COMPARISON OF 8-mm SOLAR RADIO FEATURES WITH LOCAL MAGNETIC FIELDS AND CHROMOSPHERIC FEATURES

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The new big 22-m radio-telescope of Crimean Observatory shown on Figure 1 appeared to be of very good quality: for radio emission at $\lambda = 8$ mm the antenna beam is 1'.6, the efficiency $\cong 0{\cdot}4$, and the error of automatic pointing (guiding) does not exceed $\pm 20''$. A Dicke type radiometer was used as receiver possessing a sensitivity $\simeq 2\,^{\circ}\mathrm{K}$ at the time constant $\tau = 1$ sec, and pass-band ~ 30 MHz. The error in the

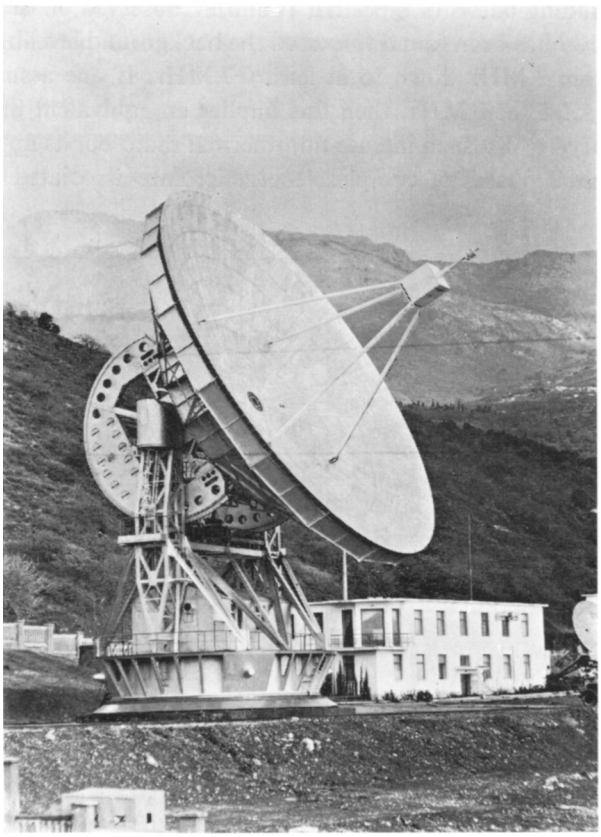

Fig. 1.

Kiepenheuer (ed.), Structure and Development of Solar Active Regions, 588–593.

contrast determination does not exceed $\pm 0{\cdot}5\%$ of the level nearly corresponding to that of the quiet Sun. The scanning of the solar image is made in right ascension with velocity 0·5 sec in sec of time, the distance between successive scans in δ being 1′.5. An example of a single scan is shown in Figure 2, where the scan through Jupiter (for the determination of antenna beam) is also presented (for description see Moiseev, 1968).

