



Newsletter of the Pomona Valley Amateur Astronomers

Things are as they are. Looking out into it the universe at night, we make no comparisons between right and wrong stars, nor between well and badly arranged constellations.

Alan Watts



Volume 42 Number 9

nightwatch

September 2022

Please join PVAA on Zoom this Friday, September 9th at 7:30 PM to hear Ken Farley PhD. He is the Project Scientist for Mars 2020 Perseverance Rover Mission. Hope you can join us.

Club Events Calendar

Sep 9	General Meeting – Ken Farley PhD, Project Scientist for Mars 2020 Perseverance Rover Mission 7:30 PM
Sep 24	Star Party – TBD
Sept 28	Board Meeting 6:15 PM
Oct 7	General Meeting (presentation: TBD) 7:30 PM
Oct 22	Star Party – TBD
Oct 26	Board Meeting 6:15 PM
Nov 4	General Meeting (presentation: TBD) 7:30 PM
Nov 19	Star Party – TBD
Nov 26	Star Party in the Park – Cahuilla PARK
Nov 30	Board Meeting 6:15 PM
Dec 3	Christmas Party



Bob Branch & Friends 6.16.22

ISS and Jupiter

Early in the morning on August 23rd, Ludd Trozpek and his friend Matt Magilke drove out to a hospital parking lot in Moreno Valley to view and capture an ISS transit of Jupiter. The "centerline" corridor is very narrow, about the size of the ISS. They update the orbital elements every few hours, and the difference between those available last night and the ones current when we updated meant we had to move our setups about 150 ft northwest.

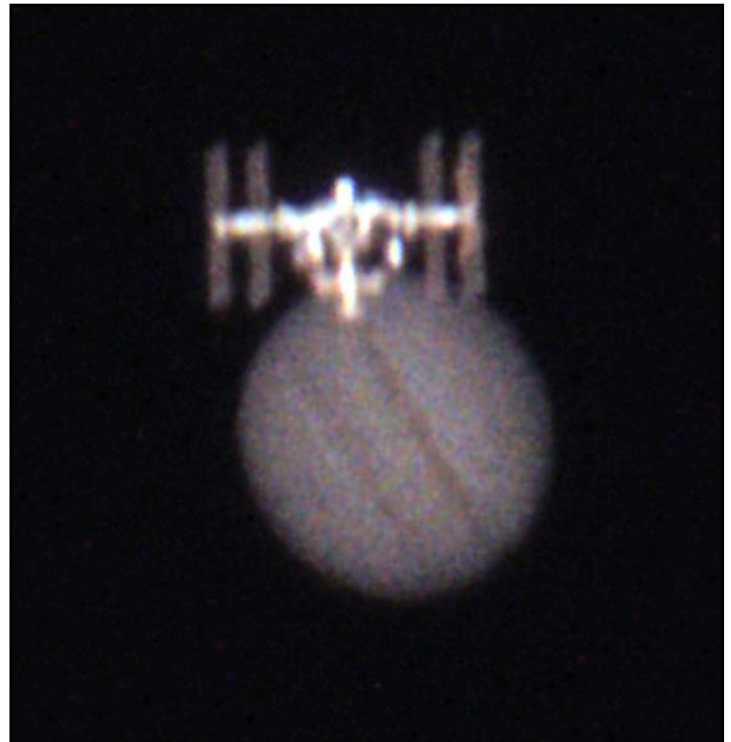
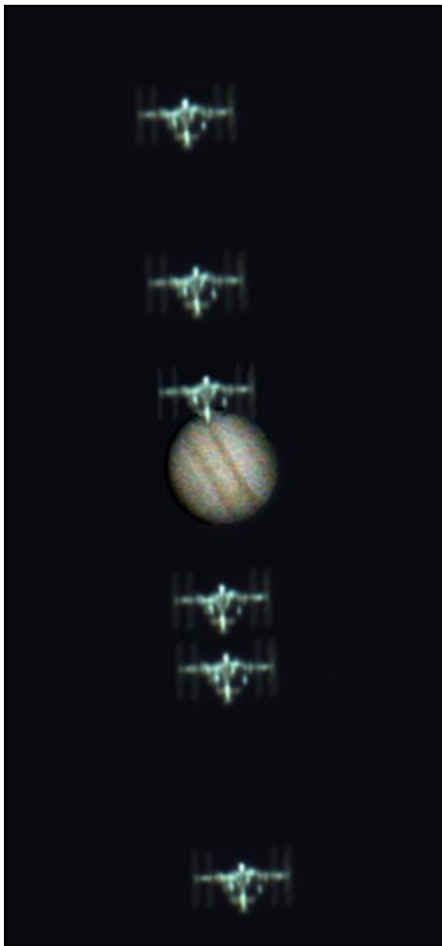
Matt used the Sky Safari app to figure out when to set up.

Below is a link to Cloudy Nights where you can see the equipment used and Matt's story of the morning. The station rose in the SW, became visible about 10 or 20 degrees above the horizon when it hit sunlight, and quickly transited the planet which was maybe 45 degrees elevation. In the images, the ISS entered from the bottom and exited at the top.

<https://www.cloudynights.com/topic/837924-august-23-jupiter-being-photobombed/?hl=%2Bjupiter+%2Biss#entry12102914>

Image captions: A composite of the six frames that had the ISS in it.

Ludd's Photoshopped view of one image with the ISS partly in front of Jupiter.



