MONTHLY OBSERVER'S CHALLENGE

Las Vegas Astronomical Society

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December 2011

NGC-598 (M-33) – Triangulum Galaxy in Triangulum

Introduction

The purpose of the observer's challenge is to encourage the pursuit of visual observing. It is 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 is 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 is 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 is 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-598 (M-33) – Triangulum Galaxy in Triangulum

Messier 33 was probably discovered by Giovanni Battista Hodierna sometime before 1654. It was later independently discovered by Charles Messier in 1764 and given the designation M-33. When William Herschel created his catalogue, he tried to be careful not to include any of Messier's objects but M-33 was an exception and it received his designation, H-V-17 in 1784. M-33 also later received the designation NGC-598 for the New General Catalog.

M-33 is a face-on spiral galaxy that shines at a mag. 5.72. That would seem to be within the range of limiting visible magnitude under dark skies. However, because of the low surface brightness, it would be a challenge unless under the most ideal conditions. Even in a telescope, because of the spread-out nature and low surface brightness, this object can be easy to miss.

Within the galaxy are at least eleven to fourteen numbered nebulous regions, with either NGC or IC designations. The brightest is NGC-604. This object is visible in modest apertures and should be within range of most of our challenge members if sky conditions are favorable. There are also a number of globular clusters buried in the spiral arms, each under a different numbering system starting with C. Most are beyond the range of backyard telescopes. However, those with cameras should be able to pinpoint many of them.

