3. SUNSPOT MAGNETIC FIELDS AND LOOP PROMINENCES

V. Bumba and *J. Kleczek*

A large active sunspot group was on the Sun during the summer of 1957. It lasted for five rotations and about 146 flares were observed in it. During its limb passages it was accompanied by a conspicuous loop activity.

One of the authors obtained magnetic maps of the group with the Crimean magnetograph. The loop activity is demonstrated by many photographs from different observatories.

We compared the loop configuration with the magnetic maps and with Hα filtergrams. Using daily photographs of the group, we could find any large changes in the group. One of several pictures we used for comparison is reproduced in Figure 1. It represents: *right part*—the loops and corona of 1957 June 28 (the ordinates of the green curve, dashed, are to be multiplied by two relatively to those of the red curve, dotted); *middle right*—plage area and spot group on June 29, that is one day later, since the active region was not well visible on June 28; *left part*—chromosphere (upper), magnetic map (middle) and spot group (bottom). A good agreement of a quiescent filament stretching across the spot group (upper left) with the line dividing both polarities (dashed in middle left) is obvious. Drifts of individual spots in the group are marked by dashed lines with arrows (bottom left).

It is evident from Figure 1, that the loops are anchored in the peaks of the photospheric magnetic field. The evidence is further stressed by the Hα filtergrams, in which the loops continue against the chromosphere like hazy streamers directly into the umbrae. The peaks for both main loop systems coincide with umbrae of the group. The loops studied by us should therefore represent magnetic tubes of force. It is worth noticing the twisting in the northern arm (denoted by C in Figure 1). It is in agreement with the model of the configuration of a spot magnetic field, proposed by one of the authors (V. Bumba, in the following paper).

A detailed discussion of the association of loops with the underlying photospheric field will be published in the *Bulletin of the Astronomical Institutes of Czechoslovakia*. See also *Observatory* **81**, 141, 1961.

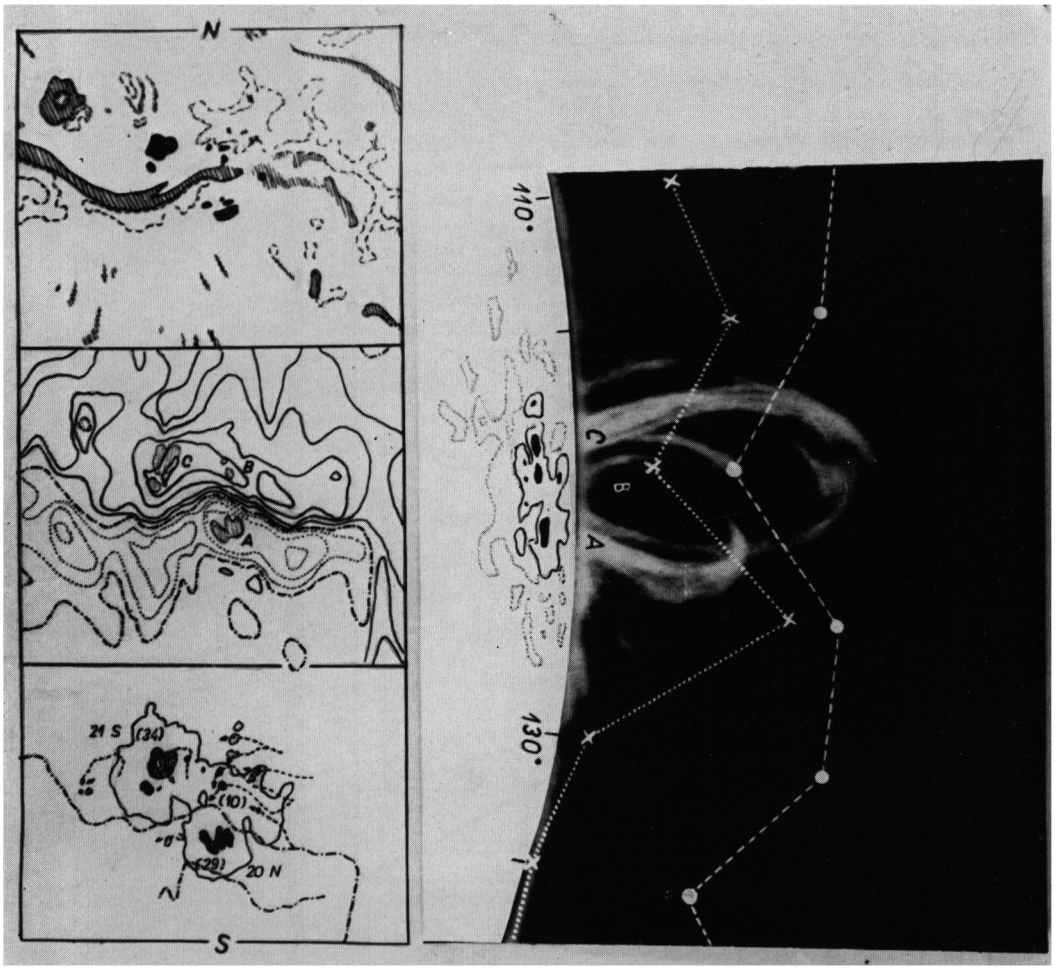
4. CONFIGURATION OF MAGNETIC FIELDS IN SUNSPOT UMBRAE

V. Bumba

We have studied the behaviour of some Fraunhofer lines in umbra spectra, obtained at the Crimean Astrophysical Observatory. By measurement of the intensities of the individual components of the split line Fe I (6302·508 Å) we came to the following conclusion: The enhancement of the π component in the Zeeman pattern could be simply explained by the configuration of the magnetic field in the umbra. We came to this idea after elaboration of a few tens of spectra for 19 umbrae in 31 different heliographic positions. We used the measured intensities of σ components for evaluation of γ, which is the angle between the line of sight and the magnetic field direction (Sears, 1913). The angle depends on the distance α of the spot from the centre of the solar disk (see Figure 1), according to the following empirical formula:

