

as possible the position occupied by the plane of polarisation of the sky with respect to the position of the sun, he designed an instrument by means of which the traces of the plane containing the line of sight and passing through the sun could be compared with those of the plane of polarisation as observed in a Savart polariscope. With this instrument it was soon found that, contrary to what has always been hitherto supposed, these planes do not coincide with one another, but that the angle between them may even exceed 6 degrees. The plane of polarisation is, moreover, always nearer the horizon than the sun, while the angle between the planes presents diurnal maxima and minima, a point of extreme interest. The electro-magnetic rotation of the plane of atmospheric polarisation is distinctly proved by the following observation:—At noon the position of the sun is such as to produce an illumination of the sky symmetrical with respect to the meridian, which ought therefore to coincide with the plane of polarisation; but as a matter of fact the coincidence of the two planes does not occur at noon, but at a later hour, so that the plane of polarisation has obviously been rotated through a certain angle. This rotation corresponds with the results obtained by direct observation by M. Becquerel upon the magnetic rotatory power of air, as regards both the magnitude and the sense of the rotation. The existence of rotatory power in gases is thus confirmed from a most unexpected source.

A SUGGESTION has been made by M. d'Arsonval for the improvement of Planté's secondary batteries. M. Planté employed as electrodes in his secondary cells two sheets of lead immersed in dilute sulphuric acid, which became spongy by use, holding the hydrogen and oxygen liberated at the respective poles in loose combination. The limits of the performance of such cells appear to be fixed by the escape of hydrogen bubbles from the kathode, and by the low conductivity of the film of peroxide of lead formed over the surface of the anode. M. d'Arsonval therefore proposes to obviate the one difficulty by electrolysing a salt of zinc instead of a dilute acid, and the other by increasing the available surface of lead at the anode. For the latter he employs shot heaped about a carbon plate. The liquid is a strong solution of sulphate of zinc. During the charging of the cell, zinc is deposited out of the solution upon the surface of a lead plate, or better, upon a free surface of mercury amalgam, sulphuric acid being formed in the solution, which attacks the zinc so soon as the cell is employed to generate a current. Whether this modification is really an improvement upon the form devised by Planté, remains to be seen. An electromotive force of 2.1 volts is claimed for the new cell.

ALBUMIN is employed by M. Regnard in the place of collodion for the purposes of microphotography, and is said to afford perfect freedom from the harshness which appears inseparable from the use of collodion films.

DR. SYDNEY MARSDEN has discovered a substance in which carbon is soluble, and from which it crystallises out partly in graphitoidal, partly in adamantine forms. The adamantine crystals exhibit beautiful octahedral shapes under the microscope, and scratch sapphire readily. There seems every reason, therefore, to regard them as true diamonds.

GEOGRAPHICAL NOTES

AT the meeting of the Geographical Society on Monday last, Sir T. Fowell Buxton, after a few explanatory observations, read an account of a visit to the famous Lukuga creek in May, 1879, by Mr. E. C. Hore, of the London Missionary Society's station on Lake Tanganyika. The result of Mr. Hore's trip from Ujiji across the lake is believed to be the vindication of Cameron's theory that the Lukuga creek was the long-sought outlet of Lake Tanganyika. From the Kiyanja ridge Mr. Hore saw the Lukuga, flowing westwards with a rapid stream, on its way to join the Congo, until it became lost to view among the hills of Kwa, Mekito, and Kalumbi's, in Urua. Mr. Hore, it is well to add, was well qualified for the investigation of this matter, being well acquainted with currents, &c., from his former experience when in the service of the Peninsular and Oriental Steam Navigation Company; he is now surveyor and scientific officer attached to the Mission station at Ujiji. Commander Cameron stated to the meeting at some length the history of Lake Tanganyika, from its discovery by Burton, and gave in detail the various theories regarding its outlet. Dr. Emil Holub followed with an address on the Marutse-Mabunda empire in South Central Africa. This empire is of recent formation out of

two peoples, the Marutse and the Mabunda, who inhabit the Zambesi region near the confluence of the Chobe with that river, and have their capital at Shesheke. After a few remarks on their geographical position and the neighbouring tribes, Dr. Holub addressed himself to the ethnographical side of his subject, and gave many interesting particulars respecting the people and their manners and customs. Among their peculiarities, as distinguished from other South African tribes, the more noteworthy are a belief in a supreme being and in a life after death, and the respect and consideration in which women are held.

THE arrangements relating to the reception of Prof. Nordenskjöld in France have been somewhat altered. The celebrated explorer having expressed his determination to accomplish personally the *periplus* of the Mediterranean coasts of Europe, he will proceed, *via* Gibraltar, to Havre, where he will be received by a deputation from the Paris Geographical Society, and be conducted to Paris, where he will be magnificently treated. The Municipal Council of Paris has subscribed a sum of 200l. to the funds. It is certain that he will land at Lisbon, where the Portuguese Geographical Society is preparing a reception. It is said that the Geographical Society of Algiers will send a requisition to Prof. Nordenskjöld asking him to visit their town, and witness their festive installation. He will not be present at the meeting of the Academy of Sciences on March 1. At a large meeting of the Geographical Society of Rome, on Sunday, its gold medal was conferred upon Prof. Nordenskjöld, who was present along with his staff. Speeches were delivered in praise of the enterprise, and Prof. Nordenskjöld replied briefly in French. King Oscar of Sweden has ordered four gold and forty-six silver medals to be struck for the officers and crew of the expedition.