Observations/Drawings/Photos

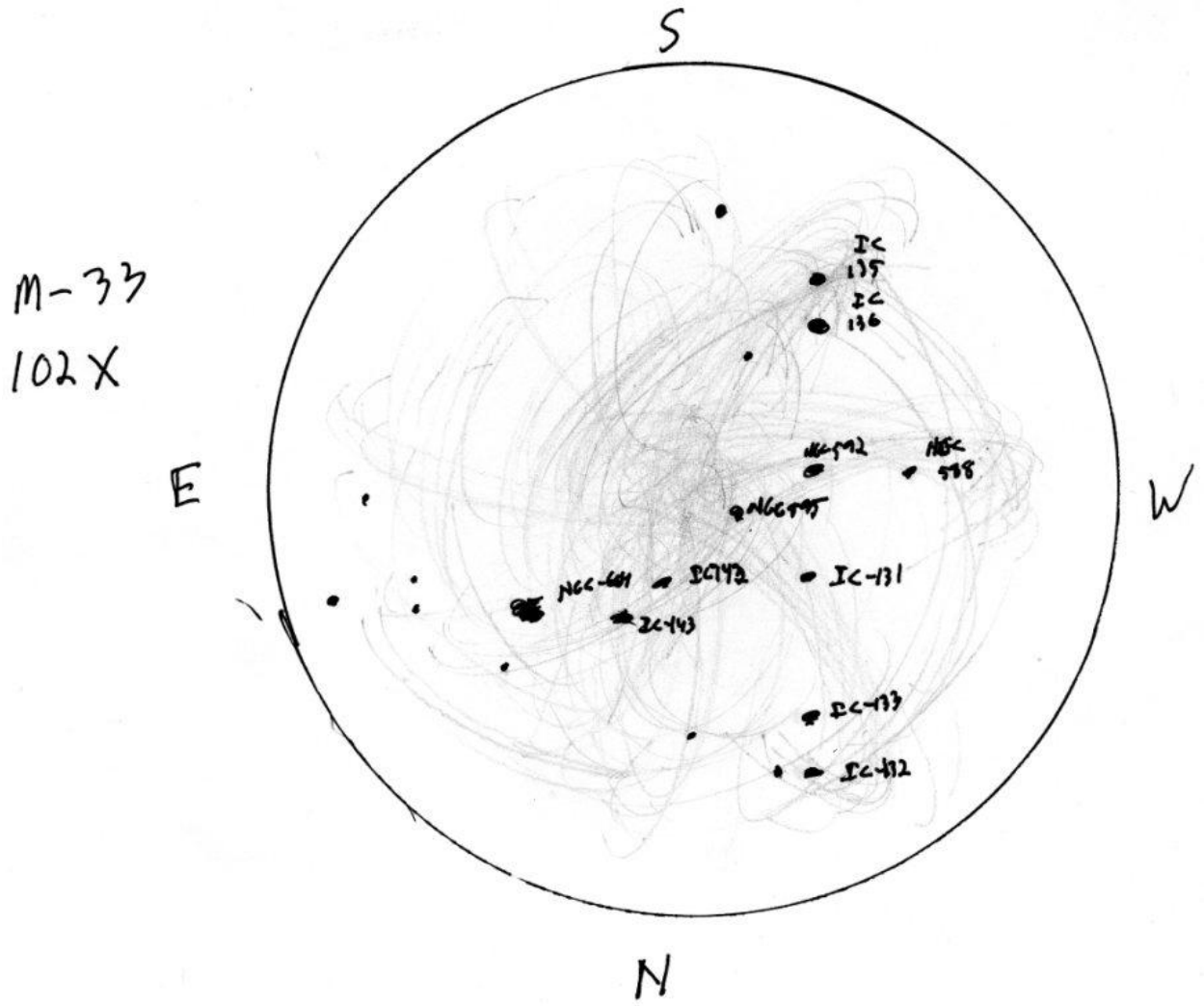
Fred Rayworth: Observer from Nevada

My first recorded observation of M-33 was with my homemade 8-inch f/9.44 reflector in July of 1982 from Eurovillas, Spain. I noted just a hazy patch. Since then I've observed it many times with a variety of telescopes, often not even bothering to record it. However, for this challenge, knowing how erratic the weather and observing opportunities could be, I looked ahead and took the opportunity to study it in much more detail than ever before on Sep 22, 2011 at Cathedral Gorge State Park in central eastern Nevada. At an elevation of 4,800 feet, the night turned out to be cool, clear and calm with a few clouds that moved through the area but left without interfering with my observing. In fact, that evening was the best of the three I was there.

Before leaving Las Vegas, I took time to print out a map of all the eleven IC and NGC galaxy knots identified in my Megastar atlas. My goal was to try and spot every one of them. The challenge was to figure them all out with the image upside down and backwards from the map! Using my 16-inch f/4.5 and a magnification of 102X, my notes were as follows for that night:

"Wow! Full of knots and patches. Saw all eleven of them. Was able to positively identify all of them from the Megastar map as IC and NGC objects. This was probably the best I've ever seen it. Even saw spiral structure though even then, it was pretty vague at best because of LSB."

My usual artistic "wizardry" is evident in the accompanying drawing. It was done with pen (stars) and pencil (spiral structure and nebulosity). It's just an impression of the spiral arms and is in no way meant to be a truly accurate representation of the galaxy. However, I took special care to try and accurately depict the placement of the little blotches, giving them their proper designations, from what I saw in the eyepiece. I spent around a half hour at the eyepiece. That was much longer than I've ever spent on a single object.



In October, I had another chance to observe it from Furnace Creek in Death Valley with the 16-inch f/4.5. I was able to spot the same patches with the same magnification, same scope. As a goof, I tried 40X but it was so small, I couldn't see much of anything. At 229X, it washed out so much detail, I couldn't see many of the knots. It seems that for this object and with my scope, at least under the conditions I observed from, 102X was the ideal magnification. I've never been a big fan of high magnification on extended large objects. Planetaries? Maybe.

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.

September 17, 1966, October 1978, October 1980: Could see with the unaided eye.

September, 1982: 8-inch reflector at 116X. Could easily see NGC-604 which appeared mostly round.

September, 1987: Easy with 2-inch refractor. Large oval with a sprinkling of stars around the edges. A nice pair of double stars could be seen with George Kelley's 12.5-inch.

Dr. James Dire: Observer from Hawaii.

