

DECEMBER DELIGHTS

The long northern nights at the close of the year offer many opportunities for scanning the skies with small scopes.

Small-Scope

Winter

Wander through winter skies and take in the delightful objects December nights offer.

When it comes to telescopes, the laws of physics tell us bigger is better. Large-aperture scopes collect more light and deliver brighter images. They also resolve finer detail. But physics has a few kind words for small telescopes, too. They're usually lightweight and portable, which makes them ideal for grab-and-go observing. They can also deliver wide fields of view, which enable stargazers to take in more expansive views of the deep sky. Here, we'll embrace this feature of small telescopes and take a tour of the winter Milky Way, where we'll find plenty of vistas that not only look good in a small instrument but appear even better than in a bigger scope.

All stops on this winter sky tour lie within reach of scopes with a focal length of about 480 mm to 700 mm, as in an earlier article on corresponding summer sights (S&T: Aug. 2019, p. 22). For the observations outlined here, I used a Televue 85 refractor (focal length 600 mm). Matched with a 24-mm eyepiece with an apparent field of view of 68°, such scopes deliver true fields of 2.3° to 3.4°, while a similar 35-mm eyepiece delivers 3.4° to 5°. A nebula filter is a big help with some objects, and dark sky is a must to see many of these sights. Hopefully, imagers will also find plenty of ideas.

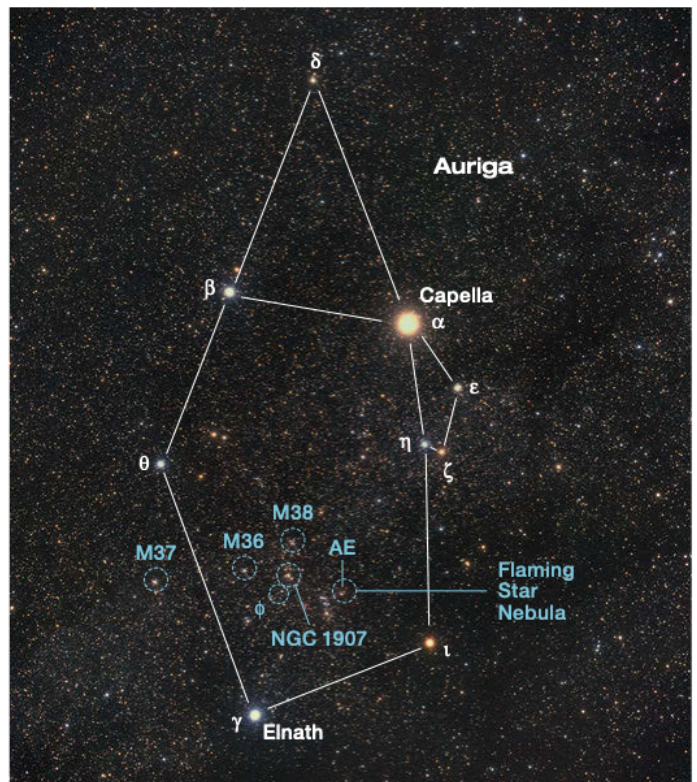
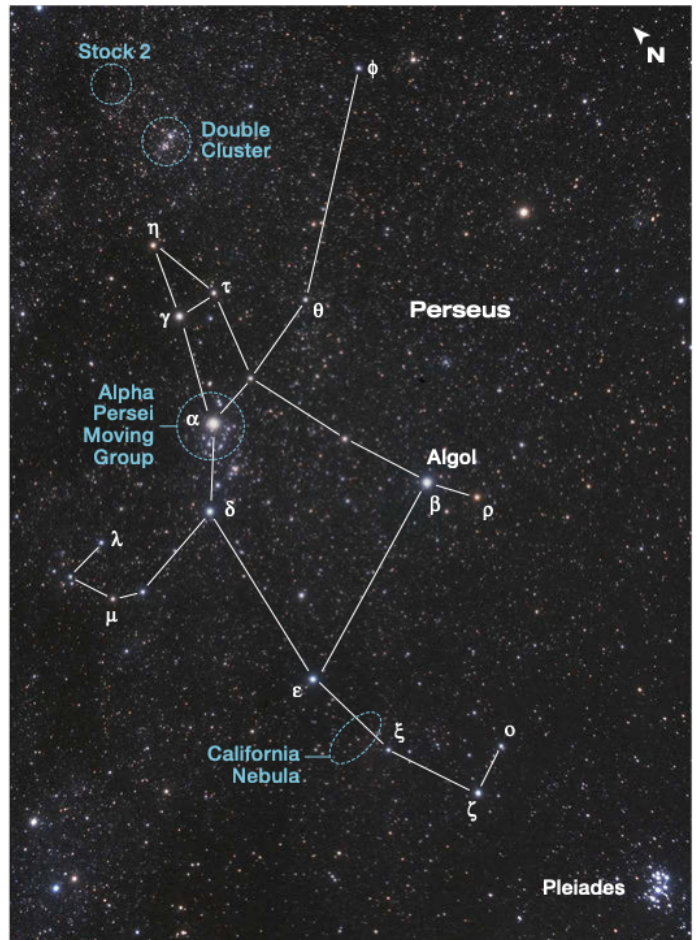
### New Stars and Nebulae in the Northern Milky Way

