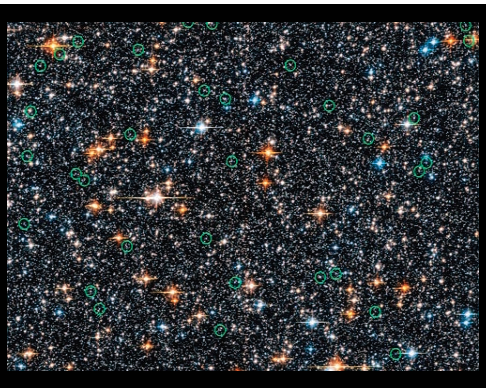
PRIMEFOCUS

Tri-Valley Stargazers

June 2013



Meeting Info

What:
Summer BBQ

Who:
Dr. Curtis Macchioni

When:
June 21, 2013
Set-up at 6:30 p.m.
Dinner at 7:00 p.m.

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

Inside

June Meeting

Summer Barbecue

Our June meeting will be our annual Summer BBQ. Plan on working up an appetite by helping to set-up and get the charcoal going at about 6:30pm. We will start eating around 7:00pm.

TVS will provide the burgers and veggie burgers, condiments, drinks, and plastic ware. Members are asked to bring a side dish, salad, or dessert to share. Please bring enough to feed about 5-8 people. Use the first letter of your last name to determine which type of dish to bring:

A-F	Macaroni or Potato Salad
G-L	Green or Fruit Salad
M-R	Appetizers
S-Z	Dessert

Please bring family, friends, and future TVS members to share in the festivities. Please note that the set-up time is 6:30pm, with dinner at about 7pm.

Reminder About Access to H2O

The club leases a comparatively dark-sky observing site on a hilltop in the Diablo Mountains south of Livermore and east of San Jose. This is private property, secured and restricted at all times for authorized members and their guests. Authorized (key holding) members can access the site any day of the year. Non-key holding members and the general public must be escorted to, while at, and from the site by key holding members -- NO EXCEPTIONS.

Members are not allowed to tell anyone, even other club members, the directions to Hidden Hill Observatory. Only board members can give out directions to the ranch or the site, the exact location (in any form including maps, coordinates, and addresses), the name of the ranch, and the combination to the gate. You cannot meet or wait for anyone at the gate to the ranch. You must meet elsewhere and drive up together with your escort. If you are an escort, there is no need to give your guests exact directions before leaving, as they must follow you up there. These rules are for your safety, as well as the safety of the property owners.

News & Notes

2013 TVS Meeting Dates

The following lists the TVS meeting dates for 2013. 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**
Jun. 21	Jun. 24	
Jul. 19	Jul. 22	Jun. 28
Aug. 16	Aug. 19	Jul. 26
Sep. 20	Sep. 23	Aug. 30
Oct. 18	Oct. 21	Sep. 27
Nov. 15	Nov. 18	Oct. 25
Dec. 20	Dec. 23	Nov. 29

Money Matters

Treasurer David Feindel indicates that as of May 20, 2013 the TVS account balances are:

Checking $12,412.87

TVS Needs YOU!!!

TVS needs your help. Please consider taking on the role of Vice-President or Program Director. Anyone interested in either (or both) of these positions is encouraged to contact any of the club officers via e-mail or at the monthly meeting.

Yosemite Star Party

This year's Yosemite Star Party will be held on Friday and Saturday, August 16 and August 17, at Glacier Point. Tri-Valley members who bring telescopes for public observing will receive free camping at the Bridalveil campgrounds. On these evenings, sunset occurs at about 8pm. On August 16, moonrise is at 4:18pm and moonset is at 2:35am. On August 17, moonrise is at 5:13pm and moonset is at 3:42am.

Those interested in participating should contact Bob McKoon (rmckoon"at"yahoo.com).

