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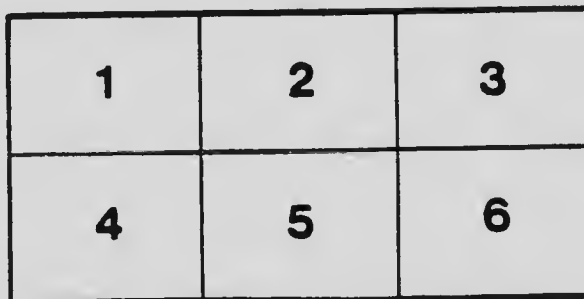
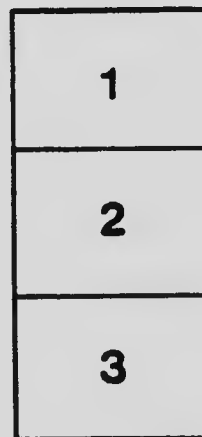
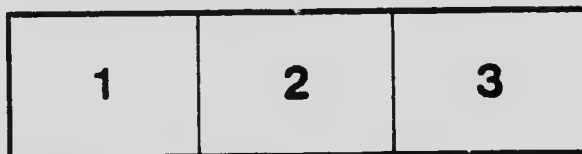
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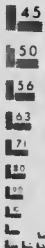
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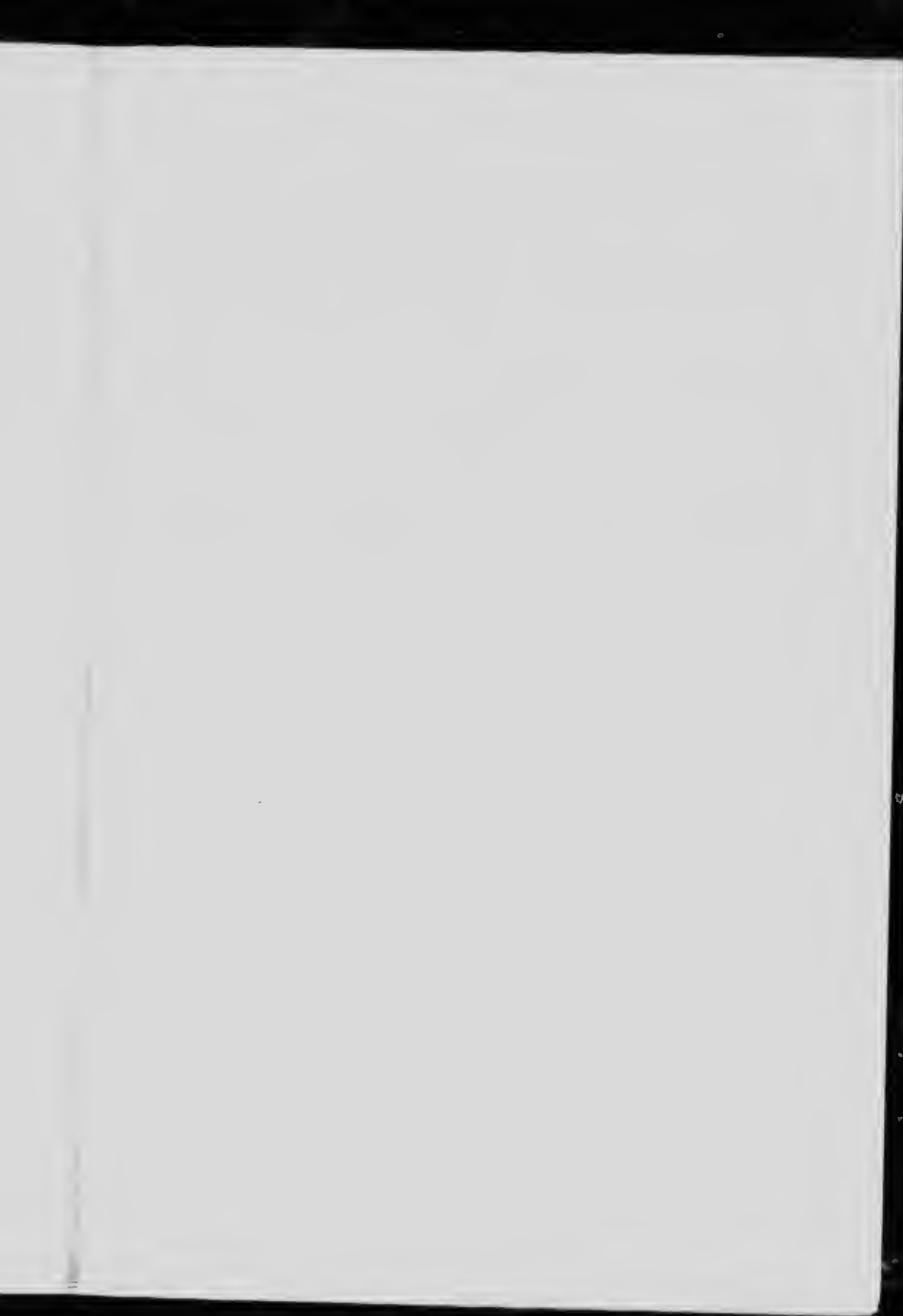
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Constellations and Comets







SWIFT'S COMET.

1

Constellations and Comets

or
Stories from Starland

BY
LILIAN B. IRELAND

GR625

I74

1910

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FOREWORD

"The stars tell it all." Do you see the constellations swinging above us, such unimaginable vastness, not roving or crashing through the illimitable at haphazard, but moving in more excellent measure and to a finer rhythm than the most delicate clock-work man ever made. The great ocean lines mark our seas with their paths through the water, the fine brains of the earth are behind the ships that sail from port to port, yet how awry the system goes: When does a ship come to harbor at an hour determined when she sailed? What is a ship beside the smallest moon of the smallest world? But here above us, moons, worlds, suns, all the infinite cluster of colossi, move into place to the exactness of a hair at the precise instant. That instant has been planned; it is part of a system, and can a system exist that no mind made? Think of the mind that made this one. Do you believe so inconceivably majestic an Intelligence as that could be anything but good? Ah, when you wonder, look above you, and you will never doubt that the sparrow's fall could be unmarked.

From "The Two Vanrevels," Booth Tarkington.
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CHAPTER I.
NORTHERN CONSTELLATIONS.



CHAPTER I.

NORTHERN CONSTELLATIONS.

IN commencing the stories about the stars the northern circumpolar constellations have been chosen first, because they circle around the pole-star, and never entirely sink below the horizon. No matter what the season, nor what the time of night, provided one lives in the northern hemisphere, and the sky is not cloudy, they may easily be found. They could even be seen in day time if viewed from the bottom of a very deep well or chiney.

“There earth, there Heaven, there ocean He
designed;
The unwearied sun, the moon completely round;
The starry lights that heaven’s high convex
crown’d;

To which around the axle of the sky,
The Bear revolving, points his golden eye,
Still shines exalted on the ethereal plain,
Nor bathes his blazing forehead in the main.”

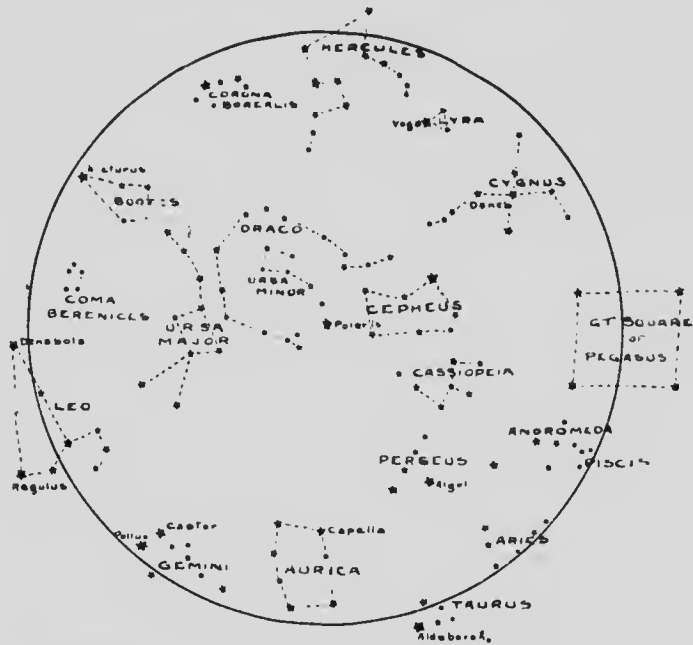
—Pope’s Trans. Iliad.

The first constellation, that you will be able to find easily, is Ursa Major, the Great Bear.

It is not the shape of a bear at all, but of an immense dipper. The people in England call it Charles’ Wain (Wagon) or sometimes the Plow,

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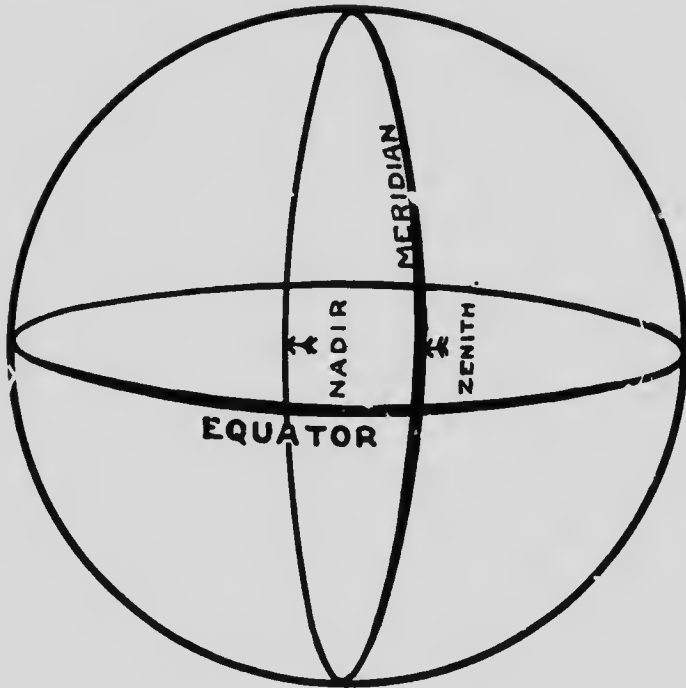
though I think that you will agree with me that it looks just like an immense sauce-pan or dipper.
Once Ursa Major is found, it will be easy to find the other northern constellations.



NORTHERN CONSTELLATIONS - CIRCLE REPRESENTS CELESTIAL EQUATOR

The north pole-star is found by drawing an imaginary line joining the first two stars of the bowl of the dipper (called the pointers), and producing it out into space. The bright star to which this line leads is almost at that point of the heavens which we call the north pole. It is named Polaris, and is as useful to the star-sailor in guiding him to the northern constellations as

it is to the sailor upon the ocean. Years ago, the Phoenician navigators steered their ships by this star.



Polaris is the end star in the tail of Ursa Minor. The Little Bear, Ursa Minor, is also like a dipper, but with the handle curved upwards. There is one strange thing about these constellations: the ancient Greeks and Romans, and also the Iroquois Indians who could have had no dealings whatever with these eastern peoples, called them bears. It is thought that they were so named because the north is the home of Polar bears. These animals

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do not go far from their homes, but circle about the northern regions, moving away only in search of food. The Polar constellations also circle about their home Polaris.

THE GREEK STORY OF THE BEARS.

Callisto was a beautiful Greek maiden. People said that she even rivalled the matchless Juno. The Queen of Heaven heard these rumors, but not until Jove became enamored with Callisto did it make her angry or jealous. "I will change her into a bear," she said, "and take away her beauty." No sooner was this said than the lovely Callisto could no longer stand upright. Down upon her knees she fell; hair covered her lovely white skin. She tried to cry for help, but only a fierce growl came from her lips; so that she was denied the privilege of even telling her loved ones what had become of her. Everything had been taken from her except her gentle disposition. How afraid she was of the lonely dark forest and of the other bears! She shrank from them, not fully realizing that now she herself was of their kind. Though she had been skilled in hunting, she trembled when she heard the baying of the hounds, for now she would be of the hunted. One day she met her son in the forest. Forgetting her misfortune in her motherly love, she hastened to embrace him, but he, not knowing, raised his spear to kill her. Jove saw her peril and snatched her from the earth, putting her in the sky as the constellation we now see. To repay Callisto in some measure for what she had

suffered, he took her son and put him near his mother, and they have ever since been known as the Great and Little Bears.

Juno's rage was terrible at this, for she felt that her rival had again triumphed. "See," she said to the God of the Ocean, "see how I have been treated. Look in the dark night, and you will see the two of them exalted in the heavens, in that part where the circle is smallest near the pole. I took away her beauty and now she is placed on high among the stars. O Neptune, forbid them, I beg of you, to come into your comforting waters." The god did as he was asked, and this is the reason why the Great and Little Bears move round and round the pole-star, and never sink, as other stars do, below the horizon.

The next constellation which we will notice is Bootes. He has so many names that it is hard to choose among them. When we think of Ursa Major as the seven plow-oxen, then we should call Bootes the Ox-driver. If we think of it as a bear, then Bootes is the Hunter or Bear-driver. He is then preceded by two dogs, Asterion and Chara. The bright star of the constellation is Arcturus. This star was named by the Greeks, and the word means Bear-guard. The Arabs called Arcturus the Spear-man.

The constellations, according to Greek mythology, which we are going to find next, belong to one family,—the Royal House of Aethopia. They are Queen Cassiopeia, King Cepheus, their beautiful daughter Andromeda, to whom Perseus was married, and to complete the story Pegasus, the winged horse of Perseus, should be added.

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Parts of these constellations are out of sight at certain times of the year, so that the best time to look for them is from October or November until March. Then they are brightest and in the best positions, and the long clear nights give a good opportunity to study the sky-fields.

To find Cassiopeia draw a line from the first star in the tail of Ursa Major through Polaris, and extend it out into space. This line will bring you to the chair. This constellation has forty-six stars visible to the naked eye, though only five of them are prominent. These five are much brighter than the others. They form an immense W, or by taking a star a little less brilliant than the other five, one can imagine the shape somewhat like a chair.

