

This is Bill Mundhausen writing to you from the Orion Center in Camdenton, Missouri, and this is a program about the winter nighttime skies. We'll take a look at the stars and constellations overhead in mid-winter as seen from mid-northern latitudes. This tour of the night sky was designed for about 9pm standard time around February 5th. If you are viewing earlier in the evening then stars and constellations will be east of the positions described. If you're viewing later in the night, then they will be west of the suggested locations. If you're viewing much before February 5th, then all stars will be east of the suggested locations and if you're viewing much after February 5th then all stars will be west of the suggested locations. You'll enjoy this sky tour best if you are in the darkest place you can find away from city lights or in a planetarium.

To get our bearings for let's find our directions. Remember where the Sun set? That's west. If you're in a planetarium, you'll have to ask your tour guide. Now, face that direction. 90 degrees to your left, your left shoulder is now pointing south. 90 degrees to your right, your right shoulder points north. Directly in back of you is east. Straight overhead is a point called the zenith. Keep these directions in mind since we will be referring to them throughout the program. Now turn left and face south.

ORION THE HUNTER

At this time of year the dominating star group—easy to spot—is Orion the hunter. Look for a large, vertical near-rectangle of four stars about half-way up toward the zenith from the southern horizon. This near-rectangle is about half-way up toward the zenith and about 20 degrees high and 12 degrees wide—or about twice as tall as the width of your fist seen at arm's length. It's standing on end, with a nearly perfectly straight row of three stars in a diagonal line right in its center. It has a bright red star in its upper left corner and a bright blue-white star in the lower right corner. (There is an even brighter star below and to the left of the near-rectangle of stars, but don't confuse that star with the rectangle of four that we're talking about right now.) One way to check that you have the correct star group is to make sure you can see the straight line of three stars inside the rectangle. These stars of the rectangle and the three inside are all part of the constellation Orion the Hunter in mythology, The three stars in a line inside the rectangle form the belt of Orion and some even fainter stars in another line, pointing down from the belt form the hunter's sword. The red star in the upper left corner of the rectangle is the bright star Betelgeuse in one of Orion's shoulders. A line of faint stars curving off that shoulder, and up over the top of the rectangle forms an arm and a club.

Betelgeuse is Orion's right shoulder (on your left as you look at him in the sky) and the other upper star to the west, or right, of Betelgeuse in the rectangle is the left shoulder of Orion. That star in his left shoulder, called Bellatrix, is a second magnitude star. To the west, or right, of Bellatrix is a curved line of faint stars, generally running north and south (up and down in the sky, if you're still facing south). These fainter stars form the shield which Orion is holding as he battles with Taurus the bull still farther to the west, or right, of him. Betelgeuse is a fine example of a red giant star. Red giants are bloated, cooler stars thought to be in the ending stages of their lifespans. Betelgeuse itself is relatively close as stars go, only about 500 light years away (but still, that means that the light you see from Betelgeuse tonight left the star 500 years ago). It's so large that, were we to replace our Sun with Betelgeuse, all the planets out through Mars would

be engulfed inside the star! Our Sun is also expected to expand to become such a red giant star about live billion years from now.

Now look at the faint line of stars representing the sword of Orion hanging down from his belt in the center of the rectangle. (you might not be able to see Orion's sword easily.) The middle star of the sword isn't really a star, but rather it's the famous Orion nebula. The nebula is an example of one of the huge clouds of gas and dust in space from which stars are forming. The Orion nebula is about 1500 light years away. But with even a modest pair of binoculars you can detect the delicate faint glow of light from the great nebula in the sword of Orion.

The bright star in the lower right corner (that is, the southwest corner) of the large Orion rectangle is the brilliant, blue-white star Rigel. Rigel is about a thousand light years away and it's a powerful light producer: Rigel would be 50,000 times brighter than the Sun if it were the center of our solar system. As stars go, Rigel is quite hot, too; its outer layers are at about 15,000 degrees Celsius, which is why it has the bluish color it does. Cooler stars have different colors (if they're bright enough to trigger our color sense at all). Our yellowish Sun, for example, has a surface temperature of about 5,700 degrees Celsius, and red Betelgeuse has a relatively cool temperature of just a bit over 3,000 degrees. Rigel forms one of the knees of Orion the hunter.

