Astron. Nachr./AN **32X** (200X) X, XXX–XXX

# Dynamics and turbulence of the chromospheric layers of a flaring atmosphere

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## 1. Introduction and data

We investigated time series of spectra of a subflare observed with high spatial and spectral resolution in chromospheric Ca II K line 393.3 nm (h∼1500 km) and two photospheric lines Fe I 522.5 nm and Fe I 557.6 nm (h∼370 km). The photospheric lines differ in magnetic sensitivity, $g_{eff} = 2.25$ and $g_{eff} = 0$ for Fe I 522.5 nm and Fe I 557.6 nm, respectively. The spectra were taken with the Vacuum Tower Telescope on June 1, 1993, simultaneously in all three spectral regions. Twelve sets of spectra were obtained from $8^h12^m30^s$ UT to $8^h14^m46^s$ UT. After applying the usual reduction steps we determined the FWHM for both Fe I lines and the asymmetry for Ca II K line (definition see in Brčeková et al. 2002). We plot the trend of spectral characteristics along the slit and compared the spectral characteristics from the photosphere and chromosphere to investigate the influence of the flare on the underlying layers of atmosphere.

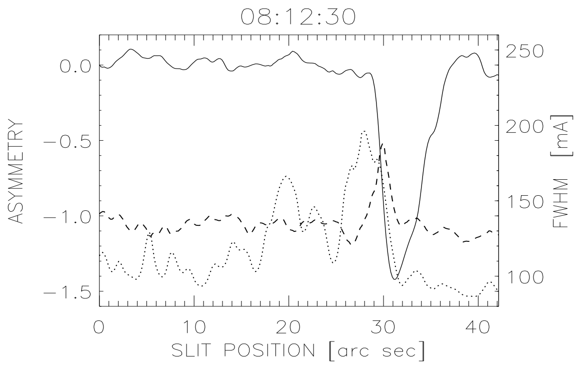


**Fig. 1.** Spectral characteristics at the beginning of the time series (first set of spectra). The FWHM in Fe I 557.6 nm (dashed line) and Fe I 522.5 nm (dotted line) along the slit with the asymmetry in Ca II K line (solid line). Negative values of asymmetry signify the red asymmetry.

## 2. Results and discussion

It is evident from Fig. 1 (solid line) that the red asymmetry in the chromospheric Ca II K line is a typical feature (Fang, Hiei & Okamoto 1991). Maximal asymmetry appeared at the beginning of time series when the flare was most energetic during the observations. During the relaxing phase, the red asymmetry decreased. The asymmetry include both the shift of the emission peak in Ca II K flare profile and the different intensities of the red and violet wings (according to the definition). In our case the red asymmetry is caused by the down-flow of the chromospheric material toward the photosphere (according to results of Brčeková et al. 2002). In photospheric magnetic sensitive Fe I 522.5 lines there are two places of enhanced FWHM along the slit (Fig. 1, dotted line). These enhanced values of FWHM up to 200 mÅ are constant during the the whole event, what contradicts the fast dynamic evolution of upper layers (decrease of red asymmetry). Thus we conclude that this enhancement of FWHM is not connected with the turbulence caused by flaring chromosphere, but reveal two spots presented in the investigated area. So the magnetic field of the spots can cause the enhanced FWHM in magnetic sensitive Fe I 522.5 nm line. On the other hand only one place of enhanced FWHM is present in magnetic non-sensitive Fe I 557.6 nm line (Fig. 1, dashed line). The maximal correlation of FWHM in Fe I 557.6 nm and the asymmetry in Ca II K line is -0.69 when the spatial lag of these two characteristics is 1.7 arc sec (compare with Brčeková et al. 2002). This enhanced FWHM is slightly decreasing with time, so it is probably caused by the turbulence of the photospheric material disturbed by the material flow from the subflare. A model of the flaring atmosphere will be calculated in the near future to support this conclusion.

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## References

Brčeková, K., Kučera A., Hanslmeier A., Rybák J., Wöhl H.: 2002, in: Proc. Euroconference and IAU Colloquium 188: Magnetic Coupling of the Solar Atmosphere, ed.: H. Sawaya-Lacoste, ESA-SP 505, in press

Fang C., Hiei E., Okamoto T.: 1991, Solar Physics 135, 89