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Role of field lines in the case of an eruptive prominence

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Abstract. We have analysed the old data of calcium K line solar prominences obtained at Kodaikanal. The analysis indicated that the height of the quiescent prominence on the limb increases with its lifetime. In one case of prominence eruption we found that initially the material moved upward as expected but after sometime started moving horizontally parallel to the solar surface. The analysis of the sunspot data indicated that this change in movement direction happened because of reconnection of field lines in the solar atmosphere due to two isolated sunspot groups.

Key words : solar prominences, prominence eruption, field lines, reconnection

1. Introduction

The prominences associated with activity generally erupt due to reorganisation of magnetic field structure in the active region. These are short lived as compared to quiescent prominences. Detailed observations of quiescent prominences over a long period can provide a clue to conditions for the onset of the eruptive instability and its development (Vrsnak 1990a,b). To study the circumstances leading to prominence eruption and filament disappearance, one eruptive prominence, one quiescent filament have been chosen. These have been studied from their first appearance on the visible disk to the final state of disappearance. In this paper we discuss the role of reconnection of field lines in the eruption of a prominence.

2. Results and discussion

Eruptive phase of the prominence has been recorded in calcium K line pictures for more than three hours beginning at 02 29 17 UT. In all, 12 pictures were obtained with an interval ranging from 7 to 30 minutes. Figure 1 shows the various stages of eruption. The first picture shows it as triangular shaped prominence with three foot points anchored in the chromosphere and had a height of 280 arcsecs above the limb. In about 10 minutes the material of the prominence moved rapidly and attained a height of about 290 arcsec. The existence and long life of knots makes it very easy to

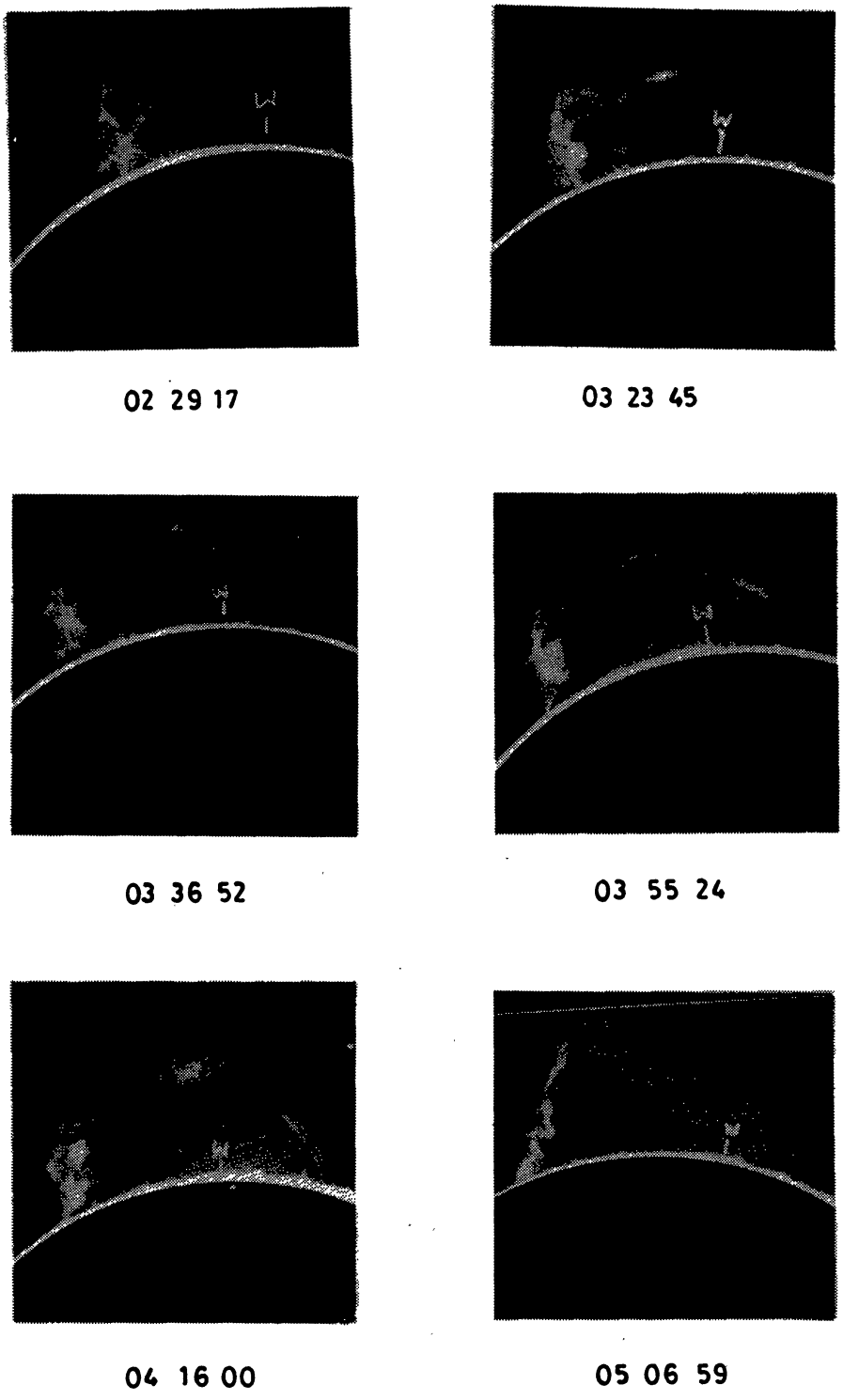

Figure 1. Calcium K line pictures of prominence during the eruptive phase on February 3, 1950. Time in UT is given below each frame.

see the movement of material of the prominence during the eruptive phase. Next frame obtained about 40 minutes later at 03 23 45 UT indicates that the material did not gain height but knots of material started moving in the northern direction almost parallel to the solar surface. The third and fourth pictures taken after about 10 and 30 minutes after the second respectively show the knots of material heading towards the solar surface from southern to northern hemisphere covering large distances. Also seen is the opening of the structures and prominence material falling on the surface near the limb at 10 to 16 degrees north in the subsequent frames. Finally, the eruptive phase of the prominence was over at 08 57 23 UT with a part of the material falling back at the location of the event, a part going in the solar atmosphere and a part falling at a far away location in the vicinity of sunspot group at 10 degree north. H-alpha pictures taken on previous days did not reveal any connection between this sunspot group and the filament.

It is interesting to note that during the eruptive phase at 03 23 and 02 36 UT of this filament, a few knots of dense prominence material, instead of rising further above the solar surface or falling down in the vicinity of the erupting prominence, move in a direction almost parallel to the solar surface. There are no sunspots or other activity associated with this filament to indicate that the knots were moving along the field lines. These knots of prominence material after rising far above in the corona fall back at the solar surface at a large distance at the locations around 10 N on the west limb. It may be recalled that a small sunspot group existed at this location. From the movement of these knots one may speculate that possibly the week field lines due to sunspot group and filament got connected far above in the corona and the prominence material moved along these field lines. The movement of the material to large distances and connection between different active regions has been confirmed by recent observations in x-rays from the YOHKOH satellite (Petersen et al. 1993).

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