LARGE-SCALE MAGNETIC STRUCTURES AND THE LONGITUDINAL DISTRIBUTION OF THE GREEN CORONAL EMISSION

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Abstract: In the first part of the communication a very brief review of the results, concerning the close relation of the location of particle-emitting flares and a characteristic large-scale pattern in the background magnetic field distribution, is given. In the second part, the longitudinal distribution of the green coronal emission is again discussed in its relation to the characteristic features in the magnetic field distribution. The connection of the minima of green coronal emission with the sources of the quiet solar wind and, hence, with coronal holes is stressed.

Location of particle-emitting flares in the "supergiant" structures of solar magnetic fields and green corona

In the first part of the present note we would like to summarize our results (Bumba and Howard, 1969; Ambrož et al., 1971; Bumba, 1972a, b; Bumba and Sýkora, 1973a, b; Bumba et al., 1972; Bumba and Sýkora, 1972a, b; Bumba, 1973) concerning the close relation of particle-emitting flares to a certain regular pattern, formed by the large-scale magnetic field, well reflected in the distribution of the green (λ 5303 Å) coronal emission, found during the recent fifteen years of the solar activity. The particle-emitting events are related in the magnetic field of a negative polarity to a drop-shaped ("supergiant") structure which has its tail stretched out to higher heliographic latitudes of the northern hemisphere. The western head of the drop, formed from older activity regions, is more stable and regular. The length of the drop without the tail is about 90—100° in heliographic longitude. The gravity centre of the major solar activity and of the particle-emitting flare occurrence is located at the eastern part of the feature, just below the root of the tail, where the activity changes more rapidly. Magnetic fields of positive polarity form a "mirror" image to that of the negative polarity fields, having their tail in the southern heliographic latitudes. The main body of the plus polarity field fits into the part of the drop of the minus polarity pattern.

The development of the mentioned magnetic field patterns represents a very complex process. We have to remind the reader that in studying the large-scale morphology of both polarities separately, we see that they do not develop their regular features simultaneously and in phase as concerns time and heliographic position. The life-time of such a "supergiant" structure is of the order of one year, although its best visibility only lasts for a few rotations.

On correlating the synoptic charts of the distribution of the green coronal emission, drawn in the form of isophotes from coronal data, they were transformed to a unified photometric scale (Sýkora, 1971, 1972) with the position of the same proton-flare active regions we may see that the large elliptical features formed from the enhanced coronal emission are practically conform with the "supergiant" body of magnetic field. The emission being concentrated to the periphery of its body is usually higher above the particle-emitting flare region.

Heliographic longitudes of the maximum and minimum green coronal emission and the distribution of the magnetic fields

Because the study of the development of the "supergiant" regular structures of the background magnetic fields from the regularities of their lon-

gitudinal distribution is a very complicated problem, connected with the question of reality and cause of "active longitudes", it may be of some interest to investigate the longitudinal distribution of the green coronal emission in its relation to the distribution of opposite polarities of the background magnetic field. As yet we have integrated the synoptic charts of the green coronal emission for only two time intervals: August 1960 — September 1961 (Rotations Nos. 1431—1444) and January 1969 — December 1969 (Rotations Nos. 1544—1556). For each mentioned rotation the integrated data were represented in hundreds of absolute coronal units and than drawn in the form of isophotes on the same scale as the magnetic synoptic charts. During both periods of time the green coronal emission has two maxima in the following heliographic longitudes: 90—120° and 320—340° (Bumba and Sýkora, 1973b). (Partly see also Fig. 1.) The internal structure of the individual emission maxima and their changes in time not only seem to be connected with the evolution of activity, but also with the different periods of rotation of the individual active regions in various heliographic latitudes etc.

Recently we have tried to show (Ambrož et al., 1971; Bumba, 1972a, b; Bumba and Sýkora, 1973a, b) that at least during the declining phase of the last cycle and during the increasing phase of the present cycle of solar activity the regions with developing solar activity tend to be closely related to the negative polarity "supergiant" features. And vice versa, the positive polarity patterns, formed from fields left by the old active regions, seem to be the source of the quiet solar wind. The same seems to be true correlating the green coronal emission maxima with the background magnetic field patterns: during the first time interval these maxima

