There are millions of other interesting objects outside our solar system. Using the same scale as the solar system, these objects wouldn't even stay on Earth. As small as the planetary scale is, if we tried to put another sign where some of these objects are, it would almost reach where Venus actually is. They would certainly go beyond the Moon. Below are just a few different kinds of objects that you can try to spot.

Mizar/Alcor

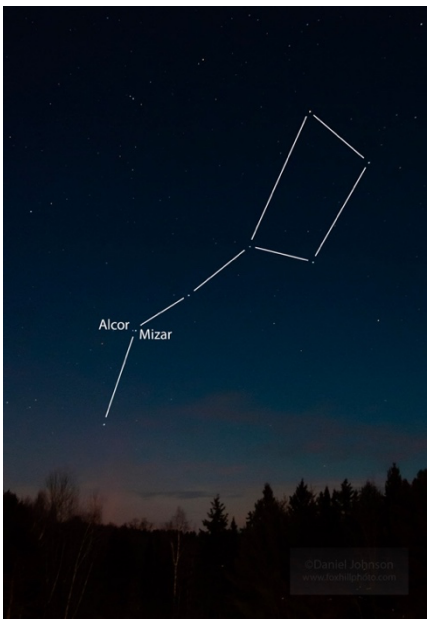


Image from Sky & Telescope by Daniel Johnson

Age: roughly 400,000 years old

Size: Alcor and Mizar are separated by about 0.8 light years, but Mizar is 5.6 light seconds wide, Alcor is 4.3 light seconds wide

Distance: about 82 light years away

Composition

Alcor and Mizar are both young, blue stars. Unlike color theory, blue is the hottest type of star and red is the coolest. Blue stars are the hottest color of star and they're usually the biggest. Bigger stars also use up their fuel more quickly, so the bigger the star is, the sooner it will explode. However, all stars have the same general composition, with multiple inner layers and a couple atmospheric layers.

Mizar and Alcor are a visual double star, meaning they appear close to each other. However, Mizar is composed of two stars in itself. If that wasn't enough, each of those two stars are again a double star. That means when you see Mizar, you're really seeing 4 stars extremely close to each other.

Location

Mizar and Alcor are the two stars that make up the middle of the Big Dipper's handle. The Big Dipper is part of the constellation Ursa Major. Ursa Major is a

circumpolar constellation, which means it is always above the horizon. Try to spot it somewhere North.

Roman vision test:

The Roman empire lasted from 753 B.C. to roughly 480 C.E. During this time, they saw Mizar and Alcor in the night sky. They realized that some people could see the separation of the two stars and others couldn't. This became the standard vision test. If someone's vision was bad enough, they made an early form of glasses. They cast glass into a cup or bowl and let it cool and then you used those glasses when you needed to see more clearly.

Polaris

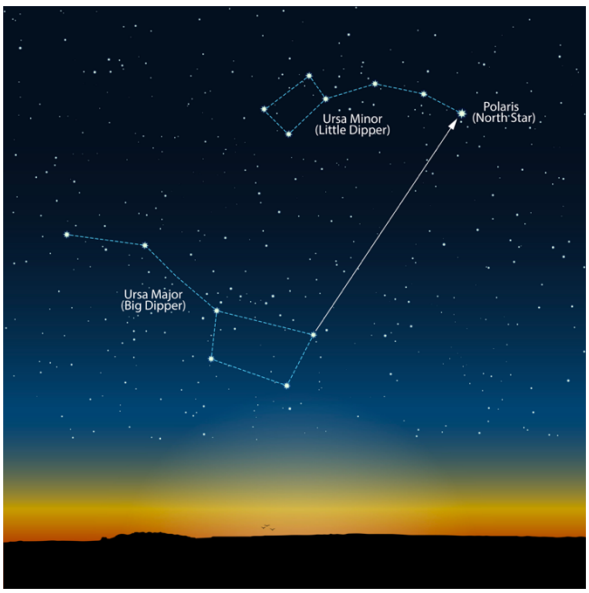


Image from Science Sparks

Age: 70 million years old

Size: 150 light seconds wide

Distance: roughly 320-430 light years away

Composition

Polaris is defined to be a hot supergiant, but it only appears small because of how far away it is. Stars are classified in different categories and sub-categories. The main categories are O-B-A-F-G-K-M. O is the biggest and hottest and M is the smallest and coolest. Within each of those categories, there are numbers 0-9 that define how hot the star is. 0 is the hottest and 9 is the coolest star within that category. Polaris is an F7 star and the Sun is a G2 star.

