MONTHLY OBSERVER’S CHALLENGE

Las Vegas Astronomical Society

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NGC 6946 (Caldwell 12) – The Fireworks Galaxy – Spiral Galaxy Cepheus

Introduction

The purpose of the observer’s challenge is to encourage the pursuit of visual observing. It’s open to everyone that is interested, and if you are able to contribute notes, drawings, or photographs, we will be happy to include them in our monthly summary. Observing is not only a pleasure, but an art. With the main focus of amateur astronomy on astrophotography, many times people tend to forget how it was in the days before cameras, clock drives, and GOTO. Astronomy depended on what was seen through the eyepiece. Not only did it satisfy an innate curiosity, but it allowed the first astronomers 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 is the tradition we are stressing in the observers challenge. By combining our visual observations with our drawings, and sometimes, astrophotography (from those with the equipment and talent to do so), we get a unique understanding of what it’s like to look through an eyepiece, and to see what is really there. The hope is that you will read through these notes and become inspired to take more time at the eyepiece studying each object, and looking for those subtle details that you might never have noticed before. Each new discovery increases one’s appreciation of the skies above us. It’s our firm belief that careful observing can improve your visual acuity to a much higher level that just might allow you to add inches to your telescope. Please consider this at your next observing session, as you can learn to make details jump out. It’s also a thrill to point out details a new observer wouldn’t even know to look for in that very faint galaxy, star cluster, nebula, or planet.
NGC 6946 (Caldwell 12) – The Fireworks Galaxy – Spiral Galaxy Cepheus

NGC-6946, also known as ARP 29 or Caldwell 12 is known as the Fireworks Galaxy. It’s a face-on spiral galaxy and lies approximately 22 million light years away. William Herschel discovered it in September, 1798. Nine supernovae have been discovered within the galaxy. It’s highly obscured from us by interstellar dust. It shines at mag. 9.6.

It’s fairly easy to locate on the border between Cepheus and Cygnus. Through smaller scopes it appears as a round smudge but through larger optics, maybe 10-inch or more, the spiral structure may be visible depending on sky conditions and the observer’s eye. What is particularly interesting about this object is that if you were using a wide-field eyepiece, there’s a nice open cluster nearby, NGC-6939 that can be squeezed into the field of view. If the scope is large enough, the view of the spiral structure of the galaxy and the sprinkling of the open cluster provides a spectacular view. An added bonus if the optics are big enough is the small and obscure UGC-11583, a mag. 14.3 galaxy that appears as a faint oval smudge. For most challenge members, this small galaxy is beyond reach.

The main challenge is, of course, the galaxy itself. The faint round glow may or may not reveal spiral structure, depending on aperture, sky conditions, and one’s eyes. However, within that glow one might be able to detect the twinkling of several faint stars superimposed upon that glow, giving the galaxy its name.
Observations/Drawings/Photos

Jaakko Solaranta (see Jaakko Solaranta.jpg): Observer from Finland

The challenge would like to welcome our first international participant. He’s a Finnish deep-sky observer and has been observing the night sky for 15 years, with a main focus in deep-sky observing and sketching. He prefers using smaller instruments such as his trusty 8-inch Dobsonian reflector and 3 smaller refractors that he commonly uses for travelling purposes. He currently writes a deep-sky observing column, every other month, for Finnish astronomy magazine "Tähdet & Avaruus" (Stars & Space) with legendary deep-sky observer Risto Heikkilä.

NGC-6946 – "The Supernova Factory Galaxy" – is situated very close to the Cepheus’ border but actually hides in Cygnus and is the brightest galaxy in the entire constellation. Without the extinction from the Milky Way, it would be even brighter by roughly 1.6 magnitudes. NGC-6946 forms a great pair with the fairly rich open cluster NGC-6939 and is an especially lovely view with small apertures and binoculars. My last proper visit to NGC-6946 was back in 2009 when I was writing a column about observing conditions (NELM, background brightness and seeing) and how it effects deep-sky objects in general. I prepared two sketches of NGC-6946 from suburban locations – one under poor conditions (NELM 5.4), one under average conditions (NELM 6.0) and the final one, yet to be made, under good conditions (NELM 7.4). This would let the reader see how much of an impact light pollution has on everyone’s beloved deep-sky objects. The observing conditions in that September were typical of rural Finland without light pollution, humid and +6°C (43°F). I estimated the naked-eye limiting magnitude (NELM) to be close to 7.4 in Ursa Minor by glimpsing HD 136727 quite easily a few times. In total, I observed the galaxy for a solid 1 hour, 42 minutes up to when it was near zenith (altitude ~77° ) for the best view. My notes of the session read:

