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THE HEATING OF FILAMENTS AS A DISAPPEARANCE PROCESS

Z. MOURADIAN
M.J. MARTRES
I. SORU - ESCAUT

Observatoire de Paris
Section de Meudon
DASOP - UA 326
F-92195 Meudon Principal CEDEX

FRANCE

INTRODUCTION

The sudden disappearance of filaments, commonly called "Disparition Brusque" (DB) is of two types : i) the well known ejection of cool prominence material into the corona, i.e., a dynamic process (DBd) and ii) the heating of the prominence plasma (Mouradian et al., 1981). When the hydrogen of the filament becomes ionised, then the filament start to be visible in EUV lines keeping the same shape and position as the cool one. This process which is a thermic disappearance was named DB thermic (DBt). In Mouradian et al., (1986) a complete description of this phenomena is given. Successive disappearances and condensations of a quiescent filament from 1973 june 13 to 17 was studied. This observation was provided by two instruments Skylab ATM abord satellite : the Harvard College Observatory polychromator and X ray telescope of the American Science and Engineering Co. (2-32, 44-55 Å).
The heating of filaments was confirmed by Malherbe et al., (1982) who observed a partial DBt consequently to a flare.
In Schmahl et al., (1982), it was pointed out that before a DB, filaments are spanned by hot arches emissive in OVI or/ and Mg X or in soft X rays. Many DBs obey to this scenario.

THE HEATING OF THE FILAMENT OF JUNE 1973

The heating of the studied filament may be explained -as seen above- by a hot arch which span it. This arch is well visible in soft X rays. It is close to the part of the filament which shows several DBs. The intensity of different EUV lines ($7 \cdot 10^3$ to 10^6 °K) was studied by the spatial variation following the transition from cool to hot prominence.
The figure 1 shows us the ratio of the filament integrated intensity over the line profile and the quiet surrounding sun. At the right site of the filament observed on June 15th at 17:22, a hot filament is visible. Note that the cool filament is in absorption ($I/I_o < 1$) in regard to the surrounding,

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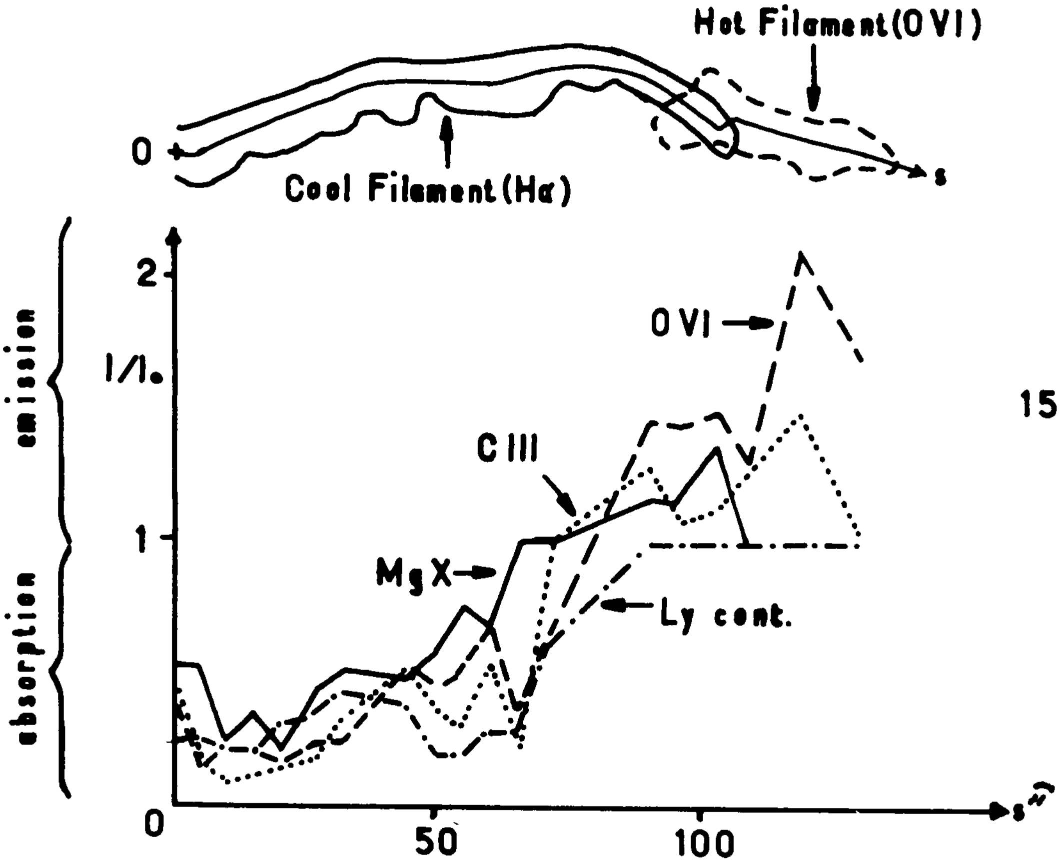

