Saturn; graphical methods for the prediction of occultations and the variation of elements; and various improvements in mechanical quadratures.

In 1882 Callandreau formed one of the Hayti expedition to observe the Transit of Venus. In 1886 he became *Répétiteur* at the École Polytechnique, and in 1893 *Professeur du Cours d'Astronomie*; in the latter year he was elected a Member of the Institute of France, in the section of Astronomy, on the death of Admiral Mouchez. He was, with MM. Bigourdan and Radau, one of the editors of the *Bulletin Astronomique*, and to Callandreau must be assigned a share of honour for the high reputation of that journal.

M. Callandreau died suddenly on February 13, at the age of 51, leaving a widow and seven children. E. T. W.

CORRESPONDENCE.

To the Editors of 'The Observatory.'

Sun-spots and Magnetic Storms.

GENTLEMEN,—

I notice on page 79 of your last issue that Mr. Maunder, in speaking of 19 great magnetic storms, is reported to have said that "7 coincided with the passage across the centre of the disk of one of the 19 great spots." Presumably the *central meridian* is intended, for no spot can transit the centre of the Sun's disk unless it is situated in an exceptionally low latitude, and most spots cross the meridian at considerable distances from the centre.

The reason I mention the point is that I wish to enquire whether distance from the centre of the disk at the time of meridian passage of a spot has any appreciable effect on the intensity and duration of the accompanying magnetic storm?

If the magnetic disturbances on the Earth are caused by streams of electrons, or charged corpuscules, projected from the very limited regions of the Sun's surface included in the umbræ of spots, it is evident that these streams must issue often at considerable angles with the direction of the Sun's radius. Yet, according to the results given in Mr. Maunder's interesting paper, this angle would seem seldom to exceed some 34° in the direction of solar longitude; for the storms usually begin from 34 hours before to 86 hours after the meridian passage of spots, which gives a total angle of 68° in longitude as the approximate limits of action * (or perhaps more than this if the duration of the storms is taken into account). If the average westerly position of the spots at

* It would be of interest to know whether the spots giving the greatest deviations from the mean position 26 hours west of the meridian are among those passing nearest to the centre of the disk. If not, then the above angle of 68° must be increased somewhat.

the commencement of the storms, *i. e.* about 26 hours west of the meridian, is wholly due to the time taken by the particles in passing from the Sun to the Earth, it follows that the streams may be equally inclined east or west of a radial line, giving thus 34° as the greatest inclination in either direction.

But how far are the effects felt in the direction of solar latitude north or south? Many of the "great" spots cross the meridian very far from the centre of the disk, especially when they appear in a hemisphere turned away from the Earth, as was the case last October. The two large spot-groups of that month never approached the centre of the disk nearer than about 25°; the emanations which reached the Earth on October 12th and 31st must therefore have been inclined northward from a radial line by this same angle.

It would appear from the above that streams may issue from a spot probably in any direction within the limits of a cone, of which the apex of 68° or thereabouts is in the spot, and the axis is in the direction of a radius. But it seems to me it would be possible with the materials now available to get some notion of the average distribution of the streams within this conical region: are they, for instance, more frequent and intense in the direction of the radius?

It would be easy to classify spots under two heads—(*a*) those which approached within some arbitrary distance, say 10°, of the apparent centre, and (*b*) those which passed outside of this limit,—to ascertain whether there was a greater frequency and duration of magnetic storms accompanying spots of class *a* than those accompanying spots of class *b*.

Yours truly,

J. EVERSHED.

Kenley, Surrey,
1904, Feb. 8.

P.S.—The view that sun-spots are the loci of radiations capable of producing magnetic storms on the Earth was put forward by me in a general discussion on the cause of the darkness of spots, published in the *Astrophysical Journal*, vol. v. (1897). It seems, however, that for "*radiation*" we must substitute the *emanation* of material particles ejected from the spot at a speed of something like 1000 miles a second.

This newer theory is, however, quite in accordance with the view I. expressed and still hold, viz. that sun-spots cannot be regarded as sinks in the photosphere filled up with cool, absorbing vapours. The darkness of a spot must rather be ascribed to the unveiling of an interior region where energy is dissipated by other means than by the emission of light.—J. E.

Eros and the Solar Parallax.

GENTLEMEN,—

In the *Observatory* for February, Mr. Hinks has an article on "Eros and the Solar Parallax." As I differ considerably from