

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

The planet Mars, which returns to opposition early next month, and comes nearer to the earth than it has been at any time for a dozen years past, has especial claims on the attention of the astronomical world at present. To be sure, it is not yet an agreeable matter for the amateur to observe him, since in the middle of June he rises at about half past 9 in the evening, and does not come to the meridian (where he can best be seen) until 2 o'clock in the morning.

But those professional astronomers, whose interests are in planetary affairs, are already rising very early, and spending the small hours of the night in the study of the surface of the body which, next to the moon, we have the best opportunity to see.

What discoveries they may make we cannot of course predict; but many things will be visible to any observer, even if his telescope is small. The ruddy disk of the planet, brighter at the edge than the center, and marked with darker greenish spots, can be seen with a very small instrument if only the air is steady, and even easier to see than the dark areas is the white polar cap.

This is the most prominent feature of the planet's surface, when it first comes well into view; but as time goes on, and the Martian season advances from spring to summer, it steadily shrinks, and at last disappears completely, only to appear once more, as large as ever, when the planet's pole can again be seen, emerging from its long arctic night.

This behavior suggests at once that these "polar caps" are polar snows, which melt away every summer, and fall again when winter has set in. But grave objections have been made to this theory.

Mars, like the earth, presumably gets its heat as well as its light from the sun. Now it is half as far again from the sun as the earth is, and since the amount of heat received from the sun varies inversely as the square of a planet's distance, it receives only 44 per cent as much heat per square mile as the earth does. But its polar caps melt off completely every summer, while the earth's polar snows do not. It would therefore seem as if Mars must be hotter than the earth, and we seem involved in a contradiction.

A recent paper by Mr. Percival Lowell, who at his observatory in Arizona has done so much to advance our knowledge of the planet, clears up this difficulty in a very pretty fashion.

It is true that the earth receives much more heat than Mars does; but it is not the heat received, but that retained by a planet which goes to warm it.

Now Mars reflects some 27 per cent of the light falling on it, and consequently retains the remaining 73 per cent. How much the earth reflects we can only estimate. But we know that half its surface on the average is covered with clouds, and that these reflect some 72 per cent of the light falling on them. Here is a loss of 36 per cent of the incident energy at the start. Then, even under a clear sky, a great deal of light is reflected by our atmosphere, which would look as bright if we looked down into it from above as it does when we look up through it from below. Finally, we have the light reflected from the materials of the earth's surface itself. Studying all this in detail, Mr. Lowell comes to the conclusion that the earth under a clear sky reflects about 59 per cent of the total energy falling on it, and retains but 41 per cent. Taking also into account the loss of heat caused by the shading effect of the clouds, he estimates that the amount of heat received by the surface of Mars per square mile is actually a little greater than on the earth. But Mars has less atmosphere than the earth, and in consequence its surface will lose more heat by radiation into space, just as high mountains do on the earth. Allowing also for this, Mr. Lowell finally concludes

that the amount of heat retained by the surface of Mars, and going to warm it up, is about 10 per cent less than the corresponding quantity for the earth. The absolute temperature of Mars, that is, the temperature measured from the absolute zero of the physicists, —460 deg. F., would be 2½ per cent less than that of the earth. Assuming the mean temperature of the earth to be 60 deg. F., we find 46 deg. for that of Mars. Some of Mr. Lowell's estimates are admittedly uncertain, but he has certainly proved that it is quite possible, and indeed probable, that the surface of Mars may be heated to a temperature well above the freezing point of water by the sun's rays alone.

It is therefore reasonable to believe that the polar caps of Mars are really snow fields. As for their melting off in summer, we have good reason to believe they are very thin compared with those on the earth. Six inches of snow covers the ground just as well as six miles, and looks the same from a distance, and the rapid melting of the caps is the only way we have to estimate their thickness.

THE HEAVENS.

Our map shows at a glance what meets our eyes in the early evening. The Great Bear and the Dragon are high in the northern sky, above the Pole, and the Little Bear, Cepheus, and Cassiopeia are below them,

the 27th, when he is at elongation 25½ degrees from the sun. At this time he is on the borders of Gemini and Cancer, not far from Castor and Pollux, and brighter than either. He sets at about 9 P. M., and will readily be observed.

