MONTHLY OBSERVER'S CHALLENGE

Las Vegas Astronomical Society

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&

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JUNE 2016

M5 (NGC-5904) Globular Cluster In Serpens Caput

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.

M5 (NGC-5904) Globular Cluster In Serpens Caput

M5, also known as NGC-5904 is a globular cluster in Serpens Caput. It was discovered by Gottfried Kirch in 1702 and Charles Messier added it to his catalog in 1764. William Herschel was the first to resolve stars in it in 1791 where he counted around 200 or so.

It lies about 24,500 light-years away and shines at about mag. 6.5. It's full of RR Lyrae variable stars, which are similar to Cepheid variable stars. It provides a great Challenge object for any telescope!

M5 also incorporates an unusual visual treat that isn't without some controversy. Called the "Ruby Eyes," this pair of stars is something few have observed or confirmed. Some don't think they exist while others have seen and verified them, at least with some satisfaction, including a few of our Challenge members. Below is a bit of history about these two stars:

Sky & Telescope, December 1993, page 108: A brief and paraphrased account from the original article:

On July 17, 1992, North Carolina amateurs Bill Henson and Arlo Gardner were testing Gardner's newly rebuilt 20-inch Dobsonian. While sweeping through Serpens, they picked up the mag. 6 globular cluster M5. Taking time to examine the cluster's tight, compact core, they both noticed a pair of ruby stars south-southeast of the cluster's center and oriented east-west. "They impressed us because of their color," writes Henson. "In fact, the pair actually seemed closer than the globular….suspended between us and M5." They estimated the stars to be around mag. 13, separated by about 30 to 40 arc seconds.

Henson now wonders whether he and Gardner did not overestimate the brightness of the stars. They also wonder whether the stars are variable. After all, M5 *does* have an unusual number of them.

"We're certain of one thing," Henson writes: If the Ruby Eyes are seen, they're not forgotten. They're like seeing the Horsehead nebula or the dark lanes in M13."

Henson later wrote in an e-mail:

I wonder how many will see the Ruby Eyes now that the path is somewhat mapped. Fred, Roger, and Tom just made them a "notch-on-the-scope" target for experienced observers. Well done guys. Bill Henson

Below is Tom English's scientific paper on the Ruby Eyes:

Identifying the Ruby Eyes of M5

After the call went out to observe M5 and to look for the mysterious pair noted by Bill and Arlo, Jim Dire provided a nice image that identified the potential Ruby Eyes (below, right, and elsewhere in the report).

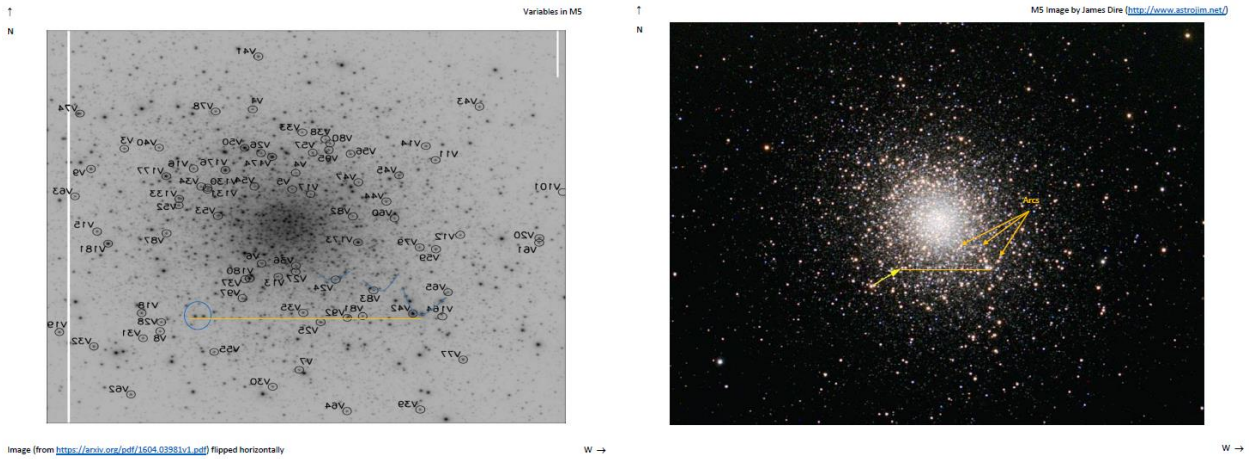
Tom English used the Simbad database (http://simbad.u-strasbg.fr/simbad/) and Jim's identification to determine information about the specific stars. The source for the magnitude data below is a paper on evolved stars in M5 by *Sandquist & Botle*, ApJ 604, 311 (2004) - http://iopscience.iop.org/article/10.1086/422134/pdf. The authors identify a pair of stars as red giant branch stars.

