PRIMEFOCUS

Tri-Valley Stargazers

March 2014

TVS Tri-Valley Stargazers

Meeting Info

What:
Touring Antique Telescopes and Other Astronomical Sites Around the World

Who:
Dr. Kenneth Lum

When:
March 21, 2014
Doors open at 7:00 p.m.
Lecture at 7:30 p.m.

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

Inside

March Meeting

Touring Antique Telescopes and Other Astronomical Sites Around the World

Dr. Kenneth Lum

The Antique Telescope Society was organized in 1992 to study the history of astronomical as well as other kinds of optics and their impact on the study of astronomy. In addition, many of the members collect, and in many cases, restore and use these fine old instruments for personal use. Each year, the Society tours a different site, typically an observatory, of importance to the history of astronomy. In this talk, I will give a brief pictorial tour of many of the places we have been to in the US and in Europe dating back to the time of the invention of the telescope in 1608. The Society also publishes a scholarly journal, The Journal of the Antique Telescope Society, to publish articles on the history of astronomical optics. More information on the Society and great resources on the history of astronomical optics along with many photographs of old telescopes can be found on its web site at: http://webari.com/oldscope/. A Yahoo discussion Group is also available at: http://groups.yahoo.com/neo/groups/ATS_Forum/conversations/messages.

Caption: The lens of the 40" Yerkes Refractor in Wisconsin. Image Credit: Dr. Kenneth Lum

Dr. Kenneth Lum is recently retired from the practice of Emergency Medicine. Since high school, he has also been an enthusiastic amateur astronomer, having built two telescopes at the Adler Planetarium in Chicago and a large Newtonian reflector when he reentered amateur astronomy in 1986 following the passage of Halley's Comet. He pursued an interest in astronomical photography during the 1990s and continues to study the history of astronomy and astronomical instrumentation. Dr. Lum is currently interested in ways to enhance the performance of small telescopes with the use of a photomultiplier eyepiece and astronomical video cameras. He also participates in numerous local educational activities related to physical and biological sciences. Since 1994, he has been traveling with the Antique Telescope Society almost annually visiting different historical astronomical observatories.

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**
Mar. 21	Mar. 24	
Apr. 18	Apr. 21	Mar. 28
May 16	May 19	Apr. 25
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 February 3, 2014 the TVS checking account balance is:

Checking $12,004.97

The club is paid up for the year for our rent for the meeting hall and for both observing sites (H2O and Del Valle).

Star Party Coordinator

Eric Dueltgen has volunteered to be the new Pubic Star Party Coordinator for TVS. Please contact him at his e-mail address, given in the Office Block on p.3, regarding requests for star parties and/or willingness to participate in scheduled events.

Developing Club Resource: Past Lectures

Hilary Jones, the TVS Webmaster, is developing a new resource for the club, with the posting of recent TVS presentations. Presently, one can find last month's presentation slides on Video Astronomy by Curtis Macchioni, and Hilary's 2013 presentation on remote astrophotography. The presentations can be found at: http://www.trivalleystargazers.org/calendar.shtml#tvslectures

San Jose Astronomical Association Auction

The 34th Annual SJAA Auction will be held on Sunday, March 16 at Hogue Park, White Oaks Ave., San Jose. Seller registration is at 10am, bidder registration from 11-11:30am, then viewing until noon, at which time bidding begins. For more details, see: http://www.meetup.com/A-A-N-C/events/169639122/?a=ea1_grp&rv=ea1

Magazine Giveaway: Black Friday

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!

Correction

I incorrectly listed Roland as having imaged Supernova 2014J on March 1, 2014. The image was taken on February 1, 2014.

Journal Club By Ken Sperber

Lunar Range-Finding: Diminishing Returns

Those of you that remember watching the Apollo moonwalks will probably remember that the astronauts spent much of their time setting up scientific instruments. On Apollo's 11, 14, and 15 they deployed corner-cube reflectors for the purpose of measuring the distance from the Earth to the Moon. Observatories on Earth shine laser pulses at these reflectors, and based on the time it takes to get a return signal (~2.7 seconds) they can calculate the Earth-Moon distance. To give you an indication of the sensitivity required to accomplish this task, presently, from a typical laser pulse containing 100 quadrillion photons, only 1 photon returns to the observatory detector. Many factors are involved in such a low return rate, including scattering of the laser pulse in the Earth's atmosphere, divergence of the beam by the reflector, and the fraction of photons that are reflected back to Earth.

