ON A PECULIAR TYPE OF FILAMENT ACTIVATION

ANTON BRUZEK
Kiepenheuer Institut, Freiburg FRG

Abstract. Hα observations of a peculiar type of filament activation are presented and discussed. Ejected filament material was stopped at a distant position and formed a new stable filament for 1/2- 1 hour until it returned to its source or faded in situ. A similar event has been observed at the solar limb.

Various types of active prominences - such as surges, sprays and eruptive filaments - show fast, large scale displacements of material. Common to all of them is that the material does not survive the motion: it either fades in the corona or it falls back to the chromosphere where is disappears immediately at impact; no material is seen coming to rest and to survive. Here I want to talk about observations of filaments which, on the contrary, settled down after displacement for some time as more or less stable filaments.

A multiple activation occurred with the complex flare event of 15 June 1972 (Bruzek 1975). The small filament shown in Figure 1 had two phases of special activity: 1) After slight changes in the early morning hours, material started moving South along a curvilinear trajectory at about 0800 UT. It partly darkened, partly brightened and showed dopplershifts indicating upward-downward motion along a large arc. The velocity of displacement was about 50 km/s. The material came to rest at position P forming a nice, rather stable filament which had its largest size between 0845 - 0900 UT. After 0900 UT the material returned along the former trajectory to its place of origin at position F - as indicated by dopplershifts and displacements - and remained there in a rather active state. 2) A second ejection of material started about 0940 UT before the onset of a class 2 flare in that region, and material moved again South along the same trajectory as before. After 1010 UT it settled down as a strong filament again at position P although with considerable internal motions. This time the material did not return to its source but faded slowly in situ during the

M. Dryer and E. Tandberg-Hanssen (eds.), Solar and Interplanetary Dynamics, 203-206.

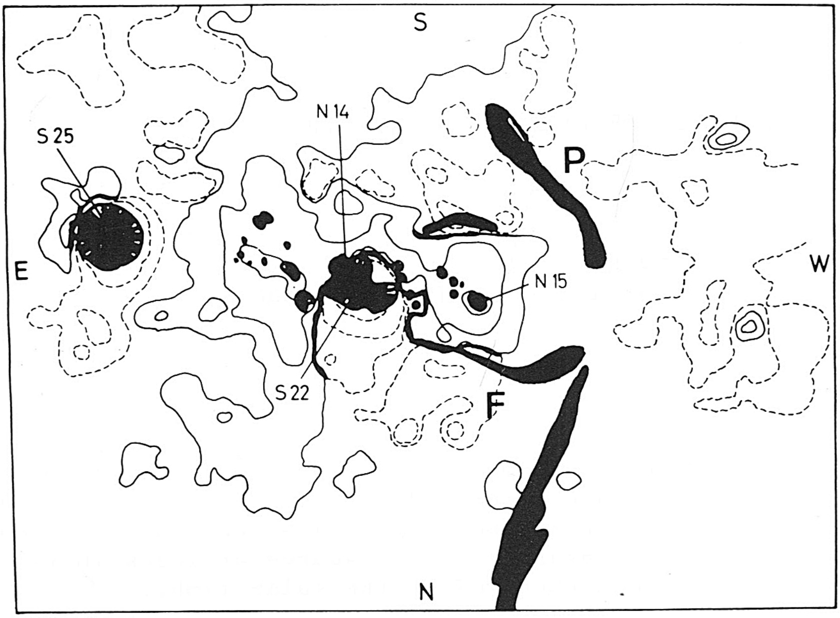

Figure 1. Spots with polarities and magnetic field strengths, and main filaments in McMath region 11926, 15 June 1972 superposed by isogausslines taken from a magnetogram of Sacramento Peak Observatory of 14 June, 1754 UT. Filament F moves to position P.

next hour. - Another disk observation of a temporary stabilization of ejected material has been reported by Zirin (1976).