On November 19, 2006, I took this image from Wildwood Pines Observatory in Earl, NC. I used an 8-inch f/7 Newtonian telescope with a Parallax HD150 mount. My camera was an SBIG ST-2000XCM CCD Camera set at 0°C. The exposure times were 5 X 5 minutes for a total of 25 minutes. Processing was done with CCDOpts with DDP filter, CCDSoft, Photoshop.

Jaakko Solaranta: Observer from Finland

There aren't many observers out there who haven't seen the Triangulum galaxy, Messier 33/NGC-598. It's very bright mag. 5.7(v) according to Wolfgang Steinicke's latest data, very large (68' x 41') but has somewhat low surface brightness of 14.2. This is why city observers often find the galaxy difficult to see under poor conditions. However, let's be honest. Even under modest skies and medium aperture, the Triangulum galaxy is easy to see, Its spiral structure is one of the easiest to make out and it's probably the easiest galaxy in the entire northern hemisphere to resolve. Even with my 3-inch poor-quality $100 refractor, I can make out two of the spiral arms with averted vision under dark skies (NELM 6.8 – 7.4) and at least 4 separate HII regions of star associations. The same feat can be achieved from my light-polluted backyard (NELM 5.2 – 6.0) during nights of good transparency, but this time using a larger aperture telescope which is my trusty old 8-inch DSE. Under dark enough skies, M-33 is also fairly easy to see with the naked eye – using averted vision - as an elliptical haze. Looking back in time, modern sources often credit Giovanni Battista Hodierna (1597-166) as the discoverer of the Triangulum galaxy, but it is far from certain. It might be that Hodierna actually saw NGC-

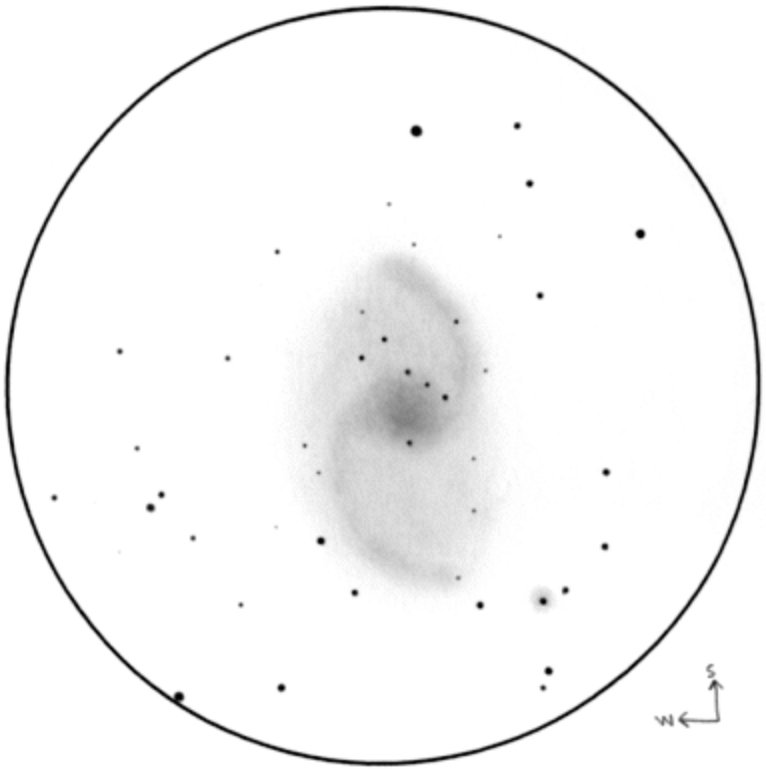
752 but nobody can know for sure. At least Charles Messier logged the galaxy in August of 1764.

Coming back to the telescope, at least for me, the Triangulum galaxy is the best galaxy in the northern hemisphere when it comes to extragalactic objects. The easiest targets in M-33 are the numerous HII regions and stellar associations. Globular clusters are numerous but a lot fainter than the ones in Andromeda Galaxy, with the ten brightest ranging between mags. 15.9 and 17.6. There is one little problem when it comes to the HII regions. Finding an appropriate designation for an object can be quite frustrating. This is mostly thanks to Guillaume Bigourdan whose original coordinates are inaccurate. Many modern sources are adding to the confusion with wrong designations.