The constellation of Perseus follows south or west (according to the time of the year) in a line from Cassiopeia. It is easily distinguished by three bright stars almost in a straight line, which form a very obtuse angled triangle. These three, with Algol, which is a little east (or south) of them, are the bright stars of this constellation. The Ancients called Algol the "Devil-star," because it performs such strange tricks. It is a star of the second magnitude, that is, second degree from the brightest. It varies from this to a fourth magnitude star.

To the east and south of Perseus, Andromeda is seen, in an autumn sky. She is represented on our star maps with arms outstretched as she was chained to the rock. East of Andromeda is the Great Square of Pegasus, so named because the four brightest stars form a square.

I shall now tell you the stories which the Grecians wrote about these strange people immortalized in the sky.

There were three Gorgons, but ancient stories tell little about any of them except Medusa. These Gorgons were monstrous females with pigs' teeth, claws of brass, and with heads covered with writhing snakes instead of hair. Medusa is said to have been very beautiful at one time, but of this she was so boastful that she compared herself with Minerva. That angry goddess cursed her by causing her lovely tresses to be changed into hissing serpents. She was then so awful to look upon that any living thing that beheld her was at once changed into stone.

When Perseus was born, an oracle had prophesied that he would be the cause of the death of his grandfather, Acrisius. His mother Danae and her tiny son were accordingly put into a chest and set adrift on the ocean. The chest floated to a distant shore and was found by some fishermen. They took the mother and her son to their king, who treated them with exceeding kindness. When Perseus was grown to manhood, his protector sent him to try and destroy the Gorgon Medusa, who was devastating the country. Minerva, when she heard about the almost hopeless task set for Perseus, sent him her shield, and Mercury lent him his winged sandals.

Thus armed by the immortals, he silently and swiftly approached the monster's home. Fortunately, he found her asleep, and watching her image in Minerva's polished shield, struck her a blow with his sword which severed the dreadful

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head from the body. Then he thrust it beneath his mantle. As he thus concealed the hideous object, drops of thick blood fell to the ground, from which a beautiful winged steed immediately arose and dashed away into the clouds. He was caught at once by Minerva's attendants who, though unseen, had been nearby. They brought the horse back to him and herode home in triumph. This was the origin of Pegasus, the winged steed.

The Aethopians were great favorites among the gods on Mount Olympus, and were at times even allowed to go and dine there with the immortals, a favor seldom granted by Zeus, the father-god.

Queen Cassiopeia was very beautiful, and the gods and goddesses praised her for her loveliness till she became so vain that she boasted herself more lovely than the nymphs. These offended goddesses complained to Neptune, and word was sent to Cassiopeia that if she would not repent of her boast the sea-god would cause her great sorrow and trouble. She scoffed at the idea, and Neptune, first commanding the queen to chain her daughter Andromeda to the rocks, sent the monstrous sea-serpent Cetus to ravage the coast and feed upon the helpless maiden. Too late the mother repented her folly, for now she had to obey. Poor innocent Andromeda lay chained to the rocky promontory, awaiting the fate brought upon her by her mother's thoughtless vanity.

As the sea-serpent arose out of the water he espied his prey, but was in no haste to seize it. As serpents do, he wished to tantalize his victim and show her how helpless she was and how awful was his strength. He lashed the sea into

foam, and the stroke of his tail on the water resounded through the air like thunder.

While he was thus disporting himself, Perseus, who had been away in quest of the Gorgon's head and was now returning on his winged horse, in the direction of the rock upon which Andromeda lay chained, at once saw her danger and hurried to her assistance. Her beauty and her helplessness drove all other duties from his mind. An instant brought him within reach of the dragon, which raised its huge head above the water and blew fire from its nostrils to terrify this molester of its sport. Perseus struck at it with his sword, but its scales defied all weapons. He tried in every way to surprise it, but all in vain. At last he bethought himself of Medusa's head. Taking it carefully from beneath his mantle and turning his eyes away lest he might bring its curse upon himself, he held it aloft before the serpent. The noise of the turbulent water ceased. Then Perseus covered the head again before he dared to look. When he did so he beheld, to his great joy, that the serpent had been turned to a huge mass of stone. If you will go today to that part of the world you will see a long serpentine rock, said to have been this great sea monster.

Andromeda begged Perseus not to go on his journey till he had visited her parents, and received from their hands a fitting reward. When they came into the Palace, the king and queen willingly offered him anything that was in their power to bestow. He claimed Andromeda for his wife. This was granted, and we are told

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that they lived a life of unalloyed happiness upon earth, and when they died the gods placed them all, Cassiopeia, Cepheus, Andromeda, Perseus and Pegasus near one another in the sky as the constellations now so named.

Following down from Cassiopeia past Perseus is the constellation of Auriga, a name which means the "Charioteer." Have you read "Ben Hur"? Then you will know all about the chariot races. They often hired chariot drivers as men now hire jockeys. Auriga was at first supposed to represent a charioteer who was Erechtheus, the son of Vulcan, but afterwards the constellation was apparently intended to represent a shepherd with three kids in his arms. One story describes Capella, the bright star, as the goat which acted as foster-mother to Jupiter, the father-god, when he was an infant. The story goes that one day when Jupiter was a young boy, while playing with the goat, he knocked off one of its horns by mistake. To this horn he gave the power of being filled with whatever the wisher wanted. From this it got the name of Cornucopia, the horn of plenty. There are three little stars near Capella called the Kids. He is generally represented as a shepherd carrying a lamb. Capella is in the lamb's body.

Draco is supposed to be the Dragon which Juno placed in the garden of the Hesperides to watch the tree on which hung the golden apples. No one dared touch the tree until at last the hero Hercules killed the monster. Juno rewarded its years of faithful service by placing it in the sky as the constellation of Draco.

This constellation, in the time of the Chaldean Astrologers, contained the north pole, but now it is twenty-four minutes fifty-two seconds from the true pole, having moved since that time. It is easily distinguished by the two bright stars which mark the eyes of the monster and the long twisted line of stars which represent its body.

In all these constellations we notice hazy places which resemble a mist, or cloud. Astronomers tell us that they are great masses of gaseous substance, which are called Nebulae. They cannot be as easily seen as the stars, but astronomers believe that they are new systems in the course of formation. There are also great star clusters, many suns clustered together. After all, how little we know of what is going on in our great universe. These and many other constellations have, within their boundaries, numbers of Nebulae, from cloudy masses to half formed stars, which show us that they are in process of growth. Some night look at them through the telescope.



CHAPTER II.
THE SUN'S ROAD, "ZODIAC."



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COULD we look at the Sun and watch the course which he takes, not daily across the sky, but as he passes through the stars from one constellation to another, we will see that in one year he apparently makes a complete circuit, and when the twelve months are past he is in the very same position in the sky as when we began to observe him.

The path which the Sun follows is called the Ecliptic. We should not say the path of the Sun, for that body only appears to move. In reality it is stationary as far as our Solar System is concerned. It is the path of the Earth around the Sun. No doubt the Sun travels in an orbit of its own, taking our whole System with it (as the Earth takes the moon) around some other body. But, if such be the case, its orbit is so large that, during all the years that the people of the Earth have been studying the heavens, there has been no perceptible change in the relation between our Solar System and the fixed stars to one another, except, perhaps, the Precession of the Equinoxes, which astronomers easily account for.

The Zodiac is a broad band across the sky, seventeen degrees wide, extending eight and a half degrees on either side of the Ecliptic. It

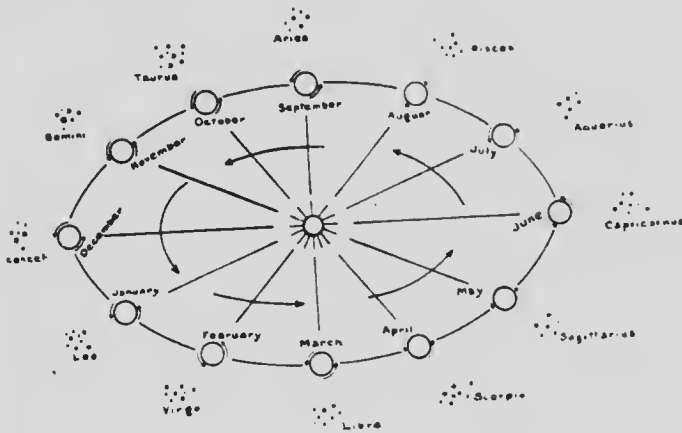
contains twelve constellations, the Sun passing through one of these every month.

The people on the Earth, looking toward the heavens, naturally observed the Sun more particularly than any other object, it being apparently the largest of the heavenly bodies. It did not appear to stay in the same group of stars, but to constantly progress, passing from one constellation into another. This movement was so very slow, that one month's time was taken in passing through one group. When the ancients made this discovery, they saw that the Sun had, apparently, a regular motion. So they set to work to observe very carefully and also to record all that they discovered about it.

Judging from what they could see, the Earth appeared to be the centre, and the Sun, moon, and stars to revolve about it. It was a very natural inference, though now we know that it is not true. Then, if it be not true, why does the Sun appear to move in the sky; first, daily across it from east to west, and second, through the stars? We will answer the second question first, and leave the first until we come to the talk about the planets.

Suppose yourself to be standing on the Earth and looking at the Sun. Your vision extends out into space beyond the Sun. When you are on the Earth looking at the Sun from the position marked March, you see the stars on the other side of it, which form the constellation called Aries. So, also, when you are at April, you see Taurus, the bull. There are twelve pictures for you to look at, one for every month, the Sun ap-

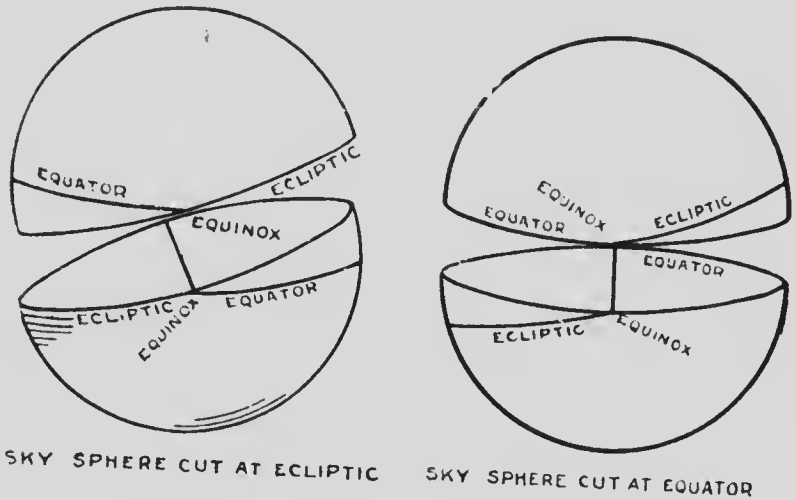
pearing to pass from one to the other as the slides change in a magic lantern. The moon, the major planets, and apparently the Sun, all travel in this area, which is called the Zodiac. The track which the Sun would make through the constellations, if it could only mark on the sky its path, is called the Ecliptic.



You will remember that on the star map in the first picture a meridian was drawn through the north and south poles of the sky, that is, a great circle around the Earth, half of which would be above the horizon and half below it. Another great circle of the sky sphere which is important to mark out and understand is the equator of the heavens. You see it here on the globe in the same

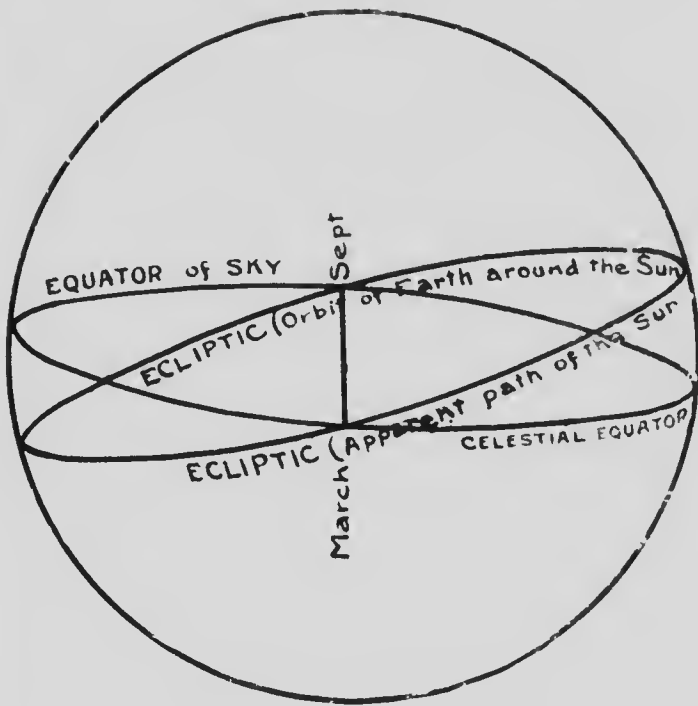
place and in the same relation to the north and south poles of the sky as the earthly equator (being ninety degrees from each of the poles in all its parts, and at right angles to the meridian).

Suppose that on the outside of this sky sphere there was also another circle, this one would



represent the Ecliptic. In the diagram, the outer circle represents the great sky sphere, on the surface of which you see the equator drawn. The other circle represents the Ecliptic. You see that the Sun does not travel parallel to the equator, but is slanted or inclines to it. Astronomers say "inclined to the Equinoctial."

Do you see the perpendicular line joining the two circles, the Equator and the Ecliptic, where they cut one another. This line represents what is called the Equinoctial. It really cuts right through our sky-sphere in joining the two points.



as you see the circles cut one another on opposite sides of the sphere. The Ecliptic is inclined to this line, and that is what is meant when it is said that the Ecliptic is inclined to the Equinoctial.

The two points where the Ecliptic and the Equator cross one another are called the Equi-

noxes. The spring one is about March 21st, when the Sun is just showing the constellation of Aries behind it. This is called the Vernal Equinox, because Vernal means "Of the Spring." The other one is called the Autumnal Equinox, because the Sun crosses the heavenly Equator in the autumn, about September 21st. At both these seasons of the year, the Earth is often visited by more or less violent storms, both on sea and land, generally called the Equinoctial gales.

