The Model of the Sun, Based on Wheeler's Geometrodynamics, is Confirmed by Recent Astronomical Observations

Anatoly V. Belyakov

Tver, Russia. E-mail: belyakov.lih@gmail.com

The detailed physical parameters of the gravitomagnetohydrodynamic model of the Sun, calculated earlier on the basis of Wheeler's geometrodynamics, are confirmed by recent astronomical observations.

In [1] and other studies, a mechanistic interpretation of Wheeler's geometrodynamics is used, which makes it possible to draw analogies between objects of different scales (in the widest range from elementary particles to planets and stars), regardless of the nature of their constituent environment, solely on the basis of the balance between gravitational, magnetic, electrical, and dynamic forces. This method, when applied to stellar objects, has showed that the Sun has a complex dynamic internal structure, and some of its model parameters are in good agreement with recent astronomical observations [2–4].

The balances of the aforementioned forces lead to the structuring of any medium, if these forces are present, into local vortex zones (vortex tubes) [1, 5], consisting of single vortex filaments.

Recall that the formulae for electric and magnetic forces are written in a "non-Coulomb" form, in which the electric charge is replaced by the electron's maximum momentum. In this case, the electric and magnetic constants ε_0 and μ_0 are as follows

$$\varepsilon_0 = \frac{m_e}{r_e} = 3.33 \times 10^{-16} \text{ kg/m}, \tag{1}$$

$$\mu_0 = \frac{1}{\varepsilon_0 c^2} = 0.0344 \text{ 1/N}, \tag{2}$$

so ε_0 is effectively the linear density of the vortex tube, and μ_0 is the reciprocal of the centrifugal force generated by the rotation of a vortex tube element of mass m_e at the speed of light c along a radius r_e.

In particular, the work [1] established that as an initially structureless medium becomes more complex, local vortex zones arise, where:

— the number z of the local zones for an arbitrary mass M is

$$z = \frac{1}{M^{1/4}}, \tag{3}$$

— their radius r and length l, respectively, are

$$r = M^{3/4} R_c, \tag{4}$$

$$l = M^{1/4} R_c, \tag{5}$$

— the circumferential velocity of individual vortex filaments rotating around the longitudinal axis of the vortex tubes is

$$v_0 = M^{1/4} c, \tag{6}$$

— the number of the vortical filaments in the zone

$$n = f M, \tag{7}$$

where f is the ratio of the electric forces to the gravitational ones, and M is a dimensionless mass measured in fractions of the characteristic mass

$$M_m = \frac{R_c c^2}{\gamma} = 1.012 \times 10^{36} \text{ kg}, \tag{8}$$

where the characteristic radius R_c is

$$R_c = (2\pi)^{1/2} c \times [\text{sec}] = 7.52 \times 10^8 \text{ m}, \tag{9}$$

so that for the Sun's mass is we have $M = 2 \times 10^{-6}$. It is obvious that as its own mass decreases, the object simultaneously becomes more complex, structuring itself into local zones in an increasingly finer manner.

Stars, forming from primordial matter, undergo a long evolutionary process, and at some point their structure conforms to the above relationships (for detail, see [1]). It is assumed that our Sun is also at this equilibrium stage of its existence, and therefore some parameters of the solar structure should correspond to them.

According to [1], the initial state of a stellar object is assumed to be a rotating disk, in which, as it becomes more complex, local radial-spiral zones form, which are pulled toward the centre by the radial components of gravitational forces.

Since magnetic forces also act in the solar plasma, the solar structure as a whole may consist of local zones in the form of closed contours-toroids (balance of magnetic and gravitational forces), whose conductive elements (vortex filaments) rotate around the closed axis of the torus (balance of magnetic and inertial forces), while the toroids themselves are located in the plane of the rotating disk (balance of gravitational and inertial forces). The core rotates faster than the periphery, and the toroids twist, converting their kinetic energy into other forms (and then, obviously, the reverse process). It would be a gross oversimplification to liken this system to a multiwinding, flatspiral mechanical pendulum; nevertheless, an

oscillatory process of the object's gravimagneticodynamic structure must take place.

Indeed, paired dark spots predominantly in the Sun's equatorial zone appear to be the outcrops of local structures that undergo magnetization reversals and change their intensity and polarity with a period of 11 years. Their observed number (from a few to hundreds) is consistent with the calculated average, according to formula (3), $z = 26.6$. In [1] other models corresponding to the real parameters of the Sun are also given.

This structure turned out not to be speculative; on the contrary, it has received new direct confirmation in the recent studies mentioned below.

1. The Daniel K. Inouye Solar Telescope registered tiny structures in the Sun's corona — ultrathin coronal loops that extend along the Sun's magnetic field lines. On average, their width was approximately 48 kilometers across, with individual loops measuring approximately 20 km [2]. It is assumed that these fine structures may be isolated elements of the solar structure.