When it comes to HII regions, no introduction is needed when it comes to NGC-604. The HII region is the bomb. It's nearly 1,500 light years in size, estimated to come only second to the Tarantula Nebula in the entire local group of galaxies. The Orion nebula (only 35 light years in size) truly pales next to this beast. With these characteristics, it's no wonder NGC-604 can be observed with pretty much any telescope and larger binoculars. With a modest size telescope, it looks like a slightly elliptical glow with a brighter center. In my opinion, this is the easiest extragalactic object in the entire northern hemisphere. NGC-206 comes close but its' appearance is more diffuse and its' surface brightness is lower. The brightest individual stars in the central region of NGC-604 are roughly mag. 16. Be sure to locate NGC-588, NGC-592 and NGC-595 on the west side of the galaxy as well. These are bright associations and HII regions visible even with small apertures.

Globular cluster C-39 (Mayall "C") might not look like much but it's something alright. Also known by its GSC number (2293:1339), C-39 has a visual mag. of 15.9 so it's right at the edge of a good 8-inch telescope under pristine conditions. This will be a great challenge and a challenge I haven't yet conquered. C-27 is second the brightest globular cluster in M-33 and is considerably fainter than C-39, being close to mag. 17 visually although the commonly given (v) mag. is 16.5. This will require larger aperture. Coordinates for this one are 01 34 43.7 +30 47 38.

Star B 342 is the brightest individual star in M33 - if you exclude the LBV stars. The star - known as "B 324" - is an A-type supergiant and lies just 6' from the center of M-33 in the star association 67 (A 67) or IC-142. The visual mag. of this star is 15.2 but is this really in M-33 or just another Milky Way star? Lundmark (1921) listed the brightest star in the galaxy to be mag. 15.7 (B). Humphreys, Massey & Freedman proved in 1990 that B 342 is indeed part of M-33 and also the brightest single star in the entire galaxy. Considering the mag., this should be a fairly easy catch with telescopes 8-inch and larger. Coordinates are 01 33 55.9 +30 45 30.4. Star GR 290 (Romano's star) is a LBV (Luminous Blue Variable) star. "It shows eruptions with amplitudes of more than 1 mag. and timescale of about 20 years and smaller oscillations with amplitude 0.5 mag. and a period of about 320 days" [ROMANO'S STAR IN M-33 - LBV CANDIDATE OR LBV? R. Kurtev et al. 2000.]. The star varies between mag. 16.5 and 17.8 so it isn't exactly for medium apertures. Don't forget to check out the LBV stars Var B, Var C and Var 83 (absolute mag. of -11.1!) in the galaxy. As with Romano's star, these are truly massive stars varying between mags. 15 down to 16.5 and from time to time display eruptions making them even brighter. For example Var C in M-33 is listed as varying between mags. 15.2 - 16.5 making it in range to moderate size telescopes. Good luck!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Jim Gianoulakis: Observer from Nevada

The Triangulum Galaxy is a spiral galaxy approximately 3 million light years from Earth in the constellation Triangulum. The galaxy spans approximately a diameter of about 50,000 light years. It is catalogued as Messier 33 or NGC-598. It is the third-largest member of the local group of galaxies, which includes the Milky Way, the Andromeda Galaxy and about 30 other smaller galaxies. Triangulum is thought to be home to 40 billion stars, compared to 400 billion for the Milky Way, and 1,000 billion stars for Andromeda. It is one of the most distant permanent objects that can be viewed with the naked eye.

About 54 globular clusters have been identified in this galaxy, but the actual number may be much higher. The confirmed clusters may be several billion years younger than globular clusters in the Milky Way, and cluster formation appears to have increased during the past 100 million years. This increase is correlated with an inflow of gas into the center of the galaxy.

In 2007, a black hole about 15.7 times the mass of the Sun was detected in this galaxy using data from the Chandra X-ray Observatory. The black hole, named M33_X-7, orbits a companion star which it eclipses every 3.5 days. It is the largest stellar mass black hole known.

