ASTRONOMY

Mythology in the Sky

Great Square of Pegasus Becomes Prominent, Bringing To Mind Legends of the Naming of Many Constellations

By JAMES STOKLEY

TO THE SOUTHERN evening sky in October there comes what is without doubt one of the most familiar of star groups—a figure that makes an excellent guide from which to start a study of the autumn constellations. This, the so-called "Great Square in Pegasus," is a rather inappropriate name. Only three quarters of the square are in Pegasus, the winged horse. The fourth star is in the adjoining constellation of Andromeda.

About nine o'clock this evening look high in the south, and there you will see this figure, as indicated on the map. Four stars of nearly similar brightness that form a good square make it easy to identify, even though none of the stars is of the first magnitude. The most brilliant is Alpheratz in the northeast corner. This is the star that is not in Pegasus but in Andromeda. Its magnitude, as determined by accurate astronomical measurements, is 2.15. Diagonally opposite, Markab is the next brightest of magnitude, 2.57. Only slightly inferior, hardly enough to be detected with the unaided eye, is the star directly above it, Scheat, whose magnitude is 2.61. Algenib, below Alpheratz, is the faintest of the quartet; 2.87 is its rating.

The other naked-eye stars in Pegasus are fainter than these. One set extends westward from Scheat. These form the forelegs of the mythical flying horse. The others extend from Markab, and according to the ancient fancies outline the animal's neck and head. Thus, as Pegasus appears in the sky for us in the northern hemisphere, he is upside down.

Story of Andromeda

Andromeda and the neighboring constellations, as well as Pegasus, are connected in mythology. The winged horse sprang into being from the blood of the Medusa when her head was struck off by Perseus. About this time Cassiopeia, queen of Ethiopia, of which Cepheus was king, boasted that she was more beautiful than the sea nymphs. This so annoyed Neptune that he sent a sea monster to ravage the coast of Ethiopia. When the oracle of Ammon was appealed to, she announced that the princess, Andromeda, would have to be chained to a rock on the coast and sacrificed to the monster, who would then spare the country. These instructions were followed, but before Andromeda was devoured Perseus arrived (not mounted on Pegasus, though some apochryphal versions of the legend have it so). Perseus slew the monster. Then he married Andromeda, even though she was betrothed to Phineus. This led to a battle royal at the wedding, in which the unsuccessful suitor and all his cohorts were slain. Later Pegasus became the steed of another hero, Bellerophon.

The positions of Pegasus and Andromeda in the sky have already been mentioned and are shown on the maps. Immediately north of Andromeda is a constellation in the shape of a W. This is Cassiopeia, the queen, represented as seated on her throne. Above and to the west of her is a constellation of somewhat fainter stars forming a smaller square with a triangle attached to its northeastern side. This is Cepheus, the king. Below Cassiopeia, and to the left of the lower part of Andromeda, is Perseus. The sea monster is low in the southwest, represented by the constellation of Cetus.

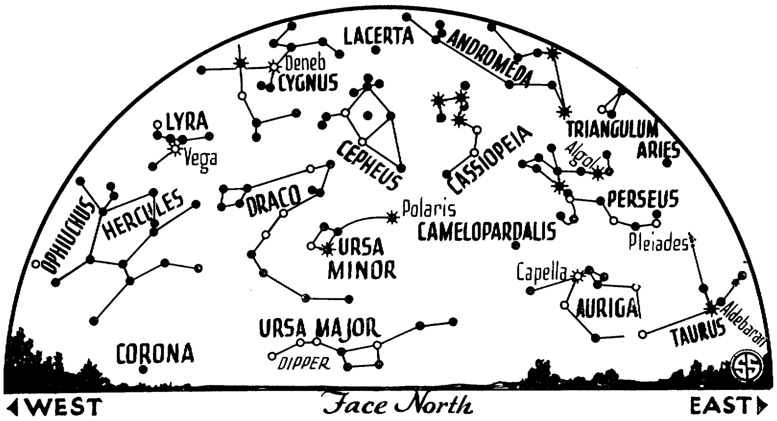
Though some of these constellations are fairly conspicuous, none of them contains first magnitude stars. There are, however, six stars of this brilliance in the October evening sky. Most brilliant of all is Vega, in Lyra, high in the west. Directly above is Cygnus the swan, sometimes called the northern cross. At the top of the cross is Deneb. To the southwest of Cygnus is Aquila, the eagle, containing the brilliant Altair.

Fomalhaut is another of the first magnitude stars now visible, and is low in the south. It is the only star of Piscis Austrinus, the southern fish, that can easily be seen from these latitudes. Just below Perseus in the northeast is Auriga, the charioteer, with Capella. Adjoining it, to the right, is Taurus, with the reddish bright Aldebaran marking the animal's eye.

First Sky Yardstick

And now let us return to Cepheus, which is this month in the best position of the year for observation in the evening sky. Though this constellation contains no very bright stars, it does boast of one which is among the most important bodies in the heavens—the first star to be discovered of a type which enables astronomers to plumb the greatest depths of the universe. This star is the uppermost one in the little square and is of the fourth magnitude, easily visible to the unaided eye, though not conspicuous. It is not bright enough to have a proper name, and is usually designated as delta Cephei. For this reason, stars like it are called Cepheids.

