



vaonis

Exploring and capturing
the wonders of
the Milky Way
with a smart telescope

Illustrated with the finest astrophotographs
captured with smart telescopes.

200 curated targets with star charts
Smart telescope capture tips
Observation planner

2026 edition

About this guide

A decade ago, the French company Vaonis pioneered a new class of instrument: the smart telescope. Their ease of use, the observing experience they offer, and the rapid progress they have made possible in astrophotography have all helped drive the growing popularity of this category.

When it comes to astrophotography, the question of what smart telescopes are capable of is still debated. Today's market spans a broad range of instruments and price points, with performance that varies accordingly. Yet the most advanced models now produce images that can unequivocally be regarded as true high quality astrophotography. This guide seeks to demonstrate that reality by showcasing some of the finest images captured by smart telescope users.

For observers still attached to traditional telescopes, another recurring criticism has been that smart telescopes do not naturally foster a deeper understanding of the night sky. Yet the opposite may well be true. By removing nearly every obstacle between the user and the night sky, the smart telescope becomes an exceptionally powerful tool for exploration. It allows observers to engage with the sky intentionally rather than devote most of their attention to technical complexity. But for that promise to be fully realized, the knowledge needed to interpret what one sees must be as immediate and accessible as the image on the screen.

That is the purpose of this guide: not simply to present a list of targets selected for smart telescopes, but to provide concise, practical context that helps observers understand each object's place and role in our galaxy and what its visible details actually represent.

The number of deep-sky objects accessible to a smart telescope is vast. The large nebulae for which this type of instrument is especially well suited are found primarily along the band of the Milky Way. This is no coincidence, since the spiral arms of our galaxy are home to these immense structures of gas, dust, and stars. As a whole, this band is the richest region of the night sky. It is therefore this celestial landscape that this guide sets out to explore.

Cover image: Mega-mosaic of The Cygnus Nebular Complex captured with Vespera. Credit: Nathanael Martin

Vaonis Vespera 3 smart
telescope in action.



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THE CORE OF THE
LAGOON NEBULA

Vaonis Vespéra 3

Total integration time 3h
Dual band filter
Bortle 5

The Milky Way

The term “Milky Way” refers to two related things with the same origin. First, it describes the faint luminous band you can see stretching across the night sky under truly dark conditions. Second, it refers to the galaxy we live in: a vast rotating disk of 100 to 400 billion stars, along with gas and dust, where our Solar System is just one ordinary inhabitant among billions.

The core of the Milky Way
photographed from a dark-sky
site with a single 20-second
exposure.



The Band in the Sky

On a moonless night far from city lights, the Milky Way appears as an irregular arc of pale light stretching from horizon to horizon, brighter and denser in the direction of Sagittarius, fainter and more diffuse toward Perseus and Auriga.

The Galaxy is a flat disk roughly 1,000 light-years thick at our position, and we are inside it. Looking along the plane of the disk, our line of sight passes through the maximum number of stars: billions of them, unresolved and piled atop each other, producing the glow. Looking perpendicular to the disk, we look straight out of the Galaxy into intergalactic space, where there are far fewer stars.

The band is not uniform. It brightens and dims, splits in places, and is crossed by conspicuous dark lanes, most famously the Great Rift, a dark channel running from Cygnus through Aquila and into Sagittarius. These are not holes in the Galaxy: they are foreground clouds of interstellar dust absorbing the visible light of the more distant stars behind them.

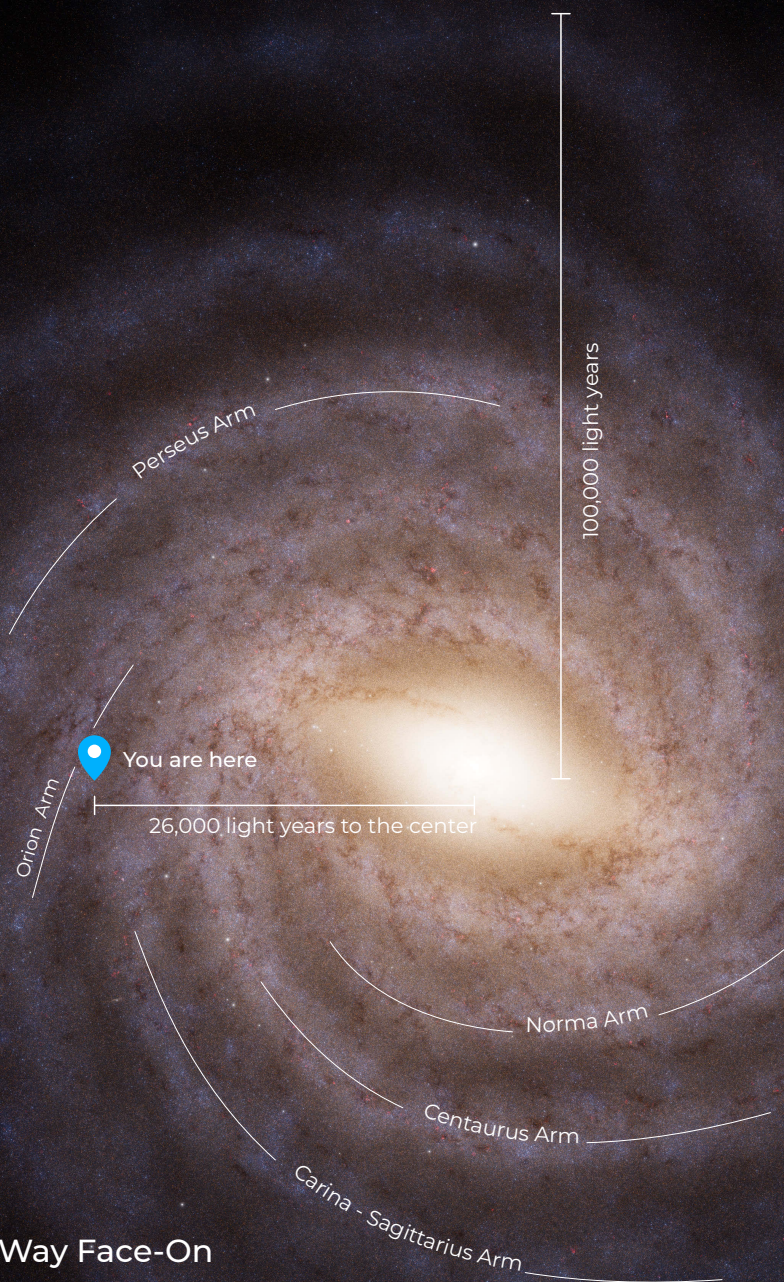
The Milky Way is not faint by astronomical standards: it is simply overwhelmed by any competing light source. A single streetlamp is enough to render it invisible. The Milky Way is now hidden from more than one-third of all people on Earth. For an increasing share of the world's population, the night sky is a permanent orange-grey haze. The generation growing up in highly urbanized areas may never see it with their own eyes.

The Galaxy we Live in

Galaxies are gravitationally bound systems of stars, gas, dust, and dark matter, all orbiting a common center of mass. Galaxies range from dwarf systems containing a few million stars to giant ellipticals holding several trillion.

Our own Galaxy, The Milky Way, is a large spiral galaxy, but not an exceptional one. It has three main structural components: the bulge (a dense, roughly spherical concentration of older stars at the center), the disk (where the spiral arms and nearly all star formation are located), and the halo (a sparse, spherical envelope of old stars and globular clusters surrounding the whole system).

The Solar System lies in the Orion Arm, also called the Orion Spur or Local Arm, a small partial arm of the Milky Way located between the Sagittarius-Carina and Perseus arms, about 26,000 to 27,000 light-years from the Galactic Center. This intermediate position strongly shapes our view of the deep sky: some nearby objects belong to our local Galactic environment, while many more distant nebulae and clusters lie in neighboring spiral arms, several thousand light-years away.



The Milky Way Face-On

Artist's impression of our galaxy, showing its structure and the position of the Sun.

Credit: ESA/Gaia/DPAC, Stefan
Payne-Wardenaar - CC

Smart telescope observing tips

Usually built around short focal lengths, fast optics, and relatively wide fields of view, or even very wide fields when using mosaic mode, smart telescopes are especially well suited to capturing the nebulae and star clusters that populate the spiral arms of our Galaxy. Here are a few tips to get the most out of your observation sessions.



From Targets to Scenes with Mosaic Mode

WHEN SINGLE-TARGET FRAMING ISN'T ENOUGH

Traditional telescope observing is built around a single object: you point the instrument, you observe or capture one isolated target. In the Milky Way band, this approach consistently leaves value on the table. The night sky along the galactic plane is rarely organized into isolated objects with empty space around them. Sometimes two or three objects of independent interest sit close enough on the sky to be captured together, and doing so produces a richer, more contextually meaningful image than any single-target framing could.

Mosaic mode addresses this directly. Instead of imaging within the telescope's native field of view, mosaic mode extends coverage by tiling a wider area.

This guide flags mosaic recommendations when it adds particular value.

WHAT TO EXPECT FROM YOUR INSTRUMENT

Automatic mosaic capture was pioneered and patented by Vaonis and has since been progressively adopted by other smart telescope manufacturers. Not all models on the market include this feature, however, so it is worth confirming mosaic availability before purchasing.

On smart telescopes with more advanced implementations, such as the Vaonis lineup, the mosaic algorithm has been refined over several years to the point where no manual stacking is required to get the best result quality. The assembled image is delivered directly at the end of the session, ready for post-processing. On entry-level models with less mature algorithms, manual stacking of

the individual frames may still be necessary to achieve the best result.

THE TRADEOFF: FIELD SIZE VERSUS INTEGRATION TIME

Covering a wider field means the telescope spends less time on any given portion of the scene per unit of session time, so reaching the same image depth across a mosaic field requires longer total integration than a single-target frame. For ambitious mosaic projects, multi-night capture becomes necessary. On Vaonis smart telescopes, the Multi-Night mode handles this automatically: each successive night's data is stacked on top of previous sessions without any manual intervention, and the final stacked image is always available for post-processing regardless of when the project is stopped.

Going Further with Mega-Mosaics

WHEN A SINGLE MOSAIC IS NOT ENOUGH.

Some regions of the Milky Way are too large even for a single mosaic acquisition. Some interesting composition of related objects may exceed what any single mosaic panel can cover. Capturing these regions completely requires assembling multiple mosaic panels into a mega-mosaic.

Mega-mosaics are long-term projects typically spread across several nights. Some of the mega-mosaic projects described in this guide, such as the complete Cygnus Nebular complex or the Rho Ophiuchi complex, realistically require 20 to 50 hours of total integration (or even more for very ambitious projects) to reach their full potential.

Tutorial

[Click here to read a tutorial presenting a workflow for capturing mega mosaics.](#)



MEGA-MOSAIC OF THE CYGNUS
NEBULAR COMPLEX

Vaonis Vespera 2

Total integration time 222 hours

Mosaic mode (48 panels)

Dual band filter

Original definition: 585 megapixels

Credit: Nathanael Martin

THE KEY CHALLENGE: SEAM-FREE ASSEMBLY

The critical factor in mega-mosaic success is homogeneity between panels. The most technically demanding step is not the capture itself but the seamless assembly of the panels afterward. Visible seams between panels, which result from differences in sky background brightness, signal-to-noise ratio, or processing treatment, are the most common failure mode. Avoiding them requires discipline during acquisition:

Capture each panel with the same total integration time.

A four-panel mega-mosaic where two panels have 4 hours of data and two have 1 hour will be very difficult to assemble without visible seams.

Capture under comparable sky conditions.

Mixing panels taken around new moon with panels taken near a bright moon introduces sky background differences that are more difficult to remove in processing.

Apply the same processing workflow to every panel before assembling.

Differences in stretching, background subtraction, or color calibration between panels will show at the seams.

On Vaonis smart telescopes, the Multi-Night mode is compatible with mosaic mode, meaning consecutive nights of mosaic data are automatically accumulated. This is currently the most streamlined available path to automated mega-mosaic acquisition. On other smart telescopes, each panel's raw frames must be stacked manually in external software before the panels themselves can be assembled.

When to Use a Filter

WHY FILTERS MATTER

Filters are among the most impactful tools available to smart telescope imagers, but knowing when to use one, and which one, matters as much as having the equipment.

Why filters help: The sky background is never perfectly dark, even from a reasonably dark site. Light pollution and moonlight all contribute a diffuse luminous haze that competes with the faint signal from deep-sky objects. A filter that selectively transmits only specific wavelengths of light suppresses this broadband background while preserving the emission from objects that radiate at those specific wavelengths. The result is dramatically improved contrast and the ability to detect fainter structures than broadband imaging would allow.

Target entries in this guide also include filter recommendation.

NARROWBAND FILTER

The most useful single filter for smart telescope work in the Milky Way is the dual-band filter, which transmits light around two specific wavelengths: the H α (hydrogen-alpha) emission line at 656 nm and the OIII doublet at 496 and 501 nm. These are the two dominant emission wavelengths of ionized gas nebulae, including emission nebulae, supernova remnants, and most planetary nebulae.



A full-aperture dual-band filter mounted on a smart telescope.

Using a dual-band filter on these targets is almost always beneficial: it increases contrast, suppresses sky glow, and separates

the two emission components by color, producing the characteristic red-and-teal palette that defines narrowband astrophotography. It also reduces star intensity.

No-filter acquisition (or broad band filter) is referred to as broadband imaging.

WHEN NOT TO USE A FILTER.

Reflection nebulae emit no light of their own: they simply scatter the white light of nearby stars across a broad spectrum. A dual-band narrowband filter suppresses almost all of this signal, effectively rendering the reflection nebula invisible. For targets like the Rho Ophiuchi complex, the Iris Nebula, or the vdB 31 field in Auriga, broadband imaging with no filter is the only effective approach. Globular clusters and open clusters fall into the same category: their interest lies in stellar color diversity, which a narrowband filter destroys.

SPECIAL CASES

Mixed targets require judgment. Some fields combine emission and reflection components in the same frame. In these cases, the right strategy depends on what you want to emphasize.

The most effective approach for mixed targets is a two-capture strategy: one session with the dual-band filter to maximize the emission signal, and a separate session without a filter to preserve the reflection nebulosity and natural star colors. The two resulting images are then combined during post-processing. This technique requires more total acquisition time and a somewhat more advanced processing workflow, but it consistently produces the most complete and visually compelling results. Several objects in this guide carry specific recommendations for this approach.

Multi-Night Capture

BUILDING SIGNAL OVER TIME

The more challenging targets in this guide could require more total integration time than a single night can provide. A supernova remnant like the Monoceros Loop or a dark nebula complex like the Cepheus Flare cannot be developed fully in two or three hours: they need ten or more hours of accumulated signal to reveal their full structure. Multi-night capture is a useful technique for serious deep sky imaging with smart telescopes.

Depending on the smart telescope model you use, different features may be available to assist you.

On more advanced instruments such as Vespera, multi-night capture is managed automatically. Each new session can be resumed with a single tap, and at the end of your acquisition sequence, you get a pre-stacked RAW image file ready for post-processing.

On other entry-level models, individual frames from each session must be stored in the telescope's memory, then either stacked later by the telescope's control app or exported for processing in third-party software.

CONSISTENCY BETWEEN SESSIONS

The quality of a multi-night stack is approximately the average of the conditions across all contributing sessions. One session captured during poor transparency or near a bright moon will degrade the final result proportionally to its contribution to the total. Where possible, restrict multi-night projects to sessions with comparable sky conditions. It is better to wait for a good night than to add mediocre data.

How much acquisition time should I aim for?

Ultimately, this is one of the key questions many smart telescope users ask. The answer depends on the object you are observing, especially its surface brightness, but even more on your goal: assisted visual observation or high-quality astrophotography.

UNDERSTANDING SIGNAL TO NOISE RATIO.

Your smart telescope's sensor captures light from celestial objects, known as the signal. However, it also generates noise, an undesirable byproduct caused by several factors such as light pollution and the functioning of the sensor electronic itself.

Since the signal from deep-space objects is so faint, it can easily be overwhelmed by noise, leading to poor image quality.

Fortunately, the noise is randomly distributed across each individual frame, while the signal remains consistent. This is where stacking comes into play: it progressively cancels out the noise while preserving the signal.

The quality of the final image can be expressed as a signal-to-noise ratio (SNR), which measures the clarity of the captured data. This is the primary concern in astrophotography.

High SNR: The signal dominates the noise, resulting in sharp, clear, and detailed images.

Low SNR: The noise competes with the signal, blurring details and reducing image quality.

The more images you stack, the less noise will affect your final image.

THE ACQUISITION TIME RULE OF THUMB.

Achieving a significant improvement in SNR requires a substantial increase in acquisition time since there's a law of diminishing return:

As a general rule of thumb, doubling the acquisition time is necessary to achieve a meaningful step in quality improvement.

While there's no hard limit, the effort required to improve image quality grows significantly. The total acquisition time required can escalate quickly, making it essential to weigh the potential gains against the effort involved.

IT'S ABOUT YOUR GOALS AND EQUIPMENT

If you want to observe a star cluster and capture a decent image, 30 minutes may be enough.

If your goal is a high-quality image of a large target requiring mosaic mode, you may need 10 hours of integration time.

The acquisition time rule of thumb.

Want noticeably better than what you have?
Double the acquisition time!

STEP 1

15mn

STEP 2

30mn

STEP 3

1h

STEP 4

2h

STEP 5

4h

STEP 6

8h

STEP 7

16h

The specifications of your smart telescope also play an important role. The key factor here is the focal ratio which is the relationship between the telescope's aperture and focal length.

On most smart telescopes, this value is around 5. With a higher focal ratio, longer integration time is required to achieve the same image quality. Conversely, a lower focal ratio allows you to reach a comparable result more quickly (such telescopes are often described as "faster.")

Here is a starting point to help you choose your acquisition time based on the type of object and your observing goals and a F-ratio of 5

Star clusters	
basic photo	15 to 30 min
high quality astrophoto.	1 to 2 h
Bright nebulae	
basic photo	1 h
high quality astrophoto.	2 to 4 h
Low-surface-brightness nebulae	
basic photo	2h
high quality astrophoto.	4 to 8 h
Large mosaic composition	
basic photo	2h
high quality astrophoto.	8 to 16h

Scheduling your Sessions

Smart telescopes are designed to operate without the user being physically present. Once a session is launched, the telescope tracks the target, manages its own exposure timing, and accumulates data entirely autonomously.

Most smart telescopes offer an observation scheduling feature. This autonomous capability transforms how long integration projects are managed in practice. Rather than staying outdoors for the full duration of a session, you can start the telescope at dusk, return indoors, and check in periodically while the instrument accumulates data through the night.

The combination of autonomous operation, and Multi-Night automatic stacking means that for long projects on Vaonis instruments, the practical workflow for a second or third session is reduced to three steps: place the telescope outdoors, launch the previously saved project, and go back inside. The telescope handles everything else.

Key Points for Optimizing Observations

LIGHT POLLUTION

Light pollution is one of the most significant limiting factors in amateur astronomy. It takes two distinct forms

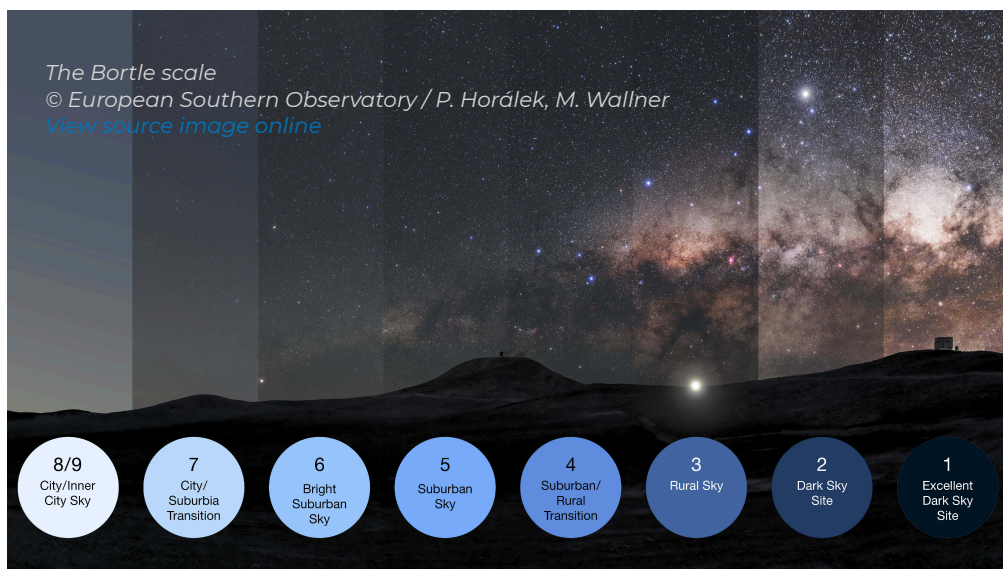
Local light pollution

It is caused by nearby artificial light sources: a neighbor's porch light, a street lamp at the end of the garden. This type is the most immediately disruptive because it can flood the optical system directly.

It is also the easiest to address. The solution is physical shielding: place the telescope so that direct light sources are blocked by a wall, a hedge, a parked vehicle, etc between the instrument and the offending light. Be aware of automatic lightning triggered by movement detection.

Sky glow and the Bortle scale

The second and more pervasive form is sky glow: the diffuse brightening of the entire sky caused by artificial light scattering off atmospheric particles above urban and



suburban areas. It cannot be blocked physically and raises the background brightness of the entire sky, reducing contrast between deep-sky objects and the sky background.

Sky glow is quantified by the Bortle scale, a nine-point classification of sky darkness running from Bortle 1 (the darkest sites on Earth, where the Milky Way casts a faint shadow and the zodiacal light is readily visible) to Bortle 9 (the inner city, where only the Moon, planets, and the brightest stars are visible to the naked eye).

The only reliable way to escape sky glow is distance from its source: driving away from cities.

Dedicated dark-sky sites (listed at darksky.org) provide the best conditions for the most demanding imagers.

Capturing from the city

For observers based in urban or suburban areas, a dual-band narrowband filter changes the equation substantially for compatible targets. A dual-band filter can make it possible to produce high-quality images of emission nebulae, supernova remnants, and planetary nebulae from an urban site.

For broadband targets, including reflection nebulae, open clusters, globular clusters, galaxies, and dark nebulae, a CLS filter is a decent alternative.

OTHER FACTORS AFFECTING OBSERVATION QUALITY

Sky darkness is not the only factor that determines observation quality. Even a very dark sky may not be enough if other conditions are not met.

Transparency

Even in the absence of clouds, the atmosphere can be loaded with particles (dust, sand, pollution, haze, smoke from forest fires...) that absorb part of the light coming from the stars. To optimize observation quality, it is wise to favor nights with great atmosphere transparency.

Turbulence

Atmospheric turbulence causes slight deviations in light rays, creating a “shimmering” effect in what we observe and is responsible for the twinkling of stars. Strong turbulence reduces the sharpness of stars and details.

As a general rule, turbulence is more pronounced in hot weather due to faster-moving air masses, while colder

temperatures often result in more stable conditions. On clear winter nights, observations may be of higher quality. Avoid setting up your telescope on surfaces that release heat accumulated during the day, such as stone or concrete. Grass or dirt is more suitable.

Moon phase

Starting from the first quarter, the Moon's brightness casts a glow across the sky, making deep-sky observations less ideal. To maximize visibility, it's best to plan your observations when the moon is not visible.

twilight phases

Even after sunset, the sky remains bright due to the scattering of sunlight in the atmosphere. True darkness, essential for astrophotography, occurs when the sun descends at least 18° below the horizon (Astronomical twilight).

It's better to wait one hour or so after the sunset to start your observations.

Target position

When celestial objects are close to the horizon, their light must pass through a thicker layer of the atmosphere than when they are higher in the sky. This increases atmospheric interference and reduces image clarity. For optimal observations, aim to observe objects when they are at least 20° above the horizon.

Vibrations

Mechanical vibrations are an often-overlooked source of image degradation. Any movement transmitted to the telescope during an exposure introduces blur that no amount of additional integration can compensate.

Wind is the most frequent culprit. Move the telescope behind a windbreak, or accept a higher proportion of rejected frames.

Close by footsteps are less obvious but also damaging, particularly when the telescope is set up on a wooden terrace or a balcony.

Do not set up your telescope on a table or any surface prone to vibration or instability.



Smart telescopes are easy to transport and can travel with you. Take advantage of this by heading to dark-sky locations with minimal light pollution and favorable weather conditions. The results will be well worth the effort.

Observation & photography guide

This guide focuses on deep-sky objects located within or in the immediate vicinity of the Milky Way band. It therefore covers the constellations that are crossed by the Milky Way and contain objects of interest for smart telescope imaging. Some large constellations extend across a vast region of sky, only a portion of which straddles the galactic plane.

Orion and Taurus are examples: for these constellations, only the deep-sky objects located in or very close to the Milky Way band are included (you won't find the Great Orion Nebula complex).

How to use this guide

This guide presents a selection of 200 deep-sky objects across 32 constellations, covering the full range of targets available to smart telescope users along the Milky Way band. The selection includes the most popular and rewarding objects for those beginning their exploration, a curated set of underrated targets that deserve far more attention than they typically receive, and a series of genuinely challenging objects for experienced imagers looking to push their equipment and their processing skills to the limit.

Every major object category is represented: emission nebulae, reflection nebulae, dark nebulae, supernova remnants, open clusters, and globular clusters.

Galaxies are the notable exception. Only two appear in this guide, and for good reason: the dense dust clouds distributed throughout the galactic plane accumulate along the line of sight and effectively block the light of any background galaxy when observing within the Milky Way band. The few galaxies that do appear are visible only because they happen to lie in directions where the dust column is thin enough to let their light through.

THE VISIBLE MILKY WAY

The visible portion of the Milky Way depends on the latitude of your observing location and the time of year. On the following pages, you'll find a map showing which section of the Milky Way is accessible depending on your latitude.

NAVIGATING THE GUIDE

The guide is organized into eight constellation groups. The observation planning section that follows allows you to determine, based on your latitude and the

current season, which groups are well placed for imaging. Once you have identified the relevant chapters, you can explore the objects each one contains. (click to jump to the section)

[Sagittarius](#) · [Serpens Cauda](#) · [Scutum](#)

[Scorpius](#) · [Ophiuchus](#)

[Ara](#) · [Norma](#) · [Lupus](#)

[Carina](#) · [Musca](#) · [Crux](#) · [Centaurus](#)

[Vela](#) · [Puppis](#) · [Canis Major](#)

[Monoceros](#) · [Gemini](#) · [Orion](#) · [Taurus](#) · [Auriga](#) · [Canis Minor](#)

[Perseus](#) · [Aries](#) · [Camelopardalis](#) · [Cepheus](#) · [Lacerta](#) · [Cassiopeia](#)

[Cygnus](#) · [Lyra](#) · [Vulpecula](#) · [Aquila](#) · [Sagitta](#)

Each chapter follows a consistent structure:

The constellations.

A brief presentation of each constellation in the group and its place in the sky.

Galactic context.

A description of what you are actually looking at in terms of galactic structure: which spiral arm the objects belong to, how far they lie from the Sun, and what the line of sight reveals about the Milky Way's architecture.

Cosmic scenes.

Many objects are best captured together, whether they form a physically related structure, a striking depth-contrast composition, or simply a field where context and surroundings add visual impact. Each cosmic scene describes the objects it includes and how to frame them.

Individual targets.

The remaining objects are presented by type and, within each type, generally ordered by magnitude.

Even modest objects gain interest by placing them in context.

Here, the small-looking globular cluster Messier 9 in Ophiuchus, one of the closest globular clusters to the Galactic Center, appears through the Milky Way's dense golden star field. In the foreground lies Barnard 64, a dark cloud that obscures the stars behind it, along with the nearby blue-white multiple star HR 6435, about 370 light-years away.

This image becomes a journey through the layers of the Milky Way, from nearby stars and foreground dust to a distant globular cluster, with a dense accumulation of Galactic stars in between.

Vaonis Vespera 3

Total integration time 4h15

Bortle 5

OBJECT MARKERS

Certain objects carry a marker indicating their character and difficulty level.

Favorite.

The most popular objects in the guide: generally spectacular, accessible, and immediately rewarding. The natural starting point for new smart telescope users or anyone revisiting the classics.

Underrated.

Objects that receive less attention than they deserve. If you have worked through the favorites and are wondering where to point your telescope next, this is the category to explore.

Challenging yet rewarding.

More demanding targets that require greater commitment, particularly in terms of integration time. The results justify the effort.

Very challenging

Trophy targets for the most experienced smart telescope users, requiring both sustained acquisition sessions and advanced image processing skills. These objects are rarely captured with a smart telescope and represent a genuine achievement when they are.

POINTING THE TELESCOPE

Most objects in this guide are included in the catalogs built into smart telescope control applications and can be found and targeted directly by name or catalog number. Some of the less commonly observed targets may not appear in these databases. For this reason, every object is accompanied by its astronomical coordinates, allowing you to create a custom target or navigate to it manually on a sky chart.

NOTE ON DATA ACCURACY

The data presented in this guide, including object distances, and physical dimensions, reflects the best available information at the time of writing. Astronomy is a field where measurements are continuously refined, and scientific sources do not always agree: distances in particular carry genuine uncertainty, and values published by different research teams can differ significantly. We have compiled information from multiple reputable sources and carried out extensive cross-checking to ensure accuracy, but some discrepancies or errors may remain.

Covered Constellations

Objects

Aquila	Aql	Eagle	Aigle	3
Ara	Ara	Altar	Autel	5
Aries	Ari	Ram	Bélier	2
Auriga	Aur	Charioteer	Cocher	10
Camelopardalis	Cam	Giraffe	Girafe	5
Canis Major	CMa	Greater Dog	Grand Chien	6
Canis Minor	CMi	Lesser Dog	Petit Chien	1
Carina	Car	Keel	Carène	8
Cassiopeia	Cas	Cassiopeia	Cassiopée	14
Centaurus	Cen	Centaur	Centaure	4
Cepheus	Cep	Cepheus	Céphée	14
Crux	Cru	Southern Cross	Croix du Sud	2
Cygnus	Cyg	Swan	Cygne	14
Gemini	Gem	Twins	Gémeaux	7
Lacerta	Lac	Lizard	Lézard	1
Lupus	Lup	Wolf	Loup	1
Lyra	Lyr	Lyre	Lyre	1
Monoceros	Mon	Unicorn	Licorne	11
Musca	Mus	Fly	Mouche	2
Norma	Nor	Carpenter's Square	Règle	3
Ophiuchus	Oph	Serpent Bearer	Serpentaire	4
Orion	Ori	Hunter	Orion	2
Perseus	Per	Hero	Persée	8
Puppis	Pup	Stern	Poupe	6
Sagitta	Sge	Arrow	Flèche	1
Sagittarius	Sgr	Archer	Sagittaire	19
Scorpius	Sco	Scorpion	Scorpion	20
Scutum	Sct	Shield	Écu de Sobieski	2
Serpens	Ser	Serpent	Serpent	5
Taurus	Tau	Bull	Taureau	8
Vela	Vel	Sails	Voiles	6
Vulpecula	Vul	Little Fox	Petit Renard	6

Above this line, the night sky is **not** observable

Above this line, the night sky is **not** observable

Above this line, the night sky is **not** observable

Above this line, the night sky is **not** observable

Below this line, the night sky is **not** observable

Below this line, the night sky is **not** observable

Below this line, the night sky is **not** observable

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Below this line, the night sky is **not** observable

Below this line, the night sky is **not** observable

Which part of the Milky Way is visible from your location?

Observation planner

Pick the latitude closest to your observing site, then refer to the chapters covering the constellations visible from your location.

If your latitude falls between two ranges, both sections may be relevant.

60° North

The Milky Way is observable from September through April, with May, June and July lost to astronomical white nights.

The autumn-winter window, from September through January, is the prime season: Cassiopeia, Cepheus, Perseus, and Auriga are all overhead or near the zenith, and Cygnus, Lyra, and Vulpecula are well placed through September.

The winter window, from October through February, adds Gemini, Orion, Taurus, and Monoceros at fine altitudes.

	Evening	Middle of night	Morning	All night
January	Ari, Lac, Tau, Aur, Gem, Ori, Vul, Lyr	Aur, Gem, Ori, Tau, Ari, Mon	Lyr, Vul	Cam, Per, Cas, Cep, Cyg
February	Aur, Tau, Ari, Gem, Ori, Mon, Cyg, Lac	Aur, Gem, Ori, Tau, Mon, Ari	Lyr, Cyg, Vul, Sge, Lac, Aql, Ser	Cam, Per, Cas, Cep
March	Aur, Gem, Ori, Tau, Mon, Ari	Aur, Gem, Ori	Lyr, Vul, Sge, Lac, Aql, Ser	Cam, Cep, Cas, Per, Cyg
April	Aur, Gem		Vul, Sge, Lac, Aql, Ser	Cep, Cam, Cas, Lyr, Cyg, Per
May	no astronomical darkness			
June	no astronomical darkness			
July	no astronomical darkness			
August	Lyr, Sge, Aql, Ser, Sct	Lyr, Sge, Tau, Aur, Aql	Tau, Aur, Gem, Ori, Mon	Cas, Cep, Cyg, Lac, Per, Cam, Vul, Ari
September	Lyr, Sge, Aql, Ser, Sct	Lyr, Sge, Tau, Aur, Aql	Tau, Aur, Gem, Ori, Mon	Cas, Cep, Cyg, Lac, Per, Cam, Vul, Ari
October	Lyr, Vul, Sge, Aql, Ser	Tau, Aur, Vul, Gem, Ori, Lyr, Sge	Aur, Tau, Gem, Ori, Mon	Cas, Per, Cep, Cam, Lac, Cyg, Ari
November	Cyg, Lac, Vul, Lyr, Sge, Aql, Ser	Aur, Tau, Gem, Lac, Cyg, Ori, Mon	Aur, Gem, Ori, Tau, Mon	Cam, Cas, Per, Cep, Ari
December	Lac, Vul, Lyr, Ari, Sge, Tau, Aql	Tau, Ari, Gem, Ori, Mon, Lac	Gem, Ori, Lyr	Cam, Per, Cas, Aur, Cep, Cyg

40° North

The Milky Way is observable year-round with two distinct prime seasons.

The summer window, from June through August, is the richest period, with Cygnus near the zenith and the galactic center region reaching its maximum altitude (23°).

The winter window, from November through February, brings Auriga, Gemini, Orion, Taurus, and Monoceros to excellent altitudes.

Scorpius presents a split picture: the northern part of the constellation reaches 24° to 30° altitude, while southern Scorpius objects remain below 15°.

	Evening	Middle of night	Morning	All night
January	Per, Ari, Cas, Tau, Aur, Lac, Cyg, Gem, Ori, Mon	Aur, Gem, Ori, Tau, Mon, Per, Cas, CMa, Ari, Pup	Lyr	Cam, Cep
February	Aur, Per, Tau, Ari, Cam, Gem, Ori, Mon, CMa, Lac, Pup, Cyg	Gem, Aur, Ori, Mon, Cam, Per, Tau, Pup, CMa	Lyr, Cyg, Vul, Ser, Oph, Sco, Aql, Sge	Cas, Cep
March	Aur, Gem, Ori, Tau, Mon, Per, Cam, Cas, Ari, CMa, Pup, Cep	Gem, Cam, Aur	Lyr, Cep, Cyg, Vul, Ser, Aql, Sge, Oph, Sct, Sco, Cas, Sgr, Lac	
April	Gem, Aur, Ori, Mon, Cam, Tau, Per, Pup, Cas, CMa	Lyr, Cam	Lyr, Cyg, Vul, Ser, Sge, Aql, Sct, Cas, Oph, Sgr, Lac, Sco	Cep
May	Cam, Gem	Lyr, Cyg, Vul, Ser, Oph, Aql, Sco, Sge, Sct, Cas, Sgr	Lyr, Cyg, Vul, Sge, Aql, Ser, Lac, Sct, Cas, Sgr, Oph, Sco, Cam	Cep
June	Sco	Lac, Sgr, Sco	Lac, Per, Sgr, Cam	Lyr, Cyg, Vul, Cep, Sge, Aql, Ser, Sct, Cas, Oph
July	Oph, Sgr, Sco	Sgr, Per, Cam, Oph	Per, Cam, Ari	Cyg, Lyr, Vul, Sge, Cep, Aql, Lac, Ser, Cas, Sct
August	Lyr, Aql, Ser, Sct, Sgr, Oph, Sco	Lyr, Aql, Per, Ser, Sct, Ari	Per, Ari, Tau, Aur, Gem, Ori	Cyg, Lac, Cep, Vul, Cas, Sge, Cam
September	Lyr, Vul, Sge, Aql, Ser, Sct, Sgr, Oph	Vul, Ari, Sge, Lyr, Tau, Aql, Aur	Ari, Tau, Aur, Gem, Ori, Mon, CMa	Lac, Cas, Cyg, Cep, Per, Cam
October	Cyg, Vul, Lyr, Sge, Lac, Aql, Ser, Sct, Sgr	Ari, Lac, Tau, Cyg, Aur, Vul, Gem, Ori	Aur, Gem, Ori, Tau, Mon, Ari, CMa, Pup	Cas, Per, Cam, Cep
November	Cyg, Lac, Vul, Sge, Lyr, Aql, Ser, Sct	Tau, Aur, Gem, Ori, Mon, Lac, Cyg	Gem, Aur, Ori, Mon, Tau, Pup, CMa	Per, Ari, Cam, Cas, Cep
December	Lac, Cep, Cyg, Vul, Ari, Sge, Tau, Lyr, Aql	Tau, Gem, Ori, Ari, Mon, Cep, CMa, Pup	Gem, Ori, Mon	Aur, Per, Cam, Cas

20° North

The Milky Way is observable year-round with two distinct prime seasons.

The summer window, from May through August, is the richest period: Cygnus, Lyra, Vulpecula, Aquila, Sagitta, Ophiuchus, Sagittarius, Scutum, and Serpens Cauda are all simultaneously accessible, with the galactic center reaching 43° and Scorpius at 30°.

The winter window, from November through February, brings Auriga, Gemini, Orion, Taurus, and Monoceros to excellent altitudes alongside Perseus and Cassiopeia.

