

# The Sky at Night

*The third in a series of educational inserts*

By E. LAURENCE PALMER

SO MUCH recommended star study deals either with profound mathematics or imaginary mythology that material intermediate between these extremes should be helpful.

The North Star, to the mythologist, is the end of the long tail of the little bear, Ursa Minor, but to those using the following pages it will be three stars, so far away that they appear as one; so far, in fact, that it takes light about 250 years to come from them to the earth. The North Star is a thousand times as brilliant as our sun, with magnitudes of 2.1 and 9 and with periods of 3.96 days and 11.9 years. And what, some may ask, do we mean by periods, magnitudes and light years? While it may take some imagination to understand some of these things, they are, no doubt, more easily understood than many of the mathematical formulae of the professional astronomer. We have no desire to discourage star study in all its complexity, but it is easier to remember a distance of 250 light years, for example, than a number with a regiment of zeros.

The term "light-year" of course refers to the distance light travels in a year. Light travels about 186,000 miles a second, or about 6 million million miles a year, so it is plain that if we deal with light years in such figures mathematical short cuts are helpful.

In star study we soon run into the term magnitude and one may naturally assume that this refers to size, when, as a matter of fact, it means brilliance. The beginner in astronomy must not assume that a star with a magnitude of 6 is brighter than one with a magnitude of 2, 3, or 4. In astronomy the most brilliant stars are given a magnitude of 1, and are spoken of as "first magnitude" stars. There are also stars brighter than magnitude 1, as Sirius, minus 1.6, and Canopus, minus 0.9. Less brilliant stars are given, in order of less brilliance, numerical values such as 2, 3 and 4. Stars whose magnitudes are indicated as of 6, or more, cannot be seen with the naked eye, even under the best conditions, which brings us back to the North Star, one of the stars that has a magnitude of 9, and cannot, of course, be seen with the naked eye.

We will meet such terms as double stars and triple stars. These are simple since they refer to the actual number of stars in what appears to the eye to be only one. At a sufficient distance an automobile's head-lights appear as one light, becoming two or more as the car approaches. So it is with our stars, and many who start to study stars are surprised that there are so many that are double, triple or multiple, but are near enough together to appear as one.

The term variable, of course, refers to differences in brilliance at different times, and stars are variable for a

variety of reasons. Study of such stars is a special phase of the study of the heavens, and to attempt to discuss this subject in a brief paragraph would be only to confuse the reader. It is, however, something worthy of special investigation, and a splendid aid to this is *The Nature of Variable Stars* by Paul W. Merrill, a popularly-written discussion.

The next most commonly used term in the charts that follow is that of "period". This refers to the length of time required for one star to complete a revolution around another.

## Use of the Remainder of This Section

The remainder of this section may be used with or without the help of a planisphere. A planisphere may be purchased separately, or may be made from the diagrams on Page 99, following the directions given.

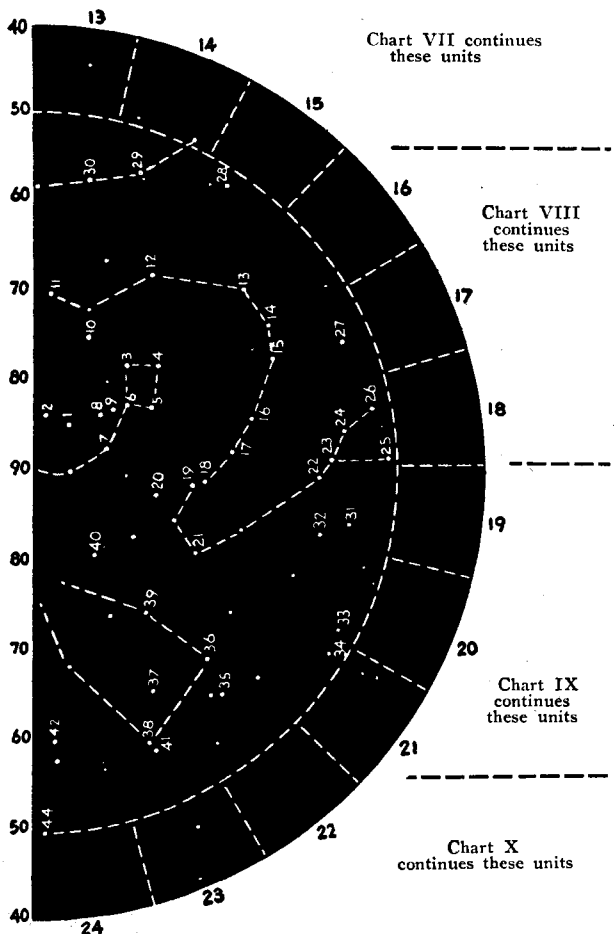
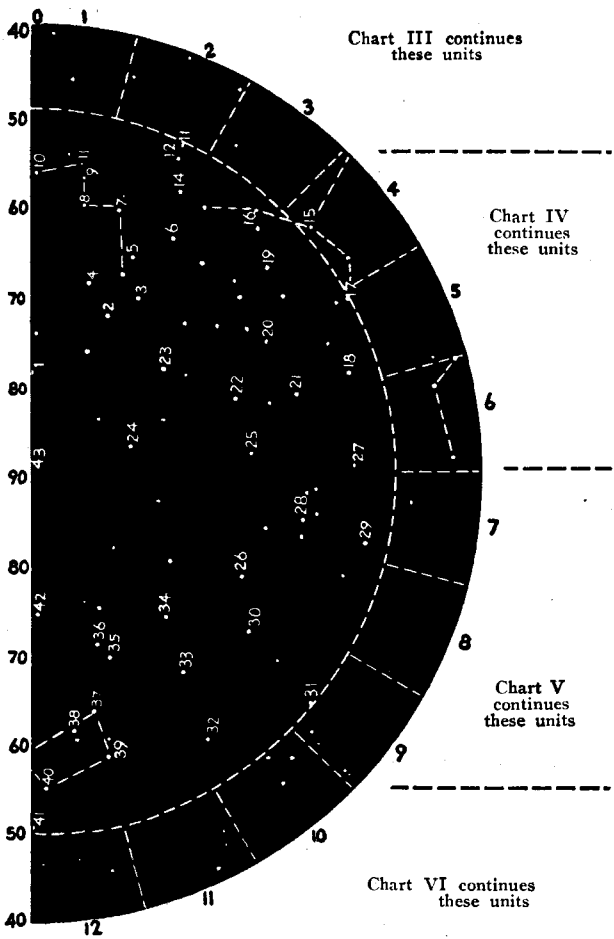
The first two charts provide maps of the heavens as they may be seen at any time of the year over most of the United States. They include the Circumpolar Constellations. The other charts are continuations of portions of the sky as indicated on the charts of circumpolar constellations. Some of the stars in these charts may easily be seen on summer evenings, and others on winter evenings. The nature of the stars numbered in these and the other charts is explained in the text opposite each chart.

If one wishes to locate a star, or constellation, whose name is known but which is not named on the planisphere map the following star and constellation directory may be useful. In it the Roman numerals are used to indicate the chart in which the star or constellation is considered, and the Arabic number to indicate the number assigned to the individual star. Thus IX, 15 refers to star number 15 in chart IX.

