

ACTIVITY IN HALE REGION 18474 (JULY 1982)

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ABSTRACT: The unusually large sunspot group of July 1982 was studied by several authors already. Here we present the evolution of some of the large flares produced by this group (on 9, 12 and 17 July). Special emphasis is given to the post-flare loops. The evolution of the flares in H-alpha is compared with the underlying magnetic field and the proper motions of the nearby sunspots.

АКТИВНОСТЬ В ОБЛАСТИ HR 18474 (ИЮЛЬ 1982): Необычно большая группа солнечных пятен июля 1982 г. была уже исследована несколькими авторами. Здесь приводится эволюция некоторых больших вспышек в этой группе (9, 12 и 17 июля). Особое внимание уделено послевспышечным петельным системам. Развитие вспышек в H-альфа сравнивается с магнитным полем под ними и собственными движениями соседних пятен.

AKTIVITA V OBLASTI HALE 18474 (JÚL 1982): Mimoriadne rozsiahla a zložitá skupina slnečných škvŕn, ktorá bola pozorovaná v júli 1982, bola predmetom štúdia viacerých autorov. V tejto práci je uvedený vývoj ďalších veľkých erupcií (z 9., 12. a 17. júla), ktoré vznikli v tejto skupine. Analýza erupcií je zameraná na sústavy po-erupčných slučiek. Evolúcia H-alfa erupcií je porovnaná s fotosférickým magnetickým poľom a vlastnými pohybmi okolitých škvŕn.

The large sunspot group of July 1982 (HR 18474, NOAA 3804, Solnechnye Dannye 228+229) attracted the attention of some researches already. Sattarov and Korobova (1983) and Ishkov et al. (1983) studied the general evolution of the group, Krundal et al. (1985) give the evolution and classification of light-bridges, Kálmán and Nagy (1985) present the sunspot proper motions.

In the Debrecen Heliophysical Observatory and its Gyula Observing Station a good series of white-light and H-alpha observations was made. The

first study of the photospheric material was shown by Kálmán and Nagy (1983), now we proceed to the H-alpha activity.

According to the Solar-Geophysical Data comprehensive flare list, the region produced 224 flares during its disk passage, this is 40% of all the flares in these days. The distribution of flares in time and by H-alpha importance is given in Table 1. From the table one can see that the group was most active near the East limb, producing two flares of 3B on 9th and 12th July. On 13th the H-alpha activity reaches a minimum, then slowly rises, and on 17th July again two flares of importance 2B occur, then -together with the decay of the group- the flare activity slowly diminishes. Although the magnetic structure of the group was very complex, this activity is not really large, taking into account of the very large area of the spots and the frequent delta-configurations. Maybe the gradients of the magnetic field were not sufficiently large because of the great extent of the active region

T A B L E 1

FLARE IN SESC REGION 3804 (08-20 JULY 1982)
(According to Solar-Geophysical Data)

Date	Importance				
	S	1	2	3	All
July 08	16	3	-	-	19
July 09	13	7	2	1	23
July 10	11	9	-	-	20
July 11	22	6	1	-	29
July 12	10	4	2	1	17
July 13	9	2	-	-	11
July 14	19	-	-	-	19
July 15	13	3	-	-	16
July 16	18	2	-	-	20
July 17	14	1	2	-	17
July 18	11	4	-	-	15
July 19	3	6	-	-	9
July 20	6	3	-	-	9
Together	165	50	7	2	224

In Debrecen we observed three of the large flares, on 9th, 12th and 17th July. On 9th July the flare begun at 7:30 UT, and after the flare and the associated surge a nice post-flare loop system appeared. In the background the large quiet filament is seen, and as the active region was near the limb, the larger height of the post-flare loops is noticeable (Figure 1).

