you an introduction to what our many missions have taught us about Mars—as well as the mysteries that remain to be solved.

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

June 17, Noon-1:00pm

What: Ejecta from Impacts: New Experiments and Insight from Missions
Who: Brendan Hermalyn, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Details unavailable.

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

Lunar Eclipse Highlights by K. Sperber

On the night of April 14-15, I met Gert and Sibylle at H2O to view and image the total eclipse of the Moon. We were greeted with an overcast sky that persisted through the night. Except for the prospect of observing an eclipse, under these conditions I otherwise would never have ventured to H2O, much less set up and aligned my equipment. Though Polaris was visible for a short time, my polar alignment scope was of no use, as the 2nd and 3rd stars that were needed to align the telescope were not visible. I was able to drift align in azimuth, but altitude corrections were not possible as stars in the east were not visible. So, I had to hope that I'd leveled the tripod correctly, pointed the DEC axis toward Polaris correctly with my offset compass, and oriented the telescope correctly before start-up. I decided to do prime focus photography with my Takahashi FS-102. Gert and Sibylle were also using a Takahashi FS-102, as well as an 5" AstroPhysics refractor.

The rising Full Moon was visible through the morass of clouds, though revealing little if any surface detail. As the evening progressed the cloud cover thinned somewhat, especially during totality, during which the Lunar Maria and the most pronounced craters shone through. Unfortunately, previous experience with exposure times was of little use due to the cloud cover. All that one could do was take a guess at a starting shutter speed and widely bracket. I decided to begin a new image sequence every 5 minutes to get the partial as well as total eclipse phases. From ~10:45pm - ~2:45am I obtained 272 images. Considering the cloud, I was very happy with my haul of images, though I should have taken longer

Lunar Eclipse Highlights continued



Caption: Gert and Sibylle took the upper two images using a Takahashi FS-102 at f/8 using a Canon 350D. The upper-left image was taken soon after totality commenced (00:27 PDT, ISO 400, 20 sec). The upper-right image was taken just after totality was over (01:30 PDT, ISO 400, 20 sec). With the cloud cover the effect mimicked that diamond ring effect seen during total solar eclipses. The bottom image is a wide-field exposure with a 55mm lens, taken at 00:50 PDT, ISO400, 60 sec, f/5.6. Spica and MArS are clearly evident. See Gert's webpage for many more images of this lunar eclipse: http://www.trivalleystargazers.org/gert/mofi_140415/mofi.htm

exposures during the deep partial phase to bring out the orange color on the shadowed portion of the Moon. During totality the cloud was at its thinnest, leading to some very nice exposures, as seen in Gert and Sibylle's images above.

For me, the most interesting aspect was the changing gradation of light across the Moon. As seen in the header image on p.1, and the upper-left image above, the western limb of the Moon was the last portion to enter the umbra. As such,

continued on page 6

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

All times Pacific Daylight Time.

May

- 6 Tue **First-Quarter Moon (8:15pm)**
10-11 Sat- Saturn at opposition, closest to Earth and visible all night
13-14 Tue- The Moon and Saturn are in conjunction
14 Wed **Full Moon (12:16pm)**
15-16 Thu- Uranus is ~1.5 degrees north of Venus
16-28 Fri- Mercury above the west-northwest horizon during its highest apparition of 2014 (after sunset)
21 Wed **Last-Quarter Moon (5:59am)**
23-24 Fri- TVS Open House. POSSIBLE new meteor shower or meteor storm from debris of Comet 209P/LINEAR (see p.30 May S&T)
26-31 Mon- Comet 209P/LINEAR passes < 0.06AU from Earth, one of the closest comet approaches in history!
28 Wed **New Moon (11:40am)**

June

- 5 Thu **First-Quarter Moon (1:39pm)**
7-8 Sat- The Moon, Mars, and Spica are in conjunction
9-10 Mon- The Moon and Saturn are in conjunction
13 Fri **Full Moon (9:11am)**
19 Thu **Last-Quarter Moon (11:39am)**
21 Sat Summer Solstice, the longest day of the year
24 Tue The Moon and Venus are spectacularly close, with The Pleiades (M45) to their upper-left (Dawn)
27 Fri **New Moon (1:08pm)**
29 Sun Jupiter well to the right of the crescent Moon (Sunset)
29-12 Sun- Ceres and Vesta less than 1/2 degree apart

it was farthest from the center of the umbra, and thus the brightest. As the eclipse progressed, the southern edge of the Moon became brightest, whereas toward the end of totality the southeastern edge of the Moon was the brightest (upper-right image on p.5). Watching the progression of the bright edge around the southern circumference of the Moon was memorable.

