MONTHLY OBSERVER'S CHALLENGE

Compiled by:

Roger Ivester, North Carolina

&

Sue French, New York

February 2022

Report #157

M42 and M43, the Orion Nebula

Sharing Observations and Bringing Amateur Astronomers Together

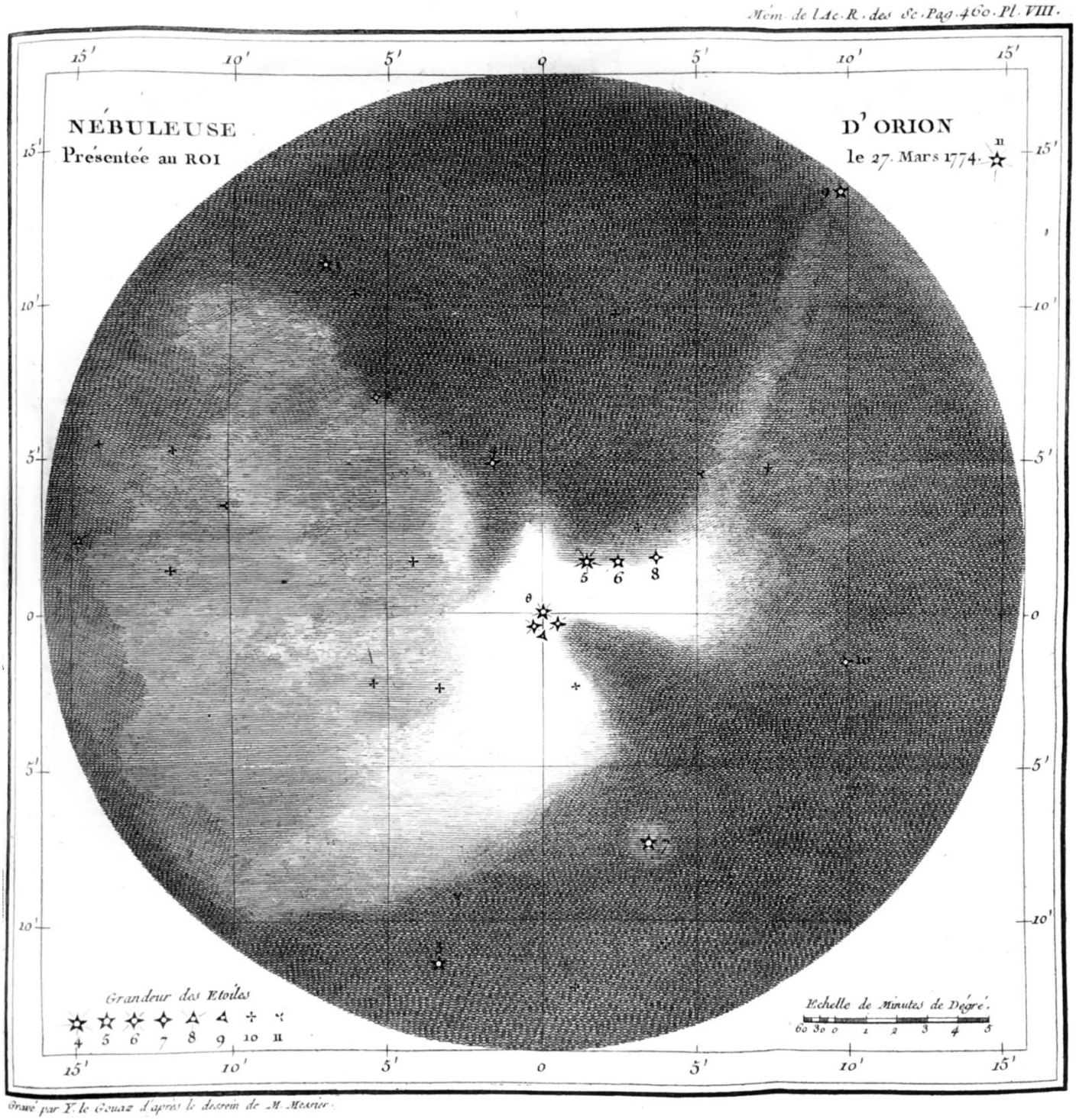
Introduction

The purpose of the Observer's Challenge is to encourage the pursuit of visual observing. It's open to everyone who's interested, and if you're able to contribute notes and/or drawings, we'll be happy to include them in our monthly summary. 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 astronomers 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 Observer's Challenge. And for folks with an interest in astrophotography, your digital 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.

This month's target:

Nicholas-Claude Fabri de Peiresc discovered the M42 (NGC 1976) on 24 November 1610 with a refracting telescope that he'd obtained from Galileo. The part of the Orion Nebula known as M43 (NGC 1982) was first noticed by Jean-Jacques Mairan in 1731, who reported: *close to the luminous space in Orion, one sees the star d of Huygens* [NU Orionis] *currently surrounded by a brilliance very similar to that which produces, as I believe, the atmosphere of our Sun, if it were dense enough and extensive enough to be visible in telescopes at a similar distance*.."

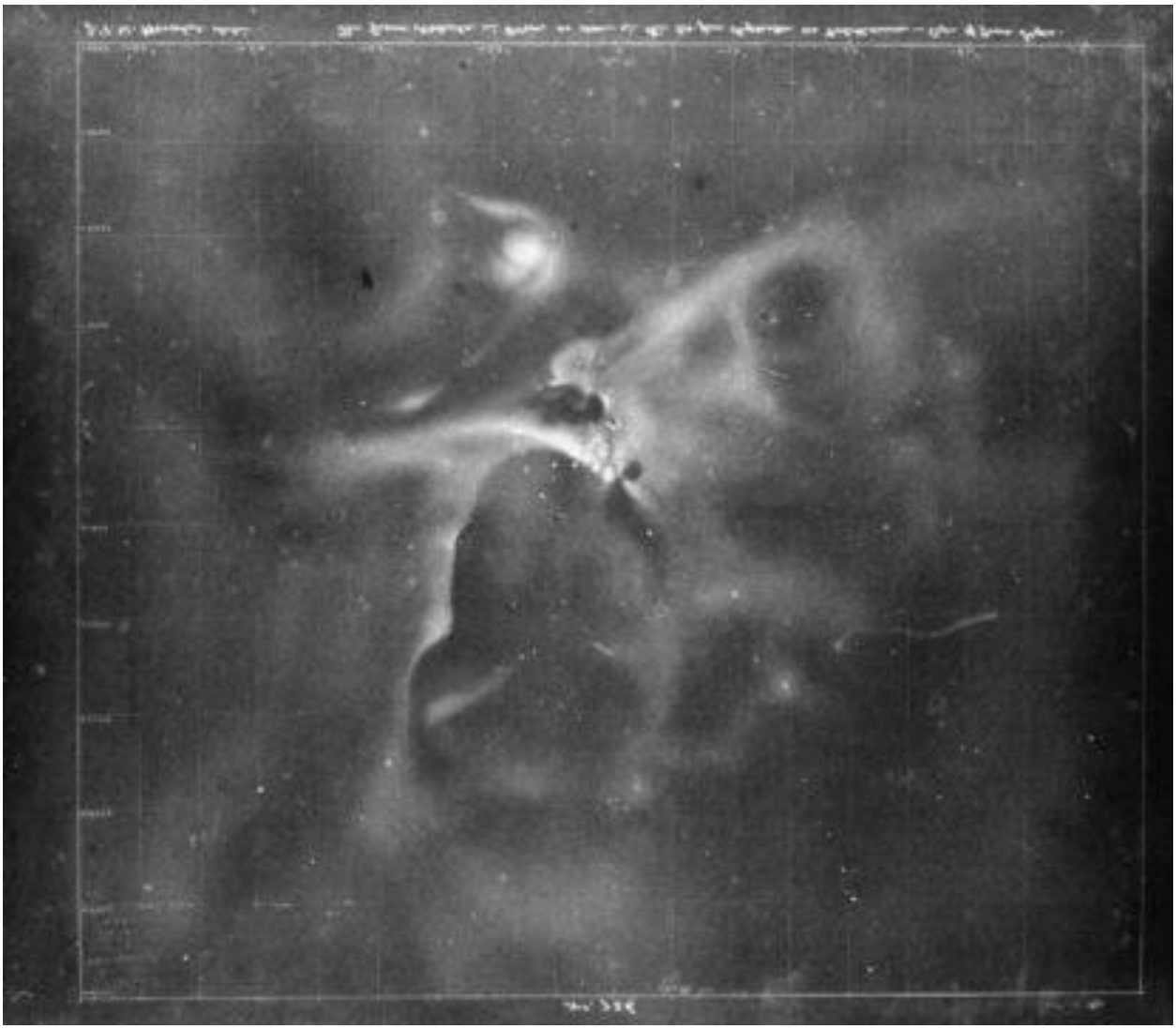
Charles Messier made the following sketch of the Orion Nebula in 1771.



Observing the nebula in 1789, William Herschel styled it as: *an unformed fiery mist, the chaotic material of future suns.*

His son John Herschel described it : *A curdling liquid or surface strewn with flocks of wool – or like the breaking up of a mackerel sky.*

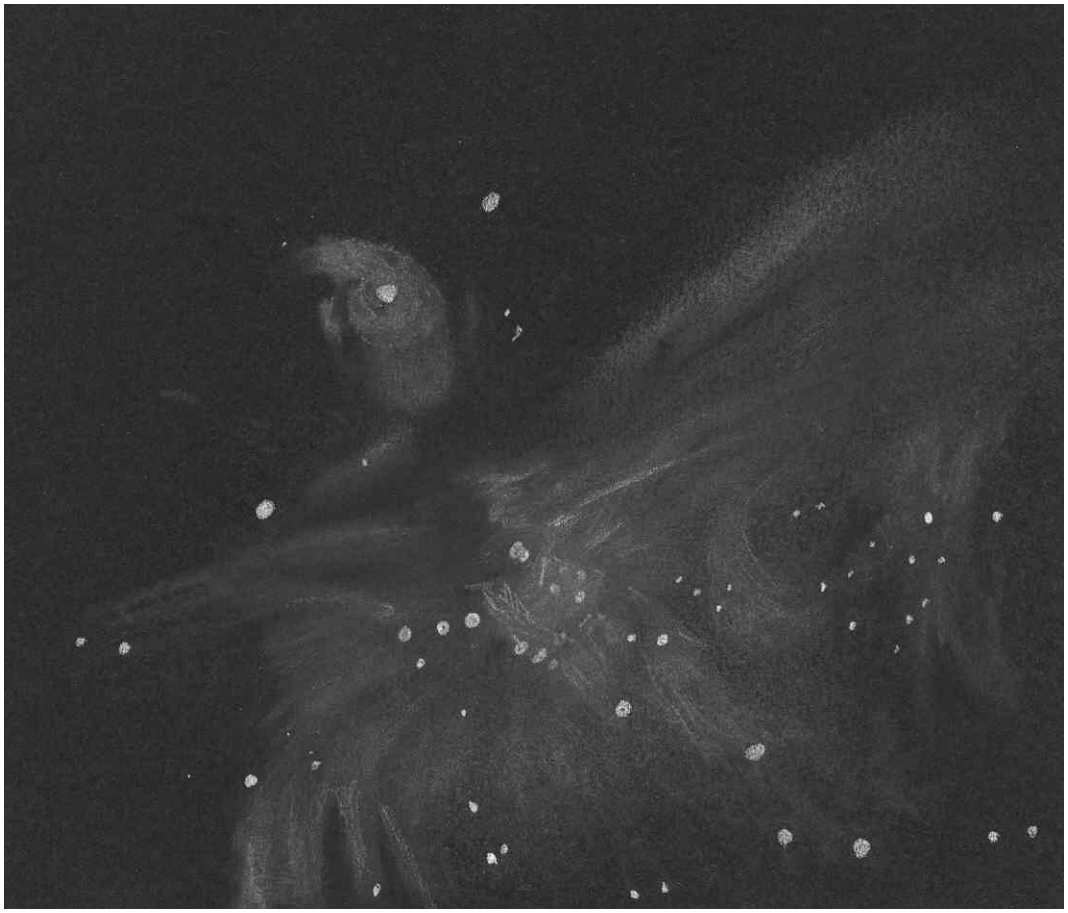
John Herschel's sketch



William Lassell's 1861 sketch. He noted the nebula's pea-green color.

Dale Holt: Observer from England, 30 miles north of London

Now onto the magnificent, the one and only Great Orion nebula M42 with its little sister M43 so very close by. It looked fantastic in the 22mm Nagler eyepiece giving me 80× in the 14″ Using a 2″ UHC filter changed and perhaps enhanced the view but it took away the natural greenish colour and made it look, well rather false and surreal. On the monitor screen through the smaller refractor it looked good too although rather less complex and detailed. I made my first attempt at capturing this very complex object with my pastels. Having visited this nebula literally hundreds of times I was amazed and frustrated at how difficult it was to capture what I saw on paper! Below is my first attempt, I pledge to do better next time!



Jeremy Perez: Observer from Arizona

Observation Notes:

In my ongoing effort to refine my observation and sketches of M42/43, I made a new sketch on January 14. I used most of the previously sketched star field as a starting point so I could spend more time on the nebula. Working within a larger 6 inch circle really helped. The minty green color was striking throughout the nebula, particularly around the trapezium. As for structure, the sketch pretty much tells the story, except for the fact that there was a lot more detail to be squeezed out. I can tell that I'll be coming back again and again for more.