	Evening	Middle of night	Morning	All night
January	Ari, Per, Tau, Aur, Cas, Cam, Gem, Ori, Cep, Lac, Mon, Cyg	Gem, Mon, Ori, Aur, Tau, CMa, Pup, Per, Cam, Ari, Vel, Cas	Sco, Oph, Lup, Cen	
February	Tau, Aur, Gem, Ori, Per, Ari, Mon, Cam, CMa, Cas, Pup, Cep	Gem, Mon, Pup, CMa, Ori, Aur, Tau, Vel	Oph, Sco, Lyr, Lup, Ser, Sgr, Vul, Sct, Aql, Cyg, Cep	
March	Gem, Ori, Mon, Tau, Aur, CMa, Pup, Per, Ari, Cam, Cas, Vel	Gem, Pup	Lyr, Ser, Oph, Sco, Vul, Aql, Sct, Sgr, Sge, Cyg, Lup, Cep, Ara, Nor	
April	Gem, Mon, Pup, Ori, CMa, Aur, Tau, Vel, Per, Cam	Sco, Oph, Lup, Cen	Ser, Lyr, Vul, Aql, Sge, Sct, Cyg, Sgr, Oph, Sco, Cep, Lac, Lup, Cas, Ara	
May	Gem, Pup, Mon, CMa	Oph, Sco, Lyr, Ser, Sgr, Lup, Vul, Sct, Aql, Cyg, Sge, Cep, Ara, Nor	Vul, Sge, Aql, Lyr, Cyg, Ser, Sct, Sgr, Cep, Lac, Oph, Cas, Sco	
June	Sco, Oph, Lup, Cen	Ser, Lyr, Vul, Aql, Sct, Sge, Cyg, Sgr, Oph, Sco, Cep, Lup, Lac, Ara, Nor	Vul, Cyg, Sge, Lac, Aql, Lyr, Cep, Ser, Cas, Sct, Sgr, Per	
July	Oph, Sco, Ser, Sgr, Lup, Sct, Ara, Nor	Ser, Sct, Sgr, Lac, Oph, Cas, Sco	Lac, Cas, Per, Ari, Cam, Tau	Vul, Sge, Aql, Lyr, Cyg, Cep
August	Ser, Lyr, Vul, Aql, Sct, Sge, Oph, Sgr, Sco, Lup, Ara, Nor	Vul, Sge, Aql, Lyr, Cas, Ser, Sct, Sgr, Per	Ari, Per, Tau, Cas, Aur, Cam, Gem, Ori, Mon	Cyg, Lac, Cep
September	Vul, Aql, Lyr, Sge, Ser, Cyg, Sct, Sgr, Oph, Lac, Sco	Lac, Cyg, Vul, Per, Sge, Ari, Aql, Cam, Lyr, Tau	Tau, Per, Ari, Aur, Gem, Ori, Mon, Cam, CMa, Pup	Cas, Cep
October	Vul, Sge, Cyg, Aql, Lyr, Ser, Lac, Sct, Cep, Sgr, Oph, Sco	Ari, Per, Tau, Lac, Cam, Cep, Cyg, Aur, Vul, Gem, Ori	Ori, Gem, Tau, Mon, Aur, Per, CMa, Ari, Pup, Cam, Vel	Cas
November	Cyg, Lac, Vul, Sge, Aql, Cep, Lyr, Ser, Sct, Sgr	Ari, Tau, Aur, Gem, Ori, Mon, Cep, Lac, CMa, Cyg	Gem, Mon, Ori, Pup, Aur, CMa, Tau, Vel, Ari	Per, Cam, Cas
December	Lac, Cas, Cyg, Cep, Per, Ari, Vul, Cam, Tau, Sge, Aql	Tau, Ori, Gem, Mon, Per, Ari, CMa, Cam, Pup, Cas, Cep	Gem, Pup, Mon, CMa, Ori, Vel	Aur

The Milky Way is observable year-round.

The summer window, from May through August, places the galactic center at 63°, Scorpius at 50°, and gives simultaneous access to both the northern and southern Milky Way in a single night, with Carina and Crux reaching 30°.

The winter window, from November through February, brings Orion, Gemini, and Canis Minor near the zenith while Centaurus and Puppis remain accessible in the evening sky.

Cepheus reaches only 18° in the north and **Camelopardalis** 20°, both requiring good transparency and a perfectly clear horizon.

	Evening	Middle of night	Morning
January	Tau, Ari, Per, Aur, Mon, Ori, Gem, CMa, Cam, Cas, Pup	Mon, Gem, Pup, CMa, Ori, Tau, Vel, Aur, Per, Car, Ari	Cen, Lup, Sco, Cru, Car, Oph, Vel
February	Mon, Ori, Tau, Gem, Aur, CMa, Per, Ari, Pup, Vel, Cam, Cas	Pup, Gem, CMa, Mon, Vel, Ori, Car, Cen, Aur, Tau, Cru	Sco, Oph, Lup, Cen, Sgr, Nor, Ara, Ser, Sct, Cru, Lyr
March	Mon, CMa, Gem, Pup, Ori, Tau, Aur, Vel, Per, Ari, Cam	Cen, Vel, Car, Pup, Cru, Gem, CMa, Lup, Mon, Sco	Oph, Sco, Sgr, Ser, Sct, Lup, Aql, Ara, Lyr, Nor, Vul, Sge, Cyg, Cen
April	Pup, Gem, CMa, Mon, Vel, Ori, Tau, Aur, Car, Cen	Sco, Lup, Cen, Oph, Cru, Nor, Ara, Car, Sgr	Ser, Sct, Sgr, Aql, Oph, Vul, Sge, Sco, Lyr, Cyg, Lup, Ara, Nor, Cep
May	Pup, Vel, Gem, CMa, Mon, Car, Cen, Cru, Ori	Sco, Oph, Lup, Sgr, Ser, Sct, Ara, Nor, Cen, Lyr, Aql, Vul, Cru, Sge	Aql, Sge, Sct, Vul, Ser, Sgr, Cyg, Lyr, Oph, Sco, Lac, Ara, Cep, Nor, Cas
June	Cen, Lup, Oph, Cru, Car, Nor, Vel, Ara, Sco	Ser, Oph, Sgr, Sct, Aql, Vul, Lyr, Sge, Lup, Ara, Cyg, Nor, Cep, Sco	Vul, Cyg, Sge, Aql, Lac, Sct, Ser, Lyr, Sgr, Cep, Cas, Sco
July	Sco, Oph, Lup, Sgr, Cen, Ser, Nor, Ara, Sct, Cru, Lyr, Aql, Vul	Sct, Ser, Sge, Sgr, Lyr, Cyg, Oph, Sco, Ara, Lac, Cep, Nor, Lup, Aql, Vul	Lac, Ari, Per, Cyg, Cas, Tau, Cep, Sge, Aql, Vul
August	Oph, Sco, Ser, Sgr, Sct, Lup, Aql, Vul, Lyr, Ara, Nor, Sge, Cyg, Cen	Vul, Aql, Sge, Cyg, Sct, Lac, Ser, Sgr, Lyr, Cep, Sco, Cas, Oph	Ari, Per, Tau, Aur, Mon, Ori, Cas, Gem, Cam, Lac, CMa
September	Ser, Sct, Aql, Sgr, Vul, Sge, Oph, Lyr, Sco, Cyg, Ara, Lup, Nor, Cep, Lac	Lac, Cyg, Vul, Sge, Cas, Aql, Cep, Ari, Per, Sct	Tau, Mon, Ori, Aur, Ari, Per, Gem, CMa, Pup, Cam, Cas
October	Aql, Sge, Vul, Sct, Ser, Cyg, Sgr, Lyr, Lac, Sco, Oph, Cep, Ara, Cas	Ari, Per, Tau, Lac, Cas, Aur, Cyg, Cam, Cep	Mon, Ori, CMa, Gem, Tau, Pup, Aur, Per, Ari, Vel, Cam
November	Vul, Cyg, Lac, Sge, Aql, Sct, Cep, Cas, Ser, Lyr, Sgr	Tau, Ari, Per, Aur, Mon, Ori, Gem, CMa, Cam, Cas, Pup	Pup, Gem, Mon, CMa, Ori, Vel, Tau, Aur, Car, Per
December	Ari, Per, Lac, Tau, Cas, Cyg, Cep, Vul, Cam	Mon, Ori, Tau, Gem, CMa, Pup, Per, Ari, Vel, Cam, Cas	Pup, Gem, CMa, Vel, Mon, Car, Ori, Cen, Cru

20°South

The Milky Way is observable year-round with two distinct prime seasons.

The galactic center window, from May through August, is the richest period: Sagittarius reaches 83°, Scorpius 70°, and Ophiuchus, Scutum, and Serpens Cauda are near the zenith.

The southern summer window, from November through February, is prime time for the southern constellations, with Centaurus at 63°, Carina and Crux at 50°, Canis Major near the zenith, and Ara and Norma well placed. Some northern targets are reduced but accessible: Auriga reaches 27°, Perseus 22°.

	Evening	Middle of night	Morning	All night
January	Tau, Ari, Ori, Per, Aur, Gem	Gem, Ori, Car, Tau, Cen, Aur, Mus, Cru	Cen, Car, Cru, Mus, Lup, Nor, Sco, Oph, Ara	Pup, CMa, Mon, Vel
February	Mon, CMa, Pup, Ori, Tau, Gem, Aur, Ari, Per	Pup, CMa, Mon, Cen, Gem, Cru, Mus, Ori	Lup, Sco, Cen, Oph, Nor, Ara, Cru, Sgr, Mus, Ser, Sct	Vel, Car
March	CMa, Mon, Pup, Vel, Gem, Ori, Tau, Aur, Per	Vel, Cru, Pup, Lup, CMa, Nor, Sco, Mon, Ara, Oph, Gem	Sco, Oph, Lup, Sgr, Ara, Nor, Ser, Sct, Cru, Aql, Vul, Lyr, Sge	Cen, Car, Mus
April	Pup, CMa, Vel, Mon, Gem, Car, Ori, Tau, Mus, Aur	Lup, Sco, Oph, Nor, Car, Ara, Mus, Sgr, Vel, Ser	Sgr, Sct, Ser, Oph, Sco, Ara, Aql, Nor, Lup, Vul, Sge, Lyr, Cyg	Cen, Cru
May	Vel, Pup, Car, CMa, Cen, Mon, Cru, Gem, Mus	Sco, Oph, Lup, Nor, Ara, Sgr, Cen, Ser, Sct, Cru, Mus, Car, Aql	Sgr, Sct, Ser, Aql, Sco, Sge, Vul, Oph, Ara, Cyg, Nor, Lyr, Lup, Lac	
June	Cen, Cru, Car, Lup, Vel, Mus, Oph, Nor, Pup, CMa	Oph, Sgr, Ser, Sct, Lup, Nor, Aql, Vul, Sge, Cen, Lyr, Cru, Cyg, Mus	Vul, Aql, Sge, Sgr, Cyg, Sct, Lac, Ser	Sco, Ara
July	Lup, Sco, Oph, Cen, Nor, Ara, Cru, Sgr, Car, Mus, Ser, Sct, Vel	Sgr, Sct, Ser, Sco, Aql, Oph, Ara, Sge, Vul, Nor, Lup, Cyg, Lyr	Ari, Per, Tau, Lac	
August	Sco, Oph, Sgr, Lup, Ser, Ara, Nor, Sct, Cen, Aql, Cru, Vul, Mus, Sge, Lyr, Car	Sgr, Aql, Sct, Sge, Vul, Ser, Sco, Cyg, Ara, Oph, Lac, Lyr, Nor	Tau, Ari, Mon, Per, CMa, Aur, Ori, Gem, Pup	
September	Sgr, Sct, Ser, Sco, Oph, Ara, Aql, Nor, Lup, Vul, Sge, Lyr, Cyg, Cen	Vul, Lac, Cyg, Aql, Sge, Sgr, Sct	Mon, CMa, Ori, Tau, Pup, Ari, Aur, Gem, Per, Vel	
October	Sgr, Sct, Aql, Ser, Sge, Sco, Vul, Oph, Ara, Cyg, Nor, Lyr, Lac, Lup	Ari, Per, Tau	CMa, Mon, Pup, Ori, Vel, Gem, Tau, Aur, Car, Per, Ari	
November	Vul, Aql, Cyg, Lac, Sge, Sgr, Sct, Ser	Mon, Tau, CMa, Ari, Per, Ori, Aur, Pup, Gem, Vel	Pup, CMa, Mon, Vel, Gem, Ori, Car, Tau, Aur, Cen, Mus, Cru	
December	Ari, Per, Tau	CMa, Pup, Ori, Tau, Gem, Vel, Aur, Ari, Per, Car	Pup, Vel, CMa, Car, Gem, Cen, Cru, Mus, Ori	Mon

40°South

The Milky Way is observable year-round, but the northern Milky Way arc is largely lost: Cassiopeia & Cepheus never rise. Cygnus and Lyra barely clear the horizon at 8° and 12°.

The galactic center window, from April through September, is the prime season: Scorpius transits at the zenith, Sagittarius reaches 77°, and Ara, Carina, Crux, and Musca are circumpolar and available all night.

The southern summer window, from October through February, brings Centaurus to 83°, Vela to 84°, and Canis Major near the zenith, making this the best period for the deep southern chapters.

	Evening	Middle of night	Morning	All night
January	Ori, Tau	Ori, Tau	Nor, Lup, Ara, Sco	Pup, Vel, CMa, Car, Mon, Cen, Mus, Cru, Gem
February	CMa, Mon, Gem, Ori, Tau	CMa, Mon, Nor, Gem, Lup, Ara	Lup, Nor, Ara, Sco, Oph, Sgr, Ser	Vel, Car, Pup, Cen, Cru, Mus
March	Pup, CMa, Mon, Gem, Ori, Tau	Pup, Nor, Lup, Ara, CMa, Sco, Oph, Mon	Lup, Nor, Sco, Ara, Oph, Sgr, Ser, Sct, Aql	Car, Cen, Cru, Vel, Mus
April	Vel, Pup, CMa, Mon, Gem, Ori	Lup, Ara, Sco, Oph, Vel, Sgr, Pup, Ser, Sct	Sco, Sgr, Ara, Oph, Sct, Ser, Lup, Aql, Vul, Sge	Cen, Cru, Car, Nor, Mus
May	Vel, Car, Pup, Cen, CMa, Mon, Gem	Sco, Oph, Cen, Sgr, Car, Ser, Sct, Vel	Sgr, Sco, Sct, Ser, Oph, Aql, Sge, Vul	Lup, Nor, Ara, Cru, Mus
June	Cen, Car, Cru, Vel, Pup, Lup, CMa, Oph, Mon	Sgr, Oph, Lup, Sct, Ser, Cen, Cru, Aql, Car, Vul, Sge	Sgr, Sct, Ser	Sco, Ara, Nor, Mus
July	Cen, Lup, Cru, Nor, Ara, Sco, Car, Oph, Sgr, Vel, Ser, Sct, Pup	Sgr, Sco, Ara, Sct, Ser, Oph, Nor, Lup, Aql, Sge, Cru, Vul, Cen, Car		Mus
August	Sco, Ara, Nor, Lup, Oph, Sgr, Cen, Ser, Sct, Cru, Car, Aql	Sgr, Sco, Ara, Sct, Ser, Nor, Oph, Aql, Sge, Vul, Lup	CMa, Mon, Pup, Vel, Car, Tau, Cen	Mus
September	Sco, Sgr, Ara, Sct, Oph, Nor, Ser, Lup, Aql, Cru, Cen, Sge, Vul, Car	Ara, Sgr, Sco, Nor, Sct	CMa, Pup, Mon, Vel, Car, Ori, Cen, Tau, Gem	Mus
October	Sgr, Sco, Ara, Sct, Ser, Nor, Oph, Aql, Sge, Vul, Lup, Cru	Vel	CMa, Pup, Mon, Vel, Car, Ori, Cen, Gem, Tau, Cru	Mus
November	Ara, Nor	CMa, Mon, Pup, Vel, Car, Tau, Cen, Ori, Ari	Pup, CMa, Vel, Mon, Car, Cen, Gem, Ori, Cru, Tau	Mus
December	Tau	Ori, Gem, Tau, Cru	Cru, Gem, Ori	CMa, Pup, Vel, Mon, Car, Cen, Mus



HII Regions & Emission Nebulae

No class of deep-sky object benefits more from smart telescope technology than the HII region. The combination of long integration capability, dual-band filters, and mosaic mode turns them into some of the most spectacular targets. These are the objects that define the visual identity of the Milky Way.

An HII region is a cloud of interstellar hydrogen gas ionized by the intense ultraviolet radiation of one or more nearby massive O and B-type stars (called OB stellar associations). The term "HII" designates ionized hydrogen: the ultraviolet photons from hot young stars strip electrons from hydrogen atoms, and when those electrons recombine with protons, they emit light at characteristic wavelengths, principally the red H α line at 656 nm and the blue-green OIII doublet at 496 and 501 nm.

HII regions are the birthplaces of stars. They form when dense molecular cloud filaments collapse under gravity, triggering star formation. The most massive stars formed in this process are the very ones whose radiation ionizes the surrounding gas, creating the glowing nebula. This creates a self-sculpting environment: stellar winds and radiation pressure erode the cloud, compressing nearby gas into pillars and globules where the next generation of stars may form.

HII regions are the most diverse object class ranging from compact bright regions of a few arc-minutes to giant complexes spanning multiple degrees. The largest ones require mega-mosaics assembled across multiple sessions. A dual-band filter is the standard tool: it dramatically increases contrast and reveals faint outer emission.

TOP FIVE EMISSION NEBULAE

		constellation	hemisphere	best period
Carina Nebula	Caldwell 92	Carina	S	Jan - May
Fighting Dragons	NGC 6188	Ara	S	Apr – Aug
Lagoon Nebula	Messier 8	Sagittarius	Both	May - Aug
North America Nebula	NGC 7000	Cygnus	N	Jun – Sep
Heart Nebula	IC 1805	Cassiopeia	N	Sep – Jan



THE HEART NEBULA

Vaonis Vespera 2 X₂ edition

Total integration time 14h

Mosaic mode (cropped) · Dual-band filter

Bortle 3

Reflection Nebulae

Reflection nebulae are the quiet counterpart to the blazing emission regions. They offer something more subtle and more painterly: dust clouds lit from within or nearby by starlight, glowing in shades of blue-white, occasionally warm gold or orange where the illuminating star is itself a cooler or reddened source.

A reflection nebula is a cloud of interstellar dust that scatters the light of a nearby star rather than absorbing its photons and re-emitting them. The blue color characteristic of most reflection nebulae is a direct consequence of Rayleigh-like scattering: dust grains preferentially scatter shorter-wavelength blue light, producing the cool blue glow so typical of young star-forming regions. Exceptions occur when the illuminating star is itself orange or red, as with the Antares nebula in the Rho Ophiuchi complex.

Reflection nebulae are often found at the edges of molecular clouds, where a young star has not yet fully dispersed its birth environment. They frequently coexist with dark nebulae, appearing as luminous borders at the illuminated surface of an opaque cloud. The Iris Nebula, the Perseus Molecular Cloud reflection nebulae, and the Rho Ophiuchi complex all exhibit this interplay: bright reflection regions against dark absorbing backgrounds, with subtle color gradients across the dust distribution.

The imaging approach is the opposite of HII regions: broadband capture only, no dual band filter. The blue reflection signal is suppressed by narrowband filters tuned to emission lines. Long integrations reveal the outer extensions of the dust cloud, which often grade imperceptibly from bright reflection to dark absorption. Mosaic mode can be useful, not to capture the compact bright core but to reveal the surrounding dark nebula context.

TOP FIVE REFLECTION NEBULAE

		constellation	hemisphere	best period
Rho Ophiuchi Complex	IC 4604	Ophiuchus	Both (S is better)	Apr - Jul
Antares Nebula	IC 4606	Scorpius	Both (S is better)	Apr - Jul
Iris Nebula	Caldwell 4	Cepheus	N	Jun - Sep
Ghost of Cassiopeia	IC 63	Cassiopeia	N	Aug - Dec
Angel Nebula	NGC 2170	Monoceros	Both	Nov - Feb

THE ANGEL NEBULA

Vaonis Vespera 2

Total integration time 20h30

Mosaic mode

Bortle 2

Credit: Nathanael Martin



Dark Nebulae

Dark nebulae are defined by absence, by what they block rather than what they emit. An opaque silhouette printed against a background of thousands of stars accumulated over hours of integration.

A dark nebula is a dense, cold molecular cloud that absorbs the light from background stars and emission regions, while emitting little to no visible radiation of its own. It is made of the same molecular material that forms stars and gives birth to HII regions. In quieter zones where star formation has not yet been triggered, this material appears as dark lanes, pillars, and globules silhouetted against the brighter galactic background. The most compact dark nebulae, known as Bok globules, may represent some of the earliest stages of future star formation: dense enough to eventually collapse, but not yet actively doing so.

Dark nebulae are particularly abundant along the galactic plane, where molecular cloud complexes are densest. The Great Rift, the dark lane that appears to split the Milky Way from Cygnus through Aquila and into Sagittarius, is not an emptiness but a foreground curtain of overlapping dark clouds blocking the richer stellar background behind them.

The defining challenge of dark nebula imaging is entirely about the background. The dark cloud itself is mostly not visible: what the integration accumulates is the surrounding star field, and the denser that accumulated background, the more dramatic the dark silhouette becomes. This means broadband imaging with no filter is universal, and integration time should be maximized rather than minimized. Transparent, dark skies are key for a successful capture.

TOP FIVE DARK NEBULAE

		constellation	hemisphere	best period
Coalsack	Caldwell 99	Crux	S	Feb - Jun
Dark Doodad Nebula		Musca	S	Feb - Jun
Snake Nebula	Barnard 72	Ophiuchus	Both	Apr - Aug
Seahorse Nebula	Barnard 150	Cepheus	N	Jun - Oct
Barnard's E Nebula	B142 & B143	Aquila	Both	May - Sep



BARNARD'S E NEBULA

Vaonis Vespera 2

Total integration time 18h30

Mosaic mode (cropped) · Dual-band filter

Bortle 3

Credit: Susan Fortney

Supernova Remnants

Supernova Remnants are the aftermath of stellar explosions that briefly outshine entire galaxies, yet they present themselves to the smart telescope as some of the most delicate and ethereal structures in the sky.

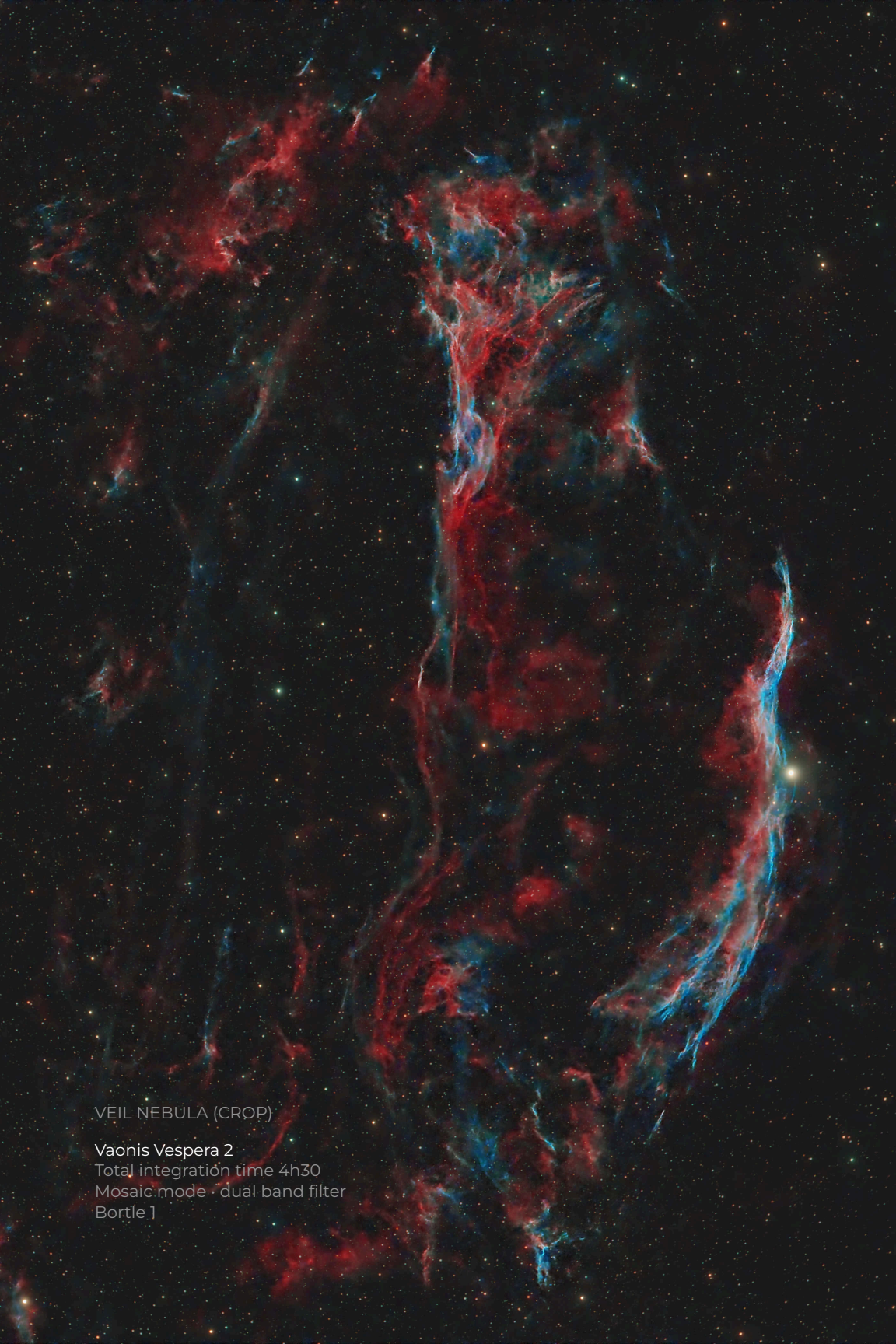
When a massive star reaches the end of its nuclear fuel supply, its core collapses in milliseconds to form a neutron star or black hole, while the outer layers are expelled in a shockwave. This expanding shell of ejected material and swept-up interstellar gas is the supernova remnant. As it expands, the shock wave compresses and heats surrounding interstellar gas to temperatures of millions of degrees, producing X-ray emission from the shock front and optical emission from cooling zones behind it. The characteristic glowing filaments visible in narrowband images trace these cooling zones, where temperatures have dropped low enough for hydrogen and oxygen to recombine and emit at H α and OIII wavelengths.

Supernova remnants evolve over thousands to tens of thousands of years. Young remnants like the Crab Nebula (approximately 970 years) still show the hot, expanding ejecta. Older remnants like the Veil Nebula (10,000–20,000 years) have expanded to enormous angular sizes as the shock wave decelerates into the surrounding medium.

The dual-band filter is particularly useful for supernova remnants: they emit mostly in H α and OIII, and their surface brightness is typically low. The OIII emission generally traces highly excited shocked gas, while H α highlights regions where hydrogen is radiating strongly within the cooling post-shock flow. Together they produce the natural blue-green and red-pink color split characteristic of the finest remnant images. The largest remnants require mosaic strategies and multi-night acquisition.

TOP THREE SUPERNOVA REMNANTS

		constellation	hemisphere	best period
Veil Nebula	NGC 6960 & NGC 6992	Cygnus	N	Jun - Sep
Jellyfish Nebula	IC 443	Gemini	Both	Nov - Feb
Crab Nebula	Messier 1	Taurus	Both	Oct - Feb



VEIL NEBULA (CROP)

Vaonis Vespera 2
Total integration time 4h30
Mosaic mode - dual band filter
Bortle 1

Planetary Nebulae

Planetary nebulae have no connection to planets: the name was coined by William Herschel in the 18th century because their round, compact disks reminded him of the visual appearance of Uranus through a small telescope. What they actually represent is one of the most important endpoints in stellar evolution

When a star of low to intermediate mass, roughly 0.8 to 8 times the mass of the Sun, exhausts its nuclear fuel, it expands into a red giant and then ejects its outer layers into space as a series of expanding shells. The hot remnant stellar core, now a white dwarf, floods the ejected gas with intense ultraviolet radiation, ionizing it and causing it to glow. The result is the planetary nebula: a glowing shell of expelled stellar material surrounding a dying star.

Their morphology is diverse. The Ring Nebula (M57) is the archetypal ring-shaped planetary nebula, a projection effect produced by viewing a barrel-like structure nearly along its axis. The Dumbbell Nebula (M27) shows a classic bipolar or hourglass morphology shaped by viewing angle and internal density structure. Older planetary nebulae have expanded over time into large, diffuse shells of very low surface brightness, making them challenging subjects.

The emission is dominated by OIII and H α , and a dual-band filter is strongly recommended to reveal the structural complexity of the ionized shells. Integration times vary significantly by target: M27 and M57 are bright enough for short to medium sessions, while the Abell objects require substantial narrowband integration to develop their faint extended halos.

TOP THREE PLANETARY NEBULAE

		constellation	hemisphere	best period
Dumbbell Nebula	Messier 27	Vulpecula	N	Jun - Sep
Medusa Nebula	Abell 21	Gemini	Both	Nov - Mar
Ring Nebula	Messier 57	Lyra	N	May - Sep



DUMBBELL NEBULA

Vaonis Vespera Pro 2
Total integration time 4-h
Dual band filter
Bortle 4

Open clusters

Open clusters are often dismissed in favor of the more dramatic other object types. This overlooks a key truth: an open cluster placed in front of a rich Milky Way star field, a glowing HII region, or next to a dark nebula lane becomes something more attractive than an isolated open cluster outside the Milky Way band.

An open cluster is a gravitationally bound, or gradually dispersing, association of stars formed from the same molecular cloud over a relatively short period, typically a few million years, compared with the cluster's overall lifetime of hundreds of millions to billions of years. Unlike globular clusters, which orbit the galactic halo as ancient fossils of the early universe, open clusters are young, disk-dwelling structures embedded in the galactic plane.

Their population ranges from a few dozen stars to several hundred or even a thousand. The youngest clusters still contain massive blue hot O and B-type stars and can be partially wrapped in the remnants of their natal nebosity. Older clusters, with their evolved orange and red giant members scattered among the remaining blue stars, offer a richer palette.

Well-calibrated color in broadband imaging is the primary technical challenge: avoid overcorrecting toward white balance neutrality, as the natural warmth of evolved stars is a physical property worth preserving.

A cluster placed in front of a rich Milky Way star cloud, a broad HII emission region, or a lane of dark nebosity gains compositional depth that standalone framing destroys. Mosaic mode, used not to enlarge coverage of the cluster itself but to include more of its context, can be an effective smart telescope strategy for these targets.

TOP FIVE OPEN CLUSTERS

		constellation	hemisphere	best period
Jewel Box	Caldwell 94	Crux	S	Feb - May
Wishing Well Cluster	Caldwell 91	Carina	S	Feb – May
Ptolemy's Cluster	Messier 7	Scorpius	Both	May – Aug
Wild Duck Cluster	Messier 11	Scutum	Both	Jun – Sep
Double Cluster	Caldwell 14	Perseus	N	Sep – Dec

PTOLEMY'S CLUSTER

Vaonis Vespera 2

Total integration time 5 h

Mosaic mode

Bortle 3



Globular clusters

Globular clusters rarely get the attention they deserve from smart telescope imagers, who tend to regard them as quick targets resolved in minutes and then set aside. This underestimates what a long integration on a dense, richly colored globular cluster can reveal: a resolved sphere of tens of thousands to millions of individual stars, often set against the dense star fields of the inner Galaxy.

A globular cluster is a tightly gravitationally bound, roughly spherical system of stars, typically containing between 10,000 and several million members. They are among the oldest structures in the universe. They orbit in the galactic halo and bulge rather than in the disk plane, which is why they are distributed across the entire sky rather than concentrated in the Milky Way band. The concentration of stars in their cores is extraordinary: near the center of Omega Centauri, the average distance between stars is only a fraction of a light-year.

Their stellar population is dominated by old stars, giving them a warm color palette very different from the blue-white tone of young open clusters.

The primary imaging challenge is the extreme dynamic range between the saturated core and the faint outer halo. Managing this requires either keeping individual exposure times short to prevent core saturation while accumulating sufficient integration for the halo. Resolution of individual stars across the cluster face is the primary aesthetic goal: a well-processed globular image should show distinct stars down to the innermost resolved zone, not an overexposed white blob at the center.

TOP THREE GLOBULAR CLUSTERS

		constellation	hemisphere	best period
Omega Centauri	Caldwell 80	Centaurus	S	Mar - Jun
Messier 4		Scorpius	Both	Apr - Jul
Messier 22		Sagittarius	Both	May - Aug



• OMEGA CENTAURI

Vaonis Vespera Pro

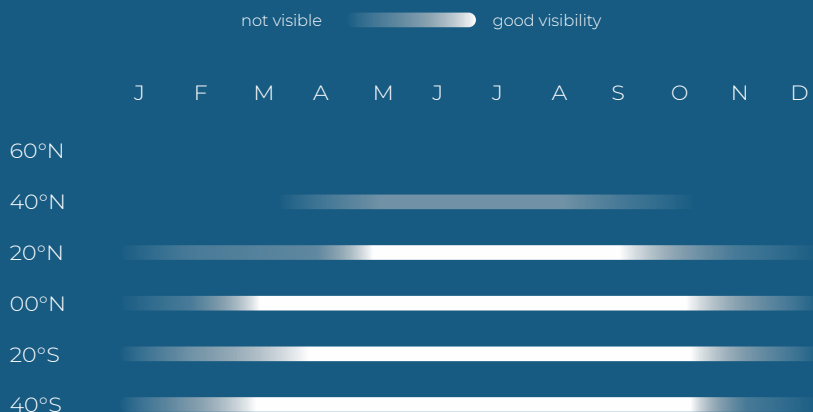
Total integration time 3 h

Bortle 1/2

Sagittarius •

Serpens Cauda • Scutum

Visibility by Latitude



To get started

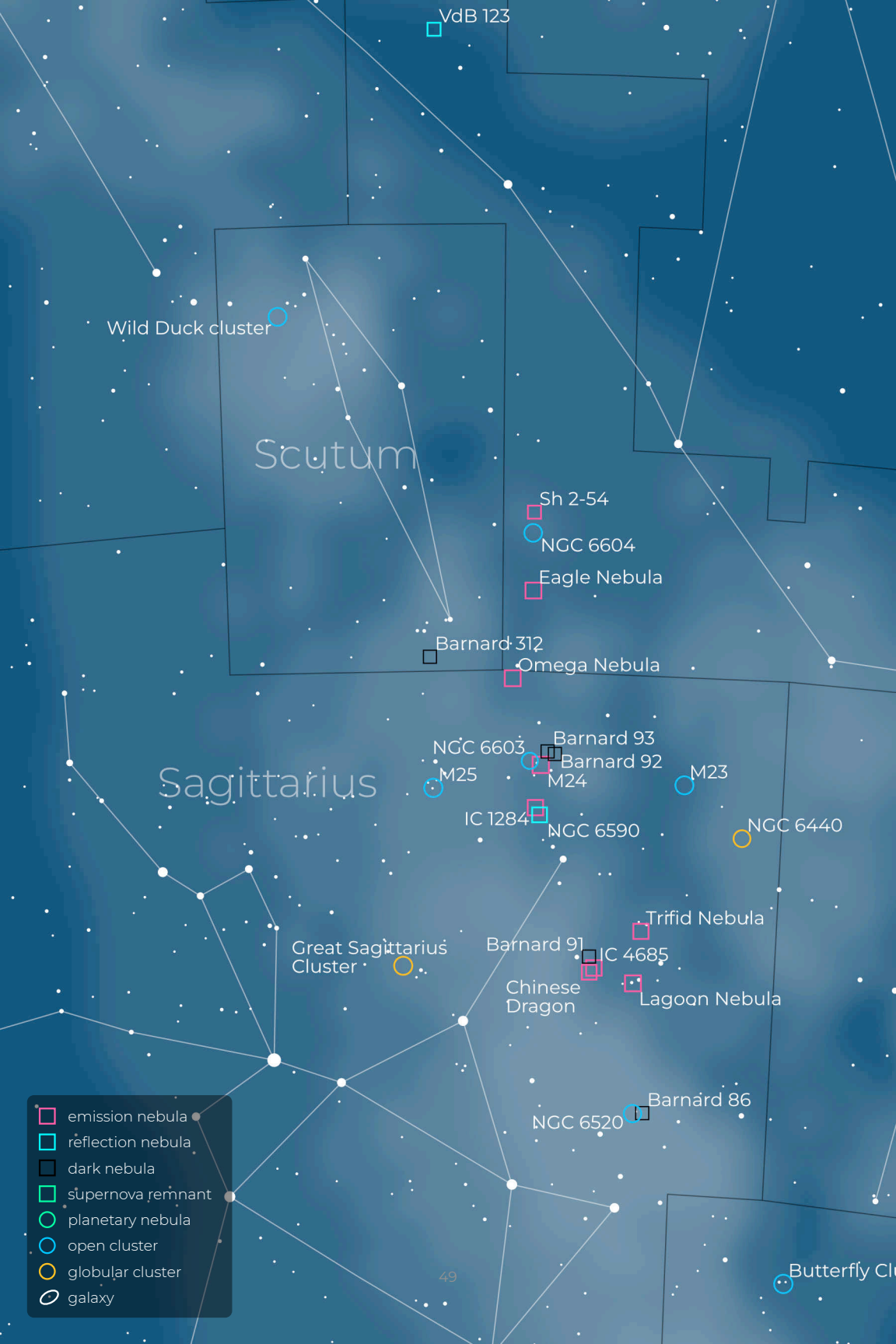
Lagoon & Trifid Nebulae (Sgr) • Eagle Nebula (Ser) • Omega Nebula (Sgr)

Go off the beaten path

Small Sagittarius Star Cloud (Sgr) • Serpent Nebula Sh2-54 (Ser)

Challenge yourself

Barnard 312 (Sct) • Barnard 86 (Sgr) • vdB 123 (Ser)



VdB 123

Wild Duck cluster

Scutum

Sh 2-54

NGC 6604

Eagle Nebula

Barnard 312

Omega Nebula

Sagittarius

NGC 6603

Barnard 93

M25

Barnard 92

M23

IC 1284

NGC 6590

NGC 6440

Great Sagittarius Cluster

Barnard 91

Trifid Nebula

IC 4685

Chinese Dragon

Lagoon Nebula

NGC 6520

Barnard 86

Butterfly Cl

49

- emission nebula
- reflection nebula
- dark nebula
- supernova remnant
- planetary nebula
- open cluster
- globular cluster
- galaxy

Cosmic scene index

The Lagoon, Trifid, Chinese Dragon Complex

The Small Sagittarius Star Cloud - Messier 24 and Its Companions

The Ink Spot Pair - Barnard 86 & NGC 6520

The Serpens OB Complex - M16, Sh2-54 & NGC 6604

Target index

♥	Lagoon	Mixed nebula	Sagittarius
★	Chinese Dragon	Mixed nebula	Sagittarius
	Omega / Swan / Horseshoe	Emission nebula / HII region	Sagittarius
♥	Eagle Nebula	Emission nebula / HII region	Serpens Cauda
	IC 4685	Emission nebula / HII region	Sagittarius
	IC 1284	Emission nebula / HII region	Sagittarius
♥	Trifid	Emission nebula / HII region	Sagittarius
★	Serpens Nebula	Emission nebula / HII region	Serpens Cauda
	NGC 6590	Reflection nebula	Sagittarius
★	VdB 123	Reflection nebula	Serpens Cauda
	Barnard 91	Dark nebula	Sagittarius
	Black Hole Nebula	Dark nebula	Sagittarius
★	Ink Spot Nebula	Dark nebula	Sagittarius
	Barnard 312	Dark nebula	Scutum
	Lagoon	Open cluster	Sagittarius
	M 25	Open cluster	Sagittarius
	Graff's Cluster	Open cluster	Serpens Cauda

M 23	Open cluster	Sagittarius
 Wild Duck Cluster	Open cluster	Scutum
NGC 6604	Open cluster	Serpens Cauda
NGC 6520	Open cluster	Sagittarius
NGC 6603	Open cluster	Sagittarius
M 22	Globular cluster	Sagittarius
NGC 6440	Globular cluster	Sagittarius
 Small Sagittarius Star Cloud	Star cloud	Sagittarius

The Constellations

Sagittarius

Sgr • Archer • Sagittaire

Sagittarius is a large zodiacal constellation. Its most recognizable feature is the Teapot asterism, formed by eight bright stars whose spout points directly toward the galactic center. The region around the Teapot contains the highest concentration of nebulae and clusters visible from Earth: no other constellation hosts more Messier objects. The Milky Way is at its most spectacular here.