Courtesy of *Wikipedia*.

About the exposure:

Mount: Orion Atlas EQ-G / Camera: Orion Star Shoot Pro V2 / Exposures: 10 20-minute sub-frames calibrated with darks no flats/bias.

Rob Lambert: Observer from Nevada

I actually had more fun analyzing my images and comparing them to star charts and sketches that depict the HII knots of M-33, after I got them home. In the past, I've been somewhat disappointed with my observations of M-33. It's a great object to observe, but I could never see enough detail to cause me to linger and really observe it. Because of the Observer's Challenge, I spent much more time observing it on the monitor screen and then studying the images I had captured.

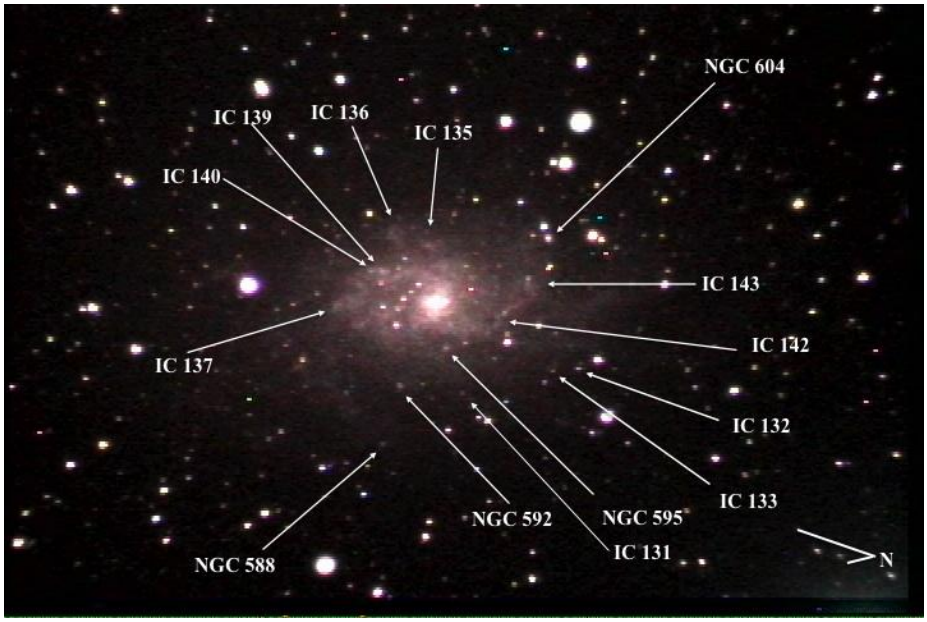
M-33 is relatively bright or relatively dim, depending on one's perspective. Compared to other galaxies I've observed, because M-33 is face-on, its' light is dispersed over a greater area and is therefore dimmer than, say, the almost edge-on Andromeda Galaxy. It doesn't jump out of the monitor like M-31, but is just as beautiful and interesting to study, in its own right.

The Triangulum Galaxy's arms are not evenly endowed. On the western side they are more distinct than on the eastern side, reaching further out from the core than the arms on the other side. There appear to be four major arms emanating from the bright, irregular central core, two coming off the northeastern and southwestern ends of the core, winding counterclockwise around the core. The two coming off the southwestern end are more defined and prominent, with more separation between the two arms. There is a curved chain of five stars superimposed across the southern end, just beyond the core.