The two stars are: 2MASS J15183955+0202520 Vmag = 13.5

2MASS J15183899+0202520 Vmag = 14.0

In the original *Sky & Telescope* article, Bill Henson suggested that the reason they had not seen the pair any other time might stem from the fact that they're variables. Exploring this idea, Tom English unearthed another study on variables in M5, and determined that the two stars

in question had thus far not been identified as being variable (Ferro, et al., submitted to *Ap&SS*, Vol. 361, No. 5, ArXiv preprint: https://arxiv.org/pdf/1604.03981v1.pdf). A figure from this paper, flipped to match Jim Dire's image, is shown below, left.



An animated .gif of the cluster generated by Bob Vanderbei of Princeton shows the RR Lyrae variables in M5 quite clearly - http://www.princeton.edu/~rvdb/images/NJP/m5-LRGB.gif. Note that our Ruby Eyes shine steadily in this image (though as RGB stars, they would not vary on the same timescales as the RR Lyr stars – but also notice that the two stars seem about the same brightness here as in the other images, another indication of lack of significant variability.)

Sue French confirmed the identification of the stars, and their lack of variability, using the resources at VizieR (http://vizier.u-strasbg.fr/viz-bin/VizieR). She also suggested that "for any unusually red sightings, the simplest explanation is likely to be the best – perhaps particulates high in our atmosphere."

Close inspection of the images and resources in Simbad indicate that the newly identified Ruby Eyes are about 8.4 arcsec apart, significantly closer together than the original estimate Bill and Arlo shared with *Sky & Telescope*. Bill communicated that their separation estimate could be in error, since it was not actually made at the eyepiece, as noted below:

Visually, the pair was close (resembling the pair you had identified), and we were most likely using a 20mm eyepiece, producing around 100X. They were close enough to be seen as a visual pair, rather than two, red stars. A distance of 30-40 arc could not create that effect. It must be wrong.

At that time, we lacked the resources that would allow accurate measurements. We most likely took a picture of M5 in one of our astronomy books and made some form of rough estimate on what we had seen afterward, trying to adjust between the image magnification differences between our visual and the book image. While that was more than 23 years ago and I do not

recall how that was estimated, that was the common method we used. We were also more interested in collecting everything we could visually, not photographically. Astrophotography and Dob usage were and are different styles of viewing. Nevertheless, the Ruby Eyes are a visual pair (not double – just sort of together, like eyes).

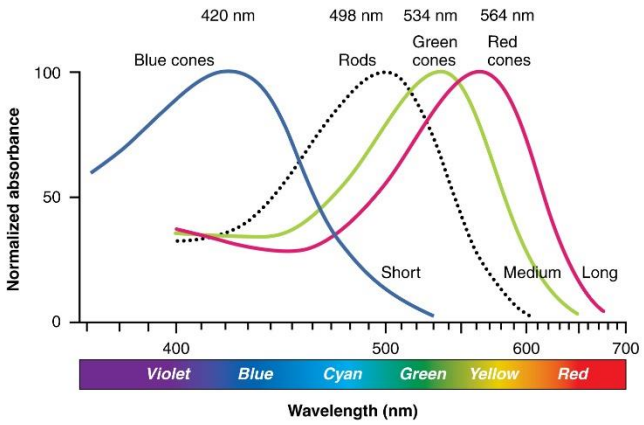
One of the advantages of a 20-inch Dob is the ability to grab light quickly – it's easy to move. One of the disadvantages is that you retain no proof, at least not back in those days. Comparisons are made later from memory, as we all remember. But it's obvious to me that the original separation estimate must be highly skewed because 30-40 could not possibly produce the pair effect in a 20-inch with a 20mm eyepiece.

To me, what Tom identified in position and separation and Fred described visually was similar to what I saw, except the red was slightly more distinct for me. Another person who saw it later in the evening, Bill Passmore, said that the red was much more faint to him and it took him longer to pick it out. But, who knows?

Let me stress that my opinion has absolutely no importance. The call is not mine. And that was well more than two decades ago, I think.

Finally, it should be noted that it should be exceedingly difficult to see color in this pair. It would be interesting to explore – for a range of observers – how faint a star can be perceived as definitely red (ruby!), and under what conditions.

Rods are famously deficient at longer wavelengths (see figure at right, from *Wikimedia Commons*, and think of the Purkinje effect). So, the ruby eyes, which are in the mag. 13.5-14.0 range, will be down near threshold for many observers, where everything looks gray (of course, depending on aperture and conditions).



Arlo & Bill had the advantage of 20-inch aperture and a dark site for their discovery observation, and Fred Rayworth's excellent conditions allowed him to identify color in the pair at low power (but not at high power) in his 16-inch. Bill weighs in again on the color issue here:

One of the things that will help observers is to know about that visual color shift...That piece of information increases the possibility that an experienced observer could see the Eyes by knowing that simply "pumping it up" is not likely to help. If we had known and followed that theory before, these might have been recovered more quickly. It seems they have the ability to hide behind that shift.

I think that it's equally interesting (in addition to seeing them) to understand why they were so hard to see (other than the obvious lack of brightness). It's an extremely valuable piece of knowledge for visual observers.