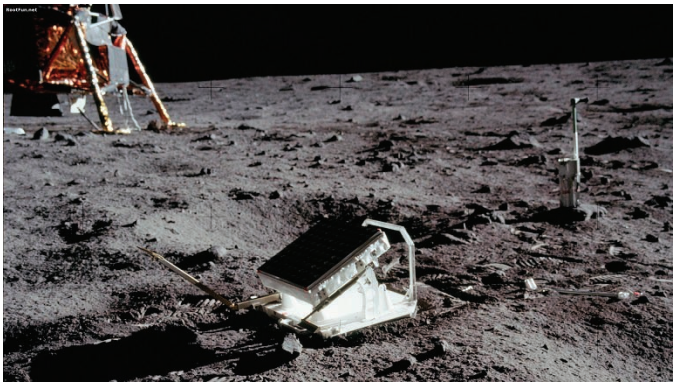


Image Caption: The Apollo 11 lunar-range reflector. Credit: NASA

As discussed in Murphy et al. (2014), the efficiency of the reflectors has dropped by a factor of 10 since they were first placed on the Moon. As you might guess, lunar dust is the culprit. You probably remember that the astronauts became coated in moondust while on their excursions. The dust that was kicked up adhered to their suits via electrostatic charge.

Header Image: Apache Point Observatory 3.5m telescope running APOLLO lunar laser ranging experiment. Credit: Dan Long See: http://commons.wikimedia.org/wiki/File:D70050914_15_ApolloLLR.jpg, This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license..

At times, the astronauts also observed what appeared to be subtle glows that hovered over the lunar surface. As it turns out, sunlight, especially ultraviolet and X-Ray radiation, knocks electrons off of the soil molecules and atoms, which then become positively charged. Once sufficiently charged the dust is repelled off of the surface, where depending on its size and charge, it can attain altitudes of meters to kilometers. Conversely, on the night side of the Moon, electrons in the solar wind give dust a negative charge. Thus, at the day-night terminator there could be substantial horizontal dust transport. The authors modelled the impact of varying amounts of dust coverage on the efficiency of the lunar reflectors. They assumed that the dust was randomly distributed across the surface to the reflector, finding that 50% duct coverage could account for the reduced efficiency of the lunar reflectors.

There is another conundrum, however. The efficiency drops by another factor of 10 as the Moon approaches full phase. Interestingly, the reflectors were designed to be most efficient around time of the Full Moon. At these times, when the Sun is nearly overhead from the perspective of being on the Moon, the reflectors were designed to reflect all of the incident sunlight. This was important since this minimized the development of temperature gradients that would affect the reflection efficiency. This led the authors to hypothesize that the dust on the surface of reflectors was heating up as the incident solar radiation increased during the lunar day. This set up a temperature gradient between the front and back of the reflector that degraded the performance. This is analogous to taking your telescope out to H2O on a cool night after your telescope was sitting in the hot shed all day. Until your mirror equilibrates with the outside temperature, the quality of the image is degraded.

Well, how do you verify such an hypothesis? You wait for a total lunar eclipse! The total lunar eclipse of December 21, 2010 was a prime opportunity, since the Moon was nearly overhead at eclipse time at the Apache Point Observatory, thus presenting a minimal path length of atmosphere through which the laser pluses would propagate. Consistent with their thermal model of the reflector and dust coating, as the Earth's shadow moved across each of the Apollo landing sites, they observed an increased in number of detected photons as the front surface of the lunar reflector cooled down to the same temperature as the rear of the reflector. Then, as the eclipse progressed, the front surface of the reflector became colder than the rear of the reflector, and the photon counts dropped once again, as predicted. After the eclipse ended, the dust covered front surface warmed up to the same temperature as the back of the reflector, during which time the photon counts rose once again. Eventually, the front surface heated up again, exceeding the rear temperature, and the photon counts returned to typical Full Moon values. What a nice piece of detective work to solve a 40 year puzzle!!!

BTW, the NASA Lunar Atmosphere and Dust Environment Explorer (LADEE) mission is currently circling the Moon in an effort to learn more about lunar dust and its transport.

For more information see: http://www.sciencedaily.com/releases/2014/02/140211121831.htm, Murphy, T.W., R.J. McMillan, N.H. Johnson, S.D. Goodrow. Lunar eclipse observations reveal anomalous thermal performance of Apollo reflectors. Icarus, 2014; 231: 183 doi: 10.1016/j.icarus.2013.12.006, and http://www.nasa.gov/mission_pages/ladee/main/

Image Credit: December 21, 2010 lunar eclipse sequence: Karen Harris

Calendar of Events

March 18, Noon-1:00pm

What: Patterns of Sunlight on Extra-Solar Planets
Who: Tony Dobrovolskis, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave.,

Calendar of Events (continued)

Mountain View, CA
Cost: Free

Exoplanets discovered to date show a wide range of orbital eccentricities; the angles between their spin equators and orbital planes are still quite unknown, but these "obliquities" may range widely as well. Both eccentricity and obliquity can have profound effects on a planet's seasons, as well as on its cycle of night and day. Remarkable patterns of insolation occur on synchronously-rotating planets, and on those in other spin-orbit states, with implications for their climates, detectability, and habitability.