Journal Club by Ken Sperber

Blue Straggler Formation: Caught in the Act

There are approximately 150 Globular Cluster's (GC's) that orbit the Milky Way Galaxy, ~500 that orbit the Andromeda Galaxy, and upwards of 10,000 that orbit the massive elliptical galaxy, M87. GC's come in a wide range of sizes, ranging from about 10,000 stars to about 1 million stars. GC's are bound by gravity with the stars in random orbits, which gives rise to their circular shape, with most stars being concentrated in the center. GC's are divided into 12 classes based on the degree to which the stars are concentrated in their centers (Class I-most concentrated; Class XII-least concentrated). According to Wikipedia, "The typical distance between stars in a globular cluster is about 1 light year, but at its core, the separation is comparable to the size of the Solar System (100 to 1000 times closer than stars near the Solar System)."

For anyone who has observed a GC through a large telescope (AMAZING!), or seen a picture of a GC (as below), you will immediately note the absence of any obscuring dust. It is believed that all of the stars in a given GC probably formed at the same time, and in the process of doing so, the remaining gas and dust were blown out by the strong winds of the nascent stars. Absent gas and dust, star formation has ceased in GC's.

Caption: Globular Cluster, M53, as imaged by the Hubble Space Telescope. M53 contains a large number of Blue Stragglers. Credit: NASA/ESA.

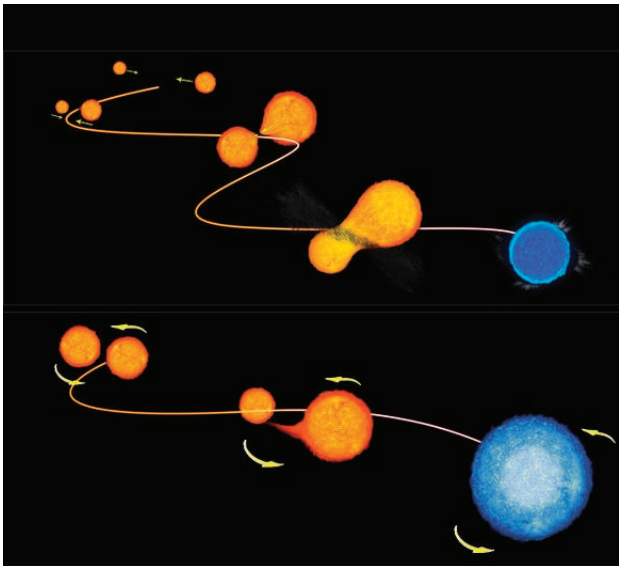
GC's are among the oldest objects in the universe as evidenced by the low concentration of metals in their stars. These low metalicity stars are termed "Population II" stars, which are also found in the galactic bulge. Given that all of the stars formed at about the same time, massive stars have long since gone supernova or turned into white dwarfs. What remain are smaller and dimmer stars that are capable of sustaining fusion for 10-13 billion years or longer! Based on

Header Image: The Hubble Telescope captures blue straggler stars in the Milky Way bulge. Credit: NASA, ESA, W. Clarkson (Indiana University and UCLA), and K. Sahu (STScI)

Journal Club (continued)

the age of GC (as inferred by the Hertzsprung-Russell (H-R) diagram of the stars color vs. luminosity) stars above a certain mass should no longer be on the main sequence.

A conundrum developed in 1953, when Allan Sandage discovered a new type of star, called a Blue Straggler, in the GC Messier 3. These stars are more luminous, more massive, and bluer in color than the main sequence stars that presently dominate the GC. As such, the Blue Stragglers appear to be much younger than the other stars, and based on the theory of GC formation, they should not exist in Globular Clusters.



Caption: Top: Theory 1: Colliding stars forming a Blue Straggler; Bottom: Theory 2: Mass transfer among binary stars forming a Blue Straggler. Credit: NASA/ESA.

Two theories for the formation of Blue Stragglers have been put forward. Recalling that stars are closely packed in GC's, one suggestion is that two stars could collide to form a more massive (and hence more luminous) Blue Straggler. The second theory stems from the observation that binary stars are common. If the two stars are close enough, the more massive of the two stars (the primary) siphons off material from the smaller (secondary) star. As the primary star becomes more massive it becomes brighter, thus transforming into a Blue Straggler.

Recently, Rozyczka et al. (2013) examined the eclipsing variable star V-60 in the GC Messier 55, finding it to be a developing Blue Straggler! First the authors needed to determine if V-60 was part of the Globular Cluster. They confirmed that is was a member of M55 by finding that V-60 was located at the correct distance, had a velocity consistent with other stars in the system, and that its proper motion across the sky was consistent with that of M55. Spectra indicate that the V-60 system has an excess of blue light consistent with it being a Blue Straggler.

