LAST PHASES OF DEVELOPMENT OF ACTIVE REGIONS*

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ABSTRACT

A close relation of filament feet to the supergranular structure has been found. Green corona brightness, 1420 MHz flux, and the location of quiescent filaments depend upon the distribution of the photospheric magnetic fields. The development of polar maxima of the green corona and their relation to the following polarity have been studied.

This communication summarizes four different papers that are prepared for printing in the *Bulletin of the Astronomical Institutes of Czechoslovakia*. The results relate to the last phases of ARs as they are described for example, by Kiepenheuer (1953). The dissolution and migration of magnetic fields (facular regions) and the formation and growth of quiescent filaments are among typical features of the last phases. From the whole complex of related problems we concentrated only on the relations of photospheric magnetic fields, green corona, quiescent filaments and radio emission at 1420 MHz and the poleward shift of these features. Only the main results are given here, and for a description of the material, its treatment and a detailed discussion of the results, the reader is referred to the original papers in the BAC.

(a) A preliminary comparison of Hα and Ca^+ filtergrams and spectroheliograms by means of a blinkcomparator indicated that the feet of quiescent filaments are anchored in junctions of three or more supergranules.

(b) About one thousand measurements of distances of the feet of quiescent filaments have shown, that these distances between neighbouring feet (26000 km and 47500 km) correspond to the geometry of the supergranular network. Moreover there are indications that the distance is a function of the phase of the cycle.

(c) The relation of GCRs (=green coronal regions, emission maxima of green corona) in spot zones to the bipolar magnetic regions (BMR) and to the magnetic background field (MBF) is rather complicated. The maximum of a GCR is usually situated over an inclusion of the following polarity into the large area of the leading polarity.

(d) The emission maxima of 1420 MHz coincide in position with maxima of the

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Kiepenheuer (ed.), Structure and Development of Solar Active Regions, 64–67.

