PRIMEFOCUS

Tri-Valley Stargazers

September 2015

TVS Tri-Valley Stargazers

Meeting Info

What:
Mirror-Making Machine, SIT Testing, and Shop Strategies

Who:
Dr. Jeff Baldwin

When:
September 18, 2015
Doors open at 7:00 p.m.
Meeting at 7:30 p.m.
Lecture at 8:00 p.m.

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

Inside

September Meeting

Mirror-Making Machine, SIT Testing, and Shop Strategies
Dr. Jeff Baldwin

Jeff Baldwin is a mirror maker in Lathrop, just south of Stockton. He has made approximately 400 mirrors. Recently he and a friend made a mirror-making machine that will produce mirrors up to about 46" in diameter. He is also using the Slit Image Test (SIT) to produce high-precision mirrors of any diameter, any conic constant, and any focal ratio. The machine is programmable to do many styles of strokes and fixed-post grinding and polishing. In the future it will also have curve-generating abilities. This machine has helped Jeff work mirrors that are too heavy and large to physically manipulate.

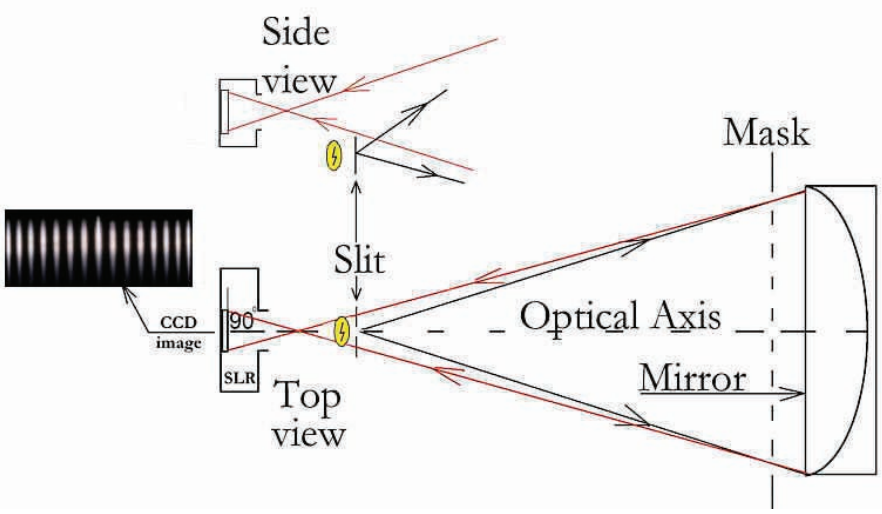


Image Caption: Schematic diagram of the Slit Image Test used by Jeff Baldwin as a test of mirror quality during the fabrication process. Credit: http://yubagold.com/tests/index.php

The SIT was "invented' by Bill Thomas of Grass Valley, CA. It is a combination of Hartman, Caustic, and other tests. The test allows the user to have high-precision, works for large or small mirrors, fast or slow focal ratios, in stable rooms or in unstable rooms, and can be done very quickly. Its repeatability is outstanding. Even though it is a good idea to use other tests along with the SIT to finalize a mirror, the test enables the optician to process mirrors very quickly and accurately. The machine, the SIT, and shop systems all work together to make large aperture fast focal ratio parabolic telescope mirrors of high quality. Shop systems and strategies keep the optician working quickly, accurately, and safely.

For additional information about telescope making see: http://www.jeffbaldwin.org/atm.htm

News & Notes

2015 TVS Meeting Dates

The following lists the TVS meeting dates for 2015. 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**
Sep. 18	Sep. 21	
Oct. 16	Oct. 19	Sep. 25
Nov. 20	Nov. 23	Oct. 30
Dec. 18	Dec. 21	Nov. 27

Money Matters

As of August 24, 2015 the TVS checking account balance is $11,462.59.

