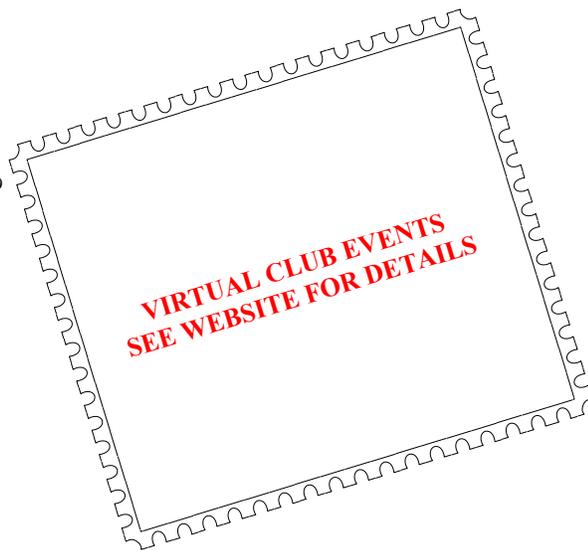




Newsletter of the Pomona Valley Amateur Astronomers

I met in the street a very poor young man who was in love.
 His hat was old, his coat worn, his cloak was out at the
 elbows, the water passed through his shoes, -
 and the stars through his soul.
 Victor Hugo



Volume 42 Number 7

nightwatch

July 2022

MEMORIAL FOR LEE COLLINS

Many of you may have already heard of Lee Collins' passing on December 14, 2021. Lee will be profoundly missed, as he touched so many of our lives with his kind nature, intellect and wit.

Please join us as we gather to remember Lee, and share stories, poetry, and song.

Date: Sunday, July 24, 2022

NOTE CHANGE OF TIME

Time: 3:00 p.m.

Location: Unitarian Universalist Church
 9195 Monte Vista Avenue
 Montclair, CA 91763

An early dinner will be served following the memorial.

Please contact Claire at pvaanightwatch@gmail.com if you'd like to contact the Memorial organizer or let her know you'll be attending so I can connect you.

Club Events Calendar

July 15	General Meeting Chris Burns "Hubble's Troublesome Constant"
July 30	Star Party – GMARS
Aug 3	Board Meeting
Aug 12	General Meeting (presentation: TBD)
Aug 27	Star Party – TBD
Aug 31	Board Meeting
Sep 3	Star Party in the Park
Sep 9	General Meeting (presentation: TBD)
Sep 24	Star Party – GMARS
Sept 28	Board Meeting

Oct 7	General Meeting (presentation: TBD)
Oct 22	Star Party – TBD
Oct 26	Board Meeting
Nov 4	General Meeting (presentation: TBD)
Nov 19	Star Party – TBD
Nov 26	Star Party in the Park
Nov 30	Board Meeting
Dec 3	Christmas Party

Grand Canyon Star Party 2022

Much to the delight of all who put it on and those who attended, the GCSP was an enthusiastically back in person event this year – with between 700 and 900 in attendance during all but one of the 8 nights of the Star Party, which ran from June 18-25, 2022. An astronomical slide show and lecture was held outside the South Rim Visitor’s Center each night at 8 PM, followed by viewing in the parking lots behind the Center from 9-11 PM. Your Club was well represented among those putting on the event as Ludd and Robin Trozpek, Bob Akers, and I joined friends met during our attendance in 2018 and 2019 along with some folks new to the Star Party this year. The GCSP as it happens now has been held for 32 years and is organized by the Tucson Amateur Astronomy Association (or T-Triple A for short). In 1991, during the first anniversary of a member’s honeymoon at the Canyon, it was noticed that a telescope set up during the day or at night soon gathered a crowd, so a public event was planned. The TAAA now works with the National Park Service and their Rangers and turned that experience into the well-publicized and attended event that it is today. Amateurs from around the country and sometimes the world bring their scopes to share with the public during the week around the new moon in June. This year saw between 30 and 60 scopes, binoculars, and image processing laptops during the evening (along with a few solar observers during the day), sharing the night sky with people from around the world. My informal survey showed we spoke to people from at least 20 countries: Germany, Indonesia, Italy, Mexico, Australia, France, Singapore, Scotland, Netherlands, Sweden, Korea, Spain, Thailand, Brazil, Norway, Belgium, Argentina, Switzerland, Canada, and Russia.

The rest of the story of PVAA at the Grand Canyon is told in photos.

Claire Stover





Here is what astronomers get up to during the day.

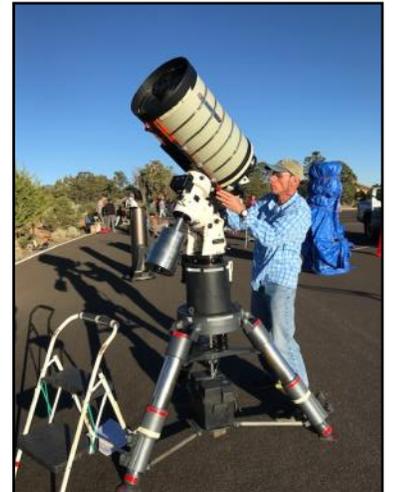
You'll see that everything and everyone needs to recharge so they are ready for the next time they are called into service.

Ludd sets up his binoculars, Mike Magras his 14" Celestron Edge.

Robin is an officially outfitted Star Guide. Her job is to welcome the public to the event, pass out the wonderful and informative GCSP Sky Guide prepared by Ludd, and to be totally visible to everyone both during the day and after dark. What you don't see in this shot is the red light collar that glowed around her neck after dark—Saturn's ring I like to call it. Over 1000 of the guides were distributed during the evening lecture, on shuttle busses, and on the scope field—a great souvenir from the GCSP.

