

THE HEAVENS IN DECEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

We spoke last month of the fact that when Venus is nearly between us and the sun, the horns of her crescent extend beyond their usual positions, so that it sometimes covers three-quarters or more of the circle.

This could not happen if the planet had no atmosphere, for in that case just one-half of her surface would be lighted by the sun, and her crescent, though varying in breadth from time to time, would always cover just half her circumference (as is the case with the moon).

But if Venus has an atmosphere, we can account for these observations. An atmosphere will extend the illuminated part of her surface in two ways. It will refract the sun's rays (like a lens) so that they are bent enough to reach the surface at points which were previously in darkness, and even beyond the limit of this action the upper layers of the atmosphere will still be illuminated, though the surface below them is dark. (This is what causes twilight on the earth.) In the same way we will see more than half the planet's surface, and still more of her atmosphere. The result of this is to extend the crescent, as observed. For suppose we were behind Venus, and so near that she completely hid the sun. In the absence of an atmosphere, she would appear quite dark (as the moon does during a total eclipse of the sun). But if there is an atmosphere, it will be illuminated by sunlight from behind (which fails to reach us), and the planet will seem to be surrounded by a luminous ring. Now suppose the sun to move off to one side. The part of the ring farthest from the sun will gradually get fainter, and will finally disappear, leaving a crescent, which however at first covers nearly the whole circle, and gradually shrinks down to smaller dimensions as the sun moves away.

This is just what is actually observed (except of course that we cannot get near enough to Venus to make her hide the sun).

From the amount of extension of the horns of the crescent we can calculate how far the twilight in Venus's atmosphere extends. In this way it is found that her atmosphere must be much less extensive than ours, for the brighter part of her twilight extends only about one degree on her surface, and the fainter part about three degrees more, while on the earth the corresponding amount is ten degrees or more.

It is therefore certain that, while Venus undoubtedly has an atmosphere, the earth has much more, and as seen from Mars, would present a similar appearance, but in an increased degree.

THE HEAVENS.

Our map shows the general appearance of the sky at the times indicated upon the margin. The brilliant winter constellations are now appearing in the east. Orion is well up, and the line of his belt points down to Sirius, which has just risen, and up to the red Aldebaran, in the constellation of the Bull. The Little Dog with the bright star Procyon is low down due east, and higher up, on the left, are the Twins (Gemini) which are now made more brilliant than usual by the presence of Jupiter. Above them in the Milky Way is Auriga, the Charioteer, and the great yellow star Capella.

Following along the Galaxy we reach Perseus, then Cassiopeia, next Cepheus, and finally Cygnus and Lyra, low down in the northwest.

The Dragon and the Little Bear are in the northern sky, west of the Pole, and the Great Bear is coming up to the eastward.

In the southwestern sky we see Aquarius the Water Bearer (who now bears the planet Saturn as well) and the Southern Fish with the lonely bright star Fomalhaut. Higher up is the great square of Pegasus, and

Andromeda is right overhead. Below it, south of the zenith, are Aries the Ram and Pisces the Fishes. Below this again is Cetus the Whale. Its principal stars are shown on the map. One of them,  $\theta$ , better known as Mira, is a very remarkable variable star. For most of the time it is of the ninth magnitude, requiring a small telescope to see it, but at intervals of eleven months it brightens up enormously till it is of the third or fourth magnitude, and fully two hundred times as bright as it was six months before.

The star is now in one of these maxima (having increased rapidly in brightness in October) and is easily visible to the naked eye. It will be interesting to watch its fall in brightness, which will probably make it invisible to the unaided vision in a month or two. Below Cetus is the still larger constellation Eridanus, which begins close to Orion and runs with many curves down to our horizon and below it. The last of its conspicuous stars which we see,  $\theta$ , has an interesting history. It was described by an Arabian astronomer, Al-Sufi, who lived about the tenth century, as of the first magnitude. As his other observations are very accurate, there is no reason to doubt his statement, and it seems that this star has lost about five-sixths of its brightness in the last thousand years. A first-magnitude star farther south, invisible in our latitude

away on the 1st and the 28th. She is in conjunction with Jupiter and Neptune on the 3d, Mars on the 11th, Venus and Mercury on the 14th, Uranus on the 16th, Saturn on the 20th, Jupiter and Neptune once more on the 30th.

