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A NOTE ON SOME RESULTS OF THE DEBRECEN OBSERVATORY

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Neki rezultati opažanja na Opservatoriju Debrecin

SAŽETAK: Opisana su opažanja fotosfere kojima se studira gibanje masa u pjegama. Praćeno je stapanje manjih pjega u veće.

ABSTRACT: Photospheric observations are described, concerned mainly with the problem of mass motions. A coalescence of smaller spots was traced.

Not only is the ultimate cause of solar activity still unknown but also the possible connections between the various kinds of phenomena of solar activity are not well enough understood. The long-term interest of the Debrecen Observatory is to study some problems of correlation of that sort, particularly concerning the mass motions in solar active regions. For this reason we introduced long series of regular photographic observations both in "white light" and in H-alpha line to investigate the movement of sunspots, of prominences as well as of bright flare knots.

The H-alpha observations are obtained by means of our 53 cm Nikolsky-type coronagraph and a Lyot filter. (Up to now an 0.5 Å Halle filter was used.) The diameter of the Sun's disk at the coudé-focus is 12.5 cm, and a portion of the disk is photographed on 35 mm films. In general we only make H-alpha observations when there are interesting events and we do not carry out H-alpha patrol observations. However, whenever possible several full-disk white-light solar photographs are taken each day both in Debrecen and in

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Gyula, our photospheric observing station. Both photoheliographs are fairly similar; the diameter of the Sun's image at the secondary focus being approximately 10.5 cm. For the exact orientation at the prime focus ($f \approx 2m$) two spider-wires are fixed and their positions are permanently controlled.

On the basis of the observations mentioned, investigations on proper motions of sunspots have formed one of the main research topics of the Debrecen Observatory for several years now. Some examples of our results are briefly given as follows:

(i) Indications have been found that there are links between the motions of umbrae and some major flare occurrences (Kovács (1977), Gesztelyi (1977), Deszö et al./in press/).

(ii) In several cases it was shown (Dezsö et al. 1977) that the formation of larger umbrae as well as the growth in area of sunspots takes place through motion and coalescence of smaller spots, umbrae and pores. We consider this process of development the crucial point in the course of evolution of sunspot groups.

In Fig.1 there is a self-explanatory fairly typical precedent for (ii). The Figure refers to the part of *p* magnetic polarity of the small sunspot group of 3-day duration, first observed near the solar central meridian on the 2nd September 1973 as a regular bi-polar group (No.167 according to the designation of the Solnechnye Dannye). On this day the *f* part of the group, not shown in Fig.1, appeared about 20" away from the *p* part; it had disappeared by 3 September. The *p* and *f* parts showed the usual divergent motion of a young spot group, its average relative velocity was 0.4 km s^{-1} on September 2, at least over 3 hrs after 13:00 UT. The rather great motions revealed by the Figure, especially in longitude, are also characteristic for young spots (behaviour for which we have numerous other examples). The average velocity in respect of the Carrington coordinate network was about 0.2 km s^{-1} parallel to the equator, considerably greater than the differential rotation would account for, and 0.1 km s^{-1} along a meridian during the period September 2-3. The three spots 1a, 1b and 1c merged through their converging motion of high velocity and formed the single