Date/Time	January 14, 2010 – 10:00 AM (January 15, 2010 05:00 UT)
Observing Loc.	Cinder Hills Overlook, Sunset Crater National Monument, AZ
Instrument	Orion SkyQuest XT8 Dobsonian (203 mm dia./1200 mm F/L)
Eyepieces/Mag.	32 mm (37.5X)
Seeing	5/10 Pickering

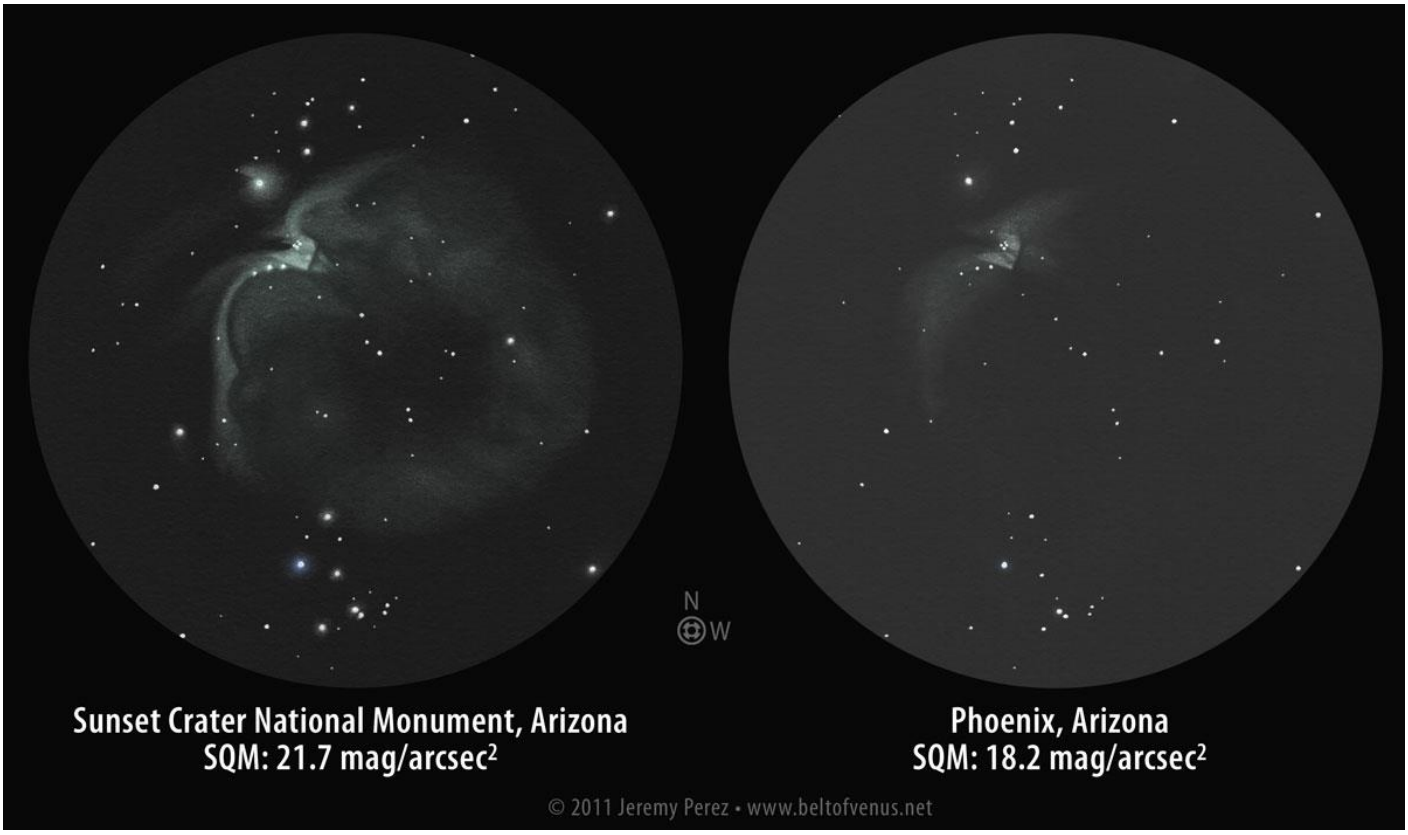
Messier 42 and 43
(Orion Nebula)

JAN 15, 2010 • 05:00 UT

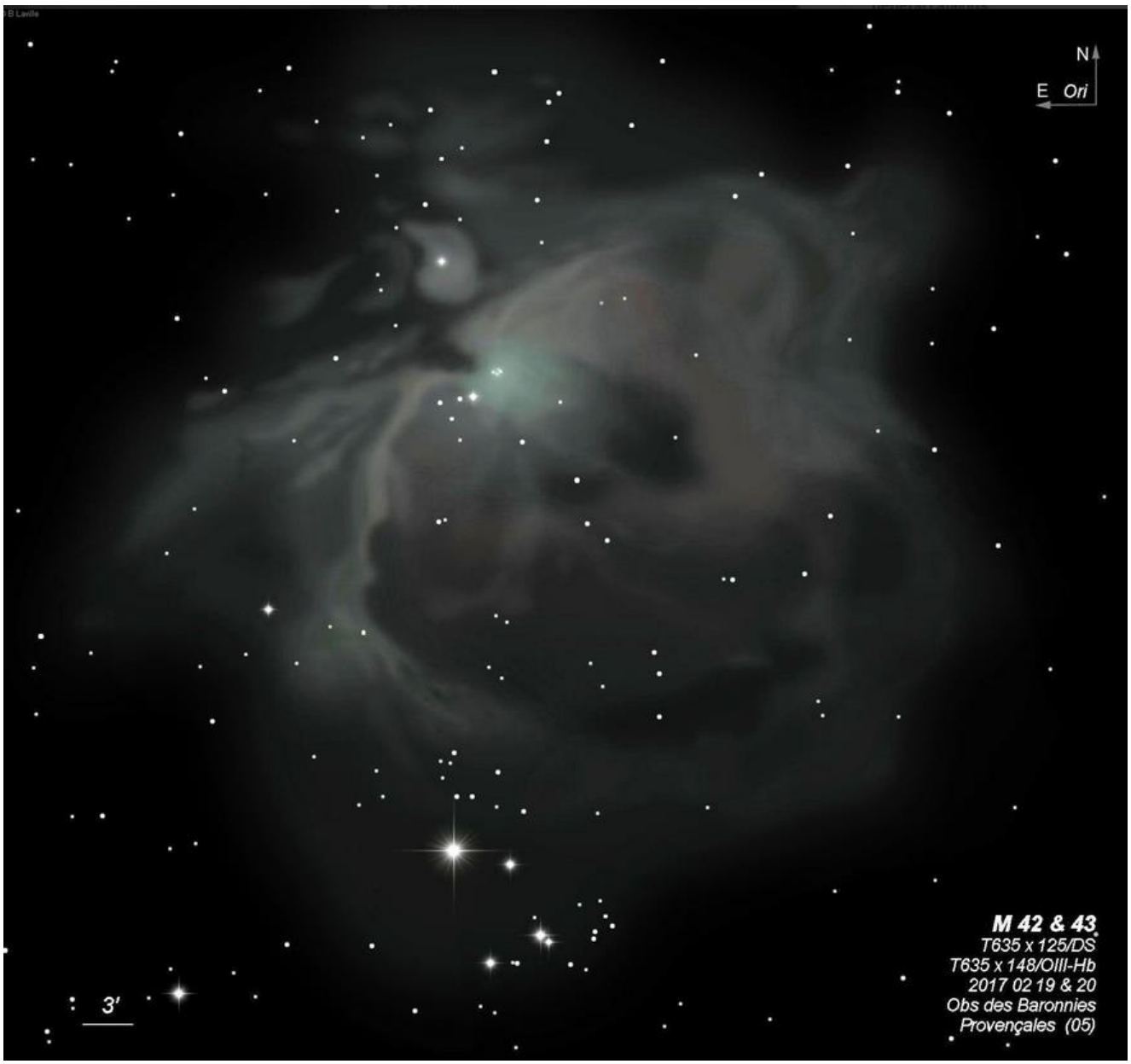
Orion XT8 - 8″ f/5.9 Newtonian
32 mm Sirius Plössl: 37.5X / 88′ TFOV

beltofvenus.perezmedia.net

Sketches of Messier 42/43 from dark sky and light polluted sky



Bertrand Laville: Observer from France



Observations Details

Date of sighting:	21 Feb 2017 18:50 UT
Duration of observation:	120 mins + 180 mins on 02/22
Object position:	Alt: 40.1°, Az: 174.6°
Observation conditions:	21:50 QZ21.50 L60N21.62 s4.5" v6.5VI4 6.6nv T1.5 P1.5 S4/240

Viewing location:	Observatory of the Baronnies Provençales
Telescope:	TN 635 Dobsonian Obsession
Main eyepiece:	Tele Vue Ethos 21mm
Magnification:	148×

The seeing is bad, and it is impossible to magnify more. Nevertheless the image is impressively structured. I decide to start observing with the Deepsky filter, actually its alter ego from Astronomik, the CLS filter.

The contours are very precise, and the isophotes are extremely sinuous. The red color is obvious, without my looking for it, on the wings of the gulf, while all the surroundings of the Trapezium are green – blue.

I use the Capella Observatory image a lot to extract the details, because the seeing considerably thickens the image. After two hours of observation, I plotted isophotes 1 to 7, but M 42 has become low on the horizon, and I no longer have time to observe with OIII and Hbeta. My drawing will therefore have to be completed during a future observation.

The main feature of the sighting is the presence of three pronounced colors in the same field: red, green – blue, and all shades of gray. However, I note, on reading my old observations, that I had noted exactly the same thing, more than 15 years ago, at the T1000 in Puimichel!

×240 Ethos 13mm
The observation was made at incomplete night, at 7:40 p.m. Of course, the 4 main components are obvious, and bright, pure white. E* and F* are easy, also pure white.

But the interest of the observation is that I perceived the two internal components, G* and I*, whereas I was not looking for them. I was of course aware of their existence, but I did not have in mind their exact position; however, they were perceived precisely at their correct location, which validates the observation. They are weak, G* a little less than I* which is borderline

The time to take the notes above, I come back at 7:50 p.m. The night is complete, and the 4 main components are much brighter, even dazzling: E* and F* are difficult, and G* and I* are no longer perceived. The change in the perceived image, in 10 minutes, is surprising.

Note: I did not perceive H* and H'* because, quite happy to discover G* and I*, I did not think of them!

×125 ES 25-100/CLS
The seeing is much better than the day before. The nebula explodes; the nebulae extend well outside the ring, which is obvious and shows a very complex structure. It is perceived much better than I expected, although of course the central regions are much brighter. The colors noted the day before are perceived well outside the center; the H alpha, in particular, is clear in the nebulosities inside the ring.

×150 Ethos 21mm/OIII-12nm
Only the central regions are much more structured; the inner regions of the ring too, but more difficult to analyze, due to lack of luminosity. The filter does nothing, and even less on the outer regions, except the NGC 1980 area, because it reduces the glare of Iota Ori, a true beacon.

×150 Ethos 21mm/Hbeta

The image of the ring is little different from that perceived with the OIII, although darker on the external parts. On the other hand, the central nebulosity disappears completely because my Hbeta Astronomik filter is a filter that cuts the H-alpha, unlike the Lumicon OIII filter (old model).

I realize that I did not observe with my UHC Astronomik filter, which lets the Hbeta through, and which should provide the best images. To do again!

2017 11 15, 01:45, SQMZ 21.09
×148 Ethos 21mm/OIII-12

I resume my observation of 2017 02 21 to refine the perceived colors and the corresponding areas. The observation conditions and the sky are practically the same.

The wings are very bright, especially the SE wing root. The entire area NW of the central area is also very bright. Both wings are an overlay of green, C105, and red, C7, with maybe a little more red. The difference in color between the wings and the central area is striking: this one is not “OIII green, C105”, but water green, C110, and that is also striking.

Uwe Glahn: Observer from Germany

Object: M42/M43 – "Orion Nebula", NGC 1973, NGC 1975, NGC 1977 - "Running Man Nebula", NGC 1981

Binoculars: 20 ×125mm

Field of view: 450×

NELM: fst 7m0+

Location: Gornergrat

You can see more of Uwe's sketches at: http://www.deepsky-visuell.de/

M42/43, NGC 1973/75

10

15.01.2002

Rony De Laet: Observer from Belgium

The Sword of Orion, with a pair of 8×56 binoculars

Orion is a bright constellation. Most of its stars belong to the Orion OB1 association. Such is the case with the "Sword" of Orion, a part of the sky which can be seen with the naked eye as a line of four fuzzy stars hanging under the Belt of Orion.

This region of the Orion OB1 association is filled with very bright stars. Many of these stars are very young giants or supergiants. The brightest star of the scene is Iota. Just a few minutes S of Iota is the double star Struve 747. Its components are only 36″ • apart, but clearly split at 7x. Struve 747 may look a little elongated in the sketch, due to the lower resolution of the rendering. It appears to me that Iota could be the lucida of a little poor open cluster, of which Struve 747 is also a member. The show-piece of the scene is Messier 42, the Orion nebula. My 8×56 binoculars reveal two stars in the middle of M42 : Theta 1 and Theta 2. The latter is accompanied by two fainter stars to the E. The heart of the Orion Nebula is extremely bright. It can be seen with direct vision, also from an urban location. With patience and averted vision, a larger part of the nebula can be witnessed. Several faint stars can be discovered in the fading glow too. The western part of the nebula is the largest and the most obvious "wing" of M42. Its northern border seems to be sharply cut away. As if a dark nebula separates M42 from the fainter Messier 43 a few minutes to the N. M43 looks like a faint star embedded in a misty glow. The dark nebula also curves S as if it wants to separate the Theta stars as well. The southern "wing" is a very diffuse feature. It is the thick and long filament know from the photos, that point towards Iota. With averted vision, this filament can be seen with 8×56 binoculars.
At 30'N of M42, the faint glow of the reflection nebula NGC 1977 shows up around 42 and 45 Orionis. A total of 3 stars can be seen within the nebula.
The final object is the loose open cluster NGC 1981, N of NGC 1977. My 8×56 binoculars show a total of about 10 medium to faint cluster members.
The above mentioned objects are all members of the OB1 association, at a distance of about 1600 l-y.

Site : Bekkevoort, Belgium (51° N)
Date : January 18, 2008
Time : around 20.30UT
Binoculars : Bresser Spezial-Jagd 8×56
FOV: 5.9°

Filter : none
Mount : Trico Machine Sky Window
Seeing : 2/5
Transp. : 3/5
Sky brightness : 19.86 magnitudes per square arc second near zenith (SQM reading).
Nelm: 5.4
Sketch Orientation: N up, W right.
Digital sketch made with Corel Paint Shop Pro X2, based on a raw pencil sketch.