Star Parties: Volunteers Needed

Eric Dueltgen, the TVS Star Party Coordinator, requests volunteers to assist with numerous upcoming star parties. The star parties are:

•Thursday, September 17 at Green Elementary School in Dublin

•Friday, October 2 at Alviso Adobe Park in Pleasanton for the City of Pleasanton's Recreational Activities for the Developmentally Disabled (RADD) program

•Friday, October 23 at Valley Christian School in Dublin

Please contact Eric if you wish to participate in these educational outreach efforts (coordinator"at"trivalleystargazers.org)

TVS Star Parties at Tesla Winery: September 19, & October 17 (6:30pm-Midnight)

TVS will hold numerous star parties at Tesla Vintners in Livermore! Tesla Vintners is located on Tesla Road near Mines Road, and it has reasonably dark skies overhead and to the south, considering its urban location. The winery is private property, and we are the guests of Steve Powell, the owner. *These star parties are only open to current club members and their guests.*

The winery has two entrances. The main entrance is likely to be closed, so plan on using the unmarked delivery entrance, the one closer to Mines Road. The winery has a large parking area in the middle of the grounds plus a large open field in the back. We are welcome to use both, but lights from the Wente winery to the east can be a problem in the back. The winery also has a bathroom which we will be able to use. The star party will run through midnight.

Normal star party etiquette applies, so no bright lights, no dogs, no loud music, and definitely no smoking or fires.

Calendar of Events

September 12, 8:00pm (New Date)

What: In the Land of Enchantment: A Decade Exploring Saturn
Who: Dr. Carolyn Porco, Space Science Institute, CICLOPS Director
Where: Mt. Tamalpais State Park, Cushing Memorial Amphitheater, more commonly known as the Mountain Theater, Rock Spring parking area
Cost: Free

A glistening spaceship, with seven lonely years and billions of miles behind it, glides into orbit around a softly-hued, ringed planet. A flying-saucer shaped machine descends through a hazy atmosphere and lands on the surface of an alien moon. These visions are not a dream but tell of the explorations of the Cassini spacecraft and its Huygens probe in 2004. Come along for the ride, and witness the sights and magic worked by these emissaries from Earth to the enchanting realm of Saturn.

For more information see: http://www.friendsofmttam.org/astronomy/schedule

September 14, 7:30pm

What: The NASA K2 Mission: Extending Kepler's Legacy
Who: Dr. Thomas Barclay, Director, Kepler/K2 Guest Observer Office, NASA Ames Research Center
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.

The NASA K2 mission makes use of the Kepler spacecraft to expand upon Kepler's ground-breaking discoveries in the fields of exoplanets and astrophysics. Its observations fill the gaps between the Kepler and Transiting Exoplanet Survey Satellite missions and offer exoplanet target identification for the upcoming James Webb Space Telescope. Astrophysics observations with K2 include studies of young open clusters such as the Pleiades and Hyades, galaxies, supernovae, and galactic archeology.

See www.calacademy.org/events/benjamin-dean-astronomy-lectures for lecture and reservation information.

September 15, 12:00pm

What: Very Long Term Planning: Integrating Planetary Protection in Human Missions
Who: Margaret Race, SETI Institute

Header Image: A New Horizons post-encounter image of Pluto being back illuminated by the Sun reveals numerous haze layers in the atmosphere. Image credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

Calendar of Events (continued)

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

Despite decades of experience with human missions in low Earth orbit (LEO), we have only scant, outdated information applicable to human missions to planetary surfaces, where contamination concerns and planetary protection requirements raise unusual challenges. It has been over 40 years since the Apollo program dealt with the challenges of humans living, exploring and returning from the surfaces of celestial bodies. Join us for a forward looking discussion on how changes in science, technology and policies are impacting future human exploration plans. Developing the necessary infrastructure, habitats, spacesuits, rovers, operations and plans for human missions beyond LEO is a very long term process, and the identification of strategic knowledge gaps in science and technology is an important part of the incremental path forward.

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

September 19, 11:00am

What: Revealing the Identity of Type Ia Supernovae
Who: Dr. Ken Shen, UCB
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.

Type Ia supernovae are famous for the role they play in determining the accelerating expansion of the Universe, which led to the 2011 Nobel Prize in Physics. In addition, they spread their nuclear burning ashes throughout galaxies, over time producing a large fraction of the heavy elements in the Universe. However, while we are fairly confident that Type Ia supernovae are the thermonuclear explosions of white dwarfs in binary stellar systems, the debate rages as to the precise nature of their companions and how the explosions are ignited. In this talk, I will review our basic understanding of Type Ia supernovae and show how recent advances are giving us hope that we will soon uncover the fundamental nature of these cosmic beacons.

For more information see: http://scienceatcal.berkeley.edu/the-sciencecal-lecture-series/

September 22, 12:00pm

What: Completing the Census of Exoplanetary Systems with Microlensing
Who: Scott Gaudi, Ohio State University
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Measurements of the demographics of exoplanets over a range of planet and host star properties provide fundamental empirical constraints on theories of planet formation and evolution. Because of its unique sensitivity to low-mass, long-period, and free-floating planets, microlensing is an essential complement to our arsenal of planet detection methods.