“Plainly visible in the 6X30 finder forming a pair with NGC-6939. At the eyepiece, the core of the galaxy is fairly faint, slightly elongated and displays a star-like core at high magnification. 12.5mm eyepiece (96X) shows this low surface brightness galaxy at its biggest but the best view, detail-wise, comes @ 160X. Using careful sweeping, trying to detect even the
faintest of variations in background brightness, the halo extends to a large size of roughly 10' X 6' and is elongated in E-W direction. The halo touches the mag. 11 star in the S, as well as two mag. 13 stars in the N. @ 96X, the disk is mottled and a strong spiral arm can be spotted running from the northern side of the halo to the E. There is an additional brightening in the E corner of the halo and it might be connected to the same spiral arm as mentioned above. The details are, however, far too faint for a proper gaze. There is another spiral arm visible running E from the nucleus toward south and ending to a mag. 12 star. On a few occasions, I suspected the spiral arm continuing more to the W but this is probably just an illusion. The brightening surrounding a mag. 14 star, SW from the nucleus is a true detail but it’s uncertain if this feature is a HII region or a simple, faint double star at the edge of visibility. There are two other brightenings on the W side of the galaxy but these were seen only twice using a 6mm eyepiece (200X) and are yet again too faint to be sure if they’re true detail or not. There is probably a third spiral arm in the galaxy as well. This starts from the SW side of the nucleus and continues to the north to a mag. 13 star. There are several very faint stars in the spiral arm so without a doubt they again contribute to the brightness of the spiral arm and make it appear brighter than it really is. It’s also possible that the entire arm is nothing more but a bunch of very faint stars making the eye and the brain play tricks on your mind. I didn’t detect a particularly irregular pattern in the spirals and this sketch shows everything I could even suspect from the galaxy’.

So, when viewing this wonderful galaxy, keep looking. The details are shady and vague but once seen, the feeling is quite rewarding!
I attended the monthly star party Saturday night September 24, 2011 at the Kamikani ball field on the southwest side of Kaua‘i. It was a cloudless night with mag. 6 transparency and seeing 1-1.5 arc sec. This was the perfect night for a star party!

I brought my 14-inch f/6 Dobsonian telescope to the ball field, arriving at sunset. By the end of astronomical twilight, I was ready to observe. The nice thing about Hawaii is that the temperature only varies about 10° from high to low. So, with the telescope in my car with the a/c running on the drive out, the 14-inch mirror was at ambient temperature when I set it up. Under these conditions, it held collimation all night long!

Of course, NGC-6939 was also on my list to observe this night. NGC-6939 is a mag. 7.8 compact open star cluster. The cluster is irregular, not circular in shape and contains approximately 70 resolvable stars, the brightest around mag. 12. The cluster resides 5,900 light years away.

NGC-6939 is located 2° southwest of the mag. 3.4 star Eta Cephei. So, I started at Eta Cephei and centered the cluster’s location in my 9X50 finder scope. I had considerable difficulty seeing the cluster in the finder, but one look in the eyepiece, I knew I was on the cluster. I used a 26mm eyepiece providing magnification 82X.

No stars stood out in the cluster, just scores of stars everywhere within the 10 arc minute diameter that the cluster spans. I panned the telescope 20 arc minutes to the southwest bringing the cluster to the edge of the field of view. There on the opposite edge of the field stood NGC-6946.

NGC-6946 is a mag. 9 face-on spiral galaxy. Like NGC-6939, it spans 10 arc minutes. He couldn’t make out the spiral arms, nor was I expecting to, but it was exciting to see the galaxy and star cluster in the same eyepiece field of view.

I took the attached picture of this celestial pair in September 2008 using a 102mm (4-inch) f/7.9 refractor with an SBIG ST-2000XCM CCD camera. The exposure was 60 minutes. The field of view was very close to what I saw in the eyepiece that Saturday night. The camera just picked up more details in the galaxy than I could see with my telescope.
The galaxy itself and the background "glow" of the open cluster NGC-6939 were drawn into the frame early-on in order to serve as references both as to where the field should be centered in the eyepiece and where certain stars should be positioned via triangulation of other objects in the field. I first started with my 32mm eyepiece to draw the objects’ positions and get a base of the surrounding star field. This could be done by drawing the brightest stars in first, which only served as references when I increased the magnification to 200X and went about the entire field and recorded the faintest members relative to the previously recorded members.
Buddy L. Barbee: Observer from North Carolina

This observation of NGC-6946, the Fireworks Galaxy, was made Monday, August 22, 2011 at the club field near Pilot Mountain, NC. I used a 10-inch Dobsonian with a 10mm eyepiece for a magnification of 92X. It was a beautiful clear night with a mild 68°F temperature. Even though the humidity was low, the naked-eye limiting magnitude was only 5.4 to 5.6 depending on where I looked.

