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SCIENTIFIC SESSION OF THE DIVISION OF GENERAL PHYSICS AND ASTRONOMY OF THE USSR ACADEMY OF SCIENCES

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A scientific session of the Division of General Physics and Astronomy of the U.S.S.R. Academy of Sciences was held on 25 and 26 February 1970 in the conference hall of the P. N. Lebedev Physics Institute. The following papers were delivered:

1. A. B. Severnyĭ. Certain New Results of Measurements of the Total Magnetic Field of the Sun and of the Stars.
2. A. A. Mikhaĭlov. Motion of the Earth's Poles.
3. K. I. Gringauz. Characteristics and Spatial Distribution of Low-Energy Plasma in the Magnetosphere and its Connection with Geomagnetic Storms.
4. G. A. Smolenskiĭ and V. V. Lemanov. Hypersonic Waves in Crystals.
5. S. A. Akhmanov. Nonlinear Optics of Picosecond Pulses.

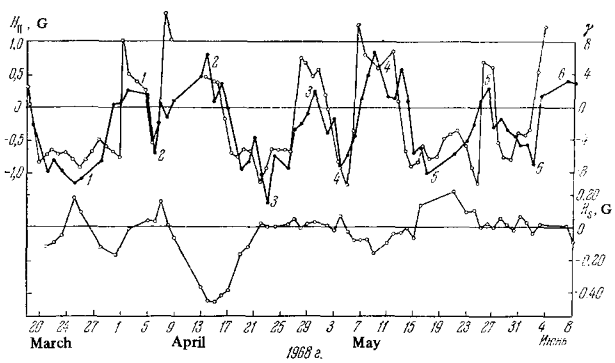
We publish below a brief summary of the papers.

A. B. Severnyĭ. Certain New Results of Measurements of the Total Magnetic Field of the Sun and of the Stars.

A photoelectric magnetograph and the solar telescope of the Crimean Astrophysical Observatory were used in 1968–1969 to measure the longitudinal component of the total magnetic field of the sun as a whole, as a star, in a parallel beam, without first constructing the image of the sun on the slit of the spectrometer. The measurements have shown periodic fluctuations of the sign and of the magnitude of the field, with a period half as long as the period of the rotation of the sun, i.e., the sun behaves as a whole as a rotating quadrupole.

These changes of the total field are more readily in antiphase with the oscillations of the total magnetic flux from all the sunspots, i.e., in antiphase with the solar activity.[1] The measurements show, furthermore, that the period of the oscillations of the N polarity is somewhat shorter than the period of the oscillations of the S polarity and corresponds to an accelerated rotation of the equatorial parts of the sun, i.e., one observes a "runout" of the N polarity on the equator relative to the S polarity of the higher latitudes. It is possible that this process is connected with the formation of a toroidal field and a short of dynamo-mechanism of generation of the total field.

A comparison of the fluctuations of the measured (longitudinal) total field of the sun with the longitudinal component of the interplanetary magnetic field, measured on the satellites "Explorer 33" and "Explorer 35" has shown a very good correspondence between the two measurements both with respect to sign and with respect to magnitude (provided that the delay due to the transport of the solar field by the solar wind amounts to 4.6) (see the figure). This shows that the interplanetary magnetic field has a solar source and that the photo-



Top—measured total magnetic field of sun (dots) and measured magnetic field of solar wind (circles). Bottom—magnetic field flux of sunspots.

spheric magnetic fields are carried out by the solar wind (joint work of I. M. Wilcox, A. B. Severnyĭ, and D. S. Colburn[2]). The observed rapid synchronous fluctuations (with duration on the order of a day) in the magnitude and sign of the solar and interplanetary field in relatively narrow tubes that emerge from small regions on the sun.

The method of measuring the total field of the sun, ensuring an accuracy of ± 0.15 G, being applicable (with some modifications) for stars to the large 2.6-meter reflector of the Crimean Astronomical Observatory, makes it possible to detect weak magnetic fields at stars (on the order of 10 G in the case of bright stars), where they were never observed before. The method was verified for the star β CrB, whose magnetic field is variable in accordance with previously known photographic measurements. Magnetic fields were observed at the supergiant star γCyg. These fields vary rapidly in magnitude and in sign, from $+200$ to -200 G (with an error of ± 28 G, whereas the usual error of the photographic method amounts to ± 100–200 G). This apparently indicates that the field of this star is concentrated in small sections of its surface, if the changes are due to relatively slow rotation. Appreciable fields are possessed also by the slowly rotating stars βOri and αTau. The well known star Sirius was found to have a field of approximately 40 G (error $\pm$ 12 G), whereas no magnetic field is observed in Procyon (β Cmi).

Investigations of such relatively weak fields at stars of different spectral classes, besides disclosing the role of magnetism in the construction and evolution of stars, can explain also the appearance of stellar "wind" in the phase of development of convection in envelopes of stars and clarify the role of rotation and the appearance of magnetic fields on surfaces of stars.

A. A. Mikhaĭlov, Motion of the Earth's Poles.

A study of the motion of the earth's poles was initiated 70 years ago, by means of systematic observations