The Sword of Orion, with a pair of 15×70 binoculars

Here is the second binocular observation of the Sword of Orion. This time, I used the 15×70 binoculars. This observation was made on a later date, and under a less transparent sky. The gain in magnification allows for a slightly better resolution of Messier 42. The bigger aperture adds more depth to the object. Both wings are easier to define. Most of the features of the Orion Nebula are easier to see. Messier 43 also shows a clearer appearance. The same is true for the dark channel between M42 and M43. The gain in limiting magnitude is not spectacular.
It may sound contradictory, but NGC 1977 does not appear more prominently. But that can be due to the lesser transparency of the sky.

Site : Bekkevoort, Belgium (51° N)
Date : January 31, 2008
Time : around 21.00UT
Binoculars : TS 15×70 Marine
FOV: 4.4°
Filter : none
Mount : Trico Machine Sky Window
Seeing : 2/5
Transp. : 2.5/5
Sky brightness : 19.60 magnitudes per square arc second near zenith (SQM reading).
Nelm: 5.2
Sketch Orientation: N up, W right.
Digital sketch made with Corel Paint Shop Pro X2, based on a raw pencil sketch.

Sketch follows.

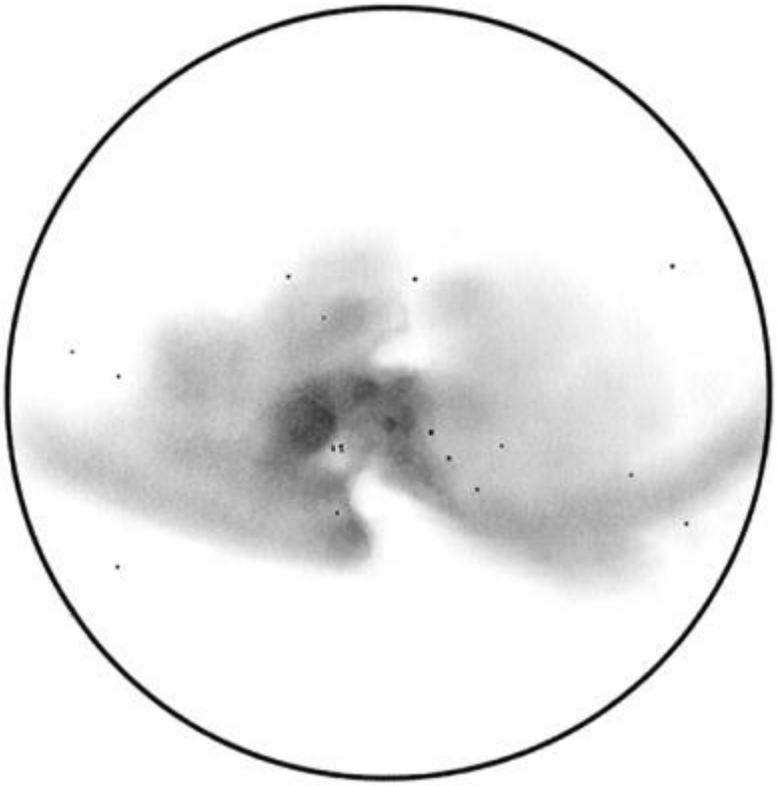

Rony De Laet

Jaakko Saloranta: Observer from Finland

4.5" Orion SkyQuest

Object: The Great Orion Nebula
Obs. place: Viertola, Hyvinkää, Finland (130 m / 426 ft)
Date: 8./9.3.2014
NE Lim.mag: 5.0 (south-west)
SQM-L: 18.40 (zenith)
Background sky: 3 (poor)
Seeing: 5-6 (good)
Transparency: 4-5 (average)
Weather: +3.0°C, humidity ~54%, 52 % moon 34° SW, 1021 hPa, SW wind 4 m /s.

Altitude: 24°
Description: Gorgeous view even with a small aperture and moonlit urban sky.



Orion Nebula with 4.5″ Orion SkyQuest drawn with multiple magnifications

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4.7″ Sky-Watcher

Object: The Great Orion Nebula / Messier 42
Obs. place: Koivukylä, Vantaa, Finland
Date: 6./7.2.2011
NE Lim.mag: ~5.0 (zenith)
SQM-L reading: 17.80 (zenith)
Background sky: 2 (very poor)
Seeing: 6 (good)
Transparency: 3 (poor)
Weather: -6.0°C, humidity ~87%, 1007HPa, snow depth 64 cm

Description: The Orion Nebula is impossible to describe in her whole glory so it is best done in parts.

Trapezium region: This is probably the most obvious feature of the entire nebula. Four stars (A, B, C and D respectively) are visible with medium magnifications such as 58× (52′). Trapezium shows only weak nebulosity in the background. SW of the cluster is the brightest part of the nebula showing a complex structure of uneven brightness. Slightly more to the W is a dark bay this might be the one listed as "Schnecke." Due NE lies the dark bay "Sinus Magnus." Due to the low altitude of the object, seeing more than 4 stars from the Trapezium is quite difficult. I could only a single observation from the Finnish Deep Sky Archive (97 sketches) that shows more than 5 stars from the region despite the large telescopes (12″ and up) and high magnifications used (200× and up). The sketch is that of Riku Henriksson showing 6 stars with a 6″ telescope done at the Tampere observatory at extremely high magnification (1600×).

Sinus Magnus region: The most obvious dark bay in Orion Nebula. It appears as an ear shaped bay (Van Gogh's left ear?) NE from the Trapezium.

Sinus Gentilii region: After "Sinus Magnus" this is the most obvious dark patch in the nebula. It appears as a cylinder-shaped feature in the S edge of the field.

Frons region: This is the brightest part in the SE region - running through from the eastern edge all the way down to Sinus Gentilii. I was, however, unable to see the "islands" in this region although there is a definite sense of "patchiness". There is a faint, elongated dark patch NW of Theta^2 Orionis and a smaller puffs of nebulosity visible in the NE region.

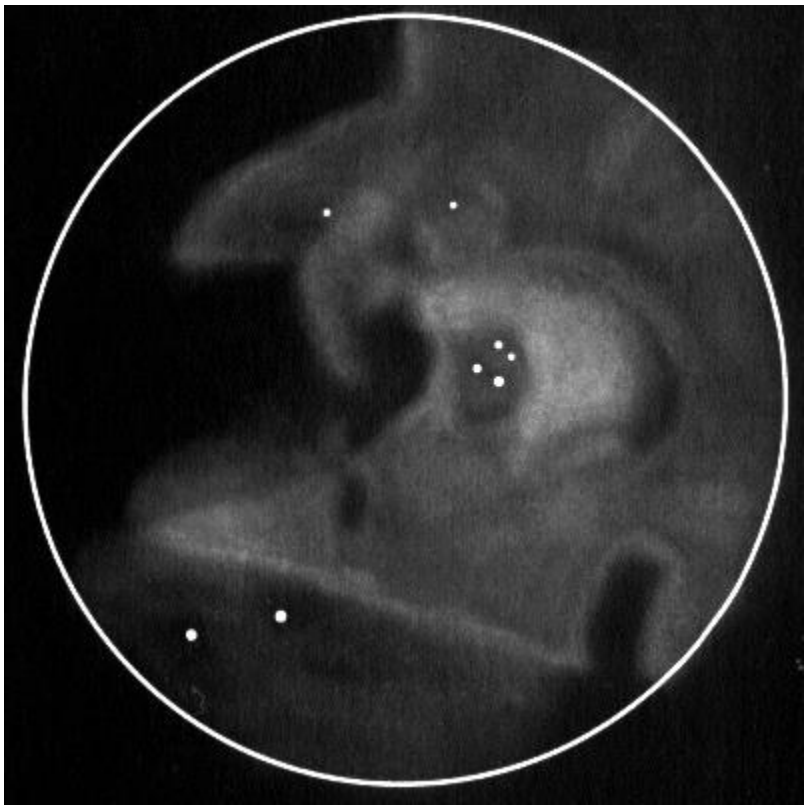
Lacus Secchii region: Visible barely as a darker section in the NW of the Trapezium.

Pons Schroteri region: Slightly brighter extension in the NE edge of the Sinus Magnus. On both sides of V1230 Ori there are two, very faint, darker patches.

Spitze region: Barely brighter part in the extreme NE edge of the Orion Nebula. Quite sharply defined.

Lacus Lasellii region: Darker part in the very NNW edge of the field - at the edge of Proboscis Minor.

Notes: Ignoring all the warnings, I decided to give it a go. Despite the low altitude (~20°) of the nebula and poor sky conditions, the Orion Nebula revealed herself quite well even to the small aperture. I observed the object for an hour before and past the culmination point using high (and maximum) magnifications and hood over my head to shield me from the local streetlights and providing me with some sort of a night vision. After sketching, I knew my best efforts had gone in vain and that once more no sketch can do the nebula any justice. Looking at the historical sketches, there are as many variations of the nebula as there are observers. The best one is probably that of Hunter & Trouvelot (1875) which represent the structure and the dark patches in a good manner. So as can be suspected, the sketch represented here is just my own version of the object and should not be taken "photographically". To preserve most of the faint nebulosity sketched, the sketch was left unedited so it displays some grain on the edges among other places.

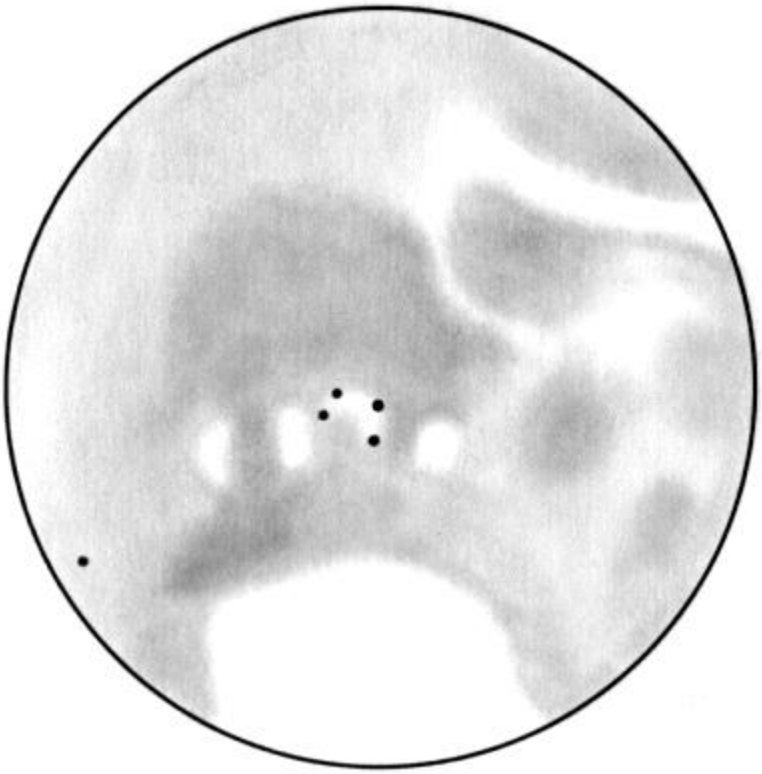


The Orion Nebula with 4.7″ Sky-Watcher @ 360×

8″ Orion

Object: Messier 42 / NGC 1976 / LBN 974
Obs. place: Koivukylä, Vantaa, Finland
Date: 28./29.1.2012
SQM-L: 17.45 (suburban sky)
NE Lim.mag: 4.5^{m}
Background sky: 2
Seeing: 2
Transparency: 2
Weather: Terrible! -12...-17°C, humidity 71%, 1057 hPa, snow depth 41 cm. 28% moon 18° W.

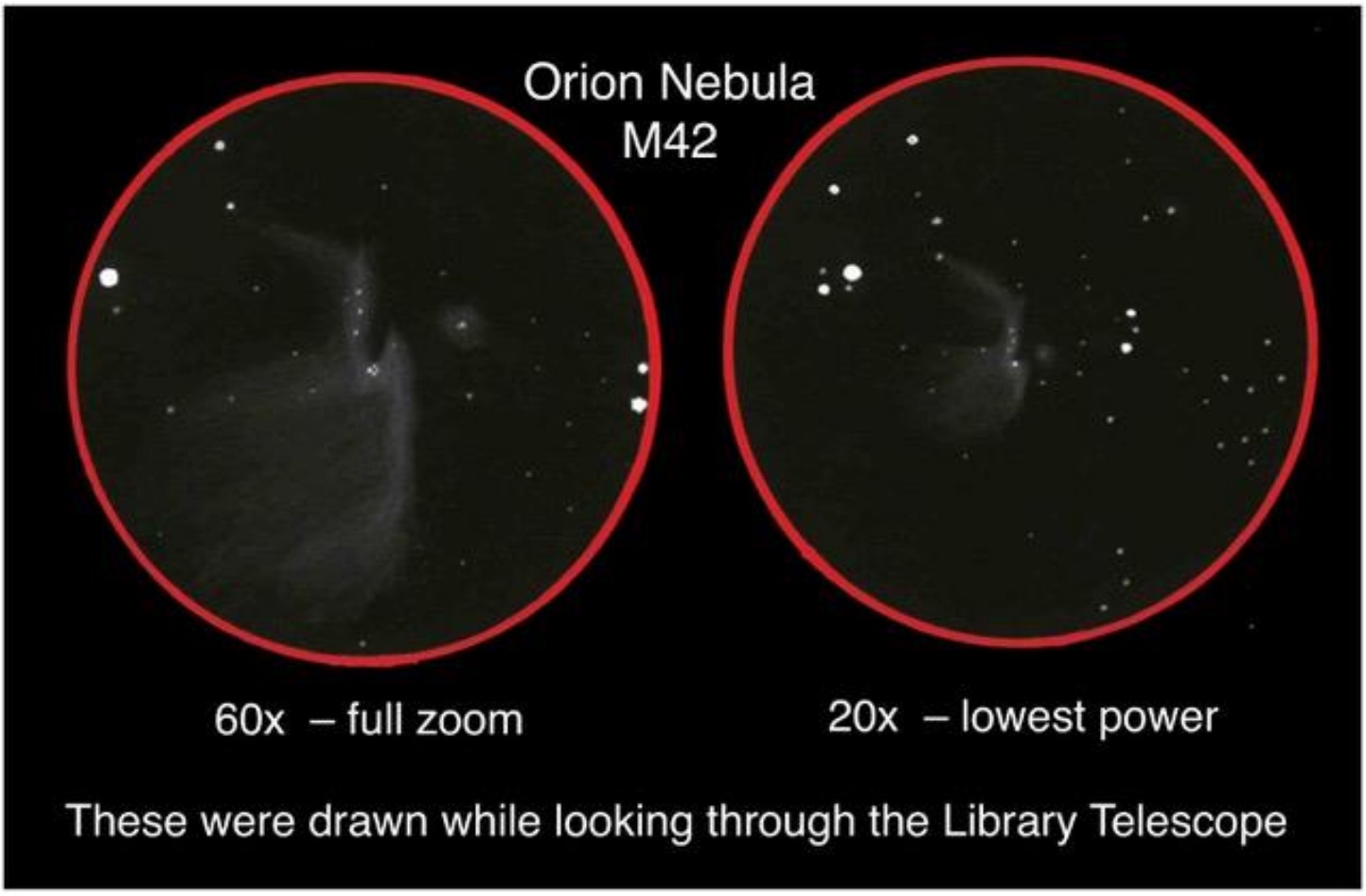
Description: A quick, poor sketch of Huygens region. 8 inch Dob vs Hubble comparison.



