SLIGHT DISAPPEARANCE OF PROMINENCE PLASMA TO THE SOLAR CORONA

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1. INTRODUCTION

The problem of prominences-corona relationship is relativelly old. Already in 1931 Lockyer [1] showed that there is a close relation between prominences distribution and the form of white-light corona. However, this problem is still debatable and poses a number of controversial questions. One of them is the question of the energy and mass exchange between prominences and the ambient corona. It is generally assumed that the mass balance exists between the corona and prominences, but unambiguous observational proofs for prominences-corona plasma exchange are very rare. There are little data [2-4], as well, that could be used to address the problem of slight plasma flows from prominences to the corona.

In this contribution we give an observational evidence for slight disappearance of prominence plasma as it was found during the H-alpha observations with Lomnicky Stit coronograph and discuss possible explanations of this phenomenon.

2. OBSERVATIONS AND DATA PROCESSING

An interesting prominence was observed with the 20-cm lens coronograph at Lomnicky Stit coronal station in August 28, 1989 (for more details see [5]). It was relatively stable but not so calm and has shown rapid changes of the shape of its upper parts. This prominence was observed in H-alpha (FWHM = 0.8 nm) during 17 minutes with one minute interval. The whole series of observations was analysed in detail using MDM 6 microdensitometer Joyce Loebl, computers and program facilities at Rozhen Observatory in Bulgaria.

3. RESULTS AND DISCUSSION

After the processing of H-alpha images of August 28 prominence we obtained 17 consecutive maps. Four of them are shown on the Figure. They ilustrate the fact that the prominence loses a noticeable, but exceedingly small quantity of plasma. The plasma at the top of two curved columns

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(dotted area) continuosly disappeared. This process can be traced in detail on the whole series of maps. In the last frames it is not already seen in H-alpha.

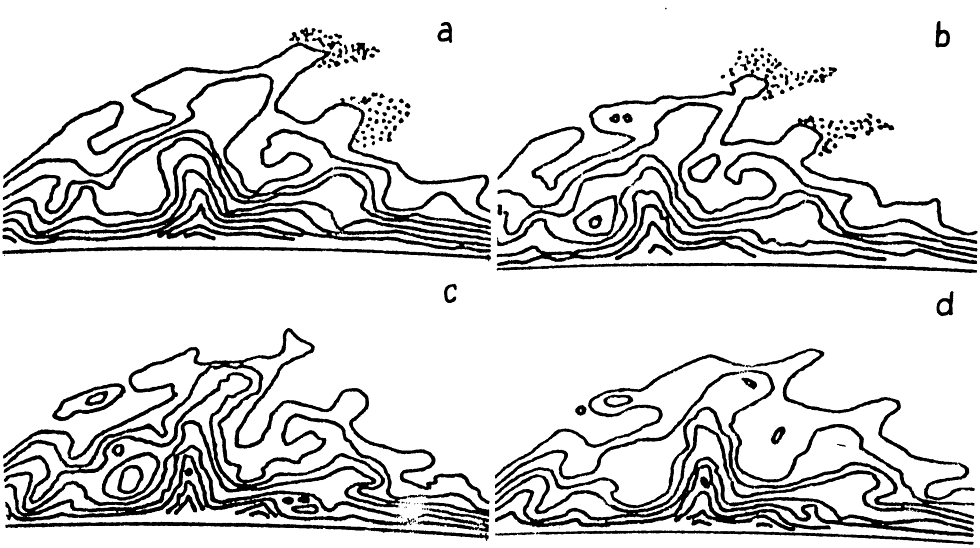

Figure. Isodensite maps of August 28, 1988 prominence (a/05:05, b/05:09 , c/05:15, d/05:20 UT). The isoline levels are 0.05; 0.15; 0.25; 0.30; 0.40; 0.50; 0.70; 0.80; 0.85; 0.95; 1.00.

The structure of this prominence was complicated but relatively stable and retained its shape. We did not observe a noticeable changes of the prominence height during the observation as for the cases of eruptive prominences.

Assuming prominence mass density of 10^{-14} g cm^{-3} [2] for the dissappeared area which has a volume of 10^{25} cm^3, we compute the total amount of prominence plasma, contained in both features, of about 8×10^{11} g.

One may suppose that this cool prominence plasma was continuosly heated to a coronal temperature. As was suggested in [6] from observations in H-alpha, 530.3 nm and 637.4 nm, fast-mode waves energy can enter the prominence and to produce an enhanced temperature region in its vicinity. A similar process could work in the case of August 28 prominence as well. However, another explanation of this observational effect is possible. In a plasma medium with a highly structured magnetic field the non-linear effects lead to generation of plasma flows, as it was shown in [7]. Along the magnetic lines of the "channels" or "edges", on the upper part of August 28 prominence, propagation of oscilations is possible. Due to the absorbtion of the momentum of such oscilations a faint prominence plasma flow could be driven. Such a flow is possible due to the action of ponderomotive force on the prominence plasma, as well.

We would like to point out that the boundary between the prominence and the corona for the most parts of prominence surface was stable during the observed sequence. It means that a flow of prominence plasma, or plasma evaporated from some parts of the prominence to the corona, could not be free, but occurs in a special magnetic field configuration. Disappearance of prominence material has also been observed during disparition brusques or from slow ascending material connected with flares [8]. However, in both these cases only several isolated knots dissipate to the solar corona.

4. CONCLUSIONS

Prominence images obtained in H-alpha showed that some of prominence plasma in the edges with special configuration can slowly enter the corona. In our opinion not only a process of heating, but some dynamic processes also are possible. We propose to consider the action of the ponderomotive force and absorbtion of the momentum of oscilation propagating along the prominence magnetic field in the places with special configuration. This observational result supports the old idea that material from underlying layers could also come into the corona through prominences.

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