At 1 P.M. on the 22d the sun reaches its greatest southern declination, and enters the sign of Capricorn, and in almanac parlance "winter commences."

THIELE'S COMET.

A comet visible in a small telescope was discovered by Holger Thiele, of Copenhagen, on November 11. It is in Leo, in R. A. 9h. 25m., declination 15 deg. north (on November 12) and is moving northeast at the rate of about 1½ deg. a day. Its orbit has not yet been computed, so it is impossible to predict its position in December.

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PEAT IN ITALY.

One of the greatest handicaps to the development of commercial industries in Italy is the lack of native coal supplies, due to the fact that the country is peculiarly deficient in workable coal deposits. Every ton of coal has to be derived from foreign sources, the annual imports exceeding 5,000,000 tons. It will thus be seen that the situation of the country is a serious one, since in the event of a war its safety would be gravely imperiled. There are, however, scattered over the country enormous tracts of peat bogs; and realizing the seriousness of the national position, and the fact that almost illimitable quantities of peat are immediately available, the government is endeavoring to turn these present wastes to profitable account. A bill has recently been passed by means of which every possible encouragement is extended for the development of a process for the conversion of peat into a satisfactory fuel, and to stimulate and foster the commercial development of any practicable system that may be devised. The formation of large companies for the utilization of peat and lignite is advocated, and several inducements are held out, such as the remission of taxes, duty-free import of machinery, and free registration. Any company, however, that is founded must have a minimum capital of \$570,000, of which amount at least one-fourth must be reserved for Italian subscribers. The Italian government itself would be an extensive purchaser, and in this connection the companies must extend their business in such a manner that they will be in the position to hold 50,000 tons at the disposal of the gov-

