feature of the Papuans which distinguishes them from other curly-haired races, is that their hairs grow in clusters, separated from one another by sinuous spaces devoid of hair. Extensive researches proved, however, that this cluster-like disposition of hairs does not exist among Papuans, not even among children. Finally, several anthropologists considered the diameter of the curls of the hairs as a feature that may help to establish a distinction between the Papuans and the Negritos; these last have been supposed to have smaller curls than the former, that is, no more than one or two millimetres wide. M. Maclay found, however, that the diameter of the curls of the Papuan also does not exceed one and a half millimetre, and that it varies very much in different parts of the head, so that this feature cannot be taken as a basis for anthropological classification.

After having taken some rest at Buitenzorg, M. Maclay left Batavia in January, 1873, for a third visit to New Guinea. The Malayans of Celebes have carried on an intercourse with New Guinea for more than three or four hundred years; they go there, as well as the inhabitants of the islands Lant, Seram, and Key, for the purchase of slaves, turtles, trepang, and pearl shells. To establish closer relations with the natives, the Malayans of Celebes bring with them Malayan girls, give them as wives to the Papuans, and export in exchange Papuan girls who are married in Celebes. (These relations were described by P. A. Leupe in the "Bijdragen tot de Taal-Land en Volkenkunde van Nederlandsch-Indie" for 1865.) Therefore it is impossible to find pure Papuans on the Papua-Onim and Papua-Notan coasts, and M. Maclay took the resolution to go to the Papua-Koviay coast. The inhabitants of this coast have a very bad reputation as robbers and anthropophagi; but still, M. Maclay hired a Malayan "praw," or "urumbay," that is, a boat thirty feet long, and, with a crew of two Christians from Amboyna, and fourteen Malayans and Papuans, he left the islands Seram-Lamut, and reached the Koviay coast. Triton Bay (where the Dutch had formerly a military settlement) proved to be a beautiful strait, to which M. Maclay gave the name of the Russian Grand Duchess Helena Pavlovna. He discovered also another bay that separates the island Namatote from the mainland of New Guinea. He stopped at Aiva, between these two straits, and his men immediately erected a hut from the "ataps" (a kind of mat made from leaves of the tapioca palm) that were brought in the boat. The inhabitants of this coast proved to belong to the same race as those of the Maclay coast; however, it was easy to perceive, especially among children, unmistakable traces of mixture of Malayan blood. The size of the men on the Maclay coast varies from 1·74 metres to 1·42; the size of full-grown women was 1·32. On the Papua-Koviay coast the size of the men was from 1·75 to 1·48 metres, and the size of the women 1·31. On the Maclay coast the length of the transversal diameter of the skull was from 64·0 to 86·4 per cent. of the longitudinal diameter, and from 62 to 80 per cent. on the Koviay coast.

Leaving ten men at Aiva, M. Maclay went with the remainder of his crew to explore the interior of the mainland. He landed opposite Coira Island, and, crossing a range of mountains 1200 feet high, reached Lake Kamaka-Vallar. He found there a tribe which calls itself Vaasirau, but does not differ from the inhabitants of the coast. The water of the lake was very warm (31° Celsius), and contained an interesting new kind of sponge, belonging to the *Hallichondriæ*. The rains in this part of New Guinea are so copious that Triton Bay is sometimes covered with a sheet of sweet water that can be taken in vessels and used for drinking. As the lake has no outlet, its water rises many years, sometimes fifteen and twenty feet, and covers the trees that grow on its shores; but after a period of rising, the rocks at its bottom give way, and the water is discharged through a temporary outlet, which is soon checked by stones and mud. Returning to the shore, M. Maclay made excursions to the neighbouring islands (discovering coal on Lakahia Island), as well as several other excursions to the highlands of New Guinea. In Telok Bay the boat of M. Maclay was attacked by a number of pirogues of Papuans, but made his escape by rowing all night. But his men at Aiva were not so fortunate. They were attacked by 200 Papuans, who destroyed the hut and killed an old man who was interpreter, as well as his wife and child. A further stay at Aiva was impossible, as the Papuans had poisoned the springs; and so the party went to stay on Aidum Island, where M. Maclay's hunter brought him every day plenty of interesting birds and other animals. The New Guinea kangaroo, *Dendrologus ursinus*, is worthy of mention, as it has to adapt itself to local conditions, strong nails, and lost at the same time the strength of the muscles of the tail; it has become thus a climbing animal and lives mostly in trees. After having taken prisoner the chief of the Papuans who had robbed his hut, (M. Maclay went one day with a few men to their camp, and simply ordered them to tie the chief; the Papuans, terrified by the sudden appearance of a white, opposed no resistance), the party returned to the Seram-Lamut Islands, where M. Maclay studied the mixed race from the crossing of Malayans with Papuans. The anthroplogical results of these studies have appeared in the above-mentioned periodical as an appendix to the paper entitled "Meine zweite Excursion nach Neue Guinea," 1874."