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

March 22, 7:30pm-8:15pm

What: A Jewel in the Sky
Who: Faride Khalaf
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Included with General Admission.

The International Space Station is the crowning achievement of many nations. It symbolizes a new beginning in the exploration of space; no longer do we compete as adversaries in our quest, instead, we explore beyond Earth as partners. Join Faride, for a look into the history of Earth-orbiting space stations and the importance of the ISS, our jewel in the sky.

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

March 25, Noon-1:00pm

What: Why SuperEarths are not Earthlike
Who: David Stevenson, California Institute of Technology
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Kepler data indicate that there are many planets that could be Earthlike in the sense of having a similar bulk composition. I will explain why such planets are unlikely to be Earthlike in other respects, especially if they are superEarths (three or so Earth masses or more). There are three main points here: (1) SuperEarths will not separate core from mantle because they are likely to be so hot internally that the critical temperature is reached for miscibility of iron alloy and silicate material. (2) Earth is (so far as we know) special in having a water budget that (expressed as an ocean) corresponds to water depths ~ mountain heights.(3) The surface will be hot either from a massive atmosphere or proximity to the parent star.

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

April 1, Noon-1:00pm

What: Towards Improved Occurrence Rates of Exoplanets: The Properties of Stars Observed by Kepler
Who: Daniel Huber, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The detection of over 3000 new exoplanets by the NASA Kepler mission has opened up the possibility to infer the occurrence rate of planets in the habitable zones of stars in our galaxy. However, both the characteristics of the detected planets and their occurrence rates crucially depend on our understanding of properties of the stars that were observed. In this talk I will present current efforts to improve our understanding of fundamental properties of Kepler target stars and their planets, in particular using the technique of asteroseismology. I will furthermore discuss the prospects of Kepler's follow-up mission, K2, for advancing our understanding of exoplanets and stellar astrophysics.

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

April 5, 7:30pm-8:15pm

What: From Kitty Hawk to the Sea of Tranquility
Who: Faride Khalaf
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Included with General Admission.

A giant leap for mankind taken by Neil Armstrong began as a small step taken by Orville Wright from the dunes of Kitty Hawk, South Carolina. On December 17, 1903, the Wright Brothers made history with the first powered flight to carry a human pilot. This great feat lasted only twelve seconds! Since that day, flying machines have advanced significantly. The idea of flying machines predates Da Vinci and we are still making innovative strides. This week, join Faride as we explore the next phases in aerospace travel.

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

April 5, 8:00pm

What: Star Formation Through Radio Eyes
Who: Dr. Chat Hull, UC Berkeley
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

CARMA, a millimeter-wave radio telescope, is being used to probe the origins of stars within their cold, dusty natal clouds revealing how magnetic fields affect the star-formation process.

Calendar of Events (continued)

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

April 8, Noon-1:00pm

What: Boulder Clustering on Martian Polygonal Patterned Ground
Who: Travis Orloff , UC Santa Cruz
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The High Resolution Imaging Science Experiment's (HiRISE) imagery of Mars allows for meter scale identification of surface features. In this imagery we can identify boulders clustering on polygonal patterned ground terrains in polar environments on Mars. Previously, terrestrial analogs of Mars were used to explain boulder clustering. However, the Mars environment is distinct from Earth's and the boulders that cluster on Mars are at least 3 - 10 times larger than any found clustering on terrestrial patterned ground terrains. Here, I propose a new mechanism for boulder clustering unique to Mars and use observations of boulder clustering around impact features to place constraints on the timescale of boulder clustering.

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

April 14, 9:00pm-3:00am

What: Total Lunar Eclipse
Who: Saturday Night Space Talks: Faride Khalaf
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: $12 for members and guests

The deck will open at 9:00pm for a special presentation about the eclipse. Stay after the presentation for the late night viewing festivities.

A Lunar Eclipse occurs when the Moon passes through the shadow of the Earth. For this to happen the Sun, Earth, and Moon must be closely aligned with the Moon and the Moon located furthest from the Sun. Watch the Moon become deep red in color as this incredible phenomenon happens! Bring binoculars, blankets and warm clothes. Hot beverages will be for sale.