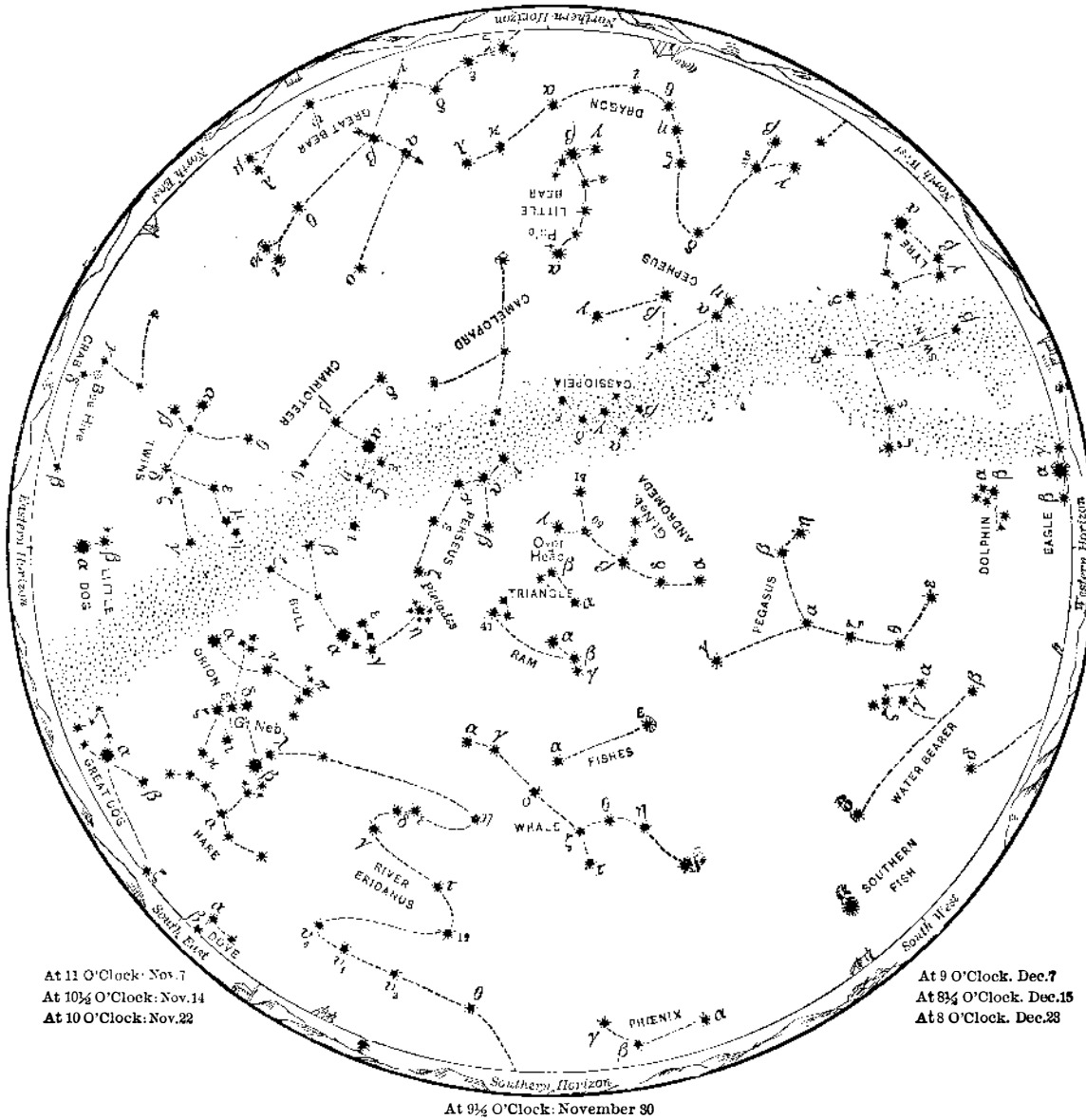
ernment in the year operations are commenced. In the third year this reserve is to be increased to 200,000 tons, and in the seventh year to no less than 500,000 tons. Though the government would thus probably constitute the largest purchaser, the terms upon which the fuel is to be purchased must be ten per cent less than the prevailing market price. Notwithstanding these inducements, however, no results have yet been attained, as no suitable process of manufacturing the peat fuel has been devised.

Noiseless Steam Engine Exhaust.

The gas engine is not the only offender in the matter of noisy exhaust. Muffling tanks to minimize the noise of the escape of exhaust steam from high-pressure non-condensing steam engines are sometimes needed. In such cases it suffices to insert near the engine a tank of 15 or 20 times the volume of the cylinder and continue the exhaust pipe from this muffler. This will do away with the disturbance caused by high-pressure exhaust steam passing through a tortuous exhaust pipe.

No oxidizing solution is equal to chloride of platinum for oxidizing silver. The deposit is extremely black and very adherent.

NIGHT SKY: NOVEMBER & DECEMBER



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.

(or in his) now goes by the name of Achernar, which Al-Sufi bestowed upon Theta Eridani.

THE PLANETS.

Mercury is morning star in Scorpio. On the 18th he is at his greatest elongation from the sun, and rises at about 6 A. M. Venus is also morning star, and is better seen at the end of the month than at its beginning, when she is very near the sun. On the 13th she is in conjunction with Mercury. Mars is likewise a morning star. He is in Virgo, and rises at about 3:30 A. M. on the 15th.

Jupiter is in opposition on the 28th, and is the brightest object in the evening sky. Transits or eclipses of his satellites occur almost daily, and afford a very interesting telescopic spectacle.

Saturn is in Aquarius, and is in quadrature with the sun on the 1st, so that he comes to the meridian at 6 P. M.

Uranus is in conjunction with the sun on the 30th, and is consequently invisible this month. Neptune is in Gemini, and will be in opposition early in January.

THE MOON.

Last quarter occurs at 9 P. M. on the 8th, new moon at 2 P. M. on the 15th, first quarter at 10 A. M. on the 22d, and full moon at 2 P. M. on the 30th.

The moon is nearest us on the 15th and farthest