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Study of a quiescent prominence

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Abstract. The evolution of a quiescent prominence (QP) seen on the NW solar limb from 11 to 13 June 1991 has been studied. The observations of the main-phase activity of the QP on 12 June 1991 are also discussed.

Key words: Hirayama (1985) model—hedgerow prominence

1. Introduction

The QP of 11 to 13 June 1991 was seen on the solar disc as a filament during 1 to 10 June. In the beginning, the filament was curved and U-shaped, on 6 June it fragmented into two parts, the part at higher latitude later evolved and appeared as a prominence on the NW solar limb. During QP continuous evolution from 11 to 13 June the lower latitude portion disappeared and only the higher latitude portion remained.

2. Evolution of the QP

The evolution of the QP fits in the model proposed by Hirayama (1985). In figure 1, the magnetic evolution sketched by Hirayama (1985) is reproduced. When the prominence evolved on 11 June, there appeared tree, like structures (figure 1a) and between the trees, large horizontal motions could be perceived. Gradually several trees developed and the prominence appeared in the form of a fully developed hedgerow prominence (figure 1b) on 12 June, which is the most stable of all kinds and the main-phase of QP activity. In its very last phase of development, on 13th June, the prominence having a vertical curtain like structure (figure 1c) seemed to belong to the faintest magnetic fields.

3. Main-phase activity of the QP

The QP observations on 12 June 1991 (about two hours) showed considerable morphological changes; we have selected nine filtergrams for the study of the same.

For illustration, in figure 2 morphological tracings of these filtergrams are shown. It appears that the prominence material descends towards the chromosphere in a series of regularly spaced footpoints, these footpoints are linked with huge arches and loops. The presence of a flare in the vicinity of the prominence at 0230 UT (figure 2a) and ejection of a surge from the boundary of the flare in its end stage at 0358 UT (figure 2f) are also shown. The surge initially originated as a bright spike from the limb and activated the prominence loop situated in position A. As a consequence thereof, mass ejections (A' and B') took place in the vicinity of the surge (figures 2g & h). The maximum height and velocity attained by the activated loop were found to be 8.624 x 10^4 km and 553 km s^{-1} respectively. Since the loop was not blown away by the blast, the condition $(\rho v^2/2) \leq (B^2/8\pi)$, is satisfied; where, B is the magnetic field strength in the loop, ρ is the mass density and v the velocity of the loop. This yields the value of B as 61 G.

