The white has a much less proportion. In spite of its small weight, the membrane contains about the same quantity and sometimes more than the white. With certain eggs it was sufficient to treat 0.15 gramme of membrane (the amount contained in one egg) to obtain a clear arsenic ring. These results, which differ from those which have been obtained hitherto, have only been made possible by an especially sensitive method which he uses. They confirm the existence and the probable rôle of arsenic in all living cells, and scientists may be confident in drawing the conclusions which follow from such an important fact.

THE HEAVENS IN DECEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The most interesting event of the past month, from the standpoint of the amateur astronomer, has undoubtedly been the appearance of two large groups of sunspots.

The first of these, which is situated some distance north of the sun's equator, must have originated about the end of September, on the far side of the sun. On October 4 the sun's rotation carried it into sight, and it was a conspicuous object, visible even to the naked eye, until it disappeared behind the western limb two weeks later. On October 31 it came round again, and on November 3 and 4 it was followed by another new group of spots, situated in the sun's southern hemisphere.

At the time of writing the first group consists of two large spots, about 30,000 and 20,000 miles in diameter, and about 80,000 miles apart, with a few smaller companions. The second group, though containing no such large spots, is more extensive, forming an irregular line fully 200,000 miles long.

It is impossible to predict just how these spots will look next month, for sunspots are short-lived affairs, and change rapidly; but both groups are so large that it is probable that they will last through at least one more rotation of the sun.

The first group should cross the sun's central meridian about December 3, and the second on the 7th or 8th, so that both of them should be visible during the first ten days of the month. If they are anything like as conspicuous as they are now, they will be easily visible with a field-glass, and perhaps even with the naked eye.

As is often the case with great sunspots, the appearance of these groups has been accompanied by great magnetic and electrical disturbances on the earth, culminating in a "magnetic storm" of unusual violence, sufficient to disturb telegraph lines all over the world, and accompanied by a brilliant auroral display.

It is now pretty well established that the aurora is due to electrical action—probably electric currents—in the extemely rarefied outer layers of our atmosphere, perhaps 100 miles high. So this, together with the deflections of the magnetic needle and the "earth currents," which affected the telegraph lines, may be regarded as parts of one great disturbance of the earth's electrical and magnetic condition. If the coincidence of such a disturbance with the appearance of a large sunspot stood alone, it would mean nothing; but dozens of such instances are known, and, what is more, the number of magnetic storms rises and falls from year to year in exactly the same fashion as the number of sunspots. The correspondence of the curves representing the two is very striking, and extends even to minor details.

It follows that the sunspots and magnetic storms must be connected in some way or other. But we do not yet know what this connection is, or how it works. It would be unsafe to assume that the visible sunspots are the cause of the magnetic storms. Both may be due to some common cause, perhaps something acting deep down inside the sun. Whatever it is that happens, it must be on an enomorus scale. The recent magnetic storm supplied energy enough to run telegraph lines several hundred miles long without batteries; and it is obvious that such lines must have taken up only an infinitesimally small fraction of the energy of the earth currents. The total expenditure of energy must have been enormous. But where this energy comes from, and how it reaches us, we do not know.

It is improbable that the observed electro-magnetic disturbances are simply inductive effects from much greater ones on the sun. Lord Kelvin has calculated the amount of energy that would have to be spent in the sun to create a typical magnetic storm on the earth in this way, and it comes out so excessively great—greater in a few hours than all the energy which the sun radiates in the ordinary way in years—that the hypothesis seems very unlikely.

It is possible that a clew to the problem may be given by the recent discoveries in electrical science, especially those which have introduced to us the new ideas of electrons and of radio-activity. But, considering the present rapid growth of the department of physics, it seems to be as likely that the explanation, if we get it, will depend upon some yet undiscovered fact, as upon those that have become known in the last few years. For the present we must simply admit that, though the connection between sunspots and magnetic storms is unquestionably real, its nature is unknown.

As for any relation between the sunspot period and other terrestrial phenomena, such as the weather, all that can be said now is that the effect, if present at all, is small, and is so much covered up by much larger variations due to other causes, that there is still much discussion among scientific men concerning its reality.