Location

Polaris is also known as the North Star. Thus, it is always in the same spot in the sky almost directly North. In order to find how high in the sky it is, refer to your latitude on Earth. Simply search in a web browser your current latitude and look that high in the sky. For example, the Huston-Brumbaugh Nature Center is about 41 degrees North, so you should look about 41 degrees high in the sky to find it. 41 degrees is about halfway between the horizon and straight overhead. This trick works because our axis is pointed at it. If you're on the equator, you'll see Polaris almost touching the horizon. If you're at the North Pole, you'll find it straight up.

Polaris is known as the North star because it is always in the northern sky. This is because Earth's axis is pointed almost directly at it. There is some variation, however. Over time, Earth's axis wobbles. This creates a process called precession. This means that in many thousands of years, we will have a new 'north star'. Precession works in a circle in the sky, and it takes about 26,000 years to make a complete circle.

Unlike what many believe, Polaris is not the brightest star in the night sky. It is the 46^{th} brightest star.

The Pleiades

Image from SciTechDaily using SAO's Fred L. Whipple Observatory Tillinghast facility

Age: 100 million years old

Size: 17.5 light years wide

Distance: 444 light years away

Composition

The Pleaides is arguably the most well-known star cluster in the night sky. It is made up of about 3,000 stars, with seven or eight being the brightest. It looks almost like a haze in the sky, and a little like the big dipper, only much smaller. There are five stars in the Pleiades that have a similar arrangement to the bucket of the big dipper and the first star in the handle closest to the bucket.

Location

The Pleiades are located in the constellation Taurus beyond Orion's upper right shoulder. It appears as a faint haze and can sometimes be seen better with averted vision. Averted vision is a technique used to see faint objects by looking just beside the object and trying to focus on the actual object.

The Pleiades was the inspiration for the logo for the Japanese vehicle manufacturer Subaru. Instead of referring to the cluster as 'the Pleiades', the Japanese refer to it

as ‘subaru’. Subaru can also mean ‘unite’ in Japanese, which embodies the Pleiades cluster for being tightly packed.

Beehive Cluster

Age: 624 million years old

Size: 15 light years wide

Distance: 574 light years away

Composition

The Beehive cluster is made of many thousands of stars. It is one of the more well-known clusters for having bright red and blue stars. Some of the stars even have planets around them, which can be unusual for star clusters. In fact, when you look up at a clear night sky, around 80% of all the stars that you see have at least one planet around them.

Location

The Beehive cluster is directly in the middle of the constellation Cancer and can sometimes appear as a haze. Other times it can be resolved into many individual stars

Orion Nebula

Age: 3 million years old

Size: 24 light years

Distance: 1,340 light years away

Composition

The Orion nebula is a dense cloud of gas and dust. There are many other regions like this in space, but not all of them are lit up. Two different kinds of these regions, called nebulae, are emission nebulae and reflection nebulae. Emission nebulae are large clouds of gas and dust that produce their own light. This happens one of two ways: either the gas itself is hot enough to produce light on its own or a nearby star heats the gas up to produce the light, but the gas won't do it alone. Reflection nebulae are large clouds that reflect the light coming in. For example, a nearby star won't heat up the gas enough to make light, but the light from the star hits the cloud and the light gets directed towards us. It looks like the cloud is producing light, but it's just a reflection. The Orion Nebula is an emission nebula. A star cluster responsible for heating up some the gas is called the Trapezium