Serpens Cauda

Ser • Serpent's Tail • Serpent

Serpens is unique among the 88 IAU (International Astronomical Union) constellations in that it is split into two non-contiguous parts by Ophiuchus: Serpens Caput (the head, to the west) and Serpens Cauda (the tail, to the east). Only Serpens Cauda is covered in this chapter. Despite its modest size, it contains two major targets: the Eagle Nebula (M16), and the vast HII complex Sh2-54.

Scutum

Sct • Shield • Ecu de Sobieski

Scutum is one of the smallest constellations in the sky. Its position coincides with a gap in the interstellar dust, allowing a clearer view into the inner Milky Way. The Scutum Star Cloud is one of the brightest and most concentrated naked-eye patches of the Galactic disk. Within this rich field lies Messier 11, the Wild Duck Cluster, one of the densest and richest open clusters in the sky, along with several dark nebulae silhouetted against the dense stellar background.

Looking Toward the Heart of the Milky Way

Pointing your smart telescope into this region means looking toward the crowded inner regions of the Milky Way. The constellations of Sagittarius, Serpens Cauda, and Scutum lie toward the inner Milky Way, close to the Galactic Center direction which sits at a distance of approximately 27,000 light-years

The emission nebulae and star-forming regions presented here (M8, M20, M17, M16) belong to the Sagittarius–Carina spiral arm, one of the major spiral-arm segments interior to the Sun's position, lying between Earth and the galactic center. At distances ranging from 4,000 to 7,000 light-years

Farther in the background, the globular cluster NGC 6440 lies about 27,000–28,000 light-years away, deep in the Galactic bulge. Messier 22, by contrast, is much closer, at about 10,000–10,600 light-years.

Golden star fields.

Most background stars appear distinctly yellow to orange in color, even when they are intrinsically blue-white stars. This is caused by interstellar reddening: dust grains distributed throughout the Galactic disk scatter and absorb short-wavelength (blue) light preferentially, while red and near-infrared photons pass through with less attenuation. The cumulative effect of several kiloparsecs of dust shifts the apparent color of distant stars toward warmer hues. The richer and deeper the star field you image in this direction, the more pronounced this effect becomes.

The Galactic Center: An Invisible Landmark Worth Imaging.

At the coordinates RA 17h 45m 40s • Dec $-29^{\circ} 00' 28''$, 27 000 light years away, in southern Sagittarius, lies the precise location of Sagittarius A* (Sgr A*), the supermassive black hole at the gravitational heart of the Milky Way. Its mass is 4 million times that of our Sun, compressed into a region smaller than the orbit of Mercury.

You cannot see it in visible light. Between Earth and the galactic center dust and gas absorb virtually all optical photons emitted from that direction. It was first definitively identified through radio observations at the National Radio Astronomy Observatory in 1974, and directly imaged at radio wavelengths by the Event Horizon Telescope collaboration in 2022.

HOW TO LOCATE THE DIRECTION.

The Teapot asterism of Sagittarius is your guide: the tip of its spout points almost directly at the galactic center. On a transparent, moonless night from a dark site, the area around the galactic center reveals an extraordinary concentration of the Milky Way's glow, visually flanked by dark rift lanes to the north and the Large Sagittarius Star Cloud - a $6^{\circ} \times 4^{\circ}$ naked-eye patch of the galactic bulge - immediately to the south.

WHAT YOU CAN IMAGE.

Aiming your smart telescope in the direction of the galactic center - anywhere within a few degrees of RA 17h 45m • Dec -29° - reveals an extraordinarily dense star field. This is the outer edge of the galactic bulge: a spheroidal concentration of hundreds of billions of stars packed into the inner 10 000 light-years of the Galaxy.

Even without a specific catalogued target at this precise location, a long-integration wide-field image centered near RA 17h 45m • Dec -29° will capture thousands of stars per arcminute and reveal subtle color gradients in the stellar background - a legitimate astrophotographic subject.



THE LAGOON - TRIFID COMPLEX

Vaonis Vespera Pro 1
Total integration time 7h30
Mosaic mode · No filter
Bortle 3

Cosmic Scenes

THE LAGOON · TRIFID · CHINESE DRAGON COMPLEX

This is one of the most spectacular wide-field cosmic scenes in the entire guide, bringing together five closely related Sagittarius star-forming and dust-cloud regions in a single imaging field. M8, the Lagoon Nebula; M20, the Trifid Nebula; NGC 6559; IC 4685; and Barnard 91 all lie at broadly comparable distances of roughly 5,000 light-years and belong to the same general Sagittarius Arm star-forming environment.

Together, the five objects span approximately $3.5^\circ \times 2.5^\circ$ on the sky. The entire scene is set against a backdrop of extraordinary stellar density toward the inner Milky Way.

📍 Lagoon Nebula

M8 · NGC 6523
Emission nebula
Mag. 6 · angular size $90' \times 40'$
RA 18h 03m 42s · Dec $-24^\circ 22' 49''$

The Lagoon Nebula is one of the two star-forming nebulae faintly visible to the naked eye from mid-northern latitudes (the other being the Orion Nebula). Its physical dimensions are approximately 110×50 light-years, and it is one of the most luminous HII regions in the inner Milky Way. The nebula's ionization is powered by several massive O-type stars embedded in or associated with the region, especially 9 Sagittarii.

Smart telescope imaging

M8 is one of the most immediately rewarding targets available. Bright, high surface brightness, and rich in structure. A short integration already delivers strong color and contrast. Longer integrations reveal the full extent of faint outer emission and begin to show the subtle filamentary structure throughout the nebula. A dual-band filter boosts contrast in the emission

regions, especially from light-polluted sites or at low elevation. For even broader coverage, include it in the full Lagoon–Trifid–Chinese Dragon mosaic described above (without dual band filter).

Lagoon Cluster

NGC 6530
Open cluster
Mag. 4.6 · angular size $6'$
18h 04m 31s / $-24^\circ 21' 29''$

Embedded in the eastern lobe of M8, NGC 6530 is a very young open cluster whose hot, massive stars are the principal ionizing agents of the Lagoon Nebula.

📍 Trifid Nebula

NGC 6514 · Messier 20
Mixed nebula (emission + reflection + dark lanes)
Mag. 8.5 · angular size $28' \times 28'$
RA 18h 02m 42s · Dec $-22^\circ 58' 19''$

The Trifid Nebula is one of the most visually photogenic nebulae, combining three distinct types of nebulosity in a compact field. Its name derives from the three dark dust lanes - trifid means "divided into three lobes" - that radiate outward from the central ionizing star

The southern three-quarters of the apparent nebula is an HII emission region, glowing red in hydrogen-alpha; the northern lobe is a separate reflection nebula illuminated by a different embedded star, appearing distinctly blue in color images. The dark lanes themselves are dense foreground dust filaments silhouetted against the bright background.

Smart telescope imaging

M20 fits comfortably within a single smart telescope frame. Since it mixes several types of nebula, a dual band filter should not be used. For maximum impact, frame M20 together with M8 in a mosaic capture.

★ Chinese Dragon Nebula

NGC 6559

Mixed nebula (emission + reflection)

Mag. 10 • angular size 10'

NGC 6559 is a compact but intricately structured mixed nebula, displaying both red emission (ionized hydrogen) and blue reflection regions illuminated by embedded young stars.

Smart telescope imaging

A dual-band filter may help to distinguish it from the bright Sagittarius star field (Yet you lose the reflection part). This object is most effective when included in the full mosaic of this cosmic scene rather than framed in isolation.

IC 4685

Emission nebula

Mag. 7.2 • angular size 15' × 10'

RA 18h 09m 17s • Dec -23° 59' 14"

IC 4685 is the brightest member of the Chinese Dragon complex.

Barnard 91

Dark nebula

Angular size 5'

Barnard 91 is a small but opaque dark nebula projected against the dense Sagittarius star field. It is small but immediately identifiable in images of the Chinese Dragon complex.

THE SMALL SAGITTARIUS STAR CLOUD - MESSIER 24 AND ITS COMPANIONS

Messier 24 is a unique object in Messier's catalog: it is not a nebula, a cluster, or a galaxy, but a star cloud - a window through a gap in the interstellar dust of the Milky Way that allows our line of sight to

penetrate much deeper into the Galaxy than in adjacent directions. The stars visible in M24 lie at distances ranging from approximately 10,000 to 16,000 light-years, far beyond the local spiral arm features described in this chapter. What you see is not a single structure but a superposition of multiple stellar populations in the inner Galactic disk.

Within and immediately around M24, five additional objects complete the scene: an open cluster, two dark nebulae, and two nebulae.

Smart telescope imaging

The full scene fits within a 4.3°×2.4° mosaic acquisition.

★ Small Sagittarius Star Cloud

IC 4715 - Messier 24

Mag. 4.5 • angular size 120' × 60'

RA 18h 16m 56s • Dec -18° 30' 52"

Messier 24 is overlooked by smart telescope users who focus on individual nebulae and clusters. Long-integration images of its star cloud reveal a density and color richness that no other field of comparable angular size can match.

The "Small" in its name distinguishes it from the Large Sagittarius Star Cloud which lies closer to the galactic center and is more obscured by dust.

Smart telescope imaging

Broadband imaging (no filter) is strongly recommended: narrowband filters suppress the star field and defeat the purpose of imaging a star cloud. The best images show the dark nebulae Barnard 92 and Barnard 93 as stark silhouettes against the shimmering stellar background



THE SMALL SAGITTARIUS STAR
CLOUD

Vaonis Vespera 2

Total integration time 7h30

Mosaic mode · No filter

Bortle 3

IC 1284

Emission nebula

Mag. 8 • angular size 17' × 15'

RA 18h 17m 40s • Dec -19° 40' 19"

IC 1284 is a bright emission nebula located approximately 30' south of the main M24 star cloud. It forms a close pairing with the adjacent reflection nebula NGC 6590, only 12' away.

NGC 6590

Reflection nebula

Mag. 9.7 • angular size 7' × 5'

RA 18h 17m 05s • Dec -19° 51' 58"

NGC 6590 is a small reflection nebula 12' from IC 1284, illuminated by an embedded B-type star. Its blue color stands in contrast to the red H α emission of the neighboring IC 1284.

NGC 6603

Open cluster

Mag. 11.1 • angular size 5'

RA 18h 18m 27s • Dec -18° 24' 22"

NGC 6603 is a distant, rich open cluster embedded in the M24 star cloud at approximately 10,000 light-years - one of the most remote open clusters accessible to amateur equipment. It appears as a compact, dense granular knot against the already crowded M24 background.

The Black Hole Nebula

Barnard 92

Dark nebula

Angular size 15'

RA 18h 15m 00s • Dec -18° 13' 00"

Barnard 92 is the most visually dramatic of the dark nebulae associated with M24 and one of the most famous dark nebulae in the sky. Its popular name "The Black Hole"

captures its appearance precisely: a circular, completely opaque patch where the M24 star cloud background is entirely extinguished - not an absence of stars, but a dense foreground dust cloud blocking everything behind it.

Smart telescope imaging

Barnard 92's power lies entirely in its background. The denser and brighter the M24 star field in your integration, the more dramatic the dark nebula appears.

Barnard 93

Dark nebula

Angular size 30' × 10'

RA 18h 16m 00s • Dec -18° 09' 00"

Barnard 93 is an elongated dark lane located just 3' from Barnard 92 within the M24 field. Its elongated shape creates a striking visual contrast with the more circular Barnard 92. It is less completely opaque than its neighbor, allowing some faint background stars to show through in long integrations.

Smart telescope imaging

Same approach as Barnard 92.

THE INK SPOT PAIR - BARNARD 86 & NGC 6520

This compact scene, located in southern Sagittarius, pairs a dark nebula with an open cluster in a rich densely packed star fields they are separated by only 8'.

The two objects are not physically related: the dark nebula is a foreground structure (estimated 1,000–2,000 light-years), while NGC 6520 is a distant open cluster (~5,000 light-years). What makes this pairing photogenic is purely a line-of-sight coincidence.

NGC 6520

Open cluster

Mag. 7.6 • angular size 5.4'

RA 18h 03m 24s • Dec -27° 53' 10"

NGC 6520 is a compact, moderately bright open cluster. Its blue stellar population stand out against the warm-toned background star field of southern Sagittarius.

★ The Ink Spot

Barnard 86

Dark nebula

Angular size 5' × 3'

18h 02m 00s / -27° 52' 00"

Barnard 86 is small but immediately recognizable: the dark patch is essentially complete - no background stars are visible through its core - creating a void that appears to be punched out of the stellar fabric of southern Sagittarius.

Smart telescope imaging

Do not hesitate to go with long integration time for a dense starfield background that will enhance contrast with the dark nebula.

THE SERPENS OB COMPLEX - M16, SH2-54 & NGC 6604

In Serpens Cauda, three objects at similar distances form a physically related scene: Messier 16 (the Eagle Nebula), the giant HII region Sh2-54 and the open cluster NGC 6604. All three belong to, or are associated with, the Serpens OB stellar association at approximately 6,500 light-years.

NGC 6604 sits inside Sh2-54 and is its primary ionization source; M16 lies approximately 2° to the south and belongs to the same large-scale molecular cloud complex. The full extent of the scene requires a mega-mosaic capture.

♥ Eagle Nebula

M 16 • NGC 6611 • IC 4703

Emission nebula / young open cluster

Mag. 6.0 • angular size 120' × 25'

RA 18h 18m 00s • Dec -13° 48' 00"

The Eagle Nebula is one of the most iconic deep-sky objects in the Messier catalog, made globally famous by the Hubble Space Telescope's 1995 image of the Pillars of Creation: towering columns of cool molecular hydrogen gas and dust within the nebula, the tallest of which is about four light-years long. These pillars are being eroded by intense ultraviolet radiation while dense evaporating gaseous globules, embedded in them shelter embryonic stars forming inside at least some of their tips.

The Eagle Nebula is an active star-forming HII region, illuminated and ionized by the young massive open cluster NGC 6611, whose hot OB stars power much of the surrounding emission.

M16 physically spans about 70 × 55 light-years. The apparent size of 120' × 25' reflects the elongated extent of the faint outer emission; the bright core around the Pillars region is approximately 30' in diameter.

Smart telescope imaging

M16 is an outstanding narrowband target. A dual-band filter makes the Pillars of Creation region stand out dramatically - the dense gas columns appear as dark silhouettes against bright H α background emission, with OIII emission adding teal tones to the surrounding gas.

★ Serpent Nebula Sh2-54

HII region / Emission nebula

Angular size 2.3°

RA 18h 17m 53s • Dec -11° 40' 58"

Sh2-54 is a large HII regions in the Milky Way, spanning approximately 2.3° in apparent diameter - larger than four full moons placed side by side. Its physical diameter exceeds 250 light-years. It is likely ionized by multiple OB stars including those in the embedded cluster NGC 6604.

Despite its enormous angular size and strong H α emission, Sh2-54 receives far less attention in amateur astronomy than its neighbor M16 - a genuine hidden gem of Serpens Cauda.

Smart telescope imaging

Sh2-54 fits within a mosaic acquisition which covers its full extent. A dual-band filter is essential: without it, the faint outer emission is lost in the bright background star-field.

NGC 6604

Open cluster

Mag. 6.5 • angular size 9'

RA 18h 18m 03s • Dec -12° 14' 35"

NGC 6604 is a young open cluster embedded within Sh2-54. It is a primary ionization source for the surrounding HII emission.

Individual Targets

EMISSION NEBULAE

♥ Omega / Swan / Horseshoe Nebula

M 17 • NGC 6618

Emission nebula

Mag. 6.0 • angular size 20' × 15'

RA 18h 20m 47s • Dec -16° 10' 18"

Messier 17 is one of the most luminous HII regions in the Milky Way. M17 lies at approximately 6,000 light-years in the Sagittarius–Carina arm - slightly more distant than M8 but in the same galactic structure. The full extent of the nebula at deep exposures exceeds 40', but the bright core is concentrated within the listed 20' × 15' footprint.

Smart telescope imaging

M17 is a dual-band target. Long integration in narrowband reveals extensive filamentary structure beyond the core. The very bright core can easily be over-exposed. Reducing camera gain setting or limiting individual exposure time to 10 seconds may help preserving details within it.

M17 and M16 are separated by approximately 2.5° on the sky. A mega-mosaic can captures both iconic nebulae. This is one of the great wide-field imaging opportunities of the summer Milky Way.

EAGLE NÉBULA

Vaonis Vespera Pro
Dual band filter
Bortle 1/2



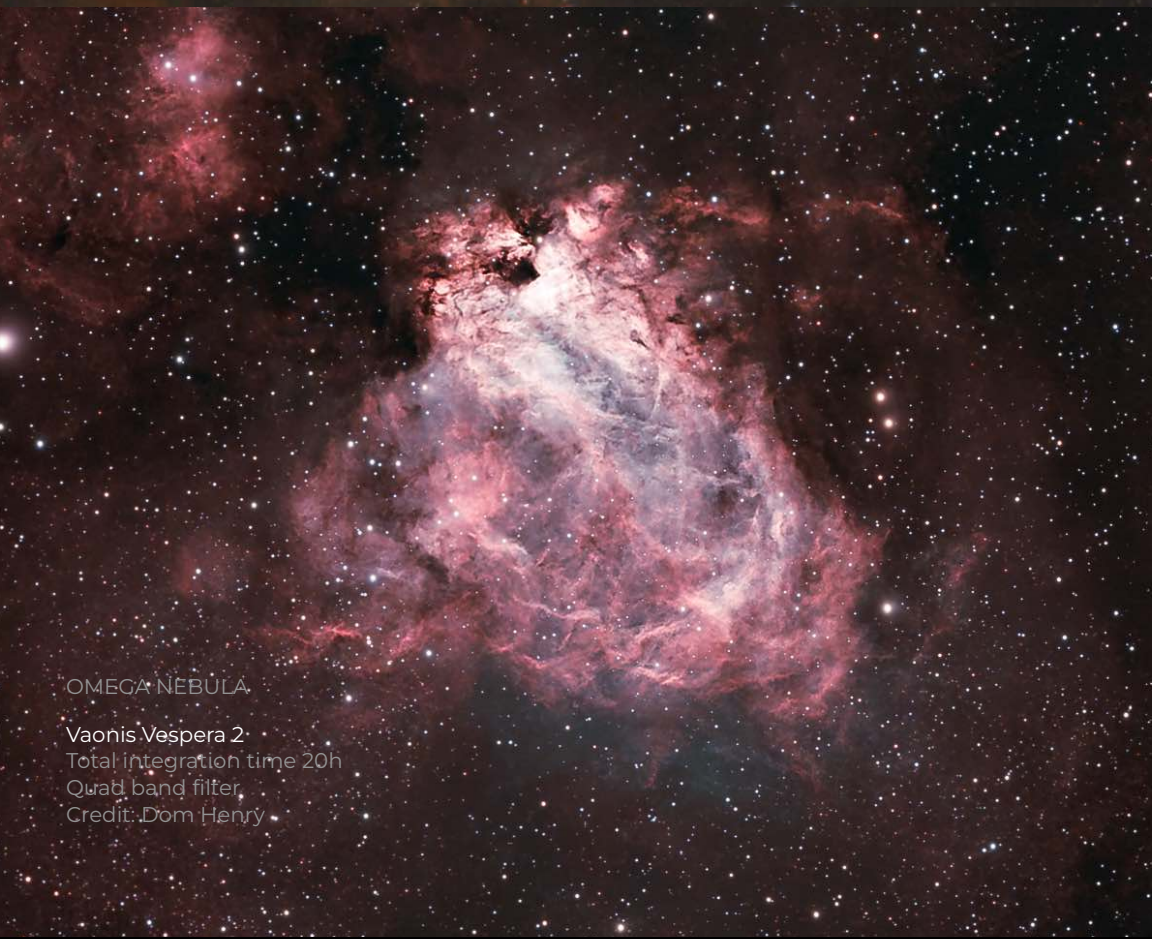


THE PILLARS OF CREATION,
CORE OF THE EAGLE NEBULA

Vaonis Vespera

dual band filter + sulfur-II layer
from Telescope Live.

Credit: Vaonis Imaging Club / Ian Baber



OMEGA NEBULA

Vaonis Vespera 2

Total integration time 20h

Quad band filter

Credit: Dom Henry

OPEN CLUSTERS

Graff's Cluster

IC 4756

Open cluster

Mag. 4.6 • angular size 24'

RA 18h 38m 52s • Dec +05° 27' 44"

IC 4756 is a large, bright open cluster in Serpens Cauda, visible to the naked eye under dark skies. The cluster contains approximately 80 stars with a mix of blue-white main sequence stars and evolved yellow giants.

Messier 25

IC 4725

Open cluster

Mag. 4.6 • angular size 40'

RA 18h 31m 47s • Dec -19° 06' 54"

Messier 25 is a bright, loose open cluster of approximately 100 stars at a distance of about 2,000 light-years. Among its members is the Cepheid variable star U Sagittarii, which pulses in brightness with a period of 6.745 days. Cepheids are fundamental to establishing cosmic distance scales.

Smart telescope imaging

The Cepheid U Sgr can be identified in repeated images by its brightness variation (between mag. 6.3 and 7.2 over a series of nights

Messier 23

NGC 6494

Open cluster

Mag. 5.5 • angular size 35'

RA 17h 57m 05s • Dec -18° 59' 07"

Messier 23 contains approximately 170 resolved stars. Unlike many younger clusters dominated by blue-white stars, M23 shows a few evolved red and yellow giant members -

indicating an age of approximately 220–300 million years.

Smart telescope imaging

Like many open clusters in this region, M23 sits in front of a rich star field background, which adds to its interest in imagery. At magnitude 5.5 and 35' apparent size, M23 is a quick, rewarding cluster target. Integration of 30 minutes is sufficient. Broadband, no filter.

★ Wild Duck Cluster

M 11 • NGC 6705

Open cluster

Mag. 6 • angular size 14'

RA 18h 51m 00s • Dec -06° 16' 00"

The Wild Duck Cluster is one of the richest and most compact open clusters in the Milky Way. Approximately 2,900 stars are packed at a distance of 6,100 light-years, making it appear as a dense, almost nebulous patch to the naked eye. At an estimated age of 220–250 million years, M11 is older than many of the bright blue clusters elsewhere in this chapter.

M11 is embedded in the Scutum Star Cloud. The cluster's dense stellar population against this rich background creates images of extraordinary depth and density.

Smart telescope imaging

M11 is an outstanding quick-win target. It shows structure within minutes. For a spectacular wide-field composition, frame M11 against the full backdrop of the Scutum Star Cloud.

GLOBULAR CLUSTERS

Messier 22

NGC 6656

Globular cluster

Mag. 5.1 • angular size 32'

18h 36m 24s / -23° 54' 13"

Messier 22 is the brightest globular cluster in Sagittarius and one of the finest in the sky.

Located at approximately 10,600 light-years, M22 is one of the nearest globular clusters to Earth, orbiting in the inner Galactic halo. Its proximity means that individual stars can be resolved by smart telescopes with the largest diameter. M22 has an extraordinary property unique among globular clusters: it contains two known planetary nebulae - GJJC 1 and PS 1 - detected from their infrared emission within the cluster's stellar population. These are tiny and unresolved by amateur equipment, but they make M22 astrophysically exceptional.

Smart telescope imaging

The key processing challenge is managing the bright core while maintaining resolution in the outer halo. It may help to lower camera gain setting and stick to short exposure.

NGC 6440

Globular cluster
Mag. 9.3 • angular size 7"
RA 17h 48m 53s • Dec -20° 21' 34"

NGC 6440 is a heavily obscured globular cluster located at approximately 27,700 light-years, well beyond the Sagittarius arm and probing the inner halo region of the Galaxy toward the bulge.

DARK NEBULAE

Barnard 312

Dark nebula
Angular size 50"
RA 18h 32m 00s • Dec -15° 28' 00"

A large, diffuse dark nebula in Scutum with a distinctive arrow shape. This dark nebula is superimposed on a glowing HII region (RC 163) and a dense star field background.

Smart telescope imaging

As with all dark nebulae, the impact depends entirely on the richness of the background star field: the longer the integration, the more dramatic the contrast. Revealing the underlying H II emission region requires deep integration and a dual-band filter, which will, however, attenuate the background star field. To get the best out of this target, combine broadband and narrowband captures.

REFLECTION NEBULAE

★ VdB 123

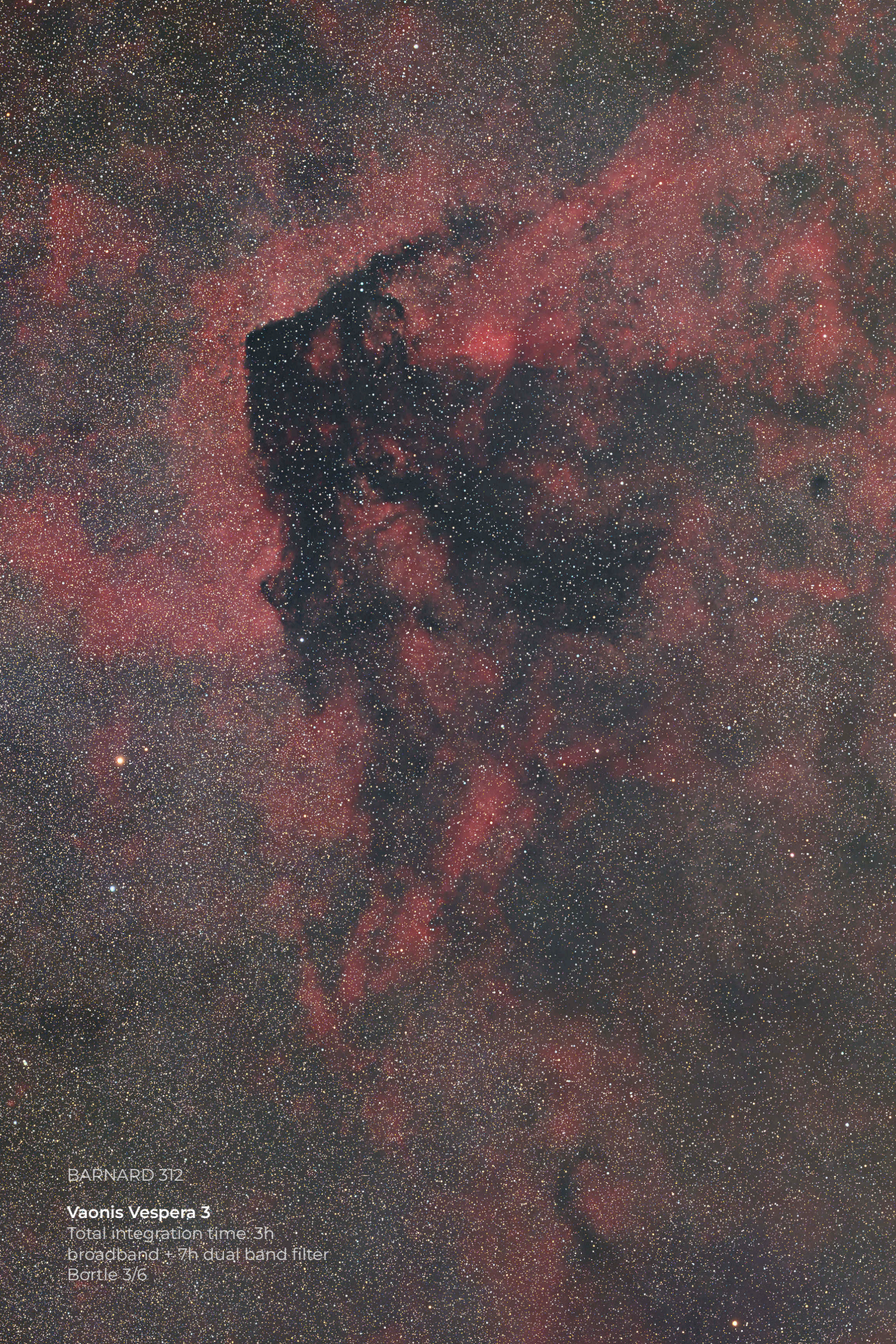
Reflection nebula
Angular size ~10' (nebula core);
surrounding dark cloud: 1.6° × 1.2°
18h 30m 24s / +01° 13' 23"

VdB 123 is a faint blue reflection nebula located within the Serpens Dark Cloud. The nebula is illuminated by an embedded B-type star, which scatters its blue light off the surrounding dust.

VdB 123 appears as a subtle blue glow against a dark molecular cloud, which itself appears as an irregular absorption region against the Milky Way golden star field background.

Smart telescope imaging

This is a challenging target requiring a long integration time. This is a target for experienced smart telescope imagers comfortable with long sessions and patient processing.



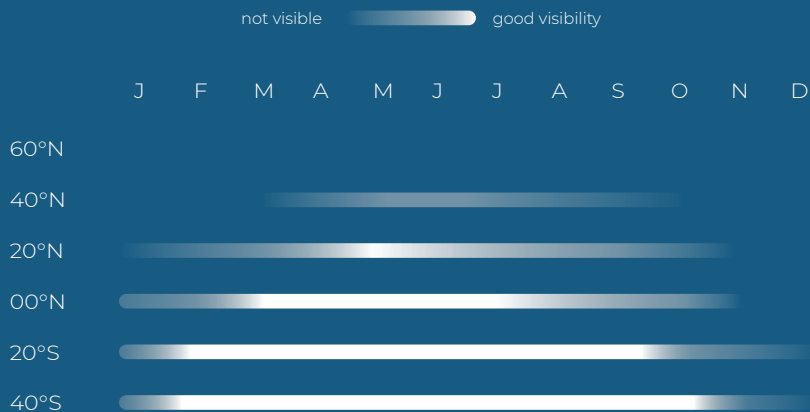
BARNARD 312

Vaonis Vespera 3

Total integration time: 3h
broadband + 7h dual band filter
Bortle 3/6

Scorpius • Ophiuchus

Visibility by Latitude



To get started

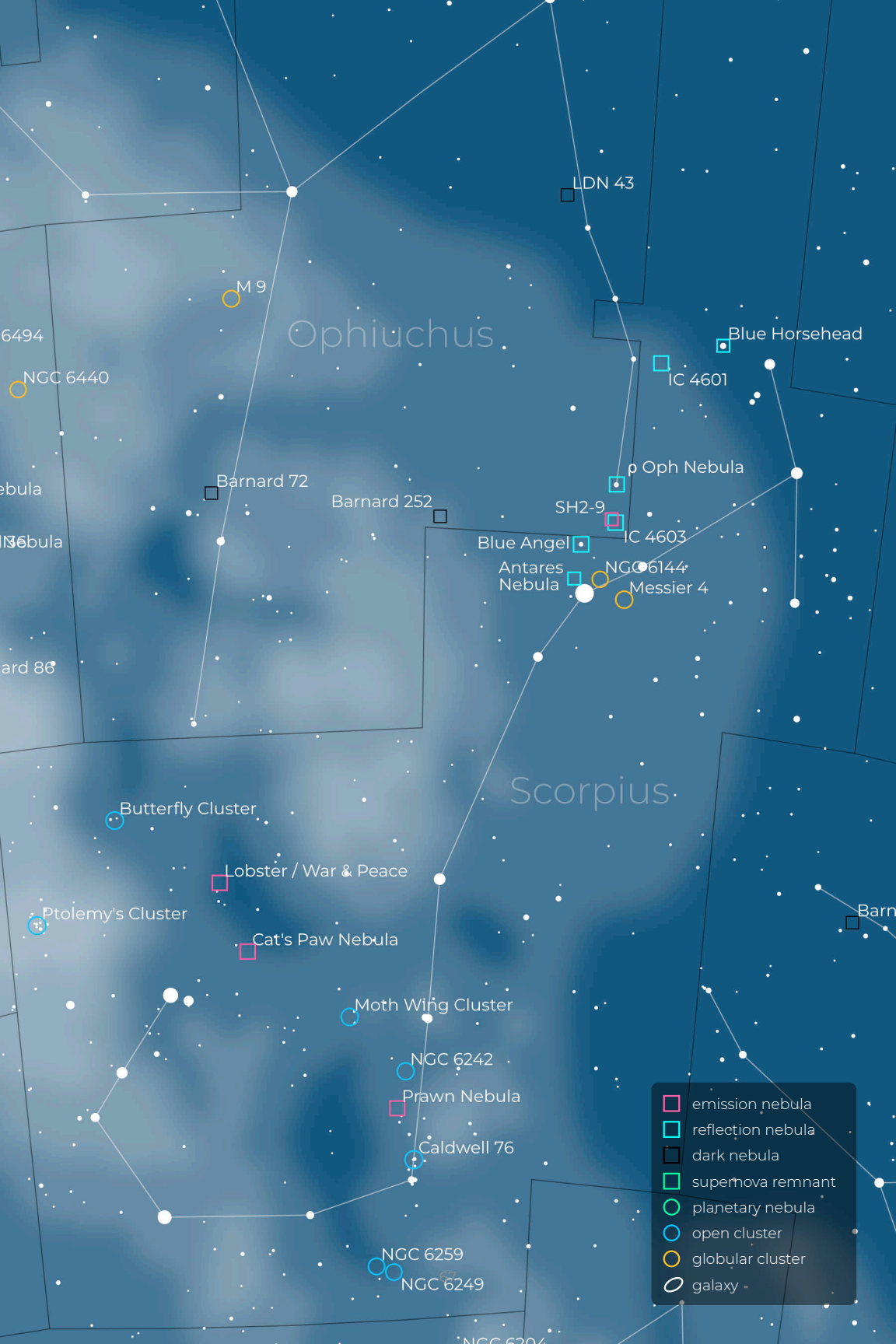
Butterfly Cluster (Sco) •
Caldwell 76 cluster (Sco) •
Prawn Nebula (Sco)

Go off the beaten path

Antares Nebula & M4
globular cluster (Sco) •
Ptolemy's cluster (Sco) •
War and Peace Nebulae
(Sco)

Challenge yourself

Rho Ophiuchi Cloud
Complex (Oph) • Blue
Horsehead Nebula (Oph) •
Snake Nebula (Oph)



Ophiuchus

Scorpius

- emission nebula
- reflection nebula
- dark nebula
- supernova remnant
- planetary nebula
- open cluster
- globular cluster
- galaxy

Cosmic scene index

The Rho Ophiuchi Cloud Complex

The Scorpius OB1 Complex, IC 4628, NGC 6231, NGC 6242 & NGC 6281

The Blue Horsehead Nebula complex

Southern Scorpius open-cluster field

Target index

★	Lobster / War and Peace	Emission nebula / HII region	Scorpius
★	Cat's Paw	HII region / Emission nebula	Scorpius
★	Prawn	Emission nebula / HII region	Scorpius
	SH2-9	Emission nebula / HII region	Scorpius
	Blue Angel	Reflection nebula	Scorpius
★	IC 4603	Reflection nebula	Ophiuchus
★	Rho Ophiuchi Nebula	Reflection nebula	Ophiuchus
	IC 4601	Reflection nebula	Scorpius
★	Blue Horsehead	Reflection nebula	Scorpius
	Antares nebula	Reflection nebula	Scorpius
	Snake	Dark nebula	Ophiuchus
★	Cosmic Bat	Dark nebula	Ophiuchus
	Dolphin	Dark nebula	Scorpius
	Caldwell 76	Open cluster	Scorpius
★	Ptolemy cluster	Open cluster	Scorpius
	Butterfly	Open cluster	Scorpius
	Moth Wing	Open cluster	Scorpius

	NGC 6242	Open cluster	Scorpius
	NGC 6259	Open cluster	Scorpius
	NGC 6249	Open cluster	Scorpius
★	M 4	Globular cluster	Scorpius
	M 9	Globular cluster	Ophiuchus
	NGC 6144	Globular cluster	Scorpius

The Constellations

Scorpius

Sco · Scorpion · Scorpion

Scorpius is one of the most visually striking constellations in the sky, tracing the unmistakable curved form of a scorpion with its distinctive hooked tail. It contains a remarkable concentration of bright stars, open clusters, and nebulae concentrated toward the galactic plane. Its most famous star, Antares (Alpha Scorpii), is a red supergiant approximately 700 times the diameter of the Sun, sitting at a distance of around 550 light-years. Antares is not merely a navigational landmark, it illuminates the surrounding dust of the Rho Ophiuchi cloud complex with its red-orange light, creating one of the most colorful reflection nebula environments in the sky. Scorpius contains several Messier objects, including the bright open clusters M6 and M7 (among the finest in the sky) and the globular cluster M4, one of the nearest to Earth.

Ophiuchus

Oph · Serpent Bearer · Serpenteaire

Ophiuchus is a large constellation that lies largely off the ecliptic but is crossed by the Sun each year, making it an unofficial 13th sign of the zodiac. It straddles the galactic plane and acts as a rich repository of dark nebulae, molecular clouds, and globular clusters. Its most prominent deep-sky features are not bright showpieces but rather sweeping dark nebular complexes like the Snake Nebula (Barnard 72), and the famous Rho Ophiuchi cloud, all interstellar dust structures silhouetted against the rich background of the inner Milky Way. Only the targets within or very close to the Milky Way band are described in this guide.

From Our Cosmic Doorstep to the Sagittarius Arm

The Scorpius–Ophiuchus region of the sky sits in a transitional zone between the local interstellar neighborhood and the dense inner Galactic disk. Looking into this area means traversing several distinct galactic structures simultaneously, each at a different depth.

The Scorpius–Centaurus OB Association, (Sco–Cen), is the nearest OB association to the Solar System lying roughly 400–650 light-years away. Its massive stars have played a major role in shaping the local interstellar medium, and past supernova explosions.

Sco–Cen is also closely linked to the wider history of the Local Bubble: the low-density cavity of hot gas, hundreds of light-years across, that surrounds the Solar System. The Local Bubble was excavated by multiple supernova explosions, probably from massive stars associated with Sco–Cen and related nearby stellar populations.

The Rho Ophiuchi molecular cloud, at only 420 light-years, is one of the closest active star-forming regions to the Solar System, and is in fact located near the edge of the Local Bubble.

Further into the Galaxy, at 5,500–6,000 light-years, lie active HII regions belonging to the Sagittarius–Carina arm: the Cat's Paw Nebula and the War and Peace Nebula.