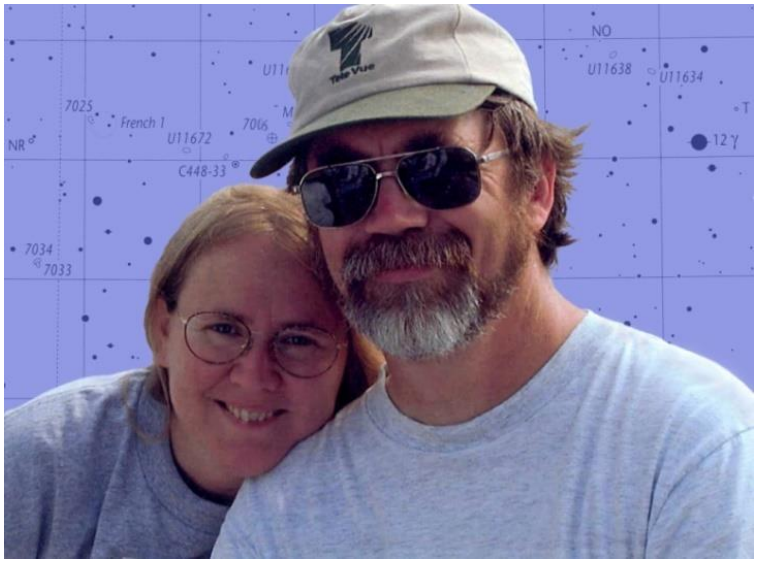
Huygens region and Trapezium in the Orion Nebula with 8-inch Orion DSE

John Goss: Observer from Virginia

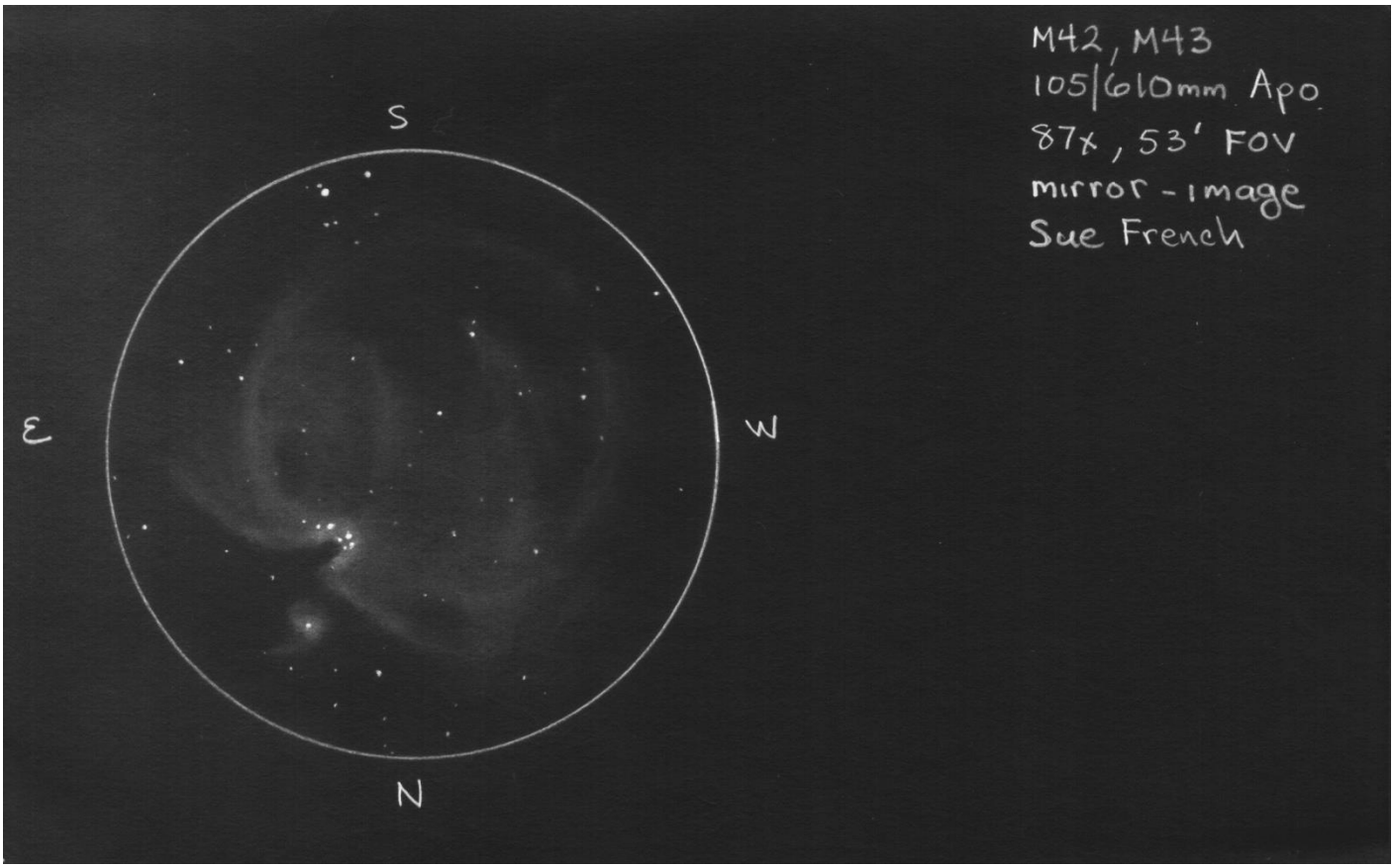
Pencil sketch: 4.5-inch f/4 Orion StarBlast, Dobsonian mount, Celestron 8-24 mm zoom.



Sue French: Observer from New York



For most Observer's Challenge objects, the aim is not simply to see if you can spot the target, but rather to push yourself to see how much detail you can sketch, log, or image. The Orion Nebula is an wonderful target for this pursuit.



Orion Nebula
1-5-2011
8:00-9:30 &
10:00-10:30
S:good T:fair
Most of the stars and a little of the nebulosity were sketched 1-3-2011 before it clouded up.
254/1494mm Newt
22mm Nagler

Glenn Chaple: Observer from Massachusetts

This month's Observer's Challenge is (drum roll) M42/M43, the Orion Nebula! You might ask why a deep-sky object that's easy to find (it's in the Sword of Orion) and see (it's bright enough to be viewed with binoculars) would be considered a challenge.

Let's begin with M42, the brighter of the two. It was discovered in 1610 by the French astronomer Nicolas-Claude Fabri de Peiresc and cataloged by Charles Messier on March 4, 1769. Binoculars and small-aperture telescopes will reveal the bright northeast part of M42, which resembles the outspread wings of a celestial eagle. One challenge is to visually capture the nebula's faint southerly region. Because M42 spans 85′ by 60′, you'll want to work with a low-power, wide-field eyepiece. A second visual challenge is to detect M42's greenish hue. I've seen it with a 13.1-inch f/4.5 scope, but not with a 4.5-inch. What is the smallest aperture that will reveal this subtle hue? Find out, and forward your result to Challenge coordinator Roger Ivester.

Being fainter and thus overshadowed by M42, M43 eluded detection until reported by Jean-Jacques Dortous de Mairan in 1731. Messier entered it in his catalog on the same date as M42. It is separated from M42 by a dark, dusty lane and surrounds the irregular variable star NU Orionis (magnitude range 6.5 to 7.6). The nebula's published magnitude of 9.0 might be on the low side, as I've seen M43 with a 60mm refractor. Admittedly, it was small and faint, and only visible when I ramped up the magnification to 140× to remove M42 from the field of view. What I saw was a roundish haze surrounding NU Orionis. In larger instruments, M43 will take on a comma shape.

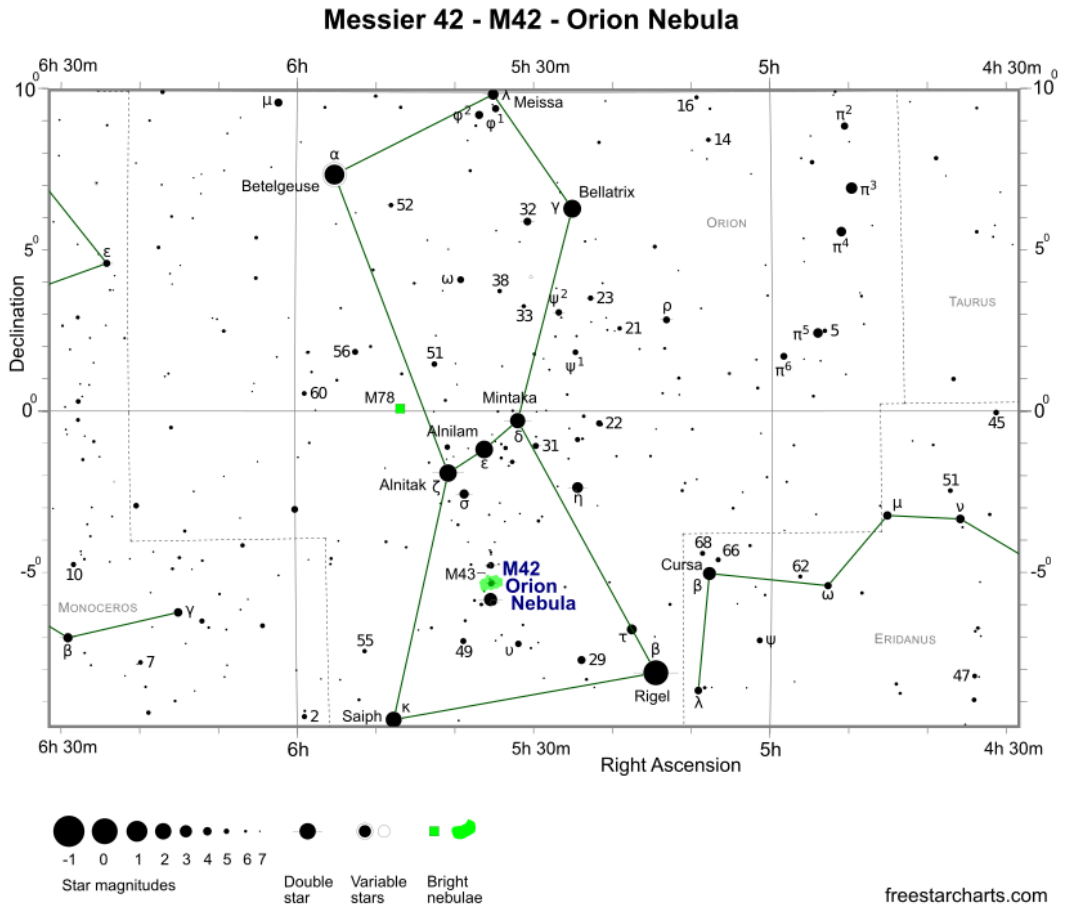
Looking for another challenge? At the heart of M42 is theta-1 (θ^1) Orionis, a stunningly beautiful multiple star birthed from the surrounding nebulosity. The four brightest members, all hot and massive *O*- and *B*-type stars, form a lop-sided diamond known as the Trapezium. Labeled A to D in order of increasing right ascension, they shine at magnitudes 6.7, 7.9, 5.1, and 6.7, respectively. A and B are eclipsing binaries- the former, bearing the variable star designation V1016 Orionis, fading to magnitude 7.5 every 65.4 days, the latter (BM Orionis) dipping to 8.5 every 6.5 days. Galileo discovered the three brightest members (A, C, and D) in 1617. The fourth (B), was discovered by the French astronomer Jean Picard in 1673. It can be difficult in a small-aperture scope, especially at the low magnification needed to view the entire Orion Nebula. If seeing conditions allow for a magnification of 200× or more, a 6-inch telescope will reveal two more stars – E (magnitude 10.3) and F (magnitude 10.2). Four other members - G, the tight double H1 and H2, and I- are extremely faint at magnitudes 14.5 to 15.5 and require large scopes and optimum seeing conditions. These are a true challenge!

Oh yeah- here's a final challenge. See if you can view the Orion Nebula, its gaseous wreaths embracing a diamond-like clutch of newborn stars, and not feel a sense of awe and wonder.

