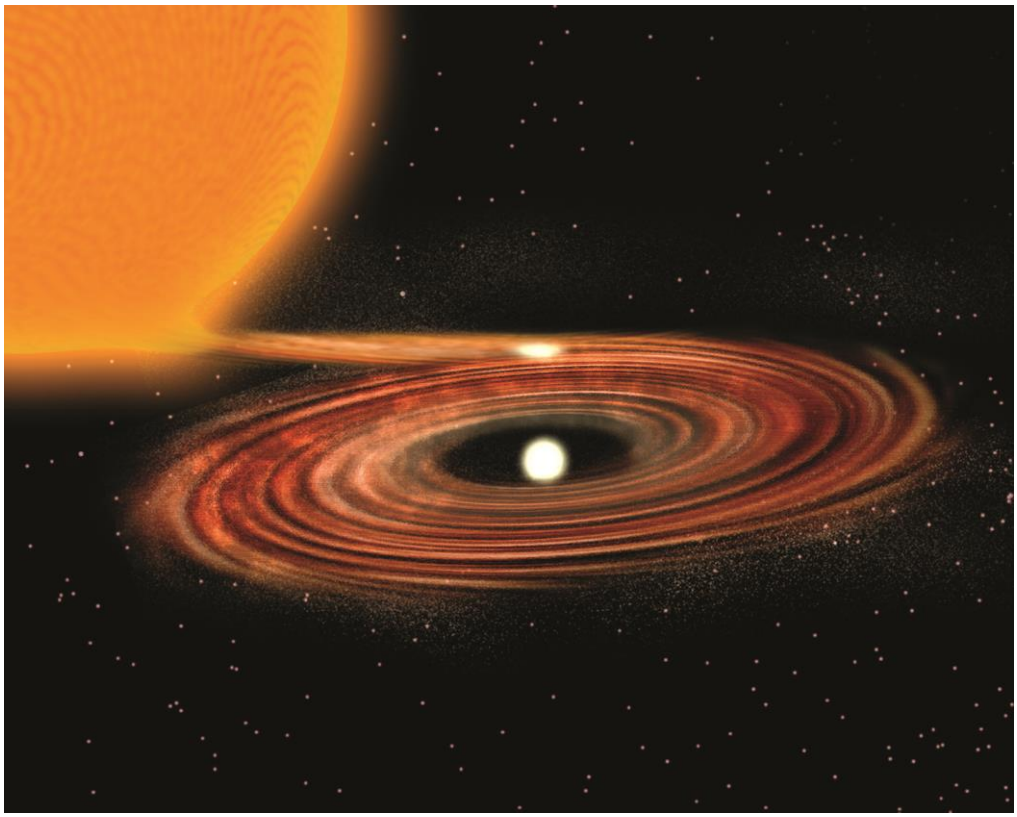
Tri-Valley Stargazers

August 2021

PrimeFocus

Seeing Double: Observing Double Stars for Fun and Science
Gary Kader, Director, Burrell Memorial Observatory, Baldwin Wallace University

About half the stars in the sky are multiple stars. They are fun to observe, particularly the ones with a wide range of temperatures which results in different colors. They are also very important scientifically as they are the only way we can measure the mass of the stars. Some doubles, as they go through their evolutionary process, result in Type 1a supernovae which we use to measure the scale of the cosmos, with the significant discovery being the acceleration of the expansion of the universe.



Caption: An artist's conception of the accretion disk in the binary star system WZ Sge. This system contains an accreting white dwarf star with a larger companion. For more information see: https://imagine.gsfc.nasa.gov/educators/programs/cosmictimes/universe_mashup/archive/pages/type_1a_supernova.html. Credit: P. Marenfeld/NOAO/AURA/NSF

Gary Kader has been an avid amateur astronomer for over 60 years. He is a past president of the Cuyahoga Astronomical Association and past vice-president of the Cleveland Astronomical Society. His pursuit of becoming a professional astronomer was diverted by a bachelor's degree in mechanical engineering followed by a 40-year engineering career. Currently he is the Director of the Burrell Memorial Observatory at Baldwin Wallace University, where he is also an instructor in the department of physics and astronomy.