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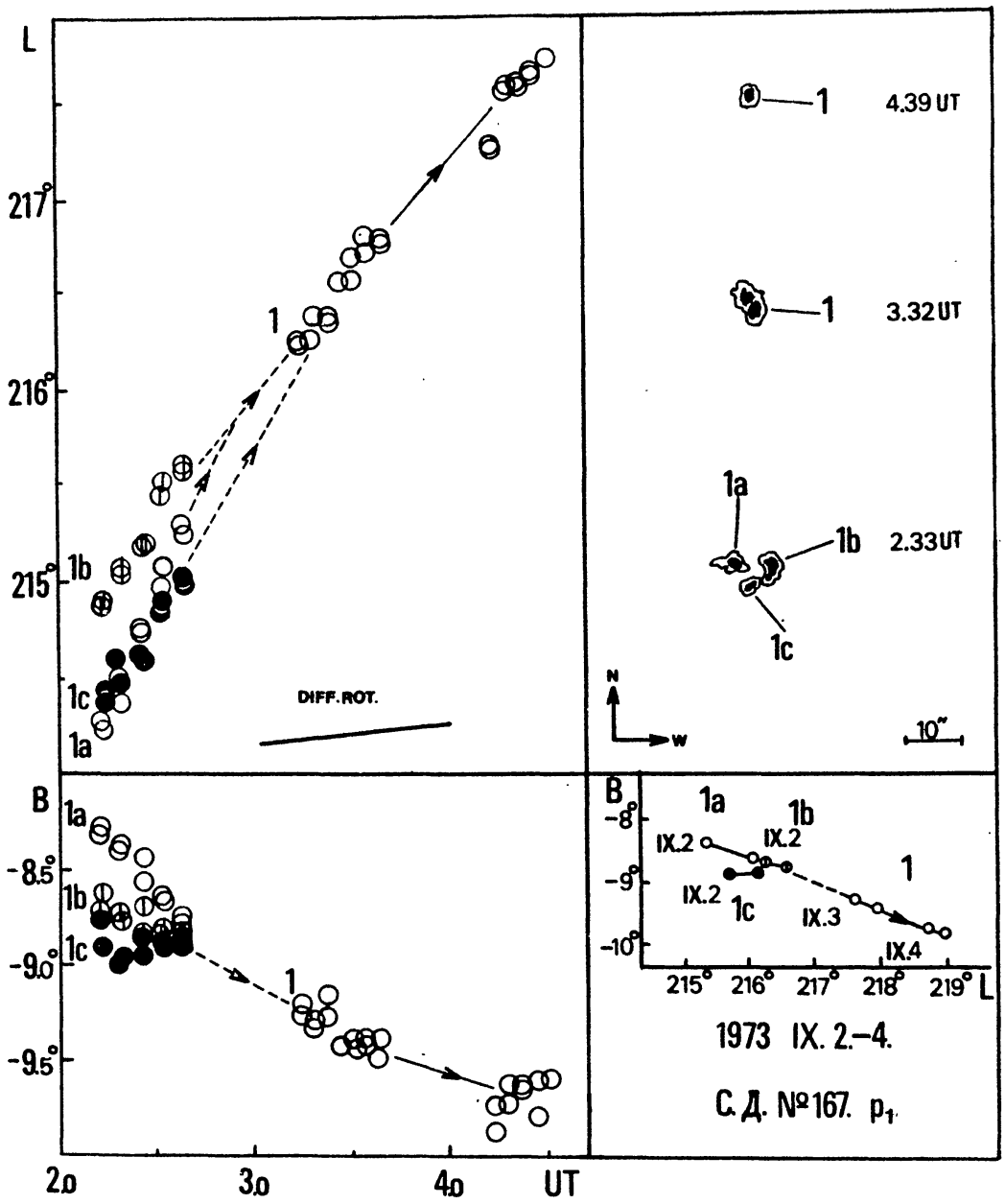

Fig.1. Mergence of sunspots through motion.

Left side: The Carrington heliographic longitude (L) and latitude (B) versus time. Each circle represents a single observation.
Lower right: The path of the *p* part of the spot group in the coordinate network. Two average coordinates are given for each day at about 8 and 12 hrs UT.
Upper right: The relevant spots with their designations; and scale and orientation.
(The observations were obtained by L.Márki-Zay and Zsuzsa Kiss; the coordinate measurements were carried out by L.Lindeisz.)

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spot 1 in a short time, practically almost on September 2. By September 3 the whole group was in decay and consisted mainly of two close umbrae of *p* polarity in a common penumbra; the decrease in area can be already guessed at from the projected pictures in the upper right corner of the Figure and are proved by the data in Table 1.

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TABLE 1

Sunspot areas

S.D.No.167/1973 p_1		U + P				U				P/U			
1973 September	UT	la	lb	lc	l	la	lb	lc	l	la	lb	lc	l
2	7:44-10:44	8.5	9.6	5.3	8.5 + 9.6 + 5.3 = 23.4	2.6	3.0	1.7	2.6 + 3.0 + 1.7 = 7.3	2.3	2.2	2.1	2.2
3	9:22-11:04				11.9				4.2				1.8
4	9:16-11:23				5.5				2.1				1.6

The areas (corrected for foreshortening) are expressed in 10^{-6} of the solar hemisphere. U+P: "whole" spot (umbra + penumbra) areas; U: umbra areas. The measurements were obtained by Ágnes Kovács, with an area measuring instrument using video facilities. Each areal data shows the mean value of 4 photoheliograms taken in the period indicated.

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