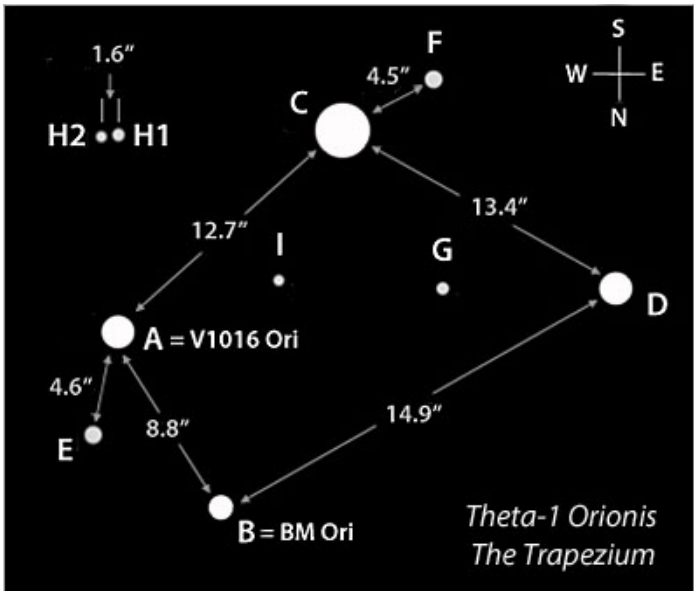
The Orion Nebula lies some 1350 light-years away. Cosmically young, it is just 2 or 3 million years old. The stars in the Trapezium are even younger, perhaps no older than 300,000 years. M42 and M43 have linear diameters 23 and 7.5 light-years, respectively, while the brightest stars in the Trapezium span a distance of about 1.5 light-years.

Messier 42 and 43 Finder Chart

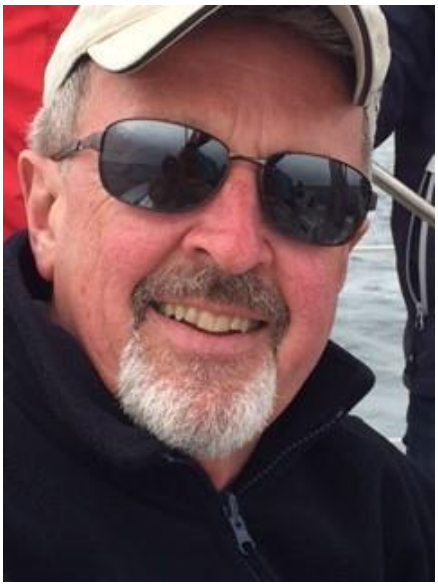
(freestarcharts.com and SEDS Messier Database)



Credit: *Sky & Telescope* Magazine →



John Bishop: Observer from Massachusetts



M42 is one of the showpiece objects in the sky. It is big, beautiful and easy to locate. It is so familiar and accessible, I might be guilty of taking it for granted. This month's Challenge reminded me what a complex area of the sky this is.

On February 20, 2022, I observed M42/M43 from the ATMoB Clubhouse in Westford, Massachusetts. I observed with my 8.25-inch f/11.5 Dall-Kirkham reflector, at magnifications of 48x to 192x. It is a portable setup, with a motor driven equatorial mount, without go-to. The sky was clear, and transparency was good. Seeing was below average, due to turbulence in the atmosphere, and a strong, gusty breeze at ground level. (Windspeed at Logan Airport in Boston this night was sustained 17 – 25 mph, with gusts to 31 mph). Temperature was a relatively tolerable 29 degrees F. at 10:00 pm., but the wind made it feel colder.

Locating M42 was straightforward, as M42 was visible to the naked eye in Orion's sword, high in the sky after darkness settled in. In the eyepiece, M42 was bright and beautiful, as usual. It was impressively large. At 80x, M42 nearly filled the FOV with ghostly, gray-blue "shrouds" of nebulosity, even without a filter. In astrophotos, M42 reminds me of a clamshell. Visually, in my scope, it is less well defined, except for the bright "wings" which form the northern edge of M42. In the past, I have seen a subtle greenish tint in the nebulosity, but not this night.

I could only confirm seeing four stars in the Trapezium, even at 192x. The atmospheric turbulence and wind gusts shaking my scope made it difficult to get a steady view. Some of the imagers on site complained that their imaging was compromised because of this.

Prior to this night, I had never identified the boundary of M43 as an object separate from M42. This night, I briefly saw the dark lane separating M42 and M43. Mostly the two nebulae blended into one another. M43 was small, bright, and more or less round. 7th magnitude Nu Orionis was visible in the luminous round area.

There are a number of interesting objects just outside M42/M43 proper: NGC 1973/1975/1977; NGC 1981; NGC 1980; and NGC 1999. It was a good exercise to try to sort them all out in one session.

Sameer S. Bharadwaj: Observer from Massachusetts

Here is a 4 panel mosaic I did with my collaborator (Andrea Bergamini) from M78 to M42.

Over 21 hours of exposure from our set up in Spain.

Tom English: Observer from North Carolina

In the 1890s, the astronomers at Lick Observatory made observations that provided insight into the physical nature of the gas in the Orion Nebula. In 1893, W. W. Campbell's spectra of different regions of the nebula showed that the green "nebulium" lines dominated the inner bright region near the Trapezium, while in the outer wings, the short wavelength lines of the hydrogen spectrum dominated. Nebulium was the name given to the mysterious unknown element that produced the strong green spectrum lines evident in nebulae. Given that the 1890s were three decades before a quantum theory of the atom was developed, astronomers did not realize at the time that nebulium was doubly ionized oxygen (OIII).

In 1898, Lick director J. E. Keeler, who was arguably the world's premier spectroscopist, verified Campbell's results and endeavored to explore the effect visually and photographically with the 36-inch Crossley Reflector at Lick. He ordered a set of filter screens to allow him to photograph the nebula in the yellow-green light most sensitive to the human eye, thus producing photographs that mimicked what the observer sees. When compared with the blue-sensitive plates that were more suited to the wavelengths of the blue-ward spectral lines of hydrogen (e.g., H-beta, H-gamma, H-delta), he could see clear differences in structure.

Keeler published his results in the Astrophysical Journal https://articles.adsabs.harvard.edu/pdf/1899ApJ.....9..133K and gave a less technical account for the Publications of the Astronomical Society of the Pacific https://articles.adsabs.harvard.edu/pdf/1899PASP...11...70K

In these articles he suggested the differences were potentially due to composition differences across the nebula, but today, with an understanding of atomic physics that was beyond Keeler's grasp at the turn of the century (the electron had just been discovered the year before he began this work, and the idea nuclear atom was a decade away), we know that the difference is in ionization states. Near the core of the nebula the strong ultraviolet emission from the hottest of the Trapezium stars ionizes the oxygen, producing the strong emission from the green OIII lines.

If you have an OIII filter and an H-beta filter, you can explore these differences visually, and perhaps you have already seen these effects. We have done so many times over the years at Cline Observatory. As Keeler said, "the remote portions and outlying streamers of the nebula" show more strongly when filtering for the hydrogen, while the OIII filter shows the inner region more prominently. Try it yourself!

Mike McCabe: Observer from Massachusetts

The Observer's Challenge object for the month of February 2022 is familiar to many of us, the Orion Nebula complex. How many times over the years had I explored this region of the sky? The legitimate answer is 'countless', mainly because while it has been many I have never bothered to record them, so there is no way to count them. It's been many.

And it's been under the gamut of conditions too. From pristine dark skies to washed out moonlit skies and everything in between. I will say this; the only way to get a full appreciation for the extensiveness of the nebulosity in M42 is to experience observing it under a pristine dark sky. Anything less has a tendency to substantially degrade the view, because while there is an inordinate amount of nebulosity in the region it still responds to poor transparency and light pollution in the same way as any other diffuse nebulosity – that is it does a disappearing act.

So now I was faced with the question; how do I best approach the challenge in a way that captures both the beauty of the wide-field view and the more subtle details that a high magnification view provides? In the end I wound up doing both and combining them into one report. I think it worked out pretty well.

For the low-power view I got out on the night of the 21st of February and set up my 28× 110mm binoculars on the pipe mount. I spent the better part of an hour just gazing in the eyepieces and putting dots in the circle. Then I outlined the extent of the nebulosity visible during the observation and rubbed in some charcoal. The night wasn't particularly transparent so the nebulosity was somewhat limited.

On the night of February 26th, I set up a 10-inch Newtonian telescope, in hopes to observe the Trapezium stars at very high powers, but the seeing limited things to about 250×. The 'E' and 'F' stars were easily discerned, but any others further along in the alphabet once again eluded detection. There was plenty of nebulosity throughout the 0.25° field of view, but snow fog from the most recent snowfall did hamper the transparency somewhat.

I hope to someday get to experience this area under a truly dark, transparent sky. I can only imagine the level of detail that might be gleaned under those conditions. This is truly a beautiful area of the sky!

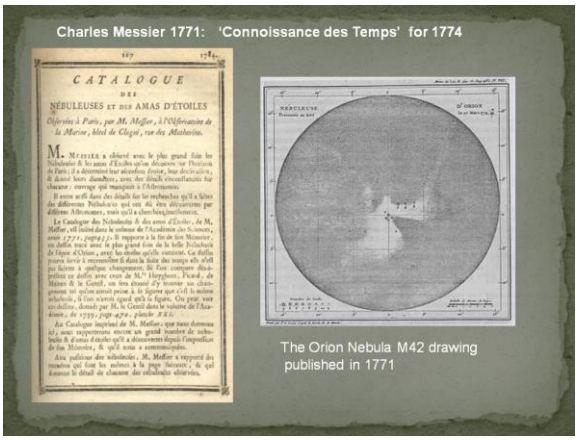
Larry McHenry: Observer from Pittsburgh, Pennsylvania

M42 & M43 (emission nebula): Located in the winter constellation of Orion, 'The Hunter', is the large, bright HII region known as the "Great Orion Nebula", the crown jewel of the Winter Sky. This 4th-magnitude deep-sky object is estimated to be about 24 light-years in diameter, around 1,344 light- years distant and about 3 million years old. At the heart of the nebula is the young star cluster called the Trapezium (Theta Orionis), estimated to be about 300,000 years old.

Historical background:
While the 'Great Nebula' in Orion has been known as the fuzzy middle star in the hunter's sword since ancient times, and even previously observed and described by prior astronomers such as Christiaan Huygens, Guillaume Le Gentil, and Edmund Halley, it was the 18th-century French astronomer Charles Messier that gave it the 'designation' that we all know it by today. Both M42 (and M43) was observed on March 4th, 1769 by Charles Messier using one of his small portable 'observatory' telescopes, a 6″ Gregorian reflector at 104×. Messier described M42 as "*Position of the beautiful nebula in the sword of Orion, around the star Theta which it contains [together] with three other smaller stars which one cannot see but with good instruments,"* and M43 as "*Position of the little star surrounded by nebulosity & which is below the nebula of the sword of Orion. "*

So, how did the Orion Nebula get its 'M' number?:
Charles Messier's passion as an astronomer was comet hunting. Occasionally, he would be fooled by finding faint dim objects that somewhat resembled comets. He would take the time to record their positions and watch for movement over several hours, sometimes for even most of an entire evening, only to finally realize he was wasting his time. The objects weren't comets, but some faint nebula or unresolved cluster of stars. Messier resolved in May of 1764 to keep a list of the objects as he found them so that during future comet sweeps, he could easily disregard these objects as not being the comets that he was interested in. By early 1769, Messier was up to 41 objects and decided to write-up his list of 'non-comet' objects, along with a description of what each one looked like and their celestial positions in the sky. But he decided to add a few more items to the list, including the already well known objects of the Pleiades and Praesepe star clusters and the Orion Nebula to round the list off at 45 objects. By 1771 Messier was able to publish the first edition of

his '*Catalog of Nebulae and Star Clusters'* in the official journal '*Connaissance des Temps*' of the French Academy. As part of his entry for M42, he included a sketch.

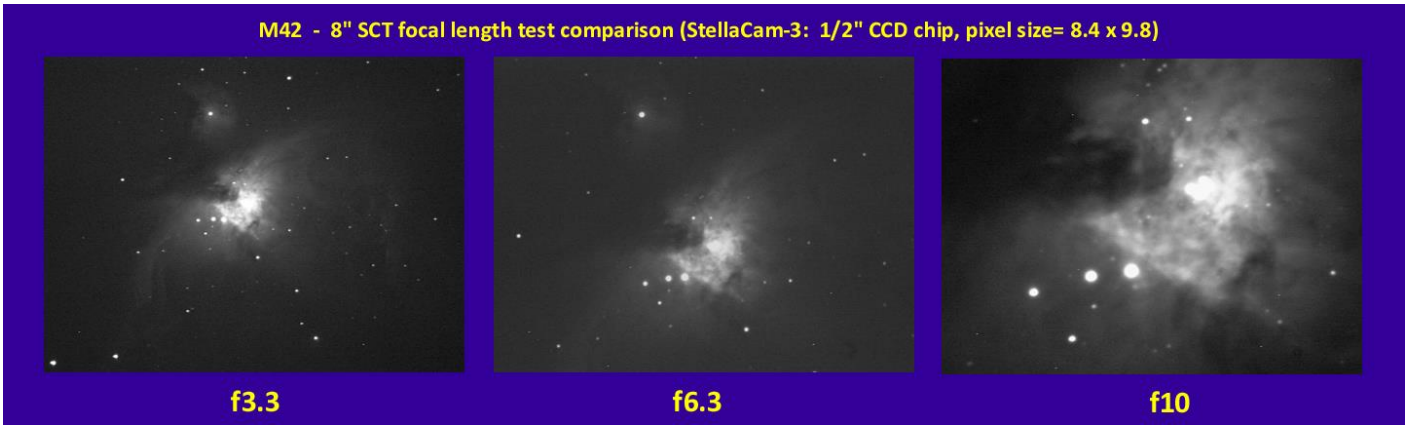


Messier's list of deep-sky objects to avoid while comet hunting has become what today's modern amateur astronomers seeks out as the bright showcase galaxies, nebula, and star clusters of the night sky. That is what Charles Messier, the "Ferret of Comets", is renowned for in the 21st century.

If you would like to read more about Charles Messier, please visit:
http://stellar-journeys.org/The%20Ferret%20of%20Comets.pdf

Observations:
Both visually and by EAA techniques, M42/M43 is visible with any type of optical aid, (even naked eye under dark skies). The larger the telescope and its focal length, the more intricate detailed swirls of nebulosity can be glimpsed around the central core of the Trapezium cluster.

