

PRIMEFOCUS

Tri-Valley Stargazers

December 2011



Meeting Info

What:

Holiday Potluck Dinner

Who:

You, family, and friends

When:

December 16, 2011
Doors open at 6:30 p.m.
Dinner at 7:00 p.m.

Where:

Unitarian Universalist
Church in Livermore
1893 N. Vasco Road

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December Meeting



Holiday Potluck Dinner

This month is our Holiday/Christmas/Hanukkah/Kwanzaa/Winter Solstice/chant for more daylight/etc. potluck dinner. We'll be opening the doors at 6:30 to set up the tables and chairs, and then the feast will begin at 7pm. TVS will provide the drinks and paper/plasticware. Members are asked to bring a dish to share, and of course bring family and friends to share in the festivities. Based on the first letter of your last name members are asked to bring a dish to share: A-F: Rice or Potato Dish; G-L: Vegetable or Fruit Dish; M-R: Dessert; S-Z: Main Dish.

Dues Are Due

TVS' membership year runs from January to December, so now is the time to renew your membership. Our membership rates remain unchanged from last year, as do the subscription rates for Astronomy and Sky & Telescope. We no longer offer the "Regular" membership level since we do not send out printed copies of the newsletter. Rather, at the "Basic" membership level we contact you via e-mail to let you know that a .pdf of the newsletter is available. The renewal form can be found on the back of this newsletter or on our website under the Membership link. Please make our Treasurer's New Year especially wonderful by sending in your renewal today.

Royal Astronomical Society of Canada (RASC) Handbooks and Calendars Available for Purchase

The club now has RASC Handbooks and Calendars available for purchase. According to the website <http://www.nova-astro.com/handbook/> the 2012 edition of the handbook 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. This increase from last year is due to both the RASC raising their prices and significantly raising their freight charges. See David Feindel for purchases, or contact him via e-mail (feindel@comcast.net) to arrange to pick up Handbooks and/or Calendars if you can't attend the meeting. For more information on the handbook and calendar, see <http://www.rasc.ca/handbook/> and <http://www.rasc.ca/calendar>

News & Notes

2011/2012 TVS Meeting Dates

The following lists the TVS meeting dates for 2011/2012. 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
Dec. 16	Dec. 19	
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 November 20, 2011 the TVS account balances are:

Checking	\$5,163.15
CD #1	\$3,765.19
CD #2	\$2,657.34

TVS Election Results

The 2011 officers were unanimously re-elected to another term in office. Their many years of service to the club are greatly appreciated.

TVS Position: To be Filled

Jim Alves will vacate the Program Director position in January 2012, but for the next month 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.

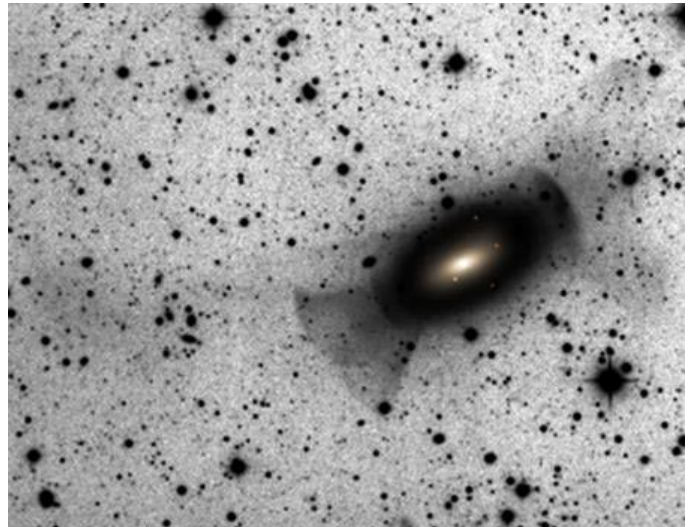
Journal Club by Ken Sperber

Galactic Shells and Cold Dark Matter

Cold dark matter cosmology is the prevailing theory of the structure of the universe and galaxy evolution. It posits that most of the matter in the universe is cold dark matter, which has yet to be identified. The observation that the visible mass

of galaxies was insufficient to account for the rotation rates of stars around galactic centers suggested the possibility of a form of missing matter that cannot be detected by conventional means. The gravitational influence of cold dark matter is theorized to account for the faster than expected rotation rates of stars around galactic centers.

