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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE N-RAYS: ARE THEY REAL OR ILLUSORY?

Just why English and German scientists have been uniformly unsuccessful in detecting the strange emanations to which Prof. Blondlot, their discoverer, has given the name "N"-rays, and why French physicists, on the other hand, furnish more convincing proof of their existence every day, is one of those scientific anomalies for which no adequate explanation can ever be offered. French eyes are certainly blessed with no greater clarity of vision than those of Englishmen; and yet the fact remains that Blondlot's rays, or at least the more important phenomena of which they are the cause, have never been observed by any but Blondlot, Charpentier, and a few French investigators. The prompt reply with which each objection to the existence of the N-rays is met by Blondlot in the form of experimental proof, and particularly the photographic evidence of N-ray activity that is now offered, would seem sufficient to dispel whatever doubts may still linger.

What the N-rays are has not been determined with any greater certainty than has attended similar inquiries into the nature of the Roentgen rays. Only their effects have thus far been studied. How the emanations were discovered is probably well known to readers of this journal who have followed the accounts that we have published from time to time of Blondlot's work. A brief recapitulation, however, may not be out of place.

In his experiments on the rapidity of propagation of the Roentgen rays, Blondlot noted effects that could be explained only by assuming the existence of undiscovered radiations. Experiments with other bodies than a Crookes' tube confirmed that assumption. A Welsbach burner, a Nernst lamp, flint exposed to the sun's rays, rapidly-vibrating sonorous bodies, the sun, and many other substances were found to be radioactive, to give off rays that resemble both heat-waves and Roentgen rays—heat waves in so far as the rays were absorbed by the slightest film of water, Roentgen rays in so far as they penetrated aluminium with ease. By far the most startling announcement that has been made by any investigator who has made the N-rays a special study, comes from Charpentier, who boldly proclaims that the human body sends forth N-rays. That it should be possible to measure the force exerted in muscular contraction, to note the activity of the brain and nerve centers, and, indeed, to trace by substances rendered phosphorescent, the general arrangement of nerves in the human system, seems more like a fantastic Jules Verne dream than a scientific achievement. And yet this is what Charpentier claims that he has done.

In Great Britain and Germany, as we have said, the existence of these puzzling emanations has been boldly denied. At the University of Glasgow seven skilled observers of one experiment were unable to note any of the characteristic phenomena of the rays. In Germany, Prof. Lummer has ingeniously shown that many of the Blondlot experiments can be imitated without employing any of the means prescribed by Blondlot, and that the effects observed may be referred to processes taking place in the eye itself. It has also been suggested that the dilation of the pupil, which occurs when the attention is fixed upon an object, may account for the peculiar manifestations recorded by Blondlot and Charpentier. A well-known British scientist offers the fanciful explanation that self-hypnotism due to the fatigue of the optic nerve is the cause of the N-ray phenomena. In a word, most if not all of Blondlot's opponents seek to account for the N-rays by classing them with optical illusions or by considering them purely subjective perceptual processes.

However plausible these theories may be, they most certainly fall before the incontestable proof afforded by means of objective instruments of precision. Blondlot has demonstrated the existence of his N-rays by photography. Furthermore, he has actually measured the wave length of the rays both by means of the diffraction grating and Newton's rings. Surely it cannot be contended that the photographic plate is subject to hallucinations; nor can it be said that optical illusions have measurable wave-lengths.

If the N-rays do exist, what are they? A satisfactory answer cannot be given until we know more of radioactivity, and until the information thus gathered has been properly classified. The Roentgen rays were discovered several years ago. And yet, how much of their true nature do we know. Even the radio-active substances discovered long before radium burst upon us are still puzzles.