Canon Zoom 100mm lens @ f/5.6 on a GEM mount, with a CMOS/USB color camera, 30-second guided exposure live stacked for 10 minutes.

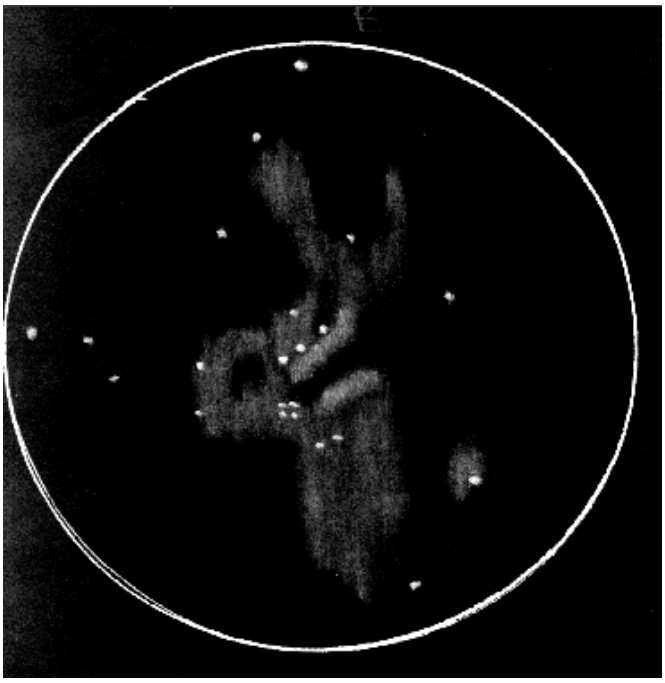


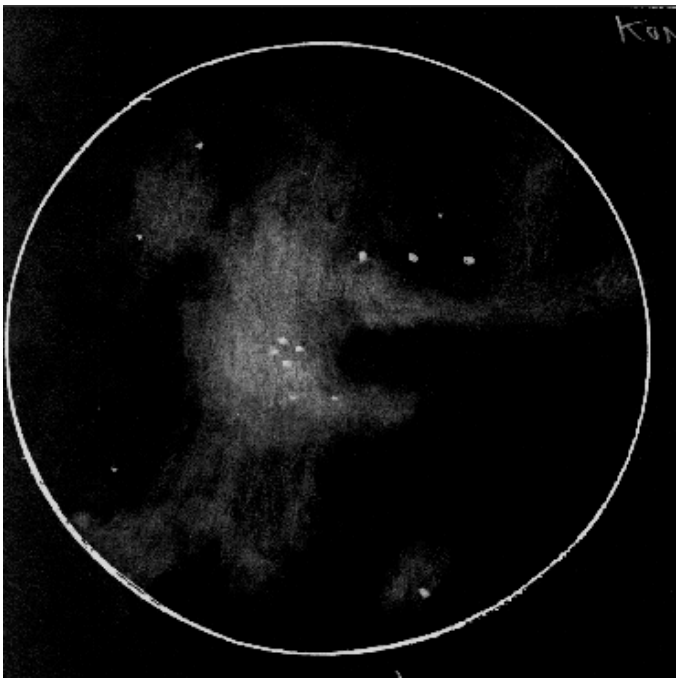
Visual Sketches:

(1) 11/25/1984 from a county park located outside of Louisville, Ky. Using a 10″ f/5.6 Dob Reflector (homebuilt) 18mm eyepiece (79×).

(2) 03/21/1988 from a suburban backyard near Louisville, Ky. Using a 13.1″ f4.5 Dob Reflector (Coulter blue-tube) 8mm König eyepiece & Lumicon UHC filter (143×).

(1) (2)





For both telescopes, the nebula was very bright with spectacular detail. The nebula arcs out of the FOV. The four main stars of the Trapezium clearly resolved!
West is to the left.

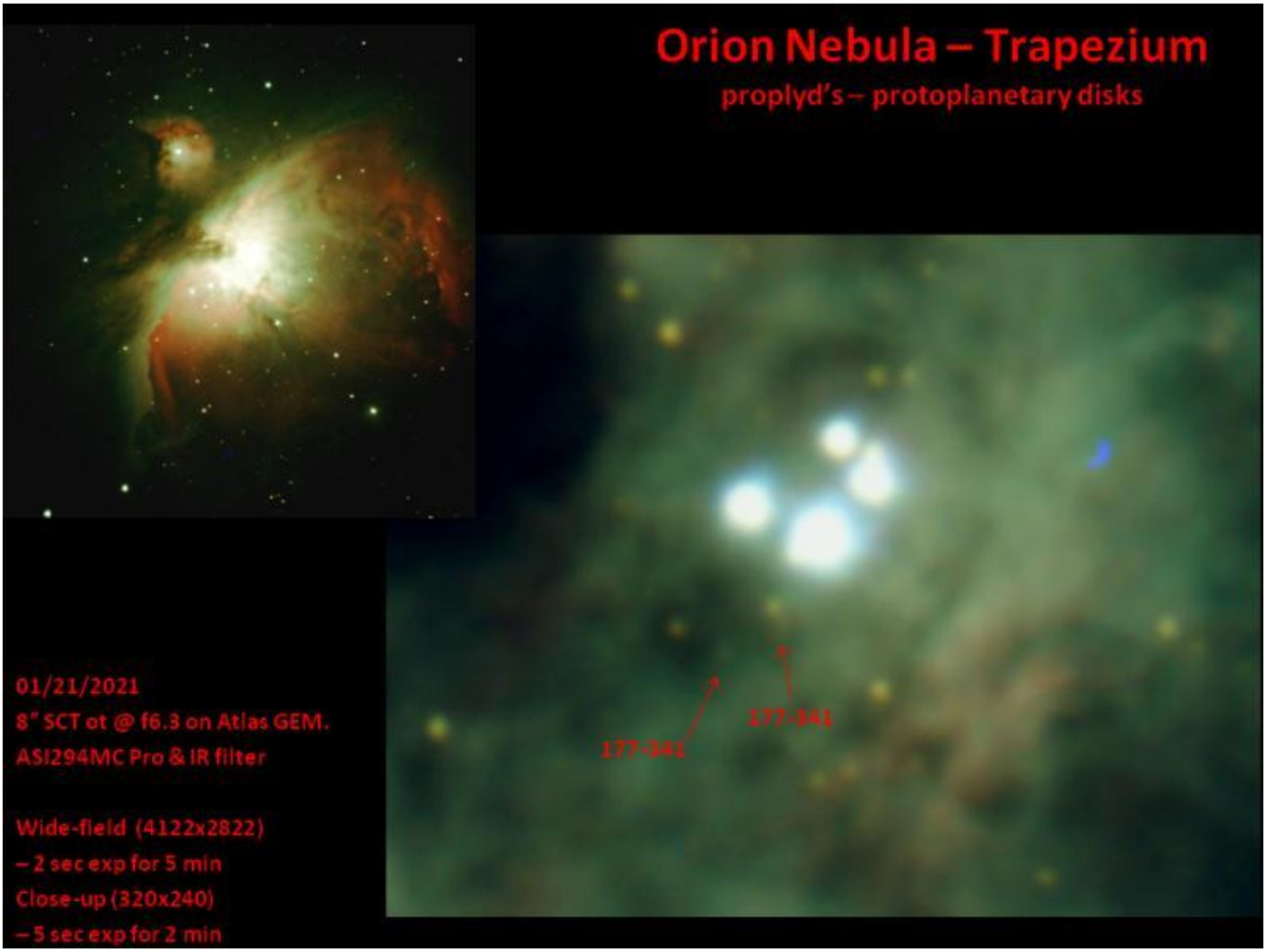
Video-Capture/EAA:
02/26/2022: from Big Woodchuck Observatory backyard in Pittsburgh, PA.
Using an 8″ SCT optical tube @ f/6.3 on a GEM mount, with a CMOS color camera and narrowband filter @3-second guided exposure, live stacked for 3 minutes.


Part of the fun things about doing EAA and live stacking is that you can 'play' with the observation in real-time. For example, in the above image of the ‘Great Nebula,’ I didn't want to blow-out the core of M42, so I toned-down the capture settings and saved a single 3 second exposure. Can anyone else see the ‘Fish Head’? But I also wanted to see more detail in the outer ‘wings’ of the nebula, so after I saved the first image, I gave the live histogram a tweak and let the capture software stack 60 subframes. Now I could follow the ‘wings’ of M42 and see more HII details as the emission nebulosity seemed to flow out from the Trapezium core. Also, nearby M43 popped into detail.

One of the things I enjoy about reading *Sky & Telescope* magazine is the great observing oriented articles that they print. Just about every issue has something in it that I want to try. In the February 2021 issue, there's an interesting article on page 57 titled - "The Newborn Nursery of Orion" on identifying "proplyds" (protoplanetary disks) within the Trapezium 'heart' of the Orion Nebula. I kept the article handy, wanting to see how many I could pull in with my EAA rig.

On January 21st, 2021, the weather cleared, allowing me to attempt an observation.
As I was going after star-like objects, I switched over to using just a regular IR filter with the ZWO ASI294 camera. I started off with taking a wide-field image of the entire Orion Nebula that included both M42 and M43. I then experimented imaging the Trapezium using smaller ROI and short 2 to 5 second exposures stacked for several minutes each. Using finder-chart from the *Sky& Tel* article, I captured in my observation two proplyds.

Here's the annotated image:



G. Brannon: Observer from North Carolina

The Orion Nebula is perhaps the most spectacular nebula in the sky and among the very easiest deep-sky-objects to observe. I was surprised to learn of its inclusion in the Observer's Challenge, so I did a few things to make it interesting. First of all, I took plenty of time in preparing these sketches so that they would be very accurate, and second of all I used some smaller instruments and compared a range of magnifications.

M42 is easy to find visually, and under dark skies can be seen with the unaided eye. The Sword of Orion, a linear and slightly fuzzy arrangement of stars below Orion's Belt, contains the nebula in its center. It's easily seen even in the suburbs with binoculars, which is where I started. I normally don't sketch what I see in binoculars because they lack stability, but I used my Celestron "Cometron" 7×50 binoculars and a photo tripod this time, which really allowed me to appreciate the view. The nebula was tough with direct vision but very broad with averted vision. After sketching with the 7×50s, I replaced the binoculars with a 60mm f/12 Maksutov-Cassegrain telescope with a 20mm eyepiece at 37.5×. With dark transparent skies (for me–still very much limited by suburban light pollution), the wings of the nebula were just barely visible with averted vision.

The first two sketches:

2022-Feb-19 – 09:00 PM EST

M42 – 7×50 (tripod-mounted)

The belt & sword of Orion will both fit into the fov at once, but the edges are too blurry to be worth sketching. The sword is easily defined by 6 bright stars, two of which are in the nebula and correspond to the Trapezium and the "tail" of M42. [by which I meant the three linear bright stars next to the Trapezium] The nebula is faint with direct vision but easy & quite broad with averted vision

M42 – Mak60 – 20mm RKE (37.5×, erect image diagonal)

The bright stars of the sword just barely fit in the fov, and the nebula is a blurry fuzzy gray blob in direct vision. Trapezium is barely split. With averted vision, the boxy part can be seen as a blurry highlight, and the wings can be glimpsed, as well as the M43 nebula.

After I finished the small scope sketches, I moved onto the 10-inch Dobsonian with my new 11mm 82° eyepiece. This was a lot of fun to sketch and may have resulted in perhaps my finest sketch of the Great Nebula yet.

The third sketch:

2022-Feb-19-09:54 PM EST

M42-250P-11mm 82° – UHC Filter (109×)

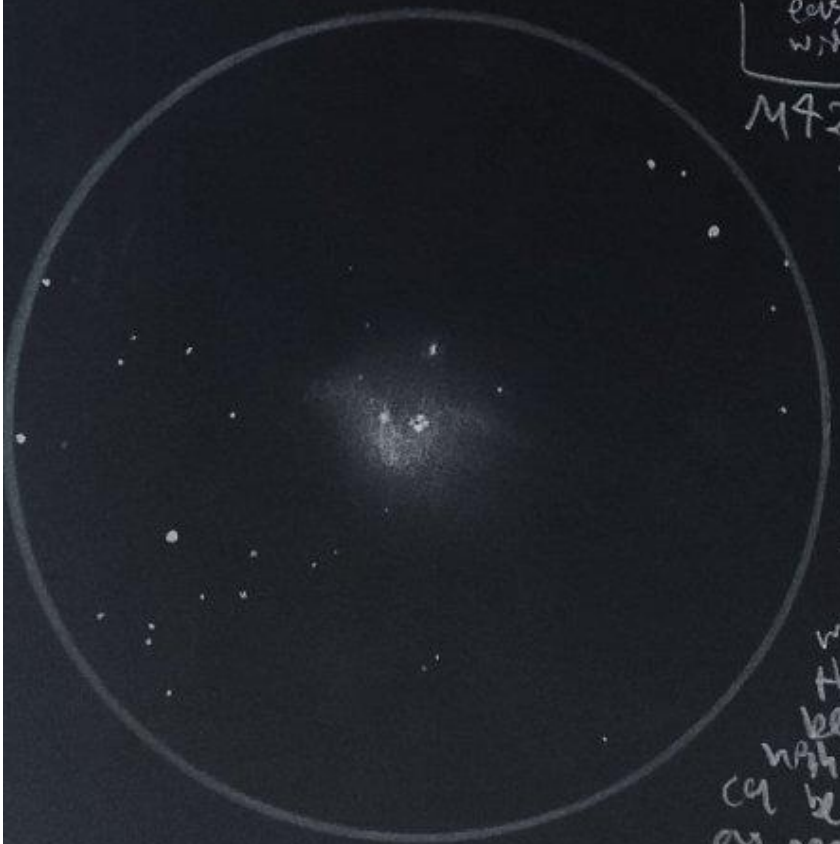
Trapezium easily split. Fifth star [the "E" star] faintly visible [w/o UHC filter; with the UHC filter it was too dim]. There is a sharp-edged boxy region with some visible mottling at the center of the nebula. A fainter glow creates the "head" and "plumage" of a bird-like figure, with the wings extending at east and west, with a great extent in averted vision. One wing, the eastern one, is bifurcated. M43 is faint but visible in direct vision and appears almost cometary, with a fat tail facing M42.