We begin in the constellation Perseus, the Hero, with one of the finest sights in the northern night sky: the great Perseus **Double Cluster**, NGC 884 and NGC 869. This sparkling pair of open clusters — among the youngest known in the galaxy — presents a rich array of scintillating and colorful stars of sapphire blue, topaz, white, and red-orange. Each cluster contains hundreds of members, some of which are thousands of times more luminous than our Sun. The pair likely formed out of a single molecular cloud in the star-making machinery of the Milky Way's Perseus Arm. The cluster duo is also distant, more than 7,000 light-years away. Were the Double Cluster as close as the Pleiades (at about 446 light-years), the pair would span a quarter of our sky, and many of its stars would shine as bright as Vega.

The Double Cluster is nicely framed in a 2° field of view, but if you can manage a 4° field, look for a string of stars arcing from the eastern edge of the Double Cluster. Follow it north to **Stock 2**, an X-shaped group of uniformly bright

► **THE HERO'S TREASURES** *Top:* Perseus is a great place to start your celestial winter wander — it's already high in the sky as dusk deepens. If you've never laid your eyes on the Double Cluster, now's the time to do it. But don't forget to visit the multitude of other targets.

► **ATTRACTIONS IN AURIGA** *Bottom:* The Charioteer's trio of open clusters — M36, M37, M38 — is always a fun catch on cold winter nights. But that's not all there is to see in the constellation!



stars. Gaze on it for a minute or two and you may see a headless stick figure emerge. Some see these stars as a man flexing his muscles, hence its moniker, the Muscleman Cluster.

A favorite of imagers, the **California Nebula** (NGC 1499) presents a worthy challenge for visual observers. E. E. Barnard discovered it in the mid-1880s with a 6-inch refractor, but he was an acute observer unburdened by electric light pollution. The nebula's low surface brightness calls for extremely dark skies — and possibly a hydrogen-beta filter — for a glimpse in a small scope. This California spans around  $2.5^\circ \times 0.5^\circ$ , but its brightest portions lie about  $\frac{1}{2}^\circ$  to  $1^\circ$  northeast of Menkib, Xi ( $\xi$ ) Persei, the hot star that lights up the nebula.

Look for Mirfak, also known as Alpha ( $\alpha$ ) Persei (the brightest star in Perseus), to see the loosely associated blue-white members of the **Alpha Persei Moving Group** spread across roughly  $4^\circ$ . This collection of stars is also cataloged as Melotte 20 and Collinder 39. The Group's brightest members lie between Alpha and Delta ( $\delta$ ) Persei, and at least a dozen shine brighter than 6th magnitude. See if you can find a long, winding shape of brighter stars that resembles a small sea monster — a mini version of the constellation Cetus, perhaps.