The circle of the Zodiac was divided by the ancients, more than four thousand years ago, into twelve equal portions. The constellations occupying these spaces were represented in their records by pictorial signs, in the following order: Aries (the ram), Taurus (the bull), Gemini (the twins), Cancer (the crab), Leo (the lion), Virgo (the virgin), Scorpio (the scorpion), Sagittarius (the archer), Capricornus (the goat), Aquarius (the water carrier), and Pisces (the fishes).

There is an old rhyme which goes as follows:

"The fishes joined by their glittering tails,
The man that carries the watering pails;
The He-goat runs, the Archer aims,
Next the Scales, and the Virgin, the lion shines
The Crab, and then the heavenly Twins;
The rhyme you see has backward run,
For after the Bull to the Ram you come."

The people who first noticed the Sun and found out about its path lived in the west of Asia

and were called Chaldeans. They were the first to observe the heavens carefully, and to leave any records. The land of the Chaldeans was flat, and the atmosphere rare, so that the stars could be easily watched. The Sun seemed to always take an angular course across the sky. It appeared each day and disappeared each night. They then supposed that the Sun travelled in a great circle around the Earth, and this circle they called the Ecliptic. They marked a space on each side of the Ecliptic. In this space the constellations were located. This broad band is called the Zodiac. The Chaldean word is not now used, the Greeks having given it the name Zodiac from a Greek word "zo-on" meaning "animal," for many of the constellations are supposed to look like, or in some way, represent animals.

The Chaldeans were very diligent in their observations. They noticed that the Sun passed through all the constellations in one year, and that when the year was up, it was ready to go over exactly the same path. They then divided the year into twelve months, to correspond with the twelve constellations. They made strange characters to stand for these constellations, and these characters, or marks, are what are called the signs, and are often seen today in almanacs and such publications.

While the Greeks and Romans retained the Zodiacal and other constellations as given by the early astronomers, they made different images or pictures to represent them, and gave some of them different names, having reference to their

own history. These were figures of their national heroes, or the emblems of their deeds. As the stars formed none of the imaginary pictures assigned to them, these changes made no difference to the scientific facts which the thoughtful Chaldeans had handed down.



Aries (the ram) was one of the constellations pointed out by the ancients. It is not supposed to represent a ram, but probably got its name from the fact that, when the Sun entered Aries, the flocks were taken from the stables and put out into the fields, or probably because the ram was used in their sacrifices. One writer suggests that it might have been chosen because it was the leader of the year and went before the eleven constellations, as the ram goes before and leads the flock.

It has Triangulum and Musca on the north and Cetus on the South. There are two bright stars in the head of the ram; Arietus, called Hamal by the Arabs, is a star of the second magnitude; the other is a third magnitude star.

The Equinoctial point is in this constellation. It is not marked in the sky by the presence of any bright stars, but it is near a third magnitude star in the constellation of Pegasus, called Algenib. This point in the heavens is very important in the study of astronomy, being the point from which

the right ascension of the heavenly bodies is reckoned upon the Equator. Their longitude is calculated upon the Ecliptic.



Taurus (the bull) is the second sign of the Zodiac. The Sun enters this sign about the 21st. of April. Taurus is bounded on the north by Pegasus, Perseus and Auriga; on the south by Orion and the star river Eridanus; on the west by Aries; and on the east by the constellation which the Sun is about to enter, Gemini. It is composed of many small stars and has the large bright one, Aldebaren, situated in the midst of the cluster Hyades, the stars of which are in the form of the letter V, Aldebaren being at the top of the letter to the left. This cluster and star, form the bull's forehead and eye. The well known cluster of the Pleiades (the seven little sisters) is situated in the bull's shoulder. It is a cluster famous in story, and is sometimes called the Snowy Constellation. It was regarded by sailors as dangerous to their ships. In the constellation of Taurus is also the great Crab cluster.

Among the Chaldeans, the priests were the astronomers. It is not strange then that their sacred animals were represented in their works upon astronomy. The bull was held sacred in their religion. Statues of winged bulls were placed at the gates of their palaces to keep out

evil spirits. The Egyptians, who were also ancient students of astronomy, held the bull sacred, and thus the name of this sign remained unchanged.

II

The third sign of the Zodiac is Gemini. This name was given because of the two very bright stars which mark this constellation. The different nations who studied the heavens gave it a variety of names. The Arabs, whose religion forbade them to represent any of the constellations as human beings, called them two peacocks. The Chaldeans showed them in their records as two kids; but the Greeks named the constellation Gemini and the two bright stars Castor and Pollux after two of their heroes.

If Regulus in the constellation of Leo and Aldebaran in Taurus be above the horizon and the space between them be equally divided, there will be found the constellation of Gemini. Castor is a remarkable star of the first magnitude; Pollux is of the second. The sun enters this sign of the Zodiac about May 21st.

Castor and Pollux were children of the gods. Helena, the beautiful woman who afterwards caused the Trojan war, was their sister. When Helena was carried away from Sparta by Paris her twin brothers, then aspiring to the heroes' wreath, followed to rescue her, and while Theseus

was absent from Attica, they managed to get her and take her back to their native city.

Castor was famous for training horses and Pollux for skill in boxing. While on one of their great adventures they met with the famous Argonautic Expedition. One of the trials with which it had to contend was a dreadful storm, so great that all feared the vessel would sink. Orpheus was also in the ship and he played upon his magic harp and prayed to the gods. Then the storm abated and stars appeared upon the heads of the two brothers. From this incident they afterwards became the patron saints of seamen.

Sometimes tongues of flame are seen jetting out from the tops of masts and other pointed parts of a ship after an electrical storm. In the middle ages they were sometimes called the fires of St. Elmo; but for the hundreds of years before that, when the Grecians and Romans successively ruled the seas, they were named after the two heroes Castor and Pollux.

After this expedition Castor and Pollux went to a war, in which Castor was slain. Pollux suffered so much from the loss of his brother, that Zeus, at his request, let him give his life as a substitute for that of Castor. It is said that they lived alternately for a while till, finally, the father-god rewarded their brotherly affections by placing them among the stars as the constellation of Gemini, the twins. The two bright stars are represented as in the foreheads of the brothers.

Cancer is the fourth sign of the Zodiac, which the Sun enters about June 21st. The constel-

lation received the name from Ptolemy, the great astronomer of Alexandria. It marks the northern limit of the Sun's course in the summer; hence it is called the sign of the summer solstice.

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Cancer is represented on Celestial globes as a crab. It is bounded on the north by the Lynx, on the south by Monoceros, on the west by Gemini and on the east by Leo. It is the least conspicuous of all the Zodiacal constellations. In mythology, we are told that during the struggle between Hydra and Hercules this crab pinched the strong man's toes and was crushed in consequence by the foot of the victor. To compensate it for its vain efforts to assist her, Juno put it in the sky in the important position of a Zodiacal constellation. Astrology assigns to it a very important place and the Chaldean philosophers supposed it to be the "Gate of Men," the portal through which the souls passed in order to come to earth and enter human bodies.

Nearly all over the world the crab is found, from the little Pea crab to the gigantic Japanese crab. The ancient people were very much interested in these strange creatures with so many legs and with eyes which they could send out of their heads and look backwards or forwards or in any direction. They saw that the crab walked backwards and observing the Sun in the sky they

noticed that after it had gone as far as it could possibly go towards the north, it began to recede and was at this time of the year coming backward towards the Equator. So they took the crab as the symbol of the summer solstice. They found or thought they found that the stars actually made the picture of a crab in the sky, in the place where the constellation is situated.

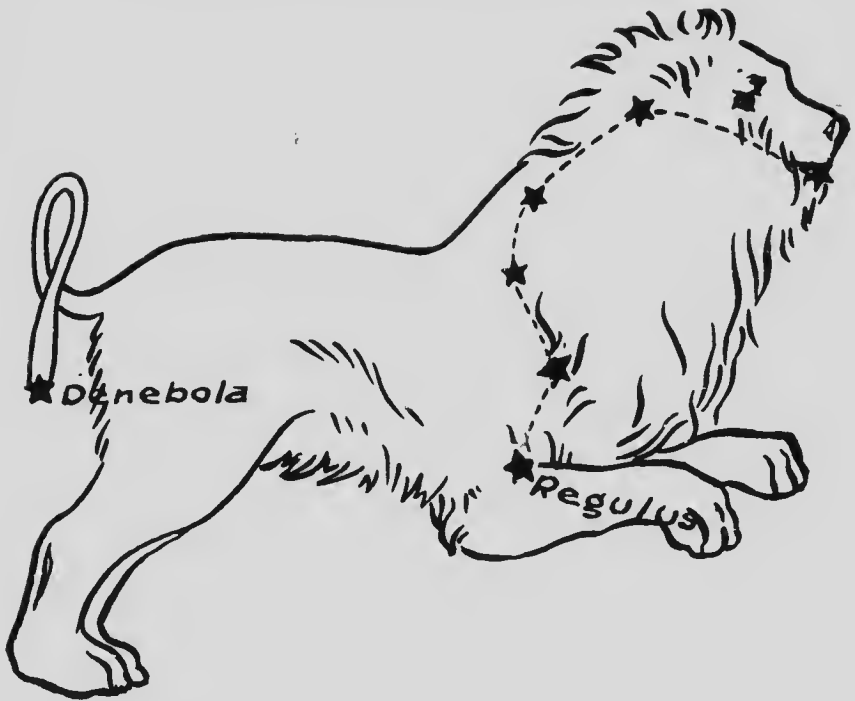


The fifth sign is Leo. The Sun enters it about July 21st. The constellation of Leo is bright in the midnight sky of spring. Six bright stars in the form of a sickle, the cutting edge towards Cancer, in the west, mark this constellation. [See illustration on page 32.] It consists of about one hundred stars visible to the naked eye. See the bright star at the end of the handle of the sickle! That is the first magnitude star Regulus. This marks the heart of Leo. Note the second magnitude star Denebola at the end of the lion's tail.

Leo is the Nemean lion which Juno sent Hercules to kill. It was impossible to kill it with arrows or other weapons, so he strangled it with his hands. When he brought it to the king who had given him Juno's commands, that ruler was so afraid of the hero's strength that he refused him admittance into the city.

In the olden time lions were very much more numerous than they are today. In Africa, in

Asia, and even in southern Europe, there were many lions. The Romans had as many as six hundred at one time at the Amphitheatre for the amusement of the Court. To the Chaldeans the lion was a symbol of fire and heat; so it marks the time when the solar heat becomes the greatest.



From the vicinity of Leo, the Leonids (the meteors which we see about November 11th), appear to come.

Virgo is the sixth sign of the Zodiac. The Sun enters it about August 21st. It is the time of the harvest; so Virgo is represented as a virgin with an ear of corn in her hand. The Greeks say

that it represents Aphrodite, their goddess of love and beauty, and she is sometimes pictured with a silver bow in her hands. The Romans called



her Venus and the Chaldeans, Ishtar. We all know the Roman story but the Chaldean myth is not often told. Ishtar went to the underworld, the world of the dead, in search of the sun-god who had been taken away by Death. It is said that she knocked at the gate of the palace but was at first refused admittance. At length she got through, but found that there were many such gates, each closed to her unless she would part with some article of her dress. First she gave her head-dress, then her ear-rings, necklace and, finally, she had to part with some of her outer robes. In humiliation she was brought to the ruler of the gloomy place. During her stay beneath, everything in the world became cold and lifeless, being deprived of love, warmth and light. When at length she was restored to the sun-god, they returned to the earth. Great was the rejoicing, and light and love and beauty were revived. This was the way the people had of telling the story of the cold winter which follows the harvest and fall.

When the Sun is passing from Leo to Virgo, the River Nile overflows. Perhaps this will answer the riddle of the Sphinx (a combination of a lion

and a woman), for the question may have been, "What will the harvest be?"

Virgo is bounded on the north by Bootes and Coma Berenices, on the north by Corvus, Crater and Hydra, on the west by Leo, and on the east by Libra.



Libra, (the balances), is the seventh sign of the Zodiac. This constellation and sign was named on account of the equality of the days and nights, a balance of daylight and darkness. The Sun enters it at the autumnal Equinox, September 21st. It is a southern constellation, lying between Virgo on the west and Scorpio on the east.

There is an old Roman legend which says that the virgin is the spirit of justice and that, on account of the wickedness of the world, she fled to the skies. When Virgo is so considered, Libra is said to be the scales upon which she weighed the deeds of men.



Scorpio is the eighth sign of the Zodiac. The Sun enters this sign about October 21st. It is bounded on the north by Ophiuchus and Serpens, on the south by Lepus, Norma and Ara, on the west by Libra, and on the east by Sagittarius. A scorpion represents this sign on celestial globes and by this it is meant to signify the unhealthy-

ness of the fall. It is a small but very brilliant constellation, especially when seen from places south of the Equator. The brightest star is Antares which is sometimes called Cors Scorpio, the heart of the Scorpion. It is a first magnitude star. Of all the constellations of the sky, few look more like the name they bear than Scorpio. The head is in the west. Two bright stars mark the sting and tail. The Scorpion was regarded as the symbol of night, darkness and evil. The Scorpions of the tropics are sometimes ten inches long and are very venomous. They are nocturnal in their habits and lurk in filthy and musty places during the day. Hence the Scorpion is a fitting emblem for the season of death and decay.



The ninth sign of the Zodiac is represented by the Archer. The Sun enters it about November 21st. It is a southern constellation, there being about eight visible stars, arranged in two quadrangles, four within, and four without the Milky Way. A line drawn through Deneb in the constellation of Cygnus, and through Altair in Aquila, will intersect Sagittarius.

CHIRON.

We read about the Centaurs in many of the Greek stories. They were supposed to be beings with a horse's body and the head and loins of

a man. These Centaurs were the only class of monsters to which the ancients ascribed any good traits.

One of them, called Chiron, was considered a favorite of the gods. He was educated by Apollo and Diana and became skilled in the arts of hunting, medicine, music and prophecy. When his education was completed he became a great teacher. Some of the most noble heroes were his pupils. Even Aesculapius, the son of Apollo, was given into his care. Among his pupils were Jason, Hercules and Achilles.