PVAA General Meeting 08/12/22

We had another Zoom gathering for our general meeting. Dave Nakamoto, former JPL System/Software Engineer, and current Griffith Observatory Planetarium Engineer was the speaker for the night. His presentation was "Mistakes Prior to the Discovery of Neptune" where he reviewed the many missed opportunities to discover Neptune.

John Couch Adams, a mathematician and astronomer, predicted the existence and position of Neptune, using only mathematics. The calculations were made to explain the discrepancies of Uranus's orbit, using the laws of Kepler and Newton. Uranus was discovered in 1781 by William Herschel. In 1821 Alexis Bouvard published astronomical tables predicting the future positions of Uranus based on Newton's laws of motion and gravity. Following observations revealed deviations from the tables, leading to the idea that some undiscovered body was perturbing Uranus's orbit. Adams started his calculations on July 3, 1841.



Photograph taken by NASA's *Voyager 2* in 1989



Adams communicated his work to James Challis, the director of the Cambridge Observatory, asking for position measurements of Saturn and Uranus in 1843. Challis received Adam's 1st paper and requests on February 3, 1844. Challis in turn sent the letter to George Biddell Airy, an Astronomer Royal and mathematician. (Astronomer Royal means he was England's head astronomer.) Airy was also the director of the Royal Observatory at Greenwich. Challis asked Airy to communicate directly to Adams, taking him out of the loop. In 1845 Adams

received the mountain of data on orbital positions from Airy. Due to the tutorial workload at St. John's college, Adams delayed his reply for almost a year. In September 1845 Adams finished his first calculations and sent them to Challis instead of Airy. Challis replied that he should send his calculations to Airy.

Then Airy ignores Adams, refusing to meet with him. In October 1846 Adams finished his second calculations with the planet's location in the sky. Airy didn't believe in Adam's work and never publishes it. He never started the search. This is

missed opportunity #1. Airy did not believe that mathematics could make this prediction. He also had a snobbish and arrogant attitude towards young scientists. Airy did show Adams first papers to William Dawes in 1845, a week after receiving them. Dawes' observatory was being remodeled, and he had no instrument in which to observe. Missed opportunity #2.

Dawes shared the data with William Lassell in September 1845. Lassell was a brewer by profession and became a Fellow of the Royal Astronomical Society in 1839. He built his own 24-inch telescope, and in 1855 a 48-inch (1200 mm) scope that he installed in Malta because the observing conditions were better than England's. He didn't immediately look for the new planet because he had a sprained ankle. His equipment was bulky and very heavy. When he healed, he found that his housekeeper had thrown out the calculations. Missed opportunity #3.

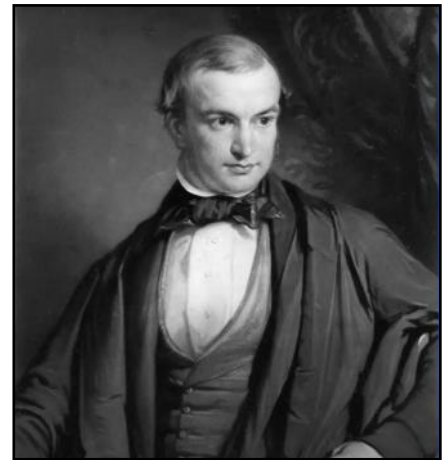
In June of 1846 French astronomer and mathematician Urbain Le Verrier independently calculated where the new planet would be. He sent his calculations to George Airy. Airy praised his work but took no action. Airy sent Le Verrier's work and request to look for it to James Challis. Challis did nothing until July. Challis used a bad search methodology and didn't find it. They then received the 3rd and updated prediction from Le Verrier. France in the meantime praised Le Verrier three times – but did nothing. No one looked through a telescope for the planet. Multiple missed opportunities.

Why didn't Adams and Le Verrier look for the planet themselves? They were theorists, mathematicians, not observers. They had no observing experience and did not have access to an observatory. Telescopes were expensive and hard to get a hold of. The professional astronomers were too busy with their own work. Observational astronomy is a different animal from mathematical astronomy.

But the French and the English weren't the only ones to do nothing. Sears Cook Walker was an American astronomer – an assistant at the US Naval Observatory. He received Le Verrier's 2nd paper predicting the position of the planet on June 1st, 1846. He wanted to start a search. His boss – Matthew Maury refused his request, saying routine work will tie up all the equipment for several months.

So, he looked for some young blood and remembered a dissertation by Johann Gottfried Galle. Johann was an assistant at the Berlin Observatory. Johann sent his dissertation to Le Verrier for review. On September 18th, 1849, Le Verrier wrote back to Galle with praise for his work. He also added a request to look for Le Verrier's planet. Johann begged Encke, head of the observatory, to use the 8-inch telescope. Encke was celebrating his birthday, and the scope was free. Encke relented, and Johann found an 8th magnitude star one degree away from the predicted position on the morning of September 23d, 1846. Galle found Neptune with the help of a young graduate student Heinrich d'Arrest. Their star charts did not go down to the 8th magnitude, but they had a new chart made exclusively for the German observatory going down to the 8th magnitude for asteroid hunting. It took them less than one hour to find the new planet. Over the next two nights the object moved 4 seconds of arc. Galle always refused credit to be acknowledged as the discoverer of Neptune; he attributed the discovery to Le Verrier.

