## LETTERS TO THE EDITOR.

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### Magnetic Storms.

IN supplement to my letter in the last issue of NATURE I may add that if a solar outburst, acting in the way supposed, causes a magnetic storm which lasts eight hours, the effective influence of the whole group of electric streams at the distance of the earth must extend over a breadth of about six million miles; so that if simply conical, with vertex at the sun's centre, the angle of the cone would be four degrees. Projected back to the surface of the sun, this would correspond to what we may call a "spot" about one-thirtieth of the visible disc in diameter; but, inasmuch as the trajectory of the particles in the beam would be slightly curved, the size of the actual solar eruption could be much less.

Until the main outlines of the view advocated are approved by those most competent to judge, it is useless to enter into further details.

I regret to notice a numerical slip—fortunately unimportant, since it affects nothing else—in the top line of my letter on p. 426, where the current equivalent should be expressed, not in hundred thousands, but in hundred millions of amperes—an order of magnitude which is "reasonable" rather than "surprisingly moderate."

October 9. OLIVER LODGE.

### Magnetic Storms and Solar Eruptions.

I HAVE read Sir Oliver Lodge's letter (NATURE, October 7, p. 425) on the above subject with some surprise. The emission theory which he supports, and which he claims to have originated, regards kathode rays from the sun as the electric carriers, and so is presumably the same as has been actively advocated by Prof. Kr. Birkeland for a number of years. He seems, however, to be unaware of the existence of Birkeland's volumes[1] on the subject, and of the numerous numerical calculations therein contained. He also makes no reference to the important mathematical work of Prof. Störmer, which cannot, I think, be disregarded by anyone whose theory postulates the introduction of charged particles from without into the earth's magnetic field. The general idea that magnetic storms are due to some action arising in the sun goes back to at least the time of Broun and Balfour Stewart, and different forms of the emission theory have naturally presented themselves to various minds independently, as Röntgen, kathode, and other rays came successively under our ken. It is when we come to details that real troubles arise. Most people, I take it, have little difficulty in believing in a general way that the changes of declination experienced at a single magnetic observatory, say Kew, during a magnetic storm can be accounted for by a stream of electrons in the magnetic meridian, provided it is possible for the direction and intensity of the stream to be altered at frequent intervals. One doubts this just as little as that the motion of the magnet of the declination magnetograph at Kew on September 25 could be reproduced with the aid of a copper wire, a single battery cell, a commutator, and a resistance box. Those who have seen Störmer's calculations and studied Birkeland's volumes will realise, however, that to be regarded as an advance of knowledge at the present day, a theory must afford an explanation, not merely of what is taking place in a single magnetic element at a single station, but of what is taking place in all three elements at a number of stations. Coming, now, to Sir Oliver Lodge's own calculation, it seems based on an inadequate idea of the phenomena of the late storm, derived from a description of one or two of the more striking changes at Kew as recorded in your columns and those of the *Times*. It is rare for a disturbance to be limited to the declination, *i.e.* for the disturbing force to be wholly perpendicular to the magnetic meridian. The component in the magnetic meridian is, as a matter of fact, usually the larger. A vertical component is also usually present. A magnetic storm does not usually consist of a disturbing force in a fixed or nearly fixed direction, waxing and waning. Each of the three elements usually exhibits values both above and below the normal, and not infrequently there are many excursions on both sides of the mean. This will, I think, be readily recognised by anyone who consults the reproduction of the Stonyhurst curve of September 25 in your columns and of the Kew curves in the *Electrician*. After inspecting these curves it will, I think, be recognised that it is quite out of the question to limit the passage of the imaginary solar jet, as Sir Oliver Lodge does, to the fifteen minutes near the end of the storm, when there occurred the prominent declination oscillation to which he has confined his attention. Even whilst this oscillation took place, it was far from representing the total disturbance. Simultaneously with it, but partly overlapping, as is often the case, there was a very large change in progress in the horizontal force. Those looking at the curves will, I think, agree that if there was a jet such as Sir Oliver Lodge supposes, its time of transit took, not fifteen minutes, but at least nine hours. His estimate of the diameter of the cone thus requires multiplication by 36, with a consequent multiplication of the cross-section, if it were circular, by 1296. Large as this may appear, the jet theory requires it to be often exceeded, as the storm of September 25 was an unusually short one. The average duration of the storms in Mr. Maunder's Greenwich list, from 1882 to 1903, was almost exactly thirty hours, so that the cross-section of the average storm-jet would be naturally fully 14,000 times that given by the calculation in your columns. The really crucial thing is that the magnetic disturbances which occur simultaneously at different stations are inter-related. It is in accounting satisfactorily for these inter-relations that Birkeland, who has given years of thought to the subject, encounters his main difficulties.

In pointing out these facts, I am not expressing any opinion for or against any or all of the emission theories. What I think is really called for at the present moment is a reservation of judgment as to theories, and a more minute study and inter-comparison of the records from different observatories with a mind as unbiased as possible by preconceived ideas. C. CHREE.

October 9.

[1] "Expédition Norvégienne de 1899-1900," and "The Norwegian Aurora Polaris Expedition, 1902-3," vol. i.

### Fireball in Sunshine.

WITH the sun shining in a beautifully clear sky on October 6, at about 9.40 a.m. a large meteorite passed over central England, and was well observed from many widely distant stations. People noticed it in Norfolk, Suffolk, Gloucester, Somerset, and other counties, but the observations, owing to the absence of visible sky marks, are not very definite.

The meteor was brilliant; it had a slow motion, traversing a long path in about four seconds, and it left a luminous trail of short duration. An observer at Bristol says it burst with rocket-like effect at the finish. The meteor had a radiant in the south or south-east sky, but the place is uncertain. At the time of the observation Leo was on the meridian and Virgo and Boötes near.

At Cottesbrook, Northamptonshire, a loud detonation followed the meteor in four minutes, which corresponds to a distance of fifty miles. At East Haddon, Holdenby, and other small towns and villages north-west of Northampton the noise of an explosion was heard, doors creaked, windows rattled, and people ran out of their houses in terror, thinking that an earthquake had occurred. The final disruption of the meteor evidently took place over the region ten or fifteen miles north-west of Northampton, and its direction of flight was from S.S.E., so it must have passed over, or nearly over, London.

Further observations will be exceedingly useful if they are sufficiently exact to be utilised. W. F. DENNING.

### The Mansfield Automatic Water Finder.

CAN any reader of NATURE supply the names of the "leading scientists" who are stated to have "thoroughly investigated" this instrument "and vouch for the successful application of the invention"?