Importantly, numerical simulations of the early universe indicate that visible matter is concentrated along networks where dark matter is concentrated. A prediction of cold dark matter cosmology is that galaxies should be surrounded by copious numbers of dwarf galaxies. However, observations indicate a dearth of dwarfs compared to expectation from theory. One possibility is that the theory is incorrect, or, as reported in Cooper et al. (2011, *Astrophysical Journal*, in press); <http://arxiv.org/abs/1111.2864>, the dwarf galaxies and clumps of dark matter have been assimilated by their hosts. Evidence for the assimilation of dwarfs and dark matter clumps comes from a comparison of deep exposures of Milky Way-type galaxies, in this case NGC7600, as seen below, with numerical simulations of galaxy evolution. The image below, taken by amateur Ken Crawford, has revealed the presence of numerous shells and tidal streams that previously were not detected.



Caption: This color inverted and contrast enhanced deep image of NGC7600 shows faint features and debris fragments not previously seen. The farthest fragment is 140 kpc in projection from the center of the galaxy. The image was made with a 20" RCOS telescope using an Apogee Alta u9000, with exposures L: 680 min, R: 160 min, G: 160 min, B: 140 min. Credit/Copyright: Ken Crawford. For more details see: <http://www.imagingdeepsky.com/Galaxies/NGC7600/NGC7600.htm>

The numerical simulation of galaxy evolution was not constructed to specifically represent NGC7600, but it produces

Header Image: Arp87 as imaged by the Hubble Space Telescope in February 2007. Arp87 is a pair of interacting galaxies that are located approximately 300 million light years away. For more information see: http://heritage.stsci.edu/2007/36/fast_facts.html

Journal Club (continued)

the types of structures seen in the observations. As noted in the paper "As the haloes coalesce, their cores oscillate ra-

dially about the center of the (gravitational) potential, creating a series of compact shells...The shells propagate rapidly outwards and by $z = 2$ have phase-mixed into a diffuse bow-tie-shaped cloud. In the next phase the halo is bombarded by a number of smaller satellites on high-angular-momentum orbits. Tidal forces disrupt many of these satellites, leaving behind streams of debris that crisscross the halo." These quotes from Cooper et al (2011) paint a picture consistent with the image taken by Ken Crawford.

I strongly suggest you download this paper, even if only to look at the figures that depict the galaxy evolution. There is also a link to the movie of the evolution, which can be found at: <http://www.virgo.dur.ac.uk/shell-galaxies/> For more information also see: <http://www.universetoday.com/91138/deep-blue-astrophotography-imaging-galactic-shells/>

Calendar of Events

December 9, 5:00-7:00pm

What: Moonlight Hike
Who: Guided Hike
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Tickets: \$7 (does not include admission into the Center), RSVP Recommended, space is limited!, Register online or call (510) 336-7373

Hike through the moonlit redwoods on a moderately strenuous 4-5 mile hike. The hike will be led by an experienced

guide and will begin and end at Chabot.

Due to a private event, the Center will not be open.

See <http://www.chabot.space.org/calendar.htm?date=12-9-2011&p=1439357> for more information.

December 10, 4:00am

What: Total Lunar Eclipse
Who: Chabot Staff and Volunteers
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: FREE but the Center will not be open, please enter through the Observatory Gate

Get up early and come to Chabot to catch the last Total Lunar Eclipse until the year 2014! Our Observatory Deck will be open for anyone who would like to enjoy the spectacle in good company. Chabot staff and volunteers will be on hand to talk about the eclipse as it happens. A total lunar eclipse is a rare meeting of the full Moon and the long shadow the Earth casts into space. The Moon will begin to enter the Earth's full shadow (umbra) starting at 4:46am, and will be totally engulfed by 6:06am. Totality will last 41 minutes, followed shortly after by moonset.

See <http://www.chabot.space.org/calendar.htm?date=12-10-2011&p=1439355> for more information.

