

STARS

A Month-by-Month Tour of the Constellations

WITH YOUR GUIDE
MIKE LYNCH

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READY TO MAKE THE STARS YOUR OLD FRIENDS?

I've been old friends with the night sky for over 50 years, and now you can be too. I created this book of star maps and constellation charts to give you a guided tour of the night sky. If you're brand-new to stargazing, I hope this book helps you get acquainted with the cosmos. If you're already an avid stargazer, I hope this offering gets you even more excited. Whatever your level of interest, I sure hope you enjoy astronomy and stargazing as much as I have.

ASTRONOMY 101

What follows will certainly not be a comprehensive course in astronomy. For that, there are many great books, films, and classes where you can learn a heck of a lot more. With that said, let me try to give you the bare essentials.

WHAT ARE STARS?

Stars are basically big balls of gas that are primarily made up of hydrogen and some helium, but they include many other elements as well. Stars are born in large clusters and form from loose clouds of hydrogen gas. These clouds are laced with heavier elements that were created in very massive stars that exploded eons ago in what astronomers call supernovas.

These gas clouds formed dense clumps and eventually combined into much larger balls of gas thanks to gravity. When they became massive enough, gravitational pressure caused the core temperatures of these "protostars" to reach millions of degrees. This set off a nuclear chain reaction inside the stellar cores, and individual hydrogen atoms began colliding with one another with enough force

that they fused into helium atoms, which are heavier. There are zillions of such collisions every second. Some of the hydrogen in them is converted into light and radiation, which makes its way out of the gargantuan ball of gas—now a full-fledged star—to help light up the night.

For stars like our sun, normal nuclear fusion can keep going for well over 10 billion years. Really massive stars are gas guzzlers and go through their nuclear fuel much faster, some in as little as a few million years. The details are a little complicated, but when a star begins to run out of hydrogen in its core, the star begins to expand, eventually turning into a huge red giant that lasts for a few more billion years.

After that, less-massive stars (like our sun) turn into small white dwarf stars and eventually flicker out. Much larger stars have a different fate, becoming unstable and exploding violently in a supernova. The extreme conditions in supernovas "cook up" heavy elements like gold, silver, and uranium and spew them out in all directions, where they become components of new stars and planets. You even have bits of these exploded stars in your own body.

What's left of these exploded stars continues to collapse, forming hyper-dense pulsars and neutron stars, objects that are so dense that one table-spoon would weigh hundreds of millions of tons on Earth! Stars that are massive enough may collapse into black holes, which have so much gravitational pull that not even light can escape.

