Orion’s Secrets Revealed
Find the Constellation’s Deep-Sky Treasures
Discover ORION’S DEEP-SKY GEMS

The beauty and variety of objects in this constellation will keep you warm even on the coldest nights.

by Stephen James O’Meara

Orion the Hunter is one of the sky’s most identifiable starry figures. It’s also one of the wealthiest constellations in terms of deep-sky riches. It contains examples of every major class of object but one (a globular star cluster). All are within reach of small- to medium-sized telescopes, and some are best seen through binoculars under a dark sky.

For this story, I’ve chosen a sampling of these treats — including some uncommon targets — as well as a few fun visual challenges for small-telescope users.

Orion’s largest … and then some

Orion’s Belt is one of the easiest star patterns to find. These three 2nd-magnitude stars, equally spaced across 3° of sky, outline the Hunter’s waist. The trio has long fueled the imagination. Australian aborigines envisioned them as young men dancing to attract the attention of maidens (the Pleiades). Early Mayans fancied them as the crack in the shell of the cosmic turtle through which the world ascended.

Today we know that at least two of the Belt stars — Mintaka (Delta [δ] Orionis) and Alnitak (Zeta [ζ] Ori) — belong to open star cluster Collinder 70, an attractive gathering of 100 hot young stars moving through space as a pack. Simple handheld binoculars will show about 70 cluster members snaking around the Belt like a giant serpent around a stick. By the way, the third star in the Belt, Alnilam (Epsilon [ε] Orionis), is roughly three times as distant as the other two, according to measurements using Hipparcos satellite data.

After making an observation of Collinder 70, you might find it easier to imagine, as in Hindu mythology, the Sun god Vishnu standing on the back of a turtle and churning out the Milky Way using … a serpent-wrapped stick!

The Belt also harbors NGC 2024, a rip-roaring burst of reflection nebulosity known as the Flame Nebula, 15° northeast of Alnitak, the Belt’s easternmost star. I regard it as one of Orion’s great wonders.

Under a dark sky, I’ve spied this 30’-wide nebula through hand-held binoculars.

You’ll find this much easier if you mount the binoculars on a tripod and occult Alnitak’s light with the sharp edge of a distant roof. Look for a sepulchral veil of dark nebulosity that slices clean through NGC 2024’s midsection, partially hiding a cluster of newborn suns. In images, NGC 2024 bears a remarkable resemblance to lipstick marks on a mirror, and from that comes one of its more popular nicknames: the Lips Nebula.

Almost equidistant southeast of Alnitak, you’ll find another highly neglected reflection nebula: NGC 2023.

Sigma (σ) Orionis is a wonderful example of a multiple star system. This sketch, made with a 6-inch Newtonian and an eyepiece that gave a magnification of 240x, shows three of its stars along with Struve 761, the thin triangle to the upper right that the author describes. JEREMY PEREZ

Reflection nebula NGC 2023 surrounds a hot star and scatters its light from a distance of 1,600 light-years. R. JAY GABANY
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This 10'-wide circular glow surrounds an 8th-magnitude star and looks like what you’d see after breathing on your eyepiece during a cold night. NGC 2023’s true nature, however, reveals itself if you compare it to similarly bright stars nearby.

There’s more! Look just 50’ south of Alnitak to find one of the most remarkable multiple star systems in the sky. Sigma (σ) Orionis (also known as Struve 762) is a quintuplet with four components available to small-telescope users. The stars are strung out in a crooked line oriented roughly northeast to southwest. Their magnitudes range from 4 to 9, with the closest companions lying 11” southwest and 13” east of the primary; the farthest one is 41’ northeast. Struve 761, a needle-thin scalene triangle of 8th-magnitude stars 3’ northwest, adds beauty to the field.

Once again, return to Alnitak. This time, stay there and push the power to 220x or more. Alnitak is one of the night sky’s unadorned multiple star systems: a magnitude 1.9 primary with a magnitude 3.7 secondary 2.4” to the southeast. Observers have described the secondary’s color as rose, lavender, and reddish-olive. What do you see? A third star, glowing at magnitude 9.5, lies 60” northeast of the primary.