The dark nebulae of Ophiuchus are foreground structures at intermediate distance silhouetted against the glow of the inner Milky Way and the more distant galactic bulge.

THE RHO OPHIUCHI
CLOUD COMPLEX

Vaonis Vespera 3

Total integration time 17h

Mega mosaic (2 panels)

Multi-night mode : no filter

Bortle 4



Cosmic Scenes

★ THE RHO OPHIUCHI CLOUD COMPLEX

This is one of the most extraordinary wide-field astrophotography subjects in the sky, a vast, colorful tapestry of reflection nebulae, dark molecular filaments, emission regions, and embedded star clusters spread across $4.5^\circ \times 6.5^\circ$ of sky.

The complex owes its extraordinary visual richness to the superposition of several distinct physical phenomena operating at the same line of sight. The bright blue reflection nebulae (IC 4604, IC 4603, IC 4605) are dust clouds illuminated by nearby hot B-type stars. The reddish-orange glow associated with Antares (IC4606) is a separate reflection nebula lit by one of the sky's most luminous red supergiants. The compact emission region Sh2-9 surrounds Sigma Scorpii, a massive B-type star whose ultraviolet radiation ionizes the local hydrogen. And threading through everything, dense dark filaments, portions of the molecular cloud complex, absorb the light of background stars in sharply defined dark lanes.

Smart telescope imaging

The full complex extends beyond what any single mosaic can capture. A mega-mosaic, created by stitching together several mosaic captures is required to do full justice to this region.

This scene rewards exceptionally long integrations. The faint outer dust lanes and color gradients, which are among the most spectacular in the sky in a deep image, require many hours of total integration in broadband, with no filter (a dual band filter suppresses the reflection nebulae, which are the heart of the complex).

★ Antares Nebula

IC4606

Reflection nebula

Angular size $60'$

RA 16h 31m 00s · Dec $-26^\circ 03' 00''$

IC4606 is the vast reflection nebula surrounding Antares (Alpha Scorpii), the red supergiant at the heart of Scorpius. Antares is one of the largest stars visible to the naked eye. Its intense red-orange light illuminates surrounding dust clouds with a warm hue completely unlike the blue-tinged reflection nebulae produced by hotter stars in the same complex. This color contrast is one of the most visually striking features of the entire Rho Ophiuchi field.

Antares itself lies at approximately 550 light-years, slightly more distant than the bulk of the Rho Ophiuchi molecular cloud at 427 light-years. Its nebulosity is physically in the foreground dust of that complex, with the supergiant's light scattering off cloud material that happens to lie along the same line of sight.

Smart telescope imaging

Do not use a narrowband filter

Blue Angel Nebula

IC 4605

Reflection nebula

Mag. 5 · angular size $30'$

RA 16h 30m 12s · Dec $-25^\circ 06' 54''$

IC 4605 is a bright blue reflection nebula illuminated by the B2-type star 22 Scorpii. The nebula's appearance in color images, a diffuse blue glow radiating from a bright central star, gives it the popular name "Blue Angel." It is one of several reflection nebulae in the Rho Ophiuchi complex whose blue color contrasts with the reddish Antares nebulosity nearby.

Smart telescope imaging

Do not use a narrowband filter

★ Messier 4

NGC 6121

Globular cluster

Mag. 5.4 • angular size 28'

RA 16h 23m 35s • Dec -26° 31' 32"

Messier 4 is the closest globular cluster to Earth at approximately 7,000 light-years. It is visible to the naked eye from dark sites.

M4 sits within the foreground dust of the Rho Ophiuchi molecular cloud, which causes visual extinction, making it appear redder and somewhat fainter than it would in the absence of dust. Its true luminosity is approximately 120,000 solar luminosities. The cluster's age is estimated at 12 billion years.

Smart telescope imaging

An outstanding target that combines ease and depth. Integration of a few dozen minutes resolves thousands of individual stars. For a spectacular wide-field composition, frame M4 with Antares and the smaller NGC 6144 globular cluster.

★ Rho Ophiuchi Nebula

IC 4604

Reflection nebula

Mag. 7.2 • angular size 60'

RA 16h 25m 31s • Dec -23° 26' 11"

IC 4604 is the brightest and most prominent reflection nebula in the Rho Ophiuchi complex, centered on the multiple star Rho Ophiuchi, a binary whose intense radiation illuminates the surrounding dust with a vivid blue-white glow.

Smart telescope imaging

Long Integration is required to develop the full color and extent.

★ IC 4603

Reflection nebula

Mag. 6 • angular size 30'

RA 16h 25m 25s • Dec -24° 28' 06"

IC 4603 is a blue reflection nebula located just 1° south-southeast of IC 4604.

Smart telescope imaging

No dual band filter. Long integrations reveal subtle dark lanes and the transition between illuminated dust and opaque foreground cloud.

SH2-9

Emission nebula

Angular size 28'

RA 16h 26m 00s • Dec -24° 23' 00"

Sh2-9 is a compact HII region surrounding Alniyat (Sigma Scorpii), a massive star whose ultraviolet radiation ionizes the local hydrogen to produce a reddish emission glow.

Smart telescope imaging

A dual-band filter enhances the red emission and helps distinguish it from the surrounding blue reflection nebula. Yet if you capture it as part of the full Rho Ophiuchi mosaic, do not use such a filter.

NGC 6144

Globular cluster

Mag. 9.63 • angular size 5.4'

RA 16h 27m 14s • Dec -26° 01' 29"

NGC 6144 sits deep in the Galactic halo, far behind the Rho Ophiuchi complex, and its light is significantly reddened by the intervening dust of the molecular cloud.

THE SCORPIUS OB1 COMPLEX

Vaonis Vespera 2

Mega mosaic (4 panels) · Multi-
night mode · dual band filter
Bottle 4

The Scorpius OB1 Complex, Prawn Nebula, NGC 6231, NGC 6242 & NGC 6281

The Scorpius OB1 stellar association is a massive young stellar association. Its core is dominated by Caldwell 76, a brilliant young open cluster at roughly 5,000 light-years distance, containing around 100 O and B-type stars. These hot massive stars help ionize and illuminate the surrounding gas, including nearby HII regions such as the Prawn Nebula. Extended nebulosity, star-forming clouds, and nearby clusters create a dense, highly structured field that strongly rewards the investment in a mega-mosaic.

Mu Scorpii (μ Sco) is a close visual double. Both components are hot stars at approximately 500 light-years.

Zeta Scorpii consists of two unrelated stars at vastly different distances. Zeta² Sco (the brighter) is a foreground red giant at only 150 light-years. Zeta¹ Sco, by contrast, is a blue hypergiant at approximately 6 000 light-years, physically identified as a member of the Scorpius OB1 association and intrinsically a million times more luminous than the Sun. Their chance alignment in the sky makes ζ Sco one of the most stunning line-of-sight coincidences among bright stars.

★ Caldwell 76

NGC 6231

Open cluster

Mag. 2.6 • angular size 14'

RA 16h 54m 11s • Dec -41° 49' 28"

At magnitude 2.6, it is brighter than any Messier open cluster except the Pleiades, it is clearly visible to the naked eye under dark skies. Its stellar content is dominated by extremely hot, luminous stars, several of which are luminous blue supergiants.

Smart telescope imaging

NGC 6231 delivers immediate results. Its concentrated blue-white stellar population against the dense southern Milky Way is spectacular.

★ Prawn Nebula

IC 4628

Emission nebula

Mag. 7.3 • angular size 90' × 60'

RA 16h 56m 58s • Dec -40° 27' 04"

The Prawn Nebula is a massive HII region at ~6,000 light-years in the Sagittarius arm. The nebula is ionized by several massive O-type stars embedded within it. Together with NGC 6231, these ionizing stars form the energetic core of Scorpius OB1.

Smart telescope imaging

A dual-band filter is useful. Without it, the diffuse H α emission is lost against the bright southern Milky Way background. Long Integration reveals intricate filamentary structure

Moth Wing Cluster

NGC 6281

Open cluster

Mag. 5.4 • angular size 10'

RA 17h 04m 41s • Dec -37° 59' 07"

It's a bright, compact open cluster positioned against a rich HII emission background. It concentrates approximately 30–40 brighter members with fainter outliers extending the population further.

Smart telescope imaging

A long integration brings out the surrounding HII emission. An interesting approach could be to blend a regular capture (to preserve the star colors) with a dual band capture to enhance the HII emission.

NGC 6242

Open cluster

Mag. 6.4 • angular size 6.6'

RA 16h 55m 33s • Dec -39° 27' 39"

CAT'S PAW & WAR AND PEACE

Located near the tail of Scorpius, two spectacular HII regions sit just 2° apart in the sky and are physically connected by a filamentary gaseous bridge, possibly forming a single extended complex: NGC 6334 (Cat's Paw Nebula) and NGC 6357 (Lobster / War and Peace Nebula)

Smart telescope imaging

Their angular separation fits within a capture with mosaic mode. A dual-band filter is strongly recommended.

★ War and Peace / Lobster Nebula

NGC 6357

Emission Nebula

Mag. 6.5 • angular size 50'

RA 17h 24m 43s • Dec -34° 12' 05"

NGC 6357 is a complex diffuse emission nebula containing a massive open cluster. The nebula's popular names reflect its dual nature: in infrared images, the bright western portion resembles a dove (peace) while the eastern portion resembles a skull (war). In visible-light narrowband images, the overall shape suggests a lobster

★ Cat's Paw Nebula

NGC 6334

HII region / Emission nebula

Mag. 6.5 • angular size 50' × 25'

RA 17h 20m 50s • Dec -36° 06' 10"

The Cat's Paw Nebula is an active stellar nursery containing many young stars, most of them hidden from visible-light observation by the nebula's dense dust.

Its three distinctive circular lobes, resembling the paw pads of a cat, are regions of gas and ionized hydrogen energized by embedded massive young stars.

THE BLUE HORSEHEAD NEBULA COMPLEX

IC 4592 and IC 4601 form a wide complex of reflection nebulosity in Scorpius, embedded in the dusty molecular material associated with the Scorpius–Ophiuchus / Sco-Cen region. The main and most recognizable structure is IC 4592, the Blue Horsehead Nebula itself, whose curved dust lanes and blue reflection glow create the apparent outline of a horse's head. Much of the light reflected by IC 4592 comes from the bright multiple star system Nu Scorpii, positioned near the “eye” of the horse.

The blue color of these nebulae is characteristic of reflection nebulosity: fine interstellar dust scatters short-wavelength blue light from hot nearby stars more efficiently than red light.

Smart telescope imaging

Given the large field of view covered by this complex (more than 5° wide with the associated dark nebulae), a mega-mosaic is required to capture the entire composition.

★ Blue Horsehead Nebula

IC 4592

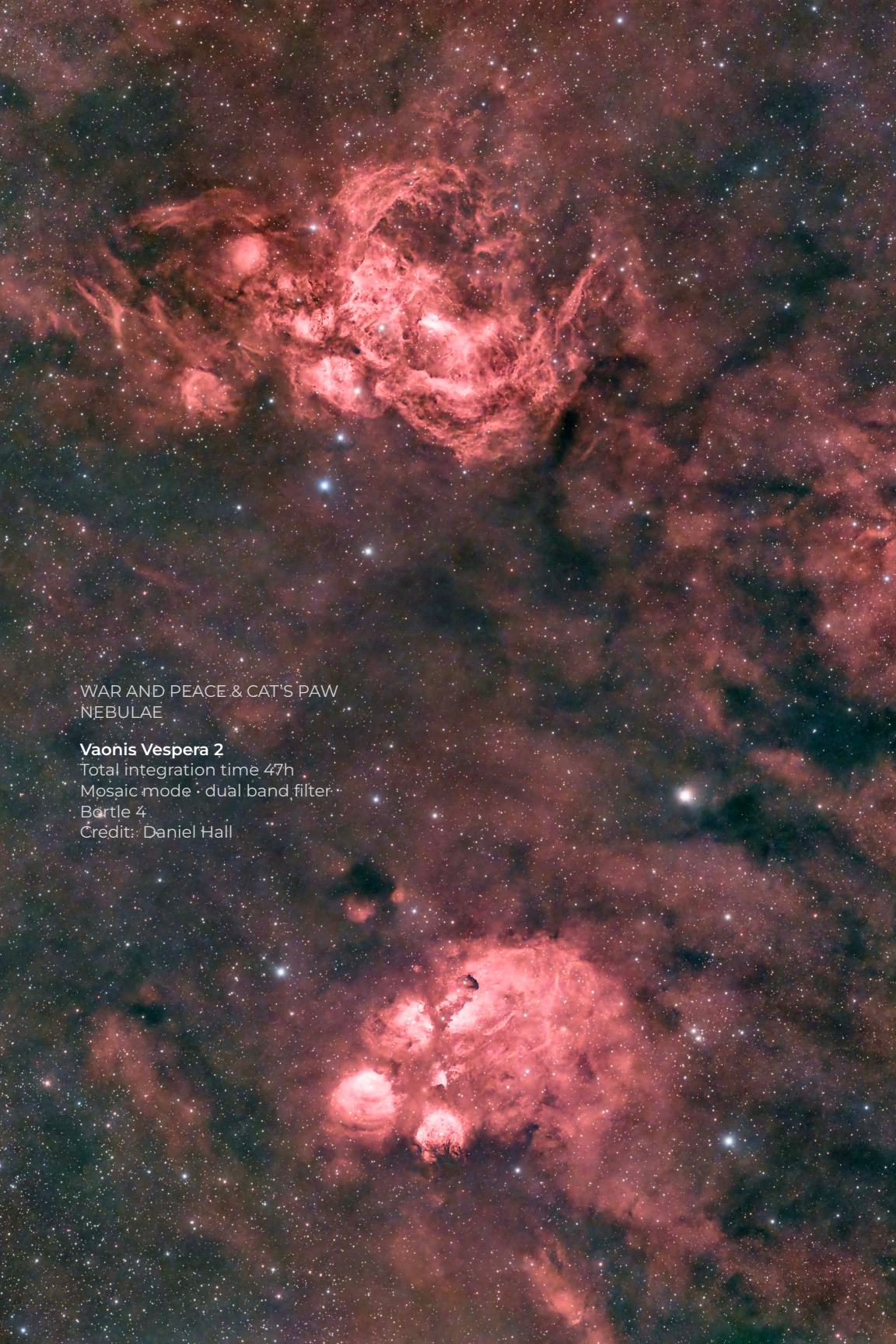
Reflection nebula

Angular size 150' × 60'

RA 16h 11m 59s • Dec -19° 27' 17"

Smart telescope imaging

This is a demanding target requiring very long broadband integrations to develop the diffuse outer nebulosity. No dual band filter. Recommended for experienced smart telescope imagers comfortable with faint surface-brightness targets and patient processing workflows.



WAR AND PEACE & CAT'S PAW
NEBULAE

Vaonis Vespera 2

Total integration time 47h

Mosaic mode : dual band filter

Bortle 4

Credit: Daniel Hall



THE BLUE HORSE HEAD
NEBULA (CROP)

Vaonis Vespera 3
Total integration time 150h
Mega mosaic (30 panels)
Bortle 2
Credit: Nathanael Martin

IC 4601

Reflection nebula

Mag. 7.5 • angular size 20' × 10'

RA 16h 20m 18s • Dec -20° 05' 14"

IC 4601 is a compact reflection nebula at similar distance to IC 4592, embedded in the same Sco-Cen dust sheet. It is significantly smaller and brighter (higher surface brightness) than IC 4592, forming a visually distinct secondary knot of blue reflection nebulosity. The two objects can be captured together in a wide 4.3°×2.4° mosaic if the frame is carefully oriented.

Smart telescope imaging

Same approach as the Blue Horsehead IC4592.

SOUTHERN SCORPIUS OPEN-CLUSTER FIELD

NGC 6249, NGC 6250, and NGC 6259 form a compact trio of open clusters in southern Scorpius. NGC 6250 is the brightest and most visually prominent of the three. The surrounding field lies in a rich Milky Way zone with dust and H-alpha emission, making the group more interesting for smart telescope imaging than the cluster magnitudes alone suggest.

Smart telescope imaging

The three clusters fit within the same field of view, without specifically requiring mosaic mode. For the best result, combine a broadband capture - without a filter, to preserve the brightness and natural color of the stars - with a dual-band capture to reveal the surrounding HII emission. This approach gives you both the rich stellar field and the faint nebular structures in the region.

NGC 6259

Open cluster

Mag. 8 • angular size 6.0'

RA 17h 00m 45s • Dec -44° 39' 18"

NGC 6250

Open cluster

Mag. 6 • angular size 13'

RA 16h 57m 59s • Dec -45° 57' 06"

NGC 6249

Open cluster

Mag. 8.2 • angular size 7.6'

RA 16h 57m 41s • Dec -44° 48' 43"

Individual Targets

OPEN CLUSTERS

★ Ptolemy's Cluster

M7 • NGC 6475

Open cluster

Mag. 3.3 • angular size 22'

RA 17h 53m 51s • Dec -34° 47' 34"

The Greek astronomer Claudius Ptolemy recorded it in 130 AD as a "nebula following the sting of Scorpius", making M7 one of the oldest documented deep-sky observations in history. It is unmistakably visible to the naked eye as a hazy concentration just north of the Scorpius tail.

M7 contains approximately 80 stars and lies at a distance of about 980 light-years. It is an intermediate-age cluster (~200 million years)

Smart telescope imaging

M7 stellar population includes a mix of blue main-sequence stars and evolved yellow giants, giving the cluster a rich color palette. Set against the dense star fields of the southern Milky Way, it offers a scene of extraordinary depth and richness. It is well suited to mosaic mode, which can capture more of its surrounding context.

It is an outstanding quick-win target for observers in the Southern Hemisphere and at low northern latitudes.

Butterfly Cluster

M 6 • NGC 6405

Open cluster

Mag. 4.2 • angular size 20'

RA 17h 40m 21s • Dec -32° 15' 15"

The Butterfly Cluster in Scorpius contains approximately 120 stars at a distance of roughly 1,600 light-years. The cluster's most notable individual star is BM Scorpii, a bright orange K-type giant that varies irregularly in brightness. Its warm color stands out prominently against the predominantly blue-white background of the cluster's younger members.

GLOBULAR CLUSTERS

Messier 9

NGC 6333

Globular cluster

Mag. 7.8 • angular size 7'

RA 17h 19m 00s • Dec -18° 30' 00"

Messier 9 is a compact globular cluster in southern Ophiuchus, located at approximately 25,800 light-years, placing it well beyond the Sagittarius arm, close to the Galactic center.

Smart telescope imaging

Messier 9 lies right next to the dark nebula Barnard 64. This is what makes it interesting to capture with a smart telescope, along with the dense stellar background. Although long integration times are often not necessary for globular clusters, in this case it helps bring out the background stars, enhance the contrast with the dark nebula, and convey more faithfully the stellar density of this region of the Milky Way.

DARK NEBULAE

Snake Nebula

Barnard 72

Dark nebula

Angular size 37' × 17'

RA 17h 23m 00s • Dec -23° 41' 00"

It is one of the most distinctive dark nebulae in the sky, forming a sinuous S-shaped dust lane silhouetted against the rich star fields of Ophiuchus. The nebula has a thickness of 2'-3', giving it its distinctly serpentine appearance.

Adjacent dark nebulae Barnard 68, 69, 70, and 74 populate the same general region, creating a field of multiple dark "holes" in the Milky Way star cloud background.

Smart telescope imaging

The Snake Nebula requires a rich, bright star field background to be visible, and the Ophiuchus field provides exactly that. Long integrations fill the background with stars and amplify the serpentine dark lane's visual impact. The best composition include the nearby dark nebulae in a wider field.

Dolphin Dark Nebula

Barnard 252

Dark nebula

Angular size 40' × 25'

RA 16h 50m 30s • Dec -24° 30' 00"

Barnard 252 is an obscuring dark nebula in Scorpius, a foreground dust patch visible against the dense Milky Way. Its popular name "Dolphin Nebula" refers to the perceived shape of the main dark region.

Smart telescope imaging

Barnard 252's impact depends entirely on the richness of the surrounding star field, the denser the accumulated background, the more the dark dust stands out.

★ Cosmic Bat Nebula

LDN 43

Dark nebula

Angular size 30' × 15'

RA 16h 34m 00s · Dec -15° 46' 00"

LDN 43 is a dense dark nebula in Ophiuchus, somewhat more distant than the main Rho Ophiuchi complex. Its popular name "Cosmic Bat" derives from the distinctive bat-wing silhouette formed by two elongated lobes of opaque dust extending outward from a central concentration. The complex includes both the primary opaque nebula and surrounding faint illuminated dust and diffuse H α emission, that are visible only in deep integrations.

Smart telescope imaging

LDN 43 is classified as very challenging due to its low surface brightness and the demanding nature of faint dark nebula imaging. The surrounding "halo" of illuminated dust that enhances the bat-wing appearance is extremely faint and requires careful processing to reveal.

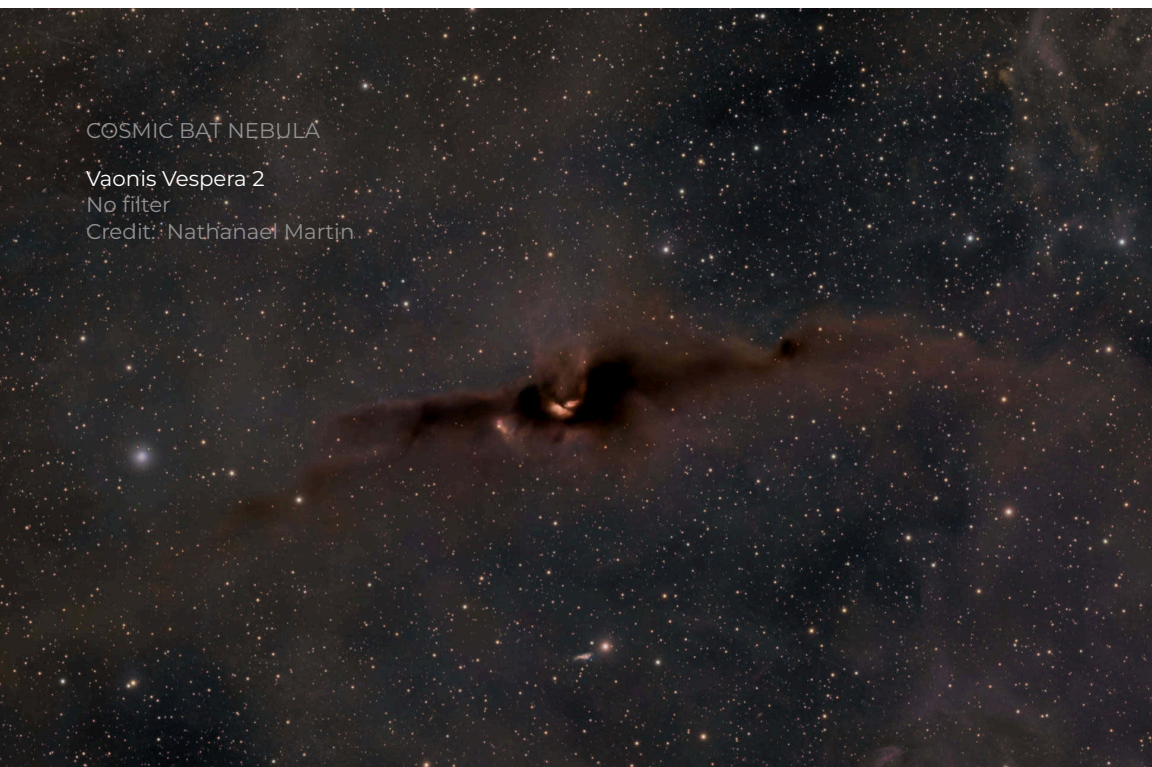
Very long broadband integration (no filter), is required. This is a target for patient imagers willing to challenge smart telescope capabilities.

COSMIC BAT NEBULA

Vaonis Vespera 2

No filter

Credit: Nathanael Martin



Ara • Norma • Lupus

Visibility by Latitude



To get started

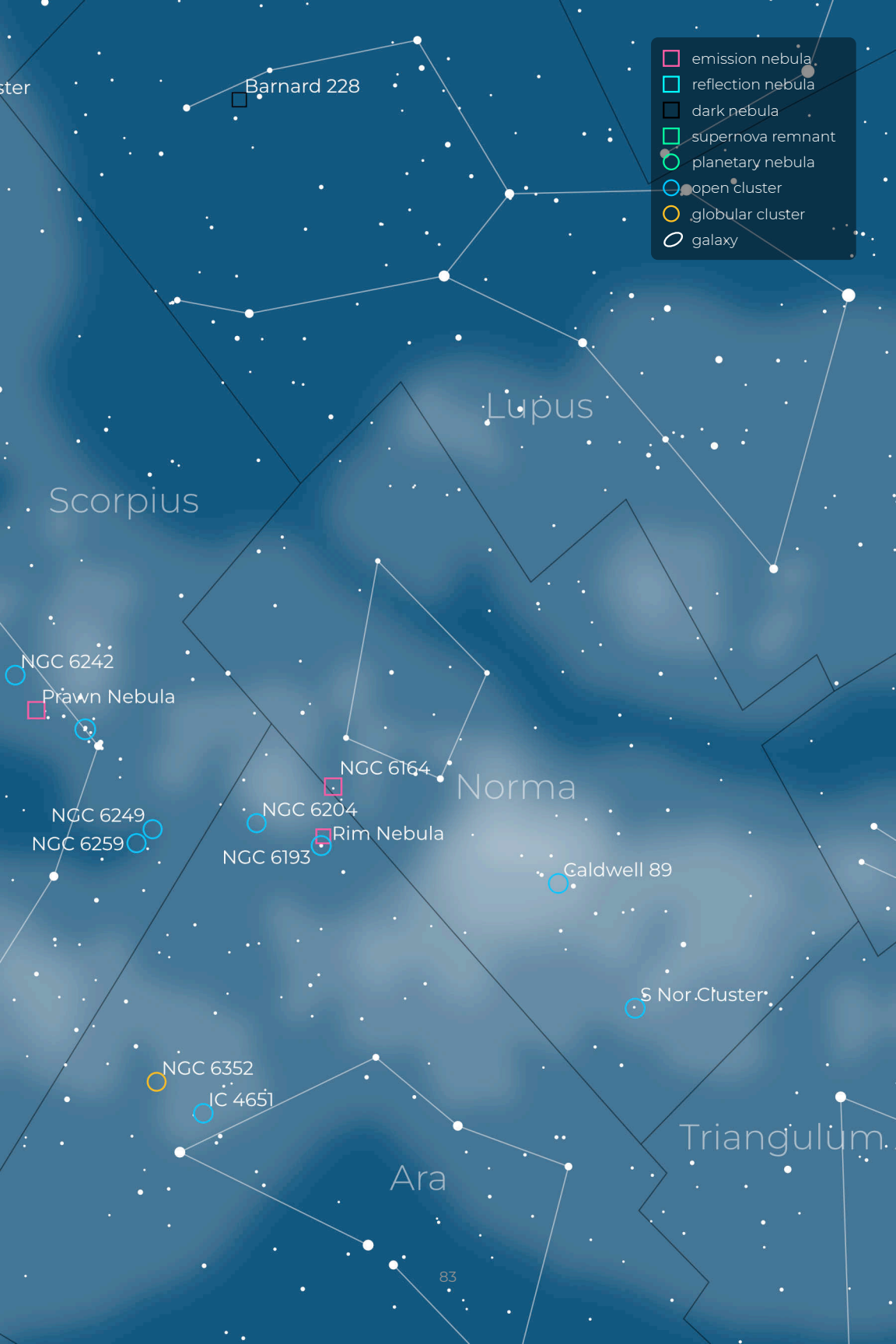
Fighting Dragons of Ara (Ara)

Go off the beaten path

S Normae Cluster (Nor)

Challenge yourself

Dark Wolf Nebula (Lup)



Cosmic scene index

The Fighting Dragons & The Dragon's Egg

The Alpha Arae Region , IC 4651 & NGC 6352

Target index

	Fighting Dragons / Rim	Emission nebula / HII region	Ara
	Dark Wolf	Dark nebula	Lupus
	Caldwell 82	Open cluster	Ara
	S Normae	Open cluster	Norma
	IC 4651	Open cluster	Ara
	NGC 6204	Open cluster	Ara
	Caldwell 81	Globular cluster	Ara

The Constellations

Ara

Ara • Altar • Autel

Ara is a small southern constellation wedged between the tail of Scorpius and Triangulum Australe. Despite its modest size, it hosts one of the most spectacular star-forming nebula pairings accessible from the Southern Hemisphere: the Fighting Dragons of Ara (NGC 6188) and the Dragon's Egg (NGC 6164). All targets in Ara require southern latitudes.

Norma

Nor • Carpenter's Square • Règle

Norma is a small southern constellation. Although faint and often overlooked, it lies along the Milky Way in a dense region close to the Galactic plane. The open cluster Caldwell 89 or the S Normae Cluster, resides here; it contains the Cepheid variable S Normae, whose membership in the cluster makes it useful for calibrating Cepheid-based distance measurements.

Lupus

Lup • Wolf • Loup

Lupus is a medium-sized southern constellation, lying between Scorpius and Centaurus. Its most remarkable deep-sky feature is the Lupus Molecular Cloud Complex, a sprawling system of dark clouds roughly 500 light-years away. Barnard 228, also known as the Dark Wolf Nebula, is a prominent dark filament within Lupus I.

Between a Local Star Nursery and the Sagittarius–Carina Arm

The Ara–Norma–Lupus region lies in the direction of the inner southern Milky Way and samples several distinct Galactic structures each at a different depth.

The Lupus Molecular Cloud Complex, at roughly 500 light-years, is one of the nearest active low-mass star-forming regions to the Solar System. It belongs to the nearby network of molecular clouds shaped by the expansion of the Local Bubble, probably driven by past supernova explosions from massive-star populations. The dark filaments of Lupus I and Barnard 228 trace this local foreground layer.

Farther into the Galaxy, at approximately 4,000 light-years, the Fighting Dragons of Ara, NGC 6188, and the surrounding OB stars of NGC 6193 mark the Ara OBI stellar association within the Sagittarius–Carina spiral arm. The open cluster NGC 6087 in Norma, also known as the S Normae Cluster, lies in the same broad southern Milky Way arm environment, though it is a separate open cluster rather than part of the Ara OBI nebular complex.

At roughly 19,000 light-years, the globular cluster NGC 6352 in Ara represents a much older stellar population than the young clusters and nebulae of the Galactic disk.

THE FIGHTING DRAGONS
OF ARA & DRAGON EGG

Vajris Vespera 2
Total integration time 14h
Mosaic mode, dual band filter
Bortle 1

Cosmic Scenes

★ THE FIGHTING DRAGONS & THE DRAGON'S EGG

In the northern reaches of Ara, one of the most visually dramatic HII regions of the southern Milky Way takes shape around the Caldwell 82 (NGC 6193) star cluster. The cosmic scene centers on NGC 6188 (the Fighting Dragons nebula), where two sculpted pillars of ionized gas confront each other across a glowing emission rim, and NGC 6164 (the Dragon's Egg), a compact bipolar nebula 1.3° to the northwest, sharing the same deep-sky field without being physically related to the Dragons.

Smart telescope imaging

The region deserves to be captured with mosaic mode. This is one of the finest compositions in the southern Milky Way. A dual-band filter is strongly recommended for the emission components. Very long integration times reveal the full rim structure and the faint outer halo of NGC 6164.

Fighting Dragons of Ara / Rim Nebula

NGC 6188

Emission Nebula

Mag. ~7.0 • angular size 90' × 60'

RA 16h 40m 06s • Dec -48° 39' 44"

The popular name "Fighting Dragons of Ara" describes the two dark columns of dense molecular gas, shaped like confronting dragon heads, that protrude into the bright emission rim and are sculpted by the ionizing radiation and stellar winds from the OB stars of NGC 6193 just to the northwest. The dark dragon silhouettes are dense columns of gas that have temporarily resisted the ionizing radiation. The nebula is located at approximately 4,000 light-years.

Smart telescope imaging

A prime narrowband target. NGC 6188 responds exceptionally well to dual-band H α /OIII imaging, which brings out the rim structure, the dark dragon silhouettes, and the diffuse background emission simultaneously.

Caldwell 82

NGC 6193

Open cluster

Mag. 5.2 • angular size 14'

RA 16h 41m 20s • Dec -48° 45' 45"

NGC 6193 is a young open cluster at approximately 4,000 light-years. Its two most luminous stars, HD 150136 and HD 150135, are the primary powerhouses responsible for ionizing the hydrogen gas of NGC 6188 and sculpting its dramatic rim structure.

Dragon's Egg Nebula

NGC 6164

Bipolar emission nebula

Mag. 6.71 • angular size 3'

RA 16h 33m 42s • Dec -48° 04' 48"

At first glance, NGC 6164 resembles a compact planetary nebula: a glowing shell of gas around a dying star. In reality, it is something rarer and stranger: A bipolar ejecta nebula surrounding the young massive star system HD 148937. Its central source is a pair of O-type stars, one of them magnetic, with stellar masses tens of times greater than the Sun's. The system is only a few million years old, while the visible nebula itself appears to be only about 7,500 years old. These massive stars will eventually end their lives as supernovae.

Recent studies suggest that HD 148937 was originally a triple system. In this scenario, two close inner stars merged violently, creating the magnetic O-type star now observed and expelling the chemically enriched gas that forms the nebula. The remaining massive companion still orbits the merged star.

Smart telescope imaging

The Dragon's Egg is compact but bright enough to show structure. A dual-band filter brings out the bipolar lobe structure and faint surrounding halo.

NGC 6204

Open cluster

Mag. 8.2 • angular size 4.5'

RA 16h 46m 10s • Dec -47° 01' 01"

NGC 6204 is a compact, moderately faint open cluster.

THE ALPHA ARAE REGION

Two objects at the same declination band in southern Ara, separated by only 0.7° in right ascension, share similar visual fields. IC 4651 (an old, rich open cluster) and Caldwell 81 (a globular cluster) sit about 1.5° apart on the sky and can be captured together with the bright star Alpha Arae (mag. 3) in a single frame, providing an unusual open cluster / globular cluster pairing against the southern Milky Way.

IC 4651

Open cluster

Mag. 6.9 • angular size 9.6'

RA 17h 24m 49s • Dec -49° 56' 18"

IC 4651 is a moderately bright, old open cluster in Ara at an estimated distance of approximately 2,900 light-years.

Caldwell 81

NGC 6352

Globular cluster

Mag. 8.87 • angular size 7.2'

RA 17h 25m 29s • Dec -48° 25' 22"

NGC 6352 is a moderately bright globular cluster in Ara at an estimated distance of approximately 19,000 light-years.

Individual Targets

OPEN CLUSTERS

S Normae Cluster

Caldwell 89 • NGC 6087

Open cluster

Mag. 5.4 • angular size 12'

RA 16h 18m 50s • Dec -57° 56' 05"

NGC 6087 is a bright open cluster in Norma, situated in a dense section of the southern Milky Way star cloud. Its most notable individual member is S Normae, a classical Cepheid variable star that pulsates in brightness with a period of approximately 9.75 days, one of the brightest Cepheids in the southern sky. Cepheid variables are foundational to the cosmic distance ladder. NGC 6087 itself lies at approximately 3 500 light-years.

DARK NEBULAE

★ Dark Wolf Nebula

Barnard 228 • Lupus 1 • Lupus Molecular Cloud

Dark nebula

Angular size 8°

RA 15h 45m 00s • Dec -34° 25' 00"

Barnard 228 is the main dark cloud within the Lupus Molecular Cloud Complex. The full Lupus complex spans approximately 8° in its longest dimension.

Smart telescope imaging

It reveals the intricate texture of a dark nebula: delicate dust filaments, subtle variations in opacity, and dark lanes silhouetted against the rich stellar background of the inner Milky Way.

This target requires exceptional conditions: very dark skies, excellent transparency, and long total integration.



Carina • Musca Crux • Centaurus

Visibility by Latitude



To get started

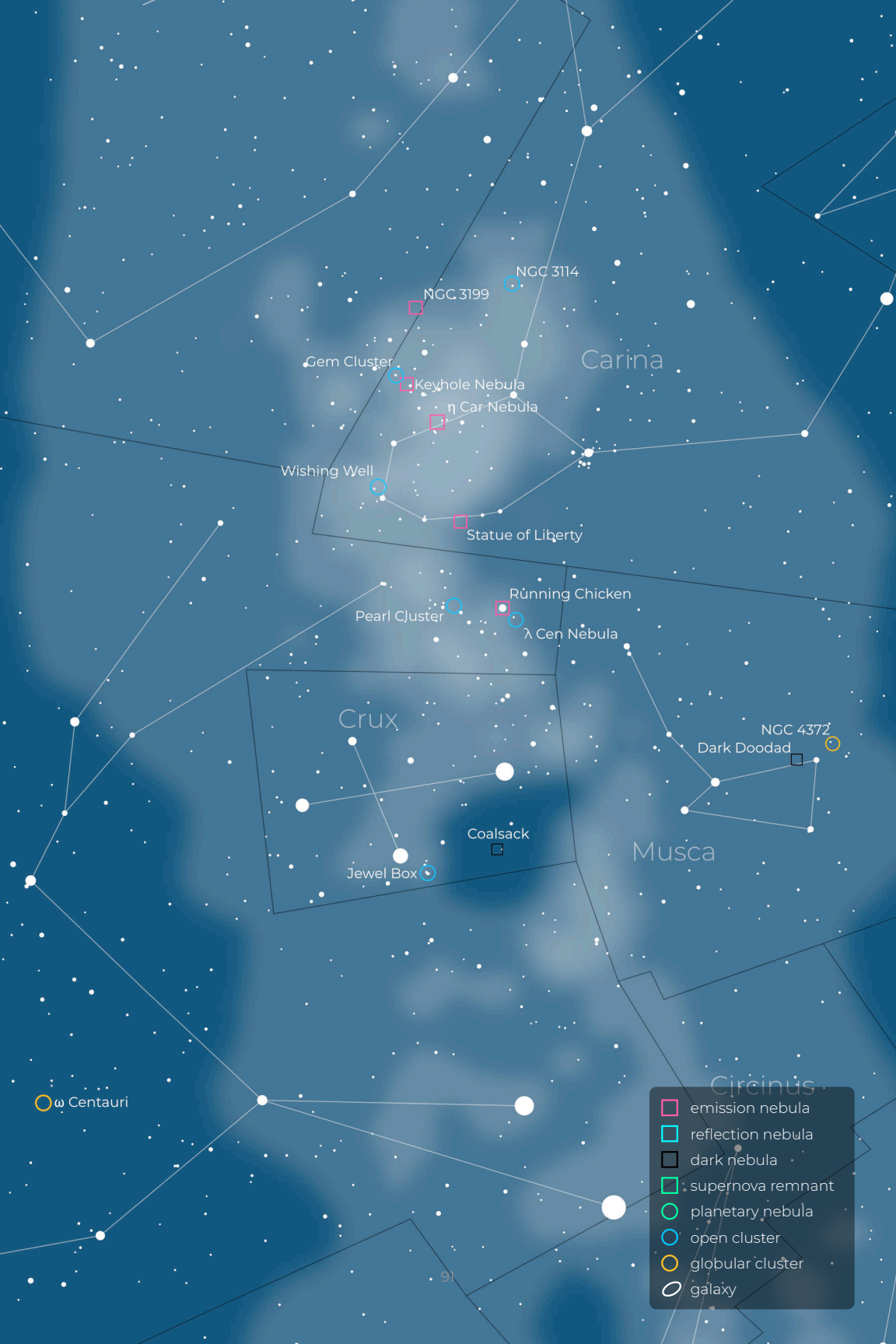
Carina Nebula (Car) •
Running Chicken Nebula
(Cen) • Omega Centauri
Cluster (Cen)

Go off the beaten path

Southern Pleiades (Car) •
Wishing Well Cluster (Car)
• Gem cluster (Car)

Challenge yourself

Dark Doodad Nebula



Cosmic scene index

The Heart of Carina

The Running Chicken Complex

The Coalsack, Heart of the Southern Cross

Dark Doodad & NGC 4372

Target index

♥	Great Carina nebula	Emission nebula / HII region	Carina
♥	Gabriela Mistral	Emission nebula / HII region	Carina
	Banana Nebula / Carina Smile	Emission nebula / HII region	Carina
♥	Statue of Liberty	Emission nebula / HII region	Carina
♥	Running Chicken	Emission nebula / HII region	Centaurus
♥	Wishing well	Open cluster	Carina
	Jewel box cluster	Open cluster	Crux
	NGC 3114	Open cluster	Carina
☆	Gem cluster	Open cluster	Carina
☆	Southern Pleiades	Open cluster	Carina
	Pearl Cluster	Open cluster	Centaurus
	IC 2948	Open cluster	Centaurus
♥	Omega Centauri	Globular cluster	Centaurus
☆	Coalsack	Dark nebula	Crux
★	Dark Doodad	Dark nebula	Musca
	Caldwell 108	Globular cluster	Musca

The constellations

Carina

Car • The Keel • La Carène

Carina is a large southern constellation, one of the three parts into which Nicolas-Louis de Lacaille divided the ancient constellation Argo Navis (the Ship), along with Puppis (the Stern) and Vela (the Sails). Its most famous star is Eta Carinae (η Car), one of the most luminous and massive stars known in the Milky Way, embedded in the Great Carina Nebula, which at about 400 light-years across is one of the most extensive HII region in the sky visible to the naked eye. Carina contains some of the finest deep-sky objects in the southern sky: the Wishing Well Cluster, the Gem Cluster, and the Carina Nebula itself.