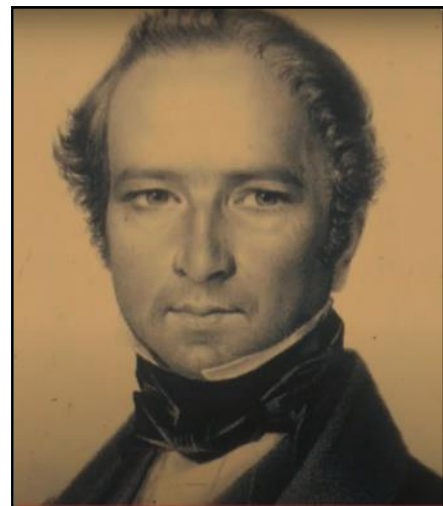
Gary Thompson



John Couch Adams



Urbain Le Verrier



Johann Gottfried Galle

PVAA Officers and Board

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Objects in the constellation Cassiopeia
CW Left to right, SH2-161, NGC 7538, SH2-159, Bubble Nebula, M52 star cluster



ES102 LCD100 ASI 6200MC PRO
Triad Ultra OAG W/ ASI 174
Santa Paula, CA
86 Images 300s -10C Full Frame
Processed in Pixinsight w/ Sharol Carter
Kay Hoevel

Another Look - September 2022

New moon Sept. 25th, Full moon 10th, New moon Aug 27

Astronomical twilight 2005 PDT

First day of Autumn: Thursday, September 22, 2022 at 6:03 pm PDT

September Full Moon this year will be the Harvest Moon since it is the full moon nearest the equinox.

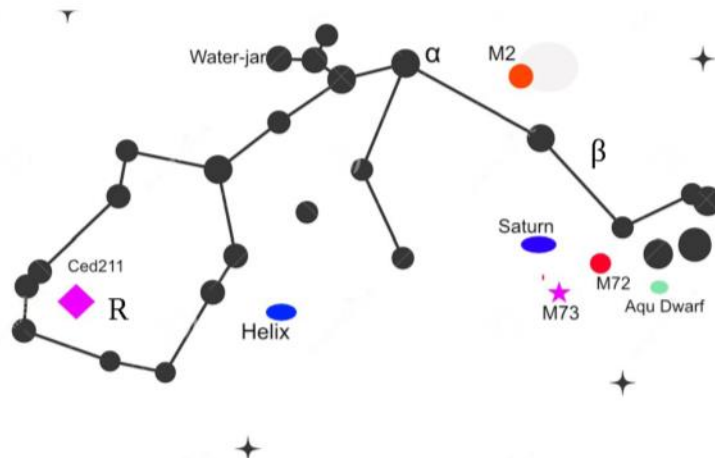
Traditionally the full moon in September is the Corn Moon, while Celtic and Old English names are Wine Moon, Song Moon, and Barley Moon

The Age of Aquarius

The Reverend T. W. Webb, edited by Margaret Mayall, describes Aquarius as “a dull looking-constellation, but well repaying telescopic research”. *Celestial Objects for Common Telescopes Thomas William Webb, 1859* No time like the present to take a look for ourselves.

Beta Aquarii β , is a visual multiple star that was used as test for the early achromatic lenses. The b and c component are 11 and 12 magnitude and under a minute from their 2nd magnitude primary, making it tough to see. Beta has a very old history, its name is Salalsuud, meaning luck of lucks from the Arabic. The Chinese called it and its neighbors the First Star of Emptiness. The Hindus pointed to that area as the mansion of the “Deities of Earthly Abundance” and very far back along the Euphrates, it was called the Star of Mighty Destiny. This earliest name may be what led to the early modern Latin: *Lucida Fortunæ Fortunarum* which translates to *the brightest of luck of lucks*.

(https://en.wikipedia.org/wiki/Beta_Aquarii)



Aquarius contains another famous supergiant star: [Sadalmelik](#), (Alpha Aquarii α), and a number of notable deep sky objects: the globular clusters [Messier 2](#) and [Messier 72](#), the asterism [Messier 73](#), and the Aquarius Dwarf Galaxy,

The Aquarius Dwarf is 14th magnitude and very diffuse. It can be found only six minutes of arc east of M72 and a half a degree south. Its notable because in this era of an expanding universe, the Aquarius

dwarf has a blue shift and is coming our way. Thank you to the *Hubble Space telescope for this image*: https://en.wikipedia.org/wiki/Aquarius_Dwarf

In the eastern region of Aquarius is Variable star R Aquarii. R is a red giant that changes brightness between 5th and 12 magnitude, a cycle that takes over a year. R also has a companion. A white dwarf whose shared orbit is about 44 years, but its a ghost, it can't be seen.

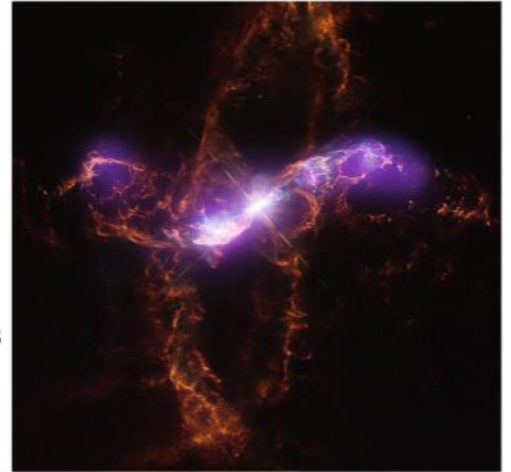
Sven Cederblad was a **Swedish astronomer** who published his catalogue of "bright diffuse galactic nebulae" as a thesis in 1936. He listed two hundred and fifteen nebula in his catalog. R is surrounded by Cederblad 211. Ced 211 is an emission nebula probably caused by a nova explosion from the dwarf that we think was recorded by the Japanese in 903AD.

