



The Nebulas of Orion

A Tour of the 14 Best Visual Targets

The Nebulas of Orion

The constellation Orion is filled with a vast star-forming region called the Orion Molecular Cloud Complex, with stellar ages ranging up to 12 million years old. The complex is between 1000 and 1400 light years away and is hundreds of light years across.

The Orion Complex is one of the most active regions of nearby star formation visible in the night sky. It is home to protoplanetary discs and very young stars. Much of it is bright in infrared wavelengths due to the heat-intensive processes involved in star formation. The complex contains a variety of dark nebulae, emission nebulae, reflection nebulae and a few notable planetary nebulae. Several nebulae can be observed through binoculars and small telescopes, and the Great Orion Nebula, M42, is visible to the naked eye.

This talk will explore a variety of nebulae within the boundaries of Orion that are visible in 4-inch and larger telescopes.



Alhena

Canis Minor

Procyon

Taurus

Aldebaran

Ceres

Betelgeuse

Orion

Bellatrix

Monoceros

Alnilam
Alnitak

Saiph

Rigel

Sirius

Great Nebula in Orion (M 42 - NGC 1976)

Type: **Nebula**
Magnitude: **4.00** (extincted to: **4.20**)
Surface brightness: **12.94** (extincted to: **13.14**)
RA/Dec (J2000.0): 5h35m24.01s/-5°27'00.0"
RA/Dec (J2022.1): 5h36m29.08s/-5°26'13.8"
Hour angle/DE: 0h54m15.29s/-5°25'02.8" (apparent)
Az/Alt: +197°36'30.4"/+39°29'02.0" (apparent)
Ecliptic longitude/latitude (J2000.0): +83°00'49.5"/-28°44'25.0"
Ecliptic longitude/latitude (J2022.1): +83°19'19.6"/-28°44'14.7"
Galactic longitude/latitude: -150°55'02.1"/-19°23'00.4"
Size: +1°06'00"



HIP 25708

45 Ori^A

Bellatrix

Rigel

HIP 26345

HIP 26189

M42 - The Great Orion Nebula



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M42 - The Great Orion Nebula

One of the greatest mysteries in the history of astronomy is how Galileo, who spent much time examining Orion and recorded three stars of the Trapezium, missed the fact that there was a grand, splendid nebula surrounding them! The first mentions of the nebula were in 1610 by Nicolas Peiresc. At magnitude 3.7, this nebula is a naked eye object, even in moderately light polluted skies! Indeed, due to its brightness, it is one of the few gaseous clouds that can show some colour in amateur telescopes, with a greenish-grey tinge.

The core of the nebula, dubbed Huygen's Region, is clearly visible in binoculars. It contains the Trapezium - a young multiple star system whose radiation is illuminating this star-forming region. At least six members of this system are accessible to small-to-moderate aperture telescopes under high magnification.

M42 - The Great Orion Nebula

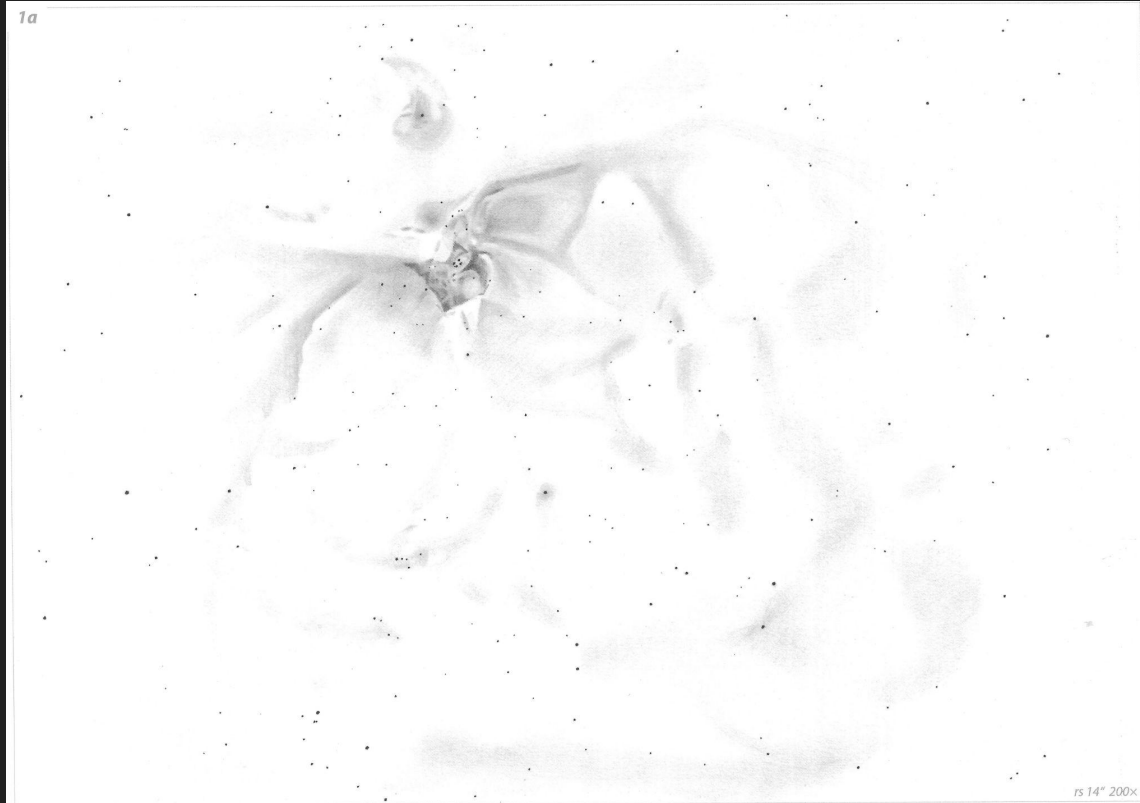
The best views of this nebula come at low to medium power. One can trace out fine wings to the east and west of the core, the Proboscis Major and Minor. There is a thrust of dark nebulosity called the Sinus Magnus that digs in towards the centre of the nebula from the north-northeast. There are many subtler arcs of nebulosity extending southwards. Larger apertures reveal more and more wonders. OIII and H-Beta filters can illuminate and highlight particular details and structures.

An observing challenge for larger scopes is to find dark nebulosity in the western portion of the nebula's rim that apparently spells out GOD in capital letters. O'Meara reports seeing portions of these letters in a 4 inch refractor under the very dark skies atop a Hawaiian volcano, but recommends 8 inches of aperture or greater for seeking out this detail.

