THE HEAVENS IN DECEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The close of the nineteenth century is marked by no celestial pageant. Indeed, the heavens are more than usually bare, for all the outer planets, except Neptune, are hidden behind the sun, and the inner ones are all three morning stars. So on the last evening of the century we shall see those silent and eternal stars alone which present the same aspect to us that they did to the sages of the East more than thirty centuries ago—Orion and the Pleiades, familiar to star-gazers when the Book of Job was yet unwritten, even as in present times, and seeming even more inconceivably far beyond our reach to us than to them.

To the fixed stars, therefore, must our attention be chiefly directed, when, as our custom is, we survey the evening skies. At 9 P. M. on December 15, the Milky Way extends in a broad span across the sky from east to west, passing a little north of the zenith. It is much brighter in the west than in the east, and also much more irregular in form and brilliancy.

Following its line from west to east, and noting the principal constellations, we come at first to Cygnus, a great cross of stars standing erect right along the center of the Galaxy, and close above the western horizon. Some distance higher up, and nearly overhead, is Cassiopeia, marked by a zigzag line of bright stars; and the next group to the east is Perseus. Midway between the last-named constellations is a bright spot in the Milky Way, which, with even the smallest telescope, is seen to be a magnificent cluster of telescopic stars.

Still following the Milky Way down toward the east, we next reach Auriga, whose brightest star, Capella, considerably surpasses any that we have so far passed. Below is Gemini, containing the conspicuous pair Castor and Pollux, both of which are almost of the first magnitude. Their line continued downward points out a little hazy spot of light which is the cluster Praesepe, in Cancer, the most characteristic feature of the constellation. The separate stars of this cluster cannot be separated by the naked eye, but are clearly seen with a fieldglass.

To the right of Cancer is Canis Minor, whose only conspicuous star is the brilliant Procyon. Further on in the same direction is Sirius, which, even at its present low altitude, is beyond comparison the brightest star in sight. The lower part of Canis Major—to which constellation it belongs—has not yet risen.

Above Sirius is Orion, which is too familiar to need description here, and high above him again is Taurus. Aldebaran, Sirius, and the two brightest in Orion, Rigel and Betelgeuse, form a remarkably perfect parallelogram.

Below and to the right of Orion is the little constellation Lepus, the Hare, which between the hunter Orion and his Great and Little Dogs must be pretty hard pressed. Just above Rigel is a moderately bright star, which is Beta Ericlani; and the classic river is represented by a long stream of faint stars extending thence to the westward, and then southward and eastward to the horizon, and filling up most of the southeastern sky.

The almost equally irregular and extensive shape of Cetus and Pisces similarly occupy the southwest. Above is Aries, a little south of the zenith, below which to the west is Andromeda, with the great square of Pegasus further down and standing on one corner.

In the northern heavens we may note that the Little Dipper hangs directly down from the Pole Star and that Draco lies below it. The Great Dipper is on the right, the last star of its handle out of sight near the horizon, and the head and paws of the Great Bear extend from it toward Gemini and Cancer.

THE PLANETS.

This month has more than the usual number of planetary conjunctions with the sun; but these are unfortunately not observable phenomena.

Mercury is morning star in Libra and Scorpio all the month. His greatest elongation occurs on the 7th, and throughout the first half of December he is well placed for observation, rising about two hours before the sun. On the morning of the 22d he passes close to Uranus, and on that of the 30th close to Jupiter, but in both cases the planets are too much involved in the dawn to be easily seen.

Venus is morning star in Virgo, Libra and Scorpio, rising nearly three hours before the sun on the 1st, and more than two hours on the 31st. She is receding from the earth and growing fainter, but remains as always the brightest of the planets.

Mars is rapidly approaching opposition and becoming more conspicuous. He is in Leo, moving slowly eastward and growing brighter. By the end of the month he will be a brilliant object, brighter than a first magnitude star, and rising about 10 P. M.

Jupiter, Saturn and Uranus are all in conjunction with the sun during this month; Uranus on the 4th, Jupiter on the 13th, and Saturn on the 28th, and all are invisible during the month, unless perhaps Saturn might be seen in very clear air just after sunset in its very first days.