The 3B flare of 12th July begun at 09:00, in Debrecen the clouds cleared only at 10:35, so we could observe only the latest phases (Figure 2), the post-flare loop system. Here also the height structure clearly can be seen: the filament is over the flare ribbon (arrow A), but under the loops (arrow B)

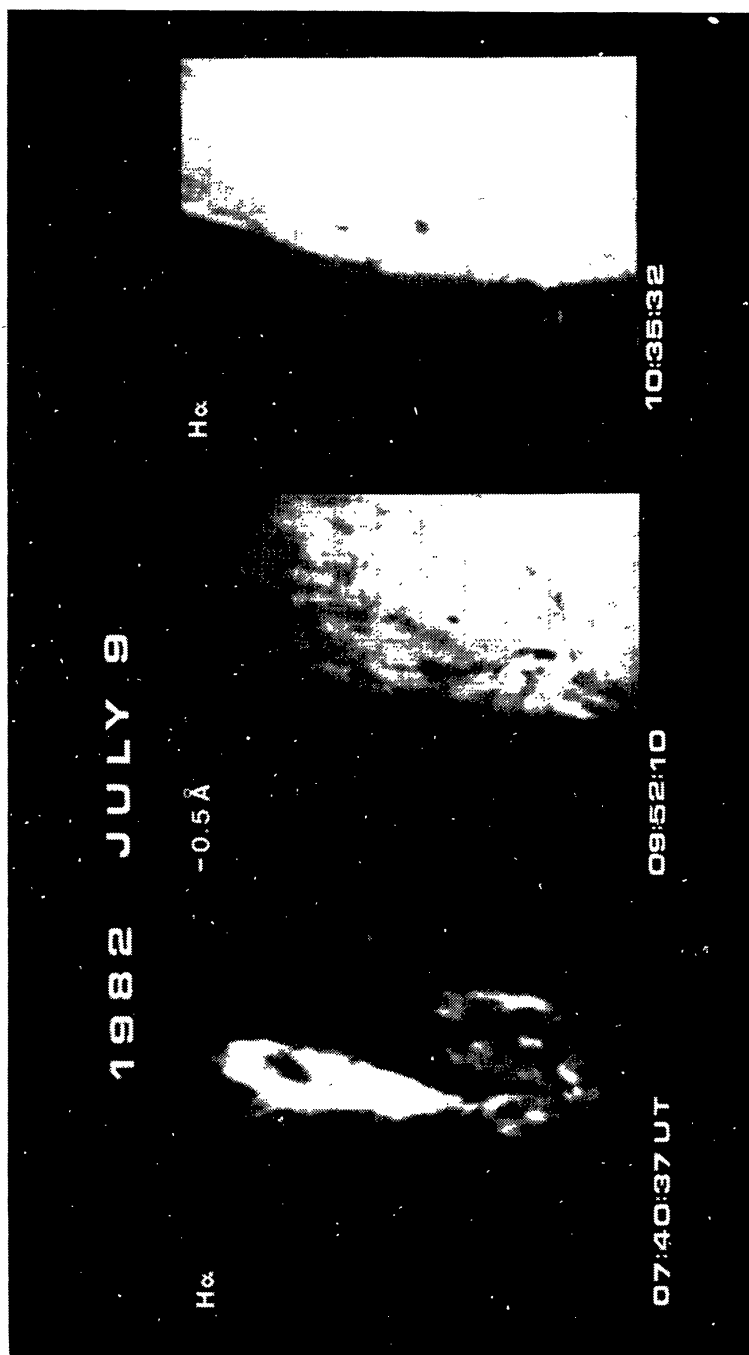


Fig. 1: The flare of July 9, 1982: the maximum phase and the post-flare loops, on the right picture the large quiet filament is also seen.