Sketch of M42 through 4.5 Inch Newtonian at 36x



Sketch of M42 through 14 inch Dob by Ronald Stoyan



M43 - De Mairan's Nebula



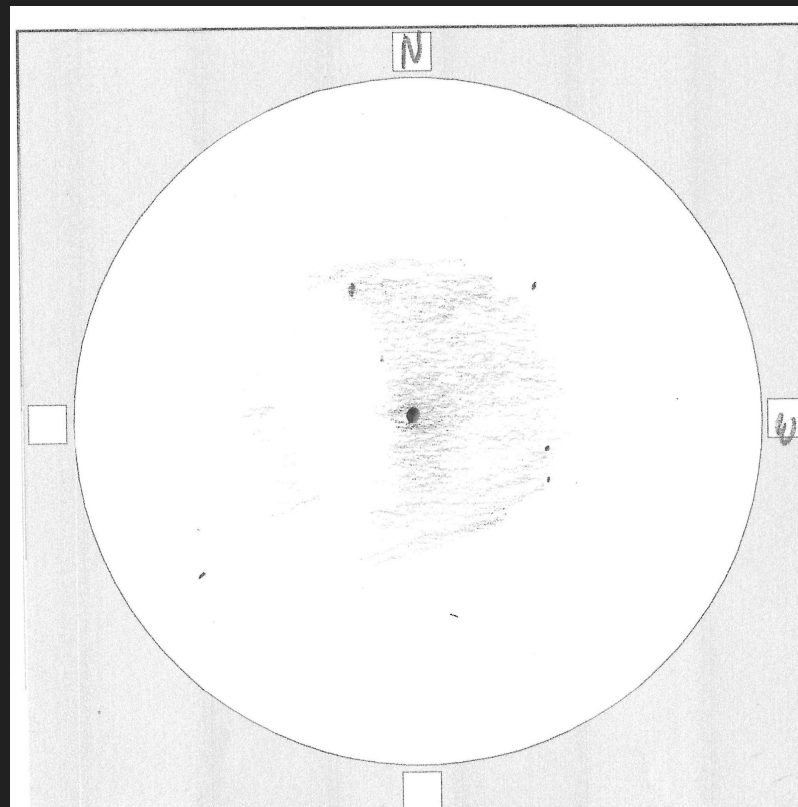
Photo: N.A. Sharp

M43 - De Mairan's Nebula

M43 is a curved wedge of nebulosity surrounding a 7th magnitude star - Bond's Star, 10' northeast of the Trapezium. It was discovered by De Mairan sometime before 1750. It harbours a wealth of detail whose examination could take up most of an evening, as long as you keep the eye from being distracted by M42.

The solution to this problem is to use higher magnifications. There is a dark pool of nebulosity immediately to the east of Bond's star, impinging on what would be a more circular glow. On the east side of this pool, observers with larger apertures will detect more glow of emission nebulosity. By tapping the telescope, some very faint extensions can be detected looping to the west, and a long wedge of material flowing to the east.

Sketch of M43 through 4.5 Inch Newtonian



Sh2-279 / NGC1977 Complex - The Running Man Nebula



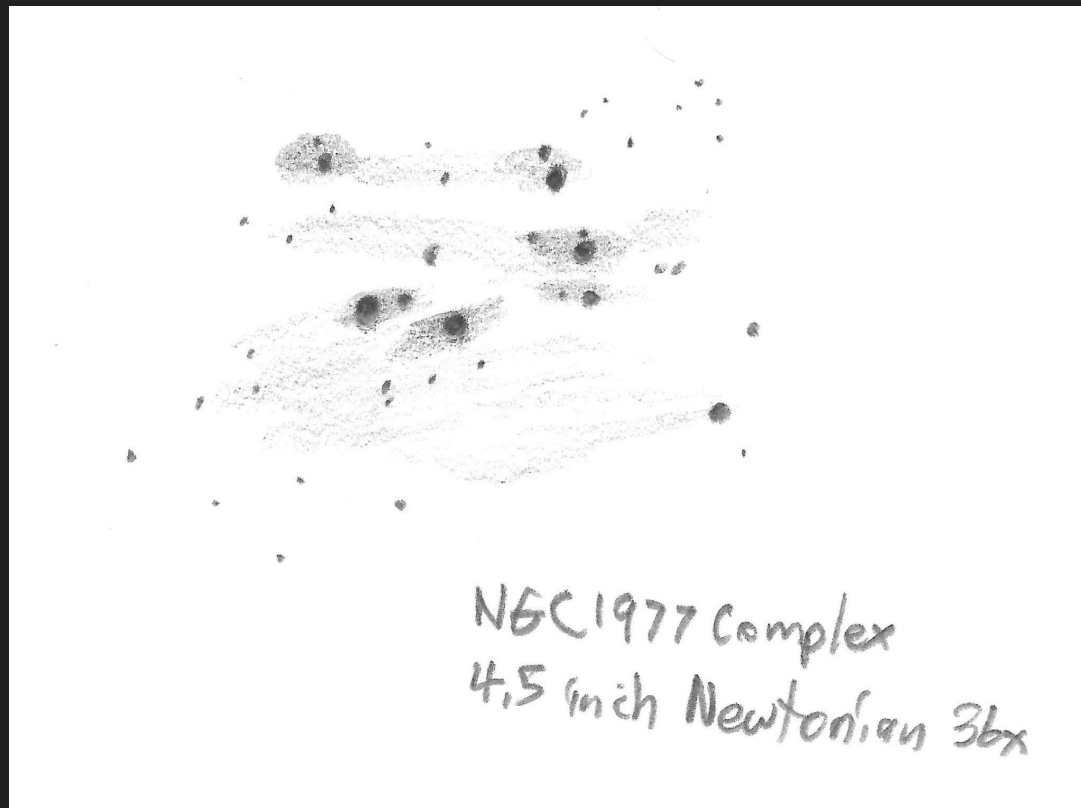
Photo: Martin Pugh
(APOD)

Sh2-279 / NGC1977 Complex - The Running Man Nebula

Often overshadowed by M42, this complex emission and reflection nebula is classified into three separate bright regions by the NGC catalogue: 1973, 1975 and 1977. Discovered by William Herschel in 1786, this nebula is deceptive - many people believe it to be relatively faint, but the brightest regions can be detected in 7x50 binoculars under very dark skies.

Through a 4.5 inch reflector at 36x under dark skies, it looks quite elegant, like folds of silvery silk. At first glance, the glow has a uniform texture, but with time and averted vision, there are three distinct, parallel bands of nebulosity separated by darker lanes. Pockets of brighter glowing gas surround the brightest five or so stars involved in the nebula.

Sketch of Sh2-279 through 4.5 Inch Newtonian



NGC1980 - The Lost Jewel of Orion



Photo: Tenho Tuomi

NGC1980 - The Lost Jewel of Orion

Discovered January 31, 1786 by William Herschel, who wrote that 'Iota Orionis and its neighbouring stars are involved in an extremely faint milky nebulosity to a great extent'. Indeed there is nebulosity there, and larger apertures will reveal it connected to M42 by a long, curving arc of gas, with a darker chasm between the objects. To view any portion of this nebulosity in smaller scopes requires dark skies.