Observations/Drawings/Photos

Tom English: Observer from North Carolina

I made these observations made on June 8, 2017 and June 11, 2017 using the 24-inch CDK reflector at Cline Observatory at GTCC in Jamestown, NC. Magnifications ranged from 140X, 190X to 380X. Conditions: generally clear, though transparency was a bit limited (NELM in the 5.0-5.5 range). The seeing was reasonable.

It was a very interesting cluster. It appeared as a granular ovoid overlaid with a veil of brighter (mag. ~12) individual stars. No color evident. The cluster was resolved, very grainy and relatively evenly concentrated across the face of its primary condensation. There was a bright star just off-center and a few other brighter members around the core.

An irregular chain of stars sat separated from the cluster to the north, giving the appearance of a void along the northern edge.

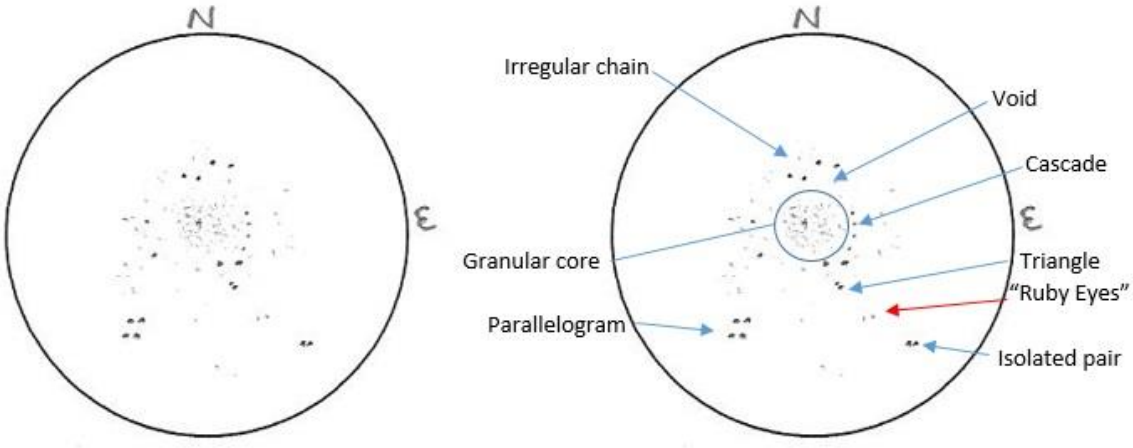
There was a cascading line of mag. ~12 stars that dropped down the eastern side, very close to the central condensation. At the base of this line (and to the SSE of the cluster's main condensation) there was a notable triangular group, with its southernmost member appearing double.

There was a general scattering of stars on the western side, extending southward toward an isolated and relatively bright parallelogram of stars isolated to the SW (about 2X farther out than the double mentioned above). The brightest member of this group (mag. ~11) was the brightest star in the field at 380X.

There was an isolated close pair to the SE of the condensed cluster, about 3X farther out than the double mentioned above.

I easily found the “Ruby Eyes” on a line between the isolated SE pair and the double in the triangular group. They were a faint E-W pair, separated by ~5-10”, but I noted no color at a range of magnifications between 140-380X.

The rudimentary sketch below was developed from the two observations summarized above, with special care to identify the stars and features noted in the description. The appearance of the core is a bit subdued in this representation, and orientation of the actual Ruby Eyes themselves is slightly skewed – they should be almost exactly E-W.



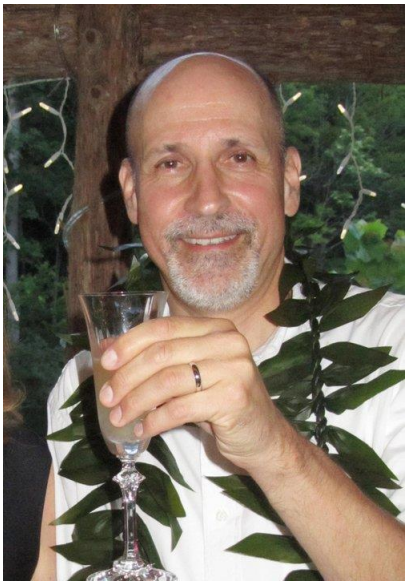
John Lourdes Pierce: LVAS member from Nevada

The global cluster M5 shows up well even in the bright Las Vegas sky. I viewed it while it was in the southwestern portion of the sky, away from the bright light globe of the Vegas Strip east of my location. I used a 10-inch reflector at about 180X. For the most part, all I was able to make out was a fuzzy bright central hub with a few individual stars visible on opposite sides of the hub. With averted vision, more individual stars of the cluster were visible. Viewing conditions seemed well for an inner city sky, though no stars were visible to my unaided eye in that area of the sky except for bright Arcturus.