## Directory

Albireo, IX, 15	Betelgeuse, IV, 25
Alcaid, VII, 1	Big Dipper, See Ursa Major, I, IV
Alcyone, IV, 19	Bootes, II, VII, VIII
Aldebaran, IV, 21	Bull, IV
Algenib, III, 13	Camelopardus, I, II
Alhena, V, 14	Cancer, VI
Alpheratz, III, 12	Canis Major, V
Altair, IX, 29	Canis Minor, V
Andromeda, III, X	Canes Venatici, VII
Antares, VIII, 35	Capella, IV, 1
Aquarius, IX	Capricornus, IX, X
Aquila, IX	Cassiopeia, I, II, III
Archer, IX	Castor, V, 1
Arcturus, VII, 18	Cepheus, I, II
Aries, III	Cetus, III
Auriga, I, IV	Circlet, V, 14
Beehive, V, 8	Coma Berenices, VIII
Bellatrix, IV, 24	Cor Caroli, VII, 4

(Continued on page 92)



**CHART I  
POLAR CONSTELLATION CHART**

**Cepheus.** Star 1, period 166.2 years.  
**Cassiopeia.** Star 2, double, magnitudes, 4.7 and 7.2; period, 52.95 years; Star 3, triple, magnitudes, 4.2, 7.1, 8.1; Star 4, triple, magnitudes, 4.4, 8.9, 9.5; Star 5, magnitude, 3.4; Star 6, gold-green, double, magnitudes, 6.1, 6.6; Star 7, magnitude, 2.8; Star 8, magnitude, 2.2; Star 9, gold-red, double, magnitudes, 3.6, 7.9; period, 507.6 years; Star 10, magnitude, 2.4; distance, 5.7 light years; Star 11, Shedir, variable, magnitudes, 3.6 to 7.9; distance, 47 light years.  
**Perseus.** Star 12, double spiral nebula joined with a ring; Star 13, double; periods 126.5 days, 63.2 days; Star 14, double, variable, magnitudes, 7.5 to 11 and 8; period, 320 days; Star 15, Mirfak, magnitude, 1.9; period, 4.09 days; Star 16, magnitude, 3.1; Star 17, magnitude, 4.5; period, 1.5 days.  
**Camelopardus, the Giraffe.** Star 18, double, magnitudes, 4.4, 11.3; period, 3.8 days; Star 19, double, magnitudes, 4.8, 9.2; Star 20, nebula; Star 21, magnitude, 4.7; Star 22, magnitude, 4.3; period, 7.9 days; Star 23, magnitude, 4.7; Star 24, double, magnitudes, 4.5, 8; Star 25, triple, magnitudes, 6.7, 7.9, 10.9; Star 26, triple, magnitudes, 6.2, 8, 9.2.  
**Auriga.** Star 27, magnitude, 2.1.  
**Lynx.** Star 28, triple, magnitudes, 5.2, 6.1, 7.4; Star 29, variable, magnitudes, 7 to 13.8; variation period, 379.2 days.  
**Ursa Major, the Great Bear.** Star 30, magnitude, 3.5; Star 31, variable, magnitudes, 8.4 to over 13; period 247 days; Star 32, double, magnitudes, 5, 5.6; period, 99.7 years; Star 33, double, magnitudes, 3.8, 9; Star 34, double, magnitudes, 5, 8; Star 35, magnitude, 4.9; period, 11.58 days; Star 36, variable, magnitudes, 7 to 13; variation period, 302 days; Star 37, Dubhe, magnitude, 2; distance, 70 light years; Star 38, double, magnitudes, 5.8, 7.1; period, 71.9 years; Star 39, magnitude, 2.4; period, .31 days; distance, 60 light years; Star 40, magnitude, 2.5; Star 41, spiral nebula.  
**Draco, the Dragon.** Star 42, double, magnitudes, 7, 8.3; period, 42 years.

**Ursa Minor, the Small Bear.** The polestar, Polaris, 43. This is really a triple star. The major group has a magnitude of 2.1, is yellow, has 190 light years distance and is a thousand times as brilliant as our sun. Two of the units turn around each other in a period of 3.96 days, and these in turn move about the third in a period of 11.9 years. Another unit has a magnitude of 9.

**CHART II**

**Camelopardus, the Giraffe.** Star 1, variable, magnitudes, 7.9 to 13.7; variation period, 269.5 days; Star 2, double, magnitudes, 5, 6.  
**Ursa Minor, the Small Bear.** Star 3, Kochab, the polestar in A. D. 140; magnitude, 2.2; distance, 230 light years. Stars 4, 5, 6, parts of the "little dipper"; Star 7, magnitude, 4.4; period, 39.5 days; Star 8, double, magnitudes, 7, 8; variation period, 115 years; Stars 9 and 10 variable; magnitudes over 7.  
**Draco, the Dragon.** Star 11, magnitude, 3.9; Star 12, Thuban, magnitude, 3.64; period, 51.38 days; the polestar when pyramids were built more than five thousand years ago; Star 13, magnitude, 3.5; Star 14, triple, magnitudes, 7.5, 7.7, 9; Star 15, double, magnitudes, 2.9, 8.1; Star 16, magnitude, 3.2; Star 17, magnitude, 4.87; period 5.28 days (the pole of the ecliptic is indicated by a cross almost south of this star); Star 18, double, magnitudes, 4.8, 6.5; Star 19, magnitude, 3.6; period, 281.8 days; Star 20, period, 4.12 days; Star 21, double, magnitudes, 4, 7.6; Star 22, triple, magnitudes, 4.7, 7.7, 7; Star 23, variable, magnitudes, 7.5 to 12.2; variation period, 426 days; Star 24, double, magnitudes, 4.6, 4.6; Star 25, magnitude, 2.4, distance, 74 light years; Star 26, double, magnitudes, 5, 5.1; Star 27, double, magnitudes, 5, 6.  
**Bootes, the Herdsman.** Star 28, double, magnitudes, 4, 12.  
**Ursa Major, the Great Bear.** Star 29, Mizar, the first double discovered, magnitudes, 2.1, 4.2; period, 20.23 days; distance, 80 light years; Star 30, magnitude, 1.68; 56 light years away; period, 4.15 years.  
**Cygnus, the Swan.** Star 31, double, magnitudes, 5, 9; Star 32, double, magnitudes, 6.8, 7.4; Star 33, variable, magnitudes, 15 to 1.9 in 10 days; Star 34, triple, magnitudes, 7, 9, 10.1.  
**Cepheus.** Star 35, triple, magnitudes, 6.3, 7.9, 8; Star 36, magnitude, 2.6; distance, 36 light years; Star 37, double, magnitudes, 4.7, 6.5; Star 38, variable, magnitudes, 3.6 to 4.3; variation period, 5 days, 8 hours, 48 minutes; Star 39, double, magnitudes, 3, 7; period, .19 days; Star 40, variable, magnitudes, 7.9 to 13; variation period, 486 days; Star 41, double, magnitudes, 9.3, 10.8; period, 54.9 years; distance, 12.5 light years.  
**Cassiopeia.** Star 42, triple, magnitudes, 7, 8.5, 9; Star 43, quadruple, magnitudes, 4.8, 10, 7.4, 8.9; period, 6 days; Star 44, variable, magnitudes, 5.3 to 12.7; variation period, 431.6 days.

