Tri-Valley Stargazers

January 2022

PrimeFocus

WHEN:

January 21, 2022
Meeting at 7:30pm
Lecture at 8:00pm

WHERE:

Virtual Meeting using Zoom
See the April 2020 issue of PrimeFocus for info on getting connected using Zoom

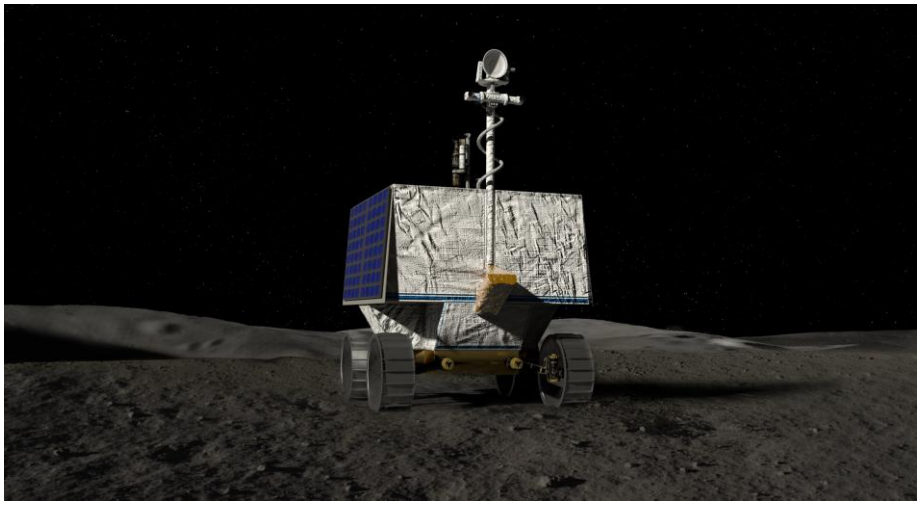
TVS QR Code

INSIDE THIS ISSUE:

VIPER: The Volatiles Investigating Polar Exploration Rover - Resource Mapping on the Lunar South Pole

Mark Rose, NASA

As recently as two decades ago, our understanding of the Moon was very different. We believed the Moon was fairly uniform and very, very dry. Recent missions have upended that vision, showing that water exists on the lunar poles, both on and below the surface. But many questions remain about the nature, abundance, origin, and distribution of water and other volatile materials. As well, NASA wants to know whether those materials can be practically harvested for use by future manned missions. The VIPER mission is one of the next steps to answering those questions. VIPER will land a mobile rover on the lunar south pole in order to prospect for and map the distribution of water and other volatiles. This talk will give an overview of the mission objectives, characteristics of the rover and instruments to meet those objectives, unique challenges for VIPER, and the overall mission planning.



Caption: An artist's concept of NASA's Volatiles Investigating Polar Exploration Rover, or VIPER. VIPER is a mobile robot that will roam the Moon's South Pole looking for water ice. The VIPER mission will give us surface-level detail of where the water is and how much is available to use. This will bring us a significant step closer to NASA's ultimate goal of a sustainable, long-term presence on the Moon – making it possible to eventually explore Mars and beyond. Credits: NASA/Ames Research Center/Daniel Rutter. See: www.nasa.gov/viper/rover

Mark has a B.S. in Mathematical and Computational Science from Stanford University. He has worked in Silicon Valley for his entire career, mostly in startups, on projects in a variety of areas including compiler development, speech recognition, automated financial portfolio management, and online learning. Since 2006 he has worked at NASA, most recently on the Transiting Extrasolar Survey Satellite (TESS) and the Volatiles Exploration Planetary Rover (VIPER) missions. On the VIPER mission he is one of the designers and lead engineers of the ground data system (GDS).