Neptune is almost opposite to the three planets last named, and comes to opposition on the 19th. He is situated on the boundary of Taurus and Gemini, and is invisible to the naked eye, and, indeed, hardly worth looking at in any but large telescopes.

THE MOON.

Full moon occurs on the morning of the 6th; last quarter on the afternoon of the 13th; new moon on that of the 21st; and first quarter on the evening of the 28th. The moon is nearest the earth on the 3d, most remote on the 15th and nearest again on the 30th. She passes Neptune on the morning of the 7th, Mars on the evening of the 12th, Venus on the night of the 18th, Mercury on the morning of the 20th, Uranus at noon the same day, Jupiter on the morning of the 21st, and Saturn on that of the 22d.

At 1 A. M. on the morning of the 22d the sun enters the sign of Capricorn, and, according to the almanacs, "winter begins." And with the stroke of midnight on the 31st the nineteenth century closes.

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COHERERS.*

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The phenomena utilized in coherers has been discovered by successive stages. Varley, in working with a system of lightning arrester for telegraph circuits, found that a conducting powder unmixed with insulating powder could not be used, as after the discharge had traversed it the particles were arranged so as to form a conducting mass. But it was supposed that the heat of the discharge produced the phenomenon. A diminution of resistance produced by weak currents was not really discovered until 1884 by Prof. Calzecchi-Onesti. He used in his experiments metallic filings contained in an insulating tube with two electrodes and observed that when the tube was slightly turned about its axis the conductibility acquired by the filings disappeared. M. Branly observed later a similar phenomenon and found that the action might be obtained by allowing a spark to pass in the neighborhood of the tube and that the original resistance was restored by a shock. Prof. Lodge arrived at the same results in 1889 by studying a fact observed already by Prof. Hughes, but unknown to him, that a very small spark between two conductors which were almost touching established a communication which disappeared by a shock.

It is not yet known exactly in what manner the phenomena of the coherer are accomplished. According to M. Branly, it is due to a modification of the dielectric between the particles, and according to Mr. Lodge it is due to exceedingly small sparks between them which give place to the production of contacts. This explanation may be completed by admitting also the possibility of slight movements of the particles by the electric forces which would arrange them in conducting filaments. According to the first theory, the shocks would have the effect of renewing the portions of the dielectric between the particles, and according to the second the shocks break the adherence produced by the sparks. The late researches have given useful data without deciding the question of the cause of the phenomena. Thus the microscopic observation made by Messrs. Arons and Van Gulick, those of M. Vincentini and Di Ciommo and Campanile upon coherers with mercury drops and those of Melagoli by the photographic method seem to uphold Mr. Lodge's views, for they have permitted observing small movements of the particles and small sparks at the instant an electric wave was produced at some distance. M. Tommasina has obtained curious chains formed by adherent metallic particles, and M. Sundorph has succeeded in removing most of the iron filings forming a coherer without causing a disappearance of the conductibility produced by a wave. Besides, the adherence produced by a small spark between two conductors which touched slightly has been observed by Mr. Lodge and lately by Mr. Maclean (United States). But on the other hand, certain facts seem difficult to explain by the theory of Mr. Lodge. For instance, peroxide of lead acts in a contrary manner to metal filings, for its conductivity diminishes under the action of electric waves and it is the same for other substances, as, according to Mr. Rose, magnesium and potassium in kerosene. To these facts, contrary to Mr. Lodge's theory, it must be added that Mr. Branly made coherers in which the particles were fixed in a solid dielectric mass. In any case, it seems that the presence of a thin layer, of oxide, the most often, at the surface of the particles is necessary or at least useful for the working of coherers. It is true that they have been made with gold or platinum filings or carbon powder; but the influence of the surface layer has been well demonstrated by M. Blondel, who produced a film of sulphide of silver in increasing thickness at the surface of silver particles and found that a certain thickness of layer exists which gives the maximum effect.