The Papuans of the Koviay coast are a very interesting race of aquatic nomads. They were centuries since in relations with Malayans, who came to New Guinea especially to purchase slaves, exported to a great extent to the Malayan Islands. The slaves were formerly purchased among the inhabitants of the sea-coast; but to have more slaves these last have begun to make raids on the highlanders, who took revenge by raids themselves, so that the inhabitants of the coast were compelled to abandon all their villages. They are living now in covered boats, and continually cruise in them along the shore in search of food, landing only during storms, for in the night, at a few well-known places, where they are safe from attacks by the highlanders. The Malayans have introduced among them the use of gold, opium, and fire-arms, and they are very miserable.

From the Koviag coast, M. Maclay returned to Java, but soon undertook a fourth journey to New Guinea, to the southern coast, in order to ascertain the existence of a yellow Malayan race, which was mentioned several times by missionaries and travellers. After an eleven months' cruise on board a schooner, during which he visited the Solomon and Luisiada Islands, M. Maclay stopped on Teste Island, and thence proceeded on board a schooner to Port Maresby (Anapuata), on the southern coast of New Guinea. During his visits to the neighbouring villages, he perceived, indeed, a mixture of Polynesian blood among the Papuans. These metiss have a lighter skin and uncurled hair. They have also taken from the Polynesians the use of tattooing; all women tattoo themselves as long as they have children, and M. Maclay remarks that not only himself, but also many Europeans, find that the tattooed Papuan women are really better looking than the un-tattooed. They cover themselves with tattooing from the forehead to the feet, and often shave the head to tattoo it. The men are tattooed only to exhibit some of their exploits; by simply looking at a tattooed man you can say how many foes he has killed. The south coast is inhabited by the same Papuans as the other parts of New Guinea. Here also brachiocephalic skulls are not uncommon; but the skulls are also distorted, as the women used to bear loads on their backs, in bags that are attached by a rope to the head. The transversal depression of the bones at the *Satura sagitalis*, which results from this custom, is met with very often, and must be transmitted by heredity.

M. Maclay made a fifth visit to New Guinea on board an English man-of-war, to exercise his conciliating influence on the commander, who was going to burn a whole village and destroy the 2000 inhabitants, in order to punish them for killing four missionaries. The visit was very short.

M. Maclay concluded his lecture with a few remarks on the influence of the whites on the inhabitants of the south coast of New Guinea. Whilst rendering justice to the efforts of the London Missionary Society, who spread, by means of their black staff, the Christian religion, and teach the natives to read and write, M. Maclay pointed out that traders follow immediately the missionaries, and spread among the natives diseases, drunkenness, and the use of fire arms, which completely counterbalance the good influence of the very small amount of knowledge that might be spread by missionaries. The London Missionary Society does not allow its members to be at the same time the bearers of religion and of the above-said "benefits of civilisation"; but several missionaries of other societies appear in both these qualities. M. Maclay hopes, however, that the climate of New Guinea will be a good ally of the natives in their struggle against the white.

THE AURORA

WE have received the following further communications relating to the electric storm and auroral display of November 17:—

HAVING read in the English journals how very extensively and simultaneously the remarkable display of aurora borealis was observed in Europe and the United States, I beg to forward the inclosed report from Prof. Tacchini (see below), taken from a newspaper in Rome, describing that splendid phenomenon as it appeared in this country on the evening of the 17th inst, which probably may interest some of your readers. I would merely add that on the evening in question I was travelling between Spezzia and this city, when my observation was absorbed by the brilliancy of the beautiful phenomenon as seen from a railway carriage, and which accords very closely with the appearance of it in Rome. Soon after sunset the north-western sky was diffused with richly-coloured roseate tints blending into crimson at the horizon, which continued up to 7 p.m.; the transparency of this apparently roseate cloud was also a very remarkable feature, for the stars of the Great Bear were seen through it with little diminution of lustre; the sunset was very noticeable, which I remarked before branching from the coast where I had the sea horizon, and I never saw a more distinct and clear disappearance of the sun at sea below the horizon, even to the clearness of the atmosphere. Aurora borealis is so seldom seen in this country that its appearance caused much public curiosity. ERASMUS OMMANNEY

Florence, 12, Lungarno, November 30

THE following account of aurora borealis, seen on the 17th ult., at the Observatory of the Roman College, was sent by Prof. Tacchini to the Roman journals:—

"Yesterday evening (the 17th), a few hours after sunset, a fine aurora borealis appeared on our horizon. Besides the magnificent rosy arch melting away above, I saw, below, the so-called dark segment, which had a most lovely azure-greenish colour.