News and Notes

2022 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Jan. 21	Jan. 24	
Feb. 18	Feb. 21	Feb. 4
Mar. 18	Mar. 21	Mar. 4
Apr. 15	Apr. 18	Apr. 1
May 20	May 23	May 6
Jun. 17	Jun. 20	Jun. 3
Jul. 15	Jul. 18	Jul. 1
Aug. 19	Aug. 22	Aug. 5
Sep. 16	Sep.19	Sep. 2
Oct. 21	Oct. 24	Oct. 7
Nov. 18	Nov. 21	Nov. 4
Dec. 16	Dec. 19	Dec. 2

Money Matters

As of the last Treasurer's Report on 12/20/21, our club's account balance is $64,423.30. This includes $43.103.14 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Lori Fenton, Sameer Panwar, and Rishindra Reddy. Please say hello and chat with them during our Zoom meetings.

Time to Renew Club Membership for 2022

Now is a great time to become part of TVS. Membership is open to anyone with an interest in astronomy. Amateurs and professionals are equally welcome; skilled amateurs comprise the majority of the membership. You do not have to own a telescope in order to be a member.

Those renewing their club membership are encouraged to do so by using the online application before the end of December. Normally our memberships are only good for the calendar year, but anyone joining after October 1st will be given a membership for the remainder of 2021 and all of 2022.

The regular club membership remains a bargain at $30. Student membership (full-time High School or College student) is only $10! To become a key holder to H2O, you must be 18 or older. There is a one-time $20 Key deposit and a $10 annual access fee.

You can join TVS or renew your membership online at: http://www.trivalleystargazers.org/membership.shtml After filling out the application form you are connected to the PayPal payment form. You do not need to have a PayPal account to pay online, since PayPal will accept credit cards. Everyone is encouraged to use the online application. Alternatively, you can mail in the Membership Application on the last page of this newsletter along with a check to the Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551-2476. Note that TVS will not share your information with anyone. We only use the e-mail address to notify you when the newsletter becomes available.

All members agree to hold the 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

H2O and Del Valle Observing Sites Reopened

The Del Valle and Hidden Hill Observatory sites have reopened for observing by those who have paid their 2021 TVS Membership dues and are approved key holders.

As of June 15, California state guidance on COVID-19 indicates that use of masks is not required for **outdoor** activities. However, common sense dictates that club members and guests

*Do not use either observing site if you are not feeling well or suspect you were recently exposed to the virus

*You use each observing site at your own risk and agree to hold the club and the landowners free of all liability

*H2O users should wear a mask while at the landowner's home depositing the daily usage fee

*H2O keyholders who wish to use the Quick Dome should first contact Ross Gaunt (secretary"at"trivalleystargazers.org) to reserve it for individual use for the day

Ross Gaunt, our club secretary, emailed the updated lock combinations and usage instructions for each site to all H2O key holders and all Del Valle registered users. If you are a H2O key holder or Del Valle registered user and didn't get Ross's email, please let Ron (president"at"trivalleystargazers.org) or Ross know and we'll straighten it out.

Calendar of Events

January 20, 2:30pm-4:00pm

What: NASAs Artemis 1 Launch
Who: Yves Lamothe, NASA Lead Systems Engineer
Sponsor: Intrepid Air & Space Museum
Online: www.youtube.com/user/IntrepidMuseum

Artemis I is a planned un-crewed test flight for NASA's Artemis program. It is the first flight of the agency's Space Launch System super heavy-lift launch vehicle and the first flight of the Orion MPCV. Artemis I is expected to launch February 2022. Hear from Comm Systems Project Manager, Yves Lamothe as he takes us on a behind the scenes look at the mission and how they are preparing for the launch next month.

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Calendar of Events (con't)

The event is hosted and co-produced by John "Das" Galloway, founder of the Kerbal Space Academy.

If you tune in a 2:00pm, there will be The Virtual Astronomy Live education pre-show that is supported by a grant from the Robert & Toni Bader Charitable Foundation.

January 20, February 17, 9:00pm-10:30pm

What: Virtual Telescope Viewing
Who: Chabot Staff
Sponsor: Chabot Space and Science Center
Online: https://www.youtube.com/c/ChabotSpace

Join our resident astronomers on Facebook Live and YouTube every Saturday evening live from Chabot's Observation deck!

