THE BRIGHT STREAKS IN THE Hα DISK CHROMOSPHERE

RAWI BHAVILAI

Dept. of Physics, Chulalongkorn University,
and Applied Scientific Research Corporation of Thailand

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Abstract. Evidence is presented demonstrating the existence of a type of chromospheric structure in the form of bright streaks. These are extensions across the solar disk of elongated bright mottles which originate in the central regions of clusters of mottles. They are best observed on good filtergrams at Hα ± 0.5 Å through comparison with filtergrams at other positions on the line profile. Their length can be as much as 200 sec of arc. The bright streaks appear to be predominantly horizontal loop structures, while the well-known spicules are mainly vertical structures. A bright streak may be well defined or rather diffuse along its length, and many of them are accompanied by darker boundaries or envelopes. It is usual to find a loop of bright streak bridging the central areas of two mottle clusters. It seems that the observed pattern in the space between the chromospheric network at Hα 0.5 Å results partly from the interactions of the bright streaks of different stages of evolution traversing the area in different directions.

1. Introduction

In a previous paper by the author (BHAVILAI, 1965), attention was drawn to the existence of bright streaks which start from the bright mottles usually associated with clusters of mottles and extending as far as 160 sec of arc across the disk. The same streaks are identifiable at Hα ± 0.5 Å. They do not reproduce well on paper prints, but can be identified on transparent prints. It was assumed that they appeared only occasionally. Recent observations with high resolution to be described in this paper show, however, that they are quite numerous and constitute a significant portion of the population of the solar chromosphere as observed in the Hα line.

It is established from these observations that the bright streaks play a significant role in producing the appearance of the space between the chromospheric networks as observed around Hα ± 0.5 Å.

Two groups of observations are used in this investigation.

(i) The observations described in Sections 2.2 and 3.4 were made with the domeless Coudé refractor at the German Solar Observatory, Anacapri, Italy, in August 1967. The diameter of the objective is 350 mm. A Halle Hα filter with a passband 0.5 Å was used. Filtergrams were taken in rapid succession with a 35-mm cine-camera on Kodak Solar Recording Film Type So-375. The solar image diameter is 150 mm. The selection of the positions of the filter passband on the line profile could be programmed and the exposure was automatic. Approximately 2000 exposures were made of quiet areas near the centre of the solar disk. About 10% of these pictures are of good quality.

(ii) The observations described in 2.3 were obtained with the chromospheric telescope of the C.S.I.R.O. Division of Physics at Fleurs, N.S.W., Australia. The telescope has an achromatic objective of diameter 130 mm and focal length 1776 mm.
An enlarging system produces a solar image of about 100 mm diameter at the final image plane. The observations were made in June 1964 with a $\frac{1}{6}$ Å tunable birefringent filter (Steel et al., 1961). A 35-mm cine-camera was used in conjunction with this filter to obtain photographs in rapid succession of a selected area on the solar disk in the light from different positions in the profile of the H$\alpha$ line. Kodak 35 mm spectroscopic film type IV-E was used for the observations.

All observations described in this paper were made near the centre of the solar disk and in quiet regions, without filaments or other disturbances in the vicinity.

2. The Bright Streaks in H$\alpha$

2.1. Method of identification

Bright streaks in H$\alpha$ filtergrams may be conveniently identified through the following procedure:

(i) Initially, careful examination of an enlarged print of a good-quality filtergram will reveal a number of prominent bright streaks.

(ii) Thereafter, a transparent enlarged print of an exposure, say at H$\alpha$ +0.5 Å, is prepared. This is superimposed on another transparent print, or an ordinary print, of another exposure made at a different position in the profile. The time of the two exposures should not differ by more than 1 min. Many bright streaks will be readily recognized by this method. This step could be repeated, using different pairs of exposures made at different positions on the line profile spaced at 0.25 Å interval. Successive photographs at the same wavelength may be used for confirmation, and also to find the lifetime of the bright streaks.

All estimates of size of streaks and mottles and their separations are based on visual examination of enlarged prints. For convenience of reference, the identified streaks are drawn in outline over a low-density enlarged print to serve as a diagram for identification.

Although a bright streak which is prominent at one wavelength may not be easily identified at another position in the line profile, filtergrams taken at 3 to 4 positions spaced at 0.25 Å are enough for identifying most of the interesting features. A good-quality filtergram at H$\alpha$ +0.5 Å or at H$\alpha$ −0.5 Å shows a great number of bright streaks. An exposure at H$\alpha$ enlarged on transparent film, used in conjunction with one of these prints, will show many otherwise obscure bright streaks. Some bright streaks appear distinctly at H$\alpha$ +0.25 Å. A picture at this wavelength is useful for identification and also for confirmation.

2.2. Observations with a 0.5 Å bandpass Halle filter

2.2.1. Filtergrams at H$\alpha$ +0.5 Å

Figure 1a represents the chromosphere near the centre of the solar disk at H$\alpha$ +0.5 Å obtained on August 16, 1967. The Fraunhofer Institute daily map of the sun for this date shows that this selected area was free from activity. Some of the bright streaks...