Please note: Eclipse is not guaranteed and weather permitting for outside viewing. Don't forget to bring your blankets

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

April 15, Noon-1:00pm

What: The WFIRST/AFTA astrophysics mission: bigger and better for exoplanets
Who: Tom Greene, NASA Ames Research Center
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

The Wide Field InfRared Survey Telescope mission is the highest priority large space project recommended by the 2010 Astronomy and Astrophysics Decadal Survey, and it is expected to begin development in 2017 when the James Webb Space Telescope is nearing launch. WFIRST was conceived to conduct wide field, near-infrared surveys for dark energy, exoplanet gravitational microlensing, and general astrophysics using a moderate aperture (~1.3-m) telescope. NASA has recently approved the use of a much larger, Hubble-sized (2.4-m) telescope that was donated by the National Reconnaissance Office. A science definition team is now studying a revamped WFIRST mission concept with this telescope, including a coronagraphic instrument for exoplanet and disk imaging and spectroscopy. This talk will highlight the mission's science potential including brief descriptions of its dark energy and general observer programs with more focus on its exoplanet microlensing survey and coronagraphic imaging and spectroscopy of nearby exoplanetary systems.

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

April 16, 7:00pm

What: Lifting the Cosmic Veil: Highlights from a Decade of the Spitzer Space Telescope
Who: Not listed
Where: Smithwick Theatre, 12345 El Monte Road, Los Altos Hills, CA 94022
Cost: Free, $3 parking (coin required)

No abstract available.

For more information see: http://www.foothill.edu/ast/index.php or phone 650-949-7888.

April 21, 7:30pm

What: The Visualization of Astronomical Information: From Galileo to the Zooniverse
Who: Alyssa Goodman, Harvard University
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.

In 1610, when Galileo pointed his small telescope at Jupiter, he drew sketches to record what he saw. After just a few nights of observing, he understood his sketches to be showing moons orbiting Jupiter. It was the visualization

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

All times Daylight Time.

March

16	Sun	Full Moon (10:08am)
17-18	Mon-	Spica and Mars form a triangle with the Moon
18-31	Tue-	Zodiacal light visible in the west from a dark location (80 minutes after sunset)
20	Thu	Spring begins in the N. Hemisphere (9:57am)
21	Fri	Saturn to the right of the Moon
23	Sun	Last-Quarter Moon (6:46pm)
27	Thu	Venus to the lower-right of the crescent Moon
30	Sun	New Moon (11:45am)

April

3	Thu	Crescent Moon passes through the Hyades (Evening; see p.50 April S&T)
7	Mon	First-Quarter Moon (1:31am)
8	Tue	Mars at opposition
12	Sat	Neptune is 0.7 degrees south of Venus
13	Sun	Vesta, the brightest asteroid, at opposition (see p.50 February S&T)
14-15	Mon-	Mars closest to Earth for 2014 (see p.50 March S&T)
15	Tue	Full Moon (00:42am)
17	Thu	Saturn near the Moon (Dawn)
22	Tue	The weak Lyrid Meteor Shower peaks this morning (see p.52 April S&T)
22	Tue	Last-Quarter Moon (0:52am)
25-26	Fri-	Crescent Moon to the upper-right (lower-left) of Venus on the 25th (26th; Dawn
27	Sun	Venus to the lower-right of the crescent Moon
28	Mon	New Moon (11:14pm)

of Galileo's observations that led to his understanding of a clearly Sun-centered solar system, and to the revolution this understanding then caused. Similar stories can be found throughout the history of Astronomy, but visualization has never been so essential as it is today, when we find ourselves blessed with a larger wealth and diversity of data, per astronomer, than ever in the past.

Using amazing new, and often free, software tools, we can immerse ourselves in data about the Universe. In a literal "immersion" setting, we can see data describing our Universe all around us on the "sky' of the Morrison Planetarium. In research, we can connect visualization, data mining, and statistical tools to each other in order to discover and understand new phenomena. In education, we can change the way we learn about the Universe by offering learners "real" data in rich, multimedia environments on desktop, touchscreen, and mobile computers. We can even use novel interfaces and gaming systems to let users interact with data, and the Universe, using whole body. Goodman will demonstrate the full power visualization brings to this range of endeavors, using examples spanning everything from a free, rich, "Universe Information System" from Microsoft Research (WorldWide Telescope program), to a NASA-sponsored system for understanding the 3D data that the James Webb Space Telescope will send to Earth ("Glue"), to the Zooniverse, where hundreds of thousands of citizens join scientists in their quest to understand the Universe using "big data."