Centaurus

Cen • Centaur • Centaure

Centaurus is a vast constellation. Its most celebrated target, Omega Centauri (NGC 5139), is the largest and most massive globular cluster in the Milky Way, containing approximately 10 million stars. Centaurus also harbors the prominent HII/cluster complex of the Running Chicken Nebula (IC 2944/IC 2948), one of the finest southern star-forming fields accessible to smart telescopes.

Crux

Cru • Southern Cross • Croix Du Sud

Crux is the smallest constellation in the sky but one of the most symbolically significant, appearing on the national flags of Australia, New Zealand, Brazil, Papua New Guinea, and Samoa. Visible at least part of the year from latitudes south of about 25°N, though very low near its northern limit, it contains two southern-sky showpieces: the Jewel Box Cluster (NGC 4755), famed for its striking blue-and-orange color contrast, and the Coalsack Nebula, the most prominent naked-eye dark nebula in the sky.

Musca

Mus • The Fly • Mouche

Musca is a compact southern constellation lying directly south of Crux, home to the Dark Doodad Nebula, an elongated sinuous dark lane stretching 3° across the southern Milky Way, and NGC 4372, a large but heavily obscured globular cluster.

From a Foreground Dust Screen to a Fossil Galactic Core

At approximately 600 light-years, the Coalsack in Crux is a foreground structure embedded in our immediate galactic environment: a cold molecular cloud absorbing the light of the richer Milky Way behind it.

Further into the Galaxy, at approximately 6,000 to 9,000 light-years, lie active HII regions belonging to the Sagittarius–Carina spiral arm: the Great Carina Nebula, the Statue of Liberty Nebula and the Running Chicken Nebula). This is the same spiral arm segment that hosts M8, M16, and M17.

At approximately 17,000 light-years, Omega Centauri belongs to the Milky Way's halo population rather than the young star-forming disk. It is the largest and most massive globular cluster in the Milky Way and is widely regarded as the likely stripped nucleus of a dwarf galaxy absorbed by our Galaxy billions of years ago.

NGC 4372 in Musca, at approximately 19,000 light-years, is another old globular cluster, often associated with the inner halo.

Cosmic Scenes

The Heart of Carina

The Carina Nebula complex is one of the supreme objects in the southern sky. Three objects belonging to this complex sit within a $2.5 \times 2.5^\circ$ region of sky, fitting a single mosaic capture: Caldwell 92 (the Carina Nebula itself), NGC 3324 (the Gabriela Mistral Nebula), an adjacent star-forming cavity at the northwestern edge of the complex, and NGC 3293 (the Gem Cluster): a brilliant young open cluster. All three sit at approximately 7,500 light-years

Smart telescope imaging

For imagers willing to invest in a bigger project, a wider mega-mosaic including The Statue of Liberty Nebula (NGC 3576, 2.5° to the east) creates an even grander composition of the full Carina star-forming complex.

★ The Great Carina Nebula

Caldwell 92 • NGC 3372
HII region / Emission nebula
Mag. 1 • angular size 150'
RA 10h 45m 08s • Dec -59° 52' 00"

The Carina Nebula is the largest and most massive HII region visible to the naked eye in the southern sky, and one of the most spectacular object in this guide. It spans approximately $2.5^\circ \times 3^\circ$ in apparent size, corresponding to a physical extent of more than 300 light-years at its distance of ~7,500 light-years. More than 70 O-type stars embedded in the Carina OBI association pour ultraviolet radiation into the surrounding gas.

At the heart of the nebula blazes Eta Carinae (η Car), one of the most massive and luminous stars known. Eta Carinae is a binary system. In a great eruption in the 1840s, the star ejected 10 to 45 solar masses of material, creating the Homunculus Nebula, a tiny bipolar gas shell visible only in high-resolution telescope images.

Other key features within NGC 3372 include the Keyhole Nebula dark and bright cloud near Eta Carinae.

Smart telescope imaging

The Carina Nebula is one of the most rewarding targets in the entire guide for sheer visual impact. Even a short integration time delivers a stunning image. A dual-band filter dramatically enhances the complex emission structure: Multiple ionization fronts, dark dust pillars, bright knots, and the Keyhole Nebula. Mosaic mode is required to capture the complete extent.

★ Gabriela Mistral Nebula

NGC 3324
Cluster + nebula
Mag. 6.7 • angular size 15'
RA 10h 37m 16s • Dec -58° 37' 11"

NGC 3324 is a compact star-forming region at the northwestern edge of the Carina Nebula complex. The cavity within NGC 3324 was blown by the stellar winds of hot stars.

The popular name "Gabriela Mistral Nebula" refers to the perceived resemblance of the main nebular profile to the face of the Chilean poet and Nobel laureate Gabriela Mistral (1889–1957).

Smart telescope imaging

It is better framed along with the Carina Nebula.

CARINA NEBULA

Vaonis Vespera 2

Total integration time 40h

Mosaic mode · Dual band filter

Credit: Neville Drake



★ Gem Cluster

NGC 3293

Open cluster

Mag. 4.7 • angular size ~10'

RA 10h 35m 49s • Dec -58° 13' 28"

The Gem Cluster is a photogenic open cluster in the Carina region, situated only 0.44° from Gabriela Mistral Nebula. Despite its proximity to the Great Carina Nebula, it receives far less attention than its neighbor. The cluster contains numerous luminous blue supergiants alongside several evolved orange and red supergiants.

Smart telescope imaging

The Gem Cluster is quick to resolve. Short integration delivers full color. No filter for the cluster itself, though the surrounding faint HII emission background responds to a dual-band filter with longer integration time.

THE RUNNING CHICKEN COMPLEX

In northwestern Centaurus, close to the border with Carina, several objects at broadly comparable distances can share the same wide-field mosaic. Caldwell 100 / IC 2944, the Running Chicken or Lambda Centauri Nebula, forms a large HII region and young cluster complex, while IC 2948 designates a bright neighboring portion of the same nebular complex. Nearby Caldwell 97 / NGC 3766, the Pearl Cluster, is a young open cluster at a similar order of distance, though it is not necessarily part of the same physical system.

♥ Running Chicken / Lambda Centauri Nebula

Caldwell 100 • IC 2944

Emission nebula + cluster

Mag. 4.5 • angular size 75'

RA 11h 35m 47s • Dec -63° 01' 11"

The Running Chicken Nebula, is a vast HII region and young stellar complex in Centaurus, commonly placed at roughly 6 500–7 600 light-years. Its wide field reveals sweeping arcs of ionized hydrogen surrounding hot young stars, and globules: dark, opaque knots of dense molecular gas silhouetted against the bright emission background.

Although the nebula is also known as the Lambda Centauri Nebula, Lambda Centauri itself is a much closer foreground star.

Smart telescope imaging

Caldwell 100 requires mosaic mode to capture its full extent. A dual-band filter is essential for the best results, the H α emission is strong, and the OIII component adds structural contrast to the ionization fronts.

Pearl Cluster

Caldwell 97 • NGC 3766

Open cluster

Mag. 5.3 • angular size 10'

RA 11h 36m 14s • Dec -61° 36' 19"

The Pearl Cluster is a brilliant, compact open cluster located just north of the Lambda Centauri Nebula complex. It shows a tight concentration of gleaming stars, like pearls scattered on a velvet surface.



RUNNING CHICKEN NEBULA

Vaonis Vespera 2
Total integration time 10h
Mosaic mode
Credit: Dom Henry

THE COALSACK, HEART OF THE SOUTHERN CROSS

★ Coalsack Nebula

Caldwell 99

Dark nebula

Angular size $7^\circ \times 5^\circ$

RA 12h 50m 00s · Dec $-62^\circ 30' 00''$

The Coalsack is the most conspicuous dark nebula in the sky, visible to the naked eye as a striking, irregular dark patch obliterating the southern Milky Way east of Acrux (Alpha Crucis). It is surrounded by an exceptionally bright section of the Milky Way, making its darkness appear even more absolute by comparison. At approximately 600 light-years, it is a cold molecular cloud with a physical diameter of approximately 35 light-years.

Smart telescope imaging

At 7° in apparent size, it is not a target to frame, unless you capture it in a mega-mosaic, but a landscape to explore. One of the most photogenic entry point is the northwestern edge of the Coalsack, which lies just 2° from the Jewel Box (NGC 4755). A mosaic centered between the two captures the brilliant color of the cluster against the approaching darkness of the Coalsack's edge.

Alternatively you can frame its most contrasted region located near the star Acrux.

DARK DOODAD & NGC 4372

In deep southern Musca constellation, two objects at different distances share an intimate visual relationship: the Dark Doodad Nebula, a sinuous 3° dark lane threading through the southern Milky Way, and NGC 4372 (Caldwell 108), a large faint globular cluster located at the western end of the dark lane. The bright star Gamma Muscae provide an additional visual anchor.

★ Dark Doodad Nebula

LDN 1780

Dark nebula

Angular size 3°

RA 12h 31m 23s · Dec $-71^\circ 34' 12''$

The Dark Doodad is a long dark filament threading through the southern Milky Way in an unmistakably serpentine shape.

In images, the dark lane shows subtle internal texture, denser concentrations of dust within the filament

Smart telescope imaging

The impact of a dark nebula depends entirely on background star density. Long integrations maximize background star accumulation.

Caldwell 108

NGC 4372 · C 108

Globular cluster

Mag. 9.85 · angular size $12'$

RA 12h 25m 45s · Dec $-72^\circ 39' 32''$

NGC 4372 is a large but faint globular cluster in Musca, located at approximately 18,900 light-years. The cluster is reddened by interstellar dust, giving it a warmer color than most globulars.

STATUE OF LIBERTY NEBULA

Vaonis Vespera Pro

Total integration time 4h

Mosaic mode - dual band filter

Bortle 2/3



BANANA NEBULA

Vaonis Vespera 2

Total integration time 27.5h

Mosaic mode - dual band filter

Bortle 4

Credit: Daniel Hall

Individual Targets

HII REGIONS & EMISSION NEB.

♥ Statue of Liberty Nebula

NGC 3576

HII region / Emission nebula

Mag. 8 • angular size 35' × 15'

RA 11h 11m 32s • Dec -61° 21' 47"

NGC 3576 is a compact, highly structured HII region east of the main Carina Nebula, and a visually striking narrowband target in the southern sky despite its modest angular size. At approximately 9,000 light-years, it is slightly more distant than the Carina Nebula and is a physically separate star-forming complex.

The popular name "Statue of Liberty" refers to the silhouette formed by curving dark filaments against the bright emission background, suggesting the torch-bearing figure of the famous statue.

Smart telescope imaging

NGC 3576 is a great dual-band target. The complex filamentary structure, including the dark silhouettes and multiple ionized lobes, responds well to H α /OIII imaging.

Banana Nebula / Carina Smile

NGC 3199

Emission nebula (Wolf-Rayet bubble)

Mag. 7 • angular size 20' × 15'

RA 10h 17m 25s • Dec -57° 55' 20"

NGC 3199 is a bright, crescent-shaped arc of ionized gas curving around its central star, resembling a banana or a smile and a complete elliptical bubble in very long exposures. Its central star is a hot and powerful Wolf-Rayet star whose intense stellar winds have blown a cavity in the surrounding interstellar medium and excited the gas to produce the observed emission.

At approximately 12,000 light-years, NGC 3199 spans physically about 75 light-years.

Smart telescope imaging

The Banana Nebula responds well to a dual-band filter. The full elliptical bubble requires a long integration time.

GLOBULAR CLUSTER

♥ Omega Centauri

Caldwell 80 • NGC 5139

Globular cluster

Mag. 3.9 • angular size 36'

RA 13h 26m 46s • Dec -47° 28' 37"

Omega Centauri is, by any measure, the greatest globular cluster. It is the largest, most massive, and most luminous globular cluster in the Milky Way, containing approximately 10 million stars within a diameter of roughly 160 light-years, at a distance of approximately 17,000 light-years. No other globular cluster comes close in sheer scale: the second-largest, 47 Tucanae, is considerably smaller.

Evidence for a central intermediate-mass black hole has led many astronomers to conclude that Omega Centauri is not a true globular cluster, but the stripped nucleus of a dwarf galaxy that was absorbed by the Milky Way billions of years ago, a fossil galactic core orbiting in our own halo. Omega Centauri is an extraordinary naked-eye object from dark southern sites.

Smart telescope imaging

Short integrations already produce spectacular results. Integration of 30 minutes delivers images of extraordinary richness. The central region requires careful processing to reveal individual stars without saturation; the outer halo needs adequate integration to show the gradual population gradient. This is one of the most rewarding targets in the entire guide for the quality of result per integration hour.

OPEN CLUSTERS

♥ Wishing Well Cluster

Caldwell 91 • NGC 3532

Open cluster

Mag. 3 • angular size 50'

RA 11h 05m 48s • Dec -58° 46' 14"

The Wishing Well Cluster is widely regarded as one of the finest open clusters in the southern sky. It is visible to the naked eye and great in binoculars.

At approximately 1,400 light-years, Caldwell 91 contains approximately 350 members. Its stellar population is dominated by evolved yellow and orange giant stars alongside remaining blue main sequence members, creating a rich color palette.

Smart telescope imaging

Caldwell 91 is a quick-win target. Short Integration delivers a rich, multi-color stellar field. The cluster's color diversity is its greatest asset.

A very long acquisition with a dual-band filter may reveal faint hints of H II emission, which can then be blended with the broadband capture for an even more striking result.

★ Jewel Box

Caldwell 94 • NGC 4755

Open cluster

Mag. 4.2 • angular size 7.8'

RA 12h 53m 37s • Dec -60° 21' 23"

NGC 4755 contains several brilliant blue-white supergiants together with one especially striking red supergiant with warm red-orange color that stands out sharply against the predominantly blue cluster members, producing the jewel-like color contrast.

For the most dramatic composition, frame the Coalsack's northwestern edge in the same field as the cluster.

★ Southern Pleiades

Caldwell 102 • IC 2602

Open cluster

Mag. 2 • angular size 50'

RA 10h 43m 14s • Dec -64° 23' 52"

Also known as the Theta Carinae Cluster, The Southern Pleiades is one of the brightest open clusters in the sky, visible to the naked eye as a conspicuous grouping of blue-white stars centered on Theta Carinae (θ Car, magnitude 2.7). It ranks among the top five brightest open clusters in the whole sky. At approximately 500 light-years, IC 2602 is one of the nearest open clusters to Earth.

Unlike the Pleiades, it isn't drenched in sweeping reflection nebulosity. Any faint haze here is subtle and delicate, and it sits against a rich, densely packed starfield that adds depth and scale.

NGC 3114

Open cluster

Mag. 4.2 • angular size 12'

RA 10h 02m 30s • Dec -60° 07' 50"

NGC 3114 is a moderately bright open cluster in Carina, located roughly 3 000 light-years away. Despite its listed integrated magnitude of about 4.2, its stars are spread over a wide area and blend into the surrounding Milky Way field, so the cluster appears less immediately striking than its brightness might suggest.

Vela • Puppis • Canis Major

Visibility by Latitude



To get started

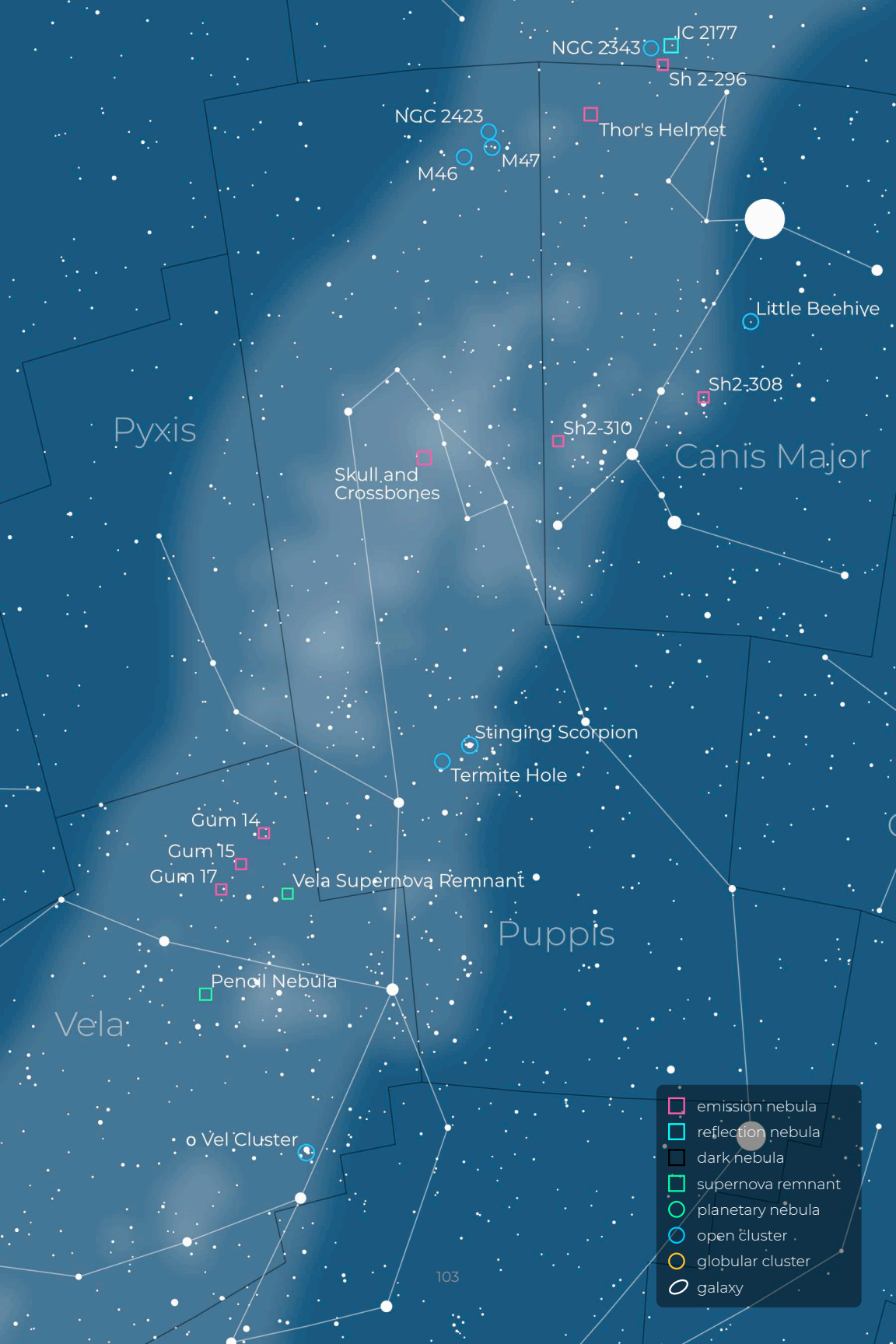
Thor's Helmet Nebula (CMa)

Go off the beaten path

Skull & Crossbones Nebula (Pup) • Puppis Trio M46, M47, NGC 2423 clusters (Pup)

Challenge yourself

Vela Supernova Remnant (Vel) • Vela Molecular Ridge (Vel)



Cosmic scene index

The Vela Supernova Remnant
The Vela Molecular Ridge
The Puppis Trio , Messier 46, Messier 47 & NGC 2423
The Southern Puppis Pair: Stinging Scorpion & Termite Hole Cluster

Target index

★	Skull and Crossbones Nebula	Emission nebula / HII region	Puppis
♥	Thor's Helmet Nebula	Emission nebula / HII region	Canis Major
★	Dolphin-Head Nebula	Emission nebula / HII region	Canis Major
	Canis Major HII Complex	Emission nebula / HII region	Canis Major
★	Seagull Nebula *	Emission nebula / HII region	Canis Major / Mon
	Gum 14	Emission nebula / HII region	Vela
	Gum 15	Emission nebula / HII region	Vela
	Gum 17	Emission nebula / HII region	Vela
	Pencil Nebula	Supernova remnant	Vela
★	Vela SNR	Supernova remnant	Vela
	Stinging Scorpion	Open cluster	Puppis
	M 47	Open cluster	Puppis
	Little Beehive Cluster	Open cluster	Canis Major
	Termite Hole	Open cluster	Puppis
	M 46	Open cluster	Puppis
	NGC 2423	Open cluster	Puppis
	Omicron Velorum Cluster	Open cluster	Vela

* Although it is presented in the next chapter, within the Monoceros · Gemini · Orion · Taurus · Auriga · Canis Minor group, the Seagull Nebula is included in this index because it spans the constellations of Canis Major and Monoceros.

The constellations

Puppis

Pup • Stern • Poupe

Puppis is one of the three constellations into which Nicolas-Louis de Lacaille divided the ancient constellation Argo Navis (the Ship), along with Carina and Vela. Because Argo Navis was divided rather than newly defined, Puppis inherited no stars labelled Alpha or Beta from the original constellation, its brightest stars begin at Zeta Puppis (magnitude 2.2). The constellation contains many open clusters, with M46, M47, M93, NGC 2477, NGC 2451, and NGC 2467.

Canis Major

CMa • Greater Dog • Grand Chien

Canis Major is dominated by Sirius (Alpha CMa, magnitude -1.46), the brightest star in the entire sky as seen from Earth, which blazes at the northwestern corner of the constellation. Sirius is merely 8.6 light-years away, making it the fifth-nearest star system to the Solar System. Canis Major contains two notable deep-sky objects: the Thor's Helmet Nebula (NGC 2359), a spectacular Wolf-Rayet bubble, and Sh2-308 (the Dolphin Head Nebula), another Wind-blown bubble of very low surface brightness. The open cluster Messier 41 is also one of the most prominent clusters.

Vela

Vel • The Sails • Les Voiles

Vela occupies the portion of the old Argo Navis corresponding to the sails of the mythological ship. Its most remarkable feature for deep-sky observers is the Vela Supernova Remnant, one of the largest and closest supernova remnants known, spanning 8° and dominating a wide section of the southern Milky Way with its intricate network of shock filaments. Vela also hosts the Vela Molecular Ridge, a complex of star-forming HII regions.

Sailing the Outer Spiral Arm

Here the line of sight crosses several distinct galactic structures at increasing depth: the Local Bubble in the immediate foreground, our own Orion Spur, and finally the more distant Perseus Arm segment.

The Vela Supernova Remnant, at approximately 900 light-years, is among the nearest supernova remnants to Earth. It belongs to the immediate foreground.

At intermediate depth (2,300 to 3,300 l.y.) the Vela Molecular Ridge forms a layer of star-forming molecular clouds hosting HII regions. Physically distinct from the much nearer Vela Supernova Remnant.

Further into the Galaxy, at approximately 12,000 to 15,000 light-years, Thor's Helmet in Canis Major and NGC 2467 in Puppis mark active massive-star environments in the Perseus Arm segment.

Cosmic Scenes

★ The Puppis Trio , Messier 46, Messier 47 & NGC 2423

One of the finest multi-cluster fields in the sky, this trio of Puppis open clusters spans 1.5° on the sky and fits within a smart telescope field of view. The three clusters appear to share the same piece of sky, but they sit at different distances: M47 at ~1,600 light-years, NGC 2423 at 2,500 light-years, and M46 at ~5 000 light-years.

One additional object lies superimposed on this field: the planetary nebula NGC 2438, which appears projected near the northern edge of M46. Despite its proximity on the sky, NGC 2438 is at ~1,400 light-years, barely a quarter of M46's distance. It shares no physical relationship with M46 and is a pure line-of-sight coincidence. It is, however, identifiable amid M46's stars, providing an unexpected fourth object of interest in the same frame.

Messier 47

NGC 2422

Open cluster

Mag. 4.4 • angular size 25'

RA 07h 36m 35s • Dec -14° 28' 57"

Messier 47 is the brightest and nearest of the three clusters in this scene, visible to the naked eye from dark sites. It is a young, loosely-scattered cluster of approximately 50 stars. The stellar population is dominated by hot blue-white stars, with two orange giants providing warm color contrast.

NGC 2423

NGC 2423

Open cluster

Mag. 6.7 • angular size 12'

RA 07h 37m 07s • Dec -13° 52' 17"

NGC 2423 is a moderately rich open cluster located approximately 0.5° north of M47.

Messier 46

NGC 2437

Open cluster

Mag. 6.1 • angular size 21'

RA 07h 41m 47s • Dec -14° 48' 36"

Messier 46 is the more densely packed of the three clusters in this scene.

Smart telescope imaging

The most remarkable feature of M46 for imagers is the superimposed planetary nebula NGC 2438 (see earlier).

The Southern Puppis Pair: Stinging Scorpion & Termite Hole Cluster

Located in deep southern Puppis, these two clusters sit just 1.5° apart in the sky. A slightly enlarged field with mosaic mode improves the composition.

Stinging Scorpion Cluster

NGC 2451

Open cluster

Mag. 2.8 • angular size 40'

RA 07h 45m 15s • Dec -37° 58' 03"

NGC 2451 is a bright, loose open cluster centered on the orange-yellow giant c Puppis (magnitude 3.6).

The object that appears to be a single loose cluster is in fact two distinct open clusters at different distances, superimposed along the same line of sight. The nearer cluster, NGC 2451A, lies at approximately 600 light-years and contains the prominent c Puppis. The more distant cluster, NGC 2451B, sits at approximately 1,200 light-years and is physically separate.

Smart telescope imaging

The warm color of c Puppis against the mixed blue and white cluster stars creates an immediately pleasing color composition.

NGC 2451 is superimposed on an HII region that requires a dual-band filter and a very long integration time to become visible. However, using such a filter suppresses the natural star colors.

Termite Hole Cluster

Caldwell 71 • NGC 2477

Open cluster

Mag. 5.8 • angular size 20'

RA 07h 52m 10s • Dec -38° 32' 00"

Caldwell 71 is a rich open cluster with approximately 300 stars compressed into a relatively small apparent diameter. It presents an appearance closer to a loose globular cluster than to a typical open cluster: densely packed and nearly circular. It is at approximately 3,600 light-years from Earth and an age of ~700 million years.

Smart telescope imaging

Framing Caldwell 71 alongside NGC 2451 creates a compelling visual contrast.

VELA SNR &
VELA MOLECULAR RIDGE

Vaonis Vespera 2

Total integration time 70h

Mega-mosaic · dual band filter

Bortle 1

Credit: Nathanael Martin



★ The Vela Supernova Remnant

At approximately 900 light-years, the Vela SNR is among the nearest supernova remnants to Earth. Its glowing shock filaments represent the expanding shell of material ejected when a massive star exploded roughly 11,000 years ago.

At the center, the Vela Pulsar spins 11.2 times per second, a still-hot neutron star about 20 km in diameter that is the collapsed remnant of the original stellar core.

Smart telescope imaging

The Vela Supernova Remnant is one of the most ambitious imaging projects available to smart telescope users. Its very large angular extent means that not even a single full mosaic can capture the whole object. A complete portrait of the Vela SNR requires a mega-mosaic of several overlapping mosaic panels assembled across multiple sessions. A more practical approach is to explore the remnant region by region, beginning with the Pencil Nebula as the brightest and most accessible entry point.

A dual-band filter is essential. Expect very long integration time.

Vela Supernova Remnant

Vela SNR • SNR G263.9,3.3

Supernova remnant

Angular size 8°

RA 08h 34m 20s • Dec -42° 52' 17"

Pencil Nebula

NGC 2736

Supernova remnant

Mag. 12 • angular size 30' × 7'

RA 09h 00m 17s • Dec -45° 56' 53"

The Pencil Nebula is the brightest and most compact filament of the Vela SNR. It is a section of the supernova shock wave where the expanding shell struck a region of denser interstellar gas.

The Vela Molecular Ridge

In northern Vela, three HII regions belonging to the Vela Molecular Ridge form a loose association of active star-forming complexes.

Smart telescope imaging

The three nebulae span approximately 4.0° and present a visually coherent wide-field composition. Capturing the whole composition can require stitching two mosaics and can be challenging since the faint Gum 14 require a dual band filter while Gum 15, which contain a reflection component, is better without filter.

Gum 14

RCW 27

Emission nebula

RA 08h 38m 00s • Dec -40° 18' 00"

Gum 14 is the westernmost of the three Vela Molecular Ridge nebulae, a large, faint H α emission region at the edge of the molecular complex. It is a challenging target due to its very low surface brightness.

Gum 15

RCW 32

Emission nebula

RA 08h 44m 56s • Dec -41° 17' 43"

Gum 15 is the central nebula of the trio and arguably the most visually interesting. It presents a mix of emission, reflection, and dark lane components.

Gum 17

RCW 33

Emission nebula

RA 08h 51m 00s • Dec -42° 05' 00"

Gum 17 is the easternmost of the Vela Molecular Ridge trio. Better imaged with a dual band filter.

Individual Targets

CLUSTER + NEBULA

★ Skull and Crossbones Nebula

NGC 2467

Cluster + nebula

Mag. 7.1 • angular size 15'

RA 07h 52m 24s • Dec -26° 26' 36"

NGC 2467 is a glowing cloud of H α emission surrounding a concentration of young blue stars, with darker pillars and knots silhouetted against the emission background.

Smart telescope imaging

A dual-band filter significantly enhances the emission structure, revealing the complex structure.

HII REGIONS / EMISSION NEBULAE

♥ Thor's Helmet Nebula

NGC 2359

HII region / Emission nebula

Mag. 8 • angular size 10' × 6'

RA 07h 18m 31s • Dec -13° 13' 38"

In Canis Major, Thor's Helmet is one of the most dramatically shaped nebulae: a wind-blown bubble whose central structure and curved side-lobes give it a distinctive helmet shape. The nebula spans approximately 30 light-years across and lies at approximately 12,000 to 15,000 light-years from Earth.

At the center blazes WR7, a Wolf-Rayet star estimated at approximately 16 solar masses and 280,000 solar luminosities. WR 7's ferocious stellar wind, which sweeps outward at millions of kilometers per hour, has excavated the bubble cavity visible as the helmet shape, and its intense ultraviolet radiation ionizes the surrounding gas to produce the nebula's glow. The nebula

glows predominantly in OIII (blue-green in narrowband images), with H α (red) present in the trailing regions.

Smart telescope imaging

Thor's Helmet is a great narrowband target. A dual-band filter dramatically enhances the contrast of both the OIII bubble and the H α rim. Longer integrations reveal faint outer filaments extending well beyond the main helmet.

★ Dolphin Head Nebula

Sh2-308

Emission nebula / Wolf-Rayet bubble

Mag. 7.0 • angular size 35'

RA 06h 54m 13s • Dec -23° 55' 42"

Sh2-308 is a large, extremely faint bubble in Canis Major, surrounding a brilliant but tiny Wolf-Rayet star. The nebula's popular name "Dolphin Head" comes from the distinctive profile of its brightest emission region in long-exposure narrowband images.

The nebula was created approximately 70,000 years ago. Fast stellar winds, reaching 1,700 km/s, swept up the material ejected by the star, inflating the bubble structure visible today. The bubble spans about 60 light-years in physical diameter. The emission is dominated by ionized oxygen (OIII), giving it a distinctly blue-green color in narrowband images.

Wolf-Rayet stars

A WR star is a massive star that has blown away its own hydrogen envelope, leaving the core exposed. What remains is a naked stellar furnace: surface temperatures of 30,000 to 200,000 K, luminosities from 100,000 to over a million suns, and a wind blowing at 1,000 to 3,000 km/s. Our telescopes only see its outflow: luminous shells out of material

The phase lasts a few hundred thousand years, then ends in a supernova or direct collapse to a black hole. Fewer than 700 are known in the Galaxy.



DOLPHIN HEAD NEBULA

Vaonis Vespera 2

Total integration time 2h

Credit: Adrien Bougaud



THOR'S HELMET NEBULA

Vaonis Vespera 2

dual band filter

Crédit: Nathanaël Martin

Smart telescope imaging

The extreme challenge of this target is its surface brightness: despite its angular size, the emission is extremely diffuse and requires very clean dark skies and substantial integration. A dual-band filter is absolutely essential, since Sh2-308 is primarily an OIII emitter (with very little H α contribution).

Canis Major HII Complex

Sh2-310

HII region / Emission nebula

Angular size 8° × 8°

RA 07h 26m 00s · Dec -25° 31' 13"

Sh2-310, also known as Gum 8, is one of the largest H II complexes known in the Milky Way: a vast ionized-hydrogen region in Canis Major associated with young star clusters and massive OB stars, with patches of reflection nebulosity visible in the surrounding star-forming field.

Smart telescope imaging

Given its huge angular size, Sh2-310 cannot be captured in its entirety in a single frame. Yet the most interesting zone that spans about 1.2° is centered on the coordinates above.

A dual-band filter will be very useful to reveal the H α structure. This target is best suited to patient, experienced imagers with access to dark, transparent skies and good astrophotography skills.

OPEN CLUSTERS

Little Beehive Cluster

M 41 · NGC 2287

Open cluster

Mag. 4.5 · angular size 39'

RA 06h 46m 00s · Dec -20° 45' 15"

Messier 41 is located just 4° south of Sirius. Its most striking visual feature is the combination of hot blue-white members alongside several conspicuous orange-red giant stars. It contains approximately 100 stars at a distance of ~2,300 light-years, with a physical diameter of ~25 light-years.

Smart telescope imaging

M41 delivers immediate results in short integrations. The color contrast between the orange giants and the blue-white members is the cluster's primary photographic interest.

Omicron Velorum Cluster

Caldwell 85 · IC 2391

Open cluster

Mag. 2.5 · angular size 29'

RA 08h 40m 32s · Dec -53° 02' 08"

Caldwell 85, also known as the Omicron Velorum Cluster, lies roughly 500 light-years away. Visually, the cluster is dominated by about 30 prominent young blue-white stars.

Close to the same line of sight lies NGC 2669, a smaller and more compact-looking open cluster. Despite its apparent proximity to IC 2391 on the sky, it is a separate background object located much farther away in the Galactic disk, probably at a distance of a few thousand light-years.

