MONTHLY OBSERVER'S CHALLENGE

Las Vegas Astronomical Society

Compiled by:

Roger Ivester, Boiling Springs, North Carolina

&

Fred Rayworth, Las Vegas, Nevada

With special assistance from:

Rob Lambert, Alabama

OCTOBER 2017

Messier 15 (NGC-7078)

"Sharing Observations and Bringing Amateur Astronomers Together"

Introduction

The purpose of the Observer's Challenge is to encourage the pursuit of visual observing. It's open to everyone that's interested, and if you're able to contribute notes, and/or drawings, we'll be happy to include them in our monthly summary. We also accept digital imaging. Visual astronomy depends on what's seen through the eyepiece. Not only does it satisfy an innate curiosity, but it allows the visual observer to discover the beauty and the wonderment of the night sky. Before photography, all observations depended on what the astronomer saw in the eyepiece, and how they recorded their observations. This was done through notes and drawings, and that's the tradition we're stressing in the Observers Challenge. We're not excluding those with an interest in astrophotography, either. Your images and notes are just as welcome. The hope is that you'll read through these reports and become inspired to take more time at the eyepiece, study each object, and look for those subtle details that you might never have noticed before.

Messier 15 (NGC-7078)

Messier 15, also known as NGC-7078, was discovered by Jean-Dominique Maraldi in 1746. Charles Messier added it to his catalog of non-comets in 1764. It lies about 33.6K light-years from earth and is about twelve billion years old, which makes it one of the oldest known globular clusters. It's approximately 175 light-years in diameter and shines at a relatively easy mag. 6.2, making it visible to the naked eye under ideal sky conditions, similar to its brighter cousin, M13.

It contains over 100,000 stars and modest apertures can resolve individual stars which average in the mag. 12 range to dimmer. Hidden within the edge of the cluster is the very challenging planetary nebula, Pease 1, discovered in 1928. It was the first of only a handful of

planetaries so far discovered within globular clusters. It shines at a very dim mag. 15.5 (depending on the source, 14.9 in some instances) and is a tiny dot that requires high magnification and at least an 8-inch or larger scope to spot. Because it *has* been spotted in as small as 8-inch scopes before, that mag. rating of 15.5 can be taken with a grain of salt. In any case, even with large aperture instruments, it takes a good finder chart and possibly blinking with a filter to pick out the speck amongst the rich background of stars in which it sits at the edge of the cluster. It truly *is* a challenge!

Observations/Drawings/Photos

Glenn Chaple: Observer from Massachusetts

Messier 15, NGC-7078, is a globular cluster in Pegasus that shines at mag. 6.2 and has a diameter of 18'. Pease 1 is a planetary nebula within M15 that shines at mag. 14.9[p], and has a diameter of 1".

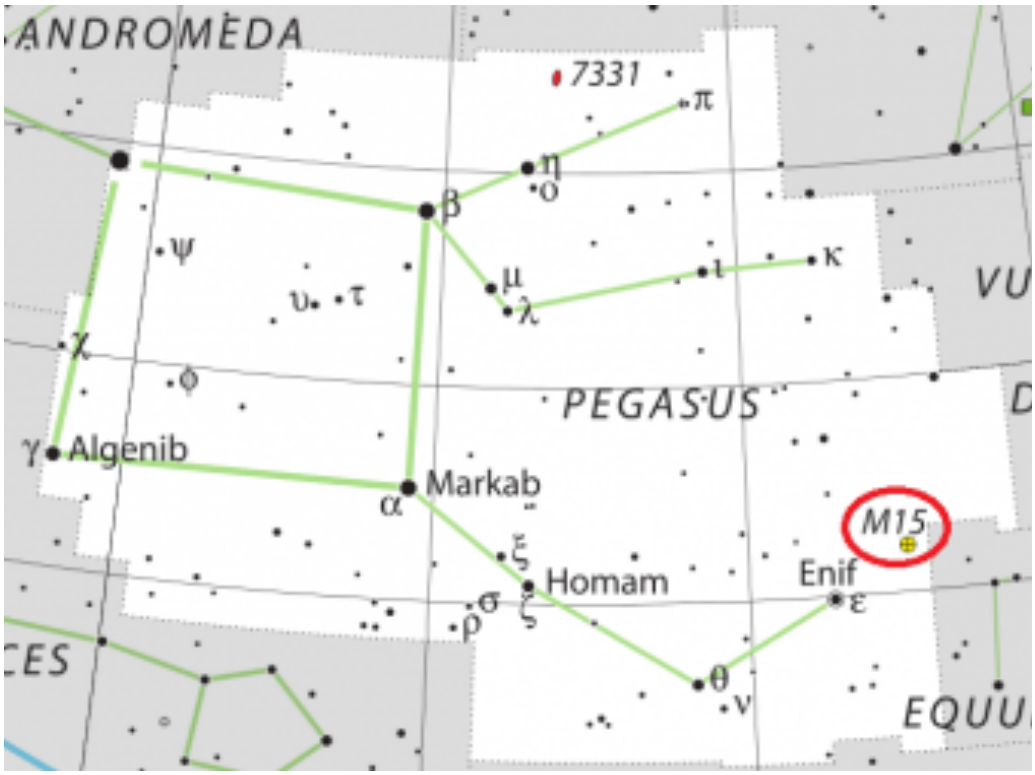
As difficult as last month's LVAS Challenge (NGC-6905) was to locate, this month's target was a breeze to find. It lies 4° NW of the mag. 2 star Enif (epsilon [ε] Pegasi) and, at mag. 6.2, can be glimpsed with the unaided eye from dark-sky locations. It's visible in binoculars as an out-of-focus star and in small-aperture scopes as a small roundish haze.