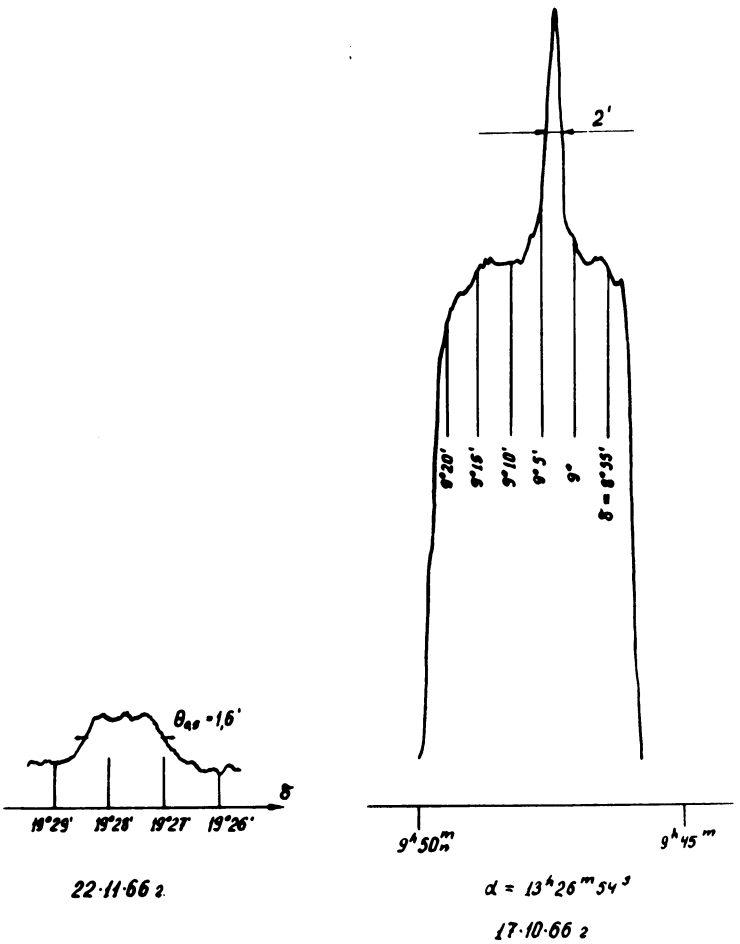

FIG. 2.

The maps of radio-isophotes (in % of undisturbed background) were obtained for October 24, 25, 26, 1966, simultaneously with the maps of isogauss of longitudinal magnetic fields over the whole disk recorded with the aid of solar magnetograph of Crimean Solar tower with the resolution $2''.5 \times 27''$ and sensitivity $\simeq 2$ gs. These overlapping maps are shown in Figures 3–5 (full lines are radio-isophotes and thin lines

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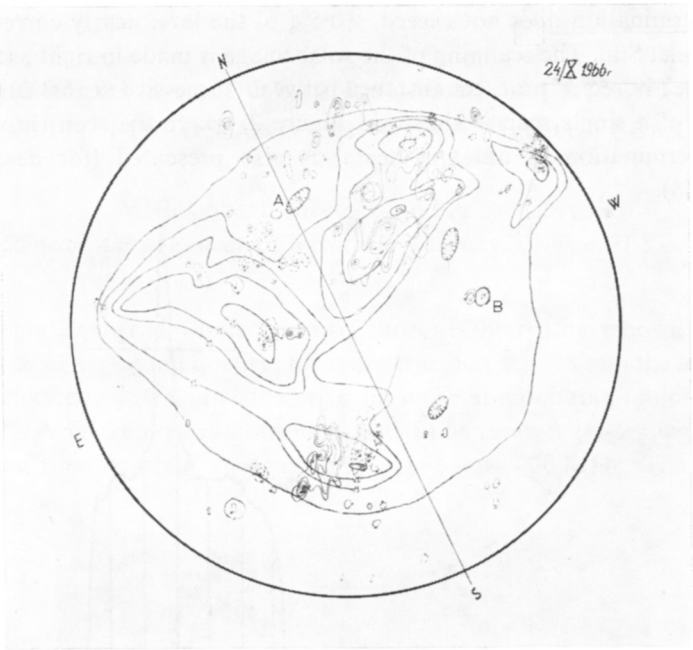

FIG. 3.