For M55, an H-R diagram of star color vs. luminosity indicates that stars greater than ~0.8 solar masses should not be on the main sequence. However, the mass of the V-60 primary star was estimated to be ~1.26 solar masses, and the mass of the secondary star was estimated to be ~0.33 solar masses. Given the age of M55, a 1.26 solar mass star would have left the main sequence long ago, and turned into a white dwarf star. Therefore, the V-60 primary star has only recently acquired additional mass. Since we (luckily) view the system edge on, examination of the light curves indicated that the orbital period was equal to 1.183 days in 2008. More recent measurements indicate that the orbital period is getting longer (in one million years the orbital period would double). The increase in the orbital period indicates that V-60 is a semi-detached binary system, with the primary star stealing

Journal Club (continued)

mass from the secondary star. Interestingly, the sum of the masses of the primary and secondary nearly equals 1.6 solar masses, suggesting that originally each star was ~0.8 solar masses, close with the maximum mass of main sequence stars in M55, as inferred by its H-R diagram. These results support Theory 2, that mass transfer among binary stars is the method by which Blue Stragglers are created.

Based on irregularities in the light curve of the primary star eclipse (it is not symmetrical) it is believed that the stream of gas between the two stars gives rise to the asymmetrical light curve. Other possibilities for the spectroscopic and photometric perturbations include shock waves where the mass transfer hits the primary, and/or irregularities in the accretion disk that spirals into the primary star. However, the orbital separation between the two stars is too small for an accretion disk to be present. Using a model of particle transfer, the authors suggest that the material flow from the secondary takes on the shape of a teardrop, directly falling on the primary. As the material hits the primary it induces a shock wave that gives off excess light.

Numerical modelling is also a method by which we could determine the relative contributions of collision vs. binary formation for Blue Stragglers. Such modelling could be used to determine how often collisions might occur, and other calculations could be used to assess how often mass transfer between binary stars would be effective at creating Blue Stragglers.

For more information see: Rozyczka et al. (2013; The Cluster AgeS Experiment (CASE): The Blue Straggler Star M55-V60 Caught Amidst Rapid Mass Exchange, Acta Astronomica, in press; http://arxiv.org/abs/1303.7345), http://www.universetoday.com/102780/a-rare-oppurtunity-to-watch-a-blue-straggler-forming/, http://en.wikipedia.org/wiki/Globular_cluster, http://en.wikipedia.org/wiki/Blue_straggler, http://www.spacetelescope.org/images/potw1205a/ and The Deep-Sky Field Guide to Uranometria 2000.0 (Willmann-Bell, Inc.)

Calendar of Events

June 15, 11:00am

What: A Deep View of the Early Universe: Extreme Makeovers and Overweight Galaxies
Who: Prof. Mariska Kriek, UC Berkeley
Where: UC Berkeley, Genetics and Plant Biology Building, Room 100 (northwest corner of campus)
Cost: Free, limited hourly pay parking on/nearby campus. The venue is within walking distance of BART and bus lines.

Galaxies are the building blocks of the Universe; massive structures that contain up to 100s of billions of stars. Galaxies in today's Universe show a striking diversity among their properties, with large variations in their appearance, age, size, weight, and stellar birth rate. Despite this diversity, galaxies can broadly be divided into two types: low-mass spiral galaxies with high stellar production rates, and massive old elliptical galaxies in which no new stars are being formed. Whereas this broad distinction was already recognized by Edwin Hubble in the 1920s, it has remained a puzzle how this dichotomy originated and how the different galaxy classes may be related to each other. In my talk I will discuss this issue and present our current view of how the different types of galaxies may have formed and have evolved over cosmic time.

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

June 15, 8:30pm

What: Dark Energy and the Runaway Universe
Who: Dr. Alex Filippenko, UC Berkeley Department of Astronomy
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

The expansion rate of the Universe is speeding up with time, rather than slowing down due to gravity as expected. The origin of the repulsive "dark energy" may be the biggest unsolved mystery in all of physics.