Image Credit: X-ray: NASA/CXC/SAO; Optical: NASA/STScI, Palomar Observatory, DSS; Radio: NSF/NRAO/VLA; H-Alpha: LCO/IMACS/MMTF

The history and mythology around Aquarius goes back thousands of years to the civilizations that grew up around the Euphrates and the Nile. The Babylonians had a god who was depicted holding a vase.

The Egyptians imagined Aquarius pouring water from his jar flooding the Nile in the Spring. Rain meant life, the rivers flooding brought new soil and new life to the fields.

Flooding and its relationship to new life are found in history back through the eras of Gilgamesh, Nimrod, through early Egypt and the Pharaohs, into Greece and in our Judaeo-Christian writings.



Our most recent tie to Aquarius goes back only a few thousand years to the Greeks.

Aquarius portrays Ganymede, a young man stolen by Zeus and taken to Mt. Olympus to serve as his cup-bearer, ie: slave. Zeus he did this by changing himself into an Eagle, represented by Aquila. The day came when Ganymede had enough and stole all his wine and water and poured it out, flooding the earth and giving the world rain.

The Abduction of Ganymede (c. 1650), by Eustache Le Sueur ([Ganymede \(mythology\) - Wikipedia](#))



The other image is from a rare globe made by Vincenzo Coronelli in the late 1600's. The title is *Globe Céleste de Coronelli* and I copied it from <https://www.wallhapp.com/urano/globe-celeste-de-coronelli-1683>.

We talked about Ced 211 and the Dwarf, but another curious case in Aquarius is M73. It makes me wonder about the quality of the seeing in 18th century Paris as well as the quality of the optics Charles Messier commonly used. His main telescope was a 4" doublet but his favorite was a 7.5" Gregorian. Long focal lengths were common in that era to mitigate the realities of silver coatings, metal mirrors and less than ideal figuring by pin hole and gas light. Messier's original description of M73 was a star cluster surrounded by nebulosity. In later observations using his much larger telescope, Herschel did not find any nebulosity nor a cluster to identify. New measurements have found that the stars of M73 have differing proper motions and distances from us and are not cojoined, leaving M73 as a fairly famous asterism.

Both M73 and M72 are 9th magnitude but you will find that M72 is a nice class IX globular.

Closer to the center of Aquarius is NGC 7009, Caldwell 55 and nicknamed the Saturn Nebula. Its an 8th magnitude planetary with ansae. ESO has a terrific image as does APOD who closed out 1997 with a wonderful show of planetaries. N7009 was Dec. 30.

Saturn, M72 & M73 and the dwarf are grouped together, sorta, near the hand of Aquarius: Epsilon ϵ and Mu μ . Further up, north of Beta β you will find M2, third magnitude and class III, a big, bright, really nice globular and a helpful finder to the three stars that make up the Waterjar: Pi π , Zeta ζ , and Gamma γ . Alpha α , marks the right shoulder of Aquarius, as noted it is named Sadalmelik. Alpha α lies between the Water Jar and M2.

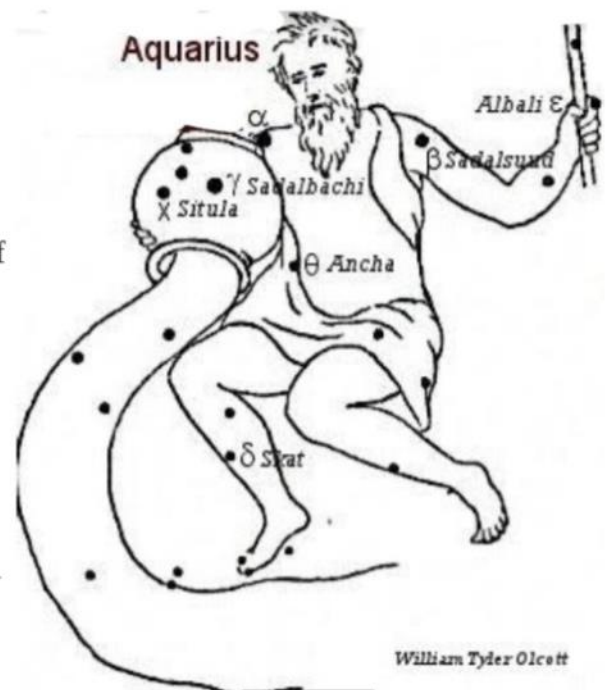
On the other side of Aquarius, are a couple of objects worthy of your time. Firstly is the Helix Nebula, NGC7293, Caldwell 63. Similar in size and appearance to the Ring. It is bright at 7th magnitude and has a lot of structure.

Over by Ced 211 is a peculiar 11th magnitude galaxy, NGC 7727. About 3 degrees north of Ced 211, N7727 has two nuclei, both of them black holes. Burnham gives its size as 2.7'x2.7', considerably smaller than the Internets 4.7'x3.5'. It would be interesting to see which matches up visually.