If the N-rays are still but little understood, we may nevertheless attempt to classify them with other undulatory phenomena. It will be remembered that by means of the old periodic law of chemistry it was possible to tabulate the chemical elements according to their properties and their atomic weights in a sequence that brought out their relation to one another strikingly. Wherever gaps occurred, it was reasonable to infer that they would be filled by elements still to be discovered—an inference that was more than once justified. By a similar tabular arrangement, the N-rays may be shown to fill a gap in the series of undulatory rays. In rate of vibration and length of wave there is a difference so vast between the shortest electrical waves (0.60 millimeters) and the longest heat waves (0.024 millimeters) that the N-rays with their average wave length of 0.2 millimeters may well be assumed to fill the intervening gap.

SUBMARINE MINES ON THE HIGH SEAS.

It is the opinion of a well-known officer of the United States navy, a leading expert on the subject of submarine mining, that both the Russians and Japanese have been sowing the waters in the neighborhood of the Liao-tung peninsula with submarine mines on a most extensive scale, each of the combatants aiming to render the harbors and roadsteads and the courses that would naturally be followed by the enemy's warships so perilous that they would either keep clear, or if they did venture into these waters, would do so at the imminent peril of losing their ships.

That such a policy has been followed with reckless abandon is suggested by the fact that during the present war no less than eight vessels, from the 15,000-ton battleship down to the small torpedo boat, have been either disabled or entirely destroyed by contact with mines. On the part of the Russians, as far as can be made out from dispatches, the torpedo cruiser "Yenesei," the protected cruiser "Boyarin," a torpedo destroyer or a torpedo launch, and the battleship "Petropavlovsk" have been utterly destroyed by these deadly weapons, while the "Pobieda" was so badly injured as to have difficulty in getting back into the shelter of Port Arthur. The Japanese acknowledge that they have lost by the same instrumentality a torpedo boat, the protected cruiser "Miyako," and the battleship "Hatsuse."

Both the Russians and Japanese freely admit that they have resorted to mine laying, the latter claiming that the "Petropavlovsk" was sunk by mines that were placed for the express purpose of intercepting Admiral Makaroff's fleet on its way out through a certain channel that led from Port Arthur. It seems also to be pretty well established that one form of mine that has been freely employed makes use of connecting cables between two or more separate floating mines, the idea being that if the ship does not happen to hit the mines themselves, her stem will engage the connecting cable, and as she moves forward through the water, the mines will be swung in against her hull and explode on contact. There is strong confirmation of this in the fact that in the sinking of both the "Petropavlovsk" and the "Hatsuse" there seem to have been two explosions at different points of the ship's length, the second following very closely upon the first, which is exactly what would happen if a ship steered across the cable, and drew the mines in upon herself, particularly if her stem engaged the connecting cable at some other point than midway between the two mines. Now the fact that this double explosion occurred in the case of both the Russian and Japanese battleships, would indicate either that both contestants are using the same form of mines, or that the loss of both battleships is to be attributed to a Japanese source. It is more than probable, however, that immediately upon the loss of the "Petropavlovsk," the Russians set about doing what the Russian press has persistently asserted was done, namely, sowing the waters frequented by the Japanese in their bombardment with mines which were laid by torpedo boats under cover of the night.

It is probable that these mines have been anchored and that in the heavy storms which have been frequent of late, many of them have broken adrift and floated far outside the immediate theater of war. According to Admiral Togo's report, the "Hatsuse" was sunk ten miles off shore. It is unlikely that the mine which sunk her was anchored, for the chance of a vessel steering directly over such a small floating object, anchored far outside the range at which she could use her guns effectively, was so remote that the Russians would not consider the chance worth the time and risk that it would take to place a mine in such a spot. No doubt this particular mine, like the two which were seen floating within three miles of the port of Wei-Hai-Wei, over eighty miles from Port Arthur, by a correspondent of the London Times, was one of the derelicts that had broken adrift.