M42 – 7x50 binoculars (tripod-mounted)

The belt & surrounding of Orion will hardly fit into the FOV at once but the edges are too blurry to be worth sketching

The sword is easily defined by 6 bright stars, two of which are in the nebula and connected to the trapezium and the tail of M42.

The nebula is faint w/ direct vision but easy & quite broad with averted vision

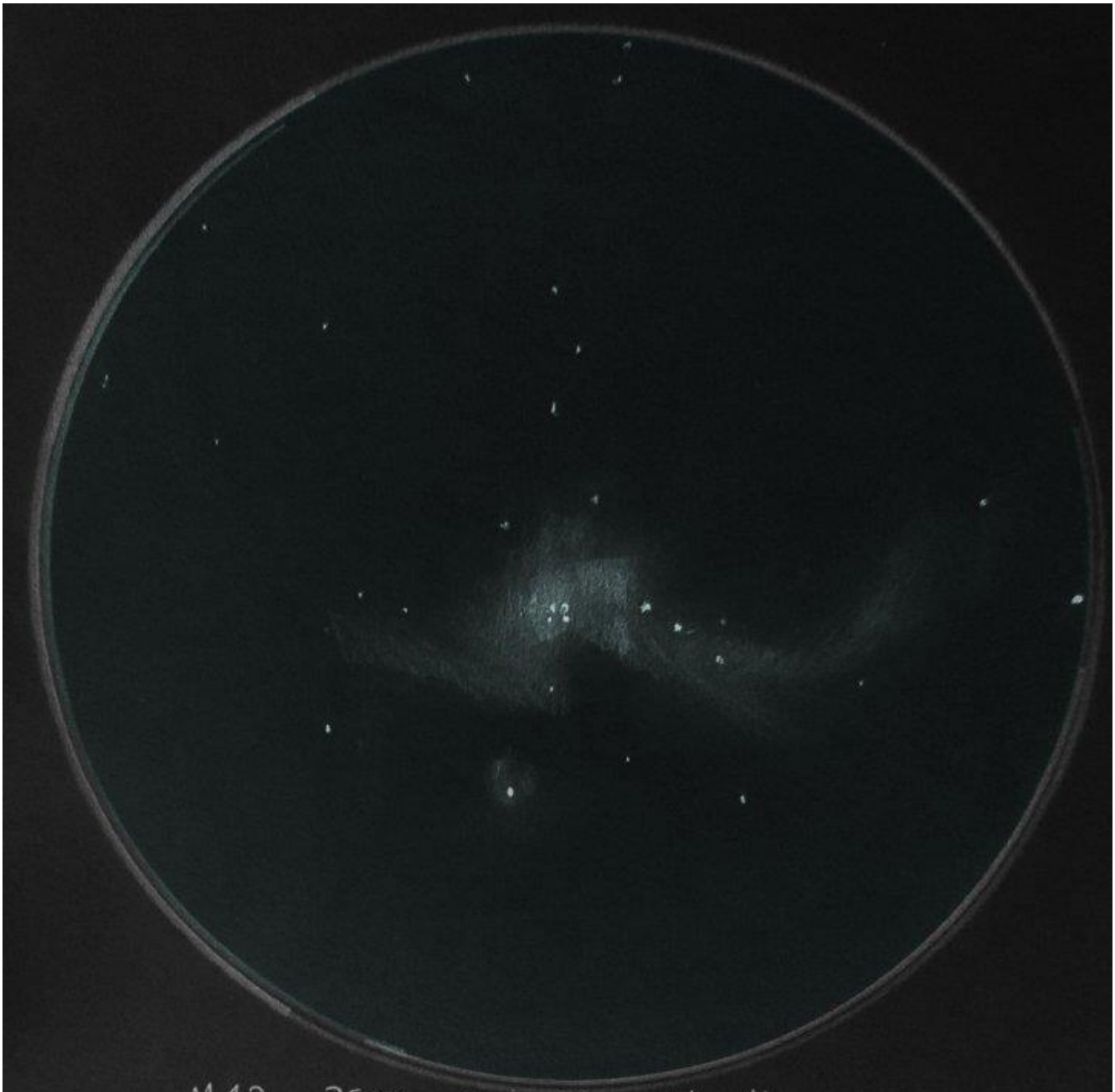


M42 – Mak 60 – 20 mm HE

The bright stars of the sword just barely fit in the FOV, and the nebula is a bluish fuzzy giant blob almost 1/3 rd.

Trapezium is barely split.

w/ averted vision, the bowl part can be seen as a blurry nebula, and the wings can be glimpsed, as well as M43 nebula.



M42 - 250P - 11mm 82° - UHC Filter

Trapezium easily seen. Fifth star faintly visible. There is a sharp-edged boxy region with some visible mottling at the center of the Nebula, a fainter glow covers the "head" and plumage of a bird-like figure, with the wings extending east and west, with a great extent in angular vision. one wing, the eastern one, is bifurcated.

M43 is faint but visible in direct vision and appears almost circular,

Mario Motta: Observer from Massachusetts

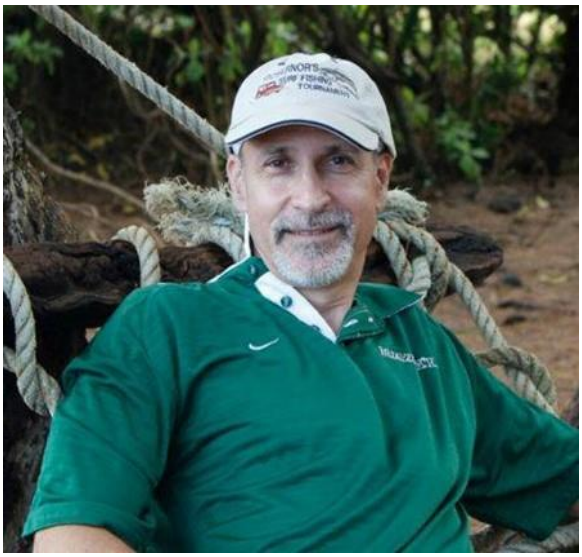
For the February Observer’s Challenge object, I've sent several images, each a bit different on this subject.

This is a bright and large object, so, with my 32-inch the view is a smaller field and my images are zoomed in to the core of M42. Using NB imaging for this, you can see the Trapezium cluster along with the “E” and “F” stars. This was just an hour total of the center of M42 with Ha, S2, and O3 filters.

For the “Full” view, I have 2 images for comparison both with my 6 inch refractor for the wider field. This one was taken with Red/green/blue filters.

For comparison, this is the same view with an Ha, S2, and O3 filter set.

James Dire: Observer from Illinois



The Orion Nebula, a.k.a M42, is not a very challenging object to find and observe. The nebula is visible to the unaided eye at the midpoint of Orion's Sword in the constellation that bear's this mythological figure's name. While not easily identifiable as a great nebula without optical aid, this behemoth, gaseous stellar nursery is easily identified in any sized telescope.

Despite how easy we find spying M42, the nebula was never mentioned prior to the discovery of the telescope! The brightest star in the nebula is Theta Orionis (actually a multiple star object). The star was cataloged by the likes of Ptolemy, Tycho Brahe, and Johann Bayer. None ever mentioned seeing a nebula. Galileo, who pointed his telescope at it on numerous occasions mentioned stars in the nebula, but never the nebula itself.

Nicholas-Claude Fabri de Peiresc, a French lawyer, is credited with being the first person to note the Orion Nebula in the year 1610. He saw it using his personal telescope. His sighting, however, was only reported in his own personal documents and never published. The nebula was found independently in 1611 by the Jesuit astronomer Johann Baptist Cysatus of Lucerne who published a sighting of it a comparing it to a comet. This publication was not well known and in 1656, Christian Huygens rediscovered the Orion Nebula. Both Edmond Halley and Charles Messier credited Huygens as having discovered the nebula.

M42 is the finest example of a diffuse emission nebula. The nebula is a huge stellar nursery where new stars are still forming today. The nebula is located 1350 light-years away and is 24 light-years in size. It is the closest stellar nursery to Earth. The nebula contains about 700 stars in all stages of development. While visible to the unaided eye, binocular and small telescopes start to reveal the splendor of this object.

As is the case for most deep space objects, the larger a telescope's aperture, the brighter the object appears and the more detail that can be seen. Very large light buckets, say 20 inches (0.5 m) and larger, will even show color when viewing M42.

Photographic imaging of M42 brings out much more color and detail than can ever be seen by the human eye. However, if the human eye could see color under faint light conditions, the accompanying photographs probably depict the nebulas blue and red hues fairly accurately.

M43 is a bright region of the Orion Nebula located on its north side, separated from M42 by turbulent dark lane. The star in the center of M43 is Nu Orionis, a magnitude 6.86 hot white, class B star.

My first image of M42 was taken with a William Optics 132 mm f/7 apochromatic refractor with a Tele Vue 0.8× FF/FR to yield f/5.6. This 90-minute exposure was taken with a SBIG ST-4000XCM CCD camera.

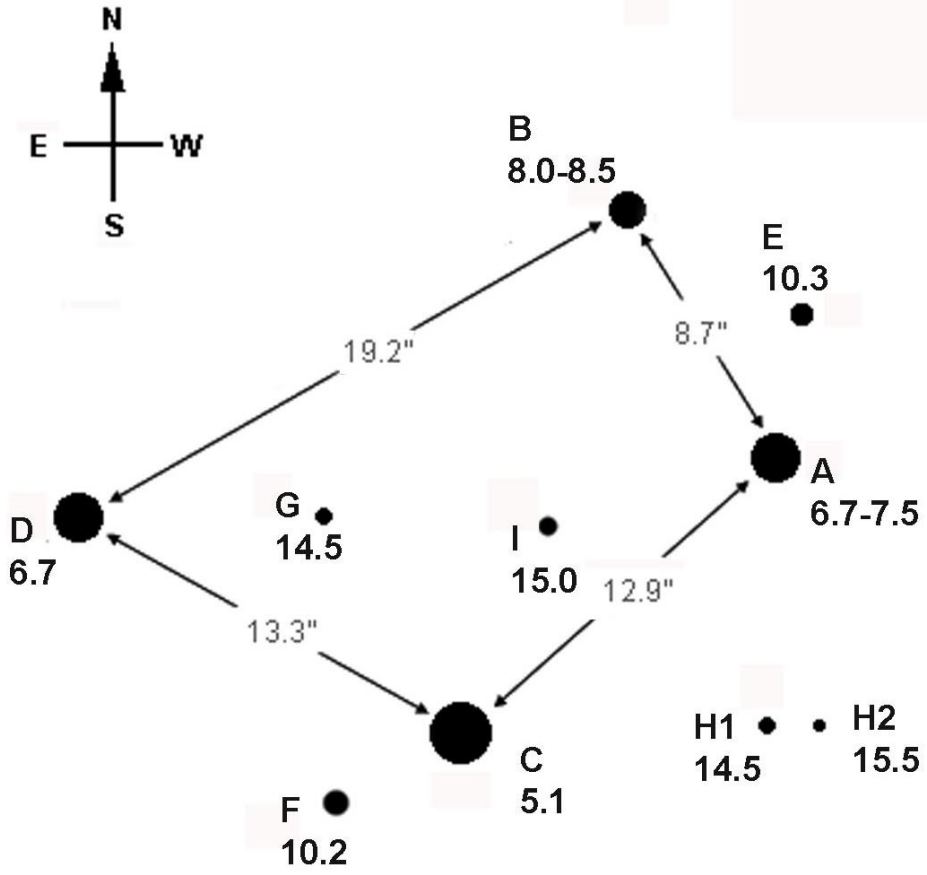
The second image displays a much wider field of view capturing all of Orion's Sword. As can be seen in this image, a large region of nebulosity extends the entire length of the sword. This image was captured using a William Optics Star 71 mm f/4.9 apochromatic refractor and a SBIG STF-8300C CCD camera. The exposure was 70 minutes.

At the center of the Orion Nebula lies a grouping of four stars, ranging from 5th to 8th magnitude, called the Trapezium, which is easily visible in small telescopes. The challenge for eight-inch and larger telescopes is find the fainter companion stars to the main Trapezium stars.

The Trapezium obtained its name because the four stars form a slightly skewed trapezoid. The shortest side of the trapezoid is 8.7 arcseconds, while the longest side is 19.2 arcseconds. The entire cluster fits within a circle of half an arc minute diameter. Very steady seeing and high magnifications (I recommend 200× or greater) are required to find the fainter members of this small star cluster. Their locations, labels and magnitudes are displayed in my third image herein.

The southernmost star in the Trapezium, labeled C, at magnitude 5.1 is the brightest. The next brightest is the 6.7-magnitude D star, located on the east side of the asterism. The other two Trapezium stars, A and D, are variable stars. Star A varies in magnitude from 7.5 to 6.7, while star B varies from magnitude 8.5 to 8.0. The cluster also contains six fainter stars from 10th to 15th magnitude. Keep in mind every five magnitudes span a factor of 100 in brightness. Therefore, a 5th magnitude star is 100 times brighter than a 10th magnitude star and 10,000 (100 x 100) brighter than a 15th magnitude star. It follows that the stars in accompanying schematic span four orders of magnitude in luminosity!