The star cluster portion of this object is a beautiful sight, and has a handful of double and multiple star systems worth exploring. Iota Orionis itself is a triple-star system. The white-sapphire primary is accompanied by a 7th magnitude aquamarine companion 11" to the southeast, and a 10th magnitude pale mango star 49" to the east and slightly south of the primary.

NGC1980 - Pencil Sketch through 4.5 Inch Newtonian



NGC 1999

Type: **Nebula**
RA/Dec (J2000.0): 5h37m30.00s/-6°42'00.0"
RA/Dec (J2022.1): 5h37m34.43s/-6°41'15.9"
Hour angle/DE: 0h53m9.93s/-6°40'01.8" (apparent)
Az/Alt: +196°55'17.6"/+38°19'20.1" (apparent)
Ecliptic longitude/latitude (J2000.0): +83°15'30.9"/-30°00'06.9"
Ecliptic longitude/latitude (J2022.1): +83°34'01.1"/-29°59'56.6"
Galactic longitude/latitude: -149°36'06.2"/-19°42'00.4"
Size: +0°16'00"



NGC1999 - The 13th Pearl or Rubber Stamp Nebula



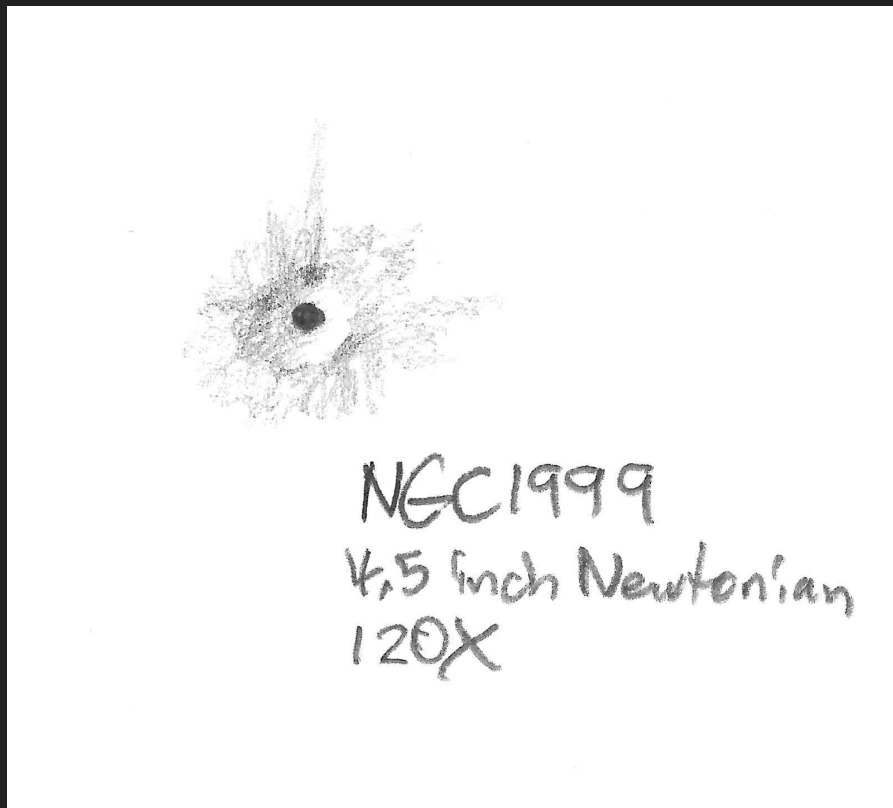
Photo: Subaru/HST

NGC1999 - The 13th Pearl or Rubber Stamp Nebula

Discovered in 1785 by William Herschel, although he classified this as a planetary nebula, not a reflection nebula. Illuminated by variable star V380 Orionis, the nebula is the leftover dust and gas from the formation of this young star.

At 36x in a 4.5 inch telescope, it looks simply like a faint fuzzy star. With averted vision it seems to swell by a full magnitude. Under 120x magnification, it is a classic example of Herschel's Class IV objects, a star surrounded by a round milky glow. With time and averted vision at high magnification, the glow becomes ring shaped, although slightly more elliptical. The northeastern segment is the brightest component. Look for a knot due north of V380 Ori, and under averted vision the fine ray streaks that emanate from it like a comet's tail.

NGC1999 - Pencil Sketch - 4.5 inch Newtonian at 120x



Rigel (β Ori - 19 Ori) - HIP 24436

Type: **pulsating variable star** (ACYG)
Magnitude: **0.15** (extincted to: **0.37**)
Absolute Magnitude: -6.96
Color Index (B-V): **-0.03**
Magnitude range: **0.17±0.22** (Photometric system: Hp)
RA/Dec (J2000.0): 5h14m32.28s/-8°12'05.9"
RA/Dec (J2022.1): 5h15m35.99s/-8°10'39.9"
Hour angle/DE: 1h15m7.84s/-8°09'19.6" (apparent)
Az/Alt: +203°03'13.1"/+35°31'11.9" (apparent)
Ecliptic longitude/latitude (J2000.0): +76°49'46.6"/-31°07'22.0"
Ecliptic longitude/latitude (J2022.1): +77°08'17.5"/-31°07'11.9"
Galactic longitude/latitude: -150°45'31.7"/-25°14'43.2"
Distance: 862.85 ly
Spectral Type: **B8 Ib**
Parallax: 0.00378"



NGC 1788

Type: **Nebula**
RA/Dec (J2000.0): 5h06m54.00s/-3°21'00.0"
RA/Dec (J2022.1): 5h08m0.20s/-3°19'19.7"
Hour angle/DE: 1h22m43.63s/-3°18'11.2" (apparent)
Az/Alt: +207°12'43.7"/+39°33'05.8" (apparent)
Ecliptic longitude/latitude (J2000.0): +75°12'34.3"/-26°06'36.9"
Ecliptic longitude/latitude (J2022.1): +75°31'05.1"/-26°06'26.9"
Galactic longitude/latitude: -156°28'34.7"/-24°42'29.5"
Size: +0°08'00"