[Star lore of all ages; a collection of myths, legends, and facts ...](#)

By William Tyler Olcott 1911

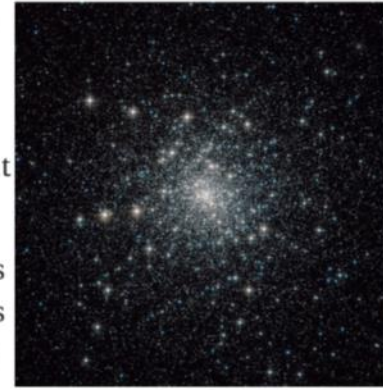
The story of Capricornus goes back over 3000 years to the Sumerians, the Babylonians, the Greeks, Romans and to Ptolemy in the 2nd century. The oldest records depict it as a "goat-fish". It was a very important constellation since it marked the winter solstice, the first day of winter. The Greeks kept the goat theme alive connecting Pan, their pipes playing horned god with the goat legs with Capricornus. He got his fish tail escaping Typhon, a winged and snake footed monster by hiding in the Nile river.



Capricornus has a couple of deep sky objects to check out. M30 is a 7th magnitude Class V globular cluster with a dense, collapsed core

https://www.wikiwand.com/en/Messier_30

and NGC 6907 is an 11th magnitude spiral galaxy with two prominent arms giving it a pronounced “S” shape.



- ★ The brightest star in Capricornus is Delta Capricorni. Delta’s δ name is Deneb Algedi, meaning Tail of the Goat. On the other side of Capricornus is Beta β , named Dabih, the Butcher. Then we have Alpha α , near Dabih named Algedi meaning the Goat. Nu ν is one of the last two named stars, Alshat meaning the sheep and Nashira
- ★ Gamma γ , meaning “Bearer of Good News”

There are also a couple multiple star systems of interest. Alpha has two stars not physically related and each star has a companion.

Alpha 2 is variable from 3.5 to 11, something to look for. Beta is also a double with contrasting colors. Per Burnham, Beta 1 is a spectroscopic triple with a 13th magnitude pair (mag. 13 & 13.4) between the two bright stars.

Quoting Webb he reports: “Minute pair between them. Very fine large field. Barnard doubled Beta 2”.

Palomar 12 is a tough globular. Its 12th mag and is pretty big, 17+ minutes of arc. The books say its about 30% younger than most globular clusters in the Milky Way..

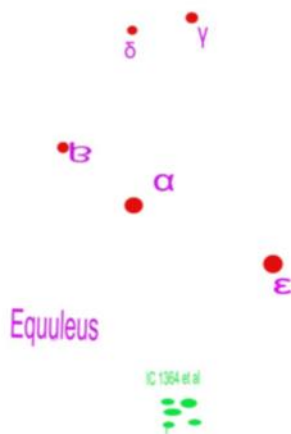
Palomar 12 Hubble.jpg



[18-Bayer-Uranometria-1603.jpg \(1078x800\)](#)

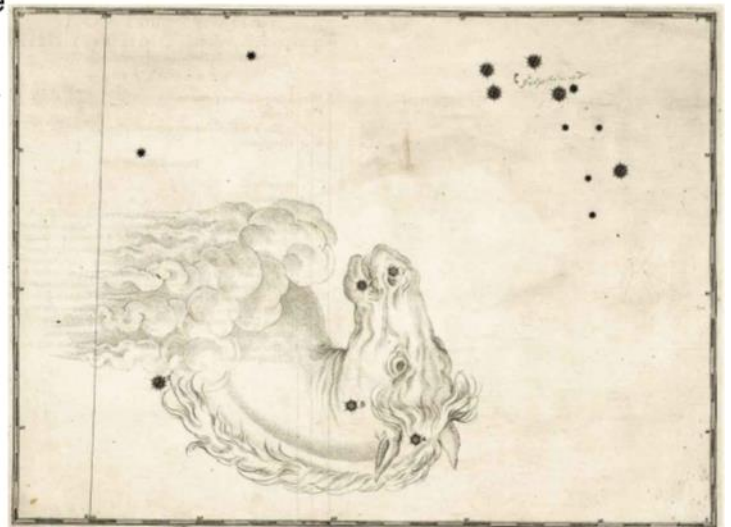
<http://wallhapp.com>

<https://webbdeepsky.com/galaxies/object/IC1365>



Equuleus is the 2nd smallest constellation. It is one of Ptolemy’s original 48 and its origin as a constellation is

steeped in pre-history. Of course the Greeks had something to say about it, the usual seductions and searches. It has no deep sky objects except for galaxies in the 12, 13 and fainter magnitudes. It has a few interesting multiple stars and a nice



globular cluster, M15, right over it border. Look for Epsilon ϵ Equulei, visual about 5th magnitude. It has 4 members ranging from 5.5 to 12.5 magnitudes. You can also try Beta β , a much more difficult triple system with magnitudes of 5-13, and 11. If you check the border between Equuleus and Aquarius you will find a small group of 12, 13 and 14 magnitude galaxies of all types and descriptions.

The Webb society has a great image of IC 1365 and NGC 7046. Its a nice little group. The Polish Wikipedia lists 10 close-in members. I wish you

Dark Skys

Dave Phelps

Meteor Shower

From Cattle Canyon Saddle at midnight,
we wait for a comet tail's frozen fragments,
a dazzle whisper bright under distant stars,
a dive down into our earthly sight
with a spirit's last sighing flash,
gasping in our vast atmosphere.
Wordless light messages from beyond,
flaming out before they reach ground.
For hours we see greenish sprites write
sketches of teasing ghostly floating trails.
Suddenly, this shower grows boundless—
we're wonder struck, hold our breath,
a phantom snowfall down from space.
Is it a birth, a death, or beyond meaning—
this radiant rain of glowing wraiths?
For profound moments we feel
awe at a deep weeping of sky,
until it fades, dies,
leaving our eyes paralyzed
in cosmic surprise.