December 14, Noon - 1:00pm

What: Resonances and the Angular Momentum of the Earth-Moon System
Who: Matija Cuk, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview

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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)

Cost: Free

The prevailing theory for the formation of the Moon is a giant collision between proto-Earth and a Mars-sized protoplanet, with the Moon being mainly made from the impactor's material. It is now known that the composition of the Moon is too similar to Earth's mantle to be derived from the impactor, seriously questioning the giant impact theory. However, this is a problem only if we assume that little or no angular momentum was lost from the system since its formation. While lunar tides keep the angular momentum in the system, certain resonances can transfer angular momentum to Earth's heliocentric orbit. These resonances are important if the Earth-Moon system formed with a much larger angular momentum, and can evolve the system to the present state. Dr. Cuk will show how it is likely that the Moon likely formed in a impact-triggered fission different from the "classical" giant impact scenario

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

December 17, 11:00am

What: Shedding Light on the Dark Side of the Universe
Who: Prof. Bernard Sadoulet, UC Berkeley, Director of UC Institute for Nuclear and Particle Astrophysics and Cosmology
Where: UC Berkeley, Genetics and Plant Biology Building, Room 100
Cost: Free

The last decade of cosmological observations tells us that 95% of the energy density in the universe is dark: the combination of about 25% of dark matter, whose nature is unknown and 70% of an even more mysterious dark energy. Ordinary matter only represents 5% of the energy budget. I will review attempts to shed light on this dark side of the universe, in particular current attempts to detect Weakly Interactive Massive Particles, which could make the dark matter.

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

December 27-29, 1:00pm and 3:00pm

What: Simulated Space Mission
Who: Flight Director
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Guests: \$10 plus General Admission, Members: \$10
Register online or call (510) 336-7373

Ages 8+: Blast-off on a simulated space missions in our Challenger Learning Center.® Guided by an experienced flight director you use problem solving skills, team work and decision making as you learn what it takes to man a space craft and lead a team of astronauts from mission control.

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

January 4, Noon - 1:00pm

What: Rotation of a Moonless Earth-Who needs a Moon?
Who: Jack Lissauer
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
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.

January 6, 5:00-7:00pm

What: Moonlight Hike
Who: Guided Hike
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Tickets: \$7 (does not include admission into the Center), RSVP Recommended, space is limited!, Register online or call (510) 336-7373

Hike through the moonlit redwoods on a moderately strenuous 4-5 mile hike. The hike will be led by an experienced guide and will begin and end at Chabot. After the hike, stay and view the night sky through Chabot's telescopes (weather permitting). Hike will take place rain or shine.

See <http://www.chabotspace.org/calendar.htm?date=12-9-2011&p=1439357> for more information.

January 18, 7:00pm

What: Scott, Amundsen and Science: A 100th Anniversary Retrospective on Antarctic Science
Who: Ed Larson, Pepperdine University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountainview
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.



Caption: Hilary Jones recently imaged NGC772 from his backyard observatory, and he has provided the following information on this interesting galaxy: This unbarred spiral galaxy is about 130 Mly away in the constellation Aries. It is also known as Arp 78. The galaxy has been seriously disturbed by the companion elliptical galaxy NGC 770, which can be seen in the picture below and to the right (at 5:00). There are several other galaxies in the picture, including PGC 7509, which is a compact reddish object to the right of NGC 770 and about halfway between it and the edge of the picture. There is also a very faint galaxy to the left of NGC 772, and another at the bottom of the picture at about 5:00.

According to one source, NGC 772 galaxy has a diameter of about 250 Kly, which makes it twice as big as the Milky Way. But another source says the diameter is 100 Kly, and therefore about the same size as the Milky Way. The galaxy had two supernovas in 2003 within only three weeks of each other. There have been some scientific studies of the galaxy, in particular modeling its structure. NGC 770 is an unusual galaxy because it has a counter-rotating core. This dwarf galaxy could thus be the result of the merger of two even smaller dwarf galaxies.

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

All times Pacific Standard Time.