Hatsya

Cursa

u Eri

v Eri

Rigel

λ Eri

t Ori

e Ori

NGC1788 - Cosmic Bat or Foxface Nebula



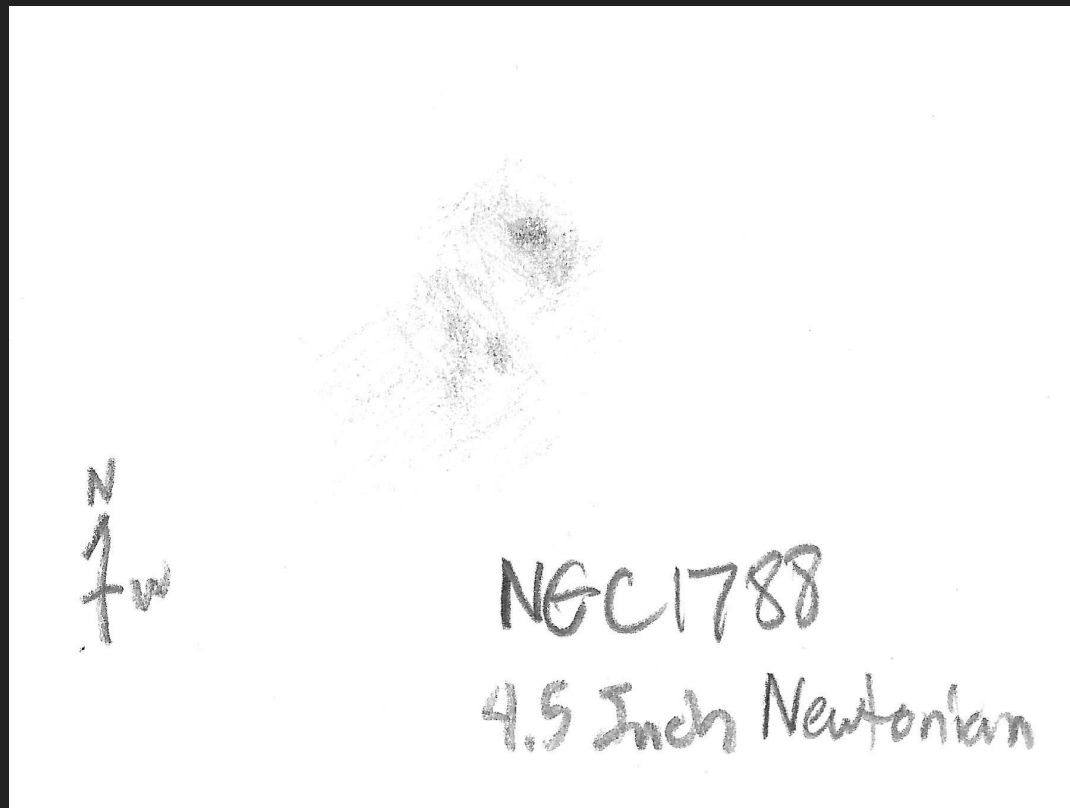
Photo: Jason Guenzel

NGC1788 - Cosmic Bat or Foxface Nebula

Discovered by William Herschel in 1786. Found only a degree and a half northwest of Cursa, Beta Eridani, this reflection nebula is small but obvious according to O'Meara. All of the stars in this isolated nebular region are very young - average age of only 1 million years. The gradation of ages in and around the nebula indicate a wave of star formation due to the strong radiation pressure and winds from the region of M42.

Telescopically, NGC1788 appears more extensive at low power than at higher magnification. The brightest patch lies southeast of a 10th mag star. At 36x, it appears as a fuzzy stellar-like object that grows with averted vision.

Sketch of NGC1788 through 4.5 inch Newtonian





Alnitak (ζ Ori - 50 Ori) - HIP 26727 A

Type: **double star**
Magnitude: **1.85** (extincted*to: **2.04**)
Absolute Magnitude: -5.15
Color Index (B-V): **-0.09**
RA/Dec (J2000.0): 5h40m45.54s/-1°56'33.2"
RA/Dec (J2022.1): 5h41m52.41s/-1°55'57.3"
Hour angle/DE: 0h48m52.14s/-1°54'54.8" (apparent)
Az/Alt: +196°51'51.1"/+43°11'35.4" (apparent)
Ecliptic longitude/latitude (J2000.0): +84°40'52.9"/-25°17'35.1"
Ecliptic longitude/latitude (J2022.1): +84°59'22.8"/-25°17'24.8"
Galactic longitude/latitude: -153°32'52.2"/-16°35'06.5"
Distance: 817.43 ly
Spectral Type: O9.5**ib**_SB
Parallax: 0.00399"



NGC2024 - The Flame Nebula



Photo: Phil Perkins

ASTRO
CRUISE

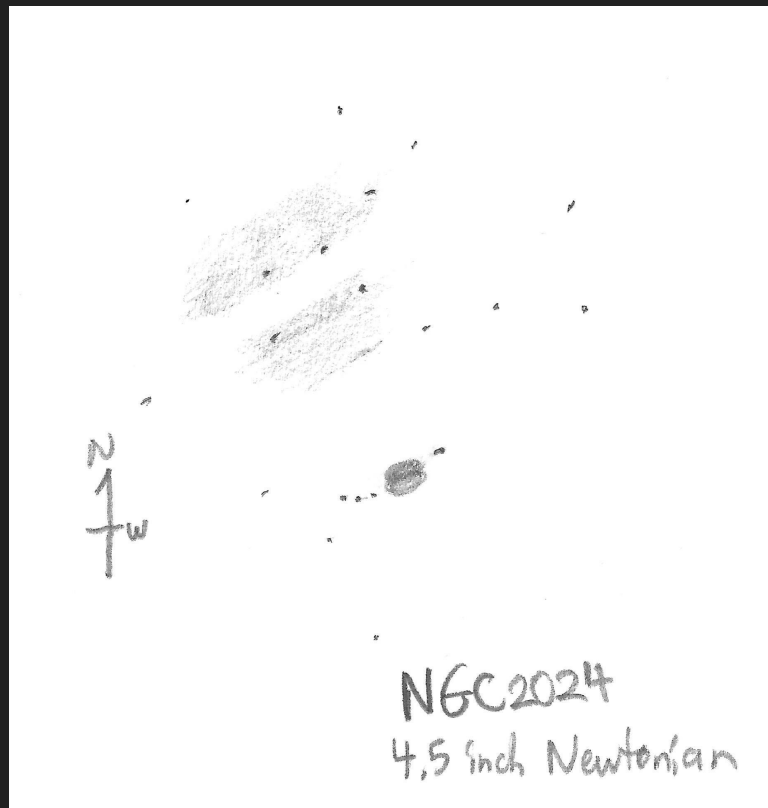
NGC2024 - The Flame Nebula

Mixed emission and reflection nebula with a dark cloud in the centre. Can be spotted in scopes of 4 inches as a faint glow surrounding a darker lane, but best appreciated in larger apertures. Use no filter. It is important, especially in smaller apertures, to place Alnitak out of the field of view or the nebula will be overwhelmed by the star's glare.

O'Meara also calls this the Lips Nebula or the Ghost of Alnitak, and through a 4.5 Inch Newtonian I can see why - the nebula's glow is like a ghostly reflection, and brighter patches on either side of the dark lane look like a pair of lips, as the fine feathering of darker nebulosity isn't apparent through smaller apertures.