The bottom panorama is the Popsicle Party, held each night for us to meet the evening's presenter and to update astronomers about the night's activities. And there were ice pops for all!

Image Credit: Claire Stover, Mike Magras, and Robin Trozpek





Left—California Condor V9 is a female born 4/3/17 in Portland and released 10/23/18

Right—Condor E3 is a male hatched 5/24/06 in LA that was parent raised and released 10/8/07

Image Credit: Bruce Collins



Extraordinary efforts can be taken to get the perfect photo. I title this one “Claire risks her life to photograph Ludd risking his life to photograph a Yucca flower.” The other shot, of course, shows what all the fuss is about.



A trip to the canyon isn't complete without seeing the iconic mules, who ferry “lucky” tourists to the bottom of the Canyon and more importantly back up again.

Bob and Claire channel early Native American cliff dwellers.

Image credits: Robin Trozpek, Ludd Trozpek, and Claire Stover



The evening activities were cancelled one night as nearby thunderstorms and frequent lightning strikes were too close to the telescope field.

All was not lost though as a few intrepid astronomers were joined by couple of early rising members of the public to enjoy planet viewing from 1-4am.

We hunkered down in inside tents and in buildings during a 1-2 hour rainstorm during the day. The only casualty was soggy camp chairs set out to day after the rain stopped.

Image credit: Robin Trozpek and Claire Stover



Eating in camp can be a laborious process for the unprepared. Staring up stoves, making sure there is fresh ice in the cooler so food doesn't go bad, remembering all the cooking and eating utensils, finding out where is the cooking oil anyway... Thanks to a nearby market with some ready to eat foods and the stellar cooking skills of Wendy Margas, we ate very well outdoors.

And lest you think we roughed it the whole week, you can see Bruce, Bob, Robin, Ludd, Wendy, Mike, and Claire enjoying some fine dining at Yavapi Tavern and the El Tovar Dining Room





Mike prepares his scope for a night of viewing and as people leave the scope field, they are encouraged to come back net year.



And here is a shot of why we are all at Grand Canyon—stunning views of the night sky!

Image Credit: Ludd Trozpek



PVAA General Meeting June 17th, 2022

After our elections for officers and board members – in which everyone was re-elected – we were treated to a presentation of the Apollo 13 mission by Ken Elchert. Ken is a retired NASA engineer and published book author. Ken is also an active member of the Pomona Valley Amateur Astronomers.

Ken started his presentation going over the Apollo 13's mission patch. The patch did not include the astronauts' names, only the 2nd patch not to have the names of the astronauts. Apollo 11 also did not include the names of the astronauts. Apollo 13 was the first Apollo mission dedicated to science. On the patch it has the Latin words: EX LUNA, SCIENTIA which means '*From the moon, knowledge.*'

The call sign for the Command Module was '*Odyssey*', and the Lunar Module's call sign was '*Aquarius*'. Odyssey was chosen for the book by Homer and the recent movie 2001: A Space Odyssey, based on a short story by Arthur C. Clarke. Mission Commander Jim Lovell like the word and its definition: '*a long voyage with many changes of fortune.*' The call sign for the Lunar Module was '*Aquarius*' – Latin for 'bringer of water' – not the popular song 'The Age of Aquarius' by the 5th Dimension.

The original crew was Commander James Lovell Jr., Command Module Pilot Thomas Mattingly II, and Lunar Module Pilot Fred Haise Jr. But both the Primary and backup crews were exposed to the German Measles. Ken Mattingly never had the measles, so he was at risk of coming down with the measles during the mission. They couldn't swap crews because Lunar Module Pilot Charles Duke of the backup crew never had the measles either. So, they swapped Command Module pilots, and John Swigert became part of the primary crew two days before launch.

The mission objectives were to perform a selenological inspection, survey, and sampling of the Fra Mauro Formation, which was their landing site. They were to deploy the Apollo Lunar Surface Experiments Package (ALSEP); further develop man's capabilities in the lunar environment; and obtain photographs of candidate exploration sites.

Apollo 13 launched at 2:13pm EST on April 11, 1970. During the launch, the center engine of the second stage cut off 2 minutes 12.4 seconds early, requiring the remaining 4 second stage engines to burn longer to make up the thrust loss. After getting into Earth orbit, and checking everything out, they did a trans-lunar injection (TLI) burn to take them to the moon. They then did another burn. After this burn they no longer had a free-return trajectory. Then 54 hours 53 minutes and 53 seconds into the mission oxygen tank #2 exploded during a stir of the tank. The explosion was equivalent to 7 pounds of TNT. This caused then outer skin of panel #4 to be blown off, the spacecraft to rotate wildly, and the RCS thrusters to fire to restore the proper attitude. The spacecraft's velocity changed by .5 ft/sec. The panel that blew off hit the high-gain antenna, which interrupted telemetry for 1.8 seconds. Fuel cell #1 and 3 failed 2.5 minutes after the explosion. Fuel cell #2 keep going for 2 more hours. Various sensors were damaged and gave erroneous readings. The venting of oxygen produced forces that were counteracted by firing the RCS thrusters.