I located NGC-6946 with the 9X50 finder scope. The galaxy was much fainter than the open cluster NGC-6939 that was only about 30 arc minutes away. In fact, I thought that NGC-6939 was the galaxy until I looked at it in the telescope. With the 24mm eyepiece at a magnification of 50X, I could just see both the cluster and the galaxy in the same field-of-view. The galaxy looked like a very faint hazy spot and the cluster was a spot of sugar grains poured out on black construction paper. I upped the magnification to 92X using a 13mm eyepiece. At first, the galaxy only looked like a large dim hazy spot. After looking at it for a couple of minutes, I noticed that it was longer in a northeast to southwest direction and appeared to be approximately 17 arc minutes long by 9 arc minutes wide. The galaxy is only moderately brighter in the center and without any noticeable nucleus. After spending some more time observing it, I started to see some gaps in the haze that started to show the spiral arms. Only two of the arms were hinted at. There are perhaps as many as 5 or 6 very faint field stars superimposed on the galaxy, that were only seen with averted vision. Most of these would blink in and out of view with the changes in seeing. I only showed the most visible of these.

I think that observing from a darker site would’ve shown much more detail in this dim face-on galaxy and hope to get the chance to do so from the Blue Ridge Parkway soon.
At first look it is a very dim hazy spot. After looking for a minute or two, I noticed it is harder in a Northwest to Southeast direction. After looking more more you start to notice gaps in the misty haze. I think from darker skies you would see much more in this galaxy.
Roger Ivester: Observer from North Carolina

My first observation of NGC-6946 was in October of 1992. I used my 10-inch reflector, with a 20mm eyepiece at 57X and was observing from my backyard. My notes were very brief: Faint and large with low surface brightness. Once found easy to see.

October 4, 1994, 10-inch @ 114X: A triangle of three bright stars to the south. The surface brightness was very low, and a brighter nucleus was noted. Several faint stars could be seen superimposed in the galaxy, and the edges faded very gradually. At low power, the galaxy appeared as little more than a faint glow, with a mostly round shape.

October 26, 1994, 10-inch @ 114X: Very large and easy to see. I don’t think that the spiral structure could be seen during the last observing session.

There have been many other observations since 1994, always looking for the spiral structure that I noted during an earlier observing session.

September 29, 2011: Observing from a dark site in the South Mountains, about 20 miles north of my home in Boiling Springs, North Carolina. I observed with Steve Davis, my good friend and observing partner of many years. He brought a 14.5” reflector, however, the skies and transparency were very poor due to high moisture. The NELM was very close to 5.0, possibly a bit less. When using 108X, the galaxy was fairly easy to see, oval in shape, with a brighter more concentrated middle. However, due to conditions, there was no trace of spiral structure. We were both disappointed. On a good night, this site would allow for a NELM of 7.0 or better.

October 2, 2011: Observing from my backyard in Boiling Springs, NC with superb conditions. The NELM from my moderately light polluted backyard was 5.6 with excellent seeing. My 10-inch presented the galaxy as fairly dim, a brighter more concentrated central region, with quite a few faint embedded stars. With careful viewing, and spending almost two hours looking at this galaxy, during fleeting moments, I could finally, at last confirm spiral structure. I could see a spiral arm with averted vision, coming out of the east side and curving south. There were other areas of spiral structure noted almost throughout the galaxy, however, this was very difficult, and was fleeting at best. After nineteen years of attempting to confirm spiral structure, I was both excited and pleased. It had been a long wait, but for sure was worth it.
NGC 6746 Galaxy Lenticular

Sunday, December 2, 2017
Location: Beavard
Bowie Station, North Carolina
Conditions: 3.6 NEIM
Humidity: 64%
Temp: 42°
Scope: 10-Inch
16mm @ 104x FOV: 0.99°

Description: Very low surface brightness, embedded from stars, around visual presence. Very delicate with binoculars.

[Signature]
At first glance in my 4.7-inch refractor at approximately 32X, NGC-6946 appeared to be not much more than a hazy smudge in a fairly rich star field with stars of various magnitudes. Closer inspection revealed a distinct but yet fuzzy core surrounded by an oval haze with short arms curving off each end of the oval. The right side of the galaxy was more defined than the left. This may be because there were more foreground stars below the galaxy, where the galaxy's lower set of arms were lost in the star glow. Not much in the way of detail was available at this magnification. If my FOV calculations were accurate, NGC-6946 took up about 5 arcminutes in my 1° FOV.