WHEN:

August 20, 2021
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:

News and Notes

2021 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
Aug. 20	Aug. 23	
Sep. 17	Sep. 20	Sep. 3
Oct. 15	Oct. 18	Oct. 1
Nov. 19	Nov. 22	Nov. 5
Dec. 17	Dec. 20	Dec. 3

Money Matters

As of the last Treasurer's Report on 7/19/21, our club's account balance is $63,772.94. This includes $44,156.20 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Kaustubh Kaustubh, Bill Fisher, Srikanth Gollapudi, Rashmi Jain, Abhay Madaan, and Rajiv Thakkar. Please say hello and chat with them during our Zoom meetings.

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.

Outreach Star Party Schedule

For **indoor** Outreach Events both vaxed and unvaxed persons are required to wear masks for events at K-12 Schools and at long term care facilities. For more information on COVID Guidance see:

https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/guidance-for-face-coverings.aspx

https://covid19.ca.gov/safely-reopening/

Contact Eric Dueltgen if you are interested in participating in future events (outreach"at"trivalleystargazers.org).

2021 Club Star Party Schedule

Save the dates for the 2021 Club Star Parties.

Del Valle star parties are also public outreach events. They are jointly hosted with the EBRPD and held at the Arroyo Staging Area. The public is invited for the first 1.5-2 hours, while club members can stay the remainder of the night.

Tesla Vintners star parties are open to only club members and their guests. These star parties end at midnight, but participants can leave earlier, should they wish.

H2O Open House star parties are open to the public. The open house ends at midnight, and all participants are encouraged to stay the duration. The drive to H2O takes about 1 hour, and the caravan leaves promptly from the corner of Mines and Tesla Rds.

September 4, 7:00pm: TVS Club Star Party, Tesla Vintners, 5143 Tesla Rd., Livermore
September 11, 7:00pm: Outreach party at Del Valle Arroyo staging area

H2O Rebuild

Construction has started for a shed at H2O which will hold some large telescopes for use while the main observatories are being constructed. A work party of Mark McCarthy, Sameep Mondhe, Ed Carreno and son, Ron, and Chuck spent three hours under the hot sun, July 31st, moving rocks and dirt to prepare the support for the floor structure. The job is now about half done and will require one more work party before the shed itself can be erected by a third work party.

Calendar of Events

August 14, 7:30pm

What: Unveiling the Dark Universe with the Dark Energy Survey
Who: Dr. Alexandra Amon (Stanford University)
Sponsor: Mt. Tam Astronomy Program
Online: https://us02web.zoom.us/j/89697734661

Throughout history, the Universe has had a way of turning our grandest thoughts upside down. Now, we see that the cosmos is dark: dominated by dark matter and dark energy. With the Dark Energy Survey imaging 1/8th of the night sky — and mapping more than 100 million galaxies — we can get a clearer understanding of the vast Universe we call home.

Calendar of Events

For more information see:
https://www.mttamastronomy.org/calendar and
https://youtube.com/MtTamAstronomy

August 18, 7:00pm

What: Can We Define Life? Should We?
Who: Prof. Haley Sapers (Caltech) and Prof. Carol Cleland (University of Colorado, Boulder)
Sponsor: SETI Institute
Online: REGISTRATION REQUIRED
https://www.eventbrite.com/e/can-we-define-life-should-we-tickets-166093878261

What is the difference between you and a rock? Are stars alive? Is a computer virus a living being? These may seem like easy questions, but scientists have struggled to formulate a universal definition of life, to draw the line between the living and the inanimate. Can life even be defined? Is such an endeavor even helpful?

We think we can intuitively recognize whether something is alive or not. But nature shows many examples that are difficult to categorize as life or non-life. The challenge may intensify as other worlds in our universe open up to exploration.

"It is commonly said," the scientists Frances Westall and André Brack wrote in 2018, "that there are as many definitions of life as there are people trying to define it." Is it possible to find life beyond Earth if we disagree about what life represents?

For more information, see: https://www.seti.org/talks

August 27, 6:30pm-10:00pm

What: Sunset Science
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline Blvd., Oakland, CA 94619
Cost: Members Free, Adults $15, Youth $5

Enjoy a warm summer evening of activities and stargazing on Chabot's stunning Observation Deck! Learn about stellar concepts and preview our new offerings with special demonstrations, hands-on challenges and more. When the Sun goes down, the stars come out for exploring the cosmos through historic telescopes.

