THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

THE principal astronomical news of the past month has been the finding of Halley's comet, which was announced by Prof. Wolf of Heidelberg, who succeeded in photographing it on September 11th. Faint images of the comet were later found on photographs taken at Greenwich two days before, which were given relatively short exposures to avoid the danger of fogging by moonlight. If the moon had been out of the way, the comet might have been observed a week or two earlier.

It is still an extremely faint object, a mere nebulous disk, with no trace of a tail, visible only in very large telescopes, and will remain faint until next spring.

At the time of discovery it was more than 300 million miles from both the earth and the sun. It is now approaching them, and moving slowly westward in the heavens, on the boundary of Taurus and Orion. On December 1st it will be in opposition, but will be too faint for small telescopes (about the 12th magnitude). It will continue to approach the earth until December 18th, when its distance from us will be about 125 million miles. After this it recedes from us, as its motion about the sun is retrograde (i. e., in the opposite direction to that of the earth) and passes on the far side of the sun about March 24th, 165 million miles from us. Then it advances to meet the earth, passes between us and the sun, about May 17th, and a few days later comes very near us, within about 12,000,000 miles. At this time the comet will be well observable in the early evening, and in all probability an impressive object. In a few days more it will double its distance from us, and later it will gradually diminish in apparent size and brightness till it fades from view, though it should be telescopically visible until the end of 1910.

It is not usual that the motion of a comet can be so accurately foretold within a few weeks of its discovery; but Halley's comet has not really been discovered at all this time; it has only been re-observed, after an interval of more than seventy-three years since it was last seen; and after this long interval the time of its return was predicted with an error of about one day. This would be a perfectly easy matter if the comet moved under the influence of the sun's attraction alone; for then it would return at exactly equal intervals. But the attraction of all the planets comes in to modify its motion, and may alter its period by several years, so that the actual calculation of a return is no easy problem, and the success attained in this instance by the English astronomers Cowell and Crommelin (who have made an exhaustive investigation of the subject) is one of which science may legitimately be proud. They have been no less successful in unraveling the past history of this remarkable member of our system; but the story of that must wait till next month.

Next among the events of the month, from our standpoint, must be mentioned the observations of Prof. Campbell on Mount Whitney, California. These show no perceptible difference between the intensity of the absorption bands due to water vapor in the extreme red end of the spectra of Mars and of the moon. It follows that the amount of water vapor in the atmosphere of Mars must be small compared even with that in the rarefied and remarkably dry air above the mountain at the time of observation.

Prof. Lowell's observations, which indicated a perceptible amount of water vapor in the Martian atmosphere, were made under conditions which, though very favorable, appear to have been hardly as good as those on Mount Whitney. What is the cause of the discrepancy it is too early to say; but it is just by the investigation of such differences that the art of observation is perfected; and it is not unreasonable to hope that the study of this case may lead us, not only to more definite conclusions concerning the atmosphere of Mars, but to still better methods of investigating the problem in future.

THE HEAVENS.

Turning to our map of the sky, we find Cassiopeia almost overhead. The five brightest stars of this constellation, forming a group which looks like a badly dilapidated letter W, can be immediately identified.

With the aid of the fainter star $\varkappa$, we can see a resemblance to a rather less dilapidated chair, with its feet away from the pole; but the conventional figure of the "Lady in the Chair" is turned just the other way, with feet toward the pole; and our initial illustration is one more example of the large share of the imagination in forming the constellation figures.

Several individual stars deserve notice. The line through the Pole star and β Cassiopeiæ points almost exactly toward the vernal equinox. It may therefore be used as an indicator to estimate the sidereal time—remembering that it is above the Pole at sidereal noon, to the left at 6 h., below at 12 h., and to the right at 18 h. With a little practice it is possible to read the sidereal time from this celestial bow band within about fifteen minutes. Then, by recalling that the sidereal clock agrees with the mean solar clock on March 22nd (or thereabout) and gains at the rate of two hours a month, one can pass to ordinary solar time. This is the simplest way to tell the time by looking at the stars.