Smart telescope imaging

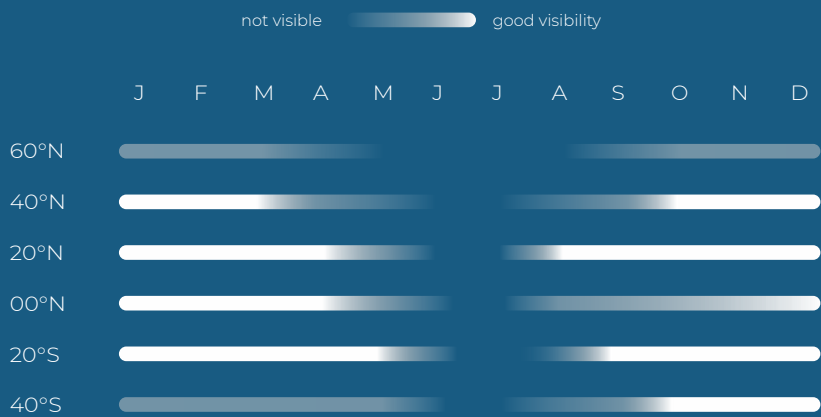
Caldwell 85 and NGC 2669 can be captured together in the same framing giving a sense of perspective to the scene

Monoceros • Gemini • Orion

• Taurus • Auriga

• Canis Minor

Visibility by Latitude



To get started

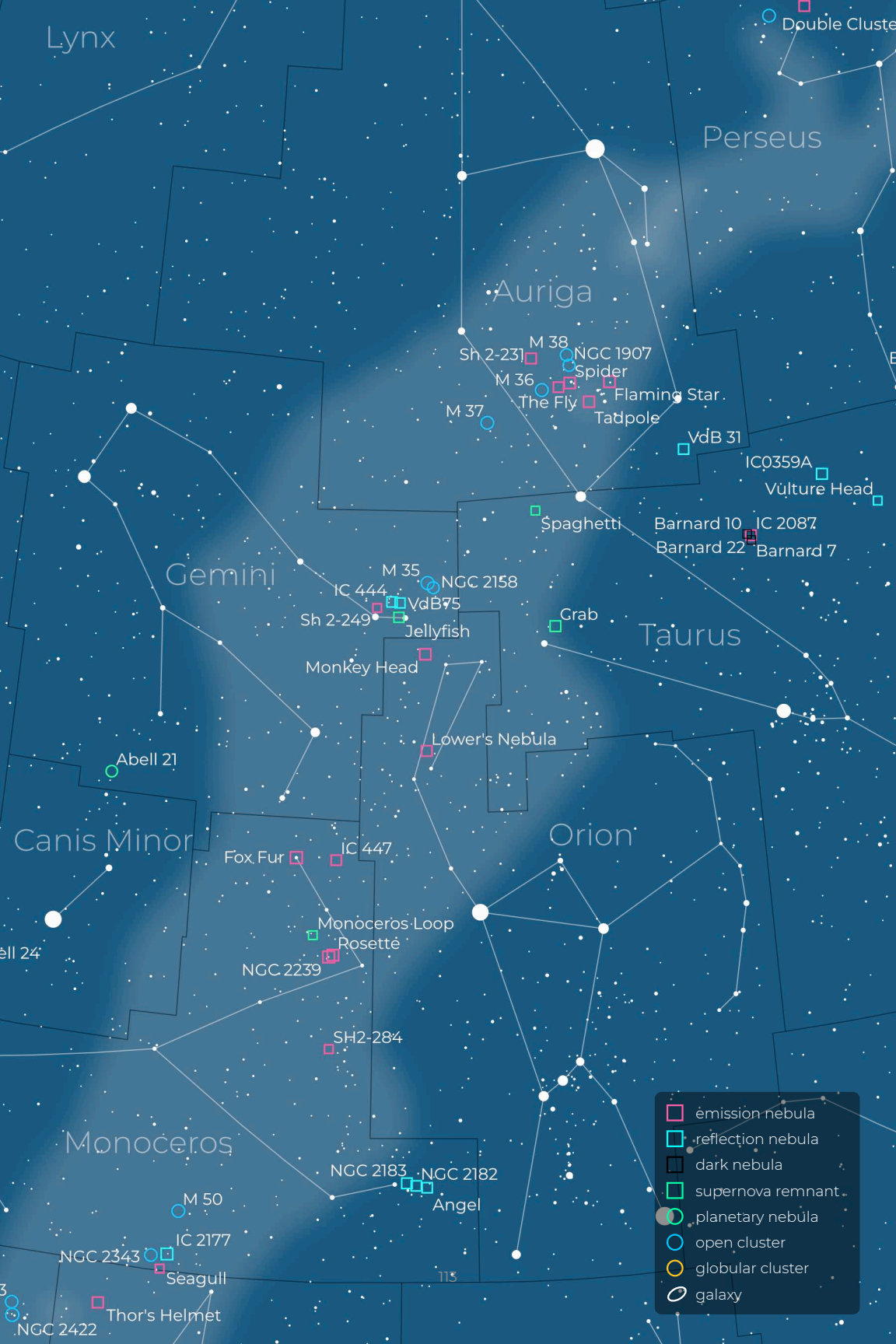
Rosette Nebula (Mon) •
Monkey Head Nebula (Ori)
• Jellyfish Nebula (Gem)

Go off the beaten path

Portal Nebula (Mon) •
Flaming Star & Tadpoles
Nebula (Aur) • Christmas
Tree Nebula (Mon)

Challenge yourself

Medusa Nebula (Gem) •
Taurus Molecular Cloud
complex (Tau) • Spaghetti
Nebula (Tau)



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The Auriga Field: Flaming Star and Tadpole Nebulae region

The Christmas Tree, Cone & Fox Fur Complex

The Rosette Nebula

The Jellyfish & Its Neighbors

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The Taurus Molecular Cloud Complex

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	Rosette Nebula	Emission nebula / HII region	Monoceros
	Flaming Star	Emission nebula / HII region	Auriga
	Monkey Head Nebula	Emission nebula / HII region	Orion
	Tadpoles	Emission nebula / HII region	Auriga
	Lower's Nebula	Emission nebula / HII region	Orion
	Dreyer's Nebula	Emission nebula / HII region	Monoceros
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	Fly nebula	Emission nebula / HII region	Auriga
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VdB 31	Reflection nebula	Auriga
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★ Abell 24	Planetary nebula	Canis Minor
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★ Shoe-Buckle Cluster	Open cluster	Gemini
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Pinwheel Cluster	Open cluster	Auriga
Salt-and-Pepper Cluster	Open cluster	Auriga
NGC 2343	Open cluster	Monoceros
Starfish Cluster	Open cluster	Auriga
NGC 1907	Open cluster	Auriga
NGC 2158	Open cluster	Gemini

The constellations

Monoceros

Mon · Unicorn · Licorne

Monoceros is a faint constellation sandwiched between the bright giants Orion, Canis Major, and Canis Minor. Its brightest star reaches only magnitude 3.9, making it one of the more inconspicuous constellations visible from mid-latitudes. Yet it lies directly on the Milky Way and is extraordinarily rich in nebular objects: the Rosette Nebula, the Christmas Tree/Cone Nebula complex, the Seagull Nebula's extension (Sh2-296), and several other star-forming regions are among its deep-sky contents.

Gemini

Gem · The Twins · Gémeaux

Gemini is one of the zodiacal constellations, anchored by the bright twin stars Castor (magnitude 1.6) and Pollux (magnitude 1.1, the nearest giant star to Earth at 34 light-years). The foot of one twin sits near the Milky Way, placing M35 and NGC 2158 in a rich stellar background. The Jellyfish Nebula (IC 443), one of the finest supernova remnants accessible to smart telescopes, lies near the star Eta Geminorum.

Orion

Ori · Hunter · Orion

Orion is one of the most renowned constellations, thanks to the iconic nebulae it contains. However, it is also a very large constellation, extending well beyond the band of the Milky Way. This section therefore covers only a small selection of Orion's many deep-sky objects, those located in the immediate vicinity of the Milky Way: The Monkey Head Nebula (NGC 2174) and Lower's Nebula (Sh2-261).

Taurus

Tau · Bull · Taureau

Like Orion, Taurus extends well beyond the band of the Milky Way. This guide therefore covers only a selection of the objects located near it, mainly those associated with the Taurus Molecular Cloud Complex, which stretches across Taurus and into Auriga and also the famous Crab Nebula.

Auriga

Aur · Charioteer · Cocher

Auriga is a pentagon-shaped constellation centred on the brilliant star Capella (magnitude 0, a binary at 43 light-years). It lies along the Milky Way and contains three Messier open clusters (M36, M37, M38) plus several remarkable nebular objects: the Flaming Star Nebula (IC 405), the Tadpoles Nebula (NGC 1893), and the Spider and Fly Nebulae (IC 417 and NGC 1931). The Auriga HII complex (Sh2-231/232/233/235) is a large-scale star-forming region in the background.

Canis Minor

CMi · Little Dog · Petit Chien

Canis Minor is a small, sparse constellation dominated by the brilliant Procyon (magnitude 0.34, at 11.4 light-years, the eighth-nearest star system to the Solar System). It contributes only one target: Abell 24.

The Local Arm and Its Richest Nebulae

The objects in this chapter sample several distinct galactic structures at radically different distances, from the nearby Taurus Molecular Cloud at ~430 light-years to the background of the Milky Way extending several thousand light-years toward the galactic anticenter.

FLAMING STAR & TADPOLES
NEBULAE

Vaonis Vespera 2

Total integration time 4,5h

Mosaic mode : dual band filter

Bortle 5

Credit: Mike Jones



TADPOLES NEBULA

Vaonis Vespera Pro

Total integration time 8,5h

Dual band filter

Credit: Raymond Mandeville



The Taurus Molecular Cloud and the Local Bubble edge. At approximately 430 light-years, the Taurus Molecular Cloud sits at the outer boundary of the Local Bubble, the low-density cavity surrounding the Solar System. Like Rho Ophiuchi and Lupus, the Taurus complex represents the ring of molecular material that was shaped at the Local Bubble's edge by past supernova explosions. The dark nebulae Barnard 7, 10, and 22, plus LBN 777, are all foreground structures in our own cosmic neighborhood.

Intermediate depth. Beyond the Taurus foreground, we cross several star-forming and nebular environments. The Flaming Star Nebula, the Jellyfish supernova remnant, the Christmas Tree and Cone Nebula region in Monoceros, and the more distant Rosette Nebula form together a layered sequence of nebulae, clusters, and remnants from roughly 1 500 to 5 000 light-years away.

The galactic anticenter direction. Looking through Gemini and Auriga means looking approximately toward the Galactic anticenter. In this direction, we look outward through the Milky Way's disk rather than inward toward its crowded core. The result is generally lower stellar crowding and less severe extinction than in the Galactic Center direction, while still revealing rich winter-Milky-Way fields filled with open clusters, nebulae, and dark clouds.

Cosmic Scenes

The Auriga Field: Flaming Star and Tadpole Nebulae region

In the heart of Auriga, a wide expanse of the winter Milky Way brings together several visually compelling nebulae. The five objects in this scene: Caldwell 31 (Flaming Star), M38 (Starfish Cluster), IC 417 (Spider Nebula), NGC 1893 (Tadpoles Nebula), and NGC 1931 (Fly Nebula), share the same rich patch of sky but are emphatically not part of the same physical structure. The flaming star at ~1 500 light-years is a local foreground object, while the Tadpole Nebula at ~12 400 light-years lies nearly eight times further

away. Together they form one of the finest wide-field compositions in the winter sky.

Smart telescope imaging

The full scene spans approximately 4° and may require a mega-mosaic for complete coverage.

★ Flaming Star Nebula

Caldwell 31 • IC 405

Mixed nebula (emission + reflection)

Mag. 6.0 • angular size 40' × 15'

RA 05h 16m 30s • Dec +34° 21' 22"

The Flaming Star Nebula surrounds the hot, irregular variable star AE Aurigae. The nebula displays both emission regions, glowing red from ionized hydrogen, and reflection regions, shining blue from starlight scattered by dust, with dark filaments threading through the field. AE Aurigae is not native to the nebula: it is a runaway star now passing through the region, temporarily illuminating and ionizing the cloud as it moves through the interstellar medium.

Smart telescope imaging

For the most complete representation of both emission and reflection, a broadband capture (no filter) combined with narrowband one (dual-band filter) is ideal.

★ Tadpoles Nebula

NGC 1893

Emission nebula / HII region

Mag. 7.5 • angular size 40' × 30'

RA 05h 22m 44s • Dec +33° 24' 43"

NGC 1893 is a rich emission nebula and embedded open cluster in Auriga. Its popular name "Tadpoles" derives from two striking elongated pillars of molecular gas silhouetted against the bright HII emission, resembling tadpoles swimming in a glowing pool.

Smart telescope imaging

A dual-band filter reveals the pillar structures against the surrounding HII emission.

Spider Nebula

IC 417

Emission + Reflection nebula

Mag. 7 • angular size 13' × 10'

RA 05h 28m 06s • Dec +34° 25' 26"

IC 417 is a compact but bright HII region. The angular size refers to the bright core only; broader HII emission extends to approximately 50'

Smart telescope imaging

A dual-band filter brings out both the H α emission and the surrounding extension.

Fly Nebula

NGC 1931

Cluster + nebula

Mag. 10.1 • angular size 5'

RA 05h 31m 25s • Dec +34° 14' 47"

NGC 1931 is a compact emission and reflection nebula with an embedded young open cluster. Often called the "Fly" in its pairing with IC 417 (the "Spider").

Starfish Cluster

M 38 • NGC 1912

Open cluster

Mag. 7.4 • angular size 21'

RA 05h 28m 42s • Dec +35° 51' 18"

Messier 38 stellar chains create a loose cross or asterism pattern that, with imagination, resembles a starfish or the Greek letter Pi. Its mix of evolved yellow-orange giant stars alongside remaining blue main-sequence members gives it an interesting color palette.

Smart telescope imaging

Long exposures reveal faint HII emission from the Auriga background yet at the cost of the colors of the stars.

♥ The Christmas Tree, Cone & Fox Fur Complex

In Monoceros, the NGC 2264 complex represents one of the finest multi-object star-forming scenes in the winter Milky Way. The designation NGC 2264 covers two formally catalogued objects, the Christmas Tree Cluster and the Cone Nebula, but the region also contains the Fox Fur Nebula (Sh2-273) and the adjacent emission/reflection nebula IC 447 (Dreyer's Nebula), which together form a spectacular wide-field composition.

All four components fit within a mosaic capture. Yet the surrounding HII region extends much farther, and a mega-mosaic may be required to cover the full region.

Christmas Tree, Cone Nebula & Fox Fur Nebula

NGC 2264

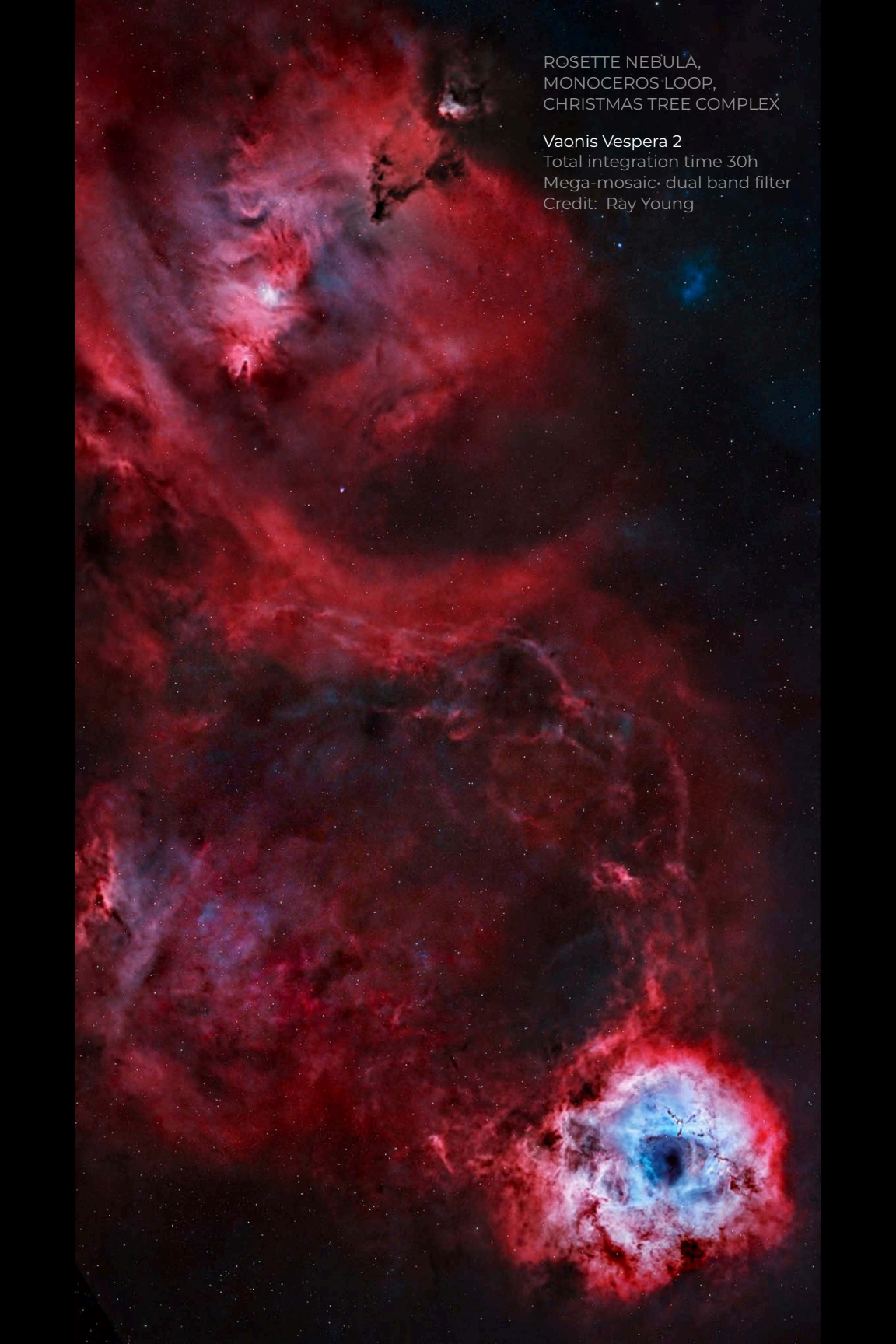
Cluster + nebula

Mag. 4 (cluster) • Angular size 60' × 40'

RA 06h 40m 58s • Dec +09° 53' 44"

NGC 2264 is a multi-component star-forming complex in Monoceros at approximately 2 500 light-years. The Christmas Tree Cluster forms a triangular shape with the dramatic Cone Nebula at its tip and the Fox Fur Nebula (Sh2-273) swirling below. The bright variable star S Monocerotis (magnitude 4.66, visible to the naked eye) marks the trunk of the tree.

The Cone Nebula is a pillar of gas approximately 7 light-years long, sculpted by stellar winds from the cluster's hot blue stars into a cone-shaped silhouette against bright background emission.



ROSETTE NEBULA,
MONOCEROS LOOP,
CHRISTMAS TREE COMPLEX

Vaonis Vespera 2
Total integration time 30h
Mega-mosaic: dual band filter
Credit: Ray Young

Smart telescope imaging

A dual-band filter enhances the H α emission around the Cone Nebula and helps reveal the surrounding Fox Fur structure. However, it reduces the reflection component, so a good strategy is to combine two captures: one in broadband, without a filter, to preserve natural star colors and reflection nebulosity, and one in dual-band to strengthen the emission signal. A long integration time is highly beneficial.

Dreyer's Nebula

IC 447

HII region / Emission nebula

Mag. 10 · angular size 25' × 20'

RA 06h 31m 00s · Dec +09° 53' 51"

IC 447 is a compact emission nebula approximately 2.4° west of NGC 2264.

♥ The Rosette Nebula

The Rosette Nebula is one of the largest and most visually striking emission nebulae and one of the most rewarding target for smart telescopes. The nebula's near-perfect ring structure, spanning approximately 2° on the sky (roughly 130 light-years in physical diameter at ~5 200 light-years), is one of the most recognizable shapes in deep-sky astrophotography.

Rosette Nebula

Caldwell 49 · NGC 2237

Emission nebula

Mag. 6 · angular size 80' × 60'

RA 06h 30m 55s · Dec +05° 02' 57"

The Rosette Nebula is a vast HII region in Monoceros. Its characteristic shape, a near-circular ring with a central void, is created by stellar winds and radiation from the embedded cluster NGC 2244 (Caldwell 50), which has evacuated the central region of hydrogen and sculpted the surrounding gas into a glowing ring. At 130 light-years in

physical diameter, it is substantially larger than the Orion Nebula.

The nebula is actually a complex of multiple NGC designations (NGC 2237, 2238, 2239, 2246) that represent different portions of the same continuous nebulous structure, catalogued separately by observers who did not initially realize they were looking at the same object.

Smart telescope imaging

The Rosette Nebula's large angular size and relatively high surface brightness make it one of the most satisfying targets for smart telescopes. The brightest part of the nebula fits within the native field of view of most smart telescopes, but mosaic mode is recommended to capture the fainter extensions and achieve a more balanced, aesthetic framing.

A dual-band filter is strongly recommended. It dramatically enhances the ring structure and reveals the gas pillars inside the nebula, silhouetted against the darker central cavity.

Even a short integration time can be rewarding, but longer acquisitions bring out finer details and reveal the nebula's faint outer extensions.

Rosette Cluster

Caldwell 50 · NGC 2244

Cluster

Mag. 4.8 · angular size 9'

RA 06h 31m 55s · Dec +04° 56' 34"

The cluster appears as a sparse grouping of brilliant blue-white stars in the central void of the Rosette ring.



ROSETTE NEBULA

Vaonis Vespera 3

Total integration time 5.5h

Mosaic mode · dual band filter

Bortle 4

The Jellyfish & Its Neighbors

In Gemini, the Jellyfish Nebula (IC 443) is the dominant feature of a rich field that includes the HII extension Sh2-249, the small reflection nebula IC 444, and the compact reflection nebula VdB 75. All four objects fit within the same mosaic field of view of most smart telescopes.

IC 443 is a supernova remnant at approximately 5 000 light-years. Sh2-249 is a separate HII region at approximately 5,200 light-years. IC 443 is the remnant of a stellar explosion while Sh2-249 is an active HII region, making them structurally and physically distinct objects. In wide-field narrowband images, Sh2-249 appears as a luminous extension of the Jellyfish field.

★ Jellyfish Nebula

IC 443 • Sh2-248

Supernova remnant

Mag. 11 • angular size 50' × 40'

RA 06h 16m 37s • Dec +22° 31' 54"

IC 443 presents several distinctive visual features. The supernova shock wave has expanded into regions of varying density, creating dramatically different morphologies across the remnant. The southeastern region, where the shock interacts with a dense molecular cloud, shows especially complex filamentary structure.

Smart telescope imaging

The entire remnant shows strong H α and OIII emission, making it an outstanding narrowband target. A dual-band filter is therefore essential for bringing out the full complexity of it. The OIII component reveals wispy, almost ethereal shock fronts in blue.

Sh2-249

HII region / Emission nebula

Angular size 80' × 80'

RA 06h 22m 32s • Dec +22° 58' 30"

Sh2-249 is an extended HII emission region immediately adjacent to the eastern edge of IC 443. In narrowband images, it appears as a bright, roughly triangular emission region extending eastward from the Jellyfish.

Smart telescope imaging

Sh2-249 is best included in the same frame as IC 443. Its strong H α emission responds well to dual-band filtering. Full coverage of Sh2-249 alongside IC 443 requires a mosaic capture.

IC 444

Reflection nebula

Mag. 10 • angular size 15' × 10'

RA 06h 18m 34s • Dec +23° 18' 48"

IC 444 is a compact faint reflection nebula. It may not be visible if using a dual band filter.

VdB 75

Reflection nebula

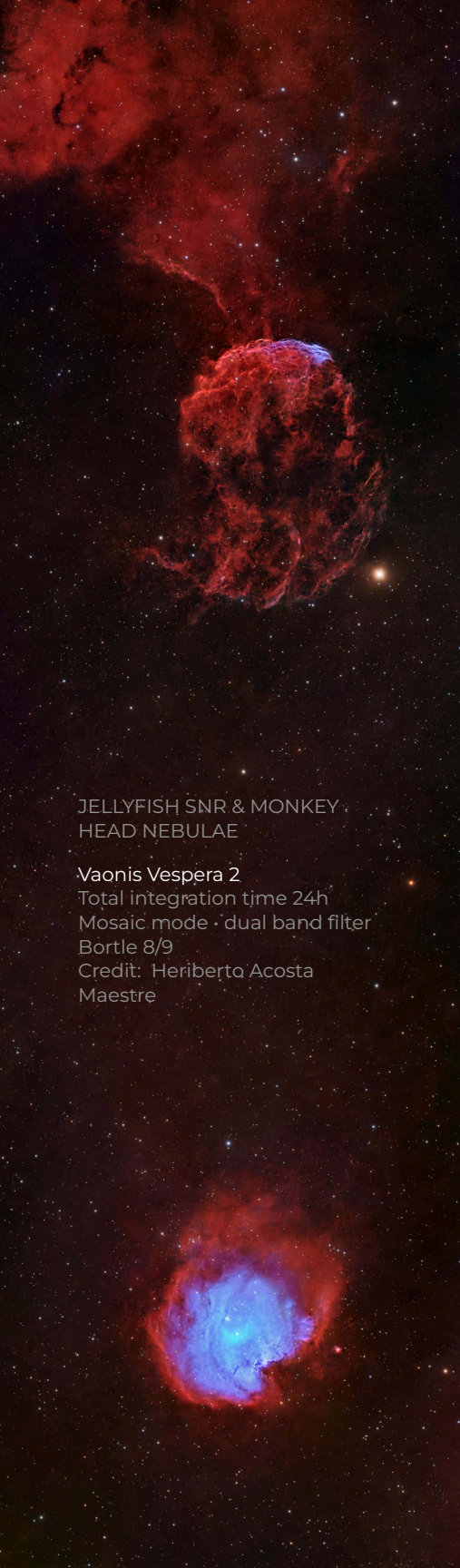
Mag. 11 • angular size 7'

RA 06h 16m 23s • Dec +23° 16' 33"

VdB 75 is a small, very faint blue reflection nebula within the Jellyfish field.

Smart telescope imaging

It is visible only in broadband imaging, so to include it in a project covering the full Jellyfish region, which benefits strongly from a dual-band filter, you will need to blend two captures: one broadband image for the reflection nebulosity, and one dual-band image for the emission structures.



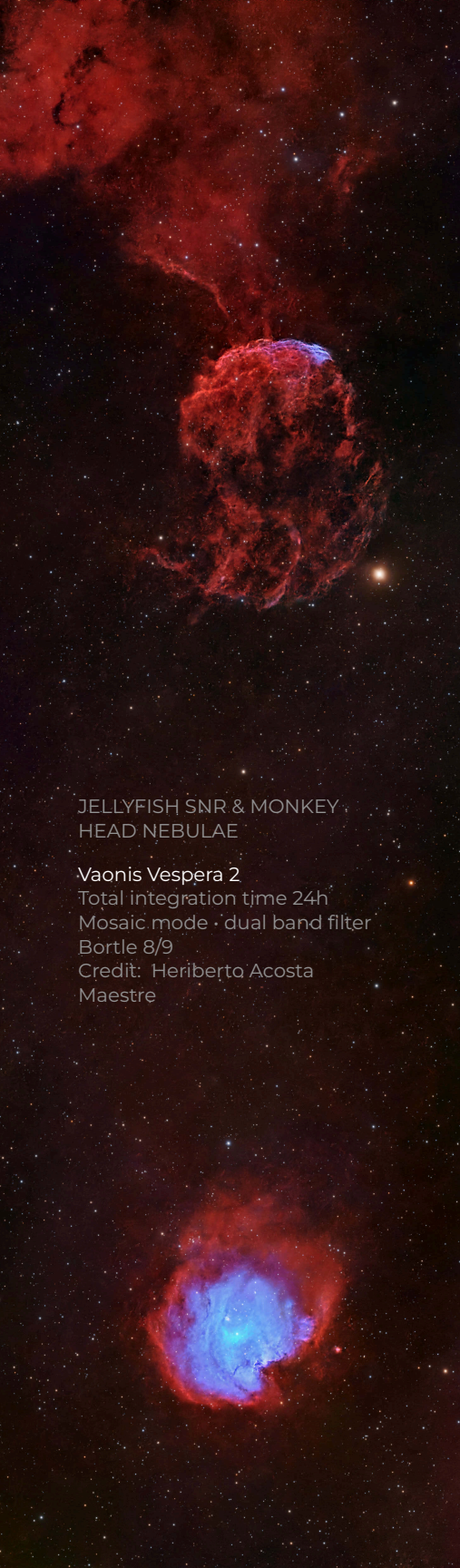
JELLYFISH SNR & SH2-240

Vaonis Vespera 3

Total integration time 5h30

Mosaic mode - dual band filter

Bortle 4



JELLYFISH SNR & MONKEY
HEAD NEBULAE

Vaonis Vespera 2

Total integration time 24h

Mosaic mode - dual band filter

Bortle 8/9

Credit: Heriberto Acosta

Maestre

★ The Seagull Nebula

Straddling the border between Monoceros and Canis Major, the Seagull Nebula is a large star-forming complex whose brightest components, IC 2177 (the head) and Sh2-296 (the wings), together span approximately 3° on the sky so mosaic mode is required to capture the full complex.

Seagull Nebula (head)

IC 2177

Reflection nebula

Mag. 5 • angular size 20' × 20'

RA 07h 04m 37s • Dec -10° 28' 16"

IC 2177 is the brightest and most compact component of the Seagull Nebula, a mixed emission and reflection nebula. The bright central region responds well to both broadband and narrowband imaging.

Seagull Nebula (wings)

Sh 2-296

HII region / Emission nebula

Angular size 120'

RA 07h 05m 54s • Dec -11° 13' 00"

Sh2-296 is the vast, very low surface brightness HII emission region forming the "wings" of the Seagull Nebula.

Smart telescope imaging

A dual-band narrowband filter is useful given the low surface brightness of the nebula. Long integration is also needed to develop the full wing structure.

NGC 2343

Open cluster

Mag. 7 • angular size 12'

RA 07h 08m 07s • Dec -10° 37' 00"

It's a compact open cluster embedded within the Seagull Nebula complex.

★ The Angel Nebula Group

In Monoceros, near the border with Canis Major and Orion, a small colorful group of reflection nebulae form a nice composition largely overlooked by smart telescope users : NGC 2170 (Angel Nebula), NGC 2182, and NGC 2183. They all belong to the same star-forming environment at estimated distances of 2 500 light-years.

Smart telescope imaging

The three reflection nebulae are associated with dark nebulae, making this a scene that rewards long broadband imaging without a filter. This approach reveals both the colorful reflection nebulosity and the dark absorption structures around it.

The three reflection nebulae fit within a native field of view, but the surrounding dark-nebula extensions are better captured with a mosaic to reveal their full extent.

★ Angel Nebula

NGC 2170

Reflection nebula

Mag. 10 • angular size 45'

RA 06h 07m 32s • Dec -06° 23' 57"

NGC 2170 is a complex reflection nebula creating a texturally interesting composition. The popular name "Angel Nebula" describes the perceived winged form of the brightest portion of the reflection cloud in long-exposure images.

Smart telescope imaging

No narrowband filter (reflection nebulae). Integration of 90–120 minutes minimum to reveal the full extent and surrounding dark nebulosity. Include NGC 2182 and NGC 2183 in the same frame. Dark skies are essential for the fainter outer extensions.

NGC 2182

Reflection nebula

Mag. 10 • angular size 10'

RA 06h 10m 44s • Dec -06° 19' 50"

A compact companion reflection nebula to NGC 2170. It contributes a secondary blue-white knot to the Angel Nebula.

NGC 2183

Reflection nebula

Mag. 9 • angular size 20'

RA 06h 12m 07s • Dec -06° 12' 12"

A slightly brighter reflection nebula at the eastern edge of the Angel Nebula group, contributing a third knot to the composition.

★ The Taurus Molecular Cloud Complex

Between the constellations Taurus and Auriga stretches a vast tangle of dense, filamentary dark molecular clouds, from which small reflection nebulae occasionally emerge.

The Taurus Molecular Cloud is one of the closest active star-forming regions to Earth, at approximately 430 light-years.

Smart telescope imaging

The objects in this section span more than 8° making complete coverage impossible in a single acquisition and requiring a mega-mosaic. However, several areas are particularly interesting and worth focusing your observations on :

• Barnard 7 & Barnard 10 Region :

A chaotic field where the dark filaments snake across the sky, mingling with blue reflection nebulae LBN 782, LBN 78.

• **Barnard 22 & IC 2087 region** : a large, dense dark cloud, while IC 2087 is a tiny reflection nebula embedded within it, appearing as a flame-like knot of light in a sea of darkness.

Long integration time is required to make the background star field stand out as well as careful image processing to preserve the contrast between the dark dust structures and the surrounding sky.

★ Barnard 22 (+ IC 2087)

Barnard 22

Dark nebula Angular size 100' × 50' RA

04h 40m 00s • Dec +25° 44' 28"

Barnard 22 is a large, elongated dark nebula while IC 2087 is a small compact reflection nebula nested within Barnard 22 that resembles a tiny core of flame within the surrounding darkness. The combination of the large dark cloud (100'×50') with the embedded bright knot of IC 2087 creates a visually striking composition.

Smart telescope imaging

Mosaic mode is recommended for the full extent. IC 2087 (5' apparent size) appears as a bright point of light within the dark cloud.

★ Barnard 7

Dark nebula

Angular size 40' × 30'

RA 04h 40m 00s • Dec +25° 30' 00"

Barnard 7 is a dense dark cloud at the center of the Taurus Molecular Cloud complex, adjacent to Barnard 10. It appears as an irregularly shaped opaque region against the faint background stars of Taurus, flanked by the blue reflection nebula LBN 782.

Smart telescope imaging

The Taurus complex's modest background star density means Barnard 7 requires excellent transparency and long integration to develop adequate contrast. Best framed together with Barnard 10 in the same field. Dark skies essential.



BARNARD 22

Vaonis Vespera 2
Total intégration time 6h
Mosaic mode
Credit: Susan Fortney

VULTURE HEAD / BABY EAGLE

Vaonis Vespera 2
Total integration time 16.5h
Bortle 4/5
Credit: Nathanael Martin

Barnard 10

Dark nebula

Angular size 60' × 40'

RA 04h 41m 00s · Dec +25° 50' 00"

Barnard 10 is a chunky, irregularly shaped dark cloud immediately adjacent to Barnard 7 in the Taurus Molecular Cloud. In imaging, it behaves like a "negative nebula", defined by the absence of background stars rather than by any emission. Both Barnard 7 and Barnard 10 are members of the LDN 1495 filamentary dark cloud system.

Smart telescope imaging

Same approach as Barnard 7, broadband, long integration, dark skies.

Baby Eagle / Vulture's Head Nebula

LBN 777 · Barnard 207

Dark nebula / cometary globule

Angular size 30'

RA 04h 04m 24s · Dec +26° 24' 51"

LBN 777 is a cometary-shaped nebula at the western edge of the Taurus Molecular Cloud, at approximately 457 light-years. Its shape, a dense "head" tapering into a diffuse "tail", is typical of cometary globules, dense clouds that have been sculpted by stellar radiation pressure.

★ IC 359A

Reflection nebula

Mag. 8 · angular size 15' × 10'

RA 04h 18m 41s · Dec +28° 17' 24"

IC 359A is a small faint reflection nebula embedded in the Taurus Molecular Cloud. It is dust scattering starlight at the Taurus cloud distance.

Individual Targets

EMISSION NEBULAE / HII REGIONS

♥ Monkey Head Nebula

NGC 2174

Emission nebula

Mag. 7 · angular size 40' × 30'

RA 06h 09m 24s · Dec +20° 39' 35"

The Monkey Head Nebula is a compact but bright HII region in Orion, on the border with Gemini, at a distance of approximately 6,500 light-years. Its popular name derives from the perceived simian profile of its brightest emission structures in narrowband images.

Smart telescope imaging

An excellent narrowband target. A dual-band filter reveals the H α emission and OIII structure beautifully.

Lower's Nebula

Sh 2-261

HII region / Emission nebula

Mag. 9 · angular size 20' × 15'

RA 06h 08m 44s · Dec +15° 40' 30"

Lower's Nebula is a moderately faint HII region in southern Orion, at approximately 3,200 light-years.

Smart telescope imaging

A dual-band filter enhances the H α emission significantly.

★ Portal Nebula

SH2-284

Emission Nebula

Angular size 60' × 40'

RA 06h 31m 00s · Dec +00° 18' 00"

The Portal Nebula is a large, faint emission nebula in southern Monoceros with a striking approximately circular structure that led to its popular name "The Portal." It contains an embedded star cluster.

Smart telescope imaging

A dual-band filter is essential for this low surface brightness target. Mosaic mode is recommended for the full extent.

OPEN CLUSTERS

★ Shoe-Buckle Cluster

M 35 • NGC 2168

Open cluster

Mag. 5 • angular size 24'

RA 06h 09m 00s • Dec +24° 20' 00"

Messier 35 is a large, rich open cluster in Gemini at approximately 3,000 light-years, the only Messier object in the constellation. It shows a mix of hot blue main-sequence stars and evolved orange-yellow giants.

What makes the M35 field uniquely compelling is the presence of NGC 2158 (see below) immediately to its southwest, a much older (2 billion years), much more distant (11,000 light-years) and far more compact open cluster that appears in the same field of view. The two clusters are in no way physically related but their juxtaposition creates one of the finest depth-contrast compositions in the winter sky.

NGC 2158

NGC 2158

Open cluster

Mag. 8.6 • angular size 8'

RA 06h 07m 26s • Dec +24° 05' 46"

It shares the same field of view with M 35

Heart-Shaped Cluster

M 50 • NGC 2323

Open cluster

Mag. 5.9 • angular size 16'

RA 07h 03m 00s • Dec -08° 20' 00"

Messier 50 is a bright, rich open cluster in Monoceros at approximately 3 200 light-years. Among its members is a conspicuous orange-red giant that provides warm color contrast.

Salt-and-Pepper Cluster

M 37 • NGC 2099

Open cluster

Mag. 6.2 • angular size 24'

RA 05h 52m 18s • Dec +32° 33' 12"

Messier 37 is the finest of Auriga's three Messier clusters, containing approximately 500 stars at a distance of ~4,500 light-years and an estimated age of ~350 million years. Its evolved stellar population includes many orange and red giant members scattered among blue main-sequence stars, a mix that creates the striking "salt and pepper" appearance.

Pinwheel Cluster

M 36 • NGC 1960

Open cluster

Mag. 6.0 • angular size 10'

RA 05h 36m 18s • Dec +34° 08' 24"

Messier 36 is the smallest and least populous of Auriga's three Messier open clusters, at approximately 4,300 light-years. Its stellar population is dominated by hot, blue stars.

NGC 1907

Open cluster

Mag. 8.2 • angular size 5'

RA 05h 28m 05s • Dec +35° 19' 33"

NGC 1907 is a small, moderately faint open cluster located only 30' south of M38, sharing the same field view. Despite being notably less rich than its neighbor, it provides a useful compositional counterpoint to M38.

Smart telescope imaging

Always framed alongside M38 in the same native Vespera field.

SUPERNOVA REMNANT

Crab Nebula

M 1 • NGC 1952

Supernova remnant

Mag. 8.4 • angular size 8' × 4'

RA 05h 34m 32s • Dec +22° 00' 52"

The Crab Nebula is one of the most historically and scientifically significant supernova remnants in the sky. It is the confirmed remnant of Supernova 1054, a stellar explosion observed by Chinese, Japanese, and Arab astronomers on July 4, 1054 CE, which remained visible in daylight for 23 days and at night for nearly two years. It was the first deep-sky object to be conclusively linked to a historical supernova observation.

At approximately 6,500 light-years from Earth, the Crab Nebula spans approximately 11 light-years in physical diameter and continues to expand at ~1,500 km/s. At its center lies the Crab Pulsar, a rapidly rotating neutron star spinning at 30 revolutions per second.

Smart telescope imaging

The Crab Nebula is very compact and better imaged with longer focal length smart telescopes.

A dual-band filter is recommended to separate the H α filaments (red, outer shell) from the synchrotron emission (blue-green, inner region). This separation is the defining photographic characteristic of M1.

★ Monoceros Loop

SNR G205.5+0.5 • Monoceros SNR

Supernova remnant

Angular size 3.6°

RA 06h 36m 00s • Dec +06° 07' 00"

The Monoceros Loop is a very large, extremely faint supernova remnant in Monoceros, spanning more than 3° on the sky. At approximately 1,600 light-years, it creates a visual link between the Rosette Nebula and the Christmas Tree complex.

Smart telescope imaging

Its extremely low surface brightness makes it one of the most challenging targets in this guide. A dual-band filter is essential.

This is a multi-session mega-mosaic project for experienced astrophotographers. You can try a composition that include the Rosette Nebula and the Christmas Tree Complex. The reward is capturing a rarely imaged supernova remnant and a spectacular composition.

★ Spaghetti Nebula

SNR G180.0-01.7

Supernova remnant

Angular size 3.5°

RA 05h 39m 06s • Dec +27° 59' 55"

One of the largest apparent supernova remnants in the sky, a vast, extremely faint web of filamentary H α strands woven across the winter Milky Way on the border between Taurus and Auriga. At approximately 3,000 light-years, its physical extent reaches nearly 150 light-years across, and its age is estimated at approximately 40,000 years.