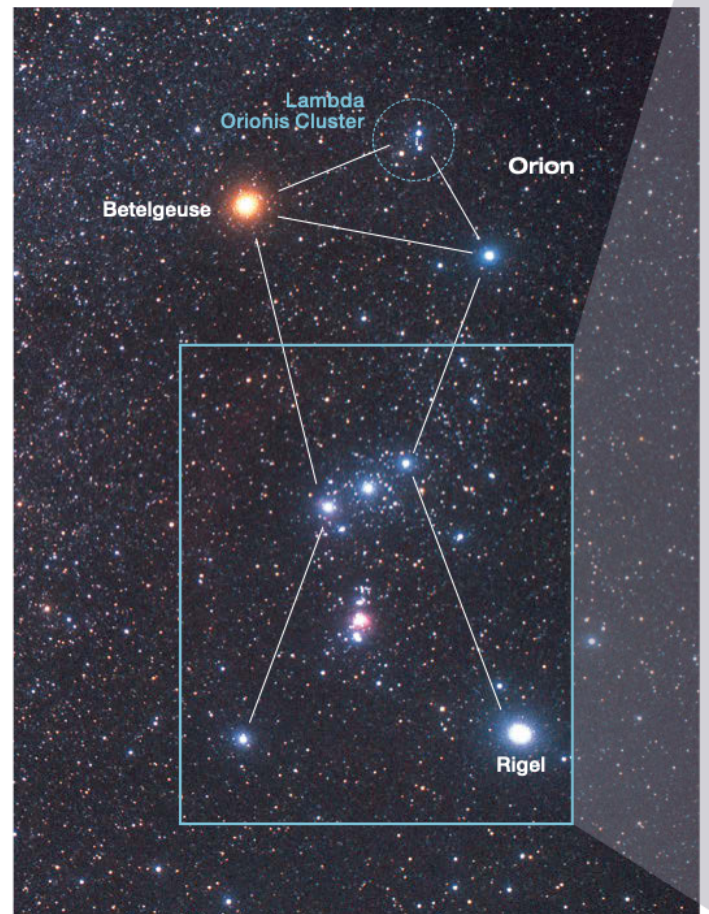


▲ **SHIMMERING SPLENDOR** A perennial favorite, the Pleiades are a delightful sight, especially in small telescopes. The Seven Sisters are a great target for the unaided eye, too. How many stars can you spot without equipment?

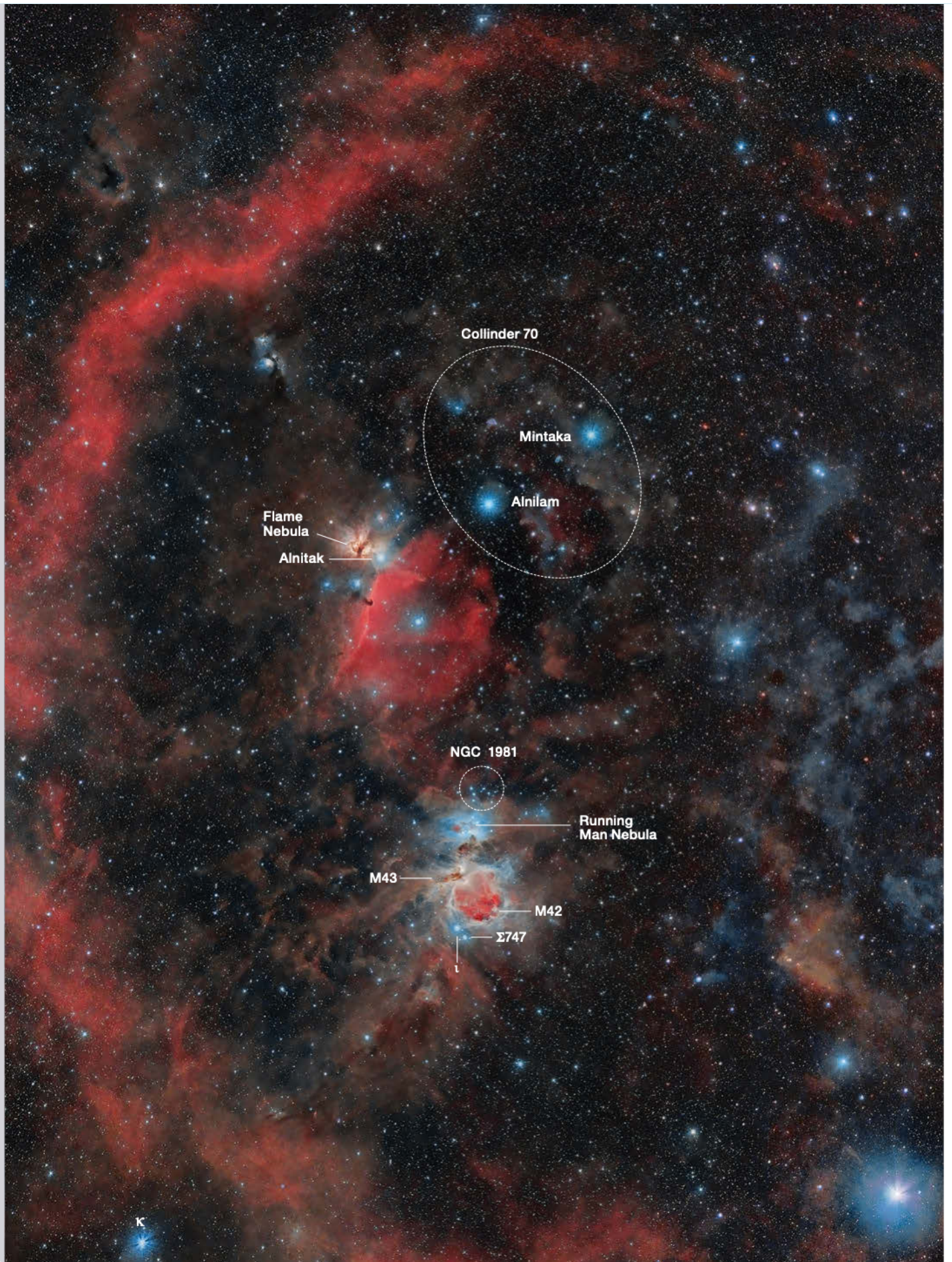
This monster's bulbous head is formed by bright Mirfak and a ring of 6th-magnitude stars, while Sigma ( $\sigma$ ) Persei marks the hump of the beast and Delta pinpoints the tip of the tail.