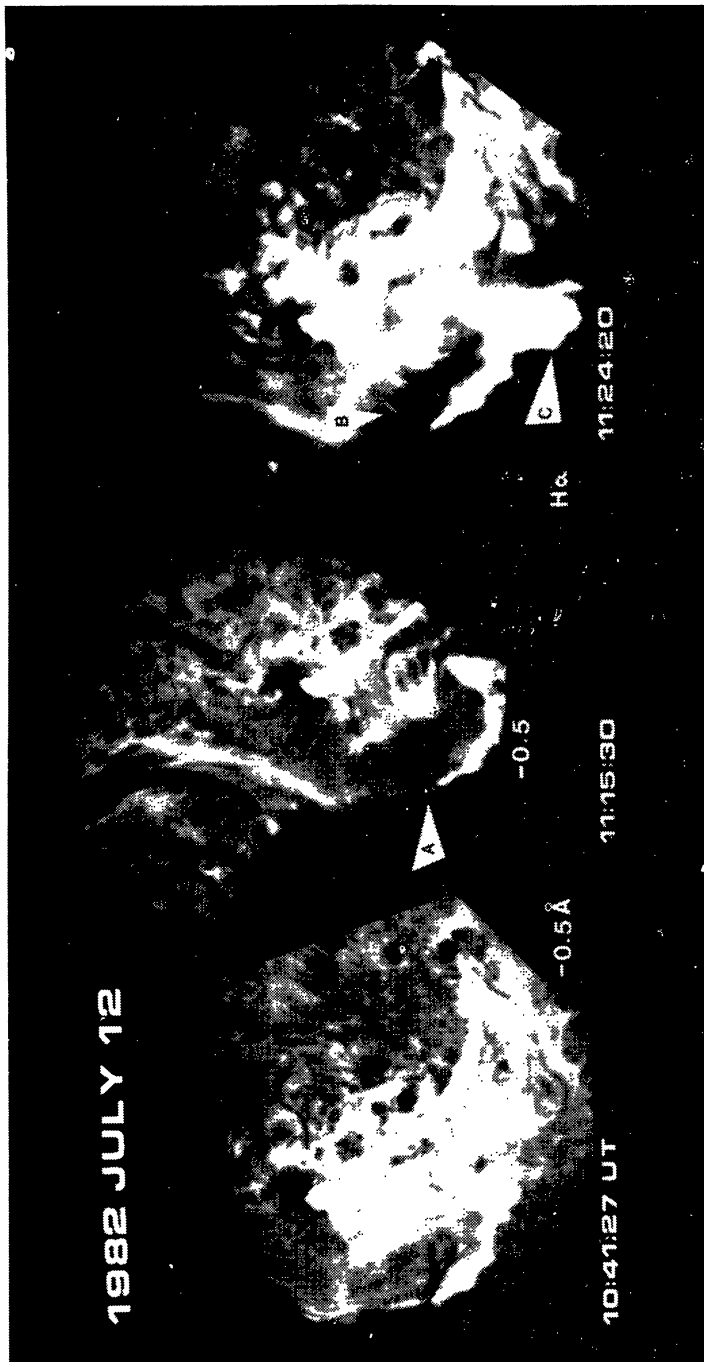


Fig. 2: Later phases of the flare of July 12, 1982. On all of the pictures the bright upper part of the loop system are visible. A: the quiet filament over the flare ribbon, B: the bright loop-top over the quiet filament, C: the extension of the flare ribbon to the weak fields (cf. Fig. 4)