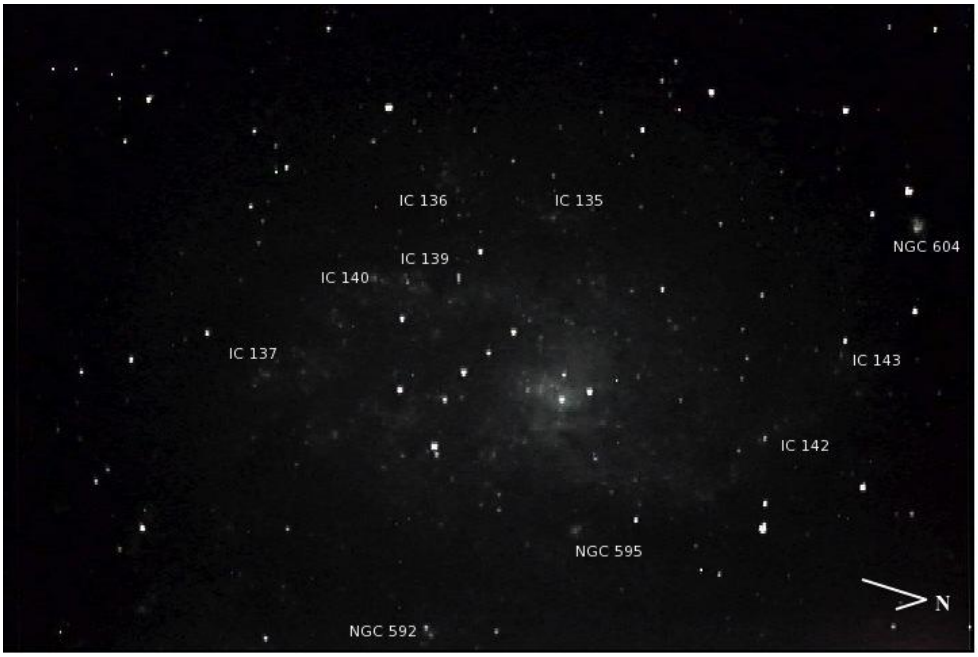
I think I was able to identify all of the NGC and IC HII knots described by Steve Gottlieb in his website article *M-33 HII Regions and Star Clouds*. NGC-588 and NGC-592 are located on the western side of the galaxy in each of the two arms that come off the southwestern end. NGC-592 is closest to the core with NGC-588 being almost the same distance further out from NGC-592, as NGC-592 is from the core. NGC-604, the brighter and larger of the HII knots is located on the outside of the arm that curves to the east from the northern end of the galaxy. The IC knots are almost evenly distributed on the north and south sides of the galaxy's core. They help define the spiral arms, especially the northern arms.

I provided several different images of M-33. The first is an unlabeled wide-field view captured with my ST120 and the Mallincam to give an unobstructed view of the galaxy.

The second is a labeled ST120 view, showing the location of the HII knots.



The third is a closer labeled view of the inner arms of the galaxy, captured through his LX200GPS.



All of the images are 15-second integrations with no post processing. The views are representative of the views I had at the monitor during the observations, although the images on the monitor were much better than what my software will capture. The stars are a bit tighter through the LX200, because the achromatic ST120 has a tendency to bloat the brighter stars.

Roger Ivester: Observer from North Carolina

November 16, 1995: Conditions: Excellent. Location: Moderately light-polluted backyard in Boiling Springs, NC. NELM 6.0

Telescope: 10-inch f/4.5 reflector. Magnification: 57X with a 1º FOV.

Description: Large and faint with low surface brightness, elongated NE-SW, and a brighter more concentrated middle. I saw two spiral arms with careful observing and averted vision. I noted one arm on the SE edge and the other on the NW, however both were very subtle. The texture of the galaxy was very uneven, I saw several knots intermittently, during moments of steady viewing. The outer regions faded very gradually outward. The brightest HII region of the galaxy, identified as NGC-604, appeared bright with an irregular oval shape. A faint star was situated very closely toward the east.

November 18, 1997: Conditions: Fair, both seeing and transparency. Moderately light-polluted backyard in Boiling Springs, NC. NELM 5.0

Telescope: 3.5-inch Maksutov. Magnification: 52X

Description: Brighter middle, large, faint, and elongated.

October 16, 1998: Conditions: Good. Location: Boiling Springs, NC. NELM 5.5

Telescope: 102mm (4-inch) refractor. Magnification: 42X

Description: Large, faint, brighter more concentrated middle, very low surface brightness with an elongated shape. The texture appeared very uniform. This was not an easy object, and would be best observed from a dark site.