Let's move eastward now into Auriga, the Charioteer. Its best open cluster, **M37**, is a solitary object. But its companions (also open clusters), **M36** and **M38**, both fit in the same field of view. Spanning just  $10'$ , M36 presents a lovely arrangement of blue-white stars. Dimmer M38 spans about  $20'$  and lies around  $2^\circ$  to the northwest. Both are at a distance of about 4,500 light-years. Just  $\frac{1}{2}^\circ$  south of M36 lies yet another open cluster, the compact, 8th-magnitude **NGC 1907**, a misty patch of unresolved stars. Not quite a degree farther to the southeast lies the 5th-magnitude, honey-hued **Phi ( $\phi$ ) Aurigae**.

If your scope yields a  $5^\circ$  field, position M36 and M38 in the northeast of the view. Now, look for a glimmer of the icy-white mist of the emission nebula IC 405, the **Flaming Star Nebula**, at the southwestern edge of the field just northeast of the star **AE Aurigae**. This runaway star, which was likely ejected from the Trapezium star cluster in the Orion Nebula, is fortuitously passing through a cold cloud of interstellar gas, setting it alight.



▲► **VISTAS IN ORION** Above: The famed Hunter of mythology offers myriad objects upon which to feast your eyes. Right: Perhaps the most famous nebula of all, the Great Orion Nebula, is a perfect place to start your exploration of this iconic constellation.



Across the border into the constellation Taurus, the Bull, we find perhaps the single best star cluster for a small telescope, **the Pleiades**. If only there were more objects like this in the night sky! By chance, this 100-million-year-old cluster is embedded in an interstellar dust cloud. It fits into a 2° to 3° field and presents a delicate lacework of nebulosity to observers with clean optics and a dark sky. The most accessible patch of haze lies largely south of **Merope**, where NGC 1435 (the Merope Nebula) appears frosty-white and barely brighter than the background sky. The nebulosity surrounding **Maia** (NGC 1432) is also within reach of a small scope.

Many multiple stars lie within the Pleiades cluster, which is ideal for low-power viewing. Look for a little triplet of 6th- to 9th-magnitude stars just northwest of **Alcyone**. **Sterope** (sometimes called Asterope) splits easily into a pair of 6th-magnitude stars. Fourth-magnitude **Taygeta** has an 8th-magnitude secondary a little more than 1' to the north-northwest.