Each week, our astronomers will guide us through spectacular night sky viewing through Nellie, Chabot's most powerful telescope. Weather permitting, we will be able to view objects live through the telescopes and our astronomers will be available to answer your most pressing astronomy questions.

Nellie is a 36-inch reflector telescope, housed in a rolling roof observatory that allows access to 180 degrees of sky. This modern, research-quality telescope offers breathtaking views of the cosmos.

For more information, see:
https://chabotspace.org/events/events-listing/

January 21, 11:30am-1:00pm

What: Building Galaxies One Star at a Time
Who: Dr. Elizabeth Stanway (University of Warwick)
Sponsor: The Astronomical Society of Edinburgh
Online: www.youtube.com/watch?v=4BCo4n0YQZk

Galaxies can now be seen to vast distances, looking back in time to less than a billion years after the Big Bang. But interpreting those galaxy observations is not a simple task – often they are small, faint smudges, and information on the stars they are forming and the impact those stars have on their environment has to be extracted by comparing the light we can see to local galaxies and to computer models. These galaxy models have to consider the complex interplay of influences from stars and from the gas that lies between those stars. In effect, we have to build our artificial galaxies one star at a time, and examining the evolution of those stars. This process is known as population synthesis and gives us a profound insight into what physics may explain the light we observe. In this talk I'll discuss my work and that of others on interpreting galaxies, using the combination of cutting-edge observatory data and equally cutting-edge computer modelling.

January 21, 22, 28, 29, 7:30pm-10:30pm

What: Free Telescope Viewing
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Free

NOTE: ALL CHABOT EVENTS THROUGH JANUARY 15 ARE CANCELLED DUE TO THE COVID-19 SURGE. CHECK PROGRAM AVAILABILITY AT THE CHABOT EVENTS WEBSITE.

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TVS E-Group
To join the TVS e-group just send an email message to TVS at: info@trivalleystargazers.org 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 (con't)

Join Chabot astronomers on the Observatory Deck for a free telescope viewing! Weather permitting, this is a chance to explore stars, planets and more through Chabot's historic telescopes. Chabot's three large historic telescopes offer a unique way to experience the awe and wonder of the Universe. Our observatory deck offers breathtaking views 1,500 feet above the Bay. Three observatory domes house the Center's 8-inch (Leah, 1883) and 20-inch (Rachel, 1916) refracting telescopes, along with a 36-inch reflecting telescope (Nellie, 2003).

For more information, see:
https://chabotspace.org/events/events-listing/

Journal Club By Ken Sperber

Supernova 2020tlf: Pre-Explosion and Post-Explosion Observations and Modelling

Numerous facilities exist to observe transient phenomena, including, for example, the Zwicky Transient Factory (https://www.ztf.caltech.edu/) and PanSTARRs (www.ifa.hawaii.edu/info/press-releases/panstarrs_release/). Using high cadence imaging, these facilities can readily identify supernova explosions, and send our burst alerts so observatories worldwide and satellites can train their optics on such events. While this allows scientists to obtain timely multi-wavelength observations to understand the unfolding explosions, the vast majority of the time there are few if any observations of the star's behavior prior to the explosion. Such pre-explosion observations are critical to understanding the initial conditions and environment in which the explosion occurred. Improved understanding of the pre-explosion conditions is also critical for validating numerical models of stellar evolution and explosion dynamics.

For improved understanding of the pre- and post-explosion astrophysics, PanSTARRs has initiated The Young Supernova Experiment (https://yse.ucsc.edu/). Their goal is "to find statistical samples of young, red, and rare transients, better understand black hole variability, and to constrain the fundamental cosmological parameters of the universe. In the case of supernovae from massive stars (core-collapse SNe), the shockwave from the supernova will "flash" ionize the material shed by the star in the final stages of its evolution allowing its chemical abundances and mass-loss history to be understood. In the case of thermonuclear (Type Ia) supernovae, early observations constrain the explosion mechanism of the white dwarf progenitor and the possible presence of a binary stellar companion." The observations will cover ~1500 square degrees of sky, with repeat observations every 3 days using exposures of 27 seconds duration. Four different filters will be used to provide multi-wavelength observations, with detection thresholds ranging from 20.5-21.7mag.

