Taras Shevchenko National University of Kyiv
Astronomical Observatory

Astronomy and Space Physics in Kyiv University

Book of Abstracts

International Conference
in part of the Science Day in Ukraine
dedicated to the 180th anniversary of the Astronomical Observatory of Taras Shevchenko National University of Kyiv, and to the 120th anniversary of the birth of Professor Serhiy Vsekhsvjatsky

May 27 – 30, 2025

Kyiv, Ukraine

longitudinal and local magnetic fields in the studied spot were obtained based on the study of the splitting of the bisectors of the I ± V profiles of the Ti I 6554.238 and 6556.066 Å, Fe I 6569.224 Å and Ca I 6572.795 Å lines.

Since the above spectral lines have incomplete spectral splitting due to low Lande factors (from 1.08 to 1.5), estimates of only the longitudinal component of the magnetic field BLOS, and not the intensity modulus, were obtained from direct measurements. This parameter in some places of the spot significantly differs by the lines of different elements and has the highest values (up to 2400 G) by the Ti I 6556.066 Å line. The data for both titanium "shadow" lines correlate well with each other, but the Ti I 6556.066 Å line shows significantly higher fields everywhere than the other titanium line. It is interesting to note that the other "shadow" line, namely Ca I 6572.795 Å, shows the lowest measured fields, up to 1700 G. In the latter line, the bisectors of the I ± V profiles have a maximum splitting at a distance of about 0.32 Å from its center, which may indicate particularly strong local fields with an intensity of about 10.5 kG.

Comparison of direct measurements of the magnetic field with the calculated depths of the formation of spectral lines in the sunspot showed that the altitudinal gradient of the magnetic field reached quite large values, about 10 G/km, in absolute value. It was also found that in the altitude range from -369.8 to -291.4 km the altitudinal gradient of the magnetic field changed its sign. Such a case, as far as the authors know, has never been observed in spots. It is possible, however, that in this case not only the height of the formation of the lines plays a role, but also their different temperature sensitivity to changes in thermodynamic conditions at different depths in the spot.

Spectral manifestations of local magnetic field amplification at the chromospheric level of a solar flare

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Current estimates of local magnetic fields in solar flares vary greatly and are in the range of 10^2–10^5 G. This is partly due to the fact that solar flares are actually very different in their physical characteristics, but also to the fact

that different methods of measuring the magnetic field are not equivalent to each other, especially if the magnetic field is significantly inhomogeneous. The least studied based on direct methods are the magnetic fields in the solar chromosphere and corona. That is why the purpose of the presented work is new estimates of chromospheric magnetic fields in a solar flare based on the analysis of the characteristic features of the Zeeman effect in the Hα line and comparison of the corresponding results with those that follow from the study of the magnetic splitting of the photospheric line Fe I 6569.2 A.

The spectral-polarization method of measuring magnetic fields was used to process observations made with the Echelle spectrograph of the horizontal solar telescope of the Astronomical Observatory of the Taras Shevchenko National University of Kyiv. The Zeeman spectrogram of the solar flare of November 5, 2004 with a magnitude of M4.1/1B for the moment of 11:37 UT was scanned, and the blackening on the spectrogram was converted into intensity taking into account the characteristic curves of both the photographic material and the scanner itself. Estimates of the averaged and local magnetic fields in the solar flare region and in neighboring areas on the Sun were made on the basis of studying the splitting of the bisectors of the I ± V profiles of the above lines.

Significant signs of altitudinal inhomogeneity of the magnetic field were found in the height range "photosphere - chromosphere". This is indicated by the fact that the longitudinal component B_{LOS} of the magnetic field was significantly different in value for the specified spectral lines. In the solar flare region, the corresponding intensities were greater by the Hα line than by the Fe I line, while outside the flare, their inverse ratio was obtained. In addition, the bisectors of the I ± V profiles in the Hα line everywhere in the studied regions do not correspond to a homogeneous magnetic field: they are mostly not parallel to each other, and in the flare region they have a maximum splitting near the centers of the emission profiles. The non-parallelism of the bisectors in the Hα line indicates that the maximal magnetic fields at the chromospheric level were significantly stronger than 1.5 kG, and possibly reached the level of 10^4 G.