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# PRE-ERUPTION DISTURBANCE OF AN ACTIVE FILAMENT

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ABSTRACT A pre-eruption disturbance of an active filament has been observed. The disturbance is characterized by untwisting rotation and vigorous upward motion. It starts at the site where microflares took place, and appears in the late phase of magnetic flux cancellation beneath the central part of the filament, when more than $10^{20}$ Mx flux had disappeared.

## INTRODUCTION

In less catastrophic case a filament might be disturbed to untwist or rise (Schmieder, 1985, 1991 and references herein). It is not clear if the disturbance is an ingredient of a whole process which leads to filament eruption and flares, and what causes the disturbance. A detailed observation with high resolution time sequence of filtergrams, Dopplergrams and magnetograms would be of importance for obtaining a clear understanding of the phenomenon.

## OBSERVATIONS

On July 8, 1989, when AR 5572 was close to the disc center, a disturbance of a filament in this region was observed at Huairou Solar Observing Station. The data base includes time sequences of $H_\beta$ filtergrams and Dopplergrams with temporal resolution of several minutes, line-of-sight magnetograms with resolution of 30 minutes to one hour. All of the data are in digital forms.

The time sequences of line-of-sight magnetograms in the photosphere and Dopplergrams in the chromosphere are shown on left and right sides in Figure 1 respectively. In the magnetograms the brighter (darker) patches represent positive (negative) polarity fields; while in the Dopplergrams the brighter (darker) features are for downward (upward) motions. In the lower-middle of the magnetograms there is a group of sunspots with positive polarity. Right above them, pieces of enhanced network of negative polarity present. The filament lies in between the positive sunspots and patches of enhanced negative network. At a piece of the neutral line, the filament lies above the concentrated network patches of positive polarity, which collide with negative flux to their north, forming several cancelling magnetic features. It is at those sites that the filament becomes disturbed.

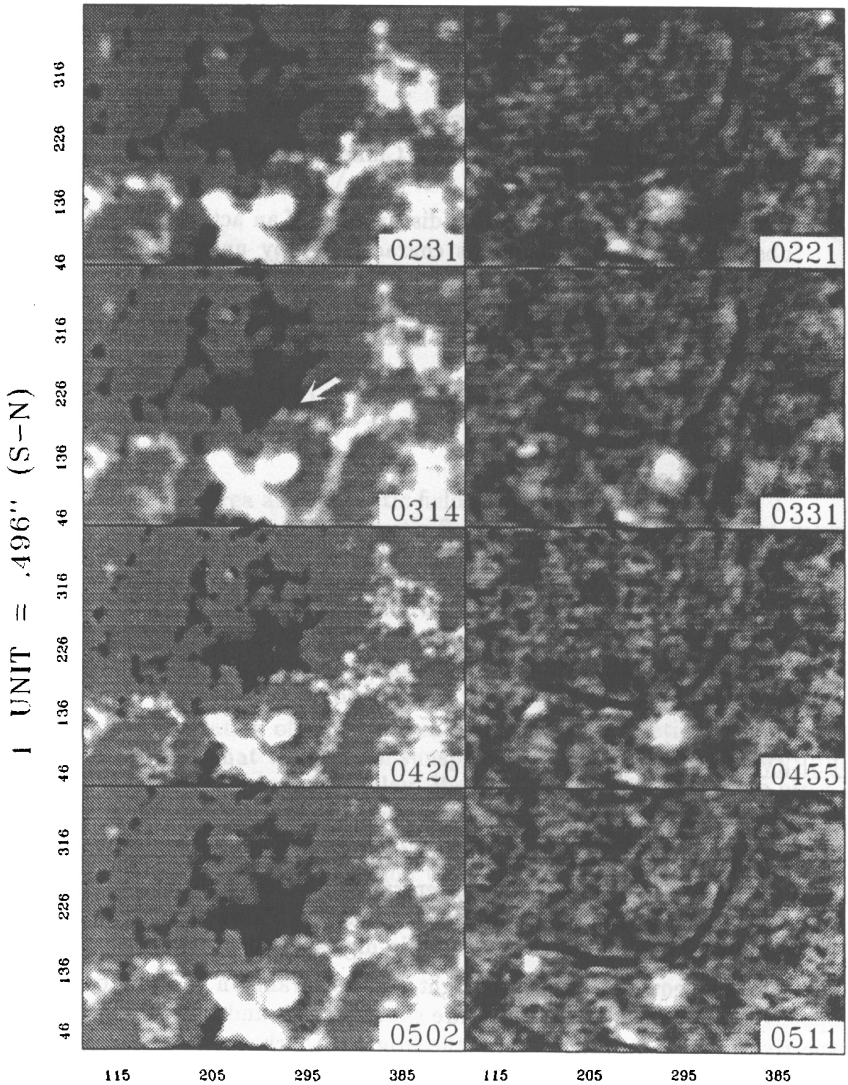


Fig.1a Time sequences of magnetograms in the photosphere and Dopplergrams in the chromosphere