Lee Collins



This article is distributed by NASA's Night Sky Network (NSN). The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

The Summer Triangle's Hidden Treasures

David Prosper

September skies bring the lovely **Summer Triangle** asterism into prime position after nightfall for observers in the Northern Hemisphere. Its position high in the sky may make it difficult for some to observe its member stars comfortably, since looking straight up while standing can be hard on one's neck! While that isn't much of a problem for those that just want to quickly spot its brightest stars and member constellations, this difficulty can prevent folks from seeing some of the lesser known and dimmer star patterns scattered around its informal borders. The solution? Lie down on the ground with a comfortable blanket or mat, or grab a lawn or gravity chair and sit luxuriously while facing up. You'll quickly spot the major constellations about the Summer Triangle's three corner stars: Lyra with bright star Vega, Cygnus with brilliant star Deneb, and Aquila with its blazing star, Altair. As you get comfortable and your eyes adjust, you'll soon find yourself able to spot a few constellations hidden in plain sight in the region around the Summer Triangle: **Vulpecula the Fox**, **Sagitta the Arrow**, and **Delphinus the Dolphin**! You could call these the Summer Triangle's "hidden treasures" – and they are hidden in plain sight for those that know where to look!

Vulpecula the Fox is located near the middle of the Summer Triangle, and is relatively small, like its namesake. Despite its size, it features the largest planetary nebula in our skies: M27, aka the Dumbbell Nebula! It's visible in binoculars as a fuzzy "star" and when seen through telescopes, its distinctive shape can be observed more readily - especially with larger telescopes. Planetary nebulae, named such because their round fuzzy appearances were initially thought to resemble the disc of a planet by early telescopic observers, form when stars similar to our Sun begin to die. The star will expand into a massive red giant, and its gasses drift off into space, forming a nebula. Eventually the star collapses into a white dwarf – as seen with M27 - and eventually the colorful shell of gasses will dissipate throughout the galaxy, leaving behind a solitary, tiny, dense, white dwarf star. You are getting a peek into our Sun's far-distant future when you observe this object!

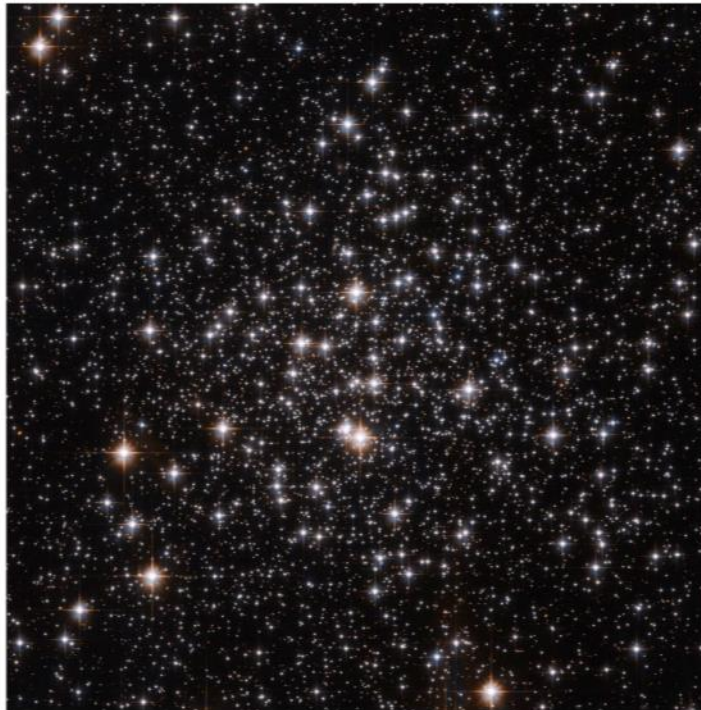
Sagitta the Arrow is even smaller than Vulpecula – it's the third smallest constellation in the sky! Located between the stars of Vulpecula and Aquila the Eagle, Sagitta's stars resemble its namesake arrow. It too contains an interesting deep-sky object: M71, an unusually small and young globular cluster whose lack of a strong central core has long confused and intrigued astronomers. It's visible in binoculars, and a larger telescope will enable you to separate its stars a bit more easily than most globulars; you'll certainly see why it was thought to be an open cluster!

Delicate **Delphinus the Dolphin** appears to dive in and out of the Milky Way near Aquilla and Sagitta! Many stargazers identify Delphinus as a herald of the fainter water constellations, rising in the east after sunset as fall approaches. The starry dolphin appears to leap out of the great celestial ocean, announcing the arrival of more wonderful sights later in the evening.

Want to hunt for more treasures? You'll need a treasure map, and the Night Sky Network's "Trip Around the Triangle" handout is the perfect guide for your quest! Download one before your observing session at bit.ly/TriangleTrip. And of course, while you wait for the Sun to set - or skies to clear - you can always find out more about the objects and science hidden inside these treasures by checking out NASA's latest at nasa.gov.