They immediately ruled out that it was instrumentation failure, or an electrical anomaly. They then tried to get fuel cells 1 and 3 back online. Failing that, they disconnected both from the bus. They then connected the CM's entry battery to bus A to aid Fuel Cell 2 in supplying electrical power. 1 hour and 43 minutes after the explosion, it was decided to power up Aquarius. The crew then moved into the LM. Odyssey was powered down with just 15 minutes of life left in the last fuel cell. The next 85 hours saw some of the most impressive improvisational engineering of the 20th century. The Lunar Module normally uses the power from the Service Module to power up, so Aquarius could not be powered up. The large batteries in the LM decent stage were essential to powering up the LM's system. They were connected to the LM's power distribution system via relays. These relays required power from Odyssey that Odyssey could not provide, and the ascent batteries could not power the relays. The LM's ascent stage's batteries were used, but they could only be used for a limited amount time. This had never been done before. It took NASA engineers about 30 minutes to create and transmit the list of instructions that the astronauts had to do to power up Aquarius. It involved between 10 to 15 switch throws and circuit breaker pulls. They were now 205,000 miles (330,000 km) from Earth & 20 hours from the moon.

All non-critical systems were turned off & energy consumption was only 20% of normal. Normally Aquarius pulled between 50 to 75 amps. It was powered down to 12 amps for environmental control, guidance, communication, and water/glycol cooling system. The cabin temperature dropped to 38 degrees in the lunar module and to 34 degrees in the command module. Condensation formed on all the walls. The inertial platform was never designed to handle extreme cold. It wasn't known if it would ever work again. Aquarius was only designed to keep 2 people alive for 45 hours, and now they had to make it last for 87 hours for 3 people.

They had to manually transfer the alignment data from the CM to the LM, and adjust it to be 180 degrees out, as the LM was facing the CM head-to-head. When they tried to check their current alignment using the stars, they found that that a debris field had enveloped the spacecraft from the explosion, and they could not reliably do that. They ended up using the Earth's terminator & the moon.

The Soviet Premier Aleksey Kosygin sent four ships to the planned back-up recovery area in the Indian Ocean. French and British ships were sent to a possible recovery area in the Atlantic Ocean. The American recovery ships were in the Pacific Ocean.

Gene Kranz, the lead flight director created 3 teams. Arnie Aldrich headed the team for creating the master checklist for re-entry procedures. William Peters' team was responsible for making sure Aquarius lasted long enough to get back to Earth. John Aaron's group would be devising how the systems would be powered up, and in what order to get the CM up and running to complete their decent through the atmosphere before the batteries died.

Option 1: Direct abort using the large SPS engine on the Service Module.

- 1) Turn around on front side of the Moon
- 2) SPS engine may have been damaged.
- 3) 133 hours total mission time
- 4) SPS has large electrical power requirements
- 5) Splashdown in the Atlantic Ocean.

Option 2: Direct abort using the LM decent engine (LMDE).

- 1) Turn around on front side of the Moon
- 2) Jettison the SM and burn the LMDE until propellant depletion – no provision for a subsequent midcourse correction
- 3) This would expose the heat shield to cold space for 40 hours.
- 4) This was the quickest option – return to Earth in 2 ½ days (mission time 118 hours)
- 5) Splashdown in mid-Pacific where the US recovery forces were deployed.

Option 3: Go around the moon on a free-return trajectory

- 1) One short burn using the LMDE to get on the free-return trajectory.
- 2) Return to Earth in about 4 days (152-155 hours mission time.)
- 3) This was the longest but simplest option.
- 4) Very little margin – critical consumables might be exhausted before reaching Earth.
- 5) Splashdown in the Indian Ocean.

Options 4 & 5: Go around the Moon on a free-return trajectory and perform a TEI burn

- 1) This called for 2 burns: return to free-return trajectory and the Trans Earth Injection

Option 4 uses the SPS engine for the TEI, which may be damaged

Option 5 The LMDE was not expected to be fired more than once, and the risk was unknown. It was never designed to be used for a TEI.

- 1) Return to Earth in 3 ½ days (Total mission time of 142 hrs. 40 min)
- 2) Splashdown in the Pacific Ocean where the primary recovery forces were deployed.

They went with option 5 with the LMDE doing the work of two burns.

They were actually lucky that the explosion didn't happen after the LM had departed for the Moon's surface.

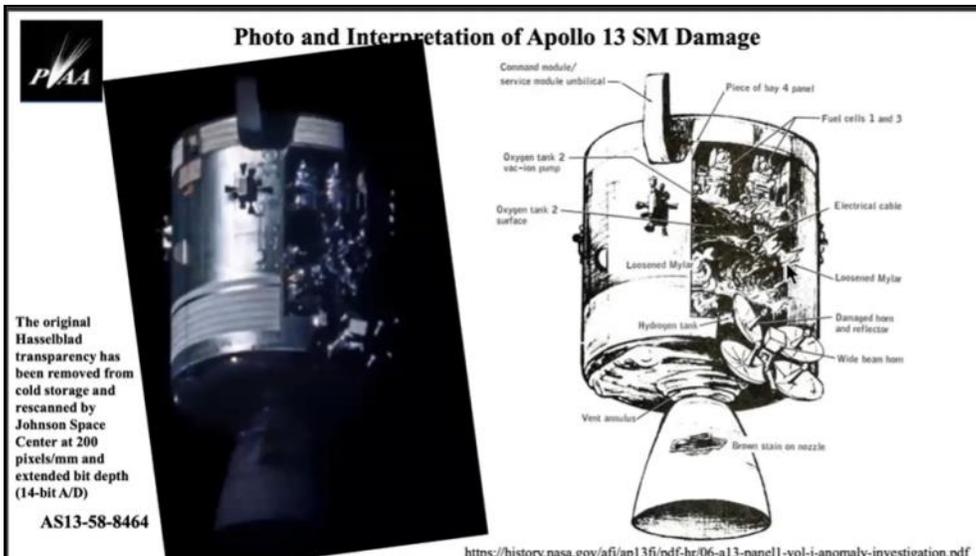
Another problem was that the LM's Lithium Hydroxide canisters used to remove the CO₂ were saturated. The LM used round canisters while the CM used square ones. The NASA engineers needed to figure out how to make the square canisters fit in the round fittings.