β Cassiopeiæ is also notable as a fairly near neighbor of ours, having a parallax of about 0.10 sec., corresponding to a distance about two million times that of the sun, or 32 light years. Two other naked-eye stars near by are nearer. One of them, η is marked on the map, between α and γ. This is a well-known binary, with a period of over 200 years and a parallax of 0.19 sec., corresponding to a distance of 17 light years.

The other, μ Cassiopeiæ, is the southern and fainter of a pair of stars which lie near the other corner of the parallelogram whose vertices are α, γ, and δ. Its parallax is about 0.11 sec. and its distance 30 light years. It is notable for its great proper motion, 3.7 sec. per year, which corresponds to an actual velocity in space of 100 miles per second.

The familiar winter constellations are beginning to return to the evening sky. At our hour of observation, Taurus is well up in the east, and Orion is rising. Gemini too is on the horizon; and Auriga is well up in the northeast. Perseus, Andromeda, and Pegasus extend upward from this to the zenith, and beyond it.

The southern constellations are inconspicuous, but Mars and Saturn, the first near the meridian and the other east of him, add luster to the otherwise vacant region. The variable star Mira (o Ceti) is now near maximum. It may easily be found with the aid of the map.

The two bright stars below and to the west of Saturn and Mars are β Ceti and Fomalhaut, which are much more nearly equal in brightness than the map would indicate.

Another group of bright stars lies in the west. Deneb, in Cygnus, is highest up. Altair is on the left, and Vega, the brightest of the three, below the first.

The Great Bear is low on the northern horizon, almost out of sight. Draco and Ursa Minor are above, and Cepheus higher still, close to Cassiopeia.

THE PLANETS.

Mercury is morning star throughout November. He is best visible at the first of the month, when he rises about 5:15 A. M. By the middle of the month he has drawn nearer to the sun, and rises about 6 o'clock; and soon after this he becomes unobservable without a telescope, with which he is best seen in broad daylight.

Venus is evening star, a long way from the sun, but very far south, so that she sets before 7:30 P. M.

Mars, though past opposition and receding from us, is splendidly conspicuous in the evening sky, coming to the meridian about 9 P. M. at the beginning of the month, and 7:30 at its close.

Jupiter is morning star in Virgo, and rises at about 3 A. M. in the middle of the month. Saturn is in Pisces, about an hour east of Mars, and is on the meridian at 9:30 P. M. on the 15th.

Uranus is evening star in Sagittarius, setting too early to be well observable. On the 23rd he is in conjunction with Venus, being 2½ deg. north of the latter.

Neptune is in Gemini, and comes to the meridian about 4 A. M. during the middle of the month.

THE MOON.

Last quarter occurs at 4 P. M. on November 4th, new moon at 9 P. M. on the 12th, first quarter at noon on the 20th, and full moon at 4 A. M. on the 27th, during the total eclipse of that date.

This lunar eclipse is visible throughout North America and the adjacent regions, but at an inconvenient time for the amateur, in the small hours of the morning.