From disk observations, however, it is not quite clear where the ejected material came to rest: in higher levels in the corona or just above the chromosphere, as most filaments do. The dopplershifts observed in our case indicate, however, descending motion at the end of the trajectory and therefore are strong evidence for the lower position. Direct evidence is provided by a limb observation made 12 September 1966 (Fig. 2). In that case material from an active prominence moved along a flat arc to a distant place where it settled down slowly and faded (or merged with the chromosphere) within half an hour. Thus it appears that ejected prominence material in some cases can stay at low levels for at least half an hour until it fades or returns to its source.

Let us turn now to the configuration of the magnetic field associated with our filament activations which is fundamental for the support and motion of prominence material. Figure 1 shows the filament in its original (F) and its displaced position (P) in a magnetogram taken at Sacramento Peak Observatory on 14 June which, however, very likely is also representative for the 15 June situa-

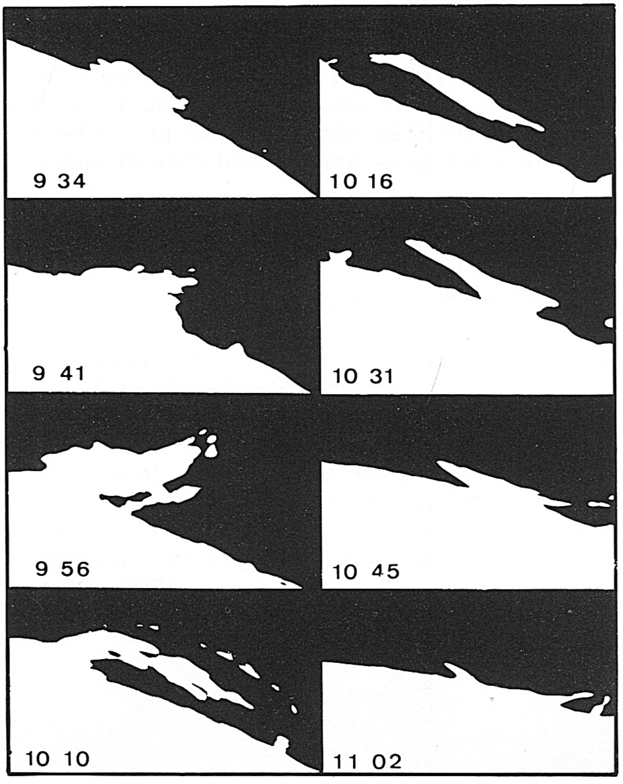

Figure 2 Active Prominence of 12 Sep. 1966; prominence material is ejected to the right and slowly descends and fades.

tion. The original filament F is rooted in a neutral line between strong opposite magnetic fields. The moving filament material runs first between weaker opposite fields but settles down in a purely southpolar region. From that, it is difficult to arrive to a consistent interpretation. It is clear that the material did not follow the direction of the magnetic field; it rather seems to move across field lines which is hard to conceive. The temporary stabilization of the filament material above a unipolar field is not understood either. Zirin's filament was also formed in an apparent unipolar field, but he found some arguments that there might have been a neutral line. In our case the field seems unambigously unipolar. At best, one could assume that a rather oblique and curved neutral sheet existed above the U-shaped neutral line around spot N15 where the filament could float high in the corona; but this contradicts the above conclusion about the low position of the filament and could not explain why the motion is stopped there.

References:

Bruzek, A.: 1975 in: Shea, M.A. and Smart, D.F. (eds) Results Obtained During the Campaign for Integrated Observations of Solar Flares, AFCRL-TR-75-0437, Special Reports No 193, p.43

Zirin, H.: 1976, Solar Phys. 50, p.399

DISCUSSION

Moore: (Comment) I think this event fits the explanation offered by Zirin for a quite similar event: the transient filament forms in a filament channel which is not able to hold material enough to be a visible filament except when there is this strong additional mass supply.