"At 5h. 50m. the red ribband rose more than 30° above the horizon, but at 5h. 55m. clouds suddenly covered almost the whole of that part of the sky occupied by the aurora, and a storm, with lightning, arose in the north. At 6h. 18m. there was a slight clearance, and through the aurora, which had already paled, shone some of the stars of Ursa Major. The highest point of the dark segment was precisely between the stars α and ζ of that constellation, being about 14° above the horizon, and 17° from the north towards west, therefore nearly in the direction of the magnetic meridian, and with an amplitude of about 45°. The weather continued bad, and at intervals rainy, and at 6h. 32m. were seen the last traces of the phenomenon. From the auroral light only a very faint continuous spectrum could be obtained, but I could not make such observations at the most opportune moment.

"Several falling stars were observed through the aurora. A magnetic perturbation occurred yesterday, and in the night, and continued also to day; and, moreover, there is on the sun a large spot, easily visible on using merely a piece of smoked glass.

"The large diameter of this spot is slightly less than the thirteenth part of the apparent diameter of the solar disc. The spot appeared on November 12, at the eastern limb in the sun's boreal hemisphere, and on the 12th and 13th magnetic perturbations occurred. Yesterday I could not observe it well, because of the bad weather; but the day before, clouds of hydrogen were seen on its nuclei, and this morning still the phenomenon is most brilliant, demonstrating the greater intensity of solar phenomena over the spots in the atmosphere of the sun, which may thus be called solar auroras.

"Again, the magnetic perturbation of yesterday and last night is connected with that vast storm depression, which embraced a great part of Central Europe and especially Italy.

"We will further record here, that in the beginning of last October another aurora borealis was observed, and that then also there were strong magnetic perturbations in the earth, and large spots on the sun, seen on the limb on September 25.

"The Director of the Telegraphs has announced that very great perturbations occurred yesterday on all the lines, and from Belluno, Milan, Turin, Moncalieri, Venice, Porto Maurizio, Parma, Modena, Genoa, Luveno, and Viesti have come telegrams, showing that in the north the phenomena must have been very splendid. From Venice the Director of the Observatory states that yesterday morning at 4 o'clock, gleams of auroral light were observed. "P. TACCHINI

"Observatory of the Roman College, November 18"

I AM afraid you must have been overburdened with auroral communications, but perhaps you will kindly allow me on this occasion a little more space. Mr. E. Dowlen witnessed at Medway, Poynton, Cheshire, but little of that of the 17th; but on the 13th saw an auroral haze with shafts of white light, at 6 p.m. in the north and north-west. This had been preceded by a rose-red sunset, unlike an ordinary one, and accompanied by magnetic clouds. He also noticed an auroral glow on several subsequent nights.

On Friday last (the 24th) the Rev. W. Pearce saw a fine aurora at West Horsley, about six miles east from here. It commenced about 9h. 15m. by a yellow glow in the north-north-east and north-north-west, which increased in brightness and rose upwards, until at 9h. 30m. the Great Bear was hidden by it. It then changed to a rose tint, and spread laterally; was at its greatest brilliancy at 9h. 50m., and disappeared at 10h. 15m. Mr. Prince, of Crowborough (who, from the movements of certain insects and the magnetic disturbances, anticipates a severe winter), remarks that the "bright beam" must have been like a row of patches of light he saw on last October 3, southward and nearly parallel with the auroral arch northward. As some of your correspondents seem to ascribe a meteoric character to this beam, I may add I examined it carefully with a large Browning direct-vision spectroscope designed for auroral observations, and found only the well-known citron line, and none other. Also a faint greenish-white continuous spectrum extending a short way from that line towards the violet. This might have been auroral or from moon reflection. I had just previously examined the sky in that direction, and found no auroral line.

Mr. Saxby's letter is interesting in fixing approximately the position and height of the beam, especially when read in connection with Messrs. De la Rue and Müller's vacuum experiments and their table of heights assigned to auroræ, and it is still paradoxical that if such electric displays be within the limits of our atmosphere the air-spectrum is conspicuous for its absence, while it is replaced by one the principal line of which is not found in any other form of matter in the sky or on the earth.

On the other hand this point would not be inexplicable if the aurora be considered a something *per se*, as, for example, phosphorescence (strongly marked in the recent auroræ), excited by the electric discharge. That in such case it might wholly or in great part appropriate the spectrum to itself is shown by the instances of indium, thallium, and some other volatile metals which, when used as electrodes for the condensed spark, give spectra in which the air lines are either absent or faint, and when burnt in the arc have a similar effect on the carbon lines. I have elsewhere pointed out the probability of the aurora being referable to a form of phosphorescence.