The embedded cluster of ~800 stars that is ionizing the gas of this H-II region is obscured by the dark lane of the nebula - a lane so dense that even Hubble cannot penetrate it to see the stars behind.

Sketch of NGC2024 in 4.5 Inch Newtonian



IC434/B33 The Horsehead Nebula

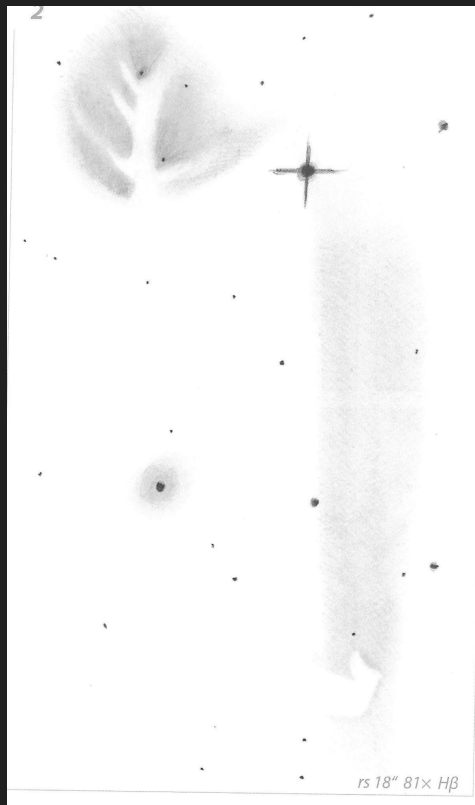


IC434/B33 The Horsehead Nebula

The emission portion of this nebula is also known as Orion's Dagger. This is a very difficult but compelling target. Although IC434 was known previously, the dark dust composing the horse's head wasn't discovered until 1888 by William Fleming on a photographic plate. This dark nebular region is actively forming low-mass stars.

The faint emission nebula IC434 is visible through scopes 8 inches and larger with an H-Beta filter. The dark horsehead shape of the intruding dark nebula B33 is very difficult without even more aperture, possibly 12 inches along with the H-Beta filter. Best appreciated with very large scopes.

Region Sketch in 14 inch Dob H Beta by Ronald Stoyan



NGC2023 & IC435 Reflection Nebulae

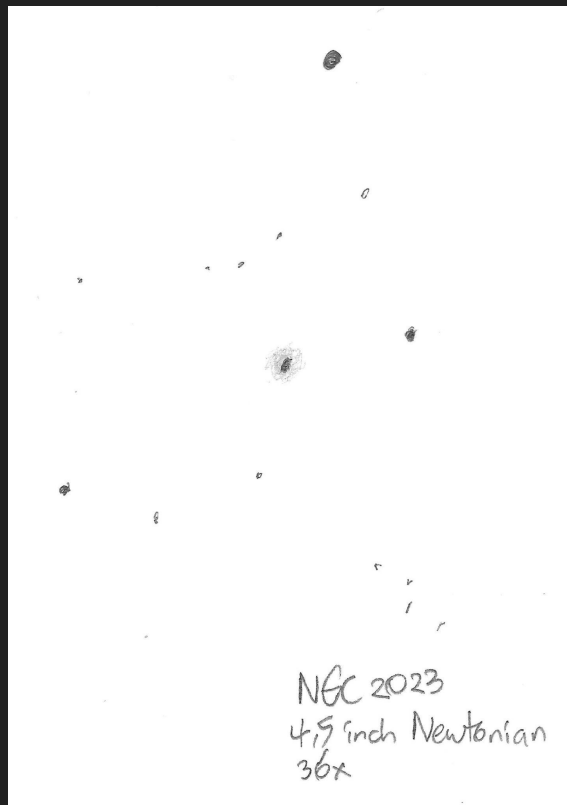


NGC2023 & IC435 Reflection Nebulae

This pair of reflection nebulae east of the Horsehead Nebula are often overlooked due to their more remarkable siblings to the north and west. NGC2023 is a target for 4 inch and larger scopes, whereas IC435 requires 8 inches of aperture to grasp.

NGC2023 was discovered by William Herschel on 6 January 1785. It is one of the largest known reflection nebulas, spanning 4 light years in diameter, and 10'x10' on the sky. In addition to the reflection and fluorescing hydrogen components of its light, there is also emission from polycyclic aromatic compounds in the nebula. In terms of stellar density, it is quite poor with only 21 infrared sources.

NGC2023 - Pencil Sketch through 4.5 inch Newtonian



M78 (M 78 - NGC 2068)

Type: **Nebula**
Magnitude: **8.00** (extincted to: **8.18**)
Surface brightness: **12.35** (extincted to: **12.54**)
RA/Dec (J2000.0): 5h46m42.00s/+0°03'00.0"
RA/Dec (J2022.1): 5h47m49.90s/+0°03'24.5"
Hour angle/DE: 0h42m54.79s/+0°04'22.5" (apparent)
Az/Alt: +195°23'06.2"/+45°26'24.9" (apparent)
Ecliptic longitude/latitude (J2000.0): +86°22'41.1"/-23°20'51.0"
Ecliptic longitude/latitude (J2022.1): +86°41'10.9"/-23°20'40.7"
Galactic longitude/latitude: -154°39'08.7"/-14°20'22.7"
Size: +0°08'00"