During this event, we'll be learning all about meteors! Those illusive streaks of light that flash across the sky hold clues to the remnants of space rocks like asteroids and comets. Enjoy comet demonstrations, hands-on activities, and games and simulations that unlock the mysteries about these space objects. Find out where meteors originate and where to catch the next meteor shower.

Food, wine and beer will be available for purchase on-site.

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

September 11, 7:30pm

What: Advanced Instrumentation in Optical Astronomy
Who: Dr. Franck Marchis (SETI Institute)
Sponsor: Mt. Tam Astronomy Program
Online: https://us02web.zoom.us/j/89697734661

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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)

Ground-based telescopes have come a long way in recent decades. Today they can take advantage of adaptive optics systems that reduce the effect of atmospheric image distortion, and, also, of fast compact computers that allow small telescopes to reach the capability of large telescopes. The result is a lively community of citizen astronomers who (among other things) can detect exoplanets and help study the size, shape, and trajectory of near-Earth asteroids.

For more information see:
https://www.mttamastronomy.org/calendar and
https://youtube.com/MtTamAstronomy

Jupiter's GRS: Then and Now

By Ken Sperber

On August 19, Jupiter is at opposition and hence it appears at its biggest and brightest of the year and it is visible all night. Jupiter's Great Red Spot (GRS) is probably only second compared to the Saturn's rings in capturing a youngster's imagination at a telescope eyepiece. The GRS is located at about 22° South latitude in Jupiter's South Equatorial Belt. The GRS has existed since at least 1665 when the first observation of it was made by Giovanni Cassini (Robert Hooke observed a spot on Jupiter in 1664, but this spot is believed to have been located in the North Equatorial Belt). The GRS was observed dozens of times in 1800's, with regular observations occurring since 1879 (https://en.wikipedia.org/wiki/Great_Red_Spot).

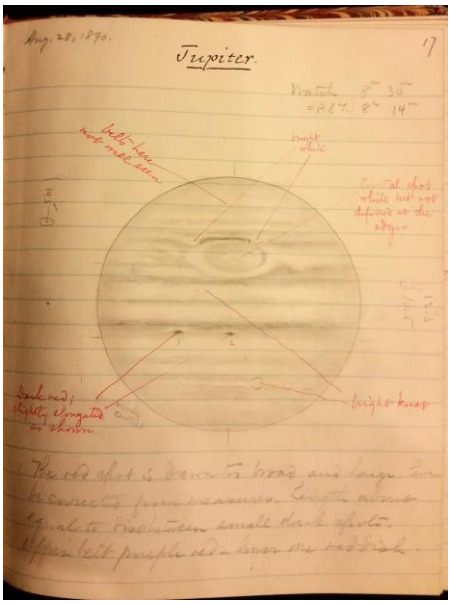


Figure 1: August 28, 1890 drawing of Jupiter by J. E. Keeler using the 36-inch Great Lick Refractor made by Alvan Clark and Sons. Observer, 1890 From Aug. 23 to Oct. 30, Number 7, p.17, © UC Regents/Lick Observatory

Some of the most famous observations were performed at Lick Observatory using their 36-inch Alvan Clark refractor. Using this telescope, James Keeler drew the GRS in the context of the full disk of Jupiter on August 28, 1890 (Figure 1, note, South is up in his drawing). In his notes at the bottom of the page he indicates that the size of the GRS is slightly overestimated in his drawing, rather its length is "equal to the distance between the small dark spots" numbered 1 and 2 in the drawing. This corresponds to a GRS diameter of approximately 25,000 miles, or about 3 Earth diameters. However, by 2017, the GRS diameter has shrunk to only about 10,200 miles, or about 1.3 Earth diameters.

Understanding the dynamics of the GRS is essential for determining the mechanism(s) by which its size has changed. Viewed at the cloud top, the GRS rotates in the counter-clockwise direction and is hence termed an anticyclonic system. It rotates once in about 6 Earth days and Voyager data indicate that its cloud top extends about 5 miles above the surrounding cloud tops. The winds at the outer edge of the GRS speed along at up to ~270 miles hr^{-1}, while those toward the center are much more quiescent. As seen in timelapse imagery from Voyager 1, westward inflow from the east carries white ovals over the northern portion of the GRS where they are subject to strong windshear and turbulence (https://commons.wikimedia.org/wiki/File:790106-0203_Voyager_58M_to_31M_reduced.gif). The ovals either merge with the GRS, are destroyed by the windshear, pass over the northern periphery of the GRS and continue westward, or they circumnavigate the GRS and then proceed eastward from the southern edge of the GRS in some distorted form. In some cases, groupings of white ovals have been observed to merge and then change to red in color.