In the 10-inch SCT, NGC-6946 appeared to have a bright core center in a sizable oval of inconsistent density. Irregular spiral arms sprouted off opposite ends of this oval. The two sets of spiral arms were probably what gave the galaxy its nickname of "The Fireworks Galaxy". The somewhat irregular pair of arms gave NGC-6946 the appearance of a Chinese spinning sparkler. These thick arms split into at least two discernible branches that quickly spread apart. The outer arms spiraled less lightly than the inner arms, contributing to the rapid spreading of the distance.
between the arms. In my 10-inch SCT image, the upper arms seemed to separate more abruptly than the lower arms. The inner upper arm appeared to wind back tightly and stretched out to a brighter star at the end of the chain of five stars that increased in magnitude as you moved away from the galaxy. At longer integrations under darker skies, it might be possible to see the full extension of the galaxy's spiral arms not visible in these short exposure images.

The 4.7-inch refractor image is a single frame, 35-second integration. The 10-inch SCT image is also a single frame, but because of the larger aperture, the integration is only 20 seconds. My observations and these images were captured during the annual LVAS Star Party and Campout at Cathedral Gorge State Park, outside of Panaca, NV on 24 September 2011.
Fred Rayworth: Observer from Nevada

I first observed the galaxy in August 2005 with my homemade 16-inch f/6.4 scope from Lee Canyon Weather Station in Nevada at 6500 feet. I used a magnification of 70X. I only noted that it was sort of round but didn’t note any other distinct features that evening.

My next observation was quite different. It was in August 2011 at the Desert National Wildlife Refuge just north of Las Vegas using my commercial 16-inch f/4.5 scope. Sky conditions were less than ideal with a bright sky and a lot of haze, yet I saw my best view yet. It had a nice faint spiral shape. Arms extended out with faint traces of a clockwise rotation. Very nice and more defined than M-33 but much smaller. A few superimposed stars but couldn’t see them very well.

The best view yet came on September 22, 2011 at Cathedral Gorge State Park in East Central Nevada at an altitude of 4,800 feet. Sky conditions were almost perfect. This was the night I saw all 11 IC/NGC galaxy knots and bright nebulae in M-33. NGC-6946 came alive. The spiral arms were distinct in a spiral formation with multiple stars twinkling amongst them. Overall, the structure appeared slightly lumpy, especially with averted vision. I noticed two bright stars off to one edge. What made the view even more spectacular was that with the 82° apparent field eyepiece at 102X, I was able to squeeze in nearby open cluster NGC-6939. It sparkled with a scattering of mostly even magnitude stars. I didn’t notice any particular color. Another bonus was just on the edge of the field I detected a very faint oval smudge which was UGC-11583, an obscure mag. 14.3 galaxy. To see it proper, I had to shift the view and center it and look with averted vision. However, I was still able to see it with the other two objects in the field, just not very well. It was still a nice bonus. My drawing reflects all three objects though the details reflect each object as they were centered rather than how they looked in the actual field of the eyepiece.
NGC- 6946
NGC- 6939
UGC- 11583
102 X
Gus Johnson: Observer from Maryland. NOTE: On April 19, 1979, Gus Johnson, visually discovered Supernova 1979C in spiral galaxy M-100. NASA announced on November 15, 2010, there was evidence of a black hole as a result of this supernova explosion.

NGC-6946

This large, dim galaxy has had a number of supernovae which can be difficult to find due to the many foreground stars. "Deep Sky Monthly" asked if an aperture under 6-inch could show this galaxy. On July 14, 1980 I tried my 4 ¼-inch f/7 Newtonian at 38X and failed to find it.

On a very clear October 16, 1985 evening, my 8-inch at 58X showed it readily and 116X showed some foreground stars.

I saw it directly in the 4 ¼-inch at 38X on October 8, 1986 while my 2-inch f/12 at 25X needed averted vision.

With my 10X50 binoculars, I saw both the galaxy and the cluster (NGC-6939) on October 8, 1986. The galaxy was a bit dimmer than the cluster.

NGC6939

This is a fair-sized but dim cluster of stars that is barely resolvable in my 6-inch f/7.8 Newtonian at 59X. 118X does much better. There seems to be a dense area that is almost nebulous. 118X shows a string of four stars almost tangential to the cluster, one of which is double aligned at right angle to the string. October 17, 1982

With my 5-inch f/4.8 Newtonian at 60X, I saw a mere sprinkling of stars over the glow of the cluster. November 15, 1982

With my 2-inch f/12 refractor at 25X I could see the cluster and my 4 ¼-inch f/7 Newtonian at 38X hinted at a few stars. October 8, 1986

With my 10X50 binoculars, the cluster was a bit brighter than galaxy NGC-6946. September 30, 1999