Betelgeuse and Rigel are the brightest stars in Orion. The other two stars which mark Orion's rectangle are called Bellatrix (the one in the upper right hand corner as you look at Orion) and Saiph (in the lower-left hand corner). Each is a relatively hot star, and each would be much brighter than the Sun if we could see them from up close. The blue-white stars in Orion and the luminous gas of the Orion nebula are all part of a large region of gas, dust, and relatively new stars—thought to be a stellar “maternity” ward” of sorts, located about a thousand light years away from us in a direction outward from the center of the Milky Way Galaxy.

By now you should have some familiarity with the splendid constellation Orion. We haven't looked at the head of Orion yet, and with good reason: there are only three faint stars that are visible to the unaided eye above and between the shoulder stars, clustered together to form his head, such as it is. Mighty Orion doesn't seem to have much of a head on his shoulders.

THE DOGS

Once we have become familiar with Orion, we can use the stars of this constellation to locate others. Still facing south, locate the three stars forming Orion's belt. Now follow the line suggested by these three stars to the southeast—that is, toward the left. They lead to the very bright star Sirius, the brightest star in Earth's night skies. Sirius is quite close in stellar terms, only about eight and a half light years away. Think back to what you were doing eight years and six months ago—the light you see from Sirius tonight left Sirius then. That light has been racing here all that time, going 186,000 miles every second of that time. Despite its seemingly huge distance though, Sirius is one of the ten closest known stars to our solar system. Sirius is so bright in our sky that it isn't really first magnitude—although we identify it as part of the group of stars we call first magnitude. Its magnitude number is technically negative or minus 1.5. If our Sun were moved in space to the distance that Sirius has from us, it would be only about as bright as Polaris, which is a second magnitude star.

Sirius is the brightest star in the constellation Canis Major, or the big dog. In mythology, Sirius forms the head of Canis Major. A line of fainter stars leads away from Sirius to the

southeast—that is, to the lower-left. This line forms the body of Canis Major. The same line branches at the lower-left end in two directions to form the legs and tail of the dog. Branching off Sirius in the other direction a pattern of stars forms the alert and upraised ears of Canis Major. Canis Major is one of Orion's two hunting dogs.

To find Canis Minor, the little dog, let's return to the big rectangle of Orion. This time we'll use the shoulder stars of Orion to guide us. Start with Bellatrix, the western, dimmer shoulder star at your upper-right. Proceed to the left in an imaginary line through the other shoulder Betelgeuse, and extend this line about three times the distance between the shoulder stars. There, we come to Procyon the brightest star of Canis Minor. Procyon is about equidistant from Betelgeuse in Orion and Sirius down in Canis Major, and forms with these stars a large equilateral triangle. Canis Minor is truly the little dog, since there's only one other easily noticeable star in the constellation, and that's a third magnitude star to the west (or right) of Procyon.

THE HYADES AND PLEIADES

Now bring your attention back to the belt of Orion. Follow the line of the belt to the west (or right) and curve up slightly. This line leads to a bright star of reddish-orange tint called Aldebaran in the constellation Taurus the bull. In fact, the ancients pictured Aldebaran as one of the eyes of Taurus. Aldebaran can be seen as part of a V-shaped group of stars with the point of the V to the southwest. This group is called the Hyades, and it's a true cluster of stars in space—all roughly the same distance away, some 130 light years. All the stars of the V except Aldebaran are members of this physical clustering of stars—Aldebaran just happens to be situated in space in the same direction but is closer to us and isn't really part of the star cluster.