Additionally, you can never have enough cameras. While I came "loaded for bear," Gert and Sibylle had an additional

camera to take widefield photos. As seen in their image on p.5, the close proximity of the Moon, Mars, and Spica made for a nice study in color contrast. Additionally, there was a bright ring around the Moon during the partial eclipse phase as a consequence of the ice crystals in the clouds.

I've seen many other lunar eclipses, but the clouds added to the aesthetic pleasure of the views. I'm looking forward to the surprises than may occur during the next lunar eclipse on October 8, 2014. Maybe I'll see you then.



The Power of the Sun's Engines

By Dr. Ethan Siegel

Here on Earth, the sun provides us with the vast majority of our energy, striking the top of the atmosphere with up to 1,000 Watts of power per square meter, albeit highly dependent on the sunlight's angle-of-incidence. But remember that the sun is a whopping 150 million kilometers away, and sends an equal amount of radiation in all directions; the Earth-facing direction is nothing special. Even considering sunspots, solar flares, and long-and-short term variations in solar irradiance, the sun's energy output is always constant to about one-part-in-1,000. All told, our parent star consistently outputs an estimated 4×10^{26} Watts of power; one second of the sun's emissions could power all the world's energy needs for over 700,000 years.

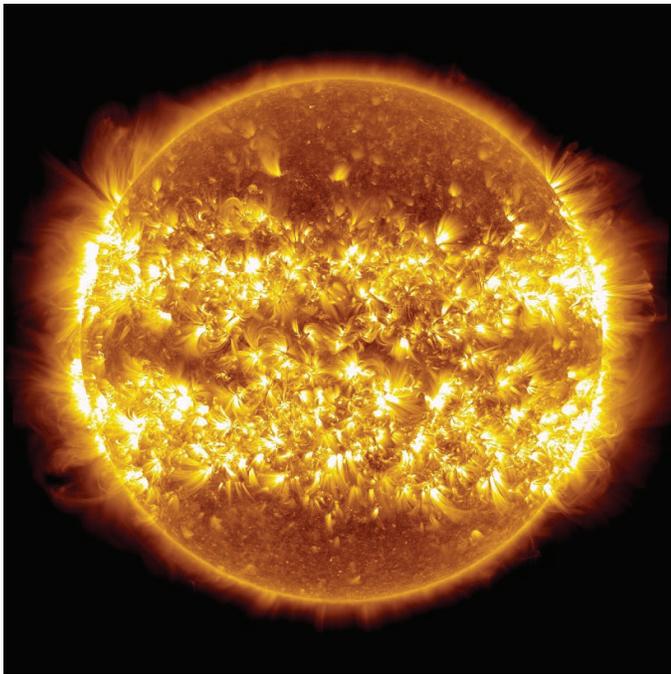


Image credit: composite of 25 images of the sun, showing solar outburst/activity over a 365 day period; NASA / Solar Dynamics Observatory / Atmospheric Imaging Assembly / S. Wiessinger; post-processing by E. Siegel.

That's a literally astronomical amount of energy, and it comes about thanks to the hugeness of the sun. With a radius of 700,000 kilometers, it would take 109 Earths, lined up from end-to-end, just to go across the diameter of the sun once.

Unlike our Earth, however, the sun is made up of around 70% hydrogen by mass, and it's the individual protons — or the nuclei of hydrogen atoms — that fuse together, eventually becoming helium-4 and releasing a tremendous amount of energy. All told, for every four protons that wind up becoming helium-4, a tiny bit of mass — just 0.7% of the original amount — gets converted into energy by $E=mc^2$, and that's where the sun's power originates.

You'd be correct in thinking that fusing $\sim 4 \times 10^{38}$ protons-per-second gives off a tremendous amount of energy, but remember that nuclear fusion occurs in a huge region of the sun: about the innermost quarter (in radius) is where 99% of it is actively taking place. So there might be 4×10^{26} Watts of power put out, but that's spread out over 2.2×10^{25} cubic meters, meaning the sun's energy output per-unit-volume is just 18 Wm^{-3} . Compare this to the average human being, whose basal metabolic rate is equivalent to around 100 Watts, yet takes up just 0.06 cubic meters of space. In other words, you emit 100 times as much energy-per-unit-volume as the sun! It's only because the sun is so large and massive that its power is so great.

It's this slow process, releasing huge amounts of energy per reaction over an incredibly large volume, that has powered life on our world throughout its entire history. It may not appear so impressive if you look at just a tiny region, but — at least for our sun — that huge size really adds up!

Check out these "10 Need-to-Know Things About the Sun": <http://solarsystem.nasa.gov/planets/profile.cfm?Object=Sun>.

Kids can learn more about an intriguing solar mystery at NASA's Space Place: <http://spaceplace.nasa.gov/sun-corona>.

Kids can learn all about GPS by visiting <http://spaceplace.nasa.gov/gps> and watching a fun animation about finding pizza here: <http://spaceplace.nasa.gov/gps-pizza>.

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.