The moonlight was unfortunate as regards the masking the fainter lines of the spectrum. I see one record of a faint red line, but except this of no other lines. If any of your readers have fixed the other lines, you will no doubt find space for so important an observation, for it is curious how little we know of the exact positions of these. I believe the measurements of a full set of the auroral lines made by my friend Prof. Vogel of Potsdam, in April, 1872, still remain the only standard, and as we now seem at an auroral period I would earnestly urge upon spectroscopists their special attention to these fainter lines, with a view to fixing their positions. This, too, is important, as there is a suspicion they are not always the same in different displays. The mode of doing this is not, however, very easy. If the spectroscope is of very small dispersion, the lines will be too close for useful measurement. With one of larger dispersion the introduction of a comparison spectrum or an illuminated micrometer scale will swamp the lines. A single illuminated point or line working across the field, the eclipsing the lines successively behind a diaphragm of tinfoil (as suggested by Mr. Lockyer), and a scale photographed on thin glass, through which the lines are seen, and which is itself illuminated by the spectrum, are severally better methods, and might perhaps yield some available results.

Guildown, Guildford, December 1 J. RAND CAPRON

THE unique nature of this meteor must be the excuse for adding another letter on the subject. Your correspondents, Mr. Taylor of Heworth Green, York, and Mr. Elger of Kempton, have kindly answered queries of mine as to the exact place of the passage; these stations being the most important, after the transit stations of Woodbridge and Old Windsor. After Mr. Saxby's letter of November 30, any farther notice may seem superfluous, were it not that the elements he assigns cannot explain the observations. At York the meteor could not have

appeared at only 8° altitude, and it is described as 6° under the moon, or 19° alt. ; and the passage from Woodbridge to Bristol could not occupy over two hours (at a mile a minute), as the whole difference of time is certainly only a minute or two. We must then seek for more consistent elements.

From the York, Bedford, and Old Windsor observations, the meteor was at about 170 miles elevation, allowing the first station half the weight of the second. Or, combining York and Bristol, which were more nearly simultaneous, it was at over 300 miles elevation. Its visible passage of about 200 miles in length did not occupy two minutes, and was so brief as to be marked by the watch errors of observers ; it therefore moved more than 100 miles a minute. Again, it was two minutes in view, by Greenwich ; and it passed the meridian with at least twice its mean apparent velocity (as most observers mention its lingering in both east and west) ; this, with the least height of 170 miles, gives a minimum of fifteen miles per second for its velocity. Another proof of its height is, that though seen in Sweden, yet it appeared to form and pause at 10° alt., as seen at Bristol and Heworth, and did not come up from the horizon.

Can it be supposed that an auroral ray would sweep over 1000 miles from Sweden to Sidmouth, with a velocity of over fifteen miles a second? This is, however, just the velocity of planetary matter ; and apparently the most probable explanation of it is that it was a cloud of meteorites ("quite unlike an auroral ray," says Mr. Capron) which just escaped grazing the earth's surface. In this case their velocity would be at least over twenty miles a second, moving in about the plane of the earth's orbit, and crossing the earth's path at least at 45°, or more radially. Perhaps some computer will work out the path approximately, as other meteors have been so discussed.

Such a cloud of meteorites must have been at least 130 × 20 miles and 20 miles deep if cylindrical, and was apparently accompanied by a smaller cloud, as seen at Clevedon. As it was seen brightly in the moonlight, and yet scarcely dulled the moon in crossing it, the visual area of the solid mass might be about a tenth of the whole area of the cloud ; so that if the particles were as dark as the moon, the cloud would reflect one-tenth as much sunlight in an equal visual area. If then the mean diameter of the meteors was but 1 inch, their volume would equal a sphere of 800 feet diameter, and would have thrown down a rain of meteors, averaging ninety one-inch balls to the square foot, over a district about twenty miles across.

Falling meteors lose practically all their velocity by friction in the atmosphere, before they strike the earth ; since travelling at even 15 miles a second, they would be heated to over 1,000,000° F. by arrest, and yet they do not show in themselves or by their effects, a sign of a thousandth of this heat. All this heat then is produced in the air ; and if a meteor strike the earth obliquely, it will be checked and fall within a very few miles. All the heating of the air must thus take place within a small area, in whatever way the meteor may strike. The result then of such a meteor cloud as has been just seen, hitting the atmosphere (as it only escaped doing by a quarter of a minute) would be to heat the air for some twenty miles in each direction to about 10,000° F., or still more if the arrest occurs entirely in the upper regions. This hot air would quickly rise, and spread out above the cooler atmosphere, causing a great in-suck along the earth from surrounding parts. On the upper surface it would quickly cool by radiation into space ; and the effects of such a shower to terrestrials would be a terrible gale, blowing towards a centre and upwards, with considerable heat radiating from above.