Gary Bruno: LVAS member from Nevada

I checked out M5 despite the 25 mph wind. It was from the S/W so I was buffeted by the many trees on that side of my yard. However, I wasn't certain I would still get a good look with so much wind. I could see Arcturus, Spica and Denebola early, so I gave it a shot. I didn't press my luck and stayed at low power (82X). I set the database and my 14-inch pointed to M5. Despite the wind, it was very clear for a backyard observation. M5 appeared very round in shape, almost like a funnel with a bright center. I'm not sure if it was being distorted, but it seemed to tilt on a slight angle toward the north, from my point of view, through my eyepiece. I was surprised how round it appeared. Now that my assignment was done it was time for fun. I went to NGC-3242, the Ghost of Jupiter. And sure enough, despite of the wind, saw it clearly. I didn't need a filter. After 4 days of clouds, I got to ease my frustration.

James Dire: Observer from Hawaii

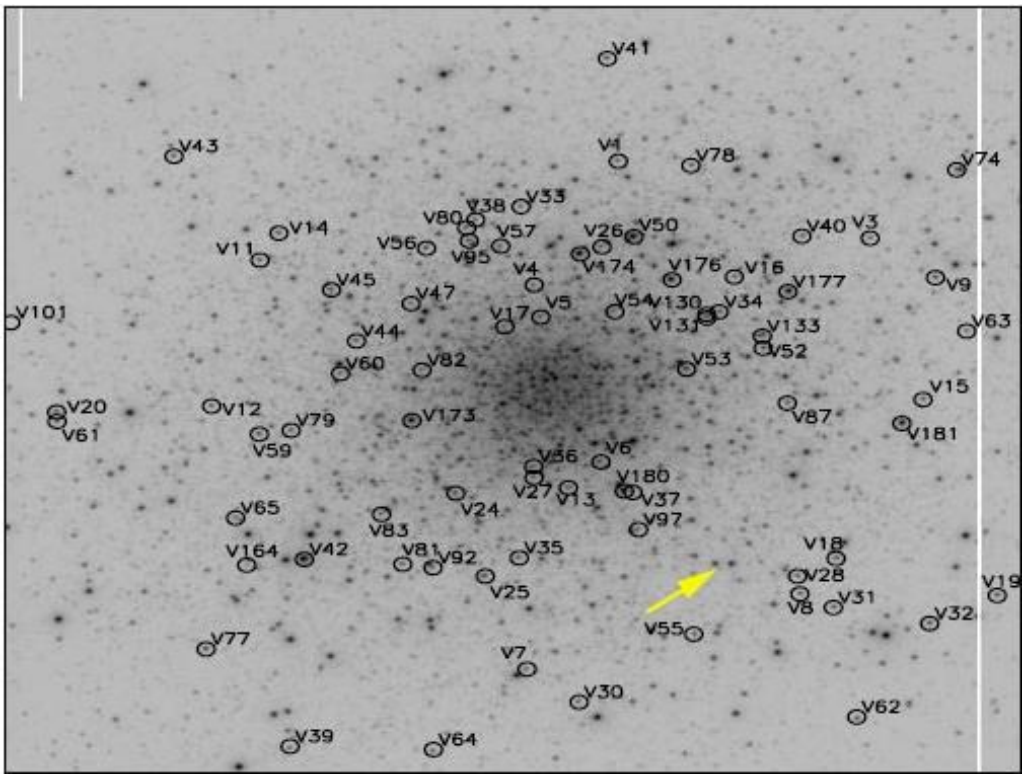


Aloha Kakou (hello guys in Hawaiian):

I have attached a copy of M5 that I took last night with a 10-inch f/6 Newtonian, one hour exposure with a CCD camera from Kauai.

Perhaps the “ruby eyes” are the two red stars I have highlighted in the attached image. They’re two red stars located south-southeast of the cluster’s center and oriented east-west. In a 20-inch scope, they’d really stand out!

I figured it out. Their image is left right reversed from mine. The attachment shows their image. I have placed an arrow showing the same two suspect stars from my image.



M5 is one of the finest globular star clusters north of the celestial equator. Located in Serpens Caput, it's very easy to find. It lies 8° due east of mag. 4 109 Virginis, 11.5° north of Beta Librae, and 7.5° southwest of Alpha Serpentis. The cluster is a mere 20 arcminutes northwest of mag. 5 MQ Serpentis (or 5 Serpentis).

M5 was discovered by Godfried Kirch in 1704. Kirch discovered it while looking at a comet nearby. Charles Messier cataloged it in 1764. The integrated mag. of the cluster is 5.6 and its diameter is 28.4 arcminutes. It's an easy find in binoculars!

This globular cluster contains hundreds of thousands of stars. Of those, nearly 100 are known to be RR Lyrae-type variable stars. These variable stars pin down the distance to the cluster at 24,500 light years. The cluster is one of the largest globular clusters in the Milky Way, spanning 165 light years. Any object within 200 light years of M5's center would be gravitationally bound to the cluster, unless moving with a radial velocity equal to the cluster's escape velocity. M5 is thought to be 13 billion years old, one of the oldest globular clusters known.

Nearby 5 Serpentis is a binary star with components of mag. 5.0 and 10.1, separated by 11.4 arc seconds. Slightly more than 2° south of M5 lies another globular cluster known as Palomar 5. Located three times farther away than M5, Palomar 5 shines at mag. 11.75 and is 16 arcminutes in size.

