Taras Shevchenko National University of Kyiv
Astronomical Observatory

Astronomy and Space Physics in the Kyiv University

Book of Abstracts

International Conference
in part of the Science Day in Ukraine

May 23 – May 26, 2023

Kyiv, Ukraine

results identify signatures in emerging active regions compared with quiet regions; i.e., before any visible indicators of strong flux emergence through the presence of pores or sunspots.

Observations of high-speed downflows in the region of the seismic source in a large solar flare according to spectro-polarimetry in the D3 line

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We present the results of a study on the extremely powerful X17.2 / 4B solar flare on October 28, 2003, which occurred in the NOAA super-active region 0486. Based on the criterion of peak X-ray power recorded by the GOES detectors since 1976, this flare is one of the most powerful - it holds the third position in the list of such flares. This flare was observed by Natalia Lozitska and Vsesolod Lozitsky with the Echelle spectrograph of the Horizontal Solar Telescope of the Astronomical Observatory of Taras Shevchenko National University of Kyiv. Some results obtained on a base of this observations were published, in particular, in MNRAS, 2018, 477, Iss. 2, 2796-2803 (see link: https://academic.oup.com/mnras/article/477/2/2796/4950618). An interesting feature of this flare is that it had three seismic sources (https://doi.org/10.1007/s11207-006-0190-6; https://doi.org/10.1086/518731). It should be noted that seismic sources are the least studied phenomena accompanying the energy release of solar flares. They are observed on the dopplerograms of the Sun's photosphere as disturbances that spread concentrically from some source. Such waves were observed in ≈ 50% of solar flares, and some flares had multiple seismic sources. Physically, these are acoustic waves moving not on the surface, but within the Sun’s interior (hence the name - seismic). They are reflected through the temperature gradient and reach the surface at a higher speed. Possible sources of energy are magnetic fields and beams of electrons and protons. Given these circumstances, it is important to obtain new observational data on magnetic fields and plasma velocities in the region of seismic sources of flares.

We analyzed the $I \pm V$ and V profiles of the D3 line in the mentioned flare for moment 11:15 UT when the entrance slit of the Echelle spectrograph was projected onto the region of the seismic source S2 / S3 according to the sources cited above. In this location, the emission in the D3 line was very intense, exceeding the level of the spectral continuum level up to 5-6 times. The splitting of the $I \pm V$ profiles of this emission corresponded to fairly strong magnetic fields, about 1.5 kG. However, this is apparently only a lower estimate of the local fields, since the pattern of splitting of the bisectors of the $I \pm V$ profiles is atypical for a uniform magnetic field: it was maximal both in the core of the emission and in its far wings. With a uniform field, this splitting should be the same everywhere.

The most interesting results were obtained when studying the Stokes V at large distances from the center of intense emission, ± 15 angstroms (Å). Two main effects were found: (1) a change in the sign of this parameter when passing through the center of the line, and (2) local and narrow areas of a sharp change in the sign of the parameter V in the "red" wing of the line at distances of 4.0, 6.5, and 8.5 Å from the center of the undisturbed line. These effects likely indicate a combination of two essential factors in the area of the seismic source: very strong magnetic fields and significant descending velocities. In particular, effect (1) is similar to that described in the paper in Advances in Space Research, 2022, 69, Iss. 12, P. 4408-4418 (DOI: https://doi.org/10.1016/j.asr.2022.04.012), where it is detected by the H-alpha line. This effect is possible with extremely strong magnetic fields of the level of 10^5 G. As for effect (2), it reflects discrete plasma descent velocities with the following average values: 200, 330, and 435 km/s. The latter can be considered as confirmation of the hypothesis that hydrodynamic shocks are the source of seismic waves in solar flares.