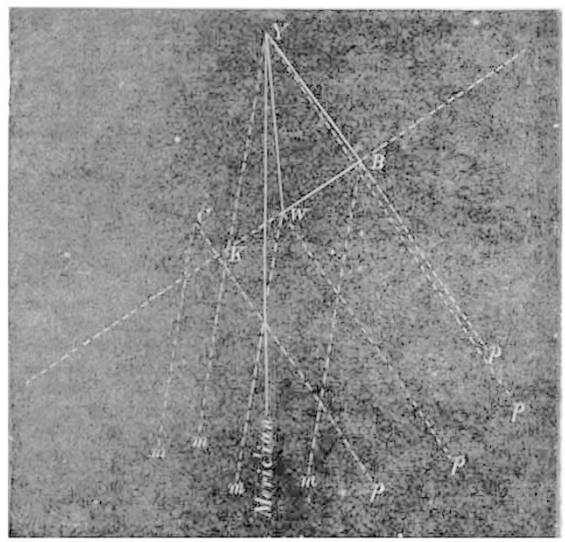
W. M. FLINDERS PETRIE

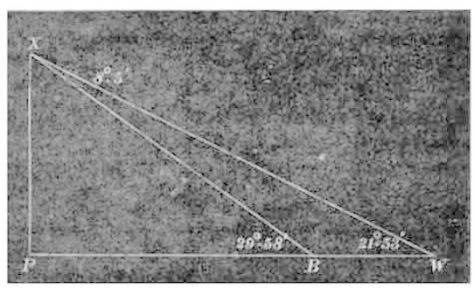
Bromley, Kent, December 2

CONCERNING the apparition during the aurora of the 17th, I ought to have stated the apparent altitude angle between it and the moon when at nearest approach, but as the angle was larger here than anywhere south, it was more difficult to estimate ; but I think it was about 12 moon-breadths, at the very most or 6° (centre to centre). Also I foolishly forgot to note the *exact* time, but it was 4 or 5 minutes past 6 p.m. I saw no repetition of the phenomenon for 5 minutes after, and I then went indoors. It is evident that if it was the same object that was seen to transit the moon's disc both at Woodbridge (near Ipswich) and Windsor, that it must have followed a path from north-east by east to south-west by west (astronomical) since the intersection of its plane of motion with the plane containing York, Woodbridge, and Windsor, lies in that direction. Most of the observers state that it seemed to appear about east, and disappear south of west. Let *Y*, *W*, and *B* represent York, Windsor, and Woodbridge respectively in their relative positions. *C* represents Clifton.

We have $Y B = 162$ miles.
$Y W = 172$,,
$B W = 94$,,
$C K = 40$,,

If it be supposed that the object pursued a *nearly straight path*, keeping at a nearly constant height (and this is not inconsistent with the observations), then it ought to have reached its greatest angle of elevation along lines drawn perpendicular to line *B W* from each place of observation (it seemed to do so at Greenwich, Bedford, and Cambridge, though all the observers do not state whether they reckoned by magnetic or astronomical bearings). The moon was about 8° past meridian, and at York the altitude was about 24°, and at Woodbridge 26° (there being 2° of latitude between). If we consider the angles with respect to the *plane Y B W*, which simplifies matters, then elevation at York = 25°, and at Woodbridge the same ; and as





angle between directions *Y m* and *Y P* = 36°. Then tan of angle of culmination at York will be equal to

$$\frac{\tan (25^\circ - 7^\circ)}{\cos 36^\circ} = \tan (21^\circ\ 53'),$$

and tan angle of culm. at Woodbridge will be equal to

$$\frac{\tan 25^\circ}{\cos 36^\circ} = \tan (29^\circ\ 58').$$

I am supposing the angle below the moon to be 7° for the sake of not exaggerating the height.

York and Woodbridge are in a line almost at right angles to *B W*. Then the parallax of the object when seen along this line (being the line of culmination) = 29° 58′ − 21° 53′ = 8° 5 about.

Thus in diagram No. (2) we have—

$$B x = 160 \text{ miles} \times \frac{\sin (21^\circ\ 53')}{\sin (8^\circ\ 5')}$$

and required height $x P = B x \sin (29^\circ\ 58')$.