Telescopes in the 4 to 6-inch aperture range will resolve the outer portions of M15, but even much larger instruments will have difficulty resolving the core. That's because it's quite possibly the densest globular cluster in the Milky Way. Half of its estimated 200,000 stars are concentrated within a 10 light-year radius from the core. The jury is still out on whether this high concentration is due to the gravitational pull of a massive centrally-located black hole or merely the cumulative gravitation of the stars themselves.

If you own a large-aperture scope, try your luck with the embedded planetary nebula Pease 1. In his book *Cosmic Challenge*, author Phil Harrington includes this planetary in a chapter devoted to "monster-scope" challenges. Discovered in 1928, it's one of just four planetary nebulae inhabiting a globular cluster and the "easiest" to capture visually. Those fortunate enough to have notched this mag. 15 object have used scopes typically with apertures of 14-inches and up, although Pease 1 has reportedly been sighted in 8-inch instruments. With a

diameter of just 1 arc-second, Pease 1 mandates near-perfect seeing conditions and a magnifying power in excess of 300X. An accurate finder chart like the one found on the messier.seds website (www.messier.seds.org/more/m015_ps1fc.html) is a must, as is an O-III filter to help you confirm the sighting. As you flicker the O-III filter back and forth between eye and eyepiece, Pease 1 will retain its brightness while surrounding stars fade noticeably.

M15 was discovered by the Italian astronomer Jean-Dominique Maraldi on the night of September 7, 1746 during observations of Comet de Chéssaux and independently by Messier about 18 years later. It lies about 34,000 light-years away and is some 175 light-years in diameter. Spectroscopic analysis shows that Messier 15 is approaching us at a rate of 66 mi (107km)/sec.



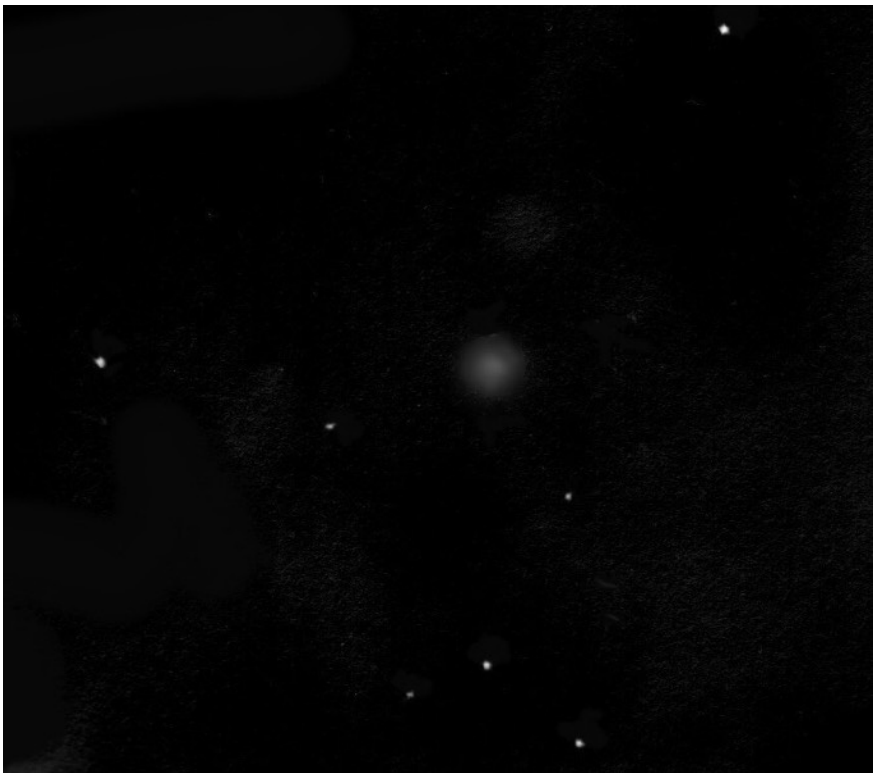
www.universetoday.com, IAU, and *Sky and Telescope*