The Trapezium
Theta Orionis

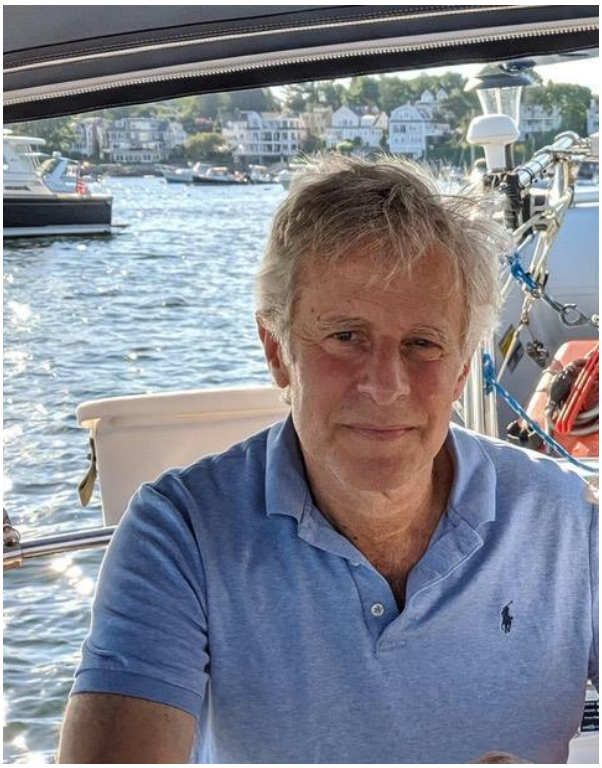


The two 10th magnitude Trapezium companion stars can be seen with 8-10 inch telescopes with sufficient magnification and steady seeing. These are labeled E and F. The stars labeled G, H (a doublet), and I, all between magnitude 14.5 and 15.5, are difficult to see in all but the largest amateur telescopes. The G star and H star are magnitude 14.5. I have seen both in a 14 inch f/6 Dob at 200× under extremely dark and steady skies. The I star is magnitude 15. My schematic actually shows H as a double star. The components are 2 arc seconds apart. The fainter component is magnitude 15.5.

It is extremely difficult to photograph the fainter stars in the Trapezium without using a large professional ground-based or space telescopes. Because of the close proximity of the stars, a very large focal length is needed to spread out the stars and the glow of the Orion Nebula, so the nebula doesn't drown out the fainter stars. Hubble Space Telescope images of the Trapezium are fantastic and easily show many more (fainter) stars than those on the accompanying schematic. These images verify that a star cluster is forming out of the gases around the Trapezium.

My best attempt at imaging the Trapezium (shown here) was using a Celestron 14-inch telescope. In my image, the F star may be a bump on the side of the C star and the E star is barely visible. My attempts at longer exposure to pick up the G, H and I stars failed as the nebula drowned out the fainter stars. Perhaps with a good Barlow and steadier skies, I might have captured them all!

Barry Yomtov: Observer from Massachusetts

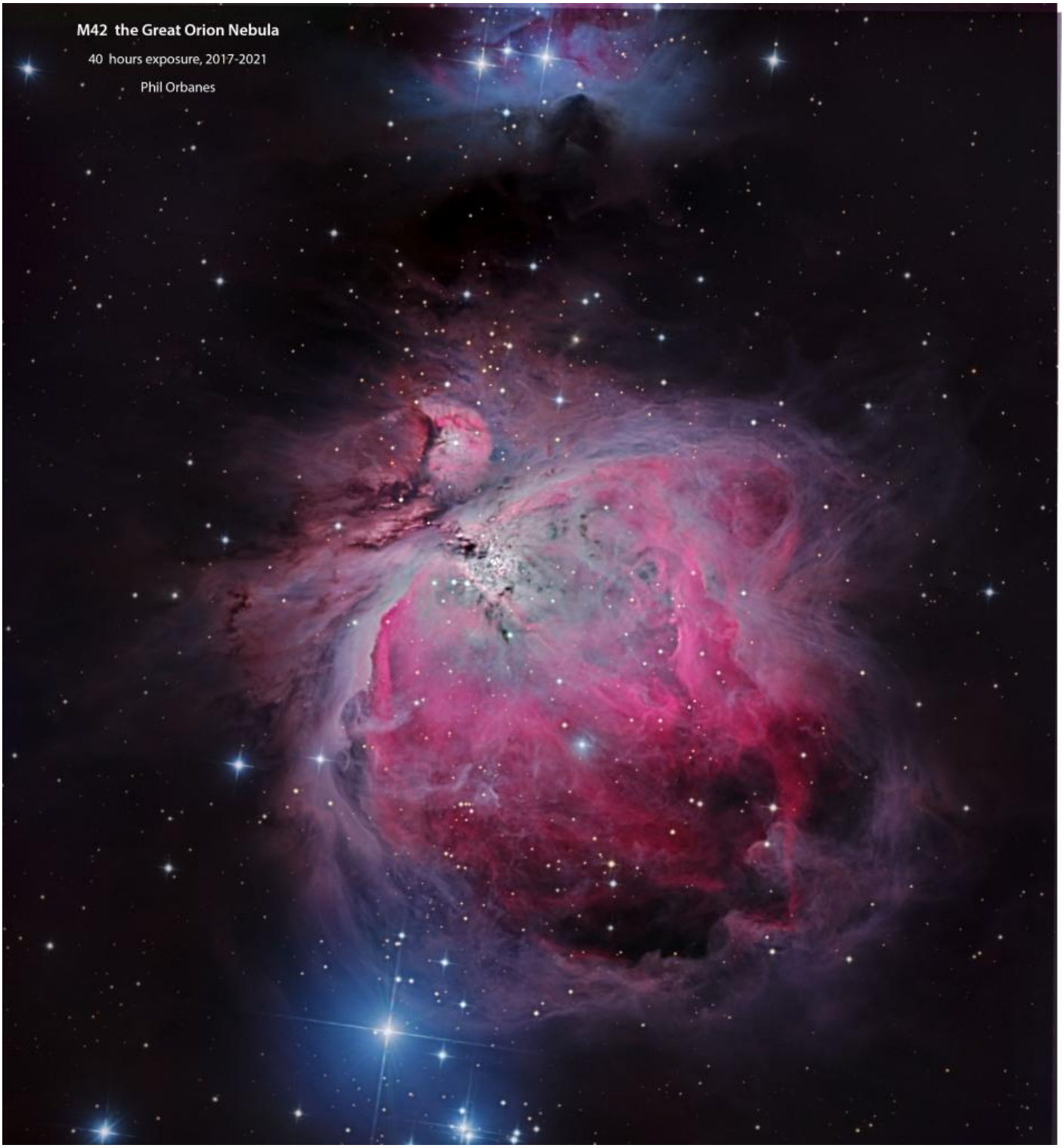


My image of M42 for February's Object of the month. The imaging session was on January 4, 2022. The optics used were a Celestron RASA 11 f/2.2, and taken with a CMOS ZWO 183pro OSC camera. Over the years the Orion Nebula has always been one of my favorite deep-sky objects to image especially with wide-field optics. Sessions with wider-field optics have allowed me to include NGC 1977 (Running Man Nebula) within the field of view. With the ZWO camera's higher sensitivity, there is an additional challenge of over exposing the Trapezium while trying to capture the edges of the nebula. My method to capture both is to take two sets of images; A short exposure of 5 seconds is taken for the Trapezium and the longer 20 second exposure for the rest of the nebula. I processed each set of stacked images independently using a combination of PixInsight and Photoshop. I then used layers and the blending tools in Photoshop to merge the two processed images. Between the two groups, a total of 159 images were taken, and yet the total exposure time was only 38 minutes.

Daniel Lee: Observer from Massachusetts

288mm focal length –
5h30m of 600s exposures (Ha/OIII)
5h of 120s/180s subs (L-Pro)
1h of 60s exposures (Ha/Hb/OIII)
taken over 7 nights in Jan/Feb and March 5th
processed using APP/PI/PS...
I added a short exposure core to highlight the trapezium, and used a non-narrowband star layer to add color to the stars.

Phil Orbanes: Observer from Massachusetts



My photo of M42 combines over 600 images (42 hours total) taken in 2017, 2018, and 2021 through my 14-inch Planewave reflector, using an FLI 16803 CCD camera.
The exposure time was divided evenly between R, G, B, Ha, and O III filters.
The processing was somewhat unique. I use PixInsight primarily, then perfect in Photoshop, but this photo is actually a layered composite of my 2018 image and my 2021 image.
I liked some aspects of each, but not fully. So, recently, I blended the two in Photoshop using the Multiply blending mode (with a reduced opacity of the 2018 picture) and was very satisfied with the attached result.

Mark Helton: Observer from Massachusetts

I used a single setup with two scopes running simultaneously. The tight image was with my Stellarvue 102T-Raptor scope, with a ZWOASI533MCPRO camera no filter. The wide image was with my Askar 180mm scope, a ZWOASI183MCPRO with a HEUIBI-II filter. The wide image was 60, 60 sec images on medium gain. The wide was 120, 20 sec images on medium gain. I processed both using Nebulosity4 to stack, Adobe Photoshop to process, and Topaz Labs for noise reduction. I was happy to be able to see the Triangulum stars in the tight image. This was one of my goals. It is a lot harder target to image than it looks, and ever version I do, or see others do, is different!

I decided to go ahead and try to see what I could get with my new ASKAR 180mm scope and ZWO 183MCPro. I was able to get about 36 45-second images. This is such a seemingly easy nebula to shoot. But it really is not. I am happy overall 'cause it’s always fun to be able to pull out some of the outer detail, and really cool to get Running Man in there as well. I don’t think Orion likes me as it seems every time I try to image it, there is something working against me!! It is also setting much earlier in the night now. It does go to show, that even on the nights you think that you won’t be able to see or image anything, you might surprise yourself! Clear Skies everyone!!

Gus Johnson: Observer from Maryland

I've seen hints of the "curdling" that William Herschel described: "A curdling liquid…" when using my 6-inch f/7.8 Cave reflector at 59× with no UHC filter. M42 is a very large and complex nebulae, making it very difficult to properly sketch, and visually describe. On nights of excellent transparency, using my 8-inch Cave reflector, the brighter parts of the nebula look pale-greenish.

I have seen the fifth star in the Trapezium with my 6-inch reflector at 76×, and the sixth star at 148×. With my 8-inch at 96×, I can see both the 5th and 6th star.

Roger Ivester: Observer from North Carolina

M42 – Bright Nebula in Orion

Date: February 1st and 2nd 2022

Telescope: 6-inch f/6 Newtonian reflector

Sketch magnification: 83×

Field-of-View: 1º

I've made pencil sketches of M42 many times over the years, but have never been pleased. A very complex object that requires much patience and time. However, on the nights of February 1st and 2nd, 2022, I tried for a better sketch, but was still not pleased. But there comes a time, when I have to say…enough is enough.

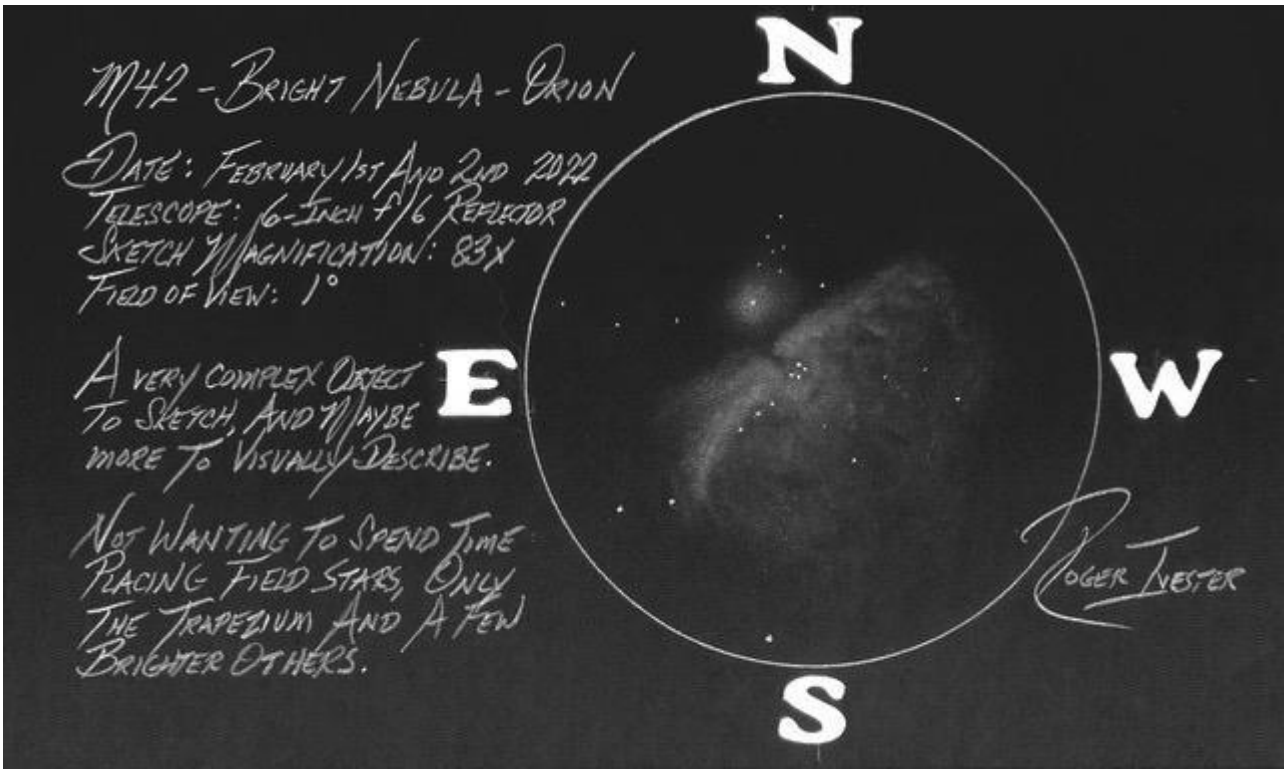
I used the first nights sketch as a preliminary, and then took the same sketch back outside the next night to make revisions: The following is that sketch made over a two night period.

Not wanting to spend extra time placing stars, I sketched only the four primary Trapezium stars, and a few of the most prominent ones. Over the years using a 102mm refractor, I could see the E star, but never the F star. And the same for the 6-inch reflector.

I have been able to see the F star many times over the years with my 10-inch reflector with nights of excellent seeing at 190×, appearing as a tiny red speck. Yes…I could see color in the F star.

Again, this is a very hard object to sketch, at least for me, and maybe more difficult to describe. So, I'm not going to try.

If you've never attempted to sketch M42, consider giving it a try. I promise that you will not regret it, and you'll have a mental picture of this nebula for all time.



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