**Shadow play**

One of Orion’s best-known objects, reflection nebula M78, shines about 2½° north-east of Alnitak. Three well-known dwarf nebulae lie nearby: NGC 2071 to the north-northeast, NGC 2067 to the north-west, and NGC 2064 to the southwest. M78 is the principal marvel, appearing as a soft, wispy 8'-wide fog around two close-knit 10th-magnitude stars. When viewed through eyepieces that give moderate to high magnifications, observers see the fog splinter in all manner of comet-like manifestations riveted with dark nodules and irregular streaks. It’s a playground for whispers of light and shadow.

Astroimagers should also try for McNeil’s Nebula, a reflection nebula named after amateur astronomer Jay McNeil, who discovered it in 2004 from his backyard in Paducah, Kentucky — using a CCD camera mounted on a 3-inch telescope! The nebula can be easy to see through medium-sized scopes, but be
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warned, it is a variable phenomenon that comes into view only when its illuminating star (a variable) flares to significance. You'll find it 7' southwest of M78.

**Face it**

Early skywatchers saw Orion's face as a misty patch with three stars at the core in the shape of a capital Greek letter Lambda (Λ). Coincidentally, Meissa (Lambda [λ] Orionis) is the brightest with Phi¹ (ϕ¹) and Phi² (ϕ²) Orionis as its fainter attendants. Of the three, Lambda and Phi¹ belong to the sparse 70'-wide open star cluster **Collinder 69**. These 20 stars include at least a half-dozen other suns hovering near the limit of naked-eye visibility.

While these stars alone are enough to cause an illusion of mistiness in the region, photographs reveal the 4'-wide nebula **Sharpless 2–264** surrounding Collinder 69, whose collective radiation energizes the nebula. Is the mist we see with our unaided eyes the nebula or an illusion created by the closeness and dimness of the cluster’s stars? The latter reason is why the Beehive Cluster (M44) in Cancer appears fuzzy to unaided eyes. You be the judge.

By the way, the distance between Lambda and Phi¹ Orionis, 27', is about the same as the apparent size of the Full Moon. Try to visualize that the next time you see these stars. It may seem hard to believe.

The region of Orion's face also contains the challenging 12th-magnitude planetary nebula **NGC 2022**. It sports a clean annulus a little more than 1° east, and a tad south, of Phi² Orionis. You'll need powers of at least 100x for its 22'-wide disk to stand out well from the background sky. Pump up the power to 300x or more, and you should see the planetary's well-defined ring that looks like two crescents facing off.

I find this feature one of the most obvious of its kind in small- to moderate-sized telescopes. If you're using a small telescope, be sure to employ averted vision (look slightly to the side of the object rather than straight at it).

**Sword of wonder**

The words “Orion’s Sword” usually conjure up a vision of three faint stars in a row dangling from Orion’s Belt and sporting the spectacular **Orion Nebula (M42)** in the middle. But Orion’s Sword actually has four naked-eye “stars,” each of which is a deep-sky splendor unto itself. Let's start from the southernmost star and work our way northward.
Iota (ι) Orionis is a white-sapphire star with two visual companions: a magnitude 7.7 aquamarine sun 11.6" southeast and a 10th-magnitude pale mango star about 50" east. Astronomers refer to them collectively as **Struve 752**. They lie in a little nest of nebulosity known as **NGC 1980** — the bright southern segment of the enormous emission nebula bubble emanating from the core of the Orion Nebula.

Now shift your gaze just 8' southwest of Iota, and you’ll find the bright double star **Struve 747**, a pair of 5th-magnitude diamonds separated by 36". To the unaided eye, Iota Orionis and Struve 747 are themselves a beautiful naked-eye double, though I wonder how many have noticed. These stars and some 30 more belong to a 15'-wide open cluster known as **Collinder 72**.

Sharpless 2–264 is a huge emission nebula that lies in the region of Orion’s head. It surrounds open star cluster Collinder 69, the slightly brighter stars in the center of the image. **McNeil’s Nebula (inset)** is a variable reflection nebula near M78. An astroimager discovered it in 2004. **Jeremy Perez**
The constellation Orion the Hunter is one of the most stunning sights in the sky. This somewhat deeper look reveals many more stars than you’ll see with your naked eyes, plus lots of gas.
Moving north, we come to the Theta¹ (θ¹) Orionis region. Theta¹ Ori, more commonly known as the Trapezium, appears to be drowning in a whirlpool of vapors at the core of M42. For mid-northern observers, the sight is unrivaled in its clarity and beauty, even through small instruments.

Enhancing the view is M42’s “sidecar” nebula, M43, just to the north-northeast. There is no need to extoll the beauty and grandeur of the joint M42/43 spectacle. These ethereal boils of hot gas will speak volumes when you look at them through your binoculars or telescopes.

