THE HEAVENS IN OCTOBER.

BY HENRY NORRIS RUSSELL, PH.D.

The season of eclipses has once more come round, though we in America will gain little by it. On the 27th instant occurs an eclipse of the moon, which, however, is only partial, as she passes so far north of the earth's shadow that less than a quarter of her disk is obscured. But as this happens at about 8 A. M., New York time, when the moon is overhead at Manila and consequently far beneath our horizon, we shall see nothing of it. The eclipse is visible generally throughout eastern Europe, Asia, and the western part of the Pacific Ocean.

Apart from this, the most interesting astronomical event of the month is the visibility of all the planets at once in the evening sky—that is, of all but Neptune, whose absence is small loss, since he can never be detected by the unaided eye. They are very far from being equally conspicuous, and their great diversity in brightness gives us occasion to explain just how such differences are expressed in astronomical language.

HOW STAR MAGNITUDE IS RATED.

We all know that the brightest stars are said to be of the first magnitude, and that those just visible to the naked eye are of the sixth, while the intermediate magnitudes express the gradations of brightness between these. But how is this system to be extended to the telescopic stars and to the brighter planets which much surpass the fixed stars?

It has been found, on measuring the brightness of the naked-eye stars, that, on the average, a star of any given magnitude gives about 2½ times as much light as one of the next lower magnitude. We can evidently extend this principle as far as we like, and so obtain a scale of magnitudes for the telescopic stars. If we make our scale such that a star of one magnitude is exactly 2½ times as bright as one of the next, we find that a first magnitude star would give 97.7 times as much light as one of the sixth magnitude. It is found more convenient to choose our scale so that any star is exactly 100 times as bright as one five magnitudes fainter. On this scale the ratio of the brightness of one magnitude to the next is 2.512. For practical purposes we may say that on this scale a star gives:

2½ times the light of one 1 magnitude fainter.
6¼ times the light of one 2 magnitudes fainter.
16 times the light of one 3 magnitudes fainter.
40 times the light of one 4 magnitudes fainter.
100 times the light of one 5 magnitudes fainter.
250 times the light of one 6 magnitudes fainter.

And so on.

The standard first magnitude is so chosen that the new system differs as little as possible from the old in the case of the stars visible to the naked eye.

As examples of stars which are of the first magnitude in this scale may be mentioned Aldebaran and Altair. The Pole star and the Pointers are nearly of the second magnitude. For an example of the third magnitude we may take Beta Cygni, which forms the foot of the "cross" of Cygnus.

The faintest stars visible to the naked eye are between the sixth and seventh magnitudes. A good field-glass will show stars between the eighth and ninth magnitudes. The most powerful telescopes yet constructed are just capable of showing stars of the seventeenth magnitude. Such a star gives but 1-25,000 of the light of the faintest stars visible to the unaided eye, and only 1-2,500,000 as much as Aldebaran.

The brightness of a star which gives more light than the standard star of one magnitude, but less than one of the next above, may evidently be expressed by a fractional magnitude. A difference of much less than a tenth of a magnitude, or about 10 per cent of actual brightness, is only perceptible by a trained eye.

But how shall we express the brightness of those bodies that are brighter than our standard first-magnitude stars? Capella, for instance, is about 2½ times as bright as Aldebaran. Referring to our table, we see that the difference in brightness is one magnitude. But the number expressing the magnitude of the brighter star must be smaller. Therefore we must say that Capella is of the magnitude 0. We may indeed have to go farther than this. Sirius is nine times as bright as Aldebaran. This amounts to 2.4 magnitudes. Hence we can only express the brightness of Sirius by saying that it is of magnitude —1.4, the negative sign expressing that it is much brighter than other stars.

This notation appears cumbersome at first sight, but a little practice shows it to be very convenient. An instance of this is afforded by its application to the planets.

Venus is at present of the —3½ magnitude; that is, she is 4½ magnitudes brighter than Aldebaran, and sends us some 70 times as much light. Jupiter's magnitude is about —2. He is consequently hardly twice as bright as Sirius, and about 16 times as bright as Aldebaran.

Mercury is of about the —0.5 magnitude, being intermediate between Sirius and Capella in brightness.

