

of the paper was 'On certain Discontinuous and Indeterminate Functions.'

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Secretary.

DISCUSSION AND CORRESPONDENCE.

REQUEST FOR CO-OPERATION IN WORK ON THE
COMING SOLAR ECLIPSE, ETC.

THERE is a very singular phenomenon observed during the moments immediately preceding and following total solar eclipses, that has, up to the present time never been satisfactorily explained so far as I know. Just before totality, usually about a minute before, alternate bright and dark bands are observed sweeping across the country. These have been called shadow bands by some observers, and diffraction bands by others. They can be observed to the best advantage by laying a large piece of white cloth on the ground.

In some eclipse reports they are styled 'Diffraction bands bordering the moon's shadow.' Fringes bordering a shadow should, however, move with the speed of the shadow. Observations show that the dark bands move quite slowly, from ten to twenty feet per second, while the shadow of the moon rushes across the country at cannon ball speed. Moreover, they move in one direction before the eclipse, and in the opposite direction after. The only half way plausible explanation that I have ever heard offered for the shadow bands is that they may be due to striæ in the atmosphere. This would bring them under the head of the scintillation phenomena treated of somewhat extensively in advanced works on optics, but I am unable to see how any such regular and symmetrical distribution of light and shade can result in this way. That the distance between the bands varies on different occasions lends some plausibility to this explanation, but it is not impossible that the width of the bands is a function of the location of the point of observation, that is to say of its distance from the center of the eclipse track. This can only be determined by numerous and extensive observations covering a wide tract of country, and it is to secure as many data as possible on this subject that I desire to secure the co-operation of all who are interested in the subject. Observa-

tions just outside of and just within the track of totality will be of especial interest. The observations can be made without any apparatus, and as the bands are not visible during totality, their observation will not inconvenience any who are more interested in the spectacular than in the scientific side. At the end of this article I shall outline as clearly as possible just how the observations should be made, and what data recorded. It has occurred to me that the stroboscopic disc may be of use in determining the cause of the bands. If a source of light produces in any way, moving bands of light and shade, it is obvious that if the eye be directed towards the source, it will receive more light from the source while a bright band sweeps across it, than during the transit of a dark band. If the alterations are not too rapid a fluctuation in the brilliancy of the source should be observed.

As a matter of fact, citing a special case, the bands are about three inches wide, and move with a velocity of about ten feet per second. This means that forty bands cross the eye every second, too many to cause any flickering effect. By means of a stroboscopic disc, which is merely a circle of cardboard with equidistant radial slits arranged to be rotated at varying speeds, it is possible to keep the eye in a dark or light band as long as we choose.

Suppose we are looking at the source of light through the slits of the revolving disc, and suppose that the speed of rotation is such that the slits cross the eye at the same rate that the dark and light bands do. This is practically keeping the eye continually in a dark or light band. If the rotation is a little faster or a little slower, the slits will alternately get into, and out of step with the bands, and the eye will be in a bright band one moment, and in a dark one the next. In this way we may make the speed of the fluctuations as slow as we please, and if we look at the sun's crescent through such a device we may possibly detect a flickering in whatever part of the source of light is operative in producing the bands. The disc should be about a foot in diameter with about eight slits in it, distributed uniformly. I should advise that three or four concentric rings of slits of different width be made, the eye being moved from one

to another. In this way the apparent brilliancy of the sun can be varied at will, which would increase the chances of detecting the flickering if it existed. The location of the flickering is to be carefully noted, that is, whether it is of a portion, or the whole of the crescent, or whether it is in the air close to the edge of the sun's limb. The disc can be rotated by hand by means of a whirling table, to be found in every physical laboratory. This simple arrangement will, I think, be found more satisfactory than a more complicated rotator, as the speed is more immediately under one's control.

I am planning to use such an arrangement myself, and hope that some of the other eclipse parties can arrange for the simple experiment also. The speed and width of the bands could also be determined by means of the stroboscope. If we receive the bands on a white cloth on which a scale is marked, and view them through the revolving disc, by carefully adjusting the speed of rotation, it is obvious that the bands can be made to appear stationary. Their width can then be accurately determined by counting the number in a given distance, and the speed with which they move calculated, if the speed of the disc at the moment is recorded. In this way any change in width could be measured.

While these observations can only be made by persons who have had some training in work of this nature, valuable data may be secured by any who are fortunate enough to live within the eclipse belt. I desire to secure, if possible, a complete record of the appearance of the bands over the entire country, together with statements regarding the direction of the wind, condition of the air, etc. The bands can be best observed by spreading a sheet or other large white cloth on the ground. As soon as the moving shadows appear, which will probably be about a minute before totality, lay a lath on the sheet parallel to the shadows, with as great accuracy as possible. Then try to estimate the width of the bands, and the velocity with which they are moving, also the direction in which they are going, that is whether from east to west or west to east. The width of the bands can be best determined, I imagine (I have never seen them), by estimating the width

of a group, say five or six, or as wide a bunch as the eye can grasp and follow with certainty as to the number of dark bands in it. A scale for reference, preferably a white board with feet and half-feet marked with strong black lines, will be of assistance. It should be laid perpendicular to the shadows, that is at right angles to the lath. The speed can be estimated by trying to keep up with the moving shadows, and may be recorded as slow walk, fast walk, slow run, etc. Those who are accustomed to counting quarter seconds, can probably make a fair estimate of the speed by noting the time of transit of a band across the sheet. The shadows will disappear at the moment of totality, but will reappear again as soon as the sun's edge emerges from behind the moon. A second lath should be laid on the sheet, parallel to the bands unless their direction is the same, and the same observations repeated, noting whether the direction of motion is reversed. After the eclipse is over, determine the direction of the two laths as accurately as possible with the compass, and measure the angle between them. Note the direction of the wind before and after the eclipse, and record the general atmospheric conditions.

Tabulate the data as follows :

BEFORE TOTALITY.

1. Direction of the bands.
2. Width of bands. (Give all data, that is, number of dark bands in given width of the system.)
3. Estimated speed. State how estimated.
4. Direction of motion. Whether from east to west, or west to east.
5. General appearance. Whether sharp or hazy, whether contrast between light and shadow is considerable. If possible estimate relative intensity of illumination in dark and light areas.
6. Direction of wind. Temperature and general atmospheric conditions.

AFTER TOTALITY.

- Repetition of the above.
- Actual angle between the laths.
- General remarks, and location of point of observation.

Reports should be sent to Professor R. W. Wood, Physical Laboratory of the University of Wisconsin, Madison, Wis.

R. W. WOOD.