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

June 18, Noon-1:00pm

What: Conformal Gravity: New Light on Dark Matter and Dark Energy
Who: Robert Nesbet, IBM Almaden
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Dr. Nesbet will describe (in layman's terms) implications of a theory that differs from standard particle physics and cosmology only by imposing a universal symmetry principle. This theory has been found to explain dark energy and dark galactic halos without invoking dark matter. Subgalactic phenomenology (relevant to our solar system) is retained.

The model postulates that strict conformal symmetry (local Weyl scaling covariance), already satisfied by standard fermion and gauge boson theory, can be extended to all elementary massless fields. This modifies Einstein-Hilbert general relativity and the Higgs scalar field model. No new physical fields are introduced.

Calendar of Events (continued)

Dr. Nesbet will show that conformal gravity and a conformal Higgs model fit empirical data on galactic rotational velocities, galactic halos, and Hubble expansion including dark energy. By implication, dark matter is not needed for an isolated galaxy. This model appears to be a promising tool for understanding both cosmology and elementary particle physics.

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

June 24, Noon-1:00pm

What: Time Reborn: From the Crisis in Physics to the Future of the Universe
Who: Lee Smolin, Perimeter Institute, Ontario, Canada
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.

July 2, Noon-1:00pm

What: Dune and ripple migration along rover Curiosity's traverse in Gale Crater (Mars)
Who: Simone Silvestro, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The NASA Mars Science Laboratory rover, Curiosity, has safely landed near a 35 km long dark dune field in Gale Crater on Mars. This dune field crosses the landing site from the NE to the SW and lies along Curiosity's traverse to Aeolis Mons. Dr. Silvestro will present evidence of recent aeolian activity in the form of ripple and dune migration and further estimate wind directions within the dune field through analysis of ripple and dune morphologies and the Mars Regional Atmospheric Modeling System (MRAMS). He will show how constraints on the wind regime provide a unique opportunity to use ground measurements from MSL to test the accuracy of winds predicted from orbital data.

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

July 9, 7:00pm

What: Discovery of a New Unique Water-rich Meteorite from Mars
Who: Carl B. Agee, University of New Mexico
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Northwest Africa (NWA) 7034 is a new type of martian meteorite discovered in Morocco in 2011. NWA 7034 aka "Black Beauty", nicknamed for its dark shiny appearance, contains ten times more water than other martian meteorites. This combined with its oxidation state which is highest among martian meteorites, its anomalous oxygen isotope values, and its early Amazonian age, make it an extraordinarily valuable specimen for understanding surface processes, aqueous alteration, and atmosphere/lithosphere exchange reactions that existed on Mars ~2 billion years ago.

Dr. Agee will show that Black Beauty appears to be the first martian meteorite to match the surface geochemistry of Mars, as seen by landers and orbiters, and as such, it has particular relevance to the current Mars Science Laboratory mission at Gale Crater.

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

July 13, 8:30pm

What: Beyond the Cradle: Kepler's Search for New Worlds
Who: Dr. Natalie Batalha, 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

NASA's Kepler spacecraft, designed to find Earth-like planets orbiting stars in our Milky Way, has been in operation since 2009. What exciting results have been found to date?

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

July 15, 7:30pm

What: The Once and Future Kepler Mission: Hot on the Trail of Habitable Earth-size Planets
Who: Dr. Jon Jenkins, SETI Institute
Where: California Academy of Science, 55 Music Concourse Dr., Golden Gate Park, San Francisco, CA
Cost: General $12, Seniors $10, Academy members $8. Reserve a space online or call 1-877-227-1831.

Kepler vaulted into the heavens on March 7, 2009, initiating NASA's search for Earth-size planets orbiting Sun-like stars in the habitable zone, where liquid water could exist on the planetary surface and support alien biology. In the 4 years since, a flood of photometric data on upwards of 190,000 stars of unprecedented precision and continuity has provoked a watershed of 132+ confirmed or validated planets, 2700+ planetary candidates and a resounding revolution in our understanding of the behavior of stars. Recent discoveries include Kepler-62 with 5 planets total of which 2 are in

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

All times Pacific Daylight Time.