Dr. Gaudi will review the microlensing method, and discuss results to date from ground-based microlensing surveys. Finally, Dr. Gaudi will motivate a space-based microlensing survey with WFIRST-AFTA, which when combined with the results from Kepler, will yield a nearly complete picture of the demographics of planetary systems throughout the Galaxy.

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

September 29, 12:00pm

What: Kepler's Heartbeat Stars: When Binary Stars Get Funky
Who: Susan Mullally, SETI Institute
Where: SETI Headquarters, 189 N. Bernardo Ave.,

continued on page 4

Mountain View, CA
Cost: Free

Because of the continuous, high-precision photometry available from the Kepler spacecraft, the Kepler team discovered a type of eccentric binary star named heartbeat stars. In these systems, the two stars come close enough to each other to cause large, periodic changes in the tidal deformation and mutual irradiation of the stars. Additionally, these tidal forces are known to cause the stars in some of these systems to continually 'ring' at shorter periods. Currently, we have discovered more than 150 of these in the Kepler data and have been taking extensive follow-up spectroscopy to model and-understand these systems.

Dr. Mullally will present an overview of these systems and discuss how these systems are allowing us to explore the physics of stellar tidal dissipation.

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

October 6, 12:00pm

What: Geomagnetic Reversals and excursions: The origin of Earth's magnetic field
Who: Bruce Buffet, UCB
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Palaeomagnetic observations offer important insights into the origin of Earth's interior, but a detailed reconstruction of the underlying dynamics is not feasible. A practical alternative is to construct a stochastic model for the time evolution of the dipole field. Slow changes in the field are described by a deterministic (drift) term, whereas short-time fluctuations are represented by a random (noise) term. Estimates for the drift and noise terms can be recovered from a time series of variations in the axial dipole moment over the past 2 million years. The results are used to predict a number of statistical properties of the palaeomagnetic field, including the average rates of magnetic reversals and excursions.

Dr. Buffet will explain how a physical interpretation of the stochastic models suggests that reversals and excursions are part of a continuum of time variations in Earth's magnetic field, arising from convective fluctuations in the core. Relatively modest changes the amplitude of convective fluctuations can produce large changes in reversal rates, including the well-known occurrence of superchrons lasting longer than 10 million years.

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

October 10, 10:00am-4:00pm

What: Universe 2015
Who: You
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Free with general admission. call (510) 336-7373

Spend the day exploring the cosmos and learning about planets, dwarf planets, and exoplanets from world renowned experts. Delve deeper into all aspects of astronomy through our interactive exhibits, planetarium shows, telescopes, hands-on activities and a special astrophotography exhibit.

Presented by the Astronomical Society of the Pacific in partnership with Chabot Space and Science Center. See http://www.chabotspace.org/events.htm for more information, or call (510) 336-7373.

October 13, 12:00pm

What: Astrochemistry: Putting the Astro in Astrobiology
Who: Alexander Tielens, University of Leiden
Where: SETI Headquarters, 189 N. Bernardo Ave., Mountain View, CA
Cost: Free

Astrobiology, the study of emergence of life and the its distribution in the Universe, addresses the most fundamental questions in science: "How does life begin ?" and "Are we alone ?" Over the last 20 years, we have discovered that planets are bountiful in the galaxy and that one in every five solar-type stars has a planet in the habitable zone. We have learned that extremophiles have spread to essential every niche – even the seemingly most inhospitable ones – on our planet. And we have learned that life started essentially as soon as conditions permitted, within some 200 million of the late heavy bombardment, or perhaps even earlier. This has resulted in a paradigm shift from "Life on Earth is unique" to the premise "life is widespread". As a result, searching for biosignatures in space has taken on a life by itself. In this talk, Dr. Tielens will summarize this shift in our thinking and the global processes that may have influenced the first steps towards life.