In a friendly contest between Hercules and the Centaurs, Chiron was accidentally shot, wounded by one of the hero's poisoned arrows. Hercules hastened to his friend's relief, but in vain did he apply the remedy given him by Chiron himself. The Centaur entered a cave and wished for death, but being immortal he could not die. He prayed to Zeus to send him some relief. The father-god granted this by placing him in the sky among the stars as the constellation of Sagittarius. He is represented on celestial globes as a Centaur holding a cross-bow in his hands, in the act of aiming an arrow at Antares, the heart of the Scorpion.



The tenth of the twelve signs of the Zodiac is Capricornus. On celestial globes it is marked by a goat. This constellation was named by the

Romans and meant a goat with a horn. The Sun enters it about the 21st. of December. It is the sign of the winter Solstice. The Tropic of Capricorn, the southern limit on which the Sun's rays fall perpendicularly, is marked on our geographical globes about twenty-three and a half degrees south of the equator.

It is a southern constellation, represented on ancient monuments by the figure of a goat, or rather a figure with its fore-parts like a goat and its hind parts like a fish.

It is suggested that it might have been the "Scapegoat which bore the sins of Israel," for the Israelites studied astronomy when they were in captivity in Babylon. Others say that it was the goat which supplied milk to Jupiter on Mount Olympus, and for this service it was raised to the skies. Still others say that it was a he-goat and represented the nature-god Pan, who had changed him " " into this form in order to hide himself from his enemy,—Summer hiding from cold Winter,—has been suggested as an explanation, for Capricorn marks the winter Solstice.



Aquarius is the eleventh sign of the Zodiac and is represented as a man with an urn in his hands, pouring out water. It is thought that this was to mark the period of heavy rains which prevail at this season of the year in Italy and the East. This sign is called in old Babylonish

writings "The month of the curse of the rain." People in hot countries usually regard rain as a blessing rather than a curse, but in the lowlands of the Euphrates and Tigris, the winter rains were too heavy. The pouring of water from a jar signified the down-pour. These dreadful rains recalled to the people of these lands the deluge, of which the Chaldeans had record as well as the Hebrews. The tower of Babel, it is thought by some, served as an observatory.



The twelfth and last sign of the Zodiac is Pisces. This constellation is large and is bounded on the east by Aries and Triangulum, on the west by Aquarius and Pegasus, on the north by Andromeda, and on the south by Cetus. This constellation is represented as two fishes some distance apart and having their tails joined by a string of stars. One of the fishes is under the right arm of Andromeda and the other under the wing of Pegasus. They are about fourth magnitude stars barely visible to the naked eye. The Sun now enters Pisces at the vernal Equinox.

The choice of fishes to represent this constellation is probably due to the early astronomers. The weary days of the rain are over and men can go to the fields; yet there was still every evidence of the excess of water. Possibly the fishes were a memorial of the deluge which seems to have been ever present in the minds of the

Chaldeans. In some of their temples images of a fish appear with a man's head, arms and feet. These represent a fish which the people supposed came from the sea in far-off times to teach them the useful arts of life. They worshipped this idol and regarded it as a god.

In many places the suggestion is given that the twelve labors of Hercules may have had reference to the labors of the Sun in passing through the twelve months of the year, Hercules representing the sun-god, and the signs of the months being the labors he had to perform. In this connection the "Ride of Phaeton" may be interesting.

Phaeton, an adventurous youth, heard for the first time that Apollo, who resided in the far east, where the Sun begins its course, was his father. The lad determined to travel thither and claim his rights and heir-ship. After a long weary journey he reached his father's palace, but the sight of it dazzled the eyes of the youth. It was made of crystal and gold and shone with the lustre of the sunlight. The portals were ornamented with strange devices and figures representing the signs and labors performed by the Sun. The boy fell upon his face on the ground stunned by the glory before him.

He lay there for some time, but finally a messenger came and conducted him to the reception room of the palace and for the first time Phaeton beheld his father. On the right hand of the dais upon which the god sat, stood the Days, Months and Years, and at regular intervals were stationed the Hours as a body guard. Spring,

Summer, Autumn and Winter were also attendants.

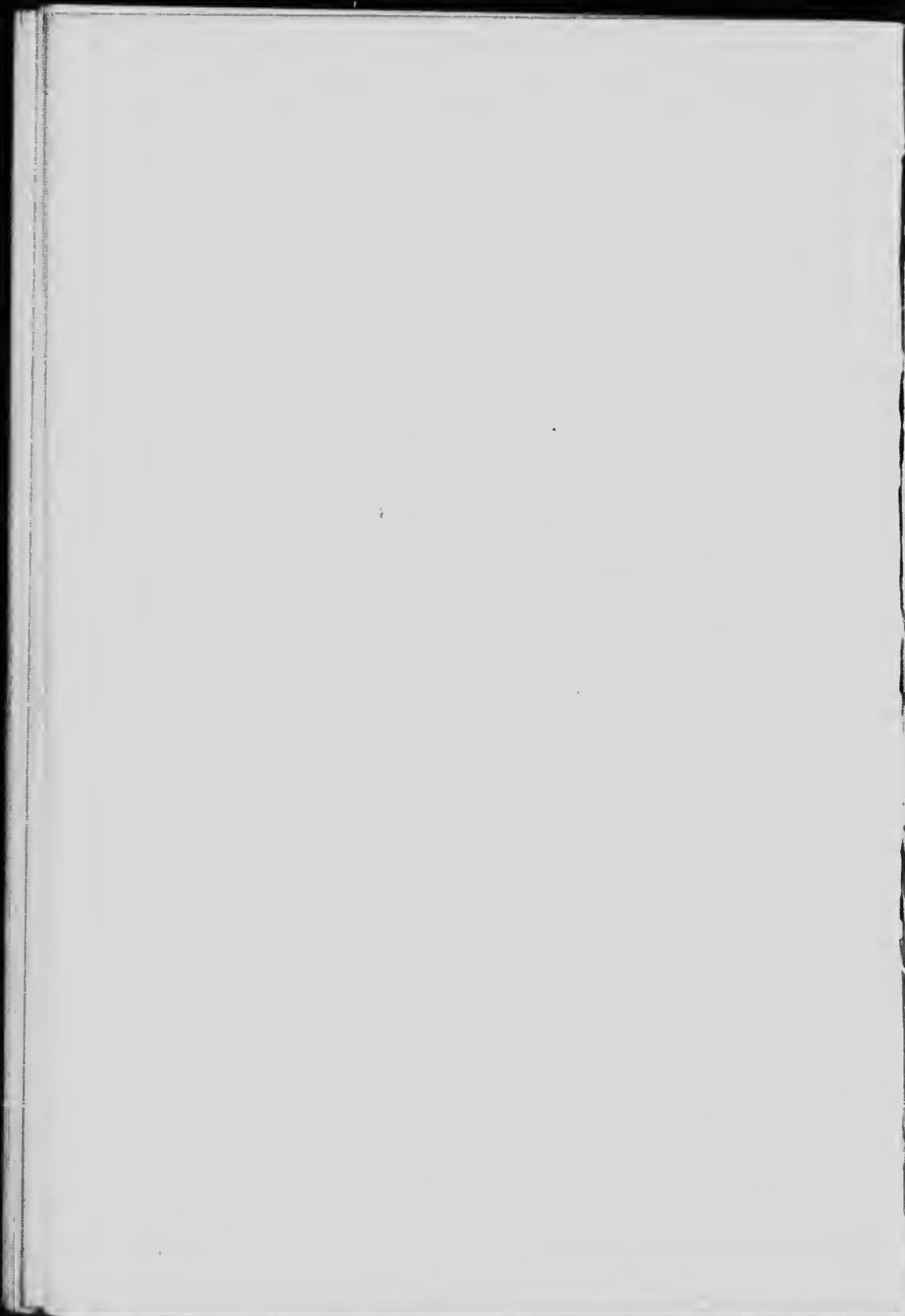
When Apollo saw the youth he rose and embraced him, telling him to ask whatever he wished and if it were in his father's power it would be granted. The importance of being the son of such a mighty father overbalanced the boy's judgment and he demanded that he be allowed to drive the sun-chariot through its rounds in the sky. Though the father remonstrated, he would not break his promise, and the boy set out.

After he got fairly started, the lad looked back to where his parent watched his departure with an anxious face. He knew too well what difficulties lay before his son. The horses were fiery but were well trained and had been over the road so often that they did not think of swerving to the right or left, till they felt when they tossed their heads that light hands held the reins. They noticed too, that the chariot swayed as it went over the rough clouds, as if a light weight were in it. Becoming reckless they sped along at a furious rate, till they were almost upon the horns of the angry bull before Phaeton could get a firm grasp of the lines. Past the Archer they flew, almost into the jaws of the Lion. The Scorpion stretched out its great arms, for it saw that a stranger drove, and the Crab tried to follow after the chariot.

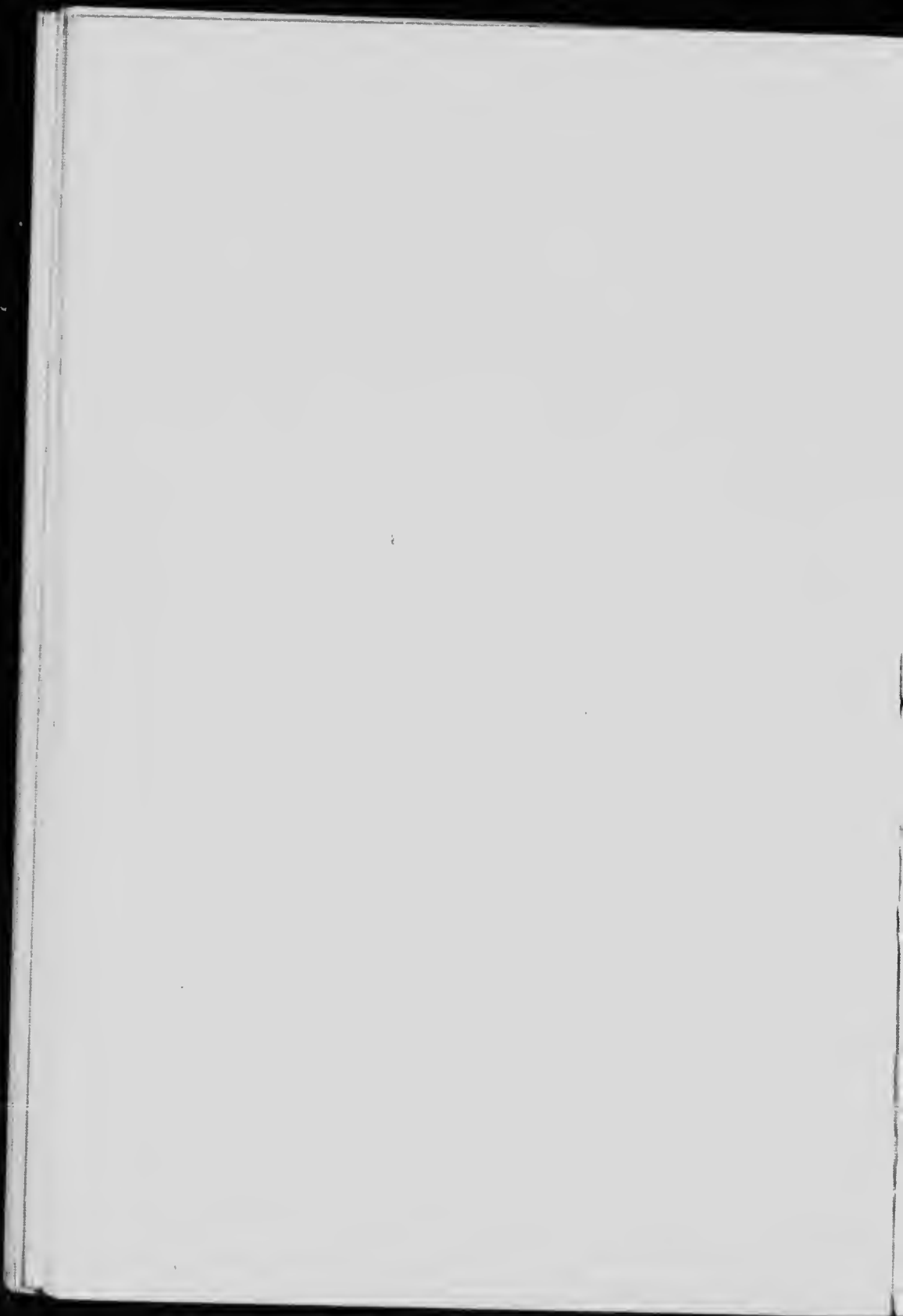
All these dreadful things terrified Phaeton so that he flung his reins from him. His father had warned him not to go to the north or south, but to keep within the middle of the Road Zodiac. Now he was too frightened to hold a firm hand

and the horses had become too reckless to be guided by any one. They reared to one side as far north as where Bootes drives the bears about the pole, then swerving south again the chariot was overturned, and Phaeton fell into the River Eridanus. Now the load being lighter still, the horses with their flaming chariot rushed hither and thither in their reckless freedom, burning all which they neared, till, finally, tired of their frolic they returned to the sun palace at night.

It is said that they came very near the earth that day just above the continent of Africa, where the Sahara is. Before this it had been a great fertile plain, but from that day it has been a burnt barren waste.



CHAPTER III.
SOUTHERN CONSTELLATIONS.



CHAPTER III.

SOUTHERN CONSTELLATIONS.

SOUTHERN and Northern skies present two very different pictures. In the South the telescopic stars are numerous, but those visible to the naked eye are much fewer in number. These comparatively few bright stars, set in the dark blue background, appear very much more brilliant in contrast with the starless tracts. They are really not any brighter than the northern stars, but the comparison appears to bring out the lustre of the constellations and make them more vivid.

Probably the most noted of all the southern constellations is the Southern Cross, occupying much the same position to its pole as our northern cluster Ursa Major does to the north pole, both travelling the sky in a circular path around these pivotal points. This is a modern constellation, having been named since the Christian era. During the sixteenth century, when the Spaniards were struggling for possessions and wealth in South America and the islands of the sea, it was looked upon by them as a sign of Heaven's approval of their work, especially when they remembered that their priests and explorers brought the gospel to the Indians. It is first mentioned in literature by Dante.