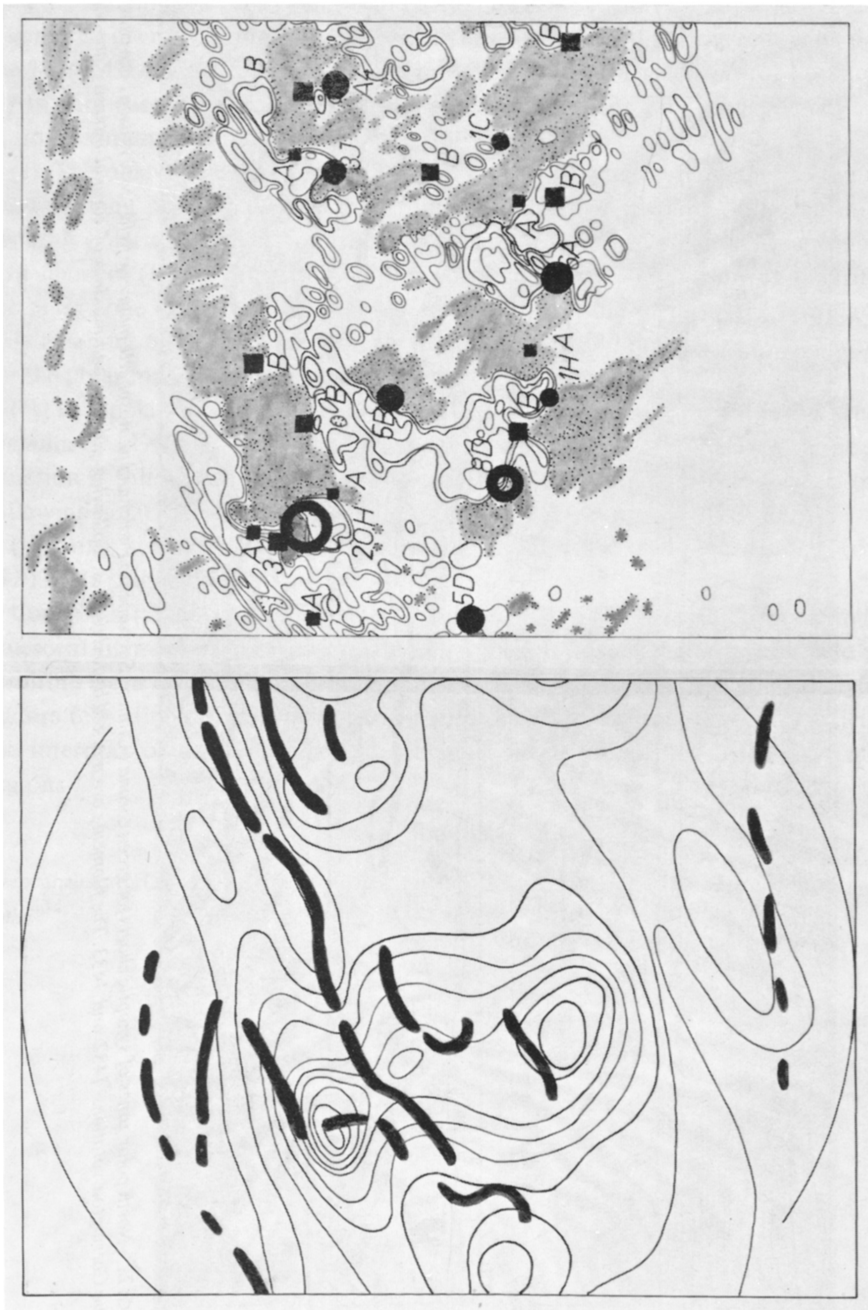

FIG. 1. *The left part is a daily (i.e. with foreshortening) 1420 MHz heliogram (Quarterly Bulletin) for September 11, 1960. Heavy lines represent filaments (Cartes synoptiques de Meudon). The right part is the corresponding section of the synoptic magnetic chart (Mt. Wilson). Dotted lines with shaded area are for minus polarity (i.e. following on the Northern hemisphere). Letters are Zürich types of ARs. Circles indicate ARs with flare activity (number of flares is assigned) while squares are ARs without flares.*

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FIG. 2. *North polar zones of synoptic charts for green corona (Climax, Sacramento Peak) and photospheric magnetic field (Mt. Wilson) are compared for the Carrington rotations 1432 and 1433. The filaments are marked by heavy lines. Following polarity and maxima of coronal intensity are shaded.*

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green corona. There are three different cases: (1) over simple BMRs (not connected with the main body of the background field, flux is practically balanced) the 1420 MHz is centered over the neutral line; (2) for the case of inclusion of the following polarity, the 1420 MHz radio emission is centered over the centre of gravity of the inclusion; (3) In rare cases, the leading polarity is included by the following polarity and the radio maximum is centered on the inclusion also (Figure 1).

(e) The polar maxima of green coronal emission are closely related to the tails of the following polarity pushed out from the spot-zone MBFs. Along the minimum dividing polar maximum from the spot-zone maximum there stretches a long quiescent filament (Figure 2). Although the poleward shift of the following polarity from the main zone of activity is observed, the polar maxima of the green corona appear only at about 60° of latitude. On our material, we could not trace any poleward shift for the polar maximum of the green corona.

(f) The polar maxima of the green corona are also followed by the secondary maxima of 1420 MHz emission. From the coincidence of 1420 MHz with the 5303 Å emission it follows, that also the 1420 MHz secondary maxima are located over the following polarity.

(g) Long quiescent filaments are marked by decrease of brightness at 5303 Å and 1420 MHz (Figure 1).

Conclusion: The changes of 5303 Å emission, of 1420 MHz brightness and of the quiescent filaments are closely related to the evolution of the magnetic-field pattern resulting from decay and interaction of several active regions. Some other dynamical factors (e.g. differential rotation and meridional circulation) may also participate in the interplay of solar plasma and magnetic fields called the 'last phases of active regions'.

Reference

Kiepenheuer, K.O. (1953) in *The Sun*, Ed. by G.P. Kuiper, The University of Chicago Press, p. 434.