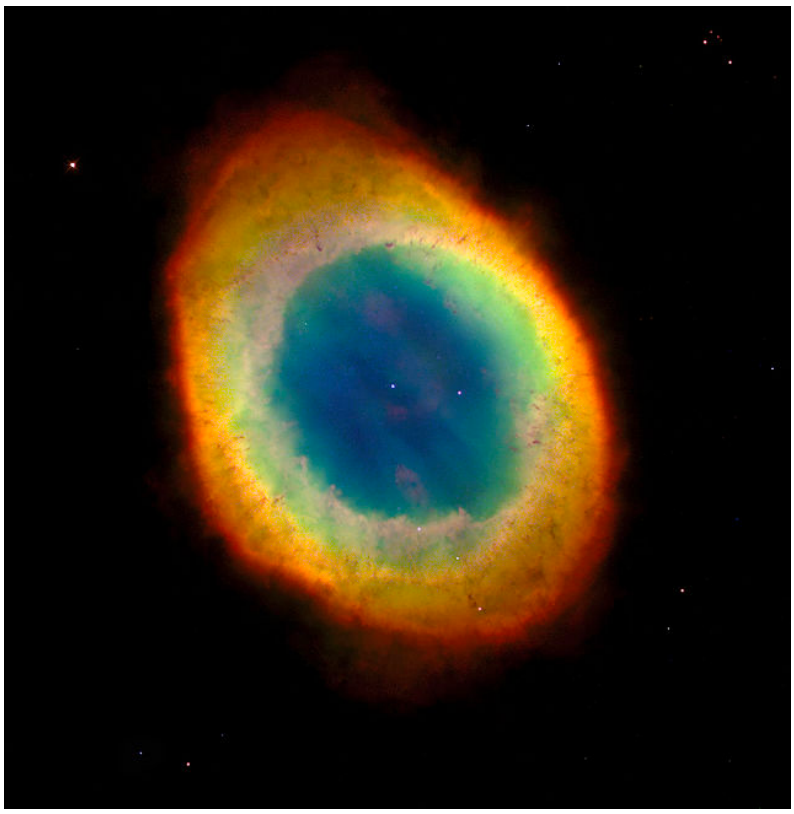
cluster. It sits in the brightest part of the Orion nebula, so it can be difficult to see. The Orion nebula is one of the most famous objects in the night sky and has been imaged extensively.

Location

The Orion nebula is located in the sword of Orion. Visible with the naked eye, you can see the nebula below the three stars that make the belt and slightly to the left. It appears as a hazy star.

The Orion nebula is also a stellar nursery. A stellar nursery is a region of gas and dust with the right conditions to form stars. Certain parts of the clouds will have enough material that the cloud condenses and forms a star, but this process can take millions of years.

Ring Nebula



Age: 7,000 years old

Size: 1 light year

Distance: 2,300 light years away

The Ring nebula is a planetary nebula known for its very circular shape. Although the name is confusing, planetary nebulae have nothing to do with planets. The reason they are called planetary nebulae is because the man who first discovered them, William Herschel, thought they were planets. The one he was looking at was circular and greenish, and it reminded him of Uranus, the most recently discovered planet. Once he realized it wasn't a planet, he named the category of objects planetary nebulae.

The Sun will eventually produce a planetary nebula in roughly 4 billion years. The Sun is the right kind of star both in size and heat to produce this kind of nebula. In order to go supernova or create a black hole, a star must be much bigger and hotter than the Sun. The Sun will expand past Earth's orbit, destroying Mercury, Venus, and Earth, and slowly blow off its outer layers. This creates a planetary nebula.

Once it’s done throwing off its layers, it cools down into a white dwarf, which is a small, cool star in the middle of the nebula.

Location

The Ring nebula can’t be seen with the naked eye, but it is on the edge of the constellation Lyra.

Cat's Eye Nebula

Age: 1,000 years old

Size: 0.4 light years wide

Distance: 5,300 light years away

The Cat's Eye Nebula is another planetary nebula. It is very well-studied in both visible and x-ray light. The x-ray light is produced because the central star produces enough heat to make the gas emit both visible and x-ray light, which is a higher energy. It was also the first object studied with a spectroscope. A spectroscope is a scientific instrument designed to figure out what kinds of elements and molecules are in an object. All elements produce their own signature of light, similar to a bar code for items in a store. A spectroscope reads the light coming from the object and separates it into the different elements it sees.

Another feature of the nebula is that it has concentric circles of gas extending outwards from its center. This is caused by periodic events where the star blows off some of its outer layers.

Location

The Cat's Eye nebula also can't be seen with the naked eye, but it is in the middle of the constellation Draco.