Chart III

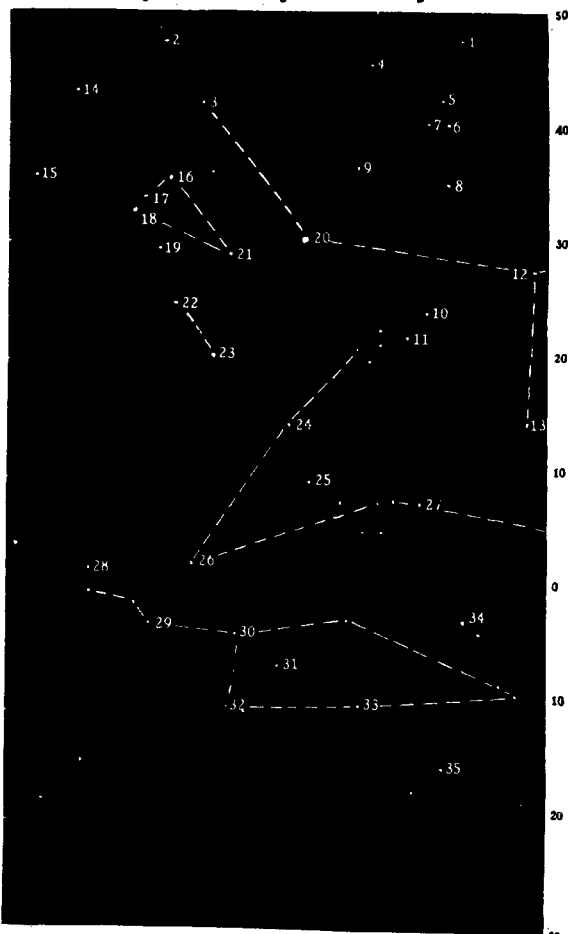


CHART III

Constellation **Cassiopeia**, Star 1, magnitude 5.02, period 1.7 days. Stars 2 to 12 are in the constellation **Andromeda**. Star 2, double, magnitudes, 6.4, 7.3; period, 204.7 years. Star 3, double, magnitudes, 2.3, 5.4, is a cerulean blue and gold star with a period of 55 years. Star 4, double, magnitudes, 4.9, 6.5, is made of two blazing suns. Star 5 is an oval pearl-white nebula. Star 6 is a great spiral nebula and the nearest of the spiral nebulae to the earth. It is 900,000 light years distant and 50,000 light years in diameter. On a reasonable assumption, it takes about 17,000,000 years for it to complete a single revolution and it produces one billion and a half times the light produced by our sun. It has a mass of the order of 1,000,000,000 times the mass of our sun. Star 7 has a magnitude of 4.4 and a period of 4.28 days. Star 8, double, magnitudes, 6, 9, has a period of 143.7 days; Star 9, magnitude, 2.4; Star 10, magnitude, 4.3; period, 17.76 days; Star 11, double, magnitudes, 6.1, 6.7; period, 109.07 years. Star 12, Alpheratz, has a magnitude of 2.2 and a period of 96.67 days. Its temperature is about 11,000° C.

Star 13, Algenib, in the constellation, **Pegasus**, has a magnitude of 2.9. One side of the Great Square of Pegasus is limited by these last two stars.

**Perseus**, Star 14, a beautiful cluster 20,000 light years distant, Star 15, a double, magnitudes, 5.6, 6.7; period, 33.3 years.

The Constellation **Triangulum** includes a number of interesting stars. Stars 16, 17, and 18 are almost in line and have magnitudes of 3.1, 5, and 4 respectively. Star 19, double, magnitudes, 5.6, 6.4, is sapphire-gold. Star 20 is a nebula 900,000 light years away with a period of 160,000 years. Star 21 has a magnitude of 3.5 and a period of 1.7 days.

In the constellation **Aries**, Star 22, Hamal, the Shepherd's Star, magnitude of 2.2; and Star 23, magnitude, 2.7, period, 107 days.

Stars 24, 25, 26, and 27 are in **Pisces**.

The constellation **Cetus, the Whale**, includes at least eight interesting stars. Star 28 is a double, magnitudes, 3, 6.8. Star 29 is Mira, whose magnitude varies from 1.7 to 9.6. It has a variation period of 332 days and is 165 light years distant. It is a globe of gas 250 million miles in diameter and about 300 times the size of our sun. Star 30 is a dark nebula, and Star 31, a nebula, is unique because it is moving through space at the velocity of 1240 miles a second. Star 32 is a dark nebula. Star 33 has a magnitude of 4. Star 34 is a double, magnitudes, 5.2, 6.4; period, 6.88 years. Star 35 has a magnitude of 2.2.

Chart IV

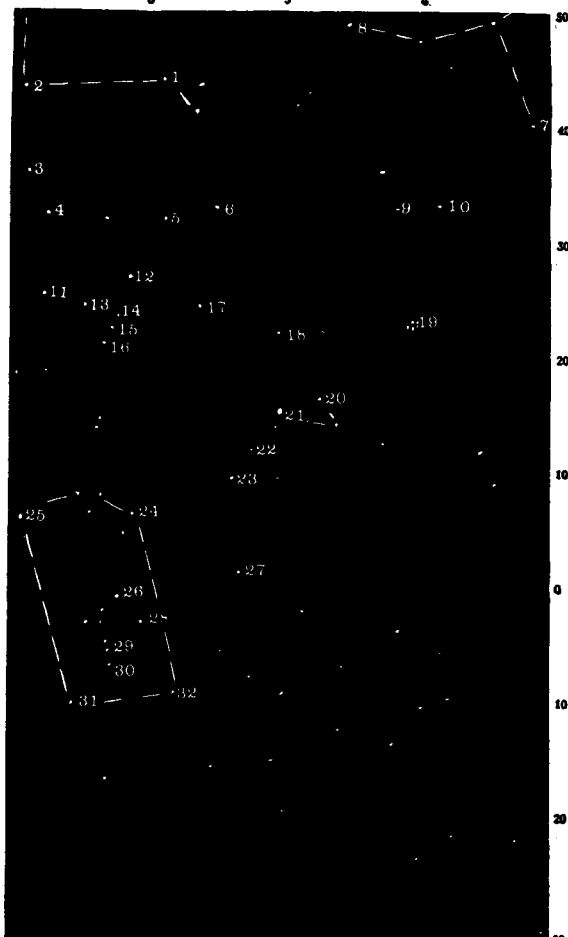


CHART IV

The star Capella, Star 1, is the most conspicuous one in **Auriga**. Its magnitude is .21; period, 104 days. It is 150 times as bright as the sun, has a surface temperature of 10,400° F., and is 47 light years distant. Star 2, magnitude, 2.7; period, 3.96 days; mass, 17 times that of the sun; Star 3, magnitude, 5.3; period, 28.2 days. Star 4 is a mass of 20,000 stars. Star 5, triple. Star 6 is a large sun, magnitude, 2.9.

**Perseus**, Algol, Star 7, the Ghoul, or Demon-Star; magnitude, 2.2 to 3.2; period, 2.87 days; mass,  $\frac{2}{3}$  that of the sun; 160 times as bright as the sun. Stars 8, 9, and 10, periods of 284 days, 6.9 days, and 4.4 days.