DISTANCES TO THE STARS

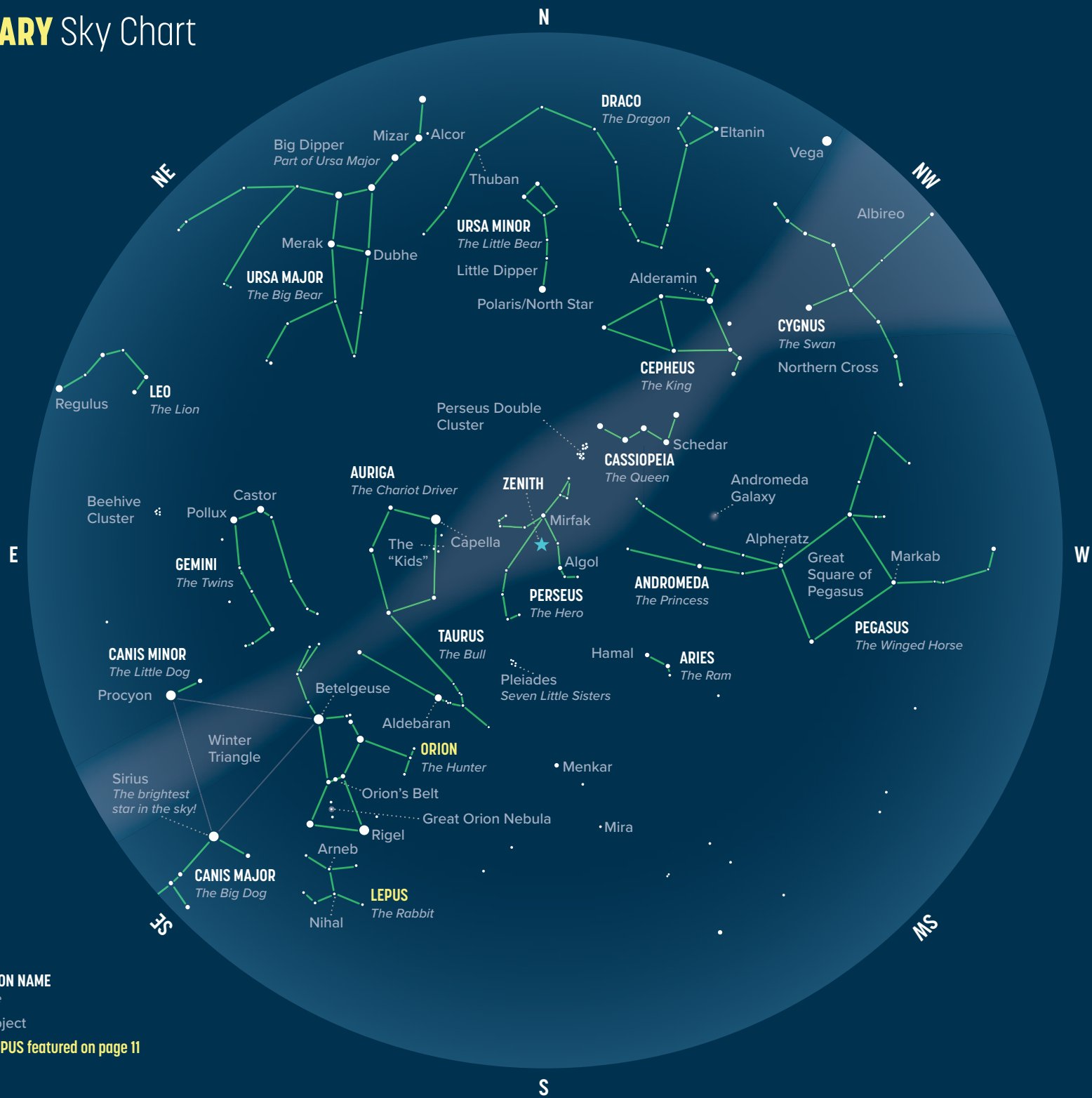
Talking about stellar distances in miles can get really cumbersome. Instead, stellar distances are measured in light-years. Light travels at just over 186,000 miles per second. How fast is that? If you had a jet airliner that could make the round trip from Los Angeles to New York and back 33 times in one

second, you'd be traveling at the speed of light. Over the course of a year, light travels just under 6 trillion miles; this distance is called a light-year. The stars that you see in the night sky can range in vast distances from you; some are under 10 light-years from Earth, while others are thousands of light-years away. Also, keep in mind that when you look into the night sky, you're actually looking back in time: after all, even light needed a lot of time to travel those incredible distances. For example, if you gaze at a star 100 light-years away, you're seeing that star as it was 100 years ago, as the light it is emitting now is just beginning its journey. If a star is 1,000 light-years away, you're seeing it as it was a millennium ago.

GALAXIES

All the stars you see in the sky are part of our home Milky Way Galaxy, which has at least 200 to 300 billion stars. Some astronomers now believe, though, that planets may easily exceed the number of stars in the Milky Way. There are several types of galaxies in the known universe. The Milky Way is considered a spiral galaxy because it has "arms" that radiate out like a pinwheel. The Milky Way has a diameter of over 100,000 light-years but is only about 1,000 light-years thick, although the central bulge is about 12 times thicker. Most of the stars in the galaxy are located in that bulge (the galactic center), which is also home to a massive black hole estimated to be over 4 million times more massive than our sun. The rest of the Milky Way's stars—including our sun—are located in one of the spiral arms, relatively far away from the core. Sometimes, especially in the summer, you can see a narrow ribbon of milky white light that stretches across the celestial dome. When you see that, you're looking into the galaxy's thinner plane. There are so many stars there (and they are so far away) that all you see is their combined glow.