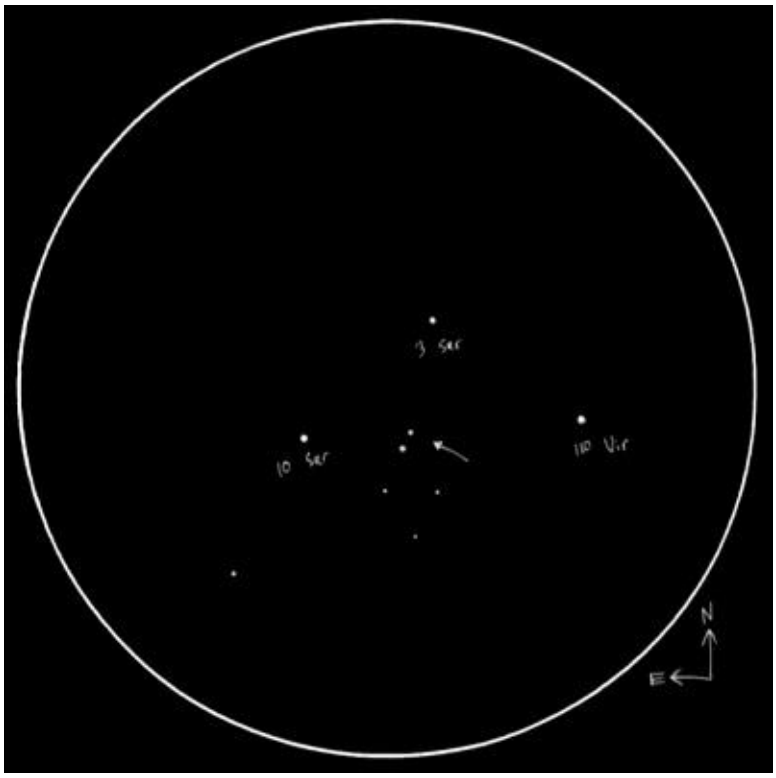
I offer two more images I took of M5. The first was taken with a 102mm (4-inch) f/7.9 APO refractor 102mm. The exposure was 30 minutes with an SBIG ST-2000XCM CCD camera. The bright star partially cut off to the lower left of the cluster is MQ Serpentis. The second image was taken with the same camera on a 10-inch f/6 Newtonian with a coma corrector. The exposure was 60 minutes. The images speak for themselves!

Jaakko Saloranta: LVAS Friend and Observer from Finland

This was a fairly difficult naked eye object. I saw a barely non-stellar spot, visible NW from the mag. 5 star 5 Serpentis. When 5 Serpentis was hidden behind a treetop, the globular became a bit easier to see. It was visible 20% of the time with averted vision when sweeping between 10 Serpentis and 110 Virginis. I suspected seeing mag. 6.5 star (HD 136027) between 4 & 6 Serpentis. It was easily visible with a pair of 8X21 binoculars.

I've also uploaded the sketch to my homepage (was waiting for LVAS to publish it first) so it's here with more detail on the location and sky conditions:

http://www.kolumbus.fi/jaakko.saloranta/Deepsky/Messier/M5.html



Regarding the "Ruby eyes," I browsed through our Deep Sky Archive, but none of the observers had noted the pair, nor was it mentioned by prestigious Risto Heikkilä (Finland's Walter Scott Houston) in his book "Deep Sky." This of course isn't a surprise since we're talking about two mag. 14 stars. So, unless you have really good skies and large telescope that might make the stars really stand out (like in Fred's case), you're probably gonna' miss them.

Like Roger noted, we're so close to the summer solstice that it's nearly impossible to do any star gazing here from Finland until the end of August. It's in fact so bright at midnight you can easily read a newspaper outside. Should the weather co-operate, I'll try to visit the "Eyes" in August, but I doubt I'll see them in high humidity and small aperture.

As many mentioned, seeing color, and especially red, is very difficult for us humans. I consider myself bad at seeing color and have seen blue/green in only a handful of objects (with my 8-inch aperture).

However, I'm always interested in checking out stuff like this that's off the beaten path. So, let me know if you have more interesting targets to look at.

(**Editor's note:** Roger and I love this stuff also!).

Gus Johnson: Observer from Maryland

In 1968, I observed M5 with an 8-inch reflector at 96X. It was excellent and resolved at 145X.

In 1988, using a 5-inch refractor, I was able to partially resolve it at 48X. I noted a brighter star in the western halo. I could see it in a 5 X 25mm finder.

Also in 1988, I observed it with an 80mm (3-inch) refractor. I saw a vague hint of resolution at 90X. When I used a stop-down mask with an effective aperture of 50mm, it took on a granular appearance.

Jay and Liz Thompson: LVAS Observers from Nevada

We viewed M5 from the dark skies of Meadview, AZ with 17-inch and 24-inch telescopes. From Henderson at the edge of the Las Vegas valley, we viewed M5 with a 16-inch SCT and imaged it with a 14-inch SCT at f/5.5.