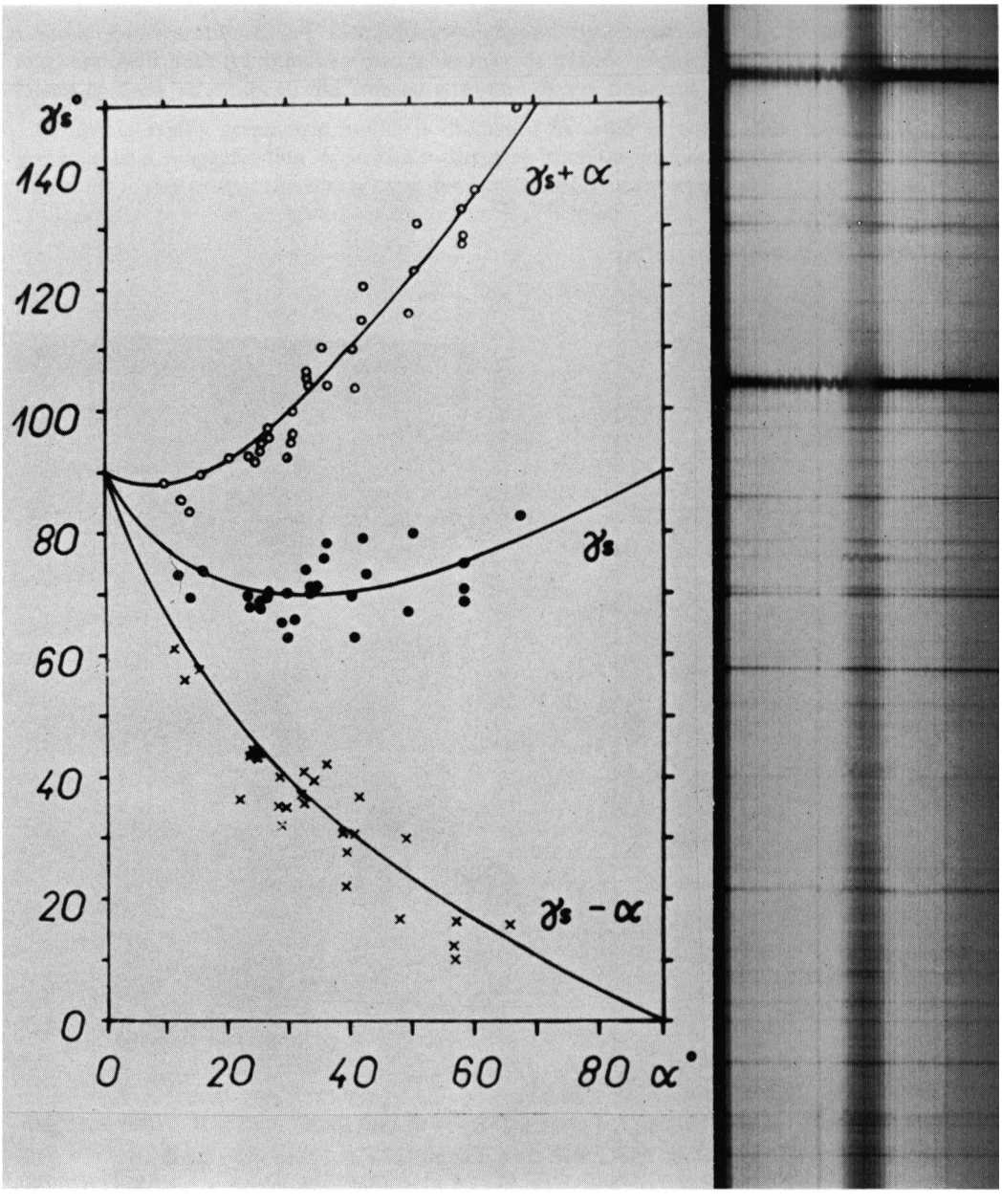
$$\gamma_s = \frac{90^\circ + \alpha \sin \alpha}{1 + \sin \alpha} \qquad (\alpha \text{ in degrees}) \qquad \text{(a)}$$

This is in good agreement with the following simple model: The lines of force are arranged in the tubes of force, coming from the umbra in form of spirals, the pitch of which rapidly increases with height. This means, that in the lower layers the lines of force form practically



Paper 3. V. Bumba and J. Kleczek, Figure 1. For description see text.

https://doi.org/10.1017/S0251107X00023051 Published online by Cambridge University Press



Paper 4. V. Bumba, Fig. 1

Fig. 2

FIG. 1. Changes in the values of angles $\gamma_s + \alpha$, γ_s and $\gamma_s - \alpha$ with growing distance α between spot and centre of solar disk. The full curves were computed according to formula (a).

FIG. 2. Photograph of the spectrum of the umbra in closest vicinity of lines D_1, D_2 of Na I with distinct 'disappearance of the serpent-like fringes'.

https://doi.org/10.1017/S0251107X00023051 Published online by Cambridge University Press