Cygnus X-1

This is not a real black hole, but an artistic illustration from Space.com

Age: 5 million years old

Size: 27 miles wide

Distance: 6,197 light years away

Cygnus X-1 was the first black hole discovered. An English teacher named John Michell thought, in 1783, that black holes could exist, but he never did any more experiments or went further with his idea. Black holes were again theorized by Einstein in 1916, but it was still long before they were ever found. Einstein found that with the theory of general relativity, stars could collapse under their own gravity and create a “well” where whatever fell in could never come out. Because the gravity in this part of space is so strong, the diameter of the black hole must be extremely small compared to other objects in space. This diameter, essentially the edge of the well, is called the Event Horizon. Once light or matter reaches this point, it can never escape. Light and matter outside of it, however, can escape given the right path. This is what the size of the black hole is.

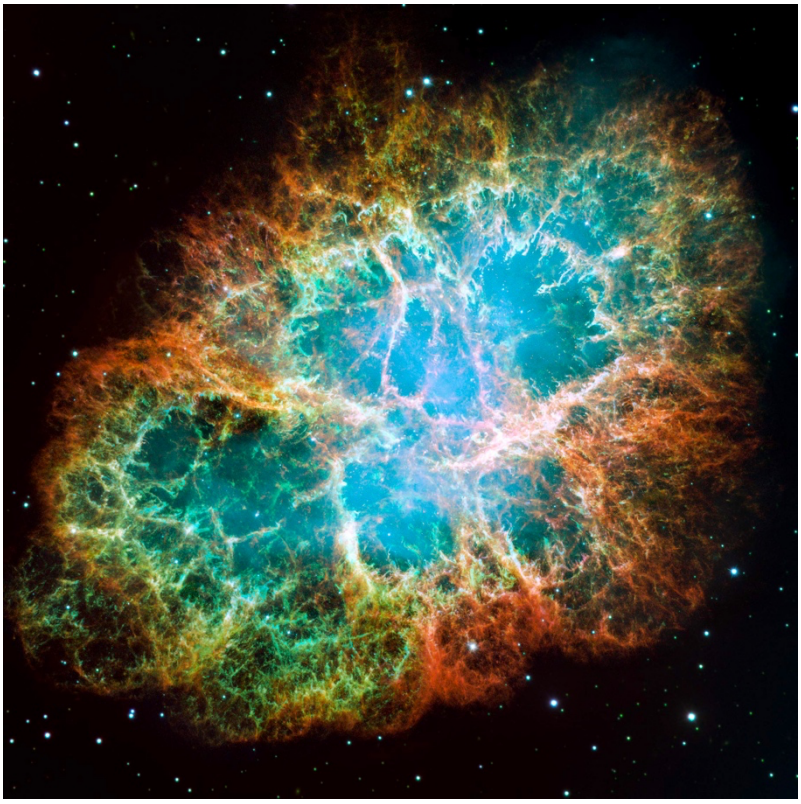
Because everything is falling towards the middle, the matter around the black hole almost always moves in a circular motion, like draining water from a bathtub. Due to the matter rubbing up against each other, the region around the black hole gets heated up to million of degrees Fahrenheit, easily much hotter than the core of the Sun. For those who have had to change a tire or brakes on a car, you know that you have to wait after someone is driving it because it gets hot. This is the same principle: that rubbing up against something moving fast heats it up.

Cygnus X-1 also has a star that orbits around it. Most stars come in pairs, so when the star that created Cygnus X-1 imploded, its companion star was still intact. The companion star still orbits the black hole, although in a different path.

Location

Cygnus X-1 is in the constellation Cygnus. It can't be seen with the naked eye, and it is important to note that it poses no threat to us.

Crab Nebula



Age: roughly 1,000 years old

Size: 11 light years wide

Distance: 6,490 light years away

The Crab Nebula is a supernova remnant. When a large star is about to die, there are two ways it can go out. If the star is massive enough, it can create a black hole. If the star doesn't quite have enough mass, it will instead go supernova. A supernova is when the star explodes and leaves only the core of the star left. The rest of the star is violently thrown out into space. The process of a star going supernova is the most powerful explosion in the universe. Because it is so powerful, they can outshine an entire galaxy. Only a few months ago, astronomers witnessed a star go supernova in the Pinwheel galaxy (M101). This star shone brighter than the entire galaxy around it. A similar process occured in 1054 A.D., when Japanese and Chinese people saw a bright light appear in the sky. The light only lasted a few weeks, but it was visible even in the daytime.

Betelgeuse is a red supergiant star in Orion, being the upper left shoulder of the constellation. It is predicted to go supernova in the range of a few years to many thousands of years. Astronomers cannot say exactly when it will explode, but in the lifetime of a star, it is soon. When Betelgeuse goes supernova, the only thing brighter will be the Sun. It will be visible in the daytime and be the brightest object in the sky at night, even with a full Moon.