But this is precisely the size of the vortex local zones predicted by the proposed model; according to the formulae (4) and (5), $r = 40.4$ km and $l = 28,200$ km. The latter is also consistent with observations, since the height of coronal loops can reach 10,000 km.

2. Furthermore, Prof. Richard Morton directly observed a small twisted type of wave (Alfvén waves), which can supply energy to the corona [3]. These waves cause rotational motion, which was detected by spectroscopic analysis, as the plasma's errution toward and away from the Earth creates characteristic red and blue shifts on opposite sides of magnetic structures. This effect was observed in the movement of iron atoms heated to 1.6×10^6 °C in the corona.

But it is precisely this vortex motion that the individual filaments that make up the toroids exhibit; their circumferential velocity, according to (6), is $v_0 = 11.3 \times 10^6$ m/sec. During solar flares, the filaments are broken, causing the charged particles that comprise them to split off and rush into space at a velocity v_{0i}, which then decreases in the Sun's gravitational field to the speed in the range of 1,000–3,000 km/sec recorded at Earth.

3. Astronomers using the European Southern Observatory's (ESO) Very Large Telescope (VLT) observed the initial phase of the supernova explosion SN 2024ggi in the galaxy NGC 3621 [4]. It was discovered that the initial mass ejection was not spherical, but rather elongated and flattened. This fact also confirms the correctness of the initial structure assumed for the star as a flat disk.

It should also be noted that the proposed model makes it possible to directly calculate the atomic number of the element at which nuclear reactions in stars cease at the end of their evolution, namely, the atomic number of iron.

In [1], when determining the parameters of a spirally structured disk, its radius in a compressed state was determined, i.e., the radius of the star's core

$$R_0 = M^{1/3} R_c \,, \tag{10}$$

and, subsequently, the core density.

In the atoms of stellar matter (mainly hydrogen), the substance, according to the electron model [6], circulates along p^+-e^- contours having a mass $\varepsilon_0 r_0$, and the circulation speed cannot be greater than the speed of light. At the same time, the magnitude of the charge e_0 is constant for any quantum number and is equal to the momentum of the mass of the circuit $\varepsilon_0 r_0 v_0$. When $v_0 \to c$, then $r_0 \to r_{0_{min}}$, therefore

$$r_{0_{min}} = \frac{e_0}{\varepsilon_0 c} \,. \tag{11}$$

The density of extremely compressed hydrogen atoms is (for a spherical volume)

$$\rho_{max} = \frac{3 m_H}{4\pi r^3_{0_{min}}} = 8.82 \times 10^7 \text{ kg/m}^3, \tag{12}$$

where m_H is the mass of a hydrogen atom.

Assuming that all matter is concentrated in the nucleus, its density is the ratio of the mass of the nucleus to the cube of its radius and, according to the formulae (8) and (10),

$$\rho_0 = MM_m / R_0^3 = M_m / R_c^3 =$$

$$= 1/(2\pi\gamma \times [\text{sec}^2]) = 2.38{\times}10^9 \text{ kg/m}^3. \tag{13}$$

That is, the core density depends only on the gravitational constant. From the ρ_0/ρ_{max} ratio, it follows that a volume equal to the volume of one compressed hydrogen atom should contain 27 atoms of the star's original material, which, in terms of proton number, corresponds to irongroup atoms. This density is typical of white dwarfs.

Thus, the highly simplified model of solar structure presented in [1] is consistent with the external manifestations of solar activity. As for the commonly used spherically symmetric quasistatic model of stellar structure, which analyzes the state of matter and pressure, temperature and luminosity as functions of radius, it is clearly insuficient, and an analysis of the Sun's gravitomagnetodynamic structure should be included.

And finally: the more complex than expected structure of stellar objects, where the dynamics of magnetic forces play a huge role, suggests the following idea: are enormous pressures and temperatures alone enough to trigger a controlled thermonuclear reaction?

References

1. Belyakov A.V. Evolution of stellar objects according to J. Wheeler's geometrodynamic concept. Progress in Physics, 2013, v. 9, issue 1, 25–40.

2. Tamburri C.A., Kazachenko M.D., Cauzzi G., et al. Unveiling unprecedented fine structure in coronal flare loops with the DKIST. The Astrophysical Journal Letters, 2025, v. 990(1), L3.
3. Morton R.J., Gao Y., Tajfirouze E., Tian H., et al. Evidence for small-scale torsional Alfven waves in the solar corona. Nature Astronomy, 24 October 2025.
4. Yi Yang, Xudong Wen, Lifan Wang, et al. An axisymmetric shock breakout indicated by prompt polarized emission from the type II supernova 2024ggi. arXiv: 2511.08824 (2025).
5. Belyakov A.V. On materiality and dimensionality of the space. Is there some unit of the field? Progress in Physics, 2014, v.10, issue 4, 203–206.
6. Belyakov A.V. Charge of the electron, and the constants of radiation according to J. A. Wheeler's geometrodynamic model. Progress in Physics, 2010, v. 6, issue 4, 90–94.