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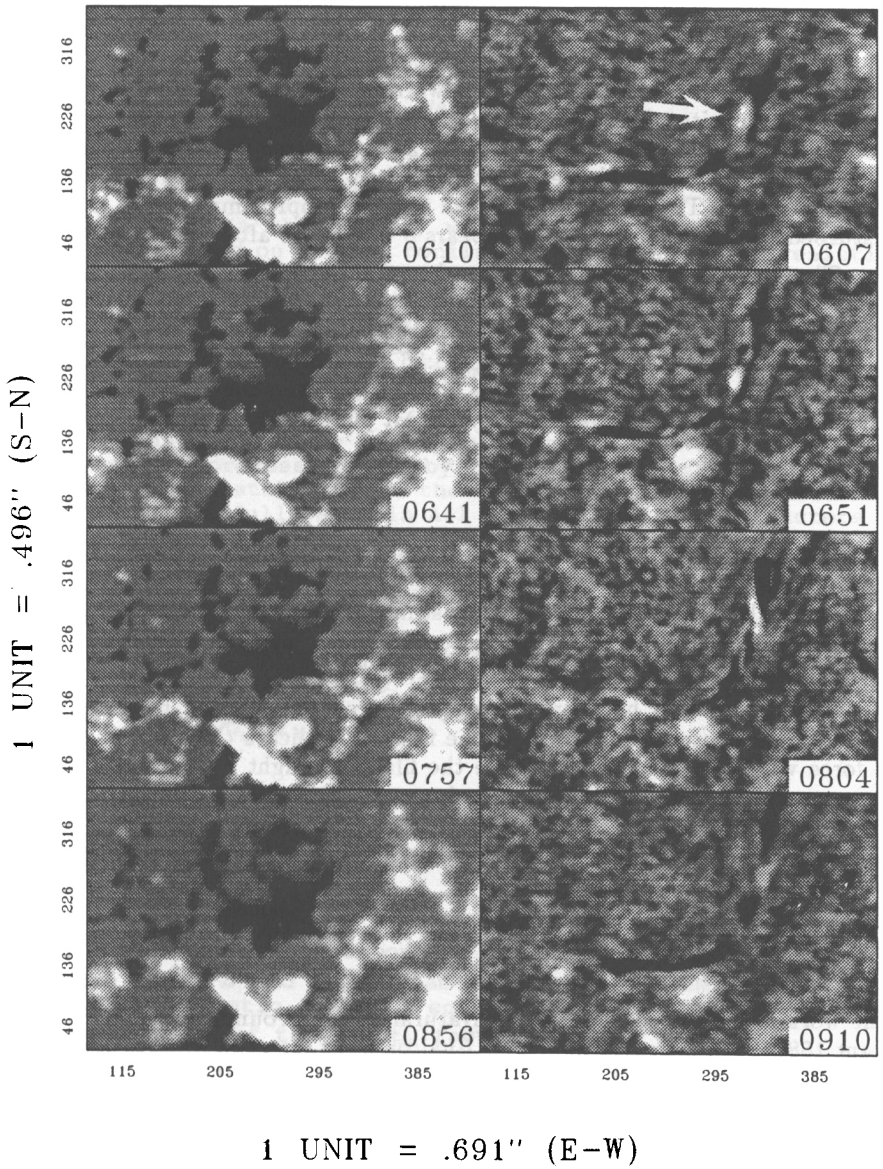


Fig.1b Time sequences of magnetograms in the photosphere and Dopplergrams in the chromosphere

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A filament normally presents an upward motion. Therefore the darker pattern in the Dopplergrams of Figure 1 depicts the shape of the filament nicely. The Evershed flows in the positive sunspots are clearly seen.

The earliest signature of the disturbance is a microflare seen at 05:11 UT. Later from 06:07 UT , a patch of downward motion (see an arrow in the figure) appears at the site of the microflare. Since then, the magnitude of the Doppler shifts increase obviously. At 08:04 UT, an untwisting rotation is identified in the eastern part of the filament from the Doppler pattern as well as the shape of the filament. The whole disturbance lasts for approximate three hours. The disturbed part of the filament disappears 8 - 14 hours after the disturbance.

The disturbance takes place in a late phase of magnetic flux cancellation beneath the center part of the filament. An arrow at 03:14 UT indicates the cancelling sites. More than $10^{20}$ Mx flux had been cancelled out by the beginning of filament disturbance. At the 08:56 UT, the positive components of the cancelling features almost completely disappeared, and the disturbance stopped. The untwisting motion is replaced by almost pure upward motion.

## SUMMARY AND DISCUSSION

The characteristics of the disturbance can be summarized as follows. The disturbance starts at the site where a microflare appears. It is first limited to a small fraction of the filament; then the untwisting rotation becomes more global with a magnitude of several km/s. The disturbance only appears in the late phase of the flux cancellation.

The correlations between the magnetic flux cancellation beneath the filament and the untwisting motion of the filament indicate that the magnetic line of force which support and stabilize the filament might be twisted around the filament and anchored at the small-scale magnetic feature in which the magnetic flux being cancelled in the photosphere. The annihilation and reconnection of magnetic field beneath the filament might be the cause of the untwisting and upward motion.

## ACKNOWLEDGEMENT

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