HIP 28413

Alnitak

Alnilam

Mintaka

σ Ori

η Ori

α Ori

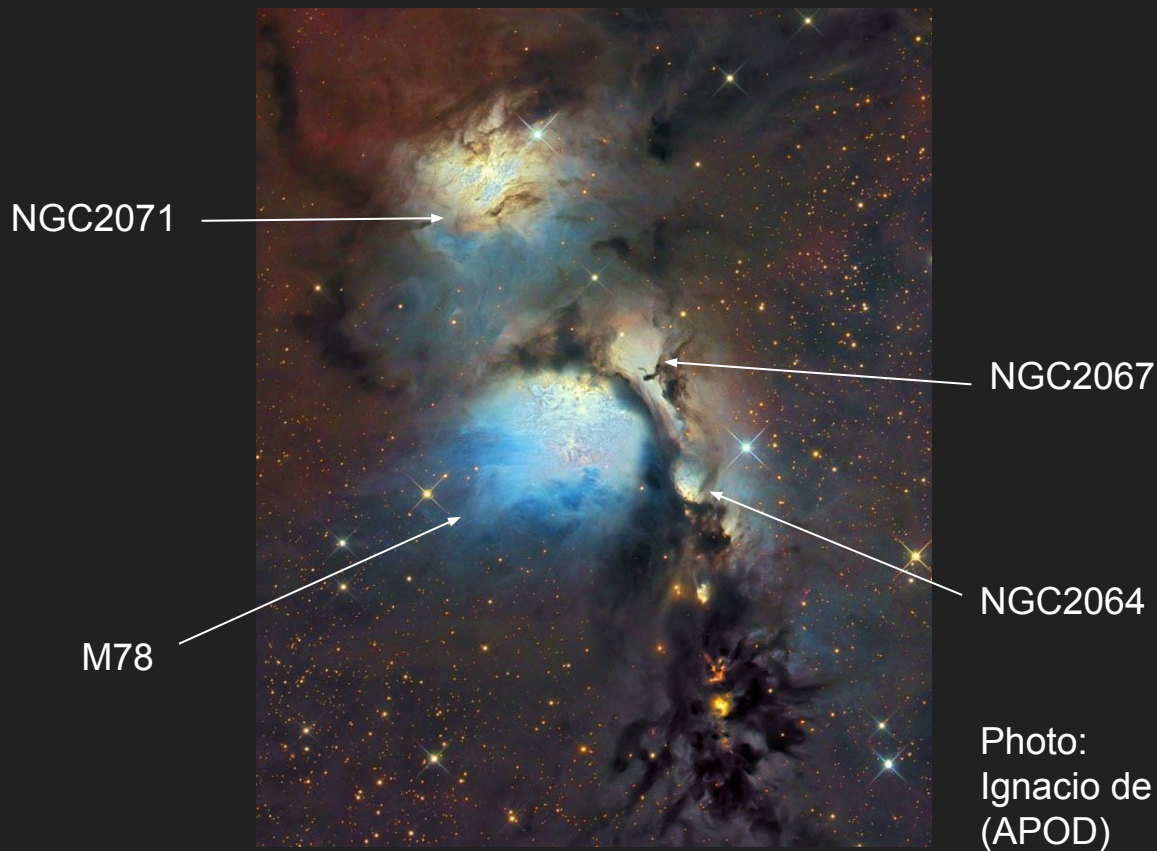
Hatsya

Planet labels [Alt+P]

Earth, Monkton, Ontario, 0m FOV 8.12° 53.2 FPS 2022-01-25 22:33:25 UTC-05:00



M78 Reflection & Dark Nebula Complex



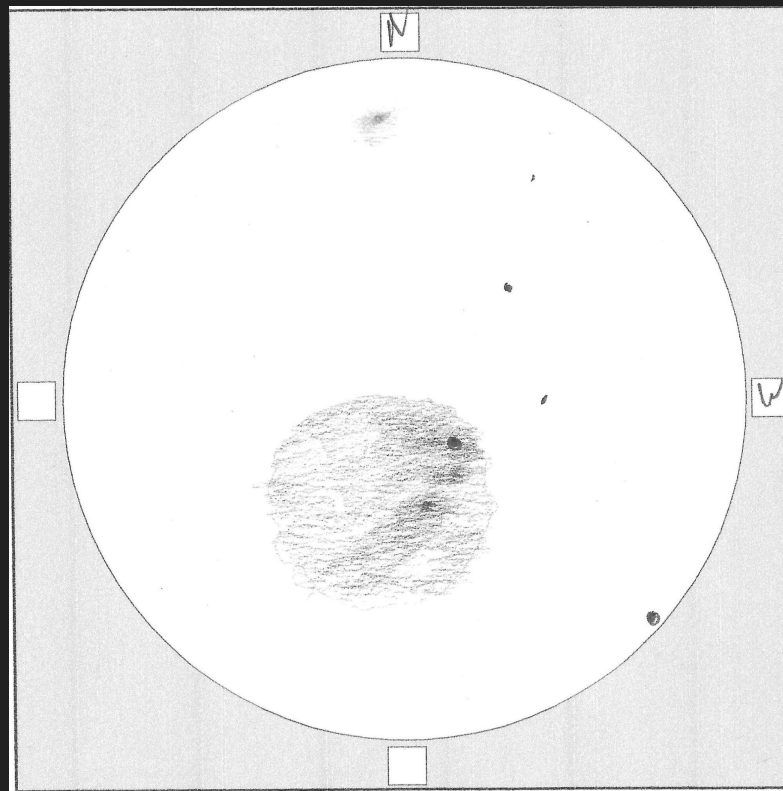
M78 Reflection & Dark Nebula Complex

The M78 region is a large complex of reflection and dark nebulae surrounding newly-formed stars, most of which are only visible in infrared light. M78 is visible under dark skies in 7x35 binoculars, but is often overlooked. NGC2071 is visible in 4-inch scopes. NGC2064 and 2067 require larger apertures of 8 inches and up.

Many observers describe M78 as appearing comet-like, with a split nucleus and tail proceeding to the southeast from the southern nucleus, surrounded by a gauzy haze.

Now for a mystery: just a few arcminutes southwest of M78 there is a region called 'McNeil's nebula', which is only occasionally visible in amateur scopes when the star V1647 Orionis is having an outburst. It was observed in 1966, and then disappeared until 2004, was active for two years, then died away, erupted again in 2008 and has been slowly dimming ever since. Check and see if you can spot it!

Sketch of M78 Region in 4.5 Inch Newtonian



Betelgeuse (α Ori - 58 Ori) - HIP 27989

Type: pulsating variable star (SRC)
Magnitude: 0.45 (extincted to: 0.61)
Absolute Magnitude: -5.47
Color Index (B-V): 1.52
Magnitude range: 0.00+1.30 (Photometric system: V)
RA/Dec (J2000.0): 5h55m10.36s/+7°24'25.7"
RA/Dec (J2022.1): 5h56m22.04s/+7°24'33.8"
Hour angle/DE: 0h34m22.86s/+7°25'18.3" (apparent)
Az/Alt: +194°16'30.7"/+53°03'23.7" (apparent)
Ecliptic longitude/latitude (J2000.0): +88°45'17.3"/-16°01'37.0"
Ecliptic longitude/latitude (J2022.1): +89°03'46.8"/-16°01'26.7"
Galactic longitude/latitude: -160°12'45.9"/-8°57'30.3"
Distance: 497.95 ly
Spectral Type: M21b
Parallax: 0.00655"
Period: 2335 days