The cause of the red color of the GRS (and other ovals) has been the subject of much debate. Upper-level clouds on Jupiter are predominantly made of ammonia, which is typically white in color. Robert Carlson finds that a combination of ammonia and acetylene turn red when irradiated by ultraviolet light (https://www.newscientist.com/article/2153721-we-may-know-why-jupiters-great-red-spot-is-red-instead-of-white/). Others suggest that this process alone cannot account for the intense red of the GRS, and that organic tholins need to be added to mix. Thus, the complex chemistry occurring in Jupiter's atmosphere is not fully understood.

While the afore-mentioned discussion has been centered on the GRS characteristics at cloud top level, it wasn't until the ongoing Juno mission to Jupiter that the depth profile of the GRS was observed (Figure 2). Using its 6-channel microwave radiometer, Juno observed that the GRS extends to a depth of at least 200 miles, with temperature greater at depth compared to the cloud tops. According to Planetary Scientist Andy Ingersoll, the "Winds are associated with differences in

temperature, and the warmth of the spot's base explains the ferocious winds we see at the top of the atmosphere." The depth of the GRS and the strength of its rotation (vorticity) are factors consistent with the longevity of the GRS, while the surrounding shear and turbulence are factors that can enhance or degrade the GRS based on the degree to which upscale energy transport is manifested.

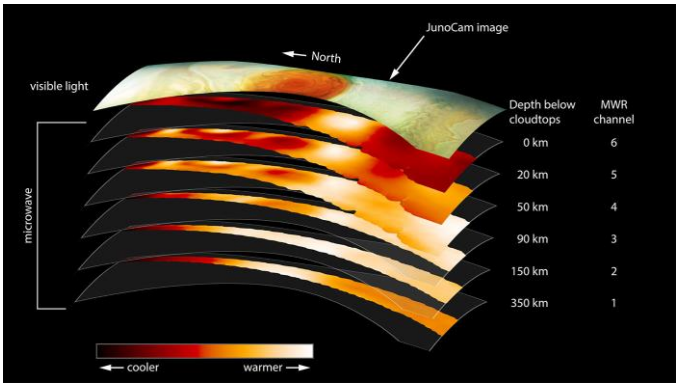


Figure 2: This figure gives a look down into Jupiter's Great Red Spot, using data from the microwave radiometer instrument onboard NASA's Juno spacecraft. Each of the instrument's six channels is sensitive to microwaves from different depths beneath the clouds. Credits: NASA/JPL-Caltech/SwRI
See: https://www.nasa.gov/feature/jpl/nasas-juno-probes-the-depths-of-jupiters-great-red-spot

In early 2019 amateur astronomers alerted the broader scientific community that the GRS appeared to be shedding "flakes" of material. The professional astronomy community then turned larger ground-based telescopes and the Hubble Space Telescope (HST) toward Jupiter to investigate the GRS interactions with anticyclonic vortices (AV) and other open circulating cells (collectively termed as South Tropical Disturbances; STrD). They even employed WinJUPOS (http://www.grischa-hahn.homepage.t-online.de/), which is software developed by amateur astronomers to derotate images in order to maintain high resolution during image stacking, such as when "lucky" imaging approaches are used for planetary imaging.

Sanchez-Lavega, et al. (2021) evaluated images taken by the HST and from JunoCam-now in orbit around Jupiter. Using sequences of images, they were able to compute cloud-track wind velocity vectors to estimate the mean zonal and meridional wind along the center of the GRS. By taking the first derivative of the wind field they calculated the relative vorticity of the GRS, which is a measure of the strength of the rotation of the GRS. For reference, they also evaluated the GRS characteristics in 2018, the year before the "flake" events. As some of the 2019 StrD approached the GRS, they "slowed down rapidly in short distance or even diluted and merged with clouds in the GRS hollow, thus disappearing." These interactions caused distortion of the GRS from its characteristic elliptical shape.