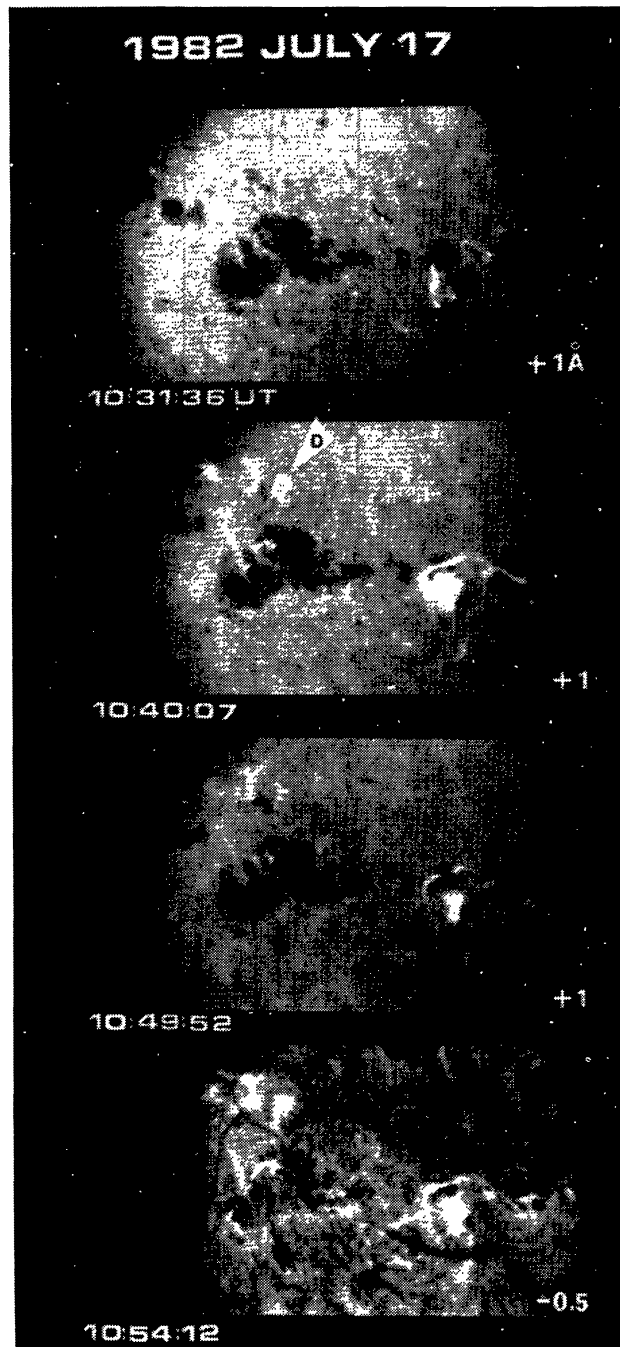


Fig. 3: The evolution of the bright flare ribbons in the flare of July 17, 1982. D: the "curl" around a small sunspot (cf. Fig. 5)

1982 JULY
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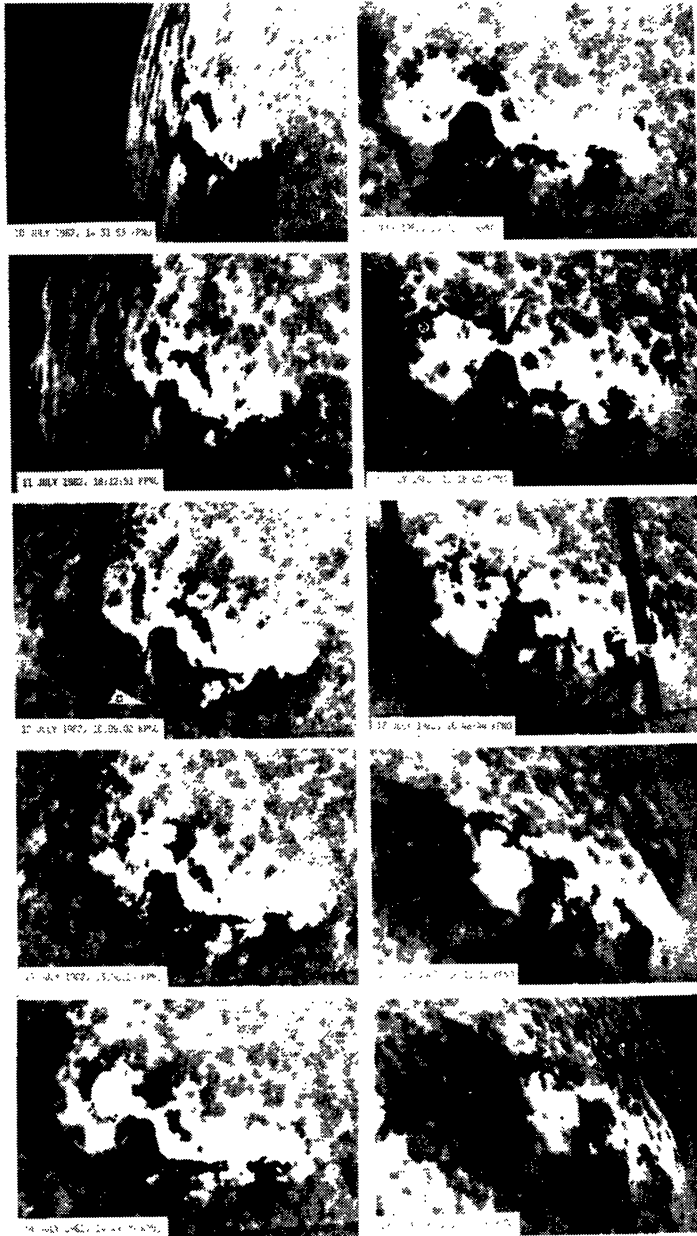


Fig. 4: The evolution of the active region's magnetic field on Kitt Peak magnetograms (courtesy J.W.Harvey). E and F: the significant changes in the structure after the July 17 flare (cf. Figs. 3 and 5)

