Multi-Wavelength Investigations of Solar Activity
Proceedings IAU Symposium No. 223, 2004
A.V. Stepanov, E.E. Benevolenskaya & A.G. Kosovichev, eds.

DOI: 10.1017/S1743921304006593

Transfer of energy within coronal bright points according to the observation in optical spectra and microwave

D. V. Prosovetsky and L. K. Kashapova

Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia, email: proso@iszf.irk.ru

Abstract. The paper is devoted to the coronal bright points. We carried out the analysis of the simultaneous observations in IR He λ10830 Å and microwaves at 5.2 and 1.76 cm. It was obtained that microwave sources correspond to the dark points in IR He λ10830 Å with line-of-sight velocities directed from a observer. The possible mechanism of the energy transport within the bright points are suggested.

The coronal bright points are the most spreading kind of a solar activity and they are registered in broad range of electromagnetic spectrum. However, the observation is showing a partial matching of coronal points at the different wavelengths (see for example Fu, Kundu, & Schmahl 1987; Maksimov, Prosovetski, & Krissinel 2001). The same emission features of the coronal objects, expanded by heights, as can be a evidence of the BP's spatial structure properties as reproduce the characteristics of energy transference from its release location to the emission levels. Multiwave observations, giving the information about the radiation from broad range of solar atmospheric levels, allow us to estimate the composition and processes within the coronal bright points more correctly.

The present contribution uses the observational data obtained on spectrograph of Large Solar Vacuum Telescope (LSVT) and Siberian Solar Radio Telescope (SSRT, 5.2 cm) and Nobeyama radioheliograph (NRH, 1.76 cm).

The scanning of solar disk by the slit of LSVT's spectrograph was made nearby the active region AR 8257 on 28 June, 1998 from 2:07 UT till 2:37 UT. The dark points in He I λ10830 Å on the spectrogram, obtained by CCD-camera, were extracted. The line-of-sight velocities and optical depth were determined in the dark points (Skomorovsky *et al.* 2001). We defined the brightness temperatures and the sizes of microwave sources corresponding to the dark points. It was investigated 12 dark points at all. The six microwave sources corresponded to them, moreover, each of source at 5.2 cm had the pair at 1.76 cm wavelength.

The ratio of brightness temperatures for the microwave sources (without level of quiet Sun), coincided with dark points in He I λ10830 Å, are about 0.112. This indicates the thermal brake gear of optically thin plasma as mechanism of microwave radiation (Maksimov, Prosovetski, & Krissinel 2001). The comparison of the matter motion directions observed in dark points with the microwave source presence shows that the microwave bright point presented only if the line-of-sight velocity of dark point was directed from the observer. Moreover, the dark points without the pairs at 5.2 and 1.76 cm wavelengths located farther from the microwave source maximums. It's notably that the “recessive” from observer dark points located along the loops seen according to TRACE's data in UV-rays (see Fig. 1).

Based on the model of a quasi-stationary loop (Vesecky, Antiochos, & Underwood 1979; Kankelborg *et al.* 1996), the estimations of coronal bright points and the line-of-sight velocities from the He I λ10830 Å observations allow us to conclude that the

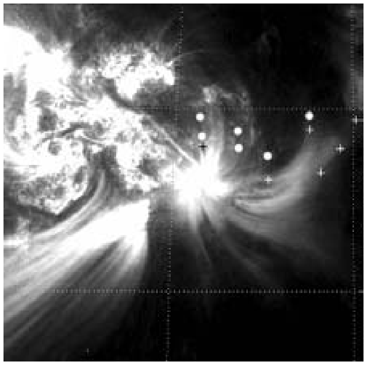

Figure 1. The DP's location on the UV image of the solar region (TRACE). The signs "+" are corresponding to DP's moving from the observer, the circles are corresponding to DP's moving to the observer.

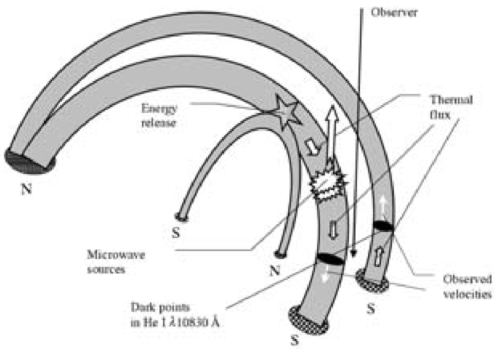

Figure 2. A schematic model of energy transport into the coronal bright points.

thermal flux moving from the lower layers of solar atmosphere can't support the conditions for the microwave source origin with the observed brightness temperature. At the same time the absolute value of thermal flux, estimated by microwave irradiation on the assumption of the thermal mechanism, is quite enough for giving to the matter the measured chromospheric velocities. So, we can assume that, the energy was released into the corona, for example, as the reconnection result of the existent and emerging magnetic fields, and transported by the thermal flux to the lower layers of solar atmosphere in order to support the conditions for observed effects (see Fig. 2).

Acknowledgements

This work was supported by Lavrentev's young scientist grant of SB RAS, grants NSh-477.2003.2 and NSh-733.2003.2 of the State Support of Leading Scientific Schools of Russia Federation, the State Scientific Technical Program "Astronomy" and grant I0208.1173 of the Federal Purpose Program "Integration".

References

Fu, Q., Kundu, M.R., & Schmahl, E.J. 1987 *Solar Phys.* **108**, 99–111.
Kankelborg, C.C. Walker A.B.C.II *et al.* 1996 *Astrophys. J.* **466**, 529–536.
Maksimov, V.P., Prosovetski, D.V., & Krissinel, B.B. 2001 *Astronomy Letters* **27**, 181–185.
Skomorovsky, V.I., Firstova, N.M., Kashapova, L.K. *et al.* 2001 *Solar Phys.* **199**, 37–45.
Vesecky, J.F., Antiochos, S.K., & Underwood, J.H. 1979 *Astrophys. J.* **233**, 987–997.