Saturn is a little above the first magnitude, say 0.8.

Mars is now so remote from us that his magnitude is 1.8, and he is but little brighter than the Pole star.

Finally, Uranus is of the sixth magnitude, and sends us only 1-100 the light of Aldebaran and but 1-7,000 that of Venus.

Neptune's magnitude is about 8.5, and consequently he cannot be seen without a strong field glass.

THE PRINCIPAL CONSTELLATIONS

visible at 9 o'clock in the evening in the middle of October are as follows: The Great Bear is on the northern horizon, below the pole. On the left of the pole is the Little Bear, surrounded by the coils of the Dragon. Cepheus is directly above the pole, with Cassiopeia on the right.

Hercules is low in the northwest, and above him is Lyra. Cygnus and Aquila are conspicuous in the Milky Way. A little south of the zenith is the great square of Pegasus. Aquarius is below, and beneath him the Southern Fish. Still lower, just on the southern horizon, are a few stars of the constellation of the Crane, which is well seen only in southern latitudes.

Capricornus is west of Aquarius, and Cetus occupies all the lower southeastern sky. Above him are the inconspicuous Pisces and the smaller, but more prominent, group of Aries.

Near the eastern horizon the Pleiades and Aldebaran show that Taurus has returned to our evening skies. From the northeast corner of the square of Pegasus runs a line of stars through Andromeda to Perseus, below which, in the same direction lies Auriga.

THE PLANETS.

Mercury is evening star in Virgo and Libra. His greatest elongation occurs on the 11th, when he is 25 degrees east of the sun. Being far south, he remains above the horizon only about three-quarters of an hour after sunset, and is consequently not easy to see. During the latter part of the month he is too near the sun to be seen.

Venus is evening star in Libra and Scorpio, and is conspicuous in the southwest after sunset. She sets a little after 7 P. M. On the morning of the 10th she is in conjunction with Mars, passing south of him, at a distance of less than a degree. She is also in conjunction with Uranus on the 25th, but this time she is nearly three times as far away.

Mars is evening star in Scorpio. He is faint and only visible in the twilight, and will be best seen when pointed out by Venus on the 10th.

Jupiter is evening star in Sagittarius, setting at about half-past 9 on the 15th. He is moving eastward, and rapidly overtaking Saturn, their apparent distance being only half as great at the month's end as at its beginning.

Those who have small telescopes can see an unusual sight on the evening of the 15th, when only the fourth satellite will be visible, since the first is behind Jupiter, the second in front of him, and the third hidden in his shadow. This phenomenon is repeated on the 22d, but the planet will then be so near setting that it cannot be observed in this part of the country.

Saturn is also in Sagittarius, and sets a few minutes later than Jupiter. He is in quadrature with the sun on the 3d, and comes to the meridian at 6 P. M.

Uranus is evening star in Scorpio, setting at about 8 P. M. in the middle of the month, and is so far involved in the twilight that he can be seen with difficulty, if at all.

Neptune is in Gemini, rising about 9 P. M. on the 15th.

THE MOON.

Last quarter occurs on the afternoon of the 4th, new moon on the morning of the 12th, first quarter near noon on the 20th, and full moon during the eclipse on the 27th. The moon is most remote on the 14th, and nearest on the 27th. She passes Neptune on the night of the 3d, Mercury on the afternoon of the 14th, Mars on the evening of the 15th, Venus on the following morning, Uranus on the night of the 16th, Jupiter on that of the 18th, Saturn on the morning of the 19th, and Neptune again on that of the 31st.

Oyster Bay, N. Y., September 17, 1901.

THE M. SANTOS-DUMONT BALLOON No. 6 FAILS.