Noting the "fluid" nature of Jupiter's atmosphere, the GRS is observed to have a mean drift in longitude of ~0.33° day^{-1}, with a 90-day oscillation period, while maintaining its latitudinal location. However, during mid-May-early June 2019 interactions the oscillation period increased to 125 days. Meanwhile, from March 2019 to May 2020 the longitudinal size of the GRS size diminished from 18,040km to 15,950km, with a minimum extent of 15,130km during the most intense "flake" events. Based on tracking well-resolved dark features the rotational velocity of the GRS increased when it shrunk in size, but the maximum vorticity did not change. Flakes also have different spectral characteristics then the main portion of the GRS, with radiative transfer models indicating the flake regions to have 50% lower particle density and optical depth in the upper cloud deck and for the tropospheric haze. The interpretation is that the flake material from the GRS has mixed with material in the anticyclonic vortices (AV).

The authors used a numerical model to understand the dynamics of the GRS-AV interactions, resolving both their horizontal and vertical dimensions. The model is initialized with the GRS and an AV of size seen in the observations and embedded in the background wind field relevant to their latitude. The flakes are well represented in the numerical simulation for an AV that initially approaches the southern flank of the GRS with a velocity of 100 m s^{-1}. At the northern edge of the GRS, the AV gets stretched out and it fragments, penetrating and distorting the shape of the GRS and then forming flakes on the western side of the GRS. For weaker approach velocities (50-60 m s^{-1}), the flakes "are less prominent and the AV material does not penetrate the GRS. Evaluating the simulated vertical structure indicates that these interactions only occur in the upper cloud layers of the GRS with the energy of an absorbed AV sufficient to "produce the observed increase in peak tangential velocity at cloud tops." Affecting only the cloud tops, the flake events "are likely to have been superficial, not affecting the full depth of the GRS." By October of 2019, the GRS had nearly returned to its larger size seen before the AV merger-flake events. The authors conclude that: "The intense vorticity of the GRS, together with its larger size and depth, compared to the interacting vortices, guarantees its long lifetime."

References

Keeler, J. E., (1890) Observer, 1890 From Aug. 23 to Oct. 30, Number 7, p.17, © UC Regents / Lick Observatory

Sanchez-Lavega, et al. (2021) Jupiter's Great Red Spot: Strong Interactions With Incoming Anticyclones in 2019. JGR-Planets, https://doi.org/10.1029/2020JE006686

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

All time are Pacific Daylight time

August

15	**Sun**	**First-Quarter Moon (8:20am)**
16	Mon	The Moon in Scorpio is ~4° from Antares (Dusk)
19	Thu	Jupiter at Opposition (Visible all night)
20	Fri	The Moon and Saturn are ~4.5° apart in the southeast (Dusk)
21	Sat	The Moon and Jupiter are ~5° apart in the east-southeast (Dusk)
22	**Sun**	**Full Moon (5:02am)**
22	Sun	The Moon, Jupiter, and Saturn form an arc in the southeast (Evening)
30	**Mon**	**Last-Quarter Moon (12:13am)**
30	Mon	The Moon is 5° from Aldebaran, with the Pleiades to their upper right (Dawn)