THE Rev. F. Coillard, of the French Basuto Mission, in company with whom it will be remembered Major Serpa Pinto made his journey from the Zambesi to the Bamangwato country and to the Makarikari, has recently delivered a lecture at Capetown, chiefly on missionary topics. He stated that he had sojourned principally among a tribe known as the Banyai in the neighbourhood of the Zambesi. On his journey thither he had passed through a tribe which was divided into small communities, and led a miserable life owing to the oppression of the Matabele. Mr. Coillard also visited the Matabele country, of which he had but a poor account to give; the climate, he says, is most unhealthy, not only for Europeans but even for the natives.

THE new *Bulletin* of the Antwerp Geographical Society contains a paper by Dr. L. Delgeur, entitled "Les Endiguements de la Néerlande: Lutte des Hollandais contre la Mer," and the text of some interesting letters which the International African Association have received from East Central Africa.

THE *Colonies and India* gives a brief description of the magnificent Tequendama Falls near Santa Fé de Bogota, in the Colombian Republic, and draws attention to the fact that it has been visited by but few English travellers.

AS supplementing No. 59 of *Petermann's Mittheilungen*, an abstract of an itinerary in Japan, by Dr. Knipping, is published. The itinerary extended from Kioto by Shimonosura to Tokio, and contains much valuable information on the country traversed. It is accompanied by three maps.

No. 8 of *Globus* describes the journey of Rohlf's and Stecker last summer from Battisal, south of Jalo, in Tripoli, to the oasis of Kufra, which lies about half-way between the western frontier of Egypt and the eastern boundary of Fezzan, and has not before been visited by Europeans. The oasis of Kufra lies between 21° and 24° E. and 26° and 24° S., and is happily described in the map which accompanies the paper as an oasis archipelago. It is represented as a series of regions covered with palms, amid a country of hills and sand dunes.

A STRANGE PHENOMENON

THE following letter from R. E. Harris, Commander A. S. N. Co.'s s.s. *Shahjehan*, dated Calcutta, January 19, appears in the *Calcutta Englishman* of January 21:—

"The most remarkable phenomenon that I have ever seen at sea was seen by myself and officers on the 5th instant between Oyster Reef and Pigeon Island (Malabar coast). At 10 P.M. we were steaming along very comfortably; there was a perfect calm, the water was without a ripple upon it, the sky was cloud-

less, and, there being no moon, the stars shone brightly. The atmosphere was beautifully clear, and the night was one of great quietude. At the above-named hour I went on deck, and at once observed a streak of white matter on the horizon bearing south-south-west. I then went on the bridge and drew the third officer's attention to it. In a few minutes it had assumed the shape of a segment of a circle measuring about 45° in length and several degrees in altitude about its centre. At this time it shone with a peculiar but beautiful milky whiteness, and resembled (only in a huge mass, and greater luminous intensity) the nebulae sometimes seen in the heavens. We were steaming to the southward, and as the bank of light extended, one of its arms crossed our path. The whole thing appeared so foreign to anything I had ever seen, and so wonderful, that I stopped the ship just on its outskirts, so that I might try to form a true and just conception of what it really was. By this time all the officers and engineers had assembled on deck to witness the scene, and were all equally astonished and interested. Some little time before the first body of light reached the ship I was enabled, with my night glasses, to resolve in a measure what appeared, to the unassisted eye, a huge mass of nebulous matter. I distinctly saw spaces between what again appeared to be waves of light of great lustre. These came rolling on with ever-increasing rapidity till they reached the ship, and in a short time the ship was completely surrounded with one great body of undulating light, which soon extended to the horizon on all sides. On looking into the water it was seen to be studded with patches of faint, luminous, inanimate matter, measuring about two feet in diameter. Although these emitted a certain amount of light, it was most insignificant when compared with the great waves of light that were floating on the surface of the water, and which were at this time converging upon the ship. The waves stood many degrees above the water, like a highly luminous mist, and obscured by their intensity the distant horizon; and as wave succeeded wave in rapid succession, one of the most grand and brilliant, yet solemn, spectacles that one could ever think of was here witnessed. In speaking of waves of light I do not wish to convey the idea that they were mere ripples, which are sometimes caused by fish passing through a phosphorescent sea, but waves of great length and breadth, or in other words, great bodies of light. If the sea could be converted into a huge mirror and thousands of powerful electric lights were made to throw their rays across it, it would convey no adequate idea of this strange yet grand phenomenon.