The V-shaped Hyades form the face of Taurus the bull. The horns of Taurus extend off the top of the V to the east over the top of Orion. Taurus and Orion are classically pictured as doing battle. To the west of the Hyades—that is, to the right—you can spot another, much smaller cluster of stars in Taurus. This cluster is the Pleiades. The Pleiades cluster is somewhat more famous than the Hyades, probably because it is more obviously a cluster of stars. Six stars stand out to the unaided eye, although with telescopes astronomers have identified more than a hundred members of the cluster. The Pleiades and Hyades are really rather similar to one another, but the Pleiades are farther away.

Let's now look back at the bright star Procyon in the constellation Canis Minor, or little dog, to the upper left of Orion. In your imagination, trace a line from Procyon down to Sirius, the very bright star in Canis Major. Now trace from Sirius up to Betelgeuse, the bright red star in Orion. Now continue from Betelgeuse down to the right to Rigel and from Rigel up to the right to Aldebaran in Taurus. In doing this we have traced a large (if somewhat uneven) W on the sky. It's called the winter W. Let's trace it again: start with Procyon—proceed to Sirius—then to Betelgeuse—then to Rigel—and finally to Aldebaran. There it is: "W" for winter!

THE TWINS

Look back to the upper left of the big winter W now, back to Procyon. Above Procyon, about as far as Sirius is below, there are two bright stars, one above the other. Also, a line from Rigel at the lower-right of Orion's rectangle, projected through Betelgeuse about twice that distance leads to these same two stars. These two stars—about a fist-width apart from one

another on the sky— are the twin stars Castor and Pollux, in the constellation Gemini the twins. Castor is the star on top, nearer the zenith, and Pollux is the lower star. A line of dimmer stars trails off each of Castor and Pollux back down toward Orion the hunter. These are the stars of the constellation Gemini the twins, just west (to the right) of the constellation Cancer, the crab. There are no bright stars or convenient star patterns to identify in Cancer, but there is a star cluster known as the Praesepe cluster there. It's more commonly called the beehive cluster.

Cancer, Gemini, and Taurus are all constellations of the ecliptic, the great circle on the sky where the planets move as they travel around the Sun at their own individual rates. It's in these constellations that the planets are seen from Earth, so if you see a bright star I haven't mentioned in Cancer, Gemini, or Taurus, it's probably a planet.

AURIGA THE CHARIOTEER

Let's look back now at Gemini, the twins—that is, the stars Castor and Pollux—and Taurus, with the V-shaped Hyades. Lying midway between and above Gemini and Taurus—and nearly overhead, near the zenith—is the constellation Auriga, the charioteer, containing the bright star Capella. Capella is a yellowish star—about the same temperature as our Sun, but larger and brighter and it's only about 40 light years away. The rest of the stars of Auriga form a five-sided figure about the size of two fists at arm's length, extending down toward Orion. There is an interesting little triangle of stars close to and southwest of Capella—toward the lower-right—called the kids. Capella was known in mythology as the she-goat which suckled the infant Jupiter, so it might be fitting to call the little triangle of stars close to Capella, the kids or young goats.

If you turn around now and face north, you'll see the Big Dipper over in the northeast to the right, with its handle projecting into the horizon. In the dead of winter, in the evenings, the dipper is on end—but in our spring session, the dipper will be prominent and high up in the sky. You may see a few meteors from time to time outdoors at night; a good dark viewing site should allow you to see about seven per hour, averaged over the course of the night. During meteor showers though, more of them can be seen, especially from a dark viewing site. Meteors are small pieces of natural space debris—or perhaps man-made space junk once in a while—that enter Earth's atmosphere at high speed some 50 miles or more over your head. Friction with the atmosphere causes them to burn up—usually in just a few seconds. Some are large enough to reach the Earth's surface, though, and are then called meteorites, but these are relatively rare. Major meteor showers during the winter are the Ursids on or about December 22nd and the Quadrantids on about January 3rd. Bright moonlight will inhibit your ability to see meteors, so if the Moon is out, don't concentrate on meteors—view the Moon instead! Exploring the Moon with a pair of binoculars can be a fascinating experience.