Another thing that had to be done was for IBM to write a program to calculate how long the LM's engine would need to burn to get them back on the Free-return trajectory. They did with more than an hour to spare. This trajectory also took them further away from Earth than anyone else. This record still stands. (As of 7/12/22) They were 248,655 miles or 400,171 km above the Earth's surface.

After the TEI burn, they shut down the LM navigation system because it used a lot of power. Now they were going to coast the rest of the way with only manual correction burns to go. Jim Lovell used the Earth's terminator lined up with the Landing Point Designator markings on the LM window to control the yaw. Fred Haise placed the Sun in the upper portion of the Alignment Optical Telescope and controlled the pitch. Jack Swigert used his OMEGA Speedmaster Professional watch to time the burn. The burn lasted for 14 seconds. This changed the velocity by 7.8 ft/sec. It steepened the flight path angle to 6.52 degrees. They had to do another correction burn using the LM RCS thrusters because a water leak was pushing them off course.

The blackout on re-entry lasted one minute and 27 seconds longer than usual and splashed down only one mile away from the target. The crew lost 31.5 lbs. in weight, and Ken Mattingly never got the measles.

Gary Thompson



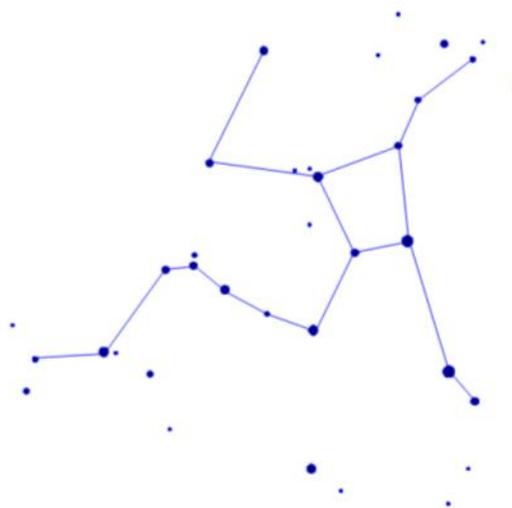
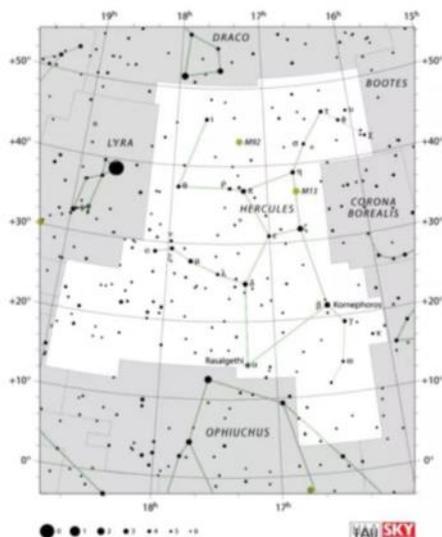
Another Look July, 2022

Buck Moon - Some refer to this moon as the Thunder moon, due to the summer storms in this month. Other names include the Hay moon, after the July hay harvest.

New Moon – July 28, 0955 PDT;

Full Moon – July 13, 1038 PDT

Some Native American tribes call it Salmon Moon and Raspberry Moon. In Celtic, this Moon was known as the Claiming Moon, Wyrth Moon, Herb Moon, and Mead Moon.



I once searched for Abell 2151, the Hercules Cluster. It is way off in a corner of Hercules almost in Serpens Caput. I remember it well. It was one of those objects that I could move the Horse to, look through the Telrad and have it in the eyepiece. I nicknamed it the String of Pearls because NGC 6040 and NGC 6041 formed a curving line with NGC 6039 and other fainter galaxies. I was mesmerized. I remember counting nearly a dozen galaxies around NGC's 6040-41 and I have read that there are over 200 galaxies in the field. Uranometria shows around 20 galaxies visible to any telescope that can reach 4th and 15th magnitude, more to add to the bucket list. The Cluster is part of the larger Hercules Super-cluster and the even bigger Hercules-Corona Great Wall, none of which I have ever studied. Maybe that's a good thing. It seems the experts are disputing whether the H-C Great Wall belongs with the other recognized GW's, though; at least one reference describes it as the largest structure in the universe. ***Hercules Constellation: Stars, Myth, Facts, Location... Constellation Guide (constellation-guide.com)***

Not too far away from Abell 2151 is the Turtle Nebula, NGC 6210, an amorphous planetary a little brighter than 9th magnitude and not too far from Beta β Herculis. Beta's name is Kornephoros and is at the shoulder of Hercules and down from the keystone. Kornephoros is the brightest star in Hercules, a few tenths brighter than Rasalgethi, Alpha α Herculi and a decent triple star system that is tough to resolve.

M92, NGC 6341 and M13, NGC 6205 are closely matched cousins, though M13 gets all the print. They differ in magnitude by only a half, 6.3 and 5.8 and are almost the same classification, IV vs V. M92 is in the upper regions of the constellation between Hercules' legs, you will see a very sharp nucleus, while, well, you know how to find M13. Point your finder a third of the way down the right side of the keystone and there is the best globular in the north.

Up closer to the top of Hercules, actually his feet, is NGC 6229 a 9th magnitude globular that is apparently quite old and quite rich in metals. Its density class is not listed though its metallicity bimodality is designated as GC(v)B in the galaxy morphological classification. Not something I am competent to discuss. If you know, send an email to the editor or the chain and let us all know.