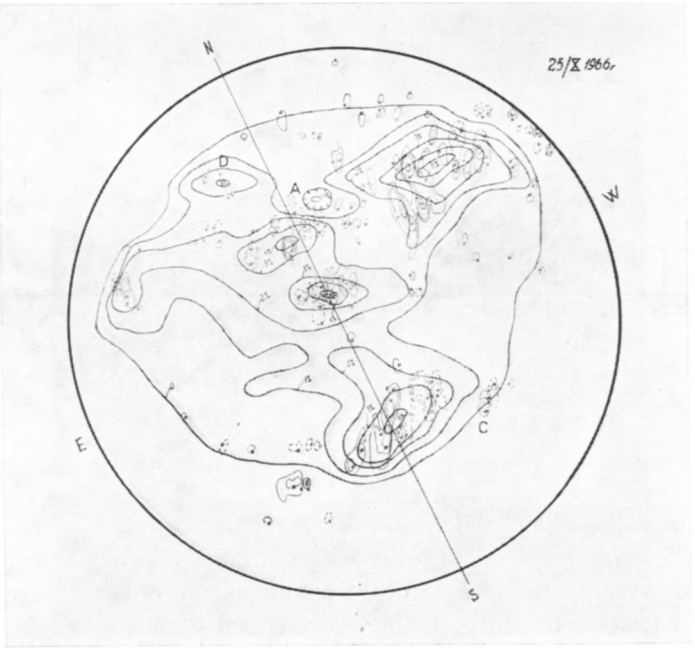

FIG. 4.

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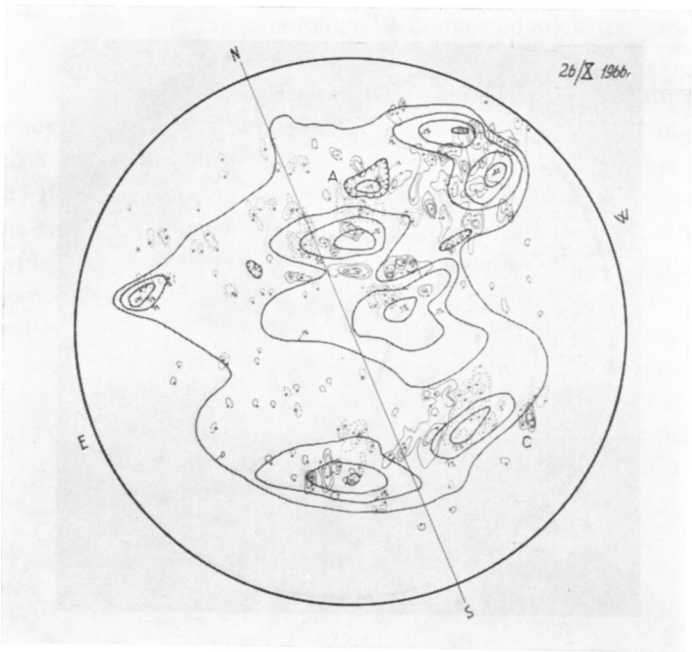

FIG. 5.

show magnetic-field strength starting with 5 or 10 gs). The main results of comparison between these two maps as well as between these maps and K and Hα-spectroheliograms obtained for the same day at double spectroheliograph of the Crimean tower (see example in Figure 6, Oct. 25, 1966) follow:

(1) All features of enhanced 8-mm radio emission are found in the regions of local magnetic fields. The reverse is not true – appreciable local magnetic fields are observed without enhanced 8-mm radio emission.

(2) In several cases the local magnetic fields are not accompanied by enhanced 8-mm emission when a dark filament is observed in the area in question. (Some examples are presented in Figures 3–5). Sometimes the presence of a high contrast dark filament leads to the depression in the level of enhanced radio emission. (See examples: region A on the map 24·10 and 26·10.)

(3) In some places (the regions A for the map 24·10 and 26·10) we observe the depression of 8-mm radio emission below the undisturbed level of the quiet Sun, and these regions are the regions without local magnetic fields but they are occupied by dark filaments (regions dashed from inside). The depression of radio emission in mm region associated with dark filaments was first observed by Khangildin (1964).