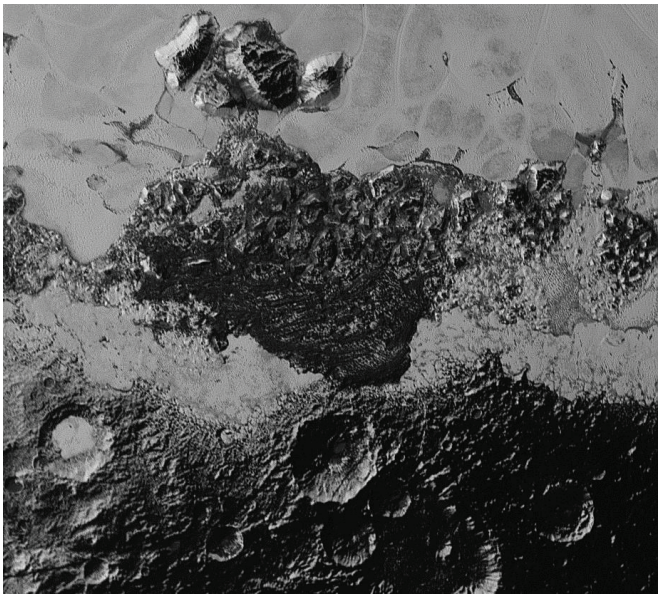
The focus in this talk will be on astrochemistry – the starting point of astrobiology – the chemical evolution that takes place in space where simple molecules are transformed into complex molecules and complex molecules are broken down to simple ones. This chemical dance of the elements produces a wide variety of organic compounds. I will review the processes that drive this chemical evolution in space. The focus will be on understanding the raw materials that are delivered to newly formed planets and their relationship to the building blocks from which prebiotic material was formed and biological systems evolve.

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

Journal Club By Ken Sperber

Pluto from New Horizons and from H2O!

The amazing views of Pluto by the New Horizons spacecraft continue to astound scientists and the general public. In the weeks following the July 14, 2015 flyby of Pluto, only 5% of the total data was downloaded to Earth. Then, in the intervening month, the download of engineering data was the priority. Finally on September 5, the return of science data recommenced, with the total download requiring at least one more year.

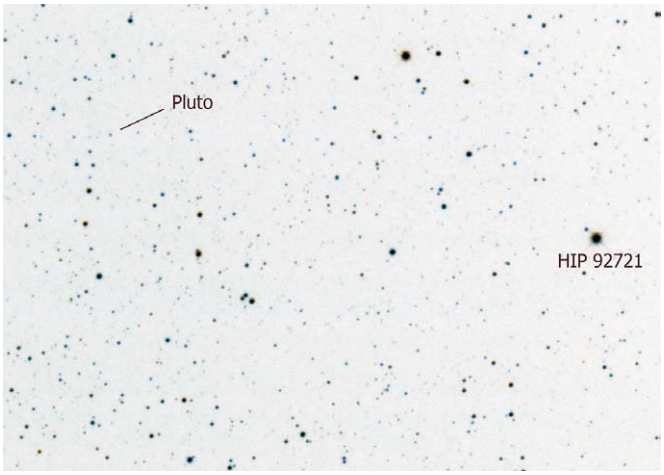


Caption: Cthulhu Regio, the dark cratered regions, with the icy plain of Sputnik Planum above. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

The above image, released on September 10, spans approximately 220 miles. This view shows the ancient multi-billion year old cratered surface of Cthulhu Regio, the dark region at the bottom of the image. Sputnik Planum is the icy region that covers the upper portion of the image. The icy surface shows evidence of flow around the mountains and hills, perhaps occurring within the last 100 million years. For the ice to flow at the cold temperatures of Pluto, ~50K, it must be composed of some combination of nitrogen ice and/or methane ice, as water ice is rock solid at these temperatures.

The close-up view of Cthulhu Regio demonstrates complex terrain. The terrain at the center of the image is the subject of much debate, as some scientists suggest the linear structures that run left-to-right might be wind blown dunes. Dr. William McKinnon, from Washington University, St. Louis says "Seeing dunes on Pluto--if that is what they are--would be completely wild, because Pluto's atmosphere today is so thin. Either Pluto had a thicker atmosphere in the past, or some process we haven't figured out is at work. It's a head scratcher."

With the excitement of New Horizons fresh in their minds, Roland and Hilary initiated a September 8th trip to H2O to visually observe Pluto. Ken, Chuck, Joy, and Richard answered their call on what turned out to be a beautiful night. Observing Pluto is no small feat, given it's visual magnitude of 14.2 and it being located 32.5 times more distant from the Sun than Earth. Additionally, due to its inclined orbit, Pluto is at a declination of nearly 21 degrees south, with the potential for light pollution interference at H2O. Furthermore, it is located in Sagittarius in close proximity to the Milky Way, so a detailed finder chart is necessary. The night before, Roland photographed Pluto from his backyard in Pleasanton, thus providing the ultimate finder chart.