JANUARY Sky Chart



CONSTELLATION NAME

English Name

Celestial Object

ORION and LEPUS featured on page 11

Sky chart is representative of 8 p.m. in January, 12 a.m. in November, and 5 a.m. in September.

The jewels of January are taking over in the cold, clear winter skies. Dress warmly and be prepared to be wowed by majestic constellations, like Orion, the Hunter, and his posse of bright stars!

These are the best times and also the worst times for stargazing. Just bundle up and think warm, and you'll be rewarded with what I think is the greatest celestial display of the year. Even if you're stargazing from the city, don't be afraid to sit back on lawn chairs and stare up into the sky, even if the neighbors think you're a little nuts . . . In fact, ask them to join you for the best show in the universe!

Believe it or not, you still have a summer constellation holding out in the northwestern sky. At the end of evening twilight, Cygnus, the Swan, is just above the horizon. Within the Swan is the famous Northern Cross, which is standing upright. Look for it as soon as darkness falls because by 8 p.m., Albireo, the star that marks the foot of the cross, will have already slipped out of view. In the western sky, autumn constellations are also visible. Look for Pegasus, the Winged Horse, with Andromeda, the Princess, in tow.

Next to the constellation Andromeda is the Andromeda Galaxy, the next-door neighbor to the Milky Way. Even though it's over 2 million light-years away, it's possible to see it with the naked eye if your sky is dark enough. Look for a tiny ghostly patch of white. This sounds crazy, but if you're having a hard time seeing it, look slightly away from it. You may see it a whole lot better if you're not looking directly at it. This is a technique amateur astronomers call "averted vision." Now if you're forced to view the Andromeda Galaxy in light-polluted skies, you should be able to see it with a small telescope

or even a good pair of binoculars. When you're looking at the Andromeda Galaxy, keep in mind that just one light-year is nearly 6 trillion miles, and this island of stars is over 2 million light-years away . . . wrap your mind around that if you can!

On the rise in the eastern sky this month is what I call "Orion and His Gang." At the center is the wonderful and distinct constellation Orion, the Hunter. There's also his surrounding gang of constellations; the group includes Taurus, the Bull; Auriga, the Chariot Driver-turned-Goat Farmer; Gemini, the Twins; and Lepus, the Rabbit, Orion's prey and nemesis.

At first glance, Orion reminds a lot of people of an hourglass or a crooked bowtie standing proudly above the eastern horizon. That outlines the trim but muscular torso of the hunter. In the middle of his massive frame are three stars in a nearly perfect row that will likely draw your attention. These luminaries outline Orion's belt. From the lower left to the upper right the stars are Alnitak, Alnilam, and Mintaka. The amazing thing about these stars is that even though they're lined up in a perfect row, they physically have nothing to do with each other. They're hundreds of light-years apart from each other. They just happen to appear in a line from our vantage point on Earth.

Orion's brightest star is Rigel, which marks the hunter's knee, and on the upper left-hand corner of the bowtie is Betelgeuse, a huge red supergiant star that has a noticeable reddish tinge to it even with the naked eye. Betelgeuse is an Arabic name that roughly translates to English as "armpit of the great one." So, when you gaze at Betelgeuse you get the pleasure of staring into one of his armpits. Oh joy!

I can pretty much guarantee that Betelgeuse is the single biggest thing you've ever seen with an unaided eye. At times, it swells to a diameter of nearly a billion miles! Our sun is not even a million miles across.

All stars are basically huge balls of hydrogen gas that shine because of nuclear fusion. During the fusion process, hydrogen deep in stellar cores is converted to helium, and a tremendous amount of light and other energy is released. Essentially, the hydrogen in a star's core is its fuel. Smaller stars, like our sun, "burn" through their hydrogen supply much more slowly than larger stars. Much larger stars, like Betelgeuse, are real gas guzzlers that go through their hydrogen much, much more rapidly. In fact, it's estimated that Betelgeuse is only 10 million years old, but already dying. Sometime in the next thousand, hundred thousand, or million years (at most), it'll blow to bits in a tremendous supernova explosion. Astronomers aren't really sure when it'll happen, but when it does, it could be as bright as the full moon for several weeks.