Very close to M92, about a degree north-east is a small group of 14th magnitude galaxies, the NGC 6329 group. I remember seeing four galaxies with not much detail. If you have a big enough mirror and an eyepiece that gives you a degree field of view, you can add them to your life list.

The figure of Hercules as a kneeling man goes back thousands of years. The Babylonians associated the asterism with their own legendary heroes, Gilgamesh, Nimrod and their sun-god Isdubar. Phoenicians identified it as the sea-god Melkarth and the Greeks from as early as 450 BC minted coins representing their demi-god Heraklee. Alexander the Great believed he was a direct descendant. In fact it is written that old Alex seemed to think he was his reincarnation. Funnily enough, though Hercules is the offspring of Zeus and the mortal Alceme, his name translates roughly as “glory of Hera”. Bet that ticked her off.

The famous keystone of Hercules is one of the most recognizable in the spring, summer and autumn skies and usually one of the first things I look for along with Lyra and Cygnus. Hercules has dozens of variable, double and multiple stars and star systems. One of the finest is Alpha α , a large orange giant with a companion of “emerald green”. (*Mary Proctor, “Evenings with the Stars”*) “Evenings with the stars”,; Proctor, Mary: Amazon.com: Books

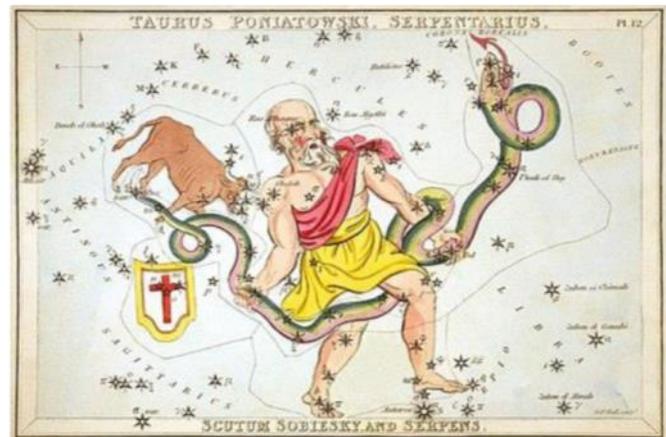
Alpha is an interesting star. As its magnitude varies from 3rd magnitude to 4th magnitude, it pulsates, ie: its size varies also. For now, imagine it from the center of the solar system to the orbit of mars, but even more, it has an envelope that extends almost 1000 AU. Alpha’s temperature averages 2500 degrees Kelvin. Its density must be about the same as a hard vacuum. I wonder how far we could travel inside that star in our 100th generation starliner. (Do you remember a “Mote in God’s Eye”?) https://en.wikipedia.org/wiki/Ramus_Pomifer#/media/File:Bode_cerberus.jpg



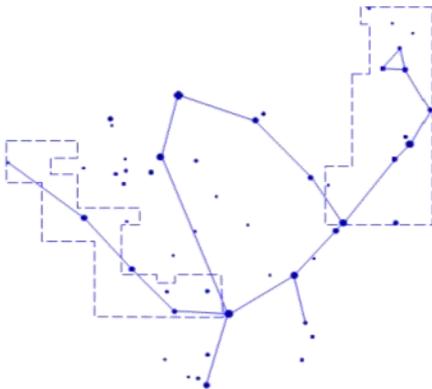
became combined with it in later depictions, with the name “Cerberus et Ramus”.

Serpens Serpens held by Ophiuchus, as depicted in Urania’s Mirror, a set of constellation cards published in London c. 1825. Above the tail of the serpent is the now-obsolete constellation Taurus Poniatovii while below it is Scutum <https://en.wikipedia.org/wiki/Serpen>

Ramus Pomifer, the latin for apple branch was a constellation between Hercules and Lyra. It was depicted in the form of a branch held in Hercules’ left hand. The also obsolete constellation of Cerberus made up of much the same stars -



Ophiuchus is the odd shaped hexagon south of Hercules that holds some of the more interesting objects in the sky along with his brother constellations Serpens Cauda and Serpens Caput. The area has represented snakes or serpents or even maybe dragons since Babylonian time. The Greeks, though, put a pin in it. Generally Ophiuchus represents Aesculapius, (many variable spellings), mythologically a son of Apollo who learned how to bring back someone from the dead. Serpens is the snake that showed Aesculapius how to do it by bringing another snake to life by dropping herbs on it. The story I remember from my Bullfinch’s is that Aesculapius was raised by the Centaur Chiron, for whom, apparently we have the constellation of the centaur. It was Chiron who taught him the art of healing. It is said that Zeus killed him with a thunderbolt because he was afraid he would make all men immortal.



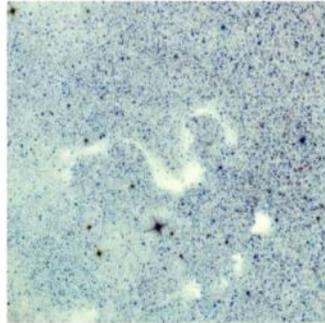
The name of the large constellation Ophiuchus means “serpent-bearer” in Greek. The ancient astronomer Ptolemy included *Ophiuchus* in his list of 48 constellations which he documented in the 2nd (*Constellations except Zodiac, Northern and Southern - Vector stencils library*) century. (It used to be referred to as *Serpentarius*, which is Latin and has the same meaning.) It is one of the 88 modern constellations.

