

ASTRONOMY

Thuban Was Once the Pole Star

Faint Star in Little Dipper, Pointed to by Upper Stars in Big Dipper Bowl, Was North Star in 3500 B.C.

THE position of the north star, close to the place around which all the stars of the heavens seem to turn so that on any clear night it can be seen in the north in practically the same spot, is a well recognized symbol of permanence. But Polaris, our pole star, is only the temporary occupant of that place of honor. The "pointers" are the two stars, Merak and Dubhe by name, in the bowl of the great dipper opposite to the handle. A line from them indicates Polaris. But if you make similar use of the upper stars in the bowl, the pair nearest the handle, including the one where the handle joins the bowl, following it over to the right but not so far as to Polaris, you come to a rather faint star, and then still farther are two brighter ones, that form part of the little dipper. It is the faint one with which we are especially concerned now. It is part of the constellation of Draco, the dragon, and is known as Thuban.

About 3500 B. C., at the time of the building of some of the pyramids in Egypt, this was the pole star, and in the Great Pyramid there was constructed a long passage, slanting up to the north, so that the priests, from the inner recesses, could observe Thuban. Thus at least one use of the pyramid was as an astronomical observatory. Many of the Egyptian temples were built in such a direction that from the innermost holy of holies the priests could look out through doors and long rows of columns to the horizon at just the place where a certain star arose, the star dedicated to the god to whom the temple was held sacred.

But today Thuban is far from the pole. What caused it to move, and what brought the star which we call Polaris into its place? The answer is found in what the astronomer calls "precession." Because the earth is not truly spherical, but has a bulge around the equator, and because this bulge is pulled by the gravitational attraction of the sun, the direction that the north pole of the earth points in the sky does not remain in the same place but de-

scribes a large circle in the sky. Something similar may be observed with a spinning top when it is starting to "die." It then wobbles in a conical manner, and finally stops. But because of the relative smallness of the forces acting upon the earth, the change, or "wobble," is very slow, and it takes nearly 26,000 years for the cycle to be completed. In an ordinary lifetime, or even in several lifetimes, the change in the position of the stars due to precession is not noticeable, except with delicate astronomical instruments. Over millenia, however, it is marked, and the constellations have slipped around the sky, so that now Polaris occupies the place it does.

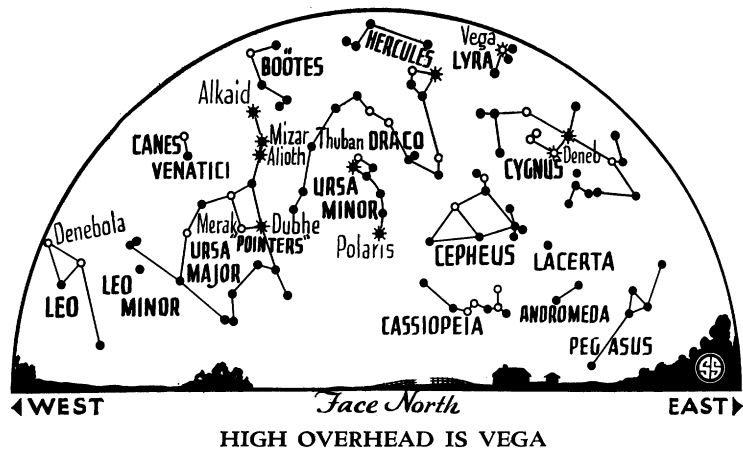
This change is still going on, which means that after a few thousand years Polaris will again be far from the pole. As a matter of fact, it is still approaching that point and about a century from now it will be even closer to it than now, though the difference will be very minute. For nearly ten thousand years there will be no bright polar star, but then it will come into the region of Deneb, the bright star in Cygnus. Deneb will then be many times as far from the pole as is Polaris. In the year 14,000 Vega, in Lyra, will be the pole star, only a few degrees away from the point,

the "center of the sky." Then, after the 26,000 years have elapsed from the present, the pole will be back among the same stars that it is now.

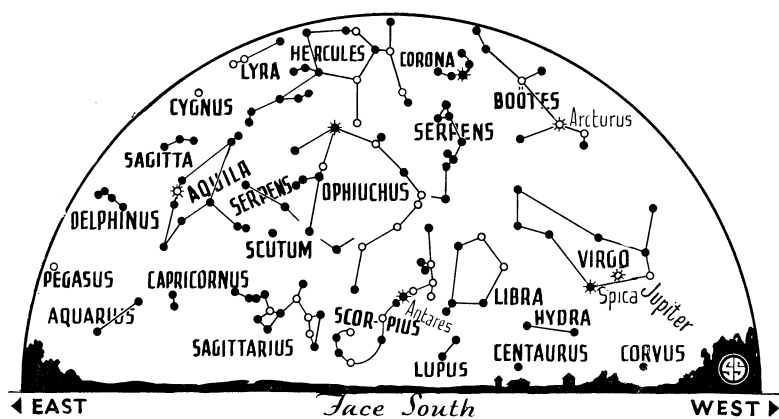
Another effect of this motion is to change the rising point of the stars. If a certain one rises today directly in the east, perhaps, a few hundred years from now it will rise a little to the north of east, and during the long precessional cycle, it may change by many degrees. The Egyptian priests found this out. When they built a temple that was oriented to a certain star, it did not remain so pointed, so in some cases they proceeded to build a new temple, at an angle slightly different from the old one. And in some cases a temple originally erected for one star was found, after many centuries, to be pointed to another, and when this happened, they again made use of it in their ceremonies. Such changes have a practical application to the Egyptologists, for when a temple was oriented to a particular star, and the identity of the star is known, as it often is from inscriptions, then the astronomer can figure out just how long it has been since the star did rise in that direction. Astronomy and archaeology may seem to be the most remotely connected of all the sciences, but by means of the former, the student of the latter is often able to date historic occurrences.