As would be expected, the best views of M5 were from a dark-sky site. With the 17-inch at 125X, M5 was nicely resolved. At 227X, it was awesome.

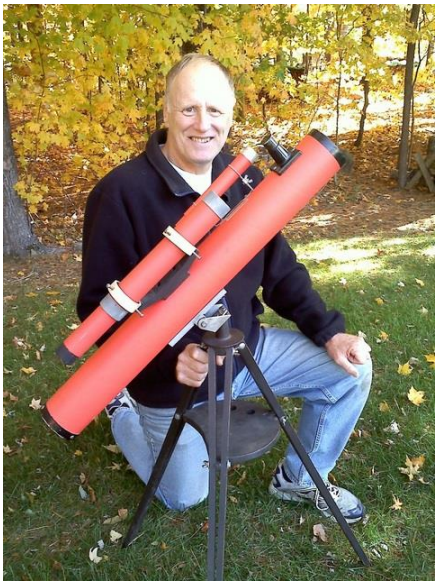
Using the 24-inch at Meadview, the cluster was resolved at 116X using a 100° apparent field of view (AFOV) eyepiece, though the nearby bright star (5 Serpens) was distracting and brightened up the field of view. Switching to an eyepiece of lower magnification (102X), but with an AFOV of 65° gave a more pleasing view since 5 Serpens was out of the field of view.

At 102X, M5 was still well resolved and very bright, as it was at 152X. Using an eyepiece with an AFOV of 84° and a magnification of 277X, M5 was spectacular. The core was resolved with direct vision, and the surrounding stars showed numerous chains. The cluster was nicely framed in the field of view and the chains of stars at the ends went practically to the edges of the field of view. With averted vision, even more stars were visible and with either direct or averted vision, the cluster has a lot of depth.

From our backyard in Henderson using a 16-inch SCT, the view of M5 was still pleasing. The trick was to increase magnification sufficiently to spread out the background skyglow, but not so much as for seeing effects to become apparent in the stars. On the night we observed, M5 was about 10° from a waxing gibbous Moon. We easily resolved M5 at 102X, but the background was bright. We obtained excellent views at 406X and 645X. At these magnifications, M5 was well resolved with a reasonably dark background. 1,069X was too much magnification for that night.

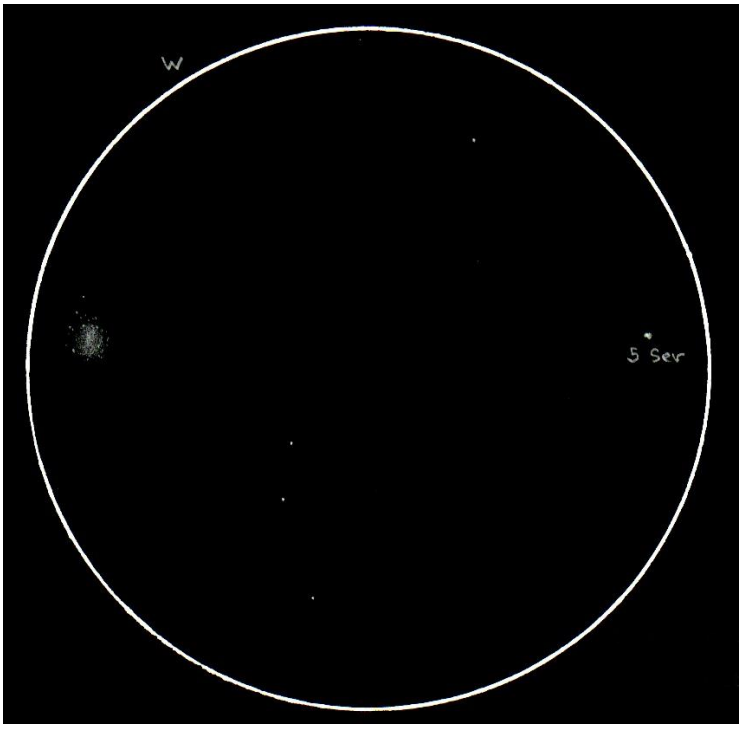
Bright globular clusters are easy targets to image, even from light-polluted sites. The attached image was taken with a 14-inch SCT at f/5.5 (a focal reducer was needed to fit the image of M5 onto the CCD chip). The exposure was for a total of five minutes.

Glenn Chaple: Observer from Massachusetts



Here's my June Observer's Challenge report on M5 which includes a sketch made using an 4.5-inch f/4.5 Dobsonian. More recently, I viewed M5 with an 4.5-inch f/8 reflector. In both cases, I saw M5 as very slightly resolved.

I tried for the Ruby Eyes using the James Dire photo as a reference, working with fellow members of ATMoB. No luck with either an 18-inch or 20-inch Dobsonian, but the NELM was only mag. 5. I might try again at Stellafane next month.



