

ASTRONOMY

Magnificent Orion

Changing Skies Bring Famous Constellation Above Horizon So That it Can be Observed Early in the Evening

By JAMES STOKLEY

THOUGH the astronomer, like other people, makes use of a calendar in his daily life, such a device is not necessary for him. The starry skies reveal the changing seasons to those who know them. Look to the southeast this evening, about nine o'clock. About a third of the way from the horizon to the zenith are three bright stars, in a vertical row. Two stars, of even greater brilliance, are seen to the right and to the left, while just above the row of three is still another bright star. Descending downwards, and to the right, from the lowermost star of the set of three, is a line of fainter stars, and, if the night is dark, and you are away from the glare of city lights, one of these appears slightly hazy.

This group of stars, of course, is the constellation of Orion, generally considered as the most magnificent of all groups in the sky. In the summer it does not come well above the horizon until long after most of us have gone to bed. But the constellation changes its habits during the winter and is now beginning to appear high up in the sky in the early evening.

To the ancients Orion represented a warrior, with a lion skin over one arm, an upraised club in the other hand, and a sword hanging from his belt. The three stars in a row form the belt. The upper one is called Mintaka, the middle one Anilam and the lower Alnitak. Each of these stars is of the second magnitude. The curved row of fainter stars extending downwards from Alnitak forms the sword, while the hazy patch, revealed better through even a small telescope, is the Great Nebula of Orion, a vast cloud of glowing gases.

The bright star to the left of the belt has a slightly reddish color, and is called Betelgeuse. The astronomer, however, usually discards these ancient names, many of which are derived from the Arabic, and to him this star is alpha Orionis, which means that it is the brightest star in the constellation of Orion. This system of designating stars by letters of the Greek alphabet, in order

of brightness, followed by the Latin name of the constellation, in the genitive case, was introduced in the year 1603, by Johann Bayer, a Bavarian attorney who was interested in astronomy, and who published in that year a famous set of star maps.

Second brightest star in Orion, and therefore known scientifically as beta Orionis, is the one to the right of the belt. Rigel is its common name, and it marks the warrior's lifted left foot. Like Betelgeuse, it is of the first magnitude. The star above the belt is of the second magnitude, and called Bellatrix, or gamma Orionis, because it is the third brightest star of the constellation. Mintaka, Anilam and Alnitak are designated, respectively, as delta, epsilon and zeta Orionis.

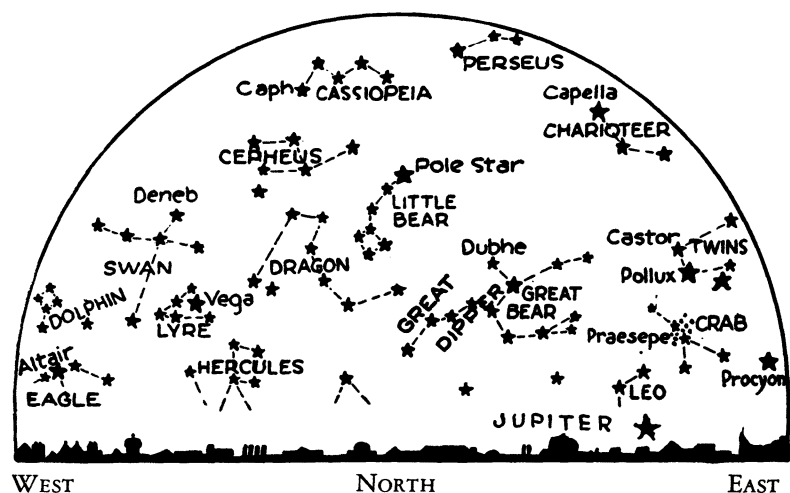
The Bull's Red Eye

Now look above Bellatrix, and you will see a bright star distinctly red in color. It is not hard to imagine this star as the baleful eye of some huge animal and the ancients must have had some such idea, for this marks the eye of the bull, Taurus. Orion is about to smite him with his club. Aldebaran is the name of the star, and a little above it is a famous cluster of fainter stars, the

Pleiades. Though legend has it that there were once seven stars visible to the naked eye in this group, it is now generally possible to see only six. But with a small telescope or even a pair of opera glasses, many more are visible. A long exposure photograph, through a powerful telescope, reveals several thousand stars in the region, and shows that they are enveloped in a cloud of nebulosity. Apparently this is an opaque cloud, and we see it illuminated by reflected light from the stars that comprise the cluster.