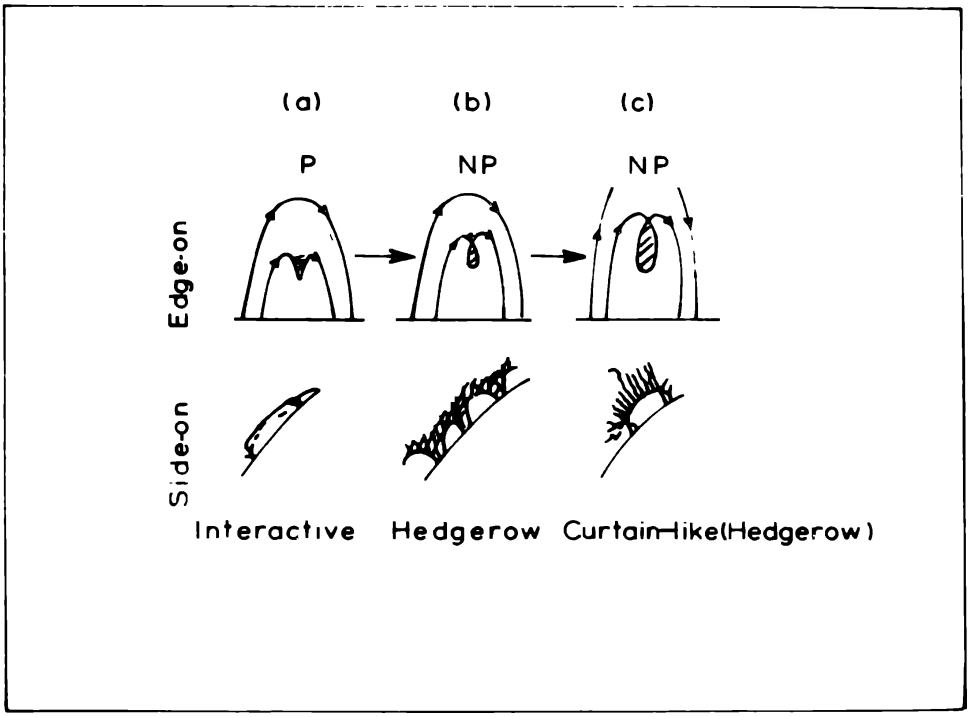

Figure 1. Possible evolution of the magnetic structure associated with a QP according to Hirayama (1985). Here P represents structure with normal (N) polarity, while NP refers to those with inverse (I) polarity.

4. Conclusions

Hirayama's (1985) model seemed to fit in the evolution of this QP; the model has proposed that the I topology can be reached either by reconnection or by shearing and twisting only. By monitoring the course of development of QP main-phase activity, one can unravel the activation of its loop.

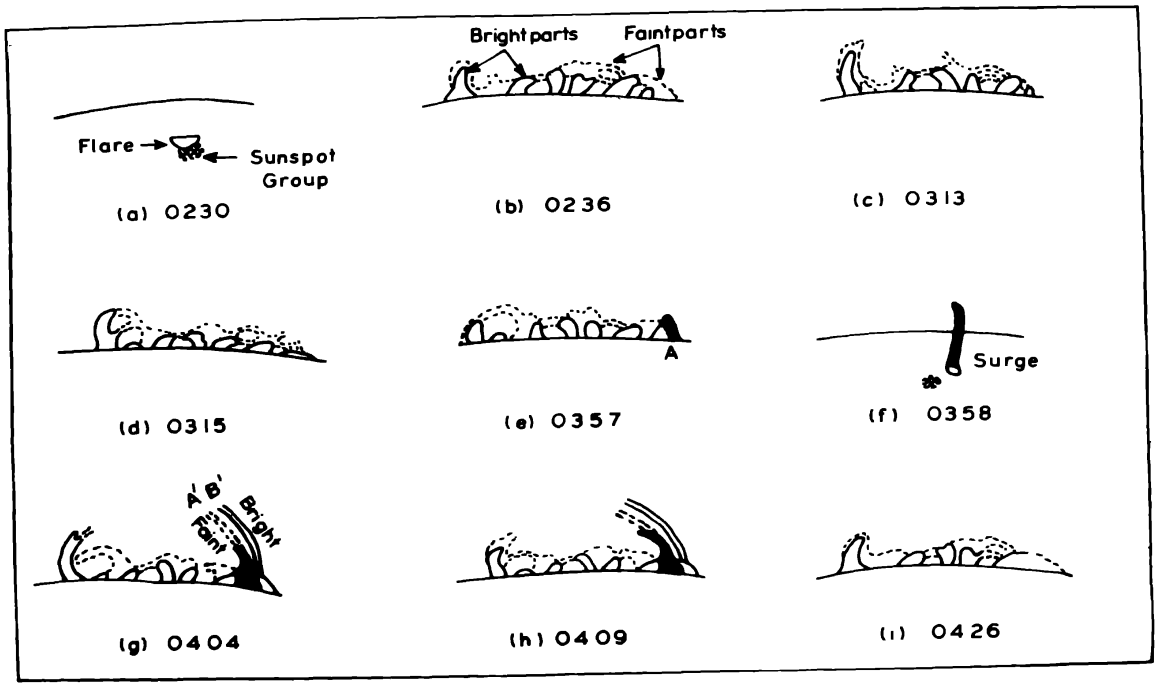

Figure 2. Development of H-alphas morphology of main-phase of the QP on 12 June 1991.

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