In Greek myth, *Ophiuchus* was said to depict the god Apollo wrestling the snake guarding the Oracle of Delphi. Although the myth changed many times over the years, it was always associated with a man wrestling a serpent.

Serpens has two Messier’s M5 and M16. Ophiuchus has seven Messier’s M9, M10, M12, M14, M19, M62 and M107. A happy hunting ground for you marathoners. *Pipe Nebula (astrosurf.com)*

There are also two Palomar Globulars Pal 15, really tough at 14th magnitude, and Pal 6, possible at 11.5 magnitude. The Palomar Cluster catalog would be a challenge for any experienced amateur with some decent equipment.

They are just difficult to see. I can remember the first time I saw Pal 6, it was small and dim and very exciting. It is located down not too far from the galactic center amid all that munge of star clouds, clusters and dark nebula. As you’re looking south, it is



just below the Pipe Nebula, the biggest(?) dark nebula in the sky and holder of several Barnard numbers, Barnard 59, 65–67, and 78. Just up from the Pipe is my favorite dark nebula, the Snake B72. *By en:user:Friendlystar - English Wikipedia, CC BY 3.0,*

[https://commons.wikimedia.org/w/index.php?curid=4986855;](https://commons.wikimedia.org/w/index.php?curid=4986855)
https://en.wikipedia.org/wiki/Snake_Nebula#/media/File:Snake_Nebula.jpg

If you decide to search for Pal 15, you will need a strong star chart like Uranometria to do the search. You will find it near the center of Ophiuchus, near M10 and M12. I believe I only saw a glimpse of it back then. Hopefully when I can get some telescope time I can search for it again. If you find yourself intrigued, there are two more Palomar’s close – Pal 5 at 12th magnitude and Pal 7 at 11th. Pal 7 is down in the left hand corner by Nu ν where Ophiuchus and S. Cauda meet. Pal 5 is tougher, its up in S. Caput very close to M5. The Palomar cluster catalog can be found at <http://www.deep-sky.co.uk/observing/palglob/palglob.htm>. *Good luck and Good Hunting.*

As you know this region of the sky is among the richest. The Milky Way, nebula, clusters, Barnard’s and constellations abound. So let me return to a suggestion I made months ago: get a decent planisphere and look at the sky. Like some of you, I was also guilty of tunnel vision. Focusing on some faint and fuzzy while staring at my setting circles. If you can’t point out the six stars that make up the body of Ophiuchus and the four stars that make up the head of Serpens Caput, you could use a refresher course on using your eyes.

Lets slip over to the “Cauda” side of Ophiuchus next and find Barnard’s star; it’s only six light years away and has the largest proper motion recorded. It’s a red 9th magnitude star. Its history is sorta cool, E.E. Barnard, a great double star hunter noticed that his star had significant movement when he compared photo-plates twenty-two years apart back in 1916. Since then he (she, shim?) has been immortalized in the literature of Douglas Adams, Arthur C. Clark and others.

You will find Barnard’s star close to Beta Ophiuchi and surrounded by lots of fun stuff. NGC 6572 is a bright planetary nebula of 8th magnitude. Very near is IC 4665 a very open star cluster. Barnard’s star is between IC 4665 and Mel 186. If you thought 4665 was spare wait till you try to identify Mel 186. There is just a ton of stuff in this area, enjoy you star hopping.

Between M16 and Barnard’s star, Aquila, Scutum and Serpens Cauda, is one of the richest square degrees of sky we have, laying there along the edge of the Milky Way. Look in from our solar system in the Perseus arm of our galaxy to the

Sagittarius arm, next arm in. Then slip you telescope down the corner where Serpens meets Scutum, and there you have it... Open Cluster NGC 6611. If you put a nebular filter in your eyepiece you will pick up IC 4703, a strong star forming region. Burnham call this object the “Star Queen” nebula because he imagined a throne in the dark notch at the center of IC 4703. He had the virtue of using some big professional instruments in his career as well as access to Mt. Wilson and Palomar plates. Then came the Hubble. You won’t see the pillars, they are the back of the Queen’s throne, but you can imagine and it would be pretty awesome to see what one of these new hybrid instruments could do. I’ve inserted an image that should give you an idea of what to look for in https://www.cloudynights.com/uploads/monthly_06_2018/post-276706-0-67698400-1530396168.jpg sw your backyard telescope. The Horse did a great job especially with a nebular filter but nothing like we see you astrophotographers doing today. I recommend that you go to the OCA web site and look at this image. It is very well done though not attributed. Emission nebula M16 (Eagle Nebula) in Serpens. - Orange County Astronomers (ocastronomers.org) While in the region, there is Barnard Dark Nebula galore within just a few degrees of the Eagle. Look for B92 and B93 close at hand, B312, up by the Swan, B103, Lynds 443, B97, B95 and B314 nearer to M11 and up there north of Scutum and into Aquila is B111, B119, Lynds 557, 564, 582 and 617.



Dark Skys

Dave Phelps

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 Outreach Jeff Schroeder 909-758-1840
 Programs Ron Hoekwater 909-391-1943

M20 - the Trifid Nebula

The most recent new moon was Tuesday, June 28, meaning there was a two-weekend opportunity for imaging at the dark site. We were on vacation for the first weekend, but since the July 4th weekend was the second dark weekend, we got an extra day of imaging – so three days over a long weekend vs four days over two weekends – that’s almost an even trade. The nights of July 1, 2, and 3 were great for imaging, cool and clear with practically no wind.