Immediately upon the sinking of the "Hatsuse," it was announced from Tokio that the Russians were sowing floating mines upon the high seas outside of the three-mile limit. The matter was taken up in the British press, and Russia was charged with violating the unwritten principles of international law as it affects the rights of neutrals on the high seas. We must confess that common fairness demands that no such charge be made until it has been absolutely proved that this has been done. It is well, however, that the point has been raised; for there is no question that scores, and possibly hundreds, of these terrible weapons have either broken loose or been deliberately cast loose, to float out on the high seas where they must, for many months, and possibly years, remain as a deadly menace to ships of all nations. It will probably never be known whose ships were blown up by whose mines, or what character of mines have been laid by whom, or where or how they were laid; but the terrible menace which undoubtedly exists will, we hope, lead to some international regulations that will put a strict limit upon the uses that are to be made by belligerents of this method of warfare.

Now that it is certain that an unknown number of mines, any one of which would be certain destruction to a merchant vessel, have been floated out onto the high seas, to be carried by wind and weather Heaven knows where, the question arises as to the length of time during which they will retain their deadly efficiency. The United States navy has some experience on this subject, purchased happily at no cost to itself; for when our ships were entering various harbors of Cuba during the Spanish war, no less than three of our vessels came in contact with Spanish mines which, most fortunately, had been clogged by the marine growths, which accumulate so rapidly in tropical waters. These mines were provided with projecting levers which, upon being struck by a ship, should have acted with a trigger-like effect and discharged the mine. There are two of these mines on exhibition to-day at the New York navy yard. Although they had been but a few months in the water, they were so incrusted with barnacles that the triggers refused to work, and our ships escaped. Many mines, however, are not dependent upon any projecting levers for detonation, the outer case being entirely free from openings, and the firing mechanism being contained within the water-tight shell; and there is no reason why, especially in the colder waters of northern seas, such a mine should not retain its efficiency for the probable duration of an ordinary war, say for one or two years. In course of time the high explosive, through chemical changes, will lose its efficiency, and ultimately the salt water will attack the shell and leakage will take place. It can safely be said, however, that for at least twelve months to come, the world at large may thank the contestants of the Russo-Japanese war for having set afloat on the high seas a tremendous peril to navigation; and we repeat, that the United States could not do better than improve the present opportunity to bring about a thorough discussion of this subject, with a view to rigidly circumscribing the area—the accidental as well as the intended area—of mining operations and risks.

A WORLD'S CONGRESS OF ACADEMIES.

The first meeting of the General Assembly of the International Association of Academies was held, it may be recalled, at Paris in 1901, under the presidency of M. Gaston Darboux, permanent secretary of the Académie des Sciences. That gathering, by a unanimous vote, decided that the next triennial Congress should take place in London, the prospective date being of course coincident with the present year. Subsequently, Whitsun-week was decided upon as the most convenient period to call the assemblage together in England, and the arrangement was made that the gathering should be under the presidency of Sir Michael Foster, the distinguished physiologist.

The establishment of this important association was not, it may be said, trumpeted among the nations; on the contrary, its birth was accomplished in so quiet a fashion that some may feel surprise when reminded of the circumstance of its foundation. However that may be, it is the fact that the subsequent progress of time, though comparatively short, has secured for the organization a unique power and influence, amply justifying the early hopes that centered around its initiation, and the original efforts to launch it as a cosmopolitan undertaking. Once ushered in, it sprang into prominence, and is now a notable force in movements affecting the progress of science and learning.

The idea for an amalgamation of this kind was not, however, of one-man inception; rather, it lay in the gradual growth, shaping, and ripening of aspirations long cherished by many men of science desirous of achieving some definite international reciprocity for the better advancement of scientific or philosophical schemes of general utility.

Foremost among those thus animated were the leaders of the four academies of Göttingen, Leipzig, Munich, and Vienna. They constituted some years ago an association called a "Cartell," a body which sent representatives from each academy, and which met regularly and in turn at the above cities for the discussion of matters of the hour, as well as to take decisions involving common action. Later on—to be precise, in 1899—the Royal Society of Göttingen invited its sister society of London to send delegates to participate in that year's Cartell. This was chiefly prompted by the fact that the project for a grand catalogue of scientific literature which the latter was then promoting was to come up for discussion. Following this invitation, the whole Cartell asked the Royal Society of London if it would join the existing association, an appeal which led ultimately to the adoption of a wider basis of organization and the adhesion, one by one, of the principal academies of the world, represented in all cases by the sections of Science and of Letters wherever these formed an integral part of the respective institutions.