One interesting astronomical event or the month will be visible, in the United States, only to people in the

☼ * ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



Look in the eastern evening sky for a large triangle of bright stars. Brightest of these is Vega, second brightest of stars to be seen from most of the United States.



SCORPIUS IN THE SOUTH

Low in the south, with tail curving eastward, is the giant writhing constellation Scorpius, the scorpion. The creature's heart is marked by the bright red star, Antares. Westward is seen the brightest object in the sky this month, Jupiter.

far west. This will be an eclipse of the moon on July 26, when our satellite will partly enter the shadow of the earth. The beginning of the eclipse will be visible quite generally in all parts of the Pacific Ocean and around its eastern and western shores. For Californians, the moon will set before it is over, so they will not see it all. The ending of the eclipse will be visible as far east as the Indian Ocean and central Asia. When at its height, just two thirds of the moon's diameter will be immersed in the earth's shadow, so that one edge will appear noticeably darker than the other, and perhaps will be of a red color.

Perhaps to make up in a measure for their failure to see the eclipse, the residents of the central and eastern parts of the United States will see another kind of eclipse, by the moon, which will not be visible to the westerners. On July 24 the moon will eclipse the bright star Nunki, known to the astronomer as sigma Sagittarii. Such an "eclipse" is more properly called an occultation.

The constellation of Sagittarius, the archer, is in the southeastern sky these evenings, immediately following the tail of the scorpion. In it is the familiar group known as the "milk dipper." The handle of the dipper points up and to the right, and the bowl is turned downwards. The dipper is a smaller one than either of the two in the north sky. Nunki is the uppermost, and brightest, star in the bowl. It is of the second magnitude.

As seen from Washington, D. C., the moon will pass in front of the star at 8:20 p. m., eastern standard time, and the star will emerge from its hiding at 9:34 p. m. Because of the fact that

the moon will then be just two days before it is full, it will be quite bright, and the star will not be as conspicuous as it is at other times. But a small telescope, or a pair of binoculars, should easily reveal the star up to the moment when it suddenly vanishes as it disappears in back of the dark edge of the moon. In places west of Washington the occultation will be earlier than the times mentioned and in the northeastern part of the country it will be a little later. Observations of occultations are regularly made by astronomers because they afford an excellent means of checking the motions of the moon.

Nunki is the brightest star that is so hidden this year, as seen from any part of the United States, but its occultation this month is really an encore. It was previously occulted on May 31.

Jupiter is the only planet visible this month in the early evening sky, when it can be seen brilliantly in the southwest. Later in the evening Saturn comes into view, rising about ten o'clock, standard time, in the beginning of the month, and two hours earlier in the end. Mercury will be at its greatest distance west of the sun on the 31st, and may then be seen low in the east before sunrise. Venus and Mars will also be visible

in the early morning, but the latter will be much the fainter, and more difficult to see.

July brings to the eastern evening sky a large right triangle of bright stars, which, during the coming months, will gradually move over to the west.

High overhead is Vega, second brightest of the stars to be seen from most of the United States. Below, and to the north, is Deneb, marking Cygnus, the swan. This group is also called the Northern Cross. Deneb is at the head of the cross, now seen on its side, while the upright of the cross goes towards the south. About as high as Deneb, but farther south, is Altair, part of Aquila, the eagle. Low in the south is a star distinctly red in color. This is Antares, forming the heart of Scorpius, the scorpion. The tail of the creature curves to the east, and then up, like a gigantic fish hook, while the claws are formed by a curved row of stars to the right of Antares.

Well above Jupiter is another brilliant star, Arcturus, marking the group of Boötes, the herdsman. Low in the west, just ready to set, is Leo, the lion, with the first magnitude Regulus.

Looking to the northwest, we see the Great Dipper, forming part of the great bear, Ursa Major. The handle of the dipper is uppermost, below are the pointers, the two stars of the bowl which indicate the direction to the right at present, of the pole star, Polaris. This is close to the north pole of the sky, the point about which the whole sky seems to turn. In the northeastern sky, on the side of the pole directly opposite to the great dipper, is the W-shaped constellation of Cassiopeia, representing a queen seated on her throne.

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The Federal Government has spent \$1,184,160,000 for highways since 1927, but has derived in taxes upon gasoline, motor vehicles, oil etc., \$1,461,444,000.

Phases of the Moon

	E.S.T.	
Last Quarter	July 3	3:27.9 p. m.
New Moon	July 11	12:5.9 p. m.
First Quarter	July 19	1:52.9 p. m.
Full Moon	July 26	7:8.6 a. m.