Search around the Summer Triangle to spot some of its hidden treasures! To improve readability, the lines for the constellations of Aquilla, Lyra, and Cygnus have been removed, but you can find a map which includes them in our previous article, Spot the Stars of the Summer Triangle, from August 2019. These aren't the only wonderful celestial sights found around its borders; since the Milky Way passes through this region, it's littered with many incredible deep-sky objects for those using binoculars or a telescope to scan the heavens. Image created with assistance from Stellarium: stellarium.org



M71 as seen by Hubble. Your own views very likely won't be as sharp or close as this. However, this photo does show the cluster's lack of a bright, concentrated core, which led astronomers until fairly recently to classify this unusual cluster as an "open cluster" rather than as a "globular cluster." Studies in the 1970s proved it to be a globular cluster after all – though an unusually young and small one! Credit ESA/Hubble and NASA. Source: <https://www.nasa.gov/feature/goddard/2017/messier-71>



United States Department of the Interior

NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK
P.O. Box 129
Grand Canyon, AZ 86023



IN REPLY REFER TO:
10.D (GRCA 8211)

July 25, 2022

Astronomy Volunteers
2022 Grand Canyon Star Party
c/o Mr. Jim O'Connor of the
Tucson Amateur Astronomy Association

Dear Grand Canyon Star Party Volunteer Astronomers,

On behalf of the National Park Service and Grand Canyon National Park, thank you all for making the 32nd annual Grand Canyon Star Party a huge success! After a two-year hiatus, we returned onsite to both the South and North Rims, celebrating eight nights of the most pristine night skies in the United States. Well over one hundred volunteer astronomers from across the country participated this year, sharing their passion, expertise, and equipment, with thousands of visitors from around the world. The number of positive comments rangers received at our visitor centers about your outreach efforts was staggering. I personally attended several nights of the event and couldn't have been more impressed with your knowledge and commitment to outreach. I understand why this event is often called the best star party in the National Park Service—you are some of the most dedicated educators with which I've had the privilege of working.

This year's event not only enjoyed our pre-pandemic visitation numbers, but skyrocketed above many outreach records of previous years. For example, in 2019, the highest attendance for one of the twilight talks was 700 visitors. This year, every night hosted between 700 and 850 visitors. Based on our statistics, well over 1,000 visitors from across the globe enjoyed the telescope lots each night, giving us an estimated attendance of over 9,200 visitors. Over 1,300 visitors attended our nightly constellation programs. Clearly, visitors were enthralled to experience Grand Canyon's night skies through your educational offerings—I hope you found providing these life-changing experiences for our visitors equally fulfilling.

I would like to thank the Tucson Amateur Astronomy Association for coordinating the South Rim portion of the event, and the Saguaro Astronomy Club for coordinating the North Rim. I especially thank the Grand Canyon Star Party Committee, Mae Smith, Jim Knoll, and Jim O'Connor, for registering volunteer astronomers from across the country, for organizing and monitoring the campgrounds, and for working throughout the year with our Dark Skies Coordinator Rader Lane on the logistics of the event. The several months of planning by the

Committee to execute this event was evident across all aspects, it was matched only by the professionalism and passion from each of you in the telescope field.

Grand Canyon National Park was certified an International Dark-Sky Park in 2019. That same year, thanks to events like the Grand Canyon Star Party, the International Dark-Sky Association awarded us International Dark-Sky Place of the Year. This year's event reaffirmed our place as one of the largest, most complex, and most revered International Dark-Sky Parks in the world. I had a tremendous experience at this year's event, from the twilight talks to the telescopes. I thank you as someone endlessly curious about the wonders of our natural universe. As superintendent, my commitments to you are to protect this cherished resource from the threats of light pollution, to support the continuation and growth of the Grand Canyon Star Party, and to work with you to make Grand Canyon National Park the best place on the planet to experience night skies. For as the sun sets, the profundities of deep time pass from the stones to the stars, and we realize that half the park is after dark.

Mark your calendars for Grand Canyon Star Party 2023, June 10-17. I know I have!

I hope to see you next year,



Edward T. Keable
Superintendent
Grand Canyon National Park
P. O. Box 129
Grand Canyon, AZ 86023



United States Department of the Interior
NATIONAL PARK SERVICE
Grand Canyon National Park
P.O. Box 129
Grand Canyon, Arizona 86023



August 1, 2022

Dear Grand Canyon Star Party (South Rim) 2022 Participants:

THANK YOU ALL for making the 32nd annual Grand Canyon Star Party a HUGE success!

A lot of estimation and extrapolation go into both reporting and compiling Star Party stats. This year, we took three nights of manual-visitor-counts (standing at the entrance with a clicker and counting visitors entering the lots) and averaged those numbers over the event. Thanks to all of you who took diligent stats this year we can all reliably assess where we stand. About **86%** of us turned in stats this year. This is 1% higher than 2019! The rest of the stats were assumed based on average contacts. Here is the final tally:

- Astronomer to visitor contacts (that is, eyeballs to eyepieces): **51,816** (2019: 81,095)
- Nighttime contacts: **46,705** (2019:76,258)
- Daytime contacts: **5,111** (2019: 4,837)
- Total nighttime attendance: **9,264** (2019: 12,544)
- Average nightly attendance: **1,158** (2019:1,568)
- Estimated total daytime attendance: **3,870** (2019: 3,870)
- **122** astronomy volunteers contributed **2,652** hours
- Theater Presentation Attendance: **5,390** (2019: 4,370)
- **1,360** visitors attended one of the three nightly Constellation Tours. **65**/tour average.
- Average of **50** telescopes were set up each of the 8 nights, including at least **7** videoscopes (2019: 15) each night for full accessibility to those in wheelchairs or otherwise eyepiece-challenged.

Special thanks to **those who set up by day AND night: 257** hours were logged by day at various locations. Keep it up!

