



THE MILKY WAY

BEAUTY: ★★★★★

BRAGGING RIGHTS: You saw our home galaxy

HOW EASY IS IT TO SEE? Dark skies required

BEST TIME TO SEE IT: February to September

TYPE: Galaxy

DISCOVERED: Known since antiquity

NOTES

Some people say that scientific knowledge destroys beauty, that knowing that a rose is just a complex arrangement of carbon-based molecules somehow interferes with appreciating its beauty. But I disagree: appreciating beauty is a visceral feeling, wholly separate from the scientific pleasure of unraveling a puzzle.

So it is with the Milky Way. Once I visited the Grand Canyon at night and saw a brilliant sky, almost as flashy as a Las Vegas casino. And the dominant feature was a frozen river of silver light, arcing across the sky, and bounded by craggy edges. It's a sight that has stayed with me ever since.

Hundreds of years ago, people must have looked at the Milky Way and felt the same thing. Yet today we know something they did not: that the river of light is our home galaxy, a spinning assemblage of 400 billion stars, many hosting planets of their own. Such knowledge only makes the sight more awesome.

WHAT TO EXPECT

Though powered by billions of suns, the Milky Way is so large and sparse that it appears as faint as a ghost to us. The light of the moon overwhelms it, and even a small amount of light pollution renders it completely invisible.

Before cities and electric lights, it was possible to see the Milky Way from anywhere, but today you'll see it only under the darkest skies. I've seen it faintly from

WHAT YOU MIGHT SEE THROUGH AMATEUR EQUIPMENT



the suburbs of San Francisco, but it paled next to my Grand Canyon memories. Choose a moonless night and travel out as far away from city lights as you can. Make sure you choose a spot where you can see the entire sky.

Once you've found a place, take in the whole view. Just standing beneath the Milky Way is enough to make you fall in love with the night sky. The unaided eye is best to appreciate just how vast it is. A pair of binoculars allows you to resolve the gossamer light into millions of faint stars.

Still, mysteries remain. We do not have a clear view of the galactic core, for example. Vast clouds of dust block all visible light. But by studying other frequencies of radiation—radio waves, infrared, and x-rays—we've been able to determine that a super-massive black hole lives in the heart of our galaxy. Scientists think this black hole is more than 4 million times heavier than our sun. Stars in its vicinity whip around at incredible speeds.

How did this black hole form? How fast is it growing? What's it like to be close to it? We don't know. Future astronomers, perhaps some of you reading this book, will have fun trying to figure that out.

OBSERVING TIPS

The band of light. The Milky Way Galaxy is a flat disk about 100,000 light-years across; the solar system is located about halfway between the galaxy's core and its edge. The band of the Milky Way that we can see is our edge-on view of this galaxy's disk.

Nebulae and star clusters are often found near the band of the Milky Way, since that's where most of the stars in the galaxy are. But galaxies (and many globular clusters) are found away from the band. The Milky Way obscures our view of distant galaxies, so we need to look away from the disk to see them.

Toward the edge. During winter in the Northern Hemisphere, the night side of Earth faces toward the edge of the galaxy (away from the core). Compared to the summer view, you may notice that the band of the Milky Way is a little thinner.

Toward the core. In summer, we face the center of the galaxy. Unfortunately, massive dust clouds block our view, so we can't see the bright core of the galaxy—a sight that would surely be magnificent. Nevertheless, the wide and graceful arc of the Milky Way is splendid. You may notice that in parts the band of the Milky Way is split by darker areas. These are dark dust clouds, obscuring the stars beyond.

The teapot of Sagittarius. The spout of Sagittarius's (see page 35) teapot points to the center of the galaxy. Though we cannot see the actual core, there are marvelous wonders in this region. Use binoculars to scan the area and you'll see star clusters and nebulae just floating in a sea of stars. Many of these objects are included elsewhere in this book, but it's great to see their surroundings as well.



THE ORION NEBULA

BEAUTY: ★★★★★

BRAGGING RIGHTS: You saw a star factory!

HOW EASY IS IT TO SEE? Best with a small telescope

BEST TIME TO SEE IT: Winter (in Orion)

TYPE: Diffuse Nebula

DISCOVERED: 1611 by Nicolas-Claude Fabri de Peiresc

NOTES

If you look at Orion on a clear winter night, you might notice that the middle of the three stars in Orion's sword is a little fuzzy. With averted vision, the star seems to grow into a tiny little cloud.

And yet, when Greek astronomers plotted this region of the sky 2,000 years ago, they made no mention of any nebula. The Arab astronomer Al-Sufi noticed the fainter Andromeda "nebula" but made no mention of anything in Orion. Even in 1609, when Galileo looked at Orion's sword with his newly created telescope, he saw nothing but stars. It wasn't until 1611 that Frenchman Fabri de Peiresc finally saw the nebula with his (presumably better) telescope.

Why so many people in the past missed seeing the Great Orion Nebula, a pretty obvious sight for observers today, is a minor mystery in astronomy.

The Orion Nebula, also known as Messier 42 (or M42), is a star factory about 1,300 light-years away. This vast cloud of gas and dust has condensed, via the force of gravity, into newly born stars. Many of these stars are hidden inside dark clouds, but others shine brightly and illuminate the surrounding nebula.

In 100,000 years or so, these newborn stars will burn away the surrounding nebula, and they'll shine alone against the black night. By then the Orion Nebula will be no more and we'll see only a bright cluster of stars, perhaps like the Pleiades today. Eventually, the

WHAT YOU MIGHT SEE THROUGH AMATEUR EQUIPMENT



gravitational eddies of the galaxy will break the cluster apart and the stars of the nebula will wander the galaxy alone, just as our sun does now.

WHAT TO EXPECT

The Great Orion Nebula is the best nebula visible from the Northern Hemisphere—only the Southern Hemisphere's Eta Carina Nebula outranks it, and even then I think M42 has a more beautiful and symmetrical shape.

Binoculars or a small telescope are best; large telescopes magnify too much to see the whole nebula. Dark, moonless skies are recommended, but the core of M42 is bright enough to punch through moderate light pollution. No matter where you are, it's probably worth it to give the Orion Nebula a look.

You won't see much, if any, color—nebulae are too faint to excite the eye's color receptors. Fortunately, the Orion Nebula is also bright enough to be an easy target for astrophotography. Other than the moon, there probably is no easier target. With sufficient exposure, you should get some color—mostly pinks and purples—in your astrophotos.

OBSERVING TIPS

Head and wings. The basic shape of the nebula will be obvious on your first view. The heart of the nebula is bright and square, with a small cut, like a mouth. It is flanked by two wings, like those of a ghostly manta ray. Above the heart you'll see a bright knot of nebulosity, technically given its own designation—Messier 43—but it's really just part of the same complex.

Trapezium. With a little bit of magnification, you'll see that the heart of the nebula has four bright stars in a rough trapezoidal shape, hence its colloquial name, Trapezium.

These four stars have already blown away the surrounding nebula gases, which is why we can see them clearly. They also provide the illumination for the rest of the nebula.

With larger telescopes, you might see two additional stars in Trapezium.

How much can you see? The complex structure of the Orion Nebula is beautiful in long-exposure photos, but even with a small telescope you should be able to discern a lot of detail.

Start at the center and try to trace the edges of the nebula. The edges of the wings appear bright, but they fade. How far can you trace them? In really dark skies you might just be able to see that one of the wings wraps almost 180 degrees around the nebula.