1982 JULY
SESC 3804

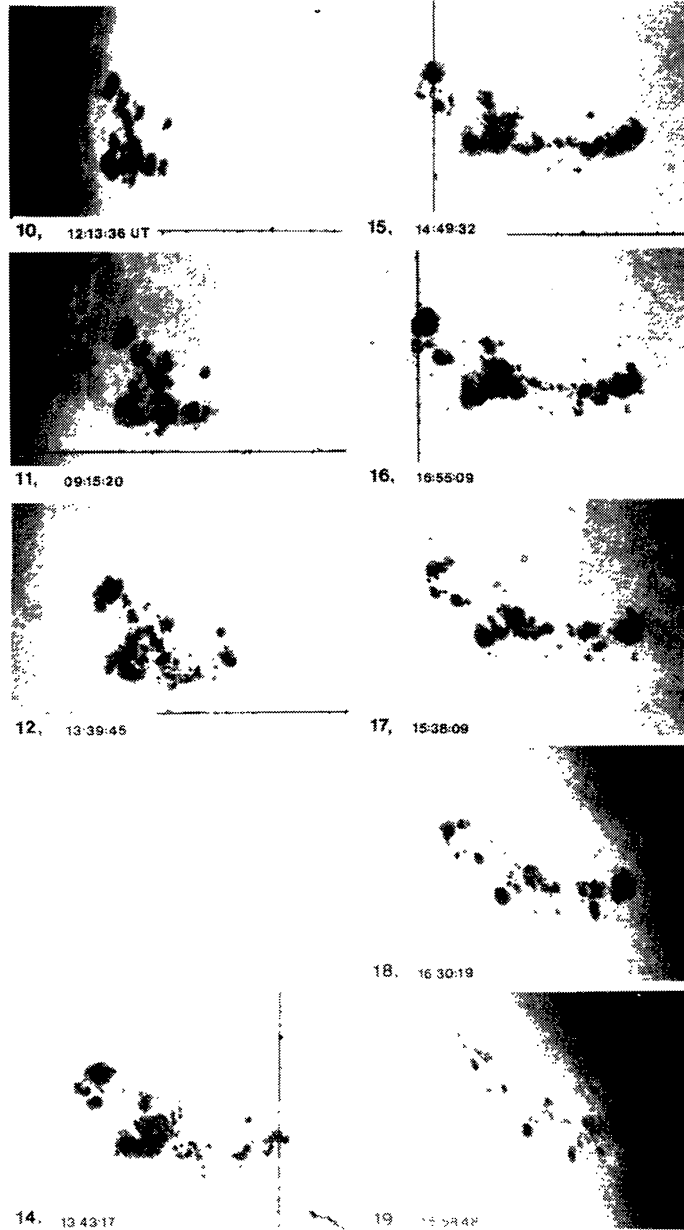


Fig. 5: The evolution of the sunspot group on Debrecen photoheliograms, in the same scale and in time near to the magnetograms of Fig. 4. On July 13 there was no observation. D: the small spot, around which the "curl" in H-alpha was observed (cf. Fig. 3), E: the significant decay of the penumbra where the flare occurred (cf. Figs. 3 and 4)

On 17th, the 2B flare between 10:28 and 11:40 UT (Figure 3) occurred mainly in the W part of the group, but some bright features were seen also in the middle, and later in the NW part.

The morphology of the flares seems to be connected with the evolution of the magnetic field (Figure 4) and the sunspots (Figure 5) in the region. At the beginning (9-12 July) the spot A (Kálmán nad Nagy, 1983) has a strongly distorted form, and the flares occur nearby. The flare ribbons tend to occur on the "ridges" of the field, in the flare of 12th, the northern ribbon stretches between spots 20 and 1, the loop system shows the magnetic field connection to the field of spot A. An interesting "spill" of brightening occurs from the southern ribbon to the area of smaller magnetic fields (arrow C).

In the flare of 17th July a small "hook" is seen (arrow D) around a small sunspot, like the "curl" in the May 16, 1981 flare (Kálmán, Nagy 1983).

Usually a simpler magnetic field structure can be observed after the large flares. After the 12th July flare the deformation of spot A could not be seen, after the flare of 17th a strong decay of spot penumbra and field gradients is observable in the W part (arrow E), and a topology change, accompanied with gradient decay can be seen in the middle (arrow F). It seems that the magnetic field simplifies itself after the flares.

Acknowledgments

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DISCUSSION

M.A. Mogilevsky:

Пробовали ли Вы анализировать положение плоскости вспышечных петель (особенно, например, для вспышек вблизи лимба) по методике предложенной Брей и Лаутхед?

B. Kálmán:

У нас накопился довольно большой материал по послевспышечным петлям и может быть в будущем мы попробуем применить эту методику.

The discussion continues on the page 288.