By the statutes that are in force, during the triennial intervals of the General Assembly, the business of the association is conducted by an international council, this being under the guidance of one of the constituent academies, and denominated the "directing academy." Since the Paris meeting, the Royal Society has acted in the latter capacity, but will now transfer the duty to such other academy as may be nominated by the vote of the Assembly. In all likelihood the Imperial Academy of Vienna will be selected for this onerous assumption of duty.

The international character of the association is seen in the category of cities from which the academies hail. They include Amsterdam, Berlin, Brussels, Budapest, Christiania, Copenhagen, Göttingen, Leipzig, London, Madrid, Munich, Paris, Rome, St. Petersburg, Stockholm, Vienna, and Washington. In the case of London, it is just now of interest to record the names of the delegates acting in the two sections. The Royal Society has chosen a distinguished band, namely, Sir William Huggins, Lord Kelvin, Sir William Ramsay, Sir Norman Lockyer, Sir David Gill, Prof. Larmor, Prof. H. E. Armstrong, Prof. G. H. Darwin, Prof. Forsyth, Prof. Liversidge, Mr. F. Darwin, Dr. Waller, Mr. A. B. Kempe, Prof. Schuster, and Mr. W. Bateson; while, similarly for letters, the British Academy for the Promotion of Historical, Philosophical, and Historical Studies sends Lord Reay, Mr. James Bryce, Sir Richard Jebb, Dr. Caird, Sir Courtney Ilbert, Sir Alfred Lyall, and Prof. Rhys Davids. This latter and newly-created body now fills the void so confessedly apparent at the Paris Assembly of 1901 through the hitherto non-existence of any organization of the kind in England, and it will join forces with the Royal Society in welcoming the Witenagemot.

From the composition of the list of foreign scientists and men of letters who have been authorized to attend the Assembly, it is evident that the best thought and culture of the several countries concerned will be represented in the conclave. For example, to specify only a few among many eminent names, the French Institute depute M. Mascart, president of the Academy of Sciences, and M. Gaston Darboux, permanent secretary, together with Prof. Moissan, the Count de Franqueville, Baron de Courcel, and M. Georges Perrott; Berlin will send Prof. W. von Bezold; Belgium, the Chevalier Descamps, president of the Belgian Academy of Sciences; Madrid, Prof. Ramon y Cajal; Stockholm, Prof. Gustav Retzius; Vienna, Prof. Viktor von Lang; and so on, through a long list of notabilities.

The United States is represented in the Assembly by the National Academy of Sciences of Washington, but we chronicle the very regrettable circumstance that no delegate has been found whose engagements would permit the short visit across the Atlantic to participate in the deliberation of the Congress. The breach has been filled by the nomination of two English members on the roll of the National Academy, namely, Sir Archibald Geikie, late Director-General of the Geological Survey of Great Britain, and Prof. Ray Lankester, the Director of the Natural History Museum. None the less is the loss of direct representation to be deplored, especially as Prof. Lincoln Goodale, delegate from Harvard, was an enforced absentee, through indisposition, on the occasion of the first meeting in 1901.