"As the waves of light converged upon the ship from all sides they appeared higher than her hull, and looked as if they were about to envelope her, and as they impinged upon her, her sides seemed to collapse and expand.

"Whilst this was going on the ship was perfectly at rest, and the water was like a millpond.

"After about half an hour had elapsed the brilliancy of the light somewhat abated, and there was a great paucity of the faint lustrous patches which I have before referred to, but still the body of light was great, and, if emanating from these patches, was out of all proportion to their number.

"This light I do not think could have been produced without the agency of electro-magnetic currents exercising their exciting influence upon some organic animal or vegetable substance; and one thing I wish to point out is, that whilst the ship was stopped and the light yet some distance away, nothing was discernible in the water, but so soon as the light reached the ship a number of luminous patches presented themselves, and as these were equally as motionless as the ship at the time, it is only natural to assume that they existed, and were actually in our vicinity before the light reached us, only they were not made visible till they became the transmitting media for the electro-magnetic currents. This hypothesis is borne out by the fact that each wave of light in its passage was distinctly seen to pass over them in succession, and as the light gradually became less brilliant, they also became less distinct, and had actually disappeared so soon as the waves of light ceased to exist."

THE NEW HYDROGEN LINES OBSERVED BY PHOTOGRAPHY, THE STAR LINES, AND THE DISSOCIATION OF CALCIUM¹

IN the month of July, 1879, I published in the Reports of the Royal Berlin Academy of Sciences, some photographs of the spectra of Geissler tubes, filled with rarefied hydrogen. In

By Dr. H. W. Vogel, from the *Photographic News* of February 20.

these photographs are visible, besides the old well-known hydrogen lines, H, α , β , γ , δ , a great many other lines in the violet and ultra-violet at the extreme end, very thin and faint, but of a character very similar to the old well-known hydrogen lines. One of the most intense of these new lines coincided almost exactly with the H line (Fraunhofer) of the sun-spectrum.

I inclined to the idea that these new lines, whose wave-length I published six months ago, were real hydrogen lines, but an objection was made to the effect that the hydrogen employed would not have been quite pure. I will mention here that I got exactly the same lines with hydrogen of different sources.

I have recently repeated my experiments, and filled Geissler tubes with the purest hydrogen, developed by electrolytical decomposition. The photographs of the spectra of these tubes show nearly all the same lines as I have published, and I venture now to declare these new lines to be *real hydrogen* lines, so that this body, besides its four chief lines in the visible spectrum, has certainly five chief lines at least in the ultra-violet part.¹

The wave-lengths of these new lines, which I have published in the Reports of the Berlin Academy, 1879, p. 590, are as follows:—

3968 bright lines coincident with H (Fraunhofer)
3887 " "
3834 fainter lines
3795 " "

The fifth line was not very distinct; its wave length, which I have not published till now, is nearly 3770.

I have received NATURE, which contains an abstract of Huggins's highly interesting paper read before the Royal Society on the photographs of the spectra of stars. Huggins gives a list of the wave-lengths of the dark lines he obtained in the ultra-violet part of the spectra of white stars, and I was much astonished to find that they corresponded almost exactly with my hydrogen lines above mentioned. I put here Huggins's and my own numbers together:—

Huggins's star lines in the ultra-violet wave-length.	My hydrogen lines in the ultra-violet wave-length
3968	3968
3887.5	3887
3834	3834
3795	3795
3767.5	3770

This conformity is so surprising that I venture the conclusion that the *chief lines of the spectra of white stars are hydrogen lines.*

Lockyer, whose admirable investigations I highly esteem, but with whose conclusions I cannot agree, regards the line 3968 (coincident with the calcium line H, Fraunhofer) in the star spectra as a calcium line, and deduces a dissociation of calcium from the fact that the second calcium line K is not visible in the star spectra. My opinion is that the line 3968 in the white star spectra is *not* a calcium, but a *hydrogen line*, and I base this theory on the fact that the well-known hydrogen lines in these spectra are much more intense and thicker than in the sun spectrum. I may point out that this line is not exactly, but very nearly, coincident with H (Fraunhofer); the first is a little less refrangible.

Lockyer supposes that calcium is also dissociated in the sun's atmosphere. He mentions the observation of Prof. Young, who observed the H seventy-five times and the K line only fifty times in the atmosphere of the sun. My opinion is that the so-called inverted H line, if visible without K in the chromosphere, is not the calcium line, but the fifth hydrogen line.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—In the event—which seems most probable—of the report of the Board of Natural Science Studies being adopted by the Senate, the Natural Sciences Tripos will, in and after 1881, be divided into two parts, each of which will include a practical examination, and will extend over five days. The names of those who have passed the first five days will be alphabetically arranged in three classes, although this part of the examination will be considered to test only the general proficiency of candidates in several branches of science. The subjects will be grouped thus: (1) Chemistry, (2) Physics, (3) Mineralogy, (4)

¹ I have only five in my photographs, because I worked with glass prism and lenses, which absorb a good deal of the ultra-violet rays.