

What is a quiet sun CaII K line profile?

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Abstract. We have derived a mean disc averaged K line profile from observations at the Kodaikanal Solar Tower Telescope on days when sun was relatively very quiet during the years 1985-86. This mean profile would represent the K-line profile of a truly quiet sun.

Key words : solar cycle—chromosphere—quiet sun

1. Aim

While evaluating the chromospheric variability in the sun (solar cycle related or any other) using the CaII K line (λ 3933.684A) as an indicator, an essential prerequisite is the knowledge of a K-line profile of a truly quiet sun. This profile serves as a bench mark over which the enhancements can be measured. This paper describes how such a K-line profile has been derived for the quiet sun in the disc integrated light i.e. for the sun as a star.

2. What do the K-line profiles represent in terms of the chromospheric features?

It is known that the contributors to the emission seen in the K-line profile are :

- (i) the quiet network,
- (ii) the bright points in the interior of the network,
- (iii) the active network, and
- (iv) the plage.

Of these, the sources of emission in the quiet chromosphere are : the quiet network, the bright points within the network and the unresolved chromosphere. Another component present at high latitudes during solar minimum years is the polar faculae which are seen in emission in the K line (Makarov & Sivaraman 1989). The plages and the active network (which are formed from the dispersal of the fragments of active regions) form the additional components of emission in the active sun.

Although the plages occupy only about 10% of the solar surface, their contribution to the integrated flux is overwhelmingly large compared to the other contributors, because of their high intensity contrast (figure 1). Their presence can therefore be easily recognised in the K-line profile of the integrated sunlight both in the rotational modulation (\sim 27 days) as well as in the variation over solar cycle.

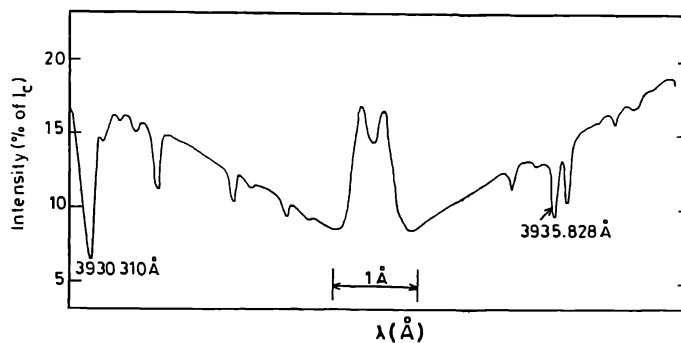


Figure 1. K-line profile over a plage region.

3. Observations and data

We have obtained the K-line profile of the quiet sun as follows : During the last solar minimum period 1986-87 there were spells when the sun was very quiet with only a weak network, the cell interior with bright points and the polar faculae. The K 1A index was lowest during this period (see figure 3 of : Sivaraman *et al.* 1993). We have picked out the spectra obtained at the Kodaikanal Solar Tower Telescope on days within these quiet spells from our archives of the K-line spectra of the disc integrated sun programme. These profiles obtained in the VI order in the K region (dispersion $\sim 9.4 \text{ mm } \text{\AA}^{-1}$) on 103 a-O emulsion with photometric calibration were converted first to relative intensity scale and then to the absolute intensity scale. For the latter, we used the calibration that the intensity on the wing at 3935.16AA is 13.8% of the continuum for disc centre (White & Suemoto 1968) and of 16.5% of the continuum for profiles averaged over the disc.

4. Result

We have presented an example of the disc integrated profile typical of a truly quiet sun in figure 2. The work of estimating the contributions from the various emission features and modelling the variability over the solar cycle using this quiet sun profile as the base line is in progress.

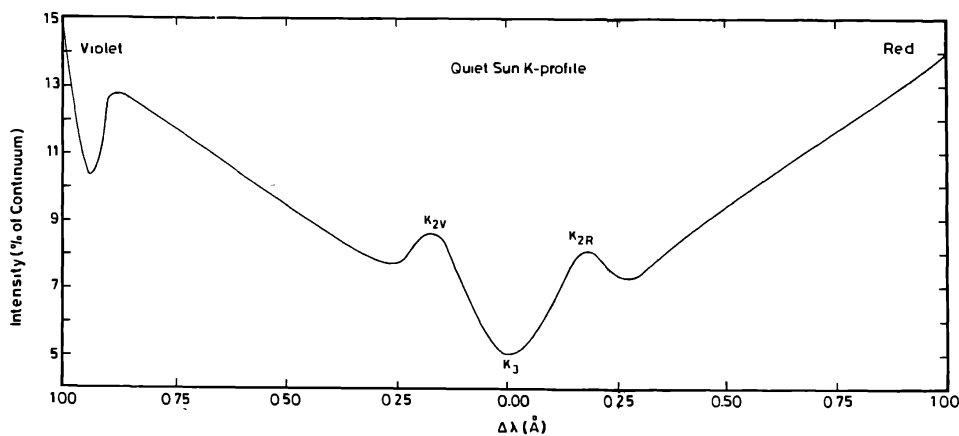


Figure 2. K-line profile of the quiet sun in the integrated light.

References

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