Mario Motta, MD

M15 and Pease 1 (pinkish object near top left) Hubble image

John Lourdes Pierce: Observer from Nevada

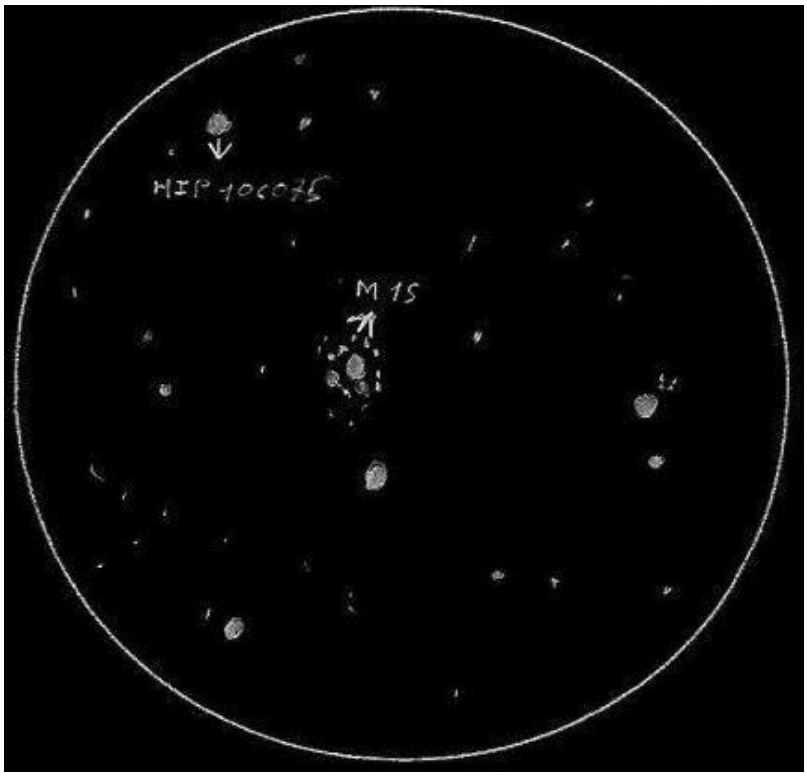
I observed the globular star cluster, M-15, through my 6-inch reflector from within a very bright Las Vegas sky. Still showed very well because of its size and brightness. This field sketch was using 60X magnification. When using higher magnification, I was able to achieve some resolution of stars within the cluster.



Francisco Silva: Observer from Nevada

I observed M15 (NGC-7078) from Mt. Potosi (5,890 feet) in Nevada on October 13, 2017, using my 10-inch reflector at 80X. The sky conditions were: Temp 77°. Humidity 32%. Wind 7 mph. Moon not up. Transparency 4 out of 5. Seeing 2 out of 5. Observer's condition was good.

It was high in the sky, but I still had a bit of difficulty locating it. This object is 33,600 light-years from us. It's one of the few that has a real planetary nebula in it. I could very well see two massive stars in the center, some gas and it had a very circular shape.


HIP 106075
M 15

Chris Elledge: Observer from Massachusetts

On October 14, 2017, @9:00pm, EDT, I used a 10-inch f/5 reflector to observe M15 from the ATMoB Clubhouse. Sky conditions were: Bortle Scale 6. NELM 4.5. Transparency poor. Seeing good.

I found M15 by pointing the telescope with a 35mm eyepiece at Enif in Pegasus and just drifting to the NW until it popped into view. I switched to a 10mm eyepiece (127X, 0.9˚FOV) to make my observations.

With the object centered, there were several noticeable stars surrounding it. The bright mag. 8 star HD204712 lay to the NNE. Fainter mag. 10 stars lay to the ESE and WNW. A fainter mag. 12 star was closer to M15 in the WNW as well. Just at the edges of the field of view were mag. 7 HD204571 to the SW and mag. 6 HR8231 to the E. They both peeked in and out of the eyepiece while adjusting the telescope.

The core was very bright with direct vision with a surrounding cloud that appeared about 10 arc-minutes across, in my view. Averted vision revealed a speckling of stars in the outer cloud. Adding a 2X Barlow to the 10mm eyepiece drastically dimmed the cloud, but I was able to resolve more stars closer to the core. Adding an O-III filter, the cloud became very faint, but was still visible. HD204712 to the NNE was still visible as well. Averted vision no longer showed speckles in the cloud. There seemed to be a single faint speckle that flickered just to the NE of the core. I was unable to determine if this was the planetary nebula, Pease 1, but it was possible.

James Mullaney: Observer from Delaware

"Striking, condensed globular cluster…3-D effect in 12-inch and larger telescopes." Beautiful sight in a 6-inch at 90X, but not completely resolved even in a 13-inch at 190X on most nights.

James Mullaney *Celestial Harvest* Dover

David Eicher: Editor – *Astronomy Magazine* and Observer From Wisconsin

The best deep-sky object in Pegasus is the bright globular cluster M15 (NGC 7078). It's quite easy to find, lying some 4º northwest of Enif (Epsilon Pegasi). Appearing as a mag. 6.4 "fuzzy star" in finder telescopes or binoculars, M15's appearance changes when viewed with a 4 or 6-inch telescope at low power (40X). The globular's 12.3' disk appears as a uniformly illuminated glow, while high power (100X) resolves its edges into dozens of tiny pinpoint stars. Larger telescopes do even better. A 12-incher at 175X resolves stars across M15's disk to create a three-dimensional effect. A 17.5-inch telescope reveals hundreds of yellow stars….while small scopes tend to give a gray or greenish tint to the cluster.