June

16	Sun	First-Quarter Moon (10:24am)
18	Tue	Mercury 2.1 degrees left of bright Venus (Dusk)
20	Thu	Summer solstice, the shortest night of the year in the northern hemisphere (10:04pm)
23	Sun	Full Moon: The largest full moon of 2013! (4:42am)
29	Sat	Last-Quarter Moon (9:54pm)

July

3	Wed	Venus and the Beehive Cluster (M44) may be visible in binoculars or a widefield telescope (1 hour after sunset)
5	Fri	Earth is farthest from the Sun (aphelion)
8	Mon	New Moon (00:14am)
15	Mon	First-Quarter Moon (8:18pm)
15	Mon	Spica and the First-Quarter Moon are very close together

Calendar of Events (continued)

the habitable zone, and are 1.4 and 1.7 times the radius of the Earth. Dr. Jenkins will highlight key science results from Kepler, and will also discuss the daunting challenges that faced the technical and scientific team as they designed, built and are now operating this amazing observatory. He will also give a brief overview of TESS, NASA's next mission to detect Earth's closest cousins.

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

July 16, Noon-1:00pm

What: Atmospheric Polar Warming at Mars
Who: Tamara McDunn, Jet Propulsion Laboratory
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.

Triple Treat

Note from K. Sperber: NASA SpacePlace articles become available mid-month, usually after the publication of that month's TVS newsletter. As such, the article below is outdated. However, since it contains educational material that is useful for conceptually understanding why eclipses occur, I suggest you enjoy Dr. Siegal's article.

By Dr. Ethan Siegal

The solar system is a busy place, with five wandering planets visible to the naked eye alone. When any two pass close by each other from our point of view, we see an astronomical conjunction, but on very rare occasions, three planets will find themselves grouped together: a triple conjunction. Towards the end of May, Mercury, Venus and Jupiter will treat us to the best triple conjunction in years.

On May 25th, Mercury will pass within 1.4° of Venus, then two days later Mercury comes within 2.4° of Jupiter, and finally on the 28th, Jupiter and Venus approach within 1° of one another. If it weren't for the slight orbital tilt of our solar system's planetary orbits, these conjunctions would all be occultations instead. During the nights of May 26th-27th, all three planets are visible immediately after sunset within the same 3° field of view, with the triple conjunction peaking in a triangular shape on the 26th. (For scale, the full Moon subtends about 1/2°.) The three planets appear close together for a few days more, making a line in the sky on the 30th/31st.

How does this happen? Mercury and Venus race around the Sun far faster than Earth, with Mercury completing more than four revolutions around the Sun for each one that Earth makes. At the same time, Jupiter is far slower, taking 12 years to orbit just once around the Sun. Jupiter's been high in the sky during the early parts of the night, but steadily lowers throughout May as Earth continues to move away from it, approaching its maximum distance from Earth. Mercury and Venus, meanwhile, begin to move out from behind the Sun during May: Venus at the beginning of the month and Mercury in the middle.

Thus, during this triple conjunction, all three planets will be on the far side of the Sun, something that happens just 25% of the time in triple conjunctions involving Mercury and Venus! If you telescopically resolve these planets into disks, you'll see our inner worlds in a nearly-full gibbous phase. Jupiter will appear largest in terms of angular diameter, followed by Venus and lastly by Mercury. Just a year ago, during its now-famous transit, Venus took up more than a full arc-minute in the sky; during this conjunction, it will just one-sixth that angular size and less than a third the apparent diameter of Jupiter. Nevertheless, Venus will still be more than six times as bright as Jupiter during this time, outshining all night-sky objects other than the Moon. Closer conjunctions of two naked-eye planets are frequent, but getting three or more like this happens just once or twice per decade, so don't miss your chance to see it.

And speaking of occultations, The Space Place has a great kid-friendly explanation of the Venus transit and solar eclipses of 2012 at spaceplace.nasa.gov/venus-transit.

Dr. Ethan Siegel, a theoretical astrophysicist, is a professor at the University of Portland (OR) and Lewis & Clark College.

Caption: The conjunction of Jupiter, Venus, and Mercury in the western sky just after sunset on May 23, 2013 as imaged by Ken Sperber.

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.