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theoretically explain the rapid observed reconstruction of magnetism of the Sun. The radial inhomogeneity of the turbulent viscosity ν_T and the condition $\mu_T << 1$, revealed by us, testify to the strong macroscopic diamagnetism of the turbulent layers of the Sun. Macroscopic turbulent diamagnetism in deep layers of the SCZ plays the role of negative magnetic buoyancy. As a result, it contributes to the formation of a magnetic layer of a steady state toroidal magnetic field with a strength of about 3000–4000 G near the bottom of the SCZ.

Magnetic fields in the main sunspot of the active region NOAA 13372

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The peculiarities of the magnetic field distribution in the plane of a large sunspot measured by the Zeeman splitting of five photospheric lines with a different formation height are presented. The spectrogram of the spot was obtained by V. Lozitsky at the HST of AO KNU on July 17, 2023. The processing of the spectra using the program of I. Yakovkin showed that the magnetic field module in the sunspot umbra reached 2600 G. No signs of stronger magnetic fields were found in this sunspot. The longitudinal component of the magnetic field in the FeI 6290.97, FeI 6297.80, and TiI 6303.76Å lines was 80-99% of the value of the magnetic field modulus, and in the FeI 6301.52, FeI 6302.51 lines it was only 65-75%. The value of the magnetic field module by named photospheric lines slightly decreases with the height in the atmosphere.

Comparison of magnetic fields and Doppler velocities in an X-class solar flare as measured by D1, D2, D3, H-alpha, and NiI 5892.9 lines

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The main goal of our research is to estimate the upper magnetic field limit in a flare using direct observations in spectral lines formed in a wide range

of height – from the photosphere to the transition region between the chromosphere and corona. Our method is based on Stokes V spectro-polarimetry of D1, D2, D3, H-alpha, and NiI 5892.9 lines and the nearest spectral continuum with a total spectral range of approximately 50 Å. The object of the study is an area of the solar flare on 17 July 2004 of the X1.1/2N class which arose in active region NOAA 10649. The main results of our study are the following: (a) the maximum magnetic field strength measured in the flare directly from the splitting of the line profiles reached 4.7–6.0 kG by the D1 and D2 lines, 1.9 kG by the D3 line, and only 0.6 kG by the H-alpha and Ni I lines; (b) Doppler (longitudinal) velocities changed sign with height in the atmosphere and were within the –4.5 to 7.7 km/s range; (c) observational indications of stronger magnetic fields (> 6 kG) were not found when studying wide spectral intervals (up to 15 angstroms) around the H-alpha and D3 lines. On the basis of these results, it can be concluded that in the studied solar flare there was a significant altitudinal heterogeneity of the magnetic field and Doppler velocities, and the peak values of the magnetic field in the chromosphere (6 kG) were greater than in the nearest sunspots at the photospheric level (2.8 kG). This indicates, likely, a local strengthening ("collapse") of the magnetic field in the region of the solar flare. The latter is confirmed by the fact that the Doppler velocities in the chromosphere had the opposite signs and can indicate the concentration of matter and magnetic field at this level in the atmosphere.

Height of the solar polar chromosphere in 2012–2024

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Based on the results of many years observations in the H_a line in 2012–2024, the height of the solar polar chromosphere in 2012–2024 was determined as a difference in the position of the maxima of radial brightness gradients in the continuum and in the H_a line core. It is shown that the height of the polar chromosphere decreases during periods of high solar activity (~4500 km or ~6.3") and increases during periods of quiet Sun (~5000 km or ~6.9"). A strong north-south asymmetry of the results in 2016–2017 was revealed, which is likely associated with the dynamics and magnitude of polar magnetic fields in the 24th solar cycle. It has been