This, when worked out, gives the astonishing height of 212 miles above the *plane YWB*. Nor can I see how this result can be lessened in any way, for I have allowed an exaggerated parallax. Again, if the mysterious object was *not* pursuing a path almost straight and parallel to the plane *YWB*, as I have supposed, for the sake of a rough calculation, it must have travelled in a *crooked* one, for which there will be evidence forthcoming no doubt. Now Clifton is forty miles off the line *B W*, and as Mr. A. M. Worthington carefully estimated the depression below the moon from centre to centre to be scarcely 3½ moon diameters, or about 1¾ degrees, then at York, which is 160 miles off line *WB*, the depression ought to be 1¾° × 4 nearly = nearly 7° (but it was not so much). I and Mr. Worthington would see it beneath the moon nearly at the same time, he a little later than I. If the height should be anything near 212 miles, then we ought to hear of it being seen overhead in the north of Italy and Southern France, and it would be 200 miles or so in length. I hope that more accurate observations will be forthcoming to enable some scientific man to calculate the path of this strange apparition with some accuracy. Of course, if the thing laid straight along its path, it would appear to observers in England to be curved along its trajectory, as it did to me. I ought to say that at its apparent formation it was partly obscured by cloud in the S.E.E. (astronomical).

Heworth, York, November 26 H. DENNIS TAYLOR

P.S.—Might I be allowed a little more space just to state that my estimate of the meteoroid's depression below the moon is considered far too much by my mother, who, happening to look out at the same time from a window, noticed it beneath the moon. She described it exactly as I had seen it, but did not notice its movement, as she only looked for a few seconds. If there had been two similar appearances at the same time, I do not see how I could have failed to notice them. Mr. S. H. Saxby estimates its height to have been 44 miles, but he will see that if that were so, then I ought to have seen it pass 17° below the moon. One cannot reasonably suppose that a different object of the same nature has been seen from the South of England, from the one that I saw. I see that Mr. A. Batson has observed it crossing the moon exactly from Hungerford, which place is in almost a direct line with York and the moon at the time of observation. Our observations would be simultaneous, and they give a height of 192 miles. The course of the meteoroid would be 22° south of west, almost as Mr. S. H. Saxby states. Being very anxious to obtain more exact data from observers in Yorkshire I sent a letter asking for information from any such to the *York Herald*, but it has not been inserted. Is there anything inherently improbable in supposing this phenomenon to have been at a height of 190 miles, for have not rapid shooting stars now and then been seen incandescent at nearly that height, indicating the existence of an attenuated atmosphere.—H. D. T.

December 3

ON Friday November 17 last, as I was walking along the north side of Lincoln's Inn Fields, at about 6 p.m., my attention was attracted to the moon, which was then shining brightly in a cloudless sky. I observed a broad band of light having somewhat the appearance of a light cloud, only much brighter, moving across the face of the moon from east to west, which was the direction of its (the light's) long diameter. It appeared to me to extend above and below the moon to about the distance of the moon's diameter, and to be in length about four times its own width; when it had passed about half its own length from the moon, it seemed to disappear entirely. The time during which it was visible, I should think, was not more than half a minute, probably not more than a quarter, and its movement across the moon as rapid as that of a cloud when a very high wind is blowing. EDWARD POLLOCK

20, York Terrace, Regent's Park, December 1

A GREAT manifestation of aurora was visible here last night. It attracted my notice at 11 p.m. At the time of observation by me the aurora was very active, projecting white streamers from a point in the south-west, and these, crossing the zenith, faded in the south-eastern sky. There was a stiff, cold north-west wind blowing, and the night was frosty. No prismatic colours were noticeable, only the usual green auroral glow in the north-west sky, where it was crossed by the shooting streamers. A grand band of vapour rested on the western, north-western, and northern horizons. In the east and north-east was a soft blue sky. The display seemed to me to last throughout the night, and to continue through the day; as all day long, at intervals, streamers shot up from a bank of clouds in the north-west horizon. At 5.30 p.m. this evening there was a powerful auroral glare in the west and north-west. After that time a cloud canopy formed and hid the sky. The weather here in the afternoon of Monday was stormy, with a rising barometer and a falling thermometer, wind nearly a gale, hail, rain, and snow falling at intervals. X.

Worcester, November 28

In NATURE, vol. xxvii. p. 548-9, and 571, will be found accounts of the aurora borealis, as seen by your correspondents on Monday evening, October 2 last. I wish to draw attention to the fact that a grand Aurora Australis of magnificent appearance was visible in Australia on Monday evening, also on October 2, but of course was seen by our Antipodean friends about twelve hours before the one seen at this end of the globe. The reports that I have of the Aurora Australis are from Adelaide, Melbourne, Sydney, Sandhurst, Ballarat, &c. So brilliant was it that the firemen turned out, imagining that there was some enormous conflagration in their neighbourhood. This concurrence opens up the question, was there any connection between these two displays? J. FRANCIS COLE

Westfield, Sutton, Surrey, November 28

BY kindness of Astronomer Royal, Greenwich, I am able to add the exact position of moon at Ramsbury, November 17, inst., at 6h. 2m. :—

R.A. = 21h. 12m. 56s.
N.P.D. = 100° 35′ 7″.

At this time the hour angle of the moon was 35m. 49s., or 8° 57′ 15″ west of the meridian.