THE HEAVENS.

The most brilliant region in the starry heavens is that which now occupies the eastern and southeastern sky. At 9 P. M. on the 15th Orion is well up in the southeast. The line of his belt points upward toward Aldebaran and the Pleiades, and downward to Sirius, which, though still low, already vindicates its claim to be the brightest of the fixed stars.

To the left of these constellations lie other hardly less conspicuous groups. Procyon, a little higher up than Sirius and considerably farther north, marks the constellation Canis Minor. Gemini lies above and Auriga still higher, near the zenith. Following the Milky Way westward, we first reach Perseus and then Cassiopeia. Farther south is Andromeda, below which in the west lies Pegasus.

Aries lies on the meridian below Perseus, marked by a triangle of unequal stars. Eridanus and Cetus occupy a large area in the south without affording any conspicuous objects. The southwestern sky is equally dull except for the presence of Jupiter.

Cygnus is low in the northwest, and Lyra still lower. Cepheus is sinking on the left of the pole, Draco and Ursa Minor are below, and Ursa Major beginning to come up again on the right.

THE PLANETS.

Mercury is evening star throughout December, but is at first too near the sun to be seen. During the last part of the month he is visible low in the southwest just after dark. On the 31st he sets an hour and a half later than the sun, but he is too far south to be conspicuous.

Venus is morning star, and is very brilliant all through the month. She is in Virgo, about 4 deg. north of Spica, on the 1st, and moves eastward into Libra during the month. On the 1st she rises at about 3 A. M., but as she is moving southward, she rises later every night, and on the 31st does not appear until nearly 4 o'clock.

Mars is evening star in Sagittarius and Capricornus, and sets about three hours after the sun. On the 20th he is in conjunction with Saturn, being a little more than half a degree south of him. As the two planets do not set till 7:30 P. M., they should be easily seen.

Jupiter is evening star in Aquarius, and is the most conspicuous feature of the evening skies. On the 7th he is in quadrature with the sun, and is due south at 6 P. M.

Saturn is evening star in Capricornus, and sets about 7:30 P. M. in the middle of the month.

Uranus is in conjunction with the sun on the 18th, and is invisible.

Neptune is in opposition on the 27th. He is in the western part of Gemini, his position on the 1st being R. A. 6h. 22m. 41s., dec. 22 deg. 15 min. 33 sec. north, and on the 31st 6h. 19m. 10s., dec. 22 deg. 17 min. 22 sec. He appears in small telescopes as a greenish star of the eighth or ninth magnitude, and, in the absence of a good star-chart, can only be surely identified by his motion. It requires a large telescope to show his disk, which is only 2½ seconds of arc in apparent diameter (about 1-20 of that of Jupiter).

THE MOON.

Full moon occurs at 1 P. M. on the 4th, last quarter at 6 A. M. on the 11th, new moon at 4 P. M. on the 18th, and first quarter at 9 P. M. on the 26th. The moon is nearest us on the 7th, and most remote on the 23d. She is in conjunction with Neptune on the 6th, Venus on the 14th, Uranus on the 18th, Mercury on the 20th, Saturn and Mars on the 22d, and Jupiter on the 25th.

At 7 P. M. on the 22d the sun reaches his greatest southern declination, enters the sign of Capricorn, and, in almanac parlance, "winter commences."

Cambridge Observatory, November 6, 1903.

REPORTING BY ELECTROPHONE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

On the occasion of the recent speech at Birmingham of the Right Hon. Joseph Chamberlain, a remarkable journalistic development was accomplished by the London Evening News, which reported the speech in London and published it complete within twelve minutes of the speaker's resuming his seat. The feat was achieved by means of the electrophone.

Birmingham is 113 miles distant from the English metropolis. In the London editorial office of the Evening News an electrophone receiving station was established, comprising twelve receivers. At the hall where the speech was delivered, just in front of the speaker, were arranged on all sides electrophone transmitters in small boxes. The wires connected thereto were switched onto the wires of the national telephone system, which were carried into the hall for this purpose. These wires led to the Birmingham post office, where they were switched through onto the trunk cable to London. At the metropolitan post office they extended to the National Telephone Company's exchange, and thence to the newspaper office.

