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"ASTRONOMY AND BEYOND: ASTROPHYSICS, COSMOLOGY AND GRAVITATION, ASTROPARTICLE PHYSICS, RADIO ASTRONOMY, ASTROBIOLOGY AND GENETICS"

PROGRAM AND ABSTRACTS

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diamagnetism consists in the displacement of global (mean) magnetic fields from areas of increased intensity of turbulent pulsations to places with less developed turbulence along the gradient of turbulent viscosity gradient ν_T with an effective macroscopic velocity $\mathbf{U}_\mu = -\nabla\nu_T/2$ ($\nu_T \approx (1/3)ul$, (u and l are the effective velocity and the characteristic pulsation scale of the velocity). We considered the role of macroscopic turbulent diamagnetism in the formation of the magnetic field layer in the lower part of the SCZ. We calculated the radial distribution of the turbulent viscosity νT along the depth z for the SCZ model of Stix (2002). It was found that the radial distribution of this parameter has the form of a convex function νT(z) with a maximum approximately in the middle of the SCZ (z ≈ 140,000 km). Noticeable positive radial gradient of the turbulent viscosity $\nabla\nu_T$, which is found in the lower part of the SCZ, causes a downward intense diamagnetic displacement of the toroidal magnetic field, the velocity of which reaches the value $U_\mu \approx 4x10^3$ cm/s near the lower base of the SCZ (z ≈ 180,000 km). Therefore, macroscopic turbulent diamagnetism in deep layers plays the role of **negative magnetic buoyancy**. Macroscopic diamagnetism acts against magnetic buoyancy, the velocity of which is $U_B(B) = B/(4\pi\rho)^{1/2}$ (B is the magnetic induction, ρ is the density of plasma), and contributes to the formation of a magnetic layer of a steady state toroidal magnetic field with a strength of $B_S = (4\pi\rho)^{1/2}\ \nu_T/2 \approx 3000$–$4000$ G.

SMALL-SCALE PLASMA FLUCTUATIONS IN TURBULENT FLOWS OF ACTIVE REGIONS AT THE SOLAR PHOTOSPHERE

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Good ground for study of small-scale processes in the solar photosphere is provided by results of high-resolution ground-based and spacecraft observations. In this report we consider generation of small-scale fluctuations in plasma density of turbulent flows in active regions (plages) of the photosphere and dependence of their characteristics on the magnetic field strength. The process was described in the framework of three-fluid approach. Taking into account a low degree of ionisation of the gas in the photosphere, we assumed that ion-electron plasma is embedded in the flow of gas and has no influence on its motion. According to data of observations the statistics of random velocity field of gas corresponds to the Kolmogorov turbulence. For analysis of the effect of magnetic field on the plasma density fluctuations, analytic expressions describing their spatial spectrum and rms level were derived. Estimations of the spectral shape and the fluctuation level were made for the photosphere near 300 km altitude under the magnetic field strength from 100 to 1000 G. It was shown that the rms amplitude of fluctuations (with length-scales smaller than 100 km) around the mean plasma density has to increase with strength of magnetic field. The spatial spectrum of plasma fluctuations can be approximated by a power law and the power index has to increase too.

COMPARISON OF MAGNETIC FIELD MEASUREMENTS IN A SUNSPOT USING SPECTRAL LINES WITH DIFFERENT LANDE FACTORS AND FORMATION HEIGHT IN ATMOSPHERE

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Direct measurements of magnetic fields in sunspots by different spectral lines are important for elucidating the true magnitude and structure of the magnetic field at different levels of the solar atmosphere. Today, magnetographic measurements are the most popular, but such measurements mainly represent the longitudinal component of the magnetic field. In the sunspot umbra, such measurements give unreliable information and do not allow to determine the true module (absolute value) of the magnetic field. Such data can be obtained from spectral-polarization observations, thanks to which the Zeeman splitting can be determined directly, and not as calibrated polarization in the line profiles. In the presented work, we investigate the magnetic fields in the sunspot on July 17, 2023, using the Echelle Zeeman spectrogram obtained at the horizontal solar telescope of the Astronomical Observatory of Taras Shevchenko Kyiv National University. The I ± V profiles of the FeI 6291.0, 6297.8, 6301.5, 6302.5, 6311.5 and TiI 6303.8, 6312.2 lines were analyzed in detail. The studied areas included the penumbra and umbra of the sunspot, as well as the surrounding photosphere. The expected increase in the magnitude of the magnetic field during the transition from the penumbra to the umbra of the spot was found, but the ratio of intensities along different spectral lines turned out to be atypical in some places. Probably, the obtained data indicate a combination of at least two effects: the dependence on the heights of the formation of lines in the solar atmosphere and the increase in the potential of the lower therm. It was also found that the shadow lines of TiI 6303.8 and 6312.2 do not exhibit stronger magnetic fields in accordance with the non-shadow lines. The obtained data are planned to be used to clarify the general picture of the magnetic field by means of simulation.

SPATIO-TEMPORAL PERTURBATION OF THE EARTH'S MAGNETIC FIELD ALONG THE "STRUVE GEODETIC ARC"

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The report presents the spatio-temporal perturbation of the geomagnetic field in connection with the assessment of its role in solar-terrestrial connections and its potential impact on the specifics of the flow of a magnetic storm. For the planet Earth, the dependence of spatio-temporal changes of the magnetic field on its rotation mode was revealed. This regularity plays an important role in understanding the