**Taurus, the Bull**, is always interesting. The **Pleiades** and the star Aldebaran are the most important. Star 11, magnitude, 4.5; period, 5.9 days; Star 12, magnitude, 1.8; Star 13, magnitude, 5; period, 27.8 days; Star 14, double, magnitudes, 5.8, 6.6; blue-white; Star 15, "crab nebula"; Star 16, magnitude, 3; period, 138 days; Star 17, a nebular cluster; Star 18, double, magnitudes, 4.3, 7.2; period, 15 days. Alcyone, Star 19, a star in the Pleiades, has a magnitude of 3 and is millions of miles in diameter. The cluster is made of over 500 giant suns and is 30 light years in diameter. The volume of each of the 5 brightest stars of the cluster is at least 800 times that of the sun. The cluster is 325 light years distant, or  $2\frac{1}{2}$  times more remote than the **Hyades**. Star 20, magnitude, 5.6; period, 8.4 days. Aldebaran, Star 21, the "eye" of the Bull, the Hyades, magnitude, 1.1, has a diameter of 40 million miles.

**Orion, the Hunter**, Stars 22 and 23, periods, 56 years and 16.61 years; Bellatrix, Star 24, the Female Warrior, magnitude, 1.7; Betelgeuse, Star 25, magnitude, .9; period, 6 years; surface temperature, 4700° F. Star 25 is 1200 times as bright as the sun. Its volume is 27 million times and its diameter 300 times that of the sun. It is 192 light years distant and has an average density of about 1/1000 of an atmosphere. Star 26, greenish; double, magnitudes, 2, 6.8; period, 5.7 days; Star 27, magnitude, 3.8; period, 3.7 days; Star 28, double, magnitudes, 3.4, 5; period, 8 days; Star 29, a great nebula; 650 light years distant; diameter, 5 or 6 light years or 30 or 40 million million miles. It is so rare that if the air left in the supposed vacuum of an electric light globe were expanded to the size of our capitol at Washington, it would approximate the condition prevailing there. Star 30, double nebula, magnitudes, 2.8, 7.3; period, 29 days; Star 31, Saiph, magnitude, 2.2; Star 32, Rigel, magnitude, .3; distance, 543 light years; blue-white; 18,000 times as bright as our sun; temperature, 28,800° F.

CHART V

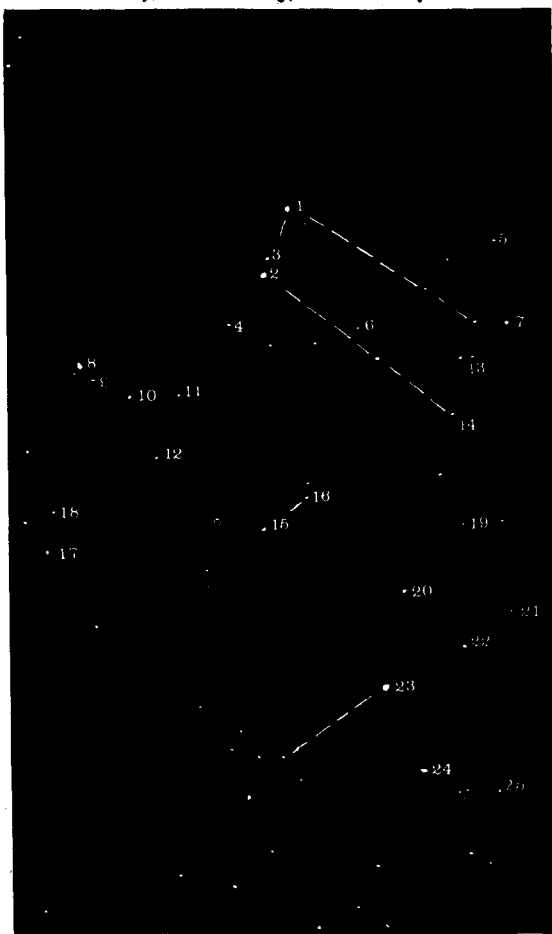


CHART VI

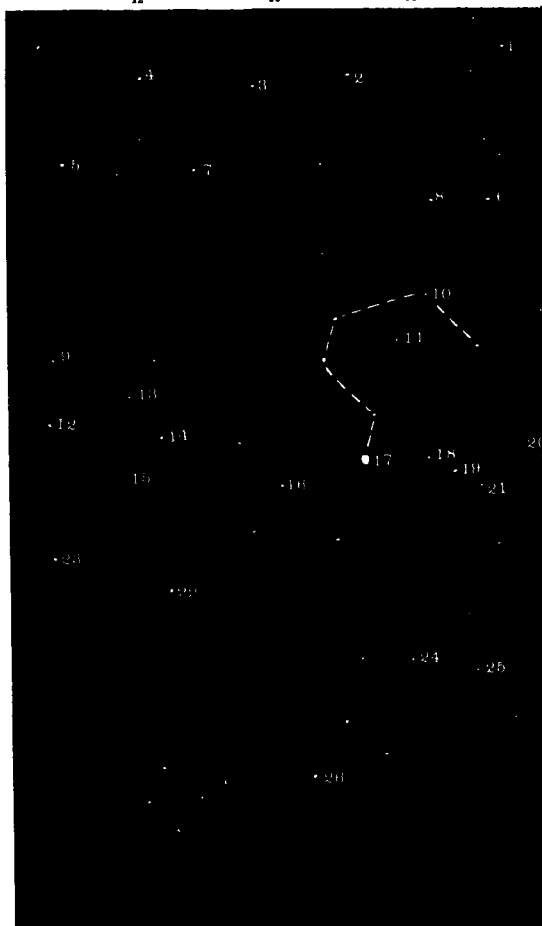


CHART V

The constellation **Gemini** is responsible for the expression, "By Jiminy". Castor, Star 1, is an important double star, magnitudes, 2, 2.8, each part, six times as brilliant as the sun would be at an equal distance; orange-blue; 42 light years distant; period 306 years. Pollux, Star 2, the other of the "twins", magnitude, 1.2; diameter 14 million miles; 33 light years distant; Star 3, magnitude, 4.6; period, 19.6 days; Star 4, variable, magnitudes, 8 to 13; variation period, 288 days; Stars 5 and 6, barely visible; Star 7, variable, magnitudes, 3.2 to 4; variation period, 231 days.

The cluster Praesepe, Star 8, 363 suns; often referred to as a "beehive". The units vary in magnitude from 6 to 12, there being 173 in the main cluster. The cluster is about 600 light years distant. Star 9, variable, magnitudes, 8.4 to over 14; variation period, 305 days; Star 10, variable, magnitudes, 7.5 to 13; variation period, 256 days; Star 11, double, magnitudes, 5.3, 6.3; period, 60 years; Star 12, variable, magnitudes, 6 to 11.3; variation period, 362 days; Star 13, magnitude, 4.4; period, 131 days; Alhena, Star 14, the "Circlet", magnitude, 1.9; period, 2,175 days.

Procyon, Star 15, is the major star in the constellation of **Canis Minor**, or **the Little Dog**. It is 10.6 light years distant;  $5\frac{1}{2}$  times as bright as the sun; pale topaz color; surface temperature, 14,400° F. Except for Sirius, it is the closest to the earth of the larger stars. It is a double, magnitudes, 5, 13.5. Star 16, variable, magnitudes, 7.5 to 13.

Star 17 is in the constellation **Hydra** and has a period of 256 days. Star 18, double, magnitudes, 3.7, 5.2; period, 15.3 years; distance, 135 light years; mass,  $3\frac{1}{2}$  times the sun.