Delta Cephei is a variable star This is not so remarkable, for many of the stars in the sky change periodically in



KEY TO SIZE OF UNIVERSE

The little star at the top of the square in Cepheus, Delta Cephei, changes its brightness in such a way that astronomers use it as a yardstick of the heavens.

brightness. Some, like Algol, a famous variable in the constellation of Perseus, consist of two bodies, a bright and a dark one, which revolve around each other. At regular intervals the dark star eclipses the bright one. But delta Cephei is a variable of another kind. It brightens rapidly, then diminishes more slowly. It takes 5 days, 8 hours, 47 minutes and 39 seconds for it to make a complete change and return to its starting point. Furthermore, the spectroscope, which shows how a star is moving, reveals that when it is increasing in brightness, the star is approaching us, when diminishing, it seems to be receding.

The most plausible explanation of this peculiar behavior is that the star is pulsating, a theory that was originally proposed by Dr. Harlow Shapley, director of the Harvard College Observatory, and which was later developed mathematically by the famous English astronomer, Sir Arthur Eddington. Thus the star does not really oscillate back and forth, towards and away from us, but the light that reaches us comes from the side towards the earth, which does so oscillate. The opposite side, which has the reverse motion, is invisible, and hence the apparent relation between motion and change in brightness.

But, interesting as this is, the most important thing about the Cepheid variable stars is a fact that was discovered by another Harvard astronomer, the late Miss Henrietta S. Leavitt. She found that the Cepheids vary greatly in the length of their period, ranging from fifteen hours to a hundred days, but that those of the same period have the same average brightness. Furthermore, she found that the longer the period, the greater is the average brightness.

Tell-Tale Brightness

The studies of Dr. Shapley showed that this relation holds good for all Cepheids, and he applied it to a measurement of their distances. Because of the characteristic way in which these stars change in light, a Cepheid can always be identified. Then the time it takes to go from maximum brightness through its cycle and back again can be measured, and the astronomer can tell how much greater or less its candlepower is than another with a different period. Perhaps it comes out a hundred times fainter than another one, but both appear the same brightness when seen through the telescope. Then it is obvious that the one with the longer period, and hence the greater intrinsic brightness, is much farther away than the other, for if they were of the same distance one would appear a hundred times as bright as the other. From these data can be calculated the relative distances of any two Cepheids. Now, if the distance of one particular Cepheid can be found independently, we have a means of telling the distance of any one of them.

This very thing has been done, for some of the Cepheids are close enough to permit a direct determination of their distance. In some of the most distant objects studied by astronomers, the spiral nebulae, stars have been found which show all the characteristics of Cepheids, and their brightness and distance have been measured. In this way the distances of two of these objects, which are galaxies of stars outside the limits of the one to which the sun and all the naked eye stars belong, have been found to be about a million light years —a million times the six trillion miles that a beam of light travels in a year. As newer and more powerful telescopes are completed, still more distant objects can be measured in the same way.

The planets are not as numerous in the evening sky this month as they have been recently, for only one is visible. This is Saturn, famous for its system of rings, which can be seen in the constellation of Capricornus, low in the southwest. On the twenty-second of the month it is in quadrature with the sun, which means that it is directly south as the sun is setting. The planet sets, therefore, at midnight. Three other planets, Venus, Mars and Jupiter, may be seen in the morning sky, before sunrise.

During October, first quarter of the moon occurs on the sixth, full on the 14th, last quarter on the 22nd, and new on the 29th. Thus from about the fourth to the 16th, the evenings will be moonlit.

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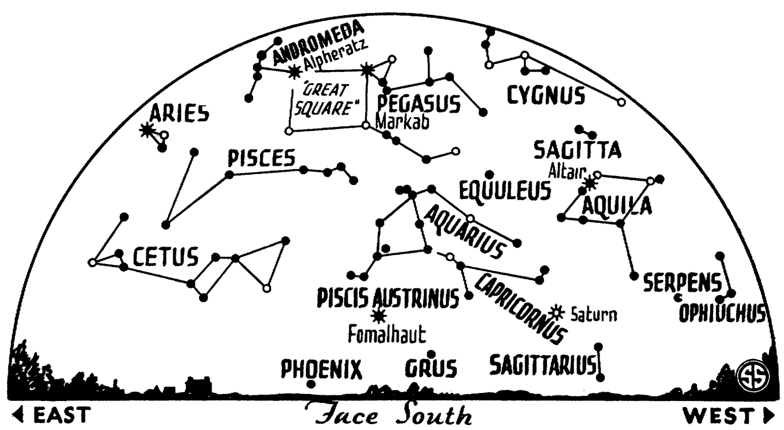
SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



SATURN ALONE IN EVENING SKY

The ringed planet is the only one that can be seen in the evening sky. Mars, Jupiter and Venus, however, are visible in the morning before sunrise,

BACTERIOLOGY

Bacteria Lived in Tube More Than 22 Years

GERMS that lived for twenty-two and a half years in a sealed tube have just been studied by Wilbur E. Deacon of the University of Nebraska. This is a long life for a group of germs growing on a nutrient medium in a tube. Ordinarily such groups of germs, called cultures, are discarded after a few weeks, or at most a few months, in favor of cultures of their descendants which bacteriologists believe to be more virile.

The germs which Mr. Deacon investigated were of the species called *Serratia marcescens,* formerly known as *Bacillus prodigiosus.* They do not cause disease, and grow on certain kinds of foods. Years ago when bread was baked at home in large batches and kept for weeks in damp storerooms, red spots appeared to trouble the housewife. The spots were caused by these bacteria.

In his report to *Science* Mr. Deacon described tests he had made and to which the germs responded in characteristic style, evidently none the worse for their many years of life in a test tube. The cultures had been made and sealed between 1903 and 1911 by the late Prof. H. H. Waite of the University of Nebraska.

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