Betelgeuse

Meissa

Orion

Bellatrix

Mintaka

Ainlam

Ainitak

NGC 2022

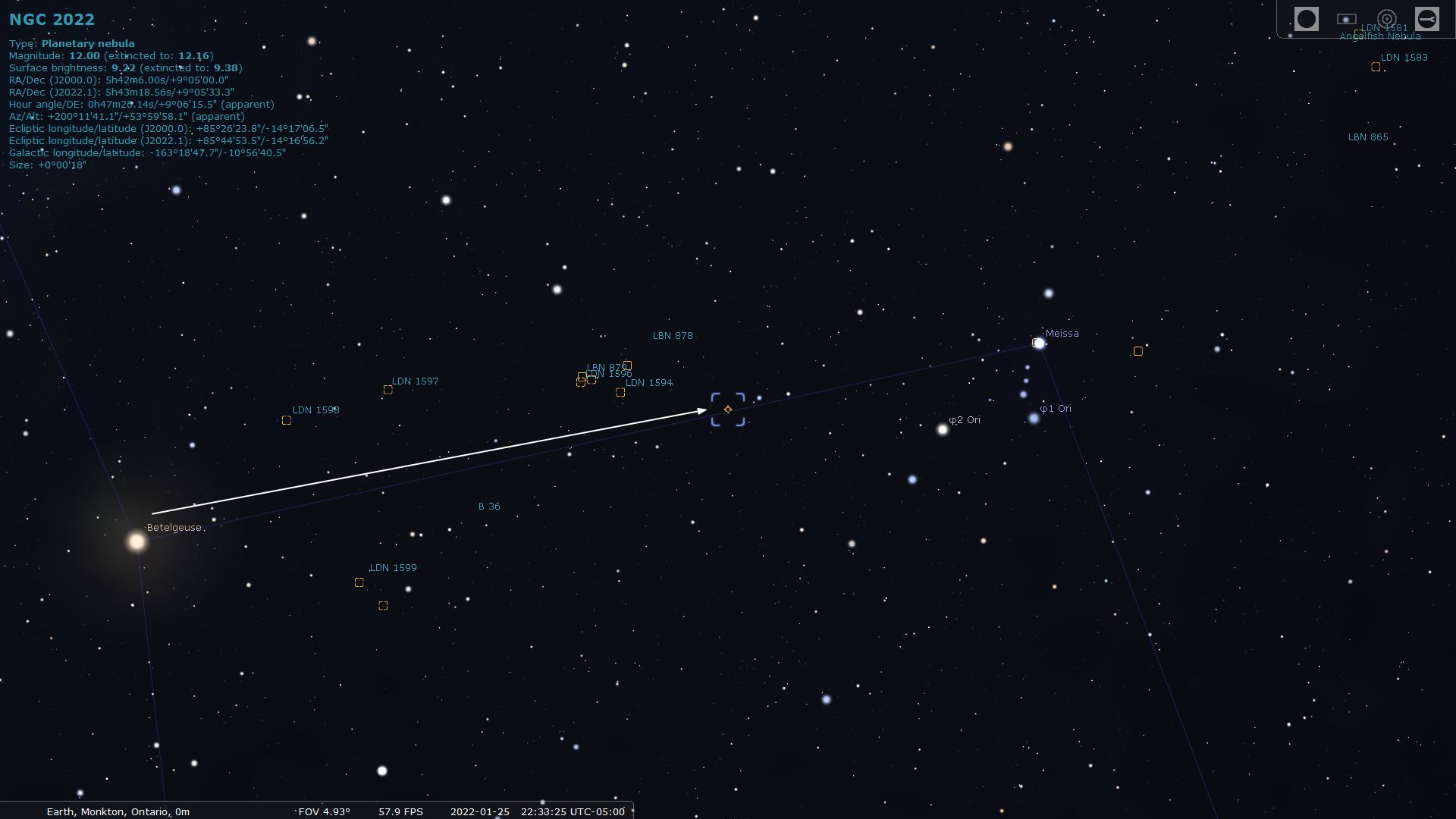
Type: Planetary nebula
Magnitude: 12.00 (extincted to: 12.16)
Surface brightness: 9.22 (extincted to: 9.38)
RA/Dec (J2000.0): 5h42m6.00s/+9°05'00.0"
RA/Dec (J2022.1): 5h43m18.56s/+9°05'33.3"
Hour angle/DE: 0h47m20.14s/+9°06'15.5" (apparent)
Az/Mt: +200°11'41.1"/+53°59'58.1" (apparent)
Ecliptic longitude/latitude (J2000.0): +85°26'23.8°/-14°17'06.5"
Ecliptic longitude/latitude (J2022.1): +85°44'53.5°/-14°16'56.2"
Galactic longitude/latitude: -163°18'47.7°/-10°56'40.5"
Size: +0°00'18"



LDN 1581
Angular Nebula

LDN 1583

LBN 865



Betelgeuse

B 36

LBN 878

Meissa

φ2 Ori

φ1 Ori

LDN 1598

LDN 1597

LBN 876
LDN 1596

LDN 1594

LDN 1599

NGC2022 - Collarbone or Kissing Crescents Nebula



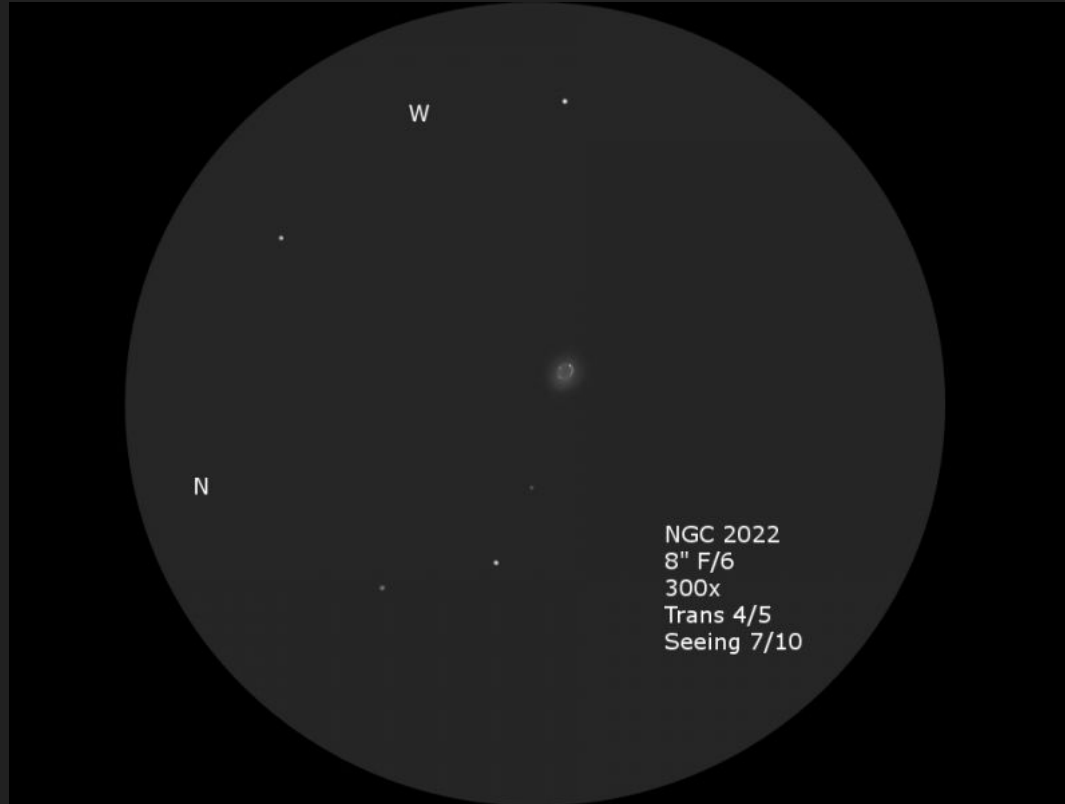
Photo: Adam Block

NGC2022 - Collarbone or Kissing Crescents Nebula

At magnitude 11.9, this planetary nebula is positively stellar at low power. Although it isn't the brightest planetary, it's early evolutionary phase and high surface brightness make it 'obvious' to O'Meara. The brightest section, an elliptical inner annulus, is oriented northeast-southwest and measures 22"x17". The dim outer shell is spherical and 28" across, a real size of approximately 1 light year at its distance of 7,600 light years.