48 SOUTHERN CONSTELLATIONS

At one time the Southern Cross was visible to the countries in northern latitudes, but owing to Precession it has become completely lost to northern vision. Now "under the Southern Cross" means among sugar canes and nutmeg groves.

This brilliant constellation is situated near the south pole and under the hind legs and body of Centaurus. Augustine Royer, in 1667, named it and grouped together the seven stars of which it is composed; the four principal ones (one being of the first magnitude) forming the well known cross. The names given to these stars in some writings concerning this constellation, are Justice Prudence, Fortitude and Virtue. These four would guide to the Harbor of Peace. Sailors from Australia, India and other Oriental countries, attach a sacred interest amounting almost to veneration, to this group of stars.

There is no star corresponding to Polaris in this hemisphere, and to those who do not delve deep into mathematics the south pole would not appear as real as our northern one does, though its position is indicated by the two stars of the cross which form the axis of it. The Cross, as our Dipper, is at different angles in the sky at different periods of the night; but at the time it crosses the meridian it is almost perpendicular. Thus by careful observation one can become quite an expert in telling the time of night by noticing the angle and position of this constellation in the sky. It has thus gained for itself the name of the clock of the south.

Pisces Australis, or the Southern Fish, is one

of the ancient southern constellations, situated south of the Zodiacal constellation of Aquarius. The first magnitude star Alpha Pisces Australis is supposed to be in the Fish's mouth.

Pisces Volans, or the Flying Fish, is one of Boyer's southern constellations. It is between the pole and Argo. No stars above the fifth magnitude are found in it, thus this group is a very insignificant object.

Cetus, the Girdle, is of more interest from the mythological point of view than those just named. It is supposed to be the famous girdle of Venus, that girdle charged with all the charms and impulses calculated to excite love. This the bridegroom clasped about the waist of his bride upon the wedding morn and loosened with his own hand at night.

The celebrated Hydra of Greek Mythology, reputed to have a hundred heads, is also represented in the southern sky. When those who went against it were fortunate enough to strike off one head, unless they were able at once to cauterize the wound, two heads would grow in its place. One of the tasks set for Hercules was to kill this monster. A friend assisted him, who kept a heated iron in readiness, and as soon as the hero struck off a head, applied this iron to the wound. In this way the dreadful monster was killed, and Hercules dipped his arrow in its gall. This fluid so poisoned the arrow that those struck by it never recovered.

In reality the Hydra is a water snake. This constellation is one of the fifteen ancient ones of the south. It is so long that it has been divided

into four parts, Hydra Crater, Hydra Proper, Hydra Corvus, and Hydra Continuata. Hydra Proper is a little south of the bright star Regulus in Leo Major.

In Ancient Greek Mythology are many strange people and animals, but none more strange than the Centaurs. They were supposed to be part man and part horse. Chiron was a very learned person, being one of the professors of Ancient Greek, yet part horse. This strange animal shape must have originated in the imaginations of the Greek poets when seeing Thessalian herdsmen riding their horses across the plains. The sight being strange to them they must have concluded that the creatures they saw were a combination of man and horse.

The constellation Centaur is above the Cross from the pole. Its principal star Alpha Centuri has been found to have a yearly parallax (change of position) of $\frac{3}{4}$ of a second. This would lead astronomers to believe that it is 200,000 times the distance of the Sun from us, or the distance light would travel in $4\frac{1}{3}$ years. This constellation must not be confused with the Zodiacal constellation of Sagittarius, though both are Centaurs.

There is only one more constellation before we come to the story of the Argo, and from the viewpoint of the observer it is not an important object. The stars are apparently insignificant, there being none worth notice. The reason why I tell you about this constellation is on account of the strange bird, the Phoenix, which the Ancients describe and from which the constellation has received its name. I do not know why

this particular name was chosen for such a constellation. Two or three other names have been given it at different times since it was first observed, all of them being the names of strange animals or monsters. It is situated straight across the pole from the Southern Cross, the south pole being about half way between the two constellations.

The Phoenix was a strange but beautiful bird, which was first described by the Assyrians. No seeds nor insects, fruit nor flowers, were ever eaten by it, its food consisting of fragrant gums, frankincense and myrrh. The story is told by Ovid and Tacitus, but Herodotus, the great Greek historian, describes its appearance, though he distinctly says that he does it from hearsay, never having seen the bird. "It is said to be like an eagle," he writes, "its plumage being partly gold and partly crimson and so beautiful that wherever it flew the other birds followed it from wonder and admiration. Each bird of its kind lived for five hundred years, existing at one time. When its five hundred years were come to an end, the Phoenix prepared for its death. Carrying quantities of aromatic shrubs and gums to the top of a high oak or palm tree, it there made for itself a sepulchre. From the mouldering flesh of the bird a large worm came forth, which grew larger daily until at last, like the butterfly, it developed into its highest form, a new Phoenix, to live its term of five hundred years, and in the same way to die. The first duty of the young bird was to attend to the funeral rites of its dead parent. Exercising

its wings by carrying bundles of myrrh and other shrubs on its back until they became strong enough, it then performed the task for which it had been preparing. This was to carry the body of the parent bird to the temple of the Sun and place it upon the Altar where it would be consumed, amid fragrant flames, to celestial music."

It was not until the seventeenth century that the truth of this myth was disputed. Then Sir Thomas Browne had courage to write that he believed the Phoenix to be a bird of imagination, like many of the creatures of the Greek and Oriental stories. Perhaps the change which the butterfly undergoes had been observed by some imaginative, poetic, Assyrian or Grecian and thus the idea originated. The imagination supplied the rest.

Argo is a very large constellation called also Argo Navis. It is now divided into three parts, though here we will retain its old form intact, for if we do so the myth of the voyage which the Argo took for the Golden Fleece, manned by the fifty-five renowned heroes will seem more real.

Jason had been driven from the court of Pelias, the usurper, with instructions not to return unless he brought with him the Golden Fleece. With the assistance of Pallas Athene, who superintended the construction of the ship, the Argo was got ready. Then they embarked in it for the distant land of Colchis. Many wonderful feats were performed by these heroes, and also many difficulties overcome, before they reached the gateway of the Black Sea. Here the

perilous rocks Symplegades were to be passed. They were such that the moment anything attempted to pass between them they crashed together. Phineus, the blind king, told them that when the rocks crashed together they immediately rebounded and that if the heroes would only let a bird fly between them and at the instant the rock began to part, would row with all their might, they ought to get through safely. They followed this advice and passed in safety, a slight damage done to the stern of their boat being the only bad result. All other difficulties were easily overcome and Colchis reached. Here Jason had to yoke the Brazen Bulls, plow the land and sow the Dragon's teeth, and all these tasks accomplished they started home again. When they reached home Jason had the boat put in a garden dedicated to Pallas Athene. One of the wonders of the ship was its mast. This was made from the wood of the Speaking Oak of Dodona, and consequently many times during the voyage the heroes consulted it. From the garden the ship disappeared, but finally it was discovered in the sky: where Athene had placed it to commemorate the daring voyage made by the first vessel to float upon the waters of the ocean. Canopus is the brightest star in this constellation. It was named after Canopus, the famous pilot of Menelaus. When that expedition reached Egypt, after the fall of Troy, Canopus died. This bright star rose above the horizon just as he breathed his last and the people believed his spirit had thus taken visible form. This star

called afterwards the "Star of the Nile" had been worshipped before this in Egypt, though the Greek writers had overlooked this fact.

Sir Norman Lockyer states that no doubt the Egyptian temples were dedicated to this star about six thousand years ago. It is a brilliant star. The rare air of the desert makes it appear much brighter and clearer than in other atmospheres.

In Argo is a notable Nebula. It lies between Argo and Centarus. It is a large being banded with many bright little stars. ϵ Arg is a remarkable variable star. In 1827 it became a first magnitude star. In 1843 it became brighter even than Sirius, which brilliancy it retained for ten years, but gradually waned until later it became quite invisible to the naked eye. At the present time it looks as if it were going to reach a brilliancy equal to its former splendor.

CHAPTER IV.

SOME CONSTELLATIONS THAT HAVE
BEEN MISSED AND ARE THE MOST
INTERESTING OF ALL.

CHAPTER IV.

SOME OTHER CONSTELLATIONS.

SEVERAL constellations are at or near the Equator of the sky. Near these you will recognize several which you have seen in the Northern, the Zodiacal and Southern Maps. They will make it easier to find and remember the new ones. Some of the most brilliant constellations of all in the sky are included in the list. Probably they will be more interesting than the others, because parts of them, if not all, can be seen from the Southern as well as from the Northern Hemisphere of our Globe.

You will no doubt remember the Zodiacal Constellation of Taurus. East from Taurus is Orion. Perhaps you will have noticed Orion before, for it is much brighter than Taurus. The three bright stars of the Belt, and the three fainter ones of the sword form a kite-shaped figure with a tail. This is the distinguishing form of the constellation. Before Orion in Taurus, is the star-cluster of the Pleiades, then to the South are Canis Major with Sirius, the brightest of all the stars, and Canis Minor with Procyon. These constellations are all connected in mythological history.

Orion, the mighty hunter, was the son of Neptune. He was a giant handsome and brave.

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His father, the sea-god gave to him the power to walk upon the water. Orion dwelt at Chios an island in the Aegean Sea. Here he met and loved Mirope, the daughter of the King, and wished to marry her. Accordingly he bestowed gifts and rendered services of all kinds to the father of the princess. In this way he hoped to please him and gain his consent to their marriage. Again and again his suit was put off, till at last, tired of the delay the hero, being angry, attempted to take his loved one by force. This enraged the father and he determined to have done with this desperate suitor. Inviting him to a banquet on the pretence of kindness and hospitality he made Orion intoxicated so that he was unable to defend himself. The king then commanded his servants to burn out the eyes of the luckless lover, and to cast him upon the seashore. Poor blind Orion wandered up and down for some time till hearing the clang of a cyclop's hammer, he followed the sound and at last reached the island of Lemnos many miles north of Chios in the Aegean Sea. At Lemnos was situated the forge of Vulcan. That god took pity upon the man and sent Cedalion, one of his assistants, to guide him to the palace of the Sun. Putting Orion upon his back, Cedalion travelled eastward, till reaching the abode of Apollo, he received his sight by the all-healing beams of the sun-god's glory.

After this he went to live with Diana, Apollo's sister. Diana was the Moon Goddess. Being both skilled in hunting they enjoyed each other's company exceedingly. It is said that Diana wished to marry Orion. Her brother sought



ORION, KITE-SHAPED FIGURE,

60 SOME OTHER CONSTELLATIONS

every means to oppose the union, and a second time the unfortunate man's love affairs were thwarted. Orion, unknown to Diana was wading in the sea with his head only, above the water. Apollo and Diana were strolling upon the sea-shore. Pointing to the dark head apparently floating upon the surface, he tauntingly said to his sister "Thou canst not hit yonder object." Diana drew her bow without a thought of what the dark object might be and the arrow shot forth. The aim was all too true. The mark was fairly hit and soon the lifeless body of Orion, her lover, floated to the shore and was washed upon the sands at her feet.

Many tears she shed over the body of the unfortunate hunter and then when her grief had somewhat spent itself, she placed him amongst the stars as the constellation of Orion. There he appears as a giant hunter, with girdle and sword, the lion's skin upon his shoulders, and his war-club in his right hand. Sirius and Procyon his faithful hunting hounds, follow at his heels, while the Pleiades, the snow white pigeons, fly before him.

Of the stars of this constellation, Rigel is a beautiful white star in the hunter's left foot, the constellation of Lepus hiding the right one. The lion's skin is indicated by a curved line of little stars near the Hyades. The belt is made up of three stars almost equidistant. From this they are known in England as the Yard-stick or Ell. The three stars which mark the sword are fainter than those of the belt. They form the tail of the kite in the sky figure. The middle one is the

SOME OTHER CONSTELLATIONS 61

multiple star in the Great Nebula of which you will hear later.

In Hindu records Orion was supposed to be a constellation of evil omen. A later account tells us that the first Punic war was lost to the Romans because the fleet sailed away to the war just after the heliacal rising of Orion.

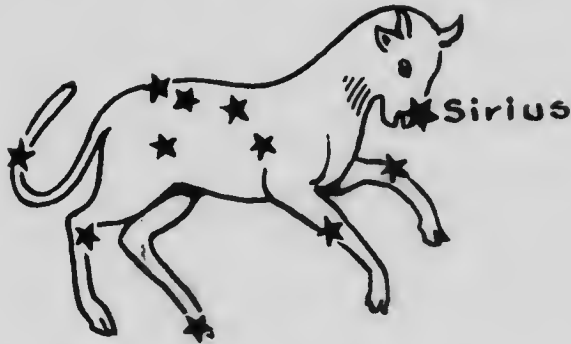
In a Hindu story concerning this constellation, the statement is made that about the first of May, at the time when Orion rises just before the sun, farmers should sow their beans and millet seed. When he rises at midnight it is time to gather the grapes, and when he is seen in the evening sky it should be midwinter.

Canis Major, the Great Dog, is south of the heavenly equator, lying just south east of Orion. The Tropic of Capricorn cuts through its centre while its eastern edge is in the Milky way. This Dog was supposed to represent Laelap, the hound of Actaeon. Later people supposed it to belong to Procris, one of the Nymphs. Another story states that it was the dog given to Cephalus, by Aurora, and so noted a beast was it for its speed that Jove the All-father, to reward it, placed it in the sky.

Sometimes this dog is linked with Taurus the Bull. The latter animal carried away Europa, whom the dog was set to guard. Some confuse Canis Major with the three headed dog Cerberus which kept the gate of Hades. But the story of Orion and the dog is the most interesting of all these. It has been linked with the Hunter from remote ages, and as such we will take it, for with this is formed the most interesting combination.