(4) One compact active region with developed local bipolar magnetic field and sunspots and plages did not show enhanced radio emission in 8 mm (region C in

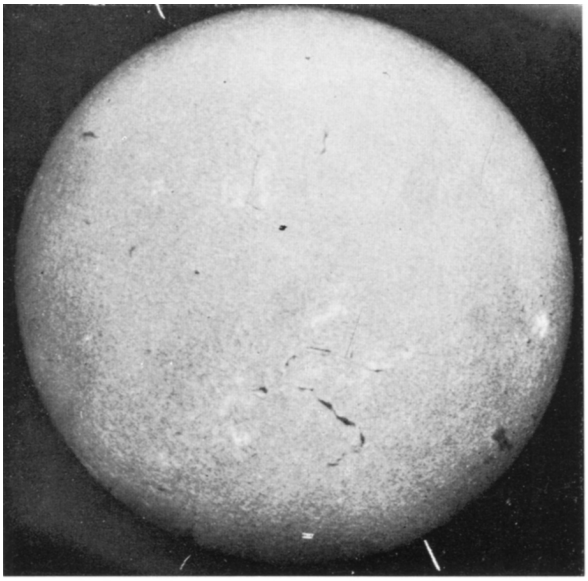

FIG. 6a.

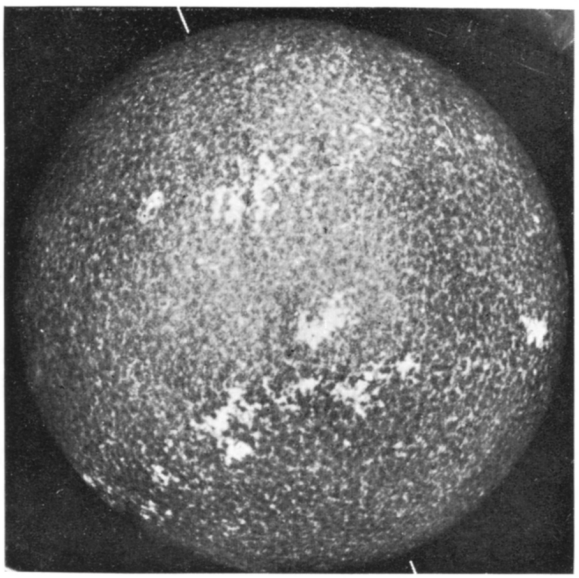

FIG. 6b.

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Figure 4 and 5). This case can eventually be connected with the influence of the limited resolving power of the radio-telescope.

(5) The most interesting are two regions where no appreciable features on K and Hα-spectroheliograms can be found but they are occupied by local magnetic fields and enhanced 8-mm radio emission as well (the region B on the map 24·10 and D on the map 25·10). This could probably be compared with the recent comparison by Tousey of the regions enhanced in X-rays with the regions of cm enhanced radio emission having no counterpart in K-spectroheliograms. Possibly these peculiar regions are some condensations confined by magnetic fields having their 'roots' deep in the photosphere but elevated *above* the level of chromosphere responsible for K-line emission. If charged particles are trapped in these regions and magnetic fields are pulsating, as we illustrated in an earlier talk (Severny, 1967) they could be able to produce X-rays due to accelerations exerted in the varying magnetic fields.

References

Khangildin, U. (1964) *Astr. Zu.*, **41**, 302.
Moiseev, I. (1968) *Izv. Krym. astrofiz. Obs.*, **38** (in press).
Severny, A. (1967) *Astr. Zu.*, **44**, 481, see also page 233 of this volume.

DISCUSSION

De Jager: Could you detect limb brightening (or darkening) at 8 mm in the quiet Sun?

Severny: It is difficult to say definitely. Sometimes the records across the disk look like a 'table', i.e. they show abrupt fall of intensity which remains about the same level inside the disk.

De Jager: Were the regions of enhanced 8-mm emission without associated optical features perhaps related to optical magnetic features that appeared later, or that has disappeared already?

Severny: We have records of magnetic fields and radio emission only for 3 days, so the data are not sufficient to have a definite answer, but magnetic features, as a rule, appear earlier and disappear later than optical features and this is why we can expect the regions of enhanced radio emission being connected with these magnetic features.