

sides the blue and violet, saw Angström's green aurora\* line perpetually over citron acetylene at W.L. 5579, and the red aurora line between sodium  $\alpha$  and lithium  $\alpha$ , but nearer to the latter, say at W.L. 6350.

3. Now, W.L. 6350 in the solar spectrum is a pretty bright scarlet red, so that orange could easily be made of it by the green aurora mixing therewith, and the spectroscope separates each of the two kinds of light with perfect ease. But how came potassium red or W.L. 7700, *i.e.*, the blood red, lurid red, and tragedy red of painters to appear so markedly to the naked eye, and yet not be seen at all in the spectroscope, either as a new ingredient or an altered place of the red line? It would apparently be by the mixing up of rays and streamers of the *blackness* out of that long, low dark arch on the northern horizon. But when a spectroscope fails (as fail it must) to show a characteristic line for a region of blackness, what other instrument can we take to prove the case?

Excessively faint greenish and bluish lines appeared at wave lengths 5300, 5100 and 4900 nearly; but the main light in the spectroscope was to the extent of 8-tenths of the whole, that of the green line 5579, and of 1·7-tenths the red line 6350; while to the naked eye the splendour of the display and its variety consisted in triple mixtures of 5579, 6350, and the unknown dark medium. Could something be ascertained about that, if those who have good telescopic star spectroscopes were to observe a star when shining through one of these inky black arches?

At 9.30 P.M. when all the aurora had faded or passed away towards the south, where a few straggling pink patches still appeared, the northern horizon and its sky being now free from the black arch, as well as the green streamers, perfectly astonished me by the clear pellucid blue of a true starlight night sky in a bright climate and clear atmosphere. Evidently the dark arch and streamers are as much a part of the aurora as the green and red lights, but how to investigate them—that is the question.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, Feb. 5

LAST evening an aurora of rather unusual brilliancy was seen here. I happened to be out with a friend in the country about sunset, when the sky was completely overcast and fine rain was falling. We noticed that darkness did not come on so quick as usual, and at 7 o'clock it was so light as to lead my friend to believe that the moon was shining above the clouds. Later in the evening slight breaks began to appear in the clouds, through which the first magnitude stars were just visible, and through these openings an intense red illumination appeared. The spectroscope gave from every part of the heavens a very bright line in the green, and another fainter one nearer the blue, together with a diffused light over the green and blue parts of the spectrum. The brightest part of the aurora was towards the S.W. From the large amount of light, although it was raining at the time, it must have been one of the brightest auroras that have been witnessed for years.

G. M. SEABROKE

Rugby, Feb. 5

COMING up the Channel on Sunday night last in the P. and O. screw-steamer *Delta*, about 9.40 P.M., I saw a very fine aurora. The sky was cloudy, which somewhat dimmed its brightness, but it was rather brilliant towards the N.

Having a Hoffman's direct vision spectroscope with me, I turned it towards the brightest red portion which lay towards the N.E., and with a moderate slit got a very sharp and distinct line in the green at or near the position of F in the solar spectrum. No other lines were visible. But on removing the telescope, and observing the spectrum with the naked eye, a fine crimson line revealed itself near C; the colour of it was exactly that of hydrogen  $\alpha$ , as seen in a vacuum tube.

I also thought that there were faint traces of structure visible in the blue and violet, but of this I cannot be sure.

There had been traces of auroral phenomena visible early in the same evening. The green line was so distinct that unpractised observers saw it easily. The red line, however, was much fainter, and appeared to flicker.

I much regret that I had no means of recording the position of the lines.

R. J. FRISWELL

ABOUT six o'clock on Sunday evening the ruddy appearance of the upper clouds gave warning of an aurora in prospect, but I was not prepared for the magnificent sight which appeared on

looking out an hour later. The higher part of the sky seemed covered with bright rose-coloured clouds, which, from the dark masses of clouds passing underneath, seemed continually to be shifting in position. Intervals of deep green appeared amongst the red, and these, when looked at with a spectroscope, gave a stronger light than their surroundings. Objects near were illuminated as if the moon had risen behind the clouds. I had a miniature spectroscope of Browning's, with which I examined the brightest parts, and obtained four lines—one very bright green, two very faint nebulous green bands, and one red line. Having a spirit lamp handy, in which were remnants of sodium, lithium, and sulphate of copper, I was able roughly to estimate the positions of the lines. The red was about a third from *D* towards the lithium line; the very bright green about a third from *D* to the copper line near *b*, the other faint green bands were more refrangible, and I should think their places were between *b* and *F*, and near *F*, but I could not get their positions so well as the other two; certainly the most refrangible was not so far as the violet-potassium line which I could see in the field.

The light green was present everywhere, the red only showed occasionally with very varying intensity, and the most refrangible green line was also continually varying, but it was brighter than the second green line.

The light around attained its maximum about a quarter to eight, and then very slowly diminished to about midnight, when it had nearly disappeared. A light drizzling rain was falling the whole time.

J. P. MACLEAR

Shanklin, Feb. 5

THERE has been a magnificent red aurora here this evening. I saw it first before twilight had quite disappeared, and at first thought it was the crimson of sunset unusually late. It was at its finest between six and seven; at that time there were columns of light shooting up from the horizon almost to the zenith, and occupying almost half the horizon from the E. of N. round by E. The crimson colour was variegated with bluish white in a way that I have not seen before. The barometer was at about 29·45 inches, with a strong breeze from the south.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Feb. 4

THERE was a fine display of aurora here yesterday evening. I first observed it about 5.30, just in the twilight, but it was then confused with the rays of the setting sun; as the darkness deepened the aurora came out alone, and was then extremely beautiful. It extended from the extreme N.E. to the extreme N.W., but from the reflection of the numerous clouds, appeared to have a much larger area. It was of a bright crimson colour, with the rays golden or orange, of which, however, only a very few were visible.

As the evening came on, about 8 o'clock, the clouds gradually became thicker, and at last almost entirely covered the sky; the only effect then apparent was a deep red glow, which continued with unequal intensity until 11.45, and with all probability much later. At 9.35 there was a break in the clouds towards the E., when the aurora shone forth in all its splendour. The aurora was most certainly visible in daylight, just appearing as the twilight came on.

I have no doubt if the atmosphere had been clearer, we should have had a most magnificent display; as it was, the effect was really beautiful.

J. S. H.

Gloucester, Feb. 5

THERE has been a magnificent and extensive auroral display this evening, of which I beg to send you the following account.

After a very heavy fall of rain, which lasted in this part of the country from 1 o'clock P.M. until 5.30 o'clock, there were collected in the northern horizon numerous *cirro-stratus* clouds, which gradually at first, and afterwards rapidly, moved towards the E., with the strata to the S. As these were passing away, I saw, about midway between these clouds and the zenith a bright patch of pale red light, which became well defined by 6 o'clock. A few minutes after this appeared I saw in the N.W. another patch of red light, and by 6.15 there stretched from N., N.W., and N.E. three very broad streamers converging in the zenith, and forming a splendid crimson canopy, the streamers being quite separated, until meeting, by dark spaces. These slowly disappeared, and of a sudden there appeared a bluish-white streamer stretching N.E. to and passing the zenith by about 10.