The business that will be dealt with at the meeting of the Assembly in London is of a varied character. A report will be furnished by Sir David Gill on the great work proceeding in South Africa appertaining to the measurement of the geodetic arc from the Cape to Cairo; there will be a discussion on a comprehensive scheme for the furtherance of seismological investigation; and one on the report of a special commission instituted by the association for the purpose of promoting the study and investigation of the anatomy of the brain. The Royal Academy of Sciences, Berlin, intend to move for the nomination of a committee charged to consider the question of securing magnetic observations at sea, with the view to an extended magnetic survey. American scientists in particular will watch with interest the outcome of a matter which will be brought up. A resolution was arrived at some time ago at Turin, by the International Congress of Physiologists, expressive of the desirability of the laboratory on Monte Rosa being recognized as an international establishment, to be carried on for the benefit of science, under the auspices of the Association of Academies. This proposition has received the joint support of the National Academy of Sciences, Washington, and of the Reale Accademia dei Lincei, Rome. It is, however, expected to provoke considerable discussion. At present the Association of Academies has no funded property, relying for support upon its collective subscriptions, so that in order to provide maintenance for this or kindred projects it must obtain donations or subventions from states, both of which courses are naturally fraught with some difficulty. So strongly is this felt by the Royal Society, that Sir Michael Foster will propose the following resolution relating to scientific undertakings: "That the initiation of any new international organization, to be maintained by subventions from different states, demands careful previous examination into the value and objects of such organization, and that it is desirable that proposals to establish such organizations should be considered by the International Association of Academies before definite action is taken."

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

There is still rather a lack of news in the astronomical world. Nothing more remarkable than the discovery of a new comet has been recorded during the past month. This is so frequent an event that it is usually hardly deserving of comment; but the present comet—discovered by Brooks at Geneva, N. Y., on April 16—may turn out to be unusually interesting, as it appears that it may have a very short period.

When a comet is discovered, the first efforts of astronomers are naturally directed to obtaining accurate observations of its position. When enough of these have been obtained, the elements of the comet's orbit can be calculated, and from these its future motion can be predicted.

It is theoretically possible to determine a comet's orbit from any three observations; and if the observations were perfectly correct, the results of the calculation would give us the true orbit. But actual observations are inevitably affected by small "accidental" errors, and an orbit calculated from three of them will represent, not the true places of the comet at the time of observation, but the slightly erroneous recorded places. Now in many cases, especially when the intervals between the dates of observation are short, it may require large alterations in the elements of the comet's orbit to produce these small changes in its calculated positions for the given times, so that an orbit calculated from only three observations (though the numerical work is perfectly correct) may nevertheless be considerably in error.

In such a case, the predicted positions of the comet will diverge more and more rapidly from the true ones as time goes on. But as more observations are obtained, the preliminary orbit can be corrected, and a new one found which represents all the observations up to date pretty closely, instead of agreeing exactly with three, and not at all with the later ones. As the interval since the discovery, and the number of observations, increase, the influence of the accidental errors of observation becomes much smaller. But it is usually not worth while to try to predict the comet's motion for more than a month ahead, until several weeks' observations are available upon which to base one's calculations. (It may be said in passing that this fact makes it difficult to give satisfactory accounts of the movements of new comets in a series of articles like the present, which must be prepared some time before publication.)

For the reasons just given, it appears that the preliminary orbits calculated by two different astronomers for the same comet may differ a good deal, though neither one has made any mistake in his computations. The errors of observation are responsible. But there is an additional cause for discrepancies. Most comets move in parabolic orbits, coming from distant space, swinging around the sun, and returning in the direction whence they came, not to return for many centuries, if at all. A respectable minority, however, move in elliptical orbits, and return regularly, sometimes in periods of only a few years. A parabolic orbit is easier to compute than an elliptical one, so most computers usually assume at first that a new comet is moving in such an orbit.

The chances are that this assumption will prove to be nearly right, and if it proves to be wrong, new elements can then be easily calculated.

Several astronomers have computed parabolic orbits for Brooks' comet, which agree in giving a perihelion distance about 2½ times the radius of the earth's orbit, though they show minor differences, due no doubt to the observational errors.