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

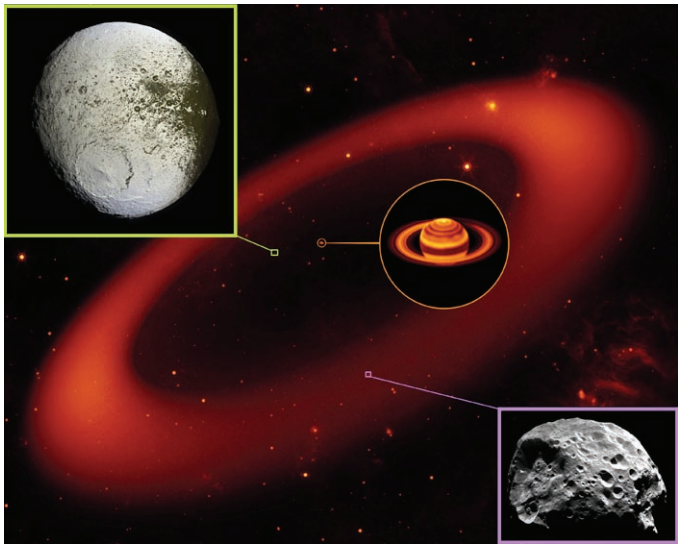
A Two-Toned Wonder from the Saturnian Outskirts

By Dr. Ethan Siegel

Although Saturn has been known as long as humans have been watching the night sky, it's only since the invention of the telescope that we've learned about the rings and moons of this giant, gaseous world. You might know that the largest of Saturn's moons is Titan, the second largest moon in the entire Solar System, discovered by Christiaan Huygens in 1655. It was just 16 years later, in 1671, that Giovanni Cassini (for whom the famed division in Saturn's rings—and the NASA mission now in orbit there—is named) discovered the second of Saturn's moons: Iapetus. Unlike Titan, Iapetus could only be seen when it was on the west side of Saturn, leading Cassini to correctly conclude that not only was Iapetus tidally locked to Saturn, but that its trailing hemisphere was intrinsically brighter than its darker, leading hemisphere. This has very much been confirmed in modern times!

In fact, the darkness of the leading side is comparable to coal, while the rest of Iapetus is as white as thick sea ice. Iapetus is the most distant of all of Saturn's large moons, with an average orbital distance of 3.5 million km, but the culprit of the mysterious dark side is four times as distant: Saturn's remote, captured moon, the dark, heavily cratered Phoebe!

Orbiting Saturn in retrograde, or the opposite direction to Saturn's rotation and most of its other Moons, Phoebe most probably originated in the Kuiper Belt, migrating inwards and eventually succumbing to gravitational capture. Due to its orbit, Phoebe is constantly bombarded by micrometeoroid-sized (and larger) objects, responsible for not only its dented and cavity-riddled surface, but also for a huge, diffuse ring of dust grains spanning quadrillions of cubic kilometers! The presence of the "Phoebe Ring" was only discovered in 2009, by NASA's infrared-sensitive Spitzer Space Telescope. As the Phoebe Ring's dust grains absorb and re-emit solar radiation, they spiral inwards towards Saturn, where they smash into Iapetus—orbiting in the opposite direction—like bugs on a highway windshield. Was the dark, leading edge of Iapetus due to it being plastered with material from Phoebe? Did those impacts erode the bright surface layer away, revealing a darker substrate?



Images credit: Saturn & the Phoebe Ring (middle) - NASA / JPL-Caltech / Keck; Iapetus (top left) - NASA / JPL / Space Science Institute / Cassini Imaging Team; Phoebe (bottom right) - NASA / ESA / JPL / Space Science Institute / Cassini Imaging Team

In reality, the dark particles picked up by Iapetus aren't enough to explain the incredible brightness differences alone, but they absorb and retain just enough extra heat from the Sun during Iapetus' day to sublimate the ice around it, which resolidifies preferentially on the trailing side, lightening it even further. So it's not just a thin, dark layer from an alien moon that turns Iapetus dark; it's the fact that surface ice sublimates and can no longer reform atop the leading side that darkens it so severely over time. And that story—only confirmed by observations in the last few years—is the reason for the one-of-a-kind appearance of Saturn's incredible two-toned moon, Iapetus!

Learn more about Iapetus here: http://saturn.jpl.nasa.gov/science/moons/iapetus.

Kids can learn more about Saturn's rings at NASA's Space Place: http://spaceplace.nasa.gov/saturn-rings

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.