Orion is not alone as he goes forth to fight the celestial bull, for his two faithful dogs accompany him. Directly under the constellation is one, Canis Major, the great dog, marked by the "dog star," Sirius, brightest of all the stars in the sky. The star is supposed to represent an ornamental jewel on the dog's collar, but, like most of the constellations, it is hard for us moderns to see any resemblance between the grouping of the stars and the object indicated. The other, and lesser dog, Canis Minor, is to the left and a little higher in the sky. Another very brilliant star, Procyon, marks this group.

Above Canis Minor is the constellation of Gemini, the twins. In the northern part of the constellation are the two stars representing the two boys. These are Castor and Pollux. At present Pollux, the brighter of the two, is lower in the sky than his brother. Now look above Gemini, and you will see Auriga,



POINTING TO THE DEMON STAR

Follow the western edge of the "A" of Perseus to the moderately bright star, Algol, shown on the other map. Algol is really two stars which eclipse each other to cause its light to brighten and dim regularly.

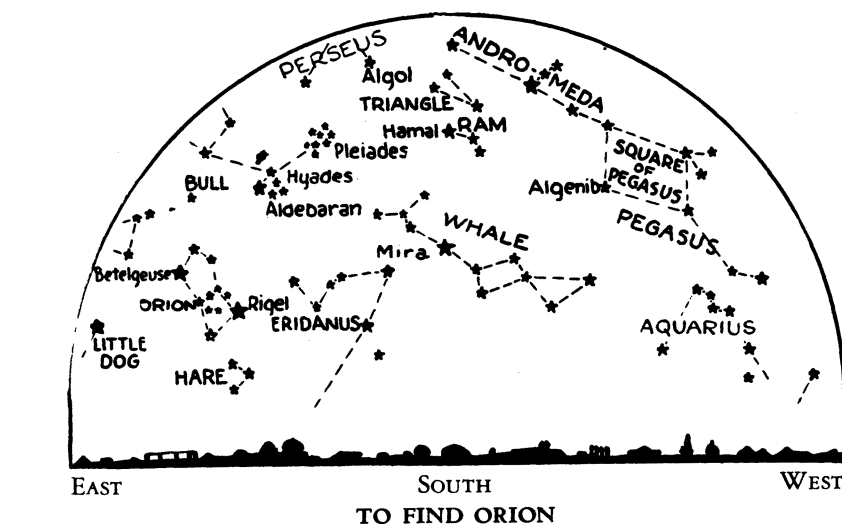
the charioteer, marked by the brilliant star Capella.

In the west is the Great Square of Pegasus, a familiar "landmark" in the study of the sky. Pegasus is the winged horse used by Perseus, and his head, shoulders and forefeet are represented. As he stands now in the western evening sky, he is taking a nose dive towards the horizon. The uppermost star of the square is not actually in Pegasus, but in the next-door constellation of Andromeda, who was the lady chained to the rock. No very bright stars mark this group, which extends in a line towards the zenith. Above her, and directly overhead, is Perseus himself.