Caption: Roland Albers took this image of Pluto and the surrounding star field on September 7, 2015 from his backyard in Pleasanton. The bright star in the field of view is 8.05 magnitude HIP 92721. He combined six 3-minute exposures taken with his AT6RC 1370mm astrograph and a Canon T3i DSLR at ISO 800. The field of view is about 27 arc minutes wide, and is cropped from the original image.

Numerous telescopes were brought to bear to observe Pluto at H2O, including an 8", 9.5", 17.5", 18" and a 20". Chuck, who has a very keen eye, was able to glimpse Pluto in the 8" telescope. In the 17.5" Marling Scope and in Hilary's 18" telescope Pluto was seen with direct vision, while in the 20" telescope Pluto and an adjacent 15.0 magnitude star were seen with direct vision. All participants were able to detect Pluto in one or more of the telescopes. Visually detecting the slight shift in the location of Pluto compared to Roland's photograph provided confirming evidence that we all saw Pluto! Currently, Pluto transits at about 8:40pm, and it sets by about 1:30am.

Dwarf planet Ceres is also in Sagittarius. Ceres is much brighter than Pluto, being about 8.2mag. However, it is located near 32 degrees south, just east of M55, so light pollution and a long atmospheric path length could make observations challenging. See p.50 of the July 2015 issue of S&T for more information on observing Pluto and Charon.

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

All times are Pacific Daylight Time.

September

11-25 Fri Zodiacal light visible in the east 1-2 hours before sunrise

12 Sat New Moon (11:41pm)

18 Fri The crescent Moon is less than 3 degrees from Saturn in the southwest (evening twilight)

21 Mon First-Quarter Moon (1:59am)

22 Tue Algol at minimum brightness for 2 hours centered on 8:20pm

24-25 Thu- Mars is less than 1 degree from Regulus, 10 degrees to the lower-left of Venus (dawn)

27 Sun Full Moon: Total Lunar Eclipse (7:50pm, see NASA Space Place article on p.7 of this newsletter and p.26, September S&T)

October

1-2 Thu- Waning Moon in the Hyades; on the 2nd the Moon occults Aldebaran near dawn

4 Sun Last-Quarter Moon (2:06pm)

8 Thu The crescent Moon, Venus, and Regulus form a triangle with Mars and Jupiter to the lower-left (dawn)

9 Fri The crescent Moon, Jupiter, and Mars form a triangle with Venus and Regulus above (dawn)

11-25 Sun- Zodiacal light visible in the east 1-2 hours before sunrise. Venus, Mars, and Jupiter visible at the base.

12 Mon New Moon (5:06pm)

12 Mon Algol at minimum brightness for 2 hours centered on 10:01pm

15 Thu Algol at minimum brightness for 2 hours centered on 9:50pm

17-18 Sat Mars less than 1/2 degree from Jupiter

20 Tue First-Quarter Moon (1:31pm)

21-22 Wed Orionid meteor shower, best in the predawn hours

24-26 Sat- Venus, Jupiter, and Mars shine above the eastern horizon (dawn)

Measure the Moon's Size and Distance During the Next Lunar Eclipse

By Dr. Ethan Siegel

The moon represents perhaps the first great paradox of the night sky in all of human history. While its angular size is easy to measure with the unaided eye from any location on Earth, ranging from 29.38 arc-minutes (0.4897°) to 33.53 arc-minutes (0.5588°) as it orbits our world in an ellipse, that doesn't tell us its physical size. From its angular size alone, the moon could just as easily be close and small as it could be distant and enormous.

But we know a few other things, even relying only on naked-eye observations. We know its phases are caused by its geometric configuration with the sun and Earth. We know that the sun must be farther away (and hence, larger) than the moon from the phenomenon of solar eclipses, where the moon passes in front of the sun, blocking its disk as seen from Earth. And we know it undergoes lunar eclipses, where the sun's light is blocked from the moon by Earth.

Lunar eclipses provided the first evidence that Earth was round; the shape of the portion of the shadow that falls on the moon during its partial phase is an arc of a circle. In fact, once we measured the radius of Earth (first accomplished in the 3rd century B.C.E.), now known to be 6,371 km, all it takes is one assumption—that the physical size of Earth's shadow as it falls on the moon is approximately the physical size of Earth—and we can use lunar eclipses to measure both the size of and the distance to the moon!

Simply by knowing Earth's physical size and measuring the ratios of the angular size of its shadow and the angular size of the moon, we can determine the moon's physical size relative to Earth. During a lunar eclipse, Earth's shadow is about 3.5 times larger than the moon, with some slight variations dependent on the moon's point in its orbit. Simply divide Earth's radius by your measurement to figure out the moon's radius!