Venus is morning star in Aries and Taurus, rising about 3 A. M. in the middle of the month. Mars is in Sagittarius, rising at about 10 P. M. on the 1st, and 8:15 P. M. on the 30th. He is very near the earth, and still coming nearer, being some 46 million miles away when June begins, and 39 million when it ends. He is almost as bright as Jupiter, and cannot be mistaken for anything else.

Jupiter is evening star in Gemini. Early in the month he is still conspicuous, setting at about 9:30 P. M., but toward its end he is too deep in the twilight to be observable. On the afternoon of the 15th he is in conjunction with Mercury, at a distance rather more than 1½ degrees.

Saturn is in Aquarius, rising about midnight in the middle of the month. He is in quadrature with the sun on the 18th. We still see the dark side of his rings, so that, except in the most powerful telescopes, he appears devoid of these appendages.

Uranus is in Sagittarius, not far from Mars, and like him very far south. He is right above the Milk Dipper, at a distance of about three degrees, and among a group of small stars, from which his motion serves to distinguish him.

Neptune is in Gemini, too near the sun to be observed.

THE MOON.

Last quarter occurs at midnight on June 2, new moon at 7 P. M. on the 10th, first quarter at 10 P. M. on the 18th, and full moon at 4 P. M. on the 25th. The moon is nearest us on the 25th, and farthest off on the 12th. She is in conjunction with Saturn on the 4th, Venus and Neptune on the 12th, Jupiter on the 13th, and Uranus and Mars on the 26th.

At 9 A. M. on the 22d the sun reaches its greatest declination north of the equator and enters the sign of Cancer, and in the parlance of the almanac, "summer commences."

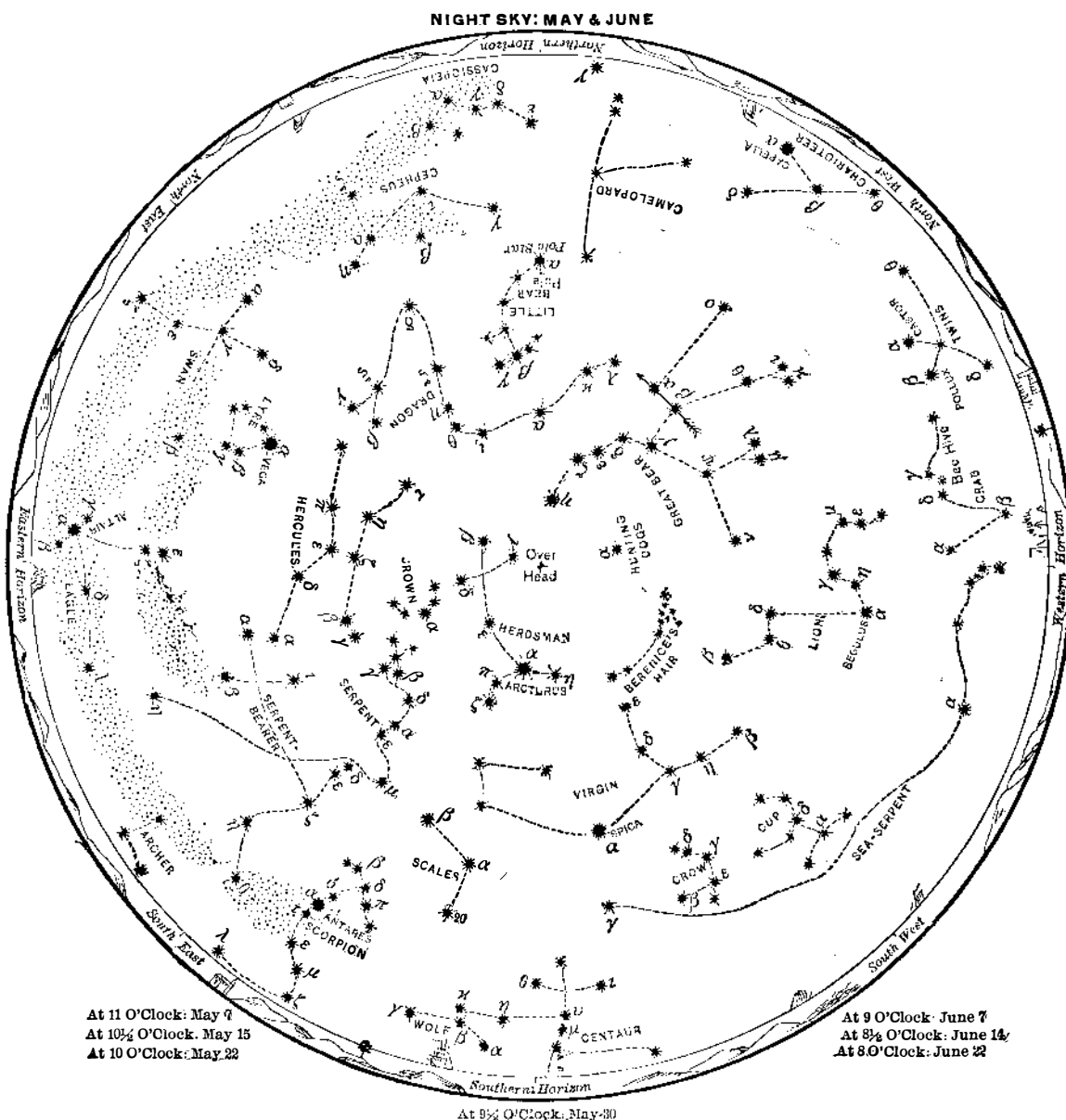
Princeton University Observatory.