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Sirius, the beautiful bright star of the Dog Constellation, because it is such a brilliant object, entered much into the superstitions of the Ancients. Some said that it was the cause of the heat of summer, and called the days between



July 3rd and August 11th, the Dog Days. At this time the sun is in the constellation of Leo, and Sirius is seen just before the dawn. But we know that the combination of these constellations has nothing whatever to do with the heat and unhealthiness of midsummer, for they only mark that period of the year when the heat is greatest. Some said that madness in dogs was due to the heat from the Dog-star. The latter superstition is still in vogue among the ignorant. The constellation is brighter in some parts than in others, therefore the animal must be a spotted dog. Pictures of it in the ruins of the Temples of Babylon, as also upon our Star Maps show it as standing upon its hind legs as if to spring upon the Hare, or as if suspicious of the intentions of Lepus. The Romans sacrificed a brown dog

to it at the time of the summer and autumn festivities. Among the hieroglyphic records of Egypt, there is no doubt of Sirius being often mentioned, and there it is always represented as a dog. Its rising marked for the Egyptians the beginning of the year. The heliacal rising of the star announced the rising of the sacred river and the inundation of the Nile country.

SIRIUS

The old night waned, and all the purple dawn
Grew pale with green and opal. The wide earth
Lay darkling and strange and silent as at birth,
Save for a single far-off brightness drawn
Of water grey as steel. The silver bow
Of broad Orion still pursued the night,
And further down, amid the gathering light,
A great star leaped and smouldered. Standing so,
I dreamed myself in Denderah by the Nile;
Beyond the hall of columns and the crowd.
And the vast pylons, I beheld afar
The goddess gleam, and saw the morning smile,
And lifting both my hands, I cried aloud
In joy to Hathor, smitten by her star!

—Archibald Lampman.

Imagine one of these massive temples built upon the borders of the Nile. Imagine the broad expanse of the desert, above it the diamond-strewn blue of the mid-night sky. One star stands out brighter and apparently nearer than them all. It is a scintillating blue. Look at it today with a mind free from all superstition and it has the same peculiar penetrating effect of an all-seeing eye. To these ignorant children of the desert it seemed to be the eye of a god. Do you wonder that they eagerly watched for its coming? The Nile river overflowed its

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banks just at the time that the star rose with the dawn. Then the boatmen went out to cast the rice upon the water, to reap it again after many days. The fertility of the Nile lands depended upon this over-flow. The sediment which fell upon the parched and burnt out earth made it possible for Egypt to be the granary of the East. Do you wonder that they worshipped this star?

Imagine if you can a great concourse of people thronging to the Egyptian temple, Denderah. Priests are stationed along the colonnade of pillars which mark the entrance. They are chanting strange litanies. They are performing weird contortions as they swing the censors of incense. They must be doing reverence to some sacred being. We pass along the dark corridors. People are going the same way, but they make no noise. There is only the swish of their loose garments. All the walls and pillars are carved with strange figures and pictures of animals. To us, today, the carving is very crude, but the histories which they tell we can now read, and are able to recognize a greater value in them than poor workmanship.

In the large room which we enter are many people—some looking eastward, others bowing towards the east, and still others lying prostrate upon the damp stone floor. Towards the eastern part of the room is an opening—just a hole in the stone wall. All else is dark. We can look through this opening down long corridors, across thick walls in a straight line towards the east. No room nor wall nor pillar intercepts our view.

The sky somewhat lighter than the dark room or black wall, can be seen through it.

In the western part of the room are many priests. Their attention seems riveted upon a central stone. It is too dark to see exactly what they do, but like all the others they seem to be waiting for some signal. A long singing note from the sentinel, a shriek from the victim upon the stone altar, a clang from the cymbals of the priests, then a shout of triumph from the people and all eyes turn towards the aperture in the eastern wall where the sky is seen. There, along its edge, moving so slowly that we hardly know that it moves at all, appears the beautiful glittering star, Sirius. It passes on and the moments go breathlessly by. As its light glows upon the altar the priests chant strange triumphant anthems. The star reaches the other edge of the opening and slowly disappears again. With a tumultuous shout, the worshippers rush towards the entrance to view the star in the heavens before the sun-god rises. Paler and paler it fades, till its light is lost in the brilliant beams of the day-star. The promise has again been given. There will be water. They know what the harvest will be. This temple construction allowing the rays of a heavenly body to fall upon an altar at the moment of its rising is called "Orienting a temple."

Although Sirius is among the nearest of the fixed stars it is not the nearest. Centauri is supposed to be closer than any other. Sirius is about the fourth distant from our earth. It is by far the brightest star being much brighter than the first magnitude. It is because of its

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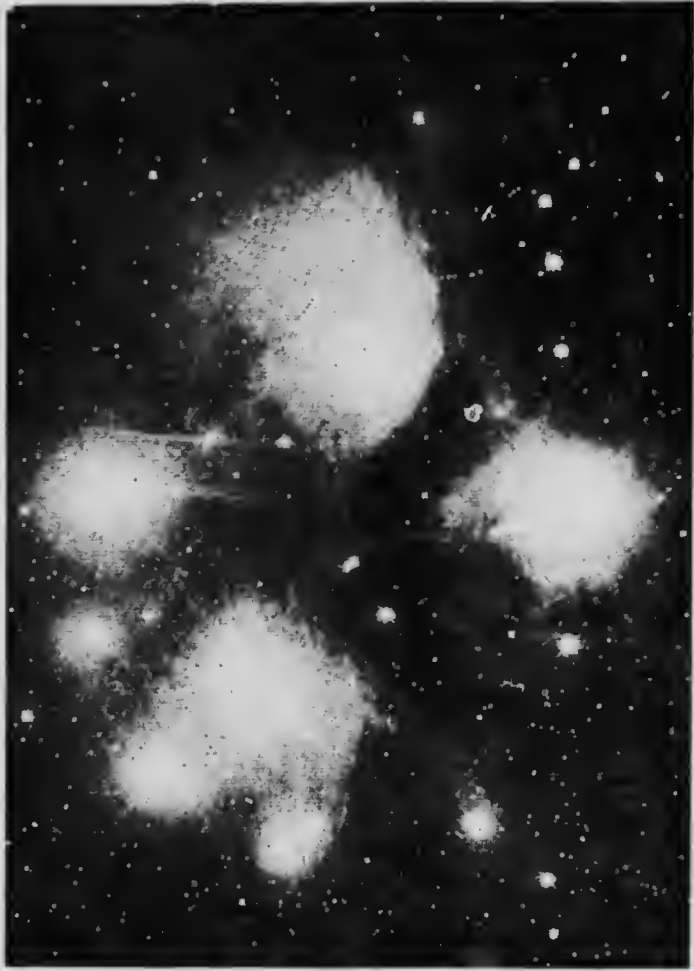
bluish whiteness that it appears so vivid. Taking its brightness and its distance into account, Sirius is said to be about 40 times more brilliant than our Sun. It also is said that this beautiful object is approaching our Solar System at the rate of about ten miles per second. Kant thought that Sirius is the central Sun of the Milky Way.

CANIS MINOR.

Orion's second hound is called Canis Minor. Procyon the name of its brightest star means Water-dog, which name it received from the earliest Greeks. There is a story about this Dog crossing the Milky Way but the details are very vague. This constellation, in astrology, always portended wealth, fame and good fortune to those it influenced.

THE PLEIADES.

The seven little sisters is a star cluster in the shoulder of the Bull. There is a myth about this cluster which describes it as a group of seven maidens. We think of them as small and dainty, but in reality they are a group of mighty suns. The photograph taken through the large telescope at Lick Observatory, showed several hundreds of them, but seven only are plainly visible to the naked eye. One named Electra, was said to have gone from her place to view the ruins of Troy, which had been founded by her son Dardanus. She was called the lost Pleiade. The tale which she told on her return of the awful destruction of that city so frightened the other sisters that they have been pale ever since.



PLIADES UNDER THE TELESCOPE.

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These daughters of Atlas, when upon Earth, were the objects of Orion's love. They ran from him and when he had almost captured them they cried to Jupiter for help. The father-god answered their prayers by changing them into pigeons. They then could easily escape from their tormentor. Afterwards they were turned into stars and placed in the sky, before the star-image of Orion, that people might never forget the story. As a star-cluster they seem to have changed their minds about Orion, for instead of fleeing from their pursuer they are slowly drifting towards the beautiful constellation of the hunter.

THE RIVER ERIDANUS.

You will, no doubt, remember the story about Phaeton, who, struck by one of Jove's thunderbolts, fell headlong into the river Eridanus. This river of the heavens is composed of 293 stars visible to the naked eye. It commences at the star Rigel, just at the feet of Orion, continuing to the feet of Cetus. It then flows south-west of the south polar regions. The last principal object is Archenar, a bright double star. Many small stars now included under this constellation extend it much farther across the southern sky.

When Phaeton fell into this river his three sisters, called the Heliades, stood weeping by the stream. Grief for the death of Phaeton caused Jupiter to be angry. It was for this reason that Cygnus was turned into a swan. When the father-god

beheld the sisters weeping, he caused them to become poplar trees and to evermore drop their tears into the river. These tears upon touching the water became drops of amber.

Many earthly rivers claim the honor of having this representative in the sky. Padus (the river Po) seems the most likely stream to connect with this myth. No doubt the Ancients, finding amber in the beds of their rivers and thinking that it resembled tear-drops, invented the story; so also, with the story of Cygnus and the Swan. That beautiful bird swims mournfully over the water, constantly diving its head beneath the surface as if sadly searching for some relic of a lost friend. The swan representing the Son of Mars, and dearest friend of Phaeton, was also placed in the sky as the constellation of Cygnus.

Deneb is the principal object of this star group. It is a northern constellation near Lyrae and lying between Draco and Pegasus. Its four principal stars form an irregular cross. From this fact it is sometimes called the Northern Cross. It lies directly in the Milky Way. Though Deneb is the brightest star, Albira in the head of the Swan, is a beautiful double star, being perhaps a more interesting object through a telescope than Vega. One of its components is gold, and the other blue. These are easily seen through a very small telescope.

OPHIUCHUS AND SERPENS.

This constellation is supposed to represent Aesculapius, the son of Apollo, and the founder of the Medical Profession. Some say that

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Apollo taught him and that he was a pupil of the noted Centaur, Chiron. However, he became so skilled in his practice that he was reputed to be able even to raise the dead. Pluto the ruler of the dead became offended at this for he feared that this great physician might rob his dominions to such an extent that the nether world would become depopulated. To please Pluto, Jupiter sent one of his thunder-bolts against Aesculapius, and scattered his marvellous wisdom so that none of the sons of earth have since been able to recover the secret of it. Apollo having thus been deprived of his son, insisted upon the young man's accomplishments being remembered by a fitting monument. He was thus honored by a place in the sky as the constellation of Ophiuchus. The serpent which is twisted about him in the picture may have been placed there as a symbol of his power. The Ancients believed that a snake-charmer had omnipotent power, and the snake gave knowledge to its master of the healing properties of herbs. Aesculapius or Ophiuchus as he is called, went on board the Argo, as ship's surgeon, when that ship made its famous voyage in search of the Golden Fleece.

It was after his return from this expedition that he restored Hippolytus to life, and then attempted to raise Orion from the dead. This brought upon him the wrath of Jupiter for his audacity. Among the Ancient Greeks this constellation was supposed to cause many deaths by poisoning.

The head of the serpent is a group of small stars east of Arcturus and a little south of Corona.

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The two brightest stars are not above the third magnitude. The serpent bends south eastward towards Ophiuchus' hand. Then five stars pass upward nearly through Bootes and downward again. The constellation is cut by the celestial equator.

The Lyre was originally the harp of Apollo. He presented it to his son Orpheus. The father taught the lad to play upon it, but the son soon surpassed his parent. He became so skilled a musician that the melodies which rang from the strings charmed the wild beasts from the forests and drew from the wilderness the usually dangerous reptiles, bewitched into docility by the magic of its music. Even the mountains were moved and the trees bowed themselves to the earth. Orpheus also accompanied the fifty heroes upon the famous Argonautic expedition. With his harp he lulled the tempests which threatened to wreck the vessel.

At his wedding with Eurydice the blessings of Hymen turned to words of evil-omen, in spite of every effort. The torches which were to cast a halo of glory about the gorgeous scene, smoked and caused the eyes of the guests to shed tears in spite of their joy. The misfortunes were not long in coming. The bride Eurydice, shortly after the wedding, while fleeing from the shepherd Aristaeus, trod upon a poisonous snake, was bitten and died.

Orpheus was inconsolable and hastened to the abode of the dead, there to intercede with Pluto and his wife Proserpine, for a new lease of life for his Eurydice. On the journey he played on

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his harp, and charmed his way to the throne of the gloomy sovereign. Here his eloquent pleading which he did by song to the accompaniment of his harp, won the reluctant promise that Eurydice might accompany him to the earthly life again, provided that as they were returning she should follow and that he should not look behind him. He kept the conditions until he had almost reached the gate. Then to be sure that he had not been tricked he took one sly glance backward. In fact he looked before he thought, and to his despair he saw that the curse of Pluto had come again, for Eurydice faded beneath that quick glance and was lost to him on earth forever. In vain did the harp moan forth his woe. All the keepers of the gloomy place were as stone. Now no magic music could move them to pity. After lingering about the portal of death for sometime he returned to earth.

On the earth he kept aloof from womenkind mourning always for his lost Eurydice. This so enraged the maidens of Thrace, who had determined that one of them should charm Orpheus out of his sadness, that they attempted to stone him to death. The musician began to play upon his harp, and the stones fell harmlessly at his feet. The Thracian maidens discovered that the sound of the music was a charm to protect him. They then began to shout so as to drown the melodies. When this was done the stones began to take effect and soon the spirit of Orpheus had gone to join his beloved Eurydice, in the realms of Pluto. They tore his poor bruised

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body, limb from limb, and cast it in fragments upon the river Hebrus. His harp also floated upon the waters moaning a sad requiem for its departed master, till Jupiter grasped it from the earth and placed it in the sky as the constellation of Lyra.