Even with this primitive method, it's straightforward to get a measurement for the moon's radius that's accurate to within 15% of the actual value: 1,738 km. Now that you've determined its physical size and its angular size, geometry alone enables you to determine how far away it is from Earth. A lunar eclipse is coming up on September 28th, and this supermoon eclipse will last for hours. Use the partial phases to measure the size of and distance to the moon, and see how close you can get!

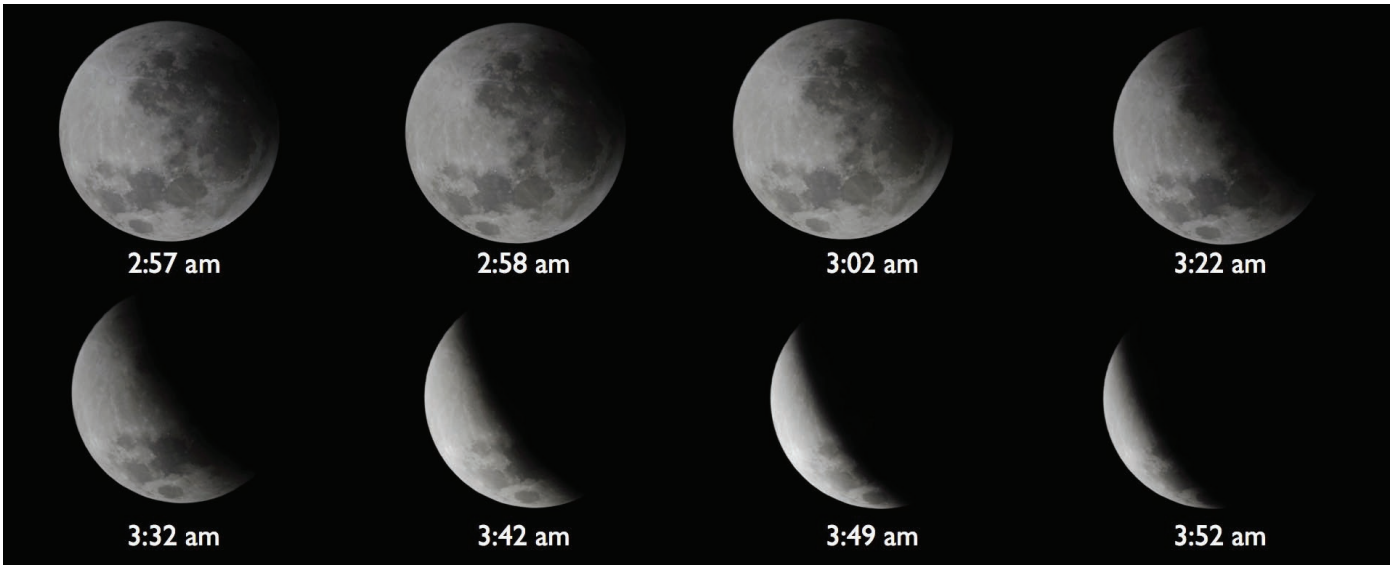


Image credit: Daniel Munizaga (NOAO South/CTIO EPO), using the Cerro Tololo Inter-American Observatory, of an eight-image sequence of the partial phase of a total lunar eclipse.

Tri-Valley Stargazers
P. O. Box 2476
Livermore, CA 94551
www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

(or apply for membership online: *www.trivalleystargazers.org/membership.shtml)*

Contact information:

Name: _____ Phone: _____

Street Address: _____

City, State, Zip: _____

Email Address: _____

Status (select one): _____ New member _____ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member ($5). Must be a full-time high-school or college student.

_____ Regular member ($30).

_____ Patron member ($70). Patron membership grants use of the club's 17.5" reflector at H2O. You must be a member in good standing for at least one year, hold a key to H2O, and receive board approval.

Hidden Hill Observatory Access (optional):

_____ One-time key deposit ($20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee ($10). You must also be a key holder to access the site.

Magazine Subscriptions (optional): Discounted subscriptions are available only to new subscribers. All subsequent renewals are handled directly with the magazine publishers.

_____ One-year subscription to Sky & Telescope magazine ($32.95).

_____ One-year subscription to Astronomy magazine ($34).

Donation (optional):

_____ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: $ _____

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. TVS will not share information with anyone other than other club members and the Astronomical League without your express permission.
Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.