Certain coherers lose their conductibility spontaneously, as Messrs. Branly, Ducretet, Popoff, Tommasina, and others have shown. Coherers of this kind would simplify experiments greatly, as a shock to the tube would not be necessary. In general, the automatic striker of M. Popoff is used, in which a relay is worked which operates a secondary circuit including the striking magnet. According to the carbon coherers recently described by Tommasina, this will not be necessary, and a simple telephone, which may contain the coherer in the interior, will reveal the waves. The form and constitution of coherers has been greatly varied by Bowlker, Maclean and others, and the arrangements of M. Tissot and Jervis Smith are especially remarkable. The frequent use of filing tubes in the last year has furnished us with data for some practical rules for the best construction. In general, it may be said that the sensitiveness is greater as the space filled by the filings is smaller and its particles smaller. But at the same time it is sensitive to outside influences, and its working is less sure. The choice of the metal is important, and it appears that nickel is the most advantageous. Again, it is well to completely inclose the glass tube and to make a vacuum in it, to be sure that the sensitiveness does not vary in time, on account of a surface alteration produced by contact with air. But few measurements have been made upon these phenomena up to the present, but it is known that the lowering of resistance produced by the discharge of a condenser through the filings is a function not only of the charge, but also of its potential, and that for a given capacity there is no effect when the potential is below a certain critical value.

*Lecture delivered at the Congress of Physics. Reported by special Paris correspondent of the SCIENTIFIC AMERICAN.

SCIENCE NOTES.

The Duke of Abruzzi has chartered the Gothenburg whaler "Capella" to proceed to Franz Josef Land in search of three missing Arctic exploration expeditions.

The supply of clams on the New England coast is diminishing. Extensive areas which four or five years ago produced great numbers of clams are now practically barren. The demand has increased at such a rate that too large a number of seed clams have been removed, and extinction quickly follows and the beds do not recover themselves.

Experiments in forestry are being carried on in California, the idea being to determine as near as possible the value of timber to a watershed. The rainfall in the lands which have been set apart for the experiments is accurately measured, and the relative amount of run-off is carefully estimated. The experiments are being conducted on a very extensive scale, so they will undoubtedly prove of great value.

The Department of Agriculture is preparing an order on the recommendation of the Department of War setting aside as forest reserves the island of Panay and the island of Pauitaui; the latter is one of the Jolo Islands. It is found that these are the richest islands in the world for rubber trees. It is the desire of the authorities in Washington to have the trees preserved, in view of the fact that our rubber supply may become exhausted.

A Chinese banknote, issued during the Ming Dynasty, about A.D. 1390, has been placed in the British Museum, among the specimens of early printing from China. The surface of the note is black with age, though the characters upon the face of it are quite discernible. This is supposed to be the earliest specimen extant of a bank note issued from any country, and is about 300 years anterior to the issue of the first note in Europe, from Stockholm.

The London Lancet complains that the ordinary closed cab is a distinct menace to health. It says they are the undoubted source of infection; microbes infesting the cushions and the mats on the floor, and the air might easily contain pathogenic organisms left by a previous user. Hansom cabs are considered to be decidedly more sanitary, but they are considered as a kind of death trap in wet weather, when those riding in them are completely inclosed by windows and aprons, making it impossible to release themselves in an emergency.

The long looked for trial of the third-rail system on the New York elevated roads was recently carried out on the Second Avenue branch, when six trips were made between 54th Street and 92d Street. The trial train consisted of six cars, the two end cars being each equipped with four motors. The two motor cars were arranged so that the cabs were respectively at the front and rear ends of the train. The trip from 92d Street to 54th Street, a distance of thirty-eight blocks, was run in four minutes, at a speed of thirty miles an hour. The superiority of the motors over the old steam locomotives was shown in the rapid acceleration; and the substitution of the air-brake for the old vacuum brake was noticeable in the greater rapidity with which the stops were made. Judging from the results achieved on the trials, it is expected that the trains will run from the Battery to 155th Street on the Sixth Avenue line in forty minutes, instead of forty-nine minutes, which was the time taken under the old system. The new and the old cars are similar in appearance, the former being somewhat wider. In place of the old steam heating and oil lighting, they will, of course, be lighted and heated by electricity.