The three principal stars of Lyra are in the form of an equilateral triangle and are easily recognized by the bright first magnitude star Vega. Vega is a deep blue star and cannot be mistaken among the other stars of the Northern Hemisphere. The Babylonians called it the "Messenger of Light." It was once the Pole Star and in ages to come (11,500 years from now) it will again occupy that position. The Chinese put Vega with the Spinning Maiden Constellation at one end of the Magpie Bridge, and Aquila the Flying Eagle with the Cowherd at the other. This arrangement is used also in Korea and Japan. Vega is a star of good omen and influences those in whom it interests itself to overcome the powers of evil. Vega comes next to Sirius in brilliancy and appears to be a star of the same style as the Dog-star. Polaris, Arcturus and Vega form a large and brilliant triangle in the Northern sky.

The lyre was supposed to have had seven strings—the Magic Seven of the Ancients. It is sometimes represented as being held in the claws of an eagle. Figures of it show the bird with half closed wings. The constellation Aquila represents a flying Eagle and has its wings outspread. Some old Greek and Roman coins still in existence have the harp and the eagle engraved upon them. Lyra is on the Western

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edge of the Milky Way. Next to it is Hercules, while Cygnus is on the east. It contains from 48 to 68 stars, according to different calculators. By the spectroscope it is judged to be a collection of suns developed beyond our own.

HERCULES.

A little west of the head of Ophiuchus and stretching to the Eastern part of Draco in the Milky Way is the constellation of Hercules. This is one of the oldest of the sky figures. It is bounded on the West by Serpens, Corona and Bootes, while on the east lie Aquila, Lyra and Cygnus. Draco is on the north. The hero is represented as resting on one knee with his foot on the head of Draco, while his head is close to Ophiuchus. There are no first or second magnitude stars, but many are of the third degree. The most noted figure formed by the stars of this constellation is the flower-pot, or key-stone as it is sometimes called. The figure made by all the stars of the constellation is supposed to be a representation of the mythical hero Hercules. The stories about this great man are all so well known that it will not be necessary to tell them to you. There is some mixing of the stars and confusion of the history of this classification in early maps and records. Sometimes we find him associated with Draco and holding in his hands the three golden apples from the garden of Hesperides. The records of the 7th century B. C. show him as still related to the Dragon, one foot is on its head. He represents

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the sun-god. His twelve adventures are the trials of the sun in going through the twelve zodiacal constellations. It is suggested that this myth came from the Euphrates and was afterwards appropriated by the Ancient Greeks. One authority notices some analogy between Hercules and Samson.

CORONA BOREALIS.

Corona Borealis is about twenty degrees north east of Arcturus. It is a northern constellation and by its shape resembles its name, the Northern Crown. It was first called a wreath. The Romans called it the crown of Vulcan, but as a rule the Greeks spoke of it as Ariadne's Crown.

Ariadne's father was Minos King of Crete and because of an injustice done to his country by the people of Greece he had levied a tax of seven Greek youths and maidens yearly, to be thrown to the Minotaur, a monster which held sway in the Labyrinth of Crete. Among those to go with the Black Ship from Greece, as tribute to Crete was the hero Theseus. With the help of Ariadne who loved him, as soon as she saw him, he was enabled to kill the Minotaur. Both of them fled. Theseus married Ariadne at Gnosos, but as soon as they reached Naxos, the hero deserted his bride while she slept. When she awakened, she abandoned herself to grief till Venus taking pity upon the poor girl came and promised her an immortal husband. Now Naxos was the favorite home of the god Bacchus and

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soon he returned there. When he saw Ariadne he requested her hand and they were married. As a wedding gift Bacchus gave her this beautiful crown, which when she died, he tossed up into the northern sky as a remembrance of her.

The Shawnee Indians called this constellation the celestial sisters and said that the brightest was the wife of the great chief Whitehawk (Areturus). One star of the Corona Borealis group will be described at another time. It blazed out in the Spring of 1866, like a central diamond in the crown. Now it is a pale yellow variable star of the eighth magnitude.

COMA BERENICES.

That Coma Berenices should be rated as a separate constellation was questioned for nearly 2,000 years. At one time it was shown as part of the Virgo, at another of Leo; but the honor of being a separate constellation was first given it by Tycho Brahe. For some time Ariadne's crown was confused with it, but from the time of Tycho it has been definitely described as the hair of Berenices. It was mentioned in the reign of Ptolemy, but it was not till the reign of the third Ptolemy that it got its name. This worthy king was embarking upon an expedition against the Assyrians. The journey was a dangerous one and in order to ensure her husband's safety and success, Queen Berenices promised to shear off her lovely auburn hair, for the beauty of which she was noted, and place it as an offering

upon the altar of his favorite goddess. When the king returned victorious she fulfilled her vow; but the gift was stolen the morning after the sacrifice. The King and Queen became furious and demanded that the kingdom be searched and the culprit brought before them. Conow, the Court Astronomer, in order to appease the wrath of the offended sovereigns and also to flatter them, showed the pair this star cluster and told them that he was confident that the goddess had immortalized the sacrifice by placing the tresses among the stars. He then named the group *Coma Berenices*.

There is another story which says that Berenice was the wife of Agrippa, who when she beheld the suffering of Christ on the way to the cross, was so overcome with sympathy that she gave him her veil to wipe the perspiration from his brow. When it was returned to her the image of Our Saviour's face was upon it. The story states that this shimmering constellation is the gossamer veil with the sparkling drops of moisture upon it,

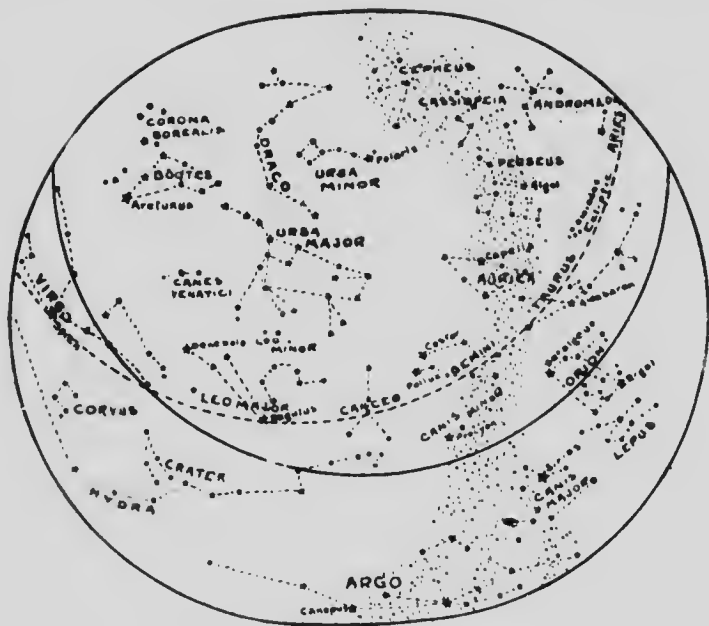
This cluster of tiny stars lies in the constellation of Leo opposite to the Pleiades. It was once known as the Dove. As it rises with the last stars of Argo, and the first of those of the husbandman, the three constellations were for a while collected as belonging to the story of Noah and the Ark. The stars are so minute as to be not worth very much notice, the principal ones being seven very faint stars. In this cluster is the pin-wheel nebula.

CETUS.

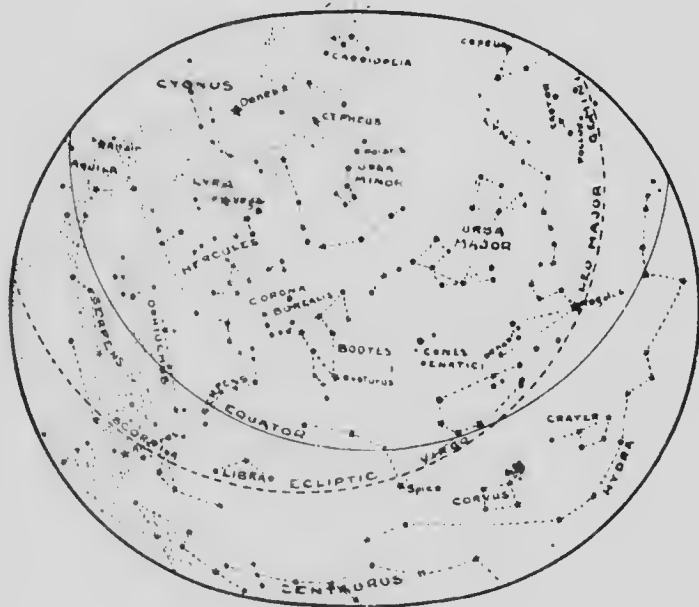
Cetus the whale, or the dog of the sea, is always associated with Andromeda and Perseus. One describes it as having the head and fore-paws of a grey-hound, a scaly body and a forked tail. Another describes it with head and claws of an eagle and the rest of the body like a fish. As marked in the sky figure, its head is an irregular pentagon, while the southern portion is like an immense dipper turned upside down, with a straight handle pointing eastward. Almost exactly between the two figures lies the wonderful variable star Mira; south of the handle of the dipper is Deneb Kaitos.

In all descriptions of Cetus, it is said to be a strange sea monster, perhaps associated with Draco, Hydra or Serpens, all perhaps branches of myths concerning the same original monster. In some stories Draco has been described as the monster who sought to destroy Andromeda.

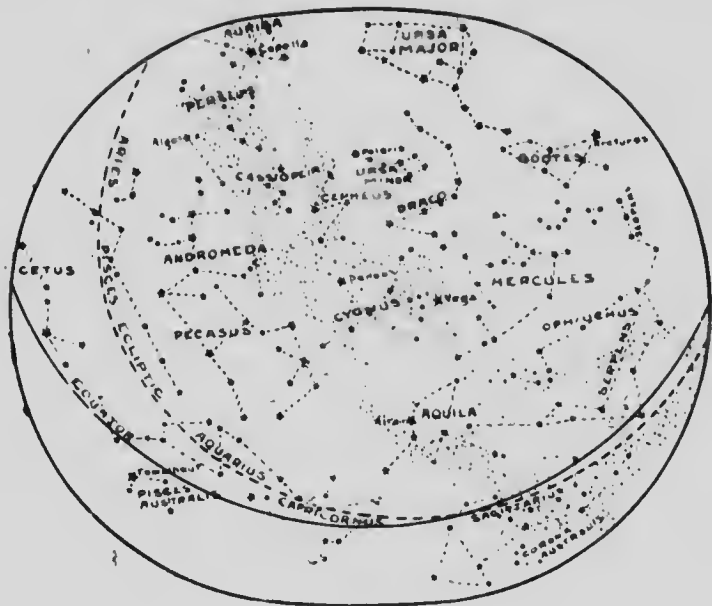
Sometimes Cetus is represented as swimming in the River Eridanus, but usually as reclining upon its banks with its front paws in the water. It is in the southern hemisphere and occupies the greatest space of any from the bend of the river where its head is, to that part of Eridanus where the Urn is situated. There are 98 stars in this constellation according to Argelander. Some early writers state that this monster represents the whale which swallowed Jonah.



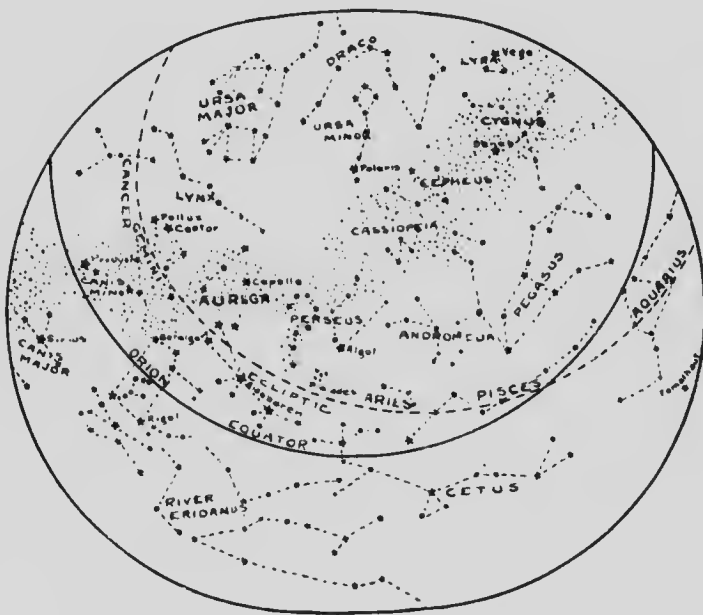
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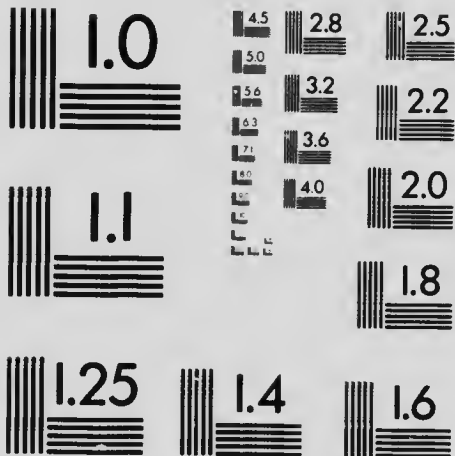


CHAPTER V.
COMETS.



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CHAPTER V.

COMETS.

The greatest phenomena pass daily before our eyes but we see them so frequently that they come and go unnoticed. The calm serenity of the heavenly bodies, always going regularly about their duties, never erring or changing perceptibly, cause us hardly to think of the magnitude of their labors; nor even of the beauties which they present. When a comet comes intruding its brilliant self into our neighborhood, we are all agog with excitement and even today, begin at once to speculate upon a possible collision or some other catastrophe.

In the middle ages these celestial transients were a source of terror to all spectators. Few had the courage to think rationally about them. It was an age of superstition and we are surprised to find men of learning and genius held captive by the popular beliefs of the day.

A brilliant comet appeared during the year in which Caesar died. The people at once said that it was the visible image of the Dictator's spirit. He had been taken captive by Uranus, they said, and was being carried to the realms of Bliss. He became immortal, escaped from the god, and taking this visible form wended his own way into eternity.