Algol, the Demon Star

The stars of Perseus form a pretty good letter A, with a point of the letter toward the northwest, and next to the W-shaped constellation of Cassiopeia. The western edge of the A points to the south, and at its southern end are two moderately bright stars, one of the second magnitude and the other of the third, a little fainter. The fainter one is at the southern end of the row of stars. The brighter of the two stars is called Algol, and is sometimes known as the "Demon Star." To find the reason for this strange appellation, watch Algol for several nights. Most of the time it is brighter than its neighbor to the south, rho Persei. But if you look at it on the evenings of December 9, 12, 15, or 29, you will see that it is much fainter than usual, scarcely brighter than rho. If you continue to watch it, on into the night, you will find that it will begin to brighten, and, after a few hours will be shining with full brilliancy, as if nothing had happened!

The cause of this periodic diminution in the light of Algol is no more mysterious than the darkness that comes over the earth when the sun is obscured by the moon during a total eclipse. In fact, it is caused in just the same way, and Algol is known as an "eclipsing variable." Algol is not really a single star, but double, the two orbs revolving around their center. One member of the pair, however, is very faint, though it is the larger of the two. It happens that the earth is close to the plane in which they move, so once in each revolution the darker star partially eclipses the brighter one, thus causing the diminution in light. Once in 68 hours and 49 minutes a revolution is completed. After the dark body starts to obscure the bright one, it takes about $4\frac{1}{2}$ hours before the time of minimum brightness is reached. It remains there for about



Face the south with this map before you and the stars will unfold themselves as they are represented on the diagram. Hence Orion will be found in the southeast about one-third of the way from the horizon to the zenith.

20 minutes, then another $4\frac{1}{2}$ hour period is required for the star to wax to its usual brightness. Of course, the entire reduction in light frequently takes place in the daytime, when the star is not visible at all, but on the nights mentioned it occurs in the evening hours. On the ninth, the time of minimum is at 10:10 p. m., eastern standard time; on the twelfth, at 7:00 p. m.; on the fifteenth, at 3:50 p. m. and on the twenty-ninth, at 11:50 p. m.

With the aid of the photoelectric cell, the magic lamp of modern science that has made possible both talking movies and television, astronomers have measured very accurately the variations in light of Algol. Prof. Joel Stebbins, of the Washburn Observatory of the University of Wisconsin has probably made the most extensive studies of this kind. The curves obtained by Prof. Stebbins, for example, show that there is a slight reduction in light at a point directly opposite to that of the principal minimum. This indicates that the fainter body is not entirely dark, because the total light is slightly reduced when it passes behind the brighter body. This change is too slight to be observed with the eye, even when aided by a telescope, but the electric eye, the photoelectric cell, reveals it.

Third Member Dark

Using these data, Prof. H. N. Russell, of Princeton University, has calculated the dimensions of the stars that make up the system we call Algol. He finds that the bright star is 1,250,000 miles in diameter, as compared with 1,450,000 miles for the faint one. The

former has a mass only about three-eighths that of the sun, even though it is about 385,000 miles greater in diameter. The centers of the two orbs are 3,000,000 miles apart. But even this is not all, for the spectroscope, which can reveal the motion of a star towards or away from the earth, and which shows the motion of the bright star as it rotates around the darker body, also indicates that these two stars revolve, in a period of nearly two years, around a third and invisible body.

Below Perseus in the evening sky, towards the northwest, is Cassiopeia, the seated lady, with the stars arranged in the shape of a W. Below her is Cepheus, and still nearer the horizon is Cygnus, the swan, or the northern cross, which is now in an upright position. The bright star Deneb is at the top. To the right of Cygnus, just about to set, Lyra, the lyre, can be seen in the early evening, with the brilliant star Vega. In the northeastern sky, also close to the horizon, appears the great dipper, in Ursa Major, the Great Bear. The bowl of the dipper is now uppermost.

During December none of the planets are well placed for observation during the entire evening. Right after sunset Venus can be seen towards the west, in the gathering dusk. It sets about an hour and 45 minutes after the sun, but its great brilliance, of the minus 3.3 magnitude, should make it easily visible. Just above Venus, and setting a quarter of an hour later, is Saturn. This planet is considerably fainter, and may be hard to find, though it is brighter than any star in the vicinity.