M. Santos-Dumont, the plucky young Brazilian aeronaut, has again come to grief with his new balloon, which is the sixth he has constructed. After the accidents of July 13, August 8 and September 6, it might be supposed that he would have quit his experiments for the season, but as the atmospheric conditions for which he had patiently waited were nearly perfect on Thursday, September 19, he decided to make the ascent. He passed the night at the balloon house, to take advantage of the early morning hours. He started from the Parc d'Aerostation at twenty minutes past eight o'clock in the morning, and crossed the Seine without any difficulty, and maneuvered successfully for an hour over the Longchamps racecourse. His success was so great that he decided to spend the whole day in experiments, but his motor began working badly, and while turning around the balloon was driven against some high trees and torn, allowing the gas to escape. The frame was broken as soon as it touched the ground, and M. Santos-Dumont walked cheerfully out of the ruins and shook hands with his friends. He was much vexed at the loss of his new balloon, which he had constructed with so much care. The accident to the machine was so serious that it will take several weeks to repair it, but notwithstanding this fact, he is going to resume his experiments as soon as the Santos-Dumont No. 6 can be repaired. If the weather conditions are favorable, he will make other ascents in October and November, and it is possible that he may take the entire apparatus to the South, where the atmospheric conditions are better.

SCIENCE NOTES.

Works of art in Rome are not particularly well guarded. The Church of Santa Sabina, on the Aventine, recently lost a picture by Sassoferrato, called "The Madonna of the Rosary." The monks found a light in the chapel which contained the picture, and on investigation found no trace of the painting except the frame and a piece of candle.

M. O. Leighton, Health Inspector of Montclair, N. J., declares that he has found bacteria to be quite abundant in clay that has been used and reused for modeling in schools. An attempt to sterilize the clay showed that the only efficient way of accomplishing this was by the use of superheated steam under a pressure of 15 to 20 pounds for 45 minutes. The species of bacteria identified were those which occur in pus formations. Sterile clay was then inoculated with the bacilli of typhoid, diphtheria and tuberculosis. A study of the clay showed the typhoid germ to be alive after 32 days and the diphtheria and tubercle to be still alive in 18 days.—The Druggists' Circular.

It is well known that wasps do much injury to fruit, and complaints have been numerous this season from many quarters in this country; but it appears that the possible injury to fruit by bees has been the subject of an exhaustive investigation by the California experiment stations. The conclusions arrived at are that although the mouth parts of bees are so constructed that they might be used for both eating and injuring fruit, all the evidence obtainable points to the fact that it is very seldom that any injury is done. In this country the bee has rarely been accused of doing any injury to fruit, but in the fruit-growing districts premiums are offered for the destruction of wasps' nests.

Experiments have been made at Havana to test whether yellow fever is carried by mosquitoes. Out of eight persons bitten by infected insects three have died, three have the fever and will possibly recover, one is not affected, while as regards the remaining case it is too early to make a diagnosis. The physicians are shocked at the result of the experiments. It was supposed that direct infection from mosquitoes caused only a mild form of the disease, and was a safe means of making the subject immune. It is now definitely known that a man bitten by an infected mosquito after being inoculated with the serum introduced by Dr. Caldas, a Brazilian expert, has developed a genuine case of fever.

R. T. Hewlett has made some experiments on the thermal death point of the tubercle bacillus (Trans. of the Aberdeen Congress, 1900, Roy. Inst. of Pub. Health). His conclusions are that: 1. As regards a non-virulent laboratory culture, a temperature of 60 deg. C. acting for ten minutes is sufficient to destroy the vitality of the bacilli. 2. A temperature of 65 deg. C. acting for fifteen minutes destroyed the infective properties of tubercular sputum in five out of six instances. 3. Tuberculous milk heated to 60 deg. C. for thirty minutes lost its infective power. 4. Tuberculous milk heated to 68 deg. to 65 deg. C. for twenty minutes in the Allenbury's pasteurizer lost its infective power. 5. In all probability pasteurization in which the milk is retained at a temperature above 65 deg. C. for not less than twenty minutes is efficient, especially if no film is formed.

The following information relative to the discovery of petroleum in New Brunswick was transmitted by Commercial Agent Beutelspacher, of Moncton, under date of August 15, 1901: "For some years past different parties have been prospecting for petroleum in this province. Very little success attended their efforts, however, until the present year, when a company operating at Memramcook, about 14 miles distant from Moncton, struck a well which it is thought will yield in paying quantities. It is producing from eight to ten barrels of oil per day. There is also a good flow of gas. The 0.860 specific gravity oil has been subjected to fractional distillation, according to the Engler method, and was found to yield a very high percentage of good burning oil. The company has placed three more boring rigs in the field, and is extending its operations rapidly."