Supernova explosions are very important because heavier elements like iron, gold, and silver are formed in the process. They are spewed out into the galaxy to become the building blocks of future stars, planets, and maybe life.

It's fair to say that the iron in your car (what little there is), the iron in your blood, the calcium in your bones, and the gold and silver you may be wearing were all once part of a former star. You have star stuff in you! Keep that in mind when basking under the glow of Orion.

By the way, what's left of Betelgeuse or any other gigantic star after it explodes will gravitationally shrink down and become a black hole. Black holes get their moniker because they have so much gravitational force that not even light can escape. Anything that falls into a black hole is never seen or heard from again as it mashes into what physicists call a singularity.

After you check out the red giant Betelgeuse, consider Bellatrix, the bright star across from Betelgeuse. It marks the left shoulder of Orion. You won't

really see much color with the naked eye, but if you point your telescope or binoculars at it, you should see that it has a very deep shade of blue to it. It's almost purple. There's really no other bright star in the sky that matches it.

Just by observing the color of a star, you can deduce quite a bit of information about it, especially its temperature. Just like flames in a campfire, stars with red or yellow flames are cooler than those with bluish flames. Bluish, purple-tinged stars like Bellatrix are much hotter than reddish-tinged stars like Betelgeuse.

Below the stars of Orion's belt, there are three more stars in a row that allegedly depict Orion's sheath. The middle "star" in the sheath is actually the Great Orion Nebula, where, even now, new stars are being born. I'll have more on the great stellar nursery in the heavens when I talk about the February night sky.

Bundle up and enjoy the January night sky, and if you can, get out into the countryside, where you can really take in the wonderful show without that nasty light pollution. Stay warm!