December

- 14-28 Wed- Mercury visible 8-10 degrees above the horizon in the southeast (Dawn)
- 17 Sat **Last-Quarter Moon (4:48pm)**
- 19-20 Mon- Saturn, Spica, and the crescent Moon align in the southeast (Dawn)
- 21 Wed Winter Solstice (9:30pm); longest night of the year
- 24 Sat **New Moon (10:06am)**
- 26 Mon A thin crescent Moon and Venus are low in the southwest (30-60 minutes after sunset)
- 27 Tue Algol at minimum brightness for ~2 hours centered on 10:41pm
- 30 Fri Algol at minimum brightness for ~2 hours centered on 10:30pm
- 31 Sat **First-Quarter Moon (10:15pm)**

January

- 3 Tue Europa and Ganymede shadow transits of Jupiter (10:27-11:57pm; see p. 52 of S&T January 2012)
- 4 Wed Quadrantid meteor shower (predawn)
- 4 Wed Earth at perihelion, its closest approach to the Sun during the year
- 4-5 Wed- Moon near the Pleiades on the 4th, and between the Pleiades and Hyades on the 5th
- 8 Sun **Full Moon (11:30pm)**
- 16 Mon **Last-Quarter Moon (1:08am)**
- 19 Thu Antares to lower-right of the Moon (Dawn)
- 19 Thu Algol at minimum brightness for ~2 hours centered on 9:15pm
- 21 Sat **New Moon (11:39pm)**



Re-thinking an Alien World: The Strange Case of 55 Cancri e

Forty light years from Earth, a rocky world named “55 *Cancri e*” circles perilously close to a stellar inferno. Completing one orbit in only 18 hours, the alien planet is 26 times closer to its parent star than Mercury is to the Sun. If Earth were in the same position, the soil beneath our feet would heat up to about 3200 F. Researchers have long thought that 55 *Cancri e* must be a wasteland of parched rock.

Now they’re thinking again. New observations by NASA’s Spitzer Space Telescope suggest that 55 *Cancri e* may be wetter and weirder than anyone imagined.

Spitzer recently measured the extraordinarily small amount of light 55 *Cancri e* blocks when it crosses in front of its star. These transits occur every 18 hours, giving researchers repeated opportunities to gather the data they need to estimate the width, volume and density of the planet.

According to the new observations, 55 *Cancri e* has a mass 7.8 times and a radius just over twice that of Earth. Those properties place 55 *Cancri e* in the “super-Earth” class of exoplanets, a few dozen of which have been found. Only a handful of known super-Earths, however, cross the face of their stars as viewed from our vantage point in the cosmos, so 55 *Cancri e* is better understood than most.

When 55 *Cancri e* was discovered in 2004, initial estimates of its size and mass were consistent with a dense planet of solid rock. Spitzer data suggest otherwise: About a fifth of the planet’s mass must be made of light elements and compounds—including water. Given the intense heat and high pressure these materials likely experience, researchers think the compounds likely exist in a “supercritical” fluid state.

A supercritical fluid is a high-pressure, high-temperature state of matter best described as a liquid-like gas, and a marvelous solvent. Water becomes supercritical in some steam turbines—and it tends to dissolve the tips of the turbine blades. Supercritical carbon dioxide is used to remove caffeine from coffee beans, and sometimes to dry-clean clothes. Liquid-fueled rocket propellant is also supercritical when it emerges from the tail of a spaceship.

On 55 *Cancri e*, this stuff may be literally oozing—or is it steaming? —out of the rocks.

With supercritical solvents rising from the planet’s surface, a star of terrifying proportions filling much of the daytime sky, and whole years rushing past in a matter of hours, 55 *Cancri e* teaches a valuable lesson: Just because a planet is similar in size to Earth does not mean the planet is like Earth.

It’s something to re-think about.

Get a kid thinking about extrasolar planets by pointing him or her to “Lucy’s Planet Hunt,” a story in rhyme about a girl

who wanted nothing more than to look for Earth-like planets when she grew up. Go to <http://spaceplace.nasa.gov/story-lucy>.

The original research reported in this story has been accepted for publication in *Astronomy and Astrophysics*. The lead author is Brice-Olivier Demory, a post-doctoral associate in Professor Sara Seager’s group at MIT.

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: Artist’s rendering compares the size Earth with the rocky “super-Earth” 55 *Cancri e*. Its year is only about 18 hours long!

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.