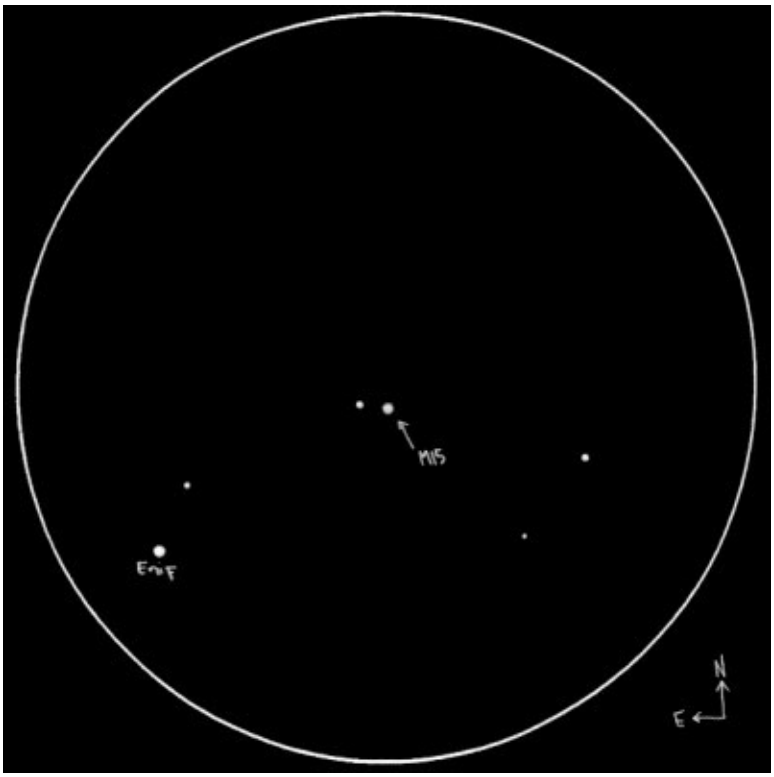
Curiously, M15 is the only globular cluster containing a known planetary nebula, Pease 1. The nebula measures 3 arc-seconds across, glows dimly at mag. 14.9, and is surrounded by hundreds of stars. It's impossible to pick out with backyard telescopes.

David J. Eicher *The Universe from Your Backyard A Guide to Deep-Sky Objects* from *Astronomy Magazine* (paraphrased)

Jaakko Saloranta: Observer from Finland

I observed M15 with the simplest of instruments – the naked eye – on the night of September 23, 2017 from Finnish Deep Sky Section's annual Deep Sky Meeting. The night was fairly good, apart from poor background brightness. The SQM-L reading was 21.35 close to zenith. Messier 15 appeared as a fuzzy star NW of Enif (Epsilon Pegasi) to the naked eye, with a faint mag. 6 companion star visible on the east side. On the best of nights, mag. 7.3 HD 204571 is very faintly visible SW of M15 – at least this was the case 15 years ago.

I quickly gazed the object with a 10-inch reflector, simply to hunt for the planetary nebula Pease 1 within. At the eyepiece, the globular had a compact, non-stellar nucleus with a multitude of mag. 14 and fainter stars visible within the halo. Proper resolution was quite difficult to achieve, despite the medium aperture. Zooming in on Pease 1, and using a magnification of over 400X, the amount of resolution I got out of the globular cluster was nowhere near enough of what I was looking and hoping for. Also, the image appeared soft for some reason, so the weather simply wasn't good enough. So, unfortunately, for the 4th time, I failed to detect the planetary.


M15
E
F
N
E

Richard Nugent: Observer from Massachusetts

Some of my favorite objects in the sky are globular clusters, and M15 is certainly near the top of the list! This densely packed star sphere is an easy target to find. I was able to see it in a pair of 8X21 binoculars under a mag. 4 sky. It was distinguishable from its mag. 6 neighbor, HIP106243. The cluster begins to resolve in small scopes, and is delightful in my 10-inch reflector. The cluster is absolutely spectacular in my 20-inch scope at all magnifications. For globulars, I (usually) prefer magnifications of 150-200X. Using a large scope, the real challenge of this cluster is to detect the embedded mag. 14.9 planetary nebula, Pease 1. To date I have had no luck in seeing this elusive object. Of course, I've tried high magnifications (525X gives an exit pupil of about 1mm), and I've tried flicking an O-III filter in front of the eyepiece. Actually, for me, that technique doesn't work at all! My frustration with the hand-held filter finally prompted me to purchase and install a filter slide assembly inside the telescope. I've consulted detailed finder charts at the eyepiece and, although I can see the suggested guide stars, I only see a jumble of unresolved stars where the planetary should be.

With a diameter of only 1", the planetary is almost star-like and should be within the range of the big scope. According to the limiting mag. calculator at www.cruxis.com, my scope should reach just fainter than mag. 16, even from my very suburban observing site (my Framingham driveway). I've never seen mag. 16 stars and mag. 15 stars are extremely difficult. It's the seeing that kills me. Try defocusing a star near the theoretical limit of your scope. What happens to the star? As the image spreads out, even just a little, its surface brightness decreases and…poof! The star is gone. New England skies are not known for their steadiness. Really faint stars pop in and out of visibility as the atmosphere acts like a constantly varying weak lens just in front of your telescope.

All of this makes me think we should have a more realistic limiting mag. for our telescopes. It would be specific for each observer depending on aperture, magnification, experience, seeing and transparency, and your level of dark adaptation. For me, using the 20-inch scope, this practical limiting mag. is around 13.5. I don't have to guess whether I can see the star or not…I can look directly at it and there it is! Neptune's moon Triton is right there…no doubt about it. It's a comfortable limiting mag.. It gives me a much more realistic idea of what I'll be able to observe and I've found that realistic expectations make for a more enjoyable observing experience. What do you think? What's your telescope's practical limiting mag.? Next time you're out observing…

Dr. James Dire: Observer From Hawaii

M15 is a globular star cluster located in the constellation Pegasus. The cluster is 4° northwest of the bright orange star Enif (Epsilon Pegasi). It's mag. 6.2 and 21 arcminutes in diameter. The cluster is an easy find in binoculars, but requires a 4-6-inch telescope to resolve it into stars. The brightest stars in the cluster are mag. 12.6.