Smart telescope imaging

This is one of the most demanding targets in the guide. A dual-band filter is essential. Realistic minimum integration is 10 hours under optimal conditions. This is a trophy target for experienced imagers with good image processing skills.

MEDUSA NEBULA

Vaonis Vespera 2

Total integration time 3.3h

Dual band filter

Credit: Mike Jones



PLANETARY NEBULA

★ Medusa Nebula

Abell 21

Planetary nebula

Mag. 10 · angular size 15'

RA 07h 29m 02s · Dec +13° 14' 12"

Abell 21 is a relatively large planetary nebula in angular size in Gemini. It is thought to be a very old planetary nebula from a star that shed its outer layers roughly 10,000 years ago.

Smart telescope imaging

A narrowband filter and long integration time is essential to reveal the arc structure.

★ Abell 24

Planetary nebula

Mag. 13.6 · angular size 6'

RA 07h 51m 38s · Dec +03° 00' 27"

Abell 24 is a mid-size old planetary nebula in Canis Minor. Like most Abell planetary nebulae, it is large in apparent size and very low in surface brightness, characteristics that reflect its advanced age: the nebula

began forming approximately 20,000 years ago, making it a genuinely old remnant of stellar death.

Smart telescope imaging

A Dual band filter is particularly effective. Expect long integration to develop the faint shell against the background.

REFLECTION NEBULAE

★ VdB 31

AB Aurigae Nebula

Reflection nebula / dark nebula

Mag. 10 · angular size 40' × 60'

RA 04h 56m 34s · Dec +30° 34' 10"

VdB 31 is a delicate, multi-component reflection nebula in Auriga surrounding the young star AB Aurigae (magnitude 7).

The nebula itself is surrounded by dark nebulae B26, B27, and B28, and an extended dark structure LDN 151 extending as a "tail" to the northeast.

Smart telescope imaging

This is a rewarding target for those who invest the integration time. Mosaic mode is recommended to capture the extended dust structures and dark lane filaments.

Perseus • Aries • Camelopardalis • Cepheus • Lacerta • Cassiopeia

Visibility by Latitude



To get started

Double Cluster (Per) •
Heart & Soul Nebulae (Cas)
• Elephant Trunk Nebula
(Cep)

Go off the beaten path

Caroline's Rose Cluster
(Cas) • Question Mark
Nebula (Cep) • Hidden
Galaxy (Cam)

Challenge yourself

Ghost of Cassiopeia
Nebula (Cas) • Seahorse
Nebula (Cep) • Cepheus
Flare Complex (Cep)



Cosmic scene index

Heart & Soul region

The Bubble Nebula Field

The Perseus Molecular Cloud

The Seahorse Nebula & the Fireworks Galaxy

Kemble's Cascade & NGC 1502

The Flying Bat & The Giant Squid

The Cepheus Flare: LDN 1235, vdB 152 & LDN 1251

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	California nebula	Emission nebula / HII region	Perseus
	Heart Nebula	Emission nebula / HII region	Cassiopeia
	Soul Nebula	Emission nebula / HII region	Cassiopeia
	Little Rosette	Emission nebula / HII region	Cassiopeia
	Wizard Nebula	Emission nebula / HII region	Cepheus
	Omicron Persei Cloud	Emission nebula / HII region	Perseus
	Pacman Nebula	Emission nebula / HII region	Cassiopeia
	Lobster claw	Emission nebula / HII region	Cassiopeia
	Cave Nebula	Emission nebula / HII region	Cepheus
	Little Pacman	Emission nebula / HII region	Perseus
	Elephant trunk nebula	Emission nebula / HII region	Cepheus
	Bubble Nebula	Emission nebula / HII region	Cassiopeia
	Ghost of Cassiopeia	Emission nebula / HII region	Cassiopeia
	Northern Lagoon Nebula	Emission nebula / HII region	Cepheus
	Question Mark / Teddy bear	Emission nebula / HII region	Cepheus
	Flying bat	Emission nebula / HII region	Cepheus

★	Great Lacerta Nebula	Emission nebula / HII region	Lacerta
★	embryo nebula	Reflection nebula	Perseus
	vdB 12	Reflection nebula	Perseus
★	vdB 13	Reflection nebula	Aries
★	vdB 16	Reflection nebula	Aries
★	Ghost of Cassiopeia	Reflection nebula	Cassiopeia
★	vdB 15	Reflection nebula	Camelopardalis
★	vdB 14	Reflection nebula	Camelopardalis
★	Wolf's Cave	Reflection nebula	Cepheus
★	Barnard 3	Dark nebula	Perseus
★	SeaHorse Nebula	Dark nebula	Cepheus
★	Shark Nebula	Dark nebula	Cepheus
★	Rotten Fish Nebula	Dark nebula	Cepheus
★	Garlic Nebula	Supernova remnant	Cassiopeia
★	Dolphin / Firefox Nebula	Planetary nebula	Cassiopeia
★	Giant Squid Nebula	Bipolar nebula	Cepheus
♥	Double Cluster (h & χ Persei)	Open cluster	Perseus
★	NGC 1528	Open cluster	Perseus
	Owl Cluster / E.T. Cluster	Open cluster	Cassiopeia
	Heart Nebula Core Cluster	Open cluster	Cassiopeia
★	Caroline's rose	Open cluster	Cassiopeia
	M 52	Open cluster	Cassiopeia
★	Golden Harp Cluster	Open cluster	Camelopardalis
	Ghost Bush Cluster	Open cluster	Cepheus
	Kemble's Cascade	Asterism	Camelopardalis
★	Hidden Galaxy	Galaxy	Camelopardalis
	Fireworks Galaxy	Galaxy	Cepheus

The constellations

Perseus

Per • The Hero • Persée

Perseus is one of the great constellations of the northern sky, lying along the outer Milky Way between Cassiopeia and Auriga. Its deep-sky content is exceptionally rich: it contains the Double Cluster, the California Nebula, NGC 1499, a vast HII region extending about 2.5° across the sky; and the Perseus Molecular Cloud, one of the nearest active star-forming regions to the Sun. Perseus also hosts the famous variable star Algol, Beta Persei, the prototype eclipsing binary, whose brightness varies from magnitude 2.1 to 3.4 over a period of about 2.87 days.

Aries

Ari • Ram • Bélier

Aries is a small zodiacal constellation included in this guide because it contains a southern, peripheral extension of the Perseus molecular cloud complex, where dark dusty filaments and reflection nebulae cross the constellation boundary from Perseus into Aries. The reflection nebulae vdB 13 and vdB 16, physically associated with this nearby star-forming complex at roughly 1 000 light-years, are the primary targets here.

Camelopardalis

Cam • Giraffe • Giraffe

Camelopardalis is a large but faint constellation in the northern sky, near the pole, containing no bright stars. Despite this, it harbors several deep-sky gems: the Hidden Galaxy (IC 342), a large nearby spiral galaxy heavily obscured by Milky Way dust; the nice wide-field composition of Kemble's Cascade leading into the open cluster NGC 1502; and the challenging reflection nebulae vdB 14 and vdB 15, embedded in the glow behind the Heart and Soul Nebulae region.

Cepheus

Cep • King • Céphée

Cepheus is a pentagonal northern constellation lying between Cassiopeia and Polaris, one of the richest constellations for astrophotography. It contains the famous Elephant Trunk Nebula, a vast HII region; the eerie Flying Bat and Giant Squid pair (Sh2-129 and Ou4); the unusual juxtaposition of the Fireworks Galaxy and the Seahorse dark Nebula; the Cave Nebula (Sh2-155); and the Wizard Nebula (NGC 7380). Its most famous individual star, Delta Cephei, is the prototype Cepheid variable and the key to the cosmic distance ladder.

Lacerta

Lac • Lizard • Lézard

Lacerta is a small and faint constellation wedged between Cygnus, Andromeda, and Cepheus. Its main contribution to this chapter is the Great Lacerta Nebula, a vast, extremely faint HII region.

Cassiopeia

Cas • Queen • Cassiopée

Cassiopeia is one of the most recognizable northern constellations, its distinctive W or M shape straddling the Milky Way throughout the year. Circumpolar from most northern sites, it is a year-round target and contains some of the finest deep-sky objects in the sky: the Heart and Soul Nebulae (IC 1805 and IC 1848); the Bubble Nebula (NGC 7635); the Pacman Nebula (NGC 281); the elegant open cluster Caroline's Rose (NGC 7789); the unusual Ghosts of Cassiopeia (IC 59 and IC 63); and the compact but bright Owl Cluster (NGC 457).

From Nearby Nurseries to the Perseus Spiral Arm

The constellations in this chapter open a line of sight through the northern Milky Way. From nearby molecular clouds only about 1,000 light-years away, to the great star-forming complexes of the Perseus Arm several thousand light-years beyond them, and finally to a handful of external galaxies glimpsed through thinner windows in the Galactic dust, this region offers an exceptional depth profile across the outer Milky Way.

The local neighborhood

At approximately 1,000 light-years, the Perseus Molecular Cloud is one of the nearest active star-forming regions to the Sun. Its dark lanes, reflection nebulae, and embedded protostars belong to the network of nearby molecular clouds that also includes Taurus, Orion, and other major star-forming complexes.

The Perseus Arm

Looking through Cassiopeia means looking across the Galactic plane into the Perseus Arm, one of the Milky Way's major spiral arms, lying roughly 6,500–8,000 light-years away in this direction. The Heart and Soul Nebulae, the Bubble Nebula, etc. are part of this distant star-forming layer.

The depths of space

Far beyond the Milky Way itself, the Hidden Galaxy at about 11 million light-years, and the Fireworks Galaxy at about 25 million light-years, represent the most distant targets in this guide. They are among the rare prominent galaxies visible through the dusty band of the Milky Way. Both lie in directions where the Galactic dust column is thin enough to let their light pass through, offering a view far beyond the star fields, nebulae, and spiral arms of our own Galaxy.

Cosmic Scenes

Heart & Soul region

The Heart and Soul Nebulae (IC 1805 and IC 1848) form one of the great wide-field subjects of the northern sky: two vast HII regions in Cassiopeia, physically associated at approximately 7,500 light-years in the Perseus Arm, together spanning nearly 5° from edge to edge. They are genuinely physically related, members of the same molecular cloud environment.

Smart telescope imaging

A complete composition of both nebulae together requires a mega-mosaic making this an ambitious yet rewarding astrophotography project.

♥ Heart Nebula

IC 1805

Emission nebula

Mag. 6.5 • angular size 150'

RA 02h 32m 42s • Dec +61° 27' 25"

IC 1805 is an immense HII region in Cassiopeia, named for the heart-like outline visible in dual band images. The nebula is ionized by the young OB stars of the embedded cluster Melotte 15. The heart-shaped outline is defined by dark lanes of foreground dust that carve the glowing gas into lobes.

Smart telescope imaging

IC 1805 requires mosaic mode to capture its full extent. A dual-band filter dramatically enhances the H α emission and reveals the dark dust lanes.

HEART AND SOUL NEBULAE

Vaonis Vespera 2 X_edition

Total integration time 28h

Mega-mosaic (2 panels)

Dual band filter

Bortle 3



Heart Nebula Core Cluster

Melotte 15

Open cluster

Mag. 6.5 • angular size 15'

RA 02h 33m 22s • Dec +61° 33' 36"

Melotte 15 is the young open cluster at the heart of IC 1805, physically embedded within and responsible for ionizing the Heart Nebula. Always imaged as part of IC 1805, the cluster is visually inseparable from the nebula.

♥ Soul Nebula

IC 1848

Emission nebula

Mag. 6.5 • angular size 120' × 60'

RA 02h 51m 11s • Dec +60° 24' 09"

The Soul Nebula is the companion of the Heart Nebula and together they form one of the most frequently photographed wide-field emission complexes in the sky.

Smart telescope imaging

A dual-band filter is strongly recommended.

The Bubble Nebula Field

In a rich section of the Milky Way along the Cassiopeia–Cepheus border, some very different objects share the same wide-field. The scene brings together an open cluster, wind-blown emission nebulosity, and active star-forming regions, creating a layered portrait of the Perseus Arm.

These objects are not all at the same distance. M52 lies in the foreground at roughly 4,600 light-years. Farther behind it, the Bubble Nebula is usually placed at about 7,000 light-years, while the nearby star-forming region NGC 7538 lies at roughly 8,000–9,000 light-years.

♥ Bubble Nebula

Caldwell 11 • NGC 7635

HII region / Emission nebula

Mag. 10 • angular size 15' × 8'

RA 23h 20m 45s • Dec +61° 12' 45"

The Bubble Nebula is a sphere of ionized gas, inflated like a soap bubble by the intense stellar wind of its central star.

Smart telescope imaging

A popular dual band target. The thin bubble wall glows brilliantly in H α and OIII

Messier 52

NGC 7654

Open cluster

Mag. 6.9 • angular size 10'

RA 23h 24m 00s • Dec +61° 35' 00"

Messier 52 is a rich, compact open cluster. It contains a population of blue-white main sequence stars and evolved yellow-orange giants.

★ Lobster Claw Nebula

Sh 2-157

HII region / Emission nebula

Mag. 7.5 • angular size 60' × 40'

RA 23h 16m 04s • Dec +60° 02' 01"

Sh2-157 is a large, faint HII region in the same line of sight as the Bubble Nebula, forming an extended emission complex whose "lobster claw" shape emerges in narrowband images.

Smart telescope imaging

Sh 2-157 receives far less attention than the more prominent Bubble Nebula. A dual-band filter is essential.

Northern Lagoon Nebula

NGC 7538

Cluster + nebula

Angular size 9' × 6'

RA 23h 13m 39s · Dec +61° 30' 45"

It is a compact star-forming HII region in Cepheus, just beyond the edge of Cassiopeia, and a visual companion to the Bubble Nebula complex.

★ The Perseus Molecular Cloud

In Perseus and adjacent Aries, the Perseus Molecular Cloud stretches across approximately 8° of sky. It contains an interesting variety of objects: reflection nebulae, dark clouds, embedded young stellar clusters.

This is a genuinely physically coherent group: all objects belong to the same molecular cloud at the same distance, forming a single star-forming complex

The most prominent members are the Omicron Persei Cloud (IC 348) a young cluster with associated nebulosity and NGC 1333 (a reflection nebula). Between them, the dark cloud Barnard 3 and the reflection nebulae vdB 12, vdB 13, and vdB 16 provide additional texture and depth to the composition.

Omicron Persei Cloud

IC 348

Cluster + nebula

Mag. 7.3 · angular size 20'

RA 03h 44m 34s · Dec +32° 09' 46"

IC 348 is a rich and active star-forming cluster in the Perseus Molecular Cloud. It contains approximately 400 young stellar objects, most of them only 1–3 million years old, still partially embedded in the natal dark cloud. The cluster is surrounded by reflection nebulosity illuminated by the cluster's young stars.

★ Embryo Nebula

NGC 1333

Reflection nebula

Mag. 5.6 · angular size 10' × 7'

RA 03h 28m 55s · Dec +31° 22' 12"

A bright blue reflection nebulosity surrounds two embedded stellar clusters (NGC 1333 North and South).

The visual appearance is dramatic: a compact blue glow set against a dark molecular cloud, surrounded by faint wisps of dust and the barely-visible threads of stellar jets.

Smart telescope imaging

A long integration is needed to develop the outer extensions and the adjacent dark nebulosity. A wider field incorporating the surrounding dark cloud context (Barnard 203 and 205) requires a mosaic capture.

vdB 12

Reflection nebula

Mag. 10 · angular size 7'

RA 03h 25m 25s · Dec +31° 43' 24"

vdB 12 is a small reflection nebula embedded in the Perseus Molecular Cloud

★ Barnard 3

Dark nebula

Angular size 45' × 30'

RA 03h 33m 00s · Dec +31° 45' 00"

Barnard 3 is a prominent dark nebula within the Perseus Molecular Cloud, visible as a dark absorption region against the faint background of the surrounding cloud

★ vdB 13

Reflection nebula

Mag. 10 · angular size 7'

RA 03h 25m 50s · Dec +30° 55' 41"

vdB 13 is a faint reflection nebula in Aries, just across the border from Perseus, embedded in the southernmost extension of the Perseus Molecular Cloud.

★ vdB 16

Reflection nebula

Mag. 10.5 • angular size 5'

RA 03h 28m 20s • Dec +29° 47' 59"

In Aries, vdB 16 is adjacent to the dark nebula Barnard 204.

★ The Seahorse Nebula & the Fireworks Galaxy

In the same 3° field in Cepheus, three objects at radically different distances create an interesting depth-contrast composition. The Seahorse Nebula (Barnard 150) is a sinuous dark filament at approximately 1,200 light-years. The Ghost Bush Cluster (NGC 6939) is a rich old open cluster at ~4 000 light-years. And Caldwell 12, the Fireworks Galaxy (NGC 6946) is a face-on spiral galaxy at approximately 25 million light-years, roughly 20 000 times farther than the dark nebula in the same frame.

Seahorse Nebula

Barnard 150

Dark nebula

Angular size 90' × 30'

RA 20h 50m 40s • Dec +60° 18' 00"

Barnard 150 is a sinuous dark filament in Cepheus named for its graceful S-shaped curve resembling a seahorse. The dark lane threads through the rich background of the Cepheus Milky Way, its opacity complete enough to blot out background stars along its length.

Smart telescope imaging

The Seahorse's power lies in background star density. The longer the acquisition, the brighter the background. Frame the seahorse with NGC 6939 and Caldwell 12 (Fireworks Galaxy) using the mosaic mode.

★ Fireworks Galaxy

Caldwell 12 • NGC 6946

Galaxy

Mag. 9.5 • angular size 11'

RA 20h 34m 52s • Dec +60° 09' 14"

The Fireworks Galaxy, is one of the most supernova-prolific galaxies, with 10 supernovae observed in the past 100 years, compared to roughly one per century in the Milky Way.

It is obscured by Milky Way foreground dust, it lies very close to the galactic plane, which gives its images a slightly warm, reddened cast compared to galaxies viewed through less dust.

Its combination with the foreground open cluster NGC 6939 creates a striking foreground/background composition. Every resolved star in the field is a member of our own Galaxy, while the background "fuzzy patch" is an entire galaxy.

Smart telescope imaging

The best composition includes NGC 6939 and Barnard 150 in the same frame, creating the "galaxy behind the galaxy" depth-contrast image.

Ghost Bush Cluster

NGC 6939

Open cluster

Mag. 7.8 • angular size 12'

RA 20h 31m 30s • Dec +60° 39' 43"

NGC 6939 is a small compact open cluster in Cepheus. Despite its richness, it is almost never the primary target of imaging sessions, it is universally overshadowed by its neighbor: the Fireworks Galaxy.

SEAHORSE NEBULA &
FIREWORKS GALAXY

Vaonis Vespera 2 X_edition
Total integration time 17h
Mosaic mode
Bortle 4



Kemble's Cascade & NGC 1502

Camelopardalis harbors a charming visual composition: an asterism with an open cluster. Kemble's Cascade is a graceful chain of approximately 20 stars spanning 3°, which appears to "flow" into the Golden Harp Cluster (NGC 1502) at its southeastern end, as if a celestial waterfall is pouring into a pool of stars.

These two objects are not physically related

Kemble's Cascade

Kemble's Cascade

Asterism

Angular size 2.5°

RA 04h 05m 00s · Dec +63° 00' 00"

Kemble's Cascade is a chain of approximately 20 naked-eye stars that forms a gently curving line in Camelopardalis. The chain is not a physical association, the stars are at different distances along the same line of sight.

Golden Harp Cluster

NGC 1502

Open cluster

Mag. 6.9 · angular size 10.2'

RA 04h 07m 49s · Dec +62° 19' 54"

NGC 1502 is a bright, compact young open cluster in Camelopardalis, the visual terminus of Kemble's Cascade.

★ The Flying Bat & The Giant Squid

In southern Cepheus, two nebulae with dramatically different emission characteristics and origins overlap in the sky to create a visually striking narrowband composition: the Flying Bat Nebula is a large faint HII region glowing red in H α ; embedded within it, visible only in OIII, is the Giant Squid Nebula, a bipolar structure glowing blue-green. The contrast between the red bat and the blue-green squid in a

single dual-band narrowband image is striking.

Smart telescope imaging

The squid appears fully embedded within the bat. The full composition requires a mosaic capture to get the extend of the Flying Bat.

A dual band filter is essential. Very long integration is needed to develop the bat's full extent and faint outer wings.

This is considered a "trophy target", difficult, demanding, but extraordinarily rewarding when captured.

★ Flying Bat Nebula

Sh 2-129

HII region / Emission nebula

Angular size 140'

RA 21h 11m 48s · Dec +59° 57' 00"

Sh2-129 is a large, extremely faint HII region in Cepheus, visible only in narrowband imaging. It frames the embedded Ou4 (Giant Squid) nebula.

★ Giant Squid Nebula

Ou 4

Bipolar nebula

Angular size 75'

RA 21h 09m 40s · Dec +59° 58' 20"

The Giant Squid Nebula is one of the most unusual deep-sky objects discovered in recent years. Found in May 2011 by French amateur astrophotographer Nicolas Outters during an imaging session of Sh2-129, the Squid's existence was entirely invisible in H α . It appeared only when Outters examined OIII frames, revealing a large, bipolar blue-green structure that had been hiding within the bat. The Squid's OIII emission dominates, with very little H α , the exact opposite of the Flying Bat, which explains why it was invisible in the original discovery images taken through H α -only filters.

The Cepheus Flare: LDN 1235, vdB 152 & LDN 1251

Above the Galactic plane in Cepheus, a large complex of cold molecular clouds and active star-forming regions stretches across the northern sky. Known as the Cepheus Flare, this high-latitude molecular-cloud system contains several interrelated dark-cloud complexes. The Iris Nebula, presented in the individual target section below, also belongs to the same wider network of dust, gas, and young stellar objects.

Three targets stand out within or near the Cepheus Flare: the Dark Shark Nebula, the Wolf's Cave Nebula and the Rotten Fish Nebula. These are dusty molecular-cloud and reflection-nebula regions, several of them associated with young stars or ongoing low-mass star formation.

Smart telescope imaging

Each object deserves its own individual exploration, but capturing them as part of a larger Cepheus Flare project conveys the scale of the whole complex. These targets are spread over a very wide area, so a standard mosaic is not enough; a true mega-mosaic is required to cover the broader field, and the full region may exceed 8° depending on the chosen framing. Long broadband integration without any filter is the preferred approach, because the key structures are dark dust, reflection nebulosity, and faint broadband cloud texture.

★ Dark Shark Nebula

LDN 1235

Dark nebula

Angular size 3.9° × 2.7°

RA 21h 58m 36s · Dec +72° 47' 24"

It is a dense, opaque dust cloud whose silhouette unmistakably resembles a great white shark defined by a dark absorbing body, a well-defined tapering snout, and two blue knots near the head that represent embedded illuminated dust. Those two blue regions (vdB 149 and vdB 150) are reflection

nebulae. Within the dark cloud, active star formation is underway.

smart telescope imaging

This is among the most demanding targets in the guide. Dark sky and very long integration time are required. Mosaic mode is also required and is barely sufficient to capture the full extent.

★ Wolf's Cave Nebula

vdB 152

Reflection nebula + dark nebula

Angular size 20'

RA 22h 13m 48s · Dec +70° 53' 00"

It is a faint blue reflection nebula embedded at the tip of the dark Bok globule (Barnard 175).

Smart telescope imaging

Same approach as the Dark Shark Nebula.

Rotten Fish Nebula

LDN 1251

Dark nebula

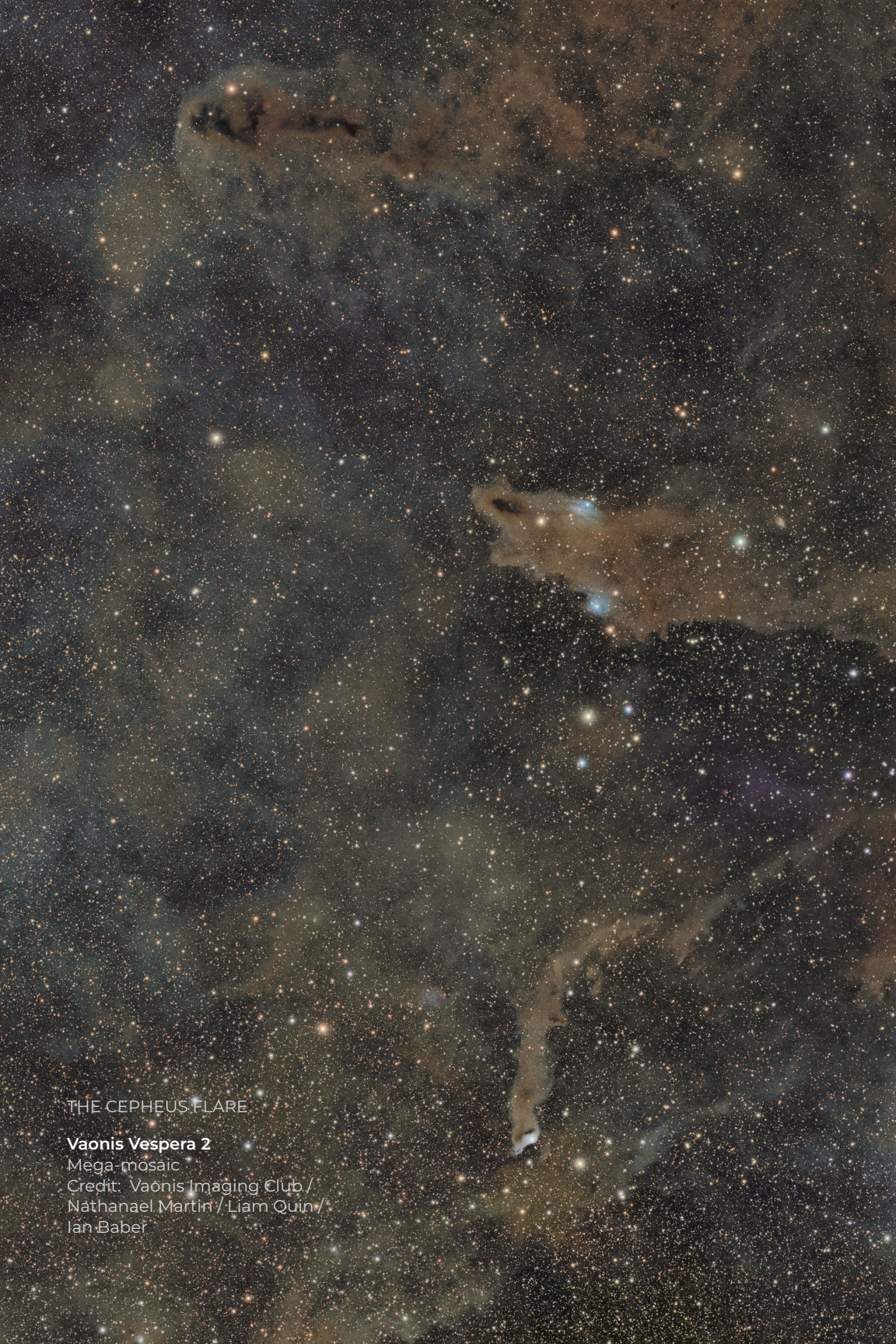
Angular size 120' × 60'

RA 22h 35m 00s · Dec +74° 54' 00"

LDN 1251 is an active star-forming dark cloud in the Cepheus Flare.

Smart telescope imaging

Same approach as the Dark Shark Nebula.



THE CEPHEUS FLARE

Vaonis Vespera 2

Mega-mosaic

Credit: Vaonis Imaging Club /
Nathanael Martin / Liam Quin /
Ian Baber

★ The Ghosts of Cassiopeia , IC 59 & IC 63

Two enigmatic nebulae lurk in the shadow of Gamma Cassiopeiae (γ Cas, magnitude 2.5): IC 63 and IC 59 are companion nebulae , one primarily an emission region, the other primarily a reflection cloud, both energized and sculpted by the intense radiation of the same brilliant nearby star.

Both objects are at approximately 550 light-years from Earth, very close to Gamma Cas itself, which lies at the same distance. Together they fit within the same field of view.

Smart telescope imaging

Since one of the components is a reflection nebula, it's better not to use any narrowband filter.

Ghost of Cassiopeia (emission component)

IC 63

HII region / Emission nebula

Mag. 13 • angular size 10'

RA 00h 59m 29s • Dec +60° 54' 42"

IC 63 is the closer and more active of the two Ghost nebulae. It displays strong H α emission driven by the ultraviolet radiation of the nearby hot B-type star which ionizes its gas.

Ghost of Cassiopeia (reflection component)

IC 59

Reflection nebula

Mag. 11 • angular size 10'

RA 00h 57m 29s • Dec +61° 08' 37"

IC 59 is the reflection-dominated companion of IC 63, located slightly farther from Gamma Cassiopeiae and therefore receiving less UV radiation , not enough to fully ionize the gas, but enough to scatter the star's light blue in the surrounding dust.

Individual Targets

OPEN CLUSTERS

♥ Double Cluster

C 14 • NGC 869 • NGC 884 • η & χ Persei

Open cluster

Mag. 3.7 / 3.8 • angular size 30' + 30'

RA 02h 18m 59s • Dec +57° 07' 02"

The Double Cluster is the finest cluster pair in the sky. Two rich open clusters, NGC 869 (η Persei, the western component) and NGC 884 (χ Persei, the eastern component), lie approximately 0.5° apart and together span a full degree of sky. Both are at approximately 7,500 light-years.

Smart telescope imaging

Both clusters can be captured in the same field of view using mosaic mode to give them more context and get a better composition.

Owl Cluster / E.T. Cluster

C 13 • NGC 457

Open cluster

Mag. 6.4 • angular size 8'

RA 01h 19m 33s • Dec +58° 17' 26"

Caldwell 13 is a young, compact open cluster in Cassiopeia whose arrangement of stars is described as either an owl (with two bright eyes formed by Phi and HD 7902, magnitudes 5 and 7) or E.T. the extraterrestrial (arms extended, eyes looking outward). An orange star provides color contrast within the cluster.

PERSEUS DOUBLE CLUSTER

Vaonis Vespera 2 X_edition
Total integration time 1h40
Mosaic mode



★ Caroline's Rose

NGC 7789

Open cluster

Mag. 6.7 • angular size 16'

RA 23h 57m 24s • Dec +56° 42' 30"

At approximately 7 600 light-years, it is a richly populated old cluster of ~1 000 stars. Its popular name derives from the rose-like pattern of its stellar chains.

smart telescope imaging

Extra long integration with a dual-band filter reveals faint HII background emission. Combine both type of capture for the best rendering.

★ NGC 1528

NGC 1528

Open cluster

Mag. 6.4 • angular size 24'

RA 04h 15m 19s • Dec +51° 12' 41"

A bright, rich open cluster in Perseus, often overlooked. It is set against a nice background star field which is one of its key attraction.

Smart telescope imaging

Quick and rewarding , a short integration reveals the cluster and its rich surroundings.

EMISSION NEBULAE / HII REGIONS

♥ California Nebula

NGC 1499

HII region / Emission nebula

Mag. 6.0 • angular size 150' × 40'

RA 04h 03m 14s • Dec +36° 25' 00"

The California Nebula is a spectacular HII region in Perseus whose elongated, irregular shape resembles the state of California. It is one of the largest emission nebulae in the sky by angular size.

Smart telescope imaging

Given its large extend, the full California Nebula requires the mosaic mode. A dual-band filter is also usefull, without it, the low surface brightness emission is lost against the sky background.

♥ Elephant Trunk Nebula

IC 1396

Emission Nebula

Mag. 9.5 • angular size 3°

RA 21h 38m 58s • Dec +57° 29' 20"

IC 1396 is a vast HII region in Cepheus, one of the largest emission nebulae in the northern sky by angular size. At a distance of approximately 2,400 light-years, the nebula physically spans about 100 light-years. The central hot blue star of the region ionizes the surrounding hydrogen and sculpts the dense molecular pillars visible at the nebula's periphery.

The most famous feature within IC 1396 is the Elephant's Trunk (IC 1396A), a prominent cometary globule, a dense, pillar-shaped region of gas and dust pointing toward the central star, with a bright-rimmed head where star formation is actively triggered.

Smart telescope imaging

While the Elephant Trunk itself can fit the native field of view of smart telescopes, mosaic mode is required for complete coverage of IC1396. A dual-band filter is strongly recommended , it brings out the H α emission of the ionized region and the OIII component of the inner cavity simultaneously.



ELEPHANT TRUNK NEBULA

Vaonis Vespera 2

Total integration time 21h

Mosaic mode

Bortle 6/7

Credit: Frederic Courteix

♥ Pacman Nebula

NGC 281
HII region / Emission nebula
Mag. 7.5 • angular size 35' × 30'
RA 00h 52m 59s • Dec +56° 37' 19"

The Pacman Nebula is one of the most recognizable HII regions in Cassiopeia, named for the video game character whose round open mouth is suggested by the dark Bok globules silhouetted against the bright emission background. NGC 281 lies at approximately 9,200 light-years, in the Perseus Arm.

Smart telescope imaging

A great narrowband target, dual-band filter is strongly recommended.

Wizard Nebula

NGC 7380
Cluster + nebula
Mag. 7.2 • angular size 25' × 20'
RA 22h 47m 21s • Dec +58° 07' 57"

The Wizard Nebula is an HII region and embedded open cluster in Cepheus. At approximately 7,000 light-years, it is a moderately compact star-forming region.

For smart telescope imaging

A good dual-band target.

★ Question Mark / Teddy Bear Nebula

NGC 7822
HII region / Emission nebula
Angular size 3°
RA 00h 03m 35s • Dec +67° 09' 42"

NGC 7822 is a very large emission nebula and cluster complex in Cepheus (with the southern point of the "question mark" extending into Cassiopeia), at approximately 3,000 light-years. The nebula shows a pillar structure in narrowband images, with dense

molecular fingers pointing toward the central cluster. Its popular names alternate between "Question Mark" (in wide-field images) and "Teddy Bear" (at closer focal lengths).

Smart telescope imaging

A dual-band filter is needed. Mosaic mode makes it possible to capture the most photogenic portion of the complex.

★ Cave Nebula

Caldwell 9
Emission nebula
Mag. 7.7 • angular size 50' × 30'
RA 22h 57m 00s • Dec +62° 37' 00"

Caldwell 9 is a complex emission region in Cepheus at approximately 2 500 light-years, combining HII emission with reflection and dark nebulosity in a compact field.

Smart telescope imaging

Both broadband and dual-band capture are worth combining. Broadband captures the reflection component, narrowband the emission.

★ Great Lacerta Nebula

Sh 2-126
HII region / Emission nebula
Angular size 160' × 160'
RA 22h 34m 38s • Dec +40° 40' 00"

Sh2-126 is one of the least-observed emission nebulae in the northern sky. At approximately 1 200 light-years in Lacerta. Its large angular size and extremely low surface brightness make it a genuine challenge even for experienced imagers.

Smart telescope imaging

A dual-band narrowband filter is essential. The full nebula requires mosaic mode. This is a project for experienced imagers with exceptional dark skies.

WIZARD NEBULA

This image shows the Wizard Nebula, a complex of interstellar dust and gas. It features a bright, irregularly shaped central region with a mix of pink, purple, and blue hues. The surrounding space is filled with numerous stars of varying brightness, creating a dense field of light points against the dark background of space.

Vaonis Vespera Pro

Total integration time 16h30

Credit: Vaonis Imaging Club /

Ian Baber

QUESTION MARK NEBULA

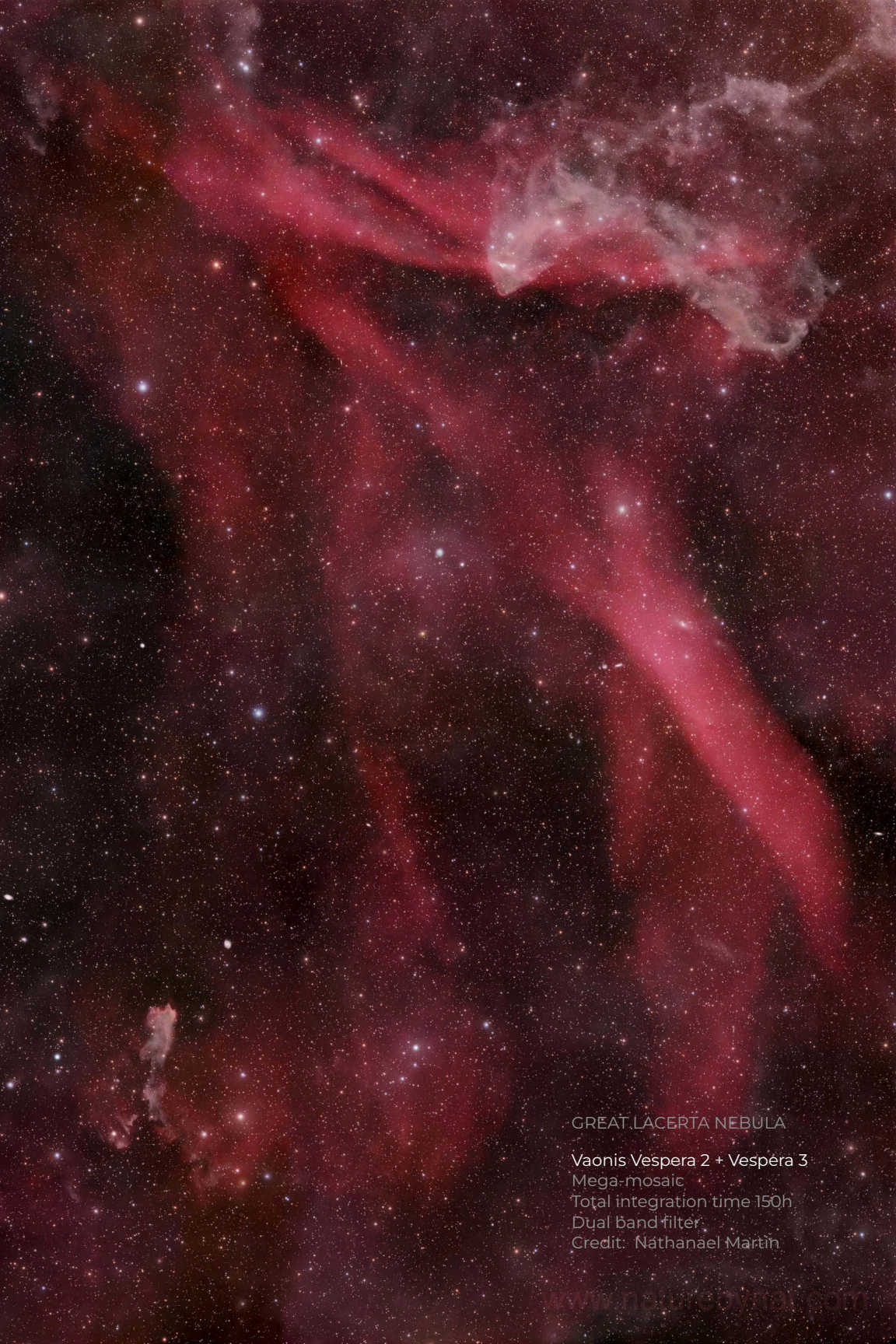
This image shows the Question Mark Nebula, a large, irregularly shaped nebula with a complex, filamentary structure. It is primarily composed of reddish-orange and brownish hues, with darker, more opaque regions interspersed throughout. The nebula's shape is somewhat reminiscent of a question mark, with a large, rounded body and a long, trailing tail. The background is filled with a dense field of stars, providing a stark contrast to the nebula's glowing structure.