The constellation **Monoceros**, **the Unicorn**, includes stars 19 to 23. Star 19 is a cluster, 20 a very bright cluster, magnitude, 6. Star 21, variable, magnitudes, 7.2 to 12.9; variation period, 332 days. Star 22, double, with masses 86 and 72 times (?) that of the sun. The magnitude is 6.6, the period 14.4 days, and the distance, 10,000 light years. Star 23 is a cluster with a ruby-colored star in the center.

The constellation **Canis Major**, or **Great Dog**, is conspicuous because of Star 24, Sirius, the Scorchers. This star is a double, magnitudes, 1.6, 8.5; period, 49.3 years; distance, 8.9 light years; 30 times as bright as the sun; mass, 3.4 times that of the sun; surface temperature, 19,800° F., weight, on the average one ton for every cubic inch. Star 25 has a magnitude of 1.9; and a period of 6 years.

CHART VI

**Ursa Major**, the constellation of **the Great Bear**, extends into the area here represented and includes stars 1 to 5. Star 1, magnitude, 5.7; period, 15.98 days; Star 2, magnitude, 3.5; Star 3, magnitude, 4.8; period, 15.8 days; Star 4, magnitude, 6.6; a large, oblong nebula. Star 5 is known as the Runaway Star. Its velocity through space is such that, every two minutes, it moves a distance equal to the path of the moon about our earth. No other known star has such a velocity. In spite of this terrific speed, it apparently moves but the breadth of the moon in 300 years. This is because of its great distance from us, 21.7 light years.

Star 6 is in the constellation **Lynx**, has a magnitude of 3.3. The constellation, **Leo Minor**, contains stars 7 and 8; Star 7, magnitude, 7.6; distance, 7.9 light years; Star 8, variable, magnitudes, 7 to 13; variation period, 370.5 days. The constellation, **Leo**, has as its most interesting star, Regulus. Star 9, double, magnitudes, 4.5, 8.4; period, 71.7 days; Star 10, magnitude, 3.1; Star 11, variable, magnitudes, 8.6 to 13; variation period, 273.1 days. Star 12 is Denebola, a star of 2.2 magnitude which is 25 light years distant from the earth. Star 13 is a luminous nebula and Star 14 is a spiral nebula. Star 15, double, magnitudes, 4, 7, shines with an amber-turquoise color. Star 16, magnitude, 3.8; period, 12.3 days. Regulus, Star 17, double, magnitudes, 1.3, 8.4, the chief star in the constellation, is 72.4 light years from the earth. It has a diameter of 3 million miles and is therefore about three and a half times as great in diameter as our sun. Regulus appears as a jewel in the handle of a sickle outlined by about six stars. It lies almost exactly on the ecliptic or the path made by the sun across the sky. It forms one angle of a conspicuous triangle, the other angles being at the stars Procyon and Pollux. Regulus appears conspicuously white. Star 18, also in the constellation Leo, is a variable star, magnitudes, 4.6 to 10.5; variation period, 312.8 days. Star 19, magnitude, 3.7; period, 14.49 days.

Stars 20 and 21 are in the constellation **Cancer**, **the Crab**. Star 20 has a magnitude of 5.1 and a period of 6.39 days; Star 21, double.

Star 22 is an oval nebula with a star center in the constellation, Leo, and Star 23 in the constellation **Virgo** has a magnitude of 3.8. This area has more nebulae than any other similar area in the heavens. Star 24, in the constellation **Sextans**, double, magnitudes, 5.8, 6.1; period, 72.76 years; Star 25, in the constellation **Hydra**, magnitude, 2.2; distance, 226 years. Star 26 is an elliptic, pale, steel-blue nebula.

CHART VII

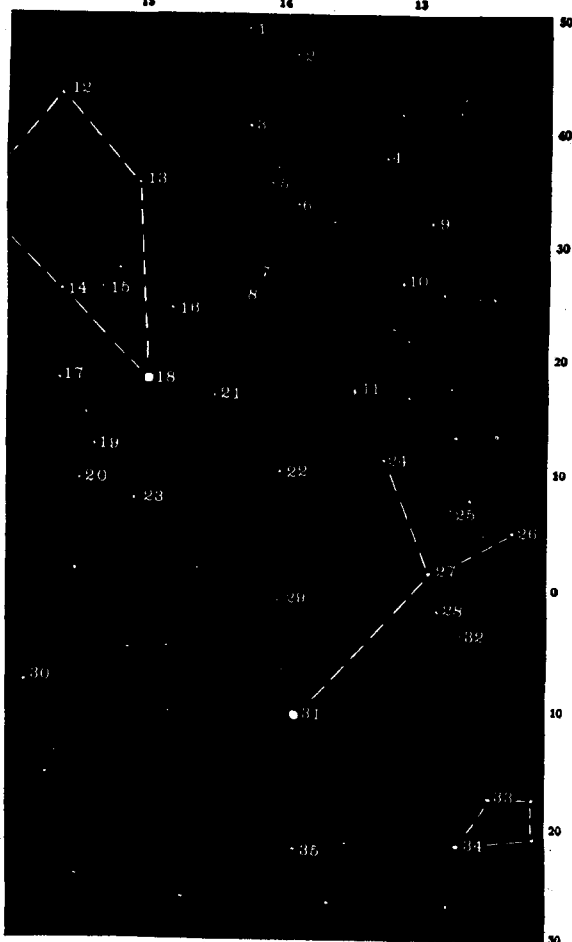


CHART VIII

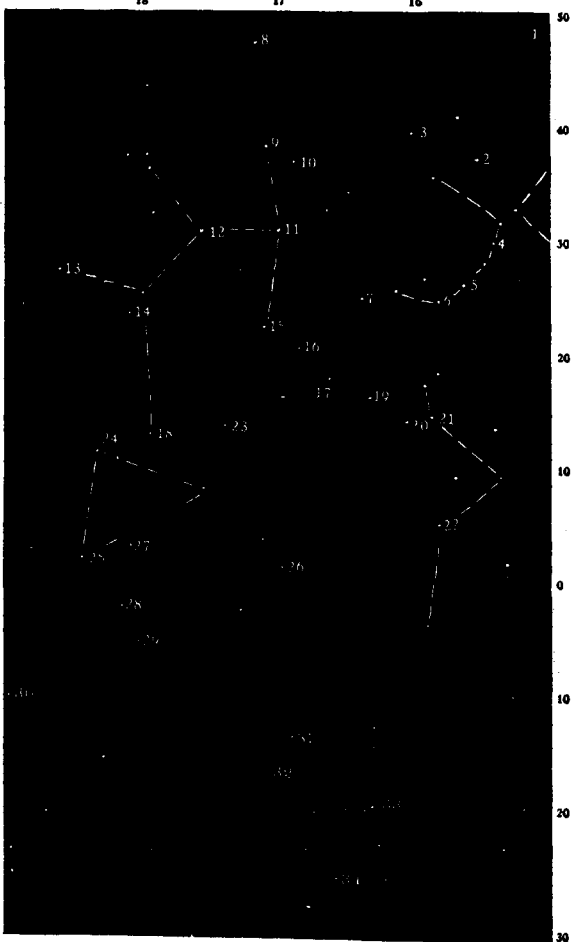


CHART VII

**Canes Venatici.** Star 1, Alcaid, has a magnitude of 1.9 and is 108 light years distant. Star 2, spiral nebula of enormous size, occupies a space equal to 20 million times the orbit of Neptune about the sun and, though whirling incredibly fast, it takes over 45,000,000 years to make one revolution. Star 3, variable, magnitudes, 6.1 to 12.7; variation period, 326 days; Star 4, Cor Coroli, double, magnitudes, 2.9, 5.7; period, 5.5 days; Star 5, double, magnitudes, 5, 5.8; period, 220 years; Star 6, double, magnitudes, 7.2, 7.7; period, 48 years; Star 7, a globular cluster visible with the unaided eye on a clear night; composed of several hundred thousand suns; 60,000 light years distant from the earth. This distance is so great that were our sun magnified twice and placed in the center of this cluster, it would be too small to be visible on a photographic plate. It requires light 65 years to cross its angular diameter. Star 8, double, magnitudes, 7.6, 8; period, 199 years.