The pre-explosion and post-explosion evolution of Supernova 2020tlf have been described by Jacobson-Galán et al. (2022, Ap. J., iopscience.iop.org/article/10.3847/1538-4357/ac3f3a). SN 2020tlf was discovered on September 16, 2020 by the Asteroid Terrestrial-Impact Last Alert System (ATLAS) at 15.89 mag in NGC5731. This was a Type II-P/L Supernova, where P stands for Plateau and L stands for Linear. Type II-P/L supernovae remain bright for an extended period of time compared to ordinary Type II supernovae, with the brightness decrease being linear rather than exponential. The authors used observations and modelled X-Ray through radio wavelengths to understand the progenitor star and its environment and the time-evolution of the explosion. Spectral analysis and modelling indicate the progenitor star to be a Red Super Giant (RSG) of 10-12 solar masses.

Analysis of PanSTARRS1 data indicated significant pre-explosion flux for ~130 prior to the supernova explosion. The pre-explosion flux occurred mainly at red and infrared wavelengths, suggesting an emission surface of low temperature. The presence of this Circumstellar Material (CSM) was further confirmed by spectral emission lines of Hydrogen, Helium, Neon, and other elements.

The model parameters that best fit the observed post-explosion light curve temporal evolution indicate the Red Super Giant progenitor star to have had a radius 1100x that of our Sun, with a mass loss of ~0.01 solar masses per year escaping at a velocity of 50-200 km/sec. This mass loss in the months leading up to the supernova is responsible for the CSM region that extends out to ~14,300x the radius of the Sun! Modelling suggests that the precursor emission before the supernova is driven by a shock front that that causes "a partial ejection of the stellar envelope." Additional modelling suggests that the mechanism of the energy injection is gravity waves "from neon/oxygen burning or even a silicon flash in the final 100-200 days before explosion." In the core of an RSG star, the time scale of fusion decreases exponentially for heavier and heavier elements, with Neon fusion occurring for about 3 years, Oxygen fusion occurring for about 0.3 years, and Silicon fusion occurring for about 5 days before supernova explosion. Silicon fuses to nickel, which then decays to iron, at which time fusion in the core ceases. This is because it takes more energy to fuse atoms of Fe than is released in the reaction, at which time core collapse and the supernova explosion begin.

Subsequently, the interaction of the supernova explosion with this CSM material is what gives rise to the extended plateau in brightness that persisted for ~110 days. The high density of the