### Vistas in Orion and Monoceros

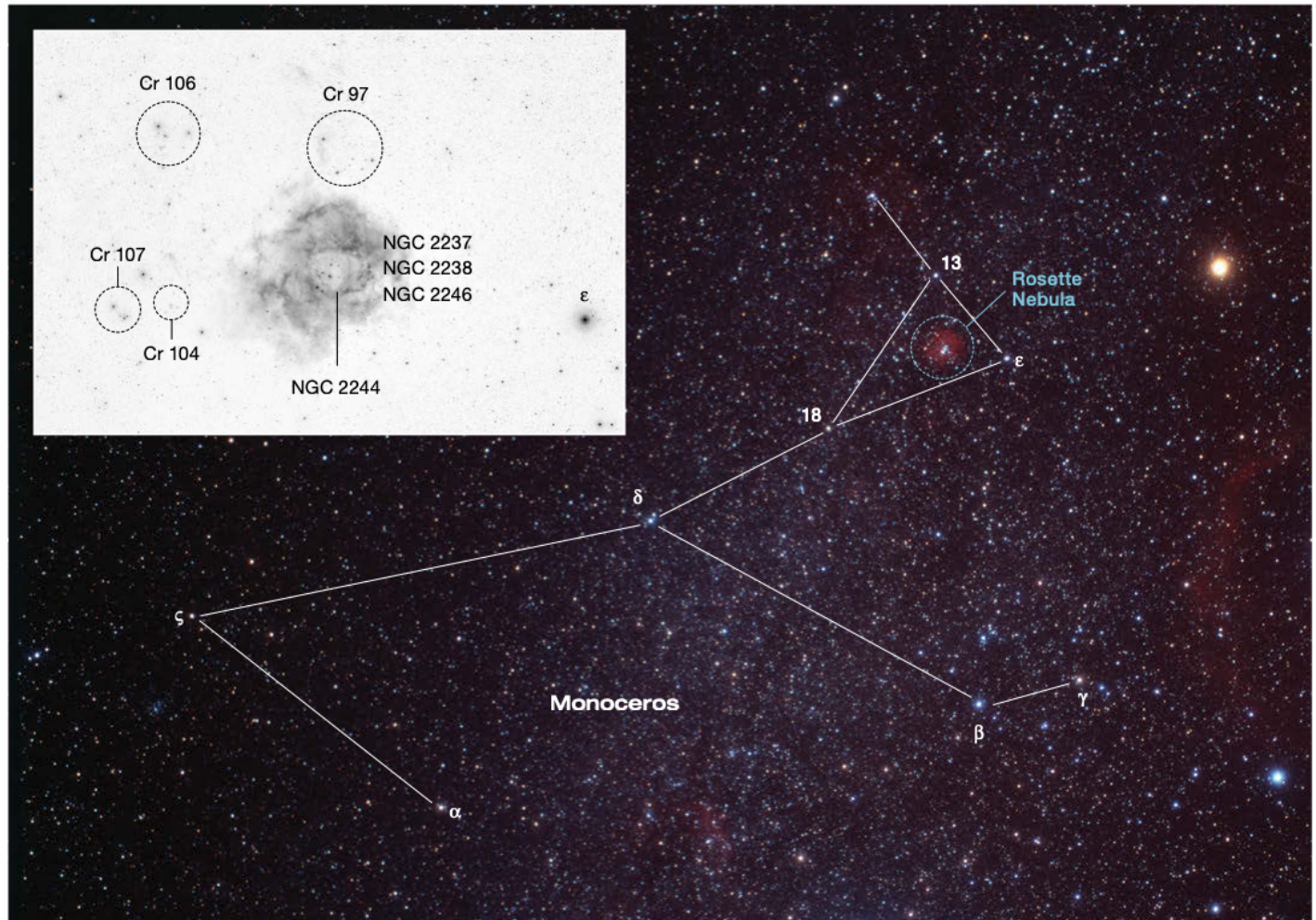
Spoiler alert: This next view is likely the best on the tour, and

one of the most beautiful in the entire night sky. It's the grand Sword of Orion, where a small telescope lets you take in half a dozen deep-sky sights at a glance, including the magnificent Orion Nebula, **M42**, where cold gas and dust — with a little help from gravity — turns into newly minted stars.

Most of Orion's Sword fits into a 2° field, but 3° frames it better. The showpiece of this field, M42, appears as a batwing-shaped glow with a mottled appearance even at low magnification. Most scopes resolve four of the stars in the Trapezium cluster embedded within the nebula. The sight of its faint outer wings forming a closed loop around the bright inner nebula is enough to get a committed stargazer out on a cold winter's night. *Sky & Telescope's* Walter Scott Houston memorably wrote of the Orion Nebula, "No amount of intensive gazing ever encompasses all its vivid splendor."

Just north of M42 lies more nebulosity, including the comma-shaped **M43**. Half a degree farther north you'll find a nest of blue-white stars enmeshed in the "1970s," the nebulae NGC 1973, NGC 1975, and NGC 1977. Together they comprise Sh 2-279, also known as the **Running Man Nebula**.

▼ **UNKNOWN UNICORN** December nights are a good opportunity to visit this oft-overlooked constellation. Monoceros might not abound with targets for small scopes, but what it does offer is worth the effort. Several Collinder clusters decorate the constellation's jewel, the Rosette Nebula (see inset).



Another  $\frac{1}{4}^\circ$  north sits the spanking new cluster **NGC 1981** with at least a dozen blue stars of 6th- to 10th-magnitude arranged in a ragged W.

The southern end of the Sword features 3rd-magnitude **Iota ( $\iota$ ) Orionis**, which has a 7th-magnitude companion star 11" to the southeast and a 10th-magnitude companion 50" to the east. Around 7' southwest of Iota lies **Struve 747** ( $\Sigma 747$ ), a wide blue-white double of magnitudes of 4.7 and 5.5 separated by 36". Immediately to the west, a mere  $2\frac{1}{2}'$  away, the fainter double  **$\Sigma 745$**  is just a chance alignment of 8th- and 9th-magnitude foreground components separated by 30".

