at random over a range of a few seconds of arc. The use of television techniques permits very short exposures to be made on bright planets and at the same time makes possible a system of continuous position correction which eliminates one destructive effect of seeing.

In the apparatus developed at the Arthur J. Dyer Observatory of Vanderbilt University the 5820 orthicon tube is used as a receiver of the telescope output. The tube's target voltage may be triggered at intervals ranging between 1/30 and 4/15 seconds permitting a considerable increase in sensitivity through target storage. Fifth magnitude is easily reached with the 24-inch reflector.

For planetary photography the cassegrain output is enlarged through a negative lens and split with a dichroic mirror to produce two images approximately $\frac{1}{2}$ " in diameter each. One image is fed to the orthicon cathode surface. The second image is fed into two radial slits placed 90° apart at the image periphery. Light passing through the slits is caught on two 1P21 photocells. The current developed in these cells is a linear function of the image position with respect to the slits. Around the image section of the orthicon, deflection coils are placed 90° apart. The photocell output currents are amplified and fed into these deflection coils in such phase as to cancel at the orthicon target the variations of image position with varying atmospheric refraction. These control currents can also be used to operate automatically the telescope's slow motion controls in R.A. and Dec. The method of position compensation appears applicable to other forms of image amplifiers. The apparatus is currently being employed to photograph Jupiter with exposure as short as 1/30 sec.

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Dodson, Helen W. and Hedeman, E. Ruth.
Flares with major early bursts at frequencies ≤ 200 Mc/s and subsequent geomagnetic disturbances.

Intercomparison of world-wide optical and radio-frequency solar data has shown that during the $7\frac{1}{3}$ year interval between January 1949 and April 1956 only 113 of the approximately 3000 observed flares are known to have had major bursts at frequencies ≤ 200 Mc/s during the pre-

maximum phase of the $H\alpha$ flare. Even though the records are unavoidably incomplete, the major early burst appears to be a relatively rare solar event. During the time interval studied, such bursts occurred in conjunction with flares in all importance categories and at all central meridian distances.

World-wide geomagnetic reports show that 92 per cent of the above 113 flares were followed by onsets of geomagnetic storms in less than five days. The average time interval between the occurrence of flares with major early bursts and the start of storms was $2\frac{1}{2}$ days. Superposed values of the geomagnetic indices (K_p and A_p) show large increases starting two days after the flare, with maximum on the third day. Special studies of all flares of importance 3 and 3+ in the same period showed that the above relationship was maintained when these flares had early major bursts but was not maintained when emission at frequencies ≤ 200 Mc/sec was not present or when such emission occurred only in the post maximum phase of the flare.

The 113 flares with major early bursts were associated with 79 separate geomagnetic storms. For 64 of the storms at least one station reported the sudden commencement phenomenon, and for 41 a majority of the stations classified the storm as sudden commencement. Only 3 of the 79 storms were members of well established 27-day recurrent series.

Studies are now in progress to evaluate the roles of flare importance and position, and phase of solar cycle. More abundant radio data giving polarization and dynamic spectra should further improve the relationships here indicated.

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Duncombe, R. L. and Clemence, G. M. On the secular change of the obliquity.

Observations of the sun, moon, and planets (Morgan 1950), of Mercury (Clemence 1943), and of Venus (Duncombe 1956) have indicated that the obliquity of the ecliptic is diminishing faster than Newcomb's theory of the motion permits. The first three lines of Table I show the observed corrections to Newcomb's centennial variation of the obliquity, with probable errors where given by the authors; the discordances are probably attributable to errors in the observations. Only a small portion of the observed corrections can be ascribed to errors in the adopted