**Coma Berenices.** Stars 9, 10 and 11 barely visible.

**Boötes, the Hunter.** Star 12, double, magnitudes, 7.5, 8; period, 97.93 years; Star 13, magnitude, 4.83; period, 211.95 days; Star 14, double, magnitudes, 4.8, 6.4; period, 159.54 days; Star 15, variable, magnitudes, 6.6 to 12.9; variation period, 223.3 days; Star 16, double, magnitudes, 4, 8; period, 9.6 days; Star 17, double, magnitudes, 4.8, 6.4; variation period, 159.54 years; Star 18, Arcturus, magnitude, 0.2; diameter, 21 million miles, or twenty-four and a half times that of the sun; 40 light years distant; 1/5000 as dense as water. From Arcturus to the handle of the Big Dipper is 40 degrees. Star 19, double, magnitudes, 4.4, 4.8; period, 130 years; Star 20, double, magnitudes, 7.8, 8.8; period, 238 years; Star 21, double, magnitudes, 2, 8; period, 497.1 days; Star 22, double, magnitudes, 6.3, 6.3; period, 23 years; Star 23, double, magnitudes, 5.5, 6.8.

**Virgo, the Virgin.** Star 24, magnitude, 3; Star 25, variable, magnitudes, 6.4 to 12.1; variation period, 145.47 days; Star 26, variable, magnitudes, 8.7 to 13.5; variation period, 339 days; Star 27, variable, magnitudes, 8 to 12; variation period, 438 days; Star 28, double, magnitudes, 3.6, 3.7; period, 182.3 years; Star 29, magnitude, 3.4; Star 30, variable, magnitudes, 4.8 to 6.2; variation period, 2,327 days. This star has an eclipse whose duration is 13 hours. Star 31, Spica, magnitude, 1.2; white; period, 4.01 days; 227 light years distant from the earth; Star 32, double, magnitudes, 8.6, 14.5; period, 218.8 days.

**Corvus, the Crow.** Stars 33 and 35, in **Hydra**.

CHART VIII

**Boötes.** Star 1, double, magnitudes, 5.3, 6.2; period, 204.74 years; Star 2, double, double, magnitudes, 4.4, 6.5, and 7.2, 7.8; period of last two, 244.37 years.

**Northern Crown, Corona Borealis.** Star 3, variable, magnitudes, 7.2 to 12; variation period, 358 days; Star 4, double, magnitudes, 5.6, 6; period, 41.5 years; Star 5, Gemma, magnitude, 2.3; period, 17.36 days; distance, 62 light years; Star 6, double, magnitudes, 4.7; period, 87.8 years; Star 7, variable, magnitudes, 7.3 to 14.2; period, 486 days.

**Hercules.** Star 8, nebula; Star 9, magnitude, 3.6; Star 10, variable, magnitudes, 7.8 to 13.5; variation period, 280.2 days; Star 11, double, magnitudes, 3, 6.5; period, 34.46 years; Star 12, magnitude, 3.9; period, 4 days; Star 13, double, magnitudes, 3.5, 9.5; period, 43.23 years; Star 14, variable, magnitudes, 8 to 12.5; variation period, 221 days; Star 15, blue-green nebula; Star 16, magnitude, 2.81; period, 410 days; Star 17, double, magnitudes, 3.8, 8.2; Star 18, double, magnitudes, 3.1, 6.1; diameter, 185,800,000 miles; 21.7 light years distant; Star 19, variable, magnitudes, 8.6 to 14.8; variation period, 317.7 days.

**Serpens.** Star 20, variable, magnitudes, 5.6 to 13; variation period, 357.3 days; Star 21, double, magnitudes, 3.7, 9.1; Star 22, Serpentina, magnitude, 2.8.

**Ophiuchus.** Star 23, variable, magnitudes, 7.3 to 12.6; variation period, 308.3 days; Star 24, magnitude, 2.1; distance, 60 light years; Star 25, magnitude, 2.9; Star 26, double, magnitudes, 4, 6.1; period, 134 years; Star 27, magnitude, 4.4; Star 28, double, magnitudes, 4.9, 6.2; period, 46 years; Star 29, magnitude, 4.6; period, 26.27 days; Star 30, double, magnitudes, 5.3, 6; period, 223.82 years; Star 31, variable, magnitudes, 7 to 10.5; variation period, 302.5 days; Star 32, variable, magnitudes, 3.8 to 13; variation period, 233.8 days; Star 33, magnitude, 2.9; period, 6.8 days; Star 34, double, magnitudes, 3, 8; period, 247 days; Star 35, Antares, magnitude, 1.2; 360 light years distant from the earth; diameter, about 450 times that of the sun. If the sun and its system were to occupy the same space, the earth would be buried throughout its orbit, as would also Mars. 121 million million worlds could crowd into Antares. It is a mammoth globe of incandescent gas whose density is .00001 that of water. It is said that it would take a million and one-third of earths to make one sun, 27 million suns to make one Betelgeuse and 91 million suns to make one Antares.