I had two targets for the weekend, but both seemed pretty faint. Then I realized that I didn’t have a good image of my favorite nebula, M20, the Trifid Nebula. My previous attempts were either poorly focused, poorly guided, or shot through high clouds. I first saw an image of it on the cover of my college astronomy textbook and immediately fell for the color contrast. The pinkish part of the nebula is from hydrogen emission excited by UV radiation from the newly formed, bright stars in center. The blue region is from starlight reflecting off nearby dust, presumably from the same stars. Then there are the dark nebulae that form the three lobes from which the nebula gets its name. (I always think it looks like four lobes, but perhaps when viewed by eye in a telescope only three lobes are seen.) All of this seemingly floats in a sea of dense stars, dark regions relatively free of stars, and clouds of glowing hydrogen. It has everything going for it!

The Trifid Nebula lies in Sagittarius, toward the Milky Way’s galactic center. Discovered in 1764 by Charles Messier, the nebula is about 4,100 light years from Earth. It has a diameter of about 42 light years and spans 28 arcminutes of the sky. Overall, the Nebula shines at magnitude 6.3, just outside the range of being visible to the naked eye. Magnitude 6.5 NGC 6531, dimmer than the Trifid, is the bright, open cluster of stars above and to the left (northeast) of the Trifid. This cluster is also known as M21 and was discovered by Messier, not surprisingly, on the same night as the Trifid. While close to the Trifid Nebula at about 3,900 light years distant, M21 is not associated with it and consists of about 100 stars, all about 6.6 million years old.

This image is an L(HaR)GB image created from 260 2-minute luminance frames, 19 5-minute red frames, 18 5-minute green and blue frames, and 12 5-minute hydrogen-alpha frames for a total

of 14 hours and 15 minutes of data collected over the evenings of July 1-3. Each was calibrated with 21 corresponding dark, flat, and flat dark frames. To create the image, I started with several weighted combinations of red and Ha. I combined each of them with the green and blue frames until I found the combination I liked, 80%

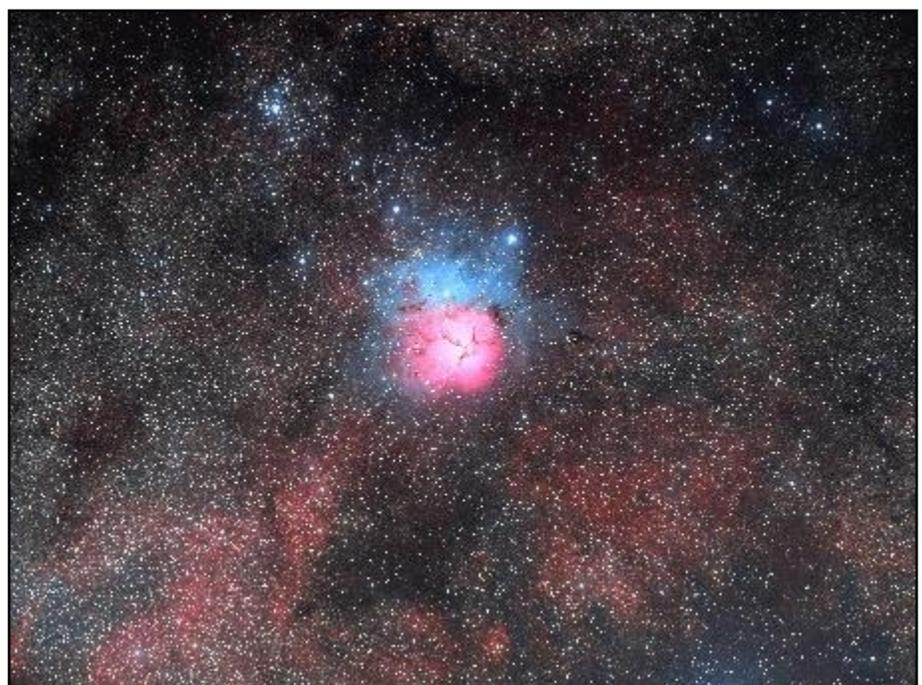
Ha and 20% red. At that point, I removed the stars from the color image and increased the contrast of the image while brightening it. I then cleaned up the noise and added the stars back to create an (HaR)GB image and set it aside for later. I removed the stars from the luminance frame and gave it the same treatment as the color image. After the stars were put back into the luminance image, it was combined with the color image to make the L(HaR)GB version. You might recall that this is done because the fine detail is in the luminance channel. Color saturation was increased and the image was stretched a little more before being transferred to Photoshop. From there, I removed more background noise and sharpened the Trifid Nebula only. At this point, I decided the stars were overwhelming the image, so a couple of iterations of star reduction to reduce the star size resulted in the final version.

For my taste, I like the high contrast between the nebula and the dark sky in the upper part of the image. I hope you like it, too!

Until next month, clear skies!

Ron Ugolick

<https://www.astrobin.com/users/rucdu/>





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Find Hercules and His Mighty Globular Clusters

David Prosper

Hercules is one of the standout heroes of Greek mythology, but his namesake constellation can be surprisingly hard to find - despite being one of the largest star patterns in our night skies! Once you find the stars of Hercules, look deeper; barely hidden in the space around his massive limbs and "Keystone" asterism are two beautiful globular star clusters: M13 and M92!

Since the constellation itself is relatively dim but bordered by brighter constellations, you can find the stars of Hercules by looking between the bright stars Vega and Arcturus. They are fairly easy to identify, and we have tips on how to do so in previous articles. Vega is the brightest star in the constellation Lyra and one of the three stars that make up the Summer Triangle (*June 2020: Summer Triangle Corner: Vega*). Arcturus is the brightest star in the constellation Boötes, and can be found by "arcing to Arcturus" from the handle of the Big Dipper (*May 2021: Virgo's Galactic Harvest*). You may be able to Hercules's "Keystone" asterism first; this distinct pattern of four stars is traditionally shown as the torso of the great hero, though some illustrators prefer marking the Keystone as the head of Hercules. What pattern do *you* see in the stars of Hercules?