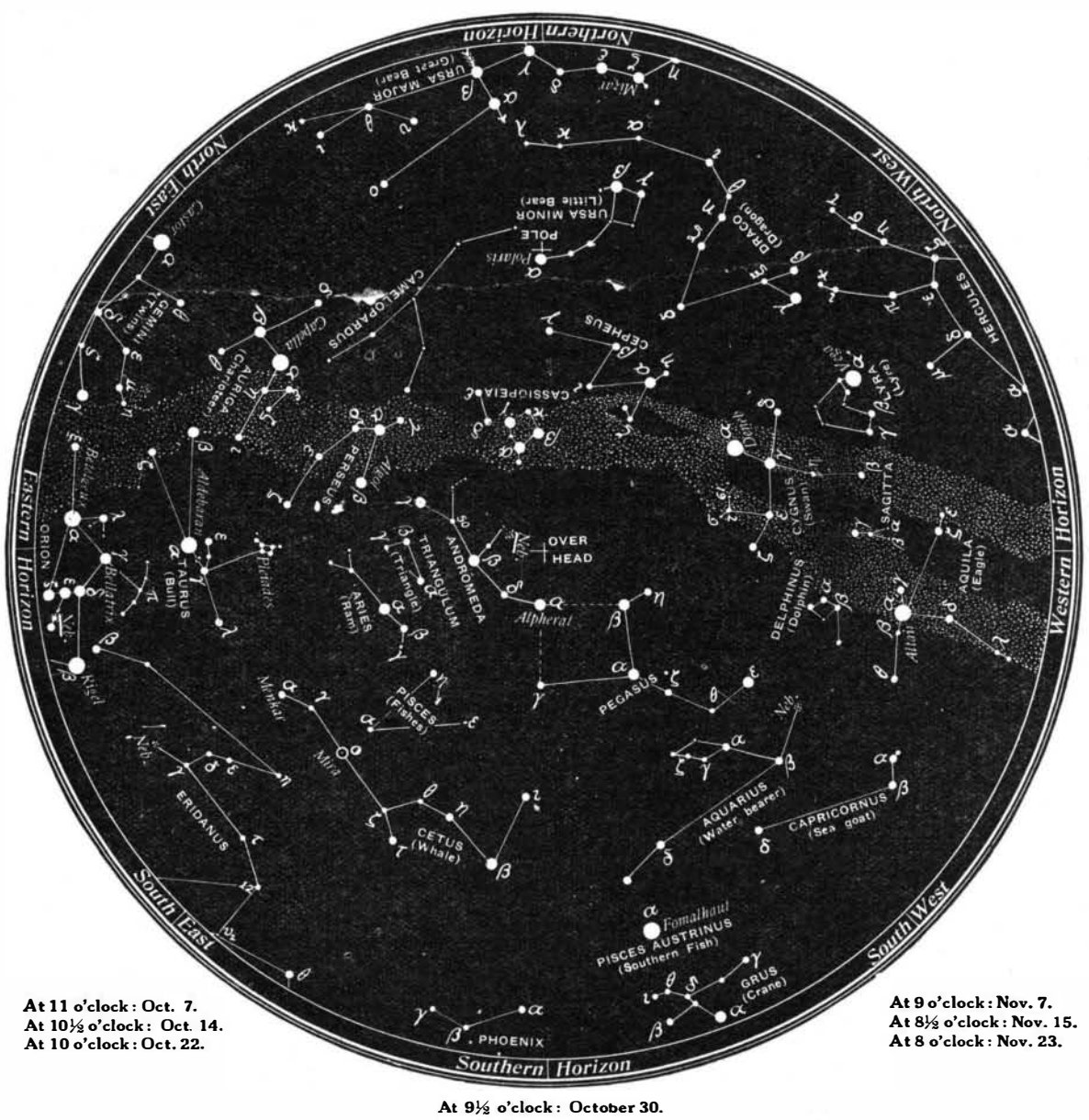
The moon enters the earth's penumbra at 1:12 A. M. eastern standard time, and first reaches the full shadow at 2:11. At 3:14 she disappears completely in it, and does not begin to emerge till 4:37. This is an unusually long duration, due to the fact that the moon goes almost centrally through the earth's shadow, which itself is larger than usual, as the moon is near the earth.

At 5:38 the moon finally leaves the shadow, and exactly an hour later she gets clear of the penumbra, and the eclipse is over.

The moon is nearest to us on the 25th, and farthest off on the 9th. She is in conjunction with Neptune on the 2nd, Jupiter on the 9th, Mercury on the 11th, Venus on the 16th, Uranus on the 17th, Mars on the 22nd, Saturn on the 23rd, and Neptune once more on the 30th.

Princeton University Observatory.

NIGHT SKY: OCTOBER AND NOVEMBER



At 11 o'clock: Oct. 7.
At 10½ o'clock: Oct. 14.
At 10 o'clock: Oct. 22.

At 9 o'clock: Nov. 7.
At 8½ o'clock: Nov. 15.
At 8 o'clock: Nov. 23.

At 9½ o'clock: October 30.

Carbon Safety Ink.—This ink is really no more than a sort of India ink kept in solution. It may be made by rubbing down 10 parts of lampblack, 10 parts of gum, 5 parts of oxalic acid, and 200 parts of water, taking at first but little water and only adding the remainder after the thick mass has become uniform.