CHART IX

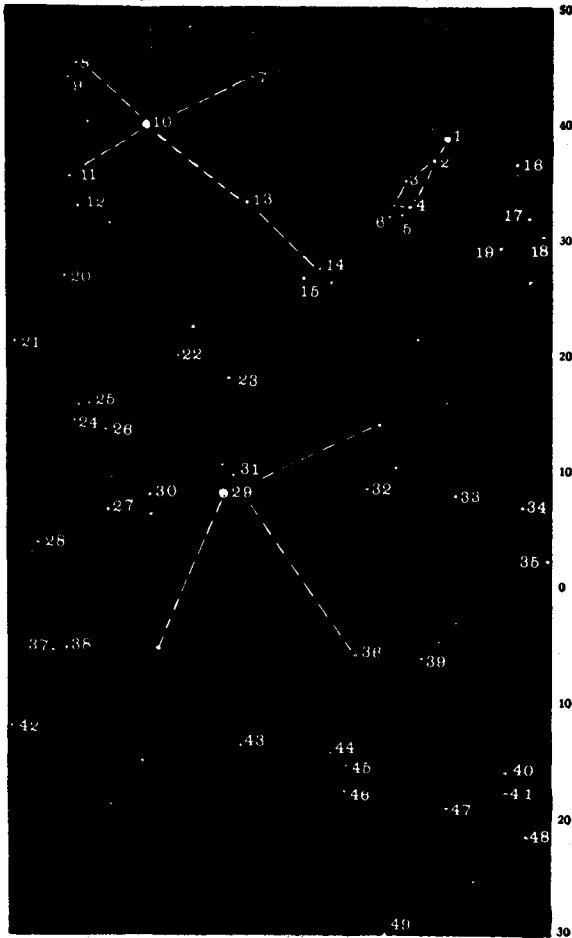


CHART IX

**Lyra, the Lyre.** Star 1, Vega, magnitude, 0.1, brightest first magnitude star in northern heavens, about 50 times as bright as our sun; distinctly blue-white. 1500 Vegas would give more starlight than all the stars in our heavens; 26 light years distant, or about 8 million times as far from the earth as the earth is from the sun. Our solar system is moving towards Vega at the rate of 400 million miles a year. In about 12,000 A. D., Vega will be our polestar just as Polaris now is. Star 2, magnitude, 4.3; period, 4.3 days; Star 3, double, magnitudes, 4.5, 6.5; period, 245 days; Star 4, double, magnitudes, 3.6, 7; period, 12.9 days; Star 5, a ring nebula; Star 6, double, magnitudes, 5.2, 8.7; period, 45.8 years; Star 7, double, magnitudes, 3, 7.9.

**Cygnus, the Swan.** Star 8, Deneb, double, magnitudes, 1.3, 12; distance, 650 light years. Though at a great distance, it is very brilliant and though it seems less brilliant than Sirius it is ten thousand times brighter than our sun. Star 9, magnitude, 4.7; period, 2.8 days; Star 10, magnitude, 2.3; distance, 540 light years; Star 11, double, magnitudes, 5, 6.3; Star 12, the eastern arm of the Northern Cross, magnitude, 2.6; Star 13, variable, magnitudes, 4 to 13.5; probably larger than Mira; variation period, 406 days; Star 14, double, magnitudes, 8.2, 8.2; period, 243.9 years; Star 15, Albireo, double, magnitudes, 3, 5.3.

**Hercules.** Stars 16 to 19 not conspicuous.

**Vulpecula, the Fox.** Stars 20 and 21 not conspicuous; Star 22, the Giant Dumbbell, Nebula.

**Sagitta, the Archer.** Star 23, double, magnitudes, 5.4, 6.4; period, 25.2 years.

**Delphinus, the Dolphin.** Star 24, double, magnitudes, 4, 5; Star 25, variable, magnitudes, 8.4 to 12; variation period, 277.5 days. Star 26, double, magnitudes, 4, 5; period, 26.8 years; Star 27, nebula; Star 28, double, magnitudes, 5.8, 6.3; period, 97.4 years.

**Aquila, the Eagle.** Star 29, Altair, blue-white, magnitude, 0.9, or nine times as bright as our sun; 15.4 light years distant; Star 30, variable, magnitudes, 7.6 to 13; variation period, 284.4 days. Star 31, distance, 112 light years; magnitude, 2.8; Star 32, variable, magnitudes, 5.8 to 12; variation period, 355 days; Star 33, variable, magnitudes, 6.5 to 9; variation period, 335 days; Star 34, nebula; Star 35, double, magnitudes, 4.1, 6; period, 87.8 years; Star 36, not visible to naked eye.

**Aquarius.** Stars 37 and 38; **Scutum.** Stars 39, 40 and 41; **Capricornus.** Star 42; **Sagittarius.** Stars 43 to 49.

CHART X

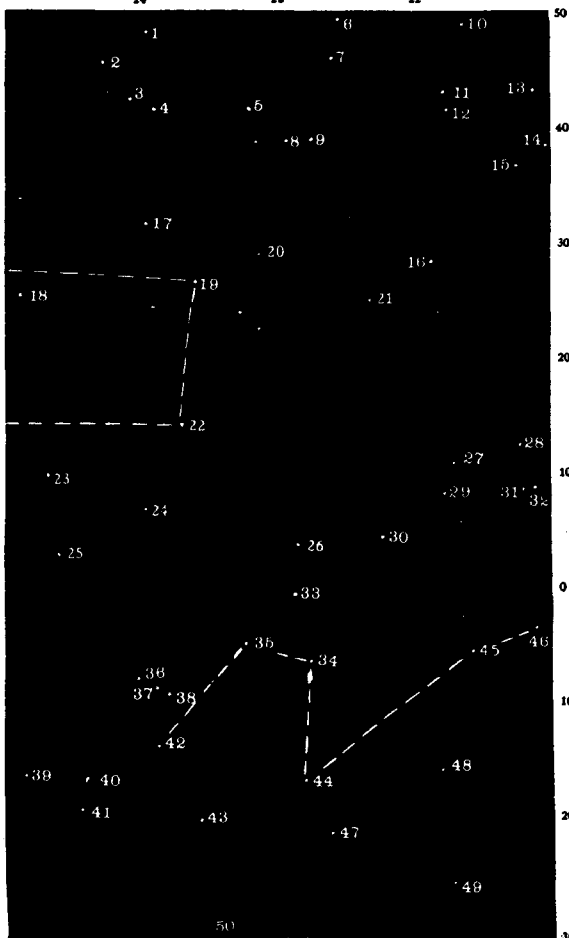


CHART X

The area here covered is relatively poorly supplied with important stars.

In the constellation, **Andromeda**, we have Star 1, a rose-colored star, magnitude, 5; Star 2, magnitude, 4; period, 20.54 days; Star 3, a bright blue-green, elliptic nebula; Star 4, magnitude, 5.9; period, 3.22 days.

The constellation, **Lacerta, the Lizard**, shows Star 5, variable, magnitudes, 8.3 to 14.5; variation period, 298.7 days; Star 6, a cluster; Star 7, magnitude, 4.6; period, 2.6 days; Star 8, a double double with magnitudes of 6.5, 6.5 and 8.5, 10; Star 9, magnitudes, 8 to 12.5.

The constellation, **Cygnus**, shows us Star 10, a cluster; Star 11, a variable; magnitudes, 8.4 to 12; variation period, 103.6 days; Star 12, a triple, magnitudes, 7, 7.9, 11; Star 13, a nebula; Star 14, double, magnitudes, 5.3, 5.9; brightness, .064 as bright as the sun; Star 15, double, magnitudes, 3.8, 8; period, 47 years; Star 16, double, red-gold to purple; magnitudes, 4, 5.

**Pegasus** is represented by Star 17, a double, magnitudes, 5.5, 7.5; Star 18, double, magnitudes, 5.8, 11; period, 26.4 years; Star 19, Scheat, whose diameter, 150 million miles, would enclose 5,000,000 suns; distance 541 light years; magnitude, 2.2; Star 20, magnitude, 3.1; period, 818 days; Star 21, magnitude, 3.6; period, 10.21 days; Star 22, Markab, magnitude, 2.6; distance, 272 light years; Star 23, double, magnitudes, 6.9, 7.3; Star 24, variable, magnitudes, 7.8 to 13; variation period, 317.5 days; Star 25, a glowing ember, magnitude, 6.2; Star 26, a double, magnitudes, 5.8, 7.2; Star 27, a globular cluster; Star 28, a variable, magnitudes, 8 to 12; variation period, 262 days; Star 29, a triple, contrasting colors; magnitudes, 2.5, 8.8, 11.5; Star 30, variable, magnitudes, 8.2 to 14; variation period, 303 days; Star 31, double, magnitudes, 5.3, 5.4; period, 5.7 years; Star 32, a triple, magnitudes, 4.1, 5.7, 11; Star 33, double, magnitudes, 4, 4.1; Star 34, double, magnitudes, 5.6, 5.7; Star 35, triple, magnitudes, 7, 7.5, 8; Star 36, double, magnitudes, 7, 8; Star 37, double, magnitudes, 7, 8; Star 38, double, magnitudes, 4, 8.5; Stars 39 to 47 either invisible to the naked eye or nearly so, and relatively unimportant.

