both for recurrent and non-recurrent geomagnetic disturbances. We postulate two different types of solar sources of such particles as follows:

(a) Small jets of corpuscles, distributed in a fine network all over the surface of the sun, and presumably associated with chromospheric spicules or photospheric granules. These jets, in the absence of deflecting solar magnetic fields, would send radial streams of corpuscles in all directions; the streams would be present at all times, regardless of the state of solar activity. In the presence of deflecting magnetic fields from active centers, and the general magnetic field of the sun, the corpuscles are deflected to form the streams responsible for the recurrent "M-region" geomagnetic disturbances.

(b) Irregular streams of ions associated with active regions, and probably most intense at the time of solar flares. Not all active centers have such streams present at all times, and there is probably also a large dispersion of particle velocities and stream energies for this type of corpuscular stream.

We present evidence from a study of geomagnetic disturbances in 1952-53 to support the hypothesis of the formation of recurrent magnetic storms by particle streams of the first type. In particular we find evidence that above certain active regions there is a "cone of avoidance" with low particle density. The center of the cone reaches earth three days later. We also show that there is some evidence that at the edges of the cone-of-avoidance the deficiency of corpuscles is compensated by regions with an excess particle density.

The hypothesis is in accord with the explanation we gave earlier for the formation of the K component of the white light corona,² here associated with the solar-terrestrial corpuscular beams. The hypothesis suggests that daily coronagraphic observation of the white light corona may prove of great value for prediction of the times of occurrence of geomagnetic storms and associated phenomena.

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1. *M. N.* 104, 13, 1944.

2. Roberts, W. O., R. Grenchik, and D. E. Billings, *A. J.* 58, 225, 1953.

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Protheroe, W. M. Determination of shadow-band structure from stellar scintillation measurements.

On three nights in March, 1954, observations of stellar shadow band structure were made using the method described by Keller.¹

The observations were made with the 12½-inch refractor of the Emerson McMillin Observatory utilizing an RCA 6199 photomultiplier tube as the detector. The photocell output was recorded on magnetic tape and played back through a General Radio 762-B vibration analyzer. In this manner the time average of the frequency spectrum of the scintillation signal was obtained over the range from 2.5 to 450 cps.

The observing technique utilized diaphragms with two one-inch apertures having center to center separations ranging from one to eleven inches. Since the shadow band pattern seems to show a biaxial symmetry about axes which are approximately perpendicular to each other, the observations with a given aperture spacing were made in duplicate, the line of centers being placed in coincidence with one and then the other axis of the pattern.

Auto-correlation functions were then constructed from these observations using the root mean square fluctuations in light intensity integrated over all frequencies and also at 20, 150, and 250 cps. These curves have the following properties:

1. They resemble zero-order Bessel functions and in general can be fitted fairly well by a single function of this type having a characteristic wave length around five or ten inches. A better fit can be obtained by the addition of one or two more zero-order Bessel functions having smaller amplitudes and other characteristic wave lengths.

2. The characteristic lengths associated with the one axis of symmetry are in general shorter than those associated with the other.

3. On one night, 16 March, the auto-correlation curves for one direction were essentially the same for all frequencies. A change in the shape of the auto-correlation curves with frequency was apparent in the other direction, however. This indicates that the amplitudes of the characteristic wave lengths measured in this direction depended on frequency. Such an effect is to be expected if the shadow band pattern is in motion along the direction of separation of the holes.