Globular star clusters appear "fluffy," round, and dense with stars, similar to a dandelion gone to seed, in contrast to the more scattered and decentralized patterns of open clusters. Open clusters are generally made up of young stars that are gradually spreading apart and found inside our Milky Way galaxy, while globular clusters are ancient clusters of stars that are compact, billions of years old, bound to each other and orbit around our galaxy. Due to their considerable distance, globular clusters are usually only visible in telescopes, but one notable exception is M13, also known as the Great Cluster or Hercules Cluster. During very clear dark nights, skilled observers *may* be able to spot M13 without optical aid along the border of the Keystone, in between the stars Zeta and Eta Herculis - and a bit closer to Eta. Readily visible as a fuzzy "star" in binoculars, in telescopes M13 explodes with stars and can fill up an eyepiece view with its sparkling stars, measuring a little over half the diameter of a full Moon in appearance! When viewed through small telescopes, globular clusters can appear orblike and without discernable member stars, similar in appearance to the fuzzy comae of distant comets. That's why comet hunters Edmund Halley and Charles Messier discovered and then catalogued M13, in 1714 and 1764 respectively, marking this faint fuzzy as a "not-comet" so as to avoid future confusion.

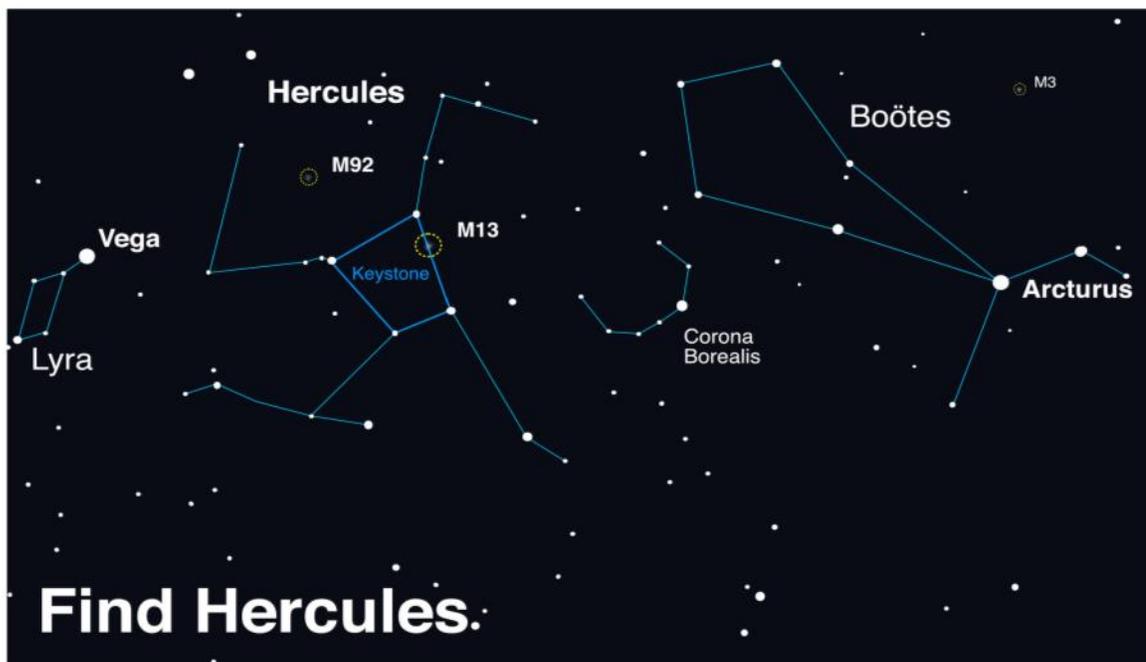
While enjoying your view of M13, don't forget to also look for M92! This is another bright and bold globular cluster, and if M13 wasn't so spectacular, M92 would be known as the top celestial sight in Hercules. M92 also lies on the edge of naked-eye visibility, but again, binoculars and especially a telescope are needed to really make it "pop." Even though M92 and M13 appear fairly close together in the sky, in actuality they are rather far apart: M13's distance is estimated at about 25,000 light years from Earth, and M92's at approximately 27,000 light years distant. Since M13 and M92 appear so close together in our skies and relatively easy to spot, switching between these two clusters in your scope makes for excellent star-hopping practice. Can you observe any differences between these two ancient clusters of stars?

Globular clusters are closely studied by astronomers for hints about the formation of stars and galaxies. The clusters of Hercules have even been studied by NASA's space telescopes to reveal the secrets of their dense cores of hundreds of thousands of stars. Find their latest observations of globular clusters - and the universe - at nasa.gov.



Composite image of the dense starry core of M92 imaged in multiple wavelengths. While your own views of these globular clusters won't be nearly as crisp and detailed, you might be able to count some of its member stars. How far into their dense cores can you count individual stars? Credits: ESA/Hubble & NASA; Acknowledgment: Gilles Chapdelaine.

Source: <https://www.nasa.gov/feature/goddard/2017/messier-92>



Look up after sunset during summer months to find Hercules! Scan between Vega and Arcturus, near the distinct pattern of Corona Borealis. Once you find its stars, use binoculars or a telescope to hunt down the globular clusters M13 and M92. If you enjoy your views of these globular clusters, you're in luck - look for another great globular, M3, in the nearby constellation of Boötes. Image created with assistance from Stellarium: stellarium.org