It was discovered by the astronomer Jean-Dominic Maraldi in September 1746. Charles Messier added it to his catalog in 1764. M15 lies approximately 33,600 light-years from Earth, yielding a cluster diameter of 175 light-years. Its age is estimated to be 13.2 billion years old, making it one of the oldest Milky Way globular star clusters.

The cluster has one of the densest cores of any globular cluster. It's suspected to have a black hole at its center with a mass of thousands of suns. X-rays from the cluster may be from the black hole's accretion disk. It has more than 100 variable stars, at least 8 pulsars and one known planetary nebula.

My first photo of M15 was taken with a 132mm f/7 APO with a 0.8X focal reducer, field flattener (FR/FF) to yield an f/5.6 system (739mm focal length). The image was taken with an SBIG ST-2000XCM CCD camera and the exposure was 30 minutes. North is up and east to the left. The brightest star is SAO107195 at mag. 6.1. This is the blue star left of the cluster. The orange star to the upper left of SAO107195 is SAO107204, mag. 8.1. The bright star just above the cluster at the 11 o'clock position is SAO107179. This star is mag. 7.65. SAO107170 is the orange star to the lower right of M15. It shines at mag. 7.3. Both SAO107195 and 107170 lie 17 arcminutes away from the center of M15, whereas SAO107179 is a mere 7 arcminutes away. All four of those bright stars are foreground objects 200-500 light-years distant from Earth.

My second photo of M15 was taken with the same camera, FR/FF, with the same exposure. The telescope was an 8-inch f/8 Ritchey–Chrétien. The effective focal length was 1300mm. Most of the stars in this image belong to M15. The most notable exception is SAO107179. The other stars scattered around the image that appear brighter than those resolved in the center of the cluster are also foreground objects. Because of the age of the cluster, only G, K and M stars are still shining. This accounts for the cluster having more red than blue stars.

Gus Johnson: Observer from Maryland

I observed M15 on multiple occasions with multiple telescopes.

In September, 1968, I used an 8-inch reflector at 58X. It was easily visible in the 7X50 finder. The main scope resolved the outer regions.

In September, 1984, I used a 6-inch reflector at 196X. The view was spectacular and I could resolve the outer regions. Double star Struve 2799 was ~1.0º SW.

In September, 1987 I used the 30-inch Allegheny refractor and the view was magnificent, resolving the cluster to the core. There was also a bright, yellow field star.

My final observation was in September, 1993. I used an 80mm (3-inch) refractor at 75X and saw hints of resolution.

Joseph Rothchild: Observer from Massachusetts

I observed M15 on October 18, 2017 under suburban skies with a 10-inch reflector. I observed at 42X, 81X and 158X. The globular cluster was small with a compact core. The core was 25% of the total diameter when observed with averted vision (similar to Mario Motta's image), but star-like with direct vision. The cluster was just resolvable with a salt and pepper appearance. It handled increased magnification well, but the appearance overall did not change significantly at higher power.

Jay and Liz Thompson: LVAS members and observers from Nevada

M15 is a bright, magnificent globular cluster that is impressive from both dark sky and moderately light-polluted locations. In the LVAS 24-inch, from Meadview, AZ, it was well resolved and very bright at 116X. At 277X, it was very condensed in the core and took up about half the field of view.

With a 16-inch SCT, from our backyard in Henderson, NV, it was well-resolved at 194X.

Encouraged by the brightness of M15, we decided to view it with a 60mm (2.4-inch) refractor from our backyard. From 10X to 28X, it was definitely non-stellar and exhibited a

bright, condensed core. At 56X, we saw some outlying stars with difficulty. At 92X, with a good focus and using averted vision, we resolved it into many faint stars.

A few nights later, we used M15 as a test object to evaluate three Plossl eyepieces using an 80mm f/11.4 refractor. The cluster was easily recognizable as non-stellar with a 32mm eyepiece at 28X. With a 25mm eyepiece, giving 36X, it showed an almost star-like nucleus when we used averted vision. With a 10mm eyepiece (91X), we could see a peppering of very dim stars around the nucleus as well as those farther out in the halo.

After some unsuccessful tries over the years, Jay was able to finally see the associated planetary nebula Pease 1 visually on September 16, 2017 (searching out such faint and difficult objects does not rank very high on Liz's list of fun things). Good finder charts from Doug Snyder (available on the web) helped, as did crazy-high magnification and a very good nebula filter. Using a 16-inch SCT at 711X, he saw Pease 1 by blinking with the nebula filter while using averted vision. He needed the high power and filter to knock down the glow from the stars of the cluster.

Imaging Results

The first images we took of M15 were part of an evaluation of various optical setups for a CCD-based finder telescope. Ideally, the CCD finder should have sufficient image scale to be able to recognize small non-stellar objects, but a field of view (FOV) sufficiently larger than the pointing errors of the digital setting circles. The first image shows the results from a 200mm focal length telephoto lens. M15 can be seen as a slightly non-stellar object. North is up and west is to the right in this and all other of our images.