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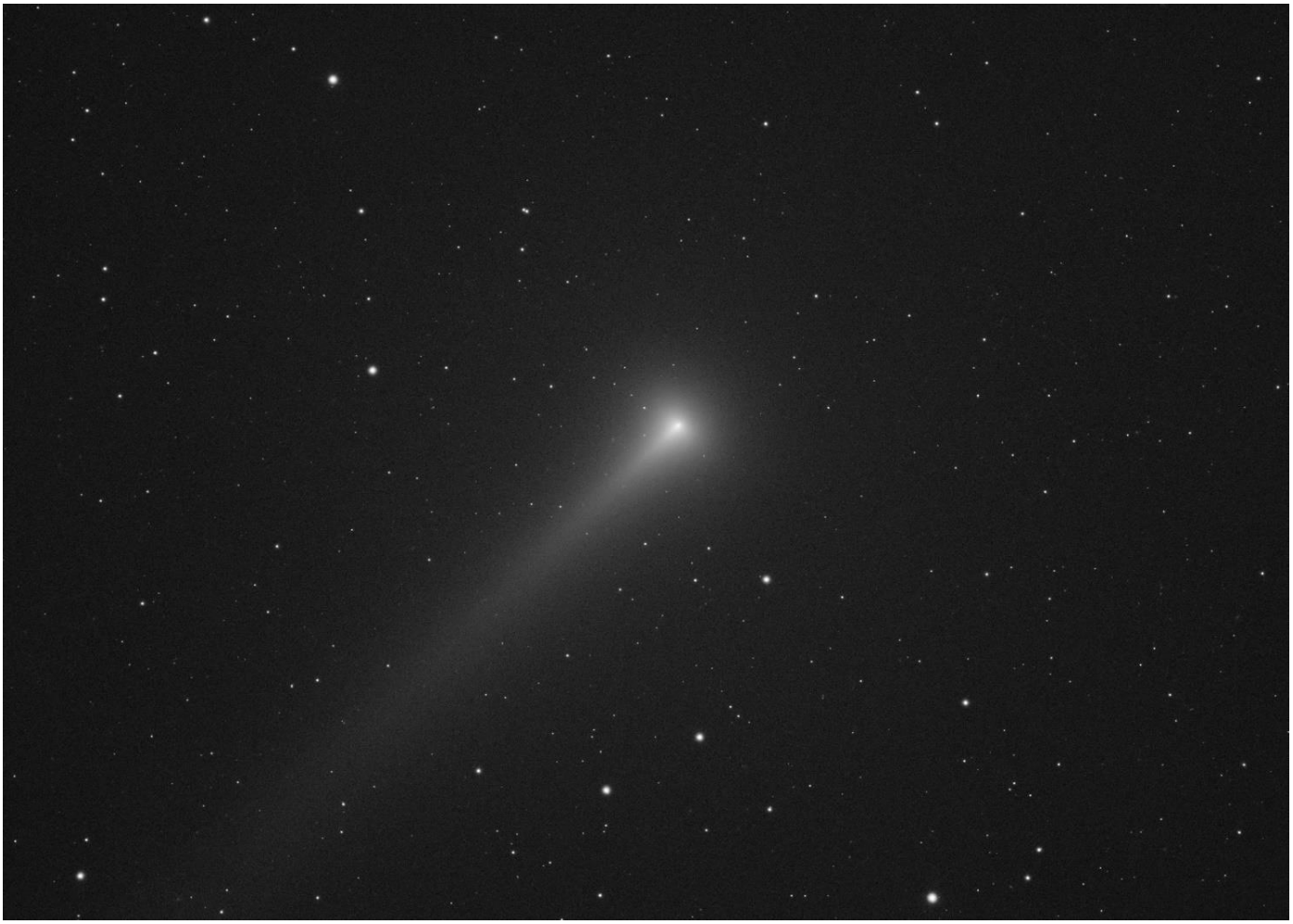
TVS Astrophotos: Comet Leonard A1 (C/2021)



Caption: Club member Brian Blau imaged Comet Leonard A1 (C/2021) from his backyard in Prescott, AZ. He used an Explore Scientific ED127 refractor with a ZWO ASI2600MM Pro using a luminance UV/IR cut filter. This is a composite of 35 exposures of 45s each. The star tracked images were obtained from 5:00am-6:10am on December 4, 2021.

Brian made a movie of the comet as it moved relative to the starfield (https://www.youtube.com/watch?v=SbX_pTtsPsQ). The movie was made during the same imaging session using 137 exposures of 30s duration each, with a Williams Optics Z61/Flat61 and a ZWO ASI1600MM Pro using a luminance UV/IR cut filter.

Journal Club (con't)

CSM was enough to completely absorb the induced X-Ray emission from the supernova shock front as it interacted with the CSM. Beyond this dense CSM (that was produced due to mass loss in the months leading up to the supernova), the CSM material from earlier mass loss events had a density too low to generate detectable amounts of X-Rays. This scenario is consistent with the lack of X-Ray detections by the Swift-XRT satellite.