New Invention for Treating Flax.

A new Australian process for converting worthless flax into a good fiber is described in the London Commercial Intelligence, as follows:

Sheaves of straw are immersed in a hot neutral solution for about one hour, after which the flax is passed through rollers during which it is sprayed, by steam force, with a special solution, and then with clean water. The flax is then dried and the straws broken and scutched in the usual manner. Each bath holds about 336 pounds of fiber and the cost of the solution (there) does not exceed 48 cents. The same bath may be used repeatedly, thus reducing the cost of the operation. Frequent use of the same bath somewhat darkens the fiber, but for some purposes this is little or no detriment. The light fiber can be used for many purposes without further bleaching treatment, which is frequently an expensive process. It is claimed by the inventors that their process can be carried on continuously, independent of weather conditions, and also that the fiber is produced so cheaply that it will ultimately, to a great extent, take the place of other fibers after meeting the world's demand for Linum flax.

The method upon which all cooling towers work is to divide the water up so that it presents a maximum amount of surface to the air. All cooling towers work on the counter-current principle. The water is lifted 25 feet to 30 feet up the tower, and then allowed to fall over specially designed splash bars, while the air enters the tower at the bottom and ascends through the falling drops of water.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

the last far down on the horizon. Auriga the Charioteer and the Twins are setting in the northwest, their bright stars Capella, Castor, and Pollux being very low. The Crab and the Sea Serpent lie on the dull southwestern horizon. The Lion, with the bright star Regulus, is higher up in the west, and the Virgin, with the rather brighter star Spica, in the south. Above her, almost overhead, is Boötes the Herdsman, with the splendid yellow Arcturus, brighter than any other star now in sight.

The Northern Crown and Hercules lie to the eastward, and lower down is the bright star Vega, in the constellation of the Lyre. Below this Cygnus the Swan has just come into view. The Eagle, with another first-magnitude star, Altair, is due east, and the tangled forms of the Serpent and the Serpent Bearer fill the southeastern sky. The Scorpion, whose heart is marked by the fiery red Antares, is well seen just east of south, and due south is part of the Centaur—a fine southern constellation whose brightest star we never see. Those who live within the tropics may see them at this season, and near them, to the westward, the Southern Cross.

THE PLANETS.

Mercury is evening star all through June, and can easily be seen at the end of the month, on or about