M42 and M43 are part of the same nebula complex. We see them as two objects, but this is an illusion due to a superimposed stream of dark nebulosity. A finger of this mysterious unlabeled dark nebula protrudes into M42 like an obsidian flow, creating an inky bay that all but rubs against the magnificent Trapezium Cluster.

I find it to be the Orion Nebula’s most striking feature; in my youth, I thought the region devoid of nebulosity, not one containing dark nebulosity. The bay’s name is Sinus Magnus, and the 19th-century English astronomer William Henry Smyth nicknamed it the Fish’s Mouth.

For a surprise, center the Trapezium, and sweep about 1½° west to the magnitude 12.5 barred spiral NGC 1924. The galaxy is concentrated (2’ by 1’) with a small fuzzy core. Small-scope users should scan the area with moderately high powers ranging between 100x and 200x. Look for a round puff of dim light a few arcminutes east-southeast of an 8th-magnitude star that lies at the northwest end of a 30’-long row of three roughly 8th-magnitude stars.

Next, return to Theta¹, and hop 35’ north to a 5th-magnitude pair of stars, 42 and 45 Orionis. Separated by 4.2”, they are the brightest members of the star cluster involved with reflection nebula NGC 1977. In fact, the duo acts like two headlights illuminating the gas. A narrow lane of dust separates elliptical NGC 1977 from its 5’-wide circular companion glow, NGC 1973, which lies to the northwest.

That cloud is itself separated by a 5’-wide dust lane from the dimmer cometary glow of NGC 1975 to the northeast. If you stitch together all the dark nebulosity in the NGC 1973/5/7 region, its shape looks like a runner, so a couple decades ago astromager Jason Ware of Texas dubbed it the Running Man Nebula.

In my opinion, the fourth and northernmost “star” in Orion’s Sword is the most...
overlooked deep-sky object in the region. It’s the 4th-magnitude open star cluster I have christened the Coal Car Cluster (NGC 1981). Through binoculars, I see this loose gathering of attractive suns forming the figure of an old coal cart.

The brightest two stars in the cluster form an attractive binocular pair. Each of these is a telescopic double: Struve 750 is the brighter of the two, with a magnitude 6.4 primary and a magnitude 8.4 companion 4.2” away; I see them as glacial blue and pleasantly pink, respectively. Struve 743, on the other hand, is a tight pair of magnitudes 7.7 and 8.2 separated by only 1.8”.

Before we leave this region, return to Iota Orionis, move 50’ south, and let your eye roam the field. Nestled among the rich field of stars is the tiny (2’-wide) reflection nebula NGC 1999. The nebula surrounds a magnitude 10.4 star, making it appear fuzzy. NGC 1999 takes magnification well.

I was able to investigate it using powers beyond 300x with a 4-inch scope.

Club favorites
In the northern part of the constellation, nearly 1½° northeast of Chi2 (χ2) Orionis in the Hunter’s club, is perhaps the most overlooked bright nebula in the heavens: NGC 2174, also known as the Monkey Head Nebula because of its photographic appearance. And, just so you know, NGC 2175 (also often called the Monkey Head) is the star cluster within the nebula.

This vast star-forming region 7,200 light-years distant shines at a respectable 7th magnitude. But its round and diaphanous form covers a 40’-wide circle of sky. You’ll need a dark sky to see it. What’s most amazing is that this nebula is better seen through binoculars than a telescope. If we could position NGC 2174 at the distance of the Orion Nebula, it would span 3° of sky and shine at 5th magnitude.

If you return to Chi2 in Orion’s club, then move 1¾° southeast, you’ll spot yet another of Orion’s marvels: NGC 2163, more familiarly known as Cederblad 62. This magnitude 11.5 bipolar reflection nebula lies only 3’ east-southeast of a magnitude 9 star and measures a mere 3’ by 2’ in extent. But its light is so condensed that it’s unmistakable at 72x through a 4-inch scope under dark skies. Look for a dim “comet” with a starlike head and a bushy tail pointing to the northwest. Increase the power to more than 220x, and the object’s bipolar nature should become apparent.

If you’re a beginning observer, this inventory of celestial treats may at first seem daunting. Believe me, we’ve only scratched the surface. I hope you’ll continue to seek out the many deep-sky objects within the Hunter’s boundaries that don’t appear on this list. Good luck!