V. A. Krat, *New Ideas on the Solar Photosphere Based on Stratospheric Investigations*. The results reported in this paper were obtained in the course of the processing of observational data recorded by the large Soviet Stratospheric Solar Observatory (SSO) between 1970 and 1973. The processing involved digital photometry, holographic methods, and mathematical theory of bursts.

Among the facts relating to the solar atmosphere that were established in this work, we particularly note the following.

1. The two-component nature of the solar granulation field (bright isolated granules and dark network). The granules can be seen right up to the solar limb. The continuity of the network is already lost for angles $\theta = 60°$ between the line of sight and the normal to the surface. For $\theta > 70°$, the network vanishes altogether. This means that, on average, the network is located in the photosphere at 100–200 km below the granules.

2. There is no morphologically continuous transition from granules to network. There are practically no granules of brightness lower than the mean brightness of the photosphere.

3. The granules and the grid are sharply delineated. There is practically no case of continuous dissipation of structures. The network closes morphologically on spots, pores, and embryonic pores (porules).

4. The motions of the photospheric elements take place at different angles to the mean surface of the photosphere. Their amplitude reaches up to ± 2.0 km/sec.

5. The granule-network temperature differences reach up to 1000°.

6. There is considerable brightness dissipation in the pores and minor sunspots. The pore brightness can undergo very considerable variation with time, including the total disappearance of a pore against the photospheric background.

7. The spot umbras and penumbras contain bright granule-like formations in the form of deep bright facular granules whose brightness is frequently greater than the mean brightness of the photosphere. Some are very persistent and can be seen for several hours (2–3 h).

8. The so-called bright rings around spots are groups of individual bright facular granules. As a rule, the same facular granules surround all the pores.

9. The horizontal displacement of the individual elements in the spot penumbra can be of the order of 10 km/sec.

10. Elements of the chromosphere are several times wider in cross section than photospheric elements.

11. In only 30% of all cases do dark and bright filaments exhibit an expansion with increasing distance from the spot nucleus with a gradient of the order of 100 m per kilometer.

The above facts can only be explained in terms of the electromagnetic picture of the structure of the solar atmosphere. Inclined motion and high temperature gradients must involve magnetic fields $H > 100$ G if the picture is to be stable (if only for a few minutes). For magnetic fields H lower by an order of magnitude, which have so far been assumed for the photosphere on the basis of terrestrial observations with solar magnetographs, the influence of the magnetic field on the atmospheric plasma would not be appreciable. Since the dark photospheric network is morphologically connected with sunspots, and is the most clearly defined formation, the enhanced magnetic field must be ascribed to the network. If this is so, this magnetic field will be practically unobservable from the earth or, more precisely, it will be concealed in the resultant image of the granules and the network. Moreover, if an azimuthal field is present in the network filaments, then depolarization in spectral line profiles is unavoidable, and the longitudinal component of the magnetic field will be nearly zero.

The expansion of atmospheric formations between the photosphere and chromosphere is explained by the magnetic pressure within the object (arc, loop, jet) in a rapidly falling pressure in the chromosphere. The absence of expansion in most of the filaments in sunspot penumbra suggests that they rise upward and remain purely photospheric formations (most likely, the apices of magnetic arcs).

The strong magnetic field H in the photospheric network can be the reason for its lower temperature. Since the mean cross-sectional diameter of the network filaments varies between 200 and 600 km, most of the filament should lie within the convective zone (in any of the existing models). The operative mechanism is then a temperature drop due to the suppression of convection in the same way as it is thought to operate in sunspots.

It is important to note that this suppression of convection is impossible for $H \approx 10$ G. The darkening of the network can occur only for $H > 100$ G.

The faculae are generally stable formations that appear suddenly (if we are concerned with individual granules) and vanish equally suddenly (over a few minutes or even a few tens of seconds). They appear at different levels in the photosphere and are genetically related to sunspots and pores. Only one explanation has been put forward for their emission, namely, the emergence of hydromagnetic waves from subphotospheric layers for $H > 100$ G.

The sun should not be regarded as a star with a low magnetic field. Its magnetic field is, in fact, comparable with stellar magnetic fields, but it has a fine structure which leads to an apparently low H in the flux of radiation averaged over the entire sun.

The following sources were used in this paper: V. V. Krat and L. M. Kotlyar, Stratosfernaya astronomiya (Stratospheric Astronomy), Nauka, M., 1987; Solnechnye dannye No. 2 (1974) and No. 2 (1976).