Location

The Crab nebula is located in the constellation Taurus just to the right of the star that makes up the left horn of the bull.

M13

Age: 13 billion years old

Size: 145 light years wide

Distance: 24,900 light years away

M13, also called the Great Cluster in Hercules, is widely regarded as the best globular cluster in the sky. A globular cluster is a dense region of stars that lie on the outskirts of galaxies. They are usually as old as the galaxies themselves, and nearly as old as the universe. Because they are so old, they were used to figure out how far the Sun is from the center of the Milky Way. Because they are on the edges of galaxies, astronomers figured out our distance from several of these clusters and gave an estimate as to where the Sun lies in relation to the whole galaxy. It contains anywhere from 200,000-500,000 stars in a very small volume.

Location

M13 is located in the constellation Hercules and can be seen as an extremely faint dot.

Center of the Milky Way

Distance: 26,000 light years away

The center of the Milky Way contains a black hole, like nearly every galaxy in the universe. The one in our galaxy is called Sagittarius A*. Because of the dust and gas from the galaxy, we can't directly see the black hole. Astronomers use visible light to take pictures near the center and radio light to take pictures of the center, since radio light can go through dust easily. Since radio can go through dust, however, it does not produce a sharp picture. There are many black holes closer than Sagittarius A*, so there is no threat to us. In fact, it helps to keep the galaxy bound together, so we would be worse off without it.

Andromeda Galaxy

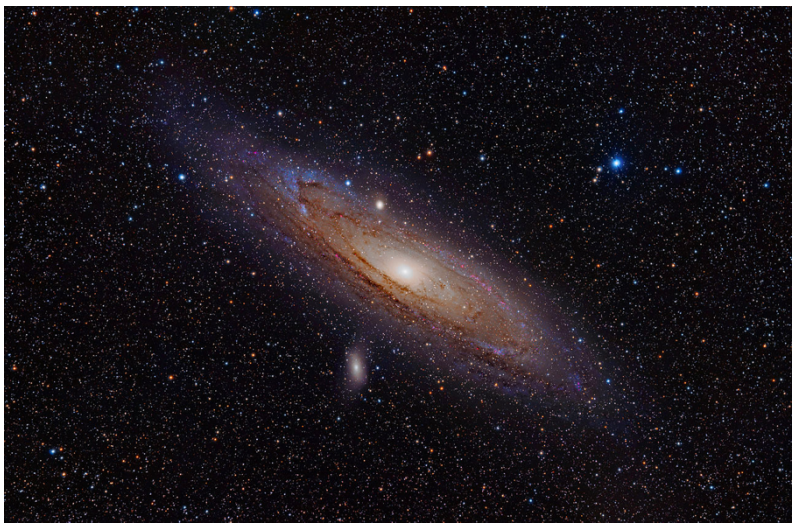


Image from Messier Objects courtesy of Adam Evans

Age: 10 billion years old

Size: 220,000 light years wide

Distance: 2.58 million light years away

The Andromeda galaxy is the closest galaxy to us. It contains many hundreds of billions of stars just like the Milky Way. Unlike every other galaxy, it is moving towards us. This means in a few billion years the Milky Way and Andromeda will collide. But because the galaxies are so big, almost nothing will hit each other. While the structures of the galaxy will change because of the collision, almost none of the stars or planets will hit each other. This is not a concern for life on Earth, because the Sun will die and consume the Earth before that happens. When the Sun dies, it will expand past the Earth's orbit and vaporize the planet. This again is not a concern because it will happen in billions of years.

Location

The Andromeda Galaxy is the farthest object you can see with the naked eye. It shows itself as a faint haze just beyond the arm of the constellation Andromeda.

We developed the signs along the Forest Buchanan trail along with seasonal brochures in the Visitors' Center to increase public awareness of astronomy. While northeast Ohio is one of the cloudiest regions in the United States, it shouldn't deter people from wanting to learn about the night sky and study it. Our ancestors thousands of years ago saw nearly the same night sky we do today, so it's a part of human nature to want to look into the depths of the universe.

Compiled by Logan Good with assistance from University of Mount Union Professor Jodi McCullough and Nature Center staff Cali Granger

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