As the lead author of the study, Wynn Jacobson-Galán says: "This is a breakthrough in our understanding of what massive stars do moments before they die."

If you wish to dig into the details of this study, the Astrophysical Journal article is OPEN ACCESS and available at: iopscience.iop.org/article/10.3847/1538-4357/ac3f3a). The associated Press Release can be found at: https://keckobservatory.org/dying-star

What's Up By Ken Sperber (adapted from S&T)

All times are Pacific Standard Time

January

17	**Mon**	**Full Moon (3:48pm)**
19	Wed	Algol at minimum brightness for 2 hours centered on 8:56pm
20	Thu	The Moon is 4° from Regulus in the west (Dawn)
24	Mon	The Moon is 5° to the upper right of Spica (Dawn)
25	**Tue**	**Last-Quarter Moon (5:41am)**
29	Sat	The crescent Moon, Mars, and Venus rise in the south-southeast (Dawn)
31	**Mon**	**New Moon (9:46pm)**

February

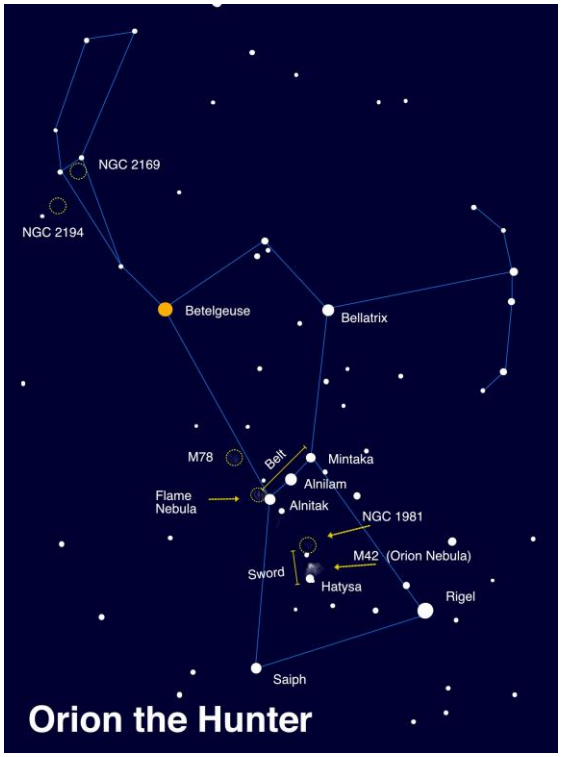
2	Wed	The 1-day old Moon hangs 4° to the lower left of Jupiter (Dusk)
8	**Tue**	**First-Quarter Moon (5:50am)**
8	Tue	The Moon is approximately 6° below The Pleiades, M45 (Dusk)
8	Tue	Algol at minimum brightness for 2 hours centered on 10:42pm
9	Wed	The Moon, in Taurus, sits in between Aldebaran and The Pleiades (Evening)
11	Fri	Algol at minimum brightness for 2 hours centered on 7:31pm
13	Sun	The Moon lines up with Castor and Pollux (Evening)
16	**Wed**	**Full Moon (8:56am)**
16	Wed	The Moon is 5° from Regulus in the east (Dusk)
18-20	Fri-Sun	Over the next 2 weeks, the Zodiacal Light is visible in the west from a dark site (Evening)
		The Moon trails Spica by ~5.5° in the east-southeast (Evening)
23	**Wed**	**Last-Quarter Moon (2:32pm)**
24	Thu	The Moon is ~3° left of Antares (Morning)
27	Sun	The crescent Moon, Mars, and Venus rise in the southeast (Dawn)

Hunting the Hunter: Observing Orion

By David Prosper

If you are outside on a clear January night, it's hard not to notice one distinctive star pattern above all: Orion! While we've covered Orion in earlier articles, we've never discussed observing the constellation as a whole. Perhaps you've received a new telescope, camera, or binoculars, and are eager to test it out. Orion, being large, prominent, and full of interesting, bright objects, is a perfect constellation to test out your new equipment and practice your observing skills - for beginners and seasoned stargazers alike.