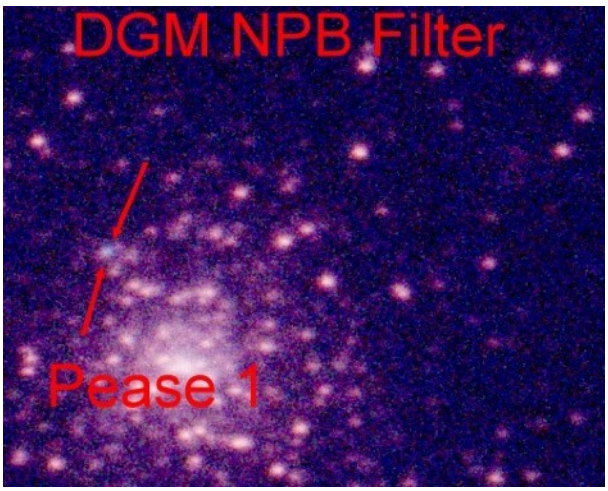
Next we tried a 5-inch SCT with a focal reducer giving f/7. M15 is clearly recognizable in the second image, and the FOV is still large relative to pointing errors.

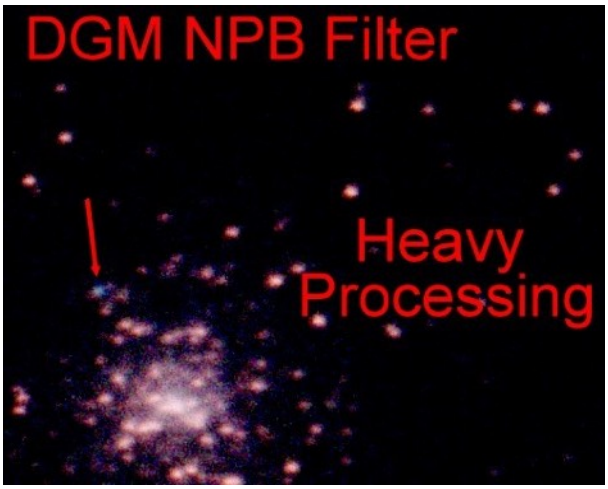
Our experience with imaging with our one-shot-color CCD camera has been that if you can see an object visually, the camera will image it in 2 seconds (with 4X4 pixel binning) or 30 seconds (full resolution). We decided to image Pease 1 with and without a nebula filter. Consistent with the approach for visual observation, we chose the f/11 focus of a 14-inch SCT for maximum image scale (magnification) and full resolution.

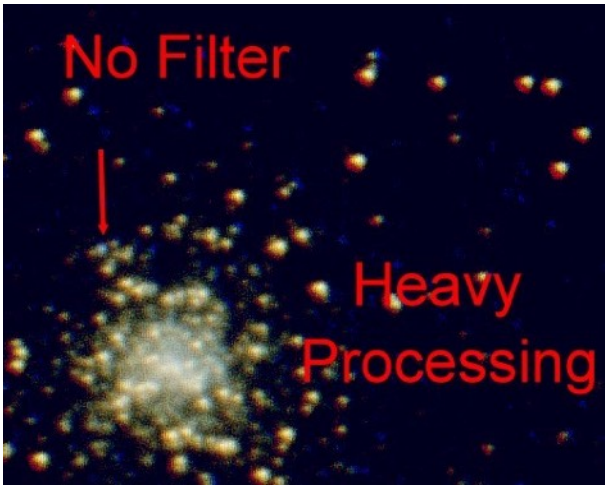
The third image is full frame with no filter, but with the resolution reduced to decrease file size for email transmittal. A close-up of the area north of the core is also shown (fourth image). This illustrates the difficulty of picking out Pease 1 visually...it's swamped by the light from cluster stars.

We then imaged M15 using a filter that passes both H-beta and the OIII lines (as well as some H-alpha). With minimal processing (fifth image), Pease 1 is much more evident than in the no-filter view. With heavier processing, Pease 1 can be brought out even more in both the filtered and non-filtered images (sixth and seventh images).