The above is the most accurate observation possible for calculating the real position with regard to the earth.

Ramsbury, Wilts ALFRED BATSON

I DO not know whether you will publish more auroral accounts, but if you do, the inclosed seems very interesting. The phenomena, as seen in the north, differed much from *our* views of them. J. RAND CAPRON

Guildown, December 4

"A singular pinkish light appeared in the western sky between 5 and 6 p.m. At the same time I noticed a light of a peculiar yellowish white rising up from the eastern horizon. The general appearance was that of two conical-shaped lights about 40° to 50° wide at base, east and west horizon, their apexes meeting at or about the zenith, Z. The whole of the northern sky was more or less illuminated, but much more marked in the transverse streaks extending east and west, or nearly so in the former case, deepening to a rich crimson pink towards the western horizon, and to the eastern horizon a bright yellowish white. Its southern termination was a well-defined sharp outline forming an arc about 30° to 40° from the south horizon, inside which the sky appeared almost black by contrast, the new moon lending additional interest to this peculiar atmospheric display.

"F. R. CLAPHAM

"Austwick Hall, Clapham, Lancaster, December 1"

WITH reference to J. E. Clark's remarks on p. 85, I would remind your readers that Sophus Tromholt, of Bergen, has organised a system of simultaneous observations on auroras, and that he will supply forms for recording them to any observer who will apply for them. I am not aware whether he has yet arrived at any definite results as regards the height of auroras; nor do I know whether he is making this specially a subject for investigation; nor whether he has enlisted the services of many observers in Britain. Surely J. E. C. is in error in saying that a height of 100 miles is far greater than is now usually supposed. In works on auroras, far greater heights are given, and I am not aware that these have ever been disproved. It is obvious that the curious spindle-shaped beam seen on the 17th must have been at an enormous height.

Sunderland, December 4 THOS. WM. BACKHOUSE

The past week has been one of remarkable electrical disturbances. Auroras were visible Tuesday evening, November 14, all Friday night, Saturday evening, Sunday night, Monday morning, and Monday evening. It was cloudy in this vicinity between the 15th and 16th, and if there were auroræ they were not visible. The aurora of Friday evening, following an intense magnetic storm, was remarkably brilliant, and lasted all night.

During the earlier part of the evening all the visible northern hemisphere was covered by it, but later, about midnight, all the visible heavens, to within 20° of the southern horizon, was covered by straight streamers extending from all points of the horizon to the zenith, where they formed a boreal crown of blood-red colour. The streamers were pulsating towards the zenith, making the sight a peculiarly magnificent one. Early in the evening the arc to the north was about 10° in elevation, and then gradually raised, showing the rich folds bordered by a dark fringe of a magnificent waving curtain, until it reached nearly to the altitude of Polaris. The southern boundary, also bordered on the south by the dark band, seemed to be nearly at right angles to the circle of the northern arc. Monday evening, the 20th, all manifestation was confined to the south. In a point in the south-east, near where Foucalhaut then was, rays shot northward past the zenith, but instead of converging, the rays diverged like the fingers of one's hand. The horizon, too, in the south, seemed much lighter than in any other direction. Though moonlight, the rays could be plainly seen to within 5° of the moon. It may be remarked that of the spots on the sun during this period of disturbance, one has been visible to the naked eye.

L. G. CARPENTER

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November 21

The electrical storm seems to have been as violent in America as it was in Europe, as will be seen from Prof. G. L. Carpenter's letter above. The American papers of November 18 contain long accounts of the phenomenon. The *New York Times* says :—

"Yesterday's storm was accompanied by a more serious electrical disturbance than has been known for years. It very seriously affected the workings of the telegraph lines both on the land and in the sea, and for three hours—from 9 a.m. until noon—telegraph business east of the Mississippi and north of Washington was at a stand-still. An aurora borealis was the first evidence of the overcharging of the atmosphere with electric fluid. This appeared at about five o'clock yesterday morning, and was brilliant in the extreme. At the same hour trouble began to be experienced in the action of the telegraph wires. The circuits were broken, and the usual annoyances accompanying such disturbances were manifested. These increased in intensity until nine o'clock, at which hour it became impossible to transmit messages over the wires having an earth circuit—that is, where the ends of the line were grounded. Such lines as had a metallic circuit worked all right throughout the day, however, and so some little business was transacted over isolated lines. The disturbance continued until 1·50 p.m., when the electric storm seemed to have ceased. During the electric storm Mr. Brown, the chief operator, stated it was impossible to work the cables at all, except by cutting off the ground wires and making a metallic circuit by connecting the land ends of two cables. This was done, but even then the cables worked in a very unsatisfactory manner From all the central offices complaints came to the general office of the failure of the lines to work. People who attempted to use the telephones heard a buzzing, ringing noise, rather than any well-defined sound while attempting communication, and occasional words only could be distinguished. A singular fact in connection with the storm was that the wires of the Law Telephone Company did not seem to be affected. Engineer Shaw stated that they had had no more trouble during the day than usual, and attributed this to the fact their lines are all short ones, and therefore less liable to be affected than the longer lines. Their wires are ground circuits, and their freedom from annoyance is a mystery that he can solve in no other way than the one suggested.