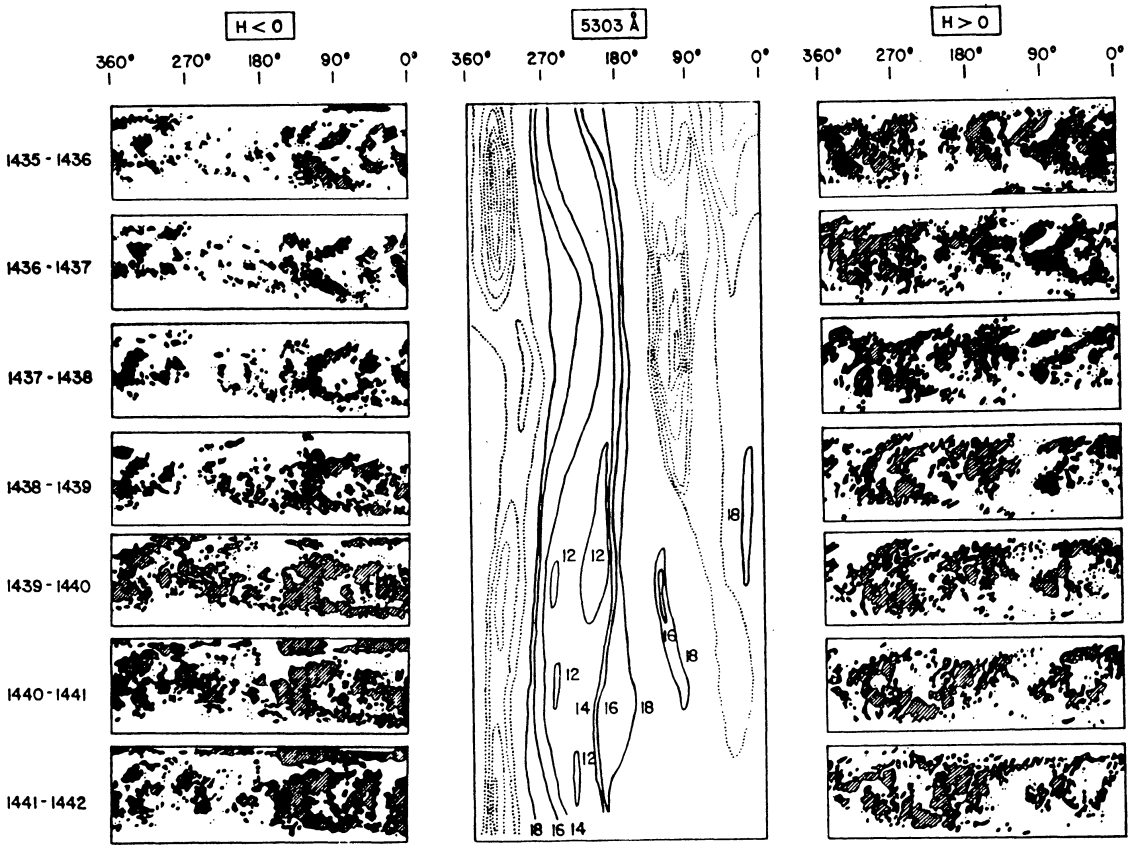

Fig. 1. The longitudinal distribution of the green (λ5303 Å) coronal emission for rotations Nos. 1435—1442, demonstrated by isophotes (in hundreds of absolute coronal units) of the maximum (dotted line) and minimum (full line) emission. The coronal longitudinal distribution is drawn in the same scale as the magnetic synoptic charts, shown on each side of the coronal data: negative polarity maps to the left and positive polarity charts to the right. For integration, two consecutive maps, one of which is repeated, are superimposed. The heliographic longitudes are indicated at the top of the picture.

coincide well in position with the negative polarity features. When a "supergiant" structure is fully developed, the position of the coronal emission maximum agrees with the eastern part of this structure, i.e. with the region the large flares tend to be connected with. As regards the correlation with the positive polarity patterns, it again agrees with that said above. The same seems to be true for the second time interval, although the magnetic situation there is more complicated.

Several papers concerning the holes in the corona have appeared recently. We think that it is possible to demonstrate these coronal holes in our synoptic charts displaying the distribution of the green coronal emission. So far we have only constructed the isophotes (in hundreds of absolute coronal units) of minimum green coronal emission for the first studied time-interval. Comparing the position of this minimum coronal emission in heliographic longitude with the synoptic charts of the background magnetic field, drawn in separated polarities, in Figure 1, we may see that, on the one hand, it coincides well with those areas of the maps which are minimally occupied by negative polarity fields, but on the other hand, it agrees very well with the longitudinal position of the positive "supergiant" body. And as shown earlier (Ambrož et al., 1971; Bumba, 1972b) these regular patterns of the positive polarity fields seem to be very closely related to the period of enhanced geomagnetic activity or, in other words, they seem to be in a very close relationship with the quiet solar wind.

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