The nebula at low power forms a northeast to southwest line with two other stars of 12th magnitude. Use a star chart and 'blink' with an OIII filter to pinpoint its position, then increase magnification. At around 120x, the nebula stands out boldly against the sky background, especially through a filter. Higher magnification is needed to clearly make out the annulus, which I could not resolve in my scope.

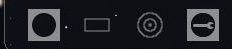
NGC2022 - Collarbone or Kissing Crescents Nebula



Sketch by:
Cloudy Nights User
Asbytec

HIP 29013 A

Type: **double star**
Magnitude: **8.30** (extincted to: **8.44**)
Absolute Magnitude: 0.37
Color Index (B-V): **0.32**
RA/Dec (J2000.0): 6h07m19.99s/+18°47'37.0"
RA/Dec (J2022.1): 6h08m37.86s/+18°47'21.7"
Hour angle/DE: 0h22m7.26s/+18°47'49.6" (apparent)
Az/Alt: +192°21'40.2"/+64°46'31.5" (apparent)
Ecliptic longitude/latitude (J2000.0): +91°44'28.3"/-4°38'04.5"
Ecliptic longitude/latitude (J2022.1): +92°02'57.8"/-4°37'54.2"
Galactic longitude/latitude: -168°44'29.8"/-0°48'57.8"
Distance: 1259.29 ly
Spectral Type: F3III
Parallax: 0.00259"



Gomeisa
S. Minor

Gemini

Tejat Posterior

Alhena

Alhath

Aldebaran

Betelgeuse

NGC2361 = Cederblad 62



Photo: Bernhard Hubl

NGC2361 = Cederblad 62

NGC2163 is a bit of a mystery in that most people don't know it exists. Discovered some time between 1870 and 1884 by Edouard Jean-Marie Stephan, when Dreyer first put it in the NGC he mistakenly gave the wrong declination for the object. This was corrected in the second Index Catalogue, but the error led later editors to miss it. It is among the hundreds of objects listed as 'non-existent' in the 1973 Revised New General Catalogue, and many star charts and atlases (including Stellarium!) since have skipped placing this curious bipolar reflection nebula in the sky.

At low power, this ~11th magnitude glow is essentially stellar. Increasing magnification to around 72x will turn the star into a 'tiny comet' (O'Meara). At high magnification, it's bipolar nature is visible, with the northern lobe more prominent.

Sketch of NGC2361 in 4.5 Inch Newtonian



Monkey Head nebula (NGC 2174)

Type: **Nebula**
RA/Dec (J2000.0): 6h09m42.00s/+20°30'00.0"
RA/Dec (J2022.1): 6h11m0.86s/+20°29'40.1"
Hour angle/DE: 0h19m44.30s/+20°30'05.9" (apparent)
Az/Alt: +191°40'47.8"/+66°32'52.0" (apparent)
Ecliptic longitude/latitude (J2000.0): +92°16'27.5"/-2°55'12.5"
Ecliptic longitude/latitude (J2022.1): +92°34'57.0"/-2°55'02.2"
Galactic longitude/latitude: -169°57'48.3"/+0°29'56.6"
Size: +0°40'00"



NGC2174/5 - Monkey Head Nebula



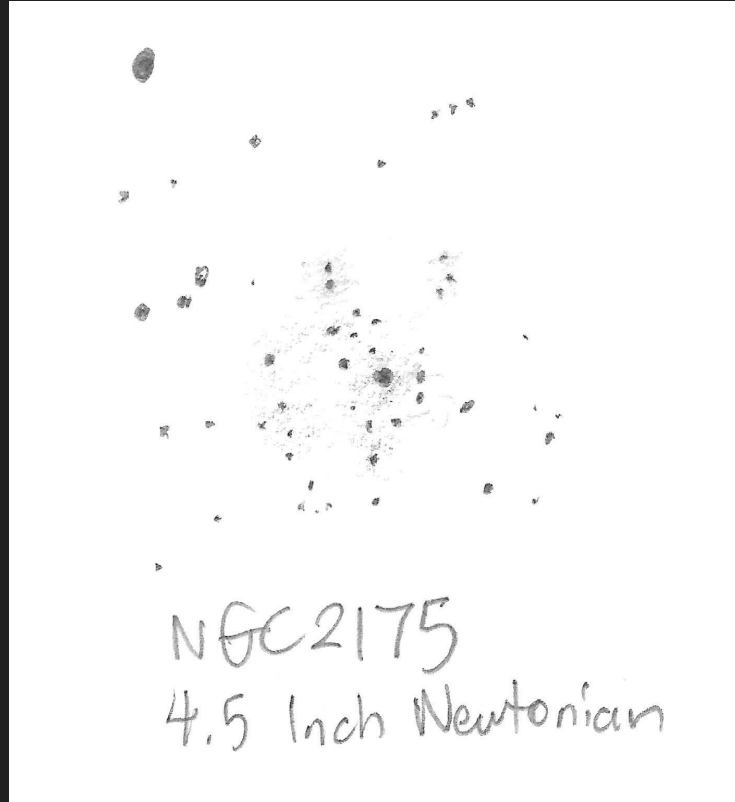
Photo: Dan Kowall

NGC2175 - Monkey Head Nebula

Near the border with Gemini, this mag 6.9 nebula is visible in binoculars in a dark sky, but it is often overlooked. Discovered in 1857 by Carl Christian Bruhns, Herschel is thought to have missed it because his telescopes had too small a field of view to notice something this large with low surface brightness. There is some confusion as to whether NGC2174 or 2175 refers to this particular nebula, but O'Meara insists that there is a separate bit of nebulosity that NGC2174 refers to slightly north-northwest of the cluster and this nebula referred to by NGC2175.

At low power, the nebula appears like a large irregularly round glow of pale, uniform light. Averted vision shows some brightenings around the bright 7.6 magnitude central star and some smaller groupings of stars. Higher power does little to improve the view.

Sketch of NGC2175 from a 4.5 Inch Newtonian



References

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<https://cseligman.com/text/atlas/>

<https://www.stellarium.org>

<https://www.wikipedia.org>