The task of reporting the speech was carried out by ten reporters, and their work was divided into two-minute spells of reporting, subsequently reduced to one-minute intervals as the speech neared completion. That is to say, the first shorthand reporter was connected to the wires for two minutes, then gave way to the second reporter, who also had a two-minute interval, and so on with the whole of the ten men in rotation. Then while No. 2 was reporting, the first shorthand writer who had been relieved transcribed his notes and was ready for another spell of reporting after the tenth man had completed his two minutes. In this manner the whole speech was reported *verbatim et literatim*. Then as fast as the shorthand notes were transcribed they were handed to the linotype operator, and the speech was composed and made ready for printing.

To guard against risk of breakdown of the cable, two other trunk cables were held in reserve, but the first cable proved sufficiently reliable for the work.

By this enterprising development the newspaper was enabled to obtain its report and publish the newspaper more than an hour before the first complete telegraphic report was received.

Mr. Chamberlain commenced his speech at 8:10 in the evening. The first batch of copy was sent to the composing room and set at 8:22. Mr. Chamberlain sat down at 10:05; the last batch of copy was sent to the linotype operator and set at 10:20. The type was cast, printed, and on sale in the street at 10:32, and the last batch of the telegraphic report was not received until 11:37, so that the electrophone beat the telegraph by 1 hour and 5 minutes.

The speech was set up and made up into columns from end to end, even including the last passages, which were not issued in the stop-press news space. Had the stop-press column been utilized for the last passages of the speech, the paper might have been published earlier.

The enterprise was purely an experiment, but was so successful that in future the electrophone will play an important part in the report of a great speech, since it is now realized that distance does not militate against the successful operation of the instrument. The words were heard with perfect distinctness, as if the reporters were in the room in which the speech was delivered. At times, it is true, the words of the speaker were drowned in the applause of the audience, and thus escaped the reporters, but that was a contingency against which they would have had to contend had they been present in the room, unless they had been exceptionally close to the speaker. Every sound in the hall was heard with extraordinary clearness.

SCIENCE NOTES.

To detect the presence of dissolved oxygen in water, A. Kaiser makes use of a solution of ferrous sulphate in boiled water acidulated with sulphuric acid. This solution is introduced by means of a pipette into a flask filled with the water to be examined; an excess of caustic potash solution is then added, the flask stoppered and shaken. If the water be rich in oxygen, the precipitate remaining in suspension immediately becomes of a yellow color, ferric hydroxide being formed. If little oxygen be present, only a greenish precipitate of ferrous hydroxide is formed, and with water free from oxygen, the precipitate remains of a greenish-white color. Small quantities of nitrates or nitrites present do not interfere with the reaction.—Journ. Soc. Chem. Ind., after Chem. Zeit.

The hypothesis that the energy lost by radio-active bodies should be recovered in the form of gravitation energy has frequently been made, and in a recent paper Herr Seigel tries to confirm this theory by exposing a small lead sphere to Becquerel rays, when a loss in weight would be noted. As, however, these losses seem to remain within the limits of possible experimental errors, T. Forch, in a note published in the Physikalische Zeitschrift, No. 11, proceeds to test his conclusions by repeating his experiments in a somewhat modified form. It results from the author's experiments that, with the radio-active substance used, no absorption of gravitation energy exceeding 1-25,000,000 of the mass of the lead will take place. A theoretical research by G. Kucera relative to the same subject is published in the same issue of the above periodical. The theoretical considerations Seigel bases himself on are tested and his assertion criticised, that the masses acting on the lead sphere should be taken as being condensed in the centers of gravity of the chords cut out by the surface of the earth and as being proportional to their length. In order to carry out an integration on a tri-dimensional figure, tri-dimensional elements should be chosen as elements of integration. Correcting in this way Seigel's calculations will modify them considerably.—A. G.