On the other hand, Dr. Leuschner, of the University of California, has computed an elliptical orbit from three observations, and reaches the very remarkable result that the comet's orbit is nearly circular, with a period of about three years. This is shorter than the period of any known comet, and, if further observations confirm these calculations, Brooks' comet will take its place among the most remarkable of such bodies. But Dr. Leuschner expressly states that in this case the errors of observation may have a large effect, and so there will be no reason for surprise if the period of the comet turns out to be actually a good deal longer.

The comet is of about the ninth magnitude, and is growing fainter. While beyond the reach of a field-glass, it is well placed for telescopic observation, being on the borders of Draco and Boötes, with a westerly motion toward Ursa Major. It is being carefully observed, and before long the true character of its orbit will be known.

THE HEAVENS.

The principal constellations which are visible at nine o'clock in the evening in the middle of June are as follows:

Cassiopeia is low in the north under the pole, Cepheus lies above, and to the right is Cygnus, lying in the Milky Way, with Lyra above it, marked by the brilliant Vega. Below on the right is Altair, the principal star of Aquila. Though there are no particularly bright stars to the south of this, the Milky Way is very conspicuous, and full of bright knots and patches.

Just south of east is Scorpio, with the ruddy Antares at its heart, and the long line of the tail curving down to the horizon and bending up again. The region west of this is barren, but higher up, near the meridian, is Boötes, with Arcturus blazing brilliantly. Between this and Vega are Corona and Hercules. Virgo lies southwest of Boötes, and its principal star, Spica, is the brightest in that part of the sky. Farther west is Leo, which is now sinking rapidly toward the horizon, and preparing to follow Gemini, whose last stars are disappearing in the northwest. Ursa Major lies north of Leo, and Ursa Minor and Draco are on the meridian above the pole.

THE PLANETS.

Mercury is morning star in Taurus, and reaches his greatest elongation on the 8th. At this time he rises an hour before the sun, and may be seen low down in the east in the dawn; but he is south of the sun, and this is not a favorable apparition.

Venus is morning star in Taurus and Gemini, but is too near the sun to be seen with the naked eye.

Mars is also morning star, and too near the sun to be seen, so that his conjunction with Venus on the 19th is unobservable.

Jupiter is morning star in Pisces, and rises before 3 A. M. on the 15th, so that he is conspicuous in the morning sky.

Saturn is in Capricornus, and comes to the meridian about 4 A. M.

Uranus is in Sagittarius, and comes into opposition on the 19th. His position on the 2d is R. A. 17h. 54m. 7s., dec. 23 deg. 38 min. south, and on the 30th R. A. 17h. 49m. 12s., dec. 23 deg. 38 min. south. As his motion between these dates is nearly uniform, it will be easy to find his exact place on a star-map. He appears as a greenish star of the sixth magnitude, just visible to the naked eye on a clear dark night.

Neptune is in conjunction with the sun on the 27th, and is invisible throughout the month.

THE MOON.

Last quarter occurs at midnight on the 5th, new moon at 4 P. M. on the 13th, first quarter at 10 A. M. on the 20th, and full moon at 3 P. M. on the 27th. The moon is nearest us on the 17th, and farthest off on the 5th. She is in conjunction with Saturn on the 4th, Jupiter at 3 A. M. on the 9th, Mercury on the 11th, Venus and Mars on the 13th, Neptune on the 14th, and Uranus on the 26th. Only the conjunction with Jupiter is close.

Cambridge, England.

CHARLES H. HASWELL'S NINETY-FIFTH BIRTHDAY.

America's oldest living engineer, Mr. Charles H. Haswell, celebrated his ninety-fifth birthday recently as a guest of the Engineers' Club in New York city. Despite his advanced years, Mr. Haswell is still actively engaged in his profession, and appears every day in the City Hall of New York at his desk. He is the assistant engineer of the Board of Estimate, and has been in the service of the city for many years. Mr. Haswell was the first chief engineer of the United States navy. He had the distinction of seeing the "Clermont" make her first run up the Hudson River.

The SCIENTIFIC AMERICAN extends its congratulations to Mr. Haswell.