No Filter
Pease 1

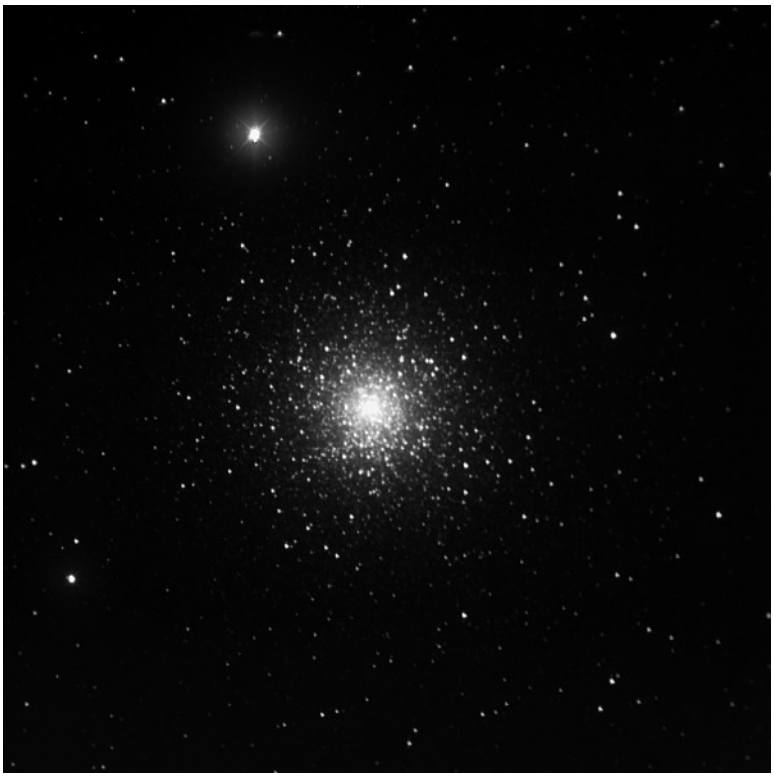

DGM NPB Filter
Pease 1


DGM NPB Filter
Heavy
Processing


No Filter
Heavy
Processing

Mario Motta: Observer from Massachusetts

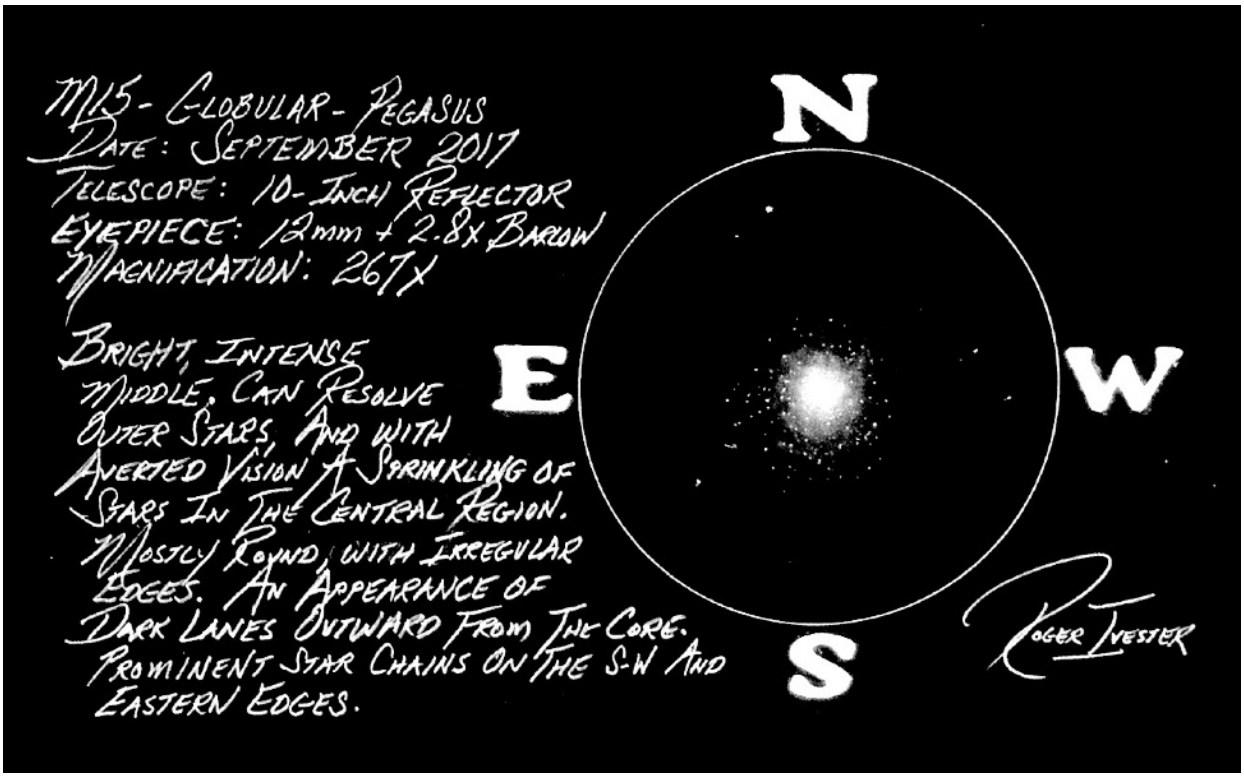
Done with a 32-inch reflector.



Roger Ivester: LVAS Observer from North Carolina

M15 was easy to see in my 7X50 finder. Using my 10-inch reflector at 267X, it appeared mostly round with a bright, intense middle, and I was able to resolve an excellent amount of stars in the outer regions. When using averted vision, I was able to see an intermittent sprinkling of faint, pin-point stars in the central region. I had the impression of dark lanes extending outward from the core, and a star chain around the SSW edge. There was a bright field star to the north.

With a 3.5-inch Maksutov, it appeared circular, with a very bright and intense center. I couldn't resolve any stars with this aperture.


M15 - Globular - Pegasus
Date: September 2017
Telescope: 10-Inch Reflector
Eyepiece: 12mm + 2.8x Barlow
Magnification: 267x
Bright, Intense Middle. Can Resolve Outer Stars, And With Averted Vision A Sprinkling of Stars In The Central Region. Mostly Round, With Irregular Edges. An Appearance of Dark Lanes Outward From The Core. Prominent Star Chains On The S-W And Eastern Edges.
N
E
W
S
Roger Ivester

Fred Rayworth: LVAS AL Coordinator and Observer from Nevada

For this challenge, though I've seen M15 many times, I relied on two observations, one (over two nights) at Cathedral Gorge and one at my usual spot at the "undisclosed location," my tongue-in-cheek name for my regular site at Lake Meade.