From Chicago, under date November 17, the following details of the disturbance were sent to the *New York Times* :—"Officers of the Western Union Telegraph Company there say the electrical disturbance was the most pronounced and wide-spread experienced for years, if indeed it has been paralleled at any time. An electric storm of the greatest violence raged in all the territory from New York to points beyond Omaha, and from Kansas City north to the terminus of telegraphic communication, practically putting a stop to the telegraphic service over the entire area. It first began to be felt about 4 o'clock this morning and increased in intensity till 9.45, when communication from every direction was cut off. This electric storm seemed to go in successive negative and positive waves, alternately neutralising the currents on the wires or increasing their intensity to such a degree as to burn everything up. The switch-board here was on fire a dozen times during the forenoon, and half a dozen keys of the instruments were melted by the current which continued to pass through. The screws burned up and the points parted to their furthest limits. The duplex and quadruplex wires were rendered entirely useless, and at noon only a single wire out of fifteen between this city and New york was in operation, and it was frequently interrupted. Word was received from Milwaukee that the atmospheric electricity coming in on one of its wires from the country had such dynamic power as to keep an electric lamp burning."

Somewhat similar observations were made at Washington. On the Chicago and Cincinnati circuits it was found impossible to work the quadruplex instruments, and they were taken out. The chief operator said that the magnetic interference was greatest on the east and west lines. The officer in charge at the office of the Signal Service, said that great trouble had been experienced in collecting the weather reports on account of the general demoralisation of telegraphic circuits.

Similar reports were sent from Cleveland, Indianopolis, Cincinnati, Milwaukee, Nashville, Bangor, Toronto, and other places. At Cleveland the disturbance was first observed at 4 or 5 o'clock in the morning. From Milwaukee it was reported that "Strong currents of electricity pervaded the atmosphere and actually suspended all telegraphic communication from 9 o'clock in the morning until afternoon. An electric lamp attached to a St. Paul wire produced a brilliant illumination without the use of a battery. Business on 'Change was virtually suspended on account of the lack of telegraphic facilities. At 2 p.m. all the telegraph offices resumed work."

The *Detroit Evening News* states that "telephone communication all over the country was greatly improved, the pronunciation being distinct and much louder than usual, which fact may suggest to electricians an improvement in telephonic communication. Another unusual thing was that the electrical storm prevailed during a cloudy sky and murky atmosphere ; heretofore such storms have occurred during a clear atmosphere. With the approach of night and the clearing away of the clouds came a most beautiful spectacle of the electrical agitation of the atmosphere. A more magnificent display of aurora borealis was never seen. It became slightly visible just at dusk, and increased in brilliancy and variety of form, movement, and colour, until midnight, when the whole vast heavens was one grand canopy of dancing flames of every conceivable hue and shape moving in all directions."

At Omaha the aurora was very brilliant, the illumination rendering the night almost as bright as day. At St. Paul the sky was of blood red colour, the display being grand and fearful. Cheyenne reports the illumination at that point as bright as day. At Denver the display in the northern heavens was most brilliant and dazzling. In California the aurora was visible from the northern part of the State as far south as San Diego, and was most brilliant. At Olympia, Washington Territory, the aurora was magnificent, the heavens north and east being brilliantly illuminated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

LONDON.—At a meeting of the Council of University College on Saturday last : 1. Mr. H. F. Morley was authorised to give a course of advanced lectures on Organic Chemistry. 2. It was resolved to invite Mr. T. W. Rhys Davids to accept the Professorship of Pali and Buddhist Literature, once held by the late Prof. R. C. Childers. 3. It was resolved to ask Mr. R. H. Gunion to take the office of Lecturer on Sanskrit. 4. The resignation of the Chair of Physiology by Prof. Burdon Sanderson was accepted.

MANCHESTER.—A public meeting was held last week to inaugurate a movement for the extension of Owens College by the addition of a museum, which is expected to cost between 50,000*l.* and 60,000*l.* It was stated that there were a few thousand pounds in hand available for the purpose, and it was resolved to ask the public for 50,000*l.* to erect and equip the museum. Fourteen subscriptions of 1000*l.* each and a number of others ranging from 100*l.* to 500*l.* each were announced in the room. Lord Derby, the Duke of Devonshire, Mr. Hugh Mason, M.P., and Mr. Grafton, M.P., each offered 1000*l.*