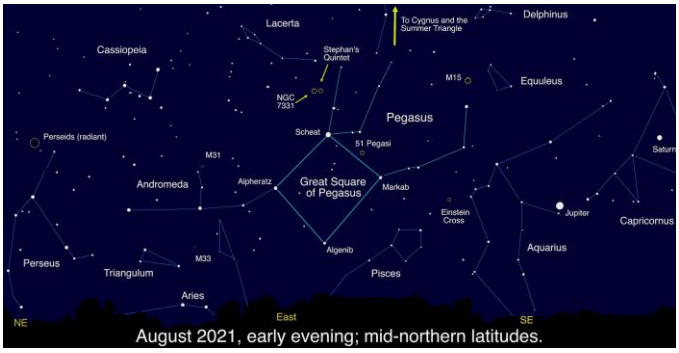
September

3	Fri	The Crescent Moon and Castor and Pollux are equidistant (Dawn)
4	Sat	The Crescent Moon in Taurus is ~4° from M44, the Beehive Cluster (Dawn)
4	Sat	Venus in Virgo is ~2° from Spica (Dusk; see S&T, September, p. 46)
5-	Sun-	Over the next 2 weeks the Zodiacal Light visible in the east (beginning 2 hours before morning twilight)
6	**Mon**	**New Moon (5:52am)**
9	Thu	The Moon and Venus are ~3.5° apart with Spica to their lower right (Dusk)
9	Thu	Algol at minimum brightness for 2 hours centered on 11:55pm
12	Sun	The Moon in Scorpio is ~3° from Antares in the southwest (Dusk)
12	Sun	Algol at minimum brightness for 2 hours centered on 8:44pm
13	**Mon**	**First-Quarter Moon (1:39pm)**
15	Wed	The Moon , Saturn, and Jupiter form a line in the south-southeast (Evening)
16	Thu	The Moon and Saturn are ~4° apart (Evening)
17	Fri	The Moon and Jupiter are ~5.5° apart (Evening)
20	**Mon**	**Full Moon (4:55pm)**
26	Sun	The Moon is about halfway between Aldebaran and the Pleiades (Dawn)
28	**Tue**	**Last-Quarter Moon (6:57pm)**
30	Thu	The Crescent Moon in Gemini is ~2.5° from Pollux (Dawn)

Corner the Great Square of Pegasus

By David Prosper

The Summer Triangle may be the most famous seasonal star pattern, but during early August evenings another geometrically-themed asterism rises: the Great Square of Pegasus. This asterism's name is a bit misleading: while three of its stars - Scheat, Markab, and Algenib - are indeed found in the constellation of the winged horse Pegasus, its fourth star, Alpheratz, is the brightest star in the constellation Andromeda!



Caption: While the stars of the Great Square of Pegasus are not as bright as those of the Summer Triangle, they still stand out compared to their neighbors, and make a great foundation for exploring this area of the night sky. Note that the brightness of the stars near the horizon is exaggerated in this picture.

August evenings are an excellent time to look for the Great Square, as it will be rising in the east after sunset. If not obvious at first, wait for this star pattern to rise a bit above the murky air, and remember that depending on your point of view, it may appear more like a diamond than a square. Look for it below the Summer Triangle, or to the southeast of nearby Cassiopeia at this time. As the Great Square rises in prominence during autumn evenings, it becomes a handy guidepost to finding more constellations, including some of the dimmer members of the Zodiac: Aries, Pisces, Aquarius, and Capricornus. Like the Summer Triangle, the Great Square of Pegasus is also huge, but Pegasus itself is even larger; out of the 88 constellations, Pegasus is 7th in size, and feels larger as the stars in its neighboring constellations are much dimmer.

There are many notable deep-sky objects found within the stars of Pegasus - ranging from easily spotted to expert level targets - making it a great constellation to revisit as your observing skills improve. Notable objects include the densely-packed stars of globular cluster M15, a great first target. The potential "Milky Way look-alike" galaxy NGC 7331 is a fun target for more advanced observers, and expert observers can hop nearby to try to tease out the much dimmer interacting galaxies of Stephan's Quintet. A fascinating (but extremely difficult to observe) object is a gravitationally-lensed quasar famously known as the Einstein Cross. Pegasus has quite a storied history in the field of exoplanet research: 51 Pegasi was the first Sun-like star discovered to be host to a planet outside our solar system, now officially named Dimidiam.

While observing Pegasus and its surroundings, keep your eyes relaxed and ready to catch some Perseids, too! August 2021 promises an excellent showing of this annual meteor shower. The crescent Moon sets early on the evening of the shower's peak on August 11-12, but you can spot stray Perseids most of the month. If you trace the path of these meteors, you'll find they originate from one point in Perseus - their radiant. Giant planets Jupiter and Saturn will be up all evening as well. Look south - they easily stand out as the brightest objects in the faint constellations Aquarius and Capricornus.

Pegasus truly holds some fantastic astronomical treasures! Continue your exploration of the stars of Pegasus and beyond with NASA at nasa.gov.

Caption: Stephan's Quintet is one of the most famous deep-sky objects in Pegasus. First discovered in 1877, it contains the first galaxy group discovered (which includes 4 of the 5 galaxies making up the Quintet) – and has been studied extensively ever since. One day this group will merge into one supergalaxy! While famous, these galaxies are hard to spot in all but the largest backyard telescopes – but are a favorite target of astrophotographers. Take a virtual flyby of these galaxies with a tour created from Hubble data at: bit.ly/quintetflyby

Credit: NASA, ESA, and G. Bacon, J. DePasquale, F. Summers, and Z. Levay (STScI)

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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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.