Farther north, Orion's Belt hosts a dazzling display that includes — in a  $3^\circ$  field — dozens of the brightest blue-white stars of the Orion OB1 association. **Alnitak**, Zeta ( $\zeta$ ) Orionis, is the easternmost star of the Belt and lights up the **Flame Nebula**, making NGC 2024 (as it's also known) visible in a small instrument in a dark sky. The famed Horsehead Nebula, south-southeast of Alnitak, presents an easy target for imagers but is out of reach for visual observation with a small scope. A lovely S-shaped group of stars snakes north to south between the Belt's middle star **Alnilam**, Epsilon ( $\epsilon$ ) Orionis, and **Mintaka**, the rightmost star (Delta Orionis);

together, these stars form the cluster **Collinder 70**. Mintaka itself makes a fine double star for a small scope, with its 7th-magnitude companion about 56" away.

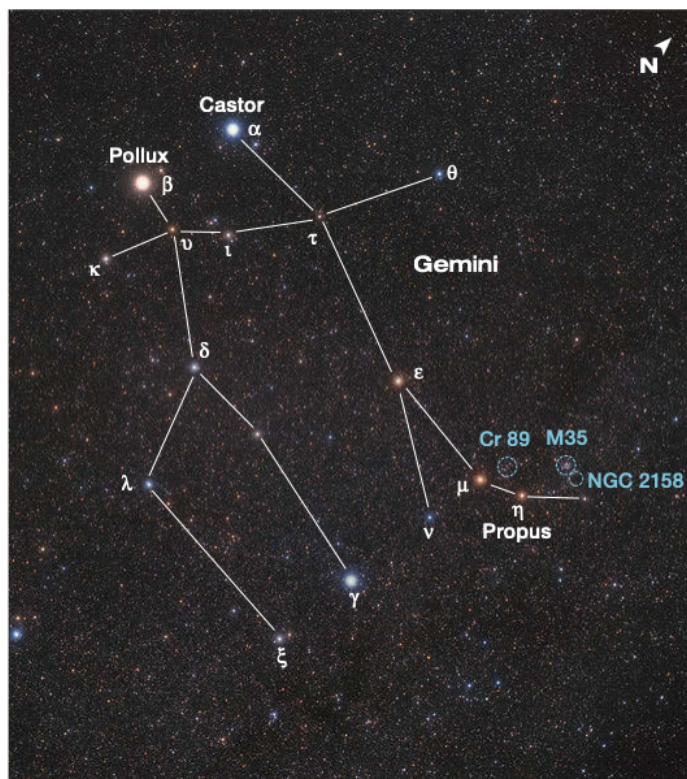
Orion's Head offers another excellent pitstop. Here you see the **Lambda ( $\lambda$ ) Orionis Cluster** (Collinder 69), a little group surrounding the star Meissa. A  $2^\circ$  field nicely frames the cluster. Only six stars are particularly bright, while the rest blend into the background star field.

We'll slide over to Monoceros, the Unicorn, for our next stop, the **Rosette Nebula**, a star factory located  $2^\circ$  east-northeast of Epsilon Monocerotis. Spanning more than a full degree, the Rosette is more than three times as large as the Orion Nebula and three times farther away.

The Rosette was once considered a challenging visual target even in a big reflector. But since the advent of nebula filters in the 1970s and 1980s, it presents only a moderately difficult sight in smaller scopes. The brightest fragments surround a dark central region and lie within reach of an 80-mm refractor with an Ultra High Contrast filter in exurban skies.

Half a dozen open clusters appear in the same  $3^\circ$  field as the Rosette. Swedish astronomer Per Collinder was hard at work here cataloging four small and sparse clusters, including





◀▲ **GEMINI'S GIFTS** The Twins bear several open clusters that are a delight in small scopes, such as M35 and NGC 2158 shown at left. If you happen to have imaging equipment, aim about 1° east of Propus to capture the supernova remnant, IC 443, also known as the Jellyfish Nebula.

**Collinder 97, 104, 106, and 107.** But the showpiece is the open cluster **NGC 2244** at the heart of the nebula itself. These stars formed within the nebula about two million years ago.

