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On the activation of a quiescent prominence

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Abstract. During the observations of a quiescent prominence of 1981 November 27, the prominence got activated and mass transfer to another active centre took place with an average velocity of 32 km s^{-1} along a looped path. The total mass transferred to the nearby active centre is estimated to be 6.75×10^{15} gm.

Key words : quiescent prominence—activation

1. Introduction

The quiescent prominence under consideration was situated on the north-eastern portion of the solar limb since 1981 November 25 (Solar Geophysical Data 1982) and its activation was recorded on 1981 November 27 around 0210 UT while observing through the 15 cm f/15 refractor and a 0.7 Å passband H-alpha Halle filter. After activation of the quiescent prominence, mass transfer took place. The temporal changes in the quiescent prominence, were recorded from 0210 UT to 0730 UT.

Here we present the analysis of the observations and the morphological changes associated with this quiescent prominence.

2. Observations

The observations comprised of photographs recorded on Kodak SO 115 film using Yashica FR I Camera with an exposure time of 1/30 s, with the 0.7 Å pass band H-alpha filter turned to the centre of the line. From the line drawings obtained after enlarging the images nearly 20 times we estimated the velocity of mass transfer and amount of the mass transferred to the nearby active centre.

3. Morphological description

From a comparison of the figure 1 (0217 UT) with the earlier filtergrams we notice increased internal motion indicating in turn that the instability of the supporting magnetic field has increased (Tandberg-Hanssen 1977). From figure 2 (0225 UT) it appears that the mass is moving turbulently along a curved trajectory towards a nearby active centre because of the attraction produced by latter (Tandberg-Hanssen

1977). In figure 3 (0255 UT) mass has already started flowing along a looped path to the nearby active centre with a velocity of 32 km s^{-1}. Figure 4 (0705 UT) shows

