CONTRAST OF FILAMENT BRIGHT RIMS

E. V. KONONOVICH¹, O. B. SMIRNOVA¹, P. HEINZEL² and P. KOTRČ²

¹ Sternberg Astronomical Institute, 119899 Moscow, Russia
² Astronomical Institute of the Czech Academy of Sciences
251 65 Ondřejov, The Czech Republic

Abstract. The Hα filtergrams obtained at Tjan-Shan High Altitude Observatory near Alma-Ata (Moscow University Station) were measured in order to specify the bright rims contrast at different points along the line profile (0.0; ± 0.25; ± 0.5; ± 0.75 and ± 1.0 Å). The mean contrast value in the line center is about 25 percent. The bright rims interpretation as the bases of magnetic structures supporting the filaments is suggested.

Key words: Sun – Filaments – Bright Rims

It was shown previously that the bright Hα rims bordering the centerward edge of most filaments sometimes have the line-center contrast increased by about several percents. However, the better resolution we is used, the more obviously these bright rims turn out to be structured. That is why we have suggested (Heinzel et al., 1990) a possible explanation of the phenomena being connected with the influence of a filament upon the surrounding chromospheric structure. To prove this suggestion we have measured another filament different from that used for the paper cited above.

In addition to our Hα filtergrams we tried to use spectral line profiles obtained at the Echelle spectrograph of the Sacramento Peak VTT for answering the question: what is the origin of the filament bright rims? As the filament rims are highly structured phenomena, two-dimensional photometric maps of the filaments environment obtained from Hα filtergrams provide rather simplified but still more comprehensive information. As an example we have used the best Hα observations made on September 18, 1989 near Alma-Ata (High-Altitude Tjan-Shan Observatory of Sternberg Astronomical Institute). The Hα filtergrams obtained through the 0.25 Å pass-band Lyot-type filter were taken in the Hα line center and at ±0.25; ±0.5; ±0.75; ±1.0 Å.

Here we discuss the results concerning the longest south-west filament (60S, 75W). The bright rims are well visible on negatives. But in contrast to the usual situation, the filament rims in our case are visible on both sides of the filament. The same pattern can be distinguished for other filaments on the same photograph, but with a less pronounced contrast.

One may suggest that the general opinion about the predominance of the filament rims on the centerward side of a filament is the result of a larger brightness on this side. The precise photometry of the chosen filament was performed using the AMD-1 microdensitometer of the Sternberg Astronomical Institute. The photometric maps revealed a complex structure of the filament and its environment. Fig. 1 presents a detailed structure in the Hα line center. This picture clearly shows the evidence of the structural origin of the bright rims. Roughly one can see three similar systems of details, oriented perpendicularly to the local direction of the filament axis: they consist of a dark filament structure surrounded by two bright areas with the form similar to those of a filament fine structure.

Figure 1. Isophotes of the filament and its bright rims. One pixel corresponds to 2 arcsec. The intensity difference between the successive isophotes is 20 units in arbitrary scale.
In the line center the mean contrast of the “summits of brightness” along the filament edge (about 20–30 arcsec away from the filament channel) is about +25%. In the same time the largest contrast of the filament is about −40%.

The structural similarity of the filament channel minima to the filament border maxima suggests their common geometric pattern. It seems possible to speculate about a reflect of a certain magnetic field configuration supporting the filament. It can be suppressed in the top of the loop and have some enhancements at the bases, like in the case of the so called “feet of the loops” (Fig. 2).

![Graph](image.png)

Figure 2. Points of local minima along the filament axis (circles with “−”), bright rims maxima (circles with “+”) and background (empty circles). The loops represent magnetic structures suggested to support the filament.

Acknowledgements. The authors are thankful to A. E. Schukin for kind help in the data reduction and for discussion.

References