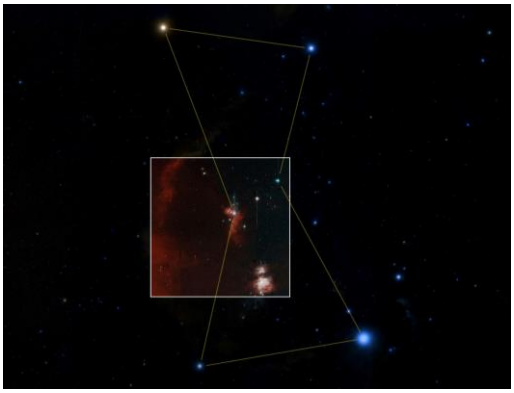
In Greek mythology, Orion is a strong hunter, with numerous legends about his adventures. Being such a striking group of stars, cultures from all around the world have many myths about this star pattern. There are so many that we can't list them all here, but you can find a wonderful interactive chart detailing many cultures' legends on the Figures in the Sky website at: figuresinthesky.visualcinnamon.com



Caption: Northern Hemisphere observers can find Orion during January evenings in the east/southeast skies. Can you spot the Orion nebula with your naked eye, in Orion's sword? How does it look via binoculars or a telescope? What other details can you discern? Please note that some deep sky objects aren't listed here for clarity's sake. You can read more in our November 2019 article Orion: Window Into a Stellar Nursery, at: bit.ly/orionlight. Image created with assistance from Stellarium.

What sights can you see in Orion? Look above the variable orange-red supergiant "shoulder star" Betelgeuse to find the stars making up Orion's "club," then move across from Betelgeuse towards the bright star Bellatrix (Orion's other "shoulder") and the stars of his bow and arrow - both essential tools for the Hunter. Many interesting sights lie near Orion's "belt" and "sword." Orion's belt is made up of three bright giant stars forming an evenly spaced line: Alnitak, Alnilam, and Mintaka. Move from the belt stars towards the stars Rigel and Saiph (Orion's "feet" or "knees") to arrive at Orion's distinctive Sword, parts of which may appear fuzzy to your unaided eyes. Binoculars reveal that fuzz to be the famed Orion Nebula (M42), perched right next to the star Hatysa! Diving in deeper with a telescope will show star clusters and more cloud detail around the Nebula, and additional magnification brings out further detail inside the nebula itself, including the "baby stars" of the Trapezium and the next-door neighbor nebula M43. Want to dive deeper? Dark skies and a telescope will help to bring out the reflection nebula M78, the Flame Nebula (NGC 2024), along with many star clusters and traces of dark nebula throughout the constellation. Very careful observers under dark clear skies may be able to spot the dark nebula known as the Horsehead, tracing an equine outline below both the Belt and the Flame Nebula. Warning: The Horsehead can be a difficult challenge for many stargazers, but very rewarding.

This is just a taste of the riches found within Orion's star fields and dust clouds; you can study Orion for a lifetime and never feel done with your observations. To be fair, that applies for the sky as a whole, but Orion has a special place for many. New telescopes often focus on one of Orion's treasures for their first test images. You can discover more of NASA's research into Orion's stars - as well as the rest of the cosmos - online at nasa.gov



Caption: The inset image is the "first light" photo from the Zwicky Transient Facility, a large survey telescope designed to detect changes in the entire night sky by detecting "transient objects" like comets, supernovae, gamma ray bursts, and asteroids. Image Credit: Caltech Optical Observatories

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

Tri-Valley Stargazers
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www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

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 ($10). Must be a full-time high-school or college student.

_____ Regular member ($30).

Hidden Hill Observatory Access (optional): Must be 18 or older.

_____ 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.

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 except as detailed in our Privacy Policy (http://www.trivalleystargazers.org/privacy.shtml).

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.