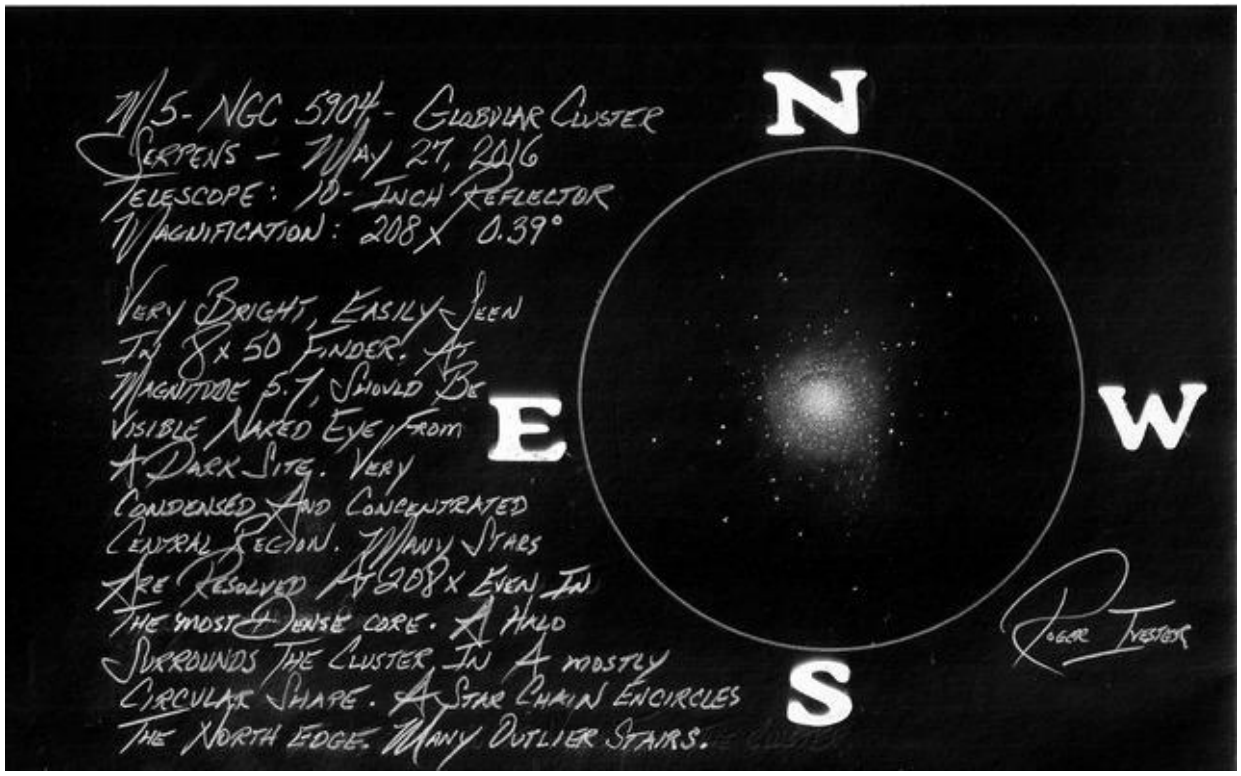
Roger Ivester: LVAS Observer from North Carolina

I observed M5 on May 27, 2016 using a 10-inch f/4.5 reflector at 208X (FOV 0.39°). The NELM was 5.0.

It was very bright, and I saw it easily through my 8X50 finder. At mag. 5.7, it should be visible naked eye from a dark site. It was well-concentrated and dense in the central region, and I resolved many stars at 208X. When I used averted vision, a chain of stars encompassed the northern edge, creating a subtle void between this chain and the main cluster. Also with averted vision, a very faint chain of stars led off toward the SW. A halo surrounded the main cluster in a mostly circular shape, with many outlying stars embedded in the halo and extending well beyond.

I also observed it with a 102mm (4.1-inch) f/9.8 refractor at a magnification of 108X, using a 26mm EP and a 2.8X Barlow.

It was bright, with a well-concentrated center and a much brighter, more intense core. I saw little to no resolution, however, many brighter outlying stars were visible. I easily saw a chain of five stars on the north edge of the cluster. The most prominent feature of this cluster, using the 102mm refractor was the triangular-shaped core.


M5- NGC 5904 - Globular Cluster
Serpens - May 27, 2016
Telescope: 10- Inch Reflector
Magnification: 208x 0.39°
Very Bright, Easily Seen In 8x 50 Finder. At Magnitude 5.7, Should Be Visible Naked Eye From A Dark Site. Very Condensed And Concentrated Central Region. Many Stars Are Resolved At 208x Even In The Most Dense Core. A Halo Surrounds The Cluster In A Mostly Circular Shape. A Star Chain Encircles The North Edge. Many Outlier Stars.
N
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W
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Roger Ivester

Fred Rayworth: LVAS AL Coordinator and Observer from Nevada

I've seen M5 many times, but only bothered to log it nine times in my database. Of those, the first time was in July 1983 using my home-built 8-inch f/9.44 reflector. I can say I'm a veteran at this object! However, since the Challenge came into being, I've never spotted the Ruby Eyes or even been aware of them until Roger Ivester brought them to my attention and I knew what to look for. In the end, what I ended up seeing was far from ruby colored, but you'll see that in the notes. Since I focused on those stars, I failed to note the odd triangular shape seen by Roger. Oh well…

For this observation, I went to Cathedral Gorge State Park in east-central Nevada. Unfortunately, I never got a second shot at it because the power supply went out in our brand new camper. We had to pack up and leave the next morning, missing out on what I was told was another great evening. On that note…I had one great night and M5 was one of the objects I was able to observe.