FIG.1
15 JUNE 1973
17:22

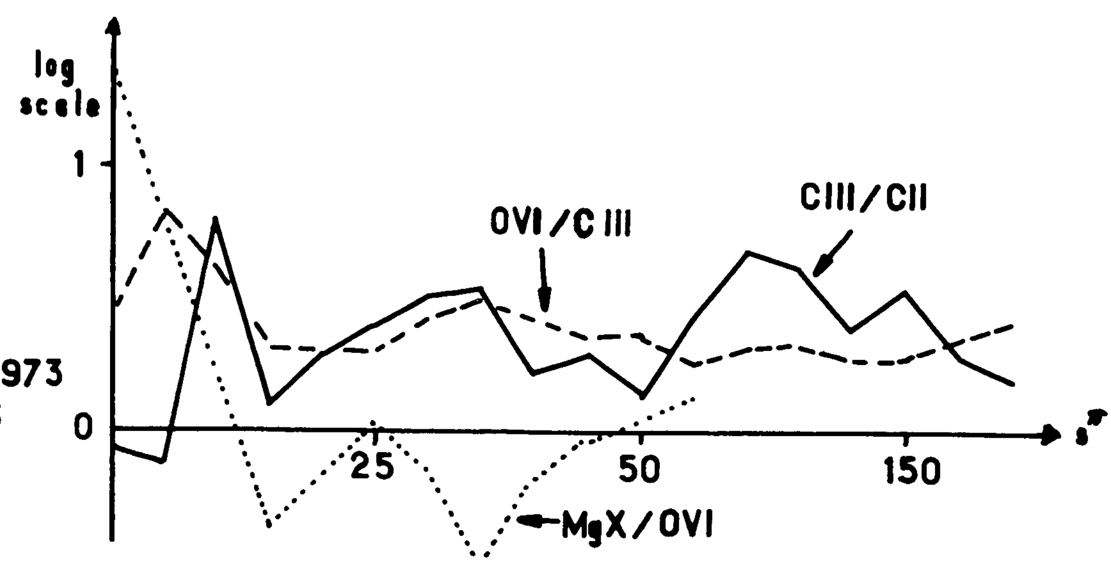

FIG.2
16 JUNE 1973
02:56

whereas the hot filament is in emission ($I/I_o > 1$). In figure 2 we show that the intensity ratio of three lines formed at three different temperatures (CIII/CII, OVI/CIII and Mgx/OVI) gives a similar result. We see that peaks appear at the end of the hot filament where is also the transition to the cool filament. These peaks (on the left of the figure) show that the heating is propagated toward the filament by conduction, because the energy transport is more efficient for the higher temperatures than for the lower ones. On the right side of the peaks the body of the filament seems to be in thermal equilibrium.
Concerning the energy transport from the hot X arch to the filament, it cannot be provided by thermal conductivity because the lines of force between the hot X arch and the prominence, are about perpendicular.
In conclusion we can say that the only likely heating mechanism is the irradiation of the filament by overspanning hot X ray emissive arches.

ENERGY INCREASE DURING THE HEATING PROCESS

It can be seen in figure 2 that the hot filament has reached an equilibrium state between the input and the lost of energy. The energy input is function of the radiation field of the X source and of the dilution factor. Using the density values (Mouradian et al., 1986) we are able to compute the thermic energy stored by the hot prominence, which is defined as :

$$E_k = \frac{3}{2} K \int_o^{\infty} \left[(n_e T)_H - (n_e T)_C \right] dT = 7\ 10^3 \text{ erg cm}^{-3}$$

where the indexes H and C mean hot and cool.
The transition between the hot and cool parts of the filament must be studied with better time resolution than that of our sample, in order to understand the energy transport mechanism.

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