Just north of Orion's upraised club, the twins of Gemini dip their toes in the winter Milky Way. Center your field half-way between the star Propus, also known as Eta (η) Geminorum, and the fine open cluster **M35**. Within a 4° field lies the partially resolved M35 along with the smaller and fainter open cluster **NGC 2158** on its southwestern edge. Two degrees east-southeast of M35 lies the sparse cluster **Collinder 89**. Propus itself shines with a lovely orange glow in the same field, while about one quarter the distance from Propus to M35 you'll see the dull red glow of the 6th-magnitude red supergiant 6 Geminorum. The entire field is a pleasure to take in against the background Milky Way. Observers with a big 5° field can include M35 at the northern edge and the emission nebula NGC 2175 at the southern edge.

### Southerly Milky Way Star Clusters

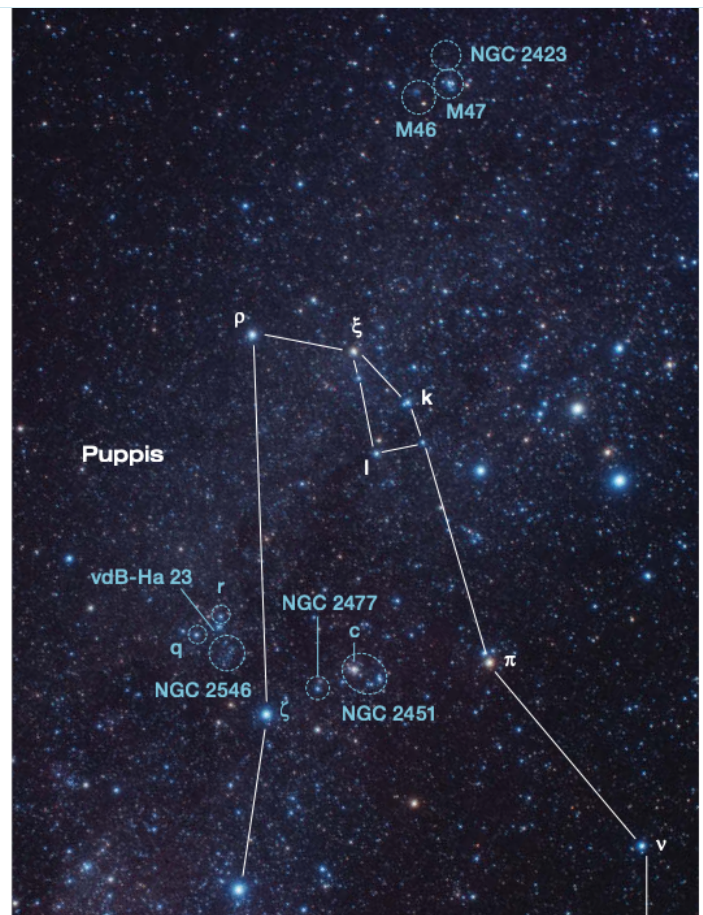
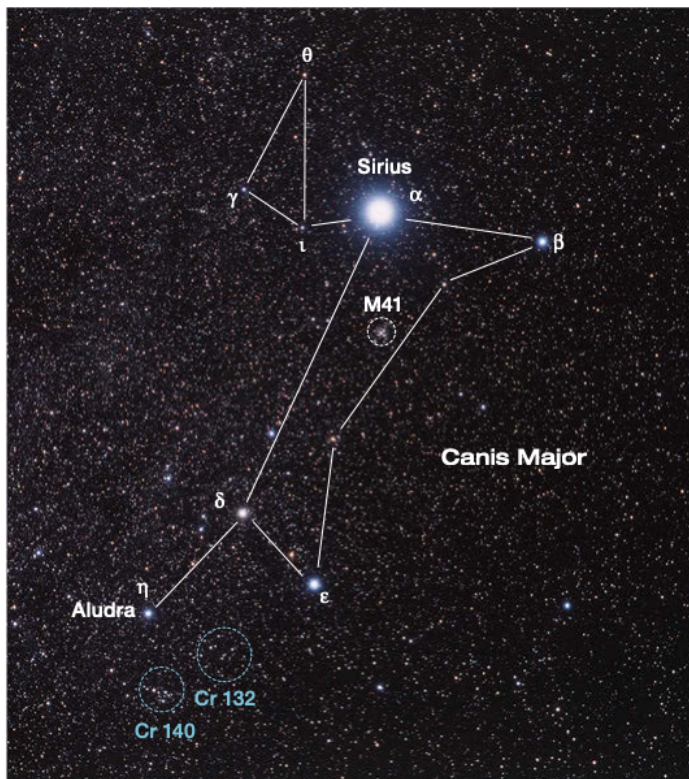
Move south of Orion and into the back legs of Canis Major, the Great Dog, and center your field about 2° southwest of Aludra (Eta Canis Majoris) to see the loose open clusters **Collinder 132** on the western edge of your field of view and the smaller **Collinder 140** on the southeastern edge. With a 4° field, brilliant Aludra joins the show. Look for its widely

spaced line-of-sight companion 3' to the west.

