Letters to the Editor.

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The Solar Eclipse of January 24 and Wireless Signals.

DURING the solar eclipse of Saturday, January 24, the engineers of the Post Office and of the International Western Electric Company, at the instance of Admiral Sir Henry Jackson, measured the strength of wireless signals received from New York at Chedzoy in Somerset and at New Southgate, London. The results show that the signal strength rose to a sharp maximum and fell to a very sharp minimum during the progress of the eclipse.

At 14.12 G.M.T. totality occurred at New York and more than half of the trans-Atlantic track of the signals was in partial darkness; at this instant the strength of the signals received in England was observed to be about twenty per cent. above normal. At 14.52 first contact was visible in London, and by this time signals had increased to about double the normal strength. A few minutes later the centre of the total phase was in mid-Atlantic about 400 miles to the south of the wave track, and the whole of the track was now in partial darkness. The signal strength rose to a maximum first at Chedzoy and then at New Southgate. During the next half-hour the centre approached the wave track rapidly by moving in a north-easterly direction, and signal strength decreased greatly. At 15.30 the last contact occurred at New York, and at about 15.40 the signals received at both places of observation had fallen in strength to a minimum value less than one-fifth of the normal. At this instant about 300 miles of the western end of the wave track was in full daylight and the centre of the eclipse was crossing the wave track about 500 miles to the west of Ireland. By 15.45 the centre had moved beyond the Faroe Islands, daylight had returned, and at about 16.10 normal signal strength was regained. Throughout the eclipse directional measurements were made by the staff of the Radio Research Board, but no effect on bearings could be detected.

The occurrence of the maximum and minimum signal strengths on this occasion recalls the observations on the eclipse of Wednesday, April 17, 1912 (see NATURE, April 25, 1912, Vol. 89, p. 191). On that occasion, as there was no conveniently placed wireless station at work, the observations were made on "atmospherics" or "strays," which the meteorological conditions indicated were coming from Spain or North-west Africa. These earlier observations and also the new ones seem to be explained by the ionisation of the atmosphere by sunlight and the re-combination of the ions when the light is removed. This explanation was set forth in a paper read to the British Association in September 1912, as follows:—"My observations indicated that, firstly, when the penumbra stole over Western Europe and Western Africa propagation grew rapidly better; secondly, as the umbra itself crossed the Bay of Biscay towards France it began to hinder propagation, its interference being greatest after it had entered France near Les Sables, which means that at this moment it lay directly between London and the source of the strays; thirdly, that when the umbra passed on, the ionic medley it had created by re-combination of ions faded quickly" and propagation improved. The suggestion here is that the hurried and irregular re-combination of ions produced an ionic turmoil which obstructed electric waves. The obstruction arose, I suggested, not so much from absorption as from irregular refraction, the refraction being a consequence of the dependence of the velocity of electric waves through rarefied air upon the nature and concentration of the ions in it.

The interesting question now arises: What levels of the atmosphere are mainly concerned in these phenomena? Students of wireless telegraphy have long believed that there is an upper region in which free electrons exist more or less permanently and a middle atmosphere in which ions of molecular size are formed daily by sunlight. If I may quote again from my own writings: "Wireless investigators would suggest that the layer beneath the auroral layer is occupied by electrons that have come as beta-rays from the sun. The atmospheric pressure at above 50 kilometres is only about a millionth of an atmosphere; the mean free path of the electrons is therefore long and they may possibly remain permanently free in large numbers. It would seem that the base of this region charged with free electrons must be regarded as the ceiling usually known as the Heaviside layer." At night this ceiling reflects wireless waves of all lengths round the globe as a whispering gallery reflects sound. In the day the air below it is ionised, absorbs the waves in some degree, and gives to the rays a curvature which is greater as wave-length increases. To the Heaviside layer is attributed the "night effect" which afflicts direction finding. As no such effect was observed during the eclipse we may provisionally assume that the Heaviside layer did not come prominently into operation and that the middle heights of the atmosphere were responsible for the phenomena observed.

Sir Arthur Schuster, in his theory of the diurnal magnetic variations (Phil. Trans., A, 208, 1907, p. 182), requires that a portion of the upper atmosphere should possess a conductivity of 10^{-13} electromagnetic units in order to account for the usual variations. Prof. S. Chapman has of recent years elaborated this suggestion. But whether this portion of the atmosphere is above or below the Heaviside layer is not yet clear. It would seem that simultaneous observations of the effects of solar eclipses on the magnetic elements and on the propagation of signalling waves offers a means of solving this question.

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Polarisation of Light from the Sky during the Solar Eclipse of January 24.

DURING the total eclipse on January 24, I was at New Haven, Connecticut, and thus very close to the middle line of the track of totality. For a portion of the period of totality I made a somewhat hasty survey of the state of polarisation of the light scattered by the sky, using for the purpose a Savart plate and Nicol prism. I was only able to cover the eastern sky from the zenith to the horizon stretching from north through east to south, and I was unfortunately not able to determine the plane of polarisation of the light scattered from the various parts of the sky. What I was able to note, however, with certainty was that there was no marked variation in the percentage of polarisation as one explored the eastward half of the sky—that is, there was no trace of the familiar maximum noted when the sun is not in eclipse.

As I am a physicist and not an astronomer I am not sufficiently familiar with the results of observations