At an altitude of 4,800 feet, it started hot, with the temperature dropping as the sun went down. It was clear and calm. The sky looked good and as it got darker, the transparency was pretty decent with spots that were clear but other places that grew heavy with moisture. Overall, the night was still a keeper.

Using my commercial 16-inch f/4.5 Dobsonian at between 102X and 229X, I obtained a great visual treat.

Wow! M5 was a dense glob with a rich core. I saw one dim but decently significant star to the side that might be one of the eyes. It wasn't part of the core, but within the halo of the cluster. It appeared a pale orange. The other (almost) twin was less prominent and gray-blue at first until I cranked the magnification up to 229X. Then that twin showed up better but there was no color

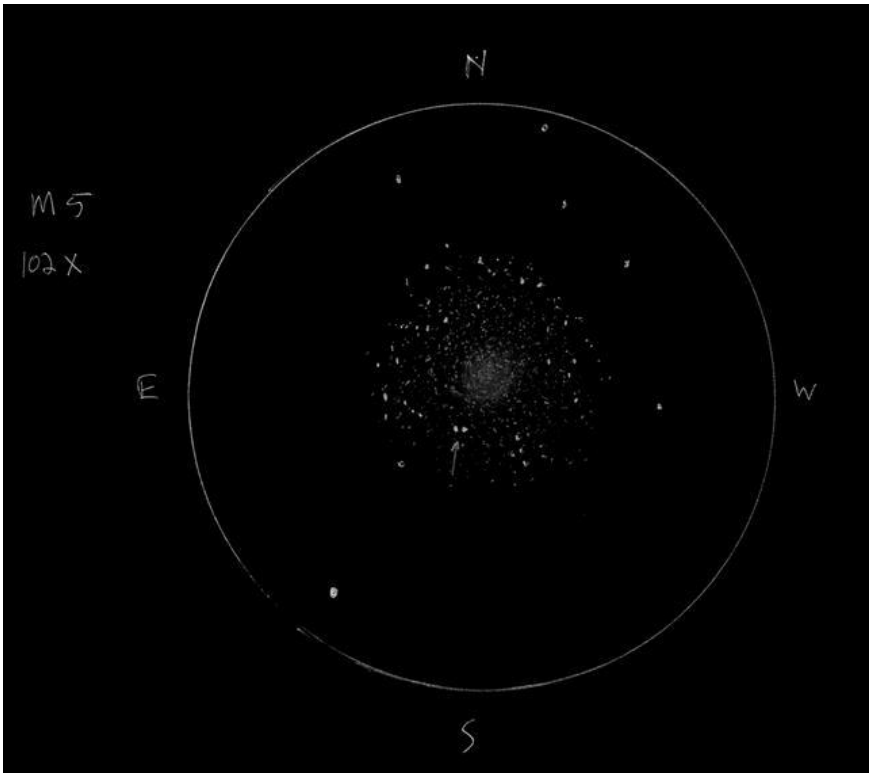
in either one. When I dropped back down to 102X, the orange color jumped out in both stars. That had to be the eyes because after carefully scanning the other stars around the cluster, I didn't see anything even close to the same hue. Not only that, but using an image I printed from Jim Dire's e-mail, I compared the approximate position in the halo around the cluster so I had an idea where to look. I noted quite a few standout stars amongst the peppering of fainter members, many I estimated well into the 14.5 to 15+ range, some little more than fuzz against the background. All except a few exhibited the standard blue-gray color. A few hinted at yellow-orange, but none of them came close to these two, once the color jumped out.

To help confirm I wasn't getting "averted imagination," I went to a few other future Challenge objects, then came back to it and this time, my eye went right to those two "orange," not ruby, stars. They certainly did not look ruby red like those carbon stars, but maybe because I have a 16-inch instead of the 20-inch that they were originally seen with. Also, because of my age, my color perception may not be as good as it once was.

I'm pretty certain I saw something, though others still believe this is a bunch of hooey. Only time and more observations from others will tell. I'll admit that I've yet to see a detailed image that shows them. Then again, every image I've seen is so overexposed that the delicate color would be wiped out. At least I assume so.

I just wish there'd been someone reliable I could've called over to look and verify what I was seeing. However, at that time, the few public that showed were keeping everyone occupied, strangely leaving me alone!

In the drawing, I added an arrow to the two "orange" stars. They're enhanced to show them better though they weren't actually that bright in the eyepiece. I'm not that good of an artist!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M 5
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