At last, we arrive at Puppis, the Stern, along the southern Milky Way. Most mid-northern observers will see this constellation low over the southeastern horizon on winter evenings, but a look at the open cluster **NGC 2546** makes it worth the effort. As with many southerly clusters, 18th-century astronomer Nicolas Louis de Lacaille, the patron saint of small-telescope astronomy, first glimpsed it with a tiny 1.5-inch refractor operating at 8×. At magnitude 5.3 and spread over a full degree, this cluster presents a superb, low-magnification sight set against the rich tapestry of background Milky Way.

Lacaille recorded two closely spaced patches of nebulosity here. The second was likely the smaller cluster **van den Bergh-Haffner 23**, which lies about 1.5° north of NGC 2546. Center your scope on NGC 2546, nudge it a degree to the northeast, and a 3° field of view will encompass both clusters along with the 4th-magnitude stars **r** and **q Puppis**. Centering again on NGC 2546, move your scope 1° to the southwest until the magnificent 2nd-magnitude star **Zeta Puppis** comes into view. One of the intrinsically brightest stars in the sky, Zeta Puppis has a mass of around 50 suns or more and burns about 800,000 times brighter, emitting most of its intense radiation in the ultraviolet.

Now look 6° west to find the jumbled but attractive open cluster **NGC 2451**. Astronomers once thought it a group of



▲ **'ROUND MIDNIGHT** *Left:* Several more collections of sparklers await you in the Great Dog, Orion's faithful companion, forever at the Giant's heels. *Right:* Toward the end of Northern Hemisphere winter evenings, close to midnight, Puppis, the Stern, delivers a fine collection of targets with which you can wrap up your observing sessions. They could prove a bit more challenging for observers at northern latitudes, but if you have clear skies and sightlines to the south, you might be able to bag some of them.

unassociated stars, but studies in the 1990s revealed two true open clusters here. The more concentrated northern section, NGC 2451B, centers on 4th-magnitude **c Puppis** and lies at a distance of about 1,200 light-years. The southern section, NGC 2451A, lies just 600 light-years away and includes a few stars around c Puppis, as well as a handful towards the south-western edge of the cluster, including 5th-magnitude n1 Puppis and 6th-magnitude d2 and d3 Puppis. The brightest parts of each cluster fit in a 2° field. About 1.5° east-southeast of c Puppis, look for the fainter and smaller open cluster **NGC 2477**.

Of the many clusters that fleck the magnificent tableau of the southern winter Milky Way, the open clusters **M46** and **M47** rank among the finest — and they fit nicely in a 2° field. Their striking and contrasting appearances will put a smile on the face of nearly any small-telescope connoisseur.

At a distance of 1,600 light-years, the relatively compact and young M47 appears as a scattering of about 50 stars as if it were assembled from odds and ends. M46 looks as large as M47, but it's three times as distant and intrinsically much larger and more uniform. It shows perhaps 100 stars to the limit of visibility of a small scope. The cluster also seemingly harbors the planetary nebula NGC 2438, evidently a foreground object. From a moderately dark observing site you can glimpse the planetary — with some effort — in an 80-mm refractor. A little less than a degree north of M47 the faint

## Observing Aids

Star charts are not only very useful in guiding you to your targets, but they're also lots of fun to peruse! You could do like Brian Ventrudo did for both his small-scope articles and use *Sky & Telescope's Pocket Sky Atlas* to navigate your way around the sky. Get your own copy at [https://is.gd/ST\\_pocket\\_sky\\_atlas](https://is.gd/ST_pocket_sky_atlas).

open cluster **NGC 2423** rounds out this glittering field.

Big scopes will always have their place in amateur astronomy, and a case of aperture fever strikes nearly every stargazer at some point. But as I hope I've shown you, there's still plenty to see in a small instrument. You may — with a little practice and a good star map — come up with your own favorite sights for a small scope, especially along the main thoroughfares and byways of the Milky Way.

■ **BRIAN VENTRUDO** is a writer, scientist, and longtime amateur astronomer. Although he never turns down a look through a big Dobsonian, he usually observes with smaller telescopes from the relatively dry and clear skies of Calgary, Canada. Ventrudo writes about astronomy and stargazing at his website **CosmicPursuits.com**.