The people of these early times had many theories as to the origin of comets. Some astronomers considered them as accidental phenomena or atmospheric meteors, some thought that they were kindled in the region of fire, but many that they were the spirits of great men on their way to the region of endless reward. To many they were omens of misfortune, as the ones which appeared during the siege of Troy and before the last wars of Napoleon. In the reign of Louis XIV. a comet appeared in the sky. The King and his brother trembled. Some thoughtless free thinking courtiers laughed at their anxiety, at which the prince exclaimed, "Ah, you may well speak at your ease, you are not princes."

A Theological-astronomer who tried very hard to mix theology with astronomy, having been struck with the fancy that the comet of 1680 might have had a considerable influence upon our planet in its early stages, worked out a theory which he published in 1696 under the title of the "New Theory of the Earth." Struggling over the causes of the creation, deluge and final state of the world he saw great possibilities in this comet. This especially appealed to him when Halley explained that the same comet might return many times, and that it was possible these wandering bodies followed well defined paths. This man, whose name was Whiston, worked on adding and subtracting till he found out that one of the dates of appearance of the comet of 1680 (which Halley said had appeared and would return every 575 years) would correspond with the date of the Deluge. Happy thought! This was all

the proof he apparently needed. He goes on to say that the comet was created at the same time as the earth, for God foresaw that man would sin and provided a punishment. First, it gave the earth its rotary motion by coming near and cutting obliquely across the earth's orbit. On the next trip, man had sinned and God was angry. It was time for punishment. So along came this convenient comet and cut-a-corner across the ecliptic and came within nine thousand miles of our Globe. Noah was at L'ekin, and it was mid-night, but you all know that he was ready. Coming so near the comet attracted the water of the sea just as the moon does, but being so much nearer, made a much greater tide. It also drew all the waters out of the springs and wells wherever they were and piled them upon the land, till the tidal wave was over six miles high. Then the atmosphere of the comet and the earth combining caused it to rain forty days and nights. Thus according to Whiston was the flood caused.

He then went on to prove that at the end of time this comet would appear again, this time behind us and attract us so much as to retard the earth in its revolution around the sun. Now, if the earth slows ever so little in this movement it will drop just so much nearer the sun. Thus the comet will cause us to drop so near as to bring about what has been called the "Regeneration by Fire." this done the saints will reign a thousand years, and then along comes the comet. This time it strikes us behind so hard as to drive us off into space, as a comet too. Our end then, is to turn

into a comet and finally fall into some star and be made over into a new world.

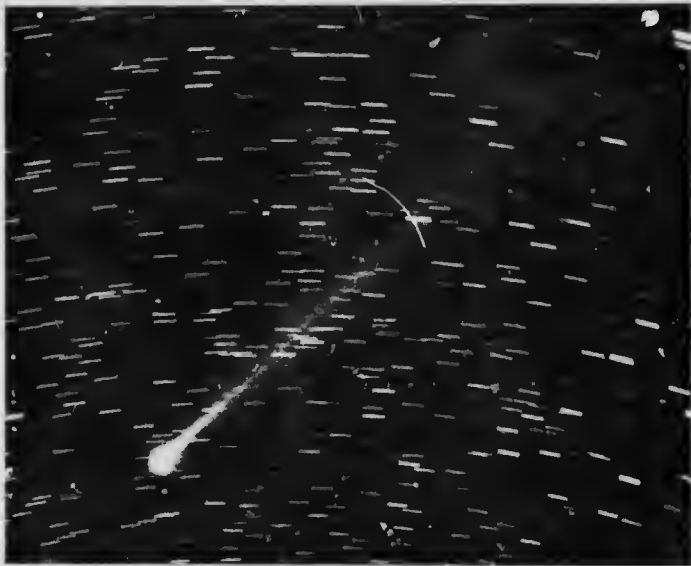
With all these strange fancies, prior to the time of Halley and Newton, only one voice was heard telling the truth. It was centuries ago. Wonderful intellect! Seneca, in the time of Nero, said with bitterness that people in the ages to come would cry "Shame" to his day for its blindness. He stated at that early date that the comets formed part of the wonderful plan of the universe, and travelled in paths of their own; but he was laughed to scorn.

Then, what is a comet? A comet is a self-luminous, nebulous body, which, as it nears the sun, reflects also the Solar light and is thus increased in brilliancy. It suddenly appears in our sky, swings itself around the sun, and finally dashes off into space, sometimes to reappear as many of our comets do, oftener to be seen once only and never to return.

Comets vary greatly in shape, size and brilliancy. We have now, in the days of telescopic photography, found that there are many of these transients in our sky; but the most of them are so minute, comparatively speaking, as to escape notice even through the telescope.

If we give any credence to middle age history, comets assumed shapes familiar to man. Sometimes these, as they approached the sun, were very peculiar. Imaginative persons compared them to earthly forms. One was described as a blood red sword held threateningly over the earth as if it were an omen of war or of heavenly wrath.

Hideous human faces with bristling hair and beards, crosses, crowns and other shapes are said to have appeared in the sky as comets. But, as we read these descriptions to-day, we know that they emanated from fevered imaginations.



COMET C 1903 (BORRELLY).

In appearance comets are of many different shapes. Generally they are made up of a nucleus, coma and tail, but many want some of these three parts. Often they are only a nebulous mass, but are recognized as comets by their approach towards the sun. Sometimes the nucleus is a thin gaseous substance, for faint stars can be seen right through it. Sometimes it is sufficiently dense enough to hide them entirely from

view. Often the same comet will make many changes during its course, as if disturbed by some internal commotion. Biela's comet reached the point of explosion, causing it to split into two parts and to separate. After several returns of the twins, this comet was seen no more, unless the shower of meteors on Nov. 27th, 1872, was its final appearance.

According to M. Bridichen, Director of the Moscow Observatory, who spent years in this field of research comets with tails generally assume three shapes. (1) The long almost straight tails (2) The fan-shaped tails, spreading out into three or six ribs. (3) The short curved tails.

As comets first appear to us they are spherical in form almost like a blur of nebula, but as they near the sun the tail begins to form, generally gaining its greatest length at its perihelion. After they pass round the sun, they travel, tail first, as if the sun exerted some repelling force upon them, and drove part of the comet away from itself. Then, as it recedes from the sun, the tail reduces, till the last we see of it is a spherical nebulous mass.

Comets could also be classified as regards brilliance and size. Some are telescopic. Some are just visible to the naked eye—these are the most numerous. Those noticeable ones which drove the ancients and even the people of the middle ages into despair were indeed grand but awful objects, some having tails of the enormous length of 198 million miles, with a thickness in some cases of over 300,000 miles. Their images

in the sky covered two-thirds of the distance from the horizon to the zenith. These figures are almost incomprehensible, and we, who have not been so fortunate as to see a spectacle of such grandeur, can hardly picture it to ourselves.

Of what is a comet made? Those with the long straight tails show hydrogen lines in the spectroscope. The fan-tailed ones show a composition of hydrogen and carbon; while the ones with short curved tails apparently have in addition, iron, chlorine and some other substances. They move so rapidly and depart so quickly that it has so far been impossible to get accurate observations.

There have been many discussions as to the actual form of these elements. Some think that they are more or less solid or liquid at the nucleus and that the tails are composed of either little luminous particles (as in the case of the rings of Saturn) or of gas. The latter theory is explained in this way: When the comet nears the sun the heat causes it to partly decompose, and this lighter portion of the nucleus is driven backward from the sun by some repellant force. This increases as it reaches the perihelion and owing to the sun supplying extra heat, the nearer it gets to the sun the farther the tail extends. As the comet leaves the sun the cause of the decomposition is removed and the gaseous matter of the tail condenses, and by the force of gravity is absorbed by the nucleus.

One other theory of the tails of comets, and one growing in favor, is that the tail is not a substance at all, but a reflection, perhaps electrical.

There are many strong arguments in favor of this theory.

One writer says it may be composed of a very rare substance known to scientists as "Fourth State," a radiant matter which can be repulsed by forces but is not retarded by the ether.

A material tail of millions of miles in length, so light that though thousands of miles thick, does not dull the lustre of a tenth magnitude star, would surely become dissipated when traveling at a rate exceeding sometimes three hundred miles per second. The tail may be really a motion of the ether itself, which constantly changes as the comet moves on. Waves of the ocean do not cause the water to move. There is no movement of the wires when we send a telegraphic message. So with this ethereal energy which we call the tail of the comet and which for some reason or other is greatly increased by nearness to the sun.

An example which helps to give credence to this theory is told by actual witnesses. An English astronomer, arising early on the morning of June 30th, 1861, wrote in his diary that there was a strange phosphorescent light in the sky, which, had it not been daylight, he would have taken for the Aurora Borealis. From all that can be gleaned, this was apparently the tail of the comet of that year. It did not disturb the earth or moon. Indeed, none of the planets are disturbed in their motion by the near approach of a comet.

Lexell's comet passed near Jupiter and was itself deflected out of its course, but not a moon

was in any way affected. The tail which our earth passed through was 110,000 leagues long, and the only impression the earth beings had of it was the Aurora. Had it been made of gaseous substances or particles of solid matter, there would have been either a stifling sensation of some new gas in our atmosphere or a hailstorm of meteors. It was absolutely transparent, only a glowing yellow light.

Biela's comet had been proven one of the returning ones. Its return was announced by the astronomers. It was to cross the earth's orbit on Oct. 30th, 1832, at the point where the earth would pass in November. Just one month! Should it for any reason be detained it might encounter our planet. There was a panic in Europe, but the comet came on time and went away quietly and in order. In reality the two bodies were no nearer to one another than fifty million miles.

The next time that there was an opportunity to observe it was in Nov. 1845, the other visits being spoiled by continuous cloudy weather. This time it came according to calculations. In January of the New Year during this visit the comet split in two and with the exception of a bridge joining them there were two comets. At the next appearance they were farther apart. They continued to separate till now they are lost to us, not having been seen since 1852. They should have come back in 1859, 1877, 1872 and in 1885, but did not. Lexell's comet was deflected from its course by Jupiter, but was found again. Not so with Biela's. No trace of it can

be found. On Nov. 27th, 1872, when it should have come, a strange sight was given to the privileged—a shower of meteors of perhaps 160,000 is said to have fallen from the constellation of Andromeda. Could this shower have been the comet Biela? The comet itself would have passed just at that time.

Let us examine the paths of these comets. Here are the mightiest triumphs of the mathematicians. Only a very small portion of the orbit of a comet, travelling in the ellipse, can be seen, yet from the curve of this fraction of the path the whole circuit can be determined. This wonderful feat was first accomplished by Halley, who said as definitely as he could, without the actual thing being witnessed, that it would return upon a certain date. In these calculations not only the distance of the orbit had to be taken into consideration, but also how much the planets, which it passed in our Solar System, would pull it out of its proper path. Jupiter by his attraction would delay it for some days. Perhaps Saturn would accelerate its speed. By carefully calculating the amount of time gained, and adding a few days here and subtracting a few days there, he found that it would return in 28,006 days from 1759, that is about Nov. 15th, 1835. This came true, though Halley did not live to see his theories verified. It comes again as we know on May 24th, 1910, A. D. From this we find that comets are not exactly erratic wanderers, but like all the wonderful works of creation perform their daily labors according to precise rules, like some gigantic piece of clock-

work. Their orbits assume three different shapes: the ellipse, parabola and hyperbola. The first, as has been described, is the shape of the path of many of the celestial objects, especially of our Solar System. A hoop will very well represent the orbits of the planets, but the cometary orbits are of every degree of eccentricity. As ellipses become longer and narrower they are said to be more eccentric. The ellipses in which comets travel are generally very eccentric, some extending out into space billions of miles.

Halley's comet goes many millions of miles beyond the orbit of Neptune. Light travels so fast that it could go seven times around our earth in one second, and it takes eight minutes for the light of the sun to reach us, but it takes four hours for it to reach Neptune. So try to imagine the extent of this comet's orbit.

The comets which travel in ellipses are the ones which return to us. An ellipse is a figure having two foci, one in each end of the figure. In the case of comets, in the focus known to us, is the sun. Now imagine a figure with only one focus and at that, the sun, and with no curve at the other end. In such a path a comet could never return to the same point again. Many of the comets move in this kind of a curve which is called a parabola. When the arms of the orbit are still wider apart, the comet is said to move in a hyperbola. These are the three classes of orbits of comets which visit our system. Most of the comets which come to us travel in parabolic paths and will never return to us again; going off into space at the rate of hundreds

of miles per second, ever travelling on, on, with no return; always on a new track, meeting new constellations, passing great systems, on, and still on for eternity.

In the first days of the New Year came an unannounced comet. It was first seen, it is said, by Prof. Drake in South Africa. Its orbit has not yet been calculated, but it is probably a transient.

Our whole Solar System is moving onwards through space, how fast or slow we cannot tell, on account of the enormous distances of the fixed stars. Perhaps in the interstellar spaces are nebulae which are constantly coming under the influence of the sun's attraction and being light, are easily acted upon. These may form some of the comets.

Joseph Hamilton, a recent writer upon this subject, states that he does not think that the sun is the influential body, but that somewhere out in space, from whence the comets come and whither they go, there is an influence of which we know not. At the best, the theories regarding comets are speculative, though there are some things—such as the repetition of their acts, as in the return of some of these wanderers at the exact period calculated—which lead us to believe that there is some truth in these speculations.

But their origin? What do astronomers say of that? Some may be nebulae, as has been said, and caught by our sun. Others may be masses travelling through space which enter the field of our solar attraction. Others may be the result of an explosion in a star. Others may have

been shot out from the sun itself. Still others may be ruined worlds spinning aimlessly through space till encountering some star they become melted over and help to make a new system.

The visit of Halley's comet this year will be a momentous one, for astronomers everywhere will be organized, so as to utilize every moment of the visitor's presence. Some will be at the spectroscope and by photographs and actual observations will try to determine the substances of which it is composed. Others will study its shape. Still others will watch its effect upon the heavenly bodies which it passes and especially upon our earth and the sun. Something about light pressure may be discovered. Some one may find something about the Corona. But perhaps the greatest will be what the spectroscope will disclose. This year brings the first brilliant comet to our system since this instrument was invented.