On September 22, 2017, at Cathedral Gorge State Park in East Central Nevada, at 4,800 feet, it was cool and getting colder. The sky was clear with possible humidity up there. It was hard to tell so early, but it wasn't too much of a factor as the night progressed. The breeze was annoying at times, mainly because it was so cold. It got much colder later on, to the point I had to finally quit.

The cluster was a dense, medium-small concentrated glob at 102X. It had a small core. I could easily see and identify individual stars in the outer halo but it became increasingly more difficult closer to the center. The center almost looked like a single bright star. Also, I looked for Pease-1, but it was so close to the center (or I thought it was that night), I couldn't pick it out in the wash. I tried 390X with and without an O-III filter, and couldn't pick out anything at all but slush. I even tried blinking with the filter and failed to see anything pop out.

On September 23, 2017 at Cathedral Gorge State Park in East Central Nevada, at 4,800 feet, it was extremely cold and breezy. It didn't clear out until 21:30, but when it did, it was okay. There were clumps of clouds here and there, mainly on the horizons. They ended up not being too much of a problem as long as I didn't look too low. The cold was almost unbearable, especially when the breeze kicked in. The humidity picked up too, and dew started to coat everything. The temp dropped to the upper thirties. I finally gave up just before midnight.

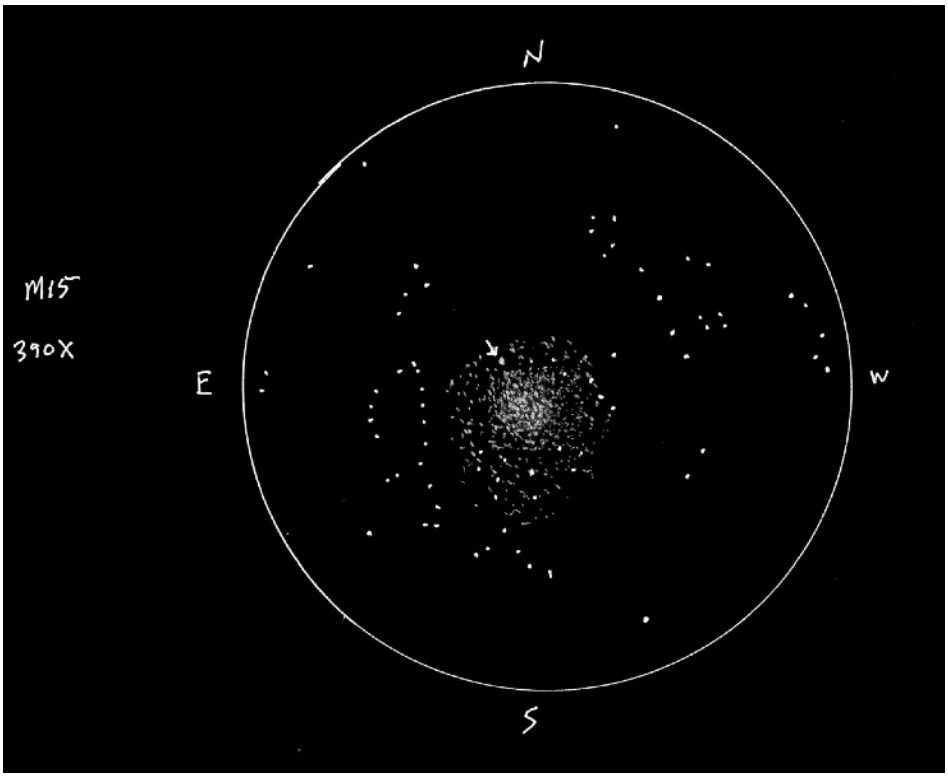
Tried multiple times, once again, to see Pease-1, but no luck. The cluster looked the same as it did the night before, same magnifications.

On October 21, 2017 from Redstone Picnic Area on the North Shore Road at Lake Mead, Nevada (the "undisclosed location") at 2,100 feet, it was cool and calm, with mushy skies at first. It started to worry me when the sun went down and the skies thickened up a bit. However, according to the Clear Sky Clock, that was all supposed to pass by 21:00 and there was a clear area to the south. Apparently, it did, because the skies became spectacular, and a good bit before 21:00. I noticed no nebulae around the brighter stars. It ended up being an outstanding night, at least for open clusters and planetary nebulae.

M15 was a moderately rich glob with a dense core and a spread that went a little bit out from the core. Not near as large as M13, but still pretty nice. It was quite easy to see individual stars almost to the core, where they blended into the haze. I tried for Pease 1 and finally succeeded.

Pease-1 was very hard to pick out amongst the myriad of stars on the periphery M15. I missed it the first time at Cathedral Gorge because I was looking in the wrong place. Once I had a finder chart, I found the "asterism" and went right to the spot. It was very tiny and without that finder chart, I never would've spotted it at all. It took 390X and an O-III to see it, then 790X to bring it out. It was only satisfying for finding it, but nothing much to look at. Just a speck.

In the drawing, the arrow points to Pease 1.


M15
390X
N
E
W
S