The lower numbers this year as compared to 2019 can be attributed to three things: 1) COVID concerns. 2) Huge media push in 2019 for Dark Sky certification. 3) Lower overall park visitation in 2022. However, proportionate to the lowered visitation, we actually maintained higher ratios with our visitor contacts than in previous years!

Successes from this year:

- The big success this year logistically was hosting the Evening Programs in the Grand Canyon Visitor Center Plaza. The last many years we had trouble accommodating the hundreds of people who were denied access to the theater presentation because of the 233-person limit (fire code). In 2019, we were able to simultaneously project the

PowerPoint presentation and the speaker voice to the outside using a stretch screen and HDMI splitter. So our theater attendance skyrocketed from 1,840 (2018) to 4,370 that year. This year, we hosted the presentations completely outside and boosted our outreach even more. In 2019, we averaged 550 people per night. This year, our *lowest* number was 710 (highest 850). We increased our outreach by over 1,000 visitors, and that is only over 7 nights (1 night was cancelled for rain). If we take the average and apply that to the cancelled night, we would have increased outreach by around 1,750 visitors.

- Grand Canyon Conservancy (GCC) overlapped Star Party with its donor event Grand Gathering. I gave a talk for them the night before Star Party in the Shrine Auditorium. Many of the donors were able to attend the first few nights of the event. They were all ecstatic about Star Party!
- Lowell Observatory contributed daytime outreach activities in front of the visitor center on June 18th. They provided solar scopes and handed out stickers/magnets/kids activities. We hope to increase our partnership with Lowell in future years.
- The Outreach Team for the James Webb Space Telescope from NASA Goddard Space Flight Center contributed daytime outreach activities in front of the visitor center on June 18th, 19th, and 20th. Among many activities, they chalked out a to-scale drawing of the JWST mirror on the cement and then compared that to a to-scale chalk drawing of the Hubble mirror. It was incredibly popular with visitors and a striking display!
- The event received coverage from [USA Today](#), which was reprinted by dozens of regional papers across North America. We also did a mixture of live and recorded interviews with several local outlets.
- The Tucson Amateur Astronomy Association designated four to five "Star Guides" every night--a new position that helped park rangers with visitor orientation and logistics. This proved to be highly successful! Thank you, [Susan Knoll](#) and team!
- We did not do Night Sky Photography Workshops this year (2019 saw 360 attendees over 5 nights of workshops) due to the complexity of getting the event running again after a two-year hiatus.
- GCC purchased a catered lunch as a show of appreciation on the last day of Star Party. We celebrated at Mather Campground. We hope to make this a regular contribution in following years.
- We had a Dark Sky String Quartet play night-sky themed classical music at our event. How cool is that?
- Superintendent Ed Keable personally attended 3 nights!

A HUGE THANK YOU to the TAAA [Grand Canyon Star Party Committee](#) for all the work you did to make this event so successful. The Committee works diligently throughout the year to plan the logistics of this event, and it showed! Thank you, [Jim Knoll](#), [Mae Smith](#), and [Jim O'Connor](#).

A big thanks to our very own [Mae Smith](#) who supported the event by running campground operations (among countless other tasks). Thanks to everyone who organized social events ([Marylin Unruh](#), [Mae Smith](#), [Susan & Jim O'Connor](#), [Susan and Jim Knoll](#), [George Barber](#), and for treating us to pizza (TAAA).

It was MY honor this year to present [Jim O'Connor](#) with the **Dark Ranger Award**. Jim, I hope it represents everyone's appreciation for your skills as an educator. A good part of our awe for the night skies is informed by and dependent upon cultural understandings. You

deeply understand this. Your ability to infuse the science with cultural understandings really does reach people--you bring the universe down to people and place it in their hearts, and you have been doing that tirelessly for decades. You connect people intellectually AND emotionally to the night skies. You make people feel welcomed, included, and, wherever they are from, inspired by their cultural connections to the skies. There is nobody else I can think of outside of the National Park Service who deserves the title of Dark Ranger than you, and I hope you continue to inspire people for many years to come!

Thanks to ALL of you for traveling so far to share your time, telescopes and knowledge so patiently and enthusiastically with so many park visitors from around the globe. Your efforts were well spent in touching lives and making new converts to amateur astronomy, science, and the preservation of dark night skies.

Some closing thoughts: In no place on nocturnal Earth as at the Grand Canyon can you stand between so much deep time revealed beneath you in stone and above you in star. If there is any place on the planet where people become so emotionally, intellectually, and spiritually inspired by the awesome power of the universe so as to redirect their lives for the betterment of our natural and cultural worlds it is at Grand Canyon during Grand Canyon Star Party. Think about that. We are changing lives with this event. As testament to this, I'll leave you with one of many visitor comments we received:

"Hi Rader! My name is Leesa and my family enjoyed the dark sky telescope experience at the Grand Canyon last night. It was beyond words for us...I have 3 boys, 14, 13, and 11 and we were traveling with another family with two more boys, age 14 and 11. We stayed until midnight and spoke to so many of the pros and amateurs (but so knowledgeable!) who were so happy to share their passion. What a gift, what a treasure of a program! An inspiration for the young. We are so grateful! At Trailer Village this morning I spoke to one of the astronomers staying near us. I wanted to know how to say thank you -- we will never forget and we will take up the dark skies cause. Thank you, and please thank the many astronomers who came out to be a part of such a cool event! BRAVO!"

Mark your calendars for **June 10-17, 2023** – the **33rd Annual Grand Canyon Star Party!**

See you down trail,

Rader Lane