**Capricornus**, Star 48, magnitude, 3; Star 49, magnitude, 5.

Fomalhaut, Star 50, magnitude, 1.3 and distance, 25.51 light years, is seen in autumn in the constellation, **Pisces Australis**, or **Southern Fish**.

# How to Make a Planisphere

A PLANISPHERE for finding the common northern constellations may be made by cutting out, or tracing, the sections on the right.

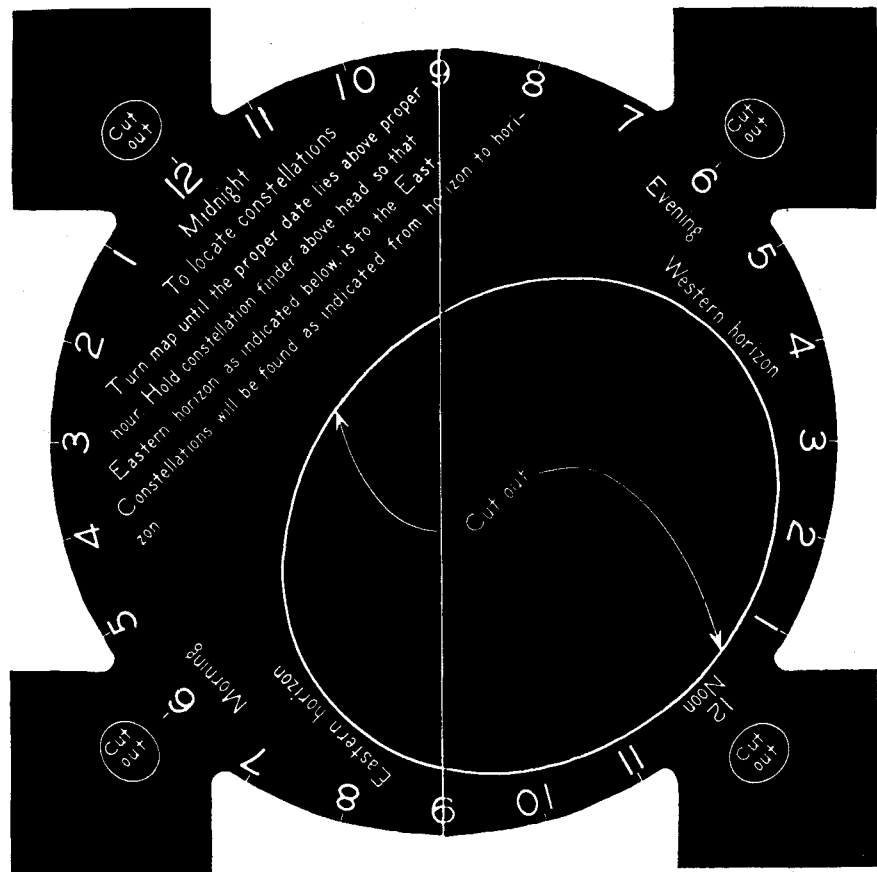
Mount the circular map on a stiff piece of cardboard and cut it out in a circular form.

Mount the frame similarly and cut out the areas indicated to be removed.

Select a third card, the size of the frame, and lay it on a table. On each of the corners lay one or two thicknesses of card such as was used to mount the map. Place the map in the center of this third card and fasten the corner pieces with glue so that the map has only slight opportunity to get out of position. Place the frame over the map and the other cards. Fasten the frame to these cards with tape or *passee-partout* so that the map may be moved about inside the frame and the third card enclosure.

To locate a major constellation follow the directions on the front of the frame. Do not expect to find all of the constellations at any one time of the year.

NOTE: If it is desired that the printed planisphere be cut out do not remove this column since the general directory of stars and constellations is printed on its back. This should remain with the text for convenience. A copy may be made of the list of references on the reverse of the planisphere plan.



This special educational insert—as well as those in the October and December issues and those to follow—is so placed in the magazine that it may be detached and preserved in a note-book cover. This insert, in particular, will be found useful in connection with Nature Magazine's regular astronomy article by Isabel M. Lewis, a feature long popular with the sky-minded readers of the magazine.

## ACKNOWLEDGMENT

THIS outline for the study of the stars is modified from a similar article prepared by the author and published in a more comprehensive form as *Cornell Rural School Leaflet*, Volume 23, Number 3, in January, 1930. The revision is made with the permission of the New York State College of Agriculture, publishers of the initial article.

As has been the case in the preparation of similar articles on other subjects, the author has supplemented his own experiences with those of others, and has, of course, received help from books. In the preparation of this material particular credit is due to Professor S. L. Boothroyd of the College of Civil Engineering of Cornell University, who reviewed the manuscript and made many helpful suggestions. The books found most useful in the preparation of this material and to which acknowledgment is due are as follows:

- Introducing the Constellations*, by Robert H. Baker, The Viking Press, New York City, 1937.
- When the Stars Come Out*, by Robert H. Baker, The Viking Press, New York City, 1934.
- The Universe Unfolding*, by Robert H. Baker, Williams and Wilkins Company, Baltimore, Md., 1932.
- 1001 Celestial Wonders as Observed with Home-built Instruments*, by Charles Edward Barns, Pacific Science Press, Morgan Hill, California, 1928.
- Handbook of the Heavens*, edited by Hubert J. Bernhard, Dorothy A. Bennett and Hugh S. Rice, Whittlesey House, McGraw-Hill Book Company, New York City, 1935.
- Our Wonderful Universe*, by Clarence A. Chant, World Book Company, Yonkers-on-Hudson, New York, 1929.
- Through the Telescope*, by Edward Arthur Fath, Whittlesey House, McGraw-Hill Book Company, New York City, 1936.
- Exploring the Heavens*, by George Clyde Fisher, Thomas Y. Crowell Company, New York City, 1937.
- Let's Look at the Stars*, by Edwin Brant Frost, Houghton Mifflin Company, Boston, 1935.
- Astronomy*, by Arthur M. Harding, Garden City Publishing Company, Garden City, New York, 1935.
- Worlds Without End*, by H. Spencer Jones, The Macmillan Company, New York City, 1935.
- Astronomy for Young Folks*, by Isabel M. Lewis, Dodd, Mead and Company, New York City, 1932.
- Pageant of the Stars*, by Willem J. Luyten, Doubleday, Doran and Company, Garden City, New York, 1929.
- A Beginner's Star-book*, by Kelvin McKready, G. P. Putnam's Sons, New York City, 1937.
- Consider the Heavens*, by Forest Ray Moulton, Doubleday, Doran and Company, Garden City, New York, 1935.
- Field Book of the Skies*, by William T. Olcott and Edmund W. Putnam, G. P. Putnam's Sons, New York City, 1934.
- Stars and Telescopes*, by James Stokley, Harper and Brothers, New York City, 1936.

## THE SKY AT NIGHT

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