Vaonis Vespera 3

Total integration time 16h

Mosaic mode • dual band filter

Credit: Daniel Lopez Baptista



GREAT LACERTA NEBULA

Vaonis Vespera 2 + Vespera 3
Mega-mosaic
Total integration time 150h
Dual band filter
Credit: Náthanael Martín

Little Pacman Nebula

NGC 1491

HII region / Emission nebula

Mag. 9.5 • angular size 9' × 6'

RA 04h 03m 14s • Dec +51° 18' 58"

A compact, moderately bright HII region in Perseus.

Smart telescope imaging

A dual-band filter greatly enhances the emission.

Little Rosette Nebula

Sh 2-170

HII region / Emission nebula

Mag. 6.5 • angular size 50'

RA 00h 01m 29s • Dec +64° 39' 03"

The Little Rosette is a compact HII region in extreme northern Cassiopeia, nicknamed the "Little Rosette" for its structural resemblance to the larger Rosette Nebula in Monoceros. At approximately 7,500 light-years, it is a modest-sized star-forming region with a nearly circular emission ring.

Smart telescope imaging

A dual-band filter is needed for this low-surface-brightness target.

PLANETARY NEBULA

★ Firefox / Dolphin Nebula

Sh 2-188

Planetary nebula

Mag. 11 • angular size 9'

RA 01h 30m 33s • Dec +58° 24' 50"

This should not be confused with Barnard 252 (the dark "Dolphin Nebula" in Scorpius). The Sh2-188 "Dolphin nebula" is a completely unrelated planetary nebula in Cassiopeia. Unlike a typical spherically symmetric planetary nebula, Sh2-188 shows

a bright, curved leading edge and a fainter trailing tail.

Smart telescope imaging:

A challenging low-surface-brightness target. A dual-band filter and long integration are needed.

REFLECTION NEBULAE

♥ Iris Nebula

C4 • NGC 7023

Reflection nebula + dark clouds

Mag. 6.8 • angular size 18' × 18'

RA 21h 01m 35s • Dec +68° 10' 10"

The Iris Nebula is a popular reflection nebula in the rich constellation of Cepheus, but it is not an easy target. The bright core is relatively compact, yet it is embedded within the Cepheus Flare molecular-cloud complex, a large-scale structure of cold molecular gas and dust. In very deep broadband integrations, the dark filaments surrounding the bright blue nebula emerge from the background, creating a striking cosmic landscape.

Smart telescope imaging

No filter is the primary mode. Medium Integration reveals the central blue nebulosity cleanly. Longer integration is required to reveal the faint surrounding dark nebulae, the most rewarding part of the composition. The central star HD 200775 (magnitude 7.1) will be visible as a bright point within the nebula. Mosaic mode is recommended to reveal the dark nebula surroundings in their full extent.



IRIS NEBULA WIDE FIELD

Vaonis Vespera 2

Total integration time 16h

Mega-mosaic

Bortle 4

Credit: Susan Fortney

★ vdB 15 (+ surrounding dark cloud)

Reflection nebula

Angular size 30'

RA 03h 29m 50s · Dec +59° 52' 40"

Smart telescope imaging

Broadband only (no filter). Mosaic mode is recommended to show it alongside vdB 14 and the surrounding dark cloud context.

★ vdB 14

Reflection nebula

Angular size 20'

RA 03h 31m 10s · Dec +50° 45' 00"

vdB 14 is a companion reflection nebula to vdB 15, also in Camelopardalis.

SUPERNOVA REMNANT

★ Garlic Nebula

SNR G116.9+0.2

Supernova remnant

Mag. 13 · angular size 45'

RA 23h 59m 18s · Dec +62° 25' 00"

The Garlic Nebula is a rarely imaged supernova remnant in Cassiopeia at an estimated distance of approximately 10 000 light-years. Its popular name comes from its roughly ovoid shape, similar to a garlic bulb.

Smart telescope imaging

This is a very demanding "trophy target". It requires very long integrations to reveal any structure. Its surface brightness is among the lowest of any object in this guide. A dual-band filter is absolutely essential.

GALAXIES

★ Hidden Galaxy

C 5 · IC 342

Galaxy

Mag. 9 · angular size 19'

RA 03h 46m 48s · Dec +68° 05' 47"

IC 342 (Camelopardalis) would be one of the brightest galaxies in the sky if it weren't hidden. Its popular name reflects the fundamental obstacle to its observation: it lies almost exactly behind the dust plane of the Milky Way, which gives its images a warm, slightly reddish cast compared to unobscured galaxies. If the Milky Way's dust were absent, IC 342 would appear as one of the most spectacular galaxies in the sky.

THE HIDDEN GALAXY

Vaonis Vespera 2 X_edition

Total integration time 2h30



Cygnus · Lyra · Vulpecula · Aquila · Sagitta

Visibility by Latitude



The diagram does not fully reflect Aquila's visibility. Its declination is significantly lower than the other constellations and at high northern latitudes its observing window is shorter and conditions less favorable while they are better at low latitudes.

To get started

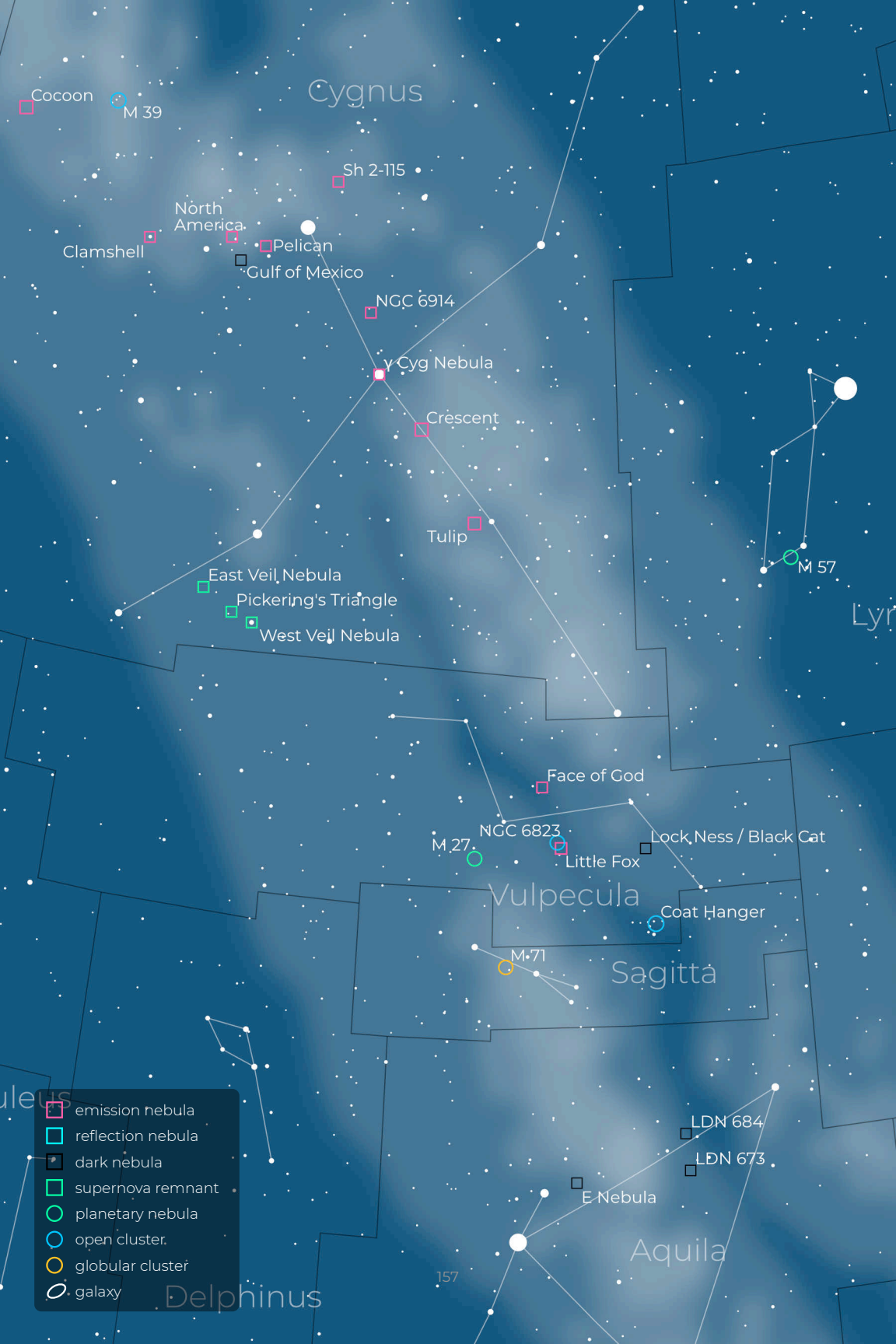
North America Nebula
(Cyg) · Veil Nebula (Cyg) ·
Dumbbell Nebula (Vul)

Go off the beaten path

Little Fox Nebula (Vul) ·
Sadr Region (Cyg) · LDN
673 Dark Nebula (Aql)

Challenge yourself

Cocoon Nebula (Cyg) ·
Face of God Nebula (Vul) ·
Barnard's E Nebula (Aql)



Cosmic scene index

North America, Gulf of Mexico & the Pelican

The Veil Nebula, Cygnus Loop

The Sadr Region, IC 1318 & NGC 6914

The Aquila Rift

Little Fox & Cluster

Target index

♥	Crescent Nebula	Emission nebula / HII region	Cygnus
♥	Tulip Nebula	Emission nebula / HII region	Cygnus
★	Little Fox Nebula	Emission nebula / HII region	Vulpecula
♥	North America Nebula	Emission nebula / HII region	Cygnus
	Pelican Nebula	Emission nebula / HII region	Cygnus
★	Gamma Cygni Nebula (Sadr)	Emission nebula / HII region	Cygnus
★	Clamshell Nebula	Emission nebula / HII region	Cygnus
★	Cocoon Nebula	Emission nebula / HII region	Cygnus
	Sh 2-115	Emission nebula / HII region	Cygnus
★	NGC 6914 Nebula complex	Mixed nebula	Cygnus
	Face of god Nebula	Mixed nebula	Vulpecula
	Gulf of Mexico	Dark nebula	Cygnus
★	Lock ness monster / black cat	Dark nebula	Vulpecula
	E nebula	Dark nebula	Aquila
	LDN 673	Dark nebula	Aquila
	LDN 684	Dark nebula	Aquila
♥	Western Veil / Witch's Broom	Supernova remnant	Cygnus

♥	Eastern Veil	Supernova remnant	Cygnus
♥	Pickering's Triangle (Veil Nebula)	Supernova remnant	Cygnus
♥	Dumbbell Nebula	Planetary nebula	Vulpecula
	Ring Nebula	Planetary nebula	Lyra
	Pyramid Cluster	Open cluster	Cygnus
	NGC 6823	Open cluster	Vulpecula
	Angelfish Cluster (often used)	Globular cluster	Sagitta
	Coathanger Cluster (Brocchi's Cluster)	Asterism	Vulpecula

The constellations

Cygnus

Cyg · Swan · Cygne

Cygnus is one of the great constellations of the northern summer and autumn sky, its distinctive Northern Cross asterism straddling the Milky Way at the point where the galactic plane splits into the Great Rift. Its brightest star Deneb (magnitude 1.25) is one of the most intrinsically luminous stars known.

The Milky Way in Cygnus is extraordinarily rich: the North America and Pelican Nebulae (NGC 7000 / IC 5070), the complete Veil Nebula supernova remnant, the Crescent Nebula (NGC 6888), the Tulip Nebula (Sh2-101) with nearby Cygnus X-1, the Gamma Cygni emission complex (IC 1318), the Cocoon Nebula (IC 5146), the Clamshell Nebula (Sh2-119), and several smaller HII regions. It concentrates many iconic narrowband targets.

Lyra

Lyr · Lyre · Lyre

Lyra is a small but famous constellation, home to Vega, magnitude 0, the fifth-brightest star in the night sky and the brightest member of the Summer Triangle. Vega lies only about 25 light-years away. Lyra also contains the Ring Nebula, M57, one of the textbook examples of a ring-shaped planetary nebula.

Vulpecula

Vul · Little Fox · Petit Renard

Vulpecula is a faint constellation sandwiched between Cygnus and Sagitta, containing no star brighter than magnitude 4.4. Yet it hosts the Dumbbell Nebula (M27), the brightest planetary nebula in the sky.

Aquila

Aql · Eagle · L'Aigle

Aquila is a prominent summer constellation dominated by Altair, magnitude 0.8, the twelfth-brightest star in the night sky and the nearest of the Summer Triangle stars at just 17 light-years. Aquila's most distinctive deep-sky feature is the Aquila Rift, a section of the Great Rift where foreground dust clouds create a prominent dark lane visible to the naked eye against the Milky Way. The constellation showcases several interesting dark-nebula fields, including Barnard 142/143, the "E Nebula" and the LDN 673/684 complex.

Sagitta

Sge · Arrow · Flèche

Sagitta is the third-smallest constellation, located between Cygnus and Aquila. It contains the star cluster M71.

The Great Rift and the Inner Northern Milky Way.

Looking through Cygnus and Aquila means pointing the telescope into one of the richest and most complex sections of the Galactic plane. The line of sight passes through several distinct structures at once: nearby dark clouds a few hundred light-years away, bright nebulae and supernova remnants a few thousand light-years deep, and more distant massive star-forming regions embedded in the Cygnus Milky Way.

The Great Dark Rift.

The dark lane that visually splits the Milky Way from Cygnus through Aquila is not an emptiness, but a foreground curtain of interstellar dust clouds. These clouds lie at different distances, often a few hundred light-years away, and absorb the light of the richer stellar background behind them. In Cygnus, LDN 935 forms the dark "Gulf of Mexico" between the North America and

Pelican Nebulae. Farther along the Rift, in Aquila, Barnard 142/143, LDN 673, and LDN 684 trace dense dusty structures within the Aquila Rift.

The nearby Cygnus.

The North America and Pelican Nebulae, NGC 7000 and IC 5070, lie about 2,600 light-years away in the Local Orion–Cygnus Arm environment. The Veil Nebula is at a comparable distance, about 2,400 light-years, but it is a very different object: the expanding remnant of a supernova explosion in our Galactic neighborhood. Together, these targets show how a single region of sky can contain both active ionized nebulae and the fossil shock waves of a dead massive star.

The deeper Cygnus star-forming layers.

Farther behind the foreground dust and nearby nebulae lie the massive-star-forming regions of Cygnus. Objects such as the Crescent Nebula and the Tulip Nebula are associated with the rich Cygnus OB environment, where hot massive stars, stellar winds, and ionized gas dominate the landscape. Other targets, such as the Cocoon Nebula and Sh2-115, add further depth to the scene, though their distances and associations are less uniform than they may appear in wide-field images.

Cosmic Scenes

♥ North America, Gulf of Mexico & the Pelican

The North America Nebula (NGC 7000) and the Pelican Nebula (IC 5070) are two portions of the same vast HII region separated in visible-light appearance by the dark foreground molecular cloud LDN 935 (known as the "Gulf of Mexico"). In radio and infrared wavelengths, LDN 935 is transparent and the full continuity of the underlying emission structure is visible. All three objects are physically related.

Smart telescope imaging

Together, the two nebulae cover a total field that barely fits a mosaic capture. A mega-mosaic of two panels provides a better composition.

The most dramatically structured portion of the entire scene is the Cygnus Wall, the bright eastern rim of the North America Nebula corresponding to the eastern seaboard of the continental silhouette.

♥ North America Nebula

Caldwell 20 • NGC 7000

HII region / Emission nebula

Mag. 4 • angular size 120' × 100'

RA 20h 59m 17s • Dec +44° 31' 44"

The North America Nebula measures roughly 90–100 light-years across at a distance of about 2,600 light-years. The Cygnus Wall is the bright active rim where ultraviolet radiation and stellar winds from massive stars encounter denser molecular-cloud material, sculpting and compressing the gas.

Smart telescope imaging

A dual-band filter is strongly recommended, dramatically enhancing the H α emission of the entire field and the OIII emission of the inner ionized regions.

Gulf of Mexico

LDN 935

Dark nebula

Angular size 60' × 30'

RA 20h 55m 00s • Dec +44° 15' 00"

This is the foreground dark molecular cloud that creates the visual "Gulf of Mexico" between NGC 7000 and IC 5070. LDN 935 absorbs virtually all visible light from the underlying HII region behind it. In radio and infrared images, LDN 935 is transparent and the Sh2-117 emission region appears continuous beneath it.



NORTH AMERICA & PELICAN
NEBULAE

Vaonis Vespera 2

Total integration time 15h

Mosaic mode · dual band filter

Bortle 4

Credit: Stephen Paterson

Pelican Nebula

IC 5070

HII region / Emission nebula

Mag. 8 • angular size 60' × 50'

RA 20h 50m 48s • Dec +44° 24' 00"

The Pelican Nebula is the western portion of the North America / Pelican HII complex physically continuous with NGC 7000 beneath the obscuring LDN 935.

The Pelican is particularly famous for one specific region near the "pelican's beak" featuring dense pillars where active star formation is occurring.

♥ The Veil Nebula / Cygnus Loop

The Veil Nebula is the most spectacular supernova remnant in the northern sky, a vast, intricate web of shocked filaments spanning approximately 3° in diameter, the remnant of a stellar explosion that occurred approximately 10,000–20,000 years ago in our galactic neighborhood. It remains one of the finest large-scale nebular structures accessible to smart telescopes.

At approximately 2,500 light-years, the Cygnus Loop physically spans 50–65 light-years in diameter. Multiple bright optically-visible sections are grouped within the same 3° circle: the Western Veil (NGC 6960, also called the Witch's Broom), the Eastern Veil (NGC 6992, NGC 6995, IC 1340), and Pickering's Triangle at the northern rim. Fainter components (NGC 6974, NGC 6979) complete the loop structure between these brighter arcs.

Smart telescope imaging

The full Cygnus Loop requires a mosaic to capture the Western Veil, Eastern Veil, and Pickering's Triangle together. Individual sections also make outstanding standalone subjects.

A dual-band narrowband filter (H α /OIII) is recommended. The leading OIII edge and the trailing H α emission create the characteristic color split.

Western Veil / Witch's Broom

Caldwell 34 • NGC 6960

Supernova remnant

Mag. 7 • angular size 70' × 6'

RA 20h 45m 38s • Dec +30° 42' 30"

The Western Veil is the most immediately striking section of the Cygnus Loop, a long, sinuous arc of glowing filaments running nearly north-south for approximately 1.2° of sky, passing directly behind the foreground star 52 Cygni (magnitude 4.2), which is physically unrelated to the supernova remnant at approximately 230 light-years compared to the Veil's 2,500 light-years.

The Witch's Broom shows one of the clearest demonstrations of dual-emission shock physics accessible to smart telescope imaging: the forward edge of the expanding shock wave glows strongly in OIII (blue-green), where collisional excitation is hottest, while the trailing wake of cooled gas emits in H α (red).

Eastern Veil

Caldwell 33 • NGC 6992 • NGC 6995

Supernova remnant

Mag. 7 • angular size 60' × 8'

RA 20h 56m 19s • Dec +31° 43' 00"

The Eastern Veil is the longest single section of the Cygnus Loop and the most structurally complex. It reveals a fine network of interwoven filaments resulting from the shock wave's interaction with density inhomogeneities in the surrounding interstellar medium.

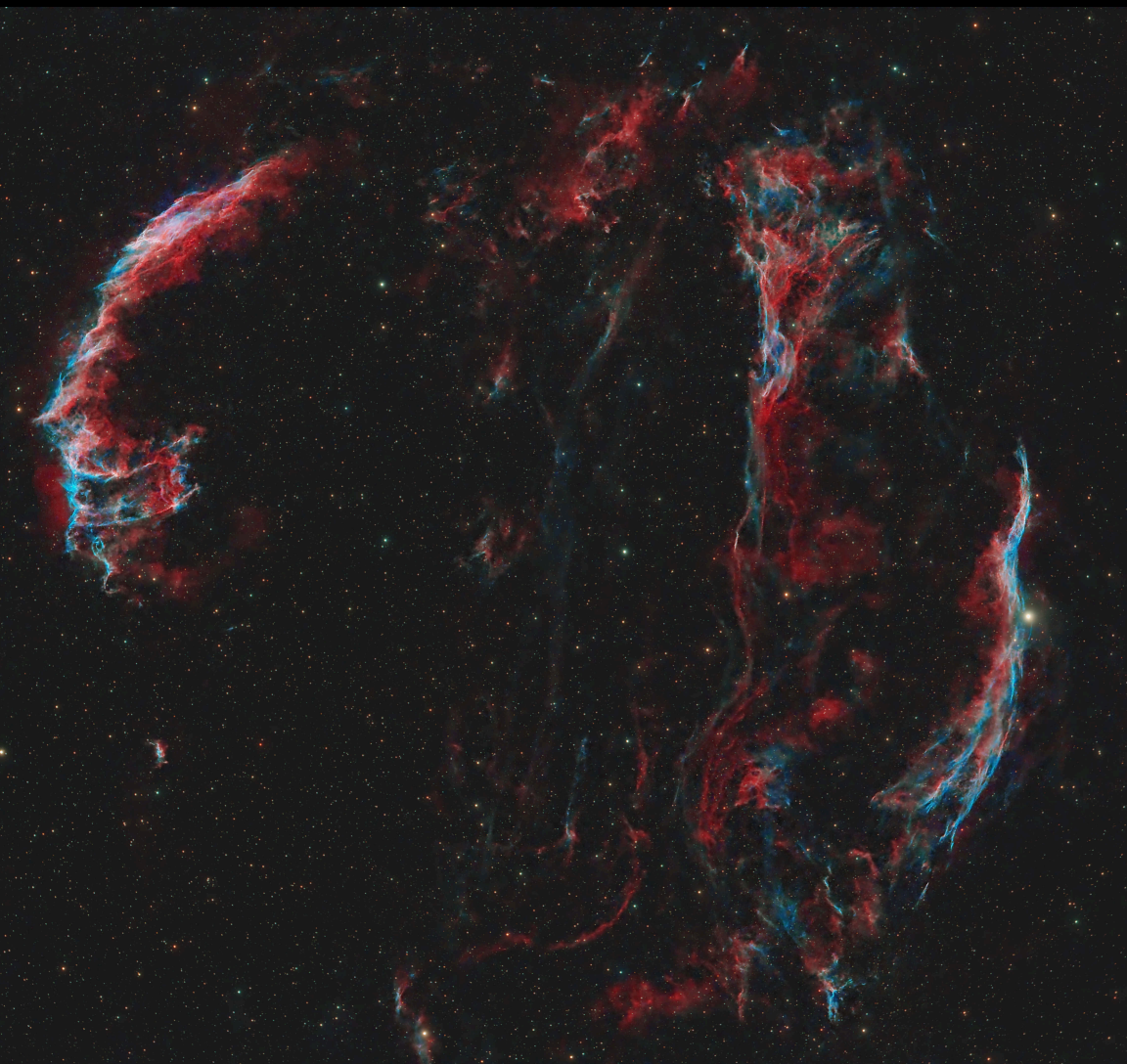
Pickering's Triangle

Supernova remnant

Angular size 60'

RA 20h 51m 00s • Dec +31° 55' 00"

Pickering's Triangle is the faintest section of the Veil Nebula. It bridges the gap between the Western and Eastern Veil in the complete loop composition.



THE CYGNUS LOOP

Vaonis Vespera 2

Total integration time 15h

Mosaic mode - dual band filter

Bortle 4

The Sadr Region, IC 1318 & NGC 6914

In the heart of Cygnus, surrounding the bright star Sadr (Gamma Cygni, magnitude 2.2), a vast canvas of emission and reflection nebulosity fills the galactic plane. The Gamma Cygni Nebula (IC 1318) is an immense emission complex whose multiple lobes surround Sadr on all sides.

★ Gamma Cygni Nebula / Sadr Region

IC 1318

Emission nebula

Angular size 3.5° × 2°

RA 20h 26m 06s · Dec +40° 39' 38"

The Gamma Cygni Nebula surrounds Sadr with a multi-lobed HII emission field, divided into distinct components (IC 1318a, b, and c, plus additional subregions) by dark absorbing lanes. The overall structure represents the ionized gas environment of the Cygnus OB association surrounding Sadr.

smart telescope imaging

IC 1318 requires mosaic mode and even a mega-mosaic for complete coverage. A dual-band narrowband filter is essential for revealing the full extent of the HII emission against the dense Cygnus star field.

★ Reflection Complex

NGC 6914

Reflection + Emission nebula

Angular size 20'

RA 20h 24m 45s · Dec +42° 22' 00"

NGC 6914 is a complex of reflection nebulae embedded within the broader Gamma Cygni Nebula. The reflection component, illuminated by hot OB stars creates a blue patch within the surrounding red H α emission.

Smart telescope imaging

The dual-component nature of NGC 6914 requires a hybrid approach: broadband (no filter) imaging captures the blue reflection component; dual-band narrowband captures the surrounding emission.

The Aquila Rift

In northern Aquila, near the bright star Tarazed (magnitude 2.7), three complexes belonging to the Aquila Rift offer some interesting dark nebulae.

The group's centerpiece is Barnard's E (Barnard 142/143). LDN 673 and LDN 684, nearby dark cloud companions, add further dark structure to the broader Aquila Rift landscape. All three objects belong to the same molecular cloud environment, though at somewhat different estimated distances.

★ Barnard's E Nebula

Barnard 142 · Barnard 143

Dark nebula

Angular size 45' × 65'

RA 19h 40m 42s · Dec +10° 57' 00"

Barnard's E is one of the most famous dark nebulae, recognized for its unmistakable letter-E silhouette. The pair consists of two distinct dark clouds catalogued separately: Barnard 143 (the darker, dominant component to the north) forms the upper horizontal bar and the central arm of the E. Together the pair spans roughly the size of a full Moon. The E spans several tens of light-years in physical extent.

Smart telescope imaging

Every additional minute of integration accumulates more background stars, increasing the contrast of the dark silhouette.

★ LDN 673

Dark nebula

Angular size 35' × 50'

RA 19h 21m 00s • Dec +11° 03' 00"

LDN 673 is a dense, fractured dark cloud complex in the Aquila Rift, at approximately 300–600 light-years. It presents a chaotic landscape of interlocking dark filaments and opaque cores, creating a rich internal texture that rewards deep integration.

Smart telescope imaging

Long observation time reveals the full internal complexity of the cloud's filamentary structure. Best presented alongside LDN 684 in a large mosaic covering the broader northwestern Aquila Rift context.

LDN 684

Dark nebula

Angular size 25' × 60'

RA 19h 23m 00s • Dec +10° 45' 00"

LDN 684 is the elongated companion dark cloud to LDN 673, immediately adjacent to its south in the Aquila Rift environment. Its elongated shape creates a distinctly different silhouette from LDN 673.

Smart telescope imaging

Frame alongside LDN 673.

Little Fox & Cluster

In Vulpecula, the compact open cluster NGC 6823 sits embedded within the surrounding emission nebula NGC 6820 (the Little Fox Nebula), forming a natural pair in which the cluster's OB stars ionize the surrounding gas. Both objects are physically associated at approximately 6,000 light-years.

What makes this pairing particularly compelling for imagers is the presence of prominent pillar structures within NGC 6820, comparable in character (though smaller in scale) to the Pillars of Creation in M16.

★ Little Fox Nebula

NGC 6820

Emission nebula

Mag. 13 • angular size 40'

RA 19h 43m 00s • Dec +23° 10' 00"

NGC 6820 is a compact but structurally rich emission nebula in Vulpecula, best known for the dramatic pillar structures visible in deep narrowband images. These pillars sculpted by the cluster's ultraviolet radiation and stellar winds, are the visual centerpiece of the nebula.

Smart telescope imaging

The nebula's surface brightness is considerably lower than its magnitude of 13 suggests. As a consequence, long integration is required.

A dual-band filter is essential, enhancing the H α emission dramatically and revealing the pillar structures against the surrounding field. The full nebula fits in the native field of view of most smart telescopes yet it deserves a mosaic capture for more context since the nebula is surrounded by a broader HII complexe (Sh2-86).

DARK NEBULA COMPLEX IN
AQUILA

Vaonis Vespera 2 X_edition
Total integration time: 5h.
Mosaic mode.
Bortle 4.



NGC 6823

NGC 6823

Open cluster

Mag. 7.1 • angular size 6'

RA 19h 43m 09s • Dec +23° 18' 00"

NGC 6823 is a young, compact open cluster physically embedded within the surrounding NGC 6820 nebula. The cluster's hot O-type and B-type members are the ionizing engines of the surrounding emission nebula.

Individual Targets

EMISSION NEBULAE / HII REGIONS

♥ Crescent Nebula

Caldwell 27 • NGC 6888

HII region / Emission nebula

Mag. 7.4 • angular size 20' × 10'

RA 20h 12m 07s • Dec +38° 21' 18"

The Crescent Nebula is a visually distinctive object in the Cygnus: a luminous, crescent-shaped arc of ionized gas inflated by the stellar wind of the central Wolf-Rayet star.

At approximately 5,500 light-years Caldwell 27 physically spans approximately 25 light-years. The crescent shape was created in two phases: A red giant first ejected its outer layers, creating a slow-moving outer shell. Then, in its Wolf-Rayet phase, it drives a fast wind that has overtaken and energized the earlier-ejected material.

Smart telescope imaging

The Crescent Nebula demands a dual band filter. The crescent's inner edge glows brightly in OIII (blue-green), while H α emission fills the outer shell wall (red).

★ Tulip Nebula

Sh 2-101

HII region / Emission nebula

Mag. 9 • angular size 16' × 9'

RA 20h 00m 29s • Dec +35° 19' 14"

The Tulip Nebula, Sh2-101, is a compact, bright HII region in Cygnus, located roughly 6,000 light-years away. It lies in a region of rich surrounding H α emission, which provides a glowing contextual backdrop in wide-field narrowband images.

Another point of interest is its apparent proximity to Cygnus X-1, located about 15' west of the Tulip Nebula in the same imaging field. Cygnus X-1 is a famous microquasar and black hole binary, first identified as one of the strongest black-hole candidates in 1971. Its visible companion, the blue supergiant HDE 226868, can be recorded by smart telescopes.

A faint bow-shock arc is also visible nearby: a curved structure of shock-excited interstellar gas produced where the jet from Cygnus X-1 interacts with the surrounding medium.

Smart telescope imaging

A dual-band filter strongly enhances the Tulip's H α emission. Imaging the Tulip Nebula is your opportunity to observe the effect of a black hole. The Cygnus X-1 bow shock appears within the same imaging frame as the Tulip. Yet it requires exceptional integration time to become visible, northwest of the Tulip.



CRESCENT NEBULA

Vaonis Vespera 2

Total integration time 13h45

Mosaic mode · dual band filter

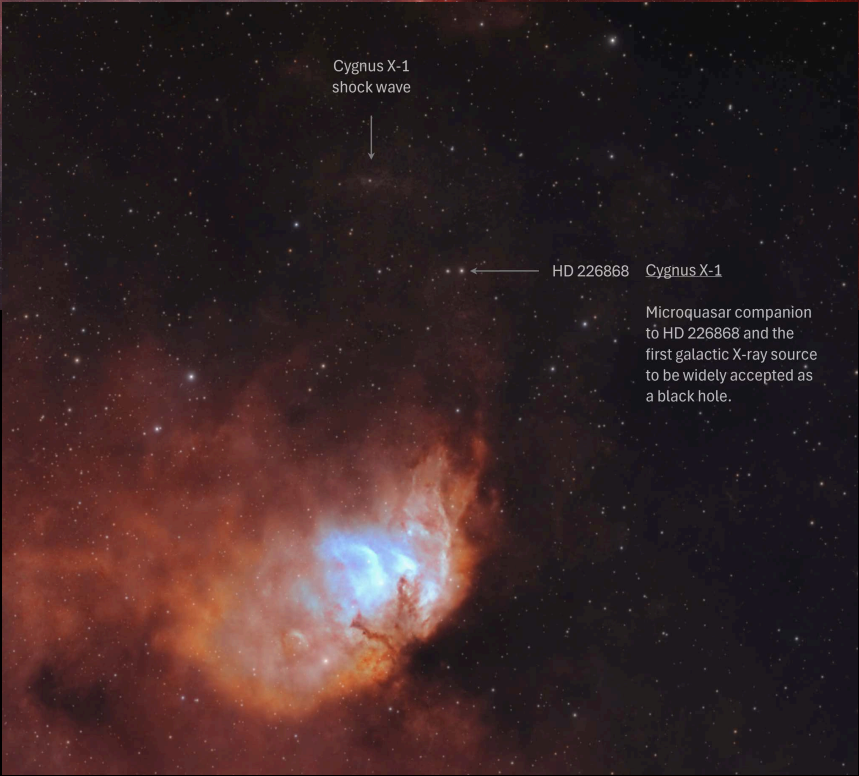
Bortle 3

Credit: Stephen Paterson



TULIP NEBULA

Vaonis Vespera 2
Total integration time 25h40
Mosaic mode · dual band filter
Bortle 3
Credit: Stephen Paterson



Cygnus X-1
shock wave



HD 226868 Cygnus X-1



Microquasar companion
to HD 226868 and the
first galactic X-ray source
to be widely accepted as
a black hole.

★ Cocoon Nebula (with Barnard 168)

IC 5146

Emission nebula / dark nebula

Mag. 7.2 • angular size 12'

RA 21h 53m 28s • Dec +47° 16' 02"

The Cocoon Nebula is a compact but striking emission nebula in northeastern Cygnus, combining H α emission, blue reflection nebosity, and dark absorption in a single field.

One of its most interesting compositional features is the dark nebula Barnard 168, which extends westward from the Cocoon for approximately 3° as a sinuous, elongated dark lane.

Smart telescope imaging

A combination of broadband and dual-band narrowband yields the most complete result: broadband captures the blue reflection and the dark Barnard 168 lane context; narrowband enhances the H α emission. Expect very long acquisition time to really make the most of it.

Mosaic mode is required to frame Barnard 168 along with the Cocoon nebula.

Sh 2-115

HII region / Emission nebula

Angular size 50'

RA 21h 27m 00s • Dec +49° 17' 00"

Sh2-115 is a large HII region split by a dark lane in northern Cygnus at approximately 7,500 light-years.

★ Clamshell Nebula

Sh 2-119

HII region / Emission nebula

Angular size 3°

RA 21h 18m 00s • Dec +43° 57' 00"

The Clamshell Nebula, Sh2-119, is a large, faint HII region in Cygnus, located near the North America and Pelican Nebulae. Spanning roughly 3° across the sky, it forms a broad, low-surface-brightness shell-like emission structure. It receives relatively little attention, partly because of its faint surface brightness and partly because it lies in a region crowded with brighter, more famous Cygnus targets.

Smart telescope imaging

A dual-band filter is essential. The full Clamshell requires a large mosaic capture.

DUMBBELL NEBULA

Vaonis Vespera Pro

Total integration time 6h45

Dual band filter

Credit: Adrien Bougaud



Face of God Nebula

Sh 2-88

Emission + Reflection nebula

Angular size 20'

RA 19h 46m 00s · Dec +25° 18' 00"

Sh2-88 is a compact mixed emission and reflection nebula in Vulpecula hosting both an HII emission component and associated blue reflection nebulosity.

Smart telescope imaging

A hybrid approach works best: dual-band for the emission component; broadband for the reflection extension.

PLANETARY NEBULAE

♥ Dumbbell Nebula

M 27 · NGC 6853

Planetary nebula

Mag. 7.4 · angular size 7'

RA 19h 59m 36s · Dec +22° 43' 16"

The Dumbbell Nebula is the brightest planetary nebula in the sky and the most accessible planetary nebula in the northern hemisphere. It was the first planetary nebula ever discovered, by Charles Messier on 12 July 1764.

At approximately 1,200 light-years M27 is one of the nearest planetary nebulae. Its central white dwarf (magnitude 13.5) produces intense ultraviolet radiation that ionizes the surrounding expelled shell.

Smart telescope imaging

Long-exposure images reveal M27 to be far more complex than its central bright structure: faint outer halos extend, and subtle filamentary structure within the main lobes becomes visible.

A dual-band filter produces M27's most distinctive feature yet the observation is also rewarding without any filter.

Even short integrations produce a striking image. Longer integration develops the faint outer halos and reveals more details.

Ring Nebula

M 57 · NGC 6720

Planetary nebula

Mag. 8.8 · angular size 3'

RA 18h 53m 35s · Dec +33° 01' 45"

The Ring Nebula is the textbook example of a ring-type planetary nebula and among the most popular objects. Yet its small apparent size makes it difficult to appreciate with a smart telescope. The central white dwarf (magnitude ~15.2) is too faint for most smart telescopes.

OPEN CLUSTERS / ASTERISM

Coathanger / Brocchi's Cluster

Collinder 399

Asterism

Mag. 3.6 · angular size 80'

RA 19h 25m 12s · Dec +20° 11' 00"

The Coathanger is one of the most distinctive naked-eye asterisms in the sky. The Coathanger stars are not gravitationally bound: they are a chance alignment of unrelated stars at various distances from approximately 200 to over 1,500 light-years.

Pyramid Cluster

M 39 · NGC 7092

Open cluster

Mag. 4.6 · angular size 30'

RA 21h 32m 12s · Dec +48° 26' 00"

Messier 39 is a bright, loose open cluster in northeastern Cygnus at approximately 1,000 light-years. The cluster contains approximately 30 hot blue stars.

M39 lies against a particularly rich Milky Way background in Cygnus, where the stellar density behind the cluster creates a great deep-sky backdrop for long-exposure images.

GLOBULAR CLUSTER

Angelfish Cluster

M 71 • NGC 6838

Globular cluster

Mag. 8.4 • angular size 7'

RA 19h 53m 46s • Dec +18° 46' 45"

At approximately 13,000 light-years in Sagitta and spanning 27 light-years in physical diameter, M71 is one of the smallest globular clusters.

Smart telescope imaging

The interest of M71 resides in the Sagitta rich star field letting the globular emerge naturally from the dense background rather than treating it as an isolated point source.

DARK NEBULAE

★ Loch Ness Monster / Black Cat

LDN 768 • LDN 769 • LDN 772

Dark nebula

Angular size 120' × 60'

RA 20h 34m 00s • Dec +24° 00' 00"

In southern Vulpecula, three adjacent dark nebulae (LDN 768, 769, and 772) collectively create an elongated, sinuous dark complex nicknamed the "Loch Ness Monster" or "Black Cat" for the creature-like silhouette their combined outline traces against the Milky Way background.



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