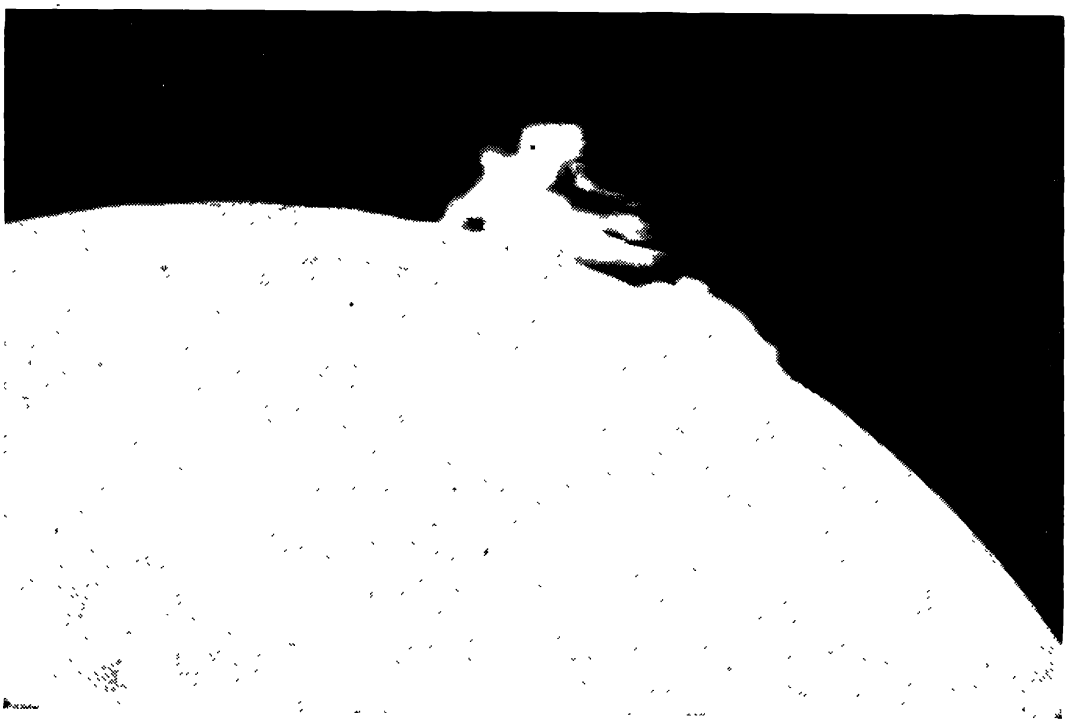

Figure 1

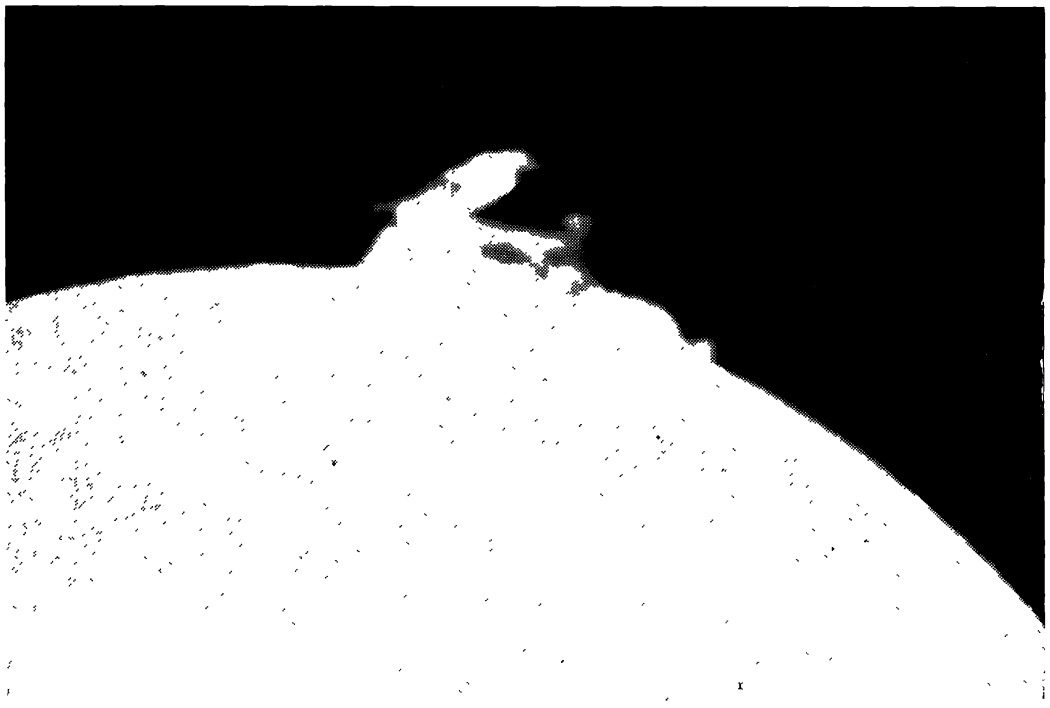

Figure 2

Figure 3

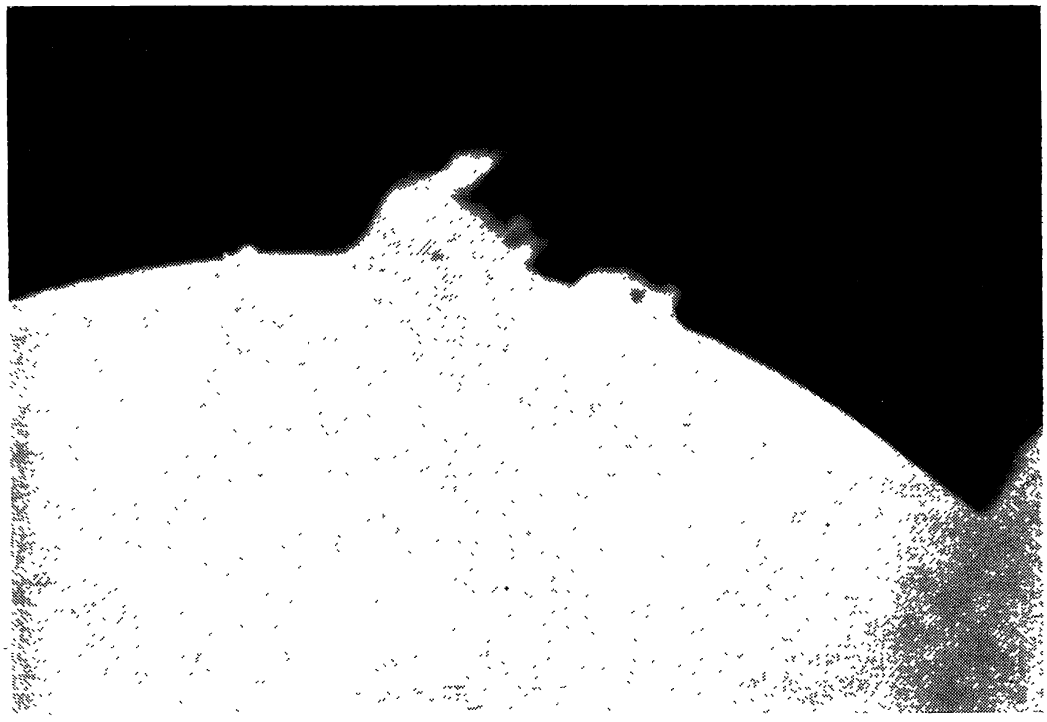

Figure 4

Figures 1–4 are some of the selected filtergrams of the activated quiescent prominence of 1981 November 27 at different moments.

that the height and the overall volume of the quiescent prominence have decreased owing to a partial mass transfer to the nearby active centre. The mass transfer to the nereby attraction centre stopped after nearly 3^h30^m indicating that the magnetic field supporting the quiescent prominence got stabilised after tnis duration.

4. Analysis of observation

From the line drawings we estimated the velocity of mass flow to the nearby attractive centre and found it to be 32 km s^{-1} along a looped path (figure 3). The looped path is inclined at 37° to the tangential direction of the solar limb in the plane of sky.

To estimate the total amount of mass flow to nearby centre, we use following formula

$$M = n_e m_H \, vAT$$

where n_e is the electron density, m_H is the proton mass, v is the velocity of mass flow, T is the total time for mass flow and A is the area of cross section of mass flow.

For the present prominence, the amount of mass transferred to the nearby active centre turns out to be nearly 6.75×10^{15} gm for $n_e = 10^{10\cdot5}$ cm^{-3} (Hirayama 1978) $T = 3^h37^m$, $v = 32$ km s^{-1} and $A = 3.06 \times 10^{23}$ cm^2, taking area of cross section as circular.

5. Possible reason for activation

Anderson (1966) and Uchida (1970) reported that prominences are activated by shock waves generated during flares. In this case activation due to a shock wave is not possible because no large flares was seen at that moment on the solar disk.

Another reason for activation is the interaction of prominences with each other (Tandberg-Hanssen 1974). Since shock waves are ruled out in the present observation, the prominence was probably activated by an interaction between the prominence and a nearby active centre which was also a prominence.

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