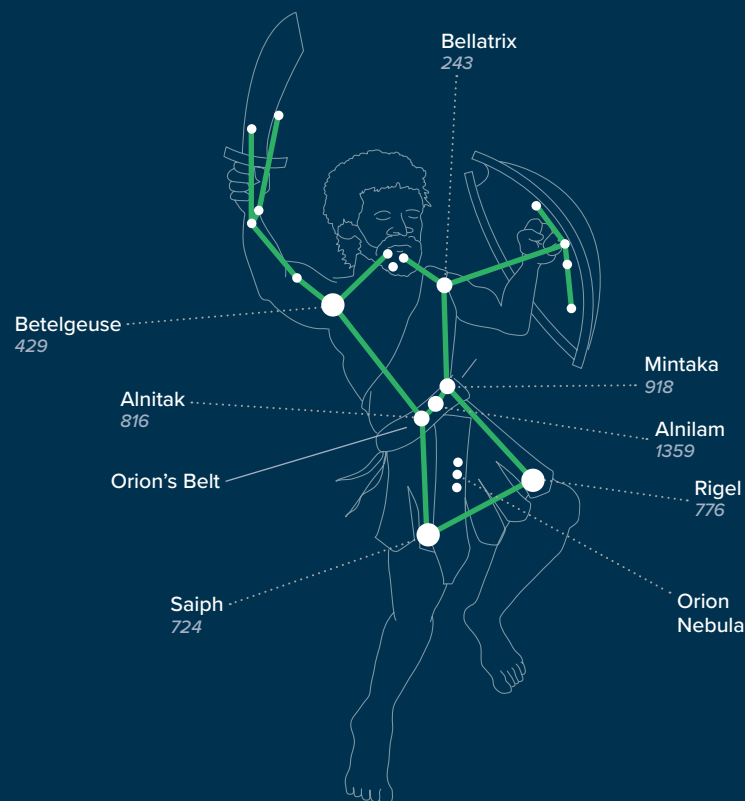
HORSESHEAD NEBULA



M38 CLUSTER

JANUARY Featured Constellations

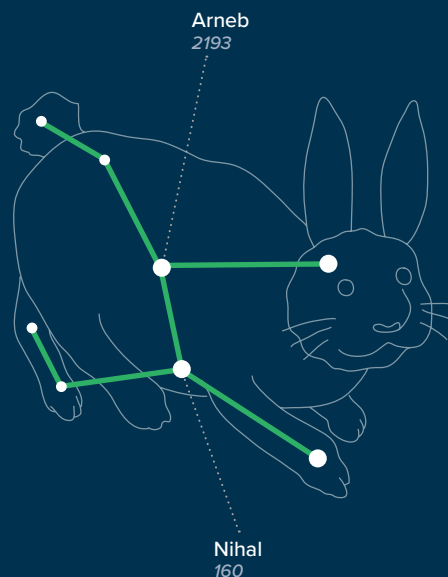
Numbers under star names represent light-years



ORION *The Hunter*

BACKGROUND/MYTHOLOGY In my opinion, Orion is the best constellation! It's the centerpiece of the wonderful group of winter constellations that I call "Orion and His Gang." According to Greek mythology, Orion was a mighty nocturnal hunter. In one of the many varying tales about his death, he was killed in a battle with a scorpion sent by the god Apollo. Apollo was angry that Orion and his sister Artemis, the goddess of the moon, had fallen in love. After his death, Artemis had his body placed in the stars.

OBSERVATION NOTES The three stars that make up Orion's belt are the constellation's hallmark. Rigel is the constellation's brightest star and marks Orion's left knee. Orion's second-brightest star, Betelgeuse, represents the armpit of the mighty hunter. Betelgeuse is a supergiant star that regularly swells out to nearly a billion miles in diameter. Below Orion's belt are three more stars in a row that make up the hunter's sheath. The middle "star" is fuzzy to the naked eye because it's actually a huge cloud of hydrogen gas where stars are being born, called a nebula. Technically referred to as M42, it's a must-see with a small telescope; you'll see four newborn stars arranged in a trapezoid. These stars are so bright that they light up the surrounding hydrogen gas like a neon light.



LEPUS *The Rabbit*

BACKGROUND/MYTHOLOGY There are many mythological stories about Lepus. The one I like best is the story about how Lepus is not only elusive but constantly harasses and plays dirty tricks on Orion, the Hunter.

OBSERVATION NOTES It's pronounced Lee-pus—what a great name for a leaping celestial rabbit. Now, I have to admit that Lepus certainly won't blow you away with its brilliance. It's small, and it's not all that bright, especially compared with how massive and brilliant Orion is. The truth is most constellations really don't look all that much like what they're supposed to be. Ancient civilizations used them as rough visual aids to help tell their stories. Back then, stories were told by word of mouth, and without any light pollution, you could really see the stars, making it a little easier to stretch the imagination enough to spot constellations like this somewhat random arrangement of stars. Next door, to the left of Lepus, is the constellation Canis Major, Orion's big hunting dog. It really resembles what it's supposed to, and you can see the big canine in hot pursuit of Lepus, even though you can't see Lepus all that well.

TOUR THE STARS, MONTH BY MONTH

THERE'S A THRILL in finding a constellation—and in showing it to others. To get started, all you need is the right resource. Beloved WCCO Radio meteorologist Mike Lynch is here to help.

Mike's unique approach to stargazing allows you to learn, one month at a time. Choose your month, and then discover easy-to-find constellations, galaxies, and more. Written in Mike's conversational tone, this guide comes complete with sky charts.

INSIDE YOU'LL FIND:

- Highlights of 27 constellations that you can find throughout the year
- Tips for locating objects in the night sky
- The stories and myths behind the constellations
- Monthly star maps showing galaxies, nebulae, and more

With his friendly tips, warm anecdotes, and step-by-step instructions, Mike will help you "make the stars your old friends."



ABOUT THE AUTHOR

For more than 50 years, accomplished astrophotographer Mike Lynch has been building telescopes, teaching classes on astronomy, and guiding tours of the stars. He writes a weekly Starwatch column that is syndicated in newspapers across the United States.

